CRR

TK 50874-4-MM (Rev. 6, 04/05)

For further information, refer to:	
CRR-40 PS & PS+ Parts Manual	TK 50961
Diagnosing Thermo King Container Refrigeration Systems	TK 41166
Electrostatic Discharge (ESD) Training Guide	TK 40282
Evacuation Station Operation and Field Application	TK 40612
Tool Catalog	TK 5955

The information in this manual is provided to assist owners, operators and service people in the proper upkeep and maintenance of Thermo King units.

This manual is published for informational purposes only and the information so provided should not be considered as all-inclusive or covering all contingencies. If further information is required, Thermo King Corporation should be consulted.

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Recover Refrigerant

At Thermo King, we recognize the need to preserve the environment and limit the potential harm to the ozone layer that can result from allowing refrigerant to escape into the atmosphere.

We strictly adhere to a policy that promotes the recovery and limits the loss of refrigerant into the atmosphere.

In addition, service personnel must be aware of Federal regulations concerning the use of refrigerants and the certification of technicians. For additional information on regulations and technician certification programs, contact your local Thermo King dealer.

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Operating Instructions (continued)

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Safety Instructions

General Precautions

- Always wear goggles or safety glasses. Refrigerant liquid and battery acid can permanently damage the eyes.
- Never operate the unit with the discharge valve closed. Never close the compressor discharge valve with the unit in operation.
- Keep your hands, clothing and tools clear of the fans when the refrigeration unit is running. If it is necessary to run the refrigeration unit with covers removed, be very careful with tools or meters being used in the area.
- Check the condition of the gauge manifold hoses. Never let the hoses come in contact with a fan motor blade or any hot surface.
- Never apply heat to a sealed refrigeration system or container.
- Fluorocarbon refrigerants produce toxic gases in the presence of an open flame or electrical arc. The gases are severe respiratory irritants capable of causing death.
- Firmly tighten all mounting bolts. Check each bolt for correct length for their particular application.
- Use extreme caution when drilling holes in the unit. The holes may weaken structural components. Holes drilled into electrical wiring can cause fire or explosion. Holes drilled into the refrigeration system may release refrigerant.
- Use caution when working around exposed coil fins. The fins can cause painful lacerations.
- Use caution when working with a refrigerant or refrigeration system in any closed or confined area with a limited air supply (for example, a trailer, container or in the hold of a ship). Refrigerant tends to displace air and can cause oxygen depletion. This can result in suffocation and possible death.
- Use caution and follow the manufacturer's suggested practices when using ladders or scaffolds.

Refrigerant Oil Precautions

Observe the following precautions when working with or around refrigerant oil:

- Do not allow refrigerant oil to contact your eyes.
- Rubber gloves are recommended when handling Polyolester based refrigerant oil.
- Do not allow prolonged or repeated contact with skin or clothing.
- Immediately wash all exposed skin after handling refrigerant oil.

Use the following First Aid practices if needed.

Eyes: Immediately flush eyes with large amounts of water. Continue flushing for at least 15 minutes while holding the eyelids open. Get prompt medical attention.

Skin: Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.

Inhalation: Move victim to fresh air. Restore breathing if necessary. Stay with victim until arrival of emergency personnel.

Ingestion: Do not induce vomiting. Contact a local poison control center or physician immediately.

Electrical Precautions

The possibility of serious or fatal injury from electrical shock exists when servicing a refrigeration unit. Extreme care must be used when working with a refrigeration unit that is connected to its power source. Extreme care must be used even if the unit is not running. Lethal voltage potentials can exist at the unit power cord, inside the control box, inside any high voltage junction box, at the motors and within the wiring harnesses.

Precautions

- Turn the unit On/Off switch to Off before connecting or disconnecting the unit power plug. Never attempt to stop the unit by disconnecting the power plug.

- Be certain the unit power plug is clean and dry before connecting it to a power source.
- Use tools with insulated handles. Use tools that are in good condition. Never hold metal tools in your hand if exposed, energized conductors are within reach.
- Do not make any rapid moves when working with high voltage circuits. Do not grab a falling tool or other object. People do not contact high voltage wires on purpose. It occurs from an unplanned movement.
- Treat all wires and connections as high voltage until ammeter and wiring diagram show otherwise.
- Never work alone on high voltage circuits on the refrigeration unit. Another person should always be standing by in the event of an accident to shut off the refrigeration unit and to aid a victim.
- Have electrically insulated gloves, cable cutters and safety glasses available in the immediate vicinity in the event of an accident.

First Aid

IMMEDIATE action must be initiated after a person has received an electrical shock. Obtain immediate medical assistance.

The source of shock must be immediately removed. Shut down the power or remove the victim from the source. If it is not possible to shut off the power, the wire should be cut with either an insulated instrument (e.g., a wooden handled axe or cable cutters with heavy insulated handles). A rescuer wearing electrically insulated gloves and safety glasses could also cut the wire. Do not look at the wire while it is being cut. The ensuing flash can cause burns and blindness.

Pull the victim off with a non-conductive material if the victim has to be removed from a live circuit. Use the victim's coat, a rope, wood, or loop your belt around the victim's leg or arm and pull the victim off. *Do not touch* the victim. You can receive a shock from current flowing through the victim's body.

Check immediately for the presence of a pulse and respiration after separating the victim from power source. If a pulse is not present, start CPR (Cardio Pulmonary Resuscitation) and call for emergency medical assistance. Respiration may also be restored by using mouth-to-mouth resuscitation.

Low Voltage

Control circuits are low voltage (24 Vac and 12 Vdc). This voltage potential is not considered dangerous. Large amount of current available (over 30 amperes) can cause severe burns if shorted to ground. Do not wear jewelry, watch or rings. These items can shortcut electrical circuits and cause severe burns to the wearer.

Electrostatic Discharge Precautions

Precautions must be taken to prevent electrostatic discharge while servicing the MP-3000a microprocessor and related components. The risk of significant damage to the electronic components of the unit is possible if these precautionary measures are not followed. The primary risk potential results from the failure to wear adequate electrostatic discharge preventive equipment when handling and servicing the controller. The second cause results from electric welding on the unit and container chassis without taking precautionary steps.

Electrostatic Discharge and the Controller

You must avoid electrostatic discharges when servicing the controller. Solid-state integrated circuit components can be severely damaged or destroyed with less than a small spark from a finger to metal object. You must rigidly adhere to the following statements when servicing these units. This will avoid controller damage or destruction.

- Disconnect all power to the unit.
- Avoid wearing clothing that generates static electricity (wool, nylon, polyester, etc.).
- Do wear a static discharge wrist strap (refer to Tool Catalog) with the lead end connected to the controller's ground terminal. These straps

are available at most electronic equipment distributors. *Do not* wear these straps with power applied to the unit.

- Avoid contacting the electronic components on the circuit boards of the unit being serviced.
- Leave the circuit boards in their static proof packing materials until ready for installation.
- Return a defective controller for repair in the same static protective packing materials from which the replacement component was removed.
- Check the wiring after servicing the unit for possible errors. Complete this task before restoring power.

Welding of Units or Containers

Electric welding can cause serious damage to electronic circuits when performed on any portion of the refrigeration unit, container or container chassis with the refrigeration unit attached. It is necessary to ensure that welding currents are not allowed to flow through the electronic circuits of the unit. The following statements must be rigidly adhered to when servicing these units to avoid damage or destruction.

- Disconnect all power to the refrigeration unit.
- Disconnect all quick-disconnect wire harnesses from the back of the controller.
- Disconnect all wire harnesses from the Remote Monitor Modem (RMM).
- Switch all of the electrical circuit breakers in the control box to the Off position.
- Weld unit and/or container per normal welding procedures. Keep ground return electrode as close to the area to be welded as practical. This will reduce the likelihood of stray welding currents passing through any electrical or electronic circuits.
- The unit power cables, wiring and circuit breakers must be restored to their normal condition when the welding operation is completed.

Removing Refrigerant Properly

Use a refrigerant recovery process that prevents or absolutely minimizes refrigerant escaping to the atmosphere. Fluorocarbon refrigerants are classified as safe refrigerants when proper tools and procedures are used. Certain precautions must be observed when handling them or servicing a unit in which they are used.

Fluorocarbon refrigerants evaporate rapidly, freezing anything they contact when exposed to the atmosphere in the liquid state. In the event of frost bite, attempt to protect the frozen area from further injury, warm the affected area rapidly, and maintain respiration.

- **Eyes:** For contact with liquid, immediately flush eyes with large amounts of water and get prompt medical attention.
- **Skin:** Flush area with large amounts of lukewarm water. Do not apply heat. Remove contaminated clothing and shoes. Wrap burns with dry, sterile, bulky dressing to protect from infection/injury. Get medical attention. Wash contaminated clothing before reuse.
- **Inhalation:** Move victim to fresh air and use CPR or mouth-to-mouth ventilation, if necessary. Stay with victim until arrival of emergency medical personnel.

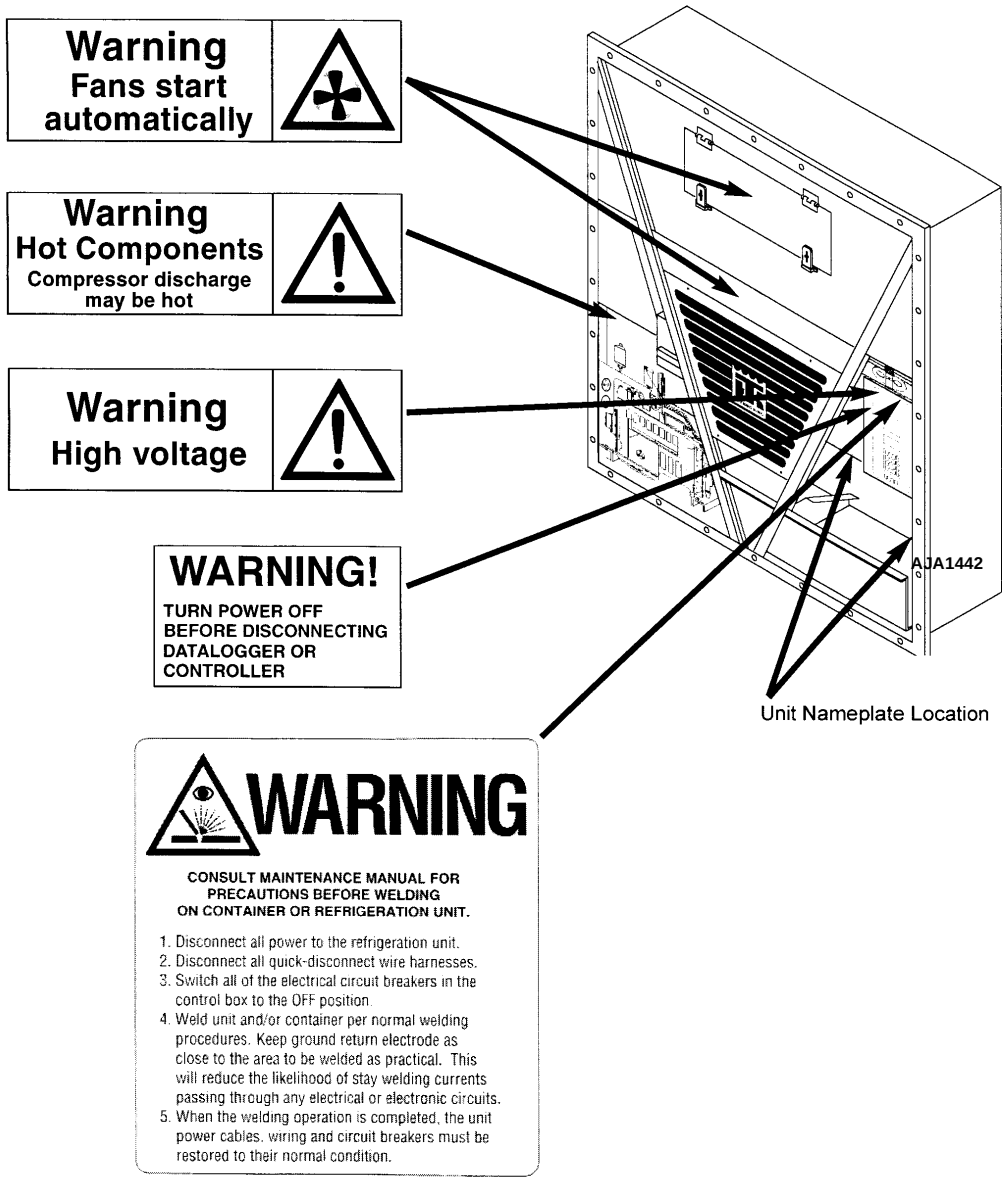


Figure 1: Nameplate and Warning Locations

Service Guide

Service Guide

A closely followed maintenance program will help to keep your Thermo King unit in top operating condition.

The following service guide table should be used as a guide when inspecting or servicing components on this unit.

Pretrip	Every 1,000 Hours	Annual/ Yearly	Inspect/Service These Items
			Electrical
•			Perform a controller pretrip inspection (PTI) check.
•	•	•	Visually check condenser fan and evaporator fan.
•	•	•	Visually inspect electrical contacts for damage or loose connections.
•	•	•	Visually inspect wire harnesses for damage or loose connections.
	•	•	Download the data logger and check data for correct logging.
		•	Check operation of protection shutdown circuits.
			Refrigeration
•	•	•	Check refrigerant charge.
•	•	•	Check compressor oil level.
	•	•	Check for proper discharge and suction pressures.
		•	Check filter drier/in-line filter for a restriction pressures.
			Structural
•	•	•	Visually inspect unit for damaged, loose or broken parts.
•	•	•	Tighten unit, compressor and fan motor mounting bolts.
	•	•	Clean entire unit including condenser and evaporator coils, and defrost drains.

Specifications

System Net Cooling Capacity-Full Cool

Air Cooled Condensing - CRR40*

Return air to evaporator coil inlet	460/230V, 3 Phase, 60 Hz Power				380/190V, 3 Phase, 50 Hz Power			
	Net Cooling Capacity			Power Consp	Net Cooling Capacity			Power Consp
	Watts	Kcal/hr	BTU/hr	kW at 460V	Watts	Kcal/hr	BTU/hr	kW at 380V
21.1 C (70 F)	13,369	11,642	46,200	-	10,695	9,314	36,960	-
1.7 C (35 F)	11,340	10,105	40,100	10.4	9,072	8,084	32,080	8.42
-17.8 C (0 F)	5,945	5,166	20,500	6.0	4,756	4,133	16,400	4.86
-28.9 C (-20 F)	3,075	2,671	10,600	4.6	2,460	2,137	8,480	3.75

* System net cooling capacity with a 37.8 C (100 F) ambient air temperature and R-134a.

Water Cooled Condensing Option with 37.8 C (100 F) Water Temp - CRR40*

Return air to evaporator coil inlet	460/230V, 3 Phase, 60 Hz Power				380/190V, 3 Phase, 50 Hz Power			
	Net Cooling Capacity			Power Consp	Net Cooling Capacity			Power Consp
	Watts	Kcal/hr	BTU/hr	kW at 460V	Watts	Kcal/hr	BTU/hr	kW at 380V
1.7 C (35 F)	10,900	9,375	37,200	9.9	8,720	7,500	29,760	8.01
-17.8 C (0 F)	5,500	4,730	18,770	5.3	4,400	3,784	15,015	4.29

* System net cooling capacity with a 37.8 C (100 F) water temperature, 30 liter/min. *8 gal./min.) water flow and R-134a.

Water Cooled Condensing Option with 30 C (86 F) Water Temp - CRR40*

Return air to evaporator coil inlet	460/230V, 3 Phase, 60 Hz Power				380/190V, 3 Phase, 50 Hz Power			
	Net Cooling Capacity			Power Consp	Net Cooling Capacity			Power Consp
	Watts	Kcal/hr	BTU/hr	kW at 460V	Watts	Kcal/hr	BTU/hr	kW at 380V
1.7 C (35 F)	12,900	11,095	44,028	9.6	10,320	8,876	35,222	7.77
-17.8 C (0 F)	6,100	5,246	20,820	5.1	4,880	4,197	16,655	4.13

*System net cooling capacity with a 30 C (86 F) water temperature, 30 liter/min. *8 gal./min.) water flow and R-134a.

System Net Heating Capacity*

Heater Type	460/230V, 3 Phase, 60 Hz Power			380/190V, 3 Phase, 50 Hz Power		
	Heating Capacity			Heating Capacity		
	Watts	Kcal/hr	BTU/hr	Watts	Kcal/hr	BTU/hr
CRR40 PS & PS+	5,800	4,984	19,800	4,814	4,136	16,434

* System net heating capacity for all models includes electric resistance rods and fan heat.

Evaporator Airflow-CRR40*

External Static Pressure (water column)	460/230V, 3 Phase, 60 Hz Power				380/190V, 3 Phase, 50 Hz Power			
	High Speed		Low Speed		High Speed		Low Speed	
	m^3/hr	ft^3/min	m^3/hr	ft^3/min	m^3/hr	ft^3/min	m^3/hr	ft^3/min
0 mm (0 in.)	6,580	3,875	3,170	1,865	5,500	3,240	2,730	1,608
10 mm (0.4 in.)	5,870	3,458	1,770	1,040	4,630	2,727	950	560
20 mm (0.8 in.)	5,000	2,940	-	-	3,760	2.215	-	-
30 mm (1.2 in.)	4,430	2,610	-	-	2,980	1,755	-	-
40 mm (1.6 in.)	3,640	2,144	-	-	1,880	1,108	-	-

Electrical System

Compressor Motor:	Type	460/380V, 60/50 Hz, 3 Phase
	Kilowatts	5.60 kW @ 460V, 60 Hz
	Horsepower	7.5 hp @ 460V, 60 Hz
	RPM	1750 rpm @ 60Hz
	Full Load Amps	15.5 amps @460V, 60 Hz; 15.5 amps @ 380V, 50 Hz
	Locked Rotor Amps	83 amps @ 460 Hz; 82 to 91 amps @ 380V, 50 Hz
Condenser Fan Motor:	Type	460/380V, 60/50 Hz, 3 Phase
	Kilowatts	0.37 kW @ 460V, 60 Hz
	Horsepower	0.50 hp @460V, 60 Hz
	RPM	1140 rpm @ 60 Hz
	Full Load Amps	1.0 amps @ 460V, 60 Hz; 1.0 amps @ 380V, 50 Hz
	Locked Rotor Amps	4.0 amps @ 460V, 60 Hz; 4.0 amps @ 380V, 50 Hz
Evaporator Fan Motors:	Type	460/380V, 60/50 Hz, 3 Phase
	Number:	2
	Kilowatts (Each)	0.75 kW @460V, 60 Hz
	Horsepower (Each)	1.0 hp @ 460V, 60 Hz
	RPM (Each): High Speed	3450 rpm @ 60 Hz
	Low Speed	1725 rpm @ 60 Hz
	Full Load Amps (Each): High Speed	1.4 amps @ 460V, 60 Hz; 1.1 amps @ 380V, 50 Hz
	Low Speed	0.55 amps @ 460V, 60 Hz; 0.5 amps @ 380V, 50 Hz
	Locked Rotor Amps: High Speed	10.3 amps @ 460V, 60 Hz
	Low Speed	2.9 amps @ 460V, 60 Hz
Electrical Resistance Heater Rods:	Type	460/380V, 60/50 Hz, 3 Phase
	Number	6
	Watts (60 Hz) (Each)	680 Watts
	Current Draw (Amps)	5 amps nominal (total) across each phase at the heater contactor

Electrical System

Control Circuit Voltage		29 Vac @ 60 Hz 24 Vac @ 50 Hz
Evaporator Overheat Switch:	Opens	54 +/- 3 C (130 +/- 5 F)
	Closes	38 +/- 4.5 C (100 +/- 8 F)

Refrigeration System

Compressor Model No.		D3DST-075E-TFD, Semi-hermetic Reciprocating with Copeland Discus ® Valve Design
Refrigerant Charge:	Standard Receiver Tank	4.9 Kg (10.8 lb) R-134a
	Water-Cooled Condenser-Receiver Tank	5.2 Kg (11.5 lb) R-134a
Compressor Oil Capacity *		4.6 liter, 1.22 gal., 155.5 oz.
Compressor Oil Type		Polyol Ester Based Type (required), TK Part No. 203-433 **
High Pressure Cutout Switch:	Cutout	2240 +/- 70 kPa, 22.40 +/- 0.70 bar, 325 +/ 10 psig
	Cutin	1590 +/- kpa, 15.90 +/- 0.70 bar, 230 +/- 10 psig
Water Pressure Switch (Option):	Open	117 +/- 21 kPa, 1.17 +/- 0.20 bar, 17 +/- 3 psig
	Close	35 +/- 21 kPa, 0.35 +/- 0.20 bar, 5 +/- 3 psig
Fusible Plug (High Pressure Relief):	Relief Temp.	100 C (212 F)
Liquid Injection Control:		
KVQ Setting Less Than 5 C (8.9 F) Below the Return Air Temperature		Liquid Injection turns ON 6 seconds every minute regardless of compressor discharge temperature
Compressor Discharge Temperature Control ***		Liquid injection activated at compressor discharge temperatures between 115 C and 125 C (239 F and 257 F), depending on KVQ valve setting
Liquid Injection Valve (Compressor):	Voltage	24 Vac
	Cold Resistance	5.6 ohms
Evaporator Pressure Regulator (KVQ Valve):		
	EPR Circuit Voltage	24 Vdc
	EPR Circuit Resistance	22 ohms
	EPRTH (Thermistor) Circuit Resistance	22,000 ohms at 20 C (68 F)

*When the compressor is removed from the unit, oil level should be noted or the oil removed from the compressor should be measured so that the same amount of oil can be maintained in the replacement compressor.

** DO NOT use or add standard synthetic or mineral oils to the refrigeration system. If Ester based oil becomes contaminated with moisture or with standard oils, dispose of properly - DO NOT USE!

Normal R-134a System Suction Pressures (D3DS Copeland Reciprocating Compressor)

Container Temperature	Operating Mode	Ambient Temperature	Suction Pressure
21 C (70 F)	Cool	27 to 38 C (80 to 100 F)	110 to 140 kPa, 1.10 to 1.40 bar, 16 to 20 psig
	Cool	16 to 27 C (60 to 80 F)	95 to 125 kPa, 0.95 to 1.25 bar, 14 to 18 psig
	Modulation Cool	27 to 38 C (80 to 100 F)	*
	Modulation Cool	16 to 27 C (60 to 80 F)	*
2 C (35 F)	Cool	27 to 38 C (80 to 100 F)	50 to 75 kPa, 0.50 to 0.75 bar, 7 to 11 psig
	Cool	16 to 27 C (60 to 80 F)	40 to 70 kPa, 0.40 to 0.70 bar, 6 to 10 psig
	Modulation Cool	27 to 38 C (80 to 100 F)	*
	Modulation Cool	16 to 27 C (60 to 80 F)	*
-18 C (0 F)	Cool	27 to 38 C (80 to 100 F)	-30 to -15 kPa, -0.30 to -0.15 bar, 9” to 5” Hg vacuum
	Cool	16 to 27 C (60 to 80 F)	-35 to -25 kPa, -0.35 to -0.25 bar, 11” to 7” Hg vacuum
-29C (-20 F)	Cool	27 to 38 C (80 to 100 F)	-45 to -35 kPa, -0.45 to -0.30 bar, 14” to 11” Hg vacuum
	Cool	16 to 27 C (60 to 80 F)	-50 to -35 kPa, -0340 to -0.20 bar, 15” to 11” Hg vacuum

* Suction pressure in Modulation Cool mode will vary between 140 and -35 kPa, 1.40 and -0.35 bar, 20 psig and 10” Hg vacuum; depending on the percent (%) of cooling capacity.

MP-3000a Controller

Temperature Controller: Type	MP-3000a microprocessor with thermostat, digital thermometer, programming keypad, mode indicators, LED display and LCD display for displaying unit operating and cargo information
Setpoint Range	-30.0 to +30.0 C (-22 to + 86 F)
Digital Temperature Display	-60.0 to 80.0 C (-76.0 to +176.0 F)
Controller Software (Original Equip.): Version	See controller identification decal
Defrost Initiation: Evaporator Coil Sensor	Manual Switch or Demand Defrost Initiation: -Coil must be below 18 C (65 F). Defrost cycle starts when technician or controller request defrost initiation -Timed Defrost Initiation: Coil must be below 10 C (50 F). Defrost cycle starts 1minute after the hour immediately following a defrost timer request for defrost initiation. For example, if the defrost timer requests a defrost cycle at 7:35, the defrost cycle will start at 8:01. Datalogger will record a Defrost event for each interval in which a Defrost cycle is pending or active (i.e both the 8:00 and 9:00 data logs.)
Demand Defrost	Demand defrost function initiates defrost when: -Temperature difference between the return air sensor and defrost (evaporator coil) sensor is too large for 90 minutes -Temperature difference between the left hand and right hand supply air sensors is too large and unit has operated for more then 90 minutes since last defrost. -Temperature difference between the supply air sensors and return air sensor is too large
Defrost Timer: Chilled Mode	-Supply Temperature at 5.1 C (41.2 F) or above: Every 8 hours of compressor operation -Supply Temperature at 5.0 C (41.0 F) or below: Every 2.5 hours of compressor operation. Defrost interval increases 0.5 hours each timed defrost interval. Defrost synchronization creates step intervals of 3, 4, 4, 5, 5, 6, 6 and 7 hours. Maximum time interval in frozen mode is 7 hours.
Defrost Timer: Frozen Mode	Every 8 hours of compressor operation. Defrost interval increases 2 hours each timed defrost interval. Maximum time interval in frozen mode is 24 hours.
Defrost Timer: Reset to Base Time	Defrost timer resets if the unit is Off more than 12 hours, setpoint is changed more than 5 C (9 F) or PTI Pretrip test occurs.
Defrost Termination: Defrost (Coil) Sensor	Chilled mode: Terminates defrost when coil sensor temperature rises to 30 C (86 F); or exceeds 18 C (65 F) for 35 minutes Frozen mode: Terminates defrost when coil sensor temperature rises to 30 C (86 F); or exceeds 8 C (46 F) for 35 minutes
Interval Timer	Terminates defrost after 90 minutes at 60 hz operation if coil sensor has not terminated defrost (120 minutes at 50 Hz operation)
Power Off	Turning unit On/Off switch OFF terminates defrost
Compressor Shutdown (Auto Reset):	
Stops Compressor	130 C (266 F)
Allows Compressor Start	90 C (194 F)

Dehumidify and Humidify Systems (Options)

Dehumidify System:	
Turn Mode ON and OFF	Set from CONTROL line of the Setpoint menu of the controller
Control Range	50% to 98% Relative Humidity
Setpoint Range (HUMSP)	Setpoint adjustable from 50% to 98% Relative Humidity
Humidify System (Option): Turn Mode ON and OFF	Set from CONTROL line of the Setpoint menu of the controller
Operating Temperature Range	0 to 60 C (32 to 140 F)
Control Range	50% to 98% Relative Humidity
Setpoint Range (HUMSP)	Setpoint adjustable from 50% to 98% Relative Humidity
Air Compressor Output	2.5 m^3/hr @ 0 kPa (1.5 CFM @ 0 psig)
Humidity Tank Heater:	240-600 Vac
	55 to 70 Watts at -17.8 C (0 F) Water Temperature
Humidity Sensor (Option): Accuracy	+/- 1.5% between 55% and 75% Relative Humidity
	+/- 3.0% between 75% and 95% Relative Humidity
Output Range:	4 to 20 milliamps
	1% Relative Humidity = 0.2 milliamp

Physical Specifications

Fresh Air Exchange Venting System (Adjustable): CRR40	0 to 280 m^3/hr (o to 165 ft^3/min.) @ 60 Hz
	0 to 232 m^3/hr (0 to 136 ft^3min.) @ 50 hz
Evaporator Fan Blade Specifications: CRR40	
Diameter	355 mm (14.0 in.)
Pitch	25°
Weight (net): CRR40	526 Kg (1159 lb)
Water-cooled Condenser-Receiver Option	13.6 Kg (30 lb)
Unit Dimensions:	
A = Flange Width	2025.5 mm (79.74 in.)
B = Gasket Width	1935 mm (76.18 in.)
C = Unit Width	1894 mm (74.57 in.)
D = Flange Height	2235.2 mm (88.00 in.)
E = Gasket Height	2140 mm (84.25 in.)
F = Unit Height	2094 mm (82.44 in.)
G = Gasket Depth	72 mm (2.83 in.) from back of flange
H = Maximum Protrusion	37 mm (1.46 in.) from back of flange
I = Unit Depth: CRR-40	420.0 mm (16.54 in.) from back of flange

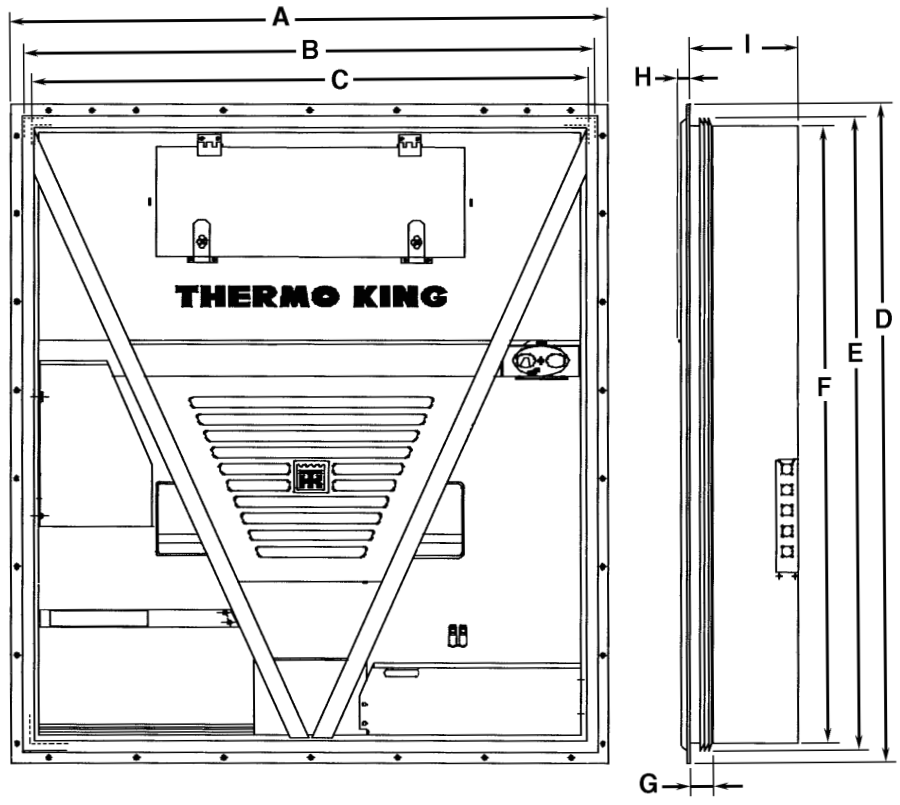


Figure 2: Physical Specification

Metric Hardware Torque Charts

Bolt Type and Class *	Bolt Size			
	M6	M8	M10	M12
	N.m (Ft.-lb.)	N.m (Ft.-lb.)	N.m (Ft.-lb.)	N.m (Ft.-lb.)
HH-CL 5.8	6-9 (4-7)	12-16 (9-12)	27-34 (20-25)	48-61 (35-40)
HH-CL 8.8	10-13 (7-10)	20-27 (15-20)	41-47 (30-35)	75-88 (55-65)
HH-CL 10.9	14-17 (10-13)	27-34 (20-25)	54-68 (40-50)	102-122 (75-90)
HH-CL 12.9	17-21 (12-16)	41-47 (30-35)	68-81 (50-60)	122-149 (90-110
HH-SS (2)	10-13 (7-10)	20-27 (15-20)	41-47 (30-35)	75-88 (55-65)

Bolt Type and Class *	Bolt Size			
	M14	M16	M18	M22
	N.m (Ft.-lb.)	N.m (Ft.-lb.)	N.m (Ft.-lb.)	N.m (Ft.-lb.)
HH-CL 5.8	75-88 (55-65)	115-135 (85-100)	177-216 (130-160)	339-406 (250-300)
HH-CL 8.8	115-135 (85-100)	177-216 (130-160)	271-339 (200-250)	475-610 (350-450)
HH-CL 10.9	136-176 (100-130)	224-298 (190-220)	393-474 (290-350)	678-813 (500-600)
HH-CL 12.9	177-216 (130-160)	285-352 (210-260)	448-542 (330-400)	881-1016 (650-750)
HH-SS (2)	115-135 (85-100)	177-216 (130-160)	271-339 (200-250)	475-610 (350-450)

*HH=Hex Head, CL=Class

Compressor Torque Chart-D3D Copeland Compressor Standard Bolt Torque

Bolt Usage		N.m	In.-lb.
Bottom Plate:	Grade 5	45.2	400
	Grade 8	59.3	525
Housing Cover		45.2	400
Oil Pump to Housing Cover		33.9	300
Bearing Cover to Housing Cover		33.9	300
Stator Cover:	Grade 5	45.2	400
	Grade 8	59.3	525
Cylinder head		59.3	525
Oil Screen Cover		31.1	275
Crankcase Heater Plug		45.2	400
Discharge and Suction Valve:	18 (5/16 in.)	25.4	225
	13 (1/2 in.)	56.5	500
Pipe Plug:	6.35 mm (0.25 in.)	33.9	300
	3.175mm (0.125 in.)	22.6	200
Oil Sight Glass:	Grade 5	4.5	40
	Grade 8	8.5	75
Terminal Plate		3.9	300
Nut on Top of Terminal Plate		5.1	45
Nut on Top of Jumper Bar		9.0	80

Unit Description, Features and Options

Introduction

This chapter will briefly describe the following items:

- General Unit Description.
- Standard Component Descriptions.
- Optional Component Descriptions.

General Description

CRR units are all-electric, single-piece, refrigeration units with bottom air supply. Each unit is designed to cool and heat containers for shipboard or overland transit of deep frozen, chilled or heated cargoes. Each unit mounts in the front wall of the container. Fork lift pockets are provided for installation and removal of the unit.

The frame and bulkhead panels are constructed of aluminum and are treated to resist corrosion. A hinged, removable evaporator compartment door provides easy service access. All operating components except the evaporator coil and electric heaters can be replaced from the front of the unit.

The unit is equipped with an 18.3 m (60 ft) power cable for operation on 460-380V/3 Ph/60-50 Hz power. For operation on 460-380V/3 Ph/60-50 Hz power, plug the 460-380V power cable into the proper power supply.

Each unit is equipped with 460-380V/3 Ph/60-50 Hz electric motors. An automatic phase correction system provides the proper electrical phase sequence for condenser fan and evaporator fan motor operation.

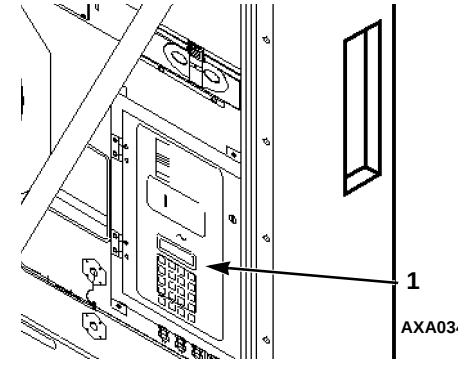
Unit power cable is stored below the control box in the condenser section. Unit features include a semi-hermetic reciprocating compressor with a liquid injection system; a microprocessor controller with integral data logger; 2-speed evaporator fans and a fresh air exchange system.

Semi-hermetic Reciprocating Compressor with Liquid Injection Cooling System

The refrigeration unit includes a semi-hermetic reciprocating compressor with forced feed lubrication system, ambient compensated internal overload and high temperature protectors, and a refrigerant injection system.

MP-3000a Controller

The MP-3000a is an advanced microprocessor controller that has been specially developed for the control and monitoring of refrigeration units. See “Controller Description and Operating Chapter” for more detailed information.



1.	MP-3000a Controller

Figure 3: MP-3000a Controller

Dual Speed Evaporator Fans

All CRR40 models feature 2-speed motors. The evaporator fans operate continuously to circulate air inside the container. The fans operate on high speed for perishable cargo at set-points of -9.9 C (14.1 F) and above. At setpoints of -10 C (14 F) and below, the evaporator fans operate on low speed for frozen cargo. The evaporator fan low speed rpm is one-half the high speed rpm.

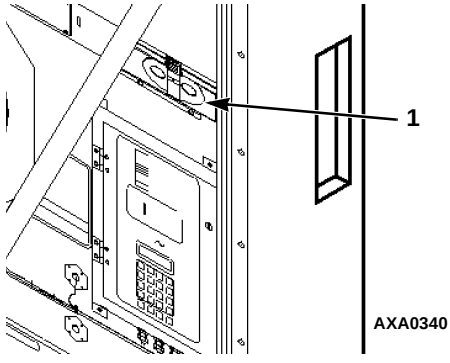
NOTE: If Economy Mode is ON:

Fresh Loads: Evaporator fans operate on low speed when container temperature is in-range.

Frozen Loads: Evaporator fans stop during the Null mode; controller operates fans on low speed for 5 minutes every 45 minutes.

Fresh Air Exchange System

The fresh air exchange system removes harmful gases from containers carrying sensitive perishable commodities. The fresh air vent is located above the control box. The fresh air vent is adjustable to accommodate a variety of frozen and chilled load operating conditions.



1.	Fresh Air Exchange Vent

Figure 4: Fresh Air Exchange Vent

Advanced Fresh Air Management (AFAM) and Advanced Fresh Air Management Plus (AFAM+) (Optional)

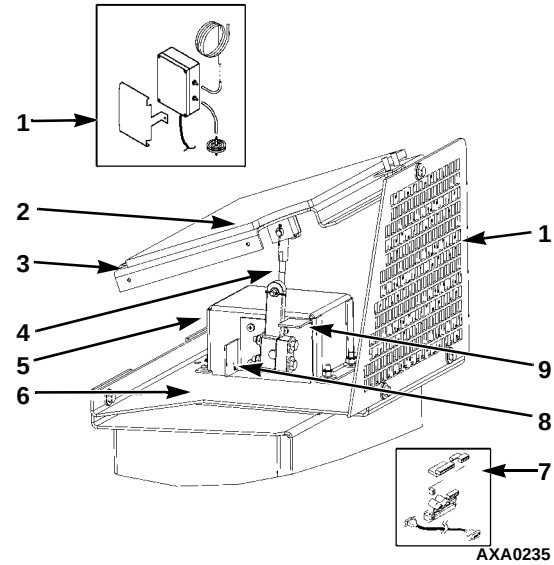
An advanced microprocessor controlled fresh air management system provides:

- programmable control of the air exchange rate
- programmable delayed vent opening
- automatic closure of the air exchange vent during low ambient conditions
- data logging of the air exchange rate and vent opening delay interval

The AFAM system includes a door control module, vent door and vent grille. The MP-3000a controller sends a communication signal to the door control module to position the vent door to the desired position. The controller can also be set to delay opening of the fresh air vent for up to 72 hours, in 1-hour increments. This allows faster product temperature pull-down.

An advanced microprocessor controlled fresh air management system also provides programmable control of the CO_2 levels in the container, and data logging of the CO_2 gas level readings.

The AFAM+ system includes a gas sensor unit, sensor filter, vent loop, pressure relief valve assembly and single purge port. The controller can be set to maintain a maximum CO_2 level in the container between 0 and 25 percent.



1.	Gas Sensor Assembly (Mounts in Evaporator)
2.	Gasket
3.	Vent Door Assembly
4.	Linkage Assembly
5.	Damper Motor Housing
6.	Damper Motor Assembly Mounting Bracket
7.	Interface Board and Cable (Mounts in Control Box)
8.	Stop Bracket, Vent Door Full Open
9.	Stop Bracket, Vent Door Closed
10.	Grille

Figure 5: Advanced Fresh Air Management (AFAM+) Option

Dehumidification Control System

A dehumidification system lowers the relative humidity in the container to the humidity setpoint. The control range is 50% to 98% while the setpoint is adjustable between 50% and 98%.

Dual Voltage

A dual voltage system includes a 15 KVA auto transformer and an 18.3 m (60 ft) power cable for operation on 230-90V/3 Ph/60-50 Hz power. The power cable is stored below the control box in the condenser section.

The 15 KVA auto transformer steps 230/190V power up to 460/380V. The auto transformer includes a 460-380V/3 Ph/60-50 Hz power receptacle.

For operation on 230/190V power, plug the 460-380V unit power cable into the receptacle on the auto transformer. Then plug the 230/190V power cable into a 230-190V power supply.

Humidification Control System

An optional humidification system increases the relative humidity in the container to the humidity setpoint. The control range is 50% to 98% while the setpoint is adjustable between 50% and 98%.

Pressure Gauge Options

A high pressure gauge is available to indicate condenser (high side) pressure. A low pressure gauge is available to indicate compressor suction (low side) pressure.

Recording Thermometer Option

Several models of temperature recorders are available for mounting on the unit. Each temperature recorder is designed to withstand widely varying environments including low and high ambient temperatures, salt water, humidity, fungus, industrial pollutants, dynamic loading, rain, sand and dust.

- The 31-day Saginomiya Recorder is electric motor driven by a dry cell type battery with a 1 year life expectancy.
- The 31-day Partlow Recorder is mechanically driven by a spring mechanism. On top air discharge units, the recording thermometer records supply air temperature.
- Partlow Recorder Sensor only.

Remote Monitoring Modem (RMM) (Optional)

A REFCON remote monitoring modem is provided to permit remote monitoring via the power cable. High speed transmission reads all controller information. Data can also be retrieved from the data logger via high speed transmission.

Remote Monitoring Receptacle Option (4-Pin) (Optional)

An optional 4-pin remote monitor connector provides 24 Vac signals for bridge lights that monitor Cool (Compressor On), Defrost and In-range conditions.

TRANSFRESH® Atmosphere Control System Options

Several TRANSFRESH options are available to meet individual customer needs. The TRANSFRESH system provides a controlled atmosphere within the container. By controlling the container temperature and atmosphere, the respiration rate of fruit and vegetables can be lowered. This allows the product quality to be maintained for longer periods of time.

- TRANSFRESH Ready: Provisions for the future installation and use of a TRANSFRESH atmosphere control system are incorporated in the unit. TRANSFRESH compatible A2 (power/defrost) and A3 (communications) cables (without connectors) are factory installed.
- Full TRANSFRESH Option: TRANSFRESH system components are installed for use of a TRANSFRESH atmosphere control system. In addition to A2 and A3 cables (with connectors), the security frame, security enclosure with insulation block, TRANSFRESH supplied single purge port, air hose and scrubber cable (A5, with connectors) are factory installed. Purge port includes a removable plug for charging the container with a modified atmosphere.

USDA Cold Treatment Temperature Recording

The datalogger includes provisions for the use of up to four USDA sensors. These sensors allow temperatures in various areas of the load to be monitored and recorded for United States Department of Agriculture use in monitoring Cold Treatment shipments.

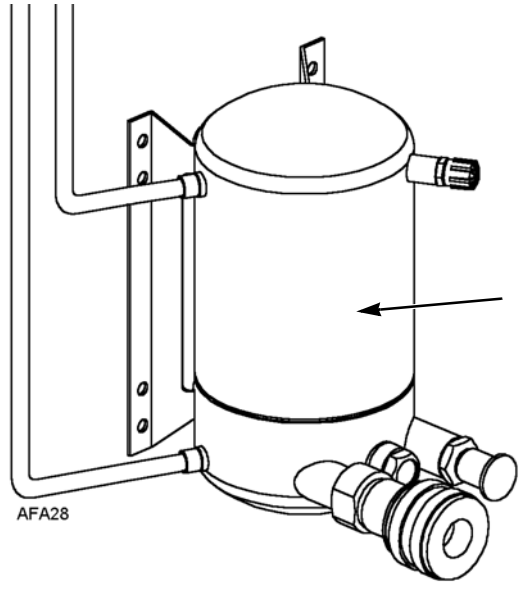
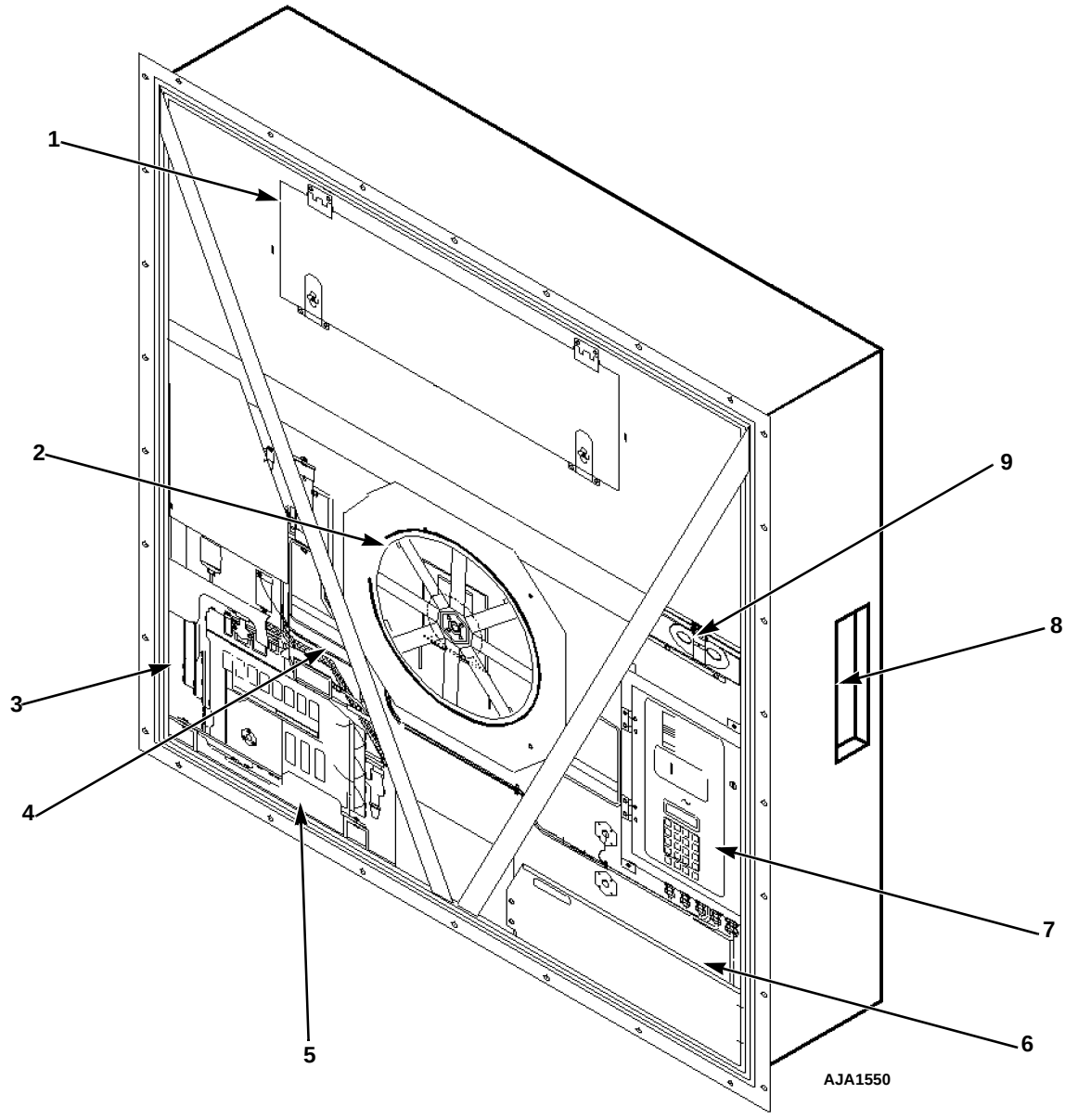


Figure 6: Water-Cooled Condenser/Receiver Tank

Water-Cooled Condenser/Receiver Tank (Optional)

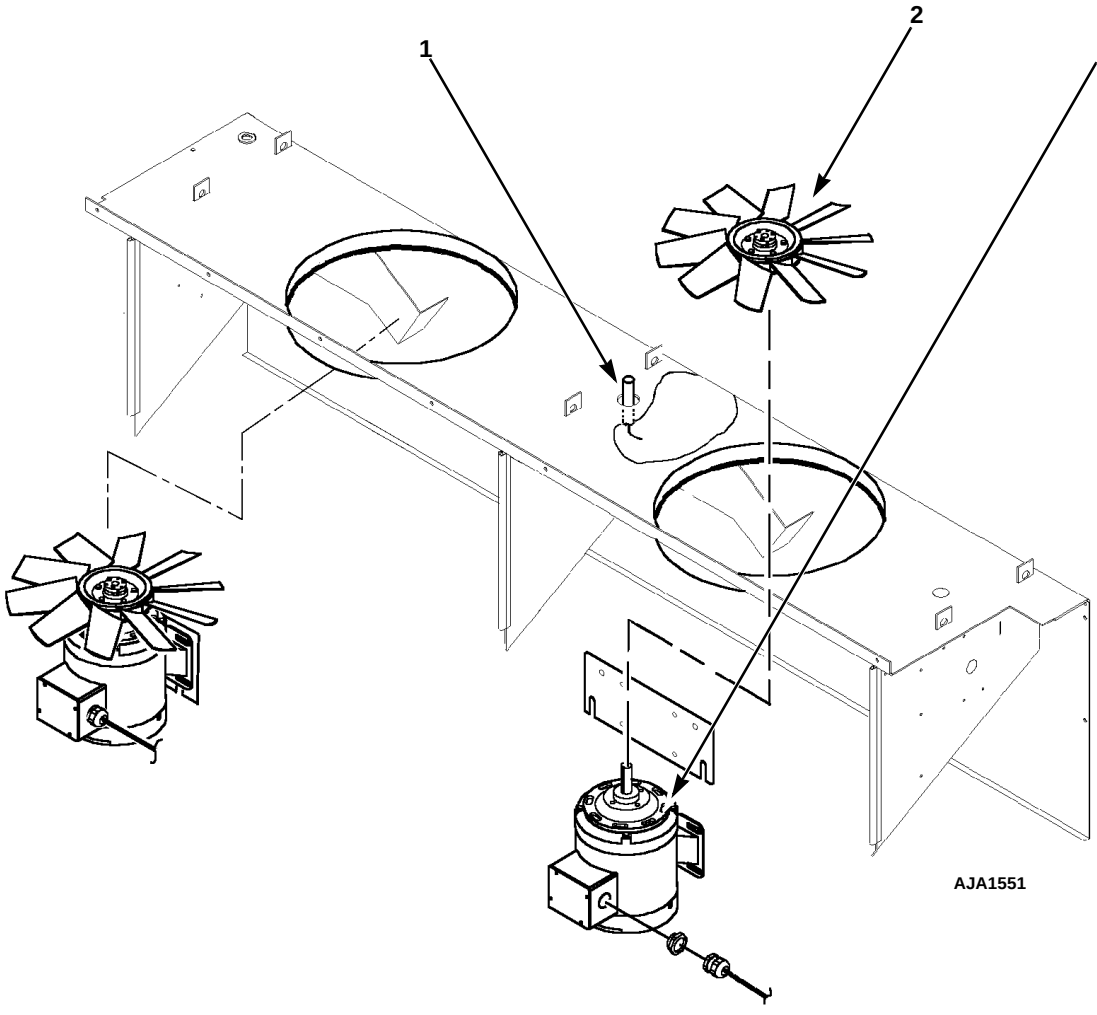
A water-cooled condenser/receiver provides the unit with above and below deck operating capabilities. Condenser fan control can be provided by a Condenser Fan Selection switch or a Water Pressure switch.

The Condenser Fan switch is provided on the control box with the water-cooled condenser option. Place the Condenser Fan On/Off switch in the Water position for water-cooled condenser operation.



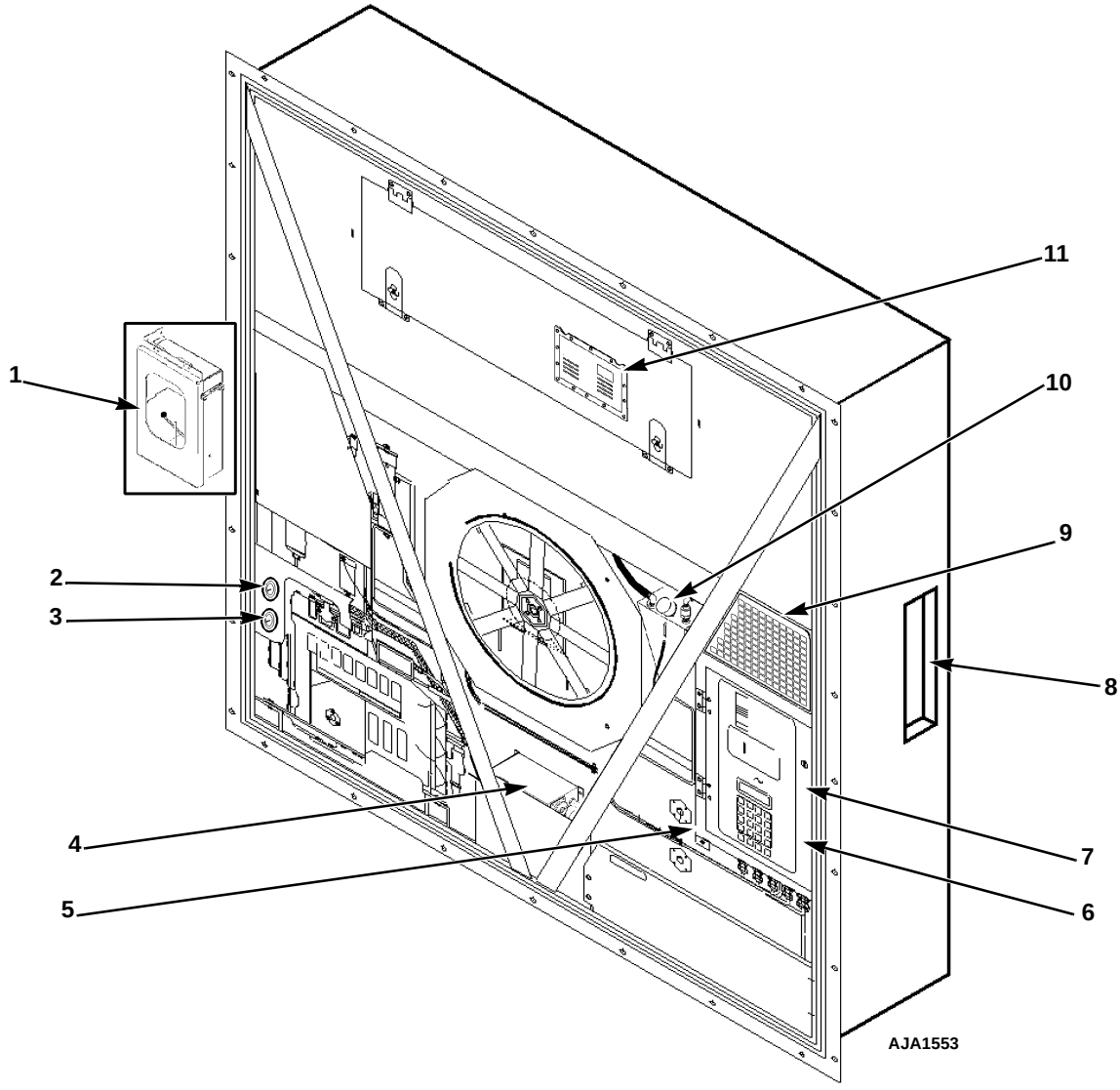
1.	Evaporator Access Door (40.08 in) Wide with two latches-Models with two evaporator fans	6.	Power Cord Storage Compartment
2.	Condenser Fan	7.	Control Box
3.	Compressor Compartment	8.	Rear Download and USDA Receptacle Panel (Access from inside container)
4.	Supply Air Sensor Probe Holder, Left Hand (Next to compressor)	9.	Fresh Air Exchange Vent
5.	Supply Air Sensor Probe Holder, Right Hand		

Figure 7: Unit Front View - CRR



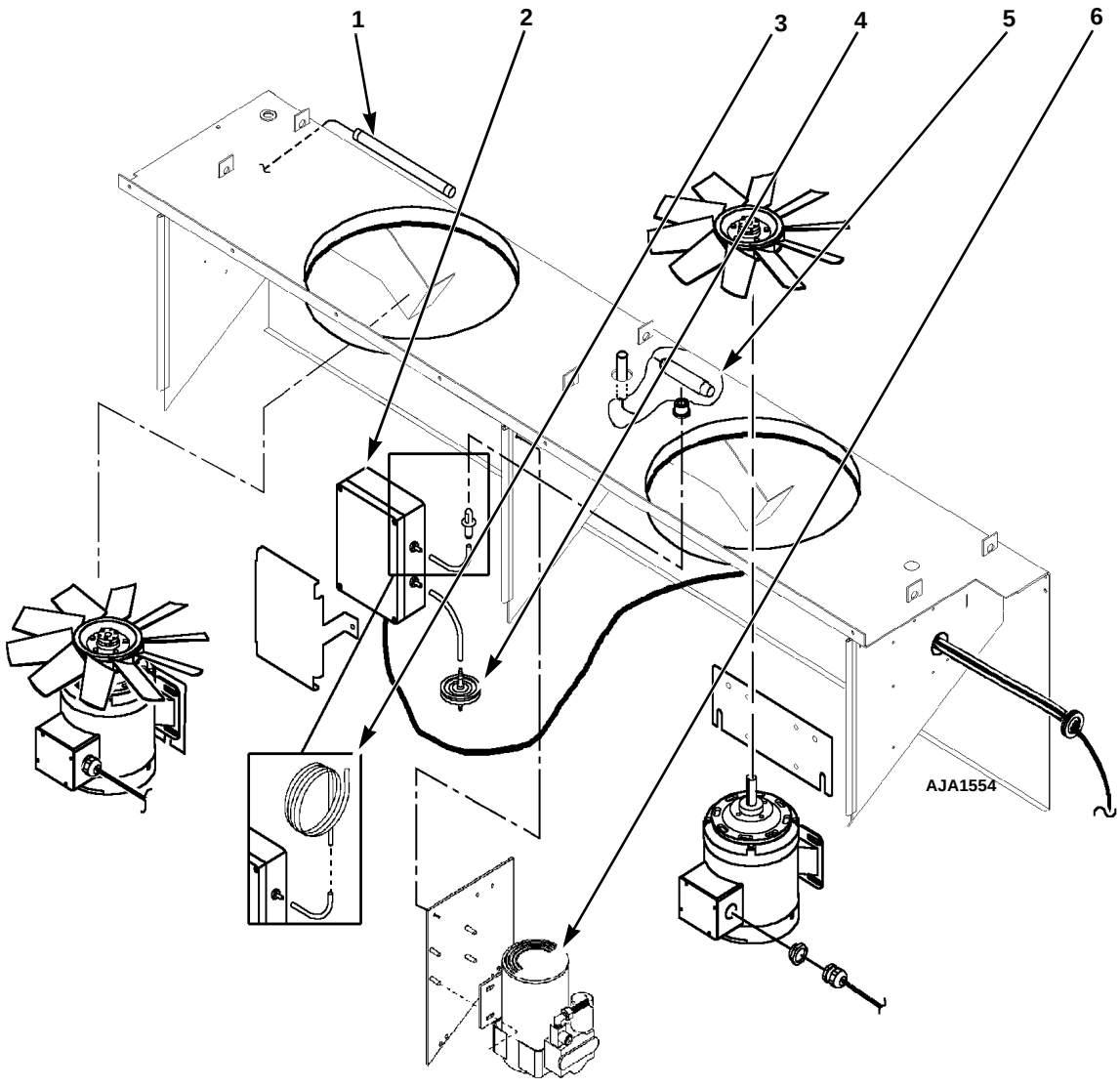
1.	Return Air Sensor
2.	Evaporator Fan Blade
3.	Evaporator Fan Motor

Figure 8: Evaporator Front View - CRR



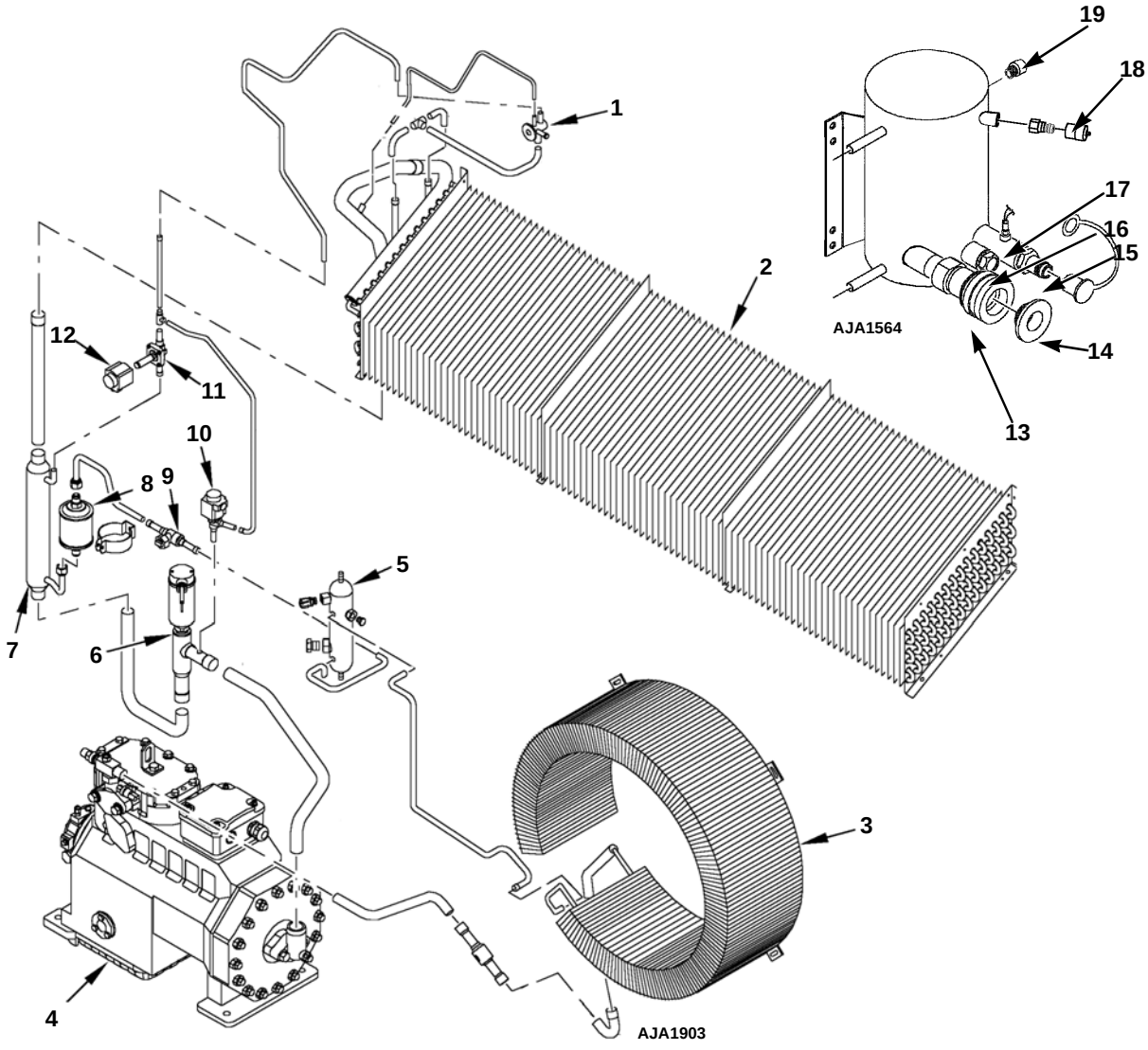
1.	Recording Thermometer Option	7.	Remote Monitor Modem for Power Line Communications (Refcon control modem inside control box)
2.	Suction Pressure Gauge Option	8.	USDA Sensor Receptacle Option (Access from inside container)
3.	Discharge Pressure Gauge Option	9.	Advanced Fresh Air Management (AFAM) Option
4.	Dual Voltage Option, see page 2-13	10.	Humidity System Option
5.	Remote Monitor Plug Option (4-Pin Connector on Side of Control Box)	11.	TransFresh® Option, Complete
6.	Thermistor Lead Option (Lead inside control box)		

Figure 9: Options-Unit Front View



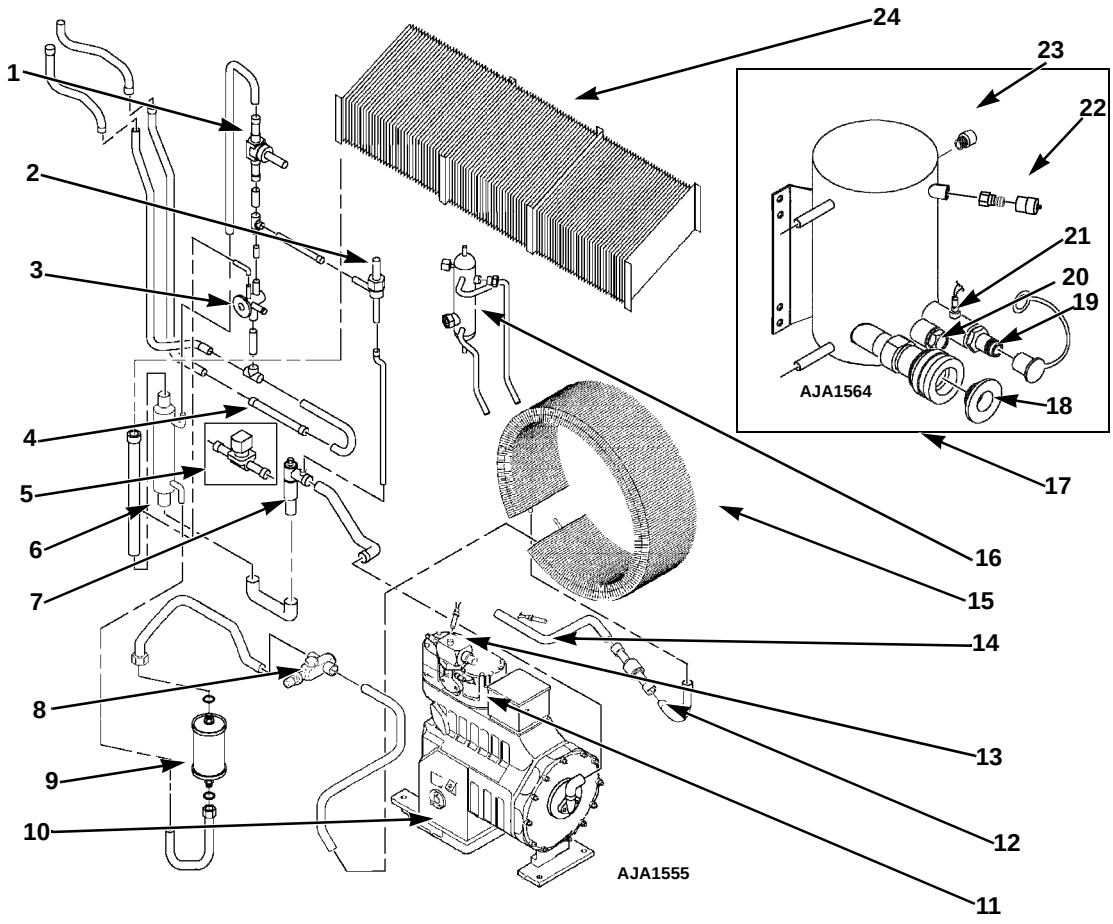
1.	Sensing Bulb Option for Recording Thermometer (Return Air)
2.	Gas Sensor Unit for AFAM+ Option
3.	Vent Loop for Gas Sensor (after 4/01) for AFAM+ Option
4.	Filter for Gas SEnsor for AFAM+ Option
5.	Humidity Sensor for Dehumidify Option or Humidity Option
6.	Air Compressor for Humidity System Option

Figure 10: Options - Evaporator Front View



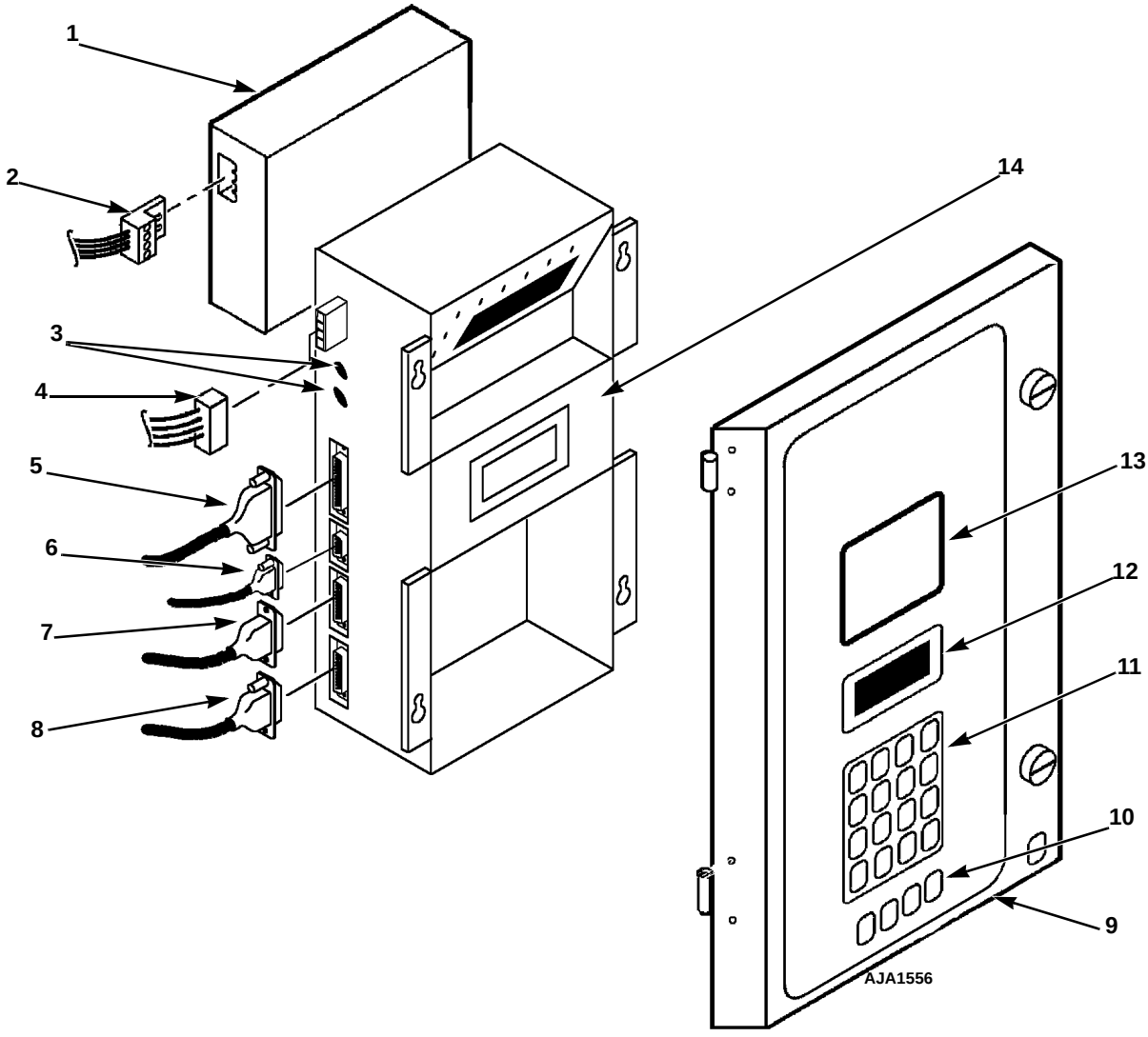
1.	Expansion Valve	11.	Solenoid Valve
2.	Evaporator Coil	12.	Valve Coil
3.	Condenser Coil	13.	Water-Cooled Condenser-Receiver Tank (Option)
4.	Compressor	14.	Water Outlet Coupling
5.	Receiver Tank Compressor	15.	Water Inlet Coupling
6.	KVQ Valve	16.	Sight Glass
7.	Heat Exchanger	17.	Water Pressure Switch (Option)
8.	Dehydrator with O-Rings	18.	Service Port Fitting
9.	Shutoff Valve	19.	Fusible Plug
10.	Solenoid Liquid Injection Valve		

Figure 11: Refrigeration System (Post 2002)



1.	Liquid Line Solenoid Valve	13.	Compressor Discharge Temperature Sensor (CRR40-196 Only)
2.	Liquid Injection Solenoid Valve	14.	Compressor Discharge Line Temperature Sensor (All models except CRR40-196)
3.	Expansion Valve	15.	Condenser Coil
4.	Tube (Standard)	16.	Standard Receiver Tank with Service Port Fitting and Fusible Plug
5.	Dehumidify Valve (Pre 2002)	17.	Water-Cooled Condenser-Receiver Tank (Option)
6.	Heat Exchanger	18.	Water Outlet Coupling
7.	KVQ Valve (Evaporator Pressure Regulator)	19.	Water Inlet Coupling
8.	Liquid Line Service Valve	20.	Sight Glass
9.	Filter Drier	21.	Water Pressure Switch (Option)
10.	Compressor Oil Sight Glass	22.	Service Port Fitting
11.	High Pressure Cutout Switch	23.	Fusible Plug
12.	Condenser Check Valve	24.	Evaporator Coil

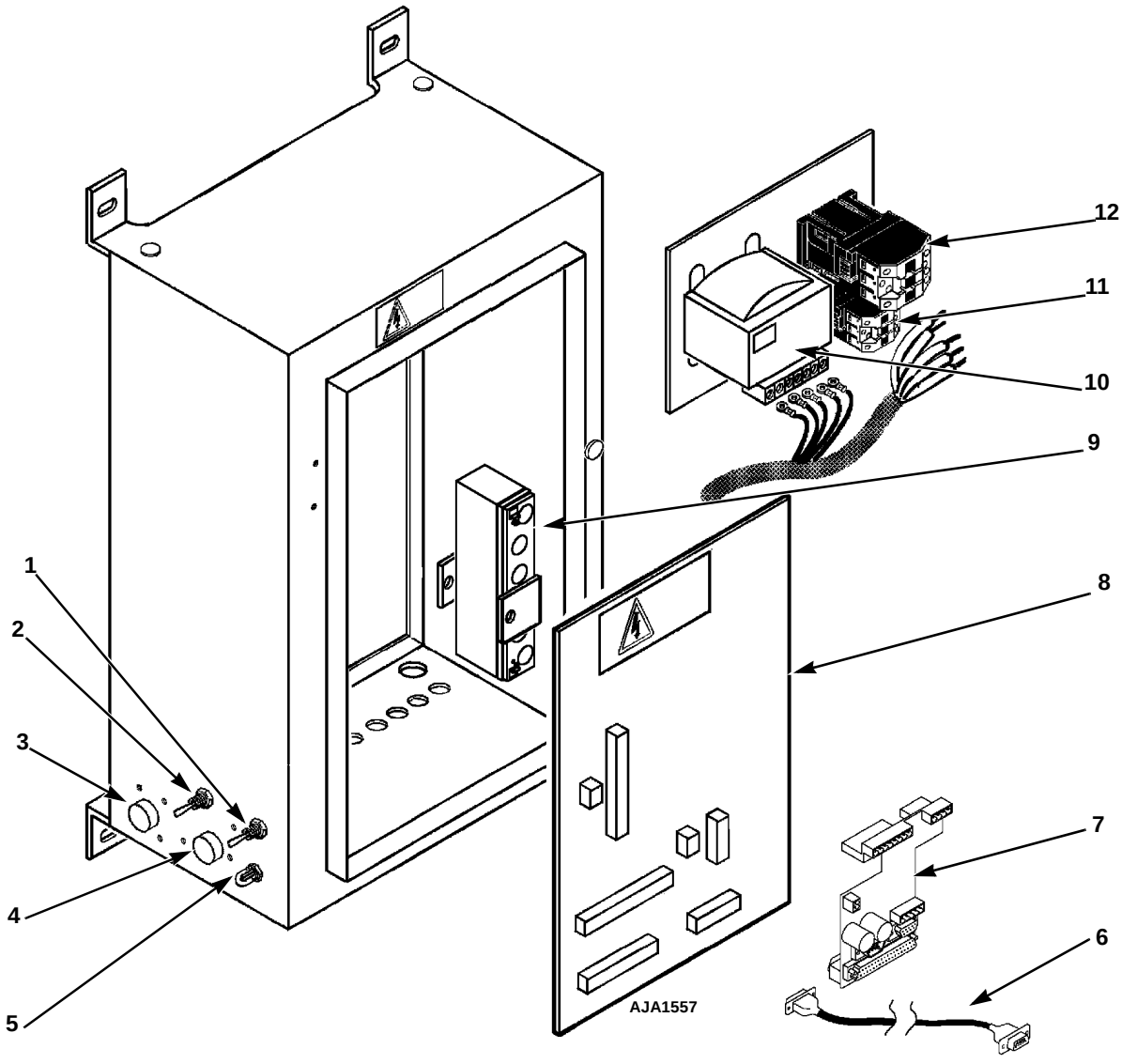
Figure 12: Refrigeration System (Pre 2002)



IMPORTANT:

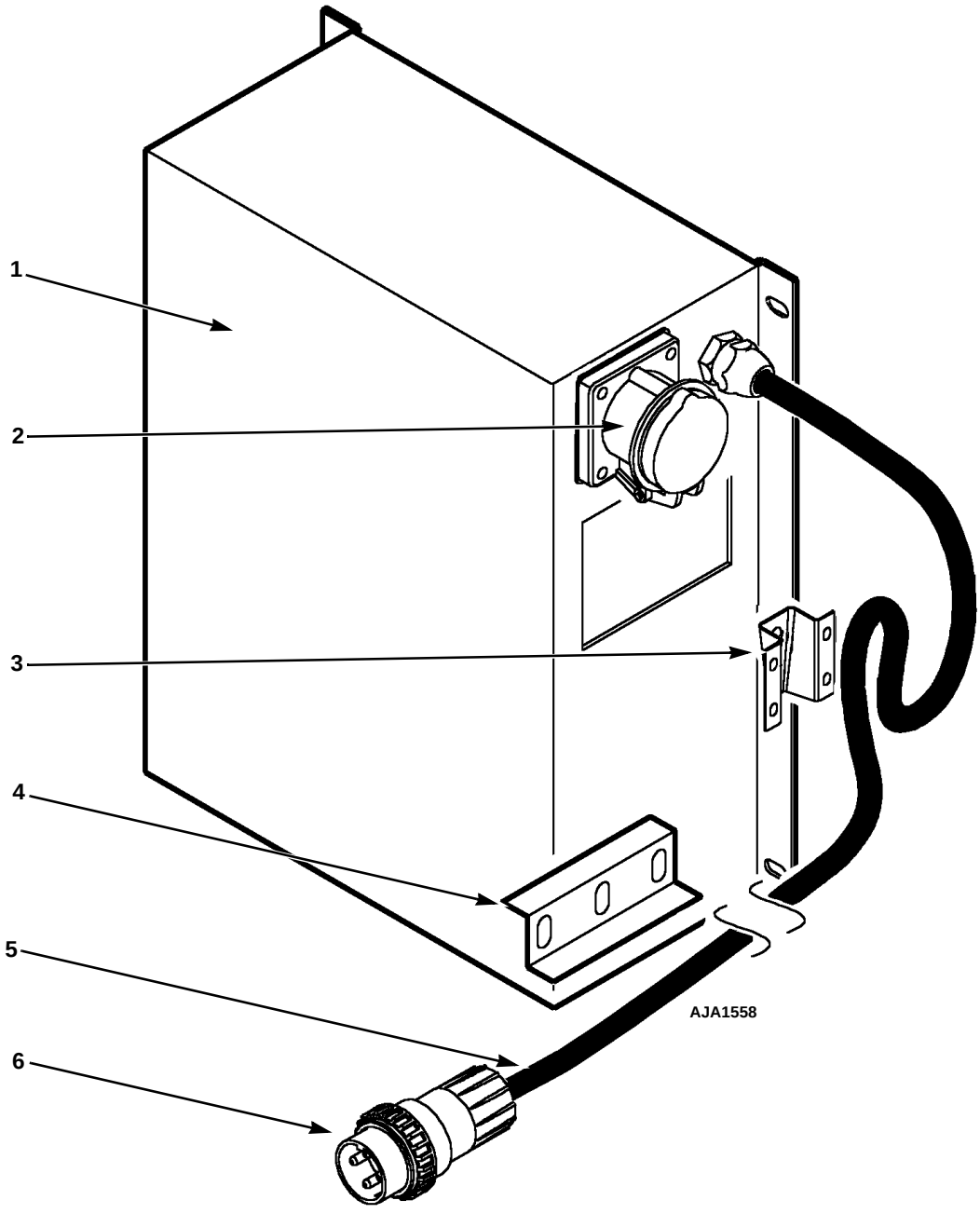
1.	Remote Monitoring Modem (RMM) Option	8.	Cable No. 1 Connection to Controller
2.	Communication Cable for RMM Option	9.	Control Box Cover and Controller Keyboard Decal
3.	Control Circuit Fuses, 2 ampere (2)	10.	Special Function Keypad
4.	Battery Cable Connection to Controller	11.	General Purpose Keypad
5.	Cable No.2 Connection to Controller	12.	LCD Display (Setpoint Temperature, Message and Controller Main Menu Tree Display)
6.	Download Cable Connection to Controller	13.	LED Display (Return or Supply Air Temperature Display and Status Indicator LED's)
7.	Cable No. 3 Connection to Controller	14.	MP-3000a Controller

Figure 13: MP-3000a Controller



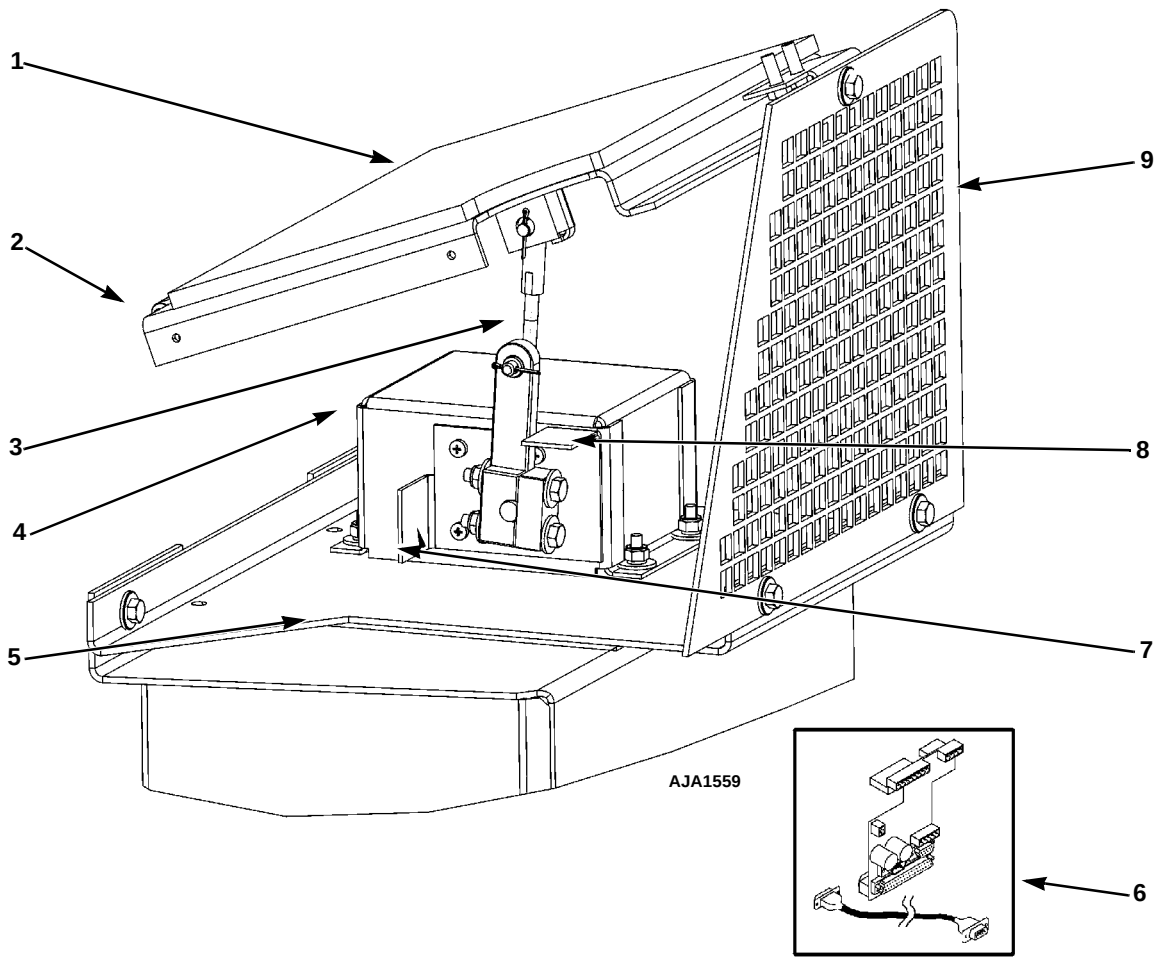
1.	Unit On/Off Switch	7.	Interface Board for AFAM Option and AFAM+ Option
2.	Condenser Fan FAN AIR/WATER Switch (CRR40-Water Cooled Condenser Units Only)	8.	Main Relay Board
3.	Remote Monitor, 4-Pin (Option)	9.	12 Vdc Battery
4.	Communications Cable for AFAM Option and AFAM+ Option	10.	Control Power Transformer
5.	Circuit Breaker	11.	Compressor Contactor
6.	Communications Cable for AFAM Option and AFAM+ Option	12.	25 Ampere Main Power Circuit Breaker

Figure 14: Unit Control Box



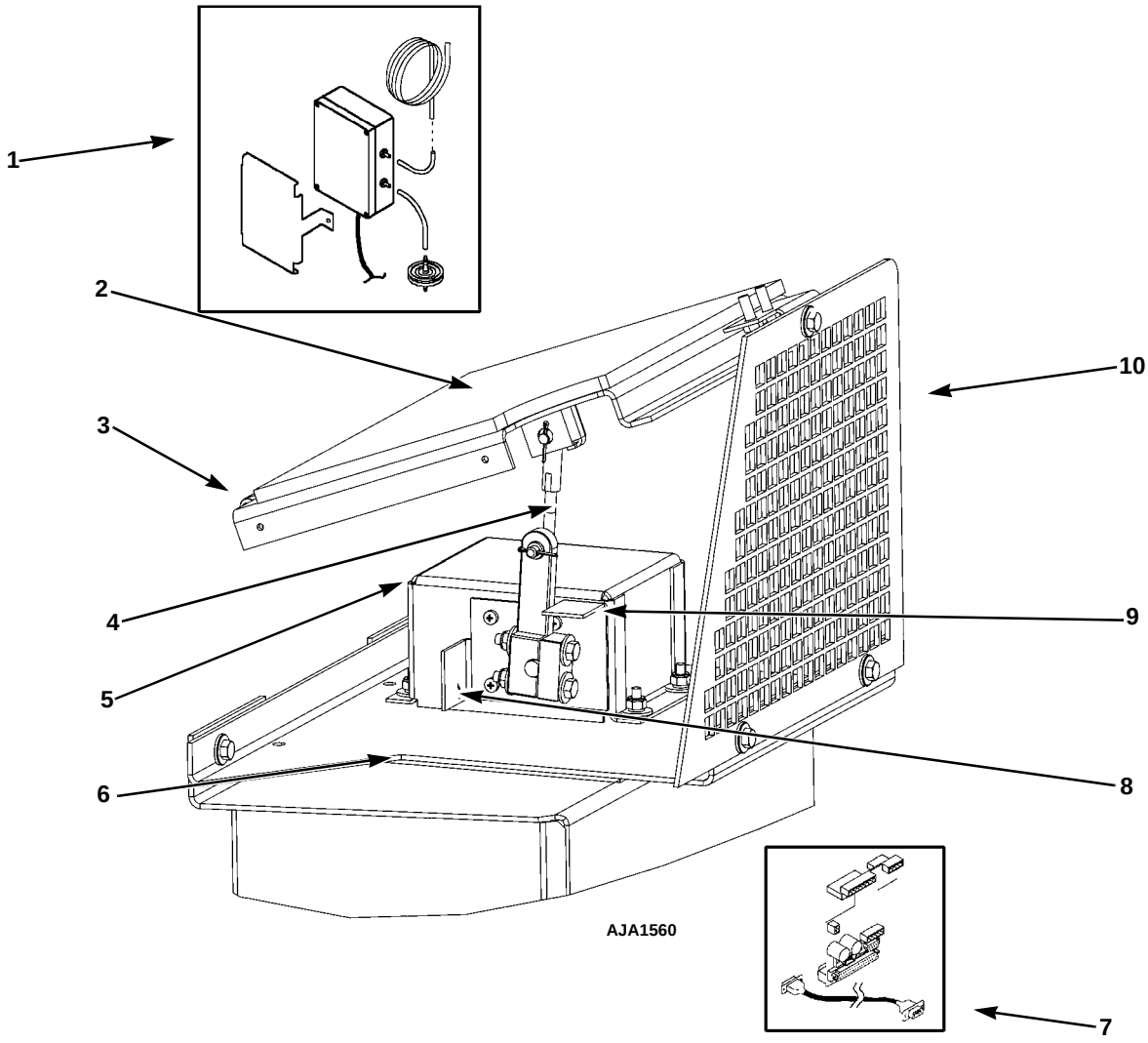
1.	15 KVA Transformer
2.	460-380V Power Receptacle
3.	Cable Bracket
4.	Cable Bracket (Early Units)
5.	230-190V Power Cable
6.	Power Plug (Option)

Figure 15: Dual Voltage Option



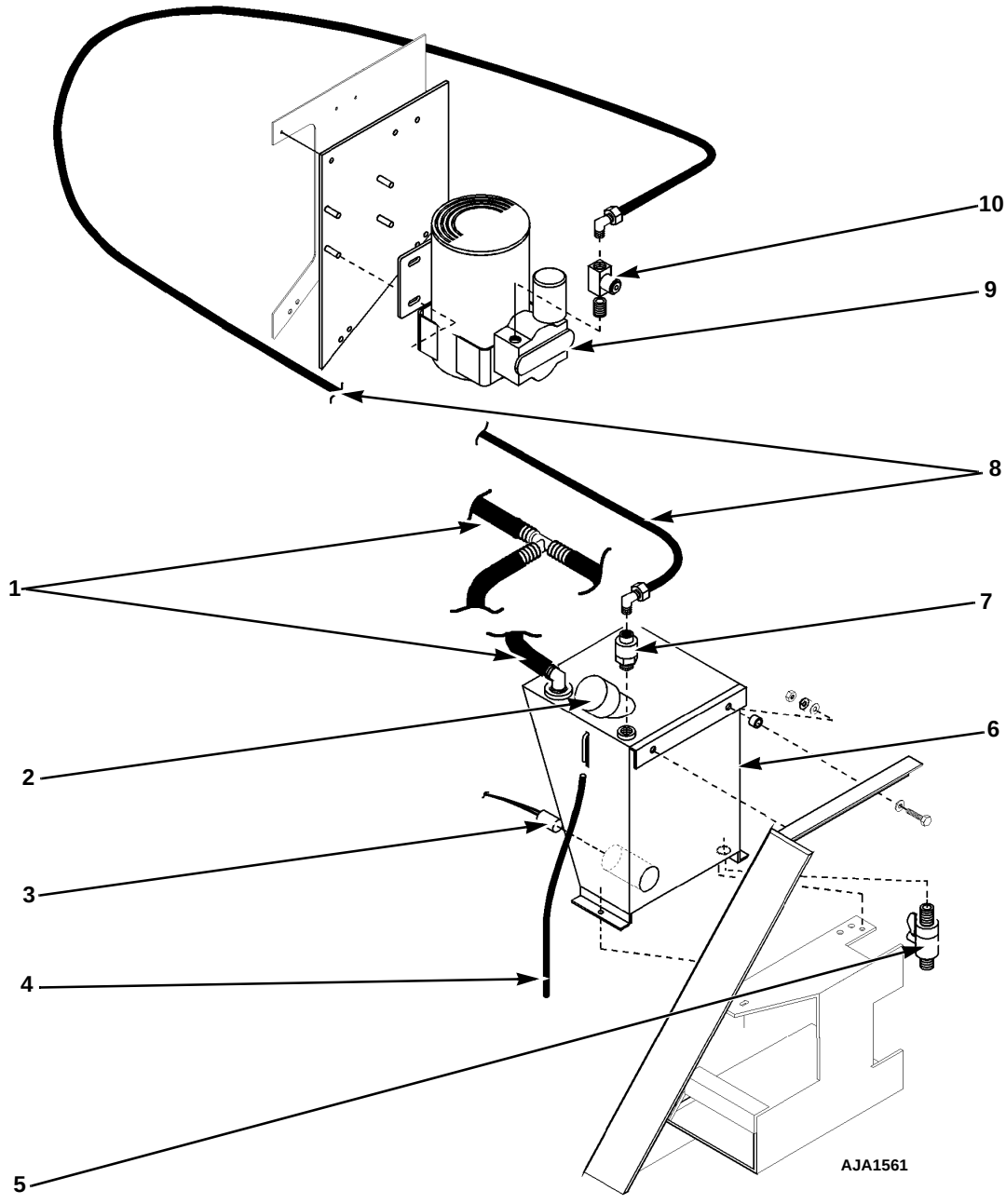
1.	Gasket	6.	Interface Board and Cable (Mounts in Control Box)
2.	Vent Door Assembly	7.	Stop Bracket, Vent Door Full Open
3.	Linkage Assembly	8.	Stop Bracket, Vent Door Closed
4.	Damper Motor Housing	9.	Grille
5.	Damper Motor Assembly Mounting Bracket		

Figure 16: Advanced Fresh Air Management (AFAM) Option



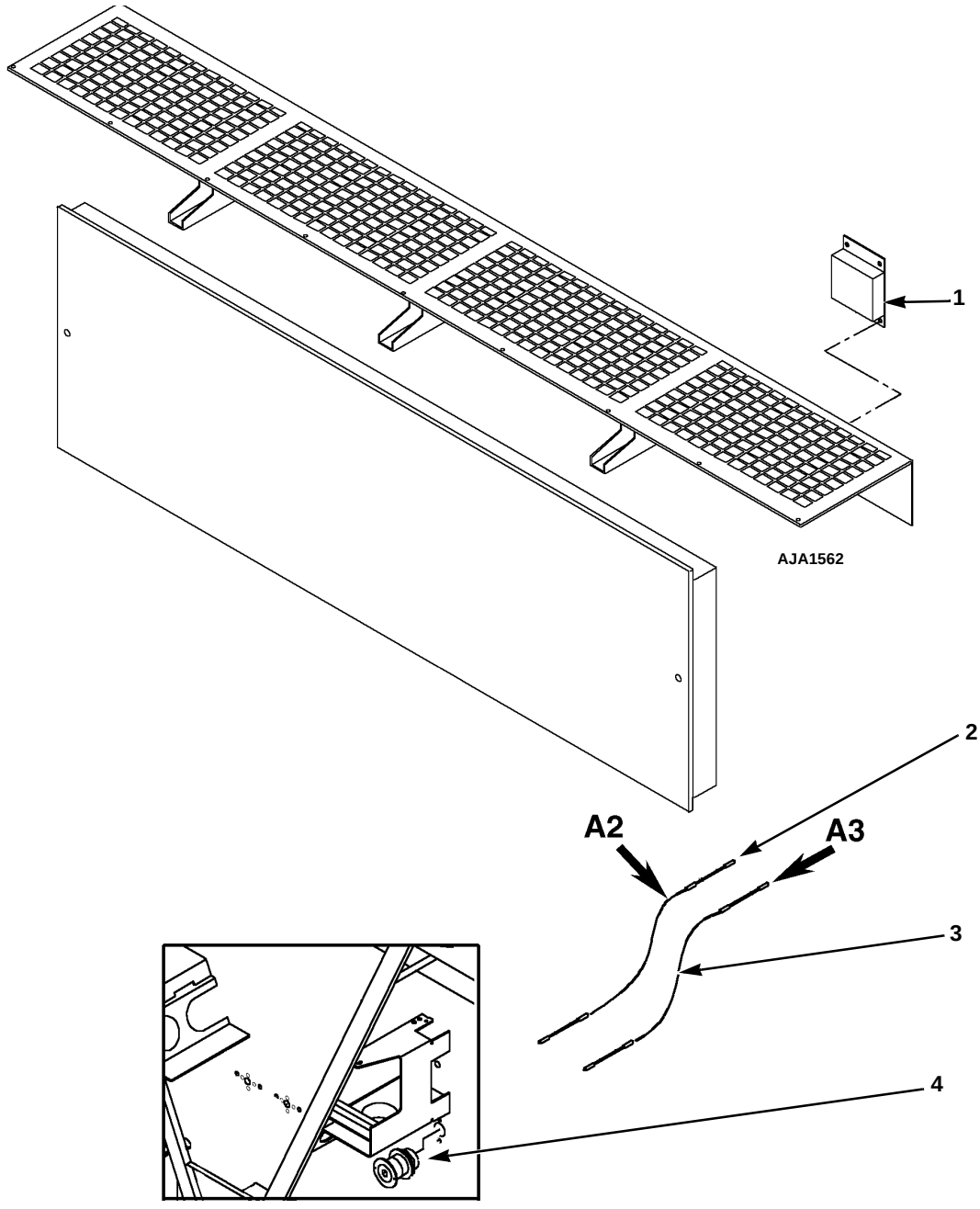
1.	Gas Sensor Assembly (Mounts in Evaporator)	6.	Damper Motor Assembly Mounting Bracket
2.	Gasket	7.	Interface Board and Cable (Mounts in Control Box)
3.	Vent Door Assembly	8.	Stop Bracket, Vent Door Full Open
4.	Linkage Assembly	9.	Stop Bracket, Vent Door Closed
5.	Damper Motor Housing	10.	Grille

Figure 17: Advanced Fresh Air Management Plus (AFAM+) Option



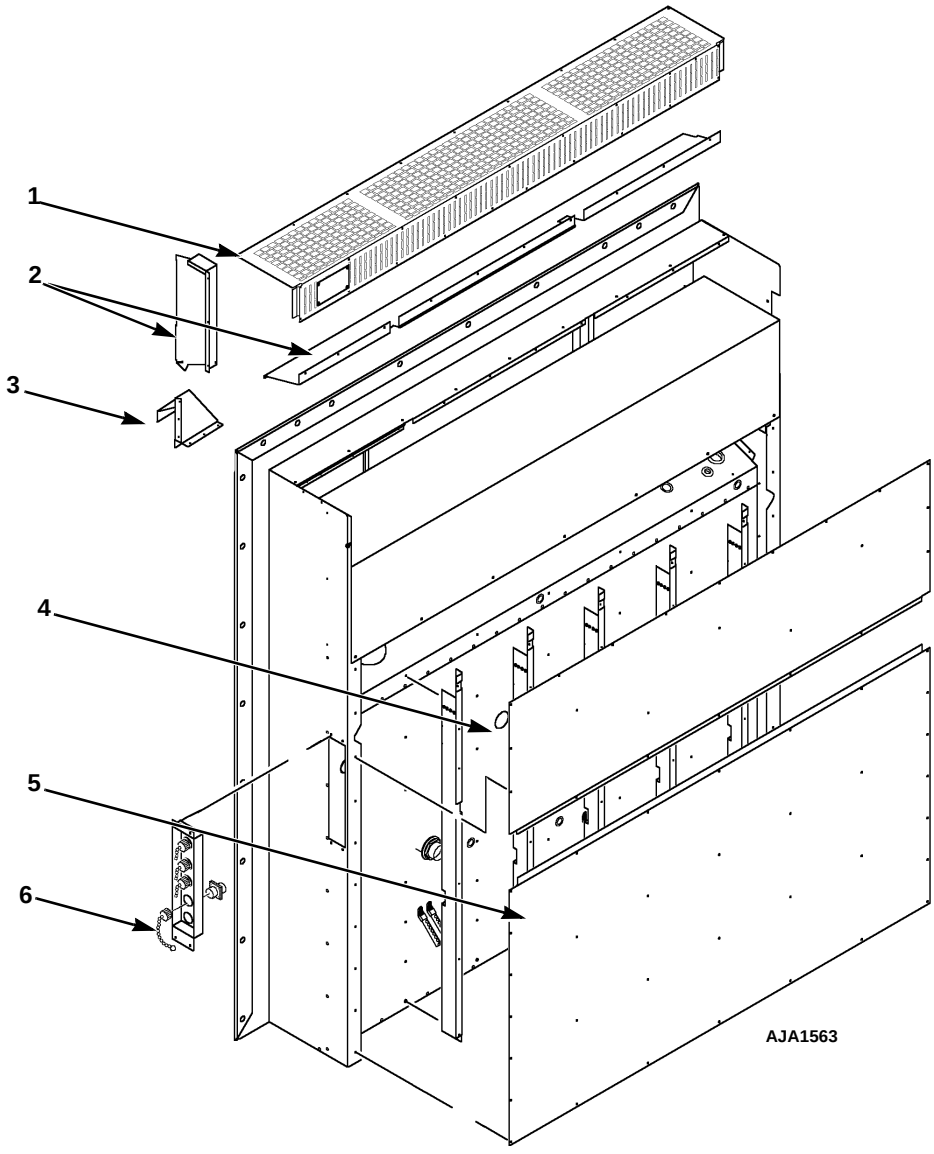
1.	Evaporator Drain Hose	6.	Water Tank
2.	Fill Cap	7.	Water Filter
3.	Water Tank Heater	8.	Water Supply Hose
4.	Tank Overflow Hose	9.	Air Compressor
5.	Drain Cock	10.	Liquid Spray Nozzle

Figure 18: Humidify System Option



1.	TRANSFRESH Box in Evaporator Grille
2.	A2 Wire Harness to TRANSFRESH Transformer
3.	A3 Wire Harness to TRANSFRESH Download Port
4.	Purge Port

Figure 19: TRANSFRESH Provision Option



1.	Evaporator Grille
2.	Air Channels
3.	Fresh Air Inlet
4.	Top Rear Plate
5.	Bottom Rear Plate
6.	Receptacle Panel: • Controller Communications and Data Download Port • USDA1/Spare 1 Sensor Connection • USDA2/Spare 2 Sensor Connection • USDA3/Spare 3 Sensor Connection

Figure 20: Unit Back View

Controller Description

The MP-3000a is an advanced microprocessor controller. It has been specially developed for the control and monitoring of refrigeration units. The controller contains the following basic features:

Temperature Status Display: Displays the controlling sensor temperature (return or supply). Also has 8 status indicator LED's. See the next page for further information.

Message Display: Displays the controller menu, alarms and messages. See the next page for further information.

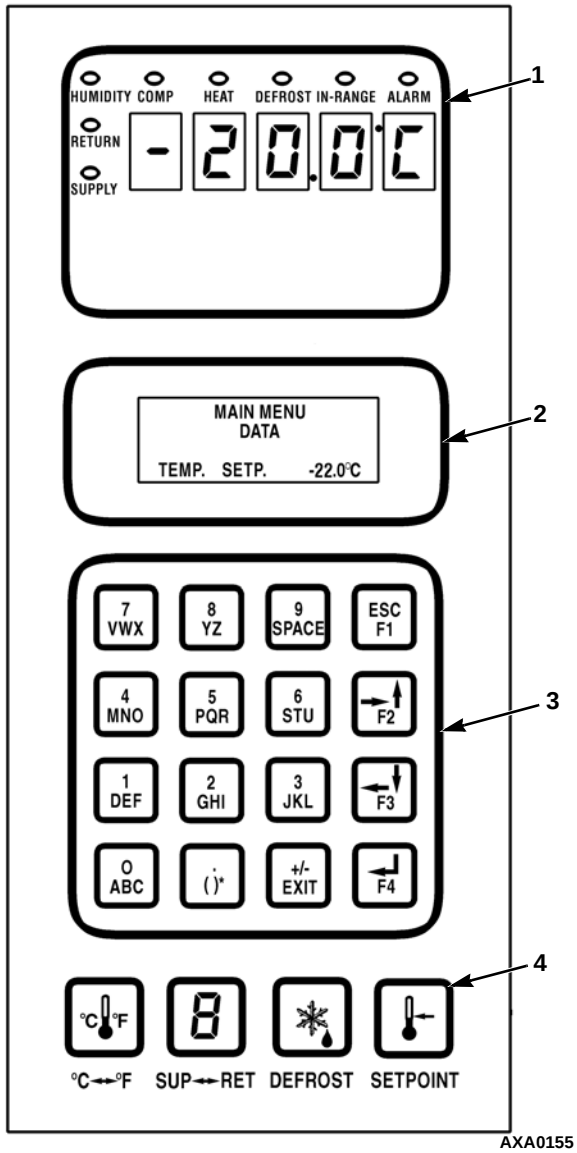
Keypad: Contain sixteen keys used to:

- Navigate/scroll the controller menu
- Enter/change text and numeric characters in the message display.

See the next page for further information.

Special Function Keys: Four special function keys are available to quickly move to a specific area of the controller menu. See the next page for further information.

Each of the above areas will be described in detail on the following pages.



1.	Temperature Status Display
2.	Message Display
3.	Keypad
4.	Special Function Keys

Figure 21: MP-3000a Controller Display Panel

Temperature Status Display

The Temperature Status Display consists of two areas: A 5 digit LED display that shows the sensor temperature in Fahrenheit or Celsius and 8 status indicator LED's.

LED Display

The LED display shows controlling (return or supply) sensor temperature. The sensor temperature shown in LED display is indicated by status indicator lights. If a sensor is out of range the display shows "+Err" or "-Err". The ± sign indicates whether the sensor temperature is out of range high or low. The LED display also shows the test stage of a pretrip (PTI) or function test.

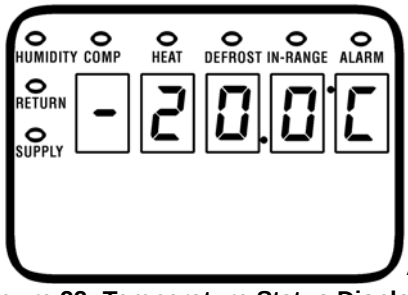


Figure 22: Temperature Status Display

Status Indicator LEDs

Eight status indicator LEDs are located along the top of the Temperature Status Display and signal the following:

- Supply (Air Temperature)
- Return (Air Temperature)
- Humidity Mode (Humidification set to On in Setpoint menu)
- Compressor (Cooling On)
- Heat (On)
- Defrost
- In-range (Temperature)
- Alarm

The indicator LEDs stay on continuously to indicate sensor temperature display, unit operating mode or condition.

The Alarm LED flashes on and off continuously when a Check Alarm or Shutdown Alarm occurs.

Message Display

The Message Display shows setpoint temperature during normal operation.

Alarms, messages and the controller menu also appear in the LCD display when special keys are pressed.

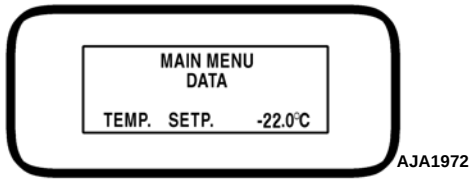


Figure 23: Message Display

Four Special Function Keys

The following four keys are located at the bottom of your controller. These special function keys allow the operator to move quickly to a specific area of information.

Figure 24: Special Function Keys

- **C/F** key: Press to view alternate temperature scale Celsius or Fahrenheit in LED display.
- **DEFROST** key: Press to initiate defrost. Evaporator coil temperature must be below 10 C (50 F).
- **SUP/RET** key: Press to view alternate return/supply sensor temperature in LED display.
- **SETPOINT** key: Press to enter Setpoint menu. The first line of the Setpoint menu is the setpoint temperature. Press **F2** or **F3** key to scroll up or down through the menu list.

NOTE: Press the* 5 *key to increase the display time of the current LCD data screen by 5 minutes. Maximum display time is 30 minutes for data screens and 100 minutes for manual tests.

Keypad

The keys are used to scroll through the Controller menu and enter text and numeric characters.

Menu Scrolling Keys

Display menus: The MP-3000a controller contains an extensive display menu that can be navigated via the 4 menu scrolling keys on the keypad. The display menu is organized into eight main menus.

General text keys **F1**, **F2**, **F3** and **F4** also include directional arrows for entering and scrolling through the controller Main menu:

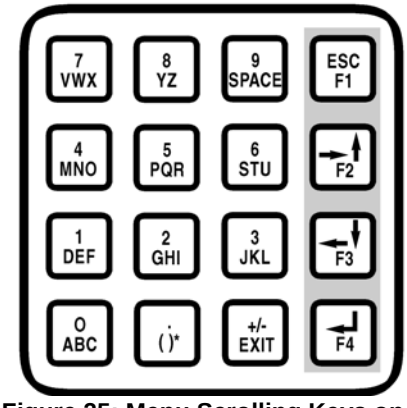


Figure 25: Menu Scrolling Keys on Keypad

- **F1** key: “ESC” indicates that pressing the **F1** key moves the cursor out of (exits) a menu list.
- **F2** key: Forward/Up Arrows indicate that pressing the **F2** key scrolls the cursor forward and/or upward through text boxes and menu lists.
- **F3** key: Backward/Down Arrows indicate that pressing the **F3** key scrolls the cursor backward and/or downward through text boxes and menu lists.
- **F4** key: Enter Arrow indicates that pressing the **F4** key moves the cursor into the next menu level or into a menu item text box.
- Setpoint Menu
- Alarm List Menu
- Data Menu
- REFCON Remote Monitoring (RMM) State
- Data logger Menu
- Miscellaneous Functions Menu
- Configuration Menu
- Commands Menu

NOTE: The screens that display on the controller are determined by the controller software setting and the options installed on the unit. All screens are NOT present on all units.

Text Input

The keyboard supports both numerical and text input. Each key can have more than one meaning. Use the special text keys **F1**, **F2**, **F3** and **F4** to enter text in an information screen:

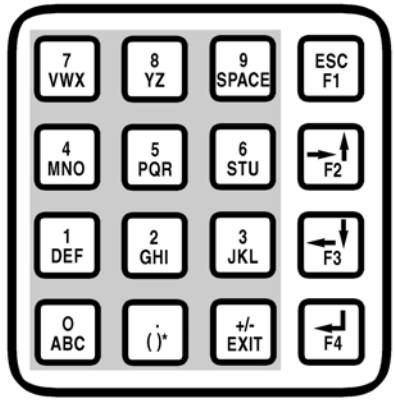


Figure 26: Text Keys on Keypad

F1 key: Press the **F1** key, then press another general purpose key to enter the number shown on the key.

F2 key: Press the **F2** key, then press another general purpose key to enter the first letter shown on the key.

F3 key: Press the **F3** key, then press another general purpose key to enter the second letter shown on the key.

F4 key: Press the **F4** key, then press another general purpose key to enter the third letter shown on the key.

NOTE: When the* F1, F2, F3 *or* F4 *key is pressed to enter a character in the display, the keypad remains on that “character level” until another “level” is selected by pressing the* F1, F2, F3 *or* F4 *key.

Text Input Example

The following paragraph gives an example of how to enter text to an informational screen.

To enter “THERMO” in an information screen:

- Enter “T” by pressing the **F3** key, then pressing **STU** key.
- Enter “H” by pressing the **GHI** key.
- Enter “E” by pressing the **DEF** key.
- Enter “R” by pressing the **F4** key, then pressing the **PQR** key.
- Enter “M” by pressing the **F2** key, then pressing the **MNO** key.
- Enter “O” by pressing the **F4** key, then pressing the **MNO** key.

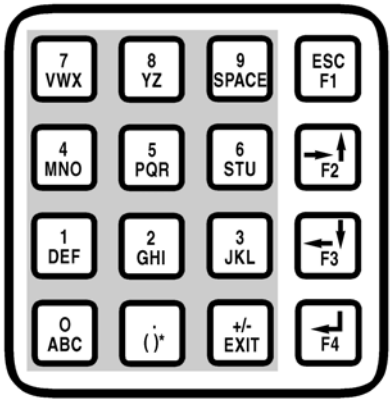


Figure 27: Text Keys

Navigating the Controller Operating Menu

The MP-3000a contains an extensive operating menu. The menu is navigated via the controller keypad. The Main menu is divided into eight major areas:

- Setpoint
- Alarm List
- Data
- RMM State
- Datalogger
- Configuration
- Misc. Functions
- Commands

A complete listing of the controller operating menu is located on an 11’ x 17’ fold out in the Wiring and Diagram section in the back of the manual (see last page in book). It is designed to be folded out so you can continuously view it as you are learning how to navigate the MP3000a Controller Menu. It is recommended to fold this menu out and leave it folded out until you become familiar with the controller menu.

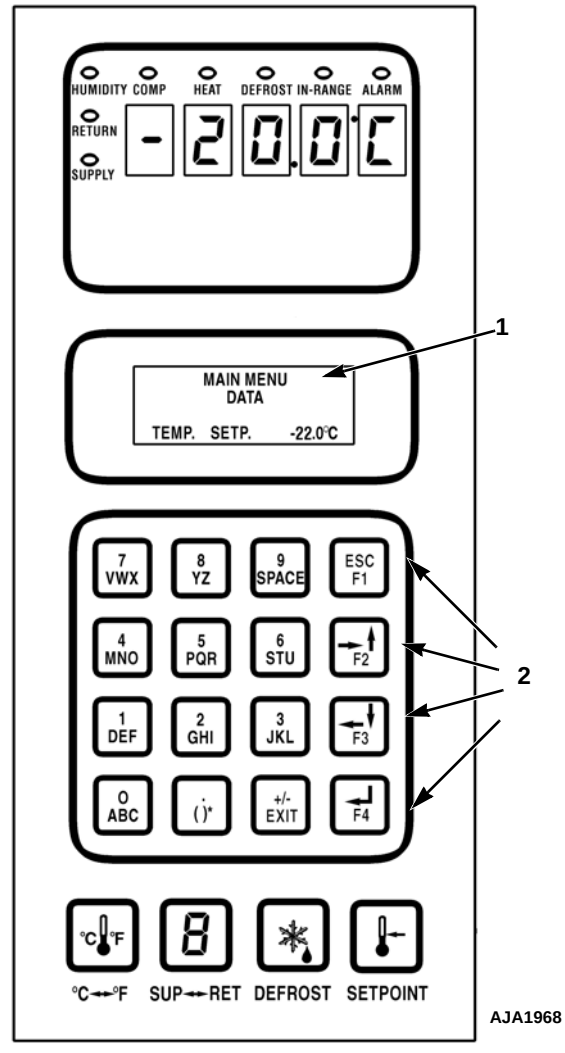
Menu Scrolling Keys

Moving through these eight menus, their submenus and entering commands requires the use of four keys:

Press the **F1** key each time you want to exit a submenu shown in the message display.

Press the **F2** or **F3** key each time you want to scroll up or down in a menu or submenu shown in the Message Display; or scroll forward or backward in a menu line.

F4 key: Press the **F4** key to enter a new menu or submenu; to access a menu line to enter information; or to load a command or value.



1.	Message Display
2.	Menu Scrolling Keys

Figure 28: MP-3000a Controller Display Panel

1. Display menus: The MP-3000a controller contains an extensive display menu that can be navigated via keypad. The display menu is organized into eight main menus:

   NOTE: The screens that display on the controller are determined by the controller software setting and the options installed on the unit. All screens are NOT present on all units.

   - Setpoint Menu: Menu screens in this group are used to enter the temperature setpoint and set the Economy mode. Setpoint menu option functions include: set Bulb mode or dehumidify operation and enter humidity setpoint, set AFAM, set AFAM delay, set AFAM rate, set O_2 Minimum, set CO_2 Maximum and OPTI-SET.
   - Alarm List Menu: Menu screens in this group display a list of alarm code(s).
   - Data Menu: Menu screens in this group are used to display unit operating information including sensor temperatures, voltage, current and frequency information.
   - REFCON Remote Monitoring (RMM) State: Menu screen show current remote monitoring state (Offline, Zombie or On-line).
   - Data logger Menu: Menu screens in this group display temperature log, event log, set log time and PTI log.
   - Configuration Menu: Menu screens in this group display refrigerant type, in-range setting, container ID, contrast (screen), language, unit type, reefer type, AFAM option, evaporator type, condenser type, USDA type, AFAM units and other unit settings.
   - Miscellaneous Functions Menu: Menu screens in this group display date/time, C/F, cargo data, program version and run time (hourmeters) information.
   - Commands Menu: Menu screens in this group are used to activate pretrip (PTI) tests, function tests, manual function tests, and power management.

   A complete listing of the controller operating menu is located on an 11’ x 17’ fold out in the Wiring and Diagram section in the back of the manual (see last page in book). It is designed to be folded out so you can continuously view it as you are learning how to navigate the MP3000a Controller Menu. It is recommended to fold this menu out and leave it folded out until you become familiar with the controller menu.

Operating Instructions

Unit Control Box

1. UNIT ON/OFF SWITCH.
   a. ON position. Unit will operate on cool or heat depending on the controller setpoint temperature and the container air temperature.
   b. OFF position. The unit will not operate.
2. CONDENSER FAN SWITCH (Water-Cooled Condenser Option - Model CRR40-303, 119, 172, 800 Only).
   a. FAN AIR position. Condenser fan operates as required during cooling to provide air-cooled condensing.
   b. WATER position. Condenser fan does NOT operate so refrigerant condensing can be provided by the water-cooled condenser.

NOTE: Water-cooled condenser requires a water flow of 19 to 38 l/min. (5 to 10 gal./min.) when Condenser Fan On/Off switch is on WATER.

MP-3000a Controller

The MP-3000a microprocessor controls all unit functions to maintain the cargo at the proper temperature. The controller also monitors and records system faults and performs pre-trip.

1. KEYPAD. Sixteen general purpose keys are used to display information, change the setpoint, change programmable features and initiate control tasks.
2. °C–°F KEY. Press this key to view temperatures in the LED display in the alternate temperature value. Alternate value (C or F) shows while the key is pressed.
3. SUP/RET KEY. Press this key to view the alternate sensor temperature in the LED display. Alternate sensor (return or supply) shows while the key is pressed.
4. DEFROST KEY. Press this key to initiate a manual defrost cycle. If the evaporator coil temperature is below 18 C (65 F), the unit will defrost and the controller will display “Defrost Activated” in the LCD display.

   If the unit ***is not*** below 18 c (65 F) the controller will display “Defrost Not Activated” in the LCD display and the unit will continue normal operation.
5. SETPOINT KEY. Press this key to change the setpoint. Cursor in the LCD display automatically appears in the “TEMP SETP” line of the Data menu. See “Changing the Setpoint” in the MP-3000a Controller chapter for complete instructions.
6. STATUS INDICATOR LEDs located in the large LED display signal:
   - Supply (Air Temperature)
   - Return (Air Temperature)
   - Humidity Mode (Humidification Option set to On in
   - Setpoint menu)
   - Compressor (Cooling On)
   - Heat (On)
   - Defrost
   - In-Range (Temperature)
   - Alarm

   The In-range LED illuminates when the controlling air sensor temperature is less than 1.5C (2.7 F) above setpoint (standard). The controller maintains the in-range signal during defrost and after defrost for 60 minutes.

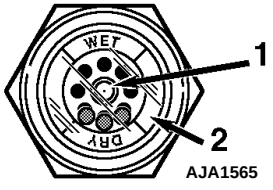
   If the controlling air sensor temperature goes out-of-range, the controller maintains the in-range signal for 5 more minutes.
7. LED DISPLAY. Large red LED display shows current control temperature during normal operation. LED display also shows current test state during a Pretrip (PTI) or Function test.
8. LCD DISPLAY. A 4-line LCD message display shows setpoint during normal operation. LCD display also shows controller menu and unit operation information when special keys are pressed.

Other Unit Controls

1. EVAPORATOR OVERHEAT SWITCH. A temperature switch near the evaporator coil opens to de-energize the heater contactor if the evaporator temperature reaches 54 +/- 3 C (130 +/- 5 F). The switch closes (resets) when the evaporator temperature decreases to 38 +/- 4.5 C (100 +/- 8 F).
2. WATER PRESSURE SWITCH (OPTION). When water pressure greater than 117 +/- 21, 1.17 +/- 0.21 bar, 17 +/- 3 psig is provided to the condenser-receiver tank, the water pressure switch opens. This causes the controller to stop condenser fan operation. When the water pressure decreases below 35 +/- 21 kPa, 0.35 +/- 0.21 bar, 5 +/- 3 psig, the switch closes, causing the controller to place the unit on air-cooled condenser fan operation.

   NOTE: Water-cooled condenser requires a water flow of 19 to 38 l/min. (5 to 10 gal./min.).

Unit Instruments



1.	Moisture Indicator: Light Green = Dry Yellow = Wet
2.	Outer ring is color coded. Compare to indicator

Figure 29: Receiver Tank Sight Glass

1. RECEIVER TANK SIGHT GLASS. A sight glass on the receiver tank contains three small balls that indicate the level of refrigerant in the tank for checking the refrigerant charge. A moisture indicator in the sight glass changes color to indicate the level of moisture in the system. Check the color of the indicator against the color decal in the sight glass. The dry eye in the sight glass is LIGHT GREEN when the system is dry and YELLOW when the system is wet (contains excessive moisture).
2. COMPRESSOR OIL SIGHT GLASS. A compressor oil sight glass indicates the relative level of compressor oil in the compressor sump.
3. SUCTION PRESSURE GAUGE (OPTION). A suction pressure gauge indicates the refrigerant pressure in the suction line returning to the compressor.
4. DISCHARGE PRESSURE GAUGE (OPTION). A discharge pressure gauge indicates the refrigerant pressure in the discharge line leaving the compressor.
5. RECORDING THERMOMETER (OPTION). The recording thermometer indicates and permanently records the temperature of the supply air leaving the evaporator section on a calibrated chart.
6. POWER LINE COMMUNICATIONS MODEM (OPTION). A REFCON remote monitoring modem is available to provide remote monitoring via the power cable. High speed transmission reads all controller information.

Unit Protection Devices

1. MAIN CIRCUIT BREAKER. A 25 ampere manual reset circuit breaker protects the 460/380V power supply circuit to the unit electric motors and control system transformer. The main power circuit breaker is located in the control box.
2. CONTROL SYSTEM CIRCUIT BREAKER. A 7 ampere manual reset circuit breaker or a 7 ampere ATO fuse protects the 29 Vac control circuit. The circuit breaker is located in the control box beside the On/Off switch. The ATO fuse is located inside the control box on the right side wall.
3. FUSES. A number of fuses are located on the main relay board and controller to protect unit circuits and components.
   - Three 20 amp fuses protect high voltage circuits on the main relay board.
   - A 2 amp fuse protects the controller’s 28 Vac system.

- A 2 amp fuse protects the controller's battery charging circuit.

4. COMPRESSOR DISCHARGE LINE TEMPERATURE SENSOR. The controller uses the compressor discharge line temperature sensor to protect the compressor from excessively high operating temperatures and activate liquid injection during Chill mode (setpoints at -9.9 C [10.1 F] and above).

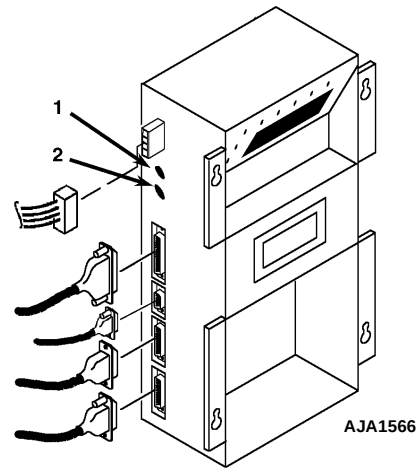
   a. High Temperature Protection:

      - The controller immediately stops unit operation if the discharge gas temperature increases to 130 C (266 F). The controller turn ON the Alarm LED and records Alarm 56, Compressor Temperature Too High. The controller restarts the unit when the sensor temperature is below 90 C (194 F).

   b. Compressor Discharge Temperature Control (Chill Mode Only):

      - Controller energizes the liquid injection valve when compressor discharge gas temperatures are between 115 C and 125 C (239 F and 257 F). The controller pulses the liquid injection valve open and closed on a 1 minute duty cycle. For example, the valve may be energized for 15 seconds and de-energized for 45 seconds. Number of seconds the valve is energized is based on the discharge temperature and the KVQ valve setting.

      - Controller energizes the liquid injection valve when the KVQ Setting less than 5 C (8.9 F) below the return air temperature. The controller energizes liquid injection valve for 6 seconds every 60 seconds regardless of the discharge temperature.



1.	28 Vac Control Circuit Fuse, 2 ampere
2.	28 Vac Control Circuit Fuse, 2 ampere

Figure 30: Control Circuit Fuses

5. HIGH PRESSURE CUTOUT (HPCO) SWITCH. If the compressor discharge pressure rises above 2240 +/- 70 kPa, 22.4 +/- 0.7 bar, 325 +/- 10 psig, the high pressure cutout opens to interrupt the ground circuit to the compressor contactor:

   - Compressor STOPS immediately.
   - Evaporator and condenser fans continue normal operation. Controller determines that a high pressure cutout switch is open when the unit current draw decreases by 7 amps for more than 3 seconds.
   - The controller LCD display shows a High Pressure Cutout message in the Misc. Function Status menu: "High Pressure Cutout Check Condenser Probe" or "High Pressure Cutout Check Condenser Fan".
   - The controller continues to call for cooling so the compressor will restart when the high pressure condition is corrected (switch resets) if power is available. The high pressure switch resets (closes) when the pressure drops to 1590 +/- 70 kPa, 15.9 +/- 0.7 bar, 230 +/- 10 psig.
   - If the switch remains open for 5 minutes, controller also activates Alarm LED and records Alarm 37, Total Power Consumption Too Low.

6. FUSIBLE PLUG FOR HIGH PRESSURE RELIEF. A fusible plug is installed in the receiver tank to avoid excessive pressure build-up within the refrigeration system from extraordinary and unforeseen circumstances. The plug blows when the plug temperature reaches 100 C (212 F). The plug is located so that refrigerant pressure expelled from the valve would be directed away from anyone servicing the unit. The plug is non-repairable and requires no adjustment. If the plug blows, recover the remaining refrigerant charge and replace the fusible plug.
7. OVERLOAD PROTECTION. The condenser fan motor, evaporator fan motors and compressor motors include internal overload protection with automatic reset.
8. PHASE SEQUENCE SELECTION. When the On/Off switch is turned ON, phase sensors on the main relay board determine the incoming power phase to ensure proper condenser and evaporator fan rotation.

Starting the Unit and Adjusting the Controller Setpoint

CAUTION: Supply power connections from the unit to the power source must always be made with the refrigeration Unit On/Off switch and power supply

1. Connect the unit power cord to proper power source:
   - 460/380V power cord to 460/380V, 60-50 Hz power source.
   - For operation on 230/190V power, insert the 460/380V power plug into the dual voltage transformer receptacle. Then connect the 230/190V power cord to a 230/190V, 60-50 Hz power source.
   - Turn the power supply On/Off switch ON.
2. Switch the Unit On/Off switch to ON position. Check for condenser fan and evaporator fan motor operation (see “Condenser Fan and Evaporator Fan Rotation” in the Electrical Maintenance chapter of this manual). If the unit was properly pretripped, correct condenser fan rotation will also indicate correct evaporator fan rotation.
3. Adjust controller setpoint to the desired temperature:

   NOTE: The setpoint temperature can be set between -30 C and +30 C (-22 F and +86 F) in either °F or °C using the °C/°F key. Just press and hold the F/C key (to display the alternate temperature scale).

   - Press SETPOINT key to display cursor flashing in the “TEMP SETP” line.
   - Press F4 key to enter new setpoint. Enter Arrow appears in the menu line and the current setpoint disappears.
   - Enter minus sign first by pressing EXIT key. Then press numeric keys to enter new setpoint.
   - With correct setpoint in display, press and hold F4 key until cursor stops flashing. Controller places new setpoint in controller memory and shows new setpoint in LCD display.

   NOTE: New setpoint must be between -30 C and +30 C (-22 F and +86 F) or controller will return to the previous setpoint display.

   NOTE: If the F4 key is not pressed within 30 seconds, the controller will default (return) to the previous setpoint. If this occurs, repeat step 4.

Pretrip Inspection

Visual Inspection

The following inspections should be made before the container is loaded:

1. Visually check the unit for physical damage.
2. Check the electrical connections in the unit control box, making sure they are fastened securely.
3. Check the conditions of wires and terminals. Repair or replace if necessary.

4. Check the refrigeration system for leaks. Inspect for evidence of oil leaks at all joints and connections.
5. Check the condenser and evaporator coils. Clean if necessary. Use an air or water spray jet directed against the coil from the air discharge side. Also inspect the condenser fan grille for damage. If the grille is damaged or missing, abnormally high head pressure may result. Repair or replace the grille if necessary.

CAUTION: Air or water spray jet pressure should not be high enough to damage (bend) coil fins.

6. Check the mounting bolts on the unit, compressor and fan motors. Tighten if necessary.
7. Clean the defrost drains.
8. Optional: Inspect water-cooled condenser-receiver tank, water lines and fittings for water leaks. When water lines are disconnected, also check to be sure that the water drains completely from the condenser-receiver tank. Report defective fittings and tanks that do not drain to a technician.
9. Optional: Check water level in humidity system tank. Add only demineralized or distilled water to prevent plugging of the atomizing nozzle.
10. Observe the unit for proper operation and functions during Pre-load Operation.
11. Check to be sure the container ID that appears in the Configuration menu is correct.

Functional Inspection

To properly perform a Full Pretrip Test on units equipped with a MP-3000a controller, the container must be empty with the rear doors closed.

1. Start the unit (see "Starting the Unit and Adjusting the Controller Setpoint" on page 3-5). A second sequence start of the required loads occurs during the Pretrip test:
   - Controller LED display turns On and then Off.
   - LED display briefly shows setpoint and then displays the controlling (return) air sensor temperature.
   - Controller senses the incoming power phase and selects the correct power phase to unit components.
   - Controller energizes unit loads, starting the evaporator fans.
   - If the controller calls for cooling, the compressor motor starts and the liquid line solenoid energizes (opens). If the unit starts in Modulation Cool, compressor start-up can be delayed up to 3 minutes while the KVQ valve opens or closes to the required setting.
   - On cooling, the condenser fan starts as required when the unit is on air-cooled condensing operation.
   - If the controller calls for heating, the electric heaters are energized.
2. Check controller setpoint for proper setting. Adjust if necessary.

   NOTE: New setpoint must be between -30 C and +30 C (-22 F and +86 F) or controller will return to the previous setpoint display.
3. Check the direction of the condenser airflow (see "Condenser Fan and Evaporator Fan Rotation" in the Electrical Maintenance chapter of this manual).

   NOTE: If the compressor fails to start, turn the On/Off switch OFF. Then repeat steps 1 through 3. If the unit still does not start, refer to "Alarm Codes, Descriptions and Corrective Actions" in the Controller chapter of this manual. Be sure to wait up to 3 minutes for the compressor to start.
4. Check direction of evaporator airflow (see "Condenser Fan and Evaporator Fan Rotation" in Electrical Maintenance chapter of this manual).
5. Perform a Pretrip (PTI) Test to check the unit refrigeration and electrical systems for proper operation.

CAUTION: The PTI test should only be performed on an empty container!

NOTE: Correct all existing alarm conditions and clear the alarm codes before performing a PTI test. The controller will automatically clear all existing alarms before beginning the PTI test.

To perform a PTI test:

- Press F2 key to enter Main Menu.
- Press F2 or F3 key to scroll up or down in menu to
- "COMMANDS".
- Press F4 key to access COMMANDS menu.
- Press F2 or F3 key to scroll up or down to "PTI".
- Press F4 to start the PTI (Pretrip) Test.
- The controller then performs the Pretrip Test.
- Observe the unit for proper operation and functions during pretrip test.
- LCD display shows PTI Test currently being performed.
- PTI test ends automatically. Press any key on the controller to return the unit to normal operation.
- If an operating problem occurs during the Pretrip Test, the Alarm LED will turn ON and FLASH. An "E" may also appear in the right side of the LED display. View and correct any alarm conditions. Then clear (acknowledge) the Alarm Code(s) and repeat the PTI Test.

NOTE: Clear the Alarm codes ONLY after the alarm codes are documented and problems repaired. A permanent record of the alarm codes remains stored in the datalogger memory for retrieval via DRU-II or SmartSponge™ retriever software.

6. Enter trip ID information into the controller using the keypad.
7. Set the fresh air vent (or Advanced Fresh Air Management system) to the desired air exchange rate.

NOTE: The air exchange rate should be established by the shipper.

- AFAM System: Set the AFAM screen in the Setpoint Menu to UNITS to control the vent door to the fresh air exchange rate setting. Set the AFAM screen to DEMAND to control the vent door to the CO_2 gas level. Then set the AFAM DELAY, AFAM RATE and CO_2 MAX as required.

8. Optional: Operate the humidify system (see "Changing the Humidity Mode Setting").

   NOTE: The use of the Humidify option should be established by the shipper.

   a. Verify that the air compressor operates and that water is drawn into the atomizing nozzle and injected into the return air stream (see "Humidify System").

   b. Adjust the humidity setpoint.

9. Stop the unit by moving the On/Off switch to the OFF position.

Sequence Of Operation

Unit Start-up

A 60 second sequence start of the required loads occurs during initial start-up of the controller. If cooling (or heating) is required, the unit operates in the cool (or heat) mode.

- When the unit On/Off switch is turned ON, the LED display turns On and then Off.
- The setpoint appears briefly in the LED display.

  NOTE: When the setpoint appears in the LED display, both the Return and Supply LEDs are lit.

- The LED then shows the controlling air sensor temperature.
- The controller senses the incoming power phase and selects the correct power phase to unit components.
- The evaporator fan motors start about 40 seconds after the unit was turned ON.

Evaporator fans operate on high speed at setpoints of

9.9 C (14.1 F) and above.

Evaporator fans operate on low speed at setpoint temperatures of -10 C (14 F) and below.

- About 10 seconds later, the compressor starts and the liquid line solenoid energizes (opens) if the controller calls for cooling.
- The condenser fan then starts if the condenser temperature requires condenser fan operation. On units equipped with a water-cooled condenser, the water pressure switch must also be CLOSED or the Condenser Fan Switch on FAN AIR position.
- If the controller calls for heating, the electric heaters are pulsed On and Off to provide heat.
- The controller turns ON the In-range LED when the controlling sensor temperature is within 1.5 C (2.7 F) of the setpoint.

NOTE: If the compressor has been off for more than 18 hours, the controller performs a compressor sequence start. See "Compressor Sequence Start" on page 114 for further details).

NOTE: Random time delays during the initial unit start-up minimize peak current draw.

Loading Procedure

1. Make sure the Unit On/Off switch is OFF before opening the container doors. (The unit may be operating when loading the container from a warehouse with door seals.)
2. Spot check and record load temperature while loading. Especially note any off-temperature product.

Post Load Procedure

1. Make sure all doors are closed and locked.
2. Start unit if unit is OFF.
3. Check controller setpoint for correct setting.
4. Enter trip identification information into the controller memory by selecting "Cargo Data" from the MISC FUNCTIONS menu of the controller.
5. One-half hour after loading, initiate a manual defrost cycle:
   - Press the DEFROST key. The Defrost and Heat LEDs turns ON as the unit enters Defrost. Defrost will stop automatically.

NOTE: The evaporator coil temperature must be below 18 C (65 F) to allow the unit the enter a defrost cycle. If the evaporator coil temperature is too high, the LCD display will read "Defrost Not Activated".

Post Trip Procedure

Trip data recorded by the MP-3000a datalogger may be down loaded via the communications port on the control box using a DRU-II handheld data retriever; or a laptop or palmtop computer with SmartSponge™ software; or via the REFCON remote monitor system.

Change the Setpoint

To change the controller setpoint, turn the **UNIT ON/OFF** switch **ON**. Complete the following steps:

1. Press the **SETPOINT** key. The Setpoint menu appears with the cursor in the [TEMP SETP] line.
2. Press the **F4** key. An Enter Arrow appears in the menu line and the current setpoint disappears.
3. Enter (type) the new setpoint in the LCD display using the general purpose keypad. Press the **EXIT (±)** key first to enter a minus setpoint. The cursor moves to the right of the screen as each key entry is acknowledged and displayed.

   NOTE: Always check that the setpoint entered in the LCD display is correct before proceeding.
4. Press and hold the **F4** key until the cursor stops flashing. The new setpoint is recorded in the controller and appears in the LCD display.

   NOTE: The controller will default (return) to the previous setpoint if the setpoint is not entered within 30 seconds. Repeat steps 1 through 4 if this occurs.

NOTE: Humidity control, humidity setpoint and Economy mode can also be set from the Setpoint menu. See "Setpoint Menu" under "Menu Operating Instructions" in this chapter.

Initiating a Manual Defrost

Turn the **UNIT ON/OFF** switch **ON**. Complete the following steps:

1. Press the **DEFROST** key.
   - If the unit operating conditions allow a manual defrost (e.g. evaporator coil temperature is less than 18 C [56 F]), the unit enters Defrost as the Defrost and Heat LEDs turn on. LCD message display shows [DEFROST ACTIVATED].
   - If unit operating conditions do *not* allow defrost, the LCD message display shows [DEFROST NOT ACTIVATED].
2. The defrost cycle automatically terminates.

   NOTE: A "timed" defrost of the evaporator coil can be performed if frost or ice can not be removed from the evaporator coil by an automatic defrost cycle:

- Activate [HEAT ON] in the Manual Function Test submenu.
- Press the **5** key six times. Heaters will be activated for 70 minutes. Unit then returns to normal operation.

Display Alternate Controlling (Supply or Return) Air Sensor Temperature

The controller can show either the supply or return air temperature in the LED Display. Turn **UNIT ON/OFF** switch **ON**. Complete the following steps to display alternate controlling temperature:

1. Check the indicator LEDs to determine which sensor temperature (supply air or return air) currently appears in the right display. This is the controlling sensor.
2. To view the alternate (supply or return) air temperature, press and hold the **SUP/RET** key. The controller will show the alternate sensor temperature as long as the **SUP/RET** key is depressed.
3. The display then returns to controlling sensor temperature when **SUP/RET** key is released.

Display Alternate Fahrenheit (F) or Celsius (C) Temperatures

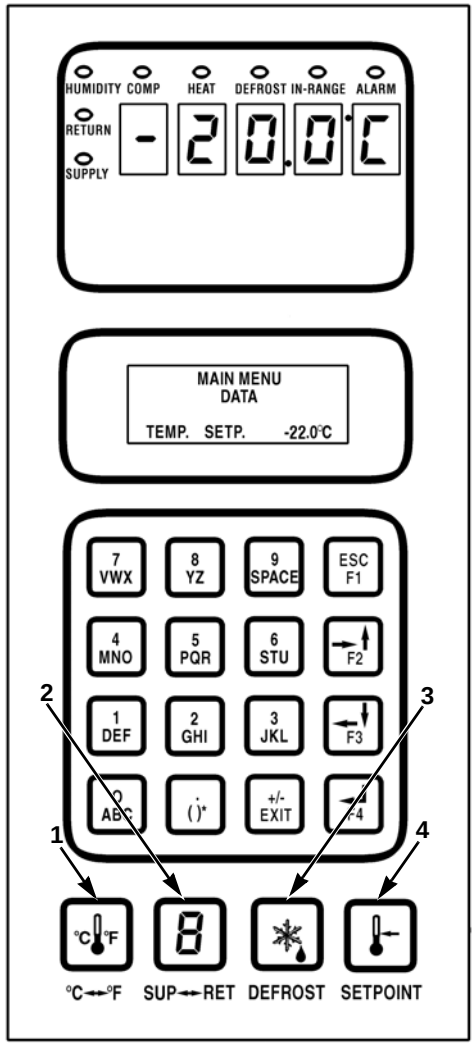
The controller can display temperatures in Celsius or Fahrenheit. Turn the **UNIT ON/OFF** switch **ON** and complete the following steps to display in fahrenheit or celsius:

1. Press and hold the **C/F** key. The controller will show both LED and LCD display temperatures in the alternate temperature scale (Fahrenheit or Celsius) as long as the **C/F** key is depressed.
2. The display then returns to the original display when the **C/F** key is released.

To change the default temperature unit display, complete the following steps:

a. Press and hold the **C/F** key.

b. Press the **SETPOINT** key for 1 second.



1.	C/F Key
2.	Sup/Ret Key
3.	Defrost Key
4.	Setpoint Key

Figure 31: Special Function Keys

Setpoint Menu

Pressing the SETPOINT key displays a list of tasks and values that can be activated or set:

- Opti-Set
- Setpoint Temperature
- Bulb Mode
- Evaporator Fan Speed
- Defrost Determination Temperature Mode
- Economy Mode
- Humidity Control
- Humidity Setpoint
- AFAM
- AFAM Delay
- AFAM Rate
- CO_2 Maximum

NOTE: The screens that display on the controller are determined by the controller software setting and the options installed on the unit. All screens are NOT present on all units.

Changing the Setpoint Temperature

See “Changing the Setpoint” in this chapter.

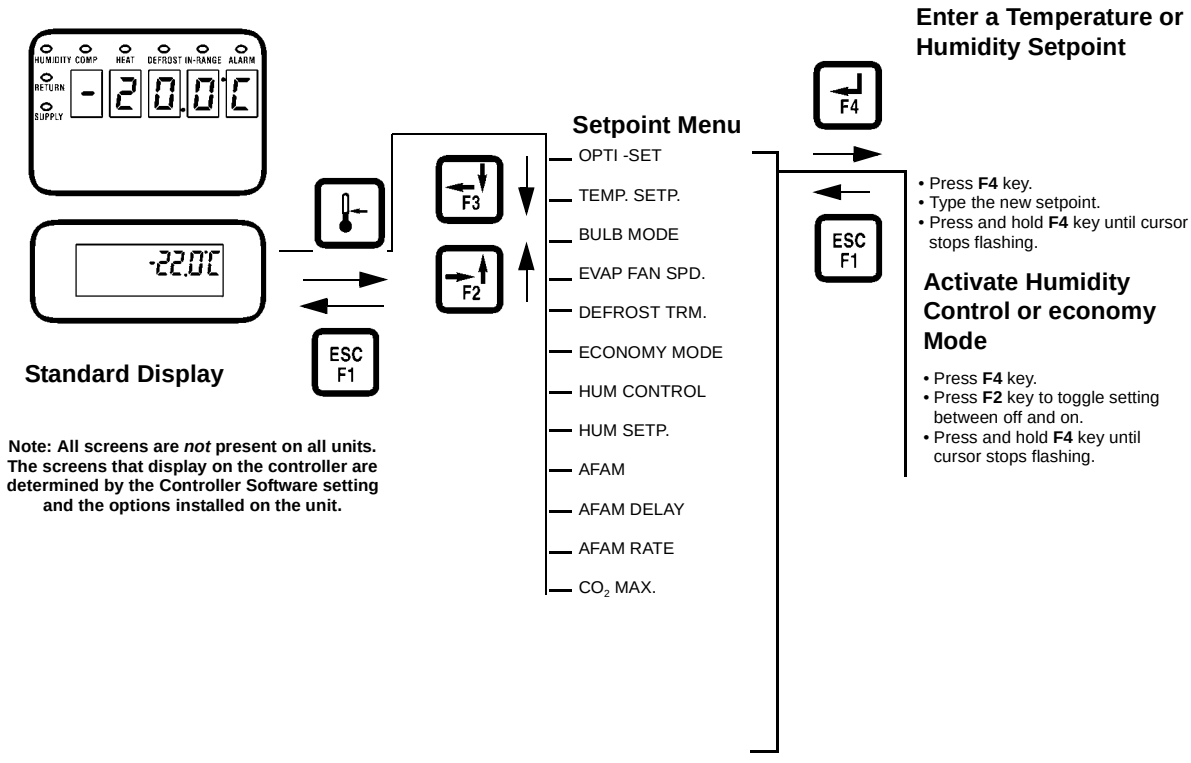
Changing the Economy Mode Setting

NOTE: Enter Setpoint temperature before turning ON the Economy mode. The controller automatically turns the Economy mode OFF when the setpoint is changed.

NOTE: Economy Mode is replaced by the VFD evaporator fan system.

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the “TEMP SETP” line.
2. Press F2 key to scroll to “ECONOMY MODE” line.
3. To change the mode setting, press F4 key. Cursor moves to end of menu line and flashes.
4. Press F2 key to toggle between OFF and ON.
5. With the desired state in the menu line, press and hold F4 key until cursor stops flashing. New mode setting appears in display.

   NOTE: On frozen loads, the Economy Mode also modifies the temperature control algorithm to extend the Null mode. See “Economy Min.” and “Economy Max.” under Configuration Menu in this chapter to check the current settings or enter new settings.
6. Press ESC key to exit the SETPOINT screen.



Note: All screens are *not* present on all units. The screens that display on the controller are determined by the Controller Software setting and the options installed on the unit.

Figure 32: Setpoint Menu Screen Flow Diagram

Changing the Humidity Mode Setting

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the “TEMP SETP” line.
2. Press F2 key to scroll to “HUM CONTROL” line.
3. To change the mode setting, press F4 key. Cursor moves to end of menu line and flashes.
4. Press F2 key to toggle between OFF and ON.
5. With the desired state in the menu line, press and hold F4 key until cursor stops flashing. New mode setting appears in display.
6. Press ESC key to exit the SETPOINT screen.

Changing the Humidity Setpoint

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the “TEMP SETP” line.
2. Press F2 key to scroll to “HUM SETP” line.
3. To enter a new setpoint, press the F4 key. An Enter Arrow appears in the menu line and the current setpoint disappears.
4. Enter (type) the new setpoint in the LCD display using the general purpose keypad. The cursor moves to the right of the screen as each key entry is acknowledged and displayed.

   NOTE: Always check that the setpoint entered in the LCD display is correct before proceeding.
5. Press and hold the F4 key until the cursor stops flashing. The new setpoint is recorded in the controller and appears in the LCD display.
6. Press ESC key to exit the SETPOINT screen.

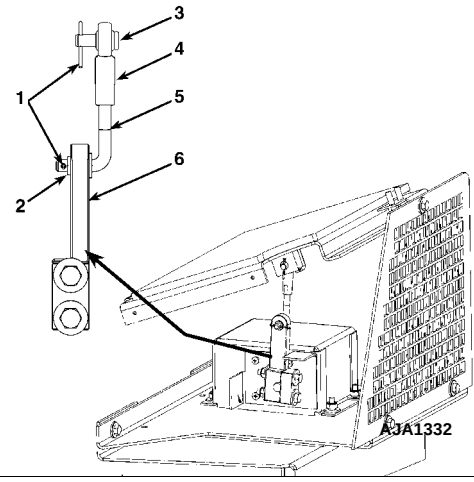
Advanced Fresh Air Management (AFAM) or Advanced Fresh Air Management Plus (AFAM+) Door (Options)

A microprocessor controlled AFAM or AFAM+ door provides programmable control of the air exchange rate. The vent door is adjusted to the desired position by a vent door motor and linkage assembly. The system is precalibrated for air exchange rates of 0 to 280 m 3 /hr (0 to 165 ft 3 /min.). The use of the AFAM or AFAM+ option should be established by the shipper.

WARNING: After installing or servicing the AFAM door, remove all tools and install the vent grille before starting the AFAM or AFAM+ system. Failure to replace the vent grille before turning the AFAM or AFAM+ system ON may result in personal injury or unit damage.

The default setting for AFAM in the SETPOINT menu is the last value set (OFF, UNITS or DEMAND). The AFAM submenu should be set to UNITS to control the vent door to the fresh air exchange rate setting.

If the controller identifies a component failure during unit startup, an alarm is recorded in the controller display and data-logger memory. If a power loss occurs after the AFAM system is turned ON, the controller automatically operates the vent door based on the previous AFAM DELAY and AFAM RATE settings when power is restored.



1.	Cotter Pins
2.	Shoulder Washer
3.	Pin
4.	Rod End
5.	L-Rod
6.	Vent Motor Linkage

Figure 33: AFAM System Linkage Adjustment

Alarm Code	Alarm Type	Description
57	Check	AFAM Control Module or Motor Error: Indicates a frozen or stuck vent door; or a problem with the control module or its wiring; or the motor current draw is not with limits.
68	Check	AFAM+ Gas Analyzer Error: Indicates a communication problem with the gas analyzer
69	Check	AFAM+ Gas Analyzer Calibration indicates problem with sensor

Linkage Installation and Adjustment

If the vent door motor, linkage assembly or vent door require repair or replacement, make sure the linkage is properly adjusted.

1. Insert L-rod in damper motor linkage so that the eyelet in the rod end aligns with the vent door bracket. Install pin, shoulder washer and cotter pin to fasten L-rod to damper motor linkage.
2. Fully thread the rod end onto the L-rod. Then back off rod end approximately 2 complete rotations.
3. Align the rod end eyelet in the vent door bracket. Temporarily insert pin to fasten rod end to door bracket.
4. Visually check the linkage alignment. The linkage should be straight and touching or almost touching the mechanical stop. If the linkage is linkage is binding or jammed against the stop, the linkage is too long. Disconnect the rod end from the door bracket. Shorten the linkage by rotating the rod end on to the L-rod additional rotations. Shorten linkage until linkage alignment is correct.
5. Visually check vent door seal. If the vent door is fully closed, but the door gasket does not create a tight seal with the air exchange openings, the linkage is too short. Disconnect the rod end from the door bracket. Lengthen linkage by backing rod end off additional rotations. Lengthen linkage until door gasket seals tightly against the air exchange openings.
6. When linkage is properly adjusted, fasten rod end securely to door bracket with pin and cotter pin.

Datalogger Menu

The Datalogger menu contains a list of functions that display unit operating information recorded in the MP-3000a datalogger. The following functions are available:

- Inspect Temperature Log: Displays temperature logs by time and date for the Setpoint; Supply (Controlling Temperature), Return, USDA1, USDA2, USDA3 and Ambient sensors; humidity sensor; and event flags.
- Inspect Event Log: Displays important event logs by time and date for events such as unit alarms, power On/Off, setpoint change, clock reset, trip start, defrost, etc.
- Set Log Time: Sets the data log interval (1 minute or 1/2, 1, 2 or 4 hours).
- Activate Tripstart: Sets the date and time of the trip start.
- Inspect PTI Log: Displays results of last PTI test including component volt and amps data and sensor temperatures. Test values are recorded at the start and end of the Chilled and Frozen Mode test.

Viewing the Datalogger Menu

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press the F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until “DATALOGGER” appears in LCD display.

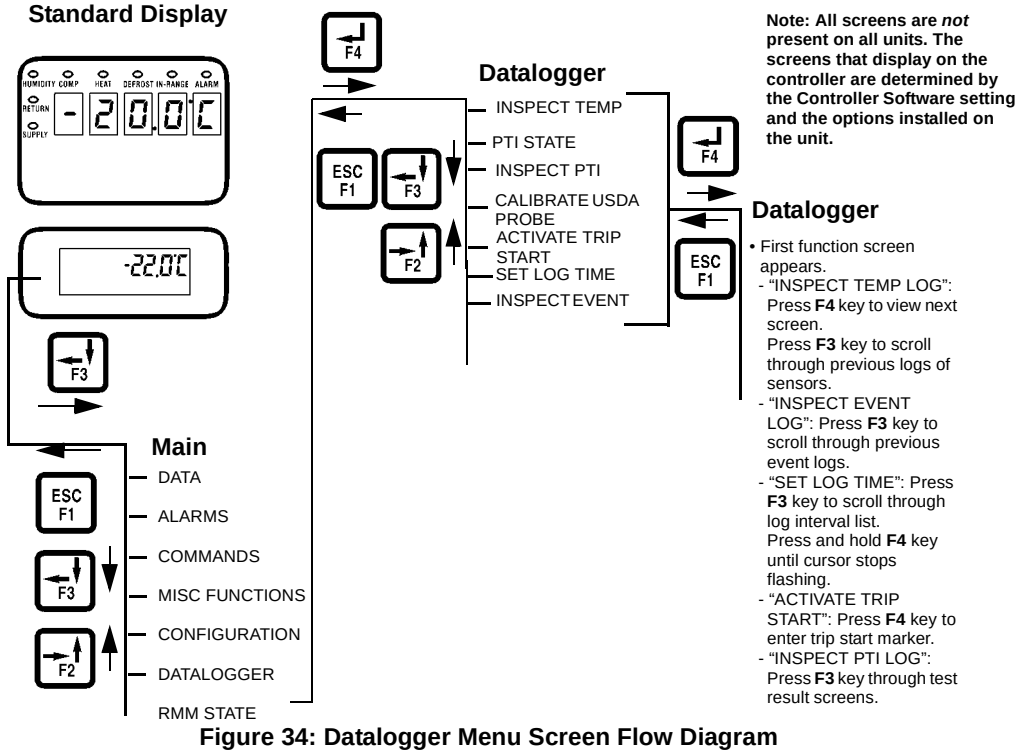


Figure 34: Datalogger Menu Screen Flow Diagram

3. Press F4 key to access the Datalogger menu. The first function appears in the LCD display: Inspect Temp Log.
4. Press F2 or F3 key to scroll to the desired function:

   - Inspect Temp Log
   - PTI State
   - Inspect Event Log
   - Set Log Time
   - Activate Tripstart
   - Inspect PTI Log
5. Press F4 key to access the function selected.

Inspect Temp Log

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F2 key to enter the menu list.
2. Press F2 key to scroll through Main Menu until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in the LCD display.
4. Press F4 key to enter Temp Log. LCD display shows the Log Time and the Setpoint, Supply and Return temperatures of the most recent log in the first screen.
   - To scroll through previous logs of the sensor temperatures currently in the display, press F3 key. All temperature logs recorded in the datalogger memory may be viewed on the LCD display.
5. To view additional sensor log and event flag screens, press F4 key again. LCD display shows USDA1, USDA2, USDA3, Relative Humidity (rH), Ambient, etc.
   - To scroll through previous logs of the sensor temperatures currently in the display, press F3 key.

Event Flags for Temperature Log

T = Tripstart Activated

P = Primary Power Off

D = Defrost in Last Interval

O = Temperature Not In-range

h = Humidity Control Active

E = Evaporator High Temperature

H = High Refrigeration Pressure

d = Defrost terminated on time limit

e = Economy mode activated

s = Reefer unit stopped (after PTI)

w = Water-cooled operation (water pressure switch is OPEN or Condenser Fan Switch is in WATER position)

A = Alarm in last interval

NOTE: All event flags that occurred during a log interval are displayed.

6. Press ESC key to exit the Temp Log.

Inspect Event Log

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in the LCD display.
4. Press F2 or F3 key to scroll through submenu until “Inspect Event Log” appears in LCD display.
5. Press F4 key to enter Event Log. LCD display shows the Log Time and the most recent event.
   - To scroll through previous event log screens, press F3 key. All event logs recorded in the datalogger memory may be viewed on the LCD display.

Event Examples

- Controller alarm status (alarms set/cleared)
- Main power On/Off status (humidity On/Off, temperature setpoint, and main power Hz)
- 12 Vdc battery discharge test (battery voltage, total unit and compressor hours if main power On) — this event logged at once a day
- Change temperature setpoint (new/old setpoint)
- Change RH setpoint (new/old RH setpoint)
- Change RH status (On/Off)
- Event log retrieval
- Temperature log retrieval
- Trip start
- New container ID

- PTI start (Unit configuration)
- PTI part 1 end (Temperature differences for tests 1, 2, 3 and heat test
- PTI end
- Defrost start (logged with demand or manual defrost only)
- Defrost end (start time)

6. Press ESC key to exit the Event Log.

Set Log Time

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the Main Menu.
2. Press F2 key to scroll through menu list until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in the LCD display.
4. Press F2 or F3 key to scroll through submenu until “Set Log Time” appears in LCD display.
5. Press F4 key to enter Temp Log. LCD display shows the current Log Time interval.
6. To enter a new log interval, press F4 key again with cursor in Log Time menu line. Arrow appears in menu line.
7. Press F3 key to scroll through a list of log time intervals:

   - 1 Minute*

   - 1/2 Hour

   - 1 Hour

   - 2 Hour

   - 4 Hour

   * The logging of USDA sensors is fixed at 1 hour intervals to comply with USDA requirement. A logging test of USDA sensors at 1 minute intervals is also possible for 72 minutes. USDA data can not be downloaded during the logging test. After 72 minutes, controller returns to previous logging interval and clears USDA test data from datalogger memory.

8. When the correct log time appears in the menu line, press and hold F4 key until cursor stops flashing. The new Log Time appears in the display.
9. Press ESC key to exit the Temp Log.

Set a Trip Start

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the Main Menu.
2. Press F2 key to scroll through menu list until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in LCD display.
4. Press F2 or F3 key to scroll through submenu until “Activate Tripstart” appears LCD display.
5. Press F4 key to enter Tripstart function. The date and time of last trip start appears in the screen.
6. Press F4 key again to enter a new start of trip date and time in the log.

   NOTE: When a PTI Test is completed, controller automatically enters a Tripstart in the log.
7. Press ESC key to exit the Datalogger menu.

Inspect PTI Log

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the Main Menu.
2. Press F2 key to scroll through menu list until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in the LCD display.
4. Press F2 or F3 key to scroll through submenu until “Inspect PTI Log” appears in LCD display.
5. Press F4 key to enter PTI Log. LCD display shows the Start Time and PTI test results of the most recent PTI log.
   - To scroll through additional test results in the log, press F3 key.

PTI Examples

- PTI stores volt and amps of all power consuming components
- PTI stores temperatures logged at both the start and end of Chilled Mode and Frozen Mode capacity tests

6. Press ESC key to exit the PTI Log.

Alarms Menu

The Alarm List menu displays alarm codes. Alarm codes are recorded in the controller memory to simplify unit diagnosis procedures. Some alarm codes are only recorded during a Pretrip (PTI) Test or Function Test. Fault codes are retained by the controller in a non-volatile memory. If the Alarm LED is ON or flashing ON and OFF, enter the ALARM LIST to view the alarm code(s).

Alarm Types

There are two types of alarms:

Shutdown Alarm (Level 1): Alarm LED flashes and unit stops. Shutdown alarms indicate the unit has been stopped to prevent damage to the unit or cargo. The condition must be corrected before restarting the unit. Alarm code 56 (compressor temperature too high) is a shutdown alarm.

Check Alarm (Level 2): Alarm LED flashes until alarm is acknowledged. Check alarms indicate corrective action should be taken before a problem becomes severe.

Alarm Code States

There are three alarm code states for Shutdown and Check alarms:

- NOT ACTIVE: An alarm condition has occurred but no longer exists in the unit. Not Active means the condition was corrected and did not recur for 1 hour; or the unit On/Off switch was turned OFF and then ON.

  When a NOT ACTIVE alarm code is acknowledged (F4 key pressed while alarm code appears in LCD display), the Alarm LED will turn OFF and the alarm code disappears from the alarm list.

- ACTIVE: An alarm condition has occurred and continues to exist in the unit; or the alarm condition occurred within the past 1 hour but does not currently exist in the unit.

  If the alarm condition currently exists in the unit and the alarm code is acknowledged, the Alarm LED will stop flashing but remain ON. The alarm code state will change to ACKNOWLEDGE in the alarm list.

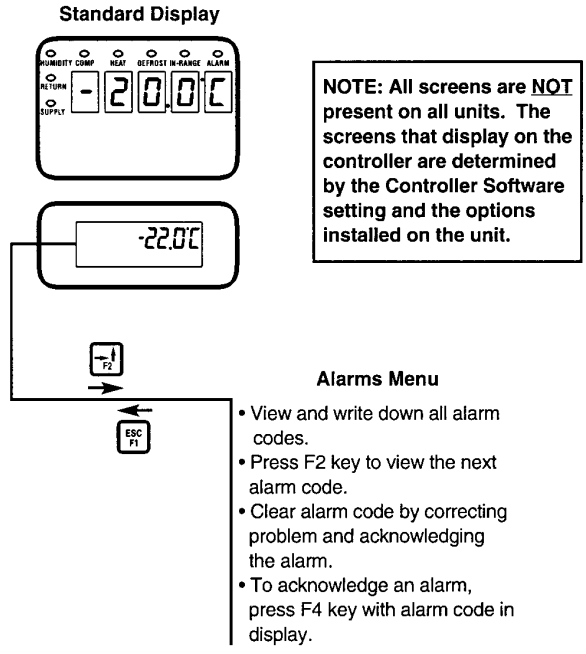


Figure 35: Alarms Screen Flow Diagram

  If the alarm condition no longer exists in the unit and the alarm code is acknowledged, the Alarm LED will turn OFF and the alarm code disappears from the alarm list.

- ACKNOWLEDGE: An alarm code has been viewed and acknowledged in the alarm list. The Alarm LED remains ON but does not flash.

  If the alarm condition is corrected, the Alarm LED will turn OFF and the alarm code disappears from the alarm list.

Viewing the Alarm List Menu

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F2 key to directly enter the Alarms menu. The first alarm code number, alarm state and alarm description appears in LCD display.

   NOTE: Alarm codes are displayed in sequential order, not in the order of occurrence.

2. Write down the first alarm code. Then press F2 key to view the next alarm code when more than one alarm code has been recorded.

3. Repeat step 2 until all alarm codes have been recorded. To scroll backward to return to a previous alarm code, press F3 key.
4. To clear all alarm codes from the current display list and turn off the Alarm LED, all problems must be corrected and the alarm code "acknowledged" in the Alarm List menu.

   NOTE: To acknowledge an alarm, press F4 while the alarm code appears on the screen. The alarm state will change from ACTIVE or NOT ACTIVE to ACKNOWLEDGE.

   NOTE: If no key is pressed for 30 seconds, the controller returns to the previous menu level or the LCD Standard Display.

Alarm List

Alarm Code	Type	Description
00	Check	Supply Air Sensor Open Circuit
01	Check	Supply Air Sensor Short Circuit
02	Check	Return Air Sensor Open Circuit
03	Check	Return Air Sensor Short Circuit
04	Check	Evaporator Coil Open Circuit
05	Check	Evaporator Coil Sensor Short Circuit
06	Check	Compressor Current Too High
07	Check	Compressor Current Too Low
10	Check	Heater Current Too High
11	Check	Heater Current Too Low
12	Check	Evaporator Fan high Speed Current Too High
13	Check	Evaporator Fan High Speed Current Too Low
14	Check	Evaporator Fan Low Speed Current Too High
15	Check	Evaporator Fan Low Speed Current Too Low
16	Check	Condenser Fan Current Too High
17	Check	Condenser Fan Current Too Low
18	Check	Power Supply Phase Error
19	Check	Temperature Too Far from Setpoint
20	Check	Defrost Time Too Long
22	Check	Capacity Test 1 Error
23	Check	Capacity Test 2 Error
24	Check	Capacity Test 3 Error
25	Check	Evaporator Temperature Test Error
27	Check	Heat Capacity Test Error
29	Check	Liquid Injection Valve Error
32	Check	Condenser Air Sensor Open Circuit
33	Check	Condenser Air Sensor Short Circuit
34	Check	Ambient Air Sensor Open Circuit
35	Check	Ambient Air Sensor Short Circuit
43	Check	Return Air Temperature Too High
52	Check	Probe Error
53	Check	High Pressure Cutout Switch Off Error
54	Check	High Pressure Cutout Switch On Error
56	Shutdown	Compressor Temperature Too High
57	Check	AFAM Control module or Motor Error
58	Check	Phase Sensor Error
59	Check	Delta Current Error
60	Check	Humidity Sensor Error
68	Check	AFAM Gas Analyzer Error
69	Check	Gas Analyzer Calibration Error
97	Check	Compressor Sensor Open Circuit
98	Check	Compressor Sensor Short Circuit
99	Check	USDA 1 Sensor Open Circuit
109	Check	KVQ Sensor Open Circuit
110	Check	KVQ Sensor Short Circuit
111	Check	KVQ Heat Error
112	Check	Zero Current Too High
115	Check	Probe Error Return & Evaporator
116	Check	Probe Error Return & Supply
117	Check	Probe Error Supply RH & Supply LH

Commands Menu

The Commands menu displays a list of tasks that can be activated. The following commands are available:

- Function Test: Controller automatically tests the operation of individual unit components. This is not a performance test of the complete system. See “Function Test” in this chapter for test details.
- PTI (Full Pre-Trip) Test: Controller automatically completes a test of individual components, checks unit refrigeration capacity, heating capacity and temperature control.

CAUTION: The PTI test should only be performed on an empty container!

- Power Management: Sets the power limit and power limit activation (“On”) time.
- Manual Function Test: Controller tests individual components selected by the technician for diagnosis. LCD display will show expected and actual current of the component being tested.
- Brief PTI (Brief Pretrip Test): Controller automatically completes a test of individual components, checks unit refrigeration capacity, heating capacity and temperature control. Also see Brief and Full Pretrip Procedure.

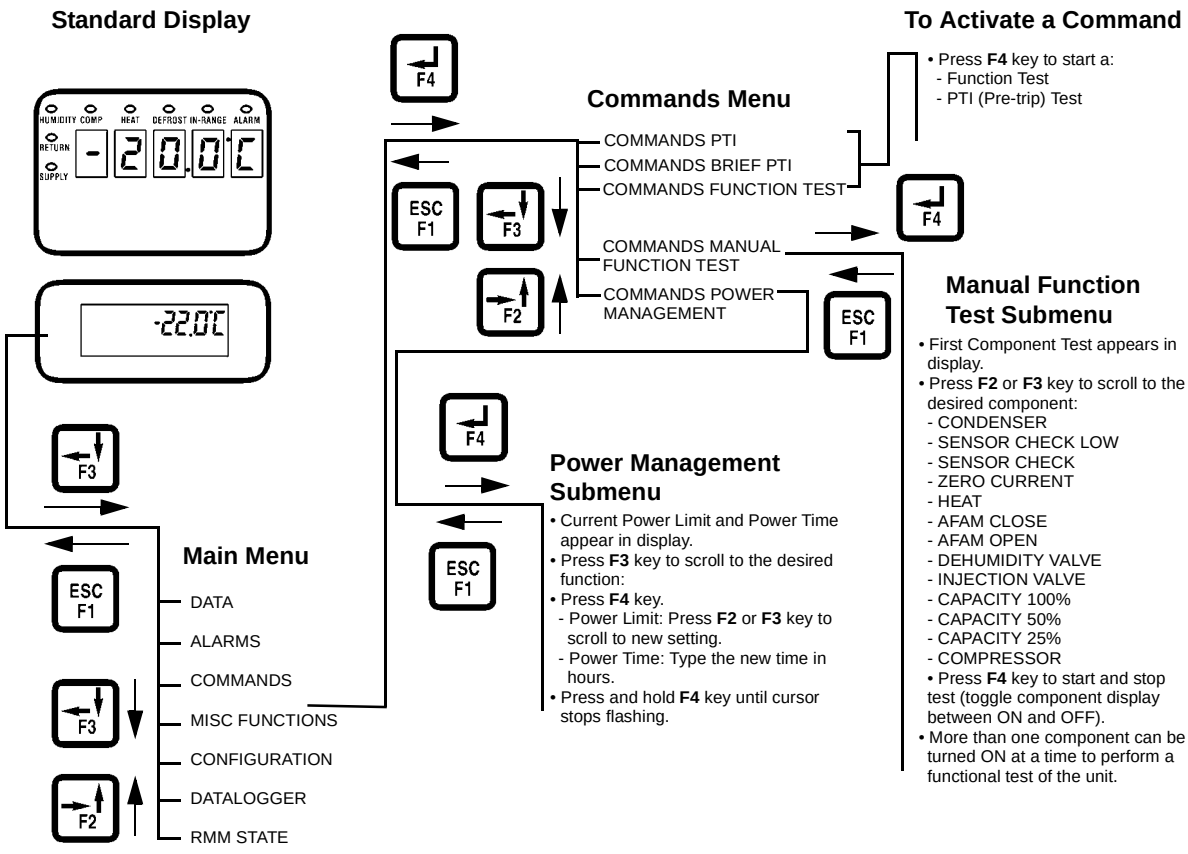


Figure 36: Commands Menu Screen Flow Diagram

Viewing the Commands Menu

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press the F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until “COMMANDS” appears in LCD display.
3. Press F4 key to access the Commands menu. The first command in the submenu (PTI Test) appears in the LCD display.
4. Press F2 or F3 key to scroll to the desired command:
   - PTI (Pretrip)
   - Power Management
   - Function Test
   - Manual Function Test
   - Brief PTI (Pre-Trip)
5. Press F4 key to activate the command selected.
   - PTI (Pretrip): LCD display shows PTI Test currently being performed. PTI test ends automatically. Press any key on the controller to return the unit to normal operation.
   - Power Management: LCD display shows current Power Limit setting and Power Time setting. Turn Power Limit feature ON and OFF, change power limit setting or change power limit time.
   - Function Test: LCD display shows functional test currently being performed. Function test ends automatically. Unit automatically returns to normal operation.
   - Manual Function Test: LCD display shows list of unit components. Test the operation of individual components or turn several components ON at the same time to perform a system test.Function Test: LCD display shows functional test currently being performed. Function test ends automatically. Unit automatically returns to normal operation.
   - Brief PTI (Pretrip): LCD display shows PTI Test currently being performed. Brief PTI test ends automatically. Press any key on the controller to return the unit to normal operation.

Brief PTI (Pretrip) Test

CAUTION: The Brief PTI test should only be performed on an empty container!

NOTE: Units equipped with a water-cooled condenser must be set to operate on air-cooled condensing to perform a complete system capacity test.

The MP-3000a controller contains a special Brief PTI pretrip test that automatically checks unit refrigeration capacity, heating capacity, temperature control, and individual components including the controller display, contactors, fans, protection devices and sensors. The test includes measurement of component power consumption and compares test results to expected values. The test takes about 25-30 minutes to complete, depending on the container and ambient temperature.

NOTE: Correct all existing alarm conditions and clear the alarm codes before performing a Brief PTI test. The controller will automatically clear all existing alarms before beginning the Brief PTI test.

With the **UNIT ON/OFF** switch **ON** and the LCD display showing the standard display (setpoint):

1. Press the **F2** or **F3** key to enter the menu list. Repeatedly press the **F2** or **F3** key to scroll through Main menu until [COMMANDS] appears in LCD display.
2. Press the **F4** key to access the Commands menu. The first command in the submenu appears in the LCD display.
3. Press the **F2** or **F3** key to scroll to [Brief PTI TEST].
4. Press the **F4** key to start the Brief PTI test. LCD display shows PTI test currently being performed. PTI test ends automatically. Press any key on the controller to return the unit to normal operation.

See the following [CRR Brief Pretrip (PTI) Test Procedure] for a detailed description of the PTI Test. Detailed PTI test results are stored in the MP-3000a Datalogger for later viewing. Any alarm codes recorded during the test can be viewed through the controller's Alarm List menu at the end of the test.

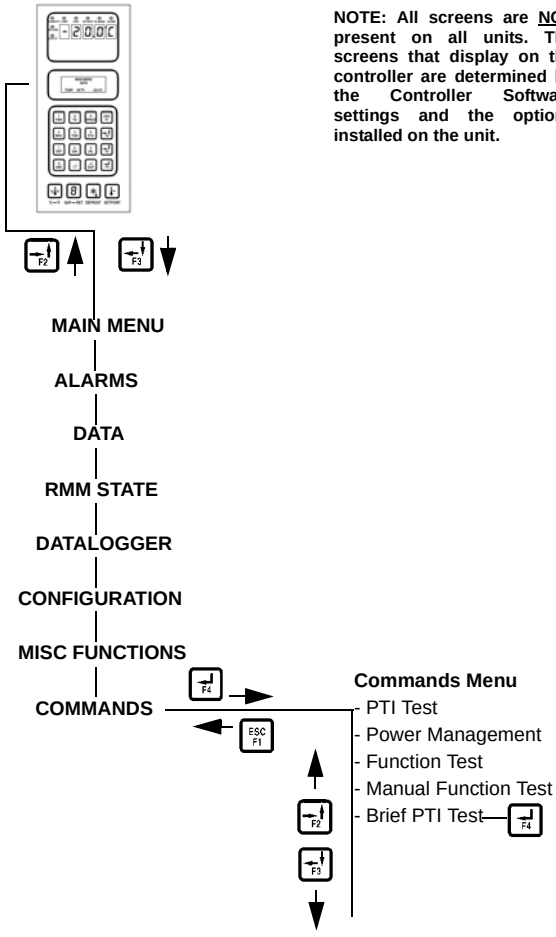


Figure 37: Brief PTI Test

CRR Brief PTI Test

LCD Display*	Description	Possible Alarms	Duration (Time)
PTI START Activated 0.1A 0.0A 0.1A	Event Log for PTI begins. All alarms are turned off. Alarm list is cleared. All relays are turned off and air vent are closed.	None	2 seconds
SENSOR TEST Activated 0.1A 0.0A 0.1A	All sensors must have values within their measuring range.	00, 01, 02, 03, 04, 05, 32, 33, 34, 35, 97, 98, 99	5 seconds
EVAP FAN LOW TEST SUP RET EVA 5.1C 5.0C 5.1C 1.1A 1.0A 1.1A	Condenser fan and compressor are turned off. With evaporator fan on low speed, amp draw is measured and compared to voltage and frequency: • CRR 40: 1.0 Amps approx. at 50 Hz, 1.0 Amps approx. at 60 Hz Amperes are recorded in the PTI log.	14, 15	10 seconds
EVAP FAN HIGH TEST SUP RET EVA 5.1C 5.0C 5.1C 2.4A 2.3A 2.4A	Condenser fan and compressor are turned off. With evaporator fan on high speed, amp draw is measured and compared to voltage and frequency: • CRR 40: 2.1 Amps approx. at 50 Hz, 2.5 Amps approx. at 60 Hz Amperes are recorded in PTI log.	12, 13	10 seconds
PROBE TEST SUP RET EVA 5.1C 5.0C 5.1C 2.4A 2.3A 2.4A	Evaporator fans operate on high speed for maximum 3 minutes. Then probe test runs until temperature difference between sensors stops increasing. Maximum temperature difference allowed: • Return/Evaporator: 1.5 C (34.7 F); return air sensor temperature must be 0.5 C (32.9 F) above evaporator sensor temperature. • Return/Supply: 0.8 C (33.0 F); return air sensor temperature must be 0.5 C (32.9 F) above supply air temperature. • LH Supply/RH Supply (if equipped): 0.5 C (32.9 F).	115, 116, 117	1 minute minimum to 13 minutes maximum
AFAM+ TEST SUP RET EVA 5.1C 5.0C 5.1C 2.4A 2.3A 2.4A	Air vent is opened and verified that the motor is operating. Evaporator fan is started and operating until CO2 value is below 0.5 percent or 20 minutes.	57, 68, 69	10 seconds minimum to 20 minutes maximum

* Readings may vary depending on voltage and temperature

COND FAN TEST SUP RET EVA 5.2C 5.0C 5.1C 1.3A 1.2A 1.3A	Condenser fan is turned on. Amp draw is measured and compared to voltage and frequency: 0.8 Amps maximum. Condenser fan amperes are recorded in PTI log.	16, 17	10 seconds

CRR Brief PTI Test

LCD Display*	Description	Possible Alarms	Duration (Time)
REVERSE PHASE TEST SUP RET EVA 1.3C 1.0C 1.3C 1.3A 1.2A 1.3A	With condenser fan on, reverse phase selector relay is energized. Condenser fan and compressor reverse current is measured.	58	30 seconds
HEAT ELEMENT TEST SUP RET EVA 1.3C 1.0C 1.3C 5.2A 5.1A 5.2A	Electric heaters are turned on. Amp draw is measured and compared to voltage: • 4.4 Amps approx. at 400V; • 5.1 Amps approx. at 460V. Heater amperes are recorded in PTI log.	10, 11	10 seconds
PRE COOL/HEAT TEST SUP RET EVA 5.1C 5.0C 5.1C 2.3A 2.1A 2.3A	If the return air temperature is above +20 C (68 F), unit operates in cool until the return sensor is less then +15 C (59 F) or 1 hour. If the return air temperature is below +5 C (41 F), unit operates in heat until return temperature is above +5 C (41 F) or 2 hours.	None	30 to 60 seconds 1 or 2 hours maximum
COMPRESSOR TEST AMB CON EVA 8.0C 15.0C 5.0C 9.1A 9.0A 9.1A	With compressor and condenser fan on, compressor is operating at 100 percent capacity. Amp draw is measured and compared to voltage. Compressor amperes are recorded in PTI log. If compressor has been off for last 18 hours less than 30 seconds on, a compressor sequence start occurs.	6, 7	30 seconds
KVQ VALVE TEST AMB CON EVA 8.0C 25.0C 2.0C 9.1A 9.0A 9.1A	With compressor, condenser fan and evaporator fan on and operating at 100% capacity. Capacity is reduced to 25%. An amp difference of 1.2 is required.	29	240 seconds maximum
COMP HI PRESS TEST AMB CON EVA 8.0C 45.0C 1.0C 9.1A 9.0A 9.1A	With compressor on, evaporator fan operates on high speed until high-pressure cutout occurs or condenser temperature is above +75 C (167 F). Condenser fan starts and operates until compressor starts.	53, 54	10 to 60 seconds Plus 30 seconds
CAPACITY 1 TEST SUP RET EVA 5.1C 5.0C 5.1C 2.3A 2.1A 2.3A	With condenser fan on, compressor on, and evaporator fans on high speed, cool capacity is set to 100 percent capacity. Liquid injection valve is turned on. A difference of approx. 4.5 C (40.1 F) is required between return and supply air temperatures, depending on return air and condenser coil temperatures.	22	3 minutes
INJECTION VALVE TEST AMB CON EVA 8.0C 25.0C 2.0C 9.1A 9.0A 9.1A	Liquid injection valve is turned on for three seconds, off for three seconds, and on for three seconds to verify valve operation.	None	20 seconds

* Readings may vary depending on voltage and temperature

CRR Brief PTI Test

LCD Display*	Description	Possible Alarms	Duration (Time)
PTI PART 1 END SUP RET EVA 5.1C 5.0C 5.1C 2.3A 2.1A 2.3A	"PTI Part 1 end" is recorded in PTI log.	None	5 seconds
PTI PASS – PRESS KEY	Unit will remain OFF until any key is pressed. If alarms occurred during PTI, LCD display shows "PTI FAIL – PRESS KEY".	None	

* Readings may vary depending on voltage and temperature

PTI (Full Pretrip) Test

CAUTION: The Full PTI test should only be performed on an empty container!

NOTE: Units equipped with a water-cooled condenser must be set to operate on air-cooled condensing to perform a complete system capacity test.

The MP-3000a controller contains a special Full PTI pretrip test that automatically checks unit refrigeration capacity, heating capacity, temperature control, and individual components including the controller display, contactors, fans, protection devices and sensors. The test includes measurement of component power consumption and compares test results to expected values. The test takes up to 2 to 2.5 hours to complete, depending on the container and ambient temperature.

NOTE: Correct all existing alarm conditions and clear the alarm codes before performing a Full PTI test. The controller will automatically clear all existing alarms before beginning the Full PTI test.

With the **UNIT ON/OFF** switch **ON** and the LCD display showing the standard display (setpoint):

1. Press the **F2** or **F3** key to enter the menu list.
2. Repeatedly press the **F2** or **F3** key to scroll through Main menu until [COMMANDS] appears in LCD display.
3. Press the **F4** key to access the Commands menu. The first command in the submenu appears in the LCD display.
4. Press the **F2** or **F3** key to scroll to "PTI TEST".
5. Press the **F4** key to start the PTI test. LCD display shows PTI test currently being performed. PTI test ends automatically. Press any key on the controller to return the unit to normal operation.

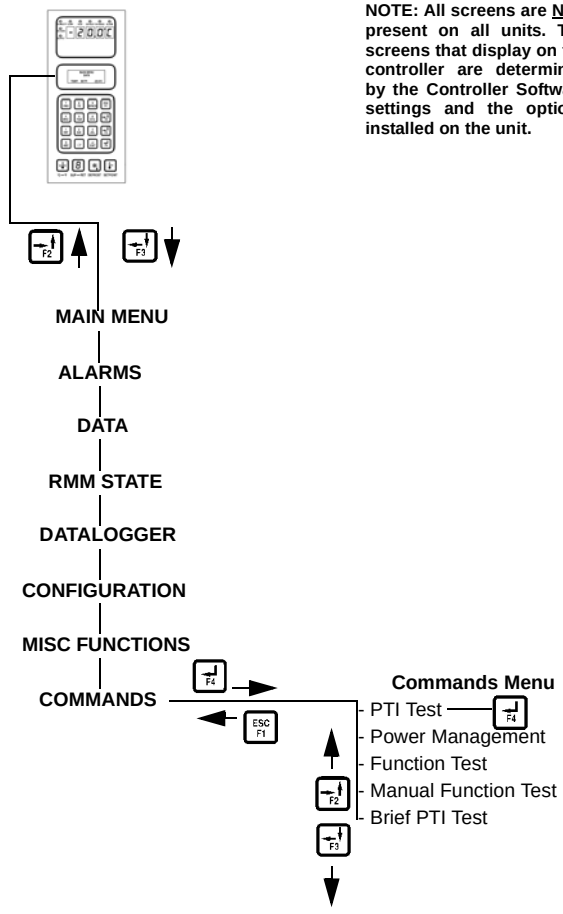


Figure 38: Full PTI Test

See the following pages for the "CRR PTI (Full Pretrip) Test Procedure" for a detailed description of the PTI Test. Detailed PTI test results are stored in the MP-3000a Datalogger for later viewing.

Any alarm codes recorded during the test can be viewed through the controller's Alarm List menu at the end of the test.

CRR PTI Full Pretrip Test

LCD Display*	Description	Possible Alarms	Duration (Time)
PTI START Activated 0.1A 0.0A 0.1A	Event Log for PTI begins. All alarms are turned off. Alarm list is cleared. All relays are turned off and air vent are closed.	None	2 seconds
SENSOR TEST Activated 0.1A 0.0A 0.1A	All sensors must have values within their measuring range.	00, 01, 02, 03, 04, 05, 32, 33, 34, 35, 97, 98, 99	5 seconds
EVAP FAN LOW TEST SUP RET EVA 5.1C 5.0C 5.1C 1.1A 1.0A 1.1A	Condenser fan and compressor are turned off. With evaporator fan on low speed, amp draw is measured and compared to voltage and frequency: • CRR 40 1.0 Amps approx. at 50 Hz, 1.0 Amps approx. at 60 Hz	14, 15	10 seconds
EVAP FAN HIGH TEST SUP RET EVA 5.1C 5.0C 5.1C 2.4A 2.3A 2.4A	Condenser fan and compressor are turned off. With evaporator fan on high speed, amp draw is measured and compared to voltage and frequency: • CRR 40: 2.1 Amps approx. at 50 Hz, 2.5 Amps approx. at 60 Hz Amperes are recorded in PTI log.	12, 13	10 seconds
PROBE TEST SUP RET EVA 5.1C 5.0C 5.1C 2.4A 2.3A 2.4A	Evaporator fans operate on high speed for maximum 3 minutes. Then probe test runs until temperature difference between sensors stops increasing. Maximum temperature difference allowed: • Return/Evaporator: 1.5 C (34.7 F); return air sensor temperature must be 0.5 C (32.9 F) above evaporator sensor temperature. • Return/Supply: 0.8 C (33.0 F); return air sensor temperature must be 0.5 C (32.9 F) above supply air temperature. • LH Supply/RH Supply (if equipped): 0.5 C (32.9 F).	115, 116, 117	1 minute minimum to 13 minutes maximum
AFAM+ TEST SUP RET EVA 5.1C 5.0C 5.1C 2.4A 2.3A 2.4A	Air vent is opened and verified that the motor is operating. Evaporator fan is started and operating until CO2 value is below 0.5 percent or 20 minutes.	57, 68, 69	10 seconds minimum to 20 minutes maximum

* Readings may vary depending on voltage and temperature

CRR PTI Full Pretrip Test

LCD Display*	Description	Possible Alarms	Duration (Time)
COND FAN TEST SUP RET EVA 5.2C 5.0C 5.1C 1.3A 1.2A 1.3A	Condenser fan is turned on. Amp draw is measured and compared to voltage and frequency: 0.8 Amps Maximum. Condenser fan amperes are recorded in PTI log.	16, 17	10 seconds
REVERSE PHASE TEST SUP RET EVA 1.3C 1.0C 1.3C 1.3A 1.2A 1.3A	With condenser fan on, reverse phase selector relay is energized. Condenser fan and compressor reverse current is measured.	58	30 seconds
HEAT ELEMENT TEST SUP RET EVA 1.3C 1.0C 1.3C 5.2A 5.1A 5.2A	Electric heaters are turned on. Amp draw is measured and compared to voltage: • 4.4 Amps approx. at 400V; • 5.1 Amps approx. at 460V. Heater amperes are recorded in PTI log.	10, 11	10 seconds
DEFROST TEST SUP RET EVA 5.0C 12.0C 15.0C 5.2A 5.1A 5.2A	If evaporator temperature is below +10 C, heater remains on until evaporator temperature is above +18 C.	20	1 hour maximum
PRE COOL/HEAT TEST SUP RET EVA 5.1C 5.0C 5.1C 2.3A 2.1A 2.3A	If the return air temperature is above +20 C (68 F), unit operates in cool until the return sensor is less then +15 C (59F) or 1 hour. If the return air temperature is below +5 C (41 F), unit operates in heat until return temperature is above +5 C (41 F) or 2 hours.	None	30 to 60 seconds 1 or 2 hours maximum
COMPRESSOR TEST AMB CON EVA 8.0C 15.0C 5.0C 9.1A 9.0A 9.1A	With compressor and condenser fan on, compressor is operating at 100 percent capacity. Amp draw is measured and compared to voltage. Compressor amperes are recorded in PTI log. If compressor has been off for last 18 hours less than 30 seconds on, a compressor sequence start occurs.	6, 7	30 seconds
DIGITAL VALVE TEST AMB CON EVA 8.0C 25.0C 2.0C 9.1A 9.0A 9.1A	With compressor, condenser fan and evaporator fan on and operating at 100% capacity. Capacity is reduced to 25%. An Amp difference of 1.2 Amps is required.	29	240 seconds maximum
COMP HI PRESS TEST AMB CON EVA 8.0C 45.0C 1.0C 9.1A 9.0A 9.1A	With compressor on, evaporator fan operates on high speed until high-pressure cutout occurs or condenser temperature is above +75 C (167 F). Condenser fan starts and operates until compressor starts.	53, 54	10 to 60 seconds Plus 30 seconds

* Readings may vary depending on voltage and temperature

CRR PTI Full Pretrip Test

LCD Display*	Description	Possible Alarms	Duration (Time)
PRE COOL/HEAT TEST SUP RET EVA 5.1C 5.0C 5.1C 2.3A 2.1A 2.3A	If the return air temperature is above +20 C (68 F), unit operates in cool until the return sensor is less then +15 C (59 F) or 1 hour. If the return air temperature is below +5 C (41 F), unit operates in heat until return temperature is above +5 C (41 F) or 2 hours.	None	30 to 60 seconds 1 or 2 hours maximum
PTI PART 1 END SUP RET EVA 5.1C 5.0C 5.1C 2.3A 2.1A 2.3A	"PTI Part 1 end" is recorded in PTI log.	None	5 seconds

* Readings may vary depending on voltage and temperature

LCD Display*	LED Display	Description	Possible Alarms	Duration (Time)
RUNNING PTI 0°C / 32°F 00:00:00 0.0C 10.0C 10.0C	Supply temp.	Unit operates in normal mode with 0 C (32 F) setpoint. When supply air temperature decreases to setpoint, Chill Arrival" temperatures are recorded in PTI log.	23	120 minutes maximum
RUNNING PTI 0°C / 32°F 00:00:00 0.0C 10.0C 10.0C	Supply temp.	Unit operates in normal mode with 0 C (32 F) setpoint for 30 minutes after previous test is completed. At the end of 30 minutes, "Chill End" temperatures are recorded in PTI log. Sensor values for supply LH, supply RH, return and evaporator sensors are recorded in the event log.	None	30 minutes maximum
RUNNING PTI DEFROST 00:00:00 -18.0C 10.0C 10.0C	Return temp.	Unit operates in normal mode with -18C (0F) setpoint and defrost activated. Defrost terminates when evaporator temperature increases to 18C (65F).	20	90 minutes
RUNNING PTI -18°C / 0°F 00:00:00 -18.0C 10.0C 10.0C	Return temp.	Unit operates in normal mode with -18C (0F) setpoint. When return air temperature decreases to setpoint, Frozen Arrival" temperatures are recorded in PTI log. "PTI End" are recorded in PTI log and a Trip Start is automatically activated.	22, 60	180 minutes maximum
PTI PASS – PRESS KEY	Return temp.	Unit will remain OFF until any key is pressed. If alarms occurred during PTI, LCD display shows "PTI FAIL – PRESS KEY".	None	

* Readings may vary depending on voltage and temperature

Function Test

The MP-3000a controller contains a special function test that automatically tests individual components including the controller display, sensors, condenser fan, evaporator fan, compressors, etc. The test includes measurement of component power consumption and compares test results to expected values.

NOTE: The function test does not test the actual performance of the complete system. Therefore it is not a pretrip test and should not be used instead of the PTI test.

With the **UNIT ON/OFF** switch **ON** and the LCD display showing the standard display (setpoint):

1. Press the **F2** OR **F3** key to enter the menu list. Repeatedly press **F2** key to scroll through Main menu until [COMMANDS] appears in LCD display.
2. Press the **F4** key to access the Commands menu. The first command in the submenu appears in the LCD display.
3. Press the **F2** or **F3** key to scroll to [FUNCTION TEST].
4. Press the **F4** key to start the Function test. LCD display shows functional test currently being performed. Function test ends automatically. Unit automatically returns to normal operation.

See “CRR Function Test Procedure” in the following table for a detailed description of the Function Test. Any alarm codes recorded during the test can be viewed through the controller’s Alarm List menu at the end of the test.

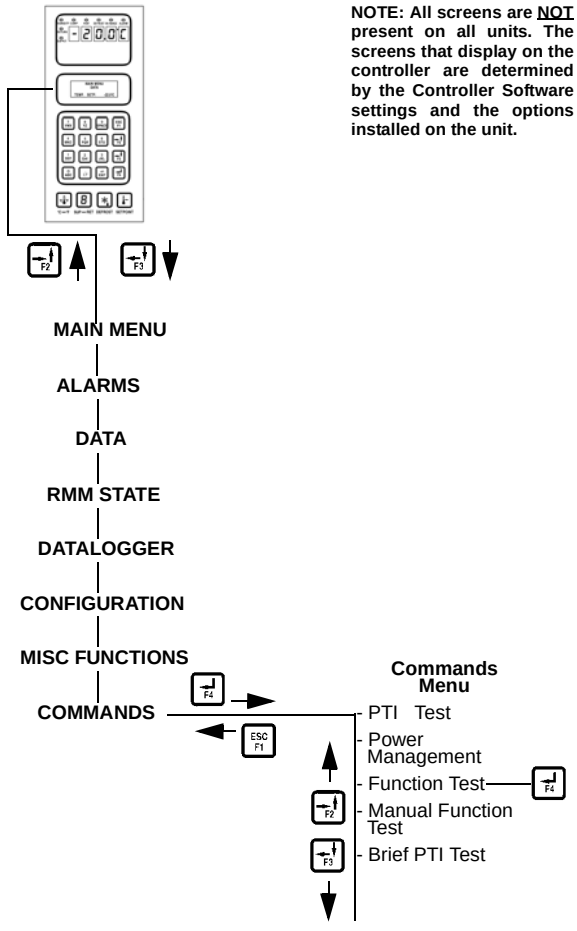


Figure 39: Function Test

CRR Function Test

LCD Display*	Description	Possible Alarms	Duration (Time)
FUNCTION TEST START Activated 0.1A 0.0A 0.1A	Event Log for FUNCTION TEST begins. All alarms are turned off. Alarm list is cleared. All relays are turned off and air vent are closed.	None	2 seconds
SENSOR TEST Activated 0.1A 0.0A 0.1A	All sensors must have values within their measuring range.	00, 01, 02, 03, 04, 05, 32, 33, 34, 35, 97, 98, 99	5 seconds
EVAP FAN LOW TEST SUP RET EVA 5.1C 5.0C 5.1C 1.1A 1.0A 1.1A	Condenser fan and compressor are turned off. With evaporator fan on low speed, amp draw is measured and compared to voltage and frequency: • CRR 40: 1.0 Amps approx. at 50 Hz, 1.0 Amps approx. at 60 Hz Amperes are recorded in the PTI log.	14, 15	10 seconds
EVAP FAN HIGH TEST SUP RET EVA 5.1C 5.0C 5.1C 2.4A 2.3A 2.4A	Condenser fan and compressor are turned off. With evaporator fan on high speed, amp draw is measured and compared to voltage and frequency: • CRR 40: 2.1 Amps approx. at 50 Hz, 2.5 Amps approx. at 60 Hz Amperes are recorded in PTI log.	12, 13	10 seconds
AFAM+ TEST SUP RET EVA 5.1C 5.0C 5.1C 2.4A 2.3A 2.4A	Air vent is opened and verified that the motor is operating. Evaporator fan is started and operating until CO2 value is below 0.5 percent or 20 minutes.	57, 68, 69	10 seconds minimum to 20 minutes maximum
COND FAN TEST SUP RET EVA 5.2C 5.0C 5.1C 1.3A 1.2A 1.3A	Condenser fan is turned on. Amp draw is measured and compared to voltage and frequency: 0.8 Amps maximum. Condenser fan amperes are recorded in PTI log.	16, 17	10 seconds

* Readings may vary depending on voltage and temperature

REVERSE PHASE TEST SUP RET EVA 1.3C 1.0C 1.3C 1.3A 1.2A 1.3A	With condenser fan on, reverse phase selector relay is energized. Condenser fan and compressor reverse current is measured.	58	30 seconds

CRR Function Test

LCD Display*	Description	Possible Alarms	Duration (Time)
HEAT ELEMENT TEST SUP RET EVA 1.3C 1.0C 1.3C 5.2A 5.1A 5.2A	Electric heaters are turned on. Amp draw is measured and compared to voltage: • 4.4 Amps approx. at 400V; • 5.1 Amps approx. at 460V. Heater amperes are recorded in PTI log.	10, 11	10 seconds
COMPRESSOR TEST AMB CON EVA 8.0C 15.0C 5.0C 9.1A 9.0A 9.1A	With compressor and condenser fan on, compressor is operating at 100 percent capacity. Amp draw is measured and compared to voltage. Compressor amperes are recorded in PTI log. If compressor has been off for 18 hours less than 30 seconds on, a compressor sequence occurs.	6, 7	30 seconds
KVQ VALVE TEST AMB CON EVA 8.0C 25.0C 2.0C 9.1A 9.0A 9.1A	With compressor, condensor fan and evaporator fan on and operating at 100% capacity. Capacity is reduced 25%. An Amp draw difference of 1.2 amps is required.	29	240 seconds
INJECTION VALVE TEST AMB CON EVA 8.0C 25.0C 2.0C 9.1A 9.0A 9.1A	Liquid injection valve is turned on for 3 seconds, off for 3 seconds and on for 3 second to verify valve operation.	None	20 seconds

* Readings may vary depending on voltage and temperature

Manual Function Test

The Manual Function Test menu allows technicians to perform specific diagnostic tests on individual components or turn several components on at the same time to perform a system test.

NOTE: When the Manual Function Test menu is entered, the UNIT STOPS. A technician can then select the control circuit or component to be checked/tested from the items shown in the menu.

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the menu list. Repeatedly press F2 key to scroll through Main Menu until “COMMANDS” appears in LCD display.
2. Press F4 key to access the Commands menu. The first command in the submenu (Defrost) appears in the LCD display.
3. Press F2 or F3 key to scroll to Manual Function Test.
4. Press F4 key to enter the Manual Function Test: “CONDENSER OFF” appears in the LCD display.
5. To test a unit component:
   a. Press F2 or F3 key to scroll to desired component test:
      - Condenser
      - Sensor Check Low
      - Sensor Check
      - Zero Current
      - Heat
      - AFAM Close
      - AFAM Open
      - Dehumidity Valve
      - Injection Valve
      - Capacity 100%
      - Capacity 50%
      - Capacity 25%
      - Compressor
   - Sensor Checks (Probe Test): Operates high speed evaporator fans only. After 5 minutes, check the temperatures of the left and right hand supply sensors, return sensor and defrost sensor. Temperatures should be approximately equal.

   b. Press F4 key to start the component test. LCD display will change the component state from OFF to ON.

   c. Verify component performance: LCD display will show expected current and actual current on phase 1, 2 and 3.

   d. Press F4 key again to stop test. LCD display will change component state from ON to OFF.

   NOTE: Controller returns unit to normal operation if no keys are pressed for 10 minutes. Pressing “5” key extends test time by 10 minutes each time it is pressed (maximum time = 100 minutes). Pressing any other key resets test time to 10 minutes.

6. System Test (test multiple components at the same time):
   a. Press F2 or F3 key to scroll to the first component.

   b. Press F4 key to turn the component ON.

   c. Press F3 key to scroll to select next component. Press F4 to turn component ON.

   d. Repeat step 6c. until all required components are ON. For example, to operate unit in Full Cool mode, start the following components:
      - Condenser Fan
      - Compressor
      - Capacity 100%
      - Evaporator High or Low

   e. Observe current draw and system performance to verify component(s) performance.

f. Press F4 key again to turn OFF components individually. Or press ESC key to exit Manual Function Test menu and turn ALL components OFF.

g. Press ESC key to exit the Manual Function Test submenu.

NOTE: Controller returns unit to normal operation if no keys are pressed for 10 minutes. Pressing "5" key extends test time by 10 minutes each time it is pressed (maximum time = 100 minutes). Pressing any other key resets test time to 10 minutes.

Power Management

Selecting a Power Limit from the Power Limit screen turns ON the power reduction control algorithm that reduces total unit electric power consumption based on the Power Limit and Power Time settings.

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the menu list. Repeatedly press F2 key to scroll through Main Menu until "COMMANDS" appears in LCD display.
2. Press F4 key to access the Commands menu. The first command in the submenu (Defrost) appears in the LCD display.
3. Press F2 or F3 key to scroll to Power Management.
4. Press F4 key to enter Power Management submenu. LCD display shows the current Power Limit setting and Power Time setting.
5. To activate or change the power limit:
   a. a. Press F4 key with cursor in the Power Limit menu line. Cursor moves to end of menu line and flashes.
   b. Press F2 or F3 key to scroll to the desired power limit setting: OFF, 13 amps, 15 amps or 17 amps.
   c. With the desired power limit in the menu line, press and hold F4 key until cursor stops flashing. Cursor stops flashing and new value appears in display.
6. To change the length of time power limit is active (ON):
   a. a. Press F2 key to scroll to Power Time menu line (standard setting = 48 hours).
   b. Press F4 key with cursor in the Power Time menu line. An Enter Arrow appears in the menu line and the previous time disappears.
   c. Enter new active period in hours.
   d. With the correct hours entered in the menu line, press and hold F4 key until cursor stops flashing. Cursor stops flashing and new value appears in display.
7. Press ESC key to exit the Power Management submenu.

Misc. Functions Menu

The Misc. Functions menu displays a list of functions that identifies trips and determines how the controller records and displays operating information. The following functions are available:

Date Time: Sets the controller time and date.

Run Time: Displays and sets operating hours for the unit and components.

Program Version: Displays the current software version loaded in the controller: Controller (CTRL), EPROM and program serial numbers (SER NO).

NOTE: The Controller Label on the side of the control box shows the controller serial number and the EPROM version.

Cargo Data: Sets important trip information about the container and the load in the controller.

C/F Mode: Sets the temperature value (Celsius or Fahrenheit) the controller uses to record and display temperature (including historical data).

Viewing the Misc. Functions Menu

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the menu list. Press F2 key to scroll through Main Menu until “MISC. FUNCTIONS” appears in LCD display.
2. Press F4 key to access the Misc. Functions menu. The first command in the submenu appears in the LCD display: Date Time.
3. Press F2 or F3 key to scroll to the desired function:
   - Date Time
   - Run Time
   - Program Version
   - Cargo Data
   - C/F Mode
4. Press F4 key to access the function selected.

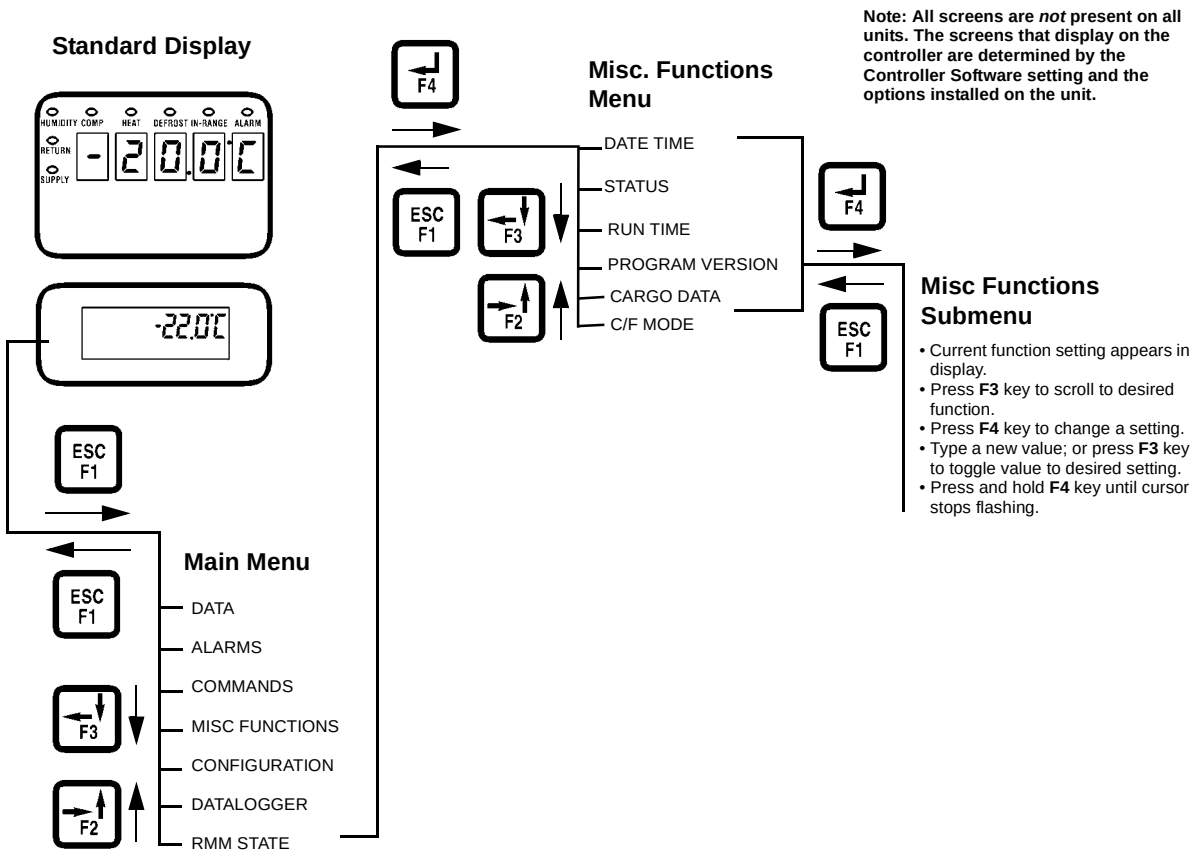


Figure 40: Misc. Functions Menu Screen Flow Diagram

Setting the Date and Time

1. Press F3 key to enter the menu list. Press F2 key to scroll to "MISC. FUNCTIONS".
2. Press F4 key to access the Misc. Functions menu. "Date Time" appears in the LCD display.
3. Press F4 key to access the Date Time screen. Date Time screen appears with cursor in the Time menu line. Display shows time in "HH.MM.SS" where H = hour, M = minute and S = second.
4. To enter a new time, press F4 key with cursor in Time menu line. An Enter Arrow appears in the menu line and the previous time disappears.
5. Enter new time in "HH.MM.SS" format. Decimal points must be included in the entry between the hour, minute and second.

NOTE: To scroll backward in the Time or Date menu line, press and hold the F4 key, then press F3 key. Press F1 key to return keyboard to "numerical" entry before typing again.

6. With the correct time entered in the menu line, press F4 key. Then press EXIT key to enter time in controller memory. Cursor stops blinking and new time appears in display.
7. To enter a new date, press F3 key to move cursor to Date menu line. Display shows date in and date in "YY.MM.DD" where Y = year, M = month and D = day.
8. Press F4 key with cursor in Date menu line. An Enter Arrow appears in the menu line and the previous date disappears.

9. Enter new date in “YY.MM.DD” where Y = year, M = month and D = day. Decimal points must be included in the entry between the year, month and day.
10. With the correct date entered in the menu line, press F4 key. Then press EXIT key to enter date in controller memory. Cursor stops blinking and new date appears in the display.
11. Press ESC key to exit the Date Time screen.

Viewing or Setting Run Time

1. Press F3 key to enter the menu list. Press F2 key to scroll to “MISC. FUNCTIONS”.
2. Press F4 key to access the Misc. Functions menu. “Date Time” appears in the LCD display. Press F2 key to scroll to “RUN TIME”.
3. Press F4 key to access the Run Time screen. The Run Time screen appears with cursor in HEAT menu line.
4. Press F3 key to scroll cursor down through cargo data list:

   - HEAT
   - COMPRESSOR
   - EVAPORATOR HIGH
   - EVAPORATOR LOW
   - CONDENSER
   - TOTAL

5. To reset an hourmeter or set hours on a replacement controller:

   a. Press F4 key with cursor in the desired menu line. The password screen appears.

   b. Press F2 key, “A” key (password is “A”), F4 key and then EXIT key. An Enter Arrow appears in the hourmeter line.

   c. Enter the desired run time setting (up to 5 characters).

   d. When the entry is complete, press and hold the F4 key until the cursor stops flashing. The new run time appears in the menu line.

6. Repeat steps 5 and 6 to reset additional hourmeters.
7. Press ESC key to exit the Run Time screen.

Setting Cargo Data

1. Press F3 key to enter the menu list. Press F2 key to scroll to “MISC. FUNCTIONS”.
2. Press F4 key to access the Misc. Functions menu. “Date Time” appears in the LCD display. Press F2 key to scroll to “CARGO DATA”.
3. Press F4 key to access the Cargo Data screen. Cargo Data screen appears with cursor in LOC. BRT menu line.
4. Press F3 key to scroll cursor down through cargo data list:

   - LOC. BRT
   - CONTENTS
   - DATE (Loading Date)
   - VOYAGE
   - SHIP
   - LD PORT (Loading Port)
   - DIS PORT (Discharge Port)
   - COMMENTS

5. To enter text in a cargo data line, press F4 key with cursor in the desired menu line. An Enter Arrow appears and the cursor flashes in the selected line. Enter (type) the desired text. When entering information:

- Enter up to 10 characters of text/numbers for each menu item.
- To scroll backwards in the text box, press and hold the F4 key, then the press F3 key.
- To delete text from a previous entry, press F4 key and then the SPACE key.
- To start entry over or quickly return to the beginning of the text box, press F4 key, then EXIT key and then F4 key again.
- When the F1, F2, F3 or F4 key is pressed to enter a character in the display, the keypad remains on that “character level” until another “level” is selected by pressing the F1, F2, F3 or F4 key.

6. When the desired text entry is complete, press F4 key. Then press EXIT key. The cursor stops flashing and the new text appears in the menu line.
7. Repeat steps 5 through 7 until all information has been entered in the Cargo Data screen.
8. Press ESC key to exit the Cargo Data screen.

Changing the Temperature Display Value (C/F)

1. Press F3 key to enter the menu list. Press F2 key to scroll to “MISC. FUNCTIONS”.
2. Press F4 key to access the Misc. Functions menu. “Date Time” appears in the LCD display. Press F2 key to scroll to “C/F MODE”.
3. Press F4 key to access the C/F Mode screen. C/F Mode screen appears with cursor in the temperature value menu line. Display shows “C/F MODE °C” where C = Celsius and F = Fahrenheit.
4. To change the temperature value, press F4 key. Cursor moves to end of menu line and flashes.
5. Press F2 key to toggle temperature value in the menu line between C and F.
6. With the desired temperature value in the menu line, press and hold F4 key until cursor stops flashing. Cursor stops blinking and new temperature value appears in display.
7. Press ESC key to exit the C/F Mode screen.

Configuration Menu

The Configuration menu displays a list of functions that identifies unit operating features and current settings. The following functions are available: Container ID, Control Type, In-Range, Contrast, Language, Economy Max, Economy Min, Unit Type, Reefer Type, Zero Current, Supply LH, CA Option, Evaporator Type, Condenser Type, USDA Type, AFAM Units, AFAM Update (time), AFAM Update (%), Auto Configuration and Unit #.

NOTE: When a spare parts controller is installed and powered up for the first time, an automatic configuration feature detects the unit options installed on a unit. After the initial unit power up, the controller turns the Auto Configuration feature Off. See "Replacing the Controller" in this chapter for more information.

Viewing or Setting Functions

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press the F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until "CONFIGURATIONS" appears in LCD display.
3. Press F4 key to access the Configurations screen. Configurations screen appears with cursor in the Container ID menu line.
4. Press F3 key to scroll cursor to view or reset the desired function:
    - Container ID: Sets the container identification number. Enter up to 11 characters (numbers or letters).
    - Control Type: Displays container length and unit type.
    - In-Range: Sets the temperature value for the controller's In-range LED and datalogger functions (factory default = 1.5 C [2.7 F]). Enter a value from 0.5 to 5.0 C (0.9 to 8.9 F).
    - Contrast: Controller automatically regulates black and white contrast value on LCD display according to display temperature. Standard setting is 45. Resetting this value is not recommended.
    - Unit Type: View display value (factory default = NO HUM). Controller automatically activates when a humidity sensor is installed for more than 1 minute. Setting this value is not necessary.
    - Dehumidification Valve
    - Reefer Type: Sets the unit model state to CRR20 PS or CRR40 PS. Must be manually set to unit type on unit serial number plate.
    - Zero Current: View display ON or OFF value (factory default = ON). However, no errors occur if a Zero Current transformer is not installed and configuration is set to ON.
    - Supply LH: View display ON or OFF value (factory default = OFF). Controller automatically activates when a left hand supply sensor is installed for more than 1 minute. Setting this value is not necessary.
    - AFAM Options: Sets the Advanced Fresh Air Management System to NONE, ANALYZER, AFAM or AFAM+ (factory default = NONE). Controller automatically activates when an AFAM system vent door and/or AFAM+ gas sensor is installed for more than one minute. Setting this value is not necessary. However, to calibrate the gas sensor unit, the container must be opened and aired out for at least 15 minutes. Then close container doors and manually set CA Option to ANALYZER. ANALYZER turns on data logging of gas sensor readings only.
    - Gas Analyzer
    - Evaporator Type: Sets the evaporator fan value. Must be manually set.
    - Condenser Type: Sets the condenser fan value to 1/2 HP, 2 HP or 3/4 HP. Must be manually set.

- Chart R: Shows: Not Present, -20 F to 80 F 31 day, -30 C to +25 C 31 day, -25 C to 25 C 31 day.

- AFAM UNITS: Sets the AFAM system units to CF (cubic feet per minute), M3 (cubic meters per hour) or PERCENT (default is M3).
- Auto Configuration: View display ON or OFF value (factory default = OFF). Set value to ON to automatically configure unit to installed components. See “Automatic Configuration of Spare Parts Controller” in this chapter for additional information.
- Unit #: Sets the unit serial number. Enter up to 11 characters (number or letters). Serial number must be manually set. Serial number is required to enable automatic detection of PT100 type USDA sensors on units with serial numbers beginning with MAE, MSF or MWC prefix.
- Unit ID: An 11 digit alpha-numeric container number.

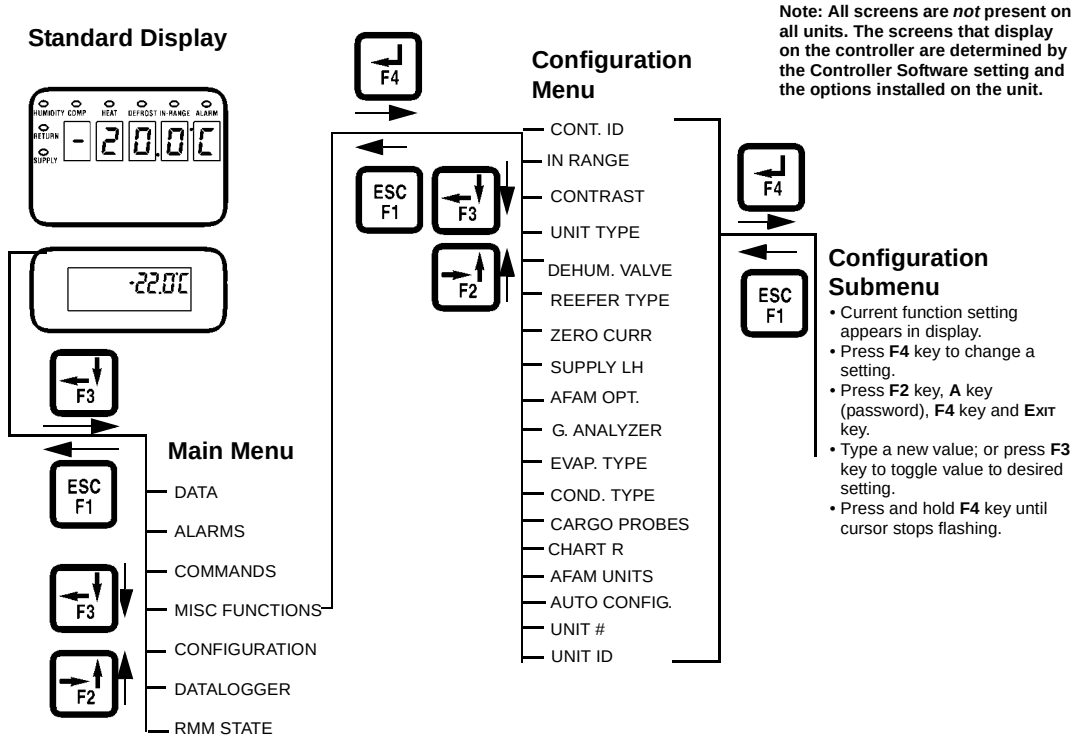


Figure 41: Configuration Menu Screen Flow Diagram

5. To set a new Configuration screen value:
   a. Press F4 key with cursor in the desired menu line. The Password screen appears.
   b. Press F2 key, “A” key (password is “A”), F4 key and then EXIT key. An Enter Arrow appears in the hourmeter line.
   c. Use the general purpose keypad to enter the desired value; or press the F3 key to toggle the value to the desired setting.
   d. When the entry is complete, press the F4 key and release. Press the exit key. The new value appears in the menu line.
6. Repeat steps 4 and 5 to reset additional configuration values.
7. Press ESC key to exit the Configurations screen.

Datalogger Menu

The Datalogger menu contains a list of functions that display unit operating information recorded in the MP-3000a datalogger. The following functions are available:

- Inspect Temperature Log: Displays temperature logs by time and date for the Setpoint; Supply (Controlling Temperature), Return, USDA1, USDA2, USDA3 and Ambient sensors; humidity sensor; and event flags.
- Inspect Event Log: Displays important event logs by time and date for events such as unit alarms, power On/Off, setpoint change, clock reset, trip start, defrost, etc.
- Set Log Time: Sets the data log interval (1 minute or 1/2, 1, 2 or 4 hours).
- Activate Tripstart: Sets the date and time of the trip start.
- Inspect PTI Log: Displays results of last PTI test including component volt and amps data and sensor temperatures. Test values are recorded at the start and end of the Chilled and Frozen Mode test.

Viewing the Datalogger Menu

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press the F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until “DATALOGGER” appears in LCD display.

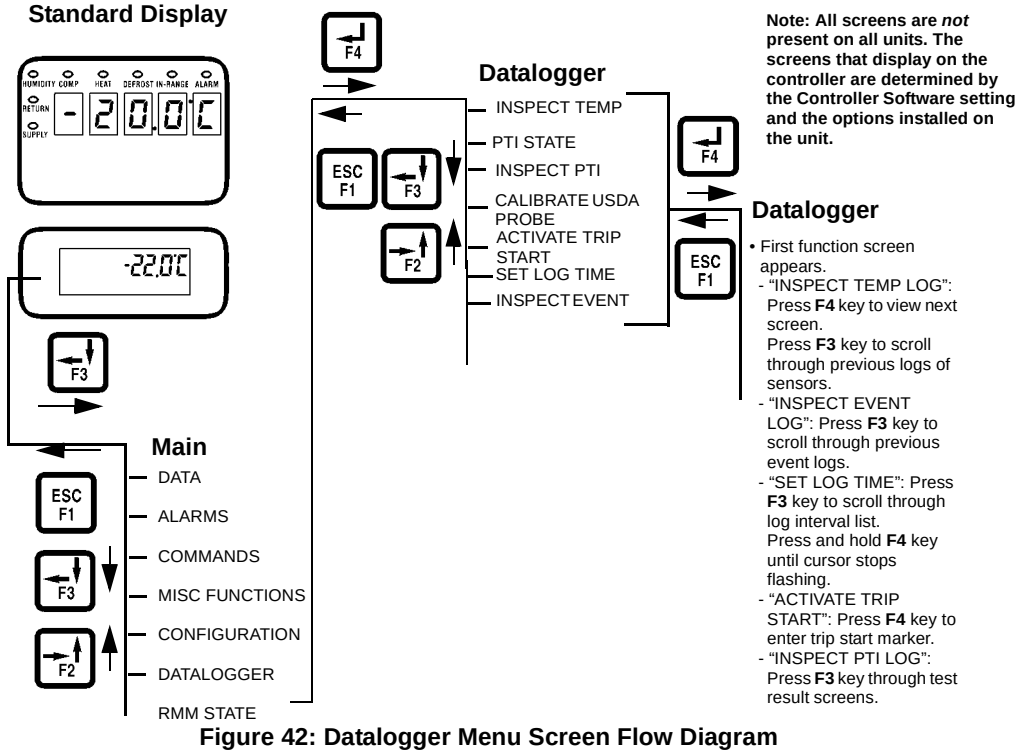


Figure 42: Datalogger Menu Screen Flow Diagram

3. Press F4 key to access the Datalogger menu. The first function appears in the LCD display: Inspect Temp Log.
4. Press F2 or F3 key to scroll to the desired function:

   - Inspect Temp Log
   - PTI State
   - Inspect Event Log
   - Set Log Time
   - Activate Tripstart
   - Inspect PTI Log
5. Press F4 key to access the function selected.

Inspect Temp Log

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F2 key to enter the menu list.
2. Press F2 key to scroll through Main Menu until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in the LCD display.
4. Press F4 key to enter Temp Log. LCD display shows the Log Time and the Setpoint, Supply and Return temperatures of the most recent log in the first screen.
   - To scroll through previous logs of the sensor temperatures currently in the display, press F3 key. All temperature logs recorded in the datalogger memory may be viewed on the LCD display.
5. To view additional sensor log and event flag screens, press F4 key again. LCD display shows USDA1, USDA2, USDA3, Relative Humidity (rH), Ambient, etc.
   - To scroll through previous logs of the sensor temperatures currently in the display, press F3 key.

Event Flags for Temperature Log

T = Tripstart Activated

P = Primary Power Off

D = Defrost in Last Interval

O = Temperature Not In-range

h = Humidity Control Active

E = Evaporator High Temperature

H = High Refrigeration Pressure

d = Defrost terminated on time limit

e = Economy mode activated

s = Reefer unit stopped (after PTI)

w = Water-cooled operation (water pressure switch is OPEN or Condenser Fan Switch is in WATER position)

A = Alarm in last interval

NOTE: All event flags that occurred during a log interval are displayed.

6. Press ESC key to exit the Temp Log.

Inspect Event Log

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in the LCD display.
4. Press F2 or F3 key to scroll through submenu until “Inspect Event Log” appears in LCD display.
5. Press F4 key to enter Event Log. LCD display shows the Log Time and the most recent event.
   - To scroll through previous event log screens, press F3 key. All event logs recorded in the datalogger memory may be viewed on the LCD display.

Event Examples

- Controller alarm status (alarms set/cleared)
- Main power On/Off status (humidity On/Off, temperature setpoint, and main power Hz)
- 12 Vdc battery discharge test (battery voltage, total unit and compressor hours if main power On) — this event logged at once a day
- Change temperature setpoint (new/old setpoint)
- Change RH setpoint (new/old RH setpoint)
- Change RH status (On/Off)
- Event log retrieval
- Temperature log retrieval
- Trip start
- New container ID

- PTI start (Unit configuration)
- PTI part 1 end (Temperature differences for tests 1, 2, 3 and heat test
- PTI end
- Defrost start (logged with demand or manual defrost only)
- Defrost end (start time)

6. Press ESC key to exit the Event Log.

Set Log Time

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the Main Menu.
2. Press F2 key to scroll through menu list until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in the LCD display.
4. Press F2 or F3 key to scroll through submenu until “Set Log Time” appears in LCD display.
5. Press F4 key to enter Temp Log. LCD display shows the current Log Time interval.
6. To enter a new log interval, press F4 key again with cursor in Log Time menu line. Arrow appears in menu line.
7. Press F3 key to scroll through a list of log time intervals:

   - 1 Minute*

   - 1/2 Hour

   - 1 Hour

   - 2 Hour

   - 4 Hour

   * The logging of USDA sensors is fixed at 1 hour intervals to comply with USDA requirement. A logging test of USDA sensors at 1 minute intervals is also possible for 72 minutes. USDA data can not be downloaded during the logging test. After 72 minutes, controller returns to previous logging interval and clears USDA test data from datalogger memory.
8. When the correct log time appears in the menu line, press and hold F4 key until cursor stops flashing. The new Log Time appears in the display.
9. Press ESC key to exit the Temp Log.

Set a Trip Start

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the Main Menu.
2. Press F2 key to scroll through menu list until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in LCD display.
4. Press F2 or F3 key to scroll through submenu until “Activate Tripstart” appears LCD display.
5. Press F4 key to enter Tripstart function. The date and time of last trip start appears in the screen.
6. Press F4 key again to enter a new start of trip date and time in the log.

   NOTE: When a PTI Test is completed, controller automatically enters a Tripstart in the log.
7. Press ESC key to exit the Datalogger menu.

Inspect PTI Log

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press F3 key to enter the Main Menu.
2. Press F2 key to scroll through menu list until “DATALOGGER” appears in LCD display.
3. Press F4 key to access the Datalogger menu. “Inspect Temp Log” appears in the LCD display.
4. Press F2 or F3 key to scroll through submenu until “Inspect PTI Log” appears in LCD display.
5. Press F4 key to enter PTI Log. LCD display shows the Start Time and PTI test results of the most recent PTI log.
   - To scroll through additional test results in the log, press F3 key.

PTI Examples

- PTI stores volt and amps of all power consuming components
- PTI stores temperatures logged at both the start and end of Chilled Mode and Frozen Mode capacity tests

6. Press ESC key to exit the PTI Log.

RMM State Menu

The RMM (Remote Monitoring Modem) State menu displays the current communications status with a REFCON system:

- Offline: No communication between the controller RMM and a REFCON system.
- Zombie: The controller has detected a REFCON system master module and is waiting for communication.
- On-line: The controller RMM is logged-in on a REFCON system.

Viewing the RMM State Screen

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press the F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until “RMM STATE” appears in LCD display.
3. Press F4 key to access the RMM State screen. The screen will show: Offline, Zombie or On-line.
4. Press ESC key to exit the RMM State screen.

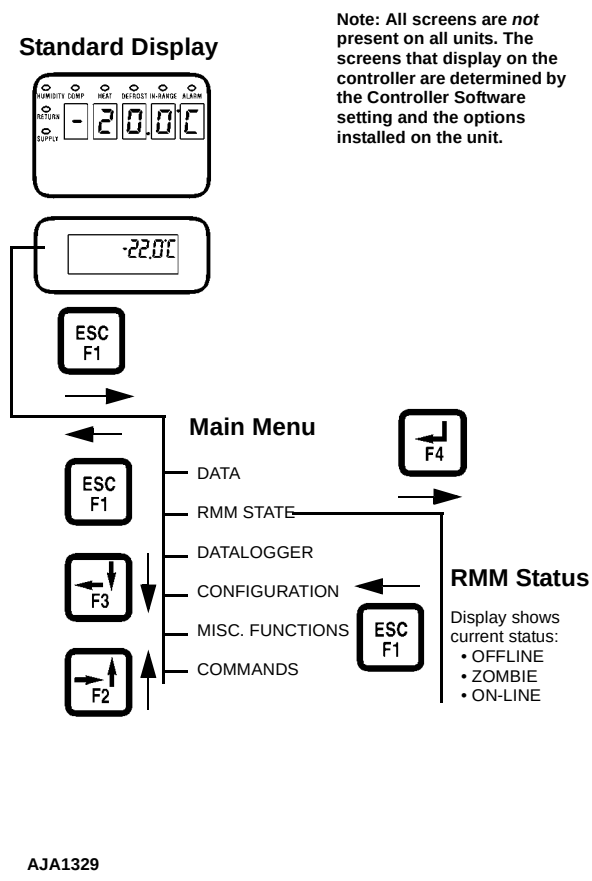


Figure 43: RMM State Menu Screen Flow Diagram

Manual Emergency Mode Operation

In the event of an emergency situation where a failure of the controller occurs, a manual emergency mode function can be used to operate the unit. However, the unit must be manually cycled ON and OFF using the unit 460/380V main circuit breaker. This is because manual control disconnects both the controller and Unit On/Off switch from the main relay board. Manual control offers a selection of six operating positions:

Position 1: Cool 1: Continuous cooling with condenser fan operation and high speed evaporator fan operation.

Position 2: Cool 2: Continuous cooling with condenser fan operation, high speed evaporator fan operation and continuous liquid injection.

Position 3: Not in Use

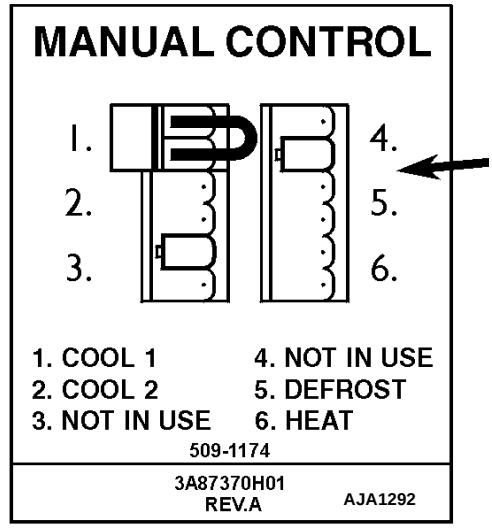
Position 4: Not in Use

Position 5: Defrost: Heaters are activated (evaporator fans off).

Position 6: Heat: Evaporator fans operate at high speed to introduce fan motor heat only into the container (no electric heater operation).

CAUTION: The unit must be cycled ON and OFF manually to maintain the desired temperature. Use the 460/380V main circuit breaker to start and stop the unit. monitor container temperature with an external thermometer.

NOTE: The unit cooling capacity on Chill loads can be reduced by almost closing the suction service valve when Cool 1 is selected. If the compressor overheats, select Cool 2.



A.	Decal for J501 jumper
B.	Decal for J18 jumper

Figure 44: Manual Emergency Control Connections

To select Manual Control:

1. Turn the unit On/Off switch to OFF.
2. Turn the unit 460/380V main circuit breaker OFF. Then disconnect the unit power cord from the power supply.

WARNING: The unit will automatically start and operate if 460/380V power is present at the main relay board when the controller is disconnected. To prevent personal injury from rotating machinery or dangerous electrical shock from high voltage controls, disconnect the supply power to the unit before preparing the unit for manual emergency mode operation.

3. Disconnect cable no. 2 from the controller and main relay board (see electrical schematic). The main relay board will now control the unit based on the manual control setting.

   NOTE: MUST check 2-pin plug location on J501 connections of main relay board to ensure correct unit operation.

4. If necessary, remove 2-pin plug from J501 (see decal on main relay board) and re-locate based on the unit operating mode required.

5. Connect the unit power cord to the proper power supply.
6. Start the unit by turning the unit 460/380V main circuit breaker ON.
7. Check for correct rotation of condenser fan and evaporator fans. Condenser air should be blowing out from the center of the grille. Evaporator air should be blowing down through the evaporator coil. If the fans are running backwards, the power supply phase must be changed. To reverse power phase:
   a. Turn the unit 460/380V main circuit breaker OFF.
   b. Disconnect unit power cord from power supply.
   c. Relocate the phase selector terminal plug from J18 (see decal on main relay board). Relocate from A to B (B to A) as required.
   d. Connect unit power cord to the proper power supply.
   e. Start the unit again by turning the unit 460/380V main circuit breaker ON. Check condenser and evaporator air flow again to confirm correct fan rotation.

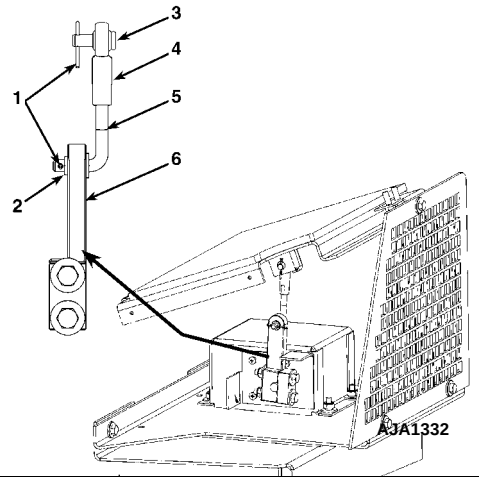
Advanced Fresh Air Management (AFAM) or Advanced Fresh Air Management Plus (AFAM+) Door (Options)

A microprocessor controlled AFAM or AFAM+ door provides programmable control of the air exchange rate. The vent door is adjusted to the desired position by a vent door motor and linkage assembly. The system is precalibrated for air exchange rates of 0 to 280 m 3 /hr (0 to 165 ft 3 /min.). The use of the AFAM or AFAM+ option should be established by the shipper.

WARNING: After installing or servicing the AFAM door, remove all tools and install the vent grille before starting the AFAM or AFAM+ system. Failure to replace the vent grille before turning the AFAM or AFAM+ system ON may result in personal injury or unit damage.

The default setting for AFAM in the SETPOINT menu is the last value set (OFF, UNITS or DEMAND). The AFAM submenu should be set to UNITS to control the vent door to the fresh air exchange rate setting.

If the controller identifies a component failure during unit startup, an alarm is recorded in the controller display and data-logger memory. If a power loss occurs after the AFAM system is turned ON, the controller automatically operates the vent door based on the previous AFAM DELAY and AFAM RATE settings when power is restored.



1.	Cotter Pins
2.	Shoulder Washer
3.	Pin
4.	Rod End
5.	L-Rod
6.	Vent Motor Linkage

Figure 45: AFAM System Linkage Adjustment

Alarm Code	Alarm Type	Description
57	Check	AFAM Control Module or Motor Error: Indicates a frozen or stuck vent door; or a problem with the control module or its wiring; or the motor current draw is not with limits.
68	Check	AFAM+ Gas Analyzer Error: Indicates a communication problem with the gas analyzer
69	Check	AFAM+ Gas Analyzer Calibration indicates problem with sensor

Linkage Installation and Adjustment

If the vent door motor, linkage assembly or vent door require repair or replacement, make sure the linkage is properly adjusted.

1. Insert L-rod in damper motor linkage so that the eyelet in the rod end aligns with the vent door bracket. Install pin, shoulder washer and cotter pin to fasten L-rod to damper motor linkage.
2. Fully thread the rod end onto the L-rod. Then back off rod end approximately 2 complete rotations.

3. Align the rod end eyelet in the vent door bracket. Temporarily insert pin to fasten rod end to door bracket.
4. Visually check the linkage alignment. The linkage should be straight and touching or almost touching the mechanical stop. If the linkage is linkage is binding or jammed against the stop, the linkage is too long. Disconnect the rod end from the door bracket. Shorten the linkage by rotating the rod end on to the L-rod additional rotations. Shorten linkage until linkage alignment is correct.
5. Visually check vent door seal. If the vent door is fully closed, but the door gasket does not create a tight seal with the air exchange openings, the linkage is too short. Disconnect the rod end from the door bracket. Lengthen linkage by backing rod end off additional rotations. Lengthen linkage until door gasket seals tightly against the air exchange openings.
6. When linkage is properly adjusted, fasten rod end securely to door bracket with pin and cotter pin.

Fresh Air Exchange System

The fresh air exchange system has an adjustable vent door for ventilation. The evaporator fans draw in outside air through an air intake and discharge an equal amount of container air through an air outlet.

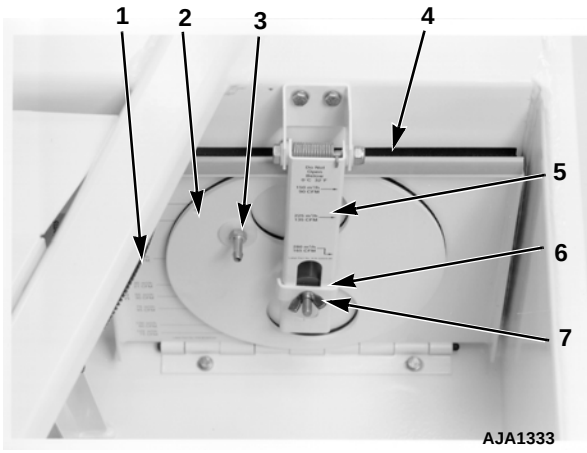
NOTE: Set the disk or door position to the ventilation rate indicated on the shipping manifest.

Disk Adjustment: Low Ventilation Rates

1. Loosen wing nut on handle assembly.
2. Rotate the disk to set the Indicator at the air exchange rate shown on the ventilation scale on the door: - CRR40 and CRR40SL Models: 0 to 125 m3 /hr (0 and 75 ft3/min.)
3. Tighten the wing nut.

Handle Adjustment: High Ventilation Rates

1. Loosen wing nut on handle assembly until handle bracket will rotate over handle.
2. Align handle bracket and wing nut over hole in handle assembly and push through handle.



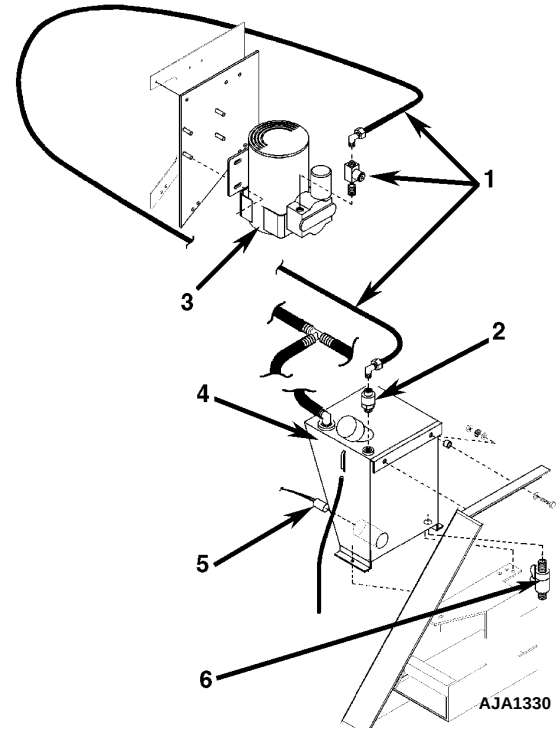
1.	Disk Scale: Low Ventilation Rates
2.	Disk Assembly with Rate Indicator
3.	CO_2 Port
4.	Ventilation Door
5.	Handle Assembly with Scale: High Ventilation Rates
6.	Handle Bracket
7.	Wing Nut

Figure 46: Air Exchange System

3. Pull handle down to lower ventilation door. Insert edge of ventilation door in a notch on handle. Spring loaded handle is shown on the handle scale:
4. - CRR40and CRR40SL Models: 150, 225 and 280m 3/hr (90, 135 and 165 ft 3/min.).

Humidify System (Option)

The Humidify Mode increases the humidity level in the container by injecting atomized water directly into the evaporator supply air stream. The use of the Humidify Mode should be established by the shipper. The Humidify Mode option is turned on from the CONTROL line in the Setpoint menu of the controller. See “Changing the Humidity Mode Setting” under “Setpoint Menu” on page 4-18 to set the Humidify system to ON. The HUMIDITY LED turns ON when the Humidify Mode is set to ON.



1.	Water Supply Hose and Atomizing Nozzle: Inspect every 1,000 hours. Clean if necessary
2.	Filter: Inspect every 1,000 hours and clean if necessary.
3.	Air Compressor: Inspect once a year
4.	Water Tanks: • Pretrip Inspection: Check water level • Every 1,000 Hours: Inspect water tank. Clean if necessary
5.	Water Tank Heater: Check for correct operation in ambient temperatures below 4 C (40 F)
6.	Drain Cock

Figure 47: Humidify System (Option)

The controller energizes (operates) the air compressor when the humidity level in the container is more than 2% below the humidity setpoint. The air compressor atomizes and injects water into the evaporator supply air stream to add moisture to the container air.

The evaporator drain hoses are routed to the water tank to replenish the water level during unit operation. However, water usage will vary depending upon the load and ambient conditions. An overflow hose on the water tank removes excess water when particularly wet loads are transported or when the humidify system is not operating.

NOTE: Only demineralized or distilled water should be used to prevent plugging of the atomizing nozzle.

Pretrip Inspection

The following items should be inspected before loading the container:

- Check the water level in the water tank to maintain an adequate water supply.
- Check humidify system operation by starting the unit, setting the Humidify mode to ON and adjusting the humidify setpoint (HUMSP) more than 2% above the current humidity level in the container. Verify that the air compressor operates and that water is drawn into the atomizing nozzle and injected into the return air stream.

Inspection and Cleaning

The following items should be periodically serviced:

- Clean and inspect the filter in the water supply hose on the water tank every 1,000 operating hours. Clean the filter screen with fresh water and a soft brush.
- Inspect the water tank, water supply line and atomizing nozzle every 1,000 hours and clean if necessary. Use fresh water, a soft brush and compressed air to clean and blow clear components.
- Inspect the air compressor for signs of overheating once a year.

Partlow (Model SR) Recording Thermometer (Option)

The 31-day Partlow Recorder is mechanically driven by a spring wound mechanism. The sensor bulb is mounted in the evaporator to record the supply air temperature.

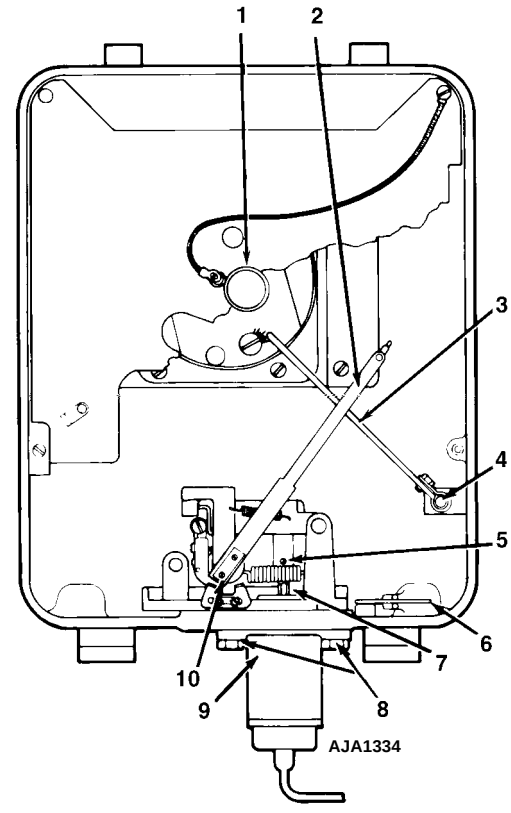
The recording thermometer should be inspected and cleaned to ensure that the stylus produces smooth clean lines and records accurate temperature readings. When changing charts, wipe the stylus and chart platen with a clean, damp cloth to remove material transferred from the back of the chart to the platen by the pressure of the stylus.

Recording Chart Replacement

1. To change the charts, remove the knurled chart nut from the drive shaft and remove the chart.
2. Install the new chart on the chart drive shaft. Position the chart edge under the four clips.
3. Replace the chant nut loosely and rotate the chart so that the correct time is indicated by the stylus. In order to operate the stylus with the door open for the purpose of checking or zeroing the control, the lifter arm can be locked in this lowered position by pushing down on the lifter arm shaft and rotating the arm on its pivot point. If the lifter arm does not retract away from the stylus when the door is closed, reposition the arm on the shaft by loosening the Allen screw on the lifter arm.
4. Hold the recording chart in position and tighten the chart nut finger tight.
5. Lower the pen by rotating the lifting arm counterclock-wise and pushing the pen against the chart. If there is insufficient pressure on the stylus to mark the chart, care-fully grip the pivot end of the stylus warm where it is riveted to the stamping with a pair of long-nosed pliers. Bend the stamping toward the instrument. Care must be used not to bend the stylus arm, but only the stamping to which it is attached.

Marking System Calibration

1. Visually inspect the recording thermometer sensing bulb located in the evaporator near the supply air grille. Make sure it is securely fastened and clear of debris.
2. Start the unit and adjust the temperature setpoint to 0 C (32 F). Operate the unit until the supply air temperature reaches 0 C (32 F). Enter the Data menu on the controller display and view the supply air temperature screen. Press the “5” key two times to lock the screen on the display for 10 minutes.
3. Wait at least 5 minutes to allow the recording thermometer sensing bulb temperature to stabilize. Then compare the supply air temperature in the controller display with the recording stylus of the recorder. Write down both readings.
4. If the average difference is 0.6 C (1.0 F) or less, DO NOT attempt to recalibrate.
5. If the recorder need recalibration:
   a. Loosen the Allen setscrew (S) using a small slotted screwdriver.
   b. Adjust shaft (J) with a 5 mm (3/16 in.) open end wrench until the recording stylus pointer is aligned to the temperature reading that agrees with the supply air temperature in the controller display. To decrease the stylus temperature reading, turn the shaft to the left (clockwise). To increase the reading, turn the shaft to the right (counterclockwise).
   c. Tighten Allen setscrew (S).
   d. Wait another 5 minutes while the unit operates on Cool. Verify that the recording thermometer reading is stable and agrees with the supply air temperature in the controller display.
   e. Press any key to unlock the controller display screen.



1.	Knurled Knob
2.	Recording Stylus
3.	Liter Arm
4.	Allen Screw
5.	Set Screw “S”
6.	Key mounting CLip
7.	Adjustment Shaft “J”
8.	Element Flange Screws “D”
9.	Thermal Element
10.	Stamping

Figure 48: Partlow (SR) Recording Thermometer

Element Replacement

The recording thermometer’s thermal element is field replace-able. To replace the element:

1. Remove element flange screws (D) and withdraw the thermal element from the recorder case. Care must be taken not to bend the hex shaft which extends from the recorder case.
2. Remove the old sensing bulb and capillary from the unit.

3. Install the new sensing bulb and capillary in the unit. The capillary of the new thermal element may be bent, but DO NOT bend the bulb.
4. Install a new thermal element in the recorder case.
5. Replace the element flange screws (D) and tighten securely.
6. Check the calibration of the recorder. Recalibrate the recorder if necessary.

Saginomiya (Model SKM) Recording Thermometer (Option)

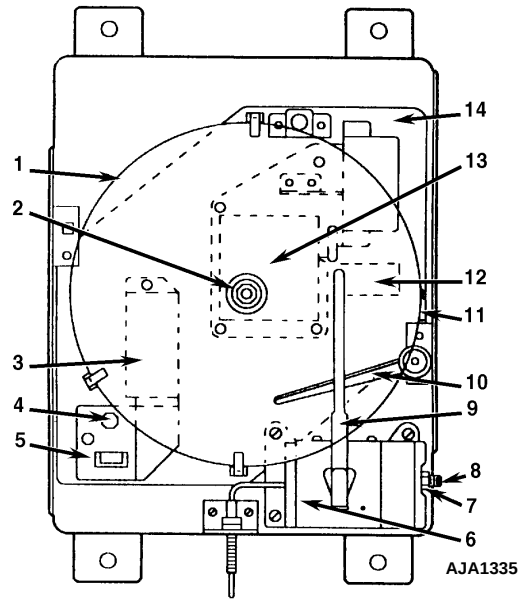
The 31-day Saginomiya Recorder is electric motor driven by a dry cell type battery with a 1 year life expectancy. The sensor bulb is mounted in the evaporator to record the return air temperature.

The recording thermometer should be inspected and cleaned to ensure that the stylus produces smooth clean lines and records accurate temperature readings.

Battery

The recording chart is driven by a battery-powered quartz motor and reducing gear. The battery charge should be checked during unit pretrip inspection or once a month. To check the battery charge, press the button the voltage indicator:

- Blue Zone — Battery good. If the indicator needle remains in the blue zone when the test button is depressed, the battery has sufficient power to operate the recorder.
- White Zone — Replace battery within 30 days. If the indicator needle remains in the white zone when the test button is depressed during a pretrip inspection, replace the battery. Although the battery may operate the recorder up to 30 more days, replacing the battery before it is completely dead is recommended.
- Red Zone — Dead battery. If the indicator needle remains in the red zone when the test button is depressed, the battery is dead and must be replaced.



1.	Recording Chart
2.	Chart Nut
3.	Battery
4.	Test Button
5.	Battery Voltage Indicator
6.	Power Element Assembly
7.	Setting Screw (Calibration)
8.	Lock Screw (Calibration)
9.	Recording Pen
10.	Lifting Arm
11.	Time Scale Plate
12.	Terminal Board
13.	Quartz Motor and Reducing Gear Assembly
14.	Recording Platen

Figure 49: Saginomiya (SKM) Recording Thermometer

To replace the battery:

1. Raise the stylus away from the chart by rotating the pen lift gear clockwise 30 degrees and releasing the lifting arm. The pen will remain in the raised position. Remove the knurled chart nut from the drive shaft and remove the chart.
2. Loosen the four setscrews that hold the recording platen in the recorder. The setscrews do not remove from the recorder base.

3. Rotate the recording platen counterclockwise and remove the platen.
4. Remove the battery from the recorder.
5. Install a new battery in the recorder making sure the battery's positive (+) and negative (-) poles are correctly aligned.
6. Press the button on the voltage indicator to make sure the indicator needle is the in blue zone.
7. Check to see that the quartz motor is running. Look through the inspection window and make sure the internal flywheel on the quartz motor is revolving.
8. Replace the recording platen on the recorder base and rotate clockwise to view setscrews. Tighten four set-screws that hold the platen in the recorder
9. Replace the recording chart and chart nut on the chart drive shaft and tighten the chart nut finger tight.
10. Lower the pen by rotating the lifting arm counterclock-wise and push the pen against the chart.

Recording Chart Replacement

1. To change the charts, raise the stylus away from the chart by rotating the pen lifting arm clockwise 30 degrees and releasing the lifting arm. The pen will remain in the raised position. Remove the knurled chart nut from the drive shaft and remove the chart.
2. Install the new chart in the slot on the platen and on the chart drive shaft. Position the chart edge under three hold-down flanges.
3. Replace the chant nut loosely and rotate the chart so that the correct date and time are indicated by the arrow on the time scale plate. Finally hold the recording chart in position and tighten the chart nut finger tight.
4. Lower the pen by rotating the lifting arm counterclock-wise and pushing the pen against the chart.

Marking System Calibration

1. Visually inspect the recording thermometer sensing bulb located in the evaporator near the return air grille. Make sure it is securely fastened and clear of debris.
2. Start the unit and adjust the temperature setpoint to 0 C (32 F). Operate the unit until the return air temperature reaches 0 C (32 F). Enter the View menu on the controller display and scroll to the return air temperature ("RET") screen. Press the ENTER key to lock the "RET" screen on the display.
3. Wait at least 5 minutes to allow the recording thermometer sensing bulb temperature to stabilize. Then compare the "RET" temperature in the controller display with the recording stylus of the recorder. Write down both readings.
4. If the average difference is 0.6 C (1.0 F) or less, DO NOT attempt to recalibrate.
5. If the recorder needs recalibration:
   a. Place the pen in the recording position (lowered against chart)
   b. Loosen the lock screw using a small Phillips screw-driver.
   c. Adjust the setting screw with a small slotted screw-driver or a 7 mm (9/32 in.) open end wrench. Rotate the setting screw clockwise until the recording pen temperature reading is 2 to 4 C (4 to 6 F) higher than the temperature reading of the test instrument.

   NOTE: Turning the setting screw one complete revolution (360 degrees) changes the temperature reading of the pen by approximately 5 C (9 F).

   d. Then rotate the setting screw counterclockwise to lower the recording pen reading until the pen reading agrees with the "RET" controller display.
   e. Tighten the lock screw.

f. Wait another 5 minutes while the unit operates on Cool. Verify that the recording thermometer reading is stable and agrees with the “RET” temperature in the controller display.

g. Press any key to unlock the controller display screen.

Power Element Assembly Replacement

The recording thermometer’s power element is field replace-able. To replace the element assembly:

1. Raise the stylus away from the chart. Remove the knurled chart nut and chart.
2. Remove the recording platen.
3. Loosen five mounting screws that mount the capillary holding plate and element assembly in the recorder. Remove the power element assembly (includes recording pen assembly).
4. Remove the old sensing bulb and capillary from the unit.
5. Install the new sensing bulb and capillary in the unit. The capillary of the new thermal element may be bent, but DO NOT bend the bulb.
6. Install the capillary in the recorder and securely tighten five mounting screws.
7. Replace the recording platen, recording chart and chart nut. Lower the recording pen.
8. Check the calibration of the recorder. Recalibrate the recorder if necessary.

Timer (Quartz Motor and Reducing Gear) Replacement

The quartz motor is field replaceable. To replace the motor and reducing gear assembly:

1. Raise the stylus away from the chart. Remove the knurled chart nut and chart.
2. Remove the recording platen.
3. Loosen the two terminal screws on the terminal board and remove the motor wires.
4. Loosen the five screws that mount the motor assembly in the recorder. Remove the motor assembly.
5. Install new motor assembly. Install an securely tighten five mounting screws.
6. Connect the motor wires to the terminal board. Make sure the red positive (+) and black negative (-) wire are correctly aligned.
7. Check to see that the quartz motor is running. Look through the inspection window and make sure the internal flywheel on the quartz motor is revolving.
8. Replace the recording platen, recording chart and chart nut. Lower the recording pen.

Battery Voltage Indicator

The battery voltage indicator is field replaceable. If the indicator needle oscillates when the test button is depressed, or the needle remains in the red zone when a new battery is installed, replace the voltage indicator assembly:

1. Remove the knurled chart nut and chart. Remove the recording platen.
2. Loosen the two terminal screws on the terminal board and remove the voltage indicator wires.
3. Loosen the two mounting screws that mount the voltage indicator assembly in the recorder. Remove the voltage indicator (includes battery holder).
4. Install a new voltage indicator. Install and securely tighten the two mounting screws.
5. Connect the voltage indicator wires to the terminal board. Make sure the red positive (+) wire and black negative (-) wire are correctly aligned.
6. Reinstall the battery in the battery holder (with correct polarity). Check the voltage indicator by depressing the test button to make sure the indicator needle is in the blue zone. Also check to see that the quartz motor is operating (flywheel revolving).
7. Replace the recording platen, recording chart and chart nut. Lower the recording pen.

Electronic Chart Recorder for MP3000a Controllers

An Electronic Temperature Chart Recorder is available for use in the MP-3000a controlled units. The recorder connects to the controller through a RS-485 port on the side of the controller. The recorder uses the sensors in the unit for it data/chart plotting. The charts that are used are any 31-day type charts currently used or available in the industry.

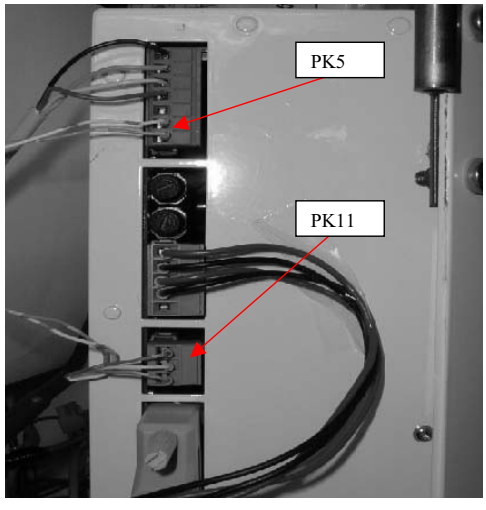
Recorder Installation

Recorder fits in TK enclosure only. If OEM Partlow box is installed, it must be replaced with TK design box.

1. Turn unit **OFF** and remove from main power.
2. Remove OEM recorder from enclosure.
3. Route recorder cable through sensor harness grommet in bottom of control box.

   NOTE: Cable end with connector is controller end. Loose wire end goes to recorder.

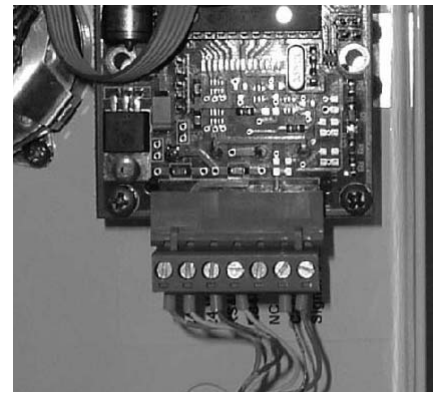
4. Plug the RS-485 plug into controller.
5. Connect power wires to battery connector on controller.



1.	PK11-1: RS485 (+) - blue
2.	PK11-2: RS485 (-) - white
3.	PK11-3: Signal GND - green
4.	PK5-6: (24Vac) - orange
5.	PK5-7: (24Vac) - orange/white

Figure 50: Power Wire Connections

6. Route recorder cable, loose wire end, through grommet in bottom of recorder enclosure and Timmerman clamp on recorder. Ensure exposed length is enough to reach recorder connections.
7. Connect cable to recorder as shown below.



1.	Pin 1: Signal GND - green
2.	Pin 2:Case ground - bare
3.	Pin 3:NC
4.	Pin 4:RS485 (-) - white
5.	Pin 5:RS485 (+) - blue
6.	Pin 6:(24Vac) - orange/white
7.	Pin 7:(24Vac) - orange

Figure 51: Chart Recorder Terminals

8. Mount recorder into enclosure using bolts provided (or existing ones removed).
9. Mechanical installation is complete. Proceed to [SETUP] section.

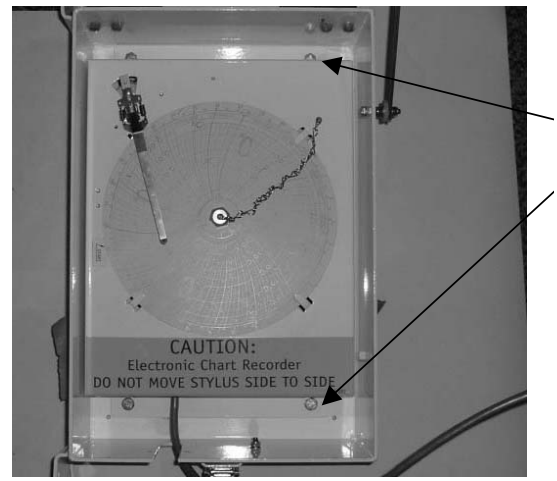


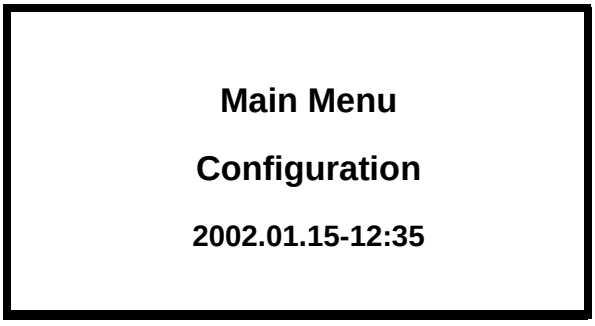
Figure 52: Electronic Chart Recorder Mounting Bolts

Recorder Setup

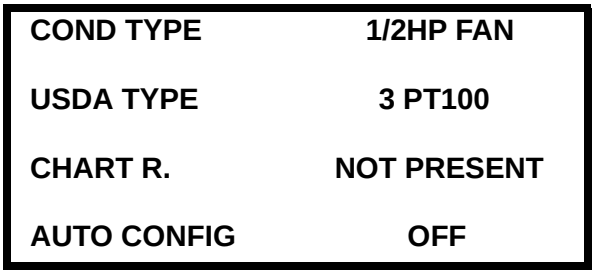
Once the recorder is installed, it needs to be added to the unit configuration. Connect unit to main power and turn ON.

NOTE: Software version 01122300 or above is required to add the electronic recorder. Flashload software as necessary

1. Press the **UP** or **DOWN** key to enter menu area.
2. Scroll up or down to [CONFIGURATION] menu. Press **F4** to enter menu.



3. Scroll up or down to find [CHART R NOT PRESENT] (below is only an example of where item is located).



4. Press the **F4** to select [CHART R. NOT PRESENT].
5. Enter password. Password is A

   NOTE: To enter password: Press F2 key, press A key, press F4 key, press EXIT key.

6. Scroll up or down to select chart type being used. Press and hold **F4** for 5 seconds.

Chart Types Available

+25/ -25 C 31-day

+25 / -30 C 31-day

+80 / -20 F 31-day

7. Controller will now enter [AUTO CONFIG] test as unit configuration has been changed.
8. Setup is complete upon completion of [AUTO CONFIG] test.

Using Special Features

An operator can create a new chart from any date range of data recorded in the datalogger. This is extremely valuable if:

- The original chart is missing
- The original chart has been damaged

Procedure for Redraw Chart

1. Install new temperature chart in recorder.
2. Press the **UP** or **DOWN** key to enter menu area.
3. Scroll up or down to [DATALOGGER] menu. Press the **F4** to enter menu.
4. Scroll up or down to [SET LOG TIME].

DATALOGGER
SET LOG TIME
2002.01.15-12:35

5. Press the **F4** key and the following menu will appear.

LOG CHART	1 HOUR
CHART RECORD	RET
CHART STATE	ONLINE
CHART CDM	ONLINE
REDRAW FROM	02.01.15
REDRAW TO	02.01.15

6. Scroll up or down to place cursor on [REDRAW FROM] line. Press the **F4**.
7. Date information will now be blank. Select date to start record. After entering, press the **F4** and EXIT.

NOTE: Date format: YY.MM.DD

8. Scroll down to place cursor on [REDRAW TO] line. Press the **F4**.
9. Date information will now be blank. Select date to end record. After entering, press the **F4** and EXIT.

NOTE: Date format: YY.MM.DD.

NOTE: Do not exceed 31 days. This is the limit of the chart.

10. Scroll up to place cursor on [CHART CMD]. Press the **F4**.
11. Use up or down to scroll to [REDRAW]. Press the **F4**.
12. Chart will now begin to plot requested date range.
13. Remove chart when complete.
14. Install new chart.

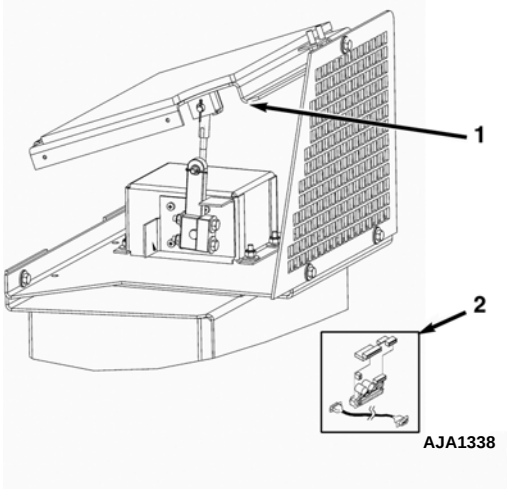
AFAM System and AFAM+ System Operation

Advanced Fresh Air Management (AFAM) System

An advanced microprocessor controlled fresh air management system provides programmable control of the air exchange rate, programmable delayed vent opening, automatic closure of the air exchange vent during low ambient conditions, and data logging of the air exchange rate and vent opening delay interval.

The AFAM system includes a door control module, vent door and vent grille. The MP-3000a controller sends a communication signal to the door control module to position to vent door to the desired position. The controller can also be set to delay opening of the fresh air vent for up to 72 hours, in 1-hour increments. This allows faster product temperature pulldown.

The system is precalibrated for air exchange rates of 0 to 280 m3/hr (0 to 165 ft3/min.). The actual door position is based on the air exchange setting, the power supply frequency (Hertz) and the VFD mode setting (CRR PS+ Models only).



1.	Vent Door Assembly and Damper Motor
2.	Interface Board and Cable (Mounts in Control Box)

Figure 53: AFAM System

If the controller identifies a component failure during unit startup, an alarm is recorded in the controller display and datalogger memory. If a power loss occurs after the AFAM system is turned ON, the controller automatically operates the vent door based on the previous AFAM DELAY and AFAM RATE settings when power is restored.

Setting AFAM System Values

WARNING: After installing or servicing the AFAM door assembly, remove all tools and install the vent grille before starting the AFAM system. Failure to replace the vent grille before turning the AFAM system ON may result in personal injury or unit damage.

The Controlled Atmosphere (CA OPTION) submenu in the CONFIGURATION menu is factory set to AFAM. The controller then adds the “AFAM”, “AFAM DELAY” and “AFAM RATE” submenus to the SETPOINT menu. If a replacement controller or new software is installed, a controller auto configuration will detect the AFAM option when the AFAM door control module is connected to the controller.

The default setting for the AFAM in the SETPOINT menu is the last value set (OFF, UNITS or DEMAND). The AFAM submenu should be set to UNITS to control the vent door to the fresh air exchange rate setting.

Starting the AFAM System

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the “TEMP SETP” line.
2. Press F2 key to scroll to “AFAM” line.
3. To change the mode setting, press F4 key. Cursor moves to end of menu line and flashes.

WARNING: The vent door and motor actuator arm move immediately when the F4 key is pressed to turn the AFAM system in DEMAND UNITS or OFF. Keep hands and tools away from the air exchange system components to prevent personal injury or unit damage.

4. Press F2 key to toggle between OFF, DEMAND and UNITS.

- OFF: Vent door stops in current position. AFAM DELAY and AFAM RATE settings become blank ("--"). If gas sensor unit is installed on unit, the CO_2 MAX settings also become blank.
- DEMAND: Controller uses the CO_2 gas level to adjust the vent door position.
- UNITS: Controller uses the fresh air exchange rate to adjust the vent door position. If a gas sensor unit is installed on the unit, control of the CO_2 gas level remains OFF.

5. With UNITS in the menu line, press and hold F4 key until cursor stops flashing. UNITS now appears in display.
6. Press ESC key to exit the SETPOINT screen.

Changing the AFAM Delay

NOTE: The fresh air exchange time delay should be established by the shipper.

The AFAM delay setting keeps the fresh air vent closed for a preset time when the unit starts. This allows faster product temperature pulldown. The AFAM delay can be set from 1 to 72 hours in 1-hour increments.

NOTE: During unit startup, the AFAM delay prevents the AFAM door from opening until the delay times out. The AFAM delay prevents the AFAM door from opening due to the AFAM Rate or CO_2 system settings.

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the "TEMP SETP" line.

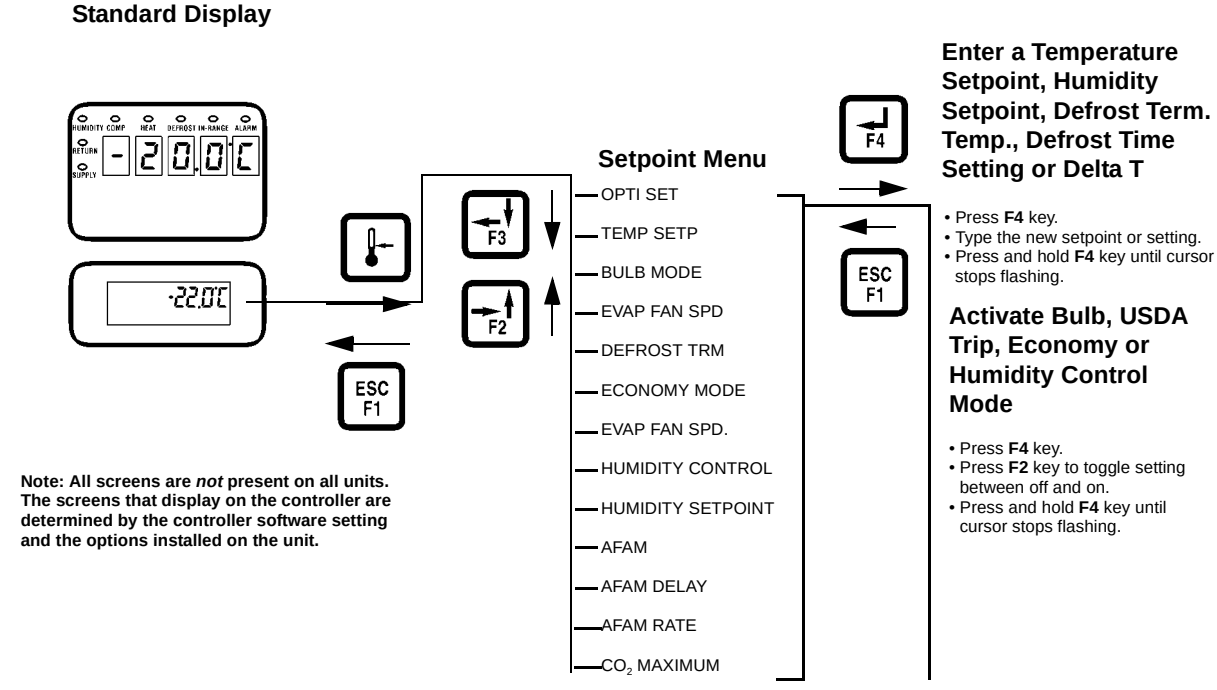


Figure 54: Setpoint Menu Screen Flow Diagram

2. Press F2 key to scroll to “AFAM DELAY” line. The current setting (“0”) appears in the display.
3. To enter a new time delay, press the F4 key. An Enter Arrow appears in the menu line and current time delay disappears.
4. Enter (type) new time delay in the LCD display using general purpose keypad: 1 to 72 hours. The cursor moves to right of the screen as each key entry is acknowledged and displayed.

WARNING: The vent door and motor actuator arm move immediately again when delay is entered. Keep hands and tools away from air exchange system components to prevent personal injury or unit damage.

5. Press and hold the F4 key until the cursor stops flashing. The new time delay is recorded in the controller and appears in the LCD display.
6. Press ESC key to exit the SETPOINT screen.

Changing the AFAM Rate

NOTE: The fresh air exchange rate should be established by shipper.

The AFAM rate sets the desired air exchange rate. The actual door position is based on the AFAM rate and the power supply frequency (Hertz).

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the “TEMP SETP” line.
2. Press F2 key to scroll to “AFAM RATE” line. The current rate and units (e.g. “0 CFM”) appears in the display.
3. To change the rate, press the F4 key. An Enter Arrow appears in the menu line and the current rate disappears.
4. Enter (type) the new rate in the LCD display using the general purpose keypad:

Units	Rate Setting
CFM	0 to 168 Cubic Feet Per Minute
M3H	0 to 280 Cubic Meters Per Hour
PERCENT	0 to 100 Percent

WARNING: The vent door immediately closes and re-opens to the new position when a rate is entered. Keep hands and tools away from the air exchange system components to prevent personal injury or unit damage.

1. Press and hold the F4 key until the cursor stops flashing. The new rate is recorded in the controller and appears in the LCD display.

Setting AFAM Units in the Configuration Menu

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press the F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until “CONFIGURATIONS” appears in LCD display.
3. Press F4 key to access the Configurations screen. Configurations screen appears with cursor in the In-Range menu line.
4. Press F3 key to scroll cursor to AFAM UNITS.
5. To set a new value, press F4 key. The Password screen appears.

6. Enter the password. Press F2 key, “A” key (password is “A”), F4 key and then EXIT key. An Enter Arrow appears in the hourmeter line.
7. Press the F3 key to toggle the value to the desired setting (default is M3):
   - M3 (Cubic Meters per Hour)
   - CF (Cubic Feet per Minute)
   - PERCENT
8. When the desired value appears in the display, press and hold the F4 key until the cursor stops flashing. The new value appears in the menu line.
9. Press ESC key to exit the Configurations screen.

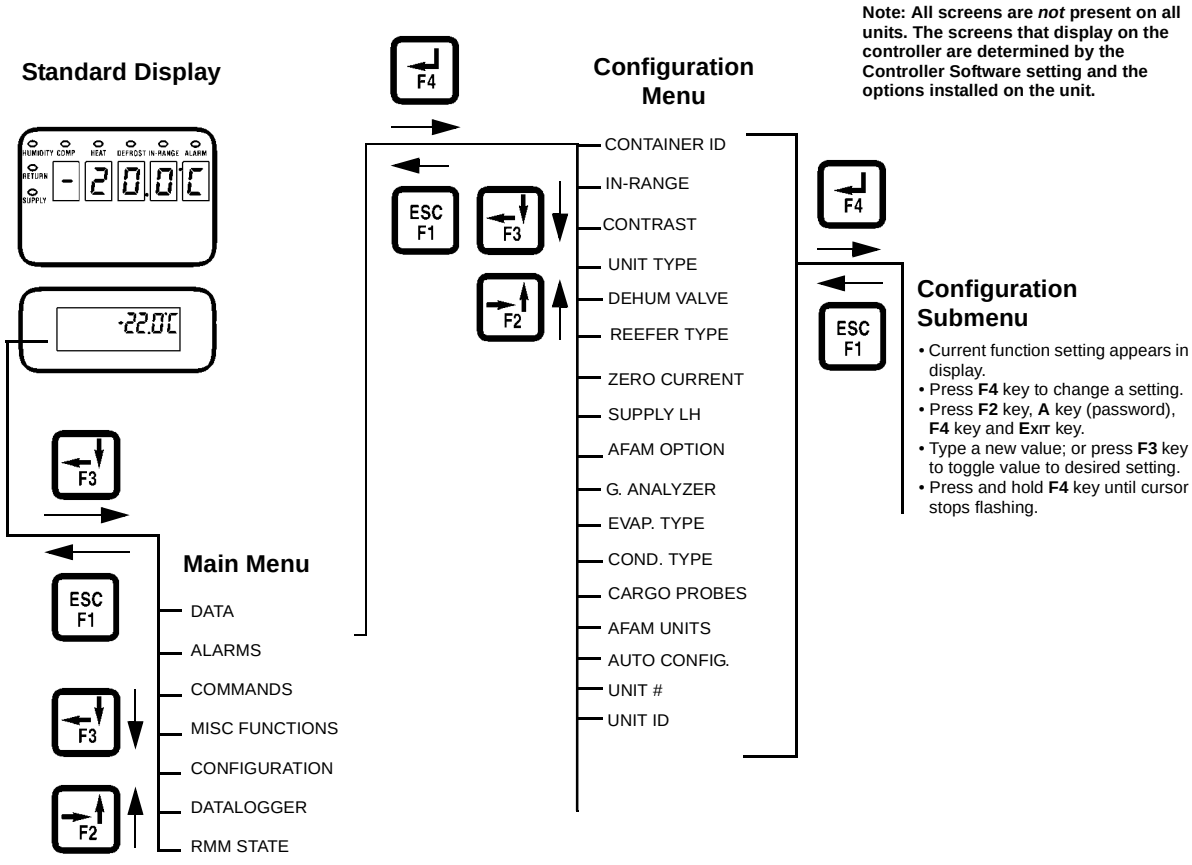


Figure 55: Configuration Menu Screen Flow Diagram

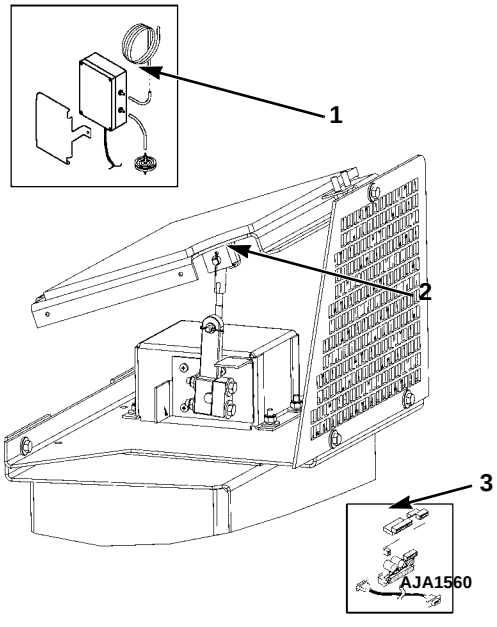
Advanced Fresh Air Management Plus (AFAM+) System

An advanced microprocessor controlled fresh air management system also provides programmable control of the CO_2 level in the container, and data logging of the CO_2 gas level reading.

The AFAM+ system includes all AFAM system components plus a gas sensor unit, sensor filter, sensor vent (before 4/01) or vent loop (after 4/01), pressure relief valve assembly and single purge port. The controller can be set to control the CO_2 level in the container level between 0 to 25 %.

Setting AFAM+ System Values

WARNING: After installing or servicing the AFAM door assembly, remove all tools and install the vent grille before starting the AFAM system. Failure to replace the vent grille before turning the AFAM system ON may result in personal injury or unit damage.



1.	Gas Sensor Assembly (Mounts in Evaporator)
2.	Vent Door Assembly and Damper Motor
3.	Interface Board and Cable (Mounts in Cable Box)

Figure 56: AFAM+ System

The Controlled Atmosphere (CA OPTION) submenu in the CONFIGURATION menu is factory set to AFAM+. The controller then adds the AFAM, AFAM DELAY, AFAM RATE, O_2 MIN and CO_2 MAX submenus to the SETPOINT menu. If a replacement controller or new software is installed, a controller auto configuration will detect the AFAM+ option when the AFAM door control module and gas sensor are connected to the controller. When an auto configuration is performed, the controller sets the CA OPTION in the Configuration menu to ANALYZER. To operate the AFAM+ system, the CA OPTION must be manually set to AFAM+.

- ANALYZER: This setting turns on data logging for the CO_2 gas level only. The AFAM+ system does not operate.
- AFAM+: This setting turns on the AFAM+ system to control the CO_2 gas level. The controller then adds the CO_2 MAX submenu to the SETPOINT display in addition to the “AFAM”, “AFAM DELAY” and “AFAM RATE” submenus.

The default setting for AFAM in the SETPOINT menu is the last value set (OFF, UNITS or DEMAND). AFAM must be set to DEMAND to control the vent door to the CO_2 gas level.

Starting the AFAM+ System

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the “TEMP SETP” line.
2. Press F2 key to scroll to “AFAM” line.
3. To change the mode setting, press F4 key. Cursor moves to end of menu line and flashes.

WARNING: The vent door and motor actuator arm move immediately when the F4 key is pressed to turn the AFAm system to DEMAND, UNITS or OFF. Keep hands and tools away from the air exchange system components to prevent personal injury or unit damage.

4. Press F2 key to toggle between OFF, DEMAND and UNITS.

- OFF: Vent door stops in current position. AFAM DELAY, AFAM RATE and CO_2 MAX settings become blank ("--").
- DEMAND: Controller uses the CO_2 gas levels to adjust the vent door position. AFAM RATE setting becomes blank.
- UNITS: Controller uses the fresh air exchange rate to adjust the vent door position. The CO_2 MAX setting becomes blank.

5. With DEMAND in the menu line, press and hold F4 key until cursor stops flashing. DEMAND now appears in display.
6. Press ESC key to exit the SETPOINT screen.

Changing the AFAM Delay

NOTE: The fresh air exchange time delay should be established by the shipper.

The AFAM delay setting keeps the fresh air vent closed for a preset time when the unit starts. This allows faster product temperature pulldown. The AFAM delay can be set from 1 to 72 hours in 1-hour increments.

NOTE: During unit startup, the AFAM delay prevents the AFAM door from opening until the delay times out or the container temperature is in-range. The AFAM delay prevents the AFAM door from opening due to the AFAM Rate, O_2, or CO_2 system settings.

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the "TEMP SETP" line.
2. Press F2 key to scroll to "AFAM DELAY" line. The current setting ("0") appears in the display.
3. To enter a new time delay, press the F4 key. An Enter Arrow appears in the menu line and the current time delay disappears.
4. Enter (type) the new time delay in the LCD display using the general purpose keypad: 1 to 72 hours. The cursor moves to the right of the screen as each key entry is acknowledged and displayed.

WARNING: The vent door and motor actuator arm move immediately again when the delay is entered. Keep hands and tools away from the air exchange system components to prevent personal injury or unit damage.

5. Press and hold the F4 key until the cursor stops flashing. The new time delay is recorded in the controller and appears in the LCD display.
6. Press ESC key to exit the SETPOINT screen.

Changing the CO_2 Maximum Setting

NOTE: The minimum CO_2 rate should be established by shipper.

The CO_2 rate sets the desired CO_2 level in the container when a gas sensor unit is installed. The actual AFAM door position is based on the CO_2 level, O_2 level and AFAM delay.

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the "TEMP SETP" line.
2. Press F2 key to scroll to "CO_2" line. The current rate and units (e.g. "2.5 %") appears in the display.
3. To change the rate, press the F4 key. An Enter Arrow appears in the menu line and the current rate disappears.
4. Enter (type) the new rate in the LCD display using the general purpose keypad: 0 to 25 %.

WARNING: Vent door and motor actuator arm may move immediately again when the rate is entered. Keep hands and tools away from the air exchange system components to prevent personal injury or unit damage.

IMPORTANT: Press and hold the F4 key until cursor stops flashing. The new rate is recorded in the controller and appears in the LCD display.

Data Recording and Downloading Data

The MP-3000a datalogger can record sensor temperatures as well as loss of power, alarms, sensor failure, setpoint change and unit shutdown events. All data logs include the time and date; setpoint temperature; supply, return, ambient, USDA1, USDA2 and USDA3 sensor temperatures; and humidity sensor. All temperature logs can be viewed from the controller's LCD message display.

Data logging interval is selectable from 1 minute or 1/2, 1, 2 or 4 hours.

When a 1 hour logging interval is selected, the datalogger memory can store approximately 680 days of information. The logging of USDA sensors is fixed at 1 hour intervals to comply with USDA requirements. A logging test of USDA sensors at 1 minute intervals is also possible for 72 minutes. USDA data can not be downloaded during the logging test. After 72 minutes, controller returns to previous logging interval and clears USDA test data from datalogger memory.

If the unit power supply is disconnected, the datalogger will continue to register 120 temperature logs (except humidity sensor) when battery voltage is above 11.4 volts. These will be maintained until the unit is re-connected to power, and the battery automatically re-charged.

Trip data can be retrieved (but not erased) from the datalogger memory using a DRU-II or SmartSponge™ handheld data retriever, or a REFCON power line remote monitoring system. DRU-II data transfer rate based on a 1 hour log interval is about 15 seconds per month of event logs and about 70 seconds per month of temperature logs. For example, downloading 90 days of data logs would take about 95 seconds for event logs only and about 210 seconds for temperature logs only.

Trip data from separate units is denoted by the identification information entered into the controller at the beginning of the trip via the general purpose keypad. Identification data may include the container ID number, location B.R.T., contents, loading data, voyage no., ship, load port, discharge port and comments. The container ID number is stored in the Configuration submenu.

Chill Loads (Setpoint at -9.9 C [14.1F] and Above)

The unit operates on Cool with Modulation and Heat to provide accurate control of chill loads. During Cool with Modulation, the controller uses a proportional-integral derivative (PID) algorithm and a KVQ valve to provide accurate control of the container temperature in direct response to load demand.

The KVQ valve is installed in the suction line and controls the amount of refrigerant returning to the compressor. The valve opens and closes in response to a controller voltage signal based on a control temperature differential. The controller uses the setpoint temperature, supply air sensor temperature (left and/or right hand sensors) and pull-down rate for the last 10 seconds, last 20 seconds and last 180 seconds to calculate the control temperature differential.

Supply Air Sensor Control

Temperature control accuracy and protection against frost damage is provided by using two separate sensors (left hand and right hand) to determine the supply temperature used to calculate the control temperature differential:

- At setpoints below -1 C (30 F), the controller uses the lowest supply air sensor temperature.
- At setpoints above 0 C (32 F), the controller uses the average temperature of the left hand and right hand supply air sensors.
- At setpoints between -1 C and 0 C (30 F and 32 F), the controller uses a sliding temperature scale from the lowest supply air sensor temperature to the average temperature of the left hand and right hand supply air sensors.

If one supply air sensor fails, the controller uses the temperature of the other supply air sensor for temperature control.

If both supply air sensors fail, the controller uses the temperature of the return air sensor plus an offset for temperature control.

Temperature Control Accuracy and Frost Protection

The PID algorithm generally minimizes container temperature fluctuations to +/- 0.1 C (+/- 0.2 F). Additional frost protections is provided by pulsing the electric heaters ON and OFF to increase the supply air temperature if the return air temperature decreases to within 0.3 C (0.5 F) of setpoint. The controller pulses the heater ON for 2 to 60 seconds every 60 seconds. The amount of ON time depends on the amount of heat required to provide frost protection.

Frozen Loads (Setpoint at -10 C [14 F] and Below)

The unit operates on Full Cool and Null to provide accurate control of frozen cargo. The controller uses the return air sensor temperature and setpoint temperature to regulate unit operation.

If the return air sensor becomes disconnected or fails, the controller uses the supply air sensors plus an offset for temperature control.

KVQ Setting Value and Cool Capacity Value in Data Menu

The KVQ Setting value displayed in the Data menu indicates the evaporating temperature the KVQ valve uses to control refrigerant return to the compressor. During maximum cooling capacity operation, the KVQ Setting value may range between -40 C and -60 C (-40 F and -76 F).

The Cool Capacity value displayed in the Data menu indicates the percent of the total unit capacity that is currently provided. For example, when controller display shows 70%, this means the KVQ valve has closed to reduce system cooling capacity from 100% to 70% (a 30% reduction).

Compressor Sequence Start

The controller performs a compressor sequence start when the compressor has not operated for more than 60 seconds within the last 18 hours. A compressor sequence start cycles the compressor ON 3 seconds, OFF 10 seconds, ON 5 seconds, OFF 10 seconds, ON 7 seconds, OFF 10 seconds and then ON continuously.

Compressor Liquid Injection

During compressor operation, a liquid injection system injects refrigerant into the suction line to protect the compressor for excessively high operating temperatures.

Compressor Discharge Temperature Control (Chill Mode Only)

- Liquid injection is activated at compressor discharge temperatures between 115 C and 125 C (239 F and 257 F). The controller pulses the liquid injection valve open for 2 to 60 seconds every 60 seconds. The number of seconds the valve is energized depends on the discharge temperature and the KVQ valve setting.
- Liquid injection is activated when the KVQ Setting is less than 5 C (8.9 F) below the return air temperature. The controller energizes liquid injection valve for 6 seconds every 60 seconds regardless of the discharge temperature.

High Temperature Protection

- If the discharge gas temperature rises above 130 C (266 F), the unit stops immediately. The controller turns ON the Alarm LED and records Alarm 56, Compressor Temperature Too High. The controller will restart the unit when the sensor temperature is below 90 C (194 F).

Power Limit Mode

The controller uses the total unit current and the condenser temperature to provide power limit control in both the Chill and Frozen modes. When the unit is on water-cooled operation, power limit control is based on the total unit current draw only.

Initial Unit Start-up and Normal Operation (Standard)

Power Limit is active during the compressor start-up in both the Chill and Frozen modes. During start-up, the controller partially closes the KVQ valve to reduce the cooling capacity load on the compressor. The actual KVQ Setting depends on the condenser temperature, but ranges between 10 C and 30 C (5.6 and 16.8 F) below the return air temperature. The KVQ valve then gradually opens to increase cooling capacity during initial pull-down as required.

When the total current draw or the condenser temperature exceeds a predetermined threshold, the controller limits unit power consumption by sending a voltage pulse to the KVQ valve. The KVQ valve closes to restrict the flow of refrigerant to the compressor. This limits the compressor motor current draw and the condenser temperature to the predetermined threshold.

Power Limit Management

Additional power limit management flexibility is available. A maximum total current draw (17, 15 or 13 amps) and power management time interval can be selected from the Power Management feature of the Commands menu. When the power management time interval expires, the unit returns to the standard power limit control algorithm.

NOTE: Setting power management current at 13 amps can be used to provide slow pull-down of loads.

Evaporator Fan Control

The controller determines evaporator fan motor speed based on the setpoint temperature and the Economy mode setting.

Chill Loads (Setpoints of -9.9 C [14.1 F] and Above)

When the Economy mode is set to Off, the evaporator fans operate continuously on high speed.

Frozen Loads (Setpoint at -10.0 C [14.0 F] or Below)

NOTE: When the Economy mode is set to Off, the evaporator fans operate on low speed. Low speed RPM is one-half the high speed RPM.

Condenser Fan Control

The controller also uses a proportional-integral derivative algorithm to control the condenser temperature and ensure a constant liquid pressure at the expansion valve. The condenser fan operates continuously in high ambients. In low ambient conditions, the controller pulses the condenser fan on and off to maintain a minimum condenser temperature. The controller maintains a minimum 30 C (86 F) condenser temperature on Chill loads and a minimum 20 C (68 F) condenser temperature on Frozen loads.

Probe Test

The controller constantly monitors the left hand and right hand supply sensors, return sensor and defrost (evaporator coil) sensor to determine when to initiate a demand defrost. If a demand defrost is requested and defrost has occurred within last 90 minutes, the controller initiates a Probe Test to check for a defective sensor.

During a Probe Test, the LCD display shows "Probe Test Please Wait". The controller operates the unit on high speed evaporator fans only for 5 minutes. All sensor temperatures are then compared:

- Sensors with large temperature differences are discarded from the control algorithm. The controller then activates the appropriate Alarm codes to identify the defective sensor(s).
- If no sensors are found defective, controller LCD display shows "Running with High Supply Difference" message.

Sensor errors recorded during a Probe Test are cleared when the next Defrost is initiated or Unit On/Off switch is turned OFF.

NOTE: A manual Probe Test can be performed by a technician by selecting Sensor Check from the Manual Test Function menu.

Dehumidify Mode (Option)

NOTE: At setpoints below 5 C (41F), dehumidification is not energized.

During Chill mode operation, a dehumidification system is available to reduce the relative humidity in the container to the desired humidity setpoint. The Dehumidify Mode option is turned on from Setpoint menu of the controller. The relative humidity can then be controlled between 60% and 95%. However, the setpoint is adjustable from 0 to 99% from the Setpoint menu.

NOTE: The use of the Dehumidify Mode should be established by the shipper.

Changing the Humidify/Dehumidify Mode program screen from OFF to ON activates the dehumidify control algorithm. When the Dehumidify Mode is ON, the supply air temperature must be in-range to activate dehumidification:

1. When the humidity level is 2% or more above setpoint and the KVQ valve has reduced the unit cooling capacity by about 25%, the controller energizes (closes) the dehumidify valve (pre 2002). This reduces the size of the evaporator providing cooling by 50%, causing the coil to become colder and condense more moisture from the container air.
2. When the humidity level is 5% or more above setpoint or if the unit does not have a dehumidity valve and the KVQ valve has reduced the unit cooling capacity by about 50% (40% at setpoint temperatures below 5 C [41 F]), the controller also pulses the electric heaters ON and OFF. This increases the cooling load on the evaporator coil, thereby causing the coil to become even colder and condense more moisture from the container air.

Sequence Of Operation

Unit Start-up

A 60 second sequence start of the required loads occurs during initial start-up of the controller. If cooling (or heating) is required, the unit operates in the cool (or heat) mode.

- When the unit On/Off switch is turned ON, the LED display turns On and then Off.
- The setpoint appears briefly in the LED display.

  NOTE: When the setpoint appears in the LED display, both the Return and Supply LEDs are lit.

- The LED then shows the controlling air sensor temperature.
- The controller senses the incoming power phase and selects the correct power phase to unit components.
- The evaporator fan motors start about 40 seconds after the unit was turned ON.

  Evaporator fans operate on high speed at setpoints of

  9.9 C (14.1 F) and above.

Evaporator fans operate on low speed at setpoint temperatures of -10 C (14 F) and below.

- About 10 seconds later, the compressor starts and the liquid line solenoid energizes (opens) if the controller calls for cooling.
- The condenser fan then starts if the condenser temperature requires condenser fan operation. On units equipped with a water-cooled condenser, the water pressure switch must also be CLOSED or the Condenser Fan Switch on FAN AIR position.
- If the controller calls for heating, the electric heaters are pulsed On and Off to provide heat.
- The controller turns ON the In-range LED when the controlling sensor temperature is within 1.5 C (2.7 F) of the setpoint.

NOTE: If the compressor has been off for more than 18 hours, the controller performs a compressor sequence start. See "Compressor Sequence Start" on page 4-5 for further details).

NOTE: Random time delays during the initial unit start-up minimize peak current draw.

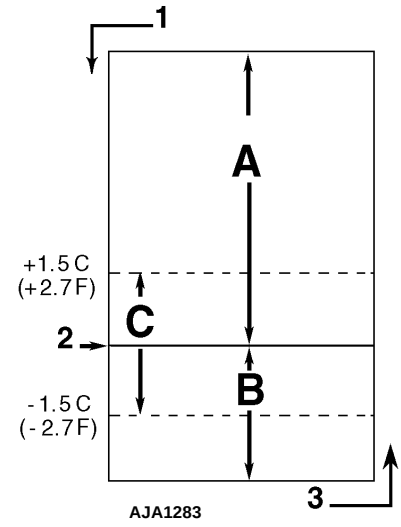
Continuous Temperature Control Operation

Chill Loads — Controller Setpoint at -9.9 C (14.1 F) and Above

The controller regulates the compressor, KVQ valve and electric heaters based on a Control Temperature Differential (see "General Theory of Operation" in this chapter for more detail). This means the unit operating mode can NOT be predicted based ONLY on the setpoint and supply air temperature.

At setpoints of -9.9 C (14.1 F) and above, the controller operates the unit on:

- Cool mode with Modulation
- Heat mode (electric heaters pulse On and Off on a 60 second duty cycle)
- Defrost mode (electric heaters On, evaporator fans Off)



A.	Cool with Modulation* (control temperature differential is above setpoint)
B.	Heat (electric heaters pulse ON and OFF on a 60 second duty cycle if the return air temperature decreases to 0.3 C [0.5 F] above setpoint; or the supply air temperature is too low)
C.	In-Range (based on supply air temperature)
1.	Decreasing Temperature
2.	Setpoint
3.	Increasing Temperature
* If the compressor stops, it must remain OFF for minimum of 5 minutes.	

Figure 57: Chill Load Control Sequence (Setpoints at -9.9C [14.1 F] and Above)

Operating Modes

NOTE: See Controller chapter for complete sequence of operation.

A sequence start of the required loads occurs during initial start-up of the unit and when a control mode shift requires the compressors to start. As the controller relays and unit loads energize, the controller LCD display shows the setpoint temperature. The controller LED display shows the controlling air sensor temperature. The controlling sensor is determined by the setpoint temperature:

Setpoint and Controlling Sensors

- With a setpoint temperature of -9.9 C (14.1 F) and above the controlling sensor is the Supply Air Sensor
- With a setpoint temperature of -10 C (14 F) and below the controlling sensor is the Return Air Sensor

The controller uses a complex proportional-integral derivative (PID) algorithm to provide accurate temperature control in direct response to load demand. Therefore it is difficult to predict which operating mode the unit should be in by comparing the setpoint to the return or supply air temperature. The unit operates in either the Fresh (Chill) or Frozen mode. Chill to Frozen mode transition point is -10 C (14 F).

NOTE: If the compressor has been OFF for more than 18 hours, or the unit has been on heat or defrost; the controller performs a compressor sequence start.

Chill Loads: Controller Setpoint at -9.9 C (14.1 F) or Above

Temperature control by the controller is based on the supply air sensor temperature, the setpoint, the modulation temperature range and the pull-down rate. The evaporator fans operate in high speed.

- Cool with Modulation (down to setpoint)
- Null (compressor and condenser fan stops, evaporator fans operate)
- Heat (resistance heaters on, evaporator fans operate)
- Defrost (resistance heaters on, evaporator fans stop)

NOTE: If the Economy Mode is set to ON, the evaporator fans operate on low speed at set-points of -9.9 C (14.1 F) and above whenever the container temperature is In-range.

Frozen Loads: Controller Setpoint at -10 C (14 F) or Below

Temperature control by the controller is based on the return air sensor temperature. The evaporator fans operate continuously on low speed (except during defrost).

- Cool (down to 1 C [1.8F] below setpoint)
- Null (compressor and condenser fan stops, evaporator fans operate)
- Defrost (resistance heaters on, evaporator fans stop)

NOTE: If the Economy Mode is set to ON, the evaporator fans stop when the unit shifts to Null. The controller automatically starts and operates the evaporator fans on low speed for 5 minutes every 45 minutes while the unit remains in Null.

CRR Operating Mode Function Chart

Chill Loads Setpoints at -9.9 C (14.4 F) and Above			Frozen Loads Setpoints at -10.0 C (14.0 F) and Below			
Cool w/Mod	**Heat**	**Defrost**	**Cool**	**Null**	**Defrost**	**Unit Function**
•[1]	•					Evaporator Fans HIGH SPEED[1]
•[1]			•	•[1]		Evaporator Fans LOW SPEED[1]
		•		•[1]	•	Evaporator Fans OFF[1]
•	•					Proportional-integral Derivative (Supply Air) Control
			•	•		Return Air Sensor Control
		•			•	Evaporator Coil Sensor Control
•			•			Compressor ON
•			•			Liquid Line Solenoid Valve OPEN (energized)
•			•			Compressor Liquid Injection ON (valve energized)[2]
•			•			Condenser Fan ON [3]
•			•[4]			KVQ Valve MODULATING (energized)[4]
•[6]	•	•			•	Electric Heaters PULSING or ON (energized)[5]
•						Dehumidify ON: Dehumidify valve (pre 2002) CLOSED (energized)[6]

[1] Setpoint temperature and Economy mode setting determine the evaporator fan speed.

Normal Operation (economy Mode set to OFF):

- Chill Loads: HIGH speed fans.
- Frozen Loads: LOW speed fans.

Economy Mode Operation (Economy Mode set to ON):

- Chill Loads: Fans switch from HIGH speed to LOW speed when temperature is in-range.
- Frozen Loads: LOW speed fans during cooling. Fans are OFF during Null mode but operate on LOW speed for 5 minutes every 45 minutes.

[2] Liquid injection valve:

- Chill Mode: When the KVQ valve setting is less than 5 C (8.9 F) below the return air temperature, the controller energizes liquid injection valve for 6 seconds every 60 seconds regardless of the compressor discharge temperature.
- Compressor High Temperature Protection: When discharge temperature is between 115 C and 125 C (239 F and 257 F), the valve pulses open on a 60 second duty cycle. Valve energizes open for 2 to 60 seconds, depending on the discharge temperature and the KVQ valve setting.

[3] Condenser fan pulses ON and OFF on a 30 second duty cycle to maintain a minimum condenser temperature:

- Chill Loads: Controller maintains a minimum30 C (86 F) condenser temperature.
- Frozen Loads: Controller maintains a minimum 20 C (68 F) condenser temperature.

NOTE: Condenser fan does not operate when COndenser Fan Switch is on WATER; or when the water pressure switch (option) is OPEN.

[4] KVQ valve MODULATES whenever unit is in a Power Limit mode; or is cooling at setpoints -9.9 C (14.4 F) and above.

[5] Controller energizes electric heaters for frost protection, heat, defrost and dehumidification[6]:

- Frost Protection (cooling): If return air temperature is within 0.3 C (0.5 F) of setpoint, heaters PULSE ON and OFF on a 60 second duty cycle.
- Heat mode (compressor OFF): If supply air temperature is tool low, heaters PULSE ON and OFF on a 60 second duty cycle.
- Defrost mode: Heaters are ON until evaporator coil temperature increases to terminate defrost.

[6] Dehumidification Option:

- Dehumidify valve (pre 2002) CLOSES (energizes) when humidity is more than 2% above setpoint and the KVQ valve has reduced cooling capacity by about 25%.
- Electric heaters are also pulsed ON and OFF by controller when humidify is more than 5% above setpoint and the KVQ valve has reduced cooling capacity by about 50% (40% at setpoint temperatures below 5 C [41 F]).

Cool with Modulation

- Controller calls for the Cool mode whenever the Control Temperature Differential (based on supply air temperature) is above setpoint.
- Controller turns ON the Compressor LED when the compressor is operating.
- Controller opens and closes KVQ valve to regulate the flow of refrigerant to the compressor. The position of the valve balances the unit cooling capacity against the actual load requirements.
- Controller turns ON the In-range LED when the supply air sensor temperature is within 1.5 C (2.7 F) of setpoint.
- Supply air sensor control algorithm increases temperature control accuracy and protection against frost damage (see “Chill Loads” under General Theory of Operation in this chapter).
- Controller pulses electric heaters ON and OFF for additional frost protection if the return air temperature decreases to within 0.3 C (0.5 F) of setpoint (see “Chill Loads” under General Theory of Operation in this chapter).
- Controller turns ON the Heat LED whenever the heaters are pulsed ON and OFF.

Heat

- If the supply air temperature is too low and the calculated KVQ valve setting is above the setpoint, the controller stops the compressor, de-energizes the liquid line solenoid and pulses the electric heaters ON for 2 to 60 seconds every 60 seconds to provide heat. The amount of ON time depends on the amount of heat required to gradually increase the supply air temperature to setpoint.

Frozen Loads — Controller Setpoint at -10 C (14 F) and Below

At setpoints of -10 C (14 F) and below, the controller locks out the Modulation and Heat modes. The controller regulates compressor operation based the return air sensor and setpoint temperatures.

At setpoints of -10 C (14 F) and below, the controller operates the unit on:

- Cool mode
- Null mode
- Defrost mode (electric heaters On, evaporator fans Off)
- Evaporator fans operate continuously on low speed (except when Economy mode is ON and the unit is in the Null mode) and continuously circulate air inside the container (except during defrost).
- Controller LED display shows the return air sensor temperature.
- Controller LCD display shows the setpoint temperature.

- Controller cycles a single-speed condenser fan ON for 2 to 30 seconds every 30 seconds when the unit is on air-cooled condenser operation (optional Condenser Fan Switch on FAN AIR or water pressure switch closed). The amount of ON time depends on the condenser coil, ambient and compressor discharge temperatures.

  NOTE: When water is supplied to the water-cooled condenser-receiver, the water pressure switch OPENS to prevent condenser fan operation.

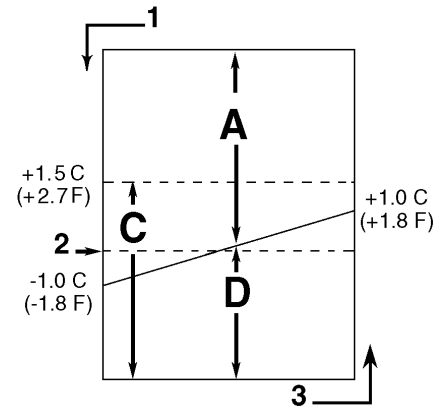
- Power limit is active during initial start-up and pull-down when the unit is cooling at return air temperatures above -10 C (14 F).

Cool

- After initial start-up and pull-down to 1.0 C (1.8 F) below setpoint, the controller calls for the Cool mode whenever the Return air temperature increases more than 1.0 C (1.8 F) above setpoint.
- Compressor must operate for a minimum of 5 minutes after startup.
- Controller turns ON the Compressor LED when the compressor is operating.
- After initial pull-down to setpoint, controller keeps the In range LED ON as long as the return air temperature remains less than 1.5 C (2.7 F) above setpoint.

Null

- The controller calls for Null when the Return Air Temperature decreases more than 1.0 C (1.8 F) below setpoint.
- The controller stops the compressor and condenser fan.
- The controller also de-energizes (closes) the liquid line solenoid valve.
- The evaporator fans continue to operate (except when Economy mode is ON; CRR PS units only).
- Compressor remains OFF for a minimum of 5 minutes.



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A.	Cool*
C.	In-Range
D.	Null*
1.	Decreasing Temperature
2.	Setpoint
3.	Increasing Temperature
* If the compressor stops, it must remain OFF for a minimum of 5 minutes. When the compressor re-starts, it must stay ON for a minimum of 5 minutes.	

Figure 58: Frozen Load Control Sequence (Setpoints at -10 C [14 F] and below)

Defrost

The evaporator coil sensor temperature must be below 18 C (65 F) to initiate a Demand Defrost or Manual Defrost. The evaporator coil sensor temperature must be below 10 C (50 F) to initiate a Timed Defrost.

- Demand defrost function initiates defrost immediately when:

  Temperature difference between the return air sensor and defrost (evaporator coil) sensor is too large

  Temperature difference between the left hand and right hand supply air sensors is too large and unit has operated for more than 90 minutes since last defrost

  Temperature difference between the supply sensors and return air sensor is too large

- Manual Defrost may be initiated immediately by pressing the Defrost key or by Refcon Remote Monitoring Modem (RMM).
- A Timed Defrost always starts at 1 minute past the hour immediately following a defrost timer request for defrost. For example, if the defrost timer requests a defrost cycle at 7:35, the defrost cycle will start at 8:01. The datalogger will record a Defrost event for each log interval in which a Defrost cycle is pending or active (i.e. both the 8:00 and 9:00 data logs on 1 hour logging interval).

  On Chill Loads (setpoints at -9.9 C [14.1 F] and above), the initial time interval is:

- 8 hours of compressor operation at supply air temperatures of 5.1 C (41.2 F) or above.
- 2.5 hours of compressor operation at supply air temperatures of 5.0 C (41.0 F) or below. One-half (0.5) hour is added to the time interval each timed defrost interval. Defrost synchronization creates step intervals of 3, 4, 4, 5, 5, 6, 6 and 7 hours. Maximum time interval is 7 hours.

  On Frozen Loads, the initial time interval is 8 hours. Two (2) hours are added to the time interval each timed defrost interval. Maximum accumulated time interval is 24 hours.

  Defrost timer resets if the unit is Off more than 12 hours, setpoint is changed more than 5 C (8.9 F) or PTI Pretrip test occurs.

  NOTE: If unit operating conditions do not allow the unit to enter a defrost cycle, "Defrost Not Activated" appears on LCD display when the DEFROST key is pressed.

When the defrost mode is initiated:

- The controller stops the compressor, condenser fan and evaporator fans and de-energizes the liquid line solenoid valve.
- When the compressor stops, the controller turns ON the Defrost LED, Heat LED and energizes the heater contactor, turning on the electric heaters.

The controller terminates the defrost mode when:

- Evaporator temperature:

  Chill mode: Evaporator coil sensor temperature reaches 30 C (86 F); or exceeds 18 C (65 F) for 35 minutes.

  Frozen mode: Evaporator coil sensor temperature reaches 30 C (86 F); or exceeds 8 C (46 F) for 35 minutes.

- Interval timer: Controller terminates defrost after 90 minutes on 60 Hz power (120 on 50 Hz power). Alarm code 20 will be generated if this occurs.
- Power OFF: Turning unit On/Off switch Off terminates defrost.

When the defrost mode is terminated:

- The Heat and Defrost LEDs turn OFF and the heater contactor is de-energized. The controller starts the compressor and energizes the liquid line solenoid to pre-cool the evaporator coil. The condenser fan starts if required.

IMPORTANT: The controller pre-cools the evaporator coil to the supply air temperature (or for 3 minutes maximum) to minimize heat energy release into the container. The controller then starts the evaporator fans.

Controller Maintenance

Replacing the Controller

1. Turn the unit On/Off switch OFF.
2. Turn the unit 460/380V main circuit breaker OFF. Then disconnect the unit power cord from the power supply.

WARNING: The unit will automatically start and operate if 460/380V power is present at the main relay board when the controller is disconnected. To prevent personal injury from rotating machinery or dangerous electrical shock form high voltage controls, disconnect the supply power to the unit before replacing the controller.

3. Disconnect battery power connection from the controller (top plug on the controller).
4. Disconnect the communication cables from the controller and remote monitoring modem (option).
5. Remove the screws that secure the remote monitoring modem to the controller.
6. Remove the screws that secure the controller to the inside of the control box door.
7. Remove the controller from the door.
8. Install the replacement controller in the door using the existing hardware. Connect the keyboard cable to the controller.
9. Install the remote monitoring modem (option) on the back of the controller.
10. Connect the communication cables to the remote monitoring modem (option) and controller.
11. Set the software selection switch on the back of the controller to position “1” (on MP-3000 controllers only).

    NOTE: Be certain that all connector plugs are fully seated.

CAUTION: Be sure to enter the container ID before releasing the unit for service. The container ID is required to identify the data downloaded form the controller datalogger via a laptop computer or a REFCON remote communications system.

NOTE: Several programmable features may need to be set to completely configure the unit to customer specifications. Adjust any additional programmable settings to customer requirements before releasing the unit for service.

NOTE: If a controller from another unit has been installed, see “Controller Software Selection” in this chapter to set software selection dial correctly.

Automatic Configuration of Spare Parts Controller

An automatic configuration feature detects the unit options installed on a unit when a spare parts controller is installed. When the controller is powered up for the first time, the controller turns the Auto Configuration feature On. After the initial unit power up, the controller turns the Auto Configuration feature Off.

The Auto Configuration feature detects the following options and sets the correct value in Configuration menu:

- Number of Supply Air Sensors (1 or 2): Controller detects left hand and right supply air sensors.
- Number of Evaporator Fans (2 or 3)
- Dehumidify (On or OFF): If controller detects a humidity sensor, it then checks for current draw on a Dehumidify valve (pre 2002).
- Humidification (On or OFF): If controller detects a humidity sensor, it then checks for current draw on an air compressor.

  NOTE: Automatic configuration will not detect NTC type USDA sensors.

Controller Software Selection

If a replacement controller was removed from another unit, check the small dial located on the back of the controller for the correct software selection. Current active software settings for dial positions are:

- Position 0: All TNE 508 units with Module load compressor
- Position 1: All CRR40/TNE 508 units with KVQ valve
- Position 2: All CSR20 PS, CSR40SL PS and CSR40 PS units with a stepper motor valve
- Position 3: All CRR40 DF units
- Position 4: All CSR40 Magnum units
- Position 7: Unit testing and service only

Changing Software Selection Dial Position

1. Turn Unit On/Off switch OFF.
2. Set dial indicator to correct position.
3. Turn Unit On/Off switch ON. New software selection is loaded during controller start-up.

Flash Loading Controller Software

Controller software must be flash loaded when software has been revised. To flash load software complete the following steps:

1. Turn the **UNIT ON/OFF** switch **OFF**.
2. Plug cable from a portable computer with controller software into the data retrieval connector on the control box.
3. Press and hold the **7** key and **F1** key at the same time. LCD display will show [FLASHLOAD].
4. Press one of the special functions keys to activate controller LCD display on battery power; or turn the **UNIT ON/OFF** switch **ON**.

NOTE: Controller will start in Emergency mode and LCD display will show "EMERGENCY MODE" if the communications cable is defective or not connected to the download port. Secure cable connection to proceed with flash loading of software.

5. Start flash load program on portable computer.
6. Flash loading of new software is complete when [FLASH LOADING] clears from the LCD display.
7. The controller then checks the new software and loads the new control program into memory.

NOTE: If the flash load procedure is interrupted or fails on a MP3000a, the controller will stay in the flash mode until correctly flash loaded.

If the flash load procedure is interrupted or fails on a MP3000, the controller will continue to use the previous control program.

NOTE: Installing new software does not change any configuration settings or the setpoint setting, or erase the data log currently stored in the controller.

Temperature Sensors

Thermistor type temperature sensors are used. Each sensor is connected to a shielded cable and placed in a sealed stainless steel tube. The temperature signal from the sensor is transmitted through the shielded cable. Temperature sensors include:

- Supply Air, Left Hand
- Supply Air, Right Hand
- Return Air
- Evaporator Coil
- Condenser Coil
- Compressor Discharge Temperature
- Ambient Air

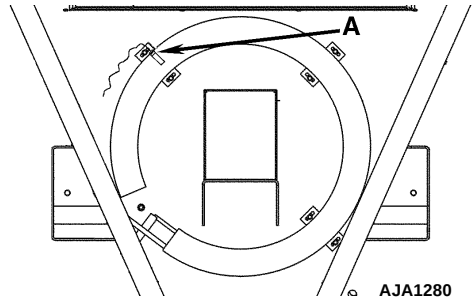
CAUTION: Sensors are permanently calibrated and can be checked using an ohmmeter. Ohm readings should agree with the data shown in the Sensor Resistance Tables.

- All sensors should be properly installed:
- Supply air sensors must be inserted to the bottom of the sensor tube and completely sealed by the grommet connection.
- Left hand supply sensor installs in the sensor tube behind the compressor.
- Right hand supply sensor installs in the sensor tube next to the control box.
- Return air sensor installs in a grommet between the evaporator fans.

Resistance Values for Supply, Return, Evaporator Coil, Condenser Coil and Ambient Air Sensors

Temp. °F	Temp. °C	OHMS	Temp. °F	Temp. °C	OHMS
-40	-40	42618	53.6	12	3360
-31	-35	32198	57.2	14	3094
-22	-30	24532	60.8	16	2852
-13	-25	18850	64.4	18	2632
-4	-20	14618	68	20	2431
5	-15	11383	71.6	22	2347
10.4	-12	9838	75.2	24	2079
14	-10	8941	78.8	26	1925
17.6	-8	8132	82.4	28	1785
21.2	-6	7406	86	30	1657
24.8	-4	6752	89.6	32	1539
28.4	-2	6164	93.2	34	1430
32	0	5634	96.8	36	1330
35.6	2	5155	100.4	38	1239
39.2	4	4721	104	40	1154
42.8	6	4329	107.6	42	1076
46.4	8	3907	111.2	44	1004
50	10	3652	113	45	970

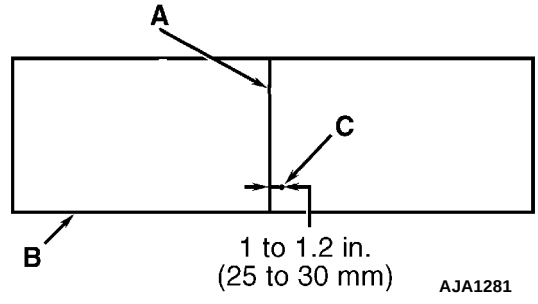
Resistance Values for Compressor Discharge Line Sensor					
Temp. °F	Temp. °C	OHMS	Temp. °F	Temp. °C	OHMS
32	0	351017	158	70	15502
35.6	2	315288	161.6	72	14410
39.2	4	283558	165.2	74	13405
42.8	6	255337	168.8	76	12479
46.4	8	230210	172.4	78	11625
50	10	207807	176	80	10837
53.6	12	187803	179.6	82	10110
57.2	14	169924	183.2	84	9438
60.8	16	153923	186.8	86	8817
64.4	18	139588	190.4	88	8242
68	20	126729	194	90	7710
71.6	22	115179	197.6	92	7216
75.2	24	104796	201.2	94	6759
78.8	26	95449	204.8	96	6335
82.4	28	87023	208.4	98	5941
86	30	79428	212	100	5574
89.6	32	72567	215.6	102	5234
93.2	34	66365	219.2	104	4917
96.8	36	60752	222.8	106	4623
100.4	38	55668	226.4	108	4348
104	40	51058	230	110	4092
107.6	42	46873	233.6	112	3854
111.2	44	43071	237.2	114	3631
114.8	46	39613	240.8	116	3423
118.4	48	36465	244.4	118	3229
122	50	33598	248	120	3047
125.6	52	30983	251.6	122	2877
129.2	54	28595	255.5	124	2718
132.8	56	26413	258.8	126	2569
136.4	58	24419	262.4	128	2430
140	60	22593	266	130	2299
143.6	62	20921	269.6	132	2176
147.2	64	19388	273.2	134	2118
150.8	66	17961	276.8	136	1953
154.4	68	16689	280.4	138	1852



A.	Insert Sensor into condenser coil between tube rows 1 and 2

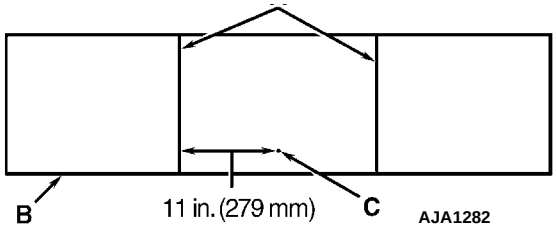
Figure 59: Condenser Coil Sensor Location

- Evaporator coil (defrost) sensor must be placed in the middle of the coil and at least 75 mm deep between the fins.
- Condenser sensor must be placed on the upper left side of the condenser coil and at least 70 mm deep between the fins.
- Ambient sensor must be placed on the bottom plate of the right forklift pocket.
- Compressor sensor must be placed in the manifold on the discharge tube before the discharge service valve.



A.	Coil Support Bracket
B.	Unit Front
C.	Insert Sensor at least 75 mm into coil between tube rows 2 and 3

Figure 60: 2-Fan Evaporator: Evaporator (Defrost) Sensor Location



A.	Coil Support Brackets
B.	Unit Front
C.	Insert Sensor at least 75 mm into coil between tube rows 2 and 3

Figure 61: Evaporator (Defrost) Sensor Location

Diagnosis and Repair

If the unit appears to be operating incorrectly, view any alarm codes that may be stored in the controller display memory. Diagnose and correct the problem associated with each alarm code (see "Alarm Codes, Alarm Types and Corrective Actions" in this chapter).

NOTE: Defrost can be delayed for 24 hours during unit diagnosis or testing: Press "7" key and F1 key at the same time from any controller screen display. Press F3 key to scroll cursor down to DELAY DEF menu line. Then press F4 key, F2 key, "A" key, F4 key and EXIT key. Cursor moves to end of line and flashes. Pressure F3 key to toggle OFF to ON. Then press and hold F4 key until cursor stops flashing.

If you have viewed and corrected these problems and the unit still appears to be operating incorrectly, eliminate any possibility that the problem is caused by failure of components other than the controller.

External Cause Checks

- Poor contact between male and female connector plugs (loose connection).
- Defective wire harness (broken wires, loose connections).
- External electrical causes such as faulty (open or stuck) contactors.
- Malfunction of refrigeration system components.

Unit Wiring

Inspect unit wiring, wire harnesses, and the controller during pre-trip inspection and every 1,000 operating hours to protect against unit malfunctions due to open or short circuits. Look for loose, chaffed or broken wires on the unit; open or short circuits and damaged components on the controller printed circuit board.

NOTE: Inspect electrical contactor points for pitting or corrosion every 1,000 operating hours. Repair or replace as necessary.

High Pressure Cutout Switch

A high pressure cutout switch is located on the compressor discharge service manifold of the compressor. If the discharge pressure becomes too high, the switch opens the ground circuit to the compressor contactor coil:

- Compressor STOPS immediately. Evaporator and condenser fans continue normal operation.
- Controller determines that a high pressure cutout switch or compressor motor internal overload protector is open when the unit current draw during compressor operation is normal and then decreases by 7 amps for more than 3 seconds.
- After 1 minute, the controller LCD display shows a High Pressure Cutout message after 1 minute:

High Pressure Cutout, Check Condenser Probe: Water pressure switch is CLOSED and the condenser temperature is low.

High Pressure Cutout, Check Condenser Fan: Water pressure switch is CLOSED and the condenser temperature is high.

High Pressure Cutout, Check Water Cooling: Water pressure switch is OPEN.

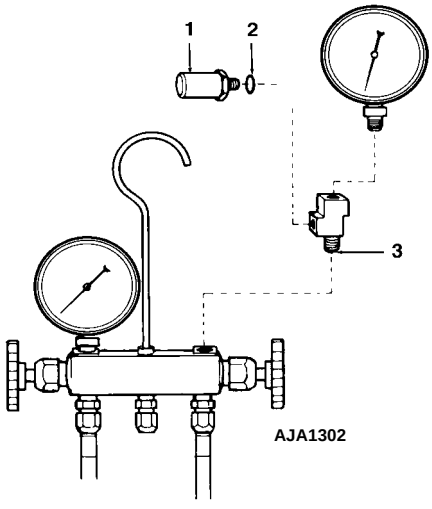
- The controller continues to call for cooling so the compressor will restart when the overload condition is corrected (switch resets) if power is available.
- If the switch remains open for 5 minutes, the controller also turns ON the Alarm LED and records Alarm 37, Total Power Consumption Too Low.

High Pressure Cutout Switch:

Opens: 2240 +/- 70 kPa, 22.4 +/- 0.7 bar, 325 +/- 10 Psig

Closes: 1590 +/- 70 kPa, 15.9 +/- 0.7 bar, 230 +/- 10 Psig

To test the switch, rework a gauge manifold per "High Pressure Cutout Manifold" illustration.



1.	Relief Valve, P/N 66-6543
2.	O-ring, P/N 33-1015
3.	Adapter Tee (Weather Head No. 55)2X3

Figure 62: High Pressure Cutout Manifold

High Pressure Cutout Manifold

1. Connect the manifold gauge to the compressor discharge service valve with a heavy duty, black jacketed thick wall #HCA 144 hose with 6024 kPa, 60.24 bar, 900 psig working pressure rating.
2. Operate the unit in Cool by performing an Capacity 100% test from the Manual Function Test menu of the controller.
3. Raise the discharge pressure of the compressor by blocking the condenser coil airflow. Temporarily cover the compressor compartment, control box and power cord storage compartment with cardboard to reduce condenser coil airflow. This should increase the discharge pressure enough to cause the switch to open. When the switch opens:

- The compressor and evaporator fans should STOP immediately.

NOTE: The discharge pressure should never be allowed to exceed 2,760 kPa, 27.6 bar, 400 psig.

4. Be sure to remove the cardboard installed in step 3.

If the HPCO switch fails to stop compressor operation, replace the switch and repeat steps 1 through 4.

Condenser Fan and Evaporator Fan Rotation

NOTE: If both the condenser fan and evaporator fans are rotating backwards, diagnose the automatic phase selection system.

Check Condenser Fan Rotation

Check for proper condenser fan rotation by placing a small cloth or sheet of paper against the condenser fan grille on the front of the unit. Proper rotation will blow the cloth or paper away from the grille. Improper rotation will hold the cloth or paper against the grille.

If the condenser fan is rotating backwards, see the unit wiring diagram to correct fan motor wiring at the fan motor junction box or condenser fan contactor. To correct improper fan rotation, reverse any two fan power cord leads at the

condenser fan contactor (disconnect power supply before reversing leads). *Do not* move the CH ground wire.

Check Evaporator Fan Rotation

Visually inspect the evaporator fan blades for proper rotation. Arrows located on the underside of the fan deck indicate the correct direction of rotation.

Check both high and low speed evaporator fan rotation by performing Evaporator High and Evaporator Low tests from the Manual Function Test menu.

If an evaporator fans rotate backwards on one or both speeds, see the unit wiring diagram to correct motor wiring at the fan motor junction box or evaporator fan contactor (disconnect power supply before reversing leads). (*Do not* move the ground wire which is labeled CH.)

NOTE: Evaporator fan motor wires EF1, EF2 and EF3 are used on low speed fan operation. Wires EF11, EF12 and EF13 are used on high speed fan operation.

Electric Heaters Malfunction

Six electric heater elements are located underneath the evaporator coil. If a heater element is suspected of malfunctioning, check the resistance of each individual heater element by performing the following procedure:

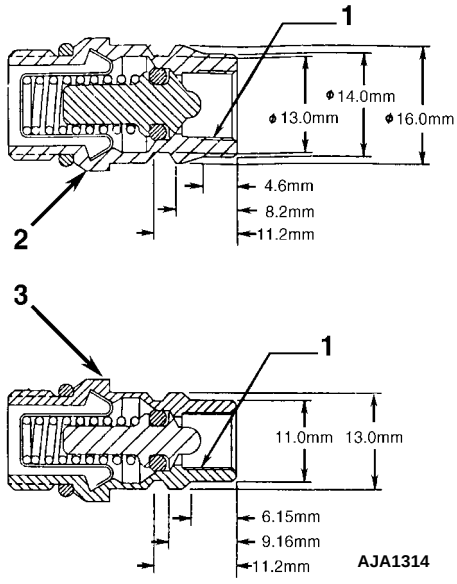
1. Turn unit power supply off.
2. Remove unit power plug from power supply receptacle.
3. Open the control box door.
4. Test the insulation of each individual heater element.
    a. Test all 3 legs of the heater circuit to a good ground connection. Connect a calibrated 500 Vdc insulation tester between each outgoing heater contactor terminal and ground.
    b. If the resistance between any contactor terminal and ground is below 0.8 meg ohms, isolate and check the resistance of each individual heater element.
5. Check the resistance of each individual heater element.
    a. Disconnect and isolate each heater from the circuit in the control box.
    b. Check resistance of each heater with an insulation tester between each heater and ground. If the resistance between each heater and ground is below 0.8 meg ohms, the heater element is defective. On a loaded container, remove the defective heater from service by disconnecting at the control box. If the container is empty, remove the evaporator cover from the rear of the unit and replace the heater or correct any defective wiring. Repeat step 5a.

NOTE: When repairing heater connections, protect the new connections from the ingress of moisture with heat shrink tubing. All heaters should be secured to prevent contact with sharp metal edges.

NOTE: The following procedures involve servicing the refrigeration system. Some of these service procedures are regulated by Federal, and in some cases, by State and Local laws.

All regulated refrigeration service procedures must be performed by an EPA certified technician, using approved equipment and complying with all Federal, State and Local laws.

NOTE: CRR units feature a large, one piece filter drier/in-line filter. The filter drier should not require replacement unless major system contamination requires evacuation and cleanup of the refrigeration system.



1.	Internal Threads for Cap
2.	High Pressure Fitting
3.	Low Pressure Fitting

Figure 63: Service Fittings Specifications

Service Tools

CAUTION: When servicing thermo king R-134a refrigeration systems, use only those service tools (i.e., vacuum pump, refrigerant recovery equipment, gauge hoses, and gauge manifold set) certified for and dedicated to R-134a refrigerant and Polyol ester based compressor oils. Residual non-HFC refrigerant or non-Ester based oils will contaminate HFC systems.

Unit Service Fittings

Special fittings are used on R-134a systems to prevent mixing of non-HFC refrigerants in R-134a units. These fittings are located in three places on CRR refrigeration systems:

- Low side near the compressor suction service valve (or suction adapter),
- High side near the compressor discharge service valve (or discharge manifold),
- High side on the receiver tank.

Leak Detection

Leaks can be detected with the use of soap bubbles and with Halogen leak detectors such as model H10G, P/N 204-712 or model H10N, P/N 204-756 (portable).

Gauge Manifold Set

A new gauge manifold set (P/N 204-758) should be dedicated for use with R-134a only. Gauge hoses should also be dedicated to R-134a.

Vacuum Pump

A two-stage (P/N 204-725), three-stage or five-stage pump is recommended for evacuation. Purging the system with dry nitrogen is recommended before evacuation. Because residual refrigerant may be present in used vacuum pumps, a new vacuum pump should be used and dedicated strictly as an R-134a refrigerant pump. Use only recommended vacuum pump oils and change oil after every major evacuation.

Because vacuum pump oils are highly refined to obtain low vacuums, failure to follow these recommendations may result in acidic conditions that will destroy the pump.

System Cleanup

Cleanup devices such as suction line filters and compressor oil filters may be used if they are properly cleaned and new filters and cartridges are used. All standard petroleum and synthetic compressor oils must be removed to prevent the contamination of R-134a systems.

Refrigerant Recovery

Use only refrigerant recovery equipment approved for and dedicated to R-134a recovery.

Compressor Oil Acid Test

Perform an oil acid test (oil test kit P/N 203-457) whenever a unit has a substantial refrigerant loss, a noisy compressor or dark/dirty oil.

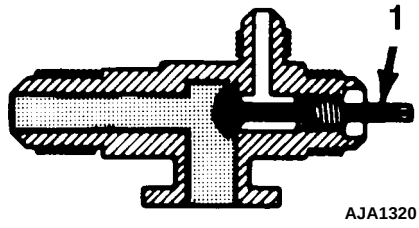
Compressor Discharge and Suction Service Valves

The discharge and suction valves isolate the compressor from the high and low sides of the refrigeration system for system diagnosis, service and repair.

NOTE: The only maintenance possible on the discharge or suction service valve is to periodically tighten the packing nut or to replace the packing. The valves are a permanently assembled unit and must be replaced in total if defective.

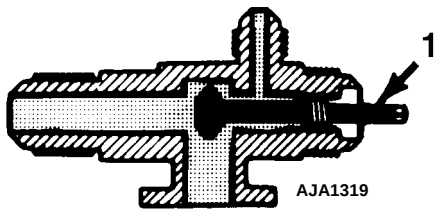
- Back Seated: Normal operation position.
- Open to Service Port: Position for servicing.
- Front Seated: To check or remove compressor.

WARNING: Do not start unit with discharge valve in FRONT SEATED position.



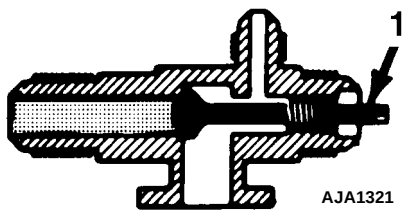
1.	Full Counterclockwise

Figure 64: Service Valve Back Seated



1.	1/2 Turn In

Figure 65: Service Valve Open to Port

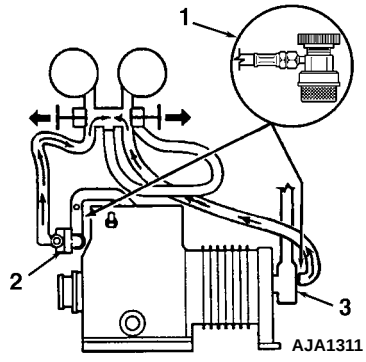


1.	Full Clockwise

Figure 66: Service Valve Front Seated

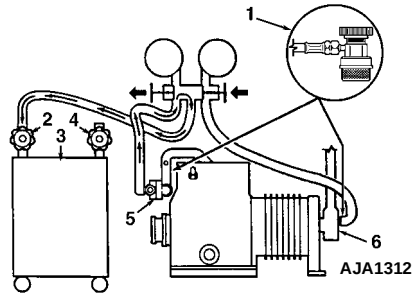
Gauge Manifold Valve Positions

The gauges indicate low and high side pressures. Operate one or both hand valves to perform the different service operations.



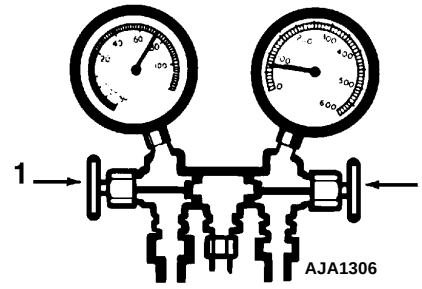
1.	Quick Disconnect Access Valve
2.	Discharge Service Valve (DSV)
3.	Suction Service Valve (SSV)

Figure 67: Balancing the Pressure



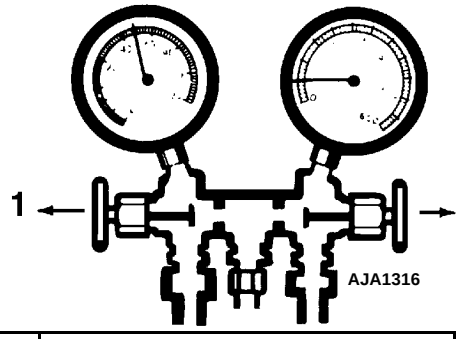
1.	Quick Disconnect Access Valve
2.	In
3.	Recliner
4.	Out
5.	Discharge Service Valve (DSV)
6.	Suction Service Valve (SSV)

Figure 68: Removing Refrigerant



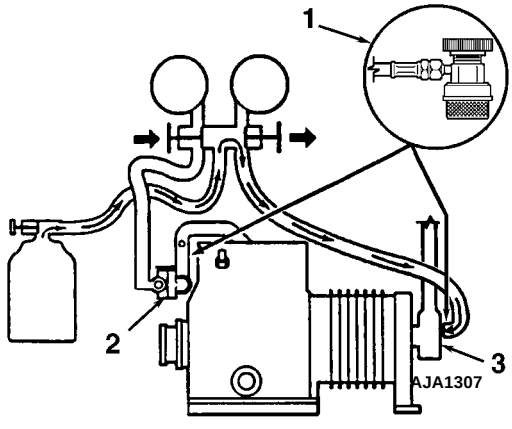
1.	Close Hand Valves

Figure 69: Gauge manifold Closed to Center Port



1.	Open Hand Valves

Figure 70: Gauge Manifold Open to Center Port



1.	Quick Disconnect Access Valve
2.	Discharge Service Valve (DSV)
3.	Suction Service Valve (SSV)

Figure 71: Charging the System

Gauge Manifold Set (With Low Loss Fittings) Attachment And Purging

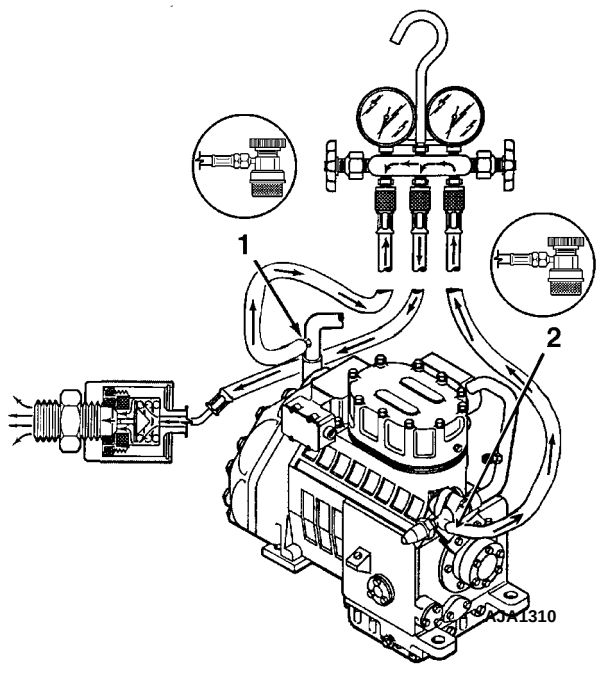
Thermo King recommends the use of access valves or self-sealing, quick disconnect fittings whenever possible to limit the loss of refrigerant into the atmosphere. A separate gauge manifold set with low loss fittings (P/N 204-758) should be dedicated for use with R-134a only. Gauge hoses should also be dedicated to R-134a.

NOTE: When any of these devices are used, carefully check to ensure that access connections are functioning properly.

Gauge Manifold Set Installation

NOTE: The following procedure purges the gauge hoses and must be followed when using new gauges or hoses for the first time. The system should be operating on Cool (10 psig [69 kPa] or greater suction pressure) when using this procedure to purge the low side hose. Gauge hoses may be removed and re-installed without additional purging so long as a slight positive pressure remains in the manifold and lines when removed from the unit.

1. Inspect gauge manifold for proper hose and fitting connections.
2. Clean dirt and moisture from around service ports.
3. Remove small service port caps from suction and discharge service fittings. Save and re-use the caps and sealing washers or gaskets.
4. Rotate both hose coupler hand wheels counterclockwise to back the stem out of the high and low hose fittings. Then attach low hose (compound gauge) to the suction line valve port.
5. With 69 kPa, 0.69 bar, 10 psig or greater pressure in the low side (unit operating on Cool), open the suction service manifold hand valve fully. Then rotate the suction hose fitting hand wheel clockwise to open (depress) the suction line port valve to the low hose.
6. Slowly screw a 1/2 inch ACME fitting into the low loss fitting on the manifold's service (center) line to purge the suction and service hoses. Remove ACME fitting after purging.



1.	Suction Connection
2.	Discharge Connection

Figure 72: Purging Gauge Manifold

7. Close the suction service manifold hand valve fully to center port.
8. Attach high side hose (pressure gauge) to the discharge service line port.
9. Open discharge service manifold hand valve fully. Then rotate discharge fitting hand wheel clockwise to open (depress) discharge line port valve to the high hose.
10. Slowly screw a 1/2 inch ACME fitting into the manifold's service (center) line to purge the high and service hoses. Remove ACME fitting after purging.
11. Close discharge service manifold hand valve fully to center port. You are now ready to use the gauge manifold to check system pressures or perform MOST service procedures.

    NOTE: These gauges may be removed and reinstalled without additional purging so long as a slight positive pressure remains in the manifold and hoses when removed from the unit. Gauge Manifold Set Removal.

NOTE: To ensure minimum refrigerant release to the atmosphere, THE SYSTEM SHOULD BE RUNNING. However, this is not possible in all cases, but the same procedure should be followed.

1. Rotate discharge hose fitting hand wheel counterclockwise to withdraw the fitting stem from the discharge line port valve. Then open both service manifold valves to center port.
2. Close the liquid line service valve and pump down the low side. Then turn the unit OFF.
3. Rotate the discharge fitting hand wheel counterclockwise to depress the port valve stem to equalize pressure at 21 kPa, 0.21 bar, 3 psig.
4. Rotate both coupler hand wheels counterclockwise to close (seal) the valve port stems to the high and low hoses.
5. Remove the gauge lines from the suction and discharge service fittings and cap the service ports.
6. Open liquid line service valve and cap valve stem.
7. Secure all manifold lines to manifold hose anchors when the manifold is not in use.

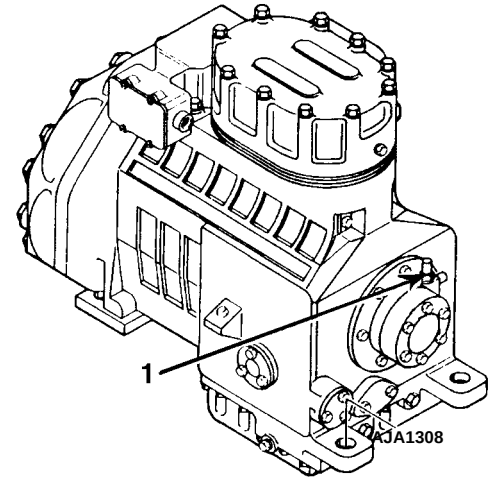
Checking Compressor Oil

CAUTION: Use ONLY Polyol Ester based refrigeration compressor oil, P/N 203-433. DO NOT mix Polyol Ester based and standard synthetic compressor oils.
CAUTION: Rubber gloves are recommended when handling Ester based compressor oil.
CAUTION: Keep Polyol Ester based compressor oil in tightly sealed containers. If Ester based oil becomes contaminated with moisture or standard oils, dispose of properly-DO NOT USE!

The compressor oil should be checked during pretrip inspections and when there is evidence of oil loss (oil leaks) or when components in the refrigeration system have been removed for service or replacement.

To check compressor oil level with an ambient air temperature above 10 C (50 F)

Install gauge manifold on the compressor. Operate the unit on COOL with a 138 kPa, 1.38 bar, 20 psig minimum suction pressure and a 689 kPa, 6.89 bar, 100 psig discharge pressure for 15 minutes or more. After the unit has maintained the above conditions for 15 minutes, observe the compressor oil level. The oil should be 1/2 to 3/4 up in the sight glass.



1.	Add and remove compressor oil at the compressor oil fitting

Figure 73: Adjusting Compressor Oil Level

To check compressor oil level with an ambient air temperature below 10 C (50 F)

With the evaporator temperature below 10 C (50 F), initiate a Manual Defrost to operate the unit through a complete DEFROST CYCLE. After completing the defrost cycle, operate the unit on COOL for a few minutes. After 2 to 3 minutes, observe the oil level. The oil should be 1/2 to 3/4 up in the sight glass.

If the container is empty, you can operate the unit on the heat cycle instead of the defrost cycle.

Adding Compressor Oil

1. Install gauge manifold set (refer to “Gauge Manifold Set Attachment and Purging”). Pump the compressor down (refer to “Low Side Pump Down”).

2. After stopping the compressor, adjust the low side pressure to 21 kPa, 0.21 bar, 3 psig using the service gauge set. (Pressure measured at the suction line service port.)
3. Remove the cap from oil pressure fitting on oil pump.
4. Using a commercial hand pump, force oil in through the oil pressure fitting. Slowly add oil and allow 5 to 10 minutes for the oil to flow down through the compressor into the sump. Add Polyol Ester oil, P/N 203-433 ONLY!
5. When the compressor oil sight glass is 1/2 to 3/4 full, remove hand pump and replace the cap on the oil pressure fitting.
6. Open the compressor suction service valve (or liquid line service valve) and operate the unit. Recheck the refrigerant charge level and the oil level before returning the unit to service.

Removing Excess Compressor Oil

1. Install an access valve actuator on the oil pressure fitting.
2. Operate the unit and remove oil while watching the level in the compressor sight glass.

   NOTE: Heavy foaming of the oil as it leaves the compressor may indicate an excess of refrigerant in the oil. Remove the access valve actuator and operate the system for 15 minutes to ensure warm sump. Then recheck the oil level.
3. When the compressor oil sight glass is 1/2 to 3/4 full, remove access valve and replace the cap on the oil pressure fitting.
4. Operate the unit and recheck the refrigerant charge level and the oil level before returning the unit to service.

Refrigerant Leak Test Procedure

Use a reliable Halogen leak detector such as model H10G, P/N 204-712 or 204-756 (portable), to leak test the refrigeration system. Inspect carefully for signs of compressor oil leakage which is the first sign of a leak in the refrigeration system.

NOTE: Due to environmental concerns and personal safety, the use of a Halide torch is no longer recommended.

If refrigerant has leaked or been removed from the unit:

1. Check entire system for possible component damage and refrigerant oil loss.
2. Attach gauge manifold set (refer to “Gauge Manifold Set Attachment and Purging” for proper procedures).
3. Attach refrigerant bottle charging hose to center of gauge manifold and purge charging hose of air.
4. Pressurize the system with refrigerant (GAS ONLY) until 345 kPa, 3.45 bar, 50 psig vapor pressure is achieved.
5. Leak check the system with an electronic leak detector to inspect all joints and connections. (Use soap solution as an alternative test component.)

If no leaks are found but the system has lost its refrigerant charge, proceed to the next step.

6. Close both hand valves on gauge manifold (front seated).
7. Disconnect the refrigerant charging hose.

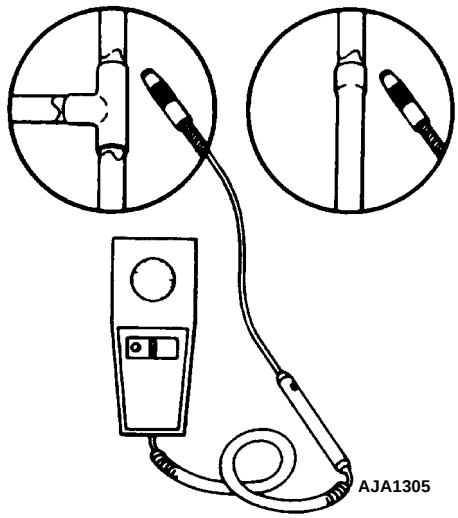


Figure 74: Testing for Refrigerant Leaks

8. Connect the charging hose to a source of nitrogen. Adjust the pressure regulator to 1380 kPa, 13.80 bar, 200 psig. See “Using Pressurized Nitrogen” in this manual chapter.

CAUTION: Nitrogen (N2) is under 15,170 kPa, 151.70 bar, 2200 psig pressure in a full cylinder at 21 C (70 F). DO NOT use oxygen, acetylene or any other type of pressurized gas in the system.

9. Pressurize the system with nitrogen to 1380 kPa, 13.80 bar, 200 psig.
10. Close the supply valve on the nitrogen bottle.
11. Use an electronic leak tester to inspect all joints and connections. (Use a soap solution as an alternative test component.)

    NOTE: If system leakage is indicated, loosen supply line hose fittings to release pressure. Repair leakage condition.

12. If system repair is necessary, recheck system after repairs are completed.

Low Side Pump Down

1. Install the gauge manifold on the compressor.
2. Set the controller setpoint temperature well below the return air temperature and operate the unit in the Cool mode until the temperature stabilizes (at least 5 minutes).
3. Close the liquid line service valve. Allow the unit to operate until it reaches -15 to -40 kPa, -0.15 to -0.40 bar, 5 to 11 in. vacuum on the suction pressure gauge (3-5 minutes). Then shut the unit down manually with the On/Off switch.

CAUTION: Never open the low side to the atmosphere while it is in a vacuum. Air and moisture will be drawn in and contaminate the refrigerant system.

4. To place the unit back in service, open the liquid line service valve and turn the On/Off switch ON.

Refrigerant Charge

The refrigerant charge should be checked during pretrip and routine maintenance inspections. A low charge of refrigerant will cause the container temperature to rise due to the lack of liquid refrigerant at the expansion valve even though the unit is operating in a cooling mode. The refrigerant charge can be checked by inspecting the receiver tank sight glasses.

NOTE: See “Receiver Tank Sight Glass” under Unit Instruments in the Operating Instructions chapter for information about checking the moisture indicator in the sight glass.

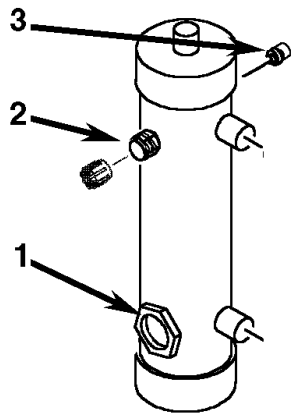
Unit Refrigerant Charge:

- Standard receiver: 4.9 kg (10.8 lb) of R-134a.
- Water-cooled condenser-receiver: 5.2 kg (11.5 lb) of R-134a.

Checking the Refrigerant Charge

1. Inspect the receiver tank sight glasses with the unit operating in COOL.
2. a. Standard Receiver Tank:
   - If the balls FLOAT in the sight glass at any time, R-134a charge is OK.
   - If the balls DO NOT FLOAT, R-134a charge is low.

   b. Water-cooled Condenser-receiver Tank with one sight glass:
   - If the balls FLOAT in the sight glass at any time, R-134a charge is OK.
   - If the balls DO NOT FLOAT, R-134a charge may be low.



1.	Sight Glass: Refrigerant charge is OK if ball floats at any time
2.	Service Fitting
3.	Fusible Plug

Figure 75: Standard Receiver Tank

3. Operate the unit on MAXIMUM COOL for 5 minutes. If necessary, place the unit in COOL using the Manual Function Test menu (start compressor, condenser fan, evaporator fans (high or low) and compressor 100%).

   a. Standard Receiver Tank:

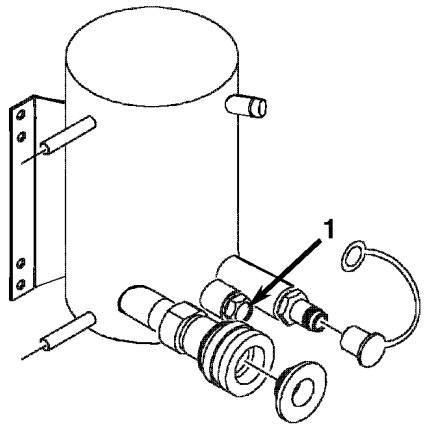
- If the balls FLOAT in the sight glass at any time, the R-134a charge is OK.

   b. Water-cooled Condenser-receiver Tank with one sight glass:

- If the balls DO NOT FLOAT in the sight glass at any time, the R-134a charge is low.
- If the balls FLOAT ALL THE WAY TO TOP of sight glass, the unit is overcharged.

NOTE: Inspect the unit for refrigerant leaks with a reliable leak detector if the unit is low on R-134a charge.

CAUTION: When adding R-134a to the unit, be careful not to OVERCHARGE the unit: Standard Receiver Tank: When the balls float in the middle of the sight glass, stop adding refrigerant. Water-cooled Condenser-receiver Tank: When the balls in the sight glass float, stop adding refrigerant.



1.	Refrigerant Level • Air-cooled Condenser Operation: The refrigerant charge is OK if balls FLOAT at any time • Water-cooled Condenser Operation: It is normal for the balls to float at the top of the sight glass. To check the refrigerant charge, operate unit on air-cooled condenser.

Figure 76: Water-Cooled Condenser-Receiver Tank with One Sight Glass

Evacuation and Cleanup of the Refrigeration System

Contamination

Whenever contaminants have entered the system, a thorough clean up is required to prevent damage or loss of compressor.

It is well known by the refrigeration service industry that the purpose of evacuation is to remove moisture and air from the refrigeration system before charging with new refrigerant after a system has been opened. The importance of thorough evacuation and system preparation cannot be over emphasized. Even infinitesimal quantities of air or moisture in a system can cause severe problems.

We know that the presence of moisture, oxygen, and heat under certain conditions can result in many forms of damage. Corrosion, sludge, copper plating, oil breakdown, carbon formation, and eventual compressor failure can be caused by these contaminants.

Things that will contaminate a system are (in order of importance):

- AIR — with oxygen as a contaminant. Oxygen in the air reacts with the oil. The oil begins to break down and can eventually lead to carbonization in the compressor and acid buildup. The longer this breakdown process goes on, the darker the compressor oil becomes until finally the color is BLACK indicating major system contamination.
- MOISTURE. Moisture in a system will cause metal corrosion and metal plating. It can freeze in the expansion valve and cause intermittent operational problems. It reacts in the oil to begin acid buildup.
- DIRT, DUST, METAL PARTICLES, OTHER FOREIGN MATERIALS. Particles of any kind left to float through the system will cause severe damage to all close tolerance items. Do not leave a system open to the infiltration of dirt. If you must open a system for any reason, seal off the open areas as soon as possible and DO NOT work in a dirty environment.
- ACID. Air and moisture cause a chemical breakdown of the oil and/or the refrigerant itself. The acid will accelerate the deterioration of the softer metals (i.e., copper) and cause metal plating as the softer material begins to cover the inside of the system. If this condition is not stopped, it can result in the total destruction of your equipment.

Compressor Oil Color Code

BLACK OIL — indicates carbonization caused by air in the system.

BROWN OIL — indicates copper plating caused by moisture in the system.

GRAY OR METALLIC OIL — indicates bearing wear or piston scoring.

NOTE: If the compressor oil is discolored, perform a compressor oil acid test (oil test kit P/N 203-457). If the compressor oil shows an acid condition, change the oil and the filter drier. Then perform a refrigeration system cleanup.

Unit Preparation and Hookup

CAUTION: Do not attempt to evacuate a unit until it is certain that the unit is leak free. A unit with less than a full charge of refrigerant should be thoroughly leak tested. Any leaks found must be repaired.

1. Recover all refrigerants from the unit and reduce the unit pressure to the proper level (US Federal Law requires a -17 to -34 kPa, -0.17 to -0.34 bar, 5 to 10 in.vacuum that is dependent upon the recovery equipment used).
2. Break vacuum with refrigerant and equalize system pressure to 0 kPa, 0 bar, 0 psig. Replace the liquid line filter drier.
3. Confirm that the Evacuation Station functions properly and determine “Blank Off” Pressure. The Blank Off Pressure of the Vacuum Pump is the deepest vacuum that the vacuum pump can attain when isolated from the rest of the system.

If a vacuum pump (isolated from a system) is started and the Micron Meter responds quickly by going to a deep vacuum, the operator can be confident that the pump and oil are in good condition. If the vacuum pump fails to reach a deep vacuum within 5 minutes, the operator should suspect the condition of the oil or the pump. It is recommended that the pump oil be changed first to see if the rate of reaching a deep vacuum is improved.

4. Connect the Evacuation Station and refrigerant tank with gauge manifold (optional) to the unit as indicated on the diagram on page 6-10. Connect evacuation hoses to the compressor suction and discharge service fittings and the receiver tank service fitting.
5. Open Evacuation Station valves (V1, V3, and V4). It is only necessary to open valve V2 when a reading on the Micron Meter is desired. This is especially true when starting to evacuate a unit and large amounts of moisture and oil will be passing by the sensor.

6. Open the vacuum pump Iso-Valve™ built into the pump housing below the handle. It is recommended that the valve be kept open at all times.
7. If connecting a refrigerant tank and gauge manifold to the evacuation station, close the gauge manifold and refrigerant tank valves to prevent refrigerant from being drawn from the tank.

Unit Evacuation

1. Turn on the Vacuum Pump. Open the Gas Ballast Valve located on top of the pump housing behind the handle (the valve is fully open at two turns counterclockwise). Evacuate the system to 500 microns to achieve a final equilibrium pressure of 2000 microns or less. The final equilibrium pressure is determined with the Thermo King Evacuation Station using the following procedure (called a pressure-rise test):
   a. Evacuate the system using the Evacuation Station until the vacuum level reaches 1000 microns. Then close the Gas Ballast Valve,
   b. Continue evacuation to 500 microns or until vacuum stabilizes at its lowest level. Contamination may delay reaching the lowest level for a period of several or more hours.
   c. Close valve V1 to isolate the vacuum pump from the system.

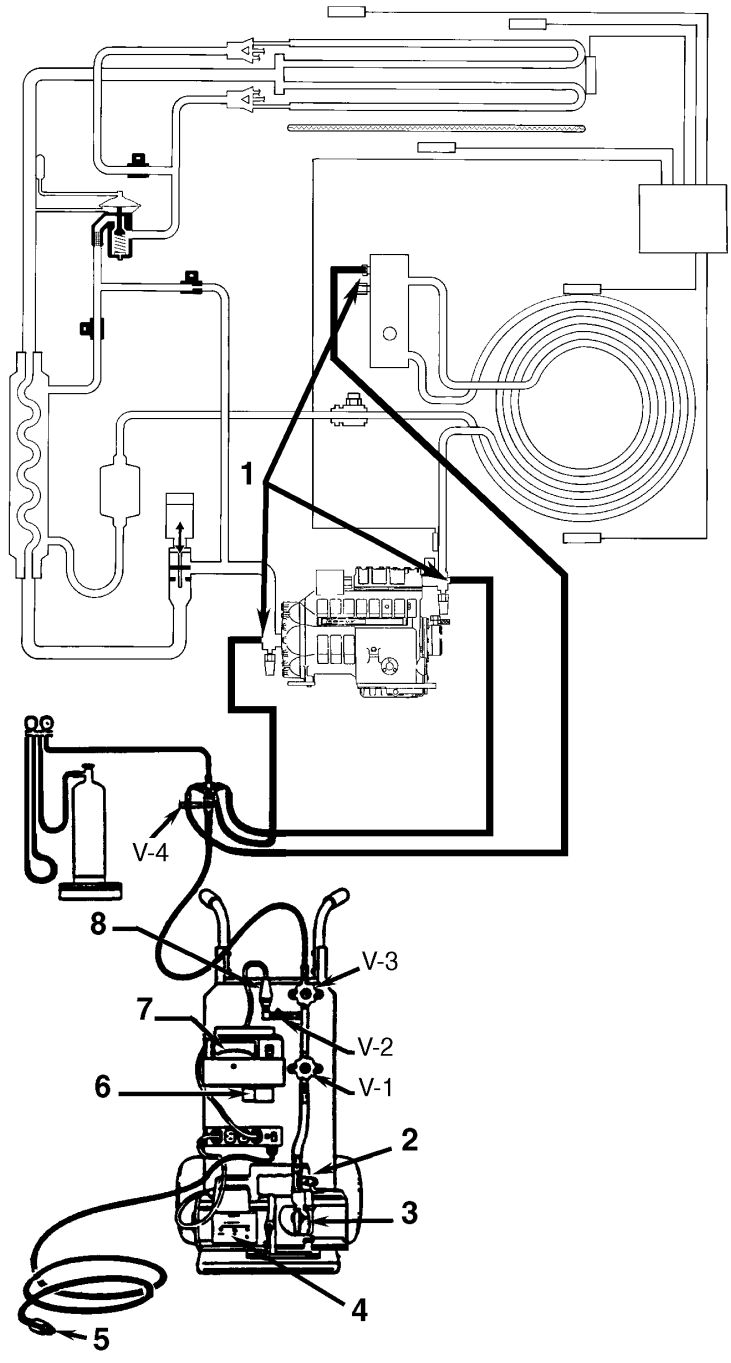
   Observe the vacuum level on the Micron Meter. When the Meter has stabilized, the value indicated on the Micron Meter is the equilibrium pressure. This reading must be 2000 microns or less.

   NOTE: The presence of refrigerant in the compressor oil may prevent a low vacuum reading from being achieved. Compressor oil can continue to outgas for long periods of time.
2. If the vacuum level appears to stall above 500 microns, back seat the discharge service valve and observe the Micron Meter.
   - A drop in pressure indicates that the compressor oil is out-gassing and further evacuation is necessary.
   - An increase in pressure indicates that a leak exists or there is moisture in the system. Perform a “Pressure Rise Test” and evaluate.
3. Close valve V1 when the desired vacuum level has been reached.
4. Wait five minutes and read the Micron Meter.
   - A system that is leak free and dry will remain below 2000 microns for five minutes.
   - A system that rises above 2000 microns but stabilizes below atmospheric pressure is probably contaminated with moisture or has refrigerant out-gassing from the compressor oil. Additional evacuation is required.
   - A system that continues to rise without stabilizing has a leak and must be repaired.
5. If the vacuum level remained below 2000 microns for five minutes, the unit is ready to charge.

Pressure Rise Test

Evacuate the system and close valve V1. With valves V3 and V4 open, the pump is isolated and the system is held under a vacuum. If the Micron Meter rises, one of the following conditions exist.

Leak: Watch the movement of the Micron Meter needle. If the needle continues to rise until it reaches atmospheric pressure, it is an indication that a leak exists somewhere in the system. When a leak is in a system, the vacuum will eventually stabilize at atmospheric pressure (see graph, “Constant Pressure Rise After Evacuation Indicates System Leak”, below).



1.	Special, self-sealing quick disconnect couplers are required for R-134a units.	5.	Two 22-/190 VAC Power
2.	Gas Ballast Valve	6.	Calibration Standard
3.	Iso Valve	7.	Micron meter
4.	Two-stage Vacuum Pump	8.	Sensor

Figure 77: Evacuation Station and Unit Hook-Up

Moisture: When the needle indicates a rise and then stabilizes at a level below atmospheric pressure, it is an indication that the system is vacuum tight, but is still wet and requires additional dehydration and pumping time (see graph, “Pressure Rise Levels Off After Evacuation Indicates Moisture in System”, below).

Factors Affecting the Speed of System Evacuation

It is almost impossible to state the exact amount of time required to evacuate any system. Some factors that can influence evacuation time are listed below.

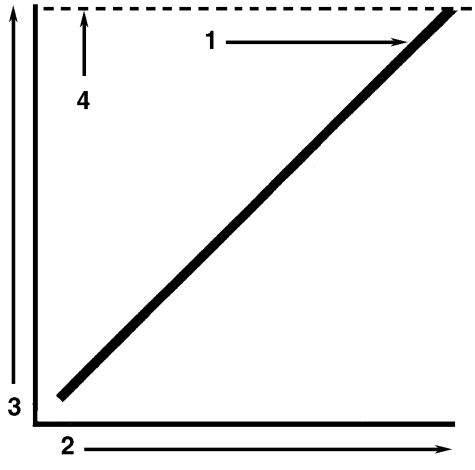
- System size
- Amount of moisture contained in the system
- Ambient temperature
- Internal restrictions within the system
- External restrictions between the system and the vacuum pump

Hose size, both diameter and length, affect evacuation times. Laboratory tests show that the evacuation time can be significantly reduced by larger diameter hoses and shorter hoses. To obtain optimum pumping speed, keep hoses as short as possible and as large in diameter as possible. For example, it takes eight times as long to pull a given vacuum through a 6 mm (1/4 inch) diameter hose as it does through a 12 mm (1/2 inch) diameter hose. It takes twice as long to pull a vacuum through a 2 meter (6 foot) long hose as it does through a 1 meter (3 foot) long hose.

Heat Saves Time

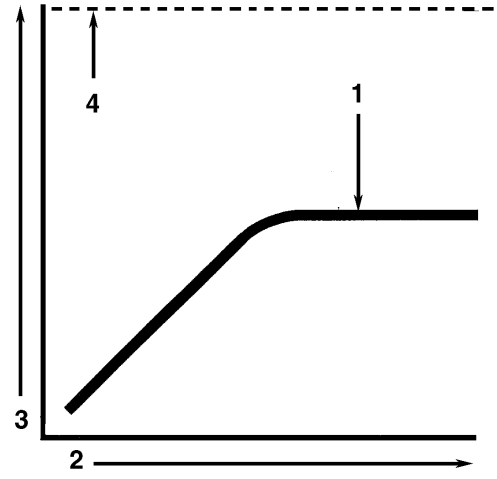
A useful and practical time saver is the application of heat to the system. Increasing the temperature of the compressor oil and refrigerant will speed up the vaporization of any water present in the system.

WARNING: Never use a torch or other concentrated heat source to heat the compressor or other refrigeration system component.



1.	Close the vacuum valve and watch the movement of vacuum gauge needle. If needle continues to rise, this is an indication that a leak exists in the unit or connecting line. The leak must then be located and eliminated.
2.	Time
3.	Pressure (Vacuum)
4.	Atmospheric Pressure

Figure 78: Constant Pressure Rise after Evacuation Indicates System Leak



1.	Close the vacuum valve and watch the movement of vacuum gauge needle. If needle shows a pressure rise but finally levels off to a constant pressure, the system still contains to much moisture. Dehydration and additional evacuation time are required.
2.	Time
3.	Pressure (Vacuum)
4.	Atmospheric Pressure

Figure 79: Pressure Rise Levels Off after Evacuation Indicates Moisture in System

Heat lamps, electric heaters, or fans can be applied to the compressor crankcase and other parts of the system to increase the temperature of the refrigerant and compressor oil.

Unit Charging (from an Evacuated Condition)

1. Close valve V4.
2. Open the Gas Ballast valve (located on top of the pump housing behind the handle).
3. Stop the vacuum pump.
4. The discharge valve remains mid-seated.
5. Connect the refrigerant tank with gauge manifold to the evacuation station (see "Evacuation Station and Unit Hookup" in this chapter).
6. Weigh the tank of refrigerant.
7. Check the unit data plate for the required weight of refrigerant charge then subtract the amount of the charge to be input to your unit from the total weight of the tank of refrigerant. This provides final tank weight after the unit receives a full system refrigerant charge.
8. Set the refrigerant tank for liquid removal. Open the hand valve on the tank.
9. With the unit OFF, open the gauge manifold hand valve and charge liquid refrigerant into the system.
10. Close the refrigerant tank hand valve when the correct amount (by weight) of refrigerant has been added or if the system will take no more liquid.

    The unit is now ready to have the Evacuation Station removed (described in the following steps, "Evacuation Station Removal"). See following, "Final Charging Procedure for Partially Charged Units" to complete charging procedure.

Evacuation Station Removal

1. Back seat the discharge service valve.
2. Remove the service hose from the refrigerant tank service fitting. Cap the receiver tank service port.
3. Operate the unit in cool mode.
4. Open the hand valve at the gauge manifold and read suction pressure.
5. Front seat the suction service valve and pump down the system to 21 to 35 kPa, 0.21 to 0.35 bar, 3 to 5 psig.
6. Back seat the suction service valve.
7. Remove the hoses from the discharge service valve.
8. Install a gauge manifold set.
    - If the unit is fully charged, perform a functional check out.
    - If the unit has a partial charge, complete the charging process as described below.

Final Charging Procedure for Partially Charged Units

1. Connect the gauge manifold to the suction line and discharge line service ports. Be sure to purge the air from the lines (see "Gauge Manifold Set Attachment and Purging" in the Refrigeration Maintenance chapter of this manual).
2. Back seat and crack the discharge service valve.
3. Connect a refrigerant tank to the gauge manifold service line.
4. Set the refrigerant tank for liquid charging. Open the refrigerant tank hand valve.
5. Start and operate the unit in the COOL mode.
6. Read the suction pressure and slowly open the gauge manifold low pressure hand valve to permit suction pressure to increase approximately 170 kPa, 1.7 bar, 25 psig. This will meter liquid refrigerant slowly into the low side.
7. Add refrigerant until the receiver tank balls float in the top sight glass.
8. Close the hand valve on the refrigerant tank.
9. Operate the unit on COOL for 10 minutes and recheck refrigerant charge.
10. Remove the gauge manifold set.

11. Cap all service ports and valve stems.

CAUTION: If the controller temperature setpoint was lowered to force COOL operation, be sure to return the controller to the setpoint indicated on the shipping manifest.

Evaporator Pressure Regulator (KVQ) Valve

The evaporator pressure regulator valve is used to control the flow of refrigerant to the compressor when the unit is operating in the Power Limit and Modulation Cool modes. As the supply air temperature approaches setpoint, the controller sends a voltage pulse to a heater in the valve. The heater warms a pressure reservoir in the valve actuator. As the pressure in the fluid reservoir increases, a pressure pin overcomes the spring tension in the bellows, closing the valve plate a precise amount. This throttles the suction gas returning to the compressor and reduces cooling capacity. As the frequency of the voltage pulse is increased, the pressure pin closes the valve plate an additional amount. Due to valve design, the flow of refrigerant gas exerts no opening or closing forces on the valve plate, allowing very precise operation.

NOTE: If the electrical circuit to the heating element fails, the valve moves to the full open position.

Service of the evaporator pressure regulator valve includes replacement of the actuator assembly or replacement of the valve body.

Tools Required:

- Digital Multimeter (P/N 204-615)
- Actuator Assembly
- Adjustable Wrench
- Torque Wrench

Heater Circuit Checkout Procedure

1. Unplug the evaporator pressure regulator valve lead wire harness.
2. Using a FLUKE multimeter, test each lead (4) resistance to ground. Low resistance indicates a short is present. Repair or replace any damaged or exposed wires.
3. Check the heater circuit and thermistor circuit resistance.

- A good heater circuit has a resistance of 20 ohms at 25 C (78 F).
- A good thermistor circuit has a resistance of 20,000 ohms at 25 C (78 F).

NOTE: The ohmmeter will display a slightly higher heater resistance if the valve was energized just prior to testing the circuit resistance.

4. To return the unit to service, plug the evaporator pressure regulator valve lead connector into the unit wire harness.

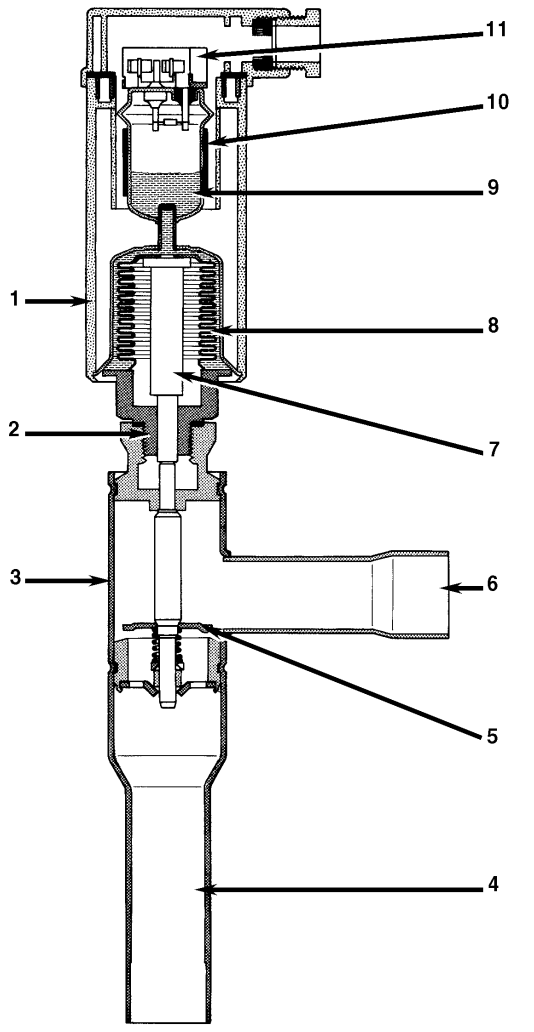
Valve Actuator Replacement

If the evaporator pressure regulator valve fails to operate properly, remove the actuator cover and inspect the assembly for rust or corrosion. Rust or corrosion can damage the actuator or heater circuit, preventing the valve from operating properly.

1. To replace actuator assembly, unplug the heater and thermistor lead wire harnesses.
2. Connect the unit's main power cable to the main power source and switch the refrigeration unit's On/Off switch to ON. Close the liquid line service valve and pump down the low side. Equalize suction pressure to 21 kPa, 0.21 bar, 3 psig.
3. Turn the unit On/Off switch to OFF. Then disconnect the main power cable from the main power source again. Close (front seat) the discharge service valve.

CAUTION: Any time the discharge valve is front seated, disconnect the unit power source to prevent accidental compressor start-up.

4. Inspect the actuator terminals and note the wire connection sequence. Then disconnect wire leads.
5. Unscrew the actuator assembly from the valve body.
6. Immediately insert new actuator assembly in valve body.
7. Thread new actuator into valve body until it is hand tight. Then tighten to 45 N.m (33 ft-lb).
8. Connect wire leads to actuator terminals in proper sequence.
9. Replace cover on actuator assembly.
10. Connect the heater and thermistor lead wire harnesses.
11. Evacuate the low side.
12. Open the discharge valve. Then open the liquid line service valve.
13. Verify that all personnel are clear and connect main power plug to power supply. Place the unit back in service.



1.	Actuator Assembly
2.	Threaded Connection
3.	Valve Body
4.	Inlet Tube
5.	Valve Plate
6.	Outlet Tube
7.	Pressure Pin
8.	Bellows Assembly
9.	Pressure Reservoir
10.	Heating Element
11.	Terminal Connections

Figure 80: KVQ Valve

KVQ Valve Replacement

If the valve body is damaged, replace the entire valve.

1. Connect the unit's main power cable to the main power source. Switch the refrigeration unit's On/Off switch to ON.
2. Close the liquid line service valve and pump down the low side to 21 kPa, 0.21 bar, 3 psig.
3. Turn the unit On/Off switch to OFF. Then disconnect the main power cable from the main power source. Close (front seat) the discharge service valve.

CAUTION: Any time the discharge valve is front seated, disconnect the unit power source to prevent accidental compressor start-up.

4. Unplug the heater and thermistor lead wire harnesses.
5. Unsolder the valve outlet (compressor side) joint from the suction line. Unsolder the inlet joint and remove valve.
6. Clean the tubes for soldering. Position the new valve in position in the suction line.
7. Solder both KVQ valve connections.

CAUTION: Use a heat sink or wrap the valve with wet rags to prevent damage to the new valve.

8. Pressurize the low side and test for refrigerant leaks (see "Refrigerant Leak Test Procedure" in the Refrigeration Maintenance chapter of this manual).

   NOTE: If pressurizing with nitrogen, front seat the discharge valve to prevent nitrogen from entering the refrigerant charge.

9. If no leaks are found, evacuate the low side and recover the leak test gas (see "Refrigerant Recovery" in the Refrigeration Maintenance chapter of this manual).
10. Plug the heater and thermistor wire harnesses into the unit wire harness.
11. Open the discharge valve. Then open the liquid line service valve.
12. Verify that all personnel are clear and connect main power plug to power supply. Start the unit and check the refrigerant charge. Add refrigerant as required.

Refrigerant Recovery

CAUTION: Use only refrigerant recovery equipment approved for and dedicated to R-134a recovery.

When removing any refrigerant from a Thermo King refrigeration system, use a recovery process that prevents or absolutely minimizes the refrigerant that can escape to the atmosphere. Typical service procedures that require removal of refrigerant from the unit include:

- To reduce the refrigerant pressure to a safe working level when maintenance must be performed on high-pressure side components.
- To empty the unit of refrigerant when an unknown amount of charge is in the system and a proper charge is required.
- To empty the unit of contaminated refrigerant when the system has become contaminated.

  NOTE: Always refer to specific recovery equipment Operator and Service Manuals.

Vapor Recovery

1. Install a gauge manifold set on the unit. Attach the service line to the recovery machine and properly purge the lines. Set the recovery machine for vapor recovery.
2. Keep unit OFF and mid-seat the discharge service valve.
3. Turn ON the recovery machine and open (back seat) both gauge manifold and hand valves.
4. Continue to operate the recovery machine until unit pressures drop to 0 kPa, 0 bar, 0 psig pressure.

Liquid Recovery

1. Install a gauge manifold's low-pressure line to the service fitting on the suction service valve. Attach the manifold's high-pressure line to receiver tank service port. Attach the service line to the recovery machine and purge the lines.
2. Operate the unit and build discharge pressures to approximately 1380 kPa, 13.80 bar, 200 psig.
3. Close the liquid line service valve and pump down the low-pressure side of the system.
4. Stop the unit.
5. Set recovery machine for liquid recovery and turn it ON.
6. Open (back seat) high-pressure valve on gauge manifold.
7. Operate the recovery machine until the unit system pressures reach approximately 0 kPa, 0 bar, 0 psig.

Using Pressurized Nitrogen

The improper use of high pressure cylinders can cause physical damage to components, or personal injury, or cause stress that would lead to failure of components.

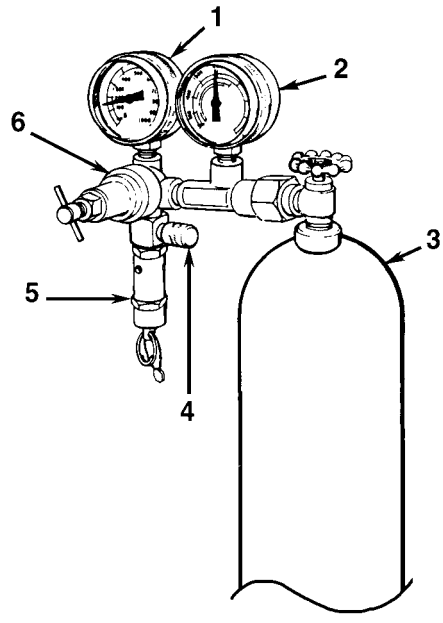
Safety Precautions

Observe the proper handling of cylinders:

1. Always keep protective cap on cylinder when not in use.
2. Secure cylinder in proper storage area or fastened to cart.
3. DO NOT expose to excessive heat or direct sun light.
4. DO NOT drop, dent, or damage cylinder.
5. Use a pressure regulator and a safety pressure relief valve as part of the pressure testing equipment. The safety pressure relief valve should be of the non-adjustable, non-tempering type. The valve should bypass any time the pressure exceeds its setting.
6. Open valve slowly; use regulators and safety valves that are in good working order.
7. The regulator should have two gauges; one to read tank pressure, the other to read line pressure. Properly maintained equipment will allow leak testing, purging, or dehydration to be done safely.

CAUTION: Nitrogen (N_2) is under 15,170 kPa, 151.70 bar, 2200 psig, or greater. Pressure is for full cylinder at 21 C (70 F). DO NOT use Oxygen (O_2), acetylene or any other types of pressurized gas on refrigeration systems or any component of a system.

Dehydration, pressure testing, purging and soldering can be accomplished with the use of dry nitrogen (N2). The proper equipment and application of equipment is of greatest importance.



1.	Line Pressure
2.	Tank Pressure
3.	Tank
4.	Pressure Test Line to System
5.	Safety Valve
6.	Pressure Regulator

Figure 81: Typical Pressurized Gas Bottle with Pressure Regulator and Gauges

Procedure

1. Attach gauge manifold set (refer to “Gauge Manifold Set Attachment and Purging” for proper procedure for connecting to compressor).
2. Close both hand valves on the gauge manifold (front seated).
3. Connect charging hose to a source of nitrogen. Adjust pressure regulator to the proper pressure for the required procedure.
4. Purge system high side to low side.

The following procedures should utilize the following MAXIMUM gas pressure:

- Leak Testing: 1030 to 1200 kPa, 10.3 to 12.0 bar, 150-175 psig,
- Purging/Dehydration: 70 to 140 kPa, 0.7 to 1.4 bar, 10-20 psig,
- During Soldering: 35 kPa, 0.35 bar, 5 psig.

Compressor Replacement

Removal

1. Remove the compressor compartment bracket. Close the liquid line service valve and pump down the low side to - 35 kPa, -0.35 bar, 10 in. vacuum. Break the vacuum with nitrogen between 10 and 20 kPa, 0.10 and 0.20 bar, 1 and 3 psig.

   NOTE: If the compressor does not operate, or the compressor is unable to pump the low side down, the refrigerant charge must be reclaimed before service can be performed on the refrigeration system.

2. Front seat the discharge valve.

   CAUTION: Any time the discharge valve is front seated, disconnect the unit power source to prevent accidental compressor start-up.

3. Remove discharge service valve, suction service valve, and liquid injection line from the compressor.
4. Disconnect the wire connector for the high pressure cutout switch.
5. Remove the three-phase electric power connection.
6. Remove the compressor mounting tray bolts and nuts.
7. Slide the compressor from the unit.
8. Keep the compressor ports covered to prevent dust, dirt, etc., from falling into the compressor.

   NOTE: When the compressor is removed from the unit, oil level should be noted or the oil removed from the compressor should be measured so that the same amount of oil can be added before placing the new compressor or repaired compressor in the unit.

Installation

1. Slide the compressor into the unit. Install mounting bolts, washers and nuts, and tighten.
2. Bolt the discharge valve to the compressor with a new gasket lightly coated with compressor oil. Bolt the suction service valve to the compressor using a new O-ring coated with compressor oil.
3. Apply refrigerant locktite to the threads of the switches. Install the switches. Connect the wire connectors for the high pressure cutout switch.
4. Connect liquid injection line to compressor body.
5. Connect three-phase electric power to the compressor.
6. Pressurize the compressor with refrigerant gas (same gas as that used in the system). Check for refrigerant leaks around the compressor assembly and gasket connections.
7. If no leaks are found, recover the refrigerant used for the leak test (see “Refrigerant Recovery” in this chapter). Because this refrigerant gas will contain some air, place it in a contaminated refrigerant bottle to be reclaimed later.
8. After all pressure is removed from the low side and compressor, hook up your evacuation equipment.

9. Evacuate the low side and compressor (see "Evacuation and Cleanup of the Refrigeration System" in this chapter).
10. Back seat the discharge service valve and open the liquid line service valve fully.
11. Operate the unit at least thirty minutes and then inspect the oil level in the compressor. Add or remove oil if necessary.
12. Check the refrigerant charge and add refrigerant if needed.

Condenser Coil Replacement

Removal

1. Recover the refrigerant charge from the unit (do NOT vent refrigerant to the atmosphere).
2. Remove the condenser fan grille, condenser fan blade and condenser fan shroud.
3. Remove the condenser coil support brackets from the coil.
4. Unsolder the coil inlet and liquid line connections.
5. Support the coil and unbolt the condenser coil mounting brackets. Slide the coil from the unit.

Installation

1. Clean the tubes for soldering.
2. Slide the coil into the unit and install the bolts in the mounting brackets.
3. Solder the inlet line and liquid line connections.

   NOTE: It is strongly recommended that dry nitrogen be used to purge the system during any solder operations (see "Using Pressurized Nitrogen" in this chapter).
4. Pressurize the system and test for leaks (see "Refrigerant Leak Test Procedure" in this chapter).
5. If no leaks are found, recover the leak test gas (see "Refrigerant Recovery" in this chapter).
6. Then evacuate the system (see "Evacuation and Cleanup of the Refrigeration System" in this chapter).
7. Replace the condenser coil support brackets, condenser fan shroud and condenser fan grille.
8. Recharge the unit with R-134a refrigerant and check the compressor oil level. Add oil if necessary.

Filter Drier/In-line Filter Replacement

Removal

1. Close the liquid line service valve and pump down the low side. Open the outlet valve slightly to equalize the pressure between 10 and 20 kPa, 0.10 and 0.20 bar, 1 and 3 psig.
2. Place the new filter drier near the unit for immediate installation.
3. Using two wrenches, "crack" both filter drier line mountings. Use two wrenches on flare fittings to prevent line damage.
4. Separate the filter drier line mountings.
5. Remove the filter bracket clamping nuts and bolts.

   NOTE: Perform the following four procedures as quickly as possible to prevent contamination.
6. Remove the old filter drier from the line.

Installation

1. Remove the sealing caps from the new filter drier.
2. Apply clean compressor oil to filter drier threads.
3. Assemble new filter drier to lines. Finger tighten mounting nuts.

   NOTE: To prevent incorrect installation of the filter drier, the inlet and outlet fittings are different sizes.
4. Reinstall filter drier clamping brackets, nut and bolts. Tighten the bolts.
5. Tighten the filter drier inlet line mounting nut.

6. Open the liquid line service valve on the inlet side of the filter drier slowly to release a small amount of refrigerant from the receiver tank to purge the air through the filter. Then tighten the outlet nut.

   NOTE: When removing or replacing the o-ring nuts on the filter drier, always hold the body of the filter drier near the flange fittings to prevent twisting the tubing when the nuts are being loosened or tightened.

7. Back seat (open) the liquid line service valve on the inlet side of the filter drier.
8. Test the filter drier for leaks (see “Refrigerant Leak Test Procedure” in this chapter).
9. If no leaks are found, place the unit in operation.

Expansion Valve Replacement

Removal

1. Close the liquid line service valve and pump down the low side to -35 kPa, -0.35 bar, 10 in. vacuum. Break the vacuum with nitrogen between 10 and 20 kPa, 0.10 and 0.20 bar, 1 and 3 psig.
2. Remove insulating tape and unclamp feeler bulb from the suction line in the condenser section. Note the position of the feeler bulb on the side of the suction line.
3. Remove insulating tape from expansion valve outlet line.
4. Heat and unsolder the equalizer line from expansion valve.
5. Heat and unsolder the liquid line inlet and outlet connections to expansion valve in condenser section.
6. Remove expansion valve from unit.

Installation

1. Clean the liquid lines and equalizer lines for soldering.
2. Place new expansion valve in position in liquid line.
3. Solder liquid line inlet and outlet line connections to valve.
4. Solder equalizer line to expansion valve.
5. Clean the suction line to a bright polished condition. Install the feeler bulb of new power head in the feeler bulb clamp on the suction line. Locate bulb on the suction line in former position. The feeler bulb must make good contact with the suction line or operation will be faulty. Cover with insulating tape.
6. Pressurize the low side and test for leaks (see “Refrigerant Leak Test Procedure” in this chapter).
7. If no leaks are found, recover the leak test gas (see “Refrigerant Recovery” in this chapter).
8. Evacuate the low side (see “Evacuation and Cleanup of the Refrigeration System” in this chapter).
9. Cover expansion valve outlet line with insulating tape.
10. Open the liquid line service valve and place the unit in operation.
11. Operate the unit and note the suction pressure and container temperature to see that the expansion valve is properly installed and that the feeler bulb is properly located.

Heat Exchanger Replacement

Removal

1. Close the liquid line service valve and pump down the low side to -35 kPa, -0.35 bar, 10 in. vacuum. Break the vacuum with nitrogen between 10 and 20 kPa, 0.10 and 0.20 bar, 1 and 3 psig.
2. Remove the “U” mounting clamps that hold the heat exchanger assembly to the wall of the condenser section.
3. Heat and unsolder liquid inlet and outlet line connections.
4. Note position of feeler bulb on the side of the suction line. Un-tape and remove the feeler bulb from the suction line.

5. Heat and unsolder the suction line connections.
6. Lift the heat exchanger assembly from the unit.

Installation

1. Clean the tubes for soldering.
2. Place the heat exchanger assembly in the unit and install the mounting hardware.
3. Solder the suction line connections.

   NOTE: It is strongly recommended that dry nitrogen be used to purge the system during any solder operations (see "Using Pressurized Nitrogen" in this chapter). If pressurizing with nitrogen, front seat the discharge valve to prevent nitrogen from entering the refrigerant charge.

   CAUTION: Any time the discharge valve is front seated, disconnect the unit power source the prevent accidental compressor start-up.

4. Solder the liquid line connections.
5. Pressurize the low side and check for leaks (see "Refrigerant Leak Test Procedure" in this chapter).
6. If no leaks are found, recover the leak test gas (see "Refrigerant Recovery" in this chapter).
7. Evacuate the low side (see "Evacuation and Cleanup of the Refrigeration System" in this chapter).
8. Clean suction line to a bright polished condition. Install feeler bulb in the feeler bulb clamps on the suction line. Locate bulb on the suction line in former position. The feeler bulb must make good contact with the suction line or operation will be faulty. Cover with insulating tape.
9. Open the liquid line service valve and place unit in operation. Operate unit and note suction pressure and container temperature to see that feeler bulb is properly installed.

Receiver Tank Replacement

Removal

1. Recover the refrigerant charge from the unit (see "Refrigerant Recovery" in this chapter).
2. Unsolder the outlet valve on the liquid outlet line.
3. Unsolder the liquid line inlet connection.
4. Loosen the mounting nuts and remove the tank.
5. Remove the adapter with fusible plug, service fitting and water fittings (option) from the receiver tank for installation in new tank.

Installation

1. Install a new tank in the unit and tighten the mounting bolts.
2. Solder the inlet line and outlet valve line with high temperature silver solder (30% silver).

   NOTE: It is strongly recommended that dry nitrogen be used to purge the system during any solder operations (see "Using Pressurized Nitrogen" in this chapter).

   NOTE: If pressurizing with nitrogen, front seat the discharge valve to prevent nitrogen from entering the refrigerant charge.

   CAUTION: Any time the discharge valve is front seated, disconnect the unit power source to prevent accidental compressor start-up.

3. Pressurize the refrigeration system and check for leaks (see "Refrigerant Leak Test Procedure" in this chapter).
4. Evacuate the system (see "Evacuation and Cleanup of the Refrigeration System" in this chapter).
5. Recharge the unit (see "Refrigerant Charge" in this chapter).

High Pressure Cutout Switch Replacement

Removal

1. Close the liquid line service valve and pump down the low side. Open the outlet valve slightly to equalize the pressure between 10 and 20 kPa, 0.10 and 0.20 bar, 1 and 3 psig.
2. Front seat the discharge service valve.

CAUTION: Any time the discharge valve is front seated, disconnect the unit power source to prevent accidental compressor start-up.

3. Purge the high pressure from the compressor head through the service port on the discharge line.
4. Disconnect the leads from the wire harness and remove the switch from the compressor discharge manifold (or remove the sensor from the compressor head).

Installation

1. Apply a refrigeration locktite (sealant) to the threads of the switch (or sensor).
2. Install and tighten the switch (or sensor). Connect the leads to the wire harness.
3. Open discharge service valve slightly to pressurize the compressor head and tube assembly. Check for leaks (see “Refrigerant Leak Test Procedure” in this chapter). Front seat the discharge service valve.
4. If no leaks are found, recover the leak test gas (see “Refrigerant Recovery” in this chapter).
5. Open the liquid line service valve and compressor discharge service valve and place the unit in operation.

Liquid Line Solenoid Valve Replacement

Removal

1. Close the liquid line service valve and pump down the low side to -35 kPa, -0.35 bar, 10 in. vacuum. Break the vacuum with nitrogen between 10 and 20 kPa, 0.10 and 0.20 bar, 1 and 3 psig.
2. Turn the unit On-Off switch OFF. Disconnect electrical connections to liquid line solenoid.

   NOTE: In most cases, only the coil requires replacement. No other repair is possible on the liquid line solenoid.

3. Unsolder the liquid line connections from the valve.
4. Remove the valve from the unit.

Installation

1. Clean the tubes for soldering.
2. Place the new valve in position and solder the connections.

CAUTION: Use a heat sink or wrap the valve with wet rags to prevent damage to the new valve.

3. Release a small amount of refrigerant from the receiver tank to pressurize the liquid line. Check for leaks (see “Refrigerant Leak Test Procedure” in the Refrigeration Maintenance chapter of this manual).
4. If no leaks are found, recover the leak test gas (see “Refrigerant Recovery” in the Refrigeration Maintenance chapter of this manual).
5. Evacuate the low side (see “Evacuation and Cleanup of the Refrigeration System” in the Refrigeration Maintenance chapter of this manual).
6. Reconnect the electrical wires to the valve.
7. Open the liquid line service valve and place the unit in operation. Check the refrigerant charge and add refrigerant as required.

Liquid Injection Valve Replacement

Removal

1. Close the liquid line service valve and pump down the low side to -35 kPa, -0.35 bar, 10 in. vacuum. Break the vacuum with nitrogen between 10 and 20 kPa, 0.10 and 0.20 bar, 1 and 3 psig.
2. Disconnect the unit power source from the unit. Disconnect the electrical connections to the liquid injection valve.

   NOTE: In most cases, only the coil requires replacement. No other repair is possible on the liquid injection valve.
3. Unsolder the liquid line connections.
4. Unbolt and remove the valve from the unit.

Installation

1. Clean the tubes for soldering.
2. Place the new valve in position.
3. Solder the liquid line connections.

CAUTION: Use a heat sink or wrap the valve with wet rags to prevent damage to the new valve.

4. Pressurize the low side with refrigerant and check for leaks (see “Refrigerant Leak Test Procedure” in this chapter).
5. If no leaks are found, recover the leak test gas (see “Refrigerant Recovery” in this chapter).
6. Evacuate the low side (see “Evacuation and Cleanup of the Refrigeration System” in this chapter).
7. Reconnect the electrical wires to the valve.
8. Open the liquid line service valve and place the unit in operation. Check the refrigerant charge and add refrigerant as required.

Dehumidify Valve (pre 2002) Replacement

Removal

1. Close the liquid line service valve and pump down the low side to -35 kPa, -0.35 bar, 10 in. vacuum. Break the vacuum with nitrogen between 10 and 20 kPa, 0.10 and 0.20 bar, 1 and 3 psig.
2. Remove insulating tape from liquid line.
3. Disconnect the electrical connections to the dehumidify valve (pre 2002).

   NOTE: In most cases, only the coil requires replacement. No other repair is possible on the liquid injection valve.
4. Unsolder the liquid line connections.
5. Unbolt and remove the valve from the unit.

Installation

1. Clean the tubes for soldering.
2. Place the new valve in position.
3. Solder the liquid line connections.

CAUTION: Use a heat sink or wrap the valve with wet rags to prevent damage to the new valve.

4. Pressurize the low side with refrigerant and check for leaks (see “Refrigerant Leak Test Procedure” in this chapter).
5. If no leaks are found, recover the leak test gas (see “Refrigerant Recovery” in this chapter).
6. Evacuate the low side (see “Evacuation and Cleanup of the Refrigeration System” in this chapter).
7. Cover liquid lines with insulating tape.
8. Reconnect the electrical wires to the valve.
9. Open the liquid line service valve and place the unit in operation. Check the refrigerant charge and add refrigerant as required.

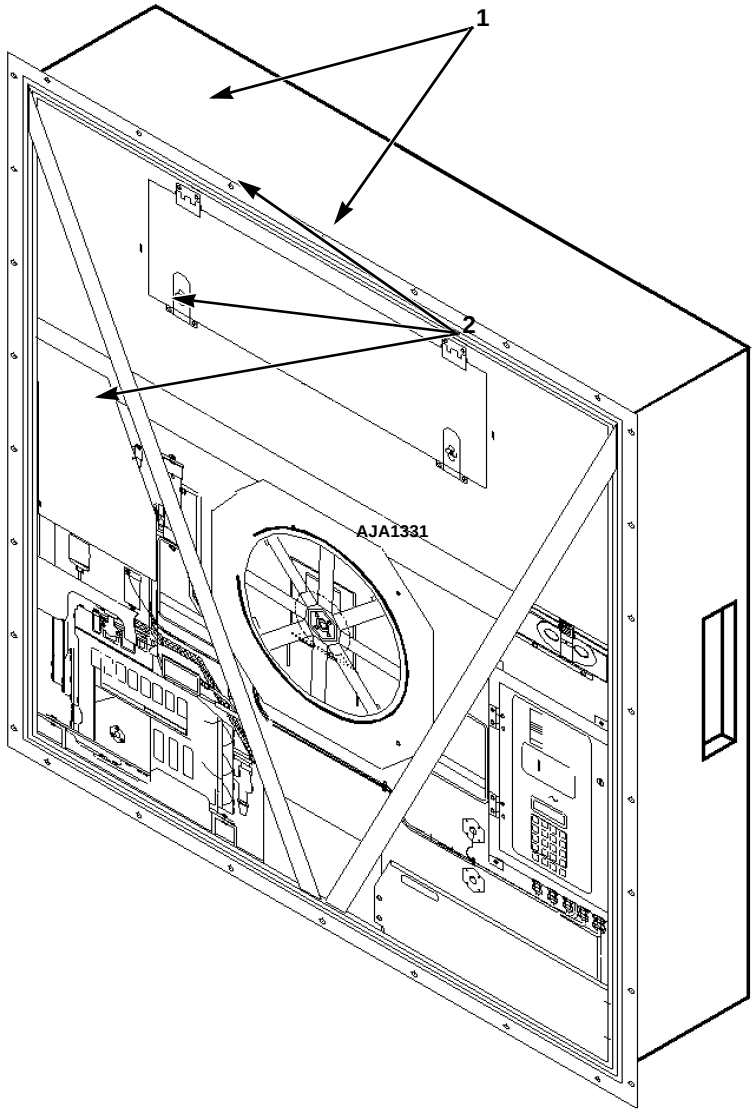
Servicing The Unit

Mounting Bolts

Check and tighten all unit, compressor, and fan motor mounting bolts during pretrip inspections and every 1,000 operating hours. Unit mounting bolts should be tightened to a torque value of 204 N.m (150 ft-lb). Compressor and fan motor mounting bolts should be tightened to a torque value of 20 to 21 N.m (15 to 20 ft-lb).

Unit Inspection

Inspect the unit during unit pretrip inspection and every 1,000 operating hours for loose or broken wires or hardware, compressor oil leaks, or other physical damage which can affect unit performance and require repair or replacement of parts.



1.	Tighten unit Mounting Bolts
2.	Tighten Compressor, Condenser Fan and Evaporator Fan Mounting Bolts

Figure 82: Mounting Bolts

Condenser Coil

Clean the condenser coil by blowing low pressure compressed air or a medium pressure warm water spray from the inside of the coil outward (opposite direction of normal airflow). Inspect coil and fins for damage and repair if necessary.

CAUTION: Air pressure or water spray must not be high enough to damage coil fins.

If a build up of salt or debris is present on the condenser coil, the coil should be cleaned using a mild alkaline cleaner with a pH of 9.5 to 10.5. For example, a 2-3% solution of SIMPLE GREEN® would make a suitable cleaning solution. Apply the solution using a pressure spray/wash type apparatus. Spray the condenser coil thoroughly from both the inside and outside of the coil. Always thoroughly rinse the coil with a fresh water spray.

Also inspect the directional airflow condenser grille for damage. This grille directs the condenser airflow out and away from the unit to increase the efficiency of the condenser coil by preventing the recirculation (short cycling) of warm air through the coil. Abnormally high head pressures may result if this special condenser grille is damaged or missing.

Evaporator Coil

Clean the evaporator coil by blowing low pressure compressed air from the bottom side of the coil upward (opposite direction of normal airflow). Inspect coil and fins for damage and repair if necessary.

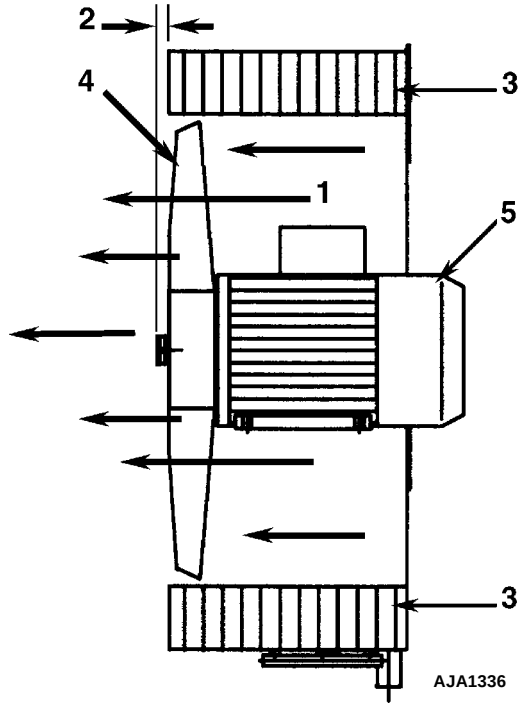
CAUTION: Air pressure must not be high enough to damage coil fins.

Defrost Drains

Clean the defrost drains every 1,000 operating hours to be sure the lines remain open.

Condenser Fan Location

Place fan blade on motor shaft with hub located on the outside of the blade for proper airflow direction. When mounting the fan blade and hub assembly on the fan shaft, center the assembly in the orifice. Position the front of the fan blade 10 mm (0.4 in.) in from the outer edge of the fan orifice.

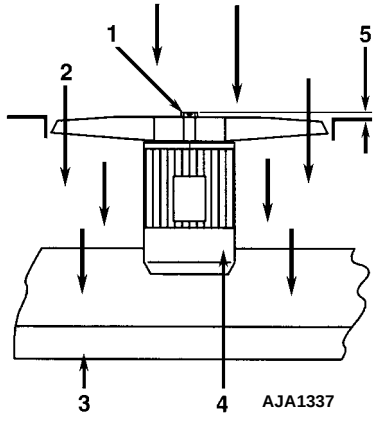


1.	Airflow Direction
2.	10 mm (0.4 in.)
3.	Condenser Coil
4.	Condenser Fan Blade
5.	Condenser Motor

Figure 83: Condenser Fan Blade Placement

Evaporator Fan Location

Place fan blade on motor shaft with hub located on the outside of the blade for proper airflow direction. When mounting the fan blade and hub assembly on the fanshaft, center the assembly in the orifice. Position the front (top) of the fan blade hub 13 mm (0.5 in.) in from the outer edge of the fan orifice.



1.	Evaporator Fan Blade
2.	Airflow DIrection
3.	Evaporator Coil
4.	Evaporator Motor
5.	12 mm (0.5 in)

Figure 84: Evaporator Fan Blade Placement

Diagnosis: Troubleshooting, Status Messages, Alarm Codes

Introduction

This chapter includes the following:

- Introduction to Controller Diagnostics
- Troubleshooting charts
- Status Messages chart
- Alarm Codes chart

The charts will help you identify and fix unit problems.

Controller Diagnostics

The MP3000a can be a very helpful diagnostic tool.

The following menu areas of the MP3000a controller menu will help you diagnose problems occurring with the Magnum unit.

Alarms Menu: The Alarm List menu displays alarm codes. Alarm codes are recorded in the controller memory to simplify unit diagnosis procedures. Some alarm codes are only recorded during a pretrip (PTI) test or function test. Fault codes are retained by the controller in a non-volatile memory. Refer to the Alarms Menu in the Operating Instructions Section.

Brief PTI Test: The MP-3000a controller contains a special Brief PTI pretrip test that automatically checks unit refrigeration capacity, heating capacity, temperature control, and individual components including the controller display, contactors, fans, protection devices and sensors. The test includes measurement of component power consumption and compares test results to expected values. The test takes about 25-30 minutes to complete, depending on the container and ambient temperature. Refer to the Brief PTI Test in the Operating Instructions Section.

Full PTI Test: The MP-3000a controller contains a special Full PTI pretrip test that automatically checks unit refrigeration capacity, heating capacity, temperature control, and individual components including the controller display, contactors, fans, protection devices and sensors. The test includes measurement of component power consumption and compares test results to expected values. The test takes up to 2 to 2.5 hours to complete, depending on the container and ambient temperature. Refer to the Full PTI Test Menu in the Operating Instructions Section.

Functions Test: The MP-3000a controller contains a special function test that automatically tests individual components including the controller display, sensors, condenser fan, evaporator fan, compressors, etc. The test includes measurement of component power consumption and compares test results to expected values. Refer to the Functions Test Menu in the Operating Instructions Section.

Manual Functions Test: The Manual Function Test menu allows technicians to perform specific diagnostic tests on individual components or turn several components on at the same time to perform a system test. Refer to the Manual Functions Test Menu in the Operating Instructions Section.

Data: The Data menu displays general unit operating information including sensor temperatures, unit electrical data, etc. Refer to the Data Menu in the Operating Instructions Section.

Mechanical Diagnosis

Condition	Possible Cause	Remedy
Compressor does not operate- no amperage draw	Controller ON; unit start sequence still timing	Wait up to 3 minutes for compressor start-up
	No Power to unit (condenser and evaporator fans do not operate)	Locate fault and repair: power source, power plug, main circuit breaker, motor contactor, motor terminals, motor
	Open in 29 VAC control circuit	Check fuses and On/Off switch. Replace or repair as required.
	Container temperature does not demand compressor operation	Adjust controller setpoint
	Compressor contactor inoperative	Replace compressor contactor
	No output signal from controller	Diagnose and replace main relay board or controller
	Unit on defrost	Turn unit On/Off switch OFF and then ON again
	Defective high pressure cutout switch	Replace high pressure cutout switch
	High condenser head pressure causing high pressure cutout	Check refrigeration system and correct fault
	Defective compressor	Replace compressor
	Controller shut unit down on Compressor Over Temperature (fault code 56)	Let compressor cool and controller will reset automatically. Check liquid injection valve and compressor temperature sensor
	Compressor motor internal thermal overload protection open	If compressor contactor is energized, wait 60 minutes for protector to cool and reset
Compressor does not operate; excessive amperage draw or intermittent cycling on overload ***NOTE: Controller sequence starts the compressor when the unit has been off for more than 18 hours.***	Piston stuck	Remove compressor head. Look for broken valve and jammed parts
	Seized or frozen compressor bearings	Replace compressor
	Improperly wired	Check/correct wiring against wiring diagram
	Low line voltage	Check line voltage-determine location of voltage drop
	High head pressure	Eliminate cause of high head pressure
	Contacts in compressor contactor not closing completely	Check by operating manually. Repair or replace
	Open circuit in compressor motor winding	Check motor stator connections. Check stator winding for continuity. If open, replace compressor
	Defective compressor motor internal thermal overload protector	Replace thermal overload protector or compressor

Condition	Possible Cause	Remedy
Compressor contactor burned out	Low line voltage	Increase line voltage to at least 90% of compressor motor rating
	Excessive line voltage	Reduce line voltage to at least 110% of compressor motor rating
	Short cycling	Eliminate cause of short cycling
Unit short cycles	Refrigerant overcharge causing cycling on high pressure cutout	Purge system
	Inefficient condenser operation causing cycling on high pressure cutout	Check condenser airflow, condenser fan motor, condenser fan grille, water pressure switch (option), water flow rate (option) and \water-cooled condenser-receiver tank (optional)
Noisy unit	Insufficient compressor oil	Add oil to proper level
	Loose mounting bolts	Tighten mounting bolts
	Oil slugging or refrigerant flooding back	Add oil or refrigerant charge. Check expansion valve adjustment
	Worn fan motor bearings	Replace bearings or motor
	Faulty compressor	Repair or replace compressor
Condenser fan motor does not operate	Unit in Heat or Defrost	Check indicator lights. If unit is in Heat or Defrost, unit operation is normal (no remedy required)
	Unit in Cool with Low condenser temperature	Check indicator lights, condenser temperature and discharge pressure. Condenser temperature may not require condenser fan operation (no remedy required; condenser fan also pulses On and Off on a 30 second cycle to control condenser temperature)
	Water Pressure switch OPEN or Condenser Fan switch in WATER position	If unit is on water cooled condenser operation, unit operation is normal. For air-cooled condenser operation, water pressure switch must be CLOSED; or Condenser Fan switch must be in FAN AIR position.
	Defective water pressure switch (option)	Replace defective switch
	Loose line connection	Tighten connections
	Open motor internal thermal overload protector	Check for seized bearings or defective thermal overload protector. Repair or replace as necessary
	Defective motor	Replace motor
	Defective condenser fan contactor	Replace defective contactor
	No condenser fan output signal from controller	Diagnose and replace condenser fan relay, main relay board, or controller

Condition	Possible Cause	Remedy
Evaporator fan motor(s) does not operate	Unit on defrost	Check operating mode indicator LED's
	unit in Economy Mode (Frozen Load; Null mode ONLY)	Check setpoint, indicator lights and Setpoint menu of the controller to verify that Economy Mode is set to ON
	Loose line connection	Tighten connections
	Open motor internal thermal overload protector	Check for seized bearings or defective thermal overload protector. Repair or replace as necessary.
	Defective motor	Replace motor
	Defective low or high speed evaporator fan contactor	Replace defective contactor
	No low or high speed evaporator fan output signal from controller	Diagnose and replace evaporator fan relay, main relay board or controller
Unit operating in a vacuum (unit not cooling) ***NOTE: When unit is in Cool with Modulation or the return air temperature is below -18 C (0 F), the suction pressure will be less than 0 kPa, 0 bar, 0 psig during normal operation***	Shortage of refrigerant	Repair leak and recharge
	Compressor motor contacts frozen	Clean points or replace contactor
	Compressor inefficient	Check valves and pistons
	Defective liquid line solenoid valve	Repair or replace liquid line solenoid valve
	Partial obstruction in low side or filter drier	Locate obstruction and repair
	Iced or plugged evaporator coil	Defrost or clean evaporator coil
	Expansion valve partially closed by ice, dirt or wax	Clean or replace expansion valve
	Expansion valve power element lost its charge	Replace expansion valve
	Defective container insulation	Correct or replace container insulation
	Poor fitting container doors	Repair or replace doors
	Partial obstruction in high side	Locate obstruction and repair
	Suction pressure gauge out of calibration	Replace service gauge
	Evaporator pressure regulator (KVQ) valve stuck closed or defective	Repair or replace valve
	Expansion valve feeler bulb improperly mounted, poorly insulated or making poor contact	Correct feeler bulb installation

Condition	Possible Cause	Remedy
Load temperature too high (unit not cooling)	Compressor does not operate	See “Mechanical Diagnosis”
	Shortage of refrigerant	Repair leak and recharge
	Overcharge of refrigerant	Purge system
	Air in refrigeration system	Evacuate and recharge
	Defective controller or main relay board	Diagnose main relay board and controller. Replace defective component
	Controller setpoint too high	Adjust controller setpoint
	Too much compressor oil in system	Remove compressor oil from compressor
	Iced or dirty evaporator coil	Defrost or clean evaporator coil
	Restricted lines on high side	Clear restriction
	Plugged filter drier	Change filter drier
	Compressor inefficient	Perform compressor efficiency test. Check valves and pistons
	Evaporator pressure regulator (KVQ) valve stuck closed or defective	Repair or replace valve
	Condenser coil dirty or airflow restricted	Clean condenser coil, clear restriction, or repair or replace fan motor or condenser fan blade
	No water flow to water-cooled condenser	Restore water flow to water-cooled condenser-receiver tank, turn Condenser Fan switch to FAN AIR position or check water pressure switch (option)
	Defective water pressure switch (option)	Replace switch
	Expansion valve open too much	Adjust or replace valve
	Expansion valve power element lost its charge	Replace power element
	Expansion valve feeler bulb improperly mounted, poorly insulated or making poor contact	Correct feeler bulb installation

Condition	Possible Cause	Remedy
Head pressure too low ***NOTE: This unit has a suction modulation capacity control system. Suction and discharge pressures may drop below expected normal readings when the unit is in Modulation Cool (control temperature within 10 C [18 F] of setpoint or in Power Limit mode).***	Shortage of refrigerant	Repair leak and recharge
	Low ambient air temperature	No remedy
	Service gauge out of calibration	Replace gauge
	Compressor suction or discharge valve inefficient	Clean or replace leaking valve plates
Head pressure too high	Refrigerant overcharge	Purge system
	Air in refrigeration system	Evacuate and recharge
	Dirty or restricted condenser coil	Clean condenser coil
	Condenser fan not operating	See “Condenser fan motor does not operate” under Mechanical Diagnosis
	Condenser fan grille damaged or missing	Repair or replace
	Condenser fan grille damaged or missing	Repair or replace grille
	Condenser fan blade damaged	Replace fan blade
	High ambient air temperature	No remedy
	Restricted filter drier or high side	Replace filter drier or clear restriction
	Defective high pressure gauge	Replace service gauge
Compressor loses oil	Refrigerant leak	Repair leak and recharge
Compressor oil migrates to system	Short cycling	See “Unit short cycles” under Mechanical Diagnosis”
Rapid cycling between Cool and Heat modes	Air short cycling through evaporator	Check and correct cargo load
	Defective controller or main relay board	Diagnose main relay board and controller. Replace defective component
	Short Cycling	See “Unit short cycles” under Mechanical Diagnosis
	Evaporator pressure regulator (KVQ) valve stuck closed or defective	Repair or replace valve
Hot liquid line	Shortage of refrigerant	Repair or recharge
	Expansion valve open too wide	Adjust or replace expansion valve
Frosted liquid line	Liquid line service valve partially closed or restricted	Open valve or remove restriction
	Restricted filter drier	Replace filter drier

Condition	Possible Cause	Remedy
Frosted or sweating suction line	Expansion valve admitting excess refrigerant	Check feeler bulb and adjust expansion valve
	Evaporator coil needs defrosting	Check defrost circuit including controller and evaporator coil sensor
	Evaporator fan does not operate	See “Evaporator fan motor does not operate” under Mechanical Diagnosis
Unit in vacuum. Frost on expansion valve only	Ice plugging expansion valve screen or orifice	Apply hot wet cloth to expansion valve. Moisture indicated by increase in suction pressure. Replace filter drier
High suction pressure	Overcharge of refrigerant	Purge system
	Expansion valve open too much	Adjust or replace valve
	Defective controller or main relay board	Diagnose main relay board and controller. Replace defective component
	Suction pressure gauge out of calibration	Adjust or replace service gauge
Low suction pressure ***NOTE: This unit has a suction modulation capacity control system. Suction and discharge pressures may drop below expected normal readings when the unit is on Modulation Cool (control temperature within 10 C [18 F] of setpoint or in Power Limit mode).***	Shortage of refrigerant	Repair leak and recharge
	Low ambient air temperature	No remedy
	Iced or dirty evaporator coil	Defrost or clean evaporator coil
	Restricted lines	Locate and clear restriction
	Plugged filter drier	Replace filter drier
	Expansion valve closed too much	Adjust or replace valve
	Expansion valve feeler bulb improperly mounted, poorly insulated or making poor contact	Correct feeler bulb installation
	Evaporator fans off	Check evaporator fan motors and control circuit and correct fault
	Defective controller or main relay board	Diagnose main relay board and controller. Replace defective component
	Suction pressure gauge out of calibration	Adjust or replace gauge

Status Messages and Controller Actions

The controller displays status messages (in the Miscellaneous Functions Menu under Status) on the LCD display for several general faults. More than one status message may appear at a time. Press F2 or F3 key to scroll through message displays.

Message No.	Status Message	Controller Action
1	**Power Error, Check 20A Fuses** **Indicates:** • One or more phases are missing • Compressor is able to draw amps on all phases while heater lacks amps on one or more phases.	• Controller activates Alarm 18 • Controller will try to restart unit after 60 minutes.
2	**High Pressure Cutout, Check Water Cooling** **Indicates:** • Unit stops due to high pressure cutout and water pressure switch is open.	• Controller clears message on compressor start-up. • No alarm is set until Controller determines that unit current draw is too low (Alarm 37) or supply air temperature is too high (Alarm 41).
3	**Probe Test, Please Wait** **Indicates:** • Incorrect temperature difference between Supply-LH, Supply-RH, or Return Air Sensor for 10 minutes with evaporator fan amps OK.	• Controller automatically activates probe test to check for a defective sensor. Message clears when test is complete. • Controller displays new message if test indicates a sensor is defective.
4	**Supply–Right Hand Problem, Sensor Disabled** **Indicates:** • Controller disables sensor due to open or short circuit or sensor failed a Probe Test.	• Controller activates Alarm 52 • Controller activates Alarm 00 or 01, depending on type of sensor failure. • Controller clears message during Defrost mode and when **UNIT ON/OFF** switch is turned **OFF**. • Controller uses left hand supply sensor to control unit if right hand sensor is defective. • Controller uses return sensor plus an offset to control unit if both supply sensors are defective.
5	**Supply–Left Hand Problem, Sensor Disabled** **Indicates:** • Controller disables sensor due to open or short circuit or sensor failed a Probe Test.	• Controller activates Alarm 52 • Controller activates Alarm 00 or 01, depending on type of sensor failure. • Controller clears message during Defrost mode and when **UNIT ON/OFF** switch is turned **OFF**. • Controller uses right hand supply sensor to control unit if left hand sensor is defective. • Controller uses return sensor plus an offset to control unit if both supply sensors are defective.
7	**High Pressure Cutout, Check Condenser Probe** **Indicates:** • Units stops due to high pressure cutout, water pressure switch is closed and condenser temperature is low.	• Controller clears message on compressor start-up. • No alarm is set until Controller determines that unit current draw is too low (Alarm 37) or supply air temperature is too high (Alarm 41).

Message No.	Status Message	Controller Action
9	**High Pressure Cutout, Check Condenser Fan** **Indicates:** • Unit stops due to high pressure cutout, water pressure switch is closed and condenser temperature is high.	• Controller clears message on compressor start-up. • No alarm is set until Controller determines that unit current draw is too low (Alarm 37) or supply air temperature is too high (Alarm 41).
13	**Compressor, High Temperature** **Indicates:** • Compressor stops because discharge temperature is above 130 C (266 F). Message remains in display until discharge temperature decreases to normal.	• Controller clears message after compressor start-up.
14	**Evaporator High Temperature Switch Open** **Indicates:** • Controller disables electric heaters due to open high temperature switch circuit. • Possible causes include evaporator temperature over 54 C (130 F), defective heater, defective evaporator overheat switch, open circuit, etc.	• Controller clears message on compressor start-up. • No alarm is set until Controller determines that heater current draw is too high (Alarm 10), unit unit current draw is too high (Alarm 36), or defrost time is too long (Alarm 20).
21	**Low Supply Voltage** • Voltage on opwer line is below 340 VAC.	• Unit stopped. • If condition is persent for 30 minutes, alarm 51 is generated.

22	**Total Current Too High**
	• Unit or component current draw is 25% above expected amps for 4 minutes.
	• Indicates:
	  • KVQ valve malfunction
	  • Compressor, evaporator fan motor, condenser fan motor or heater current too high
	  • Defective volt or amp meter on relay board
	  • Power supply voltage too low.
		• Enter Manual Function Test menu and test (operate) each component. Check volts and amps to determine which component has high amp draw.
		• Check power supply volts.
		• Check volt and ampere meter.

Message No.	Status Message	Controller Action

23	**Total Current Too Low**
	• Compressor Start-up: unit or component current draw is 50% below expected amps for 4 minutes.
	• Indicates:
	  • Defective or open fuse CB 7A
	  • Defective or open high pressure cutout switch
	  • Defective evaporator high temperature protection switch
	  • Defective or open motor internal high temperature protection switch
	  • Unit on water-cooled condensing with no water flow
	  • Defective condenser coil sensor or sensor locations
		• Check LCD display for High Pressure Cutout message.
		• Enter Manual FUnction Test menu and test (operate) each component. Check volts and amps to determine which component has low amp draw.
		• Check volt and ampere meter.

24	**Supply Air Temperature Too High**
	• During Chill or Frozen Mode: Supply air temperature is too high compared to return air temperature under operating conditions.
	• Indicates:
	  • Low refrigerant charge
	  • Incorrect connection or location of supply or return air sensor
	  • Air leakage at supply air sensor cable
	  • Ice or frost on evaporator coil
	  • Incorrect evaporator fan operation
		• Check discharge an suction pressure gauge readings and refrigerant charge.
		• Check for sensor or evaporator fan alarm codes.
		• Open evaporator door. Inspect coil for ice or frost and initiate manual defrost if necessary. Check for correct evaporator fan motor rotation and operation.
		• Check supply and return sensor connections and locations.

25	**Supply Air Temperature Too Low** • During Chill or Frozen Mode: Supply air temperature is too low compared to return air temperature under operating conditions. • Indicates: • Ice or frost on evaporator coil • Low heating capacity • Incorrect evaporator fan operation • Incorrect connection or location of supply or return air sensors	• Check for sensor or evaporator fan alarm codes. • Open evaporator door. Inspect coil for ice or frost and initiate manual defrost if necessary. Check for correct evaporator fan motor rotation and operation. • Check supply and return sensor connections and locations.
26	**Return Air Temperature Too High** • During Defrost: Return air temperature increases above 40 C (104 F). • Indicates: • Defective return or evaporator coil sensor • Return and evaporator coil sensor connections are reversed	• Check for sensor alarm codes. • Check supply and return sensor connections and locations.

Message No.	Status Message	Controller Action

27	**Evaporator Coil Temperature Too High**
	• During Chill or Frozen Mode: Evaporator coil temperature is too high compared to return air temperature under operating conditions.
	• Indicates:
	  • Low refrigerant charge.
	  • Defective evaporator coil or return air sensor
	  • incorrect connection or location of evaporator coil or return air sensor
		• Check for sensor alarm codes.
		• Check discharge and suction pressure gauge readings and check refrigerant charge.
		• Check evaporator coil and return air sensor connections and locations.

28	**Evaporator Coil Temperature Too Low**
	• During Chill or Frozen Mode: Evaporator coil temperature is tool low compared to return air temperature under actual operating conditions.
	• Controller initiates defrost if not recent defrost.
	• Indicates:
	  • Air flow is blocked in the container
	  • Evaporator fans do not operate
	  • Fresh air exchange vent open too much on frozen load
	  • Defective evaporator coil or return air sensor
		• Check for sensor or evaporator fan alarm codes.
		• Open evaporator door. Inspect coil for ice or frost and initiate manual defrost if necessary. Check for correct evaporator fan rotation and operation.
		• Inspect return air flow and cargo load. Remove any debris or cargo from blocking return air grille.
		• At setpoints below 5 C (41 F), maximum air vent setting is not allowed.
		• Check evaporator coil and return air sensor connections and locations.

Alarm Codes, Descriptions and Corrective Actions

NOTE: Sensors used with the MP-3000a controller do not require calibration. Check sensor resistance with an ohmmeter.

- Shutdown Alarm (Level 1 Alarm): Alarm light on display flashes and unit stops. Correct alarm condition and acknowledge alarm before restarting.
- Check Alarm (Level 2 Alarm): Alarm light on display flashes until alarm is acknowledged.
- Event Log (Level 3 Alarm): Alarm is recorded in datalogger only (inspect event log).

Code	Description	Corrective Action

00	**Supply Air Sensor Open Circuit (Check Alarm)**
	• Sensor circuit resistance higher than 100,000 ohms.
	• Temperature below -70C (-94F)
	• Indicates:
	  • Open circuit to left or right hand sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No. 1 or cable No. 3
	  • Defective controller
		• Identify defective sensor (left hand or right hand) by viewing Data menu.
		• Check sensor resistance between pins 1 and 2 on plug J15 and between pins 7 and 8 on plug J14. Resistance must be 2,000 ohms at 25C (77F).
		• Check cable No.1 and cable No.3 between the controller and relay board.
		• Check evaporator air flow.

01	**Supply Air Sensor Short Circuit (Check Alarm)**
	• Sensor circuit resistance lower than 200 ohms.
	• Temperature below 80C (176 F).
	• Indicates:
	  • Short circuit to left or right hand sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No.1 or cable No. 3
	  • Defective controller
		• Identify defective sensor (left hand or right hand) by viewing Data menu.
		• Check sensor resistance between pins 1 and 2 on plug J15 and between pins 7 and 8 on plug J14. Resistance must be 2,000 ohms at 25C (77F).
		• Check cable No.1 and cable No.3 between the controller and relay board.

02	**Return Air Sensor Open Circuit (Check Alarm)**
	• Sensor circuit resistance higher than 100,000 ohms.
	• Temperature below -70C (-94F).
	• Indicates:
	  • Open circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No.1
	  • Defective controller
		• Check sensor resistance between pins 3 and 4 on plug j15. Resistance must be 2,000 ohms at 25C (77F)
		• Check cable No.1 between controller and relay board.

Code	Description	Corrective Action

03	**Return Air Sensor Short Circuit (Check Alarm)**
	• Sensor circuit resistance lower than 200 ohms.
	• Temperature above 80C (176F).
	• Indicates:
	  • Short circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No.1
	  • Defective controller
		• Check sensor resistance between pins 3and 4 on plug J15. Resistance must be 2,000 ohms at 25C (77F).
		• Check cable No.1 between controller and relay board.

04	**Evaporator Coil Sensor Open Circuit (Check Alarm)**
	• Sensor circuit resistance higher than 100,000 ohms.
	• Temperature below -70C (-94F).
	• Indicates:
	  • Open circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No.1
	  • Defective controller
	  • Low evaporator coil temperature
		• Check sensor resistance between pins 5 and 6 on plug J15. Resistance must be 2,000 ohms at 25C (77F).
		• Check cable No.1 between controller and relay board.
		• Check evaporator air flow.

05	**Evaporator Coil Sensor Short Circuit (Check Alarm)**
	• Sensor circuit resistance lower than 200 ohms.
	• Temperature above 80C (176F).
	• Indicates:
	  • Short circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No. 1
	  • Defective controller
		• Check sensor resistance between pins 5 and 6 on plug J15. Resistance must be 2,000 ohms at 25C (77F).
		• Check cable No.1 between controller and relay board.

Code	Description	Corrective Action

06*	**Compressor Current Too High (Check Alarm**
	• Occurs during Pretrip (PTI) or Function test only.
	• Compressor power consumption is 25% above expected current draw (above approximately 13 amps); or compressor phase current level difference of 10% or more, depending on ambient temperature.
	• Indicates:
	  • Defective KVQ valve
	  • Defective compressor or valve plate
	  • Defective volt or amp meter on relay board
	  • Inaccurate ambient, condenser or evaporator temperature measurement
	  • Out of range power supply
	  • Excessive condenser pressure due to air or wrong refrigerant in system, or refrigerant over charge
		• Check evaporator, condenser and ambient sensor temperatures for correct value (+/-C [+/-9F] by viewing Data menu.
		• Enter Manual Function Test menu. Start and check current draw of the following components separately and together: compressor, compressor 100%, condenser fan and evaporator fan (high and low).
		• Check volt and ampere meter.
		• Check power supply volts.

07*	**Compressor Current Too Low (Check Alarm)**
	• Occurs during Pretrip (PTI) or Function test only.
	• Compressor power consumption is 25% below expected current draw (below approximately 9 amps).
	• Indicates:
	  • Defective or open fuse CB 7A, high pressure cutout switch or connection in plug j19 between pins 7 & 8
	  • No signal on plug J11 on pin 8
	  • Defective compressor relay
	  • Defective volt or amp meter on relay board
	  • Low refrigerant charge
	  • Defective compressor or valve plate
		• Enter Manual Function Test menu. Start and check current draw of the following components separately and together: compressor, compressor 25%, condenser fan and evaporator fan (high and low). If relay does NOT energize and the LED above the compressor relay is NOT ON, check for a defective cable No.2, main relay board or controller.
		• Check discharge and suction pressure gauge readings. Evaluate readings based on current cargo and ambient temperatures.
		• Check volt and ampere meter.
		• Check power supply volts.

NOTE: *If both alarms 06 and 07 are activated, the alarms are caused by a large difference in measured amps. Enter Function Test and start condenser fan, compressor, compressor 100% and evaporator fans on HIGH speed. Check the amps measurements. if necessary, check the resistance of the motor windings.		

10*	**Heater Current Too High (Check Alarm)**
	• Occurs during Pretrip (PTI) or Function Test.
	• Heater power consumption is 25% above expected current draw (above approximately 4.4 amps and 5.1 amps, depending on voltage).
	• Indicates:
	  • Incorrect heaters or heater connections
	  • Defective volt or amp meter on relay board
	  • Defective heater element
		• Enter Manual Function Test and turn heaters ON. Check current draw on each phase. Current draw should be about 4.4 amps on each phase at 400V (5.1 amps at 460V).
		• Check heater resistance between H1 and H2, H2 and H3, and H1 and H3. Resistance should be about 99 ohms on each leg.

Code	Description	Corrective Action

11*	**Heater Current Too Low (Check Alarm)**
	• Occurs during Pretrip (PTI) or Function test only.
	• Heater power consumption is 25% below the expected current draw (below approximately) 3.2 amps and 3.8 amps, depending on voltage).
	• Indicates:
	  • Defective high evaporator temperature switch
	  • Defective heater element or heat relay
	  • Defective wire connection
	  • Incorrect heaters or heater connections
		• Enter Manual Function Test and turn heaters ON. Make sure the heat relay energizes. Check current draw on each phase. Current draw should be 4.4 on each phase at 400V (5.1 amps at 460V).
		• If heat relay fails to energize, check evaporator high temperature switch. Switch should be closed at temperatures below 54c (130F); there should be continuity between pins 5 and 6 in plug J19.
		• Check cable No.2 between controller and relay board.
		• Check heater resistance between H1 and H2, H2 and H3, and H1 and H3. Resistance should be about 99 ohms on each leg.
		• Check volt and ampere meter.

12**	**Evaporator Fan high Speed Current Too High (Check Alarm)**
	• Occurs during Pretrip (PTI) or Function test only.
	• Evaporator fan power consumption is 25% above expected current draw (above 2.0 to 3.0 amps, depending on voltage)
	• Indicates:
	  • Defective or stuck evaporator fan motor
	  • Incorrect motor or motor connections
	  • Defective volt or amp meter on relay board
		• Open evaporator door and make sure all fans rotate freely.
		• Enter Manual Function Test and start evaporator fans on High speed. Make sure all fans start on high speed. Check fan motor volts and amps.
		• Check volt and ampere meter.

NOTE: *If both alarms 10 and 11 are activated, the alarms are caused by a large difference in measured amps. Enter Manual Function Test menu and start HEAT. Check the amps measurement. If necessary, check the resistance between H1 and H2, H2 and H3, and H1 and H3. resistance should be about 99 ohms on each leg. *****See note on next page***		

13**	**Evaporator Fan high Speed Current Too Low (Check Alarm)**
	• Occurs during Pretrip (PTI), Function test or Probe test.
	• Evaporator fan power consumption is 25% below expected current draw (below 1.5 to 2.3 amps, depending on voltage).
	• Indicates:
	  • Defective evaporator fan motor relay
	  • Defective or open fan motor internal over temperature protection switch
	  • Defective volt or amp meter on relay board
	  • Incorrect motor or motor connections
		• Open evaporator door and make sure all fans rotate freely.
		• Enter manual Function Test and start evaporator fans on HIGH speed. Make sure all fans start on high speed. If a motor does not start and is very hot, wait 10 minutes for internal over temperature switch to close.
		• Check fan motor volts and amps
		• Check volt and ampere meter.

Code	Description	Corrective Action

14**	**Evaporator Fan Low Speed Current Too High (Check Alarm)**
	• Occurs during Pretrip (PTI) or Function test only.
	• Evaporator fan power consumption is 25% above expected current draw (above 2.8 to 4.0 amps, depending on voltage).
	• Indicates:
	  • Defective or stuck evaporator fan motor
	  • Incorrect motor or motor connections
	  • Motor high and low speed connection are interchanged
	  • Defective volt or amp meter on relay board
		• Open evaporator door and make sure all fans rotate freely.
		• Enter Manual Function Test and start evaporator fans on LOW speed. Make sure all fans start on low speed. Check fan motor volts and amps.
		• Check volt and ampere meter.

15**	**Evaporator Fan Low Speed Current Too Low (Check Alarm)**
	• Occurs during Pretrip (PTI) or Function test only.
	• Evaporator fan power consumption is 25% below expected current draw (below 0.6 to 1.2 amps, depending on voltage).
	• Indicates:
	  • Defective evaporator fan motor relay
	  • Defective or open fan motor internal over temperature protection switch
	  • Defective volt or amp meter on relay board
	  • Incorrect motor or motor connections
		• Open evaporator door and make sure all fans rotate freely.
		• Enter Manual Function Test and start evaporator fans on LOW speed. Make sure all fans start on low speed. if a motor does not start and is very hot, wait 10 minutes for internal over temperature switch to close.
		• Check fan motor volts and amps
		• Check volt and ampere meter.

NOTE: **If both alarms 12 and 13; or 14 and 15 are activated, the alarms are caused by a large difference in measured amps. Enter manual Function Test menu and operate evaporator fans on low and high speed. Check the evaporator fan amps measurement. If necessary, check the resistance in the motors: High speed between EF11 and EF12, EF12 and EF13, and EF11 and EF13; Low speed between EF1 and EF2, EF2 and EF3, and EF1 and EF3. Resistance readings should be equal: High speed about 6 Ohms, total of 2 motors; Low speed about 20 Ohms, total of 2 motors.		

16*	**Condenser Fan Current Too High (Check Alarm)**
	• Occurs during Pretrip (PTI) or Function test only.
	• Condenser fan power consumption is 25% above expected current draw (above 1.5 to 1.9 amps, depending on voltage).
	• Indicates:
	  • Defective or stuck condenser fan motor
	  • Defective volt or amp meter on relay board
	  • Incorrect motor or motor connections
		• Enter Manual Function Test and start condenser fan. make sure the fan starts. Check fan motor volts and amps.
		• Check power supply volts and amps.
		• Check volts and ampere meter.

Code	Description	Corrective Action

17*	**Condenser Fan Current Too Low (Check Alarm)**
	• Occurs during Pretrip (PTI) or Function test only.
	• Condenser fan power consumption is 25% below expected current draw (below 0.5 to 0.7 amps, depending on voltage).
	• Indicates:
	  • Defective condenser fan motor relay
	  • Defective or open fan motor internal over temperature protection switch
	  • Defective volt or amp meter on relay board.
		• Enter Manual Function Test and start condenser fan. Make sure the fan starts. Check fan motor volts and amps.
		• Check power supply volts and amps.
		• Check volt and ampere meter.

18	**Power Supply Phase Error (Check Alarm)**
	• One or more frequency inputs are missing for more than 20 seconds.
	• Indicates:
	  • One phase on power line is missing
	  • Defective fuse on relay board
	  • Defective digital inputs on relay board
	  • Defective controller
		• Enter Data menu and view voltage reading on each phase.
		• Check all fuses. Check cable No.1 on relay board.
		• Check cable No.1 between controller and relay board.
		• Replace relay board. Check voltage reading on each phase.

NOTE: * If both alarms 16 and 17 are activated, the alarms are caused by a large difference in measured amps. Enter Manual Function Test menu and start condenser fan. Check the condenser fan amps measurement. If necessary, check the resistance in the motor between CF1 and CF2, CF2 and CF3, and CF1 and CF3. Resistance readings should be equal (approximately 25 Ohms).		

19	**Temperature Too Far from Setpoint (Check Alarm)**
	• After 75 minutes of operation, supply or return air temperature is not in-range and does not approach setpoint within preset pulldown rate.
	• Indicates:
	  • Ice or frost on evaporator coil
	  • Low refrigerant charge
	  • Air exchange vent open too much
	  • Container air leakage (doors open)
		• Press SUP/RET key to check supply and return air sensor temperatures. COmpare temperatures to evaluate unit cooling capacity and performance.Temperature difference should be 4 C to 6 C.
		• Open evaporator door. Inspect coil for rice or frost and initiate manual defrost if necessary.
		• Check refrigerant charge
		NOTE: This alarm can be activated if the supply or return air temperature varies, even if the mean temperature does approach setpoint.

Code	Description	Corrective Action

20	**Defrost Time Too Long (Check Alarm)**
	• Heat signal has been ON for more than 90 minutes on 60 Hz power during Defrost (120 minutes on 50 Hz power).
	• Indicates:
	  • Low power supply voltage
	  • Defective heater elements
	  • Defective evaporator high temperature protection switch
	  • Defective heat relay
	  • Evaporator fans running during defrost
	  • Evaporator sensor placed wrong
		• Initiate a manual defrost and check amperage draw and evaporator coil temperature. Evaluate defrost performance.
		• Open evaporator door and check location of evaporator coil sensor.
		NOTE: This alarm can be activated at low voltage and very low box temperature conditions, even under normal operating conditions.

22	**Capacity Test 1 Error (Check Alarm)**
	• Occurs during Pretrip (PTI) test only.
	• Difference between supply and return air temperature is too small with low speed evaporator fans (less than approximately 4.5C [8 F])
	• Return air temperature does not reach -18C (0 F) within preset time.
	• Indicates:
	  • Incorrect location of supply or return air sensor
	  • Air leakage at supply sensor cable
	  • Defective supply or return air sensor
	  • Interchanged sensor connections
	  • incorrect evaporator fan rotation or high speed operation
	  • Incorrect refrigeration system operation
	  • Container/side panels defective, damaged or leaking
		• Enter Manual Function Test and start evaporator fans on LOW speed. Then select Sensor Checks test and operate fans 2 to 5 minutes. Check supply, return and evaporator coil (defrost) sensor temperatures. Sensor readings should be the same (evaporator coil may be 0.5 C [1.0 F] lower due to fan motor heat).
		NOTE: This sensor check does not detect air leakage around the sensor cables.
		• Open evaporator door and inspect evaporator fan rotation. Make sure fans are rotating correctly on low speed.
		• Check the sensor connections.
		• Enter Manual Function Test menu. Start and check current draw of the following components separately and together: compressor, compressor 100%, condenser fan and evaporator fans (low). Check discharge and suction pressure readings. Also check the refrigerant charge.
		NOTE: This alarm can be activated in ambient temperatures below -10 C (14 F), even under normal conditions.

25	**Evaporator Temperature Test Error (Check Alarm)**
	• Occurs during Pretrip (PTI) test only.
	• Evaporator coil temperature too high with no evaporator fans running (above about -15 C [+5 F]).
	• Indicates
	  • Evaporator coil sensor is not in contact with evaporator coil
	  • Return and evaporator coil sensor connections are interchanged
	  • Expansion valve does not open enough or opens too much.
		• Check evaporator coil sensor location.
		• Check evaporator coil sensor and return air sensor connections.
		• Check expansion valve superheat setting.

Code	Description	Corrective Action

27	**Heat Capacity Test Error (Check Alarm)**
	• Occurs during Pretrip (PTI) test only.
	• Difference between supply and return air temperature too small with high speed evaporator fans (less than 0.4 C [0.7F]}.
	• Indicates:
	  • Incorrect location of supply or return air sensor
	  • Air leakage at supply, return or evaporator coil sensor cable
	  • Defective supply or return air sensor
	  • Interchanged sensor connections
	  • Defective heater elements
	  • Incorrect evaporator fan rotation or high speed operation
	  • Container/side panels, defective, damaged or leaking
		• Enter Manual Function Test and start evaporator fans on HIGH speed. Then select Sensor Checks test and operates fans 2 to 5 minutes. Check supply, return and evaporator coil (defrost) sensor temperatures. Sensor readings should be the same (evaporator coil may be 0.5 C [1.0 F] lower due to fan motor heat).
		NOTE: this sensor check does not detect air leakage around the sensor cables
		• Open evaporator door and inspect evaporator fan rotation. make sure fans are rotating correctly on high speed.
		• Check the sensor connections.

29	**Liquid Injection Valve Error (Pretrip) (Check Alarm)** • Occurs during Function or Pretrip (PTI) test only • Indicates: • Faulty bypass valve or circuit	• Energize and de-energize the bypass valve using “Injection Valve” in the COntroller Manual Function Test submenu. Confirm by sound that the valve energizes and de-energizes. • If the valve does not operate, check the valve coil for continuity using a high quality multimeter. • Check the circuit wiring in plug J11 for continuity using a high quality multimeter and a wiring diagram.

32	**Condenser Temperature Sensor Open Circuit (Check Alarm)**
	• Sensor circuit resistance higher than 100,000 ohms.
	• Temperature below -70 C (-94 F).
	• Indicates
	  • Open circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable no.1
	  • Defective controller
		• Check sensor resistance between pins 7 and 8 on plug J15. Resistance must be 2,000 ohms at 25 C (77 F).
		• Check cable No. 1 between controller and relay board.

Code	Description	Corrective Action
33	**Condenser Temperature Sensor Short Circuit (Check Alarm)** • Sensor circuit resistance higher than 100,000 ohms. • Temperatures below -70 C(-94 F). • Indicates: • Sensor circuit resistance lower than 200 ohms. • Temperature above 80 C (176 F). • Indicates: • Short circuit to sensor • Defective or wrong sensor • Defective relay board • Defective cable No. 1 • Defective controller	• Check sensor resistance between pins 13 and 14 on plug J15. Resistance must be 2,000 ohms at 25 C (77 F). • Check cable no. 1 between controller and relay board.
34	**Ambient Air Sensor Open Circuit (Check Alarm)** • Occurs during pretrip (PTI) test only • Sensor circuit resistance is higher than 100,000 ohms. • Temperature is below -70 C (-94 F). • Indicates: • Open circuit to sensor • Defective or wrong sensor • Defective relay board • Defective cable No. 1 • Defective controller	• Check sensor resistance between pins 13 and 14 on plug J15. Resistance must be 2,000 ohms at 25 C (77 F). • Check cable No. 1 between controller and relay board.
35	**Ambient Air Sensor Short Circuit (Check Alarm)** • Occurs during pretrip (PTI) test only. • Sensor circuit resistance is lower than 200 ohms. • Temperature is above 80 C (176 F). • Indicates: • Short circuit to sensor • Defective or wrong sensor • Defective relay board • Defective cable No. 1 • Defective controller	• Check sensor resistance between pins 13 and 14 on plug J15. Resistance must be 2,000 ohms at 25 C (77 F). • Check cable No. 1 between controller and relay board.

Code	Description	Corrective Action
43	**Return Air temperature Too High (Check Alarm)** • During defrost: Return air temperature increases above 40 C (104 F). • Indicates: • Defective return or evaporator coil sensor. • Return and evaporator coil sensor connections are reversed.	• Check for sensor alarm codes. • Check supply and return sensor connections and locations.
51	**Low Supply Voltage (Check Alarm)** • Alarm occurs if line voltage is below 350 volts for 30 minutes • If the main power supply voltage to the unit, while running, drops below 340 VAC, the unit will stop running until the voltage increases above 350 VAC. If the main power supply voltage, on initial unit start up, is below 350 VAC, the unit will not start. If the voltage remains below 350 VAC for 30 minutes, Alarm 51 (Low Voltage) will occur.	• Check line voltage of power source. Refer to the electrical specifications in the Specifications Section for correct power source requirements.

53	**High Pressure Cutout Switch Off Error (Check Alarm)**
	• Occurs during Pretrip (PTI) test only.
	• Compressor does not stop during high pressure cutout switch test.
	• Indicates:
	  • Faulty compressor contactor or control circuit
	  • Low refrigerant charge
	  • Defective high pressure cutout switch
	  • Strong winds causing cooling of condenser coil in low ambient conditions
		• Check discharge and suction pressure gauge readings and check refrigerant charge.
		• Enter Manual Function Test menu. Start the following components together: compressor 100%, compressor and evaporator fans (high). Discharge pressure should increase and compressor should stop at 2250 kPa, 22.5 bar, 326 psig (high pressure cutout switch opens).

54	**High Pressure Cutout Switch On Error (Check Alarm)** • Occurs during pretrip (PTI) test only. • Compressor does not start within normal time during high pressure cutout switch test. • Indicates: • High pressure cutout switch did not respond to pressure change within 5 seconds • Air in refrigeration system • Defective high pressure cutout switch	• Check discharge and suction pressure gauge readings. • Enter Manual Function Test menu. Start the following components together: compressor 100 percent, compressor and evaporator fans (high). Discharge pressure should increase and compressor should stop at 2250 kPa, 22.5 bar, 326 psig (high pressure cutout switch opens). Then start condenser fan. Discharge pressure must drop quickly (10 to 20 seconds) to 1550 kPa, 15.5 bar, 225 psig and compressor should start (switch closes)

Code	Description	Corrective Action

56	**Compressor Temperature Too High (Shutdown Alarm)**
	• Compressor dischage line temperature is above 130 C (266 F). COmpressor stopped until discharge line temperature decreases to 90 C (194 F);
	• Indicates:
	  • Air in refrigeration system
	  • Low refrigerant charge
	  • Defective compressor or valve plate
	  • Defective liquid injection system
	  • Wrong or defective sensor
		• Operate unit on Cool and check discharge and suction pressure gauge readings.
		• Enter Manual Function Test menu and test (operate) Injection Valve to determine if valve opens (energizes).
		• Check compressor discharge sensor resistance. Resistance must be 100,000 ohms at 25 C (77 F).
		• Check discharge line temperature with a separate electronic thermometer and compare to “HIGH PR TEMP” shown in the Data menu of controller.
		NOTE: Unit will operate normally without compressor sensor. However, controller compressor high temperature protection is not active.

57	**FAE Device Error (Check Alarm)**
	• Controller is unable to adjust vent door to desired position.
	• Indicates:
	  • Frozen or stuck vent door
	  • Defective linkage
	  • Defective control module
	  • Open circuit to control module or motor
	  • Defective motor
		• Visually inspect the vent door and linkage for ice or obstruction. Check for proper linkage adjustment.
		• Check wiring connections to the AFAM circuit board for continuity using a high quality multimeter.
		• Check motor winding for continuity using a high quality multimeter.

58	**Phase Sensor Error (Check Alarm)**
	• Occurs during Pretrip (PRI) or Function test only.
	• During Phase Sensor Test, amperage difference between correct and wrong condenser fan rotation is more than 0.2 amps.
	• Indicates:
	  • Defective phase relay
	  • Defective relay board
	  • Defective relay board cable No. 2
		• Start a Function Test. During step F1.05, check whether the phase relays on relay board receive a signal (LED energizes). Verify that the relays respond and shift to reverse phase.

59	**Delta Current Error (Check Alarm)** • 100% ampere difference between current phases. • Indicates: • Open connection on one phase of power supply to a motor or heater element	• Enter Manual Function Test menu and test (operate) each 3-phase component to locate defective connection.

Code	Description	Corrective Action

60	**Humidity Sensor Error (Check Alarm)**
	• Occurs during Pretrip (PTI) test only.
	• Relative humidity reading not between 20% and 95%.
	• Indicates:
	  • Sensor disconnected
	  • Wrong controller software configuration
	  • Defective sensor
		• Check sensor connections.
		• Check controller configuration for correct humidity setting.
		• Replace sensor.

68	**AFAM Gas Analyzer Error (Check Alarm)**
	• Gas analyzer circuit resistance is too high or low.
	• Indicates:
	  • Sensor disconnected
	  • Wrong controller software configuration
	  • Short circuit to sensor
	  • Defective sensor
		• Check sensor connections.
		• Check controller configuration for correct AFAM setting.
		• Replace sensor.

69	**AFAM+ Gas Analyzer Calibration (Check Alarm)** •Indicates problem with sensor	• Check sensor connections. • Check controller configuration for correct AFAM setting. • Replace sensor.

97	**Compressor Sensor Open Circuit (Check Alarm)**
	• Sensor circuit resistance higher than 100,000 ohms.
	• Temperature below -30 C (-22 F).
	• Indicates:
	  • Open circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No.1
	  • Defective controller
		• Check sensor resistance between pins 9 and 10 on plug J15. Resistance must be 100,000 ohms at 25 C (77 F).
		• Check cable No. 1 between controller and relay board.
		NOTE: Unit will operate normally without compressor sensor. However, controller compressor high temperature protection is not active.

98	**Compressor Sensor Short Circuit (Check Alarm)**
	• Sensor circuit resistance higher than 10,000,000 ohms.
	• Indicates:
	  • Open circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No.1
	  • Defective controller
		• Check sensor resistance between pins 9 and 10 on plug J15. Resistance must be 100,000 ohms at 25 C (77 F).
		• Check cable No. 1 between controller and relay board.

Code	Description	Corrective Action

99	**USDA 1 Sensor Open Circuit (Check Alarm)**
	• Occurs during Pretrip (PTI) test only.
	• Container ID starts with MAE, MSF or MWC.
	• Temperature below -50 C (-58 F).
	• Indicates:
	  • All 3 USDA sensors are missing
	  • Defective cable No. 3
		• Check USDA sensors and sensor connections.
		• Check cable No. 3 between controller and relay board.

109	**KVQ Sensor Open Circuit (Check Alarm)**
	• Sensor circuit resistance higher than 10,000,000 ohms.
	• Indicates:
	  • Open circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No. 1
	  • Defective controller
		• Check sensor resistance between pins 11 and 12 on plug J15. Resistance must be 20,000 ohms at 25 C (77 F).
		• Check cable No.1 between controller and relay board.

110	**KVQ Sensor Short Circuit (Check Alarm)**
	• Sensor circuit resistance lower than 200 ohms.
	• Indicates:
	  • Short circuit to sensor
	  • Defective or wrong sensor
	  • Defective relay board
	  • Defective cable No. 1
	  • Defective controller
		• Check sensor resistance between pins 9 and 10 on plug J15. Resistance must be 100,000 ohms at 25 C (77 F).
		• Check cable No. 1 between controller and relay board.

111	**KVQ Heat Error (Check Alarm)**
	• KVQ valve actuation temperature is not in range within preset time.
	• Indicates:
	  • Disconnected CB7A
	  • Defective heat element in valve actuator
	  • Inaccurate actuator temperature measurement
	  • Defective relay board
	  • Defective circuit between pin 4 and 6 on plug J11 (KVQ actuator requires power from both relays 2 and 3)
	  • Defective cable No. 2
	  • Defective controller
		• Carefully inspect actuator:
		  If actuator is hot, check that the actuator sensor has been mounted correctly in p ins 11 and 12 on plug J15.
		  If actuator is not hot, check resistance between pins 5 and 6 on plug J11. Resistance must be about 17 Ohms. Check voltage from pins 5 and 6 (relays 2 and 3).
		• Check cable No. 2 between controller and relay board.

112	**Zero Current Too High (Check Alarm)** • Ground (zero current) circuit 30 milliamps. • Indicates: • Defective motor or heater insulation to ground	• Enter Manual Function Test manual and test (operate) each motor and heater separately. not when alarm occurs.

Code	Description	Corrective Action
115	**Probe Error (Check Alarm)** • Occurs during Pretrip (PTI) test or Probe Test failed in Chilled mode • Temperature difference between return air and evaporator coil sensors is too high (1.5 C [2.7 F] difference maximum)	• Check sensor connections. Check sensor resistance of each sensor. Resistance must be 2,000 ohms at 25 C (77 F). • Check left hand and right hand supply air sensor locations.
116	**Probe Error (Check Alarm)** • Occurs during Pretrip (PTI) test or Probe Test failed in CHilled mode • Temperature difference between return air and supply air sensors is too high (0.8 C[1.5 F]	• Check sensor connections. Check sensor resistance of each sensor. Resistance must be 2,000 ohms at 25 C (77 F). • Check left hand and right hand supply air sensor locations.

117	**Probe Error (Check Alarm)**
	• Occurs during Pretrip (PTI) test or Probe Test failed in CHilled mode
	• Temperature difference between LH supply and RD supply sensors is too high (0.5 C [1.0 F] difference maximum)
	• Indicates:
	  • Incorrect temperature reading on one sensor
	  • Supply air sensor not placed in air flow stream
		• Check sensor connections. Check sensor resistance of each sensor. Resistance must be 2,000 ohms at 25 C (77 F).
		• Check left hand and right hand supply air sensor locations.

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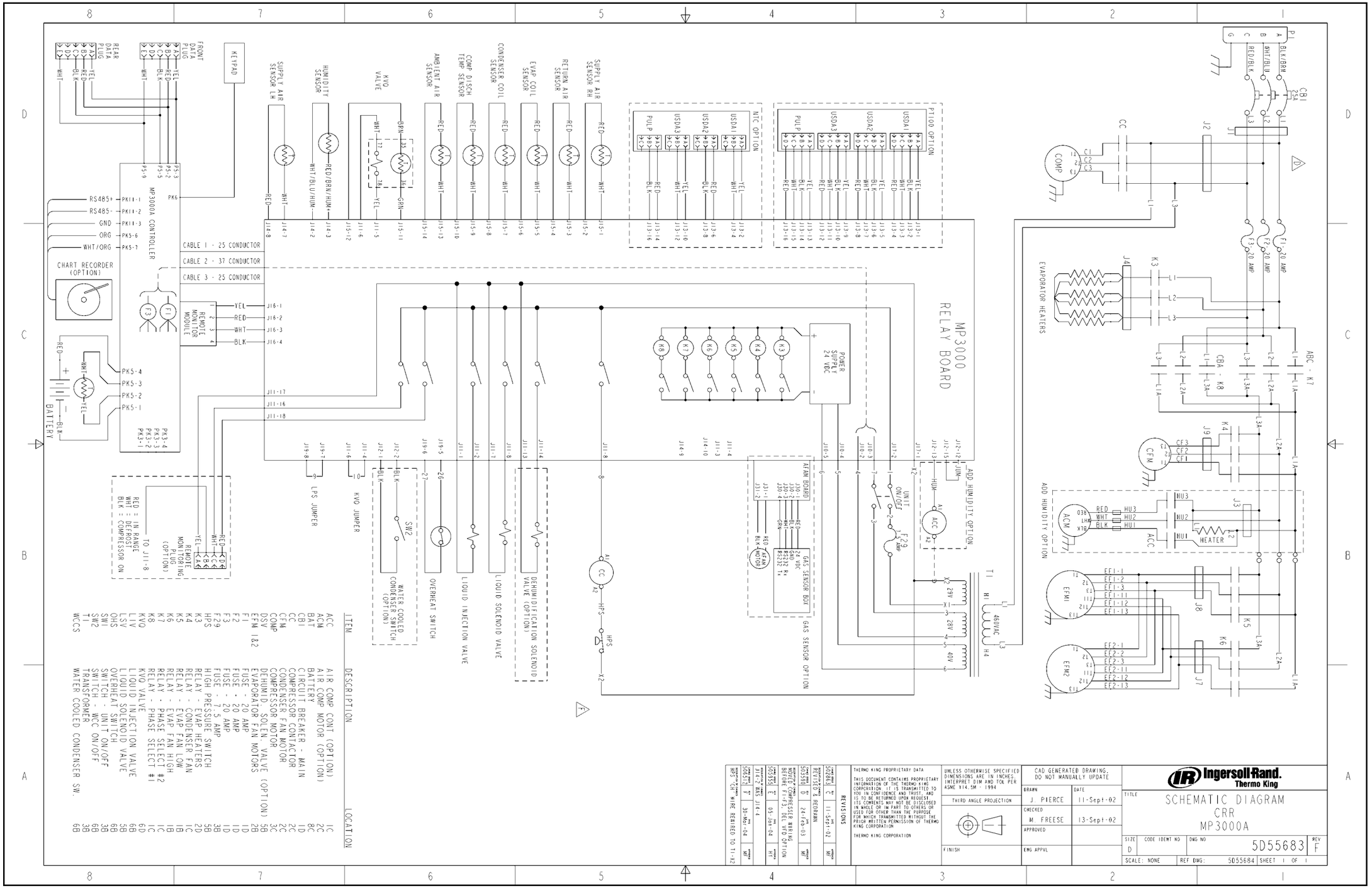
Electrical, Refrigeration and MP-3000a Menu Flow Diagrams Index

All Models Except CRR40-303: Wiring Schematic



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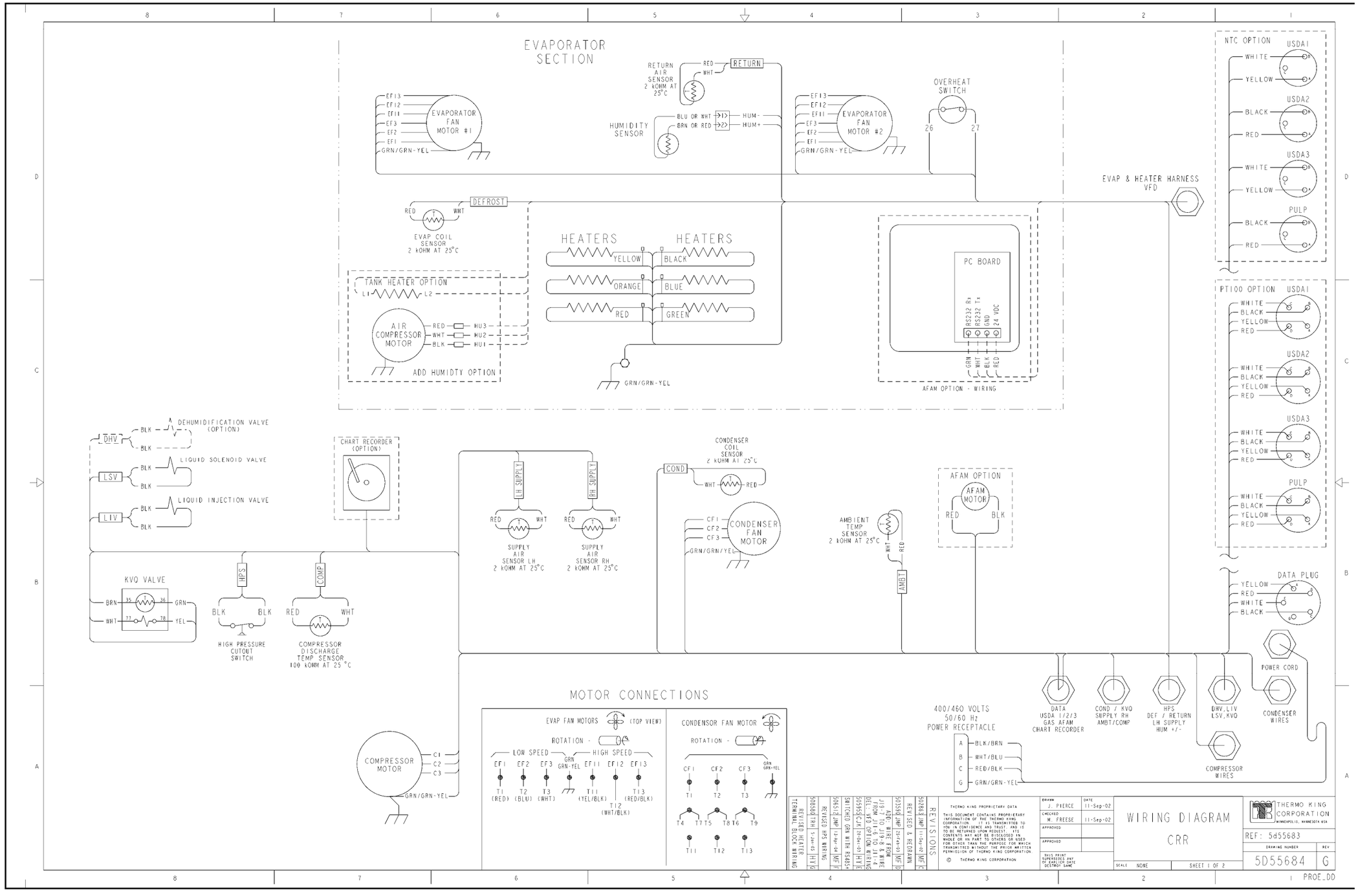

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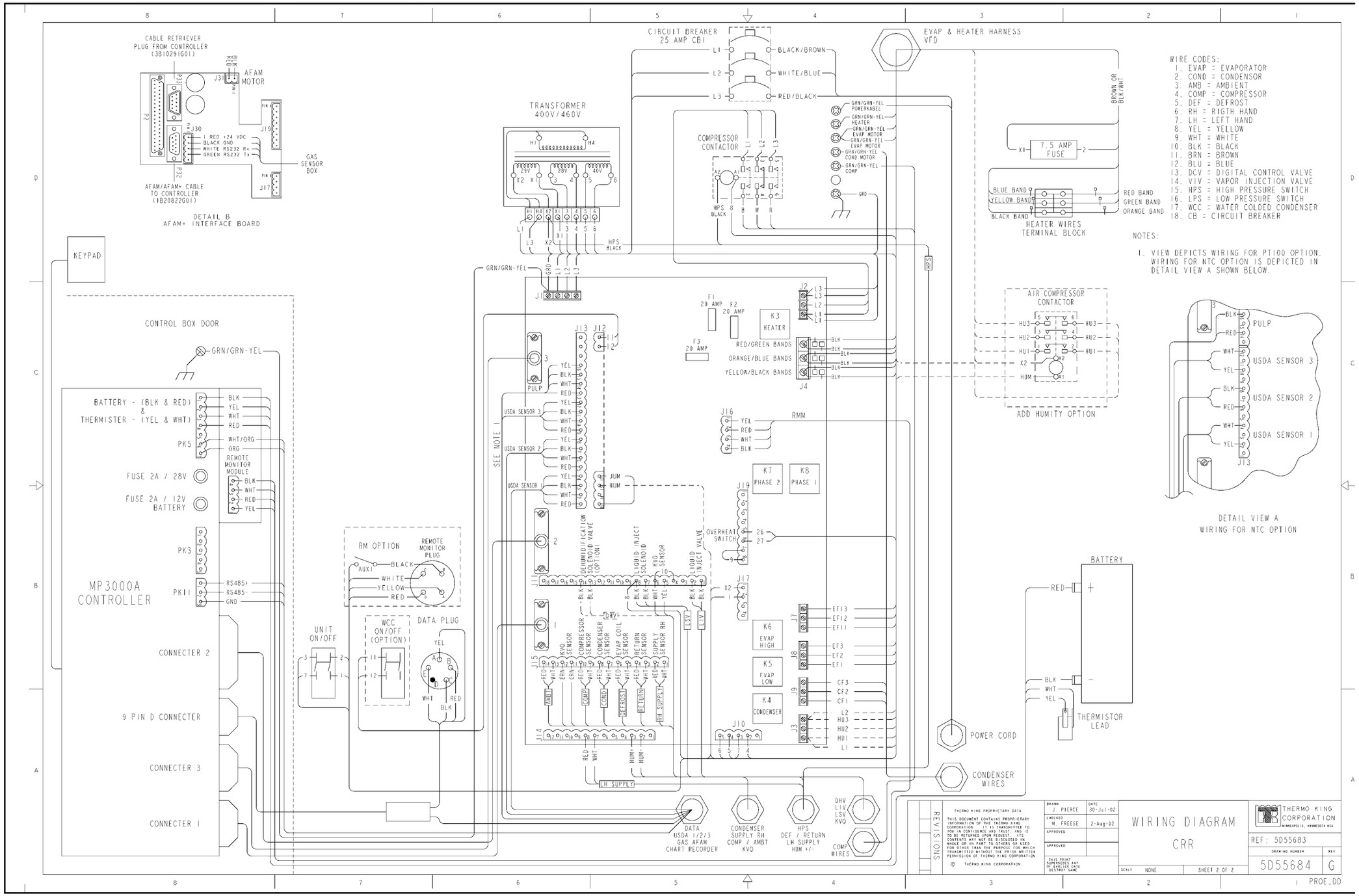
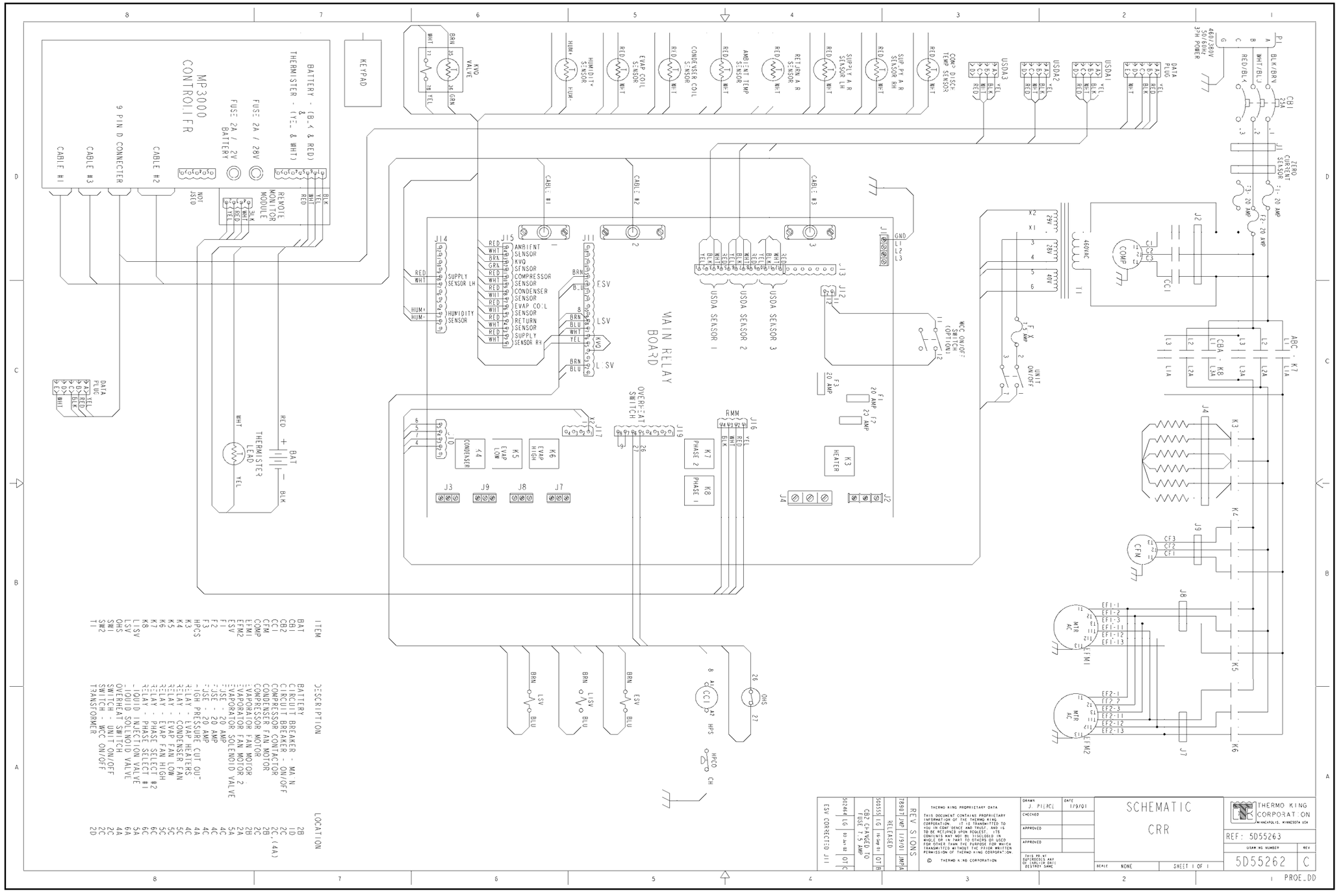


CRR40-303 Wiring Schematic



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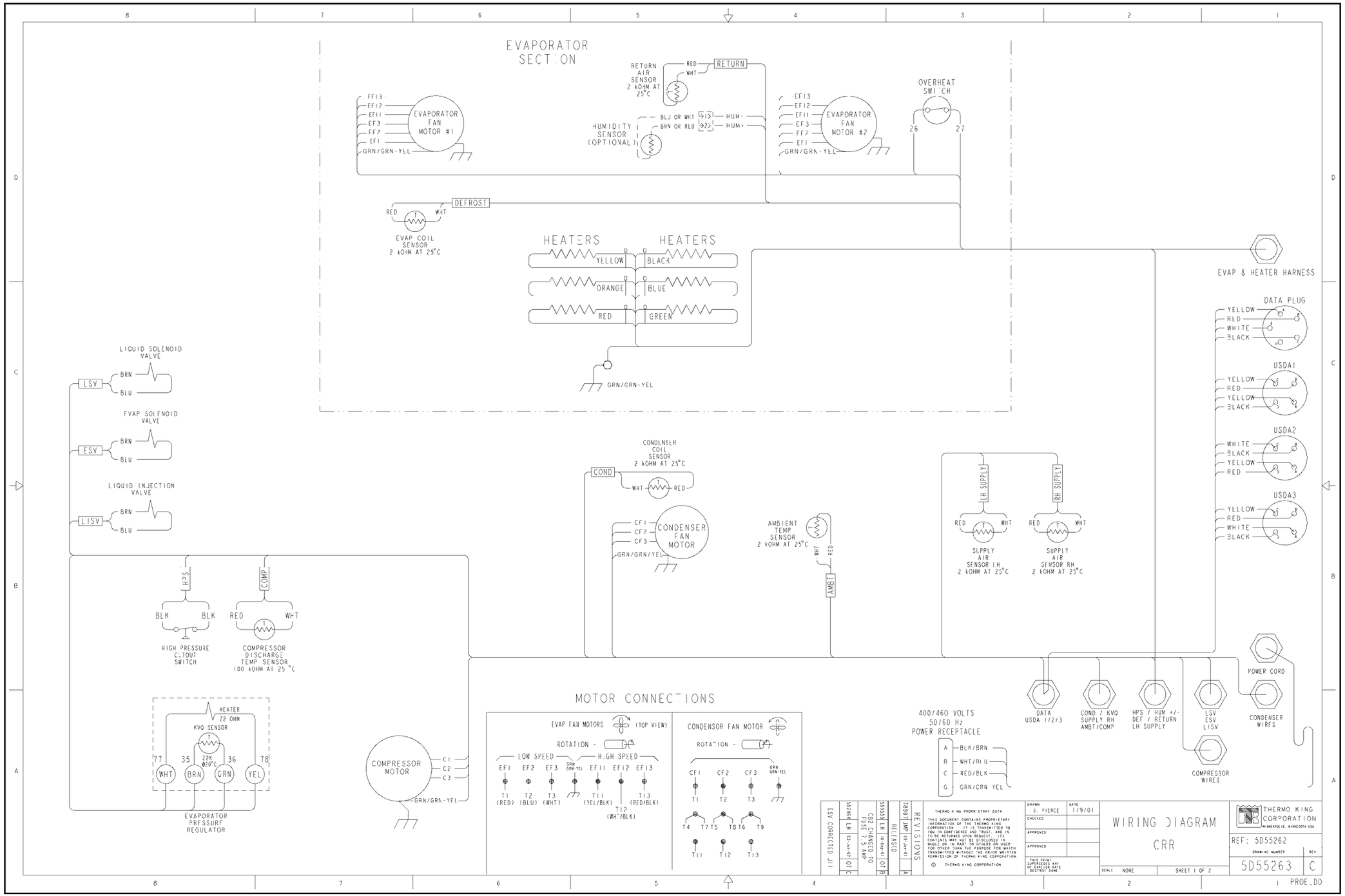

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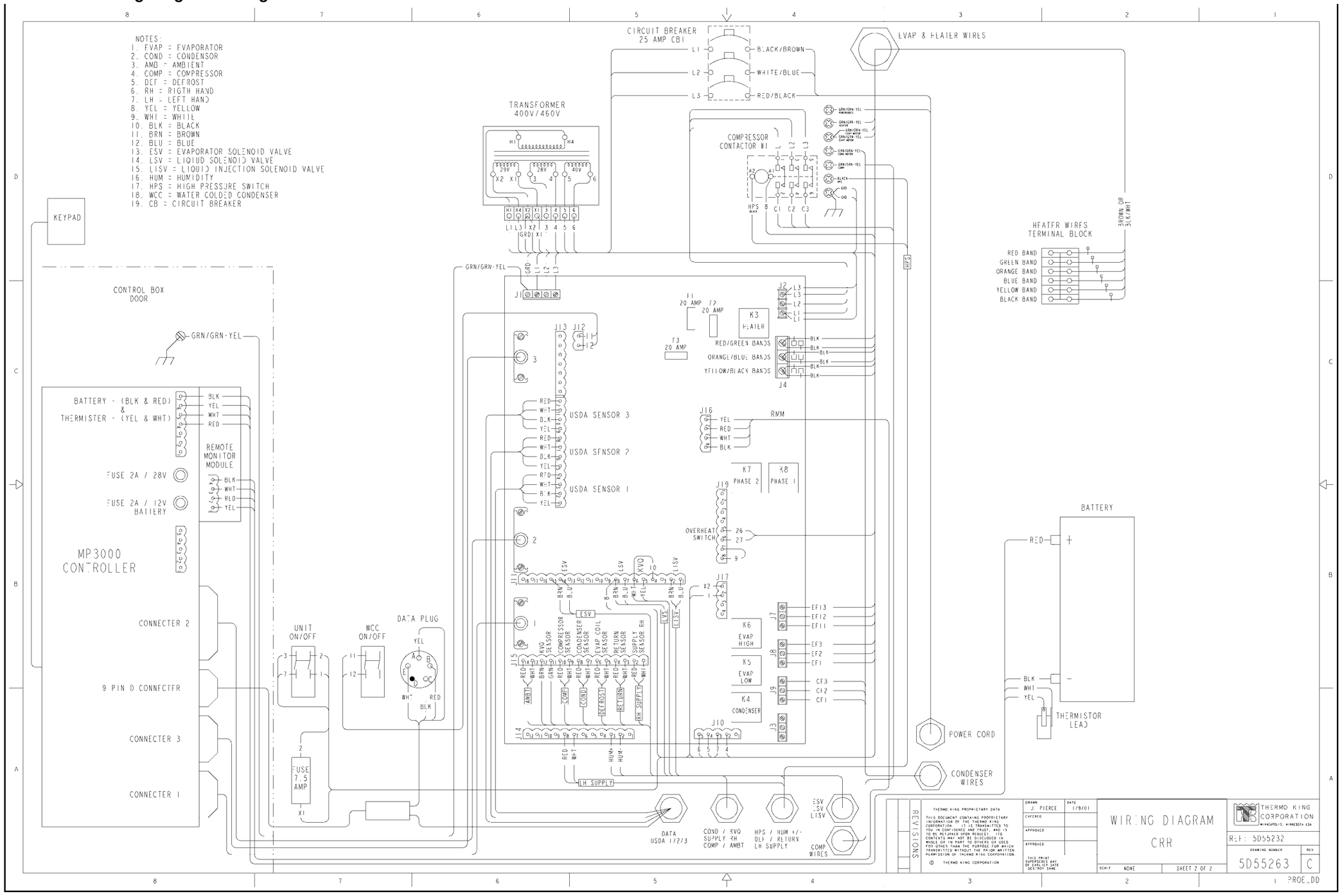
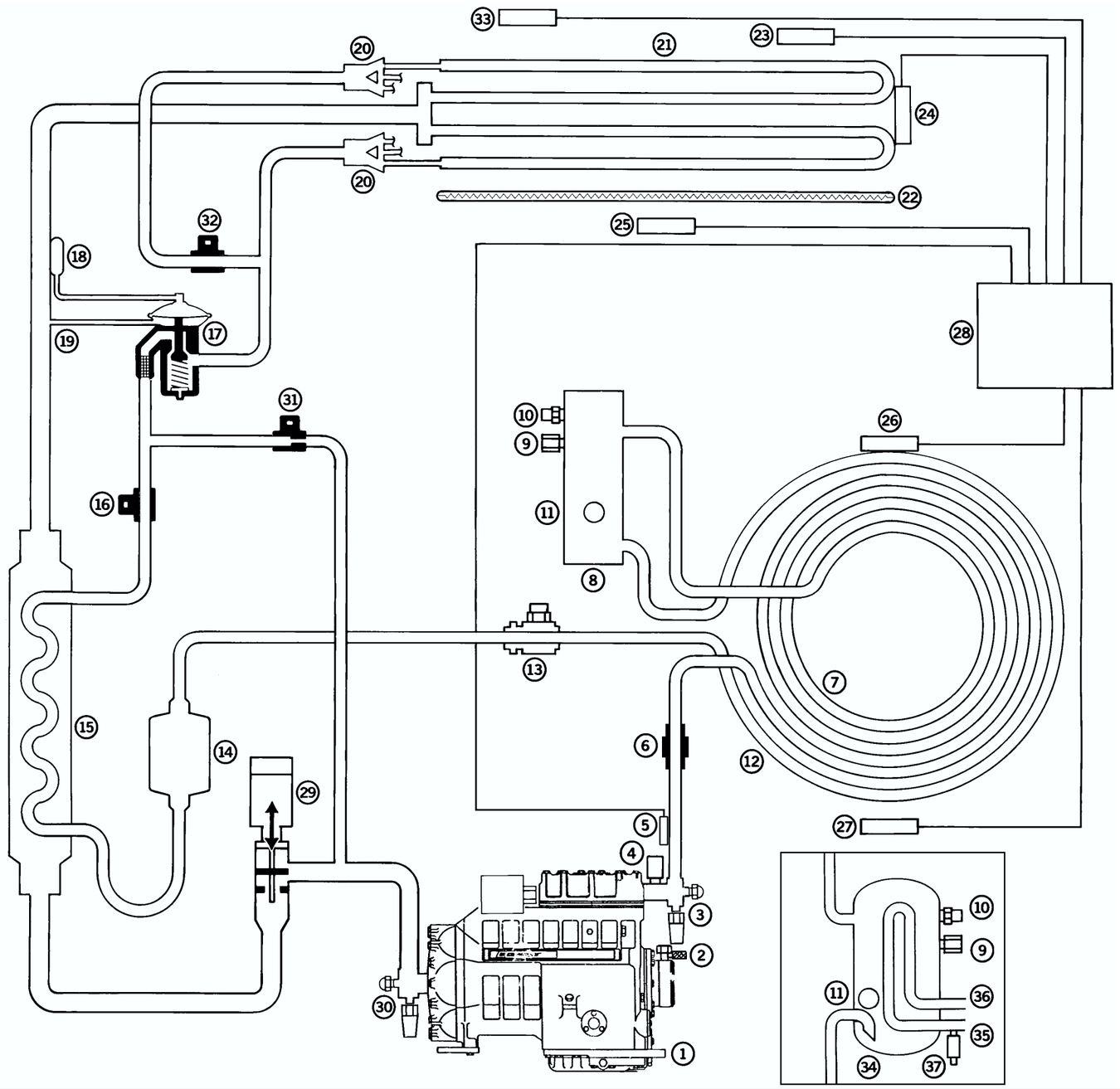


CRR-40

Refrigeration System Components

1. 3DS Compressor
2. Oil Fill / Drain Fitting
3. Discharge Service Valve
4. High Pressure Cutout Switch
5. Compressor Discharge Line Temperature Sensor*
6. Condenser Check Valve
7. Condenser Coil (Circular)
8. Receiver Tank
9. High Pressure Relief (Fusible Plug)
10. Receiver Tank Service Fitting (or Plug Fitting)
11. Sight Glass
12. Condenser Coil Subcooler Circuit
13. Liquid Line Service Valve
14. Dehydrator (Filter Drier)
15. Heat Exchanger
16. Liquid Line Solenoid (LLS)
17. Expansion Valve (TXV)
18. Expansion Valve Feeler Bulb
19. Equalizer Line
20. Distributor
21. Evaporator Coil
22. Electric Heaters
23. Return Air Sensor
24. Defrost (Evaporator Coil) Sensor
25. Supply Air Sensor
26. Condenser Coil Sensor
27. Ambient Sensor
28. MP-3000 Controller
29. KVQ Valve (Evaporator Pressure Regulator)
30. Suction Service Valve
31. Liquid Injection Valve
32. Dehumidify Solenoid Valve (Option)
33. Humidity Sensor (Option)
34. Water-Cooled Condenser-Receiver Tank (Option)
35. Water Inlet Coupling
36. Water Outlet Coupling
37. Water Pressure Switch (WPS) (Option)

*NOTE: Compressor Discharge Temperature Sensor is mounted in the compressor head on CRR40-196 models.



Full Cool Flow and Pressure Diagram

Flow and Pressure Diagram

CRR-40

Full Cool

1. D3DS Compressor
Compressor operation has a variable delay on initial start-up. A sequence start of the compressor occurs when the compressor has been OFF for more than 18 hours.

4. High Pressure Cutout Switch (HPCO)
Is a normally CLOSED switch.
It OPENS at 2240 +/- 70 kPa, 22.4 +/- 0.7 bar, 325 +/- 10 psig.
It CLOSES at 1590 +/- 70 kPa, 15.9 +/- 0.7 bar, 230 +/- 10 psig.

9. High Pressure Relief (Fusible Plug)
BLOWS at 100 C (212 F).

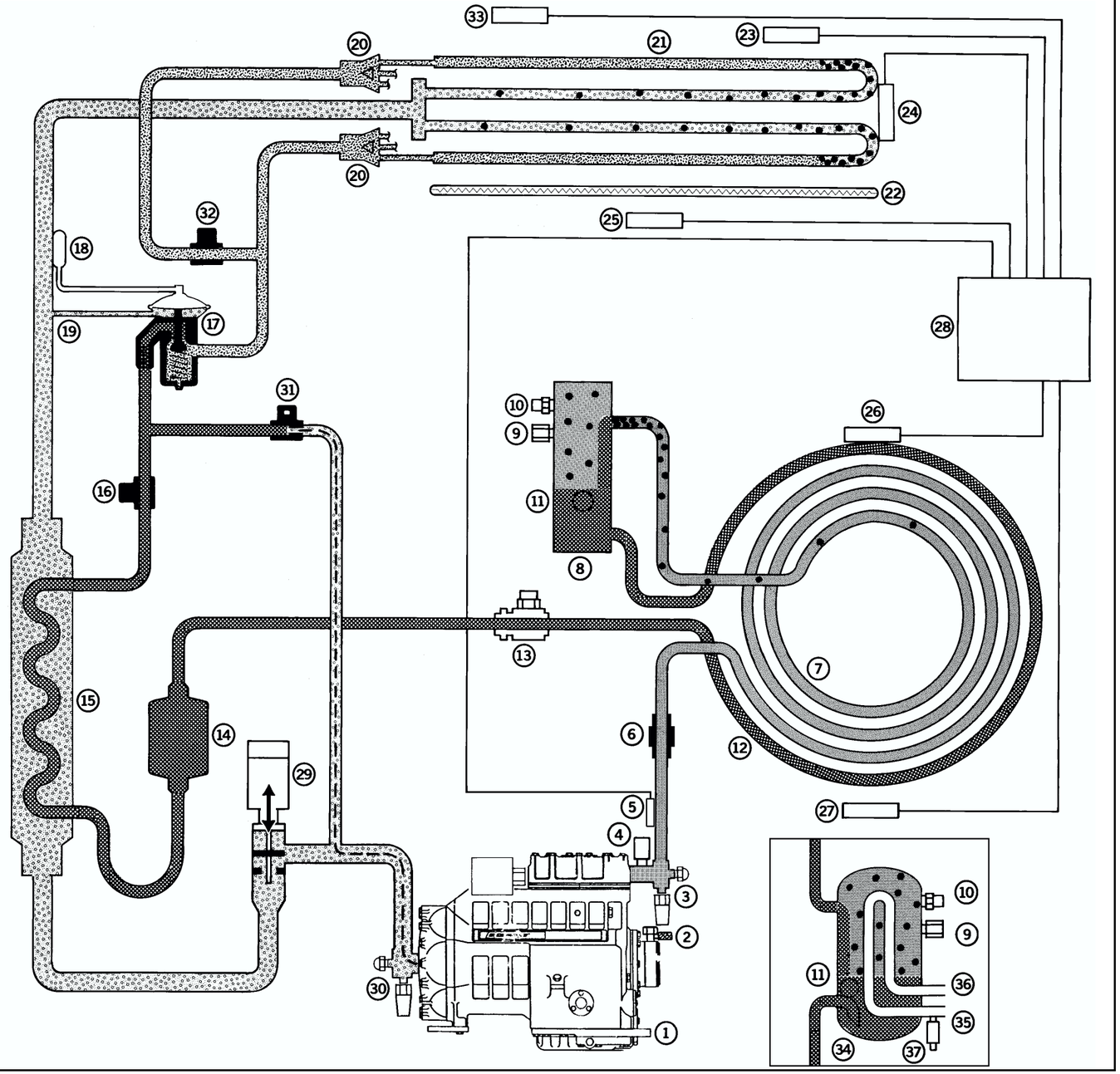
16. Liquid Line Solenoid (LLS)
Is a normally CLOSED solenoid.
It OPENS when energized, when the compressor operates.

22. Electric Heaters
During the DEFROST and HEAT modes, the electric heaters are pulsed ON and OFF.

26. Condenser Coil Temperature Sensor
Controller cycles condenser fan ON typically when the condenser coil temperature is above 35 C (95 F).

28. MP-3000 Controller
Microprocessor with digital thermostat, thermometer and fault indicator monitor.

37. Water Pressure Switch (WPS) (HPCO)
Is a normally CLOSED switch.
It OPENS at 117 +/- 21 kPa, 1.17 +/- 0.21 bar, 17 +/- 3 psig.
It CLOSES at 35 +/- 21 kPa, 0.35 +/- 0.21 bar, 5 +/- 3 psig.



- High pressure gas
- High pressure liquid
- Low pressure gas
- Low pressure liquid
- Condensing high pressure gas
- Low pressure vaporizing liquid
- Liquid refrigerant injection

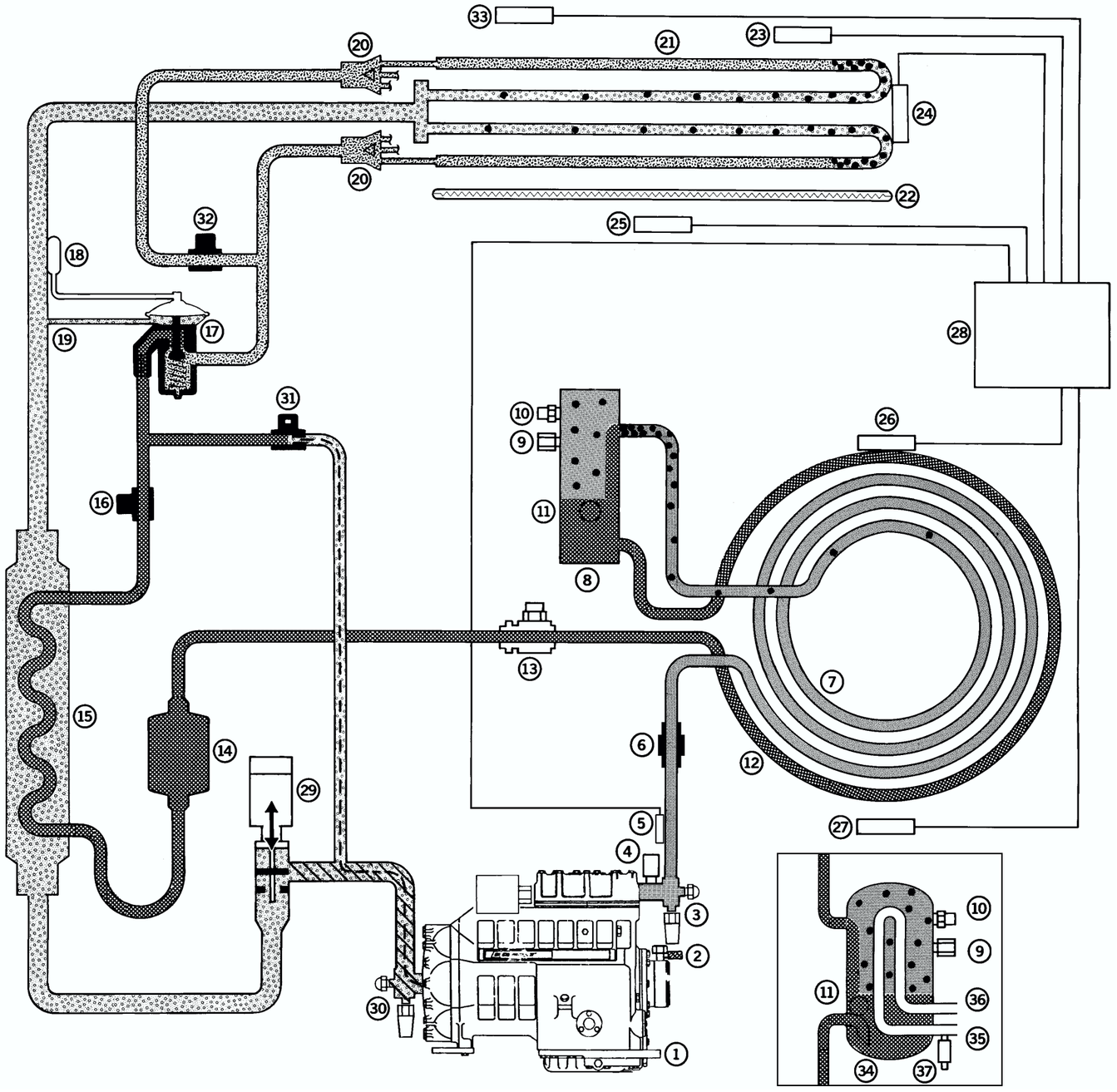
Flow and Pressure Diagram

CRR-40

Cool with Modulation (or Power Limit)

29. Evaporator Pressure Regulator (KVQ Valve)
Is a normally OPEN actuator valve. It CLOSES (or OPENS) according to the strength and frequency of a pulsing voltage signal from the controller. The voltage signal energizes a heating element in the actuator power element. Increasing the temperature of the heating element increases the pressure on the main valve actuator, forcing the valve towards the closed position. Decreasing the temperature of the heating element decreases the pressure on the main valve actuator, drawing the valve towards the open position.

31. Liquid Injection Valve (LIV)
Is a normally CLOSED valve.
It OPENS when energized. When liquid injection is required, the valve is pulsed open and closed on a 60 second cycle.
Liquid injection is controlled by the compressor discharge temperature and the temperature control algorithm.



High pressure gas
High pressure liquid
Low pressure gas
Low pressure liquid
Condensing high pressure gas
Low pressure vaporizing liquid
Liquid refrigerant injection
Modulated pressure

Flow and Pressure Diagram

CRR-40

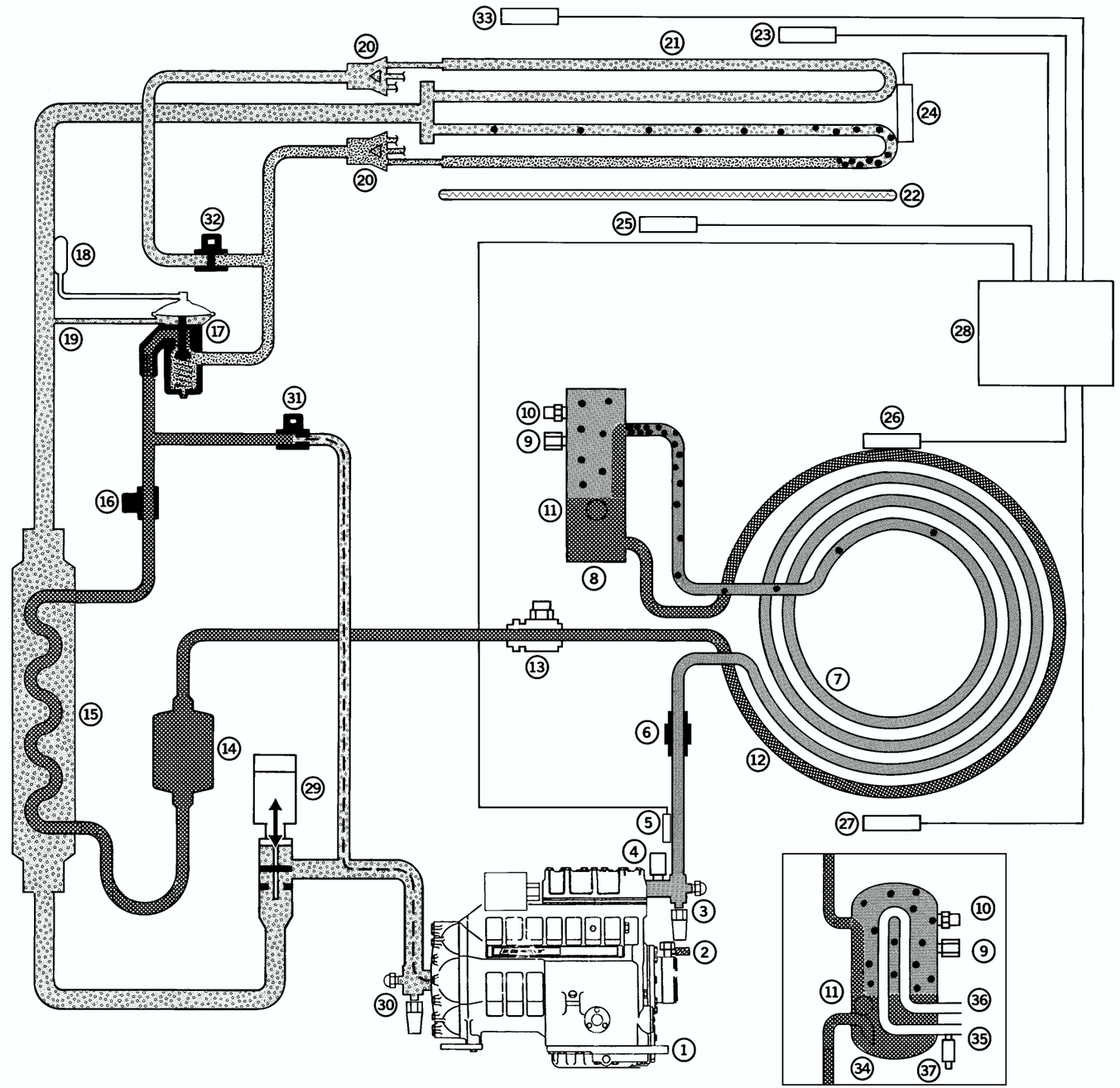
Dehumidification

NOTE: At setpoints below 5 C (41F), dehumidification is not energized.

32. Dehumidify Solenoid Valve (DSV)
Is a normally OPEN valve.
If the container humidity is 2% or more above the humidity setpoint and the KVQ valve has reduced cooling capacity by about 25%, the controller will energize (CLOSE) the normally open solenoid. This closes refrigerant distribution to 50% of the evaporator coil, thereby lowering the temperature of the active part of the coil and condensing more moisture from the container air.

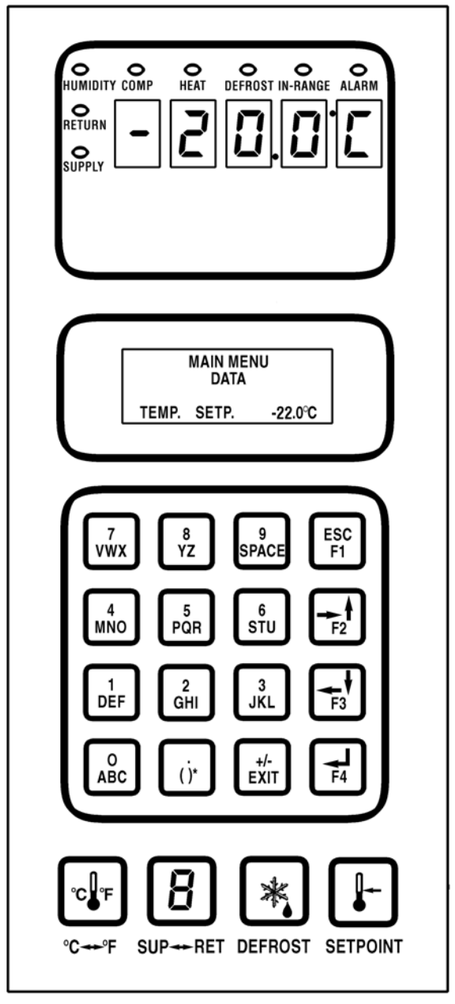
22. Electric Heaters
If the container humidity is 5% or more above the humidity setpoint, and the KVQ valve has closed to reduce cooling capacity by about 50%, the controller will pulse the electric heaters ON and OFF in addition to energizing (closing) the dehumidify solenoid valve. This increases the cooling load on the evaporator coil, thereby lowering the temperature of the entire coil and condensing more moisture from the container air.

33. Humidity Sensor (rH)
The humidity sensor is located at the top right hand side of the evaporator fan deck and measures the humidity of the return air from the cargo space.



- High pressure gas
- High pressure liquid
- Low pressure gas
- Low pressure liquid
- Condensing high pressure gas
- Low pressure vaporizing liquid
- Liquid refrigerant injection

MP-3000a Menu Flow Diagram



NOTE: All screens are NOT present on all units. The screens that display on the controller are determined by the Controller Software settings and the options installed on the unit.

Text Input: Use F1, F2, F3 and F4 keys to enter text in information screens:

• To enter a number: Press the F1 key and the desired number key.

• To enter 1st letter on a key: Press the F2 key and the desired letter key.

• To enter 2nd letter on a key: Press the F3 key and the desired letter key.

• To enter 3rd letter on a key: Press the F4 key and the desired letter key.

NOTE: When a function key (F1, F3, F3 or F4) is pressed to enter text, the keypad remains on that "character level: until another function key is pressed.

To Enter a Controller Menu or Use Special Function Key:

• Press F4 key to directly enter the Data menu.

• Press F2 key to directly enter the Alarms menu.

• Press F3 key to directly enter the Main menu.

• Press SETPOINT key to enter Setpoint menu.

• Press C/F Key to view alternate temperature scale in LED display.

• Press SUP/RET key to view alternate sensor temperature in LED display.

• Press DEFROST key to initiate a manual defrost. Evaporator coil temperature must be below 10 C (50 F).

To Enter a Submenu, a Command or a New Value in a Text Screen:

• Press F4 key.

To Scroll in a Menu or a Text Line:

• Press F2 key to scroll up or backward.

• Press F3 key to scroll down or forward.

To Exit a Menu or Text Line:

• Press F1 (ESC) key.

Special Function Keys:

• Press C/F key to view alternate temperature scale in LED display.

• Press DEFROST key to initiate a manual defrost. Evaporator coil temperature must be below 10C.

• Press SUP/RET key to view alternate return/supply-sensor temperature in LED display.

To Lock a LCD Data Screen Display:

• Each time the "5" key is pressed, the display time of the current LCD screen increases by 5 mi nutes. Maximum display time is 30 minutes for data screens and 100 minutes for manual tests. Press F1 (ESC) key to exit display.