CBci & CB MAX

w/Control Box Thermostat

TK 40738-1-MM (Rev. 1, 1/99)

The maintenance information in this manual covers unit models:

CBci 10 12V (914725)	**CB MAX 10 12V (915091)**
CBci 10 24V (914724)	**CB MAX 10 24V (915090)**
CBci 20 12V (914729)	**CB MAX 20 12V (915097)**
CBci 20 24V (914728)	**CB MAX 20 24V (915094)**

For further information, refer to…

CBci and CB Parts Manual	**TK 40097**
CBci Operating Manual	**TK 40170**
Diagnosing Thermo King Refrigeration System	**TK 5984**
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.

Sale of product shown in this manual is subject to Thermo King's terms and conditions including, but not limited to, the THERMO KING EXPRESS WARRANTY. Such terms and conditions are available upon request.

Thermo King's warranty will not apply to any equipment which has been "so repaired or altered outside the manufacturer's plants as, in the manufacturer's judgment, to effect its stability."

No warranties, express or implied, including warranties of fitness for a particular purpose or merchantability, or warranties arising from course of dealing or usage of trade, are made regarding the information, recommendations, and descriptions contained herein. Manufacturer is not responsible and will not be held liable in contract or in tort (including negligence) for any special, indirect or consequential damages, including injury or damage caused to vehicles, contents or persons, by reason of the installation of any Thermo King product or its mechanical failure.

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.

R-404A and R-134a

CAUTION: Use ONLY Polyol Ester based refrigeration compressor oil (TK P/N 203-413) in R-404A and R-134a units.

DO NOT use Polyol Ester based oil in standard Thermo King units.

DO NOT mix Polyol Ester and standard synthetic compressor oils.

Keep Polyol Ester compressor oil in tightly sealed containers. If Polyol Ester oil becomes contaminated with moisture or standard oils, dispose of properly—DO NOT USE!

CAUTION: When servicing Thermo King R-404A and R-134a units, use only those service tools certified for and dedicated to R-404A and R-134a refrigerant and Polyol Ester compressor oils. Residual non-HFC refrigerants and non-HFC refrigerants or oils will contaminate R-404A and R-134a systems.

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Safety Precautions

GENERAL PRACTICES

1. ALWAYS WEAR GOGGLES OR SAFETY GLASSES. Refrigerant liquid, refrigeration oil, and battery acid can permanently damage the eyes (see First Aid under Refrigeration Oil).
2. Never operate the unit with the compressor discharge valve closed.
3. Keep your hands, clothing and tools clear of the fans and belts when the unit is running. This should also be considered when opening and closing the compressor service valves.
4. Make sure gauge manifold hoses are in good condition. Never let them come in contact with a belt, fan motor pulley, or any hot surface.
5. Never apply heat to a sealed refrigeration system or container.
6. Fluorocarbon refrigerants, in the presence of an open flame or electrical short, produce toxic gases that are severe respiratory irritants capable of causing death.
7. Make sure all mounting bolts are tight and are of correct length for their particular application.
8. Use extreme caution when drilling holes in the unit. The holes may weaken structural components, and holes drilled into electrical wiring can cause fire or explosion.
9. Use caution when working around exposed coil fins. The fins can cause painful lacerations.
10. Use caution when working with a refrigerant or refrigeration system in any closed or confined area with a limited air supply (for example, a truck box or garage). Refrigerant tends to displace air and can cause oxygen depletion resulting in suffocation and possible death.
11. In the USA, EPA Section 608 Certification is needed to work on refrigeration systems.

REFRIGERANT

Although fluorocarbon refrigerants are classified as safe refrigerants, certain precautions must be observed when handling them or servicing a unit in which they are used. When exposed to the atmosphere from the liquid state, fluorocarbon refrigerants evaporator rapidly, freezing anything they contact.

First Aid

In the event of frost bite, the objectives of First Aid are to protect the frozen area from further injury, to warm the affected area rapidly and to 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 if necessary. Stay with victim until arrival of emergency medical personnel.

REFRIGERATION OIL

Avoid refrigeration oil contact with the eyes. Avoid prolonged or repeated contact of refrigeration oil with skin or clothing. Wash thoroughly after handling refrigeration oil to prevent irritation.

First Aid

In case of eye contact, immediately flush with plenty of water for at least 15 minutes. Wash skin with soap and water. CALL A PHYSICIAN.

ELECTRICAL HAZARDS

High Voltage

When servicing or repairing a refrigeration unit, the possibility of serious or even fatal injury from electrical shock exists. Extreme care must be used when working with an operating refrigeration unit. Lethal voltage potentials can exist on connections in the high voltage tray of the control box.

Precautions

1. When working on high voltage circuits on the refrigeration unit, do not make any rapid moves. If a tool drops, do not grab for it. People do not contact high voltage wires on purpose. It occurs from an unplanned movement.
2. Use tools with insulated handles that are in good condition. Never hold metal tools in your hand if exposed, energized conductors are within reach.
3. Treat all wires and connections as high voltage until a meter and wiring diagram show otherwise.
4. 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.
5. 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 if available.

The source of shock must be immediately removed by either shutting down the power or removing 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) or by a rescuer wearing electrically insulated gloves and safety glasses. Whichever method is used do not look at the wire while it is being cut. The ensuing flash can cause burns and blindness.

If the victim has to be removed from a live circuit, pull the victim off with a non-conductive material. 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. After separating the victim from power source, check immediately for the presence of a pulse and respiration. If a pulse is not present, start CPR (Cardio Pulmonary Resuscitation) and call for emergency medical assistance. If a pulse is present, respiration may be restored by using mouth-to-mouth resuscitation, but call for emergency medical assistance.

Low Voltage

Control circuits used in the refrigeration unit are low voltage (12 volts dc). This voltage potential is not considered dangerous, but the large amount of current available (over 30 amperes) can cause severe burns if shorted or ground.

Do not wear jewelry, watch or rings. These items can short out electrical circuits and cause severe burns to the wearer.

Specifications

R-134a REFRIGERATION SYSTEM

Compressor	Zexel DKS-15CH
Engine Compressor Oil Charge	11.5 oz (339 ml)
Electric Standby Compressor Oil Charge	5.7 oz (168 ml)
Compressor Oil Type	Polyol Ester P/N 203-413
Refrigerant Type	R-134a
Defrost Method: Truck Engine Operation: CBci^2 10 MAX	Hot gas
CBci^2 20 MAX	Hot gas
Electric Standby: CBci^2 20 MAX	Hot gas and optional electric heaters
Defrost Termination Switch: Opens	52 F (11.1 C)
Closes	42 F (5.6 C)
High Temperature Switch: Opens	200 ± 5 F (39 ± 3 C)
Closes	230 ± 5 F (110 ± 3 C)
High Pressure Cutout Switch: Opens	300 ± 25 psi (2068 ± 68 kPa)
Closes	200 ± 20 psi (3103 ± 138 kPa)
Low Pressure Cutout Switch: Opens	5 to 11 in. Hg vacuum (-17 to -37 kPa)
Closes	4 to 7 psi (28 to 48 kPa)
Condenser Pressure Fan Switch: Opens	130 ± 10 psi (896 ± 69 kPa)
Closes	180 ± 10 psi (1241 ± 69 kPa)
Suction Pressure Regulator Setting	18 psi (124 kPa)
Defrost Timer: Initiation Interval	4 hours
Termination Interval	45 minutes

R-404A REFRIGERATION SYSTEM

Compressor	Zexel DKS-15CH
Engine Compressor Oil Charge	11.5 oz (339 ml)
Electric Standby Compressor Oil Charge	5.7 oz (168 ml)
Compressor Oil Type	Polyol Ester P/N 203-413
Refrigerant Type	R-404A
Defrost Method: Truck Engine Operation: CBci^2 10	Hot gas
CBci^2 20	Hot gas
Electric Standby: CBci^2 20	Hot gas and optional electric heaters
Defrost Termination Switch: Opens	52 F (11.1 C)
Closes	42 F (5.6 C)
High Temperature Switch: Opens	200 ± 5 F (39 ± 3 C)
Closes	230 ± 5 F (110 ± 3 C)
High Pressure Cutout Switch: Opens	470 ± 7 psi (3241 ± 48 kPa)
Closes	375 ± 38 psi (2586 ± 138 kPa)
Low Pressure Cutout Switch: Opens	5 to 11 in. Hg vacuum (-17 to -37 kPa)
Closes	4 to 7 psi (28 to 48 kPa)

R-404A REFRIGERATION SYSTEM (continued)

Condenser Pressure Fan Switch:	Opens	130 ± 10 psi (896 ± 69 kPa)
	Closes	180 ± 10 psi (1241 ± 69 kPa)
Suction Pressure Regulator Setting		18 psi (124 kPa)
Defrost Timer:	Intuition Interval	4 hours
	Termination Interval	45 minutes

ELECTRICAL SYSTEM

Circuit Breaker Ratings

12 Vdc 40 amp manual reset
24 Vdc 25 amp manual reset

Condenser and Evaporator Fan Motors

Voltage	Horsepower	Power Rating in Kilowatts	rpm	Full Load Current
12 Vdc	0.17	0.12	1850 to 2250	8.0 to 14.5 amps
24 Vdc	0.1	0.12	1850 to 2250	4.2 to 7.8 amps

Pilot Solenoid and Liquid Injection Solenoid Coils

Voltage	Current	Resistance
12 Vdc	0.6 to 0.8 amps	15 to 19 ohms
24 Vdc	0.3 to 0.4 amps	62 to 72 ohms

Electric Standby Compressor Motors

Voltage	Phase	Frequency	Horsepower	Power Rating in Kilowatts	Full Load rpm	Full Load Current
230 Vac	1	60 Hz	3	2.2	1755	12.4 amps
220 Vac	1	50 Hz	2.5	1.9	1470	11.0 amps
230 Vac*	3	60 Hz	3	2.2	1750	9.8 amps
460 Vac*	3	60 Hz	3	2.2	1750	4.9 amps
380 Vac*	3	50 Hz	2.5	1.9	1420	5.0 amps
380 Vac	3	50 Hz	3	2.2	1420	5.2 amps
415 Vac	3	50 Hz	3	2.2	1420	4.7 amps

*Motor can be wired for all three voltages.

Optional Electric Heaters

Voltage	Power Rating Watts	Current	Resistance
230 Vac	800	3.48 amps	66.1 ohms
380 Vac	800	2.1 amps	180.5 ohms

BELT TENSION (Using Tool P/N 204-427)

	Field Reset
Engine/Compressor	35
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Maintenance Inspection Schedule

First Week Inspection and Maintenance

After First Week of operation:

- Check the belt tension
- Tighten the unit mounting bolts
- Check the refrigerant level
- Check the compressor oil level

Weekly	Monthly	Bi-monthly	Annually	Inspect/Service These Items
				ELECTRICAL
		•	•	Check defrost initiation and termination.
		•	•	Check thermostat cycle sequence.
		•	•	Check operation of protection shutdown circuits.
		•	•	Check thermostat and thermometer calibration in 32 F (0 C) ice-water bath
		•	•	Inspect wire harness for damaged wires or connections.
			•	Inspect/replace dc fan motor brushes yearly.
				REFRIGERATION
•	•	•	•	Check refrigerant level.
	•	•	•	Check compressor oil level.
			•	Replace dehydrator.
				STRUCTURAL
•	•	•	•	Visually inspect unit and refrigerant hoses for fluid leaks.
•	•	•	•	Visually inspect unit for damaged, loose or broken parts.
•	•	•	•	Clean defrost drains.
	•	•	•	Inspect belts (CBci^2 20) for condition and proper tension (belt tension tool P/N 204-427).
	•	•	•	Clean entire unit including evaporator coil and condenser coil.
		•	•	Check all unit mounting bolts, brackets, lines, hoses, etc.

Unit Description

The Thermo King CBci truck refrigeration system is a three-piece system consisting of a condenser, an evaporator, and a compressor. The assemblies are separate, and the condenser section can be installed either in a nosemount or an undermount position. The evaporator mounts on the inside of the front wall of the truck body close to the ceiling. The compressor is mounted on and driven by the truck engine. Refrigeration hoses or lines are used to connect the condenser, the evaporator and the compressor. Model 20 units have another compressor and an electric motor mounted in the condenser section for electric standby operation.

The units are designed for low and medium temperature applications on medium-sized trucks. There are two basic models:

- Model 10: Cool and defrost on engine-driven compressor operation.
- Model 20: Cool and defrost on both truck engine-driven and electric standby compressor operation.

The control circuits operate on 12 or 24 Vdc supplied by the truck batteries for over-the-road operation. On standby operation, the power is rectified from an AC transformer. The refrigeration system is protected by a high pressure cutout switch and a low pressure cutout switch.

The remote control box is normally mounted on the truck body. It contains the On-Off switch, manual defrost switch, thermometer, thermostat, and indicator lights. The remote control box cover must be opened to access the thermostat.

An optional cab control box is available. It is mounted in the truck cab and replaces the remote control box. The cab control box contains the On-Off switch, Manual Defrost switch, thermometer, thermostat, and indicator lights. The Model 20 cab control box also has a warning light that illuminates if the driver starts the truck engine while the electric standby cord is still plugged into the power receptacle.

The electric standby compressor is connected in parallel with the engine-driven compressor on the Model 20 units. The engine compressor is driven by a belt from the engine. The standby compressor is mounted in the condenser section and is belt driven by an electric motor. Both compressors use the same refrigeration system circuit. Check valves isolate one compressor from the other during operation. Compressor operation is controlled by the thermostat, starting the motor on electric standby or energizing the clutch during engine operation.

Selection of engine operation or standby operation is automatic on Model 20 units. When the Model 20 unit is plugged into standby power, engine operation is automatically locked out. If the driver turns the truck on while the power cord is still plugged into a power receptacle, the power cord warning light (Model 20 only) comes on to remind the driver to unplug the cord. The engine driven compressor cannot be started until the power cord is unplugged from the unit.

A three-way valve refrigeration system provides defrost in the unit. An electronic defrost timer can initiate defrost automatically. Defrost is normally terminated by the defrost termination switch mounted on the evaporator coil, but the defrost timer can also terminate defrost.

Liquid Injection System

If the discharge gas leaving the engine driven compressor reaches a temperature of 230 ± 5 F (110 ± 3 C), the high temperature switch closes, providing voltage to the liquid injection solenoid. The solenoid opens a valve, allowing liquid refrigerant to flow from the liquid line near the receiver outlet valve to the metering orifice attached to the suction fitting at the compressor. As the refrigerant passes through the metering orifice it expands and evaporates, cooling the suction gas entering the compressor. This cooling effect is transferred to the discharge gas leaving the compressor from

the adjacent cavity in the compressor head. When the discharge gas is cooled to 200 ± 5 F (93 ± 3 C), the high temperature switch opens, the liquid injection solenoid valve closes and refrigerant no longer flows through the liquid injection system.

Oil Separator

An oil separator is a standard feature. It separates compressor oil from refrigerant vapor and returns the oil to the compressor through the oil fill hole by using a special adapter. The oil separator helps provide positive oil return at high compressor speeds and low operating temperatures. This feature enhances compressor lubrication and extends compressor life.

CBci MAX Features

The CBci MAX is functionally the same as CBci units, but it uses R-404A refrigerant. This unit has a redesigned evaporator in order to operate more efficiently with R-404A refrigerant. All other operating features are the same as CBci units.

UNIT OPERATION

These units shift between cool, null, and heat (optional) to maintain the box temperature at the thermostat setpoint. The operating modes are: cool, null, heat (optional), and defrost. The thermostat controls the operation of the unit by energizing and de-energizing the cool relay and the heat relay.

When the cool relay is energized, it closes contacts that energize the fan relay and the compressor clutch (or the compressor motor contactor on Model 20 units during electric standby operation).

When the heat relay is energized, it closes contacts that energize the fan relay.

When the fan relay is energized, it closes contacts that energize the condenser and evaporator fans. The condenser fan is also controlled by the condenser fan pressure switch. This normally open switch monitors the compressor discharge pressure. When the discharge pressure rises to 180 ± 10 psi (1241 ± 69 kPa), the switch closes and energizes the condenser fan. When the discharge pressure drops to 130 ± 10 psi (896 ± 69 kPa), the switch opens and de-energizes the condenser fan.

Cool

The thermostat energizes the cool relay at box temperatures above setpoint when the temperature is dropping. The thermostat energizes the cool relay at box temperatures more than 2 ± 1 F (1 ± 0.5 C) above setpoint when the temperature is rising. The cool relay energizes the fan relay and the compressor clutch (or motor contactor). The fans and the compressor run and the unit cools.

Null

The thermostat de-energizes the cool relay and the heat relay at box temperatures between setpoint and 2 ± 1 F (1 ± 0.5 C) below setpoint when the temperature is dropping. The thermostat de-energizes the cool relay and the heat relay at box temperatures between setpoint and 2 ± 1 F (1 ± 0.5 C) above setpoint when the temperature is rising. When the cool relay and the heat relay are both de-energized, the unit does not operate unless it is in defrost.

Heat (Optional)

NOTE: Heat lockout occurs at setpoints of 15 F (-9.5 C) and lower. Heat lockout disables Heat and replaces Heat with Null.

The thermostat energizes the heat relay at box temperatures more than 2 ± 1 F (1 ± 0.5 C) below setpoint when the temperature is dropping. The thermostat energizes the heat relay at box temperatures below setpoint when the temperature is rising. The heat relay energizes the fan relay, but the compressor clutch (or motor contactor) is not energized. Therefore, the evaporator fans run but the condenser fan

does not. The heat relay also energizes the optional water pump and hot water valve, or the optional heater contactor.

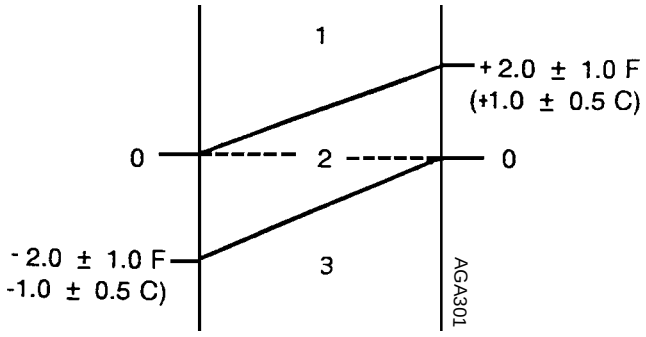
Defrost

The defrost cycle can be initiated any time the evaporator coil temperature is below 42 F (5.6 C). Defrost is initiated automatically by the defrost timer, or manually by pressing the Manual Defrost switch.

The defrost relay energizes the compressor clutch (or motor contactor) and the 26 circuit to route hot refrigerant gas to the evaporator. The defrost relay also interrupts power to the fan relay to stop the evaporator and condenser fans during defrost. The defrost cycle will continue until the evaporator coil temperature rises to 52 F (11.1 C), causing the defrost termination switch to open, which terminates the defrost cycle. If the defrost termination switch does not open in less than 45 minutes, the defrost timer will terminate the defrost cycle 45 minutes after is was started.

OPERATING MODES

- Cool—Above setpoint when the temperature is dropping. More than 2 ± 1 F (1 ± 0.5 C) above setpoint when the temperature is rising.
- Null—Between setpoint and 2 ± 1 F (1 ± 0.5 C) below setpoint when the temperature is dropping. Between setpoint and 2 ± 1 F (1 ± 0.5 C) above setpoint when the temperature is rising.
- Heat—More than 2 ± 1 F (1 ± 0.5 C) below setpoint when the temperature is dropping. Below setpoint when the temperature is rising (optional).
- Defrost—Initiated manually or automatically at evaporator temperatures below 42 F (5.6 C). Terminated when the evaporator temperature rises to 52 F (11.1 C), or 45 minutes after initiated.



0.	Setpoint
1.	Cool
2.	Null
3.	Heat* (Optional)
*Heat lockout occurs at setpoints of 15 F (-9.5 C) or lower.	

Thermostat Algorithm

UNIT FEATURES

- Digital Thermometer
- Electronic Thermostat
- Defrost Timer
- Hot Gas Defrost
- Defrost Termination Switch
- Liquid Injection System
- Manual Defrost Switch
- Receiver Tank with Outlet Service Valve
- Suction Pressure Regulator
- Oil Separator
- Compressor Powered by Truck Engine
- Three-way Valve Refrigeration System
- Accumulator Tank
- Standby Compressor (Model 20 only)
- Refrigerant Flow Controlled by Discharge Check Valve (Model 20 only)

PROTECTION FEATURES

- Control Circuit Breaker(s):

  40 amp auto reset in 12 Vdc system
- Refrigerant High Pressure Cutout
- Refrigerant Low Pressure Cutout
- Refrigerant High Pressure Relief Valve
- Power Cord Warning Light (in Optional Cab Control Box for Model 20 only)
- Overload Relay Protection for Electric Standby Motor (Model 20 only)
- Transformer Fuses (Model 20 only)

OPTIONAL FEATURES

- Cab Control Box
- Refrigerant R-134a
- Electric Motors (Model 20 only)

  230 Volt/1 Phase/60 Hz

  220 Volt/1 Phase/50 Hz

  230 Volt/3 Phase/60 Hz

  460 Volt/3 Phase/60 Hz

  380 Volt/3 Phase/50Hz

  415 Volt/3 Phase/50 Hz
- Heat, Truck Engine (Model 10)
- Heat, Truck Engine and Electric Standby Heater Strips (Model 20)
- Paint, Special Color

SERIAL NUMBER LOCATIONS

Condenser: Roadside, top corner.

Evaporator: Roadside panel.

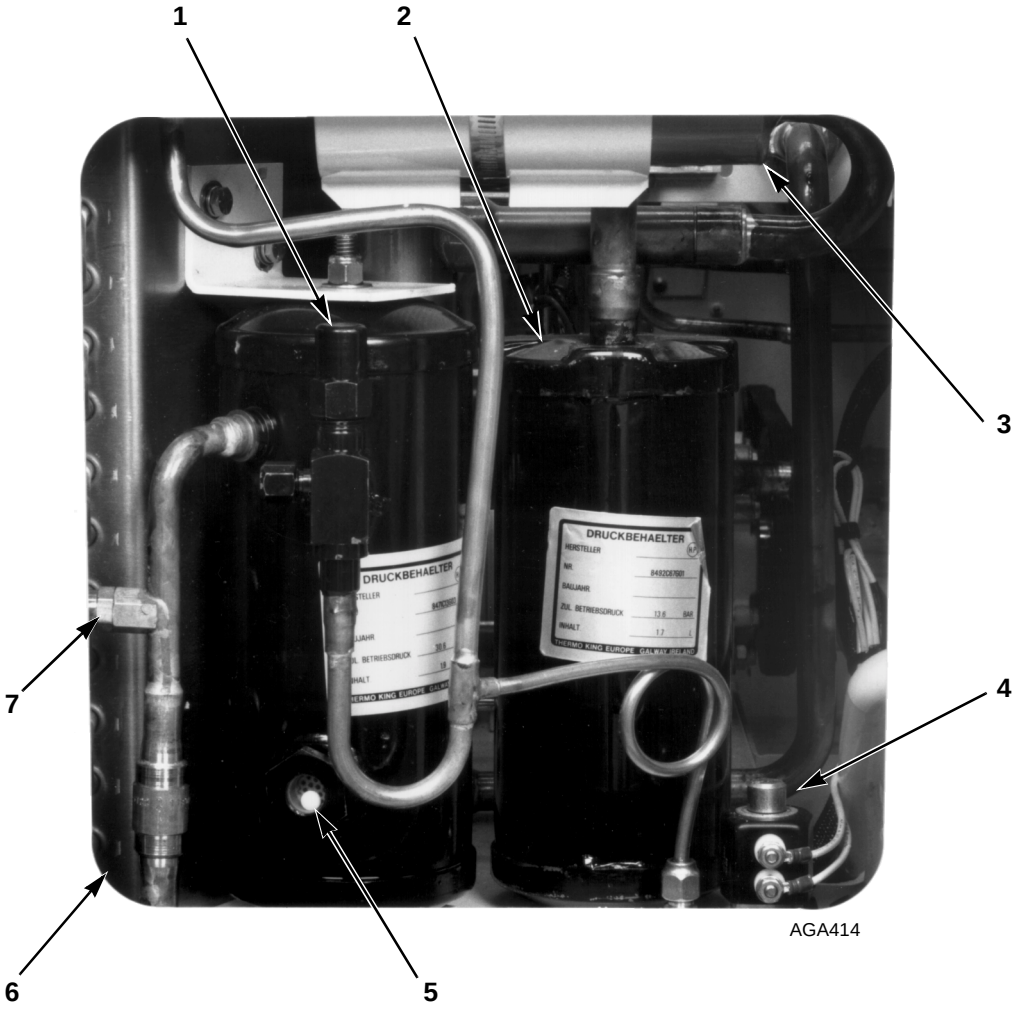
Compressor: Nameplate on compressor body.

Standby Motor: Nameplate on motor.

1.	Electric Motor Reset (Model 20 Only)
2.	Master On-Off Switch
3.	Control Box Cover

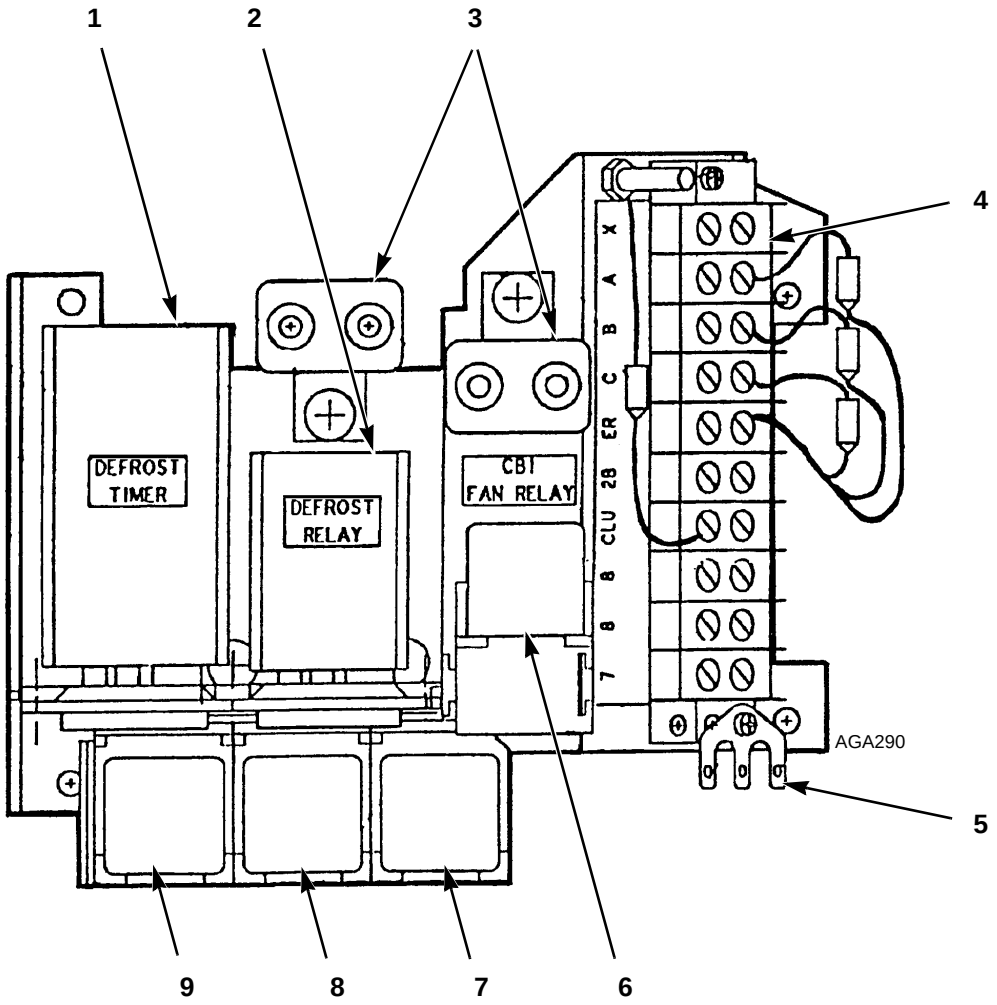
Front Curbside View

Front Roadside View



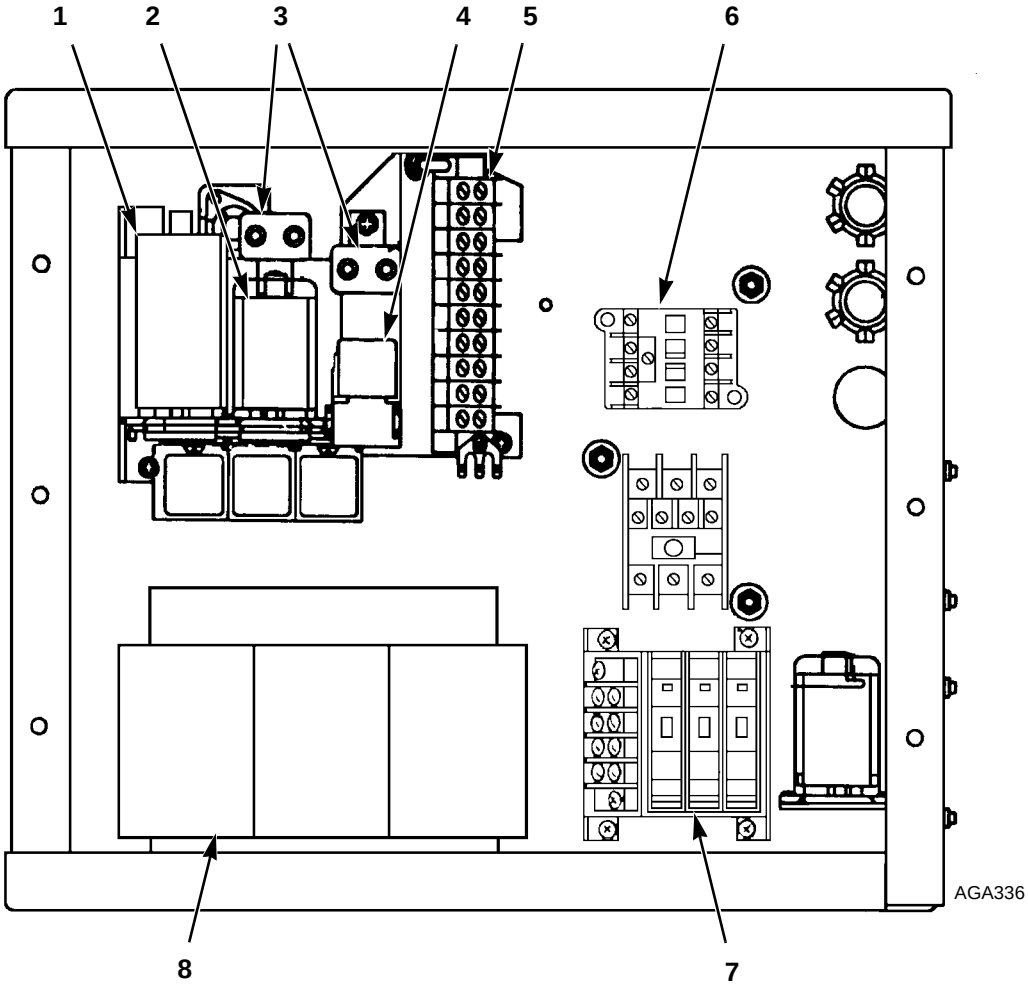
1.	Receiver Outlet Valve	5.	Sight Glass
2.	Accumulator	6.	Condenser Check Valve
3.	Drier	7.	High Pressure Valve
4.	Liquid Injection Solenoid		

Roadside Components



1.	Defrost Timer	6.	Fan Relay
2.	Defrost Relay	7.	Cool Relay
3.	Circuit Breakers	8.	Heat Relay
4.	Terminal Board	9.	Power Disconnect Relay
5.	Defrost Jumper (Emergency Use Only)		

Model 10 Control Box Components

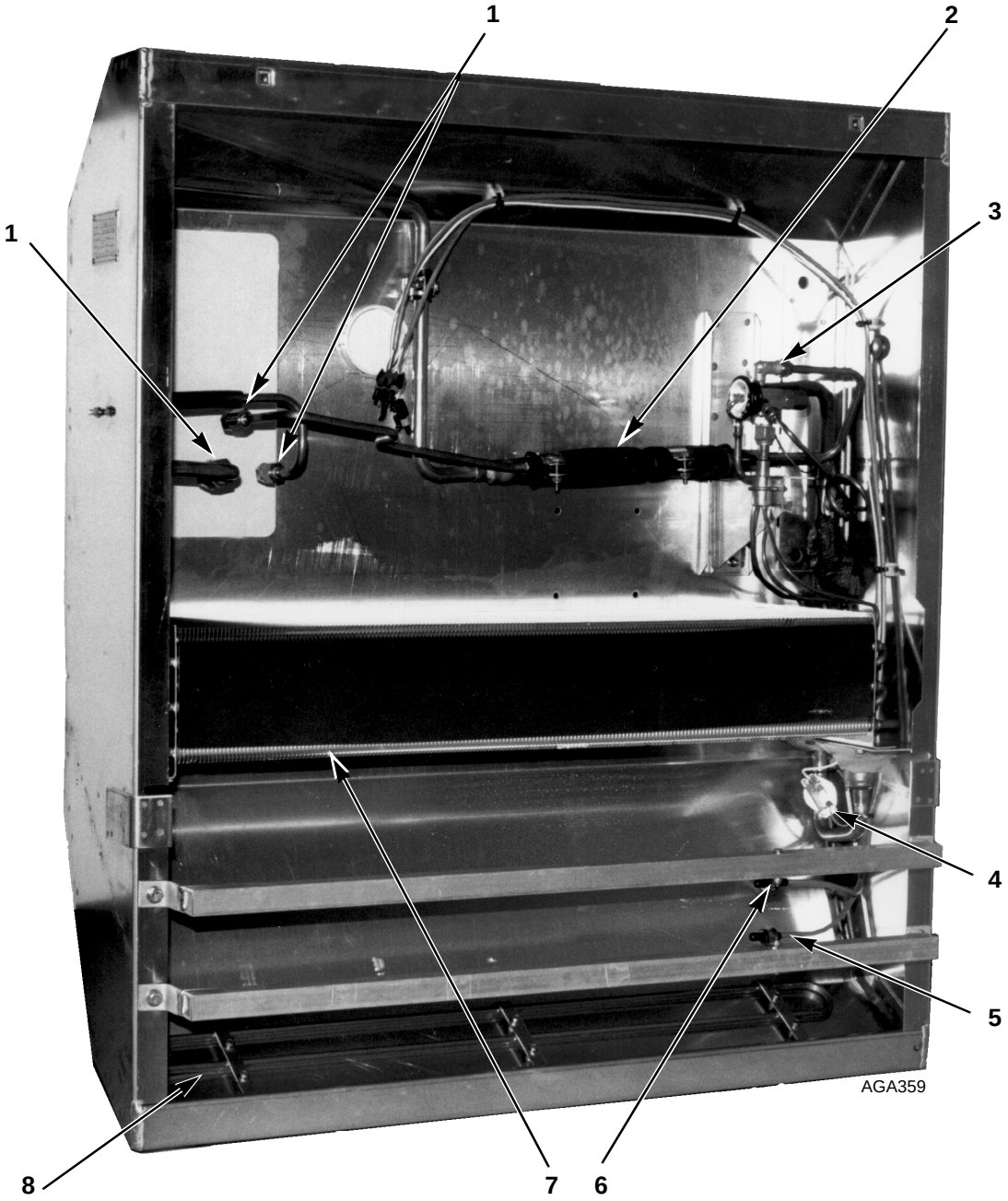


1.	Defrost Timer	5.	Terminal Board
2.	Defrost Relay	6.	Motor Contactor
3.	Circuit Breakers	7.	Overload Relay
4.	Fan Relay	8.	3-Phase Transformer

Model 20 3-Phase Control Box Components

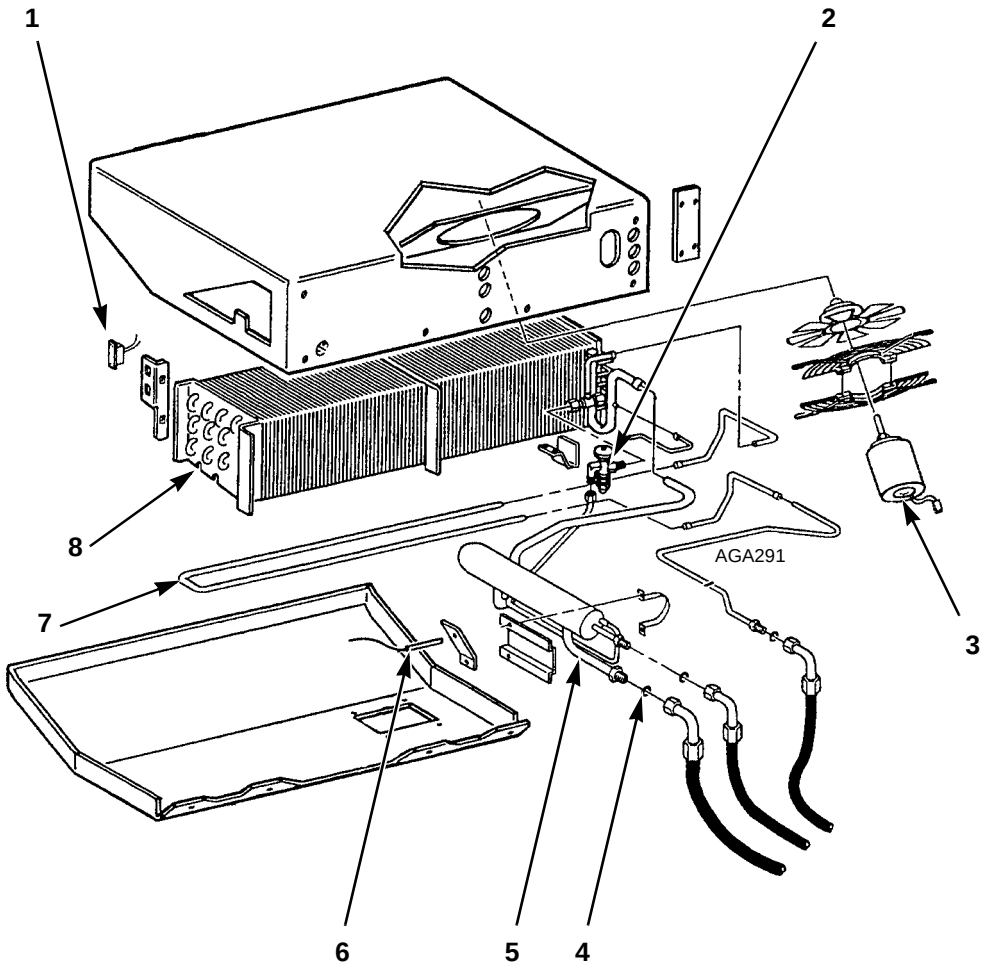
1.	Fan
2.	Thermometer Sensor
3.	Thermostat Sensor

Evaporator



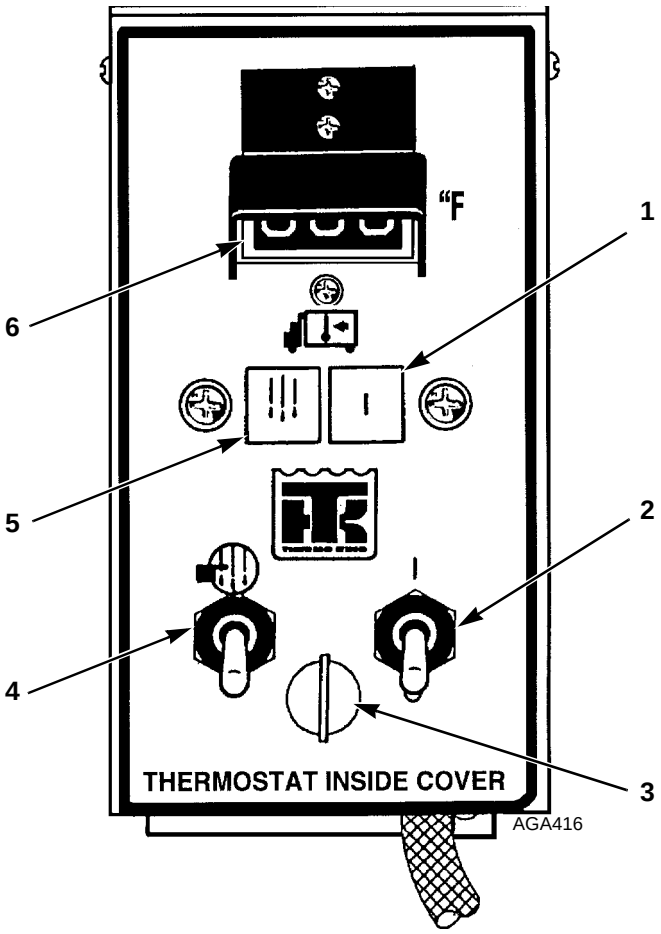
1.	ORS Fittings	5.	Thermostat Sensor
2.	Heat Exchanger	6.	Thermometer Sensor
3.	Expansion Valve	7.	Evaporator Coil
4.	Defrost Termination Switch	8.	Pan Heater

Evaporator Components



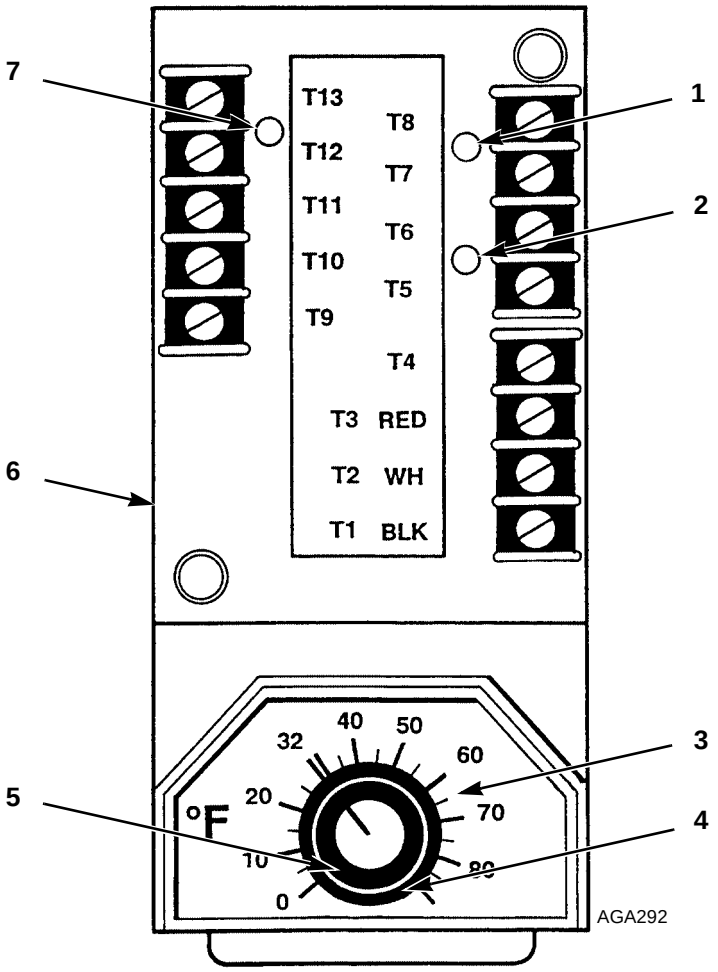
1.	Defrost Termination Switch	5.	Heat Exchanger
2.	Expansion Valve	6.	Thermostat Sensor
3.	Fan Motor (Two Used)	7.	Pan Heater
4.	ORS Fittings	8.	Evaporator Coil

Exploded View of CBci MAX Evaporator



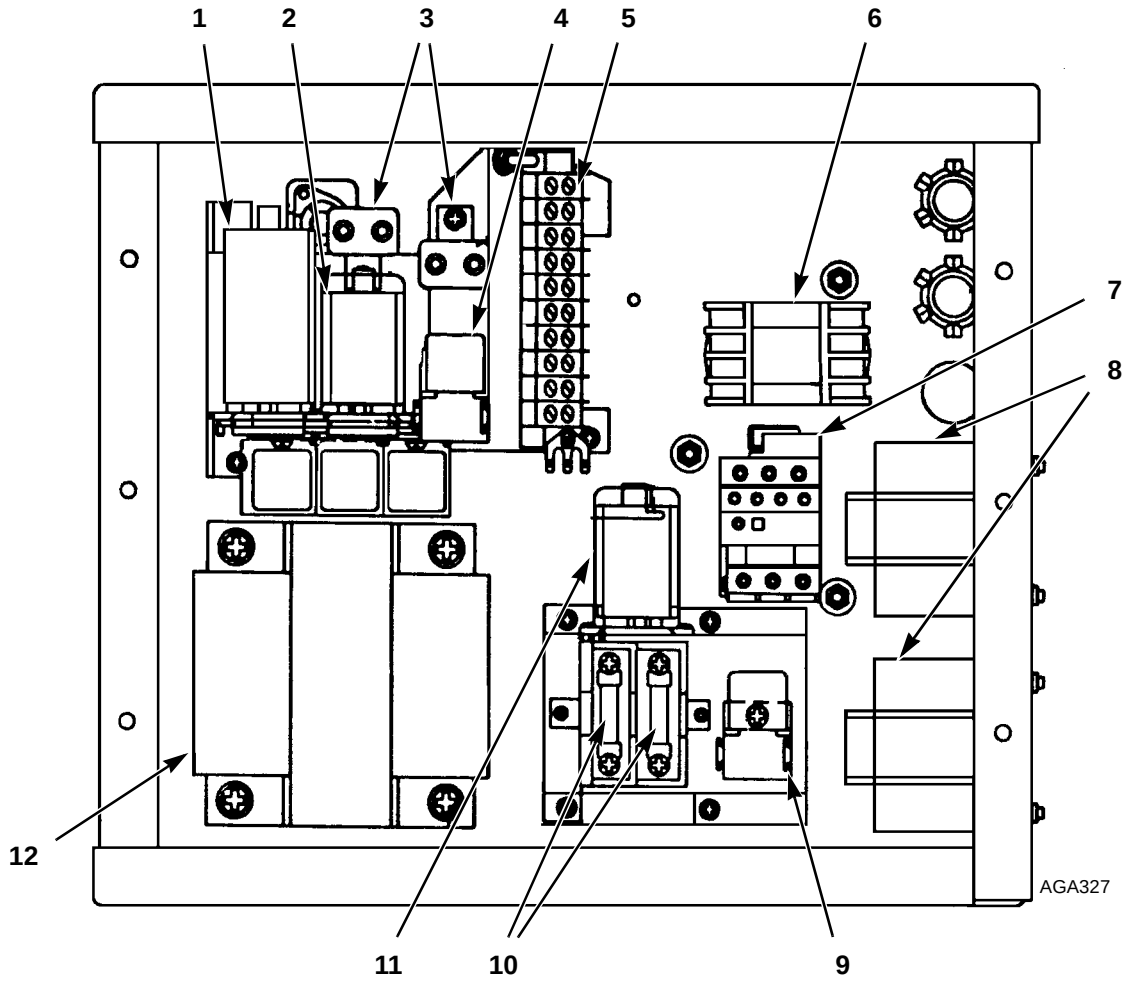
1.	On Light	4.	Manual Defrost Switch
2.	On-Off Switch	5.	Defrost Light
3.	Wing Screw	6.	Thermometer

Remote Control Box



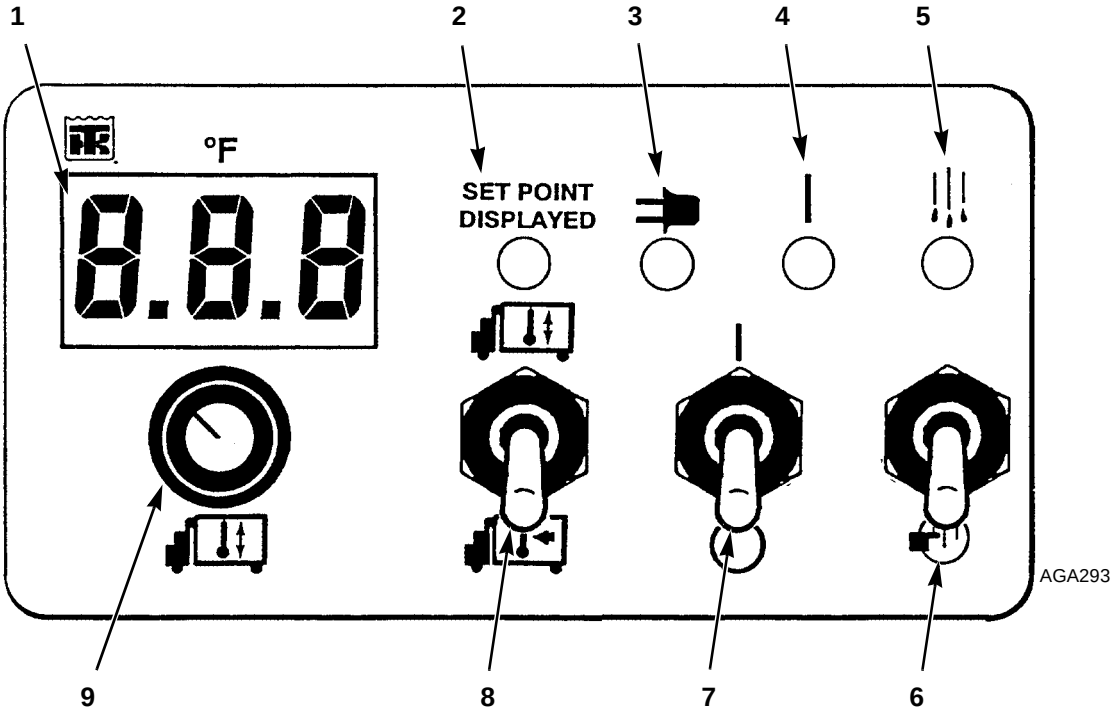
1.	Cool Light	5.	Inner Dial
2.	Heat LED	6.	Thermostat Module
3.	Thermostat Dial	7.	On LED
4.	Outer Bezel		

Inside Remote Control Box



1.	Defrost Timer	7.	Motor Overload Relay
2.	Defrost Relay	8.	Chokes
3.	Circuit Breakers	9.	Clutch Relay
4.	Fan Relay	10.	Fuse
5.	Terminal Board	11.	Standby Relay
6.	Motor Contractor	12.	Single Phase Transformer

Model 20 Single Phase Control Box Components



1.	LED Display	6.	Manual Defrost Switch
2.	Setpoint LED	7.	On-Off Switch
3.	Power Cord LED (Model 20 Only)	8.	Setpoint Switch
4.	On LED	9.	Thermostat Dial
5.	Defrost LED		

Cab Control Box

Standard on New Units

UNIT CONTROLS

Remote Control Box

1. ON-OFF SWITCH. The master On-Off switch must be in the ON position to enable this switch. Placing this switch in the ON position energizes the On light, the thermometer, and the thermostat. The unit will operate under the control of the thermostat and the defrost controls. Placing this switch in the OFF position de-energizes the On light, the thermometer, and the thermostat; the unit will not operate. If the master On-Off switch is in the OFF position, this switch is disabled.
2. MANUAL DEFROST SWITCH. Pushing this switch causes the unit to shift to defrost if the defrost termination switch is closed (the evaporator coil temperature is below 42 F [5.6 C]).
3. ON LIGHT. This light comes on when both On-Off switches are turned ON and the unit is operating.
4. DEFROST LIGHT. This light comes on when the unit is in defrost.
5. THERMOMETER. The digital thermometer displays the temperature of the air that is returning to the evaporator from the box.
6. THERMOSTAT DIAL. The thermostat dial is located inside the remote control box. Loosen the wing screw to open the remote control box and access the thermostat dial. The outer bezel must be held down to turn the inner dial. The line on the inner dial indicates the thermostat setpoint.

Optional Cab Control Box

1. THERMOSTAT DIAL. Turn this locking dial to change the thermostat setpoint. Push the outer bezel down to turn the inner knob. The setpoint switch must be pushed to display the thermostat setpoint.
2. SETPOINT SWITCH. Pushing this switch displays the thermostat setpoint on the LED display and causes the setpoint LED to light up.
3. ON-OFF SWITCH. The master On-Off switch must be in the ON position to enable this switch. Placing this switch in the ON position energizes the On LED and the thermostat. The unit will operate under the control of the thermostat and the defrost controls. Placing this switch in the OFF position de-energizes the On LED and the thermostat. The unit will not operate. If the master On-Off switch is OFF, this switch is disabled.
4. MANUAL DEFROST SWITCH. Pushing this switch causes the unit to go into defrost if the defrost termination switch is closed (the evaporator coil temperature is below 42 F [5.6 C]).
5. LED DISPLAY. The thermometer reading (sensor temperature) normally appears on this display. Pushing the Setpoint switch causes the thermostat setpoint to appear on this display.
6. SETPOINT LED. This LED lights up when the Setpoint switch is being pushed and the setpoint appears on the LED display.
7. POWER CORD LED (Model 20 only). This LED lights up if the truck is turned on while a power cord for electric standby power is connected to the unit.
8. ON LED. This LED lights up when both On-Off switches are turned ON and the unit is operating.
9. DEFROST LED. This LED lights up when the unit is in defrost.

Control Box

1. MASTER ON-OFF SWITCH. Placing this switch in ON position energizes the 8 circuit that provides power to the unit’s electrical system. Placing this switch in the OFF position de-energizes the 8 circuit and disables the unit’s electrical system.

2. DEFROST TIMER. This timer automatically places the unit in defrost every 4 hours. The defrost timer also terminates defrost 45 minutes after it starts if the defrost termination switch does not open.

3. POWER RELAY. This relay supplies power to the master On-Off switch when the truck is turned on. In Model 20 units the electric standby relay disables the power relay when the unit is connected to electric standby power.

4. ELECTRIC MOTOR RESET (Model 20 only). Pushing this button resets the electric motor overload relay if the overload relay has opened.

5. ELECTRIC STANDBY RELAY (Model 20 only). This relay is energized when the unit is connected to electric standby power. When energized, this relay disables engine-driven compressor operation and energizes the compressor motor contactor.

6. COMPRESSOR MOTOR CONTACTOR (Model 20 only). This contactor is energized by the cool relay during electric standby operation. When energized, this contactor energizes the electric standby compressor motor.

Other Controls

1. DEFROST TERMINATION SWITCH. This temperature sensitive switch is mounted on the evaporator coil and is used to control defrost. The switch closes when the evaporator temperature drops to 42 F (5.6 C). This enables defrost. The switch opens when the evaporator temperature rises to 52 F (11.1 C). This terminates defrost if the unit is in defrost. It disables defrost if the unit is not in defrost.

2. SUCTION PRESSURE REGULATOR VALVE. This valve is located in the suction line and limits the suction pressure at the compressor. The normal pressure setting for this valve is 18 psi (124 kPa).

UNIT PROTECTION DEVICES

1. CONTROL SYSTEM CIRCUIT BREAKERS. The control system circuit breaker is located in the unit control box. It trips if the control circuit is overloaded. Model 20 units have a second control system circuit breaker that protects the control circuit during electric standby operation. 40 amp circuit breakers are installed in 12 Vdc control systems, and 25 amp circuit breakers are installed in 24 Vdc control systems.

2. HIGH PRESSURE CUTOUT SWITCH. The high pressure cutout switch is a pressure sensitive switch located in the discharge line. If the discharge pressure rises above 300 psi (206 kPa), the switch opens the circuit to the compressor clutch and standby compressor motor contactor to stop unit operation.

3. CONDENSER FAN PRESSURE SWITCH. The condenser fan pressure switch is a pressure sensitive switch located in the discharge line. When the condenser head pressure rises above 180 psi (1241 kPa), the condenser fan pressure switch closes, starting the condenser fan. When the condenser head pressure falls below 130 psi (896 kPa), the condenser fan pressure switch opens, stopping the condenser fan.

4. LOW PRESSURE CUTOUT SWITCH. The low pressure cutout switch is a pressure sensitive switch located in the suction line. If the suction pressure falls below 5 to 11 psi (-17 to -37 kPa), the switch opens the circuit to the compressor clutch or the standby compressor motor contactor to stop unit operation.

5. HIGH PRESSURE RELIEF VALVE. The high pressure relief valve is designed to relieve excess pressure within the refrigeration system. The valve is a spring-loaded piston that lifts off its seat when refrigerant pressure exceeds 500 psi (3447 kPa). The valve will reset when the pressure drops to 400 psi (2758 kPa). The valve could possibly leak refrigerant after it has relieved excess pressure. Tapping the valve lightly may

help the valve reseat and SEAL PROPERLY. The valve is non-repairable and requires no adjustment. If the valve fails to reseat properly, remove the refrigerant charge and replace the valve.

The high pressure relief valve is located on a high pressure line near the condenser. Its location is such that when the pressure is expelled from the valve, it would be directed away from anyone servicing the unit.

6. LIQUID INJECTION TEMPERATURE SWITCH. The liquid injection temperature switch is mounted on the compressor discharge fitting. It activates the liquid injection system to cool the compressor. The switch closes at 230 F (110 C) and opens at 200 F (93 C).
7. OVERLOAD RELAY (Model 20 only). A manual reset overload relay protects the compressor motor. The overload relay opens the circuit from the compressor motor contactor to the electric motor if the motor overloads for any reason (e.g., low line voltage or improper power supply) while the unit is on electric standby operation.
8. TRANSFORMER FUSES (Model 20 only). The transformer fuses are located in the unit control box. They protect the transformer and rectifier from excessive current loads.

UNIT OPERATION

Weekly Pretrip Checks

The following weekly pretrip inspection should be completed before loading the truck. While the weekly inspection is not a substitute for regularly scheduled maintenance inspections, it is an important part of the preventive maintenance program designed to head off operating problems before they happen.

1. LEAKS. Inspect for refrigerant leaks and worn refrigerant lines.
2. BELTS. Inspect for cracks, wear and proper tensions.
3. ELECTRICAL INSPECTION. The electrical connections should be securely fastened. Wires and terminals should be free of corrosion, cracks or moisture.
4. DEFROST DRAINS. Check the defrost drain hoses and fittings to make sure that they are open so condensate can run out during defrost. Check the bottom end of each drain hose to make sure that it is not plugged or crushed.
5. STRUCTURAL INSPECTION. Visually check for physical damage.
6. REFRIGERANT CHARGE. Check the receiver tank sight glass for the proper charge level.

Starting the Unit

Model 10 Units

1. Adjust the thermostat setting.
2. Start the truck engine.
3. Make sure the master On-Off switch is in the ON position.
4. Place the On-Off switch in the remote or cab control box in the ON position.

Model 20 Units

Engine Operation

1. Adjust the thermostat setting.
2. Start the truck engine.
3. Make sure the master On-Off switch is in the ON position.
4. Place the On-Off switch in the remote or cab control box in the ON position.

   NOTE: The cab control box power cord light will light up if the power cord is plugged in and the truck's engine is started.

Electric Standby Operation

1. Connect the external power supply to the power receptacle. Make sure that the power supply voltage and phasing is correct for the unit as required by the electrical information plate located on the standby motor.
2. Adjust the thermostat setting.
3. Make sure the master On-Off switch is in the ON position.
4. Place the On-Off switch in the remote or cab control box in the ON position.

   NOTE: The cab control box power cord light will light up if the power cord is plugged in and the truck's engine is started.

Adjusting the Thermostat

Remote Control Box

To check or change the thermostat setting in the remote control box:

1. Open the remote control box by loosening the wing screw and lifting the cover. The thermostat dial (potentiometer) and the thermostat module will be visible.
2. The pointer on the thermostat dial indicates the thermostat setpoint.
3. The thermostat dial has a locking feature. To change the setpoint:
   a. Push the outer bezel in and hold it in with one hand.
   b. Turn the inner part of the dial to the desired setpoint with the other hand.
   c. Release the outer bezel to lock the dial in position.
4. Close the remote control box cover and tighten the wing screw.

Optional Cab Control Box

The thermometer reading (sensor temperature) normally appears on the LED display while the unit is turned on. Pressing the setpoint switch lights the setpoint LED and causes the thermostat setpoint to appear on the LED display.

To check or change the thermostat setting in the cab control box:

1. Press the setpoint switch to display the setpoint.
2. The thermostat dial has a locking feature. To change the setpoint:
   a. Push the outer bezel in and hold it in.
   b. Turn the inner part of the dial until the display shows the desired setpoint.
   c. Release the outer bezel to lock the dial in position.

   NOTE: It is difficult to press the setpoint switch, hold the outer bezel in, and turn the thermostat dial all at the same time. It may be easier to obtain the correct setpoint by repeatedly releasing the Setpoint switch, changing the position of the thermostat dial, and pressing the Setpoint switch to recheck the setpoint.

After Start Inspection

1. THERMOSTAT. Adjust the thermostat setting above and below the box temperature to check the thermostat operation (see Operating Modes).
2. PRECOOLING. With the thermostat set at the correct temperature, allow the unit to run for one-half to one hour (longer if possible) before loading the truck. Precooling will remove residual body heat and moisture from the box interior and provide a good test of the refrigeration system.
3. DEFROST. When the unit has finished pre-cooling the truck interior (the evaporator temperature has dropped below 42 F [5.6 C]), initiate a defrost cycle with the Manual Defrost switch. The defrost cycle should end automatically.

Loading Procedure

1. Make sure that the unit is Off before opening the doors to minimize frost accumulation on the evaporator coil and heat gain in the trailer. (The unit may be running when the truck is being loaded from a warehouse with door seals.)
2. Spot check and record the load temperature while loading. Especially note any off-temperature product.
3. Load the product so there is adequate space for air circulation completely around the load. DO NOT block the evaporator inlet or outlet.
4. Products should be precooled before loading. Thermo King units are designed to maintain loads at the temperature at which they are loaded. Transport refrigeration units are not designed to pull hot loads down to temperature.

Post Loading Procedure

1. Make sure that all the doors are closed and locked.
2. Adjust the thermostat to the desired temperature setpoint.
3. Start the unit.
4. One-half hour after loading, defrost the unit by momentarily pressing the Manual Defrost switch. If the coil temperature has dropped below 42 F (5.6 C), the unit will defrost. The defrost cycle should stop automatically.

Weekly Post Trip Checks

1. Wash the unit.
2. Check for leaks.
3. Check for loose or missing hardware.
4. Check for physical damage to the unit.

Electrical Maintenance

UNIT WIRING

Periodically inspect the unit wiring and the wire harnesses for loose, chafed or broken wires to protect against unit malfunctions due to open or short circuits.

REMOTE CONTROL BOX COMPONENTS

NOTE: Use a Fluke 77 or an equivalent meter for all tests.

Testing the Thermometer

Check the Thermometer Display

1. Turn the unit ON (both On-Off switches must be ON). Note what appears on the thermometer display and refer to the diagnosis chart to see what to check next.
   a. Normal display (-40 to 199 F [-40 to 93 C])
   b. Blank Display
   c. Erratic Display
   d. ⊣
   e. 1, -00, or -55

Check Power

1. Make sure the master On-Off switch is ON.
2. Open the remote control box cover.
3. Turn the remote control box On-Off switch ON.
4. Check the voltage between the 8X circuit (+ terminal) and the CH circuit (- terminal) on the back of the thermometer. Battery voltage (12 or 24 volts) should be present.
5. If battery voltage is not present, check:
   a. The wiring, connectors, and components in the power circuit (8X, 8, 2B, and 2A) to the battery.
   b. The wiring, connectors, and ground connections in the ground circuit (CH) to the battery.
6. If there are no faults in the power circuit or the ground circuit, check the sensor and the sensor circuits.
7. If there are no faults in the sensor or the sensor circuits, recheck the thermometer display. If the thermometer display has not changed, the thermometer is defective and must be replaced.

Thermometer Display Diagnosis Chart

Temperature Display	**Normal Display**	No Problem
	Blank Display	1. Check Power 2. Check Sensor and Sensor Circuits 3. Check for Reversed Red and Black Wires
	Erratic Display	1. Check Power 2. Check Sensor and Sensor Circuits
	⊣	Check Sensor and Sensor Circuits
	1, -00, or -55	Check Sensor and Sensor Circuits

Check Sensor and Sensor Circuits

1. Turn the unit ON (both On-Off switches must be turned ON).
2. Check the power to the thermometer (see Check Power).
3. Disconnect the thermometer sensor harness from the thermometer sensor wires (3 pin connector).
4. Check the voltage between the positive SN3 circuit (red wire - pin C) and the negative SN1 circuit (black wire - pin A) in the 3 pin connector on the thermometer sensor wires. The voltage should be 5.0 ± 0.5 volts.
5. If the voltage is not correct, the thermometer is defective and must be replaced.
6. If the voltage is correct, check the wiring and connectors in the SN1, SN2, and SN3 circuits to the sensor.

   If there are no faults in the SN1, SN2, and SN3 circuits, reconnect all sensor circuit connectors and recheck the thermometer display. The black, white and red wires in the thermometer lead must match the black, white, and red wires in the sensor lead.

   If the thermometer display has not changed, attach a new sensor and check the thermometer display.

   a. If the thermometer display is now normal the old sensor is defective.

   b. If the thermometer display is not normal, the thermometer is defective and must be replaced.

Faulty Thermometer

Before replacing the thermometer, make sure that another problem, such as a loose wire connection or a bad ground, is not causing the thermometer to malfunction.

Thermometer Calibration Test

1. Place the sensor in an ice-water bath for a few minutes and allow the sensor temperature to stabilize. Stir the ice-water bath occasionally to keep the temperature stable.
2. Check the thermometer reading. It should be 32 ± 1.8 F (0 ± 1 C).
3. If the thermometer reading is out of calibration, replace the sensor and repeat the test.
4. If the thermometer reading is still out of calibration, the thermometer is defective.

Testing the Thermostat

Check Power

1. Make sure the master On-Off switch is ON.
2. Open the remote control box cover.
3. Turn the remote control box On-Off switch ON. The thermostat's On LED should light up.
4. Check the voltage between the 8X circuit (T12 terminal) and the CH circuit (T13 terminal) on the front of the thermostat. Battery voltage (12 or 24 volts) should be present.
5. If battery voltage is not present, check:

   a. The wiring, connectors, and components in the power circuit (8X, 8, 2B, 2A, and 2) to the battery).

   b. The wiring, connectors, and ground connections in the ground circuit (CH) to the battery.

6. If battery voltage is present and the thermostat's On LED is not lit, the thermostat is defective.

Check the Sensor Output

1. Turn the unit ON (both On-Off switches must be turned ON).

2. Check the power to the thermostat (see Check Power).
3. Turn the On-Off switch OFF and disconnect the sensor wires from the thermostat (wires SN4, SN5, and SN6 from thermostat terminals T11, T10, and T9, respectively).
4. Check the voltage between the positive SN6 circuit (terminal T9) and the negative SN4 circuit (terminal T11) on the thermostat. The voltage should be 5.0 ± 0.5 volts.

   If the voltage is not in this range, the thermostat is defective.

Check the Thermostat Sensor

1. Turn the unit ON (both On-Off switches must be turned ON).
2. Check the thermometer display. Make sure that the thermometer is operating properly and note the reading.
3. Disconnect the thermometer sensor and the thermostat sensor from the evaporator harness (three pin connector in the evaporator). Connect the thermostat sensor to the thermometer section of the evaporator harness (wires SN1, SN2, and SN3).
4. Check the thermometer display now that the thermostat sensor is attached to the thermometer section of the evaporator harness. The thermometer should display a reading approximately equal to the reading observed in step 2. If not, the thermostat sensor is defective.

Check the Thermostat Sensor Harness and Sensor Assembly

1. Turn the unit ON (both On-Off switches must be turned ON).
2. Check the thermometer display. Make sure that the thermometer is operating properly and note the reading.
3. Disconnect the thermometer sensor harness from the thermometer sensor wires (3 pin connector).
4. Disconnect the thermostat sensor harness from the thermostat (wires SN4, SN5, and SN6 from terminals T11, T10, and T9, respectively).
5. Connect the thermostat sensor harness wires to the thermometer sensor wires. Connect wire SN4 to SN1 (red), connect SN5 to SN2 (white), and connect SN6 to SN3 (black).
6. Check the thermometer display now that the thermostat sensor harness is attached to the thermometer wires.

   The thermometer should display a reading approximately equal to the reading observed in step 2. If not, the thermostat sensor harness or the thermostat sensor is defective.

Check the Potentiometer Circuit

1. Turn the unit ON (both On-Off switches must be turned ON).
2. Check the power to the thermostat (see Check Power).
3. Check the voltage between the positive T1 circuit (black wire - T1 terminal) and the negative T3 circuit (red wire - T3 terminal) on the thermostat. The voltage should be 0.80 ± 0.10 volts. If the voltage is not in this range, the thermostat is defective.
4. Check the voltage between the positive T1 circuit (black wire - T1 terminal) and the setpoint input T2 circuit (white wire - T2 terminal) while turning the thermostat dial (potentiometer) back and forth. The voltage should increase to 0.80 volts and decrease to 0 volts as the dial is turned back and forth. If not, the potentiometer is defective.
5. Check the voltage between the negative T3 circuit (red wire - T3 terminal) and the setpoint input T2 circuit (white wire - T2 terminal) while turning the thermostat dial (potentiometer) back and forth. The voltage should increase to 0.80 volts and decrease to 0 volts as the dial is turned back and forth. If not, the potentiometer is defective.

Thermostat Switch Sequence Test

The switch sequence test should be performed during scheduled preventive maintenance operations.

NOTE: The following temperature tolerances are for temperatures at or near 32 F (0 C) and may be greater near the extremes of the setpoint range.

1. Start the unit and set the thermostat setpoint 8 to 10 F (4.4 to 5.6 C) below the thermometer reading. The Cool LED should be lit, the cool relay should be energized, the Heat LED should not be lit, the heat relay should be de-energized, and the unit should operate in cool.
2. Slowly turn the thermostat dial up to raise the thermostat setpoint about 2 F (1.1 C) every 5 seconds. When the thermostat setpoint reaches the thermometer reading ± 1 F (0.6 C), the unit should shift to null. The Cool LED should go out and the Heat LED should not be lit. The cool relay and the heat relay should both be de-energized.
3. Continue to slowly turn the thermostat dial up and raise the thermostat setpoint about 2 F (1.1 C) every 5 seconds. When the thermostat setpoint reaches 2 ± 1 F (1.1 ± 0.6 C) above the thermometer reading, the unit should shift to Heat (optional). The Heat LED should light up and the Cool LED should not be lit. The heat relay should be energized and the cool relay should be de-energized.
4. Slowly turn the thermostat dial down to lower the thermostat setpoint about 2 F (1.1 C) every 5 seconds. When the thermostat setpoint reaches the thermometer reading ± 1 F (0.6 C), the unit should shift to null. The Heat LED should go out and the Cool LED should not be lit. The cool relay and the heat relay should both be de-energized.
5. Continue to slowly turn the thermostat dial down and lower the thermostat setpoint about 2 F (1.1 C) every 5 seconds. When the thermostat setpoint reaches 2 ± 1 F (1.1 ± 0.6 C) below the thermometer reading, the unit should shift to cool. The Cool LED should light up and the Heat LED should not be lit. The cool relay should be energized and the heat relay should be de-energized.

If the unit does not shift operating modes properly, make sure that the cool relay, the heat relay, the associated wiring, and the wire connections are not defective before assuming that the thermostat is faulty. Specifically:

1. Battery voltage must be present on wire 8X (T12 terminal), and wire CH (T13 terminal) must be grounded at the thermostat when the unit is turned on.
2. Terminals T5, T7, and T13 must have continuity to each other and to the CH circuit (chassis ground).
3. The thermostat energizes the cool relay, which shifts the unit to Cool, by sending a 12 or 24 volt signal from the CR circuit (T8 terminal) to pin 85 of the cool relay coil.
4. The thermostat energizes the heat relay, which shifts the unit to heat (optional), by sending a 12 or 24 volt signal from the HR circuit (T6 terminal) to pin 85 of the heat relay coil.

Therefore, the thermostat is not defective if it sends a voltage signal (12 or 24 volts) to the CR and HR circuits properly.

Thermostat Calibration Procedure

1. Set the thermostat at 32 F (0 C).
2. Start the unit and let it run until it shifts from cool to null.

3. Use a known good thermometer (or a 32 F [0 C] ice-water bath) to check the switch points. The unit should shift from cool to null at 32 F (0 C).

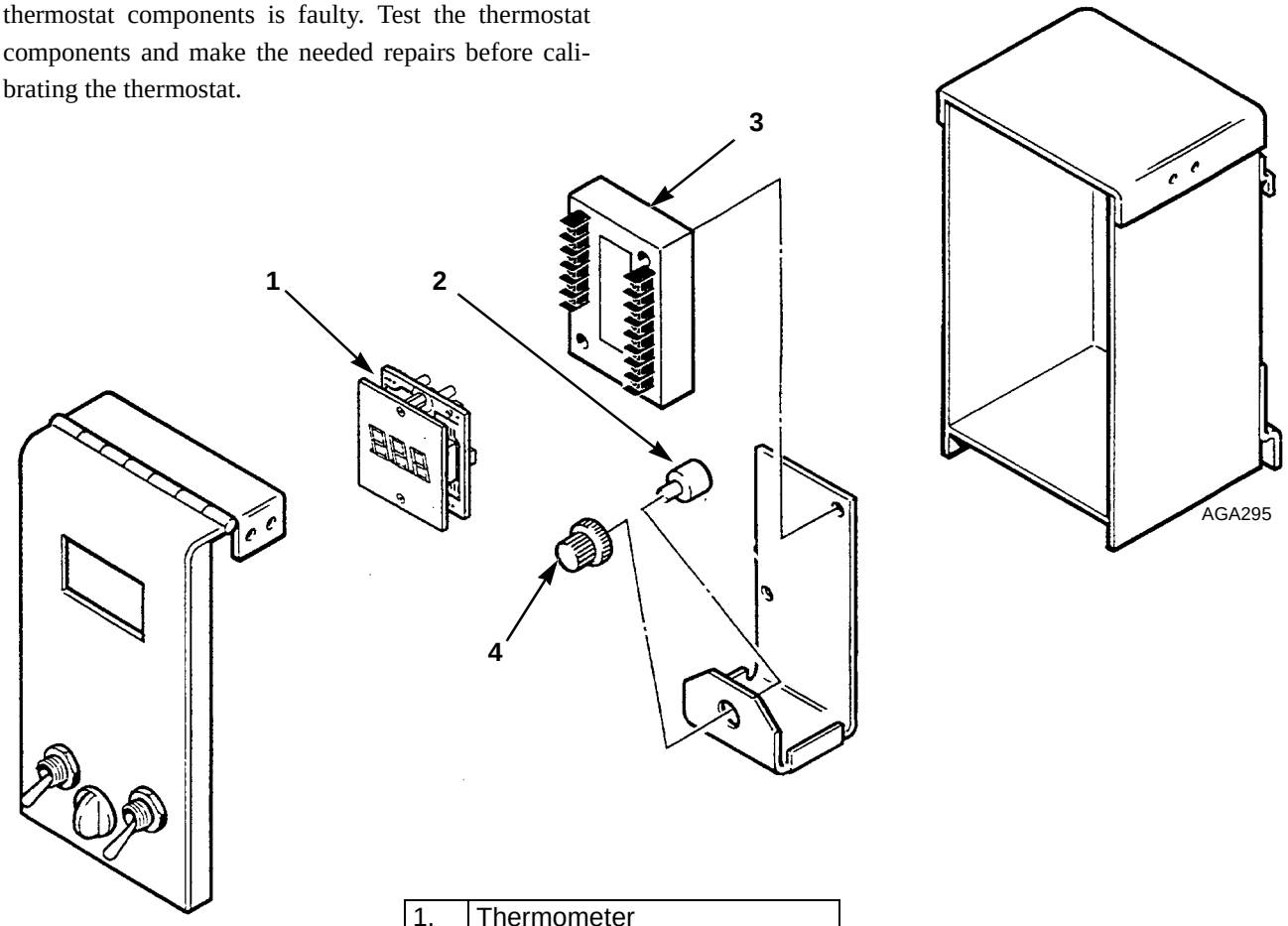
4. If the unit shifts modes properly and is out of calibration by less than 5 F (2.7 C), recalibrate the thermostat by loosening the set screw and repositioning the thermostat dial.

   If the thermostat shifts modes erratically or is out of calibration by more than 5 F (2.7 C), at least one of the thermostat components is faulty. Test the thermostat components and make the needed repairs before calibrating the thermostat.

CAB CONTROL BOX COMPONENTS (OPTIONAL)

Temperature Control Module (TCM)

The TCM is located in the cab control box. The TCM contains the thermometer and the thermostat. The thermometer and the thermostat share the same digital LED display and use the same sensor.



1.	Thermometer
2.	Potentiometer
3.	Thermostat
4.	Locking Thermostat Dial

Remote Control Box Components

Digital Thermometer

The range for the thermometer is -40 to 199 F (-40 to 93 C). Normally the thermometer reading appears on the LED display. Pressing the Setpoint switch causes the thermostat setpoint to appear on the LED display.

Thermostat

The setpoint range for the thermostat is 0 to 80 F (-18 to 30 C). The thermostat setpoint appears on the LED display when the Setpoint switch is pressed. Turning the dial under the LED display changes the setpoint. The thermostat controls the operation of the unit by controlling the cool and heat relays

Initial TCM Display Test

1. Turn the unit ON (both On-Off switches must be ON). Note what appears on the LED display. This is the temperature display.
   a. Normal display (-40 to 199 F [-40 to 93 C])
   b. Blank Display
   c. Erratic Display
   d. ⊣
   e. 1, -00, or -55
2. Press the Setpoint switch and note what appears on the LED display. This is the setpoint display.
   a. Normal Display (0 to 80 F[-18 to 30 C])
   b. Blank Display
   c. Erratic Display
   d. No Change
3. Refer to the TCM Display Diagnosis Chart to see what to check next.

TCM Display Diagnosis Chart

		Setpoint Display			
		Normal Display	**Blank Display**	**Erratic Display**	**No Change**
Temperature Display	**Normal Display**	No Problem	Faulty TCM	Faulty TCM	Faulty TCM
	Blank Display	Check Sensor & Sensor Circuits	Check Power	Check Power	Check Power
	Erratic Display	Check Sensor & Sensor Circuits	Check Power	Check Power	Check Power
	⊣	Check Sensor & Sensor Circuits	Faulty TCM	Faulty TCM	Faulty TCM
	1, -00, or -55	Check Sensor & Sensor Circuits	Faulty TCM	Faulty TCM	Faulty TCM

Check Power

1. Make sure the master On-Off switch is ON.
2. Disconnect the 14 pin connector (cab control box extension harness) from the back of the cab control box.
3. Check the voltage between the 8 circuit (pin 8) and the CH circuit (pin 13) in the 14 pin connector on the cab control box extension harness. Battery voltage (12 or 24 volts) should be present.
4. If battery voltage is not present, check:
   a. The wiring, connectors and components in the power circuit (8, 2B, and 2A) to the battery.
   b. The wiring, connectors, and ground connections in the ground circuit (CH) to the battery.
5. If there are no faults in the power circuit or the ground circuit, repeat the Initial TCM Display Test. If the results of the test have not changed, the TCM is defective and must be replaced.

Check Sensor and Sensor Circuits

1. Turn the unit ON (both On-Off switches must be turned ON).
2. Disconnect the sensor from the evaporator wire harness (three pin connector).
3. Check the voltage between the positive SN3 circuit (pin C) and the negative SN1 circuit (pin A) in the three pin connector on the evaporator harness. The voltage should be 5.0 ± 0.5 volts.
4. If the voltage is not correct, check the wiring and connectors in the SN1, SN2, and SN3 circuits back to the cab control box.

   If there are no faults in the SN1, SN2, and SN3 circuits, repeat the Initial TCM Display Test. If the results of the test have not changed, the TCM is defective and must be replaced.
5. If the voltage is correct, attach a new sensor and check the thermometer display.
   a. If the thermometer display is now normal, the old sensor is defective.
   b. If the thermometer display is not normal, check the wiring and connectors in the SN2 circuit.

      If there are no faults in the SN2 circuit, repeat the Initial TCM Display Test. If the results of the test have not changed, the TCM is defective and must be replaced.

Faulty TCM

Before replacing the TCM make sure that another problem, such as a loose wire connection or a bad ground, is not causing the TCM to malfunction.

Thermometer Calibration Test

1. Place the sensor in an ice-water bath for a few minutes and allow the sensor temperature to stabilize.
2. Check the thermometer reading. It should be 32 ± 1.8 F (0 ± 1 C).
3. If the thermometer reading is out of calibration, replace the sensor and repeat the test.
4. If the thermometer reading is still out of calibration, the TCM is defective.

Thermostat Switch Sequence Test

This test should be performed during scheduled preventive maintenance operations. Make sure that the thermometer is calibrated before performing this test.

NOTE: Press the Setpoint switch to display the thermostat setpoint.

1. Start the unit and set the thermostat setpoint 8 to 10 F (4.4 to 5.6 C) below the thermometer reading. The cool relay should be energized, the heat relay should be de-energized, and the unit should operate in cool.
2. Slowly turn the thermostat dial up to raise the thermostat setpoint about 2 F (1.1 C) every 5 seconds. When the thermostat setpoint reaches the thermometer reading ± 1 F (± 0.6 C), the unit should shift to null. The cool relay and the heat relay should both be de-energized.
3. Continue to slowly turn the thermostat dial up and raise the thermostat setpoint about 20 F (1.1 C) every 5 seconds. When the thermostat setpoint reaches 2 ± 1 F (1.1 ± 0.6 C) above the thermometer reading, the unit should shift to heat (optional). The heat relay should be energized and the cool relay should be de-energized.
4. Slowly turn the thermostat dial down to lower the thermostat setpoint about 20 F (1.1 C) every 5 seconds. When the thermostat setpoint reaches the thermometer reading ± 1.0 F (± 0.6 C), the unit should shift to null. The cool relay and the heat relay should both be de-energized.
5. Continue to slowly turn the thermostat dial down and lower the thermostat setpoint about 2 F (1.1 C) every 5 seconds. When the thermostat setpoint reaches 2 ± 1 F (1.1 ± 0.6 C) below the thermometer reading, the unit should shift to cool. The cool relay should be energized and the heat relay should be de-energized.

If the unit does not shift operating modes properly, make sure that the cool relay, the heat relay, the associated wiring, and the wire connections are not defective before assuming that the TCM is faulty. Specifically:

1. Battery voltage must be present on wire CR1 (pin 5) and wire HR1 (pin 7) in the 14 pin connector on the cab control box wire harness when the unit is turned on.
2. The thermostat energizes the cool relay, which shifts the unit to cool, by closing internal contacts that connect the CR1 circuit to the CR circuit.
3. The thermostat energizes the heat relay, which shifts the unit to heat (optional), by closing internal contacts that connect the HR1 circuit to the 11R circuit.

Therefore, the TCM is not defective if it energizes the CR and HR circuits properly.

Thermostat Calibration Procedure

1. Set the thermostat at 32 F (0 C).
2. Start the unit and let it run until it shifts from cool to null.
3. Use a known good thermometer (or a 32 F [0 C] ice-water bath) to check the switch points. The unit should shift from cool to null at 32 F (0 C).
4. If the units shifts modes properly and is out of calibration by less than 5 F (2.7 C), recalibrate the thermostat by loosening the set screw and repositioning the thermostat dial.

If the thermostat shifts modes erratically or is out of calibration by more than 5 F (2.7 C), at least one of the thermostat components is faulty. Test the thermostat components and make the needed repairs before calibrating the thermostat.

DEFROST SYSTEM

Engine Operation

A defrost cycle can be initiated by pressing the manual defrost switch or by the defrost timer when the defrost termination switch is closed. Starting a defrost cycle energizes the defrost relay and the 26 circuit, and de-energizes the fan relay, which stops the evaporator and condenser fans.

Energizing the 26 circuit diverts hot gas into the evaporator coil, melting the ice. The defrost termination switch de-energizes the defrost relay when the evaporator temperature rises above 52 F (11.1 C).

To check the defrost cycle, run the unit in cool to drop the evaporator coil to a temperature below 42 F (5.6 C). Press the manual defrost switch. The unit should shift from the cool to defrost. If the unit continues to cool, double check the evaporator coil temperature, and refer to Testing the Defrost System.

Electric Standby Operation (Model 20 Only)

Defrost operates essentially the same on electric standby as it does on engine operation.

NOTE: It takes more time to complete a defrost cycle in low ambient temperatures (below 35 F [2 C]) than it does in high ambient temperatures (above 70 F [21 C]). Therefore, consider the ambient temperature before deciding that a unit is not defrosting properly.

Defrost Components

Defrost Timer

The defrost timer initiates and, if necessary, terminates the defrost cycle.

The timer is wired to initiate a defrost cycle every 4 hours. The timing cycle begins when the defrost termination switch closes. Every time the defrost termination switch opens, the timer resets to zero.

At the initiation of the defrost cycle, a 45 minute timer is activated. If the defrost termination switch does not open and terminate the defrost cycle, the timer will terminate the defrost cycle 45 minutes after it started.

It is possible that the defrost timer could fail and not allow the unit to defrost. In this case, bypass the defrost timer by removing it from its socket and placing the defrost jumper in the defrost timer socket slots 1, 2, and 3. Pressing the Manual Defrost switch should then cause the unit to shift to defrost until the defrost termination switch opens.

Manual Defrost Switch

A Manual Defrost switch is located in the remote or cab control box. Pressing the Manual Defrost switch initiates the defrost cycle if the defrost termination switch is closed.

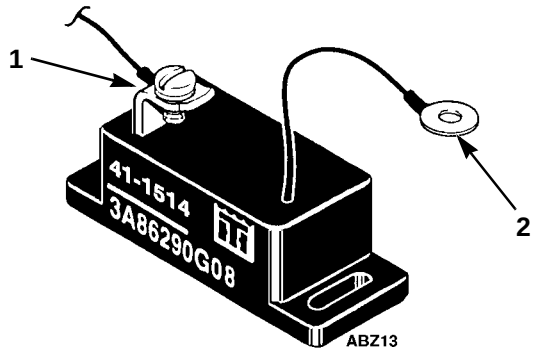
Defrost Termination Switch

The electronic defrost termination switch uses solid state components to control the defrost circuit. The switch is mounted in the evaporator and controls the defrost cycle in response to the evaporator coil temperature. The switch is closed when the evaporator coil temperature is below 42 F (5.6 C), completing the defrost circuit to ground (CH) and preparing the electrical system for the defrost cycle.

When the unit does shift into a defrost cycle, the evaporator fan stops, and heat from the hot refrigerant gas melts the frost from the evaporator coil. The switch opens and terminates the defrost cycle when the evaporator coil temperature rises to 52 F (11.1 C).

Installation

The proper polarity must be observed when installing the defrost termination switch. The wire from the switch is negative and must be attached to the chassis ground of the unit. This chassis ground wire cannot be attached to either of the switch mounting screws or an improper ground may result. The 12 wire from the unit attaches to the screw terminal that is mounted solidly on the switch. If the polarity is reversed on the device, it will conduct continuously and act like a switch that is stuck closed.



1.	Screw Terminal	2.	Ground Wire

Defrost Termination Switch

Defrost Termination Switch Bench Test

1. Connect a test light between the screw terminal on the switch and the positive battery terminal.

   NOTE: Attempting to test the electronic defrost termination switch with an ohmmeter is generally not satisfactory because of the low voltage available at the meter leads.

2. Connect the ground wire of the switch to the negative battery terminal.

3. Raise the temperature of the defrost termination switch above 52 F (11.1 C). The light should be off, indicating an open switch.

4. Cool the defrost termination switch below 42 F (5.6 C). The light should come on, indicating the switch has closed.

   NOTE: Allow adequate time for the temperature change to saturate the defrost termination switch before performing the test.

Defrost Relay

The defrost relay controls the operation of the defrost cycle. When the defrost timer or the Manual Defrost switch completes the circuit through the defrost termination switch to ground, the defrost relay is energized. This energizes the 26 circuit and de-energizes the fan relay. The defrost relay stays energized until the defrost cycle is terminated by the defrost termination switch or the automatic defrost timer.

Pilot Solenoid

The pilot solenoid is an electrical valve that controls the operation of the three-way valve in the refrigeration system. The pilot solenoid is energized by the 26 circuit. When the pilot solenoid coil is energized, it lifts the pilot solenoid valve piston and allows refrigerant pressure to shift the three-way valve. This routes hot refrigerant gas to the evaporator.

Testing the Defrost System

To test the defrost system, run the unit on Cool until the evaporator coil temperature is below 42 F (5.6 C) and press the Manual Defrost switch.

If the unit shifts to defrost momentarily but shifts out of defrost when the switch is released, check the defrost timer.

If the unit will not shift to defrost, or if the defrost cycle will not terminate, see the following defrost checkout procedure.

CAUTION: Do not forget to remove the jumper wires from the unit after checking or testing unit components.

Unit Does Not Defrost

1. Check the evaporator temperature:

   Make sure that the evaporator temperature is actually below 42 F (5.6 C) if the unit will not defrost. Use a test thermometer to check the evaporator temperature.

2. Check the defrost termination switch:

   If the unit fails to defrost, place a jumper wire between the 12 wire at the screw terminal on the defrost termination switch and a good ground. Press the Manual Defrost switch.

   If the unit shifts to defrost, the defrost termination switch is defective.

   If the unit does not shift to defrost, check for an open circuit in the 12 circuit that goes back to the Manual Defrost switch. If the 12 circuit is not open, go to step 3.

3. Check the Manual Defrost switch:

   Place a jumper wire between a good ground (CH) and the 11 wire in the four pin connector that connects the control relay harness to the main wire harness. This connector is located inside the unit control box.

If the unit shifts to defrost immediately, check for an open circuit in the 11 circuit that goes back to the Manual Defrost switch. If the 11 circuit is not open, the Manual Defrost switch is defective.

If the unit does not shift to defrost, go to step 4.

4. Check the defrost timer:

   Remove the defrost timer from its socket and insert the defrost jumper into socket slots 1, 2, and 3. Press the Manual Defrost switch.

   If the unit shifts to defrost, the defrost timer is defective.

   If the unit does not shift to defrost, go to step 5.

5. Place a jumper wire between a good ground and the 11A wire at the defrost relay socket (B terminal).

   If the unit shifts to defrost, check for an open circuit in the 11A circuit between the defrost timer socket and the four pin connector that connects the control relay harness to the main wire harness.

   If the unit does not shift to defrost, check for battery voltage on the 8 wire at the defrost relay socket (A terminal).

   If battery voltage is present on the 8 wire, the defrost relay is defective.

   If battery voltage is not present, check for an open circuit in the 8 circuit between the defrost relay socket and the terminal board.

Unit Will Not Terminate Defrost

NOTE: The defrost timer should automatically terminate the defrost cycle 45 minutes after it is initiated.

Unit Sticks in Defrost Indefinitely

1. Check the defrost timer:

   If the unit has been stuck in defrost for more than 45 minutes, remove the defrost timer from its socket.

   If the unit shifts out of defrost, the defrost timer is defective.

   If the unit remains in defrost, go to step 2.

2. Remove the defrost relay from its socket and check the 11A wire (slot B in the defrost relay socket) for continuity to ground.

   If the 11A wire is not grounded, the defrost relay is defective.

   If the 11A wire is grounded, find and repair the short to ground.

Unit Continually Fails to Terminate Defrost (In Less than 45 Minutes)

If the unit continually fails to complete the defrost cycle in less than 45 minutes and cycles between cool and defrost, check the evaporator coil temperature, three-way valve seal, refrigerant charge, defrost termination switch, and the 11 and 12 wires.

1. Check the Evaporator Temperature:

   Be sure the evaporator temperature is actually above 52 F (11.1 C) if the unit will not terminate defrost. Use a test thermometer to check the temperature. If the evaporator temperature does not rise enough to bring the unit out of defrost, the unit may be low on refrigerant, or the condenser seal in the three-way valve may be leaking.

   To check the three-way valve or the condenser check valve, refer to the procedures described in TK 5984, Diagnosing the Thermo King Refrigeration System.

   To check the refrigerant charge, refer to Refrigerant Charge in the Refrigeration Maintenance chapter.

2. Check the operation of the defrost termination switch.

   If the unit will not come out of defrost, disconnect the 12 wire from the defrost termination switch. If the unit shifts back to cool, the defrost termination switch is not opening and should be replaced. If the unit remains in defrost, move to step 3.

3. Check the 11 and 12 wires for a ground:

   If the unit remains in defrost, use an ohmmeter to check the 11 and 12 wires for a ground. If the 11 or 12 wire is grounded, find the grounded portion and repair it.

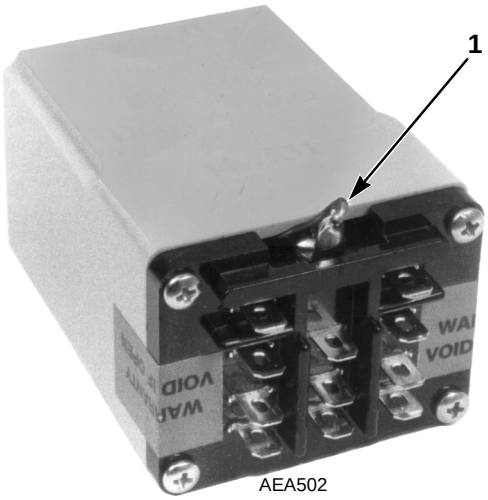
Defrost Timer

The defrost timer both initiates and terminates the defrost cycle.

First, the timer will initiate a defrost cycle at 4, 8, or 12 hour intervals. The jumper between the 7 terminal and the 5, 8 or 9 terminal of the timer socket determines the time interval.

The timing cycle begins when the defrost termination switch closes. If the defrost termination switch opens during the timing cycle, the timer will reset at zero when the defrost termination switch closes.

Second, the defrost timer will terminate the defrost cycle after 45 minutes if the defrost termination switch has not opened.



1.	Test Terminal

Defrost Timer

Temporary Defrost Timer Bypass Procedure

If the timer fails and a replacement is not available, bypassing the timer will allow the manual defrost switch to provide defrost control.

Bypass Procedure

1. Remove the defrost timer from its socket.
2. Remove the defrost jumper from the bottom of the terminal board. Insert the defrost jumper into slots 1, 2, and 3 in the defrost timer socket.
3. To install a new timer, remove the defrost jumper from the defrost timer socket and insert the new defrost timer. Place the defrost jumper back on the bottom of the terminal board.

Defrost Timer Test

1. With the defrost termination switch open, press the Manual Defrost switch. The unit should not go into defrost.
2. Connect the screw terminal on the defrost termination thermostat (12 circuit) to CH. Press the Manual Defrost switch. The unit should go into defrost. Disconnect the CH circuit from the 12 circuit. The defrost relay should open.
3. Connect the jumper from the timer test terminal to ground. Reconnect the CH circuit to the 12 circuit, and then press the manual defrost switch. The unit should go into defrost for about 10 seconds, and then terminate defrost even though the 12 circuit is still connected to CH.

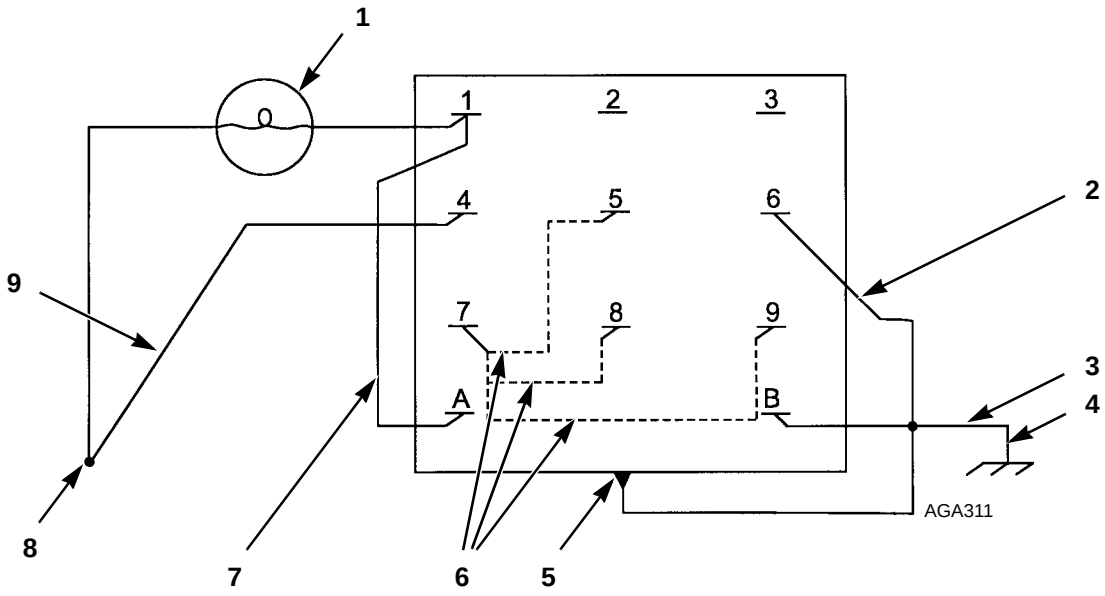
Cycle Interval	Test Duration
4 hours	1 minute
8 hours	2 minutes
12 hours	3 minutes

4. Approximately 1 to 3 minutes after the timer terminated defrost, the defrost cycle should reinitiate for another brief period of time. This On-Off cycle should repeat until the 12 circuit opens.
5. If the defrost timer fails to function properly, replace the defrost timer.

Defrost Timer Bench Test

The defrost timer may be removed from the unit and bench tested. Use the drawing to identify the terminals used to perform the bench test. Obtain a 12 volt battery or a 12 Vdc power supply, some test leads, and a test light.

1. Attach a test lead to the test terminal and to the negative terminal of the power source.
2. Attach a test lead to the B terminal and to the negative terminal of the power source.
3. Attach a test lead to the 6 terminal and to the negative terminal of the power source.
4. Connect a test light between the A terminal and the #1 terminal.
5. Attach a test lead to the 7 terminal and to the 5, 8, or 9 terminal. The terminal selected will determine the off time of the test.
   a. 5—4-hour selection Approx. 1 minute
   b. 8—8-hour selection Approx. 2 minutes
   c. 9—12-hour selection Approx. 3 minutes



1.	Test Light From Note 4 Above	6.	Test Lead From Note 5 Above
2.	Test Lead From Note 3 Above	7.	Test Lead From Note 1 Above
3.	Test Lead From Note 2 Above	8.	Battery Positive Terminal
4.	Battery Negative Terminal	9.	Test Lead From Note 7 Above
5.	Timer Test Terminal		

Defrost Timer Bench Test

6. Attach a test lead to the A terminal and to the positive terminal of the power source.
7. Attach a test lead to the 4 terminal and to the positive terminal of the power source.
8. The test light should come on for approximately 10 seconds. This is the speed-up mode of the 45 minute maximum defrost interval.
9. The test light should then turn off for approximately 1 to 3 minutes depending on which terminal 7 is connected to. This is the speed-up mode of the interval between defrost cycles.
10. A good timer will alternate between 10 second "on" time and the 1 to 3 minute "off" time until the 6 terminal is disconnected from the negative terminal of the power source. Replace the timer if it fails to function properly.

CIRCUIT BREAKERS

Units with 12 volt systems use 40 amp circuit breakers. Units with 24 volt systems use 25 amp circuit breakers.

CB2

This auto reset circuit breaker is located in the unit control box. Electrically it is located between the 2 circuit and the 2A circuit. It protects the unit control circuits during truck engine operation.

If CB2 opens, check the unit for a grounded wire, a defective solenoid, a defective relay, or a defective fan motor.

CB1 (Model 20 Only)

This auto reset circuit breaker is located in the unit control box. Electrically it is located between the 2R circuit and the 2B circuit. It protects the unit control circuits during electric standby operation.

If CBI opens, check the unit for a grounded wire, a defective solenoid, a defective relay, or a defective fan motor.

CONDENSER FAN PRESSURE SWITCH (CFPS)

The CFPS is located in the discharge line. Electrically it is located between the J circuit and the CH circuit. It closes to energize the condenser fan when the head pressure rises to 180 ± 10 psi (1241 ± 69 kPa). It opens to de-energize the condenser fan when the head pressure drops to 130 ± 10 psi (896 ± 69 kPa). To check the CFPS:

1. Install a manifold gauge set.
2. Connect a voltmeter between the J circuit and the CH circuit where the CFPS wires are connected to the main wire harness.
3. Run the unit on cool, check the voltmeter reading, and watch the condenser fan.

   a. When the head pressure is below 180 ± 10 psi (1241 ± 69 kPa), the CFPS should be open, the voltmeter should indicate battery voltage, and the condenser fan should not be running.

      If the voltage is low and the condenser fan is running, the CFPS is defective.

      If the voltage is low and the condenser fan is not running, check the power circuit (J, CF, and 8) back through the condenser fan motor and the fan relay to the battery. Also check the ground circuit (CH) back to the battery.

   b. When the head pressure rises above 180 ± 10 psi (1241 ± 69 kPa), the CFPS should close, the voltmeter should indicate a very low voltage, and the condenser fan should be running.

   c. When the head pressure drops below 130 ± 10 psi (896 ± 69 kPa), the CFPS should open, the voltmeter should indicate battery voltage, and the condenser fan should not be running.

   If the CFPS does not open or close at the proper pressures, it is defective and must be replaced.

ELECTRIC STANDBY CIRCUITS (Model 20 Only)

Make sure the unit is connected to the proper power source. The current draw through the compressor motor should not exceed the full load current listed in the Specifications.

The DC current draw through the 2B wire should not exceed 35 amps in 12 volt systems and 22 amps in 24 volt systems.

If the DC current is excessive, check the current draw through each fan motor. The current draw through an individual fan motor should not exceed the full load current listed in the Specifications.

If the fan motor currents are satisfactory, check the control relays and switches for shorts.

When the unit is inoperative, follow a systematic checking sequence. This will save time and eliminate guesswork.

Check the power cable receptacle for power. If power is present, check for power at the unit terminal board.

Check for control circuit power at the circuit breaker.

If the contactor is pulled down but the compressor motor fails to start, the trouble is probably in the compressor motor assembly.

12 Volt System, Three Phase Electric Standby

The DC voltage should be 12 to 15 volts and the current through the 2B wire should be less than 35 amps. If the current is less than 35 amps and the voltage is less than 12 volts:

1. Check the AC line voltage and the transformer fuses. The line voltage must be at least 90% of the voltage specified for the unit. If the AC line voltage is acceptable and the transformer fuses are intact, go to step 2.
2. Measure the transformer output voltage (AC) at the terminal board. Measure the voltage between wires A and B, between wires B and C, and between wires A and C. The voltage reading at each pair of wires should be equal to (within 10%) the voltage readings at the other pairs of wires. If not the transformer is defective. If the transformer output voltage is acceptable, go to step 3.
3. Check the rectifier output voltage (DC) on the 2R wires at CB1. If this voltage is less than 12 Vdc and the load is not excessive (less than 35 amps) the rectifier is defective.

24 Volt System, Three Phase Electric Standby

The DC voltage should be 24 to 30 volts and the current through the 2B wire should be less than 22 amps. If the current is less than 22 amps and the voltage is less than 24 volts:

1. Check the AC line voltage and the transformer fuses. The line voltage must be at least 90% of the voltage specified for the unit. If the AC line voltage is acceptable and the transformer fuses are intact, go to step 2.
2. Measure the transformer output voltage (AC) at the terminal board. Measure the voltage between wires A and B, between wires B and C, and between wires A and C. The voltage reading at each pair of wires should be equal to (within 10%) the voltage readings at the other pairs of wires. If not, the transformer is defective. If the transformer output voltage is acceptable, go to step 3.
3. Check the rectifier output voltage (DC) on the 2R wires at CB1. If this voltage is less than 24 Vdc and the load is not excessive (less than 22 amps), the rectifier is defective.

12 Volt System, Single Phase Electric Standby

The DC voltage should be 12 to 15 volts and the current through the 2B wire should be less than 35 amps. If the current is less than 35 amps and the voltage is less than 12 volts:

1. Check the AC line voltage and the transformer fuses. The line voltage must be at least 90% of the voltage specified for the unit. If the AC line voltage is acceptable and the transformer fuses are intact, go to step 2.
2. Measure the transformer output voltage (AC) at the terminal board. Measure the voltage between wires A and B. If the transformer output voltage is less than 16 volts AC, the transformer is defective. If the transformer output voltage is acceptable, go to step 3.
3. Check the rectifier output voltage (DC) on the 2R wires at CB1.

   If the rectifier output voltage is less than 14 Vdc and the load is not excessive (less than 35 amps), check the choke coil jumper to make sure that it is installed correctly.

   If the rectifier output voltage is more than 14 Vdc, the load is not excessive (less than 35 amps), and the choke coil jumper is installed correctly, the rectifier is defective.

   If the rectifier output voltage is more than 14 Vdc, the choke is defective.

24 Volt System, Single Phase Electric Standby

The DC voltage should be 24 to 30 volts and the current through the 2B wire should be less than 22 amp. If the current is less than 22 amps and the voltage is less than 24 volts:

1. Check the AC line voltage and the transformer fuses. The line voltage must be at least 90% of the voltage specified for the unit. If the AC line voltage is acceptable and the transformer fuses are intact, go to step 2.
2. Measure the transformer output voltage (AC) at the terminal board. Measure the voltage between wires A and B. If the transformer output voltage is less than 32 Vac, the transformer is defective. If the transformer output voltage is acceptable, go to step 3.
3. Check the rectifier output voltage (DC) on the 2R wires at CB1.

   If the rectifier output voltage is less than 28 Vdc and the load is not excessive (less than 22 amps), check the choke coil jumper to make sure that it is installed correctly.

   If the rectifier output voltage is less than 28 Vdc, the load is not excessive (less than 22 amps), and the choke coil jumper is installed correctly, the rectifier is defective.

   If the rectifier output voltage is more than 28 Vdc, the choke is defective.

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.

REFRIGERANT CHARGE

Charging the Refrigeration System

The receiver tank sight glass allows the operator to determine the amount of charge under established operating conditions. These units can be damaged by an overcharge of refrigerant. The amount of refrigerant the system can hold depends on circuit volume which is affected by hose length. The most satisfactory method of charging the engine-driven compressor circuit and the electric standby driven compressor circuit is:

1. Connect a gauge manifold to the engine-driven compressor and receiver tank.
2. Connect the center hose of the gauge manifold to the manifold of an evacuation station.
3. Connect the hose form a drum of refrigerant to the manifold of the evacuation station. Make sure the valve on the refrigerant drum is closed.
4. Open the valves on the gauge manifold and the valves on the evacuation station.
5. Start the vacuum pump and evacuate the system to 500 microns. After the system reaches 500 microns, evacuate the system for an additional hour.

   NOTE: If the system will not come down to 500 microns, there is probably a leak in the system or in the evacuation and charging equipment hoses. Find and repair the leak.

6. After the additional hour of evacuation, close the valve at the evacuation pump, stop the vacuum pump, and observe the reading on the vacuum gauge for 5 minutes. The pressure should not exceed 2000 microns.

   NOTE: If it does, repeat steps 4 and 5. This time if the pressure exceeds 2000 microns within 5 minutes, look for a leak in the system or in the evacuation and charging equipment hoses. Find and repair the leak.

7. Open the vacuum valve at the vacuum pump, start the vacuum pump and evacuate the system to 500 microns.
8. When the system reaches 500 microns, close the vacuum valve at the evacuation station manifold. The system is now ready to charge.
9. Close the low side valve on the gauge manifold, leave the high side valve on the gauge manifold open, and open the valve on the refrigerant drum to delivery liquid.
10. Allow 5 lb (2.3 kg) of refrigerant to enter the system. Then close the valve on the refrigerant drum and the high side valve on the gauge manifold.
11. Start the unit on engine operation, set the thermostat at 0 F (-20 C), and run the unit in cool until the box temperature approaches 0 F (-20 C).
12. Make sure that the unit is running in cool, the compressor is running at approximately 1000 rpm, the suction pressure is 2 to 8 psig (14 to 55 kPa), and the head pressure is at least 180 psig (1241 kPa) for R-134a systems and 275 psig (1896 kPa) for R-404A. If necessary, raise the head pressure by covering the condenser.
13. With these conditions established, open the low side valve on the gauge manifold and open the valve on the refrigerant drum to deliver liquid.
14. Observe the receiver tank sight glass. When the ball in the receiver tank sight glass reaches the top of the sight glass, close the valve on the refrigerant drum.

15. Close the low side valve on the gauge manifold and operate the unit for 15 minutes.
16. Model 20 only.
    a. Turn the unit OFF and shut off the truck engine.
    b. Connect the electric power receptacle to an appropriate electric power supply. Start and run the unit in cool on electric operation for a minimum of 15 minutes.
    c. Turn the unit OFF and disconnect the electric power supply. Start the truck and run the unit in cool on engine operation for a minimum of 15 minutes.
17. Check the receiver tank sight glass with the unit running in cool, the box temperature at 0 F (-20 C), and a head pressure of at least 180 psig (1241 kPa) for R-134a systems and 275 psig (1896 kPa) for R-404A systems. The ball should be at the top of the sight glass.

    If not, open the valve on the refrigerant drum to delivery liquid and open the low side valve on the gauge manifold. Add refrigerant liquid until the ball in the receiver tank sight glass reaches the top of the sight glass, then close the valve on the refrigerant drum and close the low side valve on the gauge manifold.
18. Stop the unit, shut OFF the truck engine and remove the gauge manifold set.
19. The above conditions MUST be established each time the refrigerant level is checked or if refrigerant needs to be added for any reason.

NOTE: To prevent oil migration from one compressor to another, and for proper oil return when a compressor is operating, operate the compressor for a minimum of 15 minutes. Do not operate the compressor for shorter intervals.

Checking the Refrigerant Charge

If the unit has an insufficient charge of refrigerant, the evaporator will be “starved” and the box temperature will rise even though the unit is operating. Also, an insufficient charge does not circulate enough oil to properly lubricate the compressor. The charge may be determined by inspection of the refrigerant through the receiver tank sight glass with the following conditions established:

Testing the Refrigerant Charge with an Empty Box

1. Place a test box over the evaporator.
2. Install a gauge manifold set.
3. Run the unit in cool on engine-driven compressor operation until the thermometer reads 0 F (-18 C). By allowing the box to leak a small amount, you will be able to maintain 0 F (-18 C).
4. The discharge or head pressure gauge should read 175 psi (1206 kPa) on the gauge manifold. If the pressure is below this, it can be raised by covering a portion of the condenser grille with a piece of cardboard.
5. Under these conditions the ball should be at the top of the sight glass to indicate a full charge.

Testing the Refrigerant Charge with a Loaded Box

1. Install a gauge manifold.
2. Run the unit in cool cycle on engine-driven compressor operation.
3. Cover the condenser to drive any excess refrigerant from the condenser into the receiver tank.
4. As the head pressure rises, check the receiver tank sight glass. If there is no indication of refrigerant in the receiver tank sight glass, indicated by the float ball being down in the bottom sight glass, the unit contains less than a full charge and more refrigerant MUST be added. Refer to Charging the Refrigeration System to add refrigerant.

CHECKING COMPRESSOR OIL CHARGE

The compressors are furnished with the amount of oil shown in the Specifications chapter. The oil level in the compressor will change after the compressor is initially run, making any level measurements inaccurate.

To ensure an adequate oil supply, the following procedure must be followed whenever the refrigerant charge is lost or removed from a unit:

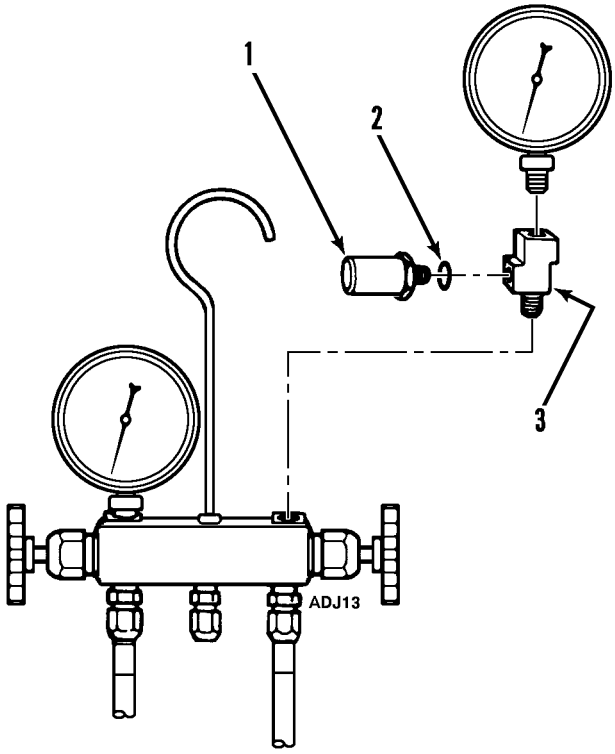
1. Install a compressor on the system having a residual oil supply and self-lubricating system such as a TK 214 model. Connect an oil separator on the discharge or suction line to collect and drain out circulated oil.

   NOTE: A suction line oil separator can be improvised by installing a suction filter upside down in the suction line near the compressor. Cap off both access ports, and use the lower one to drain off the accumulated oil.

2. Place a normal amount of oil in the cleanup compressor before operating.
3. Charge with 6 to 7 lb (2.7 to 3.2 kg) of refrigerant.
4. Operate at a low speed (600 to 800 rpm) for 2 hours, or until the compressor oil level reaches a minimum allowable level, whichever occurs first. Drain the collected oil from the oil separator as it fills, taking care to not allow any collected oil to recirculate.
5. Prepare the original compressor that was removed from the unit (or a replacement) by draining out any existing oil and replacing the oil with the amount of oil shown in the Specifications. (Service Parts compressors may already be properly filled.)
6. Install the original compressor (or its replacement), and proceed with the manual evacuation and refrigerant charging procedure.

HIGH PRESSURE CUTOUT SWITCH (HPCO)

The HPCO is located on the hot gas line (Model 10) or on the check valve assembly (Model 20) inside the condenser unit. If the discharge pressure rises above 300 psi (2068 kPa) on R-134a units, or above 450 psi (3103 kPa) on R-404A units, the HPCO opens the 7A circuit and de-energizes the compressor motor contactor or the compressor clutch. To test the HPCO, rework a gauge manifold per the High Pressure Cutout Manifold illustration.



1.	Relief Valve (66-2202)
2.	O-ring (33-1015)
3.	Adapter Tee Weather Head (No. 552X3)

High Pressure Cutout Manifold

1. Connect the gauge manifold to the compressor discharge service valve.

NOTE: Service manifold hoses must have Schrader valve (tire valve) depressors.

2. Set the thermostat well below the box temperature so that the unit will be in cool.
3. Raise the discharge pressure of the compressor first by blocking the condenser coil air flow.

   NOTE: The discharge pressure should never be allowed to exceed a pressure of 400 psi (2758 kPa) on R-134a units, or 450 psi (3103 kPa) on R-404A units.

4. Failure of the high pressure cutout system to stop compressor operation should be investigated first by checking the control circuit operation and second by replacing the HPCO.

SYSTEM CLEANUP

If the system ever becomes contaminated, cleanup the system as follows:

1. Install a compressor on the system having a residual oil supply and self-lubricating system such as a TK 214 model. Connect an oil separator on the discharge or suction line to collect and drain out circulated oil.

   NOTE: A suction line oil separator can be improvised by installing a suction filter upside down in the suction line near the compressor. Cap off both access ports, and use the lower one to drain off accumulated oil.

2. Place a normal amount of oil in the cleanup compressor before operating.
3. Charge with 6 to 7 lb (2.7 to 3.2 kg) of refrigerant.
4. Operate at low speed (600 to 800 rpm) for 2 hours, or until the compressor oil level reaches a minimum allowable level, whichever occurs first. Drain the collected oil from the oil separator as it fills, taking care to not allow any collected oil to recirculate.
5. Test the compressor oil with an acid test kit No. 203-346. Repeat Step 4 if the test shows acid in the compressor oil.
6. Remove the cleanup compressor and suction filter. Replace with a standard compressor, containing the proper amount of oil.
7. Leak test, evacuate and charge the system.

REFRIGERANT HOSE ROUTING

To prevent oil trapping, the suction hose must be clamped in a U trap before it goes to the compressor

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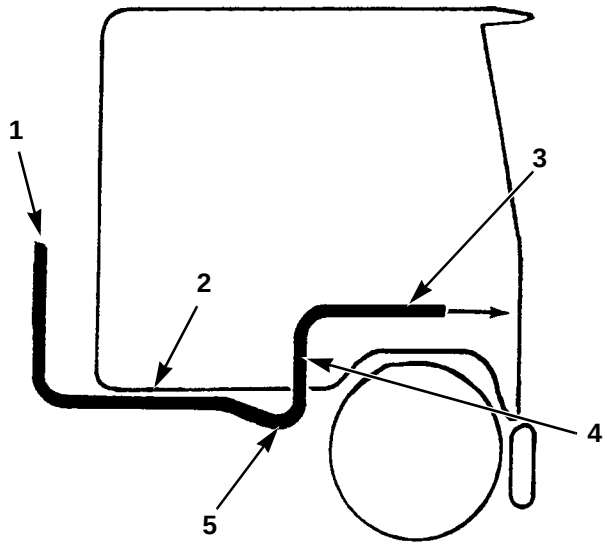
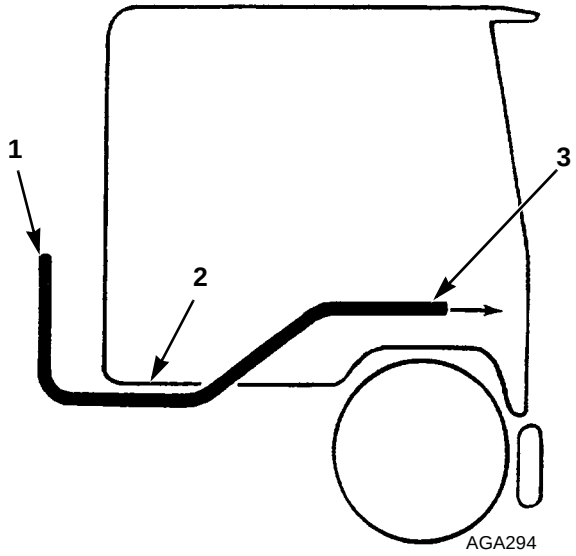


Correct Hose Routing



Incorrect Hose Routing (Will Cause Oil Trapping)

1.	To Condenser
2.	Under Cab
3.	To Compressor
4.	Vertical Lift
5.	Form A “U” Trap

THREE-WAY VALVE CONDENSER PRESSURE BYPASS CHECK VALVE

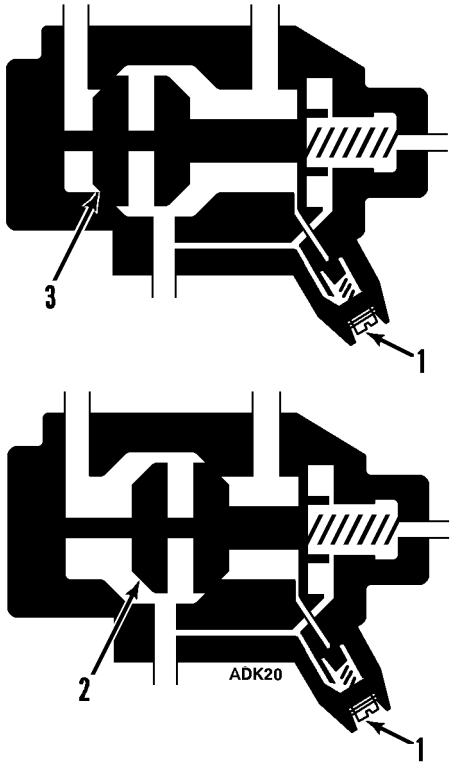
A three-way valve condenser pressure bypass check valve is used in this unit. This check valve controls the bypass flow of refrigerant gas between the condenser inlet line and the compressor discharge line.

The check valve is closed when the unit is running on cool, or whenever the discharge pressure is higher than the condenser pressure.

When the unit is running in defrost, if the condenser pressure is higher than the discharge pressure, the check valve opens and the condenser pressure is bled off until it drops to the level of the discharge pressure. The purpose of the check valve is to improve the heating/defrosting ability and the three-way valve response.

To check the operation of the check valve:

1. Remove the condenser pressure bypass check valve cap from the three-way valve.
2. Using a screwdriver, gently turn the check valve stem in until the valve is front seated.
3. Install a gauge manifold set on the compressor.
4. Close (front seat) the receiver tank outlet valve.
5. Operate the unit in cool and pump down the low side to 20 in. Hg of vacuum (-68 kPa).
6. Stop the unit. The condenser and suction pressures should remain stable, indicating no leaks.
7. Shift the three-way valve to the defrost position. The low side gauge will rise slightly and the high side gauge will drop to approximately zero as the gauges will equalize.
8. The gauges will remain in this position (approximately zero) if the three-way seals properly toward the condenser and the condenser pressure bypass check valve seals properly.



1.	Check Valve
2.	Cool Position
3.	Defrost Position

Three-way Valve Condenser Pressure Bypass Check Valve

9. Back seat the condenser pressure bypass check valve stem against the snap ring. Both gauges should rise indicating that the condenser pressure bypass check valve is properly releasing condenser pressure into the discharge tube and evaporator.
10. Replace the cap on the condenser pressure bypass check valve.

    NOTE: The check valve stem MUST be back seated during normal unit operation.

11. Open the receiver tank return outlet valve, remove the gauges, and return the unit to operation.

NOTE: It is generally good practice to replace the filter drier whenever the high side is opened or when the low side is opened for an extended period of time.

COMPRESSOR

Removal

1. Remove the refrigerant charge from the system.
2. Loosen the drive belt adjuster (engine driven compressor) or the electric motor mounts (standby compressor) and remove the compressor drive belt.
3. Disconnect the discharge, suction and liquid injection hoses.
4. Keep the compressor ports and the suction and discharge lines for the compressor covered to prevent contamination of system components.
5. Remove compressor mounting screws. Remove the compressor.

Installation

NOTE: Any compressor installed in this system must contain the proper amount of compressor oil (see the Specifications chapter). Always check to make sure that the compressor contains the proper amount of oil. Follow the system cleanup procedures to remove old oil from the system.

1. Place the compressor in position and install the mounting screws and the belt.
2. Use belt tension tool P/N 204-427 to adjust belt tension. The engine/compressor belt tension should be adjusted to 58 on the gauge; the electric motor/compressor belt should be adjusted to 57.
3. Connect the refrigeration hoses. Pour 2 oz (59 ml) of compressor oil into the suction hose before installation.
4. Pressurize the system and test for leaks.
5. Evacuate the system and recharge.

CONDENSER COIL

Removal

1. Remove the refrigerant charge.
2. Remove the cover.
3. Remove the condenser fan and motor.
4. Remove the inlet and liquid lines.
5. Remove the mounting screws and nuts.
6. Remove the condenser coil.

Installation

1. Clean the tubes for soldering.
2. Place the coil in the unit and install the screws and nuts.
3. Solder the inlet and liquid line connections.
4. Pressurize the system and test for leaks.
5. Evacuate the system.
6. Recharge the unit.
7. Reinstall the cover.

FILTER DRIER

Removal

1. Pump down the refrigeration system and equalize the pressure to slightly positive.
2. Disconnect the ORS nuts at the ends of the drier.
3. Loosen the mounting hardware and remove the drier.

Installation

1. Place new O-rings in the ORS fittings on the ends of the drier.
2. Install the new drier and tighten the mounting screws and nuts.
3. Install and tighten the inlet ORS nut. Hold the drier with a back-up wrench on the hex behind the ORS fitting.
4. Release a small amount of refrigerant to purge the air through the drier, and then tighten the outlet ORS nut.
5. Pressurize the system and inspect for leaks. If no leaks are found, open the refrigeration valves and place the unit in operation.

EVAPORATOR COIL

Removal

1. Pump down the low side and equalize the pressure to slightly positive.
2. Remove the evaporator panel. Disconnect the evaporator fan motor wires. Unbolt the expansion valve from the mounting bracket.
3. Disconnect the expansion valve from the distributor.
4. Disconnect the hot gas line from the distributor.
5. Remove the defrost termination switch wire.
6. Unsolder the suction line from the evaporator coil.
7. Remove the mounting bolts and slide the coil from the unit.

Installation

1. Place the coil in the housing.
2. Install the mounting bolts and tighten them.
3. Clean the tubes for soldering.
4. Solder the suction line to the evaporator coil.
5. Connect the hot gas line to the distributor.
6. Connect the expansion valve to the distributor.
7. Connect the defrost termination switch wire.
8. Install the expansion valve on the mounting bracket.
9. Pressurize the system and test for leaks. If no leaks are found, evacuate the system.
10. Connect the evaporator fan motor wires. Install the evaporator panel.
11. Open the refrigeration valves and place the unit in operation. Check the refrigerant charge and the compressor oil and add as required.

EXPANSION VALVE ASSEMBLY

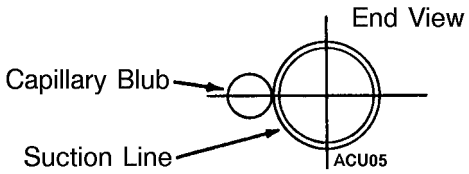
Removal

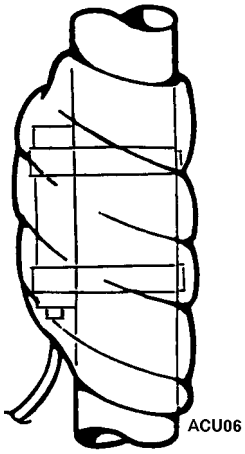
1. Pump down the low side and equalize the pressure to slightly positive.
2. Remove the feeler bulb from the suction line clamps. Note the position of the feeler bulb on the suction line.
3. Disconnect the equalizer line from the expansion valve.
4. Disconnect the liquid line and the distributor from the expansion valve.
5. Remove the expansion valve mounting bolt, and then remove the expansion valve from the unit.

Installation

1. Install and bolt the expansion valve assembly in the unit.
2. Connect the liquid line and the distributor to the expansion valve.
3. Connect the equalizer line to the expansion valve.

4. Clean the suction line to a bright, polished condition. Install the feeler bulb clamps and the feeler bulb on the side of the suction line in its former position. The feeler bulb must make good contact with the suction line or operation will be faulty. Wrap the bulb with insulating tape.
5. Pressurize the low side and test for leaks. If no leaks are found, evacuate the low side.





Completely Wrap Bulb with Tape
Location of Expansion Valve Bulb

RECEIVER TANK

Removal

1. Remove the refrigerant charge.
2. Unsolder the refrigerant lines from the receiver tank.
3. Remove the nut from the top and bottom of the receiver tank.
4. Remove the receiver tank.

Installation

1. Position the receiver tank in the unit and install the mounting nuts.
2. Solder the refrigerant lines to the receiver tank.
3. Pressurize the refrigeration system and check for leaks.
4. If no leaks are found, evacuate the system.
5. Recharge the unit.

OIL SEPARATOR

Once installed, the oil separator unit requires no maintenance. However, all connections to the separator and throughout the refrigeration system should be checked on a regular basis for leaks.

Oil Separator Kit Installation

For units which do not have oil separators, a kit is available using flare connections for installing the oil separator. The kit (PN 20-126) contains an oil separator, a mounting clamp, clamp screws, an oil return hose with fittings, an adapter, and two fittings for the discharge hose.

Installation Recommendations

1. Connect the oil separator in series with the compressor discharge line. (Inlet end of oil separator is labeled IN.)
2. Mount the oil separator as close as possible to the compressor.
3. The oil separator can be mounted horizontally or vertically, but the oil outlet MUST be at the lowest point on the oil separator.
4. Remove and discard the oil fill plug on the compressor housing. Install the special adapter with a gasket in the oil fill opening of the compressor housing. Connect the oil return hose of the oil separator to the special adapter on the compressor.

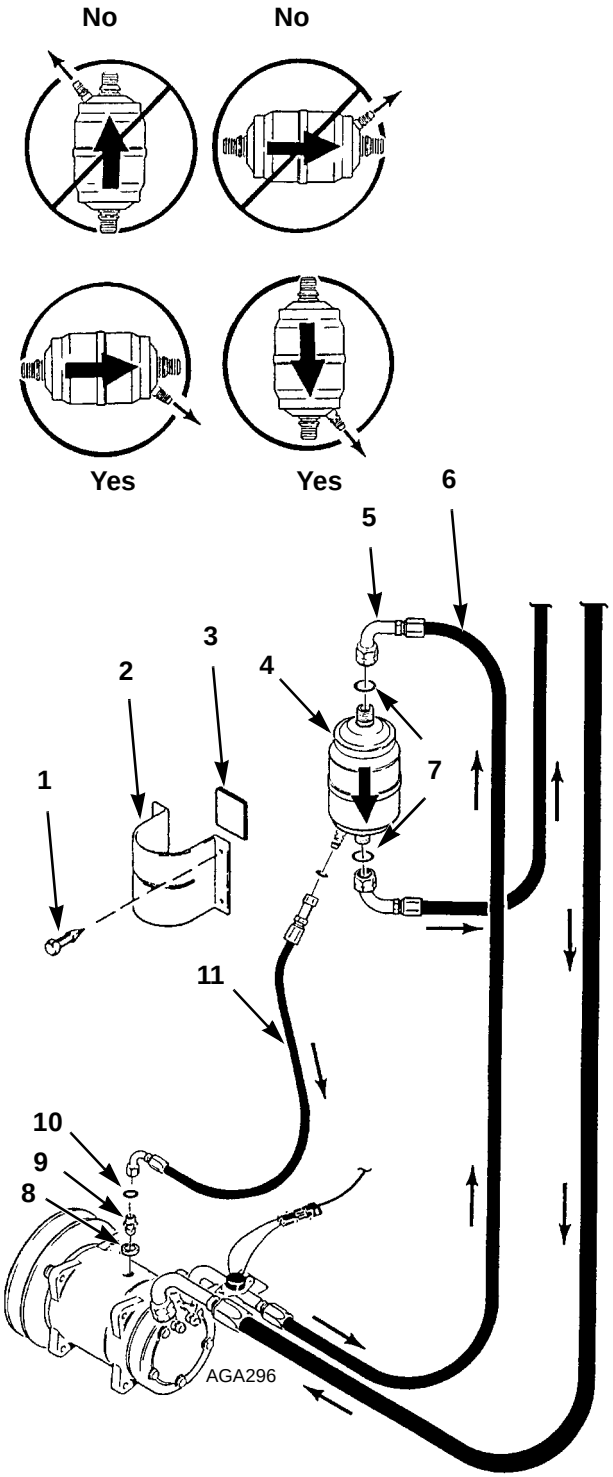
5. Use a hose cutter to cut the oil return hose to the proper length, and to cut the discharge hose for the installation of the inlet and outlet fitting. Make sure there is no foreign matter in any of the hoses.

See the following illustration as an example of the installation.

NOTES:

1. ***When using flare fittings, lubricate the mating surfaces as well as the flare fitting threads prior to connecting.***
2. ***Use tubing wrenches to tighten all connections to avoid collapsing or warping fittings. DO NOT overtighten. Tighten to the proper torque specifications.***

NOTE: The oil outlet MUST be at lowest point on the oil separator.



1.	Self-tapping Screw (4)
2.	Clamp
3.	Pad
4.	Oil Separator
5.	Fitting Hose (2)
6.	Discharge Hose
7.	Copper Washer
8.	O-ring
9.	Adapter
10.	Copper Washer
11.	Oil Return Hose

Oil Separator Installation

NOTE: Newer models have oil separator in condenser unit.

REPLACING REFRIGERANT HOSES

Disassembly

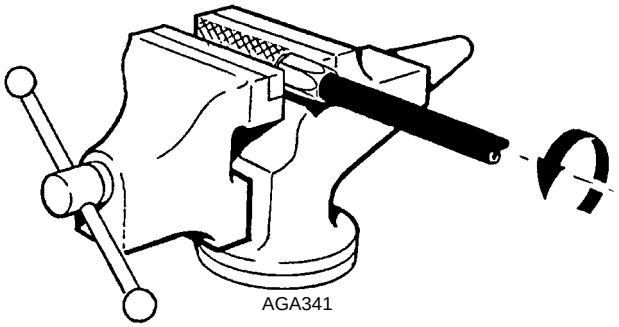
1. Remove the refrigerant charge or pump down the low side.
2. Use two wrenches to loosen the flare fittings.
3. Remove the hose and remove the fittings from the hose.

Assembly

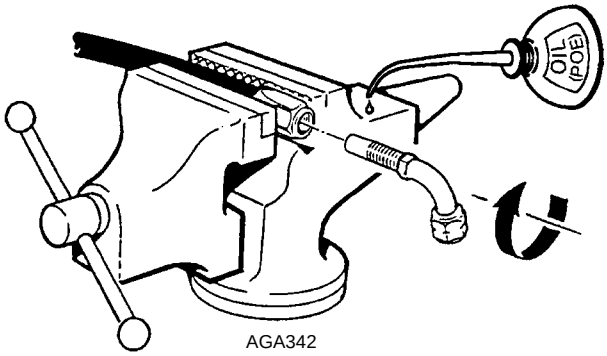
1. Measure the hose, and using a sharp knife or suitable plastic tube and hose cutter tool, cut to length. Make sure the cut is clean and square. Wipe the inside of the hose clean.

   NOTE: DO NOT use a saw to cut the hose.

2. Assemble the hose and fittings.


AGA341

   a. Place the fitting socket in a vise and screw in the hose counterclockwise until the hose bottoms. Then back out the hose 1/4 turn.



AGA342

   b. Lubricate nipple threads and inside of hose with refrigerant oil.

Refrigerant Hose Installation

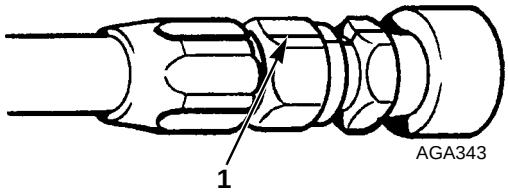
1. Apply clean compressor oil to the flares to facilitate the connection and use two wrenches to tighten the fittings.
2. Pour 2 oz. (59 ml) of compressor oil into the suction hose before connecting on new installations and whenever replacing a compressor.
3. Leak check the system.

Torque Values for Refrigeration Flare Fittings

Refrigerant connections made with flare fittings must be properly torqued to be leak free.

NOTE: Refrigerant oil must be used on flare seats to prevent damage.

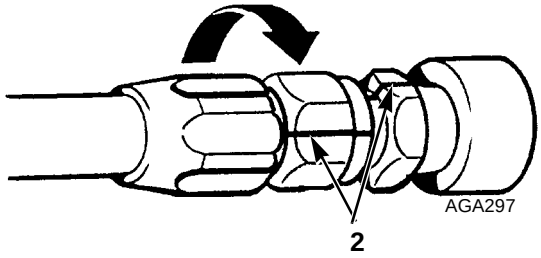
1. Tighten the nut finger tight until it bottoms the seat.



AGA343

1.	Mark a line on nut and adapter before torquing

2. Mark a line lengthwise on the nut and extend it onto the adapter.



AGA297

2.	Misalignment of mark shows amount that nut was tightened

3. Using a wrench, rotate the unit to tighten. Turn the nut the amount shown in the following chart.

Line Size	Rotate No. of Hex Flats
14	2-1/2
5	2-1/2
6	2
8	2
10	1-1/2 to 2
12	1
16	3/4 to 1
20	3/4 to 1
24	1/2 to 3/4

NOTE: Misalignment of the marks will show how much the nut was tightened, and best of all that it has been tightened.

LIQUID INJECTION SOLENOID VALVE

Removal

1. Disconnect the coil wires on the liquid injection solenoid valve.
2. Pump down the low side and shut down the unit.

   NOTE: Take caution to avoid the danger of liquid refrigerant escaping when the lines are disconnected.

3. Disconnect the refrigerant lines on both sides of the solenoid valve.
4. Unbolt the solenoid valve from its mounting bracket, and remove it.

Installation

1. Fasten the solenoid valve to the mounting bracket.
2. Connect refrigerant lines to both sides of the solenoid valve. (The line from the liquid line is connected to the port marked IN.)
3. Connect the coil wires to the solenoid valve.
4. Open the refrigeration valves.

   NOTE: The screen inside the solenoid valve is the same as that used in the pilot solenoid and may require cleaning.

LIQUID INJECTION METERING ORIFICE

Removal

1. Disconnect the coil wires on the liquid injection solenoid valve.
2. Pump down the low side and stop the unit.
3. Disconnect the flexible hose from the metering orifice and remove the metering orifice from the suction hose fitting.

   NOTE: Take caution to avoid the danger of liquid refrigerant escaping when the line is disconnected.

   NOTE: This orifice may become plugged with dirt unless the flexible hose and solenoid valve are kept clean.

Installation

1. Install the metering orifice on the suction hose fitting.
2. Connect the flexible hose to the metering orifice fitting.
3. Open the refrigeration valves.

Testing the Liquid Injection Solenoid Valve and Metering Orifice

1. Disconnect the LIS wire from the liquid injection solenoid.
2. Install a gauge manifold set on the engine-driven compressor.
3. Set the thermostat on the lowest setting.
4. Start the truck and run the unit on the engine-driven compressor until the suction pressure stabilizes.
5. Place a jumper wire between CH and the LIS terminal on the liquid injection solenoid.
6. With the jumper wire in place the suction pressure should rise.
7. With the jumper wire removed the suction pressure should return to the stabilized pressure in step 4.
8. If the suction pressure does not change, check the CLU wire for voltage, the liquid injection solenoid valve, or the metering orifice.
9. Shut off the unit and the truck, remove the gauge manifold set and replace the LIS wire.

HIGH PRESSURE CUTOUT AND CONDENSER FAN SWITCHES

Removal

1. Remove the refrigerant charge.
2. Disconnect the wires and remove the switch.

Installation

1. Apply a refrigerant locktite to the threads of the switch.
2. Install and tighten the switch and reconnect the wires.
3. Pressurize the refrigeration system and test for leaks.
4. If no leaks are found, charge the system.

LOW PRESSURE CUTOUT SWITCH

Removal

1. Pump down the low side and stop the unit.
2. Disconnect the wires and remove the switch.

Installation

1. Apply a refrigerant locktite to the threads of the switch.
2. Install and tighten the switch and reconnect the wires.
3. Pressurize the refrigeration system and test for leaks.
4. If no leaks are found, evacuate the low side.
5. Open the receiver tank outlet valve, start the unit and check the refrigerant charge.

SUCTION PRESSURE REGULATOR VALVE

Removal

1. Pump down the low side and equalize the pressure to slightly positive.
2. Release the remaining pressure and unsolder the suction pressure regulator valve from the suction tubes.

Installation

1. Clean the tubes for soldering.
2. Place the valve in position and solder the connections.
3. Pressurize the low side and check for leaks.
4. If no leaks are found, evacuate the low side.
5. Open the refrigeration valves, and place the unit in operation. Check refrigerant charge and add refrigerant as required.

DISCHARGE CHECK VALVE REPAIR (Model 20 Only)

Testing the Discharge Check Valve

The discharge check valve is a very important part of the Model 20 system. The check valve isolates the engine-driven compressor from the electric standby compressor, ensuring the compressor oil and refrigerant do not migrate between compressors. The check valve should be tested when the system is initially charged and operating and anytime the system has been opened for service or repair. Testing the check valve requires two gauge manifold sets.

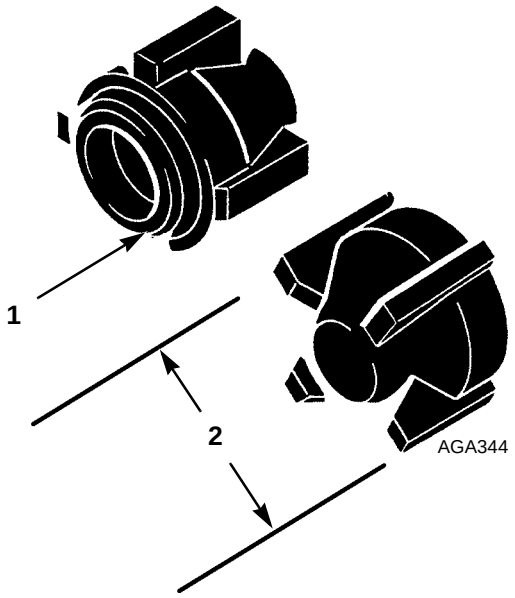
1. Disconnect the liquid injection solenoid valve wires.
2. With the unit off, install a gauge manifold set on each compressor.
3. Observe the gauge manifold readings of the electric standby compressor. If the high side and low side readings are not the same, open the gauge manifold valves and equalize the pressures. Close the gauge manifold valves.
4. Adjust the thermostat so the unit will run in cool. Start the truck and run the unit with the engine-driven compressor.
5. Observe the gauge manifold readings of the engine-driven compressor. The head pressure should increase and the suction pressure should decrease.
6. Observe the gauge manifold readings of the electric standby compressor. The high side pressure should remain the same as the pressure in step 3 after the high and low sides were equalized. If the high side pressure is increasing or has increased noticeably, the discharge check valve is leaking internally.
7. Turn the unit off and shut off the truck engine. Connect the remote control box to an appropriate electric power source.
8. Observe the gauge manifold reading of the engine-driven compressor. If the high side and low side readings are not the same, open the gauge manifold valves and equalize the pressures. Close the gauge manifold valves.
9. Adjust the thermostat so the unit will run in cool. Start the unit and run on electric standby.
10. Observe the gauge manifold readings of the electric standby compressor. The head pressure should increase and the suction pressure should decrease.
11. Observe the gauge manifold readings of the engine-driven compressor. The high side pressure should remain the same as the pressure in step 8 after the high and low sides were equalized. If the high side pressure is increasing or has increased noticeably, the discharge check valve is leaking internally. Stop the unit.
12. Remove the gauge manifold sets and the electric standby power source. Connect the wires to the liquid injection solenoid valve. If the check valve is leaking internally, refer to the repair procedures.

Discharge Check Valve Repair

Disassembly

1. Remove the refrigerant charge.
2. Loosen and remove the end cap nuts.
3. Carefully remove the end caps from the valve body. Avoid damaging the refrigeration lines, pistons or spring.
4. Remove the pistons, spring and copper sealing washers.
5. Check the spring. The free length should be 1.75 in. (44.5 mm). Replace the spring if the free length is less than 1.57 in. (37.9 mm).

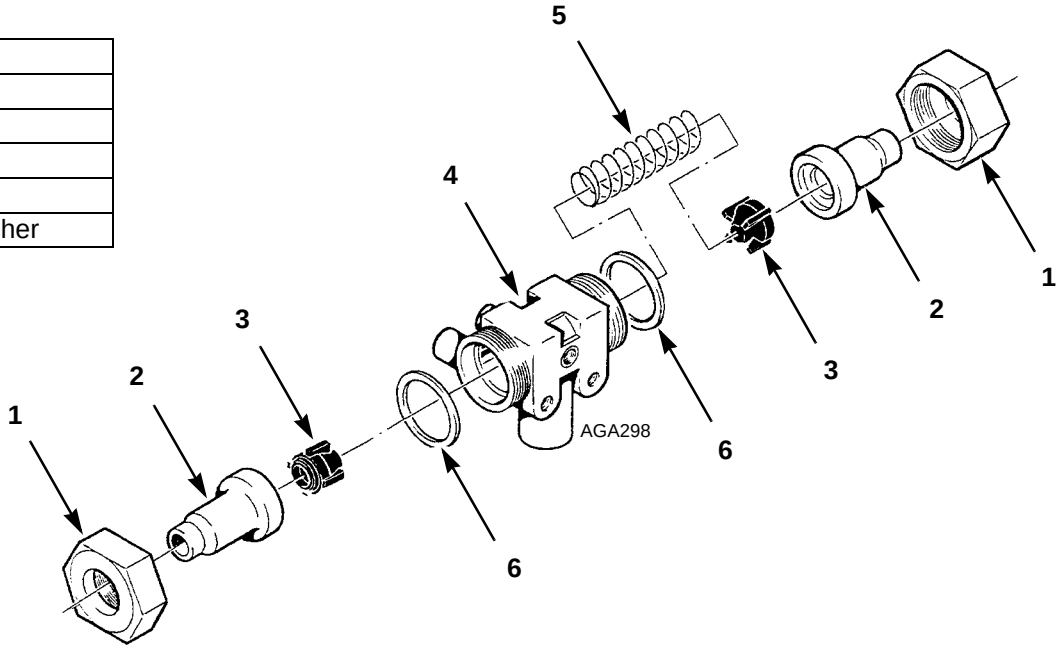
6. Measure the pistons. Replace the piston(s) if the O.D. is greater than 0.998 in. (25.35 mm) or less than 0.995 in. (25.27 mm).
7. Inspect the piston sealing surfaces. Replace the pistons if the sealing surfaces are worn or damaged.
8. Inspect the valve body. The piston bores should be clean and undamaged. The pistons should move freely in the piston bores. Clean or replace if necessary.
9. Inspect the end cap valve seats. The end cap valve seats should be clean and undamaged. Clean or replace if necessary.



1.	Sealing Surface
2.	0.995 to 0.998 in. (25.27 to 25.35 mm)

Pistons

1.	Nut
2.	End Cap
3.	Piston
4.	Valve Body
5.	Spring
6.	Sealing Washer



Discharge Check Valve Assembly

Assembly

NOTE: Coat all parts with compressor oil before assembly.

1. Place the spring in the valve body.
2. Place a piston in the valve body piston bore with the piston sealing surface facing out toward the end cap seat. Holding the spring at the other end of the valve body, push the piston in and let the spring return the piston several times to check that the piston moves freely.
3. Place a new copper sealing washer in the valve body near the piston. The sharp edge of the copper sealing washer should face the valve body and the smooth side should face the end cap.
4. Carefully place the end cap in the valve body to avoid damaging the piston, copper sealing washer or the refrigeration lines. Tighten the end cap nut finger tight.
5. Place the other piston in the other valve body piston bore with the piston sealing surface facing out toward the end cap seat. Push the piston in and let the spring return the piston several times to check that the piston moves freely.
6. Place a new copper sealing washer in the valve body near the piston. The sharp edge of the copper sealing washer should face the valve body and the smooth side should face the end cap.
7. Carefully place the end cap in the valve body to avoid damaging the piston, copper sealing washer or the refrigeration lines. Tighten the end cap nut finger tight.
8. Using a 1-3/4 in. (44.5 mm) crows foot or similar tool, torque the end cap nuts to 80 ft-lb (59 N•m).

   NOTE: A crows foot of this size increases the torque read on the torque wrench by approximately 6%. Therefore, the reading on the torque wrench should be 75 ft-lb (55 N•m).
9. Leak check, evacuate and recharge the system. Test the check valve operation.

Discharge Check Valve Replacement

Removal

1. Remove the refrigerant charge.
2. Disassemble the check valve.
3. Unsolder the lines and remove the check valve.

Installation

1. Clean the tubes for soldering.
2. Place the disassembled check valve in position.
3. Solder the connections. After the valve cools, reassemble the valve.
4. Pressurize the refrigeration system and test for leaks.
5. If no leaks are found, evacuate the system.
6. Recharge the unit with refrigerant and check compressor oil.

ACCUMULATOR

Removal

1. Pump down the low side and equalize the pressure to slightly positive.
2. Unsolder the inlet and outlet refrigerant suction lines from the accumulator.
3. Unbolt and remove the accumulator from the unit.

Installation

1. Place the accumulator in the unit and tighten the mounting bolts.
2. Solder the inlet and outlet suction lines to the accumulator.
3. Pressurize the low side and test for refrigerant leaks. If no leaks are found, evacuate the low side.
4. Open the refrigeration valves and place the unit in operation. Check the refrigerant charge and compressor oil and add as required.

THREE-WAY VALVE REPAIR

In most cases, the three-way valve can be repaired in the unit.

Disassembly

1. Remove the refrigerant charge.
2. Clean the exterior surface of the valve.
3. Remove the 1/4 in. (6 mm) copper line from the three-way valve to the pilot solenoid.
4. Loosen the four Allen head screws (DO NOT REMOVE); use Tool P/N 204-424 to break the gasket at each side of the center section.

   CAUTION: Do not force the tool into the brass or against the bolts.

5. Remove the four bolts from the valve.
6. Remove the top cap and spring.
7. Remove the spring clip. Observe the slot in the piston and slide the piston off the stem.
8. Remove the seat and stem assembly.
9. Inspect the following parts for wear or damage:
   a. Bottom cap, sealing and support area.
   b. Seat, sealing surface.
   c. Top cap, sealing and support area.

   Remove the screen. If any particles drop from the screen into the discharge line, the discharge line must be removed at the compressor.

   NOTE: The valve body cannot be reconditioned. Seat positions change and improper sealing will result.

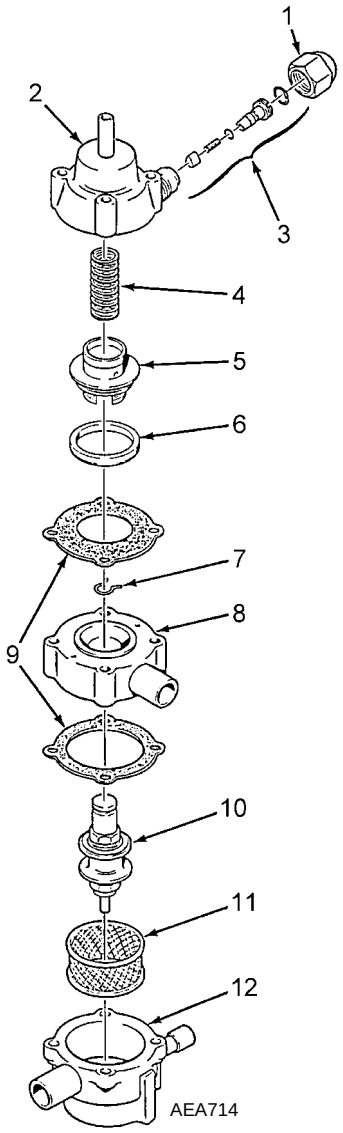
Assembly

After cleaning and inspecting all parts, reassemble the valve.

1. Place the screen in the bottom cap.
2. Place a new stem in the bottom cap.
3. Install new gaskets on both sides of the seat. Dip the gaskets in compressor oil before installing.
4. Install the piston on the stem and attach with a spring clip.
5. Install a new O-ring on the piston, then place the Teflon seal over the O-ring.

   NOTE: The Teflon seal will stretch when it is installed. To prevent this stretch from becoming permanent (and possibly causing a malfunction), the top cap must be installed immediately.

6. Install the spring and top cap.
7. Line up the passageways in the top cap and the seat. Failure to line up the holes will result in improper operation of the three-way valve.
8. Install the bolts and tighten them in a rotating sequence.
9. Install the pilot solenoid line and pressurize the system with refrigerant to check for leaks.
10. If there are no leaks, evacuate the system and recharge with refrigeration.
11. Run the unit to check for proper three-way valve operation.



1.	Cap	7.	Clip
2.	Top Cap	8.	Seat
3.	Check Valve	9.	Gaskets
4.	Spring	10.	Stem Assembly
5.	Piston	11.	Screen
6.	Seal	12.	Bottom Cap

Three-way Valve

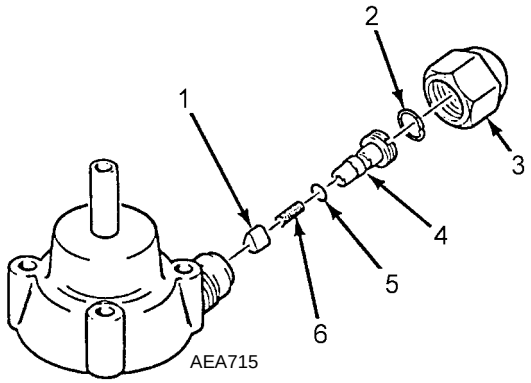
THREE-WAY VALVE CONDENSER PRESSURE BYPASS CHECK VALVE REPAIR

Removal

1. Remove the refrigerant charge.
2. Unscrew the condenser pressure bypass check valve cap from the three-way valve.
3. Remove the snap ring.
4. Unscrew the check valve stem by using a screwdriver in the slot provided.

   NOTE: The spring and the check valve are held in by the stem. While removing the stem, use care to make sure that the spring and the check valve are not lost.

5. Remove the spring and the check valve.
6. Inspect the check valve seat in the three-way valve.
7. If replacement parts are needed, a kit P/N 60-163 must be used which includes the check valve, spring, O-ring, valve stem and snap ring.



1.	Check Valve	4	Valve Stem
2	Snap Ring	5	O-ring
3	Cap	6	Spring

Check Valve Assembly

Installation

1. Coat the O-ring with compressor oil and install it on the check valve stem.
2. Insert the spring into the hole in the check valve stem and then install the check valve on the other end of the spring with the hole in the valve towards the spring.
3. Coat the entire assembly with compressor oil and place the assembly in the check valve seat in the three-way valve.

   CAUTION: The check valve must be inserted with the flat side against the valve seat to ensure proper sealing.
4. Screw the valve stem into the three-way valve until the snap ring can be installed.
5. Install the snap ring.
6. Unscrew (back seat) the valve stem against the snap ring.

   NOTE: The valve stem must be back seated during normal unit operation.
7. Coat the sealing area in the cap with compressor oil, and install and tighten the cap on the three-way valve.
8. Pressurize the refrigeration system and test for leaks. If no leaks are found, evacuate the system.
9. Recharge the unit.

PILOT SOLENOID

Removal

1. Pump down the low side and equalize the pressure to slightly positive.
2. Disconnect the coil wires.
3. Disconnect the refrigeration lines to the solenoid and immediately seal them to prevent moisture and air from entering the system.
4. Unbolt the pilot solenoid and remove it from the mounting bracket.

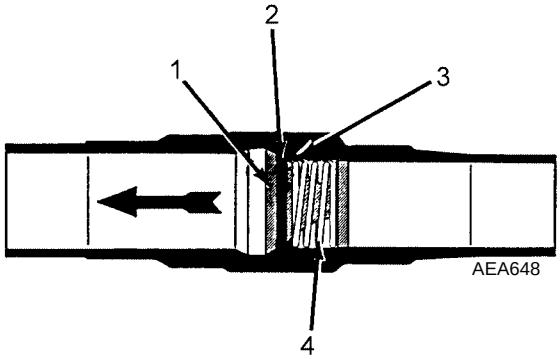
Installation

1. Bolt the pilot solenoid to the mounting bracket.
2. Remove the seals from the refrigeration lines, and connect the lines to the pilot solenoid.
3. Connect the electrical wires to the valve.
4. Open the refrigeration valves and place the unit in operation.

   NOTE: If the procedure is done quickly and carefully, there is no need for evacuation of the system. The slight amount of air in the pilot solenoid may be purged out by connecting one line tight and the other only finger tight, and then releasing the refrigerant in the system. Tighten the last line.
5. Check for leaks.

IN-LINE CONDENSER CHECK VALVE

The in-line condenser check valve is not repairable and must be replaced if it fails. A heat sink must be used on the in-line condenser check valve when it is being soldered in place to prevent damage to the neoprene seal.



1.	Valve
2.	Neoprene Seal
3.	Valve Seat
4.	Spring

Cross Section of In-line Condenser Check Valve

IN-LINE CONDENSER CHECK VALVE REPLACEMENT

Removal

1. Remove the refrigerant charge.
2. Place a heat sink on the check valve.
3. Unsolder the lines and remove the check valve.

Installation

Note: A heat sink must be used on the in-line check valve when it is being soldered in place to prevent damage to the neoprene seal.

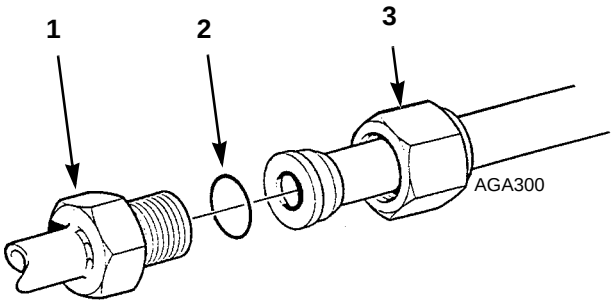
1. Clean the tubes for soldering.
2. Place the check valve in position. The arrow on the valve body indicates direction of refrigerant flow through the valve.
3. Place a heat sink on the check valve.
4. Solder the inlet and outlet connections.
5. Pressurize the refrigeration system and test for leaks.
6. If no leaks are found, evacuate the system.
7. Recharge the unit with the proper refrigerant and check the compressor oil.

O-Ring Seal (ORS) Connections

Replacement

1. Close the receiver outlet valve, pump down the low side, and equalize the pressure to slightly positive.
2. To break the threaded line connections use two wrenches. A rubber O-ring is used at line connections to assure a positive seal. Install a new O-ring whenever a line connection has been broken.
3. Before the line is connected, apply clean compressor oil to the O-ring. Hand tighten the connector nut on the line against the line fitting. Support the line fitting with a wrench and tighten the connector nut with another wrench until the fitting bottoms out. The connection bottoms out when tight, reducing the chance of over and under torque.

   NOTE: ORS O-rings are made of a material with a certain hardness. Do not substitute other O-rings. Use only O-rings from Thermo King service parts.



1.	Valve Fitting
2.	O-ring
3.	Connecting Nut

O-ring Seal (ORS)

UNIT INSPECTION

Inspect the unit during the pre-trip inspection and during scheduled maintenance inspections for loose or broken wires or hardware, compressor oil leaks, or other physical damage which might affect the unit performance and require the repair or replacement of parts.

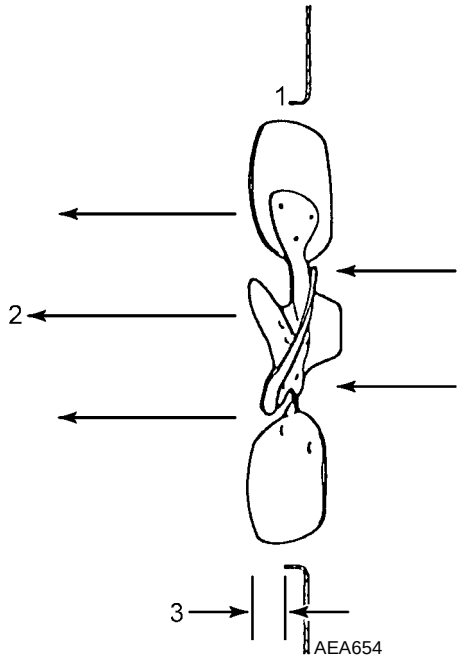
EVAPORATOR COIL

Clean the evaporator coil during scheduled maintenance inspection by blowing compressed air down through the coil out into the box (direction opposite the normal air flow). Inspect the coil and fins for damage and repair if necessary (requires removing the evaporator fan and front cover).

CAUTION: Air pressure should not be high enough to damage the coil fins.

FAN LOCATION

When mounting the fan and hub assembly on the fan shaft, position the assembly in the orifice with 30 to 35 percent of the blade width to the air discharge side for proper fan performance.



1.	Orifice
2.	Airflow
3.	30 to 35 Percent of Blade Depth to Discharge Side

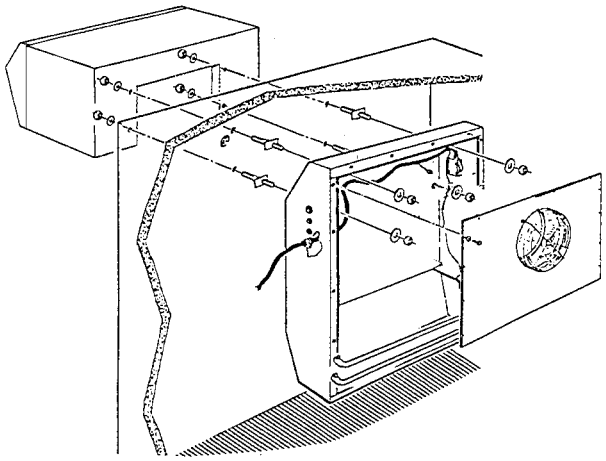
Fan Blade Position in Orifice

CONDENSER COIL

Clean the condenser coil during scheduled maintenance inspections by blowing compressed air from the back side of the coil out toward the front of the unit (the direction opposite normal air flow). Inspect the coil and fins for damage and repair if necessary.

UNIT MOUNTING BOLTS

Periodically check and torque the unit mounting bolts to 60 ft-lb (81 N•m).

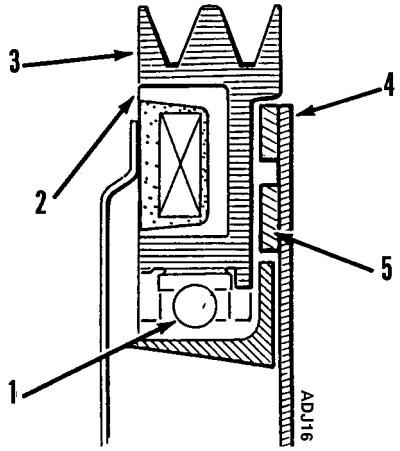


Unit Mounting Bolts

Operation

A stationary field coil is mounted on the compressor body concentric with the shaft. A pulley assembly, consisting of a pulley, a disc and a hub is mounted on the shaft of the compressor. The hub and disc are flexibly connected with flat springs that in the disengaged position, hold the disc slightly away from the pulley web (friction surface).

When an electric current flows through the field coil, a magnetic field is created. The magnetic field pulls the disk against the pulley web and compresses the flat springs. This causes the hub and disk to rotate with the pulley.



1.	Hub	4.	Disk
2.	Stationary Field Coil	5.	Flat Springs
3.	Pulley		

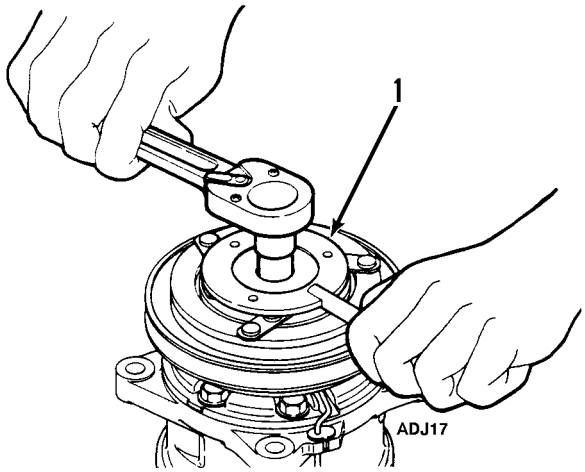
Compressor Clutch Assembly

CLUTCH REMOVAL

NOTE: Make sure the proper tools are available before performing maintenance procedures. Refer to the tool listing at the end of this chapter for tools required. Contact your local Thermo King dealer for further information.

Removal

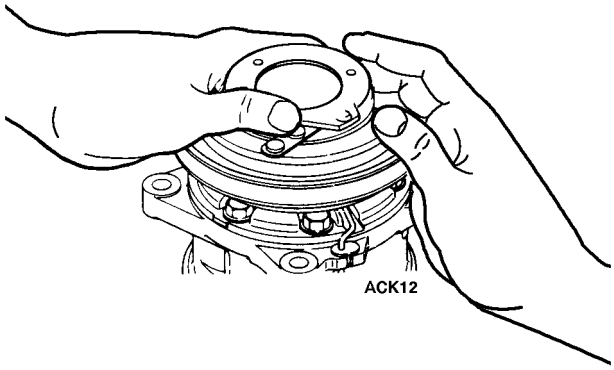
1. Remove the center bolt using the puller arbor (TK 204-804) to prevent drive plate rotation.



1.	Holder

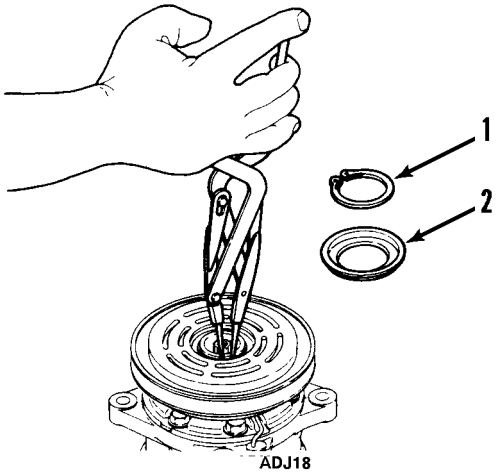
Remove Center Bolt

2. Remove the drive plate using the shaft seal kit (TK 204-805). Then remove the shims from either the drive shaft or the drive plate.



Remove Drive Plate

3. Remove the snap ring using external snap ring pliers (TK 204-808).
4. Remove the cover.

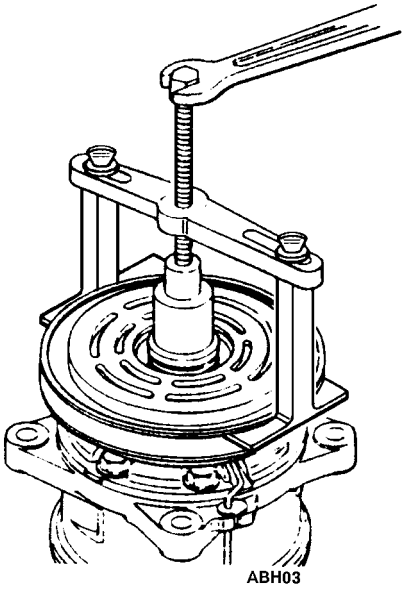


1.	Snap Ring
2.	Cover

Remove Snap Ring and Cover

5. Remove the pulley assembly using the clutch remover (TK No. 204-806) and the spacer positioned on the cylinder head hub.

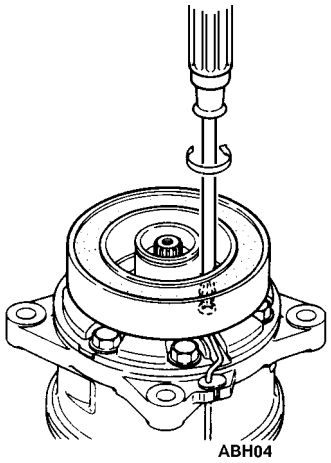
NOTE: To avoid damaging the pulley groove, the pulley claws should be hooked into (NOT UNDER) the pulley groove.



Remove Pulley

6. Remove the coil's lead wire from the holder on the top of the compressor.
7. Remove the three screws that attach the coil to the compressor and remove the coil.

NOTE: DO NOT hold the coil by the lead wire.



Remove Coil

Inspection

1. **Drive Plate**

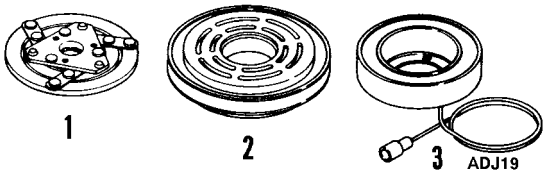
   If the contact surface is scorched, the drive plate and pulley should be replaced.

2. **Pulley Assembly**

   Inspect the appearance of the pulley assembly. If the pulley's contact surface is excessively grooved due to slippage, both the pulley and drive plate must be replaced. There should also be no foreign matter, such as oil or grit, lodged between the clutch plate and pulley. Thoroughly clean these contact surfaces and the drive plate.

3. **Coil**

   Inspect the coil for a loose connector or cracked insulation. If the insulation is cracked, replace the coil. Repair or replace the wire or the connector if either is loose or damaged.



1.	Drive Plate
2.	Pulley Assembly
3.	Coil

Inspect Components

Clutch Installation

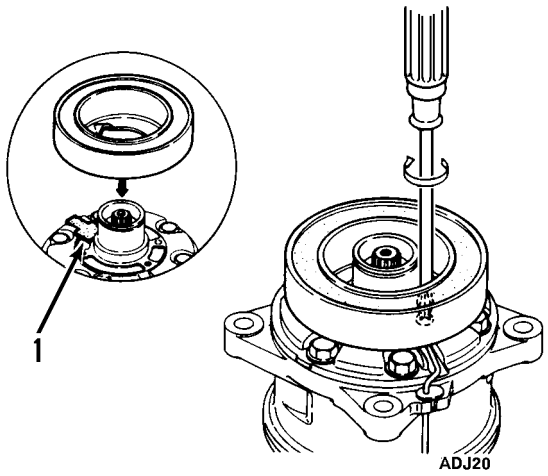
NOTE: Before installation refer to the "Inspection" procedures previously described.

1. Confirm that the felt is installed on the front of the cylinder head.

2. Install the coil on the compressor (with the lead wire on top). At this time, confirm that the coil's concave portion is aligned with the felt and then tighten the mounting screws to the specified torque.

   NOTE: Specified torque: 2.9 to 4.3 ft-lbs (0.4 to 0.6 kgm).

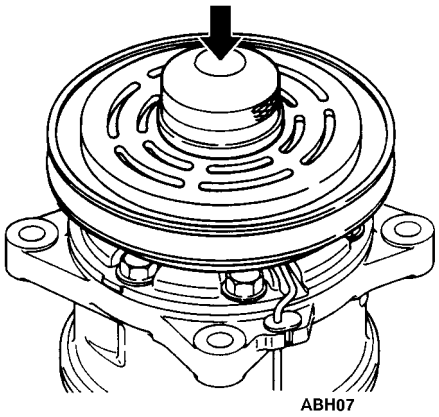
3. Install the lead wire in the wire holder on the compressor.



1.	Felt

Install Coil

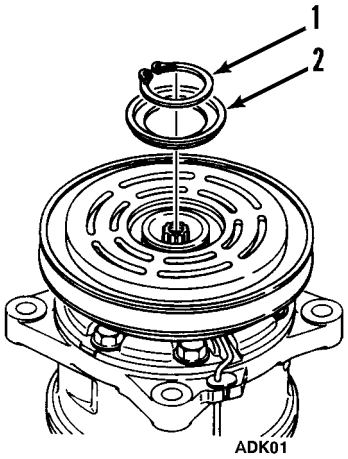
4. Install the pulley assembly using the compressor holder (TK No. 204-807) and a hand press.



Install Pulley

5. Install the cover and the snap ring using external ring pliers.

   NOTE: When installing the snap ring, the chamferred inner edge of the snap ring should face upward.



1.	Snap Ring
2.	Cover

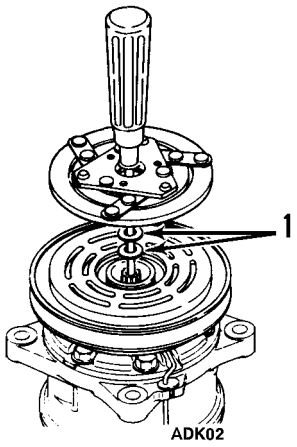
Install Cover and Snap Ring

6. Install the driver plate on the drive shaft, together with the original shim(s). Press the drive plate down by hand.

7. Tighten the bolt to the specified torque using the puller arbor (TK No. 204-804) to prevent drive-plate rotation.

   NOTE: Specified torque: 8.7 to 10.1 ft-lbs (1.2 to 1.4 kgm).

After tightening the bolt, ensure that the pulley rotates smoothly.



1.	Shims

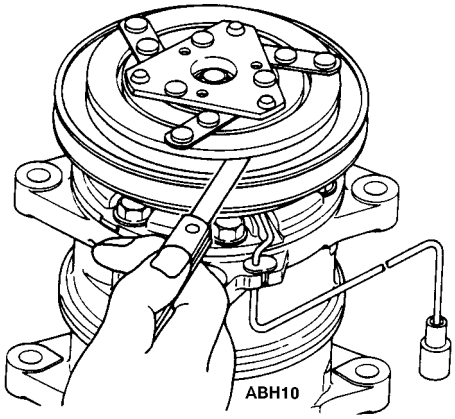
Install Shims and Drive Plate

8. Ensure that the clutch clearance is as specified. If necessary, adjust the clearance using shims.

   Adjusting shims are available in the following thicknesses:

Shim TK P/N	Thickness in. (mm)
TK 11-8031	0.0039 in. (0.1 mm)
TK 11-8032	0.0118 in. (0.3 mm)
TK 11-8033	0.0197 in. (0.5 mm)

NOTE: Specified clearance: 0.01 to 0.02 in. (0.3 to 0.6 mm).



Check Clearance

Electrical Connection

1. Connect the lead wire to the electrical circuit.

   NOTE: The stationary field is grounded at the factory; therefore, it is necessary only to connect the hot (lead) wire.

2. Engage and disengage the clutch several times to check the clutch engagement. The disc should snap firmly against the pulley.

SHAFT SEAL COVER AND SHAFT SEAL: REMOVAL AND INSTALLATION

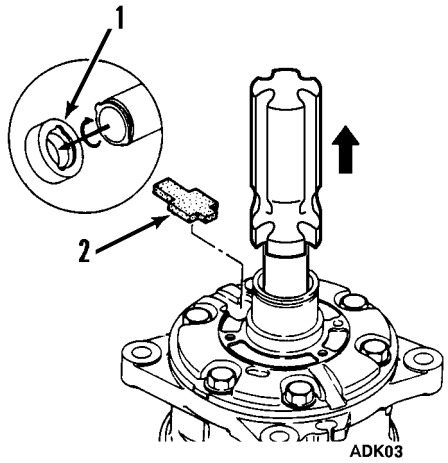
Removal

1. Remove the magnetic clutch assembly, as outlined in "Magnetic Clutch Removal" section of this manual.

2. Remove the felt pad.

3. Use the seal remover (from the shaft seal kit P/N 204-805) to remove the shaft seal cover. Turn the seal remover to engage the hook on the seal remover with the hook on the shaft seal cover, then slowly pull the shaft seal cover out of the cylinder head.

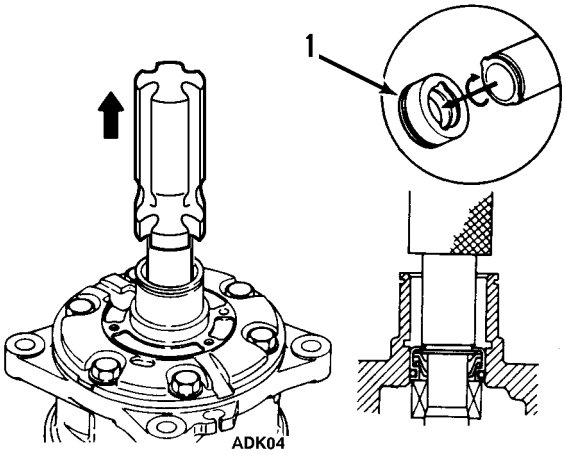
   NOTE: The shaft seal cover SHOULD NOT be reused. Always use a new shaft seal cover when reassembling a compressor.



1.	Shaft Seal Cover
2.	Felt Pad

Remove Shaft Seal Cover

4. Use the seal remover (from the shaft seal kit P/N 204-805) to remove the shaft seal. Turn the seal remover to engage the hook on the seal remover with the hook on the shaft seal, then slowly pull the shaft seal out of the cylinder head.

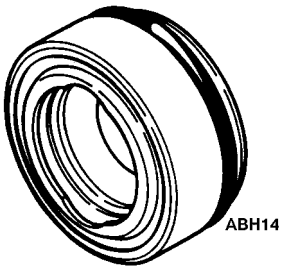


1.	Shaft Seal

Remove Shaft Seal

Inspection

The shaft seal should not be reused. Always use a new shaft seal when reassembling a compressor. Be extremely careful to make sure the lip of the shaft seal that is being installed is not scratched or damaged in any way. Make sure the shaft seal is free from lint and dirt that could damage the shaft seal surface.

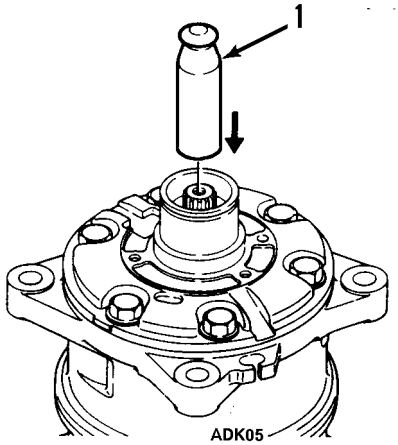


Inspect Shaft Seal

Shaft Seal Installation

Before installing a shaft seal inspect it carefully (see Inspection).

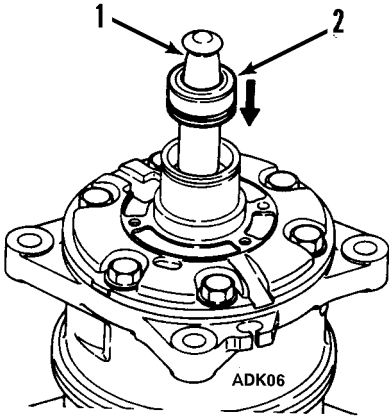
1. Clean the section of the front cylinder head that holds shaft seal.
2. Apply clean compressor oil to the new shaft seal and to the front cylinder head. If the slip surfaces are dirty, clean them with thinners, dry the clean surfaces and apply clean compressor oil.
3. Place the seal guide (from the shaft seal kit P/N 204-805) on the end of the shaft.



1.	Seal Guide

Place Guide on Shaft

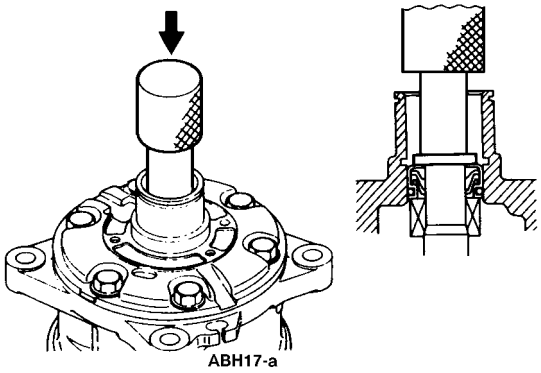
4. Place the shaft seal on the seal guide and slide the seal into the cylinder head.



1.	Seal Guide
2.	Shaft Seal

Place Shaft Seal on Guide

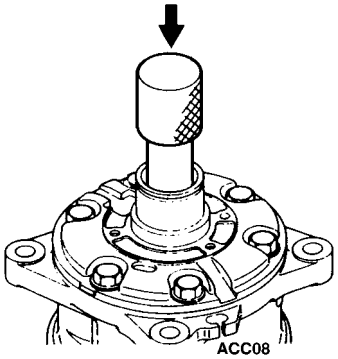
5. Use the seal installer (from the shaft seal kit P/N 204-805) to press the shaft seal into the cylinder head as far as possible.
6. Remove the seal guide from the shaft.



Press Seal Into Cylinder Head

7. Place the seal guide (from the shaft seal kit P/N 204-805) on the end of the shaft.

8. Place the shaft seal cover on the seal guide and slide the shaft seal cover into the cylinder head.

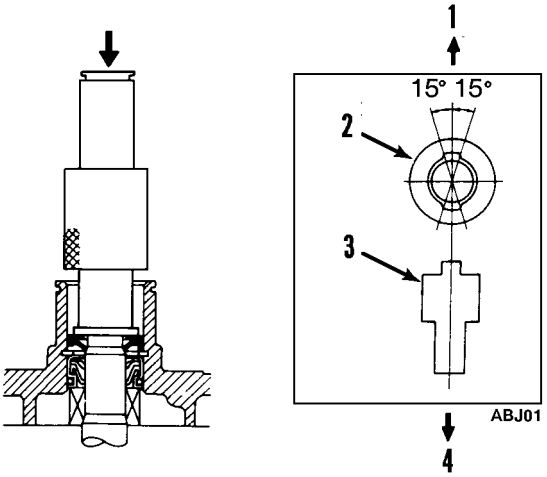


Install Shaft Seal Cover

9. Use the seal installer (from the shaft seal kit P/N 204-805) to press the shaft seal cover into the cylinder.

10. Remove the seal guide from the shaft.

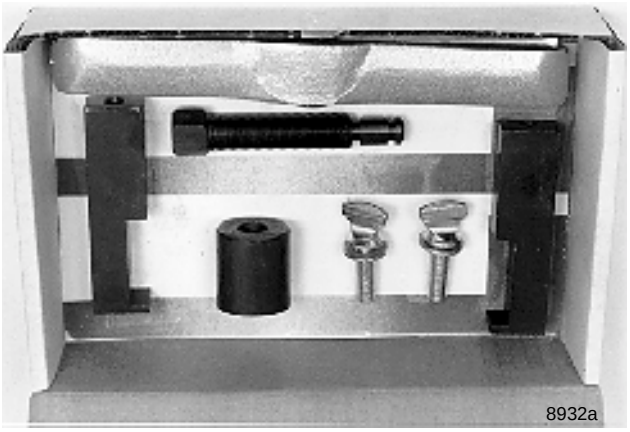
NOTE: Position the shaft seal cover as shown in the illustration. The felt pad should also be replaced with a new one when the shaft seal is replaced.



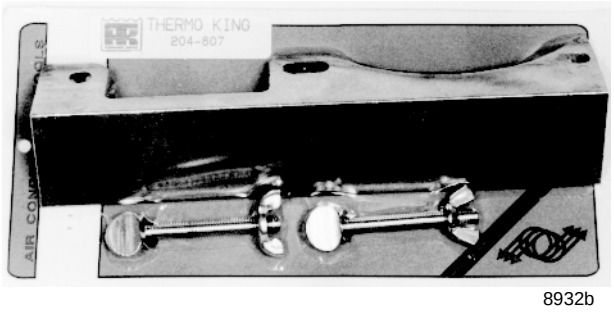
1.	Top	3.	Felt Pad
2.	Shaft Seal Cover	4.	Bottom

Proper Shaft Seal Cover Position

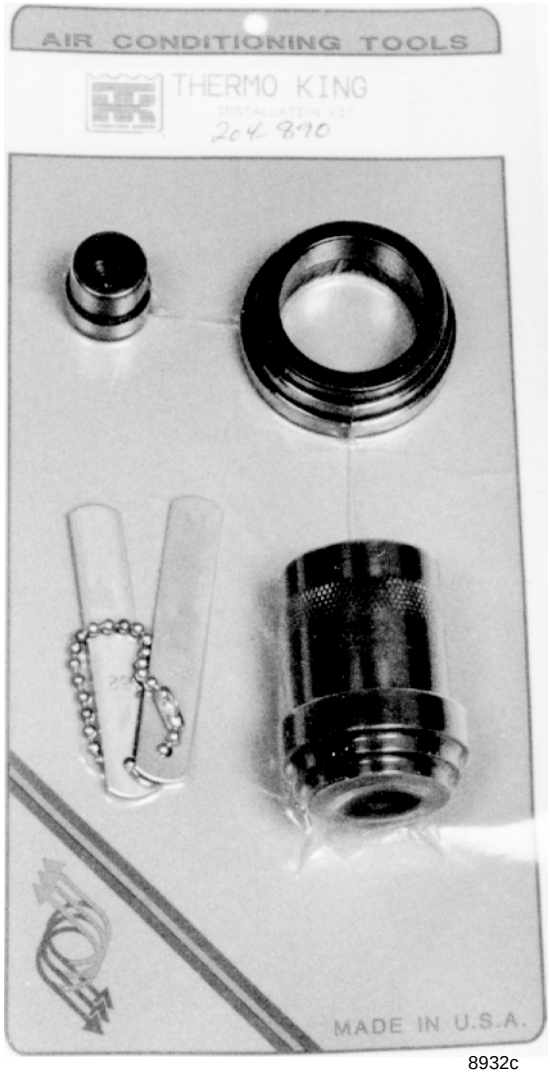
Special Tools



Clutch Remover P/N 204-806



Compressor Holder P/N 204-807



8932c

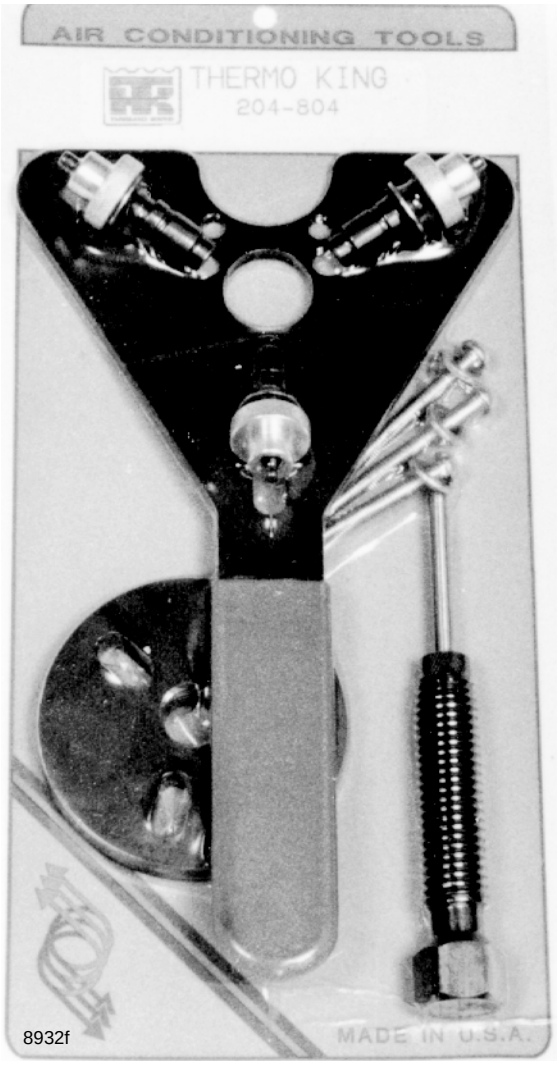
Clutch Installation Kit P/N 204-890

8932e

Shaft Seal Kit P/N 204-805

8932d

Snap Ring Pliers P/N 204-808



Pulley Arbor P/N 204-804

SYSTEM COMPRESSOR AND OIL

Installation of the Compressor

The compressor is mounted in the condenser section. The side to side mounting angle of the compressor must remain ± 45° from the horizontal. The forward to backward angle must be within ± 10° of horizontal. Access to the air conditioning system service ports is from the top of the unit.

Each compressor comes with a standard charge of Polyol Ester (POE) oil inside. This quantity of oil is enough to supply the compressor lubrication when it is installed into an already “oil wet” system. New systems require an extra quantity of oil be added to “wet” all the interior surfaces of the system.

During normal operation there is always a quantity of oil that travels around inside the system. This oil lubricates all the components, returns to the compressor for a while, and again travels around the system.

Adding Extra Oil to the System

The initial oil charge into a new system is based on the size of the system and the amount of oil, which remains in the compressor during operation.

The correct oil to use in the V250 using R-134a and R-404A is Polyol Ester (POE) oil (TK No. 203-413). Any extra or replacement oil should be placed into the system at the receiver tank port.

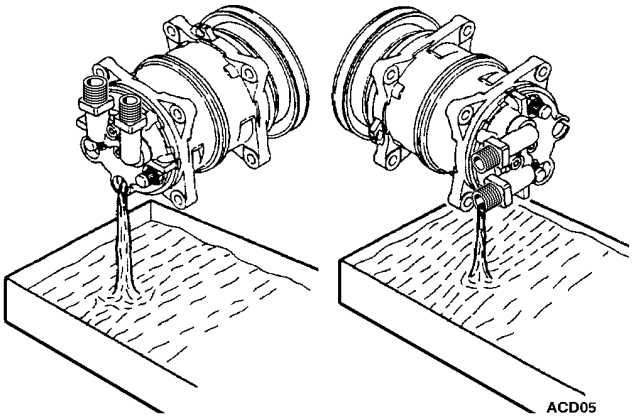
CAUTION: Keep all oil containers tightly sealed from the air. Oil tends to absorbed moisture from the air and can become contaminated if left open. If contaminated oil is put into a system, it may damage the components of the system.

Major Loss of Refrigerant

In case of a major loss of refrigerant, it must be assumed that some system oil is lost also. The oil level should be verified by the “Checking the Oil Level” method in this manual.

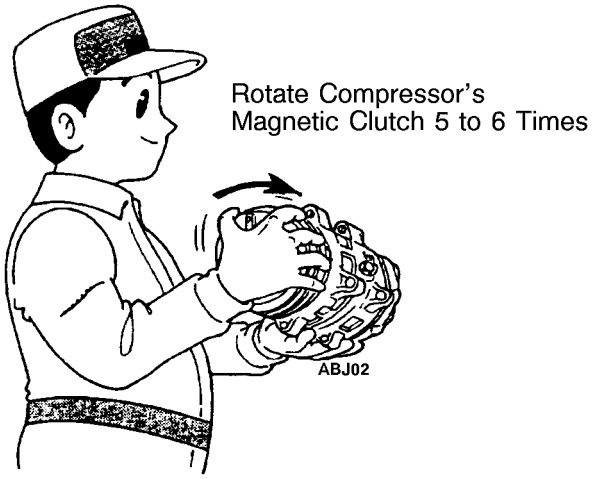
Checking the Oil Level

Drain the Oil



Draining the Oil

Remove the compressor from the unit and drain the oil from the compressor drain plug and all other ports. Turn the clutch (rotating the internal compressor parts) by hand and drain oil again. Repeat until all oil is removed from the compressor. Measure the oil in liquid ounces. Also, inspect the oil for signs of contamination.



Oil contamination.

1. Dirt in the oil.
2. Color changed to a varnish color.
3. Presence of foreign substances, metal shavings, etc. in the oil.

NOTE: Always replace oil with new fresh oil taken from a sealed container only.

NOTE: Always replace the system filter-drier anytime the system has been opened for service.

When a System Becomes Contaminated

A severely contaminated system may be indicated by black oil in the compressor. If severe contamination occurs, it will be necessary to flush the complete system. If flushing is required, use industry approved materials.

In all cases when this occurs you must determine the extent of contamination. Do this by removing the filter-drier and determine if the darker colored oil is present at that point of the system too. If it is, flushing the system is recommended.

If the oil appears clean at the filter-drier, install a new filter-drier and replace the compressor with clean new oil. Refer to checking and draining the compressor oil section for details.

CAUTION: Any extra or replacement oil should be placed into the system at the receiver tank port.

Electrical Connection

1. Connect the lead wire to the electrical circuit.

   NOTE: The stationary field is grounded at the factory; therefore, it is necessary only to connect the hot (lead) wire.

2. Engage and disengage the clutch several times to check the clutch engagement. The disc should snap firmly against the pulley.

Clutch Test

1. If the field coil lead wire is broken, replace the field coil.
2. Check the amperage and voltage. The amperage range should be 3.6 to 4.2 amps at 12 volts or 1.8 to 2.1 amps at 24 volts. Note the following symptoms and conditions.
   a. A very high amperage reading—a short within the field coil.
   b. No amperage reading—an open circuit in the winding.
   c. An intermittent or poor system ground results in lower voltage at the clutch. Check for tight fit of the coil retaining snap ring or coil retaining screws for good ground.
   d. Replace field coil if it has an open or short circuit.
3. Air Gap—An incorrect air gap could cause erratic engagement or disengagement and/or clutch rattle. Check the air gap with a feeler gauge (0.01 to 0.02 in. [0.3 to 0.6 mm]). Adjust per the Clutch Installation section.

BELT TENSIONS

Engine/Compressor Belt and Pulleys

Correct pulley alignment and proper belt tension are very important factors in compressor installation. The compressor clutch must be perfectly aligned with the engine pulley and any auxiliary idler or belt adjustment pulley components. When installing the clutch, be sure the shaft drive key is in place and the shaft bolt is properly tightened. Check the pulley alignment by holding a 24 to 35 in. (60 to 90 cm) long rod, 0.5 in. (13 mm) in diameter firmly into the V-groove of the clutch pulley and make sure the rod aligns squarely with the engine drive pulley groove. Double check by making sure the belt goes from pulley to pulley in perfect alignment with no indication of a sideward bend.

Adjust the belt tension to 58 to 60 on TK Gauge P/N 204-427. Check the belt tension again after 36 to 48 hours of initial operation of the unit because the belt may stretch slightly during the first hours of use. Remember, good alignment and proper belt tension ensure long belt life.

NOTE: Do not overtighten the belts. Proper belt tension should allow the belt to be deflected 0.5 in. (13 mm) at the center of the span with no motor movement. A belt that is too tight causes severe overload on the compressor and motor bearings. Use only approved Thermo King Service Parts replacement belts. They are specially designed for these units.

Over-the-Road Mechanical Diagnosis

If the desired box temperature cannot be obtained, any of the following may be indicated:

1. EXCESSIVE HEAT LOAD. An excessive heat load on the system will be caused by too many, or excessively long, stops with the doors open. Excessive heat loads will also be caused by loose doors, loose body panels, warm loads and poor insulation.

2. DIRT ON COILS. Dirt on the condenser or evaporator coils acts as an insulator reducing the capacity of the unit.

3. INCORRECT BELT TENSION. If the drive belt is not correctly tensioned, the compressor will not be driven at the proper speed, and unit efficiency will be reduced. By contrast, too much tension will place an additional load on the bearings causing rapid wear.

4. SHORTAGE OF REFRIGERANT. Shortage of refrigerant reduces the capacity of the unit. Find and remedy the cause of the shortage and recharge the system. DO NOT operate the unit if there is an indication of low charge. DO NOT operate below 30 F (-1 C) box temperature if the refrigerant level is below the sight glass on the receiver tank.

5. FAULTY EXPANSION VALVE ADJUSTMENT. High superheat settings will starve the evaporator causing low suction pressure. Low superheat settings will flood the coil causing high suction pressure. The superheat setting should be adjusted ONLY by a trained refrigeration service technician.

   The superheat setting is 8 F (4.4 C) at 0 F (-18 C) box temperature.

6. EXCESSIVE OIL. Too much compressor oil in the system may result in lower than normal suction pressure as well as lowered capacity.

7. MOISTURE IN THE SYSTEM. Symptom: Expansion valve freeze-up—will not refrigerate. Usually this can be checked by warming the expansion valve with either a hand or hot towels to see if the valve opens. Evacuate the system in the same manner used during installation. Install a new drier.

8. EXPANSION VALVE LOSES ITS CHARGE. If the expansion valve loses its charge, the valve will close causing the system to go into vacuum. Replace the valve.

9. AIR IN THE SYSTEM. Air is not condensable. Its presence in the system increases head pressure. When the compressor is stopped, air will gather at the high point of the high side. Purge the system high side of air and recheck the charge and head pressure.

10. TEMPERATURE OF THE LIQUID LINE. During normal operation, the liquid line will be slightly warmer than the surrounding air. An extremely hot line indicates either a shortage of refrigerant or a lack of a liquid seal at the receiver outlet. A cold line indicates a restriction, and some flashing takes place in the liquid line sight glass.

11. DIRTY OR WET DRIER. If the outlet line of the drier is colder than the inlet line, the drier is either saturated with moisture or is dirty and must be replaced.

12. DIRT IN THE EXPANSION VALVE SCREEN. Release the refrigerant charge, remove the screen and clean. Moisture in the refrigeration system will collect at the expansion valve and freeze. This is indicated by abnormally low suction pressure. Replace the drier, dry the system and recharge.

13. ICE ON THE EVAPORATOR COIL. Run the unit through a defrost cycle to remove the ice.

14. COMRPESSOR LIFE. Operating without sufficient oil in the system, or at low temperatures over-the-road at high compressor speeds, can cause short compressor life.

    Avoid extended high speed operation at low box temperatures.

15. AIR FLOW. Do not load product directly in front of the air return or discharge. Ensure that the fan is correctly positioned in the orifice to achieve maximum air flow.

16. COMPRESSOR LIFE. The following will shorten the life of a compressor:

- Operating a contaminated system
- No oil trap
- Clogged oil separator (JetLube™)
- Clogged liquid injection orifice (JetCool™)
- Defective temperature switch (JetCool™)
- Insufficient oil charge
- Wrong oil or mixed oil
- Lack of compressor lubrication on installation-startup
- Excess compressor speed (refer to the chart below)

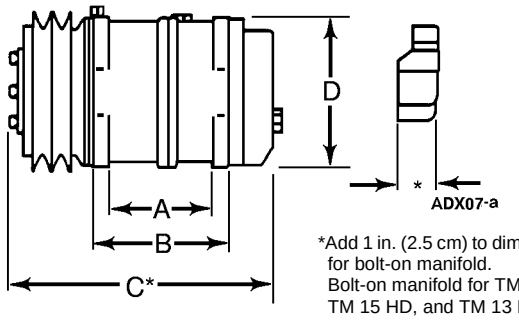
Road Compressors

Specifications

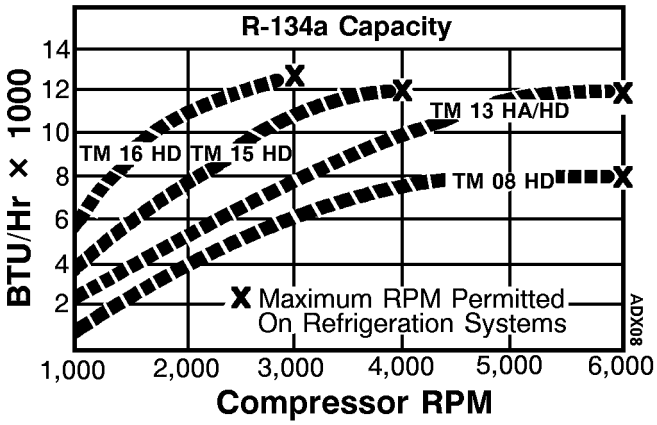
Model	Displ.	Dimensions			
MAX RPM	(Metrics)	A	B	C*	D
TM 16HD	10.5 cid	3.28in.	4.41 in.	8.77 in.	4.09 in.
3000 rpm	(163 cc)	(83.3 mm)	(112 mm)	(222.8 mm)	(104 mm)
TM 15 HD	9.0 cid	3.28 in.	4.41 in.	8.55 in.	4.09 in.
4000 rpm	(147 cc)	(83.3 mm)	(112 mm)	(217.3 mm)	(104 mm)
TM 13 HD	8.0 cid	3.28 in.	4.41 in.	8.55 in.	4.09 in.
6000 rpm	(131 cc)	(83.3 mm)	(112 mm)	(217.3 mm)	(104 mm)
TM 13 HD	8.0 cid	2.89 in.	3.86 in.	8.23 in.	4.09 in.
6000 rpm	(131 cc)	(73.3 mm)	(98 mm)	(209 mm)	(104 mm)
TM 08 HD	5.0 cid	2.03 in.	3.15 in.	6.85 in.	4.41 in.
6000 rpm	(82 cc)	(515 mm)	(80 mm)	(174 mm)	(112 mm)

Relative Performance

Compressor RPM Formula						
Drive Pulley Dia.	÷	Clutch Pulley Dia.	X	High Engine RPM	=	Maximum Compressor RPM
6.5	÷	5.25	X	2500	=	3095



*Add 1 in. (2.5 cm) to dimensions for bolt-on manifold. Bolt-on manifold for TM 16 HD, TM 15 HD, and TM 13 HD only.



Electric Standby Mechanical Diagnosis

CONDITION	POSSIBLE CAUSE	REMEDY
Compressor does not run	Improperly wired	Check wiring against diagram
	Low line voltage	Check line voltage—determine location of voltage drop
	Relay contacts not closing	Check and replace relay if defective
	Power relay open	Check relay, replace if defective
	Motor wiring defective—open circuit	Close power supply start or disconnect switch
	Tripped circuit breaker	Reset
	Open circuit in motor winding	Check stator leads. If leads OK, replace stator
	High pressure cutout switch open	Eliminate cause of excessive pressure
	Thermostat faulty	Repair or replace
	Compressor piston stuck	Replace compressor
	Frozen compressor or motor bearings	Repair or replace
	Shortage of refrigerant	Recharge
	Low pressure cutout switch open	Recharge
	Overload relay open	Reset
Unit short cycles	Evaporator fan rotating in wrong direction	Correction rotation
	Shortage of refrigerant (low pressure cutout)	Repair leak and recharge
	Restricted expansion valve (low pressure cutout)	Replace expansion valve
	Refrigerant overcharge (high pressure cutout)	Remove excess charge
	Cycling on high pressure cutout	Check air flow and fan
	Clogged condenser coil	Clean coil

CONDITION	POSSIBLE CAUSE	REMEDY
Motor contactor burnout	Low line voltage	Increase voltage (must be ± 10% of compressor motor rating)
	Excessive line voltage	Reduce voltage (must be ± 10% of compressor motor rating)
Unit operates long or continuously	Shortage of refrigerant	Repair leak and recharge
	Discharge valve leaking	Replace compressor
	Thermostat faulty	Replace cab box
	Dirty condenser	Clean condenser
	Air in system	Purge
	Compressor inefficient	Replace compressor
	Plugged expansion valve	Clean or replace
	Iced or plugged coil	Defrost or clean
	Defective truck body insulation	Correct or replace
	Too many door openings	Keep doors closed
	Load too warm	Precool hot product
	Excessive superheat at expansion valve	Adjust
	Door seals worn	Repair/replace
Box temperature too high	Refrigerant shortage	Repair leak and recharge
	Thermostat set too high	Reset control
	Expansion valve or strainer plugged	Clean or replace
	Restricted lines	Clean restriction. Tubing pinched shut
	Hot load	Precool hot product
	Expansion valve superheat too high or too low	Adjust

CONDITION	POSSIBLE CAUSE	REMEDY
Head pressure too high	Refrigerant overcharge	Remove excess
	Air in system	Evacuate system
	Dirty condenser	Clean
	Restricted condenser	Clean condenser
	Condenser fan not running	Check fan motor
	Condenser fan rotating backwards	Check direction
Head pressure too low	Refrigerant shortage	Repair leak and recharge
	Compressor suction or discharge valve inefficient	Replace compressor
Noisy unit	Insufficient compressor oil	Add oil to proper level
	Mounting bolts loose	Tighten
	Oil slugging or refrigerant flooding back	Adjust oil level or refrigerant charge. Check expansion valve for proper superheat
Compressor loses oil	Shortage of refrigerant	Repair leak and recharge
	Plugged expansion valve or strainer	Clean or replace
	Wrong oil viscosity	Use proper oil
	Short cycling	Refer to Unit Short Cycles
	Superheat too high	Adjust expansion valve
Frosted or sweating suction line	Expansion valve set too low, admitting excess refrigerant	Adjust expansion valve
	Heat exchanger internal leak	Replace
Hot liquid line	Shortage of refrigerant	Repair leak and recharge
Frosted liquid line	Restricted dehydrator or strainer	Replace restricted part
Condenser coils cool when unit is in cool	Refrigerant undercharge	Repair leak and recharge
	Compressor inefficient	Replace compressor

CONDITION	POSSIBLE CAUSE	REMEDY
Unit in vacuum. Frost on expansion valve only	Ice plugging expansion valve orifice	Apply hot wet cloth to expansion valve. Moisture indicated by increase in suction pressure. Replace drier
	Plugged expansion valve strainer	Clean strainer or replace expansion valve
	Sensor bulb lost charge	Replace expansion valve

ELECTRIC STANDBY SERVICE CHECKS

1. Motor does not run	1. Check for power at source 2. Check for power at plug 3. Check for power at compressor contactor 4. Check for power at overload terminals (contactor closed) 5. Check for power at motor terminals
2. Power at motor terminals but motor does not run	1. Replace motor
3. Motor hums but does not run	1. Check for locked rotor 2. Check for worn bearings. Replace if necessary 3. Check for locked compressor and repair 4. Power source for single phasing 5. Check capacitors (on single phase units)
4. Check transformer	1. Check for power output 16 Vac, 12 volt system
5. Check rectifier	1. Check for rectifier output 14 Vdc, 12 volt system

Refrigeration Diagnosis

Rapid cycling	Unit cools in defrost cycle	Unit heats in refrigeration cycle	High head pressure	Low head pressure	No head pressure	High suction pressure	Low suction pressure	No suction pressure	Unit operating in a vacuum	Sight glass / empty	Suction line frosting back	Noisy compressor	Unit not refrigerating	Unit not defrosting	SYMPTOM POSSIBLE CAUSES
			•									•			Overcharge of refrigerant
				•	•		•		•	•			•	•	Shortage of refrigerant
				•	•				•	•	•	•	•	•	No refrigerant
			•												Air through condenser too hot (ambient)
			•												Air flow through condenser restricted (dirty)
				•			•								Air through condenser too cold (ambient)
			•									•	•		Air in refrigerant system
			•												Condenser fan blades bent or broken
•															Air short cycling around evaporator coil
							•		•	•	•				Air through evaporator restricted
							•		•	•	•	•	•		Evaporator needs defrosting
					•								•		Broken compressor belt
				•											Compressor discharge valves leaking
							•					•	•		Too much compressor oil in system
												•			Loose compressor pulley
												•			Compressor bearing loose or burned out
				•		•						•	•		Broken valve plate in compressor
							•		•			•	•		Expansion valve power element lost its charge
						•						•	•		Expansion valve feeler bulb improperly mounted
						•					•		•		Expansion valve feeler bulb making poor contact
						•				•	•		•		Expansion valve open too much
							•						•		Expansion valve closed too much
						•					•		•		Expansion valve needle eroded or leaking
				•			•		•				•		Expansion valve partially closed by ice, dirt or wax

Rapid cycling	Unit cools in defrost cycle	Unit heats in refrigeration cycle	High head pressure	Low head pressure	No head pressure	High suction pressure	Low suction pressure	No suction pressure	Unit operating in a vacuum	Sight glass / empty	Suction line frosting back	Noisy compressor	Unit not refrigerating	Unit not defrosting	**SYMPTOM** **POSSIBLE CAUSES**
						•					•	•	•		Liquid refrigerant entering compressor
							•		•				•		Restricted line on the low side
			•						•						Restricted line on the high side
							•		•				•		Restricted dehydrator
•				•											Reversed fan rotation
						•					•		•		Leak in heat exchanger
	•	•				•							•	•	Faulty pilot solenoid
	•													•	Loose or broken electrical connections
						•	•	•	•						Gauge out of calibration
						•							•		Leaky bypass check valve
						•								•	Leaky condenser check valve
			•												Condenser fan motor not operating
							•		•		•	•	•		Evaporator fan motor not operating
													•		Belts are loose

Wiring and Schematic Diagrams Index

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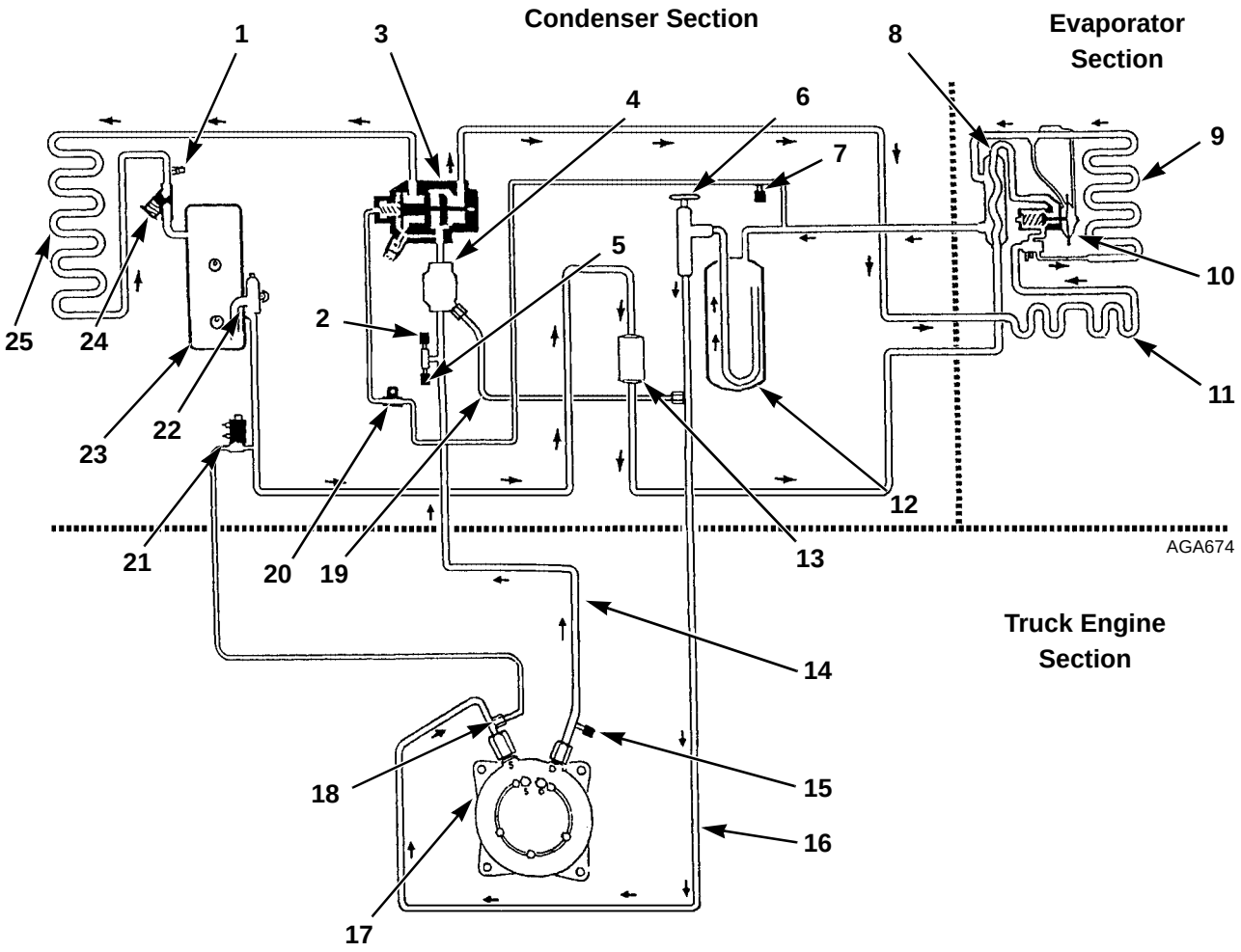
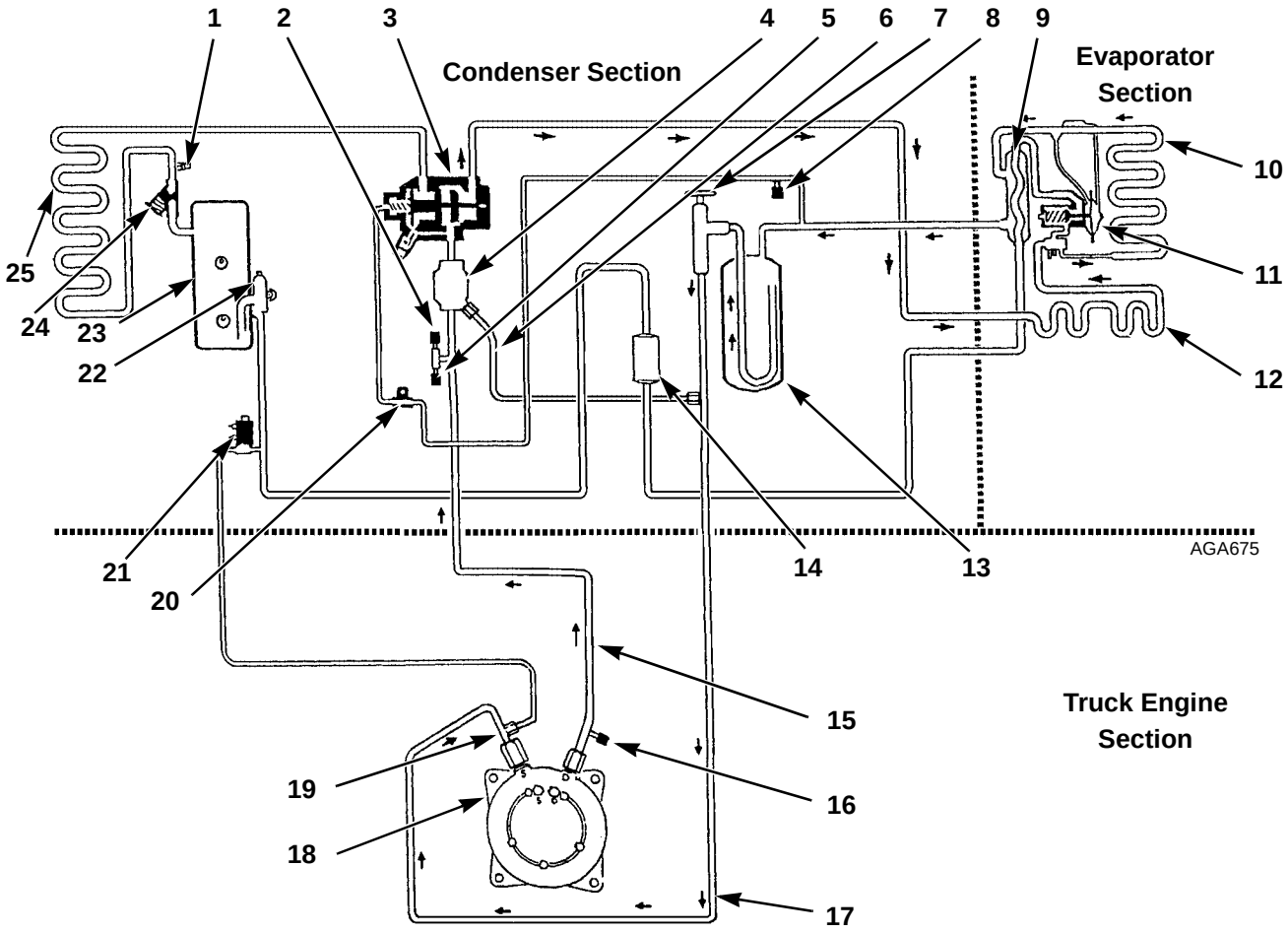
5D37311	Model 20 Wiring Diagram	C	99
5D45773	Model 20 Single Phase with Heat Option Schematic Diagram	A	100
5D39290	Model 20 Single Phase Wiring Diagram	A	101



1.	High Pressure Relief Valve	14.	Discharge Line
2.	High Pressure Cutout Switch	15.	High Temperature Switch
3.	Three-way Valve	16.	Suction Line
4.	Oil Separator	17.	Compressor
5.	Condenser Fan Switch	18.	Liquid Injection Solenoid Valve
6.	Suction Pressure Regulator	19.	Oil Return Line to Compressor
7.	Low Pressure Cutout Switch	20.	Pilot Solenoid Valve
8.	Heat Exchanger	21.	Liquid Injection Solenoid Valve
9.	Evaporator Coil	22.	Receiver Outlet Valve
10.	Expansion Valve	23.	Receiver Tank
11.	Pan Heater	24.	Condenser Check Valve
12.	Accumulator	25.	Condenser Coil
13.	Dryer		

CBci 10 in Cool



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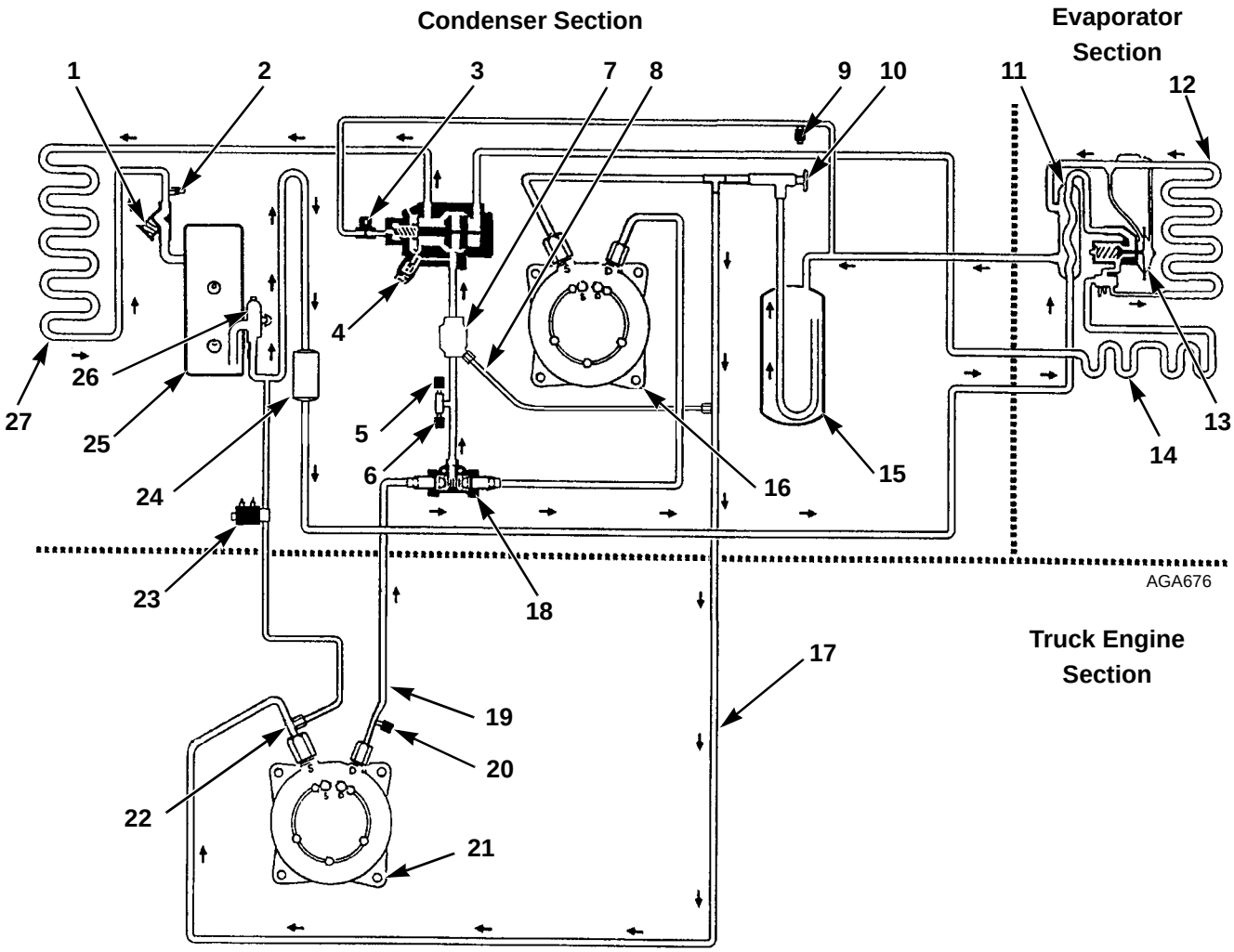
12.	Pan Heater	25.	Condenser Coil
13.	Accumulator		

CBci 10 in Defrost



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13.	Expansion Valve	27.	Condenser Coil
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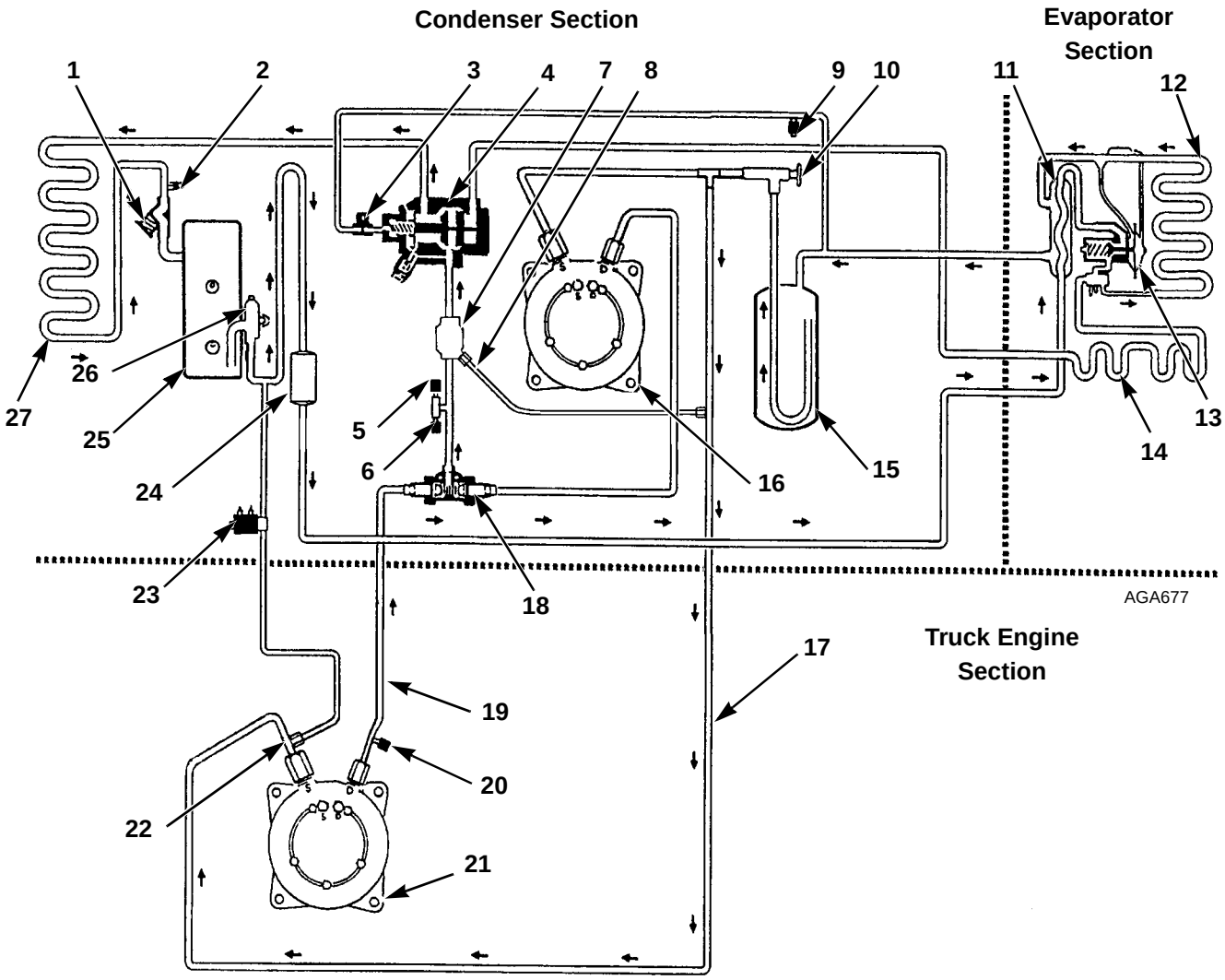
CBci 20 in Cool



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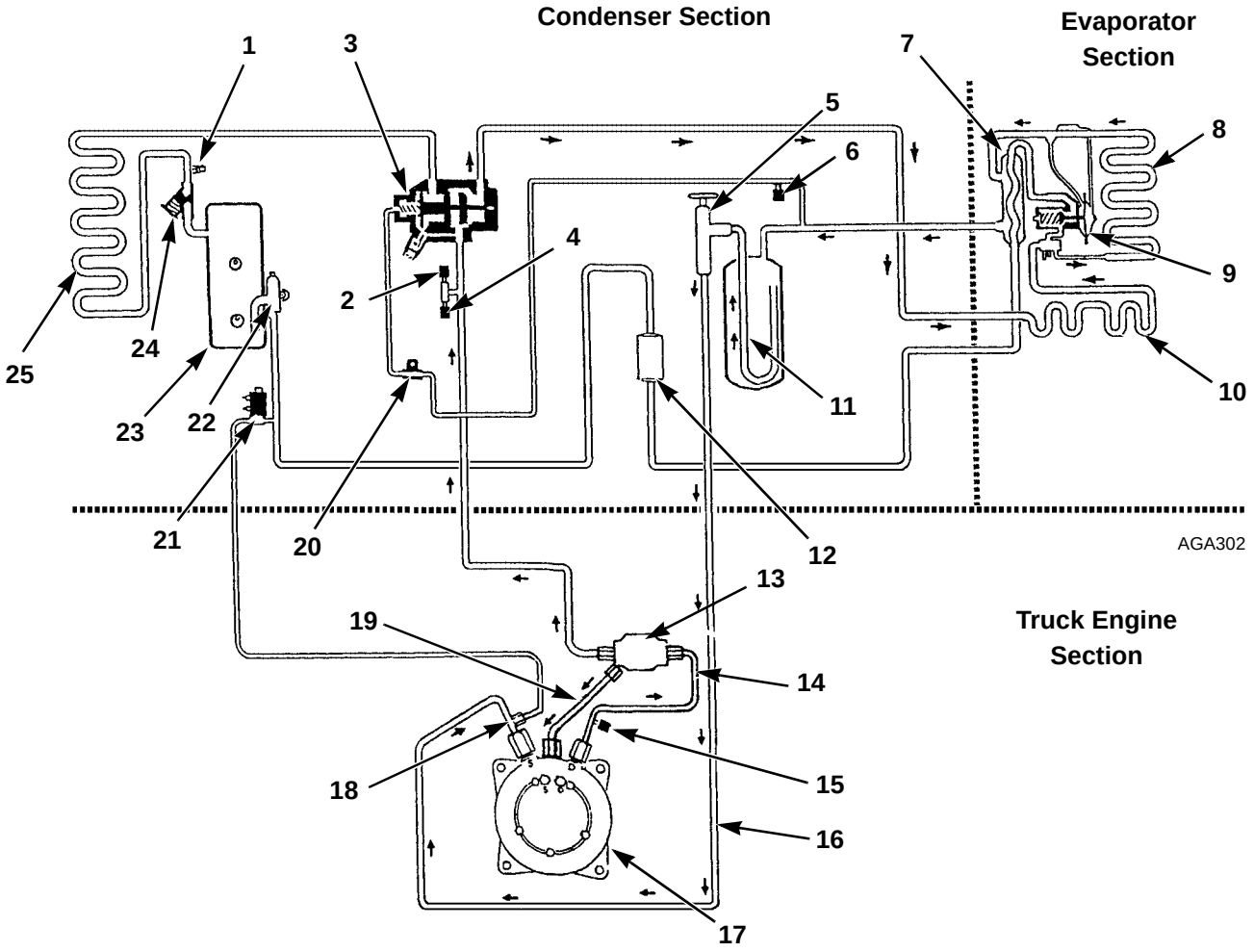

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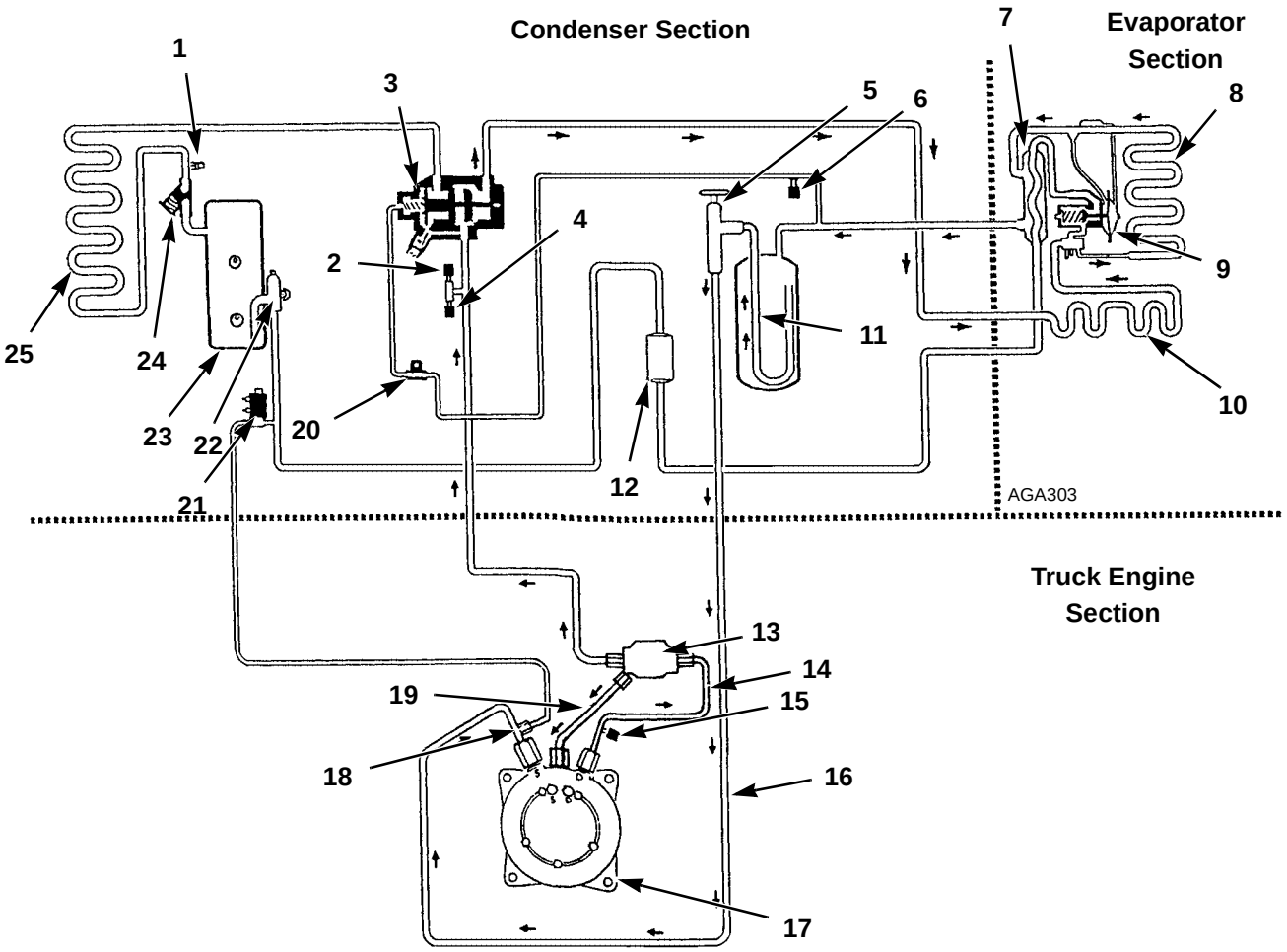
4.	Condenser Fan Switch	17.	Compressor
5.	Suction Pressure Regulator	18.	Liquid Injection Solenoid Valve
6.	Low Pressure Cutout Switch	19.	Oil Return Line to Compressor
7.	Heat Exchanger	20.	Pilot Solenoid Valve
8.	Evaporator Coil	21.	Liquid Injection Solenoid Valve
9.	Expansion Valve	22.	Receiver Outlet Valve
10.	Pan Heater	23.	Receiver Tank
11.	Accumulator	24.	Condenser Check Valve
12.	Drier	25.	Condenser Coil
13.	Oil Separator		

CBci 10 in Cool

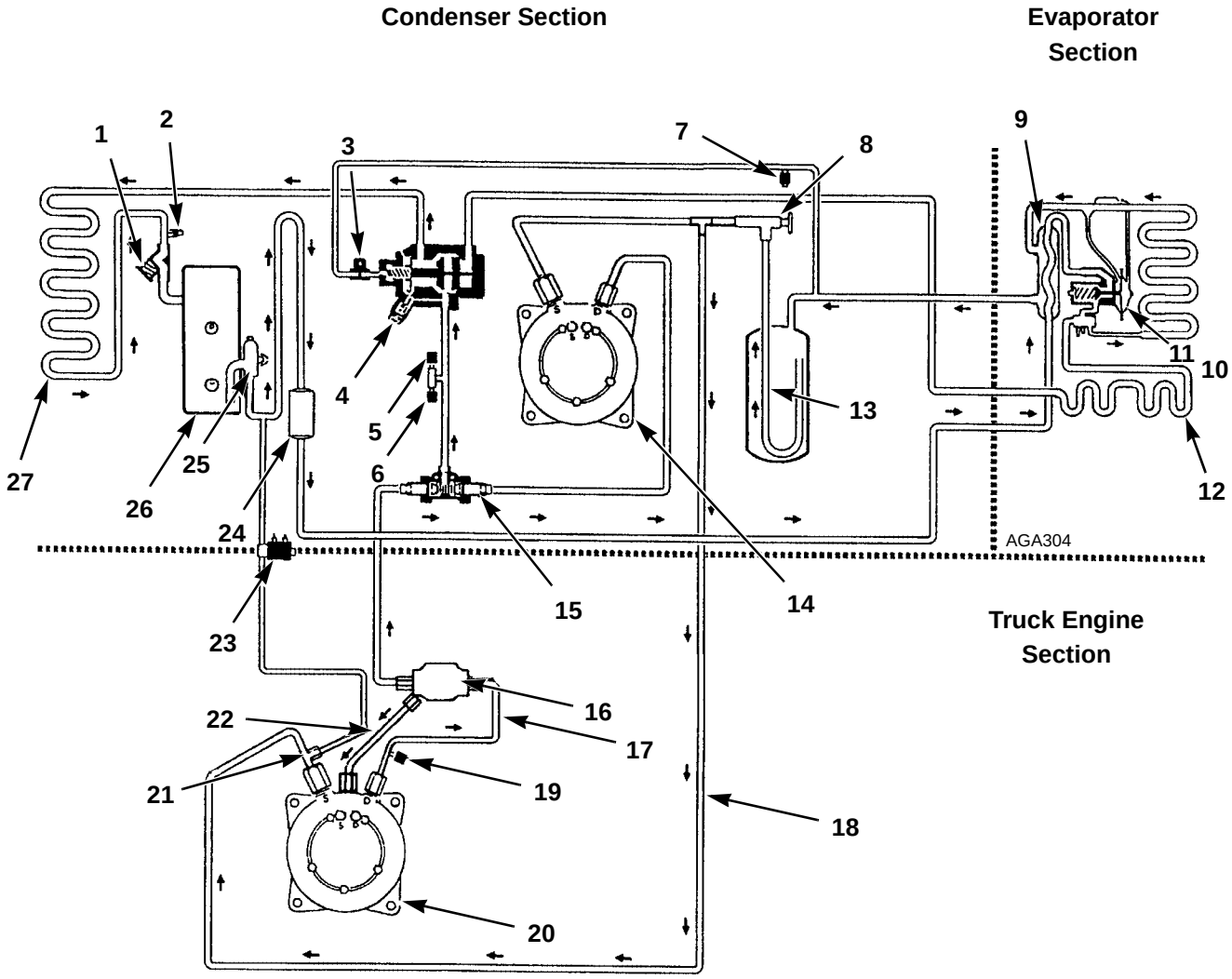
(Reference Only for Older Units)



1.	High Pressure Relief Valve	14.	Discharge Line
2.	High Pressure Cutout Switch	15.	High Temperature Switch
3.	Three-way Valve	16.	Suction Line
4.	Condenser Fan Switch	17.	Compressor
5.	Suction Pressure Regulator	18.	Liquid Injection Solenoid Valve
6.	Low Pressure Cutout Switch	19.	Oil Return Line to Compressor
7.	Heat Exchanger	20.	Pilot Solenoid Valve
8.	Evaporator Coil	21.	Liquid Injection Solenoid Valve
9.	Expansion Valve	22.	Receiver Outlet Valve
10.	Pan Heater	23.	Receiver Tank
11.	Accumulator	24.	Condenser Check Valve
12.	Drier	25.	Condenser Coil
13.	Oil Separator		

CBci 10 in Defrost

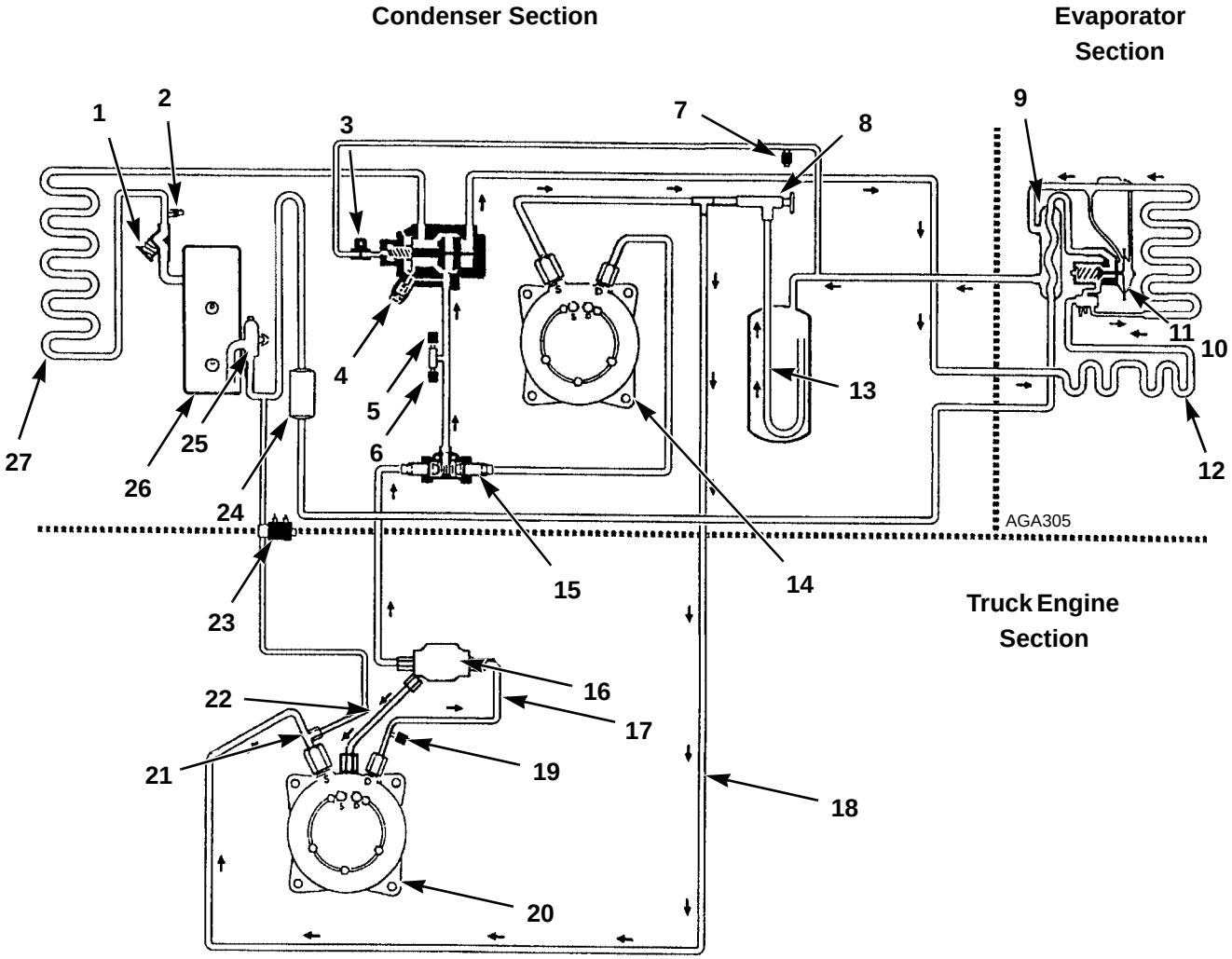
(Reference Only for Older Units)



1.	Condenser Check Valve	15.	Discharge Check Valve
2.	High Pressure Relief Valve	16.	Oil Separator
3.	Pilot Solenoid Valve	17.	Discharge Line
4.	Three-way Valve	18.	Suction Line
5.	High Pressure Cutout Switch	19.	High Temperature Switch
6.	Condenser Fan Switch	20.	Compressor
7.	Low Pressure Cutout Switch	21.	Liquid Injection Line Orifice
8.	Suction Pressure Regulator	22.	Oil Return Line to Compressor
9.	Heat Exchanger	23.	Liquid Injection Solenoid Valve
10.	Evaporator Coil	24.	Drier
11.	Expansion Valve	25.	Receiver Outlet Valve
12.	Pan Heater	26.	Receiver Tank
13.	Accumulator	27.	Condenser Coil
14.	Standby Compressor		

CBci 20 in Cool

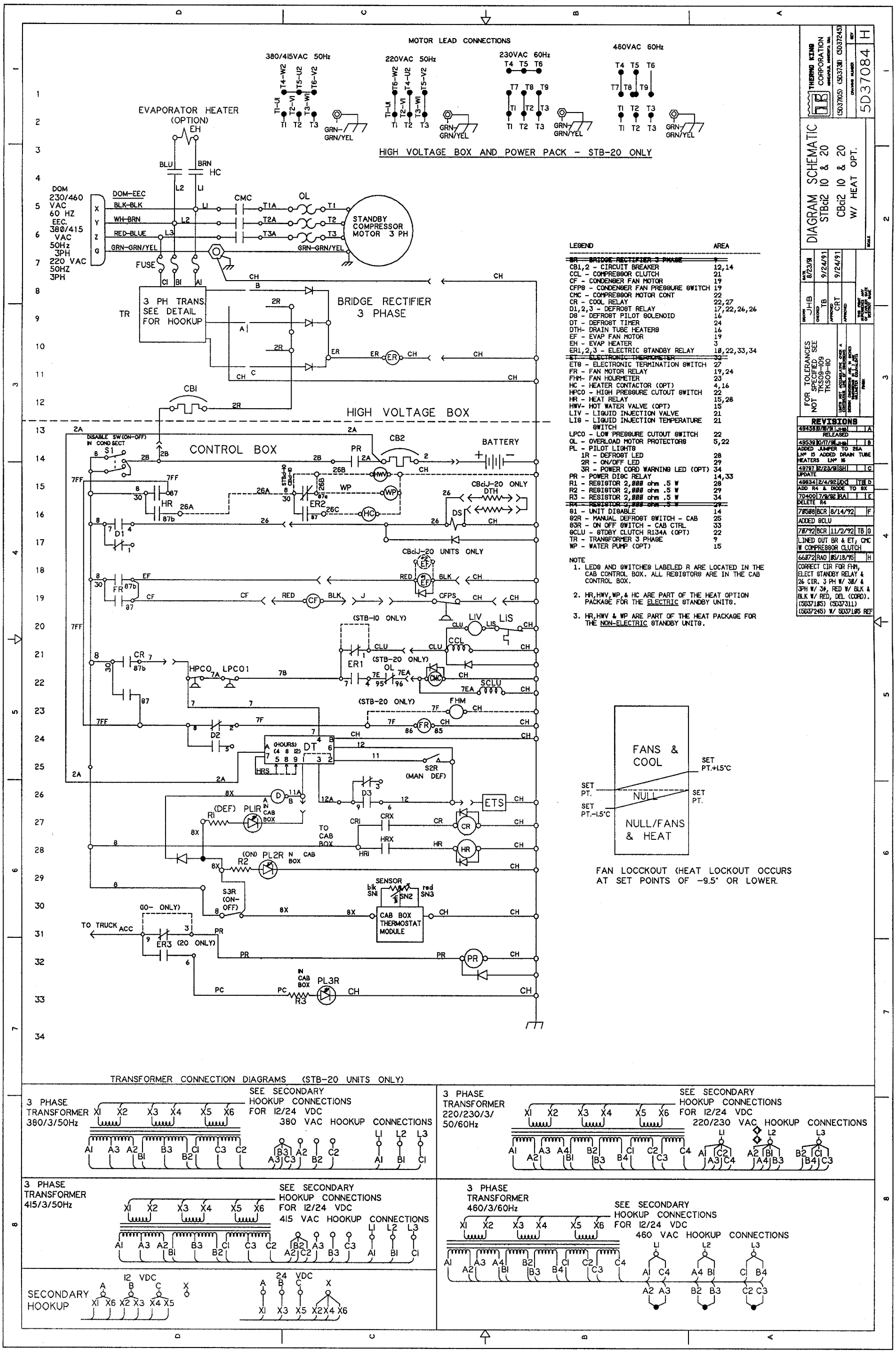
(Reference Only for Older Units)



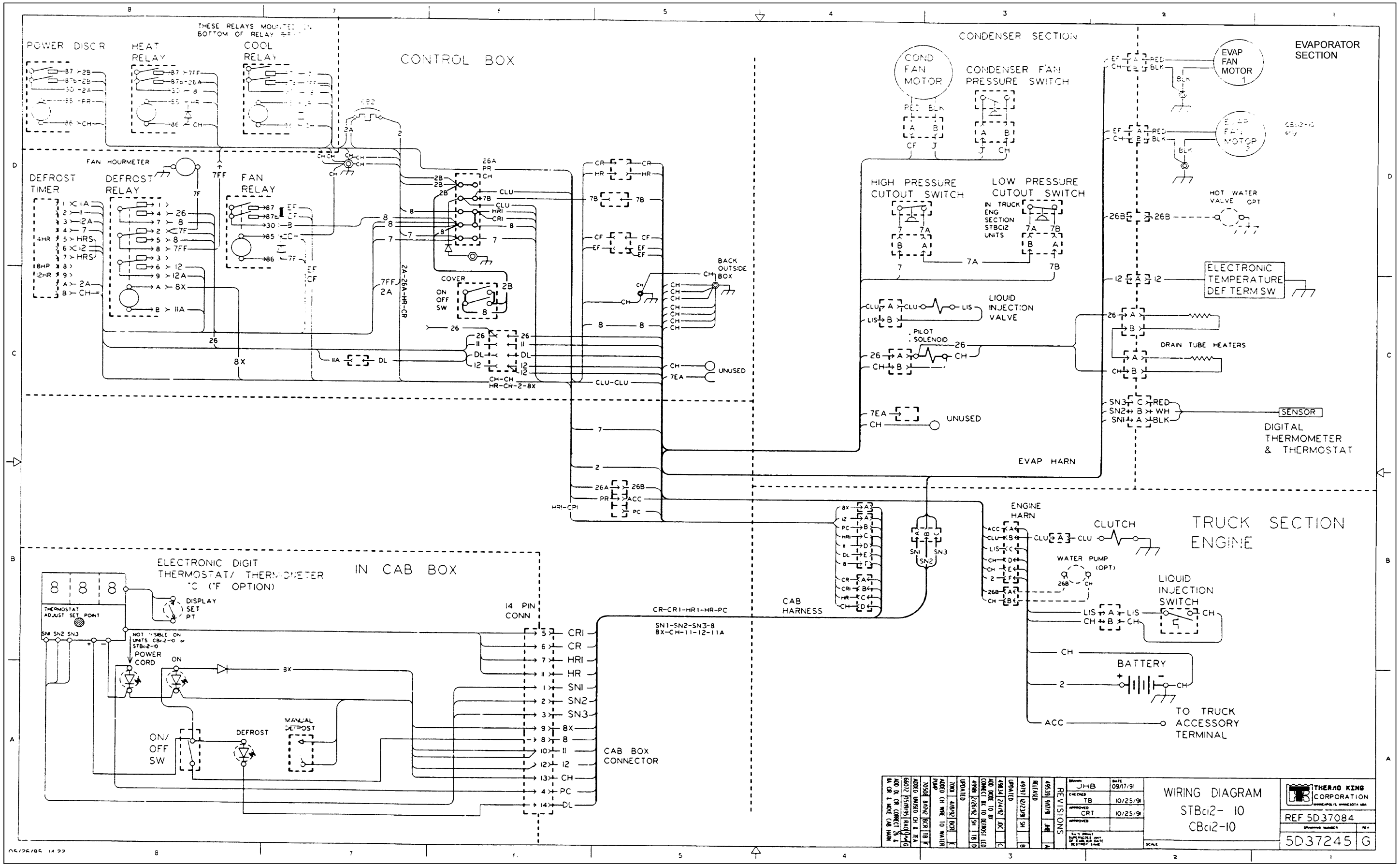
1.	Condenser Check Valve	15.	Discharge Check Valve
2.	High Pressure Relief Valve	16.	Oil Separator
3.	Pilot Solenoid Valve	17.	Discharge Line
4.	Three-way Valve	18.	Suction Line
5.	High Pressure Cutout Switch	19.	High Temperature Switch
6.	Condenser Fan Switch	20.	Compressor
7.	Low Pressure Cutout Switch	21.	Liquid Injection Line Orifice
8.	Suction Pressure Regulator	22.	Oil Return Line to Compressor
9.	Heat Exchanger	23.	Liquid Injection Solenoid Valve
10.	Evaporator Coil	24.	Drier
11.	Expansion Valve	25.	Receiver Outlet Valve
12.	Pan Heater	26.	Receiver Tank
13.	Accumulator	27.	Condenser Coil
14.	Standby Compressor		

CBci 20 in Defrost

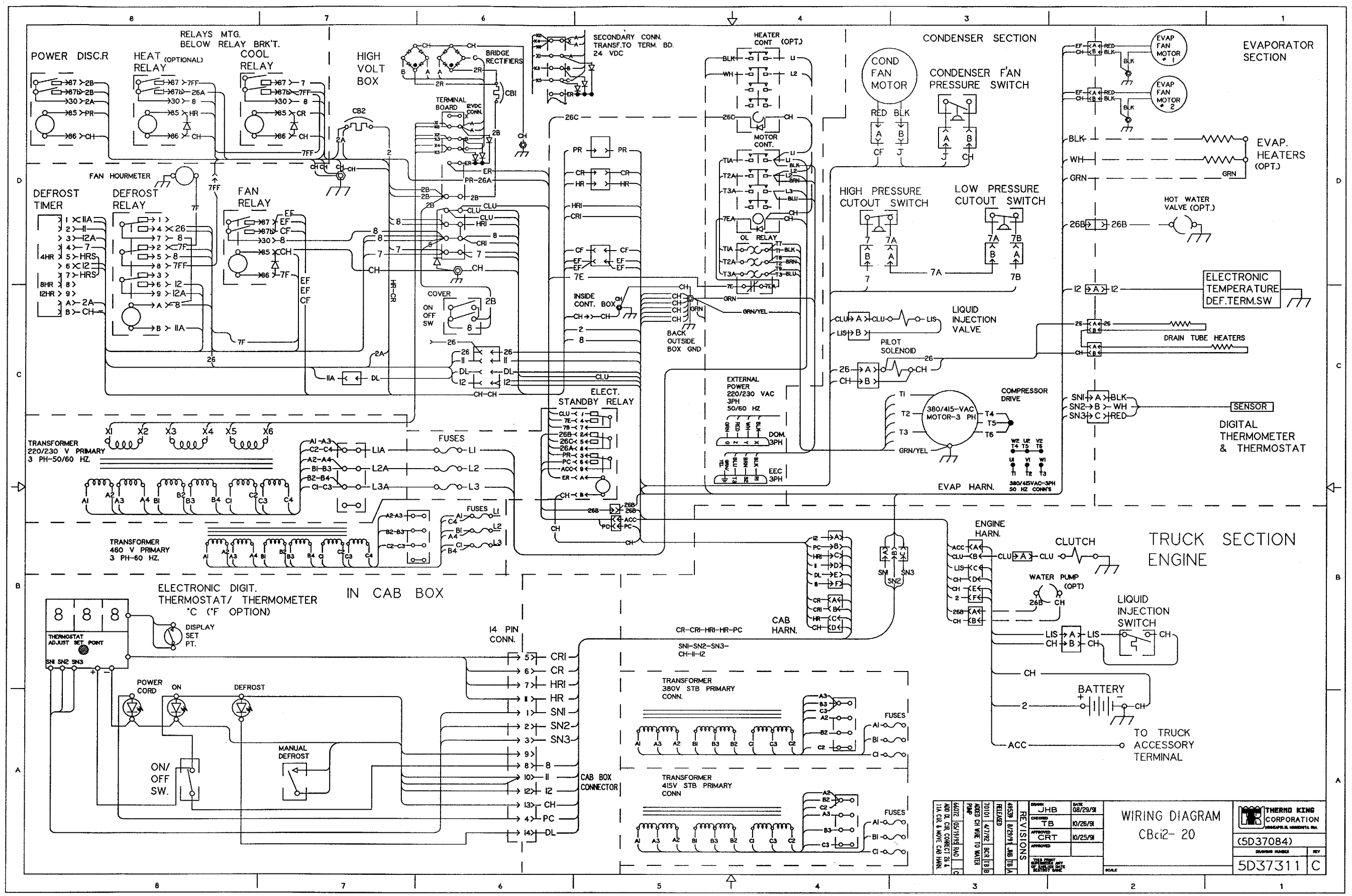
(Reference Only for Older Units)

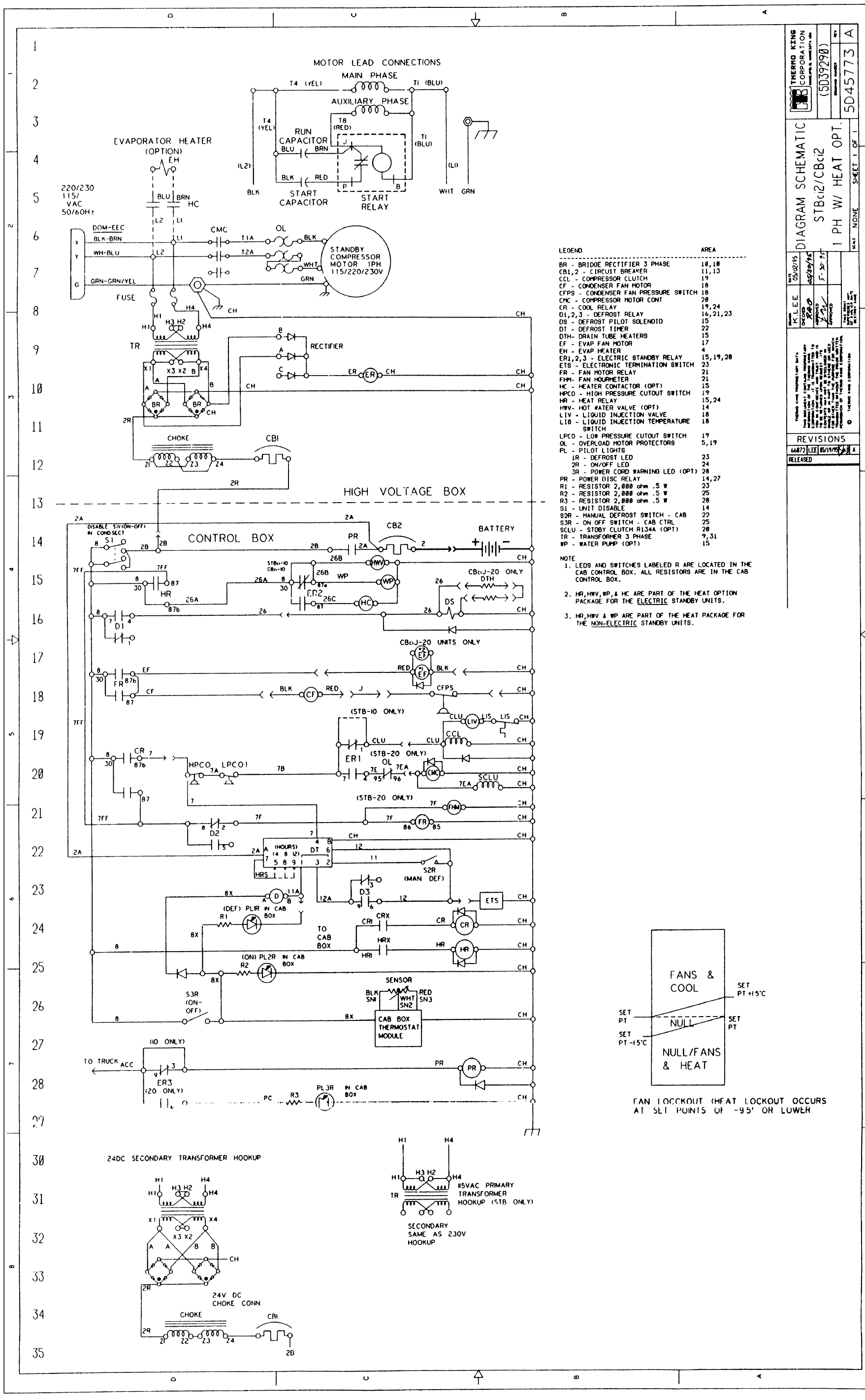

MOTOR LEAD CONNECTIONS
380/415VAC 50Hz
220VAC 50Hz
230VAC 60Hz
460VAC 60Hz
HIGH VOLTAGE BOX AND POWER PACK - STB-20 ONLY
EVAPORATOR HEATER (OPTION)
DOM 230/460 VAC 60 HZ
EEC. 380/415 VAC 50Hz 3PH
220 VAC 50HZ 3PH
DOM-EEC
BLK-BLK
WH-BRN
RED-BLUE
GRN-GRN/YEL
STANDBY COMPRESSOR MOTOR 3 PH
FUSE
3 PH TRANS. SEE DETAIL FOR HOOKUP
TR
BRIDGE RECTIFIER 3 PHASE
HIGH VOLTAGE BOX
CONTROL BOX
DISABLE SW(ON-OFF) IN COND SECT
BATTERY
CB2
CBciJ-20 ONLY
DTH
DS
CBciJ-20 UNITS ONLY
(STB-10 ONLY)
(STB-20 ONLY)
SCLU
(HOURS)
DT
HRS
S2R (MAN DEF)
ETS
PLIR IN CAB BOX
TO CAB BOX
PL2R IN CAB BOX
S3R (ON-OFF)
SENSOR
CAB BOX THERMOSTAT MODULE
TO TRUCK ACC
(20 ONLY)
PL3R IN CAB BOX
LEGEND
AREA
BR - BRIDGE RECTIFIER 3 PHASE 9
CB1,2 - CIRCUIT BREAKER 12,14
CCL - COMPRESSOR CLUTCH 21
CF - CONDENSER FAN MOTOR 19
CFPS - CONDENSER FAN PRESSURE SWITCH 19
CMC - COMPRESSOR MOTOR CONT 22
CR - COOL RELAY 22,27
D1,2,3 - DEFROST RELAY 17,22,26,26
DS - DEFROST PILOT SOLENOID 16
DT - DEFROST TIMER 24
DTH- DRAIN TUBE HEATERS 16
EF - EVAP FAN MOTOR 19
EH - EVAP HEATER 3
ER1,2,3 - ELECTRIC STANDBY RELAY 18,22,33,34
ET - ELECTRONIC THERMOSTAT 32
ETS - ELECTRONIC TERMINATION SWITCH 27
FR - FAN MOTOR RELAY 19,24
FHM- FAN HOURMETER 23
HC - HEATER CONTACTOR (OPT) 4,16
HPCO - HIGH PRESSURE CUTOUT SWITCH 22
HR - HEAT RELAY 15,28
HWV- HOT WATER VALVE (OPT) 15
LIV - LIQUID INJECTION VALVE 21
LIS - LIQUID INJECTION TEMPERATURE SWITCH 21
LPCO - LOW PRESSURE CUTOUT SWITCH 22
OL - OVERLOAD MOTOR PROTECTORS 5,22
PL - PILOT LIGHTS
1R - DEFROST LED 28
2R - ON/OFF LED 29
3R - POWER CORD WARNING LED (OPT) 34
PR - POWER DISC RELAY 14,33
R1 - RESISTOR 2,000 ohm .5 W 28
R2 - RESISTOR 2,000 ohm .5 W 29
R3 - RESISTOR 2,000 ohm .5 W 34
R4 - RESISTOR 2,000 ohm .5 W 29
S1 - UNIT DISABLE 14
S2R - MANUAL DEFROST SWITCH - CAB 25
S3R - ON OFF SWITCH - CAB CTRL 33
SCLU - STDBY CLUTCH R134A (OPT) 22
TR - TRANSFORMER 3 PHASE 9
WP - WATER PUMP (OPT) 15
NOTE
1. LEDS AND SWITCHES LABELED R ARE LOCATED IN THE CAB CONTROL BOX. ALL RESISTORS ARE IN THE CAB CONTROL BOX.
2. HR,HWV,WP,& HC ARE PART OF THE HEAT OPTION PACKAGE FOR THE ELECTRIC STANDBY UNITS.
3. HR,HWV & WP ARE PART OF THE HEAT PACKAGE FOR THE NON-ELECTRIC STANDBY UNITS.
FANS & COOL
NULL
NULL/FANS & HEAT
SET PT.
SET PT.+1.5°C
SET PT.-1.5°C
FAN LOCCKOUT (HEAT LOCKOUT OCCURS AT SET POINTS OF -9.5° OR LOWER.
TRANSFORMER CONNECTION DIAGRAMS (STB-20 UNITS ONLY)
3 PHASE TRANSFORMER 380/3/50Hz
3 PHASE TRANSFORMER 220/230/3/ 50/60Hz
3 PHASE TRANSFORMER 415/3/50Hz
3 PHASE TRANSFORMER 460/3/60Hz
SEE SECONDARY HOOKUP CONNECTIONS FOR 12/24 VDC
380 VAC HOOKUP CONNECTIONS
220/230 VAC HOOKUP CONNECTIONS
415 VAC HOOKUP CONNECTIONS
460 VAC HOOKUP CONNECTIONS
SECONDARY HOOKUP
12 VDC
24 VDC
THERMO KING CORPORATION
DIAGRAM SCHEMATIC STBci2 10 & 20
CBci2 10 & 20 W/ HEAT OPT.
5D37084 H
FOR TOLERANCES NOT SPECIFIED SEE TKS09-109 TKS09-110
REVISIONS
49458 8/8/91 JHB A RELEASED
49539 10/17/91 JHB B ADDED JUMPER TO 26A LN° 15 ADDED DRAIN TUBE HEATERS LN° 16
49797 12/23/91 SH C UPDATE
49834 2/4/92 JDC TB D ADD R4 & DIODE TO 8X
70400 7/9/92 RA E DELETE R4
7#508 BCR 8/14/92 F ADDED 8CLU
7#792 BCR 11/2/92 TB G LINED OUT BR & ET, CMC W COMPRESSOR CLUTCH
66872 RAO 05/18/95 H CORRECT CIR FOR FHM, ELECT STANDBY RELAY & 26 CIR. 3 PH W/ 38/ & 3PH W/ 34, RED W/ BLK & BLK W/ RED, DEL (CORD). (5D37185) (5D37311) (5D37245) W/ 5D37185 REF

Model 10 Wiring Diagram



Model 20 Wiring Diagram





LEGEND	AREA
BR - BRIDGE RECTIFIER 3 PHASE	10,18
CB1,2 - CIRCUIT BREAKER	11,13
CCL - COMPRESSOR CLUTCH	19
CF - CONDENSER FAN MOTOR	18
CFPS - CONDENSER FAN PRESSURE SWITCH	18
CMC - COMPRESSOR MOTOR CONT	20
CR - COOL RELAY	19,24
D1,2,3 - DEFROST RELAY	16,21,23
DS - DEFROST PILOT SOLENOID	15
DT - DEFROST TIMER	22
DTH- DRAIN TUBE HEATERS	15
EF - EVAP FAN MOTOR	17
EH - EVAP HEATER	4
ER1,2,3 - ELECTRIC STANDBY RELAY	15,19,20
ETS - ELECTRONIC TERMINATION SWITCH	23
FR - FAN MOTOR RELAY	21
FHM- FAN HOURMETER	21
HC - HEATER CONTACTOR (OPT)	15
HPCO - HIGH PRESSURE CUTOUT SWITCH	19
HR - HEAT RELAY	15,24
HWV- HOT WATER VALVE (OPT)	14
LIV - LIQUID INJECTION VALVE	18
LIS - LIQUID INJECTION TEMPERATURE SWITCH	18
LPCO - LOW PRESSURE CUTOUT SWITCH	19
OL - OVERLOAD MOTOR PROTECTORS	5,19
PL - PILOT LIGHTS	
1R - DEFROST LED	23
2R - ON/OFF LED	24
3R - POWER CORD WARNING LED (OPT)	28
PR - POWER DISC RELAY	14,27
R1 - RESISTOR 2,000 ohm .5 W	23
R2 - RESISTOR 2,000 ohm .5 W	25
R3 - RESISTOR 2,000 ohm .5 W	28
S1 - UNIT DISABLE	14
S2R - MANUAL DEFROST SWITCH - CAB	22
S3R - ON OFF SWITCH - CAB CTRL	25
SCLU - STDBY CLUTCH R134A (OPT)	20
TR - TRANSFORMER 3 PHASE	9,31
WP - WATER PUMP (OPT)	15

NOTE
1. LEDS AND SWITCHES LABELED R ARE LOCATED IN THE CAB CONTROL BOX. ALL RESISTORS ARE IN THE CAB CONTROL BOX.
2. HR,HWV,WP,& HC ARE PART OF THE HEAT OPTION PACKAGE FOR THE ELECTRIC STANDBY UNITS.
3. HR,HWV & WP ARE PART OF THE HEAT PACKAGE FOR THE NON-ELECTRIC STANDBY UNITS.

FAN LOCKOUT (HEAT LOCKOUT OCCURS AT SET POINTS OF -95° OR LOWER

THERMO KING CORPORATION
(SD39290)
5D45773 A
DIAGRAM SCHEMATIC
STBci2/CBci2
1 PH W/ HEAT OPT.
SCALE NONE SHEET 1 OF 1
DRAWN KLEE 05/02/95
CHECKED
APPROVED
APPROVED
REVISIONS
66872 LEE 05/19/95 A
RELEASED

Model 20 Single Phase Wiring Diagram