RD-II SR

TK 41131-1-MM (Rev. 04/03)

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The maintenance information in this manual covers unit models:

RD-II SR 30 (088669)	**RD-II SR 50 230/3/60 EEC (088673)**
RD-II SR 50 230/3/60 (088670)	**RD-II SR 50 220/3/50 EEC (088674)**
RD-II SR 50 380-460/3/50-6 (088671)	**RD-II SR 50 380/3/50 EEC (088675)**
RD-II SR 30 EEC (088672)	

For further information, refer to…

Thermoguard µP-T Microprocessor Controller	**TK 41087**
RD-II SR Parts Manual	**TK 41126**
Operator's Manual	**TK 41102**
Diagnosing Thermo King Refrigeration Systems	**TK 5984**
Refrigeration Systems	**TK 5715**
Tool Catalog	**TK 5955**
X426 and X430 Compressor Overhaul	**TK 6875**
The Collector Refrigerant Recovery Unit	**TK 40956**

The information in this manual is provided to assist owners, operators and service people in the proper upkeep and maintenance of Thermo King units. For detailed descriptions of Thermo King engines, compressors, or refrigeration systems, see the appropriate Thermo King Overhaul Manual or Refrigeration Systems Maintenance Manual.

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

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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."

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Recover Refrigerant

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

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

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

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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. Refrigerants in the presence of an open flame produce toxic gases. These gases 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. Holes drilled into the refrigeration system will release refrigerant.
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.

AUTO START/STOP

CAUTION: The unit may start automatically and at any time when the unit On-Off switch is in the ON position. Units with the CYCLE-SENTRY option start automatically in both CYCLE-SENTRY mode and Continuous mode. Be sure to turn the On-Off switch OFF before opening doors or inspecting or working on any part of the unit.

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.

When working on transport refrigeration systems, a recovery process that prevents or minimizes refrigerant loss to the atmosphere is required by law. In addition, service personnel must be aware of Federal, State and local regulations governing the use of refrigerants and certification of technicians.

When refrigerants are exposed to the atmosphere in liquid form, they evaporator rapidly, freezing anything they contact. If they contact the skin, severe frostbite can result.

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

Units with optional Electric Standby utilize 460, 380 or 230 volt, 3 phase or 230 volt single phase AC power any time the unit is operating in Electric mode. This voltage potential is also present any time the unit is connected to standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

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, high voltage 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.

First Aid

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

The source of electricity 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 must 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 the 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 when working on the unit. If these items contact an electrical circuit, severe burns may result.

µP-T MICROPROCESSOR CAUTIONS

The following procedures may not be readily apparent, but must be followed when working on units equipped with µP-T microprocessors.

- Precautions must be taken to prevent electrostatic discharge when servicing the microprocessor and related components. A potential difference less than that required to produce a small spark between a finger and a doorknob can cause severe damage to solid state components. Refer to the Thermoguard µP-IV Microprocessor Controller Operations and Diagnosis Manual (TK 41087) (T.I.P. Procedure #P41AA12B) and the Electrostatic Discharge Training Guide (TK 40282) for additional information.
- Never use testers consisting of a battery and a light bulb to test circuits on any microprocessor based equipment.
- Before connecting or disconnecting the battery, the microprocessor switch must be turned OFF.

NOTE: The following T.I.P. Procedures may be found in Operation and Diagnosis Manual TK 41087.

- Replacing and calibrating the return air and discharge sensor.
- Replacing the µP-T microprocessor.
- Welding on the unit or truck.

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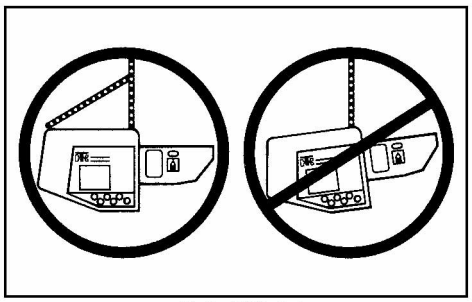

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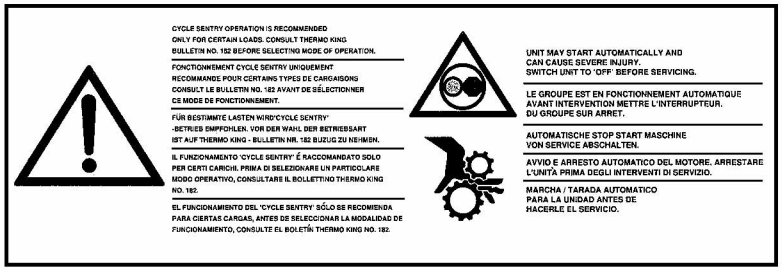

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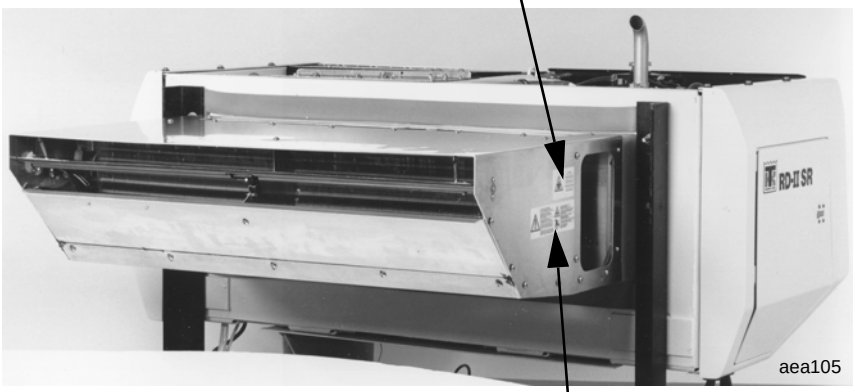

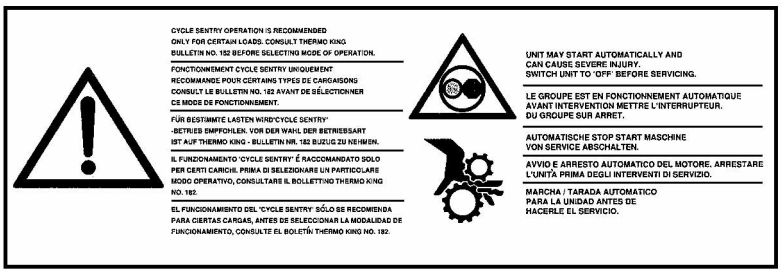

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Specifications

ENGINE SPECIFICATIONS

Engine	TK 3.95
Fuel Type	No. 2 Diesel fuel under normal conditions No. 1 Diesel fuel is acceptable cold weather fuel
Oil Capacity: Crankcase & Oil Filter	12 quarts (11 liters)
w/Bypass Oil Filter	13 quarts (12.3 liters) Fill to full mark on dipstick
Oil Type	API Type CD-SD API Synthetic Type CD after first 500 hours
Oil Viscosity*	Above 80 F (27 C): SAE 40 50 to 90 F (10 to 32 C): SAE 30 20 to 70 F (-7 to 21 C): SAE 20-20W -15 to 40 F (-26 to 4 C): SAE 10W Below 0 F (-18 C) continuously: SAE 5W
Engine rpm: Low Speed Operation	1600 rpm
High Speed Operation	2400 rpm
Engine Oil Pressure	35 to 60 psig (241 to 414 kPa)
Intake Valve Clearance	.0079 in. (0.20 mm)
Exhaust Valve Clearance	.0079 in. (0.20 mm)
Valve Setting Temperature	Room temperature
Timing Injection Pump	14° BTDC
Injection Nozzle Pressure	1700 psig (11722 kPa)
Low Oil Pressure Sensor	10 ± 2 psig (69 ± 21 kPa)—shutdown
High Coolant Temperature Sensor	220 ± 5 F (100.4 ± 2.8 C)—shutdown
Engine Thermostat	180 F (82.2 C)
Coolant System Capacity	4.8 quarts (4.5 liters) with overflow tank
Radiator Cap Pressure	7 psig (48 kPa)

Multi-viscosity weight oil with the recommended API classification may be used based on the ambient temperature and straight weight viscosity recommendations above. The above recommendations are written for mineral oil based lubricants.

BELT TENSION

	Tension No. on TK Gauge 204-427
Engine/Compressor	70 to 80
Compressor/Jackshaft (Electric Motor)	64 to 70
Compressor/Evaporator Fan/Alternator	1/2 in. (13 mm) deflection
Alternator/Evaporator Fan	1/2 in. (13 mm) deflection
Water Pump	1/2 in. (13 mm) deflection

NOTE: These are the original factory settings. Because it is difficult to use the TK gauge 204-427 in the field, adjust each belt to allow 1/2 inch (13 mm) deflection at the center of the longest span.

NOTE: Belts should be tensioned cold and again tensioned cold after 10 hours of unit running.

R-134A REFRIGERATION SYSTEM

Compressor Model	X426
Refrigerant Charge	9 lb. (4.1 kg) R-134a
Compressor Oil Charge	4 qt. 6 oz. (3.9 liters)*
Compressor Oil Type: R-134a (Solest 35)	TK No. 203-413 (Ester base) required
Throttling Valve Setting	18 to 20 psig (124 to 138 kPa)
Heat/Defrost Method: Engine Operation	Hot gas
Electric Operation	Hot gas and optional electric heater strips (Model 50)
High Pressure Cutout	325 +25/-0 psig (2088 + 172/0 kPa) Automatically reset @ 200 ± 20 psig (1379 ± 138 kPa)

R-404A REFRIGERATION SYSTEM

Compressor Model	X426
Refrigerant Charge	8 lb. (3.63 kg) R-404A
Compressor Oil Charge	4 qt 6 oz. (3.9 liters)*
Compressor Oil Type (Solest 35)	TK 203-413 (Ester required)
Throttle Valve Setting	18 to 20 psig (124 to 138 kPa)
Heat/Defrost Method: Engine Operation	Hot gas
Electric Operation	Hot gas and optional electric heater strips (Model 50)
High Pressure Cutout	470 ± 7 psig (3241 ± 48 kPa) Automatically reset @ 375 ± 38 psig (2585 ± 262 kPa)

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

ENGINE CLUTCH—HILLIARD

Model	TK No. 107-257 (Dwg. No. 5D44655G01)
Engagement	900 ± 100 rpm
Dynamic Torque	66 ft-lb (89.5 N•m) minimum @ 1600 rpm

ELECTRICAL CONTROL SYSTEM

Control System Voltage	12.5 Vdc
Battery Charging System	12 V 23 amp brush type integral alternator
Voltage Regulator Setting	14 V @ 70 F (21.1 C)
Alternator/Regulator Capacitor	4.7 mfd 50 Vdc
Alternator/Output Capacitor	.5 mfd 100 Vdc

NOTE: Disconnect components from unit circuit to check resistance.

ELECTRICAL COMPONENTS

	Current Draw (Amps) at 12.5 Vdc	Resistance—(Ohms)
Glow Plug	8.3	1.5 ± .15
Fuel Solenoid: Pull In	30 to 40	.41 to.31
Hold In	.97	12.8
Pilot Solenoid	.657	19
Starter Motor	90 to 105 (cranking)	
Damper Solenoid	5.7	2.2
DC Circuit Breakers	50 amp 20 amp	
High Speed Solenoid	5 amp (approx)	2.5 (approx.)

Electrical Standby (Model 50 Unit Only)

Electric Motor:

Voltage/Phase/Frequency	Horsepower	Kilowatts	rpm	Full Load (amps)	Locked Rotor Amps
230/3/60	7.5	5.6	1765	21.2	70.1
460/3/60	7.5	5.6	1765	10.6	35.0
200/3/50	6.25	4.7	1465	21.4	65.5
380/3/50	6.25	4.7	1465	10.7	32.8

Electric Heater Strips (Optional):	Number	3
	Watts (each)	750
Resistance (each cold and disconnected)		67.5 ohms

STANDBY POWER REQUIREMENTS

Supply Circuit Breaker	30 amp/230 V 20 amp/460 V
Extension Cord Size	Up to 50 ft—12 gauge 75 ft—10 gauge

AIR SWITCH

Air Switch Setting	.9 ±.05 in. (22.7 ± 1.27 mm) H_2O

Maintenance Inspection Schedule

Fuel Island Pre-trip	Every 750 Hours	Annual/ 3,000 Hours	Maintenance interval may be extended to 1000 hours when equipped with bypass oil filter. Inspect/Service These Items
			Engine
•			Check engine oil level.
•			Check radiator coolant. ***(CAUTION: DO NOT remove radiator cap while coolant is hot.)***
•			Inspect belts for condition and proper tension (belt tension tool No. 204-427).
	•		Check engine oil pressure hot, on high speed. Record _____psig.
•	•	•	Listen for unusual noises, vibrations, etc.
	•		Change engine oil and filters (hot).
	•		Change oil bath air cleaner element, replace dry type element, clean and service crankcase breather, and check air cleaner hose for damage.
	•		Change fuel filter.
		•	Drain water from fuel tank and check vent.
	•		Inspect/clean electric fuel pump filter.
		•	Change engine coolant every two years. Maintain year around anti-freeze protection at -30 F (-34 C).
		•	Check and adjust engine speeds (high and low speed).
		•	Check condition of engine mounts.
			Electrical
•			Check unit charging voltage (14 volts nominal)
	•		Check defrost initiation and termination.
	•		Inspect battery terminals and electrolyte level.
	•		Check operation of protection shutdown circuits.
		•	Check µP-T sensor calibration in 32 F (0 C) ice water bath.
		•	Inspect wire harness for damaged wires or connections.
		•	Check air switch setting.
		•	Inspect electric motor bearings.*
		•	Inspect electrical contacts for pitting or corrosion.
		•	Inspect DC (battery charging) alternator bearings and brushes.*

With belt removed, spin bearings by hand. Listen for noise (bearings roll freely).

Fuel Island Pre-trip	Every 750 Hours	Annual/ 3,000 Hours	Maintenance interval may be extended to 1000 hours when equipped with bypass oil filter. Inspect/Service These Items
			Refrigeration
	•		Check refrigerant level and compressor oil condition.
		•	Check suction pressure regulator regulating pressure on defrost or heating cycle.
		•	Replace dehydrator (every two years) and check discharge and suction pressures.
			Structural
•			Visually inspect unit for fluid leaks (coolant, oil, freon).
•			Visually inspect unit for damaged, loose or broken parts (includes air ducts and bulkheads, if so equipped).
		•	Inspect tapered roller bearing fanshaft and idler for leakage and bearing wear (noisy).*
		•	Clean entire unit including condenser and evaporator coils and defrost drains.
		•	Check all unit, fuel tank and electric motor mounting bolts, brackets, lines, hoses, etc.
		•	Check damper door adjustment and operation.
		•	Inspect clutch.*

With belt removed, spin bearings by hand. Listen for noise (bearings roll freely).

NOTE: Compressors are equipped with an oil filter. Every 2 years of operation or whenever there is a major service procedure performed, both the compressor oil filter and filter-drier must be changed.

Unit Description

The RD-II SR is a microprocessor based transport temperature control system, which utilizes the Thermoguard µP-T microcontroller to manage most of the system's functions.

The RD-II SR is a one-piece, front-mount, medium capacity diesel powered cooling and heating system designed especially for straight trucks. The unit mounts on the front of a truck with the evaporator portion protruding into the box. Designed for use with totally chlorine free R-404A refrigerant. An optional R-134a unit is also available. There are two basic models:

- RD-II SR 30: Cooling and heating on engine operation.
- RD-II SR 50: Cooling and hot gas heating on engine operation and electric standby electric evaporator heaters are optional.

Power is provided by the TK 3.95 three-cylinder, special clean and silent diesel engine rated at 17.0 continuous horsepower at 2400 rpm. A belt drive system transfers energy to the compressor, unit fans and alternator.

Electric standby power (Model 50) is provided by a 5 horsepower electric motor. A clutch on the diesel engine isolates the engine during electric standby operation.

Belt driven, dual evaporator fans provide superior air throw. Exclusive space condenser provides maximum cab clearance and reduced truck body height on conventional chassis. Cube saver evaporator optimizes space below the evaporator for all types of cargo. Lightweight aluminum frame allows increased payload.

The continuous monitoring function of the µP-T microprocessor optimizes the Thermo King unit's performance, thereby reducing fuel consumption and unit down time. The unit's self check can be run before the daily distribution route to identify any possible malfunctions. TherMax™ defrost/heating system increases unit heating capacity for faster defrost.

The built-in CYCLE-SENTRY, an exclusive Thermo King feature, automatically starts and stops the unit according to temperature demands. In addition, a range of programmable modes, like high speed pull-down, allow you to tailor your unit's performance to the load you are distributing.

The RD-II SR's µP-T microprocessor continually monitors unit performance and makes adjustments to pre-programmed parameters automatically. Troubleshooting is simplified with 40 built-in alarm codes to alert the driver to take corrective action before a problem develops. Diagnosis is fast and complete.

The clutch engages fully at 900 ± 100 rpm on engine operation, constantly turning the compressor and fans at both high and low speed.

Thermo King X426 Compressor

The RD-II SR unit features a Thermo King X426, four-cylinder compressor with 25.9 $in.^3$ (424 cm^3) displacement.

The features of the RD-II SR truck are as follows:

- µP-T Control System
- Choice of Installation for Control Box
- 5 Wire Remote Control (In-Cab or Truck Body Mount)
- Alert System
- Oil Level Detection
- CYCLE-SENTRY (Built-in as Standard)
- Return Temperature Sensor and Display
- Discharge Air Temperature Sensor and Display
- Coil Temperature Sensor
- Engine Coolant Temperature Sensor and Display
- Engine Tachometer Display
- Battery Voltage Display
- Phase Lockout (Model 50)
- Phase Correction (Optional, Model 50 Only)

- Automatic Diesel/Electric Selection
- Select up to 13 Readouts Covering All Key Operating Parameters
- Phase Indication
- Programmable Setpoint Range
- Low Speed Start (Programmable)
- High Speed Pulldown (Programmable)
- Choice of Units of Measure
- Low Speed Lockin

UNIT INSTRUMENTS

1. MICROPROCESSOR LCD DISPLAY. The LCD display normally shows the setpoint, the return air temperature, and any active icons, which are:
   - Cool
   - Heat
   - Defrost
   - Setpoint
   - CYCLE-SENTRY
   - Alarm
   - Electric (Optional)

   Pressing the SELECT key causes the display to show the other sensor readings.
2. ALARM ICON. The alarm icon comes on whenever there is an alarm code stored in the microprocessor memory.
3. RECEIVER TANK SIGHT GLASS. The receiver tank sight glass is used to check the amount of refrigerant in the system, and the moisture content of the refrigerant.
4. COMPRESSOR OIL SIGHT GLASS. The compressor oil sight glass is used to check the relative level of compressor oil in the compressor sump.
5. AIR RESTRICTION INDICATOR. An air restriction indicator is attached to the intake manifold. Visually inspect the restriction indicator periodically to assure the air filter is not restricted. Service the air filter when the yellow diaphragm indicates 22 in. of water column. Press the button on the top of the restriction indicator after servicing the air filter.
6. REMOTE LIGHT INDICATORS (Optional). Remote indicator lights in a box that can be mounted on the truck beneath the unit feature these signals:

   WHITE—system is in cooling cycle

   BLUE—system is in defrost cycle

   AMBER—system is in heat cycle

   GREEN—system is in high speed heat or cool

UNIT PROTECTION DEVICES

1. FUSES. A number of fuses are located on the relay board. The sizes and functions are shown in Table 1.

Table 1: Relay Board Fuse Size and Function

Fuse	Size	Function
F200	3A	2P Power to Microprocessor
F202	3A	Oil Level Switch
F300	3A	Pilot Solenoid
F301	3A	TherMax Solenoid
F302	3A	Alternator Relay
F303	3A	Damper Relay
F304	3A	Starter Relay
F305	3A	On/Run Relay
F306	3A	Preheat Relay
F037	3A	Not Used
F308	3A	Not Used
F309	15A	Alternator Excitation
F310	15A	Damper Solenoid
F311	3A	Motor Reset Solenoid
F400	3A	Motor Starter
F401	10A	Fuel Solenoid and Fuel Pump
F402	10A	Throttle Solenoid
F403	3A	Heater Contactor

2. HIGH PRESSURE CUTOUT. The high pressure cutout is a pressure sensitive switch that is located in the compressor discharge manifold. If the discharge pressure rises above 450 psig (3103 kPa) for R-404A systems or 325 psig (2088 kPa) for R-134a systems, the switch opens the 8D circuit to the fuel solenoid, which stops the engine.

3. 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 psig (3447 kPa). The valve will reseat when the pressure drops to 400 psig (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 unscrew 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.

4. LOW OIL LEVEL SWITCH. The low oil level switch closes if the oil drops below a certain level. If it stays closed for a specified time, the microprocessor will shut the unit down and record alarm code 66.

5. PREHEAT BUZZER. The preheat buzzer sounds when the CYCLE-SENTRY system energizes the glow plugs.

UNIT OPERATION

Pre-trip Inspection (Before Starting Unit)

The following pre-trip inspection should be completed before starting the unit and loading the trailer. While pre-trip 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 and breakdowns before they happen.

1. FUEL. The diesel fuel supply must be adequate to guarantee engine operation to the next check point.

2. ENGINE OIL. The engine oil level should be at the FULL mark with the dipstick NOT routed (threaded) into the oil pan. Never overfill.

3. COOLANT. The engine coolant must have antifreeze protection to -30 F (-34 C). Check and add coolant in the expansion tank.

   CAUTION: Do not remove expansion tank cap while coolant is hot.

4. BATTERY. The terminals must be clean and tight.

5. BELTS. The belts must be in good condition and adjusted to the proper tensions.
6. ELECTRICAL. The electrical connections should be securely fastened. The wires and terminals should be free of corrosion, cracks or moisture.
7. STRUCTURAL. Visually inspect the unit for leaks, loose or broken parts and other damage. The condenser and evaporator coils should be clean and free of debris. Check the defrost drain hoses and fittings to be sure they are open. The damper in the evaporator outlet must move freely with no sticking or binding. Make sure all the doors are latched securely.

Starting Unit (Full Unit Self Check)

The procedure is used for a complete checkout of the unit, and unit control circuits. It should be used when first starting the unit for a trip before the cargo is loaded. A full Unit Self Check procedure may take up to 30 minutes and the unit will run unattended.

1. Perform a Pre-trip Inspection.
2. Adjust the setpoint to the desired load temperature (refer to the Operation Manual (TK) for detailed information about adjusting the setpoint).
   a. Change the setpoint display with the arrow keys.
   b. Enter the new setpoint by pressing the ENTER key within 5 seconds.
3. Initiate a Unit Self Check (refer to the Operation Manual for detailed information about the Unit Self Check). This procedure is automatic and can be performed on the way to the loading area or while waiting to load.
   a. Press the On button.
   b. Clear any alarms.
   c. Press and hold the T/K key for at least 3 seconds until the Unit Self Check [USC] prompt screen appears.
   d. Press the ENTER key. The display will briefly show Lod (load) and the unit will then start the Unit Self Check.
4. When the PRE TRIP test is complete, PASS, CHECK, or FAIL will appear on the display until any key on the controller is pressed. Continue as follows:

   PASS (Unit running, no alarms)

   • Unit has passed the PRE TRIP, go to step 5.

   CHECK (Unit running but Check Alarms have been recorded)

   or

   FAIL (Unit has shut down and recorded Shutdown Alarms)

   a. View the Alarms with the SELECT key (refer to the appropriate Operation and Diagnosis Manual for detailed information about alarms).
   b. Correct the alarm conditions.
   c. Clear the alarms with the CLEAR key (refer to the appropriate Operation and Diagnosis Manual for detailed information about alarms).
   d. Repeat the test until PASS appears (the unit passes the unit self check).
5. Recheck the setpoint.
6. Complete the After Start Inspection.

Selection of Operating Modes on CYCLE-SENTRY Equipped Units

The Thermo King CYCLE-SENTRY system is designed to save refrigeration fuel costs. The savings vary with the commodity, ambient temperatures and trailer insulation. However, not all temperature controlled products can be properly transported using CYCLE-SENTRY operation. Certain

highly sensitive products normally require continuous air circulation.

The microprocessor has a CYCLS screen, which is used to select CYCLE-SENTRY (CYCLS YES) or Continuous Run (CYCLS NO) operation. Refer to the Operation for detailed information about CYCLE-SENTRY selection.

Your selection of the operating mode for the proper protection of a particular commodity should use the following guidelines:

Examples of Products Normally Acceptable for CYCLE-SENTRY OPERATION

- Frozen foods (in adequately insulated trailers)
- Boxed or processed meats
- Poultry
- Fish
- Dairy products
- Candy
- Chemicals
- Film
- All non-edible products

Examples of Products Normally Requiring Continuous Run Operation for Air Flow

- Fresh fruits and vegetables, especially asparagus, bananas, broccoli, carrots, citrus, green peas, lettuce, peaches, spinach, strawberries, sweet corn, etc.
- Non-processed meat products (unless pre-cooled to recommended temperature)
- Fresh flowers and foliage

The above listings are not all inclusive. Consult your grower or shipper if you have any questions about the operating mode selection of your type of load.

Restarting the Unit

These procedures are used when starting units that have been shut off for short periods of time. When a unit has been shut off for a long period of time is first started, it should be started and put through a full unit self check.

Automatic Start

1. Push the ON key.
2. After a 10 second delay, the unit should preheat and start automatically.

   NOTE: When the CYCLE-SENTRY icon is active, the unit may not start if: the compartment temperature is near the setpoint, the engine is warm, and the battery is fully charged.

If cooling or heating is required and the engine temperature is below approximately 120 F (96 C), but the engine fails to start automatically:

- Push the OFF key.
- Check for and correct any alarm conditions and clear the alarm codes. View the alarms with the SELECT key, clear the alarms with the ENTER key, and the repeat the auto start procedure. Refer to the appropriate Operation and Diagnosis Manual (TK 41087) for detailed information about alarms.
- If the engine will still not start, push the OFF push button, determine and correct the cause of the failure.

After Start Inspection

- After the unit is running, the following items can be quickly checked to confirm that the unit is running properly.

1. OIL PRESSURE. Check the engine oil pressure in high speed by pressing the SELECT key to OIL PRESS. The oil pressure should be 30 to 80 psig (207 to 552 kPa).

When first starting a cold engine, the oil pressure may be higher.

2. COMPRESSOR OIL. The compressor oil level should be visible in the sight glass.
3. REFRIGERANT. Check the refrigerant charge. See Refrigerant Charge in the Refrigeration Maintenance section.
4. PRE-COOLING. Make sure that the setpoint is at the desired temperature and allow the unit to run for a minimum of 1/2 hour (longer if possible) before loading the trailer.

   This provides a good test of the refrigeration system while removing residual heat and the moisture from the trailer interior to prepare it for a refrigerated load.
5. DEFROST. When the unit has finished pre-cooling the trailer interior, manually initiate a defrost cycle. This will remove the frost that builds up while running the unit to pre-cool the trailer.

   To manually initiate a defrost cycle, press the manual defrost key. Refer to the Operation Manual for detailed information about Manual Defrost.

   The defrost cycle should end automatically.

   NOTE: The unit will not defrost unless the evaporator coil temperature is below 45 F (7.2 C).

LOADING PROCEDURE

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

Post Load Procedure

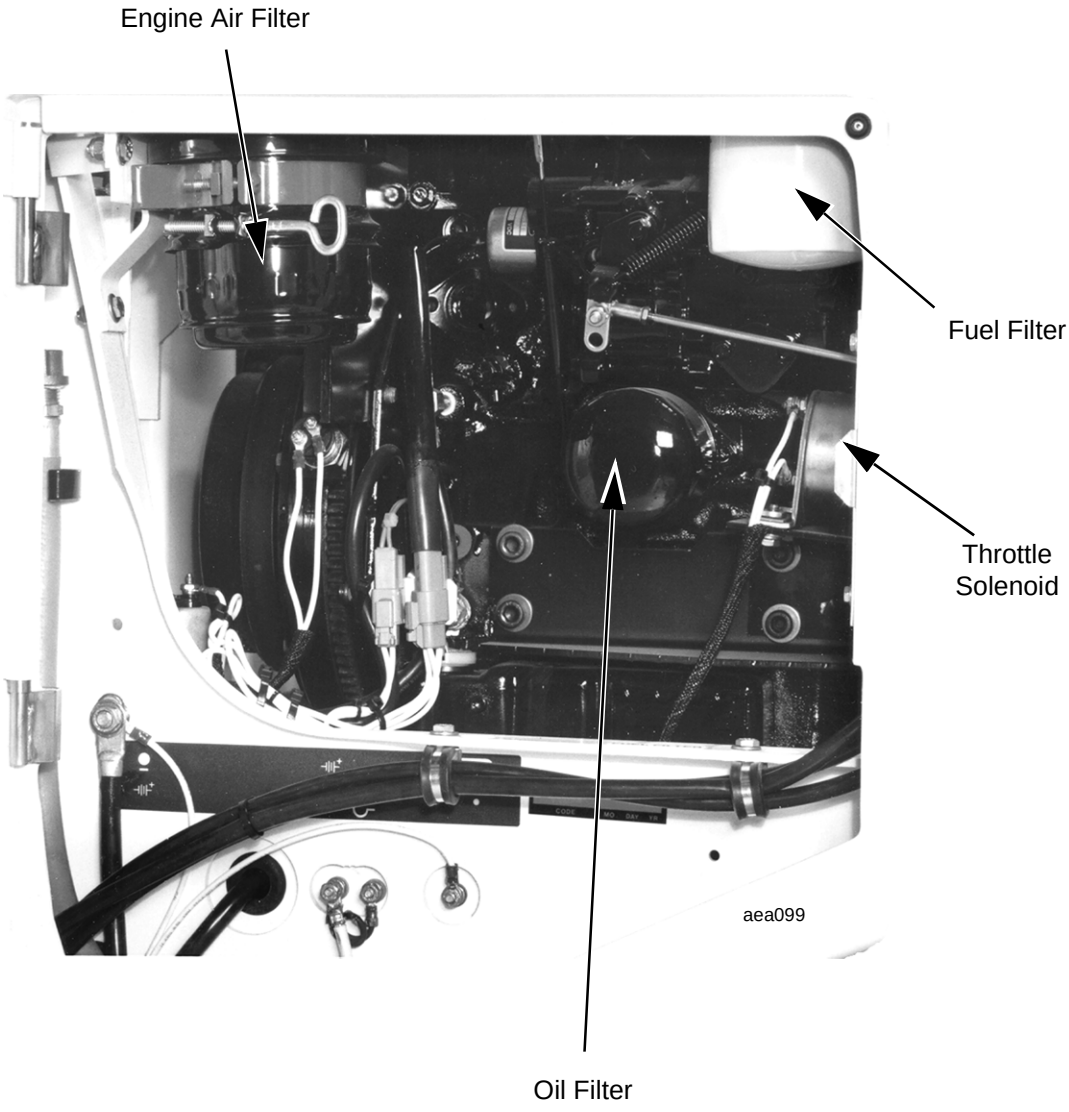
1. Make sure all the doors are closed and locked.
2. Start the unit if it was shut off to load (see Restarting Unit).
3. Make sure the setpoint is at the desired setting.
4. One-half hour after loading, defrost the unit by momentarily pressing the manual defrost switch. If the evaporator coil sensor temperature is below 45 F (7.2 C), the unit will defrost. The microprocessor will terminate defrost automatically when the evaporator coil temperature reaches 57 F (13.9 C) or the unit has been in the defrost mode for 30 to 45 minutes (depending on setting).

Post Trip Checks

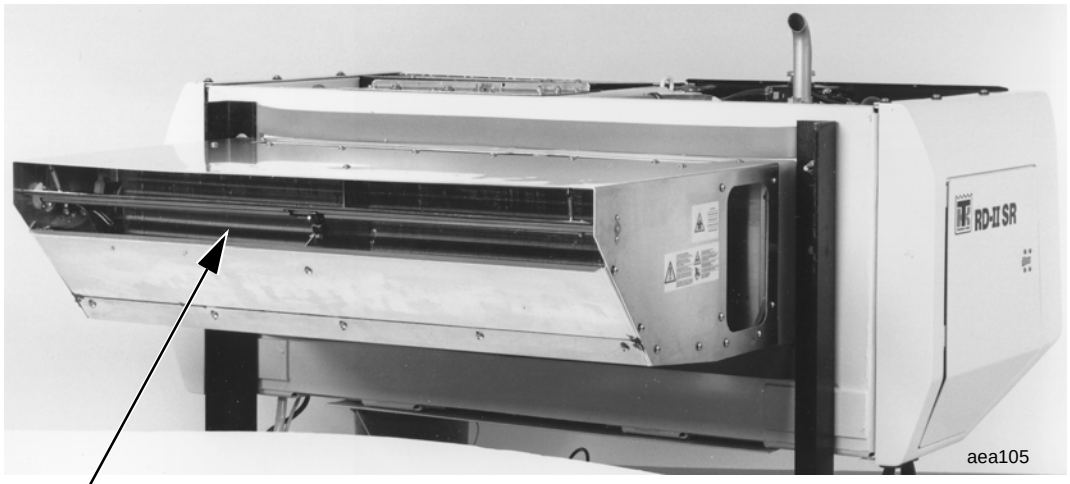
1. Wash the unit.
2. Check for leaks.
3. Check for loose or missing hardware.
4. Check for physical damage to the unit.

Front Curbside View—RD-II SR

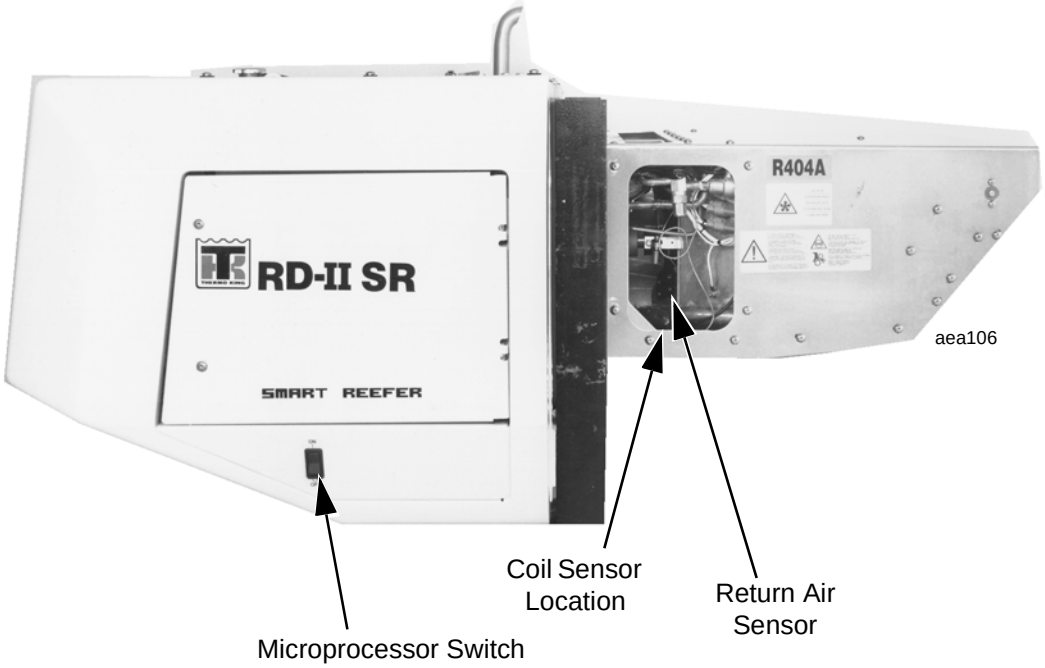
Front Roadside View—RD-II SR



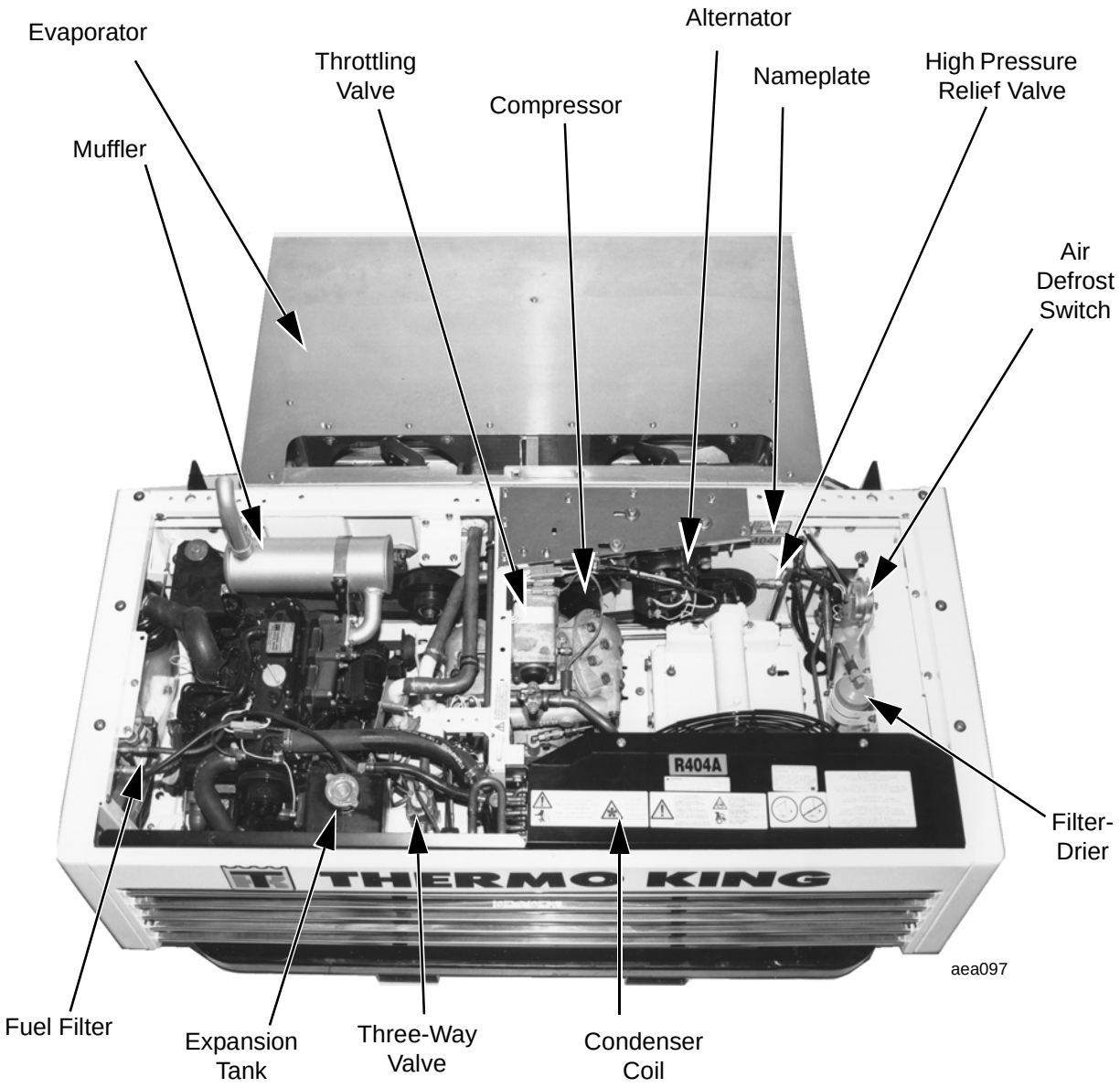
Access Panel Open (Curbside)—RD-II SR



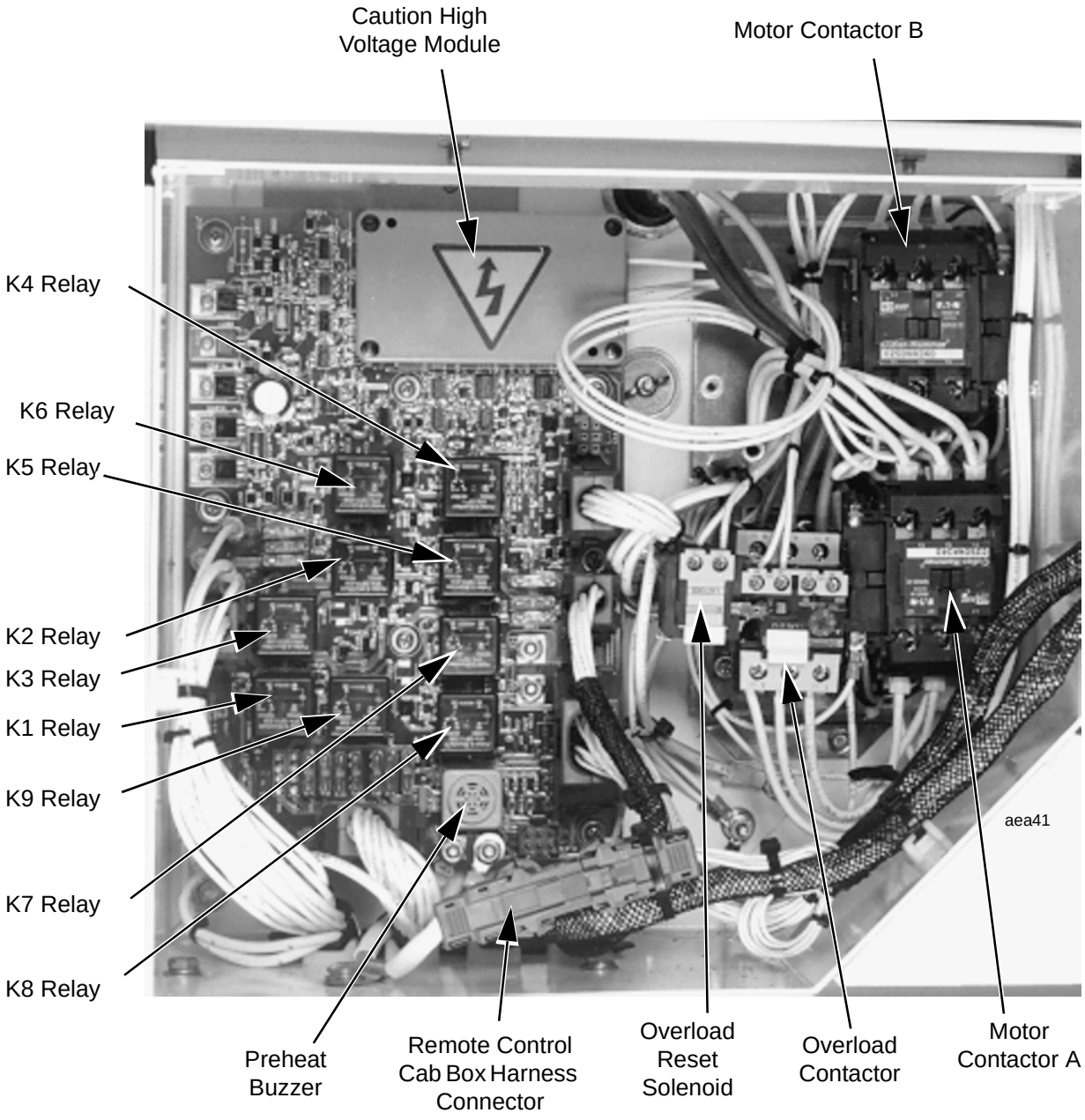
Rear View (Curbside)—RD-II SR



Side View (Roadside)


Evaporator
Throttling Valve
Alternator
Nameplate
High Pressure Relief Valve
Compressor
Muffler
Air Defrost Switch
R404A
THERMO KING
Filter-Drier
aea097
Fuel Filter
Expansion Tank
Three-Way Valve
Condenser Coil

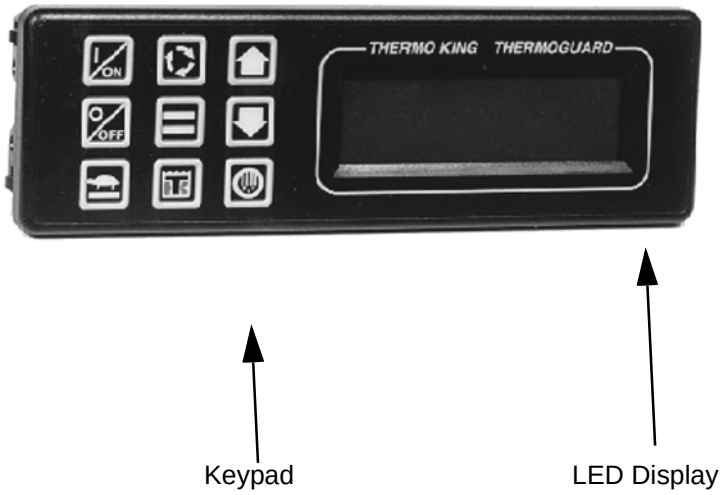
Top View


Caution High Voltage Module
Motor Contactor B
K4 Relay
K6 Relay
K5 Relay
K2 Relay
K3 Relay
K1 Relay
K9 Relay
K7 Relay
K8 Relay
aea41
Preheat Buzzer
Remote Control Cab Box Harness Connector
Overload Reset Solenoid
Overload Contactor
Motor Contactor A

Control Box

aea102

Power Receptacle Box—RD-II SR 50



Thermoguard™ Remote Control Panel

Remote Light Display

µP-T System Description

GENERAL DESCRIPTION

The µp-T microprocessor controllers are self contained temperature control units designed for RD-II Smart Reefer truck units.

Model 30 units are powered by a diesel engine and Model 50 units are powered by either a diesel engine or an external electric standby power source turning an induction motor. The unit mounts on the upper front of the truck box and the evaporator extends into the box. The compressor, condenser and evaporator fans are driven by belts. Defrost is accomplished by means of hot gas when operating in Diesel mode and hot gas and electric evaporator heaters when operating in optional Electric Heat mode.

CAUTION: Dangerous single phase or three phase AC power is present whenever the unit is operating in Electric mode or whenever the unit is connected to external standby power. Voltages of this magnitude can be lethal. Exercise extreme caution when working on the unit.

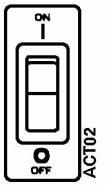
µP-T Control System

The µP-T Microprocessor Control System consists of the following main components:

- Microprocessor Power Switch
- Remote Control Panel
- µP-T Microprocessor
- Interface Board
- Sensors
- Refrigeration System Controls
- Engine Controls
- High Voltage Tray (Model 50 Units)

Microprocessor Power Switch

The microprocessor power switch applies 12 volts DC control power to the microprocessor. It is located just below the control box on the street side of the unit. Main power to the balance of the controls is supplied by the 50 amp circuit breaker CB1. Note that when the Microprocessor Power Switch is turned “off” that power is still applied to the Interface Board and control circuits via CB1. To completely remove power from the control system disconnect the unit battery.



Microprocessor Power Switch

For additional information, see Operation and Diagnosis Manual TK 41087.

Optional Electric Standby (Model 50 Units Only)

The Electric Standby option allows the unit to be operated on either the diesel engine or external electric power. The units can be supplied to operate on either single phase or three phase power.

CAUTION: High voltage AC power is present whenever the unit is operating in Electric mode and whenever the unit is connected to external standby power. Voltages of this magnitude can be lethal. Exercise extreme caution when working on the unit.

CAUTION: The Electric Power Icon will not appear in the display if electric power is not present (the unit is not plugged in), or if there are electrical voltage or phase problems while the power cord is connected

to a power outlet. Under these conditions, when the microprocessor power switch is turned on and the ON key is pressed, the unit will start and run on diesel automatically.

CAUTION: Electric operation mode is not stored in the controller if the microprocessor power switch is turned OFF. Turning the switch back ON again, even with the power cord connected, will not assure start up in Electric Standby. If the voltage is low or an electric phase is missing, the Electric icon will not be present in the display and the unit will start in diesel.

Standard Model 50 Features

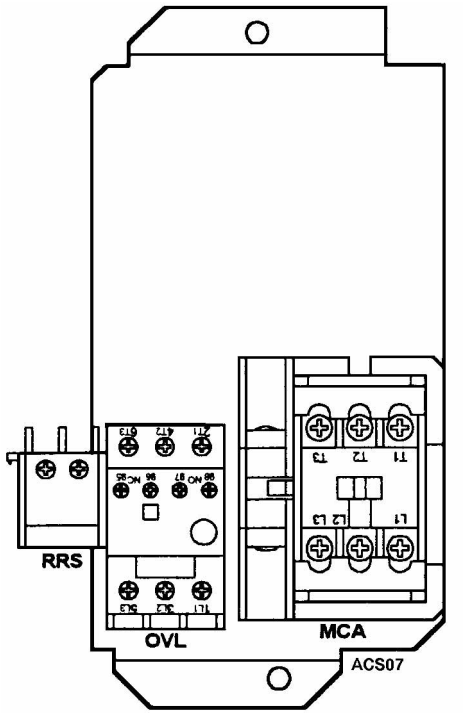
The following features are standard equipment on units equipped with Electric Standby.

- **Automatic Diesel/Electric Selection**—The unit will automatically switch to electric operation when a power cord is connected and the standby power is switched ON.
- **Phase Lockout (Three Phase Units Only)**—If the motor rotation is reversed as a result of incorrect phase rotation, the unit will shut down and generate an Alarm Code 38. The phase rotation must be manually corrected.
- **Remote Reset Solenoid**—A remote reset solenoid is provided to reset the overload relay.
- **Hot Gas Heat**—Hot gas heat is utilized on standard model 50 units.

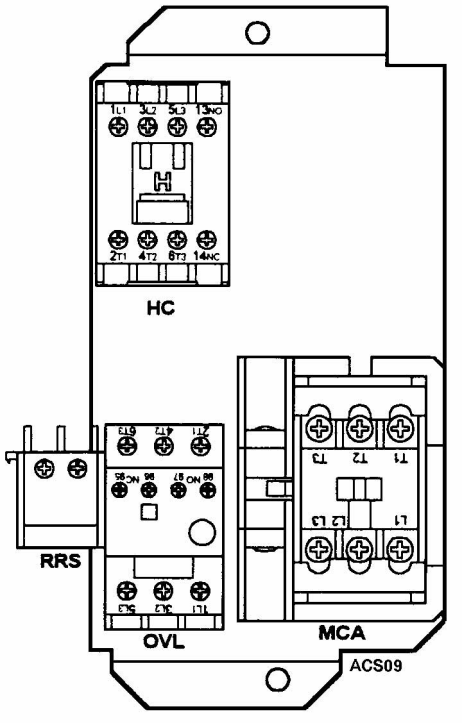
Optional Model 50 Features

The following features are available as options on units equipped with Electric Standby.

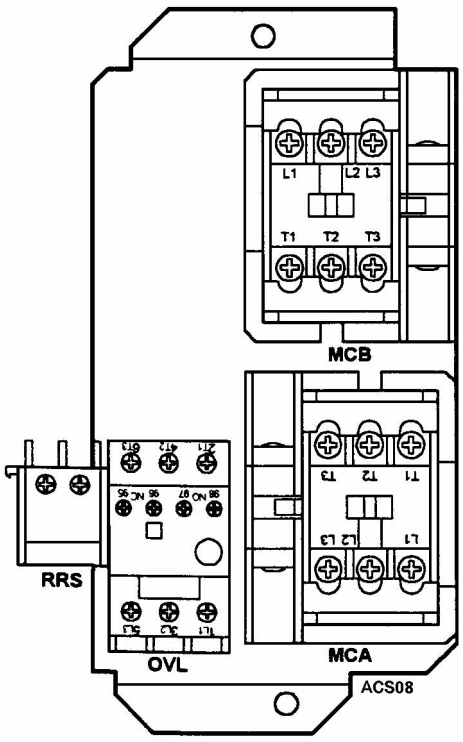
- **Automatic Phase Correction Option (Three Phase Units Only)** - The control system features two motor contactors. This allows correct motor rotation regardless of phase rotation on the incoming power.
- **Electric Heat Option** - The unit is equipped with a heater contactor and electric evaporator heaters. These heaters provide supplemental heat during electric mode heat and defrost operation.



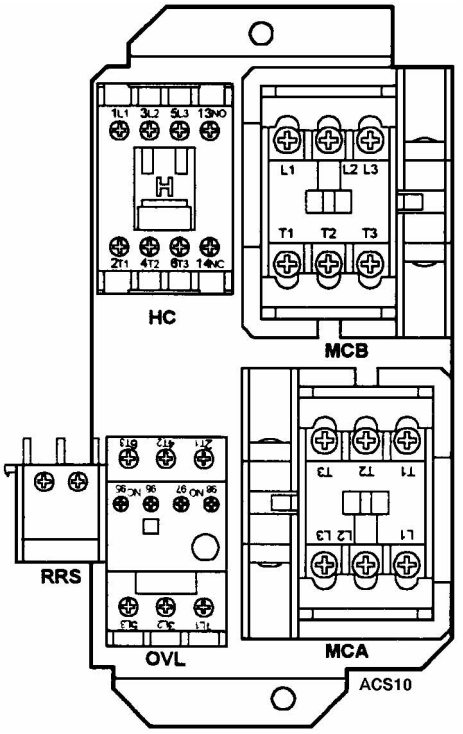
High Voltage Tray
No Options



High Voltage Tray
with Electric Heat



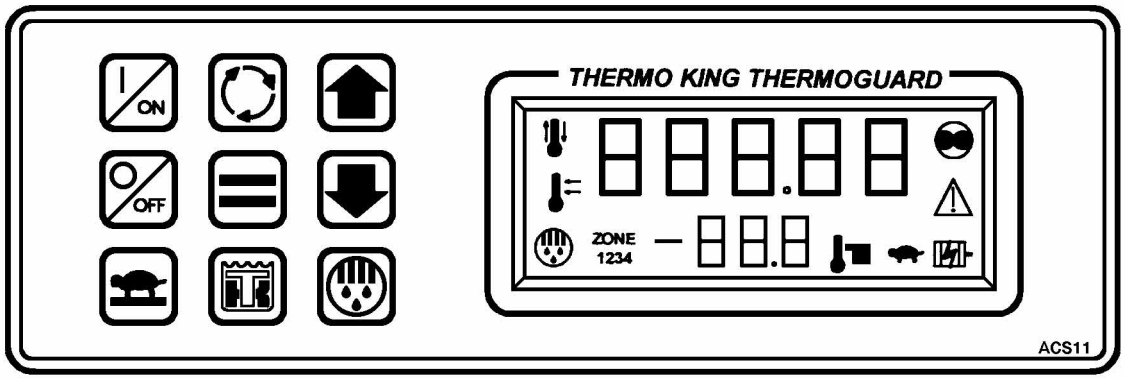
High Voltage Tray
with Phase Correction



High Voltage Tray
with Phase Correction and Electric Heat

Remote Control Panel Features

The remote panel is connected to the microprocessor and is used to operate the unit. It may be located in the truck dashboard using the supplied DIN mounting ring, under the dashboard using the supplied under dash mounting kit or on the dashboard using the supplied plastic mounting strips. An optional body mount enclosure kit is available to mount the remote control panel on the truck box.



KEYPAD

These nine touch sensitive keys are used to turn the unit ON and OFF, change the setpoint and control or change the units operation.

DISPLAY

The display normally shows the Standard Display of return air temperature and setpoint. The display shown here has all possible segments lighted.

KEYPAD KEYS

ON KEY. Turns the unit ON.

OFF KEY. Turns the unit OFF

SELECT KEY. Scrolls through the prompt and display screens.

UP ARROW KEY. Chooses prompt screen actions or increases setpoint or other setting.

DOWN ARROW KEY. Chooses prompt screen actions or decreases setpoint or other setting.

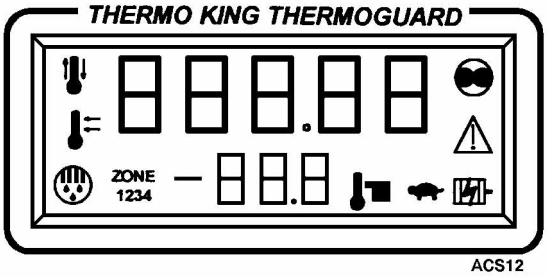
ENTER KEY. Executes prompts or loads setpoints or other new settings.

DEFROST KEY. Initiates a manual defrost cycle.

WHISPER KEY. Disables high speed diesel mode operation.

LOGO KEY. Initiates the Unit Self Check test and displays software revision.

UNDERSTANDING THE DISPLAY



The display normally shows the Standard Display of return air temperature and setpoint. In addition, the icons located at the sides of the display indicate the operating mode of the unit and shows if any alarm codes are present. Pressing the SELECT key will show the prompt and display screens. The display shown here has all possible display features turned ON.

DISPLAY ICONS

COOL ICON. Appears when the unit is cooling.

HEAT ICON. Appears when the unit is heating.

This icon appears during a remote control panel test but is not used on truck units.

DEFROST ICON. Appears when the unit is defrosting.

CYCLE SENTRY ICON. Appears when CYCLE-SENTRY mode has been selected.

ALARM ICON. Appears when an alarm condition has been detected by the microprocessor.

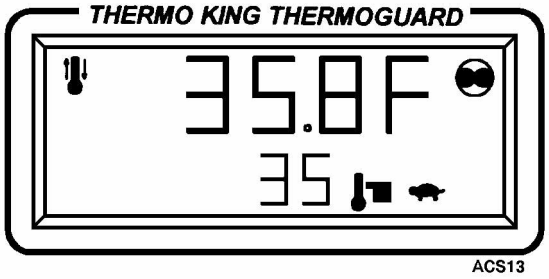
ELECTRIC ICON. Appears when AC power is connected and the phases are correct.

SETPOINT ICON. Appears when the setpoint is being shown in the lower display.

WHISPER ICON. Appears when Whisper mode has been selected.

ZONE 1234 These icons appear during a remote control panel test but are not used on truck units.

READING A TYPICAL DISPLAY

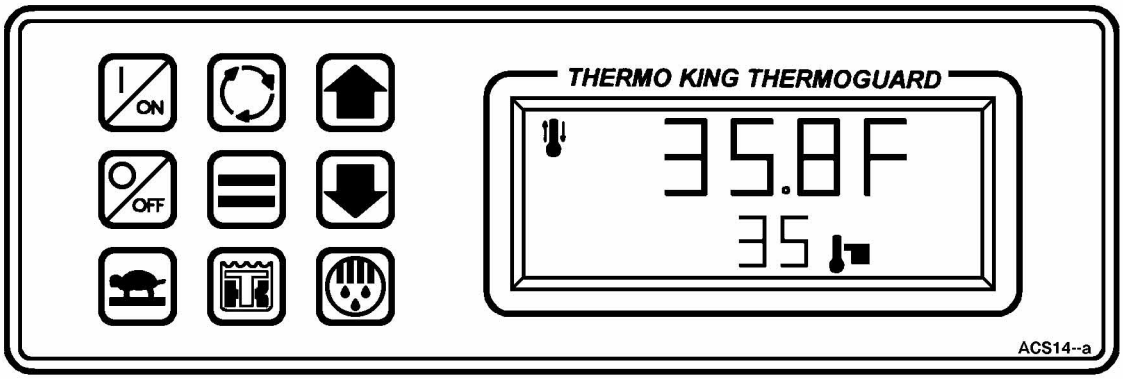


This display shows the following information:

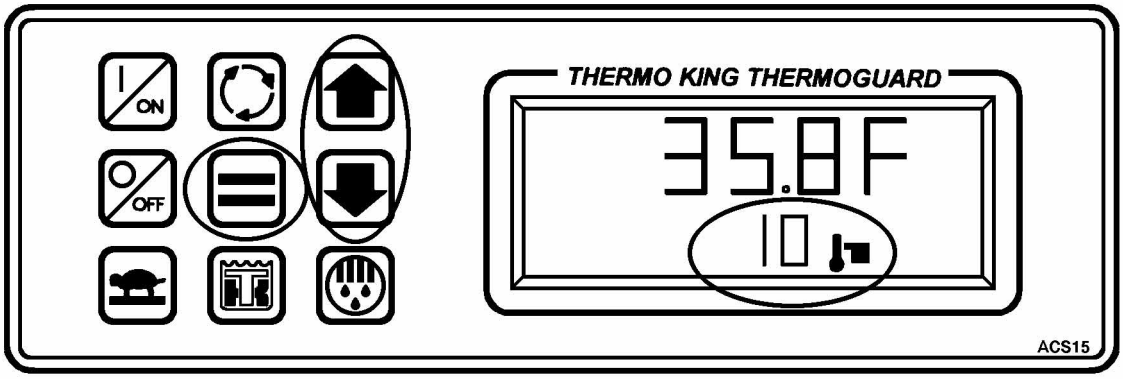
1. The unit is ON and is cooling.
2. CYCLE SENTRY mode and Whisper mode have been selected.
3. The Box temperature is 35.8 degrees Fahrenheit and the setpoint is 35 degrees Fahrenheit.

THE STANDARD DISPLAY

The Standard Display appears when the unit is turned ON and no other functions have been selected. The box temperature appears in the upper display and the setpoint appears in the lower display. This display shows a box temperature of 35.8 F and a setpoint of 35 F. The Standard Display is the starting point used to reach all other prompts and displays. To return to this display from any other prompts or display, wait 10 seconds and it will return automatically.



CHANGING THE SETPOINT



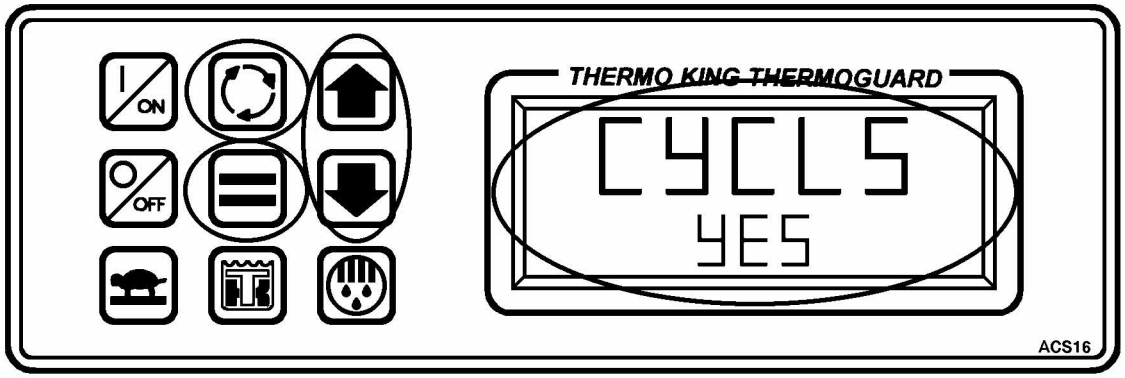
1. Press the  ON key to turn the unit ON.

2. Press the  or  Arrow keys to select the desired setpoint.

3. Press the  Enter key to load the new setpoint into the microprocessor. The display will briefly show [Lod] and then the new setpoint will reappear in the display.

IMPORTANT: The Enter key must be pressed or the setpoint will not be changed. The display will return to the Standard Display and the setpoint will return to the old setpoint in about 10 seconds if the Enter key is not pressed.

SELECTING CYCLE-SENTRY or CONTINUOUS MODE



1. Press the  ON key to turn the unit ON.

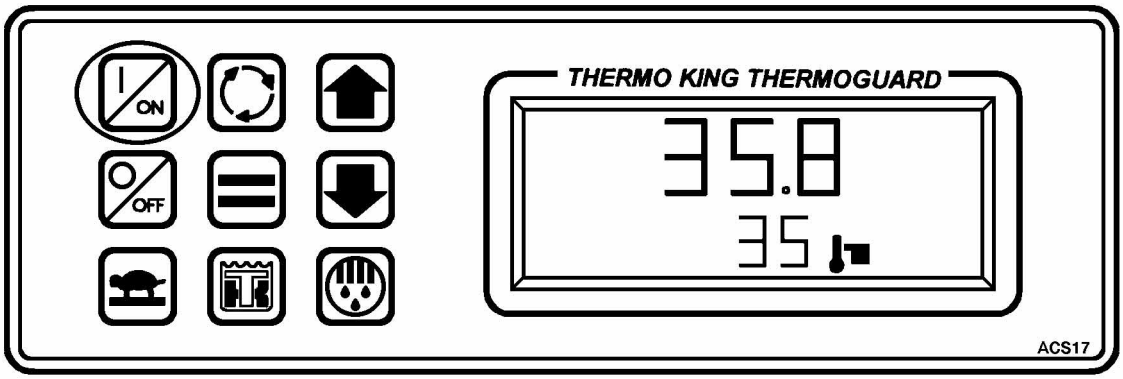
2. Press the  Select key to display [CYCLS] and [YES] or [no].

3. Press the  or  Arrow keys to select the desired mode [YES] = CYCLE SENTRY mode
[no] = Continuous mode.

4. Press the  Enter key to load the new operating mode selection into the microprocessor.

IMPORTANT: The Enter key must be pressed or the setpoint will not be changed. The display will return to the Standard Display and the setpoint will return to the old setpoint in about 10 seconds if the Enter key is not pressed.

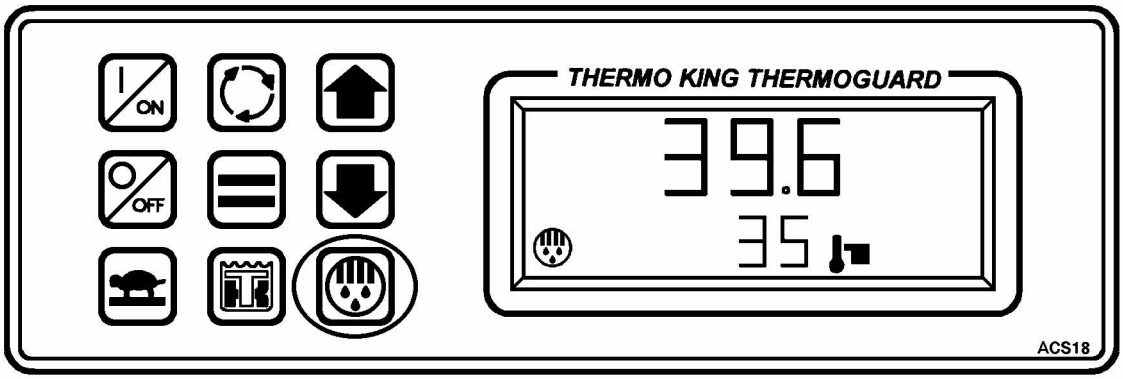
STARTING THE ENGINE



CAUTION: This unit will start automatically in either CYCLE SENTRY or CONTINUOUS mode after the ON key is pressed.

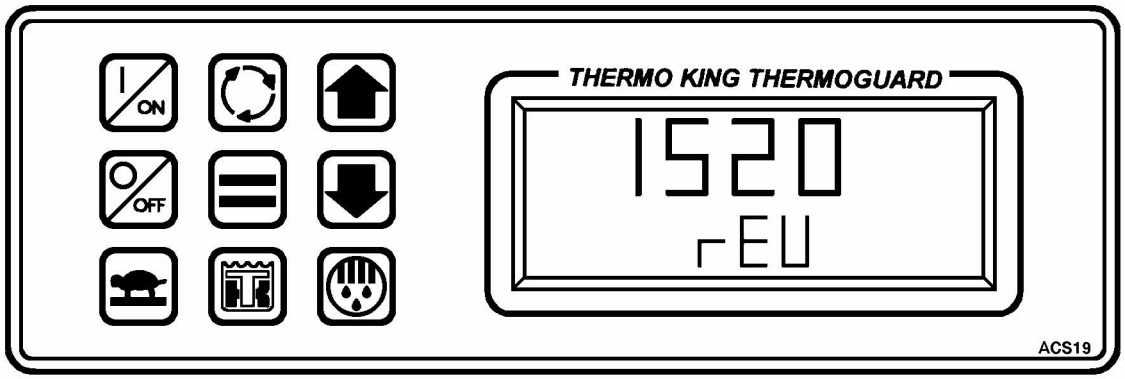
1. Press the ON key to turn the unit ON. If no other key is pressed, the engine will automatically preheat and start in about 10 seconds in either CYCLE SENTRY or CONTINUOUS mode. If other keys are pressed (for example: to change the setpoint or view display screens), the engine will automatically preheat and start about 10 seconds after the last key is pressed.

INITIATING A MANUAL DEFROST CYCLE



1. The unit must be running in either CYCLE SENTRY or CONTINUOUS mode and the coil temperature must be below 45 F. Press the Defrost key to start a manual defrost cycle. The defrost prompt will appear in the display when the unit starts a defrost cycle. The defrost cycle will terminate automatically. If the unit is not running or the coil temperature is not below 45 F, the request will be ignored.

CHECKING THE SOFTWARE REVISION



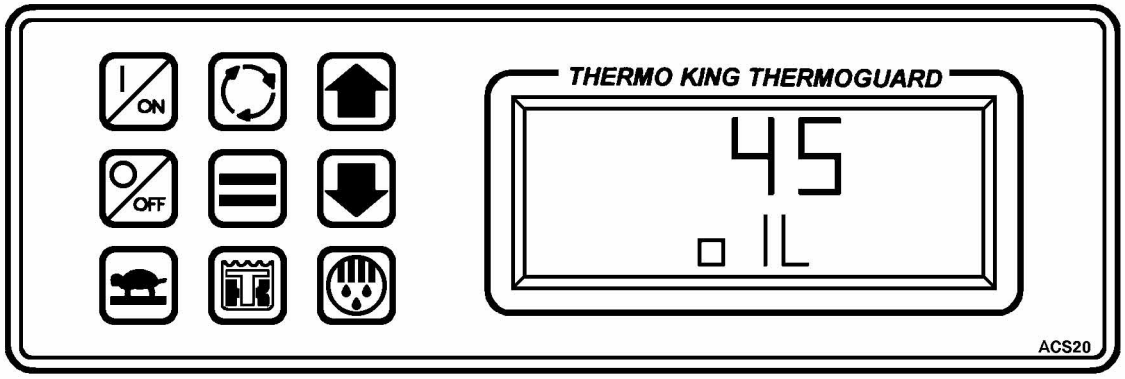
1. Press the  ON key to turn the unit ON.

2. Press and hold the  TK Logo key to display [USC].

3. Press the  Select key to display [rEU] and the software revision.

The software revision shown here is Revision 1520.

VIEWING PROMPT and DISPLAY SCREENS



1. Press the  ON key to turn the unit ON.

2. Press the  Select key repeatedly to show the prompt and display screens.

The prompt and display screens will appear in the order shown below:

[**ALr**] Alarm codes if present. If no codes exist this screen will not appear.

[**CYCLS**] CYCLE SENTRY or Continuous mode prompt screen. [YES] - CYCLE SENTRY; [no] = Continuous

[**dIS**] Discharge air temperature as measured by the discharge temperature sensor.

[**coL**] Evaporator coil temperate as measured by the evaporator coil temperature sensor.

[**tLH**] Total amount of time in hours the unit has been turned ON with the keypad On key.

[**EnH**] Total amount of time in hours the diesel engine has run.

[**ELH**] Total amount of time in hours the electric motor has run (on units equipped with Standby).

[**Hr4**] Total accumulated hours on hourmeter 4 (only appears if this hourmeter is set to Type 1, 2 or 3).

[**Hr5**] Total accumulated hours on hourmeter 5 (only appears if this hourmeter is set to Type 1, 2 or 3).

[**Hr6**] Total accumulated hours on hourmeter 6 (only appears if this hourmeter is set to Type 1, 2 or 3).

[**oIL**] Diesel engine oil pressure.

[**Ent**] Diesel engine coolant temperature.

[**rPn**] Diesel engine RPM.

[**bAt**] Battery voltage of the unit battery.

[**bLIt**] Backlight select (allows the driver to select high or low backlight illumination level).

[**dFI**] Initial defrost interval.

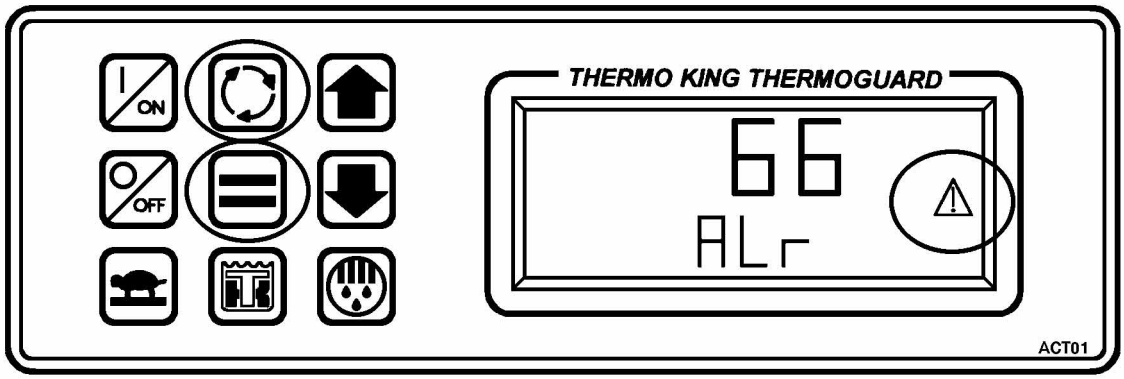
[**ddr**] Defrost duration.

Each prompt or display screen will remain on the display for about 10 seconds. If no other key is pressed, the display will then return to the Standard Display of box temperature and setpoint.

Locking a Display Screen on the Display

The display screens in the list above that are underlined can be locked on the display. Select the desired display screen by pressing the Select key and then press the Enter key. The display will now remain on the screen until any other key is pressed.

VIEWING and CLEARING ALARM CODES



1. Press the ON key to turn the unit ON.

2. If the ⚠ Alarm icon is present, one or more alarms have been detected.

To View Alarm Codes

1. Press the Select key to show the Alarm display screen.

If more than one alarm code exists, each will be displayed for several seconds.

The alarm code shown here is alarm code 66 — Low Engine Oil Level.

To Clear Alarm Codes

1. Correct the cause of the alarm code.

2. Press the Select key to display the alarm code.

3. Press the Enter key to clear the alarm code.

If more than one alarm code is present, the Enter key must be pressed to clear each alarm code individually.

µP-T ALARMS

Alarms and Alarm Codes

If an abnormal condition is sensed by the microprocessor, an alarm code is generated and saved in memory. There can be more than one alarm present at one time. An alarm code will remain in memory until it is cleared.

The Alarm icon will appear in the display to indicate that an alarm has been sensed. If the alarm occurred during a Unit Self Check, it will be preceded by a dash (-).

These alarm codes will direct a service technician to the source of a problem. Always record any alarm codes present, they will be invaluable to the service technician.

Displaying Alarms

If the Alarm icon appears on the display, press the Select key to display the alarm. If more than one alarm is present, they will “cycle” through the display, with each alarm appearing for several seconds.

Clearing Alarms

To clear an alarm after the alarm condition is corrected, press the Select key to display the alarm and then press the Enter key to clear it. Repeat this process for any additional alarms.

Types of Alarms

There are three types of alarms. They may occur individually or along with other alarms. There can be more than one alarm present at one time. Alarms that occurred during a Unit Self Check will be preceded by a dash (-).

- **Stored Alarm**. Indicates that a condition exists that does not affect unit operation but that should be investigated. The Alarm icon will appear for 30 seconds when the unit On-Off switch is turned ON and then disappear.
- **Check Alarm**. Notice to take corrective action before an abnormal condition becomes severe. The Alarm icon will appear and remain ON.
- **Shutdown Alarm**. Indicates conditions that may damage the unit. The unit will automatically shut down, the Alarm icon will appear and the entire display will flash ON and OFF.

To view the complete list of possible alarm codes and their definitions, refer to Section 3 in the Operation and Diagnosis Manual (TK 41087).

µP-T UNIT SELF CHECK TEST

The Unit Self Check is a functional test of the unit’s operating capability. Once the test is started by the operator, it is fully automatic and requires no operator attendance.

Starting the Unit Self Check

The following steps are necessary to start a Unit Self Check:

- Turn the On-Off switch ON.
- Clear any alarms.
- Press and hold the TK Logo key for at least 3 seconds until the Unit Self Check [USC] prompt screen appears.
- Press the Enter key. The display will briefly show [Lod] and the unit will then start the Unit Self Check.

If any alarms were not cleared before starting the Unit Self Check, they will be displayed at this time. They can be cleared by pressing the Enter key.

The balance of the Unit Self Check is fully automatic and requires no operator attendance. The following tests are performed:

Preheat and Start

The controller will automatically preheat and start the diesel engine.

Display Check

All segments of the display will be lighted at the same time.

Show Programmable Settings

All programmable settings will be sequentially displayed. these settings may be verified by the operator if necessary.

Defrost Check

The operation of the damper door is checked.

RPM Check

The diesel engine RPM is checked in both high and low speed.

Cooling Check

The ability of the unit to cool is checked.

Heating Check

The ability of the unit to heat is checked.

Cooling Check

A second cooling test is performed to ensure the unit can switch from cool to heat and back to cool.

Unit Self Check Report

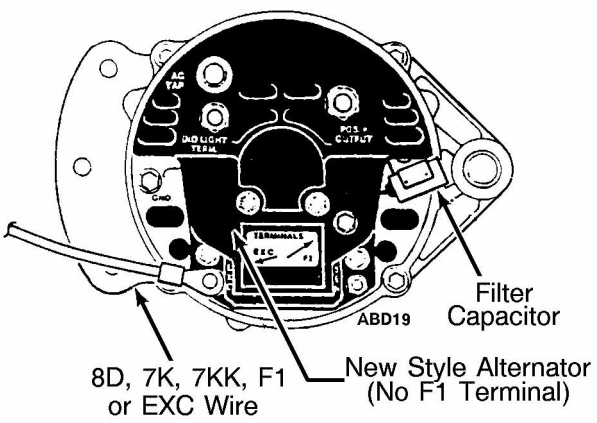
At the completion of the Unit Self Check, the check results will appear on the display. They will remain until any key on the controller is pressed. Check results are shown as either [PASS], [CHEC] or [FAIL].

[**PASS**] — The unit has passed the Unit Self Check.

[**CHEC**] — Stored or check alarm conditions were detected during the Unit Self Check. These alarms will be preceded by a dash (-) to indicate that they were detected during a Unit Self Check.

[**FAIL**] — Shutdown alarm conditions were detected during the Unit Self Check and the unit has been shut down to prevent possible damage. This will occur as soon as a shutdown condition is detected. The Unit Self Check will not be completed.

If check or shutdown alarms are detected during a Unit Self Check the condition(s) should be corrected and the check repeated before releasing the unit for service. See the Alarm Codes and Section 5 of the Operations and Diagnosis Manual (TK 41087) for details.



Prestolite Alternator

SERVICE PRECAUTIONS

ALTERNATOR WITH INTEGRAL REGULATOR

NOTE: Alternators with integral regulators and alternators with remote regulators are not interchangeable on units equipped with CYCLE-SENTRY operation. CYCLE-SENTRY units using alternators with integral regulators also use a Battery Sentry module that will not operate correctly if used on CYCLE-SENTRY units using alternators with external regulators. See TK Bulletin 300 for correct Battery Sentry module to use.

NOTE: Units manufactured with CYCLE-SENTRY and alternators with integral regulators MUST use replacement alternators with integral regulators.

CAUTION: "Full Fielding" alternators with the integral regulator is accomplished by installing a jumper from terminal F2 to ground. Attempting to full-field the alternator by applying battery voltage to terminal F2 will cause regulator failure.

Charging System Diagnostic Procedures

Complete the following checkout procedure before replacing the voltage regulator or the alternator.

1. With the unit switch OFF, attach a voltmeter to terminal SENSE and the alternator chassis. Voltmeter should indicate battery voltage.
2. With the unit switch ON, attach a voltmeter to terminal EXC and the alternator chassis. Voltmeter should indicate battery voltage.
3. To determine whether the alternator or regulator is faulty, attach a test lead between terminal F2 and chassis ground. Run the engine on high speed.

   CAUTION: Never apply battery voltage to terminal F2.

   a. Full alternator output indicates the alternator is good but the voltage regulator needs replacement.

   b. If there is LOW or NO output, the alternator is probably faulty. However, the following items are potential causes for not charging.

      — Check the alternator brushes

      — Check the 2A circuit from the alternator to the battery

      — Properly tension the alternator belt

      — Check the battery cable connections and the alternator ground. They must be clean and tight.

      — The battery must be in good condition and must accept a charge.

      — Check for excessive or unusual amperage draw by the unit control circuits.

NOTE: A loss of battery voltage to either terminal EXC or terminal SENSE will cause the alternator to stop charging.

EXCESSIVE VOLTAGE OUTPUT

12V ALTERNATORS WITH INTERNAL REGULAR SETTING

When a Thermo King unit is installed on a truck, it is often connected to a truck battery. When both the Thermo King unit and the truck engine are running on the truck battery, the charging system with the higher voltage may automatically turn off the charging system with the lower voltage output.

If it is determined that the Thermo King regulator setting is higher than the truck charging system or the batteries are consuming more water than normal the following solution may help solve the problem. Remove the wire labeled SENSE and tape off. Add a jumper wire from 2A to the SENSE terminal on the back of the alternator. This should reduce the voltage to the battery by .2 to.3 of a volt.

BATTERY

Inspect and clean the battery terminals during scheduled maintenance inspections. A dead or low battery can be the cause of an LED or ammeter (optional) indicating discharge due to lack of initial excitation of the alternator

NOTE: If the battery was discharged enough that a boost was needed, the alternator may not recharge the battery because there may not be adequate current to excite the alternator field.

UNIT WIRING

Inspect the unit wiring and the wire harnesses during scheduled maintenance inspections for loose, chafed or broken wires to protect against unit malfunctions due to open or short circuits.

ELECTRICAL CONTACTS

Inspect all relay contacts for pitting or corrosion every 1,000 operating hours, and repair or replace as necessary.

CHARGING SYSTEM (12 VDC)

Immediately after start-up, the voltmeter may show a discharge condition on systems with brush type alternators. This is due to a light film build-up on the alternator slip rings. The film build-up occurs primarily on units that have been sitting unused for long periods of time. The film should disappear after a minute or two, and the voltmeter should show a high charge rate that will continue until the battery voltage is brought back up to normal. If the voltmeter shows a discharge after start-up, check the alternator belt tension and all charging circuit connections including the battery.

NOTE: On installations where the RD-II unit is connected to the truck battery and both units are running—it is normal for the unit to indicate a discharge condition while the truck engine is running because of the truck's higher voltage charge rate.

PREHEAT BUZZER

The preheat buzzer module on the circuit board is designed to indicate preheat is in operation.

RPM SENSOR

The rpm sensor is in the engine bell housing adjacent to, but not touching, the flywheel (backed off 1/2 turn).

The rpm sensor is a device containing an inductance coil and magnet. When the magnetic field is distorted by the passing ring gear teeth, the inductance coil generates an ac

electrical signal that has a voltage and frequency variation proportional to the engine rpm.

By monitoring the frequency of this signal with the µP-T, the timing of the starter disengagement can be precisely controlled.

If the rpm sensor fails, the starter may not disengage or engage properly and a fault code will be generated to the microprocessor.

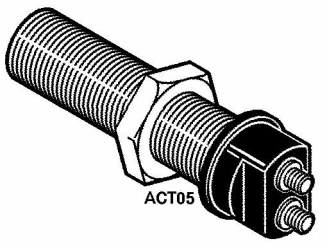
Testing the RPM Sensor

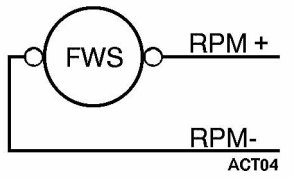
Equipment required:

- AC voltmeter capable of reading up to 10 volts
- Ohmmeter

The flywheel (rpm) sensor may be checked as follows:

1. Install the flywheel (rpm) sensor into the flywheel; bracket of the start-stop unit until it contacts the ring gear. Back out the sensor 1/2 turn and tighten the locknut.





Flywheel (rpm) Sensor

2. Disconnect wires RPM+ and RPM- from the sensor.
3. Place the unit in CONTINUOUS RUN. Run the unit o low speed and high speed. Check the ac voltage output across the sensor terminals. Use a meter with a high ohms per volt internal resistance. A Simpson 260, Fluke digital or any good VOM will work. However, an automotive type meter may not give an accurate reading because the meter may load the circuit heavily and cause the voltage level to appear lower than it actually is.
   a. The output voltage should be 1.0 to 2.0 Vac on low speed.
   b. The output voltage should be 2.0 to 2.5 Vac on high speed.

   NOTE: If the voltage is slightly off, the voltage may be increased by turning the sensor in more, and the voltage may be lowered by turning the sensor out more.
4. Reconnect RPM+ and RPM- wires on rpm sensor.

If the rpm sensor passes the above test, the sensor may be considered good.

If the unit is not available, an alternate less reliable test may be performed as follows:

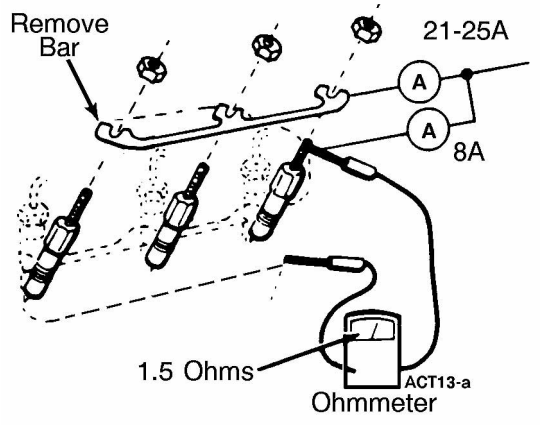
Disconnect the sensor from all wires, and measure the resistance across the terminals and from each terminal to the aluminum case. The resistance should be 250 to 300 ohms across the terminals, and there should be no continuity from each terminal to the case.

GLOW PLUGS

Glow plugs heat the combustion chamber to aid in quick starting. The glow plugs are energized when the Preheat-Start switch is pressed to the PREHEAT or START position or the microprocessor initiates unit start-up. A defective glow plug (burned out) can be detected by placing an exter-

nal ammeter in series with the plugs. Normal current draw is approximately 21 to 25 amps when preheating. A current draw of 21 to 25 amps means all three glow plugs are working. If the current draw is less than 21 amps on PREHEAT, at least one glow plug is bad.

To isolate an open circuit glow plug, remove the jumper bar and test each glow plug individually with an ohmmeter or a jumper wire and ammeter. Each glow plug should have a resistance of approximately 1.5 ohms or a current draw of about 8 amps.



With an external ammeter connected in series, a shorted glow plug will show excessive current flow (more than 12 amps) when the PREHEAT switch is pressed or when CB1 circuit breaker is tripped, check each plug.

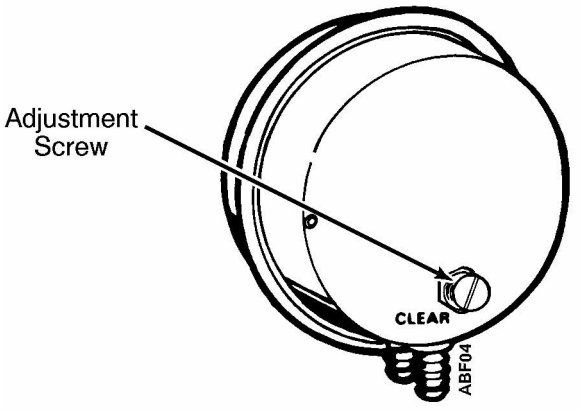
CONDENSER/EVAPORATOR FAN ROTATION (Electric Standby Operation)

The condenser and evaporator fans are belt driven. On electric standby operation, check for correct fan rotation by placing a small cloth or sheet of paper against the condenser fan grille on the front of the unit. Correct rotation will hold the cloth or paper against the grille. Improper rotation will blow the cloth or paper away from the grille. To correct improper condenser fan rotation, reverse any two power cord leads at the power cord. (DO NOT move the ground wire which is normally GREEN.)

Defrost Air Switch Checkout and Adjustment

Before testing or adjusting the air switch, check the clear plastic tubing and black plastic tubing to the evaporator coil. Make sure they are not obstructed or crushed. Check the probes in the evaporator housing to be sure they are in proper position, and make sure they are not obstructed.

1. Remove plastic sensing tubing from both sides of the defrost air switch.
2. Disconnect one wire at switch terminal. Connect test light or continuity tester to the two terminals used on the switch.
3. Install test equipment (TK 204-442 and TK 204-494) onto the hose fitting on the side of the air switch stamped BLACK.
4. Pressurize the hose until the continuity tester indicates a completed circuit. Now read the dial of the test gauge. This is the setpoint of the air switch (correct reading is 0.9 ±.05 in. [22.7 ± 1.27 mm] H_2O). Release the pressure.



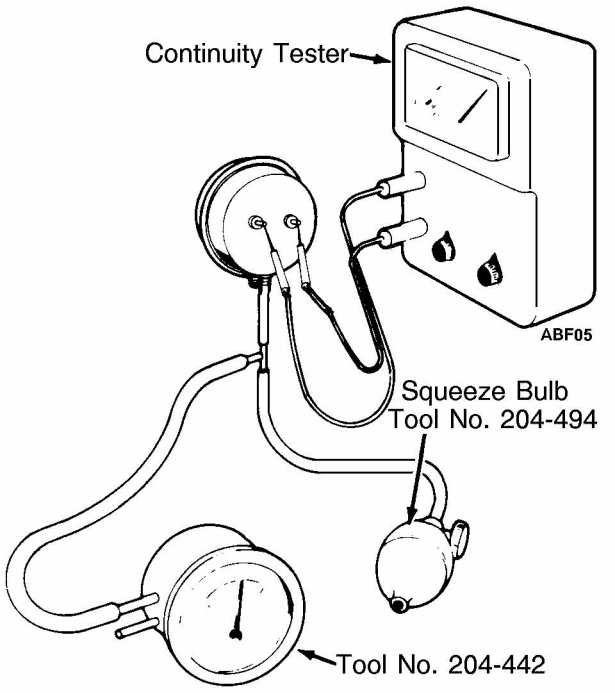
Air Switch

5. If the switch is out of calibration, pressurize the hose again until the tester indicates 0.9 in. (22.7 mm) H_2O. Adjust the screw clockwise or counterclockwise until the switch closes and the continuity tester indicates a completed circuit with the gauge reading 0.9 in. (22.7 mm) H_2O. Release the pressure.
6. Repeat test procedure several times to be sure the setting is correct.
7. Remove the test equipment. Install wire on switch terminal and air sensing tubes on air switch. The BLACK hose from the high pressure or air inlet side of the evaporator coil goes on the hose fitting on the side of the air switch stamped BLACK. The CLEAR hose from the low pressure or air outlet side of the evaporator coil goes on the hose fitting on the side of the air switch stamped CLEAR.

NOTE: Route hoses for continuous slope to avoid condensate traps.

If too much frost continues to accumulate before defrost, decrease the pressure setting. Turn the adjustment screw counterclockwise.

If defrost action occurs with too little frost accumulation, increase the pressure setting. Turn the adjustment screw clockwise.



Testing Air Switch

HIGH CAPACITY THERMAX™ HEATING SYSTEM

The High Capacity TherMax™ Heating System

The high capacity heating system increases the capacity of the heat mode by making more refrigerant available for use in the heat mode. This is accomplished by adding an additional solenoid (TherMax™ solenoid) to the refrigeration system which opens during the beginning of the heat mode to move the liquid refrigerant from the condenser to the accumulator where it can be used in the heat mode. The sequence of operation for the improved heating system is from the cool mode to the heat with refrigerant transfer mode to the heat mode. The heat mode to cool mode operation is the same as in the past. The bypass check valve, and the condenser check valve have been eliminated from the TherMax™ heating system.

The components that have been added to the system are: the TherMax™ solenoid, the TherMax™ solenoid line, and the receiver outlet check valve. The TherMax™ solenoid controls the flow of refrigerant through the TherMax™ solenoid line. The TherMax™ solenoid line goes from the liquid line just past the receiver outlet check valve to the accumulator inlet. The receiver outlet check valve is located in the liquid line near the drier/receiver outlet. This check valve prevents refrigerant from migrating back into the receiver tank and condenser during the heat mode.

Cool Mode

The cool mode has not been changed in the TherMax™ heating system. The TherMax™ solenoid, which is normally closed, is de-energized during the cool mode. The TherMax™ solenoid separates the high side from the low side. When the TherMax™ solenoid is closed, it does not allow liquid refrigerant to flow from the liquid line, through the TherMax™ solenoid line, to the accumulator.

Heat/Condenser Evacuation Mode

When the µP-T controller initiates a heat or defrost cycle, both the TherMax™ solenoid and the pilot solenoid energize simultaneously. The 26P wire from the interface circuit board supplies a ground to the pilot solenoid and the 26T wire supplies a ground to the TherMax™ solenoid. The pressure difference between the high pressure liquid in the condenser and the low pressure accumulator drives much of the refrigerant out of the condenser and receiver, and back into the accumulator. It is then available for improved heating capacity. The three-way valve and the receiver outlet check valve prevent the migration of refrigerant back into the receiver tank and condenser. The TherMax™ solenoid will remain energized until there develops a +4 degree F temperature difference between the discharge air and return air sensors (discharge air temperature - return air temperature = +4 degrees F). After this, the heat cycle will continue with just the pilot solenoid energized. The heat with refrigerant transfer mode will perform this way in every SR unit, regardless of ambient temperature or refrigerant type.

Additional Notes

In the event that either the discharge air temperature sensor or return air temperature sensor fails, as determined by the µp-T controller, the heat with refrigerant transfer mode will be controlled by the coil sensor instead. The coil temperature will be recorded at the start of the defrost or heat cycle, and the TherMax™ solenoid will stay energized until the coil sensor temperature increases by 4 degrees F

Every time the SR unit starts up on diesel engine or electric motor, the unit is placed in the heat mode for about 20 seconds. During this time, the TherMax™ solenoid is not energized.

ENGINE LUBRICATION SYSTEM

The TK 3.95 diesel engine has a pressure lubrication system. Oil is circulated by a trochoid type oil pump driven by the crankshaft timing gear and has several times the capacity required by the engine. Oil is picked up through a suction tube with a screened inlet. Oil to the rocker arm shaft flows through a tube on the outside of the engine and into the head through a restrictor fitting.

Oil pressure is affected by oil temperature, viscosity and engine speed. Subnormal oil pressures usually may be traced to lack of oil, faulty relief valve or worn bearings. The use of improper viscosity oil will also produce low oil pressure shutdowns.

Engine Oil Pressure Sensor

Engine oil pressure sensor should rise immediately on starting. If engine oil pressure drops below 10 ± 3 psig (69 ± 21 kPa), the sensor signals the microprocessor to stop the engine. Refer to Thermoguard µP-IV Microprocessor Controller Operations and Diagnosis Manual (TK 41087).

Engine Oil Change

The engine oil should be changed every 750 hours (1000 hours with bypass filter) or 6 months, whichever occurs first. Drain the oil only when the engine is hot to ensure that all the oil drains out. When changing oil, try to make sure that the trailer is not tipped away from the direction that the oil is supposed to flow from the oil pan. It is important to get as much of the residual oil out as possible because most of the dirt particles are in the last few quarts of oil to drain out. Refill the pan with 10 quarts (9.5 liters) and check the dipstick level. Run the unit, and then recheck the oil level.

NOTE: Fill the crankcase slowly so oil will not run into the breather hose, thus filling up an open cylinder. Leaving the dipstick out while adding engine oil will vent the crankcase.

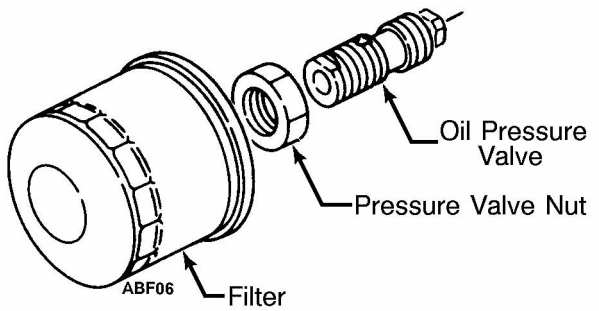
Add oil as necessary to reach the full mark. See Specifications page for correct type of oil.

Oil Filter Change

The oil filters should be changed along with the engine oil.

Spin-on Filters:

1. Remove the filter.
2. Apply oil to rubber ring of new filter and install filter.
3. Tighten the filter until the rubber ring makes contact, then tighten 1/2 turn more.



Oil Filter Parts

CRANKCASE BREATHER

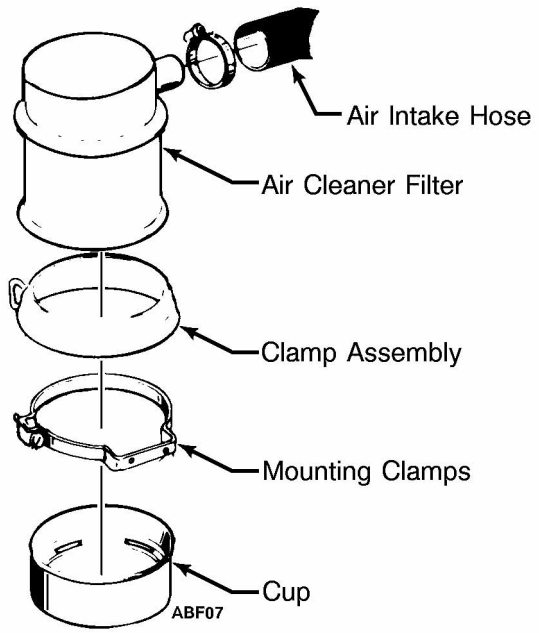
The crankcase breather system ducts crankcase gases formed in the crankcase directly to the intake elbow. Harmful vapors that would otherwise collect in the crankcase and contaminate the oil or escape to the outside, are now drawn back into the engine and burned. The breather hose should be inspected yearly to make sure it is not plugged.

ENGINE AIR CLEANER

Oil Bath Type

A heavy duty, oil bath air cleaner filters all of the air entering the engine. Excessive restriction of the air intake system reduces the flow of air to the engine affecting horsepower output, fuel consumption and engine life.

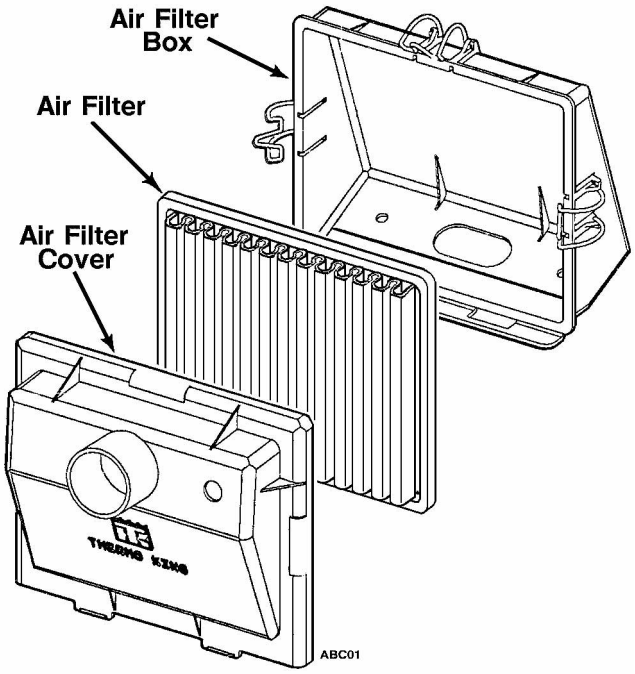
The air cleaner removes abrasive material from the air entering the engine. The air cleaner must be kept clean and open so that the air can pass freely. If the oil has absorbed the maximum amount of dirt, it allows the dirt to enter the engine. Remove the oil cup, wash thoroughly and dry every 1000 operating hours (500 hours under dusty conditions). Refill using the same weight oil used in the engine crankcase. Inspect the cleaner body and wash in solvent when it becomes dirty



Oil Bath Air Cleaner

Dry Type (Optional)

A dry element air cleaner filters all of the air entering the engine. Excessive restriction of the air intake system affects horsepower, fuel consumption and engine life. Inspect the element at regular unit service intervals.



Dry Air Cleaner (Optional)

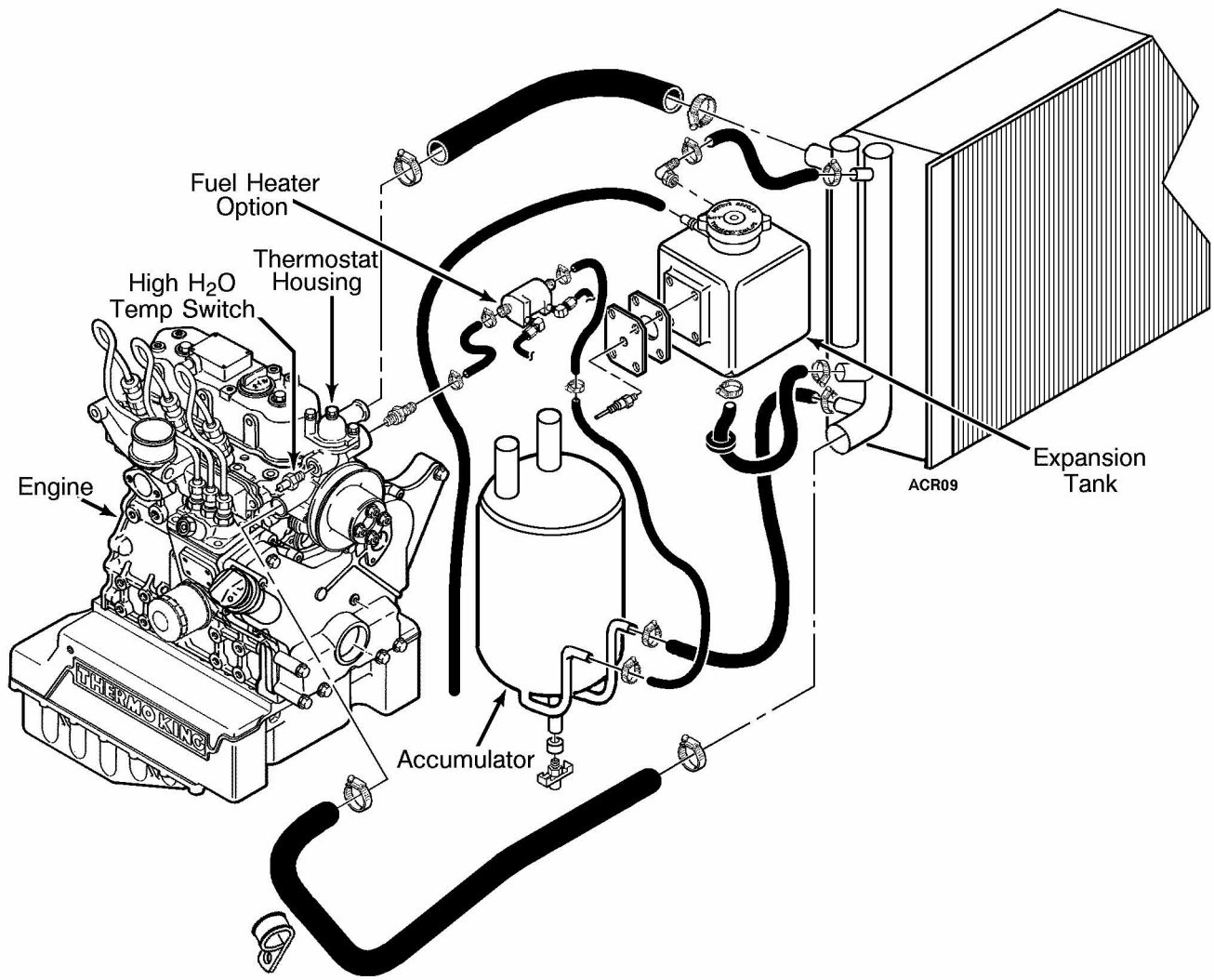
ENGINE COOLING SYSTEM

The engine employs a closed, circulating type, pressurized cooling system. Correct engine temperatures are controlled and maintained by a radiator, fan and thermostat. The coolant is circulated through the system by a belt-driven centrifugal pump. The pump draws the coolant from the side of the radiator (large header), circulates it through the cylinder block and head, then back to the radiator. A thermostat mounted in the water outlet from the cylinder head to the radiator automatically maintains coolant temperature within the specified temperature range.

All water-cooled engines are shipped from the factory with a 50% permanent type antifreeze concentrate and 50% water mixture in the engine cooling system.

This provides the following:

1. Prevents freezing down to -30 F (-34 C).
2. Retards rust and mineral scale that can cause engine overheating.
3. Retards corrosion (acid) that can attack accumulator tanks, water tubes, radiators and core plugs.
4. Provides lubrication for the water pump seal.



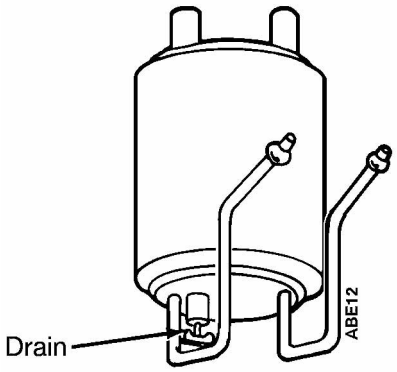
Engine Cooling Components

Checking the antifreeze

Check the solution concentration by using a temperature compensated antifreeze hydrometer or a refractometer designed for testing antifreeze. Maintain a minimum of 50% permanent type antifreeze concentrate and 50% water solution to provide protection to -30 F (-34 C). Do not mix antifreeze stronger than 68% permanent type coolant concentrate and 32% water for use in extreme temperatures.

Changing the Antifreeze

1. Run the engine until it is up to operating temperature. Stop the unit.
2. Open the engine block drain and accumulator tank drain, and completely drain coolant. Observe coolant color. If the coolant is dirty, proceed with a, b, and c. Otherwise go to step 3.



Accumulator Tank Drain

CAUTION: Avoid direct contact with hot coolant.

   a. Run clear water into radiator and accumulator and allow it to drain out of the block until it is clear.
   b. Close the block drain and install a commercially available radiator and block flushing agent, and operate the unit in accordance with instructions of the flushing agent manufacturer.
   c. Open the engine block and accumulator drain to drain water and flushing solution.

CAUTION: Avoid direct contact with hot coolant.

3. Run clear water into the radiator, and allow it to drain out of the block and accumulator until it is clear.
4. Inspect all the hoses for deterioration and the hose clamp tightness. Replace if necessary.
5. Loosen the water pump belt. Check the water pump bearing for looseness.
6. Inspect the radiator cap. Replace the cap if the gasket shows any signs of deterioration.
7. Mix one gallon of permanent type antifreeze concentrate meeting GM6038-M specification and one gallon clean water in a container to make a 50/50 mixture. (Do not add antifreeze and then add water to the unit. This procedure may not give a true 50/50 mixture because the exact cooling system capacity may not always be known.)
8. Refill the radiator with the 50/50 mixture.

Antifreeze Maintenance Procedure

As with all equipment containing antifreeze, periodic inspection on a regular basis is required to verify the condition of the antifreeze to accomplish these items. After two years of service, inhibitors become worn out and must be replaced by changing the antifreeze.

Every two years, the total antifreeze mixture must be drained, flushed and replaced to maintain total cooling system protection. When the antifreeze is replaced, use ethylene glycol type engine coolant concentrate meeting the GM6038-M specification. The factory recommends the use of a 50/50 antifreeze mixture in all units even if they are not exposed to freezing temperatures. Even in summer, the accumulator tank can get cold enough to freeze the water in the heat transfer coil. This antifreeze mixture will provide

the required corrosion protection and lubrication for the water pump.

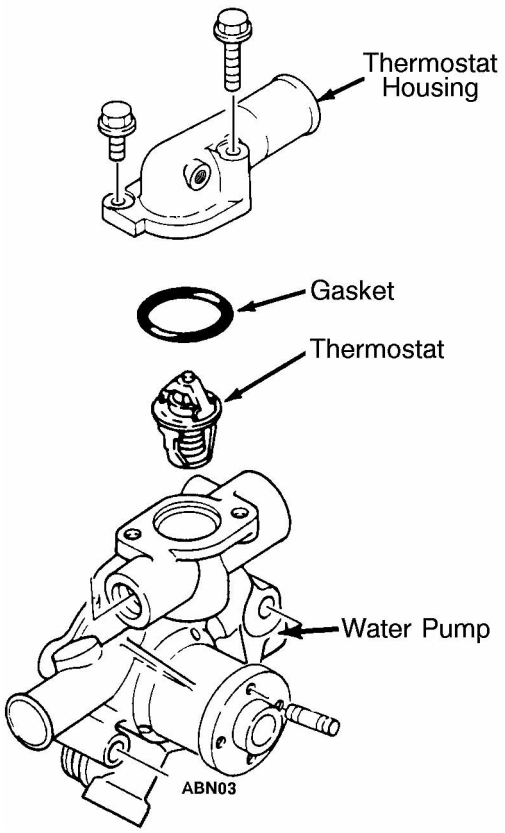
Bleeding Cooling System

After filling the radiator, run the unit up to operating temperature to check for overheating and coolant level and allow the air to be purged for a few minutes.

CAUTION: Do not remove the radiator cap while the engine is hot.

Engine Thermostat

For the best engine operation, use a 180 F (82 C) thermostat year round.



Water Pump Assembly and Thermostat

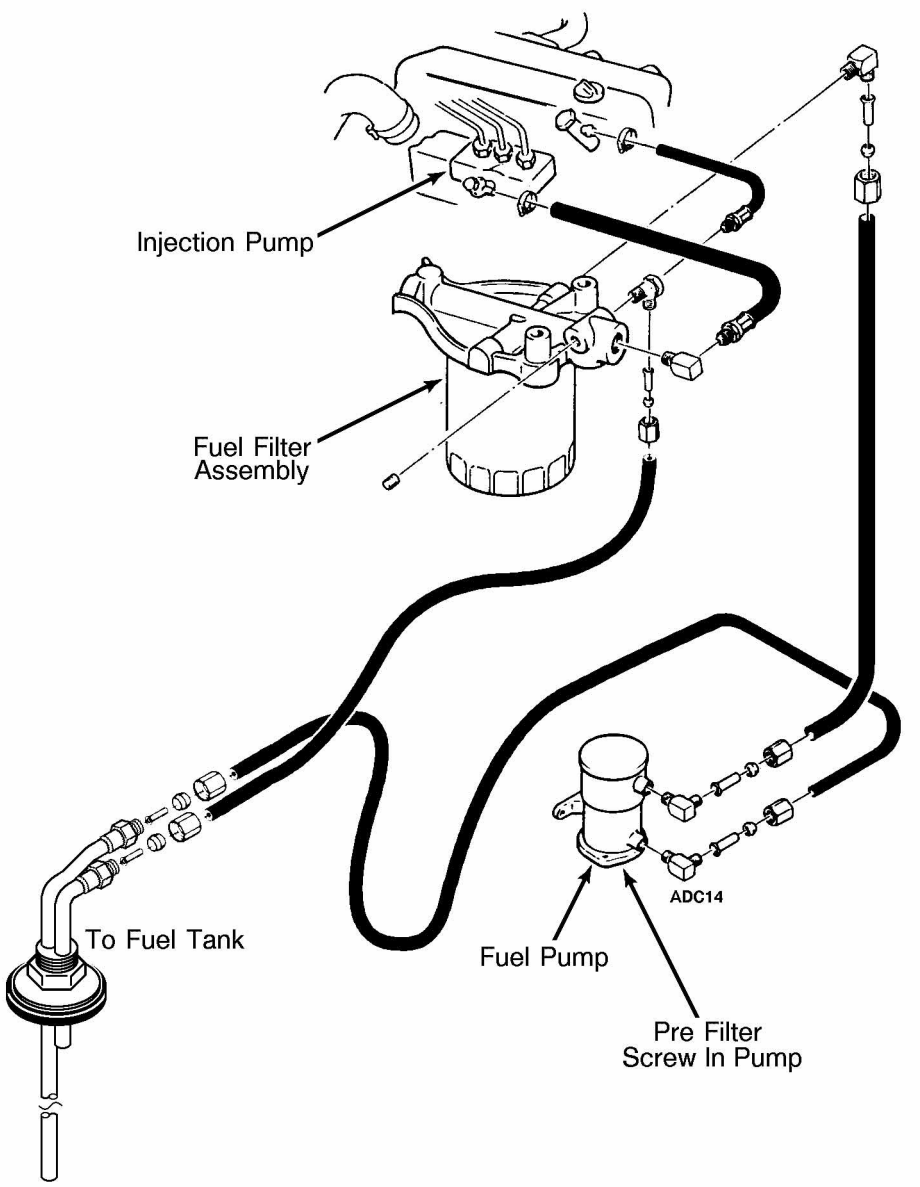
ENGINE FUEL SYSTEM

The fuel system used on the Thermo King TK 3.95 diesel is a high pressure system used in conjunction with a prechamber.

The components of the fuel system are:

1. Fuel tank (may be the truck fuel tank).
2. Electric Fuel pump.
3. Fuel filter.
4. Injection pump.
5. Injection nozzles.

A 10 psig (69 kPa) electric fuel pump pulls fuel from the fuel tank through a prefilter, then pushes it to the fuel filter, and to the injection pump. The prefilter is designed for diesel fuel and is the only type that should be used.



RD-II SR Fuel System

The injection pump plungers are activated by an extension on the engine camshaft. The governor sleeve and weight assembly is mounted on the end of the crankshaft with governor's speed requirements being relayed to the injection pump through a linkage arrangement located in the front timing cover. The injection pump raises the pressure of the fuel and meters the correct amount of fuel to the nozzle at the correct time. The increased fuel pressure will lift the spring loaded nozzle to admit fuel into the combustion chamber.

The fuel system is relatively trouble free, and if properly maintained will usually not require major service repairs between engine overhauls.

The most common cause of fuel system problems is contamination. It cannot be stressed enough that the fuel must be clean, fuel tanks must be free from contaminants, and the fuel filter must be changed regularly. Any time that the fuel system is opened up, all possible precautions must be taken to keep dirt from entering the system. This means all fuel lines should be capped when open. The work should be done in a relatively clean area, if possible, and the work should be completed in the shortest time possible.

Thermo King recommends that any major injection pump or nozzle repairs be done by a quality diesel injection service specialty shop. The investment in equipment and facilities to service these components is quite high. Therefore, this equipment is not found in most repair shops.

The following procedures can be done under field conditions:

1. Bleeding air from the fuel system.
2. Maintenance involving the fuel tank and filter system.
3. Speed and governor adjustments.
4. Electric transfer pump replacement or repair (10 psig [69 kPa] pump with diesel filter).
5. Injection line replacement.
6. Pump timing.
7. Nozzle spray pattern testing and adjustment.
8. Minor rebuilding of nozzles.

Bleeding the Fuel System

The fuel system will have to have the air bled out if the engine runs out of fuel, if repairs are made to the fuel system, or air gets into the system for any other reason.

NOTE: MAKE SURE to keep the fuel tank vent open. If the vent becomes clogged, a partial vacuum develops in the tank, and this increases the tendency for air to enter the system.

Proceed as follows:

1. Loosen the bleeder screw on the inlet fuel fitting of the injection pump.
2. Turn on the electric fuel pump. The electric fuel pump is energized when the On button is pushed. Tighten the bleeder screw on the injection pump when clear flow of fuel appears.

   NOTE: At initial start-up, open the bleeder screw at the injection pump and bleed fuel until a clear flow is noted.
3. Loosen the injector lines on the injection nozzles.
4. Crank the engine until fuel appears at the nozzles. Tighten the injector lines, and start the engine.

   NOTE: Fuel will not appear at the nozzles by merely running the electric pump. The engine must be cranked.

Water in the Fuel System

Water in the fuel system can damage the injection pump, nozzles and prechamber. This damage will subsequently cause more expensive damage to the engine. A large accumulation of water in the bottom of the fuel tank will stop a

diesel engine. Water should be drained off periodically to avoid breakdowns. This should be done after the tank has set idle for an hour. DO NOT steam clean fuel tank caps.

Fuel Filter Replacement

1. Remove the filter and discard.
2. Lubricate rubber ring of new filter with fuel.
3. Install the filter and tighten until the filter is slightly loose (rubber ring not making contact).
4. Bleed the air from the filter by operating the electric pump until fuel bubbles appear at the top of filter.
5. Tighten the filter until the rubber ring makes contact, then tighten 1/2 turn more.

ELECTRIC FUEL PUMP

Operation

The electric fuel pump must be mounted next to the fuel tank. This pump is designed to push rather than pull fuel.

Make sure the pump case completes a good ground with the battery. The pump will not operate at less than 9 Vdc. The pump is self priming as long as it is not higher than 30. in. (762 mm) from the fuel in the fuel tank.

Maintenance

Field service is limited to cleaning the bottom cover and filter. The filter and cover gasket are replaceable.

Disassembly

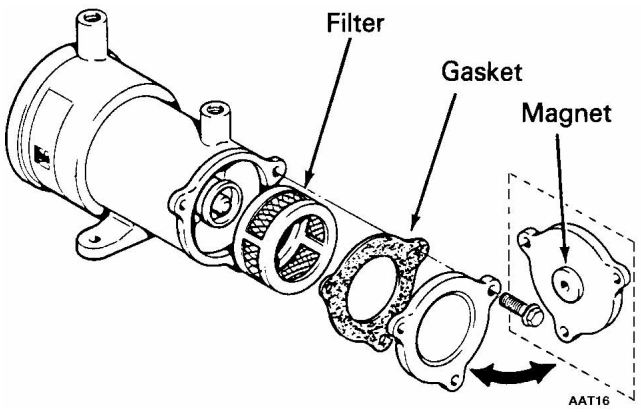
1. Remove the three screws from the cover.
2. Remove the filter, cover and cover gasket. Wash the filter in cleaning solvent and blow out the dirt and cleaning solvent with compressed air. Check the cover gasket and replace if damaged. Clean the cover.

Reassembly

Place the cover gasket on the bottom cover and install the filter and cover assembly. Replace the three screws.

If pump does not operate, check for:

1. The ground to the mount or frame.
2. Clean and tighten electrical connections.
3. The pump voltage and polarity. It must be the same as the unit system.



Electric Fuel Pump

If Pump operates but does not deliver fuel, check for:

1. Air leaks in the fuel lines or connections.
2. Kinked fuel lines or other restrictions in the line.
3. A leaking or distorted cover gasket.
4. A dirty filter.
5. A stuck seat in the outlet fitting.

Injection Pump Adjustments

When the diesel engine fails to maintain the correct engine speed, check the following before adjusting the speed:

1. Check the prefilter screen. Recheck the speed.
2. Bleed air out of the fuel system. Recheck the speed.
3. Bleed air out of the nozzles. Recheck the speed.
4. Operation of electric transfer pump.

Make the engine speed adjustments with the engine fully warmed up.

The RD-II SR has one solenoid to control the high speed function. The speed of the engine should be checked with a hand tachometer, TK P/N 204-220, on the crankshaft pulley bolt or by the use of a stroboscope tachometer, TK P/N 204-436.

Timing the Injection Pump to the Engine

There are two different types of timing procedures used on the TK 3.95 engine. One procedure involves checking to make sure the cylinders are timed correctly to each other, and the second procedure times the injection pump correctly to the engine. If the cylinders are not timed correctly to each other, it is of no value to time the injection pump to the engine because one or two of the three cylinders would be out of time. The individual plungers in the injection pump are timed to each other by the use of spacers in the pump plunger base. It is rare that an injection pump would change individual cylinder timing unless it had been through some type of repair process, but if all other possible problems with a rough running engine have been checked, and especially if the engine's injection pump has been replaced or repaired recently, it may be beneficial to check individual cylinder timing. Because the possibility of incorrect individual cylinder timing is so minimal, the procedure for timing the pump to the engine will be covered first. The procedure for individual cylinder timing is very similar to timing the injection pump so it will be covered last.

CAUTION: The cylinders on the engine are numbered from the flywheel end to the water pump end. The number 1 cylinder is next to the flywheel. The number 2 cylinder is the center cylinder. The number 3 cylinder is next to the water pump. The timing marks on the flywheel are matched to this system.

1. Rotate the engine in the direction of rotation (clockwise as viewed from the water pump end) until the number 1 cylinder (closest to flywheel) is at approximately top dead center of the compression stroke. The valve cover should be removed to identify the compression stroke. Both rocker arms of the number 1 cylinder will be loose. Check to see that the number 1 cylinder top dead center mark on the flywheel is aligned with the timing mark on the starter mounting plate.

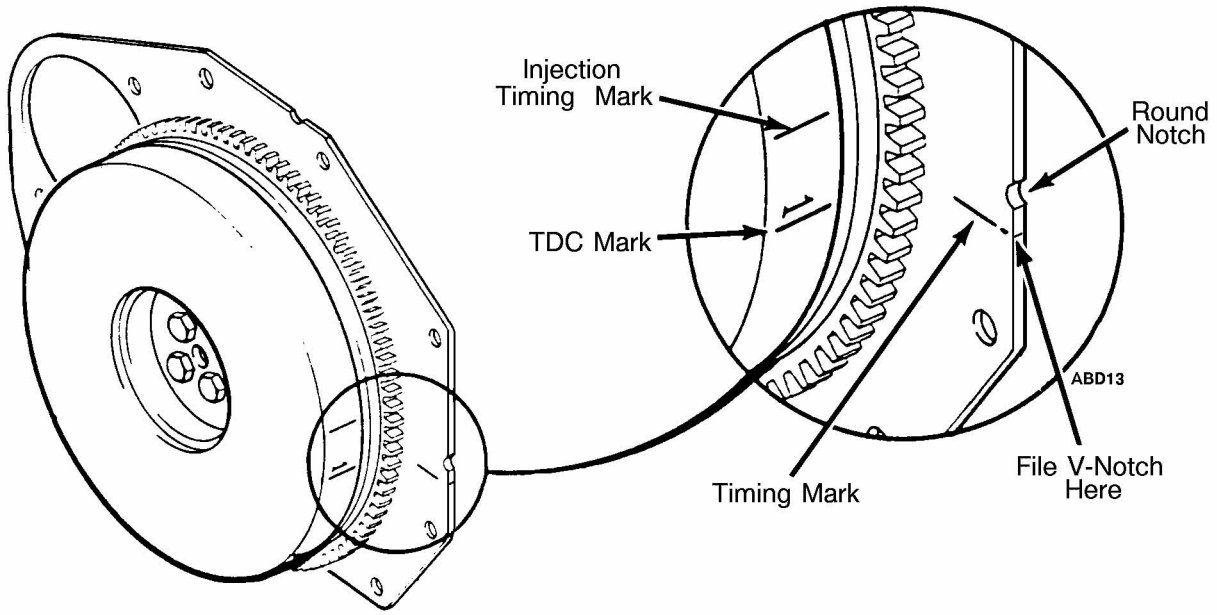
   NOTE: The timing marks for each of the three cylinders are stamped 120° apart. Top dead center marks are identified by the number of the cylinder stamped next to them. Injection timing marks are unmarked. The timing marks on the TK 3.95 engine can be difficult to align. This is because the timing mark on the starter mounting plate is near the air cleaner, on the side of the plates that faces the flywheel. It cannot be seen when looking through the curbside door opening unless you use a mirror.

   The timing mark on the starter mounting plate is a line stamped on the side of the plate facing the flywheel. To locate the timing mark, feel the back side of the plate .4 in. (10 mm) below the center of round notch in the edge of the plate. To make it easier to align the timing marks, file a V-notch in the edge of the plate in line with the timing mark on the plate. Units manufactured after 3-15-89 will have this V-notch in the edge of the plate.

2. Remove the injection line from the number 1 injector and the injection pump. Remove the delivery valve holder, delivery valve and spring. Care must be taken to prevent dirt from entering the fuel injection system. Replace the delivery valve holder and delivery valve.
3. Install a drip valve on the nozzle holder.
4. Activate the run solenoid and the fuel pump by pushing the ON button. Make sure the Diesel-Electric switch is in the DIESEL position. Use the relay board test—see manual TK 41087.

   CAUTION: The 8S wire on the starter motor should be disconnected.

   CAUTION: Loosen the injection lines on the injection nozzles of the number 2 and 3 cylinders to prevent any possibility of the engine firing.
5. The engine should be close to the top dead center position with the plunger port in the pump closed. No fuel should flow from the drip tube.
6. Turn the engine backwards past the injection timing mark until fuel flows from the drip tube.
7. Slowly rotate the engine in the direction of rotation while watching the drip tube. When the fuel flow slows to approximately one drip every 10 to 15 seconds, check the timing marks. They should be lined up.
8. ***If the timing marks did not line up, a shim or shims will have to be added or subtracted from the injection pump. Adding shims will retard the injection timing, subtracting shims will advance the timing. Increasing or decreasing shim thickness by.004 in. (0.1 mm) will change the timing by 1***^{o}.
9. After shims have been added or subtracted, recheck the timing.
10. When the injection pump has been correctly timed to the engine, remove the pump and put a light coat of silicone gasket sealer on the shim pack and the pump, or dip the new shims in lacquer thinner to activate the sealer.
11. Reinstall the pump, and torque the nuts to 18 to 20 ft-lb (24 to 27 N•m).
12. Reinstall the delivery valve and spring. Torque the delivery valve holder to 30 ft-lb (41 N•m).
13. Reinstall the injector lines, bleed the air from the nozzles, and test run the engine.



Timing Marks

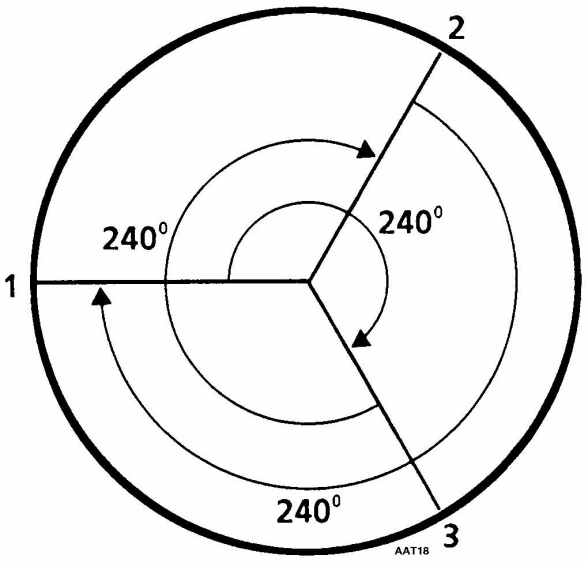
Timing Individual Cylinder Injection

This procedure should be used when a poor running engine has had all possible problems checked but continues to run badly. If the injection pump has been repaired or replaced, the chance of individual cylinder timing problems has a greater possibility of occurring.

To check individual cylinder timing, follow the pump timing procedure but instead of changing shims to adjust pump timing, check the timing of number 2 and number 3 injector to the engine after checking number 1. The cylinders should time on their respective flywheel timing marks.

If the injection pump plungers are not correctly timed to each other, the pump must be removed and sent to a diesel injection equipment repair shop for calibration.

NOTE: The order of the flywheel timing marks is 1, 2, 3, but the firing order is 1, 3, 2. This is because the engine fires every 240^{o} of crankshaft rotation. Therefore, when checking individual cylinder timing check number 1 first then rotate the engine past number 2 to number 3 and check number 3. Then rotate the engine past number 1 to number 2 and check number 2.



Individual Cylinder Timing and Firing Order

ADJUST ENGINE VALVE CLEARANCE

1. Remove the valve cover. Torque 18 mm diameter head bolts prior to adjusting the valves: 26.8 ft-lb (36.3 N•m). Valve clearance should be checked after every 2000 operating hours, maximum. It is very important that valves be adjusted to the correct specifications for satisfactory engine operation. Insufficient valve clearance will result in compression loss and misfiring of cylinders resulting in burned valves and seats. Excessive valve clearance will result in noisy valve operation and abnormal wear of the valves and rocker arms. The intake and exhaust valves are adjusted with the valve in the closed position.
2. The intake valve and exhaust valve are adjusted to .0079 in. (0.20 mm) with the temperature at 70 F (21 C).

   Turn the engine by using the belt on the crankshaft pulley. Rotate the engine in the direction of rotation (clockwise as viewed next to the flywheel) from the water pump end.

   CAUTION: Make sure the fuel rack is off to prevent the engine from starting.

   a. Turn the engine so number 1 cylinder is on compression with piston to TDC. Both push rods should turn freely. Adjust both valves on number 1 cylinder.

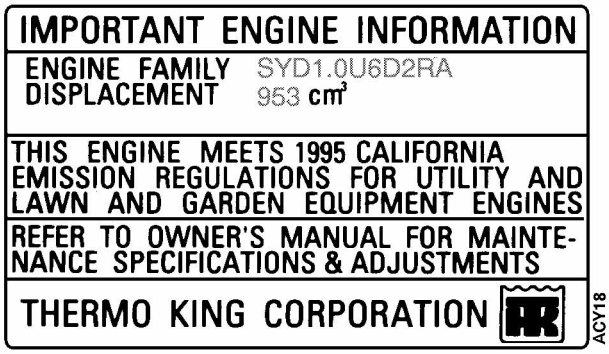
   b. Revolve the crankshaft 240° to TDC mark on number 3 cylinder, and adjust both valves.

   c. Turn the crankshaft 240° to align TDC mark of number 2 cylinder, and adjust both valves.

   d. BE SURE to tighten locking nut while holding the ball head screw in position.
3. Install the valve cover making sure that the gasket in position.

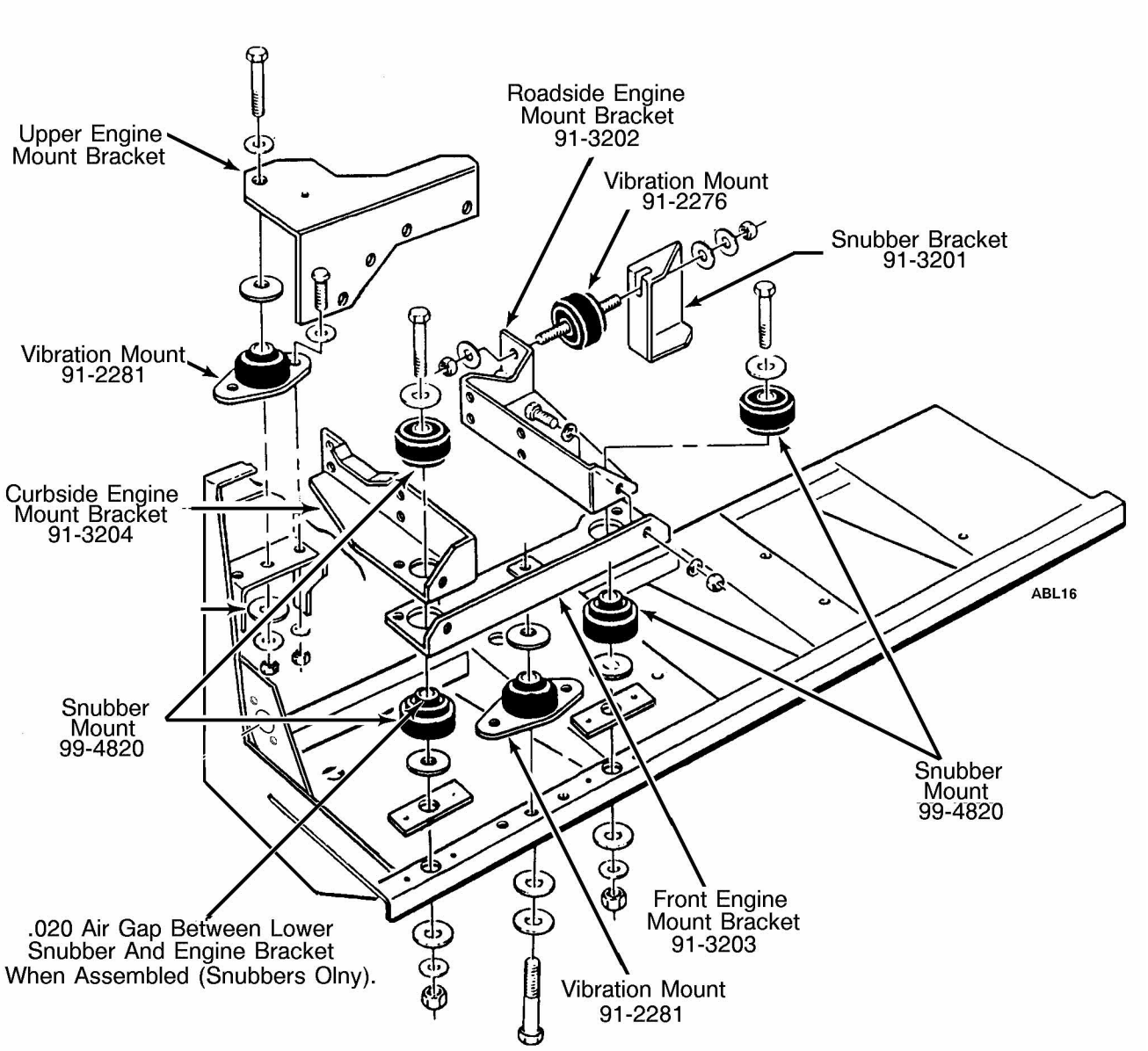
FUEL LIMIT SCREW

The fuel limit screw is not adjustable. It is equipped with an anti-tamper cap to fulfill requirements for CARB (California Air Resources Board) emission regulations. Service technicians must be CARB certified to perform service on fuel limit screw for equipment operating in California. All other equipment can be serviced per recent service bulletins with special tools and procedures. California service technicians should see your local Thermo King dealer for recent bulletins.



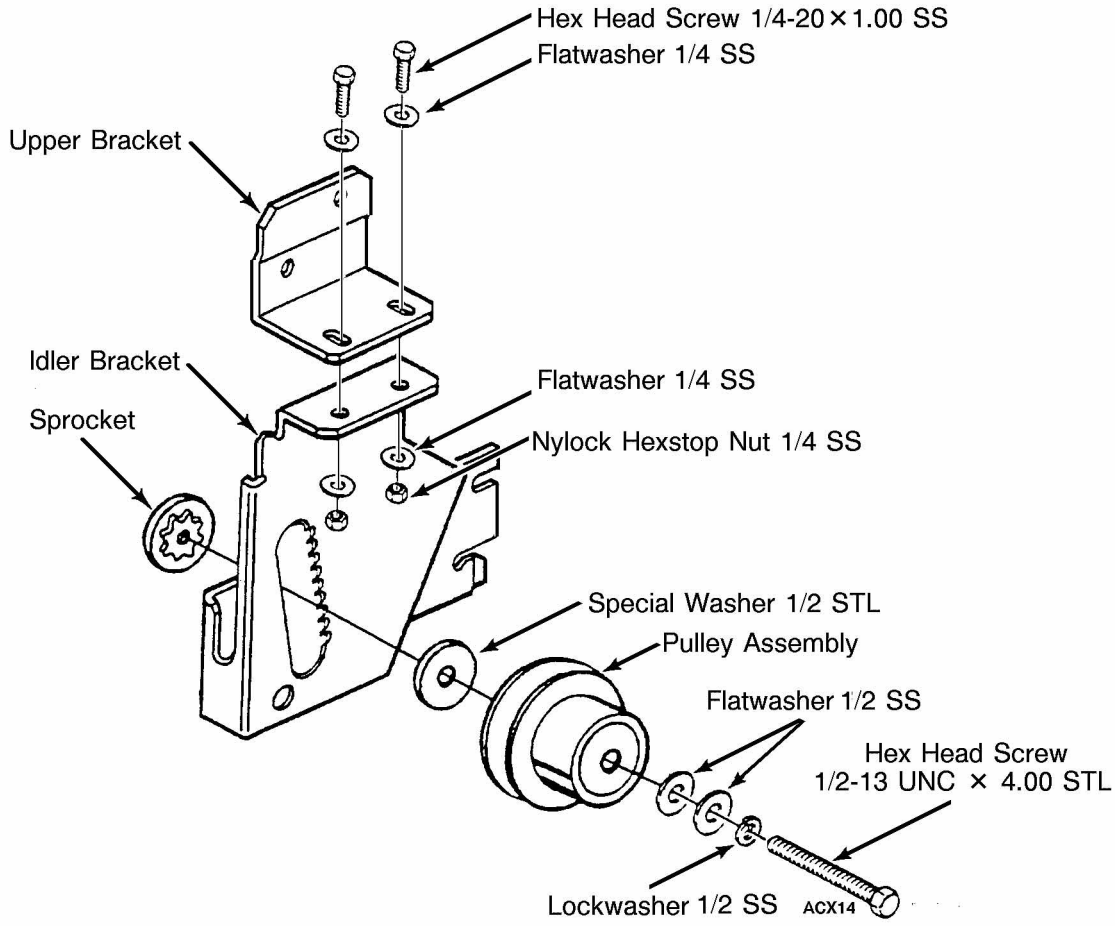
Engine Mounts for RD-II SR Unit

The engine mounting system contains three vibration mounts and two snubber mounts.



Engine Mounting Components

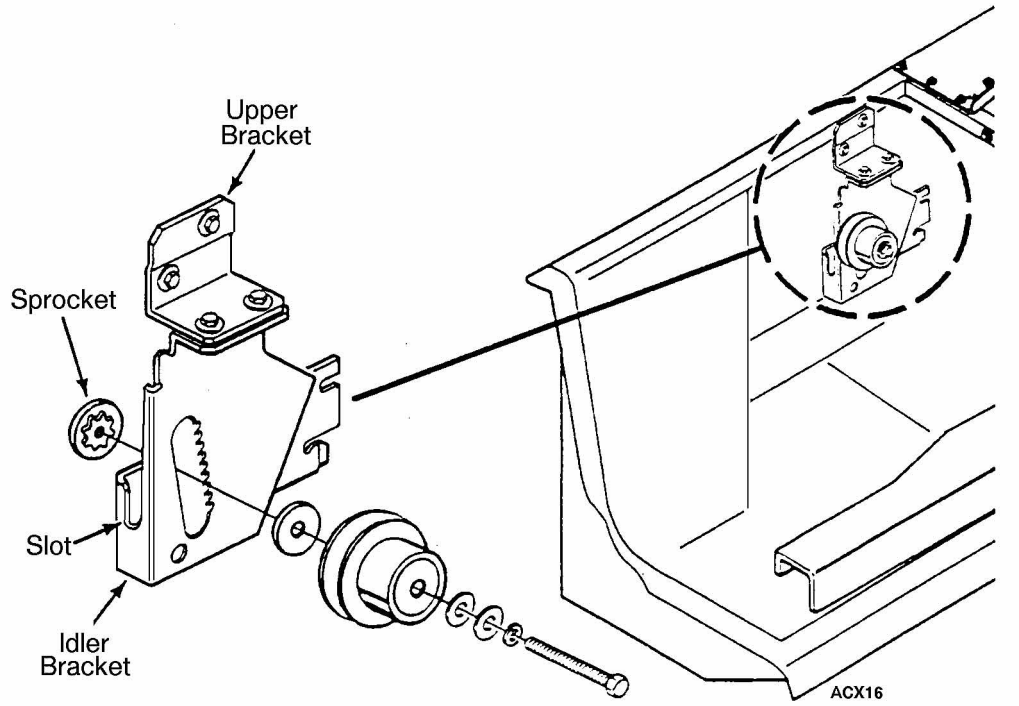
RD-II Idler Assembly



Idler Assembly—Complete

AUTO START/STOP

CAUTION: The unit may start automatically and at any time when the unit On-Off switch is in the ON position. Units with the CYCLE-SENTRY option start automatically in both CYCLE-SENTRY mode and Continuous mode. Be sure to turn the On-Off switch OFF before opening doors or inspecting or working on any part of the unit.



Idler Assembly

Engine/Compressor/Jackshaft /Belt Tension/ Adjustments

1. Place the engine/compressor belt in the idler pulley. Make sure the belt is also placed in the engine pulley and the compressor pulley.
2. Turn the sprocket with a 7/8 in. wrench to tension the belt. Tighten the pulley bolt with a 3/4 in. wrench when the belt is at the proper tension. Use <u>one</u> of following methods to check (or set) the belt tension.
   a. The belt tension should be set at a reading of 70 to 80 on the Thermo King Belt Tension Gauge P/N 204-427.
   b. The belt should deflect 1/2 in. (13 mm) at the center of the longest (lower) span.
   c. Use a 7/8 in. crow's foot attached to a 3/8 in. torque wrench to turn the sprocket and obtain a reading of 40 in-lb (4.5 N•m) on the torque wrench for used belts and 45 in-lb (5.0 N•m) for new belts. Tighten the pulley bolt while holding the sprocket in this position. When using this procedure, the pulley bolt must at first be loose enough to allow the sprocket to rotate freely. If not, the reading on the torque wrench will not produce the proper belt tension.
3. Place the compressor/evaporator fan/alternator belt in the compressor pulley and check to see that it is centered in the slot on the left side of the idler bracket. If not, adjust the position of the left evaporator fan pulley on the fan shaft so the belt is centered in the slot. Adjust the compressor/evaporator fan/alternator belt to the proper tension after it is centered in the slot.

4. Adjust the compressor/jackshaft (electric motor) belt to the proper tension. The belt tension should be set at a reading of 64 to 70 on the Thermo King Belt Tension Gauge P/N 204-427. If the Thermo King Belt Tension Gauge is not used, the belt should deflect 1/2 in. (13 mm) at the center of the longest span.

The engine/compressor belt tension should be set at a reading of 70 to 80 on the Thermo King Belt Tension Gauge P/N 204-427.

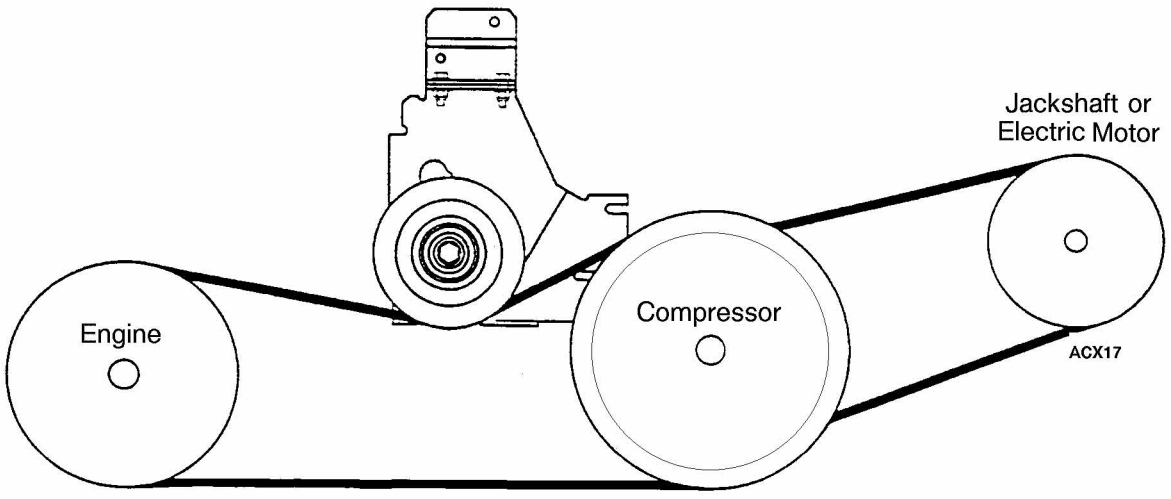
The compressor/jackshaft (electric motor) belt tension should be set at a reading of 64 to 70 on the Thermo King Belt Tension Gauge P/N 204-427.

If the Thermo King Belt Tension Gauge is not used, the belt should deflect 1/2 in. (13 mm) at the center of the longest span.

Belts should be tensioned cold and retensioned cold after 10 hours of running.

⚠ IMPORTANT ⚠

The Belts Must Be Adjusted To The Proper Tensions!

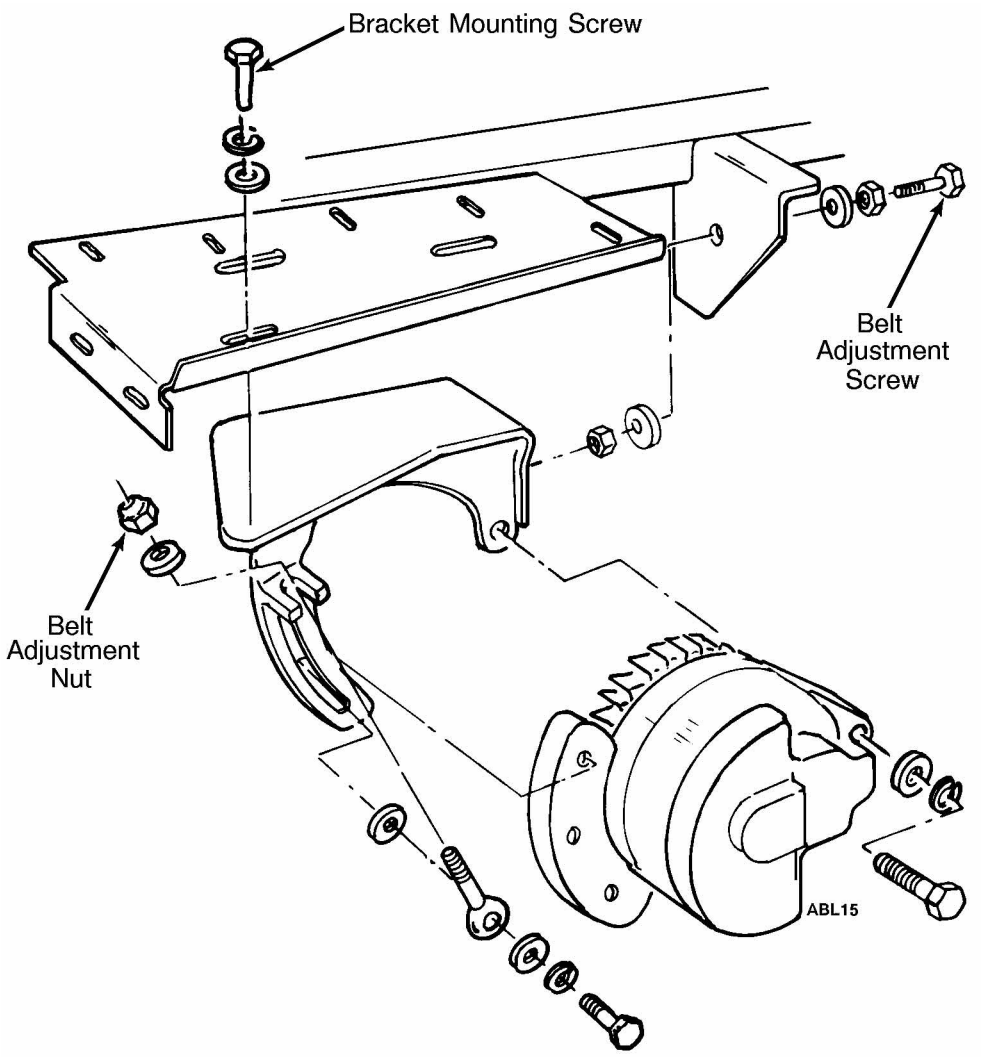


Belt Layout

Compressor/Evaporator/Alternator and Alternator/ Evaporator Fan Belts

Move the alternator upward to tighten the belts enough to obtain 1/2 inch (13 mm) deflection at the center of the longest span of the Compressor/Evaporator Fan/Alternator belts, and 1/2 inch (13 mm) deflection at the center of the span on the Alternator/Evaporator Fan belt.

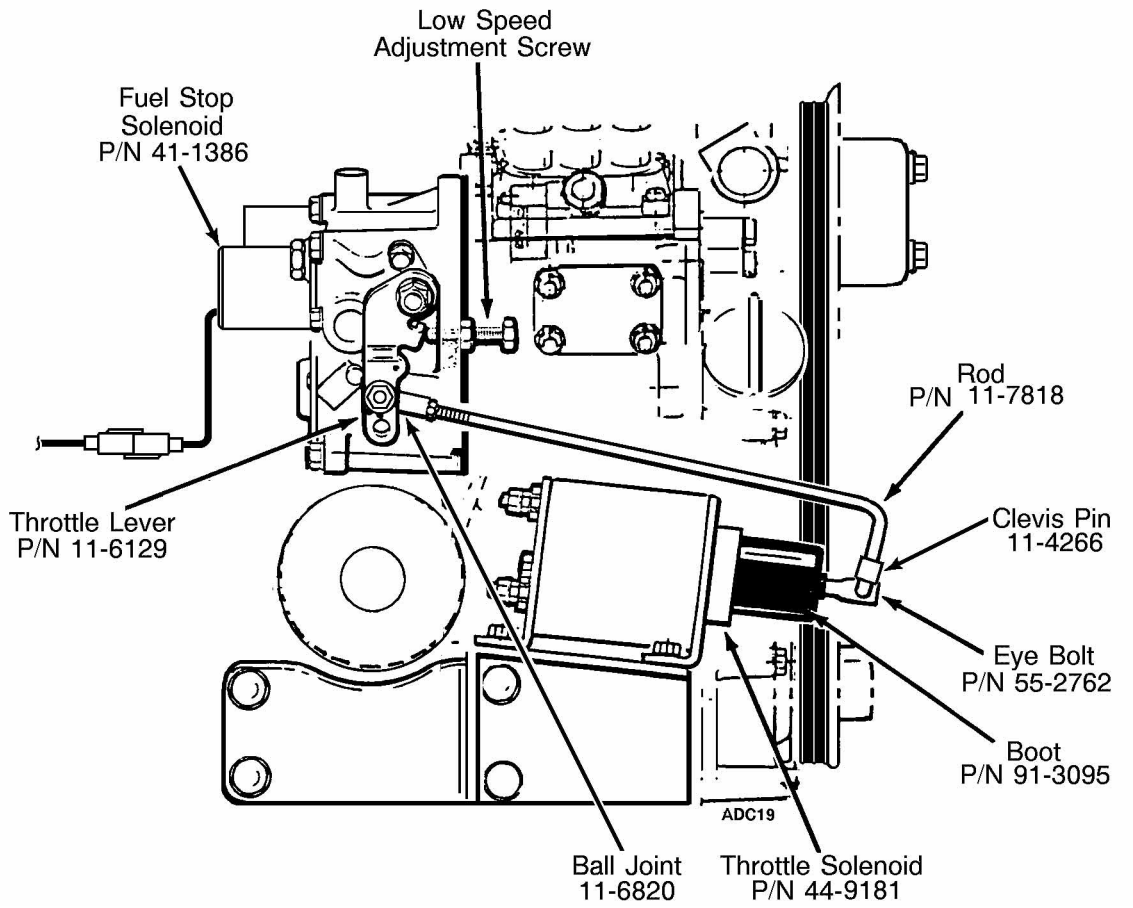
Belts should be tensioned cold and retensioned cold after 10 hours of unit running.



Alternator Mounting and Belt Tension Screws

Integral Fuel Solenoid

The fuel stop solenoid is located on the end of the fuel injection pump.



Integral Fuel Solenoid Components

TK 3.95 ENGINE

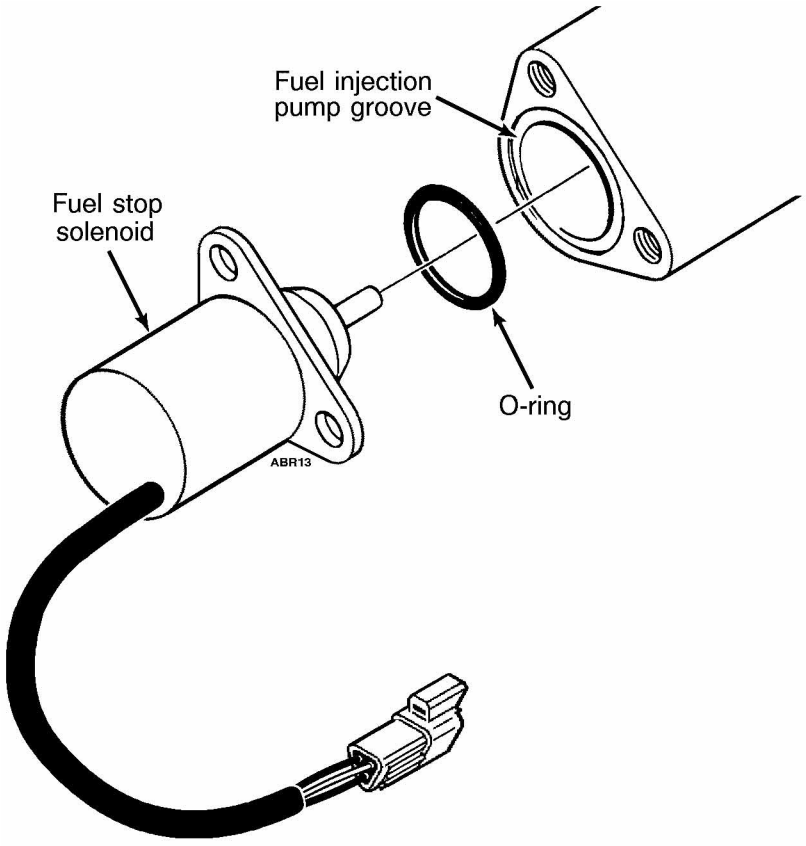
Operation of the TK 3.95 engine is controlled by the operation of the fuel solenoid and the throttle (high speed) solenoid. The fuel solenoid consists of a spring loaded plunger and electro-magnetic coil. When the engine is OFF, spring tension on the plunger maintains the plunger's "out" position. When pushed out, this causes the governor linkage to move the injection pump rack to the "Fuel Off" position.

When the fuel solenoid is energized, current is applied to the coil creating an electro-magnetic field, which pulls the plunger in. When the solenoid is in the "pulled-in" position, the plunger releases tension on the governor linkage. The governor linkage then moves the fuel injector rack, thus controlling the fuel flow and placing it in the "Fuel On" position.

Adjustments made to the throttle (high) speed solenoid change governor spring tension which in turn adjust speed settings.

Fuel Solenoid Diagnostic and Replacement

- Refer to the Interface Board diagnostic procedures in the Thermoguard µp-T Controller Operation and Diagnosis Manual TK 41087 sections 3 and 4.



Fuel Solenoid Components

Engine Speed Adjustments

Low Speed Adjustment

1. Start the unit and let it run until the engine is warmed up.
2. Set the thermostat to make the engine run in low speed and check the engine speed. The engine speed should be 1625 ± 25 rpm.
3. If the engine speed is not correct, loosen the jam nut on the low speed adjustment screw.
4. Turn the low speed adjustment screw to change the engine speed. Turn the screw in to increase the engine speed. Turn the screw out to decrease the engine speed.
5. Set the engine speed at 1625 ± 25 rpm and tighten the jam nut.

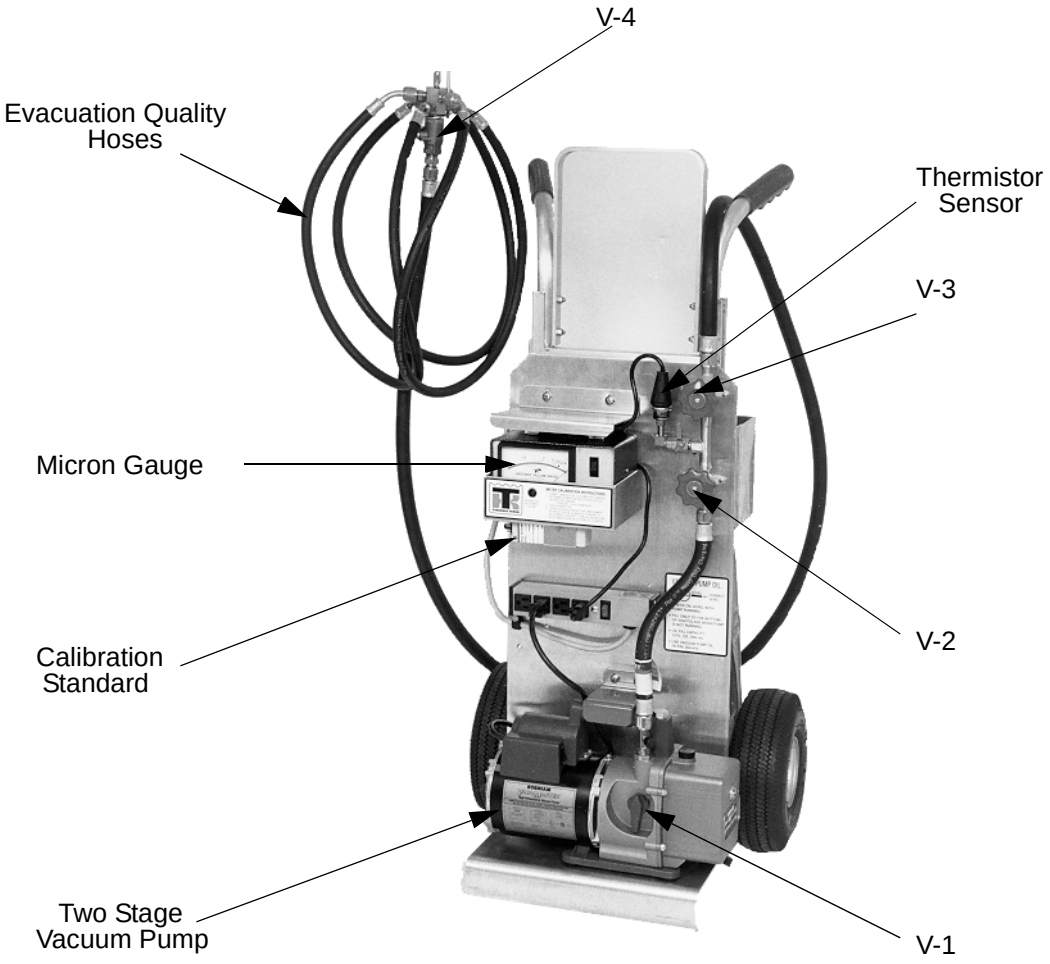
High Speed Adjustment

1. Start the unit and let it run until the engine is warmed up.
2. Set the thermostat to make the engine run in high speed and check the engine speed. The engine speed should be 2425 ± 25 rpm.
3. If the engine speed is not correct, loosen the jam nut at the end of the adjuster.
4. Unbolt the adjuster from the throttle lever and turn to adjust the engine speed. Reinstall on the throttle lever.
5. Set the engine speed at 2425 ± 25 rpm and tighten the jam nut.

Integral Fuel Solenoid Parts List

Part Description	Part Number	Quantity
Fuel Stop Solenoid	41-1386	1
O-ring	33-2770	1
Throttle Solenoid	44-9181	1
Relay	44-9111	1

SYSTEM EVACUATION



Evacuation Station—TK No. 204-725

Evacuation is Important and is Critical to System Performance!

It has been determined through testing and system analysis that refrigeration systems which contain non-condensable such as nitrogen and/or air can be overcharged with refrigerant when charged using the sight glass method. An overcharge of refrigerant will cause compressor damage.

Therefore, Thermo King recommends that all repairs to the refrigeration system include the removal and reclamation (cleaning) of the refrigerant, followed by a thorough evacuation using the proper tools and procedures. (See attached too list and evacuation procedures.)

The primary objective of evacuation is to bring the system's pressure to a low micron level to ensure the removal of moisture and non-condensables. There are however, certain other principles which must be observed. These are:

- Evacuate from 3-points to access both sides of check valves and solenoids. Energize solenoids during evacuation to prevent trapping of refrigerant or non-condensables.
- Always leave service valve caps on during evacuation and do not exercise the valve stems while the unit is in a deep vacuum. Packing glands on older valves are prone to leak.
- Never attempt evacuation without a micron or vacuum gauge. The micron gauge will help determine:
    a. If the pump is capable of pulling a deep vacuum.
    b. When the vacuum pump oil is contaminated.
    c. If the vacuum hoses and valves are leak free.
    d. If the unit is leak free.
    e. How long you should evacuate the unit.
    f. That the unit is still in a deep vacuum before any lines are disconnected or refrigerant is added.

NOTE: The attached evacuation procedures have been written to be used with the Thermo King Evacuation System (Tool No. 204-725). However, the principles of 3-point evacuation and the use of a micron gauge during evacuation should always be practiced.

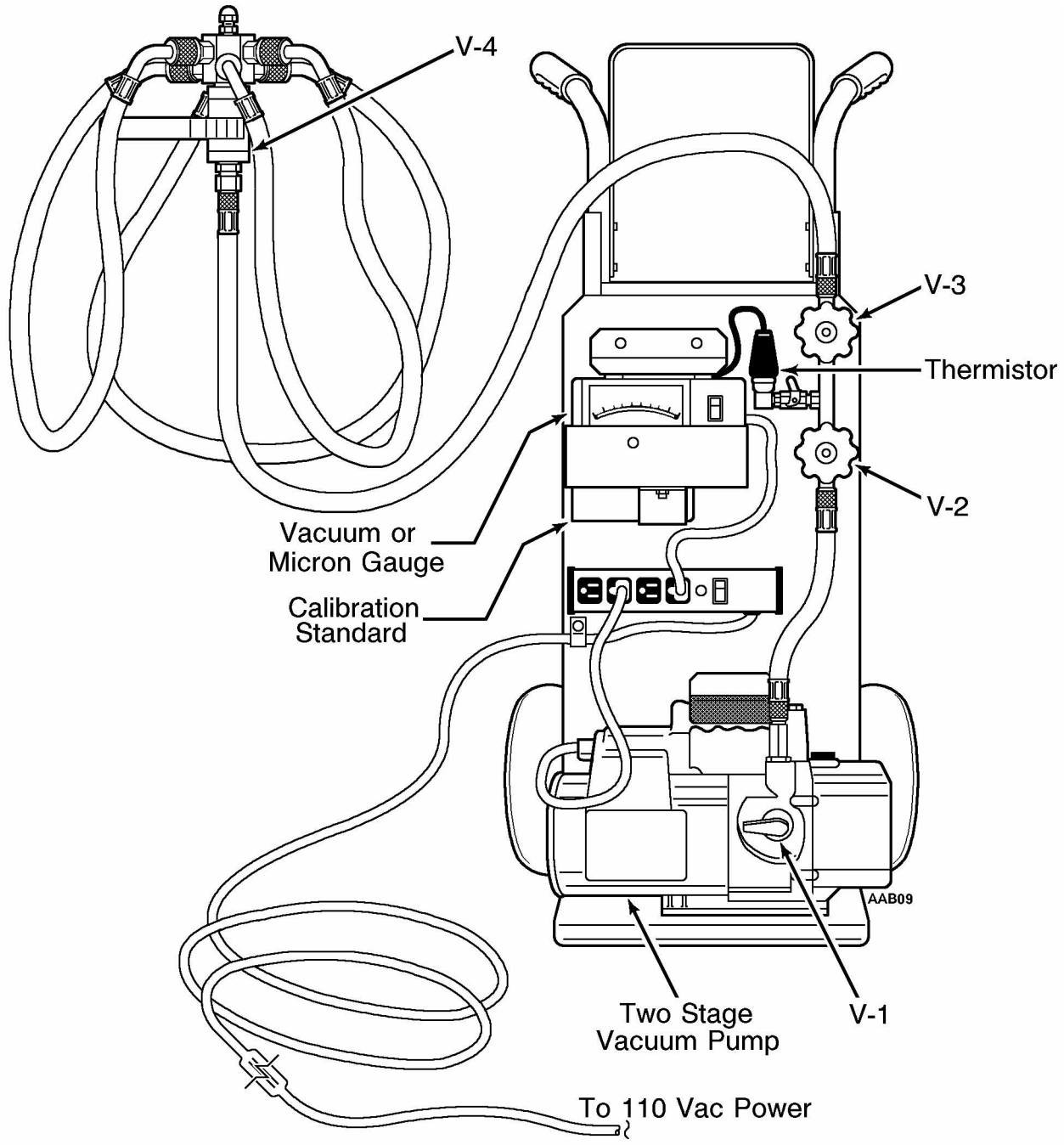
Refer to the diagram of the Thermo King evacuation station (Tool No. 204-725) and note the location of the valves.

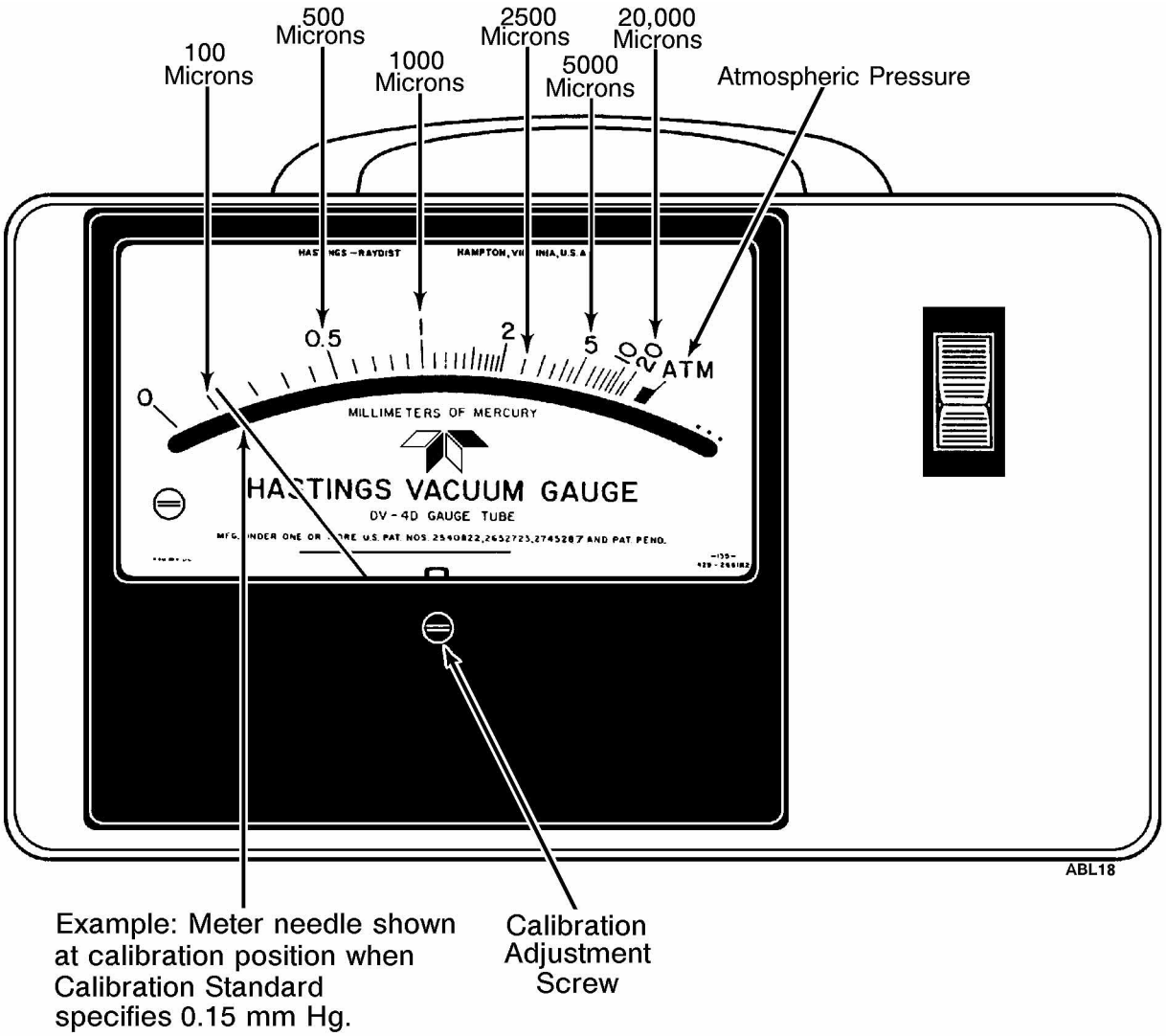
Valve #1 (V-1): Is in the open position when the pump is running to evacuate the hoses and/or the unit. When V-1 is closed, the pump has been isolated from the hoses and/or the unit.

Valve #2 (V-2): Is in the open position during unit evacuation. In the closed position, V-2 isolates the micron gauge and thermistor assembly from the hoses and/or the unit.

Valve #3 (V-3): Is in the open position during unit evacuation. When closed, V-3 isolates the micron gauge and the vacuum pump from the other evacuation hoses.

Valve #4 (V-4): Is in the open position during unit evacuation. When closed, V-4 isolates the evacuation hoses and the unit from the evacuation system.


V-4
V-3
Thermistor
V-2
Vacuum or
Micron Gauge
Calibration
Standard
AAB09
Two Stage
Vacuum Pump
V-1
To 110 Vac Power


100 Microns
500 Microns
1000 Microns
2500 Microns
5000 Microns
20,000 Microns
Atmospheric Pressure
0
0.5
1
2
5
ATM
MILLIMETERS OF MERCURY
HASTINGS VACUUM GAUGE
DV-4D GAUGE TUBE
ABL18
Example: Meter needle shown at calibration position when Calibration Standard specifies 0.15 mm Hg.
Calibration Adjustment Screw

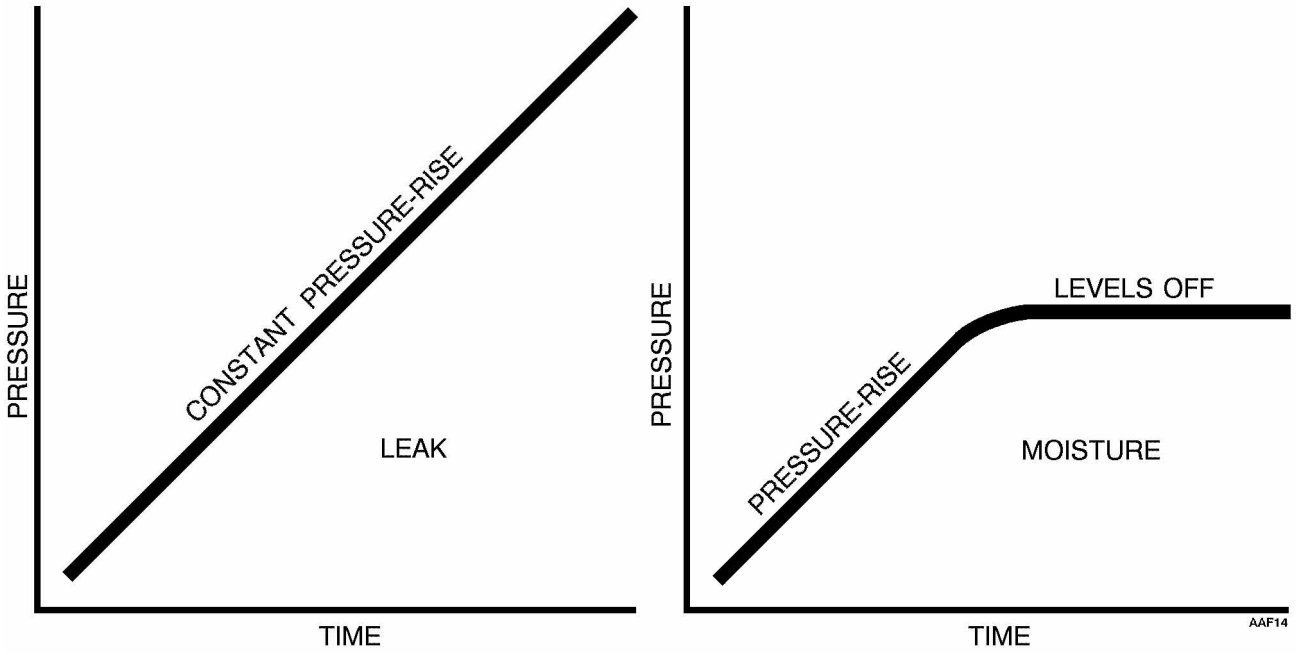
Set Up and Test of Evacuation Equipment

NOTE: Refer to the previous two pages for the following discussion.

1. Connect the evacuation system to a 110 V ac power supply. Connect a gauge manifold and refrigerant supply to the fitting above valve V-4. Turn the micron gauge ON.
2. Close valves V-1, V-3 and V-4. Valve V-2 is open.
3. Turn the vacuum pump ON.
4. Open valve V-1 at the pump. The micron gauge needle will move to the left. (Refer to micron gauge scale diagram—previous page.)

NOTE: If the vacuum pump is okay, and there are no leaks between V-1 and V-3, the micron gauge should show less than 500 microns. If not, locate and correct the problem.

5. With the pump still operating, open valve V-3. If the micron reading does not return to a level of less than 500 microns, locate and correct the problem before continuing.
6. With the vacuum pump still operating, open valve V-4. The micron level will rise momentarily. If the micron reading does not return to a level of less than 500 microns, locate and correct the problem before continuing.



LEAK

Isolate the pump from the system by closing the proper valve. Watch the movement of the vacuum gauge needle. If the needle continues to rise, this is an indication that a leak exists in the unit or the connecting line. The leak must then be located and eliminated.

MOISTURE

Should the needle show a pressure rise but finally level off to practically a constant mark, this is an indication that the system is vacuum tight but is still too wet, requiring additional dehydration and pumping time.

7. Evacuate hoses to 100 microns or lowest achievable level below 500 microns.

8. Once 100 microns is reached, close valve V-1 at the pump. Turn the vacuum pump OFF.

9. Observe the micron gauge reading. The vacuum rise should not exceed 1500 microns in 5 minutes.

10. If the rise is above 1500 microns in 5 minutes, check all hoses and connections for leaks. Hoses with moisture present will require additional evacuation time to achieve satisfactory results.

    NOTE: Dirty vacuum pump oil or a defective vacuum pump will prevent a low micron reading. Hoses and fittings can be isolated individually to identify leaks.

Unit Evacuation

NOTE: Refer to the diagram on the next page for the following discussion.

NOTE: Do not attempt to evacuate the unit until the evacuation equipment has been tested and its performance has been verified.

1. Prepare the unit for evacuation. Recover refrigerant to 0 psig (0 kPa). (New Federal Regulations may require your recovery machine to pull the system's pressures lower than 0 psig [0 kPa]).

   CAUTION: Do not attempt to evacuate a unit until you are certain that the unit is leak free. A unit with less than a full refrigerant charge should be thoroughly leak checked and all leaks must be repaired.

2. Before connecting the evacuation hoses to the unit, close valves V-1 and V-4 on the evacuation system. Turn the micron gauge ON.

3. Back seat the suction, discharge and recover tank service valves. Attach evacuation hoses to these three valves. (Check condition of the hose seals.)

4. With the service valves fully back seated, turn the evacuation pump ON. Open valve V-1 at the pump. The micron gauge should move to a deep vacuum.

5. Open valve V-4. The micron reading will rise. If the micron gauge returns to a reading of less than 500 microns, proceed to step 6. If the micron reading remains high, then a leak exists at the hose fittings or the packing glands. Locate and correct the problem before proceeding.

6. If step 5 was successful, close valve V-2 to isolate the thermistor. Open the suction, discharge and receiver service vales to port. Install brass and steel valve stem covers (with sealing washers) on the service valves and tighten. The vacuum pump continues to operate.

7. After 5 minutes of evacuation, open valve V-2 to access the thermistor and micron gauge. The micron reading now reflects the unit's pressure.

8. Evacuate the system to 500 microns or the lowest achievable level between 500 and 1000 microns.

   NOTE: The presence of refrigerant in the compressor oil may prevent a low micron reading from being achieved. The oil can continue to "outgas" for long periods of time. If the micron level appears to stall after 1/2 hour or 45 minutes between 1000 and 1500 microns, back seat the suction service valve and observe the micron gauge. A sharp drop in the micron reading (300 to 500 microns) would indicate that refrigerant is present in the oil or a leak exists in the compressor area.

9. When the desired micron level has been achieved (500 to 1000 microns), close valve V-1 at the pump. Turn the pump to OFF.

10. Observe the reading on the micron gauge after 5 minutes have elapsed. The vacuum rise should not exceed 2000 microns. If the vacuum level exceeds 2000 microns after 5 minutes, a leak is present or additional evacuation time is required.

11. If the vacuum level is acceptable, start the pump and open valve V-1 to evacuate the pressure rise (5 minutes).

12. Close valve V-1 and stop the pump. Observe the micron gauge to confirm that the system remains in a deep vacuum. Close valve V-4. The unit is ready to charge.

Unit Charging

NOTE: Refer to the diagram on the next page for the following discussion.

NOTE: Before charging, make sure that the refrigerant lines from the gauge manifold to the refrigerant supply bottle have been evacuated or purged.

1. Back seat the suction service valve. The discharge and receiver outlet valves remain open to port.

2. Set the refrigerant supply bottle for liquid. Open the gauge manifold hand valve, and charge liquid refrigerant until the system has the proper charge or until the system will take no more liquid. The remainder of the charge will be added as a vapor through the suction service valve if more refrigerant is required.

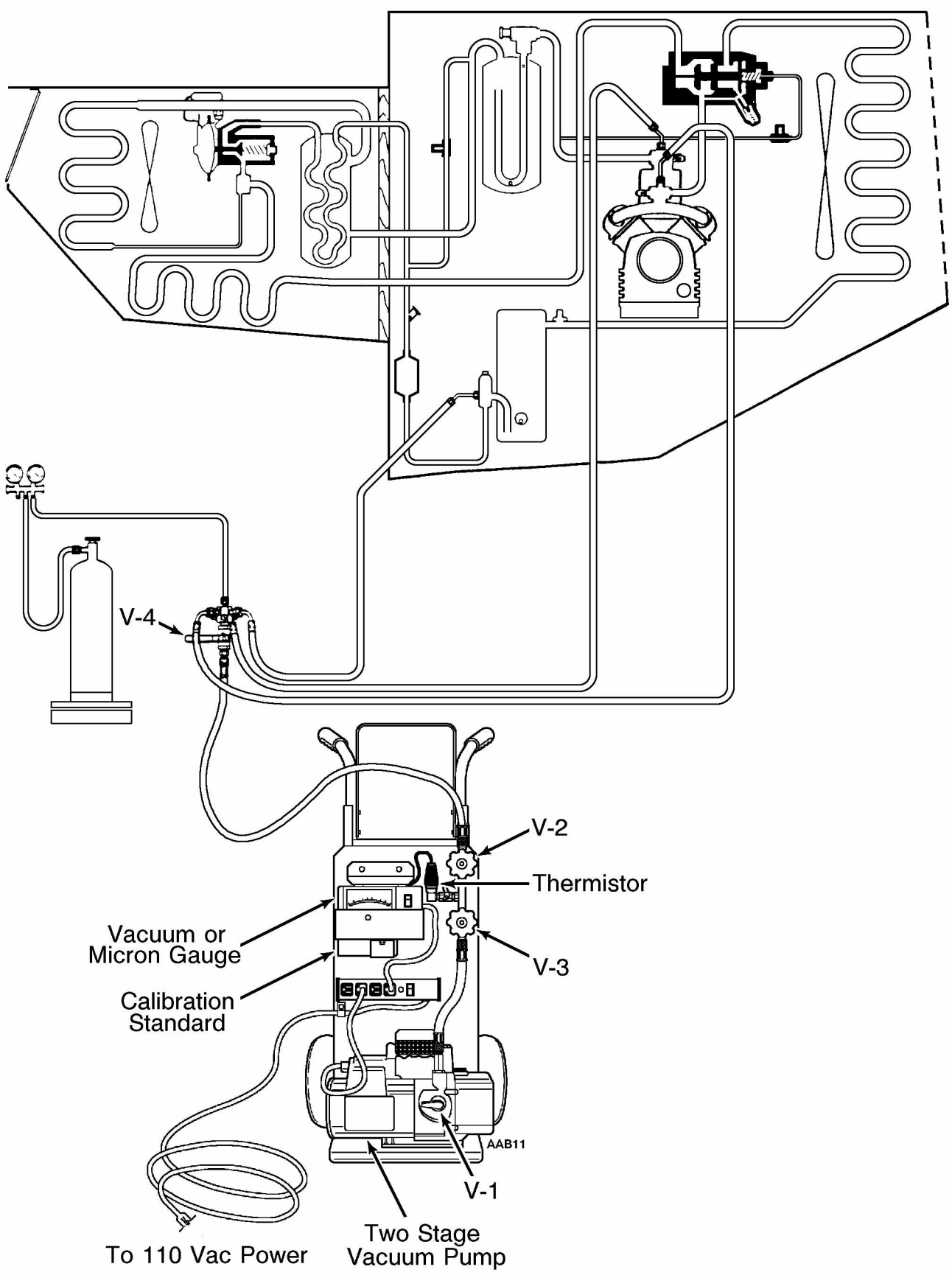
3. After the liquid refrigerant is added, close the gauge manifold hand valve. Close the valve on the refrigerant supply bottle and set for vapor.

4. Back seat (close) the receiver outlet valve. Back seat the discharge service valve. Open the suction service valve.

5. Open the refrigerant supply valve for vapor. Open the gauge manifold hand valve.

6. Start and operate the unit with the thermostat set for cool. Add vapor through the suction service valve until the correct charge is attained. Make sure that the liquid level does not rise above the sight glass. Refer to the unit serial plate for the correct amount of charge.

7. When the correct amount of charge has been added, close the gauge manifold hand valve.


V-4
V-2
Thermistor
Vacuum or
Micron Gauge
V-3
Calibration
Standard
AAB11
V-1
To 110 Vac Power
Two Stage
Vacuum Pump

Remove Evacuation Hoses

1. Run the unit in high speed cool with the receiver outlet and discharge valves back seated.
2. Front seat the suction service valve and allow the compressor to pump down to 3 to 5 psig (21 to 35 kPa). Stop the unit. Remove the hose from the suction service valve service port. Immediately install the cap on the service port and tighten.
3. Back seat the suction service valve.
4. Remove the hoses from the receiver outlet and discharge service valves.
5. Replace and tighten the service port and valve stem caps.
6. The unit is ready for a functional check out.

REFRIGERANT LEAKS

Use a reliable leak detector (e.g., electronic detector) to leak test the refrigeration system. Inspect for signs of oil leakage which is the first sign of a leak in the refrigeration system.

NOTE: It is normal for compressor shaft seals to have a slightly oily film.

REFRIGERANT CHARGE

Testing the Refrigerant Charge with an Empty Box

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. The suction pressure will drop as the refrigerant charge decreases. The charge may be determined by inspection of the refrigeration through the receiver tank sight glass with the following conditions established:

1. Place a test box over the evaporator.
2. Place a thermometer (TK No. 204-135) test lead in the box near the evaporator return air opening.
3. Install the gauge manifold.
4. Run the unit on Cool until the air in the box indicates 0 F (-18 C). By allowing the box to leak a small amount, you will be able to maintain 0 F (-18 C).
5. **R-134a Systems**—The discharge or head pressure gauge should read 150 psig (1034 kPa).

   R-404A Systems—The discharge or head pressure gauge should read 275 psig (1896 kPa).

   If the pressure is below this, it can be raised by covering a portion of the condenser coil with a piece of cardboard.
6. **R-134a Systems**—The compound gauge should be indicating 0 to 2-1/2 psig (0 to 17 kPa) gauge pressure.

   R-404A Systems—The compound gauge should be indicating 13 to 18 psig (90 to 124 kPa) gauge pressure.

   If there is any doubt about the unit gauge, check the calibration.
7. Under these conditions, the ball in the receiver tank sight glass should be floating.

Testing the Refrigerant Charge with a Loaded Box

1. Install a gauge manifold (optional).
2. Run the unit on the Cool cycle.
3. Cover at least three quarters of the condenser to drive any excess refrigerant from the condenser into the receiver tank.
4. As the head pressure is rising, check the receiver tank sight glass. The ball should be floating. If there is no indication of refrigerant in the receiver tank sight glass, the unit is low on refrigerant.

NOTE: If the ball floats, there is sufficient refrigerant in the unit for that load at that particular box temperature. This test does not determine if the unit contains a full charge of refrigerant.

CHECKING COMPRESSOR OIL

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

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

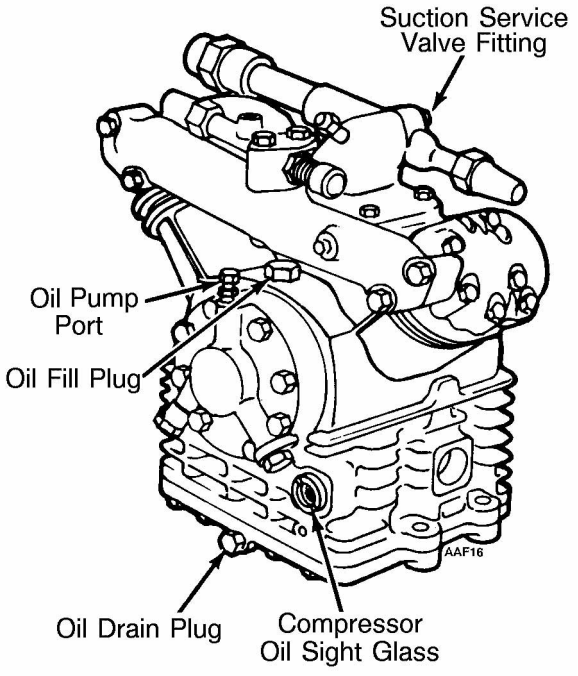
Install a gauge manifold on the compressor.

R-134a Systems—Operate the unit on Cool with a 10 psig (69 kPa) minimum suction pressure and a 100 psig (689 kPa) minimum discharge pressure for 15 minutes or more.

R-404A Systems—Operate the unit on Cool with a 10 psig (69 kPa) minimum suction pressure and 185 psig (1275 kPa) minimum discharge pressure for 15 minutes or more.

After the unit has maintained the above conditions for 15 minutes, observe the oil level. The oil should be 1/4 to 1/2 up in the sight glass.

CAUTION: Oil is under pressure. See instructions for adding oil.



X426 Compressor

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

Run the unit through a complete DEFROST CYCLE. After completing the defrost cycle, run the unit on COOLING for ten minutes. Observe the oil level. The oil should be 1/4 to 1/2 up in the sight glass.

If the evaporator temperature is above 32 F(0 C), it will be necessary to force defrost. To force defrost, use a jumper wire and jump the number 12 wire at the defrost relay to ground. Then push the manual defrost switch. Allow evaporator temperature to rise to approximately 45 F (7.2 C). Remove the jumper wire from the defrost relay.

If the box is empty, you can run the unit on the heat cycle instead of the defrost cycle.

NOTE: Use refrigeration compressor oil ONLY. R-134a and R-404A systems use a special Ester oil TK No. 203-413.

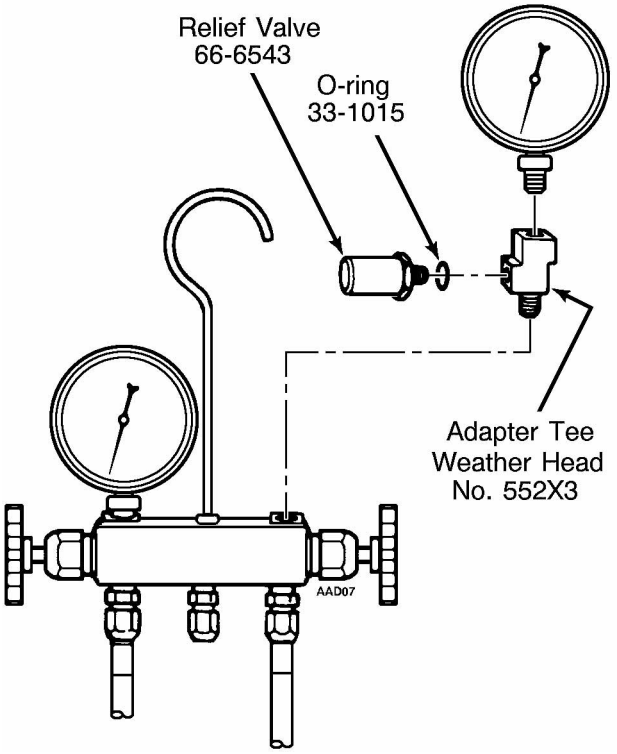
To add oil to the compressor, pump down compressor, see "Compressor Pump Down and Checkout."

HIGH PRESSURE CUTOUT

The high pressure cutout is located on the compressor cylinder head. If the discharge pressure rises above 325 psig (2240 kPa) on R-134a units or 450 psig (3103 kPa) on R-404A units, the switch opens the 8 circuit, de-energizing the fuel solenoid. To test the switch, rework a gauge manifold per illustration.

1. Connect the gauge manifold to the compressor discharge service valve with a heavy duty, black jacketed thick wall #HCA 144 hose with a 900 psig (6204 kPa) working pressure rating.
2. Set the thermostat well below the box temperature so that the unit will be in High Speed Cool.
3. Raise the discharge pressure of the compressor by blocking the condenser coil air flow by covering the roadside condenser grille with a piece of cardboard.

   NOTE: The discharge pressure should never be allowed to exceed a pressure of 400 psig (2758 kPa) on R-134a systems and 450 psig (3103 kPa) on R-404A systems.
4. Failure of the HPCO system to stop compressor operation should be investigated first by checking the control circuit operation and secondly by HPCO switch replacement.



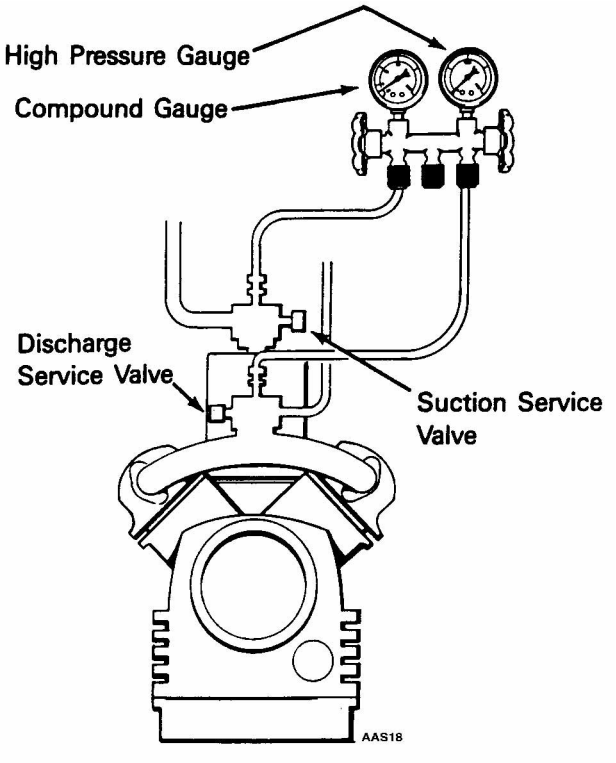
High Pressure Cutout Manifold

COMPRESSOR PUMP DOWN AND CHECKOUT

1. Install a gauge manifold set on the compressor. Open the service valves (crack the valves off of the back seated position) to access system pressure.

   NOTE: Purge air from the gauge set.

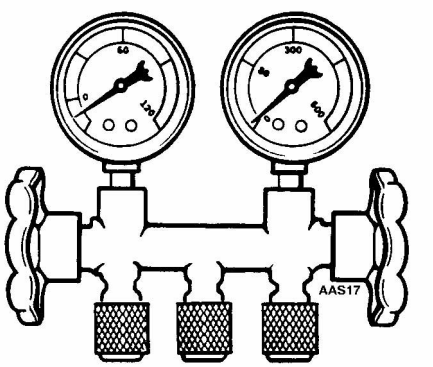
2. Set the thermostat well below box temperature, and run the unit in cooling mode until temperature is stabilized (at least 5 minutes).



Install Gauge Manifold

3. Close (front seat) the suction service valve. Pump the compressor down into a deep vacuum (25 in.). Stop the unit. If the suction pressure does not rise above 10 psig (69 kPa) in 2 minutes, perform check procedures on the three-way valve and the bypass check valve. If the pressure does not rise, go to step 4.

4. Front seat discharge service valve, and equalize the compressor to slightly positive. Disassemble and inspect the discharge valve plates.



Compound Gauge Indicating 20 in. Vacuum

THREE-WAY VALVE CONDENSER PRESSURE BYPASS CHECK VALVE

The condenser pressure bypass check valve is built into the three-way valve. This check valve controls the bypass flow of refrigerant gas between the condenser inlet line and 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 on defrost or heat, 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 valve is to improve heating/defrosting ability and thee-way valve response.

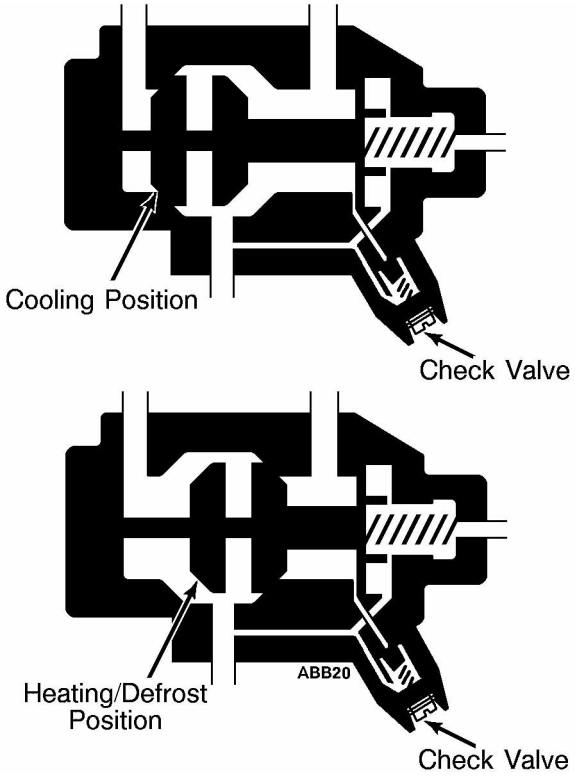
To check the operation of the valve:

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 service gauge manifold set on compressor.
4. Close (front seat) the receiver tank outlet valve.
5. Operate the unit on cooling, and pump down the low side to 20 in. (-68 kPa) of vacuum.
6. Stop the unit. the condenser and suction pressures should remain stable, indicating no leaks.
7. Shift the three-way valve to heat position. low side gauge will raise slightly. High side gauge will drop to approximately zero. Gauges will equalize.
8. Gauges will remain in this position (approximately zero) if the three-way valve seals properly toward the condenser and the condenser pressure bypass check valve seals properly.
9. Back seat condenser pressure bypass check valve stem against snap ring. Both gauges should rise indicating 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: 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 normal operation.



Three-way Valve Condenser Pressure Bypass Check Valve

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. Refer to the Refrigeration Manual (TK 5715) for system cleanup after a compressor failure or repair or replacement of basic components.

ACCUMULATOR

Removal

1. Pump down the low side and equalize the pressure to slightly positive.
2. Drain the engine cooling system. Disconnect the coolant lines from the accumulator tank.
3. Unsolder the inlet and outlet refrigerant suction lines from the accumulator tank.
4. 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 tank.
3. Pressurize the low side and test for refrigerant leaks. If no leaks are found, **evacuate the low side**.
4. Connect the coolant hoses to the accumulator tank and refill the cooling system with 50/50 ethylene glycol/ water solution.
5. Open the refrigeration valves and place the unit in operation. Check refrigerant charge and compressor oil and add as required.

COMPRESSOR

Removal

1. Pump down the compressor and equalize the pressure to slightly positive.
2. Loosen and remove the compressor/electric motor belt from the compressor pulley.
3. Front seat the discharge and suction service valves. Release remaining refrigerant pressure from the compressor.
4. Unbolt the discharge valve and the suction valves from the compressor.
5. Remove the high pressure cutout switch and disconnect the pilot valve and compound pressure gauge (optional) hoses.
6. Remove the compressor mounting bolts.
7. Lift the compressor out of the unit. Keep the compressor ports covered to prevent dust, dirt, etc., from falling into the compressor.

   NOTE: When the compressor is removed from the unit, the oil level should be noted, or the oil removed from the compressor should be measured so that the same amount of oil can be added before placing the replacement compressor in the unit.

Installation

1. Lift the compressor into the unit and install the mounting bolts.
2. Install the service valves using new gaskets soaked in refrigeration oil. Install the high pressure cutout switch.
3. Reconnect the pilot valve and compound pressure gauge hoses.
4. Pressurize the compressor and test for refrigerant leaks.

5. If no leaks are found, **evacuate the compressor**. Replace the compressor/electric motor belt and adjust the tension.
6. Back seat the suction and discharge service valves.
7. Operate the unit at least 30 minutes and then inspect the oil level in the compressor. Add or remove oil if necessary.
8. Check the refrigerant charge and add refrigerant if needed.

CONDENSER/RADIATOR COIL

Removal

1. Remove the refrigerant charge.
2. Remove the grille assembly.
3. Drain engine coolant from the expansion tank and disconnect the coolant hoses from the condenser/radiator coil.
4. Unsolder the hot gas inlet tube and liquid refrigerant line connections.
5. Unbolt and remove the condenser/radiator coil.

Installation

1. Clean the tubes for soldering.
2. Place the coil in the unit and install the mounting hardware.
3. Solder the inlet line and liquid line refrigerant connections.
4. Pressurize the refrigeration system and test for leaks. If no leaks are found, **evacuate the system**.
5. Connect the coolant hoses to the radiator and refill the expansion tank with 50/50 ethylene glycol/water solution.
6. Recharge the unit with refrigerant and check the compressor oil.
7. Reinstall the front grille.

LIQUID LINE CHECK VALVE REPLACEMENT

Removal

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

   NOTE: Disassemble valve before unsoldering.

Installation

1. Clean the tubes for soldering.
2. Place the disassembled check valve in position. Arrow on the valve body indicates the direction of refrigerant flow through the valve.
3. Solder the inlet and outlet 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 the compressor oil.

DEHYDRATOR (FILTER-DRIER)

Removal

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

Installation

1. Install the new drier and tighten the mounting screws and nuts. Install new O-rings.
2. Install and tighten the inlet nut to the receiver tank outlet valve line (inlet end of drier is labeled “IN”). Hold the drier with a back-up wrench on the hex behind the flare fitting.
3. Release a small amount of refrigerant to purge the air through the drier. Then tighten outlet nut on the dehydrator to the evaporator line.
4. 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. Remove the refrigerant charge.
2. Remove the evaporator top panel.
3. Disconnect the expansion valve from the distributor. Disconnect the air switch hoses.
4. Unsolder the suction line and drain pan hot gas line from the evaporator coil.
5. Disconnect the electric heaters and high temperature cutout switch on Model 50 units.
6. Remove the mounting bolts and slide the coil from the evaporator housing.

Installation

1. Place the evaporator coil in the housing.
2. Install the mounting bolts and tighten.
3. Clean the tubes for soldering.
4. Solder the suction line and drain pan hot gas line connections to the evaporator coil.
5. Connect the distributor to the expansion valve assembly.
6. Connect the air switch hoses and install the high temperature cutout switch and electric heaters (Model 50).
7. Pressurize the low side and test for leaks. If no leaks are found, **evacuate the unit**.
8. Open the refrigeration valves and place the unit in operation. Install the refrigerant charge and compressor oil and add as required.

EXPANSION VALVE ASSEMBLY

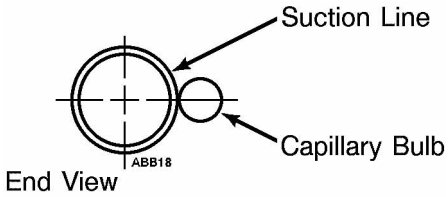
Removal

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

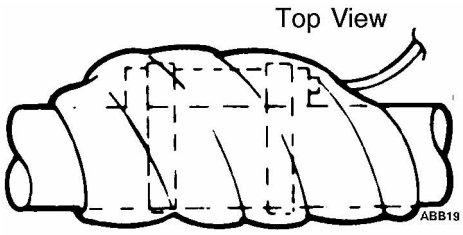
Installation

1. Install and bolt the expansion valve assembly in the unit.
2. Solder (95-5 Solder) the inlet liquid line and the distributor to the expansion valve.
3. Solder (95-5 Solder) 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 the operation will be faulty. Wrap with insulating tape.
5. Pressurize the low side and test for leaks. If no leaks are found, **evacuate the low side.**



Location of Expansion Valve Bulb



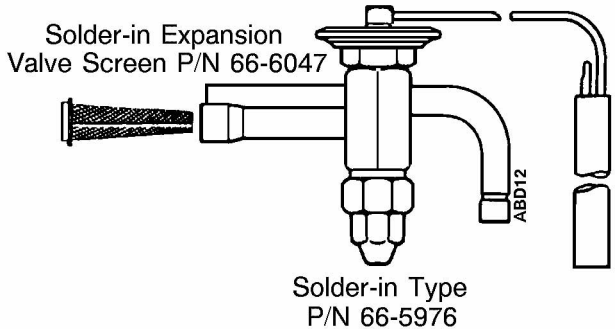
Completely Wrap Bulb with Tape

6. Open the refrigeration valves and place the unit in operation.
7. Test the unit to see that the expansion valve is properly installed.

Cleaning In-line Screen

1. Perform a low side pump down; bleed pressure back to 1 psig (7 kPa).
2. Remove the liquid line fitting.
3. A small tool with a slight hook may be needed to pull screen from the expansion valve.
4. Clean the screen and reinstall.

NOTE: Outlet screen points toward the distributor.



RD-II SR Expansion Valve

HEAT EXCHANGER

Removal

1. Remove the refrigerant charge.
2. Remove the evaporator top cover.
3. Remove the mounting bolts that hold the heat exchanger on the bulkhead.
4. Disconnect the equalizer line from the suction line.
5. Disconnect liquid outlet line flare nut from the expansion valve.
6. Note the position of the feeler bulb on the side of the suction line. Remove the expansion valve feeler bulb from the suction tube.
7. Unsolder the suction line at the evaporator coil end.
8. Unsolder the remaining outlet suction line and inlet liquid line connections from the condenser side of the bulkhead. Remove putty from around the lines before unsoldering the connections.
9. Lift the heat exchanger assembly out of the evaporator housing.

Installation

1. Clean the tubes for soldering.
2. Place the heat exchanger assembly in the evaporator housing and install the mounting hardware loosely.
3. Solder liquid inlet and suction outlet line connections on the condenser side of the bulkhead. Seal openings through bulkhead with putty when refrigerant lines have cooled off.
4. Tighten the heat exchanger mounting hardware securely.
5. Solder suction line connection to the evaporator coil.
6. Connect the equalizer line flare fitting to the suction line and liquid outlet line flare fitting to the expansion valve.
7. Pressurize the low side and test for leaks. If no leaks are found, evacuate the unit.
8. Clean the suction tube to a bright polished condition. Install the feeler bulb clamps and 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 with insulating tape.
9. Open the refrigeration valves and place the unit in operation. Install refrigerant charge.
10. Test the unit to see that the expansion valve is properly installed.

HIGH PRESSURE CUTOUT SWITCH

Removal

1. Pump down the compressor and equalize pressure to slightly positive.
2. Front seat the discharge and suction service valves. Release remaining pressure from the discharge service valve.
3. Disconnect the wires and remove the high pressure cut-out switch from the compressor cylinder head.

Installation

1. Apply a refrigerant locktite to the threads of the high pressure cutout switch.
2. Install and tighten high pressure cutout switch and reconnect the wires.
3. Pressurize the refrigeration system and test for leaks.
4. If no leaks are found, open the refrigeration valve and place the unit in operation.

HIGH PRESSURE RELIEF VALVE

Removal

1. Remove the refrigerant charge.
2. Unscrew and remove the high pressure relief valve.

Installation

1. Apply a refrigerant locktite to the threads of the high pressure relief valve.
2. Install and tighten the high pressure relief valve.
3. Pressurize the refrigeration system and test for leaks. If no leaks are found, evacuate the system.
4. Recharge the unit with refrigerant and check the compressor oil.

PILOT SOLENOID

Removal

1. Pump down the low side and equalize pressure to slightly positive.

2. Disconnect the lines to the solenoid and immediately cap to prevent moisture and air from entering the system.

   NOTE: The lines from the three-way valve to the pilot solenoid will leak refrigerant at a high velocity and should be capped.

3. Disconnect the electrical wires and remove the pilot solenoid.

Installation

1. Replace the pilot solenoid in the unit.
2. Remove the caps from the lines and connect lines to the pilot solenoid. Connect line from the three-way valve first. Connect wires to the valve.
3. Open the refrigeration valves and place the unit in operation.
4. Check for leaks.

PRESSURE REGULATOR VALVE

Removal

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

Installation

1. Clean the tubes for soldering.
2. Place the valve in position and solder 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 the refrigerant charge and add refrigerant as required.

RECEIVER TANK

Removal

1. Remove the refrigerant charge.
2. Unsolder the condenser check valve tube and bypass check valve tube from the receiver tank.
3. Unsolder the filter drier line from the receiver tank outlet tube.
4. Unbolt the mounting brackets and remove the receiver tank from the unit.

Installation

1. Place the receiver tank in the unit and install the mounting bolts and nuts loosely. Position the receiver tank so the sight glass is clearly visible and the outlet tube lines up.
2. Solder the condenser check valve tube and bypass check valve tube to the receiver tank.
3. Solder the filter drier line to the receiver tank outlet valve.
4. Tighten the receiver tank mounting hardware securely.
5. Pressurize the refrigeration system and check for leaks. If no leaks are found, evacuate the system.
6. Recharge the unit with refrigerant.

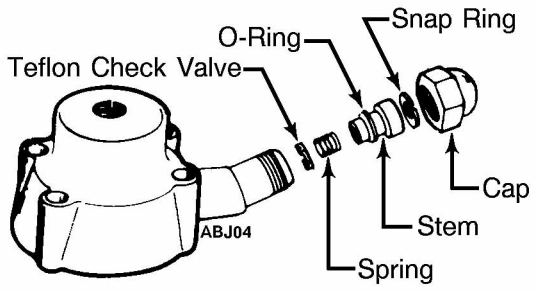
THREE-WAY VALVE CONDENSER PRESSURE BYPASS CHECK VALVE REPAIR

Removal

1. Remove the refrigerant charge.
2. Unscrew the condenser pressure bypass check valve cap from the check valve.

3. Remove the snap ring.
4. Unscrew the check valve stem by using a screwdriver in the slot provided.

   NOTE: Spring and valve are held in by the stem. While removing the stem, use care so the spring and valve are not lost.



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

Installation

1. Coat the O-ring with compressor oil (use same type of oil that is used in the system) and install it on the check valve stem.
2. Insert the spring into the hole in the check valve stem and then install the Teflon 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 install the assembly into the check valve seat in the three-way valve.

   CAUTION: The Teflon valve must be inserted with the flat side against the valve seat to ensure proper sealing.

4. Screw the check valve stem into the three-way valve until the snap ring can be installed.
5. Install the snap ring.
6. Unscrew (back seat) the check valve stem against the snap ring.

   NOTE: Valve stem must be back seated during normal unit operation.

7. Coat sealing area in cap with compressor oil (use same type of oil that is used in the system), 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.

THREE-WAY VALVE REPAIR

NOTE: The three-way valve can be repaired in the unit if leakage or damage to the Teflon seals should occur.

Removal

1. Remove the refrigerant charge.
2. Clean the exterior surface of the valve.
3. Remove the 1/4 in. copper line from the three-way valve to the pilot solenoid.
4. Loosen the four 1/4 in. Allen head screws (**DO NOT REMOVE**); use tool # 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. Unsolder the condenser line from the condenser.
6. Remove the 4 bolts from the valve.
7. Remove the top cap and spring.

8. Remove the spring clip. Observe the slot in the spool shaft and slide piston away from this slot.
9. Remove the piston.
10. Remove the center section and stem assembly.
11. Inspect the following parts for wear and damage:
    a. Bottom cap sealing and support areas.
    b. Center section, sealing surface.
    c. Top cap, sealing and support surface.

    The following parts will be discarded:

    d. Stem assembly.
    e. All gaskets.
    f. Teflon seal and O-ring.
12. Remove the screen.

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

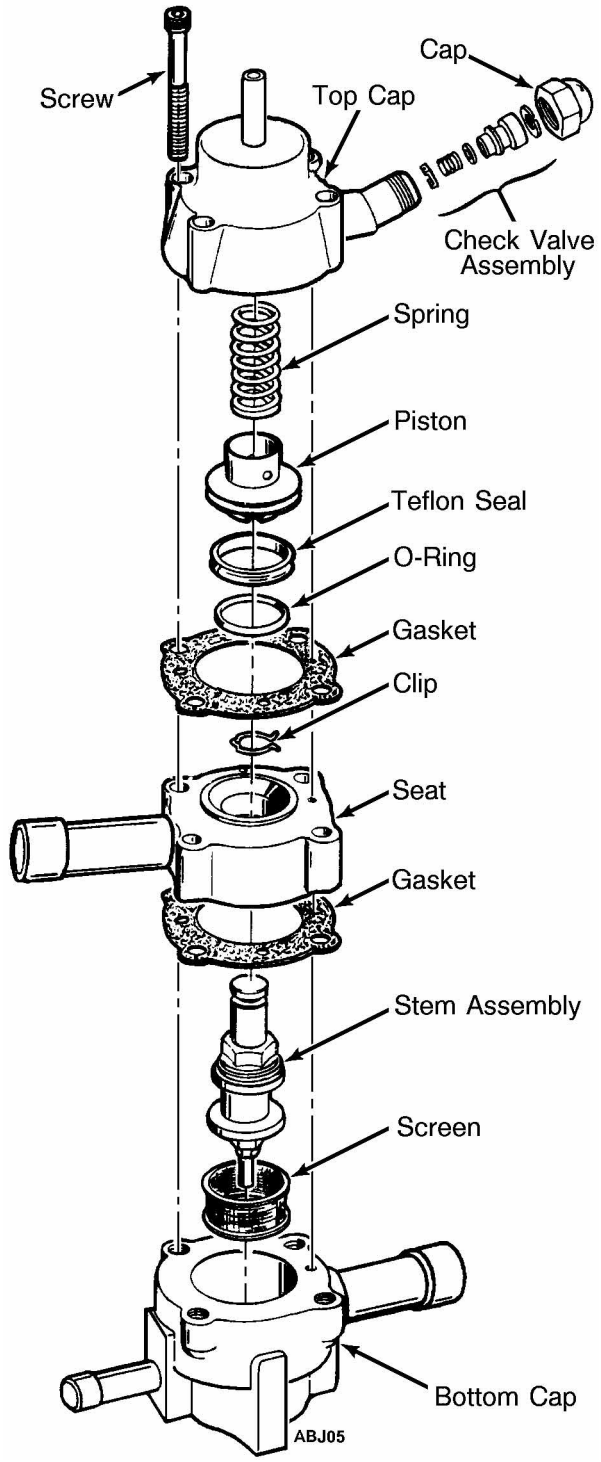
Installation

NOTE: Three-way valve kit No. 156 is used to repair three-way valves.

After cleaning and inspecting all parts, reassemble the valve. Clean solder off the condenser line and condenser head with sandpaper and tubing brush.

1. Install the screen into the bottom cap.
2. Install new stem into the center section.
3. Install new gaskets on both sides of the valve body. Dip gaskets in compressor oil (use same type of oil that is used in the system) before installing.
4. Install a new O-ring on the piston, then place the Teflon seal over the O-ring.
5. Install the piston on the stem and attach with spring clip.

   NOTE: The Teflon seal will stretch when it is installed. To prevent this from becoming permanent (and possibly malfunction), the top cap must be installed immediately.
6. Install the spring and top cap.
7. Line up the passageways in the cap and body. Failure to line up the holes will result in improper operation of the valve.
8. Install bolts and tighten in rotating sequence.
9. Solder condenser line to the condenser inlet.
10. Install pilot solenoid line and pressurize system with refrigerant to check for leaks.
11. If there are no leaks, evacuate the system and recharge with refrigerant.
12. Run the unit to check for proper three-way valve operation.



Three-way Valve Assembly

R-134a and R-404A

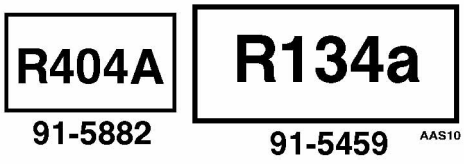
The refrigeration industry has introduced two new refrigerants called R-134a and R-404A. Both refrigerations are classified as a Hydrofluorocarbon (H.F.C.) because they contain hydrogen fluorine and carbon. They do not contain chlorine. R-134a was developed as a replacement for R-12 and R-404A was developed as a replacement for R-502. Both R-12 and R-502 contain chlorine that presents a hazard to the environment.

The pressure temperature relationship of R-134a is similar to that of R-12 and the pressure temperature relationship of R-404A is similar to that of R-502. The capacities of these new refrigerants are similar for box temperatures above 0 F (-18 C). At temperatures below 0 F (-18 C), H.F.C. refrigerant capacities are slightly less than CFC refrigerants.

Unit Identification

Units charged with R-134a and R-404A are identified by the following methods:

1. HFC-134a or HFC-404A will be stamped on the unit's serial plate.
2. "HFC" may be incorporated in the model designation on the sides of the unit such as "RD-II HFC".
3. Decals will be applied to unit as shown below:



Availability

Refrigerants 134a and 404A are available from wholesalers. The price will depend upon the quantity purchased. Thirty (30), 50 and 125 containers are available. When purchasing R-134a in 30 pound or 50 pound containers, specify industrial containers with 1/4 inch flare fittings to receiver containers with 1/4 inch flare fittings for use with Thermo King truck unit applications.

NOTE: R-134a in disposable containers for automotive applications is supplied in 30 pound and 50 pound containers with Acme threads. See Warranty Bulletin 124 for specifics.

Leak Detection

Leaks can be detected by a Halogen leak detector such as the G.E. H10G (TK No. 204-712) or portable leak detector (TK No. 204-854). See Truck and Trailer Service Bulletin T&T 048 for additional details.

Compressor Oil

As of January 1, 1993, Thermo King Corporation has chosen to use a compressor oil called Polyol Ester (POE)—also called ester based oil. POE oil is compatible with R-134a and R-404A and can be used in low temperature applications. This oil is available from service parts TK No. 203-413.

Compressors Shipped with R-134a

The RD-II SR compressors are Thermo King compressors and are charged with Polyol Ester oil (POE) (TK No. 203-413). All gauge fittings are 1/4 inch fittings.

CAUTION: POLYOL ESTER (POE) IS THE ONLY OIL FOR USE WITH THERMO KING UNITS USING R-134a AND R-404A. IT SHOULD NOT BE ADDED TO STANDARD THERMO KING UNITS, NOR SHOULD THE STANDARD OR SYNTHETIC OIL BE ADDED TO SYSTEMS CONTAINING R-134a AND R-404A. COMBINING THE TWO OILS COULD RESULT IN DAMAGE TO THE SYSTEM.

Because Polyol Ester has an affinity for moisture, it must be kept in capped containers. In addition, it should be added as the last step in system repair. Rubber gloves are recommended when handling Polyol Ester because it may cause skin irritation.

EQUIPMENT RECOMMENDATIONS FOR USE WITH R-134a AND R-404A

Dedicated Equipment

CAUTION: Equipment that has been used with other refrigerants MUST NOT be used with R-134a and R-404A refrigerants. Mixing R-134a and R-404A with other refrigerants will cause contamination of the refrigerant. Using contaminated refrigerant will cause system failure.

Vacuum Pumps

When evacuating, a two stage three or five CFM pump is recommended. It is also recommended that dry nitrogen be used first. Ideally, a new vacuum pump should be used and dedicated for use with R-134a or R-404A systems because residual refrigerants may remain in used vacuum pumps.

Pumps used with other Thermo King refrigerants may be used but extreme care should be taken to prevent contamination of R-134a or R-404A systems with other refrigerants.

The Thermo King Evacuation Station is recommended. This station is available from service parts under part number 204-725. See Truck and Trailer Service Bulletin T&T 061 for additional details.

Use only recommended vacuum pump oils and change oil after every major evacuation. Vacuum pump oils are highly refined and the use of contaminated oils will prevent the desired vacuum from being obtained. Failure to follow these recommendations may result in conditions that will destroy the vacuum pump.

Gauge Manifold Sets

Gauge manifold sets that show the correct pressure-temperature relationship should be used. Gauge manifolds and manifold hoses used with other Thermo King refrigerants maybe used but extreme care should be taken to prevent contamination of the R-134a and R-404A systems with other refrigerants. Purge manifold and hoses with dry nitro-

gen before using. NEVER USE EQUIPMENT THAT MAY BE CONTAMINATED WITH AUTOMOTIVE TYPE POLYALKYLENE GLYCOL (PAG) OILS.

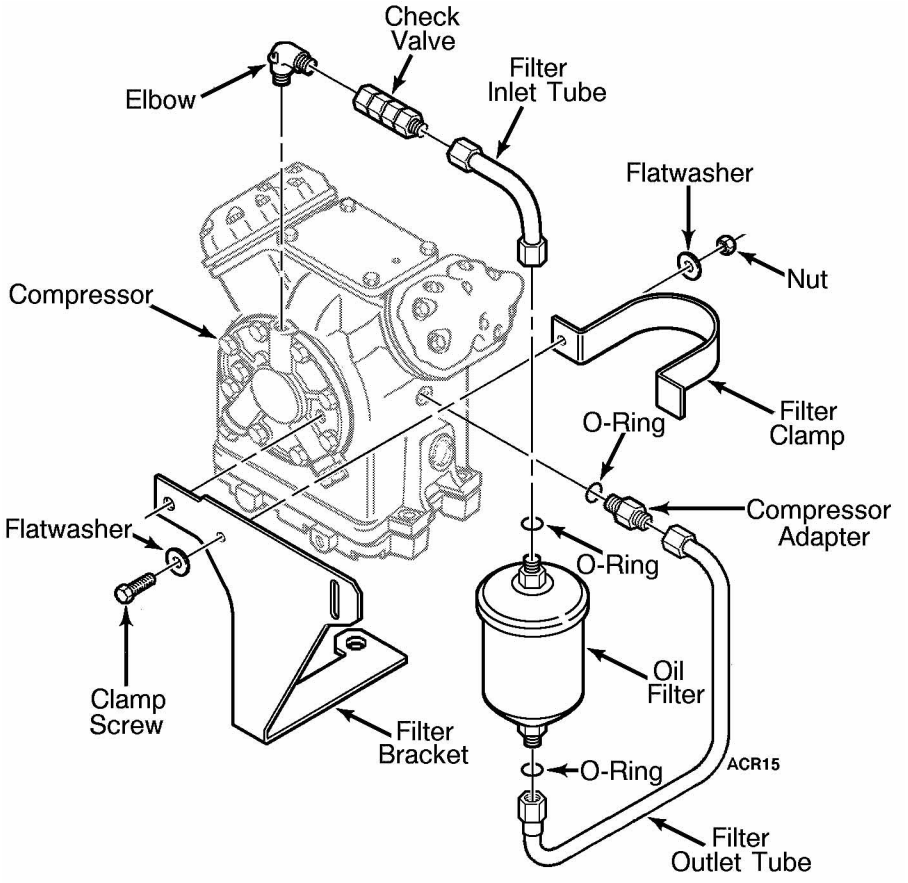
System Clean-up

Existing clean up devices such as suction line filters and compressor oil filters may be used if they are thoroughly cleaned and new filter elements are installed. All standard compressor oils must be removed from clean-up devices to prevent contamination of R-134a and R-404A systems. Dangerous contamination will result if other refrigerants or standard oils are introduced to R-134a or R-404A systems.

NOTE: For additional information on parts and supplies, consult your local Thermo King dealer and Thermo King Tool Catalog TK No. 5955.

Refrigerant Recovery

Present systems can be adapted to the recovery of R-134a and R-404A but should be dedicated to the recovery of these refrigerants. Consult the manufacturer of your recovery equipment for details.



Compressor Oil Filter

Oil Filter Maintenance

X426 compressors using R-134a and R-404A are equipped with a bypass oil filter. To ensure the system stays clean, the oil filter and filter-drier MUST be changed every two (2) years or whenever a major service procedure has been performed.

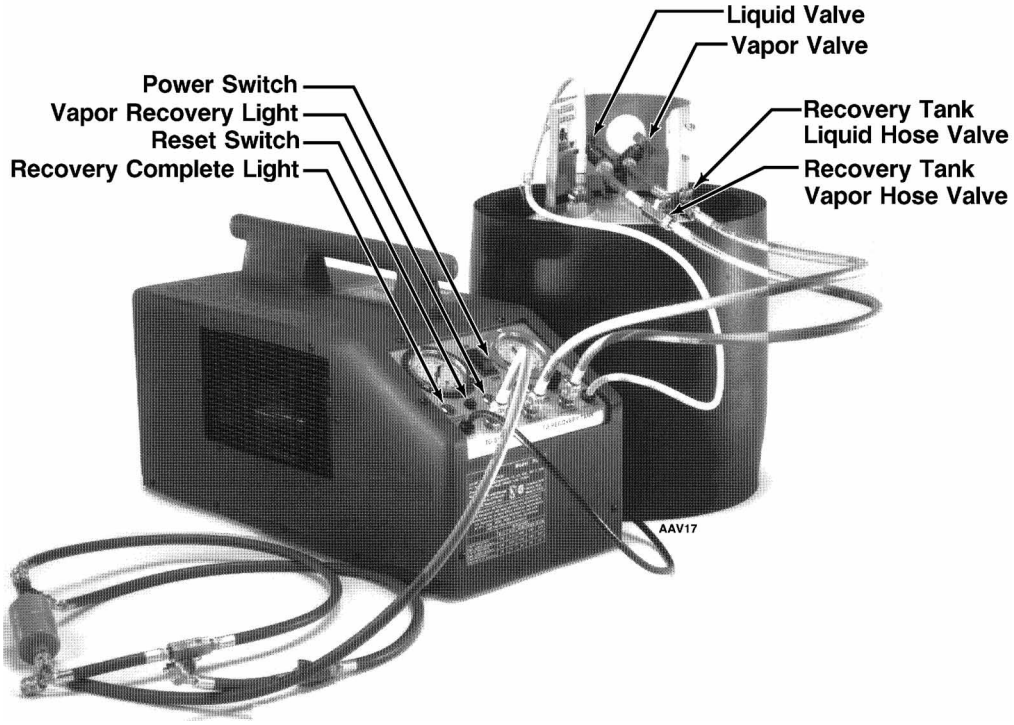
Refrigerant Recovery System—THE COLLECTOR

Thermo King now has available a refrigerant recovery system known as The Collector (TK No. 204-884). This new unit quickly and easily recovers a variety of refrigerants from refrigeration and air conditioning systems containing up to 200 lbs. of refrigerant. Not only is the Collector easy to use and reliable, it meets and exceeds government regulations, and the Collector is automatic.

- It automatically switches from liquid recovery to vapor recovery.
- Recovers both liquid and vapor refrigerant from the system through the same hose connections.
- Is equipped with a low pressure shutoff switch which automatically stops the recovery process once the system exceeds a 10 in. Hg. vacuum.
- Uses an automatic precooling technology to keep the recovery tank temperatures and pressures low, allowing for rapid recovery rates.

The Collector can recover R-12, R-22, R-500, R-502, R-507, R-134a, R-404A and R-401B refrigerants. It is not necessary to dedicate one unit to each separate class of refrigerant. Using a simple purging system allows the Collector to be switched from one unit to the next in just minutes.

Contact Thermo King Corporation at 612-887-2288 to determine compatibility of other or new refrigerants not listed above.



The COLLECTOR

THROTTLING VALVE

Removal

1. Pump down the low side and equalize pressure to slightly positive.
2. Front seat the discharge and suction service valves. Release remaining pressure.
3. Remove the suction valve and line from compound gauge.
4. Unbolt and remove the throttling valve from the unit.

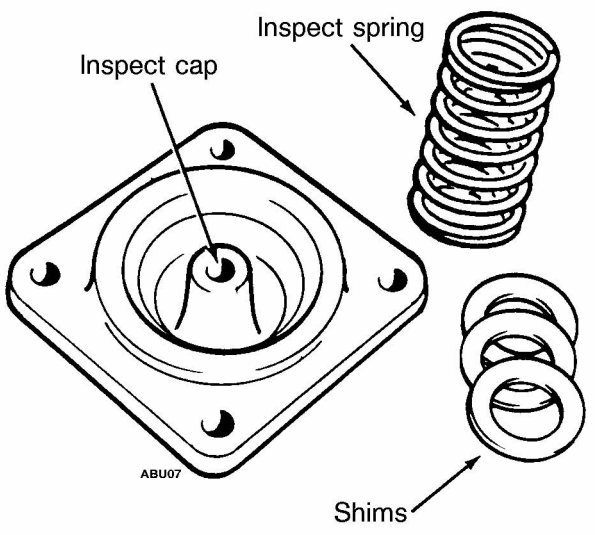
Repair

DISASSEMBLY

1. Remove the piston end cap (round end).
2. Remove the cotter pin from the castle nut and remove the nut.
3. Remove the spring and piston.
4. Loosen all the bolts on bellows end cap.

   CAUTION: This end cap is under slight spring pressure.

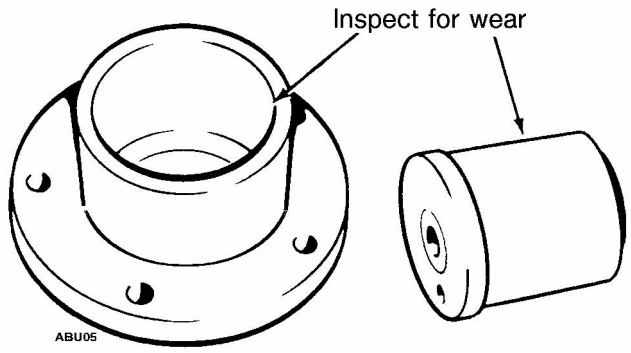
5. Break the gasket free and remove the end cap.
6. Note the number of shims next to the cap. These can be reused.

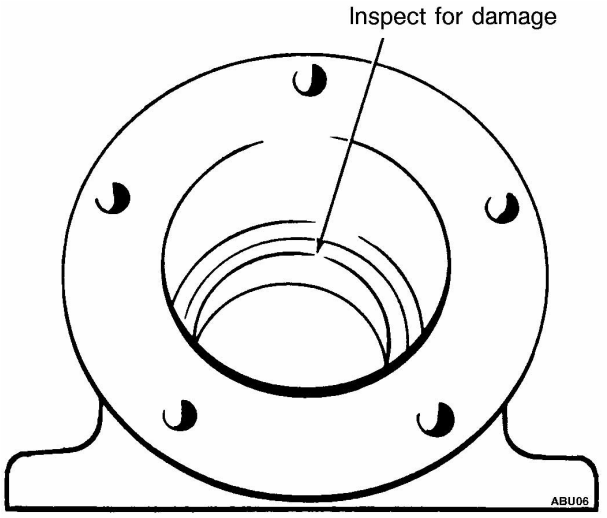


7. Remove bellows (discard).
8. Inspect all the parts (replace if excess wear is found).
   a. Piston and cap for wear (scuff marks)
   b. Body for stripped threads
   c. Bellows end cap for damage in pilot hole

   NOTE: Bellows is normally replaced.

9. Clean the parts to be reused.



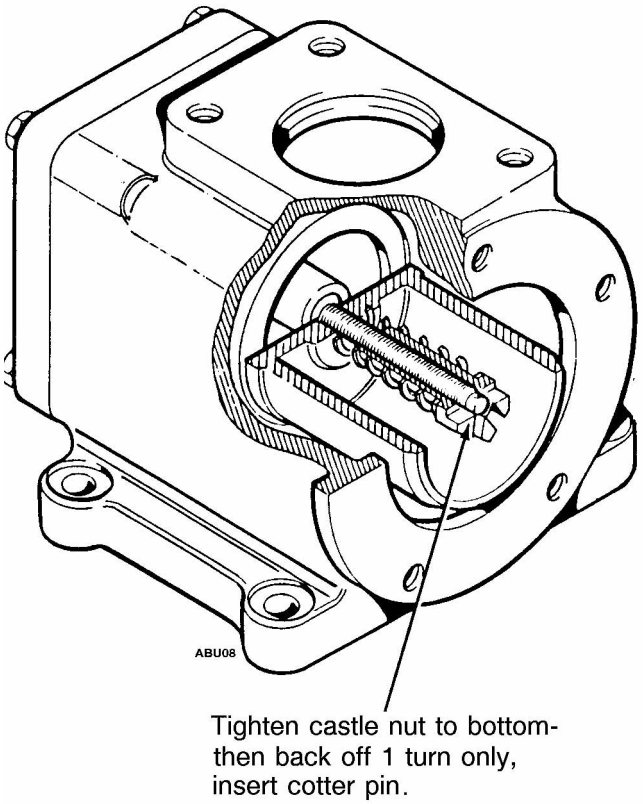


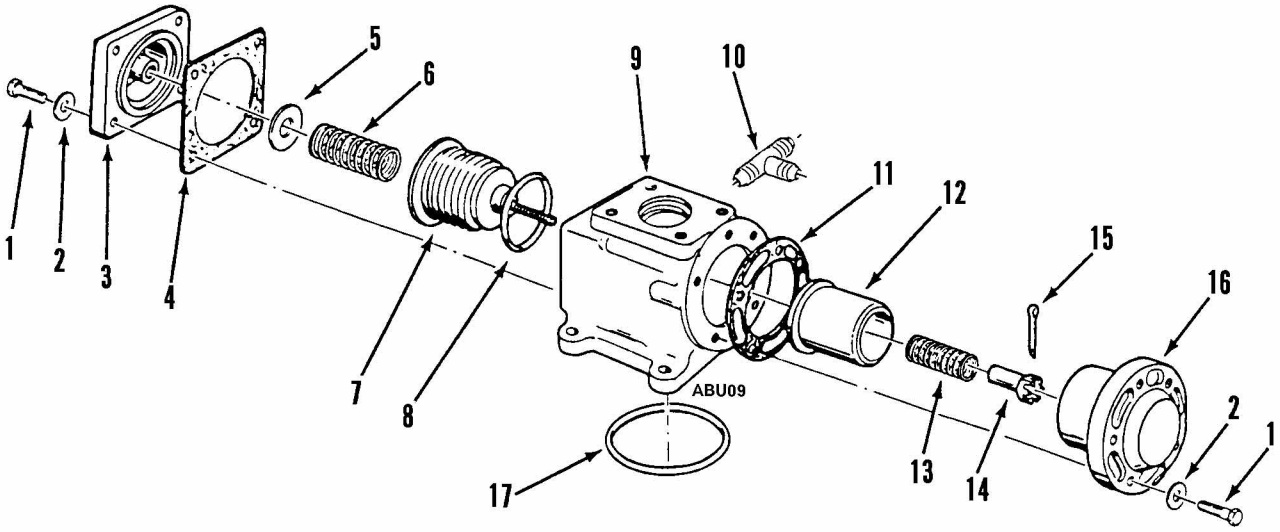
REASSEMBLY

1. Install new bellows with O-ring into the housing.
2. Center the spring on bellows shoulder.
3. Oil the gasket, install on the body, and place shims in end cap (use same number as removed). Tighten end cap in place with vent hole closest to outlet opening of the valve body.
4. Install the piston, spring and tighten the castle nut until firmly seated against the bottom of the piston.
5. Back off the castle nut, one full turn only.
6. Insert the cotter pin.
7. Oil the gasket and install the end cap.
8. Throttling valve will have to be recalibrated on operating unit. (Refer to Specification chapter for setting.)
9. Adjust by adding or removing shims under the spring.

Installation

1. Install the throttling valve using new O-ring soaked in compressor oil (same type of oil that is used in the system). Bolt the throttling valve to the compressor.
2. Connect the suction hose from the throttling valve to the accumulator tank. Install line from the compound gauge.
3. Pressurize the system and check for leaks. If no leaks are found, evacuate the system.
4. Open the refrigeration valves and place the unit in operation.

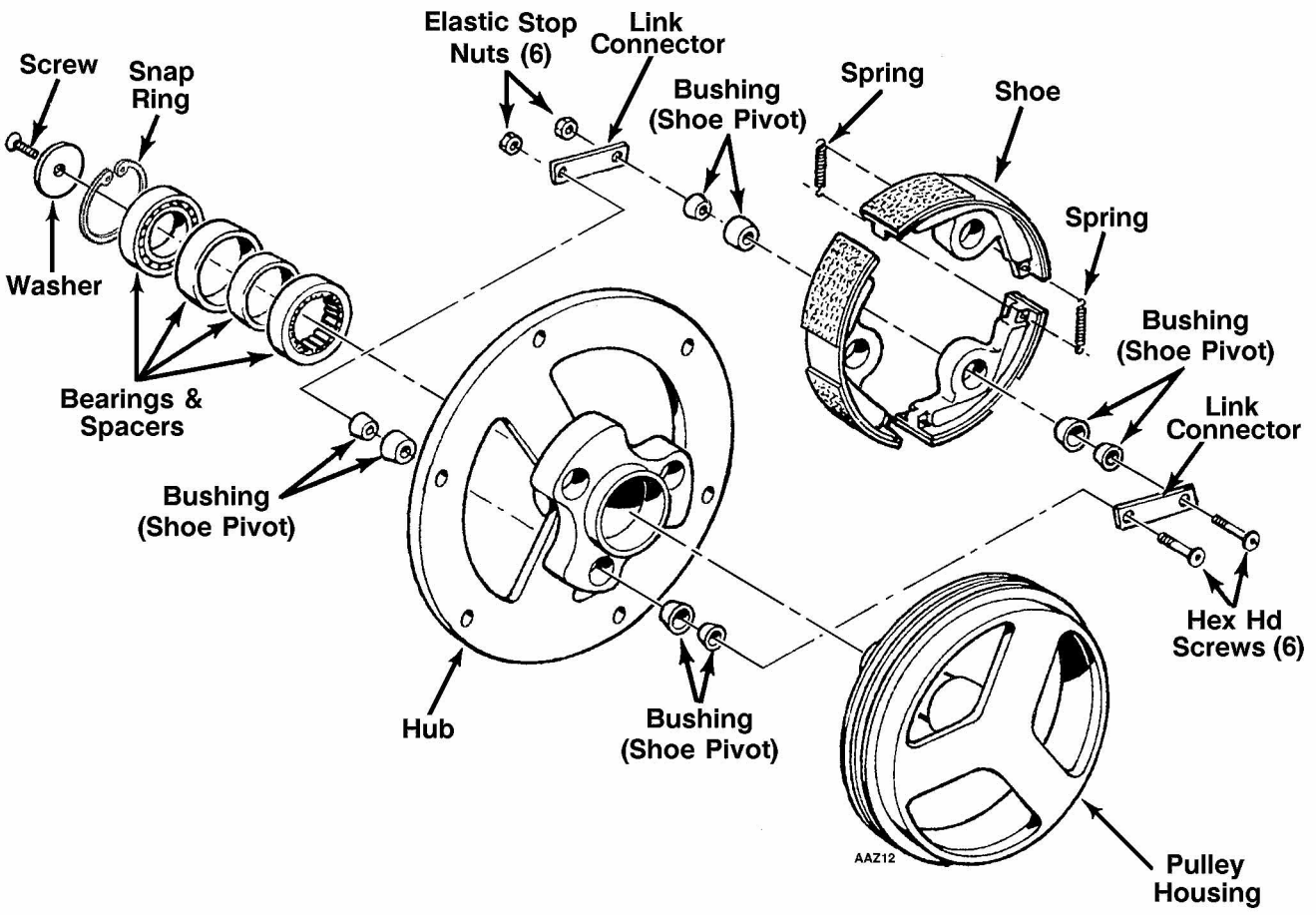




1. SCREW — plate
2. FLATWASHER
3. PLATE — bellows end
4. GASKET — end plate
5. WASHER — adjusting
6. SPRING — bellows
7. BELLOWS & SHAFT — assembly
8. O-RING
9. HOUSING
10. TEE
11. GASKET — piston housing
12. PISTON
13. SPRING — piston
14. NUT — adjusting
15. PIN — cotter
16. HOUSING — piston
17. O-RING — valve to compressor

Throttling Valve

Hilliard Clutch Maintenance



Clutch Assembly

CLUTCH MAINTENANCE

Inspect the clutch every 1000 hours of operation or yearly, whichever occurs first. Remove the clutch, clean the shoes and drum, regrease bearings or replace if they are worn. Inspect shoe anchor bushings, shoe lining and springs for wear and replace if necessary.

Tools Required

1. Snap Ring Pliers
2. Torque Wrench
3. 7/32 in. Allen Wrench
4. 1/2 in. Impact Tool
5. Rubber or Plastic Hammer
6. 7/16 in. Socket or Nut Driver
7. Arbor Press with Various Sized Arbors
8. Ratchet (Optional)

Grease

Mobil #28 (Synthetic) TK P/N 203-394

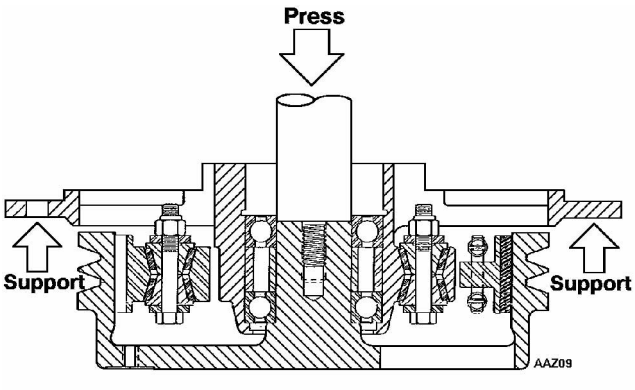
Clutch Disassembly

1. Remove retaining ring from hub bore.
2. Remove the 3/8-16 flat head cap screw and washer.

   NOTE: This screw was installed using Loctite #680 and will require the use of an impact tool for removal.

   NOTE: A small amount of heat (Acetylene or propane torch with small heating tip) applied to the cap screw head may be required to help loosen the screw.

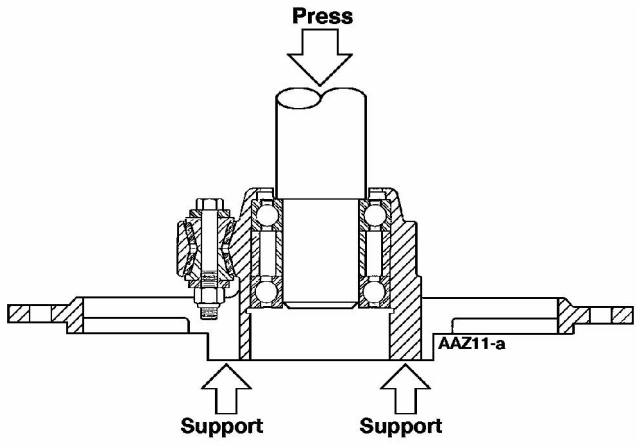
3. Remove housing from hub by supporting hub (in a minimum of three places) in spoke area, and pressing on housing shaft.



Housing Removal

4. Remove the nuts from six 1/4-28 link screws.
5. Remove the springs and bushings from the shoes.
6. Press the bearings out of the hub.

   NOTE: Bearing and spacer should press out together.



Bearing Removal

Clutch Assembly

1. Pack both bearings with Mobil 28 grease.
2. Press bearing into hub bore.

   NOTE: Be sure seal side is down.

3. Install spacers and fill cavity with Mobil 28 grease (TK No. 203-394).
4. Press second bearing in—seal side up.
5. Place Elatomer bushing and metal bushings in shoes and hub.
6. Position shoes in a circle on a flat surface and install springs on shoes.
7. Position shoes on hub.
8. Install 1/4 x 1-3/4 in. screws through links, then slide through bushings in shoes and hub.

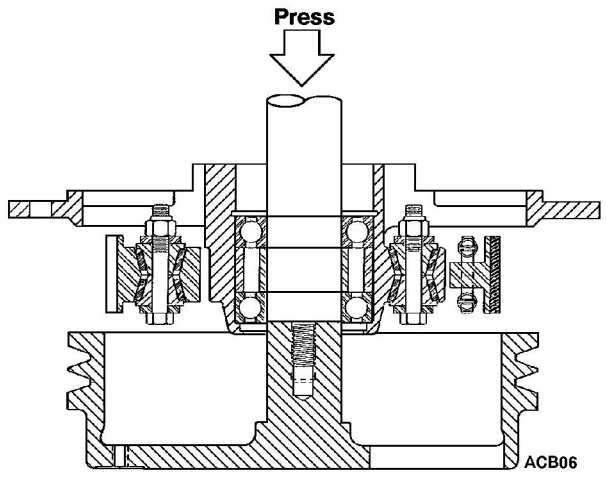
   NOTE: Threaded end of screws should be on flange side of hub. See drawing for correct position.

9. Install remaining links and 1/4-28 locknuts, torquing them to 85 to 90 in-lb (9.9 to 10.5 N•m).

   NOTE: Shoes must be held tightly against hub while nuts are tightened.

10. Place hub into housing.

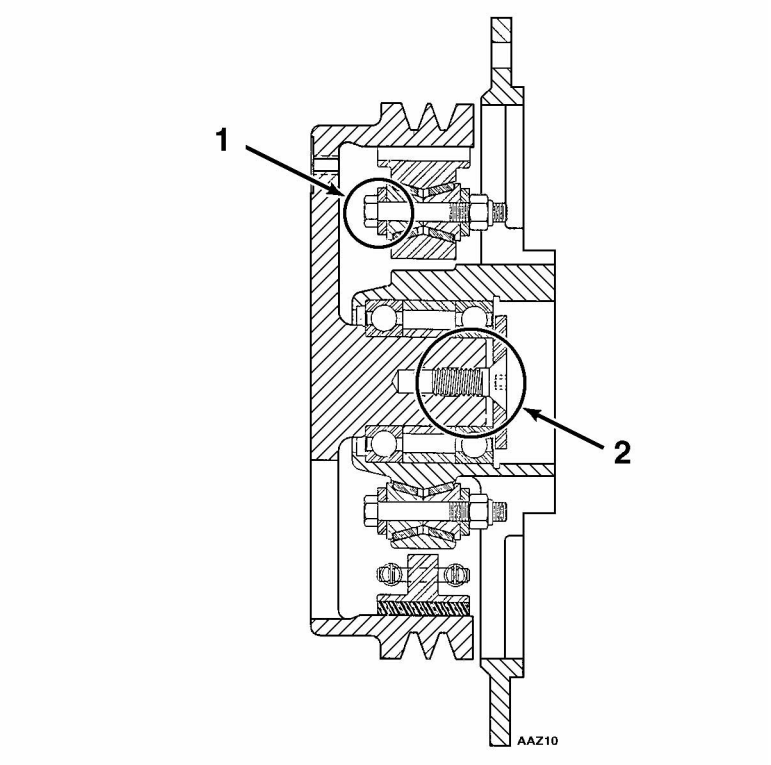
    NOTE: If bearings do not slide easily onto the housing shaft, use an arbor against the inner bearing race and press unit together.



Bearing Race Insertion

11. Apply Loctite #680 to 3/8-16x1 screw and install through washer into housing shaft. The housing and hub will be drawn together to the proper relative position as the screw is tightened. Tighten the screw to 215 to 220 in-lb (24 to 25 N•m).

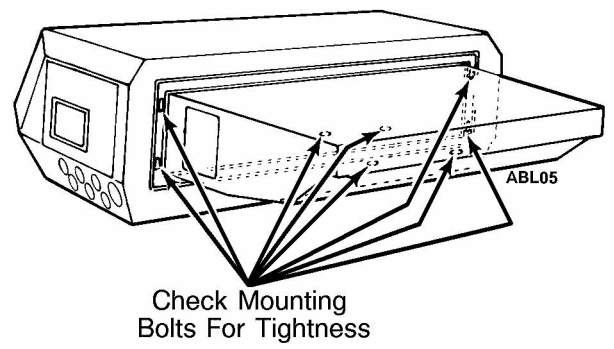
12. Install retaining ring.



Clutch Torque Values

UNIT AND ENGINE MOUNTING BOLTS

Periodically check and tighten all unit and engine mounting bolts. Torque the unit mounting bolts to 60 ft-lb (81.3 N•m). Torque the engine mounting bolts to 50 ft-lb (68 N•m).



Check Bolts For Tightness

UNIT INSPECTION

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

EVAPORATOR COIL

Clean the evaporator coil during scheduled maintenance inspections by blowing compressed air opposite normal air flow. Inspect the coil and fins for damage and repair if necessary.

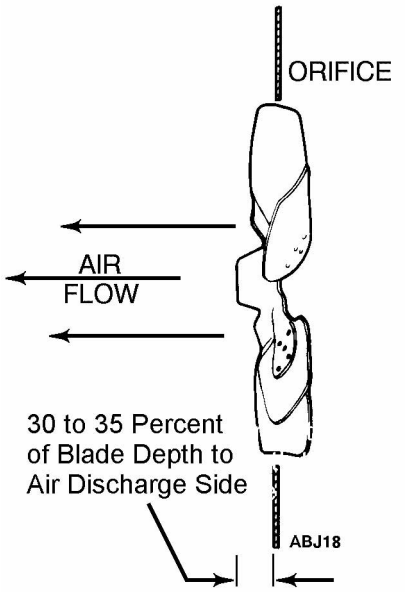
CAUTION: Air pressure should not be high enough to damage coil fins.

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 (direction opposite normal air flow). Inspect the coil and fins for damage and repair if necessary.

FAN LOCATION

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



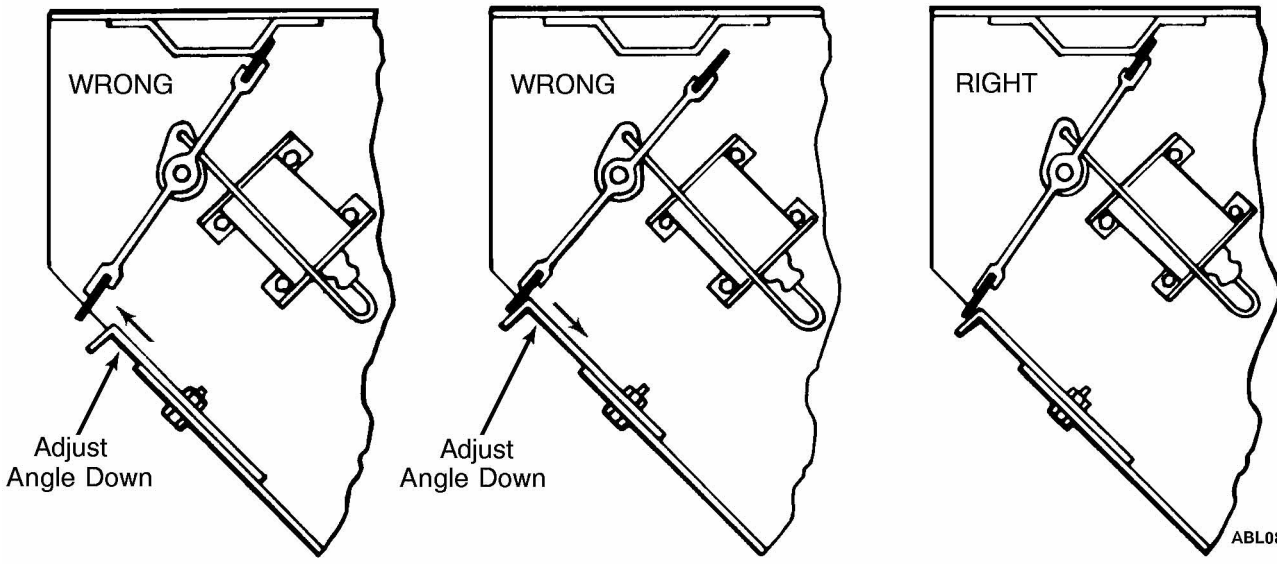
Fan Blade Position in Orifice

DEFROST DAMPER

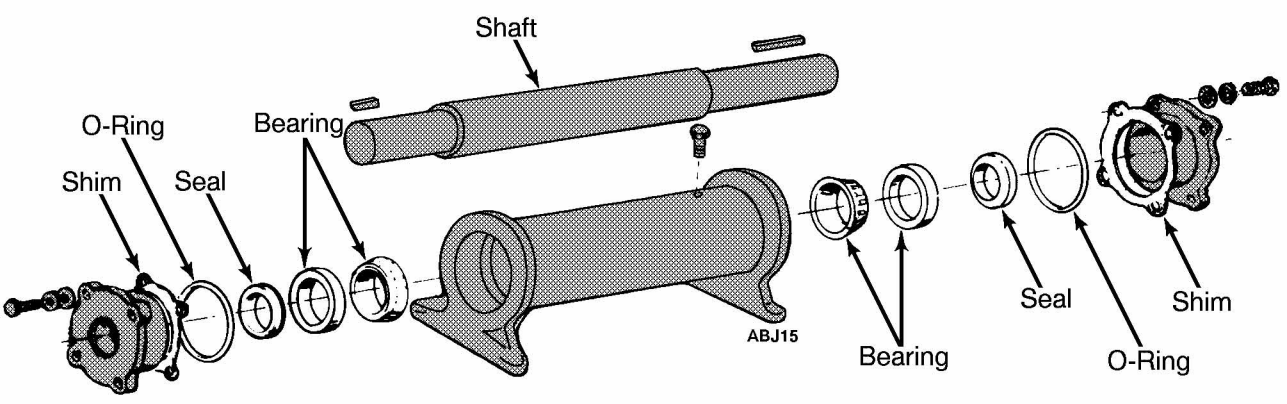
Check the damper during scheduled maintenance inspections for shaft wear, end play and sealing against air flow.

Position the damper so that the air flow is stopped top and bottom with the solenoid plunger bottomed.

1. If the damper does not close completely:
    a. Energize damper solenoid by placing a jumper wire from 12 Vdc to No. 29 wire in the evaporator harness.
    b. If damper blade closes, proceed to step 2. If not, proceed to step 1.c.
    c. Remove the jumper wire, loosen the evaporator outlet adjustment angle and move so when energized, the damper will close.
    d. Retighten the adjustment angle and repeat steps a. and b.
2. If the damper blade does not seal evenly along full width of blade:
    a. Loosen the damper bearing blocks.
    b. Manually close the damper so the blade makes contact at the top and bottom of the funnel, the full width of the blade.
    c. Retighten damper bearing blocks.
    d. Lube bearing block and shaft with low temperature grease TK No. 203-386.



Defrost Damper Adjustment



Jackshaft Assembly

JACKSHAFT ASSEMBLY

Model 30 units are not equipped with an electric motor. The electric motor is replaced by a jackshaft. The jackshaft assembly oil level plug should be removed, and the oil level checked every 1000 operating hours. Check the jackshaft during the pre-trip inspection for oil leakage. If there is any sign of leakage, remove the jackshaft assembly.

Disassembly

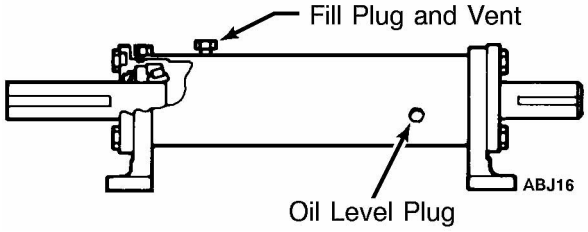
1. Remove jackshaft assembly from the unit and remove the pulleys.
2. Remove the level and fill plugs and drain oil reservoir.
3. Remove the end cap from fill plug end of the jackshaft assembly.

   NOTE: There are shims between the end cap and the housing. These should be saved for possible reuse during reassembly.

4. Remove the shaft and bearings.
5. Remove the end cap from level plug end of assembly.
6. Use a punch and hammer to remove the seals and bearing cups from end caps.
7. Use a bearing splitter or similar tool to remove the bearing cones from the shaft.
8. Clean all parts in clean solvent and then examine the bearing cups and cones for damage.

Reassembly

1. Coat the outer edges of the oil seals with a gasket sealant.
2. Using a suitable tool, install the seals in the end caps. Fill the space between the seal lips with grease.
3. Install oil level plug end of the shaft. Torque the bolts to 10 ft-lb (13.6 N•m).



Jackshaft Assembly

4. Place the shaft into housing and install the remaining end cap, O-ring and shims on housing. Torque the bolts to 10 ft-lb (13.6 N•m).

5. Check end play with a dial indicator. Add or remove shims until end play is between .001 to .005 in. (0.025 to 0.127 mm).
6. Fill oil reservoir with 3.5 ozs (104 ml) P/N 203-278 special shaft oil.

FANSHAFT ASSEMBLY

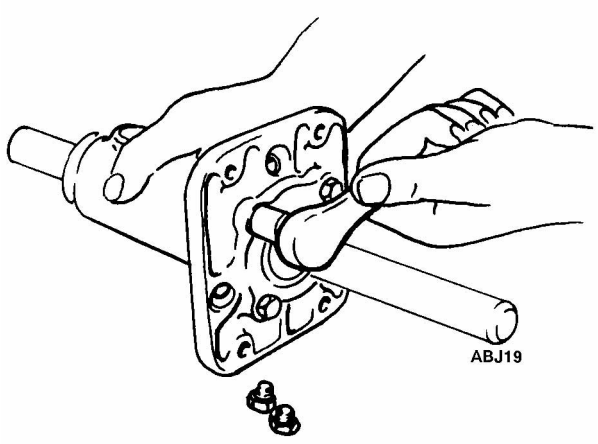
The unit is equipped with a one-piece fanshaft assembly that contains tapered roller bearings in a sealed oil reservoir. This assembly does not require any maintenance. There is a level plug and a fill plug, but they are not normally utilized except after removal and repair of the fanshaft assembly. The condenser end oil seal and the evaporator end oil seal should be checked during the pre-trip inspection for oil leakage. If there is any sign of leakage, the fanshaft assembly should be removed and repaired.

NOTE: The fanshaft assembly requires a special lubricant, TK P/N 203-278.

Fanshaft Assembly Overhaul

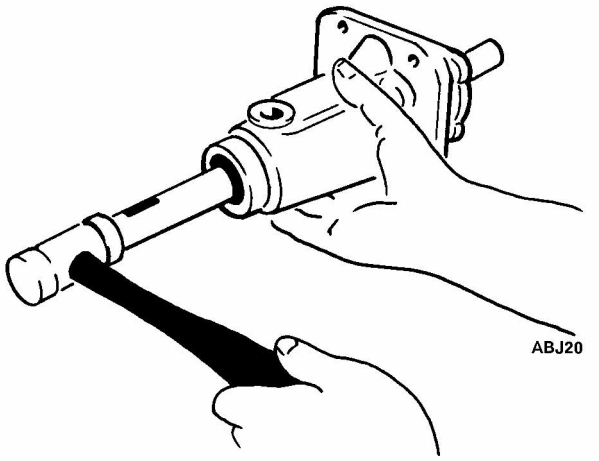
Disassembly

1. Remove the fanshaft assembly from the unit. Remove both oil plugs and drain the oil from the housing.



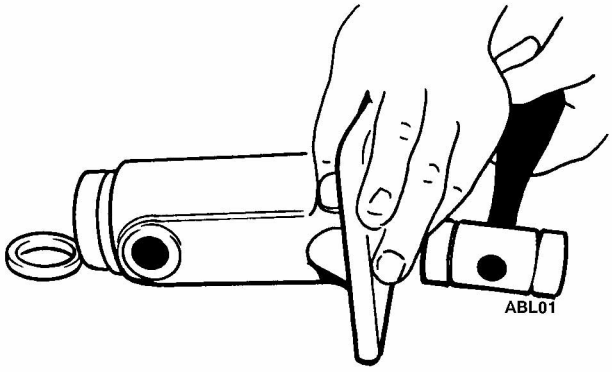
Removing Bearing Retainer Bolts

2. After draining the oil from the housing, remove the four retaining bolts from the bearing retainer cap.



Removing Shaft

3. To remove the shaft from the assembly, tap the opposite end of the shaft with a soft hammer. After the shaft has been removed, clean all parts in clean solvent.

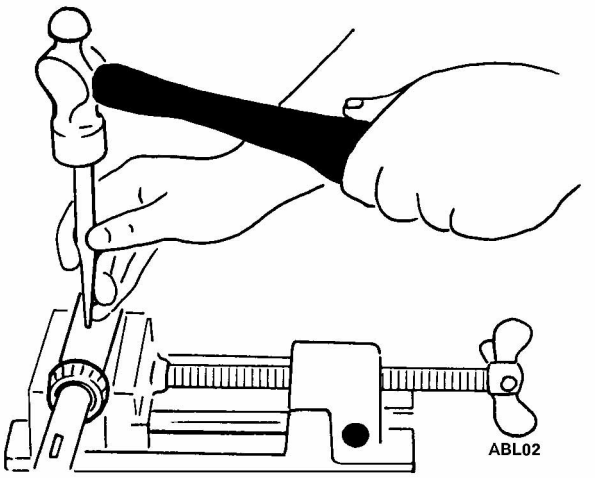


Removing Oil Seal

4. Using a punch, remove the oil seal from the evaporator end of the assembly. With the seal removed, clean the housing in solvent.
5. Check the condition of the vent. If it is loose or damaged, it must be repaired or replaced.

6. After all the parts are cleaned, inspect the bearings and bearing races for wear or damage.

7. To replace the bearings, first remove the roll pin that is in the center of the shaft.



Removing Roll Pin

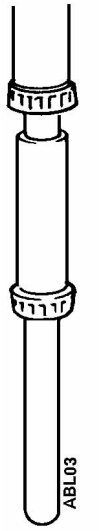
8. With the roll pin removed, place a pipe over the shaft and drive one bearing down until the opposite bearing and bearing spacer release from the shaft.

9. After removing one bearing and the bearing spacer, turn the shaft upside down and drive the other bearing off, using the pipe.

10. The bearing races can now be driven out with a punch and replaced in the same manner.

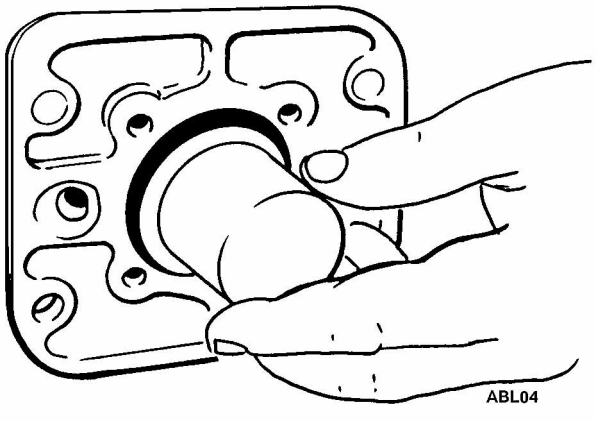
Reassembly

1. Install the new bearings on the shaft with a pipe in the same way they were removed.



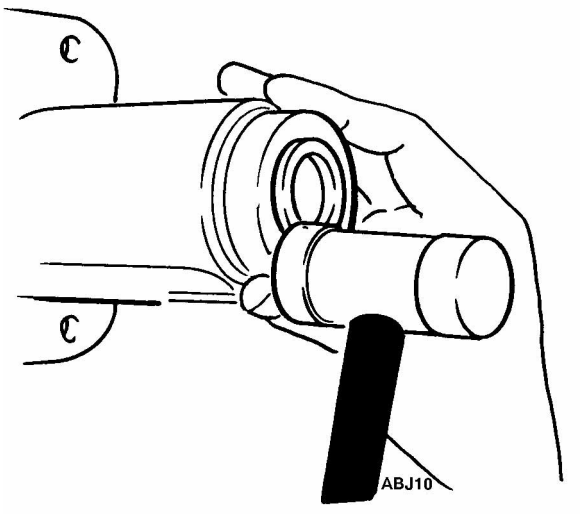
Installing Bearings

2. When replacing the bearing race on the evaporator end of the assembly, the splash guard will come out with the race. Reinstall the splash guard after replacing the bearing race.



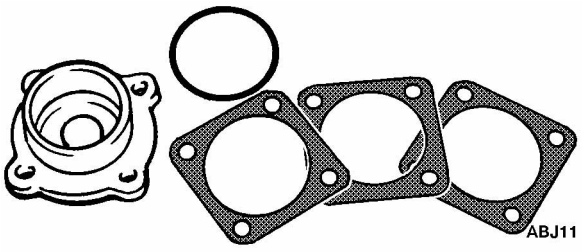
Installing Splash Guard

3. Install a new oil seal after replacing the bearing race and splash guard.



Installing Oil Seal

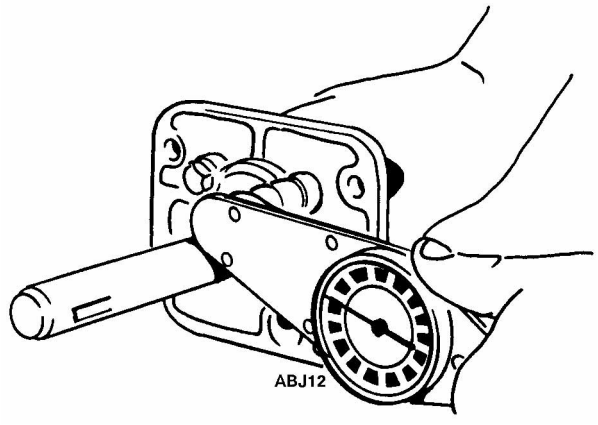
4. Place the shaft in the housing. Install a new seal in the retainer cap. Use the original shims and replace the O-ring if necessary.



Shims and O-ring

5. Install the retainer cap assembly over the shaft, and then install the bolts.

6. Torque the bolts in a criss-cross pattern in equal steps to 80 in-lbs (9.04 N•m).

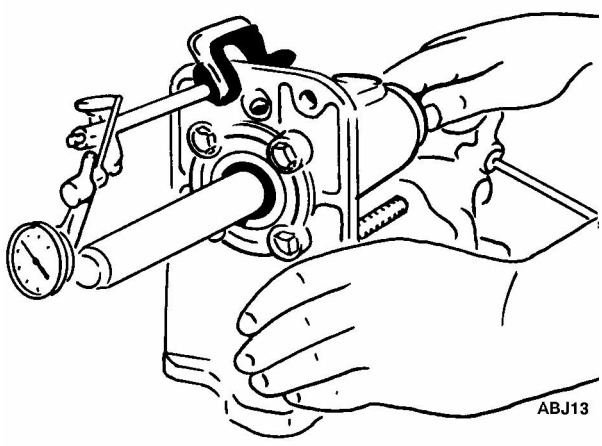


Torquing Retainer Plate Bolts

7. Lock the assembly in a vise and set up a dial indicator to read the end play. To measure the end play, rotate the shaft while pushing in one direction, and set the dial indicator to 0. Now rotate the shaft and pull in the opposite direction while reading the dial indicator. The end play should be .001 to .005 in. (0.025 to 0.127 mm). If the end play is incorrect, use different shims to obtain the correct end play.

   Shims available from the Service Parts Department:

.020 in. (0.500 mm)	P/N 99-4231
.007 in. (0.177 mm)	P/N 99-2902
.005 in. (0.127 mm)	P/N 99-2901



Checking End Play

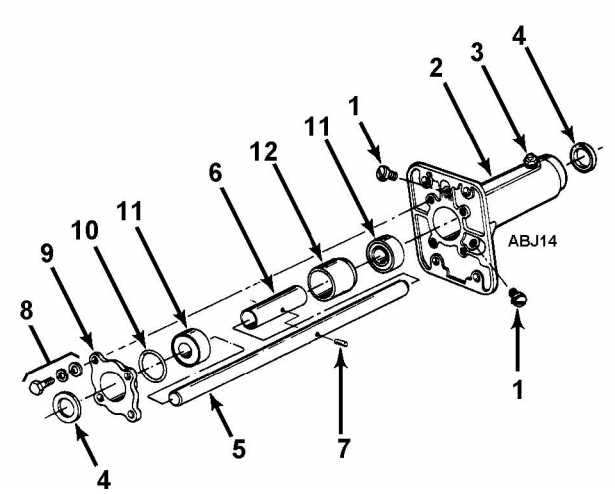
8. After the correct end play is obtained, add grease for the bearings.

   NOTE: Use ONLY Thermo King special fanshaft grease (P/N 203-278) in this assembly.

   Lock the assembly in a vise with the vent facing up. Pour grease through the top plug until it runs out of the side hole. The assembly holds 2.2 oz. (65 ml). Check the condition of the O-ring used on the plugs and replace if necessary. Install top and side plugs. Clean up any spillage.

9. Place the assembly on the workbench with the vent up. Rotate the shaft by hand. The shaft should be free enough to rotate without having to hold the housing.

   CAUTION: When installing the fanshaft assembly, make sure that the vent is mounted facing up.



1.	Oil Plug Screw with O-ring
2.	Housing
3.	Breather Vent
4.	Oil Seal
5.	Shaft
6.	Sleeve
7.	Pin
8.	Screw with Flatwasher and Lockwasher
9.	Cap and Shims
10.	O-ring
11.	Roller Bearing
12.	Splash Guard Tube

Fan Shaft Assembly

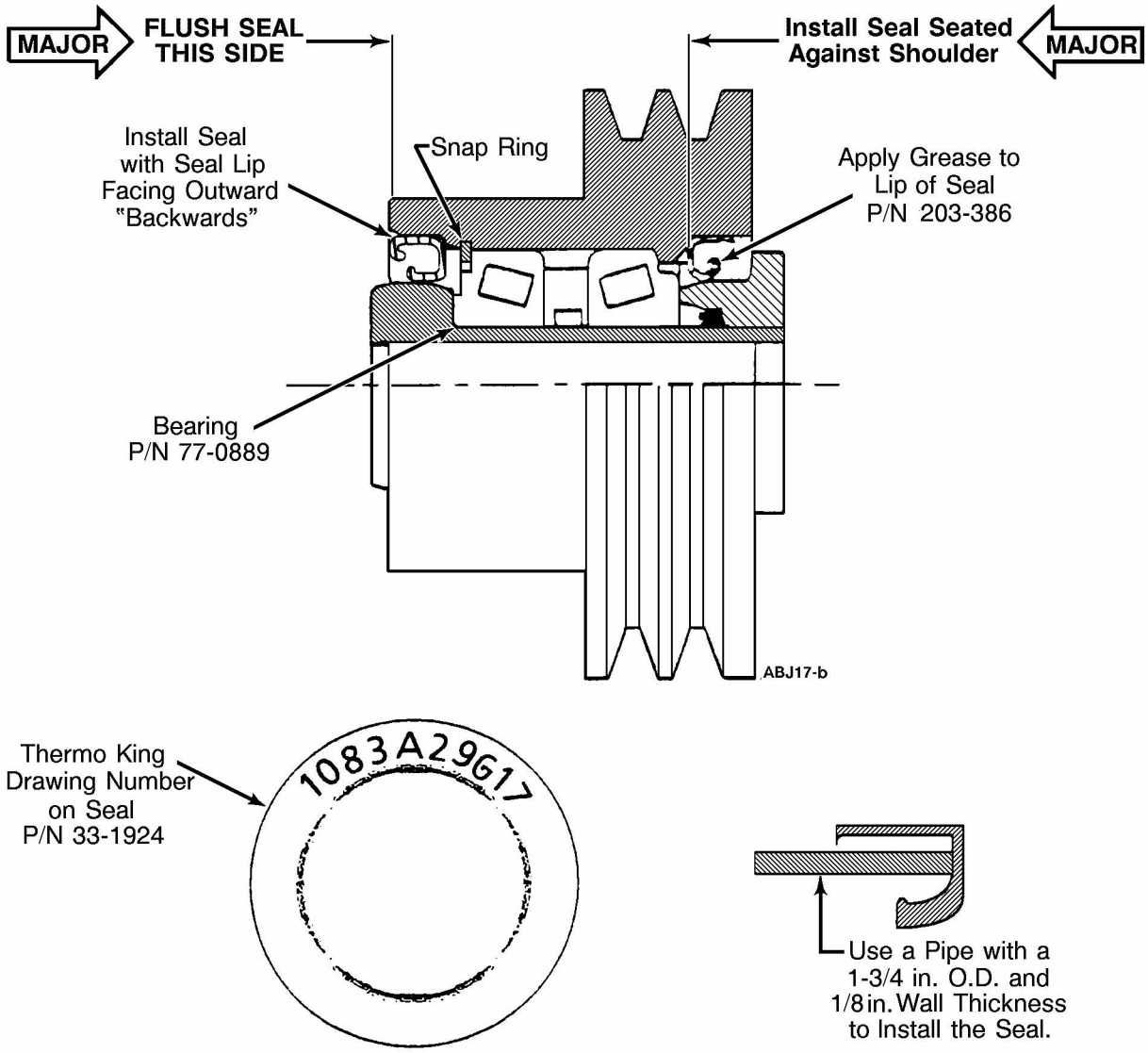
RD-II SR IDLER PULLEY SEAL INSTALLATION

NOTE: RD-II SR Idler Pulleys use seal assembly P/N 33-1924. The retaining snap rings are deleted and to prevent pressure build-up in the pulley assembly, the seals are installed with the seal lip facing outward. See diagram below.

Installation Procedure

To perform a seal change the following procedure is recommended:

1. Remove idler pulley from the unit.
2. Remove the two seals and the retaining snap ring (**DISCARD OLD SEALS AND SNAP RINGS**).



3. Pack bearings with TK P/N 203-386 synthetic grease.
4. Install seal assembly P/N 33-1924 with seal lip facing outward. Press pulley side seal until it bottoms on pulley shoulder. Press the opposite seal until it is flush with the pulley edge.
5. Install snap ring.
6. Install bearing seal and “O” in the pulley assembly.
7. Reinstall the pulley assembly back into the unit.

Mechanical Diagnosis

CONDITION	POSSIBLE CAUSE	REMEDY
Unit switch ON—nothing happens	Dead battery	Recharge or replace battery
	Remote switch off (optional)	Turn on
	Circuit breaker open	Replace or reset
	Corroded battery connections	Clean and tighten
	Fusible link blown	Check for shorted main harness and replace fusible link
Unit switch ON—indicator lights come on but engine does not crank	Battery low	Replace or recharge battery
	Circuit breaker open	Turn OFF unit for 10 seconds
	Starter solenoid defective	Repair or replace
	Starter relay defective	Replace relay
	Corroded battery connections	Clean and tighten
	Starter clutch defective	Replace
	Starter defective	Repair or replace
	Starter switch defective	Replace
Engine cranks but FAILS to start	Misadjusted fuel solenoid linkage	Adjust
	Fuel solenoid defective	Replace solenoid
	No fuel or wrong fuel in tank	Fill fuel tank. After filling a completely empty tank, first bleed fuel system.
	Engine too cold	Use winter preheat procedure
	Glow plugs defective	Replace glow plugs
	Air in fuel system	Bleed fuel system. During this operation, it can also be determined if the fuel lines are tight and filters clean.
	Speed/run relay malfunction	Check relay or unit thermostat
	Insufficient compression	Measure compression pressure. If necessary, grind valves or replace piston

CONDITION	POSSIBLE CAUSE	REMEDY
Engine cranks but FAILS to start (continued)	Electric fuel pump not operating	Check pump for running and 8 to 10 psig (55 to 69 kPa). Repair or replace fuel pump
	Injection pump incorrectly timed	Adjust timing
	Faulty injeciton nozzle(s)	Repair injection nozzle or replace it
	Faulty injection pump	Have pump repaired
Engine stops after starting	Air in injection pump	Bleed fuel system
	Fuel filter obstructed	Replace filter element
	High water temperature coolant	Add coolant. Check for leaks
	Low oil pressure	Add oil. Check for leaks
	Vent of fuel tank obstructed	Remove obstruction
	Electric fuel pump not operating	Check pump for running and 8 to 10 psig (55 to 69 kPa). Repair or replace fuel pump
	Dry air cleaner (optional) plugged	Change filter element
	Fuel solenoid not energized	Check run circuit
	High refrigerant pressure	Locate and correct cause
Engine does not reach full power	Air or dirt in fuel system	Adjust
	Fuel line leaks	Tighten connections of fuel lines. if necessary, replace damaged lines
	Speed adjustment wrong	Adjust speed
	Electric fuel pump does not run	Check voltage. Repair or replace pump
	Fuel filter blocked	Install new filter
	Electric fuel pump filter dirty	Clean and replace diesel filter
	Delivery of fuel pump insufficient	Repair or replace pump
	Cylinder head gasket leaking	Replace gasket
	Piston rings worn, stuck or broken	Replace rings
	Cylinder worn	Replace or bore

CONDITION	POSSIBLE CAUSE	REMEDY
Engine does not reach full power (continued)	Leaking injection nozzle or irregular injection caused by fouling	Clean and repair nozzle
	Insufficient compression pressure due to faulty piston or valves	Check cylinder with compression tester. if necessary, grind valves or replace piston
	Air filter clogged	Clean air filter
	Fuel tank vent clogged	Unclog vent
	Injection rate too low	Adjust pump discharge rate
	Insufficient injection pressure	Readjust or replace nozzle
	Pump injects too early or too late	Adjust injection pump timing
	Air in fuel system	Bleed fuel system
	Air is drawn into fuel pump	Check all fuel lines and fittings
	Loose governor assembly	Check and repair governor assembly
	Restricted exhaust system	Clean or replace restricted parts
Engine is sooting heavily, emits thick black clouds of smoke (excessive fuel to air ratio)	Wrong fuel	Drain and refill with correct fuel
	Clogged air intake system	Clean air cleaner
	Restricted exhaust system	Clean or replace
	Opening pressure of nozzle is too low or needle sticks	Repair nozzle. Replace if necessary
	Injection amount too great	Have pump repaired
	Oil being drawn in	Check oil level in oil bath air filter
	Injection pump too timed	Check timing of injection pump
	Excessive load	Check drive system and engine oil pressure

CONDITION	POSSIBLE CAUSE	REMEDY
Engine knocks	Insufficient air	Clean air filter
	Air in fuel system	Bleed fuel system
	Engine is cold	Warm up
	Fuel return line plugged	Remove restriction
	Injection pump not timed	Retime injection pump
	Injection nozzle fouled or opening pressure too low	Clean, repair or replace injection nozzle
	Dirty radiator	Clean radiator
	Worn engine parts	Overhaul engine
Engine runs hot	Engine coolant is low	Add coolant slowly while engine is in operation
	Dirty or plugged radiator	Clean radiator
	Cooling system heavily scaled	Clean cooling system
	Water pump leaks	Repair or replace water pump
	Worn or loose belt	Replace belt or adjust
	Cylinder head gasket leaks (bubbles appear in radiator if cylinder gasket is leaking)	Replace cylinder head gasket. Correct gasket
	Faulty thermostat	Check or replace the thermostat
	Faulty temperature gauge	Replace gauge
Oil pressure too low or drops suddenly	Insufficient oil in pan	Refill oil base after correcting cause of loss
	Leak in oil line	Tighten oil line fittings
	Oil relief valve sticking	Disassemble and clean oil pressure regulator valve
	Faulty oil pressure gauge	Check oil line to oil pressure gauge to see if it is blocked. Check oil pressure gauge. Replace if necessary

CONDITION	POSSIBLE CAUSE	REMEDY
Oil pressure too low or drops suddenly (continued)	Worn oil pump, camshaft, main or connecting rod bearings, loose oil gallery plug, oil in water through crack	Repair engine
High oil consumption	Oil leakage	Check and eliminate possible causes
	Clogged air cleaner	Clean air cleaner
	Damaged valve seals	Replace seals on valve stem
	Worn valve stem or valve guides	Replace valves and valve guides
	Broken piston rings or cylinder bore worn or scored	Have engine repaired. Replace broken piston rings
	Crankcase breather clogged	Clean crankcase breather
Blue Smoke (oil consumption)	Excessive oil consumption	Refer to High Oil Consumption. Repair as necessary
White Smoke (fuel is not burning)	Cold engine	Allow engine to warm up
	Low compression	Check and eliminate possible causes. Repair as necessary
	Timing	Readjust timing
	Air or water in fuel	Bleed system. Replace filters, clean fuel system, drain and clean tank and check supply tank for water. Use known good fuel
	Insufficient preheat	Check glow plugs
Battery is not recharging	Loose alternator belt	Tighten belt
	Loose connections in electrical system	Check all electrical connections and charging system
	Worn brushes in alternator	Repair
	Voltage regulator faulty	Replace
	Battery defective	Replace
	Alternator defective	Repair or replace

Electric Standby (Optional) Diagnosis

CONDITION	POSSIBLE CAUSE	REMEDY
Unit switch ON—indicator lights do not come on	Battery discharged	Charge or replace battery
	Circuit breaker open	Reset alarm code
	Electric motor reset switch tripping	Check for short circuit in unit wiring (high voltage)
	Fuse link blown	Replace fuse link
	Dirty battery terminals	Clean and retighten terminals
Unit switch ON—indicator lights come on but electric motor does not run	No standby power	Provide power to unit; check power at: 1. Power source 2. Power plug 3. Motor contactor hot side 4. Motor contactor load side (contactor closed) 5. Overload relay 6. Motor terminals
	Defective motor contactor	Repair or replace motor contactor
	Defective low oil pressure sensor	Replace low oil pressure sensor
	Overload relay tripping	Check for shorted motor windings or wires
	Defective motor	Replace motor
	Batteries discharged	Charge ore replace batteries
Electric motor hums but does not run	Locked rotor (overload relay will open after a period of time)	Remove interference
	Locked compressor	Repair compressor
	Defective clutch on engine (locked up)	Repair or replace clutch
	Low line voltage or no voltage on one leg	Bring voltage up to within 10% of motor rating

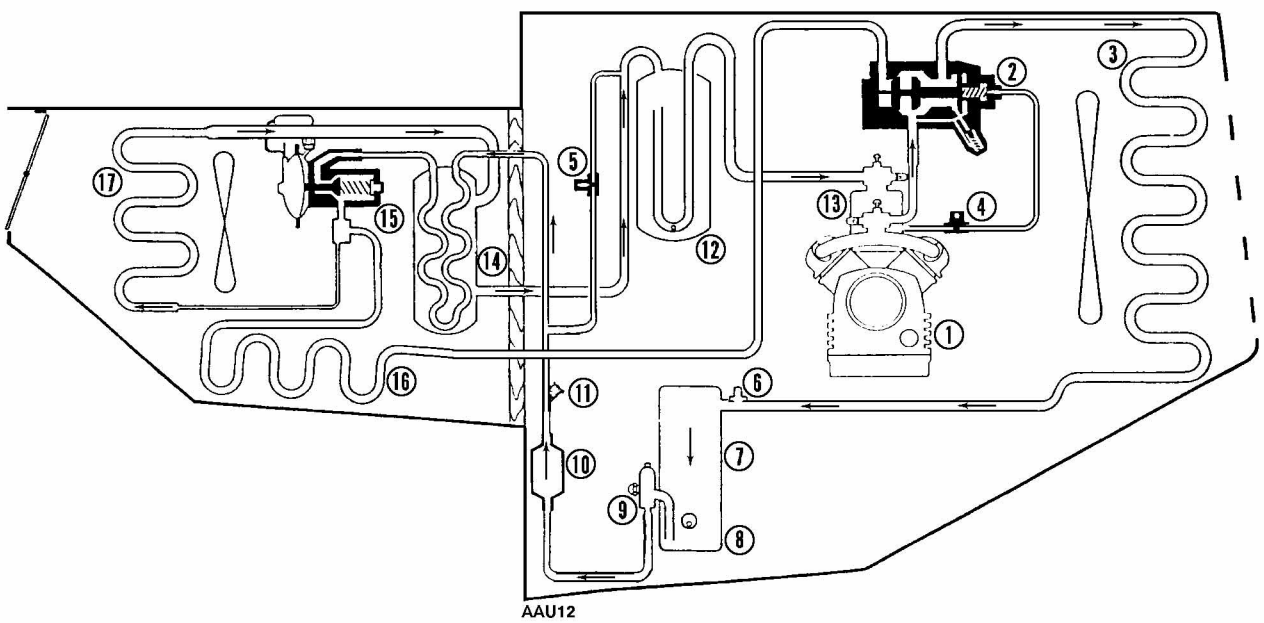
CONDITION	POSSIBLE CAUSE	REMEDY
Contact chatter	Low battery voltage	Check voltage condition. Check momentary voltage dip during starting—low voltage prevents magnet sealing
	Defective or incorrect coil	Replace coil
	Poor contact in control circuit	Check auxiliary switch contacts and overload relay contacts. Check for loose connections in control circuits
Contact welding or freezing	Abnormal in-rush of current	Check or grounds, shorts or excessive motor load current
	Low voltage	Correct voltage condition. Check momentary voltage dip during starting
	Foreign matter prevents contacts from closing	Clean contacts
	Rapid cycling	Check for cause of short cycling (such as thermostat)
	Short circuit	Correct fault
Electric heaters do not heat—(optional) indicator lights come on	Defective heater contactor	Replace contactor
	HC wire open	Locate open and repair
Battery is not recharging	Loose connections in electrical system	Check all electrical connections and charging system
	Worn brushes in alternator	Replace brushes
	Voltage regulator faulty	Repair or repalce regulator
	Battery defective	Replace battery
	Alternator defective	Repair or replace alternator
	Loose belt	Tighten belt
	Dirty battery terminals	Clean and retighten
	Alternator relay defective	Replace relay
	Fuse F309 open	Replace fuse

Refrigeration Diagnosis

Rapid cycling between cool and heat	Unit cools in heat and 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	Receiver sight glass empty	Suction line frosting back	Unable to pump down system	Unable to pull vacuum in low side	Unable to hold vacuum in low side	Noisy compressor	Unit not refrigerating	Unit not heating or defrosting	**SYMPTOM** / **POSSIBLE CAUSES**
			•			•									•	•		Overcharge of refrigerant
				•			•		•	•						•	•	Shortage of refrigerant
				•				•	•							•	•	No refrigerant
			•															Air through condenser too hot (ambient)
			•															Air flow through condenser restricted
				•			•			•								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
				•									•					Compressor discharge valves leaking
						•						•						Compressor suction valves leaking
																•		Too much compressor oil in system
															•			Faulty oil pump in compressor
															•			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

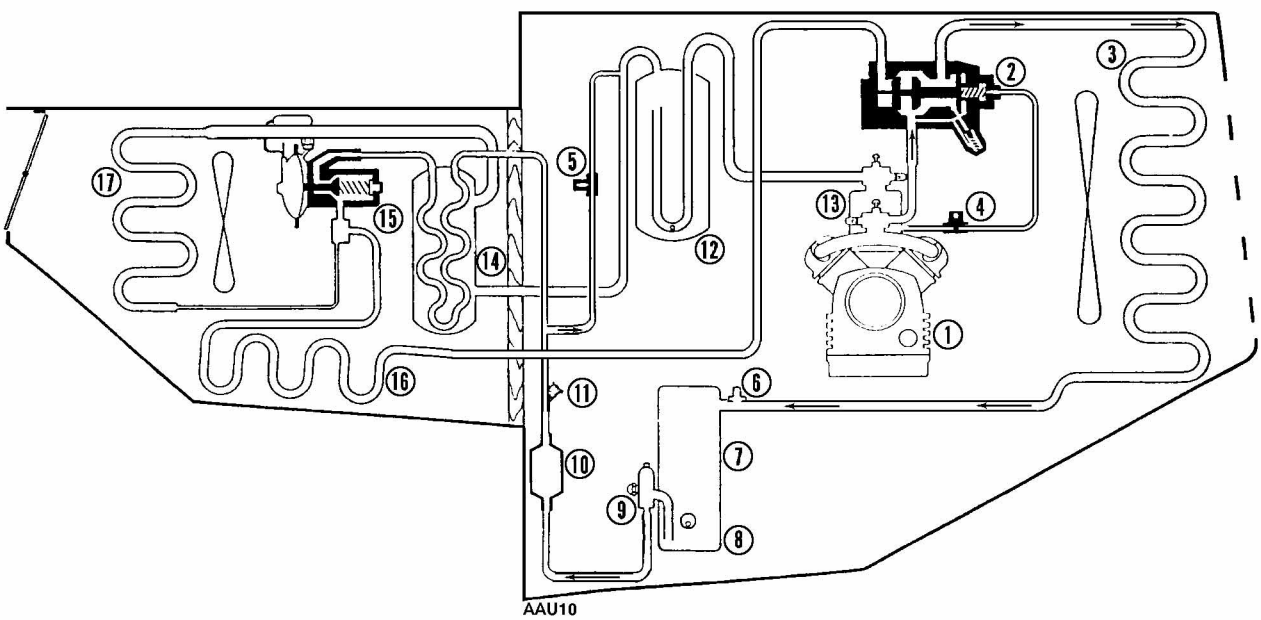
Rapid cycling between cool and heat	Unit cools in heat and defrost cycle	Unit heats in refrigeration cycle	High head pressure	Low head pressure	No head pressure	High suction pressure	Low suction pressure	No suction pressure	Unit operating in a vacuum	Receiver sight glass empty	Suction line frosting back	Unable to pump down system	Unable to pull vacuum in low side	Unable to hold vacuum in low side	Noisy compressor	Unit not refrigerating	Unit not heating or defrosting	**SYMPTOM** / **POSSIBLE CAUSES**
						•					•					•		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
						•					•				•			Liquid refrigerant entering compressor
							•		•									Restricted line on the low side
			•				•		•							•		Restricted line on the high side
			•				•		•							•		Restricted drier
																	•	Evaporator shutter open
							•		•							•		Evaporator shutter stuck closed
					•													Discharge service valve back seated
								•										Suction service valve back seated
	•	•		•		•						•		•			•	Faulty three-way valve
	•	•										•				•	•	Faulty pilot solenoid
	•																•	Loose or broken electrical connections
•						•	•		•							•		Thermostat or thermometer out of calibration
						•	•	•	•									Suction pressure gauge out of calibration
												•						Leaky receiver tank outlet valve
												•						Leaky bypass check valve
						•	•					•				•	•	Leaky condenser check valve

Cool Cycle—RD-II SR with TherMax™ Heating



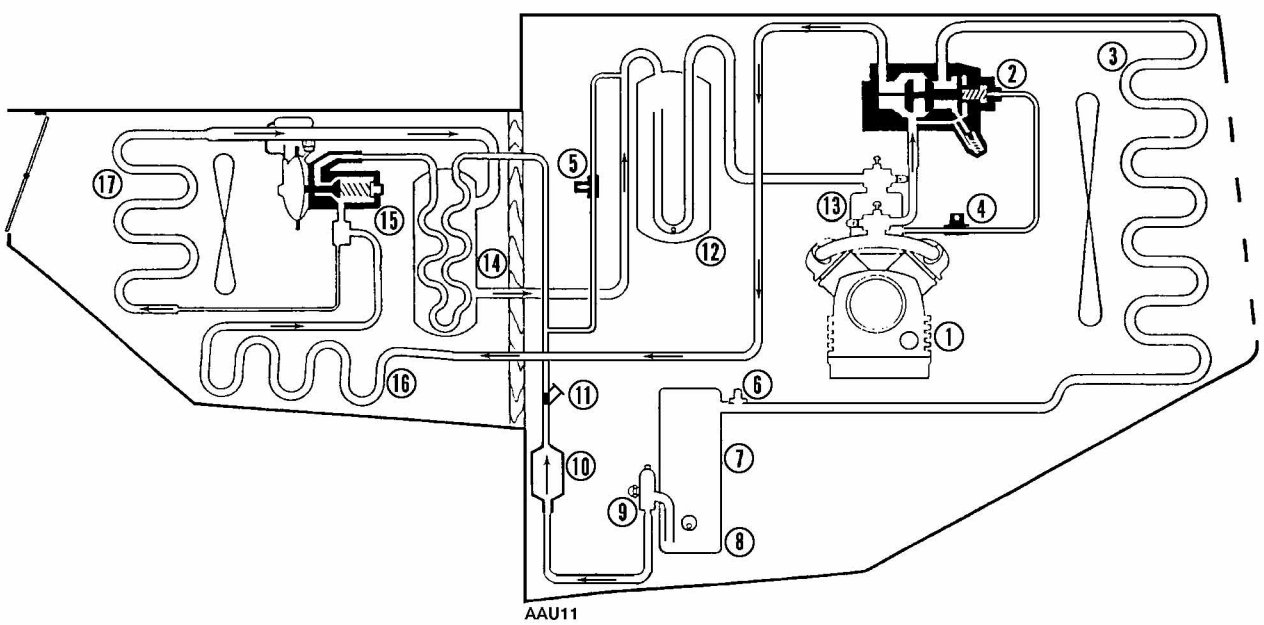
1. Compressor
2. Three-way Valve
3. Condenser Coil
4. Pilot Solenoid
5. Heat Solenoid
6. High Pressure Relief Valve
7. Receiver Tank
8. Sight Glass
9. Receiver Outlet Valve
10. Dehydrator
11. Receiver Outlet Check Valve
12. Accumulator Tank
13. Throttling Valve
14. Heat Exchanger
15. Expansion Valve
16. Pan Heater
17. Evaporator Coil

Condenser Cycle—RD-II SR with TherMax™ Heating



1. Compressor
2. Three-way Valve
3. Condenser Coil
4. Pilot Solenoid
5. Heat Solenoid
6. High Pressure Relief Valve
7. Receiver Tank
8. Sight Glass
9. Receiver Outlet Valve
10. Dehydrator
11. Receiver Outlet Check Valve
12. Accumulator Tank
13. Throttling Valve
14. Heat Exchanger
15. Expansion Valve
16. Pan Heater
17. Evaporator Coil

Heat and Defrost Cycle—RD-II SR with TherMax™ Heating



1. Compressor
2. Three-way Valve
3. Condenser Coil
4. Pilot Solenoid
5. Heat Solenoid
6. High Pressure Relief Valve
7. Receiver Tank
8. Sight Glass
9. Receiver Outlet Valve
10. Dehydrator
11. Receiver Outlet Check Valve
12. Accumulator Tank
13. Throttling Valve
14. Heat Exchanger
15. Expansion Valve
16. Pan Heater
17. Evaporator Coil

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F403 F400 F402 F401 F311 F202 F200 F308 F307 F306 F305 F304 F303 F302 F301 F300 F310 F309

MP-T

SENSOR HARNESS

SWITCH HARNESS

INTERCONNECT HARNESS

CONDENSER HARNESS

ENGINE HARNESS

TO SHEET 2

S1 ON OFF

ELECTRONIC THERMOMETER (OPTION)

ETM

REMOTE CABLE

MP-T REMOTE

CHB WHT BLK

REVISIONS

THERMO KING PROPRIETARY DATA

DRAWN JAS 10/22/98
CHECKED GP 4-12-99
APPROVED JPS 4-27-99
APPROVED -

WIRING DIAGRAM
MD-KD-RD-TD 30
TRUCK MP-T

THERMO KING CORPORATION

5D45075
DRAWING NUMBER REV
5D45077 B

SCALE: NONE SHEET 1 OF 2

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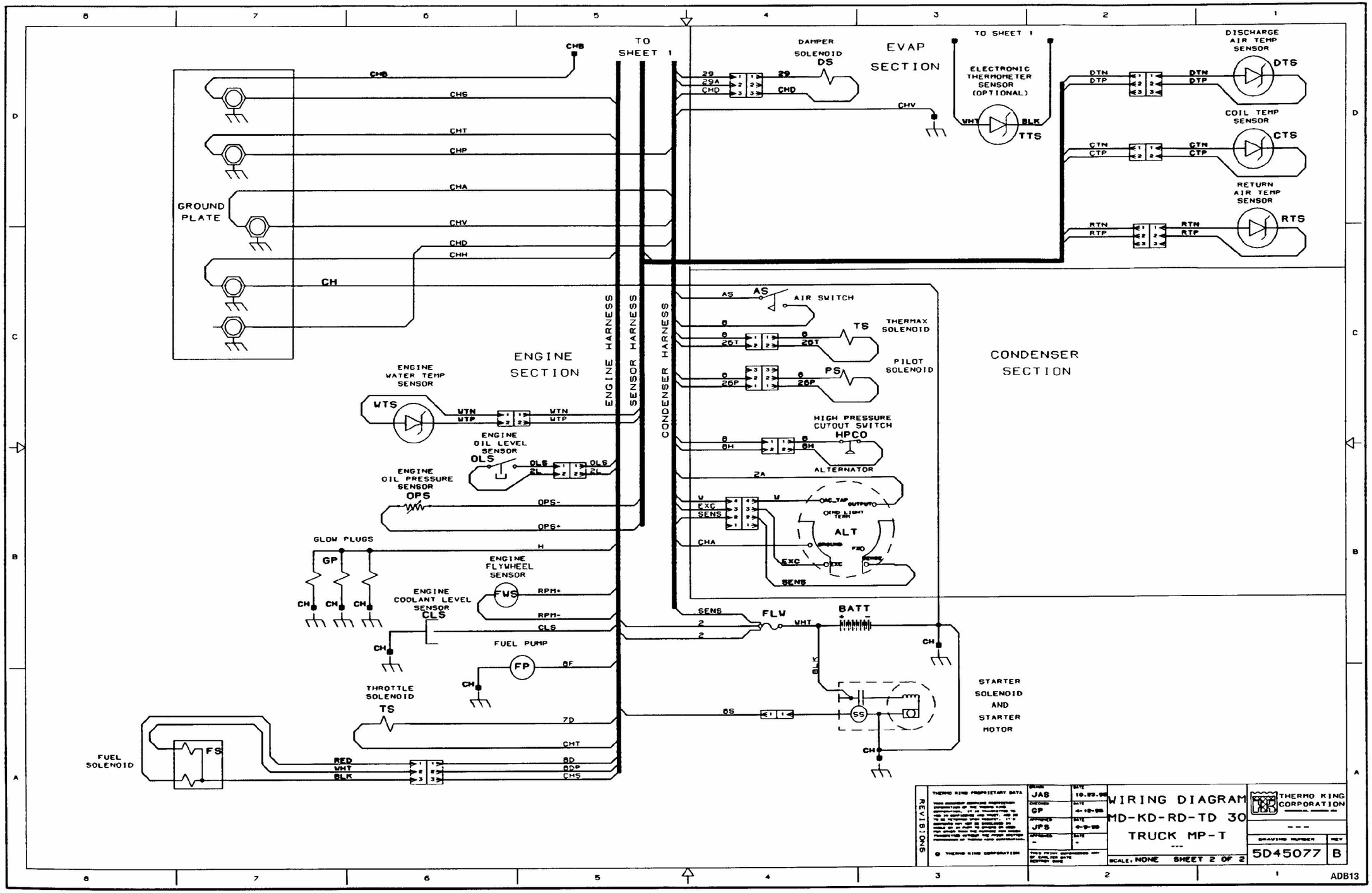
TO SHEET 1
CHB
CHS
CHT
CHP
CHA
CHV
CHD
CHH
CH
GROUND PLATE
ENGINE HARNESS
SENSOR HARNESS
CONDENSER HARNESS
ENGINE SECTION
EVAP SECTION
CONDENSER SECTION
DAMPER SOLENOID
DS
29
29A
CHD
CHV
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VHT
BLK
TTS
DISCHARGE AIR TEMP SENSOR
DTS
DTN
DTP
COIL TEMP SENSOR
CTS
CTN
CTP
RETURN AIR TEMP SENSOR
RTS
RTN
RTP
AS
AIR SWITCH
THERMAX SOLENOID
TS
20T
PILOT SOLENOID
PS
20P
HIGH PRESSURE CUTOUT SWITCH
HPCO
6H
ALTERNATOR
2A
V
EXC
SENS
ALT
CHA
ENGINE WATER TEMP SENSOR
WTS
WTN
WTP
ENGINE OIL LEVEL SENSOR
OLS
2L
ENGINE OIL PRESSURE SENSOR
OPS
OPS-
OPS+
GLOW PLUGS
GP
H
ENGINE FLYWHEEL SENSOR
FWS
RPM+
RPM-
ENGINE COOLANT LEVEL SENSOR
CLS
FUEL PUMP
FP
6F
THROTTLE SOLENOID
TS
7D
CHT
FUEL SOLENOID
FS
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THERMO KING CORPORATION
DRAWN JAS 10-23-98
CHECKED GP 4-12-99
APPROVED JPS 4-9-99
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TRUCK MP-T
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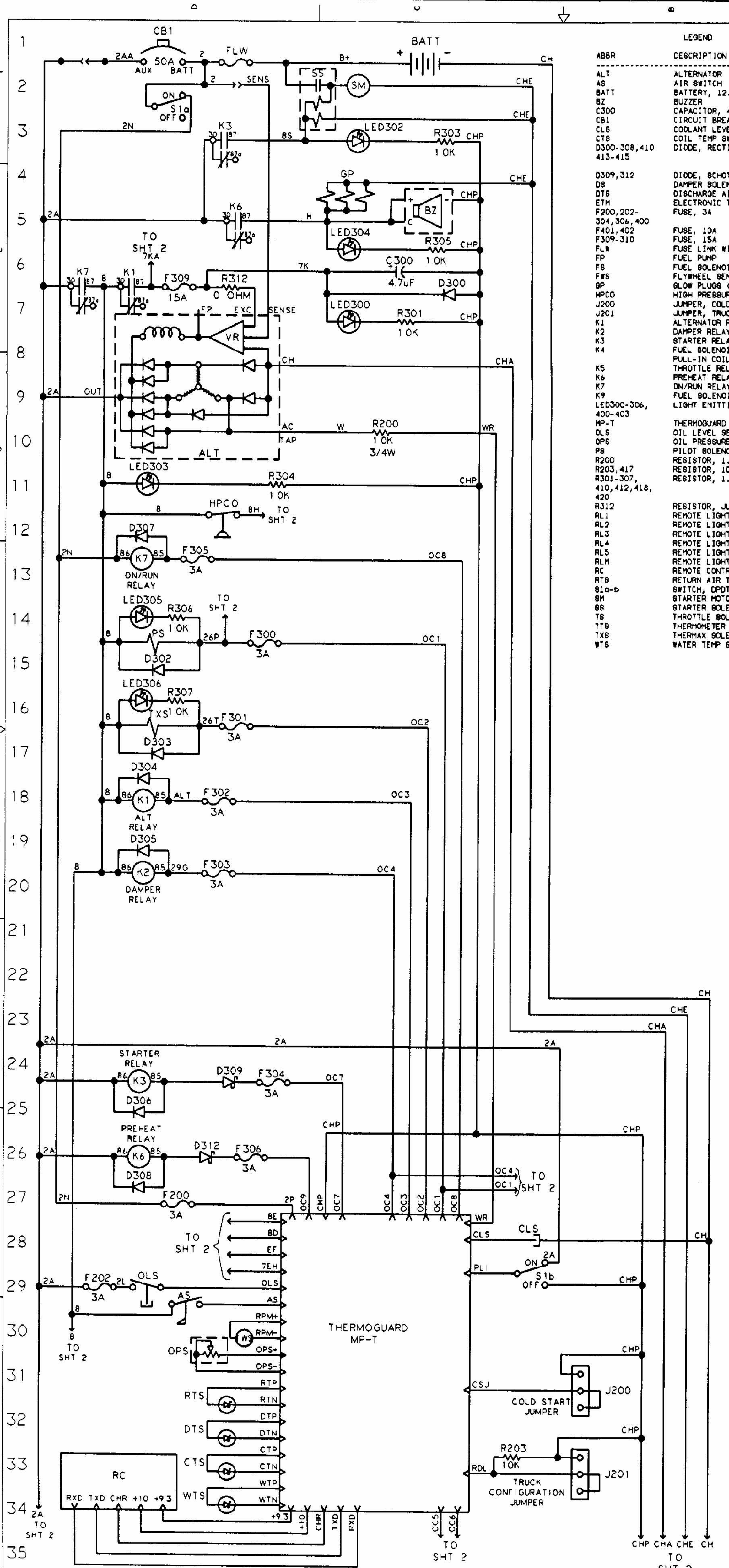

LEGEND

ABBR	DESCRIPTION	AREA
ALT	ALTERNATOR	9
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BATT	BATTERY, 12.6V	1
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DEFAULT (FACTORY) SETTINGS
USER ACCESS/GUARDED ACCESS/SUPER GUARDED ACCESS

FUNCTION	EEC	DOMESTIC
CYCLS	no	no
bLIt	lo	lo
dFI	4	4
ddr	45	45
* CrA	x	x
* CdA	x	x
dE	C	F
St1	YES	no
OIL	bAr	PSI
HSPd	YES	YES
HSd	YES	YES
LSS	no	no
rUnd	no	no
rdSP	nor	nor
StL	-29	-20
StH	27	80

* FOR CrA & CdA THE ACTUAL SENSOR GRADES FOR THE RETURN AIR & DISCHARGE AIR SENSORS ARE THE CORRECT VALUES

DESCRIPTION OF MP-T OUTPUTS

- OC1 - CONTROL SIGNAL FOR PILOT SOLENOID
- OC2 - CONTROL SIGNAL FOR THERMAX SOLENOID
- OC3 - CONTROL SIGNAL FOR ALTERNATOR RELAY
- OC4 - CONTROL SIGNAL FOR DAMPER RELAY
- OC5 - CONTROL SIGNAL FOR MOTOR CONTACTOR & FUEL SOLENOID
- OC6 - CONTROL SIGNAL FOR THROTTLE & HEATER CONTACTOR
- OC7 - CONTROL SIGNAL FOR STARTER RELAY
- OC8 - CONTROL SIGNAL FOR ON/RUN RELAY
- OC9 - CONTROL SIGNAL FOR PREHEAT RELAY

THERMO KING CORPORATION

SCHEMATIC DIAGRAM KD-MD-RD-TD 30 SR

REF 5D45077

5D45075 C

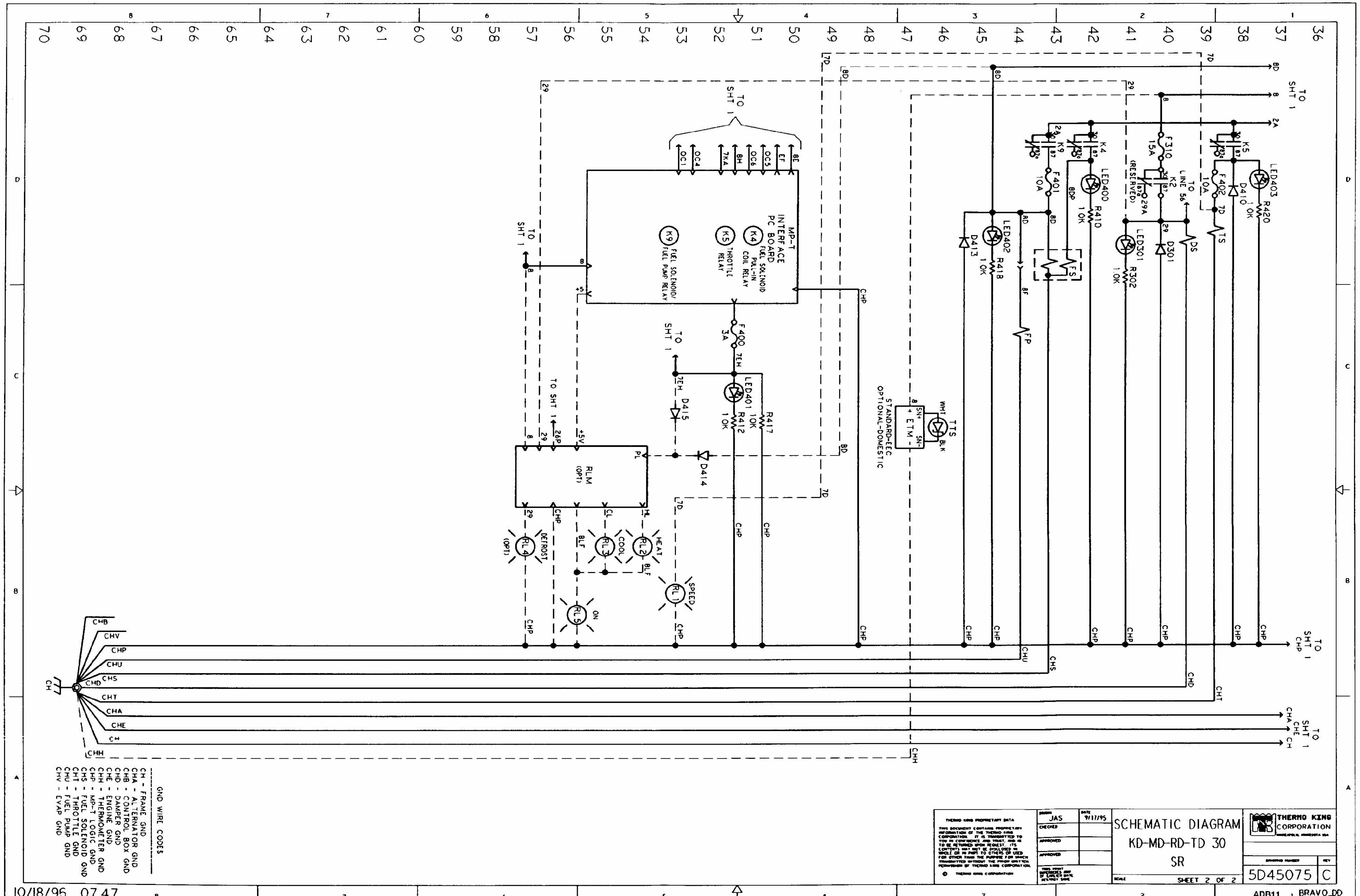
SHEET 1 OF 2

JAS 9/17/95 · GP 1/31/96 · JS 1/17/96

REVISIONS
66751 JAS 1/8/96 JS A RELEASED
67721 TMN 2/5/96 JPS B ADDED RL5
68419 MSR 8/20/96 — C ADDED CHB CIRCUIT TO GROUND

10/18/96 07 44

ADB10 BRAVO_DD


GND WIRE CODES
CH - FRAME GND
CHA - ALTERNATOR GND
CHB - CONTROL BOX GND
CHD - DAMPER GND
CHE - ENGINE GND
CHH - THERMOMETER GND
CHP - MP-T LOGIC GND
CHS - FUEL SOLENOID GND
CHT - THROTTLE GND
CHU - FUEL PUMP GND
CHV - EVAP GND
MP-T INTERFACE PC BOARD
RLM (OPT)
STANDARD-EEC OPTIONAL-DOMESTIC
SCHEMATIC DIAGRAM
KD-MD-RD-TD 30
SR
THERMO KING CORPORATION
JAS
9/17/95
SHEET 2 OF 2
5D45075
C
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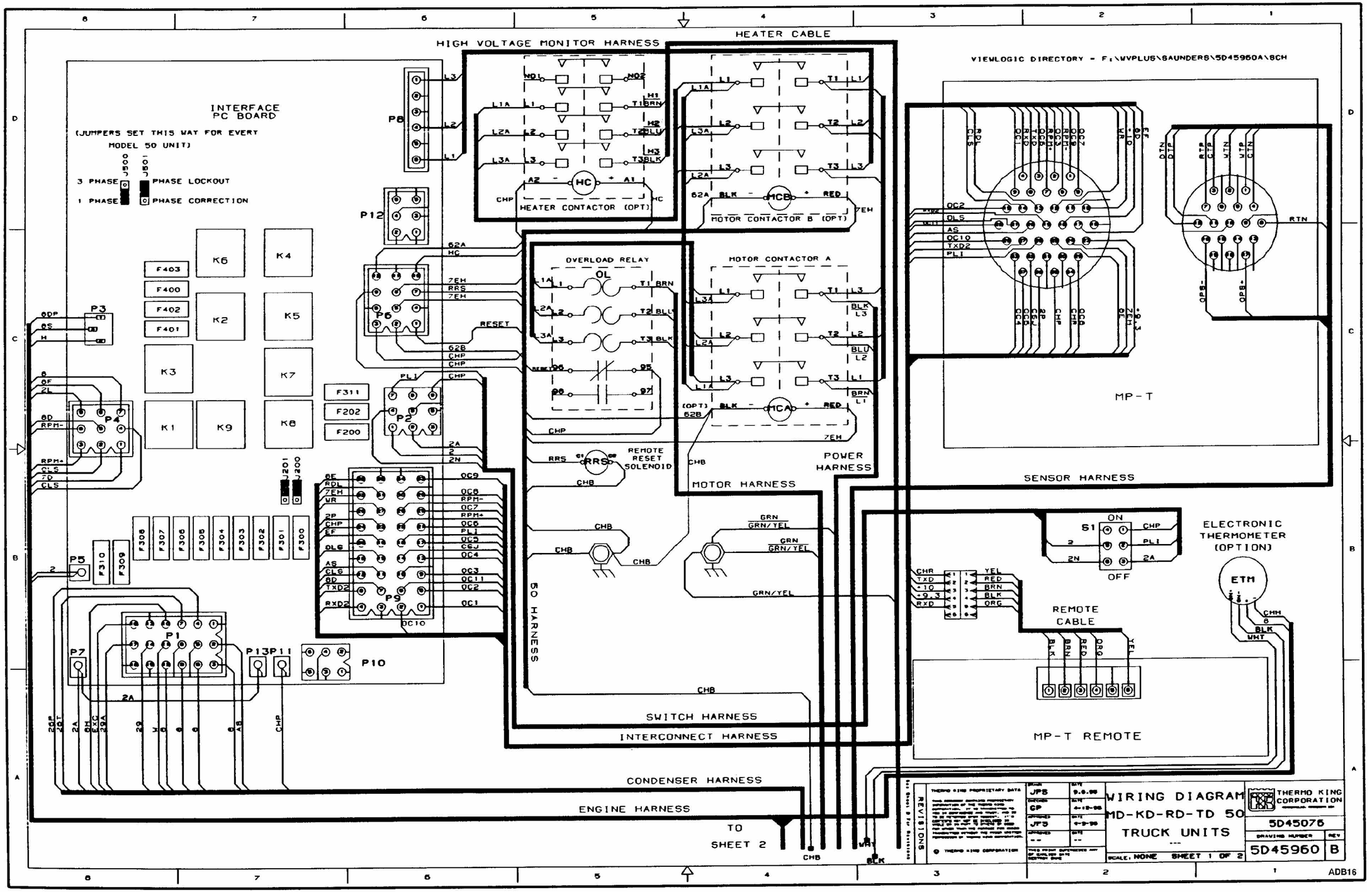
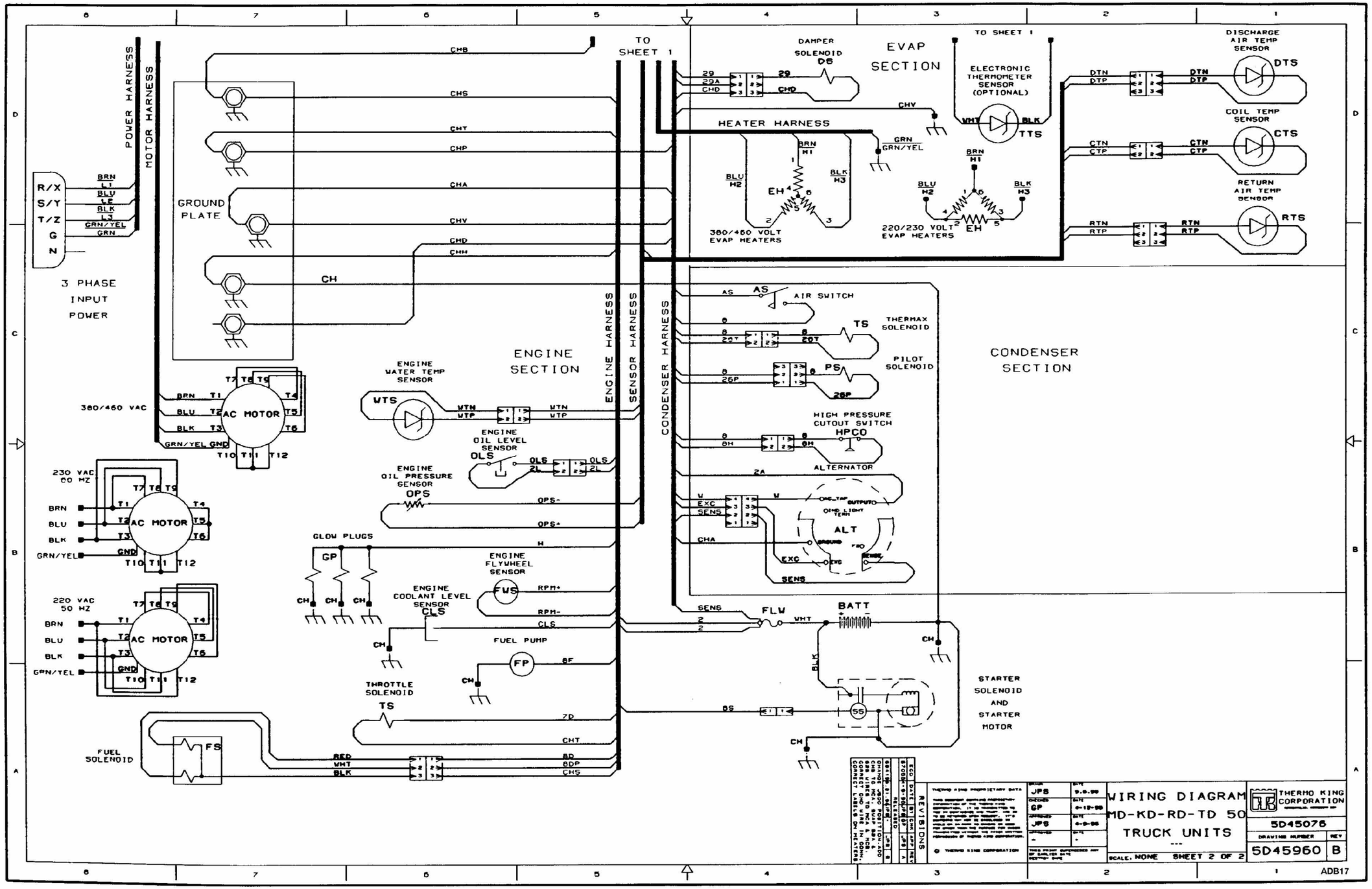
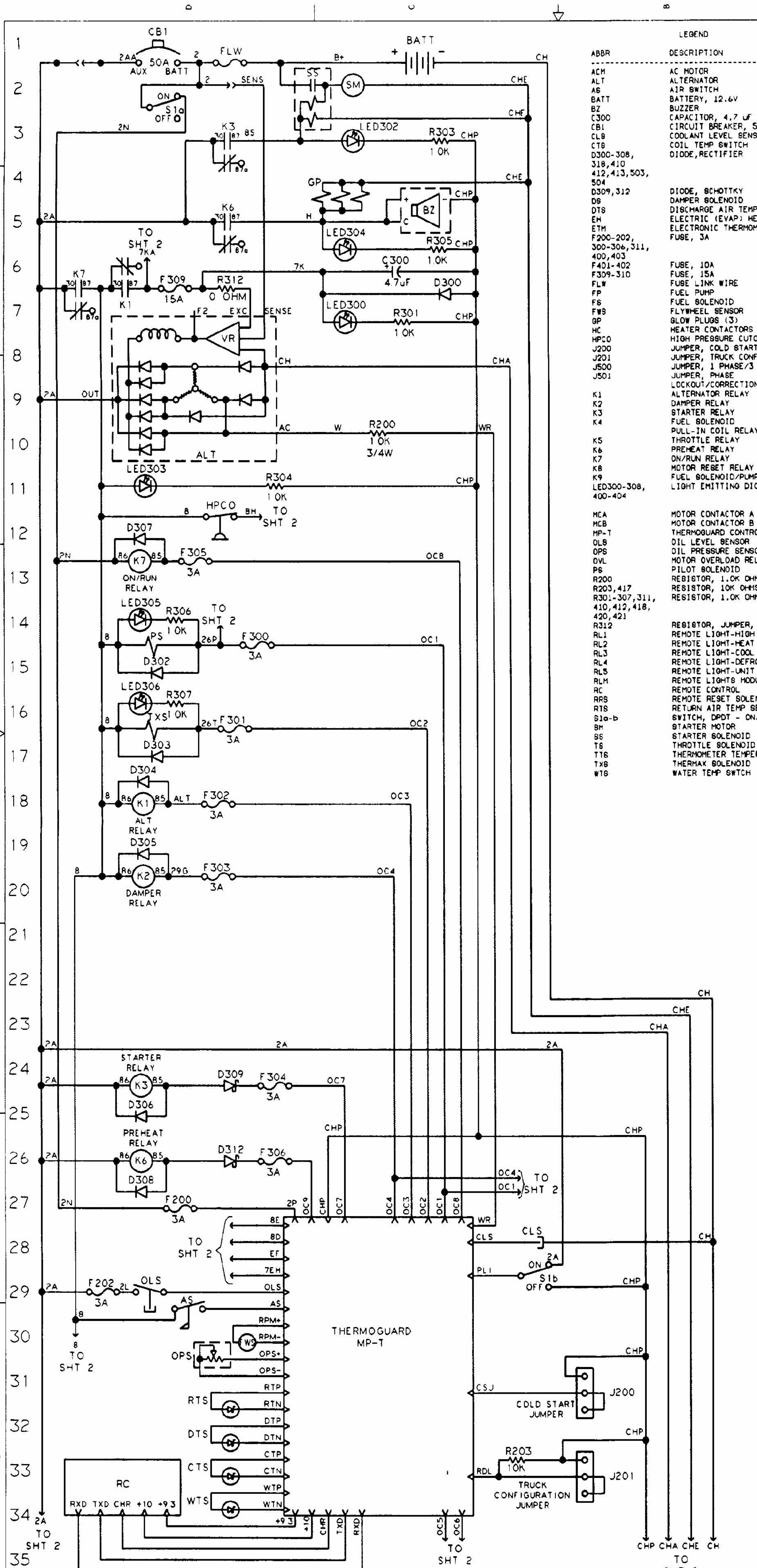
ADB11 , BRAVO_DD


HIGH VOLTAGE MONITOR HARNESS
HEATER CABLE
VIEWLOGIC DIRECTORY - F:\WVPLUS\SAUNDERS\5D45960A\SCH
INTERFACE PC BOARD
(JUMPERS SET THIS WAY FOR EVERY MODEL 50 UNIT)
3 PHASE
1 PHASE
PHASE LOCKOUT
PHASE CORRECTION
HEATER CONTACTOR (OPT)
MOTOR CONTACTOR B (OPT)
OVERLOAD RELAY
MOTOR CONTACTOR A
REMOTE RESET SOLENOID
POWER HARNESS
MOTOR HARNESS
50 HARNESS
SWITCH HARNESS
INTERCONNECT HARNESS
CONDENSER HARNESS
ENGINE HARNESS
TO SHEET 2
MP-T
SENSOR HARNESS
ELECTRONIC THERMOMETER (OPTION)
ETM
REMOTE CABLE
MP-T REMOTE
WIRING DIAGRAM
MD-KD-RD-TD 50
TRUCK UNITS
THERMO KING CORPORATION
5D45076
5D45960
B
SHEET 1 OF 2
ADB16


POWER HARNESS
MOTOR HARNESS
R/X
S/Y
T/Z
G
N
BRN L1
BLU L2
BLK L3
GRN/YEL
GRN
3 PHASE INPUT POWER
GROUND PLATE
CHB
CHS
CHT
CHP
CHA
CHV
CHD
CHH
CH
TO SHEET 1
DAMPER SOLENOID
DS
29
29A
CHD
EVAP SECTION
TO SHEET 1
ELECTRONIC THERMOMETER SENSOR (OPTIONAL)
WHT
BLK
TTS
HEATER HARNESS
BRN H1
BLU H2
BLK H3
EH
380/460 VOLT EVAP HEATERS
220/230 VOLT EVAP HEATERS
GRN/YEL
DISCHARGE AIR TEMP SENSOR
DTS
DTN
DTP
COIL TEMP SENSOR
CTS
CTN
CTP
RETURN AIR TEMP SENSOR
RTS
RTN
RTP
ENGINE HARNESS
SENSOR HARNESS
CONDENSER HARNESS
ENGINE SECTION
CONDENSER SECTION
380/460 VAC
230 VAC 60 HZ
220 VAC 50 HZ
AC MOTOR
BRN
BLU
BLK
GRN/YEL
GND
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
ENGINE WATER TEMP SENSOR
WTS
WTN
WTP
ENGINE OIL LEVEL SENSOR
OLS
2L
ENGINE OIL PRESSURE SENSOR
OPS
OPS-
OPS+
GLOW PLUGS
GP
H
ENGINE FLYWHEEL SENSOR
FWS
RPM+
RPM-
ENGINE COOLANT LEVEL SENSOR
CLS
FUEL PUMP
FP
6F
THROTTLE SOLENOID
TS
7D
CHT
FUEL SOLENOID
FS
RED
WHT
BLK
8R
8DP
CHS
AIR SWITCH
AS
20T
THERMAX SOLENOID
PS
26P
PILOT SOLENOID
HIGH PRESSURE CUTOUT SWITCH
HPCO
8H
ALTERNATOR
2A
EXC
SENS
ALT
CHA
FLW
VHT
BATT
STARTER SOLENOID AND STARTER MOTOR
8S
SS
REVISIONS
THERMO KING PROPRIETARY DATA
WIRING DIAGRAM
MD-KD-RD-TD 50
TRUCK UNITS
THERMO KING CORPORATION
5D45078
5D45960
B
SCALE. NONE
SHEET 2 OF 2
ADB17



LEGEND

ABBR	DESCRIPTION	AREA
ACM	AC MOTOR	61
ALT	ALTERNATOR	9
AS	AIR SWITCH	29
BATT	BATTERY, 12.6V	1
BZ	BUZZER	4
C300	CAPACITOR, 4.7 uF	6
CB1	CIRCUIT BREAKER, 50A	1
CLS	COOLANT LEVEL SENSOR	28
CTS	COIL TEMP SWITCH	33
D300-308, 318,410 412,413,503, 504	DIODE,RECTIFIER	6,12,15,17,17, 19,25,26,37,39, 45,47,49,53,55
D309,312	DIODE, SCHOTTKY	24,26
DS	DAMPER SOLENOID	39
DTS	DISCHARGE AIR TEMP SENSOR	32
EH	ELECTRIC (EVAP) HEATERS	64,64
ETM	ELECTRONIC THERMOMETER (OPT)	41
F200-202, 300-306,311, 400,403	FUSE, 3A	12,14,16,18 19,24,26,27, 29,46,50,51
F401-402	FUSE, 10A	38,43
F309-310	FUSE, 15A	6,39
FLW	FUSE LINK WIRE	1
FP	FUEL PUMP	44
FS	FUEL SOLENOID	43
FWS	FLYWHEEL SENSOR	30
GP	GLOW PLUGS (3)	4,4,4
HC	HEATER CONTACTORS (OPT)	50,64
HPCO	HIGH PRESSURE CUTOUT SWITCH	11
J200	JUMPER, COLD START	31
J201	JUMPER, TRUCK CONFIGURATION	33
J500	JUMPER, 1 PHASE/3 PHASE	55
J501	JUMPER, PHASE LOCKOUT/CORRECTION	54
K1	ALTERNATOR RELAY	6,18
K2	DAMPER RELAY	19,39
K3	STARTER RELAY	3,24
K4	FUEL SOLENOID PULL-IN COIL RELAY	42,51
K5	THROTTLE RELAY	37,51
K6	PREHEAT RELAY	5,26
K7	ON/RUN RELAY	6,12
K8	MOTOR RESET RELAY	46,52
K9	FUEL SOLENOID/PUMP RELAY	43,53
LED300-308, 400-404	LIGHT EMITTING DIODE (RED)	3,5,7,11,14,15 37,40,42,44,46, 48,51
MCA	MOTOR CONTACTOR A	52,61
MCB	MOTOR CONTACTOR B (OPT)	54,59
MP-T	THERMOGUARD CONTROLLER	38
OLS	OIL LEVEL SENSOR	29
OPS	OIL PRESSURE SENSOR	30
OVL	MOTOR OVERLOAD RELAY	48,61
PS	PILOT SOLENOID	14
R200	RESISTOR, 1.0K OHMS, 3/4W	9
R203,417	RESISTOR, 10K OHMS	32,50
R301-307,311, 410,412,418, 420,421	RESISTOR, 1.0K OHMS	3,5,7,11,14,15 37,40,42,44,46, 48,51
R312	RESISTOR, JUMPER, 0 OHMS	6
RL1	REMOTE LIGHT-HIGH SPEED (OPT)	54
RL2	REMOTE LIGHT-HEAT MODE (OPT)	55
RL3	REMOTE LIGHT-COOL MODE (OPT)	56
RL4	REMOTE LIGHT-DEFROST MODE (OPT)	57
RL5	REMOTE LIGHT-UNIT ON (OPT)	59
RLM	REMOTE LIGHTS MODULE (OPT)	55
RC	REMOTE CONTROL	33
RRS	REMOTE RESET SOLENOID	47
RTS	RETURN AIR TEMP SENSOR	31
S1a-b	SWITCH, DPDT - ON/OFF	2,28
SM	STARTER MOTOR	2
SS	STARTER SOLENOID	2
TS	THROTTLE SOLENOID	38
TTS	THERMOMETER TEMPERATURE SENSOR	41
TXS	THERMAX SOLENOID	16
WTS	WATER TEMP SWTCH	33

DEFAULT (FACTORY) SETTINGS
USER ACCESS/GUARDED ACCESS/SUPER GUARDED ACCESS

FUNCTION	EEC	DOMESTIC
CYCLS	no	no
bLlt	lo	lo
dFI	4	4
ddr	45	45
* CrA	x	x
* CdA	x	x
dE	C	F
St I	YES	no
OIL	bAr	PSI
HSPd	YES	YES
HSd	YES	YES
LSS	no	no
rUnd	no	no
rdSP	nor	nor
SIL	-29	-20
SIH	27	80

*FOR CrA & CdA THE ACTUAL SENSOR GRADES FOR THE RETURN AIR & DISCHARGE AIR SENSORS ARE THE CORRECT VALUES

DESCRIPTION OF MP-T OUTPUTS

- OC1 - CONTROL SIGNAL FOR PILOT SOLENOID
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REVISIONS				
66751	JAS	1/9/96	JS	A
RELEASED				
67721	TMN	2/5/96	JS	B
ADDED RL5				
68419	MSR	8/21/96	-	C
CORRECTED MCA & MCB CIRCUITS				

THERMO KING PROPRIETARY DATA. THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF THE THERMO KING CORPORATION. © THERMO KING CORPORATION

DRAWN JAS	DATE 9/17/95	
CHECKED GP	1/18/96	
APPROVED JS	1/17/96	

SCHEMATIC DIAGRAM KD-MD-RD-TD 50 SR

THERMO KING CORPORATION

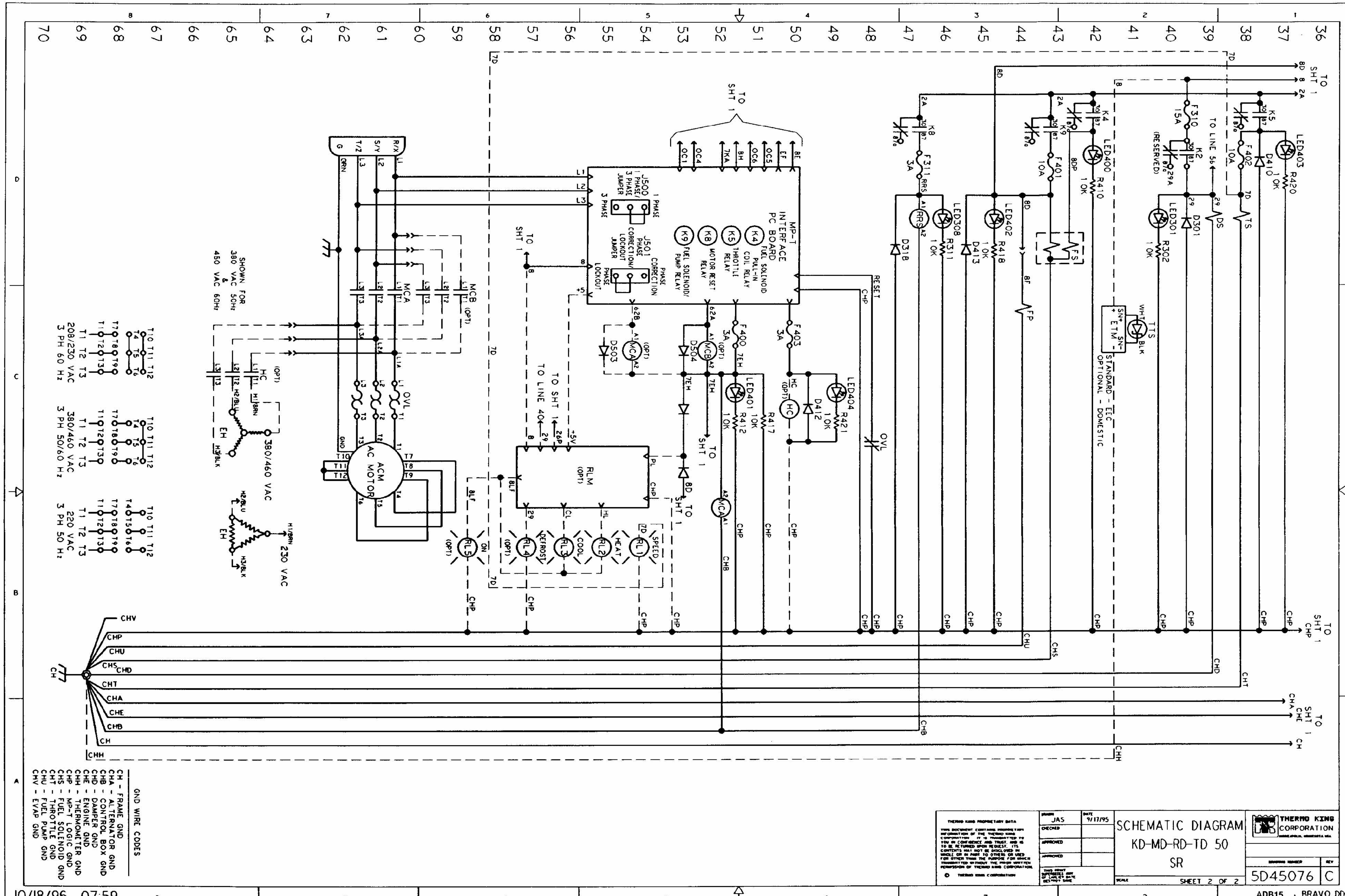
REF 5D45078

5D45076 C

SHEET 1 OF 2

ADB14 : BRAVO_DD

10/18/96 07 56


SCHEMATIC DIAGRAM
KD-MD-RD-TD 50
SR
THERMO KING CORPORATION
SHEET 2 OF 2
5D45076
C
10/18/96 07:59
ADB15 , BRAVO_DD
GND WIRE CODES
CH - FRAME GND
CHA - ALTERNATOR GND
CHB - CONTROL BOX GND
CHD - DAMPER GND
CHE - ENGINE GND
CHH - THERMOMETER GND
CHP - MP-T LOGIC GND
CHS - FUEL SOLENOID GND
CHT - THROTTLE GND
CHU - FUEL PUMP GND
CHV - EVAP GND