



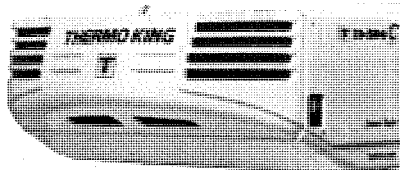
THERMO KING

Operator's Manual

TS-200, 300, 500 Series

TK 50773-1-OP (Rev. 5, 08/03)





TS-200, 300, 500 Series

TK 50773-1-OP (Rev. 5, 08/03)

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The procedures described herein should be undertaken only by qualified personnel. Failure to implement these procedures correctly may cause damage to the Thermo King unit or other property or personal injury.

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Introduction

There is nothing complicated about operating and maintaining your Thermo King unit, but a few minutes studying this manual will be time well spent.

Performing pre-trip checks and enroute inspections on a regular basis will minimize on-the-road operating problems. A regular maintenance program will also help to keep your unit in top operating condition. If factory recommended procedures are followed, you will find that you have purchased the most efficient and dependable temperature control system available.

All service requirements, major and minor, should be handled by a Thermo King dealer for four very important reasons:

- They are equipped with the factory recommended tools to perform all service functions
- They have factory trained and certified technicians
- They have genuine Thermo King replacement parts
- The warranty on your new unit is valid only when the repair and replacement of component parts is performed by an authorized Thermo King dealer.

IMPORTANT: This manual is published for informational purposes only and the information furnished herein should not be considered as all-inclusive or meant to cover all contingencies. If more information is required, consult your Thermo King Service Directory for the location and telephone number of the local dealer.

Safety Precautions

Thermo King recommends that all services be performed by a Thermo King dealer. However, there are several general safety practices which you should be aware of:



DANGER: *Never operate the unit with the compressor discharge valve closed because it could cause the compressor to explode, causing death or serious injury.*



WARNING: *Always wear goggles or safety glasses when working with or around the refrigeration system or battery. Refrigerant or battery acid can cause permanent damage if it comes in contact with your eyes.*



WARNING: *Keep hands and loose clothing clear of fans and belts at all times when the unit is operating or when opening or closing compressor service valves.*



WARNING: *Exposed coil fins can cause painful lacerations. Service work on the evaporator or condenser coils is best left to a certified Thermo King technician.*



CAUTION: *Use extreme caution when drilling holes in the unit. Drilling into electrical wiring or refrigerant lines could cause a fire. Never drill into structural components.*

Automatic Start/Stop Operation

This unit is capable of automatic operation and may start at any time without prior warning.



WARNING: *The unit may start at any time when the controller is turned on. The controller display lights up when the controller is turned on.*

Safety Precautions



WARNING: Units equipped with electric standby may start at any time when the unit is connected to live electric power and the controller is turned on.



WARNING: Be sure to press the OFF key to turn the controller off before opening doors or inspecting any part of the unit.

Electrical Hazard



CAUTION: Be sure to turn off the high voltage power supply, and disconnect the electric cable before working on the unit. Units with electric standby present a potential electrical hazard.

Refrigerant

Although fluorocarbon refrigerants are classified as safe, observe caution when working with refrigerants or around areas where they are being used in the servicing of your unit.



DANGER: Fluorocarbon refrigerants may produce toxic gases. In the presence of an open flame or electrical short, these gases are severe respiratory irritants **CAPABLE OF CAUSING DEATH.**



DANGER: Fluorocarbon refrigerants tend to displace air and can cause oxygen depletion which could result in **DEATH BY SUFFOCATION.** Provide adequate ventilation in enclosed or confined areas.



WARNING: Fluorocarbon refrigerants evaporate rapidly, freezing anything they contact if accidentally released into the atmosphere from the liquid state.

Refrigerant Oil

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



WARNING: Always wear goggles or safety glasses to protect eyes from refrigerant oil contact.

Safety Precautions



WARNING: *Protect skin and clothing from prolonged or repeated contact with refrigerant oil. Rubber gloves are recommended.*



WARNING: *Wash thoroughly immediately after handling refrigerant oil to prevent irritation.*

First Aid

First Aid—Refrigerant

Eyes: For contact with liquid, immediately flush eyes with large amounts of water. Get prompt medical attention.

Skin: Flush areas with large amounts of warm water. Do not apply heat. Wrap burns with dry, sterile, bulky dressing to protect from infection or injury. Get prompt medical attention.

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

First Aid—Refrigerant Oil

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

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

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

Ingestion: Do not induce vomiting. Immediately contact local poison control center or physician.

Safety Decals and Locations

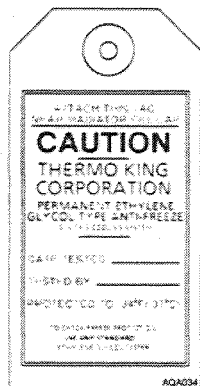


Figure 1: Antifreeze Caution
(Attached near radiator fill cap.)

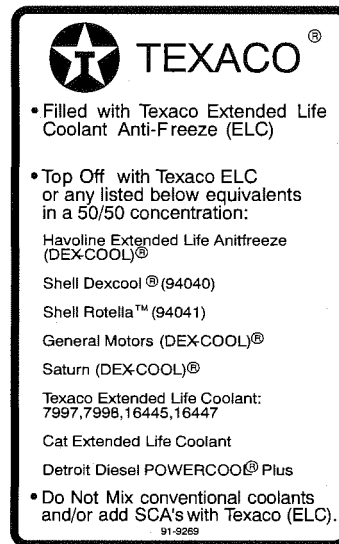
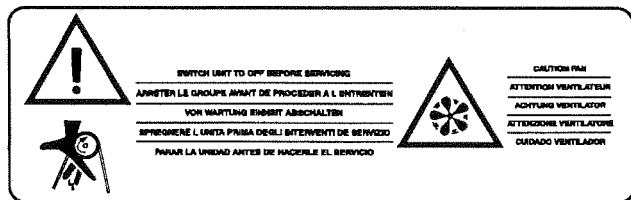


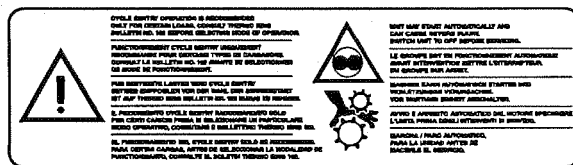
Figure 2: ELC (Extended Life Coolant) Nameplate
(Located On Expansion Tank In Units Equipped With ELC)

Safety Precautions



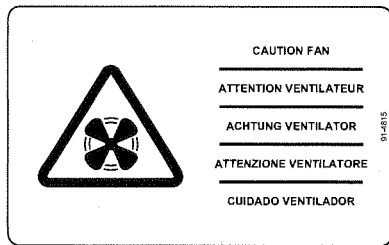
AKA98

Figure 3: Belt Caution (Locations vary depending on model. Decals are located near areas that contain belts and fans which can cause severe injuries if hands or clothing become tangled.)



AKA99

Figure 4: Automatic Start Caution (Locations vary depending on model. Decals are located near areas that contain moving parts which can cause severe injuries if hands or clothing become tangled when the unit automatically starts.)



ARA183

Figure 5: Fan Caution (Locations vary depending on model. Decals are located near areas that contain fans which can cause severe injuries if hands or clothing become tangled.)

Model 50 Units (Electric Standby)

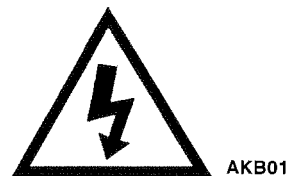


Figure 6: Electrical Hazard (Locations vary depending on model. Typically located near power receptacle, high voltage tray cover and interface board.)

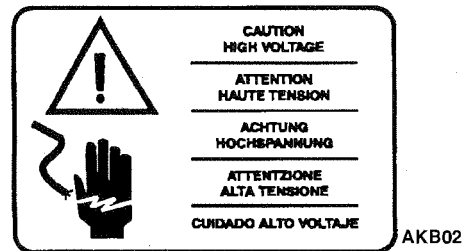


Figure 7: High Voltage Caution (Located near high voltage box.)

Emission Control

In compliance with the California ULG (Utility, Lawn and Garden) Rules, the following information is provided:

1. Selection Of Fuel Oil: Use diesel fuel only.

2-1. Modification To Any Engine Component:

Modifications to any engine component which may cause engine exhaust emission output changes are not allowed.

Any engine modification not in compliance with regulation will be the responsibility of the engine manufacturer, dealer or customer who made the modification.

2-2. Air Induction System: Air induction system must remain intact and receive regular prescribed maintenance.

Example: Air cleaner element replacement at required operation hour interval.

2-3. Exhaust System: Exhaust system must remain intact and cannot be modified in any manner that will further restrict exhaust flow.

2-4. Fuel Oil System: Fuel oil system must remain intact and receive regular prescribed maintenance. *Example:* Fuel filter replacement at required operation hour interval.

3. Engine Identification: With the forthcoming engine emission regulation worldwide, engines must be identified in a manner that will determine when they were built and what regulations they comply with. The engine must be labeled with an emission control label and the engine family name, both described below.

Emission Control

- a. Emission control label: a new label, shown in Figure 8, contains important engine information.

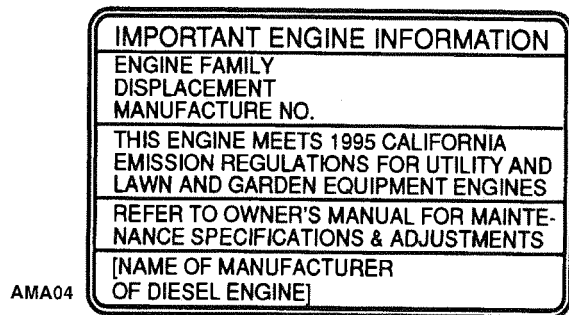


Figure 8: Emission Control Label

- b. Engine Family Name, as assigned by the California Air Resources Board, identifies engine family group, by largest displacement, within an engine family, and is shown in Figure 9.

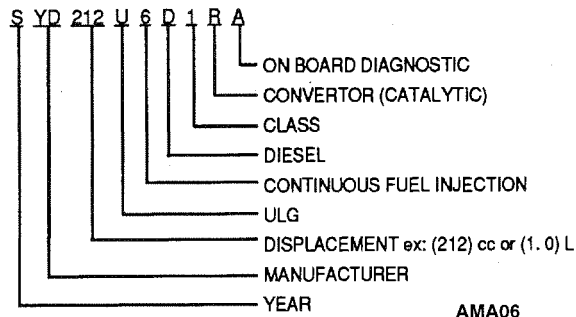


Figure 9: Engine Family Name

Emission Control

3-1 Emission Control Labels: Emission control labels are a requirement of the California ULG Rules. In the event the emission control label provided on the engine is inaccessible, there will be a supplemental label containing the same information, provided by the equipment manufacturer, located in a readily accessible location, shown in Figure 10:

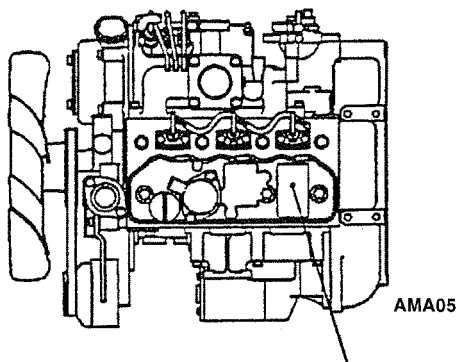


Figure 10: Emission Control Label Location

All engine labels and supplementary labels will contain the following information:

- Engine Family Name
- Displacement
- Manufacturer

The above information, along with the engine serial number, will be required to obtain proper service information and correct service repair parts. An example list which identifies the exhaust control system is shown in Figure 11.

<u>ENGINE MODEL</u>	<u>ENGINE FAMILY NAME</u>	<u>THE EMISSION CONTROL SYSTEM</u>
1) 2TN66C / 2TNE66KC	SYD493U6D2RA	IFI: INDIRECT FUEL INJECTION
2) 3TN66C/3TNE66KC	SYD739U6D2RA	IFI
3) 3TNE68C	SYD784U6D2RA	IFI
4) 3TNA72C/3TNE72KC/ 3TNE74	SYD1.0UGD2RA	IFI
5) 3TNE78AC / 3TNE82AC	SYD1.3U6D2RA	EM
6) 3TNE82C	SYD1. 4U6D2RA	EM
7) 3TNE84C / 3TNE88C	SYD1. 6U6D2RA	EM
8) 3TNE84TC	SYD1. 5U6D2RA	TC: TURBO CHARGER
9) 4TNE82C	SYD1. 9U6D2RA	EM
10) 4TNE84C / 4TNE88C	SYD2. 2U6D2RA	EM

EM : Design parameters to bring engine family into compliance were utilized, no after treatment measures incorporated.

AMA07

Figure 11: Exhaust Control System Example List

Emission Control

4. Emission Control Related Parts: The California ULG Rules require a manufacturing defect warranty on all emission control parts, including:

- Fuel Injection Pump
- Fuel Injection Nozzle
- High Pressure Oil Line
- Air Cleaner Element¹
- Fuel Filter Element¹
- Air Cleaner Gasket
- Air Intake Pipe (Manifold) Gasket
- Muffler Gasket

The warranty period is two years and complete details are included in the section of this manual titled “*California Emission Control System Warranty Statement, Your Warranty Rights And Obligations.*”

¹Any warranted part which is scheduled for replacement as required maintenance shall be warranted for the period of time up to the first scheduled replacement point for that part.

5. Maintenance Schedule: To maintain optimum engine performance and compliance with the California ULG Rules, the maintenance schedule must be adhered to.

Regular scheduled maintenance is the major key to engine service life and emission regulation compliance. Scheduled maintenance requirements must be performed regularly. See the Maintenance Schedule provided in this Operator’s Manual.

California Emission Control System Warranty Statement

Your Warranty Rights And Obligations

The California Air Resources Board and Thermo King are pleased to explain the California emission control system warranty on your 1996 and later utility equipment (ULG) engine. In California, new utility equipment (ULG) engines must be designed, built, and equipped to meet the state’s stringent anti-smog standards. Thermo King must warrant the California emission control system on your utility equipment

Emission Control

(ULG) engine for the time listed below, provided there has been no abuse, neglect or improper maintenance of your utility equipment (ULG) engine.

Your California emission control system includes parts such as the fuel injection pump, the fuel injection nozzle, and the high-pressure fuel line. Also included are the air filter element and the fuel filter element which are covered under this California emission control system warranty only up to the first scheduled maintenance replacement.

Where a warrantable condition exists, Thermo King will repair your utility equipment (ULG) engine with California emission control system parts or components at no cost to you, including diagnosis, parts and labor.

Manufacturer's Warranty Coverage

1996 and later utility equipment (ULG) engines: California emission control system parts and components are warranted for the period of two years (24 months). If any California emission control system part or component on your utility equipment (ULG) engine is defective, the part or component will be repaired or replaced by Thermo King.

Owner's Warranty Responsibilities

As the utility equipment (ULG) engine owner, you are responsible for the performance of the required maintenance listed in this Operator's Manual. Thermo King recommends that you retain all receipts covering maintenance on your utility equipment (ULG) engine, but Thermo King cannot deny warranty solely for the lack of receipts or your failure to ensure the performance of all scheduled maintenance.

As the utility equipment (ULG) engine owner, you should be aware that Thermo King may deny you warranty coverage if your utility equipment (ULG) engine, or a part or component, has failed due to abuse, neglect, improper maintenance, or unapproved modifications.

You are responsible for presenting your utility equipment (ULG) engine to an authorized Thermo King dealer as soon as a problem exists. The emission control system parts or component repairs should be completed in a reasonable amount of time not to exceed 30 days.

If you have any questions regarding your warranty rights and responsibilities, contact a Thermo King service representative at 952-887-2337.

Manufacturer Explanation Of Emission Control System Warranty Coverage

A. Warranty Commencement Date

The California emission control system warranty period begins on the date the engine or equipment is delivered to the original retail purchaser.

B. Length Of Coverage

Thermo King warrants to the original purchaser, and each subsequent purchaser, that the engine emission control system is free from defects in material and workmanship that cause the failure of the warranted California emission control system part or component for a period of two years (24 months) beginning on the day the utility equipment (ULG) engine is delivered to the original purchaser.

C. What Is Covered

1. **Repair or Replacement of Parts:** Repair or replacement of any California emission control system warranted part or component will be performed at no charge to the owner

at a Thermo King authorized service dealer. To obtain the phone number of your nearest Thermo King authorized service dealer, call the Cold Line at: 952-887-2202.

2. **Warranty Period:** Any warranted California emission control system part or component that is not scheduled for replacement as required maintenance, or that is scheduled only for regular inspection to the effect of repair or replacement as necessary, shall be warranted for the warranty period. Any warranted part that is scheduled for replacement as required maintenance shall be warranted for the period of time up to the first scheduled replacement point for that part or component.
3. **Diagnosis:** The owner shall not be charged for diagnostic labor which leads to the determination that a California emission control system warranted part or component is defective, if the diagnostic work is performed at a Thermo King authorized service dealer.
4. **Consequential Damages:** Thermo King is liable for damages to other engine parts or components caused by the failure of an emission control system part or component within the above stated California emission control system warranty period.

Emission Control

D. What is Not Covered

1. Failures caused by abuse, neglect, or improper maintenance.
2. Add-On or Modified Parts. The use of add-on or modified parts can be grounds for disallowing a warranty claim. Thermo King is not liable for failures of emission control system parts or components caused by the use of add-on or modified parts.
3. Use of fuel other than the California Title 13, CCR Section 2282 (g)(3), low sulfur, low aromatic, with a cetane number of 48 minimum, will nullify this warranty.

E. How to File a Claim

Warranty claims for California emission control system parts or components are to be filed by the Thermo King authorized servicing dealer on behalf of the engine owner.

F. Where to Get Warranty Service

Warranty service or repairs shall be provided at all Thermo King authorized service dealers. You can generally find dealers in the Yellow Pages of your regional telephone directory, or

call the customer service representative at 888-887-2202 for the location of the nearest Thermo King authorized service dealer.

G. Maintenance, Replacement and Repair of Emission Control System Related Parts

Any Thermo King approved replacement part can be used in the performance of any warranty maintenance or repairs on emission control system parts or components, and must be provided without charge to the owner if the part is still under the California emission control system warranty.

H. Emission Control System Warranty Parts List

- Part Name
- Fuel Injection Pump
- Fuel injection Nozzle
- High Pressure Fuel Oil Line
- Air Cleaner Element
- Fuel Filter Element
- Air Cleaner Gasket
- Air Intake Pipe (Manifold)

Emission Control

- Gasket Muffler Gasket

I. Maintenance Statements

The owner is responsible for the performance of the required maintenance as defined by Thermo King within this Operator's Manual.

EPA Emission Control System Warranty Statement

Thermo King warrants to the initial owner and each subsequent owner that the certified non-road diesel engine in your unit is:

1. Designed, built and equipped so as to conform, at the time of sale, with all applicable regulations adopted by the United States Environmental Protection Agency (EPA).
2. Free from defects in materials and workmanship in specific, emission-related parts for a period of five years or 3,000 hours of operation, whichever comes first, after date of delivery to the initial owner.

If an emission-related part or component fails during the warranty period, it will be repaired or replaced. Any such part or component repaired or replaced under warranty is warranted for the warranty period.

During the term of this warranty, Thermo King will provide, through a Thermo King authorized service dealer or other establishment authorized by Thermo King, repair or replacement of any warranted part at no charge to the non-road engine owner.

In an emergency, repairs can be performed at any service establishment, or by the owner, using any replacement part. Thermo King will reimburse the owner for their expenses, including diagnostic charges, for such emergency repair. These expenses shall not exceed Thermo King's suggested retail price for all warranted parts replaced, and labor charges based on Thermo King's recommended time allowance for the warranty repair and the geographically appropriate hourly labor rate.

Any replacement part can be used for maintenance or repairs. The owner should ensure that such parts are equivalent in design and durability to genuine Thermo King parts. However, Thermo King is not liable for parts which are not genuine Thermo King parts.

Emission Control

A part not being available within 30 days or repair not being completed within 30 days constitutes an emergency.

As a condition of reimbursement, replaced parts and received invoices must be presented at a place of business of a Thermo King authorized service dealer or other establishment authorized by Thermo King.

This warranty covers the following emission-related parts and components:

- Fuel Injection System
- Intake Manifold
- Exhaust Manifold
- Miscellaneous hoses, clamps, connectors and sealing devices used in the above systems.

If failure of one of these parts or components results in failure of another part or component, both will be covered by this warranty.

Responsibilities

This warranty is subject to the following:

Thermo King Corporation Responsibilities

During the emission warranty period, if a defect in material or workmanship of a warranted part or component is found, Thermo King will provide:

- New, remanufactured, or repaired parts or components required to correct the defect.

NOTE: Items replaced under this warranty become the property of Thermo King.

- Labor, during normal working hours, required to make the warranty repair. This includes diagnosis and labor to remove and install the engine, if necessary.

Owner Responsibilities

During the emission warranty period, the owner is responsible for:

- The performance of all required maintenance. A warranty claim will not be denied because the scheduled maintenance was not performed. However, if the lack of required maintenance was the reason for the repair, then the claim will be denied.

Emission Control

- Premium of overtime cost.
- Cost to investigate complaints that are not caused by defect in Thermo King material or workmanship.
- Providing timely notice of a warrantable failure and promptly making the product available for repair.

Remedies under this warranty are limited to the provision of material and services as specified herein. Thermo King is not responsible for incidental or consequential damages such as downtime or loss of engine-powered equipment.

Limitations

Thermo King is not responsible for resultant damages to an emission-related part or component resulting from:

- Any application or installation Thermo King deems improper as explained in this Operator's Manual, or any other manuals provided with the unit.
- Attachments, accessory items, or parts not authorized for use by Thermo King.
- Improper off-road engine maintenance, repair, or abuse.
- Owner's unreasonable delay in making the product available after being notified of a potential product problem.

This warranty is in addition to Thermo King's standard warranty applicable to the off-road engine product involved.

Unit Description

General Description

The TS-200, TS-300 and TS-500 units are microprocessor based transport temperature control systems that use the ThermoGuard® μ P-T microcontroller to manage system functions.

The units are one-piece, front-mounted, diesel powered cooling and heating systems designed for straight trucks. The units mount on the front of a truck with the evaporator portion protruding into the box. They are designed for use with chlorine free R-404A refrigerant. The basic models provide the following:

Model 30: Cooling and hot gas heating on engine operation.

Model 50: Cooling and hot gas heating on engine operation and electric standby operation. Electric evaporator heaters are optional.

Engine power for the unit is provided by a diesel engine. Optional electric standby power (Model 50) is provided by an electric motor. A clutch on the diesel engine isolates the engine during electric standby operation.

The continuous monitoring function of the μ P-T microprocessor optimizes the unit's performance, thereby reducing fuel consumption and unit down time. The unit has a self check feature that can be run before the daily distribution route to identify possible malfunctions. The 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 allow you to tailor performance to the load you are hauling.

Design Features

- Air Cleaner, Dry Type
- Air Switch
- Alarm Code Display
- Alternator, 23 amp
- Automatic Phase Correction (Model 50)
- Battery Voltage Display
- Bypass Oil Filter (As of First Quarter 2001)
- Condenser Top Screen
- Continuous System Monitoring
- Coolant Expansion Tank
- Coolant Temperature Display
- Corrosion Resistant Protection
- CYCLE-SENTRY Start/Stop Controls
- Diesel/Electric Autoswitching
- Electric Hourmeter
- Engine Hourmeter
- Fahrenheit and Celsius Scales
- Fuel Filter, Spin On
- In-Cab Remote Display
- Microprocessor Controller μ P-T
- Oil Filter, Full Flow
- Oil Pressure Display
- R-404A
- Scroll Compressor
- Smart Defrost
- Stainless Steel Condenser Hardware
- Stainless Steel Evaporator Hardware
- Tapered Roller Bearing Jackshaft (Model 30)
- TherMax™ System, Defrost/Heating
- TK 3.74 Engine (TS-200 and TS-300)
- TK 3.95 Engine (TS-500)
- Total Run Hourmeter
- Unit Self Check-pretripping

Unit Options

- Bypass Oil Filter (Standard as of First Quarter 2001)
- DAS (Data Acquisition System)
- Door Switch
- Easy Read Thermometer
- Electric Heater Strips (Model 50)
- Electric Standby
- Engine Block Heater
- Evaporator Side Screens
- Fuel Tank
- Remote Light Display
- Silicone Hoses

Engine

Engine power for the TS-200 and TS-300 is provided by the TK 3.74, a three-cylinder, special clean and silent diesel engine rated at 12.6 continuous horsepower (9.4 kW) at 2450 RPM. A belt drive system transfers energy to the compressor, unit fans, and alternator.

Engine power for the TS-500 is provided by the TK 3.95, a three cylinder, special clean and silent diesel engine rated at 17.0 continuous horsepower (12.7 kW) at 2425 RPM. A belt drive system transfers energy to the compressor, unit fans and alternator.

ELC (Extended Life Coolant)

ELC (Extended Life Coolant) has been phased into these units as of the first quarter of 2001. The maintenance interval for ELC is five years or 12,000 hours. A nameplate on the coolant expansion tank identifies units with ELC (see “Safety Decals and Locations”). The new engine coolant, Texaco Extended Life Coolant, is Red instead of the previous Green or Blue-Green conventional coolants.

Unit Description

ELC cannot be used in older units. The water pump seal bellows and O-rings used in older units are not compatible with ELC.



CAUTION: *Do not add Red Extended Life Coolants to cooling systems using Green or Blue-Green coolants. Do not add Green or Blue-Green coolants to cooling systems using Red Extended Life Coolants.*

NOTE: *The use of 50/50% pre-mixed ELC is recommended to ensure that deionized water is being used. If 100% full strength concentrate is used, deionized or distilled water is recommended instead of tap water to ensure the integrity of the cooling system is maintained.*

NOTE: *Units equipped with ELC are not necessarily equipped with EMI 2000, but units equipped with EMI 2000 are equipped with ELC.*

EMI 2000

EMI 2000 is an extended maintenance interval package. It was phased in as standard equipment on these units in the first quarter of 2001. The EMI 2000 package consists of the following key components:

- New EMI 2000-Hour Cyclonic Air Cleaner Assembly and Air Cleaner Element (standard equipment on all TS Units)
- New EMI 2000-Hour Fuel Filter (black with gold lettering)
- New EMI 2000-Hour By-Pass Oil Filter (black with gold lettering)
- API Rating CG-4 Mineral Oil
- Five Year or 12,000 Hour ELC (Extended Life Coolant)

The EMI package allows standard maintenance intervals to be extended to 2,000 hours, or 1 year, whichever occurs first.

NOTE: *Units equipped with the EMI 2000 package do require regular inspection in accordance with Thermo King's maintenance recommendations.*

Unit Description

Clutch

The centrifugal clutch engages fully at 600 ± 100 RPM on engine operation, constantly turning the compressor, alternator, and fans at both high and low speed. The clutch isolates the engine from the belt drive system during electric standby operation on Model 50 units.

Scroll Compressor

The units feature high performance TKO Scroll compressors.

ThermoGuard μ P-T Controller

The μ P-T is a solid-state, programmable microprocessor that contains integrated circuits and software to control unit operation.

The μ P-T controller uses a remote control panel and interface relay board. The remote control panel inputs data into the controller and displays operating conditions. The interface relay board contains fuses to protect control circuits and

external relays to control unit operation. When the controller is set below 15 F (-9.4 C), the microprocessor locks out high speed heat.

CYCLE-SENTRY Start/Stop System

A CYCLE-SENTRY Start/Stop fuel saving system provides optimum operating economy.



WARNING: Turn the unit off by pressing the **OFF** key before opening doors or inspecting any part of the unit. The unit can start at any time without warning if it has been turned on by pressing the **ON** key.

The CYCLE-SENTRY system automatically starts the unit on microprocessor demand and shuts down the unit when all demands are satisfied.

The system monitors and maintains the compartment temperature, the engine block temperature, and battery charge levels at a point where quick, easy starts are possible.

Defrost

Frost will gradually build up on the evaporator coils as a result of normal operation. Periodically this frost must be melted to prevent a loss of cooling and airflow.

Defrost is accomplished by passing hot refrigerant gas through the evaporator coils, thus melting the frost (or ice). Melted frost drains out of the unit onto the ground through the drain tubes. The defrost damper closes during defrost to prevent warm air from entering the cargo area. The optional electric heater strips are also energized in defrost during electric standby operation.

Defrost can be initiated at any time the evaporator coil temperature is below 42 F (5.5 C).

There are three methods of defrost initiation:

μP-T Microprocessor Controller: The Microprocessor Controller is programmed to automatically initiate timed and forced defrost cycles. The μP-T uses temperature sensors to determine if forced defrost is required.

Air Switch: The unit is equipped with an air switch to detect if the coil is blocked by frost.

Manual Defrost: Manual Defrost allows the operator to initiate a defrost cycle by pressing the **DEFROST** key. See “Initiating a Manual Defrost Cycle”.

DAS - Data Acquisition System (Optional)

The DAS (Data Acquisition System) works with the μP-T to monitor and record the temperatures of (up to) six additional sensors. The sensors are independent from the microprocessor and are normally located in the truck box to monitor load temperatures. Data from the DAS sensors and the μP-T can be downloaded through a serial port to an IBM® PC compatible computer. WinTrac™ 4.0 (or higher) software is used to view and analyze the data. Brief reports can be printed on a microprinter connected to the serial port.

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.



DANGER: High voltage AC power is present whenever the unit is operating in the 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.

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.

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.

Automatic Phase Correction (Three Phase Units Only): The control system features two motor contactors. This allows correct motor rotation regardless of phase rotation on the incoming power.

Optional Model 50 Features

The following feature is available as an option on units equipped with Electric Standby.

- Electric Heat

Engine Compartment Components

Air Restriction Indicator (if equipped): This is used with the dry element only. It is not used with the oil bath filter. The air restriction indicator is attached to the top of the air cleaner assembly. Visually inspect the restriction indicator periodically to assure the air filter is not restricted. Service the air filter when the yellow diaphragm indicates 25 in. (635 mm) of H₂O. Press the button on the top of the restriction indicator after servicing the air filter. Replace the EMI 2000 air cleaner element at 2,000 hours or 1 year (whichever occurs first) if the air restriction indicator has not reached 25 in. (635 mm).

Coolant Expansion Tank: The coolant level and temperature are monitored by the μ P-T controller. If the coolant temperature becomes too high or the level becomes too low, an alarm will occur and the engine will shut down.

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



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



CAUTION: Do not add Red Extended Life Coolants to cooling systems using Green or Blue-Green coolants. Do not add Green or Blue-Green coolants to cooling systems using Red Extended Life Coolants.

Compressor Oil Sight Glass: The compressor oil sight glass is used to check the relative level of compressor oil in the compressor sump.

Engine Oil Dipstick: Use the engine oil dipstick to check the engine oil level.

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.

Unit Protection Devices

Battery Fuse: Late model units have a battery fuse (F1), which protects the 2 circuit. This 60 amp fuse is located in a fuse holder in the 2 wire near the battery.

Circuit Breaker (CB1): CB1 is a 50 amp, auto reset circuit breaker. It protects the unit's main power circuit.

Fuses: A number of fuses are located on the interface board. The sizes and functions are shown below.

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

Fuse	Size	Function
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	10A	Motor Reset Solenoid
F400	5A	Motor Starter
F401	10A	Fuel Solenoid and Fuel Pump
F402	10A	Throttle Solenoid
F403	3A	Heater Contactor

Compressor High Temperature Cutout Switch: This temperature sensitive switch open circuits to shut down the unit if the discharge temperature rises above the switch setting.

Unit Description

Engine Coolant Level Sensor: The coolant level is monitored by the μ P-T controller. If the level becomes too low, an alarm will occur.

High Pressure Cutout: A high pressure cutout is located in the compressor discharge manifold. This pressure sensitive switch open circuits to shut down the unit if the discharge pressure rises above the switch setting.

High Pressure Relief Valve: This valve is designed to relieve excessive pressure in the refrigeration system.

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 (normal code when changing oil).

Oil Pressure Sensor: This sensor provides an oil pressure input to the microprocessor. If the oil pressure remains too low, the controller stops the unit and records an alarm.

Preheat Buzzer: The preheat buzzer sounds when the CYCLE-SENTRY system energizes the glow plugs. This should warn anyone near the unit that the CYCLE-SENTRY system is about to start the diesel engine.

Water Temperature Sensor: This sensor provides an engine coolant temperature input to the microprocessor. If the engine coolant temperature is too high, the controller stops the unit and records an alarm.

Electric Motor Overload Relay (Model 50): The overload relay protects the electric standby motor. The overload relay opens the circuit from the linestarter to the electric motor if the motor overloads for any reason and an alarm will occur. The relay resets when the alarm code is cleared.



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Figure 12: Front View

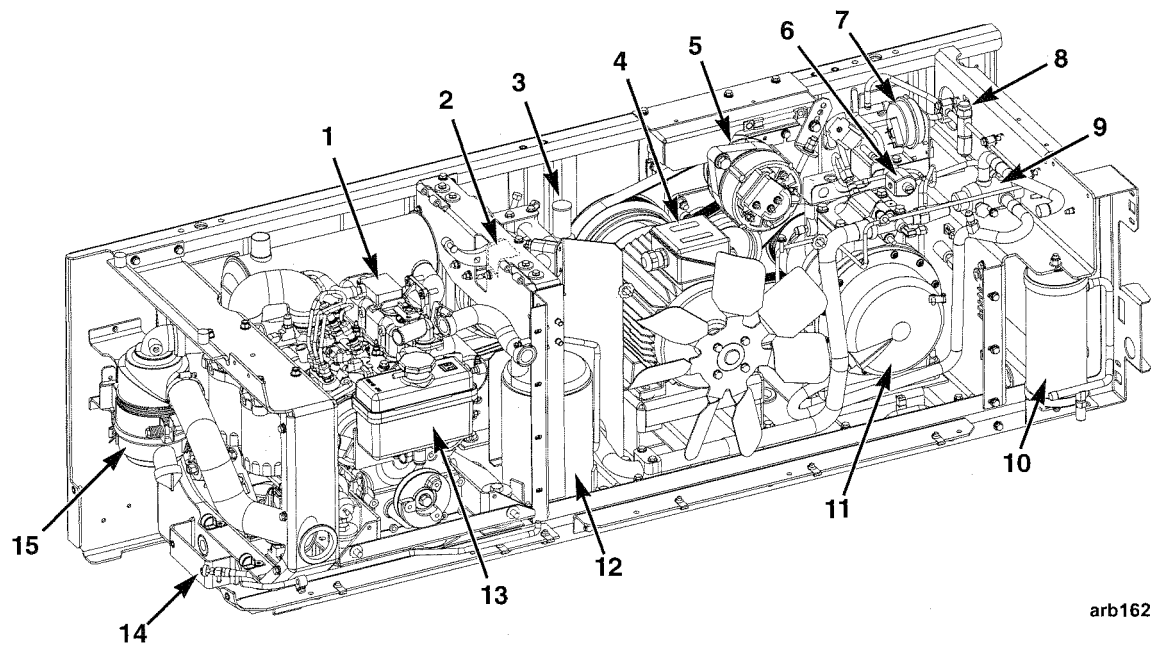


Figure 13: Engine Components TS-200 and TS-300

Unit Description

1.	Engine	8.	Liquid Injection Valve
2.	Discharge Pressure Regulator (Located Behind Accumulator)	9.	Three-way Valve
3.	Suction Pressure Regulator	10.	Receiver Tank
4.	Electric Motor	11.	Scroll Compressor
5.	Alternator	12.	Accumulator
6.	Pilot Solenoid	13.	Coolant Expansion Tank
7.	Air Switch	14.	Engine Coolant Drain
		15.	Air Cleaner

See Figure 13: “Engine Components TS-200 and TS-300” on page 40.

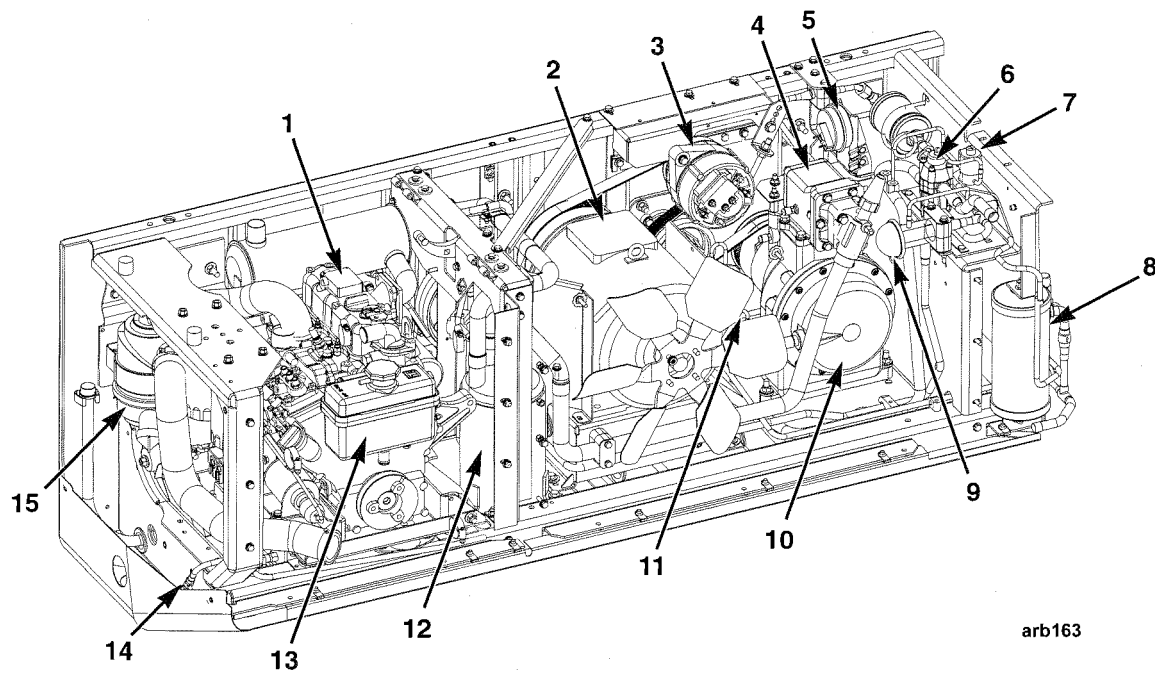
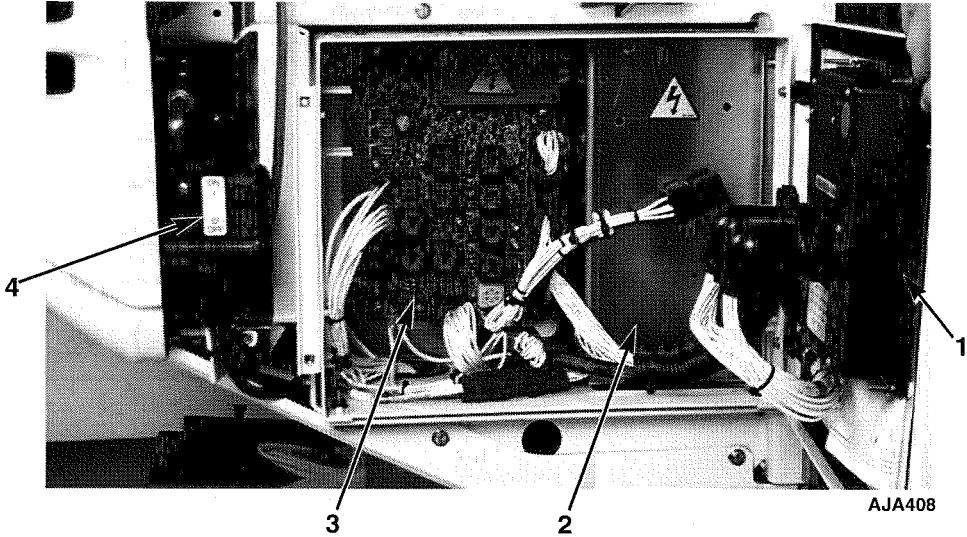


Figure 14: Engine Components TS-500

Unit Description

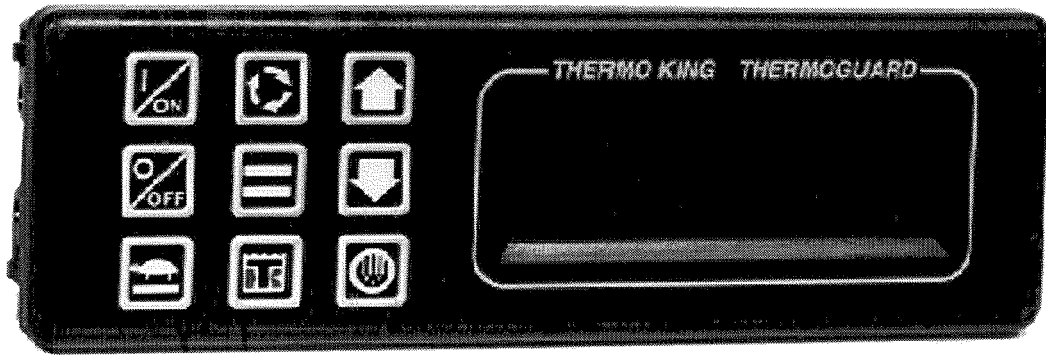
1.	Engine	8.	Receiver Tank
2.	Electric Motor	9.	Discharge Pressure Regulator
3.	Alternator	10.	Scroll Compressor
4.	Throttle Valve	11.	Liquid Injection Valve
5.	Air Switch	12.	Accumulator
6.	Three-way Valve	13.	Coolant Expansion Tank
7.	Pilot Solenoid	14.	Engine Coolant Drain
		15.	Air Cleaner

See Figure 13: “Engine Components TS-500” on page 42.



1.	Microprocessor	3.	Interface Board
2.	High Voltage Tray Cover	4.	Microprocessor Power Switch

Figure 15: Control Box



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Figure 16: Remote Control Panel

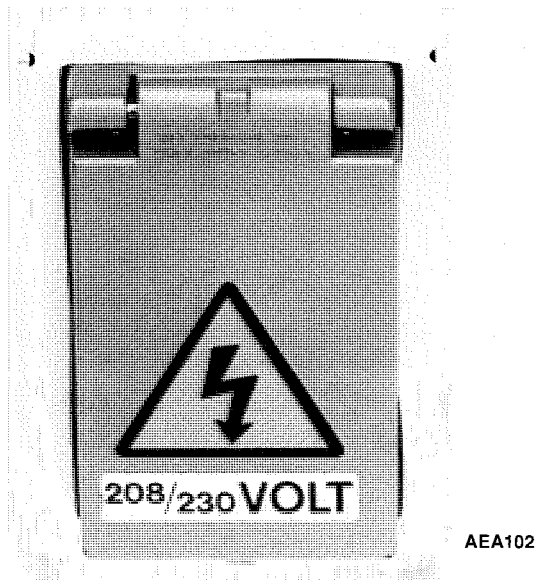


Figure 17: North American Power Receptacle Box

μP-T System Description

The μP-T microprocessor controllers are self contained temperature control units designed for Smart Reefer truck units. The microprocessor controls all unit functions to maintain the cargo at the proper temperature.

The microprocessor continuously monitors unit operational information including return air, discharge air and coil temperature sensors, unit hourmeters, oil pressure gauge, water temperature gauge, voltmeter, tachometer, mode indicators, and temperature control system controls.

The Microprocessor Power Switch and the Remote Control Panel are used to control the operation of the microprocessor.

Microprocessor Power Switch

The microprocessor power switch applies power to the microprocessor and must be on to operate the unit. It is typically located on or near the control box. Main power to the balance of the controls is supplied by circuit breaker CB1.

NOTE: *When the Microprocessor Power Switch is turned "OFF," 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.*



Figure 18: Microprocessor Power Switch

Remote Control Panel

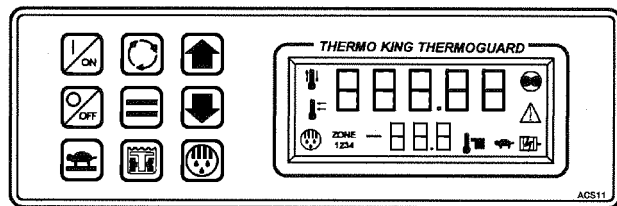


Figure 19: Remote Control Panel

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

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 show if any alarm codes are present. Pressing the **SELECT** key will show the prompt and display screens. The display shown Figure 20 has all possible display features turned on.

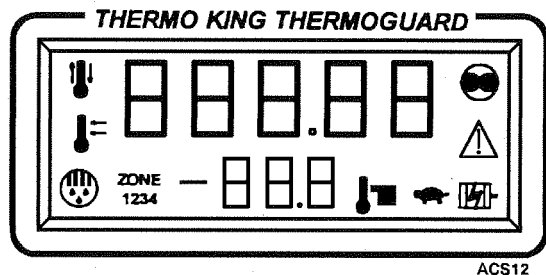


Figure 20: Display

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

Reading a Typical Display

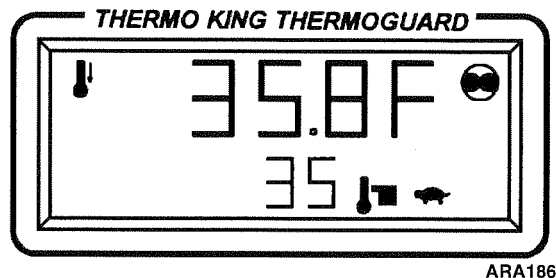


Figure 21: Typical Display

The above 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 F and the setpoint is 35.0 F.

The Standard Display

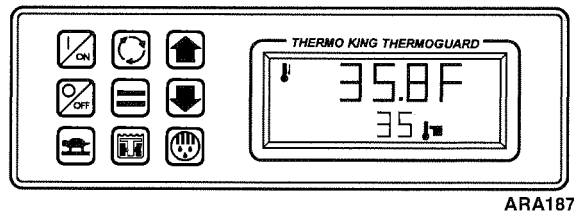
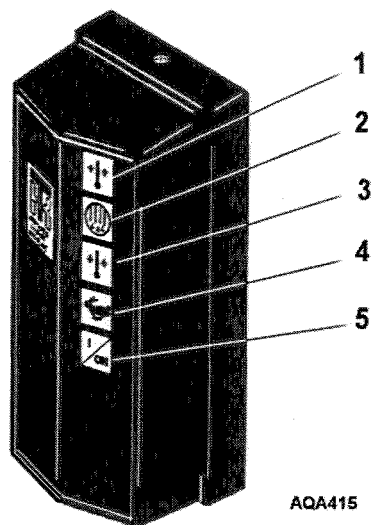


Figure 22: Standard Display

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.

Remote Indicator Lights



AQA415

Remote indicator lights are an option. The remote indicator light display mounts on the truck to offer convenient indication of the unit's operating mode. The following conditions are indicated by the respective light(s) being on:

1.	Cool (White)	The unit is cooling.
2.	Defrost (Tan)	The unit is defrosting.
3.	Heat (Amber)	The unit is heating.
4.	High Speed (Blue)	The unit is in high speed.
5.	On (Green)	The unit is turned on and may start at any time if it is not already running.

Figure 23: Remote Indicator Light Display

Remote Indicator Lights

Manual Pre-Trip Inspection (Before Starting the Unit)

Pre-trip inspections are an important part of regularly scheduled preventive maintenance programs designed to minimize operating problems and breakdowns before they happen. Pre-trips are not intended to take the place of regular maintenance inspections.

You should perform the following suggested pre-trip inspection before every trip involving refrigerated cargo.

Fuel: The diesel fuel supply must be adequate to guarantee the operation of the engine to at least the next check point.

Engine Oil: The engine oil level should be at the FULL mark on the dipstick. Never overfill.



CAUTION: *Make sure the engine is off before attempting to check the engine oil level.*

Coolant: Level and temperature are monitored by the μ P-T controller. The coolant should be a 50/50 mixture of antifreeze and water and provide protection to -30 F (-34 C).



WARNING: *Do not remove the expansion tank cap while the coolant is hot.*



CAUTION: *Do not add "RED" Extended Life Coolants to cooling systems using "GREEN" or "BLUE-GREEN" coolants. Do not add "GREEN" or "BLUE-GREEN" coolants to cooling systems using "RED" Extended Life Coolants. See "Engine Coolant Types" in "Specifications" for more information.*

Battery: The terminals must be tight and free of all corrosion. Electrolyte should be at full mark.

Manual Pre-Trip Inspection (Before Starting the Unit)

Belts: The belts must be in good condition and adjusted to the proper tension. Allow 0.5 in. (13 mm) deflection at the center of the span between pulleys.

Electrical: Check all electrical connections to make certain they are securely fastened. Wires and terminals should be free of corrosion, cracks or moisture.

Structural: Visually inspect the unit for leaks, loose or broken parts and other damage.

Gasket: The unit mounting gasket should be tightly compressed and in good condition.

Coils: The condenser and evaporator coils should be clean and free of debris.

Cargo Box: Inspect the interior and exterior of the box for damage. Any damage to the walls or insulation must be repaired.

Defrost Drain: Check the defrost drain hoses and fittings to be sure they are open.

Doors: Be sure doors and weather seals are in good condition, the doors latch securely and weather seals fit tightly.

Unit Operation with THERMOGUARD μ P-T

The μ P-T controller is a programmable microprocessor that controls all unit functions to maintain the cargo at the proper temperature. The μ P-T controller continuously monitors unit operational information including return air, discharge air and coil temperature sensors, unit hourmeters, oil pressure switch, water temperature gauge, voltmeter, tachometer, mode indicators, and temperature control system controls.



CAUTION: *Operation in confined spaces. Diesel operation should be avoided in areas or circumstances where fumes from the engine could become trapped and cause serious injury or death.*



WARNING: *The unit may start automatically AT ANY TIME when the CYCLE-SENTRY symbol is visible in the controller display. Make sure to press the OFF key before opening unit doors or inspecting any part of the unit.*



CAUTION: *The microprocessor power switch, located on the right side of the unit next to the control box, must be in the OFF position before disconnecting or connecting the unit battery.*

NOTE: *The microprocessor power switch must be in the ON position to operate the unit.*

NOTE: *Refer to THERMOGUARD μ P-T Microprocessor Controller Diagnosis Manual, for complete operation and diagnosis information.*

Displaying Operating Data

Unit operational information appears on liquid crystal display (LCD). During normal operation, the Standard Display appears on the screen. The Standard Display is the return air temperature (upper display) and setpoint temperature (lower display). Check the symbols (icons) that appear on the display. These symbols identify the operating information that currently appears (see “Display Icons”).

The keypad allows the operator to select information to display and program unit features including the setpoint temperature. If no key is pressed for about 10 seconds, the display will return to the Standard Display.

Entering the Setpoint

1. Press the **ON** key to turn the unit on.
2. Press the **UP** or **DOWN ARROW** keys to select the desired setpoint.

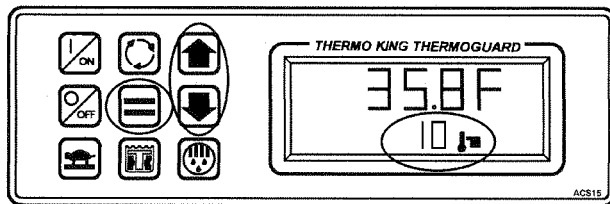


Figure 24: Entering the Setpoint

3. Press the **ENTER** key to load the new setpoint into the microprocessor. The display will show [Lod] (abbreviation for Load) for a few seconds and then the new setpoint will reappear in the display.

IMPORTANT: You must press the **ENTER** key 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

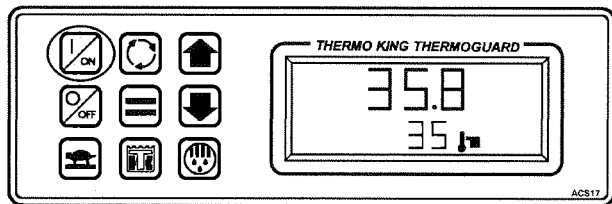


Figure 25: Starting the Engine



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

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

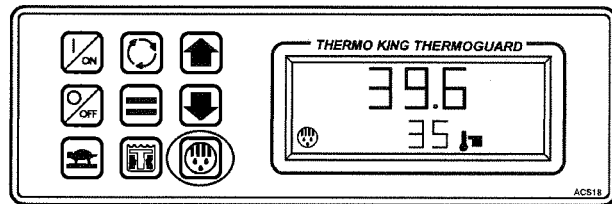


Figure 26: Initiating a Manual Defrost

The unit must be running in either *CYCLE-SENTRY* or *Continuous* mode and the coil temperature must be below 45 F (7 C). 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 (7 C), the request will be ignored.

Selecting CYCLE-SENTRY or Continuous Mode

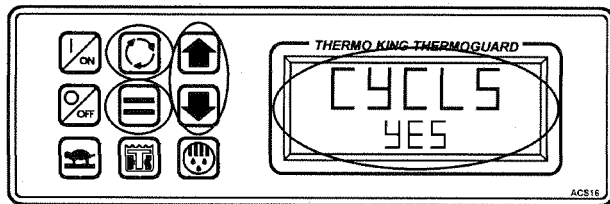


Figure 27: Selecting Cycle-Sentry or Continuous Mode

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 **UP** or **DOWN** 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:** You must press the **ENTER** key or the operating mode will not be changed. The display will return to the Standard Display and the operating mode will return to the old operating mode in about 10 seconds if the **ENTER** key is not pressed.*

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.

CYCLE-SENTRY is designed for use only with products which do not require tight temperature control or continuous airflow, such as all deep frozen products and non-perishable non-frozen products.

The start/stop nature of CYCLE-SENTRY does not satisfy the temperature control or airflow requirements for perishable or temperature sensitive products. Thermo King therefore does NOT recommend the use of CYCLE-SENTRY control for these products.

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

Products 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.

Products Acceptable for CYCLE-SENTRY Operation

- Frozen foods (in adequately insulated trucks)
- Boxed or processed meats
- Poultry
- Fish
- Dairy products
- Candy
- Chemicals

Unit Operation with THERMOGUARD μ P-T

- Film
- All non-edible products.

NOTE: 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.

μ P-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

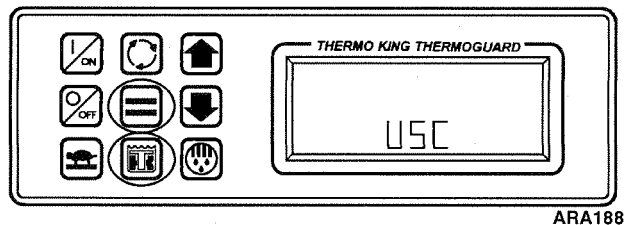


Figure 28: Starting the Unit Self Check

1. Disconnect the electric standby power cord if present.
2. Press the **ON** key to turn the unit on.
3. Clear any alarms.
4. Press and hold the **TK LOGO** key for at least 3 seconds until the Unit Self Check [USC] prompt screen appears.
5. Press the **ENTER** key. The display will briefly show [Lod] and the unit will then start the Unit Self Check.

NOTE: The Unit Self Check can also be started if the unit is already running by starting at step 3.

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.

Unit Operation with THERMOGUARD μ P-T

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: Checks unit's heating performance.

Cooling Check: Second cooling test ensures 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 chapter of this manual, and the μ P-T Microprocessor Diagnosis Manual, for details.

Starting Unit with 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 Manual Pretrip Inspection (see the Manual Pretrip Inspection chapter).
2. Adjust the setpoint to the desired load temperature (see “Entering the Setpoint” on page 56).
3. Select CYCLE-SENTRY or Continuous Mode (see “Selecting CYCLE-SENTRY or Continuous Mode” on page 58).
4. Initiate a Unit Self Check (see “mP-T Unit Self Check Test” on page 60). This procedure is automatic and can be performed on the way to the loading area or while waiting to load.

5. When the Unit Self Check is complete, [PASS], [CHEC], or [FAIL] will appear on the display until a function key (e.g., **SELECT** or **ENTER**) is pressed. Continue as follows:

PASS—The unit is running and no alarms have been recorded. The unit has passed the Unit Self Check. Go to step 7.

CHEC—The unit is running but Check Alarms have been recorded. Go to step 6.

FAIL—The unit has shut down, recorded Alarm Code 28, and possibly recorded other Shutdown Alarms. Go to step 6.

6. View the Alarms (see “Viewing and Clearing Alarm Codes” on page 67).
 - a. Correct the alarm conditions. See the Alarm Codes chapter of this manual, and the μ P-T Microprocessor Diagnosis Manual, for details about Alarm Codes.
 - b. Clear the alarms (see “Viewing and Clearing Alarm Codes” on page 67).
 - c. Repeat the Unit Self Check test until [PASS] appears (the unit passes the Unit Self Check).
7. Recheck the setpoint.
8. Complete the After Start Inspection (see “After Start Inspection” on page 63).

After Start Inspection

After the unit is running, check the following items to confirm that the unit is running properly.

Oil Pressure: Engine oil pressure is automatically checked by the controller. If oil pressure is within the acceptable operating range, the engine will continue to run. If oil pressure is not within the acceptable operating range, the controller will shut off the engine and display alarm code 19.

Compressor Oil: The compressor oil level should be visible in the sight glass after 15 minutes of operation.

Pre-cooling: Make sure that the setpoint is at the desired temperature and allow the unit to run for a minimum of 30 minutes (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.

Defrost: When the unit has finished pre-cooling the truck interior, manually initiate a defrost cycle (see “Initiating a Manual Defrost Cycle” on page 57). This will remove the frost that builds up while running the unit to pre-cool the truck.

The defrost cycle should end automatically.

NOTE: *The unit will not defrost unless the evaporator coil temperature is below 45 F (7 C).*

Restarting the Unit—Automatic Start

This procedure is used when starting a unit that has been shut off for a short time. When a unit that has been shut off for a long time is first started, it should be started and put through a full Unit Self Check (see “Starting Unit with Full Unit Self Check” on page 62).

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.*

Unit Operation with THERMOGUARD μ P-T

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

1. Push the **OFF** key.
2. 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. See the Alarm Codes chapter of this manual, and the μ P-T Microprocessor Diagnosis Manual, for detailed information about alarms.
3. If the engine will still not start, push the **OFF** key, determine and correct the cause of the failure.

Checking the Software Revision

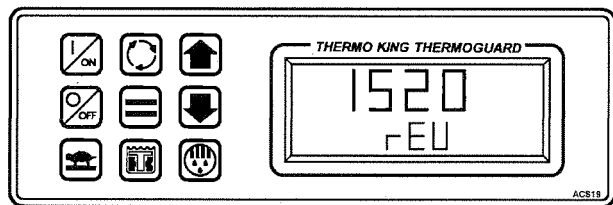


Figure 29: Checking the Software Revision

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.
4. The software revision shown here is Revision 1520.

Viewing Prompt and Display Screens

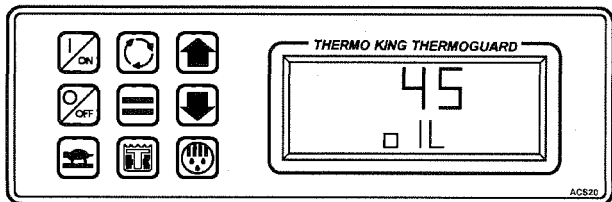


Figure 30: Viewing Prompt and Display Screens

1. Press the **ON** key to turn the unit on.
2. Press the **SELECT** key repeatedly to show the prompt and display screens.

Each prompt or display screen will remain on the display for about 10 seconds. The display will then return to the Standard Display of box temperature and setpoint if no other key is pressed. The prompt and display screens will appear in the order shown following:

[ALr]: Alarm codes. Only appears if alarm codes exist.

[Pnt]: Print DAS report. Only appears with revision 154x or later software, DAS module installed and the [Pnt - YES - nO] screen in Super Guarded Access set to [YES]. Also, the unit must be on for about 15 seconds with no key pressed for the unit microprocessor to confirm the presence of the DAS module and sensors.

[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.

[ds.1 - ds.6]: DAS sensor temperature (up to six sensors). Only appears for the sensors that are connected with revision 154x or later software and DAS module installed. Also, the unit must be on for about 15 seconds with no key pressed for the unit microprocessor to confirm the presence of the DAS module and sensors.

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

Unit Operation with THERMOGUARD μ P-T

[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 Electric Standby).

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

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

[Hr6]: Total accumulated hours on hour meter 6 (only appears if this hour meter 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.

Locking a Display Screen on the Display

The display screens in the preceding list 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

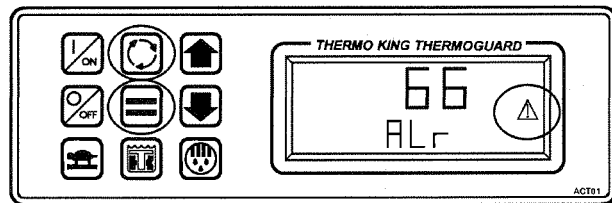


Figure 31: Viewing and Clearing Alarm Codes

Unit Operation with THERMOGUARD μ P-T

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

Press the **SELECT** key to show the Alarm display screen.

If more than one code exists, they will “cycle” through the display, with each alarm appearing 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. See Alarm Codes chapter.
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, press the **ENTER** key to clear each alarm code individually.

Alarm Codes

Introduction

An alarm is generated when the microprocessor senses an abnormal condition. Alarms direct an operator or service technician to the source of a problem.

Multiple alarms can be present at one time. All generated alarms will be stored in memory until cleared by the operator. Document all alarm occurrences and report them to the service technician.

NOTE: The chart on the following pages shows all possible alarm codes for all possible applications. Not all codes will be applicable to each individual unit.

Repair

The operator can repair certain faults, other faults can only be repaired by your Thermo King Dealer. Refer to the table on the following pages for the proper corrective action.

NOTE: Document all alarm faults and report them to the service technician.

NOTE: Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if the condition does not reoccur.

NOTE: The corrective actions listed on the “Table of Alarm Codes” are suggestions only. Always consult your company for final decisions.

Alarm Types

The three types of alarms are described below. They can occur individually or with other alarms. More than one alarm can be present at one time.

Stored Alarm: Indicates a condition exists that should be investigated, but does not affect unit operation. The alarm icon will appear for 30 seconds when the unit On/Off switch is turned on, then it disappears.

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 could damage the unit. The unit will automatically shut down, the alarm icon will appear, and the entire display will flash on and off.

NOTE: Alarms that occurred during a unit pre-trip or self check will be preceded by a dash (-). Refer to the Alarm Type column on the following chart.

NOTE: Some alarms are self-clearing. These alarms will clear automatically when the operating condition causing the alarm returns to normal.

Corrective Action

There are three levels of corrective action that can be taken when an alarm condition occurs.

OK To Run: An alarm condition exists but does not affect unit operation. Corrective action can occur at a later date.

Check As Specified: An alarm condition exists that could affect unit operation. Follow directions in the Corrective Action column on the following chart.

Take Immediate Action: An alarm condition exists that will damage the unit or load. Take immediate action to correct the problem.

NOTE: The corrective actions listed above and on the following chart are suggestions only. Always consult your company for final decisions.

Alarm Code 84 (Restart Null)

Alarm Code 84 is a temporary abnormal condition resulting from other alarms. The unit shuts down for approximately 15 minutes. The unit will restart after approximately 15 minutes, or after the condition has reset, and in most cases the other alarm(s) will have been cleared. If after 3 attempts, the condition continues to occur, the alarm that caused the shutdown will appear on the display and the unit will shut down until the alarm is cleared. Code 84 will automatically clear after the final attempt at restarting has occurred.

Alarm Code 85 (Forced Unit Operation)

Alarm Code 85 is also a temporary abnormal condition resulting from other alarm(s). The unit goes into an abnormal mode which allows the unit to continue to run without shutting down. When the alarm that caused 85 is no longer active, Alarm Code 85 will be reset.

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action		
			Ok To Run	Check	Shut Down
00	No Fault	None required			
01	Microprocessor Power Up Reset	Will not affect unit operation, data log only - clear alarm	X		
02	Evaporator Coil Sensor	Monitor box temp, repair as required		X	
03	Return Air Sensor	Unit controls on discharge air sensor, monitor box temp, repair as required		X	
04	Discharge Air Sensor	Unit controls on return air sensor, monitor box temp, repair as required		X	
05	Ambient Air Sensor	Unit operating with reduced features, repair as required		X	
06	Engine Water Temp Sensor	Unit operating with reduced features, repair as required		X	
07	Engine RPM Sensor	Unit operating with reduced features, repair as required		X	

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
08	Remote Return Air Sensor	Remote zone controls on coil sensor, monitor box temp, repair as required		X		
09*	High Evaporator Temperature	Unit shut down to prevent damage, repair immediately			X	
10*	High Discharge Pressure or Temp	Unit shut down to prevent damage, clear and retry, if reoccurs repair immediately			X	
11	Unit Controlling on Alternate Sensor	Secondary alarm related to Alarm Code 3 or 4, monitor box temp, repair as required		X		
12	Sensor Shutdown	Unit shut down to prevent damage, repair immediately			X	
13	Check Sensor Calibration	Monitor box temp with independent thermometer, repair as required		X		
14	Defrost Terminated by Time	Clear alarm, repair after delivery	X			
15	Glow Plug Check	Repair after delivery	X			

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
16	Manual Start Not Completed	Engine was not manually started, clear alarm and manually start engine	X			
17*	Engine Failed to Crank	Attempt to start in Continuous mode, repair as required				X
18*	High Engine Water Temperature	Check belts and coolant level, repair as required				X
19*	Low Engine Oil Pressure	Check engine oil level, add oil as needed, repair as required				X
20*	Engine Failed to Start	Check fuel level, attempt to start in Continuous mode, repair as required				X
21	Cooling Cycle Check	Monitor box temp, repair as required		X		
22	Heating Cycle Check	Monitor box temp, repair as required		X		
23*	Cooling Cycle Fault	Unit shut down to prevent damage, repair immediately				X
24*	Heating Cycle Fault	Unit shut down to prevent damage, repair immediately				X

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
25	Alternator Check	Check alternator charging rate, repair immediately		X	X	
26	Check Refrigeration Capacity	Monitor box temp, repair as required		X		
27	Unassigned					
28	Pretrip or Self-check Abort	Pretrip or self-check was terminated, check for other alarms and repeat		X		
29	Damper Circuit	Unit or zone may not defrost, monitor box temp, repair as required		X		
30	Damper Stuck Closed	Damper is stuck closed, repair immediately				X
31	Oil Pressure Switch	Oil pressure switch is not functioning				X
32	Refrigeration Capacity Low	Unit shut down to prevent damage, repair immediately				X
33	Check Engine RPM	Check and note RPM, repair as required		X		

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
34	Modulation Circuit	Check modulation circuit breaker or fuse, monitor box temp, repair as required		X		
35	Run Relay Circuit	Check run relay circuit, repair immediately			X	
36*	Electric Motor Failed to Run/Loose Belt	Check standby source of power and motor drive belt, repair immediately			X	
37	Check Engine Water Level	Check coolant level, add as needed		X		
38	Phase Reversed /Overload Tripped	Standby power phased wrong or motor overload tripped, repair immediately			X	
39	Water Valve Circuit	Unit operating with reduced heating, monitor box temp, repair as required		X		
40	High Speed Circuit	Check high speed operation, monitor box temp, repair as required		X		

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
41	Engine Water Temp Check	Check belts and coolant level, repair as required		X		
42	Unit Forced to Low Speed	Temporary overheat condition, if condition persists repair as required		X		
43	Unit Forced to Low Speed Mod	Temporary overheat condition, if condition persists repair as required		X		
44*	Fuel System	Check fuel level in unit fuel tank, add fuel, purge fuel lines and restart as required				X
45	Hot Gas Circuit	Unit operating with reduced modulation control, repair as required		X		
46	Air Flow Check	Cargo may be restricting air flow, check load		X		
47	Remote Sensor Shutdown	Multi-temp zone sensor failed, zone shut down, monitor temp and repair as required				X

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
48	Check Belts or Clutch	Drive clutch or belts slipping, repair immediately			X	
49	RF Tag Communications Error	Data Tag disconnected or inoperative, affects data tag only, repair as required	X			
50	Reset Clock	Unit will operate normally, set date and time to clear alarm	X			
51	Shutdown Circuit	Secondary protection circuit failed, repair as required		X		
52	Heat Circuit	May have no heat, monitor box temperature, repair as required		X		
53	Economizer Valve Circuit	Unit operating with reduced heat performance, monitor box temp, repair as required		X		
54	Test Mode Time-out	A diagnostic mode timed out, does not affect unit performance	X			

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
55	Check Engine Speeds	Engine speed out of spec, check RPM, monitor box temp, repair as required		X		
56	Evap Fan Low Speed	Unit operating with no low speed evaporator fan, repair as required (RC units only)		X		
57	Evap Fan High Speed	unit operating with no high speed evaporator fan, repair as required (RC units only)		X		
58	Cond Fan Low Speed	Unit operating with no low speed condenser fan, repair as required (RC units only)		X		
59	Cond Fan High Speed	Unit operating with no high speed condenser fan, repair as required (RC units only)		X		
60	Boost Circuit	Unit operating without boost capacitors, repair as required (RC units only)			X	

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action		
			Ok To Run	Check	Shut Down
61	Low Battery Volts	Check charge rate and battery voltage, repair as required			X
62	Ammeter Out of Cal Range	Ammeter inaccurate, repair as required			X
63*	Engine Stopped	Engine should be running, try restart, repair as required			X
64	Pretrip Reminder	Does not affect unit operation, perform Pretrip or Unit Self Check to clear alarm	X		
65	Unassigned				
66	Low Engine Oil Level	Check engine oil level, add as needed			X
67	Liquid Line Solenoid Circuit	Unit operating with reduced performance, monitor box temp, repair as required		X	
68	μ P Internal Fault Code	Clear and retry, monitor box temp, repair as required		X	
69	Remagnetization Circuit	Clear and retry, if alarm reoccurs or is shutdown repair as required (RC units only)		X	

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
70	Hourmeter Failure	Will not affect unit operation, repair after delivery	X			
71	Hourmeter 4 Exceeds Set Limit	Maintenance alarm dependent on customer selection, will not affect unit operation	X			
72	Hourmeter 5 Exceeds Set Limit	Maintenance alarm dependent on customer selection, will not affect unit operation	X			
73	Hourmeter 6 Exceeds Set Limit	Maintenance alarm dependent on customer selection, will not affect unit operation	X			
74	µP Reverted to Default Settings	Unit has reset, control parameters. May be inaccurate, repair immediately		X		
75	µP Internal Fault Code	Controller may be defective, repair immediately				X
76	µP Internal Fault Code	Controller may be defective, repair immediately				X
77	µP Internal Fault Code	Controller may be defective, repair immediately				X

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action		
			Ok To Run	Check	Shut Down
78	μP Internal Fault Code	Controller may be defective, repair immediately			X
79	Data Log Overflow	Data logger missed logging one event, no action required, clear alarm	X		
80	Compressor Temp Sensor	Compressor protection reduced, repair as required		X	
81	High Comp Temp	Compressor operating above temp limits, repair as required		X	
82	High Comp Temp Shutdown	Compressor shut down to prevent damage, repair immediately			X
83	Low Coolant Temp	Reduced heating capacity, monitor box temp and engine temp, repair as required		X	
84	Restart Null	Temporary shutdown resulting from other alarm codes. Refer to detailed explanation at start of chapter		X	

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
85	Forced Unit Operation	Temporary forced operation resulting from other alarm codes. Refer to detailed explanation at start of chapter.		X		
86	Discharge Press Transducer	Unit operating with reduced performance, monitor box temp, repair as required		X		
87	Suction Press Transducer	Unit operating with reduced performance, monitor box temp, repair as required		X		
88	Unassigned					
89	Electronic Throttling Valve Circuit	If Check Alarm, unit operating with reduced performance, monitor box temp, repair as required. If Shutdown Alarm, ETV or refrigeration system failure, repair immediately		X	X	
90-92	Unassigned					

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action		
			Ok To Run	Check	Shut Down
93	Low Compressor Suction Pressure	Suction pressure lower than expected for current conditions, repair as required			X
94	Loader Valve #1	Suction pressure drops less than specified when Loader Valve #1 is energized during unit start up, repair as required		X	
95	Loader Valve #2	Suction pressure drops less than specified when Loader Valve #2 is energized during unit start up, repair as required		X	
96-98	Unassigned				
99	High Compressor Pressure Ratio	Compression ratio of discharge to suction pressure has risen above specification, repair as required			X
100-104	Unassigned				

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action			
			Ok To Run	Check	Shut Down	
105	Receiver Tank Press Solenoid Circuit	Unit operating with reduced heat performance, monitor box temp, repair as required		X		
106	Purge Valve Circuit	Unit operating with reduced heat performance, monitor box temp, repair as required		X		
107	Condenser Inlet Solenoid Circuit	Unit operating with reduced performance, monitor box temp, repair as required		X		
108	Door Open Timeout	Door open for extended time, close door and clear alarm		X		
109	High Discharge Pressure/Sensor	High discharge press or defective discharge press sensor, high speed prevented		X		
110	Suction Line Solenoid Circuit	Unit operating with reduced performance, monitor box temp, repair as required		X		
111	Unit Not Configured Correctly	Controller not set properly for unit type, repair immediately			X	

Table of Alarm Codes

**Alarms with an asterisk (*) can exist with Alarm Code 84. The alarm can clear automatically if condition does not reoccur.*

NOTE: Not all alarm codes are available with all microprocessor controllers or all revisions of software.

Code	Description	Corrective Action	Level Of Action		
			Ok To Run	Check	Shut Down
112	Remote Fan Zone 2-3 Circuit	Remote fan failure in indicated zone, repair as required		X	
113	Electric Heat Circuit	Electric heating problem, repair as required		X	
114	Multiple Alarms, Can Not Run	Multiple problems prevent unit operation, check alarm codes, repair immediately			X
115-120	Unassigned				
121	Liquid Injection Valve	Unit operating with reduced performance, monitor box temp, repair as required		X	

Electric Standby Operation

Model 50 units are equipped with Electric Standby. This feature allows the unit to operate on electric power as well as be powered by the standard diesel engine.

During Electric Standby operation, power to the unit is supplied by an electric motor connected to a high voltage power source. Check the unit for proper power source ratings.



WARNING: Units equipped with electric standby can start at any time when the unit is connected to live electric power and the controller is turned on.



CAUTION: Always turn the electric power supply off when handling, connecting, or disconnecting high voltage power cords.

Electric Power Receptacle

The electric power receptacle is used to connect the unit to an appropriate electric power source for electric standby operation. Press the unit **OFF** key before connecting or disconnecting the power cord.

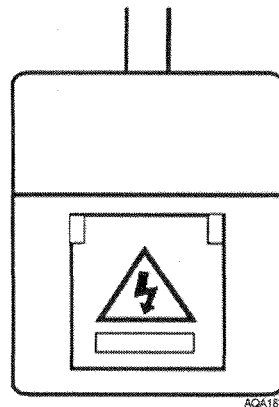


Figure 32: Model 50 Power Receptacle Box

Electric Standby Operation

NOTE: *The Model 50 control system automatically determines if diesel or electric power is desired.*

If power is supplied to the receptacle (the unit is plugged in), the microprocessor power switch is turned on, and the **ON** key is pressed, the unit will automatically run in the electric standby mode.

If the power is removed or interrupted at the receptacle, the controller will display [StArt Eng] (start engine) on the display. If the **ENTER** key is pressed, the unit will start and run in diesel. You can program this feature so the diesel engine restarts on electric standby power failure are fully automatic.



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.*

NOTE: *In Continuous mode, the unit will operate in both Diesel and Electric operation. In CYCLE-SENTRY mode, the unit will operate in both Diesel and Electric operation.*

Starting the Unit on Electric Standby Operation

Use this procedure to start a unit that has been shut off for a short time. When a unit that has been shut off for a long time is first started, put it through a full Unit Self Check (see “μP-T Unit Self Check Test” on page 60).

1. Perform a Manual Pretrip Inspection (see Manual Pretrip Inspection chapter).
2. Press the **OFF** key to make sure the unit is turned off.
3. Connect the electric power receptacle to an appropriate electric power supply (see “Electric Standby” in the Specifications chapter).



CAUTION: *Always turn the electric power supply off when handling, connecting, or disconnecting high voltage power cords.*

Electric Standby Operation

4. Turn the high voltage power supply on. The Automatic Phase Correction system adjusts the phase sequence of the power supply to correspond to the wiring of the electric motor.
5. Press the **ON** key. If the controller determines the unit should cool or heat, the appropriate icons will appear and the electric motor will start. It may not start if the return air sensor is within a few degrees of setpoint.
6. Complete an After Start Inspection (see “After Start Inspection” on page 63).
- 7.



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.*

Unit Fails to Start

If cooling or heating is required by the controller and the electric motor fails to start (Alarm Codes 36 or 38): -

1. Press the **OFF** key to turn the unit off.
2. Determine and correct the cause for not starting.
3. Clear the alarm codes. Clearing the codes will reset the electric motor overload.

Electric Standby Operation

Loading and Enroute Inspections

Thermo King refrigeration units are designed to maintain the required temperature for the product being carried during its time in transit. Because of the unit's unique design, special care is required during loading to prevent cargo spoilage.

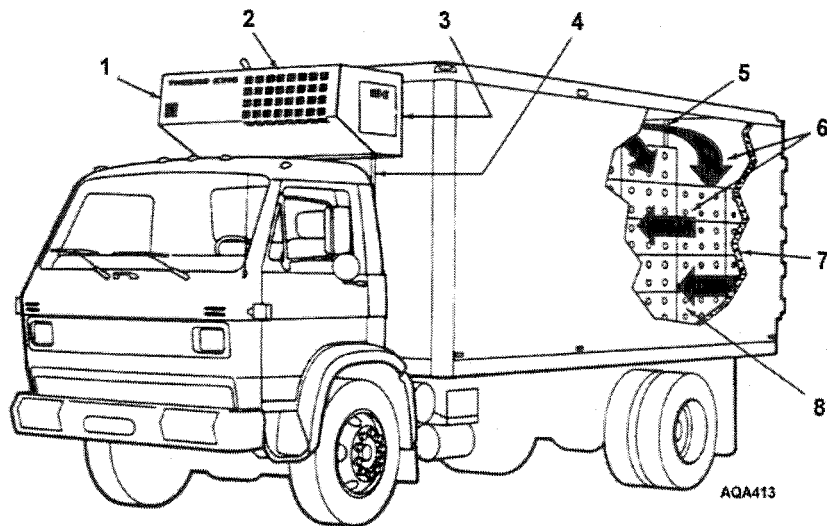
Pre-Loading Inspection

1. Inspect all door seals, including vent doors, for condition and a tight seal with no air leakage.
2. Inspect the cargo compartment inside and out for damaged or loose skin and insulation.
3. Inspect the inside of the cargo compartment for damaged walls, air ducts, floor channels or "T" flooring, clogged defrost drain tubes, and clogged or damaged floor channels which could block the air return, creating isolated areas in the load that are warmer than the desired temperature.
4. Pre-cool the cargo compartment. Adjust the setpoint to the desired cargo temperature and allow the unit to run a minimum of 30 to 60 minutes (longer if possible) before loading. Check to be certain the setpoint temperature is correct for the cargo.

Pre-cooling before loading will remove residual heat and moisture from the cargo compartment and prepare it to receive the refrigerated load. Pre-cooling also provides a good test of the refrigeration system.

5. Make sure products are pre-cooled to the proper temperature before loading. Any variance should be noted on the manifest.
6. Supervise product loading to make sure that there is sufficient air space around and through the load so air flow is not restricted.

Loading and Enroute Inspections



1.	Unit Inspection
2.	Good Outside Air Circulation
3.	Gaskets Equally Compressed
4.	Clear Defrost Drains
5.	Tight Doors
6.	Good Air Circulation Around Load
7.	Interior and Exterior Walls and Insulation in Good Condition
8.	Cargo at Proper Temperature Prior to Loading

Figure 33: Loading Considerations

Inspecting the Load

Never assume that the product has been loaded properly. Watch for and perform the following tasks. It takes only a few minutes and could save you or your employer considerable time and money later on.

1. Make sure the unit is off before opening the cargo compartment doors. During operation, the unit blows out refrigerated air, and draws in outside air.

NOTE: The unit can be run with the doors open if the truck is backed into a refrigerated warehouse with tight door seals.

2. Perform a final check of the load temperature. If the load is too hot or too cold, make a final notation on the manifest.



CAUTION: Make sure cargo is pre-cooled to the proper temperature before loading. The unit is designed to maintain temperature, not cool an above-temperature load.

3. While inspecting to see that the cargo is loaded properly, make sure the evaporator inlets and outlets are not blocked.
4. Close or supervise the closing of the cargo compartment doors. Make sure they are securely locked.
5. Check to make sure the unit setpoint is set at the desired temperature as listed on the manifest.
6. If the unit was stopped, restart using the appropriate starting procedure outlined in this manual.
7. Repeat the after-start inspection.
8. Defrost the unit 30 minutes after loading by starting a manual defrost cycle.

Enroute Inspections

NOTE: *Enroute inspections are recommended every four hours for the prevention of damage to the cargo.*

1. Note the setpoint to make certain no one has altered the setting since picking up the load.
2. Note the return air temperature reading. It should be within the desired temperature range. If the return air temperature reading is not within the desired temperature range, it indicates one of the following:
 - a. The unit has not had sufficient time to pull down the temperature. Refer to log, if possible, for history of load (for example, above temperature load, properly pre-cooled cargo compartment, length of time on road).
 - b. The unit is in defrost or has just completed defrost.

NOTE: *You can cancel defrost by turning the unit off, then restarting the unit.*

- c. The evaporator is plugged with frost. Initiate a manual defrost cycle. The defrost cycle will be automatically terminated.
- d. Improper air circulation within the cargo compartment. Inspect the cargo compartment (if possible) to determine if the evaporator fans are working and properly circulating the air. Poor air circulation can be due to improper loading of the cargo or shifting of the load, or the fan belt slipping. You can check the fan belt tension by depressing the belt with your thumb. A 0.5 in. (13 mm) deflection is normal.



WARNING: *The unit may START automatically AT ANY TIME while it is turned ON. Make sure to turn the unit OFF before opening unit doors or inspecting any part of the unit.*

- e. The unit did not start automatically. If the unit cranked without starting, determine and correct the cause for not starting.

Loading and Enroute Inspections

- f. The unit may have a low refrigerant charge. If liquid is not showing in the unit receiver tank sight glass, the refrigerant charge may be low. Adding refrigerant or repairing the refrigeration system requires a competent mechanic. Refer such problems to the nearest Thermo King dealer or authorized Service Center, or call the Thermo King Cold Line telephone number shown on the inside back cover of this manual for referral.

NOTE: If the temperature in the compartment is not within the desired temperature range, repeat the Enroute Inspection every 30 minutes until the compartment temperature comes within the desired temperature range.



CAUTION: Stop the unit if the compartment temperature remains outside the desired temperature range from the setpoint on two consecutive 30 minute inspections. Contact the nearest Thermo King Service Center or your company office immediately. Take all necessary steps to protect and maintain proper load temperature.

3. Initiate a Manual Defrost cycle after each Enroute Inspection.

Loading and Enroute Inspections

Specifications

Engine Specifications for TS-200 and TS-300

Engine	Thermo King TK 3.74
Fuel Type	Use Diesel Fuel only. No. 2 diesel fuel under normal conditions No. 1 diesel fuel is acceptable cold weather fuel
Oil Capacity	Crankcase and filter: 9.1 quarts (8.6 liters) With bypass oil filter: 10.1 quarts (9.5 liters) Fill to full mark on dipstick
Oil Type: Mineral Oil Synthetic Oil* (After First 500 Hours)	API Classification CG-4 (or better) API Classification CG-4 (or better)
<i>* Thermo King synthetic oil is compatible with petroleum lubricants so there is no danger if accidental mixing occurs or if an emergency requires addition of petroleum oil. Mixing is not recommended, however, since it will dilute the superior performance properties of the synthetic oil.</i>	

Engine Specifications for TS-200 and TS-300 (Continued)

Oil Viscosity	5 to 122 F (–15 to 50 C): SAE 15W-40 –13 to 104 F (–25 to 40 C): SAE 10W-40 –13 to 86 F (–25 to 30 C): SAE 10W-30 –22 to 32 F (–30 to 0 C): SAE 5W-30
Engine Oil Pressure	20 to 50 psig (138 to 345 kPa) in low speed 40 to 60 psig (276 to 414 kPa) in high speed
Engine RPM: Low Speed Operation High Speed Operation	1625 ± 25 RPM 2450 ± 50 RPM
Cooling System Capacity	5.5 quarts (5.2 liters) with overflow tank
Engine Coolant Type: Conventional	Conventional coolant (antifreeze) is green or blue-green. Units equipped with conventional coolant <i>do not</i> have an ELC nameplate on the expansion tank.
	<i>CAUTION: Make sure you know what type of coolant is in your unit. Do not mix conventional coolant and ELC.</i>

Engine Specifications for TS-200 and TS-300 (Continued)

Engine Coolant Type (continued): ELC (Extended Life Coolant)	ELC is red. Units equipped with ELC have an ELC nameplate on the expansion tank (see "Safety Decals and Locations"). Use a 50/50 concentration of any of the following equivalents: Texaco ELC (16445, 16447) Havoline Dex-Cool® (7994, 7995, 7997, 7998) Havoline XLC for Europe (30379, 33013) Shell Dexcool® (94040) Shell Rotella (94041) Saturn/General Motors Dex-Cool® Caterpillar ELC Detroit Diesel POWERCOOL® Plus
Engine Thermostat	180 F (82 C)
Radiator Cap Pressure	10 psig (69 kPa)

Engine Specifications for TS-500

Engine	Thermo King TK 3.95
Fuel Type	Use Diesel Fuel only. No. 2 diesel fuel under normal conditions No. 1 diesel fuel is acceptable cold weather fuel
Oil Capacity	Crankcase and filter: 11.8 quarts (11.2 liters) With bypass oil filter: 12.8 quarts (12.1 liters) Fill to full mark on dipstick
Oil Type: Mineral Oil Synthetic Oil* (After First 500 Hours)	API Classification CG-4 (or better) API Classification CG-4 (or better)
Oil Viscosity	5 to 122 F (–15 to 50 C): SAE 15W-40 –13 to 104 F (–25 to 40 C): SAE 10W-40 –13 to 86 F (–25 to 30 C): SAE 10W-30 –22 to 32 F (–30 to 0 C): SAE 5W-30
Engine Oil Pressure	20 to 50 psig (138 to 345 kPa) in low speed 40 to 60 psig (276 to 414 kPa) in high speed
* Thermo King synthetic oil is compatible with petroleum lubricants so there is no danger if accidental mixing occurs or if an emergency requires addition of petroleum oil. Mixing is not recommended, however, since it will dilute the superior performance properties of the synthetic oil.	

Engine Specifications for TS-500 (Continued)

Engine RPM: Low Speed Operation High Speed Operation	1625 \pm 25 RPM 2425 \pm 25 RPM
Cooling System Capacity	4.0 quarts (3.8 liters) with overflow tank
Engine Coolant Type: Conventional	Conventional coolant (antifreeze) is green or blue-green. Units equipped with conventional coolant <i>do not</i> have an ELC nameplate on the expansion tank.
	<i>CAUTION: Make sure you know what type of coolant is in your unit. Do not mix conventional coolant and ELC.</i>
ELC (Extended Life Coolant)	ELC is red. Units equipped with ELC have an ELC nameplate on the expansion tank (see "Safety Decals and Locations"). Use a 50/50 concentration of any of the following equivalents: Texaco ELC (16445, 16447) Havoline Dex-Cool® (7994, 7995, 7997, 7998) Havoline XLC for Europe (30379, 33013) Shell Dexcool® (94040) Shell Rotella (94041) Saturn/General Motors Dex-Cool® Caterpillar ELC Detroit Diesel POWERCOOL® Plus

Engine Specifications for TS-500 (Continued)

Engine Thermostat	180 F (82 C)
Radiator Cap Pressure	10 psig (69 kPa)

Belt Tension

<i>NOTE: Use belt tension gauge (see Tool Catalog) whenever possible to check belt tension. New belts should be tensioned cold, and then tensioned cold again after 10 hours of unit operation.</i>	
Engine/Jackshaft or Electric Motor	55 to 60 on bottom span between engine and jackshaft or electric motor
Jackshaft or Electric Motor/Compressor	55 to 60 between alternator and jackshaft or electric motor (or 1/4 in. [6 mm] deflection with 10 lb. [4.5 kg] pressure)

μ P-T Controller - Factory Settings

tLH	=	Total Hours	Protection Time
EnH	=	Diesel Engine Hours	Diesel Run Time
ELH	=	Electric Motor Hours	Electric Run Time
oIL	=	Engine Oil Pressure	Switch
dFI	=	Defrost Interval	4 hours
ddr	=	Defrost Duration	45 minutes

Electrical Control System

Voltage	12.5 Vdc (nominal)
Circuit Breaker (CB1), Main	50 amp auto reset
Fusible Link (early models)	P/N 44-8244
Battery Fuse (later models)	60 amp
Battery Charging System	12 Volt, 23 amp, brush type integral alternator
Voltage Regulator Setting	14.1 Vdc at 70 F (21 C)
Fuses	See "Fuses" on page 37.

Electric Standby (Model 50)

TS-200 Electric Motor				
Voltage/Phase/Frequency	Horsepower	Kilowatts	RPM	Full Load Amps
230/3/60	6.0	4.5	1765	16.2
460/3/60	6.0	4.5	1765	8.1
220/3/50	5.0	3.7	1465	14.0
380/3/50	5.0	3.7	1465	8.1
TS-300 Electric Motor				
Voltage/Phase/Frequency	Horsepower	Kilowatts	RPM	Full Load Amps
230/3/60	7.2	5.4	1765	19.2
460/3/60	7.2	5.4	1765	9.7
220/3/50	6.0	4.5	1460	17.0
380/3/50	6.0	4.5	1460	9.8

Electric Standby (Model 50) (Continued)

TS-500 Electric Motor				
Voltage/Phase/Frequency	Horsepower	Kilowatts	RPM	Full Load Amps
230/3/60	10.0	7.5	1750	24.4
460/3/60	10.0	7.5	1750	12.2
220/3/50	8.0	6.0	1455	20.3
380/3/50	8.0	6.0	1455	11.7

Electric Standby Power Requirements

Supply Circuit Breaker	50 amp for 220-230 Volt (TS-500) 30 amp for 220-230 Volt (TS-200 and TS-300) 20 amp for 380-460 Volt (all units)
Extension Cord Size	380-460 Volt up to 25 ft–12 gauge, up to 75 ft–10 gauge 220-230 Volt up to 25 ft–10 gauge, up to 75 ft–8 gauge

NOTE: *Electrical wiring must conform to all local and national electrical codes.*

R-404A Refrigeration System

Compressor Model: TS-200 and TS-300 TS-500	TKO 4 hp Scroll TKO 6 hp Scroll
Refrigerant Charge: TS-200 TS-300 TS-500	7.0 lb. (4 kg) R-404A 7.2 lb. (4 kg) R-404A 9.0 lb. (4 kg) R-404A
Compressor Oil Charge*	1.6 quarts (1.5 liters) Ester Base type oil TK 203-433 (Required for scroll compressor)
Suction Pressure Regulator Setting: TS-200 TS-300	28 to 30 psig (193 to 207 kPa) 36 to 38 psig (248 to 262 kPa)
Throttling Valve Setting: TS-500	28 to 30 psig (193 to 207 kPa)
Heat/Defrost Method	Engine Operation: Hot gas Electric Operation: Hot gas (and optional electric heater strips)
High Pressure Cutout Switch	Opens at 470 psig (3241 kPa) or higher (shutdown) Automatic reset at 375 psig (2586 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.	

R-404A Refrigeration System (Continued)

Defrost Time Interval	Programmable in 2, 4 or 6 hour increments. Factory preset at 4 hours.
Air Switch Setting: TS-200 and TS-300 TS-500	0.9 in. (22.8 mm) H ₂ O 1.5 in. (38 mm) H ₂ O



WARNING: Use *ONLY* ester based refrigeration compressor oil in this unit's R404A refrigeration system.

DO NOT use ester based oil in other Thermo King units.

DO NOT mix ester based oil with PAG or standard synthetic compressor oils.

Keep ester based compressor oil in tightly sealed containers. If ester based oil becomes contaminated with moisture or standard oils, dispose of properly - **DO NOT USE!**



WARNING: When servicing Thermo King R404A refrigeration systems, use only those service tools certified for and dedicated to R404A refrigerant and ester based compressor oils. Residual non-HFC refrigerants and non-ester based oils will contaminate this unit's refrigeration system.

Maintenance Inspection Schedule

A closely followed maintenance program will help to keep your Thermo King unit in top operating condition. The following general schedule is provided to assist in monitoring that maintenance.

The schedule covers units with conventional coolant and units with ELC. See “ELC (Extended Life Coolant)” on page 31 for more information about coolants.

The schedule also covers units with and without EMI 2000. See “EMI 2000” on page 32 for more information about EMI 2000.

For more specific detail, see the maintenance manual for your unit and to the PreTrip Inspection chapter in this manual.

After first week of operation:

- Check belt tension.
- Tighten unit mounting bolts.
- Check coolant level.
- Check refrigerant oil level.
- Check refrigerant level.

Maintenance Inspection Schedule

Pretrip	1,200 Hours	2,000 Hours	Annual 3,000 Hours	Inspect/Service These Items
				<i>NOTE: The 1,200 hour maintenance interval may be extended to 2,000 hours or 1 year (whichever occurs first) when equipped with EMI fuel filter and EMI bypass oil filter.</i>
				Engine
				<i>NOTE: These service intervals require the use of either CG-4 mineral oil or synthetic oil.</i>
•				Check fuel supply.
•	•			Check engine oil level.
•	•			Inspect belts for condition and proper tension.
•	•			Check engine oil pressure; hot, high speed. Minimum 40 psig (276 kPa, 2.8 bar).
•	•		•	Listen for unusual noises, vibrations, etc.

Maintenance Inspection Schedule

Pretrip	1,200 Hours	2,000 Hours	Annual 3,000 Hours	Inspect/Service These Items
				<i>NOTE: The 1,200 hour maintenance interval may be extended to 2,000 hours or 1 year (whichever occurs first) when equipped with EMI fuel filter and EMI bypass oil filter.</i>
				Engine (continued)
•		•		Dry air cleaner. Check air restriction indicator (if so equipped). Change air cleaner element when indicator reaches 25 in. Replace air cleaner element at 2,000 hours or 1 year (whichever occurs first) if air restriction indicator has not reached 25 in. If not equipped with an air restriction indicator, replace air cleaner element at 2,000 hours or 1 year (whichever occurs first).
	•			Clean and service crankcase breather and check air cleaner hose for damage.
	•			Change standard (white) fuel filter.
		•		Change EMI 2000 (black) fuel filter.
	•			Inspect and clean fuel prefilter and electric fuel pump filter.
			•	Drain water from fuel tank and check vent.
			•	Check and adjust engine speeds (high and low speed).

Maintenance Inspection Schedule

Pretrip	1,200 Hours	2,000 Hours	Annual 3,000 Hours	Inspect/Service These Items <i>NOTE: The 1,200 hour maintenance interval may be extended to 2,000 hours or 1 year (whichever occurs first) when equipped with EMI fuel filter and EMI bypass oil filter.</i>
				Engine (continued)
			•	Check condition of engine mounts.
			•	Maintain year around antifreeze protection at -30 F (-34 C).
			—	Change green engine coolant every 2 years.
			—	Change ELC (red) engine coolant every 5 years or 12,000 hours. Units equipped with ELC have an ELC nameplate on the expansion tank (see "Safety Decals and Locations").
				Engine Oil Change Intervals (see below) <i>NOTE: Change engine oil and filters (hot).</i>
	•			Oil change interval with API classification CG-4 (or better) mineral oil or synthetic oil.
		•		Oil change interval with API classification CG-4 (or better) mineral oil or synthetic oil, and EMI 2000 bypass oil filter.

Maintenance Inspection Schedule

Pretrip	1,200 Hours	2,000 Hours	Annual 3,000 Hours	Inspect/Service These Items
				<i>NOTE: The 1,200 hour maintenance interval may be extended to 2,000 hours or 1 year (whichever occurs first) when equipped with EMI fuel filter and EMI bypass oil filter.</i>
				Electrical
•				Check controller for alarms.
•				Run Unit Self Check Test. See "µP-T Unit Self Check Test."
•	•			Check battery voltage screen.
	•			Inspect battery terminals and electrolyte level.
	•			Inspect electrical contacts for pitting or corrosion.
	•			Inspect wire harness for damaged wires or connections.
			•	Check calibration of return and discharge air sensors, and optional temperature sensors, in 32 F (0 C) ice water.
			•	Check air switch setting.
			•	Inspect alternator bearings* and brushes.
			•	Inspect electric motor bearings* (Model 50).
* With belt removed, spin bearings by hand. Listen for noise (bearings roll freely).				

Maintenance Inspection Schedule

Pretrip	1,200 Hours	2,000 Hours	Annual 3,000 Hours	Inspect/Service These Items
				<i>NOTE: The 1,200 hour maintenance interval may be extended to 2,000 hours or 1 year (whichever occurs first) when equipped with EMI fuel filter and EMI bypass oil filter.</i>
				Refrigeration
•	•			Check refrigerant level.
•	•			Check compressor oil level.
	•		•	Check suction pressure regulator or throttling valve setting on defrost or heat.
			•	Check discharge and suction pressures.
			•	Check compressor efficiency.
			—	Replace dehydrator and compressor oil filter every two years.

Maintenance Inspection Schedule

Pretrip	1,200 Hours	2,000 Hours	Annual 3,000 Hours	Inspect/Service These Items <i>NOTE: The 1,200 hour maintenance interval may be extended to 2,000 hours or 1 year (whichever occurs first) when equipped with EMI fuel filter and EMI bypass oil filter.</i>
				Structural
•	•			Visually inspect unit for fluid leaks (coolant, oil, refrigerant).
•	•			Visually inspect unit for damaged, loose or broken parts (includes air ducts and bulkheads, if so equipped).
	•		•	Inspect clutch for shoe and anchor bushing wear with a mirror. Check bearings.*
			•	Inspect idlers, fan shafts and jackshaft for leakage and bearing wear.*
			•	Clean entire unit including condenser and evaporator coils and defrost drains.
			•	Check defrost damper operation.
			•	Check all unit, fuel tank, engine and electric motor mounting bolts, brackets, lines, hoses, etc.
* With belt removed, spin bearings by hand. Listen for noise (bearings roll freely).				

Maintenance Inspection Schedule

Warranty

Terms of the Thermo King Warranty are available on request.
Please reference document TK 50047 for the Thermo King
Self-Powered Truck Unit Warranty.

Glossary

This glossary is published for informational purposes only and the information being furnished herein should not be considered as all-inclusive or meant to cover all contingencies.

***NOTE:** Additional terms not found in the glossary may be located in the index section of this manual.*

accumulator: A device located in the suction line to collect liquid refrigerant and meter it safely back to the compressor as gas.

ambient air temperature: Temperature of the air surrounding an object.

amp: Abbreviation for ampere. The basic measuring unit of electrical current.

bar: A metric unit of pressure. 1 bar = 100 kPa = 14.5 psi.

Battery Sentry: Part of the CYCLE-SENTRY™ system. The Battery Sentry module monitors alternator charge rate and will keep the unit running until the battery is adequately charged.

box temperature: The temperature within a temperature-controlled compartment.

Btu (british thermal unit): The quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit. 1 Btu = 252 calories.

bulkhead: 1) *return air bulkhead.* A metal or plastic “wall” placed at the front of the box to prevent loading of product tightly against the Thermo King unit. (Loading too close to the unit restricts air flow and system efficiency.) 2) *bulkhead divider.* A thick, insulated “wall” used to separate compartments of a multi-temperature truck or trailer.

calorie: The amount of heat required to raise temperature of one gram of water one degree Celsius. 1 calorie = 0.004 Btu.

Celsius: The metric unit of temperature measurement. The preferred alternate to the term centigrade. Abbreviated “C.”

centigrade. See *Celsius*.

Glossary

CFC: Chlorofluorocarbon. A chlorine-based refrigerant consisting of chlorine, fluorine and carbon. Example: R12. In many countries it is illegal to release this type of refrigerant to the atmosphere because chlorine damages the earth's atmosphere. CFC refrigerants are not used in modern Thermo King units.

circuit breaker: A thermal device that automatically interrupts an electrical circuit when the current in the circuit exceeds the predetermined amperage rating of the breaker. See *amp*.

coil: A cooling or heating element made of pipe or tube, formed into a helical or serpentine shape, that may be equipped with thin metal fins to aid heat transfer.

cold curtains: Flexible vinyl curtains used to reduce air exchange between the refrigerated compartment and the outside during door openings.

compound gauge: A gauge calibrated in psig (or kPa) to measure pressure, and in inches of mercury (Kg/cm²) to measure vacuum.

compressor: The refrigeration component that compresses refrigerant vapor and creates refrigerant flow.

condenser: An arrangement of tubing in which the vaporized and compressed refrigerant is liquefied as heat is removed.

cycles per second: See *Hertz*.

damper door: A door on the evaporator section that closes during defrost to prevent hot air from entering the refrigerated cargo compartment.

data logger: An electronic device that monitors and stores unit operating and temperature data for later review. Examples: DMS, DAS, DRS and AccuTrac.

DE: Dual Evaporator. A multi-temp host unit with two evaporators capable of refrigerating two separate, longitudinal compartments.

defrost: The removal of accumulated ice from an evaporator coil. Periodic defrost is necessary when the evaporator coil is operating below freezing. Defrost is required more frequently when the air passing through the evaporator has a high moisture content.

defrost termination switch: A component that terminates defrost operation at a specific temperature.

Glossary

defrost timer: A solid state module that initiates defrost at selected intervals. Also establishes a maximum defrost duration if normal circuits malfunction.

dehydrator: A device used to remove moisture from refrigerant. Also called a drier.

discharge air temperature: The temperature of air leaving the evaporator.

drier: See *dehydrator*.

ECT: A ceiling-mounted Thermo King remote evaporator. See *EW* and *TLE*.

ERC: Extended Remote Unit Control. (Door switches) An option on Thermo King multi-temperature units to improve temperature control when doors are opened during delivery. When a compartment door is opened, the refrigeration unit for that compartment may be forced to NULL, defrost, or some other mode. Opening a compartment door may also affect the operating mode of other compartments. ERC systems are connected in a variety of ways to meet customer needs.

ETV (Electronic Throttling Valve) : A device used with a microprocessor to precisely control the refrigeration system.

evaporator: The part of the refrigeration system that absorbs heat during the cooling cycle.

EW: A wall-mounted Thermo King remote evaporator. See *ECT* and *TLE*.

F: See *Fahrenheit*.

Fahrenheit: A unit of temperature measurement used in the United States. Abbreviated "F."

freeze up: 1) Failure of a refrigeration system to operate normally due to moisture in the refrigerant and the formation of ice at the expansion valve. The expansion valve may be frozen shut or open, causing improper unit operation in either case. 2) The formation of a solid ice mass over the evaporator coil reducing air flow.

fuse: An electrical safety device (typically a cartridge) inserted into an electrical circuit. It contains material that will melt or break when the current is increased beyond a specific value. When this occurs, the circuit is opened and electrical current flow is stopped.

fusible link: An electrical safety device (typically a short piece of wire) inserted into an electrical circuit. The wire melts or breaks when the current is increased beyond a specific value. When this occurs, the circuit is opened and electrical current flow is stopped.

HCFC: Hydrochlorofluorocarbon. A chlorine-based refrigerant containing hydrogen, chlorine, fluorine and carbon. Example: R22. Because chlorine damages the earth's atmosphere, in many countries, it is illegal to release this type of refrigerant to the atmosphere. HCFC refrigerants are not used in modern Thermo King units.

Hertz: A unit of frequency equal to one cycle per second. Abbreviated "Hz."

HFC: A refrigerant consisting of hydrogen, fluorine and carbon. Examples: R134a and 404A. HFC refrigerants contain no chlorine and are, therefore, considered "safe" for the environment.

high pressure relief valve: A safety valve on the refrigeration system that allows refrigerant to escape from the system if pressure exceeds a predetermined value.

hp (horsepower): A unit of power equivalent to 746 watts or 550 foot-pounds per second.

HPCO (High Pressure Cut Out Switch): A pressure-operated switch that opens to stop unit operation when discharge pressure reaches a predetermined maximum.

invertible: A multi-temperature truck or trailer unit designed to allow the placement of deep-frozen cargo in any compartment. See *Multi-Temp*.

kPa: Kilopascals. A metric unit of pressure. $1 \text{ kPa} = 0.01 \text{ bar} = 0.145 \text{ psi}$.

load: 1) The product being refrigerated and transported.
2) The amount of heat being removed by the refrigeration system. (For example, a compressor is under a heavy heat load when expected to cool a very warm box.)

LPCO (Low Pressure Cut Out Switch): A pressure-operated switch that opens to stop unit operation when suction pressure reaches a predetermined minimum.

modulation: An optional system that reduces load (product) dehydration and avoids "top freeze."

Glossary

movable bulkhead: A thick, insulated, portable wall-like device used to compartmentalize a temperature-controlled truck or trailer. See *bulkhead*.

Multi-Temp: A Thermo King truck or trailer unit capable of maintaining different set-points in multiple compartments.

no. 1 diesel fuel: A grade of diesel fuel formulated to prevent “jelling” in low ambient temperatures.

no. 2 diesel fuel: A grade of diesel fuel formulated for moderate to warm ambient temperatures.

ohm: An electrical unit measuring the amount of resistance (opposition to the current flow) in an electrical circuit.

pre-cooling: 1) To cool down an empty box (temperature-controlled area) to the desired load temperature prior to loading. 2) To cool cargo to a desired temperature before loading.

pre-heat: The heating of diesel engine glow plugs prior to start-up. Some engines use an intake manifold heater rather than glow plugs.

pre-trip inspection: Checking the operation of a refrigeration system before loading.

psi: Pounds per square inch. A unit of pressure.
1 psi = 0.069 bar = 6.89 kPa.

psig: Pounds per Square Inch Gauge. Pressure in pounds per square inch as displayed by a gauge calibrated to zero when open to the atmosphere.

receiver tank: A refrigerant storage device included in nearly all Thermo King units.

refrigerant: The medium of heat transfer in a refrigeration system which absorbs heat by evaporating at a low temperature and releases heat by condensing at a higher temperature.

refrigerant oil: A special oil used to lubricate compressors in refrigeration systems.

remote evaporator: A separate evaporator unit located in a second or third compartment of a multi-temperature truck or trailer unit.

return air bulkhead: A structure (metal or plastic) mounted in the front of a trailer and designed to prevent restriction of return air flow to the Thermo King unit due to improper loading. See *bulkhead*.

Glossary

return air temperature: The temperature of the air returning to the evaporator. See box temperature.

rpm: Revolutions per minute.

setpoint: The temperature selected on a thermostat or microprocessor controller. This is normally the desired box temperature.

short cycling: When a refrigeration unit cycles between the heat and cool modes more often than normal.

sight glass: A system component that permits visual inspection of oil or refrigerant level and condition.

thermostat: A device that controls unit modes of operation to maintain a selected box temperature.

TLE: Thin-line evaporator. A Thermo King remote evaporator designed to be compact (thin) while supplying superior air flow. See *ECT* and *EW*.

top freeze: When the top portion of perishable cargo is damaged by freezing temperatures discharged from the refrigeration unit. This may occur near the front of the box when product is placed too close to the cold, discharge air flow.

Vac (volts alternating current): An electric current that reverses direction at regularly recurring intervals.

Vdc (volts direct current): An electric current that flows in one direction only and is constant in value.

volts: The basic measuring unit of electrical potential.

watt: The basic measuring unit of electrical power.

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Serial Number and Refrigerant Label Locations

Write the unit model and unit serial number in the spaces provided in the following Emergency Cold Line chapter. This information is needed to service the unit.

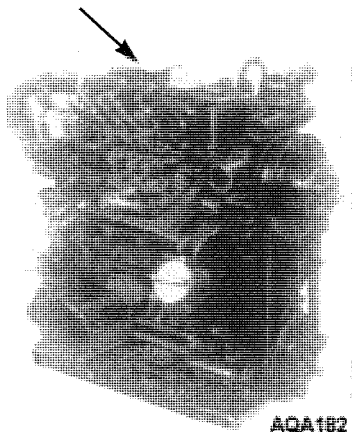


Figure 34: Engine Serial Number Location

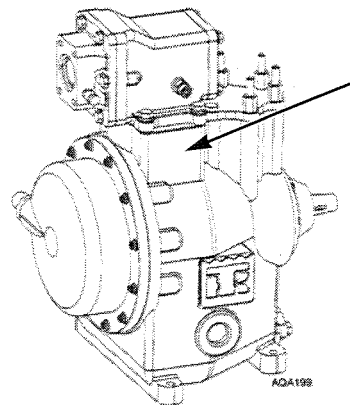
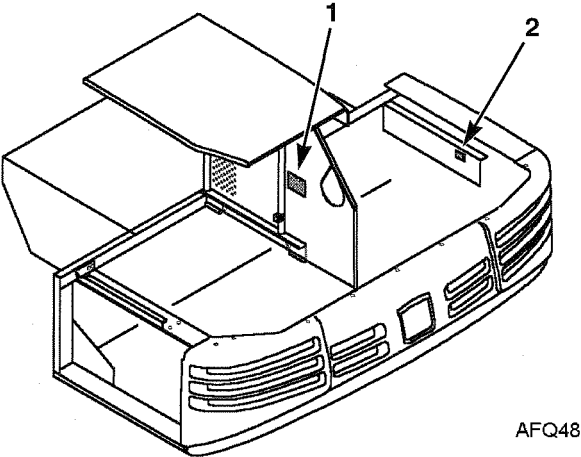


Figure 35: Compressor Serial Number Location

Serial Number and Refrigerant Label Locations



1.	Refrigerant Type
2.	Unit Serial Plate

Figure 36: Label Locations

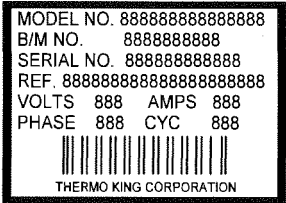


Figure 37: Laminated Unit Serial Number Plate

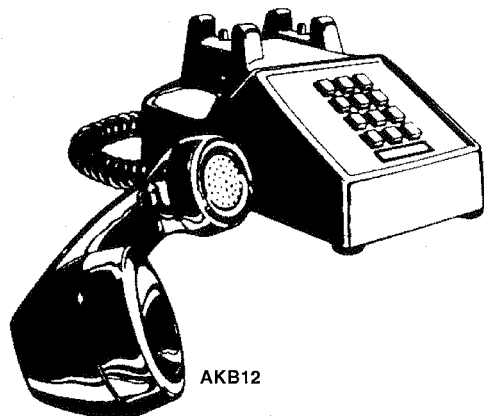
- Nameplate on inside of top right side of unit frame near three-way valve.



Figure 38: Refrigerant Type Label

- This label identifies the type of refrigerant in the unit.

Emergency Cold Line



If you can't get your rig rolling, and you have tried the Thermo King North American Service Directory (available from any Thermo King dealer) to reach a dealer without success, *then* call the Toll Free Emergency Cold Line Number (888) 887-2202.

The answering service at the factory will assist you in reaching a dealer to get the help you need. The Cold Line is answered 24 hours a day by personnel who will do their best to get you quick service at an authorized Thermo King Dealer. Have the following information available when you call:

Name _____ Title _____

Company _____ Phone No. _____

Address _____

Location _____ Destination _____

Product _____ Required Temp. _____

Present Temp. _____ Time Out Of Service _____

Unit Model _____ Problem _____

Serial Number _____

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.

CALIFORNIA

Proposition 65 Warning

**Diesel exhaust is a chemical known to
the State of California to cause cancer.**



Ingersoll Rand's Climate Solutions sector delivers energy-efficient HVACR solutions for customers globally. Its world class brands include Thermo King, the leader in transport temperature control and Trane, a provider of energy efficient heating, ventilating and air conditioning systems, building and contracting services, parts support and advanced controls for commercial buildings and homes.

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