T-Series Operator's Manual
T系列操作手册

THERMO KING
World Leader In Transport Refrigeration

T-600M, T-800M & T-1000M with TSD Control Panel

TK 54616-1-OP (Rev. 0, Nov. 15, 2010)

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Disclaimer

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

Thermo King Corporation and its affiliates shall have no liability in contract or tort (including negligence and/or strict liability) or otherwise, to any person or entity for any personal injury, property damage or any other direct, indirect, special or consequential damage or liability whatsoever, arising out of or resulting from any actions by any person that are contrary to this manual or any of the information, recommendations or descriptions contained herein or the failure of any person to implement the procedures described herein correctly or to follow caution and safety decals located on the Thermo King unit.

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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.

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 many 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.

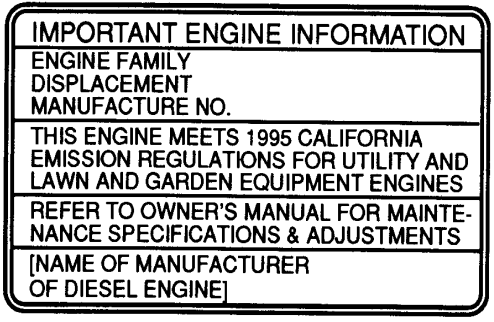
2-2. Air Induction System: Air induction system must remain intact and receive regular prescribed maintenance. *Example*: Air cleaner element replacement at required operation hour interval.

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: 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.

a. Emission control label: a new label, shown in Figure 1, contains important engine information.



AMA04

Figure 1: 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 2.

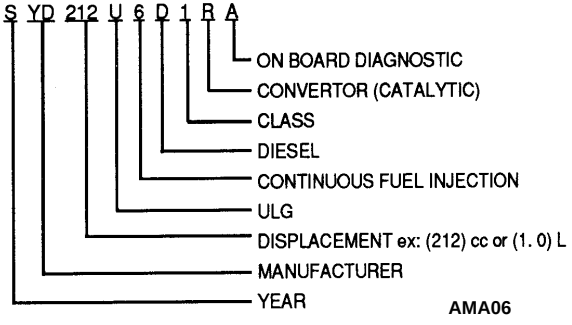


Figure 2: Engine Family Name

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 3:

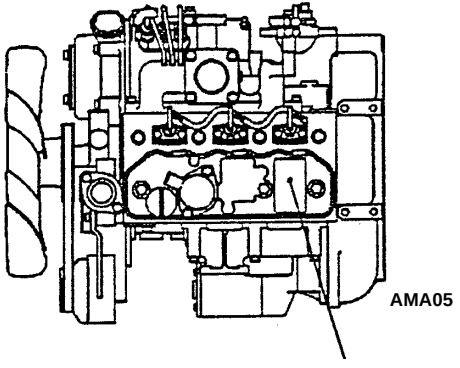


Figure 3: Emission Control Label Location

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 4.

	Engine Model	Engine Family Name
1.	3TNV70-TK	6YDXL0.85W3N
2.	3TNV76-TK	6YDXL1.11W3N
Note: Design parameters to bring engine family into compliance were utilized; no after treatment measures incorporated.		

Figure 4: Exhaust Control Systems

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 Element[1]
- Fuel Filter Element[1]
- 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*."

[1]Any 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

(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.

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)

- 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 changes 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.

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.

- 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.

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.

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.

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:

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.

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.

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.

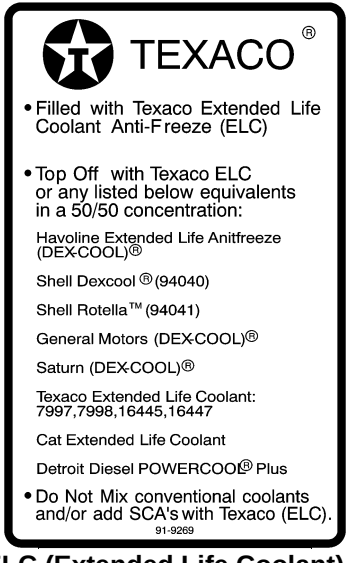
Skin: Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.

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.

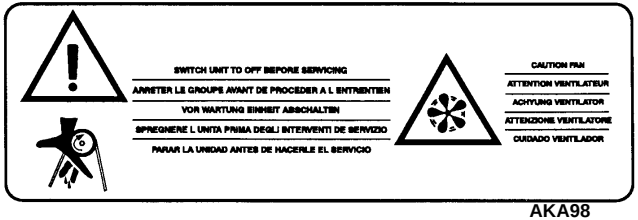
Safety Decals and Locations

Figure 5: Antifreeze Caution (Attached near radiator fill cap.)



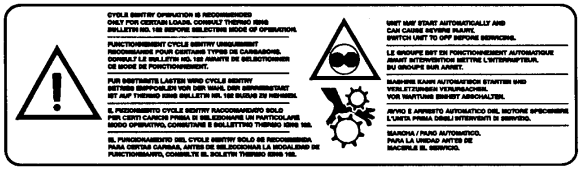
ARB108

Figure 6: ELC (Extended Life Coolant) Nameplate (Located On Expansion Tank In Units Equipped With ELC)



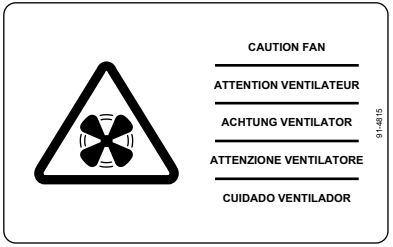
AKA98

Figure 7: 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

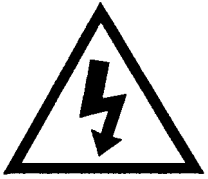
Figure 8: Automatic Start Caution (Locations vary depending on model. Decals are located near areas that contain moving parts which can cause severe injuries if hands or clothing become tangled when the unit automatically starts.)



ARA183

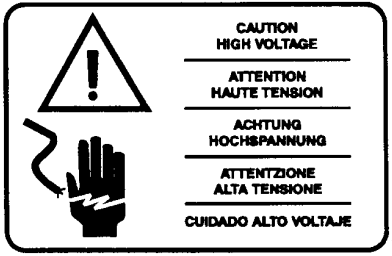
Figure 9: Fan Caution (Locations vary depending on model. Decals are located near areas that contain fans which can cause severe injuries if hands or clothing become tangled.)

Model 50 Units (Electric Standby)



AKB01

Figure 10: Electrical Hazard (Locations vary depending on model. Typically located near power receptacle, high voltage tray cover and interface board.)



AKB02

Figure 11: High Voltage Caution (Located near high voltage box.)

Unit Description

General Description

The T-600M, T-800M and T-1000M are microprocessor based transport temperature control systems thatuse the TSD Control Panel 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 refrigerants. 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 TSD microprocessor optimizes the unit's performance, 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 built-in CYCLE-SENTRY, an exclusive Thermo King feature, automatically starts and stops the unit according to temperature demands.

Design Features

- Microprocessor Controller, TSD
  - Alarm Code Display
  - Continuous System Monitoring

  - CYCLE-SENTRY™ Start/Stop Controls
  - Engine and Electric (Model 50) Hour Display
  - In-Cab Remote
  - Smart Defrost
  - Symbolic Controller Interface
  - Unit Self Check-pretripping
- Aerodynamic Thermo Plastic Recyclable Geloy Injection Molded Skins with In-mold Color
- Air Cleaner, Dry Type
- Alternator, 12 Volt, 37 Amp
- Automatic Phase Correction (Model 50)
- Bypass Oil Filter
- Coolant Expansion Tank
- Diesel/Electric Autoswitching (Model 50)
- Economy Mode
- Fahrenheit and Celsius Scales
- Fuel Filter, Spin On
- Oil Filter, Full Flow
- Poly-V Stretchy Belt System with Quiet Channel Technology
- R-404A Chlorine-free Refrigerant
- Robotic Welded Steel Frame with Automotive Grade 2 Coat Paint Finish
- X214 Compressor (T-800M, T-600M)
- X426 Compressor (T-1000M)
- Stainless Steel Condenser and Evaporator Hardware
- TK370 Tier 4 Diesel Engine (T-800M, T-600M)
- TK376 Tier 4 Diesel Engine (T-1000M)
- Top Cover System

Unit Options

- Easy-Read Thermometer
- Electric Evaporator Heater
- Electric Standby Operation (Model 50)
- Engine Block Heater

- Fuel Tank
- Hose Management System
- Hybrid SmartPower Operation
- Incremental Heating (electric & over the road)
- Low Decible Kit
- Quick Oil Drain Kit
- Remote Indicator Light
- Synthetic Oil

Engine

Engine power for the T-600M/T-800M is provided by the TK370, a three-cylinder, EPA Tier 4, special clean and quiet diesel engine rated at 15.0 continuous horsepower (11.2 kW) at 2425 RPM. A belt drive system transfers energy to the compressor, unit fans, and alternator.

Engine power for the T-1000M is provided by the TK376, a three cylinder, EPA Tier 4, special clean and quiet diesel engine rated at 19.6 continuous horsepower (14.6 kW) at 2425 RPM. A belt drive system transfers energy to the compressor, unit fans and alternator.

ELC (Extended Life Coolant)

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 coolants.

CAUTION: Do not add Green or Blue-Green coolants to cooling systems that use 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.

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.

Reciprocating Compressor

The T-600M/T-800M features the X214, 2 cylinder reciprocating compressor with 13.92 cu in(229 cc)displacement..

The T-1000M features the X426, 4-cylinder reciprocating compressor with 25.9 cu in (424 cc) displacement.

TSD Control Panel

The TSD Control Panel is used to operate the unit and display unit information. The Control Panel is typically located in the vehicle driver's compartment and communicates with the base controller using a connection on the interface board.

Figure 12: TSD Control Panel

CYCLE-SENTRY™ Start/Stop System

The 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 coil, 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 two methods of defrost initiation:

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

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

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.

Overload Relay: The overload relay is self-resetting.

Hot Gas Heat: Hot gas heat is utilized on all units.

Automatic Phase Correction: 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 features are available as options on units equipped with Electric Standby.

- Electric Heater Strips

Engine Compartment Components

Coolant Expansion Tank: The coolant level and temperature are monitored by the base controller. If the coolant temperature becomes too high or the level becomes too low, an alarm will occur.

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 Green or Blue-Green coolants to cooling systems that use Red Extended Life Coolants.

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 assist in checking the amount of refrigerant in the system.

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

Unit Protection Devices

High Pressure Cutout Switch (HPCO): This normally closed switch monitors the discharge pressure at the compressor. It opens on high discharge pressure to shut the unit down to prevent damage.

Suction Pressure Regulator (SPR): This component is a mechanical control device used to limit the suction pressure to the compressor. The valve controls suction pressure based on the actual system pressure.

Engine Oil Pressure Switch/Sensor: The engine oil pressure switch/sensor is located on the filter head above the bypass oil filter. Engine oil pressure should rise immediately on starting. If engine oil pressure drops below 10 ± 2 psig (69 ± 14 kPa), the switch/sensor signals the microprocessor to stop the engine.

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.

Coolant 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 contactor 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.

Fuses: Sizes and functions are described in the Specifications section of this manual.

AMA1231

Figure 13:T-600M/T-800M Front View

AMA1232

Figure 14: T-1000M Front View

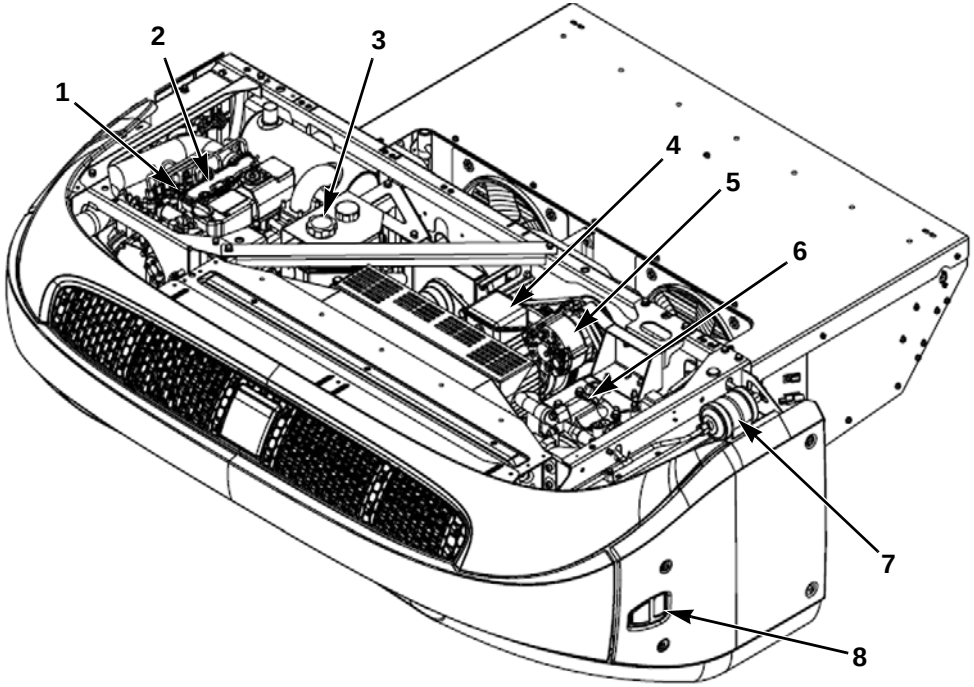


Figure 15: Main Components

1.	Engine Oil Dipstick (on side of engine)	5.	Alternator
2.	Engine	6.	Compressor
3.	Coolant Expansion Tank	7.	Dehydrator (Filter-Drier)
4.	Electric Motor	8.	On/Off Switch

Main Components in Figure 15

Unit Operation

Standard Display (TSD) Control Panel

The Truck Standard Display (TSD) Control Panel is supplied as standard equipment on TSR Single Temperature Truck applications. It is used to operate the unit and display some unit information. The Truck Standard Display (TSD) Control Panel communicates with the Base Controller via the CAN (Controller Area Network) bus. It is connected to the Base Controller via CAN Connector J35 on the Base Controller. The Truck Standard Display (TSD) Control Panel is typically located in the vehicle driver's compartment. It may be located in the truck dashboard using a DIN mounting ring or under the dashboard using an under dash mounting kit.

Figure 16: TSD Control Panel

- The Truck Standard Display (TSD) Control Panel consists of a display and nine touch-sensitive keys.
- The TSD Control Panel can show numbers only and can light several icons. It cannot display text, making it suitable for use with any language.
- Amber indicator LED's are located next to each of the four function keys below the display. The LED will light when that function is active.

- A red indicator LED is located between the ON Key and OFF Key. This indicator will glow if Alarm Code 91 Check Electric Ready Input occurs. It will also glow if a 15 pin Thermo King data cable is connected to the serial port on the back of the controller.

Controller Features

- Displays Box Temperature and Setpoint in Fahrenheit or Celsius
- Displays Engine Running and Electric Motor Running Hourmeters
- Changes Setpoint
- Selects and Indicates CYCLE-SENTRY or Continuous Mode Operation
- Selects and Indicates High Speed Lock-Out Operation
- Initiates and Indicates a Defrost Cycle
- Indicates an Alarm Condition Exists, Displays and Clears Alarms
- Initiates and Indicates a Pretrip Test
- Sends a Start of Trip to the ServiceWatch data logger.
- Changes Display Brightness
- Shows TSD Control Panel Serial Number and Software Revision

Display

The display presents information to the operator. This information includes setpoint and box temperature, hourmeter readings, alarms and several icons as shown below. All display segments and icons are shown in Figure 17.

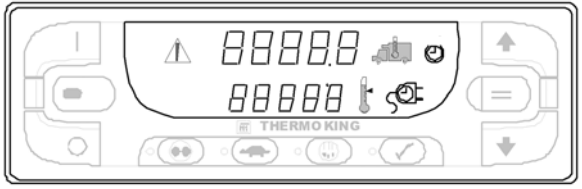


Figure 17: Display

The upper row of numbers can display the Box Temperature, Engine Run Time Hourmeter or Alarm Code(s).

The lower row of numbers can display the Setpoint, Electric Run Time Hourmeter or Total Number of Alarms.

The meaning of the display icons are shown in the table below.

When this icon is present the upper display is showing the actual box temperature inside the truck box.

When this icon is present the lower display is showing the current setpoint.

When this icon is present the upper display is showing the diesel engine run time.

When this icon is present the lower display is showing the electric motor run time (if the unit equipped with optional ELECTRIC STANDBY).

When this Alarm Icon is present one or more alarm conditions have occurred. If the display is not flashing any alarms are Check Alarms. If the display is flashing on and off a shutdown alarm has occurred and the unit has been shut down. Immediate action must be taken.

Keys and LED Indicators

There are nine touch sensitive keys. Some of these keys have more than one function as shown in Figure 18.

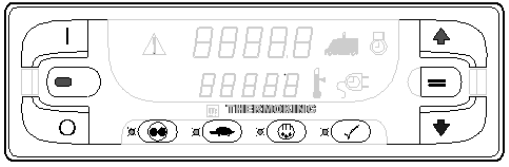


Figure 18: Keys and LED Indicators

There are amber indicator LED's located next to each of the four function keys below the display. The LED will glow amber when that function is active.

A red indicator LED is located between the ON Key and OFF Key at the left side of the display. This indicator will glow if Alarm Code 91 Check Electric Ready Input occurs. It will also light if a 15 pin Thermo King data cable is connected to the serial port on the back of the controller (DPD).

The primary and secondary key uses are shown in the table below. If the key has more than one use the primary use is shown first.

ON Key

Primary Use - Pressing the ON Key will turn the unit on.

Secondary Use - When the unit is on, pressing this key and the PRETRIP Key at the same time will display any alarm codes that are present.

Secondary Use - When the unit is on, pressing and holding this key allows the UP ARROW Key and DOWN ARROW Key to increase or decrease the display brightness.

Secondary Use - When the unit is on, pressing this key will return to the Standard Display of box temperature and setpoint.

OFF Key

Pressing the OFF Key will turn the unit off.

UP ARROW Key

Primary Use - When the unit is turned on and the Standard Display is shown, pressing the UP ARROW Key will increase the setpoint.

Secondary Use - When alarms are being displayed, pressing this key will scroll thru the alarms (if more than one alarm is present).

Secondary Use - While holding ON Key down with the unit turned on, pressing this key will increase the display brightness (Low, Medium, High).

DOWN ARROW Key

Primary Use - When the unit is turned on and the Standard Display is shown, pressing the DOWN ARROW Key will decrease the setpoint.

Secondary Use - While holding ON Key down with the unit turned on, pressing this key will decrease the display brightness (High, Medium, Low).

ENTER Key

If the setpoint has been changed using the UP ARROW Key and/or DOWN ARROW Key, pressing the ENTER Key enters the setpoint into the base controllers memory.

Secondary Use - When alarms are being displayed, pressing this key will clear the alarm shown on the display.

Secondary Use - When the unit is turned on, press and hold this key for 5 seconds to send a Start of Trip (SOT) to the data logger.

CYCLE-SENTRY/Continuous Key

Primary Use - If the unit is turned on and is in Continuous Mode, pressing the CYCLE-SENTRY/CONTINUOUS Key will switch operation to CYCLE-SENTRY Mode and the amber LED indictor will glow. If the unit is running in CYCLE-SENTRY Mode, pressing this key will switch operation to Continuous Mode and the amber LED will turn off.

HIGH SPEED LOCK-OUT Key

Primary Use - If the unit is turned on, pressing the HIGH SPEED LOCK-OUT Key will activate High Speed Lock-Out. The unit will switch to low speed operation and the amber LED indictor will glow. No further high speed operation is allowed until this feature is turned off. Unit may automatically return to high speed operation after a programmed time limit if timer feature is enabled.This feature is typically used in noise sensitive areas to reduce unit noise.

NOTE: The HIGH SPEED LOCK-OUT Key is only used when the unit is operating in Diesel Mode. The HIGH SPEED LOCK-OUT Key does not have any effect in Electric Mode operation.

DEFROST Key

Primary Use - If the unit is turned on, pressing the DEFROST Key will initiate a manual defrost cycle if conditions allow. If the evaporator coil temperature less than 45 F (7 C) the unit will enter a defrost cycle. The amber LED will flash while the defrost cycle is initialized and will glow during the defrost cycle. The defrost cycle will terminate automatically and the amber LED will turn off when the evaporator coil temperature is greater than 52 F (11 C). To manually terminate a defrost cycle turn the unit off and back on.

PRETRIP TEST Key

Primary Use - Pressing and holding the PRETRIP TEST Key for 5 seconds will initiate either a Full Pretrip Test or Engine Running Pretrip Test so long as no alarm conditions exist. If the Alarm Icon is glowing, record and clear the alarms before starting the Pretrip Test.

Press and hold the PRETRIP TEST Key for 5 seconds. The amber LED may flash while the Pretrip Test is initialized and will glow steady while the Pretrip Test is running. When the Pretrip Test is complete the amber LED will turn off.

- If there are no alarm codes set when the Pretrip Test is complete, the unit passed.
- If there are alarm codes set when the Pretrip Test is complete, the unit failed. Check and correct the alarm conditions and repeat the test.
- If a shutdown alarm occurred, Alarm Code 28 Pretrip Abort will be set and the unit will be shut down. Check and correct the alarm conditions and repeat the test.

Secondary Use - When the unit is turned off press and hold this key for 5 seconds to show the

TSD Control Panel Serial Number (in the upper display) and the TSD Control Panel Software Revision (in the lower display).

Turning the Unit On and Off

The unit is turned on by pressing the ON Key and off by pressing the OFF Key. When the ON Key is pressed the display briefly shows dashes as the display initializes.

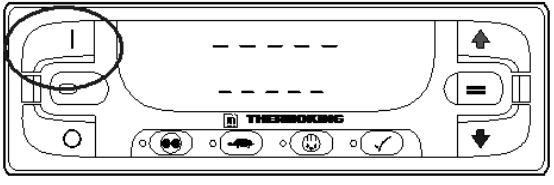


Figure 19: Keys and LED Indicators

Then the unit running time hourmeters are shown for 30 seconds. The diesel engine run time hours and Diesel Icon are shown in the upper display. If the optional Electric Standby Feature is installed, the electric motor run time hours and Electric Icon are shown in the lower display.

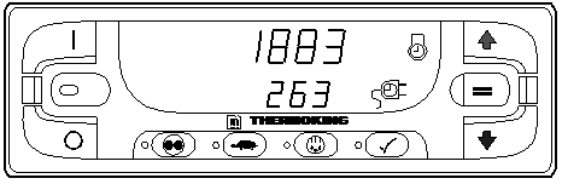


Figure 20: Electric Motor Run Time Hours and Electric Icon

When the unit is ready to run the Standard Display of box temperature and setpoint appears. The box temperature and Box Temp Icon are shown in the upper display. The setpoint and Setpoint Icon are shown in the lower display. The box temperature shown in Figure 21 is 35.8 F (2.1 C) with a 35 F (1.6 C) setpoint.

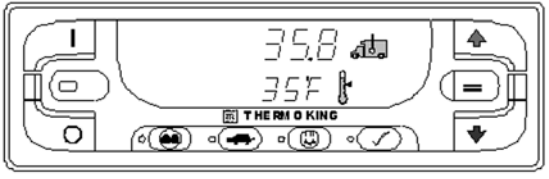


Figure 21: Standard Display of Box temperature and Setpoint

Pressing the OFF Key stops unit operation. The unit shuts down immediately and the display goes blank. To start the unit again, press the ON Key.

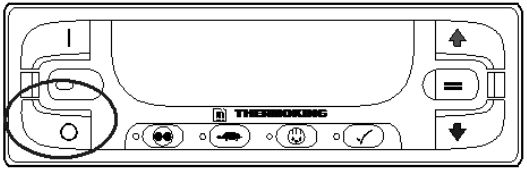


Figure 22: ON Key

The Standard Display

The Standard Display is the default display that appears if no other display function is selected. The box temperature is that measured by either the return air sensor or coil temperature sensor. The box temperature and Box Temperature Icon are shown in the upper display. The setpoint and Setpoint Icon are shown in the lower display. The box temperature in Figure 23 is 35.8 F (2.1 C) with a 35 F (1.6 C) setpoint.

Figure 23: Standard Display

- If another display is shown, pressing the ON Key will return the display to the Standard Display.

Changing the Setpoint

From the Standard Display, press the UP ARROW Key and/or DOWN ARROW Key until the desired setpoint is shown. In Figure 24 the setpoint has been increased to 40 F (4.4 C) using the UP ARROW Key.

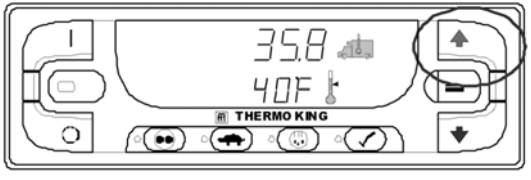


Figure 24: UP ARROW Key

When the desired setpoint has been selected using the UP ARROW Key or DOWN ARROW Key, the ENTER Key must be pressed within about 20 seconds to confirm and load the new setpoint.

- If the setpoint is changed using the UP ARROW Key and DOWN ARROW Key, the setpoint display will begin to flash 10 seconds after the last press of the UP ARROW or DOWN ARROW key as a reminder to press the ENTER Key.
- The setpoint display will flash for 10 additional seconds. If at the end of this time the ENTER Key still has not been pressed to complete the setpoint change, the setpoint will return to the old setpoint and Alarm Code 127 Setpoint Not Entered will be set. The Alarm Icon will appear in the display.

Figure 25: ENTER Key

The new setpoint of 40 F (4.4 C) will remain on the display after the ENTER Key has been pressed.

Failure to confirm the new setpoint by pressing the ENTER Key within 20 seconds of changing the setpoint will result in no setpoint change. In addition, Alarm Code 127 Setpoint Not Entered is set, to indicate that the setpoint change was started but was not completed.

Figure 26: Alarm Icon and Setpoint

Notice that the setpoint has returned to the old setpoint of 35 F (1.6 C) and the Alarm Icon has lighted indicating that Alarm Code 127 Setpoint Not Entered is set.

IMPORTANT: If the setpoint is changed using the UP ARROW Key or DOWN ARROW Key, the change must be confirmed by pressing the ENTER Key within 20 seconds of changing the setpoint.

- If the ENTER Key is pressed, the setpoint change made with the UP ARROW Key and/or DOWN ARROW Key is accepted, the setpoint is changed, and the display returns to the Standard Display showing the new setpoint.
- If the ENTER Key is not pressed within 20 seconds of making a change with the UP ARROW Key and/or DOWN ARROW Key, the setpoint is not changed and the display returns to the Setpoint Display showing the old setpoint. Alarm Code 127 Setpoint Not Entered is set and the Alarm Icon will appear on the display, to indicate that the setpoint change was started but not completed.

Starting the Diesel Engine

Verify the Base Controller On/Off switch is in the ON position. Diesel engine preheats and starts are automatic in both Continuous Mode and Cycle Sentry Mode. The engine will preheat and start as required when the unit is turned on. The engine pre-heat and start sequence will be delayed in Cycle Sentry mode if there is no current need for the engine to run.

NOTE: If the unit is equipped with optional Electric Standby there may be some additional prompts before the engine will start. See STARTING THE ELECTRIC MOTOR on the following pages for details.

CAUTION: The engine may start automatically any time the unit is turned on.

WARNING: Never use starting fluid.

When the engine is preparing to start, the TSD Control Panel will continue to display the Standard Display as shown in Figure 27. The preheat buzzer at the unit (located on the unit Base Controller) sounds during the engine pre-heat and crank sequence.

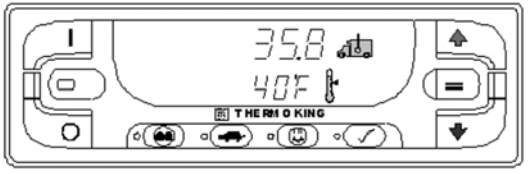


Figure 27: Standard Display

Starting the Electric Motor

Units equipped with the Electric Standby option only.

Verify the Base Controller On/Off switch is in the ON position. Electric motor starting is automatic in both Continuous Mode and CYCLE-SENTRY Mode. The motor will start as required when the unit is turned on in Standby Mode and standby power is connected.

CAUTION: The motor may start automatically any time the unit is turned on.

When the motor is preparing to start, the TSD Control Panel will continue to show the Standard Display as shown in Figure 28. The preheat buzzer at the unit (located on the unit Base Controller) sounds for 20 seconds before the electric motor starts.

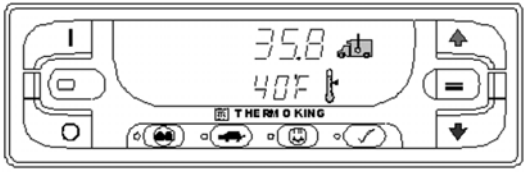


Figure 28: Standard Display

Switching from Diesel Mode to Electric Mode

IMPORTANT: Applies to units with the Electric Standby Option only.

IMPORTANT: Diesel to Electric Auto Switch and Electric to Diesel Auto Switch are not programmable features on TSR Truck units. Diesel to Electric Auto Switch is set [YES] on TSR units and cannot be changed. Electric to Diesel Auto Switch is set [NO] on TSR units and cannot be changed.

IMPORTANT: Cycle Sentry and Continuous operating modes are allowed as shown below.

- When running in Diesel Mode, a TSR unit can operate in either Cycle Sentry or Continuous. Cycle Sentry or Continuous operation is selectable by the operator in Diesel Mode.
- When a TSR unit is switched from Diesel Mode to Electric Mode, the unit is forced to Cycle Sentry operation. Continuous operation is not available in Electric Mode. However, the previous Diesel Mode operating condition (Cycle Sentry or Continuous) is held in memory. This information is retained even if the unit is turned off.
- When a TSR unit is switched from Electric Mode to Diesel Mode, the unit is forced to the previous Diesel Mode operating selection, either Cycle Sentry or Continuous. Cycle Sentry or Continuous operation is selectable by the operator in Diesel Mode.

Switching from Diesel Mode to Electric Mode

The unit will switch automatically from Diesel Mode to Electric Mode when standby power is connected and present.

Switching from Electric to Diesel

IMPORTANT: Applies to units with the Electric Standby Option only.

IMPORTANT: Cycle Sentry and Continuous operating modes are allowed as shown below.

- When running in Diesel Mode, a TSR unit can operate in either Cycle Sentry or Continuous. Cycle Sentry or Continuous operation is selectable by the operator in Diesel Mode.
- When a TSR unit is switched from Diesel Mode to Electric Mode, the unit is forced to Cycle Sentry operation. Continuous operation is not available in Electric Mode. However, the previous Diesel Mode operating condition (Cycle Sentry or Continuous) is held in memory. This information is retained even if the unit is turned off.
- When a TSR unit is switched from Electric Mode to Diesel Mode, the unit is forced to the previous Diesel Mode operating selection, either Cycle Sentry or Continuous. Cycle Sentry or Continuous operation is selectable by the operator in Diesel Mode.

Switching from Electric Mode to Diesel Mode

If the unit is operating in Electric Mode and standby power is disconnected or fails, the unit will not automatically switch to Diesel mode. This is primarily designed to prevent unauthorized diesel engine starts when the truck is indoors or on a ferry where engine operation is strictly prohibited.

If the unit is operating in Electric Mode and standby power is disconnected or fails, Alarm Code 91 Check Electric Ready Input will be set. The red LED between the ON key and OFF Key will glow, the Alarm Icon will glow and the box temperature and setpoint displays will disappear as shown in Figure 29.

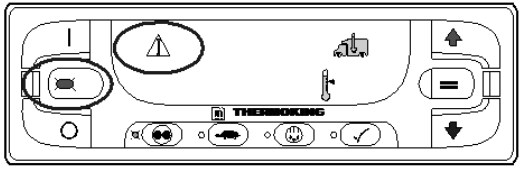


Figure 29: Alarm Icon

Alarm Code 91 Check Electric Ready Input will be cleared and the unit will restart automatically if power is restored.

Pressing the ON Key will clear Alarm Code 91 Check Electric Ready Input and turn the unit back on in Diesel Mode. If unit operation is required, the diesel engine will start as shown previously in STARTING THE DIESEL ENGINE.

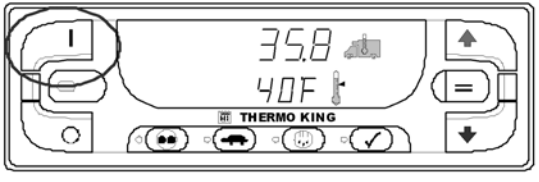


Figure 30: Press ON Key

Preferred Method for Manually Switching from Electric Mode to Diesel Mode

1. Press the TSD Control Panel OFF Key to turn the unit off.
2. Turn off the standby power and disconnect the cord.
3. Press the TSD Control Panel ON Key to turn the unit on. The Hourmeters display will briefly appear and then the screen will appear as shown in Figure 31.

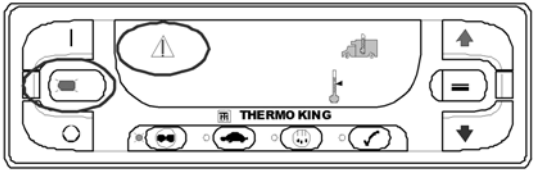


Figure 31: Display, Preferred Method for Manually Switching from Electric Mode to Diesel Mode

4. Press the TSD Control Panel ON Key again to clear Alarm Code 91 Check Electric Ready Input and turn the unit back on in Diesel Mode.

IMPORTANT: When the display shown in Figure 31 is present, do not press the TSD Control Panel OFF Key to turn the unit off. Press the TSD Control Panel ON Key again to clear Alarm Code 91 Check Electric Ready Input and turn the unit back on in Diesel Mode.

If the TSD Control Panel OFF Key is pressed when the display shown in Figure 31 is present, the unit will turn off and the display will be blank.

To restart the unit in Diesel Mode, proceed as follows:

- Press the TSD Control Panel ON Key. The Hourmeters display and a blinking Alarm Icon will appear.
- When the Hourmeters display and a blinking Alarm Icon is shown, press the TSD Control Panel ON Key again. The display will go blank but the blinking Alarm Icon will remain on and blinking.
- When the display goes blank and the blinking Alarm Icon is shown, press the TSD Control Panel ON Key again. The box temperature and setpoint will appear, the blinking Alarm Icon will disappear and the unit will start in Diesel Mode.

Selecting CYCLE-SENTRY or Continuous Operation

When CYCLE-SENTRY mode is selected the unit will start and stop automatically to maintain setpoint, keep the engine warm and the battery charged. When Continuous operation is selected, the unit starts automatically and runs continuously to maintain setpoint and to provide constant airflow throughout the truck box.

Diesel Mode

When running in Diesel Mode, Cycle Sentry or Continuous operation is selected by pressing the CYCLE SENTRY/CONTINUOUS Key when the unit is turned on. If the unit is running in Continuous Mode, pressing this key will switch operation to Cycle Sentry Mode and the amber LED indictor will glow. If the unit is running in Cycle Sentry Mode, pressing this key will switch operation to Continuous Mode and the amber LED will turn off.

The unit shown in Figure 32 is running in CYCLE-SENTRY Mode.

Figure 32: CYCLE-SENTRY/Continuous Key

CAUTION: The engine may start automatically any time the unit is turned on.
CAUTION: If the unit is in CYCLE-SENTRY null and the mode is switched to Continuous operation, the unit will start automatically.

Electric Mode

When running in Electric Mode, the unit is forced to Cycle Sentry operation. Continuous operation is not available when the unit is running in Electric Mode.

When switched to Electric Mode, the previous Diesel Mode operating condition (Cycle Sentry or Continuous) is held in memory. This information is retained even if the unit is turned off. When the unit is switched back to Diesel Mode, the unit will operate in the previous Diesel Mode condition.

Selecting High Speed Lock-Out

If the High Speed Lock-Out feature is turned on, the unit will run only in low speed until the High Speed Lock-Out feature is turned off or the High Speed Lock-Out Timer is exceeded. This feature is typically used in noise sensitive areas to reduce unit engine noise.

High Speed Lock-Out is turned on or off by pressing the HIGH SPEED LOCK-OUT Key when the unit is turned on. Pressing this key will turn High Speed Lock-Out on, pressing it again will turn High Speed Lock-Out off. If High Speed Lock-Out is turned on, the unit will switch to low speed operation and the amber LED indictor will glow. No further high speed operation is allowed until this feature is turned off or the High Speed Lock-Out Timer is exceeded.

IMPORTANT: HIGH SPEED LOCKOUT TIMER: If High Speed Lock-Out Mode is selected, the High Speed Inhibit Timeout feature may be enabled to return the unit to normal operation after a set time period has expired. This prevents unintended extended operation with high speed operation locked out. The time period may be set from 15 minutes to 2 hours. If a time period is set and exceeded, the unit will return to normal operation with high speed operation allowed and the amber LED indicator will turn off. If necessary to return to High Speed Lock-Out Mode, press the HIGH SPEED LOCK-OUT Key again.

The unit shown in Figure 33 has High Speed Lockout turned on.

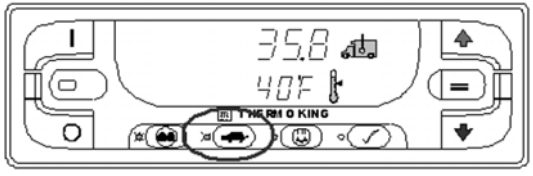


Figure 33: HIGH SPEED LOCKOUT Key

NOTE: The HIGH SPEED LOCK-OUT Key is only used when the unit is operating in Diesel Mode. The HIGH SPEED LOCK-OUT Key does not have any effect in Electric Mode operation.

Initiating a Manual Defrost Cycle

Defrost cycles are usually initiated automatically based on time or demand. Manual defrost may also be available. Defrost is only available if the unit is running and the evaporator coil temperature is less than or equal to 45 F (7 C). Other features such as door switch settings may not allow manual defrost under some conditions.

To initiate a manual defrost cycle, press the DEFROST Key as shown in Figure 34. If conditions allow, the unit will enter a defrost cycle and the amber LED next to the DEFROST Key will glow.

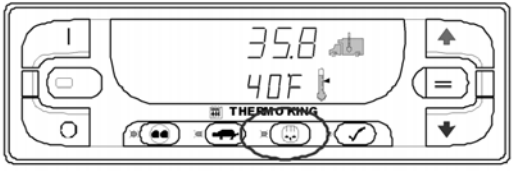


Figure 34: DEFROST Key

IMPORTANT: During the defrost cycle, the box temperature will rise toward 50 F (10 C). This is normal and is caused by the defrost cycle warming the evaporator coil. Since the damper door is closed during the defrost cycle, this warm air is not allowed to pass into the truck box.

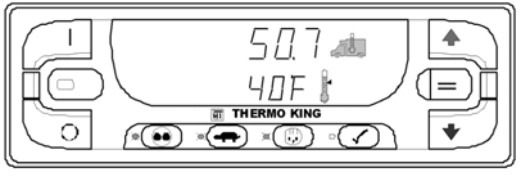


Figure 35: Box temperature will rise toward 50 F (10 C)

Terminating a Defrost Cycle

The defrost cycle terminates automatically when the coil temperature is greater than or equal to 52 F (11 C) or the maximum defrost timer expires. When the defrost cycle is completed the amber LED next to the DEFROST Key will turn off. Defrost can also be terminated by turning the unit off and back on.

Alarms

Alarm Code Notification

If an alarm condition occurs, the Alarm Icon will appear on the display. If the alarm is a Check Alarm, the Alarm Icon will turn on but the unit will continue to run. If the alarm is a Shutdown Alarm, the Alarm Icon and the display will flash on and off and the unit will shut down.

Figure 36: Alarm Icon

Displaying Alarm Codes

Alarms are displayed by simultaneously pressing and holding the ON Key and PRETRIP TEST Key. The alarm display will appear as shown below. The upper display shown in Figure 37 indicates that Alarm Code 127 Setpoint Not Entered has been set. The lower display indicates that only one alarm code exists.

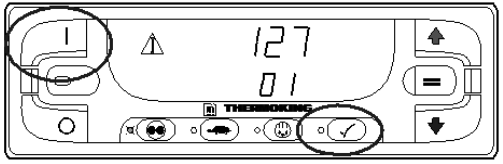


Figure 37: ON and PRETRIP TEST Keys

If more than one alarm code has been set, they are displayed with the most recent alarm shown first. Use the UP ARROW Key to scroll through the alarms.

Clearing Alarm Codes

After the alarm situation is resolved, press the ENTER Key to clear the alarm code currently being shown. When all alarms have been cleared the display will show all zeros to indicate that no alarm codes exist.

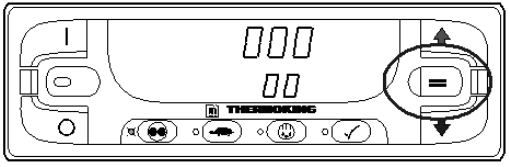


Figure 38: ENTER Key

The display will return to the Standard Display about 30 seconds after all alarms have been cleared.

Figure 39: Standard Display

Important Alarm Notes

- All alarms must be viewed before any of the alarms can be cleared.
- If an alarm will not clear, it may still exist. If the alarm is not corrected, it will not clear or may be immediately set again.
- Some alarms cannot be cleared using the TSD Control Panel. These alarms must be cleared by maintenance personnel using PC Monitor.
- Alarm Code 91 Check Electric Ready Input is cleared by turning the unit off and back on. See SWITCHING FROM ELECTRIC TO DIESEL in this section.

TSD Alarm Codes

NOTE: Not all alarm codes are used with all applications.

Code	Description	Operator Help
0	No Alarms Exist	

Code	Description	Operator Help
2	Check Evaporator Coil Sensor	Manually monitor load temperature. Report alarm at end of the day.
3	Check (Control) Return Air Sensor	Manually monitor load temperature. Report alarm at end of the day.
5	Check Ambient Air Sensor	Report alarm at end of the day.
6	Check Coolant Temp Sensor	Report alarm at end of the day.
7	Check Engine RPM Sensor	Report alarm at end of the day.
9	High Evaporator Temperature	Manually monitor load temperature. Report alarm at end of the day.
10	High Discharge Pressure	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.

Code	Description	Operator Help
12	Sensor or Digital Input Shutdown	The indicated zone is not longer able to operate and has been shut down. Repair immediately.
13	Sensor Check	Manually monitor load temperature. Report alarm at end of the day.
17	Engine Failed to Crank	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
18	High Engine Coolant Temperature	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
19	Low Engine Oil Pressure	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.

Code	Description	Operator Help
20	Engine Failed to Start	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
21	Cooling Cycle Check	Manually monitor load temperature. Report alarm at end of the day.
22	Heating Cycle Check	Manually monitor load temperature. Report alarm at end of the day.
23	Cooling Cycle Fault	The indicated zone is not longer able to operate and has been shut down. Repair immediately.
24	Heating Cycle Fault	The indicated zone is not longer able to operate and has been shut down. Repair immediately.
25	Alternator Check	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
26	Check Refrigeration Capacity	Manually monitor load temperature. Report alarm at end of the day.
28	Pretrip or Self Check Abort	Report alarm at end of the day.
29	Defrost Damper Circuit Check	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
31	Check Oil Pressure Switch	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
32	Refrigeration Capacity Low	The indicated zone is not longer able to operate and has been shut down. Repair immediately.

Code	Description	Operator Help
33	Check Engine RPM	Report alarm at end of the day.
35	Check Run Relay Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
36	Electric Motor Failed to Run	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
37	Check Engine Coolant Level	Report alarm at end of the day.
38	Electric Phase Reversed	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
42	Unit Forced to Low Speed	Report alarm at end of the day.
48	Check Belts or Clutch	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
50	Reset Clock	Report alarm at end of the day.
54	Test Mode Timeout	Service Test or Base Controller Test timed out after 15 minutes. Report alarm at end of the day.
61	Low Battery Voltage	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
63	Engine Stopped	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
64	Pretrip Reminder	Report alarm at end of the day.

Code	Description	Operator Help
66	Low Engine Oil Level	Check engine oil level. If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
68	Internal Controller Fault Code	Report alarm at end of the day.
70	Hourmeter Failure	Report alarm at end of the day.
74	Controller Reset to Defaults	Report alarm at end of the day.
84	Restart Null	Report alarm at end of the day.
90	Electric Overload	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
91	Check Electric Ready Input	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
93	Low Compressor Suction Pressure. GT-1 Units Only.	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
117	Auto Switch from Diesel to Electric	Report alarm at end of the day.
118	Auto Switch from Electric to Diesel	Report alarm at end of the day.
127	Setpoint Not Entered	Be sure the setpoint is set to the required temperature.
128	Engine Run Time Maintenance Reminder #1	Report alarm at end of the day.

Code	Description	Operator Help
129	Engine Run Time Maintenance Reminder #2	Report alarm at end of the day.
130	Electric Run Time Maintenance Reminder #1	Report alarm at end of the day.
131	Electric Run Time Maintenance Reminder #2	Report alarm at end of the day.
132	Total Unit Run Time Maintenance Reminder #1	Report alarm at end of the day.
133	Total Unit Run Time Maintenance Reminder #2	Report alarm at end of the day.
134	Controller Power On Hours	Report alarm at end of the day.

Code	Description	Operator Help
145	Loss of Controller "On" Feedback Signal	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
154	Check Low Suction Pressure Switch GT-1 Units Only	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.

Pretrip Test

A Pretrip Test verifies unit operation. The PRETRIP Key allows either a Full Pretrip Test or an Engine Running Pretrip Test to be initiated by the operator.

Pretrip Test Conditions

- The current unit settings are saved and restored at the end of the Pretrip Test or if the unit is turned off and back on.
- The Pretrip Test can be run in either Diesel or Electric Mode.
- The unit will auto switch from Diesel Mode to Electric Mode or from Electric Mode to Diesel Mode during a Pretrip Test if these features are enabled and the auto switch conditions occur.

Conditions where Pretrip Tests are not allowed

- Pretrip Tests are not allowed if any shutdown alarms are present.
- Pretrip tests are allowed with some Check and Log alarms present.

Pretrip Test Sequence

Pretrip tests proceed in the order shown below.

Full Pretrip Test

Full Pretrip Tests include all of the tests shown below.

- Amp Checks - Each electrical control component is energized and the current drawn is confirmed as within specification.
- Engine Start - The Engine will start automatically.
- Defrost - If the coil temperature is below 45 F (7 C), a defrost cycle is initiated.
- RPM Check - The engine RPM in high and low speed is checked during the Cool Check.
- Cool Check - The ability of the unit to cool in low speed is checked.
- Heat Check - The ability of the unit to heat in low speed is checked.

- Report Test Results - The test results are reported when the Pretrip Test is completed. If the Pretrip Test fails, alarm codes will exist to direct the technician to the source of the problem.

Engine Running Pretrip Test

Engine Running Pretrip Tests include all of the tests shown below. They do not include the Amps Check or the Engine Start tests.

- Defrost - If the coil temperature is below 45 F (7 C), a defrost cycle is initiated.
- RPM Check - The engine RPM in high and low speed is checked during the Cool Check.
- Cool Check - The ability of the unit to cool in low speed is checked.
- Heat Check - The ability of the unit to heat in low speed is checked.
- Report Test Results - The test results are reported when the Pretrip Test is completed. If the Pretrip Test fails, alarm codes will exist to direct the technician to the source of the problem.

Pretrip Test Considerations

When performing a Pretrip Test, the following issues should be considered.

- Whenever possible, run the Pretrip Test with an empty truck box.
- If running a Pretrip Test on a truck loaded with dry cargo, insure that proper airflow can occur around the load. If the load restricts airflow, false test results may occur. Also, units have high refrigeration capacity which results in rapid temperature change. Sensitive dry cargo may be damaged as a result.
- If running a Pretrip Test on a truck that has just been washed down, the extremely high humidity inside the truck box may result in false test results.
- If running a Pretrip Test on a truck loaded with sensitive cargo, monitor the load temperature during the test as normal temperature control is suspended during pre-trip operation.
- Always perform Pretrip Tests with the cargo doors closed to prevent false test results.

Performing a Pretrip Test

Starting a Pretrip Test

The Full Pretrip Test must be started with the unit not running. Turn the unit on and clear all alarm codes. Turn the unit off.

Turn the unit on and wait for the unit running time hourmeters to be shown on the display. When the unit running time hourmeters are shown on the display, press and hold the PRETRIP Key for 5 seconds.

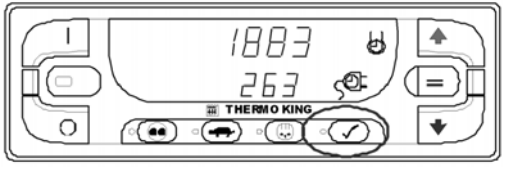


Figure 40: Pretrip Test

- A flashing Pretrip LED indicates that the Pretrip Test is being initialized. When the Pretrip Test starts, the Pretrip LED will glow steady amber. The display will show the Standard Display.
- The Amps Check Test will be preformed and then the unit will start automatically. The balance of the tests will be completed.
- The Pretrip Test will take about 20 - 30 minutes, depending on conditions.

IMPORTANT: The box temperature will vary during the Pretrip Test. This is normal operation.

- When the Pretrip Test is complete or if a Shutdown Alarm occurs, the amber Pretrip LED will turn off.
- Stopping a Pretrip Test: To stop a Pretrip Test at any time, press the POWER OFF Key to turn the unit off. This will generate Alarm Code 28 Pretrip Abort. Other alarm codes may also be generated. This is normal when the Pretrip Test is halted before completion.

Starting an Engine Running Pretrip Test

The Engine Running Pretrip Test must be started with the unit running. Turn the unit on and clear all alarm codes. Allow the unit to start.

With the unit running, press and hold the PRETRIP Key for 5 seconds.

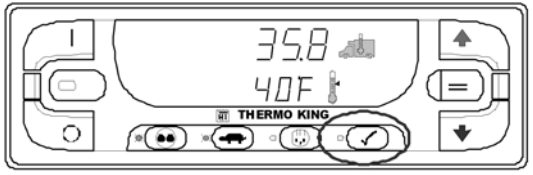


Figure 41: PRETRIP Key

- A flashing Pretrip LED indicates that the Pretrip Test is being initialized. When the Pretrip Test starts, the Pretrip LED will glow steady amber to indicate the test is in progress. The display will show the Standard Display.
- The Pretrip Test will take about 20 - 25 minutes, depending on conditions.

IMPORTANT: The box temperature will vary during the Pretrip Test. This is normal operation.

When the Pretrip Test is complete or if a Shutdown Alarm occurs, the amber Pretrip LED will turn off.

Stopping a Pretrip Test: To stop a Pretrip Test at any time, press the POWER OFF Key to turn the unit off. This will generate Alarm Code 28 Pretrip Abort. Other alarm codes may also be generated. This is normal when the Pretrip Test is halted before completion.

Pretrip Test Results

Pass Pretrip Test

- If the unit passes the Pretrip Test, the amber Pretrip Test LED will turn off at the completion of the test and the unit will continue to run as required. This signifies that the unit passed the Pretrip Test.

Fail Pretrip Test with Check Alarms

- If the unit fails the Pretrip Test with Check alarms, the Alarm Icon will appear when the alarm condition occurs. The Pretrip Test will continue to run unless a Shutdown Alarm occurs.

- The amber Pretrip Test LED will turn off at the completion of the test, but the Alarm Icon will remain lit. This indicates that one or more Check Alarm conditions occurred during the Pretrip Test. More than one alarm may be present.
- View and record the alarm(s), correct as necessary, clear the alarm(s) and repeat the Pretrip Test.

Fail Pretrip Test with Shutdown Alarms

- If the unit fails the Pretrip Test with a Shutdown alarm, the Alarm Icon will appear when the alarm condition occurs, the unit will immediately shut down and the amber Pretrip Test LED will turn off.
- The Pretrip Test will be aborted.
- Alarm Code 28 Pretrip Abort will be set along with the Shutdown Alarm that was detected. This signifies that a Shutdown Alarm occurred during the Pretrip Test and that the test was aborted. Other alarms may also be present.
- View and record the alarm(s), correct as necessary, clear the alarm(s) and repeat the Pretrip Test.

TSD Control Panel Display Brightness

The brightness of the TSD Control Panel display can be adjusted to allow for changing ambient light conditions. The choices available to the operator are HIGH, MEDIUM and LOW.

To change the display brightness press and hold the ON key then press the UP ARROW Key to increase display brightness and the DOWN ARROW Key to decrease display brightness.

Figure 42: ON Key, UP/DOWN Arrow Keys

Keypad Lockout

The Keypad Lockout feature allows the operator to lock the keypad to prevent tampering. If the Keypad Lockout feature is turned on, all keys except the ON Key and OFF Key are prevented from functioning. The unit can still be turned On and Off, but doing so does not clear Keypad Lockout.

To turn Keypad Lockout on, simultaneously press and hold the ON Key, CYCLE SENTRY Key and HIGH SPEED LOCK-OUT Key for 5 seconds. The display shown in Figure 43 will appear, with [0 - - - n] replacing the box temperature. When the three keys are released, the display will return to the Standard Display of box temperature and setpoint.

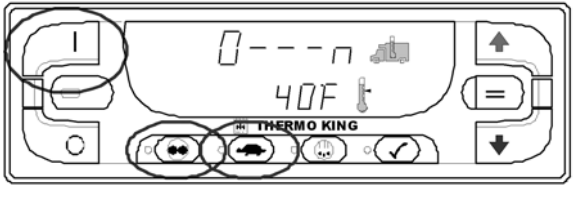


Figure 43: [0 - - - n] Replaces Box Temperature

When Keypad Lockout is turned on, only the ON and OFF Keys are functional. All other keys are locked out. Pressing any key other than the ON Key and OFF Key will cause the box temperature to display [0 - - - n]. When the key is released, the display will return to the Standard Display of box temperature and setpoint.

To turn Keypad Lockout off, simultaneously press and hold the ON Key, CYCLE SENTRY Key and HIGH SPEED LOCK-OUT Key for 5 seconds. The display shown above will appear, with [0 - - - n] replacing the box temperature. When the three keys are released, the display will return to the Standard Display of box temperature and setpoint. All keys will function normally.

Checking TSD Control Panel Serial Number and Software Revision

The TSD Control Panel serial number and software revision can be displayed if necessary. To display the serial number and software revision press and hold the PRETRIP key for 5 seconds when the unit is turned off.

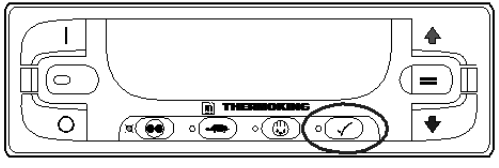


Figure 44: PRETRIP Key

The TSD Control Panel serial number is shown at the top of the display and the installed software revision is shown at the bottom of the display. The HMI Control Panel Serial Number shown in Figure 45 is 00186. The software revision shown in Figure 45 is Revision 2202.

Figure 45: Software Revision and Serial Number

Checking or Setting Unit Time and Date

With all TSR control systems, the system time and date is maintained by the TSD Control Panel. The time and date held by the TSD Control Panel cannot be viewed using the TSD Control Panel itself.

Time and date can be checked and changed using WinTrac 4.8.1 or later. Power must be connected to the TSD Control Panel and the unit must be turned off in order to check or change the time and date.

1. Remove the TSD Control Panel as necessary to gain access to the back of the device.
2. Turn the unit on to verify that power is available to the TSD Control Panel. Turn the unit back off.
3. Remove the back cover from the TSD Control Panel.
4. Connect a Thermo King 9 to 15 pin serial cable from the PC computer to the 15 pin connector on the back of the TSD Control Panel shown in Figure 46.

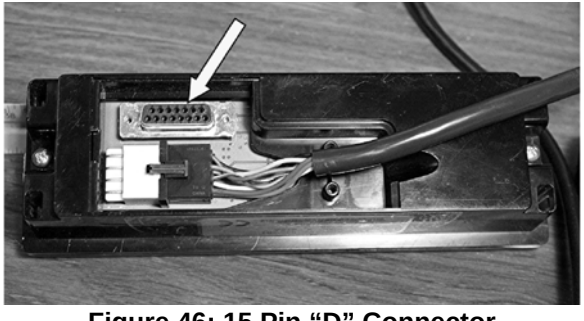


Figure 46: 15 Pin "D" Connector

5. When the cable is connected, be sure the red LED indicator located between TSD Control Panel POWER ON Key and POWER OFF Key is illuminated as shown below. If the red LED indicator is not illuminated the time and date cannot be changed. If the red LED indicator is not illuminated, be sure the unit is turned off.

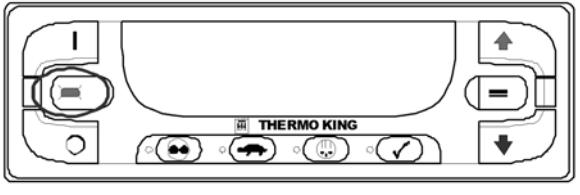


Figure 47: Red LED

6. Open WinTrac 4.8.1 or later. Earlier versions of WinTrac will not work.
7. Select Seek Device.
8. Use WinTrac to set the time and date. See the WinTrac Manual for additional information.

9. When the time and date is set and checked, disconnected the cable, replace the back cover and reinstall the TSD Control Panel as necessary.
10. Turn the unit on and perform a Data Logger download using PC Monitor to verify the time and date are correct.

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. Turn the unit OFF before connecting or disconnecting the power cord.

Figure 48: Model 50 Power Receptacle Box

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

See “Starting the Electric Motor” in the Unit Operation chapter of this manual.

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.

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.

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.

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.

Specifications

Engine

Model: T-600M/T-800M T-1000M	TK370 (Tier 4) TK376 (Tier 4)
Fuel Type	No. 2 Diesel fuel under normal conditions No. 1 Diesel fuel is acceptable cold weather fuel
Oil Capacity:T-600M/T-800M Crankcase & Oil Filter T-600M/T-800M w/Bypass Oil Filter T-1000M Crankcase & Oil Filter T-1000M w/Bypass Oil Filter	9.0 quarts (8.5 liters) 10.0 quarts (9.5 liters) Fill to full mark on dipstick 12.0 quarts (11.4 liters) 13.0 quarts (12.3 liters) Fill to full mark on dipstick
Oil Type	API Classification CI-4 or better (ACEA Rating E3 or better for Europe)

Engine (Continued)

Oil Viscosity	14 F to 122 F (-10 C to 50 C): SAE 15W-40 (Synthetic) 5 to 104 F (-15 to 40 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 122 F (-30 to 50 C): SAE 5W-40 (Synthetic) Below -22 F (-30 C): SAE 0W-30 (Synthetic)
Engine rpm:Low Speed Operation High Speed Operation	1650 ± 25 rpm 2200 ± 25 rpm
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
Intake Valve Clearance	0.006 to 0.010 in. (0.15 to 0.25 mm)
Exhaust Valve Clearance	0.006 to 0.010 in. (0.15 to 0.25 mm)
Valve Setting Temperature	70 F (21 C)
Fuel Injection Timing	16 ± 1 degrees BTDC
Injection Nozzle Pressure	1784 to 1929 psig (12,300 to 13,300 kPa)
Low Oil Pressure Switch/Sensor	10 ± 2 psig (69 ± 14 kPa)—shutdown
High Coolant Temperature Sensor	220 ± 5 F (104 ± 3 C)—shutdown

Engine (Continued)

Engine Thermostat	160 F (71 C)
Engine Coolant Type	ELC (Extended Life Coolant), which is “RED” Use a 50/50 concentration of any of the following equivalents: Chevron Dex-Cool Texaco ELC Havoline Dex-Cool® Havoline XLC for Europe Shell Dexcool® Shell Rotella Saturn/General Motors Dex-Cool® Caterpillar ELC Detroit Diesel POWERCOOL® Plus
	CAUTION: Do not add “GREEN” or “BLUE-GREEN” conventional coolant to cooling systems using “RED” Extended Life Coolant, except in an emergency. If conventional coolant is added to Extended Life Coolant, the coolant must be changed after 2 years instead of 5 years.

Engine (Continued)

Coolant System Capacity: T-600M/T-800M T-1000M	4.5 quarts (4.3 liters) with coolant expansion tank 5.0 quarts (4.7 liters) with coolant expansion tank
Coolant Expansion Tank Cap Pressure	15 psig (103 kPa)

Belt Tension

Belt	**Tension No. on TK Gauge P/N 204-427**		**Frequency Gauge P/N 204-1903 Setting Where Applicable**	
	New Belt	**Field Reset**	**New Belt**	**Field Reset**
Water Pump Belt	40	40		
Engine/Electric Motor (Jackshaft)	81	77	62 Hz	55 Hz
Electric Motor (Jackshaft)/Compressor	Automatically tensioned by tensioner position. See “Belts” in Engine Maintenance Chapter.			

Engine Clutch - Hilliard

Engagement	600 ± 100 RPM
Dynamic Torque	66 ft-lb (89.5 N•m) minimum @ 1600 RPM

Refrigeration System

Compressor Model: T-600M/T-800M T-1000M	Thermo King X214 Thermo King X426 LSC5
Refrigerant Charge:T-600M/T-800M T-1000M	8.0 lb(3.6kg) R-404A / 8.5 lb (3.9 kg) R-404A 9.0 lb (4.1 kg) R-404A
*Compressor Oil Charge:X214 in T-800M/T-600M X426 in T-1000M	3.2 quarts (3.0 liters) 4.3 quarts (4.1 liters)
Compressor Oil Type	Ester base P/N 203-513 required
Suction Pressure Regulator Valve Setting: T-600M T-800M T-1000M	28 to 31 psig (193 to 214 kPa) 35 to 37 psig (241 to 255 kPa) 21 to 23 psig (145 to 159 kPa)

Refrigeration System (Continued)

High Pressure Cutout Switch: Open Close	470 ± 7 psig (3241 ± 48 kPa) 375 ± 38 psig (2586 ± 262 kPa)
** When the compressor is removed from the unit, oil level should be noted or the oil removed from the compressor should be measured. This is to be sure that the same amount of oil can be added before placing the replacement compressor in the unit.*	

Electrical Control System

Control System Voltage	12.5 Vdc
Battery Charging System	12 volt, 37 amp, brush type, Thermo King alternator
Voltage Regulator Setting	13.95 to 14.35 volts @ 77 F (25 C)
NOTE: Fuse F14 (Bypass resistor for Prestolite Alternator) must be removed for the Thermo King Alternator.	

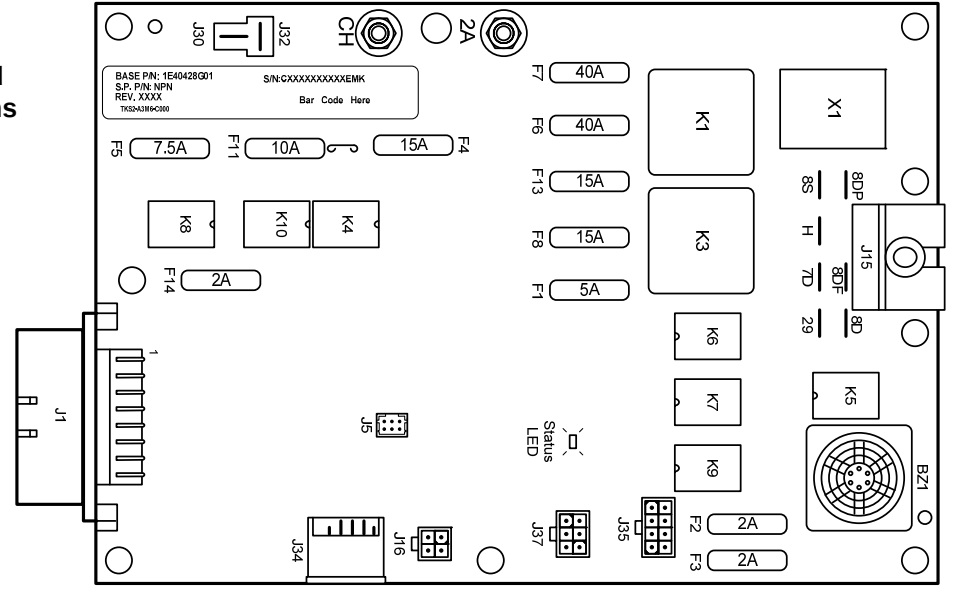
Fuses

Fuse	Size	Function
F1	5A	2P Circuit - Battery Power to TSD CAN Connector
F2	2A	8XP Circuit - Switch On Power to TSD CAN Bus
F3	2A	8FC Circuit - Remote Light
F4	15A	Power to On/Off Switch
F5	7.5A	HPCO/PHPCO Circuit
F6	40A	Preheat Circuit
F7	40A	Starter Solenoid Circuit
F8	15A	Damper Solenoid Circuit
F11	10A	8X Circuit - Power From On Relay (K4) - Install fuse in upper position.
F13	15A	High Speed (Throttle) Solenoid Circuit
F14	None 2A	No Fuse - All Bosch and Thermo King Alternators 2A Fuse - All Prestolite Alternators
F20	2A	Battery Power to Alternator Sense Circuit

Fuses (Continued)

Fuse	Size	Function
F21	60A	Main Fuse (2 Circuit)
F11 When fuse F11 is installed in the lower position the On/Off keys on the TSD Control Panel turn the unit on and off. When fuse F11 is installed in the upper position the unit will start and run without the TSD control panel.		
F14 Remove fuse F4 for units with Australian Bosch or Thermo King Alternators. Install fuse F4 for units with Prestolite Alternator.		

TSR Base Controller and Fuse Locations



AMA1236

Electrical Components

Component	Current Draw (Amps) at 12.5 Vdc	Resistance (Ohms)
Glow Plugs (3) Each	4.3	2.3 ± 0.2
Fuel Solenoid: Pull In Coil Hold In Coil	35 to 45 0.5	0.2 to 0.3 24 to 29
High Speed (Throttle) Solenoid	3.3	3.8
Damper Solenoid	5.7	2.2
Condenser Inlet Solenoid (CIS)	1.8	6.9
Hot Gas Solenoid (HGS)	1.1	11.3
Purge Valve (PV)	1.1	11.3
Starter Motor (No Load Bench Test)	90	

Electrical Standby (Model 50 Units Only)

T-600M/T-800M Electric Motor and Overload Relay

Voltage/Phase/Frequency	Horsepower	Kilowatts	rpm	Full Load (amps)	Overload Relay Setting (amps)
230/3/50	6.0	4.5	1460	17.0	19
230/3/60	7.2	5.4	1765	19.4	22
400/3/50	6.0	4.5	1460	9.8	11
460/3/60	7.2	5.4	1765	9.7	11

T-1000M Electric Motor and Overload Relay

Voltage/Phase/Frequency	Horsepower	Kilowatts	rpm	Full Load (amps)	Overload Relay Setting (amps)
230/3/50	10.0	7.5	1460	22.5	25
230/3/60	12.0	8.9	1750	28.8	32
400/3/50	10.0	7.5	1460	17.0	16
460/3/60	12.0	8.9	1750	14.4	16

Standby Power Requirements

Supply Circuit Breaker: T-600M/T-800M 200-230/3/50-60 T-1000M 200-230/3/50-60 All 380-460/3/50-60	 30 amps 50 amps 20 amps
Extension Cord Size:	Up to 50 ft—10 gauge 75 ft—8 gauge

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.

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
				Microprocessor
•				Run pretrip test (see “Pretrip Test” in Operating Instructions Chapter).
				Engine
•				Check fuel supply.
•	•			Check engine oil level.
•	•			Check condition of belts.
•	•			Check engine oil pressure hot, on high speed.
•	•	•	•	Listen for unusual noises, vibrations, etc.
	•			Check air cleaner hose for damage.
	•			Inspect and clean electric fuel pump filter.

Pretrip	1,200 Hours	2,000 Hours	Annual/ 3,000 Hours	Inspect/Service These Items
		•		Dry air cleaner. Replace air cleaner element at 2,000 hours or 1 year (whichever occurs first)
		•		Change EMI 2000 (black) fuel filter.
		•		Change engine oil and oil filters (hot). Requires oil with API Rating CI-4 or better (ACEA Rating E3 for Europe) and EMI 2000 bypass oil filter.
		•		Adjust electric motor (jackshaft)/compressor belt to field reset position.
		•		Check restraining mount (snubber) pre-load adjustment.
			•	Drain water from fuel tank and check vent.
			•	Check and adjust engine speeds (high and low speed).
			•	Check condition of engine mounts.
			•	Maintain year round antifreeze protection at –30 F (–34 C).

Pretrip	1,200 Hours	2,000 Hours	Annual/ 3,000 Hours	Inspect/Service These Items
			•	Test fuel injection nozzles at least every 3,000 hours.*
			—	Change ELC (red) engine coolant every 5 years or 12,000 hours. Units equipped with ELC have an ELC nameplate on the expansion tank.
* Based on EPA 40 CFR Part 89.				
				Electrical
•				Check controller for alarms.
•				Run pretrip test
•				Check battery voltage.
	•			Inspect battery terminals and electrolyte level.
	•			Inspect wire harness for damaged wires or connections.
			•	Inspect alternator bearings and brushes.**
			•	Inspect electric motor bearings (Model 50).**
** With belt removed, spin bearings by hand. Listen for noise (bearings roll freely).				

Pretrip	1,200 Hours	2,000 Hours	Annual/ 3,000 Hours	Inspect/Service These Items
				Refrigeration
•	•			Check refrigerant level.
	•			Check compressor oil level.
			•	Check suction pressure regulator setting on Defrost or Heat.
			•	Check discharge and suction pressures.
			•	Check compressor efficiency.
			—	Replace dehydrator and compressor oil filter every two (2) years.

Pretrip	1,200 Hours	2,000 Hours	Annual/ 3,000 Hours	Inspect/Service These Items
				Structural
•	•			Visually inspect unit for fluid leaks.
•	•			Visually inspect unit for damaged, loose or broken parts (includes air ducts and bulkheads).
	•		•	Inspect clutch for shoe and anchor bushing wear with a mirror. Check bearings.**
			•	Inspect idlers, fan shafts and jackshaft (if so equipped) for leakage and bearing wear.**
			•	Clean entire unit including condenser coils, evaporator coils, and defrost drains.
	•	•	•	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).				

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 safety 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.*

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.

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.

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 kPa = 0.01 bar = 0.145 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."

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*.

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.

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.

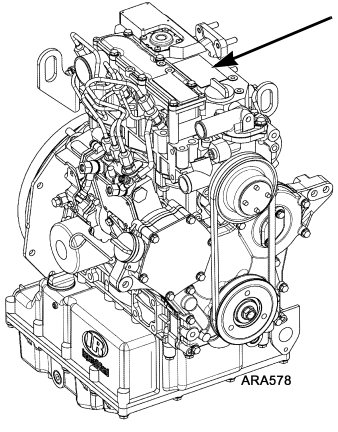


Figure 49: Engine Serial Number Location

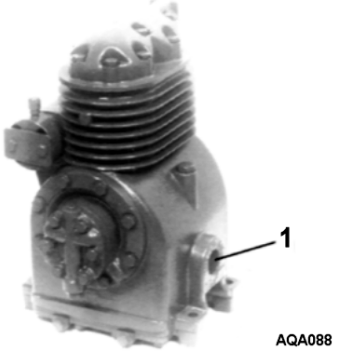


Figure 50: X214 Compressor Serial Number Location

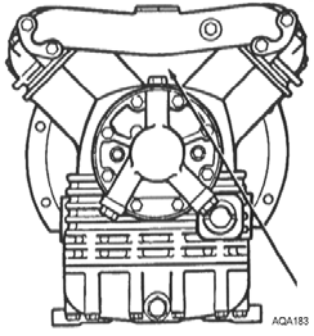


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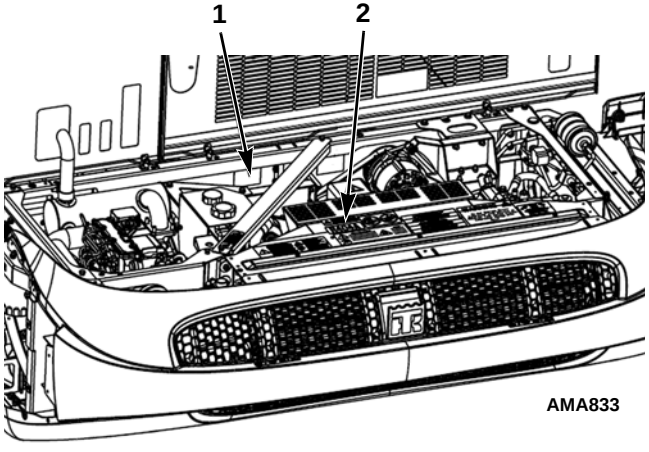
Figure 51: X426 Compressor Serial Number Location



1.	Unit Serial Plate
2.	Refrigerant Type

Figure 52: Label Locations

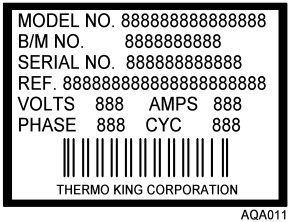


Figure 53: Laminated Unit Serial Number Plate

Figure 54: Refrigerant Type Label

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

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.

Emergency Cold Line

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

The answering service at the factory will assist you in reaching a dealer to get the help you need. The Thermo Assistance number is answered 24 hours a day by personnel who will do their best to get you quick service at an authorized Thermo King Dealer.