T-Series Operator's Manual

THERMO KING
World Leader In Transport Refrigeration

En

T-Series
T-1200R, T-1200R Intermodal, T-1000R, T-800R, T-600R, T-500R
T-1200R SPECTRUM,T-1000R SPECTRUM, T-800R SPECTRUM

OPERATOR'S MANUAL

TK60483-1-OP (Rev. 5, 09/14)

INTRODUCTION

GENERAL INFORMATION

The driver's manual 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. If further information is required, consult your Thermo King Service Directory for the location and phone number of the local dealer.

All service requirements, major and minor, should be handled by a Thermo King dealer.

Performing pre-trip checks on a regular basis minimizes operating problems. A closely followed maintenance program will also help keep your unit in top operating condition (see the "Maintenance Inspection Schedule" in this manual).

THERMO ASSISTANCE

Thermo Assistance is a multi-lingual communication tool designed to put you in direct contact with an authorized Service Dealer should you require one.

Note: Call charges will vary

THERMO KING

THERMO Assistance

00800 80 85 85 85

back up numbers:

Holland	+31 202 02 51 09
Belgium	+32 270 01 735
France	+33 171 23 05 03
Spain	+34 914 53 34 65
Italy	+39 02 69 63 32 13
U.K.	+44 845 85 01 101
Denmark	+45 38 48 76 94
Germany	+49 695 00 70 740
All others	+32 270 01 735

To use this system, you need the following information before you call:

- Your Contact Phone Number
- Type of Thermo King Unit Model
- Thermostat Setting
- Present Load Temperature
- Probable Cause of Fault
- Warranty Details of the Unit
- Payment Details for the Repair

Leave your name and contact number and a Thermo Assistance Operator will call you back. At this point you can give details of the service required and the repair will be organized.

Please note that Thermo Assistance cannot guarantee payments and the service is designed for the exclusive use of refrigerated transporters with products manufactured by Thermo King.

DISCLAIMER

The manufacturer, Thermo King, assumes no responsibility for any act or action taken on the part of the owner or operator in the repair or operation of the products covered by this manual that are contrary to the manufacturer's printed instructions. No warranties express or implied, including warranties arising from cause of dealing or usage or trade, are made regarding the information, recommendations, and description contained herein. The manufacturer is not responsible and will not be held liable in contract or in tort (including negligence) for any special, indirect, or consequential damages, including injury or damage caused to vehicles, contents, or persons, by reason of the installation of any Thermo King product, its mechanical failure, or the failure of owner/operator to heed caution and safety decals strategically located on the product.

FIRST AID AND SAFETY

REFRIGERANT

EYES

Immediately flush eyes with large amounts of water and get prompt medical attention.

SKIN

Flush area with large amounts of warm water. Do not apply heat. Wrap burns with dry, sterile, bulky dressing to protect from infection/injury and get medical attention.

INHALATION

Move victim to a fresh air location and restore breathing if necessary. Stay with them until the arrival of emergency medical personnel.

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 any contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.

INHALATION

Move victim to a fresh air location and restore breathing if necessary. Stay with them until arrival of emergency personnel.

INGESTION

Do not induce vomiting. Contact local poison control centre or physician immediately.

REFRIGERANT INFORMATION

Always observe caution when working with refrigerants and in areas where they are being used.

Fluorocarbon refrigerants evaporate rapidly, freezing anything that they come in contact with if accidentally released to the atmosphere from their liquid state.

Refrigerants may produce toxic gases which, in the presence of an open flame or electrical short, can become severe respiratory irritants which can be fatal.

Refrigerants displace air and can cause oxygen depletion which could result in death by suffocation. Observe caution at all times when working with or around refrigerant, or air conditioning systems which contain refrigerant, especially in enclosed or confined areas.

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.

SAFETY PRECAUTIONS

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

1. Always wear 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.
2. Never operate the unit with the compressor discharge valve closed.
3. Always keep your hands and loose clothing clear of fans and belts when unit is running or when opening or closing compressor service valves.
4. Always use extreme caution if you ever have occasion to drill holes in your unit. This could weaken structural components. Drilling into electrical wiring or refrigerant lines could cause a fire.
5. All service work on evaporator or condenser coils be completed by a certified Thermo King technician. If you ever do have occasion to be working around the coils, use extreme caution as exposed coil fins could cause painful lacerations.

CYCLE-SENTRY

If your unit is equipped for CYCLE-SENTRY operation, the unit may start automatically at any time when the unit is turned on and the CYCLE-SENTRY is selected.

ELECTRIC STANDBY

On Model 50 units, the unit may start automatically at any time when the unit is switched on, connected to live electric power and/or the electric operation is selected.

Be sure to switch the unit off before opening the doors or inspecting any part of the unit.

ELECTRICAL HAZARD

Units with electric operation or electric standby present a potential electrical hazard. Always disconnect the high voltage power cable before working on the unit.

WARNING!

Electric welding generates high amperage currents which can damage electrical and electronic components. To minimize damage, prior to any welding operation on the vehicle, the microprocessor and unit battery must be electrically disconnected from the vehicle. Switch the Microprocessor On/Off switch to Off. Remove the negative battery cable. Remove all connectors from the rear of the microprocessor. Close the control box. Connect the welder ground cable as close as possible to the area being welded. When welding is completed, remove the welder ground cable. Reconnect the cables to the rear of the microprocessor. Reattach the negative battery cable. Switch the microprocessor On/Off switch to On. Reset all alarms and codes to previous settings. Run a full Pretrip. A detailed procedure may be found in Thermo King Service Procedure A26A.

BATTERY INSTALLATION AND CABLE

Routing

WARNING: *Improperly installed battery could result in a fire or explosion! A Thermo King approved battery must be installed and properly secured to the battery tray.*

WARNING: *Improperly installed battery cables could result in fire or explosion! Battery cables must be installed, routed and secured properly to prevent them from rubbing, chaffing or making contact with hot, sharp or rotating components.*

WARNING: *Do not attach fuel lines or any additional wiring harnesses to the battery cables as this could cause an electrical fire!*

CAUTION: *Do not connect other manufacturer's equipment or accessories to the Thermo King unit. This could result in severe damage to equipment and void the warranty!*

CAUTION: *Set all unit electrical controls to the OFF position before connecting battery cables to the battery to prevent unit from starting unexpectedly and causing personal injury.*

CAUTION: *Always wear protective clothing, gloves and eye wear when handling and installing batteries. Battery acid can cause serious burns when exposed to eyes or skin. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flood it with running cold water for at least twenty minutes and get medical attention immediately.*

CAUTION: *Always cover battery terminals to prevent them from making contact with metal components during battery installation. Battery terminals grounding against metal could cause the battery to explode.*

UNIT DESCRIPTION

GENERAL DESCRIPTION

The T-Series unit is a microprocessor based transport temperature control system that uses the TSR/TSR-3 Truck HMI microcontroller to manage system functions.

The unit is front-mounted, diesel powered cooling and heating system designed for straight trucks. The unit mounts on the front of a truck with the evaporator portion protruding into the box. It is designed for use with chlorine free R-404A refrigerant. The SPECTRUM condensing unit mounts on the front of the truck cargo compartment. Remote evaporators are used to control temperatures in up to three individual cargo compartments.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 TSR/TSR-3 microprocessor optimises 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, TSR/TSR-3
  - •Alarm Code Display
  - •Battery Voltage Display
  - •Continuous System Monitoring
  - •CYCLE-SENTRY™ Controls
  - •Engine and Electric (Model 50) Hour Display
  - •In-Cab Remote
  - •Smart Defrost
  - •Symbolic Controller Interface
  - •Unit Self Check-pretripping
- Aerodynamic Recyclable Skins with In-mold Color
- Air Cleaner, Dry Type
- Alternator, 12 Volt, 37 Amp
- Alternator, 12 Volt, 120 Amp (SPECTRUM)
- 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
- Whisper Kit
- Oil Filter, Full Flow
- Poly-V Stretch Belt System with Quiet Channel Technology
- R-404A Chlorine-free Refrigerant
- TK X214 Compressor (T-600R/T-800R/ T-800R SPECTRUM),
- TK X426 Compressor (T-1000R/T-1000R SPECTRUM) and TK X430 Compressor (T-1200R/T-1200R SPECTRUM)
- Stainless Steel Condenser and Evaporator Hardware
- TK370 Diesel Engine (T-600R/T-800R/ T-800R SPECTRUM),
- TK376 Diesel Engine (T-1000R/T-1200R/ T-1000R SPECRTUM/ T-1200R SPECTRUM)
- TK270 Diesel Engine (T-500R)

UNIT OPTIONS

- Body Mount HMI Enclosure Systems
- DAS (Data Acquisition System)(except T-500R)
- Door Switch
- Electric Evaporator Heater
- Electric Standby Operation (Model 50)
- Hose Management System
- Rear Remote Control (flushmount)
- Remote Indicator Light
- Snow Cover (except T-500R)
- Telematics
- EON Battery

ENGINE

Engine power for the T-1200R, T-1000R, T-1200R SPECTRUM and T-1000R SPECTRUM is provided by the TK376, a three cylinder, clean and quiet diesel engine rated at 19.6 continuous horsepower (14.6 kW) at 2425 RPM.

Engine power for the T-600R, T-800R and T-800R SPECTRUM is provided by the engine TK370 rated at 15.0 continuous horsepower (11.2 kW) at 2425 RPM.

Engine power for the T-500R is provided by the engine TK270 rated at 10.0 continuous horsepower (7.5 kW) at 2950 RPM. A belt drive system transfers energy to the compressor, unit fans and alternator.

ELC (EXTENDED LIFE COOLANT)

The maintenance interval for ELC is 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.

DO NOT ADD GREEN OR BLUE-GREEN COOLANTS TO COOLING SYSTEMS THAT USE RED EXTENDED LIFE COOLANTS.

Note: The use of 60/40% 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-500R (w/o bypass oil filter), T-600R, T-800R and 800R SPECTRUM feature the reliable TK214 four-cylinder reciprocating compressor. The T-1000R and T-1000R SPECTRUM feature the reliable TK426 four-cylinder reciprocating compressor. The T-1200R and T-1200R SPECTRUM feature the reliable TK430 four-cylinder reciprocating compressor.

HMI CONTROL PANEL

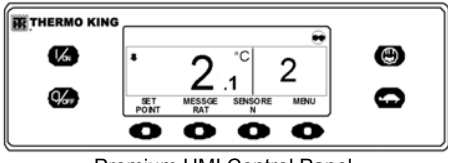
STANDARD

The Standard HMI Control Panel (Human/Machine Interface) 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.

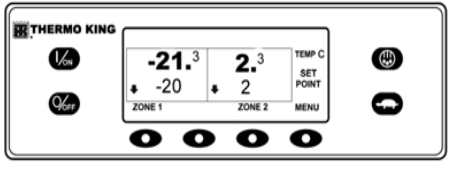
PREMIUM (Not available on T500R)

The Premium Truck HMI (Human/Machine Interface) Control Panel is available as an option on TSR-3 applications. It is used to operate the unit, display unit information and access all TSR-3 Maintenance and Guarded Access Menus. 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.

Standard HMI Control Panel



Premium HMI Control Panel



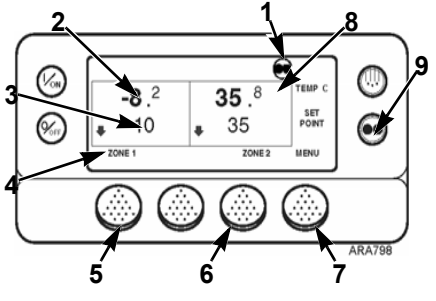
Premium HMI Control Panel - SPECTRUM

T-1200R INTERMODAL

Your T-1200R Intermodal unit uses the (Trailer) SR-3 control system to operate cooling, heating, and defrost functions. See below some basic information on operating the unit.

Note: Please contact your Dealer in order to refer to our appropriate "Drivers Guide to Simple Operation" for more details on operating the standard unit. See below picture of this unit, but from here on through this manual the standard TSR-3 Premium display will be referenced as it has the same or similar functionality.

T-1200R INTERMODAL SPECTRUM SR-3 CONTROLLER DISPLAY



1.	Cycle Sentry Icon
2.	Box Temperature (Zone 1)
3.	Setpoint (Zone 1)
4.	Cooling (Zone 1)
5.	Zone 1 Soft Key
6.	Zone 2 Soft Key
7.	Menu Soft Key
8.	Zone 2 Display
9.	High Speed Lockout

CYCLE-SENTRY™ SYSTEM

The CYCLE-SENTRY™ fuel saving system provides optimum operating economy.

> ***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:

TSR/TSR-3 Microprocessor Controller

The Microprocessor Controller is programmed to automatically initiate timed and forced defrost cycles. The TSR/TSR-3 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.”

DAS - DATA ACQUISITION SYSTEM (OPTIONAL - EXCEPT ON T-500R)

The DAS (Data Acquisition System) monitors and records the temperatures of (up to) six additional sensors. The sensors are independent from the microprocessor controller and are normally located in the truck box to monitor load temperatures. DAS data can be downloaded through a serial port to an IBM® PC compatible computer. WinTrac™ 4.8 (or higher) software is used to view and analyze the data. Brief reports can be printed on a microprinter connected to the serial port.

ELECTRIC STANDBY (MODEL 50 UNITS ONLY)

The Electric Standby option allows the unit to be operated on either the diesel engine or external electric power.

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 an option on units equipped with Electric Standby.

- Electric Heater Strips
- Water Heat

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 –34 C (-30 F). 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.

Electronic Throttling Valve (ETV) - (T-1200R, T-1200R SPECTRUM):

This component is an electromechanical control device used to limit the suction pressure to the compressor. The valve is controlled by the microprocessor controller.

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)

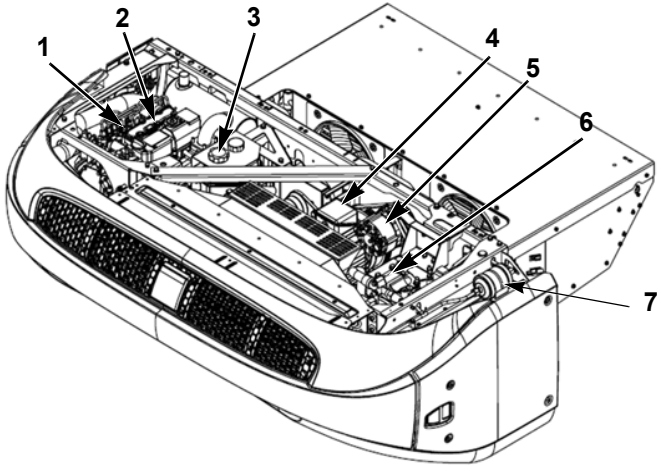
The overload relay protects the electric standby motor. The overload relay opens the circuit from the contactor to the electric motor if the motor overloads for any reason and an alarm will occur. The relay resets when the alarm code is cleared.

Fuses

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

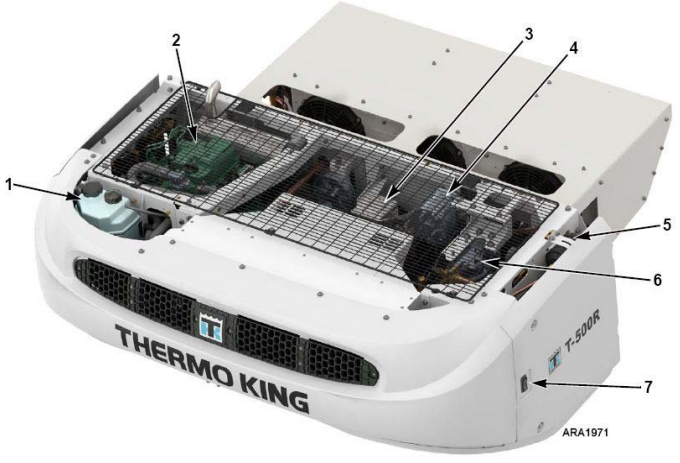
T500R runs 3 electric evaporator fans. Independantly fused.

Sample T-Series Front Views



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		

Main Components in T-Series Unit (except T-500R)



1.	Coolant Expansion Tank	5.	Dehydrator (Filter-Drier)
2.	Engine	6.	Compressor
3.	Electric Motor	7.	On/Off switch
4.	Alternator		

Main Components in T-500R Unit

UNIT OPERATING INSTRUCTIONS STANDARD TSR/TSR-3 HMI CONTROLLER

The TSR/TSR-3 Standard HMI (Human/Machine Interface) Control Panel is supplied as standard equipment on TSR/TSR-3 Single Temperature and Multi-Temperature Truck applications. It is used to operate the unit and display some unit information. The TSR/TSR-3 Standard HMI Control Panel communicates with the base controller. The TSR/TSR-3 Standard HMI Control Panel is typically located in the vehicle driver's compartment. It may be located in the truck dashboard.

TSR/TSR-3 HMI Controller

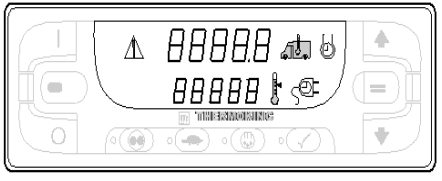
- The TSR/TSR-3 Standard HMI Control Panel consists of a display and nine touch-sensitive keys.
- The display is capable of showing numbers and lighting several icons. It does not display text, thereby making it suitable for use with any language.
- Amber indicator LED's are located next to each of the 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 (DPD).

CONTROLLER FEATURES

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



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.

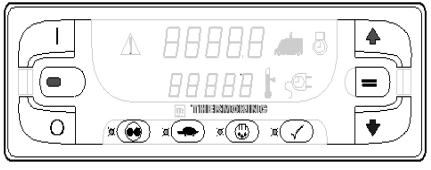
When this icon is present the upper display is showing the diesel engine run time.

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 below.



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

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.

POWER OFF Key

Pressing the OFF Key will turn the unit off.

UP ARROW Key

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

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.
Multi-Temp Use – Pressing this key will enable Manual Zone Selection mode and scroll through the installed zones, one zone at a time. When a zone is manually selected the zone can be turned on or off, the setpoint can be changed and a manual defrost cycle can be initiated if zone conditions permit.

CYCLE-SENTRY/ Continuous Key

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

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.
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

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.
Multi-Temp Use – A zone must be selected before initiating a manual defrost cycle.

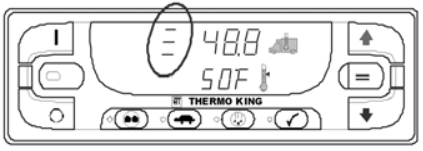
PRETRIP TEST Key

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. If the unit is not running when the PRETRIP TEST Key is pressed the unit will perform a Full Pretrip that includes circuit amps and running system checks. If the unit is running when the PRETRIP TEST Key is pressed the unit will perform the running system checks only. 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.
Control Panel Software Revision (in the lower display).

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 HMI Control Panel Serial Number (in the upper display) and the HMI

THE MULTI-TEMPERATURE DISPLAY AND ZONE INDICATORS

Horizontal bars to the left of the box temperature are used to indicate the zone currently shown on the display.



Zone 3 is being shown on the display

When one horizontal bar is present at the left side of the box temperature,then Zone 1 is being shown on the display. The display will automatically scroll through all configured zones, showing each zone for 10 seconds.

When two horizontal bars are present at the left side of the box temperature, then Zone 2 is being shown on the display. The display will automatically scroll through all configured zones, showing each zone for 10 seconds.

When three horizontal bar is present at the left side of the box temperature, then Zone 1 is being shown on the display. The display will automatically scroll through all configured zones, showing each zone for 10 seconds.

IMPORTANT: If the unit is configured as a 2 zone unit, Zone 3 will still appear in Automatic Zone Scrolling and Manual Zone Selection mode. However, Zone 3 is turned off and cannot be turned on.

In Figure 1, Zone 1 is being shown on the display. The box temperature in Zone 1 is -22.3°C and the setpoint is -23°C.

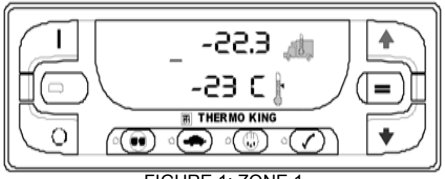


FIGURE 1: ZONE 1

In the screen in Figure 2, Zone 2 is being shown on the display. The box temperature in Zone 2 is 2.1°C and the setpoint is 1.7°C.

FIGURE 2: ZONE 2

In Figure 3, Zone 3 is being shown on the display. The box temperature in Zone 3 is 9.3°C and the setpoint is 10°C. Zone 3 only appears on units configured with 3 zones.

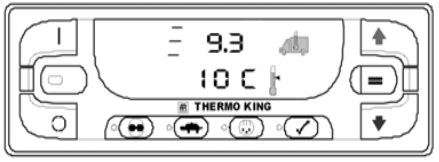


FIGURE 3: ZONE 3

Contact your Dealer about our "Drivers Guide to simple Operation for more details on how to operate the unit

STARTING THE DIESEL ENGINE

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 TSR/TSR-3 Standard HMI Control Panel will continue to display the Standard Display. The preheat buzzer at the unit (located on the unit Interface Board) sounds during the engine pre-heat and crank sequence.

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.

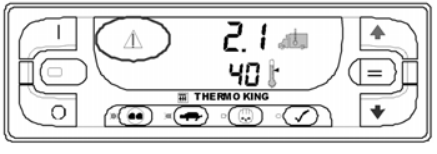
Caution: The motor may start automatically any time the unit is turned on.

When the motor is preparing to start, the TSR/TSR-3 Standard HMI Control Panel will continue to show the Standard Display. The preheat buzzer at the unit (located on the unit Interface Board) sounds for 20 seconds before the electric motor starts.

ALARMS

ALARM CODE NOTIFICATION

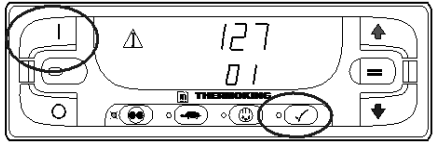
If an alarm condition occurs, the Alarm Icon will appear on the display. If the alarm is a Check Alarm, the Alarm Icon will turn on but the unit will continue to run. If the alarm is a Shutdown Alarm, the Alarm Icon and the display will flash on and off and the unit will shut down.



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 indicates that Alarm Code 127 Setpoint Not Entered has been set. The lower display indicates that only one alarm code exists.



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.

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

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 Standard Truck HMI Control Panel. These alarms must be cleared by maintenance personnel from the Maintenance or Guarded Access Menus.
- Alarm Code 91 Check Electric Ready Input is cleared by turning the unit off and back on.

See Alarm Codes in the next chapter for more details •

SENDING A SERVICEWATCH DATA LOGGER START OF TRIP

When the unit is turned on, press and hold the ENTER Key for 5 seconds to send a Start of Trip (SOT) marker to the unit ServiceWatch Data Logger and the optional DAS Data Logger (if equipped).

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 7 C (45 F), 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 7 C (45 F), 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.

DISPLAY BRIGHTNESS

The brightness of the TSR/TSR-3 Standard HMI 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.

CHECKING TRUCK HMI CONTROL PANEL SOFTWARE REVISION AND SERIAL NUMBER

The Standard Truck HMI Control Panel serial number and software revision can be displayed if necessary.

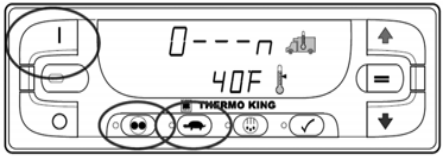
To display the serial number and software revision press and hold the PRETRIP key for 5 seconds when the unit is turned off.

The serial number is shown at the top of the display and the software revision is shown at the bottom of the display. The HMI Control Panel Serial Number shown in Figure is 00212. The software revision shown below is Revision 2200.

Software Revision and Serial Number

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 below 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.



[0 - - - n] Replaces Box Temperature

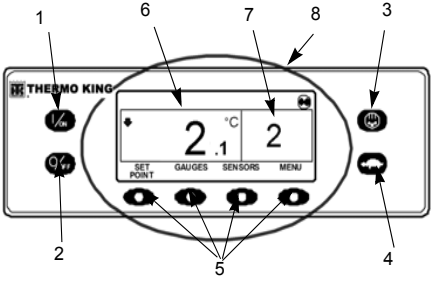
When Keypad Lockout is turned on, only the ON and OFF Keys are functional. All other keys are locked out. Pressing any key other than the ON Key and OFF Key will cause the box temperature to display [0 - - - n]. When the key is released, the display will return to the Standard Display of box temperature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

NOTE: With the Standard Truck HMI Control Panel, the Keypad Lockout feature is present even if the Guarded Access / Main Menu Configuration / Add Keypad Lockout to Mode Menu feature is disabled.

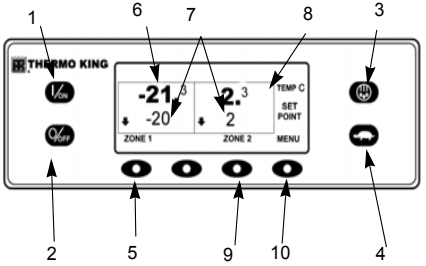
UNIT OPERATING INSTRUCTIONS PREMIUM HMI CONTROLLER

The Premium Truck HMI (Human/Machine Interface) Control Panel is available as an option on TSR-3 Truck applications. It is used to operate the unit, display unit information and access all TSR-3 Maintenance and Guarded Access Menus. The Premium HMI Control Panel communicates with the base controller via the CAN (Controller Area Network) bus. It is connected to the base controller via CAN Connector J14 on the interface board. The Premium HMI Control Panel is typically located in the vehicle driver's compartment. It may be installed in the truck instrument panel using a DIN mounting ring or under the instrument panel using an under dash mounting kit.



Premium HMI Control Panel Display

	Hard Keys
1.	On Key
2.	Off Key
3.	Defrost
4.	High Speed Lockout
5.	**Soft Keys**
6.	Box Temperature
7.	Setpoint
8.	Display



SPECTRUM - Premium HMI Control Panel Display

	Hard Keys
1.	On Key
2.	Off Key
3.	Defrost
4.	High Speed Lockout
5.	Zone 1 Soft Key
6.	Box Temperature
7.	Setpoints
8.	Zone 2 Display
9.	Zone 2 Soft Key
10.	Menu Soft Key

The HMI control panel consists of a display and 8 touch-sensitive keys.

The display is capable of showing both text and graphics.

The keys on the left and right sides of the display are dedicated single function "hard" keys.

The four keys under the display are "soft" keys. The functions of these soft keys change depending on the operation being performed. If a soft key is active the current key function is shown in the display directly above the key.

CONTROLLER FEATURES

- Displays Box Temperature and Setpoint in Fahrenheit or Celsius
- Displays Engine Running and Motor Running Hourmeters
- Changes Setpoint
- Indicates Alarm Condition Exists
- Displays and Clears Alarms
- Selects and Indicates CYCLE-SENTRY or Continuous Mode Operation
- Selects and Indicates High Speed Lock-Out Operation
- Initiates and Indicates a Defrost Cycle
- Initiates and Indicates a Pretrip Test

Sends a Start of Trip to the ServiceWatch data logger.

DISPLAY

The display presents information to the operator. This information includes setpoint and temperature, unit operating information, gauge readings, temperatures and other information as selected by the operator.

The Standard Display of box temperature and setpoint is shown here. The CYCLE-SENTRY Icon in the upper right of the display shows the unit is running in CYCLE-SENTRY (Start-Stop) Mode. The unit has a setpoint of 2 C, and an actual box temperature of 2.1 C. The down-pointing arrow at the left side of the display shows the unit is cooling.

The four keys under the display are termed "soft" keys. The functions of these keys change depending on the operation being performed. The function of each soft key is shown by labels in the display located directly above each soft key. In the example shown above, pressing the left soft key accesses the SETPOINT and pressing the right soft key accesses the MAIN MENU. The other two soft keys access the GAUGES menu and SENSORS menu as shown by the labels above the keys.

KEYS

HARD KEYS

The keys on either side of the display are dedicated or "hard" keys. Their function always remains the same.

SOFT KEYS

Soft Key	Description
	The four "soft" keys under the display are multi-purpose keys. Their function changes depending on the operation being performed. If a soft key is active the key function is shown in the display directly above the key. The keys are numbered from left to right, with Key 1 on the far left and Key 4 on the far right.

Typical soft key functions:

- MENU
- NEXT/BACK
- YES/NO
- +/-
- SELECT/EXIT
- CLEAR/HELP
- HOUR METERS/SENSORS
- GAUGES

TURNING THE UNIT ON AND OFF

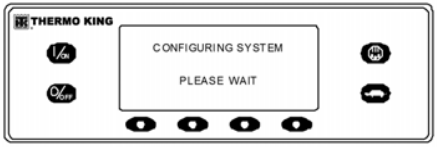
The unit is turned on by pressing the ON key and off by pressing the OFF key. When the ON key is pressed the display briefly shows the THERMO KING Logo as the display initializes.

Important: The ON key must be held down until the Thermo King Logo appears. If the ON key is not held down long enough (approximately ½ second), the display may flicker but the unit will not start up. If this occurs, hold the ON key down until the Thermo King logo appears.

Note: With extremely cold ambient temperatures it may take up to 15 seconds for the display to appear on initial startup.

Thermo King Logo

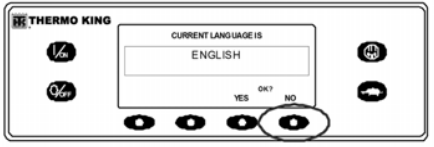
Then the startup screen shown in Figure appears while communications are established and the unit prepares for operation.



Startup Screen

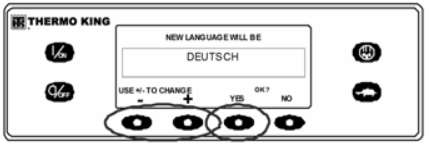
IF MORE THAN ONE LANGUAGE IS ENABLED

If more than one language has been enabled, a prompt will appear to allow the desired language to be chosen as shown below. Only languages enabled from the Guarded Access Menu are available. If a different language is desired, press the NO key as shown in Figure .



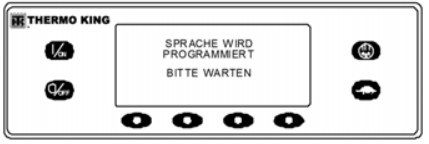
NO key

The Language menu will appear as shown in Figure . Press the + or - keys to select the desired language. When the desired language is shown press the YES key to confirm the choice.



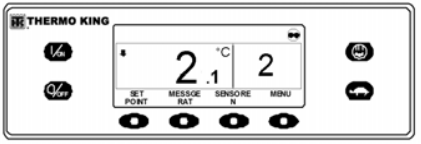
YES Key

The display will briefly show PROGRAMMING LANGUAGE - PLEASE WAIT in the new language as shown below.



Programming Language

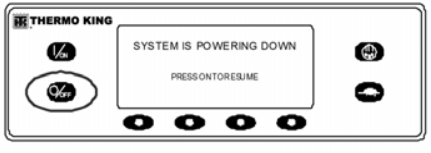
The new language is confirmed, and then the Standard Display will appear in the new language as shown below. The unit is ready to run.



Standard Display

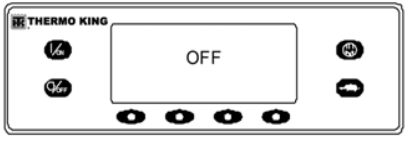
Should it be necessary to change to another language at any time, return to the Standard Display and then press and hold the first and last soft keys for 5 seconds . The Language Menu will appear in the current language. Press the + or - keys to select the desired language. When the desired language is shown press the YES key to confirm the choice. Note that all languages in the installed software can be selected using this method. When the unit is ready to run the Standard Display appears.

Pressing the OFF key stops unit operation. The unit shuts down immediately and the display briefly shows the power down message.



Power Down Message

The display briefly shows OFF and then goes blank. To start the unit again, press the ON key.



Off Display

THE STANDARD DISPLAY

The Single Zone Control Standard Display

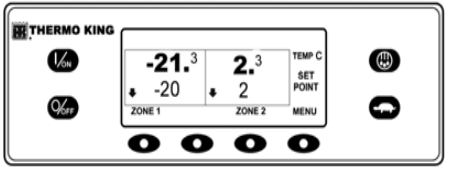
The Standard Display is the default display that appears if no other display function is selected. The Standard Display shows the box temperature and setpoint. The box temperature is that measured by the controlling sensor, usually the return air sensor. The box temperature in Figure "Premium HMI Control Panel Display" page 23 is 2.1°C with a 2°C setpoint.

The CYCLE-SENTRY Icon in the upper right corner of the display shows that the unit is operating in CYCLE-SENTRY Mode. If the CYCLE-SENTRY Icon is not present, the unit is operating in Continuous Mode.

The down-pointing arrow indicates that the unit is cooling. If the unit was heating the arrow would be pointing upward.

Pressing the left soft key allows the user to change the SETPOINT, and pressing the right soft key accesses the MAIN MENU. The other two soft keys access the GAUGES menu and the SENSORS menu.

The Two Zone Standard Display

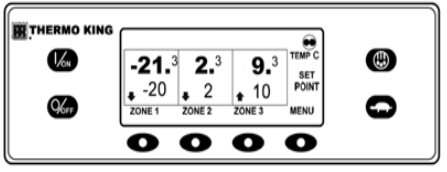


2 Zone Standard Display

The 2 Zone Standard Display in a figure shows the return air temperature and setpoint for two zones.

- The Cycle Sentry Icon in the upper right of the display shows that the unit is operating in Cycle Sentry mode.
- The return air temperature for Zone 1 is -21.3°C with a -20°C setpoint. The down-pointing arrow indicates that Zone 1 is cooling.
- The return air temperature for Zone 2 is 2.3°C with a 2°C setpoint. The down-pointing arrow indicates that Zone 2 is also cooling.
- The soft key under each zone is used to turn that zone on and off and allows the Setpoint for that zone to be changed.
- The soft key labeled MENU allows the Main Menu to be selected

The Three Zone Standard Display



The 3 Zone Standard Display adds the third zone for units equipped with three zones. The 3 Zone Standard Display functions the same way as the 2 Zone Standard Display.

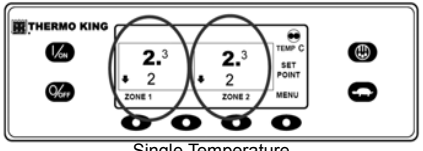
OPERATING THE UNIT IN SINGLE ZONE CONTROL MODE (SPECTRUM)

The following differences exist when operating the unit in Single Zone Control Mode.

- Single Zone Control Mode will appear in the Main Menu/Mode Menu only if the Single Zone Control feature has been enabled in the Guarded Access/Main Menu Configuration menu.
- If Single Zone Control operation is selected then all zones will be forced on and will control to the same setpoint.
- Unit control is based on the temperature sensors of one zone, usually Zone 1.
- All bulkheads should be taken down to create one large compartment.
- With the exception of defrost the operating mode of eachzone evaporator(s) will be same when in this mode. Unit control is based on the temperature sensors of one zone, usually Zone 1.
- f Single Zone Control operation is selected the Single Zone Standard Display provides one soft key labeled Set Point as shown above. This allows the setpoint for all zones to be changed simultaneously.
- If Single Zone Control operation is selected the individual zones cannot be turned off. The unit and all zones are turned On and Off simultaneously using the On and Off hard keys at the left side of the display.

OPERATING THE UNIT AT A SINGLE TEMPERATURE (SPECTRUM)

If Single Zone Control Mode is not enabled, the unit can still be run at a single temperature.



Single Temperature

- All bulkheads should be taken down to create one large compartment.
- Turn all zones on.
- Set all zones to the same setpoint.

Contact your Dealer aout our "Drivers Guide to Simple operation" for more details on operating the unit display.

STARTING THE DIESEL ENGINE

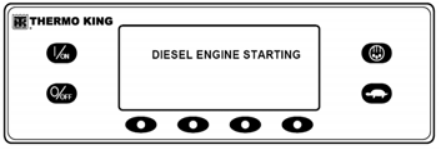
Diesel engine preheats and starts are automatic in both Continuous Mode and CYCLE-SENTRY Mode. The engine will preheat and start as required when the unit is turned on. The engine preheat and start will be delayed in CYCLE-SENTRY mode if there is no current need for the engine to run. If any keys are being pressed on the HMI control panel the engine will not preheat and start until 10 seconds after the last key is pressed

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 HMI control panel will display the engine start screen, as shown in Figure . The preheat buzzer sounds during the engine preheat and crank sequence.



Engine Start Screen

After the engine is started the display returns to the Standard Display of temperature and setpoint.

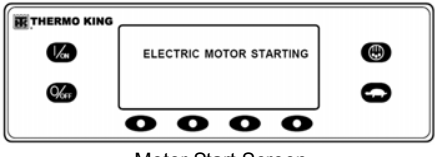
STARTING THE ELECTRIC MOTOR

Units equipped with the Electric Standby option only.

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. If any keys are being pressed on the HMI control panel prior to the motor start, the motor start will be delayed until 10 seconds after the last key is pressed.

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

When the motor is preparing to start the HMI control panel will display the motor start screen, as shown in Figure below. The preheat buzzer sounds for 20 seconds before the electric motor starts.

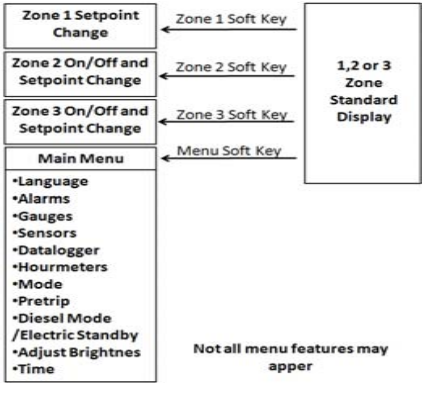


Motor Start Screen

After the motor is running the display returns to the Standard Display of temperature and setpoint.

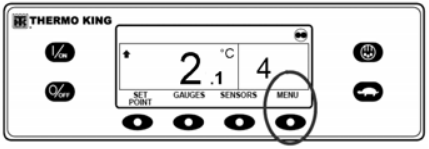
MAIN MENU OVERVIEW (SPECTRUM)

Truck SR-2 SPECTRUM M/T Operator and Main Menu.



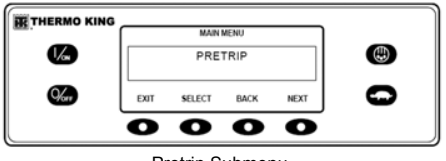
USING THE MAIN MENU

The Main Menu contains several additional submenus that allow the operator to view information and modify unit operation. To access the Main Menu press the MENU key.



Menu Key

The first Main Menu choice will appear. Press the NEXT and BACK keys to scroll thru the menu choices. When the desired selection is shown on the display, press the SELECT key to access it. The Pretrip submenu is shown below.



Pretrip Submenu

See “Main Menu Choices.” For detailed information see the individual explanations of each submenu item on the following pages.

To return to the Standard Display press the EXIT key.

MAIN MENU CHOICES

LANGUAGE - If more than one language is enabled, this will be the first menu item to appear. If only one language is enabled, this menu will not appear. The Language Menu allows the operator to select a language from a list of up to 11 languages at one time. All subsequent displays are shown in the selected language. Three different language packages with a total of 23 languages are available. English is the default language and is provided in each of the packages.

ALARMS - Allows the operator to view all alarms, and allows most alarms to be cleared. If only one language is enabled this will be the first menu item to appear.

DATA LOGGER - Allows the operator to set a Start of Trip marker to the ServiceWatch data logger. Also allows a Start of Trip and Print requests to be sent to the Optional DAS Data Logger (if installed).

HOURMETERS - Allows the operator to view the unit hourmeters that have the view feature enabled in the Guarded Access menu. If the view feature for a particular hourmeter is not enabled then that hourmeter will continue to accumulate time but cannot be viewed from the Main Menu. However, all hourmeters can be viewed from the Maintenance Menu, even if they are not enabled.

MODE - Allows the operator to change the unit operating modes if allowed. Not all modes may appear depending on the settings selected from the Guarded Access menu and the HMI Control Panel software version.

- "Turn Off CYCLE-SENTRY Mode/Turn On CYCLE-SENTRY Mode (If CYCLE-SENTRY is Off unit runs in Continuous).
- Allow Keypad Lockout to be selected.
- Start Sleep Mode.

PRETRIP - Allows the operator to start a Pretrip Test. If an alarm is active, the Pretrip Test is not allowed and the operator is prompted to clear the alarm(s).

ELECTRIC STANDBY - If the Electric Standby option is present and the Diesel to Electric Auto-switch feature is set NO, this feature allows the operator to manually select electric mode operation. This feature does not appear if the unit does not feature optional Electric Standby or if the Diesel to Electric Auto-switch feature is set YES.

DIESEL MODE - If a unit equipped with electric standby is running in electric mode and the Electric to Diesel Auto-switch feature is set NO, this feature allows the operator to manually select diesel mode operation. This feature does not appear if the unit does not feature optional Electric Standby or if the Electric to Diesel Auto-switch feature is set YES.

ADJUST BRIGHTNESS - Allows the operator to adjust the HMI Control Panel display backlight intensity as required by local conditions.

TIME - Allows the operator to view the unit time and date. The time and date cannot be changed from this menu.

ALARMS

ALARM TYPES

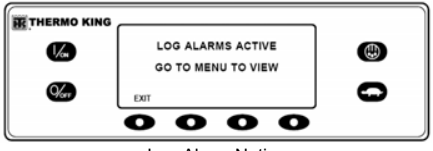
Alarms may be one of four types as shown.

LOG ALARMS

Log Alarms are indicated for 30 seconds each time the unit is turned on. This level of alarm serves as a notice to take corrective action before the condition impacts unit performance. Maintenance items such as maintenance hourmeter time-outs are log alarms.

When the unit is turned on the display will show the Thermo King Logo and then the "Configuring System" message. If log alarm(s) are present the Log Alarm notice will appear on the display for 60 seconds as shown. The amber K symbol of the remote indicator alarm light (if installed) will also be on during this period. The Standard Display will appear and the remote indicator alarm light will go to the white T symbol after 60 seconds.

Note: The Alarm Icon does not appear on startup with log alarms present.



Log Alarm Notice

Note: If required, an engine start may occur while the display in Figure is shown. This is normal operation.

CHECK ALARMS

Check Alarms are indicated by an Alarm Icon in the display. The amber K symbol of the remote indicator alarm light (if installed) will be on. This level of alarm serves as a notice to take corrective action before a problem becomes severe. The unit will run with check alarms but some features and functions may be inhibited.

SHUTDOWN ALARMS

Shutdown alarms will be set if continued operation could cause damage to the unit or the load. Shutdown Alarms are indicated by the following:

- The Alarm Icon will appear in the display.
- The display and backlight will flash on and off.
- The display will switch from normal video to reverse video and back to normal video.

(Light areas become dark and dark areas become light.)

- The remote indicator alarm light (if installed) will display only a row of LEDs at the bottom.

Shutdown alarms will force the unit into shutdown to prevent potential damage to the unit or load. The unit will remain in shutdown until the shutdown alarm is manually cleared. Exceptions are some engine and electric shutdown alarms that become log alarms when switched to the alternate operating mode (diesel to electric or electric to diesel).

Zone Level Shutdown Alarms (SPECTRUM)

A Zone Level Shutdown Alarm will force the affected zone to shutdown, but allow the unit to continue to run as required by the host unit or other zones.

- A small Alarm Icon will appear next to the affected zone
- and blink with a period of 1/2 second on - 1/2 second off.
- If a Zone Shutdown Alarm occurs in all zones then the
- unit will shut down and Alarm Code 114 Multiple Alarm – Can Not Run will be set.

PREVENT ALARMS

Prevent Alarms are also indicated by a steady Alarm Icon in the display. The remote indicator alarm light (if installed) will be on. The unit will attempt to resolve the situation as shown below.

- The unit will be temporarily shut down if a Prevent Alarm is active.
- The unit will remain shut down for a timed restart interval or until the fault conditions are corrected.
- If the unit is in a temporary shutdown, Alarm Code 84 Restart Null will be present along with the associated Prevent Alarm.
- The unit will restart and run (in most cases with forced reduced performance) to determine if continued operation is possible. The unit will run in this manner for a timed interval. If the unit is running with forced reduced performance, Alarm Code 85 Forced Unit Operation will also be present under some conditions.
- If the alarm does not reoccur during the timed running interval with reduced performance, the unit will return to full performance to determine if continued operation is possible. The unit will run in this manner for a timed interval. If the unit is successfully able to return to full performance for the timed interval without the alarm re-occurring, the alarm is auto cleared and the unit will run normally.
- All Prevent Alarm events and conditions are logged by the ServiceWatch Data Logger.
- In general, if the alarm condition re-occurs a defined number of times, the alarm is set as a shutdown alarm and no further restarts are possible.

Note: If the Restart After Shutdown feature in the Guarded Access Menu is set for CONTINUOUS, then an unlimited number of restart attempts are allowed.

Pretrip Alarm Codes

If an alarm occurs during a Pretrip Test the alarm code will be displayed as Pretrip Alarm XX, where XX is the alarm code.

Zone Level Prevent Alarms (SPECTRUM)

A Zone Level Prevent Alarm will force the affected zone into a temporary shutdown, but allow the unit to continue to run as required by the host unit or other zones.

- A small Alarm Icon will appear next to the affected zone.
- If a Zone Prevent Alarm occurs in all zones then the unit will be forced into a unit level Prevent shut down.

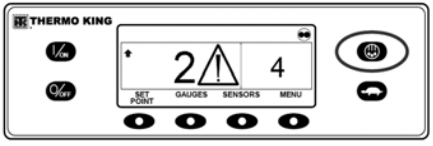
Alarm Codes When Switching Between Diesel and Electric

If a shutdown alarm occurs that affects only diesel mode operation and the unit is switched to electric, the diesel mode shutdown alarm becomes an electric mode log alarm. This allows the unit to run in electric mode without clearing the shutdown alarm that is preventing diesel mode operation. If the unit is switched back to diesel mode, the alarm again become a diesel mode shutdown alarm and prevents unit operation.

In the same manner, if a shutdown alarm occurs that affects only electric mode operation and the unit is switched to diesel, the electric mode shutdown alarm becomes a diesel mode log alarm to allow diesel mode operation. If the unit is switched back to electric mode, the alarm reverts to an electric mode shutdown alarm and prevents unit operation. If the unit is configured for electric to diesel autoswitch, it automatically starts and runs in diesel mode if an electric shutdown occurs.

ALARM CODE NOTIFICATION

The Alarm Icon used in previous Thermo King controllers has been incorporated. If a Check alarm condition occurs the Alarm Icon will appear in the display as shown.



Alarm Icon

If a Shutdown Alarm occurs it will be indicated by all of the following:

1. The Alarm Icon will appear.
2. The display and backlight will flash on and off.
3. The display will switch from normal video to reverse video and back to normal video. (Light areas become dark and dark areas become light.)

CLEARING ALARM CODES

Most alarm codes can be cleared conventionally from the Alarm Menu using the CLEAR key.

The following control and display sensor alarm codes can only be cleared from the Maintenance Menu or Guarded Access Menu:

- Alarm Code 03 Check Control Return Air Sensor
- Alarm Code 04 Check Control Discharge Air Sensor

The following alarm codes clear automatically.

- Alarm Code 64 Pretrip Reminder - Clears when a Pretrip Test is performed.
- Alarm Code 84 Restart Null - Clears when the unit is no longer in a restart null due to a Prevent Alarm.
- Alarm Code 85 Forced Unit Operation - Clears when the unit is no longer running in a forced mode due to a Prevent Alarm.
- Alarm Code 91 Check Electric Ready Input - Clears automatically when the unit starts running.
- Alarm Code 92 Sensor Grades Not Set - Clears when the sensor grade is changed from 5H.

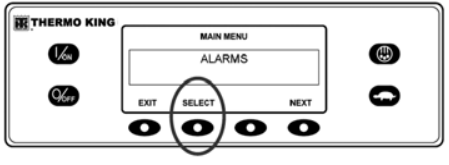
If the Limited Alarm Restarts feature is enabled the following additional alarm codes may only be cleared from the Guarded Access Menu. If this is the case, the CLEAR soft key will not appear if the alarms are displayed from the Main Menu or the Maintenance Menu.

- Alarm Code 10 High Discharge Pressure
- Alarm Code 23 Cooling Cycle Fault
- Alarm Code 24 Heating Cycle Fault
- Alarm Code 32 Refrigeration Capacity Low

DISPLAYING AND CLEARING ALARM CODES

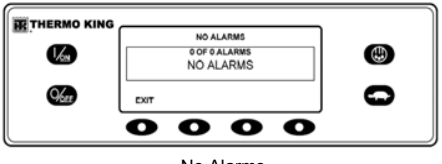
Alarms are displayed and cleared using the Alarm Menu. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarms Menu will appear. If the Language Menu appears press the NEXT key to show the Alarm Menu. When the Alarms Menu is shown press the SELECT key.



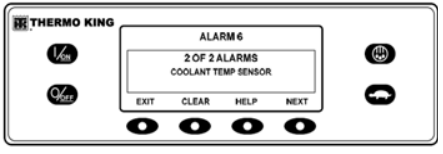
Select Key

The Alarm Display will appear. If no alarms are present NO ALARMS will be shown.



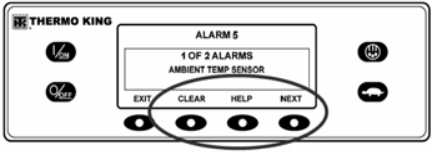
No Alarms

If alarms are present, the quantity of alarms (if more than one) and the most recent alarm code number will be shown. In the example in Figure , there are two alarms present. The most recent is Alarm Code 5 (Figure). It indicates a problem with the coolant temperature sensor.



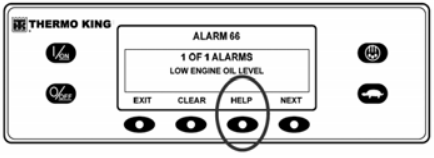
Alarm Code 6

After the alarm situation is resolved press the CLEAR key to clear the alarm. For additional information regarding the alarm shown on the display, press the HELP key. To display the next alarm, press the NEXT key.



Next Key

If a serious condition occurs, the unit will be shut down to prevent damage to the unit or the load. If this occurs, the display will show that the unit is shut down and display the alarm code that caused the shutdown. In the example, the unit is shut down due to low oil level. For additional information regarding the alarm shown on the display, press the HELP key.



Help Key

A help message will appear. For the alarm shown, the message "CHECK OIL LEVEL. IF UNIT IS SHUT DOWN, REPAIR IMMEDIATELY. OTHERWISE, REPORT ALARM AT END OF THE DAY" will be shown on the display. Check the oil level and add oil as required, clear the alarm and restart the engine.

To select a different Main Menu item press the NEXT key. To return to the Standard Display press the EXIT key.

Important Alarm Notes

- 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.
- If an alarm cannot be cleared from the Main menu, the Clear key will not appear. These alarms must be cleared from the Maintenance or Guarded Access Menus.
- All alarms must be viewed before any of the alarms can be cleared.

DATALOGGER

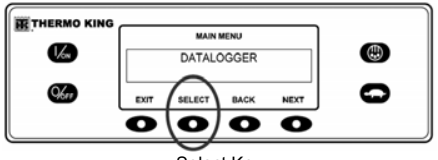
The unit can be equipped with an optional DAS Data Logger if desired.

A Start of Trip marker can be sent to the unit ServiceWatch Data Logger and the optional DAS Data Logger (if equipped).

If equipped with the optional DAS Data Logger, the most recent DAS trip record can be printed. The most recent trip is defined as the trip following the last Start of Trip marker sent to the data logger.

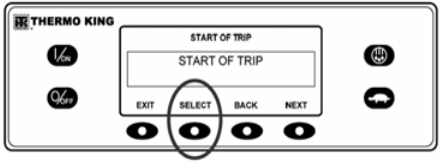
The ServiceWatch Data Logger and DAS Data Logger (if equipped) are accessed using the Data Logger Menu. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to display the Data Logger Menu. When the Data Logger Menu is shown press the SELECT key.



Select Key

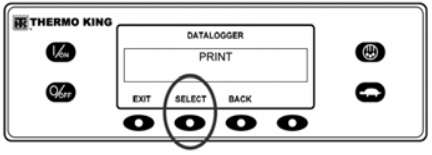
The first feature that appears is the Start of Trip. To send a Start of Trip to the ServiceWatch Data Logger and DAS Data Logger (if equipped), press the SELECT key to select the feature, and then press it again to send the Start of Trip. The display will briefly show START OF TRIP COMPLETE to confirm that a Start of Trip marker was set in the data logger(s).



Start of Trip

NOTE: The start of trip marker is sent to both the ServiceWatch Data Logger and DAS Data Logger (if equipped).

Press the NEXT key to select the PRINT feature. The PRINT screen will appear. Press the SELECT key to print the most recent trip record.



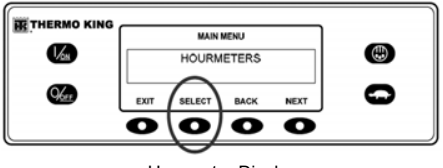
Select Key

Pressing the EXIT key returns the display to the Main Menu.

HOURMETERS

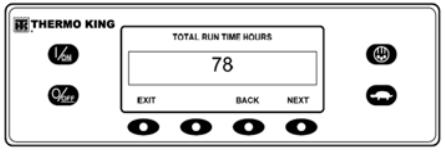
Hourmeters are displayed using the Hourmeter Menu. Only hourmeters enabled in the Guarded Access Menu will be shown. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to display the Hourmeter Menu. When the Hourmeter Menu is shown press the SELECT key. The Hourmeter Display will appear.



Hourmeter Display

Press the NEXT or PREVIOUS key to scroll through the enabled hourmeters.



Scroll Through Hourmeters

Hourmeter names and definitions are shown in the table below in the order they appear. Only hourmeters enabled in the Guarded Access Menu will be shown. To return to the Standard Display, press the EXIT key.

HOURMETER NAMES AND DEFINITIONS

Total Hours Total number of hours the unit has been turned on (protection hours).

Total Run Time Hours Total number of hours the unit has run in both diesel and electric mode.

Engine Hours Total number of hours the unit has run in diesel mode.

Electric Run Hours Total number of hours the unit has run in electric mode.

Zone 1 Run Time Hours: Total number of hours Zone 1 has run.

Zone 2 Run Time Hours: Total number of hours Zone 2 has run.

Zone 3 Run Time Hours: Total number of hours Zone 3 has run.

Total Run Reminder 1 User Programmable - The number of hours before a Total Unit Run Time Maintenance Reminder 1 occurs.

Total Run Reminder 2 User Programmable - The number of hours before a Total Unit Run Time Maintenance Reminder 2 occurs.

Controller Power On Total hours the controller and HMI control panel have been turned on.

Pretrip Reminder User Programmable - number of hours before a Pretrip Reminder occurs.

Engine Reminder 1 User Programmable - The number of hours before an Engine Run Time Maintenance Reminder 1 occurs.

Engine Reminder 2 User Programmable - The number of hours before an Engine Run Time Maintenance Reminder 2 occurs.

Electric Reminder 1 User Programmable - The number of hours before an Electric Run Time Maintenance Reminder 1 occurs.

Electric Reminder 2 User Programmable - The number of hours before an Electric Run Time Maintenance Reminder 2 occurs.

IMPORTANT: If a programmable hourmeter is not enabled or the view for that hourmeter is not turned on it will not appear in the display sequence.

MODE

Various operating modes can be selected using the Mode menu. Not all modes may be available, depending on settings of other programmable features. The following modes may be available.

TURN CYCLE-SENTRY ON OR OFF

CYCLE-SENTRY Mode can be turned On or Off. If CYCLE-SENTRY Mode is turned Off then unit will run in Continuous mode.

KEYPAD LOCKOUT

If enabled in Guarded Access, the keypad can be locked to prevent unauthorized use. If the keypad is locked only the ON and OFF keys function. The keypad will remain locked even if the unit is turned Off and back on. If Keypad Lockout is active, press and hold any soft key for 5 seconds to deactivate the feature.

SINGLE ZONE CONTROL – MULTI ZONE CONTROL (SPECTRUM)

If enabled in Guarded Access, Single Zone Control allow single temperature operation. If Single Zone Control operation is selected then all zones will be forced on and will control to the same setpoint. All bulkheads should be down to create one large compartment. Multi Zone Control allows separate control for each configured zone.

START SLEEP MODE

If enabled in Guarded Access, Sleep Mode is used to keep the engine warm and the battery charged when the unit is not in use. When the unit is in Sleep Mode the display will show "SLEEP" and the current time. When Sleep Mode is entered the unit will start and run to confirm proper battery charge level and engine temperature.

IMPORTANT: While in Sleep Mode the unit will not monitor or maintain setpoint and load temperature. Fuel level should be monitored as the unit may run periodically, particularly in cold weather.

The following features are available in Sleep Mode.

Program Wakeup Time: This feature allows a wakeup time to be specified. When the selected time is reached the unit will start and resume normal operation.

If a Wakeup Time is selected the following features are available:

Day to Wake Up: This feature allows the day of the week the unit is to wake up to be specified.

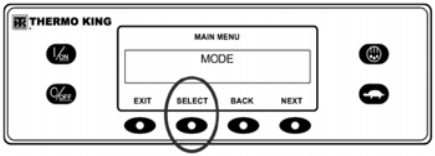
Hour to Wake Up: This feature allows the hour the unit is to wake up to be specified.

Minute to Wake Up: This feature allows the minute the unit is to wake up to be specified.

Run Pretrip on Wakeup: This feature allows a Pretrip Test to be automatically run when the unit wakes up.

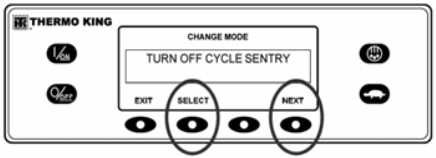
Mode changes are made using the Mode Menu. From the Standard Display, press the MENU key.(Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to show the Mode Menu. When the Mode Menu is shown press the SELECT key.



Select Key

The first mode change screen will appear. To choose that function, press the SELECT key. To Scroll thru the Mode Menu press the NEXT key.

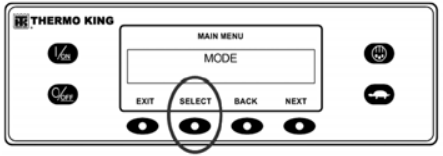


Select and Next Keys

SELECTING CYCLE-SENTRY OR CONTINUOUS MODE

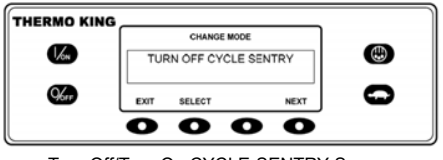
When CYCLE-SENTRY mode is selected the unit will start and stop automatically to maintain setpoint, keep the engine warm and the battery charged. When Continuous Mode is selected, the unit will start automatically and run continuously to maintain setpoint and provide constant airflow. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to display the Mode Menu. When the Mode Menu is shown press the SELECT key.



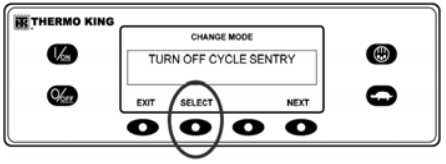
Select Key

The Turn Off/Turn On CYCLE-SENTRY screen will appear. In the display shown below, the unit is operating in CYCLE-SENTRY mode. Turning CYCLE-SENTRY mode off will result in the unit running in Continuous mode.



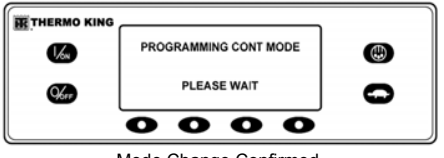
Turn Off/Turn On CYCLE-SENTRY Screen

Pressing the Select key will change the mode from CYCLE-SENTRY to Continuous.



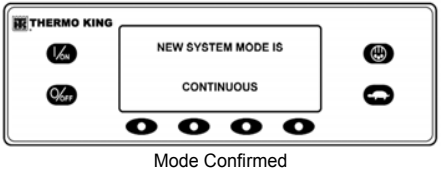
Select Key

The display will confirm the change as shown below.



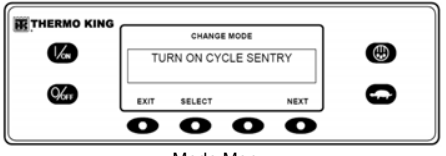
Mode Change Confirmed

The new mode is then confirmed for 10 seconds.



Mode Confirmed

The display then returns to the Mode Menu. In the example here the unit is currently running in Continuous mode. Pressing the Select key again allows the operator to change back to CYCLE-SENTRY mode operation.



Mode Menu

IMPORTANT: If the unit is in CYCLE-SENTRY null and the mode is switched to Continuous Mode, the unit will start automatically.

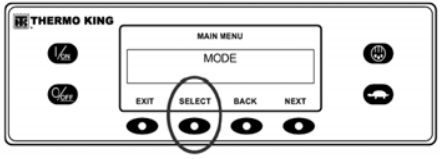
SELECTING SLEEP MODE

Normal CYCLE-SENTRY mode starts and stops the unit as required to maintain the desired setpoint temperature, maintain the unit battery in a charged condition and keep the unit engine warm in cold ambient conditions. Sleep mode does not consider setpoint or maintain cargo temperatures - it only keeps the engine warm and the unit battery charged. This is useful in extremely cold weather or when the unit is to be out of service for an extended time. Sleep mode operates in both Diesel mode and Electric mode. In Diesel mode the unit will start and stop as required to maintain engine temperature and battery charge. In Electric mode the unit starts and stops as necessary to maintain battery charge only.

When Sleep mode is entered, the operator can program an automatic Wake-up Time up to a week away. Using this feature, the unit will automatically restart and run normally at the determined time. If a Wake-up Time is programmed the operator can also program an automatic Pretrip Test when the unit restarts.

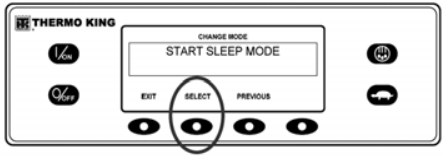
Sleep Mode is turned On and Off using the Mode Menu. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to show the Mode Menu. When the Mode Menu is shown press the SELECT key.



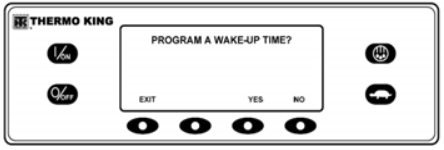
Select Key

Press the Next key as required to display the Sleep Mode prompt. Press the Select key to choose the Sleep Mode menu.



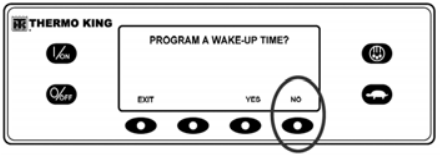
Sleep Mode Menu

The screen shown will appear.



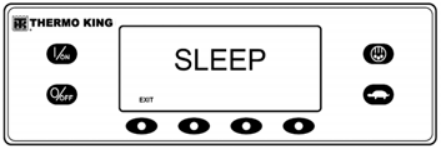
Start of Sleep Mode Menu

The operator can now choose a Sleep Mode Wake-up Time or simply enter Sleep Mode immediately. If NO is pressed the unit will immediately enter Sleep Mode.



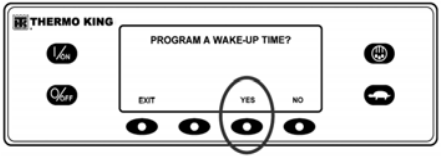
Select No to Enter Sleep Mode

The display will show SLEEP and the unit will start and stop as required to keep the engine warm and/or the battery charged. Sleep mode does not consider setpoint or maintain cargo temperatures. To exit Sleep Mode press the EXIT key or turn the unit off and back on. The unit will resume normal operation and control to setpoint.



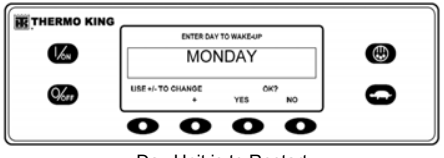
Sleep Mode Display

To enter a Wake-up Time, verify the unit clock is set properly. Then press the YES key at the Sleep Mode menu.



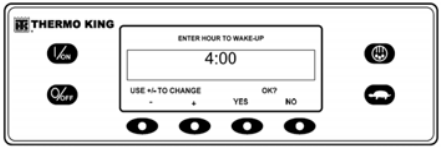
Yes Key

The display will prompt the operator for the DAY the unit is to restart in normal operation. In figure shown Monday has been chosen. Press the YES key to confirm the DAY.



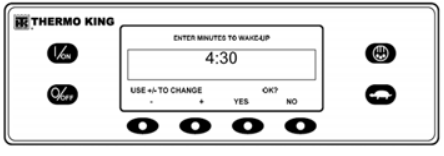
Day Unit is to Restart

The display will now prompt the operator for the Hour the unit is to restart in normal operation. In figure shown 4:00 am has been chosen. Press the YES key to confirm the HOUR. Note that 24 hour "military time" is used.



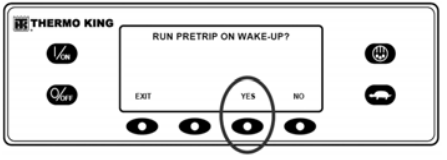
Confirm Hour

The display will now prompt the operator for the MINUTE the unit is to restart in normal operation. In figure shown 4:30 am has been chosen. Press the YES key to confirm the MINUTE.



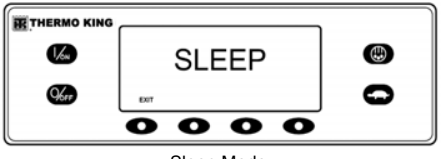
Confirm Minute

The display will now prompt for a Pretrip Test on Wake-up. Press the YES key to perform a Pretrip Test on Wake-up. If the No key is pressed the unit will resume normal operation on Wake-up.



Press Yes Key for Pretrip Test

The display will show SLEEP and the unit will start and stop as required to keep the engine warm and/or the battery charged. Sleep mode does not consider setpoint or maintain cargo temperatures.



Sleep Mode

The unit will restart at the programmed time (in this example 4:30 am) and perform a Pretrip Test (if selected). After the Pretrip Test is complete the test results will be displayed and the unit will resume normal operation and control to setpoint.

To exit Sleep Mode before the selected Wake-up time press the EXIT key or turn the unit off and back on. The unit will resume normal operation and control to setpoint.

PRETRIP

A Pretrip Test verifies unit operation. This display allows a Pretrip Test to be selected and initiated by the operator. If the Pretrip Test is entered with the unit shut down a Full Pretrip Test with device amp checks will be performed. If the Pretrip Test is entered with the unit running in either diesel or electric mode a Running Pretrip Test is performed, but the device amps checks are not performed. Test results are reported as PASS, CHECK or FAIL when the Pretrip Test is completed. If an alarm occurs during a Pretrip Test the alarm code will be displayed as Pretrip Alarm XX, where XX is the alarm code.

PRETRIP TEST CONDITIONS

- Current unit settings are saved and restored at the end of the Pretrip Test or if the unit is turned off and back on.
- 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

- If any shutdown alarms are present. Pretrip tests are allowed with some Check and Log alarms.
- If the unit is in Sleep Mode.
- If the unit is in Service Test Mode, Interface Board Test Mode or Evacuation Mode.

Pretrip Test Sequence

Pretrip tests proceed in the order shown below. A Full Pretrip Test includes all tests. A Running Pretrip Test is started with the engine or motor running and does not include the Amp Checks or Engine Start Check.

- 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 (each zone in SPECTRUM).
- Heat Check - The ability of the unit to heat in low speed is checked (each zone in SPECTRUM).
- Report Test Results - The test results are reported as PASS, CHECK or FAIL when the Pretrip Test is completed. If test results are CHECK or FAIL 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.

- If running a Pretrip Test on a truck or trailer loaded with dry cargo, insure that proper airflow can occur around the load. If the load restricts airflow, false test results may occur. Also, TSR-3 units have high refrigeration capacity which results in rapid temperature changes. Sensitive dry cargo may be damaged as a result.
- If running a Pretrip Test on a truck or trailer that has just been washed down, the extremely high humidity inside the truck or trailer may result in false test results.
- If running a Pretrip Test on a truck or trailer loaded with sensitive cargo, monitor the load temperature during the test as normal temperature control is suspended during a Pretrip Test.
- Always perform Pretrip Tests with the truck or trailer cargo doors closed to prevent false test failures.

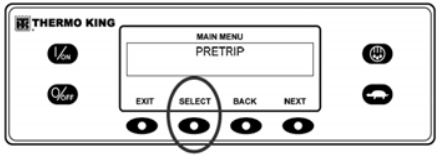
PERFORMING A PRETRIP TEST

If a Pretrip Test is initiated with the engine shut down a Full Pretrip Test will be performed. If a Pretrip Test is initiated with the engine or motor running a Running Pretrip Test is performed.

- Before initiating a Pretrip Test, clear all alarm codes.
- To stop a Pretrip Test at any time, turn the unit off. Alarm Code 28 Pretrip Abort will be set. Other alarms may also be set, depending upon test in progress when the test was terminated.

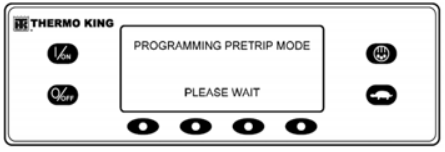
Pretrip Tests are initiated using the Pretrip Menu. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to display the Pretrip Menu. When the Pretrip Menu is shown press the SELECT key.



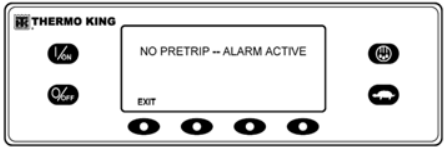
Select Key

If the unit is not running a Full Pretrip Test will be initiated. If the unit is running in either diesel or electric mode a Running Pretrip will be performed.



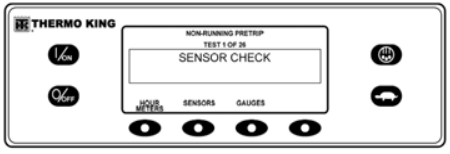
Running Pretrip

If all alarms were not cleared a prompt appears as shown. Exit the Pretrip Test, clear all alarms and restart the Pretrip Test.



No Pretrip Prompt

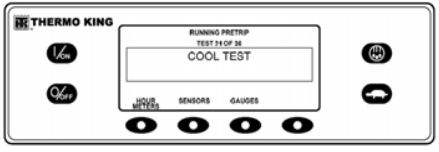
If no alarms are present, the Pretrip Test display appears.



Pretrip Test Display

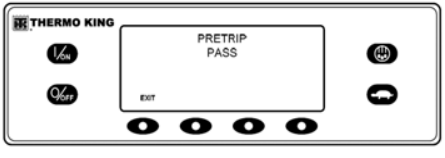
- The top line of the display indicates the unit is performing the non-running portion of the Pretrip Test.
- The second line measures test progress. The number of tests completed of the total number of tests to be performed is shown. In Figure the unit is performing Test 1 of 26, Sensor Check.
- The soft keys may be used during the Pretrip Test to select the Hourmeter, Gauge or Sensor menus.
- To stop a Pretrip Test at any time 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.

When the non-running tests are complete the unit will start automatically and continue with the Running Pretrip Test. In the example in Figure the unit is in the Running Pretrip and is performing Test 21 of 26, Cool Test.



Performing Cool Test

When all tests are complete, the results are reported as PASS, CHECK or FAIL. If the results are CHECK or FAIL, the accompanying alarm codes will direct the technician to the cause of the problem.



Pass, Check or Fail

If the Pretrip Test results are CHECK or FAIL the problem should be diagnosed and corrected before the unit is released for service.

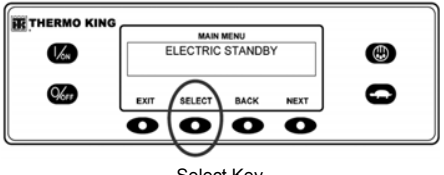
DIESEL/ELECTRIC MENU

The Diesel Mode/Electric Standby menu allows the operator to manually select diesel or electric mode operation. The unit can also be programmed to automatically select electric mode operation when standby power is available and to automatically select diesel mode operation if standby power fails or is removed. If the unit is programmed to switch automatically from diesel to electric and electric to diesel these screens do not appear.

SWITCHING FROM DIESEL TO ELECTRIC

If the unit is running in diesel and manual switching to electric mode is enabled, the unit is switched using the Electric Standby Menu. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

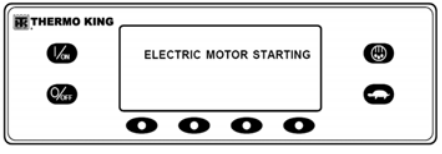
The Language Menu or Alarm Menu will appear. Press the NEXT key as required to display the Electric Standby Menu. When the Electric Standby Menu is press the SELECT key.



Select Key

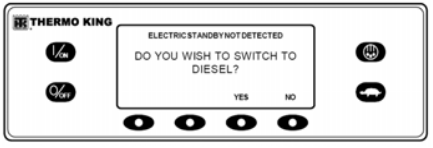
NOTE: This screen will not appear if diesel to electric autoswitching is enabled.

If the unit has standby power available and is turned on, the electric standby run screen will appear. The new mode is then confirmed for 10 seconds. The unit will start and run in electric mode. If electric standby power is not available the display will prompt for a return to diesel mode as shown below.



Electric Standby Run Screen

If the electric standby power source fails or is disconnected and manual switching to diesel mode is selected, the unit will prompt for a switch to diesel. Selecting YES will switch unit operation back to diesel mode. Pressing the NO key will allow the unit to remain in Electric Standby mode even though standby power is not available. The unit will not run and Alarm Code 91 Check Electric Ready Input will be set as a prevent alarm.

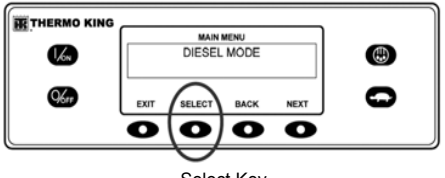


Prompt for Switch to Diesel

SWITCHING FROM ELECTRIC TO DIESEL

If the unit is running in electric and manual switching to diesel mode is enabled, the unit is switched using the Diesel Mode Menu. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to display the Diesel Mode Menu. When the Diesel Mode Menu is shown press the SELECT key.



Select Key

NOTE: This screen will not appear if electric to diesel autoswitching is enabled.

The unit will return to Diesel Mode operation.

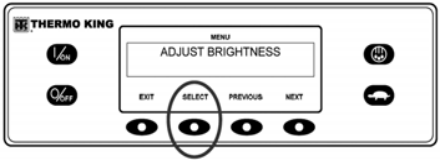
The unit can be programmed to automatically switch to electric mode operation when standby power is available. It can also be programmed to automatically switch to diesel mode operation if the standby power fails or is disconnected.

ADJUST BRIGHTNESS

The brightness of the HMI Control Panel display can be adjusted to allow for changing ambient light conditions. The choices available to the operator are HIGH, MEDIUM, LOW and OFF. OFF actually results in a very dim screen suitable for low light conditions.

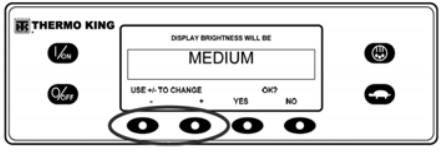
Display brightness is adjusted using the Adjust Brightness Menu. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to display the Adjust Brightness Menu. When the Adjust Brightness Menu is shown press the SELECT key.



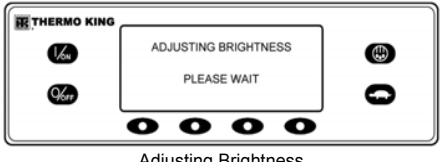
Select Key

The Display Brightness menu will appear as shown below. Press the + or - keys to select the desired display brightness. When the desired brightness is shown press the YES key to confirm the choice.



+ and - Keys

The display will briefly show ADJUSTING BRIGHTNESS - PLEASE WAIT.



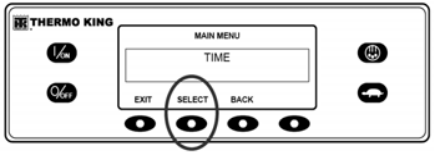
Adjusting Brightness

The display brightness is changed to the new setting.

TIME

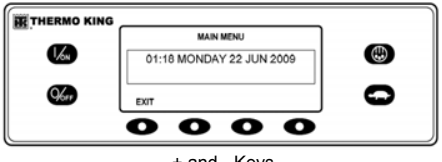
The system time and date is viewed using the Main Menu. Time and Date cannot be changed from the Main Menu. From the Standard Display, press the MENU key. (Figure "Menu Key" page 29)

The Language Menu or Alarm Menu will appear. Press the NEXT key as required to display the Time Menu. When the Time Menu is shown press the SELECT key.



Select Key

The current time and date will appear.



+ and - Keys

TSR/TSR-3 ALARM CODES

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

Code	Description	Operator Help
0	No Alarms Exist	
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.
4	Check (Control) Discharge 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.
11	Unit Controlling on Alternate Sensor	Manually monitor load temperature. Report alarm at end of the day.
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.
14	Defrost Terminated by time.	Report alarm at end of the day.
15	Check Glow Plugs or Intake Air Heater	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
16	Manual start not completed	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.
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.

Code	Description	Operator Help
24	Heating Cycle Fault	The indicated zone is not longer able to operate and has been shut down.
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.
30	Defrost Damper Stuck	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.
33	Check Engine RPM	Report alarm at end of the day.
34	Check Modulation circuit	Manually monitor temperature. Report alarm at the 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.
39	Check Water Valve Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
40	Check High Speed Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
41	Check Engine Coolant Temperature	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.
43	Unit Forced to Low Speed Modulation	Report alarm at end of the day.
44	Check Fuel System	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
45	Hot Gas or Hot Gas Bypass Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.

Code	Description	Operator Help
46	Check Air Flow	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
47	Remote Sensor shutdown	Unit/zone cannot operate and is shutdown, needs to be repaired immediately.
48	Check Belts or Clutch	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
49	Check spare sensor 1	Report alarm at end of the day.
50	Reset Clock	Report alarm at end of the day.
51	Check Shutdown circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
52	Check Heat Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
53	Check Economizer valve circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
54	Test Mode Timeout	Service Test or Interface Board Test timed out after 15 minutes. Report alarm at end of the day.
55	Check engine speeds	Report alarm at end of the day.
56	Check evaporator fan low speed (zone)	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
57	Check evaporator fan high speed (zone)	If unit is shut down repair immediately. Otherwise, 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.
62	Ammeter Out of Calibration	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.
66	Low Engine Oil Level	Check engine oil level. If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
67	Check Liquid Line Solenoid Circuit	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.

Code	Description	Operator Help
77	Data log EPROM Checksum Failure	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
79	Internal Data Logger Overflow	Report alarm at end of the day.
80	Check Compressor Temp Sensor	Report alarm at end of the day.
81	High Compressor Temp	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
82	High Compressor Temp Shutdown	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
83	Low Engine Coolant Temperature	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
84	Restart Null	Report alarm at end of the day.
85	Forced Unit Operation	Report alarm at end of the day.
86	Check Discharge Pressure Sensor	Report alarm at end of the day.
87	Check Suction Pressure Sensor	Report alarm at end of the day.
89	Check Electronic Throttling Valve Circuit	If unit is shut down repair immediately. Otherwise, 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.
92	Sensor Grades Not Set	Report alarm at end of the day.
93	Low Compressor Suction Pressure	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
94	Check Loader #1 Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
95	Check Loader #2 Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
96	Low Fuel Level	Check engine fuel level. If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
98	Check Fuel Level Sensor	Report alarm at end of the day.
99	High Compressor Pressure Ratio	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
104	Check Remote fan speed	Manually monitor Temperature. Report alarm at end of the day.
105	Check Receiver tank press sol circuit	Manually monitor Temperature. Report alarm at end of the day.
106	Check purge valve circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.

Code	Description	Operator Help
107	Check condenser inlet sol circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
108	Door Open Timeout	Close Doors. Report alarm at end of the day.
110	Check suction line sol circuit (zone)	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
111	Unit Not Configured Correctly	Report alarm at end of the day.
112	Check remore fans	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
113	Check Electric Heat Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
114	Multiple Alarms - Can Not Run	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
115	Check High Pressure Cut Out Switch	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
116	Check High Pressure Cut In Switch	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.
120	Check Alternator Excite Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
121	Check Liquid Injection Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
122	Check Diesel/ Electric Circuit	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
127	Setpoint Not Entered (zone)	Be sure the setpoint is set to the required temperature.
128	Engine Run Time Maintenance Reminder #1	Report alarm at end of the day.
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.
135	Check Spare Digital Inputs	Report alarm at end of the day.
136	Check Spare Digital Outputs	Report alarm at end of the day.
137	Check Damper Motor Heater Output	Report alarm at end of the day.

Code	Description	Operator Help
141	Autoswitch Diesel to Electric Disabled	Report alarm at end of the day.
143	Check remote drain hose heater o/p (zone)	Report alarm at end of the day.
144	Lost CAN communications to expansion module	Unit cannot operate, needs to be repaired immediately
145	Loss of Controller "On" Feedback Signal	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
146	Software Version Mismatch	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
147	Check Multitemp fan speed control o/p (zone)	Manually monitor load temperature. Report alarm at end of the day.
148	Autoswitch Electric to Diesel Disabled	Report alarm at end of the day.
149	Alarm Not Identified	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
150	Out of Range Low	Manually monitor load temperature. Report alarm at end of the day.
151	Out of Range High	Manually monitor load temperature. Report alarm at end of the day.
153	Expansion module flashload failure	Report alarm at end of the day.
154	Low suction pressure switch failure	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
155	Lost CAN communications to HMI	Unit cannot operate and needs to be repaired immediately
156	Check suction/ liquid heat exchanger bypass valve	If unit is shut down repair immediately. Otherwise, report alarm at end of the day.
157	Optiset plus profile mismatch	Report alarm at end of the day.
159	Check battery connection	Report alarm at end of the day.
160	Lost CAN communications to Radio Expansion board	Report alarm at end of the day.
163	Emission control failure	
203	Check Display Return Air Sensor	Manually monitor load temperature. Report alarm at end of the day.
204	Check Display Discharge Air Sensor	Manually monitor load temperature. Report alarm at end of the day.
233	REB transitioning from conservative to Full Null	Report alarm at end of the day.
234	Check relative humidity sensor	Report alarm at end of the day.
251	Check radio expansion board configuration	Report alarm at end of the day.
252	Check Auto Fresh air exchange circuit	Report alarm at end of the day.
254	Check auxilary	Report alarm at end of the day.

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.

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

See “See Starting the Electric Motor on page 19” or on page 28 in the Unit Operation chapters of this manual.

CARE AND MAINTENANCE

PRE-TRIP INSPECTION

Pre-trip inspections are essential to minimize operating problems and breakdowns, and must be performed before every trip involving refrigerated cargo.

1. Diesel Fuel

Must guarantee engine operation to the next check point.

2. Engine Oil

Should be at the FULL mark. Never overfill.

3. Coolant

The indicator should be in the FULL (white) range. If the coolant level is in the ADD (red) range, add coolant to the expansion tank. Coolant should be a 60/40 mixture of ethylene glycol and water to provide protection to -34°C.

CAUTION!

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

4. Battery

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

5. Belts

The belts must be in good condition and adjusted to the proper tension.

6. Electrical

Ensure all electrical connections are securely fastened. Wires and terminals should be free of corrosion, cracks or moisture.

7. Structural

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

8. Seal

The unit mounting seal should be tightly compressed and in good condition.

9. Coils

Ensure condenser and evaporator coils are clean and free of debris.

10. Cargo Box

Inspect the interior and exterior of the truck for damage. Any damage to the walls or insulation must be repaired.

11. Defrost Drains

Check the defrost drain hoses and fittings to ensure they are open.

12. Doors

Ensure doors and weather seals are in good condition, doors latch securely and weather seals fit tightly.

13. Remote Evaporators (SPECTRUM)

- Visually inspect Evaporator(s) for damaged, loose, or broken parts.
- Check also for refrigerant leaks.

Check Defrost initiation and termination (including defrost timer) by activating/ initiating a manual defrost.

AFTER START INSPECTION

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

1. Oil Pressure

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

2. Pre-cooling

Make sure that the setpoint is at the desired temperature and allow the unit to run for a minimum of 30 minutes (longer if possible) before loading the cargo box.

3. Defrost

When the unit has finished pre-cooling the cargo box interior, manually initiate a defrost cycle. This will remove the frost that builds up while running the unit to pre-cool the truck.

The defrost cycle should end automatically.

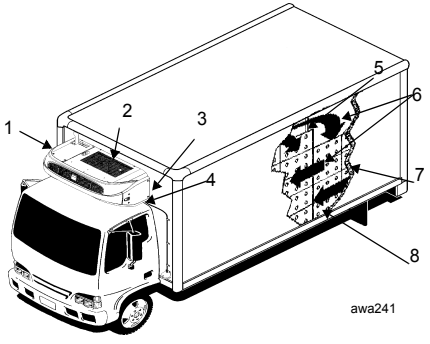
Note: The unit will not defrost unless the evaporator coil temperature is below 6 C.

LOADING

GENERAL INFORMATION

1. Inspect the cargo box for proper insulation.
2. Ensure all door seals are tight seal with no air leakage.
3. Inspect the cargo box inside and out for damaged or loose doors or skin.
4. On the inside, look 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 “Hot Spots” in the load.
5. Pre-cool the cargo box as required.
6. Ensure loads are at proper carrying temperature when you pick them up. Note any variance.
7. Supervise loading of the product to assure sufficient air space around and through the load so as not to restrict air flow.

INSPECTING THE LOAD



1.	Unit inspection
2.	Good outside air circulation
3.	Seals equally compressed
4.	Clear defrost drains
5.	Tight doors
6.	Good air circulation around load
7.	Interior/exterior walls and insulation in good condition
8.	Cargo proper temperature prior to loading

Always inspect load prior to departure.

1. Ensure unit is off before opening cargo box doors. Otherwise refrigerated air is expelled hot air drawn in. The unit may be run with the doors open if the truck is properly backed into a refrigerated warehouse.
2. Perform final external and internal load temperature checks. Note any irregularities on the manifest.
3. Ensure cargo is not blocking the evaporator inlets and outlets and that ample circulation space has been provided around the load.
4. Ensure truck doors are securely locked.
5. Ensure controller setpoint is at the desired temperature.
6. If the unit was stopped, restart using the starting procedures outlined in this manual.
7. Repeat the After Start Inspection.
8. Defrost the unit one half-hour after loading by selecting the Manual Defrost. The Defrost cycle terminates automatically.
9. Carry out an on the road inspection every four hours of operation.

Note: The unit will not defrost unless the evaporator coil temperature is below 6°C.

ENROUTE INSPECTIONS

1. Carry out an inspection every four hours of operation.
2. Note controller setpoint to ensure setting is unaltered since picking up the load.
3. Note the return air temperature, it should be +/- 4°C of the controller setpoint.
   If the temperature reading is not +/- 4°C of the controller setpoint, keep the unit running for 15 minutes and re-check the temperature. Wait 15 minutes more and if the temperature is still out of range, contact a Thermo King dealer for service.
4. We recommend you record the return air temperature reading each time you check the unit. This is important information if you need service later on.

Notes:

If cargo temperature is too high it could indicate:

- Evaporator is plugged with frost in which case standard defrosting procedure is needed or there is improper air circulation within the cargo area.

Inspect the unit to determine if the evaporator fan is working and circulating the usual amount of air. Poor circulation could be caused by:

- Fan belt slipping or damaged. (Have the fan belt checked by a qualified mechanic.)
- Improper loading of product in cargo box or load shifting in transit so that there are restricted air passages around and through the load.
- Unit may have a low refrigerant charge. If you cannot see a liquid level in receiver tank sight glass with the unit running in COOL, it is an indication that the charge may be low.

It is advisable that any of the above mentioned problems found during your enroute inspection be referred to the nearest authorized Thermo King dealer as quickly as possible. Check your service directory for phone number and location.

AFTER FIRST WEEK OF OPERATION:

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

INSPECTION AND SERVICE SCHEDULES

To ensure that your Thermo King unit operates reliably and economically over its full life, and to avoid limiting its warranty cover, the appropriate inspection and service schedule must be followed. Inspection and Service intervals are determined by the number of unit operating hours and by the age of the unit. Examples are shown in the table below. Your Dealer will prepare a schedule to suit your specific needs.

Note: T-500R has a different EMI to all other T-Series units and therefore must be presented at an authorised Thermo King dealer or service provider every 1000hrs for full service.

For more specific detail, refer to the maintenance manual for your unit and to the Unit Operating Instructions in this manual.

Operating hours per year	1000	2000	3000
Full Service	12 months (1000 hours)	12 months (2000 hours)	8 months/ 2000 hours
Inspection	24 months/ 2000 hours	24 months/ 4000 hours	12 months/ 3000 hours
	(continue as above)	(continue as above)	(continue as above)

SERVICE RECORD

Each inspection and service performed should be recorded on the Service Record Sheet found at the back of this Manual

WARRANTY

Your Complete Thermo King T-Series unit is covered by Warranty for 24 months from the Date in Service, to the conditions stated below. Should you require warranty service during the warranty period, simply present your copy of the Service Record Sheet (found at the back of this Manual) to any of the dealer locations shown in the Thermo King Service Directory. They will be happy to help you in accordance with the conditions stated below

INGERSOLL RAND International Ltd. 24 MONTH* LIMITED WARRANTY : T-Series

1. Subject to the conditions hereinafter stated, INGERSOLL RAND International Ltd. ("Thermo King") warrants its complete unit to be free from defects in material and workmanship for a period of twenty four (24) months from the date in service or thirty (30) months from the date the unit is shipped by Thermo King, whichever is earlier.

– Clutch's are covered for a maximum of 24 months or 4000 diesel run hours, whichever is sooner.

– Belts are covered for a maximum of 24 months or 4000 diesel & electric run hours, whichever is sooner.

– In T-500R - Engine oil is covered for a maximum of 12 months or 1000 diesel run hours, whichever is sooner.

2. Such warranty extends only to the original owner of the unit and is limited at Thermo King's discretion to repair or replace with new or remanufactured parts at any authorised Thermo King service location of any parts which are found by Thermo King to have been defective under normal use and service within the specified warranty period. Repair or replacement shall be buyers exclusive remedy, and correction of defects in the above manner shall constitute complete fulfillment of all obligations and liabilities of Thermo King with respect to the unit sold hereunder, whether based in contract, in tort (including negligence and/or strict liability), or otherwise.

3. Any part of a unit which is repaired or supplied as a replacement under Thermo King's Warranty will be installed without charge to buyer for labour or parts. Any part which is replaced shall become the property of Thermo King. Such warranty services must be performed by an authorised Thermo King service location and will not include call-out charges, overtime, mileage, telephone calls or telegrams, or cost of transportation and/or relocation of equipment or service personnel.

4. Thermo King's warranty does not cover any installation, adjustments, loose parts or damage. Thermo King's warranty also does not include consumable or maintenance items, such as, but not limited to, engine oil, lubricants, fuses, filters and filter elements, glow plugs, cleaning materials, light bulbs, refrigerant gases, dryers and non-Thermo King supplied batteries

5. In order for the warranty to apply to the mechanical and electrical portions of a refrigeration system using remote eveporators, the unit interconnecting pipe work and wiring must be installed by an authorised Thermo King Dealer or Sevice Provider.

6. Thermo King's warranty shall not apply to any unit which (i) has been so installed, maintained, repaired or altered as, in Thermo King's judgement, to affect any integrity, (ii) has been subject to misuse, negligent handling or accident, or (iii) has been operated contrary to Thermo King's printed Instructions. Thermo King or any authorised Thermo Service location shall have the right to require that the buyer provide maintenance records to show that a unit has been properly maintained.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND ALL WARRANTIES ARISING FROM THE COURSE OF DEALING OR CUSTOM OR USAGE OF TRADE, EXCEPT OF TITLE AND AGAIINST PATENT INFRINGEMENT.

LIMITATION OF LIABILITY: THERMO KING SHALL HAVE NO LIABILITY IN CONTRACT OR IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE, FOR ANY INJURY OR DAMAGE CAUSED TO VEHICLES, CONTENTS, PRODUCT CARGO OR OTHER PROPERTY OR FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES WHATSOEVER. INCLUDING, BUT NOT LIMITED TO, LOSS OR INTERRUPTION OF BUSINESS, LOST PROFITS AND LOSS OF USE. THE REMEDIES OF THE BUYER HEREIN ARE EXCLUSIVE AND THE TOTAL CUMULATIVE LIABILITY OF THERMO KING SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OF THE UNIT OR PART ON WHICH SUCH LIABILITY IS BASED.

SPECIFICATIONS

ENGINE

Model: T-500R T-600R, T-800R, T-800R SPECTRUM T-1000R,T-1000R SPECTRUM, T-1200R, T-1200R SPECTRUM, T-1200R Intermodal	 TK270 TK370 TK376
Fuel Type	No. 2 Diesel fuel under normal conditions No. 1 Diesel fuel is acceptable cold weather fuel B7 biodiesel - (acceptable with no modifications to engine or maintenance intervals)
Oil Capacity: T-500R, T-600R and T-800RCrankcase & Oil Filter T-500R, T-600R and T-800R w/Bypass Oil Filter T-1000R and T-1200RCrankcase & Oil Filter T-1000R, T-1200R Intermodal and T-1200R w/Bypass Oil Filter	 8.5 liters (9.0 quart) 9.5 liters (10.0 quarts) Fill to full mark on dipstick 11.4 literss (12.0 quart) 12.3 liters (13.0 quarts) Fill to full mark on dipstick
Oil Type	API Classification CI-4 or better (ACEA Rating E3 or better for Europe)
Oil Viscosity Always for T-1200R Intermodal	-10 C to 50 C (14 F to 122 F): SAE 15W-40 (Synthetic) -15 to 40 C (5 to 104 F): SAE 15W-40 -25 to 40 C (-13 to 104 F): SAE 10W-40 -25 to 30 C (-13 to 86 F): SAE 10W-30 -30 to 50 C (-22 to 122 F): SAE 5W-40 (Synthetic) Below -30 C (-22 F): SAE 0W-30 (Synthetic)
Engine rpm: Low Speed Operation (T-Series) High Speed Operation T-500R T-Series (except T-500R)	 1650 ± 25 rpm 2200 ± 25 rpm 2250 ± 25 rpm

ENGINE (CONTINUED)

Engine Oil Pressure	138 to 345 kPa (20 to 50 psig) in low speed 276 to 414 kPa (40 to 60 psig) in high speed
Intake Valve Clearance	0.15 to 0.25 mm (0.006 to 0.010 in.)
Exhaust Valve Clearance	0.15 to 0.25 mm (0.006 to 0.010 in.)
Valve Setting Temperature	21 C (70 F)
Fuel Injection Timing	16 ± 1 degrees BTDC
Injection Nozzle Pressure	12,300 to 13,300 kPa (1784 to 1929 psig)
Low Oil Pressure Switch/Sensor	69 ± 14 kPa (10 ± 2 psig)—shutdown
High Coolant Temperature Sensor	104 ± 3 C (220 ± 5 F)—shutdown
Engine Thermostat	71 C (160 F)
Engine Coolant Type	ELC (Extended Life Coolant), which is “RED” Use a 60/40 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

ENGINE (CONTINUED)

	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.
Coolant System Capacity:T-600R and T-800R T-1000R, T-1200R Intermodal and T-1200R T-500R With Micro-Channel Radiator Coil	4.3 liters (4.5 quarts) with coolant expansion tank 4.7 liters (5.0 quarts) with coolant expansion tank 4.6 liters (4.9 quarts) with coolant expansion tank
Coolant Expansion Tank Cap Pressure	103 kPa (15 psig)

ENGINE CLUTCH - HILLIARD

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

REFRIGERATION SYSTEM

Compressor Model: T-500R, T-600R, T-800R, T-800R SPECTRUM T-1000R, T-1000R SPECTRUM T-1200R, T-1200R Intermodal, 1200R SPECTRUM	 Thermo King X214 Thermo King X426 LSC5 Thermo King X430 LSC5
Refrigerant Charge: T-500R T-600R T-800R T-1000R T-1200R, T-1200R Intermodal T-800R/1000R/1200R SPECTRUM	 2.5 kg (5.5 lb) R-404A 3.0 kg (6.0 lb) R-404A 3.0 kg (6.0 lb) R-404A 3.8 kg (8.4 lb) R-404A Approximately 6.1 kg (13.4 lb) to 7.5 kg (16.5 lb) R-404A
Compressor Oil Charge*	3.0 liters (3.2 quarts) X214 4.1 liters (4.3 quarts) X426, X430
Compressor Oil Type	Ester base P/N 203-513 required
High Pressure Cutout Switch: Open Close	3241 ± 48 kPa (470 ± 7 psig) 2586 ± 262 kPa (375 ± 38 psig)
* 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/ 120 amp (SPECTRUM'S), brush type, Thermo King alternator
Voltage Regulator Setting	13.95 to 14.4 volts @ 77 F (25 C)
NOTE: Fuse F4 (Bypass resistor for Prestolite Alternator) must be removed for the Thermo King Alternator.	

ELECTRIC HEATER STRIPS (OPTIONAL)

Number	3
Watts	750 watts (each)
Resistance	71 ohms (each)

STANDBY POWER REQUIREMENTS

Supply Circuit Breaker: T-500R, T-600R and T800 200-230/3/50-60 T-1000R, T-1200R, T-1200R Intermodal and SPECTRUM'S 200-230/3/50-60 All 380-460/3/50-60	 30 amps 50 amps 20 amps
Extension Cord Size:	Up to 15 m — 10 gauge 23 m—8 gauge

FUSES

Fuse	Size	Function
F2	15A	Power to On/Off Switch
F3	40A	Fuel Sol Pull-In/Starter Circuit
F4	None 2A	No Fuse - All Bosch and Thermo King Alternators 2A Fuse - All Prestolite Alternators
F5	40A	Preheat Circuit
F6	15A	Damper and High Speed Circuits
F7	2A	8XP Circuit - Controller On Feedback to HMI
F8	5A	CAN Connector J12
F9	5A	CAN Connector J14
F10	10A	8X Power (Install fuse in upper position)
F12	5A	CAN Connector J13
F13	2A	8FC Circuit (Remote Lights)
F20	2A	Alternator Sense
F21	60A	Main Fuse (2 Circuit)
F25	7.5A	HPCO/Run Circuit
F4 Remove fuse F4 for Model 30 units with Australian Bosch or Thermo King Alternators. Install fuse F4 for Model 50 units with Prestolite Alternator.		
F10 When fuse F10 is installed in the upper position the On/Off keys on the HMI turn the unit on and off. When fuse F10 is installed in the lower position the unit will start and run without the HMI control panel.		

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) - (T-600R, T-800R, T-1000R)	1.1	11.3
Electronic Throttling Valve (ETV):(T-1200R only) Coil A (Red [EVA] and Blue [EVB] Wires) Coil B (Black [EVC] and White [EVD] Wires)	 - -	 20 to 35 20 to 35
Starter Motor (No Load Bench Test)	90	

Electrical Standby (Model 50 Units Only) T-500R, T-600R,T-800R and T-800R Spectrum

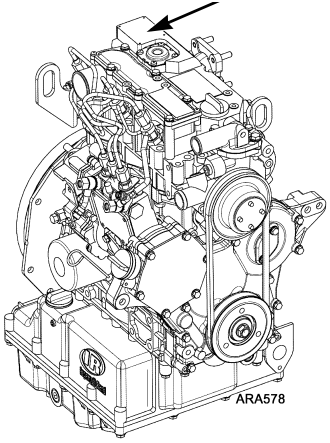
Voltage/Phase/Frequency	Horsepower	Kilowatts	rpm	Full Load (amps)	Overload Relay Setting (amps)
230/3/50	6.0	4.5	1460	17.0	19
230/3/60	7.2	5.4	1765	19.4	22
400/3/50	6.0	4.5	1460	9.8	11
460/3/60	7.2	5.4	1765	9.7	11

Electrical Standby (Model 50 Units Only) T-1000R,T-1200R, T-1200R Intermodal, T-1000R SPECTRUM and T-1200R SPECTRUM

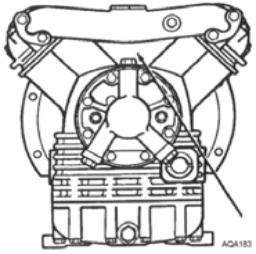
Voltage/Phase/Frequency	Horsepower	Kilowatts	rpm	Full Load (amps)	Overload Relay Setting (amps)
230/3/50	10.0	7.5	1460	22.5	25
230/3/60	12.0	8.9	1750	28.8	32
400/3/50	10.0	7.5	1460	17.0	16
460/3/60	12.0	8.9	1750	14.4	16

SERIAL NUMBER AND REFRIGERANT LABEL LOCATIONS

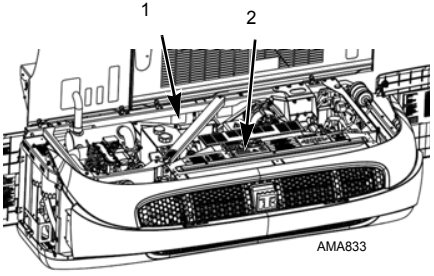
Write the unit model and unit serial number in the spaces provided in the following Emergency Cold Line chapter. This information is needed to service the unit.



Sample Engine Serial Number Location

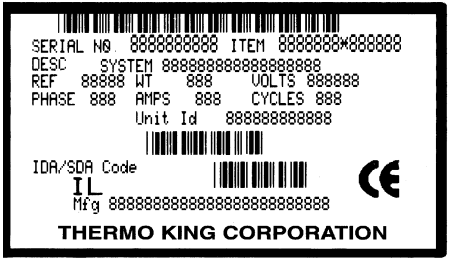


Compressor Serial Number Location



1.	Unit Serial Plate
2.	Refrigerant Type

Sample Label Locations



Laminated Unit Serial Number Plate

Refrigerant Type Label

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