THERMO KING

Operator's Manual

B-Series Units with Direct Smart Reefer

B-100, B-100 ECO and B-100 MAX (North America)

(Rev. A)

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TK 56869-18-OP-EN

TRANE TECHNOLOGIES

Introduction

This manual is published for informational purposes only. Thermo King® makes no representations warranties express or implied, with respect to the information recommendations and descriptions contained herein. Information provided should not be regarded as all-inclusive or covering all contingencies. If further information is required, Thermo King Corporation Service Department should be consulted.

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

Thermo King's warranty shall not apply to any equipment which has been "so installed, maintained, repaired or altered as, in the manufacturer's judgment, to affect its integrity."

Manufacturer shall have no liability to any person or entity for any personal injury, property damage or any other direct, indirect, special, or consequential damages whatsoever, arising out of the use of this manual or any information, recommendations or descriptions contained herein. The procedures described herein should only be undertaken by suitably qualified personnel. Failure to implement these procedures correctly may cause damage to the Thermo King unit or other property or personal injury.

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

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

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

- They are equipped with the factory recommended tools to perform all service functions.
- They have factory trained and certified technicians.
- They have genuine Thermo King replacement parts.

- The warranty on your new unit is valid only when the repair and replacement of component parts is performed by an authorized Thermo King dealer.

Copies of the approved Thermo King documentation can be found on the Thermo King iService Portal: http://iservice.thermoking.com/esa

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Safety Precautions

Danger, Warning, Caution, and Notice

Thermo King® recommends that all service be performed by a Thermo King dealer and to be aware of several general safety practices.

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this unit depend upon the strict observance of these precautions. The four types of advisories are defined as follows:

⚠ DANGER

Hazard!

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Hazard!

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Hazard!

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury and unsafe practices.

NOTICE

Hazard!

Indicates a situation that could result in equipment or property-damage only accidents.

General Practices

⚠ DANGER

Hazard of Explosion!

Never apply heat to a sealed refrigeration system or container. Heat increases internal pressure, which might cause an explosion resulting in death or serious injury.

⚠ DANGER

Hazardous Gases - Personal Protective Equipment (PPE) Required!

Refrigerant in the presence of an open flame, spark, or electrical short produces toxic gases that are severe respiratory irritants which can cause serious injury or possible death. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ DANGER

Risk of Injury!

Keep your hands, clothing, and tools clear of fans and/or belts when working on a unit that is running or when opening or closing compressor service valves. Loose clothing might entangle moving pulleys or belts, causing serious injury or possible death.

⚠ DANGER

Refrigerant Vapor Hazard!

Do not inhale refrigerant. Use caution when working with refrigerant or a refrigeration system in any confined area with a limited air supply. Refrigerant displaces air and can cause oxygen depletion, resulting in suffocation and possible death. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ WARNING

Hazard of Explosion!

Never close the compressor discharge service valve when the unit is operating. Never operate the unit with the discharge valve closed (front seated). This condition increases internal pressure, which can cause an explosion.

⚠ WARNING

Proper Equipment Condition!

Gauge manifold hoses must be in good condition before using them. Never let them come in contact with moving belts, fans, pulleys or hot surfaces. Defective gauge equipment can damage components or cause serious injury.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Always wear goggles or safety glasses and proper PPE when working on a unit. Refrigerant liquid, oil, and battery acid can permanently damage your eyes. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ WARNING

Equipment Damage and Risk of Injury!

Never drill holes into the unit unless instructed by Thermo King. Holes drilled into high voltage cables could cause an electrical fire, severe personal injury, or even death.

⚠ WARNING

Risk of Injury!

When using ladders to install or service refrigeration systems, always observe the ladder manufacturer's safety labels and warnings. A work platform or scaffolding is the recommended method for installations and servicing.

⚠ CAUTION

Sharp Edges!

Exposed coil fins can cause lacerations. Service work on the evaporator or condenser coils should only be accomplished by a certified Thermo King technician.

NOTICE

Equipment Damage!

All unit mounting bolts must be installed, be the correct length for their application, and torqued to specifications. Missing bolts, incorrect bolt lengths and improper torque specifications can damage equipment and void the warranty.

⚠ DANGER

Risk of Injury!

Keep your hands, clothing, and tools clear of fans and/or belts when working on a unit that is running or when opening or closing compressor service valves. Loose clothing might entangle moving pulleys or belts, causing serious injury or possible death.

⚠ CAUTION

Sharp Edges!

Exposed coil fins can cause lacerations. Service work on the evaporator or condenser coils should only be accomplished by a certified Thermo King technician.

Auto Start/StopAuto Start Hazards

⚠ CAUTION

Risk of Injury!

The unit can start and run automatically any time the unit is turned on. Turn the unit On/Off switch Off and disconnect the Auto Start Disable switch on top of the electrical cabinet before doing inspections or working on any part of the unit. Please note that only Qualified and Certified personnel should attempt to service your Thermo King unit.

⚠ CAUTION

Risk of Injury!

The vehicle's engine may be equipped with Auto Start/Stop. The vehicle must be turned off before servicing the unit.

⚠ CAUTION

Risk of Injury!

The unit can start and run automatically any time the unit is turned on. Turn the unit On/Off switch Off before doing inspections or working on any part of the unit. Please note that only Qualified and Certified personnel should attempt to service your Thermo King unit.

⚠ CAUTION

Risk of Injury!

The vehicle's engine may be equipped with Auto Start/Stop. The vehicle must be turned off before servicing the unit.

⚠ CAUTION

Risk of Injury!

The unit can start and run automatically any time the unit is turned on. Turn the unit On/Off switch Off before doing inspections or working on any part of the unit. Please note that only Qualified and Certified personnel should attempt to service your Thermo King unit.

⚠ CAUTION

Risk of Injury!

Some vehicles may be equipped with an Auto Start-Stop feature allowing the engine to restart automatically if required by the system. Refer to your vehicle’s operator’s manual regarding the Auto Start-Stop safety warnings before accessing the engine compartment. Failure to do so may result in serious injuries due to automatic engine restart.

⚠ CAUTION

Risk of Injury!

Thermo King units can start and run automatically any time the unit’s HMI controller is on. Before removing covers, or working on any part of the unit, always turn off the HMI Main Power On/Off switch.

⚠ CAUTION

Risk of Injury!

Some vehicles may be equipped with Auto Start-Stop feature allowing the engine to restart automatically if required by the system. Switch the ignition off before opening the hood or performing any maintenance. Failure to do so may result in serious injuries due to automatic engine restart. Always switch the ignition off before leaving vehicle, as the system may have turned the engine off, but the ignition will still be on and automatic restart may occur. Refer to your vehicle owners manual for further information.

Battery Installation and Cable Routing

⚠ WARNING

Hazard of Explosion!

An improperly installed battery could result in a fire, explosion, or injury. A Thermo King approved battery must be installed and properly secured to the battery tray.

⚠ WARNING

Hazard of Explosion!

Improperly installed battery cables could result in a fire, explosion, or injury. 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

Fire Hazard!

Do not attach fuel lines to battery cables or electrical harnesses. This has the potential to cause a fire and could cause serious injury or death.




- **Conventional Batteries**

⚠ WARNING

Personal Protective Equipment (PPE) Required!

A battery can be dangerous. A battery contains a flammable gas that can ignite or explode. A battery stores enough electricity to burn you if it discharges quickly. A battery contains battery acid that can burn you. Always wear goggles or safety glasses and personal protective equipment when working with a battery. If you get battery acid on you, immediately flush it with water and get medical attention.

- **AGM Batteries**

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Overcharging or over-discharging of an AGM Battery. There is a very real possibility of inducing enough heat into an AGM battery to initiate thermal runaway if the battery is charged at too high a voltage. This could cause your AGM battery to get very hot. Always wear personal protective equipment when working with a battery.

- **Lithium Ion Batteries**

⚠ WARNING

Personal Protective Equipment (PPE) Required!

A battery can be dangerous. Lithium Ion batteries are potentially hazardous. The combustion gas from these batteries is toxic and can present a serious FIRE HAZARD if damaged, defective or improperly used. A battery stores enough electricity to burn you if it discharges quickly. Always wear goggles or safety glasses and personal protective equipment when working with a battery. Do not replace the battery with any type other than the one approved by Thermo King for this unit.

⚠ WARNING

Hazard of Explosion!

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.

⚠ CAUTION

Hazardous Service Procedures!

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.

NOTICE

Equipment Damage!

Do not connect other manufacturer's equipment or accessories to the unit or to the TK Batteries unless approved by Thermo King. Failure to do so can result in severe damage to equipment and void the warranty.

Electrical Hazards

NOTICE

Equipment Damage!

Do not connect other manufacturer's equipment or accessories to the unit or to the TK Batteries unless approved by Thermo King. Failure to do so can result in severe damage to equipment and void the warranty.

⚠ DANGER

Hazardous Voltage!

Units equipped with Electric Standby option operate on 115 or 230 volts ac. This voltage is potential dangerous, causing serious injury or death.

⚠ WARNING

Live Electrical Components!

Control circuits are low voltage (24 Vac and 12 Vdc). This voltage potential is not considered dangerous. Large amount of current available (over 30 amperes) can cause severe burns if shorted to ground. Do not wear jewelry, watch or rings. These items can shortcut electrical circuits and cause severe burns to the wearer.

High Voltage

⚠ DANGER

Hazardous Voltage!

When servicing or repairing a temperature control unit, the possibility of serious or even fatal injury from electrical shock exists. Extreme care must be used when working with a refrigeration unit that is connected to a source of operating power, even if the unit is not operating. Lethal voltage potentials can exist at the unit power cord, inside the control box, at the motors and within the wiring harnesses.

⚠ WARNING

Hazardous Voltage!

The unit On/Off switch must be turned Off before connecting or disconnecting the standby power plug. Never attempt to stop the unit by disconnecting the power plug.

⚠ WARNING

Risk of Injury!

The unit power plug must be clean and dry before connecting it to a power source.

⚠ WARNING

Risk of Injury!

Do not make rapid moves when working on high voltage circuits in refrigeration units. Do not grab for falling tools because you might accidentally touch a high voltage source.

⚠ WARNING

Hazardous Voltage!

Treat all wires and connections as if they were high voltage until a meter and wiring diagram indicate otherwise. Only use tools with insulated handles. Never hold uninsulated metal tools near exposed, energized conductors. If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other local, state, or country-specific requirements for arc flash protection PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASHING CLOTHING. ELECTRICAL METERS AND EQUIPMENT MUST BE PROPERLY RATED FOR INTENDED VOLTAGE.

⚠ WARNING

Hazardous Voltage!

Never work alone on high voltage circuits in the refrigeration unit. Another person should be nearby to shut off the unit and provide aid in the event of an accident. If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other local, state, or country-specific requirements for arc flash protection PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASHING CLOTHING. ELECTRICAL METERS AND EQUIPMENT MUST BE PROPERLY RATED FOR INTENDED VOLTAGE.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

In the event of an electrical accident, all required PPE should be near the work area in accordance with OSHA, NFPE 70E, or other local, state, or country-specific requirements for a Category 2 risk.

⚠ WARNING

Hazardous Voltage w/Capacitors!

Be careful when working with electrical circuits that contain capacitors. Some capacitors hold a significant electrical charge that might cause burns or shocks if accidentally discharged. Capacitors must be discharged before working on electrical circuits. If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other local, state, or country-specific requirements for arc flash protection PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASHING CLOTHING. ELECTRICAL METERS AND EQUIPMENT MUST BE PROPERLY RATED FOR INTENDED VOLTAGE.

Low Voltage

⚠ WARNING

Live Electrical Components!

Control circuits used in refrigeration units are low voltage (12 to 48 Vdc). However, the large amount of amperage available can cause severe burns if accidentally shorted to ground with metal objects, such as tools. Do not wear jewelry, watches, or rings because they increase the risk of shorting out electrical circuits and damaging equipment or causing severe burns. If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other local, state, or country-specific requirements for arc flash protection PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASHING CLOTHING. ELECTRICAL METERS AND EQUIPMENT MUST BE PROPERLY RATED FOR INTENDED VOLTAGE.

Refrigerant Hazards

Although fluorocarbon refrigerants (R-404A/R-452A and R-134a) are classified as safe, observe caution when working with refrigerants or around areas where they are being used in the servicing of your unit.

⚠ DANGER

Hazardous Gases - Personal Protective Equipment (PPE) Required!

Refrigerant in the presence of an open flame, spark, or electrical short produces toxic gases that are severe respiratory irritants which can cause serious injury or possible death. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ DANGER

Refrigerant Vapor Hazard!

Do not inhale refrigerant. Use caution when working with refrigerant or a refrigeration system in any confined area with a limited air supply. Refrigerant displaces air and can cause oxygen depletion, resulting in suffocation and possible death. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Refrigerant in a liquid state evaporates rapidly when exposed to the atmosphere, freezing anything it contacts. Wear butyl lined gloves and other clothing and eye wear when handling refrigerant to help prevent frostbite. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ DANGER

Hazardous Pressures!

Always store refrigerant in proper containers, out of direct sunlight and away from intense heat. Heat increases pressure inside storage containers, which can cause them to burst and could result in severe personal injury.

⚠ DANGER

Combustible Hazard!

Do not use oxygen (O_2) or compressed air for leak testing. Oxygen mixed with refrigerant is combustible.

⚠ WARNING

Hazardous Gases!

Do not use a Halide torch. When a flame comes in contact with refrigerant, toxic gases are produced. These gases can cause suffocation, even death.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Refrigerant in a liquid state evaporates rapidly when exposed to the atmosphere, freezing anything it contacts. Wear butyl lined gloves and other clothing and eye wear when handling refrigerant to help prevent frostbite. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

Refrigerant Oil Hazards

Observe the following when working with or around refrigerant oil.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Protect your eyes from contact with refrigerant oil. The oil can cause serious eye injuries. Protect skin and clothing from prolonged or repeated contact with refrigerant oil. To prevent irritation, wash your hands and clothing thoroughly after handling the oil. Rubber gloves are recommended. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Protect your eyes from contact with refrigerant oil. The oil can cause serious eye injuries. Protect skin and clothing from prolonged or repeated contact with refrigerant oil. To prevent irritation, wash your hands and clothing thoroughly after handling the oil. Rubber gloves are recommended. When working with or around hazardous chemicals, ALWAYS refer to appropriate Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

NOTICE

Equipment Damage!

Use the correct oil in Thermo King systems to avoid damaging equipment and nullifying its warranty.

NOTICE

Equipment Damage!

Do not mix refrigerant oils. Mixing incompatible oils will damage the system.

NOTICE

Equipment Damage!

Use dedicated refrigeration equipment to prevent contaminating refrigeration systems with the wrong type of oil or refrigerant.

NOTICE

System Contamination!

Do not expose the refrigerant oil to the air any longer than necessary. Store refrigerant oil in an approved sealed container to avoid moisture contamination. The oil will absorb moisture, which results in much longer evacuation times and possible system contamination.

NOTICE

Material Damage!

Wipe up spills immediately. Refrigerant oil can damage paints and rubber materials.

First Aid

REFRIGERANT

- **Eyes:** For contact with liquid, immediately flush eyes with large amounts of water and get prompt medical attention.
- **Skin:** Flush area with large amounts of warm water. Do not apply heat. Remove contaminated clothing and shoes. Wrap burns with dry, sterile, bulky dressing to protect from infection. Get prompt medical attention. Wash contaminated clothing before reuse.
- **Inhalation:** Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.
- **Frost Bite:** In the event of frost bite , the objectives of First Aid are to protect the frozen area from further injury, warm the affected area rapidly, and to maintain respiration.

REFRIGERANT OIL

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention.
- **Skin:** Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.

- **Inhalation:** Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.
- **Ingestion:** Do not induce vomiting. Immediately contact local poison control center or physician.

ENGINE COOLANT

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention.
- **Skin:** Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.
- **Ingestion:** Do not induce vomiting. Immediately contact local poison control center or physician.

BATTERY ACID

Under normal usage, the Ni-MH batteries are hermetically sealed. In case of accident, perform the following instructions:

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention. Wash skin with soap and water.
- **Skin:** Immediately remove contaminated clothing. Wash skin with large volumes of water, for at least 15 minutes. Wash skin with soap and water. Do not apply fatty compounds. Seek immediate medical assistance.
- **Inhalation:** Provide fresh air. Rinse mouth and nose with water. Seek immediate medical assistance.
- **Ingestion:** If the injured person is fully conscious: make the person drink extensive amounts of milk. Do not induce vomiting. Take the injured person immediately to a hospital.

ELECTRICAL SHOCK

Take IMMEDIATE action after a person has received an electrical shock. Get quick medical assistance, if possible.

The source of the shock must be quickly stopped, by either shutting off the power or removing the victim. If the power cannot be shut off, the wire should be cut with an non-conductive tool, such as a wood-handle axe or thickly insulated cable cutters. Rescuers should wear insulated gloves and safety glasses, and avoid looking at wires being cut. The ensuing flash can cause burns and blindness.

If the victim must be removed from a live circuit, pull the victim away with a non-conductive material. Use wood, rope, a belt or coat to pull or push the

victim away from the current. DO NOT TOUCH the victim. You will receive a shock from current flowing through the victim's body. After separating the victim from power source, immediately check for signs of a pulse and respiration. If no pulse is present, start Cardio Pulmonary Resuscitation (CPR). If a pulse is present, respiration might be restored by using mouth-to-mouth resuscitation. Call for emergency medical assistance.

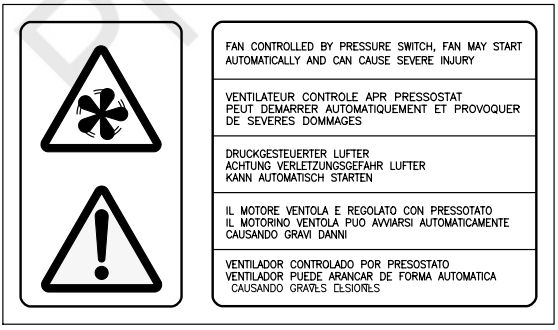
ASPHYXIATION

Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.

Safety Decals

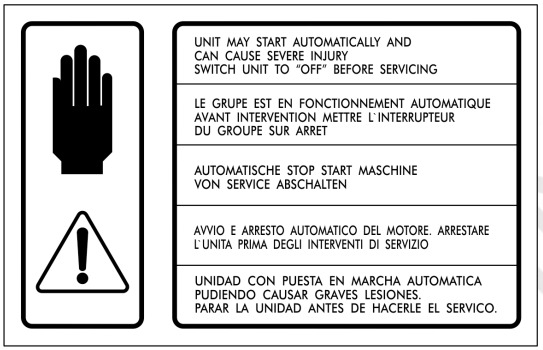
Safety decals and locations vary depending on model.

Figure 1. Fan Caution



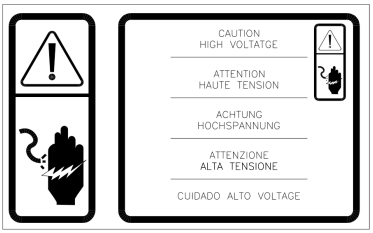
SAP1000

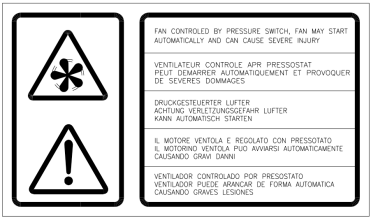
Figure 2. Automatic Start Caution

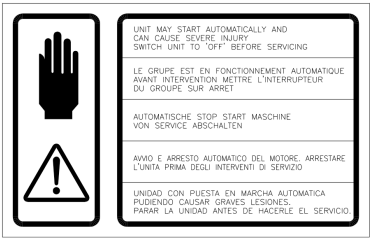


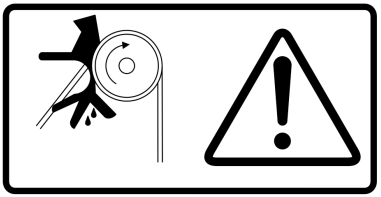
Observe all safety decals placed in various locations on the unit.

Figure 3. Typical Safety Decals









RCS541

Electric Standby Nameplates (Models 20 and 50 Only)

Figure 4. Electrical Hazard Cautions

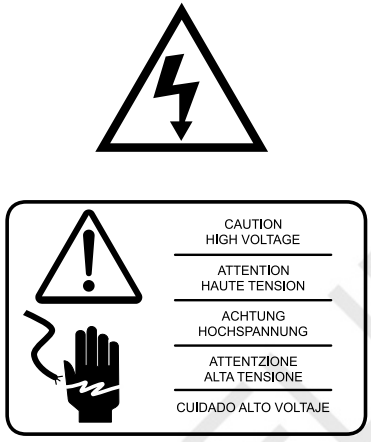
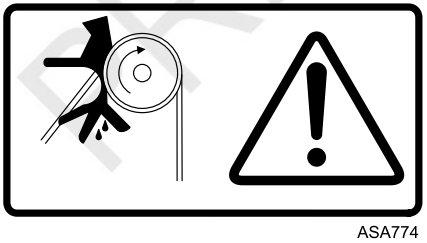
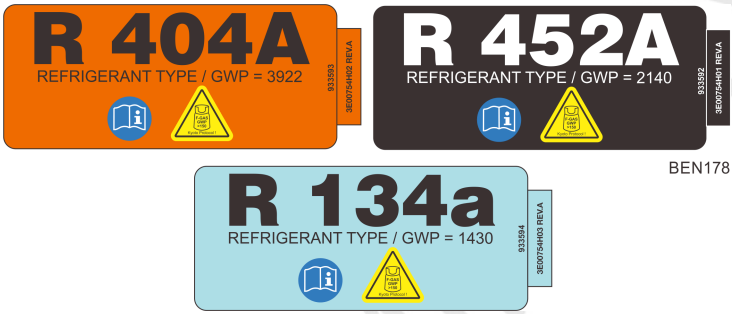


Figure 5. Belt Caution



Refrigerant

Refrigerant Decal is located adjacent to the service ports for charging or recovering the gas, as per the F-Gas regulation.



BEN178

F Gas decal indicates that this equipment Contains fluorinated greenhouse gases.

SAP1243

Unit Description

Thermo King B-Series are electric powered two-piece units (condenser and evaporator) designed for fresh, frozen, and deep frozen applications for small trucks and vans.

The system is powered by the vehicle's battery during mobile operation. Optional SmartPower© units operate when the unit is connected to an AC power source during stationary operation.

The user friendly Direct Smart Reefer (DSR) controller makes operating your unit simple, while its modular design allows for ease of service.

B-Series Units Include:

- **B-100, B-100 ECO:** for fresh temperature applications above 32°F (0°C).
- **B-100 MAX:** for frozen temperature applications below 32°F (0°C) and down to -26°F (-32°C).

There are four basic models:

- **Model 10:** Cool and Defrost with battery operation.
- **Model 20:** Cool and Defrost with both battery or electric standby operation.
- **Model 30:** Hot gas heat, Cool, and Defrost with battery operation.
- **Model 50:** Hot gas heat, Cool, and Defrost with both battery or electric standby operation.

Two add-on heat options are available:

- Coolant Heat (Models 10 and 20 only).
- Coolant and Electric Heat (Model 20 only).

Standard Unit Features

- **Condenser** - Lightweight design, easy to service with automotive grade polypropylene cover.
- **Evaporator** - Ultra slim design, aluminum construction automotive grade Acrylonitrile Butadiene Styrene (**ABS**) cover.
- **Compressor(s)** - Industry-standard reciprocating compressor that delivers excellent performance in a compact size. For increased reliability and performance.
- **Compressor(s)** - Industry-standard swash plate compressor that delivers excellent performance in a compact size. For increased reliability and performance, reciprocating compressors are also available.

- **Controls** - User friendly Direct Smart Reefer (DSR) In-Cab controller.
- **Refrigerant** - R-134a, R-452A or R-404A (depending on unit model).
- **Electric Standby**
- **Start/Stop and Increased Idle Speed Functionality** - improves the refrigeration performance during long periods of engine stops due to vehicle START/STOP activation/vehicle running in idle (eg. Traffic jam, urban distribution with high density of traffic lights,...). Needs Dealer activation and installation according to each chassis OEM's conversion manual.

Options

- SmartPower™(Electric Standby)

  Electric Standby
- Hot Gas, Electric or Coolant Heating
- Hot Gas
- Door Switch Kit

  Note: *Installing door switch(es) is strongly recommended if the application will use holdover mode.*
- Discharge Muffler Kit
- Snow Covers
- Refrigeration Hose / Harness Covers
- Roof Top Mounting Kit
- TracKing®
- **Hold-over functionality** - using extended vehicle battery to allow the user to maintain the temperature control of the compartment for a certain period when there is no alternator or stand-by power sources available. Needs Dealer activation.
- **TK Batteries** - This option allows to get up to 2 x 1.8kWh Li-ion batteries mounted in the driver's cabin. This will keep the refrigeration unit in operation while the vehicle is stopped and cannot be connected to shore power. This is useful to hold the cargo box temperature during the following circumstances for example: deliveries to customers, lunch breaks etc. without the need to return to base. Each battery can support the refrigeration unit operating more than 1 hour in standard conditions. This option is not compatible with using extended vehicle battery for short holdover times.

- Electric Standby Plug (115 Vac, 230 Vac 1phase NOT in V800/V1000, 230 Vac 3 phase, 400 Vac 3 phase)
- Electric Standby Plug (230V single phase 50Hz/60Hz or 115V single phase 60Hz options)

Note: *Some options are available factory installed or as a retrofit option to suit individual customer needs.*

System Components

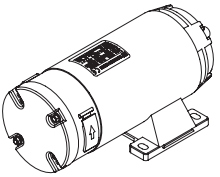
The system consists of the following main components:

- Electric DC motor
- Electric AC motor (SmartPower units only)
- Reciprocating compressor (belt driven)
- Condenser
- Evaporator
- In-cab controller

DC Electric Motor

The DC electric motor located inside the condenser operates the reciprocating compressor. The system is powered by the vehicle's battery (minimum 250 amp alternator recommended) during mobile operation.

Figure 6. DC Motor

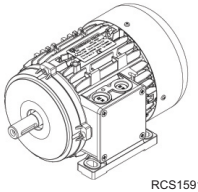


RCS1590

AC Electric Motor

SmartPower units have an additional AC electric motor located inside the condenser that operates the reciprocating compressor. Power for the motor is supplied when unit is connected to an AC power source during stationary operation.

Figure 7. AC Motor



Compressor(s)

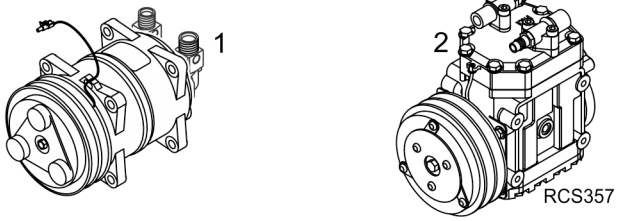
With E-Series units, mobile operation and electric standby modes operate with a compressor driven by an DC/AC inverter. Power is taken from vehicle battery or auxiliary batteries in mobile operation or from shore power in electric standby.

All V-Series systems utilize an engine driven compressor and a swash plate or reciprocating compressor depending on model. Electric standby models also have an electric motor that operates a second compressor located inside the condenser.

All V-Series systems utilize an engine driven compressor and a swash plate compressor. Electric standby models also have an electric motor that operates a second compressor located inside the condenser.

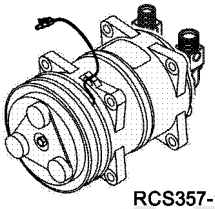
All B-Series units are battery driven, and therefore there is no need for a compressor in the engine department. Electric standby models however, have an electric motor that operates a reciprocating compressor located inside the condenser.

Figure 8. Compressors



1.	Swash Plate
2.	Reciprocating

Figure 9. Swash Plate Compressor



RCS357-1

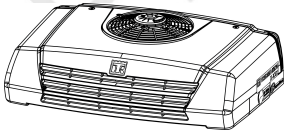
Condenser

The condenser is located on the roof of the vehicle or on the front of the cargo box. The cover can easily be removed to access the fuses or service the unit.

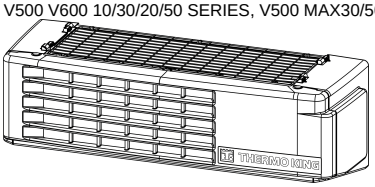
Figure 10. Condenser

Figure 11. Condensers, V-Series

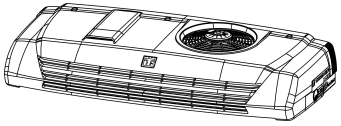
V-100 10/30



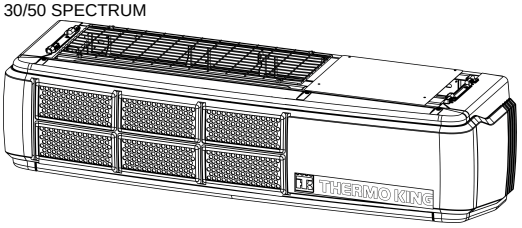
V500 V600 10/30/20/50 SERIES, V500 MAX30/50 SPECTRUM



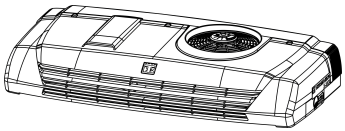
V200/V300 20/50



V800/V1000 10/20 SINGLE TEMP., 30/50 SINGLE TEMP., 30/50 SPECTRUM



V200/V300 SPECTRUM 20/50



BEE967

Evaporator

The evaporator is mounted on the ceiling inside the cargo box. The cover can easily be removed for service.

Figure 12. Evaporator

Figure 13. Evaporator

In-Cab Controller

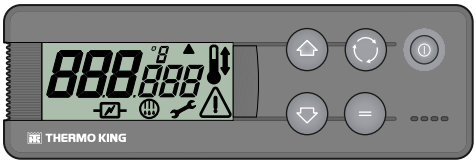
⚠ WARNING

Risk of Injury!

Never operate the unit unless you completely understand the controls; otherwise serious injury may occur.

The Direct Smart Reefer (DSR) Controller is mounted in the vehicle cab and is used to operate the refrigeration unit. Refer to Operating Instructions ("Introduction," p. 41).

Figure 14. DSR In-Cab Controller



RCS360

Electrical System

The unit's controls and refrigeration components operate on 12 Vdc.

The unit's controls and refrigeration components operate on 12 Vdc or 24 Vdc (must match the voltage of the vehicle alternator)

SmartPowerElectric Standby units have a standby motor that operates on 230 Vac, 400 Vac 3 ph when connected to a remote power source. A transformer in the condenser unit converts the (NOT 115 V) 230 Vac 1 ph or 400 Vac 1 ph to 12 or 24 Vdc to operate the unit's controls and refrigeration components.

Fuses

The electrical components are protected by various fuses.

Main Power Fuse - The main power fuse is located in the vehicle's engine compartment and is connected directly to the vehicle's battery.
For B-Series and V-Series: This in-line fuse is non-serviceable and must only be replaced by an authorized Thermo King Dealer.
Main Power Fuse - The main power fuse is located in the vehicle's engine compartment and is connected directly to the vehicle's battery (or extended hold-over battery if fitted).
For E-Series: This 150 amp in-line fuse is non-serviceable and must only be replaced by an authorized Thermo King Dealer.

TK Battery Fuses - Each Battery is protected by a fuse installed inside the metal battery enclosure. If one battery is installed, the fuse must be 150Adc MEGA type. If two batteries an 80Adc MEGA type must be installed inside the metal battery enclosure. These fuses are non-serviceable and must only be replaced by an authorized Thermo King Dealer.

Smart Charger Module Fuses - Inside the electrical cabinet there are two fuses (F71 and F72) for the SCM protection, one in the input and one in the output (60A MIDI type).

BMS Supply Fuses - There are two **non-serviceable** fuses inline with the harness (F84 and F8) and installed inside the electrical cabinet that is protecting the BMS supply. These fuses are 10Adc rating.

Ignition Power Fuse - The ignition power fuse is connected to the vehicle's fused ignition system. Depending on the vehicle, the location of the fuse panel could be located inside the cab or under the hood of the vehicle.

Unit Component Fuses - These fuses are located in the condenser unit. Remove the condenser cover to access them. Depending on your model, some fuses may not be usedRefer to (“,”).

Figure 15. V-200 V–300 Condenser, Fuses Location

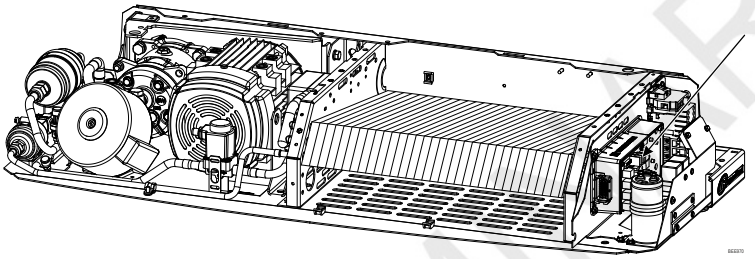


Figure 16. V-200 V–300 SPECTRUM Condenser, Fuses Location

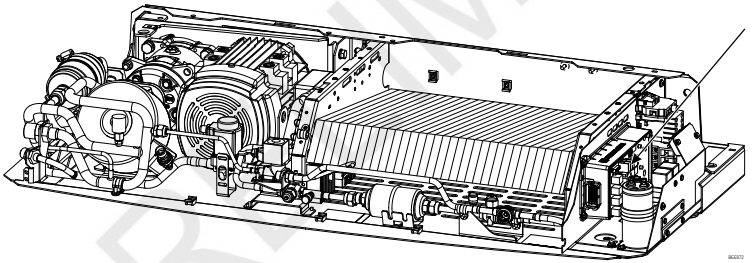
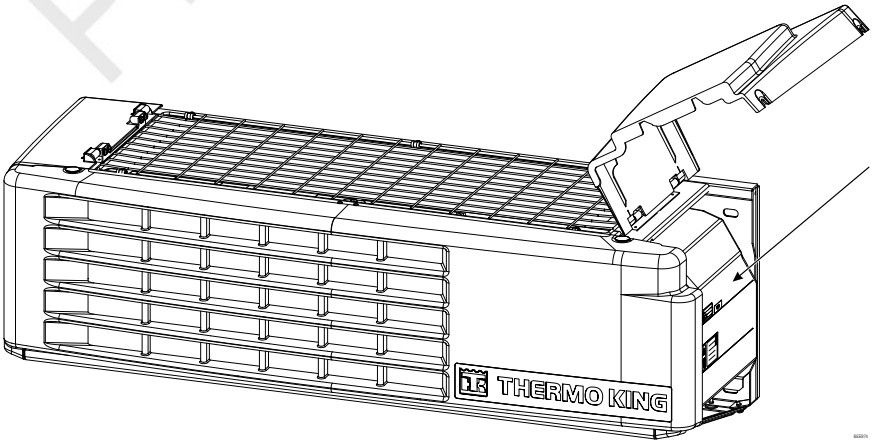
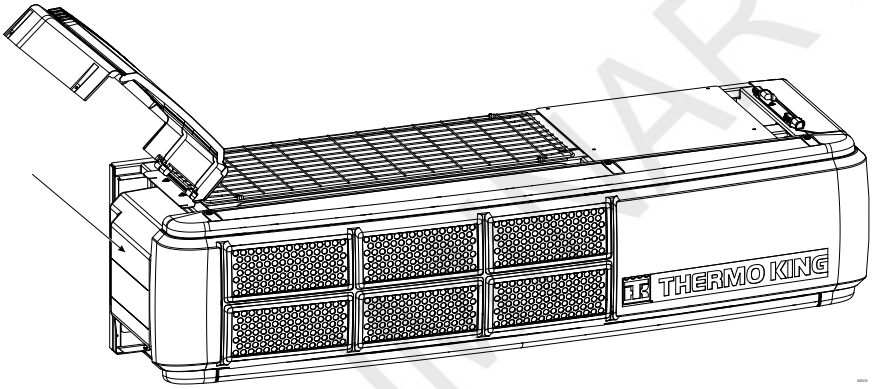


Figure 17. V-500 V–600 Condenser, Fuses Location



Note: *Remove the cover to access the fuses.*

Figure 18. V-800 V–1000 Condenser, Fuses Location



Note: *Remove the cover to access the fuses.*

Figure 19. Fuse Location (condenser cover and electric box cover removed)

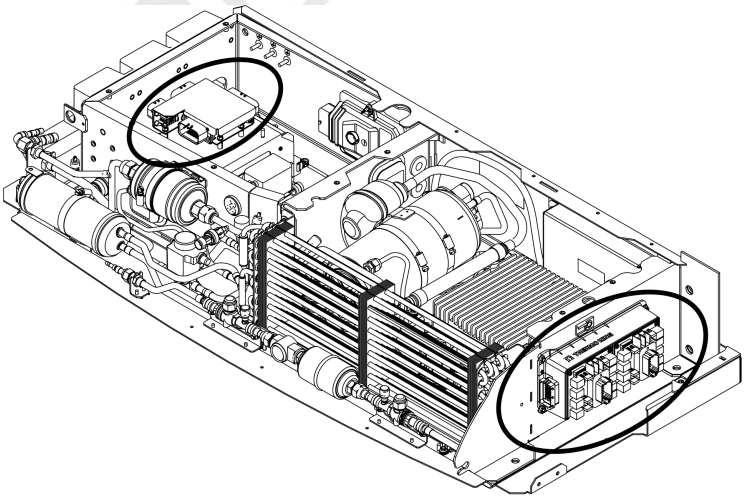
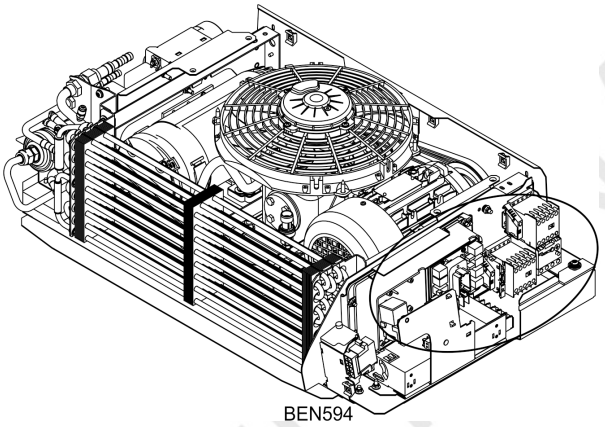


Figure 20. Fuse Location (condenser cover removed)



Operating Instructions

Introduction

In vehicle powered units, temperature control is based on two values: The setting (Setpoint) of the controller and the evaporator return air temperature. The difference between these two temperatures will determine the mode of operation: cool, heat, or null.

Cool: When the temperature in the compartment is 3°F (2°C) ***higher*** than the setpoint, the unit runs in cool mode to reduce the evaporator return temperature to achieve the setpoint.

Heat: When the temperature in the compartment is 3°F (2°C) ***lower*** than the setpoint, the unit changes to heat mode to raise the evaporator return temperature to achieve the setpoint.

Null: Once the Setpoint Temperature has been reached, and the temperature remains at or within the temperature differential, (there is no demand for heat or cool), the unit stops operating and goes into the Null mode.

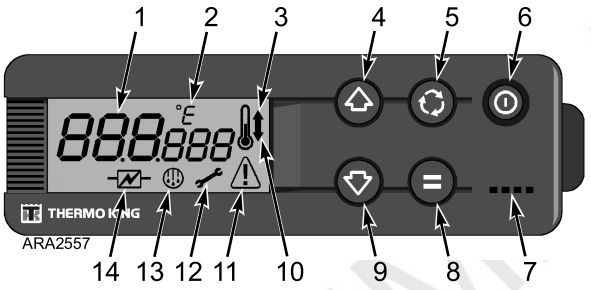
While in the Null mode, the unit is still monitoring the compartment temperature and will resume operation only if the temperature increases or decrease by 3°F (2°C) above or below the setpoint.

Defrost: After a period of time in cool mode, (time is setup during installation between 0 and 8 hours), the unit checks the coil temperature. If the temperature is cold enough to form ice, the unit runs in automatic Defrost Mode to eliminate ice that has accumulated in the evaporator coil. Defrost can also be initiated manually by selecting the defrost mode on the DSR controller. The unit will run in defrost until one of the two events occurs: 1) the coil temperature is back within range, or 2) the defrost termination timer has expired. (time is setup during installation).

Note: *The return air temperature will increase slightly while in defrost, however it will quickly return to the desired setpoint after completion of the defrost cycle.*

Unit Controls

Figure 21. In-Cab Control Box Display, Keys, and Symbols



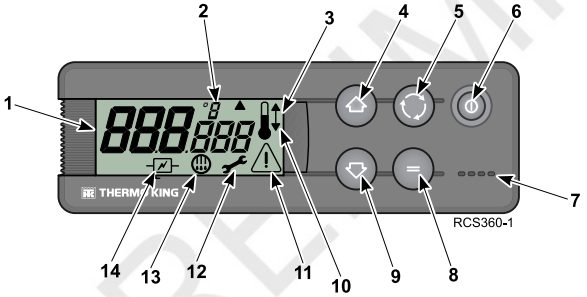
1. Display	It is always active and backlit except when the unit is disconnected (no power) or when the unit is connected but has been manually switched off from the In-Cab Control Box. It normally displays the return air temperature.
2. C/F Symbol	Indicates whether the on-screen temperature reading is in degrees Celsius (C) or degrees Fahrenheit (F).
3. Heat Symbol	(Thermometer with an arrow pointing upward). The unit is heating.
4. Up Key	Is used to increase the setpoint temperature.
5. Select Key	Selects prompt screens and information screens.
6. On/Off Key	This key is used to start/stop the unit. It is always lit except when the unit is disconnected (no power), and thus acts as an indicator of the presence of power in the unit.
7. Buzzer	It is energized when the vehicle battery and the electric power supply are connected simultaneously. It is also energized if the doors are opened while the refrigeration unit is running.
8. Enter Key	Is used to enter a new command such as manual defrost, etc.
9. Down Key	Is used to reduce the setpoint temperature.
10. Cool Symbol	(Thermometer with an arrow pointing downward). The unit is cooling.
11. Alarm Symbol	Indicates that there is an alarm in the system.
12. Maintenance Symbol	Warns of the need to carry out maintenance to the unit.

13. Defrost Symbol	Indicates the unit is in Defrost Mode.
14. Electrical Symbol	Indicates that the unit is in Electric Standby.

⚠ WARNING

Risk of Injury!

Never operate the unit unless you completely understand the controls; otherwise serious injury may occur.



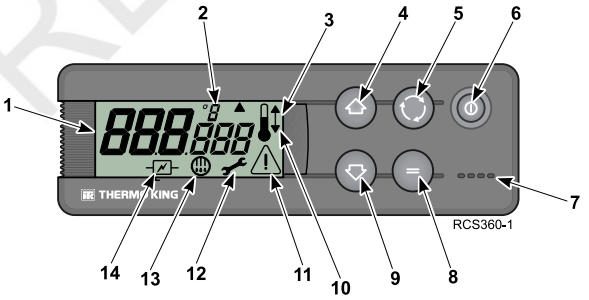
1.	Main Display	Always active and back-lit except when the unit has been manually switched off from the In-Cab Controller. It normally displays the evaporator return air temperature but also displays setpoint temperature, hours, etc. depending on the selection chosen.
2.	C/F Symbol	Indicates temperature reading is in degrees Celsius (C) or degrees Fahrenheit (F).
3.	Heat Symbol	The unit is heating (Thermometer with an arrow pointing upward).
4.	Up Key	Is used to increase the setpoint temperature.
5.	Select Key	Is used to scroll through prompt displays and information displays.
6.	On/Off Key	This key is used to start/stop the unit.
7.	Buzzer	Alerts when vehicle battery and electric power supply are connected simultaneously (Models 20/50 only). Alerts if doors are opened while the refrigeration unit is running (Door Switch Option Only). Can be configured by Thermo King dealer to suit individual customer needs.

8.	Enter Key	Is used to enter a new command such as manual defrost, etc.
9.	Down Key	Is used to reduce the setpoint temperature.
10.	Cool Symbol	The unit is cooling (Thermometer with an arrow pointing downward).
11.	Alarm Symbol	Indicates there is an alarm in the system.
12.	Maintenance Symbol	Indicates the need to carry out maintenance to the unit. Refer to ("Maintenance Inspection Schedule," p. 70).
13.	Defrost Symbol	Indicates the unit is in Defrost Mode.
14.	Electrical Symbol	Indicates the unit is connected to electric standby AC power (Models 20/50 only).

⚠ WARNING

Risk of Injury!

Never operate the unit unless you completely understand the controls; otherwise serious injury may occur.



1.	Main Display	Always active and back-lit except when the unit has been manually switched off from the In-Cab Controller. It normally displays the evaporator return air temperature but also displays setpoint temperature, hours, etc. depending on the selection chosen.
2.	C/F Symbol	Indicates temperature reading is in degrees Celsius (C) or degrees Fahrenheit (F).
3.	Heat Symbol	The unit is heating (Thermometer with an arrow pointing upward).
4.	Up Key	Is used to increase the setpoint temperature.

5.	Select Key	Is used to scroll through prompt displays and information displays.
6.	On/Off Key	This key is used to start/stop the unit.
7.	Buzzer	Alerts when vehicle battery and electric power supply are connected simultaneously (Models 20/50 only). Alerts if doors are opened while the refrigeration unit is running (Door Switch Option Only). Can be configured by Thermo King dealer to suit individual customer needs.
8.	Enter Key	Is used to enter a new command such as manual defrost, etc.
9.	Down Key	Is used to reduce the setpoint temperature.
10.	Cool Symbol	The unit is cooling (Thermometer with an arrow pointing downward).
11.	Alarm Symbol	Indicates there is an alarm in the system.
12.	Maintenance Symbol	Indicates the need to carry out maintenance to the unit. Refer to ("Maintenance Inspection Schedule," p. 70).
13.	Defrost Symbol	Indicates the unit is in Defrost Mode.
14.	Electrical Symbol	Indicates the unit is connected to electric standby AC power (Models 20/50 only).

Operating the Unit

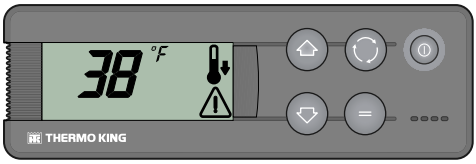
Vehicle Engine Operation

1. Start the vehicle's engine.
2. Press the On/Off Key on the DSR controller. The Standard Display will appear.

   The Standard Display normally displays the return air temperature and the current operating mode with the appropriate symbol. The example below shows: 38 F temperature and cool mode with an alarm present.

   If an alarm is present, the Alarm symbol will also appear on the display. Refer to ("Alarm Code Descriptions," p. 53).
3. Check the setpoint, and adjust if necessary. Refer to ("Entering the Setpoint Temperature," p. 47).

Figure 22. Standard Display



Standby Operation (Models 20 and 50 Only)

⚠ WARNING

Hazardous Voltage!

A certified electrician should verify that the proper standby power requirements are being supplied before connecting to a new power source.

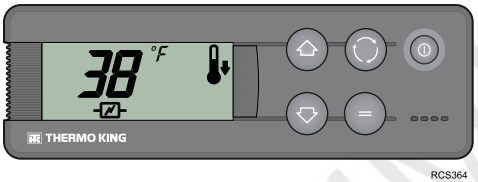
These units may be operated in electric standby mode by connecting the proper voltage power cable to the unit's power receptacle mounted on the vehicle. Standby operation is used while the vehicle is stationary with the engine shut off.

Figure 23. Standby Power Receptacle

1. Connect the external power supply to the electric power receptacle. Verify the power supply is the correct voltage, phase and frequency for unit.
2. Press the On/Off Key on DSR controller. The display will be activated. The electric symbol will appear on the display.
3. Check the setpoint, and adjust if necessary. Refer to ("Entering the Setpoint Temperature," p. 47).

Note: *When the unit is connected to an electric power source, engine driven operation is automatically blocked. If the vehicle engine is started up while the power cable is still connected to the electric power source, the unit will continue to operate in electric standby mode and the buzzer will sound (if enabled).*

Figure 24. Standard Display with Standby Symbol



Entering the Setpoint Temperature

The Setpoint Temperature can be quickly and easily changed.

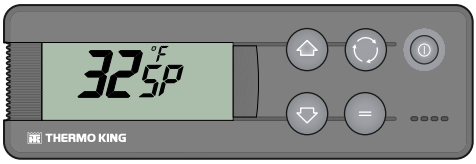
1. Press and release the Select key twice (three times for reverse cycle units), and the current Setpoint Temperature and the letters SP will appear on screen.
2. Press the Up or Down arrow keys to select the desired Setpoint Temperature. Each time either of these buttons is pressed and released, the Setpoint Temperature will change one degree.
3. Press and release the Select key, and the Standard Display will reappear on display.

   Important: *If the Select key is not pressed within 20 seconds to select the new Setpoint Temperature, the unit will continue to run at the original Setpoint Temperature.*

4. Press and release the Enter key to enter the setpoint, or press and release the Select key to enter the setpoint and return to the Standard Display.

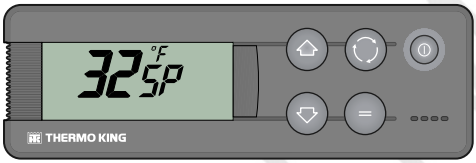
   Important: *If the Enter or Select key is not pressed within 20 seconds to select the new Setpoint Temperature, the unit will continue to run at the original Setpoint Temperature.*

Figure 25. Setpoint Temperature Display



RCS366

Figure 26. Setpoint Temperature Display



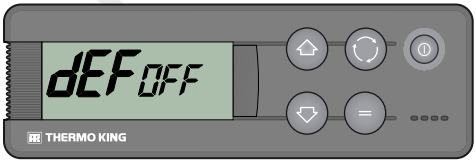
RCS366

Initiating Manual Defrost Cycle

Important: *Before initiating a manual defrost, verify that the unit is not already in a defrost cycle. When the unit is in a defrost cycle the defrost symbol appears on display.*

1. Press and release the Select key once, and the letters dEF will appear (flashing) on display along with the present defrost condition OFF.

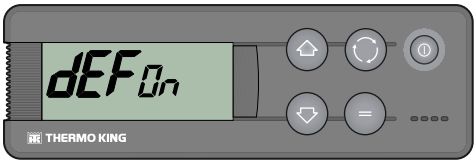
Figure 27. Defrost Off



RCS371

2. To activate manual defrost, press the Enter key and then the Up or Down key and the defrost will change to ON.

Figure 28. Defrost On



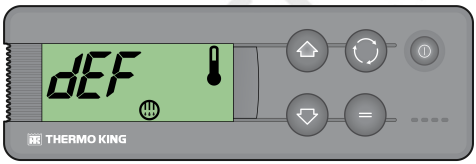
RCS372

3. Press the Select key twice to return to the Standard Display where the Defrost symbol will appear when the defrost cycle begins.

   Note: *Manual defrost will be aborted if there is no ice on the coil.*

   Important: *The evaporator coil must be below 36°F (2.26°C) for a defrost to be enabled.*

Figure 29. Defrost Cycle in Process



RCS433

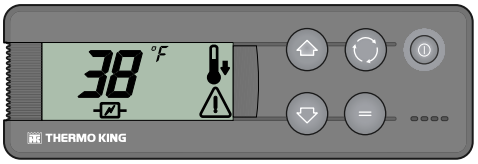
Alarms

When the unit is not operating properly, the microprocessor records the alarm code, alerts the operator by displaying the Alarm symbol, and shuts the unit down. Press and release the Select key to display the current alarm code. If there is more than one active alarm, all the alarm codes on the unit can be viewed in sequence by pressing and releasing the Select key. Refer to ("Alarm Code Descriptions," p. 53).

Auto Start (after an alarm)

When an alarm stops unit operation, the Alarm icon appears on the Standard Display. After the condition that caused the alarm is corrected and the alarm has been cleared, the unit will start automatically. Refer to ("Alarm Code Descriptions," p. 53).

Figure 30. Auto Start Alarm



RCS368

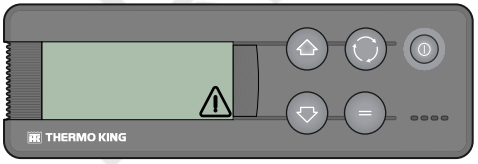
Manual Start (after an alarm)

When a Manual Start alarm stops unit operation, the Alarm icon appears on the Standard Display with no other icons present.

Note: *This information applies only to the OL (Electric Standby overload) alarm and bAt (low battery voltage) alarm.*

After the condition that caused the alarm is corrected, the On/Off key on the In-cab Control Box must be pressed, in order to start unit operations. Once the unit is powered back up, the alarm must be cleared. Refer to ("Clearing Alarm Codes," p. 51).

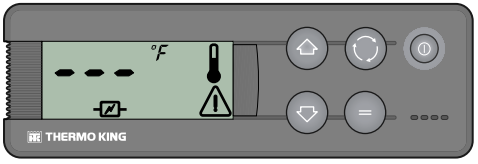
Figure 31. Alarm Symbol



RCS370

Should a **P1E** alarm occur, return air temperature read error alarm code — will appear on display together with the alarm symbol, instead of the return air temperature reading.

Figure 32. P1E Alarm



RCS369

Press and release the Select key to display the current alarm code. If there is more than one active alarm, all the alarm codes on the unit can be viewed in sequence by pressing and releasing the Select key.

Clearing Alarm Codes

- The alarm condition in the unit must first be corrected.
- After correcting the alarm condition, press and release the Select key to remove existing Alarm Codes.
- If more than one alarm code is present, press the Select key to clear each alarm code individually.
- The standard display will appear once the Alarm Codes have been cleared.

The alarm condition in the unit must first be corrected. See important note below. After resolving the alarm condition, press and release the Select key to remove existing Alarm codes. The Standard Display will appear once the Alarm codes have been cleared.

To Clear Alarm Codes:

- Correct the cause of the alarm code.
- Press the Select key to remove the alarm code.
- If more than one alarm code is present, press the Select key to clear each alarm code individually.

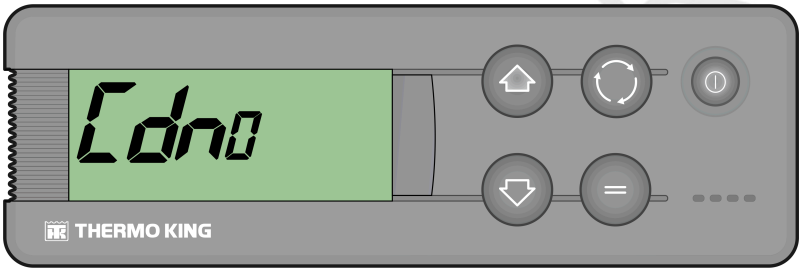
Important: *Continually clearing alarm codes without resolving the problem will result in damage to the unit and compressor.*

Notes: *The bAt alarm is the unique DSR-III alarm that requires manual confirmation. The DSR-III will keep in OFF condition until the operator acknowledges and the voltage is above the BCH value(factory setting 10.5v).*

The way to acknowledge this alarm is as follows:

1. *Press the Select key once to show the Alarm screen. You will now see the bAt Alarm code.*
2. *Press the Select key again to acknowledge the alarm, and Press the select key again and again until the screen returns to the standard Display.*

Note: *After Clearing all active Compressor Drive Module Alarms, Cdn0 will appear after Acknowledging the Alarm*



BEN991

Buzzers (Optional)

A buzzer sounds when the vehicle battery and the electrical supply are connected simultaneously (the unit continues running in standby mode). It can also sound if the door(s) is open or the return air temperature is out of range. Buzzers are configurable to different parameters to suit individual customer needs. Contact your Thermo King Dealer for assistance.

Alarm Code Descriptions

Table 1. Color Code Definitions

OK TO RUN	CHECK AS SPECIFIED	TAKE IMMEDIATE ACTION

Alarm		Description
Manual Start		
OL		**Electric Motor Overload (Electric standby models only)** - The electric motor overload relay has tripped due to excessive current draw. *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
bAt		**Low Battery Voltage** - Check vehicle battery.
Auto Start		
HP		**High Pressure Alarm** - The system has detected excessively high discharge pressure. *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
LP		**Low Pressure Alarm** - The system has detected excessively low suction pressure. *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
PSE		**High Pressure Sensor Failure** - The high pressure sensor has become faulty or disconnected. *Contact your Thermo King Dealer.*
tEP, tP4		**Thermal Protection Alarm** - If the problem persists when the unit is restarted, contact your Thermo King Dealer.
dr1, dr2		**Cargo Doors Are Open (Units with door switch option only)** - Check if the Doors are open. if not, then the door switches are faulty, or improper door switch configuration. *Contact your Thermo King Dealer.*
tCO		**Control Module Overheating** *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
SOF		**Software Failure** *Contact your Thermo King Dealer.*
P1E		**Faulty Cargo Box Return Air Temperature Sensor** - Faulty or disconnected return air temperature sensor. *Contact your Thermo King Dealer.*

Alarm		Description
P2E		**Remote Cargo Box Return Air Temperature Reading Error (open circuit or short-circuit)** *Contact your Thermo King Dealer.*
C		**Communications Failure** *Contact your Thermo King Dealer.*
H01		**DSR communication lost** - Communication lost to the other Electronic Control Module.
H02		**HMI communication lost** - Communication lost to the HMI.
H03		**SCM communication lost** - Communication lost to Smart Charger Module.
H04		**CDM communication lost** - Communication lost to Compressor Drive Module.
H0A		**Low Power Mode Activation** - ignition key of the vehicle is disconnected and the unit is not connected to the shore power. Operation of the unit may be inhibited but remains operational.
H0B		**Sleep Mode Activation**- While the unit OFF, the vehicle battery voltage dropped below a threshold. Normal operation of the controller will resume as soon as the power is restored.
H0C		**Power Derating Shutdown** - Low Voltage Shutdown alarm - your battery voltage has dropped below a defined level. The shutdown alarm is automatically cleared once the voltage rises over this limit once more.
H10		**Internal flash erase error** - Internal, System reset needed
H12		**Default parameters in use** - This will typically happen after a new firmware version has been loaded.
H15		**eMMC erase error** - An error occurred while loading parameters to the DSR-IV Controller.
H16		**eMMC write error** - An error occurred while loading parameters to the DSR-IV Controller or performing the datalogging process.
H17		**eMMC read error** - An error during powering-up when reading configuration paramenters.
H18		**Flash Loading Failed** - An error occurred while loading firmware to the DSR-IV Controller.
H1A		**Non-Compatible SW** - Indicates that one of the Electronic components contains an incorrect or out-of-date Software version.

Table 2. Compressor Drive Module Alarms

H21		**Phase overcurrent**- Shutdown alarm
H2A		**Overcurrent of DC/DC converter**- Shutdown alarm
H22		**Input overvoltage** - Shutdown alarm
H23		**Input undervoltage** - Consider let the engine run to allow the alternator to charge the vehicle battery.
H24		**Motor Endstage temperature too high** - Shutdown alarm
H25		**Motor controller communication error** - Critical, Motor controller alarm
H26		**Locked Rotor** - Critical, Motor controller alarm
H27		**Compressor start-up failure** - Critical, Motor controller alarm
H28		**Phase Loss** - One of the phases carrying current to the Compressor Drive Module (CDM) is disconnected.
H40		**CFLT activated**

Table 3. Battery Management Alarms

H50 to H5D		**Battery internal alarm (Thermal or Voltage problem)** - Shutdown alarm
H5E		**Battery communications lost** - Shutdown alarm
H5F		**Low Battery warning.** - Please connect your unit to shore power to charge the TK Battery.
H60 to H63		**Battery internal alarm (internal sensors)** - Shutdown alarm
H6B, H6C		**Battery deeply discharged.** - Please connect your unit to shore power to charge the TK Battery
H6D		**BMS communication lost.** - Restart the E-200.
H70 to H77		**SCM Charging Condition.** - Restart the E-200.
H78, H79		**Over Temperature in the Power Supply Unit (Main Unit)** - Let the unit cool down, then restart the E-200.
H7A. H7B		**Relay Malfunction** - Shutdown alarm
H7C, H7D		**Batteries current imbalance warning (2 Battery Application ONLY)** - Please connect E-200 to shore power to charge the TK battery.

Note: *Refer to the Direct Smart Reefer III Microprocessor Control System Diagnostic Manual TK 61096 for more information about Alarm Codes and diagnosis.*

Note: *For further information, please refer to the DSR–IV Controller Control System Operator and Diagnostic Manuals for more information about Alarm Codes and diagnosis.*

Alarm	Description
Manual Start	
OL	Electric Motor Overload. Unit protection system during electric standby operation.
bAt	Low Battery Voltage. Unit and battery protection system.
Auto Start	
HP	High Pressure Alarm. Indicates that the refrigeration system will shut down in the event of excessively high pressure in the refrigerant circuit.
LP	Low Pressure Alarm. Indicates that the refrigeration system will shut down in the event of excessively low pressure in the refrigerant circuit.
PSE	High Pressure Sensor Failure. The high pressure sensor has become faulty or disconnected.
tEP	Electric standby motor thermal protection alarm
tP4	Power supply thermal protection alarm. Indicates that the power source thermal protection circuit has opened due to overheating of the power source or circuit failure.
dr1, dr2	Doors Open. *This option must be activated.*
tCO (Hot)	Electronic Control Module Overheating.
SOF	Software failure. The software in the microprocessor is corrupted.
P1E	Main or Single Cargo Box Return Air Temperature Reading Error (open circuit or short-circuit).
P2E	Remote Cargo Box Return Air Temperature Reading Error (open circuit or short-circuit).
C	Communication error between the cab control box and the ECM Electronic Control Module.

Table 4. Color Code Definitions

OK TO RUN	CHECK AS SPECIFIED	TAKE IMMEDIATE ACTION

Alarm		Description
Manual Start		
OL		**Electric Motor Overload (Electric standby models only)** - The electric motor overload relay has tripped due to excessive current draw. *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
bAt		**Low Battery Voltage** - Check vehicle battery.
Auto Start		
HP		**High Pressure Alarm** - The system has detected excessively high discharge pressure. *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
LP		**Low pressure alarm** – The system has detected excessively low suction pressure and has protected the compressor from an abnormal condition. Unit operation will resume automatically once the normal suction pressure is restored, and the alarm can be cleared (see "Clearing Alarm Codes," p. 51). Among other reasons, this could be due to: • Dirty evaporator coil – excessive ice formation. • Load stacked in front of the evaporator does not allow proper air recirculation through the box. *If the problem persists when the unit is restarted, contact your Thermo King dealer.*
PSE		**High Pressure Sensor Failure** - The high pressure sensor has become faulty or disconnected. *Contact your Thermo King Dealer.*
tEP, tP4		**Thermal Protection Alarm** - If the problem persists when the unit is restarted, contect your Thermo King Dealer
dr1, dr2		**Cargo Doors Are Open (Units with door switch option only)** - Check if the Doors are open. if not, then the door switches are faulty, or improper door switch configuration. *Contact your Thermo King Dealer.*
tCO		**Control Module Overheating** *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
SOF		**Software Failure** *Contact your Thermo King Dealer.*
P1E		**Faulty Cargo Box Return Air Temperature Sensor** - Faulty or disconnected return air temperature sensor. *Contact your Thermo King Dealer.*

Alarm		Description
P2E		**Remote Cargo Box Return Air Temperature Reading Error (open circuit or short-circuit)** *Contact your Thermo King Dealer.*
C		**Communications Failure** *Contact your Thermo King Dealer.*
H01		**DSR communication lost** - Communication lost to the other Electronic Control Module. *Contact your Thermo King Dealer.*
H02		**HMI communication lost** - Communication lost to the HMI. *Contact your Thermo King Dealer.*
H03		**SCM communication lost** - Communication lost to Smart Charger Module. *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
H04		**CDM communication lost** - Communication lost to Compressor Drive Module. *Contact your Thermo King Dealer.*
H0A		**Low Power Mode Activation** - ignition key of the vehicle is disconnected and the unit is not connected to the shore power. Operation of the unit may be inhibited but remains operational. *Report Alarm at the end of the day.*
H0B		**Sleep Mode Activation**- While the unit OFF, the vehicle battery voltage dropped below a threshold. Normal operation of the controller will resume as soon as the power is restored. *Report Alarm at the end of the day.*
H0C		**Power Derating Shutdown** - Low Voltage Shutdown alarm - your battery voltage has dropped below a defined level. The shutdown alarm is automatically cleared once the voltage rises over this limit once more. *Contact your Thermo King Dealer.*
H10		**Internal flash erase error** - Internal, System reset needed *Report Alarm at the end of the day.*
H12		**Default parameters in use** - This will typically happen after a new firmware version has been loaded. *If the problem persists when the unit is restarted, contact your Thermo King Dealer.*
H15		**eMMC erase error** - An error occurred while loading parameters to the DSR-IV Controller. *Internal, System reset needed, contact your Thermo King Dealer.*

Alarm		Description
H16		**eMMC write error** - An error occurred while loading parameters to the DSR-IV Controller or performing the datalogging process. *Internal, System reset needed, contact your Thermo King Dealer.*
H17		**eMMC read error** - An error during powering-up when reading configuration paramenters. *Internal, System reset needed, contact your Thermo King Dealer.*
H18		**Flash Loading Failed** - An error occurred while loading firmware to the DSR-IV Controller. *Internal, System reset needed, contact your Thermo King Dealer.*
H1A		**Non-Compatible SW** - Indicates that one of the Electronic components contains an incorrect or out-of-date Software version. *Contact your Thermo King Dealer.*

Table 5. Compressor Drive Module Alarms

H21		**Phase overcurrent**- Shutdown alarm *Contact your Thermo King Dealer.*
H2A		**Overcurrent of DC/DC converter**- Shutdown alarm *Contact your Thermo King Dealer.*
H22		**Input overvoltage** - Shutdown alarm *Contact your Thermo King Dealer.*
H23		**Input undervoltage** - Consider let the engine run to allow the alternator to charge the vehicle battery. *Contact your Thermo King Dealer.*
H24		**Motor Endstage temperature too high** - Shutdown alarm *Contact your Thermo King Dealer.*
H25		**Motor controller communication error** - Critical, Motor controller alarm *Contact your Thermo King Dealer.*
H26		**Locked Rotor** - Critical, Motor controller alarm *Contact your Thermo King Dealer.*
H27		**Compressor start-up failure** - Critical, Motor controller alarm *Contact your Thermo King Dealer.*
H28		**Phase Loss** - One of the phases carrying current to the Compressor Drive Module (CDM) is disconnected. *Contact your Thermo King Dealer.*
H40		**CFLT activated** - Repeating non-critical alarms or a threshold of Active Alarms is reached which forces the unit to shutdown for maintenance. *Contact your Thermo King Dealer.*

Table 6. Battery Management Alarms

H50 to H5D		**Battery internal alarm (Thermal or Voltage problem)** - Shutdown alarm *Contact your Thermo King Dealer.*
H5E		**Battery communications lost** - Shutdown alarm *Contact your Thermo King Dealer.*
H5F		**Low Battery warning.** - Please connect your unit to shore power to charge the TK Battery. *If problem persists Contact your Thermo King Dealer.*
H60 to H63		**Battery internal alarm (internal sensors)** - Shutdown alarm *Contact your Thermo King Dealer.*
H6B, H6C		**Battery deeply discharged.** - Please connect your unit to shore power to charge the TK Battery *If problem persists Contact your Thermo King Dealer.*
H6D		**BMS communication lost.** - Restart the E-200. *If problem persists Contact your Thermo King Dealer.*
H70 to H77		**SCM Charging Condition.** - Restart the E-200. *If problem persists Contact your Thermo King Dealer.*
H78, H79		**Over Temperature in the Power Supply Unit (Main Unit)** - Let the unit cool down, then restart the E-200. *If problem persists Contact your Thermo King Dealer.*
H7A. H7B		**Relay Malfunction** - Shutdown alarm *Contact your Thermo King Dealer.*
H7C, H7D		**Batteries current imbalance warning (2 Battery Application ONLY)** - Please connect E-200 to shore power to charge the TK battery. *If problem persists Contact your Thermo King Dealer.*

Viewing Information Displays

Main Menu

From the Standard Display use the Select key to display:

- Alarms (if any active)
- Defrost Status
- Temperature Setpoint

Hourmeter Menu

To open the Hourmeter Menu from the Standard Display, press the Select key for three seconds and release, then press the Select key to display:

- **HC**: Hours remaining to maintenance notice.
- **tH**: The total amount of time unit has been switched on.
- **CC**: Engine-driven compressor operating hours.
- **EC**: Electric standby compressor operating hours.

Unit Operation and Loading Procedures

This chapter describes unit operation and proper loading procedures. Thermo King refrigeration units are designed to maintain the required product load temperature during transit. Transport refrigeration units are not designed to reduce the load temperature. Follow these recommended procedures to help prevent cargo spoilage.

Unit Operation (Before Loading Refrigerated Cargo)

Start Unit: Adjust the thermostat setting to above and below the compartment temperature to check thermostat operation.

Pre-Cooling: With the thermostat set at the desired temperature, run the unit for half-an-hour to one hour (or until the desired setpoint is reached) before loading the refrigerated cargo. Pre-cooling eliminates residual heat and acts as a good test of the refrigeration system.

Defrost: When the unit has finished pre-cooling the cargo box the evaporator temperature should have dropped below 36°F (2.2°C). Initiate a manual defrost cycle with the In-Cab Controller. The defrost cycle will stop automatically.

Loading Procedure

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

Important: *Product should be pre-cooled before loading. Thermo King units are designed to maintain the load at the temperature at which it is loaded. Transport refrigeration units are not designed to reduce the load temperature.*

Note: *To minimize frost accumulation in the evaporator coil and a heat increase inside the load compartment, ensure that the unit is OFF before opening the doors.*

1. Carefully check and record the load temperature when loading the refrigerated cargo. Note whether any products are out of temperature range.
2. Load the product to verify sufficient air space is maintained around and through the load in compartment. Airflow around the cargo must not be restricted. DO NOT block the evaporator inlet or outlet. Refer to the Air Circulation Diagram on the following page.
3. Minimize door opening times and close door(s) in between loading to preserve box temperature.

Figure 33. Air Circulation Diagram

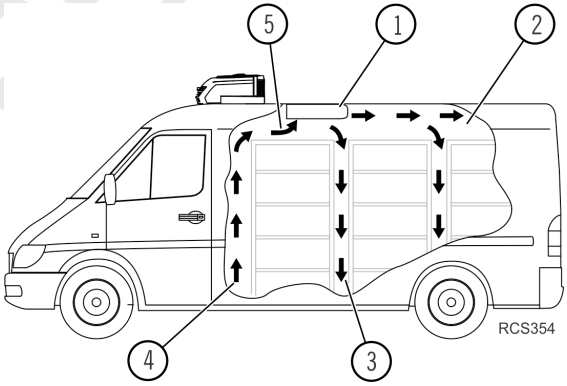
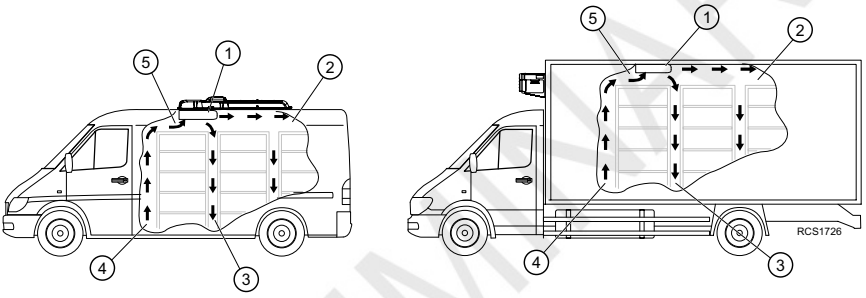


Figure 34. Air Circulation Diagram



1.	Evaporator air outlet not blocked by cargo.
2.	Sufficient air space is maintained above cargo.
3.	Good air circulation around and between cargo.
4.	Cargo separated from bulkhead and walls a minimum of 4.00 inch (100 mm).
5.	Evaporator air inlet not blocked by cargo.

Enroute Inspections

To help prevent damage to the cargo, complete the following enroute inspection every four hours.

Inspection Procedure

1. Verify the setpoint is correct.
2. Check the return air temperature readings. The temperature readings should be within the desired temperature range. If the readings are not within this range, refer to (Table 7, p. 65).

Inspection Troubleshooting

1. If a return air temperature reading is not within the desired temperature range, refer to (Table 7, p. 65). Correct the problem as needed.
2. Repeat the Enroute Inspection every 30 minutes until the compartment temperature is within the desired temperature range. Stop the unit if the compartment temperature is not within desired temperature range on two consecutive 30 minute inspections, especially if the compartment temperature appears to be moving away from the setpoint.
3. Immediately contact the nearest Thermo King Dealer.
4. Take the necessary steps to protect and maintain proper load temperature.

Table 7. Inspection Troubleshooting

Problem	Cause	Remedy
Return air temperature reading is not within desired temperature range of the setpoint.	Unit has not had time to cool cargo to correct temperature.	Refer to load log history. Look for above temperature load records, properly pre-cooled cargo compartment, length of time on road, etc. Correct as required. Continue monitoring return air temperature until reading is within desired temperature range of the setpoint.
	Unit may have a low refrigerant charge	Contact nearest Thermo King dealer, or call the Thermo King Cold Line for referral.
	Unit is in defrost or has just completed a defrost cycle.	Monitor return air temperature after defrost cycle is completed to see if temperature returns to desired temperature range of the setpoint. ***Note:*** *Temperature will increase slightly during defrost cycle.*
	Evaporator is plugged with frost.	Initiate a manual defrost cycle. Defrost cycle will automatically terminate when complete. Continue monitoring return air temperature until reading is within desired temperature range of the setpoint.

Table 7. Inspection Troubleshooting (continued)

Problem	Cause	Remedy
Return air temperature reading is not within desired temperature range of the setpoint.	Improper air circulation in the cargo compartment.	Inspect unit and cargo compartment to determine if evaporator fans are working and properly circulating the air. Poor air circulation may be due to improper loading of the cargo or shifting of the load. Correct as required. Continue monitoring return air temperature until problem is corrected. **⚠ CAUTION** **Risk of Injury!** The unit can start and run automatically any time the unit is turned on. Turn the unit On/Off switch Off before doing inspections or working on any part of the unit. Please note that only Qualified and Certified personnel should attempt to service your Thermo King unit.
	The unit did not start automatically.	Contact nearest Thermo King dealer, or call the Thermo King Cold Line for referral.
	Air leaks in cargo box.	Inspect cargo box for air leaks such as doors that are not fully closed or bad/ missing door seals. Repair as necessary.

Specifications

Fuses

FUSED COMPONENT	FUSE NUMBER	FUSE SIZE	FUSE LOCATION
Evaporator Fan 1	F3	15A	Controller (in condenser)
Evaporator Fan 2	F4	15A	Controller (in condenser)
Road Compressor Clutch Standby Compressor Clutch Liquid Injection Switch Liquid Injection Valve Defrost Hot Gas Solenoid Motor Contactor Pilot Heat Solenoid Water Solenoid** Water Pump**	F5	20A	Controller (in condenser)
Drain Pan Heaters	F6	2A	Controller (in condenser)
Control Board			
(fused Ignition power) (vehicle power) (AC power)	F14 F15 F16	4A 4A 4A	In vehicle or engine compartment Near vehicle battery Capacitor (in condenser on 20/50 models only)
Transformer (glass tube fuse)	F20	5A	Fuse holder above contactor (in condenser)
Main Power Fuse*	F21	60A	Near vehicle battery
Evaporator Fan 2***	F26	15A	In harness (in-line fuse holder)
Condenser Fan	F30	20A	In harness (in-line fuse holder under terminal strip)

* Refer to ("Fuses," p. 37) for important information regarding replacing main power fuse F21.
** Only if coolant heat option is installed.
*** Only if electric heat option is installed.

Fuses		
	12 Vdc	24 Vdc

Fuse 1: Main Fuse	100 amps	60 amps
Fuse 3: Evaporator Fan Motor (EFM1)	15 amps	10 amps
Fuse 5: Signals	20 amps	10 amps
Fuse 6: Drain Heaters (H3 and H4)	2 amps	2 amps
Fuse 7: Transformer AC Power Supply 2	10 amps	10 amps
Fuse 14: Vehicle Ignition Switch	5 amps	5 amps
Fuse 20: Transformer AC Power Supply (located at compressor motor contactor in condenser section)	4 amps	4 amps
Fuse 25: Battery Fuse	5 amps	5 amps
Fuse 30: Condenser Fan Motor (CFM) (located in CF1 wire near terminal strip in condenser section)	16 amps	10 amps
Fuse 31: Fuse - Heater 1	20 amps	20 amps
Fuse 32: Fuse - Heater 2	20 amps	20 amps
Fuse 33: Fuse - Heater 3	20 amps	20 amps
Fuse 34: Fuse - Heater 4	20 amps	20 amps

* Refer to ("Fuses," p. 37) for important information regarding replacing main power fuse F1.
** Only if coolant heat option is installed.
*** Only if electric heat option is installed.

Electric Standby Power Supply Requirements (Models 20 and 50 Only)

				Power Cord Size (AWG) Power Cord Length		
Voltage (Vac)	**Phase**	**Hz**	**Power Supply Circuit Breaker**	25 ft.	50 ft.	75 ft.
115	1	60	30 amp	10	8	None

208/230	1	60	20 amp	12	10	8
208/230	3	60	20 amp	12	10	8

				Power Cord Size (AWG) Power Cord Length		
Voltage	**Phase**	**Hz**	**Power Supply Circuit Breaker**	**25 ft.**	**50 ft.**	**75 ft.**
230 (Vac)	1	50/60	16 amp	AWG16/ 1.5mm2	AWG16/ 1.5mm2	AWG16/ 1.5mm2
115 (Vac)	1	50/60	20 amp	AWG14/ 2.5mm2	AWG14/ 2.5mm2	AWG14/ 2.5mm2

				Power Cord Length Power Cord Size (AWG)		
Voltage	**Phase**	**Hz**	**Power Supply Circuit Breaker**	**25 ft.**	**50 ft.**	**100 ft.**
230 (Vac)	1	50/60	20 amp	AWG12	AWG10	AWG8
115 (Vac)	1	50/60	20 amp	AWG12	AWG10	AWG8

Important: *Failure to use properly sized power cord may result in improper unit operation, or unit failure.*

Maintenance Inspection Schedule

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

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

Daily	Weekly	12 Months or 2000 Hours	24 Months or 4000 Hours	Inspect/Check/Service These Items
•				Check unit for any active alarms.
•				Inspect exterior of evaporator and condenser.
•				*Inspect evaporator air inlet and outlet for blockage (dirt, debris, cargo, etc.).
•				*Inspect condenser air inlet and outlet for blockage (dirt, debris, etc.).
•				Adequate air space above and around cargo.
	•			Inspect evaporator drain hoses (Verify water is not collecting in drain pan).
	•			Check unit for proper defrost operation.
		•		*Clean evaporator drain hoses.
		•		*Clean evaporator and condenser coils.
		•		Inspect moisture indicator and refrigerant level.
		•		Inspect wiring harnesses and connectors.
		•		Inspect refrigerant hoses.

Daily	Weekly	12 Months or 2000 Hours	24 Months or 4000 Hours	Inspect/Check/Service These Items
		•		Inspect refrigerant hose connections for leaks.
		•		Inspect roadside compressor drive belt condition and tension.
		•		Inspect standby compressor drive belt condition and tension (20 and 50 Models Only).
		•		Check return air temperature sensor calibration.
			•	Check suction pressure regulator setting (20, 30, 50 MAX Models Only).
			•	Inspect evaporator and condenser mounting hardware.
			•	Inspect ground terminals.
			•	Replace filter dryer.

*More frequent cleaning may be required based on operating environment (dusty conditions, etc.).

Warranty

Terms of the Thermo King North American Vehicle Powered Truck Unit Limited Warranty are available on request from your Thermo King Dealer. Please reference document TK 51350.

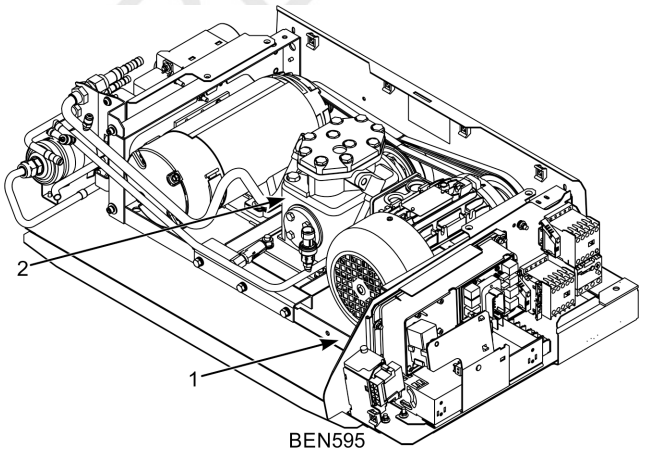
Serial Number Locations

CONDENSER: Nameplate located on the front inside edge of condenser frame.

STANDBY COMPRESSOR: Nameplate located on compressor body. The Standby compressor is located inside the Condenser assembly.

1. **CONDENSER:** Nameplate located on the front inside edge of condenser frame (Cover needs to be removed).
2. **STANDBY COMPRESSOR:** 20 and 50 Models only. Nameplate located on standby compressor body. Standby compressor is located inside the Condenser.

Figure 35. Condenser and Standby Compressor Serial Number Locations



Recover Refrigerant

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

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

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

Emergency Cold Line

If you can't get your unit operating and need assistance, you can locate a Thermo King Dealer anywhere in the United States by going to thermoking.com or by using the Thermo King North American Service Directory (available from any Thermo King dealer). If you are unable to reach a dealer, then call the Toll Free Emergency Cold Line Number (888) 887-2202. The answering service will assist you in reaching a dealer to get the help you need. The Cold Line is answered 24 hours a day by personnel who will do their best to get you quick service at an authorized Thermo King Dealer

If you need assistance, and you have tried the Thermo King Container Service Directory (available from any Thermo King dealer) to reach a dealer without success, then call the Toll Free Emergency Marine Cold Line Number (800) 227-2506 or International number +1 (512) 712 1399. The answering service will assist you in reaching a dealer to get the help you need. The Cold Line is answered 24 hours a day by personnel who will do their best to get you quick service at an authorized Thermo King Dealer.

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Thermo King – by Trane Technologies (NYSE: TT), a global climate innovator – is a worldwide leader in sustainable transport temperature control solutions. Thermo King has been providing transport temperature control solutions for a variety of applications, including trailers, truck bodies, buses, air, shipboard containers and railway cars since 1938. For more information, visit www.thermoking.com or www.tranetechnologies.com.

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