



User Guide

Installation Standards and Procedures Guide V220 and V320 Series Units

Revision B

June 2022

TK 56430-18-IP-EN

TRANE
TECHNOLOGIES

Introduction

This guide 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.

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.

Revision History

Revision A	(03/18) New manual format.
Revision B	(06/22) Changed the clutch air gap specifications

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How To Use This Guide

Please take a few minutes to read this page. It explains the content and structure of this guide. This will make it easier for you to find the information you need. Reading and understanding each section prior to installing a Thermo King Vehicle Powered Truck Refrigeration System will help make for a successful installation.

Section 1 - Introduction

Explains the objective of this guide.

Section 2 - Safety Precautions

Contains general safety information to follow when installing and servicing a Thermo King Vehicle Powered Truck unit.

Section 3 - Required Tools

Contains a list of tools required to properly install Thermo King Vehicle Powered Truck units.

Section 4 - Unit Installation Standards and Procedures

Contains unit mounting standards and procedures along with cargo box requirements, unit mounting hardware, grades, and torque specifications.

Section 5 - Compressor Selection and Installation Standards

Describes how to select the correct compressor for your application. It also covers; speed calculations, oil requirements, pulley and belt selection, belt alignment compressor installation and torque specifications.

Section 6 - Refrigeration Hose and Fittings Standards

Describes how to properly fabricate, route and secure hoses. It also covers how to choose and install fittings and how to tighten them to the proper torque specifications.

Section 7 - Electrical Standards

Describes how to properly connect the harnesses to the unit's individual components and the vehicle's electrical system. It also covers main fuse installation, harness routing, harness securing and ground connections.

Section 8 - Evaporator Drain Hose Standards

Describes the standards for installing evaporator drain hoses and heater resistance wires.

Section 9 - Configuring Software and Controller Procedures

Describes the procedures for controller installation, Firmware installation, uploading configuration files, and modifying customer specific settings.

Section 10 - System Evacuation Procedures

Describes the correct procedures for evacuating the refrigeration system using either a 2-point, 3-point or 4-point gauge and manifold connections.

Section 11 - System Leak Check Procedures

Describes the correct procedures for checking the refrigeration system for leaks prior to charging with refrigerant.

Section 12 - System Charging Procedures

Describes the correct procedures for charging the refrigeration system.

Section 13 - Unit Performance Adjustments

Describes which units are equipped with SPR and CPR valves, definitions of the valves, and why they must be adjusted for optimum unit performance.

Section 14 - Commissioning and Pre-Delivery Inspection (PDI) Forms

Describes how the Commissioning and PDI forms helps assure Thermo King equipment is installed with the highest degree of quality, reliability and durability to meet or exceed the expectations of our customers resulting in total customer satisfaction.

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Section 1 - Introduction

Objective

The objective of this guide is to provide Thermo King Dealers, Original Equipment Manufacturers (OEMs), and 3rd Party Installers with installation standards and procedures to assure Thermo King equipment is installed with the highest degree of quality, reliability, and durability to meet or exceed the expectations of our customers resulting in total customer satisfaction.

Defining Standards and Procedures

STANDARDS must occur during installation: Standards explain what is required by Thermo King. The standards in this guide are based on documented engineering principles and a philosophy of continuous improvement. Adhering to these standards will help assure the system is installed correctly and operates as designed.

PROCEDURES are recommended, but not required: Procedures explain the proper steps to take to complete a task. Following the procedures will help assure the installation is completed in a timely manner.

It is also recommended that installers of Thermo King equipment not only become familiar with this manual, but also any other referenced publications listed herein before beginning the installation process.

While this manual emphasizes safety, quality, reliability and durability, each installer also has the responsibility to:

- Ensure vehicle modifications do not reduce the vehicle's integrity.
- Verify vehicle safety is maintained.
- Comply with all Federal, State, and local regulations.
- Complete the entire installation using the best workmanship standards.
- Meet or exceed the requirements and expectations of the customer.

Important Information About This Guide

This guide is intended for installers who are aware of the appropriate National, Federal, State, and/or Local regulations governing the use of refrigerants and certification of technicians. EPA Section 608 is required to work on refrigeration systems in the United States. It is not intended to be a complete "how-to" authority, or a substitute for sound engineering and other judgment. Modifications to vehicles to accept Thermo King equipment requires skills and knowledge not covered in this guide.

If further information is required, Thermo King Corporation Service Department should be consulted at 612-887-2200.

Section 2 - Safety Precautions

Overview

This section includes general safety precautions, specific cautions, and first aid information. Read this material carefully before installing or working on any Thermo King vehicle powered truck refrigeration unit. In the U.S., all technicians who maintain, service, repair, or dispose of equipment that could release refrigerants into the atmosphere must be EPA 608 certified.

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.

Safety Precautions

⚠ 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 moving parts when the unit is operating or vehicle's engine is running. Loose clothing can become entangled in moving parts, 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

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

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

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

Risk of Injury!

E-Series and V-Series condensing units and ES Series remote evaporators are shipped with a 5-10 psi (35-69 kPa) holding charge of nitrogen. While this holding charge may be safely vented into the atmosphere, eye protection should be worn when removing fitting caps.

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.

Auto Start Hazards

⚠ 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.

Refrigerant Hazards

⚠ 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 (O₂) 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

⚠ 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.

Electrical Hazards

⚠ 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.

Battery Removal Hazards

⚠ WARNING

Hazard of Explosion!

When removing battery cables, ALWAYS disconnect the negative battery terminal first. Then remove the positive terminal. When reconnecting the battery terminals, connect the positive terminal (+) first, and connect the negative (-) terminal last.

Welding Precautions

Take precautions before performing electric welding on any portion of the unit or vehicle to which the unit is attached. Verify welding currents are not allowed to flow through the electronic circuits of the Thermo King unit.

Microprocessor Precautions

The following procedures must be followed when working on microprocessor based control systems:

- Never use testers consisting of a battery and a light bulb to test circuits on any microprocessor based equipment.
- Always turn the unit off by pressing the HMI Main Power On/Off key before connecting or disconnecting the truck batteries. Read and follow all truck instructions for removing batteries.



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

- **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 a 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.

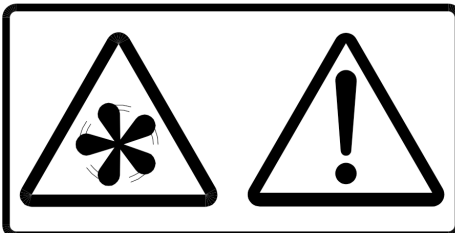
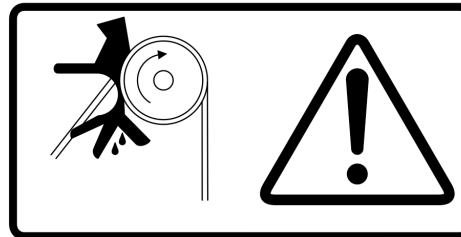
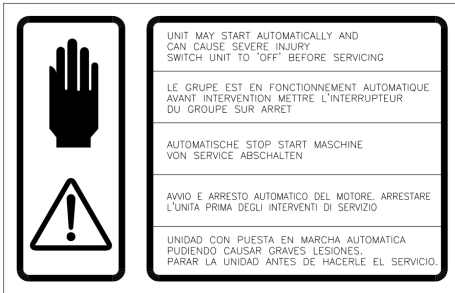
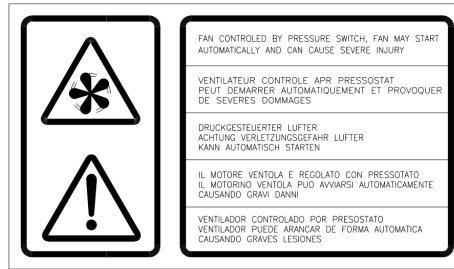
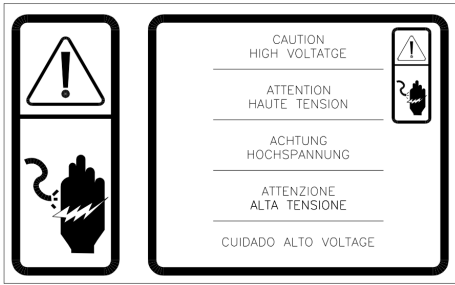
ASPHYXIATION

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

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

Figure 1. Typical Safety Decals



RCS541

Section 3 - Required Tools

Overview

While basic mechanics tools and refrigeration service equipment are a necessity, there are also special tools that are required when installing Thermo King Vehicle Powered Truck Units. Using these tools will assure the installation is done correctly. Many of these are available from Thermo King.



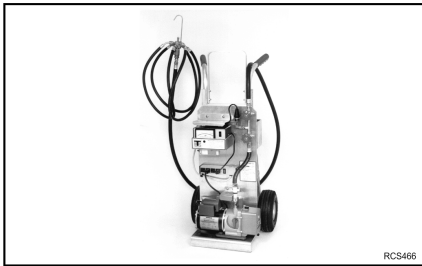
Hose Cutting Tool
(204-677)



#4 - #12 Hose Fitting Tool
(204-1045)



#16 Hose Fitting Tool
(2041128)



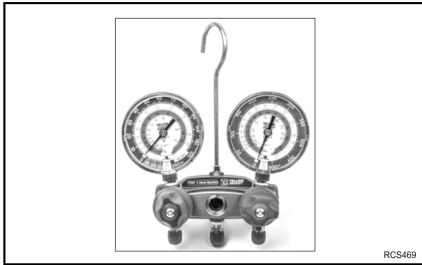
Evacuation Station
(204-725)



Leak Detection Probe
(2040888)



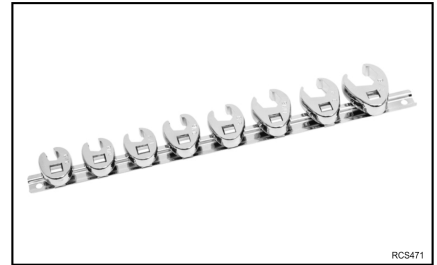
Solenoid Valve Magnet
(204-1074)



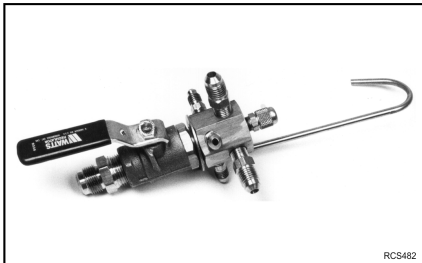
Gauge Manifold Set
(204-1925)



Torque Wrench



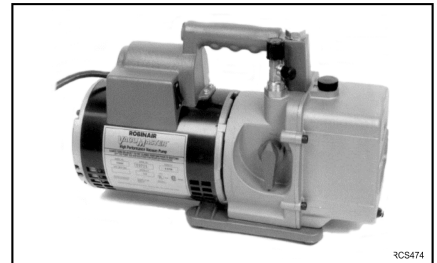
Crows Foot Wrenches



Manifold Assembly*
(2040732)

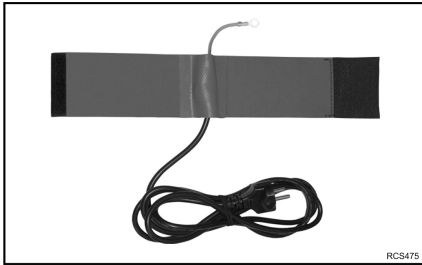


Micron Gauge*



Vacuum Pump*
(204713)

*These are included with the Evacuation Station 204-725.



**Heating Blanket
for 30/50 lb. Tanks
(204077)**

RCS475



**TK 2000 Assembly Kit
(2041044)**

RCS476



**Digital Voltage Meter
(2041079)**

RCS477



**Controller DSR
Communication Tool
(2041126)**

RCS478



**Serial Adapter
(2041151)**

RCS479



**USB Serial Adapter
(420575)**

RCS480



**WinTrac Software
(latest version must always be used)**

RCS481-1



**Scale
(204760)**

RCS472

Section 4 - Unit Installation Standards and Procedures

Overview

This section defines Thermo King unit installation standards to correctly and safely install the individual components that make up the complete refrigeration system. Proper installation of each component onto the vehicle is critical. Improper installation can not only result in poor system performance, but it can also become a safety concern. It is the responsibility of the installer to follow these standards to assure the components are installed correctly and the unit operates as designed.

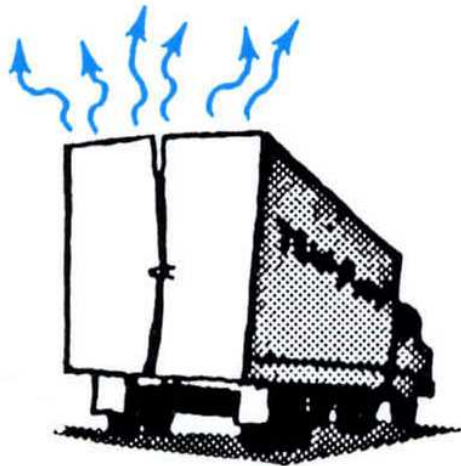
Cargo Box Requirements

The cargo box size, insulation thickness, door openings per delivery day and temperature requirements must be matched to the Thermo King refrigeration system being installed. The wrong size unit on the wrong size cargo box may not perform as designed. The interactive Unit Selection Guide should be used to verify the correct unit is selected.

Additional Requirements:

- The cargo box must be designed and built for refrigeration applications with insulated walls, ceilings and floors. All cargo box doors must close and seal tightly.
- Cargo boxes that fail to meet these requirements are not suited for refrigerated applications and the Thermo King equipment will *not* maintain temperature.
- Additionally, the cargo box front wall, roof and ceiling must be able to support the weight of the condenser and remote evaporator. Additional supports may be required and are the responsibility of the installer to supply.
-

Note: Unit weights can be found in the product brochures.



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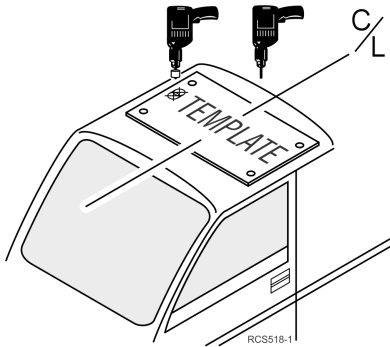
Installation Manuals

Unit installation manuals are available online at thermoking.com or through the Asset Library and ReqDirect ordering system. . These manuals provide unit specific information to assist with the installation such as oil amounts, refrigerant capacity, and valve settings. They also explain in detail the correct refrigeration hose and fitting locations and the electrical harnesses connections. Before beginning the installation, you should review the unit installation manual to familiarize yourself with the various components that make up your particular system.

Installation Templates

Paper templates are available to assist with the installation of the condenser and evaporator. These templates provide the installer with a “footprint” of the component and provide the correct mounting and access hole locations. Thermo King Dealers can access templates through InfoCentral or order them through the ReqDirect system.

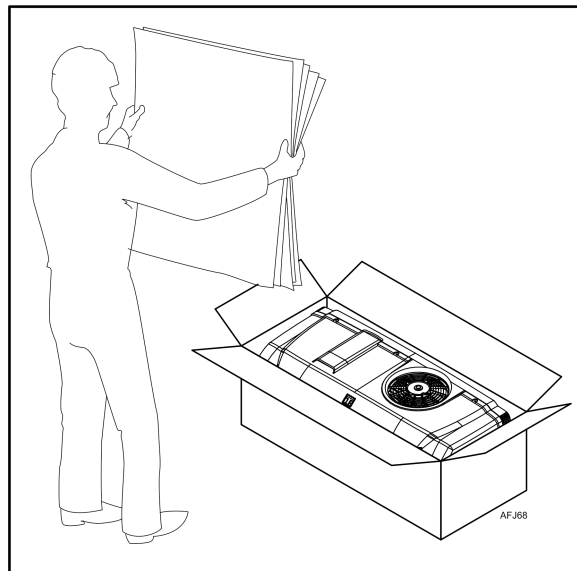
- Using templates saves time and errors by eliminating the time required to measure and mark the locations of the individual holes.
- When installing multiple units, paper templates should be transferred to a more durable material such as aluminum. This will allow you to reuse the templates as needed.



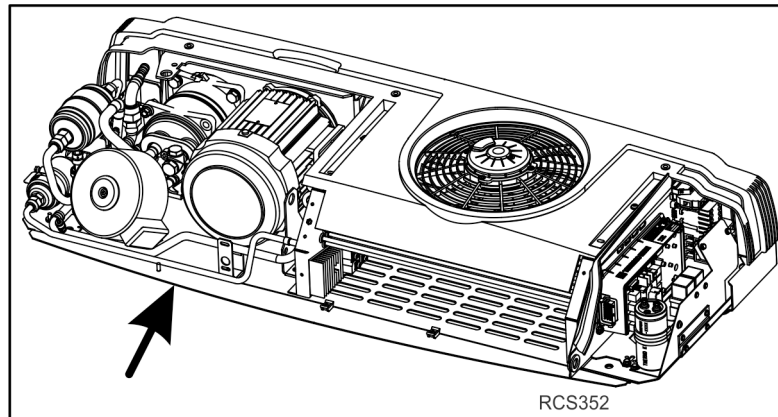
Unpacking and Inspecting Components

Components are carefully packaged at the factory to prevent damage during shipment. However, if components are found to be damaged, contact the shipping company immediately. Contact Thermo King if components are missing. Before beginning the installation, check the following against the sales order:

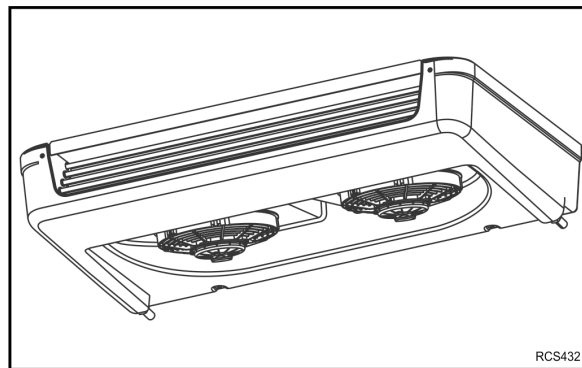
Confirm all components are accounted for including the kits and any options.



Confirm condenser model and voltages shown on the condenser serial plate matches the sales order.



Confirm evaporator model matches the sales order.



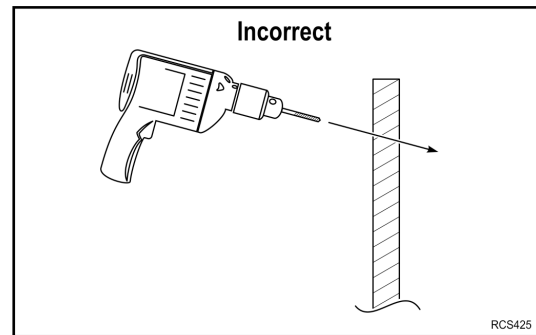
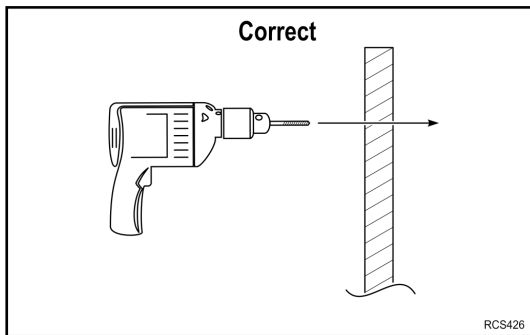
Drilling Holes

All installations will require holes be drilled into the vehicle or cargo box. Spending a few minutes reviewing your particular vehicle before drilling any holes can help prevent problems later.

Important: *Never drill holes into the condenser unit or evaporator. Doing so will weaken the structure and void your warranty.*

Note: *Verify there is no interference with OEM electrical wiring, internal supports, etc. before drilling holes in vehicle.*

- Consult your vehicle's manufacturer/box builder before drilling any holes in the chassis, cargo box or structural supports.
- Use the unit specific installation manual to determine how many refrigerant lines and electrical harnesses need to pass through the cargo box wall or roof.
- Select the appropriate size hole saw to cut a hole that is large enough to accommodate all the hoses and electrical harnesses.
- Holes drilled for mounting components must be the correct size for the mounting hardware. Holes larger than the diameter of the mounting bolts will result in water/air leakage, damage to the vehicle and to the refrigeration components.
- Holes must be drilled straight – not at an angle.



- No sharp edges or burrs are allowed around access holes for harnesses and refrigerant hoses. Protective edging material must be installed.
- All mounting holes must be completely sealed to prevent water/air leakage. Refer to ("[Sealing Holes](#)," p. 22).

Sealing Holes

Proper sealing of all holes drilled into the cargo box is very important. Air leaks will greatly affect the performance of the unit and water leakage can damage or ruin the cargo.

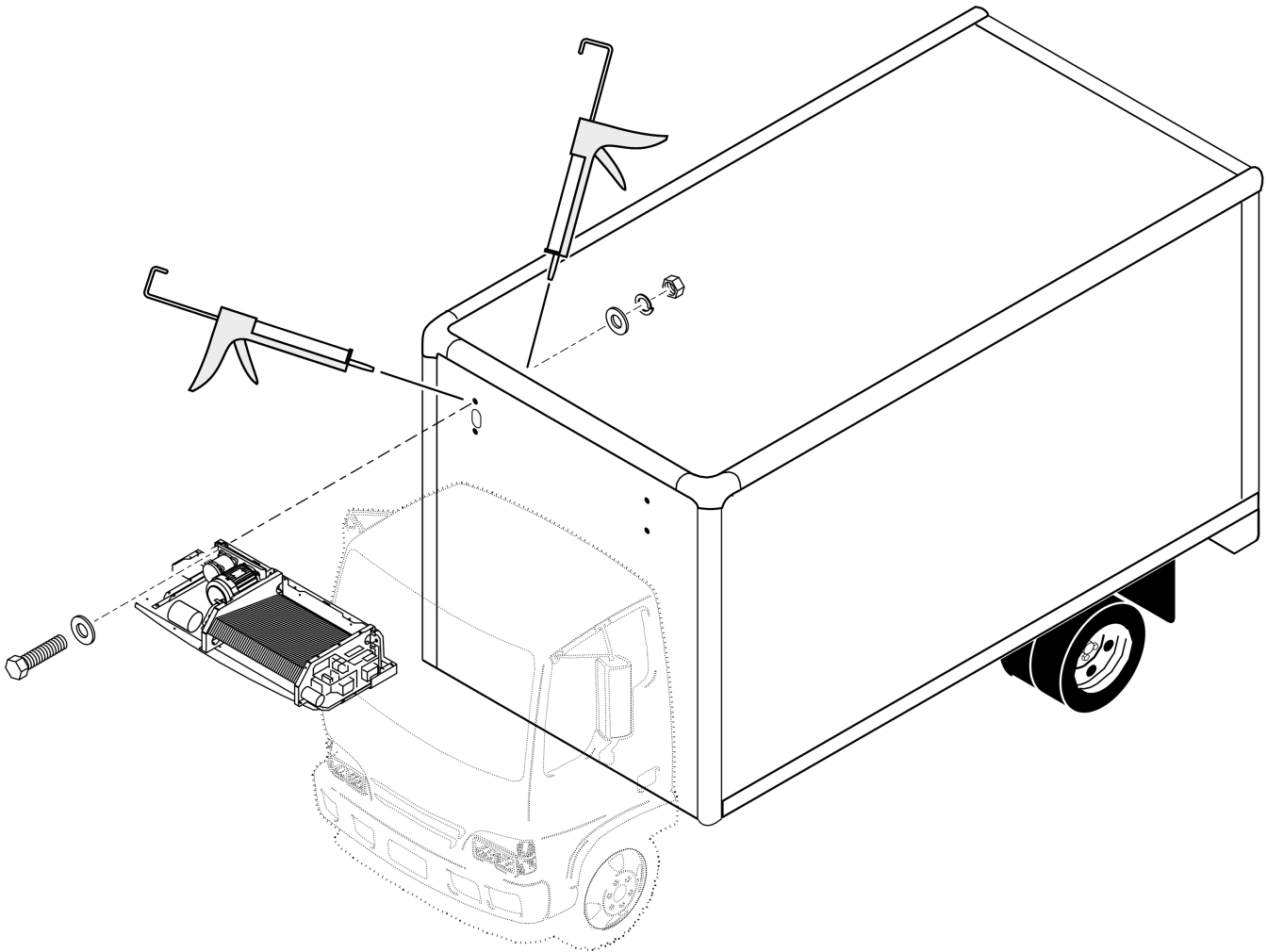
All component mounting holes and access holes for electrical and refrigerant hoses must be sealed both inside and outside the cargo box.

Sealing Methods

Any of the following sealing methods are acceptable:

- Silicone Sealant (neutral/alcohol cure, exterior grade, flexible, non-hardening)
- Strips of foam rubber material applied between surfaces (closed cell foam only)
- Molded gaskets (for specific applications)
- Expandable Spray Foam (for larger holes)
- Plumbers putty

All unit mounting holes must be sealed both inside and outside the cargo box.



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Sealing Refrigerant Lines and Electrical Harnesses

Once the access hole has been cut and all refrigerant hoses and electrical harnesses have been routed and connected, the hole must be sealed properly by following these steps:

1. Position rubber grommet around the access hole to determine cut length.
2. Cut the grommet so the ends touch and no sharp edges of the wall are exposed.
3. Cut one piece of grommet for each side of the box.
4. Fill hole with expandable foam (installer supplied). Spray the foam in between the hoses and harnesses so the hole is completely filled with foam.
5. Once the foam has cured, trim excess foam around hoses and harnesses so the foam is flush with the wall or roof.
6. Seal the foam hole from moisture with either silicone sealant or plumbers putty.

Figure 2. Grommets shown installed in access hole both inside and outside cargo box.

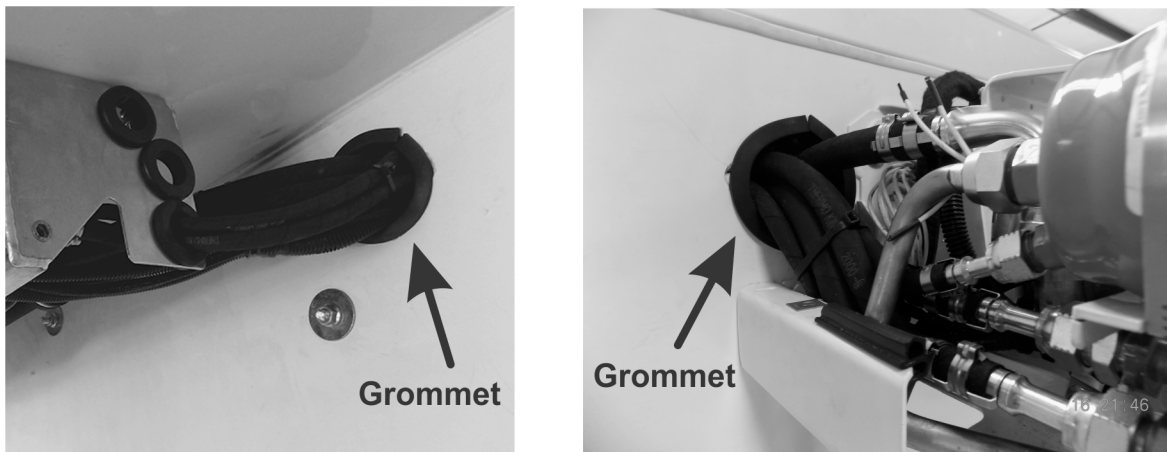
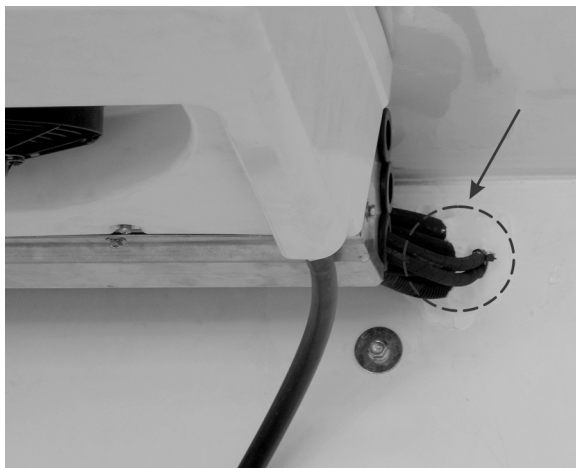


Figure 3. Access hole inside cargo box shown sealed with silicone. Condenser side done similarly.

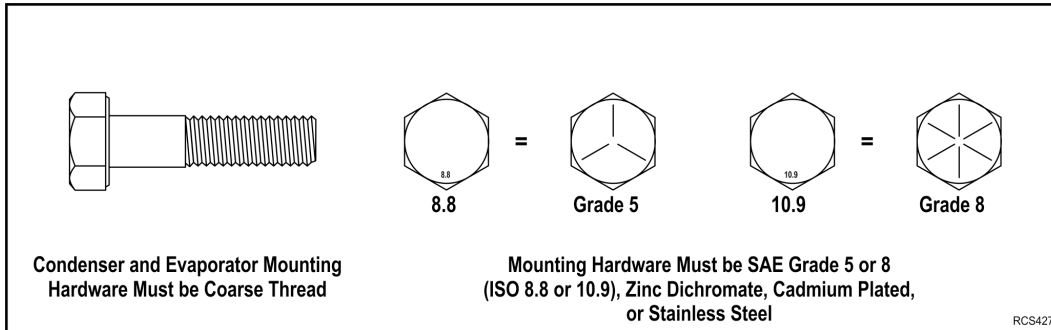


Mounting Hardware

Always use the proper mounting hardware when installing Thermo King equipment. Choosing the wrong hardware can result in equipment failure, vehicle damage, or serious injury. All mounting hardware must be the correct grade, size and length for the application and tightened securely.

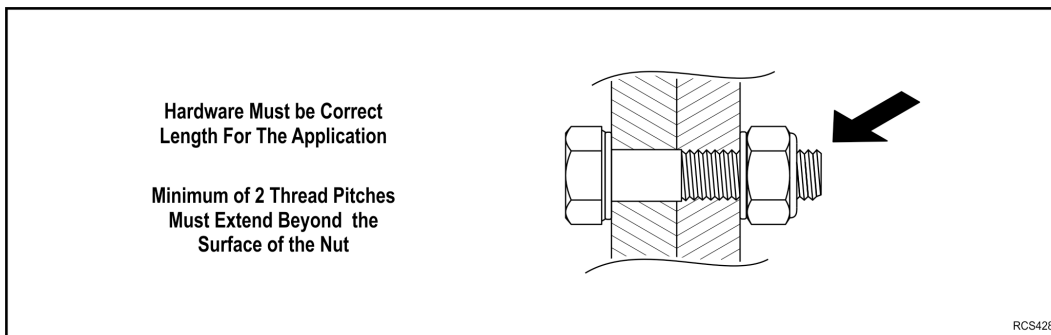
Threads, Grade and Finish

Figure 4. Mounting hardware threads, grade and finish requirements.



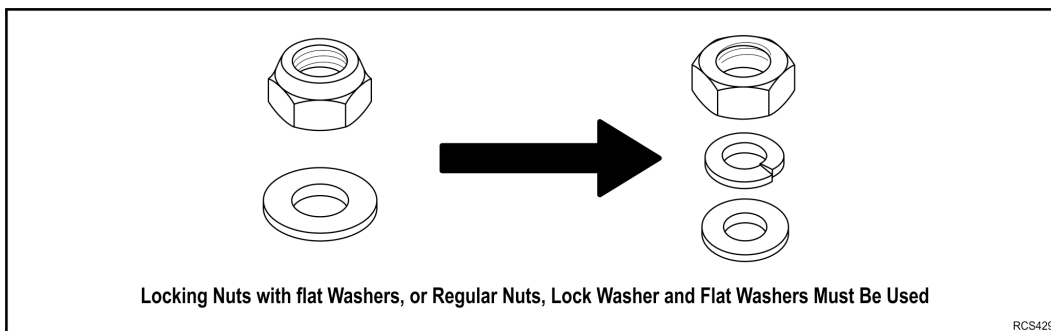
Hardware Length

Figure 5. Correct hardware length and nut requirements shown.



Nuts and Washers

Figure 6. Correct nut and washer requirements shown.

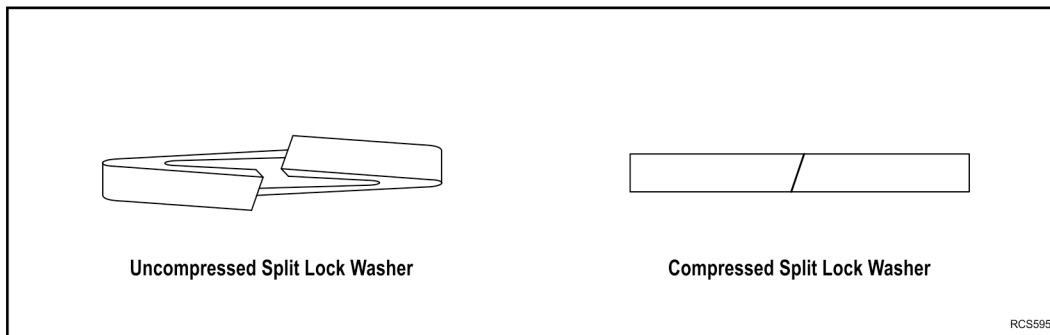


Tightening Mounting Hardware

- Care must be taken when tightening mounting hardware to verify the insulation, cargo box, or unit is not crushed or damaged from over tightening. The use of large fender washers or backer plates (installer supplied) is recommended.
- Hardware must be tightened so that it will not rotate freely by hand. Backer wrenches must be used on hardware that goes through the cargo box.

- When a split lock washer is used, tighten the hardware so the split lock washer is fully compressed.

Figure 7. Tighten hardware so split lock washer is fully compressed as shown.



Vehicle Powered Truck Units

Vehicle powered truck units are available for small, medium, and large vans, or body-on-chassis vehicles. Two different versions are available: nosemount and rooftop mounted.

Nosemounted Units

The condenser portion of a nosemounted unit is designed to be mounted onto the front of a cargo box while the remote evaporator(s) are installed inside the cargo box. An engine driven compressor operates the unit on the road, while the Electric Standby SmartPower option allows the unit to operate while stationary by using a standby AC power source.

Figure 8. Typical V-Series Nosemount Unit Shown.



Rooftop Mounted Units

The condenser portion of a rooftop mounted unit is mounted directly onto the roof of the van, while the remote evaporator(s) are installed inside the cargo box. Rooftop mounted units operate the same as nosemount units.

Figure 9. Typical V-Series Rooftop Mounted Unit Shown.



Nosemount and Rooftop Mount Similarities

Both nosemount and rooftop units are referred to as “Split Systems”, meaning individually installed components make up the completed refrigeration system. Installing and connecting each component correctly is critical to a successful installation.

While each unit may be different, they all require:

- A separate compressor be installed onto the vehicle’s engine.
- A condenser be mounted either on the nose or roof of the box truck, or on the roof of the vehicle.
- Remote evaporator(s) be installed inside the cargo area.
- Refrigeration hoses be fabricated, routed, and connected to the individual components.
- Electrical harnesses be routed and connected to the individual components.
- 12 Vdc power be integrated into the vehicle’s electrical system.
- In-cab controller be installed inside the vehicle’s cab.
- Remote standby receptacle box be installed onto the exterior of the vehicle (Electric Standby SmartPower models only).
- The system be evacuated, leak checked and charged with proper refrigerant per your specific application.
- Final operation setup, software programming and refrigeration system adjustments.
- Adjustments to the Suction Pressure Regulator (SPR) or Compressor Pressure Regulator (CPR) valve (if equipped) for maximum performance.
- Completion of the Commissioning Form.

Installation Sequence

Thermo King has determined the best installation sequence for vehicle powered units to help minimize the installation time. It is recommended the sequence shown below be followed for either nosemount or roof mount units:

1. Unpack and inspect all components.
2. Determine which unit configuration is being installed (nosemounted or rooftop mounted) and review vehicle for component locations, along with refrigerant hose and electrical routing.
3. Prepare for the installation by gathering required tools.
4. Provide protection to vehicle’s finish to prevent damage during installation process.
5. Install engine driven compressor per your specific kit instructions.
6. Install condenser.
7. Install remote evaporator(s).
8. Fabricate and attach refrigeration hoses to all condenser connections.
9. Fabricate and attach refrigeration hoses to all evaporator connections.
10. Fabricate and attach refrigeration hoses to the engine driven compressor.

11. Begin evacuation of system (continue with the installation while system is being evacuated).
12. Route and connect condenser harness to evaporator(s).
13. Install evaporator cover, drain hoses and if required, the defrost heater wires.
14. Install driver's controller inside vehicle and connect fused power wire to switched ignition power source.
15. Install standby receptacle box securely onto vehicle (Electric Standby SmartPower models only).
16. Connect condenser harness to engine driven compressor.
17. Install unit ground cable to battery
18. Install in-line fuse onto unit power cable and connect to vehicle battery.
19. Charge the system with refrigerant (after evacuation process is completed).
20. Operate the unit in all modes.
21. Adjust SPR and CPR valves (if applicable).
22. Complete the Commissioning Form.
23. Reinstall condenser covers, clean the vehicle and return to customer.

Note: Always refer to the unit specific installation manual included with each unit. These manuals cover specific installation requirements such as how to remove components to access mounting locations and refrigeration fittings.

The following pages describe nosemount and rooftop mounted installation standards and procedures.

Nosemount Condenser Installation

The following points must be addressed before installing the nosemount condenser:

- Refer to the Safety Section regarding holding charge precautions. DO NOT release the holding charge until necessary to prevent moisture from entering the system.
- The front wall of the vehicle must be able to support the weight of the condenser. Additional supports (installer supplied) may be required. Unit weights can be found in the product brochures.
- Nosemount unit must not interfere with tilt cab function. Tilt cab to nosemount unit clearances must be checked before installing the condenser.
- The use of a device capable of safely lifting your particular unit is required.
- The use of a work platform is recommended to safely install the condenser.

Note: Depending on the model, the condenser cover and fan assembly may need to be modified prior to installation. Additional components may need to be removed to access unit mounting holes and refrigeration fittings. Refer to the unit specific installation manual for details.

The following points must be addressed when installing the nosemount condenser:

- Use template to center condenser onto cargo box and to locate mounting and access holes.
- Drill correct size holes for the mounting bolts and for the refrigerant/electrical access holes.
- Silicone sealer must be applied around all mounting holes prior to installing condenser.
- Use unit lifting points and appropriate lifting device to install condenser.
- The condenser must be mounted directly to the cargo box front wall. *DO NOT use any rubber washers or gasket material between the condenser unit and the cargo box front wall.*
- All condenser mounting hardware must be the correct size, grade, finish and tightened securely. Refer to ("[Mounting Hardware](#)," p. 24) in this section.

Note: Insulation tape *MUST* be applied on the backside of the condenser unit before installing it to the wall. This is supplied from Factory.

Figure 10. Nosemount unit must not interfere with tilt cab function.

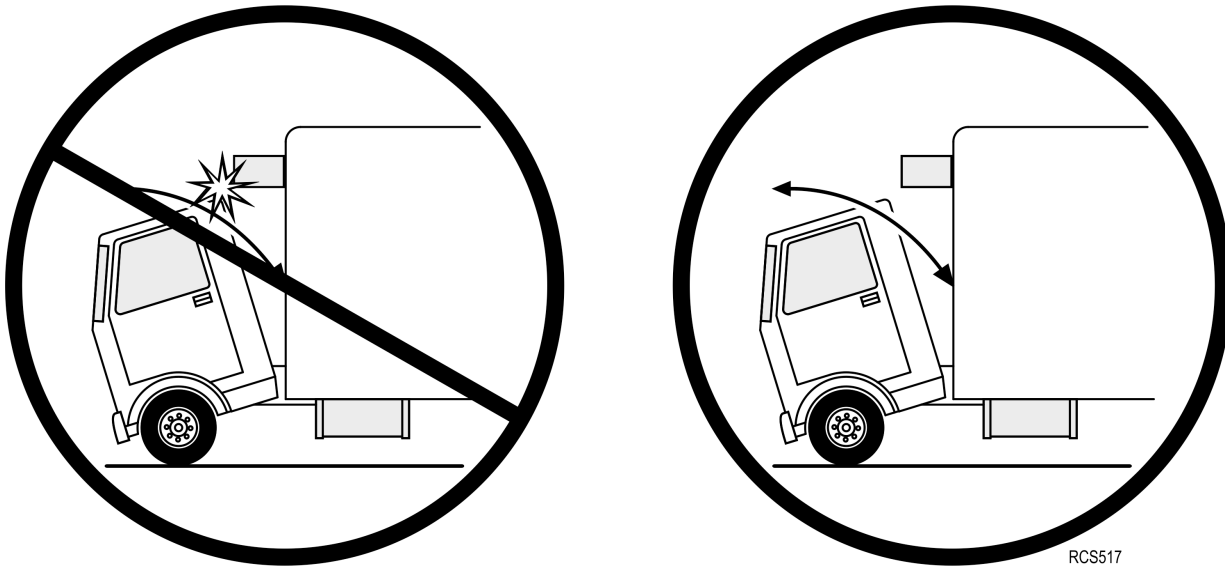


Figure 11. Nosemount installation template shown.

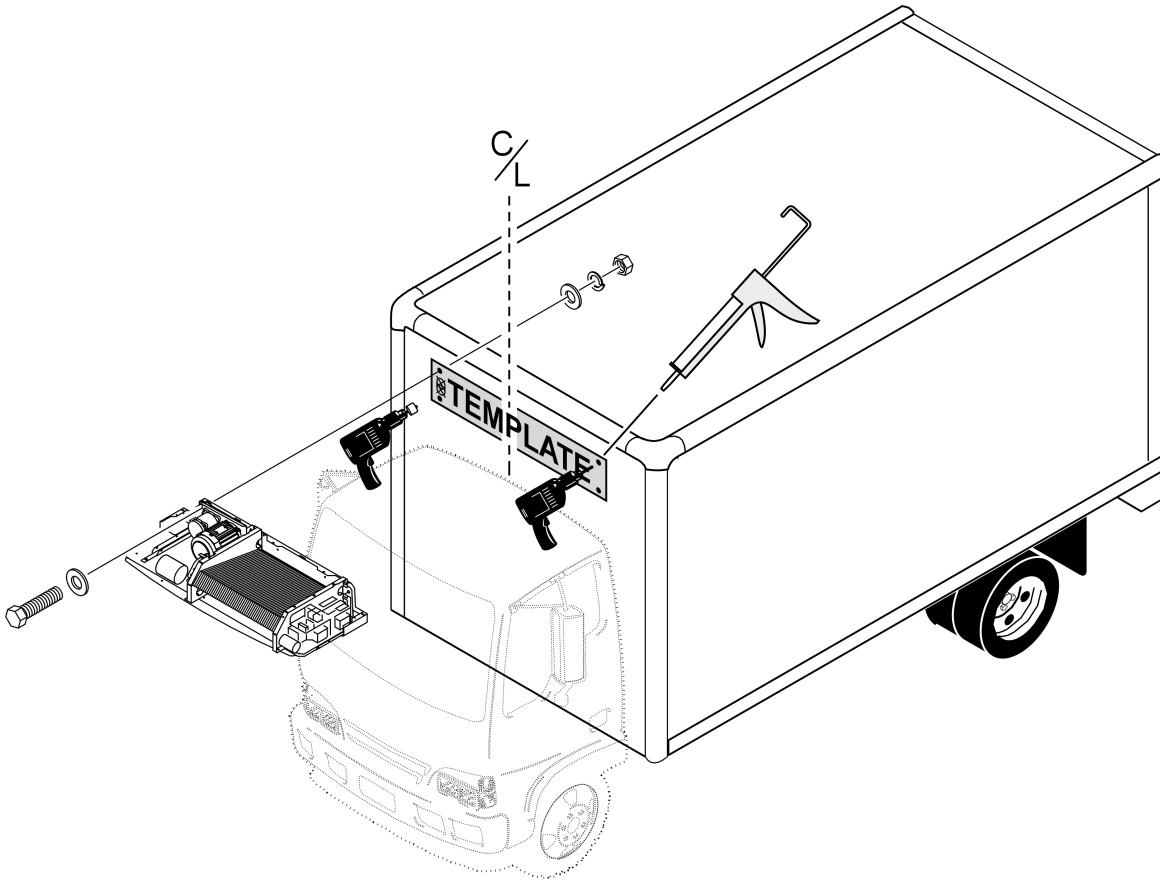
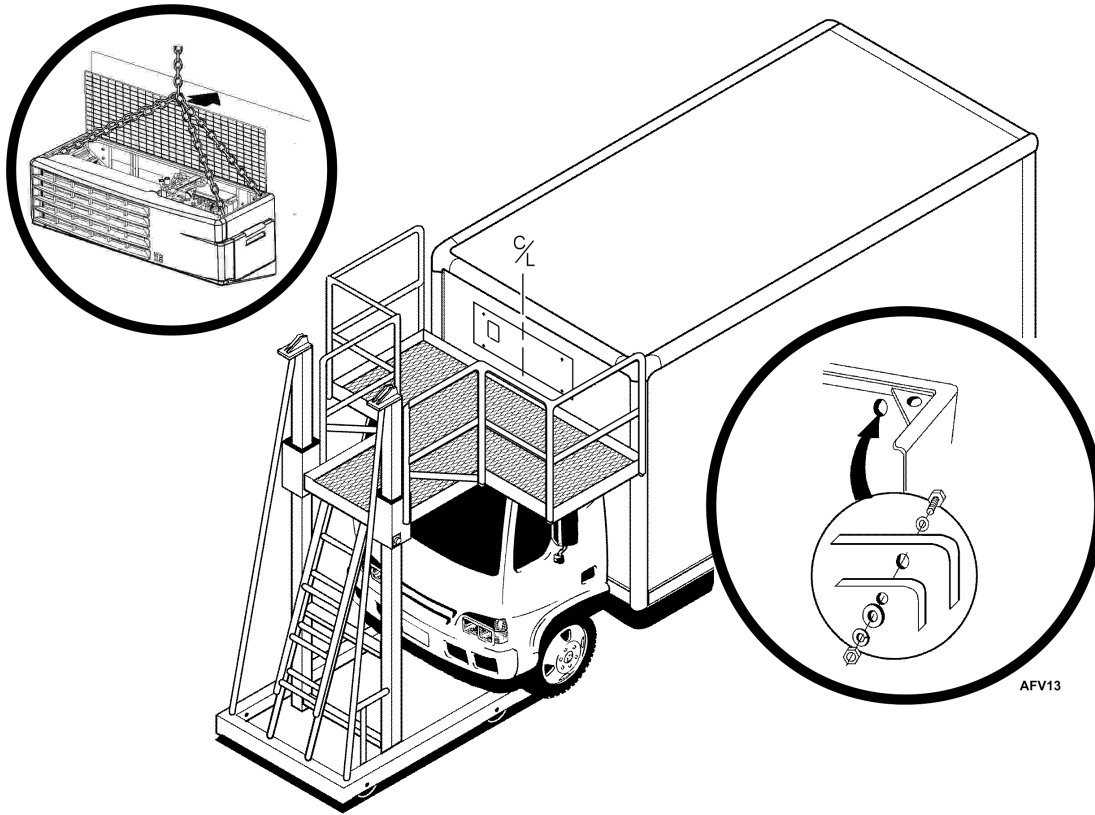


Figure 12. Lifting device and work platform shown.



Rooftop Mounted Condenser Installation

Important: Not all Vehicle Powered Truck Units can be installed on the rooftop. V-300 Series Units and smaller only.

The following points must be addressed before installing the rooftop mounted condenser:

- Refer to the Safety Section regarding holding charge precautions. DO NOT release the holding charge until necessary to prevent moisture from entering the system.
- The roof of the vehicle must be able to support the weight of the condenser unit, or on some models the Refrigeration Module, Power Pack Module and Condenser Module. Additional supports (installer supplied) may be required. Unit weights can be found in the product brochures.
- The use of a device capable of safely lifting your particular unit is required.
- The use of a work platform is recommended to safely install the condenser.

Note: Depending on the model, the condenser cover and fan assembly may need to be modified prior to installation. Additional components may need to be removed to access unit mounting holes and refrigeration fittings. Refer to the unit specific installation manual for details.

The following points must be addressed when installing the rooftop mounted condenser:

- The condenser must be installed so the air inlet grille faces forward on the vehicle.
- Use template to center unit onto cargo box and to locate mounting and access holes.
- Drill correct size holes for the mounting bolts and for the refrigerant/electrical access holes.
- Silicone sealer must be applied around all mounting holes prior to installing condenser.
- Use unit lifting points and appropriate lifting device to install condenser.
- The condenser must be level on the roof. A rooftop installation kit is available that provides special adjustable rubber washers that not only avoid direct contact between the condenser and the vehicle's roof, but also allow the unit to be mounted level on a curved roof.
- All condenser mounting hardware must be the correct size, grade, finish and tightened securely. Refer to ("[Mounting Hardware](#)," p. 24) in this section.

Figure 13. Correct V-Series rooftop condenser mounting direction shown.

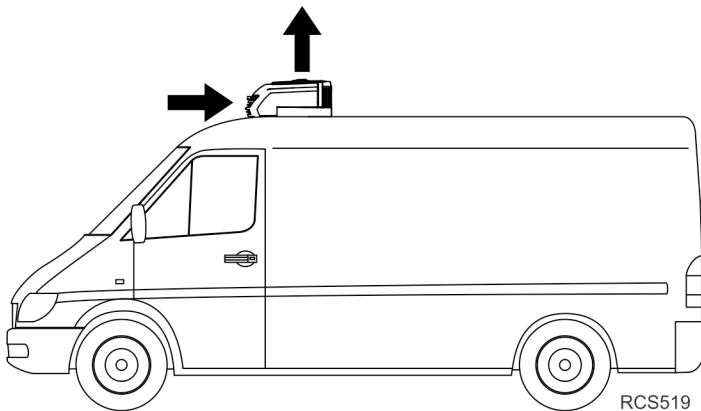
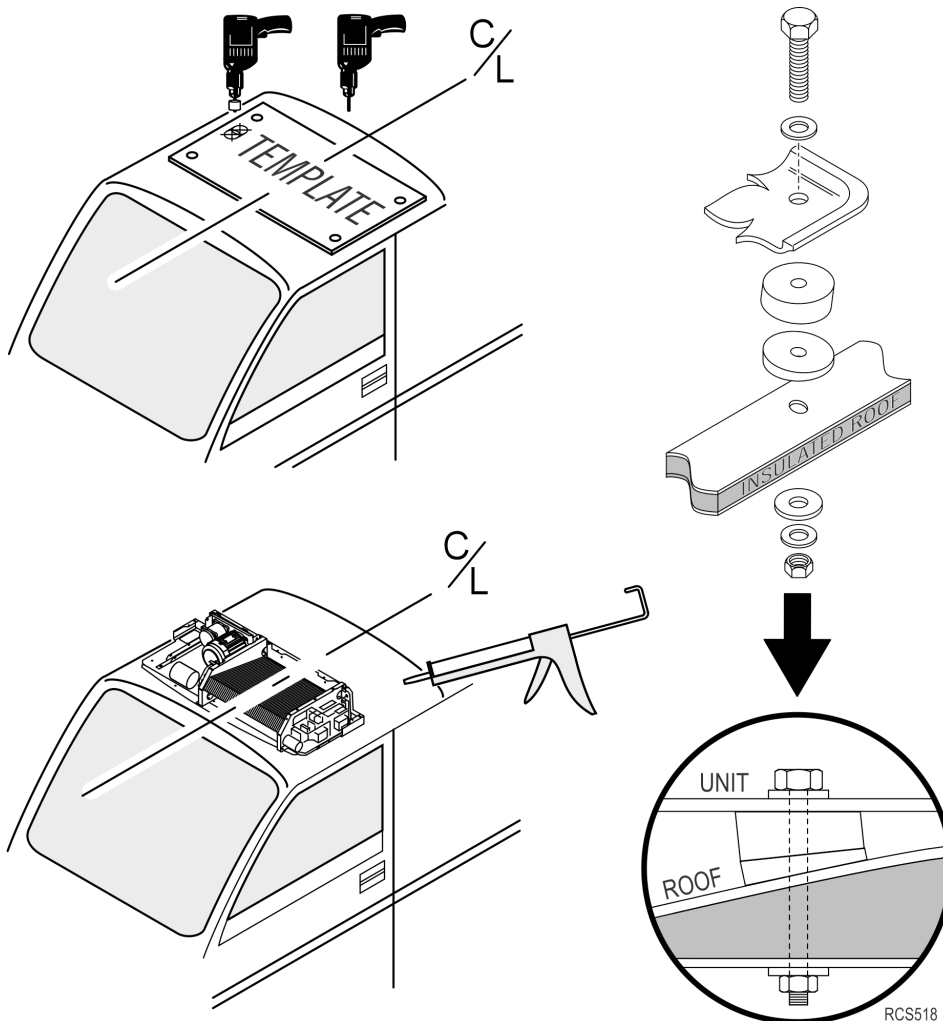


Figure 14. V-Series template and rooftop mounting kit shown.

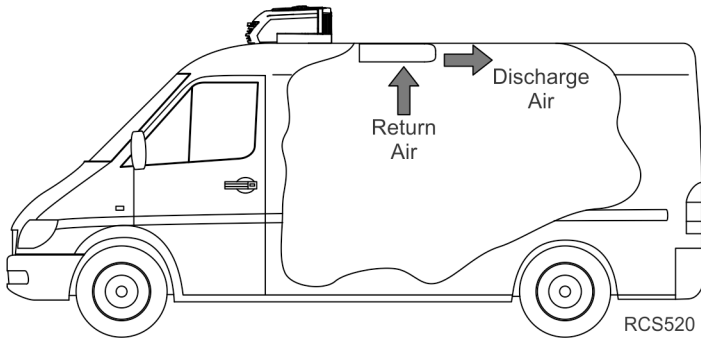
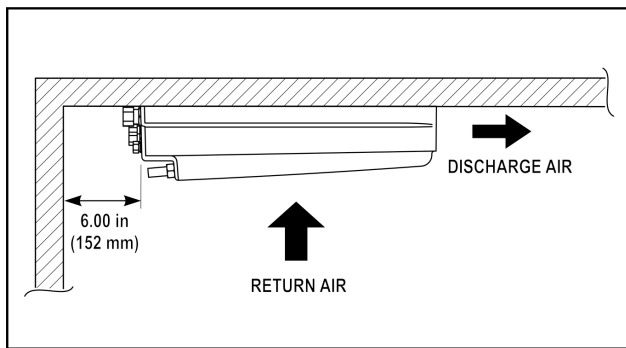


Remote Evaporator Installation

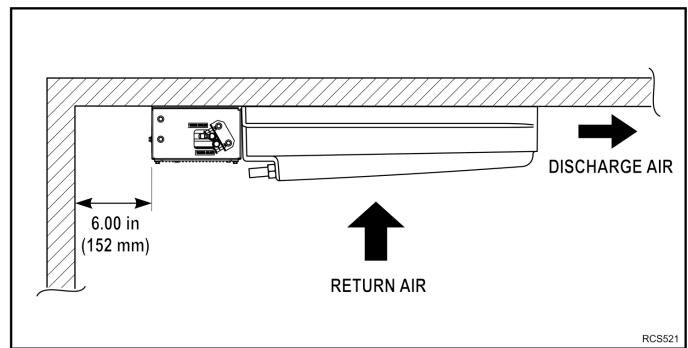
Important:

1. See Safety Section regarding holding charge precautions. **DO NOT** release the holding charge until necessary to prevent moisture from entering the system.
2. The roof/ceiling of the vehicle or cargo box must be able to safely support the weight of the evaporator. Additional supports (installer supplied) may be required. Unit weights can be found in the product brochures.

- Evaporator must be installed to allow for best air distribution.
- Standard evaporator must be installed a minimum distance of 6.00 in. (152 mm) measured from the cargo wall (bulkhead) to the rear of the evaporator. This distance is required to allow for refrigerant and drain hose connections.
- Some evaporators include an accumulator assembly. They evaporators must be installed a minimum distance of 6.00 in. (152mm) measured from the cargo wall (bulkhead) to the rear of the accumulator. This distance is required to allow for refrigerant and drain hose connections.
- Evaporators must be installed securely to steel support plates pre-installed in the cargo box ceiling by the body builder or by using long bolts with backer plates (installer supplied) down through the roof of the cargo box. Refer to ("Evaporator Installation with Pre-Installed Support Plates," p. 32) and ("Evaporator Installation without Support Plates," p. 33).

Figure 15. Evaporator return and discharge airflow shown.

Figure 16. Distance shown required to allow for refrigerant and drain hose connections.


Standard Evaporator (10 and 20 Models)
Minimum Distance from cargo wall to rear of evaporator shown.

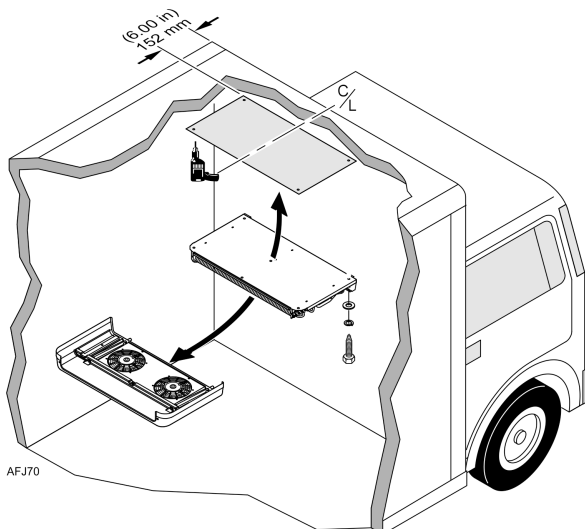


Evaporator with Accumulator (30 and 50 Models)
Minimum Distance from cargo wall to rear of accumulator shown.

Evaporator Installation with Pre-Installed Support Plates

Thermo King recommends installing a support plate with mounting studs or threaded inserts (installer supplied) to the truck's interior roof structure to safely support the weight of the evaporator(s). The plate should be installed prior to insulating and finishing the cargo area. The plate should also position the evaporator the required distance from the front bulkhead wall to allow for refrigerant and drain hose connection.

1. Remove the evaporator cover and install the evaporator directly to the support plate and tighten hardware securely.

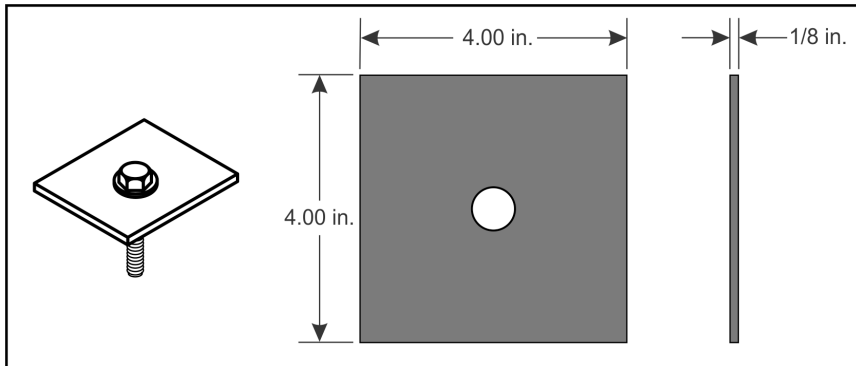
Figure 17. Cargo box shown with pre-installed evaporator support plate.


Evaporator Installation without Support Plates

If no supports or brackets for hanging or mounting the evaporator were added prior to installing the insulation package or liner, thru bolts with backer plates must be used to verify the evaporator is properly secured.

Each evaporator mounting bolt requires a backer plate. Backer plates (installer supplied) should be made from aluminum (or painted steel) with the correct diameter hole per your bolt size.

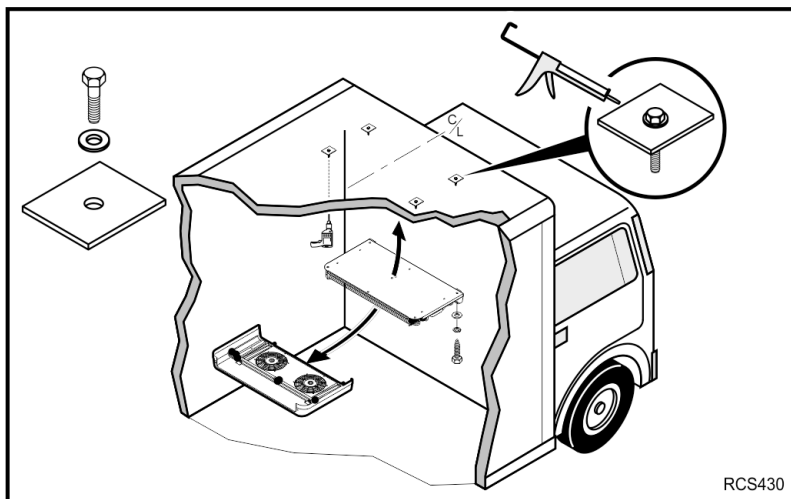
Figure 18. Example of backer plate shown.



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- Apply a bead of silicone sealant around the hole on both sides of each backer plate and install mounting hardware.
- Remove the evaporator cover and install the evaporator directly to the support plates and tighten hardware securely.
- Once the hardware has been tightened, apply more silicone sealant on the bolt heads until they are completely covered. This will help prevent water from migrating down the bolts and into the cargo area.

Figure 19. Backer plates shown installed in exterior of roof.



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Section 5 - Compressor Selection and Installation Standards

Overview

This section defines Thermo King’s requirements for selecting and installing the correct compressor for various vehicle powered units. The installer must follow these requirements to ensure the system operates as designed.

Compressor Selection

Important: The correct compressor ***MUST*** be selected for each vehicle powered unit. Failure to use the correct compressor may result in premature compressor failure and will void the compressor warranty.

Use the table below to select the correct compressor for the unit being installed:

Table 1. Compressor Selection

Unit Model	Required Compressor
V-200 / V-220 (MAX)	TK 13
V-300 / V-320 (MAX)	TK 15
V-520 (MAX)	TK 16
V-520 RT (MAX)	TK 16
V-800	TK 21

Compressors are available with either direct mount (pad mount) and/or tab mount (ear mount), shown below.

1. Consult the bracket kit manufacturer to determine which is required.
2. Verify with Thermo King that the required compressor is available. **In the rare case where there is no solution available, please contact the Thermo King service department.**

Figure 20. Tab Mount and Direct Mount Compressors Shown.



Tab Mount Assembly



Direct Mount Assembly

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Section 5 - Compressor Selection and Installation Standards

Understand Compressor Speeds

Proper compressor speed is critical to preventing premature compressor failure. Select a compressor that meets the requirements for the specific application. There are three speeds to consider:

Table 2. Minimum Compressor Speed

Value	750 RPM for all Compressors
Importance	This is the compressor RPM during engine idle. Lubrication of the compressor has been verified operating at this speed and above, but may not be sufficient and cause accelerated wear at lower speeds.

Table 3. Compressor Peak Efficiency Speed

Value	2400 RPM for all Compressors
Importance	This is the compressor speed at which Thermo King rates unit capacity because it provides the highest performance versus reliability. This speed provides the capacity quoted in the current selection guide. Going faster than 2400 RPM gains minimal capacity.

Table 4. Compressor RPM at Highway Speed

Value	3000 RPM for all Compressors
Importance	This is the maximum speed the compressor should run continuously in order to maximize reliability. Important: <i>The compressor must never exceed this speed for more than two seconds at a time.</i>
How to Calculate	This is the compressor RPM at highway speed (about 70 MPH) when vehicle is in its highest gear. Refer to (" Calculate the Compressor Speeds ," p. 36). Note: <i>Vehicles with manual transmissions must be handled differently as the shift points and times at higher RPMs are varied by the driver.</i>

Table 5. Compressor RPM During Shifting

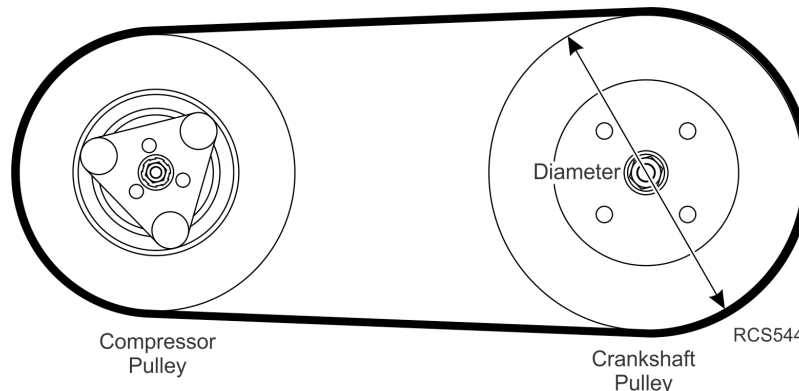
Value	Maximum 6000 RPM for all Compressors
Importance	This is the speed the compressor endures for brief periods during acceleration, up shifting or down shifting. Important: <i>The compressor speed should never exceed 6000 RPM at any time, including shifting.</i>
How to Calculate	This is the compressor RPM when the engine is up shifting or down shifting – at its peak engine shift point. Refer to (" Calculate the Compressor Speeds ," p. 36).

Choose the Best Compressor Pulley

To achieve the optimal compressor speeds, the correct compressor pulley must be selected from the table below. Changing the pulley size will change compressor speed.

Note: *The 4.69 in. (119 mm) diameter pulley is standard on a Thermo King swash plate compressors.*

Compressor Pulley Diameters Available
4.69 in. (119 mm) diameter
5.43 in. (137 mm) diameter
6.14 in. (156 mm) diameter



Calculate the Compressor Speeds

To calculate the compressor speed, follow the steps below, or obtain a speed calculator from your local dealer.

1. Document the crankshaft pulley diameter (OEM or add-on pulley in bracket kit-whichever drives compressor belt).
2. Drive the vehicle to document:
 - a. Engine RPM at highway speed (about 120 km/h (70 MPH) or faster)
 - b. Peak engine RPM during shifting (can determine using the engine’s performance curve or redline on tachometer).
3. Choose a compressor pulley to evaluate and calculate the resulting compressor speeds:

$\frac{\text{Crankshaft Pulley Diameter}}{\text{Compressor Pulley Diameter}} \times \text{Engine RPM at Highway Speed} = \text{Compressor RPM at Highway Speed}$	←	Must be between 2400 and 3000 RPM
$\frac{\text{Crankshaft Pulley Diameter}}{\text{Compressor Pulley Diameter}} \times \text{Engine RPM at During Shifting} = \text{Compressor RPM During Shifting}$	←	Must be a MAX of 6000 RPM

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4. If the compressor RPM is acceptable in both situations, the chosen pulley diameter is approved for the application. If it is not, repeat step 3 using the other available pulley diameters.

Note: If a pulley other than the standard is needed, refer to (“[Changing Compressor Clutch](#),” p. 41) for procedures.

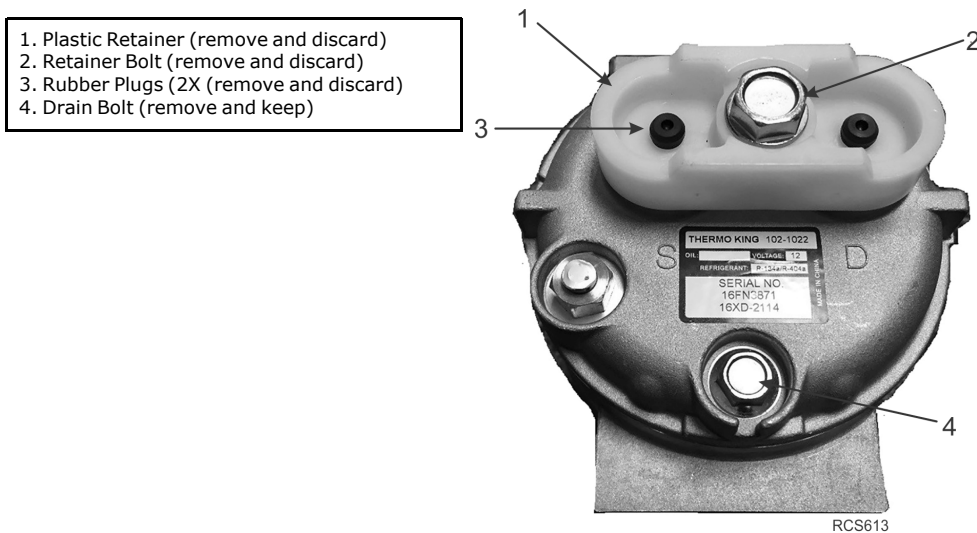
Compressor Installation

Adding Oil

1. Remove compressor from box and inspect the serial tag.
2. Verify that the compressor model number is correct (see the previous Compressor Selection).
3. Verify the model number ends in “XD” (ex. 16XD-XXXX). This means the compressor should be dry and ready to be filled with POE Solest 120 oil (TK P/N 203-505.)

Important: If model number ends in “HD” (ex. 16HD-XXXX) or the tag lists the refrigerant oil type as PAG oil, the compressor must not be used for a VP truck application.

4. On a workbench, remove the components shown below. Keep the drain bolt and discard the remaining components.



5. Carefully measure out 4 fl. oz. of Solest 120 compressor oil (TK P/N 203-505) into a clean container and pour directly

into the drain plug of the compressor. Be careful not spill.

Figure 21. Add oil to compressor.



6. Replace the drain plug bolt and torque to 9 ft.lbs.
7. Place a small amount of compressor oil onto each green O-ring around the compressor ports and coat the entire mating surface.

Figure 22. Add oil to O-rings.



8. Place the swivel manifolds on the compressor ports and place the manifold retainer over the manifolds.
9. Add blue thread locker to the end of the manifold retainer bolt as shown below. Add enough to coat one thread one revolution around the bolt.

Figure 23. Add blue thread locker to retainer bolts.



10. Place the bolt through the manifold retainer and torque to 36.9 ft.lbs. (50 N.m).

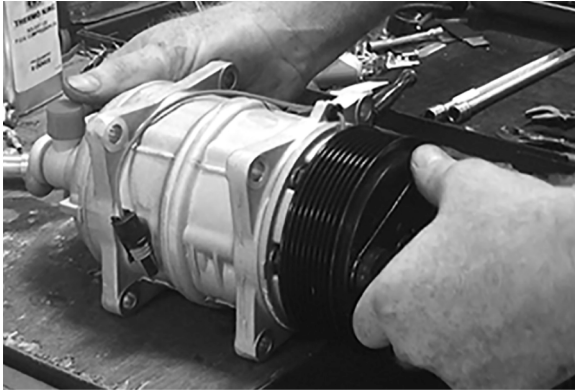
Important: Do not use an impact drive to tighten this as it may damage the manifold and/or compressor.

Note: Before torquing the retainer bolt, a test fit may need to be performed onto the drive kit to verify the manifolds are in the correct orientation to connect with the refrigerant lines.

11. Rotate the compressor clutch by hand several times to verify the oil spreads to lubricate the internal components.



Figure 24. Rotate the compressor by hand.



12. Look up the oil charging quantities for the specific model being installed in the unit's Installation Manual (available on Thermo King Info Central).

13. Pour the correct amount of oil into the suction line where it connects to the vehicle driven compressor.

Note: It is easier to add the oil before attaching the suction line fitting.

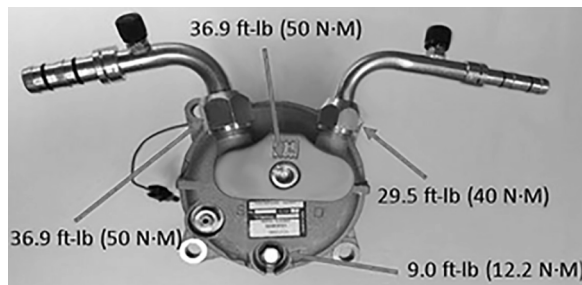
Figure 25. Add oil into suction line.



Torque Specifications

When connecting the tube-O style fittings to the compressor manifold, the following torques are required. Failure to properly torque the fitting connections can result in leaks or damage to the aluminum manifolds.

Figure 26. Required torque specifications.

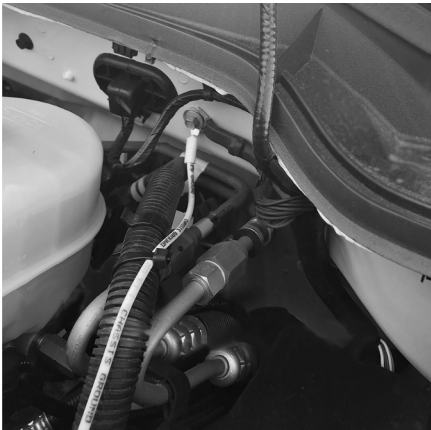


Ground Strap Installation

Every Vehicle Powered truck unit comes with a compressor ground strap kit. This ground strap ensures that the Thermo King compressor is properly grounded and will received adequate voltage. If the ground strap is not used, the compressor will be grounded through the vehicle's engine block which could result in electrical resistance and decreased voltage. Decreased voltage to the compressor will result in the compressor clutch not fully engaging, increased current and higher temperatures which in turn lead to excess clutch wear and premature clutch failure.

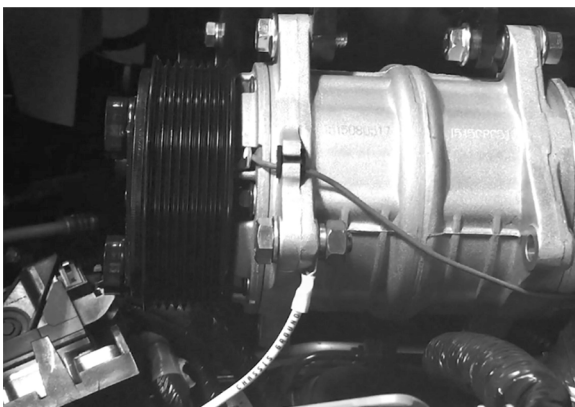
Mount one end of the chassis ground wire to either the firewall of the engine compartment (as shown in photo) or directly to the vehicle frame. The mounting location on the firewall or frame must be free of paint to ensure a good electrical connection. Remove enough paint until bare metal is showing and so the entire area of the ground strap ring terminal is touching bare metal. The compressor ground strap may share a fastener with an OEM ground strap. Use an ohmmeter to check the resistance of the ground circuit. Hold one probe of the ohmmeter to an unpainted area on the frame or chassis and hold the other probe onto the loose end of the chassis ground strap. If the resistance is greater than 0.1 ohms, the connection needs to be improved. Once a good ground is established, cover the interface between the chassis and the ring terminal with dielectric grease to minimize corrosion and verify a good electrical connection.

Figure 27. Typical ground strap shown installed on vehicle's firewall.



Mount the compressor to the drive kit per the drive kit instructions. Fasten the other end of the chassis ground wire to one of the open mounting holes on the compressor ears (if ear mount style – shown in first photo below) or under one of the compressor mounting bolts (if direct mount style – shown in second photo below.) Cover the interface between the compressor body and the ring terminal with dielectric grease to minimize corrosion and verify a good electrical connection.

Ground Strap shown installed on ear mount style and direct mount style compressors.



Belt Alignment

Once the compressor mount kit and the compressor are installed, the pulley alignment must be checked to verify a full life of the serpentine belt. Remove the serpentine belt, if already installed, and use a laser alignment tool to verify the compressor pulley is in alignment. If the mount kit uses an add-on crank shaft pulley (additional pulley used to drive only the Thermo King compressor,) only the alignment between the compressor and the additional pulley needs to be verified. If the mount kit uses the existing crankshaft pulley and has the Thermo King compressor pulley share the same belt as the OEM vehicle components (such as the alternator, power steering, etc.), the compressor pulley alignment needs to be checked with the components before and after the compressor following the belt path.

There are several manufacturers of alignment tools, but the easiest to use and permanently calibrated is the Dayco laser belt alignment tool (Dayco Part Number 93874). Such tools are readily available from auto parts stores online.

⚠ CAUTION

Risk of Injury!

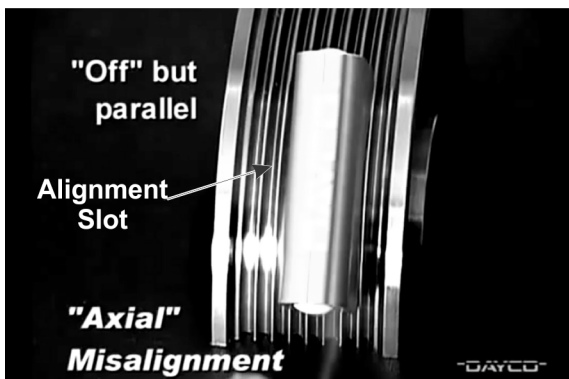
Shining the laser directly into someone's eye can cause permanent damage. Use care when around others and use personal protective equipment to minimize risk of injury.

Figure 28. Dayco Belt Alignment Tool

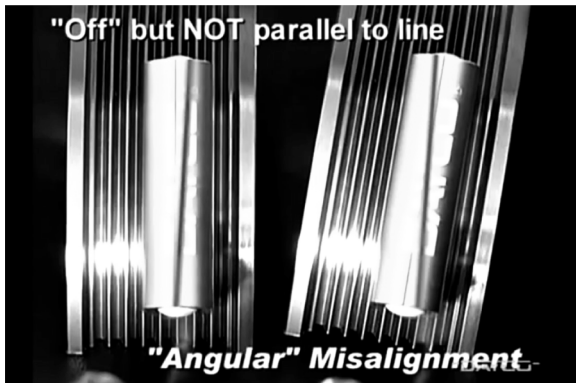


When checking the pulley alignment, both the angular and axial alignments need to be checked. An **axial** misalignment will result in the laser being parallel but offset to the alignment slot on the target component (Figure 29, p. 40). In the case where the axial alignment is off, spacers/shims can be added between the bracket and compressor to correct the misalignment. Special attention should be given to which groove the alignment tool is used on. Most vehicles use six groove pulleys and belts and the TK compressor come with an eight groove pulley to allow for more flexibility in axial alignments.

Figure 29. Axial Misalignment



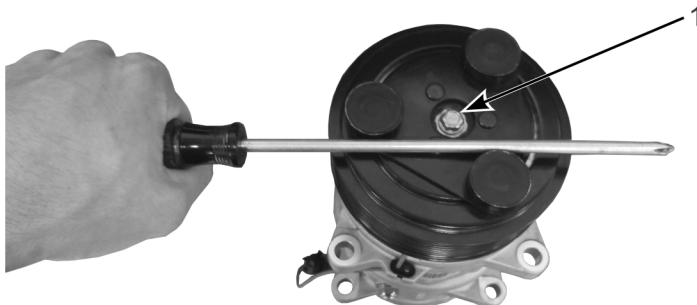
An **angular** misalignment will result in the laser not parallel to the alignment slot on the target component (Figure 30, p. 41). When checking the angular alignment, rotate the pulley with the target component 1/8 of a turn in each direction to check for angular misalignment in all planes. If there is angular misalignment, verify that the compressor clutch is not bent or improperly assembled. If no problems are found with the compressor, contact the bracket manufacturer.

Figure 30. Angular Misalignment


Changing Compressor Clutch

Removal

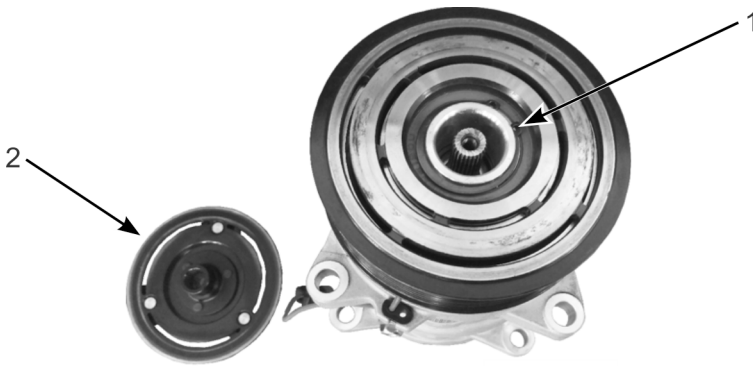
If the compressor is installed on the vehicle, verify that there is enough room in the engine compartment to work without damaging the compressor or any adjacent components. If there is not, remove the compressor from the engine. Place a suitable holding tool between the armature's rubber dampers to prevent rotation (Figure 31, p. 41). Use a 10 mm socket and wrench to remove the armature retaining bolt.

Figure 31. Removing Armature Retaining Bolt.


1.	Armature Retaining Bolt
----	-------------------------

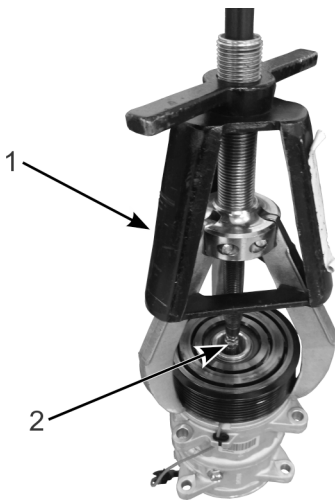
Remove the armature assembly from the compressor shaft and the snap ring holding the pulley onto the compressor shaft (Figure 32, p. 42). If using a new clutch assembly, discard the snap ring and use the new one supplied with the clutch kit.

Note: *There may be shims installed between the armature assembly and the compressor shaft. Set these shims aside as they will be reused during installation.*

Figure 32. Removing Armature and Snap Ring.


1.	Snap Ring
2.	Armature Assembly

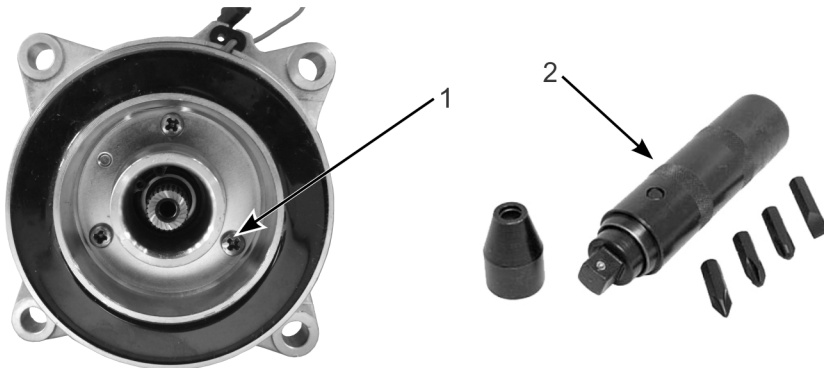
Reinstall the armature retaining bolt back into the compressor shaft finger tight. Install an appropriately sized 2 or 3 jaw puller onto the compressor shaft and pulley (Figure 33, p. 42). Slowly turn the puller bolt clockwise using a wrench until the compressor pulley is removed from the compressor shaft. If reusing the pulley, verify the pullers jaws are not deforming the pulley grooves.

Figure 33. Removing Compressor Pulley.


1.	3 Jaw Puller
2.	Armature Retaining Bolt

Remove the bolt from the compressor shaft and the three screws securing the clutch coil onto the compressor body (Figure 34, p. 43). A manual impact driver is very useful if screws are damaged during removal. If using a new clutch assembly, discard the removed hardware and use the new hardware supplied with the clutch kit. Remove the clutch wire retaining clip from the compressor body and slide the clutch off the compressor shaft.

Figure 34. Removing the Clutch Coil.



1.	Coil Retaining Screw
2.	Manual Impact Driver

Installation

Verify that the clutch being installed is the desired voltage. If the clutch has a red wire it is a 12 Vdc coil and green for a 24 Vdc coil. Place the new coil assembly on the compressor body and align the tab on the back side of the coil assembly with the oval shaped notch in the compressor body. Route the coil wire through the notch in the compressor and slide the retaining clip into the notch until it is locked in place (Figure 35, p. 43).

Figure 35. Clutch Coil Installed and Wires Properly Routed.



Red Wire = 12 Vdc
Green Wire = 24 Vdc

Install new coil retaining screws provided in the hardware kit and torque to 4-6 ft-lb (5.4 -8.1 Nm).

Note: It is recommended to use one drop of thread locker on each of the retaining screws.

Align the new compressor pulley with the compressor shaft. If the pulley does not slide on the compressor, use a 60 mm bearing/seal driver and rubber mallet to install the pulley onto the shaft until the bearing is seated against the compressor housing.

Note: Use caution not to damage the pulley when installing the pulley and the pulley must not be installed at an angle or bearing damage will occur.

Verify that the pulley bearing is entirely below the compressor shaft's snap ring groove. Install the new snap ring provided in the hardware kit using a suitable external snap ring pliers.

Note: When installing the snap ring, the inner edge of the snap ring with a chamfer should face upward.

Verify the snap ring is fully seated into the groove all the way around the compressor shaft (Figure 36, p. 44).



Figure 36. Install Pulley and Snap Ring.



1.	Snap Ring
----	-----------

Place all the shims back into the female socket on the backside of the armature assembly. Carefully slide the armature onto the compressor shaft verifying none of the shims fall out while doing so. If using a new clutch kit, the shims removed from the original clutch will often times set the proper air gap on the replacement clutch assembly. Install the armature retaining bolt (use new bolt if installing new clutch kit) and torque to 8.7 to 10 ft-lb (12 to 14 Nm). Check the air gap at three points (under each of the armature's rubber dampers) on the compressor clutch (Figure 37, p. 44).

Setting Air Gap

NOTICE

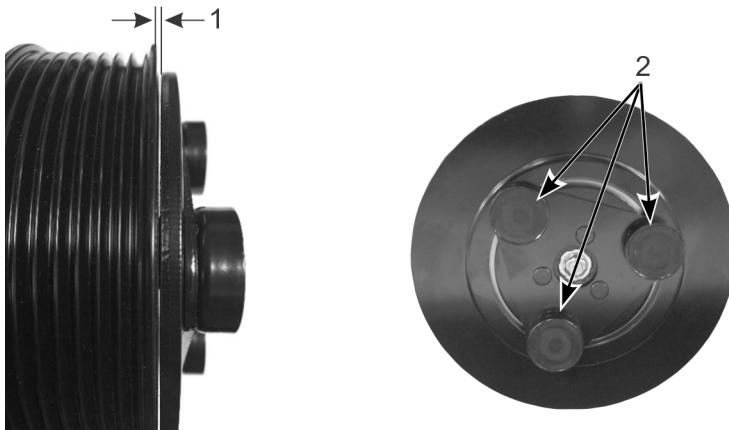
Equipment Damage!

Failure to properly set the air gap will result in premature clutch failure.

Calculate the average of the three air gap readings. If the average air gap between the three readings is out of specification, remove the armature assembly as previously described and install the appropriately sized shim(s). In the event the air gap requires adjustment, five shims have been provided in the hardware kit. **Shim Sizes Provided in Hardware Kit: 0.04, 0.02, 0.004 inches (1.0, 0.5, 0.1 mm).** The shims are not marked with their size. Use a dial caliper or similar measuring device to find the size of each shim. Reinstall the armature assembly, torque the retaining bolt, and recheck the air gap. Continue adjusting the shim sizes until the proper air gap is achieved.

Note: Clutch Air Gap Specifications: 0.03 to 0.08 inches (0.76 to 2.0 mm).

Figure 37. Measure and Set Air Gap.



1.	Air Gap
2.	Armature Rubber Damper

Liquid Injection Temperature Sensor Installation Procedures (Max Units Only)

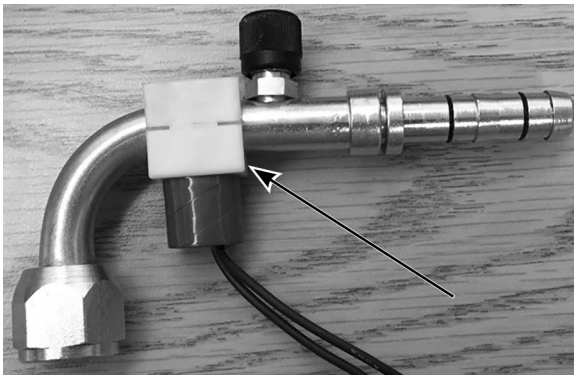
1. Inspect alignment of sensing pad with respect to plastic clip. The curves in the two parts should be perfectly aligned with each other as shown below.

Figure 38. Sensing pad and plastic clip shown perfectly aligned.



2. Clip the temperature sensor onto the straight portion of the compressor discharge fitting as shown below.

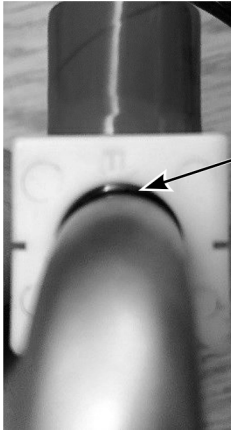
Figure 39. Temperature sensor shown correctly installed.



3. Verify the temperature sensing pad is touching the fitting as shown by looking down the fitting.

Note: If a gap is present, thermal paste should be applied between the fitting and the temperature sensor. This will verify the correct temperature is being read.

Figure 40. Temperature sensing pad shown touching the fitting.



4. Place the metal spring clip over the plastic clip to verify the temperature sensor stays on the fitting.

Figure 41. Spring clip shown correctly installed.



Section 6 - Refrigerant Hose and Fittings Standards

Overview

⚠ CAUTION

Risk of Injury!

Only refrigeration fittings and bulk refrigeration hose supplied by Thermo King are to be used. Fittings and bulk hose supplied by other manufacturers could result in sudden or unintended escape of refrigerant gases, damage to equipment, and/or void the warranty. Personal injury and/or violations of EPA regulations may also occur as a consequence.

This section defines Thermo King's requirements for fabricating and installing refrigeration hoses and fittings onto vehicle powered truck units. Following these standards will result in a system that operates as designed.

Hose Layout and Design

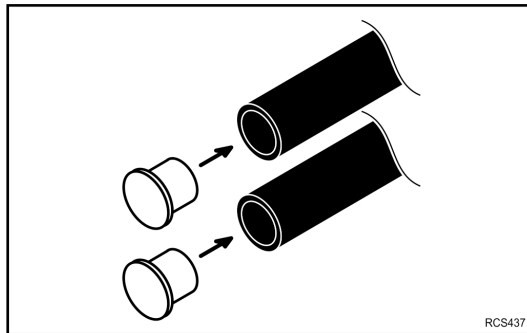
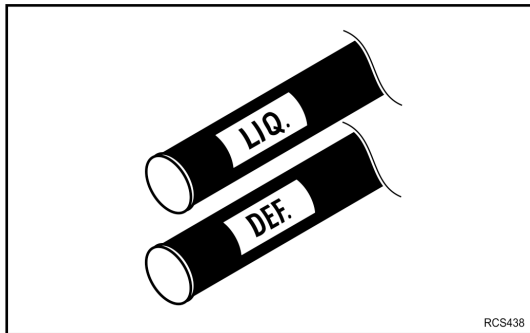
Determining ahead of time which types of fittings to use, best hose routing, along with obstacles to avoid, will go a long way towards a successful installation.

Before routing refrigeration hoses, refer to the unit specific installation manual to determine how many, and which size hoses will be connected to each of the units components. In most installations, two of the same size hoses will be run to the same area (i.e., liquid line and defrost line are both #6 hose). In this case, it is mandatory to label each of the hoses to identify which component they connect to. This is important to avoid confusion when making the hose connections.

NOTICE

Equipment Damage!

Connecting the wrong hose to the wrong component will result in damage to the unit.



- Always label similar size hoses to identify which component they connect to.
- All hose ends must be capped or taped off during installation to prevent contamination and moisture buildup which reduces system pump down time.
- Always keep the holding charge in the condenser and evaporator until hoses have been routed and are ready to be connected to the components.

Allowing for Movement

Refrigerant hoses must be installed to allow for changes in length due to component motion, vibration, pressures, and temperatures. Failure to allow for movement will cause hoses to leak and fail.

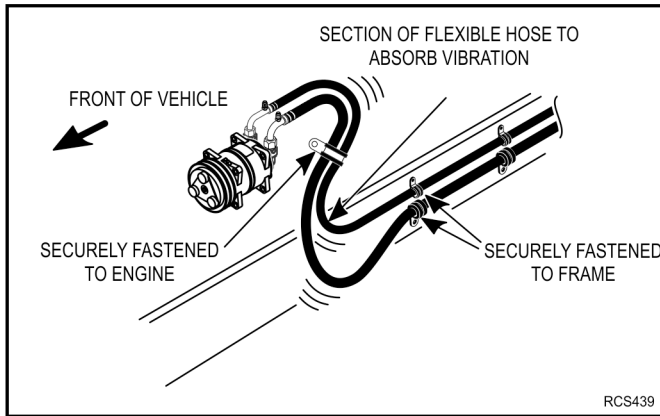
Two examples are shown below where hoses need to allow for movement.

Example 1: The transition point from the stationary frame to a moving engine must include a section of flexible hose to absorb vibration.

- Hoses attached to the compressor must be allowed to move with normal engine operation.
- Under high torque loads, the vehicle's engine can rotate substantially. You must provide enough hose slack so this engine movement does not apply force to the compressor fittings.
- Additionally, hoses spanning the gap between the vehicle's engine, the unit's compressor, and the vehicle's frame, must be properly secured to both the frame and the engine block. This limits normal engine vibrations and torque from being transferred to the compressor fittings.

Important: It is critical that P-Trap is installed in the suction line before the roadside compressor. Refer to ("[Suction Line Routing and P-Trap Formation](#)," p. 56).

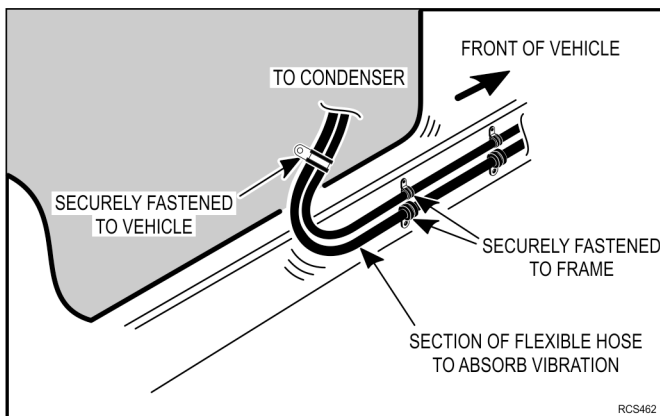
Figure 42. Example 1



Example 2: Similar situation for a condenser unit:

- Hoses attached to the cargo box or van body must have a section of flexible hose to absorb vibrations and allowed to move and flex with normal vehicle operation.
- Hoses must be securely fastened to the vehicle and the frame.

Figure 43. Example 2



Examples of Hose Designs

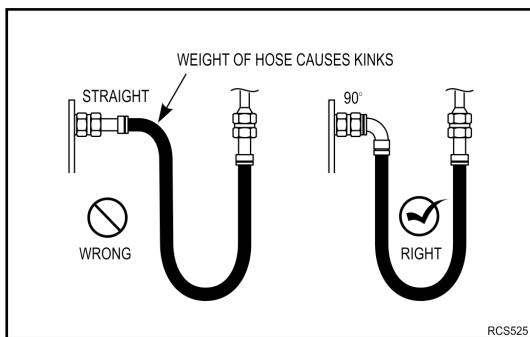
Before fabricating hoses, always review how each hose will be routed and connected to the component. Refer to the following examples showing right and wrong hose designs.

Important: Poorly designed hoses will fail prematurely.

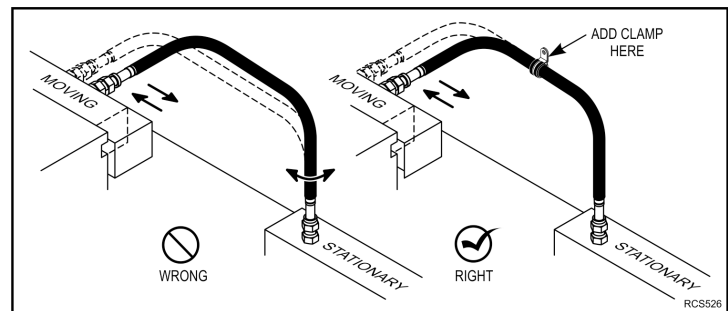
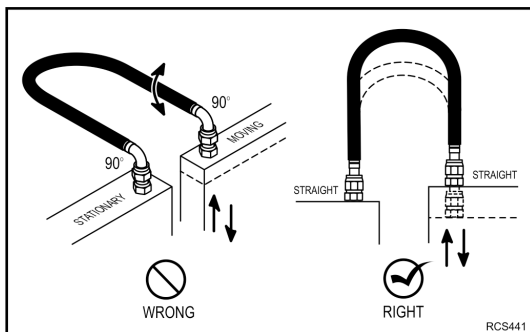
- Hoses should never be stretched tight! Hoses must be installed onto components in such a way as to allow for movement.

Important: Hoses should never be stretched tight! Hoses must be installed onto components in such a way as to allow for movement, **however** they must not sag either, as this collects oil.

- Always use the correct hose fittings to prevent hose kinks at the fittings.



- Hoses must be designed to allow hose to bend on one plane only to prevent hose from twisting.

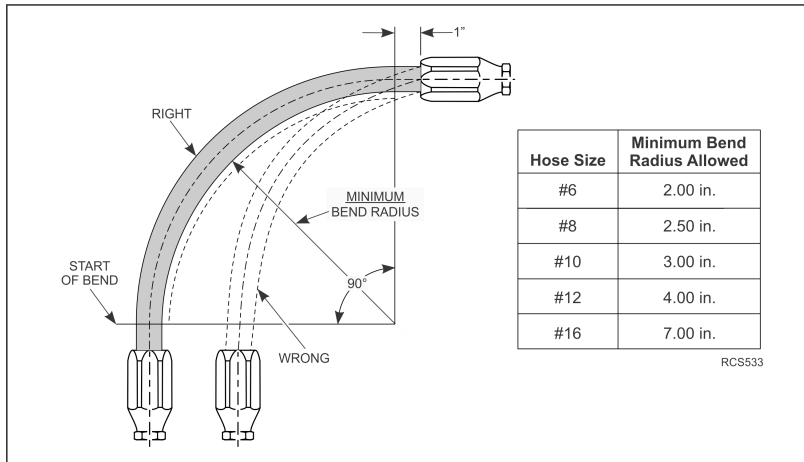


Minimum Hose Bend Radius

- Hoses must be designed to allow for a smooth, gradual bend radius.
- Hoses that are made too short will have a bend radius too small. When the bend radius is too small, the hose can be kinked and damaged which will result in decreased performance and premature hose failure.
- Damage to the internal liner of the hose can be present without evidence on the exterior.

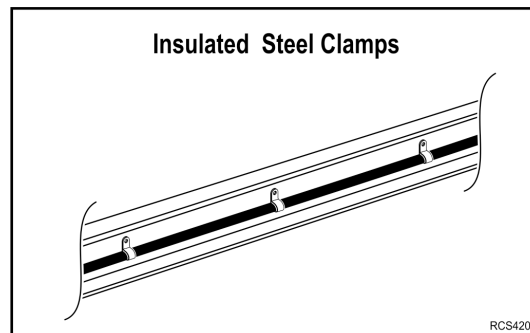
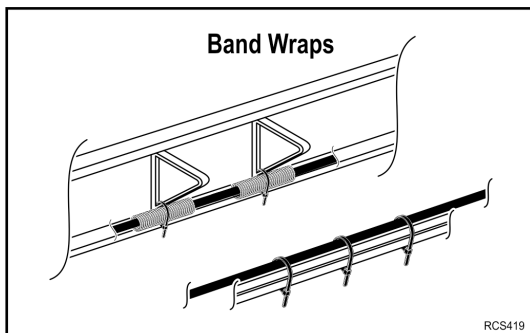
Important: A new hose must be installed if the hose has any appearance of kinks or damage.

Figure 44. Minimum bend radius allowed for the various hose sizes.


Securing Refrigeration Hoses

All refrigeration hoses must be neatly routed and secured adequately to prevent damage from rubbing, chafing, or making contact with hot or rotating components.

- Band wraps can be used to secure unit hoses to existing vehicle harnesses, frame mounts or electrical harnesses.
- Insulated clamps can be used to secure hose(s) to vehicle's chassis when no existing attaching points are available.
- Hoses can also be bundled together with other hoses or harnesses.
- Refrigeration hose(s) should be secured to existing frame mounts or to vehicle's harnesses with band wraps as shown.
- Refrigeration hoses should be secured to vehicle's frame with insulated steel clamps as shown.


Supporting Hoses

Vehicle powered truck units require various size refrigeration hoses be run long distances, therefore it is important they are adequately supported to prevent damage.

- Due to the weight and bulk of the refrigeration hoses, insulated steel clamps should be used to secure hoses a minimum of every 12 inches.

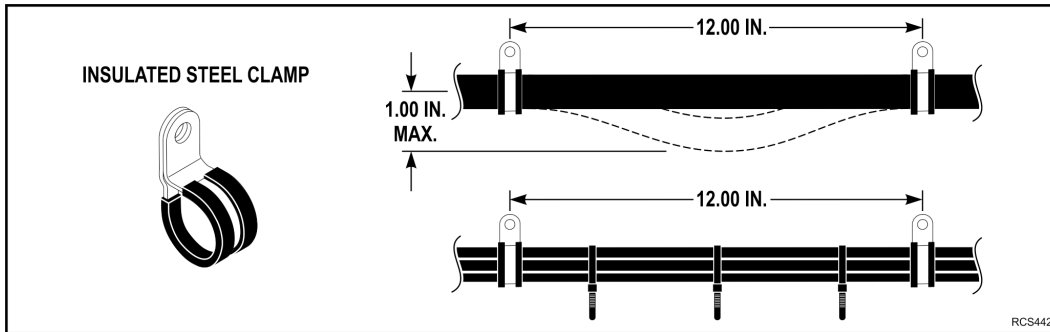
Section 6 - Refrigerant Hose and Fittings Standards

Note: Nylon or plastic clamps can get brittle and fail over time allowing the hoses to become unsupported and become damaged.

- Hoses should not be able to move more than 1 inch in-between clamps. Add additional clamps if necessary.
- When multiple hoses are routed together they can be bundled and secured with band wraps to improve rigidity and decrease vibrations.

Note: The actual distance may need to take into account the hose size and weight.

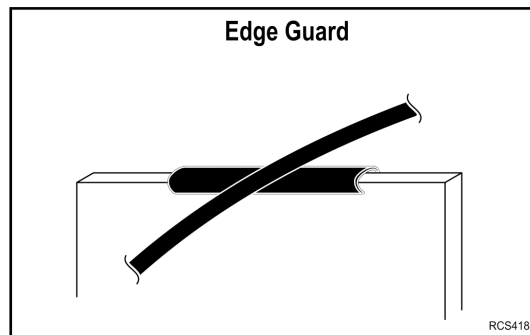
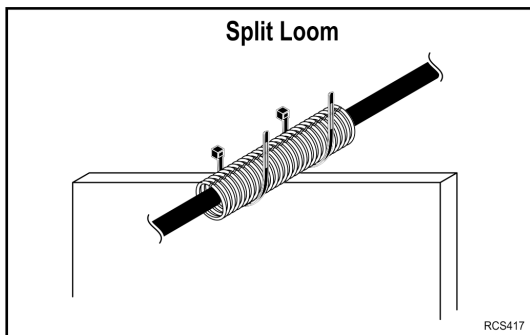
Figure 45. Always support hoses adequately to prevent damage.



Abrasion Protection

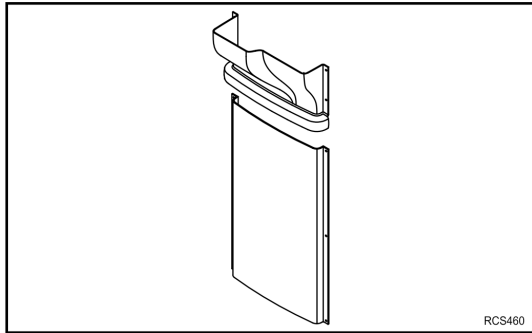
Abrasion protection is required on all refrigeration hoses where rubbing and chafing may be an issue. Hoses must also be secured in these areas as well to minimize movement.

- Always keep refrigeration hoses from rubbing or chafing against sharp metal objects, rotating components or hot components.
- Split loom, edge guard, or similar protection (installer supplied) must be used.

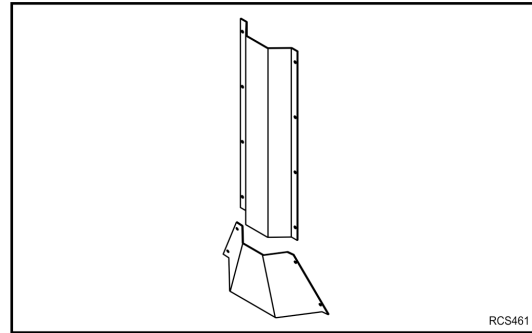


Protective Covers and Guards

Protective covers and guards are recommended for any exposed refrigeration hoses either inside or outside the cargo box that could become damaged during daily use. These covers and guards are available from Thermo King.



Exterior Plastic Cover



Interior Aluminum Cover

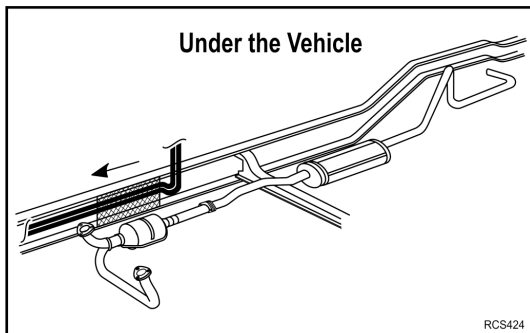
Protective Heat Shields

The installation of protective heat shields (installer supplied) is recommended for any exposed refrigeration hoses located near vehicle heat sources such as the exhaust system. Exhaust temperatures can exceed 1600°F and cause damage to refrigeration hoses if they are not properly shielded.

Refrigeration hoses need a shield when located within:

- 4.00 in. (102 mm) from engine exhaust manifolds, catalytic converters and mufflers.
- 2.00 in. (51 mm) from exhaust systems under the vehicle.
- Exhaust systems move with the engine. Always allow for exhaust and engine movement when routing and securing refrigeration hoses to the engine or chassis.

Figure 46. Protective heat shield shown next to catalytic converter.



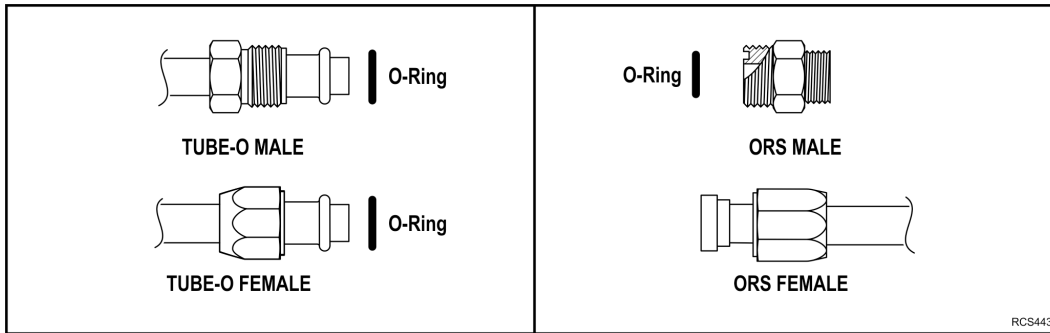
Refrigeration Fittings

Three different types of refrigeration fittings are used on vehicle powered truck units: Tube-O, ORS and Flare. Tube-O fittings are used only on the compressor, while ORS (O-Ring Seal) fittings are used for the majority of the other connections. Tube-O and ORS fittings require matching O-Rings (EPDM ONLY!) to seal properly. Flare fittings (not shown) are connected to the suction splice connector on units equipped with an oil return and/or Jet Cool. These fittings do not use O-Rings. Tube-O and ORS fittings typically come in male and female ends, straight, 45° and 90°, and with or without charge ports. Before assembling any hoses, first match the fitting to the component, then match the hose to the fitting.

Note: While most fitting sizes match the hose size (i.e., #10 fitting to #10 hose), some #10 Tube-O fittings attach to a #12 hose. Always refer to your unit installation manual for the proper size hoses required for your specific model.

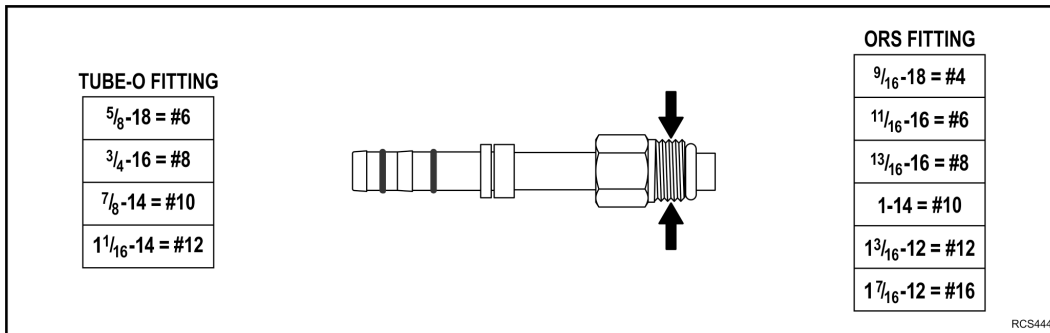
Determining Fitting Type

Figure 47. Tube-O and ORS fittings shown.



Determining Fitting Size

Figure 48. Measure thread diameter to determine fitting size.



Refrigerant Hoses

Refrigeration hoses come in various sizes from #4 through #16. Always refer to your unit installation manual for the proper size hoses required for your specific model. Typical hose sizes for vehicle powered trucks are shown below.

Determining Hose Size

Measure the inside diameter (I.D.) of the hose to determine the hose size.

Table 6. Determining hose size.

Hose I.D.	Hose Size
.20 in. (5.1mm)	#4
.31 in. (10/3mm)	#6
.41 in. (10.3mm)	#8
.50 in. (12.7mm)	#10
.63 in. (15.9mm)	#12
.88 in. (22.4mm)	#16

O-Rings

All Tube-O and ORS refrigerant fittings require matching O-Rings to seal the system. Improperly installed, pinched or missing O-Rings is a common cause of refrigeration leaks.

Important: All vehicle powered truck units require EPDM O-Rings. NO OTHER O-RINGS ARE ACCEPTABLE.

- O-Rings should be inspected for damage or flaws prior to installation and never be reused.
- Always lubricate the O-Rings with POE refrigerant oil and install correctly into cavity before tightening fittings. Refer to (“Tightening Refrigeration Hose Fittings,” p. 54).
- The correct replacement O-Rings are available from your Thermo King dealer.

Table 7. Replacement Thermo King O-Rings by fitting size.

Fitting Size	Thermo King O-Ring Part Number
#4	335679
#6	335209
#8	335680
#10	335682
#12	335683
#16	334997

Tightening Refrigeration Hose Fittings

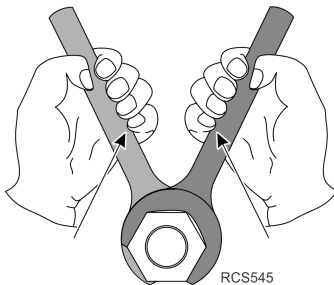
A common cause of refrigeration leaks is caused by over tightening the fittings. Always use two wrenches while tightening refrigeration hose fittings or damage to the components can occur.

Important:

1. Over tightening refrigeration fittings will cause damage to the fittings and O-Rings resulting in a refrigeration leak.
2. Always apply refrigeration oil to the threads and friction surfaces of the fittings prior to torquing.

Fitting Size	Torque Specifications
#4 Flare	11-12 lb-ft (15-16 N•m)
#4 ORS	10-12 lb-ft (13.5 -16 N•m)
#6 ORS	11-13 lb-ft (15-17 N•m)
#8 ORS	15-20 lb-ft (20-27 N•m)
#10 ORS	21-27 lb-ft (28-37 N•m)
#12 ORS	28-33 lb-ft (38-45 N•m)

Figure 49. Always use two wrenches while tightening refrigeration hose fittings or damage to the components can occur.



Suction Line Splice Connector

Certain vehicle powered truck units come equipped with a suction line splice connector with two service ports. This connector is used to attach either the oil return hose, the liquid injection hose, or on some models, both to the unit's refrigeration system.

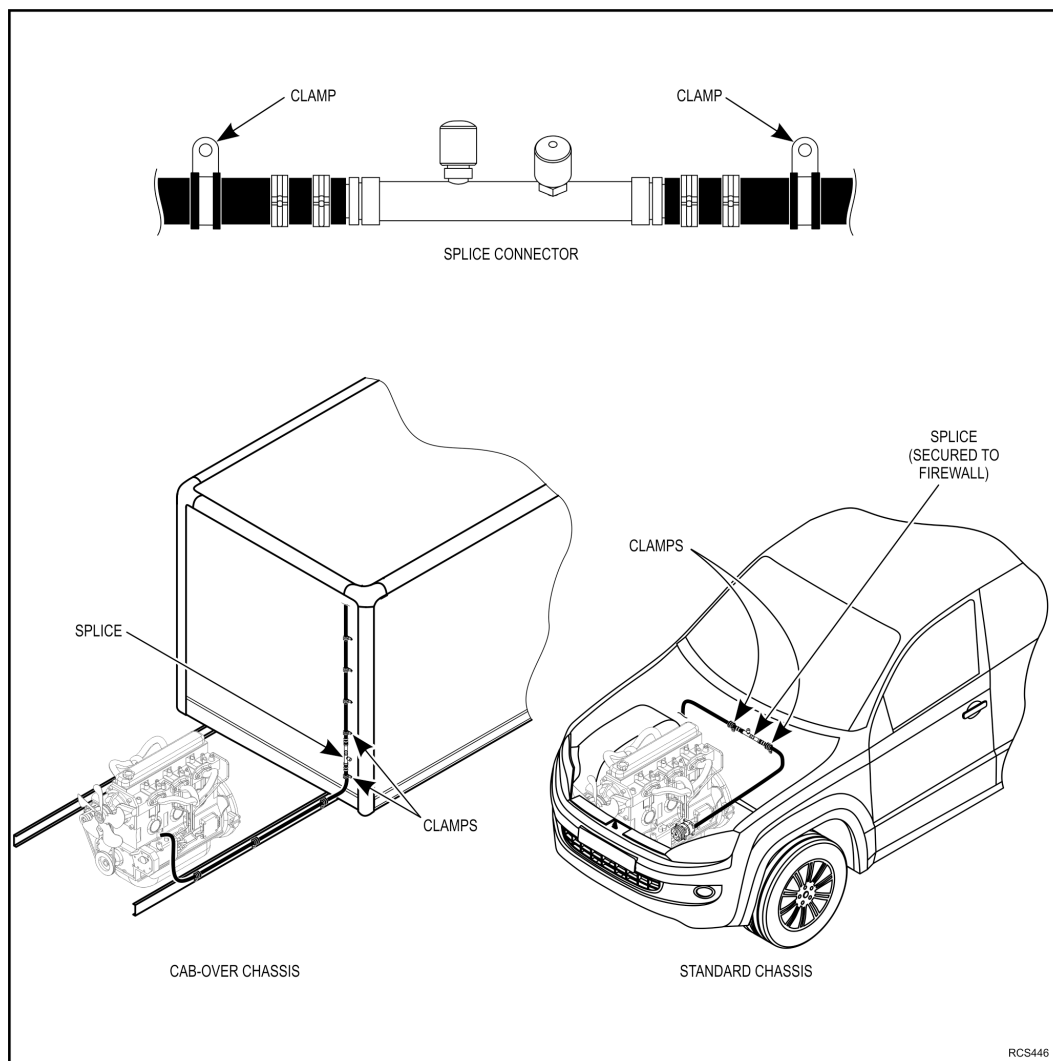
It is important that the splice connector be installed correctly and hoses connected to the correct service ports.

Installation

This splice connector must be installed in the suction hose **as close to the compressor as possible** without being on a section of hose between the frame and the engine.

- The splice connector can be mounted vertically or horizontally.
- The refrigerant hose must be secured on both sides of the splice connector to prevent movement.

Figure 50. Suction Line Splice Connector shown correctly installed.



Splice Connector Service Ports

Two service ports are located on the splice connector. Depending on the model, these ports are used to connect either the oil return hose, the Jet Cool hose, or both.

- Schrader valve(s) must be removed from the port(s) prior to connecting the oil return or Jet Cool hose.
- Unused service port must retain the Schrader valve and cap.

- These ports accept a #4 Flare fitting, **not** an ORS fitting.

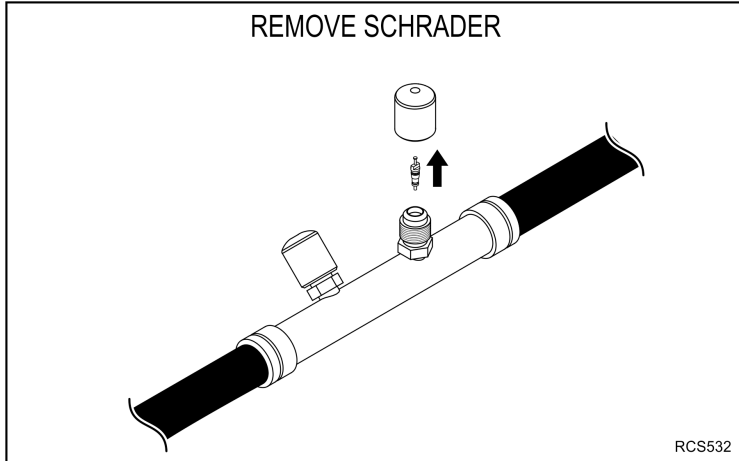
Units with Oil Return Hose

- Remove the Schrader valve from one of the service ports on the splice connector **before** attaching oil return hose.
- Attach the oil return hose with #4 Flare fitting onto service port securely.

Important: Failure to remove the Schrader valve will cause the oil return system to not function, ruin the compressor, and void your warranty.

- Unused service port must retain the Schrader valve and cap.

Figure 51. Remove Schrader valve and attach oil return hose.

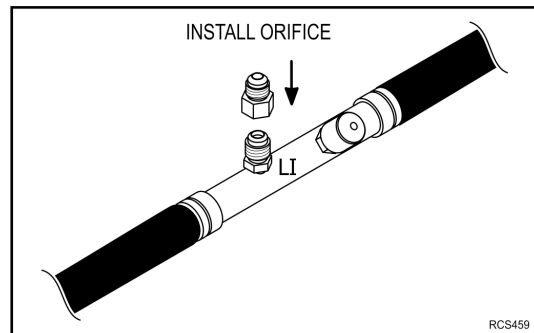
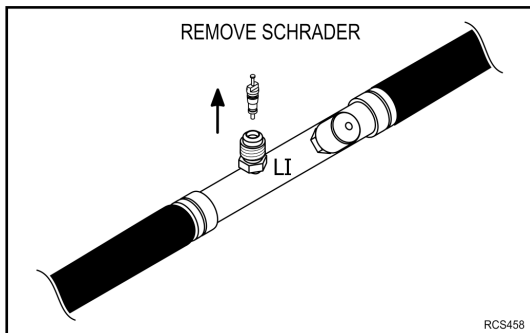


Units with Jet Cool (Liquid Injection System)

All MAX units are equipped with a liquid injection system that requires a special orifice be installed onto the service port located on the suction line splice connector.

- Remove Schrader valve from the service port on splice connector and install orifice.
- Attach the liquid injection hose with #4 Flare fitting securely. **Verify only the liquid injection hose is attached to this orifice, NOT the oil return hose.**

Important: Failure to remove the Schrader valve will cause the liquid injection system to not function, ruin the compressor, and void your warranty.



Suction Line Routing and P-Trap Formation

The P-Trap creates an oil trap in the suction line which helps ensure proper compressor lubrication. As refrigerant flows through the P-Trap it picks up oil and carries it to the compressor ensuring proper compressor lubrication.

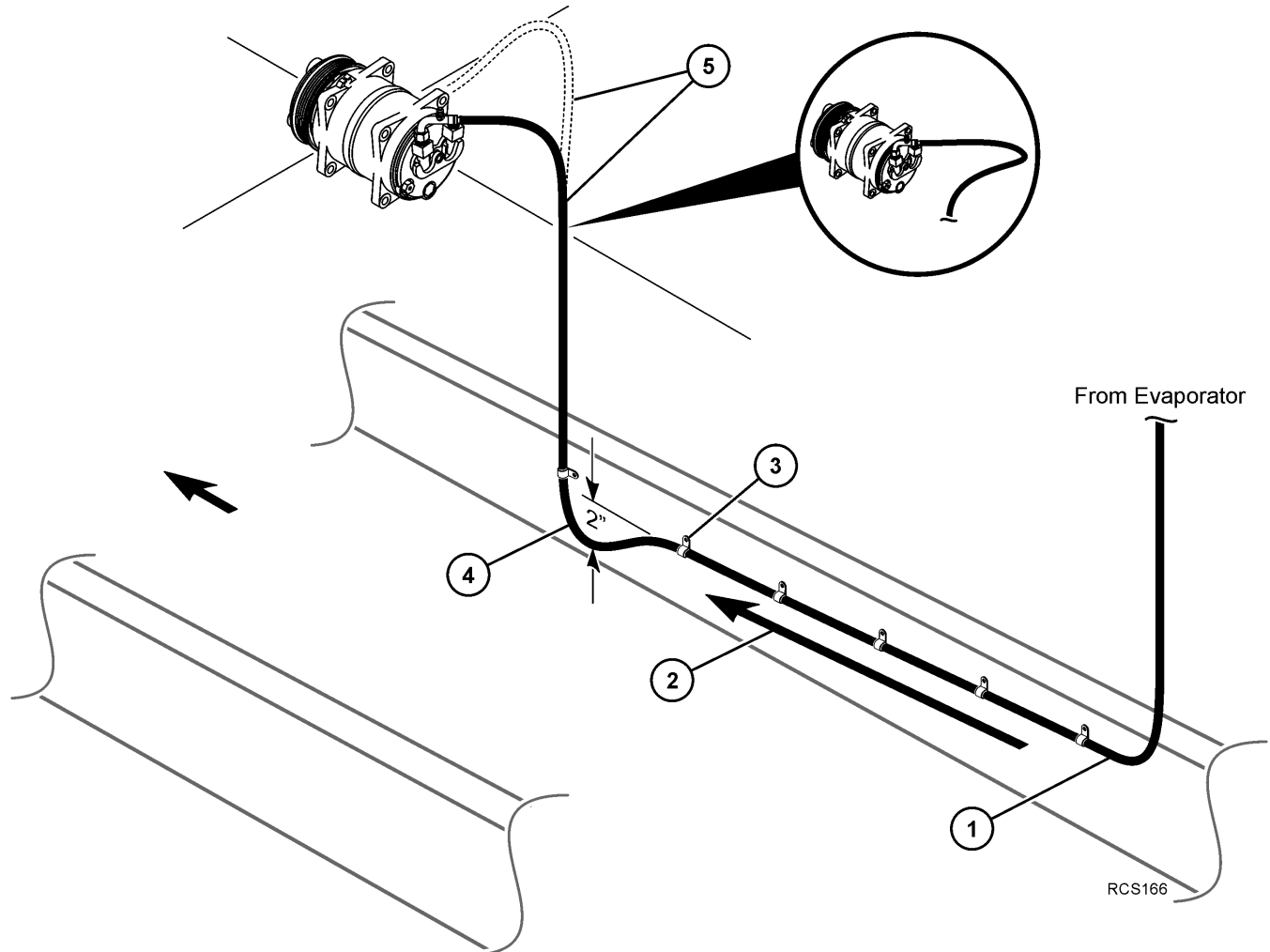
Important: It is critical that P-Trap is installed in the suction line before the roadside compressor.

1. All hose bends must maintain at least minimum bend radii with no kinks. Refer to ("[Minimum Hose Bend](#)")

Radius," p. 50).

2. Suction line should have a slight (if possible) downhill angle from the unit towards the compressor. **Horizontal angle is acceptable, uphill angle is not.**
3. Hoses should be secured adequately to prevent rubbing or chafing against hot, sharp or moving components.
4. P-Trap to be formed immediately before vertical run upwards to compressor while maintaining minimum bend radius with no kinks. It should be a minimum of 2" below the lowest point of the horizontal run hose as shown.
5. After vertical run, the suction line must be horizontal or downwards to the compressor and cannot have any sag or droop.

Figure 52. Correct suction line routing and P-Trap formation shown.



TK 2000+ System

Thermo King uses the TK 2000+ System which is designed for assembly with multi-refrigerant hose only.

Assembly Materials Checklist

⚠ CAUTION

Risk of Injury!

Do not reuse TK 2000+ Speedy Clip System components. Failure to follow these instructions and/or the use of TK 2000+ Speedy Clip System hose with fittings supplied by other manufacturers could result in sudden or unintended escape of refrigerant gases. Personal injury and/or violations of EPA regulations may occur as a consequence.

- Hose Fitting Tool (204-1045 and 204-1128)
- Hose Cutting Tools (204-677)
- TK 2000+ Multi-Refrigerant Hose
- Nipple Assembly
- Appropriately Sized Clips and Cage
- POE Refrigerant Oil (203-505)

Notes:

1. The two black O-rings on the nipple assembly are of a specific rubber compound and size. They should not be removed or replaced.
2. Thermo King recommends adherence to all guidelines, including EPA guidelines concerning the service of refrigerant systems.

Figure 53. TK 2000+ Components.



Hose Fabrication Procedures

Always keep the refrigeration fittings clean and capped until the installation of the refrigeration hoses. This helps keep moisture and debris from entering the refrigeration system.

Always keep the refrigeration hoses capped prior to connecting to the refrigeration system components. This helps keep moisture and debris from entering the refrigeration system and helps reduce the evacuation time.

Cut the Hose

1. Cut the hose to proper length with an appropriate cutting tool. **NEVER USE A SAW!** Hand-held hose cutter (204-677) has been specially designed for cutting all non-wire reinforced hose, such as TK 2000+ Multi-Refrigerant hose. Verify the cut is made square to the hose length.

Figure 54. Cut the hose with an appropriate cutting tool.



Slip on Two Clamps

2. Install two proper-size clips onto the cut end of the hose. Orientation of the clips does not affect the performance of the connection. However for ease of assembly, both clips should have the same orientation.

Important: Failure to slide the clips over the hose at this time will require the clips to be stretched over the hose or fitting later. This may permanently damage the clips. Clips cannot be reused.

Figure 55. Slide on the clamps.



Oil the Nipple

3. Lubricate the nipple and both O-Rings with a generous amount of POE or PVE oil (depending on the application). This MUST be done to lower the force of nipple insertion.

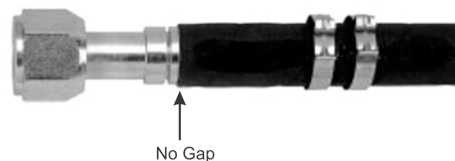
Figure 56. Apply oil to the nipple and both O-Rings.



4. Insert the nipple into the hose. To verify that the nipple is fully inserted, check to confirm there is no gap between the cut end of the hose and the shoulder on the nipple. Care should be taken to avoid kinking or other damage to the hose during nipple insertion.

Note: Be sure to wipe excess oil from the nipple and hose.

Figure 57. Hose shown fully inserted onto nipple with no gap.



Section 6 - Refrigerant Hose and Fittings Standards

Snap on the Cage

5. Snap the cage into the groove on the nipple. The arms should extend over the hose length. When the cage has been carefully installed in the cage groove, the cage will be able to rotate in the groove. This step must be performed to verify:
 - The clips will be located over the O-ring on the nipple.
 - The connection will be compatible with the connection's pressure rating.

Figure 58. Cage shown installed into the groove on the nipple.



Slide the Clips

6. Slide the clips over the cage arms and into the channels on each arm.

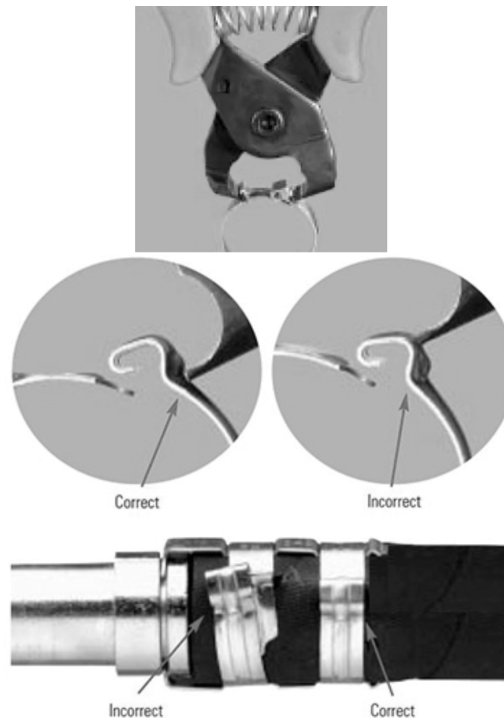
Figure 59. Clips shown installed correctly.



Close the Clips

7. Use the fitting tool (204-1045 or 204-1128) to close the clips. The tool should be positioned squarely on the clip connection points and should remain square during the closing of the clip.
 - For easiest assembly, the clasp should be closed between the cage arms.
 - Nose of the tool should be firmly seated under the assembly bump and lock latch.
 - If the tool is not kept square during closing the clip, the clasp may have an offset. Use the tool to correct the clasp alignment.

Figure 60. Use the fitting tool to close the clips correctly.



Section 7 - Electrical Standards

Overview

The Electrical Standards section of this manual defines how to properly connect the Thermo King electrical harness to the individual components and to the vehicle's electrical system.

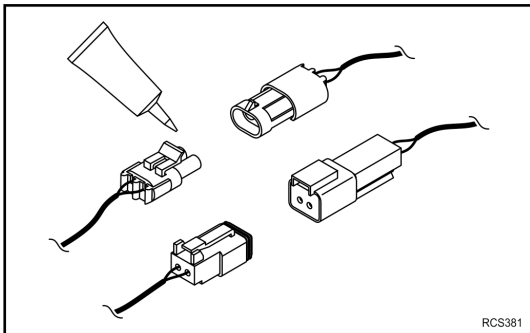
This section covers both low voltage (12 Vdc) and high voltage (115 or 230 Vac) connections.

Dielectric Grease

Dielectric grease is a non-conductive, silicone-based grease that is designed to seal out moisture and prevent corrosion on electrical connectors. The following applies to the use of dielectric grease:

- A light film should be applied only to low voltage sealed connector pins.
- **DO NOT** use on high voltage components.
- **DO NOT** use on fuses.

Figure 61. Apply a light film of dielectric grease to the pins of one end of the connectors.



DC Low Voltage Harnesses

Vehicle powered truck units operate on low voltage (12 Vdc) with harnesses routed to the systems individual components and to the vehicle's battery or ignition system. The main harness supplied with the unit comes preassembled with connectors installed. These connectors simply plug into the mating connectors of the unit's individual components (e.g., evaporator fan motors, in-cab controller, etc.). Refer to the unit specific installation manuals for individual component connections and locations.

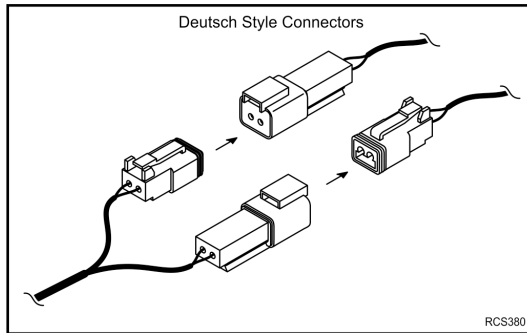
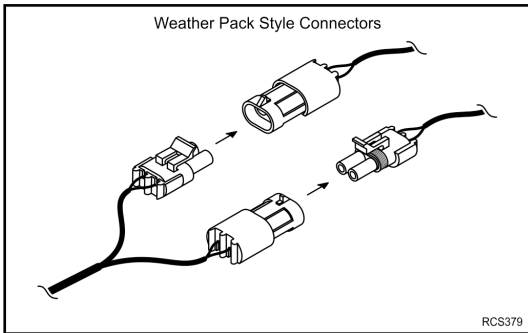
Important: Harnesses with factory installed connectors are not to be cut, shortened, or otherwise modified by installer.

Note: Some individual wires (e.g., main power, controller, and battery ground) are provided without connectors. These wires will need to be cut to length by the installer, properly terminated, and connected during unit installation.

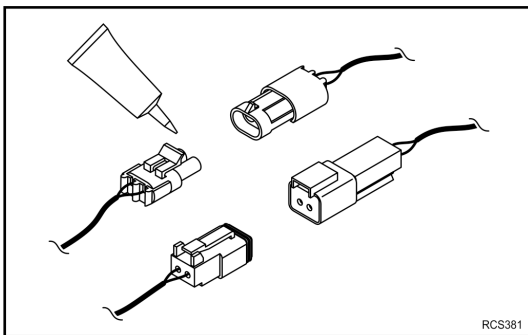
Two types of low voltage electrical connectors are used: Sealed and Unsealed.

Sealed Connectors

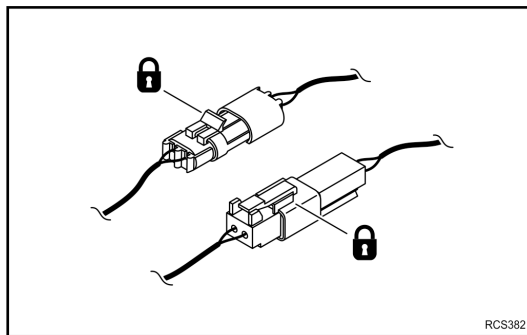
Sealed connectors are used inside the cargo box, outside the vehicle and in the engine compartment. These connectors use seals to keep moisture and dirt out of the connector to help prevent corrosion of the connections. Two styles of sealed connectors are used: Weather Pack and Deutsch.



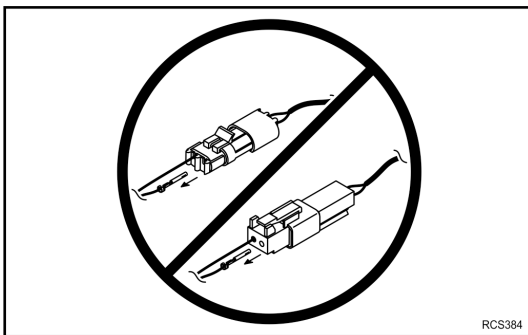
Important: All connectors must be clean and locked together securely. Always follow these procedures when connecting sealed connectors:



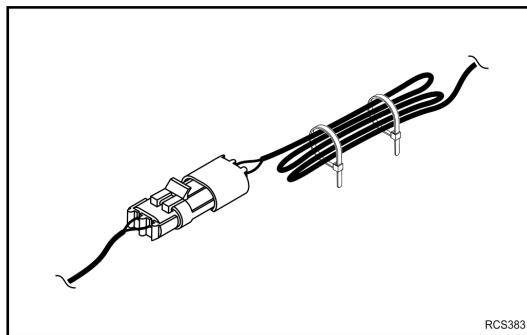
1. Apply a light film of dielectric grease to the pins of one end of the connectors.



2. Join connectors together until they lock securely in place.



3. During connection, verify the terminals did not push out the back of the connectors.



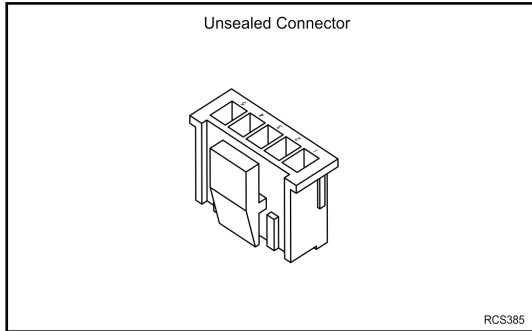
4. Secure any excess harness adequately with band wraps.

Unsealed Connectors

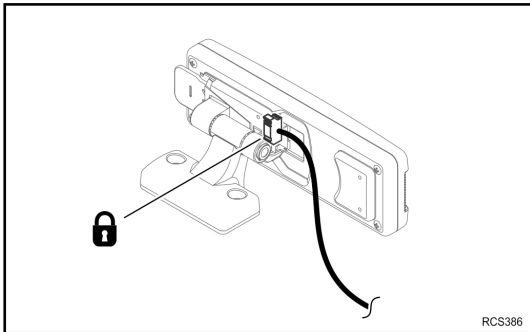
Unsealed connectors are designed for use in the interior of the vehicle where protection from moisture and dirt are not required (i.e., In-Cab controller harness). The harness supplied with the unit comes with the in-cab controller connector installed. This connector simply plugs into the mating connector on the back of the controller.

Important: *Harnesses with factory installed connectors are not to be cut, shortened, or otherwise modified by installer.*

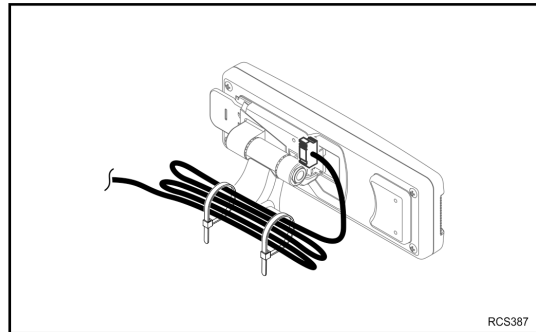
Figure 62. Typical unsealed connector shown.



Important: *All connectors must be clean and locked together securely.*



1. Attach connector to rear of controller verifying it locks securely in place.

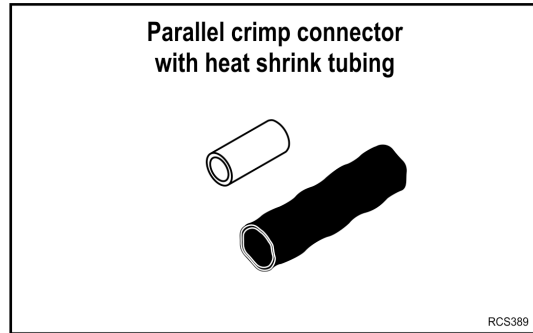
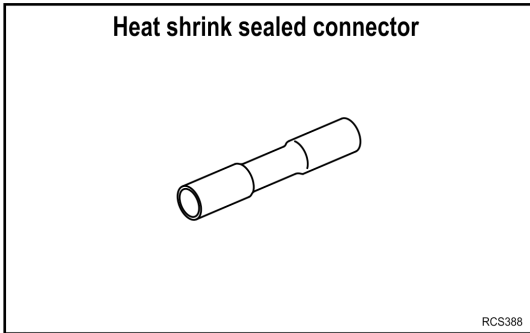


2. Secure any excess harness adequately with band wraps.

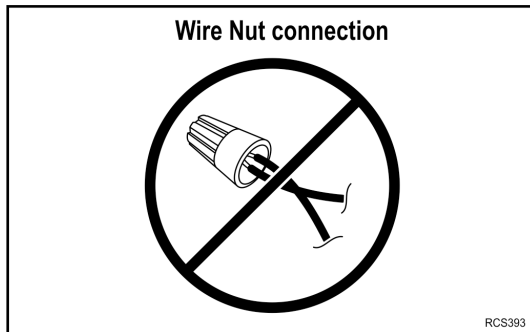
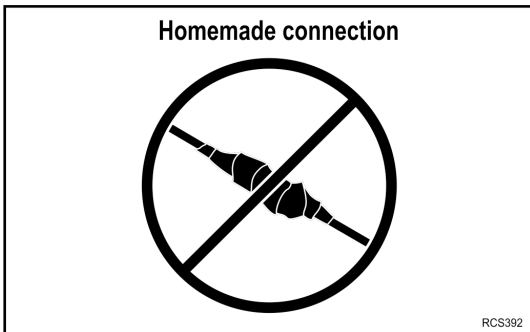
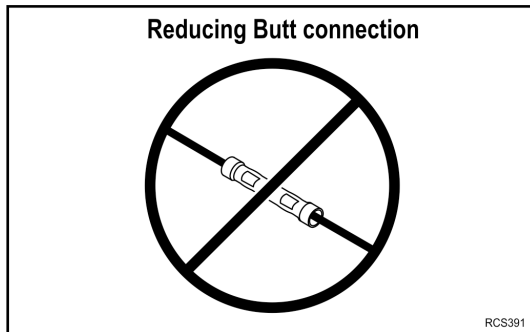
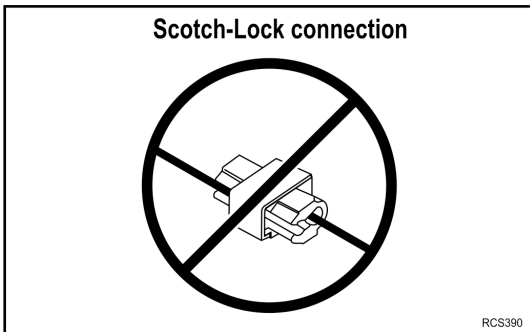
Sealed Splice Connectors

Sealed connectors keep moisture and dirt out of the connector and help prevent corrosion of the connections (i.e., inside the engine compartment). Two types of sealed splice connectors are provided by Thermo King: heat shrink butt splice and a parallel crimp connector with heat shrink tubing.

Important: No other types of splice connections should be used.



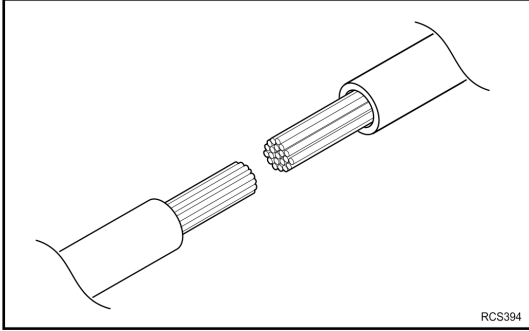
Unacceptable Splice Connections



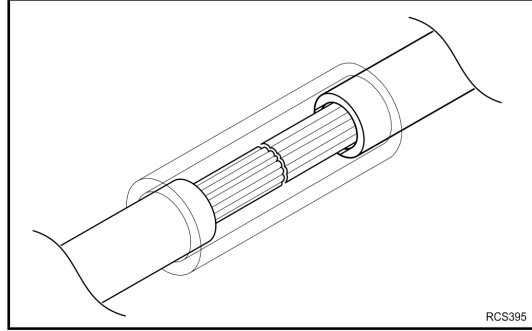
Heat Shrink Sealed Butt Splice Connectors

Important: All splice connectors must be sized for the correct gauge wires.

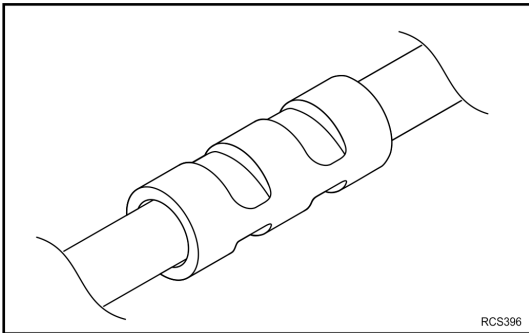
Always follow these procedures when making sealed butt splice connections:



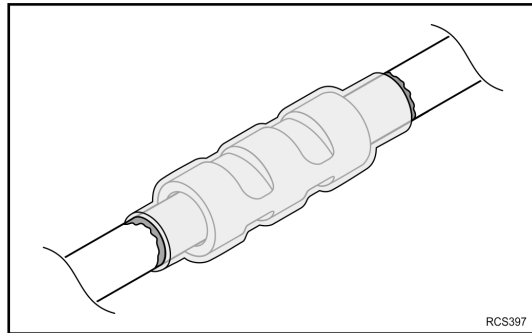
1. Strip both wire ends the same length.



2. Insert both wires all the way into splice.



3. Crimp splice securely using correct crimper tool.

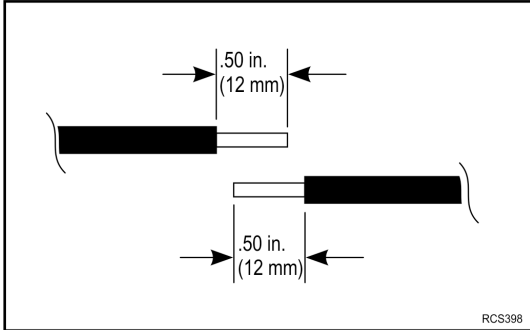


4. Apply heat until glue appears at both ends of crimp.

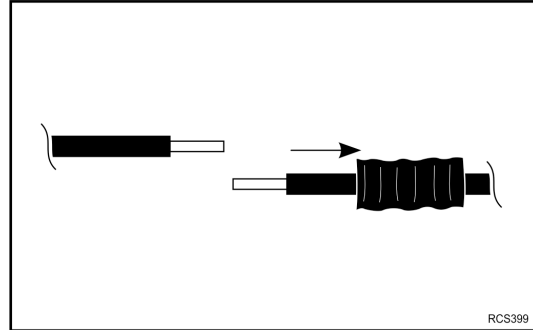
Parallel Crimp Connectors with Heat Shrink Tubing

Important: All parallel crimp connectors must be sized for the correct gauge wires.

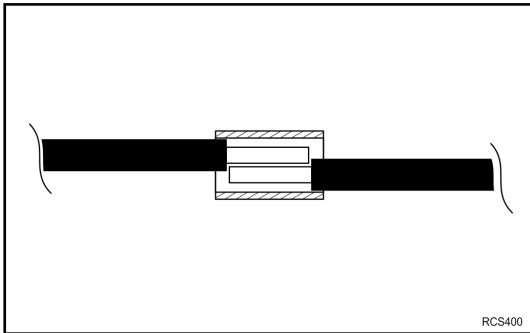
Always follow these procedures when making a parallel crimp connection:



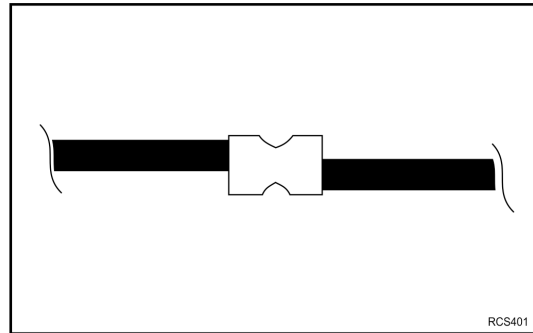
1. Strip both wires .50 in. (12 mm).



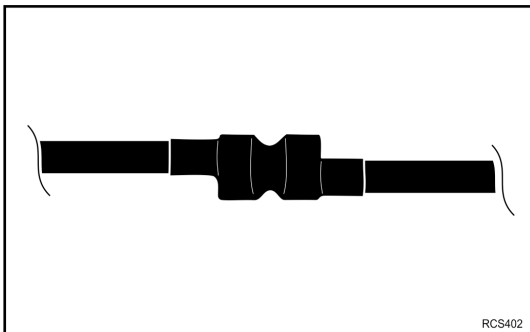
2. Slide shrink tubing onto wire away from joint.



3. Position wires side-by-side inside crimp.



4. Crimp securely using correct crimper tool.



5. Slide heat shrink tubing over joint and apply heat.

Unit Ground Wire to 12 Vdc Negative Battery Connection

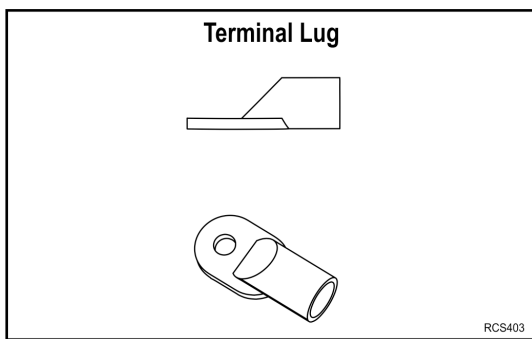
Important: Please seek advice from the vehicle manufacturer for correct connection. Most vehicle manufacturers have a Body Builder Guideline Web Portal, to get the information registration is usually required. The method we are showing here may not be compliant with some.

Battery terminal lug connectors are required to connect the unit's ground wire to the vehicle's negative battery connection. Various size terminals are supplied in the installation kit. The installer is responsible to install the correct size terminal lugs for the specific size battery terminals.

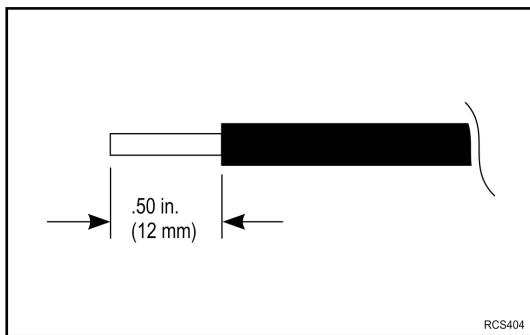
Important:

1. Terminal lug must be sized for correct gauge wire.
2. No other means of negative (-) battery connection is allowed.
3. All battery connections must be clean and tight.

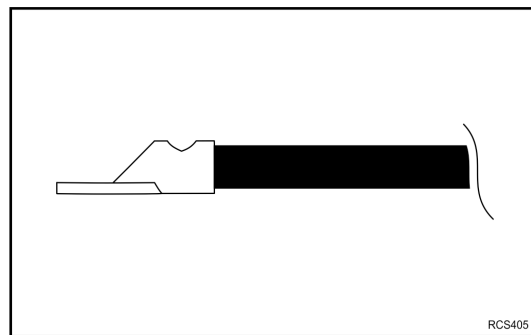
Figure 63. Typical battery terminal lug shown.



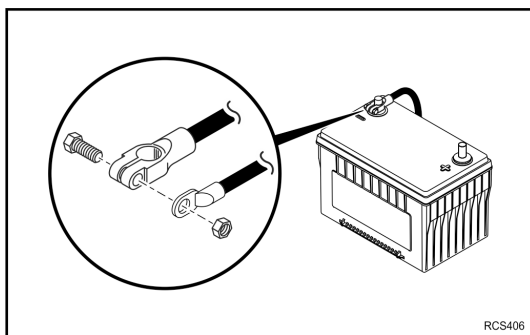
Always follow this procedure when attaching the lug to the unit's ground wire and to the vehicle's battery:



1. Strip wire .50 in. (12 mm).



2. Crimp terminal lug securely onto wire using correct crimper tool.



3. Attach terminal lug securely onto negative battery connection.



Unit Main Power Connections to 12 Vdc Positive Battery Connection

The unit's main power (2) wire and the (BAT) wire (with mini-fuse*) must both be connected to the vehicle's positive battery connection with the supplied large sealed in-line fuse kit. The kit contains a large in-line fuse assembly, parallel crimp connector, heat shrink tubing, and three terminal lugs. The correct size terminal lug with heat shrink tubing must also be installed.

Important: *The large in-line fuse is a non-serviceable assembly.*

* An in-line mini fuse assembly with a sealed splice connector must be first attached to the BAT wire. Then the BAT wire along with the 2 wire can be connected to the sealed in-line fuse.

Always follow the best practices below when connecting the unit's in-line fuse to the vehicle's positive (+) battery connection.

Important: *No other means of positive (+) battery connection is allowed.*

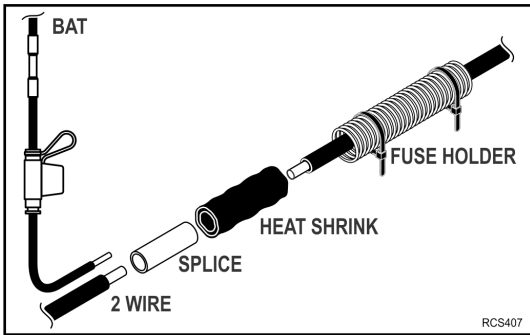
Large In-Line Fuse Best Practices

- The large in-line fuse must be located in an accessible location as close to the battery as possible while keeping it from directly touching or laying on the battery.
- The distance from the battery positive (+) terminal to the large in-line fuse should be kept to a minimum and not exceed 12.00 in. (305 mm).
- Depending on the application, the wire from the large in-line fuse to the unit's power wire may need to be shortened to eliminate excess or coiled wire.
- Large In-line fuse should be positioned **vertically** to help promote water drainage away from fuse.
- Large fuse mounted **horizontally** must have the slit in the split loom sleeving pointing downwards to keep water from migrating into the fuse.
- Large in-line fuse must be secured to the vehicle or alongside the positive battery cable with the supplied cable ties.

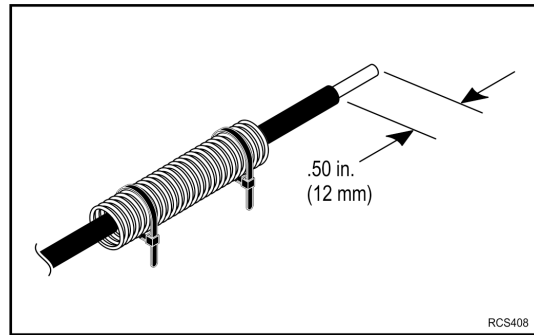
Battery Connections Best Practices

- If the vehicle is equipped with a battery disconnect switch, always connect the unit's power wire after the switch. This allows power to the unit to be turned off by the battery disconnect switch.
- The ring terminals used must be sized to match the battery power stud or lug bolt. Oversized ring terminals can contribute to high resistance resulting in the fuse overheating and failure. Various size terminal rings are provided in the kit - choose the correct size for your specific battery requirement.
- All hand crimped terminals must be securely crimped and covered with heat shrink tubing.
- Use harness routing that provides adequate protection against possibility of short circuit.
- All battery/electrical connections must be clean and tight.

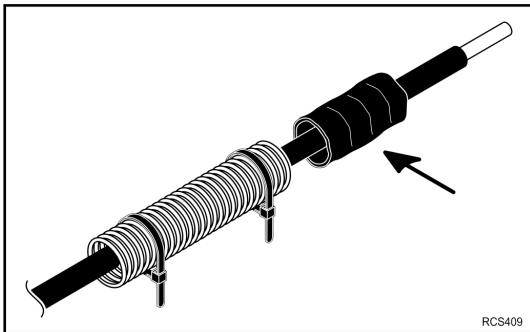
Always follow this procedure when connecting the 2 and BAT wires together with the large in-line fuse and attaching the vehicle's battery:



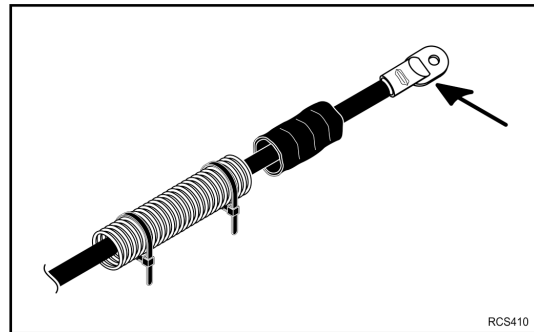
1. Attach the in-line fuse to the **2** and the **BAT** wires by following the parallel crimp connector procedures in this section.



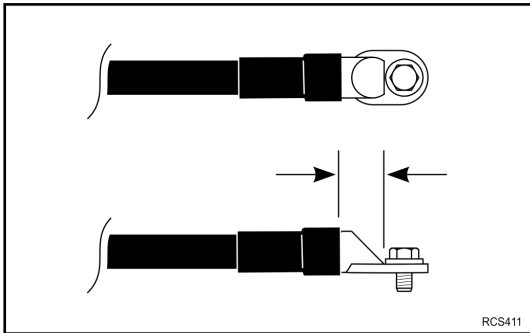
2. Strip in-line fuse wire end .50 in. (12 mm).



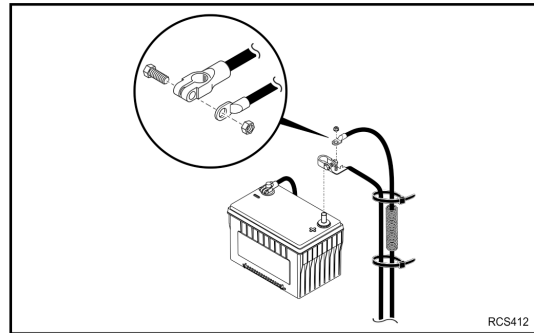
3. Slide shrink tubing onto wire and move it away from the wire end.



4. Install proper size terminal lug and crimp securely using correct crimper tool.



5. Position heat shrink tubing over lug so it does not interfere with connection and apply heat.



6. Attach fuse terminal securely onto the positive battery connection.

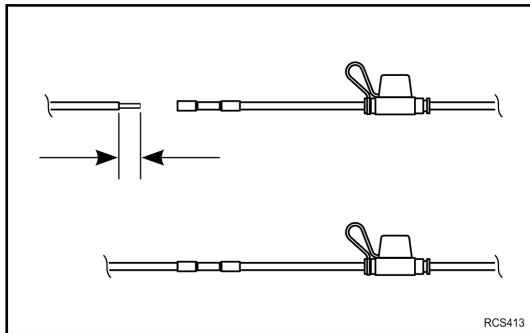
12 Vdc Positive Ignition Connection

Important: Please seek advice from the vehicle manufacturer for correct connection. Most vehicle manufacturers have a Body Builder Guideline Web Portal, to get the information registration is usually required. The method we are showing here may not be compliant with some.

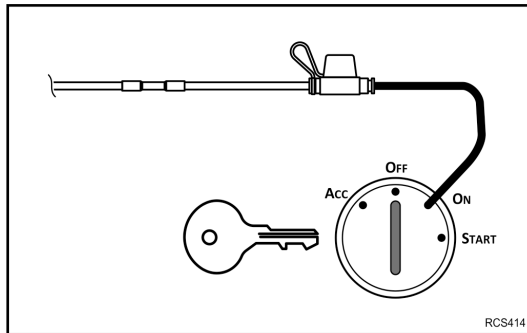
The HMI controller (01) wire must be connected to the vehicle's ignition switch **ON** circuit. An in-line mini fuse assembly is supplied with a sealed splice connector attached and must be attached to the HMI controller power (01) wire. This power wire then must be connected to a fused circuit of the vehicle to provide power to the in-cab controller only when the ignition switch is in the ON position.

Important: No other means of fused power connection is allowed.

Always follow this procedure when connecting the 4 amp in-line fuse power connection to the vehicle's fused ignition ON circuit:



1. Cut power wire (01) to appropriate length, attach to in-line fuse splice connector and crimp.



2. Attach fused power (01) wire to ignition ON circuit. Ignition connection will vary by application.

AC High Voltage Power Cable

⚠ WARNING

Hazardous Voltage!

All high voltage wiring must be done by a licensed electrician and comply with all NEC state and local codes.

Units equipped with the standby option (Models 20 and 50) come pre-wired from the factory with a power cable attached to the remote receptacle box. The installer needs only to route and secure the cable and box onto the vehicle.

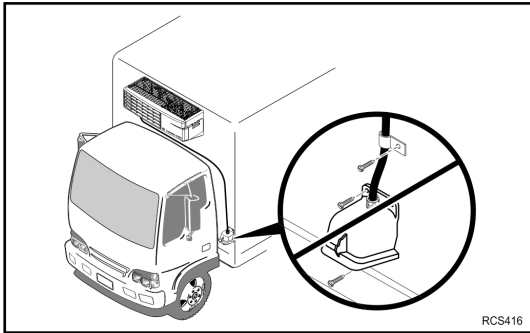
Note: A standby power cable with mating connector plug will be required by the customer to attach to the truck's receptacle box. Thermo King recommends that only a correctly sized and fused power source be used for electric standby operation. Specific information regarding fuse, circuit breaker and power cord requirements can be found in the unit's Operator's Manual. Standby power cable wiring connections for both the connector plug and receptacle for each available voltage option are included on the next page of this manual.

Receptacle Box Installation

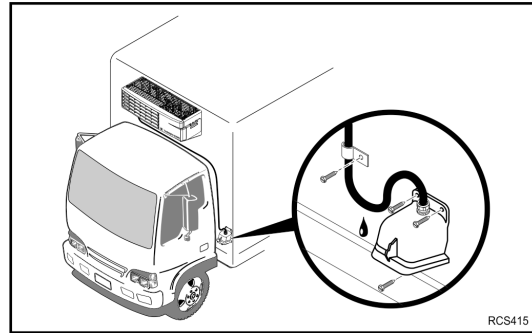
Always follow these requirements when installing the standby receptacle onto the vehicle:

- The receptacle box must be installed securely to the exterior of the vehicle. It must be easily accessible while not interfering with the driver's visibility or operation of the vehicle.
- The power cable must be routed and secured adequately to the vehicle.
- A drip loop is required on the power cable to prevent water from traveling directly down the cable and migrating into the receptacle box.

Important: DO NOT roll up the excess electrical wire or create splices in the electrical wire.



INCORRECT - No Drip Loop



CORRECT - With Drip Loop

Standby Power Cable Wiring Connections

Figure 64. 115V / 1PH / 60HZ Wiring Connections.

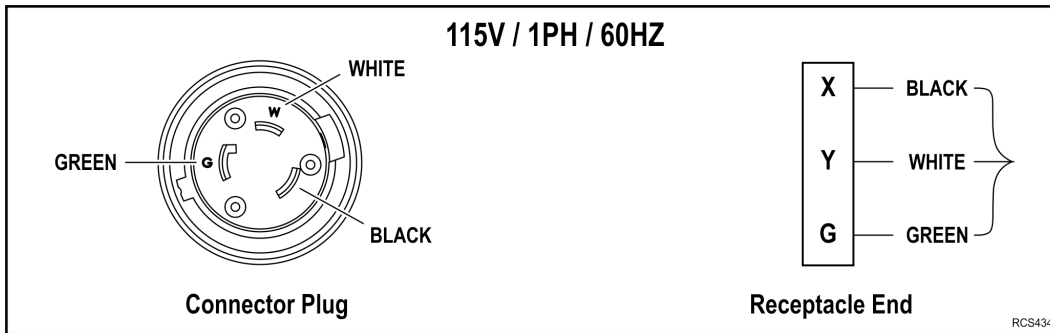


Figure 65. 230V / 1PH / 60HZ Wiring Connections.

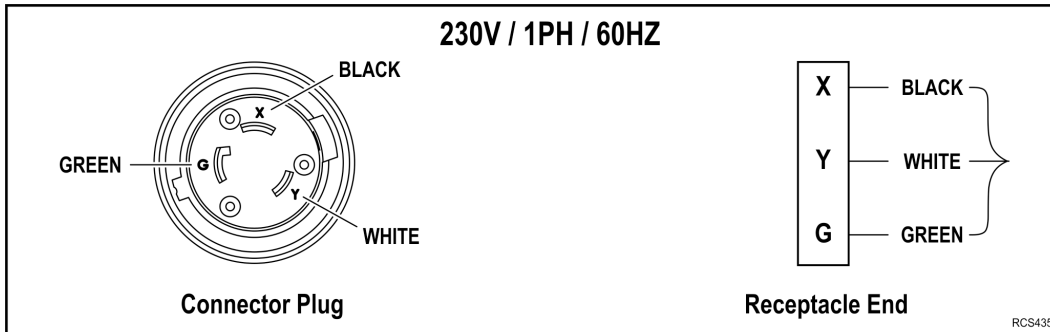
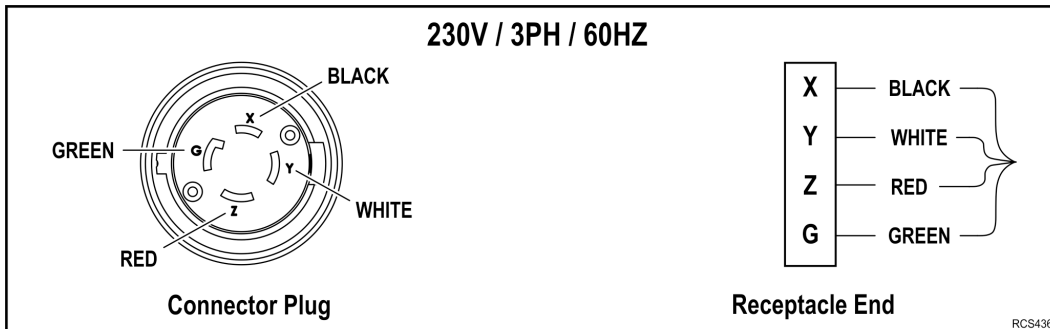


Figure 66. 230V / 3PH / 60HZ Wiring Connections.



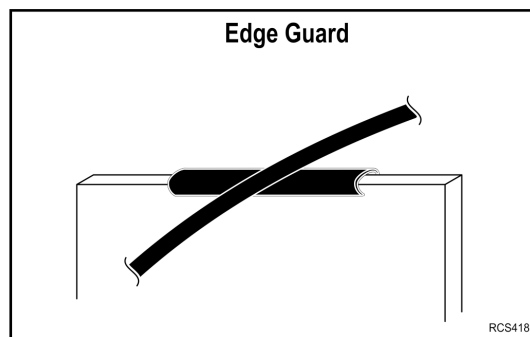
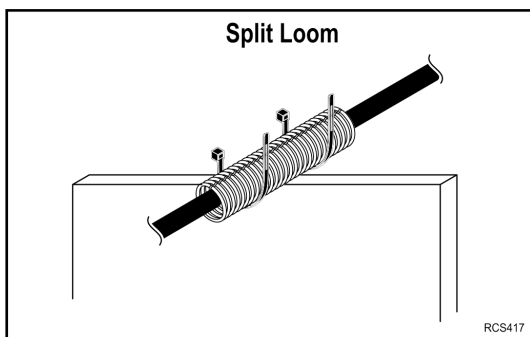
Electrical Harness Protection

All Thermo King low voltage (12 Vdc) electrical harnesses and all high voltage power cables (115 and 220 Vac) must be installed and routed correctly to prevent damage. Taking your time to properly route and secure the harnesses will go a long way in providing a trouble free unit.

Abrasion Protection

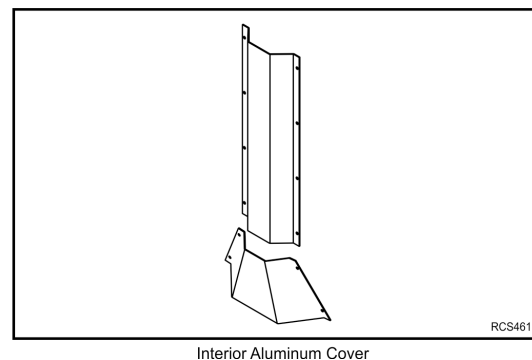
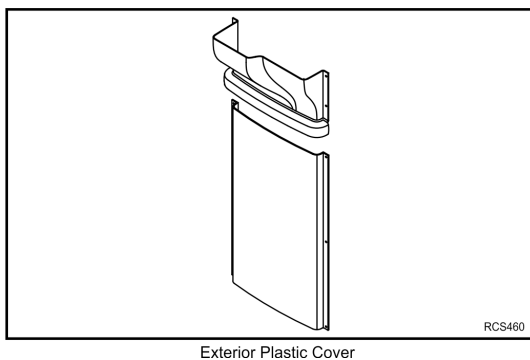
Abrasion protective is required on all electrical harness where rubbing and chafing may be an issue. Split loom or edge guard (installer supplied) is recommended to help provide protection. Harnesses should also be secured with band wraps in these areas as well to minimize movement.

- Always keep electrical harnesses from rubbing or chafing against sharp metal objects, rotating components or hot components.
- Protective cover, split loom, shields or high temperature wraps (installer supplied) should be used if necessary.



Protective Covers and Guards

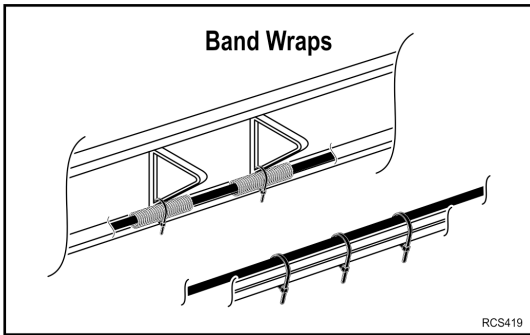
Protective covers and guards are recommended for any exposed electrical harnesses either inside or outside the cargo box that could become damaged during daily use. These covers and guards are available from Thermo King.



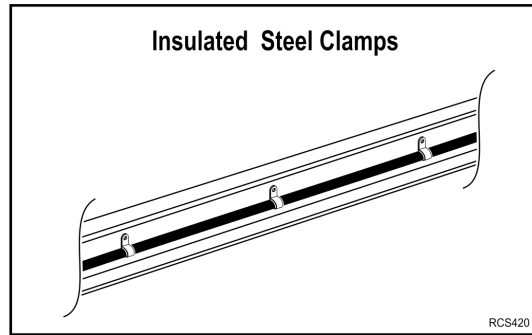
Routing and Securing Electrical Harnesses

All electrical harnesses must be neatly routed and secured adequately to prevent damage from rubbing, chafing, or making contact with hot or rotating components.

- Band wraps can be used to secure unit harnesses to existing vehicle harnesses, frame mounts or refrigeration hoses.
- Secure harnesses to vehicle's chassis with insulated steel clamps when no existing attaching points are available.
- Harnesses can also be bundled together with other hoses or harnesses.



Electrical harnesses should be secured to existing frame mounts or to vehicle's harnesses with band wraps as shown.



Electrical harnesses should be secured to vehicle's frame with insulated clamps as shown.

Routing Harnesses through Metal Holes

Electrical wires routed through metal holes must be protected from damage and to avoid electrical shorts.

Figure 67. All burrs and sharp edges must also be removed from all holes drilled in metal.

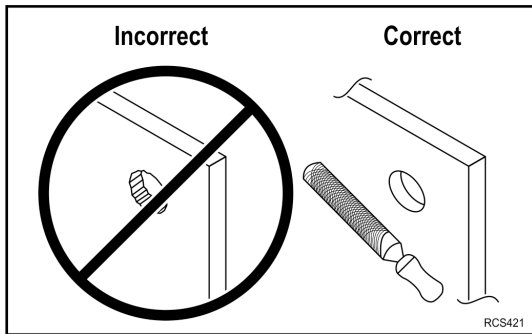


Figure 68. Rubber grommets (installer supplied) must be used to provide protection to electrical wires running through metal holes.

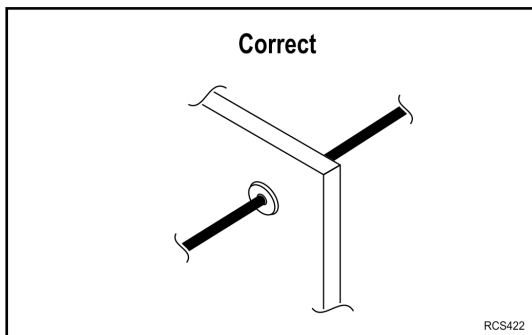
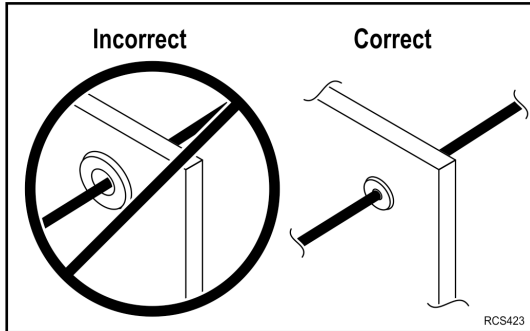


Figure 69. Rubber grommets must be sized correctly for both the hole and for the harness to prevent water intrusion.



Protective Heat Shields

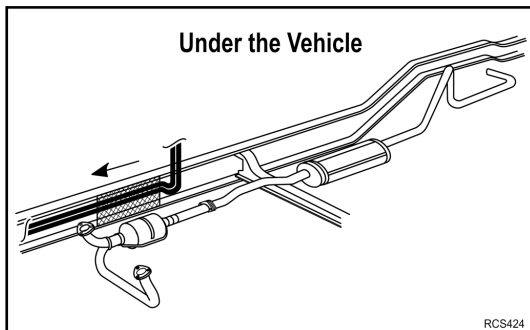
The installation of protective heat shields (installer supplied) is recommended for any exposed electrical harnesses located near vehicle heat sources such as the exhaust system. Exhaust temperatures can exceed 1600°F and cause damage to electrical harnesses if they are not properly shielded.

Electrical harnesses need a shield when located within:

- 4.00 in. (102 mm) from engine exhaust manifolds, catalytic converters and mufflers.
- 2.00 in. (51 mm) from exhaust systems under the vehicle.

Note: Exhaust system move with the engine. Always allow for exhaust and engine movement when routing and securing electrical harnesses to the engine or chassis.

Figure 70. Protective heat shield shown next to catalytic converter.

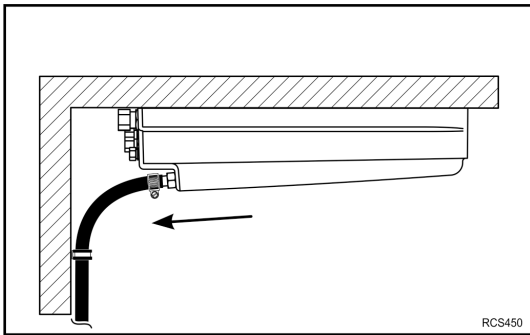


Section 8 - Evaporator Drain Hose Standards

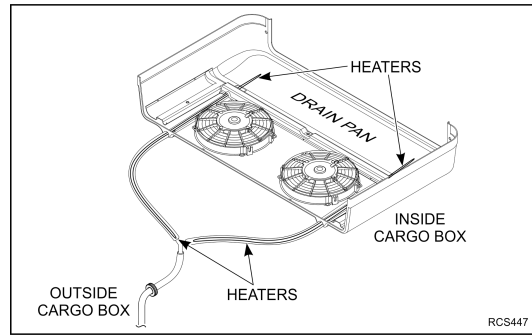
Overview

During normal operation, condensate moisture accumulates on the evaporator coil fins and drips into the drain pan. Drain tubes in the pan allow the water to drain out of the evaporator, down the drain hoses and out of the cargo box onto the ground. The supplied drain hoses must be installed onto both evaporator drain tubes. One-way water valves (kazoos) are supplied to help keep heat, exhaust fumes and debris from entering the cargo area up through the drain hose(s). These valves must be installed securely onto the end of the drain hose with a band wrap.

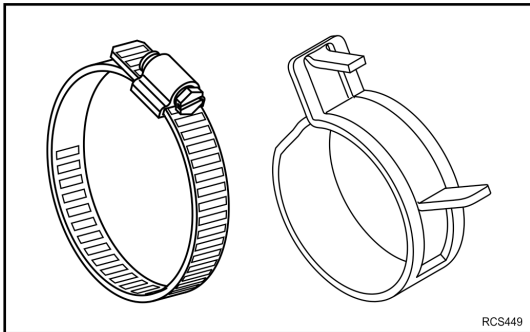
Drain Hose Standards



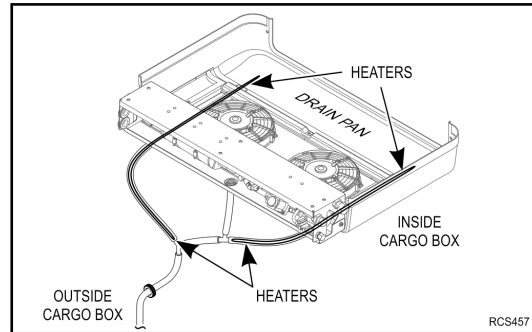
Evaporators and drain hoses must have sufficient slope to verify the water drains away from the evaporator.



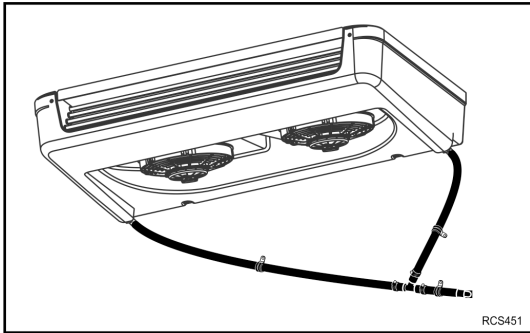
Attach drain hoses onto both evaporator drain tubes and combine into a single hose using supplied Y-connector. MAX Units Only - Install heater into each drain hose as far as they will go.



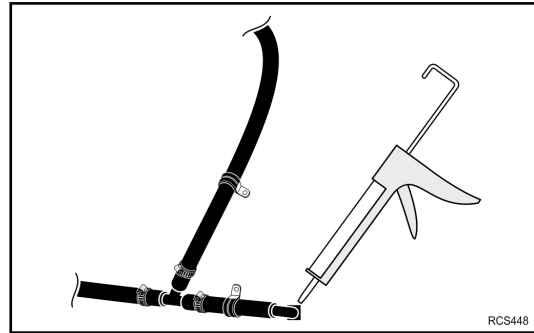
All hose connections must use worm drive or constant tension clamps - NOT BAND WRAPS.



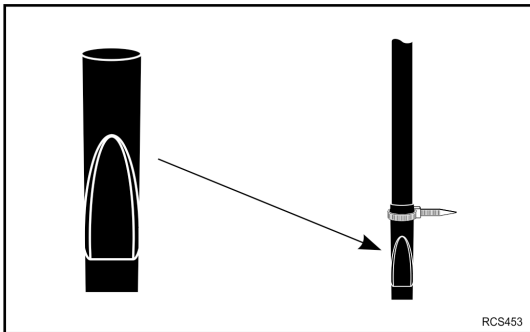
ES320 MAX 30/50, V520 RT, and nose-mounted SPECTRUM units ONLY: These evaporators are equipped with an accumulator assembly which includes a separate drain hose. This drain hose must be connected along with the other two drain hoses using the T and Y connectors.



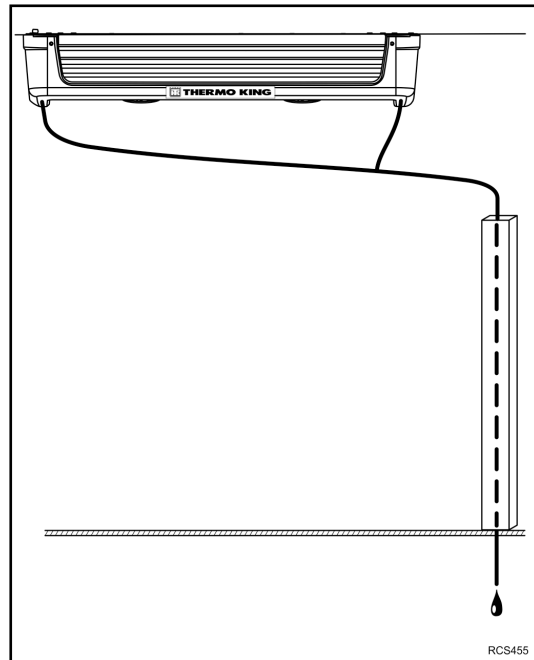
Drain hoses must be routed without kinks or sharp bends and adequately secured to wall with clamps.



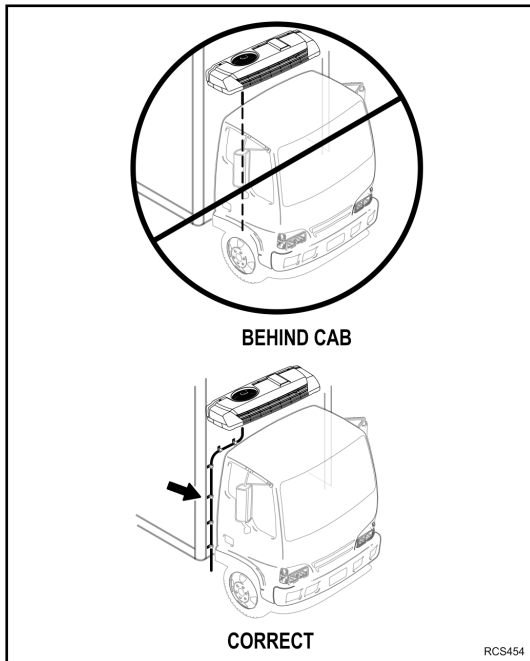
Access holes must be sealed both inside and outside with neutral/alcohol cure silicone sealant.



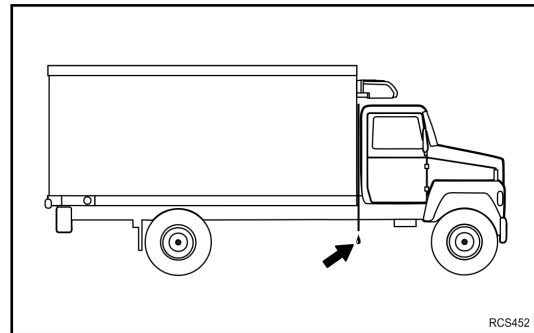
One-way water valves (kazoos) must be installed securely onto the end of the drain hose with a band wrap.



Drains that run inside the walls should be installed in a channel so they can be easily cleaned or replaced if needed.



On box trucks, the drain hose should not be run behind the cab as they will not be serviceable. Drain hose should always be run to the outside.



Drain hoses must be routed out of the cargo area and exit under the vehicle.

Drain Heater Standards

Evaporators that operate in below freezing cargo temperatures are equipped with drain heaters. These heaters (resistance wires) are inserted into the drain hoses (by installer) and get warm enough to keep the condensate in the drain hoses from freezing.

All MAX (R404A/R-452A) system evaporators are equipped with drain heaters. They are also available as an option on Non-MAX (R-134a) systems.

Spectrum Models, when heater wires are installed in fresh compartments, the supplied fuse must be installed.

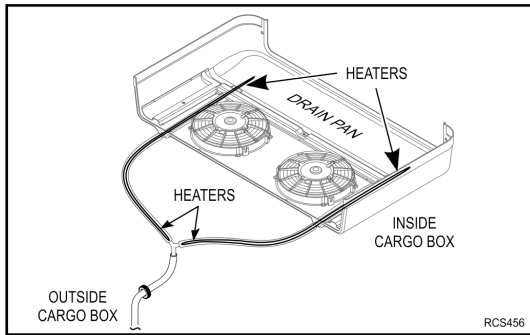
Heater Resistance Wires

Heater wires must be extended into drain pan and be inserted into each drain hose as far as they will go.

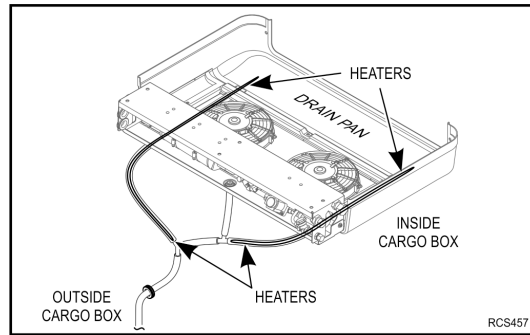
- NEVER CUT HEATER RESISTANCE WIRES!
- DO NOT install more than one heater wire into each drain tube.
- DO NOT use band wraps to hold heater wires.
- DO NOT cover or wrap heater wires.
- DO NOT pinch the end of the heater wires tight.



Section 8 - Evaporator Drain Hose Standards



Heater wires must extend into the drain pan and inserted into each drain hose as far as they will go.



ES320 MAX 30 / 50, V520 RT and nose-mounted SPECTRUM units ONLY: All three drain hoses must be connected together into a single hose and immediately exit the cargo box. Heater wires must extend into the drain pan and inserted into each drain hose as far as they will go.

Section 9 - Configuring Software and Controller Procedures

Controller Overview

This chapter is a high level overview of the controller. The installer should refer to the DSR III Diagnostic Manual (TK 61096) for more detailed instructions on diagnostics, repair, and operation.

Two different controllers are used on VP truck units: the DSR II and DSR III.



DSR II Controller



DSR III Controller

- The DSR II and DSR III Controllers are not interchangeable as the pin-outs, mounting pattern, and harness connecting them to the unit are different.
- The controller's fuses are different for 12 Vdc and 24 Vdc configurations. See the unit specific installation manual's wiring schematic for exact fuse values.
- The DSR II and DSR III Controllers both use the same DSR In-Cab Display.
- The DSR II and DSR III controllers have different firmware (software) that programs the controllers.
 - The DSR II controllers have version **380.10** loaded from the supplier.
 - The DSR III controllers have version **544.03** loaded from the supplier.
- All DSR controllers require a configuration file that is dependent on **both the firmware version and type/family of units**. Example: V520RT MAX 50.

NOTICE

Equipment Damage!

Installing the incorrect configuration file can result in damage to the unit.

Note: Refer to ("Configuration Files," p. 83) for the loading procedures.

Figure 71. DSR In-Cab Display



HMI Overview

The HMI is very simple to operate with five buttons and a LCD display screen. The icons for the five buttons are shown below with their functions:



On/Off Key: Turns the unit on and off. Always lit (except when the unit is disconnected). Provides a visual indication that the unit is powered-up.



Select Key: Scrolls through the menu screens.



Up Arrow Key: Chooses menu screen actions or increases the setpoint temperature or other settings.



Down Arrow Key: Chooses menu screen actions or decreases the setpoint temperature or other settings.



Enter Key: Executes menu screen actions or loads the setpoint temperature or other new settings.



Buzzer: Sounds an audible warning whenever these events occur:

1. When the vehicle battery and the optional Electric Standby power source are connected simultaneously
2. When the load compartment doors are opened while the unit is operating.

The LCD display has many icons to help the user identify what function the unit is performing and what state the compartment is at. The icons displayed on the home screen are shown below:



Cool Icon: Appears when the load compartment is cooling.



Heat Icon: Appears when the load compartment is heating.



Degrees Icon: Indicates whether the on-screen temperature reading is in degrees Celsius (°C) or degrees Fahrenheit (°F).



Maintenance Icon: Appears when a user-defined maintenance event should occur.



Defrost Icon: Appears when the evaporator coil is defrosting (the unit is in Evaporator Defrost mode)



Condenser Defrost Icon: Appears when the condenser coil is defrosting and at the same time as the defrost icon (the unit is in Condenser Defrost mode)



Alarm Icon: Appears when an alarm condition has been detected by the microprocessor.



Electric Icon: Appears when the unit is in Electric Standby mode.



Setpoint Icon: Appears when the setpoint temperature is being shown in the display.

Controller Menu

The DSR II and III controllers have four menus: the main menu, the hour meter menu, the information menu, and the guarded access menu. Refer to (Figure 72, p. 82).

Main Menu

To access the main menu, press the Select key. Press the select key to scroll through the menu.

- The main menu is used to view the alarms, initiate a manual defrost, and modify the set point(s).

Hour Meter

To access the hour meter menu, press and hold the Select key for three seconds. Press the select key to scroll through the menu.

- The hour meter menu contains the following times: maintenance hour counter, total unit hours, vehicle compressor hours, and standby compressor hours. Note:

Note: The maintenance hour counter is the only resettable counter and must be accessed through WinTrac™.

Information Menu

To access the information menu, press and hold the Up Arrow key and the Enter key simultaneously for three seconds.

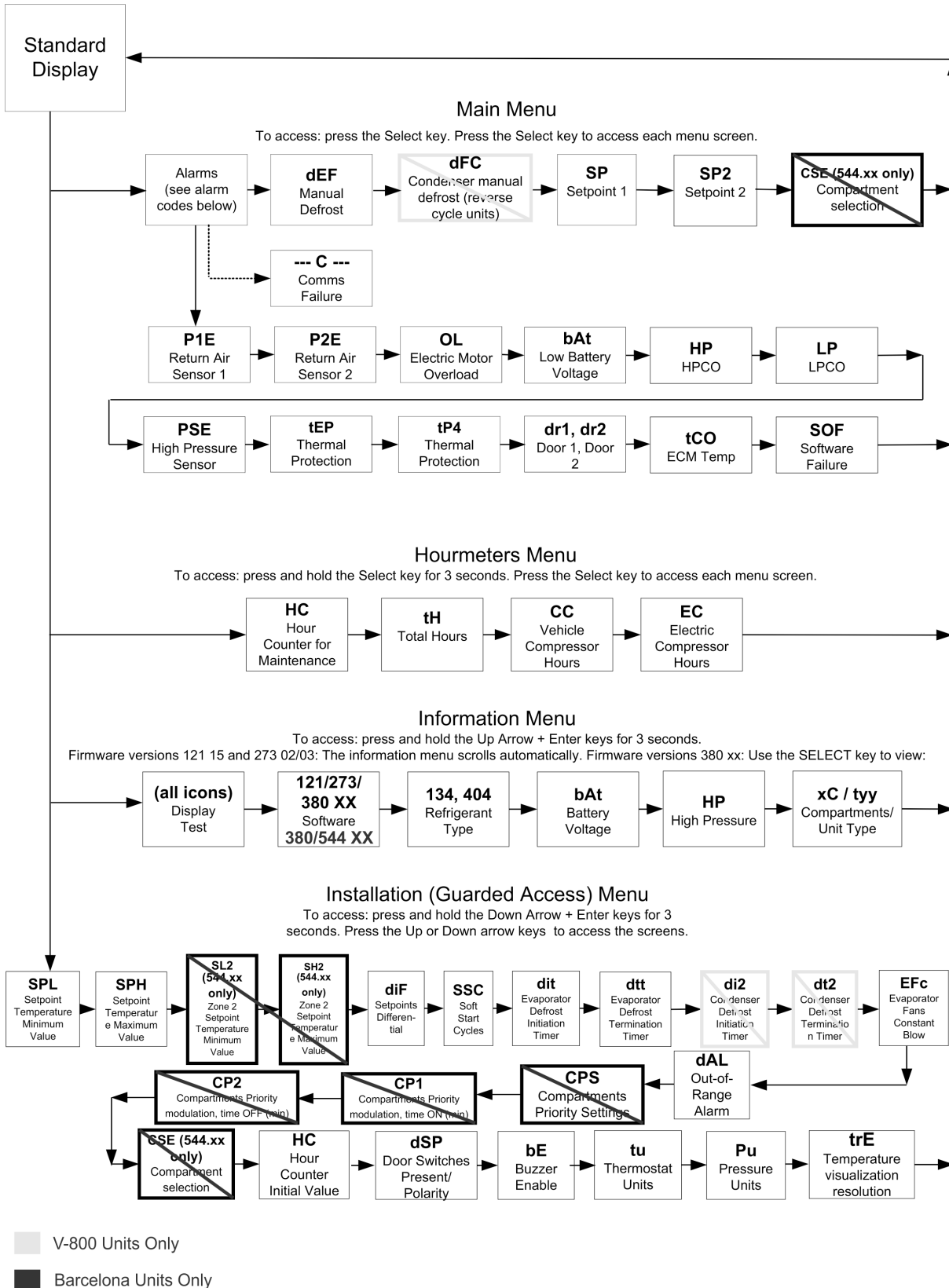
- The information menu contains a display test (activates all pixels on the display), displays the software (firmware) version, the refrigerant type (r-134a or r-4xx), the battery voltage, the high pressure transducer reading, and the number of compartments (1C for 1 single temp units and 2C for multi-temp units) and unit type (t10, t20, t30, and t50.)

Installation Menu

To access the installation (guarded access) menu, press and hold the Down Arrow key and the Enter key simultaneously for three seconds.

- The installation menu contains menu options that can be set for customer specific applications. These options are the following: the lower limit and upper limit set points, the set point differential (number of degrees the temperature can drift from set point before energizing the clutch), the soft start cycle for the compressor (**MUST REMAIN ON FOR ALL UNITS**), defrost initiation timer (the time between checking coil for ice), defrost termination timer, evaporator fans constantly on, the out of range alarm, the hour counter initial value, door switch presence/polarity, buzzer enabled, temperature units (°F/°C), pressure units (PSI/bar), and the temperature resolution.

Figure 72. Direct Smart Reefer Microprocessor Controller Menus and Screens (viewed at the in-cab control box)



Configuration Files

NOTICE

System Damage!

Failure to properly load the correct configuration files with the addition of the electric heat option will result in decreased performance and possible damage to the system.

Every Thermo King Vehicle powered system requires a unit specific configuration file to be loaded onto the DSR controller either at the factory or at the installing dealer depending on which options are being added. The configuration file must be loaded using WinTrac 5.7 or newer, a 204-1126 DSR interconnect cable, and a 42-575 USB to serial adapter.

Important: Any unit getting the coolant heat / electric heat option will need a new configuration file loaded by the installing dealer.

The configuration files can be found on TSA Info Central using the following path: Home > Software Downloads > Truck and Trailer > Microprocessors > Truck Microprocessor Updates > Vehicle Powered.



204-1126 DSR Interconnect Cable

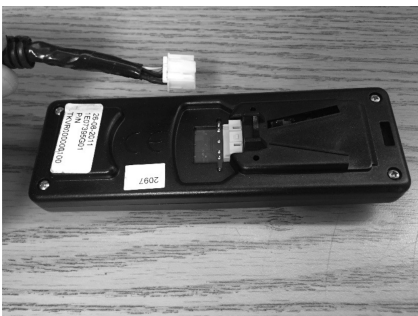


42-575 USB to Serial Adapter Shown.

Flash Loading Configuration Files

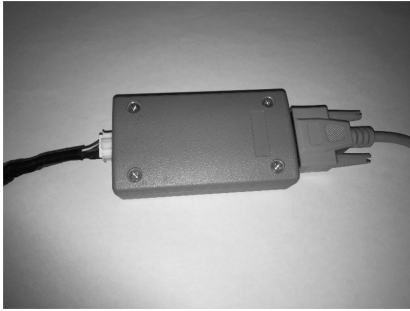
1. Verify the unit's main power wire (02) and BAT wires are fused and connected to the positive lug on the vehicle's battery. (Reference chapter 7 of this manual.)
2. Verify the unit's main ground (CHA) is connected to the negative lug on the vehicle's battery. (Reference chapter 7 of this manual.)
3. Verify that the unit's ignition wire (01 or ACC) is fused and connected to a 12 Vdc ignition source on the truck that is only powered when the vehicle's ignition is on. (Reference chapter 7 of this manual.)
4. Turn the power on to the vehicle's ignition.
5. Disconnect the harness from the back of the in-cab controller (HMI).

Figure 73. Harness shown disconnected from in-cab controller (HMI)

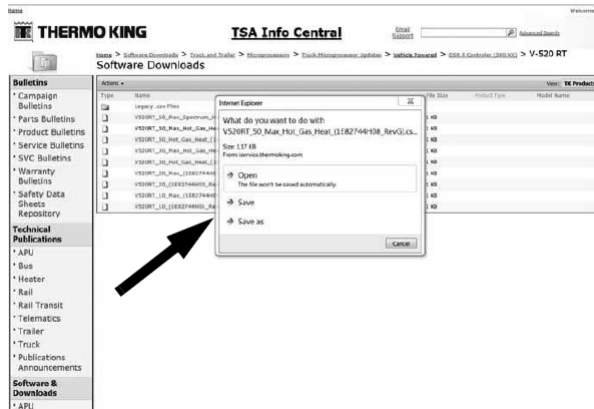


6. Connect the in-cab controller (HMI) harness to the box on the 204-1126 DSR interconnect cable.

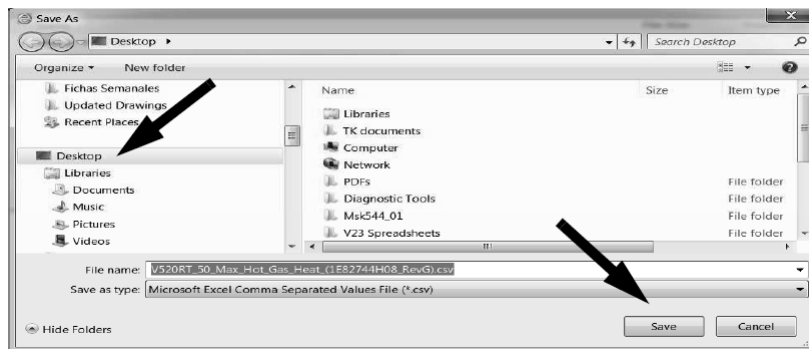
Figure 74. In-cab controller (HMI) harness shown connected to the box on the 204-1126 DSR interconnect cable.



7. Connect the 204-1126 DSR interconnect cable to the 42-575 USB to serial adapter and connect to a computer/laptop.
8. Go to TSA Info Central and click on the correct configuration file for the unit being installed. A dialogue box should appear asking, "What do you want to do with the file?"

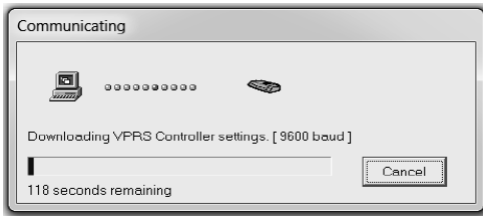


9. Click the "save as" option and save the file to your desktop.



10. Launch WinTrac and connect to the DSR controller.
11. If WinTrac is communicating properly with the controller, a notification should appear stating that it is communicating and the time remaining until the download is complete.

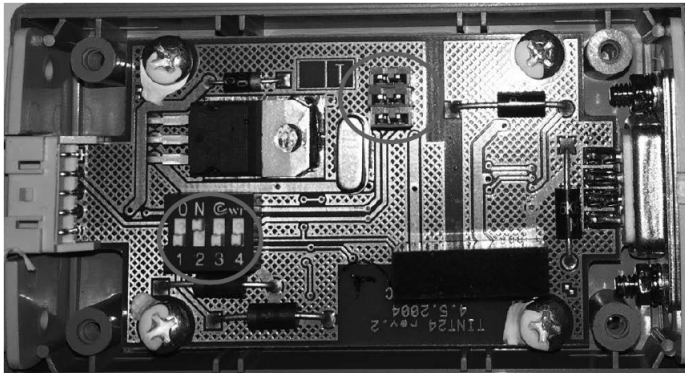
Section 9 - Configuring Software and Controller Procedures



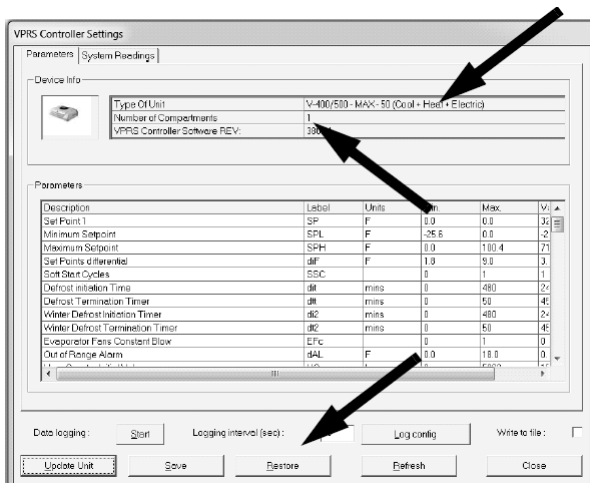
12. If the “searching for TK device” box appears and communication between WinTrac and the controller never starts, there may be one of two issues.

- Unit is not powered correctly.
- 204-1126 DSR interconnect cable is not configured properly.
 - a. Open the box (connected to the 204-1126 DSR interconnect cable) by removing the 4 Phillips head screws.
 - b. Toggle the numbered switches inside the box to match the photo below. (1 = off, 2 = on, 3 = off, 4 = off).
 - c. Verify that the three jumpers are present and in the orientation shown (Figure 75, p. 85). Replace cover.

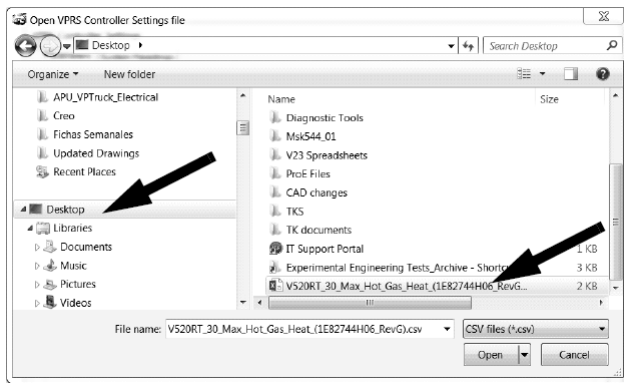
Figure 75. Cover removed from box showing switch positions and three jumper orientations.



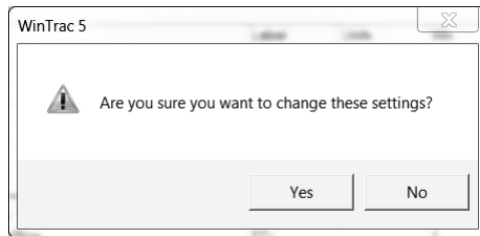
d. Once WinTrac has established communication with the controller, the settings box appears which shows the configuration file and firmware version the controller currently has loaded on it.



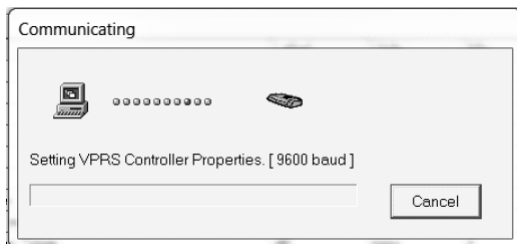
13. To load a new configuration file, click the restore button at the bottom of the window (shown in photo above.) The open file window will appear and select the desktop in the left side of the window and select the .csv file that was downloaded and saved earlier from Info Central in the right window. Press the “Open” button.



- a. If the configuration file you are loading is different than the configuration file currently on the controller, a confirmation window will appear asking if you want to change the settings.



14. Click yes and a communication window will appear. Once the new configuration file has been loaded, the communication window will disappear and the settings window should show the name of the new configuration file loaded.



15. Click close the settings window and close down WinTrac. Disconnect power to the unit by turning the truck ignition off and/or unplugging the unit from shore power.
16. Verify that the correct configuration was stored by re-powering the controller and re-connecting to WinTrac.
17. Delete the .csv configuration file saved to the desktop during the loading procedure.

Important: Configuration files get updated periodically and new files should be downloaded every time to verify the most recent version is being used.

Section 10 - System Evacuation Procedures

Overview

To help ensure optimal system performance and reliability it is critical that proper evacuation procedures are followed during installation and repair events. This section outlines the updated evacuation procedure for all Vehicle Powered Truck units utilizing swash plate or reciprocating compressors.

Important: *Failure to properly evacuate the system may result in decreased system performance, reliability, and compressor failures.*

Evacuation Procedures

Proper evacuation is required to verify ensure unit performance and reliability. The use of the Thermo King Evacuation Station (204725) is recommended, however proper individual devices can also be used (e.g., gauge manifold(s), vacuum pump, micron gauge, etc).

Note: *Depending on the unit, it will require a 2, 3 or 4 point evacuation. The minimum number of evacuation points required for each model unit is shown in the chart below.*

Examples of 2-point, 3-point, and 4-point evacuation connections are shown on the following pages.

Table 8. Required Evacuation Points

Model	Required Evacuation Type*
V-220/V-320 10	2 Point
V-220/V-320 20	3 Point
V-520 NM 10	3 Point
V-520 NM 20	4 Point
V-520 NM 30	4 Point
V-520 NM 50	4 Point
V-520 NM Spectrum 10	4 Point
V-520 NM Spectrum 20	4 Point
V-520 NM Spectrum 50	4 Point
V-520 RT 10	2 Point
V-520 RT 20	3 Point
V-520 RT 30	3 Point
V-520 RT 50	4 Point
V-520 RT Spectrum 50	4 Point
V-800 10	4 Point
V-800 20	4 Point
VM-405 Max EL	3 Point
VM-405 PBBD2	3 Point
*This is the minimum number of evacuation points required. Using more will improve evacuation efficiency and speed.	

Figure 76. 2-Point Evacuation using Thermo King Evacuation Station

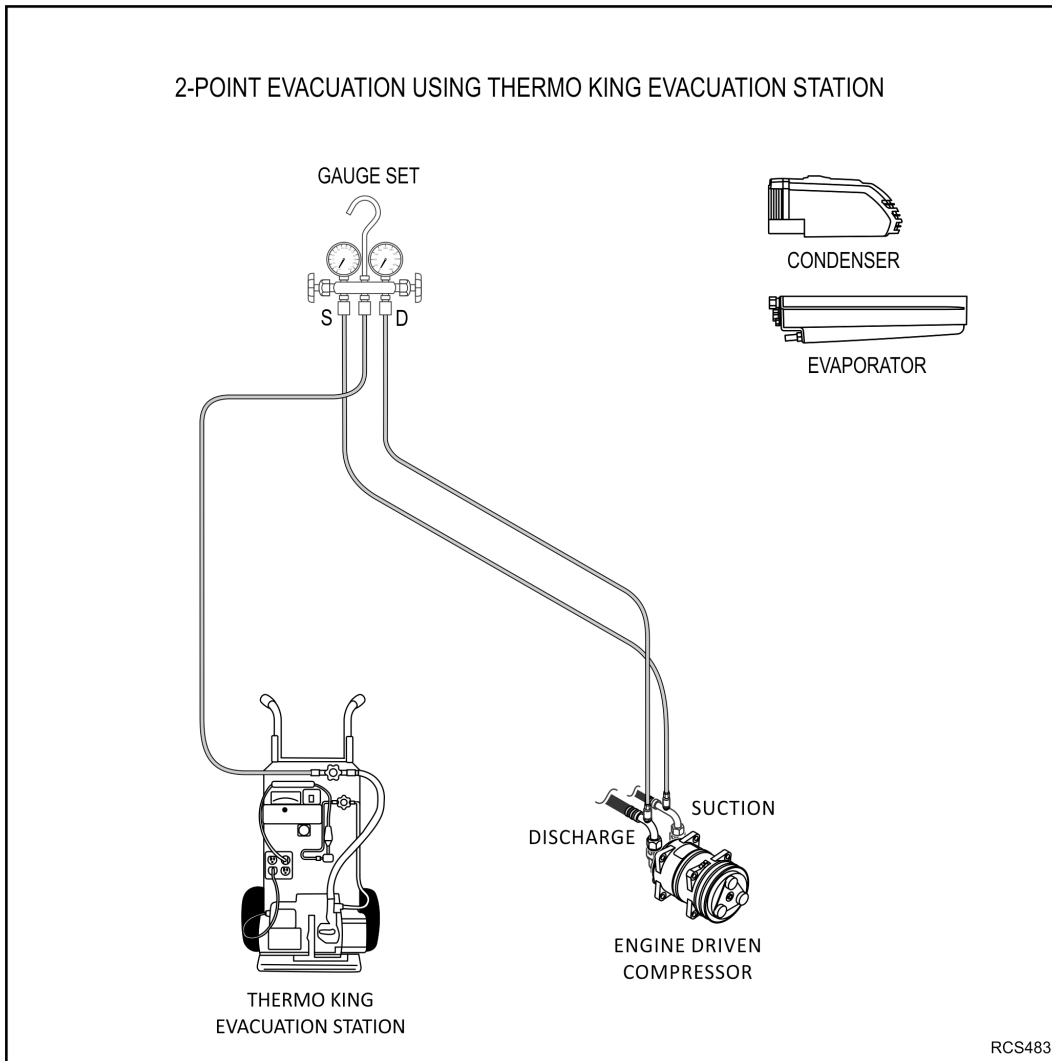


Figure 77. 2-Point Evacuation using Separate Vacuum Pump and Micron Gauge

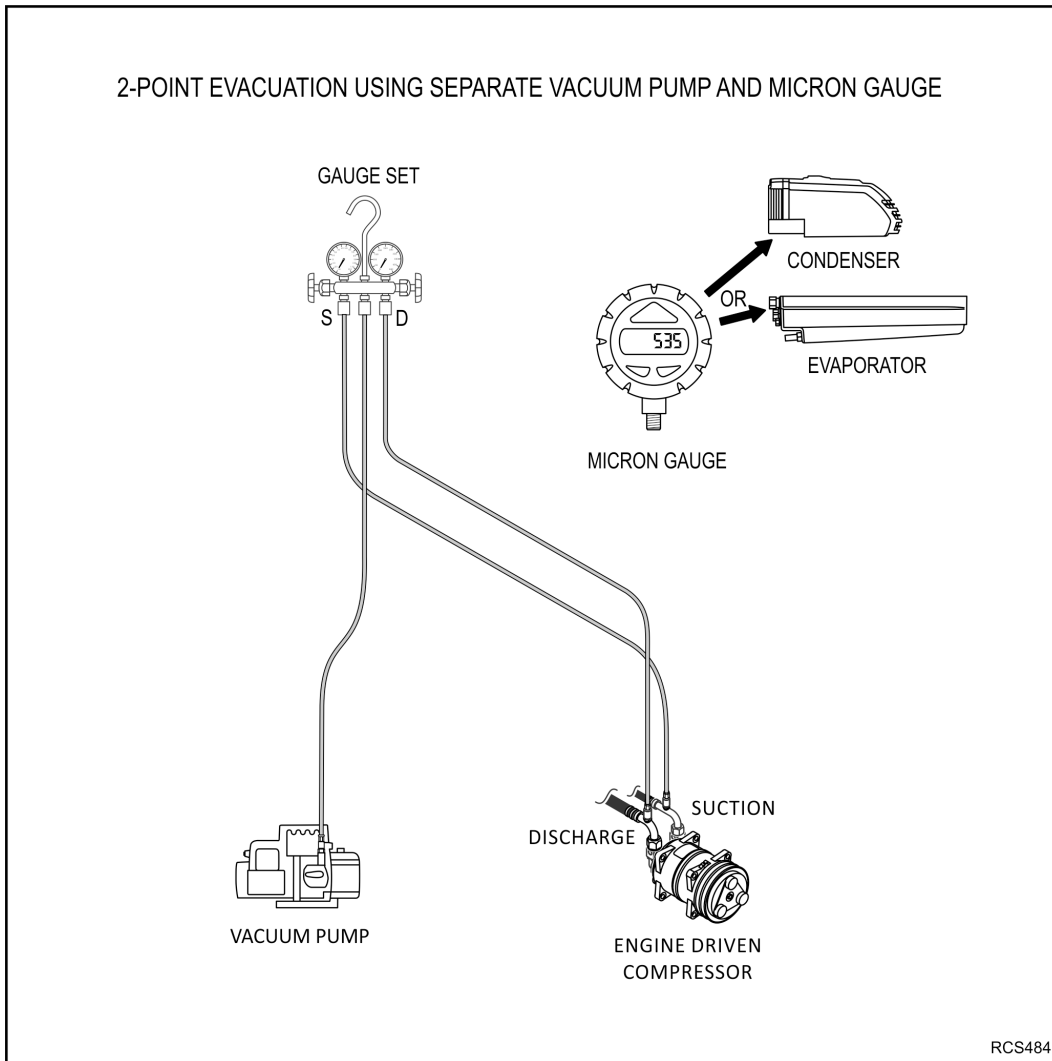


Figure 78. 3-Point Evacuation using Thermo King Evacuation Station

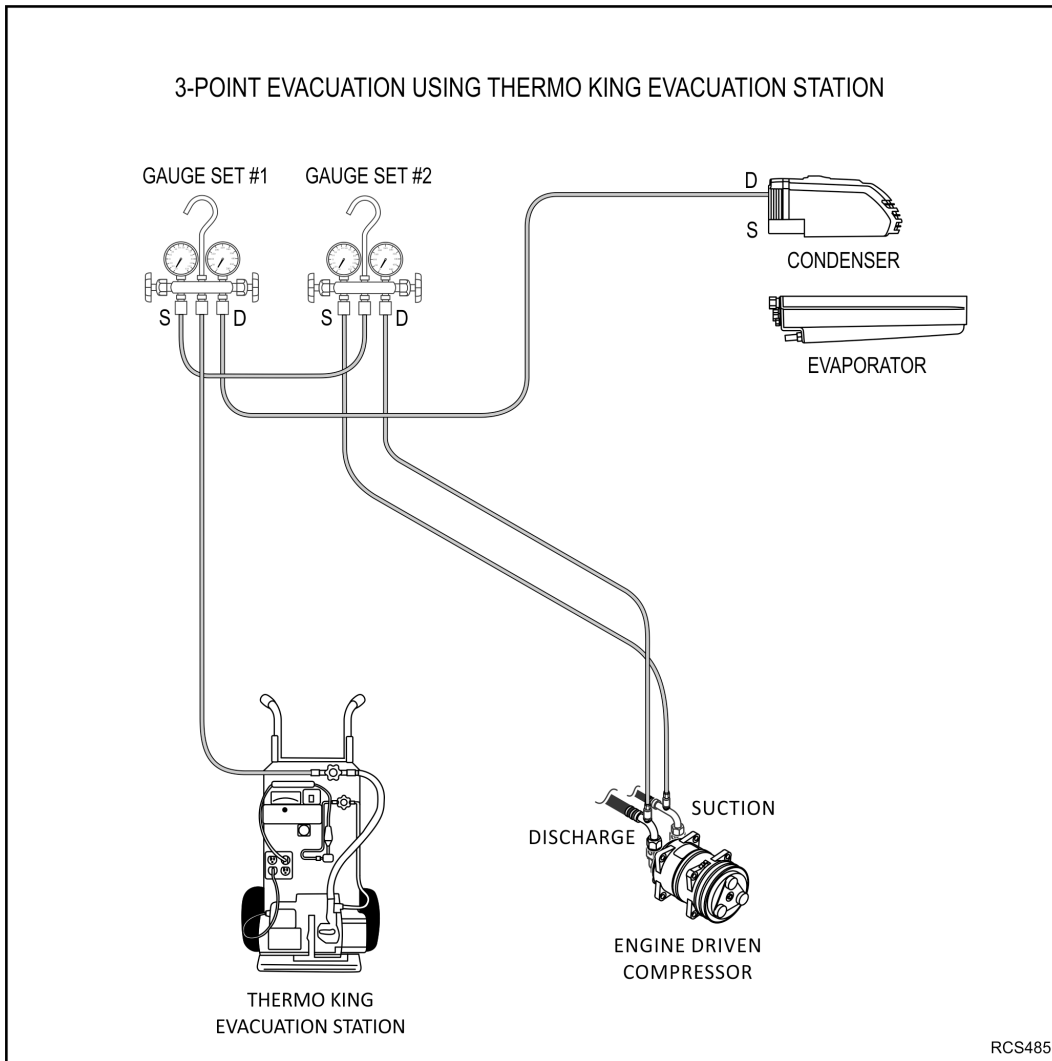


Figure 79. 3-Point Evacuation using Separate Vacuum Pump and Micron Gauge

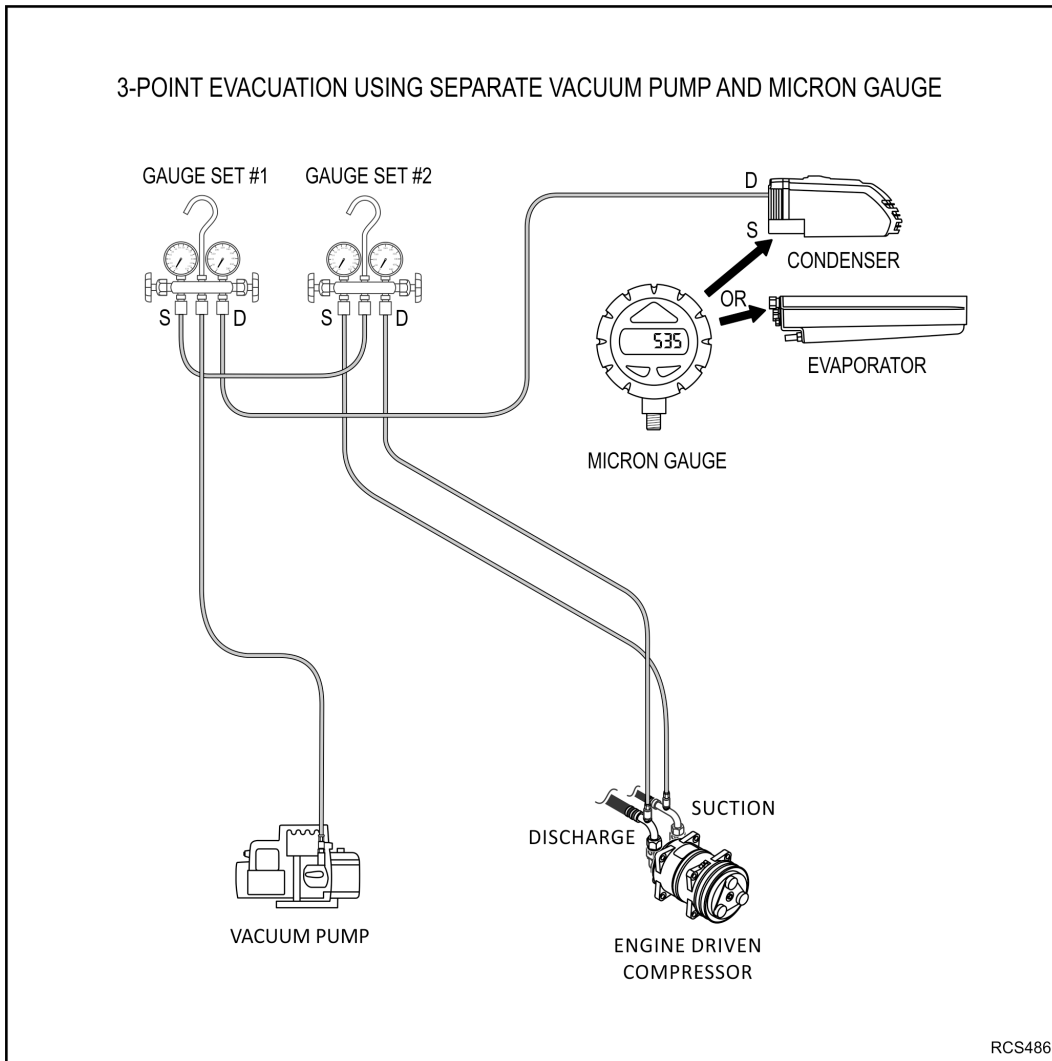




Figure 80. 4-Point Evacuation using Thermo King Evacuation Station

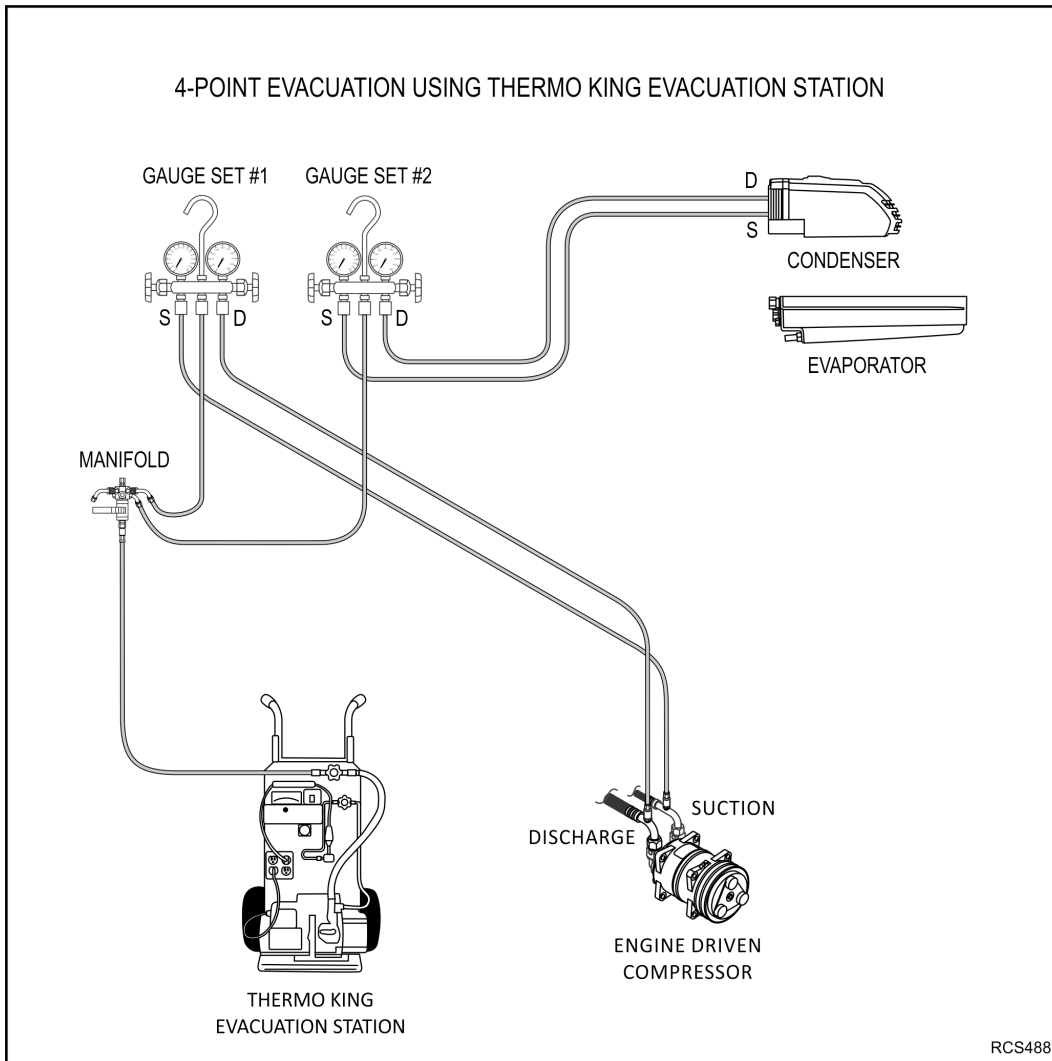
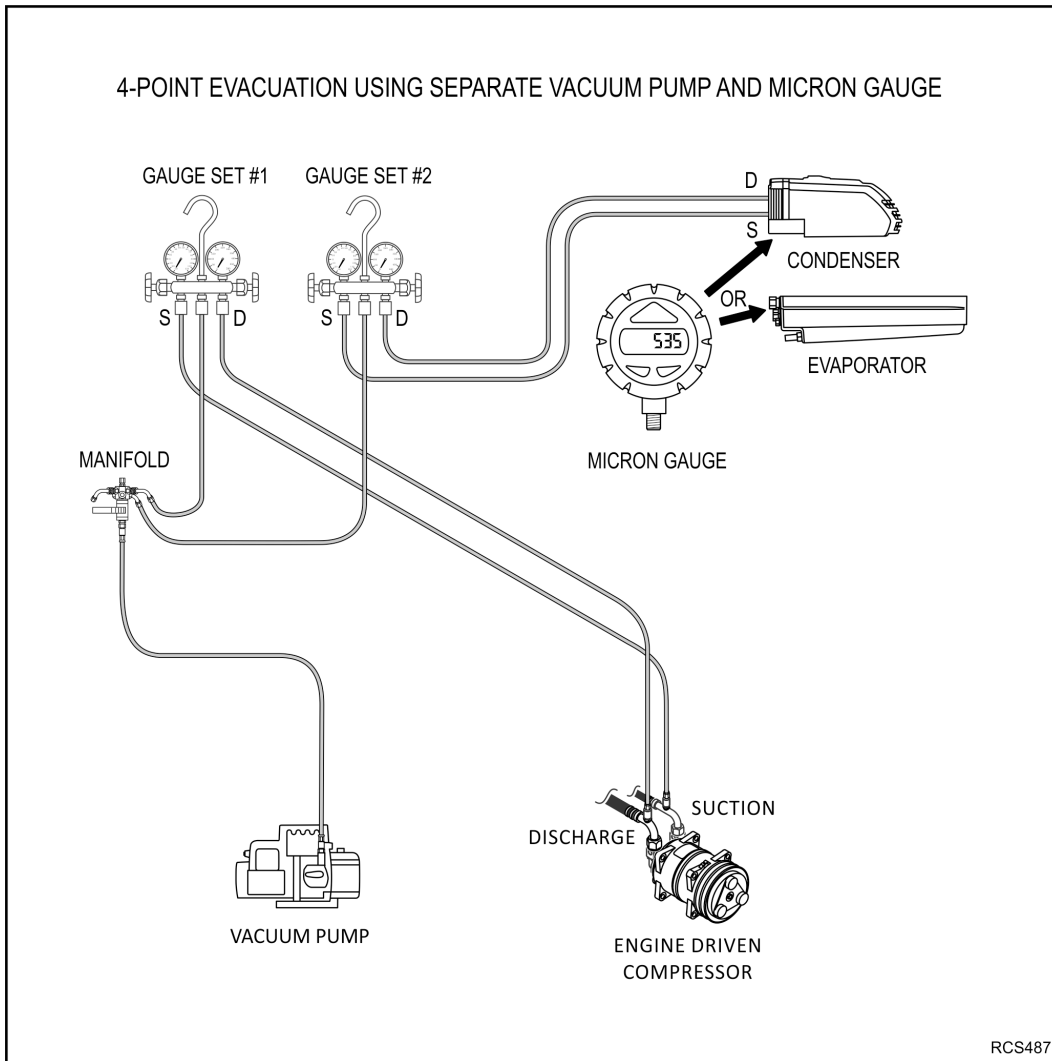


Figure 81. 4-Point Evacuation using Separate Vacuum Pump and Micron Gauge



Section 10 - System Evacuation Procedures

1. Connect the Thermo King evacuation station, or individual vacuum pump, gauge manifold(s) and micron gauge to the unit. It is recommended to install the micron gauge as far away from the vacuum pump as possible to obtain a more accurate reading. Example: evaporator.
2. **Using Solenoid Valve Magnet 2041074** - Place magnets or manually energize with a DC power supply the normally closed (N/C) valves in the unit. Refer to (Table 9, p. 95) for a list of valves and their positions (N/C or N/O) for each unit.
 - When a magnet is installed on a valve a “click” should be heard as the valve opens.

Note: The liquid injection valve (LIV) on V200, V300, and V520s units MUST be manually energized with a DC power supply since no magnet is available to manually open the valve.



Solenoid Valve Magnet
(204-1074)

DSR III Equipped Units with 544.xx Firmware

Some units (B-100, V-220, V-320, V-800) are equipped with Evacuation Mode which energizes all of the normally closed valves. This eliminates the need to manually open the normally closed valves with a magnet or power supply. Evacuation Mode can be enabled and disabled in the Installation Menu on the HMI. Alternative method is to use magnets (See step 2).

Note: If this operation is done using the vehicle's battery for a very long time, you should connect a 20 amp or larger battery charger to the vehicle's battery to avoid discharging it.

1. From the Standard Display, press and hold the Up Arrow key and Down Arrow key for seven seconds, then release them. The Evacuation Menu screen appears.



ASA1003

2. **Using Magnets** - Place magnets or manually energize with a DC power supply the normally closed (N/C) valves in the unit. When a magnet is installed on a valve a “click” should be heard as the valve opens.

Table 9. Solenoid Valve Positions

Model	Liquid Injection (LIV)*	Solenoid Valves					
		Liquid Line (PS3)	Liquid Line 2 (PS2)	Defrost 1 (PS1)	Defrost 2 (PS4)	CPR Bypass (PS8)	Condenser Blocking
V-200/V-300 10	N/C	-	-	N/C	-	-	-
V-200/V-300 20	N/C	-	-	N/C	-	-	-
V-520 NM 10	N/C	-	-	N/C	-	-	-
V-520 NM 20	N/C	-	-	N/C	-	-	-
V-520 NM 30	N/C	-	-	N/C	-	-	N/O
V-520 NM 50	N/C	-	-	N/C	-	-	N/O
V-520 NM Spectrum 10	N/C	N/C	N/C	N/C	N/C	N/O	-
V-520 NM Spectrum 20	N/C	N/C	N/C	N/C	N/C	N/O	-
V-520 NM Spectrum 50	N/C	N/C	N/C	N/C	N/C	N/O	-
V-520 RT 10	N/C	-	-	N/C	-	-	-
V-520 RT 20	N/C	-	-	N/C	-	-	-
V-520 RT 30	N/C	-	-	N/C	-	-	N/O
V-520 RT 50	N/C	-	-	N/C	-	-	N/O
V-520 RT Spectrum 50	N/C	N/C	N/C	N/C	N/C	N/O	N/O
V-800 10	N/C	-	-	N/C	-	-	-
V-800 20	N/C	-	-	N/C	-	-	-
VM-405 Max EL	-	-	-	N/C	-	-	-
VM-405 PBBD2	-	-	-	N/C	-	-	-

* MAX and all V-520 Nosemount Units Only
 N/C = Normally Closed
 N/O = Normally Open

Open the gauge manifold and vacuum pump valves. Start the vacuum pump and pump the system down until the micron gauge reads *500 microns*. Continue to pump down the system for an additional one hour after the system reached 500 microns.

Note: *If the system will not pump down to 500 microns there is likely a leak in the system or evacuation hoses.*

3. Once the system has reached 500 microns for one hour close the vacuum pump valve and turn off the vacuum pump. Monitor the micron gauge for 5 minutes.
 - Micron gauge REMAINS BELOW 2000 microns proceed to Step 5.
 - Micron gauge RAISES ABOVE 2000 microns proceed to Step 4.
4. If the system pressure rose above 2000 microns in 5 minutes the system may require additional evacuation or a leak is present.
 - A SLOW RISE in system pressure likely indicates the system requires additional evacuation due to the presence of moisture in the system. Repeat Steps 2 and 3.
 - A RAPID RISE in system pressure likely indicates a leak in the system or evacuation hoses. Properly leak check the system, repair the leak and repeat Steps 2 and 3.



Section 10 - System Evacuation Procedures

Note: To leak check the unit refer to: Section 11 - System Leak Check Procedures.

5. Turn on the vacuum pump and open the vacuum pump valve. Pump down the system to 500 microns a second time.

Note: It is required to pump down the system to 500 microns a second time to ensure the system can be properly charged with refrigerant on the High Side of the system.

6. Close the vacuum pump and gauge manifold(s) valves. Disconnect the vacuum pump and micron gauge.
7. **Disable Evacuation Mode** - To return to the Standard Display, Press and hold the Up Arrow key and Down Arrow key for seven seconds, then release them, or switch off the In-cab Control Box.
 - a. Or, remove the magnets and or power supply from all of the valves. Install the solenoids onto the valves and connect the electrical leads.
8. Evacuation is complete and the unit is ready to be charged with refrigerant.

Refer to Section 12 - System Charging Procedures.

Section 11 - System Leak Check Procedures

Overview

It is critical that the unit is leak free to ensure unit performance and reliability. This section outlines the leak check procedure for all Vehicle Powered Truck units utilizing swash plate or reciprocating compressors.

Important: Failure to properly eliminate system leaks will result in decreased system performance, reliability, and compressor failures.

Testing System for Leaks

⚠ DANGER

Combustible Hazard!

Do not use oxygen (O₂), acetylene, or other pressurized gas in the system.

⚠ DANGER

Hazardous Gases!

Due to environmental concerns and personal safety, do not use a Halide torch. Using this torch creates a poisonous gas which may cause death.

⚠ CAUTION

Hazardous Pressures!

Nitrogen (N) is under 152 bar/2200 psig (15169 kPa) pressure in a full cylinder at 70 F (21 C).

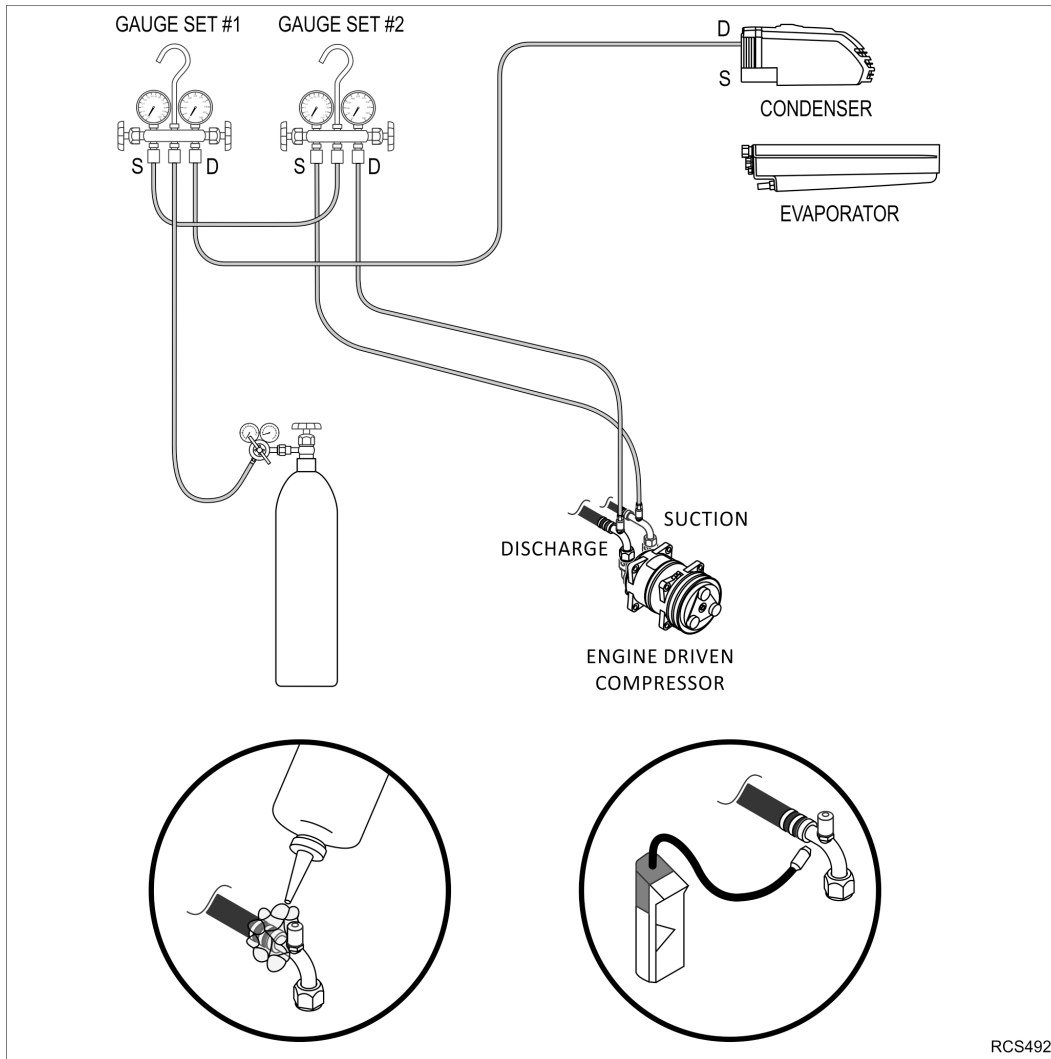
Use a regularly calibrated electronic leak detector capable of detecting fluorine-based refrigerants, or use a leak check solution to leak test the refrigeration system. Carefully inspect the entire system for refrigerant leaks.

Use this procedure for systems that are empty or have lost most of their refrigerant.

1. Attach a gauge manifold to the unit.
2. When using an electronic leak detector, connect the center hose from the gauge manifold to a refrigerant bottle (same type refrigerant used in the system). Purge the center hose of any air. When using a soap solution, skip this step and go to step 6.
3. Pressurize the system with a trace amount of refrigerant, approximately 2 to 3 psig (14 to 21 kPa).
4. Close both hand valves on the gauge manifold.
5. Disconnect the center hose to the gauge manifold from the refrigerant bottle.
6. Connect the center hose from the gauge manifold to a source of nitrogen. Pressurize the system with nitrogen gas to the desired pressure. Refer to (Table 10, p. 99).
7. Close the supply valve on the nitrogen bottle.
8. Use electronic leak detector or a leak check solution to leak test the refrigeration system. If you detect leaks, loosen the supply line hose fittings to release the pressure. Repair the leaks as necessary and recheck the system.
9. After leak testing is completed, remove the remaining trace amount of refrigeration and nitrogen.
10. Evacuate the system and charge per standard procedures.



Figure 82. Testing for Leaks using Nitrogen



RCS492

Using Pressurized Nitrogen

Safety Precautions

⚠ CAUTION

Hazardous Pressures!

Nitrogen (N) is under 152 bar/2200 psig (15169 kPa) pressure in a full cylinder at 70 F (21 C).

Improper use of high pressure cylinders can cause physical damage to components, personal injury, or stress that can lead to failure of components. Observe the proper handling of cylinders:

- Always keep the protective cap on the cylinder when not in use.
- Secure the cylinder in a proper storage area, or fasten the cylinder to a cart.
- Do not expose to excessive heat or direct sunlight.
- Do not drop, dent, or damage the cylinder.
- Use a pressure regulator and a safety pressure relief valve as part of the pressure testing equipment. The safety pressure relief valve should be the non-adjustable, non-tampering type. The valve should bypass any time the pressure exceeds its setting.
- Open the supply valve slowly. Use regulators and safety valves that are in good condition

- The regulator should have two gauges; one for tank pressure and one for line pressure. The equipment allows leak testing, purging, or dehydration to be done safely.

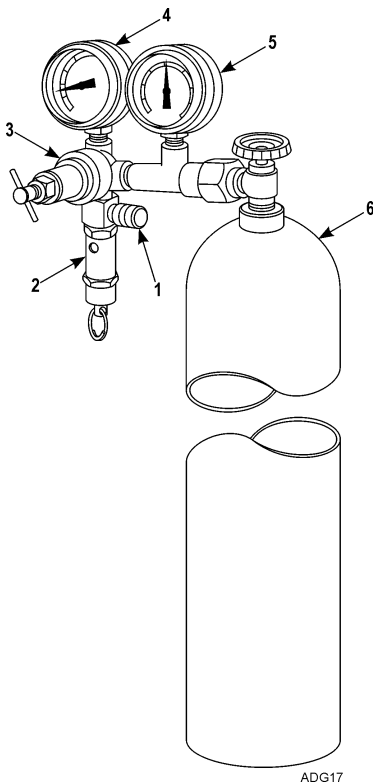
Procedures

Use dry nitrogen (N) for dehydration, pressure testing, purging, and soldering. Always use the proper equipment and procedures.

- Attach a gauge manifold set to the system.
- Close both hand valves on the gauge manifold.
- Connect the center hose from the gauge manifold to pressure regulator outlet on the nitrogen supply bottle. Adjust the pressure regulator to the correct pressure for the required procedure. Refer to (Table 10, p. 99).
- Purge the system from the high side to the low side.

Table 10. Testing Pressures

Procedure	Maximum Pressure		
	Bar	psig	kPa
Leak Testing Low Side	10.3 - 12	150 - 175	034 - 1206
Leak Testing High Side	10.3 - 17.2	150 - 250	034 - 1724
Purging Dehydration	0.7 - 1.4	10 - 20	69 - 138
Soldering	0.3 - 1.4	5	34



Typical Pressurized Gas Bottle with Pressure Regulator and Gauges

- Pressure Regulator Outlet (Pressure Test Line to System)
- Safety Valve
- Pressure Regulator
- Line Pressure
- Tank Pressure
- Tank

Section 12 - System Charging Procedures

Overview

To help ensure optimal system performance and reliability it is critical that proper refrigerant charging procedures are followed during installation and repair events. This section outlines the updated refrigerant charging procedure for all Vehicle Powered Truck units utilizing swash plate or reciprocating compressors.

Refrigerant Charging Procedures

Following proper refrigerant charging procedures is required to ensure system performance and reliability.

Important: Failure to properly charge the unit with refrigerant will result in the following:

- Compressor Failure
- System Overcharged: Fault codes, or system damage due to high discharge pressure.
- System Undercharged: Fault codes, reduced system performance or compressor damage.

Depending on the model, charging can be done using a 2-Point, 3-Point, or 4-Point connection. Refer to (Table 8, p. 87).

Discharge (High Side) Charging

Important: Failure to properly charge the system with refrigerant will result in immediate damage to the compressor.

1. Connect the gauge manifold set to the liquid port on the refrigerant bottle, open the liquid valve on the refrigerant bottle and purge the gauge manifold set.
2. Verify the gauge manifold set red hose (High Side) is connected to a Discharge (High Side) service port (connected in previous procedure).
3. Place the refrigerant bottle on a scale and zero the scale.
4. Open the High Side valve on the gauge manifold set and add the recommended amount of refrigerant for your unit. Refer to the unit specific installation manual to identify the recommended initial charging amount of refrigerant for each unit.
 - The actual amount of refrigerant required for each unit will vary based on hose lengths and compressor type/size. Additional refrigerant may need to be added or removed.
 - It may be necessary to heat the refrigerant bottle using a heating blanket or warm water to add the full charge to the High Side of the system. This will vary based on ambient temperatures.
 - If the full charge cannot be added through the High Side of the System, the remaining charge will be added by following the "Suction (Low Side) Bump Charging," p. 101.
5. Close the gauge manifold set valves and refrigerant bottle valve.
 - Models WITH Electric Standby: Operate the unit on Electric Standby.
 - Connect the power cord. Turn the unit "ON" and place the unit in "Cool" mode for five minutes. Turn off the unit and disconnect the power cord. Proceed to Step 6.
 - Models WITHOUT Electric Standby: Proceed to Step 6.
6. Start the vehicle's engine and operate it at 1000 RPM.
7. Turn the unit "ON" and place the unit in "Cool" Mode. Lower the set point to the following:
 - R-134a: 25 degrees F (-4 degrees C)
 - R-404A/R-452A: 0 degrees F (-18 degrees C)
8. Operate the unit until the following box temperature is reached:
 - R-134a: 35 degrees F (2 degrees C)
 - R-404A/R-452A: 10 degrees F (-12 degrees C)
9. Check to verify the following discharge pressures are met or exceeded:
 - R-134a: 180 psig (12.5 bar)
 - R-404A/R-452A: 275 psi (19 bar)

Note: Partially blocking the condenser coil may be necessary to achieve these pressures.

10. Inspect the sight glass.

- NO BUBBLES PRESENT: The system is full of refrigerant. Proceed to Step 11.
- BUBBLES PRESENT: The system is low on refrigerant. Proceed to the .
- Verify the unit is not over charged. Elevate engine RPM to 3000-4000 RPM for three minutes. Verify that the unit does not shutdown on high head pressure. If unit shuts down on high head pressure the system is overcharged. Reduce the refrigerant charge amount until the unit no longer shuts down on high head pressure.

Note: *If the condenser coil was covered in previous Step 9 leave the condenser coil covered for Step 11.*

11. Turn off the unit and shut off the vehicle's engine. Remove the gauge manifold(s) and refrigerant bottle.

Refrigerant charging is complete.

Suction (Low Side) Bump Charging

Important: *Failure to properly charge the system with refrigerant will result in immediate damage to the compressor.*

1. Connect the gauge manifold set to the liquid port on the refrigerant bottle and purge the gauge manifold set (if not already completed in the previous procedure).
2. Connect the gauge manifold set blue hose (Low Side) to a Suction (Low Side) service port (if not already completed in the previous procedure).

Note: *Select a service port that is as far away from the roadside compressor as possible. Do NOT connect the Suction (Low Side) hose to the Suction service port at the roadside compressor. Compressor damage may occur.*

3. Connect the gauge manifold set red hose (High Side) to a Discharge (High Side) service port (if not already completed in the previous procedure).
4. Start the vehicle's engine and operate it at 1000 RPM.
5. Turn the unit "ON" and place the unit in "Cool" Mode. Lower the set point to the following:
 - R-134a: 25 degrees F (-4 degrees C)
 - R-404A/R-452A: 0 degrees F (-18 degrees C)
6. Operate the unit until the following box temperature is reached:
 - R-134a: 35 degrees F (2 degrees C)
 - R-404A/R-452A: 10 degrees F (-12 degrees C)
7. Check to verify the following discharge pressures are met or exceeded:
 - R-134a: 180 psig (12.5 bar)
 - R-404A/R-452A: 275 psi (19 bar)

Note: *Partially blocking the condenser coil may be necessary to achieve these pressures.*

8. Open the Low Side valve on the gauge manifold set for **ONE SECOND** and close.

9. Wait a minimum of ten seconds. Inspect the sight glass for bubbles.

- NO BUBBLES PRESENT: The system is full of refrigerant. Proceed to Step 10.
- BUBBLES PRESENT: The system is low on refrigerant. Repeat Steps 8 and 9 until no bubbles are present in the sight glass.

10. Close the gauge manifold valves and refrigerant bottle valve. Turn off the unit and shut off the vehicle's engine.

Refrigerant charging is complete.

Section 13 - Unit Performance Adjustments

Overview

Various models of vehicle powered truck units are equipped with either a Suction Pressure Regulator (SPR) valve or a Compressor Pressure Regulator (CPR) valve. After unit installation, these valves require adjustments for maximum performance. Conditions such as high or low ambient temperatures or the voltage option selected, may require that the settings be fine-tuned for optimum performance. Adjustment procedures can be found in the unit specific installation manuals. The table (Table 11, p. 102) shows which units have these valves.

Definitions of SPR and CPR Valves

SPR Valves: SPR valves are used to regulate the current draw on the electric standby motors by limiting pressure going into the compressor and in turn limiting the load on the compressor.

CPR Valves: On vehicle powered truck units, the CPR valves have two main purposes. First, a CPR valve is required for hot gas heat operation. During a hot gas heat cycle, the compressor must create a pressure differential. Because the expansion valve is being bypassed, the CPR valve is used to drop the pressure so the compressor can function properly. Failure to properly set the CPR valve on units with hot gas heat will result in a reduction of heat capacity. Secondly, on multi-temperature units, the CPR valve is used for zone-priority / zone-control. When both fresh and frozen zones are requiring cooling, the fresh box suction pressures are much higher due to the higher box temperature, and will always use the majority of the refrigerant. The CPR valve is used to drop the suction pressure of the fresh evaporator, when the frozen is requiring cooling, to match the frozen zone's suction pressure allowing both zones to cool simultaneously. If the Spectrum unit's CPR valve is not set properly, the frozen zone will not cool until the fresh zone has reached setpoint.

FAILURE TO ADJUST THESE VALVES MAY NOT ALLOW THE UNIT TO OPERATE AT ITS MAXIMUM CAPACITY.

Table 11. VP Truck Units with SPR or CPR Valves

VP Model	SPR	CPR	VP Model	SPR	CPR
V-200/V-300 10			V-520 NM SPECTRUM 10 MAX		X
V-200/V-300 20			V-520 NM SPECTRUM 20 MAX		X
V-200/V-300 10 MAX			V-520 NM SPECTRUM 50 MAX		X
V-200/V-300 20 MAX	X		V-520 RT 10/10 MAX		
V-220/V-320 10			V-520 RT 20/20 MAX	X	
V-220/V-320 20			V-520 RT 30/30 MAX		X
V-220/V-320 20 MAX	X		V-520 RT 50/50 MAX	X	X
V-220/V-320 30		X	V-520 RT SPECTRUM 50 MAX	X	X
V-220/V-320 50		X	V-800 10 MAX	X	
V-520 NM 10/10 MAX			V-800 20 MAX	X	
V-520 NM 20/20 MAX	X		VM-405 MAX EL	X	
V-520 NM 30 MAX		X	VM-405 PBBD2		
V-520 NM 50 MAX	X	X			

Section 14 - Commissioning and PDI Forms

Commissioning Form Overview

All vehicle powered truck units come with the Commissioning Form (TK 56482) included in the documents package. This form is also available online at Thermo King ReqDirect. By completing the Commissioning Form, the **installer** confirms the installation was done per Thermo King's Installation Standards and Procedures Guide and the unit operates as it should. Commissioning Forms should be completed for all unit installations and retained by the **installer**.

The Thermo King Commissioning Form is available online on EMEA Infocentral. By completing the Commissioning Form, the **installer** confirms the installation was done per Thermo King's Installation Standards and Procedures Guide and the unit operates as it should. Commissioning Forms should be completed for all unit installations and retained by the **installer**.

Pre-Delivery Inspection (PDI) Form Overview

PDI Form (TK 56444) is also included in the documents package of all vehicle powered truck units. This form is also available online at Thermo King ReqDirect. The PDI form is used when the unit installation was performed by someone other than the selling party. By completing the form, the **seller** confirms the unit operates as it should. PDI Forms should be completed for all unit sales and retained by the **seller**.

Completing both the Commissioning and the Pre-Delivery Forms helps assure Thermo King equipment is installed with the highest degree of quality, reliability, and durability to meet or exceed the expectations of our customers resulting in total customer satisfaction.

Figure 83. Commissioning Form (Page 1 of 3)


Vehicle Powered Truck Commissioning Form

(Complete and Retain for Your Records)

Customer Name				
Address				
City		State		Zip

Installer Name				
Address				
City		State		Zip

Vehicle Information	
Vehicle Make:	
Vehicle Model:	
Vehicle Year:	
Vehicle VIN Number:	
Engine Cylinders:	<input type="checkbox"/> 4 <input type="checkbox"/> 6 <input type="checkbox"/> 8 <input type="checkbox"/> 10
Fuel Type:	<input type="checkbox"/> Gas <input type="checkbox"/> Diesel <input type="checkbox"/> Natural Gas <input type="checkbox"/> Electric
Engine Displacement (liters):	
Unit Information	
Unit Model:	
Unit Serial Number:	
Compressor Serial Number:	
Compressor Part Number:	
Compressor RPM @ Hwy Speed:	
Compressor RPM @ Max Engine RPM:	
Compressor Drive Kit Mfr:	
Part Number:	
Drive Kit Belt Part Number:	

Install Date:	
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Comments:	
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IMPORTANT: It is Installer's responsibility to perform the following inspection prior to releasing unit to customer. Further information can be found in the VP Truck Installation Standards and Procedures Guide TK#56430 available through Thermo King Publications.

CONDENSER INSTALLATION

Qty Mounting bolts installed:
 Mounting bolts/holes have been sealed: Yes No
 Condenser cover hardware in place and tightened securely: Yes No

EVAPORATOR INSTALLATION

Qty Mounting bolts installed:
 Mounting bolts/holes have been sealed: Yes No
 Evaporator cover hardware in place and tightened securely: Yes No
 Drain hoses are routed with downward slope: Yes No
 Drain line heaters are properly routed and connected - **MAX Units Only:** Yes No
 Kazoo(s) installed on drain hose(s): Yes No

COMPRESSOR DRIVE KIT INSTALLATION

Drive kit installed per mfr instructions: Yes No Drive belt properly aligned: Yes No

REFRIGERANT HOSE AND FITTINGS INSTALLATION

Hoses are routed away and protected from heat sources such as exhaust system, etc.: Yes No
 Hoses are properly secured: Yes No
 Hose protection has been added to prevent rubbing or chaffing: Yes No

Figure 84. Commissioning Form (Page 2 of 3)

Hoses do not extend below the lowest point on the vehicle: Yes No
P-Trap installed before roadside compressor: Yes No
Hoses are not taut (to allow for movement): Yes No
Hoses secured to engine prior to bridging gap to vehicle's frame (flexible hose section created): Yes No
Hose fittings have been torqued and witness marks placed on fittings: Yes No

REMOTE OIL RETURN AT ROADSIDE COMPRESSOR – (SELECT 10/30 MODELS)

Hose splice installed near compressor: Yes No Schrader valve core removed from splice: Yes No

REMOTE LIQUID INJECTION AT ROADSIDE COMPRESSOR – (SELECT MAX UNITS)

Hose splice installed near compressor: Yes No Schrader valve core removed and orifice installed in hose splice: Yes No

WIRING INSTALLATION

Wire harnesses are routed away and protected from heat sources such as exhaust system, etc.: Yes No
Wire harnesses are properly secured: Yes No
Wire harness protection added to prevent rubbing or chaffing: Yes No
Main power supply fuse installed within 12.00 in. (30.5 mm) of battery: Yes No
Power supply and ground connections are secure and tight with dielectric grease applied: Yes No

ELECTRIC STANDBY INSTALLATION – (SmartPower UNITS ONLY)

Receptacle is mounted in an easily accessible location: Yes No Drip loop installed on electrical cable: Yes No

HMI INSTALLATION

HMI is properly mounted and harness installed securely: Yes No

VEHICLE CARGO BOX

All openings for hoses and wiring have been sealed: Yes No

COOLANT HEAT – (IF EQUIPPED)

Air purged from cooling system: Yes No
Vehicle coolant level is full: Yes No
Coolant valve is closed during "Cool" Mode: Yes No
Coolant valve is open during "Heat" Mode: Yes No
Leaks present: Yes No

ELECTRIC HEAT – (IF EQUIPPED)

Electric heat specific controller configuration file installed: Yes No

EVACUATION AND CHARGING

Amount of oil added to roadside compressor: _____ ounces/mL (Optional) Total amount of oil added to unit: _____ ounces/mL
Amount of oil added to the system: _____ ounces/mL
Evacuation performed: Yes No
Micron level reached during evacuation: _____ microns



Section 14 - Commissioning and PDI Forms

Figure 85. Commissioning Form (Page 3 of 3)

Refrigerant Type: 134a 404A (MAX Units)
 Amount of Refrigerant Added: _____ lbs/kg _____ ounces
 Inspect sight glass at 35 F (2 C) (134a units) or 10 F (-12 C) (404A units) box temperature - bubbles present: Yes No

UNIT OPERATION	
Single-Temp Units	Cool Mode: Operate on roadside compressor and electric standby (if equipped): 134a Units – Achieved 35 F (2 C) Box Temperature: <input type="checkbox"/> Yes <input type="checkbox"/> No 404A (MAX) Units – Achieved 0 F (-18 C) Box Temperature: <input type="checkbox"/> Yes <input type="checkbox"/> No Heat Mode (if equipped): Operate on roadside compressor and electric standby (if equipped): Raised box temperature 15 F (9 C) or more: <input type="checkbox"/> Yes <input type="checkbox"/> No
Multi-Temp Units	Cool Mode: Operate on roadside compressor and electric standby (if equipped): Fresh Zone – Achieved 35 F (2 C) box temperature: <input type="checkbox"/> Yes <input type="checkbox"/> No Frozen Zone <input type="checkbox"/> Achieved 0 F (-18 C) box temperature: <input type="checkbox"/> Yes <input type="checkbox"/> No Heat Mode (if equipped): Operate on roadside compressor and electric standby (if equipped): Fresh Zone Only – Raised box temperature 15 F (9 C) or more: <input type="checkbox"/> Yes <input type="checkbox"/> No
All Units	Defrost operates properly: <input type="checkbox"/> Yes <input type="checkbox"/> No Alarm codes present on HMI: <input type="checkbox"/> Yes <input type="checkbox"/> No Door switches operate properly (if equipped): <input type="checkbox"/> Yes <input type="checkbox"/> No

ELECTRIC STANDBY-- (SmartPower UNITS ONLY)

SPR valve adjustment performed: Yes No
 SPR setting: _____ PSI/Bar
 Overload relay setting: _____ Amps
 Electric motor current draw in heat or defrost mode: _____ Amps
 Shore power cord provided to the customer: Yes No
 Shore power cord size: _____ Gauge
 Shore power cord length: _____ Feet/Meters

30 AND 50 MODELS ONLY – (INCLUDING SPECTRUM)

CPR valve adjustment performed: Yes No CPR setting: _____ PSI/Bar

FINAL ADJUSTMENTS AND SETTINGS

Minimum and maximum setpoints adjusted per customer's requirements: Yes No
 Zone 1: Min Setpoint (SPL) _____ Max Setpoint (SPH) _____
 Zone 2: Min Setpoint (SL2) _____ Max Setpoint (SH2) _____
 Setpoint differential (diF) set: _____
 Defrost initiation timer (dit) set: _____ Hours _____ Minutes
 Defrost termination timer (dtt) set: _____ Hours _____ Minutes
 Evaporator fan constant blow (EFc) Enabled: Yes No
 Temperature out of range alarm (dAL) Enabled: Yes No
 HMI buzzer (bE) Enabled: Yes No
 Thermostat units (tu) set to: Fahrenheit Celsius
 Pressure units (Pu) set to: PSI Bar

Figure 86. Pre-Delivery Inspection (PDI) Form (Page 1 of 2)



Vehicle Powered Truck Pre-Delivery Form

(Complete and Retain for Your Records)

Customer Name				
Address				
City		State		Zip

Seller's Name				
Address				
City		State		Zip

Vehicle Information	
Vehicle Make:	
Vehicle Model:	
Vehicle Year:	
Vehicle VIN Number:	
Unit Information	
Unit Model:	
Unit Serial Number:	
Compressor Drive Kit Mfr:	
Part Number:	
Drive Kit Belt Part Number:	

Warranty Start Date:	
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Comments:	
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IMPORTANT: It is Seller's responsibility to perform the following inspection prior to releasing unit to customer:

<p>Condenser</p> <p>Condenser cover is properly secured and installed: <input type="checkbox"/> Yes <input type="checkbox"/> No Condenser air inlet and outlet is free of obstructions: <input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Evaporator</p> <p>Evaporator cover is properly secured and installed: <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Evaporator air inlet and outlet is free of obstructions: <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Evaporator drain hoses are connected and have a downward slope: <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Evaporator drain hoses drain outside of the cargo box: <input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Electric Standby (SmartPower Units Only)</p> <p>Shore power cord receptacle is easily accessible: <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Shore power cord provided to the customer: <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Shore power cord is sized properly based on guidelines listed in the unit's Operator Manual: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA</p> <p>Shore power cord size: _____ Gauge</p> <p>Shore power cord length: _____ Feet/Meters</p>
<p>Miscellaneous</p> <p>HMI is easily accessible: <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>HMI is configured properly (PSI/Bar, Fahrenheit/Celsius, etc.): <input type="checkbox"/> Yes <input type="checkbox"/> No</p>



Figure 87. Pre-Delivery Inspection (PDI) Form (Page 2 of 2)

Verifying Operation	
Single-Temp Units	Cool Mode: Operate on roadside compressor and electric standby <i>(if equipped)</i> : 134a Units – Achieved 35 F (2 C) Box Temperature: <input type="checkbox"/> Yes <input type="checkbox"/> No 404A (MAX) Units – Achieved 0 F (-18 C) Box Temperature: <input type="checkbox"/> Yes <input type="checkbox"/> No Heat Mode <i>(if equipped)</i> : Operate on roadside compressor and electric standby <i>(if equipped)</i> : Raised box temperature 15 F (9 C) or more: <input type="checkbox"/> Yes <input type="checkbox"/> No
Multi-Temp Units	Cool Mode: Operate on roadside compressor and electric standby <i>(if equipped)</i> : Fresh Zone – Achieved 35 F (2 C) box temperature: <input type="checkbox"/> Yes <input type="checkbox"/> No Frozen Zone <input type="checkbox"/> Achieved 0 F (-18 C) box temperature: <input type="checkbox"/> Yes <input type="checkbox"/> No Heat Mode <i>(if equipped)</i> : Operate on roadside compressor and electric standby <i>(if equipped)</i> : Fresh Zone Only – Raised box temperature 15 F (9 C) or more: <input type="checkbox"/> Yes <input type="checkbox"/> No
All Units	Defrost operates properly: <input type="checkbox"/> Yes <input type="checkbox"/> No Alarm codes present on HMI: <input type="checkbox"/> Yes <input type="checkbox"/> No Door switches operate properly <i>(if equipped)</i> : <input type="checkbox"/> Yes <input type="checkbox"/> No



THERMO KING

Notes

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.

Thermo King has a policy of continuous product and product data improvements and reserves the right to change design and specifications without notice. We are committed to using environmentally conscious print practices.