



Installation Manual

V-500, V-600, V-800, V-1000

Single Temperature and Multi-Temperature Systems

Revision A

September 2021

TK 61906-18-IM-EN

TRANE
TECHNOLOGIES

Introduction

This manual was written to assist with the general installation of Thermo King® components onto trucks designed and built for refrigerated applications. The **Thermo King Installation Standards and Procedures Guide** provides more detailed information that must be followed to safely and properly complete the entire installation.

Due to its complexity, you should not attempt this installation unless you:

- Are an experienced mechanic.
- Can safely lift 34 kilos (75 lbs.).
- In the U.S., EPA 608 certified and trained in the repair and maintenance of transport refrigeration systems.
- Have a basic understanding of electricity and electrical wiring.
- Have the necessary tools and equipment to complete the installation.
- Have a truck body designed and built to meet the requirements of this installation.
- Follow all safety precautions outlined in the Thermo King Installation Standards and Procedures Guide.

This manualguide 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 (09/21) New manual format.

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Table of Contents

- Safety Precautions 5**
 - Danger, Warning, Caution, and Notice 5
 - Safety Precautions 5
 - Recover Refrigerant 6
- Required Tools 8**
- Required Support Materials 10**
- Operating Method 11**
- Unpacking and Unit Inspection 13**
- Condenser Installation 14**
- ES Evaporator 17**
 - Preparing the ES Evaporator for Installation 17
 - Evaporator Installation 18
 - Evaporator Drain Hose Installation 19
 - Drain Circuit in the ES800 Evaporator 19
- Preparing the Refrigeration Hoses 20**
- Hose Connections 21**
- Connecting the Hoses to the Condenser Unit 29**
- Installing the Wiring Sleeve in the Evaporators 31**
- Wiring Connections 32**
- Hose Cover Installation 44**
- Drain Circuit in the V-500, V-600, V-800 and V-1000 Condenser Units 45**
- Connecting Hoses to the over-the-road Compressor 46**
- Torque to Apply to Compressor Manifold and Fittings 47**
- Circuit Seal Test (I) 48**
- Circuit Seal Test (II) 49**
- In Case of Leaks 50**
- Leak Check and Evacuation with MAX Spectrum Units 51**
- Leak Chart and Evacuation Procedure for MAX Spectrum Units 52**
- Installing the In-Cab Controller 53**
- Optional DIN Adaptor (by order only) 56**



| | |
|---|----|
| Vehicle Battery Connection | 57 |
| Fitting the Power Supply - Units with Electric Standby..... | 58 |
| Installing the Discharge Adjustable Muffler (Optional) | 59 |
| In-Cab Control Box | 60 |
| Checking the Installation | 63 |
| Standby Receptacle Box Installation (Models 20 and 50 Only)..... | 64 |
| Completing the Installation..... | 65 |
| Suction Pressure Regulator (SPR) Adjustment Procedures - MAX 20 | 66 |
| Compressor Oil Amounts and Type | 68 |
| Electrical System..... | 69 |
| Single temperature SPR Valves Setting..... | 72 |
| Spectrum SPR Valves Setting | 73 |
| Condenser and Evaporator Dimensions | 74 |

Safety Precautions

Danger, Warning, Caution, and Notice

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

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

⚠ DANGER

Hazard!

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

⚠ WARNING

Hazard!

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

⚠ CAUTION

Hazard!

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

NOTICE

Hazard!

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

Safety Precautions

Important: Additional Safety Precautions must be followed when installing this unit. See "Section 2 - Safety Precautions" in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide (TK 56430).

⚠ CAUTION

Risk of Injury!

Thermo King condenser units and remote evaporators are shipped with a 35 kPa (5 psi) holding charge of Helium. Be careful when removing cap. This holding charge may be safely vented into the atmosphere.

⚠ 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.

Recover Refrigerant

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

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

When working on transport temperature control systems, a recovery process that prevents or minimizes refrigerant loss to the atmosphere is required by law. In addition, service personnel must be aware of the appropriate European Union, National, Federal, State, and/or Local regulations governing the use of refrigerants and certification of technicians. For additional information on regulations and technician programs, contact your local THERMO KING dealer.

Service Tools - Use the proper service tools. Gauge manifold sets should include appropriate shutoff valves or disconnects near the end of each service line.

Recovery Equipment - Recovery equipment must be used. Proper recovering, storing and recycling of refrigerants is an important part of all service work.

Service Procedures - Recommended procedures must be used to minimize refrigerant loss.

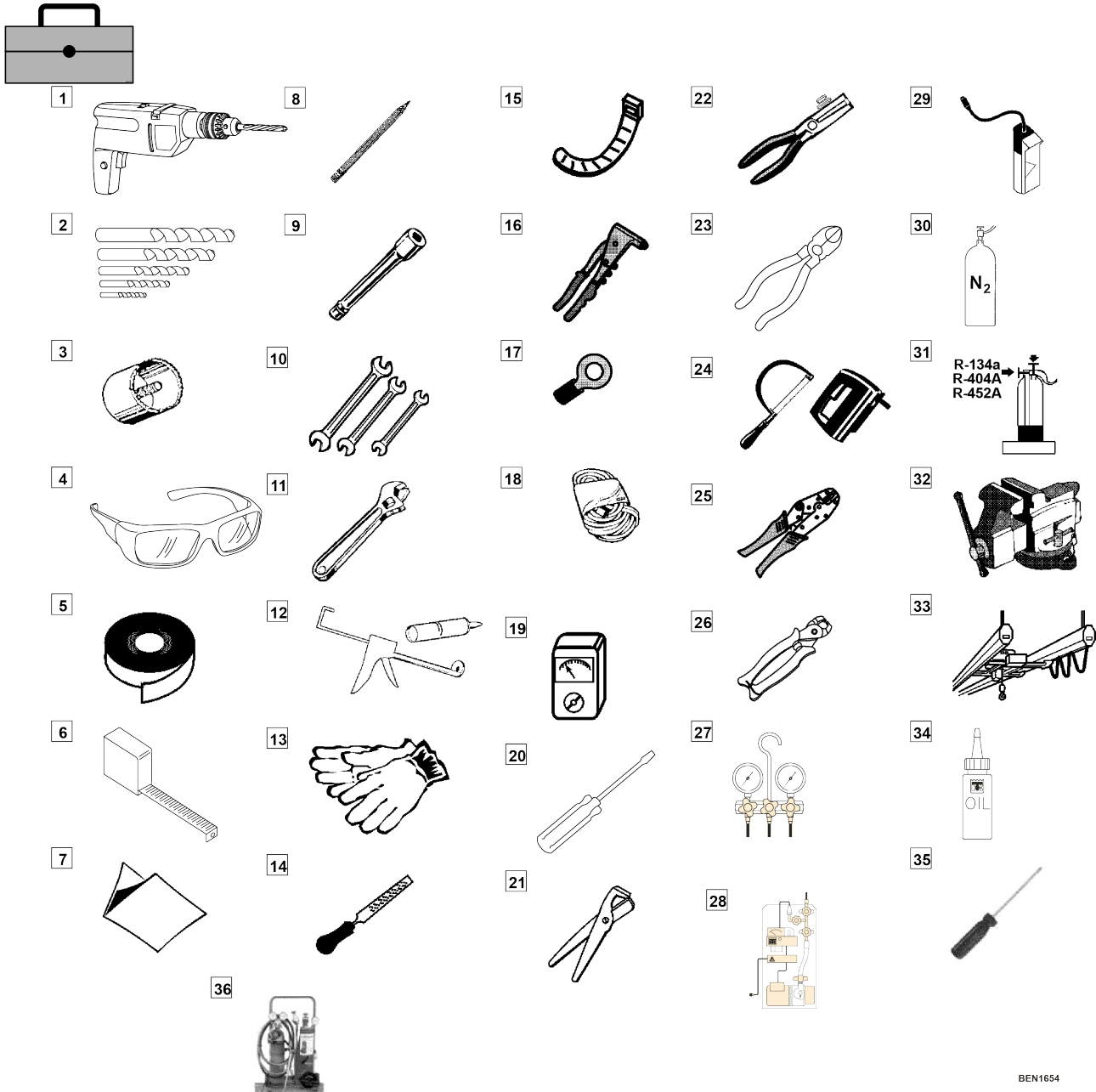
Components may be isolated by closing service valves and performing system pump-downs.

Components unable to be isolated for service must be repaired only after refrigerant is properly recovered.

Required Tools

Note: Equipment such as scales, gauges, refrigerant leak detectors, and torque wrenches should be in good working condition and routinely calibrated to assure accurate readings.

Figure 1.



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Required Tools

| | | | | | |
|-----|-----------------------------|-----|------------------------|-----|---------------------------|
| 1. | Electric drill | 13. | Protective gloves | 25. | Electrical terminal press |
| 2. | Set of drill bits | 14. | File | 26. | Pincers for hose clips |
| 3. | Set of glass-shaped cutters | 15. | Plastic flanges | 27. | Gauge manifold |
| 4. | Protective goggles | 16. | Riveter | 28. | Vacuum pump |
| 5. | Adhesive tape | 17. | Electric connectors | 29. | Leak detector |
| 6. | Measuring tape | 18. | Electrical wire | 30. | Nitrogen cylinder |
| 7. | Drilling template | 19. | Voltmeter | 31. | Refrigerant cylinders |
| 8. | Pencil | 20. | Set of screwdrivers | 32. | Table-mounted vice |
| 9. | Socket wrenches | 21. | Hose cutters | 33. | Crane or hoist |
| 10. | Fixed wrenches | 22. | Wire strippers | 34. | TK refrigerant oil |
| 11. | Monkey wrench | 23. | Wire cutters | 35. | Philips Screw Driver |
| 12. | Silicone | 24. | Electric and hand saws | 36. | Autogenous welding set |

Required Support Materials

Please have the following support materials to hand prior to starting your installation - as they are listed as reference throughout this manual:

1. Vehicle Powered Truck Installation Standards and Procedures Guide EMEA - located in Infocentral: [Technical Publications](#)
2. Commercial Brochure for your unit - includes weight specifications and applicable unit options: [Commercial Brochures](#)
3. **For Multi-Temperature Units only** - [Multi-Temperature Configuration Guides](#)

Operating Method

Single-Compartment Units

The operations indicated in this manual should be carried out by a mechanic in the exact sequence in which they are presented in the manual. In order to speed up the installation, two mechanics can work together. In this case, the installation can be completed in less than eight hours (one working day). In order to achieve this objective, each mechanic should have his/her own separate tool kit.

The diagram on the following page shows the way in which the different tasks should be divided between the two mechanics.

Each one should work on different parts of the vehicle at all times, and on unrelated tasks, which will avoid interference between them.

- Mechanic A installs the condenser and evaporator. He/she should not modify the vehicle engine in any way and once the work is completed, the unit is ready to be connected to the over-the-road compressor.
- Mechanic B fits the drive kit, installs the electrical system, checks the installation and charges the refrigeration circuit. He/she should not enter the load compartment at any time during the installation.

Spectrum Units

The operations indicated in this manual should be carried out by a mechanic in the exact sequence in which they are presented in the manual.

In order to speed up the installation, two mechanics can work together. In this case, the installation can be completed in less than eight hours (one working day). In order to achieve this objective, each mechanic should have his/her own tool kit.

The diagram on the following page shows the way in which the different tasks should be divided between the two mechanics.

Each one should work on different parts of the vehicle at all times, and on unrelated tasks, which will avoid interference between them.

- Mechanic A should install the condenser and the evaporators. He/she should not modify the vehicle engine in any way and once the work is completed, the unit should be ready to be connected to the over-the-road compressor.
- Mechanic B should mount the drive kit, install the electrical system, check the installation and charge the refrigeration circuit. He/she should not enter the cargo box during the entire installation.



Operating Method

| TASK | t(min) | 1h | 2h | 3h | 4h | 5h | 6h | 7h |
|--------------------------------|---------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Unpacking | 10 min | █ | | | | | | |
| Inspection | 5 min | █ | | | | | | |
| Install Condenser | 25 min | █ | █ | | | | | |
| Install Evaporator | 20 min | | █ | █ | | | | |
| Prepare hoses | 10 min | | █ | | | | | |
| Connect hoses to condenser | 14 min | | █ | | | | | |
| Connect hoses to evaporator | 22 min | | █ | █ | | | | |
| Electrical connections | 10 min | | █ | █ | | | | |
| Drainage circuit | 5 min | | █ | | | | | |
| Drive kit | 180 min | ████████████████████ | ████████████████████ | ████████████████████ | | | | |
| Connect hoses to compressor | 18 min | | | █ | █ | █ | █ | █ |
| Vacuum and leak test | 180 min | | | █ | ████████████████████ | ████████████████████ | ████████████████████ | ████████████████████ |
| Install in-cab control | 10 min | | | | █ | | | |
| Control cable connection | 5 min | | | | █ | | | |
| Connect to battery | 15 min | | | | █ | █ | | |
| Standby socket | 10 min | | | | | █ | █ | |
| Check installation | 10 min | | | | | | █ | █ |
| Charge refrigerant | 30 min | | | | | █ | █ | █ |

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Unpacking and Unit Inspection

Unpacking

1. Open the packaging.
2. Find the unit documentation.
3. Verify that the packaging contains all the accessories indicated on the list attached with the documentation.
4. Check that the hose length is correct before starting the installation. Checking can be carried out by consulting the "Packing List" included with the unit documentation (1 in = 2.54 cm).

Unit Inspection

1. Open the condenser unit cover and the evaporator unit cover (Spectrum Units only) and check that:
 - Neither the cover nor the unit show any shock damage or imperfections.
 - The voltage of all the electrical components is correct (12/24V).
2. Open the condenser unit cover and ensure the following:
 - The condenser battery is charged with helium gas.
 - In electric standby units, the phase used by the unit (1pg or 3ph) that is indicated on the specification plate on the electric motor.
3. Open the evaporator unit cover and ensure the following:
 - The evaporator battery is charged with helium gas.

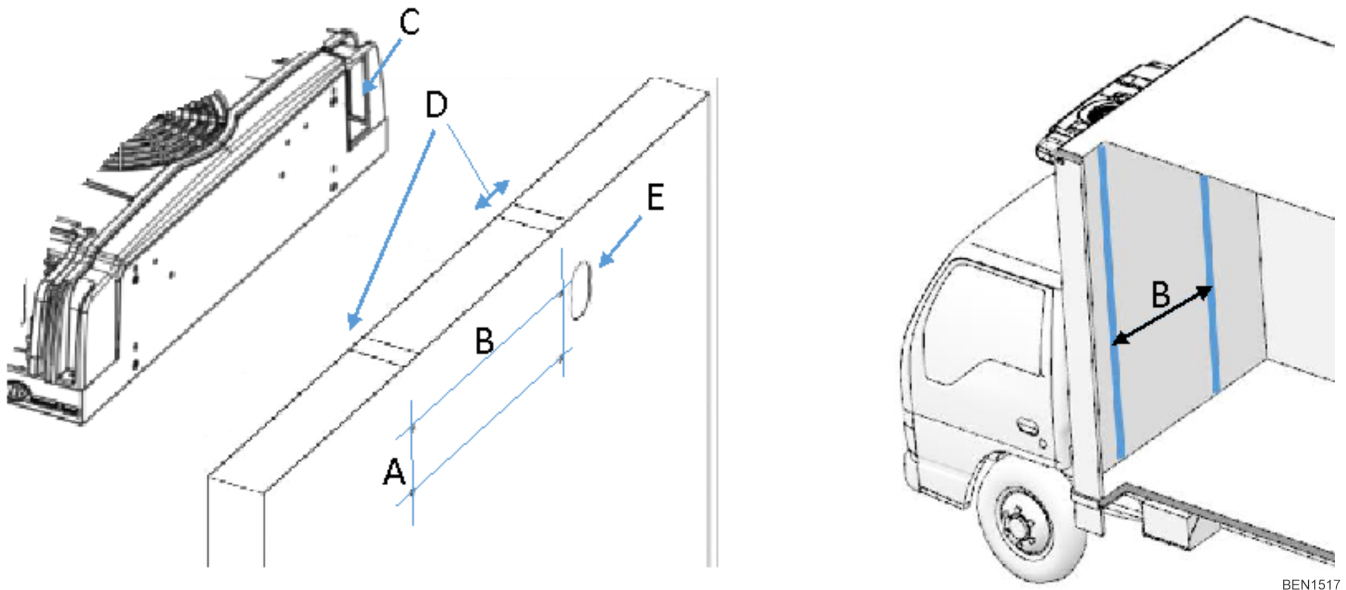
Condenser Installation

Important: See Section 4 - Unit Installation Standards and Procedures in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide (TK 61588)(TK 56430).
THESE PROCEDURES MUST BE FOLLOWED!

Note: Nose mount condenser mounting and access hole dimensions can be found at the back of this manual.

- For V500 and V600, Truck front wall body panel should be structurally prepared in advance prior to installing unit. This panel should be reinforced at fixing points(A and B) with vertical beams as indicated (D). This work should be completed by qualified body builder. The body builder needs to ensure that the centerline distance (B) between vertical columns of front panel are as indicated for corresponding unit installation template.

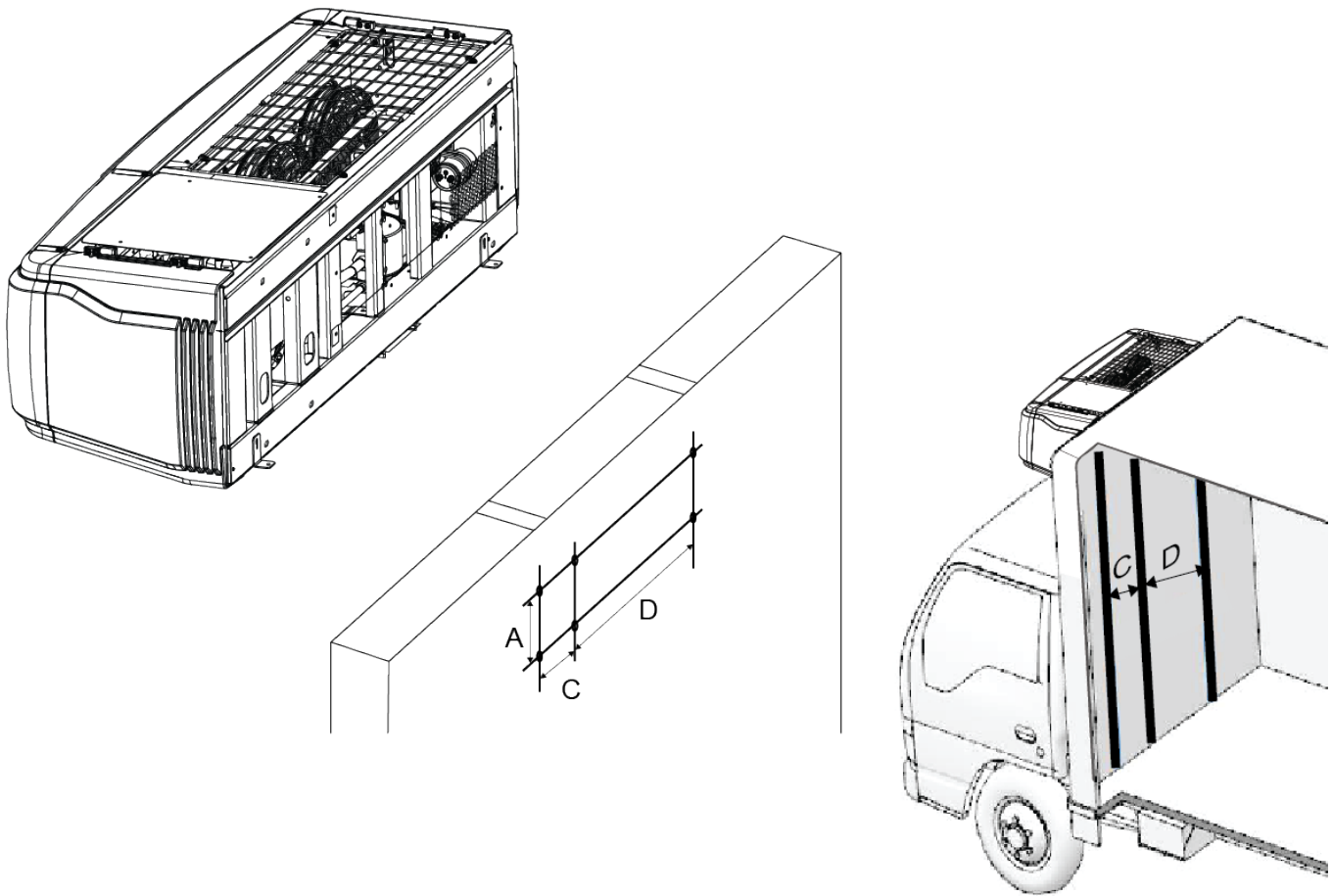
Figure 2. V500 and V600



| Model | A | B |
|-------|----------|---------|
| V-500 | 330.2 mm | 1150 mm |
| V-600 | 330.2 mm | 1150 mm |

- For V800 and V1000, Truck front wall body panel should be structurally prepared in advance prior to installing unit. This panel should be reinforced at fixing points(A and B) with vertical beams. This work should be completed by qualified body builder. The body builder needs to ensure that the centerline distance (B), (C) and (D) between vertical columns of front panel are as indicated for corresponding unit installation template.

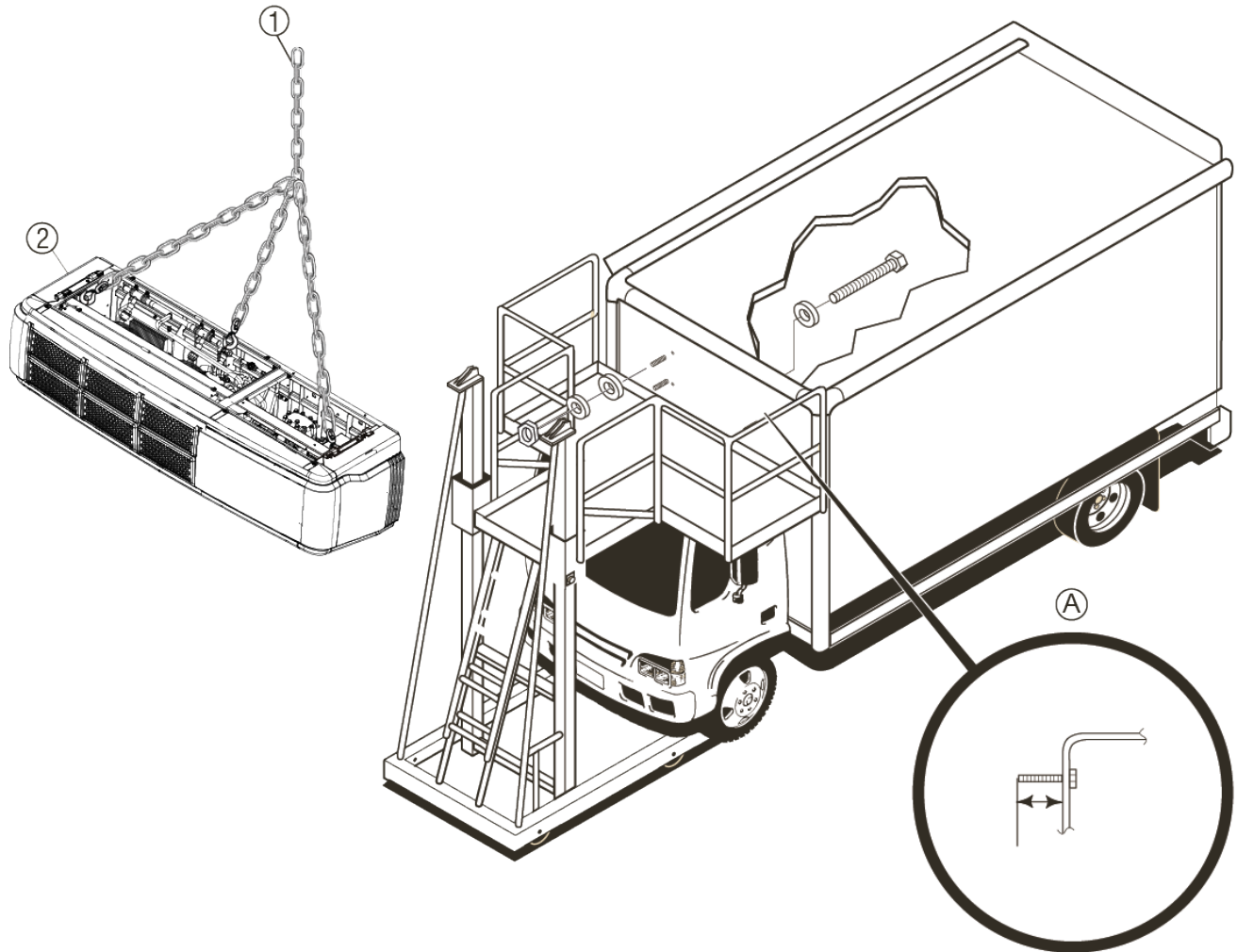
Figure 3. V800 and V1000



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| Model | A | C | D |
|--------|--------|--------|-----------|
| V-800 | 395 mm | 274 mm | 1107.5 mm |
| V-1000 | 395 mm | 274 mm | 1107.5 mm |

3. Fit the template according to the instructions given.
4. Mark the position of the drilled holes and openings (AxB) for V500 and V600 and, (AxC) and (AxD) for V800 and V1000 ensure that holes are drilled through center of vertical columns. Avoid any possible interference with electrical wires and parts of the vehicle chassis.
5. Use a bridge crane to raise the unit up to the correct position, making sure that it remains in a horizontal position.
6. Drill the holes to hold the compressor unit in place (D 12) as well as the holes for routing hoses (D 70).
7. Lift the unit, making sure that it remains in a horizontal position.



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Note: For safety purposes use approved code of practice for lifting equipment and processes.

Note: Use forged clevis and pins, forged chain links and forged locking hooks with strength equal to total lift capacity of hoist mechanism and that meet all safety standards.

8. Mount condenser using the mounting bolts provided. Insert the mounting bolts from the body side and ensure that a large flat washer is used on body side. A flat washer and locking washer is to be used on unit side. Torque the mounting bolts to 36.5 Nm (26.9 lb/ft).
9. Route the refrigeration hoses and electrical harnesses through the corresponding hole in the structure. Seal all holes where hoses and screws pass through the body to ensure water and moisture cannot enter the loadspace or the insulation of the truck body.

Note: Place the plugs supplied in the mounting holes that were not utilized during installation.

ES Evaporator

Preparing the ES Evaporator for Installation

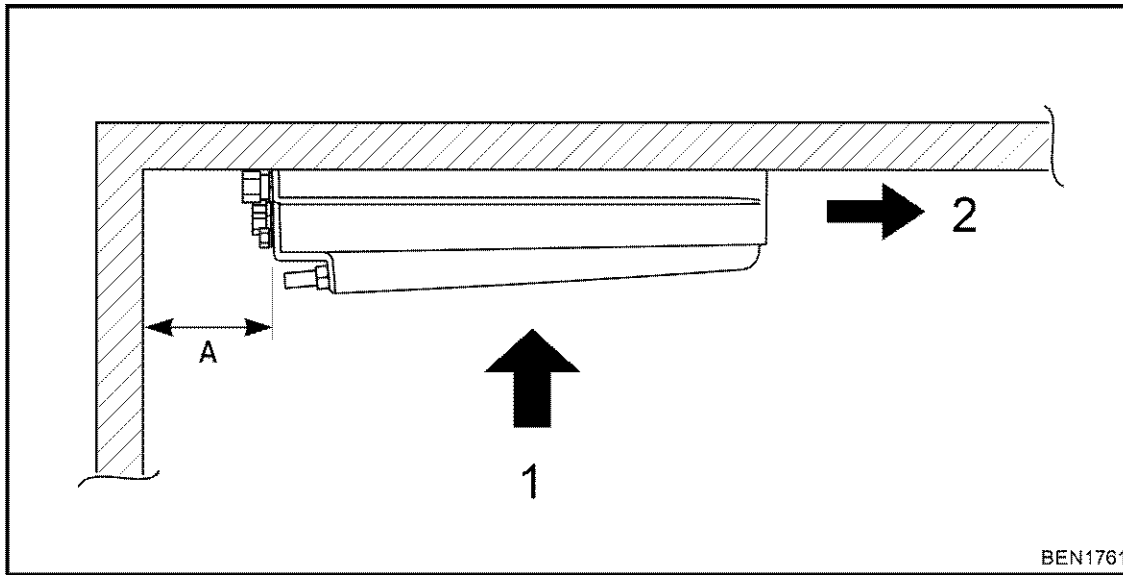
1. Fit the template according to the instructions given.
2. Mark the position of the drilled holes. Avoid any possible interference with electrical wires and parts of the vehicle chassis.
3. Drill blind holes to screw the evaporator unit in place. Screw in the bolts and washers supplied for the ceiling. Do not tighten.
4. Cut the hole to route the moisture drain hose (diameter 22).
5. Install the unit on the ceiling supported by the bolts screwed in previously.
6. Tighten the bolts.

Evaporator Installation

Important: See Section 4 - Unit Installation Standards and Procedures in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide (TK 61588). **THESE PROCEDURES MUST BE FOLLOWED!**

Note: Evaporator mounting hole locations can be found at the back of this manual.

Figure 4. Standard Evaporator Minimum distance from cargo wall to rear of evaporator shown.



| | |
|----|---------------|
| 1. | Return Air |
| 2. | Discharge Air |

| Model | A |
|--------|---------------|
| ES100N | 112 mm (4 in) |
| ES150 | 112 mm (4 in) |
| ES300 | 112 mm (4 in) |
| ES400 | 152 mm (6 in) |
| ES500 | 152 mm (6 in) |
| ES800 | 152 mm (6 in) |
| ES1000 | 152 mm (6 in) |

Evaporator Drain Hose Installation

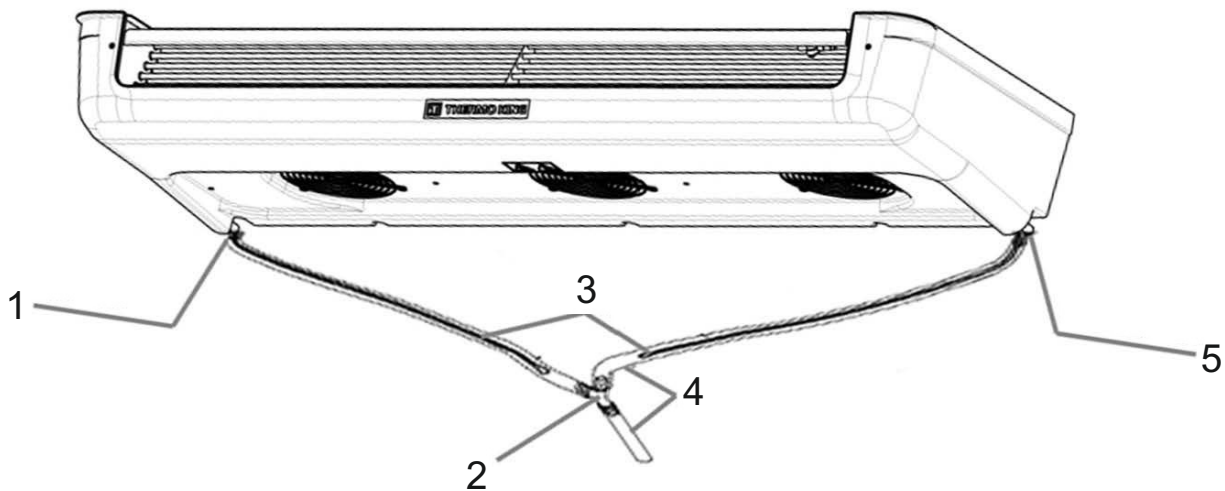
Important: See Section 8 - Evaporator Drain Hose Standards in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide . THESE PROCEDURES MUST BE FOLLOWED!

1. DO NOT fit band wrap to hold the wires.
2. DO NOT cut the wires to fit.
3. DO NOT cover the Heaters.
4. DO NOT fit more than 4 wires into the tube.

Drain Circuit in the ES800 Evaporator

Notes:

- NEVER CUT HEATER RESISTANCE WIRES!
 - 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.
1. Cut the drain hose to the required length.
 2. Join the three sections of hose using the Y hose connection.
 3. Slide the defrost heater through each drainage hose, along its entire length.
 4. Allow the drain hoses a sufficient slant to ensure that the water drains away and connect the hoses to the drain tubes. Secure the connections with plastic flanges.
 5. Pass the hose through the drain hole and seal hermetically.
 6. Check that the corresponding siphon or moisture trap is installed at the end of each drain hose. If not, install it.

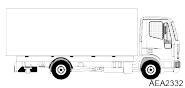
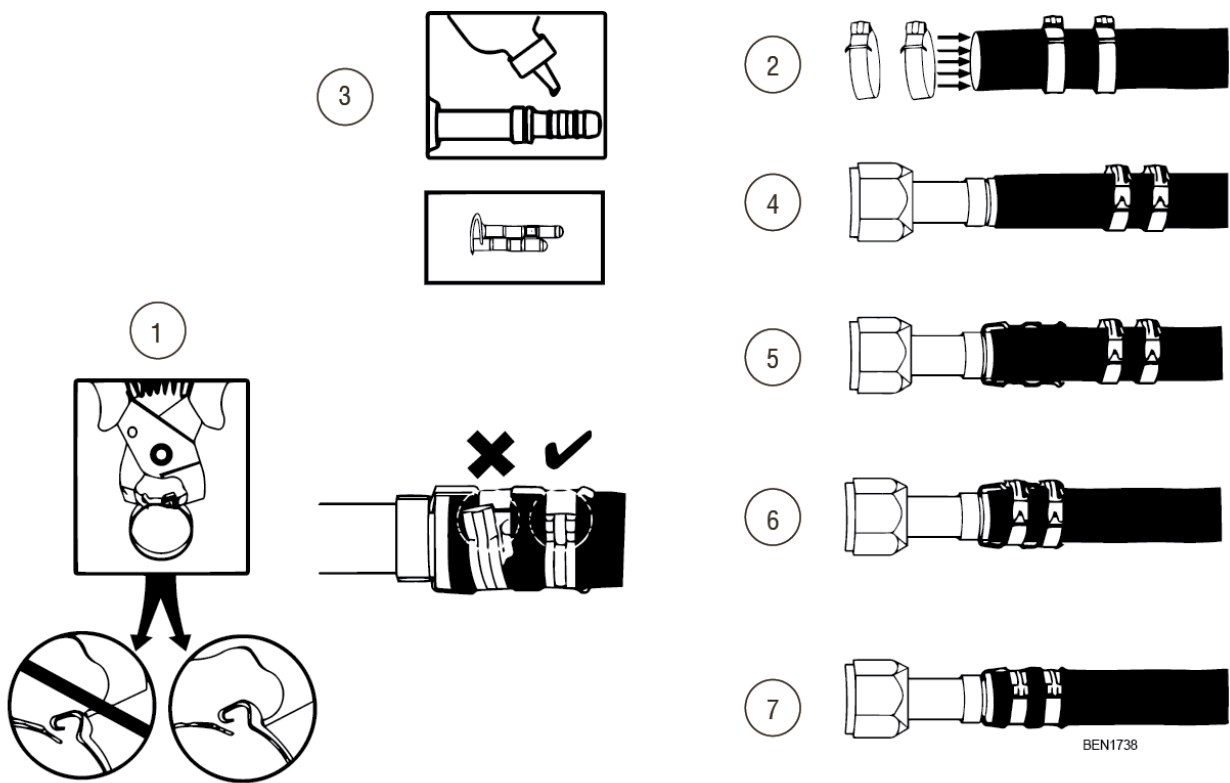


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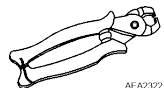
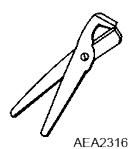
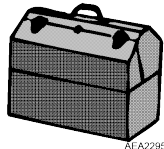
| | |
|----|-----------------------|
| 1. | Evaporator Drain tube |
| 2. | Y Hose Connection |
| 3. | Heaters |
| 4. | Drain hose |
| 5. | Evaporator Drain tube |

Preparing the Refrigeration Hoses

1. Cut the hose to the required length. Use the recommended hose cutters. Do not use saws, knives or similar tools.
2. Pass two clips of appropriate diameter over the hose.
3. Lubricate the cylinder of the fitting to be inserted in the hose, using Thermo King refrigerant oil.
4. Manually insert the fitting into the hose. The hose should touch the projecting part of the fitting without going into it. Clean off excess oil.
5. Place the clamp for the clips into the fitting slot. The clamp is properly positioned when it can rotate within the slot.
6. Place the clips in the clamp arm seats.
7. Close both clips using recommended pincers. Check that the clips are properly positioned and closed (see drawings).



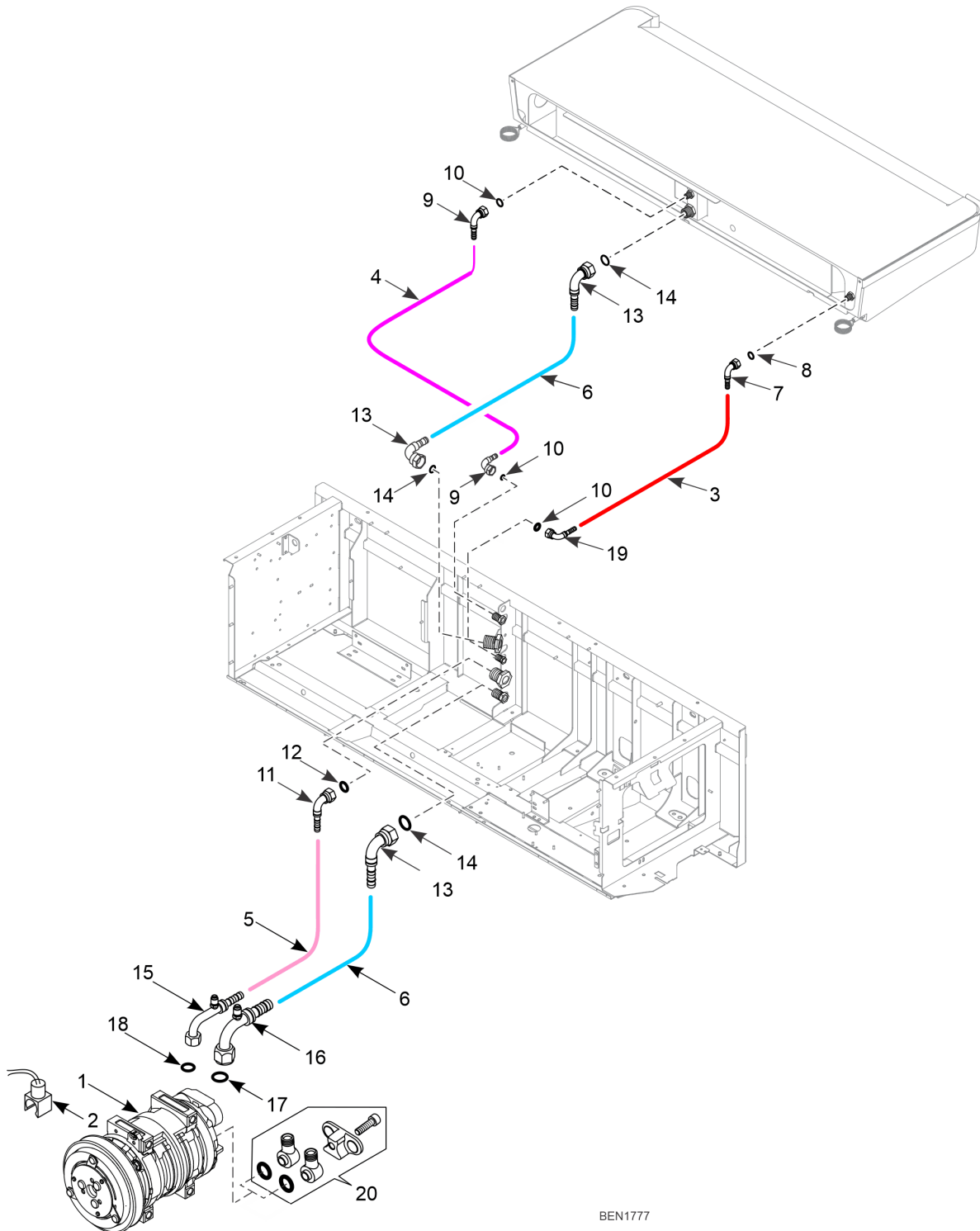
T = 10 min.



Hose Connections

Important: See Section 6 - Refrigerant Hose and Fittings Standards in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide. **THESE PROCEDURES MUST BE FOLLOWED!**

Figure 5. Hose Connection Single Temperature Model 10 and 20



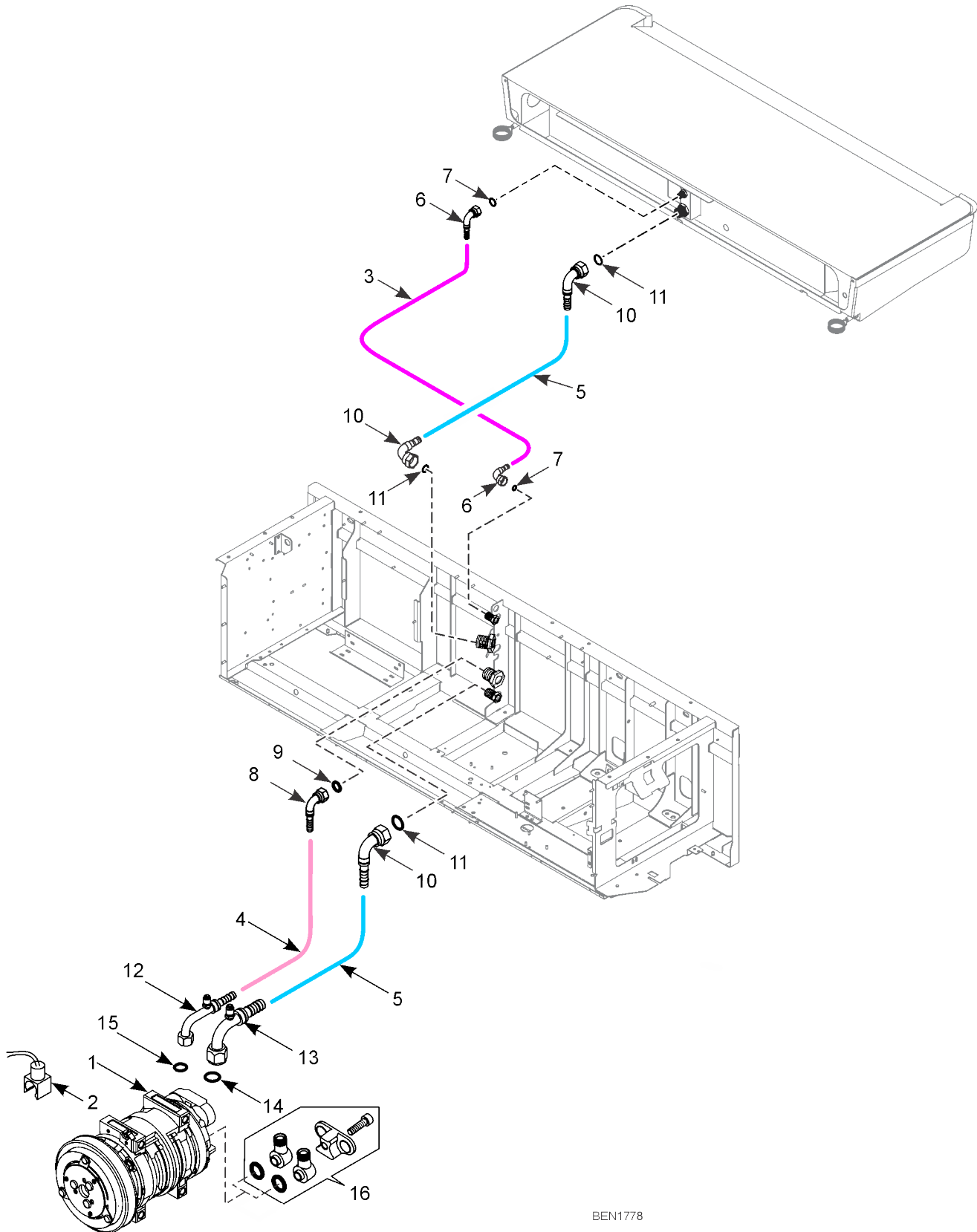
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Legend

| | | | |
|-----|---|-----|---|
| 1. | Compressor | 11. | Fitting - 90 degree (female o-ring seal, #10 fitting, #10 hose) |
| 2. | Switch | 12. | O-RING (#10) |
| 3. | Hose (#6, 200 ft) | 13. | Fitting - 90 degree (female o-ring seal, #16 fitting, #16 hose) |
| 4. | Hose (#8, 200 ft) | 14. | O-RING EPDM (#16) |
| 5. | Hose (#10, 200 ft) | 15. | Fitting - 90 degree (female tube-o, long pilot, #8 fitting, #10 hose) w/ charging port |
| 6. | Hose (#16, 200 ft) | 16. | Fitting - 90 degree (female tube-o, long pilot, #16 fitting, #16 hose) w/ charging port |
| 7. | Fitting - 90 degree (female o-ring seal, #6 fitting, #6 hose) | 17. | O-RING (Suction Line) |
| 8. | O-RING (#6) | 18. | O-RING (Discharge Line) |
| 9. | Fitting - 90 degree (female o-ring seal, #8 fitting, #8 hose) | 19. | Fitting - 90 degree (female o-ring seal, #6 fitting, #8 hose) |
| 10. | O-RING (#8) | | |

Figure 6. Hose Connection Single Temperature Model 30 and 50



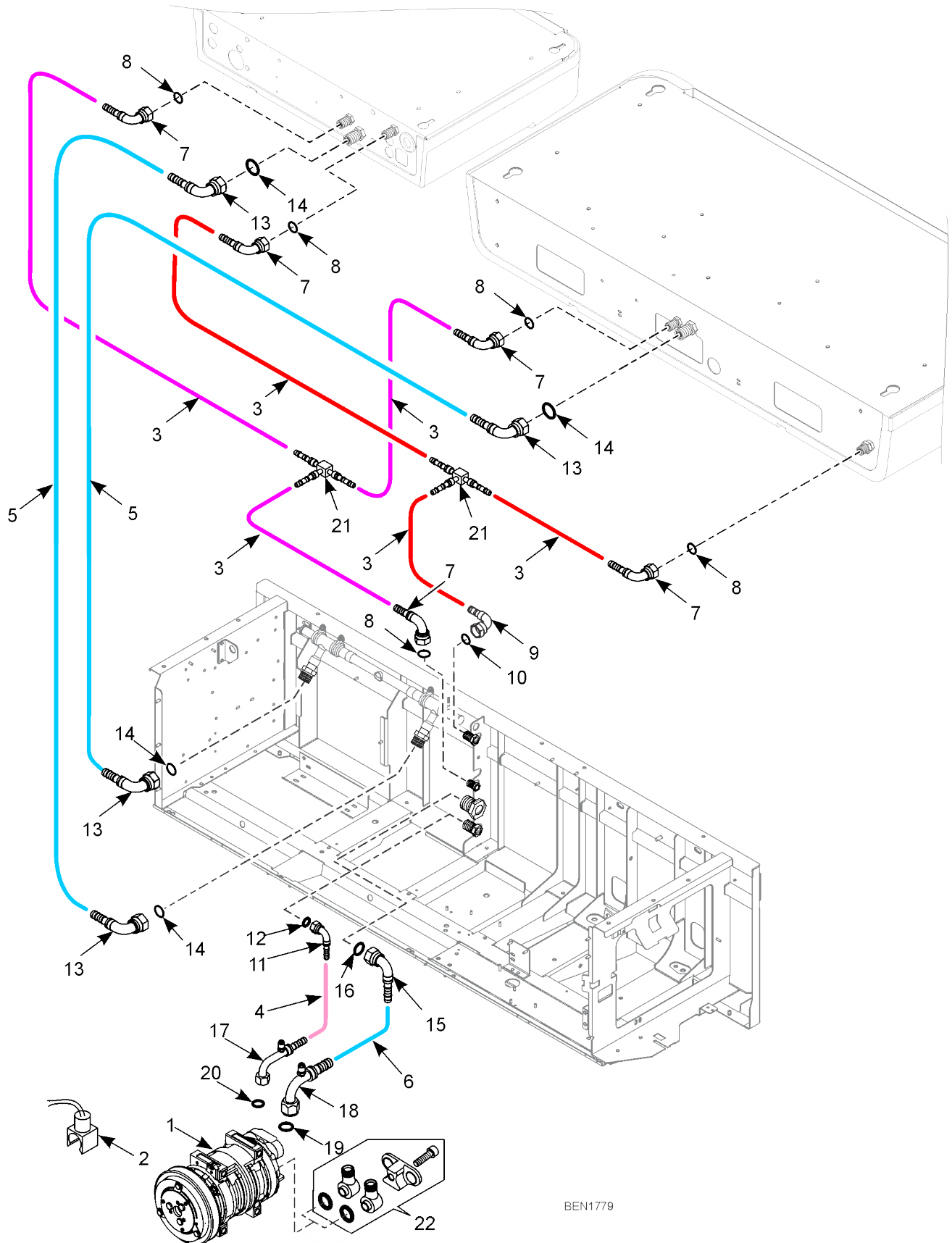
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Legend

| | | | |
|----|---|-----|---|
| 1. | Compressor | 9. | O-RING (#10) |
| 2. | Switch (Thermostat) | 10. | Fitting - 90 degree (female o-ring seal, #16 fitting, #16 hose) |
| 3. | Hose (#8, 200 ft) | 11. | O-RING EPDM (#16) |
| 4. | Hose (#10, 200 ft) | 12. | Fitting - 90 degree (female tube-o, long pilot, #8 fitting, #10 hose) w/ charging port |
| 5. | Hose (#16, 200 ft) | 13. | Fitting - 90 degree (female tube-o, long pilot, #16 fitting, #16 hose) w/ charging port |
| 6. | Fitting - 90 degree (female o-ring seal, #8 fitting, #8 hose) | 14. | O-RING (Suction Line) |
| 7. | O-RING (#8) | 15. | O-RING (Discharge Line) |
| 8. | Fitting - 90 degree (female o-ring seal, #10 fitting, #10 hose) | | |

Figure 7. Hose Connection Multi Temperature Model 30 and 50 (Two Zones)

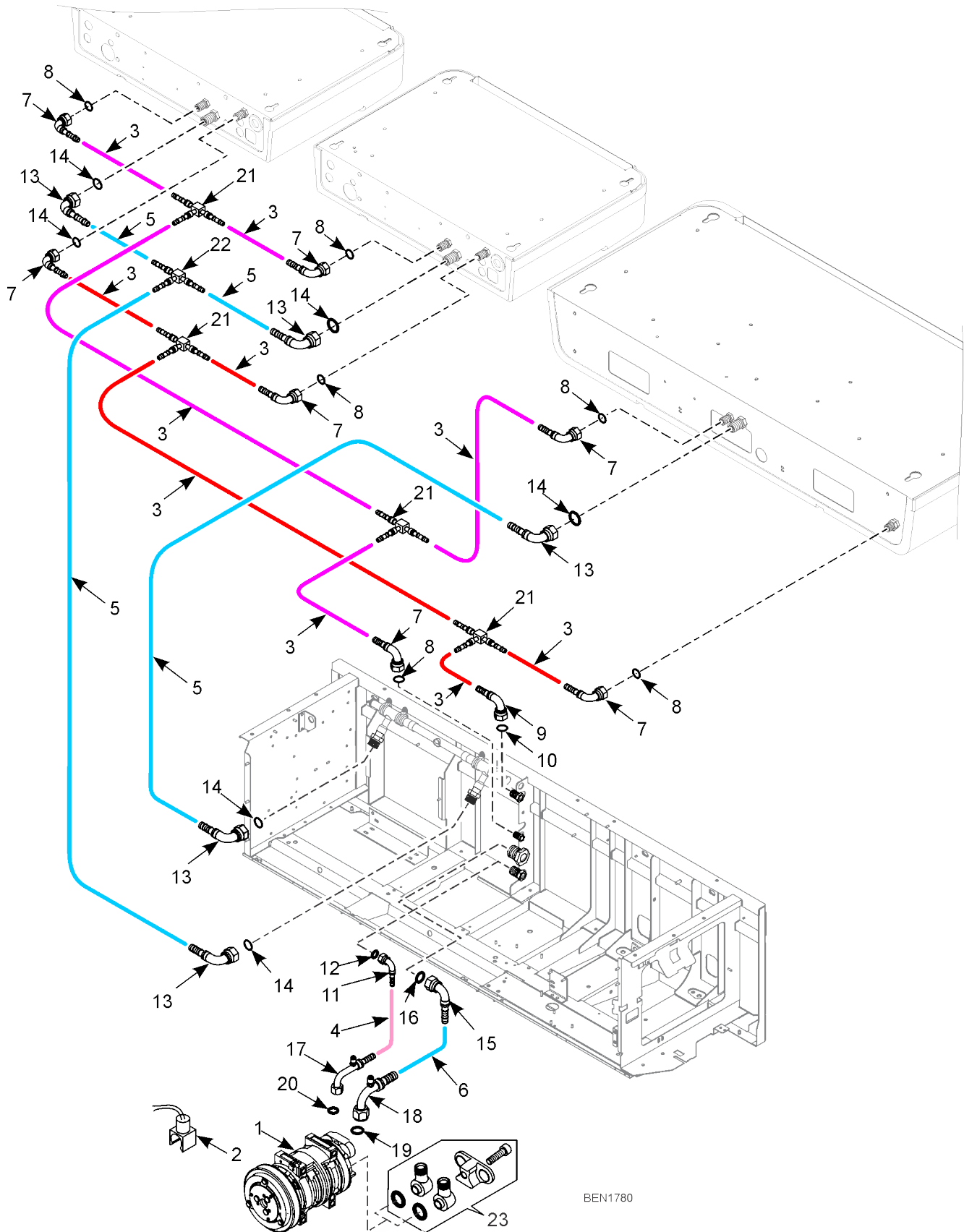




Legend

| | | | |
|-----|---|-----|---|
| 1. | Compressor | 12. | O-RING (#10) |
| 2. | Switch (Thermostat) | 13. | Fitting - 90 degree (female o-ring seal, #12 fitting, #12 hose) |
| 3. | Hose (#6, 200 ft) | 14. | O-RING (#12) |
| 4. | Hose (#10, 200 ft) | 15. | Fitting - 90 degree (female o-ring seal, #16 fitting, #16 hose) |
| 5. | Hose (#12, 200 ft) | 16. | O-RING EPDM (#16) |
| 6. | Hose (#16, 200 ft) | 17. | Fitting - 90 degree (female tube-o, long pilot, #8 fitting, #10 hose) w/ charging port |
| 7. | Fitting - 90 degree (female o-ring seal, #6 fitting, #6 hose) | 18. | Fitting - 90 degree (female tube-o, long pilot, #16 fitting, #16 hose) w/ charging port |
| 8. | O-RING (#6) | 19. | O-RING (Suction Line) |
| 9. | Fitting - 90 degree (female o-ring seal, #6 fitting, #8 hose) | 20. | O-RING (Discharge Line) |
| 10. | O-RING (#8) | 21. | TEE (Splicer, #6) |
| 11. | Fitting - 90 degree (female o-ring seal, #10 fitting, #10 hose) | | |

Figure 8. Hose Connection Multi Temperature Model 30 and 50 (Two Zones with Three Evaporators)





Legend

| | | | |
|-----|---|-----|---|
| 1. | Compressor | 12. | O-RING (#10) |
| 2. | Switch (Thermostat) | 13. | Fitting - 90 degree (female o-ring seal, #12 fitting, #12 hose) |
| 3. | Hose (#6, 200 ft) | 14. | O-RING (#12) |
| 4. | Hose (#10, 200 ft) | 15. | Fitting - 90 degree (female o-ring seal, #16 fitting, #16 hose) |
| 5. | Hose (#12, 200 ft) | 16. | O-RING EPDM (#16) |
| 6. | Hose (#16, 200 ft) | 17. | Fitting - 90 degree (female tube-o, long pilot, #8 fitting, #10 hose) w/ charging port |
| 7. | Fitting - 90 degree (female o-ring seal, #6 fitting, #6 hose) | 18. | Fitting - 90 degree (female tube-o, long pilot, #16 fitting, #16 hose) w/ charging port |
| 8. | O-RING (#6) | 19. | O-RING (Suction Line) |
| 9. | Fitting - 90 degree (female o-ring seal, #6 fitting, #8 hose) | 20. | O-RING (Discharge Line) |
| 10. | O-RING (#8) | 21. | TEE (Splicer, #6) |
| 11. | Fitting - 90 degree (female o-ring seal, #10 fitting, #10 hose) | 22. | TEE (Splicer, #12) |

Connecting the Hoses to the Condenser Unit

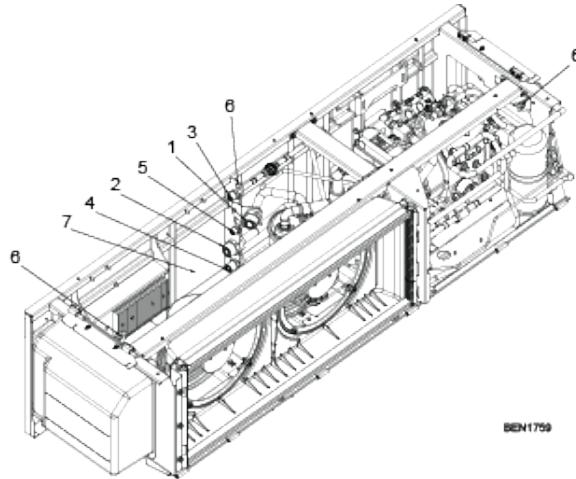
Note: Remove plugs from all tubing. Lubricate all refrigeration intakes with Thermo King refrigerant oil. Fit an O-ring to the seating in all refrigeration intakes. Check that the O-ring is properly fitted and connect each hose, using two fixed wrenches. The loose end of the hoses should remain sealed.

1. First fit the discharge fitting.
2. Assemble the oil return fitting in the separator.
3. Fit the defrost fitting.
4. Mount the filter with the liquid sight glass in the liquid line.
5. Remove the plug from the liquid sight glass, and fit an O-ring.
6. Assemble the liquid line fitting.

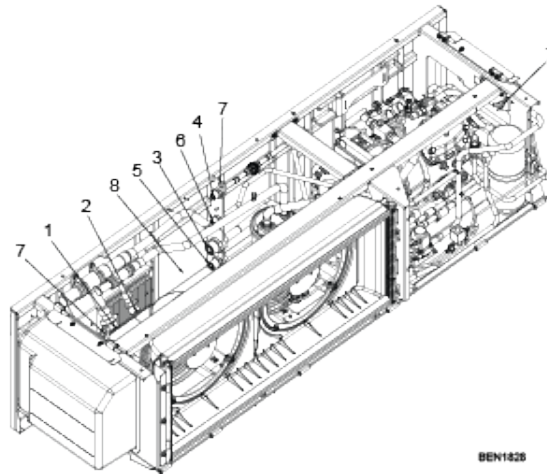
Multi-Temperature (Spectrum Only)

7. Mount the compressor’s suction line fitting.
8. Mount the evaporator’s suction line fitting.

Figure 9. Single Temperature

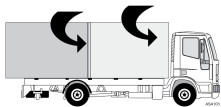
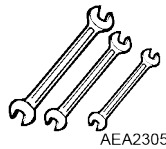
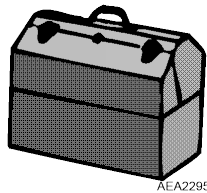


| Sr. Number | Description |
|------------|---|
| 1 | SUCTION LINE CONNECTION Host Evaporator-Condenser (hose #16) |
| 2 | SUCTION LINE CONNECTION Condenser-Road Compressor (hose #16) |
| 3 | LIQUID LINE CONNECTION (hose #8) |
| 4 | DISCHARGE LINE CONNECTION (hose #10) |
| 5 | HOT GAS LINE CONNECTION (hose #6) |
| 6 | LIFTING EYES |
| 7 | SPACE TO ROUTE HOSES TO EVAPORATOR |

Figure 10. Multi Temperature


BEN1426

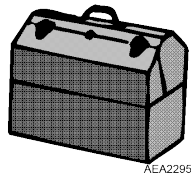
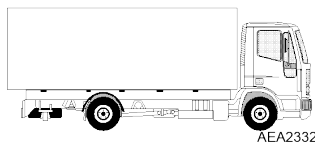
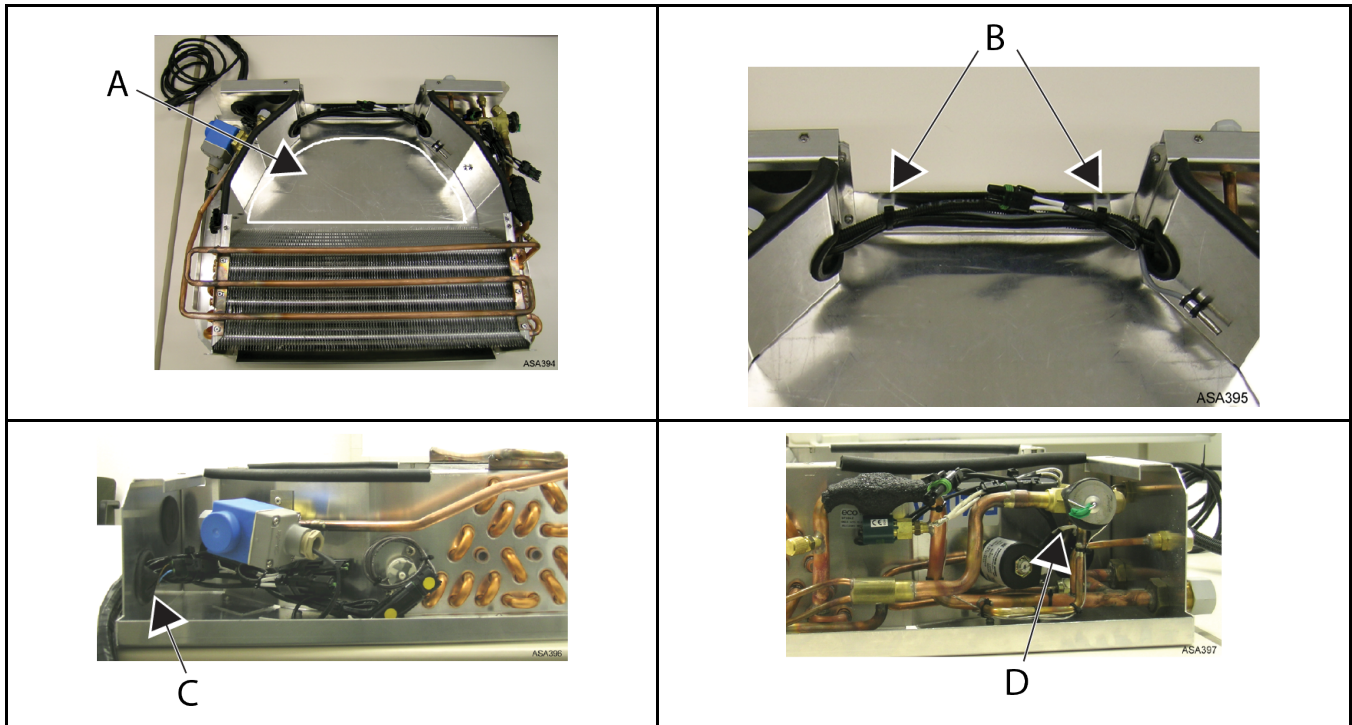
| Sr. Number | Description |
|------------|---|
| 1 | SUCTION LINE CONNECTION Host Evaporator-Condenser (hose #12 and hose #16 for max30/50) |
| 2 | SUCTION LINE CONNECTION Remote Evaporator-Condenser (hose #12) |
| 3 | SUCTION LINE CONNECTION Condenser-Road Compressor (hose #16) |
| 4 | LIQUID LINE CONNECTION (hose #6 and hose #8 for max30/50) |
| 5 | DISCHARGE LINE CONNECTION (hose #10) |
| 6 | HOT GAS LINE CONNECTION (hose #6 and hose #8 for max30/50) |
| 7 | LIFTING EYES |
| 8 | SPACE TO ROUTE HOSES TO EVAPORATOR |


T = 25 min.


Installing the Wiring Sleeve in the Evaporators

1. Ensure area A is completely free to guarantee maximum air flow.
2. **10/30 Models:** Use plastic flanges to secure the wiring sleeve to the supports, **B** fitted to the evaporator.
- 20/50 Models:** Insert the plastic clips mounted on the electrical hose into holes **C** to fasten it to the evaporator.
3. Enter the wiring sleeve into the evaporator through **C**.
4. Pass the wiring sleeve through **D**.

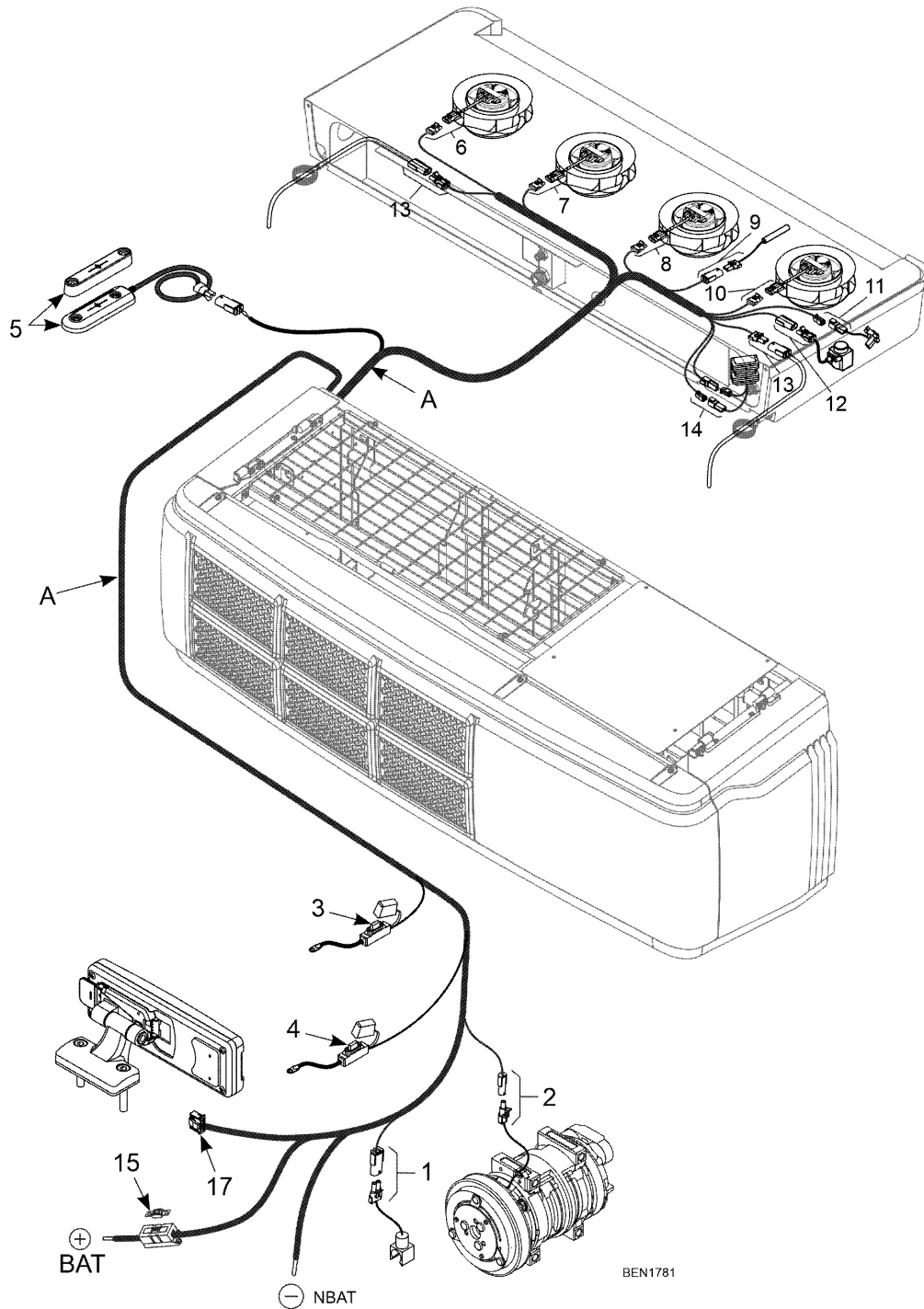
Note: The images show an ES100 but the same principle applies to all ES Evaporators.



Wiring Connections

Important: See Section 7 - Electrical Standards in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide .THESE PROCEDURES MUST BE FOLLOWED!

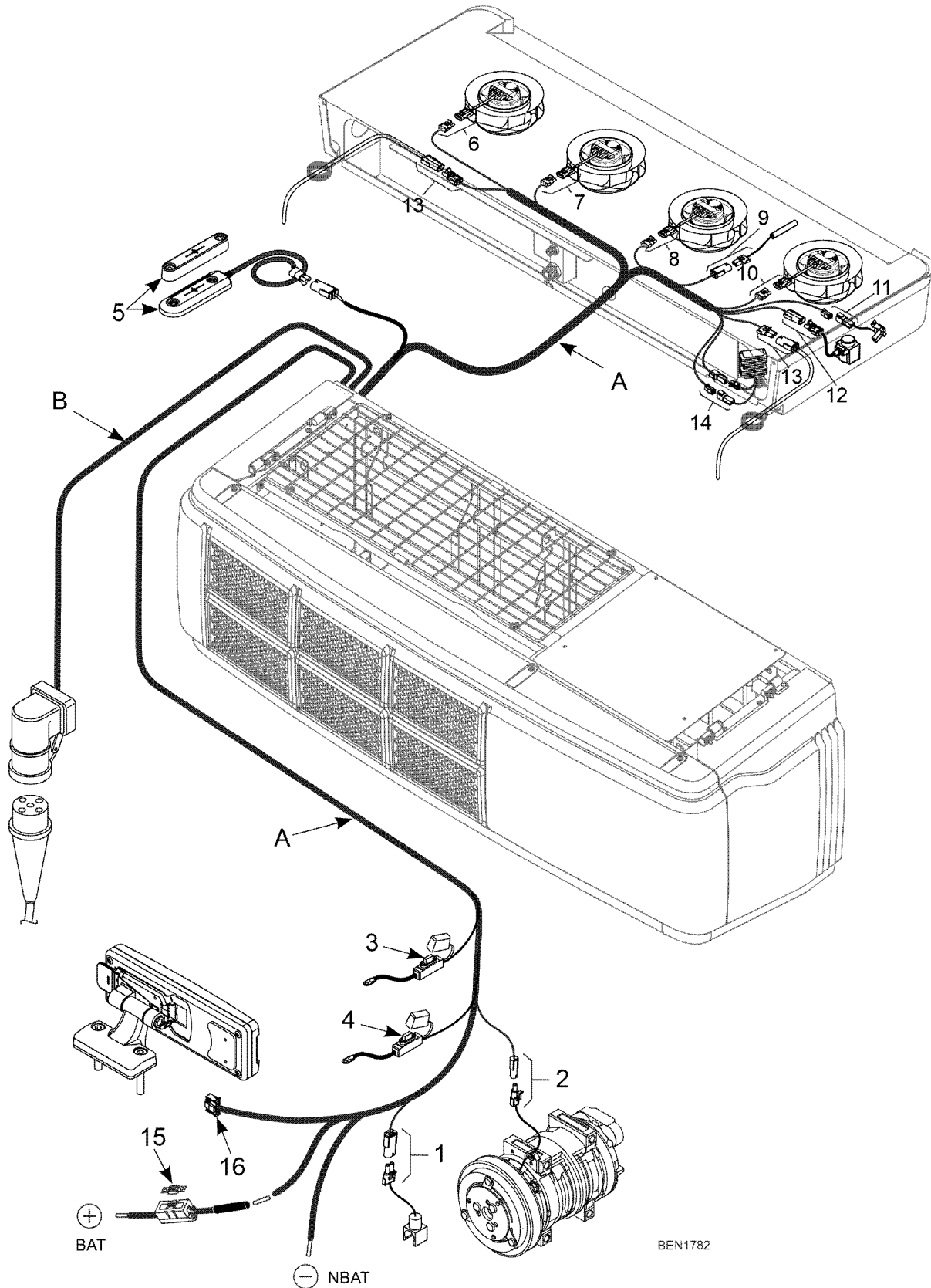
Figure 11. Wiring Connections Model 10 & 30 (Single Temperature)



Note: Make sure that the compressor is connected to the vehicle chassis.

| # | Component | Connections | # | Component | Connections |
|---|-------------------|-------------|----|-----------------------------|-------------|
| A | Main Harness | | 9 | Temperature Sensor | BLK/PNK |
| 1 | Thermo Switch L1S | C-26 | 10 | Evaporator Fan 4 | EF4/CHE |
| 2 | To Compressor | CLU | 11 | Switch, Defrost Termination | PS1/26/CHF |
| 3 | Ignition Fuse | 5A | 12 | Coil Valve | 12/CHB |
| 4 | Fuse Holder | | 13 | Drain Tube Heater Harness | 27A/CHJ1 |
| 5 | Door Switch | DSW1/CHW | 14 | Convertor | 26/CHF |
| 6 | Evaporator Fan 1 | EF1/CHD | 15 | Vehicle Battery Fuse | 5A |
| 7 | Evaporator Fan 2 | EF2/CHC | 16 | HMI | |
| 8 | Evaporator Fan 3 | EF3/CHN | | | |

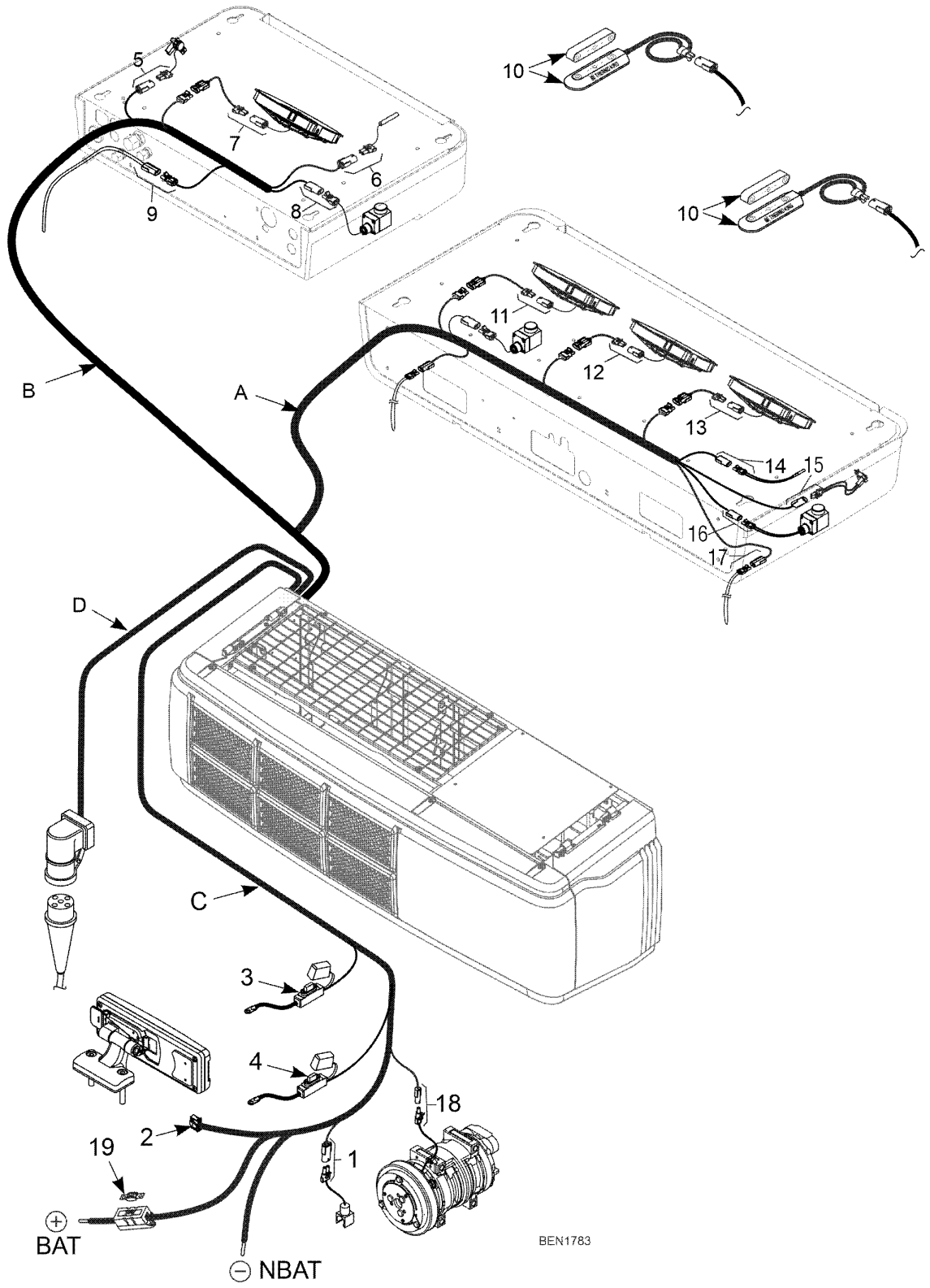
Figure 12. Wiring Connections Model 20 & 50 (Single Temperature)



BEN1782

| # | Component | Connections | # | Component | Connections |
|---|----------------------|-------------|----|-----------------------------|-------------|
| A | Main Harness | | 8 | Evaporator Fan 3 | EF3/CHN |
| B | Shore Power Cable | | 9 | Temperature Sensor | BLK/PNK |
| 1 | Thermo Switch L1S | C-26 | 10 | Evaporator Fan 4 | EF4/CHE |
| 2 | To Compressor | CLU | 11 | Switch, Defrost Termination | PS1/26/CHF |
| 3 | Ignition Fuse (MINI) | 5A | 12 | Coil Valve | 12/CHB |
| 4 | Battery Fuse (MINI) | 5A | 13 | Drain Tube Heater Harness | 27A/CHJ1 |
| 5 | Door Switch | DSW1/CHW | 14 | Convertor | 26/CHF |
| 6 | Evaporator Fan 1 | EF1/CHD | 15 | Vehicle Battery Fuse (MIDI) | 5A |
| 7 | Evaporator Fan 2 | EF2/CHC | 16 | HMI | |

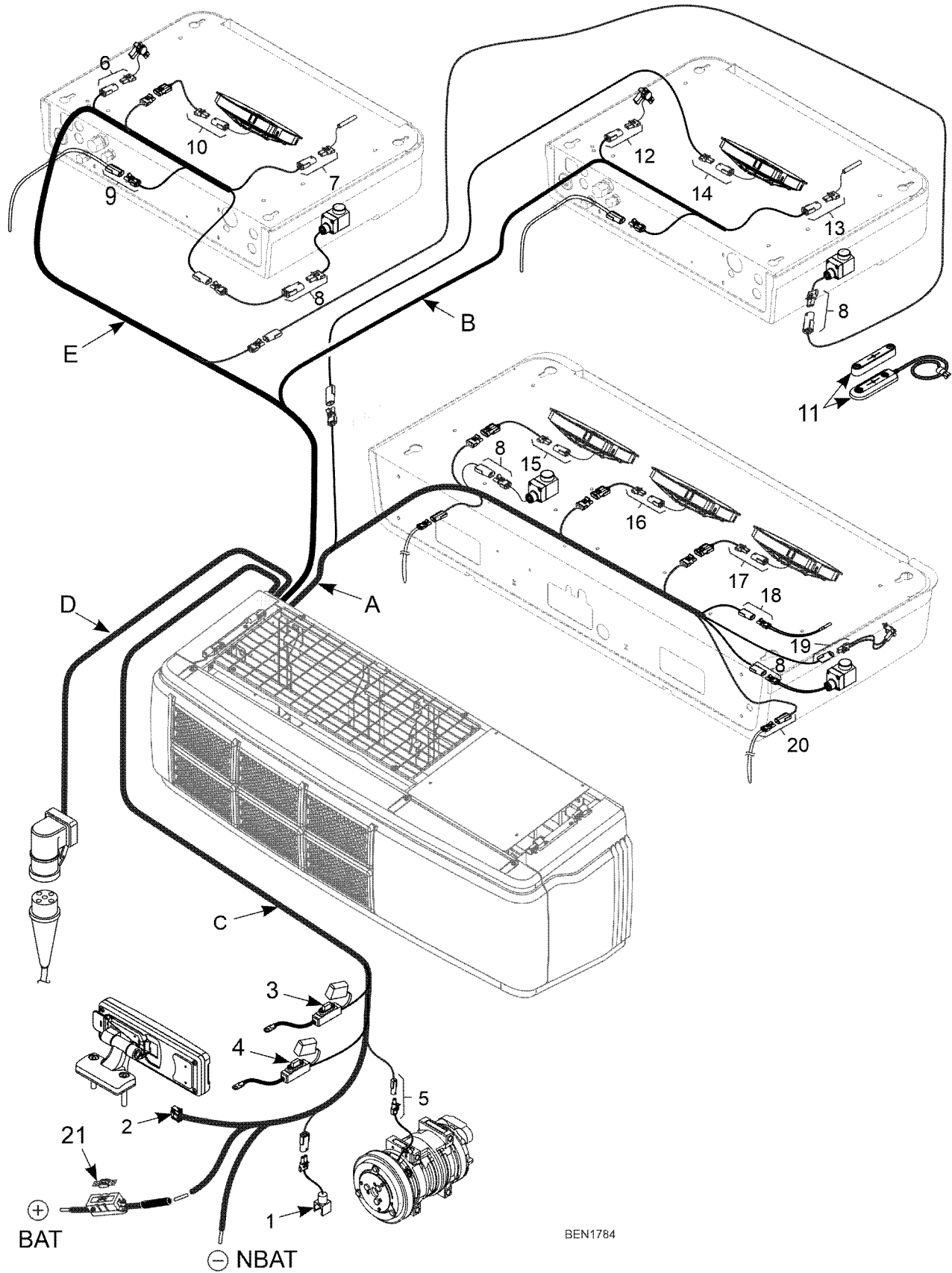
Figure 13. Wiring Connections Model 30 & 50 (Multi Temperature, Two Zones)



BEN1783

| # | Component | Connections | # | Component | Connections |
|---|----------------------------|-------------|----|-----------------------------|----------------|
| A | Main Harness | | 9 | Switch, Defrost Termination | CHB2/12A/DK2 |
| B | Spectrum Add-on | | 10 | Door Switch | PS2/12V/CHQ/33 |
| C | To Vehicle Ignition Switch | | 11 | Evaporator Fan 1 | EF1/CHD |
| D | To Power Receptacle | | 12 | Evaporator Fan 2 | EF2/CHC |
| 1 | Thermo Switch L1S | C-26 | 13 | Evaporator Fan 3 | EF3/CHN |
| 2 | HMI | | 14 | Temperature Sensor | BLK/PNK |
| 3 | Ignition Fuse (MINI) | 5A | 15 | Switch, Defrost Termination | PS1/26/CHF |
| 4 | Battery Fuse (MINI) | 5A | 16 | Coil Valve | 12/CHB |
| 5 | Coil Valve | | 17 | Drain Tube Heater Harness | 27A/CHJ1 |
| 6 | Temperature Sensor | | 18 | To Compressor | CLU |
| 7 | Evaporator Fan 4 | EF4/CHE | 19 | Vehicle Battery Fuse (MIDI) | 5A |
| 8 | Coil Valve | | | | |

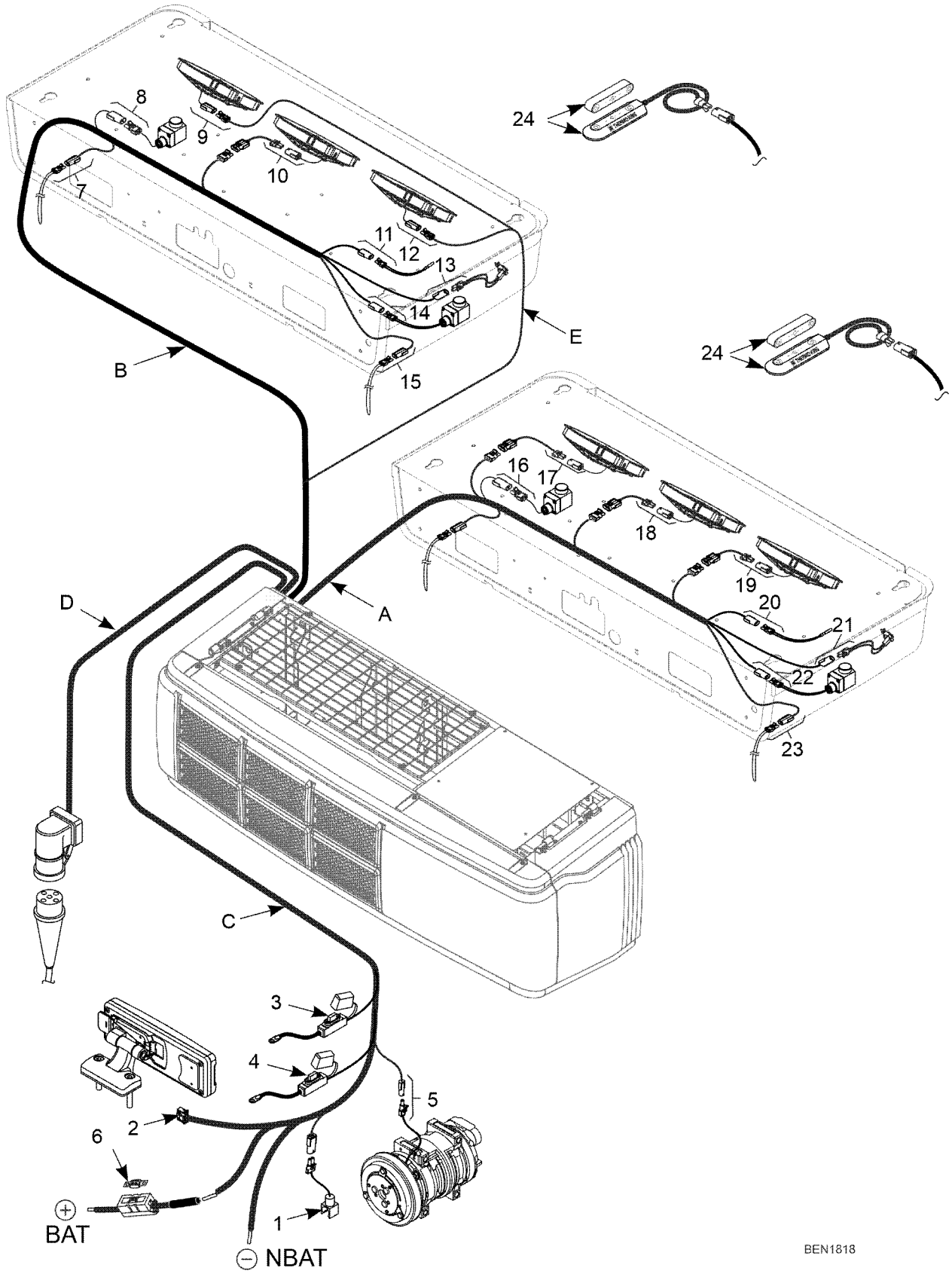
Figure 14. Wiring Connections Model 30 & 50 (Multi Temperature, Three Zones)



BEN1784

| # | Component | Connections | # | Component | Connections |
|---|-----------------------------|-------------|----|-----------------------------|-------------|
| A | Main Harness | | 10 | Evaporator Fan 6 | EF6/CHEF6 |
| B | Spectrum Extension | | 11 | Door Switch | DSW1/CHW |
| C | Main Harness | | 12 | Switch, Defrost Termination | |
| D | Main Harness | | 13 | Temperature Sensor | |
| E | Add-on Harness | | 14 | Evaporator Fan 5 | EF5/CHEF5 |
| 1 | Thermo Switch L1S | C-26 | 15 | Evaporator Fan 1 | EF1/CHD |
| 2 | HMI | | 16 | Evaporator Fan 2 | EF2/CHC |
| 3 | Ignition Fuse (MINI) | 5A | 17 | Evaporator Fan 3 | EF3/CHN |
| 4 | Battery Fuse (MINI) | 5A | 18 | Temperature Sensor | BLK/PNK |
| 5 | To Compressor | CLU | 19 | Switch, Defrost Termination | PS1/26/CHF |
| 6 | Switch, Defrost Termination | | 20 | Drain Tube Heater Harness | 27A/CHJ1 |
| 7 | Temperature Sensor | | 21 | Vehicle Battery Fuse (MIDI) | 5A |
| 8 | Coil Valve | 12/CHB | | | |
| 9 | Drain Tube Heater Harness | | | | |

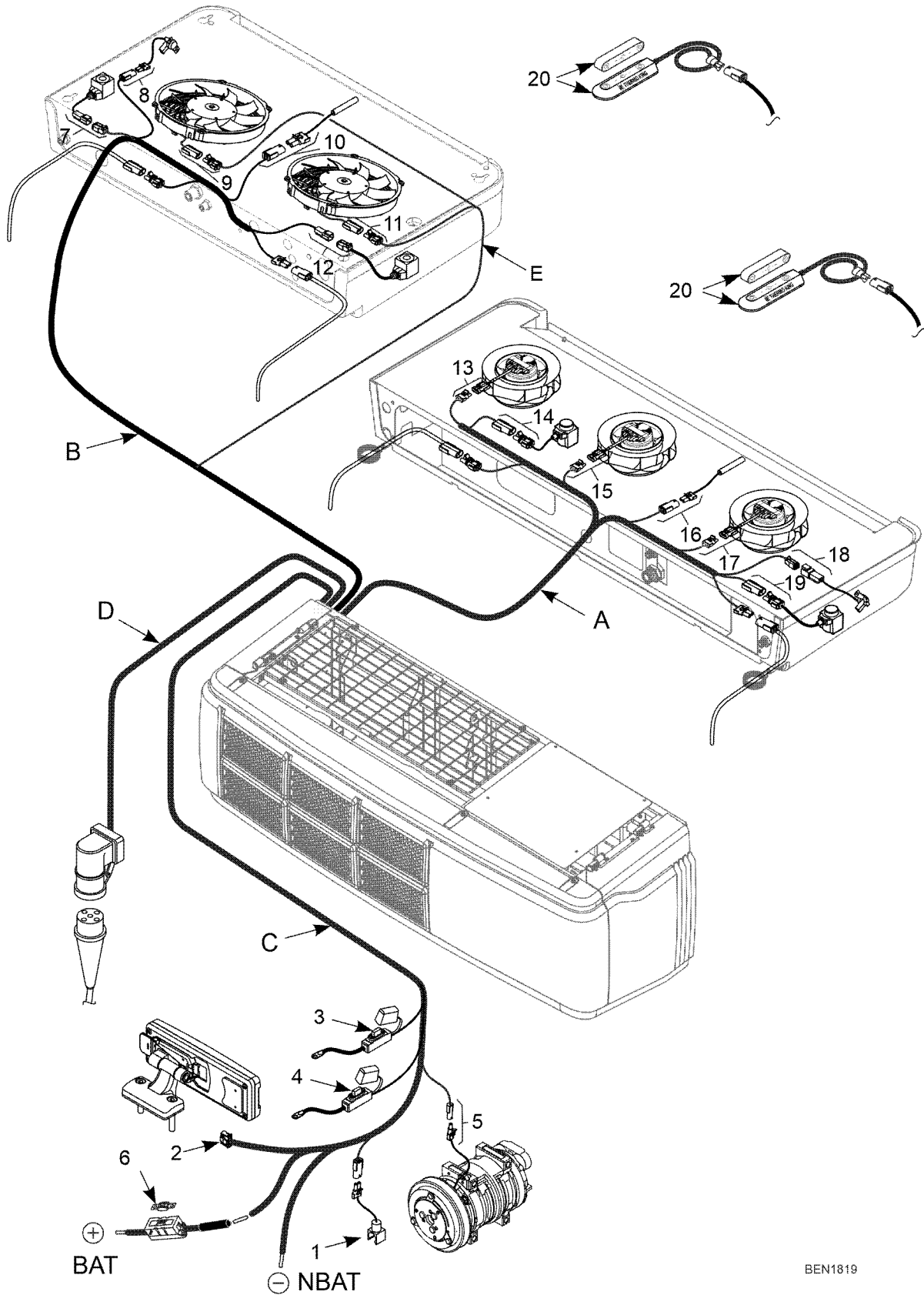
Figure 15. Wiring Connections Model 50 (Multi Temperature, Two Zones)



BEN1818

| # | Component | Connections | # | Component | Connections |
|----|-----------------------------|-------------|----|-----------------------------|-------------|
| A | Main Harness | | 11 | Temperature Sensor | |
| B | Spectrum Harness | | 12 | Evaporator Fan 3 | EF3/CHN |
| C | To Vehicle Ignition Switch | | 13 | Switch, Defrost Termination | |
| D | To Power Receptacle | | 14 | Coil Valve | |
| E | Add-on Harness | | 15 | Drain Tube Heater Harness | |
| 1 | Thermo Switch L1S | C-26 | 16 | Coil Valve | |
| 2 | HMI | | 17 | Evaporator Fan 5 | EF5/CHEF5 |
| 3 | Ignition Fuse (MINI) | 5A | 18 | Evaporator Fan 4 | EF4/CHE |
| 4 | Battery Fuse (MINI) | 5A | 19 | Evaporator Fan 6 | EF6/CHEF6 |
| 5 | To Compressor | CLU | 20 | Temperature Sensor | |
| 6 | Vehicle Battery Fuse (MIDI) | 5A | 21 | Switch, Defrost Termination | |
| 7 | Drain Tube Heater Harness | | 22 | Coil Valve | |
| 8 | Coil Valve | | 23 | Drain Tube Heater Harness | |
| 9 | Evaporator Fan 1 | EF1/CHD | 24 | Door Switch | DSW1/CHW |
| 10 | Evaporator Fan 2 | EF2/CHC | | | |

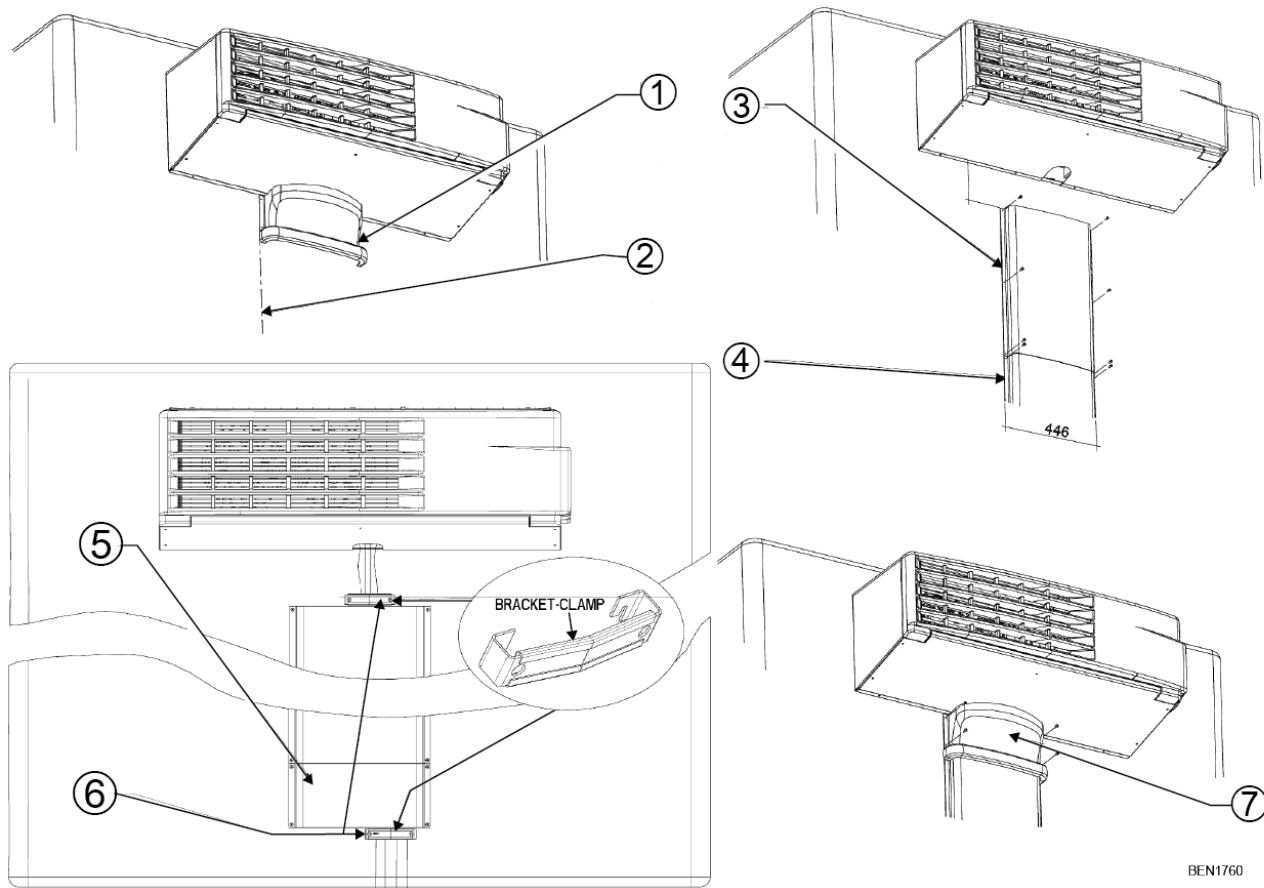
Figure 16. Wiring Connections Model 50 (Multi Temperature, Two Zones)



BEN1819

| # | Component | Connections | # | Component | Connections |
|---|-----------------------------|-------------|----|--------------------|-------------|
| A | Main Harness | | 9 | Evaporator Fan 5 | EF5/CHEF5 |
| B | Spectrum Harness | | 10 | Temperature Sensor | |
| C | To Vehicle Ignition Switch | | 11 | Evaporator Fan 6 | EF6/CHEF6 |
| D | To Power Receptacle | | 12 | Coil Valve | |
| E | Add-on Harness | | 13 | Evaporator Fan 1 | EF1/CHD |
| 1 | Thermo Switch L1S | C-26 | 14 | Coil Valve | |
| 2 | HMI | | 15 | Evaporator Fan 2 | EF2/CHC |
| 3 | Ignition Fuse (MINI) | 5A | 16 | Temperature Sensor | |
| 4 | Battery Fuse (MINI) | 5A | 17 | Evaporator Fan 3 | EF3/CHN |
| 5 | To Compressor | CLU | 18 | Evaporator Fan 4 | EF4/CHE |
| 6 | Vehicle Battery Fuse (MIDI) | 5A | 19 | Coil Valve | |
| 7 | Coil Valve | | 20 | Door Switch | DSW1/CHW |
| 8 | Switch, Defrost Termination | | | | |

Hose Cover Installation



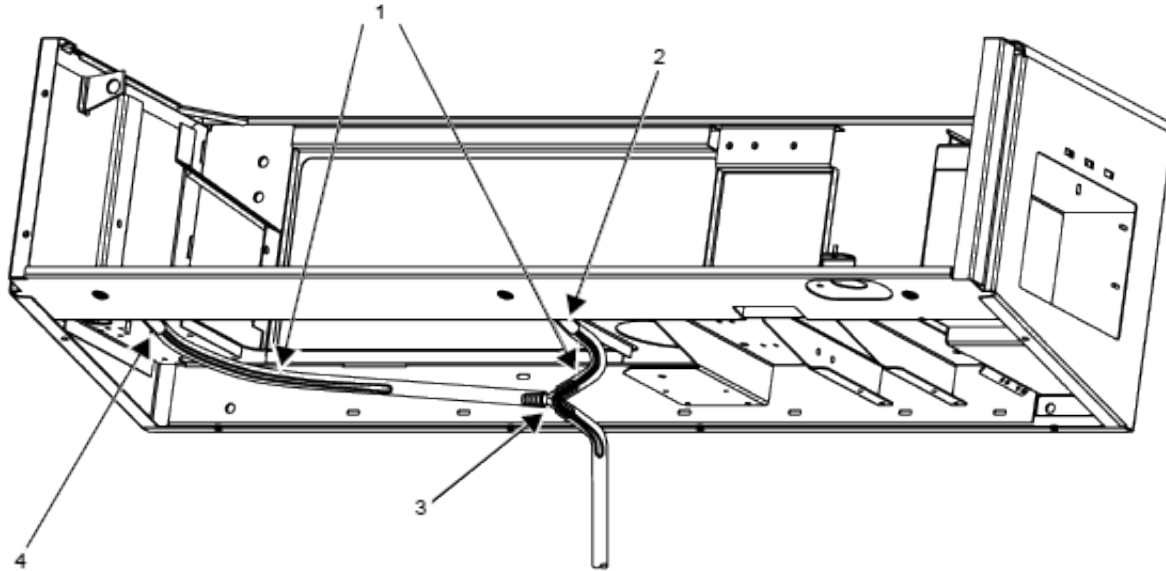
BEN1760

1. Mount the elbow part.
2. Mark the left reference line to install the first cover hose straight part.
3. Mount and install the straight part, using the screws and the cosmetic parts supplied. In order to achieve the right curvature, the total width should be 446 mm.

Note: Depending on the characteristics of each installation, the hoses should be routed before or after the straight part has been installed.

- a. Put on the floor all the straight parts as required, taking care of matching the round and curvature.
- b. Apply the piece of tape over the joints. Fix all straight parts.
- c. Continue with the step 6 and do not forget to remove the tape.
4. If required add additional straight parts.
5. Cut the last straight part as required.
6. Fix the hoses with the bracket-clamp. Chose the best location along the cover width.
7. Mount and install the elbow part using the screws and the cosmetic parts supplied.

Drain Circuit in the V-500, V-600, V-800 and V-1000 Condenser Units



DO NOT fit wrap band to hold the wires



DO NOT cover the heaters



DO NOT cut the wires

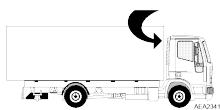


DO NOT fit more than 4 wires into the tube

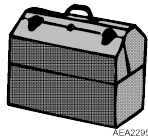


ASA220

| Sr. Number | Description |
|------------|-------------------------|
| 1 | Heaters |
| 2 | Condenser Draining Tube |
| 3 | Y Hose Connection |
| 4 | Condenser Draining Tube |



T = 5 min.

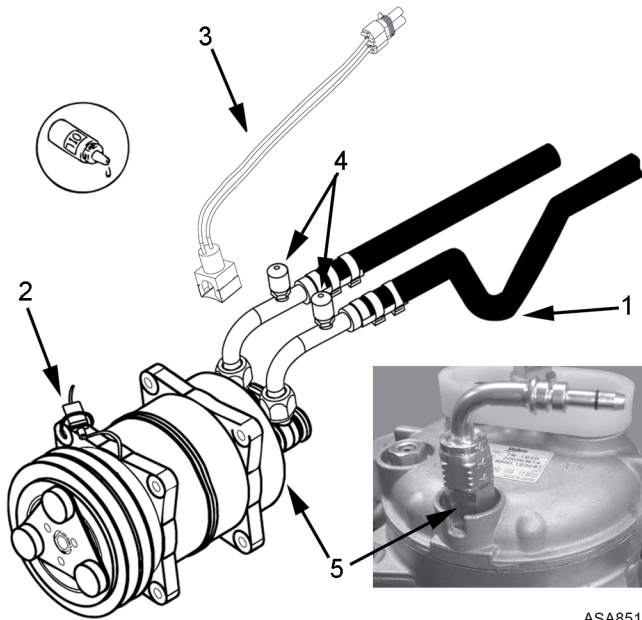


Connecting Hoses to the over-the-road Compressor

Note: Refer to the VPtruck Installation Standards and Procedures Guide for hose routing of the over-the-road compressor.

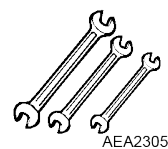
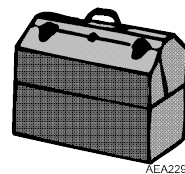
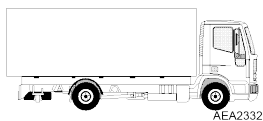
1. Prepare the suction and discharge refrigeration hoses. See section: "Preparing Refrigeration Hoses".
2. Lubricate the compressor refrigeration intakes using Thermo King refrigerant oil.
3. Place an O-ring on each compressor intake.
4. Connect the suction hose to compressor intake S and the discharge hose to intake D. **The suction intake cannot be below the compressor shaft. Connect the least accessible hose first.** The O-ring should be properly installed before the fitting is screwed on.
5. Make a siphon 1 (oil trap) with the suction line hose.
6. Connect the CLU wire to the compressor connector. To avoid damages to the wire caused by the vibrations of the compressor, secure it with a flange 2 on one of its tabs, as indicated in the drawing.
7. MAX units only: Mount the liquid injection switch 3 to the discharge fitting and connect to the condenser harness.
All MAX units are equipped with a liquid injection system (jet cool) that requires a special orifice be installed onto the service port located on the suction line splice connector (Refer VPtruck Installation Standards and Procedures Guide).
8. 10/30 Units only: Connect the oil return hose to the oil return intake (5) on the compressor. Be careful not to spill oil when removing the top of the oil return intake on the compressor, otherwise extra oil will have to be added to the system.

Note: Always mount the pressure intakes, 4, upwards.



ASA851

T = 18 min.

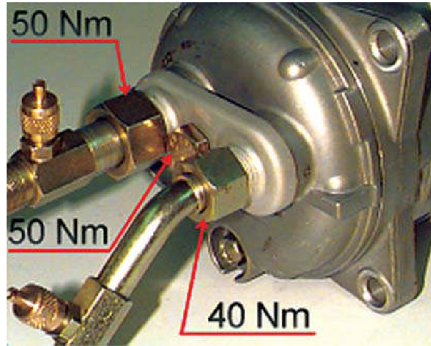


Torque to Apply to Compressor Manifold and Fittings

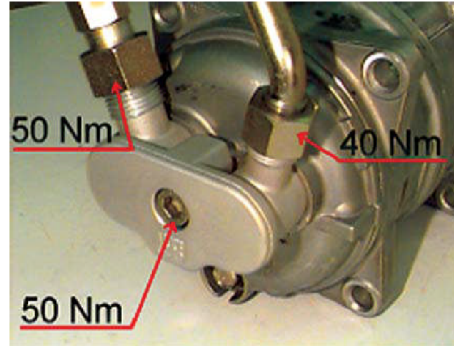
- The purpose of this section is to indicate the correct torque to apply to Thermo King compressor manifolds (straight and standard models) and fittings to ensure good performance, reliability and longevity of all direct drive units.

Note: 50 Nm = 36.87 ft.lb
 40 Nm = 29.50 ft.lb

Note: Apply 60 Nm (44.25 ft-lb) torque at the suction side for QP25.

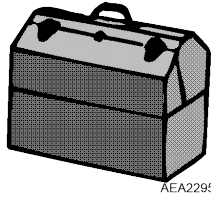
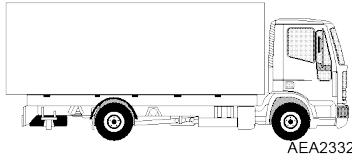


Thermo King straight manifold



Thermo King standard manifold

ASA1009



Circuit Seal Test (I)

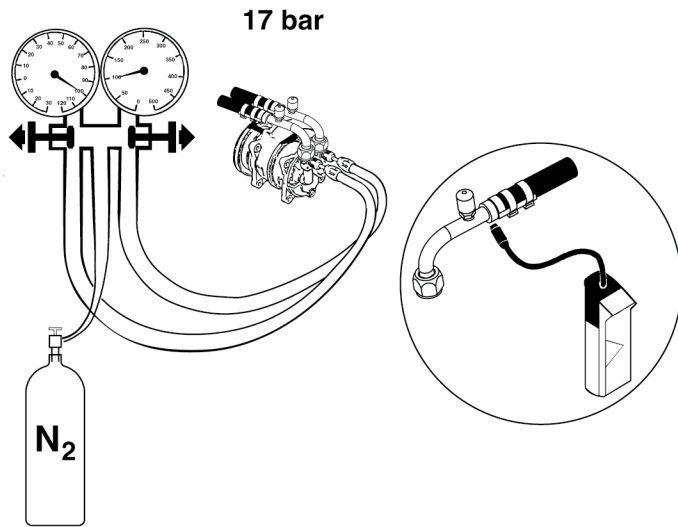
Note: Refer to the VPtruck Installation Standards and Procedures Guide (Section 11 - System Leak Check Procedures) to perform the circuit seal test (I).

Circuit Seal Test (II)

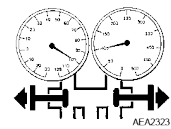
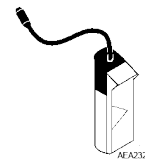
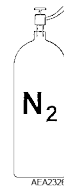
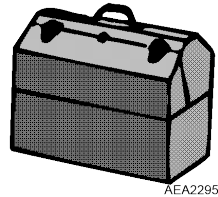
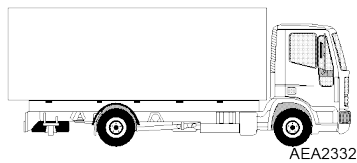
Note: Refer to the VPtruck Installation Standards and Procedures Guide (Section 11 - System Leak Check Procedures) to perform the circuit seal test (II).

In Case of Leaks

1. Pressurize the circuit to 17 bar with nitrogen.
2. Identify the defective part (fitting, sleeve, line, hose, O-ring, etc.) and replace it with a new part (if in doubt replace the entire joint). **Use the recommended leak detector.**
3. Repeat the seal test from the beginning.



ASA090



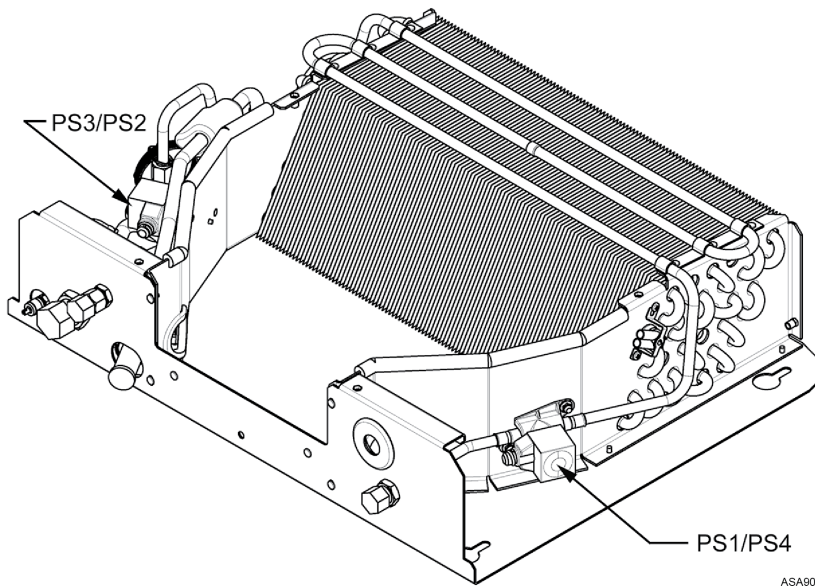
Leak Check and Evacuation with MAX Spectrum Units

Note: When checking for leaks and during evacuation of MAX SPECTRUM units, all the solenoid valves must be open. The evaporators used in these units have two valves that are normally closed. These are the PS1/PS3 in the main evaporator and the PS4/PS2 in the remote evaporator. The controller in the cabin cannot carry out a maintenance test to open the valves during the evacuation process, and so the valves must be opened manually. A tool with code 2041074 is available in the Replacement Parts Department.

This is a permanent magnet designed to open Danfoss solenoids without having to electrically energise the coil. Two magnets are needed per unit for the MAX SPECTRUM units.



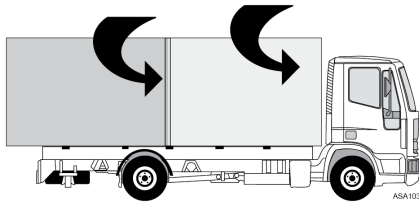
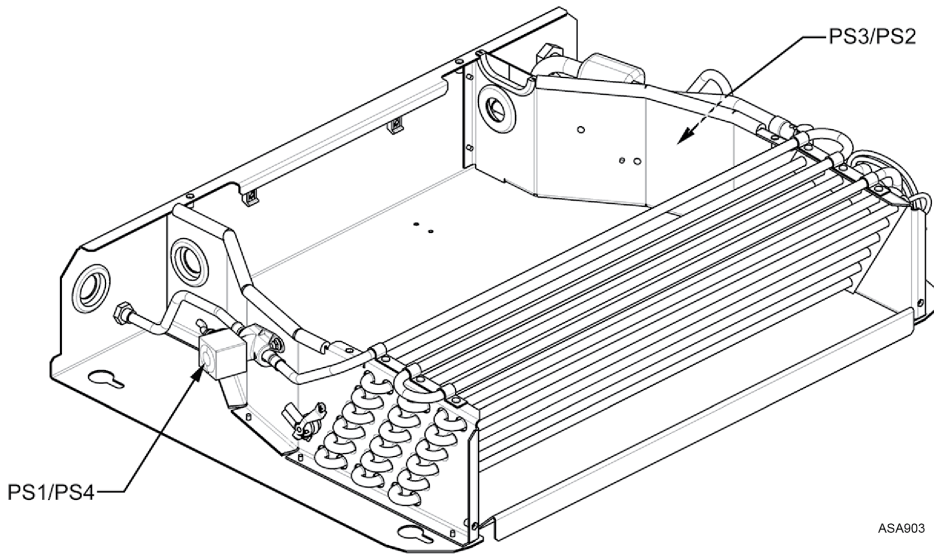
ES100 MAX



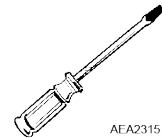
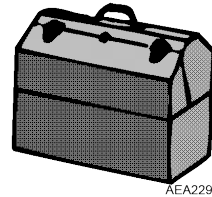
Leak Chart and Evacuation Procedure for MAX Spectrum Units

1. Ensure that the unit is switched off.
2. Remove all the coils from the PS1/PS3 and PS4/PS2 solenoid valves in the evaporators.
3. Place a magnet with code 204-1074 in each of the solenoid stems specified below:
4. PS1/PS3 in the main evaporator and PS4/PS2 in the remote evaporator
5. Carry out any necessary leak detection and evacuation procedures.
6. Remove the magnets from the solenoids.
7. Replace the set of coils in the solenoids and manually tighten the solenoid coil nuts.

ES150 MAX



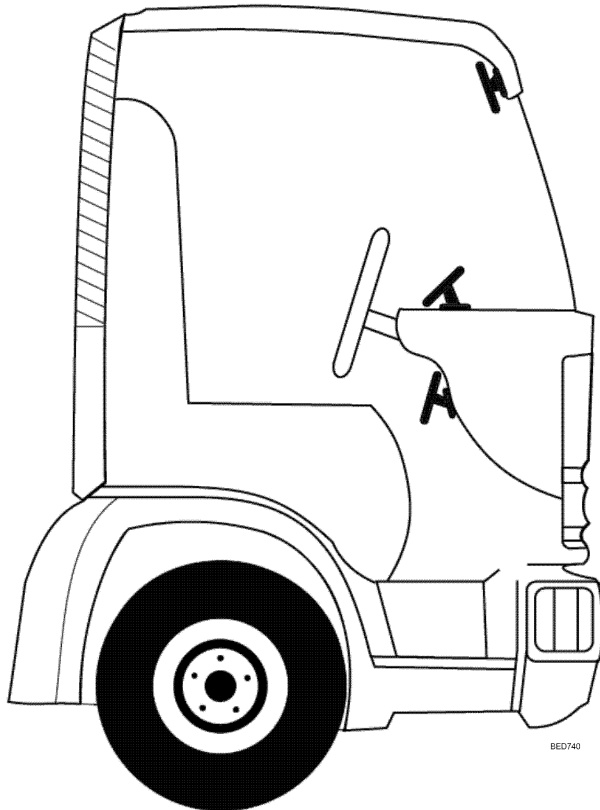
T = 20 min.



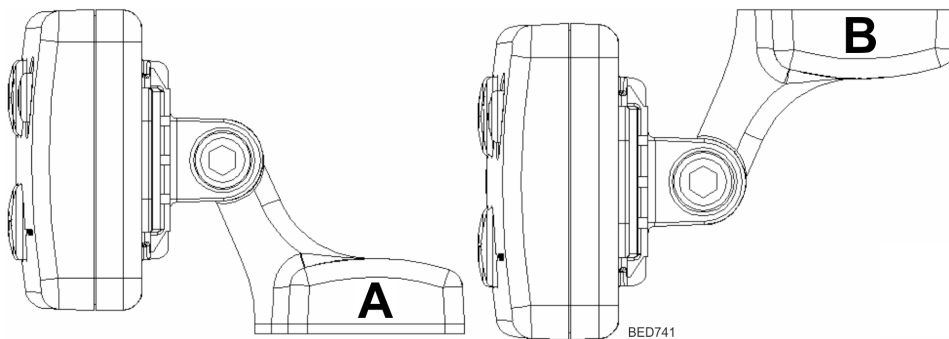
Installing the In-Cab Controller

Important: See Section 7 - Electrical Standards in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide (TK 56430). **THESE PROCEDURES MUST BE FOLLOWED!**

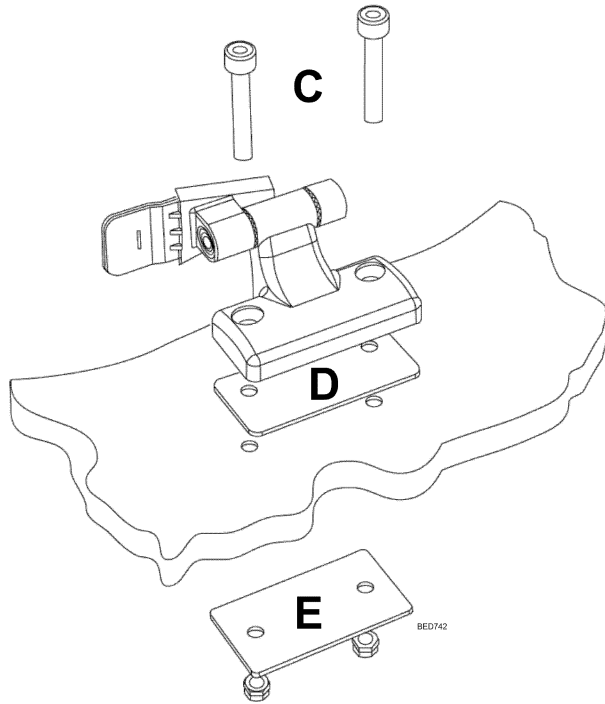
1. Install the mounting bracket for the in-cab control box. Its design allows the mounting bracket to be positioned in various places in the cab interior. Find a **location which is accessible and visible from the driver's seat**, and which does not restrict the mobility or visibility of either the driver or the vehicle's instruments and levers.



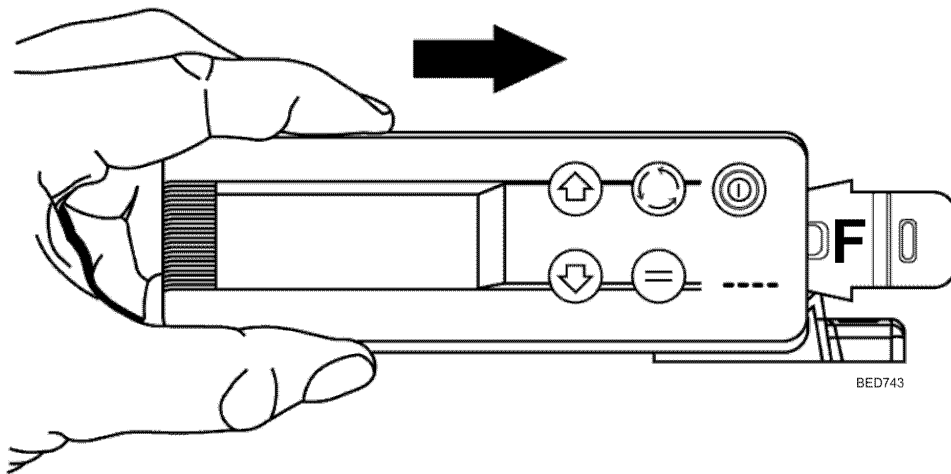
2. Depending on the location chosen, the base should be mounted following either Option A or Option B.



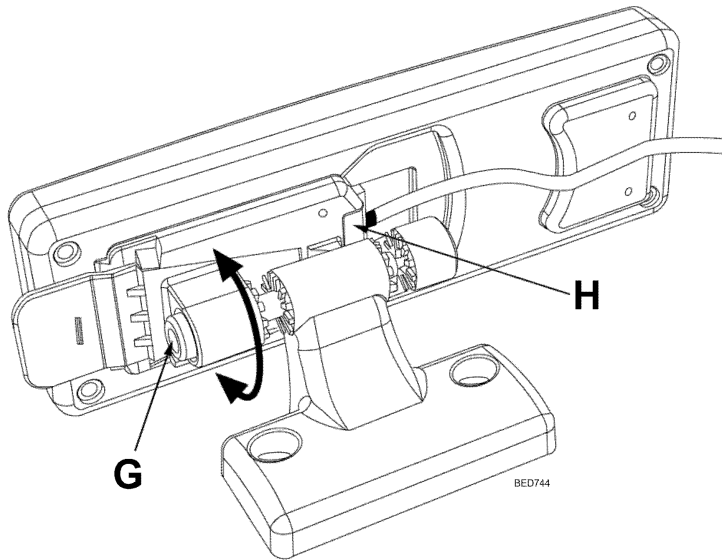
3. Mount the base of the mounting bracket in the chosen location. Use screws (C), rubber mat (D) and metal plate (E), which are supplied by Thermo King, as indicated in the drawing.



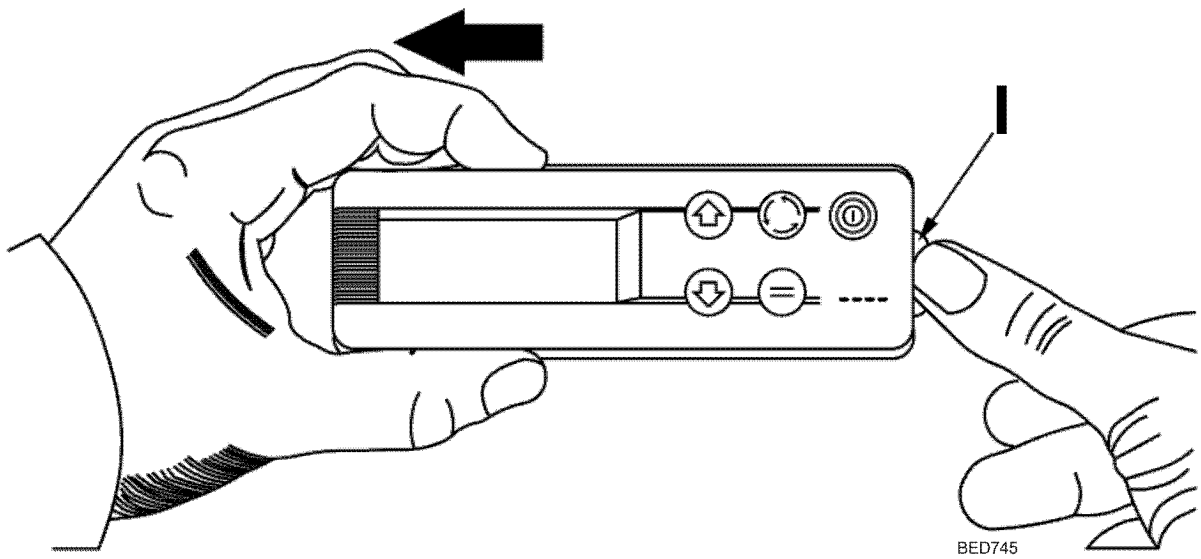
4. When placing the in-cab control box on the bracket, rest the in-cab control box on the arm (F), and slide it to the right until the arm tab is properly fitted to the in-cab control box frame.



5. The tilt of the in-cab control box's front face may be altered by loosening screw G.
- Connect the data cable to connector H.

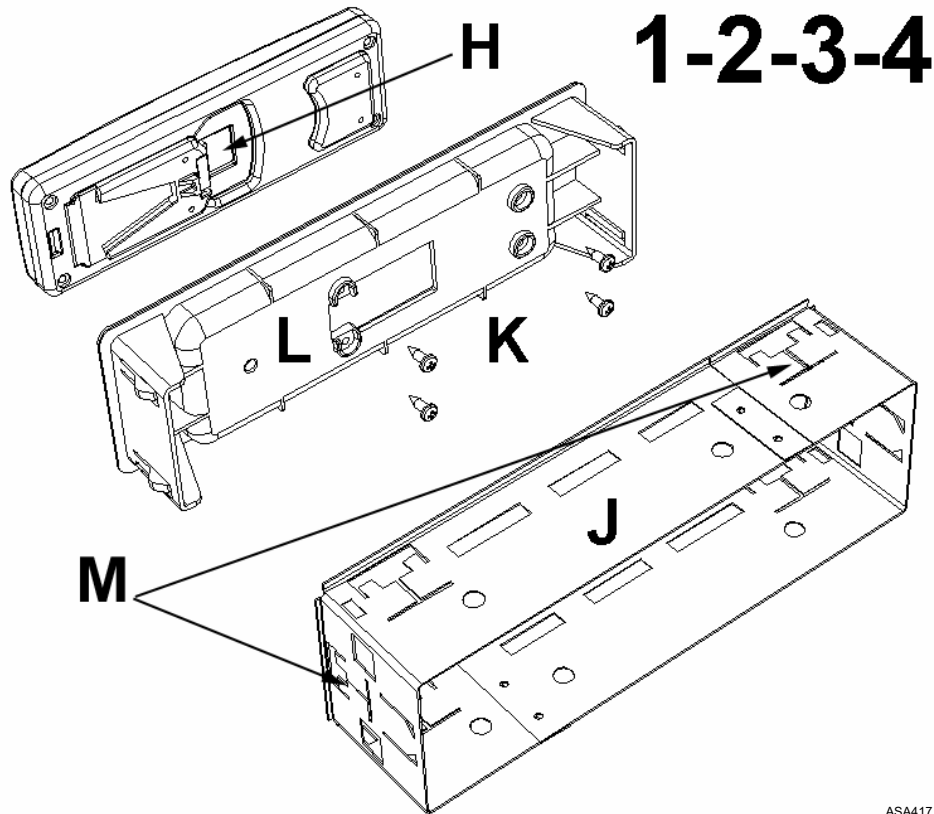


6. To remove the in-cab control box from the bracket, press the tab (I) and slide to the left.



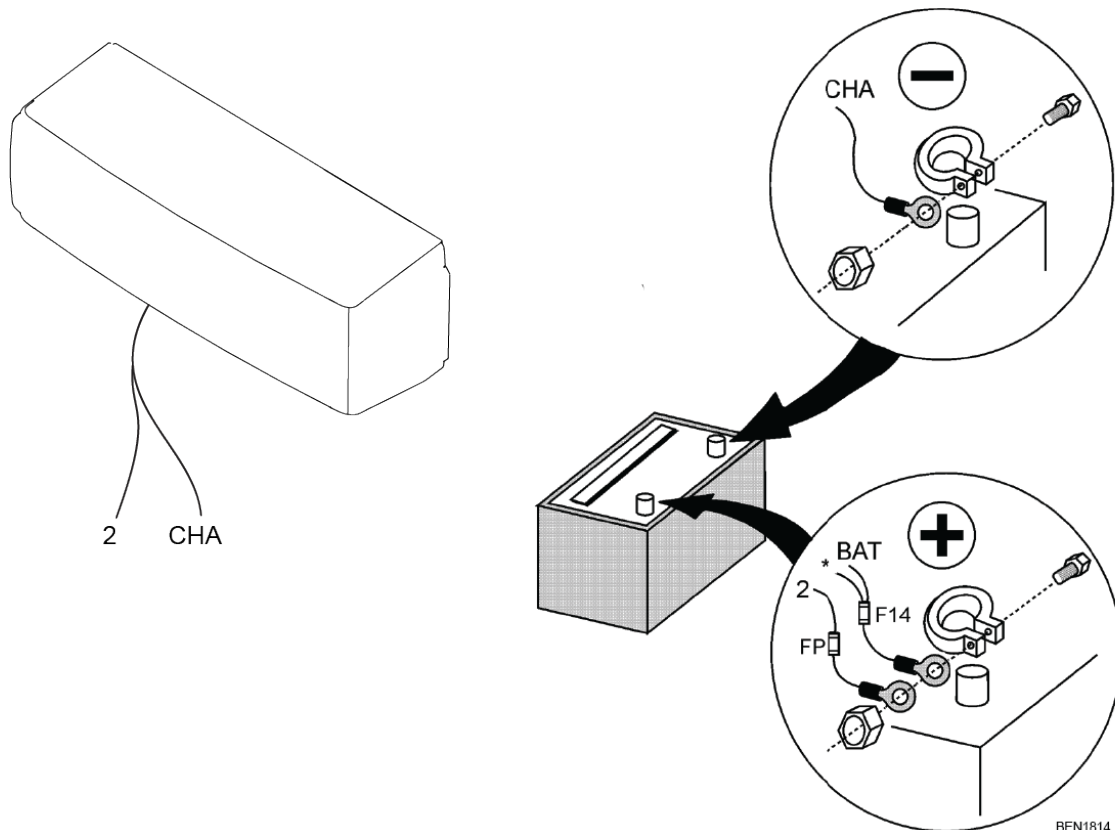
Optional DIN Adaptor (by order only)

1. Place the metal box (J) supplied in the housing designed for the radio. Raise the tabs (M) sufficiently to fit the box into the housing.
2. Attach the control to the plastic bracket (L) using the 4 screws (K).
3. Connect the data cable to the control connector (H).
4. Insert the assembly formed by the control box and the plastic bracket into the metal box, until the bracket tabs are properly fitted to the metal box.



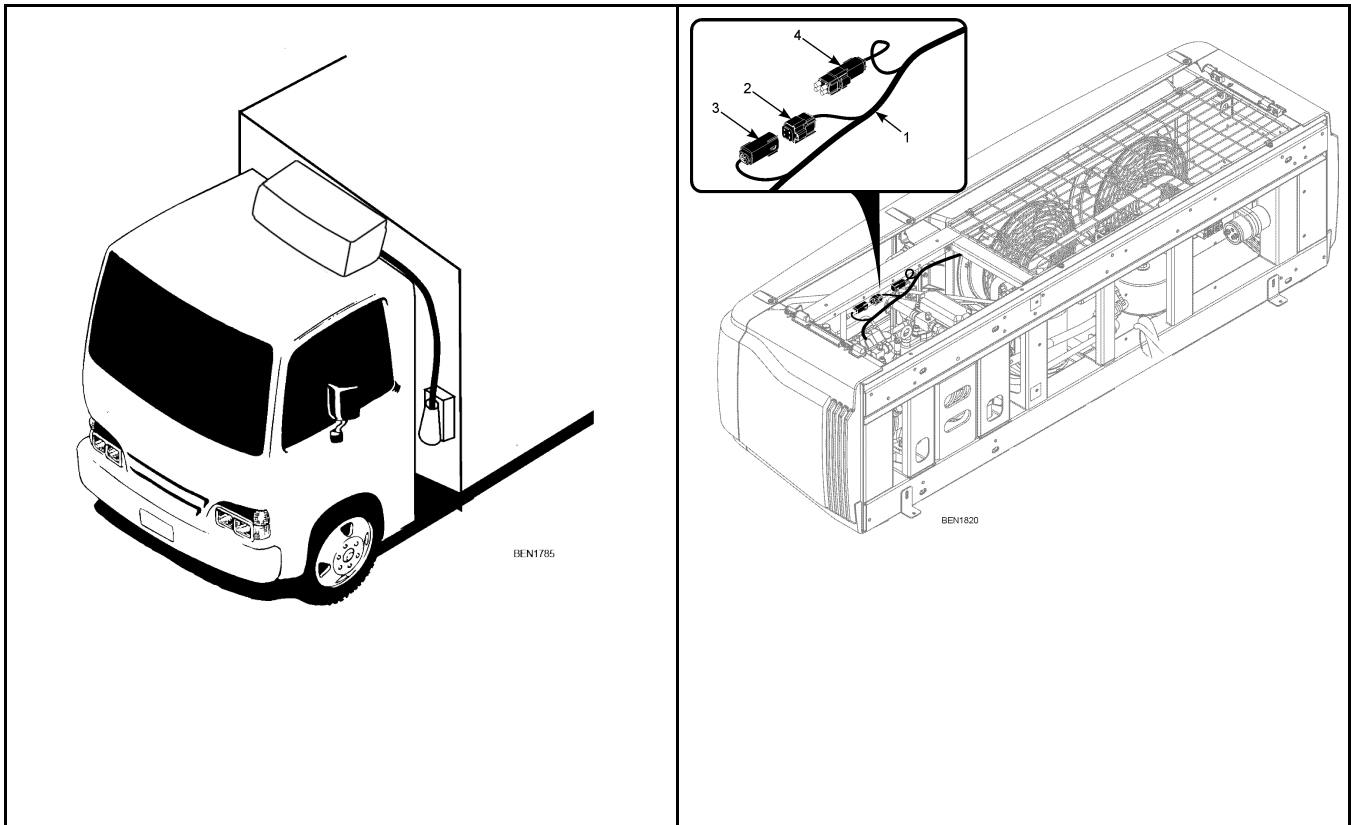
Vehicle Battery Connection

1. Pass electrical wires CHA (black), 01, BAT and 2 (brown) to the battery.
2. Using the recommended tools, cut the wires to the proper length. **Do not coil or splice the excess wire.**
3. Connect wire 2 to one end of the fuse FP fuse holder (both supplied by Thermo King) and connect the other end of the fuse holder to the battery's positive pole. Install fuse FP (100 A /12 V or 60 A /24 V) in the fuse holder.
4. Connect the CHA wire to the clamp of the battery's negative pole.
5. Strip the wires and position the terminals supplied with the recommended tools.
6. Disconnect the clamp from the battery's negative terminal.
7. Connect the wire (wire between the battery and the vehicle starter key) and the BAT wire to one end of the fuse F14 fuse holder (both supplied by Thermo King), and connect the other end of the fuse holder to the battery's positive pole. Install fuse F14 (5A) in the fuse holder. **If F14 cannot be connected to the *wire, connect an additional fuse (5 A) between wire 01 and the vehicle starter key.**
8. Connect the clamp of the battery's negative terminal.

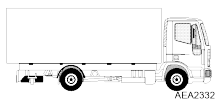


Fitting the Power Supply - Units with Electric Standby

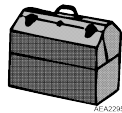
1. Install the power supply housing in a protected and accessible location.
2. Route the wire from the unit to the power supply, using the clamps provided.
3. Cut off the excess electrical wire. In order to avoid the coil effect, **do not roll up the excess electrical wire. Do not create splices in the electrical wire.**
4. Connect the electrical wire to the power supply, using recommended tools.
5. For **3ph** units select the proper voltage inside the electric box: 230 V or 400 V.
6. For V-800 and V-1000 units only: Depending on the unit configuration, connect the receptacle (C-31) to the mating connector plug (C- 32 for 230V and C-30 for 400V) located above the compressor.



| | |
|----|-----------------------|
| 1. | Power Cable |
| 2. | Receptacle (C-31) |
| 3. | Connector Plug (C-32) |
| 4. | Connector Plug (C-30) |

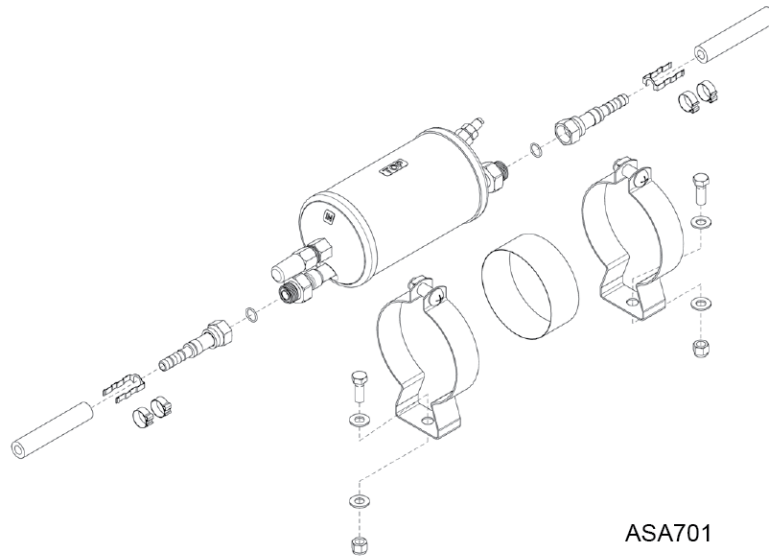


T = 10 min.

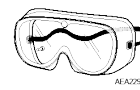
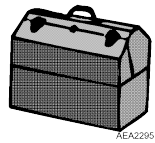


Installing the Discharge Adjustable Muffler (Optional)

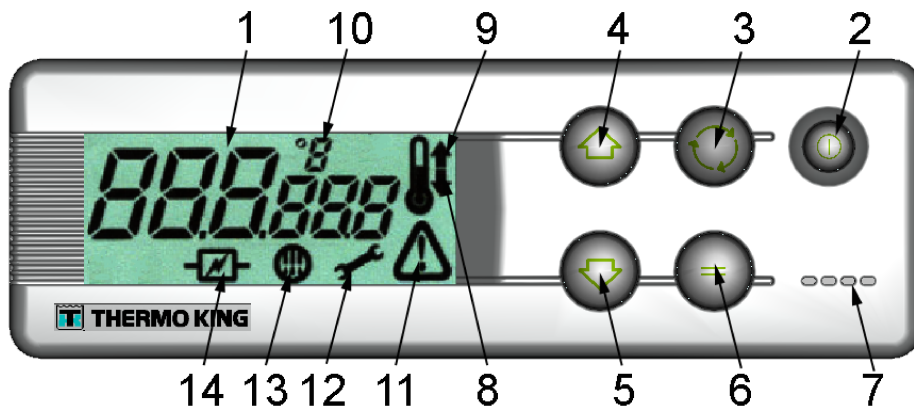
1. **MOUNTING VERTICALLY:** Connect the "IN" end (the end with the adjustable stem) to the discharge line leaving the compressor. Always mount the "IN" end up so that the gas flows down through the muffler.
2. **MOUNTING HORIZONTALLY:** Install with the offset fittings down so the muffler will drain itself of oil.
3. Remove the stem cap and with the screw driver, back the stem all the way back (turning counter clockwise) before starting the system.
4. **ADJUSTING THE MUFFLER:** After the system has been in operation long enough that conditions have stabilized final adjustment is made. Turn the adjustable stem clockwise until the minimum noise condition is attained.



T = 20 min.



In-Cab Control Box



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

HOURLY METER MENU

From the **Standard Display** press the SELECT key for 3 seconds to enter the **Hourmeter Menu**, then use the SELECT key to display:

1. **HC:** Hours remaining to maintenance notice.
2. **tH:** The total amount of time the unit has been switched on protecting the load.
3. **CC:** Engine-driven compressor operating hours.
4. **EC:** Electric standby compressor operating hours.
5. Return to Standard Display.

Units with firmware 380.03 and previous versions: The unit of measurement is tens of hours (e.g. 150 = 1,500 hours)

Units with firmware 380.06 and later versions: The unit of measurement is hours

INFORMATION MENU

From the **Standard Display** press the ENTER plus the UP key during 3 seconds to enter the **Information Menu**,

- Firmware versions 121 15/19/21 and 273 02/03: this menu will automatically advance through the following steps:
- Firmware version 380.xx: next, use the SELECTION key to view:
 1. Display test (all symbols on).
 2. Software version.
 3. Refrigerant type.
 4. **bat**: Current battery voltage (value in volts, decimal).
 5. **HP**: Current pressure.
 6. Number of Compartments/Unit type.
 7. Return to Standard Display.

INSTALLATION MENU

From the **Standard Display** press the ENTER plus the DOWN key for 3 seconds to enter the **Installation Menu**: the first parameter will be displayed, the value in the large digits and its name in the small digits. To modify the parameter value press the ENTER key, the value will flash, press the UP or DOWN key to modify the value and confirm by pressing the ENTER key again. To scroll through the menu press the UP or DOWN keys.

| NAME | DESCRIPTION | DEFAULT | MIN | MAX |
|------------|---|--|--------|-------|
| SPL | Minimum Set Point value Increments of 1° | -32 °C (R-404A) -20 °C (R-134a) | -32 °C | SPH |
| SPH | Minimum Set Point value Increments of 1° | 22 °C | SPL | 38 °C |
| diF | Maximum Set Point Value Once the Setpoint Temperature has been reached, and while the temperature remains between diF °C/F above or below the setpoint, there is no demand for transfer of heat or cold, and the unit remains in null mode. Increments of 1°. | 3 | 1 | 5 |
| SSC | Setpoint differential Programmable soft start for the road compressor clutch | OFF | OFF | ON |
| dit | Soft Start Cycles (ON/OFF) Increments of 30 minutes. On time out the unit will switch from cool to the appropriate defrost mode. The timer will count all the time the system is in any cool mode. The timer will be reset when a defrost starts. When the value is set at 0, is the test position: the defrost will begin in 15 seconds. | 240 | 30 | 480 |
| dtT | Defrost initiation timer (minutes) Increments of 5 minutes. Timer will count from defrost mode initiation. Timer will reset after a temperature defrost termination or timer time out. On time out the unit will switch from defrost to null mode. When the value is set at 0, is the test position: the defrost will stop in 15 seconds. | 45 | 5 | 50 |
| EFc | Defrost termination timer (minutes) on : evaporator fans stays on also during null mode. off : the evaporator fans remain off in Null mode. | OFF | OFF | ON |
| CPS | Compartments Priority Settings (num) 0 = non priority setting (default - same behaviour as current) 1 = priority cooling compartment 1 (1 priority is set for compartment 1) 2 = priority cooling compartment 2 (2 priority is set for compartment 2) 3 = automatic priority setting (3 priority is automatically set, controller decides which compartment is prioritized. Set points shall be away more than 10°C, priority is selected for the compartment with lower set point. If set point is changed, controller checks the condition again and changes priority zone if required.) | 0 | 0 | 3 |
| CP1 | Compartments Priority modulation, time ON (min) Modulation timer: (both compartments ON) Selectable from 1 to 30 minutes. Default is 3 minutes. While CP1 is counting, both compartments are running in their corresponding mode (COOL/HEAT) | 3 | 1 | 30 |



In-Cab Control Box

| | | | | |
|------------|--|------------|---|-----|
| CP2 | Compartments Priority modulation, time OFF (min) Modulation timer: (Only Priority compartment ON) Selectable from 1 to 30 minutes. Default is 10 minutes. While CP2 is counting, only priority compartment is ON (COOL/HEAT) Non priority compartment is in NULL mode | 10 | 1 | 30 |
| dAL | Out of range alarm Programmable from 1° up to 10° or off (0). When the return air temperature exceeds set point, the on-screen return air temperature reading flashes. | 0 | 0 | 10 |
| HC | Hour Counter initial value for maintenance purposes (tens of hours, e.g. 150=1500 hours), programmable from 1000 up to 5000, 500 steps. | 150 | 0 | 500 |
| dSP | Doors Switches Presence/Polarity 0: normally closed, 1: normally open, 2: not present. | 1 | 0 | 2 |
| bE | Buzzer Enable 0: not enabled, 1: enabled, 2: enabled also when keys are pressed, 3: enabled only when keys are pressed. | 2 | 0 | 3 |
| tu | Thermostat units C: temperature visualization in °C, F: temperature visualization in °F. | C | C | F |
| Pu | Pressure units b: pressure visualization in bar, P: pressure visualization in psi. | P | b | P |
| trE | Temperature display resolution 0: whole; 1: resolution 0.5; 2: resolution: 0.1 | 0 | 0 | 2 |

Checking the Installation

- All holes should be sealed with silicone or foam.
- Check with a sheet of paper that the fans blow in the right direction.
- The drain circuit should be slanted on all evaporators and the moisture trap should be installed.
- The hole should be located at the expansion valve on all evaporators.
- The temperature sensor should be connected on all evaporators.
- The in-cab control box should be located in a spot that it is accessible and visible from the driver's position.
- The contact draw should be made.
- Hoses should not be taut (they should be able to absorb vibrations and be shortened in case of leaks).
- Hoses should not rub against moving parts, sharp parts, or parts that can reach high temperatures.
- The oil return should be connected.
- The fluid injection hole should be properly located (R-404A/R-452A units only).
- The compressor should be primed with oil.
- The unit should be connected to the battery.
- The drive kit test should have been carried out.
- The seal test should have been carried out.



Standby Receptacle Box Installation (Models 20 and 50 Only)

Important: See Section 7 - Electrical Standards in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide (TK 61588). THESE PROCEDURES MUST BE FOLLOWED!

Completing the Installation

Important: BEFORE COMPLETING THE INSTALLATION, YOU MUST PERFORM THE FOLLOWING PROCEDURES IN ACCORDANCE WITH THE THERMO KING INSTALLATION STANDARDS AND PROCEDURES GUIDE:

- SYSTEM EVACUATION PROCEDURES
- SYSTEM LEAK CHECK PROCEDURES
- SYSTEM CHARGING PROCEDURES
- CONFIGURATION SOFTWARE PROCEDURES
- CONTROLLER PARAMETER SETUP

Suction Pressure Regulator (SPR) Adjustment Procedures - MAX 20

Important: All new unit installations require these adjustment procedures. Failure to do so may not allow the unit to operate at its maximum capacity.

Note: The following procedures are for initial settings. Sometimes conditions such as high or low ambient temperatures may require that the settings be fine-tuned for optimum performance.

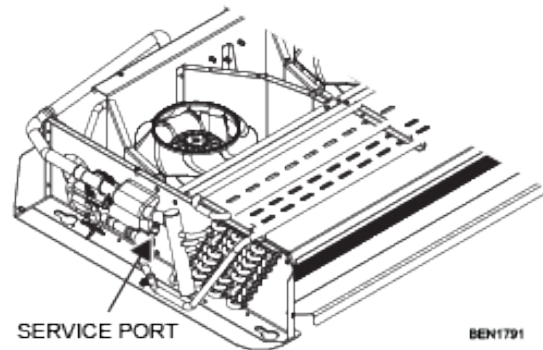
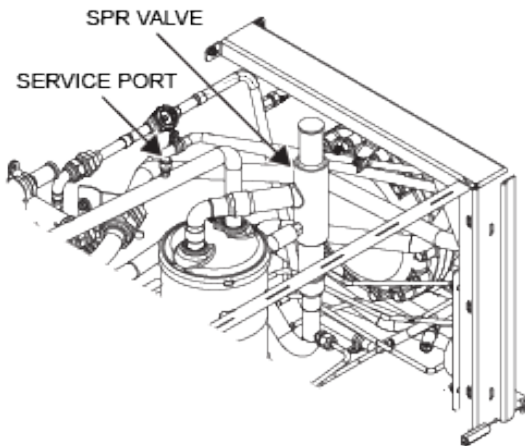
MAX 20 units are equipped with a SPR valve located in the evaporator (See illustration below). The valve is used to limit the load on the standby compressor. This also affects the current draw of the electric motor. Monitor the current drawn of the electric motor when making this adjustment to ensure it is below the motor overload relay setting.

1. Install gauge manifold set onto the suction service port at the standby compressor (See illustration below).
2. Attach an additional compound gauge on suction service port located on copper suction tube in evaporator to monitor suction pressure going to the SPR valve (See illustration below).
3. Connect clamp on amp meter to T1 (Black) motor wire on a 115V/230V 1 PH unit, or to the leg of the highest voltage motor wire of a 230V 3 PH unit.
4. Connect standby power receptacle to an appropriate electric power source.
5. Place jumper wire between the 12 and CHB wires at the defrost termination switch to verify the unit will run in defrost.
6. Start unit and run in defrost on the electric standby compressor until the pressure on the additional compound gauge attached to the suction service port stabilizes at a pressure above 45 psig (310 kPa).
7. Check the suction pressure on the gauge attached to the suction service port at the standby compressor. It should be 24 ± 2 psig (165 ± 14 kPa) without exceeding the following electric motor current draws:

| Voltage/Phase/Frequency | Overload Relay Setting (amps) |
|------------------------------|-------------------------------|
| V-500/V-600 | |
| 115/1/60 | 14 |
| 208/1/60 | 9.5 |
| 230/1/60 | 9 |
| 208/3/60 | 7.2 |
| 230/3/60 | 7 |
| V-800 (ES600+2xES150) | |
| 230/3/50 | 9.6 |
| 230/3/60 | 11.5 |
| V-800 | |
| 230/3/50 | 18 |
| 400/3/50 | 14 |
| 230/3/60 | 18 |
| 400/3/60 | 14 |
| V-1000 | |
| 230/3/50 | 24 |
| 400/3/50 | 16 |
| 230/3/60 | 24 |
| 400/3/60 | 16 |

Suction Pressure Regulator (SPR) Adjustment Procedures - MAX 20

8. If the pressure is not within range, or the current is above the specific values, remove the protective cap and adjust the SPR valve to the correct setting.
9. Remove gauge manifold set, the additional compound gauge, and the jumper wire when finished with the procedure.



Compressor Oil Amounts and Type

Note: Refer to the Maintenance Manual to find the correct amount and type of oil to use in compressor.

*Important: Using the absence of bubbles in the sight glass as an indicator of correct refrigerant charge can be misleading, **YOU MUST** refrigerate the box to 0-5°C (32-41°F) to get a more precise indication from the sight glass.*

NOTICE

Compressor Damage!

Failure to add the correct amount and type of oil will damage the compressor.

Electrical System

| Fuses | | |
|--|-----------------------------|-----------------------------|
| V-800/ V-1000 and Spectrum | 12 Vdc | 24 Vdc |
| Fuse 1: Condenser Fan Motor (CFM1) | 15 amps | 10 amps |
| Fuse 2: Condenser Fan Motor (CFM2) | 15 amps | 10 amps |
| Fuse 3: Evaporator Fan 1 | 15 amps | 10 amps |
| Fuse 4: Evaporator Fan 2 | 15 amps | 10 amps |
| Fuse 5: PS1, PS7, CMC, LIV,PS5, RCV, CCL | 20 amps | 10 amps |
| Fuse 6: Drain Heaters 1/2 | 2 amps | 2 amps |
| Fuse 8: (Spectrum Only) EVAP2 Liquid Solenoid Valve (PS2), EVAP1 Liquid Solenoid Valve (PS3), EVAP2 Defrost Hot Gas Solenoid Valve (PS4), Drain Heaters 3 and 4 (HT3, HT4) | 20 amps | 10 amps |
| Fuse 9: (Spectrum Only) Evaporator Fan 3 | 15 amps | 10 amps |
| Fuse 10: (Spectrum Only) Evaporator Fan 4 | 15 amps | 10 amps* |
| Fuse 11: Drain Heaters (H3 and H4) | 2 amps | 2 amps |
| Fuse 14: Ignition | 5 amps | 5 amps |
| Fuse 17: TrackKing | 5 amps | 5 amps |
| Fuse 20: Transformer AC Power Supply | 5 amps (time delay fuse) | 5 amps (time delay fuse) |
| Fuse 21: Battery Power Supply | 100 amps | 60 amps |
| Fuse 41: Evaporator Fan 5 | 15 amps | 10 amps |
| Fuse 42: Evaporator Fan 6 | 15 amps | 10 amps |

| Condenser Fan Motor | | |
|----------------------------|----------|------------|
| Voltage | 13 Vdc | 26 Vdc |
| Full Load Current | 11 amps | 4.7 amps |
| Power Rating | 145 W | 288 W |
| RPM with Full Load | 2,570 | 3,400 |
| Control voltage range | 1-10 Vdc | 6.5-10 Vdc |

| Evaporator Fan Motors (Each) | | |
|-------------------------------------|----------|--------|
| Voltage | 13 Vdc | 26 Vdc |
| Full Load Current | 7.5 Amps | 4 Amps |
| Power Rating | 97.5 W | 104 W |
| RPM with Full Load | 2,800 | 2,800 |

| AC Electrical Power Supply Motor | |
|---|------------------------------|
| Voltage/Phase/Frequency | 230/1/50, 230/3/60, 400/3/50 |
| Output Power | 0.75 kW |



THERMO KING

Electrical System

| | |
|-----------------------|---|
| Nominal Current Drawn | 5.2 amps |
| OL Relay Adjustment | 10 / 20 Units - 5.2 Amps 30 / 50 Units - 10.5 Amps |

| DC Electrical Power Supply Motor | | |
|---|---------|---------|
| Voltage | 12 Vdc | 24 Vdc |
| Output Power | 600 W | 600 W |
| Nominal Current Drawn | 65 amps | 30 amps |

| Coil for Hot Gas Solenoid (PS1, PS2, PS3, PS4) | | |
|---|--------|--------|
| Voltage | 12 Vdc | 24 Vdc |
| Current | 14 W | 14 W |

| Coil for Liquid Injection Solenoid (LIS) – MAX Only | | |
|--|--------|--------|
| Voltage | 12 Vdc | 24 Vdc |
| Current | 14 W | 14 W |

| Coil for Heat Pilot Solenoid (PS5) - Truck Engine Coolant Heat Option Only | | |
|---|---------|--------|
| Voltage | 12 Vdc | 24 Vdc |
| Current | 21 amps | 21 W |

| Drain Line Heaters (Each) - MAX Only | | |
|---|-----------|---------|
| Voltage | 12 Vdc | 24 Vdc |
| Resistance | 2.095 ohm | 7.5 ohm |

| Battery Relay (BATR) | | |
|-----------------------------|--------------------|---------------------------------|
| Type | | Single Pole Single Throw (SPST) |
| Contacts | Terminals 30 to 87 | Normally Open (NO) |
| Coil Resistance | Terminals 85 to 86 | 90 ohms |

| Electric Standby Power Relay (STDR) | | |
|--|---|---|
| Type | | Single Pole Single Throw (SPST) |
| Contacts | Terminals 30 to 87 Terminals 30 to 87A | Normally Open (NO) Normally Close (NC) |
| Coil Resistance | Terminals 85 to 86 | 90 ohms |

| Compressor Motor Contactor (CMC) | | |
|---|---------------|---------------|
| Contacts | Normally Open | Normally Open |
| Coil Voltage | 12 Vdc | 24 Vdc |
| Coil Current | 0.25 amps | 5.4 Watt |

| Transformer | |
|---------------------------|---|
| Power | 1100 VA |
| Frequency | 50/60 Hz |
| Primary Inputs | 230-400 Vac |
| Secondary Nominal Voltage | 2 windings: 11.7 Vac (47 Amps) 11.7 Vac (47 Amps) |

AC Electric Compressor Motors and Overload Relays

| Voltage/Phase/ Frequency | Horsepower | Kilowatts | RPM | Full Load (amps) | Overload Relay Setting (amps) |
|-------------------------------------|-------------------|------------------|------------|-------------------------|--|
| V-800 | | | | | |
| 230/3/50 | 3 | 2.3 | 1450 | 57/16.6 amps | 18 |
| 400/3/50 | 3 | 2.3 | 1450 | 32.9/9.6 amps | 14 |
| 230/3/60 | 3 | 2.3 | 1740 | 68.4/19.9 amps | 18 |
| 400/3/60 | 3 | 2.3 | 1740 | 39.5/11.5 amps | 14 |
| V-1000 | | | | | |
| 230/3/50 | 5 | 3.7 | 1450 | 22/109 amps | 24 |
| 400/3/50 | 5 | 3.7 | 1450 | 12.7/63.1 amps | 16 |
| 230/3/60 | 5 | 3.7 | 1740 | 26.5/121 Amps | 24 |
| 400/3/60 | 5 | 3.7 | 1740 | 15.3/70.1 amps | 16 |

Single temperature SPR Valves Setting

SPR default factory setting

SPRs are set to 2 bar as default from factory, measured in the pressure port close to the valve.

Recommended SPR valve settings depending on the customer application

To maximise unit pull-down and performance both in cool and heating modes, SPR valves must be adjusted to the following values depending on the average ambient temperature during the summer months (T):

- $T > +25\text{ °C}$ (warm countries): 2.2 bar (value measured at main compressor suction port)
- $T < +25\text{ °C}$ (cool countries): 2.7 bar (value measured at main compressor suction port)

SPR valve adjustment procedure

Before adjusting the SPR valves, the unit must be fully installed on the vehicle according to Thermo King procedures and have the appropriate oil and refrigerant charge (the expansion valve does not need to be adjusted). The process described below assumes that the ambient temperature is high enough to have system pressures (discharge and suction) under normal operating conditions. However, if system pressures are too low due to low ambient temperature conditions ($< 0\text{ °C}$), the same process could be followed by running the unit on heating mode when possible and letting the compartment temperature rise to an acceptable level ($> 15\text{ °C}$).

1. Connect the pressure gauges to the road compressor ports. Start the unit in cooling on road mode (2000 - 2400 compressor rpm).
2. Adjust the SPR valve until the suction pressure reading on the road compressor port matches the recommended value for the application. Leave the unit running for 10-15 mins to check that the pressure reading is stable.
3. Stop unit and disconnect pressure gauges.

Spectrum SPR Valves Setting

SPR default factory setting

SPRs are set to 2 bar as default from factory, measured in the pressure port close to the valve.

Recommended SPR valve settings depending on the customer application

To maximise unit pull-down and performance both in cool and heating modes, SPR valves must be adjusted to the following values:

- Warm countries: 2.2 bar (measured at road compressor suction port)
- Cool countries: 2.7 bar (measured at road compressor suction port)

These settings allow the unit to operate properly in fresh/fresh and fresh/frozen conditions. However, for fresh/frozen applications, heat load in the fresh compartment should represent at most 20% of the maximum full unit capacity, as per ATP certificate at 0°C / -20°C conditions.

If the fresh compartment heat load is greater than 20% of full unit capacity, the SPR valve located in the fresh compartment shall be adjusted to a 1.3 barg pressure reading, measured in the pressure port close to the valve. This is to ensure that the evaporator in the frozen compartment can deliver cooling capacity when the evaporator in the fresh compartment is running. This change leaves the unit asymmetrically configured, so fresh/frozen compartments cannot be swapped and have the same performance. In addition, the pull-down process does not occur symmetrically in both evaporators either due to the unbalanced pressure setting of the SPR valves.

In this case, if unit symmetry and reversibility must be maintained, both SPR valves shall be set to 1.3 barg, measured in the pressure port close to the valve. However, the impact on unit pull-down time and performance is significant.

SPR valve adjustment procedure

Before adjusting the SPR valves, the unit must be fully installed on the vehicle and have the appropriate oil and refrigerant charge (the thermostatic expansion valve does not need to be adjusted). The process described assumes that the ambient temperature is high enough to have system pressures (discharge and suction) under normal operating conditions. However, if system pressures are too low due to low ambient temperature conditions (< 0 °C), the same process could be followed by running the unit on heating mode and letting the compartment temperature rise to an acceptable level (> 15 °C).

1. Connect the pressure gauges to the road compressor ports. Start the unit in cooling on road mode (2000 - 2400 compressor rpm).
2. Stop compartment 2's functionality (by disconnecting that compartment's temperature sensor or via the compartment selection menu on the In-cab Control Box), so that only compartment 1 remains functional.
3. Adjust the SPR valve in compartment 1 until the suction pressure reading on the road compressor port matches the recommended value for the application. Leave the unit running for 10-15 min to check that the pressure reading is stable.
4. Activate compartment 2 (by reconnecting the temperature sensor, if it was disconnected, or via the compartment selection menu on the In-cab Control Box) and deactivate compartment 1, following the same process as for compartment 2.
5. Adjust the SPR valve in compartment 2 until the suction pressure reading on the road compressor port matches the recommended value for the application. Leave the unit running for 10-15 min to check that the pressure reading is stable.
6. Activate compartment 1 again and check that the suction pressure reading on the road compressor port remains stable as set during 5-10 min.
7. Stop unit and disconnect pressure gauges.

Condenser and Evaporator Dimensions

Note: Paper Templates are available to assist in 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. These Templates can be downloaded and printed from EMEA Infocentral in the following location: Technical Publications/ Vehicle Powered Truck/ Drawings and Diagrams/Installation Templates.

Important: See Section 4 - Unit Installation Standards and Procedures in the Thermo King Vehicle Powered Truck Installation Standards and Procedures Guide (TK 61588). **THESE PROCEDURES MUST BE FOLLOWED!**

Figure 17. Condenser Roof Top Mounting/Access Hole Locations (V-500/V-600)

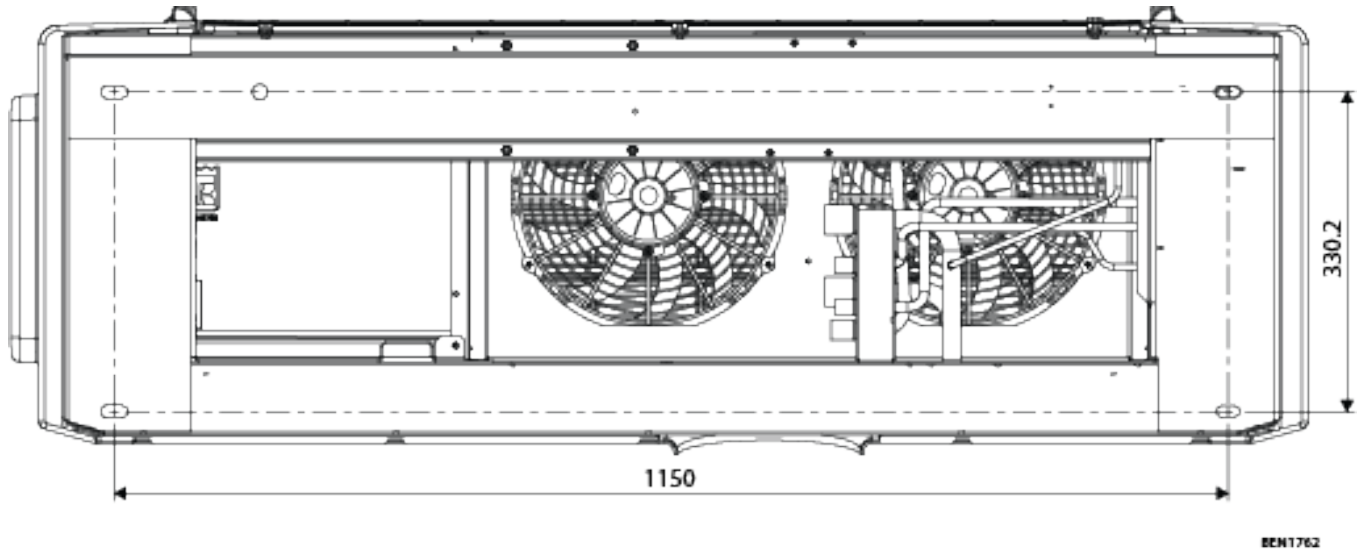


Figure 18. Condenser Roof Top Mounting/Access Hole Locations (V-800/V-1000)

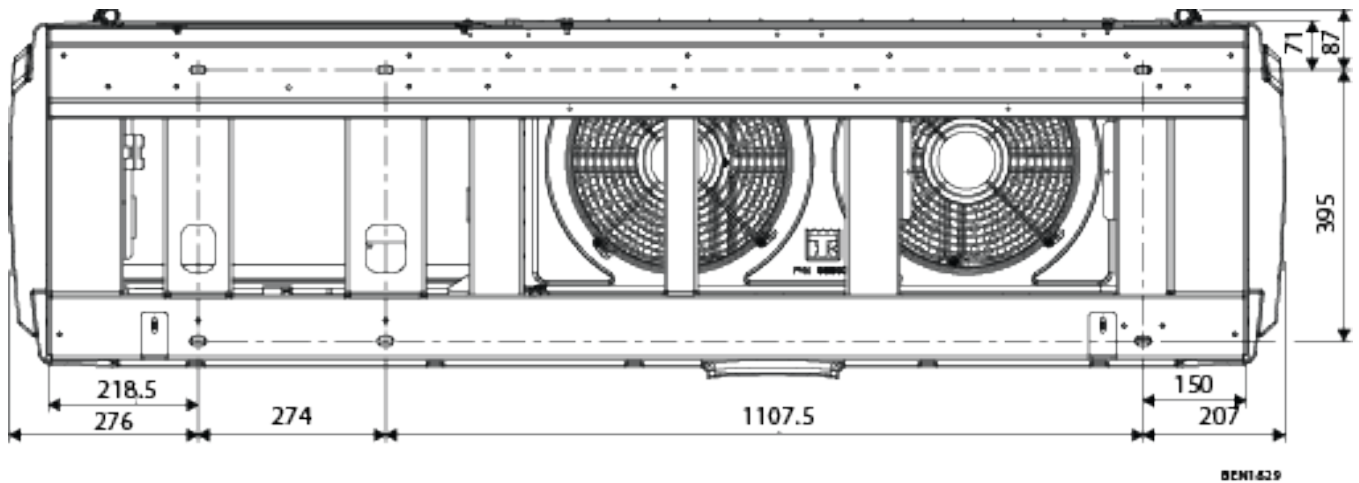
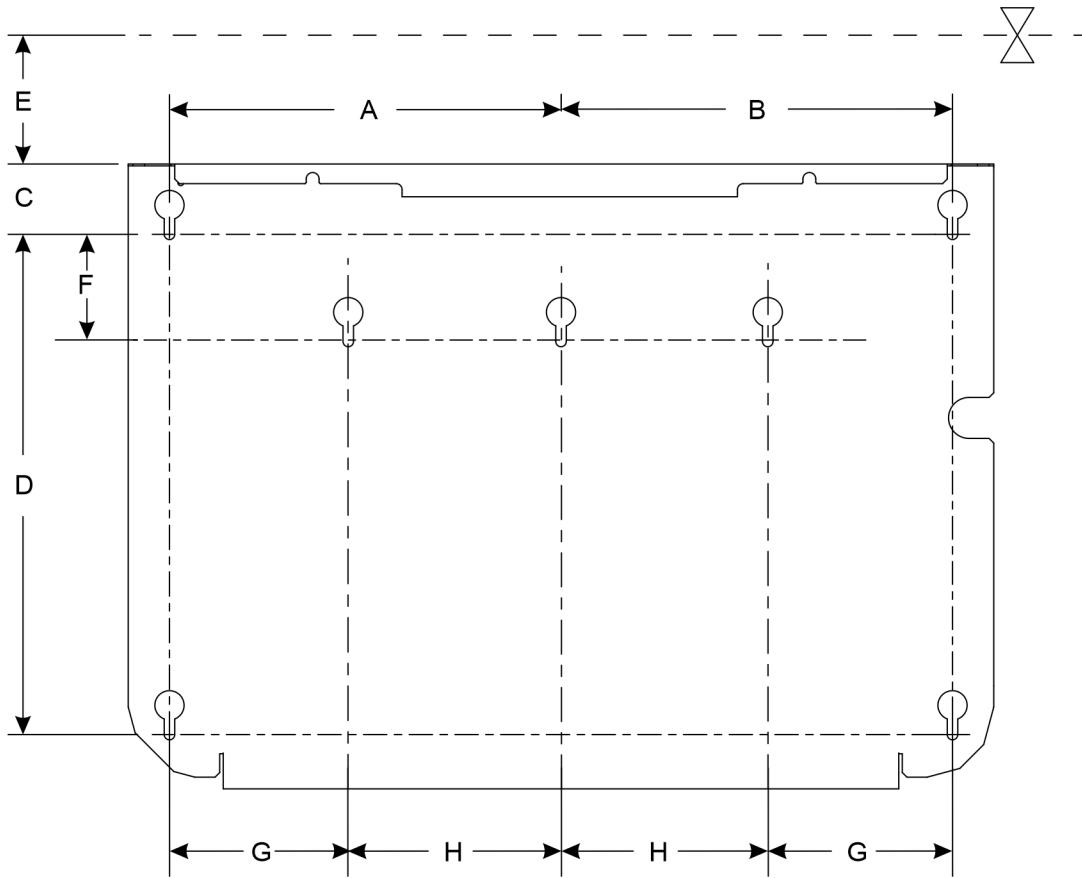


Figure 19. Evaporator Mounting/Access Hole Locations


BEN1734

| Model | A | B | C | D | E | F | G | H |
|---------------|----------|----------|---------|----------|--------|------|----------|----------|
| ES100N | 197.5 mm | 197.5 mm | 70.5 mm | 410 mm | 110 mm | NA | NA | NA |
| ES150 | 335 mm | 335 mm | 60.1 mm | 427.5 mm | 110 mm | NA | NA | NA |
| ES300 | 450 mm | 450 mm | 50.5 mm | 443 mm | 110 mm | NA | NA | NA |
| ES400 | 470 mm | 470 mm | 50 mm | 450 mm | 150 mm | NA | NA | NA |
| ES500 | 595 mm | 595 mm | 50 mm | 450 mm | 150 mm | NA | NA | NA |
| ES800 | 755 mm | 755 mm | 50.5 mm | 450 mm | 150 mm | NA | NA | NA |
| ES1000 | NA | NA | 50.5 mm | 520 | 150 mm | 99.5 | 442.5 mm | 412.5 mm |

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