



Installation Manual

Truck Edition

V-520 Series

Single Temperature and
SPECTRUM Multi-Temperature Systems

Revision 11

March 2018

TK-54014-18-IM

TRANE
TECHNOLOGIES

Installation Manual

Truck Edition V-520 Series Single Temperature and SPECTRUM Multi-Temperature Systems

TK 54014-18-IM (Rev. 11, 03/18)

V-520 Installation Manual

Release History

Released	(09/09)
Rev. 1	(06/10) Corrected weight of V-520 Model 10 Single Temperature unit from 117 kg (260 lbs.) to 70.3 Kg (155 lbs.) and added optional heater installation instructions.
Rev. 2	(09/11) Added Model 30 and Model 50 information.
Rev. 3	(12/11) Page 7: Revised Safety Precautions to include Battery Installation and Cable Routing warnings and cautions, page 18: removed "supplied condenser template" which is no longer being supplied, page 37:corrected art as defrost and liquid connections were identified wrong.
Rev. 4	(01/12) Page 13: Corrected ES300 evaporator dimension errors.
Rev. 5	(08/12) Page 12: Corrected V-520 dimension error from 39.0 in. to 39.4 in.
Rev. 6	(09/13) Page 5: Changed compressor oil from 203-513 to 203-515.
Rev. 7	(12/13) Pages 8, 13, 14 and 22: changed text and art to clarify the minimum distance required from the cargo wall to the rear of the evaporator with or without heat option.
Rev. 8	(08/14) Pages 9, 18,19, 56 and 57: Added compressor ground wire.
Rev. 9	(01/15) Pages 18 and 33: Added compressor oil quantity chart, page 15 and 39: changed art to show new horizontal accumulator tank.
Rev. 10	(10/15) General update to manual including adding SPR and CPR adjustment procedures, system leak check and evacuation procedures, updated information on battery connections and how to properly secure maxi-fuse holder.
Rev. 11	(03/18) Pages 37: updated amount of oil required for each model, page 65: updated the initial refrigerant charge amount required for each model.

Introduction

This manual was written to assist with the installation of a **Thermo King V-520** condenser unit with **ES300** or **ES500** remote evaporators onto trucks designed and built for refrigerated applications. Due to its complexity, you should not attempt this installation unless you:

- Are an experienced mechanic.
- Can safely lift 34 kilos (75 lbs.)
- Are certified or 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.

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

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.

Table of Contents

Safety Precautions	6	Installation - Refrigeration Hoses to Evaporator(s).....	42
Tips for a Successful Installation	8	System Leak Check and Evacuation	48
Required Tools	12	Electrical Connections - Evaporator(s)	50
Dimensions and Weight - V-520	14	Installation - Drain Hoses	54
Dimensions and Weight - ES300	15	Installation - HMI	58
Dimensions and Weight - ES300 (with ACSM)	16	Installation - Standby Power Receptacle	60
Dimensions and Weight - ES500	17	Installation - Electrical Connections to Compressor and Battery	62
Dimensions and Weight - ES500 (with Heat Option)	18	System Charging	64
Dimensions - HMI	19	SPR and CPR Adjustment Procedures	66
Installation - Vehicle Powered Compressor	20	Installation Check List	69
Installation - V-520 Condenser	22	Refrigeration Diagram V-520 - 10	70
Installation - ES500 Evaporator	24	Refrigeration Diagram V-520 - 20	71
Installation - (2) ES300 Evaporators	26	Refrigeration Diagram V-520 - 30	72
Fabricating Refrigeration Hoses	28	Refrigeration Diagram V-520 - 50	73
Important - Suction Line Routing and P-Trap Formation	34	Refrigeration Diagram V-520 - 10 SPECTRUM	74
Installation - Refrigeration Hoses to Vehicle Powered Compressor	36	Refrigeration Diagram V-520 - 20 SPECTRUM	75
Installation - Refrigeration Hoses from Vehicle Compressor to Condenser Unit	38	Refrigeration Diagram V-520 - 50 SPECTRUM	76
		Wiring and Schematic Diagram Numbers	77

Recover Refrigerant

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

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

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

R-404A/R-134a



WARNING: Use *ONLY Polyol Ester based refrigeration compressor oil (TK P/N 203-515) in R-404A and R-134a units.*

DO NOT use Polyol Ester based oil in standard Thermo King units.

DO NOT mix Polyol Ester and standard synthetic compressor oils.

Keep Polyol Ester compressor oil in tightly sealed containers. If Polyol Ester oil becomes contaminated with moisture or standard oils, dispose of properly—DO NOT USE!



WARNING: When servicing Thermo King R-404A and R-134a units, use only those service tools certified for and dedicated to R-404A or R-134a refrigerant and Polyol Ester compressor oils. Residual non-HFC refrigerants or oils will contaminate R-404A and R-134a systems.




CAUTION


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





CAUTION: SEVERE COMPRESSOR DAMAGE will result from operating the unit before completing the installation which includes: installing the components, releasing the holding charge, connecting refrigeration lines, leak testing, evacuation, clean-up and charging of the system with the proper amount and type of refrigerant.


Safety Precautions


The  symbol appears next to a point that is particularly important:


 **DANGER:** Addresses a circumstance that, if encountered, will lead to death or serious injury.


 **WARNING:** Addresses a circumstance that, if encountered, might lead to death or serious injury.


 **CAUTION:** Addresses a circumstance that, if encountered, may cause damage to equipment or minor injury.


 **DANGER:** Never operate the unit with the discharge valve closed as it could cause the compressor to explode, causing death or serious injury.


 **DANGER:** Never apply heat to a sealed refrigeration system or container because it could explode, causing death or serious injury.


 **DANGER:** Fluorocarbon refrigerants, in the presence of an open flame or electrical short, produce toxic gases that are severe respiratory irritants capable of causing death.

 **DANGER:** Be careful when working with a refrigerant or refrigeration system in any enclosed or confined area with a limited air supply (i.e., a trailer, container or the hold of a ship). Refrigerant tends to displace air and can cause oxygen depletion which may result in death by suffocation.

 **WARNING:** Always wear eye protection such as goggles or safety glasses. Refrigerant liquid, refrigeration oil, and battery acid can permanently damage the eyes (see First Aid under Refrigeration Oil).


 **WARNING:** Keep your hands away from fans when the unit is running. This should also be considered when opening and closing the compressor service valves.


 **WARNING:** Make sure gauge manifold hoses are in good condition. Never let them come in contact with a belt, fan motor pulley, or any hot surface.


 **WARNING:** Make sure all mounting bolts are tight and are of correct length for their particular application.


Safety Precautions


Battery Installation and Cable Routing


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

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


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

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

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

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

Refrigerant

 **WARNING:** Although fluorocarbon refrigerants are classified as safe refrigerants, certain precautions must be observed when handling them or servicing a unit in which they are used. When released to the atmosphere in the liquid state, fluorocarbon refrigerants evaporate rapidly, freezing anything they contact.

First Aid


FROST BITE: In the event of frost bite, the objectives of First Aid are to protect the frozen area from further injury, to warm the affected area rapidly and to maintain respiration.

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 lukewarm water. Do not apply heat. Remove contaminated clothing and shoes. Wrap burns with dry, sterile, bulky dressing to protect from infection/injury. Get medical attention. Wash contaminated clothing before reuse.

INHALATION: Move victim to fresh air and use CPR or mouth-to-mouth ventilation, if necessary. Stay with victim until arrival of emergency medical personnel.

Refrigeration Oil

 **WARNING:** Avoid refrigeration oil contact with the eyes. Avoid prolonged or repeated contact of refrigeration oil with skin or clothing. Wash thoroughly after handling refrigeration oil to prevent irritation.

First Aid

NOTE: In case of eye contact, immediately flush with plenty of water for at least 15 minutes. CALL A PHYSICIAN. Wash skin with soap and water.

Tips for a Successful Installation

GENERAL INFORMATION

- Read this manual to better understand how components are to be located and properly installed.
- The vehicle's 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.
- The front wall of the cargo box must be able to adequately support the weight of the V-520 condenser. Additional supports (installer supplied) may be required. ***“Dimensions and Weight - V-520” on page 14***
- The compartment ceiling of the cargo box must be able to adequately support the weight of the ES300 or ES500 evaporators. Additional ceiling supports (installer supplied) may be required. ***See “Dimensions and Weight - ES300” on page 15, “Dimensions and Weight - ES300 (with ACSM)” on page 16, “Dimensions and Weight - ES500” on page 17, “Dimensions and Weight - ES500 (with Heat Option)” on page 18***
- Thermo king recommends securely installing a steel support plate with mounting studs or threaded inserts (installer supplied) directly to the interior roof structure of the cargo box prior to insulating and finishing the cargo area.
- Verify tools and special equipment required for the installation are available and in good operating condition.
- Verify all measurements before drilling any mounting holes in the vehicle.
- Verify there is no interference with any OEM electrical wiring, internal supports, etc. before drilling any mounting holes in the vehicle.
- Provide protection to the vehicle's finish to prevent damage during the installation process.
- Install all components using the correct hardware and tighten securely.

- All access holes through the cargo area must be sealed with a neutral/ alcohol cure silicone sealant to prevent moisture from entering and from escaping.
- Always use protective grommets when routing electrical harnesses or refrigeration hoses through sheet metal floors or walls.
- Always keep electrical harness and refrigeration hoses from rubbing or chafing against sharp metal objects or rotating components.
- The fabrication and installation (by the installer) of protective covers for any exposed refrigerant hoses and electrical wiring inside or outside the cargo box is recommended.

V-520 CONDENSER

- Check clearance for tilt cab applications before installing the V-520 condenser.
- Never install any compressible washers or other materials between the condenser and the cargo box.

ES300 and ES500 EVAPORATORS

- Verify the evaporator air outlet is facing the correct direction for proper airflow before installing.
- Standard ES300 and ES500 - Allow a minimum distance of 152 mm (6.00 in.) from the cargo area wall to the rear of the evaporator for refrigerant hose and drain hose connections.
- Optional ES300 with Advanced Control System Module or ES500 with Heat Option - Allow a minimum distance of 152 mm (6.00 in.) from the cargo area wall to the rear of the accumulator assembly for refrigerant hose and drain hose connections.
- Always install the orifice screen correctly into the expansion valve of the evaporator before installing the refrigeration hoses.
- Evaporator drain hoses should be installed and routed correctly with no kinks or sharp bends to provide for proper drainage.

Tips for a Successful Installation

REFRIGERATION HOSES

- Always keep refrigeration system fittings capped and sealed until the installation of the refrigeration hoses.
- Only cut refrigerant hoses with the correct hose cutting tool (204-677). NEVER USE A SAW!
- Always use the correct hose fitting tool (204-1045 or 204-1128) when assembling refrigerations hoses.
- Always lubricate hose fittings with refrigerant oil when assembling to refrigeration hoses.
- Always install and lubricate o-rings with refrigerant oil when connecting refrigeration hose fittings to component connections.
- All refrigeration connections should be tightened securely using two wrenches.
- Always remove the Schrader valve from the suction line tee before installing the metering orifice fitting for the Jet Cool system.
- Refrigeration hoses should be installed onto components in such a way as to allow for vibration and movement. THEY SHOULD NEVER BE STRETCHED TIGHT!
- Refrigeration hoses should be carefully routed from the vehicle's engine compartment, up the exterior wall of the cargo box, and into the cargo box.
- The suction hose must be installed correctly and include one P-Trap. See "Important - Suction Line Routing and P-Trap Formation" on page 34.
- All hose bends must maintain at least minimum bend radius with no kinks. See "Minimum Bend Radii" on page 33.

ELECTRICAL

- Anti-corrosion gel (203-377) or equivalent should be applied to all electrical connections.
- All electrical harnesses should be neatly routed and secured with band wraps or clamps.
- Evaporator heater resistance wires must be installed as far as possible into the drain hoses. NEVER CUT HEATER RESISTANCE WIRES!
- Electrical power to the In-Cab controller must be connected to a fused circuit of the vehicle to provide power only when the ignition switch is in the ON position.
- If the vehicle is equipped with a battery disconnect switch, always wire the unit after the switch. This allows power to the unit to be turned off by the battery disconnect switch.
- The unit's power wire (2) must be spliced with supplied 50 amp in-line fuse for single temperature units and 60 amp in-line fuse for multi-temperature units and connected securely to the vehicle's positive (+) battery connection.
- The dc control power supply voltage from the vehicle's electrical system (ACC) and the voltage level in the vehicle's battery (BAT) must be spliced together with the supplied 10 amp in-line fuse and connected securely to the vehicle's ignition switch.
- The unit's ground wire (CH) must be connected securely to the vehicle's negative (-) battery connection.
- Verify the main power harness ground cable is properly connected to the vehicle's negative battery post.

Tips for a Successful Installation

ELECTRICAL (continued)

- The In-Cab controller should only be mounted inside the vehicle. It should be accessible and visible from the driver's position while not interfering with the driver's mobility, visibility or access to the vehicle controls and instruments.
- A separate ground wire must be installed from the engine driven compressor to chassis ground. The location used on the vehicle chassis should be clean and free of paint to make a proper ground path. See "Compressor Ground Wire" on page 20 for details.

ELECTRIC STANDBY MODELS

NOTE: Thermo King recommends a 20 amp fused power source for electric standby operation.

- Verify the receptacle box is wired for the correct voltage for your application.
- The standby receptacle box should be installed securely to the cargo box. It should be easily accessible while not interfering with the driver's visibility or tilt cab operation.

SYSTEM EVACUATION AND CHARGING

- Flush compressor with oil (203-515).
- The Liquid Injection and Defrost Solenoid Valves must both be in the OPEN position during evacuation procedures. The valves are normally in the closed position and must be held open manually using special magnets (204-1074) designed for this purpose. DO NOT put a magnet onto the Condenser Blocking Solenoid valve (Heat Option Only) as this is a normally open valve and a magnet will close it.
- Thermo King Evacuation Station P/N 204-725 and Evacuation Station Operation and Field Application Instructions (TK-40612) is required.
- Verify the refrigeration system is charged with the correct type and amount of refrigerant for your application.
- Verify the refrigeration system has been checked for leaks by using an electronic leak detector.
- Verify the SPR and CPR adjustment procedures were followed and the unit operates at its maximum capacity.

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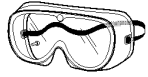
Required Tools

1. Protective Eye Wear
2. Drill
3. Drill Bits
4. Tape Measure
5. Hand Saw
6. File
7. Mechanics Tools
8. Torque Wrench
9. Wire Crimper
10. Hose Cutting Tool (204-677)
11. Hose Fitting Tools (204-1045 and 204-1128)
12. Voltmeter
13. Neutral/Alcohol Cure Silicone Sealant (203-436) or equivalent
14. Manifold Set
15. Evacuation Station
16. Reclaiming Station
17. Electronic Leak Detector
18. Nitrogen
19. Refrigerant and Scale
20. Overhead Crane or Hoist
21. Work Platform (Recommended)
22. Installation Manual
23. Solenoid Valve Magnet (204-1074)

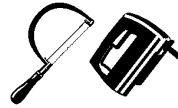
IMPORTANT: Equipment such as scales, gauges, and torque wrenches should be in good working condition and routinely calibrated to assure accurate readings.

Required Tools

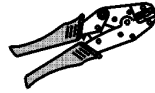
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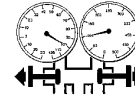
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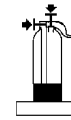
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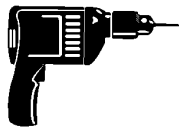
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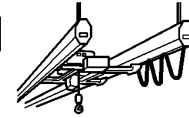
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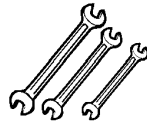
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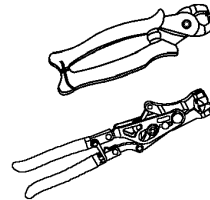
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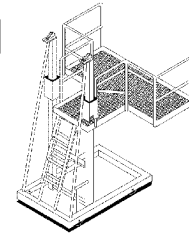
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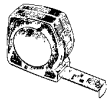
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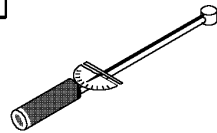
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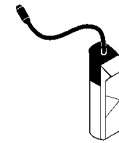
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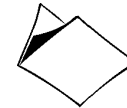
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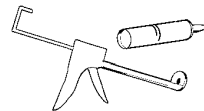
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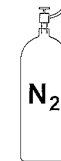
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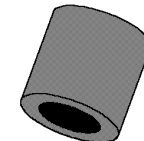
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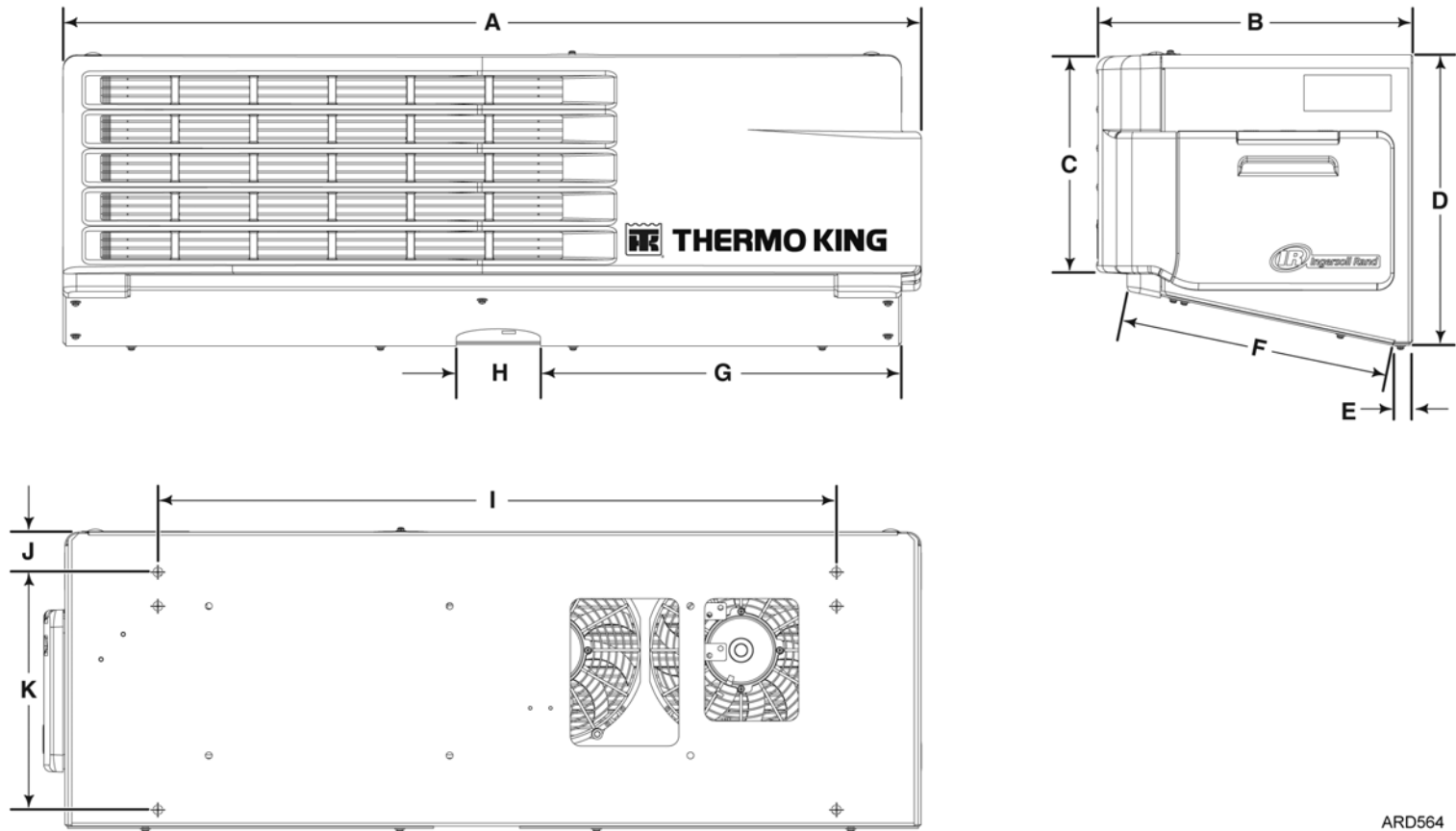


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AFV01

Dimensions and Weight - V-520



ARD564

Approximate Weights:

V-520 Model 10 and Model 30 Single Temperature = 70.3 kg (155 lbs.)

V-520 Model 20 and Model 50 Single Temperature = 125 kg (275 lbs.)

V-520 Model 10 Multi-Temperature = 73 kg (160 lbs.)

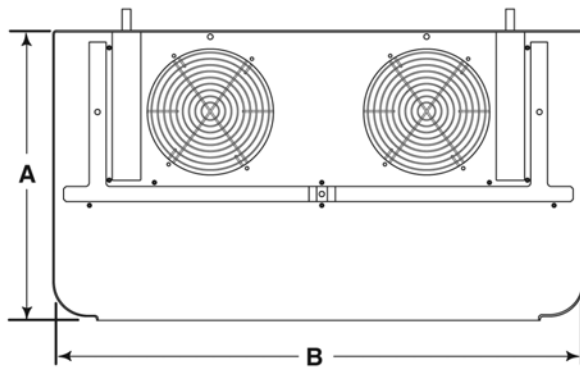
V-520 Model 20 Multi-Temperature = 132 kg (290 lbs)

V-520 Model 50 Multi-Temperature = 132 kg (290 lbs)

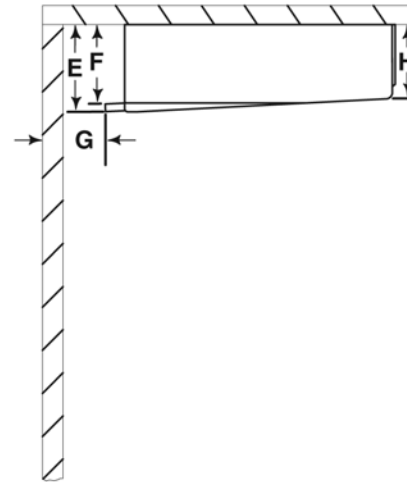
A.	1292 mm (50.8 in.)	G.	543 mm (21.4 in.)
B.	475 mm (18.7 in.)	H.	127 mm (5.0 in.)
C.	330 mm (13.0 in.)	I.	1000 mm (39.4 in.)
D.	436 mm (17.2 in.)	J.	62 mm (2.4 in.)
E.	28mm (1.1 in.)	K.	350 mm (13.7 in.)
F.	409 mm (16.0 in.)		

Dimensions and Weight - ES300

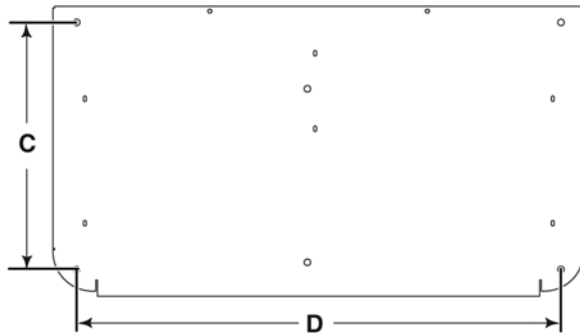
TOP VIEW



SIDE VIEW



BOTTOM VIEW



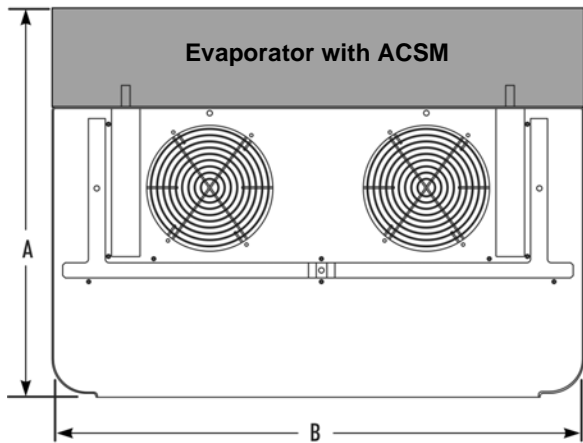
ARD565

**Approximate Weight:
ES300 = 18 kg (40 lbs.)**

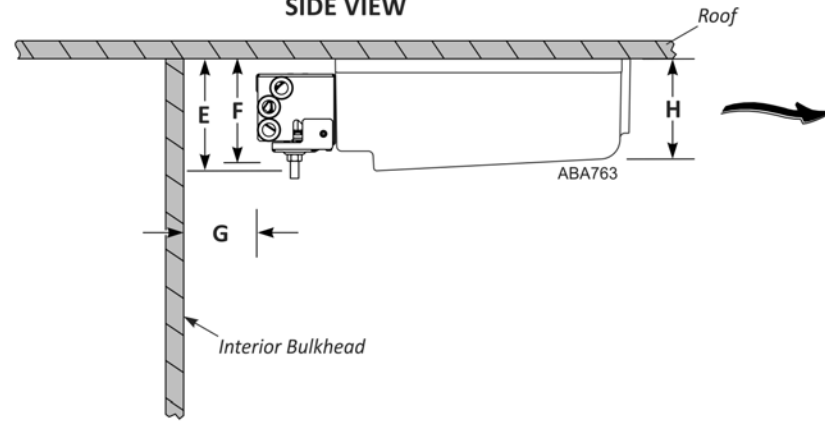
A.	524 mm (20.7 in.)	E.	183 mm (7.2 in.)
B.	976.8 mm (38.5 in.)	F.	152.5 mm (6.0 in.)
C.	455 mm (18.0 in.)	G.	152 mm (6.0 in.)
D.	892 mm (35.0 in.)	H.	147 mm (5.8 in.)

Dimensions and Weight - ES300 (with ACSM)

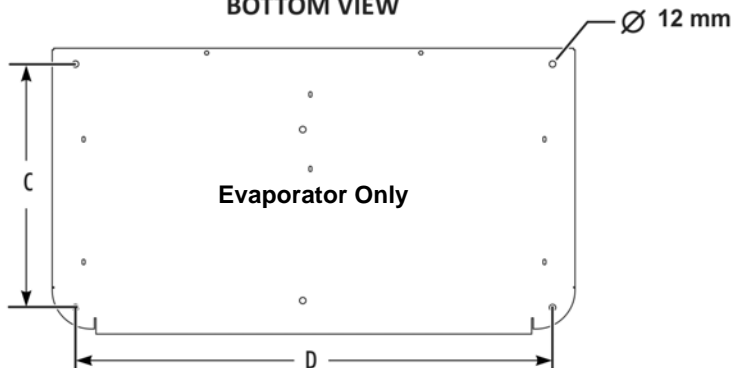
TOP VIEW



SIDE VIEW



BOTTOM VIEW

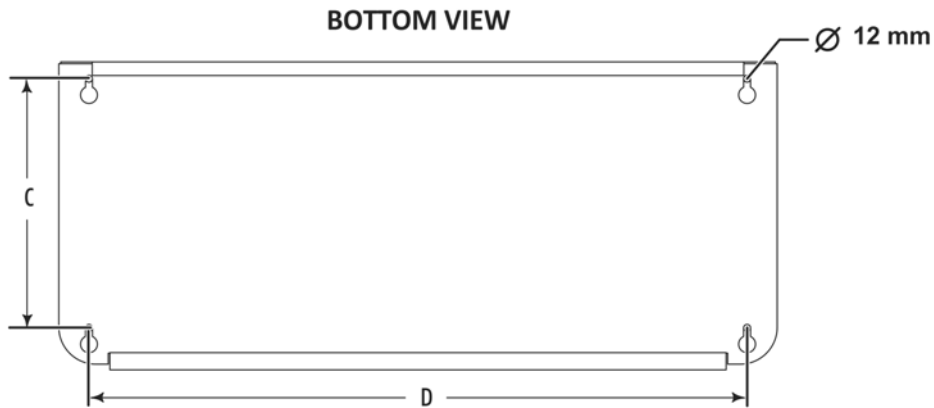
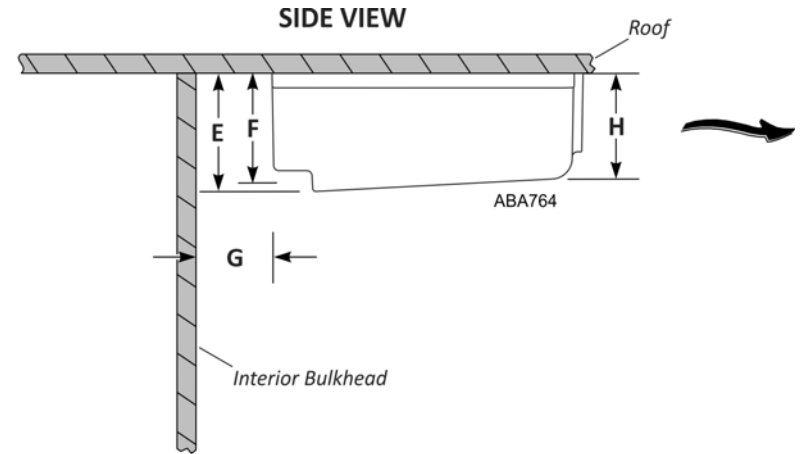
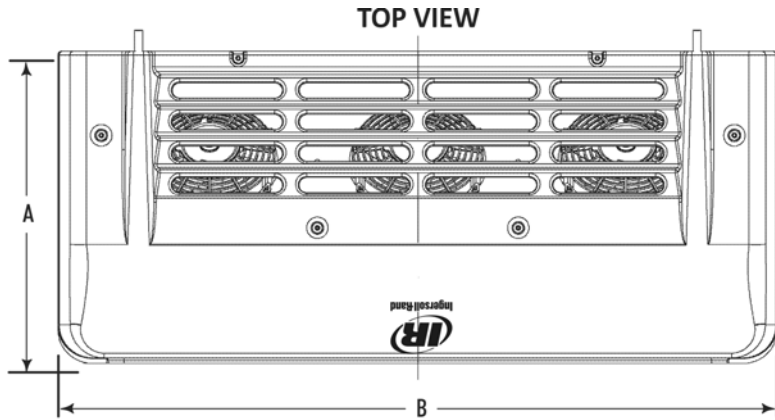


Approximate Weight:

ES300 Remote Evaporator with ACSM = 33 kg (72 lbs.)

Dimensions			
A.	662.9 mm (26.1 in.)	E.	183 mm (7.2 in.)
B.	976.8 mm (38.5 in.)	F.	152 mm (6.0 in.)
C.	455 mm (18.0 in.)	G.	152 mm (6.0 in.)
D.	892 mm (35.0 in.)	H.	147 mm (5.8 in.)

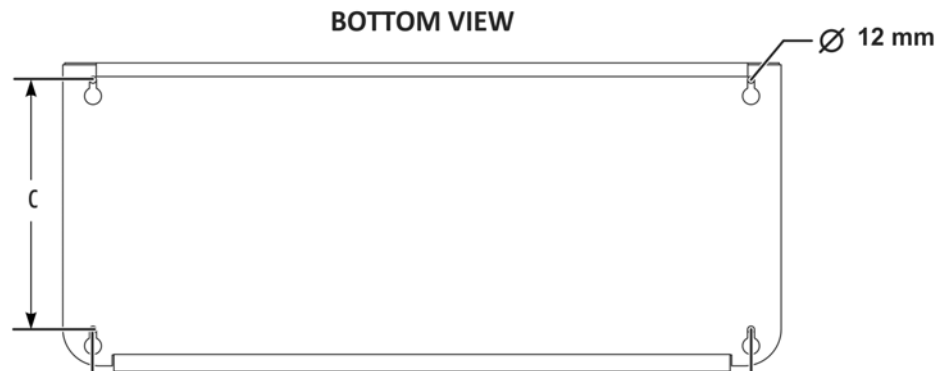
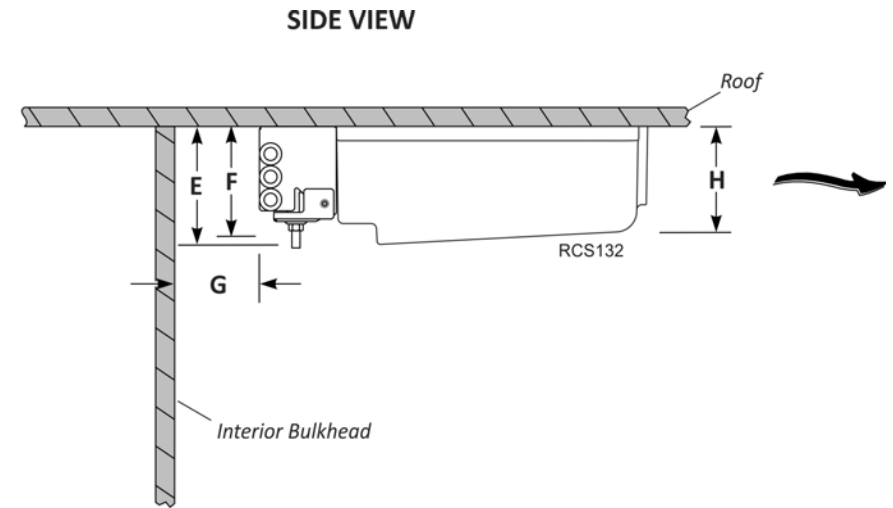
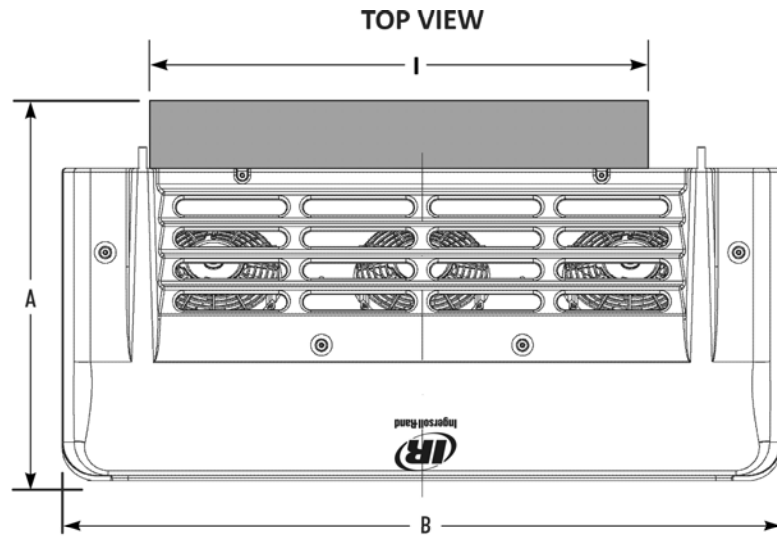
Dimensions and Weight - ES500



Approximate Weight: ES500 = 23 kg (51 lbs.)

A.	562 mm (22.0 in.)	E.	220 mm (8.5 in.)
B.	1304 mm (51.0 in.)	F.	202 mm (8.0 in.)
C.	450 mm (17.7 in.)	G.	152 mm (6.0 in.)
D.	1194 mm (47.0 in.)	H.	192 mm (7.5 in.)

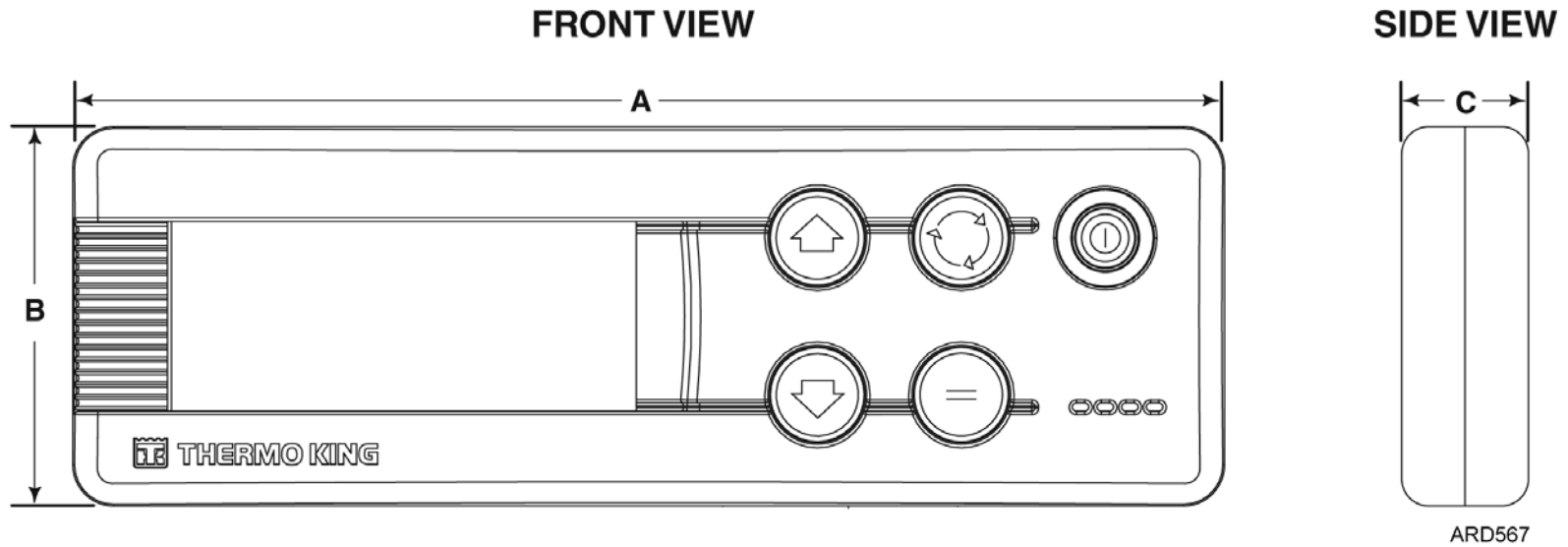
Dimensions and Weight - ES500 (with Heat Option)



Approximate Weight: ES500 (with Heat Option) = 33 kg (72 lbs.)

A.	685.8 mm (27.0 in.)	F.	202 mm (8.0 in.)
B.	1304 mm (51.0 in.)	G.	152 mm (6.0 in.)
C.	450 mm (17.7 in.)	H.	192 mm (7.5 in.)
D.	1194 mm (47.0 in.)	I.	914.4 mm (36.00 in.)
E.	236 mm (9.29 in.)		

Dimensions - HMI



A.	140 mm (5.50 in.)
B.	46 mm (1.80 in.)
C.	12 mm (.50 in.)

Installation - Vehicle Powered Compressor

Installation

NOTE: Always confirm compressor installation kit is correct for your vehicle before preceding with the installation.

Add only 4 oz. of oil (supplied) to the compressor and rotate clutch end to circulate the oil throughout the compressor. Do not add more than 4 oz. of oil to the compressor at this time.

Additional oil will be added later to the system. See “Oil Capacity for Units Utilizing Swash Plate Roadside Compressors” and “Oil Capacity for Units Utilizing Reciprocating Roadside Compressors” on page 37.

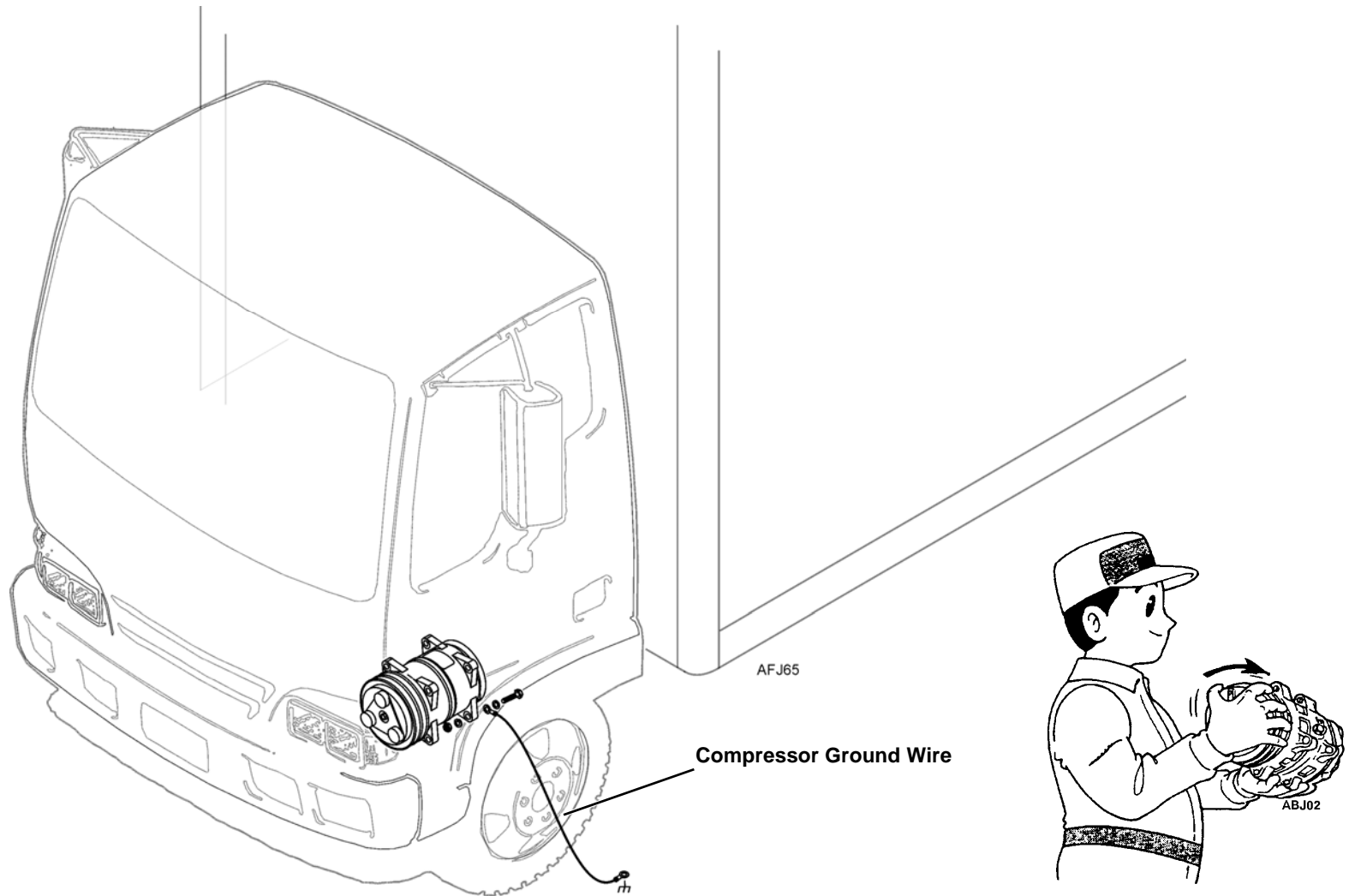
Install compressor on the vehicle by following the instructions included in the compressor kit.

Compressor Ground Wire

Install the chassis ground wire to the compressor frame using the supplied hardware. Use anti-corrosion gel (203-377) or equivalent on ground wire connection to compressor and vehicle chassis.

IMPORTANT: Failure to install the compressor ground wire to the chassis may result in intermittent clutch operation and premature clutch failure!

Installation - Vehicle Powered Compressor



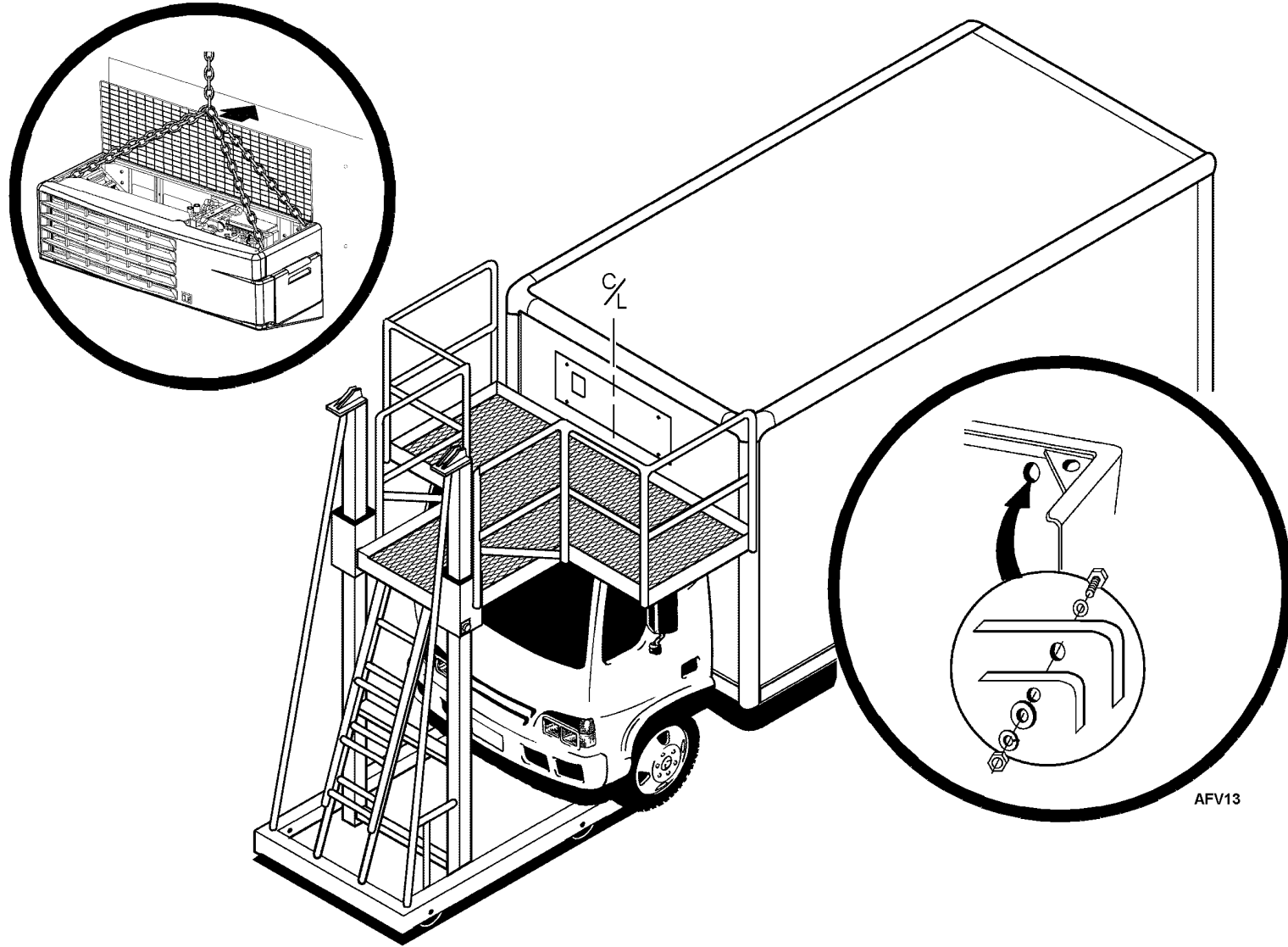
IMPORTANT: Failure to install the compressor ground wire to the chassis may result in intermittent clutch operation and premature clutch failure!

Installation - V-520 Condenser

Installation

1. Locate and mark the center line (C/L) on the truck box.
2. Measure, mark and drill four 1/2 in. (14 mm) condenser mounting holes.
3. Measure, mark and cutout the refrigeration tubing access opening. Remove any sharp edges around the opening with a file.
4. Use an appropriate lifting device to raise the condenser into position.
5. Install four 1/2 in. (14 mm) Grade 5 mounting bolts, washers and locking nuts. Tighten nuts securely and torque to 81.4 N•m (60 ft-lb).
6. Seal all mounting holes with silicone sealant.
7. Route the electrical harnesses:
 - compressor/battery harness to the vehicle's engine compartment.
 - controller harness inside vehicle.
 - evaporator harness into the cargo box.
 - standby harness (if applicable) outside the cargo box.

Installation - V-520 Condenser



AFV13

Installation - ES500 Evaporator

Single Temperature Systems - Models 10, 20, 30 and 50

Support Plates

Thermo King recommends securely installing steel support plates with mounting studs (installer supplied) directly to the truck's interior roof structure to safely support the weight of the ES500 evaporator prior to insulating and finishing the cargo area. The support plates should be correctly located to position the evaporator (with or without Heat Option) the required distance from the front bulkhead wall to allow refrigerant and drain hose connections.

Preferred Installation Method (with pre-installed support plates)

1. Remove the plastic cover from the evaporator.
2. **HEAT OPTION ONLY** - Position the accumulator assembly at the rear of the evaporator:
 - Connect the supplied 7/8" tube assembly with o-rings to the mating fitting inside the evaporator.
 - Secure the accumulator to the rear of the evaporator with supplied hardware and tighten securely.
3. Position the evaporator onto (installer supplied) ceiling mounting studs.
 - Install washers and locking nuts and tighten hardware securely.

NOTE: The evaporator cover will be installed later.

Alternative Installation Method (without pre-installed support plates)

1. Remove the plastic cover from the evaporator.
2. **HEAT OPTION ONLY** - Position the accumulator assembly at the rear of the evaporator:
 - Connect the supplied 7/8" tube assembly with o-rings to the mating fitting inside the evaporator.
 - Secure the accumulator to the rear of the evaporator with supplied hardware and tighten securely.
3. Locate and mark the center line (C/L) of the interior compartment ceiling.
4. **ES500 (without heat option)** - Allow a minimum distance of 152 mm (6.00 in.) from the cargo area wall to the rear of the evaporator for refrigerant hose and drain hose connections.
ES500 (with heat option) Allow a minimum distance of 152 mm (6.00 in.) from the cargo area wall to the rear of the accumulator assembly for refrigerant hose and drain hose connections.
5. Position the evaporator up to the ceiling and mark the location of the four mounting holes. **NOTE: Be sure the evaporator's air outlet is facing the correct direction for proper airflow.**
6. Drill four 5 mm (0.472 in.) mounting holes into the ceiling and loosely install the supplied 1/4" lag bolts and washers.
7. Apply neutral/alcohol cure silicone sealant (installer supplied) per the sealant manufacturer's instructions to the top surface area of the evaporator.
8. Position the evaporator onto the mounting hardware in the ceiling and hand tighten bolts securely.

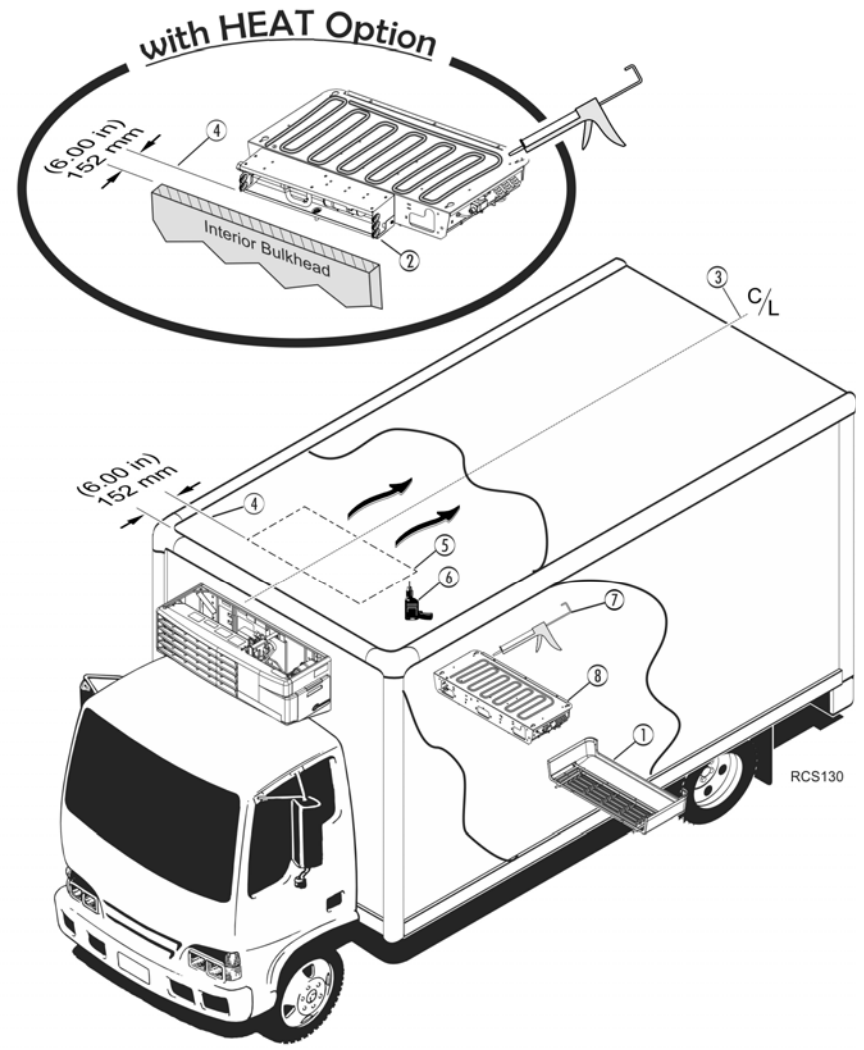
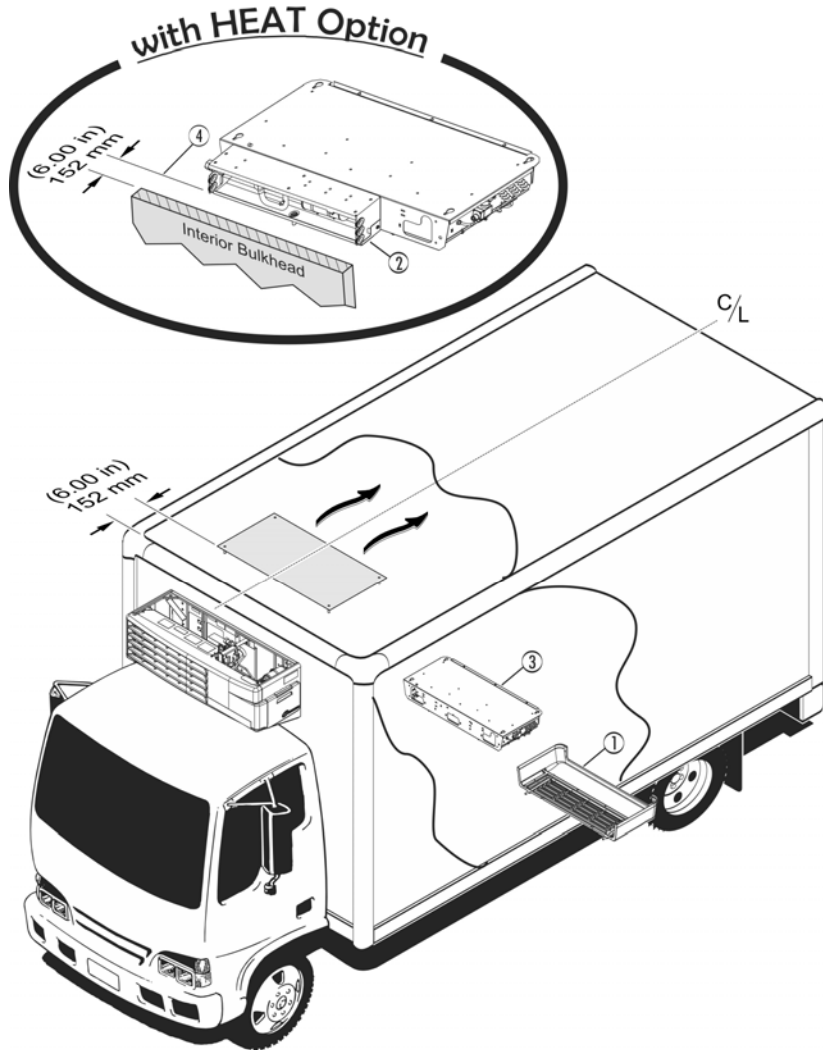
NOTE: The evaporator cover will be installed later.

Installation - ES500 Evaporator

Single Temperature Systems- Models 10, 20, 30 and 50

Preferred Installation Method

Alternative Installation Method



RCS130

Installation - (2) ES300 Evaporators

SPECTRUM Multi-Temperature Systems - Models 10, 20 and 50

Support Plates

Thermo King recommends securely installing steel support plates with mounting studs (installer supplied) directly to the truck's interior roof structure to safely support the weight of the ES300 evaporators prior to insulating and finishing the cargo area. The support plates should be correctly located to position the evaporator (with or without ACSM Option) the required distance from the front bulkhead wall to allow refrigerant and drain hose connections.

- **Standard ES300** - Allow a minimum distance of 152 mm (6.00 in.) from the cargo area wall to the **rear of the evaporator** for refrigerant hose and drain hose connections.
- **Optional ES300 with Advanced Control System Module** - Allow a minimum distance of 152 mm (6.00 in.) from the cargo area wall to the **rear of the accumulator** assembly for refrigerant hose and drain hose connections.

IMPORTANT: *Be sure to install the correct evaporator in each compartment. The HOST evaporator has drain pan heater wires while the REMOTE evaporator does not. REMOTE evaporator with ACSM option will always go in the FRESH compartment.*

Preferred Installation Method (with pre-installed support plates)

1. Remove the plastic cover from the evaporators.
2. Position the **HOST** evaporator onto (installer supplied) ceiling mounting studs in the **FROZEN COMPARTMENT**.
 - Install washers and locking nuts and tighten hardware securely.

3. Position the **REMOTE** evaporator onto (installer supplied) ceiling mounting studs in the **FRESH COMPARTMENT**.
 - Install washers and locking nuts and tighten hardware securely.

NOTE: *The covers for both evaporators will be installed later.*

Alternative Installation Method (without pre-installed support plates)

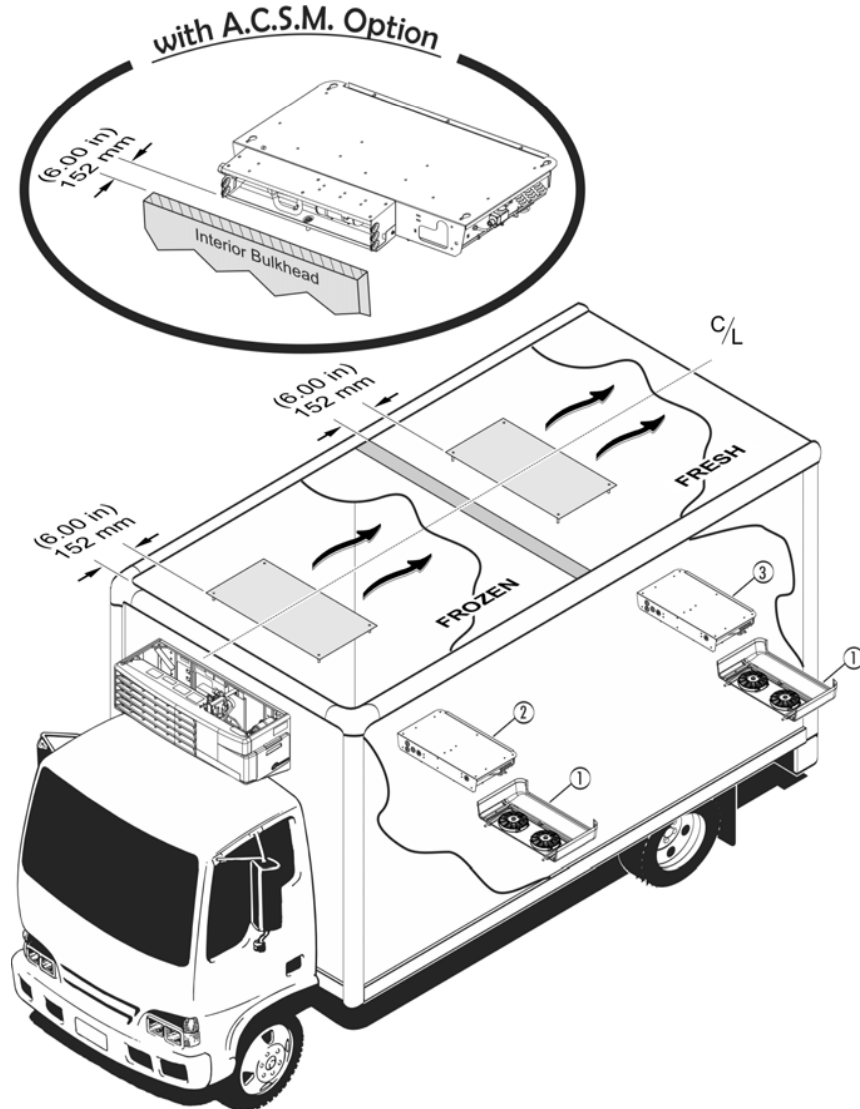
1. Locate and mark the center line (C/L) of the interior compartment ceiling.
2. Allow a minimum distance as specified. See Support Plates page 26.
3. Position each evaporator up to the ceiling and mark the location of the four mounting holes. **NOTE:** *Be sure the evaporator's air outlet is facing the correct direction for proper airflow.*
4. Drill four 5 mm (0.472 in.) mounting holes into the ceiling and loosely install the supplied 1/4" lag bolts and washers.
5. Remove the plastic cover from the evaporators.
6. Apply neutral/alcohol cure silicone sealant (installer supplied) per the sealant manufacturer's instructions to the top surface area of the evaporator.
7. Position the evaporator onto the mounting hardware in the ceiling and hand tighten bolts securely.

NOTE: *The evaporator covers will be installed later.*

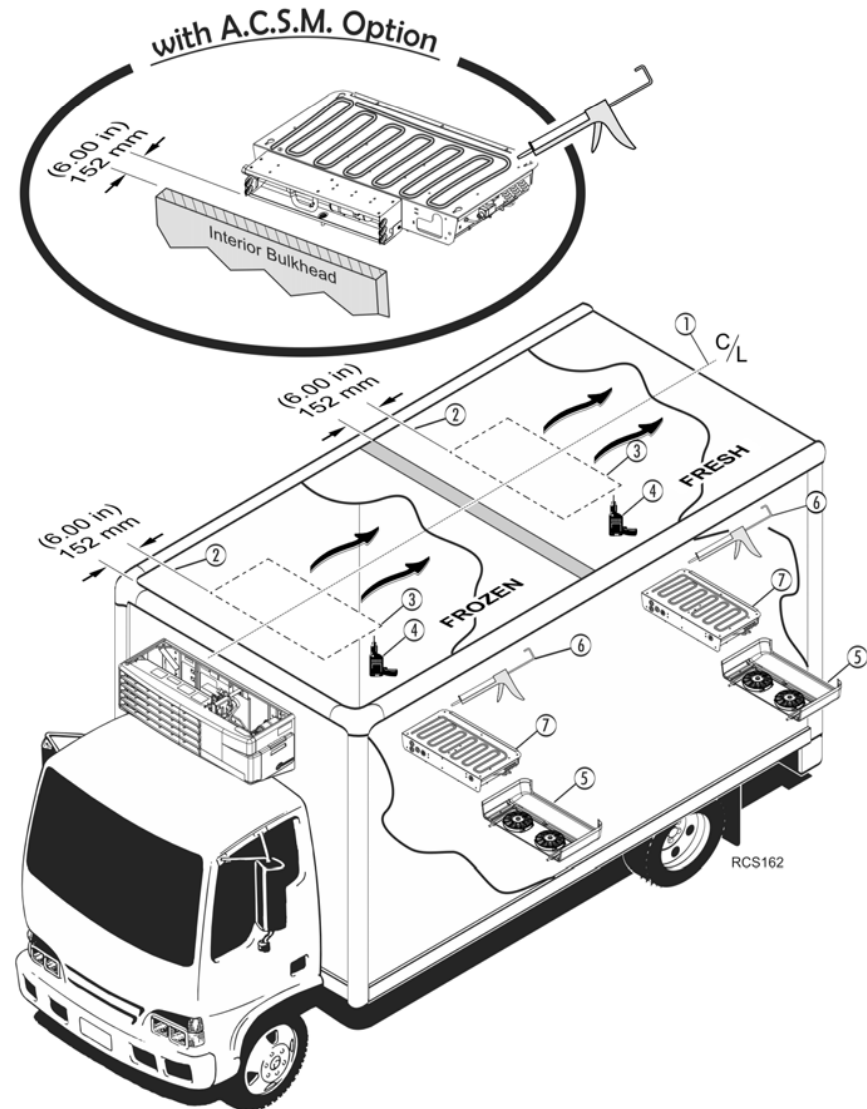
Installation - (2) ES300 Evaporators

SPECTRUM Multi-Temperature Systems - Models 10, 20 and 50

Preferred Installation Method



Alternative Installation Method



Fabricating Refrigeration Hoses

TK 2000 Assembly System

The TK 2000 System is designed for assembly with Multi-Refrigeration hose only.

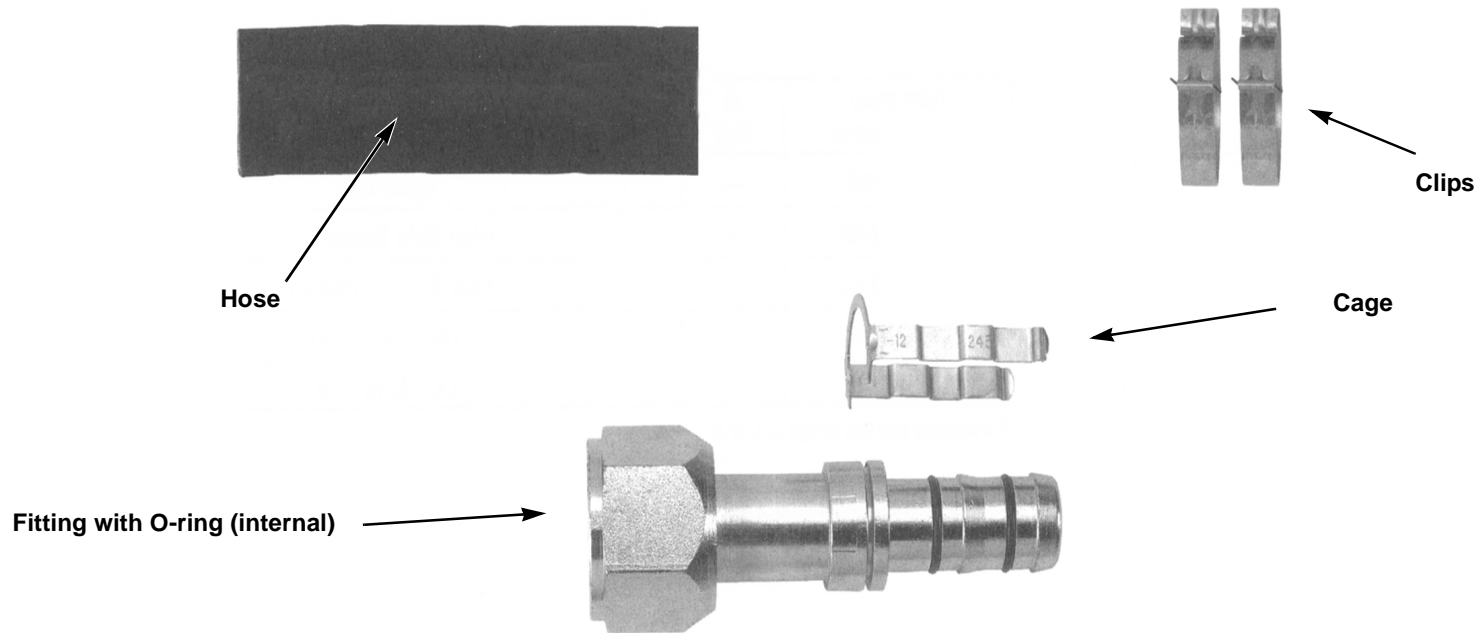
The benefits are virtually endless:

- No Guess work
- No Leaking Crimps
- No Power Supply Needed
- As easy to use as a pair of Pliers
- Easy to use in confined areas

Assembly Materials Checklist

- Hose Fitting Tools (204-1045 and 204-1128)
- Hose Cutting Tools (204-677)
- TK 2000 Multi-Refrigerant Hose
- Nipple Assembly
- Appropriately Sized Clips and Cage

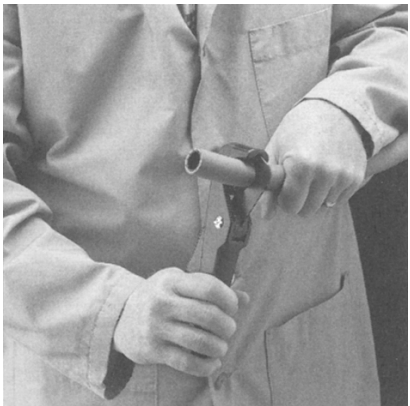
NOTE: The two black O-rings on the nipple assembly are of a specific rubber compound and size. They should not be removed or replaced.



Fabricating Refrigeration Hoses

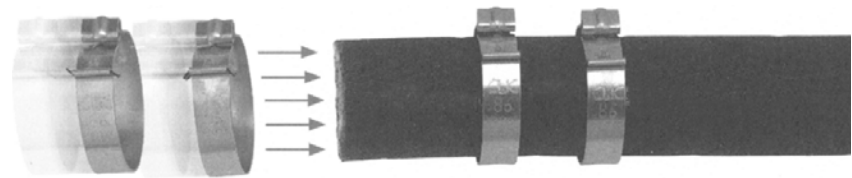
Cut the Hose

1. Cut the hose to proper length with an appropriate cutting tool. Hand-held hose cutter (204-677) has been specially designed for cutting all non-wire reinforced hose, such as TK 2000 Multi-refrigerant hose. Be sure the cut is made square to the hose length.



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.



CAUTION: 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 clip

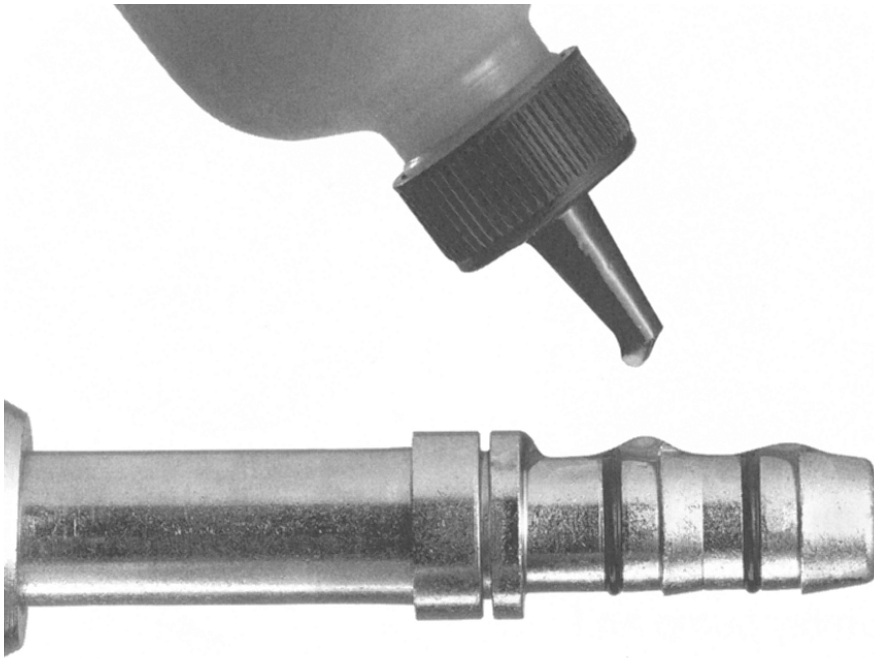
Fabricating Refrigeration Hoses

Oil the Nipple

3. Lubricate the nipple with a generous amount of the refrigeration or A/C system's compressor lubricating oil. This **MUST** be done to lower the force of nipple insertion.

4. Insert the nipple into the hose. To ensure that the nipple is fully inserted, check the 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.

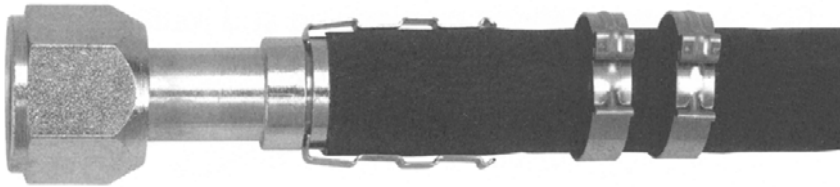
NOTE: *Be sure to wipe excess oil from the nipple and hose.*



Fabricating Refrigeration Hoses

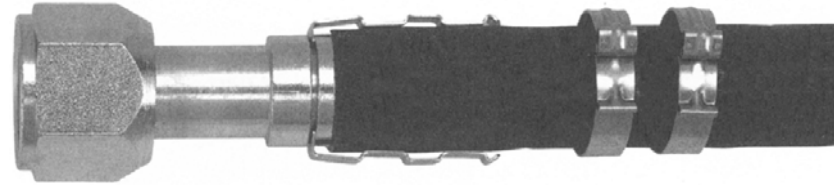
Snap on the Cage

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 ensure:
 - The clips will be located over the O-ring on the nipple.
 - The connection will be compatible with the connection's pressure rating.



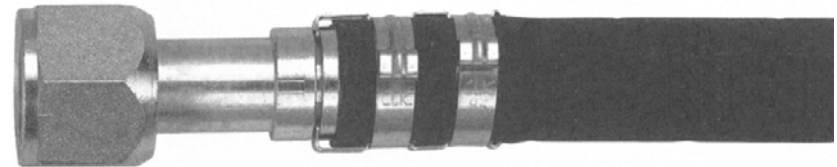
Slide the Clips

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



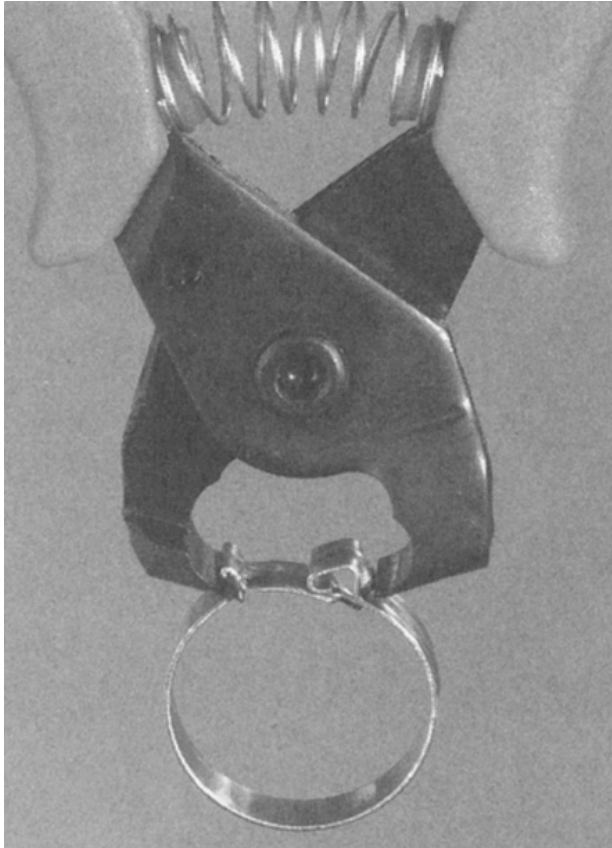
Close the Clips

7. Use the fitting tool (204-1045 or 204-1128) to close the clips. The pliers should be positioned squarely on the clip connection points and should remain square during the closing of the clip.



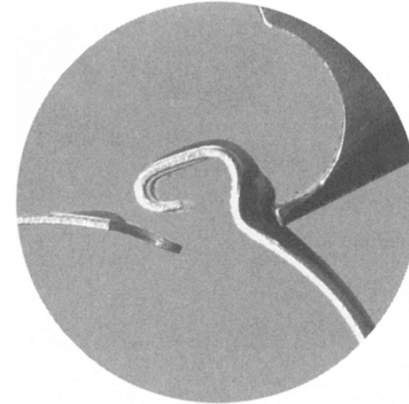
NOTE: For easiest assembly, the clasp should be closed between the cage arms.

Fabricating Refrigeration Hoses

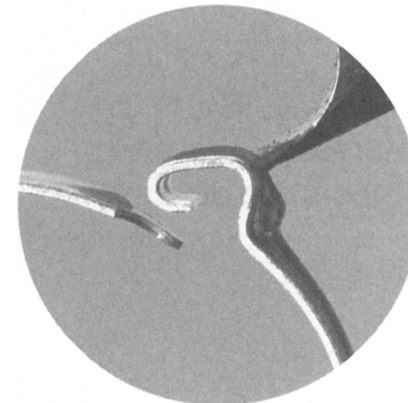


Nose of the pliers should be firmly seated under the assembly bump and lock latch.

If the pliers are not kept square during closing the clip, the clasp may have an offset. Use the pliers to correct the clasp alignment.



Correct

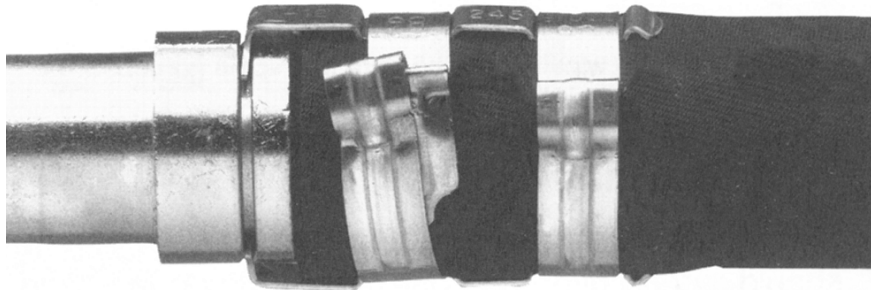


Incorrect

Fabricating Refrigeration Hoses

⚠ CAUTION: TK 2000 Speedy Clip System components should not be reused. Failure to follow these instructions and/or the use of TK 2000 Speedy Clip System hose with fittings supplied by other manufactures could result in sudden or unintended escape of refrigerant gases. Personal injury and/or violations of EPA regulations may occur as a consequence.

NOTE: Thermo King recommends adherence to all guidelines, including EPA guidelines concerning the service of refrigerant systems.

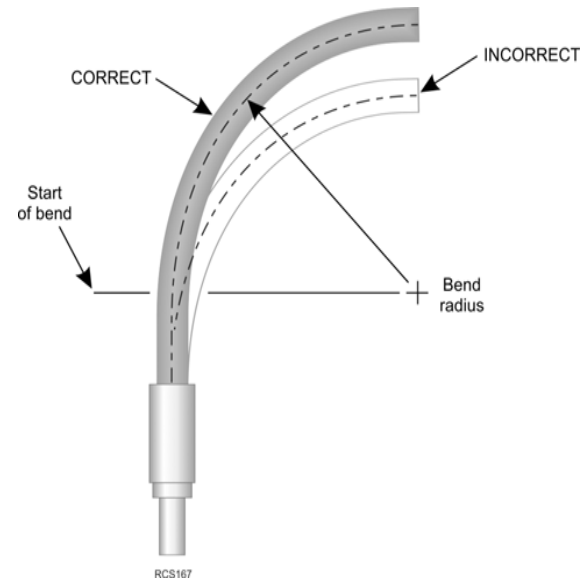


Improperly Installed Clip

Minimum Bend Radii

All hoses must be routed as to maintain the minimum bend radii given in the table below.

Hose Size	Minimum Bend Radius
#6	2.00 in.
#8	2.50 in.
#10	3.00 in.
#12	4.00 in.
#16	7.00 in.

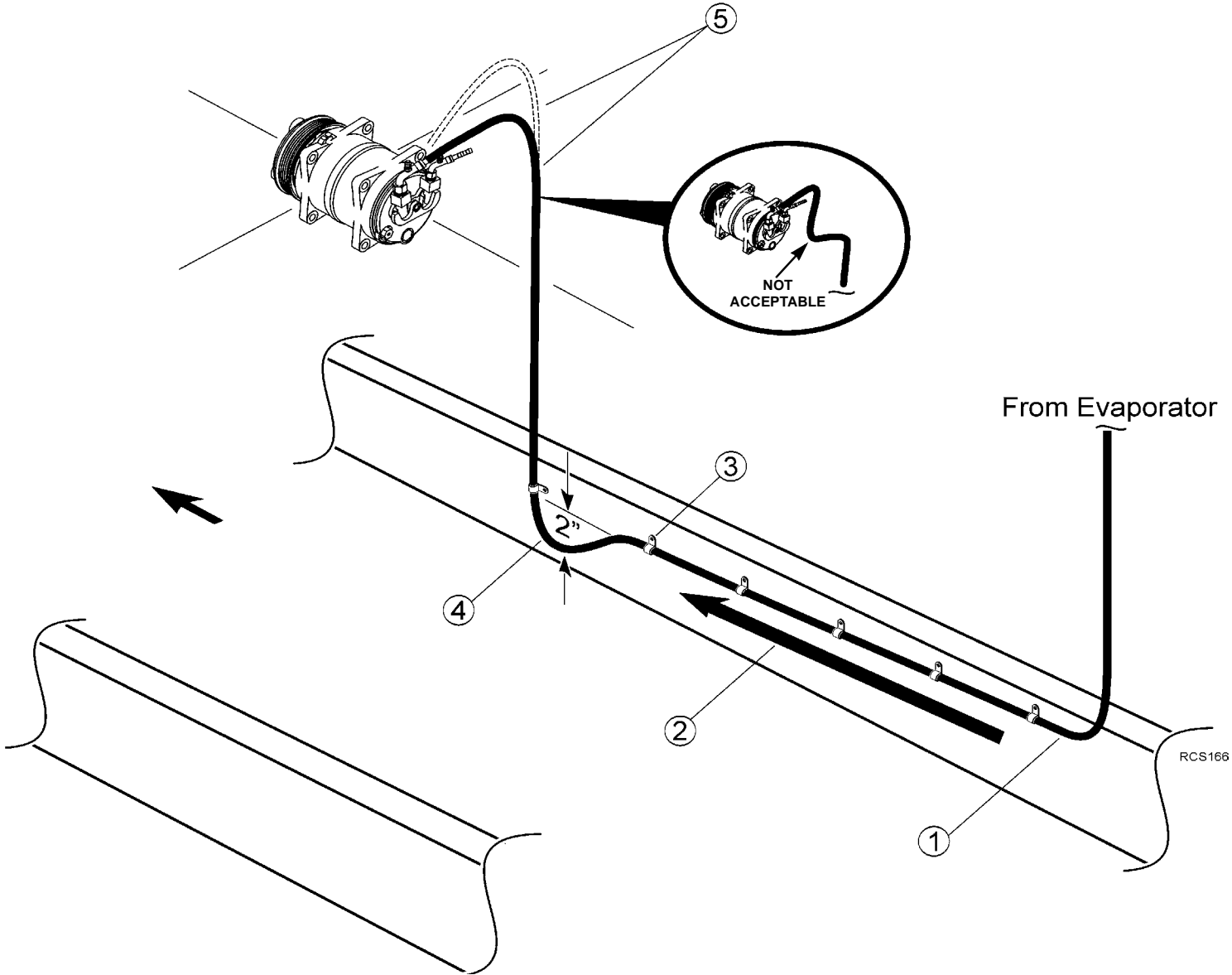


Important - Suction Line Routing and P-Trap Formation

Best Practices That Must Be Followed (Refer to the illustration on following page)

1. All hose bends must maintain at least minimum bend radii with no kinks. *See “Minimum Bend Radii” on page 33.*
2. Suction line should have a slight (if possible) downhill angle. 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.

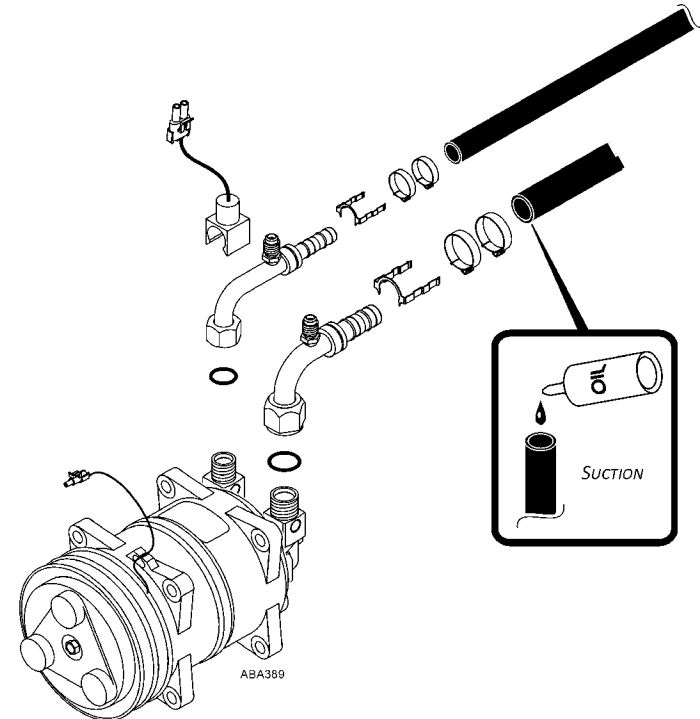
Important - Suction Line Routing and P-Trap Formation



Installation - Refrigeration Hoses to Vehicle Powered Compressor

The refrigeration hoses must be routed from the cargo box, along the vehicle's chassis to the engine compartment and compressor while maintaining the minimum bend radii. See "*Minimum Bend Radii*" on *page 33*. The hoses should be secured adequately to prevent rubbing or chafing against hot, sharp or moving components.

1. Install a #16 90° female ORS fitting onto the #16 suction hose and #8 90° female ORS fitting onto the discharge hose.
2. Place an O-ring on each compressor fitting.
 - Lubricate the compressor refrigeration fittings and O-rings with refrigerant oil.
3. Refer to the oil charts on the following pages and add the correct amount of compressor oil for your specific model directly into the suction hose.
 - provide an oil trap and connect the **SUCTION** hose fitting onto the compressor fitting marked **S**.
4. Connect the **DISCHARGE** hose fitting onto the compressor fitting marked **D**.
5. Use two wrenches and tighten refrigeration hose fittings.
6. Mount the liquid injection switch onto the compressor discharge fitting.



Installation - Refrigeration Hoses to Vehicle Powered Compressor

Oil Capacity for Units Utilizing **Swash Plate** Roadside Compressors

Model	Roadside Compressor	Oil Supplied in the Unit		Oil Added at Installation			Total System Capacity (oz.)
		System Oil	Standby Compressor	Add to Roadside Compressor (oz.)	Add to Suction Line (oz.)	Total Oil added at Installation (oz.)	
V-520 10	TK 16	5	-	4	6	10	15
V-520 20	TK 16	5	40	4	8	12	57
V-520 30*	TK 16	5	-	4	10	14	19
V-520 50*	TK 16	5	40	4	12	16	61
V-520 SPECTRUM 10	TK 16	5	-	4	11	15	20
V-520 SPECTRUM 20	TK 16	5	40	4	13	17	62
V-520 SPECTRUM 50**	TK 16	5	40	4	17	21	66

Oil Capacity for Units Utilizing **Reciprocating** Roadside Compressors

Model	Roadside Compressor	Oil Supplied in the Unit		Oil Added at Installation			Total System Capacity (oz.)
		System Oil	Standby Compressor	Add to Roadside Compressor (oz.)	Add to Suction Line (oz.)	Total Oil added at Installation (oz.)	
V-520 10	TK 312	5	-	26	6	32	37
V-520 20	TK 312	5	40	26	8	34	79
V-520 30*	TK 312	5	-	26	10	36	41
V-520 50*	TK 312	5	40	26	12	38	83
V-520 SPECTRUM 10	TK 312	5	-	26	11	37	42
V-520 SPECTRUM 20	TK 312	5	40	26	13	39	84
V-520 SPECTRUM 50**	TK 312	5	40	26	17	43	88

* Units built before April 15, 2016 add an additional 8 oz. of oil to the suction line during installation.

** Units built before December 1, 2016 add an additional 8 oz. of oil to the suction line during installation.

NOTICE: If utilizing a discharge muffler add an additional 3 oz. of oil during installation.

Installation - Refrigeration Hoses from Vehicle Compressor to Condenser Unit

Single Temperature Systems - Models 10, 20, 30 and 50

IMPORTANT: All hose bends must maintain at least minimum bend radii with no kinks. See “Minimum Bend Radii” on page 33.

Models 10 and 30

Route the Suction and Discharge hoses from the vehicle’s compressor up through the access hole in the bottom of the V-520 condenser.

1. SUCTION LINE

- Cut the suction hose to length and install a #16, 90° fitting.
- Attach the hose onto the #16 suction fitting inside the condenser.

2. DISCHARGE LINE

- Cut the hose to length and install a #8, 90° fitting.
- Attach the hose onto the #8 fitting located on top of the oil separator inside the condenser.

Models 20 and 50

Route the Suction and Discharge hoses from the vehicle’s compressor up through the access hole in the bottom of the V-520 condenser.

1. SUCTION LINE

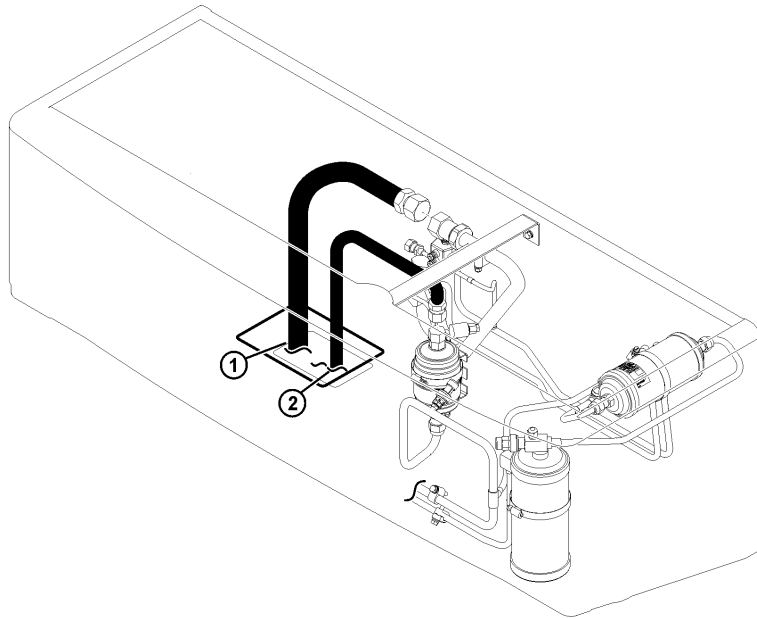
- Cut the suction hose to length and install a #16, 90° fitting.
- Attach the hose onto the #16 suction fitting inside the condenser near the bottom access hole in the frame.

2. DISCHARGE LINE

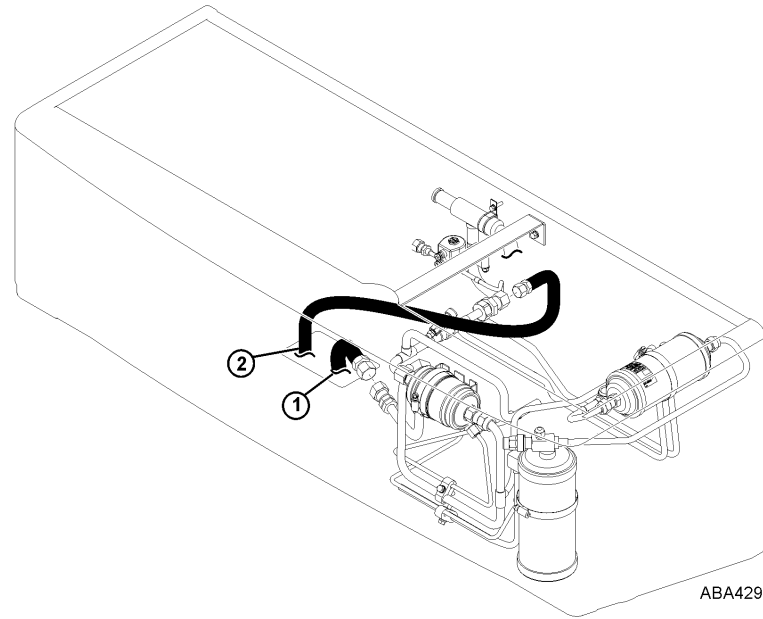
- Cut the hose to length and install a #8, 90° fitting.
- Attach the hose onto the #8 fitting located on top of the oil separator inside the condenser.

Installation - Refrigeration Hoses from Vehicle Compressor to Condenser Unit

Single Temperature Systems- Models 10, 20, 30 and 50



Models 10 and 30



Models 20 and 50

ABA429

Installation - Refrigeration Hoses from Vehicle Compressor to Condenser Unit

SPECTRUM Multi-Temperature Systems - Models 10, 20 and 50

All hose bends must maintain at least minimum bend radii with no kinks. See “Minimum Bend Radii” on page 33.

SPECTRUM Model 10

Route the Suction and Discharge hoses from the vehicle’s compressor up through the bottom access hole of the V-520 condenser.

1. SUCTION LINE

- Cut the hose to length and install a #16, 90° fitting.
- Attach the hose onto the #16 suction line fitting inside the condenser.

2. DISCHARGE LINE

- Cut the hose to length and install a #8, 90° fitting.
- Attach the hose onto the #8 fitting located on top of the oil separator inside the condenser.

SPECTRUM Models 20 and 50

Route the Suction and Discharge hoses from the vehicle’s compressor up through the bottom access hole of the V-520 condenser.

1. SUCTION LINE

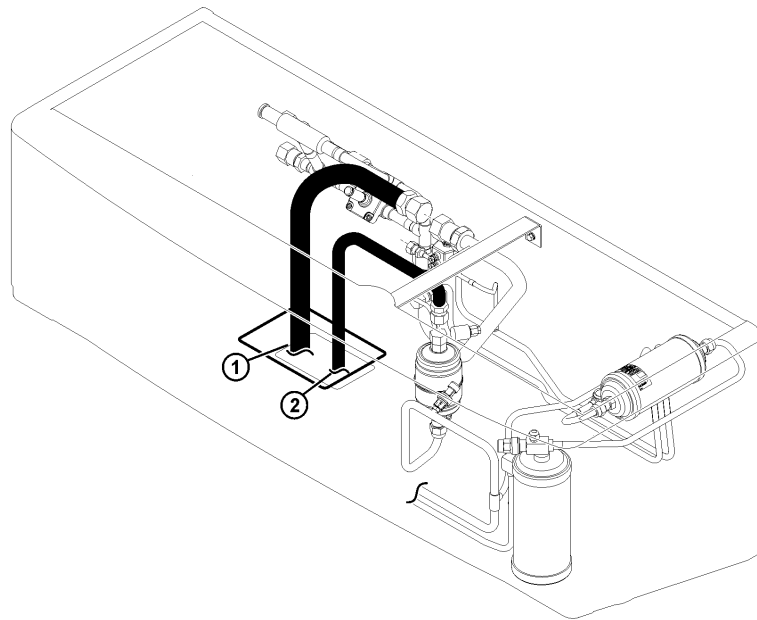
- Cut the suction hose to length and install a #16, 90° fitting.
- Attach the hose onto the #16 suction fitting inside the condenser near the bottom access hole in the frame.

2. DISCHARGE LINE

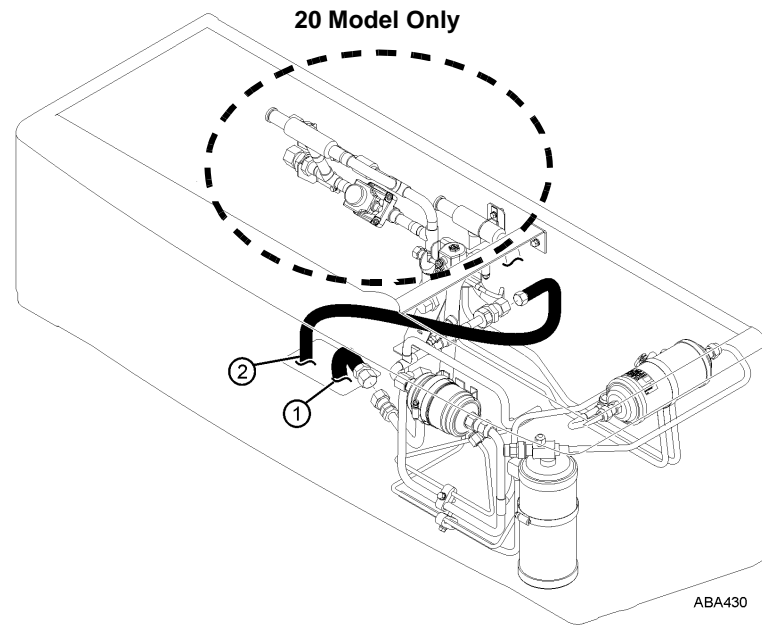
- Cut the hose to length and install a #8, 90° fitting.
- Attach the hose onto the #8 fitting located on top of the oil separator inside the condenser.

Installation - Refrigeration Hoses from Vehicle Compressor to Condenser Unit

SPECTRUM Multi-Temperature Systems - Models 10, 20 and 50



SPECTRUM Model 10



Model 50 Standby Compressor not shown for clarity

SPECTRUM Model 20 and 50

Installation - Refrigeration Hoses to Evaporator(s)

Single Temperature Systems - Models 10, 20, 30 and 50

IMPORTANT: All hose bends must maintain at least minimum bend radii with no kinks. See “Minimum Bend Radii” on page 33.

1. SUCTION LINE

- Fabricate a #16 hose and fitting and install onto the suction line fitting located inside the condenser.
- Route the hose out of the condenser through the rear access hole and connect to the #16 fitting in the evaporator.
- **HEAT OPTION ONLY** - Suction hose connects to the #16 fitting on the accumulator tank assembly attached to the evaporator.

2. LIQUID LINE

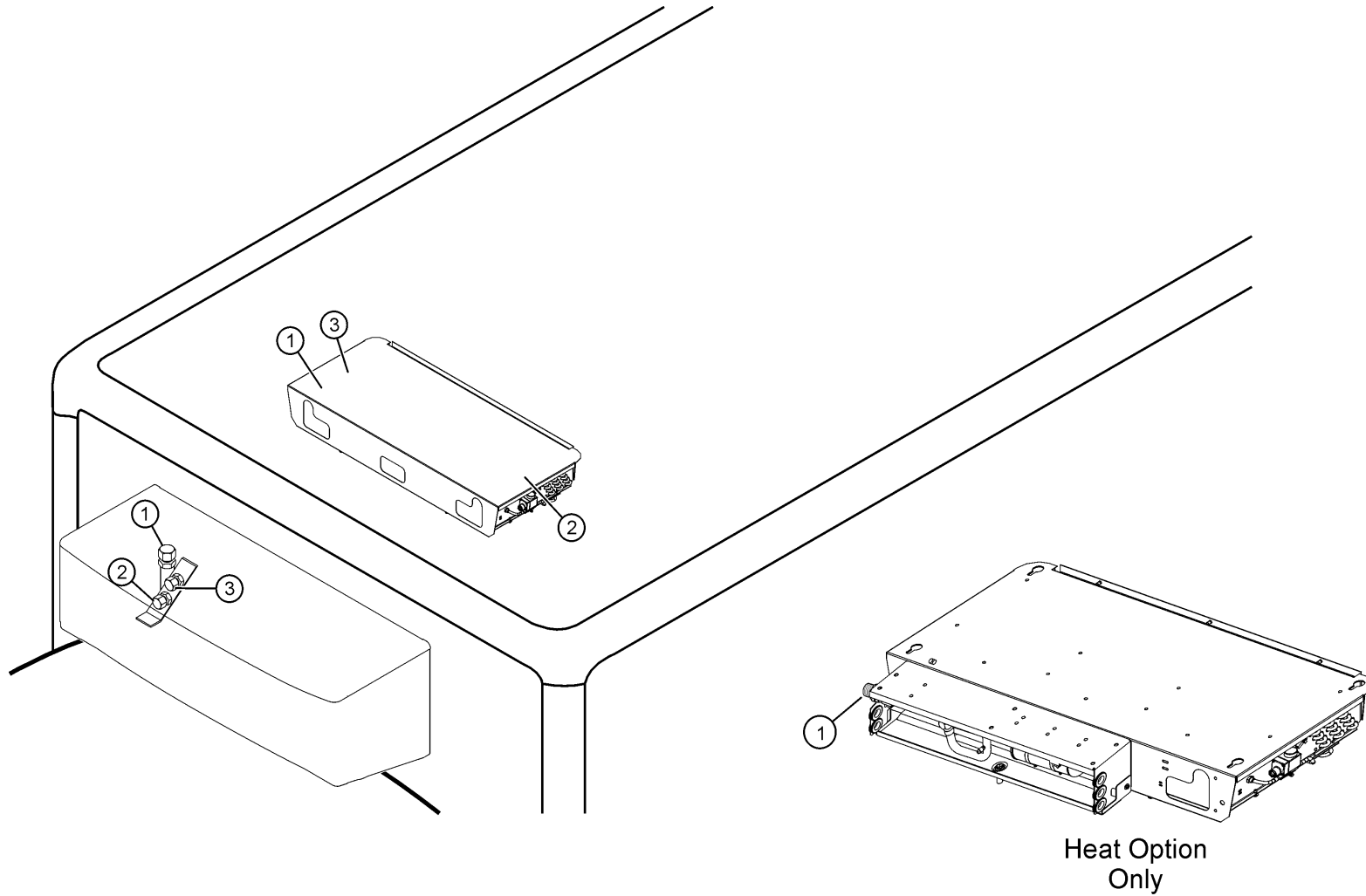
- Fabricate a #6 hose and fitting and install onto the #6 liquid line fitting located inside the condenser.
- Route the hose out of the condenser through the rear access hole and connect to the #6 fitting in the evaporator.

3. DEFROST LINE

- Fabricate a #6 hose and fitting and install onto the #6 defrost line fitting located inside the condenser.
- Route the hose out of the condenser through the rear access hole and connect to the #6 fitting in the evaporator.

Installation - Refrigeration Hoses to Evaporator(s)

Single Temperature Systems - Models 10, 20, 30 and 50



RCSD129

Installation - Refrigeration Hoses to Evaporator(s)

SPECTRUM Multi-Temperature Systems Models 10 and 20 with (2) ES300 Evaporators

IMPORTANT: All hose bends must maintain at least minimum bend radii with no kinks. See “Minimum Bend Radii” on page 33.

1. SUCTION LINE - HOST EVAPORATOR (Frozen)

- Fabricate a #12 hose and fitting and install onto the **UPPER** suction line fitting on the valve assembly located inside the condenser.
- Route the hose out of the condenser through the rear access hole and connect to the #12 fitting in the **HOST** evaporator.

2. SUCTION LINE - REMOTE EVAPORATOR (Fresh)

- Fabricate another #12 hose and fitting and install onto the **LOWER** suction line fitting on the valve assembly located inside the condenser.
- Route the hose out of the condenser through the rear access hole and connect to the #12 fitting on the **REMOTE** evaporator.

3. LIQUID LINE

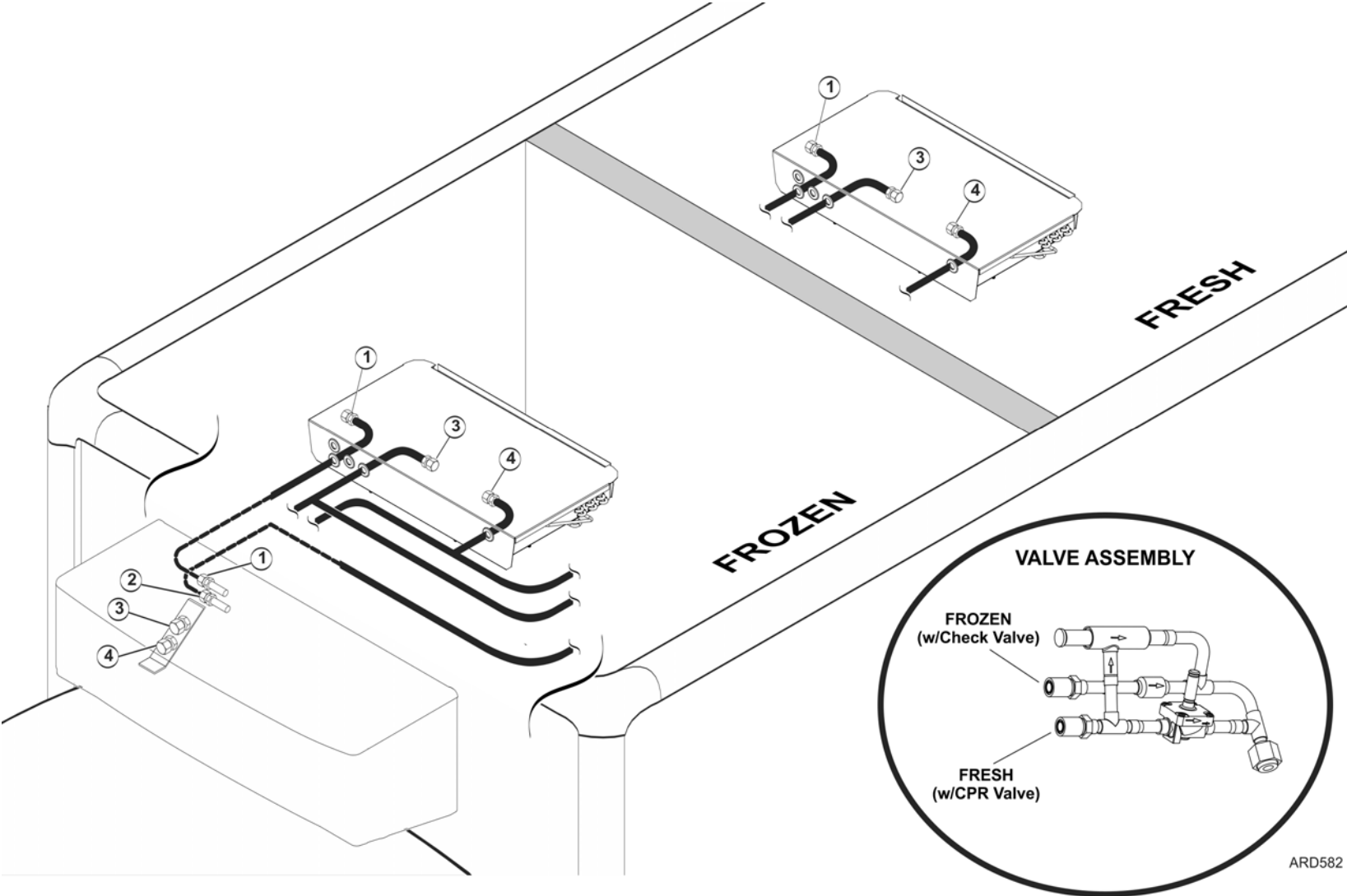
- Fabricate a #6 hose and fitting and install onto the #6 liquid line fitting located inside the condenser.
- Route the hose out of the condenser through the rear access hole to the **HOST** evaporator.
- Install the supplied tee fitting onto the liquid hose.
- Fabricate and connect #6 hoses from the tee fitting to the liquid line fittings onto each **HOST** and **REMOTE** evaporators.

4. DEFROST LINE

- Fabricate a #6 hose and fitting and install onto the #6 defrost line fitting located inside the condenser.
- Route the hose out of the condenser through the rear access hole to the **HOST** evaporator.
- Install the supplied tee fitting onto the defrost hose.
- Fabricate and connect #6 hoses from the tee fitting to the defrost line fittings onto each **HOST** and **REMOTE** evaporators.

Installation - Refrigeration Hoses to Evaporator(s)

SPECTRUM Multi-Temperature Systems Models 10 and 20 with (2) ES300 Evaporators



ARD582

Installation - Refrigeration Hoses to Evaporator(s)

Multi-Temperature System Model 50 with (1) ES300 Evaporator and (1) ES300 Evaporator with ACSM (option)

IMPORTANT: All hose bends must maintain at least minimum bend radii with no kinks. See “Minimum Bend Radii” on page 33.

1. SUCTION LINE - REMOTE EVAPORATOR (Fresh)

- Fabricate a #16 hose and fitting and install onto the suction line fitting on the Suction Pressure Regulator Valve assembly located inside the condenser.
- Route the hose out of the condenser through the rear access hole and connect to the upper fitting in the ACSM on the **REMOTE** evaporator located in the **FRESH** compartment.

2. SUCTION LINE - HOST EVAPORATOR (Frozen)

- Fabricate a #12 hose and fitting and connect to the lower fitting in the ACSM on the **REMOTE** evaporator located in the **FRESH** compartment.
- Route the hose out of the **FRESH** compartment and connect to the fitting on the **REMOTE** evaporator located in the **FROZEN** compartment.

3. LIQUID LINE

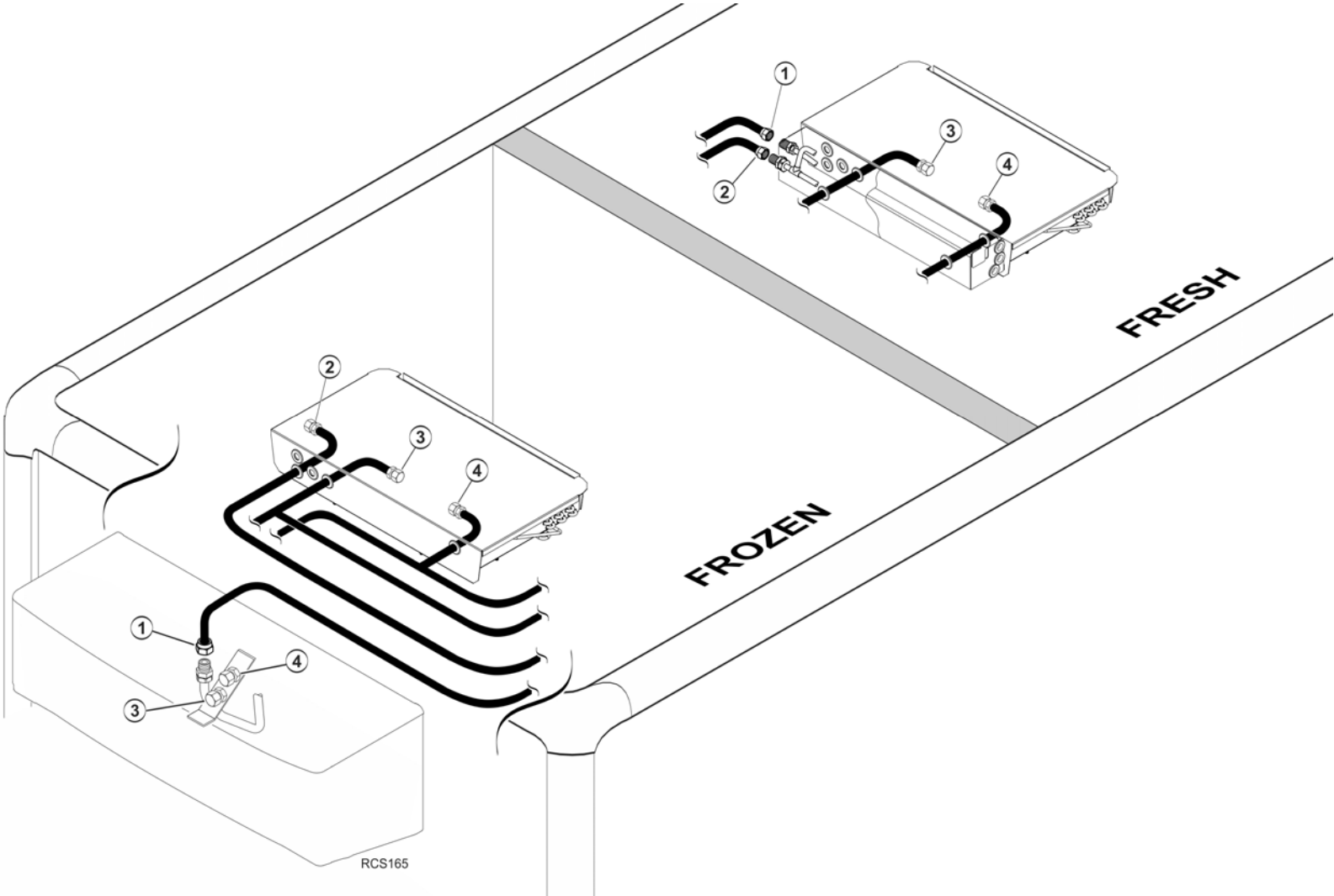
- Fabricate a #6 hose and fitting and install onto the liquid line fitting located inside the condenser.
- Route the hose out of the condenser through the rear access hole to the **HOST** evaporator.
- Install the supplied tee fitting onto the liquid hose.
- Fabricate and connect #6 hoses from the tee fitting to the liquid line fittings onto each **HOST** and **REMOTE** evaporators.

4. DEFROST LINE

- Fabricate a #6 hose and fitting and install onto the #6 defrost line fitting located inside the condenser.
- Route the hose out of the condenser through the rear access hole to the **HOST** evaporator.
- Install the supplied tee fitting onto the defrost hose.
- Fabricate and connect #6 hoses from the tee fitting to the defrost line fittings onto each **HOST** and **REMOTE** evaporators.

Installation - Refrigeration Hoses to Evaporator(s)

Multi-Temperature System Model 50
with (1) ES300 Evaporator and (1) ES300 Evaporator with ACSM (option)



System Leak Check and Evacuation

IMPORTANT: Thermo King Evacuation Station P/N 204-725 and Evacuation Station Operation and Field Application Instructions (TK-40612) is required.

NOTE: The oil in the evacuation station vacuum pump should be changed after each use.

Solenoid Valve Positions

IMPORTANT: The Liquid Injection Solenoid Valve and the Defrost Solenoid Valve must both be in the OPEN position during evacuation procedures. The valves are normally in the closed position and must be held open manually using special magnets (204-1074) designed for this purpose. MODEL 30 and 50 ONLY - DO NOT put a magnet onto the Condenser Blocking Solenoid Valve as this is a normally open valve and a magnet will close it.

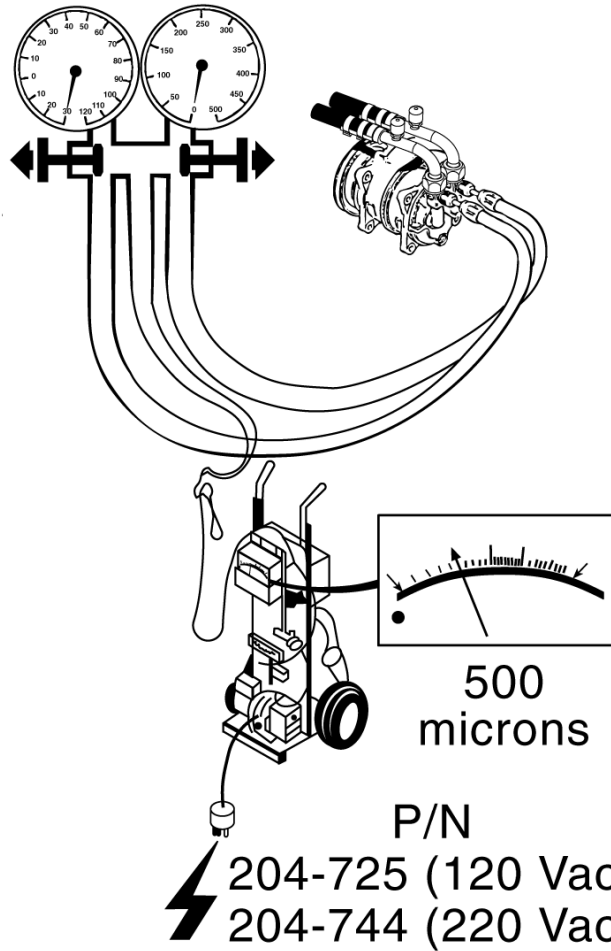
- a. Unscrew the solenoid coil retaining nut and remove the coil assembly.
- b. Place a magnet tool on the solenoid valve stem.
- c. Carry out the required leak check and evacuation procedures.
- d. After completing the leak check and evacuation procedures, remove the magnet tools and replace the solenoid coil assembly on the solenoid valve and hand tighten the coil retaining nut.

Leak Check and Evacuation

1. Connect the gauge manifold to the suction and discharge intakes of the vehicle compressor.
2. Connect the central line of the gauge manifold to the vacuum pump. Always use recommended vacuum equipment. Before each use, check that there are no leaks in the vacuum equipment either in the pump itself or in the hoses.
3. Open the gauge manifold and vacuum pump valves. Open all the solenoid valves in the circuit.
4. Start the vacuum pump and maintain suction until it reaches 500 microns.
5. Once it reaches 500 microns, leave suction running for **one hour**.
6. Close the vacuum pump valve, switch off the pump, checking that the gauge reading for the vacuum pump does not exceed **2000 microns** in the following five minutes. If vacuum level exceeds 2000 microns after five minutes, a leak is present or additional evacuation time is required.
7. Start the vacuum pump again and open the vacuum valve. Leave the pump running until it reaches **500 microns** of pressure again.
8. Once it reaches 500 microns, close the vacuum pump valve and switch off the pump.

The unit is ready to be filled with refrigerant.

System Leak Check and Evacuation



ASA 092

Electrical Connections - Evaporator(s)

Single Temperature Systems - Models 10, 20, 30 and 50

Route the **Evaporator Harness** from the V-520 condenser into the cargo box and make the following connections:

1. Evaporator Fan Motor 1 (**EFI, CHC**).
2. Evaporator Fan Motor 2 (**EF2, CHD**).
3. Evaporator Fan Motor 3 (**EF3, CHE**).
4. Defrost Termination Switch (**12, CHB**).
5. Hot Gas Defrost Solenoid (**26, CHM**).
6. Temperature Sensor 1 (**PNK, BLK**).

MAX UNITS ONLY

7. See “Installation - Drain Hoses” on page 54 regarding the correct placement of the drain heater wires (**27, CHF**), (**27A, CHG**) and installing the evaporator cover.

MODELS 30 and 50 ONLY

8. Route the hot gas solenoid jumper harness from the refrigeration module down through the access hole and into the cargo area and make the following connections at the evaporator:
 - Disconnect the existing 2-pin harness connector (**CHM, 26**) from hot gas solenoid and connect it to the 2-pin connector on the jumper harness.
 - Connect the other 2-pin connector from the jumper harness to the mating connector on the hot gas defrost solenoid.

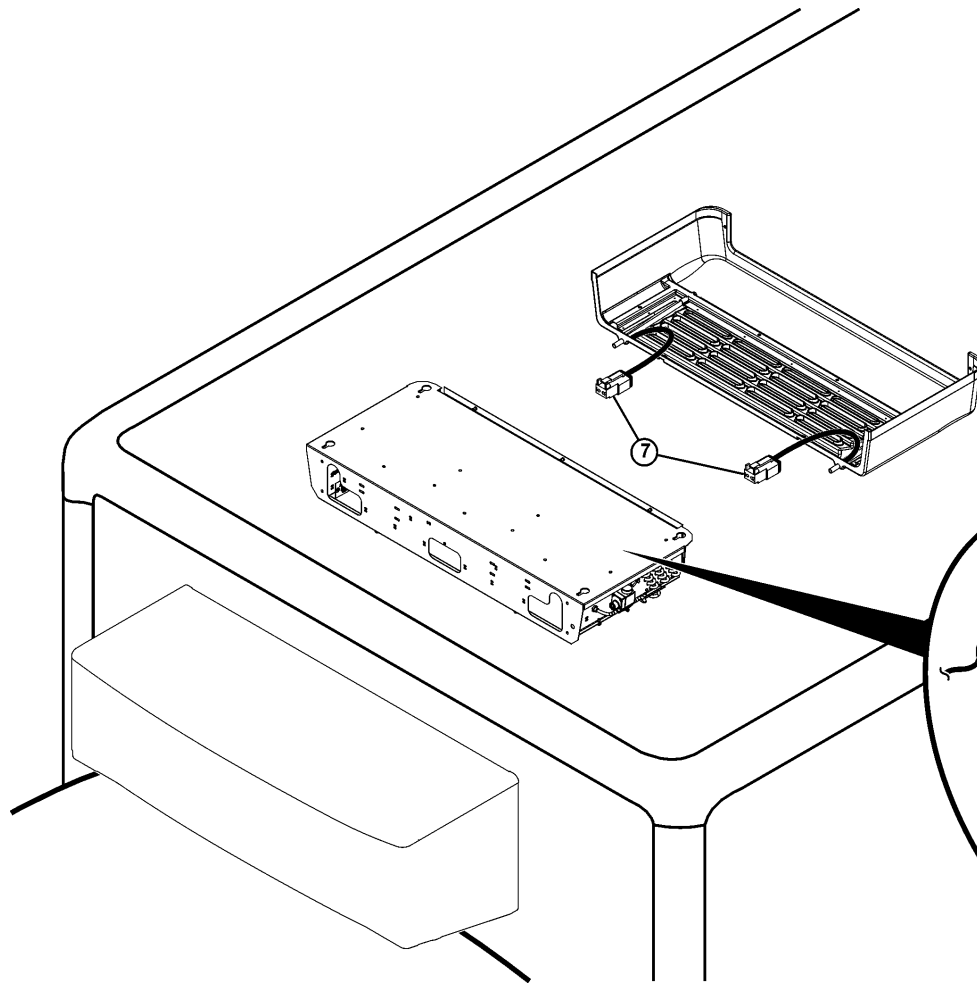
DOOR SWITCH OPTION

9. Remove and discard blank plug (**DSW1, CHH**) and connect mating door switch harness connector.

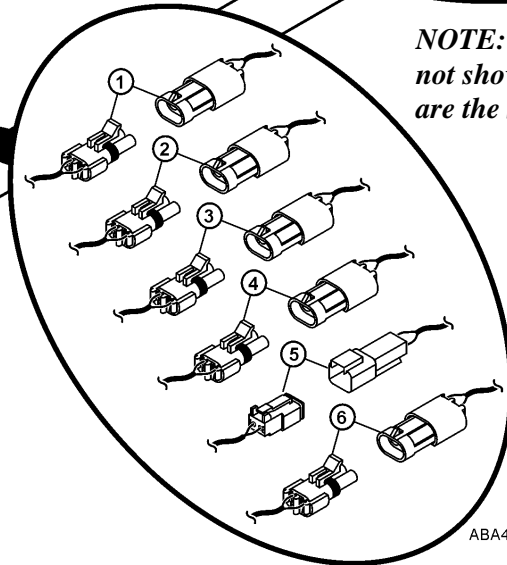
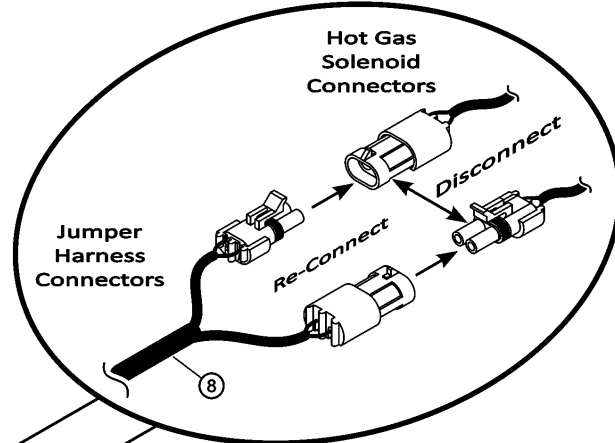
NOTE: *Make sure all harness are neatly routed and secured to prevent rubbing or chafing against sharp edges inside the evaporator assembly.*

Electrical Connections - Evaporator(s)

Single Temperature Systems - Models 10, 20, 30 and 50



Model 30 AND 50 ONLY



NOTE: Evaporator with Heat Option not shown, but electrical connections are the same.

ABA427

Electrical Connections - Evaporator(s)

SPECTRUM Multi-Temperature Systems with (2) ES300 Evaporators

Installation

Route the **Evaporator Harness** from the V-520 condenser into the cargo box and make the following connections:

Host Evaporator

1. Defrost Termination Switch (**12, CHB**) to mating connector.
2. Hot Gas Defrost Solenoid (**26, CHM**) to mating connector.
3. Liquid Solenoid (**B3-01,CHZ**) to mating connector.
4. Temperature Sensor (**PNK, BLK**) to mating connector.
5. Drain Heaters (**27, CHF**) and (**27A, CHG**) to each mating connector.
6. Fan Motor 1 (**EFI, CHC**) to the mating connector.
7. Fan Motor 2 (**EF2, CHD**) to the mating connector.

OPTION - Door Switch (**DSW1, CHH**) to door switch connector.

NOTE: Make sure all harness are neatly routed and secured to prevent rubbing or chafing against sharp edges inside the evaporator assembly.

Remote Evaporator

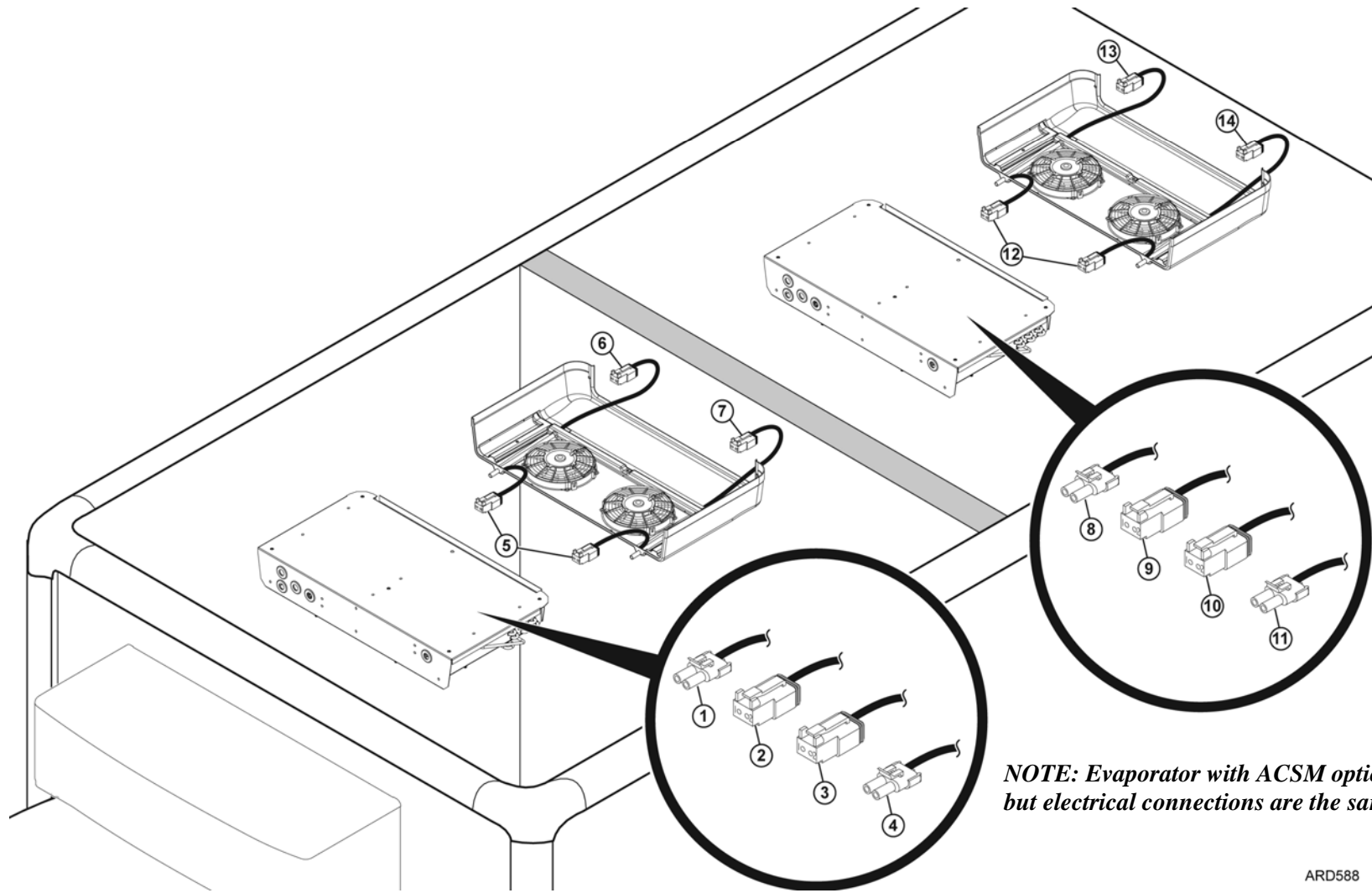
8. Defrost Termination Switch (**12A, CHB2**) to mating connector.
9. Hot Gas Defrost Solenoid (**28, CHS**) to mating connector.
10. Liquid Solenoid (**33, CHY**) to mating connector.
11. Temperature Sensor (**G, B**) to mating connector.
12. Drain Heaters (**27B, CHF2**) and (**27C, CHG2**) to each mating connector.
13. Fan Motor 3 (**EF3, CHE**) to the mating connector.
14. Fan Motor 4 (**EF4, CHR**) to the mating connector.

OPTION - Door Switch (**DSW2, CHH2**) to door switch connector.

NOTE: Make sure all harness are neatly routed and secured to prevent rubbing or chafing against sharp edges inside the evaporator assembly.

Electrical Connections - Evaporator(s)

SPECTRUM Multi-Temperature Systems with (2) ES300 Evaporators



NOTE: Evaporator with ACSM option not shown, but electrical connections are the same.

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Installation - Drain Hoses

Single Temperature Systems (R134a)

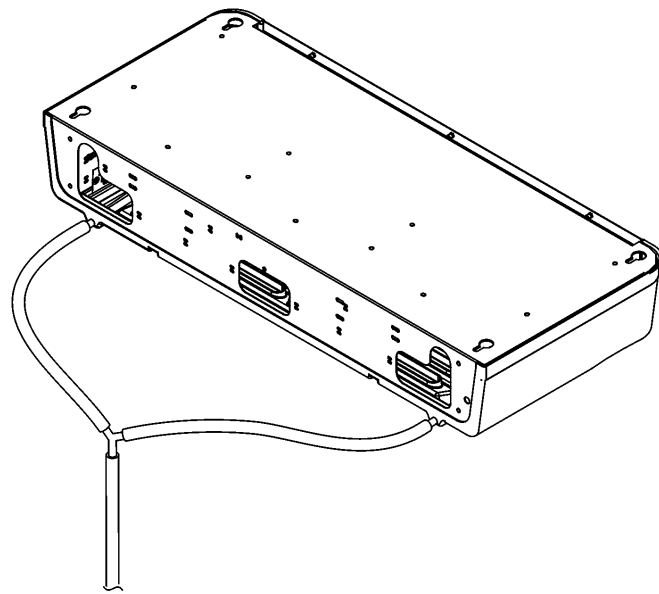
1. Cut the drain hose into two sections of suitable length and attach each drain hose onto the evaporator drain tubes.
2. Allow the drain hoses a sufficient slope to ensure that the water drains away from the evaporator.
3. Secure the connections with tie bands.
4. Route both hoses directly out through the compartment wall and join to a third single drain hose using the **Y connector**.
5. Route the single drain down the outside of the cargo box and secure with clamps.
6. Seal the drain hose holes in the cargo box with neutral/alcohol cure silicone sealant.

Single Temperature - Max Systems (R404A)

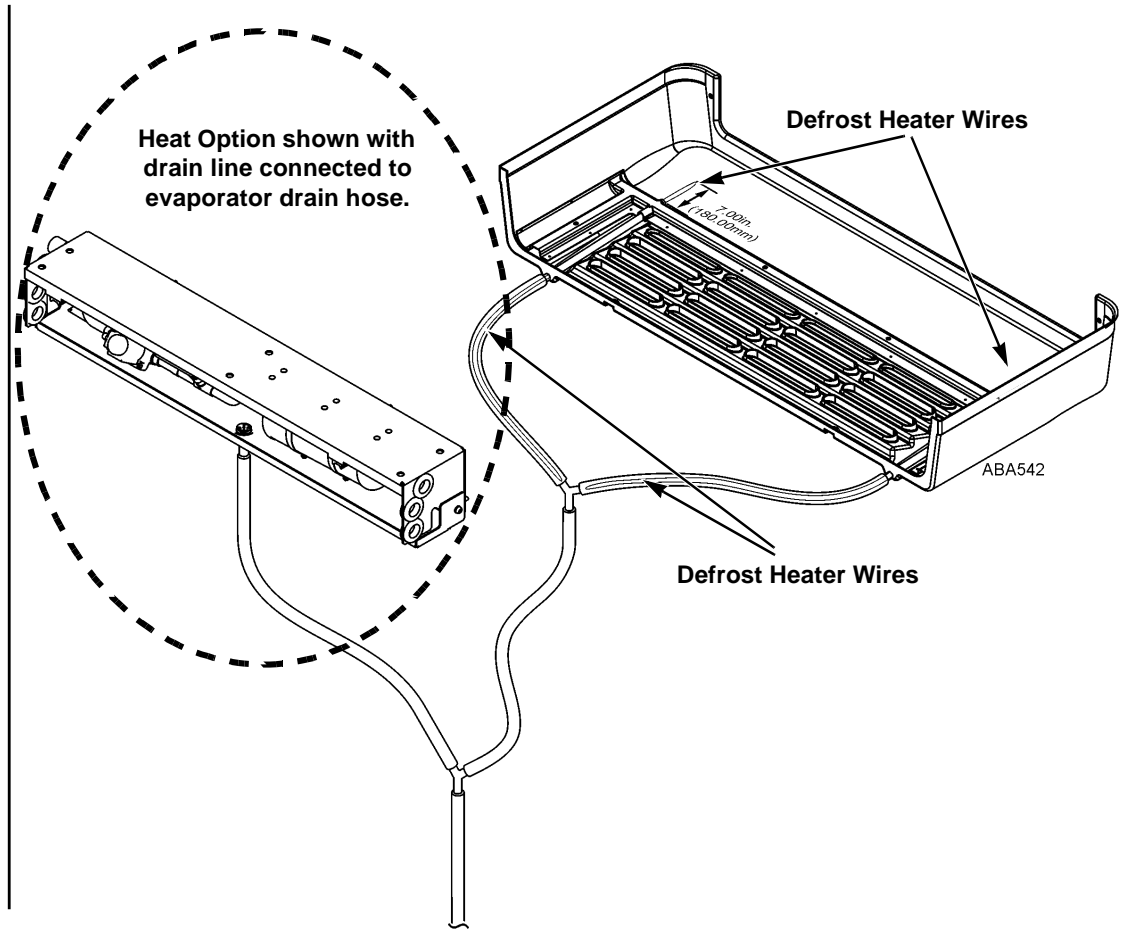
1. Cut the drain hose into two sections of suitable length and attach onto the drain tubes.
2. Allow approximately 7.00 in. (180 mm) of defrost wire to extend from each defrost tube into the pan.
3. Insert the defrost heater wires through each drain hose and along its entire length.
 - **Do not** use band wraps (wire ties) to hold the defrost heater wires.
 - **Do not** cover or wrap the defrost heater wires.
 - **Do not** cut the defrost heater wires.
 - **Do not** install more than 4 defrost heater wires into the drain tube.
4. Install the cover onto the evaporator.
5. Secure the connections with tie bands.
6. Route both hoses directly out through the compartment wall and join to a third single drain hose using the **Y connector**.
7. Route the single drain down the outside of the cargo box and secure with clamps.
8. Seal the drain hose holes in the cargo box with neutral/alcohol cure silicone sealant.

Installation - Drain Hoses

Single Temperature Systems



Single Temperature - Max Systems



Installation - Drain Hoses

SPECTRUM Multi-Temperature Systems with (2) ES300 Evaporators

Host Evaporator

1. Cut the drain hose into two sections of suitable length and attach onto the drain tubes.
2. Allow approximately 7.00 in. (180 mm) of defrost wire to extend from each defrost tube into the pan.
3. Insert the defrost heater wires through each drain hose and along its entire length.
 - **Do not** use band wraps to hold the defrost heater wires.
 - **Do not** cover or wrap the defrost heater wires.
 - **Do not** cut the defrost heater wires.
 - **Do not** install more than 4 defrost heater wires into the drain tube.
4. Install the cover onto the evaporator.
5. Secure the connections with tie bands.
6. Route both hoses directly out through the compartment wall and join to a third single drain hose using the **Y connector**.
7. Route the single drain down the outside of the cargo box and secure with clamps.
8. Seal the drain hose holes in the cargo box with neutral/alcohol cure silicone sealant.

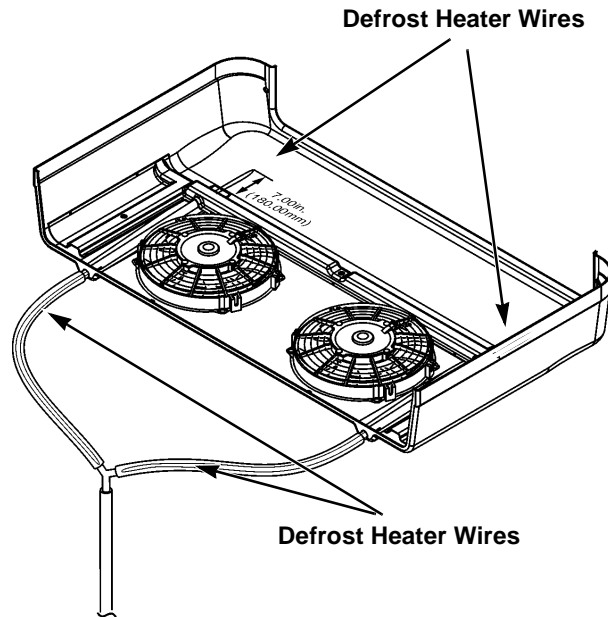
Remote Evaporator

1. Install the cover onto the evaporator.
2. Cut the drain hose into two sections of suitable length and attach each drain hose onto the evaporator drain tubes.
3. Allow the drain hoses a sufficient slope to ensure that the water drains away.
4. Secure the connections with tie bands.
5. Route both hoses directly out through the compartment wall and join to a third single drain hose using the **Y connector**.
6. Route the single drain down the outside of the cargo box and secure with clamps.
7. Seal the drain hose holes in the cargo box with neutral/alcohol cure silicone sealant.

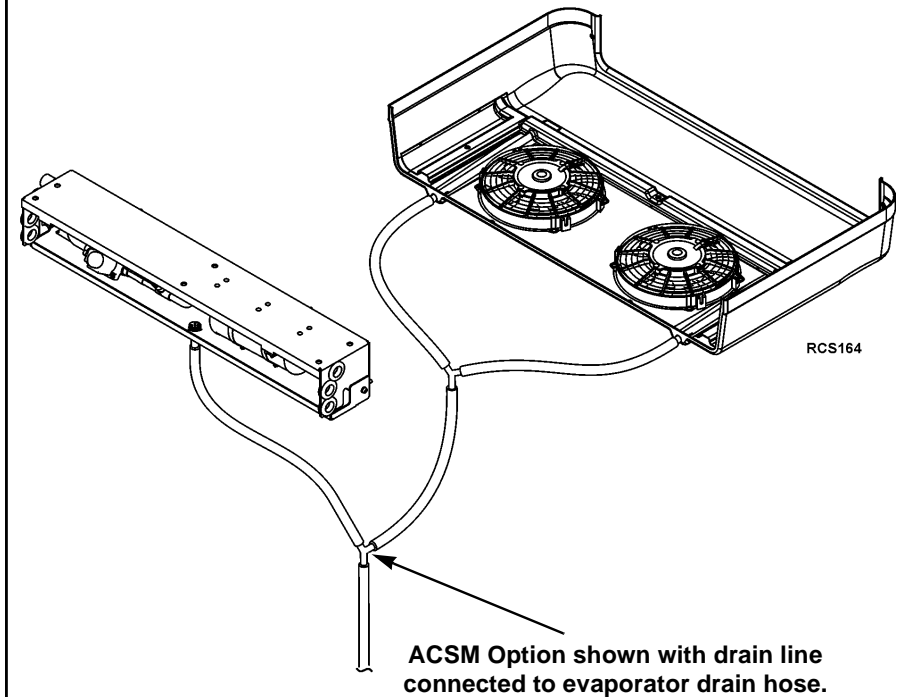
Installation - Drain Hoses

SPECTRUM Multi-Temperature Systems with (2) ES300 Evaporators

Host Evaporator (with Defrost Heater Wires)



Remote Evaporator (without Defrost Heaters)



Installation - HMI

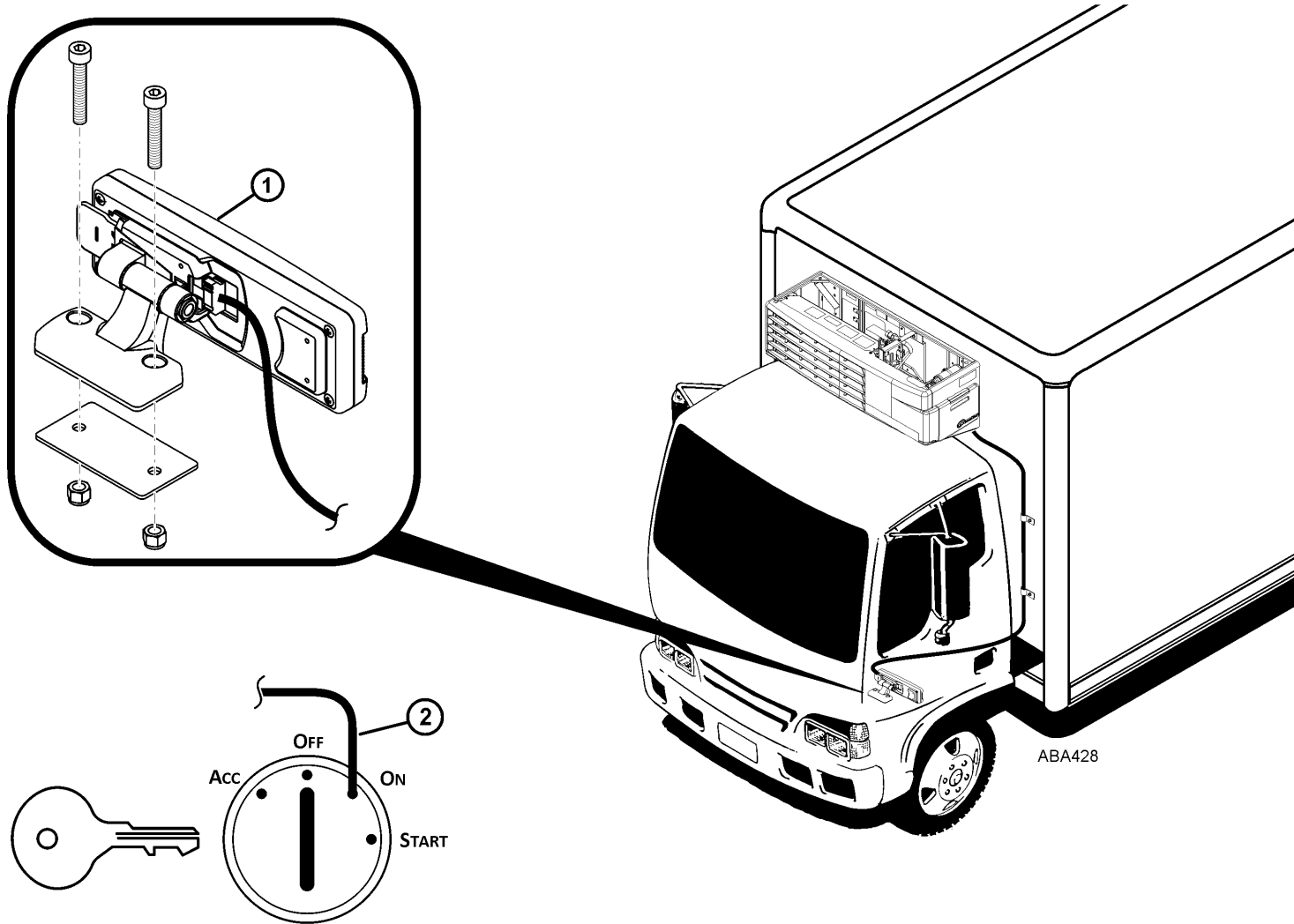
Procedures

1. From the cargo area route the multi-conductor **Controller Harness** with wire colors **Blue (CH0), Black (TXD), White (RXD) Brown (9V) and Drain Wire (SHIELD)** and the **Vehicle Ignition Switch wires (ACC, BAT)** to the interior of the cab.
 - Attach the 5-pin connector (**BLUE, BLACK, WHITE, BROWN SHIELD**) firmly to the rear of the controller.
 - Install the controller to the bracket.

NOTE: Install the HMI in a location that is accessible and visible from the driver's position and that does not hinder the driver's mobility, visibility or access to the vehicle instruments and levers.

2. Splice the **ACC** and **BAT** with the supplied 10 amp in-line fuse using the crimp connector in the kit and attach the in-line fuse (with ACC and BAT wires to the ON side of the vehicle ignition switch.
3. Neatly route and secure all harnesses.

Installation - HMI



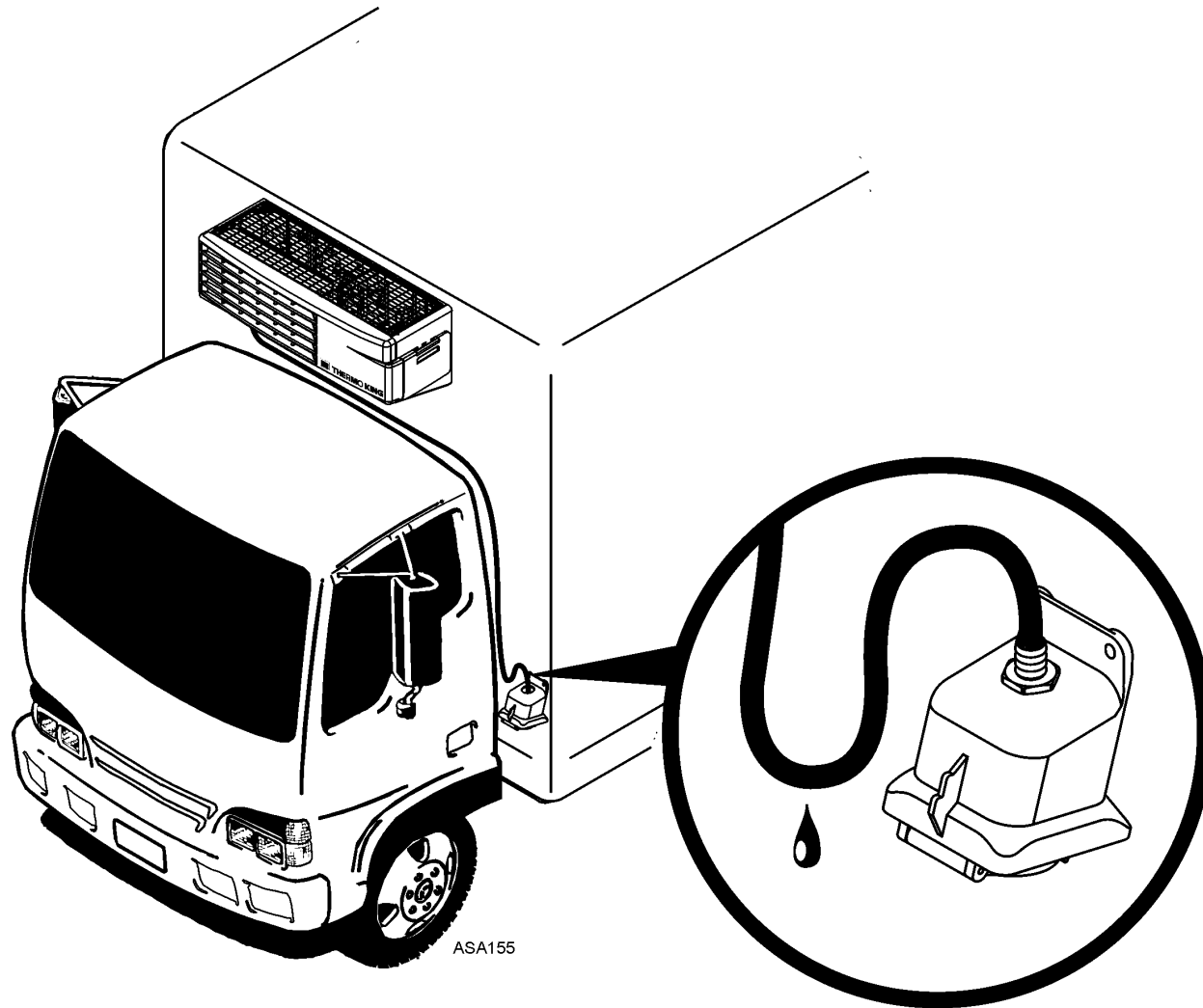
Installation - Standby Power Receptacle

Procedures

NOTE: Thermo King recommends a 20 amp fused power source for electric standby operation.

- Verify the receptacle box is wired for the correct voltage for your application.
- The standby receptacle box should be installed securely to the exterior of the vehicle. It should be easily accessible while not interfering with the driver's visibility or operation of the vehicle.

Installation - Electric Standby Power Supply (20 and 50 Models Only)



Installation - Electrical Connections to Compressor and Battery

Important Battery Cable Information

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

NOTE: If the vehicle is equipped with a battery disconnect switch, always wire the unit after the switch. This allows power to the unit to be turned off by the battery disconnect switch.

1. Route compressor harness with connectors (LIS, CLU) and (CLU1) to engine compartment.
2. Connect Liquid Injection (LIS, CLU) connector to mating connector on liquid injection switch.
3. Connect Clutch Harness (CLU1) to mating connector on clutch.

Important Battery Connection Information

IMPORTANT: The ring terminals used for the battery connections should be sized to match the battery studs. Oversized ring terminals can contribute to high resistance resulting in maxi fuse overheating and failure.

4. Connect the Positive (2) wire to the Positive (+) post of the battery:
 - Splice the 2 wire with the supplied 50 amp in-line fuse for single temperature units using the splice connector in the kit.
 - Attach the in-line fuse (with 2 wire) onto the positive (+) post of the battery. See important note above.
5. Connect negative (CH) wire to **negative (-)** post of battery using correct size ring terminal.

Compressor Ground Wire

Install chassis ground wire to engine driven compressor to chassis ground using supplied hardware. Use anti-corrosion gel (203-377) or equivalent on ground wire connection to compressor and vehicle chassis. The location used on the vehicle chassis should be clean and free of paint to make a proper ground path.

IMPORTANT: Failure to install the compressor ground wire to the chassis may result in intermittent clutch operation and premature clutch failure!

Important Maxi Fuse Information

IMPORTANT: The in-line maxi fuse holder must be mounted securely to the vehicle with a bolt and nut to help reduce excessive vibration as the truck operates. **DO NOT** secure with bandwraps. Failure to properly secure the maxi fuse can contribute to high resistance resulting in maxi fuse overheating and failure.

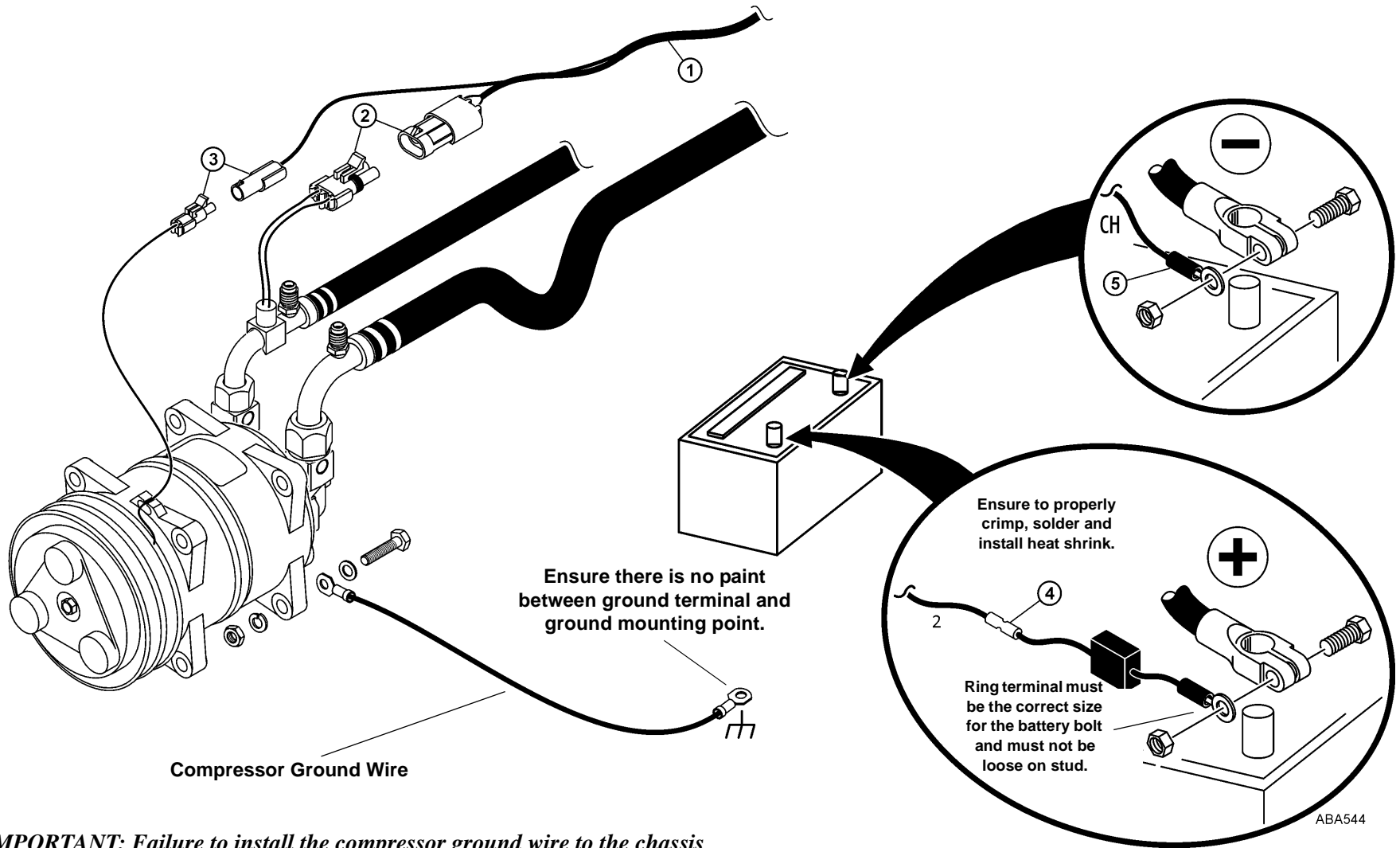
IMPORTANT:

- Mount fuse holder securely with a bolt and nut to vehicle in an accessible location.
- Flat washers may be required to space the holder away from the vehicle.
- A cushion clamp should be used as a strain relief for the cable as shown.



Maxi Fuse shown properly secured to vehicle with bolt and clamp.

Installation - Electrical Connections to Compressor and Battery



IMPORTANT: Failure to install the compressor ground wire to the chassis may result in intermittent clutch operation and premature clutch failure!

System Charging

Procedures

1. Connect a gauge manifold set to the suction and discharge service ports on the engine driven compressor.
2. Connect the refrigerant bottle to the gauge manifold and place it on a scale.
3. Connect the refrigerant bottle valve and drain the gauge fitting line.
4. Keep the low pressure side valve of the gauge manifold closed. Open the high pressure side valve.
5. Add refrigerant until reaching approximately:
 - 1.6 kg(3.5 lb.) for R-134A or for R-404A

NOTE: The refrigerant charge must be made in liquid phase for R-404A.

6. Close the refrigerant bottle valve and the high side valve of the gauge manifold.
7. Start the vehicle engine, run at approximately 1000 rpm and turn the unit ON.
8. Set the unit thermostat at 0C/32F (see operating manual).
9. Run the unit until it reaches a temperature close to that indicated, and a high circuit pressure of 12.5 bar (**180 psig for R-134a**) or 19 bar (**275 psig for R-404A**). Partially block off the air intake to the condenser if necessary.

10. Open the low side valve of the gauge manifold and the refrigerant bottle valve, and add refrigerant slowly until no bubbles can be seen through the liquid sight glass.
11. Close the refrigerant bottle and gauge manifold valves.
12. Leave the unit running for 15 minutes.
13. Check that there are no bubbles in the sight glass. If bubbles are seen, repeat steps 10 and 11.
14. Units **WITHOUT** Electric Standby:
 - Turn OFF the unit, stop the vehicle and remove the gauge manifold.
15. Units **WITH** Electric Standby:
 - Turn OFF the unit and stop the vehicle.
 - Connect the unit to electrical standby source. Run the unit on electric standby operation for 15 minutes.

NOTE: Thermo King recommends a 20 amp fused power source for electric standby operation.

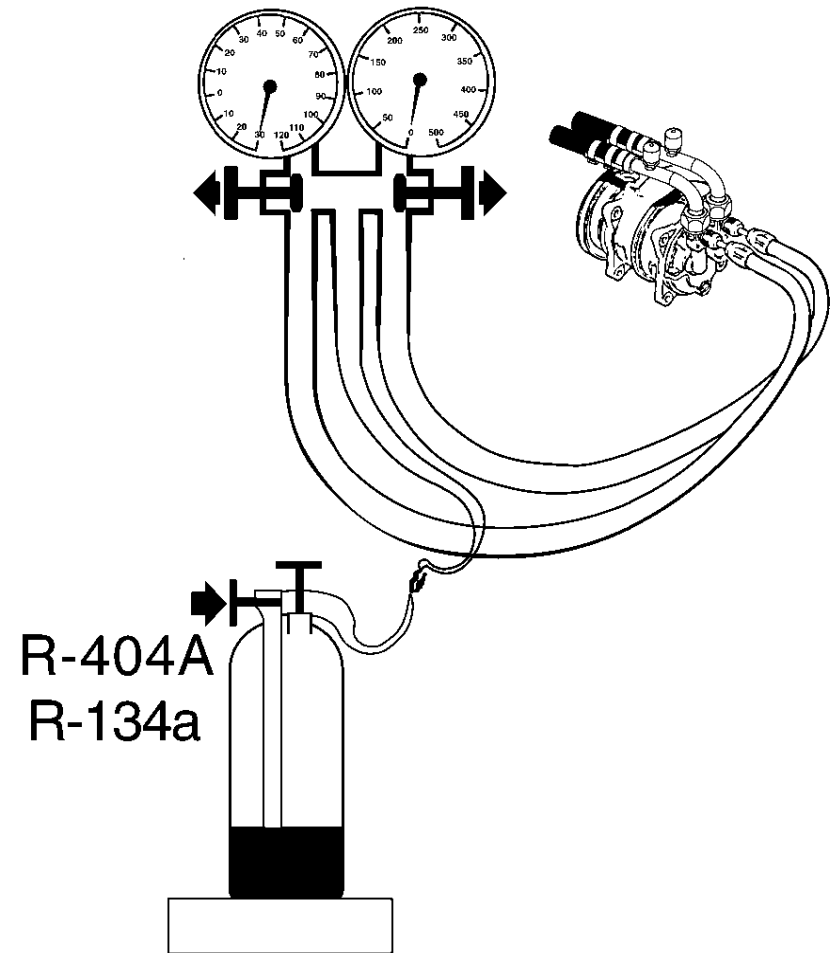
- Turn the unit OFF and remove the electrical standby plug.
- Remove the gauge manifold.

NOTE: The above conditions MUST be established each time the refrigerant level is checked or if refrigerant needs to be added for any reason.

System Charging

Model	Initial Refrigerant Charge*	
	lb.	kg
V-520 10	5.3	2.42
V-520 10 MAX	4.9	2.22
V-520 20	5.7	2.57
V-520 20 MAX	5.2	2.37
V-520 30 MAX	5.5	2.52
V-520 50 MAX	5.4	2.43
V-520 SPECTRUM 10 MAX	5.3	2.42
V-520 SPECTRUM 20 MAX	5.7	2.57
V-520 SPECTRUM 50 MAX	5.8	2.63

* Final refrigerant charge will vary based on each unique installation.



ASA091

SPR and CPR Adjustment Procedures

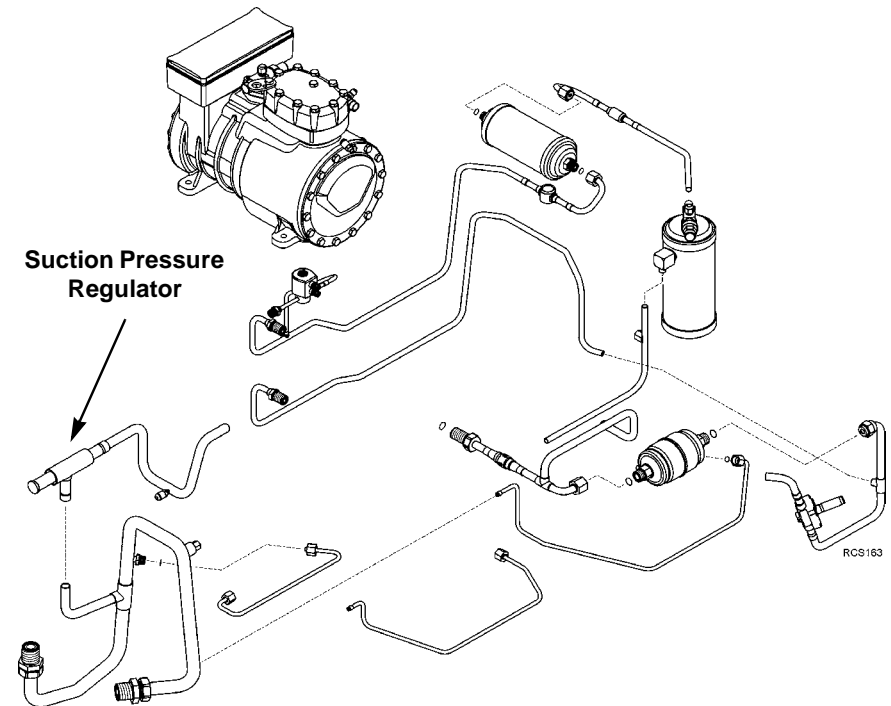
IMPORTANT: The following applicable procedures must be performed on all new unit installations. Failure to do so may not allow the unit to operate at its maximum capacity.

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.

Suction Pressure Regulator Valve (Model 20 and 50 Only)

Model 20 and 50 units are equipped with a suction pressure regulator (SPR) valve. The valve is used to limit the load on the electric standby compressor. This also affects the current draw of the electric motor. Monitor the current drawn of the electric motor when making this adjustment and keep it at least 1.5 amps below the overload relay setting.

1. Install a gauge manifold set on the electric standby compressor. Attach an additional compound gauge to the suction service port on the engine driven compressor to monitor suction pressure at the inlet to the suction pressure regulator.
2. Connect the unit power receptacle to an appropriate electric power source.
3. Place a jumper wire between the 12 and CHB wires at the defrost termination switch to ensure the unit will run in Defrost.
4. Start the unit and run it 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).
5. Check the suction pressure on the gauge attached to the suction service port at the standby compressor. It should be 39.0 ± 4 psig (269 ± 28 kPa). If the setting is incorrect, remove the protective cap and adjust the suction pressure regulator valve to the correct setting.
6. Remove the gauge manifold set, the additional compound gauge, and the jumper wire when finished with the procedure.



V-520 Model 20 and 50 Refrigeration Module Components

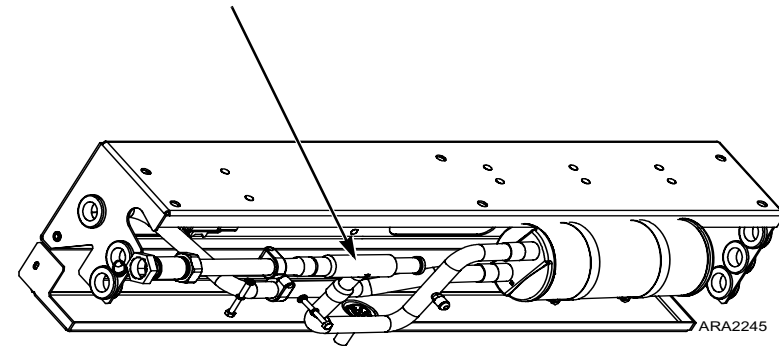
SPR and CPR Adjustment Procedures (continued)

Compressor Pressure Regulator Valve (Single Temperature Model 30 and 50 Only)

The compressor pressure regulator valve (CPR) is located in the optional accumulator module mounted on the back of the evaporator. It is used to limit the suction pressure during heat.

1. Install a gauge manifold set on the engine driven compressor. Attach an additional compound gauge to the evaporator suction service port to monitor suction pressure in the evaporator.
2. Set the thermostat on the highest setting.
3. Start and run the unit in Heat on the engine driven compressor until the pressure on the additional compound gauge attached to the evaporator suction service port stabilizes at a pressure above 60 psig (414 kPa).
4. Check the suction pressure on the gauge attached to the suction service port at the compressor. It should be 50.0 ± 5 psig (345 ± 34 kPa). If the setting is incorrect, remove the protective cap and adjust the compressor pressure regulator valve to the correct setting.
5. Remove the gauge manifold set and the additional compound gauge when finished with the test.

Compressor Pressure Regulator



Typical V-520 Accumulator Module Components Used On Both
Roof Top and Nose Mount Style Units.

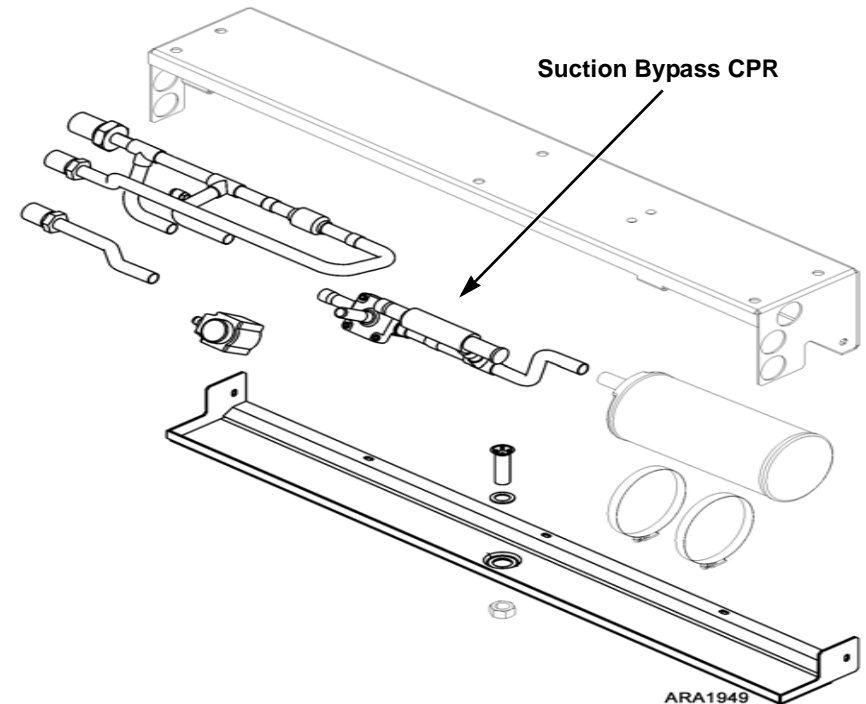
SPR and CPR Adjustment Procedures (continued)

Suction Bypass CPR Valve (SPECTRUM Units Only)

The suction bypass CPR valve is located in the optional advanced control system module mounted on the back of the evaporator. The advanced control system balances the suction pressure between the fresh and frozen evaporators to allow both evaporators to have equal capacity to control the two zones. This system gives priority to the frozen section. It also keeps refrigerant from migrating into the frozen evaporator when it is not running.

1. Install a gauge manifold set on the engine driven compressor.
2. Shut off the fresh compartment by raising its setpoint to the highest setting.
3. Start the unit on the engine driven compressor at 1800 to 2000 RPM.
4. Bring the frozen compartment to 5 to 7 F (3 to 4 C) above desired setpoint. Record the suction pressure and then shut the unit off.
5. Remove the suction bypass solenoid coil and install a magnet (P/N 204-1074) to close valve.
6. Raise the frozen compartment setpoint to the highest level and lower the fresh compartment setpoint to 35 F (2 C) and start the unit.
7. With the unit running, set the suction pressure to the recorded value from step 4 by adjusting the suction bypass CPR valve. Ensure the adjustment is complete prior to the fresh compartment reaching setpoint. Once the suction pressure has been set, turn the unit off.
8. Remove magnet and reinstall the coil on the suction bypass solenoid.
9. Remove the gauge manifold set.
10. Start the unit with both compartments set to desired setpoints and let the unit pull down.

11. It is normal for the frozen compartment to pull down faster than the fresh compartment on first start up.

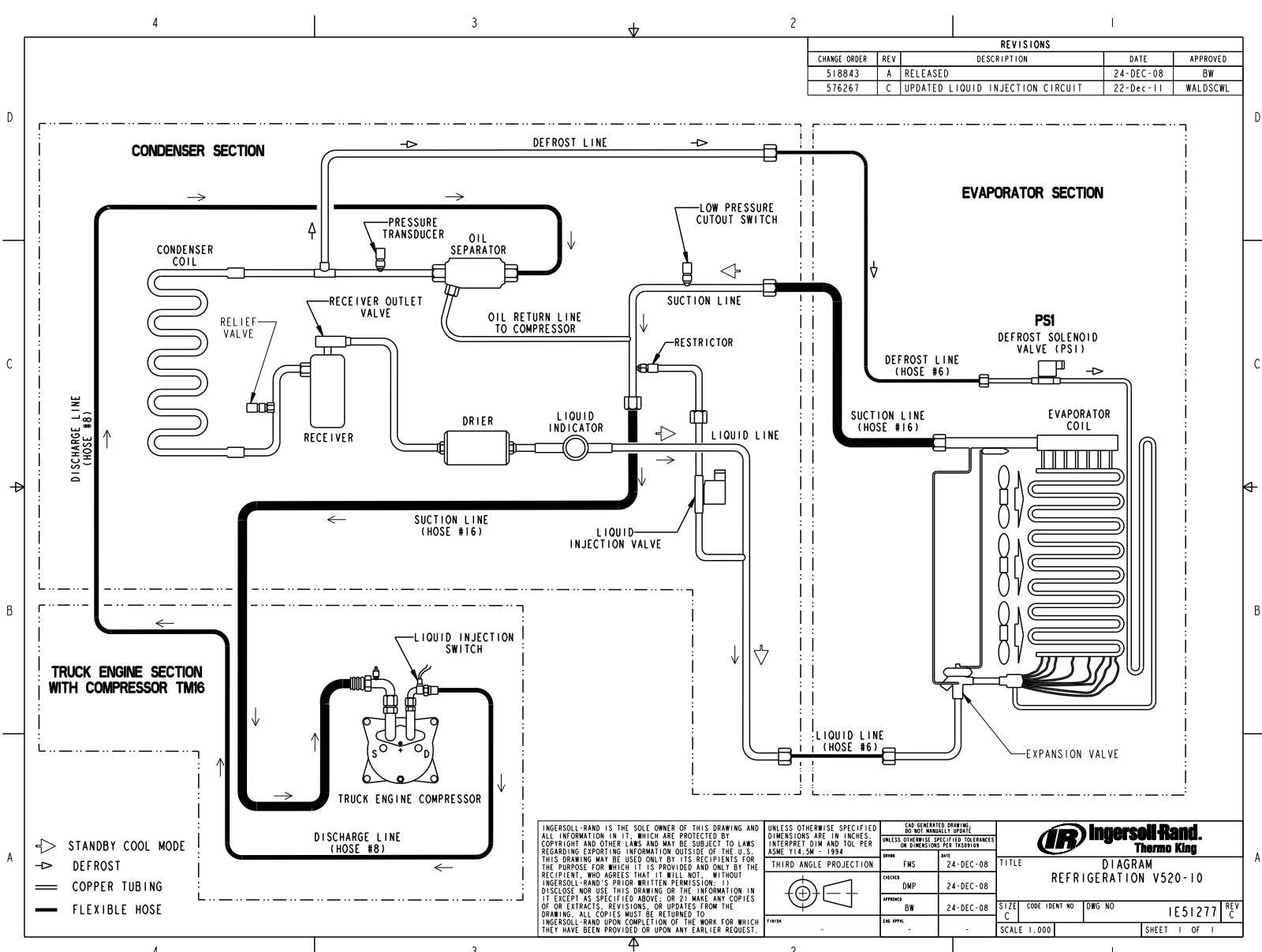


V-520 SPECTRUM Advanced Control System Module

Installation Check List

- All mounting holes and access holes are sealed with neutral/alcohol cure silicone sealant.
- All covers, guards or screens are installed securely on unit.
- The evaporator fans blow in the right direction.
- The drain hoses are slanted on all evaporators.
- The drain hose heaters are installed correctly.
- The orifice screen is installed in the expansion valve at the evaporator.
- The temperature sensor is connected at the evaporator.
- The in-cab control box is installed in a area that it is accessible and visible from the driver's position.
- MODELS 20 and 50 ONLY - The unit's electrical contact draw was verified. (Thermo King recommends a 20 amp fused power source for electric standby operation.)
- Refrigerant hoses are not taut. They should be able to absorb vibrations and be shortened in case of leaks.
- Refrigerant hoses and harnesses are not rubbing against moving parts, sharp parts, or parts that can reach high temperatures.
- The oil return hose is installed.
- The liquid injection hose is installed.
- The liquid injection orifice is installed in the tee.
- The vehicle compressor was primed with oil.
- All battery connections are clean and tight.
- Maxi Fuse holder was secured properly with bolt and nut to vehicle.
- The vehicle compressor drive kit test was carried out.
- The system was checked for leaks.
- The unit was charged with correct type and amount of refrigerant.
- SPR and CPR adjustment procedures were carried out and unit operates at its maximum capacity
- The unit operates correctly.

Refrigeration Diagram V-520 - 10



REVISIONS				
CHANGE ORDER	REV	DESCRIPTION	DATE	APPROVED
518843	A	RELEASED	24-DEC-08	BW
576267	C	UPDATED LIQUID INJECTION CIRCUIT	22-DEC-11	WALDSCWL

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THIRD ANGLE PROJECTION

DATE	24-DEC-08	DATE	24-DEC-08
BY	FMS	DATE	24-DEC-08
CHECKED	DMP	DATE	24-DEC-08
APPROVED	BW	DATE	24-DEC-08
ENG APPR.	-	DATE	-

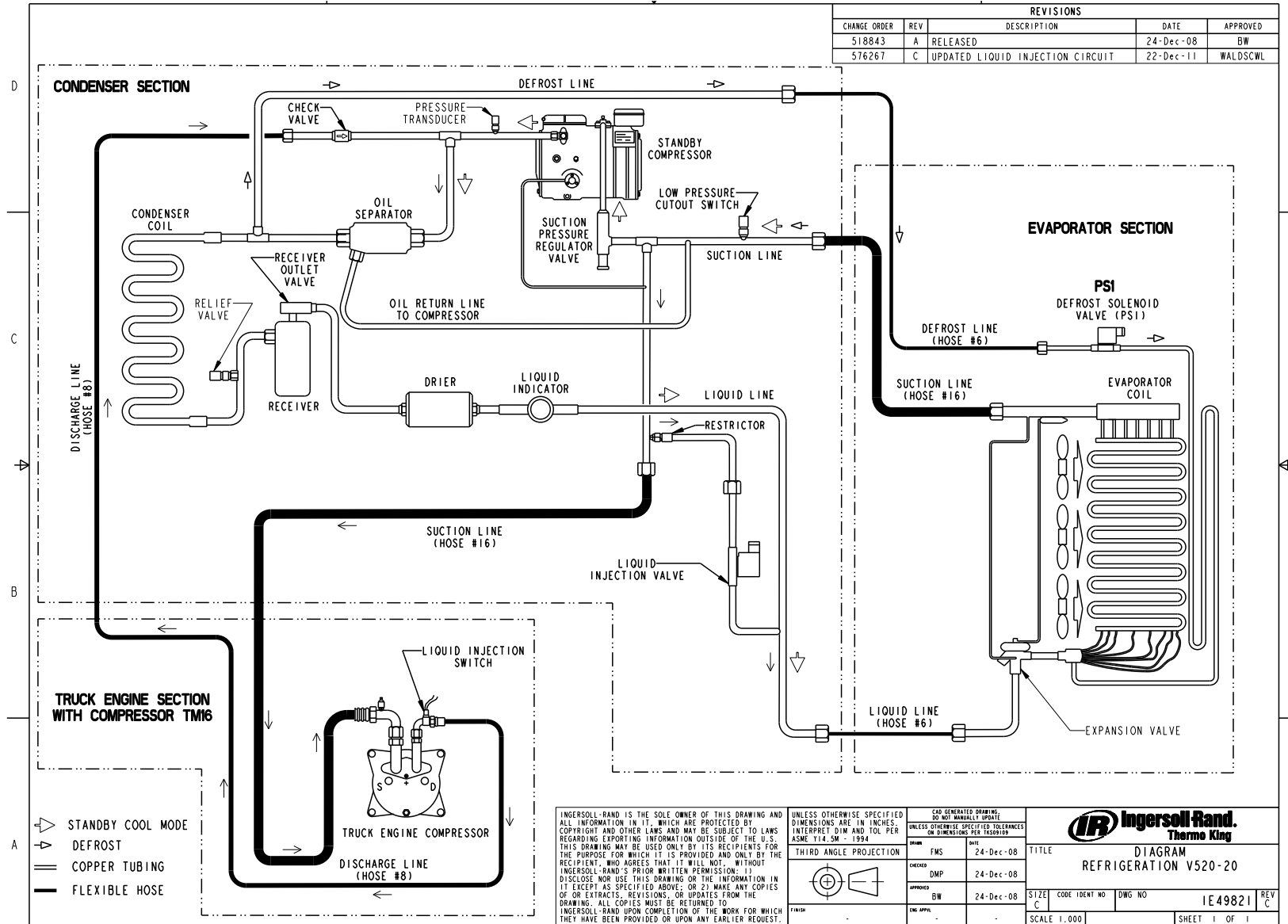
SCALE 1:1000 SHEET 1 OF 1

Ingersoll-Rand
Thermo King

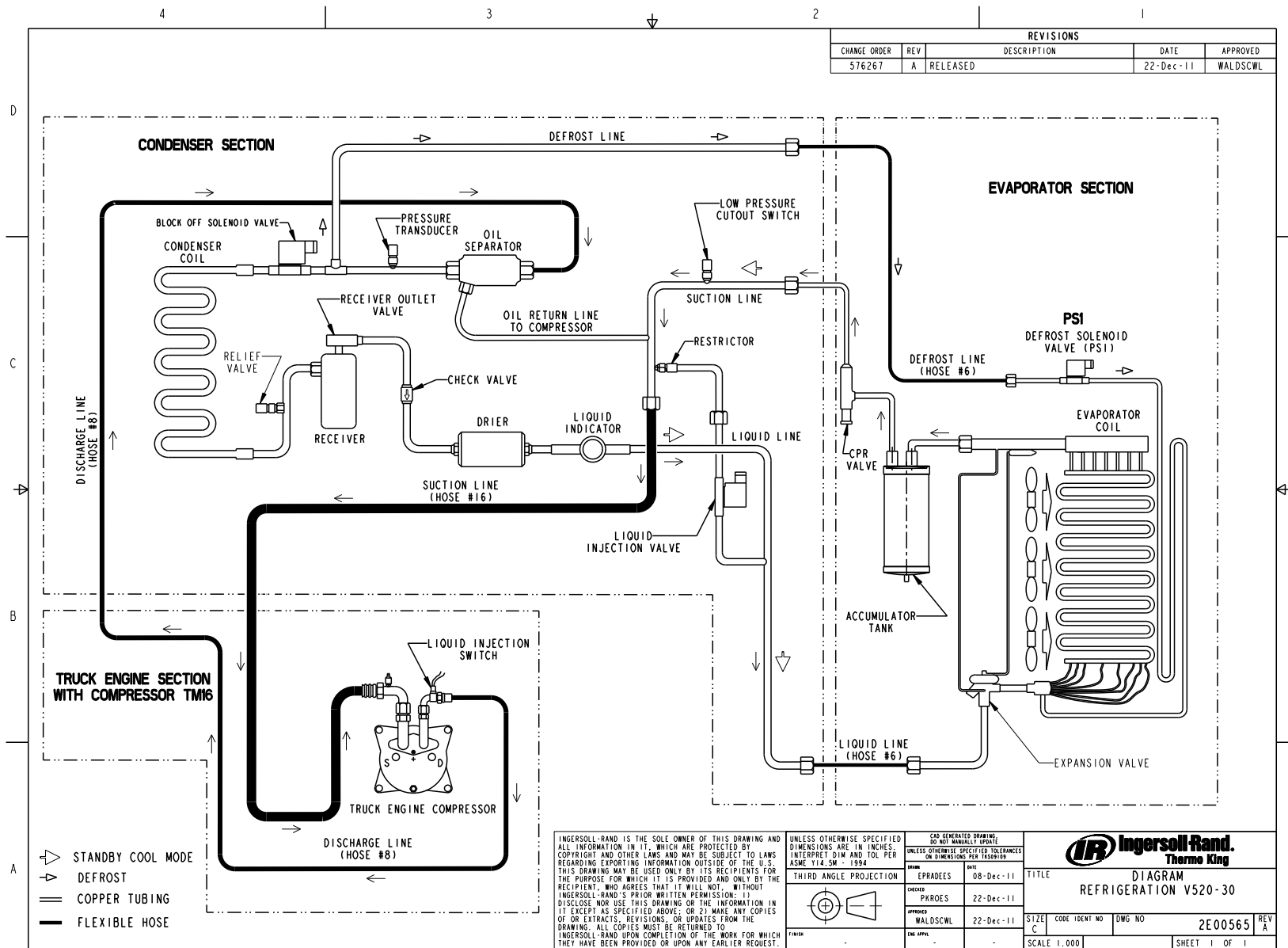
TITLE: DIAGRAM REFRIGERATION V520-10

SIZE: C CODE IDENT NO: DWG NO: IE51277 REV: C

Refrigeration Diagram V-520 - 20



Refrigeration Diagram V-520 - 30



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CAD GENERATED DRAWING. DO NOT MANUALLY UPDATE. UNLESS OTHERWISE SPECIFIED TOLERANCES ON DIMENSIONS PER Y145B1919

THIRD ANGLE PROJECTION

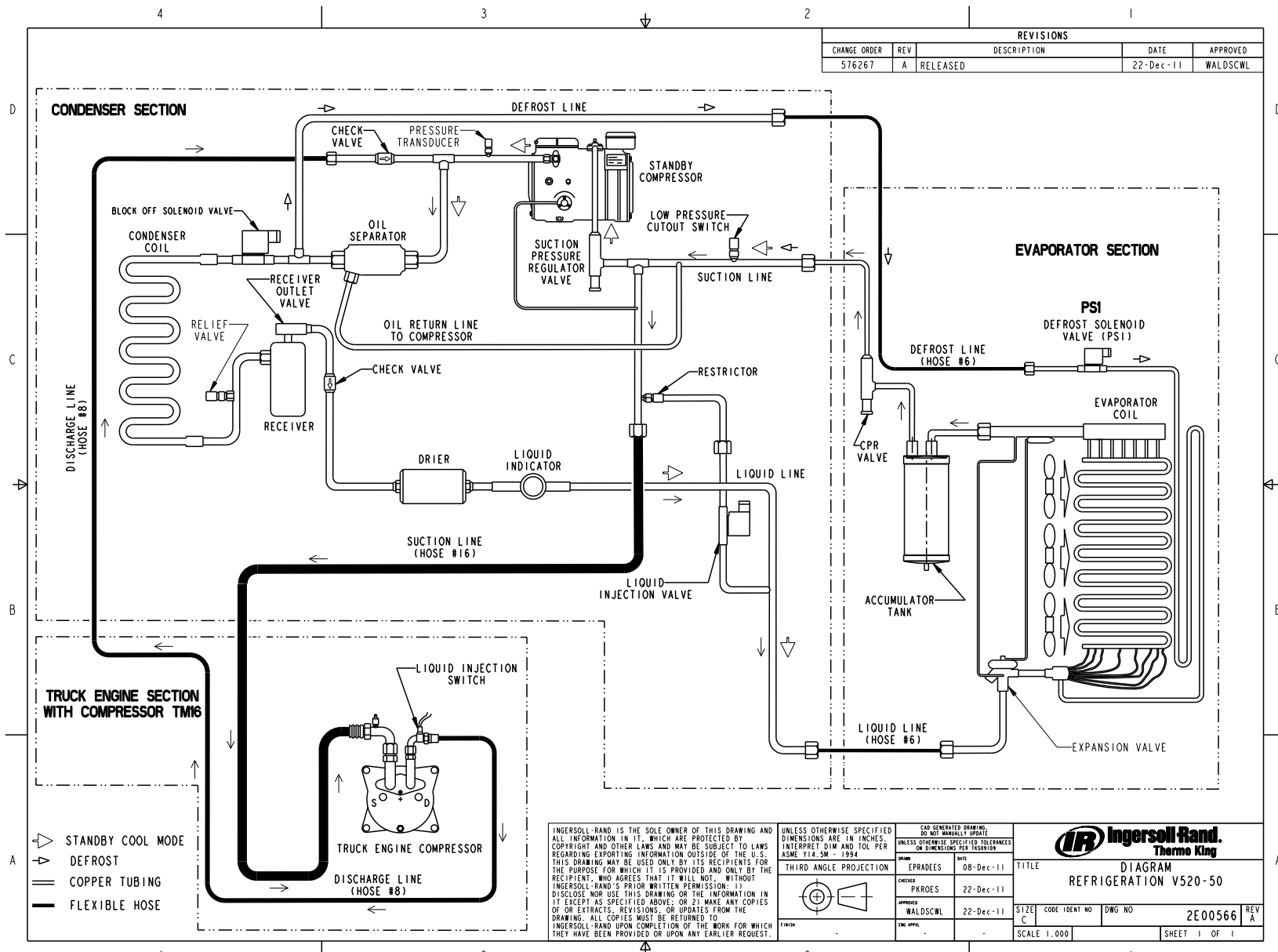
DATE	08-Dec-11
DESIGNED BY	PKROES
DATE	22-Dec-11
APPROVED BY	WALDSCWL
DATE	22-Dec-11

IR Ingersoll-Rand. Thermo King

DIAGRAM REFRIGERATION V520-30

TITLE	DIAGRAM REFRIGERATION V520-30
SIZE	C
CODE IDENT NO	
DWG NO	2E00565
SCALE	1:000
SHEET	1 OF 1

Refrigeration Diagram V-520 - 50



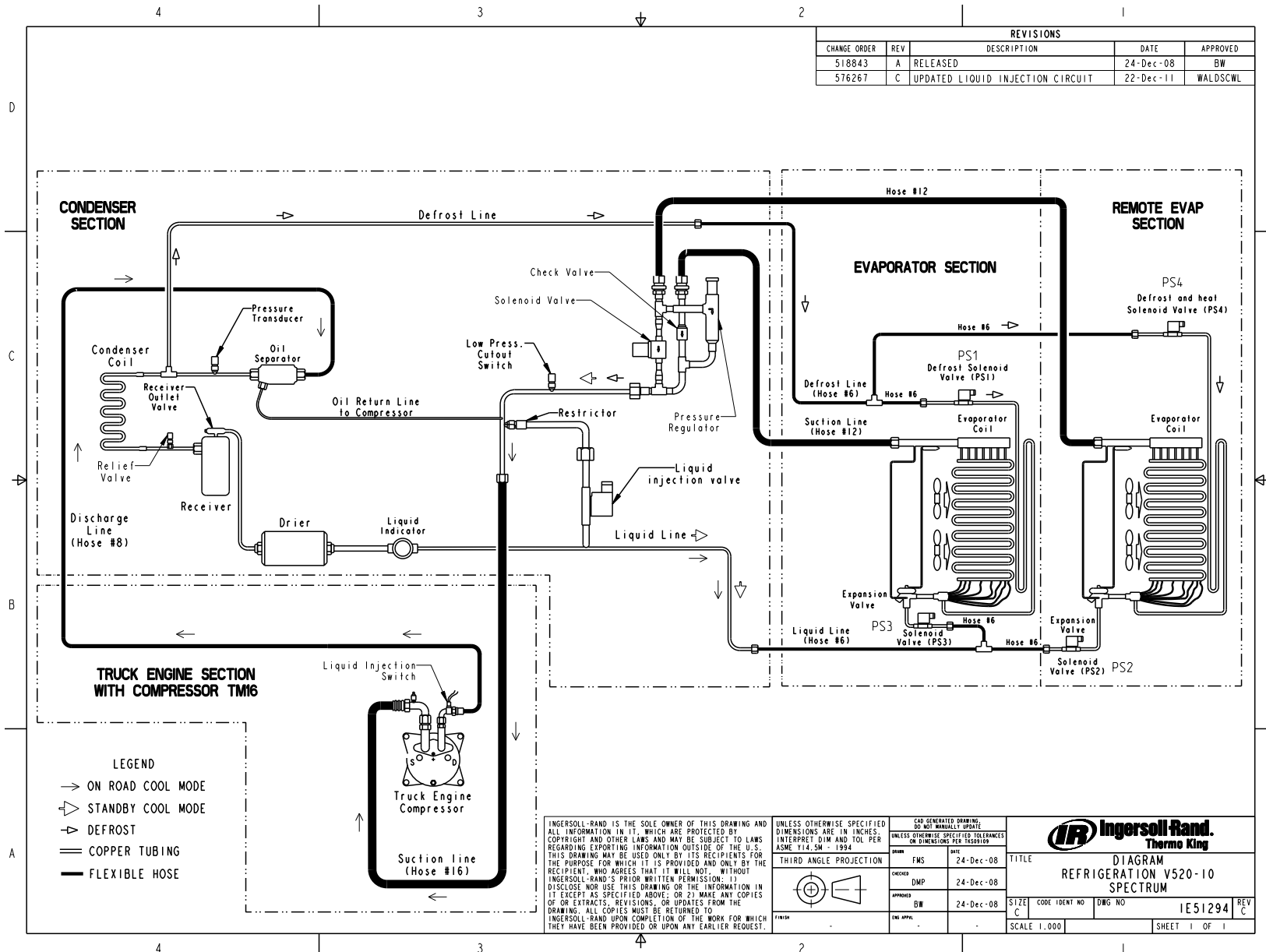
REVISIONS				
CHANGE ORDER	REV	DESCRIPTION	DATE	APPROVED
576267	A	RELEASED	22-Dec-11	WALDSCWL

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DATE	08-Dec-11	TITLE	DIAGRAM REFRIGERATION V520-50
DRAWN	EPRADEES	DATE	22-Dec-11
CHECKED	PHROES	DATE	22-Dec-11
APPROVED	WALDSCWL	DATE	22-Dec-11
FINISH	END APPR.	SCALE	1:000

SIZE	C
CODE IDENT NO	
DWG NO	2E00566
REV	A
SHEET 1 OF 1	

Refrigeration Diagram V-520 - 10 SPECTRUM



REVISIONS				
CHANGE ORDER	REV	DESCRIPTION	DATE	APPROVED
518843	A	RELEASED	24-Dec-08	BW
576267	C	UPDATED LIQUID INJECTION CIRCUIT	22-Dec-11	WALDSCWL

- LEGEND**
- ON ROAD COOL MODE
 - ⇄ STANDBY COOL MODE
 - ⇄ DEFROST
 - == COPPER TUBING
 - FLEXIBLE HOSE

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THIRD ANGLE PROJECTION

CAP GENERATED DRAWING: DO NOT MANUALLY UPDATE UNLESS OTHERWISE SPECIFIED TOLERANCES OR DIMENSIONS PER THIS DRAWING	
DATE	DATE
24-Dec-08	24-Dec-08
24-Dec-08	24-Dec-08
24-Dec-08	24-Dec-08

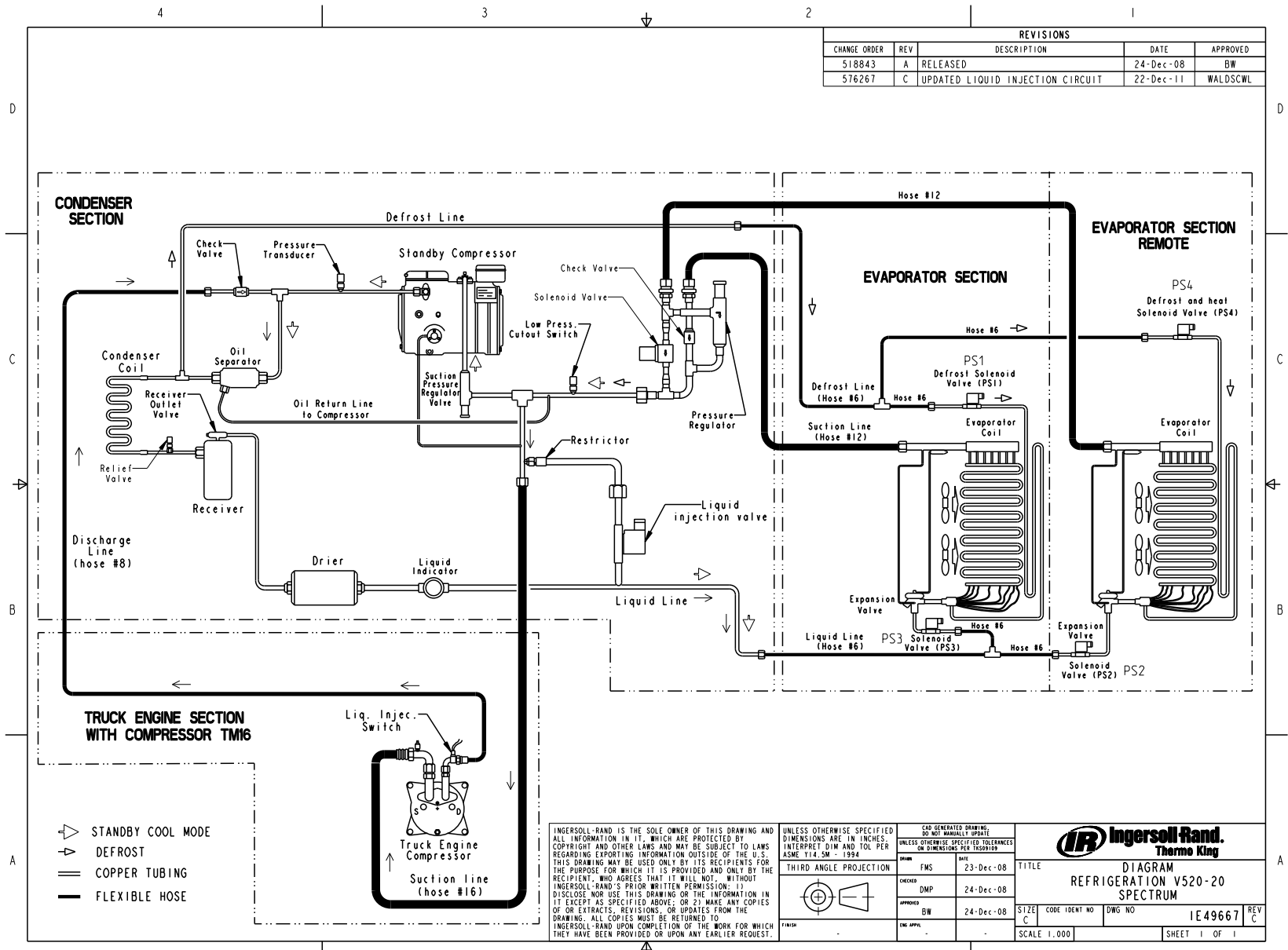
IR Ingersoll-Rand Thermo King

TITLE: **DIAGRAM REFRIGERATION V520-10 SPECTRUM**

SIZE: C CODE IDENT NO: DWG NO: IE51294 REV: C

SCALE: 1:000 SHEET: 1 OF 1

Refrigeration Diagram V-520 - 20 SPECTRUM



REVISIONS				
CHANGE ORDER	REV	DESCRIPTION	DATE	APPROVED
518843	A	RELEASED	24-Dec-08	BW
576267	C	UPDATED LIQUID INJECTION CIRCUIT	22-Dec-11	WALDSCWL

- ▷ STANDBY COOL MODE
- ▽ DEFROST
- ══ COPPER TUBING
- FLEXIBLE HOSE

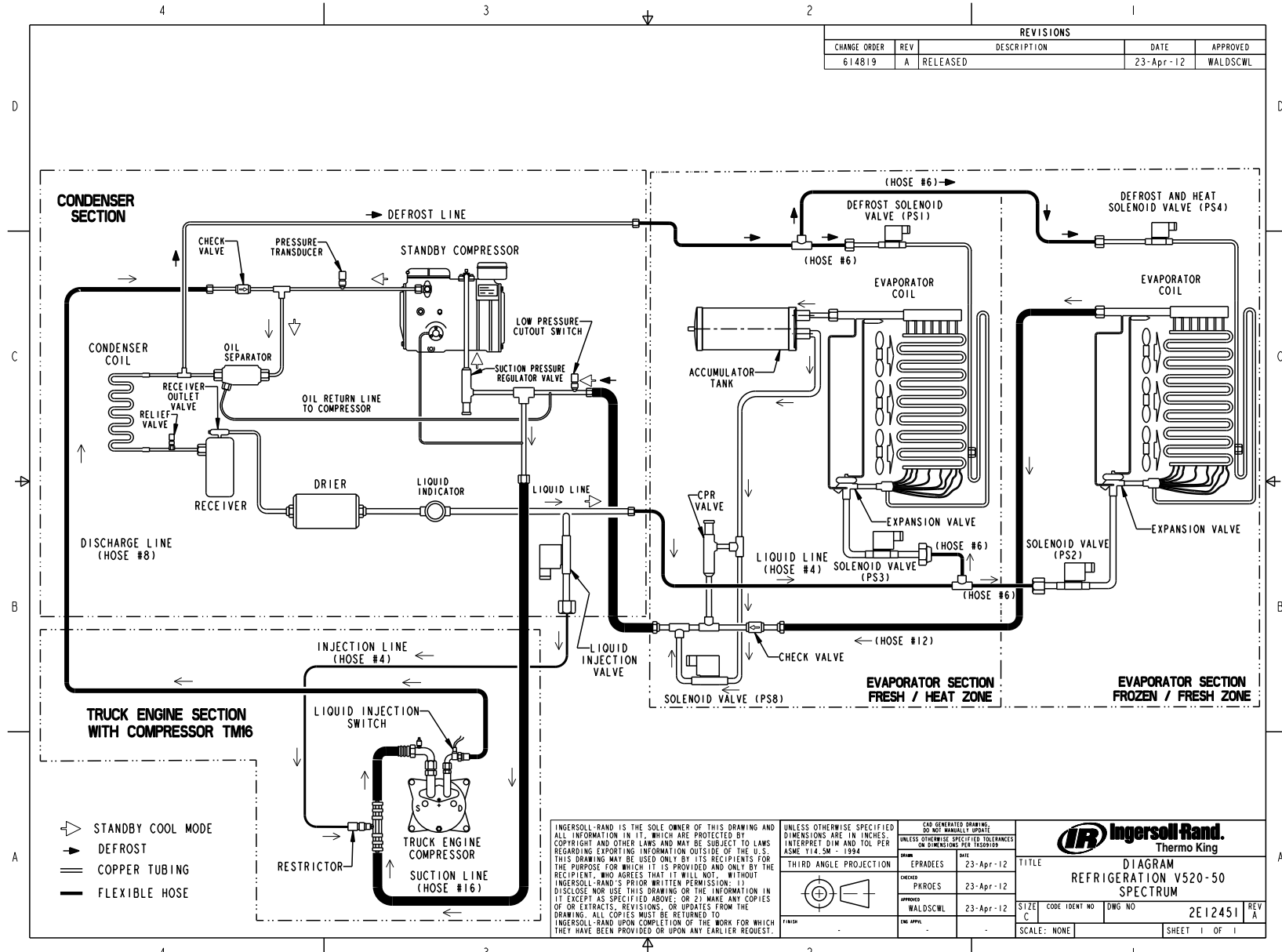
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DATE	23-Dec-08	DATE	24-Dec-08
CHECKED	DMP	DATE	24-Dec-08
APPROVED	BW	DATE	24-Dec-08
DATE		DATE	

		DIAGRAM REFRIGERATION V520-20 SPECTRUM	
SCALE	1:000	DWG NO	1E49667
SHEET	1 OF 1	REV	C

Refrigeration Diagram V-520 - 50 SPECTRUM

RELEASED 19/Jul/2012



REVISIONS				
CHANGE ORDER	REV	DESCRIPTION	DATE	APPROVED
614819	A	RELEASED	23-Apr-12	WALDSCWL

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. INTERPRET DIM AND TOL PER ASME Y14.5M - 1994

THIRD ANGLE PROJECTION

FINISH -

ENG APPL -

DATE	DESCRIPTION	DATE	DESCRIPTION
23-Apr-12	APPROVED	23-Apr-12	APPROVED
23-Apr-12	DRAWN	23-Apr-12	DRAWN
23-Apr-12	CHECKED	23-Apr-12	CHECKED
23-Apr-12	DESIGNED	23-Apr-12	DESIGNED

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 Thermo King

TITLE: DIAGRAM REFRIGERATION V520-50 SPECTRUM
 SIZE: C CODE: 1020 NO: DWG NO: 2E12451 REV: A
 SCALE: NONE SHEET 1 OF 1

Wiring and Schematic Diagram Numbers

V-520 and V-520 MAX				
MODEL	10/30	20/50	20/50	
VOLTAGE		230/1/60	230/3/60	
WIRING DIAGRAM*	2E54899	2E54901	2E54903	
SCHEMATIC DIAGRAM*	2E54898	2E54900	2E54902	

V-520 SPECTRUM					
MODEL	10	20	20	50	50
VOLTAGE		230/1/60	230/3/60	230/1/60	230/3/60
WIRING DIAGRAM*	2E79656	2E79813	2E79815	2E54905	2E54907
SCHEMATIC DIAGRAM*	2E79655	2E79812	2E79814	2E54904	2E54906

* Available in the unit Maintenance Manual.

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