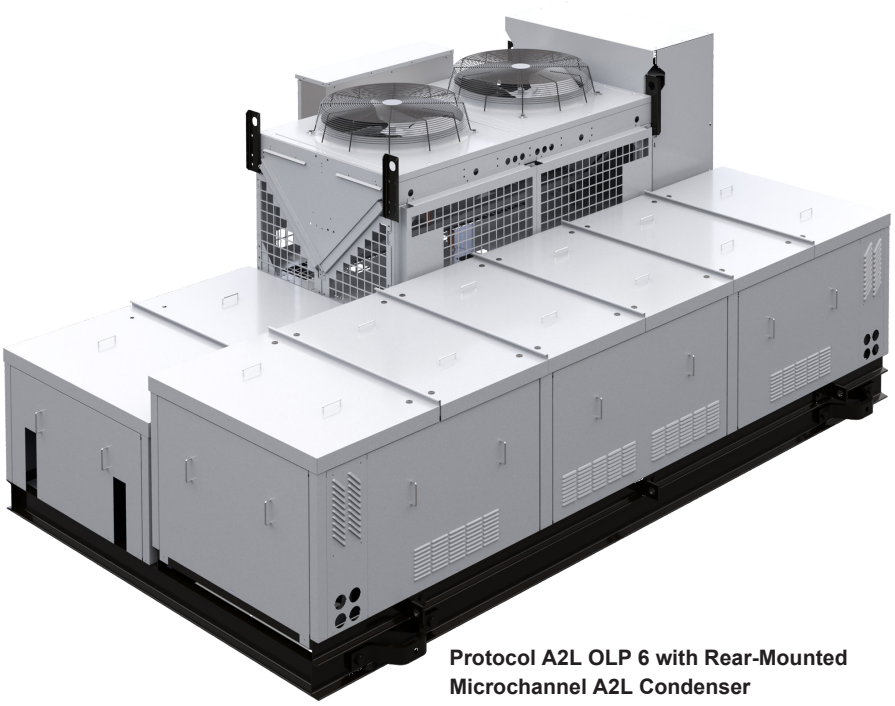
HUSSMANN®

EVOLVE® A2L



Protocol A2L OLP 6 with Rear-Mounted Microchannel A2L Condenser

Installation, Operation, and Service Manual

Protocol® A2L

Horizontal Compact Outdoor Rack System

P/N 3230173 **Rev** A

October 2025

Certifications

c UL us LISTED

WARNING:

READ THE ENTIRE MANUAL BEFORE INSTALLING OR USING THIS EQUIPMENT.

If the information in these instructions are not followed exactly, a fire or explosion may result, causing property damage, personal injury, or death. Installation and service must be performed by a qualified installer or service agency.

Equipment uses an A2L as the refrigerant. If a refrigerant leak is present or even suspected, do not allow untrained personnel to attempt to find the cause. No open flames, cigarettes, or other possible sources of ignition should be used in the vicinity of the equipment.

Equipment is limited to use in an altitude of 6,562 ft (2 km) or less.

FAILURE TO ABIDE BY THESE WARNINGS COULD RESULT IN AN EXPLOSION, DEATH, INJURY, AND PROPERTY DAMAGE.

We reserve the right to change or revise specifications and product design in connection with any feature of our products. Such changes do not entitle the buyer to corresponding changes, improvements, additions or replacements for equipment previously sold or shipped.

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Spanish P/N 3233026
French P/N 3233025

Protocol A2L

Table of Contents

Protocol A2L

User Safety and Product Information

Legal Disclaimer

Review all safety warnings on the case and in this manual before attempting start-up. Hussmann shall not be liable for any repair of replacement made without the written consent of Hussmann, or when the product is installed or operated in a manner contrary to the printed instructions covering installation and service which accompanied such product. Please note that failure to follow the instructions in this document may void your factory warranty.

As used herein, “appliance”, “unit”, and “equipment” each refer to the Protocol A2L unless otherwise stated or contextualized and “system” means a set of things working together as parts of an interconnecting network.

Environmental Concerns

Hussmann recommends responsible handling of refrigerants. Only certified technicians may handle these refrigerants.

All technicians must be aware and follow the requirements set forth by the Federal Clean Air Act (Section 608) for any service procedure being performed on this equipment that involves refrigerant. Additionally, some states have other requirements that must be adhered to for responsible management of refrigerants.

ANSI Z535.5 Definitions

The definitions below are used to clarify the magnitude and urgency of harm and damage, considering problems arising from misuse. Relative to their potential danger, the definitions are divided into five parts according to ANSI Z535 Series.

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

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

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE is used to address practices not related to personal injury.

SAFETY INSTRUCTIONS (or equivalent) signs indicate specific safety-related instructions or procedures.

Proposition 65

This warning does not mean that Hussmann products will cause cancer or reproductive harm, or is in violation of any product-safety standards or requirements. As clarified by the California State Government, Proposition 65 can be considered more of a ‘right-to-know’ law than a pure product safety law. When used as designed, Hussmann believes that our products are not harmful.
We provide the Proposition 65 warning to stay in compliance with California State law. It is your responsibility to provide accurate Proposition 65 warning labels to your customers when necessary. For more information on Proposition 65, please visit the California State Government website.

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Protocol A2L

User Safety and Product Information

Serial Plate Location

Serial plate is located on the control panel. Serial plate contains all pertinent information such as model, serial number, amperage rating, and refrigerant type.

UL Listing

This equipment is manufactured to meet ANSI / UL 60335-2-89 and CSA C22.2 standard requirements for safety. Proper installation is required to maintain this listing. This appliance is to be installed in accordance with the Safety Standard for Refrigeration Systems, ANSI/ASHRAE 15.

Federal / State Regulation

At the time they are manufactured, this equipment meets all federal and state/provincial regulations. Proper installation is required to ensure these standards are maintained.

Legend and Labeling

Each Protocol is shipped with a detailed legend that identifies the specialized components used such as compressors, valves, oil separators, etc., and details BTU/hr loads, control valves, circuit information, and suction temperatures. The type of refrigerant and lubricant to be used are prominently displayed on the front of the Protocol. All Protocols include complete wiring diagrams (control, primary power, board and point layout). All wiring is color coded.

Additional Important Labeling

The symbols below indicate specific types of information on the equipment.

DANGER—Indicates a risk of fire or explosion. Flammable refrigerant used. To be repaired only by trained service personnel. Do not puncture refrigerant tubing.

Grounding Connection Location

Protocol A2L

User Safety and Product Information

General Safety Instructions

SAFETY INSTRUCTIONS

This manual was written in accordance with originally prescribed equipment that is subject to change. Hussmann reserves the right to change or revise specifications and product design in connection with any feature of our products.

Only qualified personnel should install and service this equipment. Personal Protection Equipment (PPE) is required. Wear safety glasses, gloves, protective boots or shoes, long pants, and a long-sleeve shirt when working with this equipment and while handling glass.

The safety of our customers and employees is paramount. The precautions and procedures described in this manual are intended as general methods for safe use of this equipment. Please be sure to comply with the precautions described in this manual to protect you and others from possible harm. Always follow OSHA standards for safety.

Observe the refrigerant type the unit is designed to work with and any and all precautions on tags, stickers, labels and literature provided and referenced for this equipment. Use only Hussmann approved parts approved through the Hussmann Performance Parts Website. Verify that all repair parts are identical models to the ones they are replacing. Do not substitute parts such as motors, switches, relays, heaters, compressors, power supplies, or solenoids. Read all safety information regarding the safe handling of refrigerant and refrigerant oil, including the Material Safety Data Sheet. MSDS sheets can be obtained from your refrigerant supplier. Service is to be performed by factory-authorized service personnel, so as to minimize the risk of possible injury due to incorrect parts or improper service.

Contractors shall strictly adhere to specifications provided by the Engineer of Record (EOR), as well as US EPA regulations, OSHA regulations, and all other federal, state, and local codes. There are numerous hazards, not limited to, but including: burns due to high temperatures or refrigerant flammability, high pressures, toxic substances, electrical arcs and shocks, very heavy equipment with specific lift points and structural constraints, public safety, noise, and possible environmental damage.

Protocol A2L

User Safety and Product Information

WARNING—READ ENTIRE MANUAL BEFORE ATTEMPTING TO SERVICE THIS PRODUCT. ALL SAFETY PRECAUTIONS MUST BE FOLLOWED. ALL WARNINGS MUST BE UNDERSTOOD BEFORE INSTALLATION OR USE.

⚠ DANGER

A2L FLAMMABLE REFRIGERANT USED

- A2L refrigerant is flammable. Units that are configured to use A2L refrigerants require special attention. No open flames, cigarettes, or other possible sources of ignition should be used inside or in the vicinity of units containing flammable refrigerants.
- Failure to follow instructions can result in an explosion, death, injury and property damage.

⚠ WARNING

THIS REFRIGERATION EQUIPMENT WAS MANUFACTURED FOR USE WITH A2L LOWER FLAMMABILITY REFRIGERANTS. INSTALLATION AND SERVICE MUST ONLY BE PERFORMED BY A QUALIFIED SERVICE PROVIDER. FAILURE TO ABIDE BY THIS WARNING COULD RESULT IN AN EXPLOSION, DEATH, INJURY AND PROPERTY DAMAGE

- WARNING—Risk of fire or explosion. Flammable refrigerant used. To be repaired only by trained service personnel. Do not puncture refrigerant tubing.
- WARNING – Risk of fire. Dispose of properly in accordance with federal or local regulations. Flammable refrigerant used.
- WARNING – Risk of fire. Flammable refrigerant used. Consult repair manual/owner's guide before attempting to service this product. All safety precautions must be followed.
- WARNING – Risk of fire due to flammable refrigerant used. Follow handling instructions carefully in compliance with national regulations.
- WARNING – Risk of fire or explosion – Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.
- WARNING: In order to reduce flammability hazards the installation of this appliance must only be carried out by a suitably qualified person.
- WARNING – Risk of fire or explosion. Dispose of properly in accordance with federal or local regulations. Flammable refrigerant used.
- A2L refrigerants are denser than air.
- Refrigerant collects first in the low areas but can be circulated by the fans.
- If a refrigerant leak is present or suspected, do not allow untrained personnel to attempt to find the cause.
- A refrigerant leak must be repaired by a qualified service technician.
- No open flames, cigarettes, or other possible sources of ignition should be used inside the building where the units are located until the qualified service technician and/or local fire department determines that all refrigerant has been cleared from the area and from the refrigeration systems.
- Component parts are designed for use with flammable refrigerants and are non-incendive and non-sparking. To minimize the risk of possible ignition due to incorrect parts, component parts shall only be replaced with identical repair parts. Servicing shall be done by qualified service personnel only, so as to minimize the risk of possible damage due to incorrect parts or improper service.
- This unit is to be installed in accordance with the Safety Standard for Refrigeration Systems, ANSI/ASHRAE 15.

Protocol A2L

User Safety and Product Information

⚠WARNING

- The appliance shall not be installed in public corridors or lobbies.
- All servicing of this appliance shall be performed only as recommended in this manual.
- This appliance shall only be connected to another appliance suitable for the same refrigerant.
- WARNING—Read entire manual before attempting to service this product. All safety precautions must be followed.
- Installation and service must be performed by a qualified installer or service agency only as recommended by the manufacturer. Do not use any means to clean or service other than those recommended by the manufacturer.
- Contractors shall strictly adhere to specifications provided by the Engineer of Record (EOR), as well as US Environmental Protection Agency regulations, OSHA regulations, and all other federal, state and local codes. This work should only be done by qualified, licensed contractors.
- Installation and use of this appliance includes numerous hazards, not limited to, but including: burns due to high temperatures, high pressures, toxic substances, electrical arcs and shocks, very heavy equipment with specific lift points and structural constraints, food and product damage or contamination, public safety, noise, and possible environmental damage.
- Never leave operating compressors unattended during the manual soft-start process. Always power rocker switches off when unattended.
- Do not store items or flammable materials atop the unit. Do not walk or climb on unit.
- Do not store explosive substances, such as aerosol cans with flammable propellant, in this appliance.
- This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- Children should be supervised to ensure that they do not play with the appliance.
- WARNING: Do not damage the refrigerating circuit.
- Piping in refrigeration systems shall be so designed and installed to minimize the likelihood of hydraulic shock damaging the system. Solenoid valves shall be correctly positioned in the piping to avoid hydraulic shock.
- Solenoid valves shall not block in liquid refrigerant unless adequate relief is provided to the refrigerant system low pressure side.
- If a leak is present or even suspected, do not allow untrained personnel to attempt to find the cause.
- A hand-held leak detector (“sniffer”) will be used before any repair and/or maintenance.
- Do not use any means to clean, other than those recommended by the manufacturer.
- Do not use means to accelerate the defrosting process.
- Do not pierce or burn.
- Be aware that refrigerants may not contain an odour.
- Protection devices, piping, and fittings shall be protected as far as possible against adverse environmental effects, for example, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and debris.
- Piping material, pipe routing, and installation shall include protection from physical damage in operation and service, and be in compliance with national and local codes and standards, such as ANSI/ASHRAE 15, IAPMO

⚠WARNING

Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.

- Always use a pressure regulator when operating nitrogen tanks.
- The installation of pipe-work shall be kept to a minimum.
- Provision shall be made for expansion and contraction of long runs of piping.
- Flexible pipe elements shall be protected against mechanical damage, excessive stress by torsion, or other forces, and that they should be checked for mechanical damage annually.
- After completion of field piping for split systems, the field pipework shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, according to the following requirements:
  1. The minimum test pressure for the low side of the system shall be the low side design pressure and the minimum test pressure for the high side of the system shall be the high side design pressure, unless the high side of the system cannot be isolated from the low side of the system in which case the entire system shall be pressure tested to the low side design pressure.
  2. The test pressure after removal of pressure source shall be maintained for at least 1 h with no decrease of pressure indicated by the test gauge, with test gauge resolution not exceeding 5 % of the test pressure.
  3. During the evacuation test, after achieving a vacuum level specified in the manual or less, the refrigeration system shall be isolated from the vacuum pump and the pressure shall not rise above 1,500 microns within 10 min. The vacuum pressure level shall be specified in the manual, and shall be the lessor of 500 microns or the value required for compliance with national and local codes and standards, which may vary between residential, commercial, and industrial buildings.
- Mechanical connections made in accordance shall be accessible for maintenance purposes.
- LOCK OUT / TAG OUT — To avoid serious injury or death from electrical shock, always disconnect the electrical power at the main disconnect when servicing or replacing any electrical component. This includes, but is not limited to, such items as doors, lights, fans, heaters, and thermostats.
- Means for disconnection must be incorporated in the fixed wiring in accordance with the wiring rules.
- Unit must be grounded. All wiring must be in compliance with NEC and local codes.
- Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes
- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans..
- Particular attention shall be paid to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.
- Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer’s specifications.

Protocol A2L

User Safety and Product Information

⚠WARNING

- During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
- Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.
- Replace components only with parts specified by the manufacturer. Other parts can result in the ignition of refrigerant in the atmosphere from a leak.
- If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
- Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use.
- Ducts connected to an appliance shall not contain a potential ignition source.
- Be careful when moving or lifting Protocol. Serious bodily injury or death could occur from falling equipment.
- Precautions shall be taken to avoid excessive vibration or pulsation of the refrigerant piping
- WARNING: Keep clear of obstruction, all ventilation openings in the appliance enclosure.
- Any insulation shall be suitable for use with the material being insulated.
- Ensure that the apparatus is mounted securely. Do not use adhesives to fix the unit in place, since they are not considered to be a reliable fixing means.
- Refrigerant circuit access ports located outdoors shall be secured to prevent unauthorized access.

FAILURE TO ABIDE BY THESE WARNINGS COULD RESULT IN AN EXPLOSION, DEATH, INJURY, AND PROPERTY DAMAGE. READ ALL WARNINGS PRIOR TO INSTALLING, PERFORMING MAINTENANCE, OR SERVICING THE EQUIPMENT.

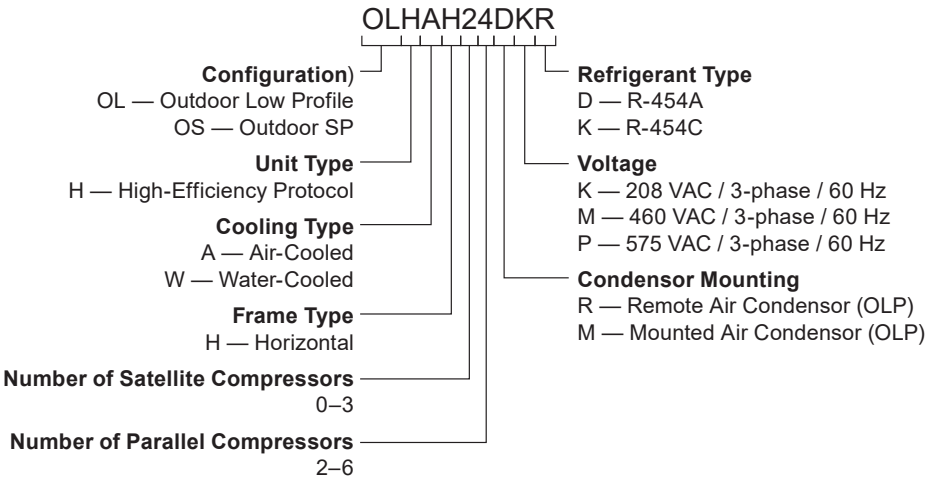
Protocol A2L

User Safety and Product Information

Model Description

Hussmann Protocol A2L is a compact rack system ideal for both new construction and remodel projects for locations such as supermarkets and warehouses. This system operates using A2L refrigerant (R-454A or R-454C) and meets current and upcoming regulatory requirements. A2Ls are synthetic, mildly flammable refrigerants that meet low GWP regulatory requirements and offer the greatest ease of use for technicians compared to other solutions.

System Nomenclature



Glossary

Terms

Refrigerant: A fluid used to freeze or chill (as food) for preservation. A refrigerant, such as R-454A or R-454C, is used to remove heat from cases and unit coolers and transfer the heat to the condenser.

Compressor: This is a device that compresses the refrigerant from a low-pressure low temperature gas to a high pressure high temperature gas and provides mass flow of refrigerant throughout the system.

Liquid/Suction Heat Exchanger: This is a device built for efficient heat transfer between the liquid line and suction line of the primary refrigerant. This device also sub-cools the liquid refrigerant and aids in the complete evaporation of the suction gas.

Electronic Expansion Valve: This is a device built to control the amount of superheat at the evaporator and the air temperature.

Abbreviations

EEV	Electronic Expansion Valve (aka EXV)	**SST**	Saturated Suction Temperature
LT	Low Temperature	**BPHE**	Brazed Plate Heat Exchanger
MT	Medium Temperature	**PRV**	Pressure Relief Valve
PLM	Phase Loss Monitor	**EV**	Economizer Valve

Protocol A2L

User Safety and Product Information

Hussmann Product Control

Serial number and shipping date of all equipment are recorded in Hussmann's files for warranty and replacement part purposes. All correspondence pertaining to warranty or parts ordering must include the serial number of each piece of equipment involved. This is to ensure the customer is provided with the correct parts.

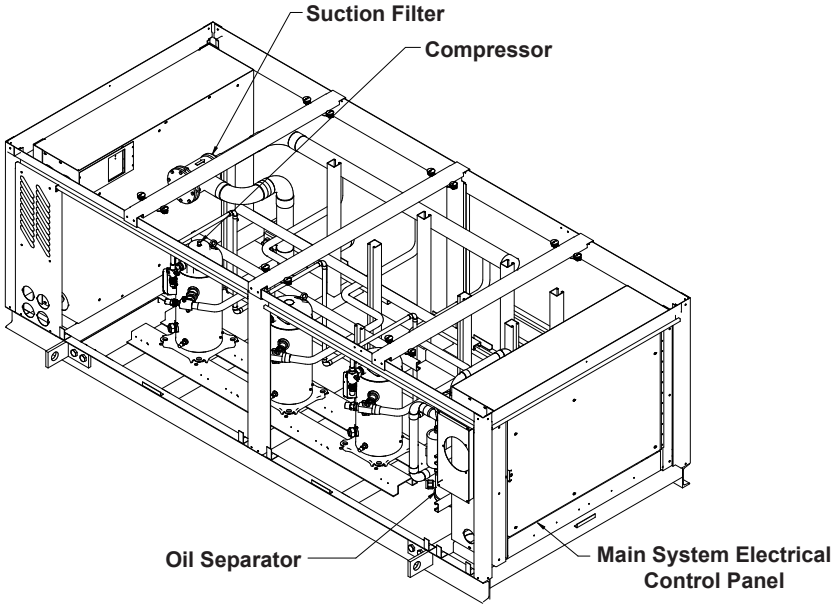
Before Working with A2L Refrigerant

Safety Checks

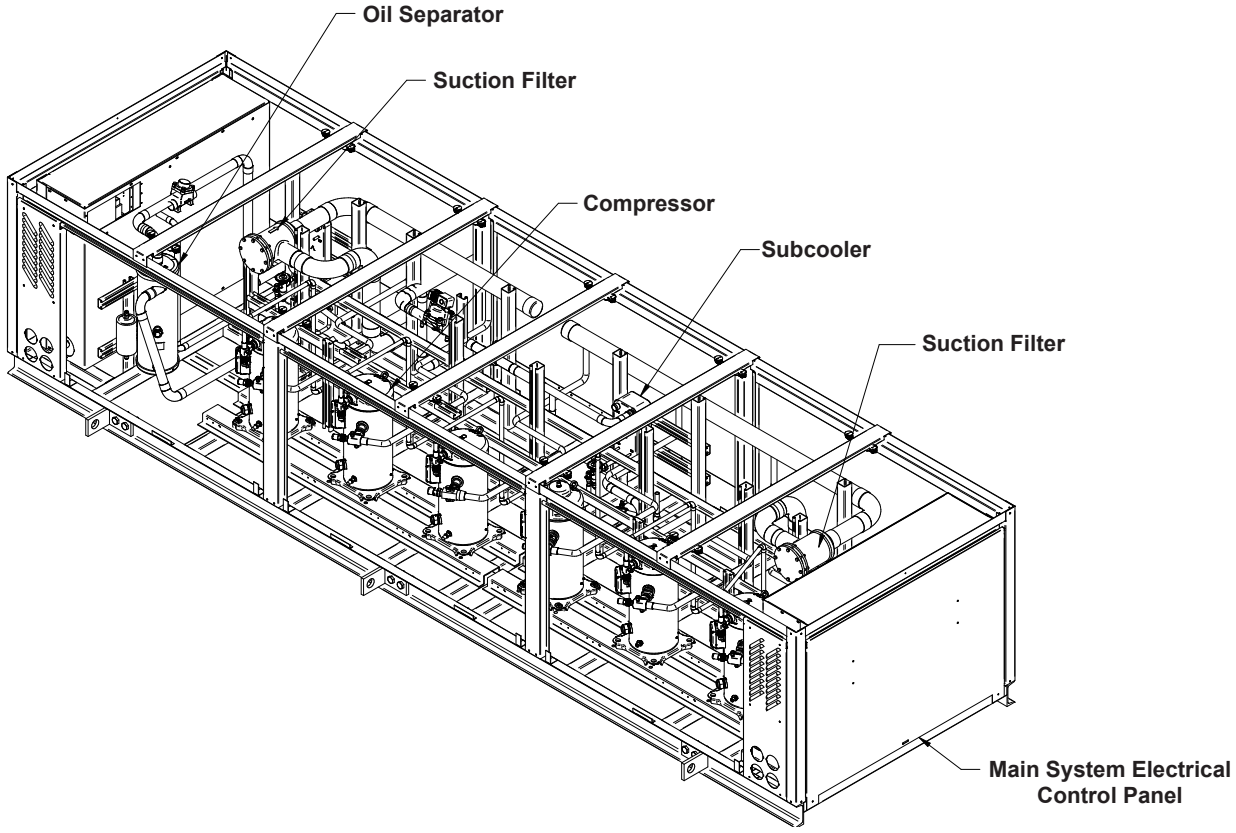
- Prior to beginning work on systems containing FLAMMABLE REFRIGERANTS, safety checks are necessary to ensure that the risk of ignition is minimized.
- Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.
- All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.
- The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e., non-sparking, adequately sealed, or intrinsically safe.
- If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available on hand. A dry chemical or CO2 fire extinguisher should be adjacent to the charging area.
- No person carrying out work in relation to a REFRIGERATING SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment shall be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.
- Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times, the manufacturer's maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer's technical department for assistance.
- The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:
  a. The actual REFRIGERANT CHARGE is in accordance with the room size within which the refrigerant containing parts are installed.
  b. The ventilation machinery and outlets are operating adequately and are not obstructed.
  c. If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant.
  d. Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
  e. Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

Protocol Component Views

SPO / OLP 3 Configuration



OLP 6 Configuration



Protocol A2L

Installation Information

Equipment Inspection / Shipping Damage

Upon delivery of the equipment, verify that the correct equipment has been received by comparing the information on the equipment serial plate with the ordering and submittal documents. All equipment should be thoroughly examined for shipping damage before and during unloading. Equipment has been carefully inspected at our factory prior to shipment. Any claim for loss or damage must be made to the carrier. The carrier will provide any necessary inspection reports and/or claim forms.

Apparent Loss or Damage

If there is an obvious loss or damage, it must be noted on the freight bill or express receipt and signed by the carrier's agent; otherwise, carrier may refuse claim.

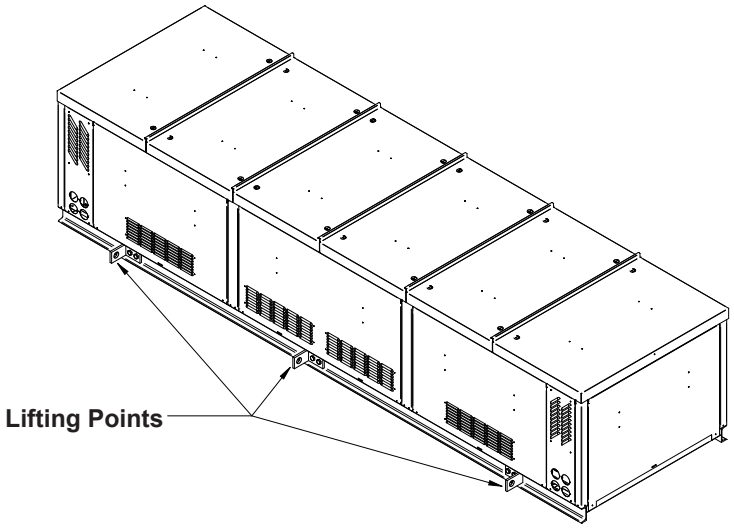
Concealed Loss or Damage

When loss or damage is not apparent until after equipment is uncrated, retain all packing materials and submit a written response to the carrier for inspection within 15 days.

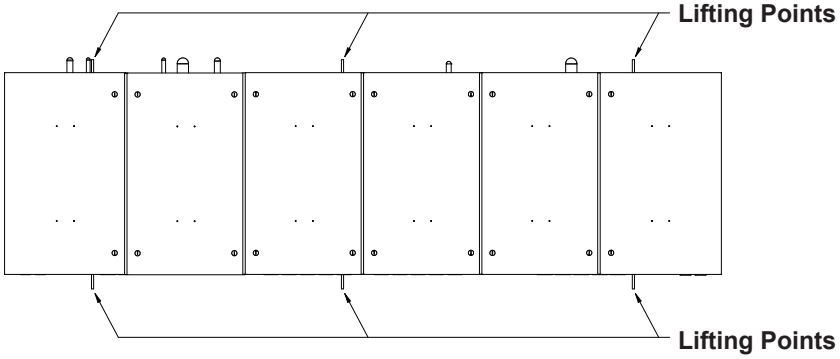
Equipment Handling

Each unit is shipped on skids with panels installed. Lifting points are mounted on the frame as shown. Do not attempt to lift or move the unit using other lift points. Ensure force is not applied to the exterior panels and straps do no contact the Protocol when lifting or moving.

The installer is responsible for ensuring that the equipment used to move the Protocol is operated within its limits. Under no circumstances should the top of the unit or the outer panels be used for lifting or moving the unit. For strap rigging, run the straps to the lifting points only and utilize all provided lifting points.



6-compressor unit shown. Smaller units, such as a 3-compressor model, may use only four total lift points (two per side).



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Protocol A2L

Installation Information

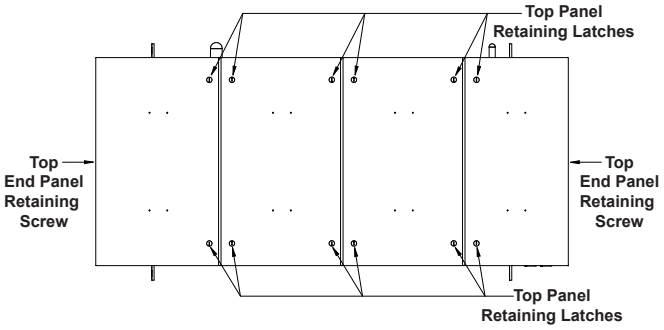
Exterior Loading

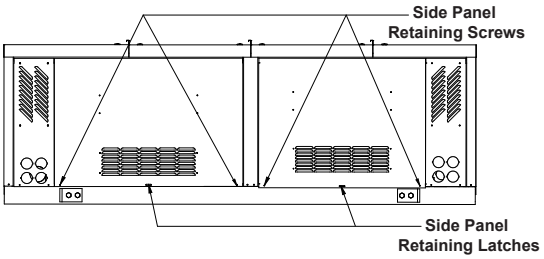
Do not stack or store items on or inside of the Protocol for any reason.

Panel Removal

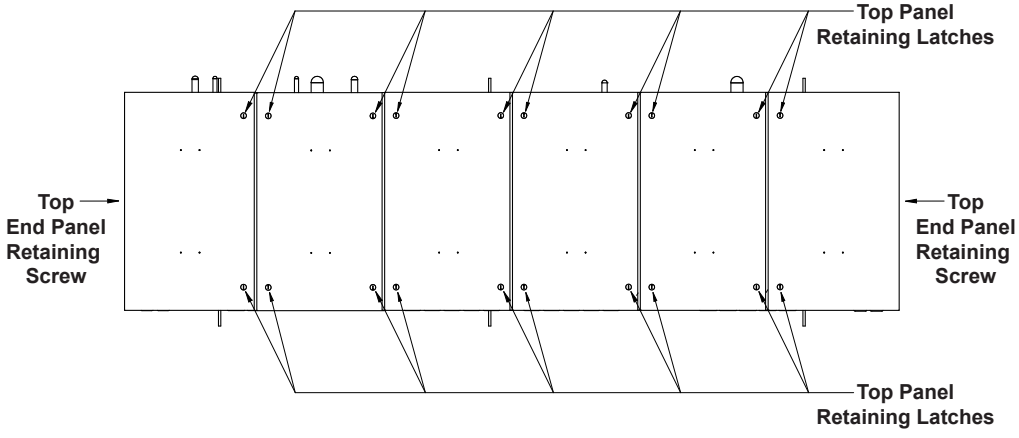
Latch and Fastener Locations

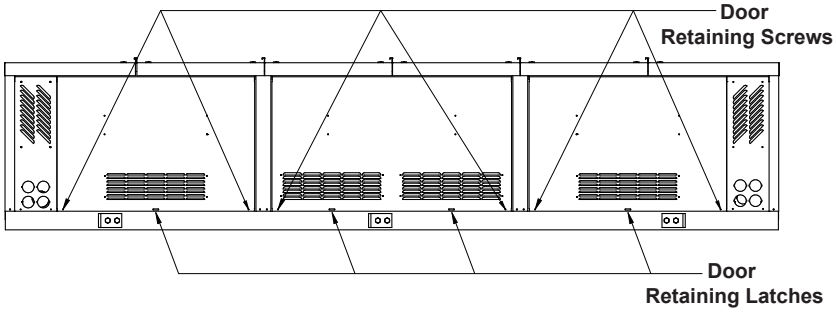
SPO / OLP 3 Configuration





OLP 6 Configuration





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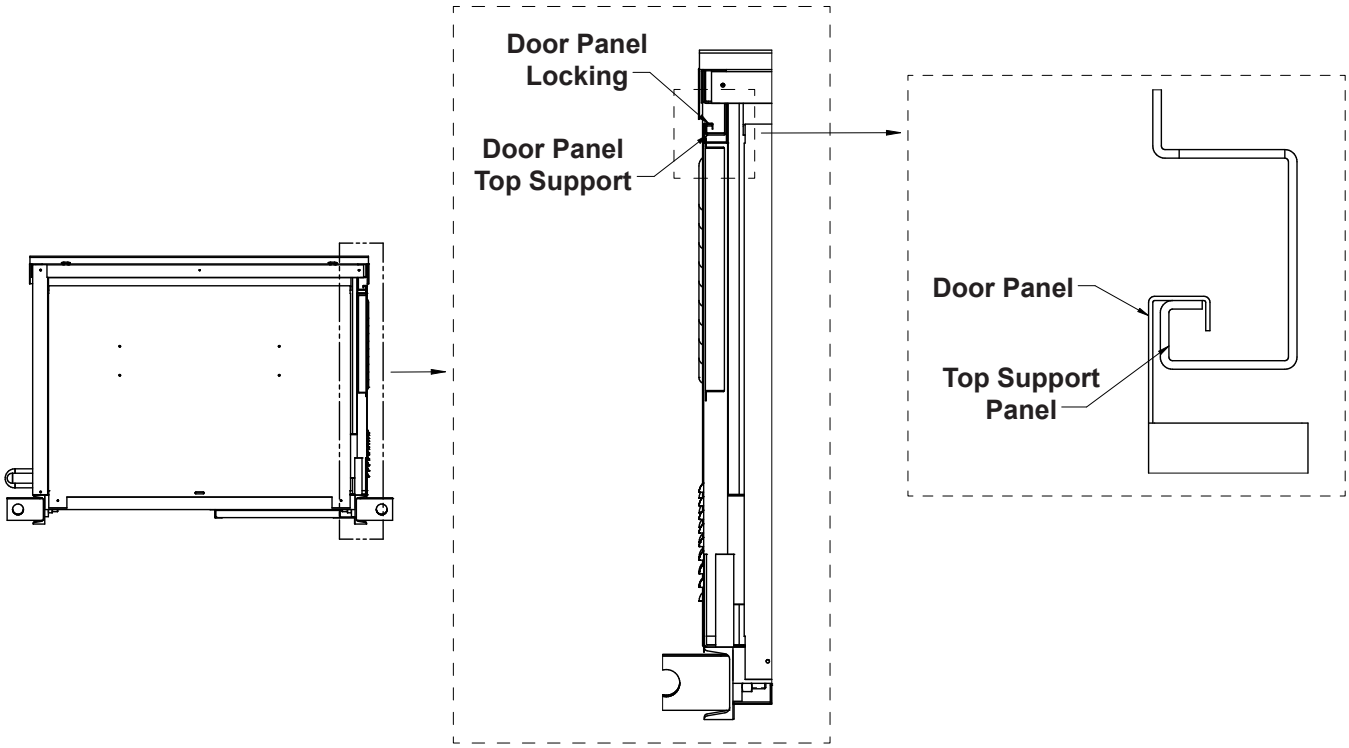
Protocol A2L

Installation Information

Side Panel

At the top, a bracket in a channel supports each panel (pictured below). At the bottom, each panel is secured using two screws and a latch. Remove the screws at the bottom of the panel, release the latch, slide the panel out at the bottom, and then slide up and out to remove it.



Top Panel

For non-end panels, release all latches and lift the panel off. For end panels, remove the retaining screw on the side of each panel, then release latches and lift the panel off.

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Protocol A2L

Installation Information

Location

Equipment must be located in a dedicated operating area to provide enough working space for service personnel and meet applicable electrical codes.

The floor/ground must solidly support the compressor unit as a live load. Ground level installation seldom presents problems, but a mezzanine installation must be carefully engineered. A concrete base must be built on the mezzanine floor to keep mechanical vibrations and noise to an acceptable level.

- Outdoor units of any kind shall not be installed within 20 ft (6.1 m) of any building opening.
- If this product is enclosed within a penthouse, lean-to, or other open structure, natural or mechanical ventilation shall be provided.
- Any pressure-relief devices and fusible plugs shall discharge to the atmosphere at a location not less than 15 ft (4.57 m) above the adjoining ground level and not less than 20 ft (6.1 m) from any window, ventilation opening, or exit in any building.
- Refrigerant circuit access ports located outdoors shall be secured to prevent unauthorized access.

Recommended spacing is site specific. It is the installer's responsibility to check local codes and standards.

Protocol A2L

Installation Information

Receiver Size

Model	Receiver Size(s) (may vary by configuration)
SPO / OLP 3	30" x 8 5/8" 30" x 6"
OLP 6	55" x 6" 42" x 8 5/8" 60" x 10 3/4" 52" x 8 5/8" (tandem)

Water Loop Components

SPO units come equipped a flow control/shutoff valve for servicing the plate heat exchanger. Y-type strainer, circuit setter, and water regulating valve can also be factory-installed as ordered. All non factory-installed water loop components must be field-supplied and field-installed. A 16-mesh strainer is required immediately upstream of each Protocol.

Accessibility

All standard control panel doors require 40 in. (1,016 mm) accessibility clearance. Control panel doors require 48 in. (1,219 mm) accessibility clearance. A minimum of 40 in. (1,016 mm) access to all sides (and top) is also recommended.

It is the responsibility of the installer to ensure that the final equipment installation meets all applicable code requirements. For electrical clearances, N.E.C. and local electrical code restrictions must be followed.

Protocol A2L

Installation Information

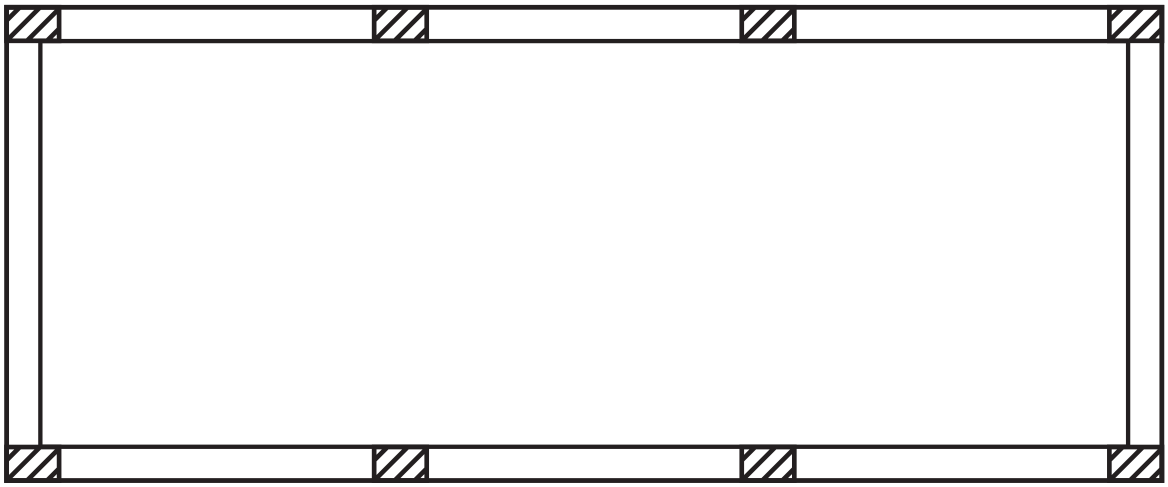
Vibration Pads

Vibration isolation pads are supplied with each Protocol. The entire weight of the Protocol must rest on these pads. Eight pads are included with each Protocol. The pads should be evenly spaced and be located as shown in the image below. Cross-level the compressor unit so all compressors are level with each other.

WARNING: Be careful when moving or lifting Protocol. Serious bodily injury or death could occur from falling equipment.

Vibration Pad Installation:

1. Lift the Protocol following local, state, and federal requirements for safety.
2. Place minimum 15-gauge 3 in. by 3-in. galvanized or stainless steel shims to compensate for uneven surfaces. (shims must be field supplied)
3. Place vibration isolation pads on top of shims, evenly distributed along the base of the unit. There are eight to ten pads for each horizontal indoor unit and four for each vertical indoor unit; all supplied pads must be used.



Protocol A2L

Installation Information

Electrical Overview

Custom wiring schematics are located on the doors of each Protocol. Protocols are wired for either 208 VAC / 3-phase / 60 Hz, 460 VAC / 3-phase / 60 Hz, or 575 VAC / 3-phase / 60 Hz. Appropriate branch, ground, and neutral circuits must be provided for the voltage required by the Protocol being installed. Refer to the serial plate located on the control panel to determine MCA and MOPD. Refer to merchandiser serial plates or datasheets for electrical supply requirements for cases.

The control circuit is powered from main feed and may use a separate power supply for low voltage controllers. The Protocol control panel may contain several potential controller voltages depending on configuration including 24 VDC, 120 VAC, and/or 208 VAC.

Standard 120 VAC input components include one service receptacle (5 A max), 120 VAC to 24 VDC transformer, compressor control coils, valve solenoids, and external alarm light.

NOTE: The current draw required by an analog meter (Volt-Ohm Meter or VOM) can permanently damage some electronic equipment. Never use a VOM to check computer components or computer-controlled systems. Use a digital multimeter (DMM) to measure voltage, current, and/or resistance. If a range is exceeded the display will display OL (overload).

Field Wiring

Protocol components are wired as completely as possible at the factory with all work completed in accordance with the National Electrical Code (NEC). All deviations required by governing electric codes will be the responsibility of the installer.

The lugs on the circuit breaker package in the convenience switch box are sized for copper wire with 75° C THW insulation only. All wiring must be in compliance with governing electrical codes. Based on the full load amps of the system, select the largest connectible wire size.

Total connected FLA largest connectible wire:
200 A (max) 3 /0 per Ø
400 A (max) (2x) 3 /0 per Ø

Include control circuit amps if single point connection transformer option is used; 6 A for 460 V systems (refer to NEC for temperature duration factors).

Note: A convenience switch is provided as part of the unit. A Branch Circuit must be built to the unit using information supplied on the unit data plate for Minimum Current Ampacity (MCA) and Maximum Over Current Protective Device (MOPD).

Sizing Wire And Over-Current Protectors

Check the serial plate for Minimum Circuit Ampacity (MCA) and Maximum Over-current Protective Devices (MOPD). Follow NEC guidelines.

Protocol A2L

Installation Information

Component Wiring Guidelines

Check the store legend for components requiring electrical circuits to either the panel, which may include:

- Remote alarm
- Electronic temperature probe
- Defrost termination thermostat
- 24 V power supply
- Fan and anti-sweat heater circuits
- Satellite control
- Electrical defrost heaters
- Case mounted refrigeration solenoid
- Case lighting
- Unit cooler fan power (electric defrost only)

1. Disconnect all power sources, and if the equipment has a dual power source, disconnect both and follow NEC guidelines when installing wires or changing components.
2. When running control wires for a 120 V separate power circuit, the voltage rating of the wire should be at least 600 V.
3. Use caution not to damage any assembled wires during installation and when removing the knockouts. Use appropriate strain reliefs so that no nick or burr could cause insulation damage.
4. Ensure the appropriate length of wire is used, and when running the wires allow adequate spaces and creepage distances as permitted by NEC.

All thermostat wires should be sized for Protocol control circuit breaker. Refer to the controller manufacturer's literature for temperature sensor wiring. Check field wiring requirements for appropriate quantity of wires.

Other Controls

Refer to the wiring schematics included with the Protocol when other controls are used.

Protocol A2L

Installation Information

Merchandiser Electrical Data

Technical data sheets are included with merchandisers. The datasheets provide merchandiser specifications such as electrical data, electrical schematics, and performance data where available. Refer to the technical datasheets and merchandiser serial plate for electrical information.

Merchandiser Field Wiring

Field wiring must be sized for component amperes stamped on the serial plate. Actual ampere draw may be less than specified. Field wiring from the refrigeration control panel to the merchandisers is required for defrost termination thermostats and for optional refrigeration thermostats. When multiple display cases are on the same defrost circuit, the defrost termination thermostats are wired in series.

WARNING: Always check the serial plate for component amperes.

Electrical Connections

All wiring must be in compliance with NEC and local codes. Based on rain-test results, all control wiring located outside the electrical panel shall terminate in dedicated junction boxes (J-boxes) mounted adjacent to the compressor.

Electrical / Wiring Diagrams

All electrical schematics reflect the standard ladder diagram. Electrical schematics are included with each Protocol. Please keep in mind any diagrams in this manual are only examples. Wiring may vary, refer to the diagram included with each Protocol. To focus on circuit logic, the diagram may separate a relay coil and its contacts. Electrical terminal connections are clearly numbered and aid in troubleshooting should a problem arise.

Cooler Door Switch Wiring

Check the store legend for door switch requirements. The switch must be mounted to the cooler door frame and must be wired to control the electronic expansion valve and the evaporator fan circuit. Door switches are wired in series.

Protocol A2L

Installation Information

Electrical Legend

RELAY CONTACTS NORMALLY OPEN

RELAY CONTACTS NORMALLY CLOSED

JUMPER

SPLICE

CLOSE ON RISE
FAN CONTROL

CLOSE ON RISE PRESSURE CONTROL
LOW PRESSURE

OPEN ON RISE PRESSURE CONTROL
HIGH PRESSURE

OIL CONTROL

LIGHT

COOLING FAN

TERMINAL BLOCK

THERMOSTAT OPEN ON RISE
DISCHARGE TEMPERATURE OR DEFROST TERMINATION THERMOSTAT

THERMOSTAT CLOSE ON RISE
REFRIGERATION THERMOSTAT

\# COMPRESSOR OR CIRCUIT NUMBER

FACTORY WIRING

FIELD WIRING

GROUND

120V RECEPTACLE

CURRENT SENSING RELAY

CONTACTOR

COMPRESSOR

SOLENOID (SUCTION SOLENOID,
HOT GAS SOLENOID, LIQUID SOLENOID,
INJECTION SOLENOID, HEAT RECLAIM
SOLENOID, LIQUID DIFFERENTIAL SOLENOID,
MAIN LIQUID LINE SOLENOID)

RELAY OR COIL (ALARM RELAY,
MOTOR CONTACTOR COIL, FAN RELAY,
FAN CONTACTOR, ALARM RELAY, ETC.)

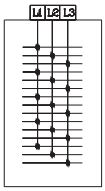
SINGLE POLE CIRCUIT BREAKER

TWO POLE CIRCUIT BREAKER

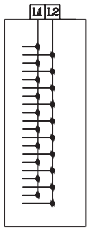
THREE POLE CIRCUIT BREAKER

PHASE MONITOR

TRANSFORMER



THREE PHASE
BUSSBAR

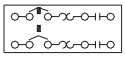


SINGLE PHASE
BUSSBAR

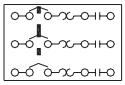
POWERLINK MOTOR

POWERLINK POWER SUPPLY

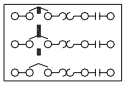
SINGLE POLE POWERLINK



TWO POLE POWERLINK



THREE POLE POWERLINK



THREE POLE MOTORSTARTER
460V OR 575V COMPRESSORS

MISC. NOMENCLATURE

PL - POWERLINK CIRCUIT BREAKER
PS - POWERLINK POWER SUPPLY
AR1 - ALARM RELAY #1
GAR - GENERAL ALARM RELAY
HPC - HIGH PRESS. CONTROL
LPC - LOW PRESS. CONTROL
OLA - OIL LEVEL ALARM
PLA - PHASE LOSS ALARM
SBA - SWITCHBACK ALARM RELAY
LS - LIQUID SOLENOID VALVE
RT - REFRIGERATION T'STAT
SS - SUCTION STOP SOLENOID VALVE
HGV - HOT GAS SOLENOID VALVE
* - DISCONNECT TERMINAL PIN

WIRE COLOR CODE

B = BLACK
BL = BLUE
BR = BROWN
O = ORANGE
P = PURPLE
R = RED
Y = YELLOW
W = WHITE
G = GREEN

Protocol A2L

Installation Information

Piping Overview

Important: Since Hussmann has no direct control over the installation, providing freeze-burst protection is the responsibility of the installing contractor.

Always use a pressure regulator with a nitrogen tank. Do not exceed 2 psig (0.14 bar) and vent lines when brazing. Do not exceed 350 psig (24.1 bar) for leak testing on high side. Do not exceed 150 psig (10.3 bar) for leak testing on low side. Always recapture test charge in approved recovery vessel for recycling. The Water Loop should be tested for leaks using pressurized water. DO NOT exceed 75 psig (5.2 bar) at the lowest point in the piping.

This section provides information for installing the refrigeration lines for a Protocol. The components are piped as completely as practical at the factory. Field piping requires only interconnection of the major components and the coolers, freezers, and display cases. Piping must also be supported to minimize vibration. Pulsation of the refrigerant and compressor vibration can cause piping to vibrate. This vibration can cause line breakage and damage to components.

Use only clean, dehydrated, sealed refrigeration grade copper tubing. Use dry nitrogen at low pressure in the tubing during brazing to prevent the formation of copper oxide.

Vertical risers should be supported within 18 in. of the inverted trap.

Hanger should attach to top chord of the rafter/truss.

All Protocol units have one-inch drip pan at the bottom of the unit. DO NOT run piping through the pan.

Piping Installation Requirements

- Installation shall include protection from physical damage in operation and service and be in compliance with national and local codes and standards, such as ANSI/ASHRAE 15, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.
- The installation of pipework shall be kept to a minimum.
- A brazed, welded, or mechanical connection shall be made before opening the valves to permit refrigerant to flow between the refrigerating system parts.
- Mechanical connectors used indoors shall comply with ISO 14903 or UL 207 or CSA C22.2 No. 140.3. When mechanical connectors are reused indoors, sealing parts shall be renewed. When flared joints are reused indoors, the flare part shall be refabricated.
- Refrigerant tubing shall be protected or enclosed to avoid damage. Flexible refrigerant connectors (such as connecting lines between the indoor and outdoor unit) that might be displaced during normal operation shall be protected against mechanical damage.
- Mechanical connections shall be accessible for maintenance purposes.
- Provision shall be made for expansion and contraction of long runs of piping.
- Protection devices, piping, and fittings shall be protected as far as possible against adverse environmental effects, for example, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and debris.
- Piping in refrigeration systems shall be so designed and installed to minimize the likelihood of hydraulic shock damaging the system.
- Steel pipes and components shall be protected against corrosion with a rustproof coating before applying any insulation.

Installation Information

- Flexible pipe elements shall be protected against mechanical damage, excessive stress by torsion, or other forces, and they should be checked for mechanical damage annually.
- Precautions shall be taken to avoid excessive vibration or pulsation of the refrigerant piping.
- After completion of field piping for split systems, the field pipework shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, according to the following requirements as detailed by UL safety standard. Pressures may come from unit data plate or from customer specification.
  1. The minimum test pressure for the low side of the system shall be the low side design pressure and the minimum test pressure for the high side of the system shall be the high side design pressure, unless the high side of the system cannot be isolated from the low side of the system in which case the entire system shall be pressure tested to the low side design pressure.
  2. The test pressure after removal of the pressure source shall be maintained for at least 1 hour with no decrease of pressure indicated by the test gauge, with rest gauge resolution not exceeding 5% of the test pressure.
  3. During the evacuation test, after achieving a vacuum level specified in the manual or less, the refrigeration system shall be isolated from the vacuum pump and the pressure shall not rise above 1,500 microns within 10 min.
- Field-made refrigerant joints indoors shall be tightness tested according to applicable codes and requirements.
- Equipment piping in the occupied space shall be installed in such a way to protect against accidental damage in operation and service.
- Solenoid valves and/or safety shut-off valves shall be correctly positioned in the piping to avoid hydraulic shock or pressure.
- Insulation shall be suitable for use with the material being insulated.
- The indoor equipment and pipes shall be securely mounted and guarded such that accidental rupture of equipment cannot occur from such events as moving furniture or reconstruction activities.

Field Piping and TXV Sizing

Besides standard discharge lines, the liquid return line from the condenser must also be piped back to the unit when remote air-cooled units are used with low temperature cases.

If the unit has low and medium temp suction groups, the Protocol unit will have two liquid lines leaving the unit—one for medium temperature cases and one for low temperature cases. Only the liquid to the low temp cases will be sub-cooled to 50° F (10° C). The liquid to the medium temp cases will be at the condensing temperature.

Units with low temp compressors must insulate the liquid line to the low temp cases/walk-ins coolers since the refrigerant is at a sub-cooled temperature. Also, suction line sizing should take into account the lower liquid temperature.

When expansion valves are selected for the cases, they should be sized for a liquid temperature of 50 °F (10° C) due to sub-cooling.

TXV and EPR Service Access

There is a shut-off valve before the TXV for service of solenoids, TXV, or EPR in the low temp economizer loop. Shut-off valves are also present at each compressor injection port.

Hussmann Corporation • Bridgeton, MO 63044 U.S.A. • www.hussmann.com
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900

Protocol A2L

Installation Information

Copper Tubing and Fittings

Brazed joints should be made with standard industry practices. Use nitrogen purging, flux, and Sil-fos (Hussmann recommends 15% silver content) for copper-to-copper joints. For copper to dissimilar metal, Hussmann recommends 45% silver.

Insulation requirements should follow job specifications. Standard tube bracing and supports are required, and standard suction practices are required (trapping and proper riser sizing).

Maximum Spacing Between Pipe Supports for Copper Tubing

Nominal Diameter (OD)	Maximum Span in Feet
5/8”	5
7/8”	6
1 1/8”	7
1 3/8”	8
1 5/8”	9
2 1/8”	10
2 5/8”	11
3 1/8”	12
3 5/8”	13
4 1/8”	14

Protocol A2L

Installation Information

Copper Tubing

Included below is the Mueller pressure rating chart for Type-L & K ACR copper tubing. The below information provided is from Mueller Industries and is available on muellerstreamline.com

STREAMLINE® NITROGENIZED seamless copper tube is available in sizes 3/8" OD through 3-1/8" OD. Larger sizes from 3-5/8" OD through 8-1/8" OD are cleaned and capped. Manufactured and cleaned in accordance with ASTM B280. 20-ft. lengths hard drawn - cleaned and capped - color coded - Marked "ACR/MED"

TYPE K NITROGENIZED ACR / MED — **RATED WORKING PRESSURE (PSIG)**

O.D. DIA.	WT/FT	150°F	200°F	250°F	300°F	400°F
3/8	0.145	913	877	860	842	537
1/2	0.269	960	923	904	885	565
5/8	0.344	758	728	713	698	446
3/4	0.418	700 †	700 †	700 †	577	368
7/8	0.641	700 †	700 †	700 †	668	426
1 1/8	0.839	700 †	700 †	700 †	513	327
1 3/8	1.04	700 †	700 †	700 †	416	266
1 5/8	1.36	700 †	700 †	700 †	387	247
2 1/8	2.06	700 †	700 †	700 †	341	217
2 5/8	2.93	700 †	700 †	700 †	312	199
3 1/8	4	500^	500^	500^	302	193
3 5/8	5.12	450^	450^	450^	286	183
4 1/8	6.51	450^	450^	450^	282	180
5 1/8	9.67	293	281	276	270	172
6 1/8	13.9	295	283	277	271	173
8 1/8	25.9	314	301	295	289	184

TYPE L NITROGENIZED ACR / MED

3/8	0.126	777	747	731	716	457
1/2	0.198	700 †	700 †	700 †	612	391
5/8	0.285	700 †	700 †	700 †	567	362
3/4	0.362	700 †	700 †	700 †	496	316
7/8	0.455	700 †	700 †	700 †	457	292
1 1/8	0.655	700 †	700 †	700 †	388	248
1 3/8	0.884	700 †	700 †	700 †	344	220
1 5/8	1.14	650^	650^	650^	320	205
2 1/8	1.75	550^	550^	550^	285	182
2 5/8	2.48	500^	500^	500^	263	168
3 1/8	3.33	450^	450^	450^	249	159
3 5/8	4.29	450^	450^	450^	238	152
4 1/8	5.38	400^	400^	400^	230	147
5 1/8	7.61	229	229	215	211	135
6 1/8	10.2	213	213	201	196	125
8 1/8	19.3	230	230	216	212	135

Tables give computed allowable stress at indicated temperatures for copper tube that has been annealed either through brazing or an annealing furnace.

† UL Recognized to 700 PSI (select sizes)
^ Rated in accordance with UL 207 Performance Testing

A BRAND OF MUELLER INDUSTRIES

Refrigeration Line Runs

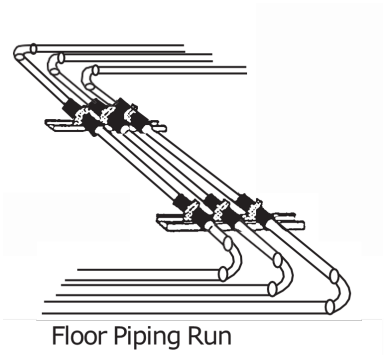
Liquid lines and suction lines must be free to expand and contract independently of each other. Do not clamp or solder them together. Supports must allow tubing to expand and contract freely. Do not exceed 100 feet without a change of direction and/or offset.

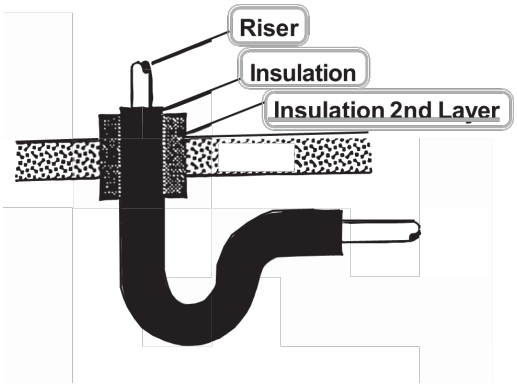
Pitch horizontal suction lines toward the compressor Protocol with a slope of 1/2” for every 10 feet. All suction risers should have a p-trap installed at the base of the riser and have an inserted trap installed at the top of the riser. All traps should be the same diameter as the horizontal run. Install a suction midpoint p-trap for every 16’ of vertical rise. Install a one-piece trap for both the base and inverted trap.

Use long radius elbows to reduce line resistance and breakage. Avoid the use of 45-degree elbows. Install service valves at several locations for ease of maintenance and reduction of service costs. These valves must be UL approved for the minimum design working pressure of the system (450 psig).

Piping Through Walls and Floors

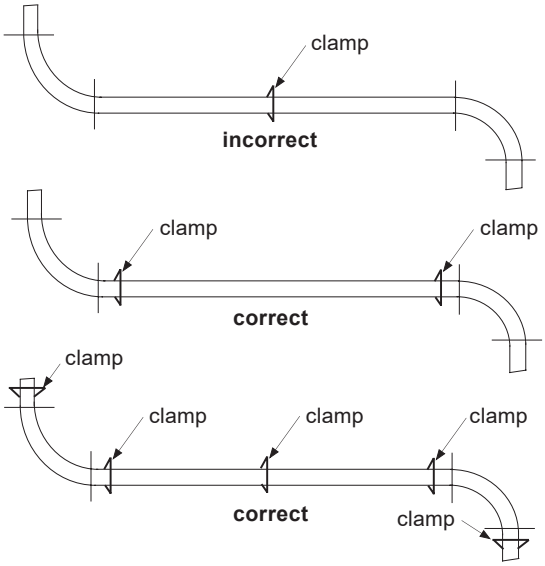
Refrigeration lines that are run through walls or floors must have a p-trap installed, and the lines must be properly insulated. Avoid running lines through the refrigeration cases. When this is done, the lines must be adequately insulated using a closed-cell elastomeric foam insulation.


Floor Piping Run



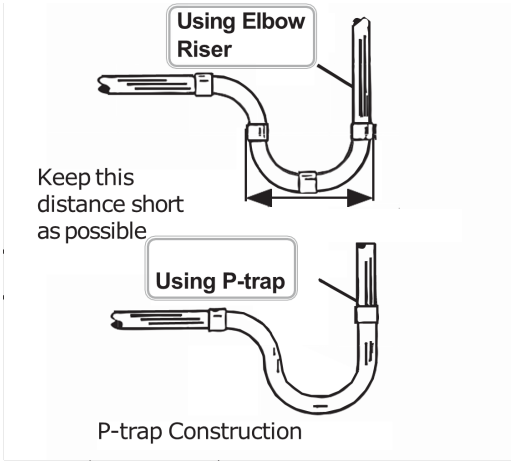
Piping From Machinery to Solid Object

When mounting lines from machinery to a solid object, allow line to be able to move appropriately to prevent metal fatigue from vibration. Do not over support piping that is in contact with the compressor. The machinery must not be tightly stressed from piping that does not allow for some vibration. If piping is too tight metal fatigue will occur.



P-Trap Construction

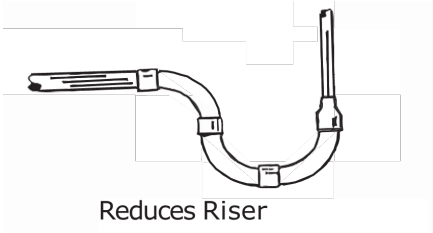
P-traps must be installed at the bottom of all suction risers to return oil to the compressors to avoid trapping oil.



P-trap Construction

Reduced Riser

When a reduced riser is necessary, place the reduction coupling downstream of the p-trap.


Reduces Riser

Protecting Valves and Clamps

When brazing near factory installed clamps or valves be sure to protect them with a wet rag to avoid overheating. Insulate all reduced risers. Avoid using water or wet rags to cool a brazed joint. Allow brazed joints to air cool.

All clamps must be properly anchored. Rubber grommets must be installed to prevent chafing of the lines.

Elbows

Only use long radius elbows. Long elbows have been shown to have less pressure drop and greater strength. It is especially important to use long radius elbows for hot gas discharge lines.

Factory Supplied Stubs

Stub sizes provided from the manifolds do not automatically correspond to the line sizes necessary. It is the installer's responsibility to supply reduction couplings.

Protocol A2L

Installation Information

Offset and Expansion Loop Construction

Inches of Linear Expansion per Length of Run

For low temperature applications, multiply the length of the run-in feet by 0.0169.

For medium temperature applications, multiply the length of the run-in feet by 0.0112.

Example 1:

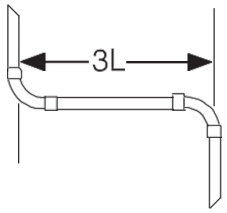
Low temperature application, a run of 84 ft of 1 3/8 in. OD pipe.
84 ft x .0169 = 1.4196 inches of expansion

Select the smallest “Inches of Expansion” figure equal to or greater than the product in step one from the table below. Follow that column down until it intersects the OD line size of the run. The number listed at the intersection is the “L” valve for figuring offset an expansion loop size.

Equivalent Feet for Angle Valve and 90° Elbow				
Inches of Expansion				OD Line Size
0.5	1	1.5	2	
10	15	19	22	7/8”
11	16	20	24	1 1/8”
11	17	21	26	1 3/8”
12	18	23	28	1 5/8”
14	20	25	31	2 1/8”
16	22	27	32	2 5/8”
18	24	30	34	3 1/8”
20	28	34	39	4 1/8”

Example 2 (Offset Construction):

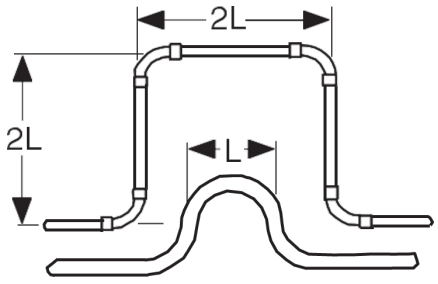
The smallest “Inches of Expansion” equal to or greater than 1.4196 is 1.5. The 1.5 column intersects with the 1 3/8” line at 21. Use “L” value 21. For an offset multiply the “L” value by 3 to determine the length of the offset.



An “L” value of 21 would mean 3L = 3 X 21 or 3L = 63.

Example 3 (Expansion Loop Piping):

The offset distance required for low temperature application for an 84 ft run of 1 3/8” line is 63 inches. For an expansion loop, multiply the “L” value by 2 if hard copper and long radius elbows are used. If the expansion loop is formed in soft copper the loop diameter equals “L”.



For the same 84 ft run, a hard copper loop is 42 x 42 inches. A soft copper loop is 21 x 21 inches.

Application Notes

Do not exceed a straight run for 100 feet without a change in direction or construction of an expansion loop. Place an offset or loop in the middle of the run to minimize pipe shift and joint stress.

Sizing of all refrigerant lines is the responsibility of the installing contractor. Contact Hussmann Application Engineering if assistance is needed.

Protocol A2L

Installation Information

Branch Line Piping

Suction Line

Pitch in the direction of flow. A p-trap is required for all vertical risers. Line size may be reduced by one size at one third of case run load and again after the second third. Do not reduce below evaporator connection size. Suction returns from evaporators and must enter at the top of the branch line.

Liquid Line

May be reduced by one size after one half other case load run. Do not reduce below evaporator connection size. Take-offs to evaporators must exit from the bottom of the liquid line. Provide an expansion loop for each evaporator take-off (minimum 3-inch diameter).

Copper Tubing Considerations

During the brazing process, it is required to flow dry nitrogen within the piping to prevent oxidation and scaling.

WARNING: Always use a pressure regulator when operating nitrogen tanks.

Copper Tube and Fitting Pressure Rating

Product Line	*Product Type*	*Diameter*	
Copper Tube	Streamline ACR – Type L (Hard Lengths) Streamline ACR – Type K (Hard Lengths)	1/8″ – 1 3/8″ 1/8″ – 2 5/8″	UL Approved for 700 psi (48 Bar)
Copper Fittings	Streamline Wrot Solder-Joint Pressure	1/8″ – 2 5/8″	

Safety Shut-Off Valves

a. Do not attempt to operate system without shut-off valves installed on interior components of the refrigeration system.
b. Safety shut-off valves will not block in liquid refrigerant unless adequate relief is provided to the refrigerant system low pressure side.
c. Safety shut-off valves are located in a way such that leaks upstream of the safety shut-off valve will not enter the internal volume of the partial unit and in a space with a room volume large enough so that the maximum refrigerant charge complies to the limit for releasable charge.

Protocol A2L

Installation Information

Water Loop Piping

Important: Since Hussmann has no direct control over the installation, providing freeze-burst protection is the responsibility of the installing contractor.

It is mandatory that glycol be added to the water loop before startup to prevent freezing. Use only non-ferrous metal or PVC for water loop piping. The water loop should be tested for leaks using pressurized water.

CAUTION: DO NOT exceed 75 psig (5.2 bar).

Piping Connection

- PVC pipe should be solvent-welded (glued) together as described in the adhesive instructions.
- Pipe fittings must be clean and dry.
- Cut pipe with a guillotine type cutter to get a clean, square cut—remove any burrs after cutting.
- Use purple primer on both pipe and fitting before adhering pipes together.
- Apply adhesive to both pipe and fitting and join with a twisting motion.
- Hold joint together for approximately 30 seconds to allow adhesive to set.
- Allow adhesive to dry for 24 hours before putting in to service.
- Where it is necessary to connect plastic and metal pipe, DO NOT USE A THREADED CONNECTION. A compression type fitting should be used. For larger pipe sizes, a flanged connection may be used.

Isolation Valve

Install isolation valves at inlet and outlet of each unit. It is good practice to include isolation valves at several locations throughout the piping. For example, valves should be used where branches tie into main supply and return lines. PVC plastic ball valves may be used.

Strainers

Use a 16-mesh strainer at inlet of each unit. Position isolation valves so that this strainer can be opened for cleaning as needed.

Air Vent Valves

Manual air vent valves are recommended. Air vent valves should be located at piping high points where air will tend to collect. Momentarily open these vents and release trapped air a few times during startup.

Tie-Ins to Supply Headers

Branch supply pipes SHOULD NOT tie into the bottom of main supply pipes. Always tie into top of a main supply pipe—the “T” fitting should point UP, NOT DOWN.

Protocol A2L

Installation Information

Pipe Supports

Pipe supports should be provided as follows:

Nominal Pipe Size in Inches	Distance Between Supports in Feet (Schedule 40 Pipe @ 100° F [37.8° C])	Distance Between Supports, feet (Schedule 80 Pipe @ 120° F [48.9° C])
1	4.5	3.5
1.5	5	3.5
2	5	4
3	6	4.5
4	6.5	5
6	7.5	6

Do not clamp supports tightly—this restricts axial movement of the pipe. Supports should provide a smooth bearing surface that conforms to the bottom of the pipe and should be a minimum of 2 in. (51 mm) wide.

Exposure to Direct Sunlight

Piping should not be exposed to direct sunlight. A thin layer of cover can provide adequate shade.

Leak Check

Check for leaks in the piping before startup by filling with pressurized water at 50 psig (3.4 bar).

Cleaning and Flushing

The pipe loop should be cleaned before the system is put into service.

- Fill the closed loop with a solution of 1% trisodium phosphate and 99% water (by weight).
- Circulate the detergent/water solution for 24 hours.
- Drain the loop and refill with fresh water. Circulate for at least 3 hours.
- Drain and refill again.
- Repeat until all phosphate is gone.

Filling System

The water loop MUST have adequate corrosion protection. In most situations, using fully-inhibited, industrial grade ethylene glycol or propylene glycol 30% (by volume) with water can provide corrosion protection. For most installations, 30% glycol by volume will also provide BURST protection to -20° F (-28.9° C).

If the store location has particularly hard water—with a total hardness greater than 100 ppm—the water used to fill the loop should be softened or distilled. Local water treatment vendors can provide information on water quality.

Use only industrial grade, fully inhibited ethylene or propylene glycol, such as Dow Chemical's Dowtherm SR-1 or Dowfrost. Consult local regulations as to which type to use—ethylene or propylene. Propylene glycol is generally considered non-toxic, while ethylene glycol is somewhat toxic. DO NOT USE AUTOMOTIVE GRADE GLYCOL.

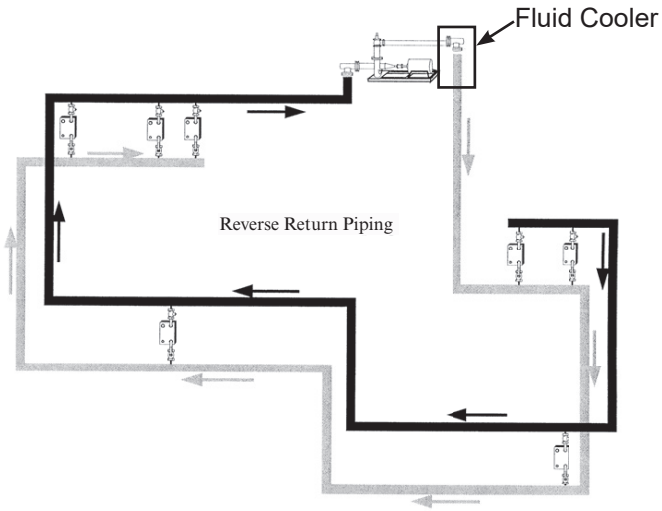
Use a refractometer to check the glycol concentration at least once a year.

The pumping station has a low fluid pressure switch set at roughly 10–20 psig (0.7–1.4 bar), which should be tied into an alarm. It is good practice to test the operation of this switch at least once a year.

Balance Valve Adjustment

A flow balancing valve is located inside each Protocol. These valves should be set at startup using the following procedure.

Presetting The Flow Control (Balancing) Valve (Bell & Grossett 1½ inch Circuit Setter)

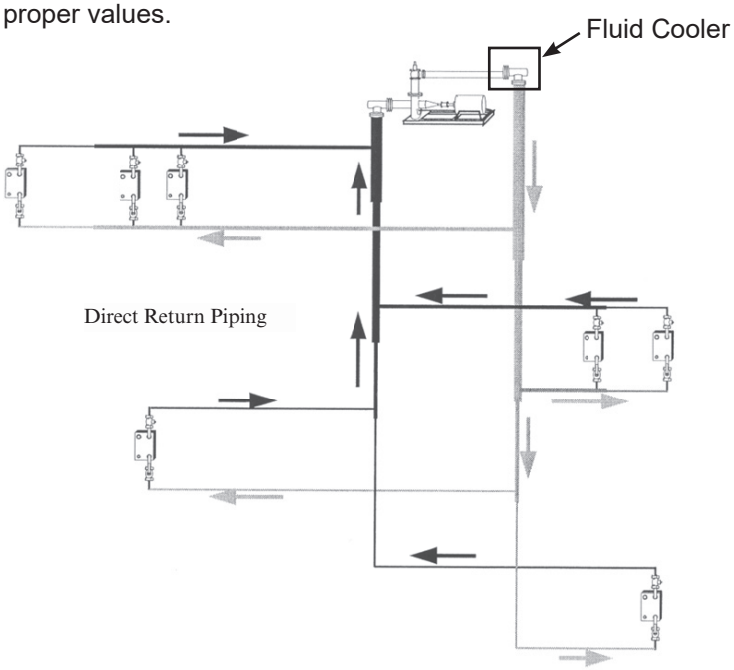


Balancing the Water Loop for Direct Return Piping

Several factors must be accounted for when balancing the water loop using direct return piping. Two major factors stand out:

1. Balancing to attain the correct water flow for each Protocol
2. Balancing the system for piping head loss

Since these factors have nearly unlimited combinations, the factors should be separated to more easily define the proper values.



Protocol A2L

Installation Information

Balancing the Water Flow for Each Protocol

If the store were designed so that each Protocol condenser was supplied from and returned to a Very Large Box, and the piping to each condenser was identical; then flow rate (GPM) would be proportional to the Degrees of Closure on each Circuit Setter.

Balancing the System for Piping Head Loss

If the store were designed so that each Protocol™ condenser was identical; the flow rate (GPM) for each condenser could be set from a simple table. Balancing Head Loss for Length of Piping Run could be equated to Degrees of Closure on each Circuit Setter.

By accounting for head loss and flow rate (GPM/LPM) for each Protocol in a system, a preset value for each Protocol unit's circuit setter can be established. Since each installation is unique, all Protocol units must be carefully monitored during store startup. Once all Protocol units are running, the water loop must be checked and final balancing performed.

Proportional Closure for the Circuit Setter Based on GPM/LPM

GPM (LPM)	° Closure	GPM (LPM)	° Closure	GPM (LPM)	° Closure
58 (220)	0	42 (159)	8	26 (98)	16
57 (216)	0	41 (155)	8	25 (95)	16
56 (212)	1	40 (151)	9	24 (91)	17
55 (208)	1	39 (148)	9	23 (87)	17
54 (204)	2	38 (144)	10	22 (83)	18
53 (201)	2	37 (140)	10	21 (79)	18
52 (197)	3	36 (136)	11	20 (76)	19
51 (193)	3	35 (132)	11	19 (72)	19
50 (189)	4	34 (129)	12	18 (68)	20
49 (185)	4	33 (125)	12	17 (64)	20
48 (182)	5	32 (121)	13	16 (61)	21
47 (178)	5	31 (117)	13	15 (57)	21
46 (174)	6	30 (114)	14	14 (53)	22
45 (170)	6	29 (110)	14	13 (49)	22
44 (167)	7	28 (106)	15	12 (45)	23
43 (163)	7	27 (102)	15		

Proportional Closure for the Circuit Setter Based on Run Length

Length (f [m])	° Closure	Length (f [m])	° Closure
1,000 (305)	0	500 (152)	10
950 (290)	1	450 (137)	11
900 (274)	2	400 (122)	12
850 (259)	3	350 (107)	13
800 (244)	4	300 (91)	14
750 (229)	5	250 (76)	15
700 (213)	6	200 (61)	16
650 (198)	7	150 (46)	17
600 (183)	8	100 (30)	18
550 (168)	9	50 (15) and below	19

Protocol A2L

Installation Information

Presetting the Degree of Closure

Use the table and steps below with the previous data tables to calculate the necessary value for presetting degree of closure.

1. Look up flow rate (GPM [LPM]) for each Protocol. Find the closest value in the table on the previous page.
2. Establish length of run for each Protocol. Find the closest run length in value in the table on the previous page.
3. Add the two values to create the 'total' value.
4. Subtract the 'lowest total' value from the total to get presetting degree of closure.

Note: Run length includes both the supply and return piping.

	A	B	C	D	E	F	G	H	J
Flow Rate in GPM (LPM)									
+									
Run Length in ft (m)									
=									
Total									
-	16								
Lowest Total Value									
=									
Presetting Degree of Closure									

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Protocol A2L

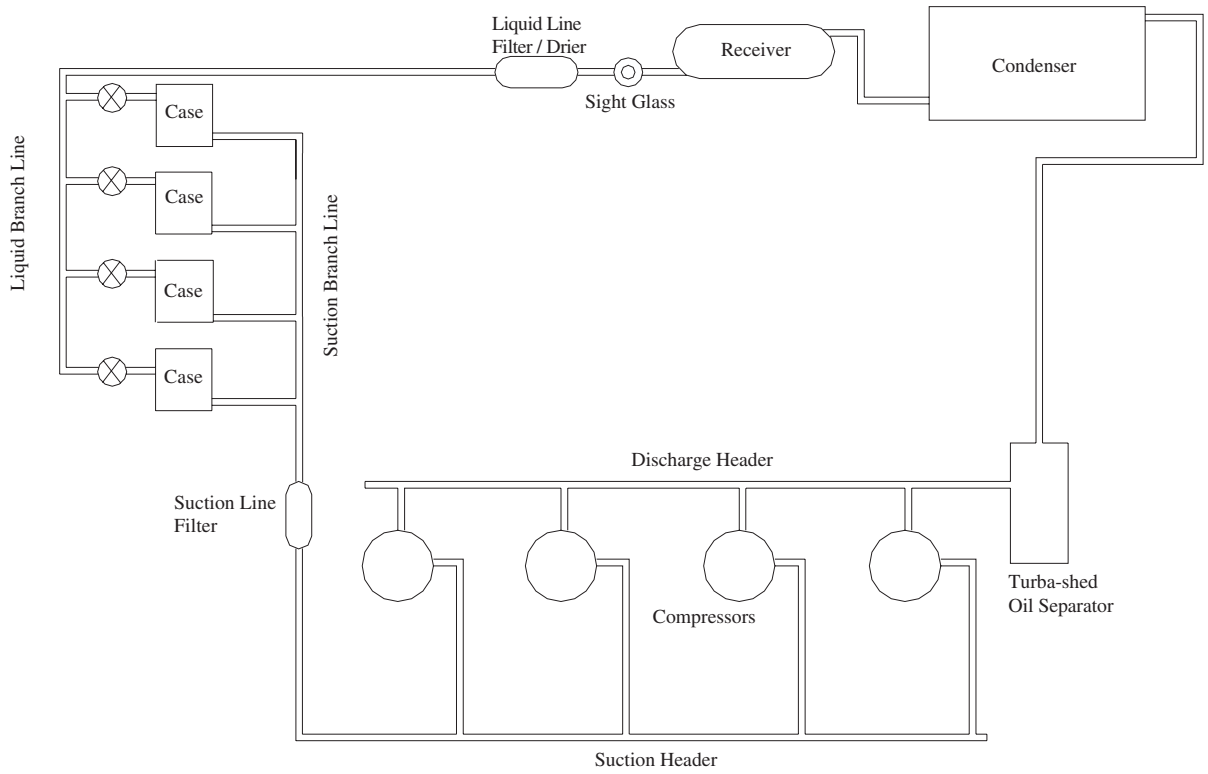
Installation Information

System Diagrams

Refrigeration Cycle (standard)

- Beginning with the compressors, refrigerant vapor is compressed into the discharge header.
- The oil separator effectively divides the refrigerant from the lubricant in the system.
- The lubricant is then returned to the compressors.
- The condenser dissipates the unwanted heat from the refrigerant into either a water/glycol or air condenser depending on the type used.
- The receiver acts as a vapor trap and supplies the liquid line with quality liquid refrigerant.
- A liquid line filter/drier removes water and other contaminants from the refrigerant.
- The liquid branch line supplies liquid refrigerant to the thermostatic expansion valve (TXV), which in turn feeds refrigerant to connected case evaporator coils.
- These coils pick up heat from the product stored in the cases.
- A suction filter— which is factory-supplied and field-installed—removes system contaminants from return vapor.
- Isolation valves can be installed for ease of service.

Note: The oil return system and safety shut-off valve system are not shown in the following illustration.



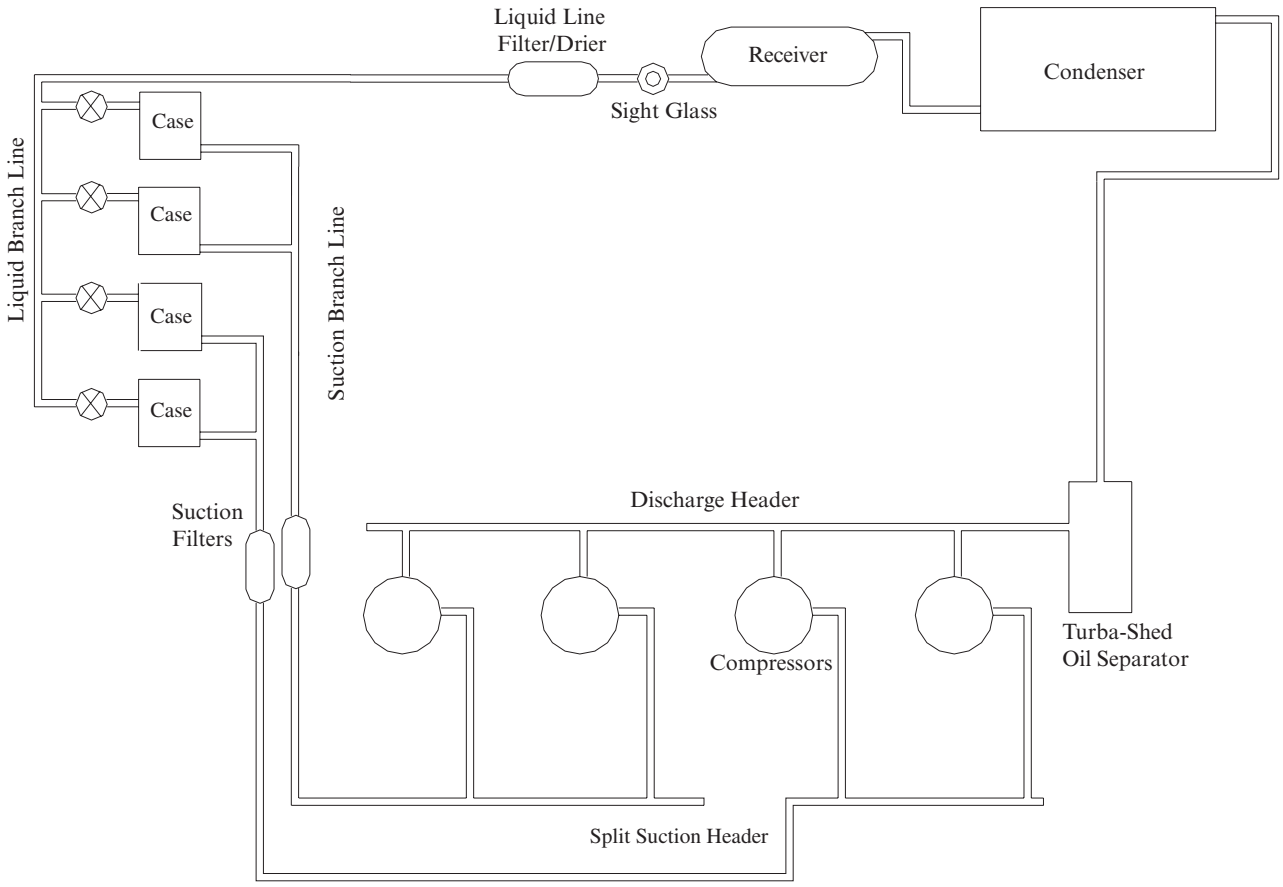
Protocol A2L

Installation Information

Split Suction Option

- Split suction is used when two temperatures are required from the same Protocol unit.
- The use of split suction allows for greater efficiency due to the fact that the compressors are operating closer to the desired suction temperature.

Note: The oil return system and safety shut-off valve system are not shown in the following illustration.



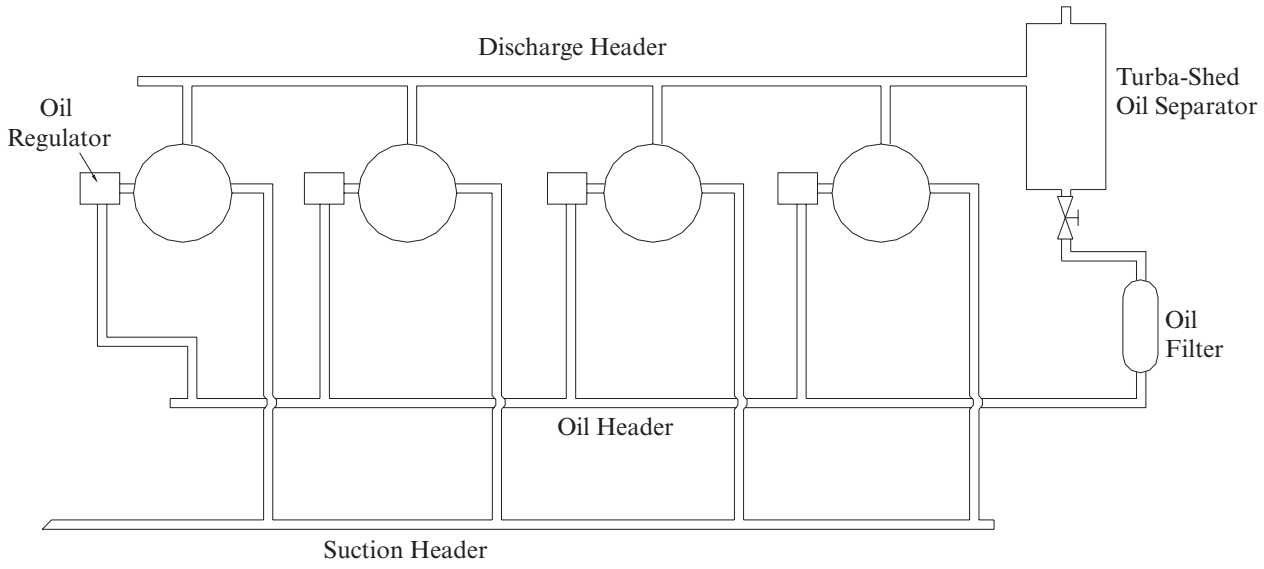
Oil Cycle and Oil Levels

Discharge refrigerant carries droplets of oil from the compressor's outlet. The oil separator separates the oil from the refrigerant. The oil is stored in the oil separator until needed. The oil returns to the system through the high-pressure line and oil filter.

The oil filter removes impurities from the oil. The high-pressure oil is distributed to the electronic oil level control, which feeds oil into the compressor through a solenoid valve.

Electronic oil regulators monitor oil levels. The units are powered by a 24 V power supply. When the oil level in the compressor drops below ½ sightglass, the fill light comes on and the oil solenoid is energized. If after 90 seconds the oil level does not rise above ½ sightglass, the unit opens the compressor control circuit. If oil becomes available, the electronic oil level control will automatically reset and the compressor will resume operation.

If the oil is low, add the appropriate oil or lubricant to match the compressor used. Consult the compressor manufacturer for the correct oil type per the given application.



Protocol A2L

Installation Information

Insulation

The insulation should be sized to allow for the worst-case conditions of heating from showroom lighting and ambient temperatures. To minimize the required insulation thickness, install pipe in air-conditioned space as much as possible. Do not size insulation for condensation prevention only. Pipe should be insulated according to local codes and customer specifications.

When installing piping that has not been pre-insulated, there are several options for insulation. Closed-cell elastomeric insulation is very popular in refrigeration applications. This type of insulation can also be used in secondary system applications.

For detailed information regarding elastomeric insulation visit the Armaflex website at: www.armaflex.com. Always follow the manufacturer's recommendations for insulation thickness and proper installation.

Pre-Charge Checklist

While the system is being evacuated, preparation for charging can begin. During any of the pull downs check the following:

- ☐ Merchandiser's electrical requirements and power supply electrical connections are tight and clean
- ☐ Walk-in coolers and freezers electrical requirements and power supply
- ☐ Check for proper fan and pump operation and case controller and thermostat settings

Control Checks

Low pressure controls should be set below the Protocol setpoint. They should be verified with a set of gauges and close the suction stems to verify each control will cut out.

Each control should display an alarm in the controller when each test is complete.

Low Pressure Controls

Compressor low pressure controls are field set. Consult your Hussmann factory representative for setting parameters and operational criteria.

Refrigeration System Pre-Startup Checklist

- ☐ All electrical connections are tight, clean, and secure
- ☐ Main and control power are on and measure to the correct voltage
- ☐ All control boards online and communicating
- ☐ Temperature sensors reading correctly in controller
- ☐ Pressure transducer valves are open and related readings are correct
- ☐ Verify safety shut-off valves are 'open' (active mode)

Protocol A2L

Installation Information

Protocol Evacuation

WARNING: Always use a pressure regulator when operating nitrogen tanks.

CAUTION: Never trap liquid refrigerant between closed valves as this could cause a hydraulic explosion.

Do not simply purge the system. This procedure is expensive, harmful to the environment, and may leave moisture and nitrogen behind.

Do not run the compressors to evacuate. This procedure introduces moisture into the compressor's crankcase oil and does not produce adequate vacuum to remove moisture from the rest of the system at normal temperatures.

The system has a low tolerance for moisture so care should be taken to evacuate the system before charging. Nitrogen and moisture will remain in the system unless proper evacuation procedures are followed. Nitrogen left in the system may cause head pressure problems. Moisture causes EEV ice blockage, wax build up, acid oil, and sludge formation. Ensure all individual line tests have been completed and all the nitrogen has been removed before completing the vacuum process. Using the correct pump (minimum of 10 CFM) and technique for the vacuum to obtain the target of 70 microns. The Protocol will also need to be evacuated and put under vacuum before charging.

The triple evacuation method should be used to achieve a leak-free, dry system. For the first evacuation, the system should be pulled down to 1,000 microns. The second evacuation should be pulled to 500 microns. The final evacuation should be pulled down to at least 300 microns. A dry, leak-free system is when the system holds a vacuum of 300 microns for 24 hours with the vacuum pump de-energized and valved off. Between each evacuation, break the vacuum with dry nitrogen.

Use a copper manifold to join the connections on the high, intermediate, and low side simultaneously. Ensure that the connections to the vacuum pump can be manually isolated.

A maximum of two vacuum pumps will be allowed, adding up to at least 10 CFM. However, it is preferable to use a single vacuum pump, capable of at least 25 CFM. It is important that the oil in the pumps be changed regularly until the micron level has been reached:

- 1st oil change after first evacuation
- 2nd oil change after second evacuation

Pressure transducers—open angle valves.

Leave open ball valves to branches, condenser, and receiver.

Set all mechanical pressure controls.

During the last evacuation, look up and make a list of the required control settings for the system.

Vacuum Pump Setup

Using an 8 CFM (0.23 CMM) or larger vacuum pump, connect to the access port on both the suction and discharge header of the Protocol unit. Connect one micron vacuum gauge at the pump, and one at the furthest point in the system from the compressor. The vacuum pump must be in good condition and filled with fresh oil to achieve desired results.

Protocol A2L

Installation Information

A few things should be considered when starting the vacuum process:

- Ensure the system is 100% free of leaks.
- All the connections from the vacuum pump to the Protocol should be soft drawn copper lines 5/8”.
- Ensure the connections have been tested before starting the pump.
- All the caps on the Protocol and in the cases need to be installed and tightened.
- All the valve packings need to be tightened.
- Ensure liquid filters are installed before starting the third vacuum.
- Crankcase heaters should be turned on.

It is important to note that a low vacuum pulled on transducers may damage the sensor. Consult with the sensor manufacturer to determine if the transducer should be isolated during these conditions.

It is important that the start-up sheet be filled out and a picture of the gauge indicating 300 microns (hold for 24 hours) be kept for records.

Open compressors—open service valves on suction and discharge.

Open oil supply line immediately downstream of the oil separator and reservoir.

Pressure transducers—open angle valves.

Leave open ball valves—to branches and condenser.

Set all mechanical pressure controls.

During the last evacuation, look up and make a list of the required control settings for the system.

Protocol A2L

Installation Information

Refrigerant Charging Procedure

The charge amount is shown on the serial plate. Only the refrigerant listed on the serial plate should be used.

When connecting hoses between the refrigeration system, manifold gauges, and refrigerant cylinder, ensure that the connections are secure and there are no potential sources of ignition nearby. Ensure that contamination of different refrigerants does not occur when using charging equipment.

Use dedicated hoses to service refrigeration systems. Hoses or lines should be as short as possible to minimize the amount of refrigerant contained in them.

Ensure that the refrigeration system is properly grounded prior to charging the system with refrigerant, to avoid the potential for static build-up.

In addition to conventional charging procedures, the following requirements shall be followed:

a. Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
b. Cylinders shall be kept in an appropriate position according to the instructions.
c. Ensure that the REFRIGERATING SYSTEM is earthed prior to charging the system with refrigerant.
d. Label the system when charging is complete (if not already).
e. Extreme care shall be taken not to overfill the REFRIGERATING SYSTEM.

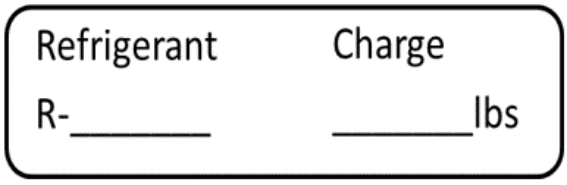
Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Extreme care must be taken not to overfill the refrigeration system. After charging, carefully disconnect the hoses, attempting to minimize the quantity of refrigerant released. Further leak check the service ports, hoses, refrigerant tanks.

Thoroughly leak check the service ports. If no leak is present, use a pinch-off tool to close the ends of the service tubes before brazing them shut. If a Schrader valve is used on the compressor service tube, it must be removed and the previous steps followed in order to braze the service tube shut.

Refrigerant Charge Label

After charging is complete, note the refrigerant type and charge amount using permanent marking on the refrigerant charge label affixed to the unit.



Protocol A2L

Installation Information

Refrigerant Charge

Remember the condenser in the Protocol SPO holds only a small amount of refrigerant. It is very easy to overcharge the SPO unit specifically unless care is taken during the charging process. Charging until the liquid sight glass is clear of bubbles will often overcharge the system causing head pressure alarms. Charge only until the sight glass on the receiver is covered with refrigerant when the system is operating in a balanced refrigeration mode.

Protocol units with gas defrost should also be monitored during defrost to ensure that the receiver does not completely empty. Add enough refrigerant, if necessary, to maintain a liquid seal on the receiver outlet if the receiver empties during defrost.

Oil Charge

Oil separator is shipped without an oil charge. Use POE 32 oil only— always check compressor manufacturer's requirements. Fill compressor to the top half of the sight glass and the oil separator to between the two sight glasses.

Note: The compressors and the oil separator must be closely monitored during startup because the POE oil does not return from the evaporators as quickly as mineral oil.

Compressor Motor Rotation

To check compressor rotation, use the following procedure:

1. Install gauges on suction and discharge headers. Be aware of satellite and split-suction Protocol units when connecting. A momentary compressor run should cause a drop in suction pressure and a rise in discharge pressure.
2. With convenience switch off, switch off all breakers in the control panel except the control circuit breaker.
3. Turn on convenience switch.
4. Look for the green light on the single-phase protector. If the light is red, turn off the convenience switch. All Protocol 3-phase wiring is connected L1 to T1, L2 to T2, and L3 to T3. Have the field connections corrected so the phase protector indicates phase alignment (so the light is green).
5. Turn on convenience switch.
6. Turn all compressors on using the electronic controller.
7. Momentarily turn on compressor breaker #1 and verify correct pumping direction. Check all compressors before switching any wires. If all compressors are rotating backwards, change two legs at the field side of the convenience switch. For individual compressor, change the legs on the load side of the compressor contactor.
8. Restore system to default configuration.

Caution—Never run the compressors in a vacuum as this may quickly damage the compressors.

Protocol A2L

Installation Information

Control Settings

The mechanical low-pressure controls are required to be set in the field.

- High Pressure Safety – 395 psig (27.2 bar)
- Vacuum Pressure Safety – 1 psig (0.07 bar)
- Discharge Temperature Sensor – 240° F (115.6° C)

Electronic Oil Level Control

Electronic oil regulators monitor oil levels. The units are powered by a 24 VDC power supply. When the oil level in the compressor drops below 1/2 sight glass, the fill light comes on and the oil solenoid is energized. If after 90 seconds the oil level does not rise above 1/2 sight glass, the unit opens the compressor control circuit. If oil becomes available, the control will reset and the compressor will resume operation.

Return Gas Superheat

Return gas superheat should be 10°–30° F (-12.2°– -1.1° C) on all units.

Auxiliary Systems

This form of sensor inputs can be programmed for analog operation (case temperature sensor) or digital operation (such as Klixon). The auxiliary sensors are typically used to provide information to controller regarding a particular defrost circuit. The auxiliary sensors can also be used to provide monitoring inputs from some external devices; such as those related to glycol temperature, computer room thermostat, or pump station alarm relay closure.

It is important to remember that the auxiliary sensors, when used to provide information regarding a particular defrost circuit, must be located in the correct defrost circuit lineup of cases. Sensor A1 can only be used on defrost circuit #1. Sensor A2 can only be used on defrost circuit #2. The same attachment of sensors to defrost circuits can be repeated for A3 through A6.

Temperature Termination (digital mode)

When an auxiliary sensor is used to connect a defrost termination thermostat device such as a Klixon (no case temperature sensor present) to the control in order to terminate defrost on high temperature, the following information is required for proper operation.

Note: When temperature termination is enabled, the control will automatically alarm on a non-defrost mode contact closure from the defrost termination thermostat device. It is assumed that while in refrigeration, the defrost termination thermostat (which is a close on rise device) should be open.

Temperature Termination (analog mode)

In some applications of the Protocol, there are not enough inputs to provide all the information to the control for terminating defrost, alarming, and monitoring purposes. When this is the case, a temperature sensor and a defrost termination thermostat can be wired in parallel at the case and then one cable run back to the Protocol control and connected auxiliary input. Under this application, the temperature sensor is used to provide alarming and monitoring of discharge air while the defrost termination thermostat provides the termination input.

Protocol A2L

Installation Information

Electric Defrost

Application

Protocol electric defrost is similar to other systems except that the circuit breaker is used for the defrost loads. This breaker will provide overload protection and the contactor switches the defrost heaters on and off. Liquid solenoids should be used to control temperature and defrost for each circuit. This prevents a possible pump down problem. The defrost solenoid and breakers are controlled by independent output relays on the defrost board, but will be assigned (programmed) to the same defrost circuit so that they will be energized simultaneously. The amp draw for each circuit must be entered into the controller so that a defrost shedding of compressors can occur reducing the overall amp draw of the unit. Isolation ball valves for each case lineup are recommended for ease of servicing.

Defrost Operation

1. The control board will de-energize the solenoid (suction or liquid) when a defrost occurs while simultaneously energizing the relay controlling the defrost breakers.
2. When the defrost relay is energized, the breakers will receive a momentary charge or pulse from a capacitor in its contactor. The energized motor moves a push/pull rod similar to what might be found in a manual switch. A slight delay between the control circuit demand and the contactor response will be noticed. This pulse switches the contactor such that the heaters are now energized. At the termination of defrost, the contactor will be switched off.

Off-time Defrost

Application

Off-time defrost is the simplest defrost type. A relay is used to de-energize a solenoid valve at specific times. Suction stop solenoid valves should be used to control temperature on long lineups due to the limited receiver capacity. Isolation ball valves for each case lineup are recommended for ease of servicing.

Defrost Operation

1. To initiate a defrost, the control board will de-energize the specific circuit solenoid.
2. After the preset time for defrost has elapsed, the unit will energize the solenoid allowing normal refrigeration.

Sensor Inputs and Applications

Suction Pressure Sensor

This suction pressure input provides the electronic controller the necessary information to cycle the compressors on and off to maintain an overall setpoint. Setpoint, high alarm, low alarm, and range will need to be programmed.

The high and low alarm settings provide a window of safe operation that the Protocol should operate within. If the suction pressure moves outside this margin of operation for more than 30 minutes, the control will default to switchback operation and control of the compressors will be passed to a low pressure mechanical switch mounted inside the Protocol cabinet.

Suction Pressure Input

This suction pressure input has a dual function—it can provide the electronic controller the necessary information to cycle the compressors on and off under a split suction configuration or it can be used to monitor the discharge pressure. If the input is used to monitor discharge pressure, you will need to program high alarm, low alarm, and range (typically 500 psig [34.5 bar]).

Under split suction configuration, this input provides the electronic controller pressure signal used to cycle compressors on and off. The split suction configuration may contain multiple compressors (2 or more) or a single compressor (low or high end satellite). When two or more compressors are attached to the second suction header, split suction operation (enabled/disabled), number of compressors, split suction setpoint, high alarm, low alarm, and range will need to be programmed.

If only a single compressor is used (satellite configuration), satellite operation (enabled/disabled), satellite setpoint, satellite differential, high alarm, low alarm, and range will need to be programmed.

Temperature Input

This temperature input has a dual function operation—temperature input for suction pressure reset feature or alarming and monitoring of temperature for a display case. The suction pressure reset function allows the suction pressure setpoint to float upward to reduce compressor energy consumption. The temperature sensor used with the suction pressure reset function allows a setpoint to be entered for a specific display case—normally the case containing the evaporator with the lowest suction temperature. When the temperature in this case is satisfied, the suction pressure setpoint will increase by 1 psig (0.07 bar). Suction pressure reset (enable/disable), suction pressure reset setpoint, high alarm, and low alarm will need to be programmed.

When this temperature input is used to monitor and raise an alarm on temperature of a given display case, high alarm, low alarm, alarm activation (enabled/disabled), alarm delay, and circuit attachment should be used.

All Additional Pressure/Temperature Inputs

This temperature input has a dual function operation—pressure input for monitoring discharge pressure or alarming and monitoring of temperature for a display case. Since this input can operate as temperature or pressure, you will need to configure both the hardware (input circuitry) and software (memory settings) for proper operation. When operating as a pressure input, input mode (set to pressure), high alarm, low alarm, and alarm activation (enable/disabled) will need to be programmed.

When operating as a temperature input, input mode (set to temperature), high alarm, low alarm, alarm activation (enable/disabled), circuit attachment will need to be programmed.

Final Checks

Once the Protocol is up and running, it is the responsibility of the installer to see that all the fine adjustments are made so the Protocol delivers maximum temperature performance and efficiency for the customer.

Adjustments may include:

- Thermostatic expansion valve superheat adjustment
- Electronic pressure regulator settings
- Defrost scheduling and timing
- Condenser flow balance
- High and low pressure controls
- Thermostat settings
- Electronic controller adjustment
- Electronic oil level controls

Thoroughly inspect all field piping while the equipment is running and add supports where line vibration occurs. Be sure additional supports do not conflict with pipe expansion and contraction. When merchandisers are completely stocked, check the operation of the system again.

At 90 days, recheck the entire system including all field wiring.

Pre-Startup Procedures

The closed-loop system and evaporative fluid cooler must be running before starting up any Protocol units. Once there is enough load to keep the Protocol running, look at all the amperages on all compressors. Record this data for future reference (can be written on the control panel).

Charging the Closed Loop

i. The closed loop can be filled through a large ball valve at the highest point in the system. Use a funnel when pouring or pumping the glycol into the loop—water may be added with a hose. The funnel provides an air break, and ensures no glycol contamination of the water supply. Where the high point is not accessible, glycol must be pumped into the system. Water charging from a utility supply line will require anti-backflow equipment (a simple check valve in the supply line is not sufficient).
ii. Trapped air must be vented. Place a towel around the vent valve to catch any liquid. Any valve and hose assembly used in venting should not be used for anything else. If the loop employs reverse return piping, open each circuit setter completely. For direct return piping, adjust the circuit setter proportionally for piping head loss and GPM (LPM) requirements.
iii. Start pumps individually, just long enough to check for proper rotation. If pumps are running backwards, have the field connections corrected.
iv. Continue to periodically vent trapped air during startup.

Charging the Refrigeration Side

i. Visually inspect all lines and joints for proper piping practices and test for leaks. Refer to the "Leak Detection" section of this manual for additional information.
ii. Check all electrical connections. If all connections and wiring check out, open circuit breakers to all compressors.
iii. Isolate compressors using the front seat service valves on suction and discharge lines and close angle valves on pressure transducers.
iv. Open valves to condenser and receiver. Liquid line solenoid valve should be energized.
v. Verify refrigerant requirements for system, compressors, and TXVs in merchandisers and coolers and electrical supply and component requirements are all appropriately met.

Test Charge

Using properly regulated dry nitrogen and refrigerant mixture, pressurize the system with vapor only. Bring the system pressure up to 150 psig (10.3 bar). Use an electronic leak detector to inspect all connections. If a leak is found—isolate, repair, and retest. Be sure system is at 150 psig (10.3 bar) and all valves closed to repair the leak are re-opened. After the last leak is repaired and retested, the system must stand unaltered for at least 12 hours with no pressure drop from 150 psig (10.3 bar).

Evacuation

Nitrogen and moisture will remain in the system unless proper evacuation procedures are followed. Nitrogen left in the system may cause excessive head pressure. Moisture causes TXV ice blockage, wax build up, acid, oil, and sludge formation.

Do not simply purge the system because this procedure is illegal, expensive, harmful to the environment, and may leave moisture and nitrogen.

Do not run the compressor to evacuate because this procedure introduces moisture into the compressors crankcase oil and does not produce adequate vacuum to remove moisture from the rest of the system at normal temperatures.

Protocol A2L

Installation Information

Startup Sequence

1. Prior to starting the Protocol up or putting power to the Protocol, make sure all the electrical connections in the Protocol panels and compressors are tight. Controller panels for all coolers, freezers, and cases should be checked.
2. At least 40% of the Protocol evaporator load (both MT and LT) should be available prior to Protocol startup.
3. Several tests should be performed on the Protocol prior to running. (Note: Control must be powered up)
   - Perform a phase loss test to make sure all the case controller EEVs shut down
   - Once the phase loss is reset, all the case controllers should return to normal
   - Leak detection in all walk-in boxes and mechanical rooms must be tested, and fully functional—the exhaust fan should be in operation prior to charging of the system
   - It is not recommended for leak detection to shut down the Protocol as this may result in additional refrigerant being released to the atmosphere
4. Check the system operating temperatures and defrost time. The length and number of defrost cycles must be set in accordance with case manufacturers' recommendations and the owner/operators defrost guidelines.
5. A final defrost schedule must be provided to the store manager during the week of grand opening as well added to the door of the Protocol. All work within start-up procedure needs to be recorded in a logbook kept in a secure, accessible location on site.
6. After the compressor is started, continue charging until the system has sufficient refrigerant for proper operation. During start-up, no compressor is to be left operating unattended and unwatched until the system is properly charged with refrigerant and oil.
7. After the system has been in operation for a minimum of seven days, all expansion valve strainers must be cleaned and is recommended for valves with removable screens.

NOTE For new construction, it is recommended that all freezer boxes are set at 35° F (1.7° C) and run for a minimum of 48 hours, then drop to 10° F (-12.2° C) for 24 hours. This will pull the moisture out of the floor in the freezers. Afterward, if the customer has a requirement or specification, follow it.

Monitor the Following:

- Flood back
- Monitor oil levels in the oil reservoir and well as in the compressor crankcase
- It is recommended to place the filters back in the suction shell

Protocol A2L

Installation Information

After Startup

Oil and Filter Replacement

Access filter (near oil separator) and loosen threaded connections to remove and replace. Replace oil as needed or any time the system is broken open to avoid potential contamination.

Thermostat Settings

1. Thoroughly inspect all field piping while the equipment is running and add supports where line vibration occurs. Be sure additional supports do not conflict with pipe expansion and contraction.
2. When merchandisers are completely stocked, check the operation of the system again.
3. At 90 days, recheck the entire system, including all field wiring. Future maintenance costs may be reduced if an oil acidity test is run at this time. Replace acidic oil.

Sequence of Operation

The Protocol sequence of operations establishes control objectives, recommendations, and standard operating parameters for a refrigeration system. The system is capable of running in low and high ambient conditions.

For the purposes of this sequence, the Protocol is comprised of multiple MT and/or LT compressors on common suction headers. All compressors discharge to a common discharge header. All compressors are fed from a common oil separator or reservoir (depending on unit size). Other components typically found on a Protocol: suction filters, liquid driers, compressor oil level controls, and liquid injection system. Protocol systems also include an economizer heat exchanger and vapor injection into the high-efficiency scroll compressors.

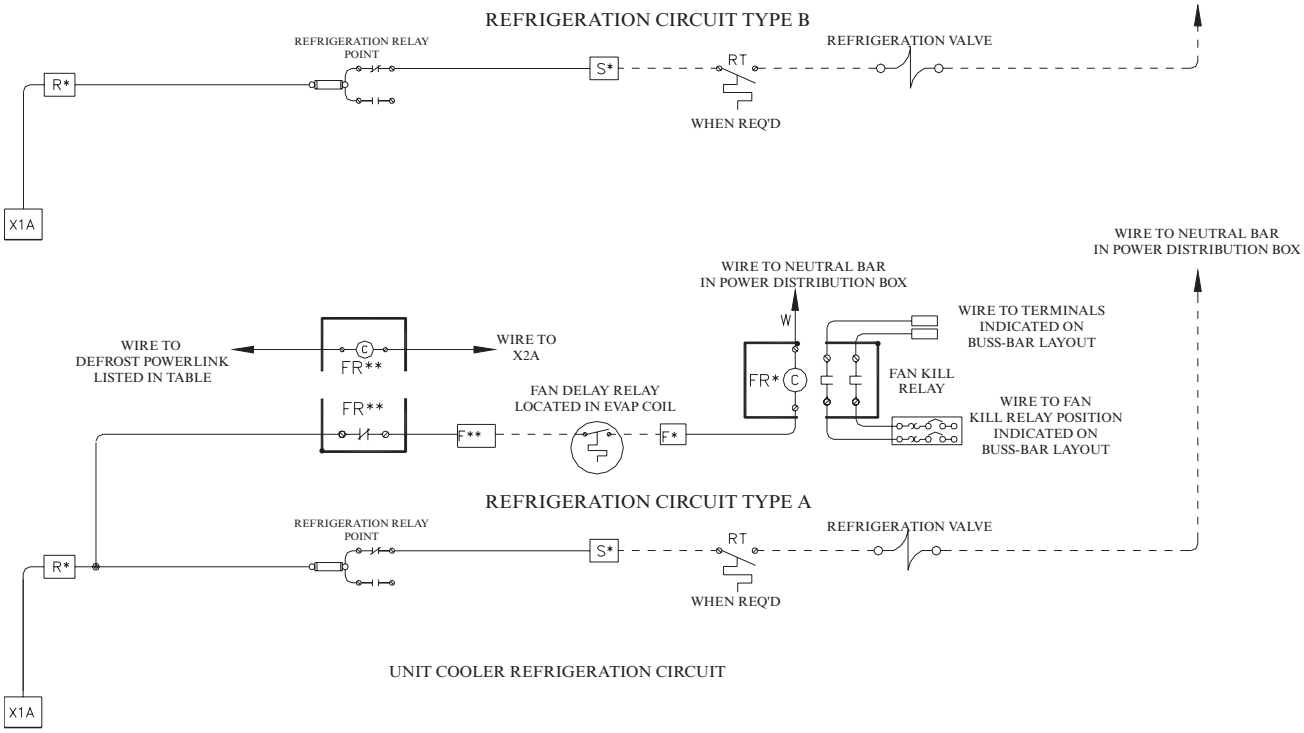
The specific functions in which this sequence will control are:

- Compressor staging
- System operation
- Compressor variable capacity
- Pressure relief valves
- Oil management
- Circuit stage-up (auto restart after power failure)
- Condenser fan control
- Economizer
- Valve controls (e.g., liquid, vapor injection, etc.)
- Phase loss

Defrost Schedule

Refrigeration Circuit Control

The following circuits show the electrical connections during the refrigeration cycle. Power comes into the control board from X1A. The refrigeration solenoid valve and thermostat (if needed) are wired to the terminal pin. The unit cooler circuit is the same as a simple refrigeration circuit but it has an additional fan control circuit. The fan control circuit ensures that the fans will not turn on during the defrost cycle. It should be noted that off time defrost is achieved by turning the refrigeration valve off.



Off-Time Sequence of Operation

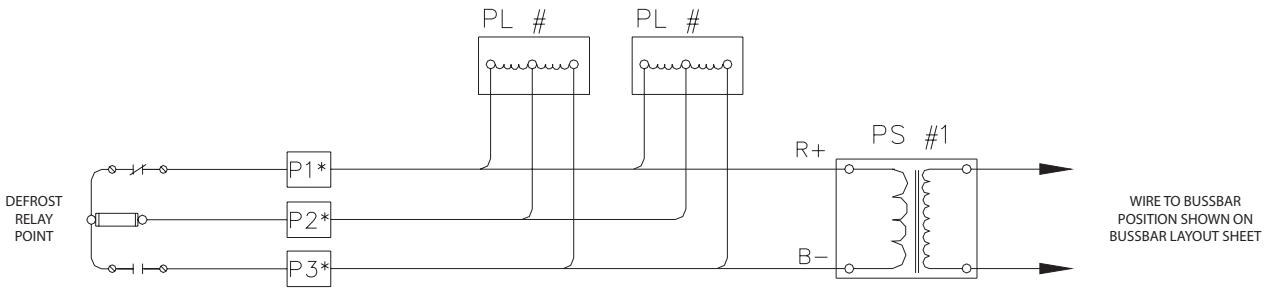
1. The control board energizes the defrost board relay coil, which open the main liquid line solenoid circuit.
2. The main liquid line valve closes. As evaporators empty, the compressors cycle off on low pressure.
3. Defrost may be terminated by time or temperature.

Electric Defrost

The control board energizes two defrost board relay coils for each defrost circuit:

1. When the relay output is de-energized, the contactor and heaters are also de-energized. Liquid line solenoids are open and refrigeration is active.
2. When the relay output is energized, the contactor and heaters are energized while the liquid line solenoids are closed.

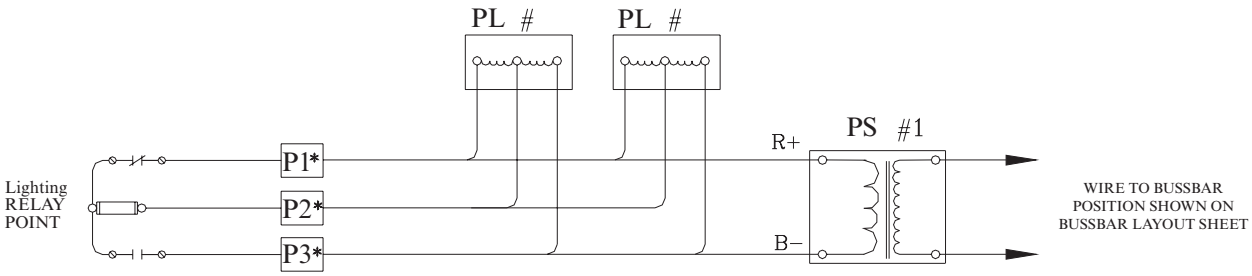
DEFROST CIRCUIT TYPE ELECTRIC



Lighting Control

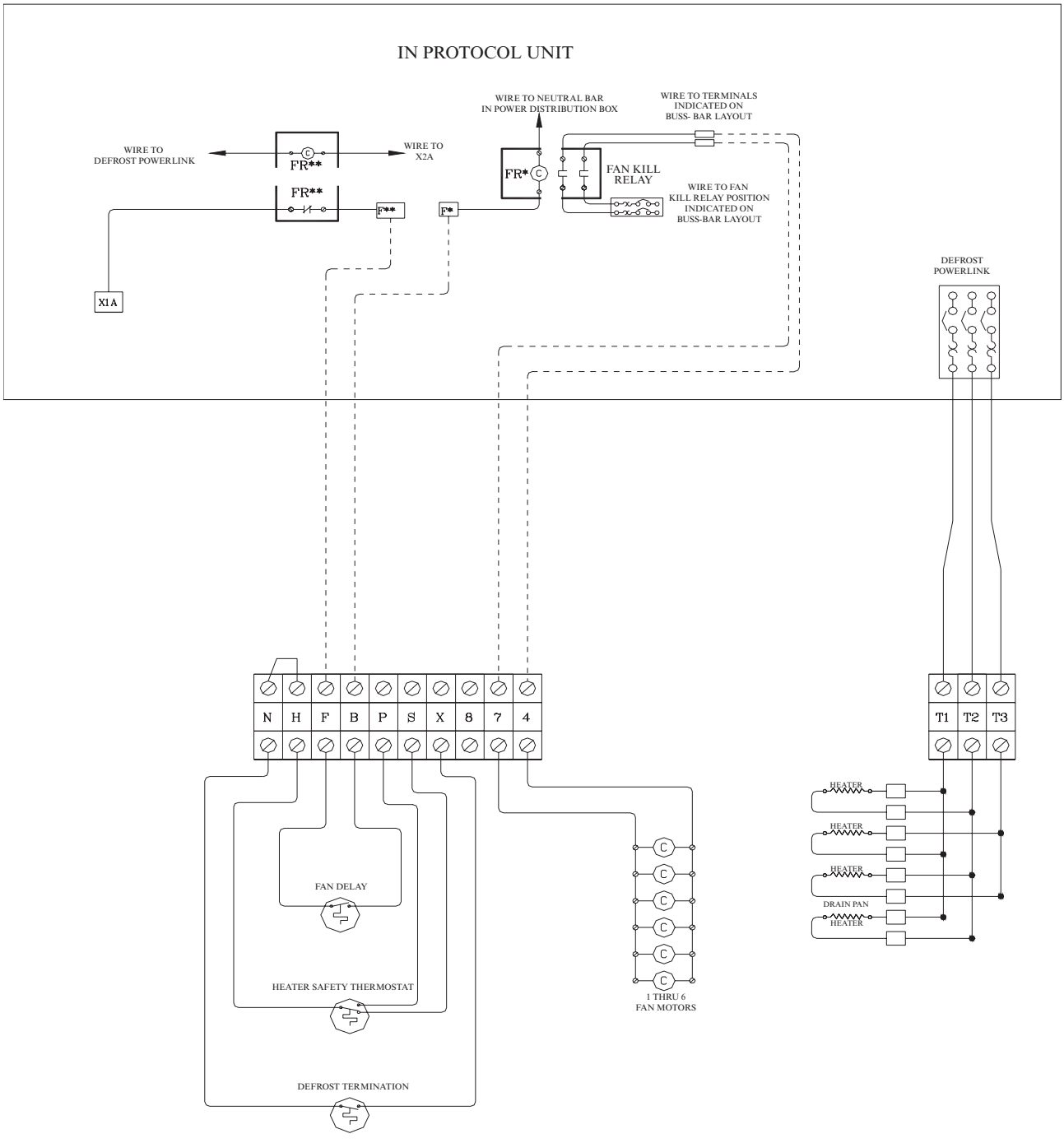
For outdoor units equipped with lighting, the control board energizes one output relay for each lighting circuit. Each lighting circuit has a schedule which determines when the output is turned on and off.

Lighting Relay Point



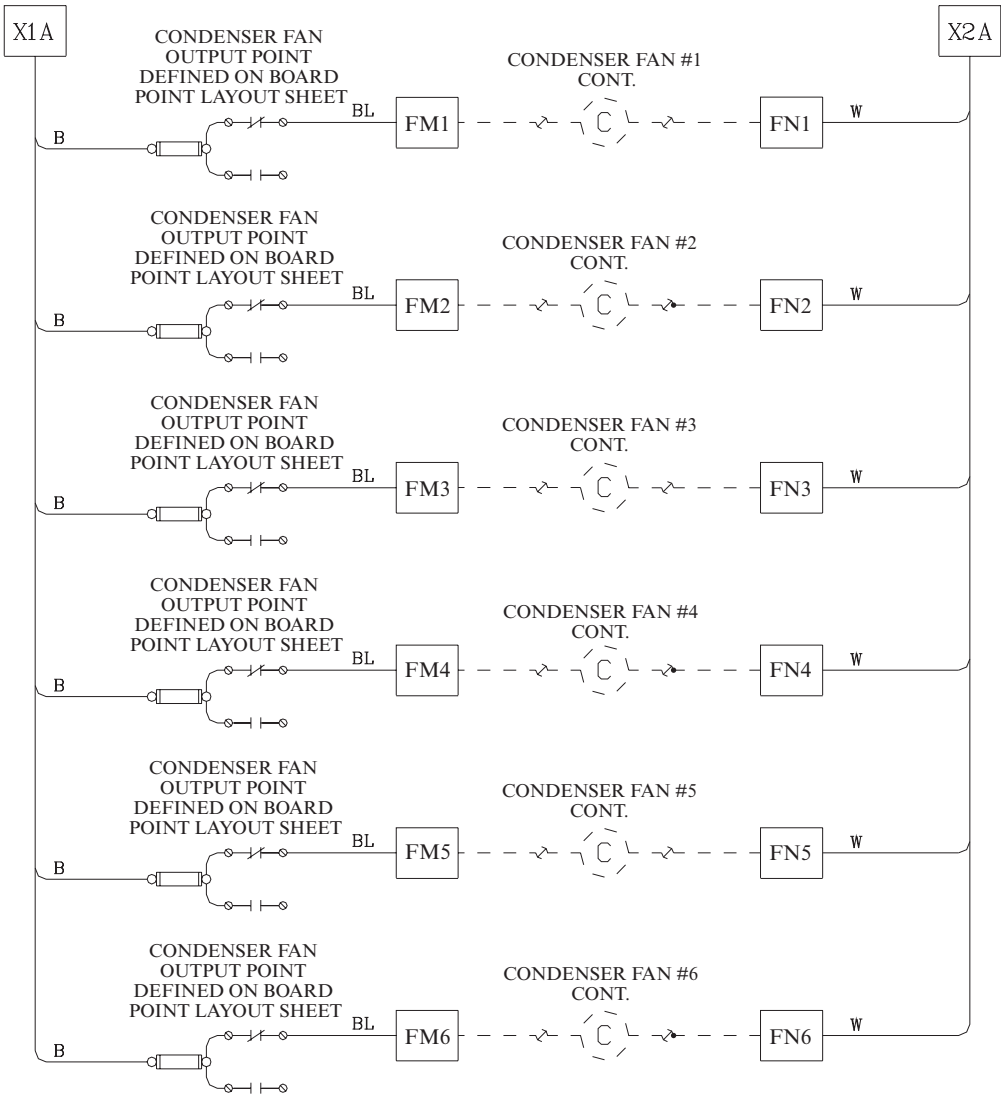
Unit Cooler Fan Wiring

The following drawing shows the wiring to control the fans in a unit cooler. Defrost termination by Klixon may connect back to the controller relay board based on individual customer specs. See job-specific board layout sheets and wiring diagrams for the specific installation.



Protocol Remote Condenser Fan Wiring

The installer must wire the condenser fan to the terminal pin that corresponds to the correct board point in order to ensure proper control of the condenser fans. The following diagram shows the wiring for a typical Protocol with a remote condenser.



In the event that the condenser is ordered with control boards attached, these boards must be connected back to the controller with communication cable in a manner appropriate for the individual controller. The board addressing and the controller program should be checked to verify that the boards are addressed correctly and the controller is programmed to recognize the boards and control the condenser through them.

Protocol A2L

Operation and Controls

Typical Input and Output Points

Analog Output – Digital IDCM signal (Digital Compressor Capacity Modulation)

Relay Outputs (N.O.) — Compressor On/Off (1 per compressor)

Relay Outputs (N.O.) — Economizer On/Off (Control for Vapor injected HE Scroll Compressors Low Temp applications)

Relay Outputs (N.O.) — General Unit Alarm

Relay Output (N.O.) — Motor Fan Condenser Control On/off (1 per fan)

Relay Output (N.O.) — Split Condenser control

Alarm Digital Input (N.O.) — Phase Loss

Alarm Digital Input (N.O.) — Leak Detection (Leak Mitigation system activated)

Alarm Digital Input (N.O.) — General Compressor alarm (1 per standard HE compressor)

Analog Input — Suction Pressure (1 per suction group)

Analog Input — Suction Temperature

Analog Input — Discharge Pressure

Analog Input — Discharge Temperature

Analog Input — Economizer Temperature

Analog Input — Ambient Temperature

Analog Input — Drop leg Temperature

Analog Input — Drop leg Pressure

Analog Input — Liquid Level Indicator

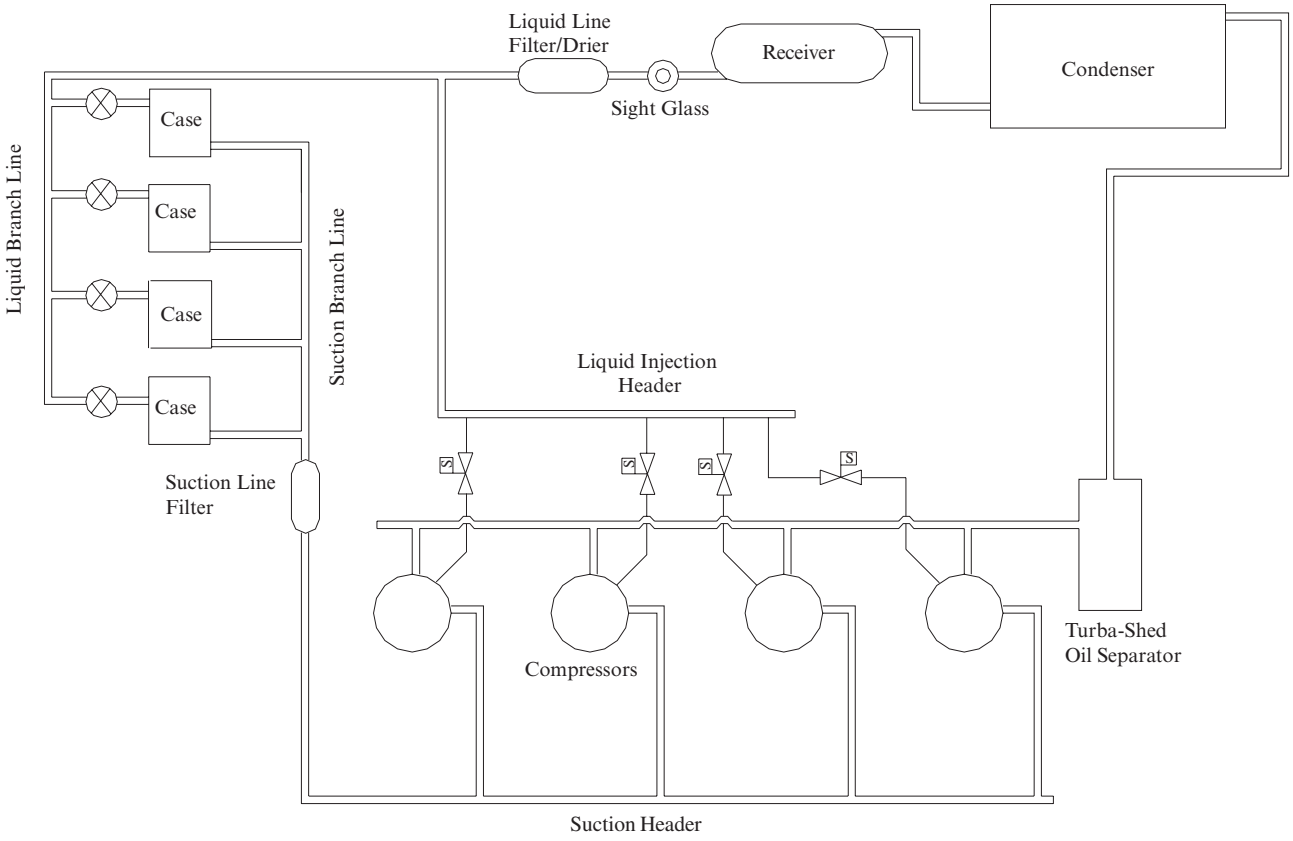
Liquid Injection

When operating at high compression ratios, injecting liquid partway through the compression process is a method of cooling the scroll compressor. A DTC (discharge temperature control) valve must be applied for liquid injection. Each compressor liquid injection line has its own shutoff valve, injection solenoid valve with DTC valve, and supply hose.

Hussmann applies liquid injection on all units below 0° F (-17.8° C) evaporating temperature. Each compressor has its own discharge temperature control (DTC) valve, which is an all-in-one injection solenoid that allows for a more energy efficient use of liquid.

When the compressor is off, the solenoid valve is de-energized via a current sensing relay mounted at the compressor contactor. If the DTC valve is used, the DTC valve will close when the compressor is off.

Note: On units with remote receivers, liquid refrigerant must be piped to the liquid injection stub-out at the back of the unit.



Vapor Injection

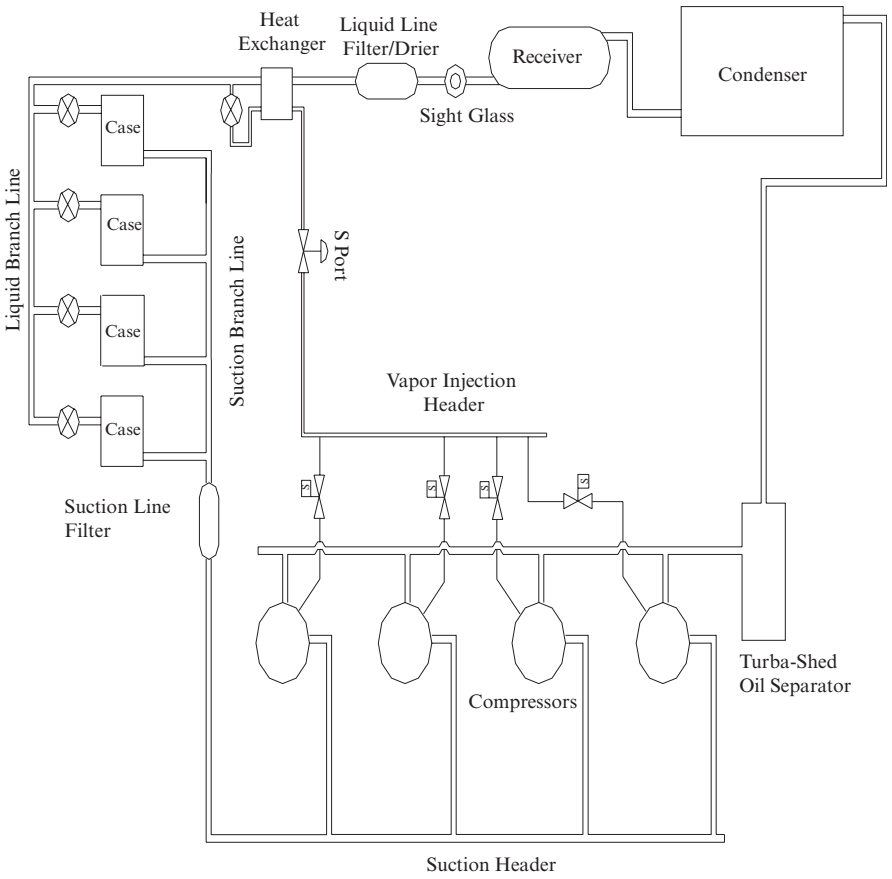
Another method of cooling the scroll compressor is to use vapor injection. Vapor Injection takes a small portion of liquid refrigerant from the main liquid line and runs it through a thermostatic expansion valve and a heat exchanger, which helps to ensure vapor is sent to the compressor as well as sub-cooling the main refrigerant before it goes to the TXV and evaporator in the case.

SPO units incorporate water-cooled options. These units MUST BE accessible from the top. DO NOT EXCEED 90% of capacity rating. Liquid lines MUST BE INSULATED.

The economizer system is pre-installed on every Protocol unit. EPR valves will need to be adjusted once the Protocol is installed and running. Valves are located between the heat exchanger and compressor injection ports in the system and should be set with a 35° F (1.7° C) SST.

The expansion valve in the economizer loop may also need to be adjusted once the system is operating. Settings need to maintain approximately a 10° F (5.6° C) superheat after the heat exchanger.

The sub-cooled liquid to the cases is designed to be approximately 50° F (10° C) leaving the heat exchanger when vapor injection is activated. When liquid temperatures entering the subcooler fall to 55° F (12.8° C), the thermostat control in the unit will open and will de-energize the vapor injection solenoid, disabling vapor injection. The thermostat control will re-energize the solenoid when the condensing temperature reaches 65° F (18.3° C). Consult Hussmann Engineering representative if adjustment of the thermostat control is required.



Protocol A2L

Operation and Controls

Phase Loss (main feed)

The PLM provides a digital input to the protocol controller anytime the voltage is outside the nominal range of the system. When a PLM provides a contact closure, the Protocol goes into an emergency event. It is recommended that the digital input closure be provided with a 1–3 second programmed delay to prevent any false trips due to transient voltage on the cable or input board. A longer delay may be required to prevent an intermittent shutdown when the Protocol switches to generator power. It is recommended that the PLM module does not include any significant delays. The Protocol controller should incorporate those delays as part of its stage up sequence.

Circuit Stage-Up (after shutdown)

Anytime the Protocol exhibits an emergency event, the system will go through a staged approach to systematically turn the system back on. After the emergency event clears and a short delay (typically 60 seconds), the compressors are allowed to stage back up. At the same time, if suction pressures are within nominal range the evaporator loads get enabled again. The number of circuits that turn back on at a time can vary and is usually setup on a per store basis, which typically consists of about 15–25% of the total system. The order of circuits can also vary on a per-store basis but typically consists of critical product first (e.g., meat, service, etc.) and less critical circuits last (e.g., produce, beverage, prep rooms, etc.).

Protocol Controller Operation

General use information on optional controllers that can be ordered with the unit can be found on the controller manufacturer's site. Please use the following links for quick access to this information.

- Copeland E3
  https://www.copeland.com/en-us/products/controls-monitoring-systems/facility-controls-electronics/facility-and-system-controls/supervisory-controls-e3
- Site Supervisor
  https://www.copeland.com/en-us/products/controls-monitoring-systems/facility-controls-electronics/facility-and-system-controls/supervisory-control-ss
- Danfoss AKSM800
  https://www.danfoss.com/en/products/dcs/electronic-controls/system-managers/#tab-overview

Protocol A2L

Operation and Controls

Control Panel

The control panel contains all the necessary energy management components and motor controls factory-wired to the compressors. The interconnected compressors are cycled on and off by a central controller to match refrigeration capacity with load requirements.

Factory-wired control panel has:

- Pre-wired distribution power block
- Individual component circuit breakers and contactors
- Color-coded wiring system

Items supplied separately for field installation:

- Vibration isolation pads
- Liquid drier cores (optional)
- Suction filter cores (optional)
- Ship loose valves (optional)
- Remote defrost panel (optional)

Electronic Oil Level Regulators

For any brand of electronic oil level regulator to work accurately, the unit and each compressor must be level. A sight glass filled with oil may indicate a damaged regulator. A 24 VDC transformer powers the electronic oil level control. All circuit logic including oil solenoid control is 24 VDC. Only the alarm contact is 120 VAC.

Satellite Short Cycle Control Relay

The satellite short cycle control relay is intended to prevent rapid cycling when the compressor goes into pumpdown mode. It is a single-shot time-delay relay. When the low pressure control opens on a decrease in pressure, the short cycle control relay becomes energized and starts timing. After 3 minutes (regardless of the action of the low pressure control) this relay will close, re-engaging the control circuit and allowing the compressor to run again.

Protocol A2L

Operation and Controls

Compressor Control

Each control panel is wired with independent compressor control circuits so any compressor can be electrically isolated without causing the other compressors to be shut down. A typical compressor control will consist of the following:

- Electrical control
- Low pressure switch
- High pressure switch
- Oil pressure switch
- Overload contact (if used)
- Contactor coil
- Crankcase heater (optional)
- Lighted toggle switch

Terminal pins will be used between control points for easy testing and troubleshooting.

Electronic Controller

The electronic controller uses a suction transducer to “read” the suction manifold pressure. From this, sequence compressors are turned on or off through a relay board to achieve the target suction pressure.

Time Delay

Automatic time delays are built into most electronic controllers. This helps avoid short cycling.

Pressure Switches

There are basically two pressure switches in the compressor control circuit. A low-pressure switch is used to close the control circuit during high suction and open the circuit during low suction pressure. A high-pressure switch is used to open the control circuit during a critical high discharge pressure state. The high-pressure switch is available in automatic reset.

For proper setting of switches, see control settings section.

Crankcase Heaters

A crankcase heater is used to alleviate liquid migration to the compressor during off cycle periods. The crankcase heater is interlocked through the compressor contactor and is to be powered when the compressor is not running.

Defrost Controls

There are many types of defrost circuits and they are controlled by the case controller.

Refrigeration Temperature Controls

Control of the evaporator can be performed via main controller or case controller. If the case controller is used, it is capable of managing both the air temperature and the superheat of the coil using the electronic expansion valve. When a stepper type expansion valve is used, it’s recommended to install a liquid line solenoid prior to the valve in case of power failure so the evaporator does not flood back to the Protocol.

Use shielded and grounded Belden cable #8762 or equivalent between control panel and case sensors or thermostats.

Important: Shielded cable must be used. The shield wire must be attached to the panel liner on the control panel door.

Alarm Control

Alarm System

The Protocol basic alarm package includes alarms for:

- Oil failure (each compressor)
- Phase loss
- Low liquid level
- High suction pressure
- Compressor failure

Ladder diagrams emphasize the circuit continuity and logic. They aid troubleshooting and testing by identifying point-to-point connections and color coding rather than just physical location. A ladder diagram normally moves from left to right so the user can “read” the series of switches, relays, terminals, and components that make up a circuit.

Alarm Control (Electronic)

When an electronic protocol controller is utilized, all alarm functions are performed by the Protocol controller. High suction pressures are “read” by transducers connected to the Protocol controller. The liquid level is a digital input.

Phase loss, oil failure, and the compressor failure alarms are connected to the Protocol controller through a digital input. An optional modem can be installed to allow the Protocol controller to call out any refrigeration alarms.

Alarm Wiring

Each Protocol provides one NO/NC pilot duty relay for remote alarm. The field connection pins are located in the convenience switch panel.

Alarm System (except leak detection)

Separate from the leak detection system, alarms are present in the controller software to assist in preliminary troubleshooting.

Evaporator Mounted Refrigeration Solenoid

Power for refrigeration solenoids at the evaporator comes from the Protocol case electrical terminal pins, located in the main control panel.

Protocol A2L

Maintenance and Service

WARNING

READ ALL WARNINGS AND PROCEDURES IN THIS MANUAL AND ON THE UNIT BEFORE SERVICING OR PERFORMING MAINTENANCE ON THIS EQUIPMENT.

FAILURE TO ABIDE BY THESE WARNINGS COULD RESULT IN AN EXPLOSION, DEATH, INJURY, AND PROPERTY DAMAGE.

Before Servicing Equipment

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized.

- Work shall be undertaken under a controlled procedure, as documented below, to minimize the risk of a flammable gas or vapor being present while work is being performed.
- Prior to performing any service work, make sure all tools and equipment have been certified for use with flammable refrigerants.
- All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.
- The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e., non-sparking, adequately sealed, or intrinsically safe.
- If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available on hand. A dry chemical or CO_2 fire extinguisher should be adjacent to the charging area.
- No person carrying out work in relation to a refrigerating system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment shall be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.
- Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.
- During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation. Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to the original specification, damage to seals, incorrect fitting of glands, etc.
  i. Ensure that the apparatus is mounted securely.
  ii. Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer’s specifications.

Protocol A2L

Maintenance and Service

- Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer's specifications.
- Component parts are designed for use with flammable refrigerants and are non-incendive and non-sparking. To minimize the risk of possible ignition due to incorrect parts, component parts shall only be replaced with identical repair parts. Servicing shall be done by qualified service personnel only, so as to minimize the risk of possible damage due to incorrect parts or improper service.
- Always use a pressure regulator when using a nitrogen tank. Do not exceed 2 psig (0.14 bar) and vent lines when brazing. Do not exceed 350 psig (24.1 bar) for leak testing high side. Do not exceed 150 psig (10.3 bar) for leak testing low side.
- Always recapture any test charge in approved recovery vessel for recycling.
- If necessary to test the water loop, testing should be done using pressurized water (not to exceed 75 psig [5.2 bar]).
- Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

Electrical

- Make certain than no power supply circuit is closed/on before working on the unit. There may be more than one supply connection to a given unit. Remove all power before working on electrical components.
- Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times, the manufacturer's maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer's technical department for assistance.
- Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised. Initial safety checks shall include:
  i. Ensure that capacitors are discharged—this shall be done in a safe manner to avoid the possibility of sparking.
  ii. Ensure that no live electrical components and wiring are exposed while charging, recovering, or purging the system.
  iii. Ensure that there is continuity of earth bonding.
- Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use.
- Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.
  i. Replace components only with parts specified by the manufacturer. Other parts can result in the ignition of refrigerant in the atmosphere from a leak.
- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.
- If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.

Protocol A2L

Maintenance and Service

General Maintenance

Regular inspection and upkeep is critical to operation of the Protocol. Because of the numerous options and accessories that are unique to each store, it is impossible to list all the maintenance guidance for individual systems.

Maintenance must be performed by a well-qualified technician to diagnose and prevent problems before they may occur. The information below is a general guideline. Recommended service intervals in your area may vary depending on the operating environment and equipment used. Contact your Hussmann representative for further information.

All service must be logged.

Generally, the following items should be checked on a biweekly basis:

- Diagnostic data such as system pressures and temperatures should be reviewed for abnormal trends
- Alarm history
- Main power voltage
- Oil levels

Generally, the following items should also be checked on a monthly basis:

- Oil separator pressure drop
- System leak testing
- All filters and drier cores
- Insulation, conduit, electrical boxes, and control panels
- Secondary systems and accessories
- Fan motors, contactors, and electrical connections
- Check for tightness of fittings, fan blades, and motor mounts

Generally, the following items should also be checked on a quarterly basis:

- Investigate and record data on operating conditions for the following:
  -Suction, liquid, and discharge pressures and temperatures
  -Sub-cooling, superheat, and ambient temperatures
  -Safety controls, operating controls, and alarms
  -Amperage coming from compressors
  -Pumping station inlet and outlet pressures
- Check water strainers at each unit and clean as necessary

Each year, also check the following:

- If equipped with water-cooled condenser, check freezing point of glycol in closed loop and add water or glycol as required
- If equipped with water-cooled condenser, check alarm functions at pumping station
- If equipped with air-cooled condenser, inspect and clean as needed
- Straighten or replace fan blades as needed
- Change the liquid, oil, and suction filters
- Get an oil sample and determine the quality and change if required

Each two years, also check the following:

- Sample the closed loop fluid and have it analyzed (if using a Dow product, contact Dow and request a fluid sampling kit)

Protocol A2L

Maintenance and Service

Inspection Checklist

Store:				Location:				
Date:		Time:		Unit:				
Model Number:				Serial Number:				
Factory Order Number:				Manufacture Date:				
Defrost	Defrost Notes:							
Circuit Number	1	2	3	4	5	6	7	8
Type:								
Number Per Day:								
Duration:								

Superheat:	
Suction Setpoint:	
Suction Pressure:	
Suction Temperature:	
Split/Satellite Superheat:	
Split/Satellite Suction Setpoint:	
Split/Satellite Pressure:	
Split/Satellite Temperature:	

Oil:	
Oil Separator Level:	
Pressure Differential:	

Condenser	Condenser Notes:	
Head Pressure:		
Water Temperature (in):		
Water Temperature (out):		

Refrigerant:	
Receiver Level:	
Liquid Sight Glass:	

Compressor Number	1	2	3	4	5	6	7	8
Compressor Model Number:								
Discharge Temperature:								
Current Draw:								
Shell Temp. at Oil Connection:								
Float or Oil Level:								
Oil Control Solenoid Condition:								

Controller:	
Alarms:	
Time and Date Displayed:	

Notes:

Troubleshooting

This section assumes that the reader has a working knowledge of the electronic controller communications platform used in networking the Protocol electronic controls. It will be necessary to have a copy of the control manuals on hand to facilitate the troubleshooting process as well.

In most cases, the electronic controller will be used to determine whether the problem lies within the electronic control itself or external to the control. You will need to follow the instructions carefully to ensure an accurate method of solving the problem being presented.

NOTE: The current draw required by an analog meter (Volt-Ohm Meter or VOM) can permanently damage some electronic equipment. Never use a VOM to check computer components or computer-controlled systems. Use a digital multimeter (DMM) to measure voltage, current, and/or resistance. If a range is exceeded the display will display OL (overload).

Refer to A2L Leak Detection Sensor Service and Mitigation section for information related to that system.

Electrical Troubleshooting

Problem	Troubleshooting Steps
The compressor will not turn on or run.	1. Visually observe if the alarm on the control board is on. If it on, go to step 2. If it is off, go to step 9. 2. Access the Protocol and enter the force comp on the sub-menu. Enter the compressor number you wish to turn on. Visually observe if the correct compressor relay output LED on the control board is turned on. If turned on, go to step 3. If it does not turn on, go to step 7. 3. If the compressor contactor is energized, verify that the compressor turned on by cycling the compressor circuit breaker (the compressor should turn on and off with the circuit breaker) or use an amp probe and measure all three-phase wires between the contactor and the compressor. If the compressor contactor did not energize, go to step 6. 4. Important: Turn the compressor circuit breaker off before implementing this check. If the compressor contactor energized, but the compressor cannot be cycled with the circuit breaker, the compressor terminal box located on the side of the compressor will need to be opened to ensure that the power wires are tightened down. 5. If the compressor wires are tight within the terminal box, the compressor may be damaged internally and may need to be replaced. 6. The problem appears to be located in the control circuit wiring, most likely in one of the safeties. Referring to the supplied unit-specific wiring diagram, use a digital voltmeter and determine where the circuit is being broken. The control circuit originates from the phase monitor, passes through the control board safety switch, the discharge line thermostat, and finally through the electronic oil level control safety. 7. If the compressor can't be forced on through the controller parameters: -No electric defrost is currently engaged. Electric defrosts implement a compressor shedding routine, which may be keeping the particular compressor offline. -The correct number of compressors is installed. -Check that the suction pressure is not below 2 psi (0.14 bar) activate the vacuum prevention routine which will not allow the compressors to turn on. 8. If the preceding parameters check out, the electronic control board may need to be replaced. 9. At this point, it is assumed that the electronic control board is in switchback. If the compressor being examined is not wired to the switchback control circuit (refer to the supplied unit-specific wiring diagram), the cause of this switchback condition will need to be investigated further to correct the existing problem. 10. If the compressor is wired into the switchback control circuit, use a digital voltmeter and determine where the circuit broken. The switchback control circuit originates from the phase monitor, passes through the switchback relay on the control board, through the low pressure mechanical backup switch, back through the control board relay and fuse, through the high pressure safety switch, through the discharge line thermostat, and finally through the electronic oil level control safety.

Problem	Troubleshooting Steps
Evaporator is not defrosting.	1. Visually observe if the Alarm Relay LED on the control board is on. If LED is on, go to step 2. If LED is off, refer to the "Troubleshooting Alarms" section. 2. Verify that the clock contained in the Protocol is keeping time. Access and select the set the clock submenu. If the clock is running, go to step 3. If the clock is not running, try changing the time to the correct setting and troubleshoot for possible electrical noise interference. 3. Enter the defrost circuit number and activate it. Now exit and go to the defrost menu. Observe the circuit forced into defrost. If the status indicates defrost proceed to step 4. If the status does not indicate defrost, go to step 7. 4. Visually observe which defrost relay located on the defrost board is energized. The corresponding indicator light on the defrost board should be on. If the indicator light is on, proceed to step 5. If the indicator light is off, proceed to step 10. 5. At this point, it is assumed that the control is responding correctly and the problem lies within the control panel. Use a digital voltmeter to check that voltage is present at the correct terminal blocks in the power distribution box. Refer to the supplied, unit-specific wiring diagram to determine which terminal blocks are providing power for the particular case load that is defrosting. If voltage is present at the terminal blocks, verify that the case is in defrost by visual inspection and then go to step 6. If voltage is not present at the terminal blocks, go to step 11. 6. If the status of this defrost circuit indicates it is deactivated, reactivate the circuit and verify the programming of this circuit as outlined in controller manual. If the status of this defrost circuit indicates that it is not installed (N/A) go to the Protocol configuration menu and access the Protocol setup submenu. Enter the DEFR setup program with the correct number of defrost circuits. Repeat this step to verify that the circuit is activated. 7. Verify the number of defrosts per day, the defrost length, and defrost start times to ensure proper configuration. Go to step 9. 8. Verify that the correct output(s) have been assigned to the appropriate defrost circuit. Now that all programming information has been verified, return to step 3 to force the defrost on. 9. Verify that the correct output(s) have been assigned to the appropriate defrost circuit, that the status shows the circuit is in defrost, and check the ribbon cable between the control board and defrost board. Try replacing the ribbon cable with one from another Protocol if possible to verify they cable is good or bad. -If the cable is good, replace the control board. The defrost output drive chip has possibly been damaged. -If the correct outputs have not been assigned, enter the correct programming and repeat this step. 10. Use a digital voltmeter to verify where the circuit is being broken. Power for defrost solenoids originates from the ‘X1’ terminal block, passes through the fuse relay located on the defrost board, and ends at the terminal block located in the power distribution block. If the fuse on the defrost board has blown, replace it with another fuse and repeat the voltage checks. For electric defrosts, a minimum of two defrost outputs will be used for defrost—one for the solenoid and one for the defrost heaters. The power for the solenoid can be checked as described previously in this step. To verify the defrost heater wiring go to step 12. 11. Visually inspect that the circuit breaker handles, located on the bus bars within the control panel, are in the on position. If the handle is in the on position, use a digital meter and check for voltage at the terminals of the device and again at the terminal blocks in the power distribution panel. If voltage is not present at these two points, got to step 13. 12. There should be 24 VDC across the terminals of the low voltage power supply. If 24 VDC is not present, replace the power supply.

Problem	Troubleshooting Steps
Evaporator is not defrosting.	13. Check fuse on defrost relay board. Replace fuse if it is blown. If fuse is good, measure the voltage present at the white connector on the defrost relay board. Place the positive test lead of you meter on the normally open (NO) contact of the defrost relay board connector. Place the negative test lead of your meter on the common (COM) contact of the defrost relay board connector. Your digital meter should read 24 VDC. If 24 VDC is present, the contactor must be replaced. If 24 VDC is not present, verify that wiring is correct as compared with the supplied unit-specific wiring diagram.
Pressure transducer is not reading properly.	The transducer cable is shielded and should not have the bare drain wire attached to door panel liner. The mechanical ground connection is achieved through the threaded fitting on the suction and/or discharge header. 1. Use a service gauge to verify the actual pressure reading. If the pressure reading of the gauge and the reading of the handheld controller is more than 2 psig (0.14 bar), check the pressure transducer offset, which is available on the electronic control. 2. Verify that the transducer range is set properly. Select the pressure input currently having problems and observe the transducer range. Suction transducers should be set to a 200 psig (13.8 bar) range, while discharge transducers require a 500 psig (34.5 bar) range. If the range is not set properly, make the programming change and reevaluate the transducer. If the range is set properly, go to step 3. 3. Use a digital voltmeter set to DC voltage to measure the supply voltage and output signal voltage of the transducer 4. If the supply voltage is not within the range specified by the controller manufacturer, check pressure. 5. If the pressure reading, matches the reading of the handheld device, replace the transducer. If the pressure reading, as indicated by the above formula, does not match the reading of the handheld device, replace the control board. 6. Use a digital voltmeter to measure the control transformer secondary voltage. With meter set to AC volts, remove the power plug connected to the Protocol control and place your test leads of the meter to the two outside pins. The voltage present at these two pins should be between 20 and 27 VAC. If the secondary voltage is within limits, replace the control board. If the secondary voltage is out of limits, investigate supply voltage to the control transformer.
Temperature sensor is not reading properly.	1. Begin by verifying sensor placement: Ensure the probe is properly positioned in the air stream at the evaporator outlet. Confirm it is not in direct contact with any coil or surface that may skew readings. 2. Next, check wiring and connections. Inspect sensor wiring for loose, corroded, or damaged connections and verify continuity of the wires from the sensor to the controller using a multimeter. 3. Measure resistance (at ambient temperature) by disconnecting the sensor from the circuit and use a digital multimeter set to resistance (ohms) to measure the sensor resistance at a known ambient temperature. 4. Compare the measured resistance with the manufacturer's resistance-temperature chart (e.g., at 77° F [25° C], a 10 kΩ NTC should read ~10,000 ohms). 5. Simulate temperature changes by applying heat or cold to the sensor (e.g., hold it in your hand or place it in ice water). Monitor the change in resistance—resistance should decrease with heat and increase with cold (NTC behavior). If resistance does not change appropriately, the thermistor may be defective. 6. Measure sensor voltage (in circuit) next. Reconnect the sensor and power the system, then use a voltmeter to measure the voltage across the sensor while it is operating. Confirm the voltage range is appropriate for the controller's sensing circuit. 7. Next, check controller input. If the sensor resistance and voltage are within expected values but the temperature reading is still inaccurate, verify that the controller or input module is configured correctly for an NTC sensor and the correct resistance curve. 8. If the sensor shows open circuit, short circuit, or resistance values far off from expected even at known temperatures, replace it.

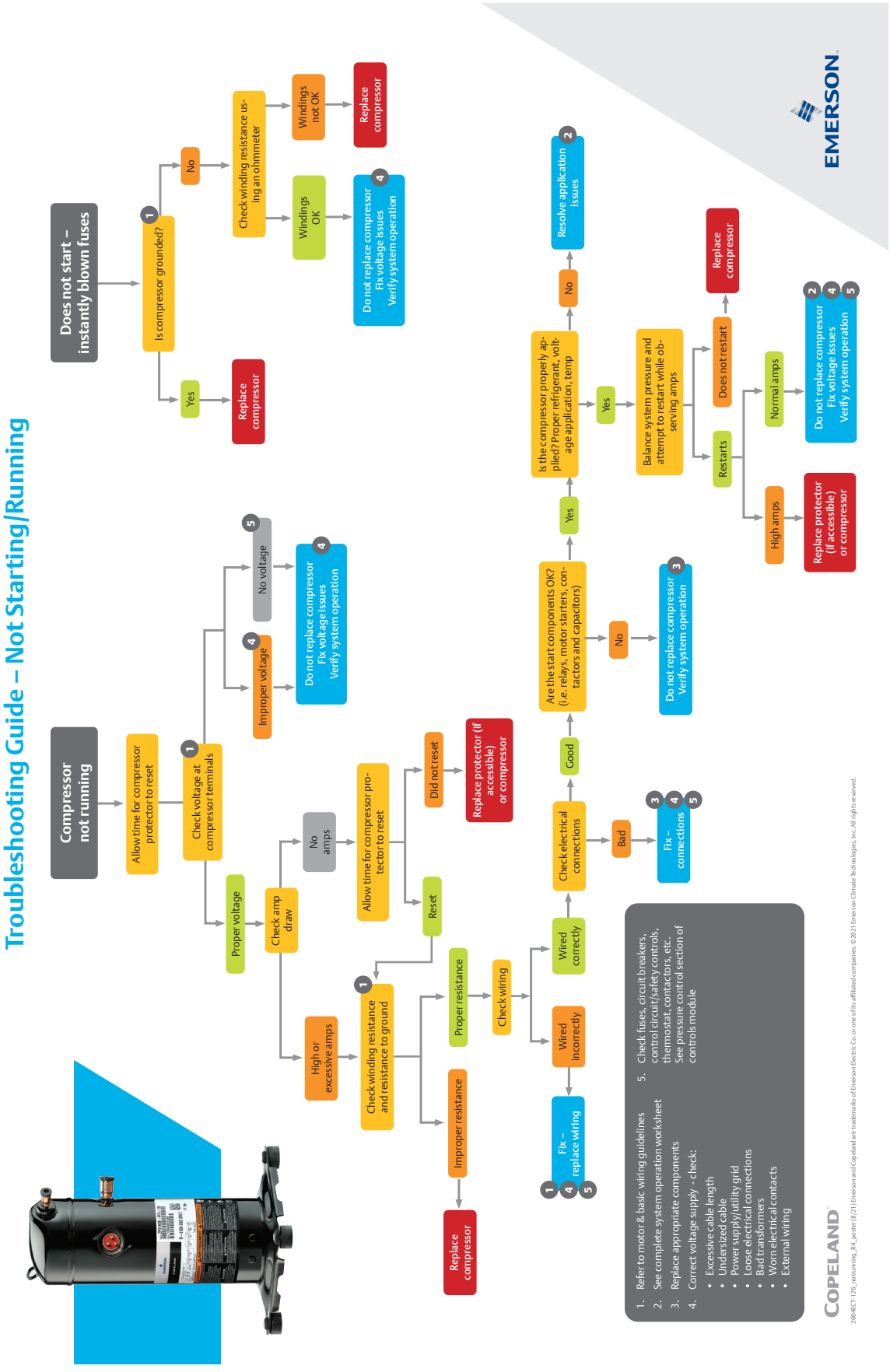
Troubleshooting Alarms

The first step in analyzing alarms is to determine when the alarm occurred. The alarms will appear in the controller. The cause, time, and date of the alarm will be shown. There are two types of alarms—switchback and non-switchback.

A switchback alarm is normally the result of some external failure as seen or interpreted by the electronic control. When a switchback alarm occurs, the electronic control removes itself from control of the compressors. If this happens, operation and cycling of the compressors will be controlled by a low pressure mechanical switch located inside the Protocol system, which will cycle one half of the compressors. The indication of alarm will be dependent upon which alarm device has been installed: auto dialer, in-store alarm, or computer notification system. Under a switchback alarm, no defrosts will occur. There are three types of switchback alarms: high suction pressure, low suction pressure, or all compressors off for more than 60 minutes.

All other types of alarms fall under the “non-switchback” category, such as high discharge temperatures. The control will continue to cycle compressors and manage defrosts under this category of alarms.

Alarm	Possible Causes	Troubleshooting Steps
High Suction Pressure -30-minute time delay -ignored during defrost	1. One or more compressors are non-operational 2. High alarm limit is not set properly	1. Enter the alarm menu. Observe the time and date of the alarm. There will be a prompt to clear the current alarm. 2. Proceed to the status menu for this Protocol. Observe the operation of compressors turning on and watch for suction pressure to come down. If the suction pressure does not come down when a compressor comes on, it is an indication that some external device is keeping the compressors offline (high pressure safety, oil safety, phase monitor, etc.). Check the Protocol and investigate whether or not compressors are running.
Low Suction Pressure -30-minute time delay -ignored during defrost	1. Refrigerant charge is low 2. Low alarm limit is not set properly	1. Enter the alarm menu. Observe the time and date of the alarm. There will be a prompt to clear the current alarm. Press the DEL key to remove the current alarm condition. 2. Observe the operation of the compressor turning on, as indicated by Xs. The Protocol should begin to operate the compressors and suction pressure should be maintained. If this does not occur, the Protocol operation will need further investigation.
All Compressors Off -60-minute time delay	1. One or more compressors has been unintentionally turned on by something other than the controller 2. Faulty reading from the pressure transducer	This alarm occurs when suction pressure (as read by the electronic controller) is both above the low alarm limit and below the suction pressure setpoint. 1. Enter the alarm menu and observe the time and date of the alarm. There will be a prompt to clear the current alarm. 2. Observe the operation of compressors turning on, as indicated by Xs. The Protocol should begin to operate the compressors and suction pressure should be maintained. If this does not occur, you will need to further investigate the Protocol operation.


Troubleshooting Guide – Not Starting/Running
Compressor not running
Allow time for compressor protector to reset
Check voltage at compressor terminals
Proper voltage
Check amp draw
No amps
Improper voltage
No voltage
Do not replace compressor Fix voltage issues Verify system operation
High or excessive amps
Check winding resistance and resistance to ground
Improper resistance
Replace compressor
Proper resistance
Check wiring
Wired correctly
Wired incorrectly
Fix – replace wiring
Allow time for compressor protector to reset
Reset
Did not reset
Replace protector (if accessible) or compressor
Check electrical connections
Bad
Fix – connections
Good
Are the start components OK? (i.e. relays, motor starters, contactors and capacitors)
No
Do not replace compressor Verify system operation
Yes
Is the compressor properly applied? Proper refrigerant, voltage application, temp
No
Resolve application issues
Yes
Balance system pressure and attempt to restart while observing amps
Restarts
Does not restart
Replace compressor
High amps
Replace protector (if accessible) or compressor
Normal amps
Do not replace compressor Fix voltage issues Verify system operation
Does not start – instantly blown fuses
Is compressor grounded?
Yes
Replace compressor
No
Check winding resistance using an ohmmeter
Windings OK
Do not replace compressor Fix voltage issues Verify system operation
Windings not OK
Replace compressor
1. Refer to motor & basic wiring guidelines
2. See complete system operation worksheet
3. Replace appropriate components
4. Correct voltage supply - check:
• Excessive cable length
• Undersized cable
• Power supply/utility grid
• Loose electrical connections
• Bad transformers
• Worn electrical contacts
• External wiring
5. Check fuses, circuit breakers, control circuit/safety controls, thermostat, contactors, etc. See pressure control section of controls module
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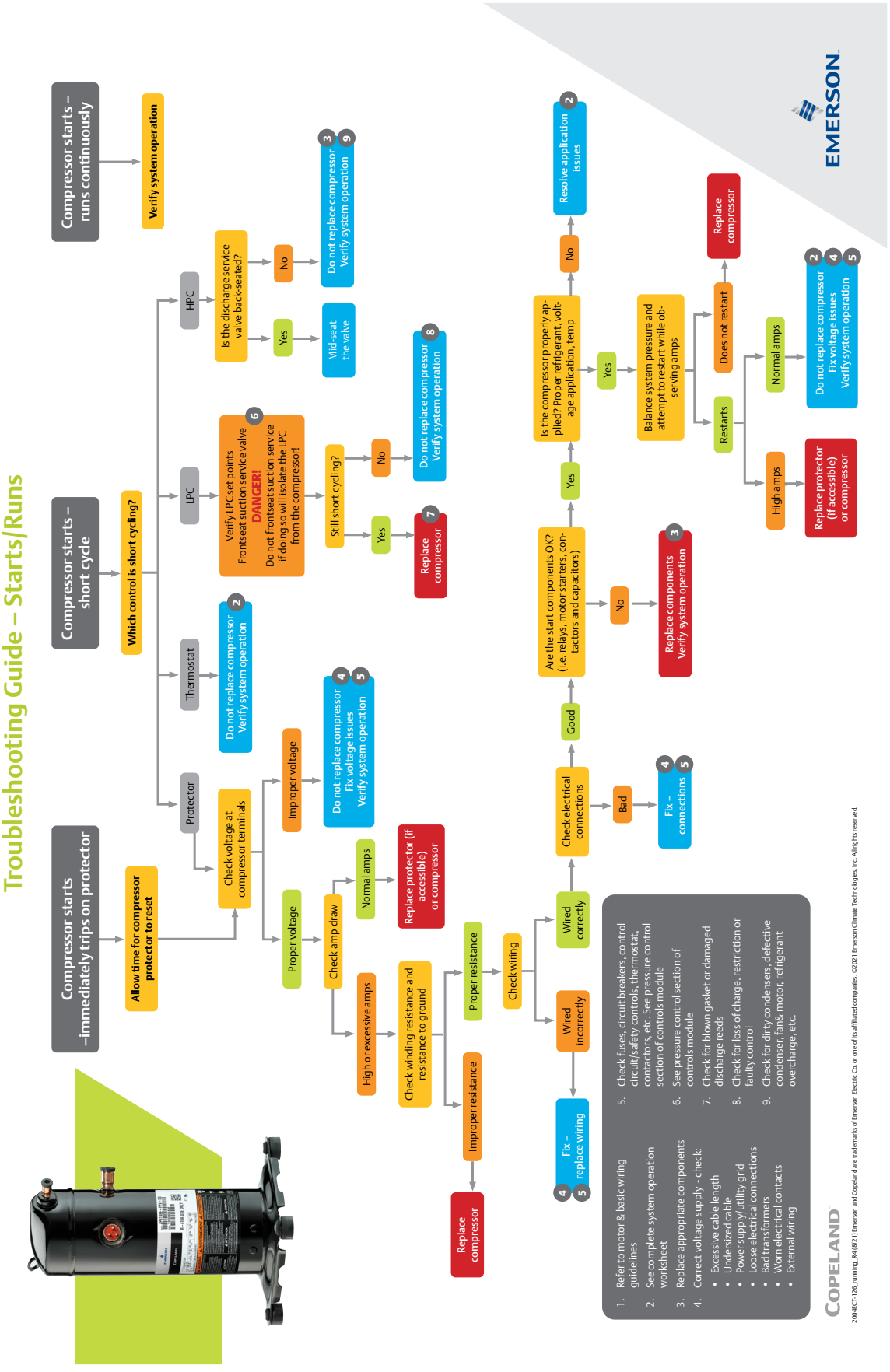
Protocol A2L

Maintenance and Service



Refrigerant Removal, Evacuation, and Recovery

When breaking into the refrigerant circuit to make repairs—or for any other purpose—conventional procedures shall be used. The following procedure shall be adhered to:

a. Safely remove refrigerant following local and national regulations
b. Purge the circuit with inert gas
c. Evacuate
d. Purge with inert gas
e. Open the circuit by cutting or brazing.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. Compressed air or oxygen shall not be used for purging refrigerant systems.

Refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

Ensure that adequate ventilation is available.

Recovery Procedure

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely. When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available.

All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e., special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants including. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.

The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level. The evacuation process shall be carried out prior to returning the compressor to the supplier. Only electric heating to the compressor body shall be employed to accelerate this process.

When oil is drained from a system, it shall be carried out safely.

Protocol A2L

Maintenance and Service

Leak Detection

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

The following detection methods are deemed acceptable for all refrigerant systems:

a. Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity might not be adequate, or might need recalibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.
b. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine can react with the refrigerant and corrode the copper pipework. Examples of leak detection fluids are:

    -Bubble method
    -Fluorescent method agents

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.

If a leak is detected—after proper safety precautions have been observed—visually inspect all lines and joints for proper piping practices.

Compressor Replacement

Since each machine room or rooftop unit tends to be unique, plan carefully as to how you will move the compressor without harming personnel, equipment, or the building. Before beginning removal of an old compressor, make replacement unit ready to install:

1. Verify replacement compressor electrical requirements, refrigerant, application, capacity, piping hookup location, and design suction and discharge gaskets.
2. Mounting requirements: Have compressor in an easily accessible position, uncrated, and unbolted from shipping pallets.
3. Disconnect electrical supply: Turn off motor and control panel power supplies to the Protocol. Turn off control circuit and open all compressor circuit breakers. Tag and remove electrical wires and conduit from the compressor.
4. Isolate compressor from Protocol: Front seat suction and discharge service valves. Close oil supply and equalizing lines. Bleed compressor pressure through both discharge and suction access ports into an approved recovery vessel.
5. Remove oil supply and equalizing lines. Remove externally mounted components which will be re-used on the replacement compressor. Plug holes to compressor manufacturer's specifications.
6. Remove bolts from suction and discharge service valves.
7. Remove mounting bolts: When moving the compressor, use a come-along, hoist, or hydraulic lift to carry the weight.

WARNING: Do not use the Protocol piping or panel to support a hoist or come along.

WARNING: Do not use ceiling trusses to support a hoist or come along.

The rear support channel on the Protocol or a properly constructed ceiling rail may be used to support a hoist or come along. To make hookup and lifting easier, an eye bolt may be installed in the rear top of the compressor head.

If a compressor removal table is used, slide the compressor fully on to the table then roll table to overhead hoist or hydraulic lift area. When the old compressor has been removed, clean the suction and discharge service valve gasket surfaces to shiny metal. Clean the gasket surfaces on the new compressor to shiny metal. Be careful not to groove or round the surfaces. Gasket surfaces must be clean to prevent leaking.

Install the new compressor in reverse order of removal. Do not open the new compressor to the system until after it has been leak tested and triple evacuated.

Oil level regulator sight glasses are designed to provide a hermetic seal when internally pressurized.

Some leaking may occur when a deep vacuum is pulled.

Drier Replacement

1. Shut down the system.
2. Isolate the drier to be replaced and bleed off pressure into an approved recovery vessel.
3. Replace the drier.
4. Pressurize, leak test, and bring back online if all checks are cleared.

Replacement Parts List

Ensure all warnings contained in this manual and on the equipment are observed and understood before servicing this equipment.

Component	Description	Part Number
Oil Filter	3/8" F / 3/8" F Oil Filter SF283F	0312527
Suction Filter	1 3/8" Suction Filter RSF4811T	0340738
	1 5/8" Suction Filter RSF4813T	0340739
	2 1/8" Suction Filter RSF4817T	0340740
	2 1/8" Suction Filter RSF9617T	0422111
	2 5/8" Suction Filter RSF9621T	0422112
	3 1/8" Suction Filter RSF9625T	0422113
Suction Filter Core	Suction Filter Core RPE48BD	0340741
Liquid Drier	Drier 7/8" C487G	0709985
	Drier 1 1/8" C489G	0256162
	Drier 1 1/8"C969G	0708460
	Drier 1 3/8" C9611G	0708461
	Drier 1 5/8" C14413G	0708462
Liquid Drier Core	Drier RCW48 (Gold)	0417585
Exhaust Fan	Tubeaxial fan	3191339
Ultracap	12" SEC99AD12D	0704738
	18" SEC99AD18D	0705711
	24" SEC99AD24D	0705712
	36" SEC99AD36D	0705713
	48" SEC99AD48D	0705714
	60" SEC99AD60D	0707572
	70" SEC99AD70D	0709149
Ultratube	18" SEC99BD18D	0709321
	24" SEC99BD24D	0709322
	36" SEC99BD36D	0709323
	48" SEC99BD48D	0709324
	60" SEC99BD60D	0709590

Protocol A2L

Maintenance and Service

Component	Description	Part Number
Compressor	Copeland YFI15KAETF5FSD	3187822
	Copeland YB28KAETF5FSE	3194138
	Copeland YFI19KAETF5FSD	3194130
	Copeland YB14KSETF5MSA	3194134
	Copeland YB34KAETF5FSE	3194139
	Copeland YFI22KAETFCFSD	3194131
	Copeland YB15KSETF5MSA	3194135
	Copeland YB40KAETF5FSE	3194141
	Copeland YB20KSETF5MSA	3194136
	Copeland YB44KAETF5FSE	3194142
	Copeland YFI10KAETF5FSD	3187823
	Copeland YB23KSETF5MSA	3194137
	Copeland YB50KAETF5HCN	3194145
	Copeland YFI15KAETFDFSD	3194434
	Copeland YB28KAETFDFSE	3194446
	Copeland YFI19KAETFDFSD	3194435
	Copeland YB14KSETFDMSA	3194440
	Copeland YB34KAETFDFSE	3194447
	Copeland YFI22KAETFDFSD	3194436
	Copeland YB15KSETFDMSA	3194441
	Copeland YB40KAETFDFSE	3194449
	Copeland YB20KSETFDMSA	3194442
	Copeland YB44KAETFDFSE	3194450
	Copeland YFI10KAETFDFSD	3194433
	Copeland YB23KSETFDMSA	3194444
	Copeland YB50KAETFDHCN	3194451
	Copeland YFI15KAETFEFSD	3195090
	Copeland YB28KAETFEFSE	3195113
	Copeland YFI19KAETFEFSD	3195092
	Copeland YB34KAETFEFSE	3195114
	Copeland YFI22KAETFEFSD	3195100
	Copeland YB40KAETFEFSE	3195116
	Copeland YB44KAETFEFSE	3195117
	Copeland YFI10KAETFEFSD	3195087
	Copeland YB50KAETFEHCN	3195118
	Copeland YB20KSETFEMSA	3195110
	Copeland YB23KSETFEMSA	3195111
Compressors continued on next page		

Component	Description	Part Number
Compressor	Copeland YBD20KSETF5MSB	3194146
	Copeland YBD28KAETF5FSH	3194147
	Copeland YBD34KAETF5FSH	3194148
	Copeland YBD34KAETF5FSH	3194149
	Copeland YBD50KAETF5HCP	3194150
	Copeland YBD20KSETFDMSB	3194452
	Copeland YBD28KAETFDFSH	3194453
	Copeland YBD34KAETFDFSH	3194454
	Copeland YBD40KAETFDFSH	3194455
	Copeland YBD50KAETFDHCP	3194456
	Copeland YBD20KSETFEMSB	3195119
	Copeland YBD28KAETFEFSH	3195120
	Copeland YBD34KAETFEFSH	3195121
	Copeland YBD40KAETFEFSH	3195122
	Copeland YBD50KAETFEHCP	3195123
	Copeland YBD20KSEPFVMSB	3195151
	Copeland YBD28KAEPFVFSH	3195152
	Copeland YBD34KAEPFVFSH	3195153
	Copeland YBD40KAEPFVFSH	3195154
	Copeland YBD50KAEPFVHCP	3195155
	Copeland YFJ15KAETF5FSB	3187821
	Copeland YFJ10KAETF5FSB	3194132
	Copeland YFJ19KAETF5FSB	3194133
	Copeland YFJ10KAETFDFSB	3194437
	Copeland YFJ15KAETFDFSB	3194438
	Copeland YFJ19KAETFDFSB	3194439
	Copeland YFJ10KAETFEFSB	3195104
	Copeland YFJ15KAETFEFSB	3195106
	Copeland YFJ19KAETFEFSB	3195107
	Copeland YFJ10KAEPFVFSB	3195137
	Copeland YFJ15KAEPFVFSB	3195138
	Copeland YFJ19KAEPFVFSB	3195139

Component	Description	Part Number
Powerlink Contactor/Breaker	1P-20A Breaker Powerlink QO120PL5392	0374149
	2P-20A Breaker Powerlink QO220PL5392	0369211
	2P-30A Breaker Powerlink QO230PL5392	0369210
	2P-40A Breaker Powerlink QO240PL5392	0417034
	3P-20A Breaker Powerlink QO320PL5392	0365951
	3P-30A Breaker Powerlink QO330PL5392	0365952
Power Supply	Block Power Supply Link QOPLPS	0365953
Circuit Breaker	1P-15A 208 V QO115	0365954
	1P-20A 208 V QO120	0365955
	1P-30A 208 V QO130	0398323
	1P-40A 208 V QO140	0425998
	2P-15A 240 V QO215	0708241
	2P-20A 208 V QO220	0374150
	2P-30A 208 V QO230	0369237
	2P-40A 208 V QO240	0377743
	2P-60A 208 V QO260	0425997
	3P-15A 208 V QO315	0369233
	3P-20A 208 V QO320	0369242
	3P-25A 240 V QO325	1H17061003
	3P-30A 208 V QO330	0365866
	3P-35A 240 V QO335	1H17061004
	3P-40A 208 V QO340	0377594
	3P-45A 208 V QO345	2H12779001
	3P-50A 208 V QO350	0369234

Protocol A2L

Decommissioning

Decommissioning Process

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its details. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample should be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

a. Become familiar with the equipment and its operation.
b. Isolate the system electrically.
c. Before attempting the procedure, ensure:
   i. Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
   ii. All personal protective equipment is available and being used correctly.
   iii. The recovery process is supervised at all times by a qualified, competent person.
   iv. Recovery equipment and cylinders conform to the appropriate standards.
d. Pump down refrigerant system, if possible.
e. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
f. Make sure that cylinder is situated on the scales before recovery takes place.
g. Start the recovery machine and operate in accordance with instructions.
h. Do no overfill cylinders (no more than 80% volume liquid charge).
i. Do not exceed the maximum working pressure of the cylinder, even temporarily.
j. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
k. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.

Equipment shall be labeled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. For appliances or cylinders containing flammable refrigerants, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

HUSSMANN®

Warranty

To obtain warranty information or other support, contact your Hussmann representative or visit: https://www.hussmann.com/services/warranty.

Please include the model and serial number of the product.

For questions about your equipment, please contact our Technical Support Team at 1-866-785-8499

For general support or service calls, contact our Customer Support Call Center at 1-800-922-1919

For ordering aftermarket warranty parts, call 1-855-HussPrt (1-855-487-7778) or email the following address: Hussmann_part_warranty@hussmann.com

Square D Tech Support Hotline 888-SQUARED (888-778-2733)
Level one provides product initial tech support and can connect the caller to level two if required.

Revision History

Revision A: (October 2025) Initial release

Scan the QR code on your mobile device to access additional product information or order parts using equipment serial number.

Parts may also be ordered at:
parts.hussmann.com
Call toll free: 1.855.487.7778

U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.hussmann.com

Spanish P/N 3233026
French P/N 3233025