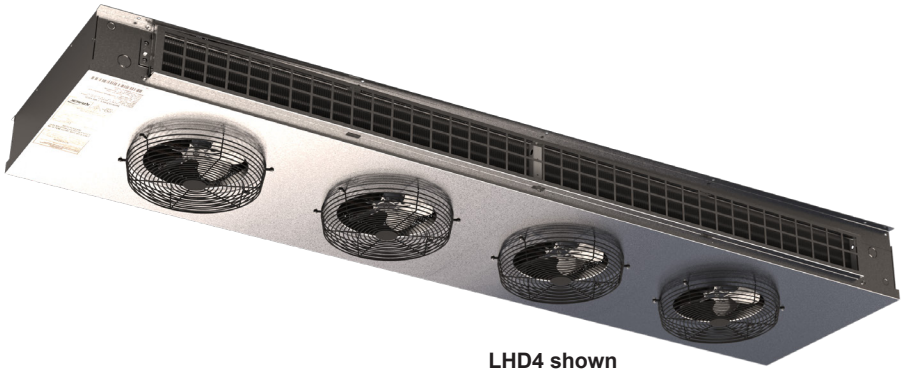
KRACK

EVOLVE A2L



LHD4 shown

## Installation, Operation, and Service Manual

# LH-A2L Series

### Low Profile Evaporator/ Unit Cooler

**P/N** 3235344 **Rev** A
October 2025

**Refrigerant Type**
A2L (R-454A or R-454C)

**Certifications**

c UL US LISTED

CLASSIFIED UL EPH

**WARNINGS:**

**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.

This equipment uses a low-flammability 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 inside or 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.

©2025 Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

**French P/N 3235353**
**Spanish P/N 3235355**

## Table of Contents


**User Safety and Product Information** **3**
- Legal Disclaimer 3
- Environmental Concerns 3
- ANSI Z535.5 Definitions 3
- Serial Label Location 4
- UL Listing 4
- Sanitation Listing 4
- Federal / State Regulation 4
- Additional Important Labeling 4
- General Safety Instructions 5
- Equipment Labeling 10
- System Nomenclature 10
- Krack/Hussmann Product Control 10
- Before Working with A2L Refrigerant 11
- Refrigerant Detection System Overview 12

**Installation Information** **13**
- Equipment Inspection / Shipping Damage 13
- Exterior Loading 13
- Location 14
- Minimum Room Floor Area 15
- Equipment Mounting 17
- Component / Dimensional Views 18
- Electrical Information 19
- Field Wiring 19
- Electrical Connections 19
- Defrost Wiring Diagrams 20
- Piping Overview 24
- Piping Installation Requirements 24
- Drain Line 25
- Refrigerant Distributor Nozzles 26
- Expansion Valves 27
- Safety Shut-Off and Check Valves 28
- Pre-Startup 29
- Refrigerant Charging Procedure 30

**Operation and Controller** **31**
- Sequence of Operation 31
- Standard Unit Cooler Operation 31
- Electric Defrost Operation 31
- Variable Speed Motor Operation 32
- System 450 Controller Operation 32
- Operation Check 34
- Controller 34

**Maintenance and Service** **35**
- Maintenance and Cleaning 37
- Troubleshooting 38
- Refrigerant Removal, Evacuation, and Recovery 39
- Leak Detection 40
- A2L Leak Detection Sensor Service and Mitigation 41
- Danfoss Sensor 42
- Copeland Sensor 45
- A2L Sensor Location 49
- A2L Sensor Reset Instructions (After Leak Event) 49
- Service 50
- Coil Guards 51
- Replacement Parts List 52
- Decommissioning Process 54

**Decommissioning** **54**

**Warranty** **55**

**Revision History** **55**




Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

### Legal Disclaimer

Review all safety warnings on the case and in this manual before attempting start-up. Hussmann/Krack shall not be liable for any repair of replacement made without the written consent of Hussmann/Krack, 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 LH-A2L evaporators unless otherwise stated or contextualized and “system” means a set of things working together as parts of an interconnecting network.

### Environmental Concerns

Hussmann and Krack recommend 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.

### Serial Label Location

The serial label is located on the fan side of the equipment. Serial label contains all pertinent information such as model, serial number, amperage rating, and refrigerant information.

### UL Listing

These unit coolers are 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.

### Sanitation Listing

Specific installation requirements (addressed in the installation section) must be met to comply with sanitation standards in food service applications.

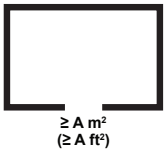
### Federal / State Regulation

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.

### 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.




Minimum Room Floor Area

Grounding Connection Location

# SAFETY INSTRUCTIONS

## General Safety Instructions

This manual was written in accordance with originally prescribed equipment that is subject to change. Hussmann/Krack 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 equipment 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/Krack 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 must 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.

**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—Store in a well ventilated room without continuously operating flames or other potential ignition.
- 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.
- WARNING—Do not damage the refrigerating circuit.
- WARNING—Do not use mechanical devices or other means to accelerate the defrosting process, other than those recommended by the manufacturer.
- WARNING: Keep clear of obstruction, all ventilation openings in the appliance enclosure or in the structure for building-in.


Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

**⚠WARNING**

- 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.
- Safety shut-off valves are factory-supplied with each unit.
- Do not bypass safety shut-off valves.
- 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.
- 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 must 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 must 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.
- 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.
- Factory installed refrigerant sensors or detectors shall not be disconnected.
- 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.

**⚠WARNING**

- The appliance shall be stored in a room without continuously operating ignitions sources (for example: open flames, an operating gas appliance or an operating electric heater).
- 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 Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed. Mechanical connections made in accordance shall be accessible for maintenance purposes.
- 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.

- 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.

## ⚠WARNING

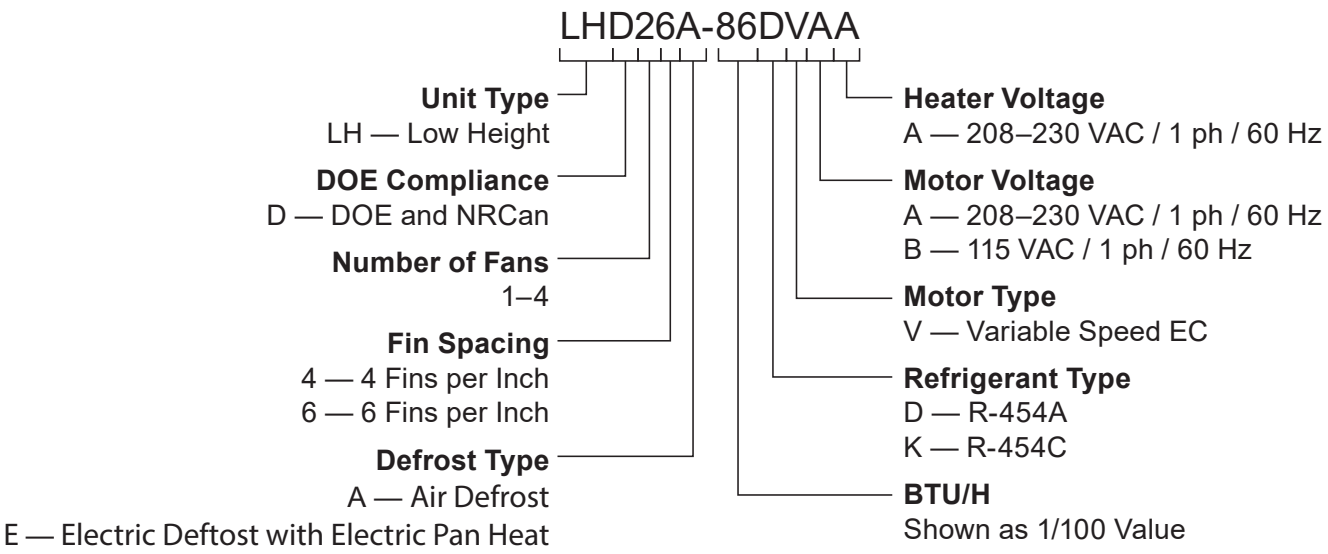
- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans..
- Particular attention shall 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.
- 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.
- 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 must be done by qualified service personnel only, so as to minimize the risk of possible damage due to incorrect parts or improper service.
- 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 unit. Serious bodily injury or death could occur from falling equipment.
- Precautions shall be taken to avoid excessive vibration or pulsation of the refrigerant piping.
- 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.
- 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.

**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 IN ANY WAY.**

### Equipment Labeling

The type of refrigerant to be used is prominently displayed on the serial label. All equipment includes complete wiring diagrams. All wiring is color coded.

### System Nomenclature




### Krack/Hussmann Product Control

Serial number and shipping date of all equipment is 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.
- 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.
- 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.

## Refrigerant Detection System Overview

### Refrigerant Detection System

This equipment uses a Danfoss A2L gas sensor for gas concentration monitoring as standard, factory-installed equipment.

### Application

A2L detection devices represent distinctive and intelligent refrigerant or flammable gas detectors. They are designed to identify and precisely measure A2L refrigerants commonly employed in refrigeration applications—detecting potential flammable gas leaks. A2L stationary gas sensors are engineered to continuously monitor and identify leaks of specific flammable refrigerants.

### Installer And Operator Responsibility

Sensors require installation and maintenance by a qualified technician who follows all instructions and adheres to the prevailing standards in their respective industry and location. It is crucial to note that these guidelines serve as a reference, and the manufacturer disclaims any responsibility for misuse, improper installation, or operation of these components.

Failure to install and operate the equipment in conformity with provided instructions and all industry and local guidelines may result in severe injuries, including fatality, for which the manufacturer will not be held accountable.

### Maintenance

Although the A2L sensor does not require calibration throughout its operational lifespan, routine maintenance is essential to ensure its proper functioning. Routine maintenance involves checking that the sensor membrane is clean and not blocked. Blockage can be removed by lightly brushing with a clean, damp cloth.

Verify its correct operation regularly as part of a maintenance routine. Avoid cleaning the device with corrosive chemicals, solvents, or abrasive detergents. Refrain from spraying cleaning or polishing aerosols onto the device.

View the “A2L Leak Detection Sensor Service and Mitigation” section for information on components, maintenance, and service.

### Sensor Life

Leak sensors have an expected fifteen-year lifespan. If any malfunction happens, and it cannot be fixed following the proper troubleshooting procedure before this period, replace it immediately to prevent any fault. This component must be replaced with the same exact part by authorized service personnel only.

It is imperative that the refrigerant sensor, which has been initially installed at the factory, remains integral and should not be intentionally disconnected. Unauthorized disconnection of the factory-installed refrigerant sensor is strictly prohibited, and maintaining its operational status is essential for ensuring the ongoing safety and functionality of the system. Any tampering or disconnection may compromise the ability to detect and alert to the presence of refrigerant, posing potential risks to both equipment and personnel. It is imperative to adhere to these guidelines to uphold the integrity of the refrigeration system and comply with safety standards.

### Sensor Location and Position

The location and position of the refrigerant sensor is critical and it should not be moved. It is crucial that the sensors are located only as defined by manufacturer. The position has been determined by laboratory testing to maximize effectiveness in detecting any leak promptly. Positioning sensors as directed by the manufacturer provides accurate performance of the sensor and enhances the overall safety and reliability of the system.

The sensor has an ongoing, self-testing routine to determine if a malfunction has occurred. If the sensor detects a malfunction, the sensor will trigger a mitigation event. Additionally, when the sensor reaches end of life, it will trigger a mitigation event. In both cases, the sensor will need to be replaced to restart the system.

### 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 label 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.

Each unit cooler is leak tested, evacuated to remove moisture, and then shipped with a gas holding charge. Absence of this charge may indicate a leak has developed in transit. The system should not be charged with refrigerant until it is verified that there is no leak or the source of the leak is located and repaired.

#### 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.

### Exterior Loading

Do NOT walk on top of the equipment or damage to the equipment and serious personal injury could occur. Equipment is not structurally designed to support external loading such as the weight of a person.

# LH-A2L Series

## Installation Information

### Location

For all defrost types, unit coolers must have proper airflow to maintain a uniform room temperature and have a complete defrost. These are designed for a maximum ceiling height of 12 ft (3.7 m).

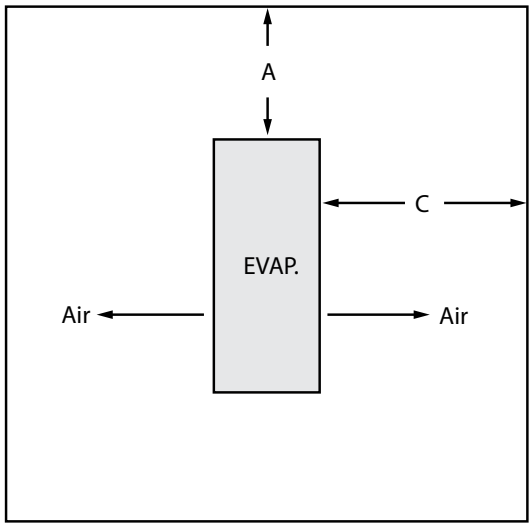
These evaporators are a blow-through design thus they draw air upward into the equipment through the fan(s), blowing it through the cooling coil and discharging it laterally into the room in two directions. For the best performance, it is desirable to arrange one air discharge toward the door of the cooler to minimize the entrance of warm moist air when the door is open. The evaporator must be at least 36 inches (914 mm) from the wall to ensure proper airflow. Install the evaporator in a location that provides the shortest reasonable distance between the evaporator and the condensing unit.

Do not install the evaporator directly above a door. Do not mount the evaporator in an area where product will likely block air flow on any side.

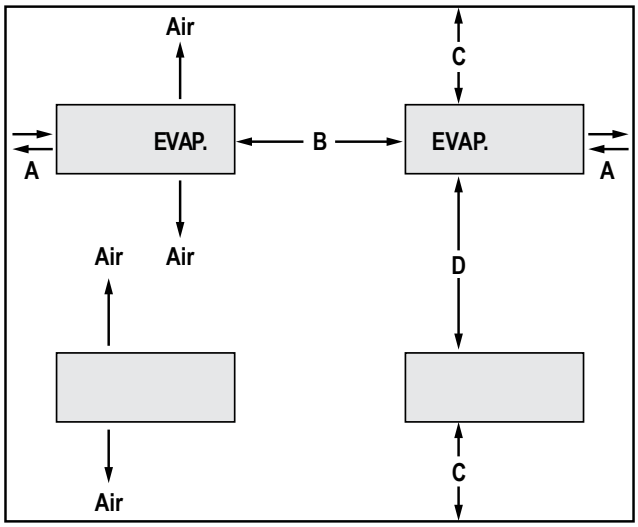
See below for recommended installation minimum and maximum clearances.

| Clearance | | Minimum | Maximum |
|---|---|---|---|
| A | space between wall and solid side of evaporator | 1 ft (0.3 m) | 8 ft (2.4 m) |
| B | space between evaporators (solid side to solid side) | 2 ft (0.6 m) | 16 ft (4.9 m) |
| C | space between wall and coil side of evaporator | 3 ft (0.9 m) | 12 ft (3.7 m) |
| D | space between evaporators (coil side to coil side) | 8 ft (2.4 m) | 24 ft (7.3 m) |

Single Evaporator




Multiple Evaporators




Note: 28 1/2 in. (0.73 m) of clearance is required under the unit for access.


Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

# LH-A2L Series

## Installation Information

### Minimum Room Floor Area

≥ A $m^2$
(≥ A $ft^2$)

The "Minimum Room Floor Area" label provides the minimum room size into which the evaporator can be placed. On evaporators, this value includes 20 ft (6.1 m) of pipe, as the shut-off and check valve must be field-installed. It is the responsibility of the installer to ensure any additional piping installed between those components and the evaporator inside a given room—beyond the included 20 ft (6.1 m)—is also accounted for during installation. Evaporator shall not be placed in a room with a floor area less than the value indicated next to the symbol on the unit plus the piping value(s) as relates to the specific room in which the equipment is installed.

Note: Refer to the "Minimum Room Floor Area Table (piping)" section to find the appropriate piping value(s).

There are two elements related to the room area: Minimum and Actual. Based on the releasable charge determined by internal volume of every component in the evaporator, a Minimum Area is calculated. The equipment cannot be used in a space with an area smaller than the Minimum Area. Depending on the Actual Area of the room, different mitigation actions are determined. The Actual Area is based on the inside dimensions of the enclosed space.

Any fluid circuits connected to the appliance (such as to a water heat exchanger) shall safely release abnormal pressure. It shall not allow the release of FLAMMABLE REFRIGERANT into areas served by the other circuits if these do not comply with minimum room area limit.

**Minimum Room Floor Area, Refrigerant Charge, and Connection Sizes (all defrost types)**

| Model | Estimated Refrigerant Charge[A] — lb (g) | | Minimum Room Floor Area $ft^2$ ($m^2$) | Line Connection Sizes | |
|---|---|---|---|---|---|
| | Operating Charge | | | Liquid | Suction |
| | R-454A | R-454C | | | |
| LHD14A-36[ ]V | 0.7 (318) | | 60 (5.57) | 1/2" | 7/8" |
| LHD16A-47[ ]V | 0.7 (318) | | 60 (5.57) | 1/2" | 7/8" |
| LHD24A-73[ ]V | 1.2 (544) | | 64 (5.95) | 1/2" | 7/8" |
| LHD26A-94[ ]V | 1.2 (544) | | 64 (5.95) | 1/2" | 7/8" |
| LHD34A-109[ ]V | 1.8 (816) | | 80 (7.43) | 1/2" | 7/8" |
| LHD36A-140[ ]V | 1.8 (816) | | 80 (7.43) | 1/2" | 7/8" |
| LHD44A-145[ ]V | 2.4 (1,089) | | 96 (8.92) | 1/2" | 1 1/8" |
| LHD46A-187[ ]V | 2.4 (1,089) | | 96 (8.92) | 1/2" | 1 1/8" |
| LHD14E-33[ ]V | 0.7 (318) | | 60 (5.57) | 1/2" | 7/8" |
| LHD16E-43[ ]V | 0.7 (318) | | 60 (5.57) | 1/2" | 7/8" |
| LHD24E-67[ ]V | 1.3 (590) | | 64 (5.95) | 1/2" | 1 1/8" |
| LHD26E-86[ ]V | 1.3 (590) | | 64 (5.95) | 1/2" | 1 1/8" |
| LHD34E-100[ ]V | 1.9 (862) | | 80 (7.43) | 1/2" | 1 1/8" |
| LHD36E-129[ ]V | 1.9 (862) | | 80 (7.43) | 1/2" | 1 1/8" |
| LHD44E-132[ ]V | 2.4 (1,089) | | 96 (8.92) | 1/2" | 1 1/8" |
| LHD46E-171[ ]V | 2.4 (1,089) | | 96 (8.92) | 1/2" | 1 1/8" |

[ ] Refrigerant letter code


Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

# LH-A2L Series

## Installation Information

### Minimum Room Floor Area Table (piping)

| Liquid Line Piping Minimum Area in ft² (m²) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Line Length ft (m) | Line Size (OD) | | | | | | | | | |
| | 3/8" | 1/2" | 5/8" | 7/8" | 1 1/8" | 1 3/8" | 1 5/8" | 1 7/8" | 2 1/8" | 2 5/8" |
| 5 (1.5) | 25 (2.3) | 30 (2.8) | 40 (3.7) | 60 (5.6) | 85 (7.9) | 125 (11.6) | 165 (15.3) | 220 (20.4) | 275 (25.5) | 410 (38.1) |
| 10 (3) | 30 (2.8) | 45 (4.2) | 60 (5.6) | 100 (9.3) | 155 (14.4) | 225 (20.9) | 315 (29.2) | 420 (39) | 530 (49.2) | 805 (74.8) |
| 15 (4.6) | 40 (3.7) | 55 (5.1) | 80 (7.4) | 140 (13) | 225 (20.9) | 330 (30.7) | 460 (42.7) | 620 (57.6) | 785 (72.9) | 1,200 (111.5) |
| 20 (6.1) | 45 (4.2) | 70 (6.5) | 100 (9.3) | 180 (16.7) | 290 (26.9) | 435 (40.4) | 605 (56.2) | 825 (76.6) | 1,040 (96.6) | 1,590 (147.7) |
| 25 (7.6) | 50 (4.6) | 80 (7.4) | 120 (11.1) | 220 (20.4) | 360 (33.4) | 540 (50.2) | 755 (70.1) | 1,025 (95.2) | 1,300 (120.8) | 1,985 (184.4) |
| 30 (9.1) | 60 (5.6) | 95 (8.8) | 140 (13) | 260 (24.2) | 430 (39.9) | 645 (59.9) | 900 (83.6) | 1,225 (113.8) | 1,555 (144.5) | 2,380 (221.1) |
| 40 (12.2) | 70 (6.5) | 120 (11.1) | 180 (16.7) | 340 (31.6) | 565 (52.5) | 850 (79) | 1,195 (111) | 1,625 (151) | 2,065 (191.8) | 3,165 (294) |
| 50 (15.2) | 85 (7.9) | 145 (13.5) | 220 (20.4) | 420 (39) | 705 (65.5) | 1,060 (98.5) | 1,490 (138.4) | 2,030 (188.6) | 2,575 (239.2) | 3,950 (367) |
| 75 (22.9) | 115 (10.7) | 210 (19.5) | 325 (30.2) | 625 (58.1) | 1,045 (97.1) | 1,580 (146.8) | 2,225 (206.7) | 3,035 (282) | 3,855 (358.1) | 5,915 (549.5) |
| 100 (30.5) | 150 (13.9) | 270 (25.1) | 425 (39.5) | 825 (76.6) | 1,385 (128.7) | 2,100 (195.1) | 2,960 (275) | 4,040 (375.3) | 5,135 (477.1) | 7,885 (732.5) |
| Vapor Line Piping Minimum Area in ft² (m²) | | | | | | | | | | |
| Line Length ft (m) | Line Size (OD) | | | | | | | | | |
| | 3/8" | 1/2" | 5/8" | 7/8" | 1 1/8" | 1 3/8" | 1 5/8" | 1 7/8" | 2 1/8" | 2 5/8" |
| 5 (1.5) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 25 (2.3) | 25 (2.3) | 30 (2.8) |
| 10 (3) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 25 (2.3) | 25 (2.3) | 30 (2.8) | 30 (2.8) | 40 (3.7) |
| 15 (4.6) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 25 (2.3) | 25 (2.3) | 30 (2.8) | 35 (3.3) | 40 (3.7) | 50 (4.6) |
| 20 (6.1) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 25 (2.3) | 25 (2.3) | 30 (2.8) | 35 (3.3) | 40 (3.7) | 45 (4.2) | 60 (5.6) |
| 25 (7.6) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 25 (2.3) | 30 (2.8) | 30 (2.8) | 40 (3.7) | 45 (4.2) | 50 (4.6) | 70 (6.5) |
| 30 (9.1) | 20 (1.9) | 20 (1.9) | 20 (1.9) | 25 (2.3) | 30 (2.8) | 35 (3.3) | 40 (3.7) | 50 (4.6) | 60 (5.6) | 80 (7.4) |
| 40 (12.2) | 20 (1.9) | 20 (1.9) | 25 (2.3) | 25 (2.3) | 35 (3.3) | 40 (3.7) | 50 (4.6) | 60 (5.6) | 70 (6.5) | 100 (9.3) |
| 50 (15.2) | 20 (1.9) | 20 (1.9) | 25 (2.3) | 30 (2.8) | 35 (3.3) | 45 (4.2) | 55 (5.1) | 70 (6.5) | 85 (7.9) | 120 (11.1) |
| 75 (22.9) | 20 (1.9) | 25 (2.3) | 25 (2.3) | 35 (3.3) | 45 (4.2) | 60 (5.6) | 75 (7) | 95 (8.8) | 120 (11.1) | 170 (16) |
| 100 (30.5) | 20 (1.9) | 25 (2.3) | 30 (2.8) | 40 (3.7) | 55 (5.1) | 75 (7) | 95 (8.8) | 125 (11.6) | 150 (13.9) | 225 (20.9) |


Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

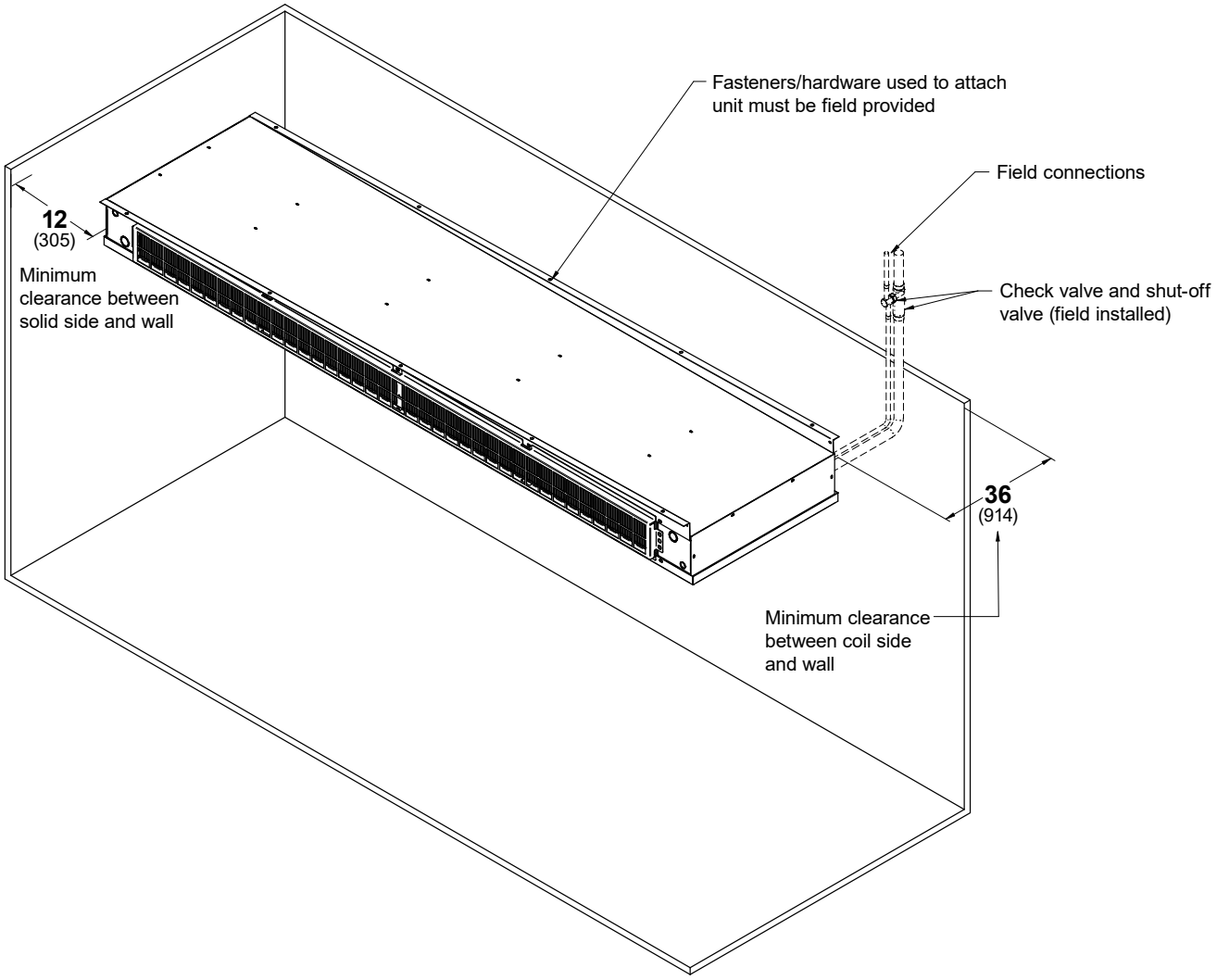
# LH-A2L Series

## Installation Information

### Equipment Mounting

The unit cooler may be suspended with 3/8” diameter hanger rods or flush mounted to the ceiling using 3/8” minimum lag screws with flat washers. Rods should be double nutted at the top and bottom. Suspended equipment must have enough clearance above for cleaning the top.

The equipment must be level in all directions to insure proper drainage of condensate. If necessary to drain two or more evaporators into a common drain, ensure any traps in the drain lines are individual to each evaporator to prevent vapor migration.




### Installing Equipment for Food Service Applications

For rod-mounted installations that must be NSF compliant, adequate space must be allowed between the top of the equipment and the ceiling for cleaning and maintenance. For flush mount installations that must be NSF compliant, ensure the equipment is perfectly flush with the top of the cooler and seal the joint between the top of the equipment and ceiling with an NSF approved sealant.

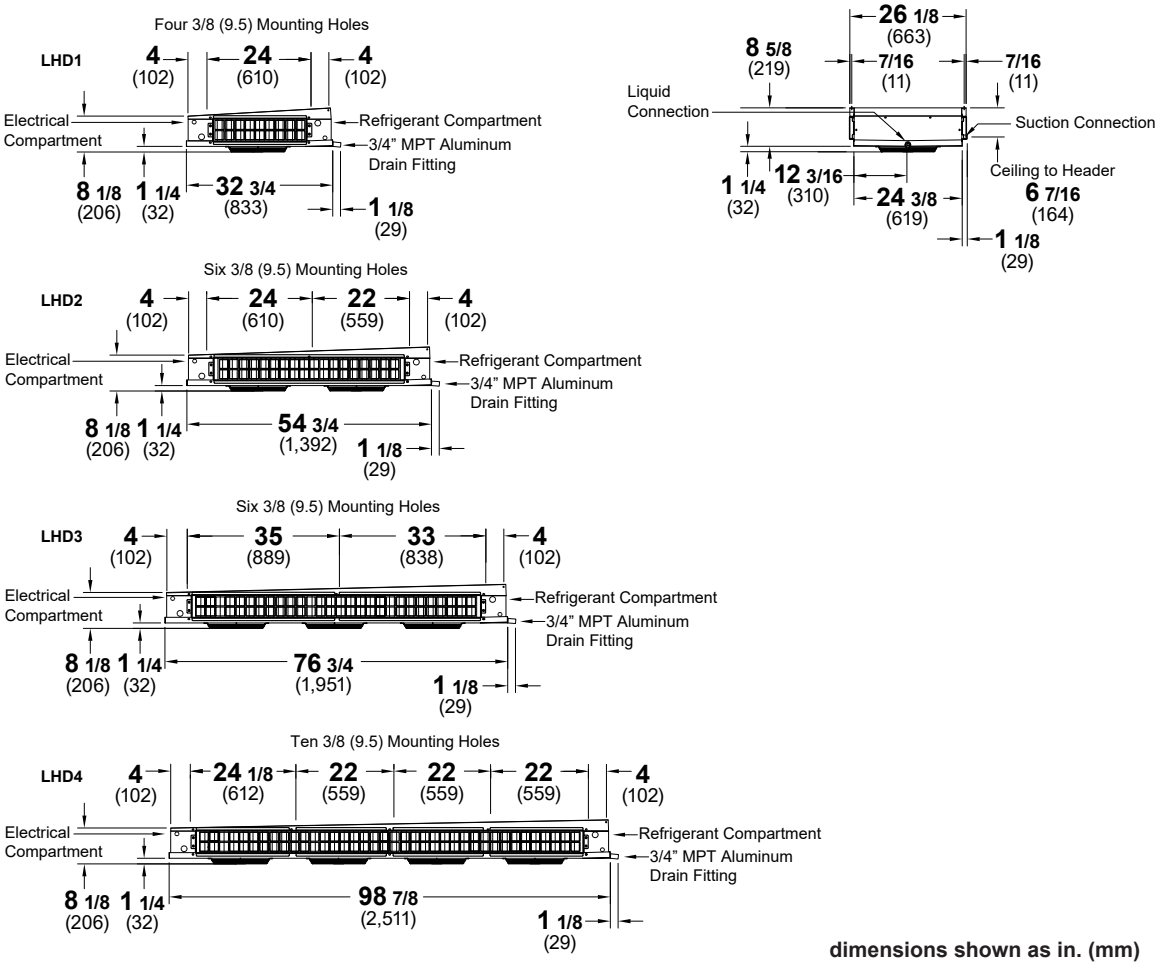
It is also important to ensure all fasteners and mounting hardware are installed in compliance with NSF requirements for the area.


Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

# LH-A2L Series

## Installation Information

### Component / Dimensional Views




**dimensions shown as in. (mm)**

### Electrical Information

The field wiring compartment is constructed as part of the unit cooler enclosure. Wiring connections are made at the terminal block provided inside the equipment on the end opposite the refrigerant connections.

Equipment requires a dedicated electrical circuit(s) with ground. Consult equipment datasheet for additional electrical specifications. Always use a dedicated circuit with the voltage and amperage stated on the equipment. Do not overload the circuit.

It is necessary to allow for disconnection of the appliance from the supply power after installation. Disconnect power before servicing any equipment.

If in doubt, consult an electrician.

### Field Wiring

WARNING: All power supplied to the equipment must be shut off before opening any compartments, cleaning, or performing maintenance.

WARNING: Always check the serial label or datasheet for component voltage and amperes.

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. All wiring must be in compliance with governing electrical codes.

Field wiring must be sized for component amperes stamped on the serial label. Actual ampere draw may be less than specified. Based on the full load amps of the system, select the largest connectible wire size based on NFPA 70® (NEC) and local codes.

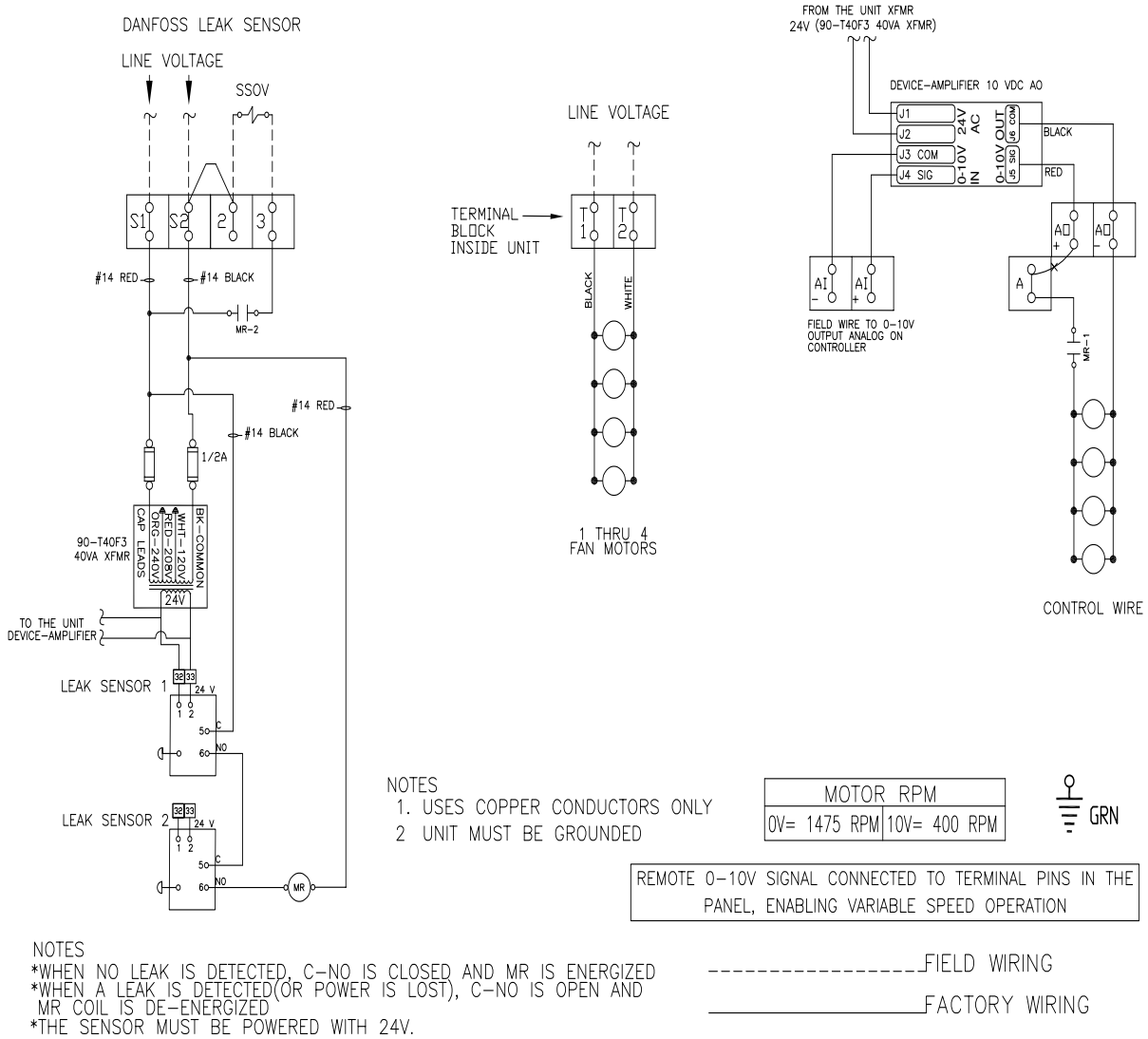
### Electrical Connections

All wiring must be in compliance with NEC and local codes. All electrical connections are to be made at a terminal block, in the electrical wireway, or in a handy box. The equipment must be properly grounded.

### Wiring Diagrams

Wire color and configuration depicted on defrost wiring diagrams provided in this document may change depending on configuration or for other design reasons. Example diagrams are provided, but do not represent every possible option. Always consult the wiring diagrams provided with the equipment being worked on for the most accurate information. Equipment-specific wiring diagrams are included in the electrical compartment of the equipment from the factory and must remain in the unit after installation for future use—do not discard.

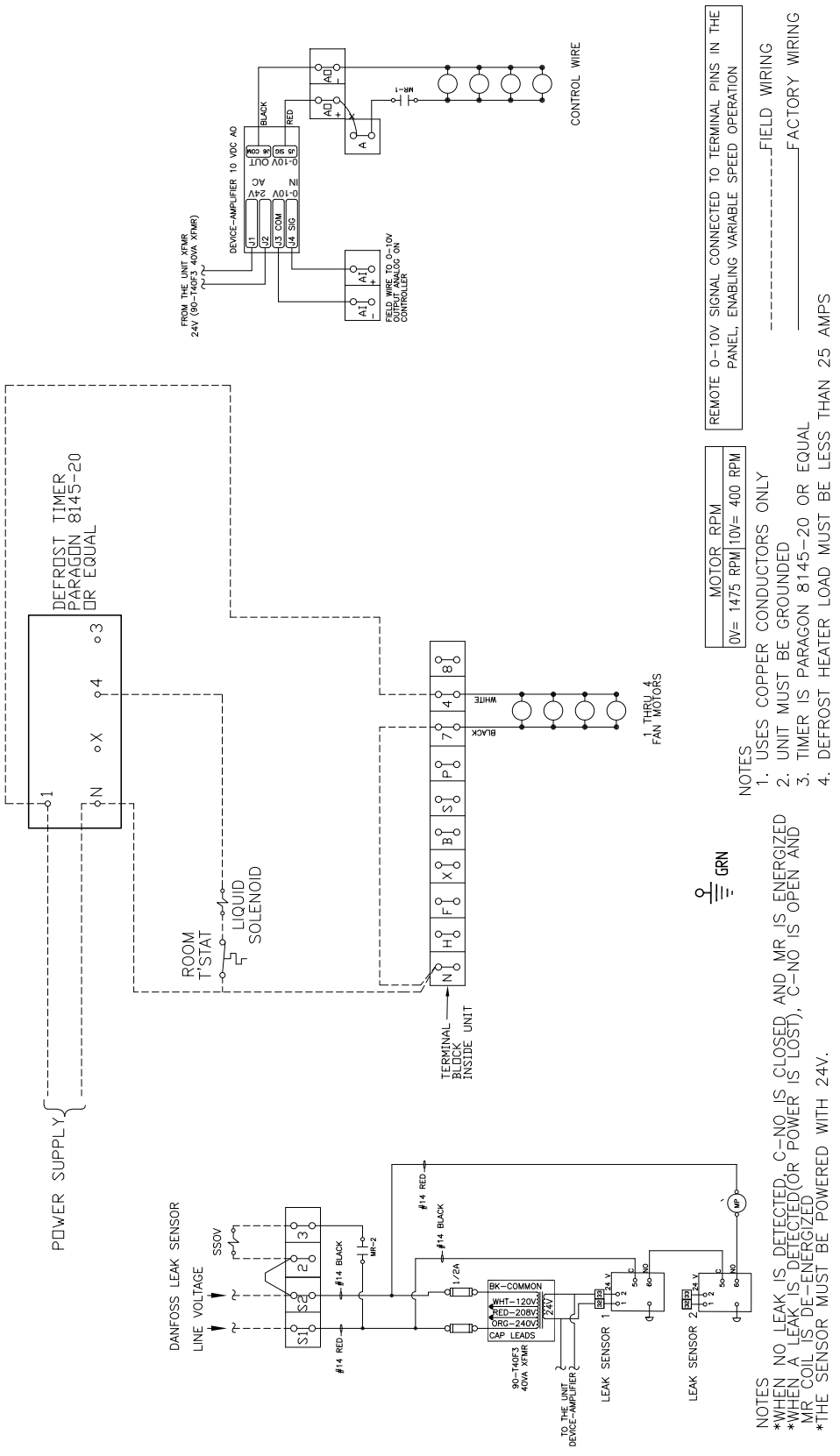
**Air Defrost Wiring Diagram (without timer)**



# LH-A2L Series

## Installation Information

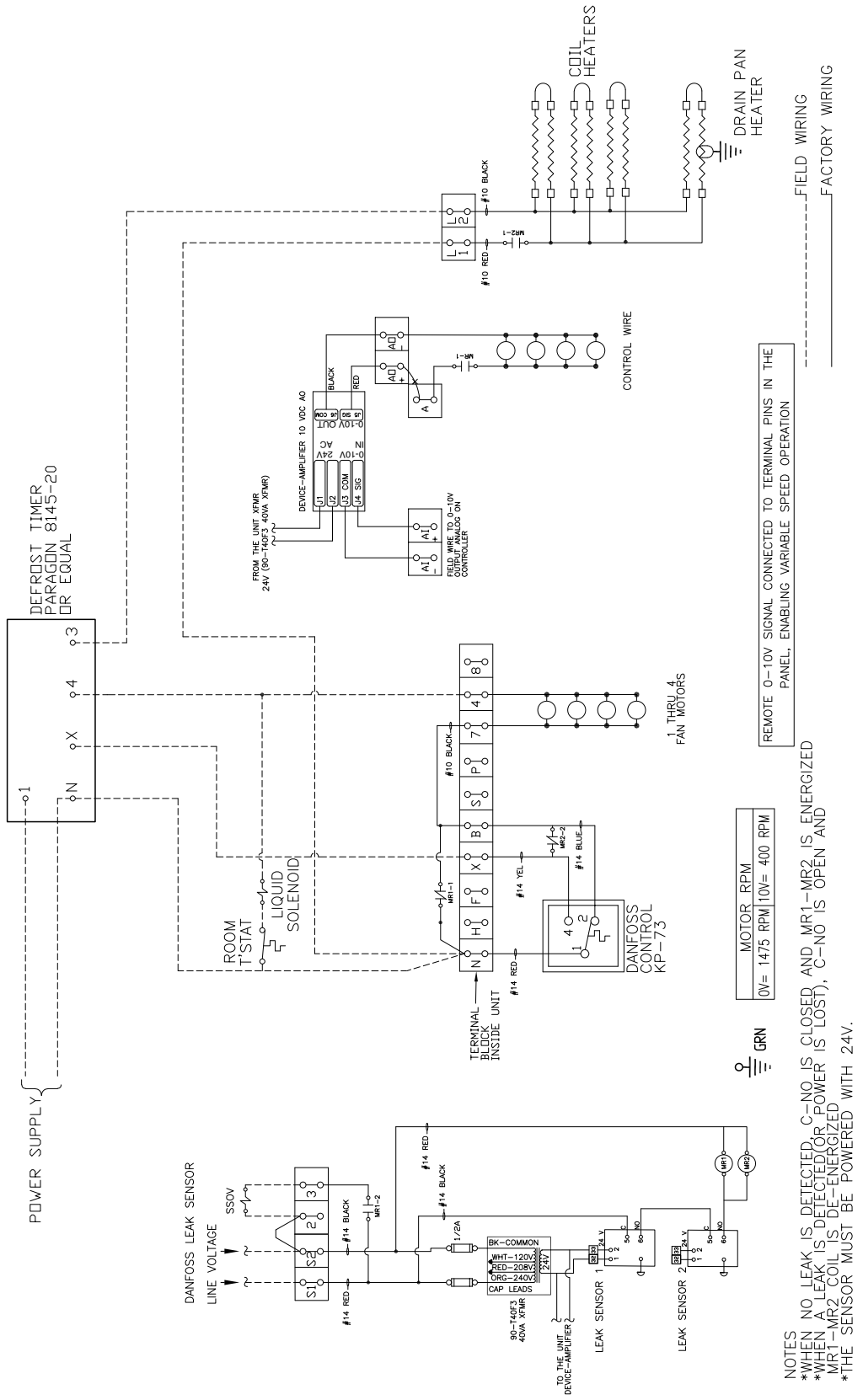
### Air Defrost Wiring Diagram (with timer)



# LH-A2L Series

## Installation Information

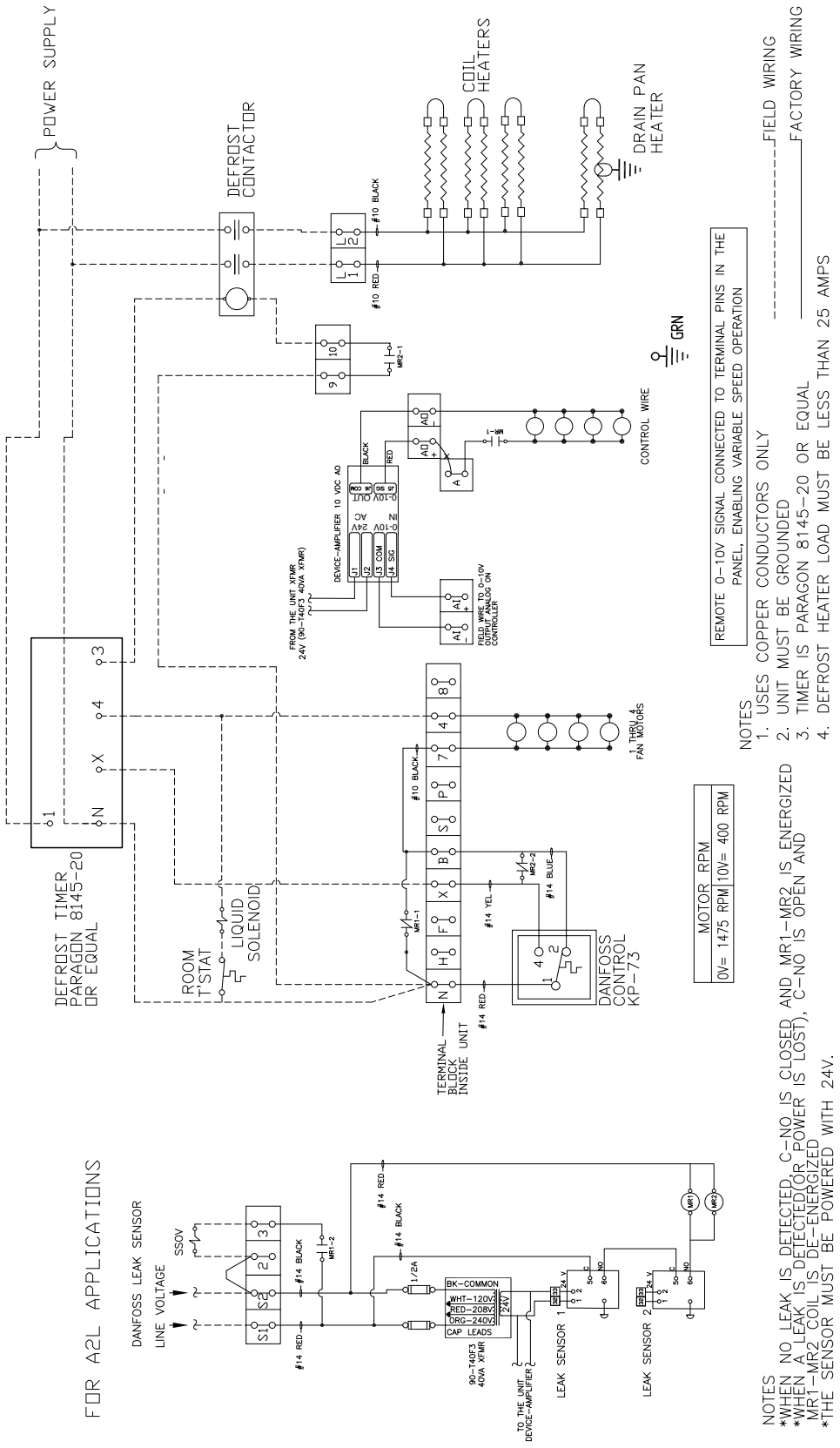
### Electric Defrost Wiring Diagram (with timer only)



# LH-A2L Series

## Installation Information

### Electric Defrost Wiring Diagram (with timer and defrost contactor)



### Piping Overview

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

System design must conform to all local and national codes, laws, and regulations applying to the site of installation. In addition, the safety code for mechanical refrigeration (ASME B31.5) should be followed as a guide for installation and operation practice.

Refrigerant line sizes and piping techniques should be obtained from the ASHRAE guide or equivalent reference. Under no circumstances should the refrigerant connection size of the unit be used as the basis for sizing the lines.

The horizontal suction line should slope away from the unit toward the compressor. Vertical suction risers may require a trap at the bottom of the riser for proper oil return.

For Food Service installations – seal any joint between unit cooler and cooler wall with a sealant Listed by the National Sanitation Foundation.

### 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.

- 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.
- Look for the room area label on the unit to identify the minimum room size. The information in this manual can also be used as an estimate. Always confirm the exact value on the unit before installation.
- 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 label 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 1500 microns within 10 min.

- Field-made refrigerant joints indoors shall be tightness tested according to applicable codes and requirements. The test method shall have a sensitivity of 0.18 oz (5 g) per year of refrigerant or better under a pressure of at least 0.25 times the maximum allowable pressure. No leak shall be detected.
- 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.

### Drain Line

The drain line should be as short and as steeply pitched as possible with a minimum of 1/4” drop per foot of run. Any traps in the drain line must be in a location with an ambient temperature above freezing. If the temperature surrounding the trap or drain line is below freezing (32° F [0° C]) it must be wrapped with a drain line heater (which must be continuously energized).

Be sure to also wrap the unit drain coupling. Cover the drain line, drain coupling, and heat tape with insulation.

Be sure to follow the manufacturer’s recommendation when installing the drain line heat tape.

A union at the drain connection in the drain pan is recommended for ease of installation and future servicing. The union should be located as close to the drain pan as possible. Use two wrenches when tightening to prevent the drain fitting from twisting and damaging the unit.

Long runs of drain line (i.e., more than a few feet) should be supported by hangers to avoid damage to the drain pan.

### Refrigerant Distributor Nozzles

Distributor nozzles are included using a refrigerant distributor with a changeable nozzle design. The nozzle(s) are packed in individual plastic envelopes along with a retainer ring and instruction card. The instruction card provides information on nozzle used based on refrigerant. There may be one, two, or three envelopes with nozzles located near the distributor.

The nozzles provided with the unit have been selected for design conditions of 10°F (5.6° C) T.D. and 95°F liquid refrigerant at the expansion valve inlet. If the unit will be operated at conditions that are substantially different from these conditions, it may be necessary to select a different size nozzle. Consult factory for additional information.

The nozzle must be installed in the distributor or the auxiliary side connector before the expansion valve is installed. There are nozzle identification numbers stamped on one side of the nozzle. Ensure the numbers are visible (for identification information) when inserting the nozzle into the distributor.

The nozzle is held in place by a retainer ring that is easily inserted or removed with a pair of needle nose pliers.

### Air Defrost Model Distributor Nozzles

| Models | Refrigerant Type | |
|---|---|---|
| | R-454A | R-454C |
| LHD14A-36[ ]V | L - 1/4 | L - 1/3 |
| LHD16A-47[ ]V | L - 1/3 | L - 1/2 |
| LHD24A-73[ ]V | L - 3/4 | L - 3/4 |
| LHD26A-94[ ]V | L - 1 | L - 1 |
| LHD34A-109[ ]V | L - 1 | L - 1 |
| LHD36A-140[ ]V | L - 1 1/2 | L - 1 1/2 |
| LHD44A-145[ ]V | L - 1 1/2 | L - 1 1/2 |
| LHD46A-187[ ]V | L - 2 | L - 2 |

Note: Distributor nozzle selections are based on 25° F (-3.9° C) suction temperature, 10° F (5.6° C) T.D., and 95° F (35° C) liquid temperature
[ ] Refrigerant letter code

### Electric Defrost Model Distributor Nozzles

| Models | Refrigerant Type | |
|---|---|---|
| | R-454A | R-454C |
| LH14E-33[ ]V | L - 1/2 | L - 1/2 |
| LH16E-43[ ]V | L - 3/4 | L - 3/4 |
| LH24E-67[ ]V | L - 1 | L - 1 |
| LH26E-86[ ]V | L - 1 1/2 | L - 1 1/2 |
| LH34E-100[ ]V | L - 1 1/2 | L - 1 1/2 |
| LH36E-129[ ]V | L - 2 | L - 2 |
| LH44E-132[ ]V | L - 2 | L - 2 |
| LH46E-171[ ]V | L - 2 1/2 | L - 2 1/2 |

Note: Distributor nozzle selections are based on -20° F (-28.9° C) suction temperature, 10° F (5.6° C) T.D., and 95° F (35° C) liquid temperature.
[ ] Refrigerant letter code

### Expansion Valves

Before installing the unit, install the expansion valve and connect the equalizer tube. The expansion valve should be installed directly to the distributor body or as close as possible with no elbows or bends. Locate the expansion valve bulb on a horizontal length of suction line as close to the suction header as possible. Position the bulb in a 3, 4, 8, or 9 o'clock position (do not position on the bottom side of the pipe). Clamp the bulb down flush and tightly against the pipe and insulate. Never locate the bulb in a trap or downstream from a trap.

It is important that the operation of the expansion valve be checked out after the system has balanced out at the desired room temperature. If the coil is being starved, it is necessary to reduce the superheat setting of the valve by turning the adjusting stem counterclockwise. If the superheat is too low, it is necessary to increase the superheat setting of the valve by turning the adjusting stem clockwise. It is recommended that for a 10° to 12° F (5.6° to 6.7° C) T.D. system, the valve should be adjusted to maintain 5° to 6° F (2.8° to 3.3° C) superheat.

**Air Defrost Model Expansion Valves**

| Models | Refrigerant Type | |
|---|---|---|
| | R-454A | R-454C |
| LHD14A-36[ ]V | ERTE-1/3-C | ERVE-1/2-GA |
| LHD16A-47[ ]V | ERTE-1/2-C | ERVE-1/2-GA |
| LHD24A-73[ ]V | ERTE-3/4-C | EGVE-1-GA |
| LHD26A-94[ ]V | ERTE-1-C | EGVE-1-GA |
| LHD34A-109[ ]V | ERTE-1-C | EGVE-1 1/2-GA |
| LHD36A-140[ ]V | ERTE-1 1/2-C | EGVE-1 1/2-GA |
| LHD44A-145[ ]V | ERTE-1 1/2-C | EGVE-1 1/2-GA |
| LHD46A-187[ ]V | ERTE-2-C | ERVE-2-GA |

Note: TXV selections are based on 25° F (-3.9° C) suction temperature, 10° F (5.6° C) T.D., and 95° F (35° C) liquid temperature, 105° F (40.6° C) condensing temperature, and high side pressure drop of 10 psig (0.7 bar).

[ ] *Refrigerant letter code*

**Electric Defrost Model Expansion Valves**

| Models | Refrigerant Type | |
|---|---|---|
| | R-454A | R-454C |
| LHD14E-33[ ]V | ERTE-1/2-Z | EGVE-3/4-Z |
| LHD16E-43[ ]V | ERTE-3/4-Z | EGVE-1-Z |
| LHD24E-67[ ]V | ERTE-1-Z | EGVE-1 1/2-Z |
| LHD26E-86[ ]V | ERTE-1 1/2-Z | EGVE-1 1/2-Z |
| LHD34E-100[ ]V | ERTE-1 1/2-Z | EGVE-2-Z |
| LHD36E-129[ ]V | ERTE-2-Z | EGVE-3-Z |
| LHD44E-132[ ]V | ERTE-2-Z | EGVE-3-Z |
| LHD46E-171[ ]V | ERTE-3-Z | ERVE-4-Z |

Note: TXV selections are based on 25° F (-3.9° C) suction temperature, 10° F (5.6° C) T.D., and 95° F (35° C) liquid temperature, 105° F (40.6° C) condensing temperature, and high side pressure drop of 10 psig (0.7 bar).

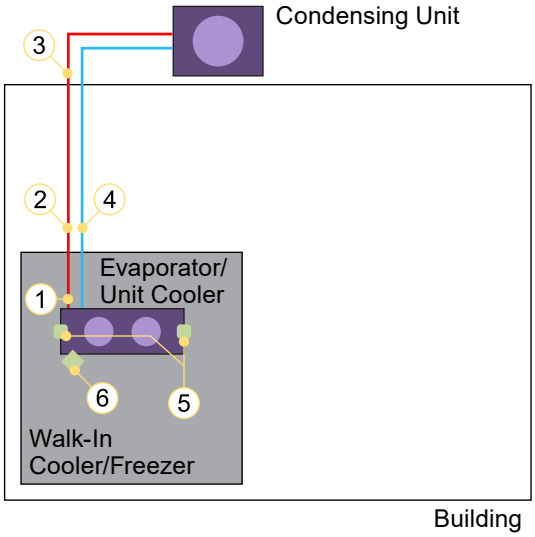
[ ] *Refrigerant letter code*

### Safety Shut-Off and Check Valves

a. Safety shut-off valve and check valve ship loose and must be field installed in the liquid and suction lines of the system. The ideal location for the safety shut-off valve is just outside the cooler/freezer in the liquid line. If this is not possible, the valve can be installed in the liquid line just outside the building itself, nearer the condensing unit. The alternate location is not preferable as it increases the potential volume that could leak if the unit is damaged. The check valve must be installed on the suction line, ideally just outside the cooler/freezer.

**Typical System**

1. Typical liquid valve location
2. Ideal safety shut-off valve location
3. Alternate safety shut-off valve location if ideal location is not practical
4. Check valve location
5. Refrigerant leak detection sensors
6. Leak mitigation controller (may be located on unit or remote)




b. Do not bypass safety shut-off valves once installed or attempt to operate system without shut-off valves installed.
c. Safety shut-off valve installation shall avoid hydraulic shock.
d. Safety shut-off valves shall not block in liquid refrigerant unless adequate relief is provided to the refrigerant system low pressure side.
e. Safety shut-off valves positions must be made in appropriate locations as the minimum room area may be determined based on the maximum amount of refrigerant that can be leaked.
f. Safety shut-off valves shall be located in such a way such that leaks upstream of the safety shut-off valve shall 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 in a section complies to the limit for releasable charge. Safety shut-off valves shall be positioned to enable access for maintenance by any authorized person.

### Pre-Startup

After installation is complete, a review of the following items as well as all warnings, cautions, and safety requirements should be performed before the system is placed into operation:

- Check electrical connections, fan blade set screws, fan motors, guards, and all other fasteners for tightness.
- Ensure the thermostatic expansion valve bulb is properly located, strapped, and insulated.
- With the system operating, check the supply voltage. It must be within +/- 10% of the voltage marked on the unit serial label.
- For electric defrost systems, check the defrost timer to see that is set for the correct time of day, and that the starting pins have been installed (normally two per day). The defrost should be scheduled for times when the freezer doors are not likely to be open.
- When the system is first started up, the box temperature is typically above the opening temperature of the fan delay thermostat. The fans may remain off for an extended period. To prevent this, it is permissible to install a temporary jumper wire between terminals “F” and “B” or “N” and “B” depending on the unit wiring arrangement. Once the box temperature is below 25° F (-3.9° C), the jumper wire should be removed.

### Refrigerant Charging Procedure

Only the specified refrigerant type can be used. See the equipment labeling for specific information about the correct refrigerant type and the approximate refrigerant charge related to that specific piece of equipment.

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.

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 the type of refrigeration system being serviced (e.g., R-454C equipment for an R-454C system). 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:

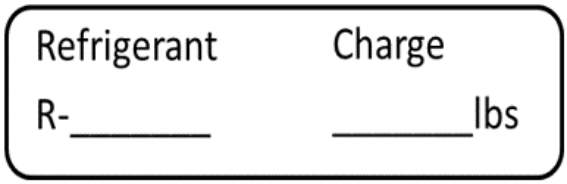
a. Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
b. Cylinders shall be kept in an appropriate position according to the instructions.
c. Ensure that 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.

#### 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 equipment. This will be mounted on the condensing unit or the condenser in most cases. Original service port washer and cap must be reinstalled to prevent refrigerant leaks.




#### Dewpoint to Bubble (Glide)

| Refrigerant | TD |
|---|---|
| R-454A | 6.8 |
| R-454C | 7.8 |

## Sequence of Operation

### Standard Unit Cooler Operation

1. The unit cooler fan motors are energized and the fans operate continually.
2. The room thermostat calls for cooling. The liquid solenoid valve opens allowing liquid to flow to the unit cooler. The suction pressure rises and starts the compressor.
3. When the room temperature is satisfied, the thermostat opens and closes the liquid solenoid. The compressor continues to run until the suction pressure reaches the low-pressure cutout setting and shuts off the compressor.
4. The fan circulates air over the coil and frost melts. For air defrost to work properly, the compressor run time should not exceed 40 minutes per hour.

### Electric Defrost Operation

Step A: Normal Refrigeration Cycle

5. Power is supplied to terminals “N” and “4” on the defrost timer.
6. The heater safety thermostat is closed. The fan delay thermostat is closed and the defrost termination thermostat is off.
7. The unit cooler fan motors are energized and the fans operate continuously (defrost heaters are off).
8. The system compressor operates in accordance with the demand of the room thermostat.
9. Frost slowly builds up on the evaporator fins.

Step B: Defrost Cycle (default)

1. Defrosting of the evaporator is started by the timer at predetermined intervals—typical settings of the timer would be two defrost periods per 24-hour day.
2. The timer mechanically disconnects power to terminal “4” which closes the liquid line solenoid valve and shuts off the evaporator fan motors. Simultaneously, power is connected to timer terminal “3” which allows current to flow to the defrost heaters.
3. The heaters—embedded in slots in the coil face—give up heat directly to the evaporator fins. This heat raises the coil temperature to 32° F (0° C) causing the frost to melt.
4. As the frost melts it drips into the heated drain pan and flows down the drain.
5. When the frost has completely melted from the coil (typical cycle length is 20 to 25 minutes) the coil continues to warm up above 32° F (0° C).
6. When the coil reaches the temperature setting of the defrost termination thermostat, it closes, which allows current to flow to terminal “X” on the timer. This energizes the switching solenoid in the timer. The timer disconnects power to terminal “3” which turns off the defrost heaters. Simultaneously, power is connected to terminal “4” of the timer. The heater safety thermostat may open but under normal conditions it will remain closed. The heater safety thermostat will open only if the defrost termination thermostat fails to close. The timer has a failsafe (inner dial) which should be set for 30 minutes.

Step C: Return to Normal Refrigeration Cycle

1. Because there is power at terminal “4” the liquid line solenoid opens and the compressor restarts.
2. The evaporator fan motor(s) remain off because the fan delay thermostat is open. This prevents warm air from being blown into the refrigerated area.
3. The evaporator coil cools down approaching operating temperature.
4. When the coil temperature reaches 25° F (-3.9° C)—approximately two to three minutes after defrost termination—the fan delay thermostat closes thus allowing the fan motors to restart. The unit is now back in normal operation.

NOTE: On systems where the room temperature is above 25° F (-3.9° C), the fan delay thermostat may not close for an extended period. If the fan delay time is too long, it is permissible to install a jumper wire between terminals “F” and “B” at the unit, allowing the fans to turn on immediately after the defrost period.

### Variable Speed Motor Operation

Variable speed motor needs 0–10 V signal from controller (field-provided). 0–10 V signal wires will be connected to terminals 5 and 6 in the evaporator panel. 0 V signal will set the motor to the high speed (1,475 RPM) and 10 V signal will set motor speed to low speed (400 RPM). Speed varies between those values based on the signal voltage received by motor.

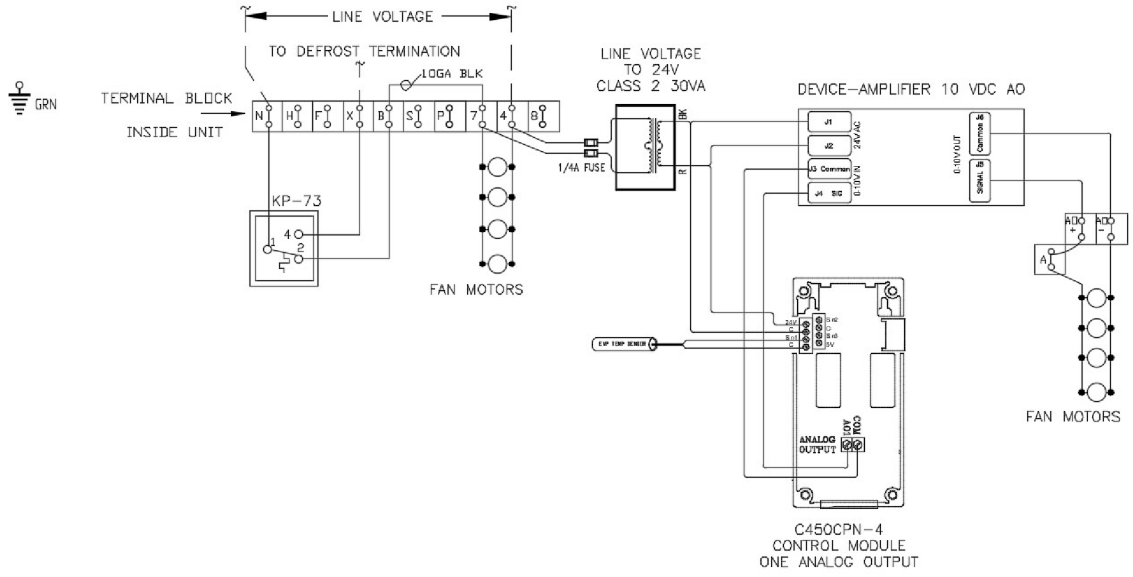
### System 450 Controller Operation

An installed System 450 C450CPN-4 controller will be utilized to supply a 0–10 V signal to the variable speed motor. A temperature sensor installed in the evaporator and wired to the System 450 control module will be utilized to measure the box temperature.

Fan motor will receive 0 V signal at setpoint (SP) from System 450 controller and the fans will run at full speed. At endpoint (EP), fans will receive 10 V signal and the fans will run at minimum speed. The analog signal varies between setpoint to endpoint (and relative fan speed) proportionally based on the box temperature measured by installed temperature sensor.

<u>System 450 Controller Parameters</u>

- Setpoint (SP) is the target value that the control system drives toward. Setpoint at which fan motor will run at full speed is target box temperature.
- Endpoint (EP) is the maximum deviation from the target value. Setpoint at which fan motors will run at minimum speed is 5° F (2.8° C) below target box temperature.
- Output at Setpoint (OSP) is the signal strength level of the analog output when the input sensor is at SP. The OSP is expressed as a percentage (0 to 100%) of the full-scale output. Output signal strength at setpoint, i.e., analog signal at setpoint is 0% – 0 V.
- Output at Endpoint (OEP) value is the signal strength level of the analog output when the input sensor is at the EP. The OEP is expressed as a percentage (0 to 100%) of the full-scale output. Output signal strength at endpoint, i.e., analog signal at endpoint is 100% – 10 V.
- Signal Amplifier is used enhance the analog signal strength from System 450 and then feed the signal to the motor to vary the fan speed.
- Sensor Failure Mode in the System 450 allows the user to select the mode of operation for control system outputs in the event of a sensor (or sensor wiring) failure. Set SNF as OFF**.** Analog output SNF OFF means the output signal strength is set at OSP. i.e., analog output will fail at OSP setpoint, sending 0 V signal to motor.



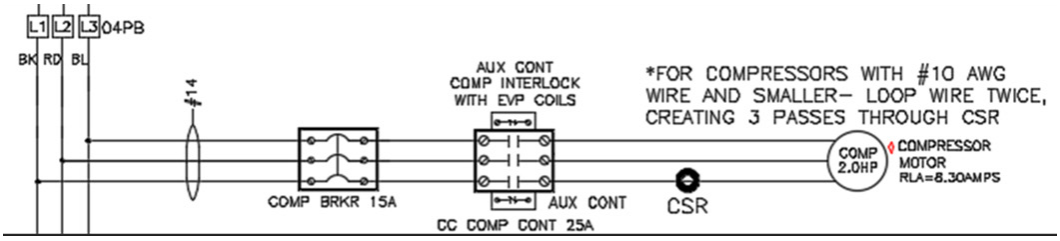
### Interlocking Single Compressor Condensing Unit

When a single compressor unit is utilized, the evaporator fan should run at full speed whenever the compressor is running and the variable speed motor fan speed should not modulate when the compressor is running. Fan speed can modulate only when compressor is turned off due to system operation.

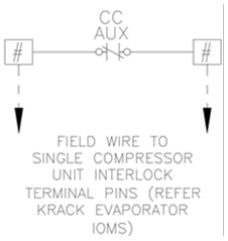
When used with single compressor condensing units from Hussmann or Krack (e.g., H-Series), there is a provision given to interlock the compressor with evaporator fans.

Single compressor units use a contactor for compressor operation—an NC Aux contact attached to the main contactor and will be used to interlock.

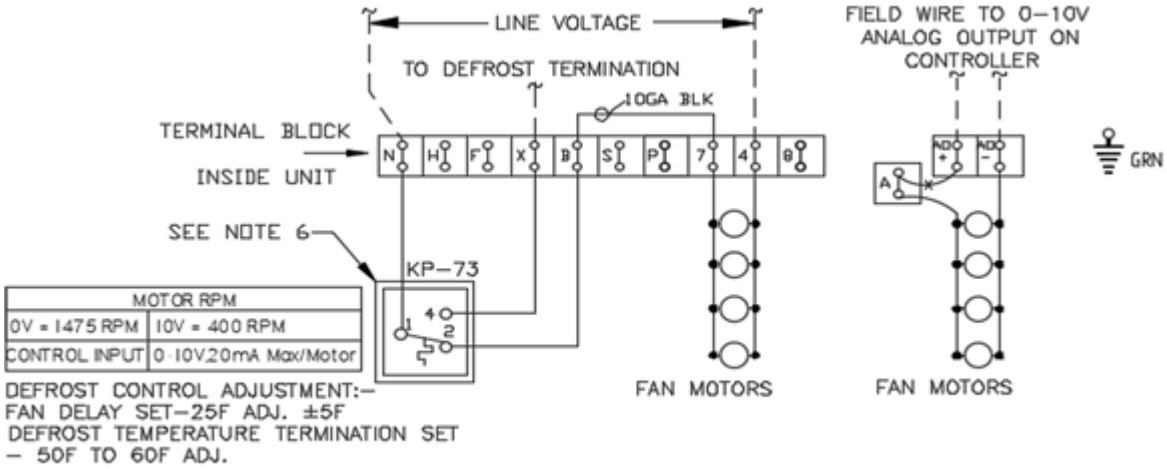
**Single Compressor Condensing Unit Setup**




**Aux Contact to Terminal Wiring**




Because of the variable speed motor coils, the jumper between the terminal A0+ and A should be removed and the aux contact from the single compressor unit must be wired in series. Whenever the compressor contactor is energized, the aux contact energizes and NC contacts change state to NO. This opens the analog 10 V signal circuit. Whenever the controller sends the 10 V signal, it goes through the aux contact and ensures the compressor is on, deactivating the analog signal circuit. When the compressor is ON, the fans will not be able to modulate, regardless of controller signal.






Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

### Operation Check

Once everything is set up properly, check the room thermostat setting and ensure it functions properly.

After the system has balanced out at the desired room temperature, check the operation of the expansion valve by properly measuring the superheat at the sensing bulb.
Note: As much as 30 minutes may be required for the new balance to take place after an adjustment is made.

For electric defrost systems, once the coil is frosted, manually advance the defrost timer to initiate a defrost. Observe the defrost cycle to see if all controls are functioning properly and that the coil is clear of all frost before the system returns to refrigeration. Reset the defrost timer to the correct time of day.

A defrost cycle is only needed when the frost builds up, such that it impedes the airflow through the coil. The defrost requirements will vary on each installation and may change depending on the time of the year and other conditions.

### Controller

Controllers can be pre-configured or user specified. Please refer to the controller documentation for the specific controller being used for instructions on programming and use not already outlined in this manual.

## ⚠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.**

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.

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- To reduce the risk of fire, electrical shock or injury when cleaning this equipment:
  -Remove supply power from the equipment before cleaning.
  -Keep all liquids away from electrical and electronic components.
- 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.

### Maintenance and Cleaning

Proper maintenance and cleaning are critical for optimal system performance. Dirty coils use more energy and can reduce system capacity compared to clean ones. Increases in operating pressure and temperature can also result, potentially resulting in compressor or other component damage over time.

It is recommended that the equipment and all piping, fans, and coils be visually inspected at least every three to six months depending on installation conditions and the coil and fans should be cleaned regularly at a operator-defined interval to maintain efficiency and prevent potential issues. No acidic or caustic cleaners and no abrasive materials should be used to clean the equipment.

**⚠WARNING**

- Remove supply power from the evaporator and connected refrigeration system before working on the equipment.
- Use caution and proper safety precautions when working on or around sheet metal pieces or fan blades to avoid potential injury.

#### Fan Inspection

With supply power and refrigeration system off, carefully remove the fan guard(s) and clean the guard(s) gently using a soft brush (a mild detergent and water can be used as needed). Examine the fan blades for any damage and ensure the fans spin freely without abnormal noise or interference. Ensure mounts are secured. Once complete, carefully reinstall the fan guard(s), making sure not to over-tighten the nuts.

- Do not restore power to the equipment without the fan guards installed.

#### Coil and Lower Cover (Condensate Pan) Cleaning

With supply power and refrigeration system off, carefully remove the lower cover (the fan guards may remain in place). Fan blades may be removed for easier access as needed. Use an explosion-proof vacuum (vacuum must be safe for operation in a flammable environment) with a soft brush tip to clean build-up from the coil. A soft brush with a mix of water and mild detergent (recommended part numbers can be found in parts list section) can also be used. While off, use a soft brush with a mix of water and mild detergent to clean the interior of the panel as well. Once cleaning is complete, reinstall any removed fan blades and panels in the reverse order of how they were removed, making sure not to over-tighten the fasteners.

Note: The lower cover may be fairly large, so it is recommended to use an appropriate means of support and/or an additional qualified person with proper safety equipment to assist with removal and reinstallation.

- Do not resume using the equipment without panels or fan blades installed.
- Do not use pressure-washing or sprayed liquid to clean the coil.
- Do not apply pressure to the fins or try to force debris through the coil.

### Troubleshooting

Make certain to observe all safety warnings and precautions listed in this manual during the troubleshooting process. For A2L leak detection system information, please refer to that section.

| Issue | Probable Cause(s) | | Potential Solutions |
|---|---|---|---|
| coil freezing | lack of airflow over the coil | incorrect installation | check for proper clearance and installation location |
| | | coil clogged/dirty | clean coil |
| | | fan issue | check fans for cleanliness and proper function |
| | | controller issue | check for proper controller settings and operation |
| | low refrigerant charge/pressure | | check system charge/pressure |
| | | | check system piping to ensure there are no problematic restrictions or design features |
| | | | check for abnormal pressure drops at metering devices and valves |
| excessive/abnormal fan or motor noise | dirty fan guard or blade | | clean guard/fan |
| | damaged fan blade or motor | | inspect fan blade and motor for physical or functional damage; replace as needed |
| | interference with housing or guard | | check for proper component clearance |
| condensate pan not draining properly | pan is dirty | | remove and clean pan |
| | drain line is blocked | | inspect drain line and clear blockage accordingly |
| fans not operating | improper or damaged wiring | | check wiring and repair/replace as needed |
| | defective motor | | replace motor |
| | defective defrost timer, termination thermostat, or fan delay switch | | test and as needed replace defective component(s) |
| | room temperature too high for use of fan delay switch | | jump fan delay switch (terminals F and B) to check functionality then make adjustments as needed to correct room temperature |

## Refrigerant Removal, Evacuation, and Recovery

When breaking into the refrigerant circuit to make repairs—or for any other purpose—conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. 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. The system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. 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 the outlet for the vacuum pump is not close to any potential ignition sources and that 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, when applicable, FLAMMABLE REFRIGERANTS. 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 to make certain that FLAMMABLE REFRIGERANT does not remain within the lubricant. 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.

### 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 leak detection methods are deemed acceptable for all refrigerant systems:

- 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.
- 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 pipe-work.

Note: Examples of leak detection fluids are bubble method and fluorescent method agents.

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. Removal of refrigerant shall be according to the Refrigerant Recovery section provided.

### A2L Leak Detection Sensor Service and Mitigation

**WARNING**

- Do not drop or apply direct impact to the sensor.
- Do not apply any sharp-pointed items to the membrane filter. A broken filter will damage the water protection feature and accuracy in detection.
- Do not cover the membrane filter.
- Do not apply any air or liquid flow with high pressure.
- Do not install the sensor on curved surfaces unless the sensor remains securely fixed without bending.
- The sensor should NOT be mounted with the membrane and sensor exposed to protect the sensor from contamination and moisture.
- Do not expose the detector to temperatures above 248° F (120° C); the plastic housing may become deformed.
- Do not spray any cleaning agents on the sensor.
- Do not clean the device with corrosive chemical products, solvents, or abrasive detergents.
- Clean the enclosure only with a damp cloth. Electrostatic spark risk.
- If a leak is suspected, all naked flames shall be removed/extinguished.
- The use of silicon sealant can inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior to working on them.
- IMPORTANT—Electrostatic Spark Risk—Disconnect all electrical connections and pass a damp cloth on the detector enclosure before performing any maintenance.

It is recommended to always have spare sensors on-hand to prevent system from being down for an extended period in the event of a sensor expiration or failure.

It is important not to relocate, remove, or disable any factory leak detection devices. These components must be replaced with the same exact part by authorized service personnel only.

### Refrigerant Detection Parts List

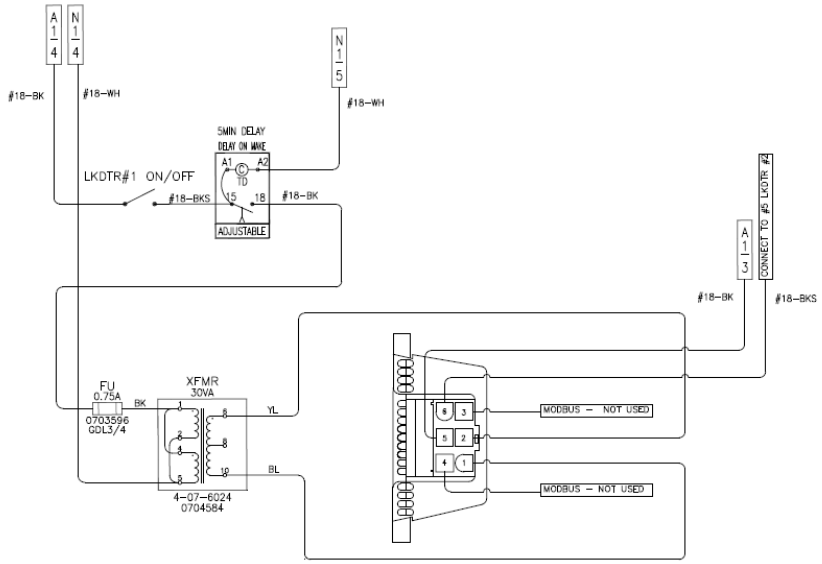
| Danfoss System | |
|---|---|
| **Part Description** | **Part Number** |
| R-454A sensor | 3216202 |
| R-454C sensor | 3216203 |
| 12-inch (305 mm) sensor harness | 3216204 |
| 40-inch (1 m) sensor harness | 3216206 |
| 60-inch (1.5 m) sensor harness | 3216207 |
| 100-inch (2.5 m) sensor harness | 3216208 |
| 240-inch (6.1 m) sensor harness | 3216209 |

| Copeland System | |
|---|---|
| **Part Description** | **Part Number** |
| R-454A Sensor | 3202148 |
| R-454C Sensor | 3196687 |
| power supply | 3165622 |

## Danfoss Sensor

### Danfoss Sensor Specifications and Wiring

| Specification | Value |
|---|---|
| Electrical Voltage | 24 VAC +/- 10% and 24 VDC (8–32 VDC) |
| Compatible Refrigerant | R-454A or R-454C (as specified) |



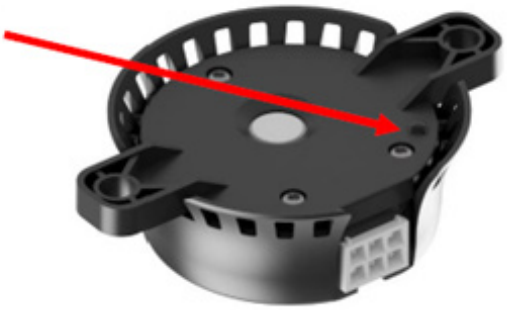

Relay dry contact shown in normally in open unenergized state.

- Relay is energized on power up when not in alarm state
- Relay is de-energized in alarm or no power state

### Danfoss Sensor Mitigation and Alarms

When the sensor is powered on, an LED positioned on the back of the sensor near the sensor membrane indicates its status. When the sensor is mounted, the LED backlights the sensor and can be seen as a reflection on the mounting surface.

| | | |
|---|---|---|
| Solid green | -Sensor power-up and self-test |
| Blinking green | -Normal operation (heartbeat) |
| Solid red | -Alarm state – gas detected |
| Blinking red | -Sensor fault |



When the sensor detects a gas reading at or above the alarm threshold, the relay de-energizes, causing the relay contacts to open during the alarm. Additionally, the alarm flag is set in the alarm status register.

To reset the alarm, the sensor reading must drop at least 2.5% below the alarm threshold. Once this condition is met, the relay re-energizes and the sensor returns to normal operation. The alarm flag is also cleared. After the alarm is reset, the relay remains open for five seconds before resuming normal operation.

Self-diagnostics are performed when the sensor is first powered on. These tests ensure the integrity of the memory, embedded program, and power supply.

The sensor continuously performs diagnostics to monitor its integrity, checking for issues such as shorts, open circuits, out-of-range values, and communication errors, as well as the integrity of the on-board memory, programming, oscillator, and voltage levels.

### Danfoss Sensor System Check

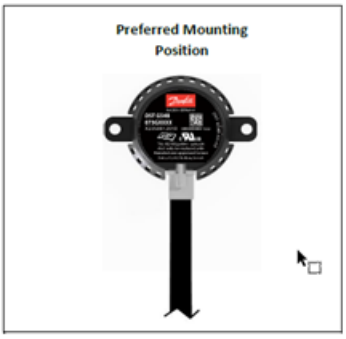
These steps should be verified at system startup and periodically (at least annually) during normal maintenance.

1. Power on the sensor 1 and let it complete initialization routine.
2. Green light should be active (normal status).
3. Place a jumper across the sensor 1 between pin #5 and #6 or expose the sensor 1 to mixture using a lighter (it should trigger in less than 60 seconds).
4. Verify if sensor 1 triggers an alarm (open/de-energized inside relay) and activates red light.
5. Verify relay R1 activation and that it shuts off all heaters as well as energizing fans and running them at maximum speed.
6. Verify that the liquid solenoids are closed.
7. Validate if the digital signal for leak alarm activates.
8. Remove jumper from sensor 1.
9. Wait five minutes, then manually reset the sensor and verify it is in normal state.
10. Repeat steps 3–9 for sensor 2.

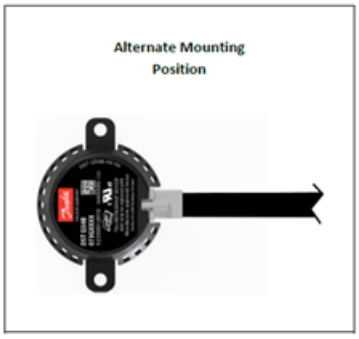
### Danfoss Sensor Replacement

Replacement sensors should be of the same type and mounted in the original locations and orientation only.

- Max torque for screws is 6.2 lb-in (0.7 N-m)
- Mounting holes are sized for #10– #12 self-tapping sheet metal screws
- Recommended installation position is with connector down. When this is not possible, rotation up to 90 degrees left or right is acceptable.




Mount Sensor with cable facing downward if possible. This is to minimize Water ingress from the cable and connector.




Alternative mounting if downward is not possible. Cable can exit 90 degrees from right or left side. Any angle from downward 0 degrees up to 90 degrees can be used.

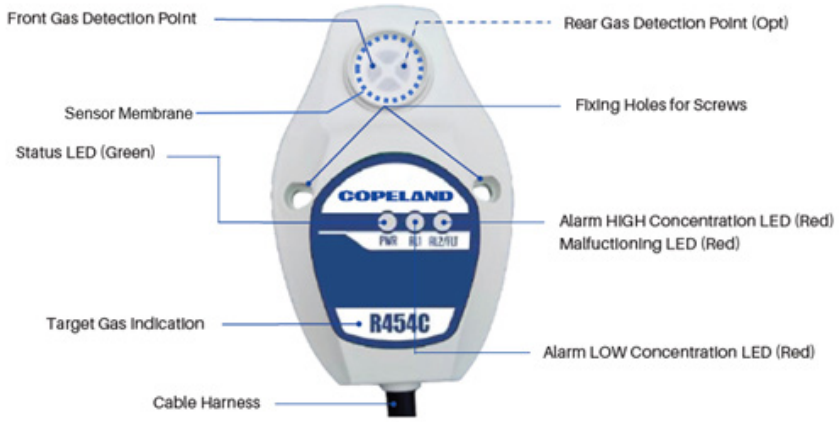
Replacement Steps

1. Before replacing sensor, first ensure no refrigerant leak is detected and then that the power is off.
2. Remove two mounting screws from sensor.
3. Disconnect wires from relay and controller.
4. Attach new sensor in the same orientation and position with the previously removed screws.
5. Connect wiring to relay and controller per the wiring diagram.
6. Reconnect power. The refrigerant sensor should now run through the initialization process.

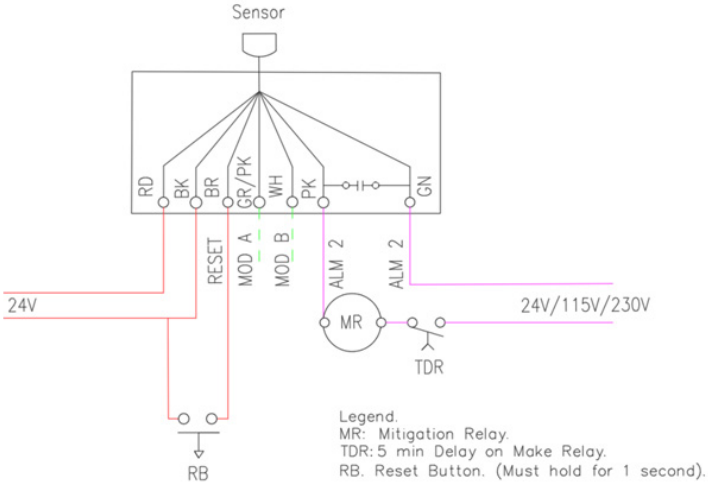
### Copeland Sensor

#### Copeland Sensor Electrical Wiring

Each Copeland A2L sensor is comprised of a singular gas concentration monitoring unit, including an enclosure, harness, electronics, and a pre-calibrated gas sensor. Two will be used per evaporator to monitor for leaks.




| Wiring Color | Connection |
|---|---|
| red | V+ 12 VDC or 24 VDC |
| black | GND |
| gray and pink | + TX/RX non-inverting Modbus signal |
| white | - TX/RX inverting Modbus signal |
| blue | relay alarm 1 — A1 |
| violet | relay alarm 1 — A2 |
| pink | relay alarm 2 and Fault — A1 |
| green | relay alarm 2 and Fault — A2 |
| yellow | current output (4–20 mA) |
| brown | program mode wire (to be connected to GND only for programming) |
| red and blue | volt output (0.1–2.9 V) |
| gray | DO NOT USE (leave or cut) |



### Copeland Sensor Mitigation and Alarms

During the initialization phase, the green LED (PWR) blinks slowly (1 Hz) to indicate startup and the red LEDs switch on. Once the initialization is complete, the green LED remains fixed and the red LEDs switch off. In normal operating mode (monitoring mode) when there are no fault indications, the gas concentration of the sensor is continuously polled and measured.

The sensor has two alert levels. When refrigerant is detected at a low concentration level, it activates *relay 1* (R1) that can provide a notification indicating refrigerant has been detected, but the refrigerant concentration is not yet at a level where system actions must be taken. The use of R1 is optional. When the sensor detects refrigerant at a high concentration level, it activates *relay 2* (R2) that triggers required safety mitigation actions, such as turning off compressors and closing safety solenoid shut-off valves.

The alarm relays are *normally open* (NO). In an alarm, mitigation, or fault state, the relay contacts are open. When the sensor is functioning normally and no refrigerant is detected, the relay contacts are closed.

When gas is detected and R1 is enabled, the low concentration alarm will activate causing the green LED to blink rapidly (2 Hz) and the corresponding red LED to light up.

When the high concentration threshold is reached, the red LED for R2 will switch ON when the relay is activated. This will activate mitigation actions, meaning R2 will shut down all the compressors and close the solenoid valve at the liquid line (LLSV) and the solenoid valve at the discharge line (DISCH SV). If Copeland E3 or Site Supervisor controller is used, during this safety shutdown event the leak alarm (digital input: 2.7) will be activated in the controller.

Once gas is no longer detected, the green LED will blink slowly and after fifteen seconds will be fully ON while R1 goes back to normal. The second LED will be RED and ON and R2 will stay OPEN until reset. R2 will remain triggered until a manual reset is done.

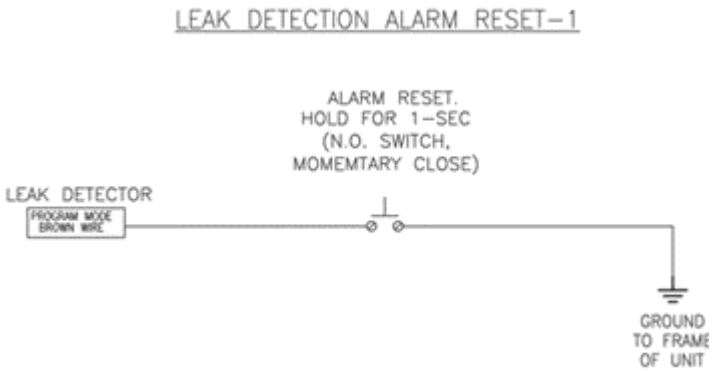
The gas concentration LFL (lower flammability limit) setpoint to trigger *alarm 2* (R2 relay) is 20% LFL.

### Copeland Sensor Mitigation and Alarms (cont.)

| Sensor Status | Status LED | | | Analog Output[B] | Relays | |
|---|---|---|---|---|---|---|
| | Power (green) | Alarm 1 (red) | Alarm 2 / Fault (red) | | R1[C] | R2[D] |
| Initialization | blink (1 Hz) | active | active | 0.1 V / 4 mA | open[C] | open[C] |
| Normal Monitoring Mode | active | | | 0.4 V / 6 mA | closed[D] | closed[D] |
| **Monitoring (Low Concentration Detected)** | | | | | | |
| Gas Detected, Low Concentration Alarm 1 Active | blink (2 Hz) | active | | 0.4–2 V / 6–18.6 mA | open[C] | closed[D] |
| No Gas Detected, Automatic Reset in 10 Sec Alarm 1 Reset | blink (1 Hz) | active | | 0.4 V / 6 mA | open[C] | closed[D] |
| **Monitoring (High Concentration Detected)** | | | | | | |
| Gas Detected, High Concentration Alarm 1 and 2 Active Mitigation Mode in Progress | blink (2 Hz) | active | active | 0.4–2 V / 6–18.6 mA | open[C] | open[C] |
| No Gas Detected, Automatic 10 Second Reset | blink (1 Hz) | active | active | 0.4 V / 6 mA | open[C] | open[C] |
| No Gas Detected Mitigation Mode | active | | active | 0.4 V / 6 mA | closed[D] | open[C] |
| Alarm 2 Needs Manual Reset | active | | active | 0.4 V / 6 mA | closed[D] | closed[C] |
| **Malfunctioning** | | | | | | |
| Detected Fault | | | active | 2.9 V / >19 mA | closed[D] | open[C] |

Alarm Reset

The low concentration alarm is automatically reset if the Lower Flammability Limit (LFL) level is lower than the preset threshold for more than 10 seconds. The high concentration alarm and fault alarm are not automatically reset for safety reasons, but can be reset manually. This can be done via hardware, connecting the PM (Program Mode) to ground for 1 second (reset button placed in diagram). Only after having ascertained that gas is no longer present, it is possible to reset the pending alarm 2 on the device manually.




[B] During monitoring, the value depends on the gas concentration (0-100% LFL)

[C] Relay 'NO' de-energized; contact open (alarm state)

[D] Relay 'NO' energized; contact closed (gas concentration below threshold)

### Copeland Sensor System Check

These steps should be verified at system startup and periodically (at least annually) during normal maintenance.

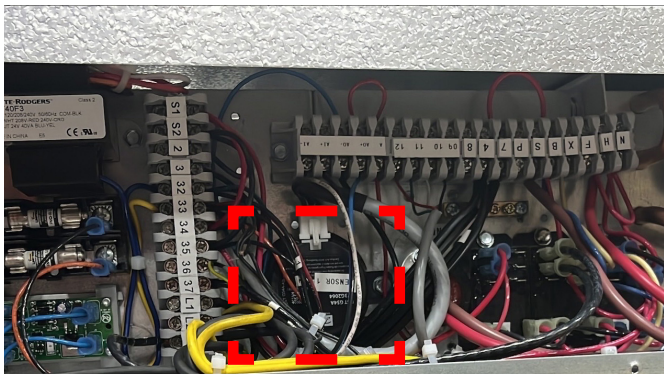
1. Verify entire control system is powered and operating.
2. Place a jumper across the sensor (PK) and (GN) terminals of sensor 1.
3. Validate that:
   - (MR) relay is energized
   - Discharge solenoid valve is closed
   - Liquid solenoid valve is closed
   - Alarm relay is energized
   - Compressor circuits are de-energized
   - Controller in use registers alarm
4. Remove jumper from sensor 1 and place on sensor 2 and repeat steps 3–8.

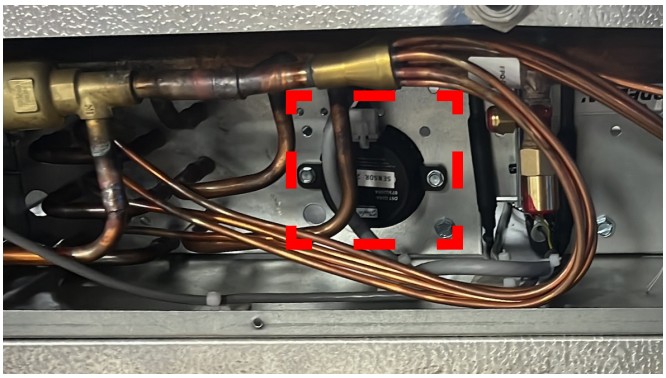
### Copeland Sensor Replacement

1. Before replacing sensor, first ensure no refrigerant leak is detected and then that the power is off.
2. Remove two mounting screws from sensor.
3. Carefully cut wiring, making certain to leave enough harness to be able to connect the new sensor.
4. Connect new sensor to the wiring harness.
5. Attach new sensor in the same orientation and position with the previously removed screws.
6. Reconnect power. The refrigerant sensor should now run through the initialization process.

### A2L Sensor Location

One sensor is located on each side of the equipment. Regardless of sensor type, the relative location will remain the same—one each mounted on the electrical side and the refrigeration side of the unit.





### A2L Sensor Reset Instructions (After Leak Event)

1. Verify Safe Conditions
   - -Confirm that there is no active refrigerant leak and that the environment is safe to proceed.
   - -Ensure all personnel involved are properly trained and authorized to perform reset operations.
2. Access Control Panel
   - -Open the electrical control panel where the power for leak detection system is installed.
3. Perform Power Cycle Reset
   - -Remove power from the leak detection system and/or entire evaporator for 5 minutes.
   - -Reapply power and wait for sensor to initialize.
4. Confirm System Reset:
   - -Verify that the sensor alarm has been cleared.
   - -Confirm that all safety valves have returned to their normal operating state.
   - -Observe the system for any abnormal indicators or alarm recurrence.

## Service

Make certain to observe all safety warnings and precautions listed in this manual during the service process. For A2L leak detection system information, please refer to that section.

### Fan Blade Replacement

1. Ensure system is fully powered down and all supply power is disconnected.
2. Remove the four nuts attaching the fan guard and place the guard aside.
3. Loosen the set screw and gently and evenly pull the fan blade off of the motor shaft.
   Note: It is important to protect your hands from both the fan and the edges of evaporator. Do not attempt to remove in a way that will cause your hands to be caught between the evaporator housing and fan blade.
4. Once the old blade is removed, place the new blade on the shaft in the same orientation and position, then tighten the set screw.
5. Check for proper rotation and clearance.
6. If no interference is present, reinstall the fan guard and the retaining nuts.
   Note: Do not under any circumstance connect power to the evaporator or attempt to use the system without the fan guard(s) installed.
7. Restore power to the evaporator and system and check for proper operation.

### Fan Motor Replacement

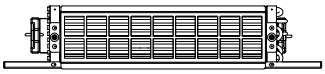
1. Ensure system is fully powered down and all supply power is disconnected.
2. Remove the four nuts attaching the fan guard and place the guard aside.
3. Loosen the set screw and gently and evenly pull the fan blade off of the motor shaft.
   Note: It is important to protect your hands from both the fan and the edges of evaporator. Do not attempt to remove in a way that will cause your hands to be caught between the evaporator housing and fan blade.
4. Unplug the motor electrical connections.
5. Remove the nuts attaching the motor mount to the motor and pull the old motor out of the evaporator.
6. Mount the new motor to the motor mount in the same orientation as the original.
7. Connect motor electrical wiring.
8. Attach fan blade in the same orientation and position as it was in prior to removal, then tighten the set screw.
9. Check for proper rotation and clearance.
10. If no interference is present, reinstall the fan guard and the retaining nuts.
    Note: Do not under any circumstance connect power to the evaporator or attempt to use the system without the fan guard(s) installed.
11. Restore power to the evaporator and system and check for proper operation.

### Coil Guards

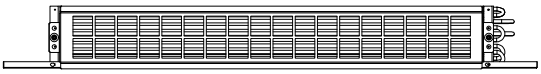
LH-A2L units have coil guards on opposing sides, and as such the illustrations below show only half of the applicable guards for a given unit.

Coil Guards

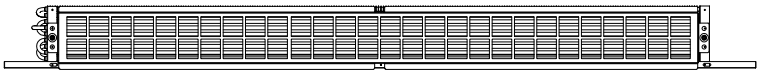
LHD1 P/N 3210933



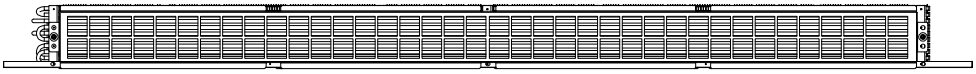
LHD2 P/N 3210934

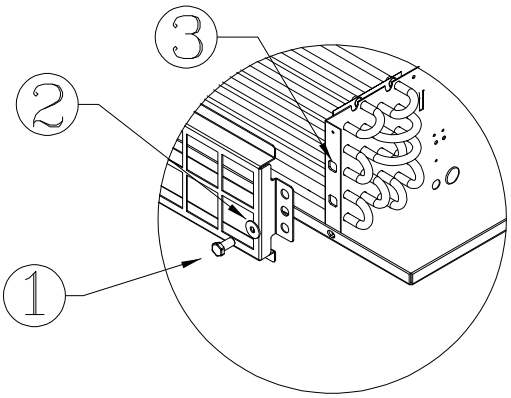


LHD3 P/N 3210936



LHD4 P/N 3210937





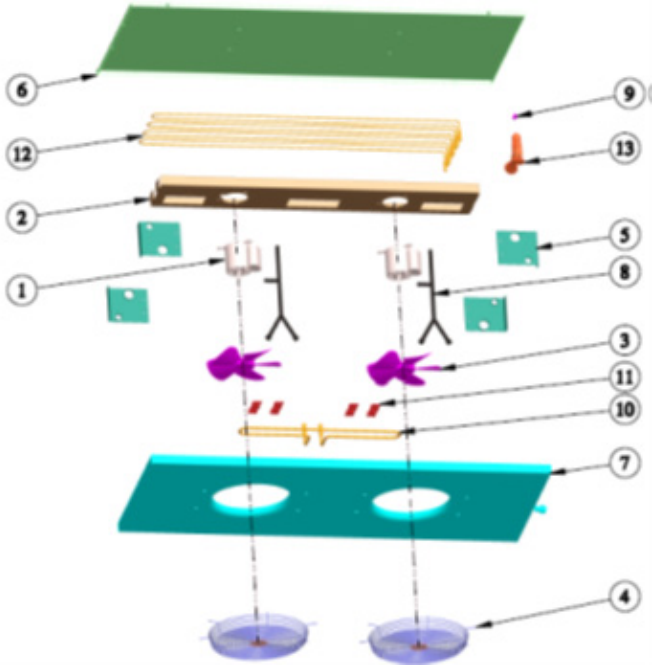

Hardware for
LHD1, LHD2, LHD3, and LHD4

| |
|---|
| tem#1-(05032000003)/8-16X3/4 HHCS ZP |
| Item#2-(051280) FLAT WASHERS 3/8 |
| Item#3-(051560)3/8-16 NUT RETAINER |


Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

### Replacement Parts List

For A2L leak detection system or coil guard part numbers, please refer to the respective section for those components.




| Item Number | Description | | Hussmann/Krack Part Number |
|---|---|---|---|
| 1 | fan motor (1,475–400 RPM) | | 3170075 |
| 2 | 22" motor mount | | E104108 |
| | 44" motor mount | | E104109 |
| | 66" motor mount | | E104110 |
| 3 | fan blade | | 112650 |
| 4 | fan guard | | E103789 |
| 5 | corner panel | | E104129 |
| 6 | 1-fan top panel | | E104111 |
| | 2-fan top panel | | E104112 |
| | 3-fan top panel | | E104113 |
| | 4-fan top panel | | E104114 |
| 7 | 1-fan drain pan | | CE104119 |
| | 2-fan drain pan | | CE104120 |
| | 3-fan drain pan | | CE104121 |
| | 4-fan drain pan | | CE104122 |
| 8 | 1-fan) | fan control wiring harness | 3086202 |
| | | fan power wiring harness | E206449 |
| | 2-fan | fan control wiring harness | 3086203 |
| | | fan power wiring harness | E206450 |
| | 3-fan | fan control wiring harness | 3086204 |
| | | fan power wiring harness | E206451 |
| | 4-fan | fan control wiring harness | 3086205 |
| | | fan power wiring harness | E206452 |

| Item Number | Description | | Hussmann/Krack Part Number |
|---|---|---|---|
| 9 | thermostat | defrost termination thermostat (Klixon) | E206100 |
| | | heater safety thermostat | 109560 |
| | | heater safety thermostat SPDT | E206465 |
| | | fan delay | E201818 |
| | | KPU71 thermostat | 3239497 |
| | fan speed control | amplifier | 3122367 |
| | | System 450 controller | 3059162 |
| | | room thermostat | E206766 |
| | | A99BC-300 temperature sensor | E205564 |
| 10 | 1-fan drain pan heater | | 3120001 |
| | 2–4-fan drain pan heater | | E104187 |
| 11 | heater support clip | | E104132 |
| 12 | 1-fan coil heater | | E104182 |
| | 2-fan coil heater | | E104183 |
| | 3-fan coil heater | | E104184 |
| | 4-fan coil heater | | E104185 |
| 13 | ERVE-1/2-GA expansion valve | | 3219028 |
| | EGVE-1-GA expansion valve | | E206378 |
| | EGVE-1 1/2-GA expansion valve | | E206309 |
| | ERVE-2-GA expansion valve | | 3219030 |
| | EGVE-1-Z expansion valve | | E205722 |
| | EGVE-1 1/2-Z expansion valve | | E205724 |
| | EGVE-3-Z expansion valve | | E205884 |
| | ERVE-4-Z expansion valve | | 3219038 |
| | EGVE-3/4-Z expansion valve | | E205720 |
| | EGVE-2-Z expansion valve | | E205726 |
| | ERTE-1/2-C expansion valve | | 3218325 |
| | ERTE-1-C expansion valve | | 3218327 |
| | ERTE-1 1/2-C expansion valve | | 3218328 |
| | ERTE-2-C expansion valve | | 3218329 |
| | ERTE-1/3-C expansion valve | | 3218324 |
| | ERTE-3/4-C expansion valve | | 3218326 |
| | ERTE-3/4-Z expansion valve | | 3218338 |
| | ERTE-1 1/2-Z expansion valve | | 3218340 |
| | ERTE-2-Z expansion valve | | 3218341 |
| | ERTE-3-Z expansion valve | | 3218342 |
| | ERTE-1/2-Z expansion valve | | 3218337 |
| | ERTE-1-Z expansion valve | | 3218339 |
| | ERTE-3-C expansion valve | | 3218330 |

## Decommissioning

| Item Number | Description | Hussmann/Krack Part Number |
|---|---|---|
| N/A | 1/2" ODF SSOV solenoid shut-off valve | 3208585 |
| | 7/8" ID CSOV check valve for KR1D, KR2D, and KR3D | 3189498 |
| | 1 1/8" ID CSOV check valve for KR4D, KR5D, and KR6D | 3198248 |
| | 25–75 A Contactor | E209975002 |
| | 90 A Contactor | E209976002 |
| | Hussmann coil cleaner concentrate (1-gallon) | 3078662 |
| | Hussmann coil cleaner spray (1-quart) | 3083319 |

### 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.


Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

## Warranty

To obtain warranty information or other support, contact your Krack 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

---

### 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

©2025 Krack, a Hussmann Corporation Brand • Bridgeton, MO 63044-2483 U.S.A.
U.S. & Canada 1-800-922-1919 • Mexico 800-890-2900 • www.krack.com

**French P/N 3235353**
**Spanish P/N 3235355**