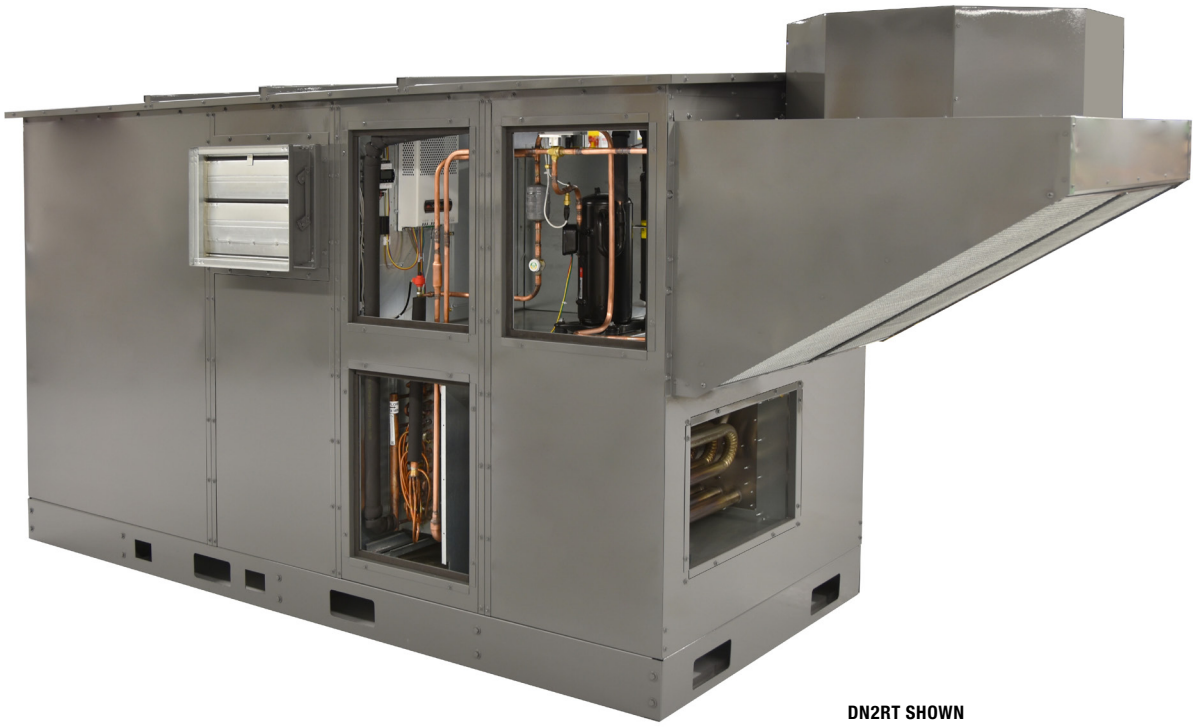
RenewAire
Energy Recovery Ventilation

# PACKAGED REFRIGERATION FOR DN SERIES DOAS

## Supplemental Manual

DN2RT
DN3RT
DN5RT



DN2RT SHOWN

AHRI CERTIFIED® www.ahridirectory.org
Air-to-Air ERV
AHRI Standard 1060
Energy Recovery COMPONENT is certified. Actual performance in packaged equipment may vary.

c ETL LISTED US
Intertek

## ⚠ WARNING

ARC FLASH AND ELECTRIC SHOCK HAZARD

Arc flash and electric shock hazard. Disconnect all electric power supplies, verify with a voltmeter that electric power is off and wear protective equipment per NFPA 70E before working within electric control enclosure. Failure to comply can cause serious injury or death.

Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable.

Before proceeding with installation, read all instructions, verifying that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

The line side of the disconnect switch contains live high-voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch and verify that power is off with a volt meter. Refer to unit electrical schematic. Follow all local codes.

## ⚠ CAUTION

RISK OF ELECTRIC SHOCK

VFDs use capacitors that retain a high-voltage charge even after power is disconnected. When power to the DX unit is disconnected, wait five minutes for the capacitors to discharge themselves.

## ⚠ CAUTION

RISK OF ELECTRIC SHOCK OR EQUIPMENT DAMAGE

Whenever electrical wiring is connected, disconnected or changed, the power supply to the DOAS and its controls must be disconnected. Lock and tag the disconnect switch or circuit breaker to prevent accidental reconnection of electric power.

## IMPORTANT

This equipment is to be installed by following Industry Best Practices and all applicable codes. Any damage to components, assemblies, sub-assemblies or the cabinet which is caused by improper installation practices will void the warranty.

## IMPORTANT

Air ducts connecting this DOAS to the Occupied Space must be installed in accordance with the Standards of the National Fire Protection Agency for the installation of Air-Conditioning and Ventilating Systems (Pamphlet No. 90A) and Warm-Air Heating and Air-Conditioning Systems (Pamphlet No. 90B).

## ⚠ WARNING

COMPRESSED REFRIGERANT HAZARD

This unit contains compressed refrigerant (R-410A) in a confined space. If the refrigerant tubing or other hardware is heated too much, the possibility of an explosion exists.

If the tubing or other hardware is punctured or broken, a sudden discharge of the R-410A refrigerant is likely. This presents a danger of freeze burns or frostbite. When working with the refrigerant system, always wear appropriate Personal Protective Equipment (PPE), as defined by OSHA.

Only EPA-certified technicians are to work on this compressed refrigerant system.

If a refrigerant leak occurs, evacuate the area until the refrigerant gas has dispersed. R-410A refrigerant gas may be odorless.

## ⚠ CAUTION

RISK OF CONTACT WITH HOT SURFACES

The compressor and other electrical components are extremely hot during operation. Allow sufficient time for them to cool before working within the unit cabinet. Use extreme caution and wear protective gloves and arm protection when working on or near hot compressors, associated piping and electrical components.

## ⚠ CAUTION

RISK OF COMPRESSOR DAMAGE

All compressors have an integral crankcase heater system that must be enabled for at least SIX HOURS prior to operation of the compressors.

The crankcase heater boils off any liquid refrigerant that may be in the compressor. Liquid refrigerant cannot be compressed and can cause damage to the compressor.

## IMPORTANT

This unit is not for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience or 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 they do not play with the appliance.

## ⚠ AVERTISSEMENT

RISQUE D'ARC ÉLECTRIQUE ET DE CHOC ÉLECTRIQUE

Risque d'arc électrique et de choc électrique. Débranchez toutes les alimentations électriques, vérifiez avec un voltmètre que l'alimentation électrique est coupée et portez un équipement de protection conforme à la norme NFPA 70E avant de travailler dans l'enceinte de commande électrique. Le non-respect peut entraîner des blessures graves ou la mort.

Le client doit fournir une mise à la terre à l'unité, conformément aux codes NEC, CEC et locaux, le cas échéant. Avant de procéder à l'installation, lisez toutes les instructions, vérifiez que toutes les pièces sont incluses et vérifiez la plaque signalétique pour vous assurer que la tension correspond à l'alimentation secteur disponible.

Le côté ligne du sectionneur contient une haute tension sous tension.

La seule façon de s'assurer qu'il n'y a pas de tension à l'intérieur de l'unité est d'installer et d'ouvrir un interrupteur de déconnexion à distance et de vérifier que l'alimentation est coupée avec un voltmètre. Se référer au schéma électrique de l'unité. Suivez tous les codes locaux.

## ⚠ ATTENTION

RISQUE DE CONTACT AVEC DES SURFACES CHAUDES

Le compresseur et les autres composants électriques sont extrêmement chauds pendant le fonctionnement. Laissez-leur suffisamment de temps pour refroidir avant de travailler dans l'armoire de l'unité.

Soyez extrêmement prudent et portez des gants de protection et une protection des bras lorsque vous travaillez sur ou à proximité de compresseurs chauds, de la tuyauterie associée et des composants électriques.

## ⚠ ATTENTION

RISQUE D'ENDOMMAGEMENT DU COMPRESSEUR

Tous les compresseurs ont un système de chauffage de carter intégré qui doit être activé pendant au moins SIX HEURES avant de faire fonctionner les compresseurs. Le réchauffeur de carter évapore tout réfrigérant liquide qui pourrait être dans le compresseur.

## IMPORTANT

Les conduits d'air reliant ce DOAS à l'espace occupé doivent être installés conformément aux normes de l'Agence nationale de protection contre les incendies pour l'installation de systèmes de climatisation et de ventilation (brochure n ° 90A) et de systèmes de chauffage et de climatisation à air chaud (Brochure n ° 90B).

## ⚠ AVERTISSEMENT

RISQUE DE RÉFRIGÉRANT COMPRIMÉ

Cette unité contient du réfrigérant comprimé (R-410A) dans un espace confiné. Si la tubulure de réfrigérant ou autre matériel est trop chauffée, la possibilité d'une explosion existe.

Si le tube ou autre matériel est perforé ou cassé, une décharge soudaine de réfrigérant est probable. Cela présente un risque de brûlures de gel ou d'engelures. Lorsque vous travaillez avec le système de réfrigération, portez toujours un équipement de protection individuelle (EPI) approprié, tel que défini par l'OSHA.

**Seuls les techniciens certifiés EPA doivent travailler sur ce système de réfrigérant comprimé.**

En cas de fuite de réfrigérant, évacuez la zone jusqu'à la dispersion du gaz réfrigérant. Le gaz réfrigérant R-410A peut être inodore.

## ⚠ ATTENTION

RISQUE DE CHOC ÉLECTRIQUE OU DE DOMMAGES MATÉRIELS

Chaque fois que le câblage électrique est connecté, déconnecté ou changé, l'alimentation électrique du DOAS et ses commandes doivent être déconnectées. Verrouillez et étiquetez le sectionneur ou le disjoncteur pour éviter toute reconnexion accidentelle de l'alimentation électrique.

## ⚠ ATTENTION

RISQUE DE CHOC ÉLECTRIQUE

Les VFD utilisent des condensateurs qui conservent une charge haute tension même après avoir coupé l'alimentation. Lorsque l'alimentation de l'unité DX est déconnectée, attendez 5 minutes que les condensateurs se déchargent.

## IMPORTANT

Cet appareil doit être installé conformément aux meilleures pratiques de l'industrie et à tous les codes applicables. Tout dommage aux composants, assemblages, sous-ensembles ou à l'armoire causé par des pratiques d'installation incorrectes annulera la garantie.

## IMPORTANT

Cet appareil n'est pas destiné à être utilisé par des personnes (y compris des enfants) ayant des capacités physiques, sensorielles ou mentales réduites, ou un manque d'expérience ou de connaissances, sauf si elles ont reçu une supervision ou des instructions concernant l'utilisation de l'appareil par une personne responsable de leur sécurité.

Les enfants doivent être surveillés pour s'assurer qu'ils ne jouent pas avec l'appareil.

**IMPORTANT**

This unit is intended for general ventilating, heating, and cooling only. Do not use to exhaust hazardous or explosive materials and vapors. Do not connect this equipment to range hoods, fume hoods or collection systems for toxics.

**IMPORTANT**

This unit is for ventilating finished structures only. It is not to be used until after all construction has been completed and construction debris and dust are cleaned from the Occupied Space.

**IMPORTANT**

This unit is for use at elevations up to 6999 feet. For elevations 7000 feet or higher, consult the factory.

**IMPORTANT**

This appliance must be installed in a location not accessible to the general public.

**IMPORTANT**

Cet appareil est destiné à la ventilation générale, pour chauffage et au refroidissement uniquement. Ne pas utiliser pour évacuer des matières et vapeurs dangereuses ou explosives. Ne connectez pas cet équipement à des hottes de cuisinière, des hottes ou des systèmes de collection des produits toxiques.

**IMPORTANT**

Cette unité est destinée à la ventilation des structures finies uniquement. Il ne doit pas être utilisé tant que la construction n'est pas terminée et que les débris de construction et la poussière ne sont pas nettoyés de l'espace occupé.

**IMPORTANT**

Cette unité doit être utilisée à des altitudes allant jusqu'à 6999 pieds. Pour des élévations de 7000 pieds ou plus, consultez l'usine.

**IMPORTANT**

Cet appareil doit être installé dans un endroit non accessible au grand public.

## READ AND SAVE THIS MANUAL/LIRE ET CONSERVER CE MANUEL

**NOTICE**

This manual contains space for maintaining written records of unit maintenance and/or repairs. See Section 8.2 Maintenance Records. At the time the DOAS is commissioned, a maintenance schedule should be developed by the user to incorporate monthly and seasonal maintenance and include start up maintenance tasks as described in this manual.

NOTE: This page is to be completed by the installing contractor. The completed document is to be turned over to the owner after start up.

## UNIT INFORMATION

Record information as shown below.

In the unlikely event that factory assistance is ever required, information located on the unit label will be needed.

Locate the RenewAire unit label found on the outside of the unit.

NOTE: This information is for purposes of identifying the unit-specific option data from the Option Code.

Option Code:

DN-□-JRT□□□□P-□□□□□□-□□

Serial Number:

□□□□□□□

SO#:

□□□□□

NOTE: Digit 14 of the unit configuration code (Option Code) indicates that the unit has a Packaged Refrigeration. For further information on the DOAS configuration code, see the *DN-Series Installation, Operation, and Maintenance Manual.*

UNIT INFORMATION

**ENERGY RECOVERY VENTILATOR**

IPX4

RenewAire Energy Recovery Ventilation

Toll Free: 800-627-4499

**⚠ WARNING**

Danger of electric shock.
Always disconnect power source before servicing.
Not For Use In Cooking Area.
Use Copper Supply Wires Only.

**⚠ AVERTISSEMENT**

Danger de choc electrique. Toujours deconnector la source d'alimentation avant les reparations.
Ne Pas Utilise Dans Une Zone De Cuisson.
Utiliser Des Fils D'Alimentation En Cuivre.

Motors Thermally Protected / Moteurs proteges thermiquement

| POWER SUPPLY TO UNIT / Alimentation d'energie a l'unite | | |
|---|---|---|
| Voltage | Minimum Circuit Amps | Max Overcurrent Protection Device |
| **230V** | | |
| 60 HZ 3~ | Amp. Minimales de Circuit | Dispositif de protection maximum contre les surintensites |

| Coil | Type | Rows | FPI | Max Pressure (psi/MPa) |
|---|---|---|---|---|
| Dehumidify | | | | |
| Re-heat | | | | |
| Heat | | | | |
| | Type | Rangee | FPI | Max. Pression (psi/MPa) |

| MOTOR/MOTEUR SPEC. | | |
|---|---|---|
| Voltage | (Qty) & kW/HP | FLA |
| **200-240** | **2@2.7 kW/3.6 hp** | **8.6-7.2** |
| | (Qty) & kW/CV | APC |

| Motors Protected by Variable Frequency Drives | Les moteurs protégés par la frequence variable conduit | |
|---|---|---|
| Voltage | (Qty) & kW/HP | FLA |
| | | |
| | (Qty) & kW/CV | APC |

| ELECTRIC HEATER/CHAUFFAGE ELECTRIQUE | | |
|---|---|---|
| Voltage/Phase | Amps | kW |
| **240V/3-Ph** | **36.1** | **15** |
| | Label No: 133986_000 | |

Option Code: **DN-3-JRTBH135P-RE3EN4---L**

MODEL/MODELE: DN-3RT Serial Number: **B21 00000**

SO#: **000000** JO#: **00000-0000**

**UNIT LABEL (TYP)**

**PACKAGED CONDENSING UNIT**

**Class 1 Appliance**

RenewAire Energy Recovery Ventilation

Waunakee, WI

Toll Free: 800-627-4499

| REFRIGERANT/RÉFRIGÉRANT | | | | |
|---|---|---|---|---|
| | Charge (lbs/kg) | | Max. Pressure (psi/MPa) | |
| Type | 1-Circ | 2-Circ | Low Side | High Side |
| **R410A** | | | | |
| Type | Charge (lbs/kg) | | Max. Pression (psi/MPa) | |

| FAN MOTOR/MOTEUR de VENTILATEUR | | |
|---|---|---|
| Motors Thermally Protected | | |
| Voltage | (Qty) & kW | FLA |
| | | |
| | (Qty) & kW | APC |
| Moteurs Proteges Thermiquement | | |
| Motors Protected by Variable Frequency Drives | | |
| Voltage | (Qty) & kW | FLA |
| | | |
| | (Qty) & kW | APC |
| Les moteurs protégés par la frequence variable conduit | | |

| CONDENSER COIL | | | |
|---|---|---|---|
| Type | Rows | FPI | Max. Pressure (psi/MPa) |
| **R410A** | | | |
| Type | Rangee | FPI | Max. Pression (psi/MPa) |

| COMPRESSOR/COMPRESSEUR | | | |
|---|---|---|---|
| Motors Protected by Variable Frequency Drives | | | |
| Voltage | (Qty) & kW | | FLA |
| | | | |
| | (Qty) & kW | | APC |
| Les moteurs protégés par la frequence variable conduit | | | |
| Motors Thermally Protected | | | |
| Voltage | (Qty) | RLA | LRA |
| | | | |
| | (Qty) | RLA | LRA |
| Moteurs Proteges Thermiquement | | | |
| | | Label No: 133992_000 | |

**PACKAGED CONDENSING UNIT LABEL (TYP)**

## TABLE OF ILLUSTRATIONS



## TABLE OF WIRING SCHEMATICS



## TABLE OF P&I DIAGRAMS

# 1.0 OVERVIEW

## 1.1 DESCRIPTION

NOTE: This manual is for the Packaged Refrigeration system as used on RT model (rooftop) DOAS units.

The DN-Series DOAS with Packaged Refrigeration option is a versatile, multi-application system, available for all rooftop (RT) DOAS units that use three-phase power. It's engineered to function as a stand-alone system, providing conditioned Supply Air, on demand.

The Packaged Refrigeration system is classified by the Environmental Protection Agency (EPA) as a Class II device.

All Packaged Refrigeration systems include a variable-speed compressor, condenser and evaporator coils and a dedicated variable speed condenser fan(s). The Packaged Refrigeration system may also include an optional Hot Gas Reheat Coil (HGRH) for humidity control. The DN-Series DOAS with Packaged Refrigeration is fully wired and piped at the factory. It is fully charged and tested prior to shipment.

The DN-Series with Packaged Refrigeration system includes a single variable-speed compressor for small cooling capacity (single circuit), while larger cooling capacities have a variable-speed compressor coupled with a fixed-speed compressor (two-circuit).

Control of the Packaged Refrigeration is accomplished by a dedicated refrigeration controller connected to the RenewAire unit (DOAS) integrated programmable controller, via a serial cable. The DOAS unit controller, with its integral sensors, monitors air conditions and then provides a Call for Cooling to the refrigeration controller. The refrigeration controller monitors refrigerant temperatures and pressures and controls the compressor(s) and the condenser fan(s) to maintain the desired supply air temperature. The Call for Cooling is based on either Supply Air or Return Air temperature.

When an HGRH coil is ordered, the modulating HGRH function is controlled directly by the DOAS unit Integrated Programmable Controls (IPC).

The 24VAC needed by the refrigeration controller is provided by a step-down transformer located in the unit E-box, while high-voltage power for the compressors, fans and VFDs are wired directly to the unit main disconnect switch.

The DN unit with Packaged Refrigeration utilizes the same airflow configurations as DN-Series Rooftop Units. The airflow configuration is indicated by Digit 10 of the unit configuration code.

This manual is to be used in conjunction with the *DN Series DOAS Rooftop Installation, Operation and Maintenance Manual* and the *DN Series Integrated Programmable Controls User Manual.*

## 1.2 SYSTEM SIZING

The refrigeration system is sized to meet the customer-specified operating conditions. Much of the system sizing is accomplished automatically within RenewAire's CORES unit configuration software based on customer design conditions. The evaporator coil capacity is determined based on design conditions and a compressor is selected to meet the cooling capacity. Then, the condenser coil capacity is then designed to match the evaporator coil and compressor. Piping sizes are automatically selected along with the additional refrigeration components required for the system.

## 1.3 COOLING CAPACITY

Each DOAS model has multiple cooling capacities that can be specified. Cooling capacity is determined by matching the customer's design conditions to a combination of evaporator and condenser coils, compressor(s) and fans. Each DOAS model has several different component combinations available to attain the required cooling capacity, taking into consideration the expected operating conditions.

DN-2: 2–10 tons cooling capacity

DN-3: 3.5–20 tons cooling capacity

DN-5: 5.5–30 tons cooling capacity

## 1.4 REHEAT CAPACITY

Each DOAS model has multiple reheat capacities that can be specified. Reheat capacity is determined by matching the expected operating conditions of the unit to the customer's desired leaving air temperature of the Supply Air.

## 1.5 EVAPORATOR COIL OPERATION

Liquid refrigerant enters the evaporator coil at the Evaporator Temperature (~40°F) and at a low pressure (~119 psig). Heat from the unit Fresh Air transfers to the refrigerant. Due to the heat absorption, the refrigerant changes from a liquid to a vapor as it flows through the evaporator coil. By the time the refrigerant leaves the evaporator coil, it is all vapor and is at the Superheat Temperature, which the Evaporator Temperature plus the degrees of Superheat. The refrigerant vapor, at a low pressure, is then drawn into the compressor.

## 1.6 CONDENSING COIL OPERATION

Refrigerant vapor is discharged from the compressor and enters the condenser coil at the Condensing Temperature (~130°F) and at high pressure (~477 psig). Heat from the refrigerant transfers to the ambient air as it is pulled through the condenser coil by the condenser fan. Due to the heat rejection, the refrigerant changes from a vapor to a liquid as it flows through the condenser coil. By the time the refrigerant leaves the condenser coil it is a liquid and is at the Liquid Temperature, which is the Condensing Temperature minus the Sub-cooling Temperature.

## 1.7 HOT GAS REHEAT COIL OPERATION

The hot gas reheat coil is basically a condensing coil that is located next to the evaporator coil, on the downstream side. It receives a regulated amount of refrigerant vapor at condensing temperature and rejects heat into the cooled Supply Air airstream. The amount of the refrigerant vapor entering the HGRH coil is controlled by a motorized 3-way modulating valve that is controlled by the DOAS IPC. The amount of heat rejected into the Supply Air airstream leaving the evaporator coil is sufficient to raise the Supply Air temperature to the desired temperature. Because of the heat that is rejected by the HGRH coil, the refrigerant changes from a vapor to a liquid before merging with the liquid refrigerant leaving the condensing coil.

## 1.8 USER INTERFACE

The user interface for the refrigeration system is the keypads and data screens found on the faces of both the primary DOAS Controller and the secondary refrigeration controller. The two controllers are connected by a serial cable. The DOAS controller requires various configuration settings to operate (at the primary user interface), and will then provide a Call for Cooling signal to the secondary refrigeration controller. The refrigeration controller also requires configuration settings (configured at the factory and accessible from the primary DOAS controller). The DOAS controller is connected to an expansion board and are located in the main unit electrical box. The refrigeration controller is mounted in the compressor compartment near the compressor Variable Frequency Drive (VFD) (refrigeration controller does not normally need access as interface is with the primary DOAS controller).

For ease of use, both the DOAS controller and the refrigeration controller may be connected to an optional Remote User Terminal (RUT) or to a laptop computer. See the *DN-Series Integrated Programmable Controls User Manual* for more information including password.


**FIGURE 1.8.0 PROGRAMMABLE CONTROLLER AS USED FOR DOAS AND PACKAGED REFRIGERATION CONTROL**

## 1.9 SAFETY FEATURES

- Step-down power supply transformers have an integral circuit breaker that will trip in case of overload.
- Each phase of the electrical power supply is fused (optional).
- VFDs are fused, which protects the VFD and the driven variable-speed compressor.
- High pressure limit switch with manual reset for variable-speed and fixed speed compressors.
- Motor starter with overload relay for fixed-speed compressors.

# 2.0 COMPONENT DESCRIPTIONS

## 2.1 CABINET

The DN DOAS with Packaged Refrigeration varies from the standard DOAS unit. Access panels are added to the back of the cabinet and the metal panel that separates the EA fan compartment from the controls compartment includes a removable access panel, for servicing the compressor compartment.

In addition, a condenser fan module is added to the outside of the unit that contains the condenser coil with condenser fan, mounted on top of the condenser hood.


FIGURE 2.1.0 DOAS WITH PACKAGED REFRIGERATION: FRONT VIEW


FIGURE 2.1.1 DOAS WITH PACKAGED REFRIGERATION: BACK VIEW

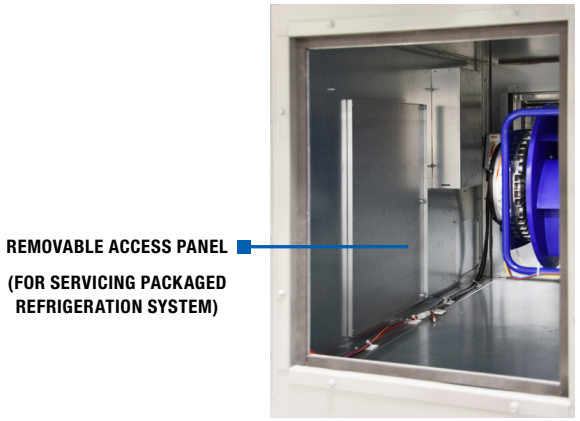



FIGURE 2.1.2 DOAS WITH PACKAGED REFRIGERATION: EA FAN COMPARTMENT

## 2.2 REFRIGERANT

The refrigerant used in all Packaged Refrigeration systems is R-410A. There are minimal hazards involved in its use. It is a non-flammable, colorless, volatile liquid with a faint sweetish odor. It may also be odorless. There are two primary hazards involved in its use: since it will displace air, it could cause a reduction in available oxygen levels, causing dizziness. The second issue is that if it is accidentally released, the vapor stream could cause freeze burns or frostbite.

**⚠ WARNING**

COMPRESSED REFRIGERANT HAZARD

This unit contains compressed refrigerant (R-410A) in a confined space. If the refrigerant tubing or other hardware is heated too much, the possibility of an explosion exists.

If the tubing or other hardware is punctured or broken, a sudden discharge of the R-410A refrigerant is likely. This presents a danger of freeze burns or frostbite. When working with the refrigerant system, always wear appropriate PPE, as defined by OSHA.

Only EPA-certified technicians are to work on this compressed refrigerant system.

If a refrigerant leak occurs, evacuate the area until the refrigerant gas has dispersed. R-410A refrigerant gas may be odorless.

## 2.3 POLYOLESTER OIL

Polyolester Oil (or POE Oil) is used as a synthetic lubricant for the compressors. It is fully compatible with the R-410A refrigerant.

**⚠ CAUTION**

RISK OF ALLERGIC REACTION

Polyolester oil may cause an allergic skin reaction. Use Personal Protective Equipment (PPE) such as gloves and face shield when handling POE oil. Clean up any spills immediately.

## 2.4 EVAPORATOR COIL

The evaporator coil is a standard RTFP (round copper tubes with pressed aluminum fins) coil located in the coil compartment. The evaporator coil is sized to meet the cooling requirements of the unit. Liquid refrigerant is changed to a gas as it enters the coil. When the gas expands (evaporates), it readily absorbs the available heat energy, from the Fresh Air airstream.

## 2.5 CONDENSING COIL

Condensing coils, sometimes referred to just as “condensers,” are located in the condenser module attached to the outside of the DOAS unit. They are standard RTFP coils. The compressors compress the refrigerant gas returning from the evaporator coil and push it into the condenser coil, where it changes back to a liquid as it cools. Ambient air is drawn through the condenser coils, allowing the hot refrigerant to reject its heat energy.

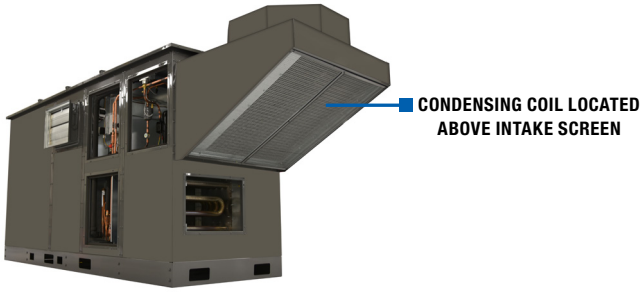



FIGURE 2.5.0 DOAS CONDENSING COIL LOCATION

## 2.6 CONDENSER FANS

Condenser fans are variable-speed, EC type unless the unit is 575VAC, where the condenser fans are run by a VFD. DN-2 DOAS units have one condenser fan, while DN-3 and DN-5 units have two. The fans are controlled by the refrigeration controller. Both fans run simultaneously, at the same speed. The fans are always located on top of the condenser module.

FIGURE 2.6.0 DOAS CONDENSER FAN (SHROUD NOT SHOWN)

## 2.7 COMPRESSORS

The compressors used in all units are scroll-type. If there is only one compressor, it is a variable speed scroll compressor. DOAS units requiring greater cooling capacity will have a second compressor, but it is fixed-speed. Variable-speed compressors use a VFD to drive them at the correct speed, while fixed-speed compressors use contactors to turn them ON and OFF. The contactors are mounted in an electrical box on the wall in the compressor compartment, near the refrigeration controller.

Several SIAM and Copeland models are used for variable speed and three Copeland models are used for fixed speed.

FIGURE 2.7.0 VARIABLE-SPEED AND FIXED-SPEED COMPRESSORS (TYP)

| Tonnage | EEV | 208/230 VAC | 460 VAC | 575 VAC |
|---|---|---|---|---|
| 3 | E2V24 | ANB33FBSMT | ANB33FLGMT | ZPV0282E |
| 5 | E2V30 | ANB52FKKMT | ANB52FKPMT | ZPV0382E |
| 6 | E2V30 | ANB66FVCMT | ANB66FVQMT | N/A |
| 7 | E2V30 | ANB78FVCMT | ANB78FVQMT | N/A |
| 8 | E2V35 | N/A | ANB87FVLMT | N/A |
| 15 | E3V45 | ZPV0662E | ZPV0662E | ZPV0662E |
| 20 | E3V45 | ZPV0962E | ZPV0962E | ZPV0962E |
| 24 (15 + 9) | E3V45/ E2V35 | ZPV066 + ZP104K | ZPV066 + ZP104K | ZPV066 + ZP104K |
| 30 (20 + 10) | E3V45/ E2V35 | ZPV096 + ZP122K | ZPV096 + ZP122K | ZPV096 + ZP122K |
| 35 (20 + 15) | E3V45/ E3V45 | ZPV096 + ZP182K | ZPV096 + ZP182K | ZPV096 + ZP182K |

FIGURE 2.7.1 COMPRESSOR USAGE

2.7.1 Compressor Crankcase Heaters

All compressors have either an internal or an external crankcase heater that operates whenever power is supplied to the DOAS and the disconnect switch is turned ON. Only fixed-speed compressors have external crankcase heaters. Crankcase heaters prevent refrigerant migration and the resulting “liquid slugging” when the compressor is turned on.

FIGURE 2.7.2 EXTERNAL CRANKCASE HEATER (TYP)

**⚠ CAUTION**

RISK OF COMPRESSOR DAMAGE

All compressors must have power applied to the crankcase heater for a minimum of SIX HOURS prior to operation. Failure to do so may result in the compressor not starting.

2.7.2 Variable Frequency Drive (VFD)

All variable-speed compressors are driven by a VFD, sometimes referred to as a “drive.” There is always a single drive installed, found on the wall of the compressor compartment. The most commonly-used drive is a Carel Power+Speed Drive. This drive is used with all SIAM variable-speed compressors. Whenever Copeland scroll variable-speed compressors are used, an Emerson Drive is used. Operating parameters for the specific compressor are built into the drive firmware. The VFD receives a Call for Cooling from the Refrigeration controller and the VFD then provides power to the compressor at a frequency that will satisfy the Call for Cooling.

When the Refrigeration controller is properly configured for the system type, it automatically applies correct compressor operating parameter settings. Do not override the factory-installed parameters.

VFDs are always fused. The fuse block is located in an electrical box near the VFD.

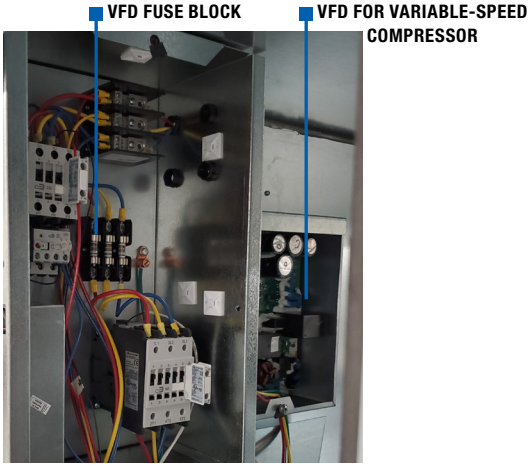



FIGURE 2.7.3 VFD AND FUSE BLOCK

## 2.8 CONTROLLER

The Packaged Refrigeration system has its own secondary refrigeration controller that is, in turn, controlled by the primary DOAS Controller. The refrigeration controller is responsible for monitoring temperature and pressure readings, as measured by the sensors in the refrigeration piping. When the refrigeration controller receives a Call for Cooling from the primary DOAS controller, the refrigeration controller assesses current data from the temperature and pressure sensors and, when appropriate, will turn on the compressor(s) and condenser fan(s) to control their speed.

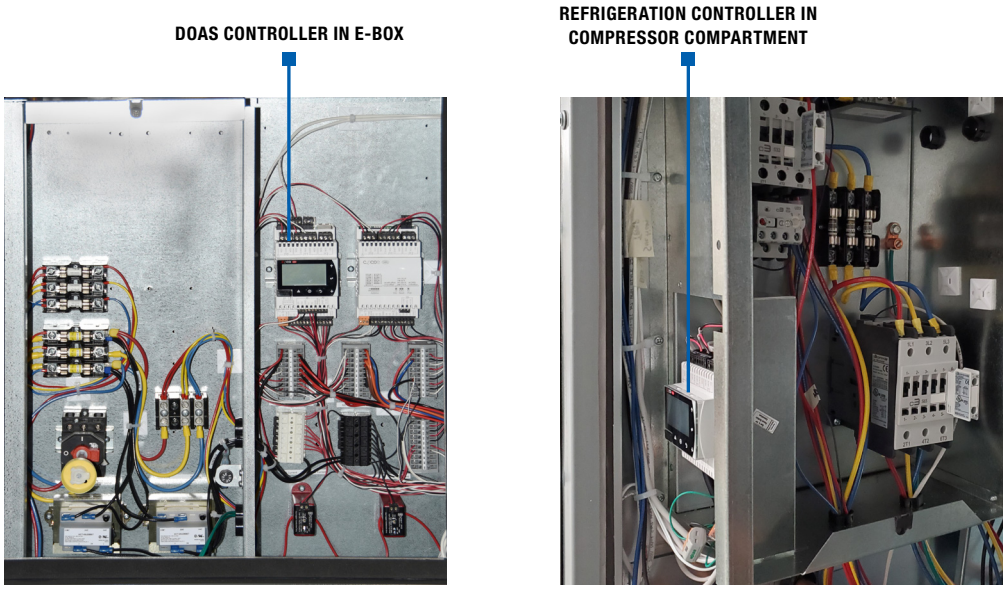



FIGURE 2.8.0 DOAS CONTROLLER AND REFRIGERATION CONTROLLER

## 2.9 ELECTRONIC EXPANSION VALVE (EEV)

There is at least one electronic expansion valve (EEV) installed in each Packaged Refrigeration unit. This EEV regulates the flow of refrigerant into the evaporator coil. It is always located on the variable-speed compressor circuit and is controlled by the refrigeration controller. See the P&I diagrams in Section 5.3 of this manual.

A second EEV is installed for a fixed speed compressor circuit. It is controlled by the refrigeration controller. Its control signal is generated by the refrigeration controller and passed to the main controller, where it is sent to the valve.

FIGURE 2.9.0 ELECTRONIC EXPANSION VALVE (EEV)

## 2.10 FILTER-DRIER

A filter-drier is provided on the liquid line between the condenser coil and the evaporator coil. It is a permanent device that filters small amounts of contaminants and any remaining moisture that may be present in the refrigerant. Under normal operation the filter drier does not require any maintenance.

FIGURE 2.10.0 FILTER-DRIER

## 2.11 SIGHT GLASS

Sight glasses are installed in the refrigeration piping to reveal the presence of moisture. If there is no moisture present, the colored dot in the center of the sight glass will be green and if moisture is present, the dot will turn yellow.

FIGURE 2.11.0 SIGHT GLASS

## 2.12 PRESSURE LIMIT SWITCH

A high pressure limit switch is provided for the variable speed compressor, and for the fixed speed compressor when present. The limit switch is on the discharge line, just after the compressor. When the refrigerant discharge pressure exceeds the pre-set limit, the switch will trip and shut down the compressor. The limit switch has a manual reset button.

FIGURE 2.12.0 PRESSURE LIMIT SWITCH

## 2.13 TEMPERATURE SENSOR AND PRESSURE TRANSDUCER

Temperature sensors and pressure transducers are both passive devices that provide data to the refrigeration controller. The pressure transducers are screwed onto a service port to enable reading of refrigerant pressure while the temperature sensors are attached to the exterior of the copper piping. A set of temperature sensor and pressure transducer is mounted on both the low pressure side and high pressure side of the compressor(s).

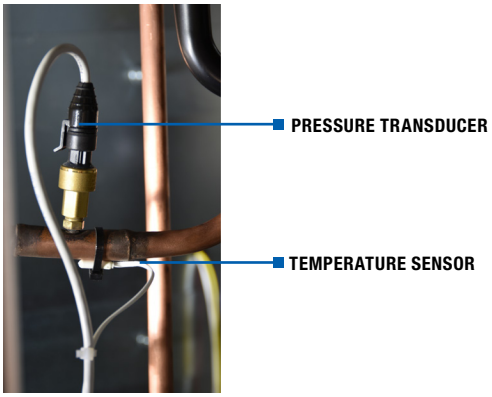



FIGURE 2.13.0 TEMPERATURE SENSOR AND PRESSURE TRANSDUCER

## 2.14 SERVICE PORT

Service ports are installed in several locations in the Packaged Refrigeration piping. They are standard Schrader valves.

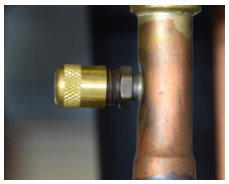


FIGURE 2.14.0 SERVICE PORT (TYP)

## 2.15 HOT GAS REHEAT COIL (OPTION)

The optional Hot Gas Reheat coil is located in the coil compartment, just downstream from the cooling coil. It is controlled by the DOAS unit controller. It receives a variable amount of refrigerant from the modulating 3-way valve.


FIGURE 2.15.0 HGRH COIL

## 2.16 SUCTION ACCUMULATOR (OPTION)

A suction accumulator is a refrigerant buffering reservoir, installed on the refrigerant line between the evaporator coil and the variable speed compressor. It is always and only used on systems having optional Hot Gas Reheat. The accumulator intercepts any slugs of liquid refrigerant or oil and provides a space for the refrigerant to change back to a gas. Any oil that accumulates is metered back into the system.

FIGURE 2.16.0 SUCTION ACCUMULATOR

## 2.17 MODULATING 3-WAY VALVE (OPTION)

A motorized three-way modulating valve is provided for all Packaged Refrigeration units having optional Hot Gas Reheat. The valve diverts a variable amount of hot refrigerant leaving the compressor, to the HGRH coil. The valve is controlled by the DOAS IPC.

FIGURE 2.17.0 MODULATING 3-WAY VALVE

## 2.18 CHECK VALVE (OPTION)

A check valve is installed in all Packaged Refrigeration units having optional HGRH. It is located on the HGRH coil discharge line before it re-enters the refrigerant line between the condenser coil and the evaporator coil. The check valve prevents backflow of the refrigerant through the HGRH coil. See the P&I diagrams in Section 5.3 of this manual.

FIGURE 2.18.0 CHECK VALVE

# 3.0 SHIPPING/RECEIVING/HANDLING

DOAS units that are equipped with the Packaged Refrigeration option are substantially larger and heavier than those that do not have the option. They are shipped with condenser/condenser fan assemblies installed. EA and OA hoods are shipped loose.

See the unit IOM for further instructions on rigging the unit for hoisting. See Section 3.1.2 in this manual for further information on shipping weights and dimensions. See Section 3.1.3, 3.3.4, and 3.1.5 for Center of Gravity (COG) drawing with corner weights.

## 3.1 UNIT WEIGHTS AND DIMENSIONS

The unit weights and dimensions vary based on configuration of the unit and options selected. The following sections provide weight ranges for units with packaged refrigeration.

3.1.1 Unit Dimensions and Weight

DN-2-RT PKGD with 1" cabinet walls
Dimensions: 189 3/8" L x 76 3/4" W x 76 3/4" H
Weight Range: 2450–3150 lbs.

DN-2-RT PKGD with 2" cabinet walls
Dimensions: 191 3/8" L x 78 3/4" W x 77 3/4" H
Weight Range: 2550–3275 lbs.

DN-3-RT PKGD with 1" cabinet walls
Dimensions: 210 3/4" L x 106 1/8" W x 78 1/2" H
Weight Range: 3400–4900 lbs.

DN-3-RT PKGD with 2" cabinet walls
Dimensions: 212 3/4" L x 108 3/4" W x 79 1/2" H
Weight Range: 3525–5100 lbs.

DN-5-RT PKGD with 1" cabinet walls
Dimensions: 247 3/8" L x 126 3/8" W x 95" H
Weight Range: 4825–6600 lbs.

DN-5-RT PKGD with 2" cabinet walls
Dimensions: 249 3/8" L x 128 3/8" W x 96 1/4" H
Weight Range: 5000–6800 lbs.

3.1.2 Shipping Dimensions and Weight

DN-2-RT PKGD with 1" cabinet walls
Dimensions: 165 3/4" L x 90" W x 81 3/4" H
Weight Range: 2625–3375 lbs.

DN-2-RT PKGD with 2" cabinet walls
Dimensions: 167 3/4" L x 90" W x 82 3/4" H
Weight Range: 2725–3500 lbs.

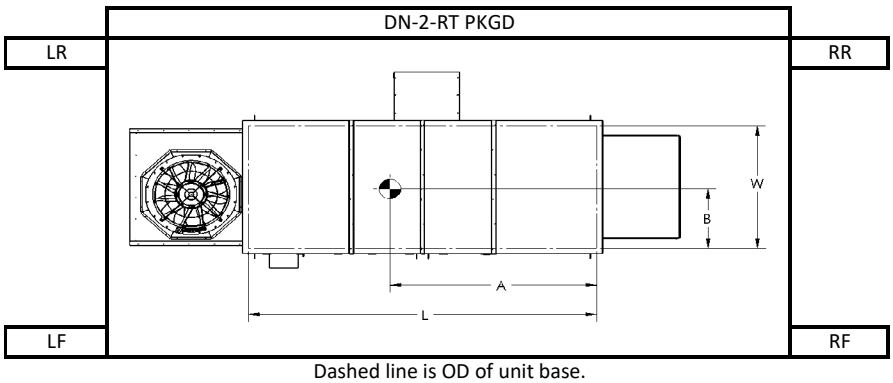
DN-3-RT PKGD with 1" cabinet walls
Dimensions: 187 1/8" L x 90" W x 83 1/2" H
Weight Range: 3575–5175 lbs.

DN-3-RT PKGD with 2" cabinet walls
Dimensions: 189 1/8" L x 90" W x 84 1/2" H
Weight Range: 3700–5375 lbs.

DN-5-RT PKGD with 1" cabinet walls
Dimensions: 219 3/4" L x 100 1/4" W x 100" H
Weight Range: 5050–6950 lbs.

DN-5-RT PKGD with 2" cabinet walls
Dimensions: 221 3/4" L x 101 1/4" W x 101 1/4" H
Weight Range: 5225–7150 lbs.

### 3.1.3 DN-2-RT Packaged Corner Weights and COG Drawing




Dashed line is OD of unit base.

| DN-2-RT PKGD 1" CABINET UNIT WEIGHTS (LBS) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **MODELS** | **L** | **W** | **A** | **B** | **UNIT** | **LF** | **LR** | **RR** | **RF** |
| ERV + Coil | 95.26 | 48 | 58.255 | 24.271 | 2500 | 756 | 773 | 491 | 480 |
| ERV + Coil + EH | 119.89 | 48 | 58.98 | 23.48 | 2775 | 697 | 668 | 690 | 720 |
| ERV + Coil + GH | 119.89 | 48 | 61.74 | 22.95 | 2975 | 800 | 733 | 690 | 753 |
| ERV + Coil + ST | 119.89 | 48 | 60.87 | 22.63 | 2875 | 772 | 688 | 667 | 748 |

Center of Gravity "A" and "B" Dimensions +/- 2"

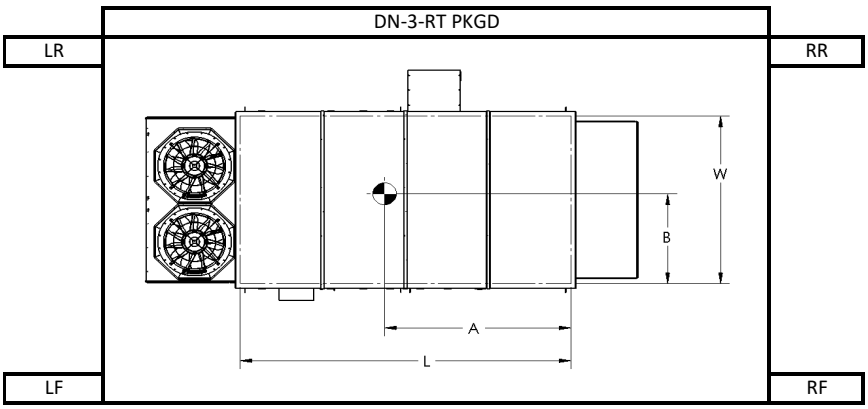
| DN-2-RT 2" PKGD CABINET UNIT WEIGHTS (LBS) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **MODELS** | **L** | **W** | **A** | **B** | **UNIT** | **LF** | **LR** | **RR** | **RF** |
| ERV + Coil | 97.26 | 50 | 59.255 | 25.271 | 2610 | 786 | 804 | 515 | 504 |
| ERV + Coil + EH | 121.89 | 50 | 59.98 | 24.48 | 2900 | 728 | 699 | 721 | 752 |
| ERV + Coil + GH | 121.89 | 50 | 62.74 | 23.95 | 3100 | 831 | 764 | 721 | 784 |
| ERV + Coil + ST | 121.89 | 50 | 61.87 | 23.63 | 3000 | 803 | 720 | 698 | 779 |

Center of Gravity "A" and "B" Dimensions +/- 2"

| ADDITIONAL WEIGHTS FOR OPTIONS (LBS) | |
|---|---|
| **OPTIONS** | **UNIT** |
| RECIRC | 25 |
| VFD | 150 |

Add the additional weights for options to the Unit Weights to determine Unit and Corner weights for a specific unit.

### 3.1.4 DN-3-RT Packaged Corner Weights and COG Drawing




Dashed line is OD of unit base.

| DN-3-RT PKGD 1" CABINET UNIT WEIGHTS (LBS) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **MODELS** | **L** | **W** | **A** | **B** | **UNIT** | **LF** | **LR** | **RR** | **RF** |
| ERV + Coil | 95.26 | 77.42 | 59.96 | 38.76 | 3550 | 1116 | 1119 | 659 | 657 |
| ERV + Coil + EH | 141.70 | 77.42 | 79.22 | 38.57 | 4600 | 1291 | 1281 | 1010 | 1018 |
| ERV + Coil + GH | 141.70 | 77.42 | 80.49 | 37.94 | 4700 | 1361 | 1308 | 995 | 1035 |
| ERV + Coil + ST | 141.70 | 77.42 | 78.58 | 38.86 | 4625 | 1277 | 1288 | 1034 | 1026 |

Center of Gravity "A" and "B" Dimensions +/- 2"

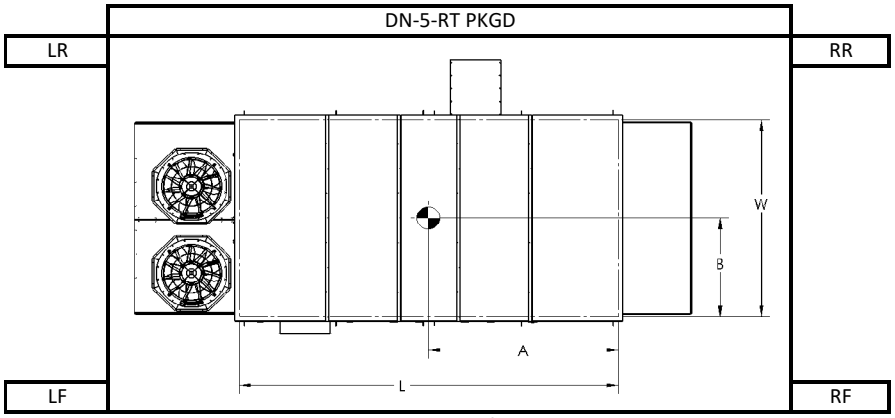
| DN-3-RT PKGD 2" CABINET UNIT WEIGHTS (LBS) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **MODELS** | **L** | **W** | **A** | **B** | **UNIT** | **LF** | **LR** | **RR** | **RF** |
| ERV + Coil | 97.26 | 79.42 | 60.96 | 39.76 | 3700 | 1158 | 1161 | 691 | 690 |
| ERV + Coil + EH | 143.70 | 79.42 | 80.22 | 39.57 | 4800 | 1345 | 1335 | 1056 | 1064 |
| ERV + Coil + GH | 143.70 | 79.42 | 81.49 | 38.94 | 4900 | 1416 | 1362 | 1040 | 1081 |
| ERV + Coil + ST | 143.70 | 79.42 | 79.58 | 39.86 | 4825 | 1331 | 1341 | 1081 | 1072 |

Center of Gravity "A" and "B" Dimensions +/- 2"

| ADDITIONAL WEIGHTS FOR OPTIONS (LBS) | |
|---|---|
| **OPTIONS** | **UNIT** |
| RECIRC | 25 |
| VFD | 175 |

Add the additional weights for options to the Unit Weights to determine Unit and Corner weights for a specific unit.

### 3.1.5 DN-5-RT Packaged Corner Weights and COG Drawing




Dashed line is OD of unit base.

| DN-5-RT PKGD 1" CABINET UNIT WEIGHTS (LBS) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **MODELS** | **L** | **W** | **A** | **B** | **UNIT** | **LF** | **LR** | **RR** | **RF** |
| ERV + Coil | 109.78 | 91 | 65.52 | 45.65 | 5000 | 1487 | 1497 | 1011 | 1005 |
| ERV + Coil + EH | 168.00 | 91 | 89.28 | 45.48 | 6050 | 1608 | 1607 | 1417 | 1418 |
| ERV + Coil + GH | 168.00 | 91 | 91.06 | 45.435 | 6225 | 1689 | 1685 | 1423 | 1427 |
| ERV + Coil + ST | 168.00 | 91 | 89.05 | 45.71 | 6125 | 1616 | 1631 | 1446 | 1433 |

Center of Gravity "A" and "B" Dimensions +/- 2"

| DN-5-RT PKGD 2" CABINET UNIT WEIGHTS (LBS) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **MODELS** | **L** | **W** | **A** | **B** | **UNIT** | **LF** | **LR** | **RR** | **RF** |
| ERV + Coil | 111.78 | 93 | 66.52 | 46.65 | 5175 | 1535 | 1545 | 1051 | 1044 |
| ERV + Coil + EH | 170.00 | 93 | 90.28 | 46.48 | 6250 | 1660 | 1659 | 1465 | 1466 |
| ERV + Coil + GH | 170.00 | 93 | 92.06 | 46.435 | 6425 | 1742 | 1737 | 1471 | 1475 |
| ERV + Coil + ST | 170.00 | 93 | 90.05 | 46.71 | 6325 | 1668 | 1683 | 1494 | 1481 |

Center of Gravity "A" and "B" Dimensions +/- 2"

| ADDITIONAL WEIGHTS FOR OPTIONS (LBS) | |
|---|---|
| **OPTIONS** | **UNIT** |
| RECIRC | 50 |
| VFD | 340 |

Add the additional weights for options to the Unit Weights to determine Unit and Corner weights for a specific unit.

# 4.0 UNIT PLACEMENT

## 4.1 UNIT PLACEMENT

The DOAS should be placed in accordance with instructions in the DN Series *DOAS Rooftop Installation, Operation and Maintenance Manual*. Observe all required clearances for servicing the unit and required clearances for adequate airflow, as shown in the dimensioned drawings. After the DOAS unit is placed, check the unit for level and plumb. Make sure the unit is not twisted, causing binding of any of the access doors.

The condenser hood requires clearance underneath for unrestricted air flow through the condenser coil. It also requires clearance above the condenser fan for unrestricted discharge of condenser air.

# 5.0 INSTALLATION

The Packaged Refrigeration system comes pre-installed in the DOAS and is ready to operate. The only installation step required that is specific to the Packaged Refrigeration system is design and installation of a condensate P-trap. See the *DN Series DOAS Rooftop Installation, Operation and Maintenance Manual* for further information on condensate traps.

## 5.1 ELECTRICAL CONNECTIONS

**⚠ WARNING**

ARC FLASH AND ELECTRIC SHOCK HAZARD

Arc flash and electric shock hazard. Disconnect all electric power supplies, verify with a voltmeter that electric power is off and wear protective equipment per NFPA 70E before working within electric control enclosure. Failure to comply can cause serious injury or death.

Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable.

Before proceeding with installation, read all instructions, verifying that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

The line side of the disconnect switch contains live high-voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch and verify that power is off with a volt meter. Refer to unit electrical schematic. Follow all local codes.

5.1.1 High-Voltage Power Supply

The optional Packaged Refrigeration system is completely installed and wired in the factory. Terminate the high-voltage power supply wires on the top of the unit disconnect switch, as shown in the DOAS IOM. When the disconnect switch is turned ON, the Packaged Refrigeration system has high-voltage power.

5.1.2 Low-Voltage Power Supply

The Packaged Refrigeration system receives its low-voltage power from two stepdown transformers, found in the unit E-Box.

NOTE: Any changes to unit low-voltage wiring should be made with the disconnect switch in the OFF position.

## 5.2 CONDENSING UNIT WIRING SCHEMATIC

5.2.1 Single-Circuit Wiring Schematic

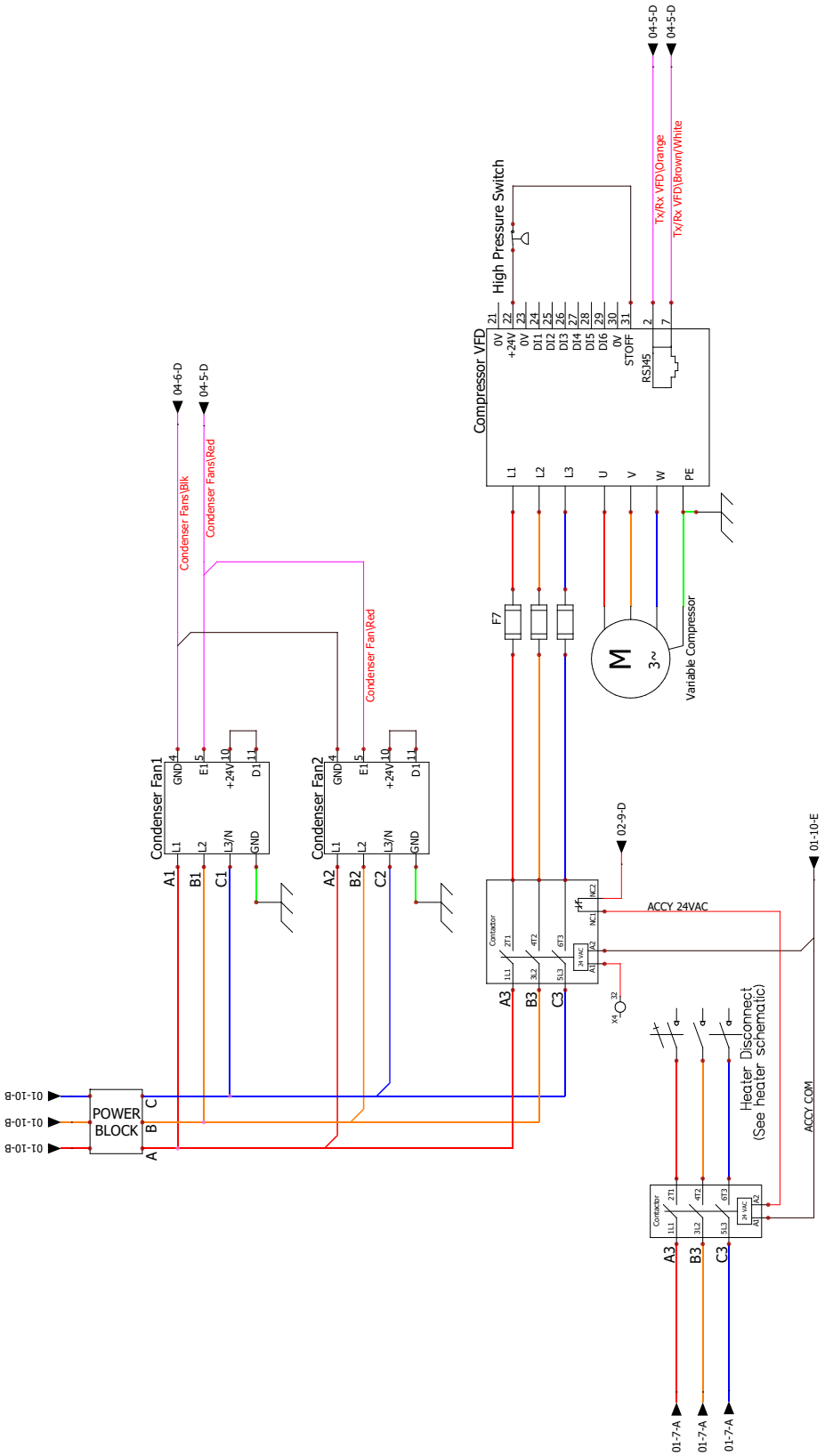



FIGURE 5.2.0 HIGH VOLTAGE SINGLE-CIRCUIT WIRING SCHEMATIC (TYP)

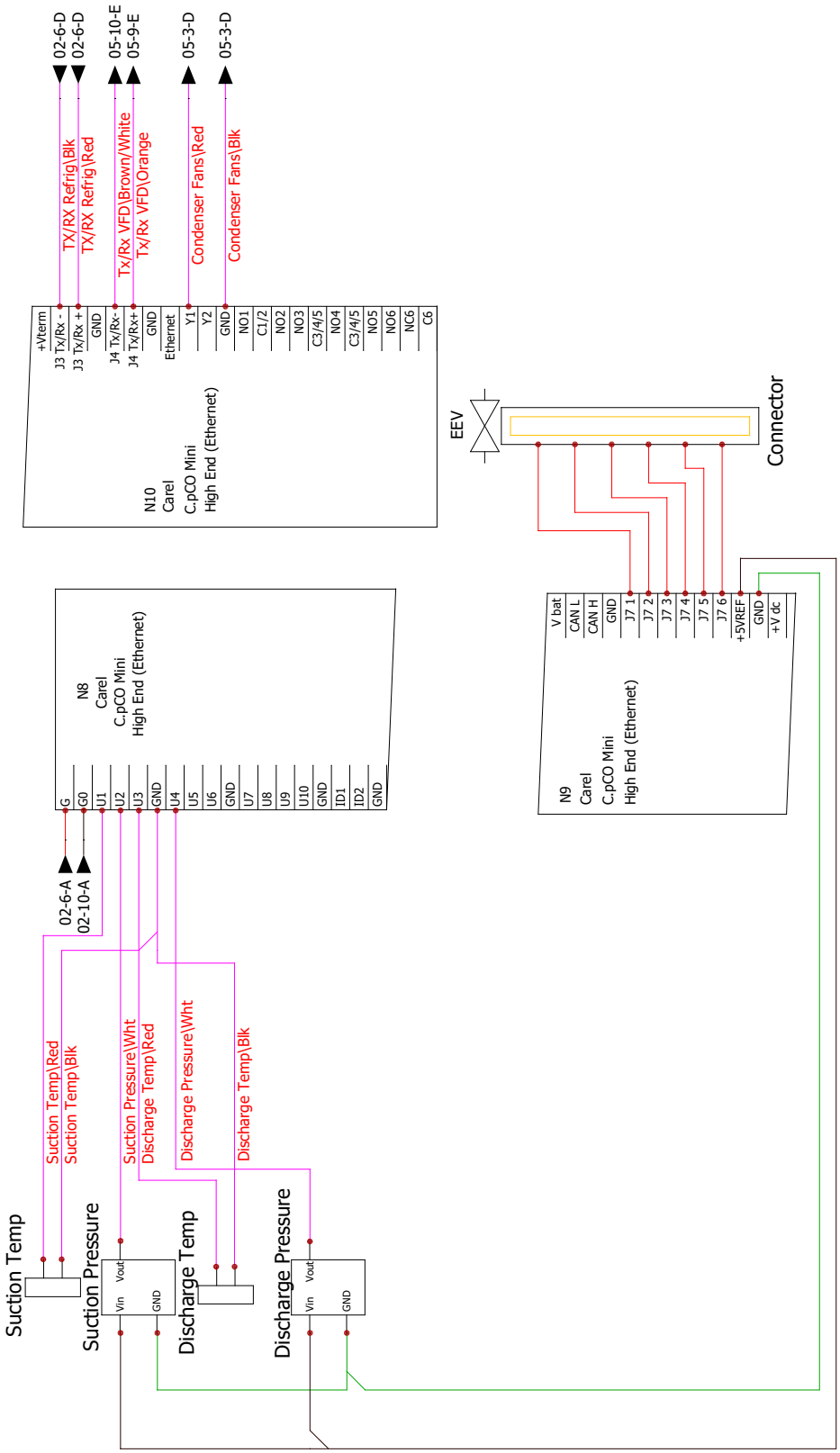



**FIGURE 5.2.1 CONTROL SINGLE-CIRCUIT WIRING SCHEMATIC (TYP)**

5.2.2 Two-Circuit Wiring Schematic

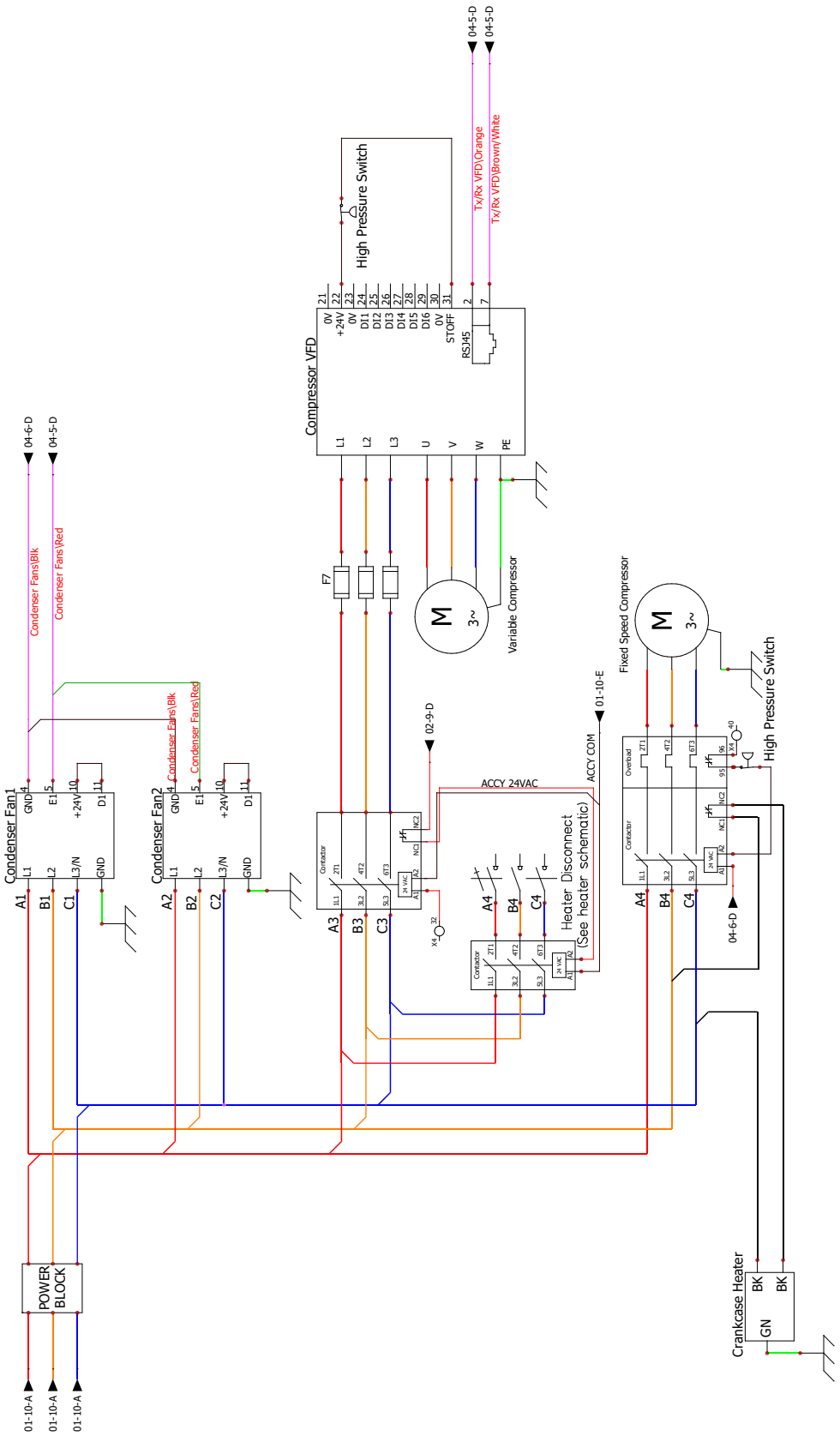



FIGURE 5.2.2 HIGH VOLTAGE TWO-CIRCUIT WIRING SCHEMATIC (TYP)

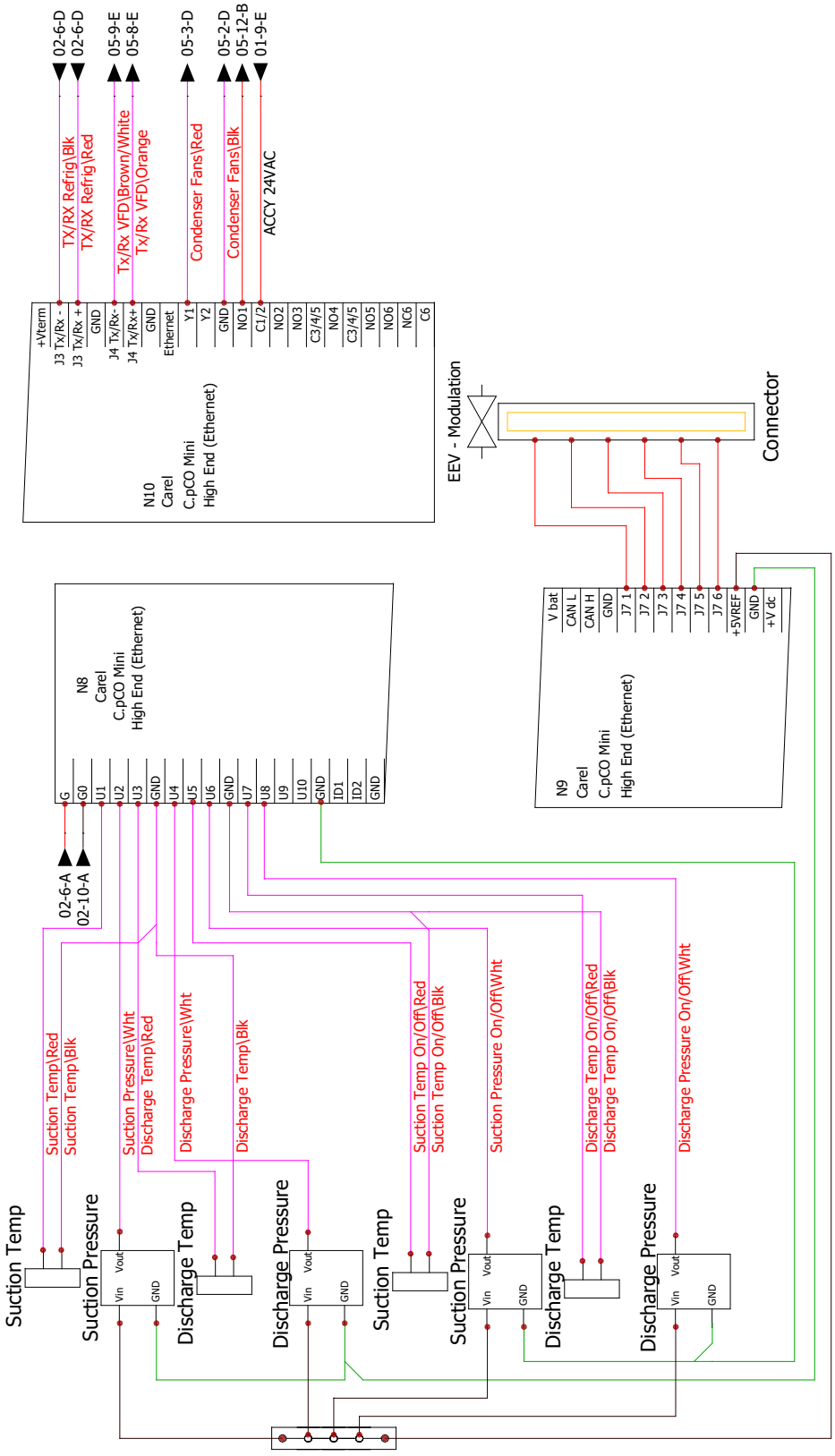



**FIGURE 5.2.3 CONTROL TWO-CIRCUIT WIRING SCHEMATIC (TYP)**

## 5.3 P&I DIAGRAMS (PROCESS AND INSTRUMENTATION)

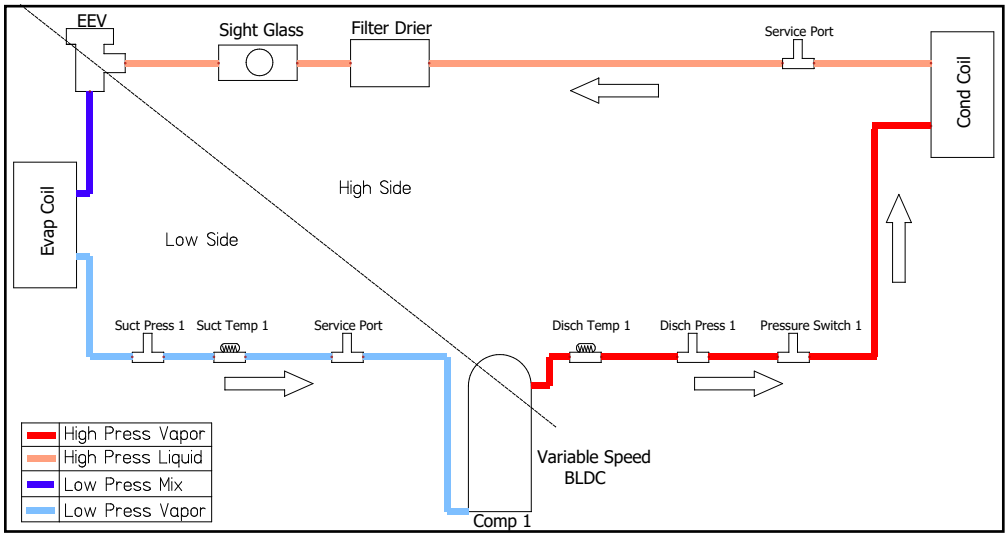



**FIGURE 5.3.0 VARIABLE SPEED CIRCUIT, NO HGRH**

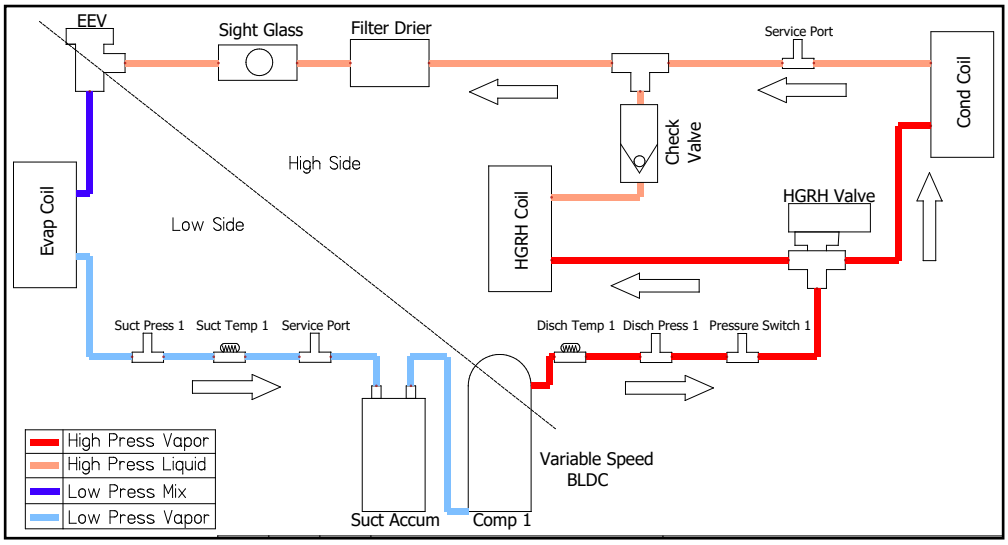



**FIGURE 5.3.1 VARIABLE SPEED CIRCUIT, WITH HGRH**

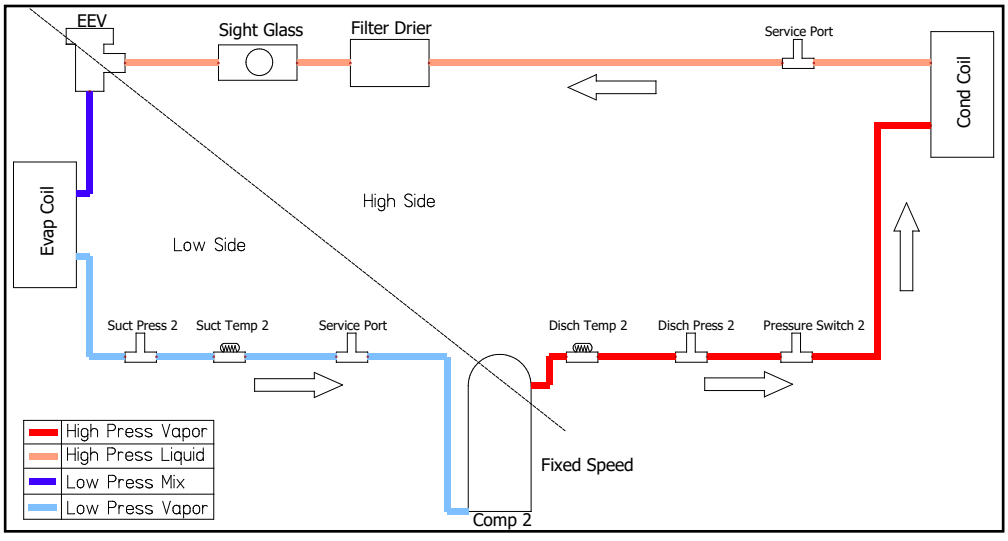



**FIGURE 5.3.2 FIXED SPEED CIRCUIT**

## 5.4 REFRIGERANT PRESSURE CHARTS

The R410A refrigerant temperature-pressure chart is shown below. The pressure is shown in PSIA. If PSIG is required, then subtract atmospheric pressure from the chart value to get gauge pressure.

| Temp (°F) | Pressure (psia) | |
|---|---|---|
| | Liquid pf | Vapor pg |
| 0 | 63.11 | 62.93 |
| 5 | 69.81 | 69.61 |
| 10 | 77.05 | 76.81 |
| 15 | 84.84 | 84.58 |
| 20 | 93.21 | 92.93 |
| 25 | 102.20 | 101.89 |
| 30 | 111.84 | 111.49 |
| 35 | 122.15 | 121.77 |
| 40 | 133.17 | 132.74 |
| 45 | 144.92 | 144.46 |
| 50 | 157.44 | 156.93 |
| 55 | 170.76 | 170.20 |
| 60 | 184.91 | 184.31 |
| 65 | 199.93 | 199.28 |
| 70 | 215.86 | 215.14 |
| 75 | 232.72 | 231.94 |

| Temp (°F) | Pressure (psia) | |
|---|---|---|
| | Liquid pf | Vapor pg |
| 80 | 250.55 | 249.71 |
| 85 | 269.40 | 268.49 |
| 90 | 289.29 | 288.31 |
| 95 | 310.27 | 309.22 |
| 100 | 332.38 | 331.24 |
| 105 | 355.65 | 354.44 |
| 110 | 380.12 | 378.84 |
| 115 | 405.84 | 404.49 |
| 120 | 432.85 | 431.43 |
| 125 | 461.18 | 459.72 |
| 130 | 490.88 | 489.39 |
| 135 | 521.98 | 520.51 |
| 140 | 554.53 | 553.12 |
| 145 | 588.57 | 587.27 |
| 150 | 624.12 | 623.02 |

**FIGURE 5.4.0 R-410A SATURATION PROPERTIES**

## 5.5 REFRIGERANT CHARGE CHARTS

All DN-Series DOAS units with Packaged Refrigeration are shipped from the factory charged with R410A refrigerant. The DOAS unit can have a single compressor or two (2) compressors depending on the application. When two compressors are present the total refrigerant charge is the sum of the individual compressors' charge.

Each compressor is shipped from the factory with Polyolester (POE) oil. There should not be any need for oil to be added in the field. POE oil is compatible with R410A. Do not use any other type of oil as it may contaminate the refrigerant.

The table below lists the oil charge for each compressor.

| Voltage | Compressor Model | Compressor Manufacturer | POE Oil Factory Charge (oz) |
|---|---|---|---|
| 230V | ANB33FBSMT | SIAM | 57.5 |
| 460V | ANB33FLGMT | SIAM | 47.3 |
| 230V | ANB52FKKMT | SIAM | 77.8 |
| 460V | ANB52FVRMT | SIAM | 64.2 |
| 230V | ANB66FVCMT | SIAM | 77.8 |
| 460V | ANB66FVQMT | SIAM | 64.2 |
| 230V | ANB78FVCMT | SIAM | 77.8 |
| 460V | ANB78FVQMT | SIAM | 77.8 |
| 460V | ANB87FVLMT | SIAM | 77.8 |
| 230/460/575V | ZPV0282E | Copeland | 40 |
| 230/460/575V | ZPV0382E | Copeland | 40 |
| 230/460/575V | ZPV0662E | Copeland | 85 |
| 230/460/575V | ZPV0962E | Copeland | 85 |
| 230/460/575V | ZP104KCE | Copeland | 85 |
| 230/460/575V | ZP122KCE | Copeland | 85 |
| 230/460/575V | ZP182KCE | Copeland | 114 |

**FIGURE 5.5.0 OIL CHARGE BY COMPRESSOR MODEL**

Care must be taken when charging a system with refrigerant. An under-charged system can result in loss of capacity. An over-charged system can result in liquid refrigerant flooding the compressor.

## 5.6 CHECK AND CHARGE REFRIGERANT

Each DN-Series DOAS with packaged refrigeration is fully charged with refrigerant at the factory and tested. The actual refrigerant charge for each circuit is printed on the Condenser Unit Nameplate Label that is located on the exterior of the unit. Once the unit has been installed and operational, check the refrigeration system to verify it is performing correctly. It may be necessary to add refrigerant. Only EPA-certified technicians should work on the refrigeration system.

# 6.0 UNIT OPERATION

The packaged refrigeration system is designed to operate in ambient air temperature from 50°F to 120°F. The system must not be operated when ambient air temperature falls below 40°F.

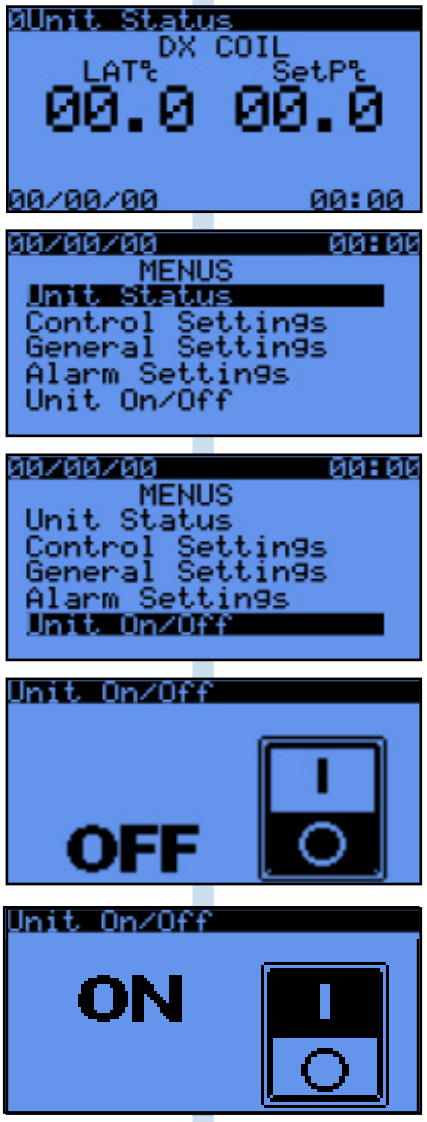
## 6.1 PRINCIPLE OF OPERATION

In order for the Packaged Refrigeration system to operate,

- the controller must be enabled locally,
- the unit must have no critical alarms,
- the unit must receive an enable command from the main controller.

### 6.1.1 Enabling the Unit Locally

In order to enable the unit locally, you can use the keypad on the front of the refrigeration controller. This enable command will be held on power cycle. The keystrokes are as follows. For more information on operating the keypad, refer to Section 4.0 User Interface in the *DN-Series Integrated Programmable Controls User Manual*.




From the default screen, press the Escape (Back) button.

This will take you to the menus. Press the Down button until you get to the Unit On/Off line.

Press the Enter button to enter this area.

Press the Up button to turn the unit on.

The unit is now locally enabled.

It may still be OFF due to enable through the main controller, alarm, etc.

**FIGURE 6.1.0 ENABLING THE UNIT LOCALLY**

6.1.2 Checking for Critical Alarms

If alarms are present, the alarm light will be lit red. Refer to Section 8.1 for more information on alarms.

6.1.3 Enable Signal from Main Controller

When connected to a RenewAire DOAS unit, the refrigeration controller will automatically receive an enable command through a Modbus connection to the J3 terminal on the refrigeration controller (upper left) whenever the main unit has a Call for Cooling.

6.1.4 Viewing the Current State of the Unit

The current state of the unit can be viewed in the controller on the main screen as shown. Any active timers will also be shown.

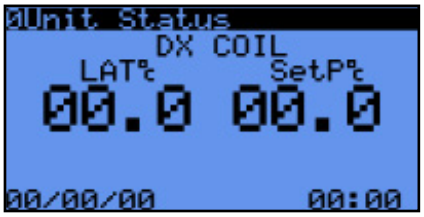



FIGURE 6.1.1 MAIN UNIT STATUS SCREEN

The meaning of these statuses are as follows (multiple may apply):

| | |
|---|---|
| ON | Unit is on and running normally. |
| OFF BY LOCAL KEYPAD | The local Unit On/Off switch on the controller display is set to off. |
| UNIT OFF BY ALARM | An alarm condition is preventing the unit from running. |
| OFF AT MAIN CONTROL | Main controller has not enabled the unit. |
| COMP IN Start up | The main compressor is at start up speed. |
| RESTART AFTER FAIL | The main compressor is trying to start after a failure to start. |
| BLDC OVER MAX PRESS | The main compressor detects too high of a pressure delta to start. |
| COMP OFF BY ALARM | The main compressor is in alarm. This will also cause the unit alarm. |
| COMP 2 ALARM | The second compressor (if present) is in alarm. The unit may still run. |

## 6.2 CONTROLLING THE UNIT

Once the unit is established to be ON, the unit will use the setpoint and process value from the main controller via Modbus to establish a demand for cooling. These values can be seen on the main Unit Status screen. This demand will be used to stage the available cooling to meet that demand.

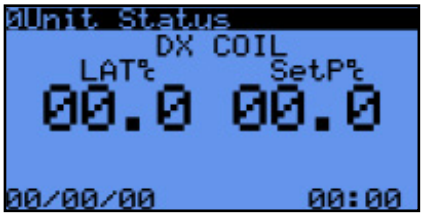



FIGURE 6.2.0 MAIN UNIT STATUS SCREEN

The unit leaves the factory ready to operate with reasonable default values. The following section describes the operation and advanced settings for fine tuning. An advanced service password is required to change any of these values.

### 6.2.1 Demand Calculation

The controller uses a proportional integral loop to calculate demand. The values for Proportional and Integral are passed through from the main controller.

### 6.2.2 Unit Running States—Single Compressor

The diagram below illustrates the flow of the unit stages for a single compressor unit.

- Once the demand goes over the initial start up percentage, the compressor runs at start up speed for the start up time.
- If the demand goes below minimum speed the compressor enters a “pre-shutdown phase.”
- If it remains there for more than the shutdown time, it enters shutdown and runs at shutdown speed.
- If at any time the unit is disabled, it enters shutdown.
- If at any time the unit encounters a serious alarm, it goes to the alarm state until it is reset.

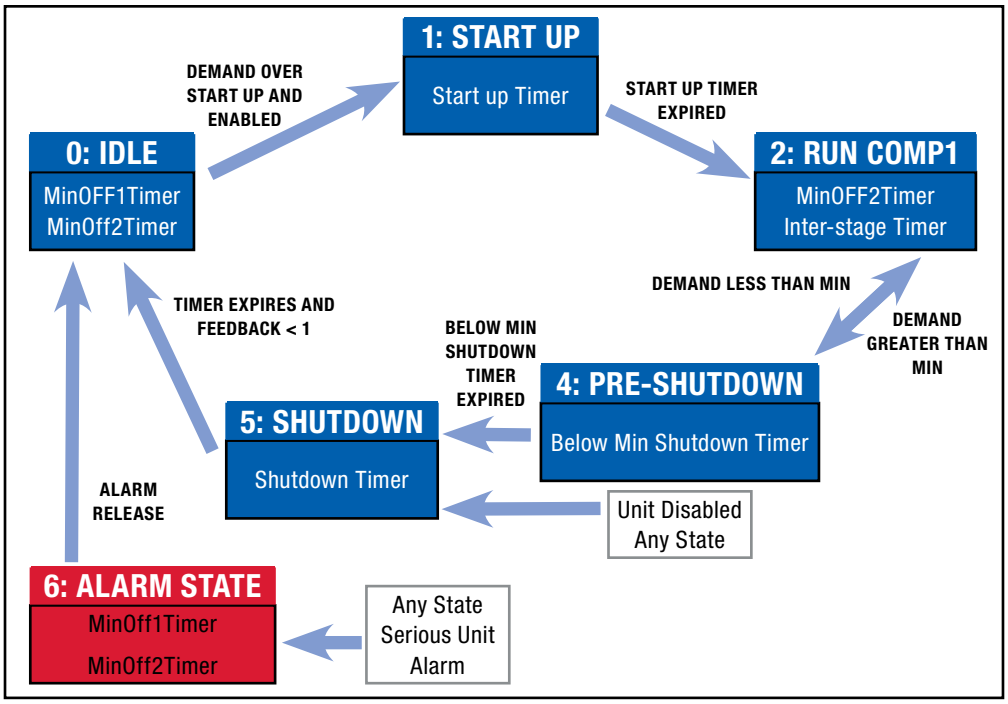



FIGURE 6.2.1 VARIABLE SPEED COMPRESSOR STATES

The current states and status of active timers can be viewed from this screen in Unit Status.

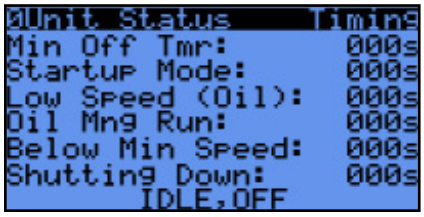



FIGURE 6.2.2 UNIT STATUS TIMER SCREEN

All of the settings are set in password protected screens in the Advanced Service Menu.

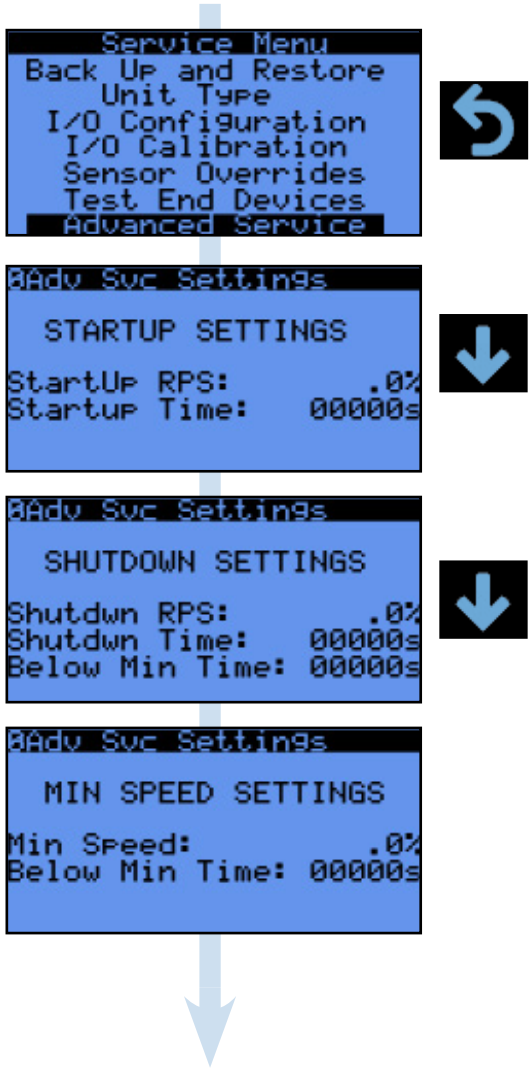



FIGURE 6.2.3 GENERAL COMPRESSOR SETTINGS

6.2.3 Safety Timing

The compressors have built-in safety timing for minimum on and off times as well as an inter-stage delay time for time between stages, shown in the Advanced Service menu.

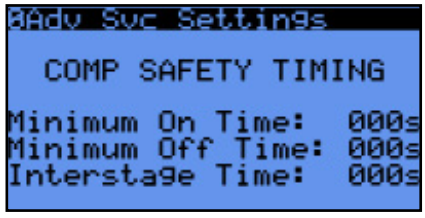



FIGURE 6.2.4 COMPRESSOR SAFETY TIMING SETTINGS

6.2.4 Additional State for Second Compressor

The figure below shows the flow of the unit staging in the second compressor. The second compressor is allowed to come on when the inter-stage delay timer has expired, and the demand is greater than the first compressor can satisfy.

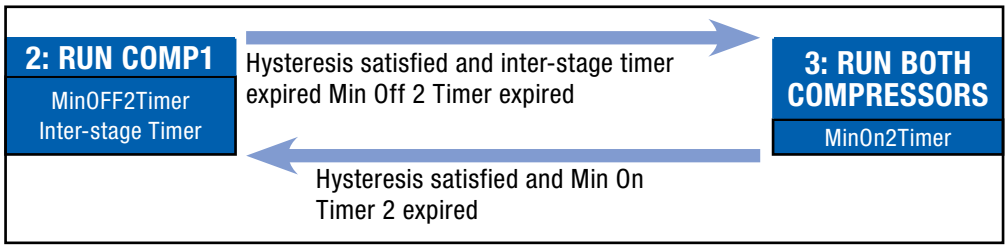



FIGURE 6.2.5 STAGING OF SECOND COMPRESSOR

The values for the hysteresis are set here in these password protected screens in the Advanced Service Menu.

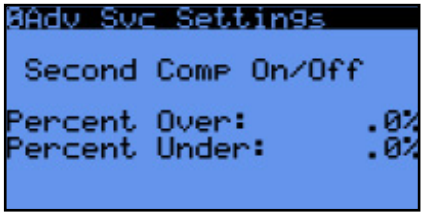



FIGURE 6.2.6 SECOND COMPRESSOR STAGING PARAMETERS

They affect the operation as shown.

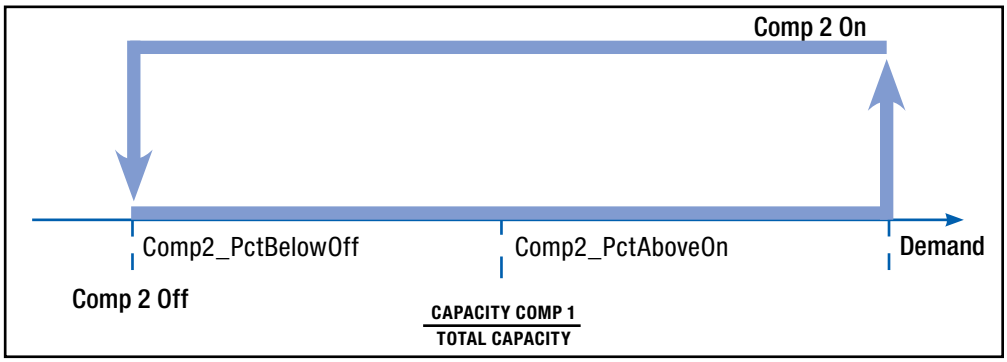



FIGURE 6.2.7 SECOND COMPRESSOR STAGING DIAGRAM

6.2.4.1 Relative Values to Illustrate Compressor Staging Concept

The following tables show the calculations to describe the actions relating to the system demand.

| | One Compressor System | Two Compressor System |
|---|---|---|
| System Demand from PID | Demand | Demand |
| System Capacity | Capacity Comp 1 | Capacity Comp 1 + Capacity Comp 2 |
| Demand Share of Comp 1 | 100 | Capacity Comp 1/System Capacity |
| Demand Share of Comp 2 | 0 | Capacity Comp 2/System Capacity |
| Minimum Start Demand | Start up Speed of Comp 1 | Start up Speed of Comp 1 + Demand Share Comp 1/100 |
| Minimum Run Demand | Minimum Speed of Comp 1 | Minimum Speed of Comp 1 + Demand Share Comp 1/100 |
| Running Speed of Comp 1 When Comp 2 is Off | N/A | (Demand/Demand Share Comp1)*100 |
| Running Speed of Comp 1 When Comp 2 is On | N/A | ((Demand - Demand Share Comp 2)/ Demand Share Comp 1)*100 |

6.2.4.2 Example to Illustrate Compressor Staging Concept

With a system with two compressors with the following settings:

- Capacity of Compressor 1 = 20 tons
- Capacity of Compressor 2 = 15 tons
- Start Speed of Compressor 1 = 25%
- Minimum Speed of Compressor 1 = 20%
- Comp2_PctAboveOn Setting = 3%
- Comp2_PctBelowOff Setting = 2%

The values will be calculated as follows:

| | |
|---|---|
| System Capacity | Capacity Comp 1 + Capacity Comp 2 = 35 Tons |
| Demand Share of Comp 1 | Capacity Comp 1/System Capacity = 57% |
| Demand Share of Comp 2 | Capacity Comp 2/System Capacity = 43% |
| Minimum Start Demand | Start up Speed of Comp 1*Demand Share Comp 1/100 = 14.25% |
| Minimum Run Demand | Minimum Speed of Comp 1*Demand Share Comp 1/100 = 11.4% |
| Running Speed of Comp 1 When Comp 2 is Off | (Demand/Demand Share Comp 1)*100 |
| Running speed of Comp 1 When Comp 2 is On | ((Demand - Demand Share Comp 2)/Demand Share Comp 1)*100 |

The compressor staging is illustrated in the following two diagrams.

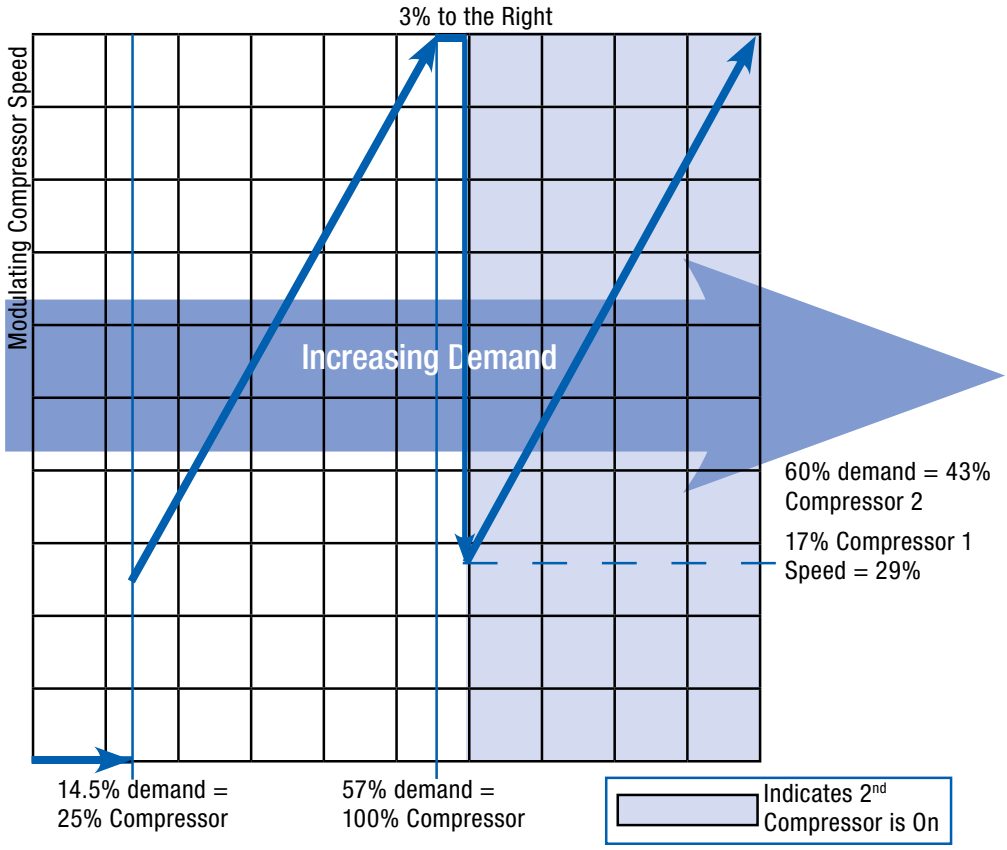



FIGURE 6.2.8 COMPRESSOR STAGING EXAMPLE—INCREASING DEMAND

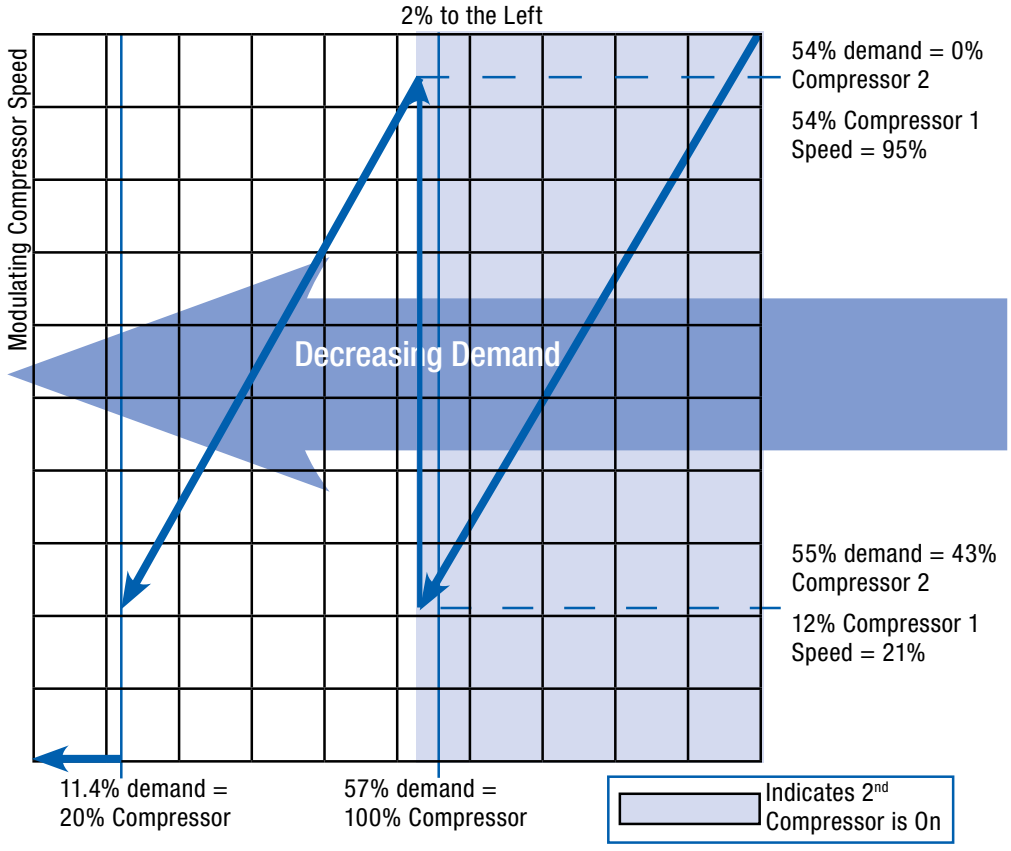



FIGURE 6.2.9 COMPRESSOR STAGING EXAMPLE—DECREASING DEMAND

6.2.5 Compressor Oil Management

If the compressor is running at a low speed for an extended amount of time, the oil boost feature will speed up the compressor for a short time to move the oil around. The detection level and speed, as well as the boost run speed and time are set here.

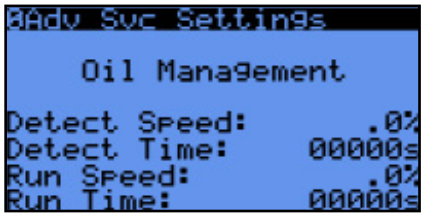



FIGURE 6.2.10 OIL MANAGEMENT PARAMETERS

6.2.6 Compressor Envelope Control

Each type of a compressor has a unique operating envelope which is specified by the compressor manufacturer. The controller will modify operations slightly to keep the compressor in the operating envelope. If the compressor goes out of the envelope for an extended length of time and the controller is not able to correct it, an alarm will occur, and the compressor will shut down. The setting for that time is here.

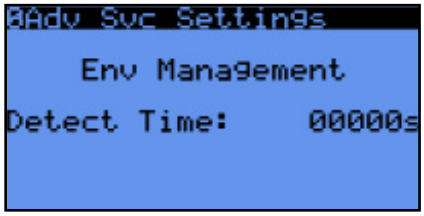



FIGURE 6.2.11 ENVELOPE ALARM TIMING PARAMETER

The current envelope “zone” as well as the other refrigeration circuit statuses can be seen on the second unit status screen, shown below.


FIGURE 6.2.12 MAIN UNIT STATUS SCREEN—SHOWS ENVELOPE ZONE

The zones are shown in blue.

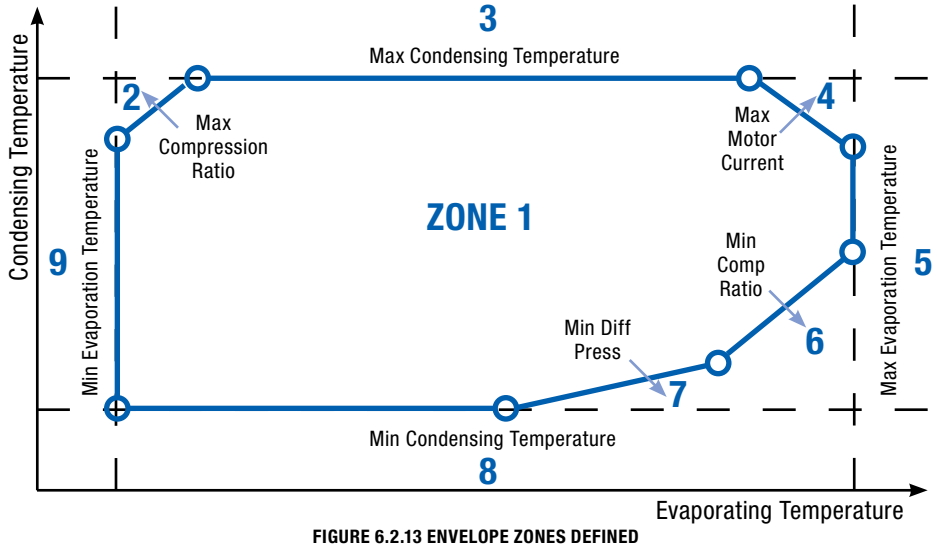



FIGURE 6.2.13 ENVELOPE ZONES DEFINED

6.2.7 Superheat Control

The electronic expansion valves will operate to maintain a steady superheat condition. The setting is here.


FIGURE 6.2.14 SUPERHEAT SETPOINT

The current status can be viewed on the third Unit Status screen, shown below.

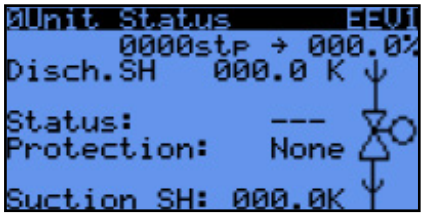



FIGURE 6.2.15 ELECTRONIC EXPANSION VALVE STATUS SCREEN

The current status of the second circuit can be viewed on this screen if applicable.

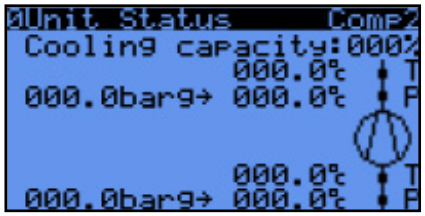



FIGURE 6.2.16 ELECTRONIC EXPANSION VALVE STATUS SCREEN CIRCUIT 2

6.2.8 Condenser Fan Control

The condenser fan(s) will run when the compressor is running and will continue to run for a short time after, as shown in the delay off setting. The condenser fan(s) will run at minimum speed of 20% at the Min @ Temp and at maximum speed of 100% at the Max @ Temp in these settings.

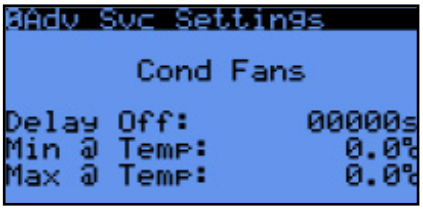



FIGURE 6.2.17 CONDENSER FAN PARAMETERS

### 6.3 CRANKCASE HEATER

When the unit is powered up, power is also supplied to the crankcase heaters. The crankcase heaters must have power supplied for a minimum of six hours prior to start up.

## 7.0 START UP

Refer to the *DN-Series Start up Guide*.

# 8.0 MAINTENANCE

The optional Packaged Refrigeration system requires annual maintenance, normally just before the start of the cooling season. The Packaged Refrigeration system should have its own service schedule because its operation is seasonal.

**NOTICE**

This Packaged Refrigeration system is classified by the Environmental Protection Agency (EPA) as a Class II device. Any technician working on the refrigeration system who tests the system by means of connecting gauges, or adds or removes refrigerant from the system must be EPA certified for Class II refrigeration systems. Individual states or municipalities may have further requirements that must also be complied with.

## 8.1 MAINTENANCE SCHEDULE

**NOTICE**

It is the responsibility of service/maintenance technicians to devise additional service records that comply with EPA, state and municipality requirements for EPA Class II refrigeration devices.

Experience on the part of the service person is the most important issue in establishing a maintenance schedule. There will be times of the year when frequent inspection of the condenser coil and condenser fan intake screen will be required, such as spring and summer when there may be pollen, dust, dirt or debris from budding trees and bushes that can clog the coil and screen.

The optional Packaged Refrigeration system requires Commissioning, Start-of-Season, End-of-Season and Monthly maintenance during the cooling season. Even though the Packaged Refrigeration system does not run during the off-season, power is still applied to the Refrigeration controller, the VFD and to the crankcase heaters. Proper operation of these three elements must be verified both at start-of-season and at end-of-season shut-down.

### 8.1.1 Service Requirements

Service required on the refrigeration system should only be performed by qualified personnel. This includes, but is not limited to, those trained and EPA-certified in the proper handling, installation, cleaning, servicing, and disposal of refrigerant.

When performing any service or maintenance, protect tubing from physical damage. Prior to starting any service or maintenance, ensure the area is in the open or adequately ventilated. Check the area with an appropriate refrigerant detector. Ensure the leak detection equipment is suitable for use with R410A refrigerant. Leak detection fluids are suitable for use with most refrigerants but avoid detergents containing chloride as it may have undesirable reactions with the refrigerant and copper piping.

If a leak is found, or a component needs replacing that requires brazing, all refrigerant should be recovered from the system prior to performing the service. When breaking into a refrigerant circuit, Industry Best Practices and local codes should be followed and filter drier must be replaced.

When charging a refrigerant system, follow Industry Best Practices and local codes. Ensure contamination of different refrigerants does not occur when using charging equipment. Care should be taken not to overfill the refrigerant system. The actual refrigerant charge from the factory is printed on the Packaged Condensing Unit label found on the exterior of the unit. As a reference, Section 5.5 lists the compressor manufacturers' maximum refrigerant charges.

Prior to recharging the system, a pressure test should be conducted. After charging the system, a leak test should be conducted. A follow-up leak test should be conducted prior to leaving the site.

8.1.2 Commissioning Maintenance

24 hours after unit start up:

- Inspect the Packaged Refrigeration system for any condensation that occurs where it does not belong. Inspect the condensate pan and the P-Trap for proper operation. Correct any leaks or other faulty conditions.

After 30 days of operation:

- Turn the DOAS unit disconnect switch to OFF and tighten all electrical connections, paying special attention to VFD wiring.

8.1.3 Start-of-Cooling Season Maintenance (Annual)

- All coils, to include evaporator and condenser and HGRH, must be carefully inspected and cleaned, when necessary. Check for dirt, dust and debris on the coil fins. Look for bent fins that must be straightened.
- Verify the condenser fan does not touch the fan housing when rotated and that it does not squeak. Any dirt buildup on the fan blades should be cleaned off. Clean the condenser fan air intake screen, as needed.
- In a single-circuit system, there is one sight glass. In a 2-circuit system, there are two sight glasses. Inspect each one, looking for indications of moisture in the system.
- The condensate pan is directly beneath the evaporator and HGRH coils. Inspect the condensate pan and P-Trap. Make sure the P-Trap is intact and prime it, as needed. Inspect for the presence of mold or algae and clean/disinfect/treat, as needed.
- Before starting the compressor(s) inspect the compressor crankcase heaters to make sure they are warm. Variable speed compressors have an internal crankcase heater. All fixed speed compressors have an external crankcase heater, located at the bottom of the compressor. Either feel the compressor to make sure it is warm or use a multimeter with temperature probe. Crankcase heaters work whenever the DOAS has power applied and the main disconnect switch is turned ON.
- Power electronics have limited life and may exhibit changed characteristics or performance deterioration after years of use under normal conditions. Periodic inspection and maintenance of the drive unit is required.

The VFD manual that was shipped with the unit typically has a maintenance and inspection schedule. If the VFD manual does not contain a maintenance schedule, create one and place it with the attached Maintenance Log.

The drive will require more frequent inspection if it is placed in harsh environments, such as:

- High ambient temperatures
- Frequent starting and stopping
- Fluctuations in the AC supply or load
- Excessive vibrations or shock loading
- Poor storage conditions

Inspect all VFDs annually to verify that cooling fans are not blocked and are operating properly without causing overheating of either the VFD or the driven compressor.

- Most VFDs have a means of recording and displaying alarm history. If the VFD periodically went into alarm and then cleared itself, it indicates there is a marginal operating condition. Check the VFD for alarm history to see if there are repeated instances of self-cleared alarms. If there were multiple alarms, discover the reason and correct it.
- The refrigeration controller has a memory section specifically for recording alarm conditions. View the alarm history to see if there are repeated instances of alarms that cleared themselves. If there were multiple alarms, investigate the reason and correct it.

- Inspect the interior of the Packaged Refrigeration compartments for any dirt, debris or foreign objects.
- Inspect the Packaged Refrigeration compartment doors and latches. With age, the foam gasketing may compress and no longer maintain a seal. If the doors no longer seal properly, adjust the latches to tighten them.
- Run the Packaged Refrigeration unit through an entire cycle, verifying that the variable-speed compressor ramps up properly, the second compressor (when present) starts properly and the unit will attain its cooling set point and proper superheat and maintain them until the unit is shut down. Verify that the condenser fan(s) operate properly during the cycle.
- Test the HGRH system to verify it is working correctly. If there is no call for dehumidification, the HGRH coil with no dehumidification the reheat valve is closed. Change to “the HGRH coil should feel cool. If possible, enable dehumidification to verify the reheat coil is achieving the desired unit supply air temperature.

8.1.4 End-of-Cooling Season Maintenance (Annual)

End-of-season maintenance consists of all the items in Start-of-Season maintenance plus attention must be given to preparing the system for freezing conditions.

- Before arrival of freezing weather, inspect the condensate pan and P-Trap. Either drain both and wipe them dry or winterize them by adding glycol to prevent freezing of condensate. Inspect for evidence of mold or algae and treat as necessary.
- Turn the Packaged Refrigeration system OFF by changing ENABLE to OFF on the Refrigeration controller.

8.1.5 Periodic Maintenance (Monthly)

NOTE: The condenser coil air inlet screen is designed so that it can be unscrewed at the leading edge and then swung down out of the way for access to the coil face.

**FIGURE 8.1.0 SWING-DOWN CONDENSER SCREEN**

- Inspect the condenser coil air inlet screen and clean, if necessary.
- Inspect the condenser coil for dirt and debris. Clean, if necessary.
- Listen to the unit run. Listen for noise from the condenser fan and listen to the compressors start up. Any excessive vibration from the compressors or any clattering noise at start up are indications of compressor “slugging.” Slugging will damage the compressors and the condition must be corrected immediately.

## 8.2 MAINTENANCE RECORDS

The following maintenance records are provided as a model for the user. They should be modified and supplemented, as needed.

8.2.1 Commissioning Maintenance Log

| ENTER DATES OF SERVICE AND INITIAL | | |
|---|---|---|
| AFTER 24 HOURS OF OPERATION, INSPECT THE PACKAGED REFRIGERATION SYSTEM FOR ANY LEAKS OR DRIPS | AFTER 30 DAYS OF OPERATION, TURN DISCONNECT SWITCH OFF AND TIGHTEN ALL ELECTRICAL CONNECTIONS | TECHNICIAN INITIALS |
| | | |

8.2.2 Start-of-Cooling Season Maintenance Log

| ENTER DATES OF SERVICE AND INITIAL | | | | | |
|---|---|---|---|---|---|
| INSPECT/CLEAN ALL COILS | INSPECT/CLEAN CONDENSER FAN AND INTAKE SCREEN | CHECK SIGHT GLASSES FOR MOISTURE | INSPECT CONDENSATE PAN AND P-TRAP | CRANKCASE HEATERS WORKING? | INSPECT AND SERVICE VFD |
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| ENTER DATES OF SERVICE AND INITIAL | | | | | | |
|---|---|---|---|---|---|---|
| INSPECT VFD FOR ALARMS | INSPECT REFRIGERATION CONTROLLER FOR ALARMS | INSPECT PACKAGED REFRIGERATION COMPARTMENTS FOR DIRT/DEBRIS | INSPECT PACKAGED REFRIGERATION COMPARTMENT DOORS, GASKETS AND LATCHES | RUN PACKAGED REFRIGERATION SYSTEM THROUGH A COMPLETE CYCLE | HGRH WORKING? | TECHNICIAN INITIALS |
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8.2.3 End-of-Cooling Season Maintenance Log

| ENTER DATES OF SERVICE AND INITIAL | | | | | | |
|---|---|---|---|---|---|---|
| INSPECT/CLEAN ALL COILS | INSPECT/CLEAN CONDENSER FAN AND INTAKE SCREEN | CHECK SIGHT GLASSES FOR MOISTURE | CRANKCASE HEATERS WORKING? | INSPECT AND SERVICE VFD | INSPECT VFD FOR ALARMS | INSPECT REFRIGERATION CONTROLLER FOR ALARMS |
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| ENTER DATES OF SERVICE AND INITIAL | | | | | | |
|---|---|---|---|---|---|---|
| INSPECT PACKAGED REFRIGERATION COMPARTMENTS FOR DIRT/DEBRIS | INSPECT PACKAGED REFRIGERATION COMPARTMENT DOORS, GASKETS AND LATCHES | RUN PACKAGED REFRIGERATION SYSTEM THROUGH A COMPLETE CYCLE | SHUT DOWN | INSPECT/CLEAN/DRY CONDENSATE PAN | WINTERIZE CONDENSATE P-TRAP | TECHNICIAN INITIALS |
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8.2.4 Periodic Maintenance (Monthly)

| ENTER DATES OF SERVICE AND INITIAL | | | |
|---|---|---|---|
| INSPECT/CLEAN CONDENSER COIL SCREEN | INSPECT/CLEAN CONDENSER COIL | LISTEN TO UNIT RUN | INITIALS |
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| ENTER DATES OF SERVICE AND INITIAL | | | |
|---|---|---|---|
| INSPECT/CLEAN CONDENSER COIL SCREEN | INSPECT/CLEAN CONDENSER COIL | LISTEN TO UNIT RUN | INITIALS |
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8.2.5 Service Notes

| MISCELLANEOUS SERVICE NOTES | | |
|---|---|---|
| DATE | SERVICE | INITIALS |
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## 8.3 SERVICE PARTS

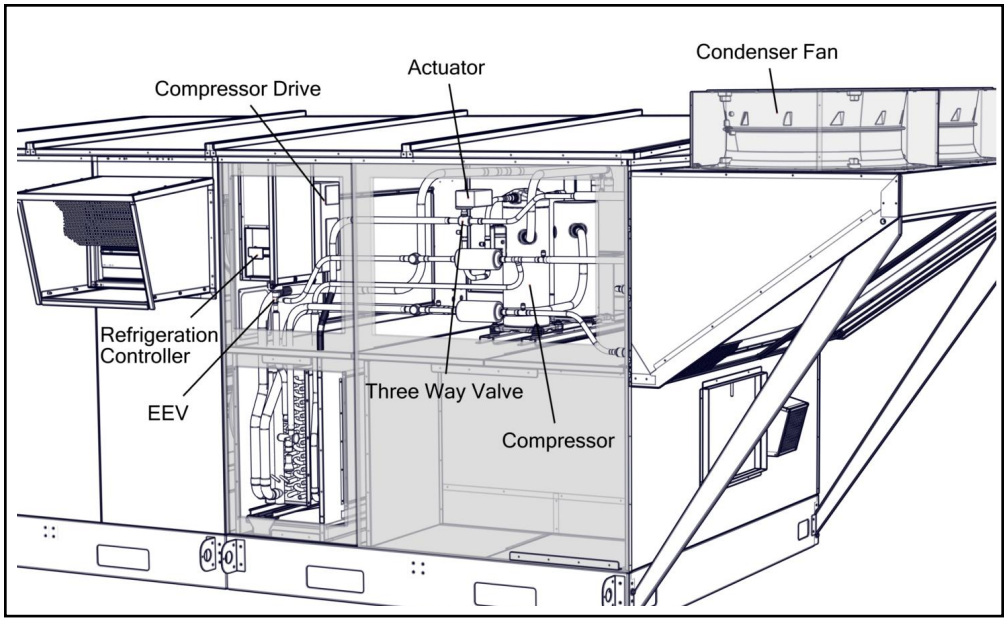


FIGURE 8.3.0 PACKAGED DN SERVICE PARTS

# 9.0 TROUBLESHOOTING

If problems occur with a RenewAire ERV, the primary resources for trouble-shooting are the unit controller alarms, as-built wiring schematics and the Sequence Of Operation (SOO) for each control scheme.

## 9.1 ALARMS

Alarms that occur in the Refrigeration controller will also be visible on the DOAS controller.

**NOTICE**

If an unspecified suction alarm occurs during extremely hot ambient conditions, check the connections to the three phase wiring.

| DEVICE MANAGEMENT ALARMS | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 0 | User Reset | Error in the number of retain memory writings |
| 1 | User Reset | Error in retain memory writings |
| 2 | Auto Reset | Device Test is Running–Outputs Disabled |
| 3 | Auto Reset | BMS or Main Controller Offline |
| 4 | Auto Reset | Device offline alarm CPCOE |
| 5 | Auto Reset | Wrong configuration on device CPCOE |
| 6 | | |

FIGURE 9.1.0 DEVICE MANAGEMENT ALARMS

| REFRIGERANT PROBE ALARMS | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 50 | Auto reset | Discharge Pressure Transducer in error - Circuit 1 |
| 51 | Auto reset | Discharge Temperature Sensor in error - Circuit 1 |
| 52 | Auto reset | Suction Pressure Transducer in error - Circuit 1 |
| 53 | Auto reset | Suction Temperature Sensor in error - Circuit 1 |
| 54 | Auto reset | Discharge Pressure Transducer in error - Circuit 2 |
| 55 | Auto reset | Discharge Temperature Sensor in error - Circuit 2 |
| 56 | Auto reset | Suction Pressure Transducer in error - Circuit 2 |
| 57 | Auto reset | Suction Temperature Sensor in error - Circuit 2 |

**FIGURE 9.1.1 REFRIGERANT PROBE ALARMS**

| GENERAL MAINTENANCE ALARMS | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 60 | Auto reset | OA Filter Pressure Alarm |
| 61 | Auto reset | RA Filter Pressure Alarm |
| 62 | | |
| 63 | Auto reset | Unit Service Threshold Reached |
| 64 | | |
| 65 | | |
| 66 | Auto reset | Condenser Fan Service Life Threshold Reached |
| 67 | Auto reset | Compressor 1 Service Threshold Reached |
| 68 | Auto reset | Compressor 2 Service Threshold Reached |

**FIGURE 9.1.2 GENERAL MAINTENANCE ALARMS**

| REFRIGERANT CIRCUIT 1 ALARMS | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 100 | Auto reset | High Pressure Cutout on Circuit 1 |
| 101 | Auto reset | High Temperature Cutout on Circuit 1 |
| 102 | Auto reset | Low superheat protection - Circuit 1 |
| 103 | Auto reset | Low evaporation temperature protection - Circuit 1 |
| 104 | Auto reset | High evaporation temperature protection - Circuit 1 |
| 105 | Auto reset | High condensation temperature protection - Circuit 1 |
| 106 | Auto reset | Low suction temperature - Circuit 1 |
| 107 | Auto reset | EEV motor error - Circuit 1 |
| 108 | Auto reset | Ineffective adaptive control - Circuit 1 |
| 109 | Auto reset | Emergency closing alarm - Circuit 1 |
| 110 | Disabled | Parameter range error (some children in the data structure are out of bounds) - Circuit 1 |
| 111 | Auto reset | ServicePosit_perc must take value 0.0â€¦100.0 - Circuit 1 |
| 112 | Auto reset | VlvID must take value 1 or 2 - Circuit 1 |
| 113 | Auto reset | Low Discharge Pressure Circuit 1 |
| 114 | Auto reset | Low Suction Pressure Circuit 1 |
| 115 | Auto reset | High Suction Pressure Circuit 1 |
| 116 | Auto reset | Low Delta Pressure Circuit 1 |
| 117 | Auto reset | Low Pressure Ratio Circuit 1 |
| 118 | Auto reset | High Pressure Ratio Circuit 1 |
| 119 | Auto reset | High Discharge Pressure Circuit 1 |
| 120 | Auto reset | Low Discharge Temperature Circuit 1 |
| 121 | Auto reset | High Current Circuit 1 |

**FIGURE 9.1.3 REFRIGERANT CIRCUIT 1 ALARMS**

| REFRIGERANT CIRCUIT 2 ALARMS | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 150 | Auto reset | High Pressure Cutout on Circuit 2 |
| 151 | Auto reset | High Temperature Cutout on Circuit 2 |
| 152 | Auto reset | Low superheat protection - Circuit 2 |
| 153 | Auto reset | Low evaporation temperature protection - Circuit 2 |
| 154 | Auto reset | High evaporation temperature protection - Circuit 2 |
| 155 | Auto reset | High condensation temperature protection - Circuit 2 |
| 156 | Auto reset | Low suction temperature - Circuit 2 |
| 157 | Auto reset | EEV motor error- Circuit 2 |
| 158 | Auto reset | Ineffective adaptive control- Circuit 2 |
| 159 | Auto reset | Emergency closing alarm- Circuit 2 |
| 160 | Auto reset | Parameter range error (some children in the data structure are out of bounds)- Circuit 2 |
| 161 | Auto reset | ServicePosit_perc must take value 0.0â€¦100.0- Circuit 2 |
| 162 | Auto reset | VlvID must take value 1 or 2- Circuit 2 |
| 163 | Auto reset | Low Discharge Pressure Circuit 2 |
| 164 | Auto reset | Low Suction Pressure Circuit 2 |
| 165 | Auto reset | High Suction Pressure Circuit 2 |
| 166 | Auto reset | Low Delta Pressure Circuit 2 |
| 167 | Auto reset | Low Pressure Ratio Circuit 2 |
| 168 | Auto reset | High Pressure Ratio Circuit 2 |
| 169 | Auto reset | High Discharge Pressure Circuit 2 |
| 170 | Auto reset | High Discharge Temperature Circuit 2 |
| 171 | Auto reset | High Current Circuit 2 |

**FIGURE 9.1.4 REFRIGERANT CIRCUIT 2 ALARMS**

| COPELAND COMPRESSOR ALARMS | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 172 | Auto reset | Copeland Alt Phase Overcurrent |
| 173 | Auto reset | Copeland Alt AC Input Overcurrent |
| 174 | Auto reset | Copeland Alt DC Bus Overvoltage |
| 175 | Auto reset | Copeland Alt DC Bus Undervoltage |
| 176 | Auto reset | Copeland Alt AC Input Overvolt |
| 177 | Auto reset | Copeland Alt AC Over Overvolt |
| 178 | Auto reset | Copeland Alt AC Input Loss of Phase |
| 179 | Auto reset | Copeland Alt HP Switch Open |
| 180 | Auto reset | Copeland Alt Power Module Overtemp |
| 181 | Auto reset | Copeland Alt Lost Rotor Position |
| 182 | Auto reset | Copeland Alt DC Bus Voltage Low |
| 183 | Auto reset | Copeland Alt Comp Phase Overcurrent 2 |
| 184 | Auto reset | Copeland Alt Phase Current Foldback |

**FIGURE 9.1.5 COPELAND COMPRESSOR ALARMS**

| COPELAND COMPRESSOR ALARMS CONTINUED | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 185 | Auto reset | Copeland Alt Power Mod Temp Foldback Current Timeout |
| 186 | Auto reset | Copeland Alt AC Input Current Foldback Timeout |
| 187 | Auto reset | Copeland Alt Auto Config Comm Timeout |
| 188 | Auto reset | Copeland Alt Modbus Comm Loss |
| 189 | Auto reset | Copeland Alt Sensor 2 High Temp |
| 190 | Auto reset | Copeland Alt Power Mod Temp High |
| 191 | Auto reset | Copeland Alt Comms to DSP Comm Loss |
| 192 | Auto reset | Copeland Alt Comp Phase Current Imbalance |
| 193 | Auto reset | Copeland Alt Micro Elect Fault EEPROM |
| 194 | Auto reset | Copeland Alt Comp Model Config Error |
| 195 | Auto reset | Copeland Alt High Pressor Sensor Config Error |
| 196 | Auto reset | Copeland Alt Sensor 2 Low Temp or Open |
| 197 | Auto reset | Copeland Alt Power Module Sensor Low or Open |
| 198 | Auto reset | Copeland Alt Fault Limit Lockout |

FIGURE 9.1.6 COPELAND COMPRESSOR ALARMS CONTINUED

| SIAM COMPRESSOR ALARMS | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 200 | Auto reset | Dis Start DP State _BLDC |
| 201 | Auto reset | Start Fail Lock - BLDC |
| 202 | Auto reset | Start Fail Retry - BLDC |
| 203 | Disabled | Compressor shut off - BLDC |
| 204 | Disabled | Out of Envelope - BLDC |
| 205 | Auto reset | Low delta pressure |
| 206 | Auto reset | High discharge gas temperature |
| 207 | Auto reset | Envelope zone alarm 2: high compressor ratio |
| 208 | Auto reset | Envelope zone alarm 3: high discharge pressure |
| 209 | Auto reset | Envelope zone alarm 4: high current |
| 210 | Auto reset | Envelope zone alarm 5: low suction pressure |
| 211 | Auto reset | Envelope zone alarm 6: low compressor ratio |
| 212 | Auto reset | Envelope zone alarm 7: low pressure differential |
| 213 | Auto reset | Envelope zone alarm 8: low discharge pressure |
| 214 | Auto reset | Envelope zone alarm 9: low suction pressure |
| 215 | Auto reset | Envelope zone alarm 10: high discharge temperature |
| 216 | Auto reset | 01: Inverter over current |
| 217 | Auto reset | 02: Inverter motor overload |
| 218 | Auto reset | 03: Inverter DC bus over voltage |
| 219 | Auto reset | 04: Inverter DC bus under voltage |

FIGURE 9.1.7 SIAM COMPRESSOR ALARMS

| SIAM COMPRESSOR ALARMS CONTINUED | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 220 | Auto reset | 05: Inverter drive over temperature |
| 221 | Auto reset | 06: Inverter drive under temperature |
| 222 | Auto reset | 07: Inverter over current HW |
| 223 | Auto reset | 08: Inverter motor over temperature |
| 224 | Auto reset | 09: Inverter IGBT module error |
| 225 | Auto reset | 10: Inverter CPU error |
| 226 | Auto reset | 11: Inverter parameters default |
| 227 | Auto reset | 12: Inverter DC bus ripple |
| 228 | Auto reset | 13: Inverter data communication fault |
| 229 | Auto reset | 14: Inverter drive thermistor fault |
| 230 | Auto reset | 15: Inverter auto-tuning fault |
| 231 | Auto reset | 16: Inverter drive disabled |
| 232 | Auto reset | 17: Inverter motor phase fault |
| 233 | Auto reset | 18: Inverter internal fan fault |
| 234 | Auto reset | 19: Inverter speed fault |
| 235 | Auto reset | 20: Inverter PFC module error |
| 236 | Auto reset | 21: Inverter PFC over voltage |
| 237 | Auto reset | 22: Inverter PFC under voltage |
| 238 | Auto reset | 23: Inverter STO detection error |
| 239 | Auto reset | 24: Inverter STO detection error |
| 240 | Auto reset | 25: Inverter Ground fault |
| 241 | Auto reset | 26: Inverter internal error 1 |
| 242 | Auto reset | 27: Inverter internal error 2 |
| 243 | Auto reset | 28: Inverter drive overload |
| 244 | Auto reset | 29: Inverter microcontroller safety drive stopped |
| 245 | Auto reset | 98: Inverter unexpected restart |
| 246 | Auto reset | 99: Inverter unexpected stop |
| 247 | Auto reset | 01: Inverter micro safety current measurement fault |
| 248 | Auto reset | 02: Inverter micro safety current unbalanced |
| 249 | Auto reset | 03: Inverter micro safety over current |
| 250 | Auto reset | 04: Inverter micro safety STO alarm |
| 251 | Auto reset | 05: Inverter micro safety STO hardware alarm |
| 252 | Auto reset | 06: Inverter micro safety main power supply missing |
| 253 | Auto reset | 07: Inverter micro safety HW fault inverter command buffer |
| 254 | Auto reset | 08: Inverter micro safety HW fault heater circuitry |
| 255 | Auto reset | 09: Data communication fault |
| 256 | Auto reset | 10: Inverter micro safety compressor stall detect |
| 257 | Auto reset | 11: Inverter micro safety DC bus over current |
| 258 | Auto reset | 12: Inverter micro safety HWF DC bus current |

**FIGURE 9.1.8 SIAM COMPRESSOR ALARMS CONTINUED**

| SIAM COMPRESSOR ALARMS CONTINUED | | |
|---|---|---|
| INDEX | ALARM TYPE | DESCRIPTION |
| 259 | Auto reset | 13: Inverter micro safety DC bus voltage |
| 260 | Auto reset | 14: Inverter micro safety HWF DC bus voltage |
| 261 | Auto reset | 15: Inverter micro safety input voltage |
| 262 | Auto reset | 16: Inverter micro safety HWF input voltage |
| 263 | Auto reset | 17: Inverter micro safety DC bus power alarm |
| 264 | Auto reset | 18: Inverter micro safety HWF power mismatch |
| 265 | Auto reset | 19: Inverter micro safety NTC over temperature |
| 266 | Auto reset | 20: Inverter micro safety NTC under temperature |
| 267 | Auto reset | 21: Inverter micro safety NTC fault |
| 268 | Auto reset | 22: Inverter micro safety HWF sync fault |
| 269 | Auto reset | 23: Inverter micro safety invalid parameter |
| 270 | Auto reset | 24: Inverter micro safety FW fault |
| 271 | Auto reset | 25: Inverter micro safety HW fault |
| 272 | Auto reset | 26: Inverter micro safety - Reserved |
| 273 | Auto reset | 27: Inverter micro safety - Reserved |
| 274 | Auto reset | 28: Inverter micro safety - Reserved |
| 275 | Auto reset | 29: Inverter micro safety - Reserved |
| 276 | Auto reset | 30: Inverter micro safety - Reserved |
| 277 | Auto reset | 31: Inverter micro safety - Reserved |
| 278 | Auto reset | 32: Inverter micro safety - Reserved |
| 279 | Auto reset | Offline inverter |

**FIGURE 9.1.9 SIAM COMPRESSOR ALARMS CONTINUED**

## 9.2 SEQUENCE OF OPERATION

The refrigeration controller is enabled by a signal from the main controller and the keypad.

Once enabled, the refrigeration controller will use the setpoint and process variable sent by the main controller to create a demand signal.

Based on the demand signal, the controller will modulate the first compressor and stage the second compressor (if present) to meet the demand.

The electronic expansion valve(s) shall modulate to maintain superheat of each circuit any time the compressors are running.

The condenser fans shall modulate to control the discharge pressure of each circuit.

## 9.3 BMS INTEGRATION

| TYPE | OBJECT INSTANCE | VARIABLE | DESCRIPTION | VALUE RANGE | READWRITE MODE |
|---|---|---|---|---|---|
| Analog Input | 100 | Demand | Cooling Demand | XXX.Y % | Read_NoWrite |
| Analog Input | 101 | EV1.EEV_PosPercent.Val | Circuit 1 Valve Percent | XXX.Y % | Read_NoWrite |
| Analog Input | 102 | GEN_CompSpeedFeedback_PCT | Circuit 1 Comp Percent | XXX.Y % | Read_NoWrite |
| Analog Input | 103 | GEN_RefrigerationStage_Mod_BN | 0 = OFF | 0-6 | Read_NoWrite |
| | | | 1 = STARTING UP | | |
| | | | 2 = COMP RUNNING | | |
| | | | 3 = BOTH COMPS RUNNING | | |
| | | | 4 = RUNNING AT MINIMUM | | |
| | | | 5 = SHUTTING DOWN | | |
| | | | 6 = IN ALARM | | |
| Analog Input | 104 | CondFanOut.Val | Condenser Fan Speed | XXX.Y % | Read_NoWrite |
| Analog Input | 105 | EV2.EEV_PosPercent.Val | Circuit 2 Valve Percent | XXX.Y % | Read_NoWrite |
| Binary Input | 106 | CompOnOff_Circ2.Val | Comp 2 On Off | Off/On | Read_NoWrite |
| Analog Input | 107 | DscgPress_1.Val | 1 Discharge Pressure | XXX.Y Pressure [PSI/Bar] | Read_NoWrite |
| Analog Input | 108 | DscgTemp_1.Val | Circ 1 Discharge Temperature | XXX.Y Degrees [F/C] | Read_NoWrite |
| Analog Input | 109 | SuctPress_1.Val | Circ 1 Suction Pressure | XXX.Y Pressure [PSI/Bar] | Read_NoWrite |
| Analog Input | 110 | SuctTemp_1.Val | Circ 1 Suction Temperature | XXX.Y Degrees [F/C] | Read_NoWrite |
| Analog Input | 111 | DscgPress_2.Val | Circ 2 Discharge Pressure | XXX.Y Pressure [PSI/Bar] | Read_NoWrite |
| Analog Input | 112 | DscgTemp_2.Val | Circ 2 Discharge Temperature | XXX.Y Degrees [F/C] | Read_NoWrite |
| Analog Input | 113 | SuctPress_2.Val | Circ 2 Suction Pressure | XXX.Y Pressure [PSI/Bar] | Read_NoWrite |
| Analog Input | 114 | SuctTemp_2.Val | Circ 2 Suction Temperature | XXX.Y Degrees [F/C] | Read_NoWrite |
| Analog Input | 115 | REF_UnitStatus_BN | Ref Status | 1 = Unit on | Read_NoWrite |
| | | | | 2 = Unit switched off due to alarm | |
| | | | | 4 = Unit switched off locally | |
| | | | | 5 = Unit is in Manual Mode | |
| | | | | 6 = Compressor in Start up | |
| | | | | 7 = Restarting after starting failure | |
| | | | | 8 = Comp Off by Alarm | |
| | | | | 9 = Off By Main Controller | |
| | | | | 10 = BLDC Over Max Press | |
| | | | | 11 = Comp2 Off By Alarm | |

FIGURE 9.3.0 BMS POINTS

# 10.0 FACTORY ASSISTANCE

In the unlikely event that you need assistance from the factory for a specific issue, make sure that you have the information called for in the Unit Information section at the front of this manual. The person you speak with at the factory will need that information to properly identify the unit and the installed options.

To contact RenewAire Customer Service:

**Call 800-627-4499**

**Email: RenewAireSupport@RenewAire.com**

Remember that RenewAire Customer Service can only assist with the products sold by RenewAire, it cannot resolve engineering issues that result from air handling system design by others.

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## About RenewAire

For over 30 years, **RenewAire has been a pioneer in enhancing indoor air quality (IAQ)** in commercial and residential buildings of every size. This is achieved while maximizing sustainability through our fifth-generation, static-plate, enthalpic-core **Energy Recovery Ventilators (ERVs) that optimize energy efficiency**, lower capital costs via load reduction and decrease operational expenses by minimizing equipment needs, resulting in significant energy savings. Our ERVs are competitively priced, simple to install, easy to use and maintain and have a quick payback. They also enjoy the industry's best warranty with the lowest claims due to long-term reliability derived from innovative design practices, expert workmanship and **Quick Response Manufacturing (QRM)**.

As the pioneer of static-plate core technology in North America, RenewAire is the largest ERV producer in the USA. We're **committed to sustainable manufacturing** and lessening our environmental footprint, and to that end our Waunakee, WI plant is 100% powered by wind turbines. The facility is also one of the few buildings worldwide to be LEED® Gold and Green Globes certified, as well as having achieved ENERGY STAR Building status. In 2010, RenewAire joined the Soler & Palau (S&P) Ventilation Group in order to provide direct access to the latest in energy-efficient air-moving technologies. For more information, visit: renewaire.com

201 Raemisch Road | Waunakee, WI | 53597 | 800.627.4499 | RenewAire.com

Soler&Palau Ventilation Group
Member of the S&P Group
Family of Brands

RenewAire® Energy Recovery Ventilation