HUSSMANN®

H-Series Condensing Unit

Installation and Operation Manual

PN 0708232_J
March 2020

BEFORE YOU BEGIN

Read the safety information completely and carefully.

The precautions and use of the procedures described herein are intended to use the product correctly and safely. Comply with the precautions described below to protect you and others from possible injuries. Relative to their potential danger, the relevant matters are divided into four parts as defined by ANSI Z535.5

ANSI Z535.5 DEFINITIONS

• **DANGER –** Indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury.

• **WARNING –** Indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury.

• **CAUTION –** Indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury.

• **NOTICE –** *Not related to personal injury* **–** Indicates[s] situations, which if not avoided, could result in damage to equipment.

* *

Environmental Concerns

Hussmann recommends responsible handling of refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those that contain Hydrogen, Chlorine, Fluorine, and Carbon (HCFCs). Only certified technicians may handle these refrigerants. All technicians must be aware and follow the requirements set forth by the Federal Clean Air Act (Section 608) for any service procedure being performed on this equipment that involves refrigerant. Additionally, some states have other requirements that must be adhered to for responsible management of refrigerants.

WARNING

PERSONAL PROTECTION EQUIPMENT (PPE)

Only qualified personnel should install and service this equipment. Personal Protection Equipment (PPE) is required whenever servicing this equipment. Wear safety glasses, gloves, protective boots or shoes, long pants, and a long-sleeve shirt as required when working with this equipment. Observe all precautions on tags, stickers, labels and literature attached to this equipment.

WARNING

Contractors shall strictly adhere to specifications provided by the Engineer of Record (EOR), as well as US Environmental Protection Agency regulations, OSHA regulations, and all other federal, state and local codes. This work should only be done by qualified, licensed contractors. There are numerous hazards, not limited to, but including: burns due to high temperatures, high pressures, toxic substances, electrical arcs and shocks, very heavy equipment with specific lift points and structural constraints, food and product damage or contamination, public safety, noise, and possible environmental damage. Never leave operating compressors unattended during the manual soft-start process. Always power rocker switches off when unattended.

⚠ WARNING

Proper Field Wiring and Grounding Required! Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

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

⚠ WARNING

— LOCK OUT / TAG OUT —

To avoid serious injury or death from electrical shock, always disconnect the electrical power at the main disconnect when servicing or replacing any electrical component. This includes, but is not limited to, such items as controllers, electrical panels, condensers, lights, fans, and heaters.

⚠ CAUTION

This manual was written in accordance with originally perscribed equipment that is subject to change. Hussmann reserves the right to change all or part of the equipment for future stores such as, but not limited to, controllers, valves and electrical specifications. It is the installers responsibility to reference the refrigeration drawings supplied for each installation, as directed by the Engineer of Record.

⚠ WARNING

This equipment is prohibited from use in California with any refrigerants on the "List of Prohibited Substances" for that specific end-use, per California Code of Regulations, title 17, section 95374.

Use in other locations is limited to refrigerants permitted by country, state, or local laws and is the responsibility of the installer/end-user to ensure only permitted refrigerants are used.

This disclosure statement has been reviewed and approved by Hussmann and Hussmann attests, under penalty of perjury, that these statements are true and accurate.

TABLE OF CONTENTS

MODEL NUMBERING SYSTEM

Name:

Unit Type:
D - Outdoor, High Efficiency
E - Indoor, High Efficiency
T - Outdoor N - Indoor
R - Remote
S - Satellite
W - Water Cooled

Base:
S - Standard
H - Heavy Duty

Compressor Vendor:
B - Bitzer Ecoline Motor 2 E - Bitzer Ecoline Motor 1
D - Copeland Discus
S - Copeland Semi-Hermetic
Z - Copeland Scroll

Compressor Horsepower:
005 - 1/2 HP
030 - 3 HP
100 - 10 HP

Alternative:
0 - Basic
1 - First Alternative
2 - Second Alternative
3 - Third Alternative

Application (Temp Range):
M - Medium
L - Low

Refrigerant:
S - R404A T - R448A
P - R507A R - R449A
Q - R407A
F - R407F

Voltage Designation
D - 208V / 1PH / 60 Hz
K - 208V / 3PH / 60 Hz
M - 460V / 3PH / 60 Hz
P - 575V / 3PH / 60 Hz
U - 380V / 3PH / 50 Hz

Air Condenser:
A - 20 X 32 3R 1F
B - 37.5 X 36 3R 1F
C - 37.5 X 36 3R 2F
D - 37.5 X 36 4R 2F
E - 37.5 X 72 3R 4F
F - 37.5 X 72 4R 4F
G - (2X) (C)
H - (2X) (D)
J - 50 X 87 4R 6F
K - 37.5 x 42.5 6R 4F

Receiver Size:
A - 6” x 12”
B - 6” x 18”
C - 6” x 23”
D - 6” x 30”
E - 8-5/8” x 30”
F - 10-3/4” x 30”
G - 10-3/4” x 38”
H - 12-3/4” x 30”
M - 5” x 12”
N - 6” x 15”
O - 6” x 12”
P - 6” x 36”
X - No Receiver

D = DOE/NRCan Compliant
A = Non-Regulated-Applications

Water Condenser:
A - WC1X06
B - WC1X09
C - WC1X12
D - WC1X18
E - WC1X24
F - WC1X30
G - WC1X36
H - WC1X42
I - WC1X48
J - WC1X60
K - WC1X72
L - WC1X84
M - WC2X48
N - WC2X60
O - WC2X72
P - WC3X48
Q - WC3X60
R - WC3X72
X - None

INSTALLATION INSTRUCTIONS

SHIPPING DAMAGE

All equipment should be thoroughly examined for shipping damage before and while unloading. This equipment has been carefully inspected at our factory and the carrier has assumed responsibility for safe arrival. If damaged, either apparent or concealed, claim must be made to the carrier.

Apparent Loss or Damage

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

Concealed Loss or Damage

When loss or damage is not apparent until after equipment is uncrated, a claim for concealed damage is made. Upon discovering damage, make request in writing to carrier for inspection within 15 days and retain all packing. The carrier will supply inspection report and required claim forms.

RIGGING AND LIFTING

Under no circumstances should the manifolds, piping return blends or control panel be used for lifting or moving the unit. Use lifting eyes provided on two tier units. On singles tier units, secure lifting hooks to the under side of the base, or use the holes provided in the base. The installer is responsible to see that equipment used to move the unit is operated within its limits.

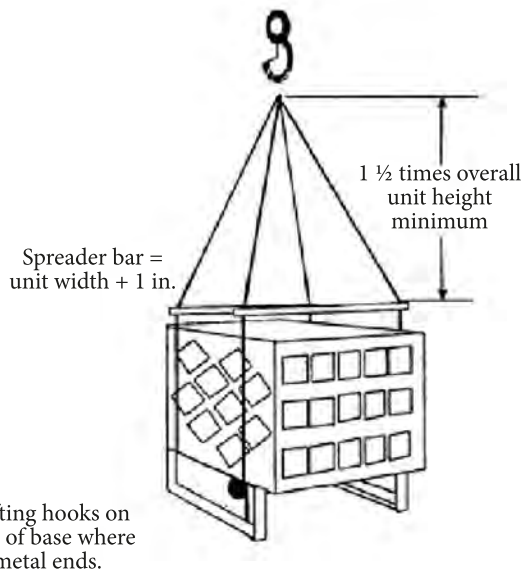


Figure 1-1 Rigging and Lifting

MACHINE ROOM REQUIREMENTS

The equipment room floor must solidly support the compressor unit as a live load. Ground level installation seldom presents problems, but a mezzanine installation must be carefully engineered. Equipment must be located in the machine room to provide enough working space for service personnel, and to meet electrical codes.

When a Remote Condenser Unit, Satellite Unit or a Water Cooled Condensing Unit is installed, the ventilation should be 100 cfm per compressor unit horsepower. The air inlet should be sized for a maximum of 600 fpm velocity (0.5 ft^2 of air intake per compressor unit horsepower).

The Indoor Condensing Unit ventilation should be 750 to 1,000 cfm with 2 to 2.5 ft^2 of air intake per compressor unit horsepower. The ventilation fans should cycle by thermostatic control. All machine room ventilation equipment must be field supplied. Check local codes for variances. Proper ventilation provides airflow across the compressors. Duct work may be necessary.

Provide a floor drain for disposal of condensate that may form on the compressor unit or header defrost assembly.

Consult NEC National Fire Handbook, particularly "Installation of Switch Boards" and "Working Space Requirements." Refer to local codes for each installation. Reference individual drawings shown in the Appendix.

SHIPPING BLOCK REMOVAL

Hard mounting is standard on all units. All piping was carefully design to absorb the vibration that is generated by the compressor and fan motors.

When the spring mounting kit (optional) is installed, the unit is shipped with blocks under each compressor foot to prevent transit damage.

Loosen the mounting spring nuts at least one full turn and remove the blocks. Adjust the torque on the mounting spring nuts so that the compressor feet are 1 inch above the unit's base.

UNIT PLACEMENT

When setting the units, plan in relation to the rest of the equipment to be installed and existing structures. Some minimum and maximum distances are listed. **Note:** Piping equivalent is not the same as linear distance.

MINIMUM ALLOWABLE CLEARANCES

Between an Outdoor Condensing Unit and any vertical structure (except open chain link fence) the minimum allowable distance is 4 feet.

Between one Outdoor Condensing Unit exhaust and another Outdoor Condensing Unit intake the minimum allowable distance is 15 feet.

Between the sides of two Outdoor Condensing Units the minimum allowable distance is 5 feet.

On Indoor Condensing Unit, Satellite Unit, Remote Condenser Unit and Water Cooled Condensing Unit, the minimum distance between the Control Panel and the wall is 42 inches.

On Indoor Condensing Unit, Satellite Unit, Remote Condenser Unit and Water Cooled Condensing Unit, the minimum distance between the Control Panel and another live panel is 4 feet.

On Indoor Condensing Units the minimum distance between the Condenser Air Intake and a louvered wall is 30 inches.

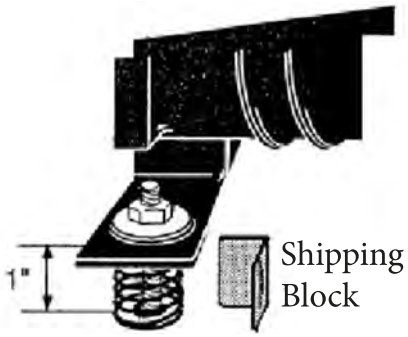


Figure 1-4 Shipping Block Removal

PIPING CONSIDERATIONS

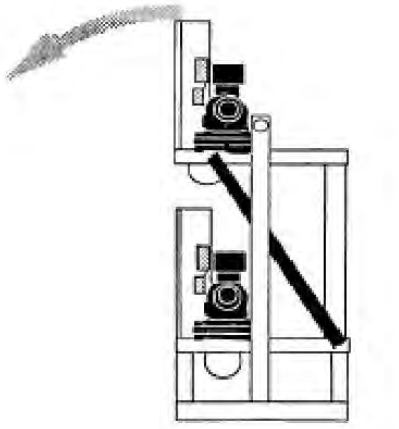
When piping a suction riser the maximum vertical distance between P-traps is 20 feet.

When piping from Remote Condenser Unit to a Condenser, the maximum allowable piping equivalent is 100 feet.

TWO-TIER APPLICATION

The two-tier unit is only an option when it is installed on the heavy duty base (option) and it is designed for indoor, water-cooled, remote condenser or satellite application.

WARNING:
Two Tier Remote Condenser Units
Are Front Heavy.



Take appropriate precautions during shipment and moving of unit. Fasten to floor upon final placement.

Figure 1-5 Two Tier Remote Condenser Units

RECEIVER CAPACITY

The receiver capacity is listed on the table below.

	Capacity - 90%			
H-series Receivers	R404A/R507A	R448A/R449A	R407A	R407F
6x12	11.1	11.7	12.2	11.9
6x18	16.7	17.6	18.4	18.0
6x23	21.4	22.5	23.6	23.0
6x30	27.9	29.3	30.7	30.0
8-5/8x30	53.9	56.6	59.4	57.9
10-3/4x30	82.3	86.5	90.7	88.5
10-3/4x38	106.2	111.6	117.0	114.2
12-3/4x30	100.1	105.2	110.3	107.6
5x12	7.9	8.3	8.7	8.5
6x15	14.6	15.3	16.1	15.7
6x12	11.4	12.0	12.6	12.3
6x36	36.1	37.9	39.8	38.8

PRESSURE RELIEF

It is standard that a fusible plug is installed on all the receivers. The connection size for piping from the fusible plug to outside is 3/8” NPT.

It is also available as an option a relief valve, which replaces the fusible plug, and has the same connection size for piping (3/8” NPT).

WATER COOLED CONDENSER

Flush the water lines before connecting them to the water-cooled condenser.

Consult Water Cooled Condensing Unit Catalog for pressure drop, recommended inlet water temperature and water flow through the condenser.

REFRIGERATION PROCESS

OVERVIEW

This section details the refrigeration process by tracking the refrigerant flow through the system components. Heat Reclaim, Demand Cooling, Oil separation and return is explained. See *Piping* for piping guidelines.

Typically, refrigeration falls into low or medium temperature ranges. An average low temperature condensing unit maintains a suction temperature of -20°F with a low-temp Satellite operating at -33°F. A common medium temperature condensing unit operates at +25°F with a low-temperature Satellite operating at +7°F.

In these instructions the following constants are maintained to assist the reader.

In the diagrams refrigerant flow direction is generally clockwise and indicated by directional arrows.

Electric solenoid valves carry the same initial abbreviations as in the electric schematics.

Refrigeration lines not actually in the cycle being discussed are shown closed or removed. Pressure in oil lines will also retain a fixed pattern.

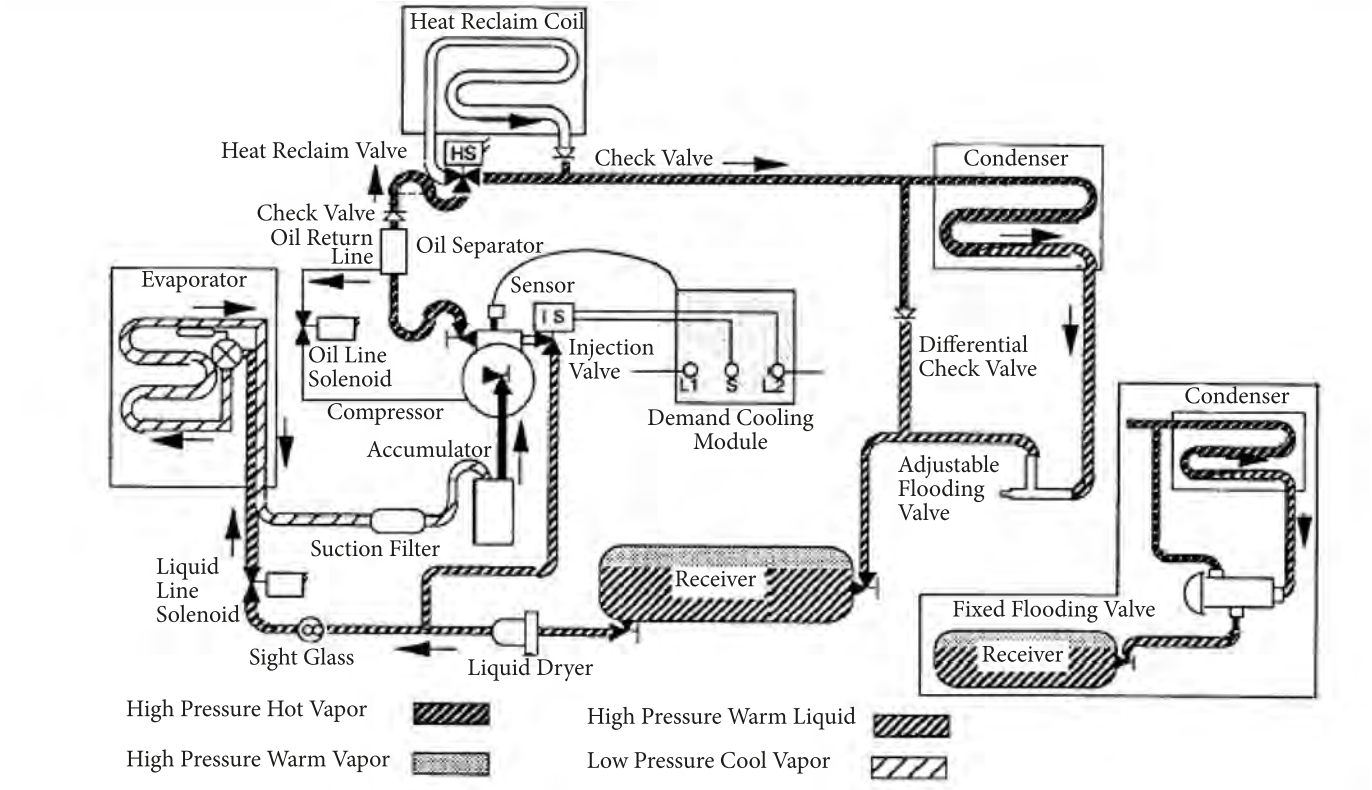


Figure 2-1 Refrigeration Cycle

REFRIGERATION CYCLE

Beginning with the Compressor, refrigerant vapor is compressed and flows to the Oil Separator, which separates the oil from the discharge gas by centrifugal force and screen baffles. The oil is stored in the bottom of the Oil Separator and returned to the compressors through the oil return line.

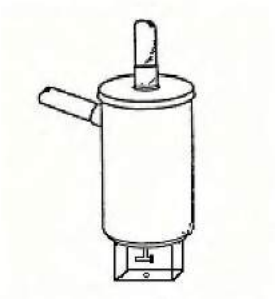


Figure 2-2 Oil Separator

When an Oil Separator is installed the following components are required:

- Check Valve on the discharge line after the Oil Separator, to prevent refrigerant migration during low ambient temperatures from the condenser to the Oil Separator, and from that to the Compressor.
- Oil Line Solenoid on the oil return line, to prevent the oil to return from the compressor when the compressor is not running. The excessive oil in the carter when the compressor starts, could cause damage to the compressor such as broken valve plate or piston, etc.

A 3-Way Heat Reclaim Valve directs the superheated discharge gas to either the condenser or a Heat Reclaim device when energized. When the reclaim solenoid is deenergized, the valve directs the refrigerant to the condenser.

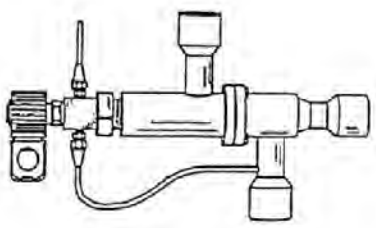


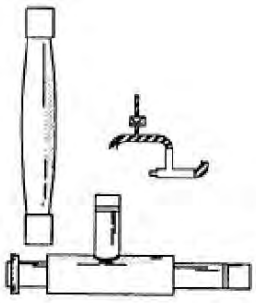
Figure 2-3 Heat Reclaim Valve

The Condenser rejects the heat that must be removed from refrigerant to cause it to condense.

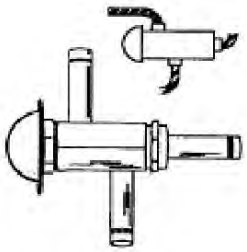
For Low Ambient Conditions, Fan Cycling or Flooding Valves are required. These valves may be fixed or adjustable. The adjustable flooding valve works in parallel with a 20 pound differential check valve.

The Flooding Valve maintains head pressure in low ambient conditions by restricting liquid refrigerant flow from the Condenser. This causes liquid refrigerant to be backed up in the condenser thus reducing available heat transfer surface and causing the discharge pressure to rise.

Outdoor High-Efficiency units are equipped with adjustable ORI flooding valves for winter control and ORD differential valves for receiver pressure regulation. (standard) Outdoor multi-fan High-Efficiency units are also equipped with a temperature control to cycle off half the fans in low-ambient conditions (standard).



Adjustable Flooding Valve and Differential Check Valve



Fixed Flooding Valve

Figure 2-4 Flooding Valves

The Receiver is a holding vessel for liquid refrigerant that compensates for fluctuations in liquid requirements due to changing load, defrost, and weather.

A Liquid Line Drier removes moisture and contaminants from the refrigerant.

The Sight Glass allows service personnel to view refrigerant flow inside the liquid line.

The Liquid Line Solenoid Valve closes off refrigerant supply to the evaporator.

Figure 2-5 Liquid Line Solenoid Valve

The Thermostatic Expansion Valve (TEV), located in the merchandiser, meters liquid refrigerant through its orifice to the low pressure side of the system where it absorbs heat from the coil causing the liquid to evaporate.

Figure 2-6 Thermostatic Expansion Valve

The Accumulator catches liquid refrigerant in the suction line and provides a means for it to boil off before it reaches the compressor.

A Suction Filter is placed upstream of the compressor to remove system contaminants from the refrigerant vapor.

At critical locations along the refrigerant path, service valves or ball valves allow isolation of components.

HEAT RECLAIM VALVE

A 3-Way Heat Reclaim Valve directs the refrigerant to either the Condenser or a Heat Reclaim Coil. When the solenoid is deenergized the valve directs the refrigerant to the condenser.

When the solenoid is de-energized the high-pressure inlet is stopped and the passage between suction and valve chamber is open. When the solenoid is energized the suction outlet is stopped and the passage between high pressure and the valve chamber is open.

"B" version of the valve has a bleed port through the drive piston to the suction manifold. The bleed port provides a vent for fluids trapped in the Heat Reclaim circuits during normal operation.

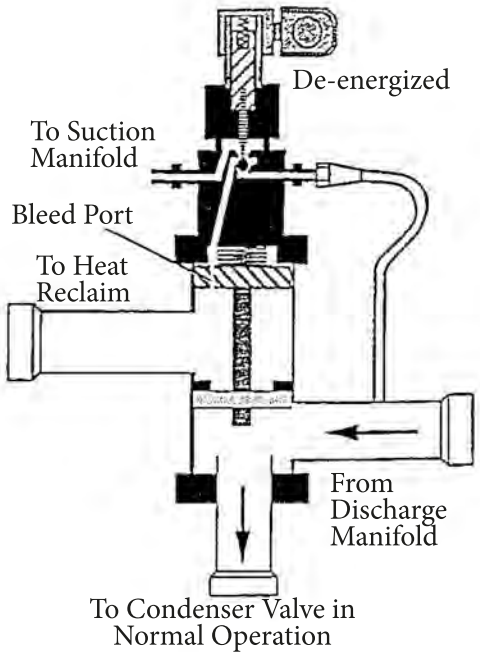


Figure 2-7 Heat Reclaim Valve Normal Operation

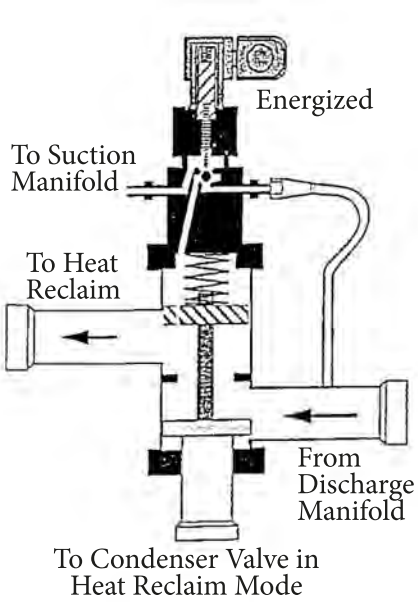


Figure 2-8 Heat Reclaim Valve
Heat Reclaim Mode

DEMAND COOLING

The Demand Cooling System is designed to inject saturated refrigerant into the suction cavity when the compressor internal head temperature exceeds 292°F. Injection continues until the temperature is reduced to 282°F. If the temperature remains above 310°F for one minute the control shuts down the compressor. After correcting the cause of shutdown, manual reset is required.

The System Parts
Temperature Sensor
Control Module
Injection Valve

The Temperature Sensor uses a Negative Temperature Coefficient (NTC) Thermistor to provide signals to the Control Module. The NTC resistance drops on temperature rise.

Temperature °F	Approximate Ohm Reading
77	90,000
282	2,400
292	2,100
310	1,700

The Control Module responds to the Temperature Sensor input by energizing the Injection Valve Solenoid when 292°F is exceeded. Too high or too low a resistance from the thermistor circuit will cause the Module to shutdown the compressor after one minute.

The Injection Valve meters saturated refrigerant into the suction cavity of the compressor. The valve orifice is carefully sized to meet the requirements of a specific compressor. Valve sizes correspond to the four compressor bodies- 2D, 3D, 4D.

Probe test readings between 100,000 Ohms and 1,600 Ohms usually indicate an operating probe.

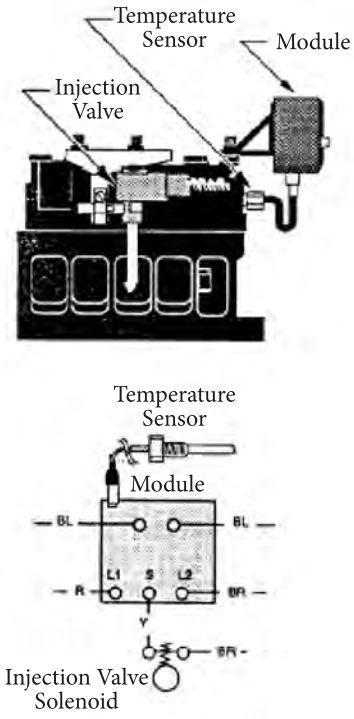


Figure 2-9 Demand Cooling Components

Component Testing

Remove power to the system. Unplug the Temperature Sensor from the Module. The Sensor should ohm out between 1,600 Ohms and 100,000 Ohms.

Leave the Sensor unplugged and restart the system. There should be no voltage between terminals "S" and "L2" on the Module. The inlet and outlet sides of the Injection Valve should feel the same temperature. After one minute the alarm relay should trip. Remove power to the system. Press the manual reset on the Module.

Using a small piece of wire, jump the Sensor circuit at the female plug in the Module. Restart the system. There should be voltage between terminals "S" and "L2" on the Module. The outlet side of the Injection Valve should feel colder than the inlet side. After one minute the alarm relay should trip.

Remove power to the system. Press the manual reset on the Module.

Remove the jumper wire and plug in the Temperature Sensor.

Restart the System.

Alarm Circuit

The Alarm Circuit has three terminals in the Control Module.

"L" – Common
"M" – Normally Closed
"A" – Normally Open

"L" and "M" are wired into the compressor control circuit so an alarm condition removes the compressor from the line and power to the Module. A manual reset is required to call attention the alarm condition.

Figure 2-10 Demand Cooling Alarm Connections

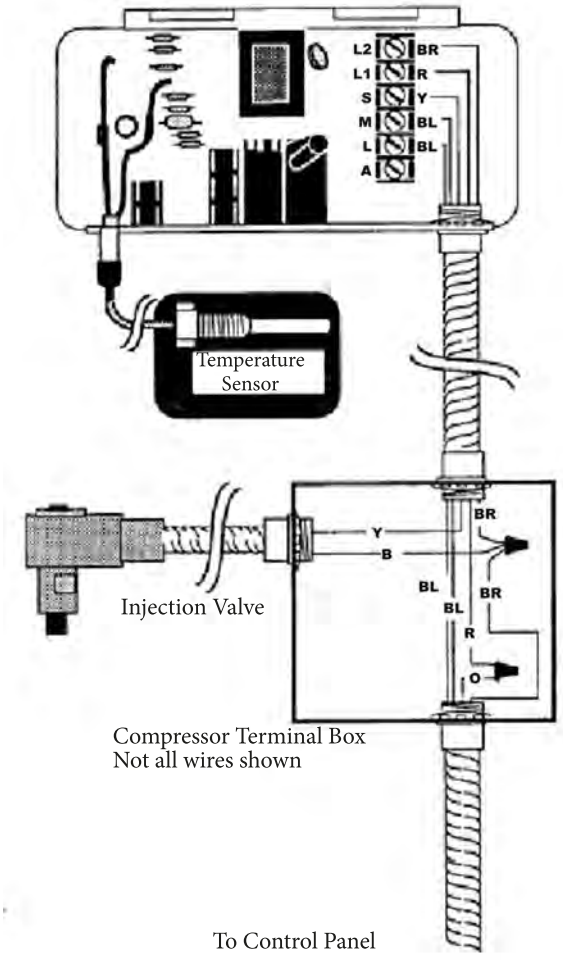


Figure 2-11 Demand Cooling Wiring

Alarm Relay

The Alarm Relay is activated after a one minute delay under the following three conditions:

- Compressor discharge temperature exceeds 310°F.

- A shorted circuit or very low Thermistor Resistance.

- An open circuit or very high Thermistor Resistance.

Operational Notes

Demand Cooling does NOT replace head cooling fans, which may be required on low temperature applications.

On indoor and outdoor condensing units, the condenser fans replace the head cooling fan.

When fan cycling is applied, at least one condenser fan MUST always be ON with the compressor, so head cooling fan will be not necessary.

Temperature Sensor cables must not touch any hot surfaces or the cable will be damaged.

COMPONENT PIPING

OVERVIEW

This section deals with the information necessary for installing the refrigeration lines for a condensing unit. The components are piped as completely as practical at the factory.

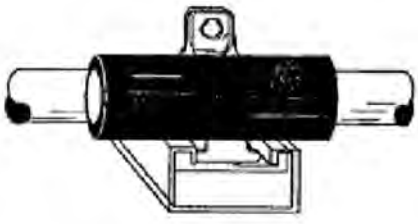
Use only clean, dehydrated, sealed refrigeration grade copper tubing. Use dry nitrogen in the tubing during brazing to prevent the formation of copper oxide. All joints should be made with silver alloy brazing material, and use 45% silver solder for dissimilar metals.

WARNING
Always use a Pressure Regulator on the nitrogen tanks.

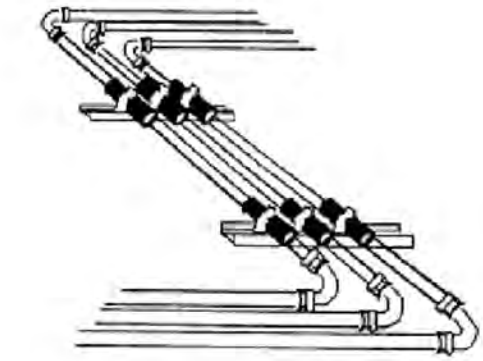
REFRIGERATION LINE RUNS

Liquid Lines and suction lines must be free to expand and contract independently of each other. Do not clamp or solder them together. Run supports must allow tubing to expand and contract freely. Do not exceed 100 feet without a change of direction and / or offset. Plan proper pitching, expansion allowance and P-traps at the base of all suction risers. Use long radius elbows to reduce line resistance and breakage.

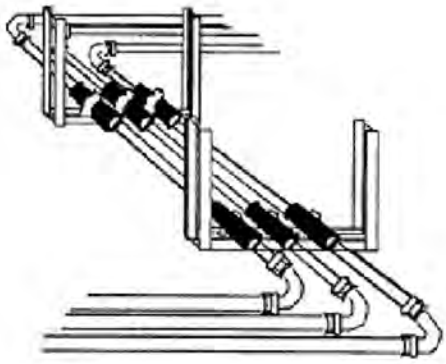
Avoid completely the use of 45 degree elbows. Install service valves at several locations for ease of maintenance and reduction of service costs. These valves must be UL approved for 410 psig minimum working pressure.



Support Detail



Floor Run



Ceiling Run

Figure 3-1 Supporting Refrigeration Lines

Through Walls or Floors

Refrigeration lines run through walls or floors must be properly insulated. Avoid running lines through the refrigeration cases. When this is done the lines must be adequately insulated.

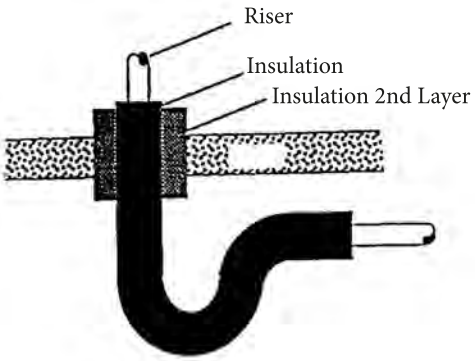


Figure 3-2 Insulating a Riser

From Machine to Solid Object
When mounting lines from machinery to a solid object allow line freedom for vibration to prevent metal fatigue.

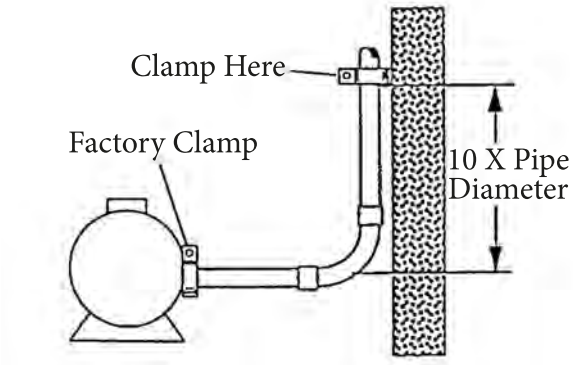


Figure 3-3 Vibration Allowance

P-Trap Construction
A P-Trap must be installed at the bottom of all suction risers to return oil to the compressors.

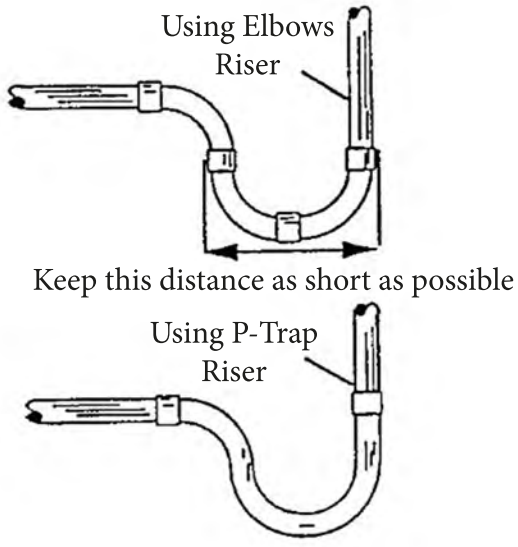


Figure 3-4 P-Trap Construction

Reduced Riser
When a reduced riser is necessary, place the reduction coupling downstream of the P-Trap.

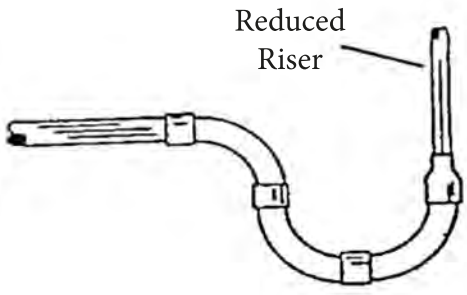


Figure 3-5 Reduced Riser

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

Protecting Valves and Clamps
When brazing near factory installed clamps or valves be sure to protect them with a wet rag to avoid overheating.

Connecting Remote Condenser
- Discharge Line will be routed directly to the condenser inlet stub with a purge valve at the highest point.
- Liquid Return line will be pitched downstream and provide trap less drainage to the Receiver.

Purge Valve Location
The purge valve will be installed at the highest point of an inverted P-Trap, with at least a 6" rise. (Use with approved recovery vessel.)

WARNING
Vent the Receiver Safety Relief Device properly.

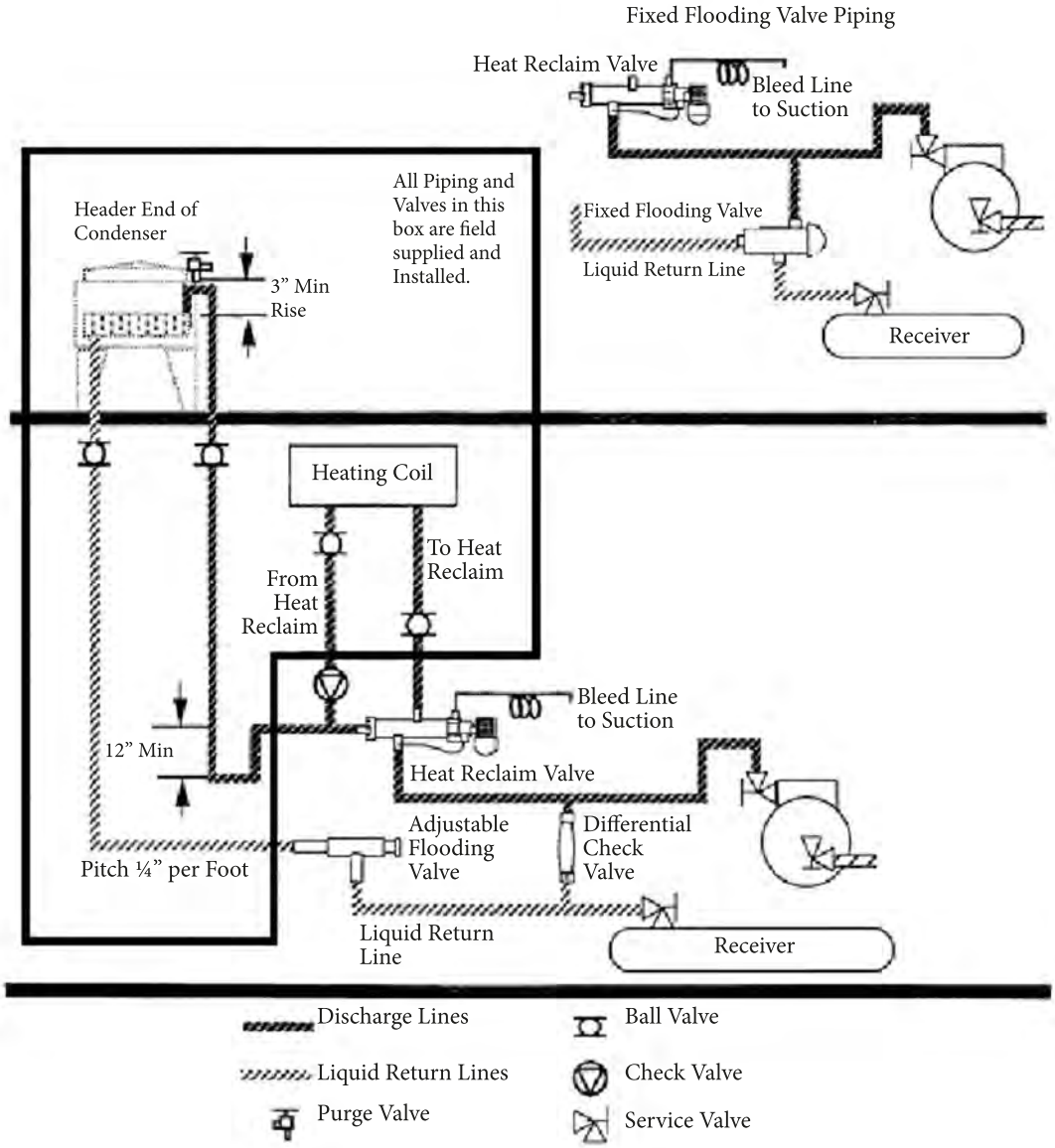


Figure 3-6 Remote Condensing Unit Piping

Note: The Heat Reclaim Valve could be factory or field installed and depends on the customer request.

MERCHANDISER PIPING

Suction Line

- Pitch in direction of flow.
- May be reduced by one size at one third of run load and again after the second third. Do not reduce below evaporator connection size.
- Suction returns from evaporators enter at the top of the branch line.

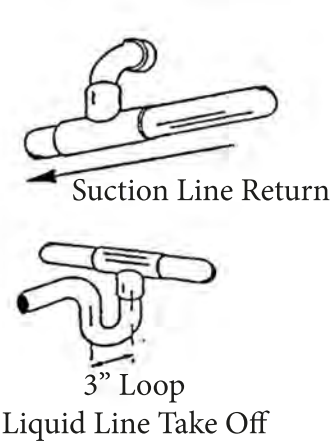


Figure 3-7 Line Piping Inside Merchandisers

Liquid Line – Off Time and Electric Defrost

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

Field Connections of Heat Reclaim

Each circuit of the heat reclaim coil is tagged to correspond with a specific condensing unit and must be connected only to that unit.

The supply and return lines are to be installed as shown in Figure 3-6.

Notice that heat reclaim could be factory or field installed, and depends on customer order.

SPECIAL PIPING FOR OPEN ROOMS

An open preparation room allows heat infiltration from the rest of the store at a rate which may jeopardize total refrigeration performance. To protect the rest of the refrigeration system, open preparation evaporators must be piped with a Crankcase Pressure Regulating Valve (CPR).

The CPR is field installed in the suction line(s) from the evaporator(s). And the installer is responsible for proper adjustment of the Valve. (See: Control Valve Section for adjustment procedures.)

RUN LENGTHS AND EQUIVALENT FEET

When figuring run lengths, angle valves and 90 degrees elbows are figured as additional straight pipe. The chart below gives equivalent lengths for these components.

Tubing Size	Angle Valve	Long Radius Elbow 90°
1/2	6	0.9
5/8	7	1.0
7/8	9	1.4
1 1/8	12	1.7
1 3/8	15	2.3
1 5/8	18	2.6
2 1/8	24	3.3
2 5/8	29	4.1
3 1/8	35	5.0
3 5/8	41	5.9
4 1/8	47	6.7

Table 3-1 Equivalent Feet for Angle Valve and Elbow 90º
(ASHARE 1994 Refrigeration Handbook)

INSULATION

Additional insulation for the balance of the liquid and suction lines is recommended wherever condensation drippage is objectionable or the lines are exposed to ambient conditions.

REFRIGERANT LINE SIZING

General Information

This document supersedes all previously published line sizing data – including planning data, installation instructions, or other stand-alone documents.

Refer to ASHARE standards for line sizing. The installer is responsible for sizing the piping for each application.

Refrigeration Line Stubs Out

Stub sizes do not match line sizes. Reduction fittings are field supplied and installed. These are general guidelines. The installer is responsible to account for any factors which may affect the system.

Condenser Line Sizing

A Condenser Line Sizing chart is established for an equivalent pipe run of 100 feet. For longer runs use the following formula:

$$\text{Table Capacity} * \sqrt{100/\text{Longer Length}} = \text{Longer Line Capacity}$$

Note: This formula applies only to remote condenser lines, and only to longer runs of these lines. A 25 ft run does not necessarily have double the capacity of a 100 ft. run.

OVERVIEW

The scope of this section is limited to main field wiring connections, and to the control panel.

The standard Condensing Unit is available wired for 208-230/1/60, 208-230/3/60, 460/3/60, 575/3/60 or 380/3/50 compressors (note that some compressors may be available in all voltages). In either case, the control circuit is 208-230V.

The standard 460V and 575V Condensing Unit require two single point connections, one for the compressor (460V or 575V) and one for the control and defrost circuits (208-230V). When a single point connection is specified for 460V and 575V condensing units, the factory will install a transformer to supply 208-230V for just the control circuit.

Refer to the serial plate located on the control panel to determine wire size (MCA) and over-current protection (MOPD).

GUIDELINES FOR FIELD WIRING

Condensing Unit components are wired as completely as possible at the factory with all work completed in accordance with UL file. All deviations required by governing electrical codes will be the responsibility of the installer.

The main lugs in the compressor control panel are sized for copper wire only, with 75° C insulation. All wiring must be in compliance with governing electrical codes.

- **For 208-230/1/60 Condensing Units:**

To each condensing unit provide; one 208-230/1/60 branch circuit,

- **For 208-230/3/60 Condensing Units:**

To each condensing unit provide; one 208-230/3/60 branch circuit,

- **For 460/3/60 Condensing Units:**

To each condensing unit provide;
one 460/3/60 branch circuit,
one 208/3/60 circuit – see Note 1

- **For 575/3/60 Condensing Units:**

To each condensing unit provide;
one 575/3/60 branch circuit,
one 208/3/60 circuit – see Note 1

ELECTRICAL

- **For 380/3/50 Condensing Units:**

To each condensing unit provide;
one 380/3/50 branch circuit, one Neutral

Note 1 – Omit when single point connection kit is used.

Unit Cooler Fan Wiring

Off Time Defrost: the unit cooler fan should be wired from the condensing unit panel or an outside panel.

Electric Defrost: the unit cooler fan should be wired from the condensing unit panel.

Evaporator Mounted Liquid Line Solenoid

Power for a liquid line solenoid can be picked up from the fan circuit.

Cooler Door Switch Wiring

The switch must be mounted to the cooler door frame, and must be wired to control the field installed liquid line solenoid and evaporator fans. Door switches are wired in series.

Sizing Wire and Overcurrent Protectors

Check the serial plate for Minimum Circuit Ampacity (MCA) and Maximum Overcurrent Protective Devices (MOPD), follow NEC guidelines.

Defrost Controls

The basic defrost circuits are shown on the wiring diagrams in this section.

Other Controls

When other controls are used, refer to the manual included with that control.

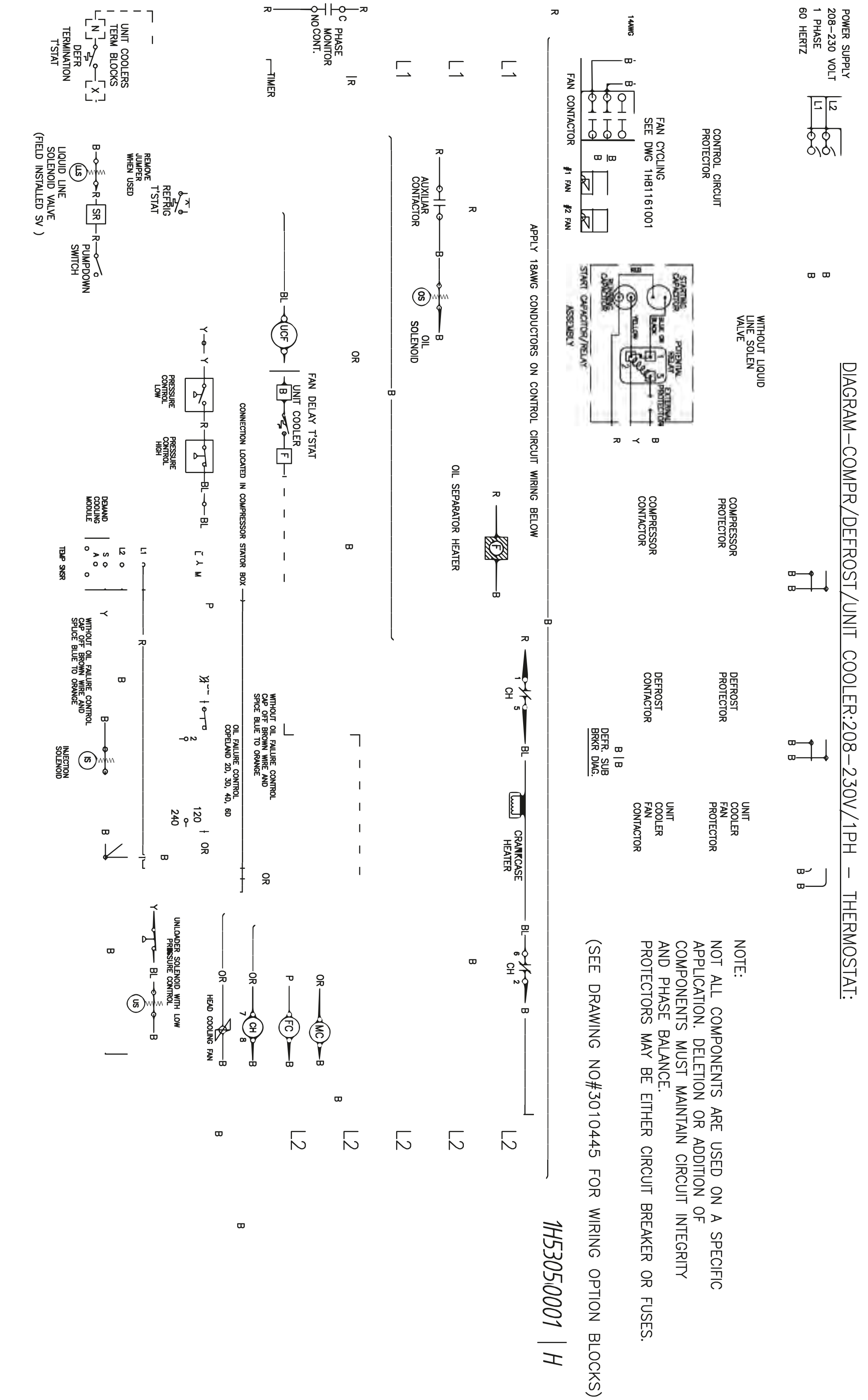
ABOUT THESE ELECTRICAL DIAGRAMS

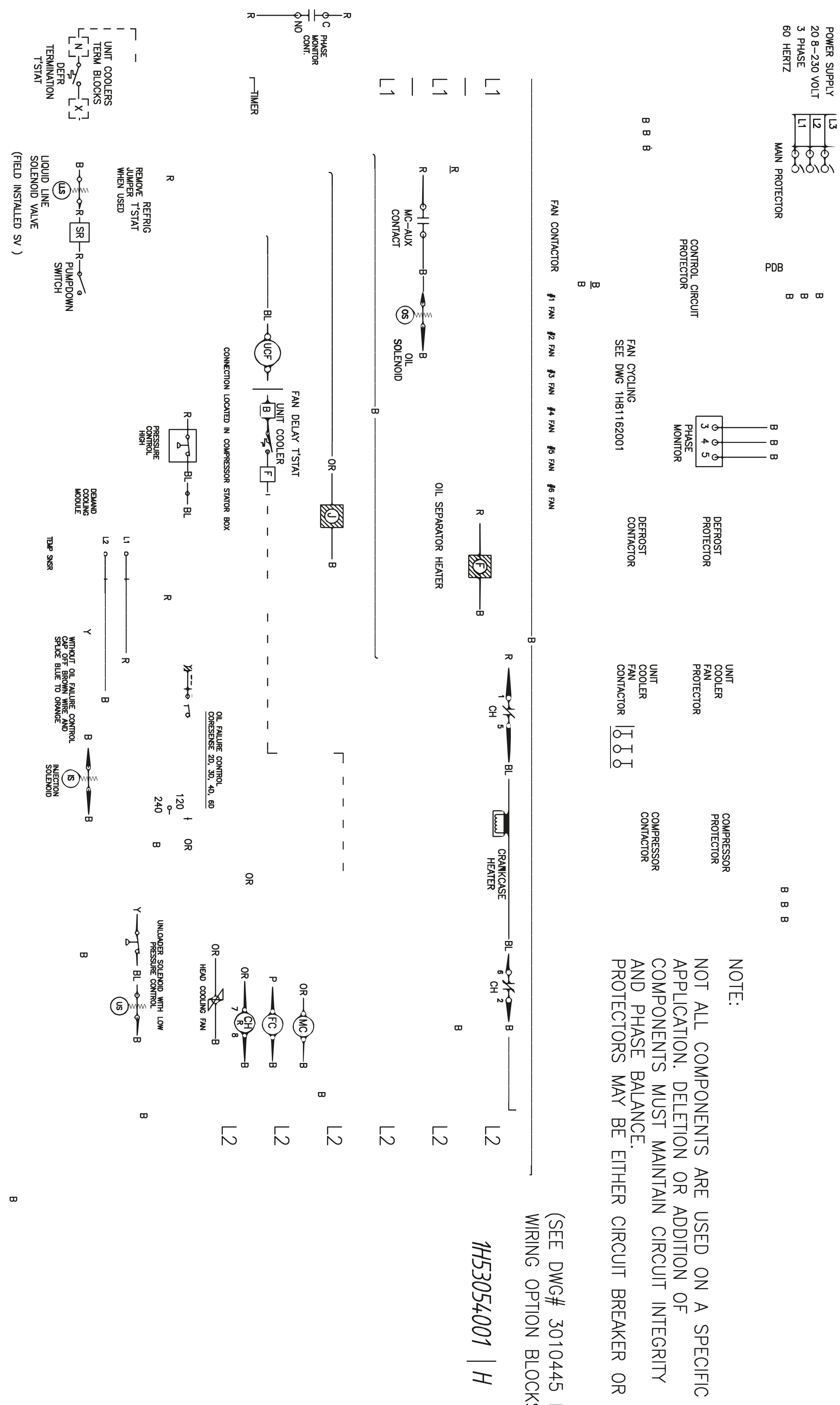
All diagrams show the electrical system DE-energized and in refrigeration mode. Diagrams emphasize individual circuit continuity and logic. They aid troubleshooting and testing by identifying point-to-point connections. Color coding wires allows easy transfer to the control panel. The diagrams normally move from left to right so the user can read the series of components and their terminals which make up a circuit.

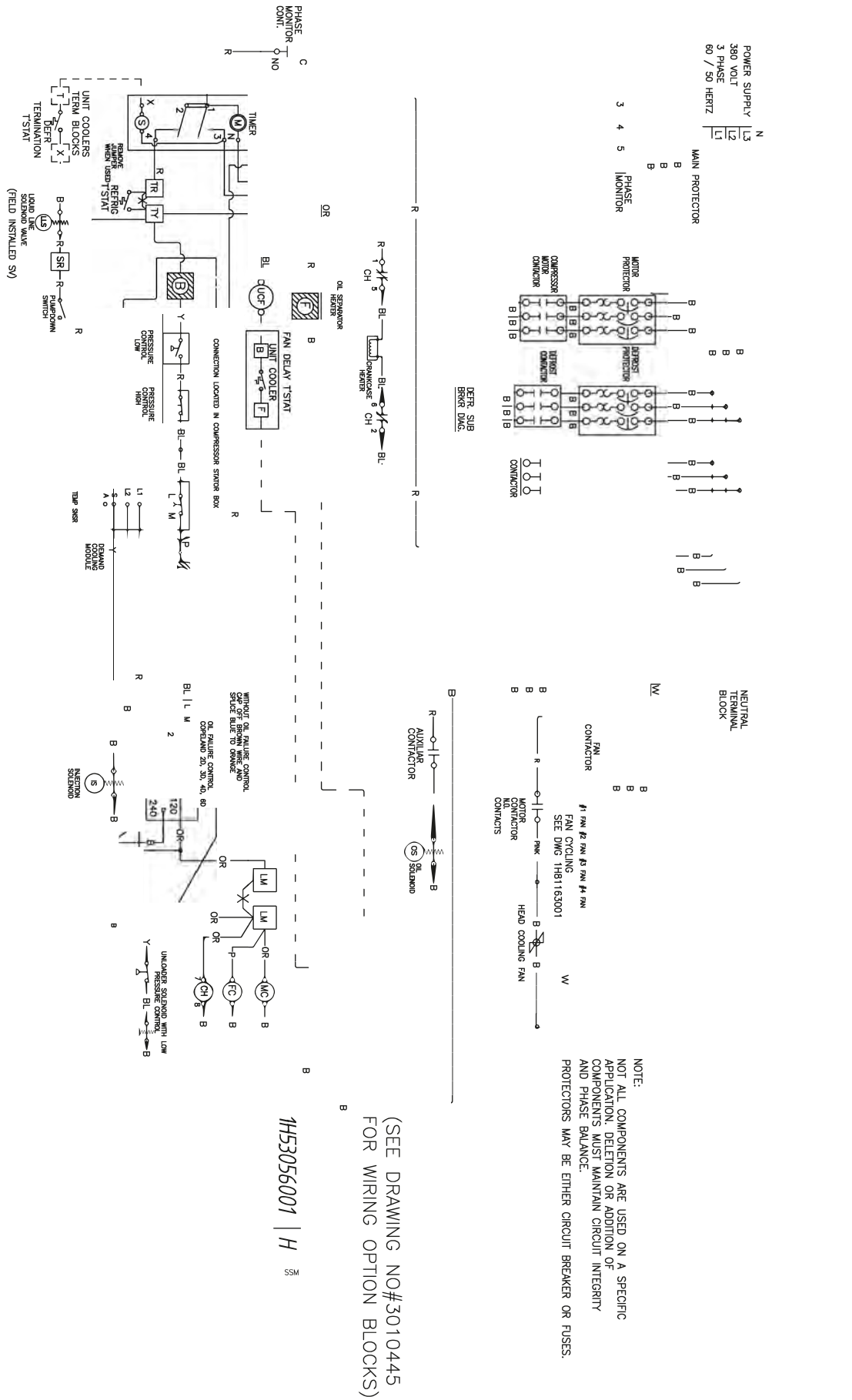
Generally, in a control circuit the loads are limited to coils, lights, and bells. By identifying one control circuit load and “reading” the schematic to the load, the sequence of operation becomes obvious. Troubleshooting that circuit then breaks into test point terminals. Take only one circuit at the time.

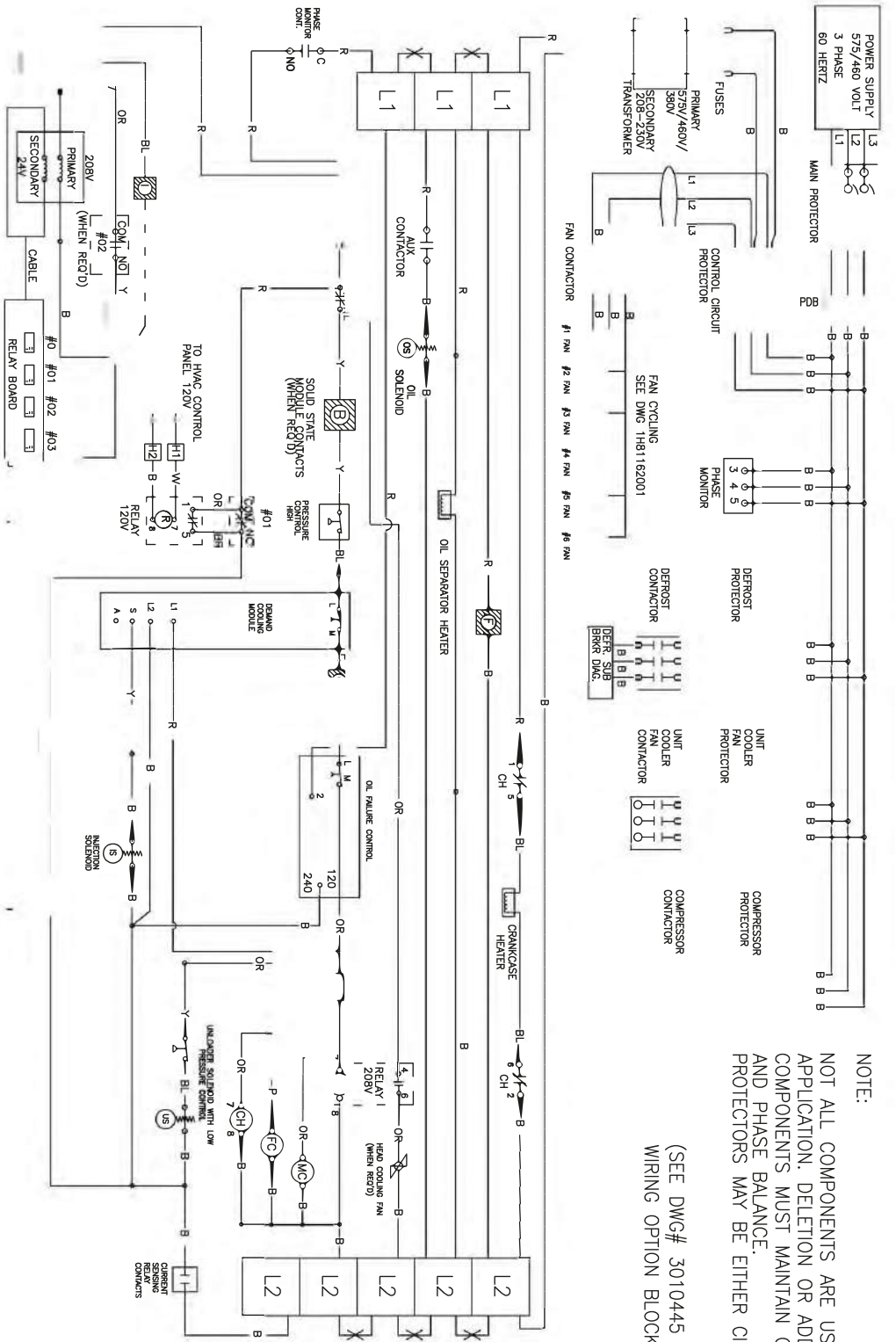
Important Note:

The electrical diagrams in this section show circuit logic. They are not intended for troubleshooting or design work. For unit cooler fan power, electric defrost sub circuit balance, and other location specific circuits refer to the schematics on control panel.


DIAGRAM–COMPR/DEFROST/UNIT COOLER:208–230V/1PH – THERMOSTAT:
POWER SUPPLY
208–230 VOLT
1 PHASE
60 HERTZ
NOTE:
NOT ALL COMPONENTS ARE USED ON A SPECIFIC APPLICATION. DELETION OR ADDITION OF COMPONENTS MUST MAINTAIN CIRCUIT INTEGRITY AND PHASE BALANCE.
PROTECTORS MAY BE EITHER CIRCUIT BREAKER OR FUSES.
(SEE DRAWING NO#3010445 FOR WIRING OPTION BLOCKS)
APPLY 18AWG CONDUCTORS ON CONTROL CIRCUIT WIRING BELOW
CONTROL CIRCUIT PROTECTOR
COMPRESSOR PROTECTOR
COMPRESSOR CONTACTOR
DEFROST PROTECTOR
DEFROST CONTACTOR
UNIT COOLER FAN PROTECTOR
UNIT COOLER FAN CONTACTOR
FAN CYCLING SEE DWG 1HB161001
FAN CONTACTOR
OIL SEPARATOR HEATER
CRANKCASE HEATER
AUXILIAR CONTACTOR
OIL SOLENOID
FAN DELAY T'STAT
UNIT COOLER
PHASE MONITOR
TIMER
UNIT COOLERS TERM BLOCKS
DEFR TERMINATION T'STAT
REFRIG T'STAT
LIQUID LINE SOLENOID VALVE (FIELD INSTALLED SV)
PUMPDOWN SWITCH
1H53050001 | H


POWER SUPPLY
208-230 VOLT
3 PHASE
60 HERTZ
MAIN PROTECTOR
PDB
CONTROL CIRCUIT PROTECTOR
FAN CONTACTOR
FAN CYCLING
SEE DWG 1H8116200I
PHASE MONITOR
DEFROST PROTECTOR
DEFROST CONTACTOR
UNIT COOLER FAN PROTECTOR
UNIT COOLER FAN CONTACTOR
COMPRESSOR PROTECTOR
COMPRESSOR CONTACTOR
NOTE:
NOT ALL COMPONENTS ARE USED ON A SPECIFIC APPLICATION. DELETION OR ADDITION OF COMPONENTS MUST MAINTAIN CIRCUIT INTEGRITY AND PHASE BALANCE.
PROTECTORS MAY BE EITHER CIRCUIT BREAKER OR FUSES.
(SEE DWG# 3010445 FOR WIRING OPTION BLOCKS.)
OIL SEPARATOR HEATER
CRANKCASE HEATER
MC-AUX CONTACT
OIL SOLENOID
FAN DELAY T'STAT
UNIT COOLER
CONNECTION LOCATED IN COMPRESSOR STATOR BOX
PHASE MONITOR CONT.
TIMER
UNIT COOLERS TERM BLOCKS
DEFR TERMINATION T'STAT
REMOVE REFRIG JUMPER T'STAT WHEN USED
LIQUID LINE SOLENOID VALVE
(FIELD INSTALLED SV)
PUMPDOWN SWITCH
HIGH PRESSURE CONTROL
DEMAND COOLING MODULE
TEMP SNSR
WITHOUT OIL FAILURE CONTROL CAP OFF BROWN WIRE AND SPLICE BLUE TO ORANGE
INJECTION SOLENOID
OIL FAILURE CONTROL
CORESENSE 2D, 3D, 4D, 6D
HEAD COOLING FAN
UNLOADER SOLENOID WITH LOW PRESSURE CONTROL
1H53054001 | H
HUSSM

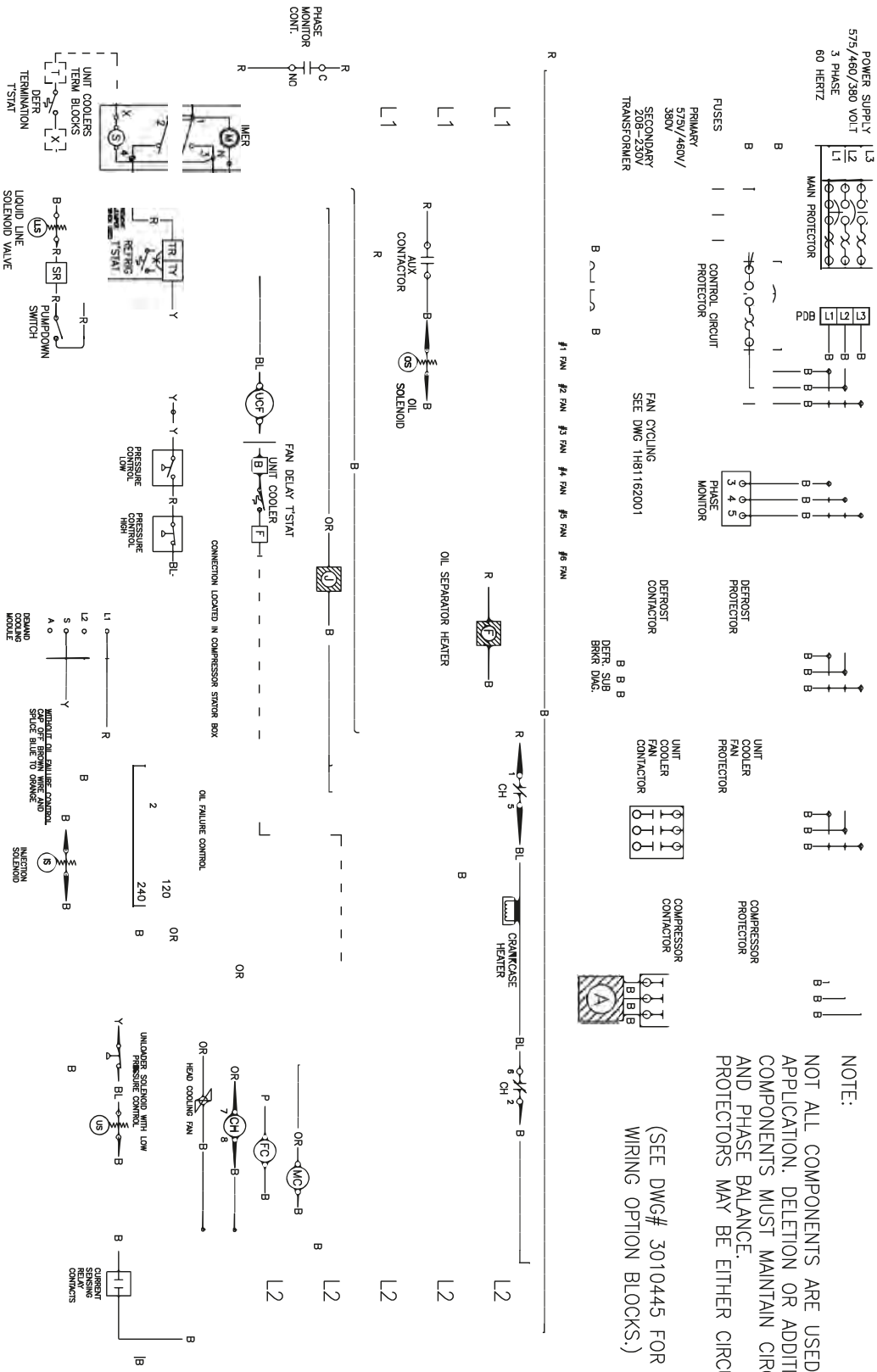

POWER SUPPLY
380 VOLT
3 PHASE
60 / 50 HERTZ
MAIN PROTECTOR
PHASE MONITOR
MOTOR PROTECTOR
COMPRESSOR MOTOR CONTACTOR
DEFROST PROTECTOR
DEFROST CONTACTOR
CONTACTOR
NEUTRAL TERMINAL BLOCK
FAN CONTACTOR
#1 FAN #2 FAN #3 FAN #4 FAN
FAN CYCLING
SEE DWG 1H8116300
MOTOR CONTACTOR N.O. CONTACTS
HEAD COOLING FAN
PHASE MONITOR CONT.
TIMER
UNIT COOLERS TERM BLOCKS
TERMINATION T'STAT
REMOVE JUMPER WHEN USED T'STAT
REFRIG T'STAT
LIQUID LINE SOLENOID VALVE (FIELD INSTALLED SV)
PUMPDOWN SWITCH
OIL SEPARATOR HEATER
CRANKCASE HEATER
FAN DELAY T'STAT
UNIT COOLER
CONNECTION LOCATED IN COMPRESSOR STATOR BOX
PRESSURE CONTROL LOW
PRESSURE CONTROL HIGH
TEMP SNSR
DEMAND COOLING MODULE
DEFR. SUB BRKR DIAG.
AUXILIAR CONTACTOR
OIL SOLENOID
OIL FAILURE CONTROL COPELAND 20, 30, 40, 60
WITHOUT OIL FAILURE CONTROL JUMPER WIRE AND SPACE BLUE TO ORANGE
UNLOADER SOLENOID
UNLOADER SOLENOID WITH LOW PRESSURE CONTROL
NOTE:
NOT ALL COMPONENTS ARE USED ON A SPECIFIC APPLICATION. DELETION OR ADDITION OF COMPONENTS MUST MAINTAIN CIRCUIT INTEGRITY AND PHASE BALANCE.
PROTECTORS MAY BE EITHER CIRCUIT BREAKER OR FUSES.
(SEE DRAWING NO#3010445 FOR WIRING OPTION BLOCKS)
1H53056001 | H
SSM

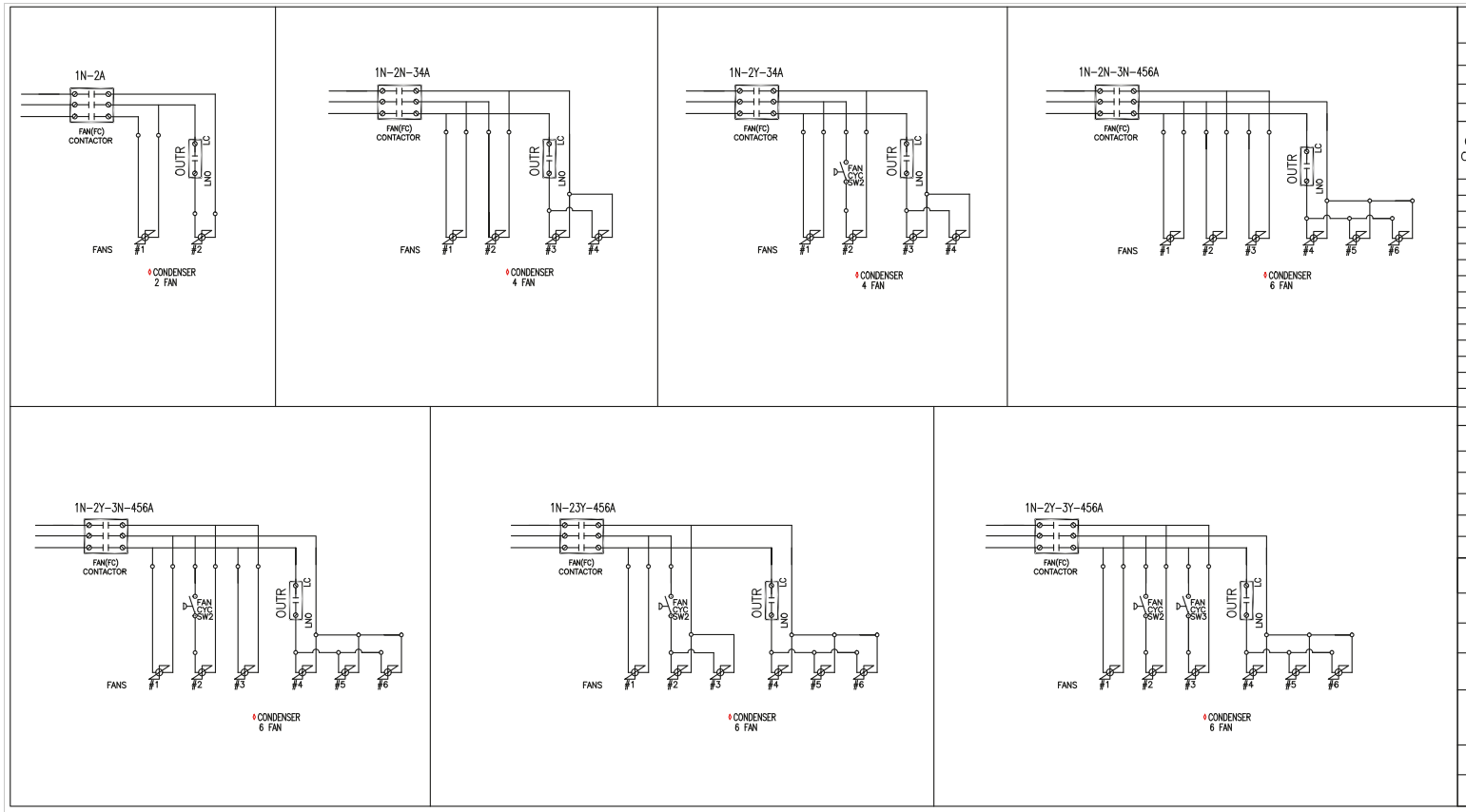


NOTE:

NOT ALL COMPONENTS ARE USED ON A SPECIFIC APPLICATION. DELETION OR ADDITION OF COMPONENTS MUST MAINTAIN CIRCUIT INTEGRITY AND PHASE BALANCE. PROTECTORS MAY BE EITHER CIRCUIT BREAKER OR FUSES.

(SEE DWG# 3010445 FOR WIRING OPTION BLOCKS.)


POWER SUPPLY
575/460/380 VOLT
3 PHASE
60 HERTZ
MAIN PROTECTOR
PDB
FUSES
PRIMARY
575V/460V/
380V
SECONDARY
208-230V
TRANSFORMER
CONTROL CIRCUIT
PROTECTOR
PHASE
MONITOR
FAN CYCLING
SEE DWG 1H81162001
DEFROST
CONTACTOR
DEFROST
PROTECTOR
DEFR. SUB
BRKR DIAG.
UNIT
COOLER
FAN
CONTACTOR
UNIT
COOLER
FAN
PROTECTOR
COMPRESSOR
CONTACTOR
COMPRESSOR
PROTECTOR
#1 FAN
#2 FAN
#3 FAN
#4 FAN
#5 FAN
#6 FAN
OIL SEPARATOR HEATER
CRANKCASE
HEATER
AUX
CONTACTOR
OIL
SOLENOID
PHASE
MONITOR
CONT.
UNIT COOLERS
TERM BLOCKS
DEFR
TERMINATION
T'STAT
IMER
RETRO
T'STAT
LIQUID LINE
SOLENOID VALVE
PUMPDOWN
SWITCH
FAN DELAY T'STAT
UNIT COOLER
PRESSURE
CONTROL
LOW
PRESSURE
CONTROL
HIGH
CONNECTION LOCATED IN COMPRESSOR STATOR BOX
OIL FAILURE CONTROL
WITHOUT OIL FAILURE CONTROL
CAP OFF BROWN WIRE AND
SPLICE BLUE TO ORANGE
INJECTION
SOLENOID
DEMAND
COOLING
MODULE
HEAD COOLING FAN
UNLOADER SOLENOID WITH LOW
PRESSURE CONTROL
CURRENT
SENSING
RELAY
CONTACTS
NOTE:
NOT ALL COMPONENTS ARE USED ON A SPECIFIC
APPLICATION. DELETION OR ADDITION OF
COMPONENTS MUST MAINTAIN CIRCUIT INTEGRITY
AND PHASE BALANCE.
PROTECTORS MAY BE EITHER CIRCUIT BREAKER OR FUSES.
(SEE DWG# 3010445 FOR
WIRING OPTION BLOCKS.)
0705469 H
HUSSM



VOLTAGE PHASE TAPE OR CONDUCTOR COLOR			
V/L	L1	L2	L3
208V	BLACK	RED	BLUE
460/380V	BROWN	ORANGE	YELLOW
575V	RED	BLACK	BLUE

CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
50	8
60	6
70	4
80	4
90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
RD = RED	YL = YELLOW
BL= BLUE	WH = WHITE
OR= ORANGE	BR= BROWN
PR = PURPLE	BK = BLACK
PK= PINK	GR= GRAY

LEGEND

- – NORMALLY OPEN CONTACT
- – NORMALLY CLOSE CONTACT
- – ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- OUTR LC LNO – AMBIENT TEMP SNSR NORMALLY OPEN CONTACT
- – WIRE CONNECTION SPLICE
- – CONDENSER FAN

FAN CYCLING NOTES:
1. MAKE LABELS FOR FANS AND CORRESPONDING CYCLING SWITCHES AS FOLLOWS:
   LABEL FANS AS FAN#1, FAN#2, FAN#3, ETC.
   LABEL CYCLING SWITCHES AS FAN CYC SW2, FAN CYC SW3, ETC.

REVISION HISTORY					
REV	DATE	REVISION DESCRIPTION	REV BY	CHKD BY	APPR BY
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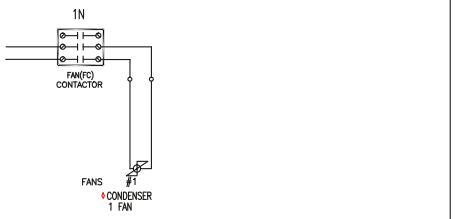
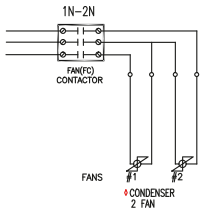
MATERIAL- ----
MODEL BY / DWG BY-KARTHIK
CHECKED BY- KARTHIK
APPROVED BY- KH
REF- SUPERSEDES:
DATE DRAWN -26SEPT19
SHEET 1 OF 9
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
DECIMALS .XX ±.03, .XXX ±.010
ANGLES ± 2°
THIRD ANGLE PROJECTION

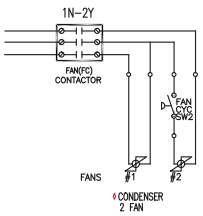
HUSSMANN®

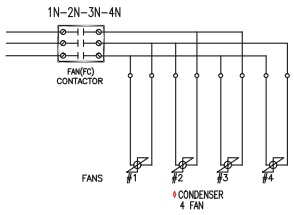
CONDENSER FAN WIRING
HE OUTDOOR UNIT

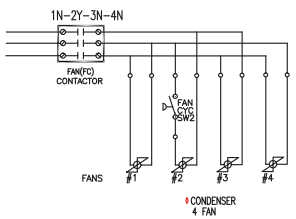
208V-3PH | 0

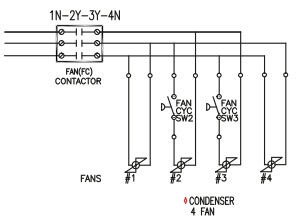


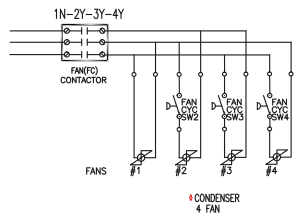


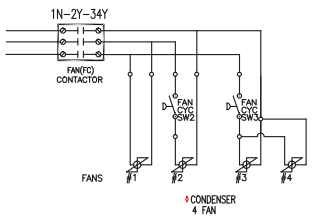


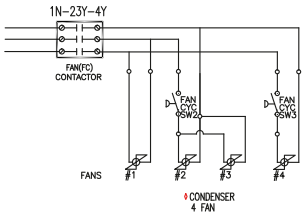












VOLTAGE PHASE TAPE OR CONDUCTOR COLOR			
V/L	L1	L2	L3
208V	BLACK	RED	BLUE
460/380V	BROWN	ORANGE	YELLOW
575V	RED	BLACK	BLUE

CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
50	8
60	6
70	4
80	4
90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
RD = RED	YL = YELLOW
BL= BLUE	WH = WHITE
OR= ORANGE	BR= BROWN
PR = PURPLE	BK = BLACK
PK= PINK	GR= GRAY

LEGEND

- NORMALLY OPEN CONTACT
- NORMALLY CLOSE CONTACT
- ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- OUTR — AMBIENT TEMP SNSR NORMALLY OPEN CONTACT (LC, LNO)
- WIRE CONNECTION SPLICE
- CONDENSER FAN

FAN CYCLING NOTES:
1. MAKE LABELS FOR FANS AND CORRESPONDING CYCLING SWITCHES AS FOLLOWS:
   LABEL FANS AS FAN#1, FAN#2, FAN#3, ETC.
   LABEL CYCLING SWITCHES AS FAN CYC SW2, FAN CYC SW3, ETC.

REVISION HISTORY

REV	DATE	REVISION DESCRIPTION	REV BY	CHKD BY	APPR BY
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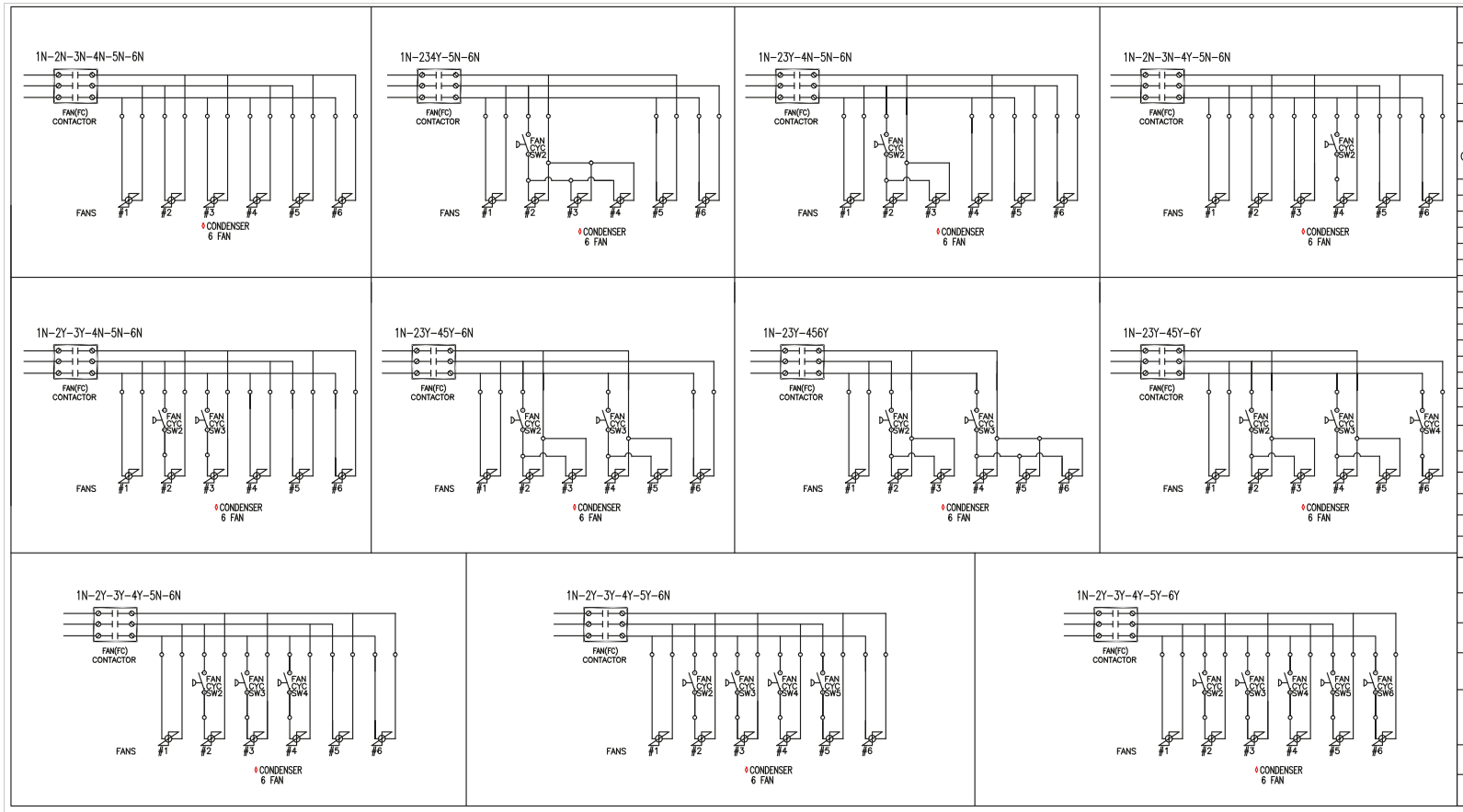
MATERIAL-----
MODEL BY / DWG BY-KARTHIK
CHECKED BY- KARTHIK
APPROVED BY- KH
REF- SUPERSEDES
DATE DRAWN -26SEPT19
SHEET 2 OF 9
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
DECIMALS .XX ±.03, .XXX ±.010
ANGLES ± 2°
THIRD ANGLE PROJECTION

HUSSMANN®

CONDENSER FAN WIRING
FAN 2 & 4

208V-3PH | 0



VOLTAGE PHASE TAPE OR CONDUCTOR COLOR			
V/L	L1	L2	L3
208V	BLACK	RED	BLUE
460/380V	BROWN	ORANGE	YELLOW
575V	RED	BLACK	BLUE

CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
50	8
60	6
70	4
80	4
90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
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BL= BLUE	WH = WHITE
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LEGEND

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- – NORMALLY CLOSE CONTACT
- – ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- OUTR LC LNO – AMBIENT TEMP SNSR NORMALLY OPEN CONTACT
- – WIRE CONNECTION SPLICE
- – CONDENSER FAN

FAN CYCLING NOTES:

1. MAKE LABELS FOR FANS AND CORRESPONDING CYCLING SWITCHES AS FOLLOWS:
   LABEL FANS AS FAN#1, FAN#2, FAN#3, ETC.
   LABEL CYCLING SWITCHES AS FAN CYC SW2, FAN CYC SW3, ETC.

REVISION HISTORY					
REV	DATE	REVISION DESCRIPTION	REV BY	CHKD BY	APPR BY
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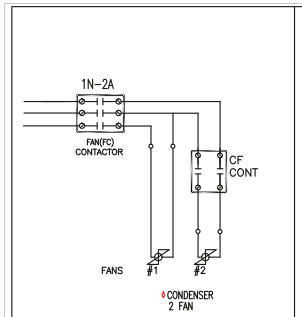
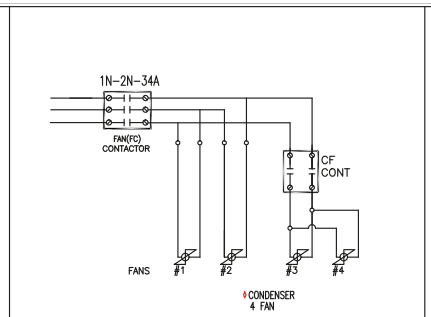
MATERIAL-----
MODEL BY / DWG BY-KARTHIK
CHECKED BY- KARTHIK
APPROVED BY- KH
REF- SUPERSEDES
DATE DRAWN -26SEPT19
SHEET 3 OF 9
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
DECIMALS .XX ±.03, .XXX ±.010
ANGLES ± 2°
THIRD ANGLE PROJECTION

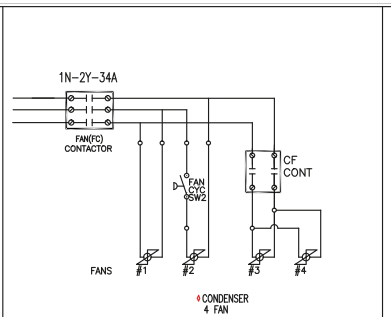
HUSSMANN®

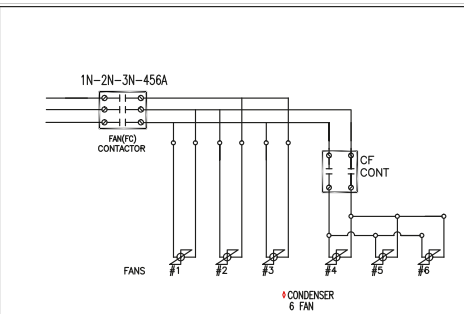
CONDENSER FAN WIRING
FAN 6

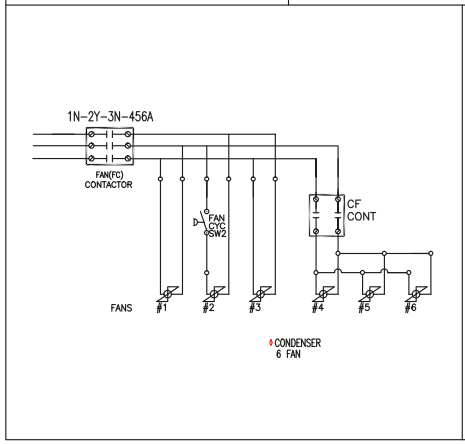
208V-3PH | 0

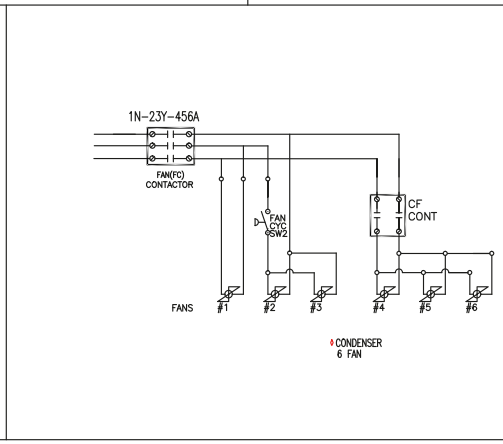


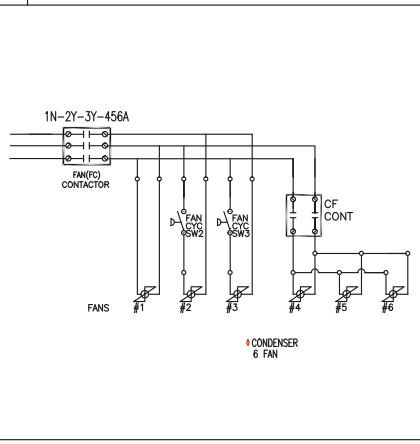












VOLTAGE PHASE TAPE OR CONDUCTOR COLOR			
V/L	L1	L2	L3
208V	BLACK	RED	BLUE
460/380V	BROWN	ORANGE	YELLOW
575V	RED	BLACK	BLUE

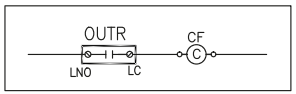
CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
50	8
60	6
70	4
80	4
90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
RD = RED	YL = YELLOW
BL= BLUE	WH = WHITE
OR= ORANGE	BR= BROWN
PR = PURPLE	BK = BLACK
PK= PINK	GR= GRAY

LEGEND

- NORMALLY OPEN CONTACT
- NORMALLY CLOSE CONTACT
- ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- OUTR (LC, LNO) – AMBIENT TEMP SNSR NORMALLY OPEN CONTACT
- CONTACTOR COIL
- WIRE CONNECTION SPLICE
- CONDENSER FAN

FAN CYCLING NOTES:
1. MAKE LABELS FOR FANS AND CORRESPONDING CYCLING SWITCHES AS FOLLOWS:
   LABEL FANS AS FAN#1, FAN#2, FAN#3, ETC.
   LABEL CYCLING SWITCHES AS FAN CYC SW2, FAN CYC SW3, ETC.



REVISION HISTORY					
REV	DATE	REVISION DESCRIPTION	REV BY	CHKD BY	APPR BY
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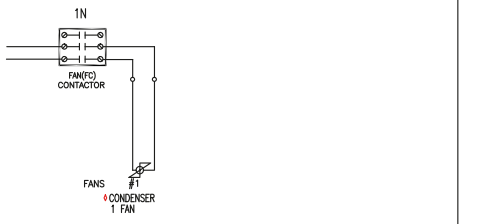
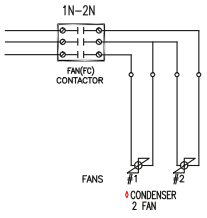
MATERIAL-----
MODEL BY / DWG BY-KARTHIK
CHECKED BY- KARTHIK
APPROVED BY- KH REF- SUPERSEDES:
DATE DRAWN -26SEPT19 SHEET 4 OF 9
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE: DECIMALS .XX ±.03, .XXX ±.010 ANGLES ± 2°
THIRD ANGLE PROJECTION

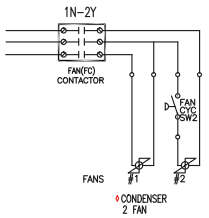
HUSSMANN®

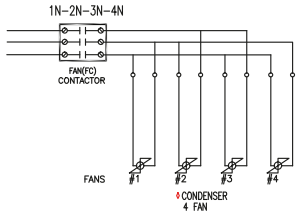
CONDENSER FAN WIRING HE OUTDOOR UNIT

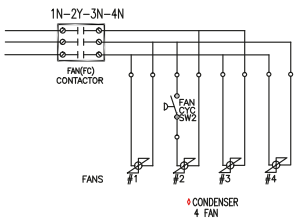
380/460/575V-3PH | 0

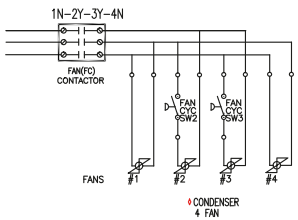


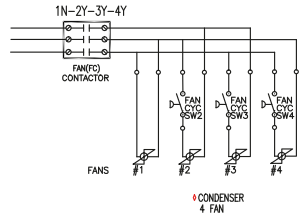


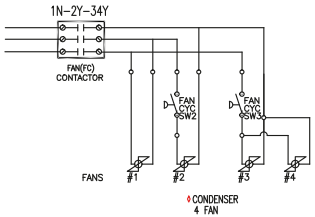


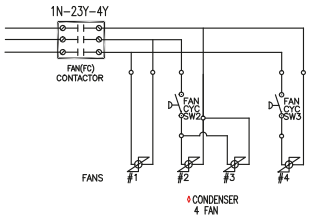












VOLTAGE PHASE TAPE OR CONDUCTOR COLOR			
V/L	L1	L2	L3
208V	BLACK	RED	BLUE
460/380V	BROWN	ORANGE	YELLOW
575V	RED	BLACK	BLUE

CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
50	8
60	6
70	4
80	4
90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
RD = RED	YL = YELLOW
BL= BLUE	WH = WHITE
OR= ORANGE	BR= BROWN
PR = PURPLE	BK = BLACK
PK= PINK	GR= GRAY

LEGEND

- – NORMALLY OPEN CONTACT
- – NORMALLY CLOSE CONTACT
- – ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- OUTR LC LNO – AMBIENT TEMP SNSR NORMALLY OPEN CONTACT
- – WIRE CONNECTION SPLICE
- – CONDENSER FAN

FAN CYCLING NOTES:
1. MAKE LABELS FOR FANS AND CORRESPONDING CYCLING SWITCHES AS FOLLOWS:
   LABEL FANS AS FAN#1, FAN#2, FAN#3, ETC.
   LABEL CYCLING SWITCHES AS FAN CYC SW2, FAN CYC SW3, ETC.

REVISION HISTORY

REV	DATE	REVISION DESCRIPTION	REV BY	CHKD BY	APPR BY
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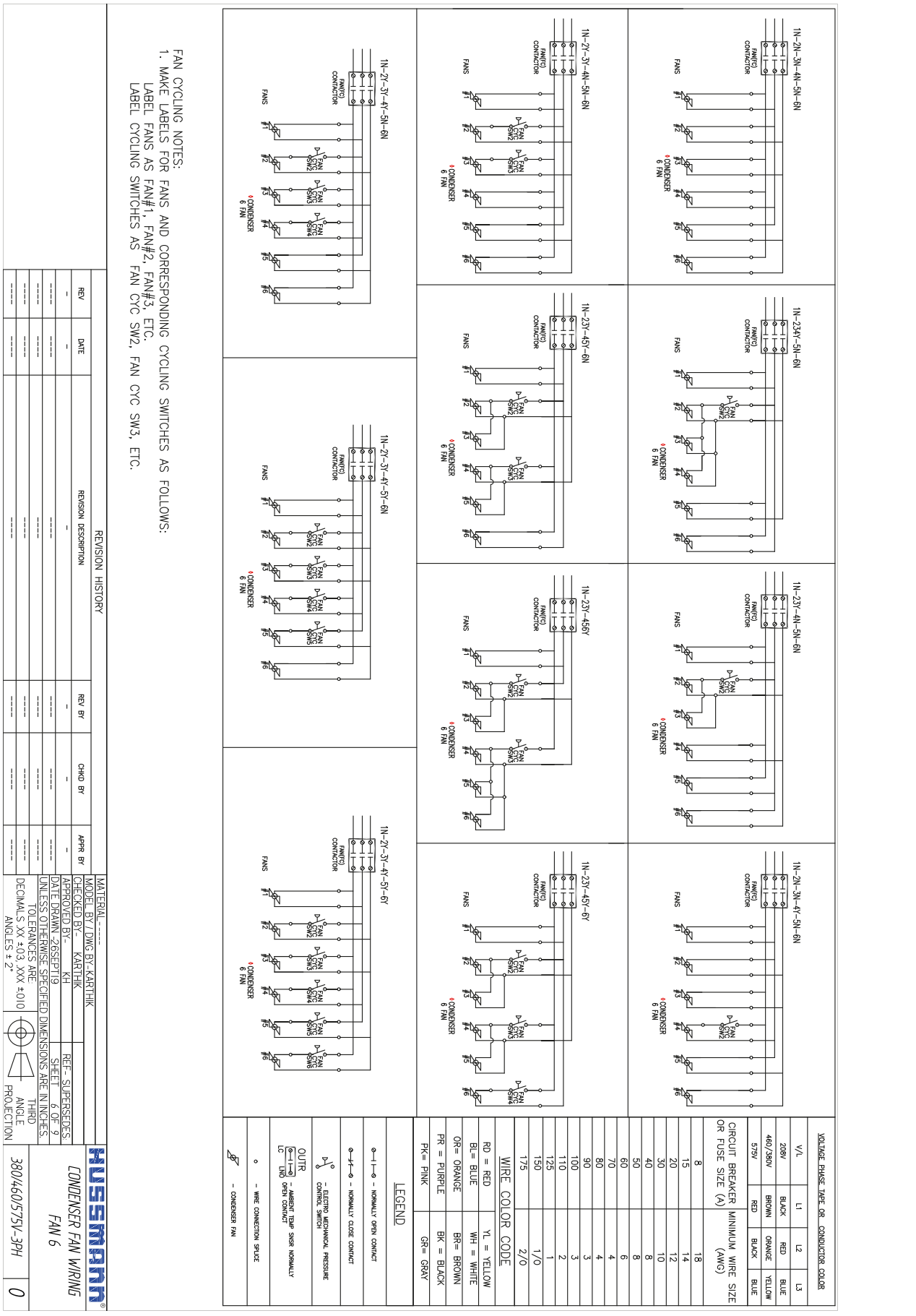
MATERIAL- ----
MODEL BY / DWG BY-KARTHIK
CHECKED BY- KARTHIK
APPROVED BY- KH
REF- SUPERSEDES:
DATE DRAWN -26SEPT19
SHEET 5 OF 9
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
DECIMALS .XX ±.03, .XXX ±.010
ANGLES ± 2°
THIRD ANGLE PROJECTION

HUSSMANN®

CONDENSER FAN WIRING
FAN 2 & 4

380/460/575V-3PH | 0



VOLTAGE PHASE TAPE OR CONDUCTOR COLOR				
	V/L	L1	L2	L3
	208V	BLACK	RED	BLUE
	460/380V	BROWN	ORANGE	YELLOW
	575V	RED	BLACK	BLUE

CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
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90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
RD = RED	YL = YELLOW
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PK= PINK	GR= GRAY

LEGEND

- NORMALLY OPEN CONTACT
- NORMALLY CLOSE CONTACT
- ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- AMBIENT TEMP SNSR NORMALLY OPEN CONTACT
- WIRE CONNECTION SPLICE
- CONDENSER FAN

FAN CYCLING NOTES:

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REVISION HISTORY

REV	DATE	REVISION DESCRIPTION	REV BY	CHKD BY	APPR BY
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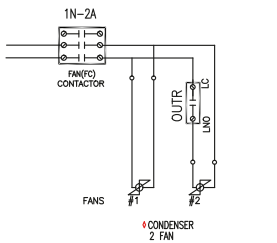
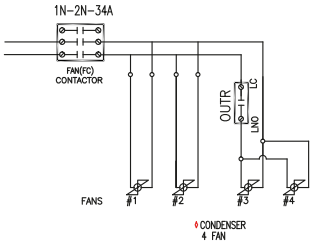
MATERIAL: -----
MODEL BY / DWG BY: KARTHIK
CHECKED BY: KARTHIK
APPROVED BY: KH
DATE DRAWN: 26SEP19
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
DECIMALS .XX ±.03, .XXX ±.010
ANGLES ± 2°
THIRD ANGLE PROJECTION

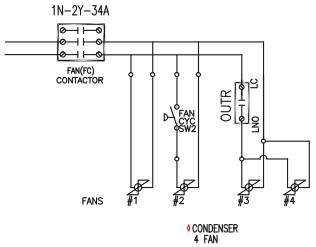
REF- SUPERSEDES
SHEET 6 OF 9

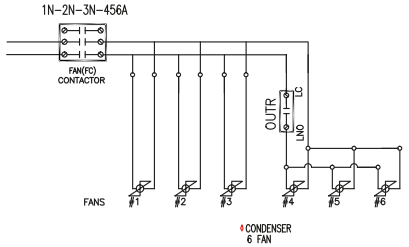
HUSSMANN®

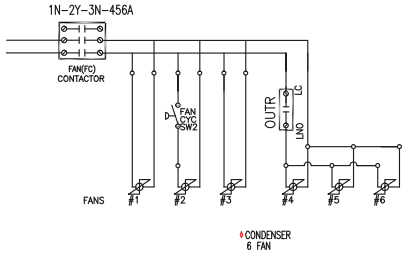
CONDENSER FAN WIRING
FAN 6
380/460/575V-3PH
0

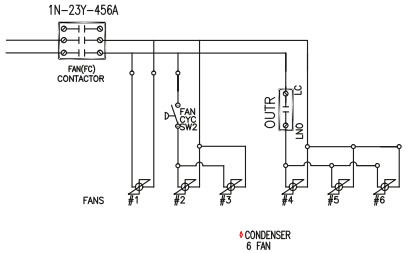


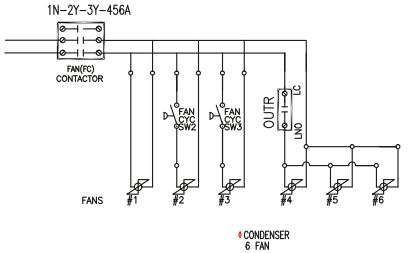












VOLTAGE PHASE TAPE OR CONDUCTOR COLOR			
V/L	L1	L2	L3
208V	BLACK	RED	BLUE
460/380V	BROWN	ORANGE	YELLOW
575V	RED	BLACK	BLUE

CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
50	8
60	6
70	4
80	4
90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
RD = RED	YL = YELLOW
BL= BLUE	WH = WHITE
OR= ORANGE	BR= BROWN
PR = PURPLE	BK = BLACK
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LEGEND

- – NORMALLY OPEN CONTACT
- – NORMALLY CLOSE CONTACT
- – ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- OUTR LC LNO – AMBIENT TEMP SNSR NORMALLY OPEN CONTACT
- – WIRE CONNECTION SPLICE
- – CONDENSER FAN

FAN CYCLING NOTES:
1. MAKE LABELS FOR FANS AND CORRESPONDING CYCLING SWITCHES AS FOLLOWS:
   LABEL FANS AS FAN#1, FAN#2, FAN#3, ETC.
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REVISION HISTORY

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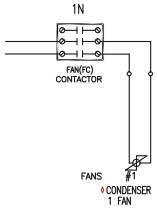
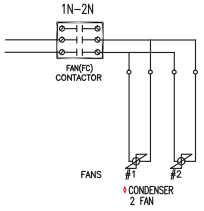
MATERIAL-----
MODEL BY / DWG BY-KARTHIK
CHECKED BY- KARTHIK
APPROVED BY- KH
REF- SUPERSEDES:
DATE DRAWN -26SEPT19
SHEET 7 OF 9
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
DECIMALS .XX ±.03, .XXX ±.010
ANGLES ± 2°
THIRD ANGLE PROJECTION

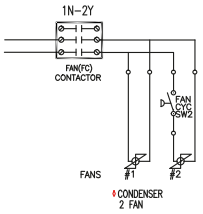
HUSSMANN®

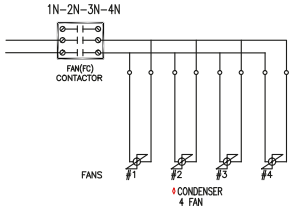
CONDENSER FAN WIRING
HE OUTDOOR UNIT

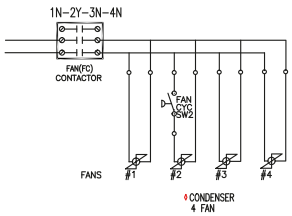
208V-1PH | 0

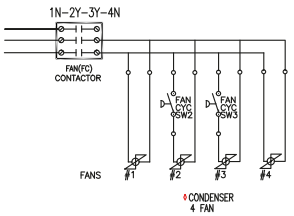


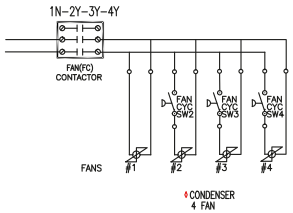


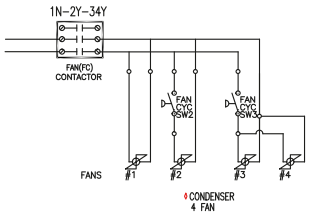


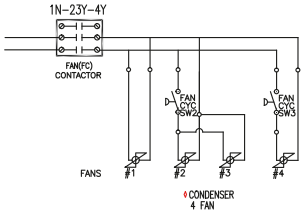












VOLTAGE PHASE TAPE OR CONDUCTOR COLOR			
V/L	L1	L2	L3
208V	BLACK	RED	BLUE
460/380V	BROWN	ORANGE	YELLOW
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CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
50	8
60	6
70	4
80	4
90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
RD = RED	YL = YELLOW
BL= BLUE	WH = WHITE
OR= ORANGE	BR= BROWN
PR = PURPLE	BK = BLACK
PK= PINK	GR= GRAY

LEGEND

- NORMALLY OPEN CONTACT
- NORMALLY CLOSE CONTACT
- ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- OUTR, LC, LNO – AMBIENT TEMP SNSR NORMALLY OPEN CONTACT
- WIRE CONNECTION SPLICE
- CONDENSER FAN

FAN CYCLING NOTES:
1. MAKE LABELS FOR FANS AND CORRESPONDING CYCLING SWITCHES AS FOLLOWS:
   LABEL FANS AS FAN#1, FAN#2, FAN#3, ETC.
   LABEL CYCLING SWITCHES AS FAN CYC SW2, FAN CYC SW3, ETC.

REVISION HISTORY

REV	DATE	REVISION DESCRIPTION	REV BY	CHKD BY	APPR BY
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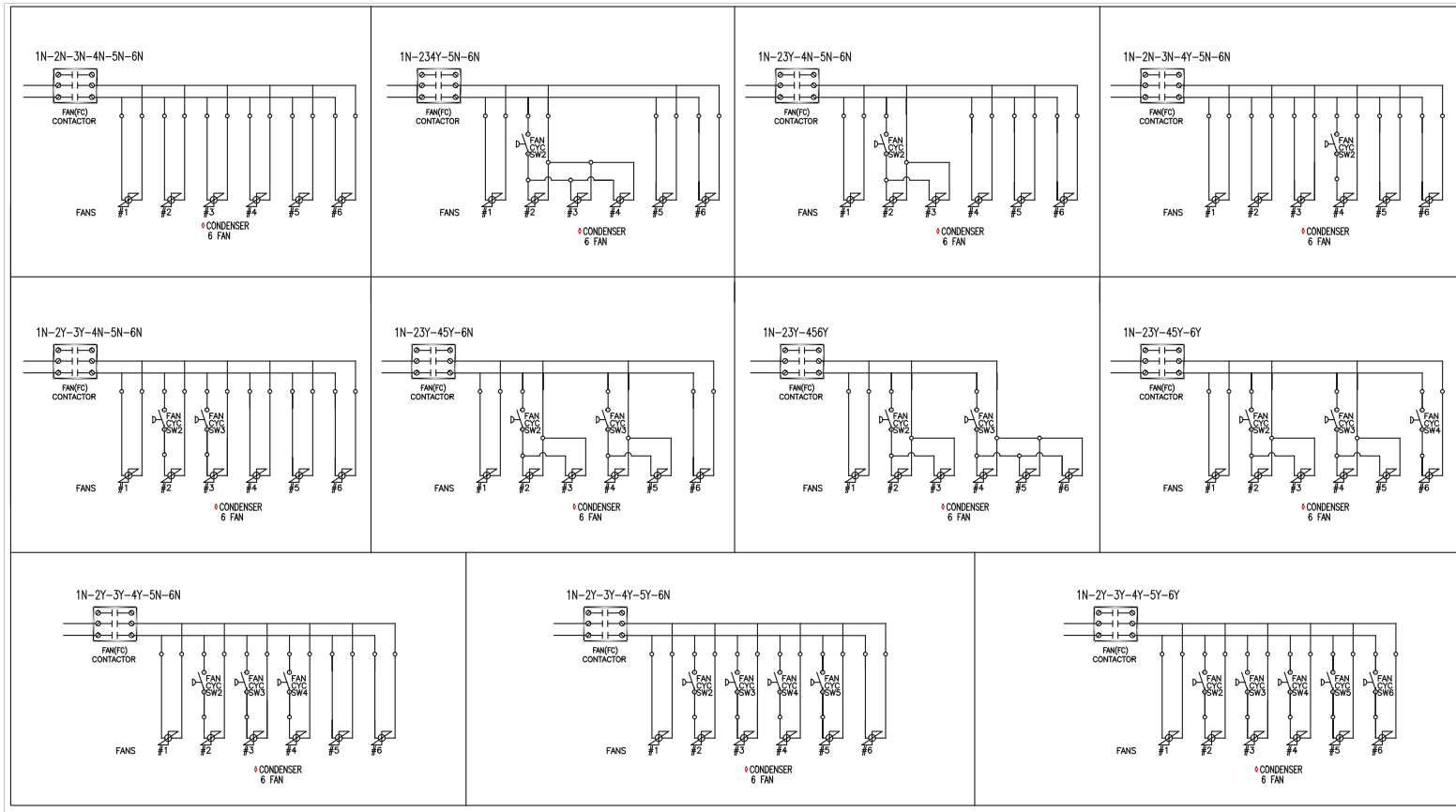
MATERIAL- ----
MODEL BY / DWG BY-KARTHIK
CHECKED BY- KARTHIK
APPROVED BY- KH
REF- SUPERSEDES:
DATE DRAWN -26SEPT19
SHEET 8 OF 9
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
DECIMALS .XX ±.03, .XXX ±.010
ANGLES ± 2°
THIRD ANGLE PROJECTION

HUSSMANN®

CONDENSER FAN WIRING
FAN 2 & 4

208V-1PH | 0



VOLTAGE PHASE TAPE OR CONDUCTOR COLOR			
V/L	L1	L2	L3
208V	BLACK	RED	BLUE
460/380V	BROWN	ORANGE	YELLOW
575V	RED	BLACK	BLUE

CIRCUIT BREAKER OR FUSE SIZE (A)	MINIMUM WIRE SIZE (AWG)
8	18
15	14
20	12
30	10
40	8
50	8
60	6
70	4
80	4
90	3
100	3
110	2
125	1
150	1/0
175	2/0

WIRE COLOR CODE	
RD = RED	YL = YELLOW
BL= BLUE	WH = WHITE
OR= ORANGE	BR= BROWN
PR = PURPLE	BK = BLACK
PK= PINK	GR= GRAY

LEGEND

- NORMALLY OPEN CONTACT
- NORMALLY CLOSE CONTACT
- ELECTRO MECHANICAL PRESSURE CONTROL SWITCH
- OUTR — AMBIENT TEMP SNSR NORMALLY OPEN CONTACT (LC, LNO)
- WIRE CONNECTION SPLICE
- CONDENSER FAN

FAN CYCLING NOTES:
1. MAKE LABELS FOR FANS AND CORRESPONDING CYCLING SWITCHES AS FOLLOWS:
   LABEL FANS AS FAN#1, FAN#2, FAN#3, ETC.
   LABEL CYCLING SWITCHES AS FAN CYC SW2, FAN CYC SW3, ETC.

REVISION HISTORY

REV	DATE	REVISION DESCRIPTION	REV BY	CHKD BY	APPR BY
-	-	-	-	-	-
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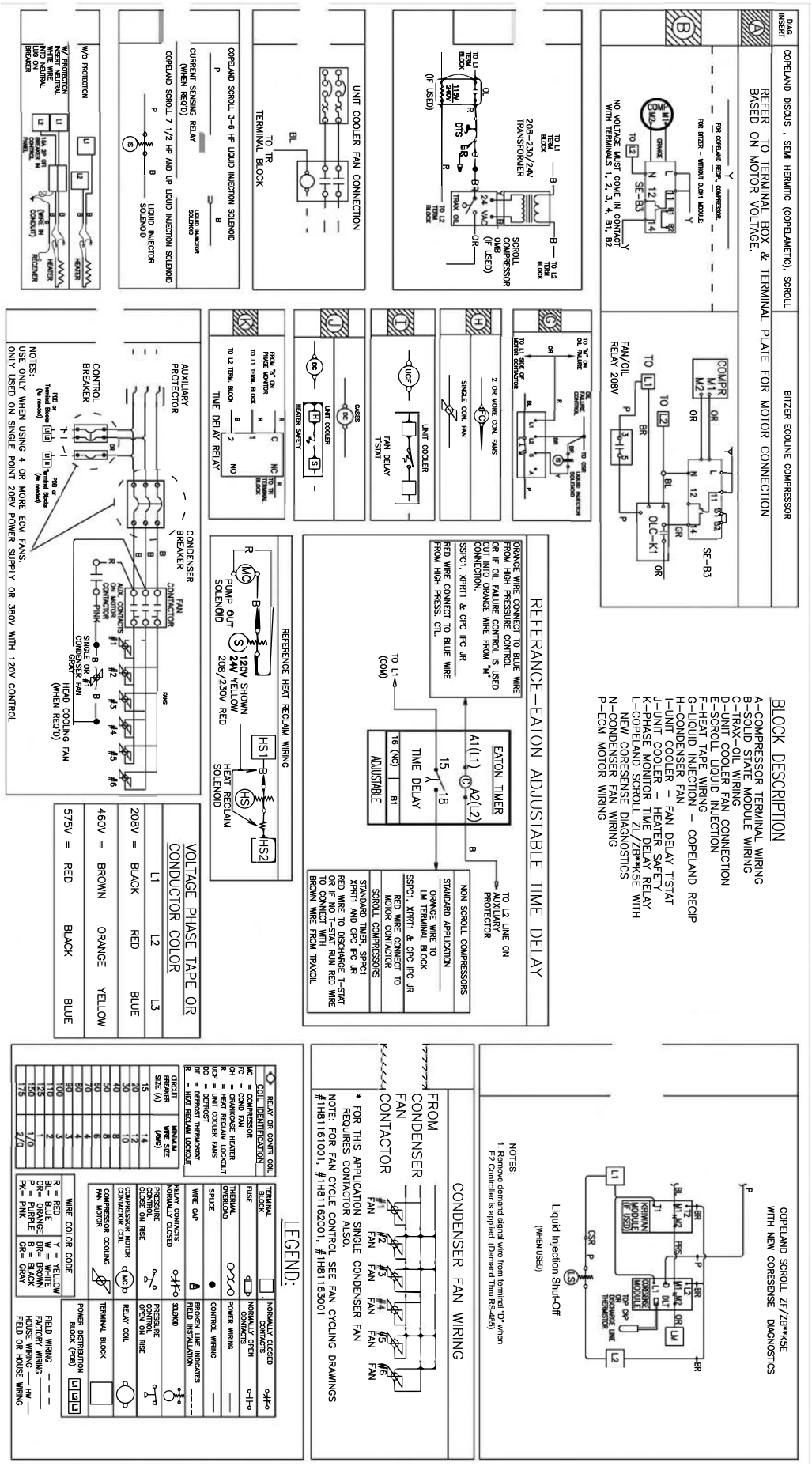
MATERIAL-----
MODEL BY / DWG BY-KARTHIK
CHECKED BY- KARTHIK
APPROVED BY- KH
REF- SUPERSEDES:
DATE DRAWN -26SEPT19
SHEET 9 OF 9
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
DECIMALS .XX ±.03, .XXX ±.010
ANGLES ± 2°
THIRD ANGLE PROJECTION

HUSSMANN®

CONDENSER FAN WIRING
FAN 6

208V-1PH | 0

36


BLOCK DESCRIPTION
A–COMPRESSOR TERMINAL WIRING
B–SOLID STATE MODULE WIRING
C–TRAX–OIL WIRING
D–UNIT COOLER FAN CONNECTION
E–SCROLL LIQUID INJECTION
F–HEAT TAPE WIRING
G–LIQUID INJECTION – COPELAND RECIP
H–CONDENSER FAN
I–UNIT COOLER – FAN DELAY TSTAT
J–UNIT COOLER – HEATER SAFETY
K–PHASE MONITOR TIME DELAY RELAY
L–COPELAND SCROLL ZF/ZB**KSE WITH NEW CORESENSE DIAGNOSTICS
N–CONDENSER FAN WIRING
P–ECM MOTOR WIRING
REFERANCE–EATON ADJUSTABLE TIME DELAY
EATON TIMER
TIME DELAY
ADJUSTABLE
NON SCROLL COMPRESSORS
SCROLL COMPRESSORS
CONDENSER FAN WIRING
FROM CONDENSER FAN CONTACTOR
COPELAND SCROLL ZF/ZB**KSE WITH NEW CORESENSE DIAGNOSTICS
Liquid Injection Shut-Off
(WHEN USED)
REFER TO TERMINAL BOX & TERMINAL PLATE FOR MOTOR CONNECTION BASED ON MOTOR VOLTAGE.
BITZER ECOLINE COMPRESSOR
UNIT COOLER FAN CONNECTION
CONDENSER BREAKER
CONTROL BREAKER
AUXILIARY PROTECTOR
REFERENCE HEAT RECLAIM WIRING
PUMP OUT SOLENOID
HEAT RECLAIM SOLENOID
VOLTAGE PHASE TAPE OR CONDUCTOR COLOR
208V = BLACK RED BLUE
460V = BROWN ORANGE YELLOW
575V = RED BLACK BLUE
LEGEND:
WIRE COLOR CODE
FIELD WIRING
FACTORY WIRING
HOUSE WIRING
FIELD OR HOUSE WIRING

STARTUP

WARNING

Know whether a circuit is open at the power supply or not. Remove all power before opening control panels. **Note**: Some equipment has more than one power supply.

Always use a pressure regulator with a nitrogen tank. Do not exceed 2 pounds of pressure and vent lines when brazing. Do not exceed 350 pounds of pressure for leak testing high side. Do not exceed 150 pounds of pressure for leak testing low side.

Always follow current EPA regulations and guidelines.

STARTUP

Leak Testing - Visually inspect all lines and joints for proper piping practices.
Isolate - Compressors – Front Seat Service Valves on Suction and Discharge

Pressure Transducers **-** Close Angle Valves.

Open - Valves – to condenser, heat reclaim and receiver.

Liquid Line Solenoid Valve - Solenoid should be energized.

Disconnect - Defrost Time Clock – Disconnect power to the clock.

Verify - Refrigerant requirements for System, Compressors, and TEV's in merchandisers and coolers.

Electrical supply and component requirements.

WARNING

Always recapture test charge in approved recovery vessel for recycling.

Oil Levels

Check oil levels for the compressor: Compressor sight glass 1/8 to 1/2 full.

Note: Check the oil sticker on the condensing unit before adding oil.

Test Charge

Using properly regulated dry nitrogen and R22 pressurize the system with vapor only. Add dry nitrogen to bring the system pressure up to 150 psig. Using an electronic leak detector inspect all connections. If a leak is found, isolate, repair, and retest. Be sure system is at 150 psig and all valves closed to isolate the leak are opened. After the last leak is repaired and retested, the system must stand unaltered for 12 hours with no pressure drop from 150 psig.

Compressors with Pre-Charged Oil as Standard	**Compressors Shipped Dry**
H-Series Condensing Units Krack C Series Condensing Units	*H-Series Condensing Units with Bitzer Compressors

*Any H-Series Condensing Units selected with Bitzer Compressors will not have oil pre-charged or included as standard, but can be ordered as an option (ship loose).

Evacuation

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

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

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

Setup

Using all copper lines and packless valves, connect an 8 CFM or larger vacuum pump to suction or liquid line. Connect one-micron vacuum gauge at the pump. Plan procedures so breaking the vacuum with refrigerant will not introduce contaminates into the system. The vacuum pump must be in good condition filled with fresh oil to achieve desired results.

Procedure

Pull a vacuum to 1500 microns. If the vacuum fails to hold, determine the cause and correct. Begin again with the first of the three required evacuations.

Break the vacuum with refrigerant vapor to a pressure of about 2 psig. Do not exceed the micron gauge transducer's maximum pressure limit. Liquid refrigerant may cause damage to components through thermal shock or a pressure surge to the transducer of the micron gauge.

Repeat first two steps.

Install the suction and liquid drier cores, if applicable.

Pull a vacuum to 500 microns. Close vacuum header valves and allow system to stand for a minimum of 12 hours.

If the 500-micron vacuum holds, charging may begin. If not the cause must be determined and corrected. Repeat the entire evacuation procedure from the first step.

WARNING
Never trap liquid refrigerant
between closed valves.
A hydraulic explosion may result.

Pre-Charge Check List

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

Check controller
- Program if applicable.

Merchandisers
- Electrical requirements and power supply
- Electrical connections tight and clean
- Proper fan operation
- Thermostat setting.

Walk-in coolers and freezers
- Electrical requirements and power supply
- Electrical connections tight and clean
- Proper fan operation
- Thermostat setting.

Condensing Unit
- Electrical requirements and power supply
- Electrical connections tight and clean
- Proper fan operation
- Pressure settings
- Defrost settings
- Adjust head pressure valve

To obtain maximum energy efficiency, the ORI flooding valve should be field-adjusted to allow the minimum condensing temperature permitted for the application in question, based on the compressor operating envelope.

Due to variations in equipment designs and installations, the ORI flooding valve may need to be adjusted to a slightly higher pressure setting to achieve proper operation of the refrigeration system."

The temperature control setpoints should be field-adjusted to cycle off half the fans at ambient temperatures below 40°F.

Air Cooled Condenser

Electrical requirements and power supply
Electrical connections tight and clean
Proper fan operation
Thermostat or pressure settings
Damper operation, if equipped.

Water Cooled Condenser

Flush water lines before connecting them to water-cooled condenser.

Heat Reclaim and other systems

Electrical requirements and power supply
Electrical connections tight and clean
Component operation.

Note: Remember to reinstate control to unit components jumpered to make test.

Set all mechanical pressure controls. Compressor should still be isolated from the rest of the system.

During the last evacuation look up and make a list of the required control settings for the system. High and low pressure, heat reclaim lockout, winter control settings, and other controls on the system should be noted.

Charging

Use standard procedures for charging while watching for possible problems. Check:

Suction and discharge pressure
Oil level
Voltage differential and balance
Ampere draw and balance

Shut down the unit at first indication of unusual operation, locate and correct cause.

Leak testing, evacuation and initial charging are now completed.

Note: With non-azeotropic refrigerants, it is best to charge the entire contents of the cylinder to prevent fractionalization of the refrigerant when charging vapor.

Winter Charge

When charging the condensing unit equipped with winter head pressure control valve, additional refrigerant is required for winter operation. [See Table Below]

Compressor Motor Rotation (Scroll)

To check compressor rotation, use the following procedure:

Install gauges on suction and discharge side of compressor. A momentary compressor run should cause a drop in suction header and a rise in discharge header pressure.

With main disconnect OFF, switch OFF all breakers or fuses in the control panel.

Turn ON main disconnect.

Condenser Size	Summer Charge (pounds)	Winter Charge (pounds)
A	1	6
B	3	13
C	3	13
D	4	17
E	6	26
F	8	34
J	13	56
K	7	30

*Charges Based on R407A

Look for the light on the single phase protector. If it is not lit, turn OFF the main disconnect. Have the field connections to the main breaker of the unit corrected so the phase protector indicates phase alignment (The light is lit).

Turn ON the main disconnect.

Momentarily turn ON the compressor and verify correct pumping direction. If the compressor is rotating backwards, change two legs on the load side of the compressor contactor.

Note: DO NOT run compressors for more than 10 seconds during test.

Final Checks

Once the system is up and running it is the responsibility of the installer to see that all the fine adjustments are made so the Condensing Unit delivers maximum temperature performance and efficiency for the customer. These include:

- Confirm ORI flooding valve setpoint (when applied).
- Confirm fan-cycling temperature-control setpoint (outdoor High-Efficiency units).
- Confirm factory-installed scroll compressor terminal rain cover (when supplied) is properly re-installed on outdoor units after service. The black ABS cover is secured to the compressor shell with heat-resistant webbing and a squeeze-release buckle.
- Defrost scheduling and timing Condenser controls
- Winter controls
- TEV superheat adjustment
- High and low pressure controls
- Thermostat settings
- Adjustments to electronic controls
- Inlet / Outlet water temperature (water cooled units only)
- Reinstall the wire grille on the front side of the unit enclosure.
- Make sure electrical enclosure is properly grounded, and reinstall panel door after service.

Thoroughly inspect all field piping while the equipment is running and add supports where line vibration occurs. Be sure additional supports do not conflict with pipe expansion and contraction.

When condition space is completely stocked, check the operation of the system again.

At 48 hours of operation, replace the liquid drier and suction filter cores (if applicable).

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

MAINTENANCE

This Procedure is not designed to cover system changeover to a different refrigerant.

COMPRESSOR REPLACEMENT

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

Verify:
Replacement compressor
- Electrical requirements
- Refrigerant application
- Capacity
- Piping hookup location and design
- Suction and discharge gaskets
- Mounting requirements

Have compressor in an easily accessible position, uncrated and unbolted from shipping pallets.

Disconnect Electrical Supply:
Turn off motor and control panel power supplies to the Condensing Unit.

Turn off control circuit and open all compressor circuit breakers or fuses.

Tag and remove electrical wires and conduit from the compressor.

Isolate Compressor:
Front seat Suction and Discharge Service Valves. Close oil supply and equalizing lines.

Bleed compressor pressure through both discharge and suction access ports into an approved recovery vessel.

Remove externally mounted components which will be re-used on the replacement compressor.

Plug holes to compressor manufacturer's specifications.

Remove bolts from suction and discharge service valves.

Remove mounting bolts.

When moving the compressor, use a come-along, hoist or hydraulic lift to carry the weight.

Do not use the piping or panel to support a hoist or come-along.

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

The rear support channel on the rack or a properly constructed ceiling rail may be used to support a hoist or come-along.

To make hookup and lifting easier, an eyebolt may be installed in the rear top of the compressor head.

If a compressor removal table is used, slide the compressor fully on to the table, then roll table to overhead hoist or hydraulic lift area.

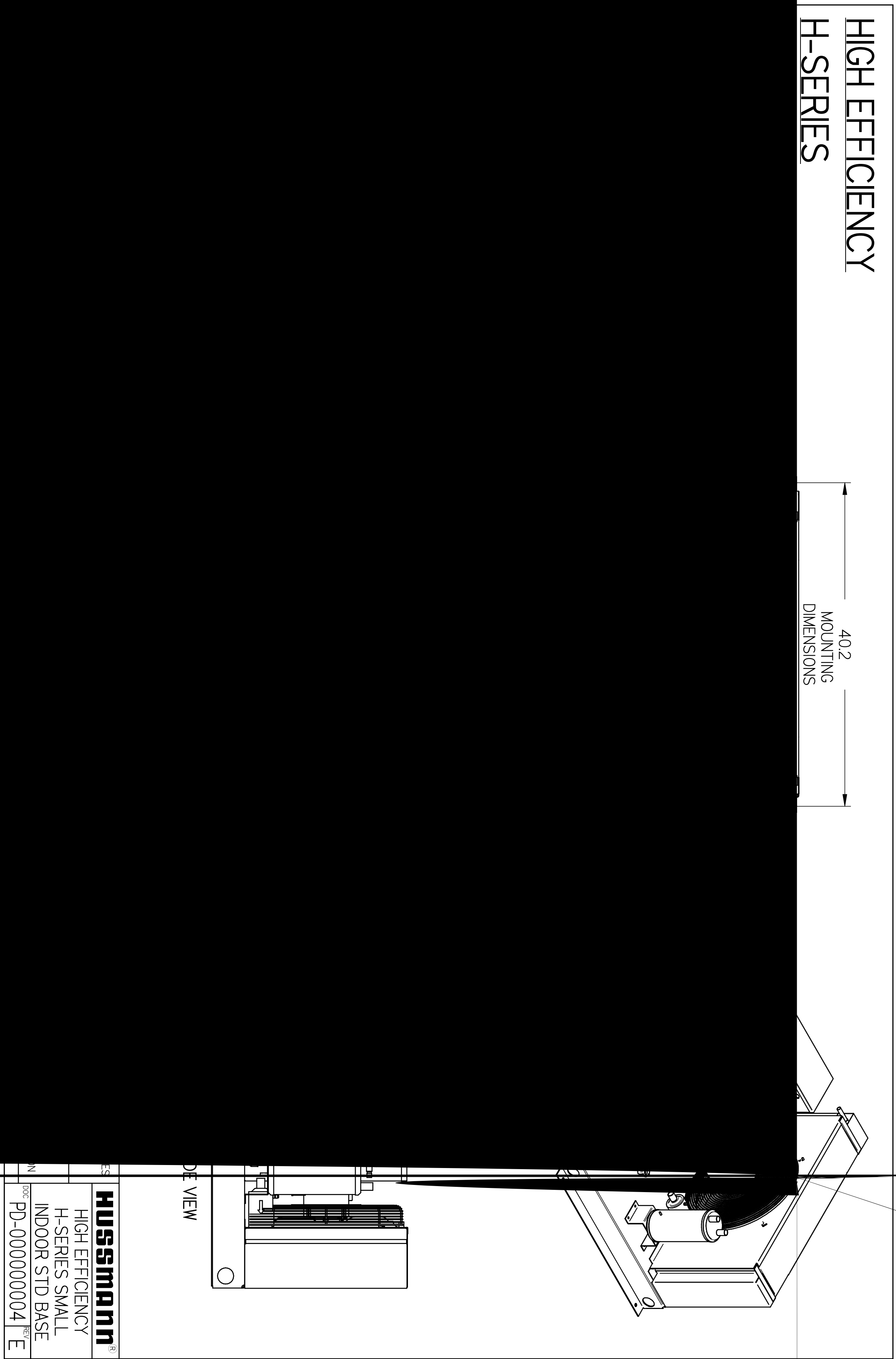
When the old compressor has been removed, clean the suction and discharge service valve gasket surfaces to shiny metal. Clean the gasket surfaces on the new compressor to shiny metal. Be careful not to groove or round the surfaces. Gasket surfaces must be clean to prevent leaking.

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

REPLACING DRIER AND FILTER CORES

Shut down the system. Isolate the core to be replaced and bleed off pressure into an approved recovery vessel. Open housing, replace core and close up. Pressurize, leak test and bring back into line.

APPENDIX A – DIMENSION DRAWINGS


HIGH EFFICIENCY
H-SERIES
40.2
MOUNTING
DIMENSIONS
HUSSMANN
HIGH EFFICIENCY
H-SERIES SMALL
INDOOR STD BASE
PD-0000000004
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SWN 1.0 SUBMITTAL SHEET SIZE D