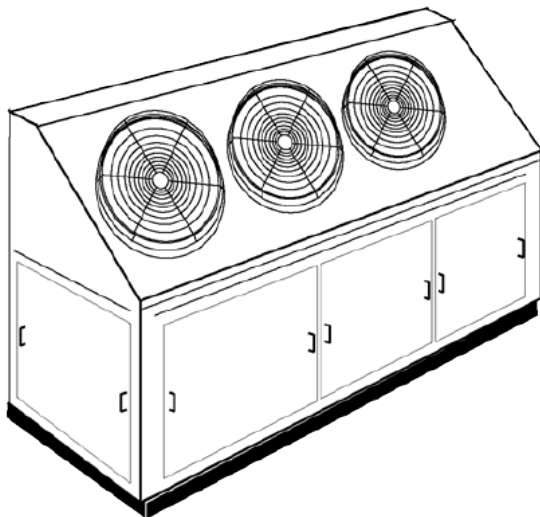
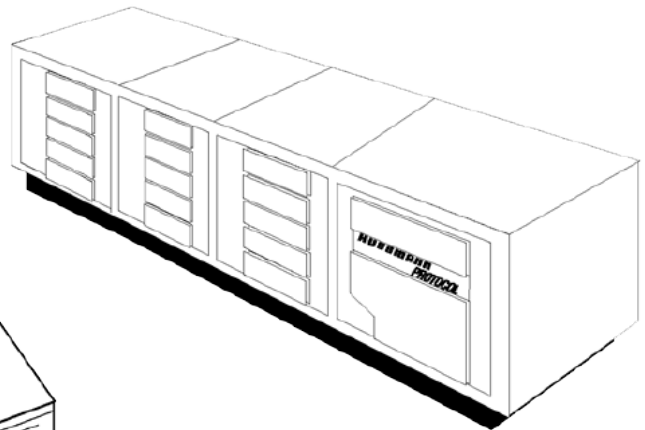
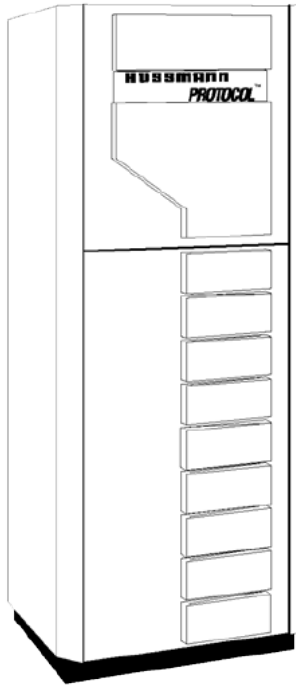


HUSSMANN®

PROTOCOL™ and ***PROTO-AIRE***

Installation and
Operation Manual



P/N 0385841_H
January 2023

Table Of Contents

Installation	5
Overview	5
Shipping Damage	5
Apparent Loss or Damage.....	5
Concealed Loss or Damage	5
On Site Damage Control	5
Compressor System Nomenclature	6
Receiver Capacities.....	7
Field Supplied and Installed Water Components.....	7
Accessibility.....	7
Panel Removal.....	8
Horizontal Units – Top Removal.....	9
Rigging and Hoisting	10
Vibration Pads.....	10
TYPICAL PIPING & ELECTRICAL HOOKUP.....	11
Vertical Units.....	11
Horizontal Units	16
Proto Aire Units (Submittal Documents)	28
REFRIGERATION PIPING	51
Overview	51
Refrigeration Line Piping	51
Return Gas Superheat	51
Suction Line	51
Liquid Line.....	52
Refrigeration Cycle.....	52
Protocol™ with 3-Pipe Gas Defrost	53
Protocol™ with Heat Reclaim	54
Protocol™ with Split Suction	55
Oil Cycle.....	56
Liquid Injection.....	57
Vapor Injection.....	58
Field Piping.....	58
Water Loop Piping	59
Overview	59
Water Loop Guidelines.....	59
Pipe Connections.....	59
Isolation Valves	59
Strainers	59
Air Vent Valves.....	60
Tie-Ins to Supply Headers	60
Pipe Supports	60
Exposure to Direct Sunlight	60
Leak Check	60
Cleaning and Flushing.....	60
Filling.....	60

Balance Valve Adjustment	61
Presetting The Flow Control (Balancing) Valve.....	61
Balancing the Water Loop	62
Balancing the Water Loop for Direct Return Piping.....	62
Balancing the Water Flow.....	63
Balancing the System for Piping Head Loss	64
Presetting the Degree of Closure	66
Electrical.....	68
Field Wiring	68
Maximum Field Wire Size	68
Sizing Wire and Overcurrent Protectors.....	68
Alarm Wiring	69
Temperature Sensors and Defrost Termination Thermostats.....	69
Additional Circuits	69
Evaporator Mounted Refrigeration Solenoid	70
Cooler Door Switch Wiring.....	70
Panel Voltages.....	70
Terminal Connections	74
120V Circuit Logic	74
24V Circuits.....	74
Electronic Oil Level Control.....	74
Satellite Short Cycle Control Relay.....	74
Liquid Injection.....	75
Vapor Injection.....	75
Field Piping and TXV Sizing	76
Defrost Schedule	77
Refrigeration Circuit Control	77
Defrost Circuit Control	77
Off time Sequence of Operation	77
Hot Gas.....	78
Electric Defrost.....	78
Special Case of Heat Reclaim with Hot Gas Defrost.....	79
Lighting Control.....	80
Unit Cooler Fan Wiring	81
Protocol™ Remote Condenser Fan Wiring	82
Proto-Aire™ Fan Wiring.....	83
POWERLINK™ Operation.....	84
Wiring Optional Auto Dialer and In-Store Alarm.....	85

Startup.....	86
Startup	86
Charging the Closed Loop.....	86
Charging the Refrigeration Side	86
Procedure – Triple Evacuation.....	88
Pre-charge Check List.....	88
Refrigerant Charge	88
Compressor Motor Rotation	89
Final Checks.....	90
Control Settings.....	90
Electronic Oil Level Control.....	91
Auxiliary Systems	91
Temperature Termination (Digital Mode)	91
Temperature Termination (Analog Mode).....	91
3-Pipe Gas Defrost	92
Electric Defrost	92
Offtime Defrost	93
Sensor Applications.....	93
Suction Pressure Sensor.....	93
Suction Pressure Input.....	93
Temperature Input.....	94
All Additional Pressure/Temperature Inputs	94
Programming the Optional In-store Alarm and Auto Dialer	94
Recommended Phone Number Programming	94
Troubleshooting Guide	96
Electrical Questions.....	97
Trouble Shooting Alarms	101
Service and Maintenance.....	103
Recommended Maintenance	104
Sample Protocol™ Checklist	106

Installation

Overview

This section is limited to the information needed to set the Protocol™ Unit. Auxiliary equipment information is found in the sections devoted to them or in the manuals accompanying them.

Related information is contained in Protocol™ Planning Data and the Pumping Station Planning Data.

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, the 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.

On Site Damage Control

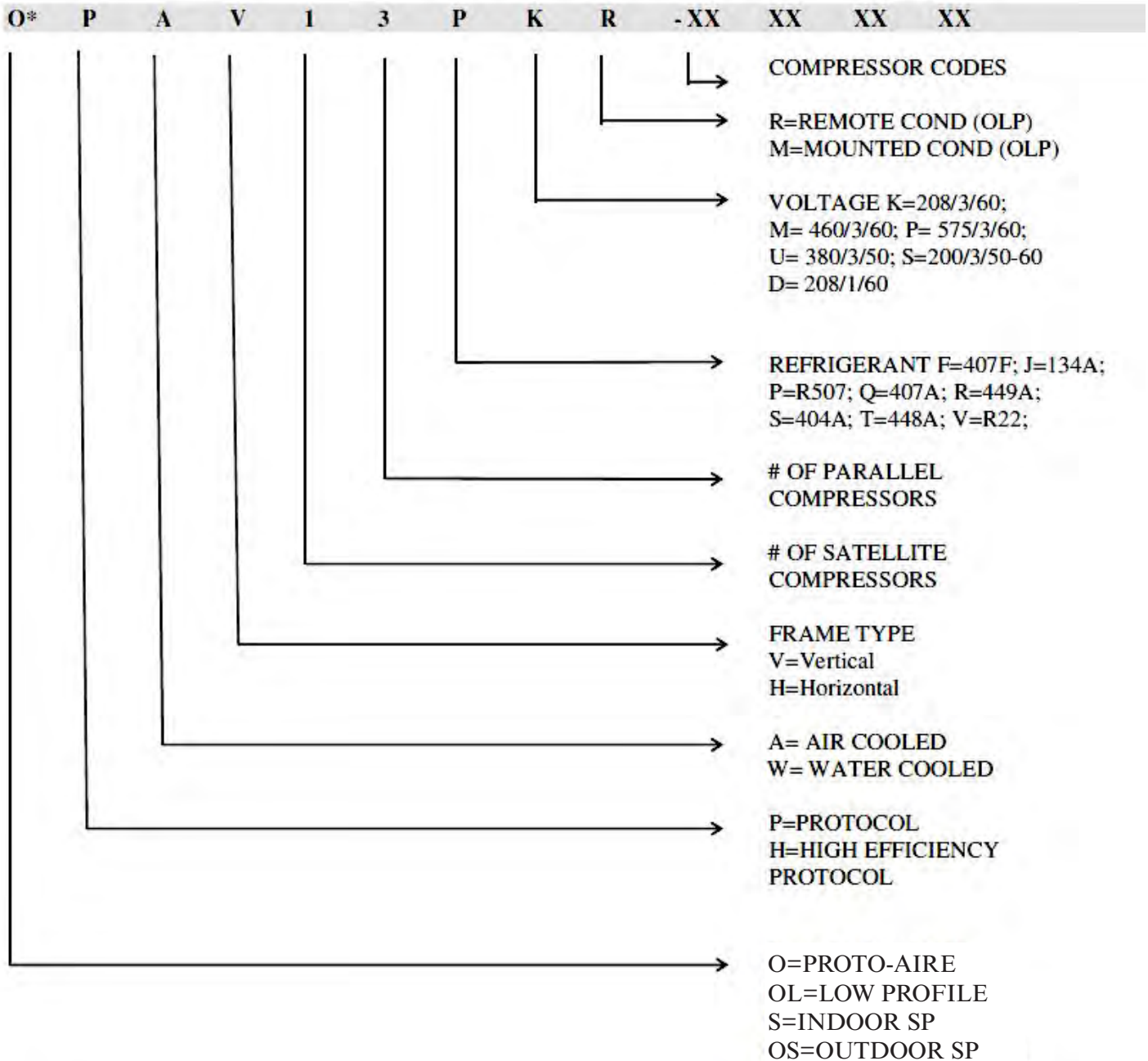
The Protocol™ is shipped on skids with panels installed. Remove panels to access lifting points on frame. Do not attempt to move the unit from the skids without first removing the panels.



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.

PROTOCOL UNIT NOMENCLATURE

The model numbers of PROTOCOL units are shown on the legend in modular form. The nomenclature is interpreted as follows:



The unit nomenclature is part of the UL code requirements and must be included on the legend as well as the data plate for each unit.

Receiver Capacities are based on 80% liquid fill at 105 °F.

Vertical – 55 lb		
Horizontal– 72 lb (Standard)	200# option	300# option

*Refer to Proto-Aire Submittal Documents

Field Supplied and Installed Water Components

The Protocol™ comes equipped with a flow control/shutoff valve for servicing the plate heat exchanger. All other water loop components must be field supplied and installed. A 16-20 mesh strainer (1 mm) is required immediately upstream of each Protocol™.

Accessibility

All standard control panel doors require 40 inches accessibility clearance. Oversized control panel doors require 48 inches accessibility clearance. Access to either side is also recommended. horizontal protocol units must be serviceable from three sides, the front and right side as well as the top or back as viewed facing the removable panels. A minimum of 40 inches clearance is recommended.

It is the responsibility of the installer to ensure that the final equipment installation meets all applicable code requirements.

For electrical clearances, N.E.C. and local electrical code restrictions must be followed.

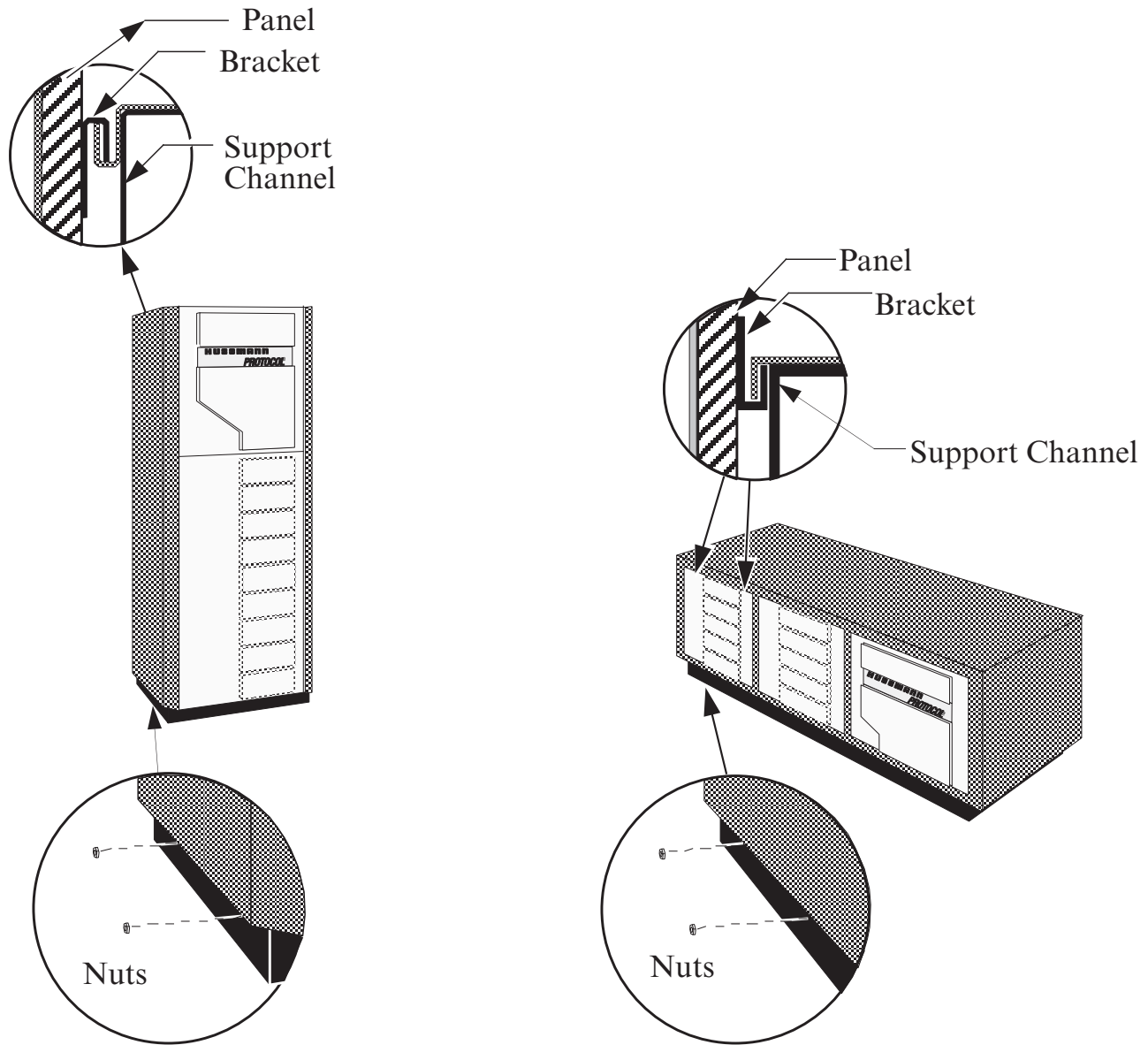
Panel Removal

Vertical Units

At the top, a bracket in a channel supports each panel. At the bottom, each panel is held in place by two nuts. Remove the nuts at the bottom of the panel, then lift up and out.

Horizontal Units

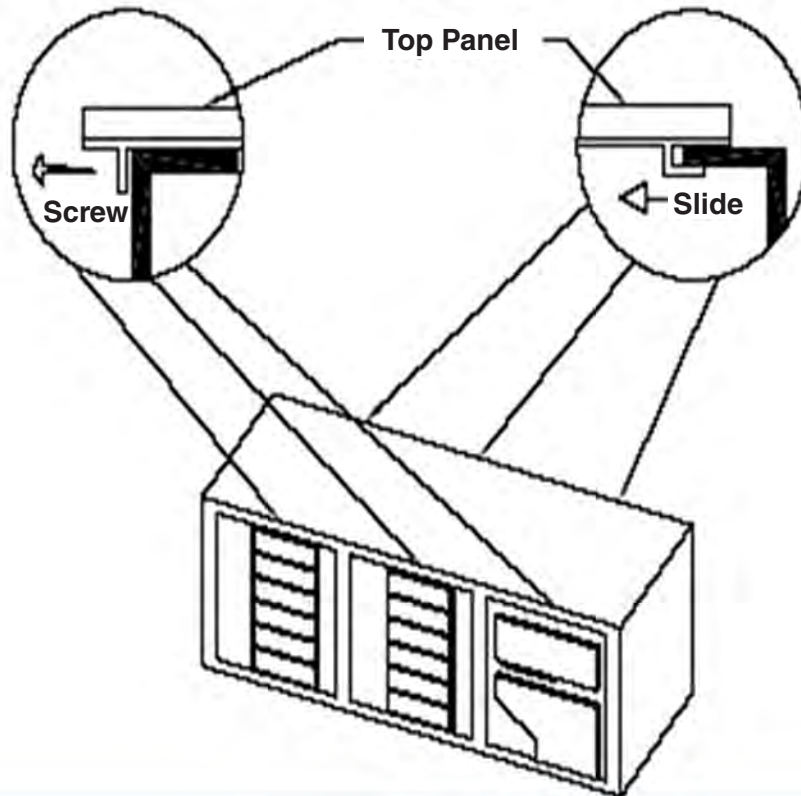
At the top, a bracket in a channel supports each panel. At the bottom, each panel rests on two studs and is held in place by nuts. Remove the nuts at the bottom of the panel, then slide the panel out at the bottom and down.



Horizontal Units – Top Removal

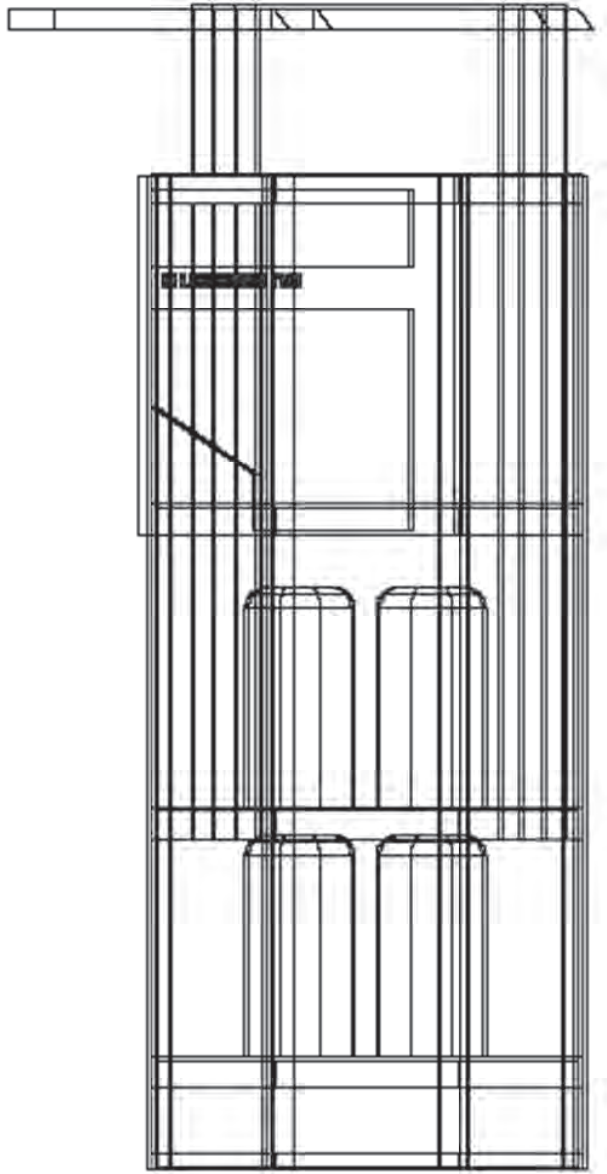
To remove the top assembly, first remove the front panels. Then remove the bracket screw at top center of each panel opening and above the control panel. Slide the top assembly forward until the back clips disengage. Lift the top off. Reverse procedure to install.

For some under-table applications, it may be desirable to remove the finished top panel to reduce the Protocol™ unit's height by two inches. To separate the top panel assembly, remove it and take out the screws holding the finished top panel to the sub-panel. The sub-panel **MUST** be installed, even when the finished top is not used.



Rigging and Hoisting

The installer is responsible for ensuring that the equipment used to move the Protocol™ is operated within its limits. Under no circumstances should the top of the unit or the outer panels be used for lifting or moving the unit. For strap rigging, run the straps under the top level of compressor mounting channel.

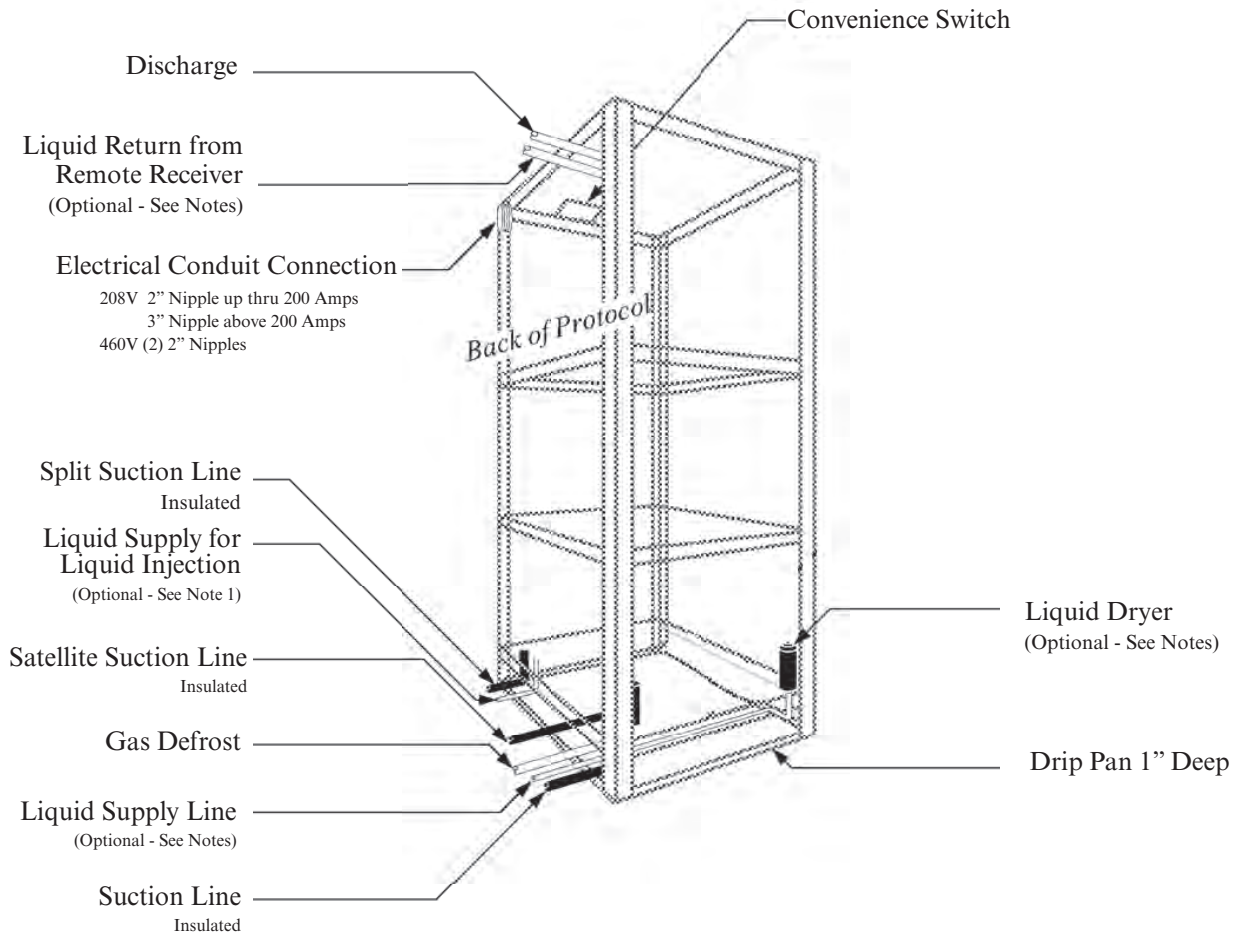


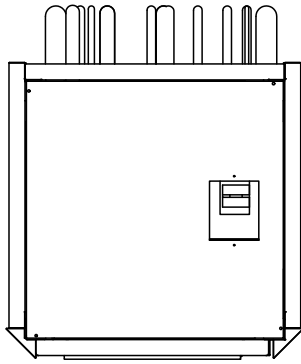
Vibration Pads

Vibration Isolation Pads are supplied with each Protocol™ unit. To adjust for slightly uneven floors, place 16 gauge galvanized steel shims between the vibration pads and the floor (shims must be field supplied). One vibration pad is installed under each upright channel. Vertical units use four pads. Horizontal units use 8 to 10 pads.

TYPICAL PIPING & ELECTRICAL HOOKUP

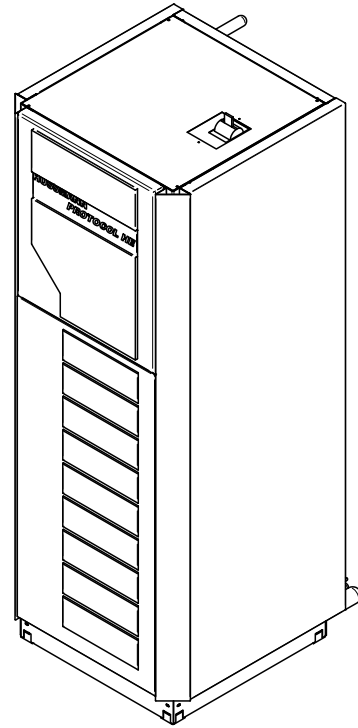
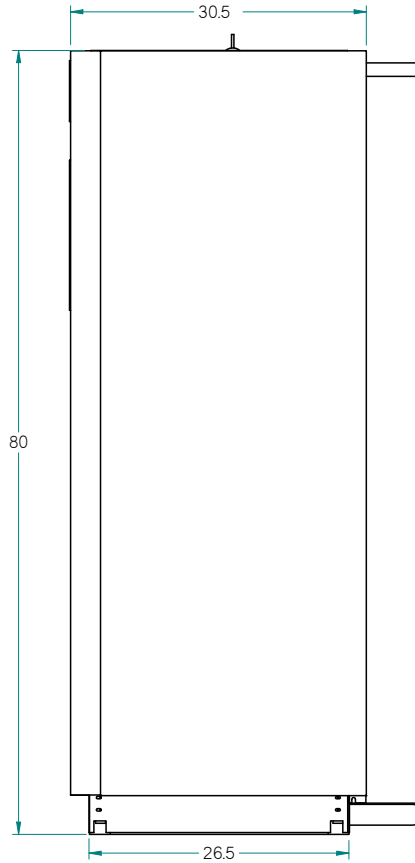
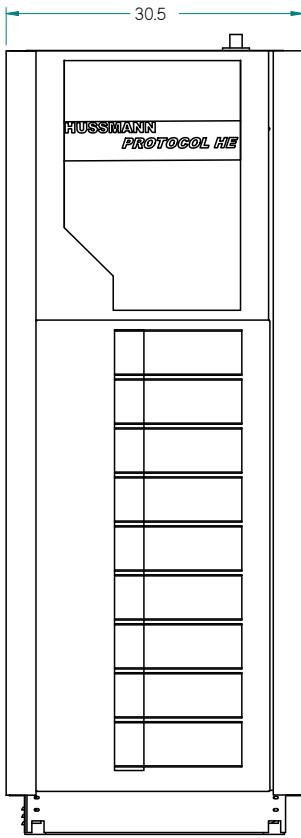
Vertical Units





**WEIGHT OF THE
UNIT= 1200 LBS.**

ASSM 2 WIDE
VERTICAL
PROTOCOL



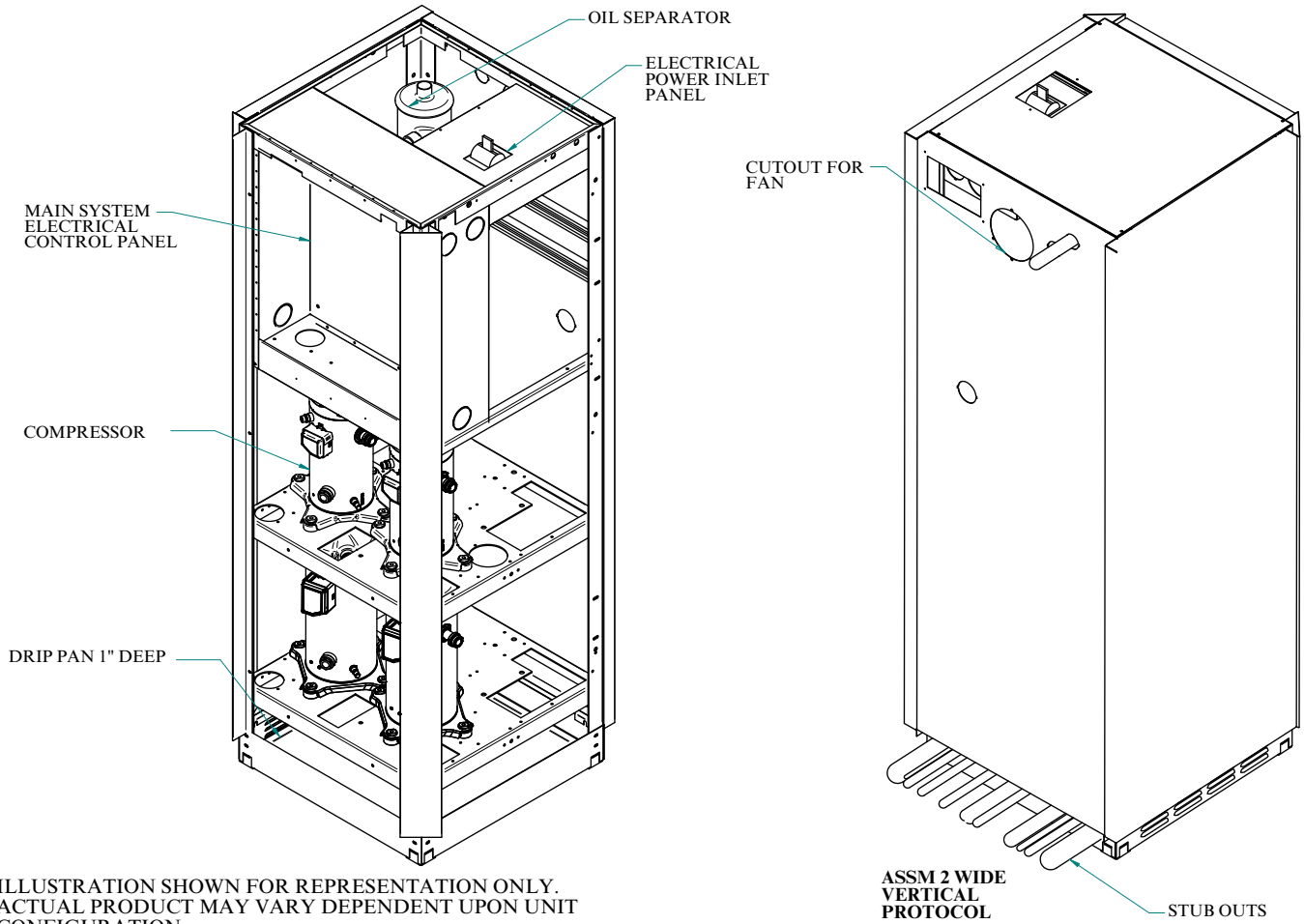


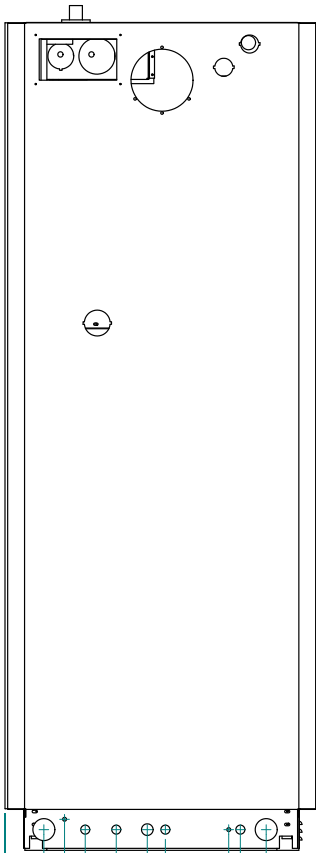
ILLUSTRATION SHOWN FOR REPRESENTATION ONLY. ACTUAL PRODUCT MAY VARY DEPENDENT UPON UNIT CONFIGURATION

ACCESSIBILITY

ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FACING THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED.

IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS.

FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.

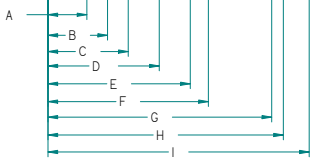


AIRCOOLED 2WIDE VERTICAL PROTOCOL

STUB OUT LINE DETAILS.		
	LINE TYPE	SIZE O.D.
A	SPLIT SUCTION	1 5/8" TO 2 1/8"
B	LIQUID INJECTION	3/8"
C	LT LIQUID TO CASES	7/8"
D	MT LIQUID TO CASES	7/8"
E	LIQUID FROM CONDENSER / RECEIVER	7/8" TO 1 1/8"
F	SATELLITE SUCTION	7/8"
G	GAS DEFROST	5/8"
H	LIQUID LINE	7/8"
I	SUCTION LINE	2 1/8"

Actual Line Sizing may be adjusted to match system capacities.

ASSM 2 WIDE VERTICAL PROTOCOL



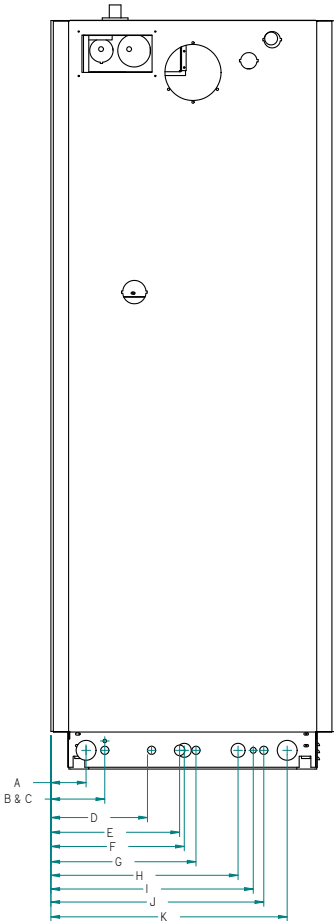
MEASUREMENT OF STUB OUT LINES								
A - SPLIT SUCTION	B - LIQUID INJECTION	C - LT LIQUID TO CASES	D - MT LIQUID TO CASES	E - MT LIQUID FROM RECEIVER	F - SATELLITE SUCTION	G - GAS DEFROST	H - LIQUID LINE	I - SUCTION
3 1/2"	5 1/2"	7 1/2"	10 1/2"	13 1/2"	15 1/4"	21 3/8"	22 1/2"	25"

WATER COOLED 2WIDE VERTICAL PROTOCOL

STUB OUT LINE DETAILS.	
Conduit Connection	
LINE TYPE	SIZE OD
A SPLIT SUCTION	1 5/8" TO 2 1/8"
B LIQUID INJECTION	7/8"
C LT LIQUID TO CASES	7/8"
D MT LIQUID TO CASES	7/8"
E LIQUID FROM CONDENSER / RECEIVER	7/8" TO 1 1/8"
F & H WATER INLET	1 1/2"
G SATELLITE SUCTION	7/8"
H GAS DEFROST	5/8"
I LIQUID TO RECEIVER	7/8"
J SUCTION	2 1/8"

Actual Line Sizing may be adjusted to match system capacities.

MEASUREMENT OF STUB OUT LINES										
A - SPLIT SUCTION	B - LIQUID INJECTION	C - LT LIQUID TO CASES	D - MT LIQUID TO CASES	E - MT LIQUID FROM RECEIVER	F - WATER INLET	G - SATELLITE SUCTION	H - WATER OUTLET	I - GAS DEFROST	J - LIQUID TO RECEIVER	K - SUCTION
3 1/2"	5 1/2"	5 1/2"	10 1/2"	13 1/2"	14"	15 1/4"	19 3/4"	22 3/8"	22 1/2"	25"



ASSM 2 WIDE VERTICAL PROTOCOL



AIRCooled 3WIDE VERTICAL PROTOCOL

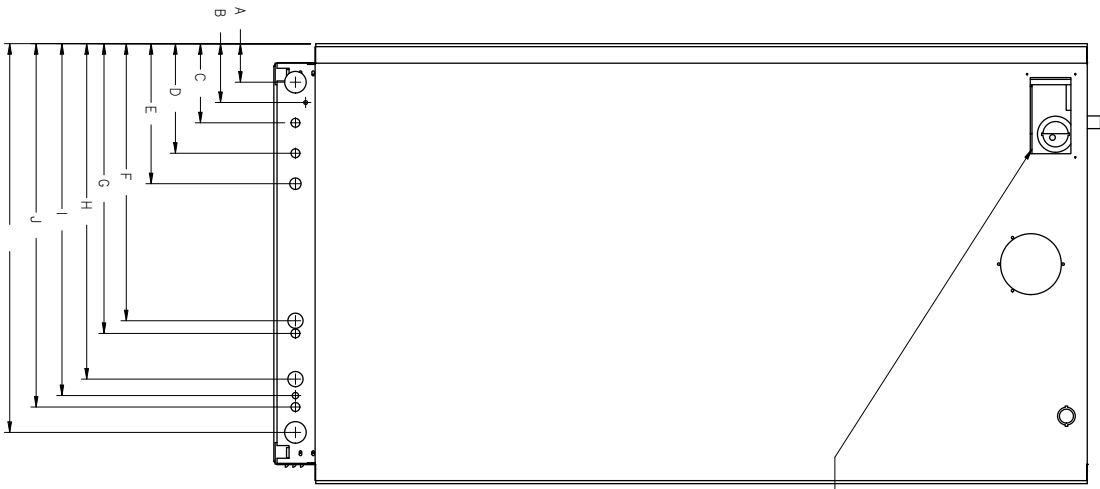
3W VERTICAL PROTOCOL SUBMITTAL

STUB OUT LINE DETAILS	
LINE TYPE	SIZE O.D.
A - SPLIT SUCTION	2 1/8"
B - LIQUID INJECTION	3/8"
C - LT LIQUID TO CASES	7/8"
D - MT LIQUID TO CASES	7/8"
E - MT LIQUID FROM CONDENSER / RECEIVER	7/8" TO 1 1/8"
F - SATELLITE SUCTION	7/8"
G - GAS DEFROST	5/8"
H - LIQUID LINE	7/8"
I - SUCTION LINE	2 1/8"

ACTUAL LINE SIZE CAN BE ADJUSTED TO MATCH SYSTEM CAPACITIES

MEASUREMENT OF STUB OUT LINES

A - SPLIT SUCTION	B - LIQUID INJECTION	C - LT LIQUID TO CASES	D - MT LIQUID TO CASES	E - MT LIQUID FROM RECEIVER / CONDENSER	F - SATELLITE SUCTION	G - GAS DEFROST	H - LIQUID LINE	I - SUCTION
3 1/2"	5 1/2"	7 1/2"	10 1/2"	13 1/2"	28 1/4"	34 3/8"	35 1/2"	38"



WATERCOOLED 3WIDE VERTICAL PROTOCOL

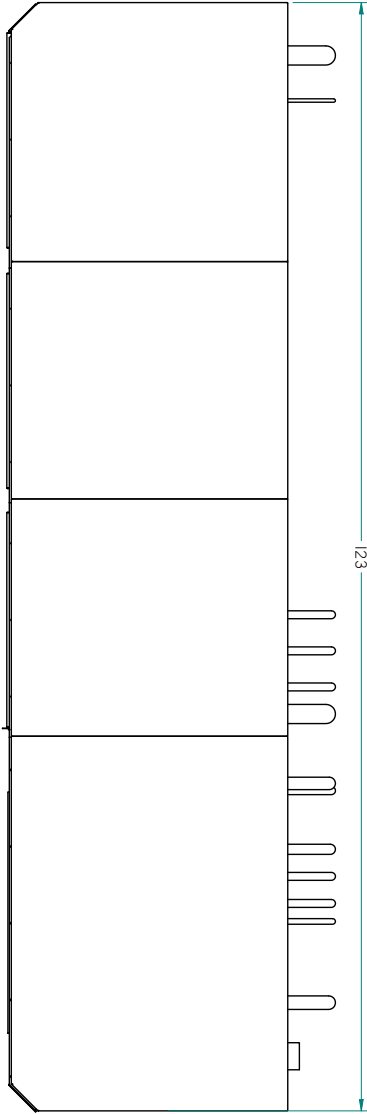
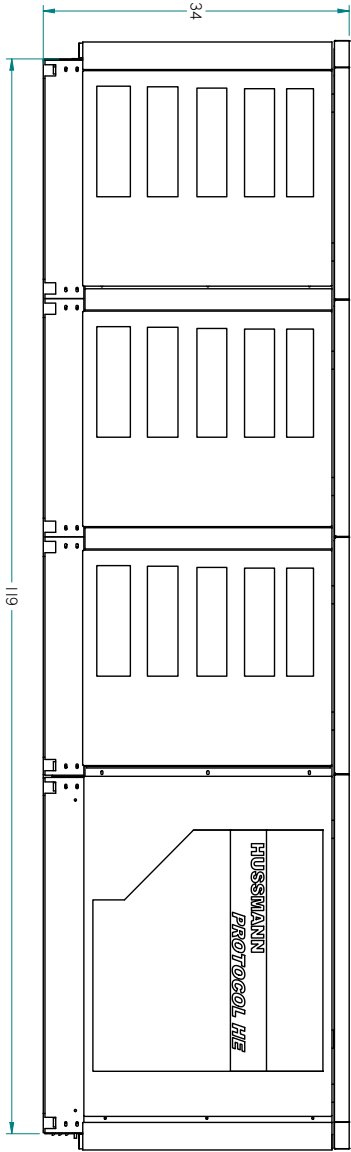
3W VERTICAL PROTOCOL SUBMITTAL

ACTUAL LINE SIZE CAN BE ADJUSTED TO MATCH SYSTEM CAPACITIES

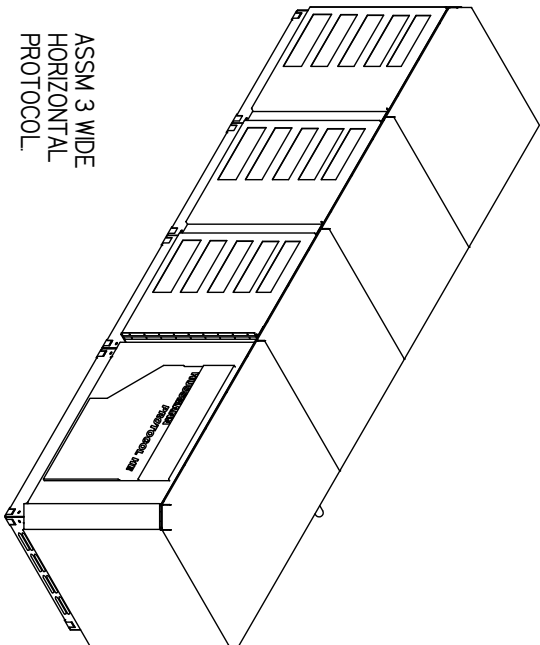
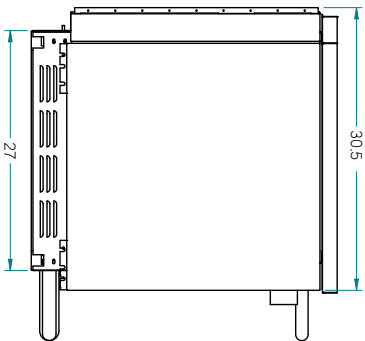
STUB OUT LINE DETAILS	
LINE TYPE	SIZE O.D.
A SPLIT SUCTION	2 1/8"
B LIQUID INJECTION	3/8"
C LT LIQUID TO CASES	7/8"
D MT LIQUID TO CASES	7/8"
E LIQUID FROM CONDENSER / RECEIVER	1 1/8"
F & H WATER LINE	1 1/2"
G SATELLITE SUCTION	7/8"
I GAS DEFROST	5/8"
J LIQUID TO RECEIVER	7/8" TO 1 1/8"
K SUCTION LINE	2 1/8"

MEASUREMENT OF STUB OUT LINES

LINE TYPE	MEASUREMENT
A - SPLIT SUCTION	3 1/2"
B - LIQUID INJECTION	5 1/2"
C - LT LIQUID TO CASES	7 1/2"
D - MT LIQUID TO CASES	10 1/2"
E - MT LIQUID FROM RECEIVER / CONDENSER	13 1/2"
F - WATER INLET	27"
G - SATELLITE SUCTION	28 1/4"
H - WATER OUTLET	32 3/4"
I - GAS DEFROST	34 3/8"
J - LIQUID TO RECEIVER	35 1/2"
K - SUCTION	38"



WEIGHT OF THE UNIT W/O RECEIVER = 1700 LBS.
WEIGHT OF THE UNIT WITH RECEIVER = 1900 LBS.



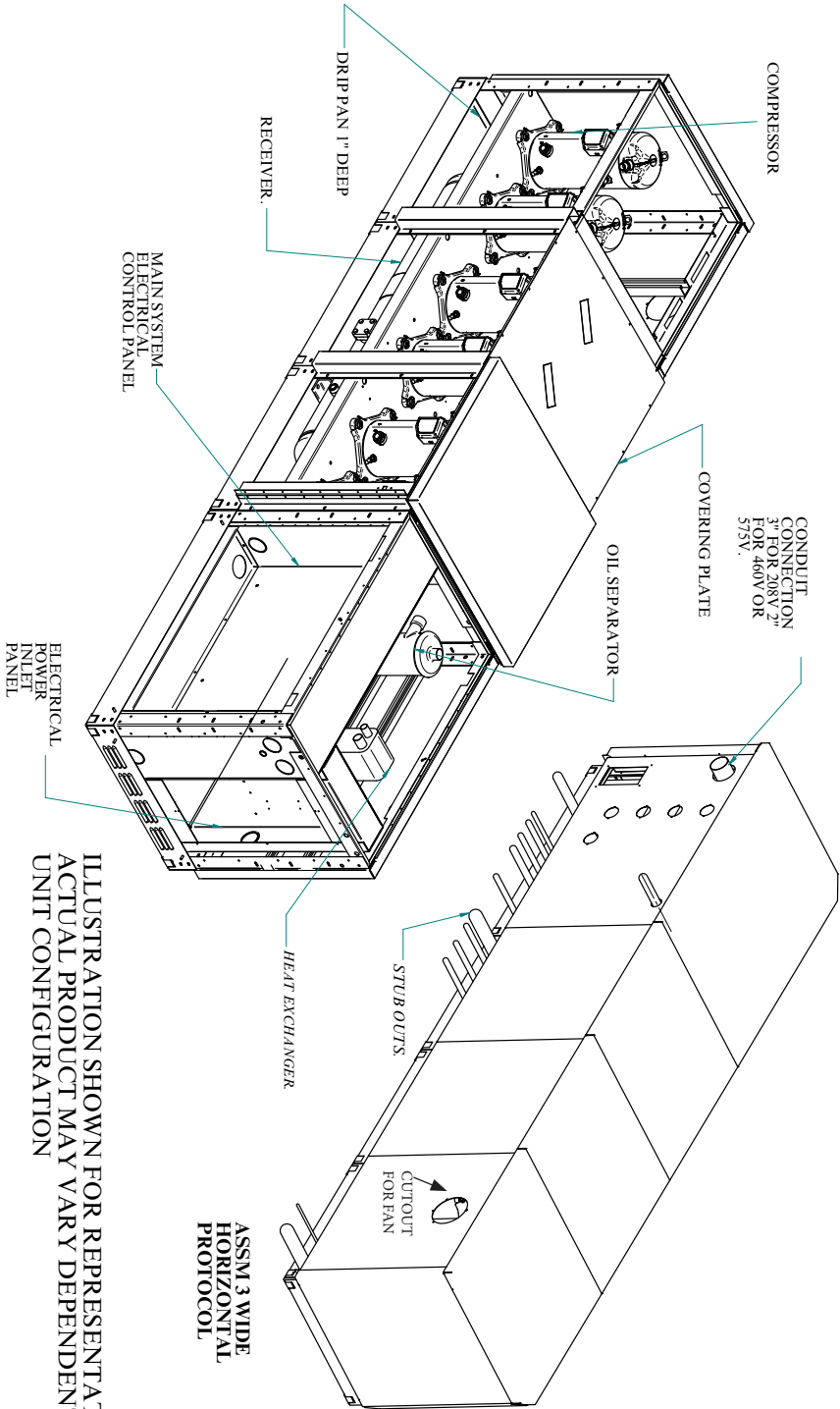


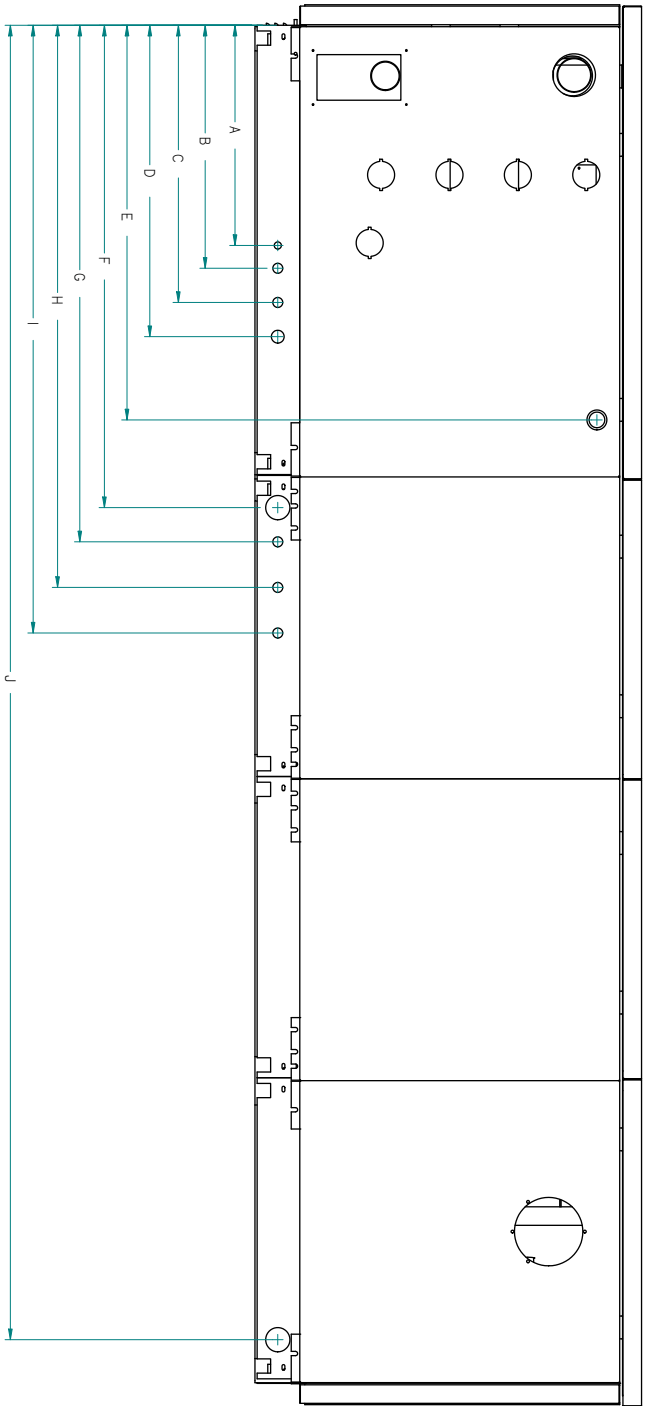
ILLUSTRATION SHOWN FOR REPRESENTATION ONLY. ACTUAL PRODUCT MAY VARY DEPENDENT UPON UNIT CONFIGURATION

ACCESSIBILITY

ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FACING THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED.

IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS. FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.

AIRCOOLED 3WIDE HORIZONTAL PROTOCOL



STUB OUT LINE DETAILS	
LINE TYPE	SIZE O.D.
A GAS DEFROST	5/8"
B LT LIQUID TO CASES	7/8"
C MT LIQUID TO CASES	7/8"
D LIQUID FROM CONDENSER / RECEIVER	7/8" TO 1 1/8"
E DISCHARGE	1 3/8"
F SUCTION LINE	2 1/8"
G SATELLITE SUCTION	7/8"
H LIQUID LINE	7/8"
I RECEIVER REGULATOR LINE	7/8"
J SPLIT SUCTION	2 1/8"

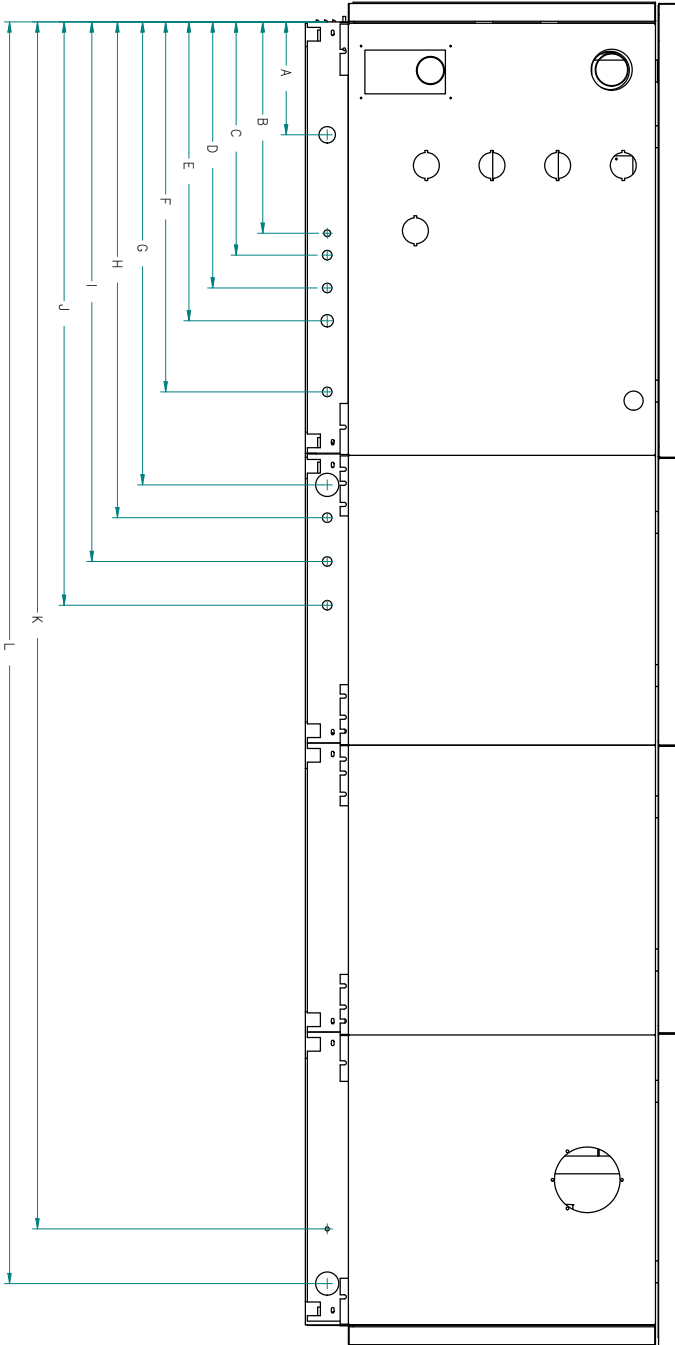
Actual Line Sizing may be adjusted to match system capacities.

MEASUREMENT OF STUB OUT LINES

A - GAS DEFROST	B - LT LIQUID TO CASES	C - MT LIQUID TO CASES	D - LIQUID FROM RECEIVER / CONDENSER	E - DISCHARGE	F - SUCTION LINE	G - SATELLITE SUCTION	H - LIQUID LINE	I - RECEIVER REGULATOR LINE	J - SPLIT SUCTION
19"	21"	24"	27"	35"	42"	45"	49"	53"	115"

ASSM 3 WIDE HORIZONTAL PROTOCOL

WATER COOLED 3WIDE HORIZONTAL PROTOCOL



MEASUREMENT OF STUB OUT LINES

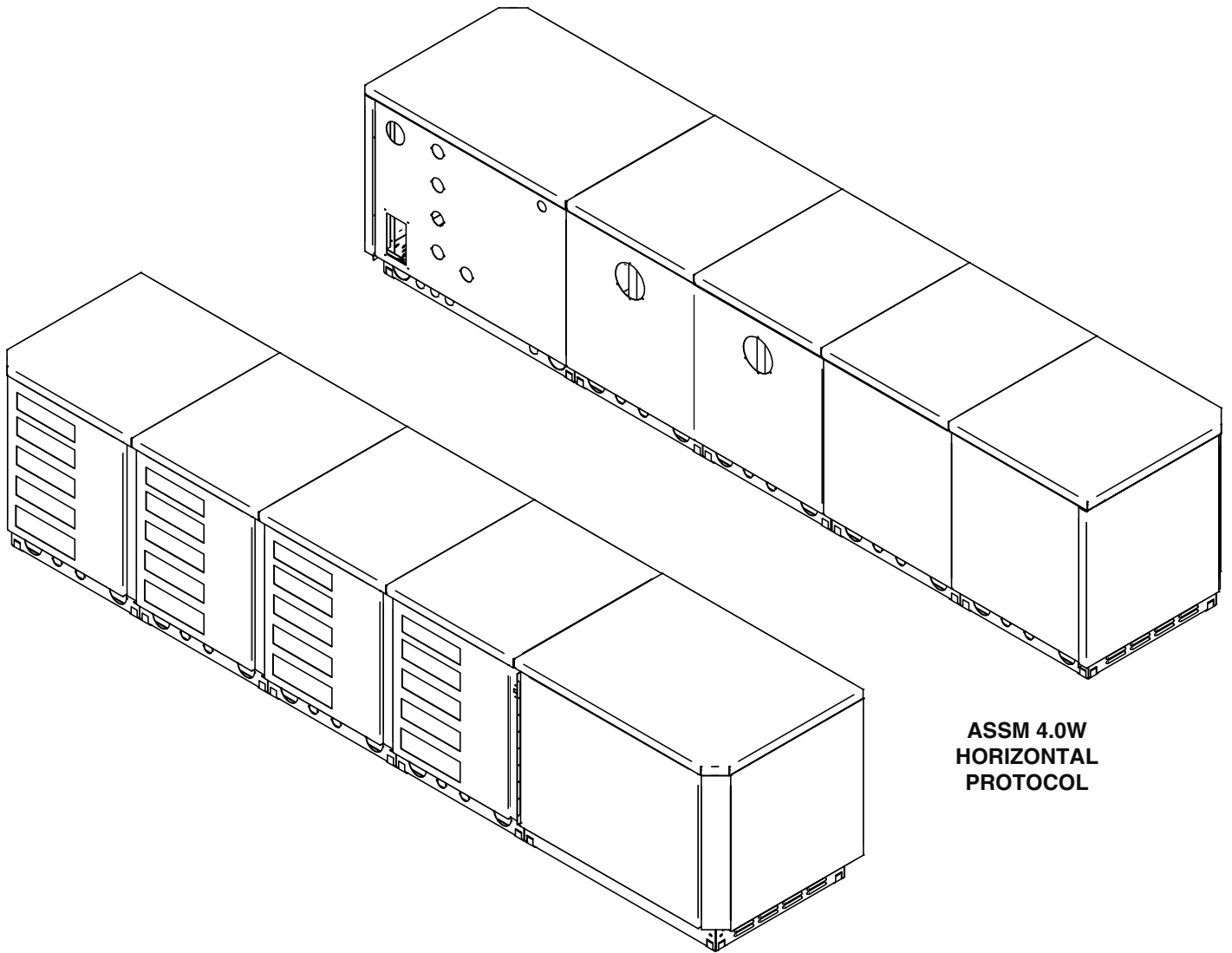
A - WATER OUTLET	B - GAS DEFROST	C - LT LIQUID TO CASES	D - MT LIQUID TO CASES	E - MT LIQUID FROM RECEIVER	F - LIQUID TO RECEIVER	G - SUCTION	H - SATELLITE SUCTION	I - WATER INLET	J - SPLIT SUCTION	K - LIQUID INJECTION	L - LIQUID LINE
10"	19"	21"	24"	27"	33.5"	42"	45"	53"	115"	112"	49"

ASSM 3 WIDE HORIZONTAL PROTOCOL.

STUB OUT LINE DETAILS

LINE TYPE	SIZE OD
A & I WATER LINE	1 1/2"
B GAS DEFROST	5/8"
C LT LIQUID TO CASES	7/8"
D MT LIQUID TO CASES	7/8"
E LIQUID FROM RECEIVER	1 1/8"
F LIQUID TO RECEIVER	7/8"
G SUCTION	2 1/8"
H SATELLITE SUCTION	7/8"
J SPLIT SUCTION	2 1/8"
K LIQUID INJECTION	3/8"
L LIQUID LINE	7/8"

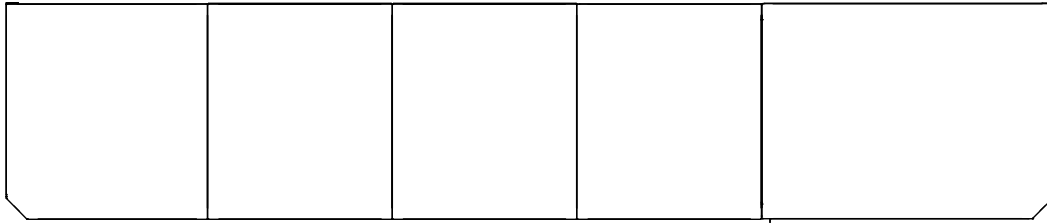
Actual Line Sizing may be adjusted to match system capacities.



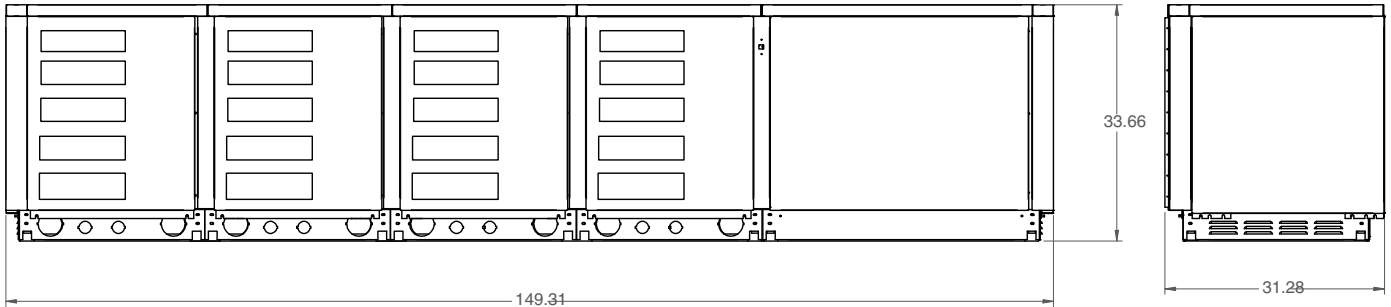
**ASSM 4.0W
HORIZONTAL
PROTOCOL**

WEIGHT OF THE UNIT WITHOUT RECEIVER= 1900 LBS.
WEIGHT OF THE UNIT WITH RECEIVER= 2200 LBS

ILLUSTRATION SHOWN FOR REPRESENTATION ONLY.
ACTUAL PRODUCT MAY VARY DEPENDENT UPON UNIT
CONFIGURATION



**ASSM 4.0W
HORIZONTAL
PROTOCOL**

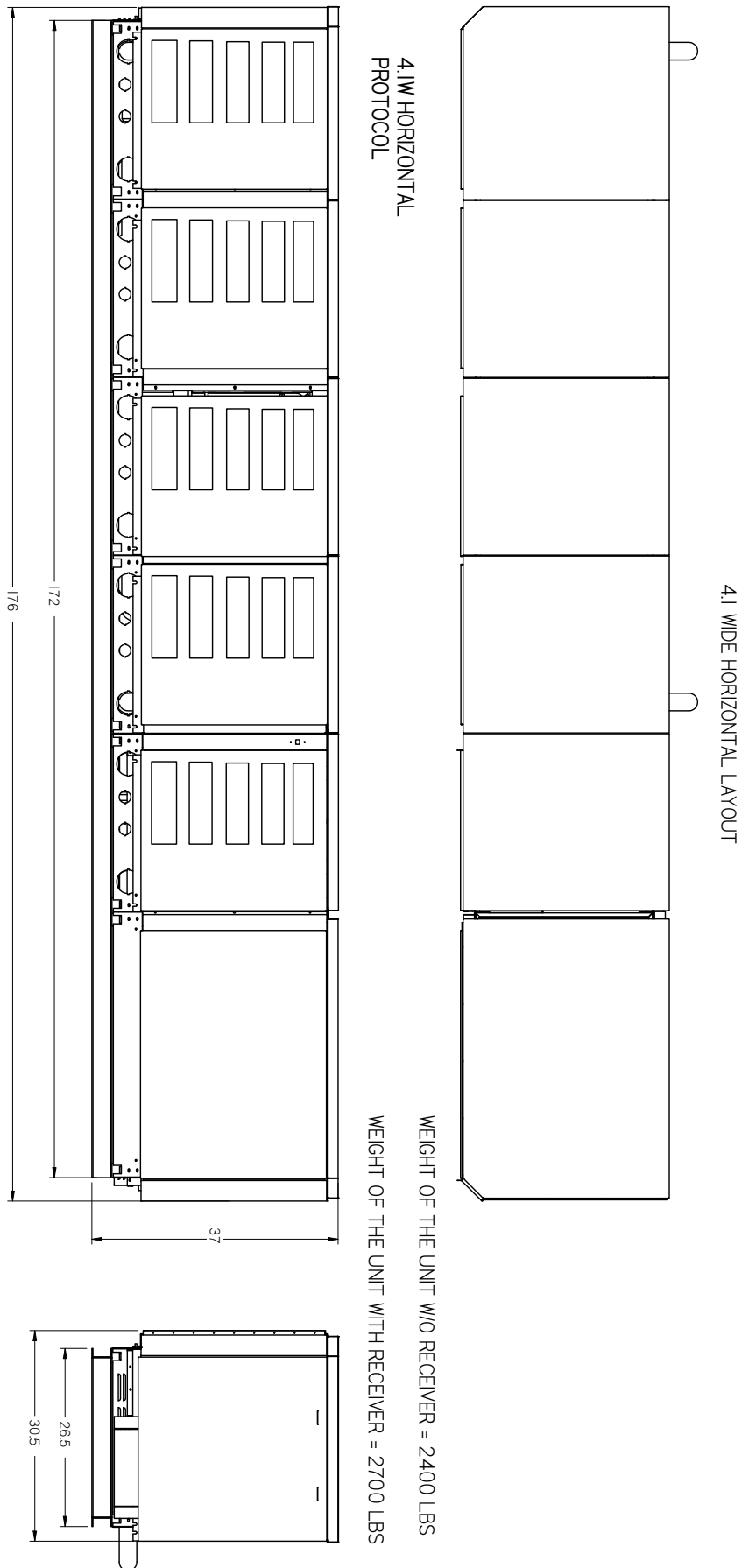


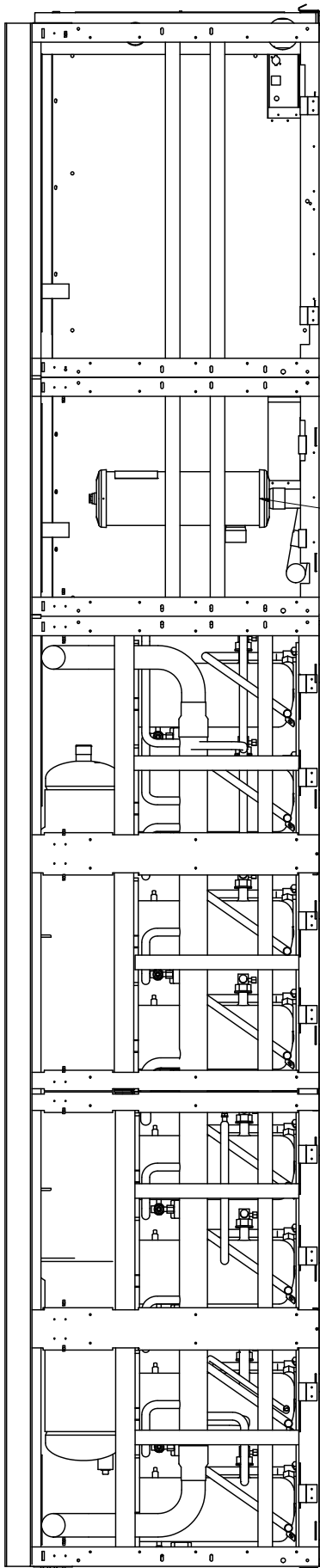
ACCESSIBILITY

ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FACING THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED.

IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS.

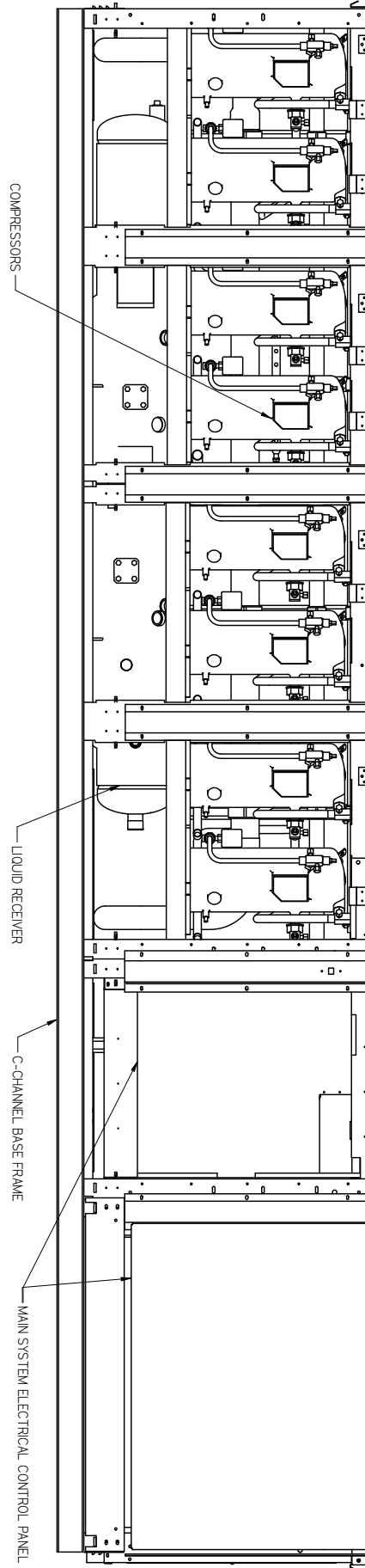
FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.



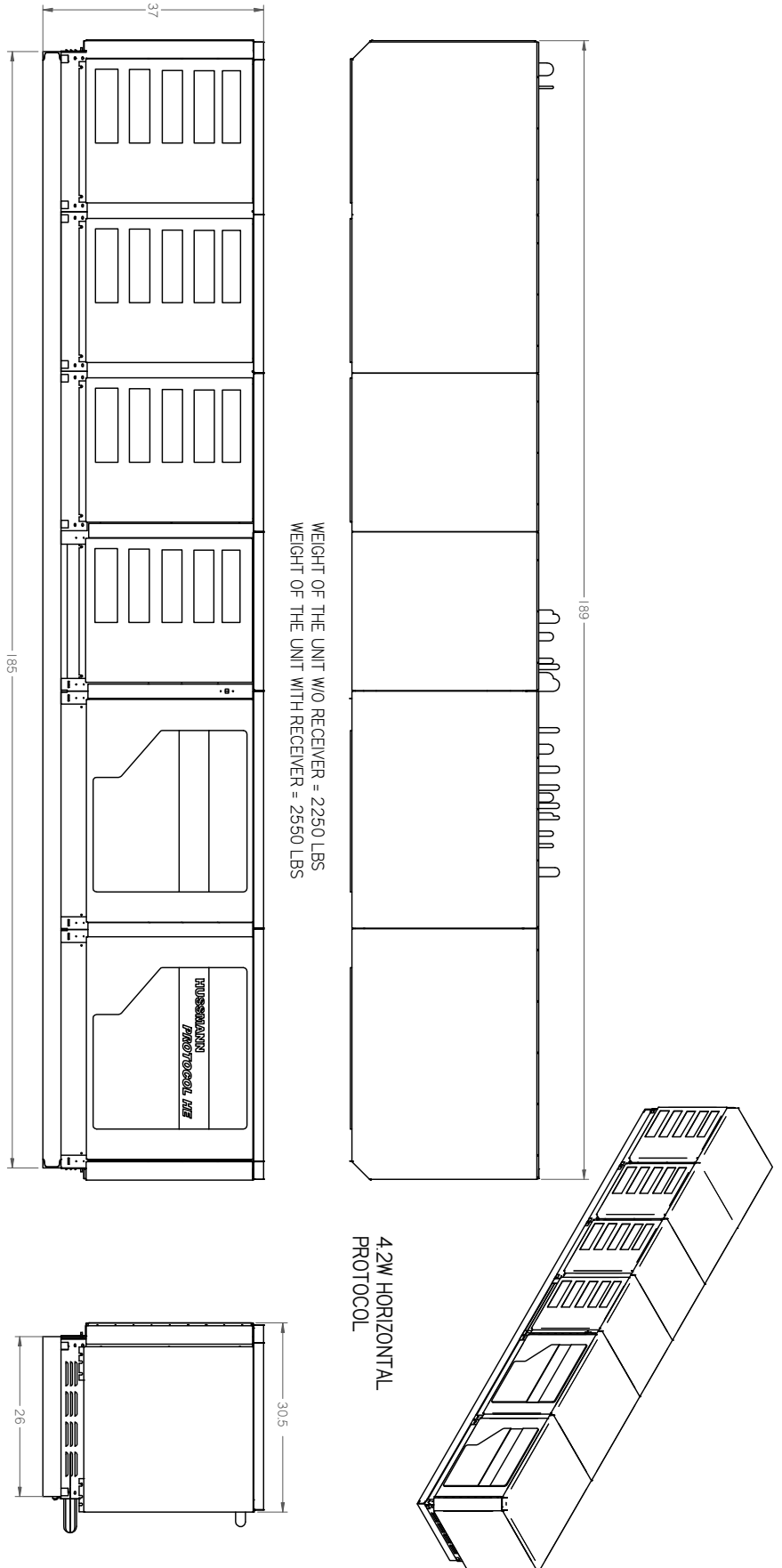


UNIT SHOWN WITHOUT SKINS FOR CLARITY BACK VIEW

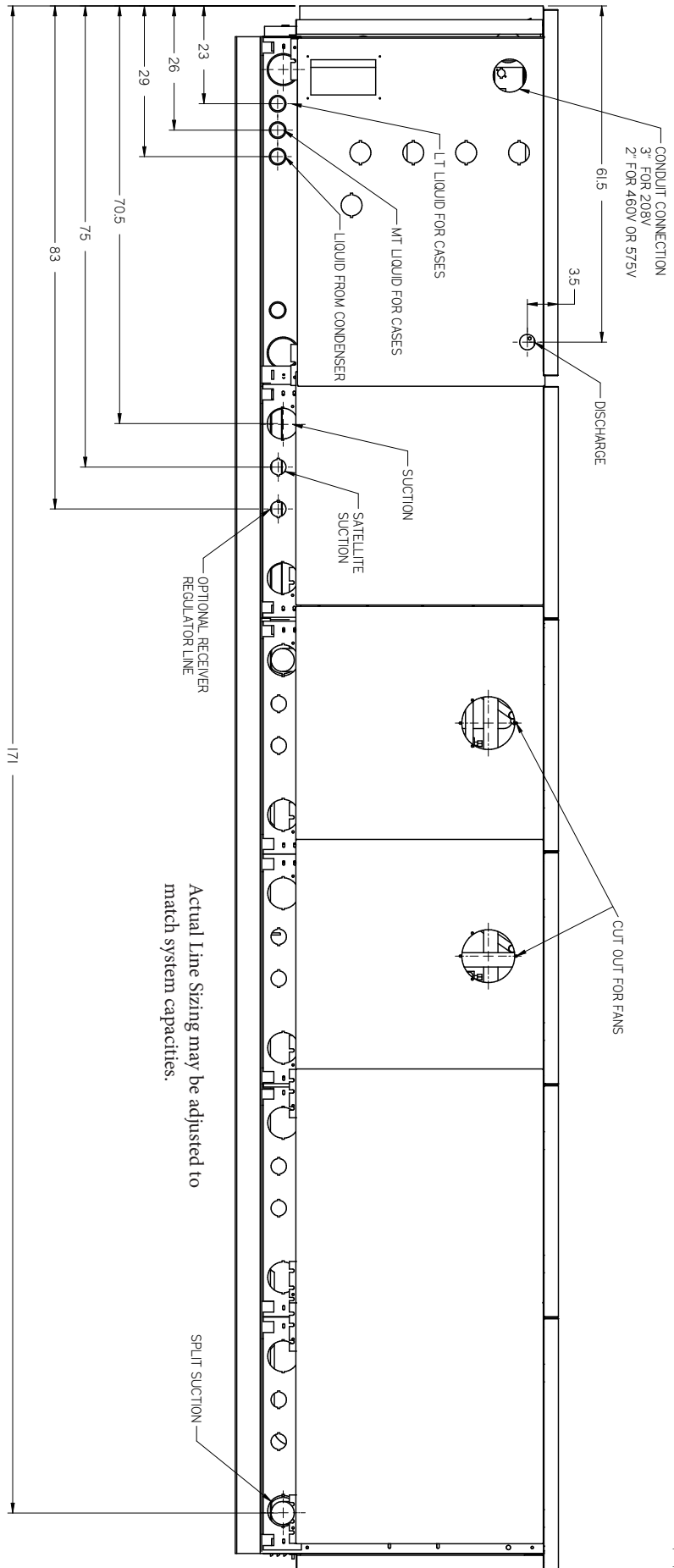
4.1W HORIZONTAL
PROTOCOL



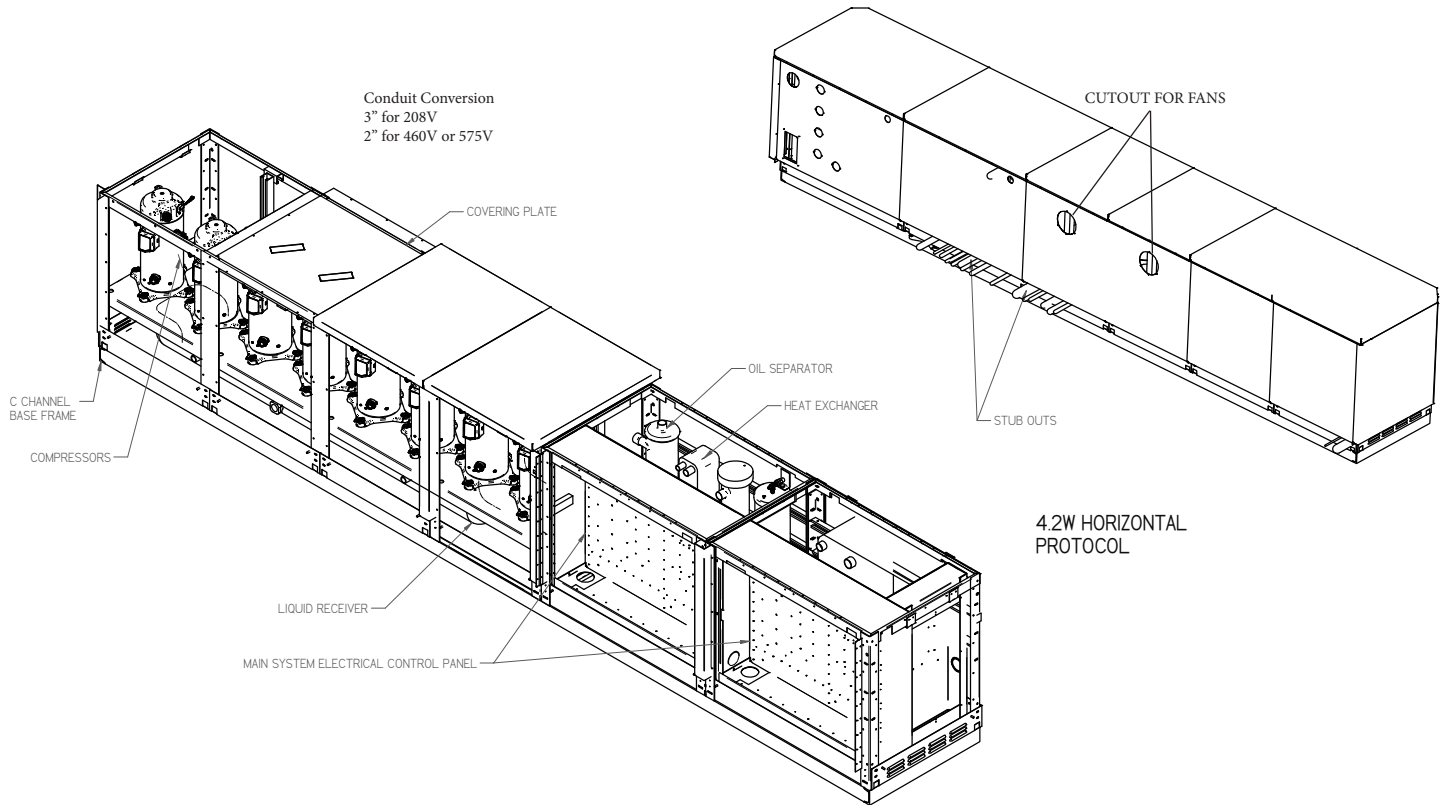
UNIT SHOWN WITHOUT SKINS FOR CLARITY FRONT VIEW



PIPE STUBS - DESIGNATIONS & LOCATIONS BACK OF PROTOCOL



Actual Line Sizing may be adjusted to match system capacities.



ACCESSIBILITY

ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FACING THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED.

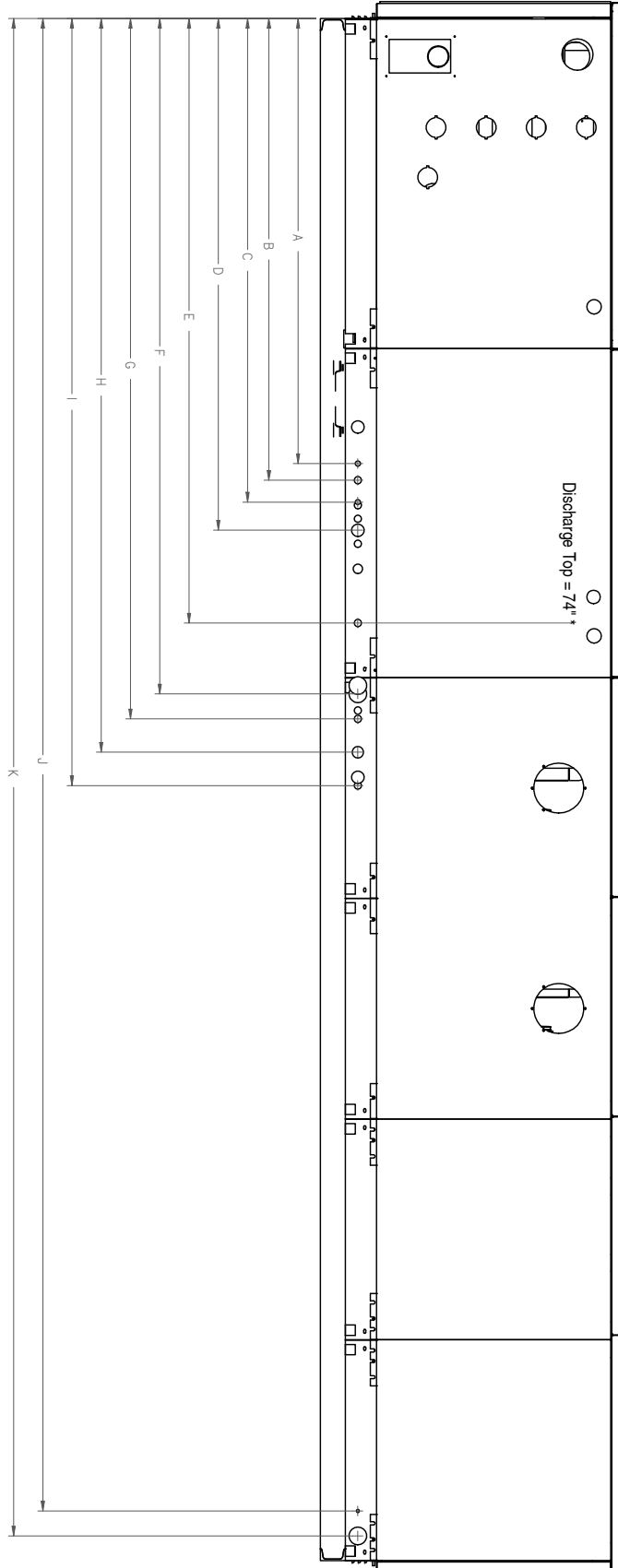
IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS.

FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.

AIRCOOLED 4.2WIDE HORIZONTAL PROTOCOL

Actual Line Sizing may be adjusted to match system capacities.

4.2W HORIZONTAL PROTOCOL



MEASUREMENT OF STUB OUT LINES

A-GAS DEFROST	B-L LIQUID FOR CASES TO CASES	C-MT LIQUID TO CASES	D-LIQUID FROM RECEIVER / CONDENSER	E-DISCHARGE	F-SUCTION	G-SAT SUCTION	H-LIQUID SUPPLY LINE	I-OPTIONAL RECEIVER REGULATOR LINE	J-FOR INJECTION	K-SPLIT SECTION
71"	55 3/8" OR 27"	54"	61 3/8" OR 66"	69" 3/8" OR 74"	81" OR 82"	84" OR 85"	88" OR 89"	96"	179"	182"

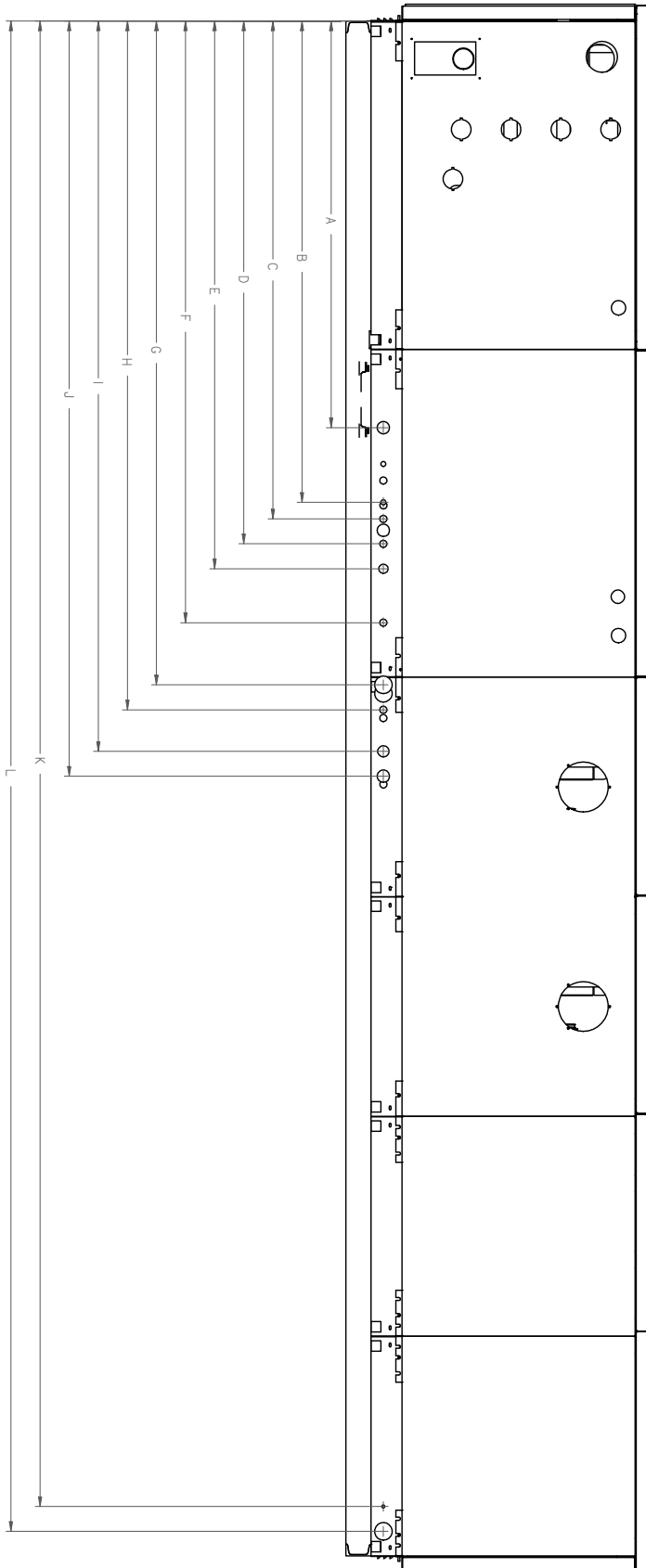
STUB OUT LINE DETAILS

LINE TYPE	SIZE OD
A GAS DEFROST	5/8"
B L LIQUID TO CASES	7/8" OR 1 1/8"
C MT LIQUID TO CASES	7/8" OR 1 1/8"
D LIQUID FROM CONDENSERS	7/8" OR 1 1/8"
E DISCHARGE	1 5/8"
F SUCTION LINE	2 5/8"
G SAT SUCTION	7/8" OR 2 5/8"
H LIQUID SUPPLY LINE	1 3/8"
I OPTIONAL RECEIVER REGULATOR LINE	7/8"
J FOR INJECTION	3/8"
K SPLIT SUCTION	2 5/8"

WATERCOOL ED 4.2 WIDE HORIZONTAL PROTOCOL

Actual Line Sizing may be adjusted to match system capacities.

4.2W HORIZONTAL PROTOCOL



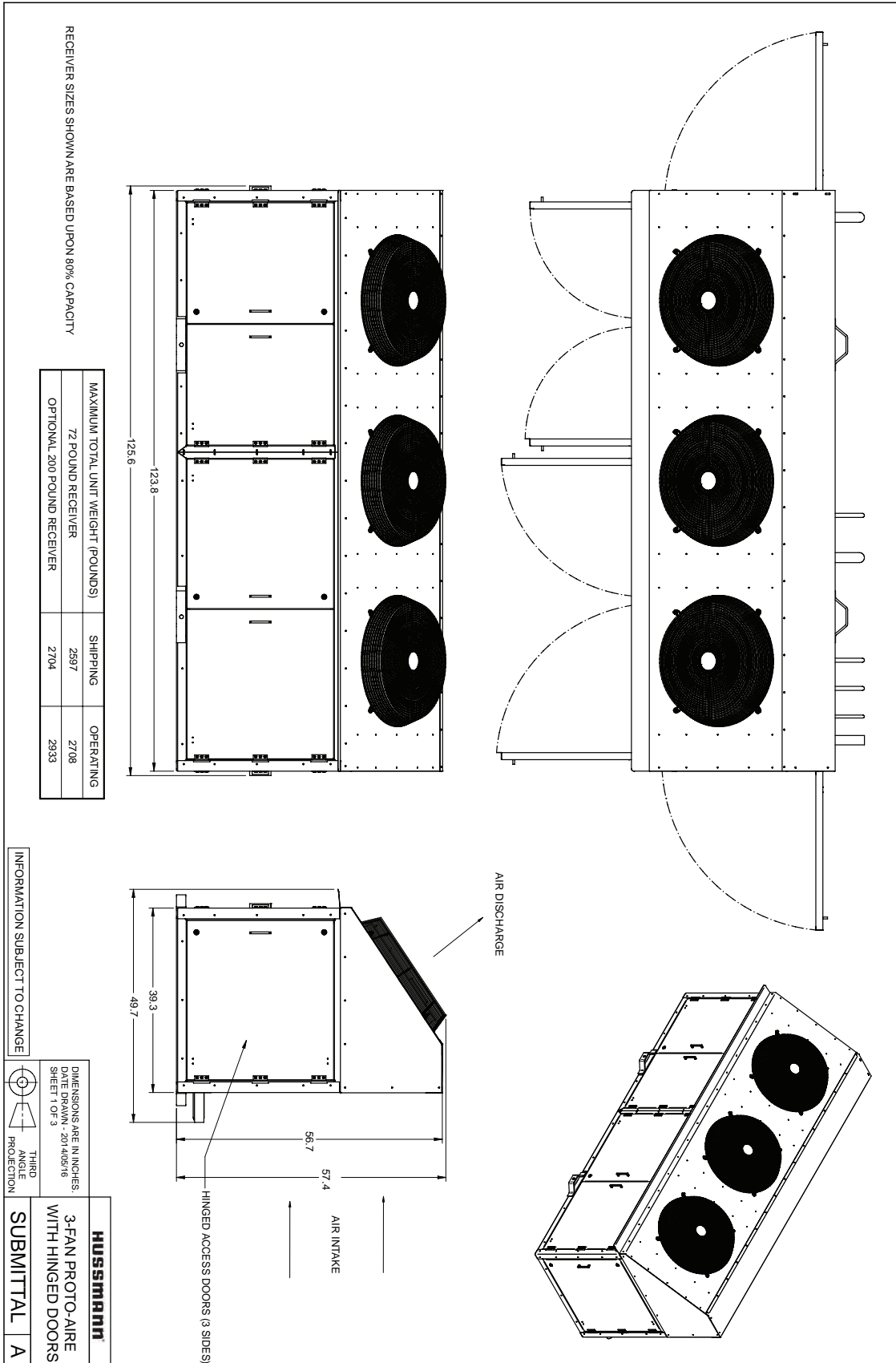
MEASUREMENT OF STUB OUT LINES

A - WATER OUTLET	B-GAS DEFROST	C-LT LIQUID FOR CASES	D-MT LIQUID FOR CASES	E - MT LIQUID FROM RECEIVER	F-LIQUID TO RECEIVER	G- SUCTION	H-SAT SUCTION	I LIQUID LINE	J WATER INLET	K FOR INJECTION	L SPLIT SECTION
49"	38"	60"	63"	66"	72 1/2"	90" OR 91" - 92"	83" OR 85"	88" OR 89"	91" OR 93"	17.9"	182"

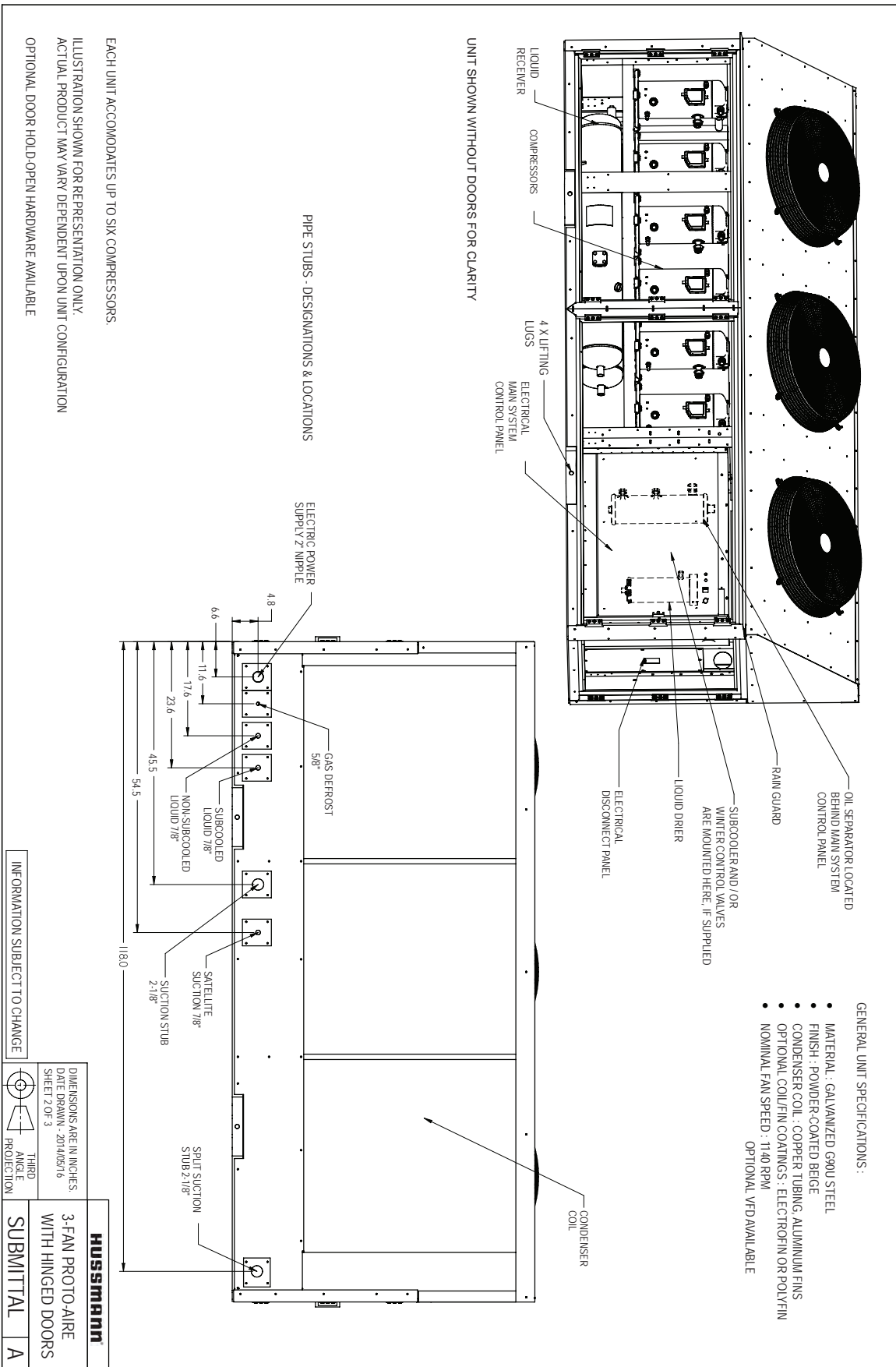
STUB OUT LINE DETAILS

A	WATER OUTLET	1 1/2"
B	GAS DEFROST	5/8"
C	LT LIQUID FOR CASES	7/8"
D	MT LIQUID FOR CASES	7/8"
E	MT LIQUID FROM RECEIVER	7/8" OR 1 1/8"
F	LIQUID TO RECEIVER	7/8" OR 1 1/2"
G	SUCTION	2 5/8"
H	SAT SUCTION	7/8"
I	LIQUID LINE	1 3/8"
J	WATER INLET	2 1/8"
K	FOR INJECTION	3/8"
L	SPLIT SUCTION	2 5/8"

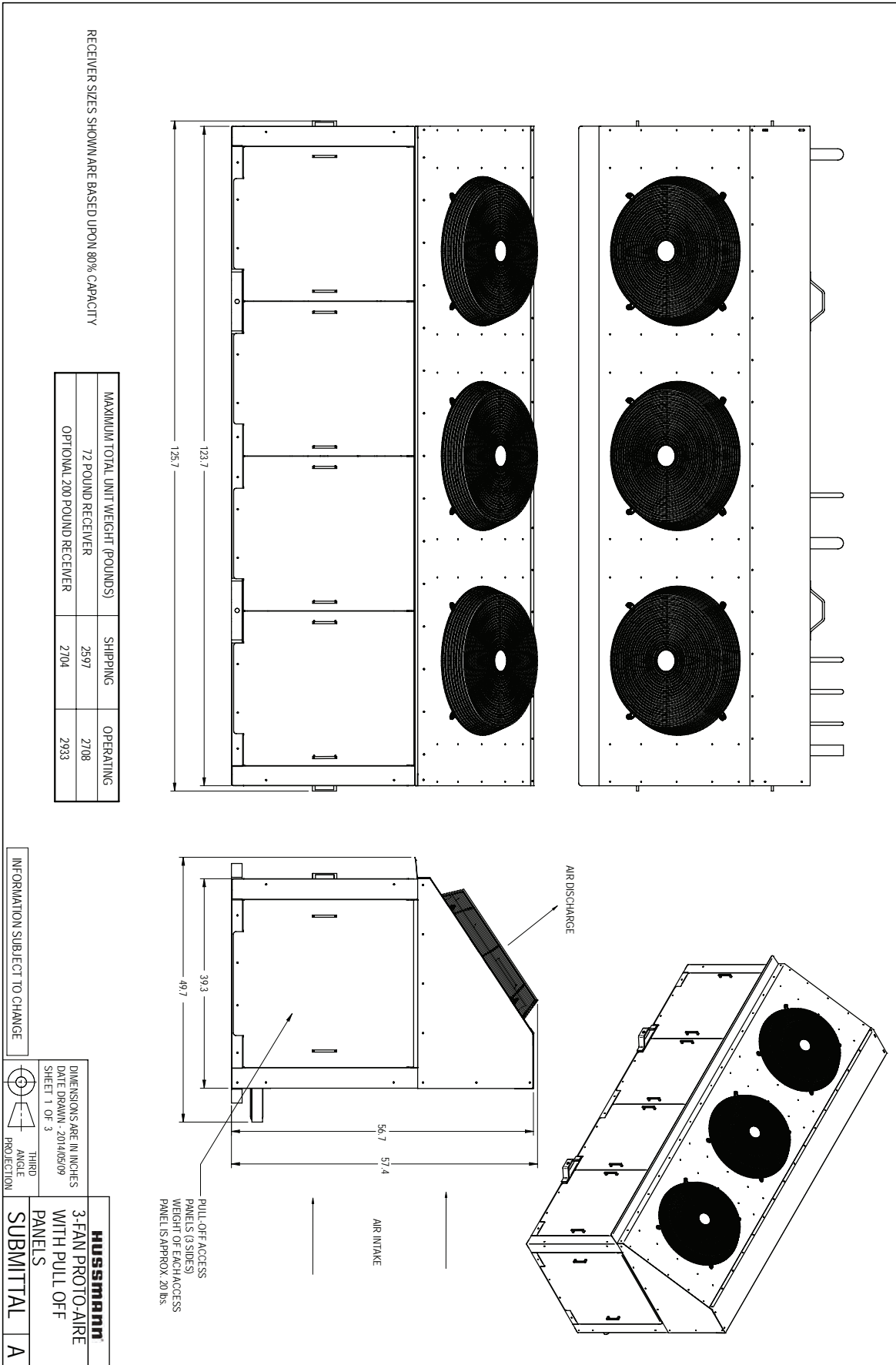
Proto Aire Units

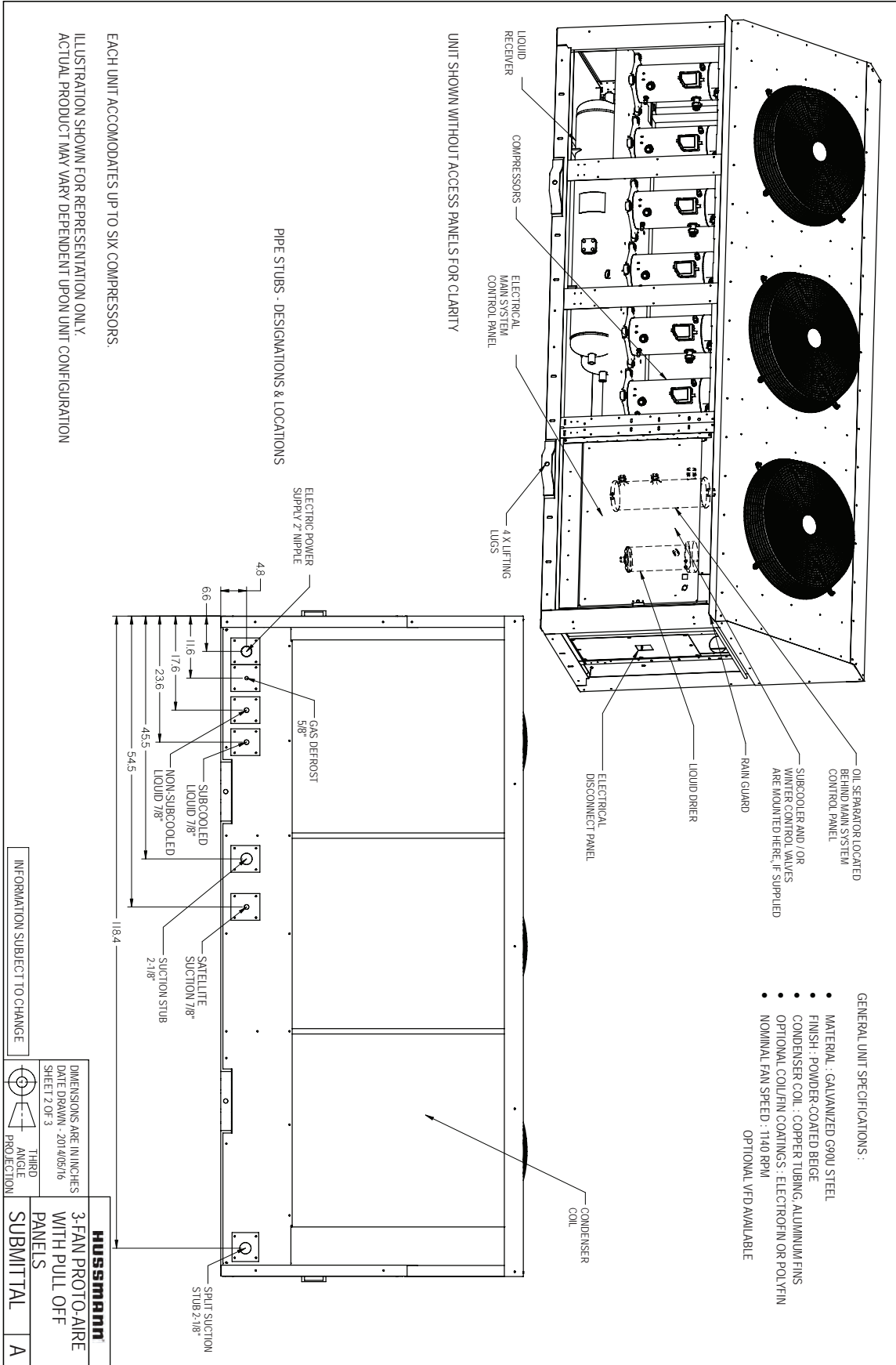


HUSMANN_GDF_2.0 SHEET SIZE D



EACH UNIT ACCOMMODATES UP TO SIX COMPRESSORS.
ILLUSTRATION SHOWN FOR REPRESENTATION ONLY.
ACTUAL PRODUCT MAY VARY DEPENDENT UPON UNIT CONFIGURATION
OPTIONAL DOOR HOLD-OPEN HARDWARE AVAILABLE





ACCESSIBILITY

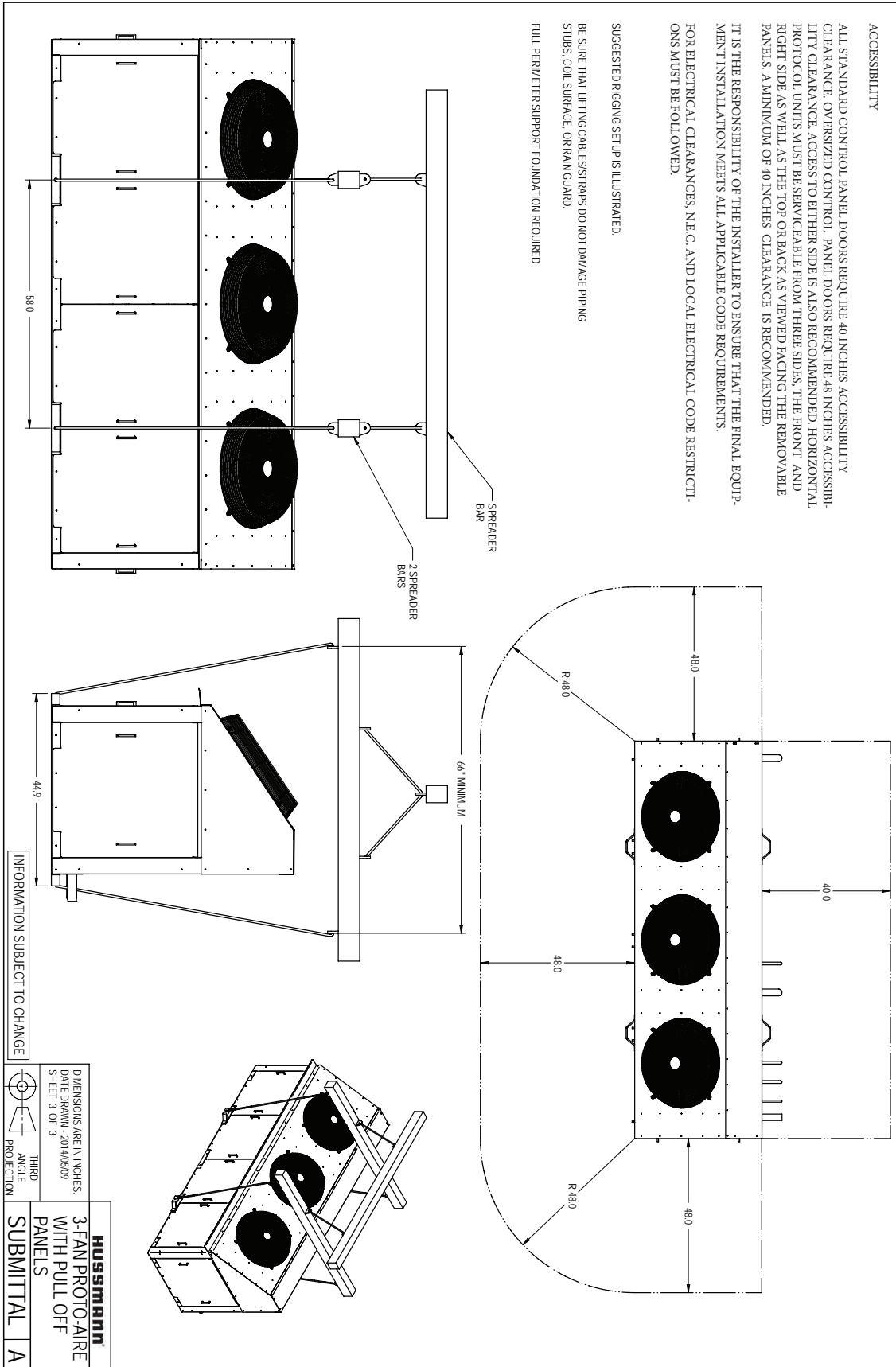
ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FACING THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED.

IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS. FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.

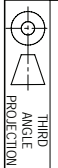
SUGGESTED RIGGING SETUP IS ILLUSTRATED

BE SURE THAT LIFTING CABLE STRAPS DO NOT DAMAGE PIPING STUBS, COIL SURFACE, OR RAIN GUARD.

FULL PERIMETER SUPPORT FOUNDATION REQUIRED

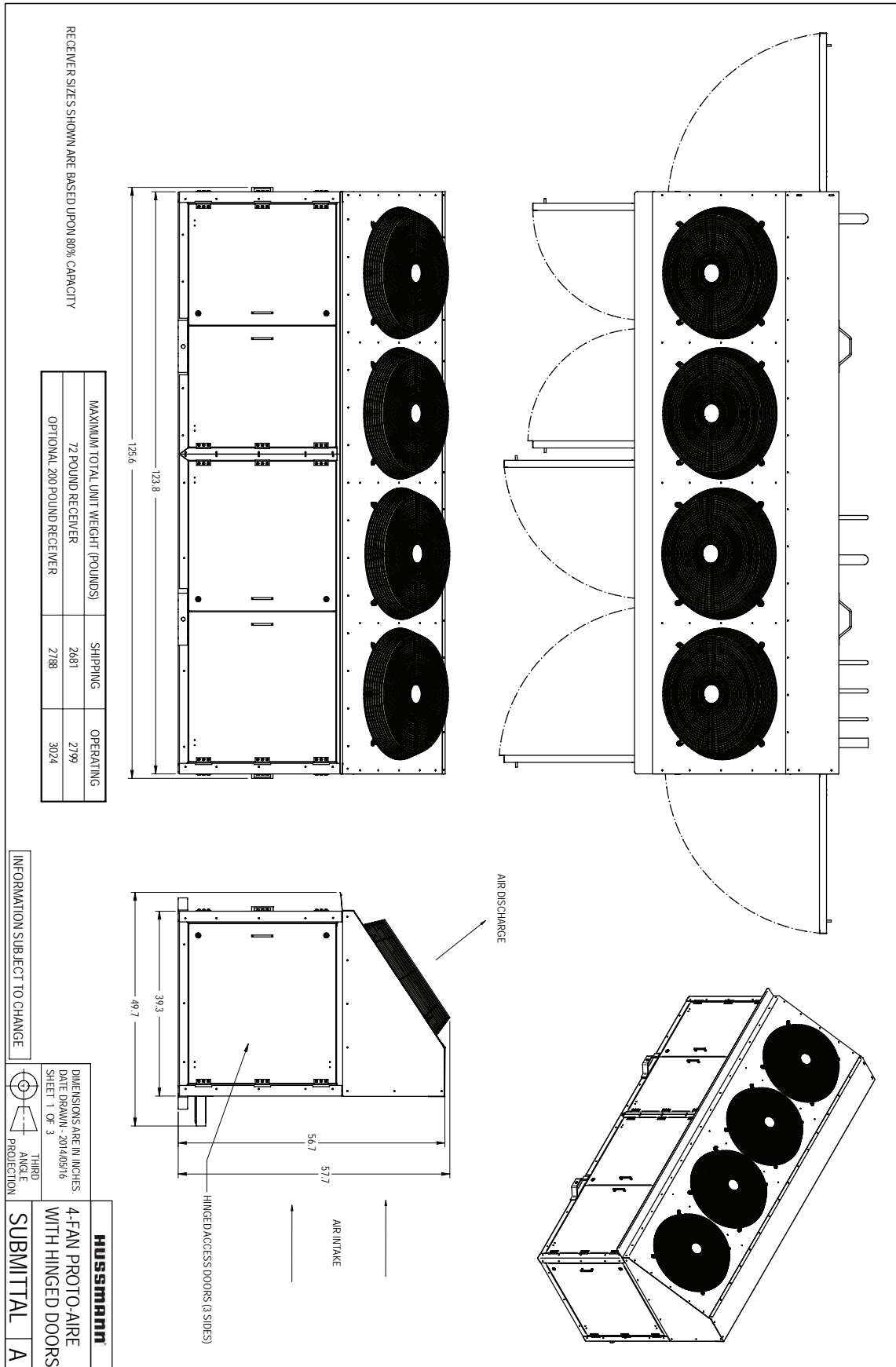


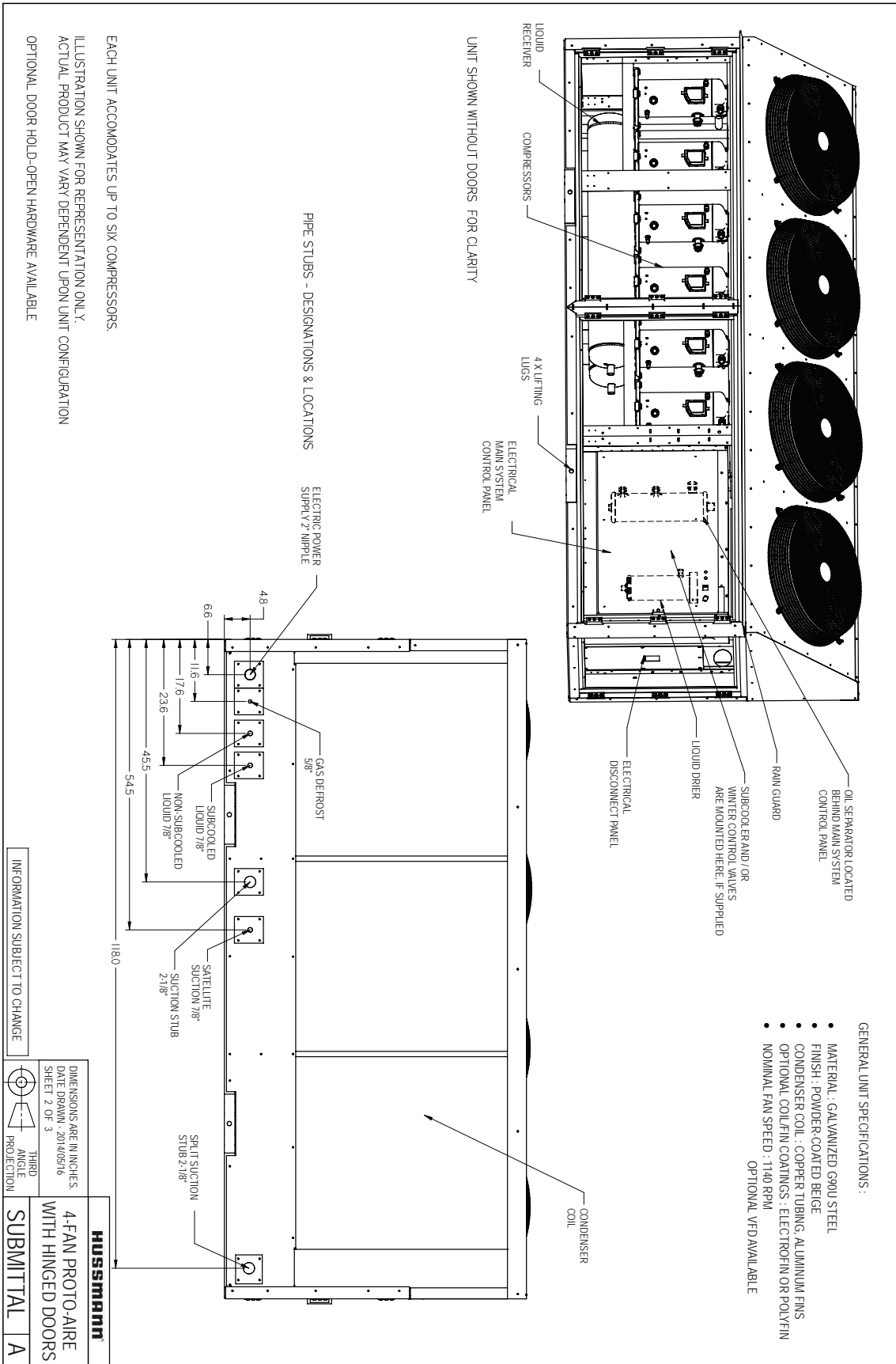
INFORMATION SUBJECT TO CHANGE



HUSMANN
 3-FAN PROTO-AIRE
 WITH PULL OFF
 PANELS
 SUBMITTAL A

DIMENSIONS ARE IN INCHES
 DATE DRAWN - 2014/05/09
 SHEET 3 OF 3

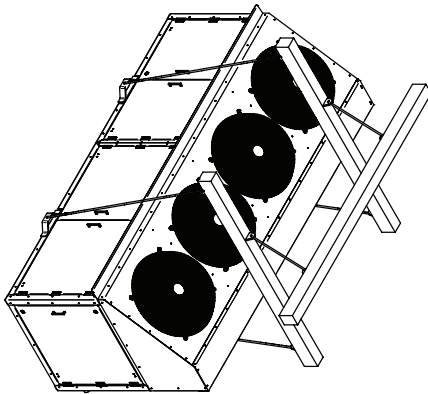
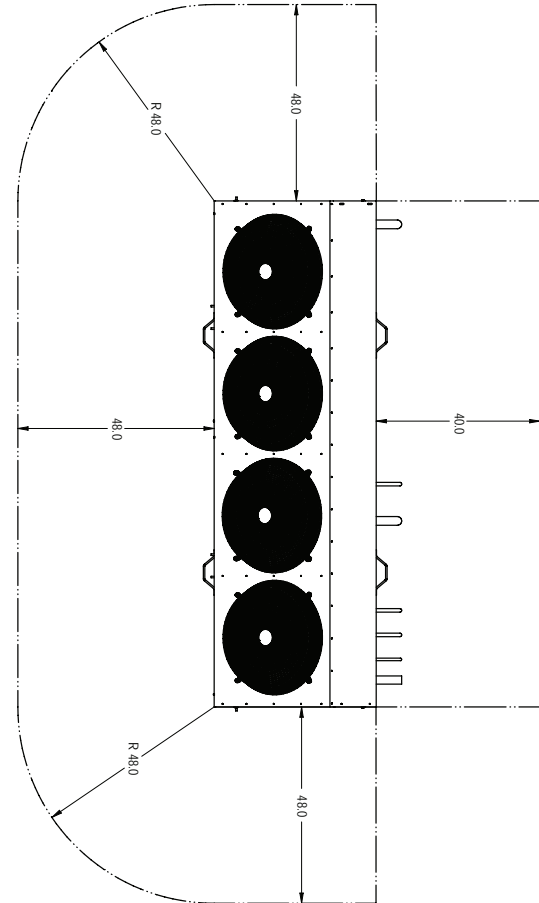
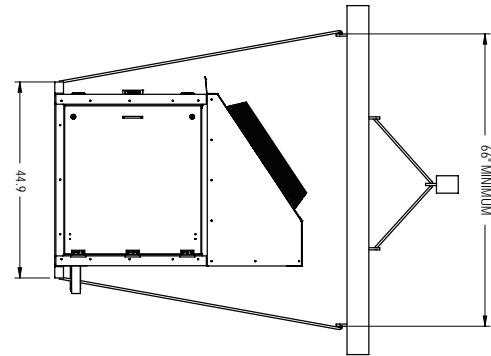
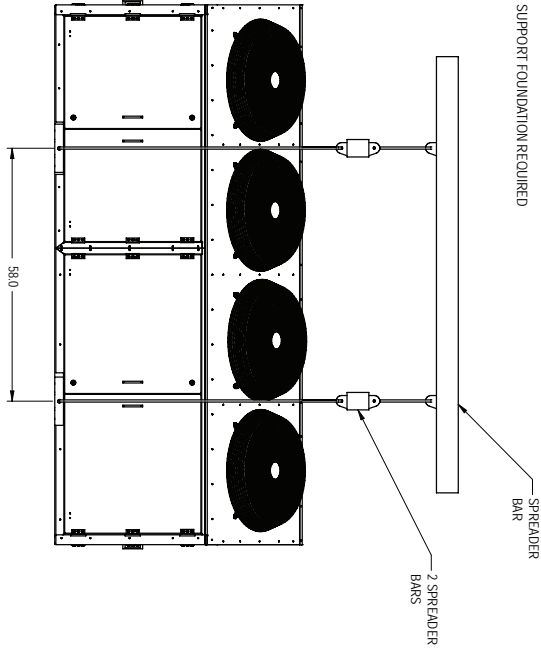




ACCESSIBILITY

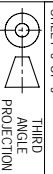
ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FACING THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED. IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS. FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.

SUGGESTED RIGGING SETUP IS ILLUSTRATED.
 BE SURE THAT LIFTING CABLES/STRAPS DO NOT DAMAGE PIPING STUBS, COIL SURFACE, OR RAIN GUARD.
 FULL PERIMETER SUPPORT FOUNDATION REQUIRED



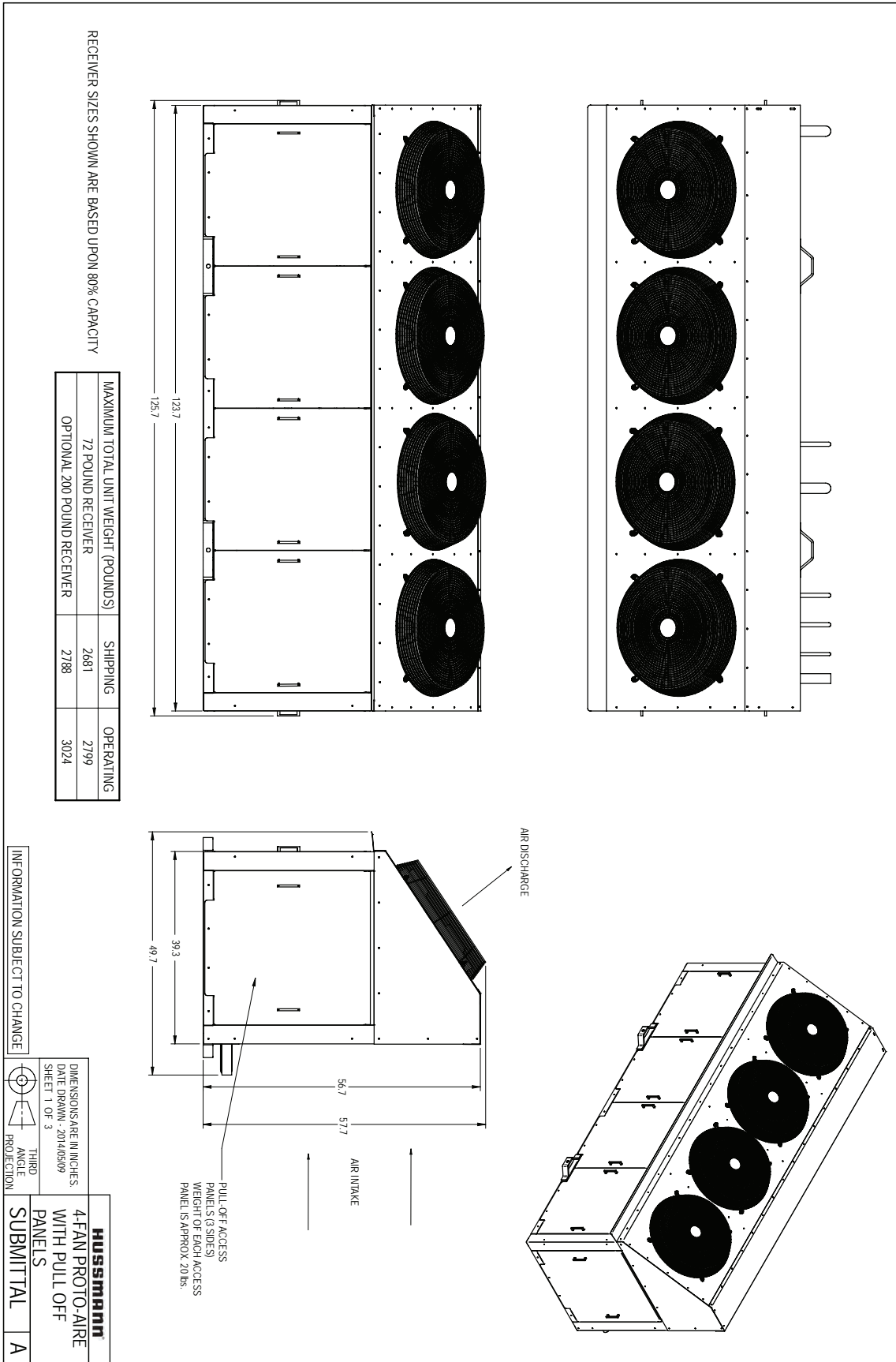
INFORMATION SUBJECT TO CHANGE

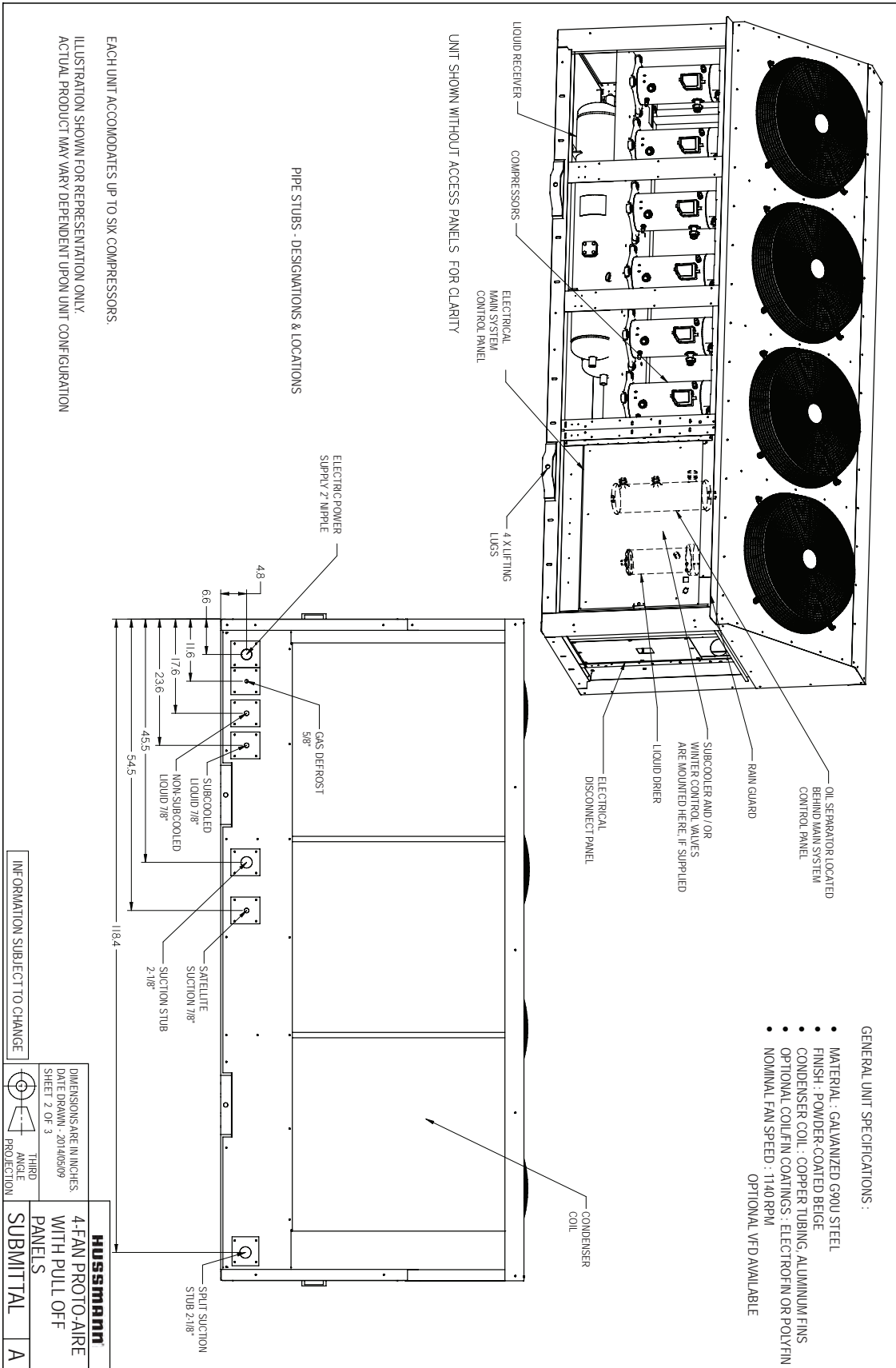
HUSSMANN
 DIMENSIONS ARE IN INCHES
 DATE DRAWN - 2014/05/16
 SHEET 3 OF 3



4-FAN PROTO-AIRE WITH HINGED DOORS
 SUBMITTAL A

HUSSMANN_GDF_2.0 SHEET SIZE D





ACCESSIBILITY

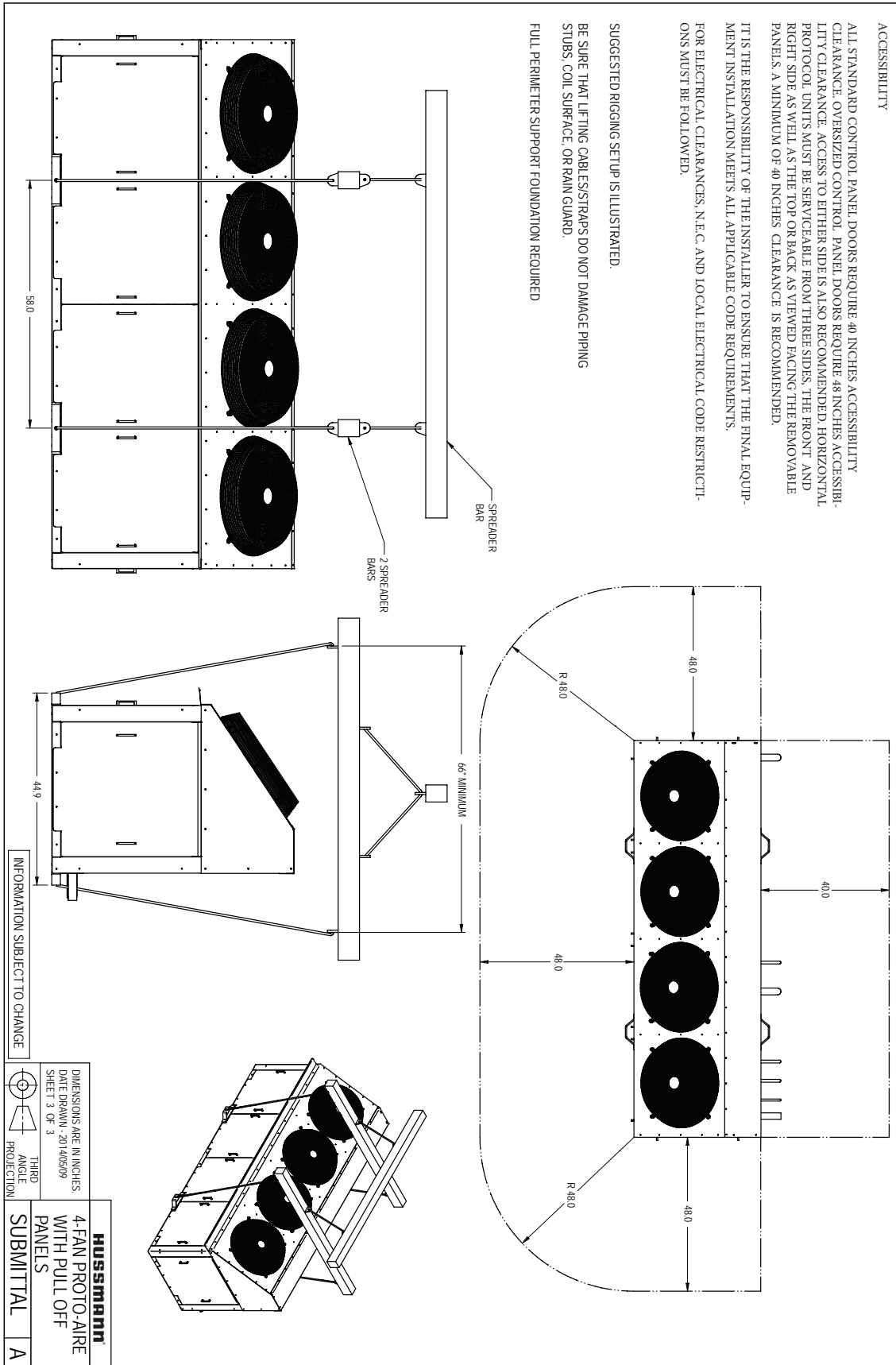
ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FROM THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED.

IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS. FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.

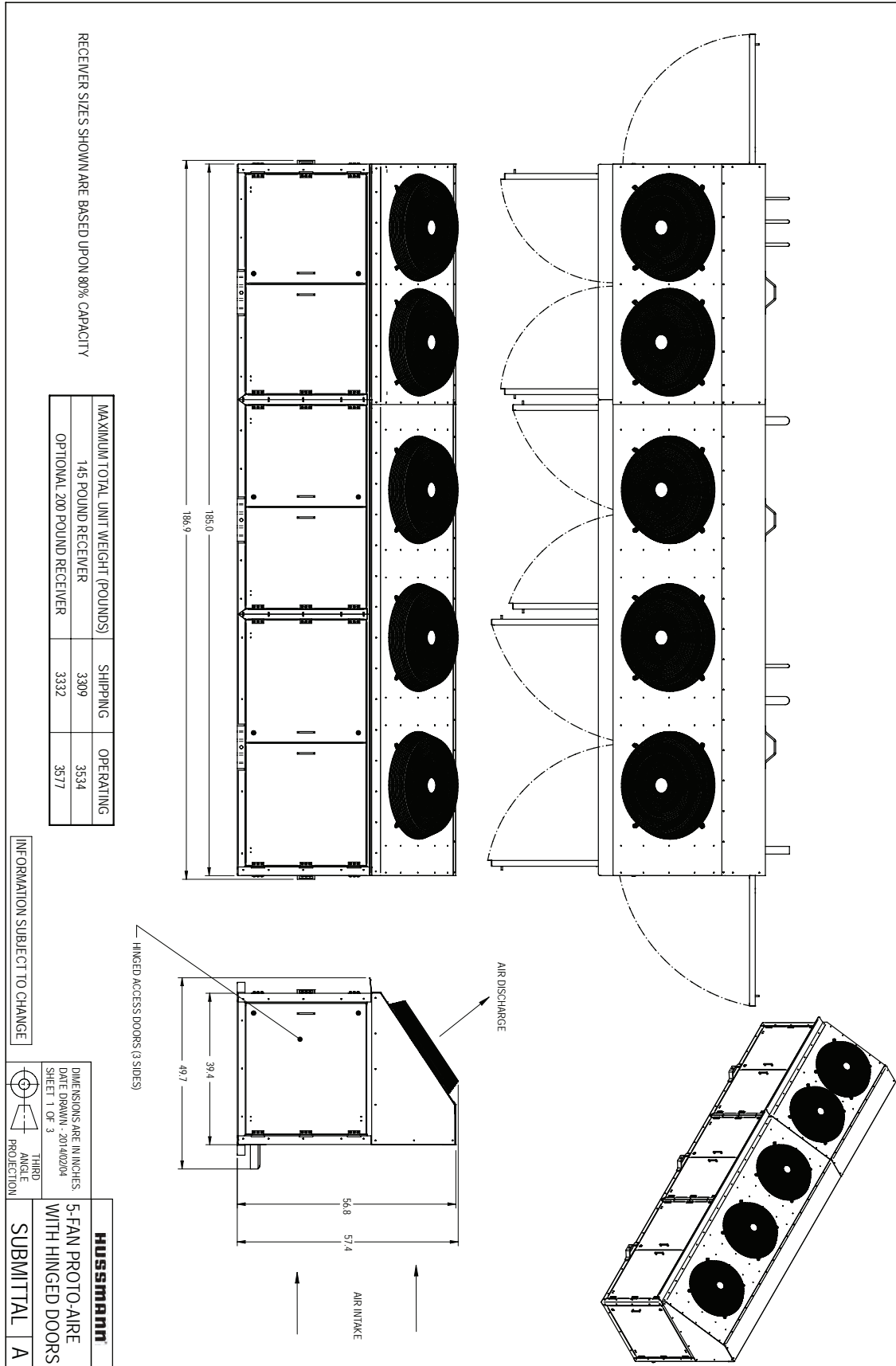
SUGGESTED RIGGING SETUP IS ILLUSTRATED.

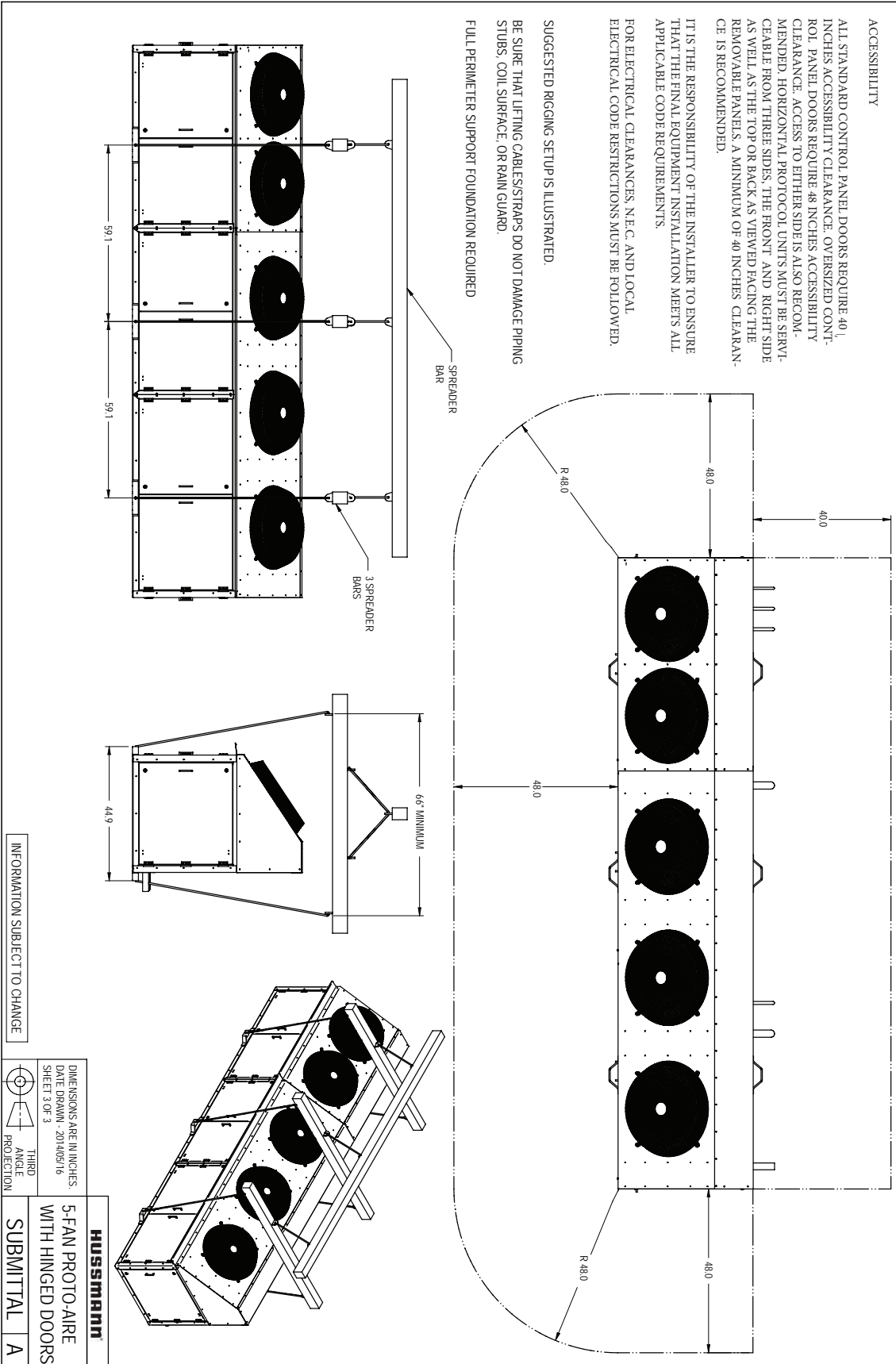
BE SURE THAT LIFTING CABLE STRAPS DO NOT DAMAGE PIPING, STUBS, COIL SURFACE, OR RAIN GUARD.

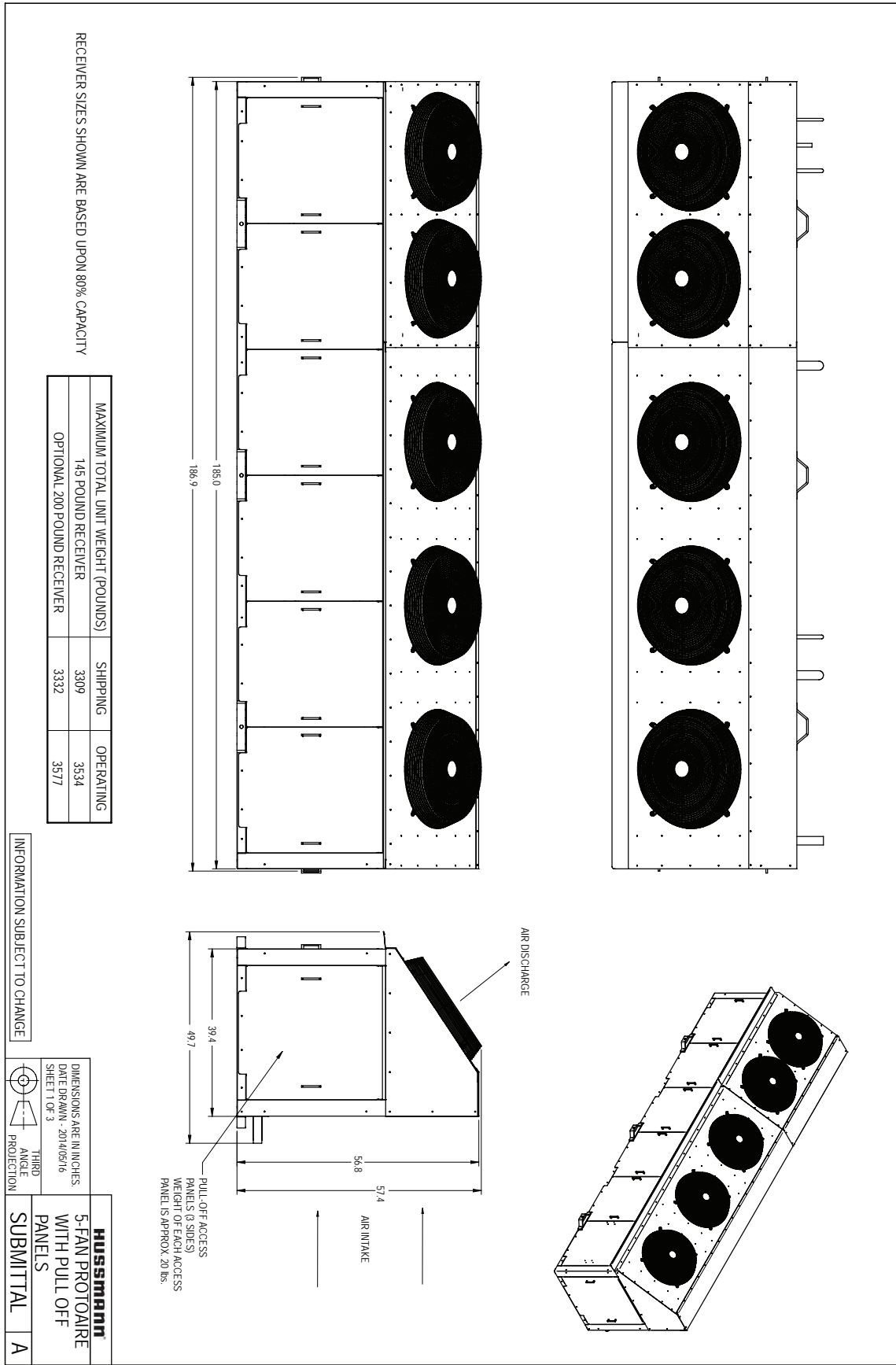
FULL PERIMETER SUPPORT FOUNDATION REQUIRED

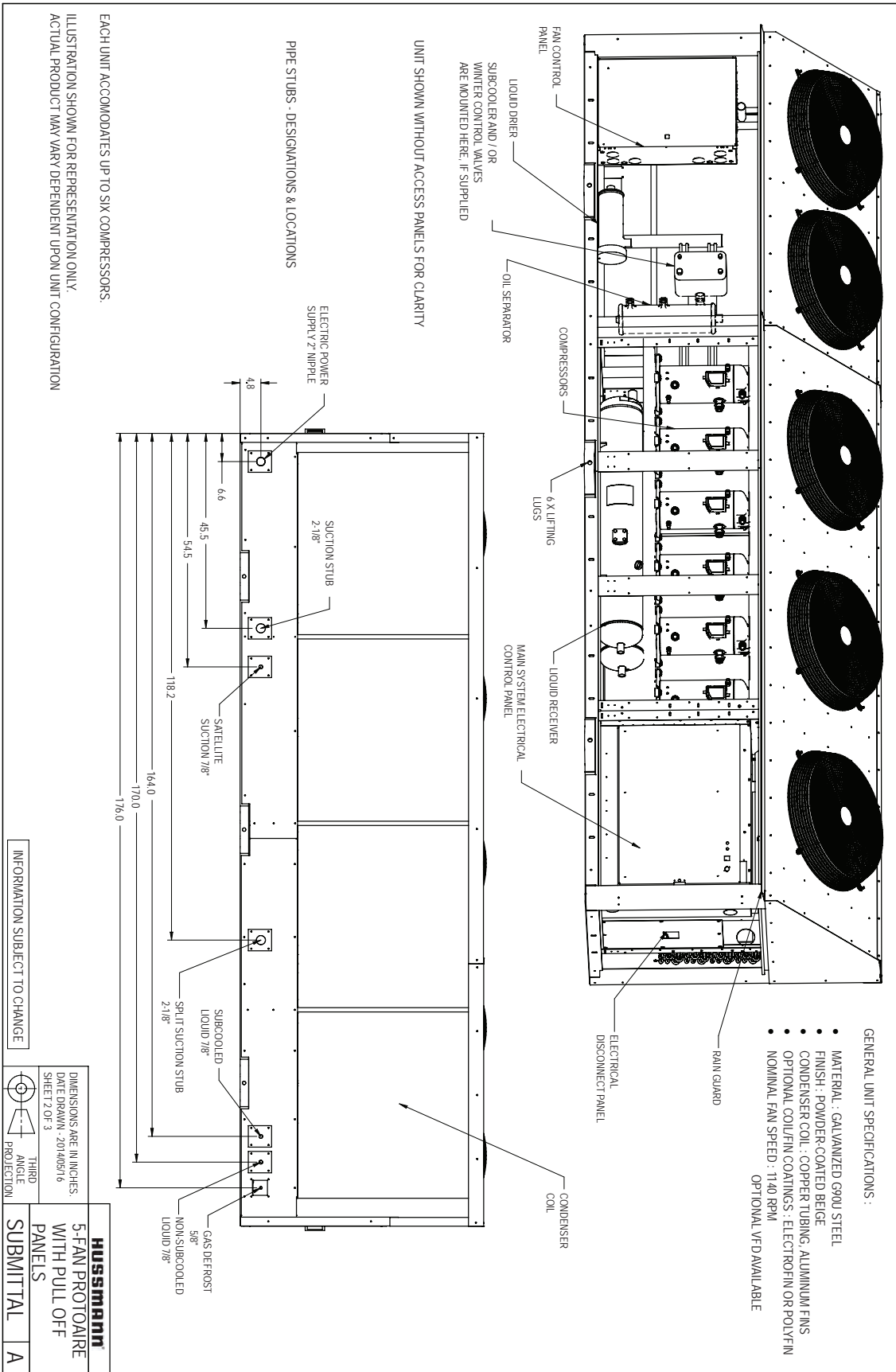


HUSSMANN_GDF_20 SHEET SIZE D









ACCESSIBILITY

ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FROM THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED.

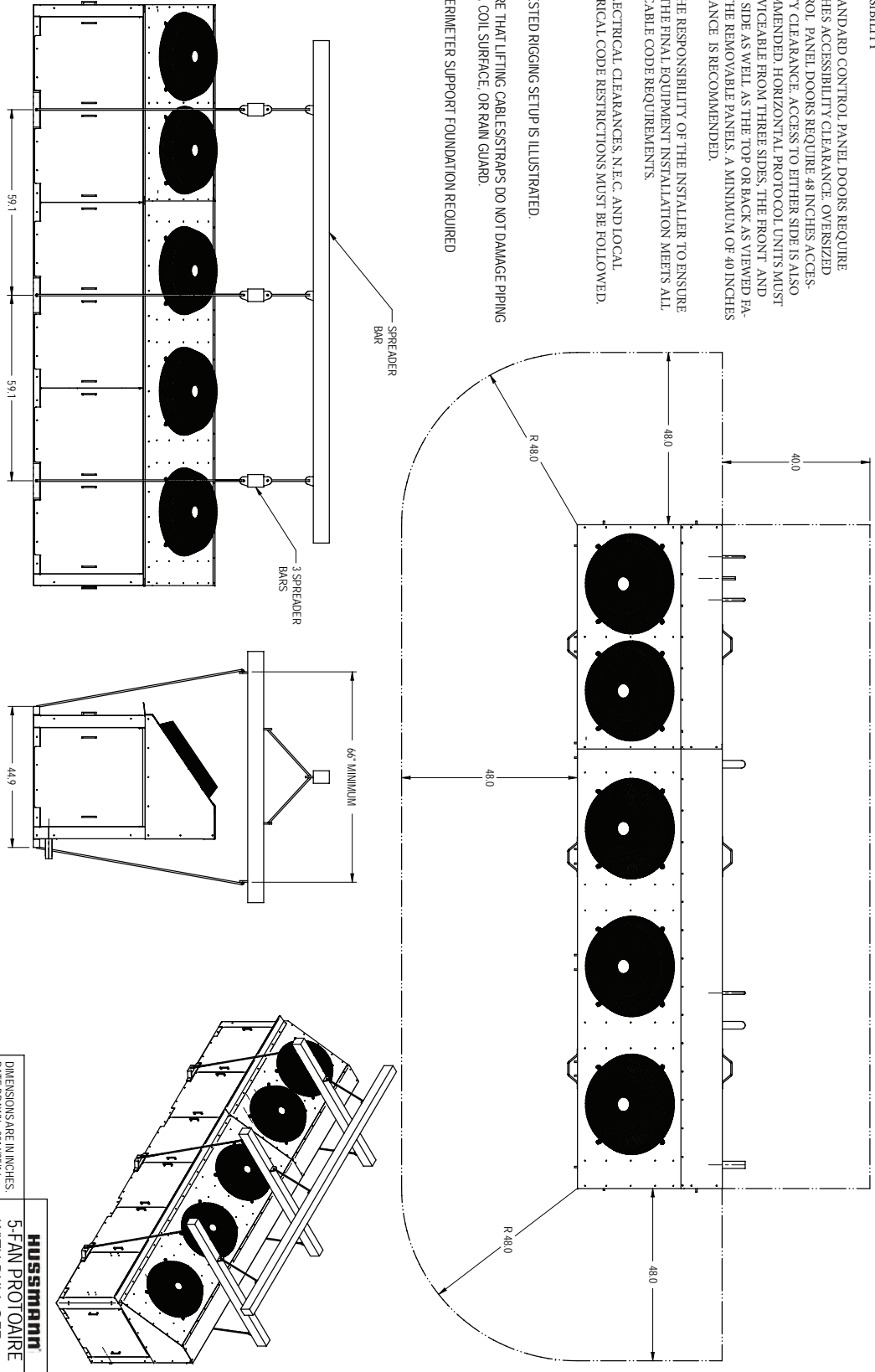
IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS.

FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.

SUGGESTED RIGGING SETUP IS ILLUSTRATED.

BE SURE THAT LIFTING CABLES/STRAPS DO NOT DAMAGE PIPING STUBS, COIL SURFACE, OR RAIN GUARD.

FULL PERIMETER SUPPORT FOUNDATION REQUIRED



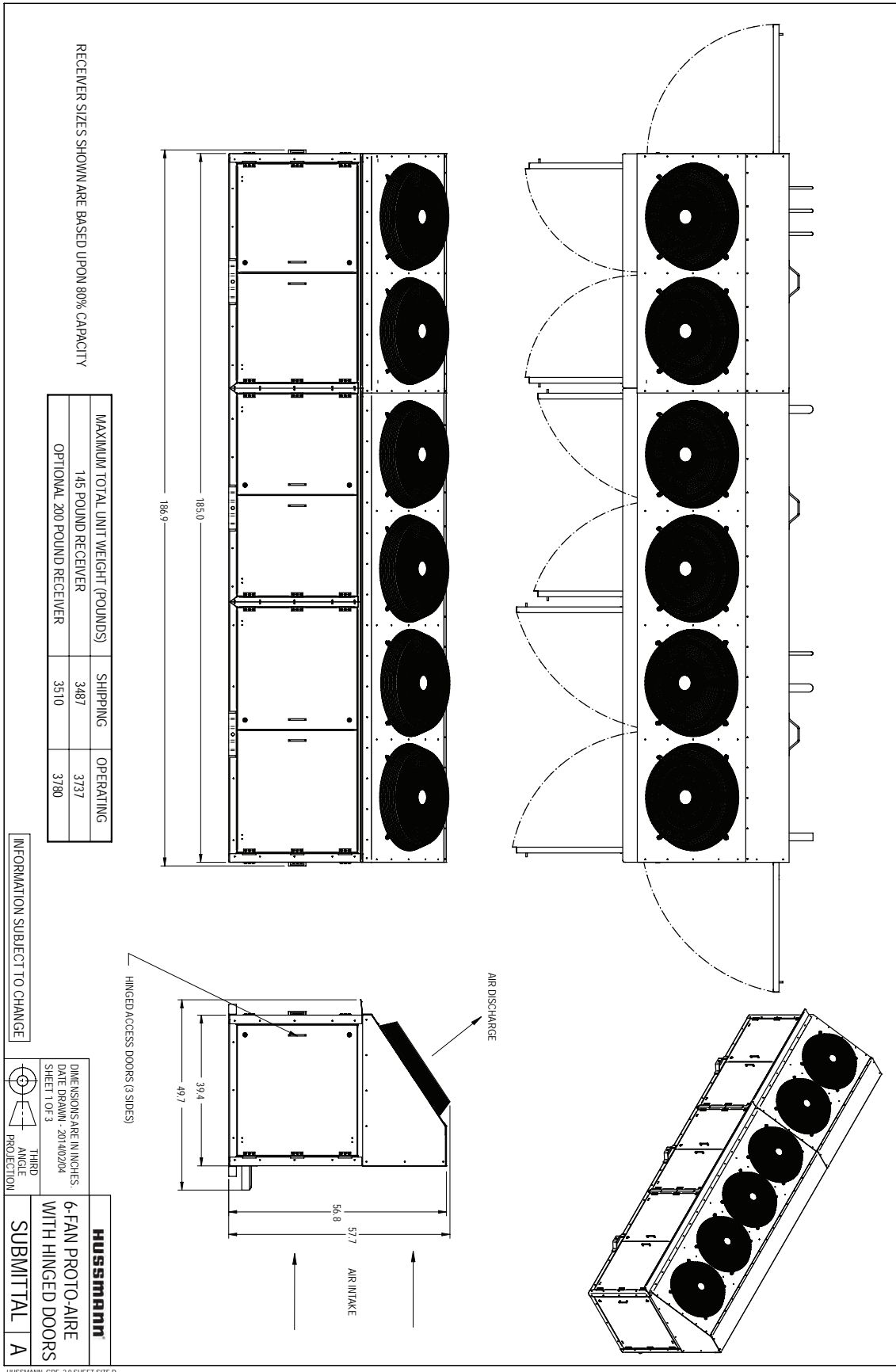
INFORMATION SUBJECT TO CHANGE

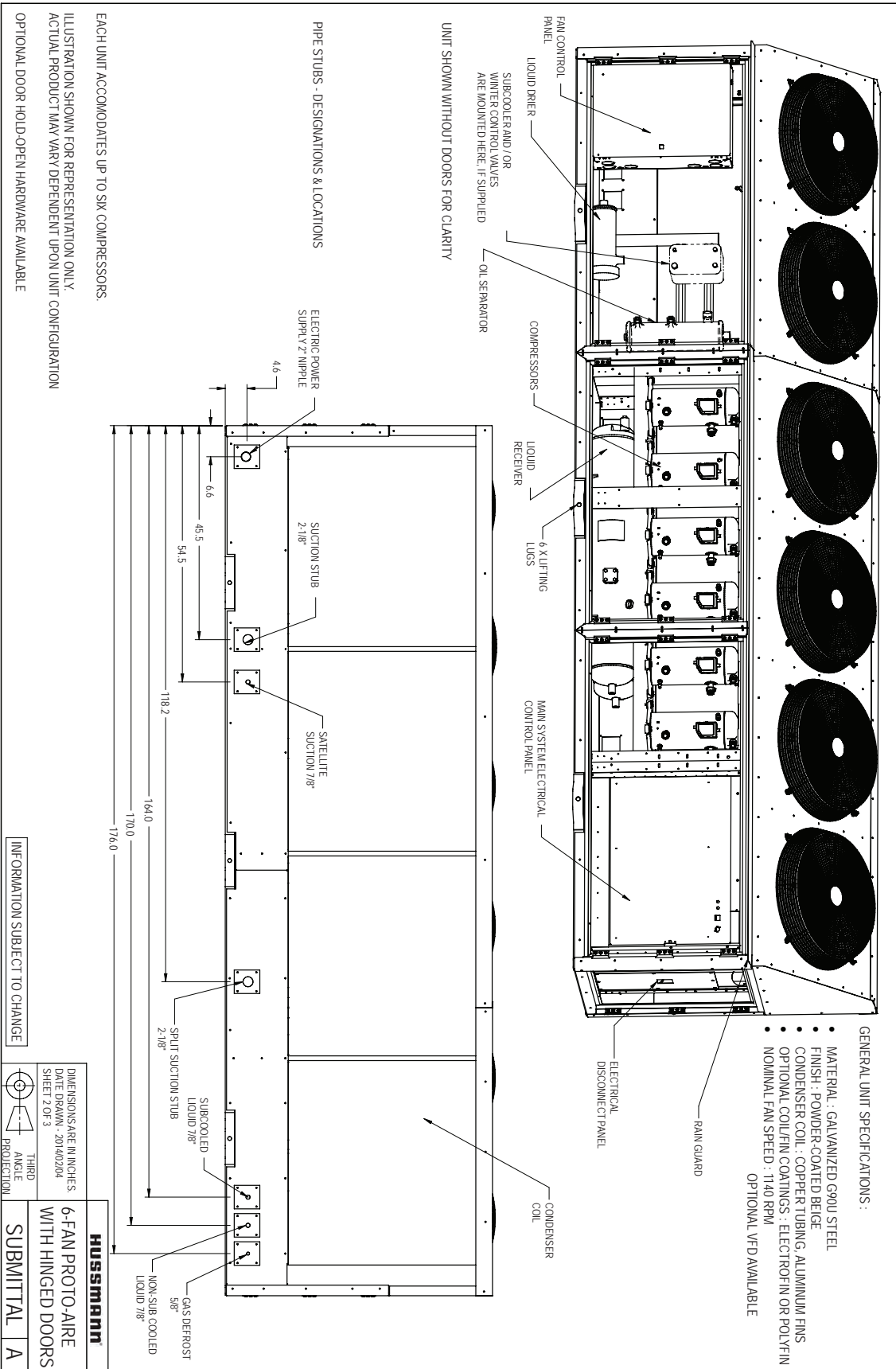
HUSSMANN
 5-FAN PROTOAIRE
 WITH PULL OFF
 PANELS
 SUBMITTAL A

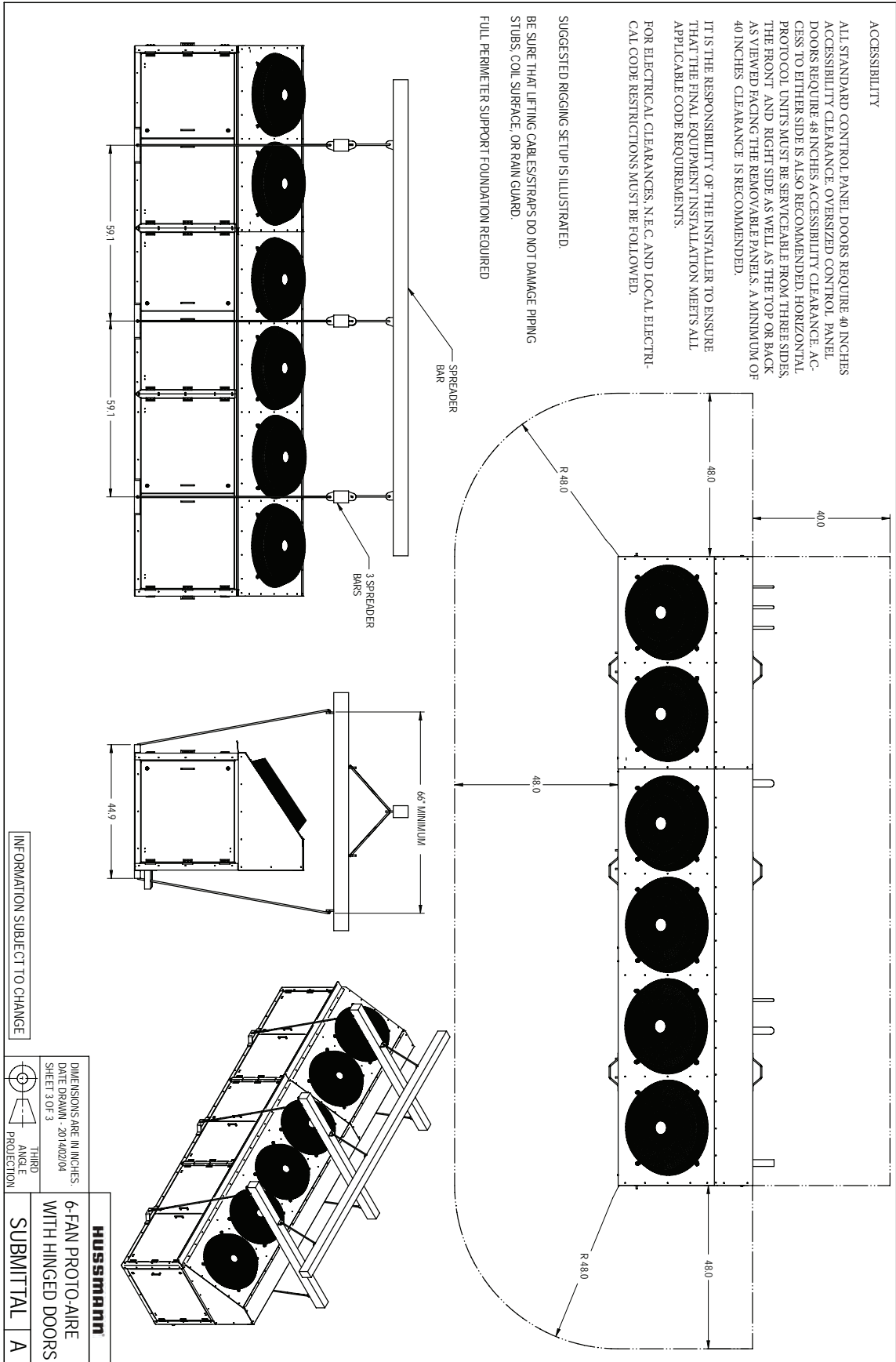
DIMENSIONS ARE IN INCHES.
 DATE: DRAWN: 3/20/05/16
 SHEET 3 OF 3

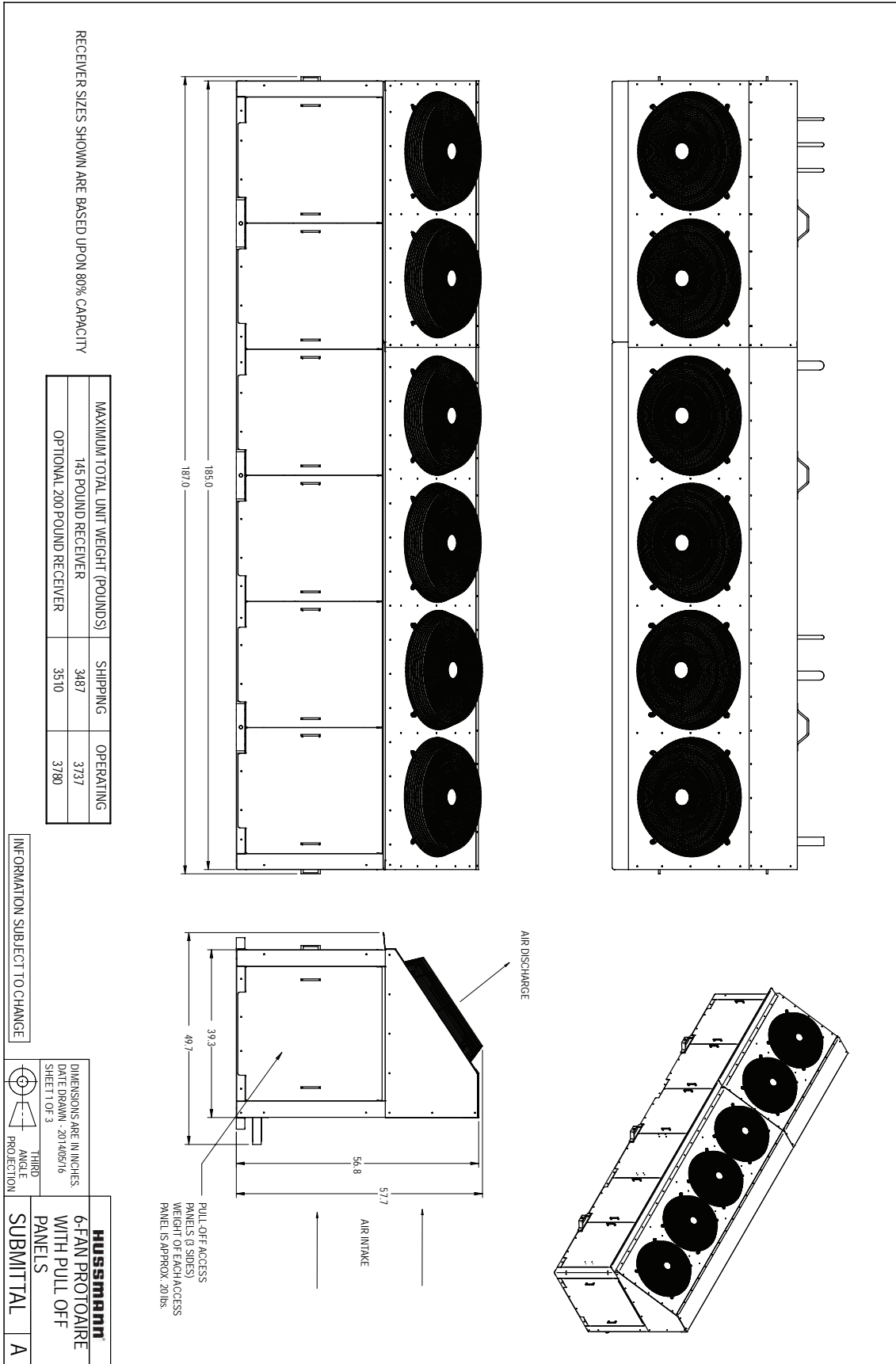
THIRD ANGLE PROJECTION

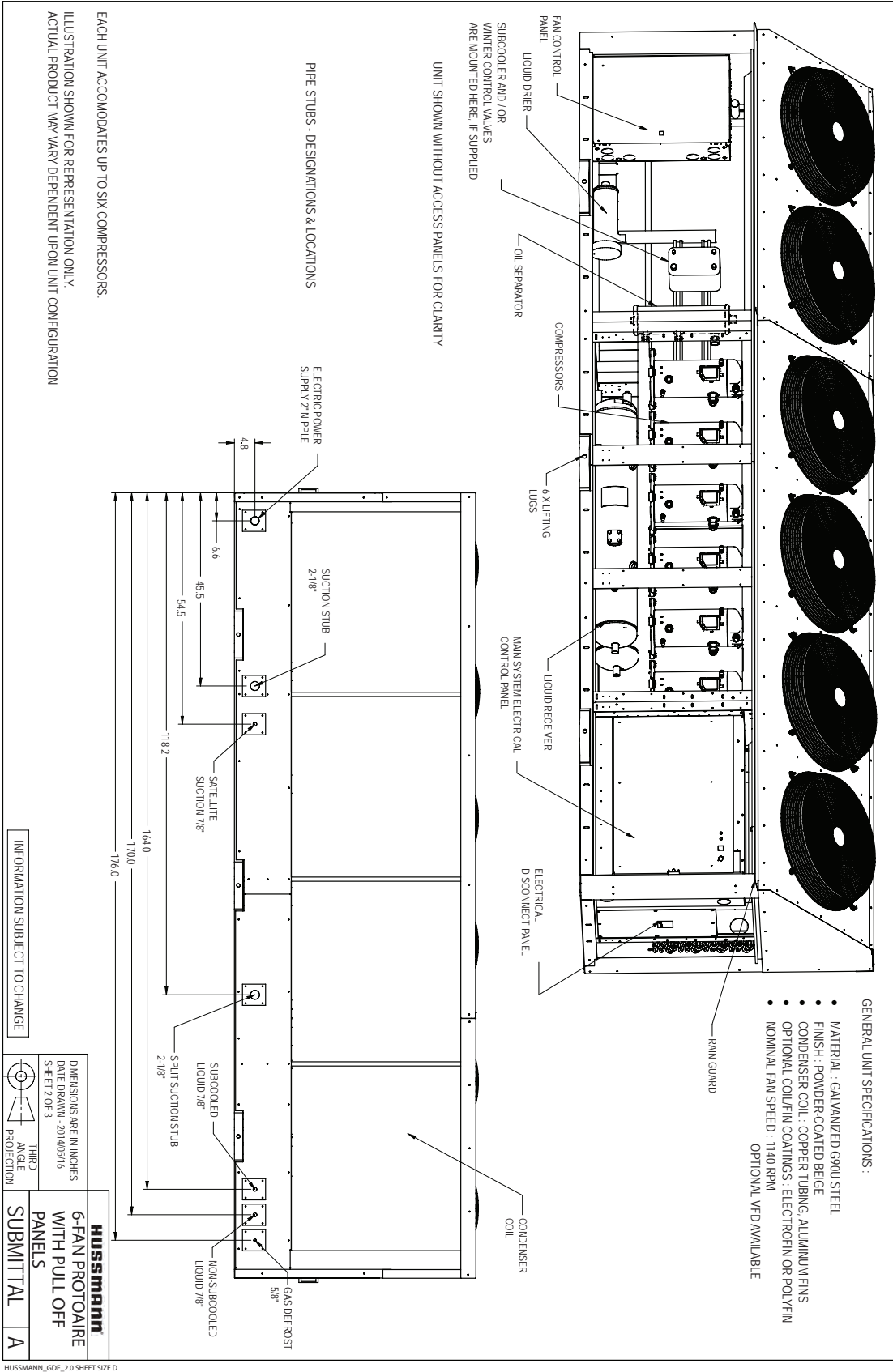
HUSSMANN_GDF_2.0 SHEET SIZE D











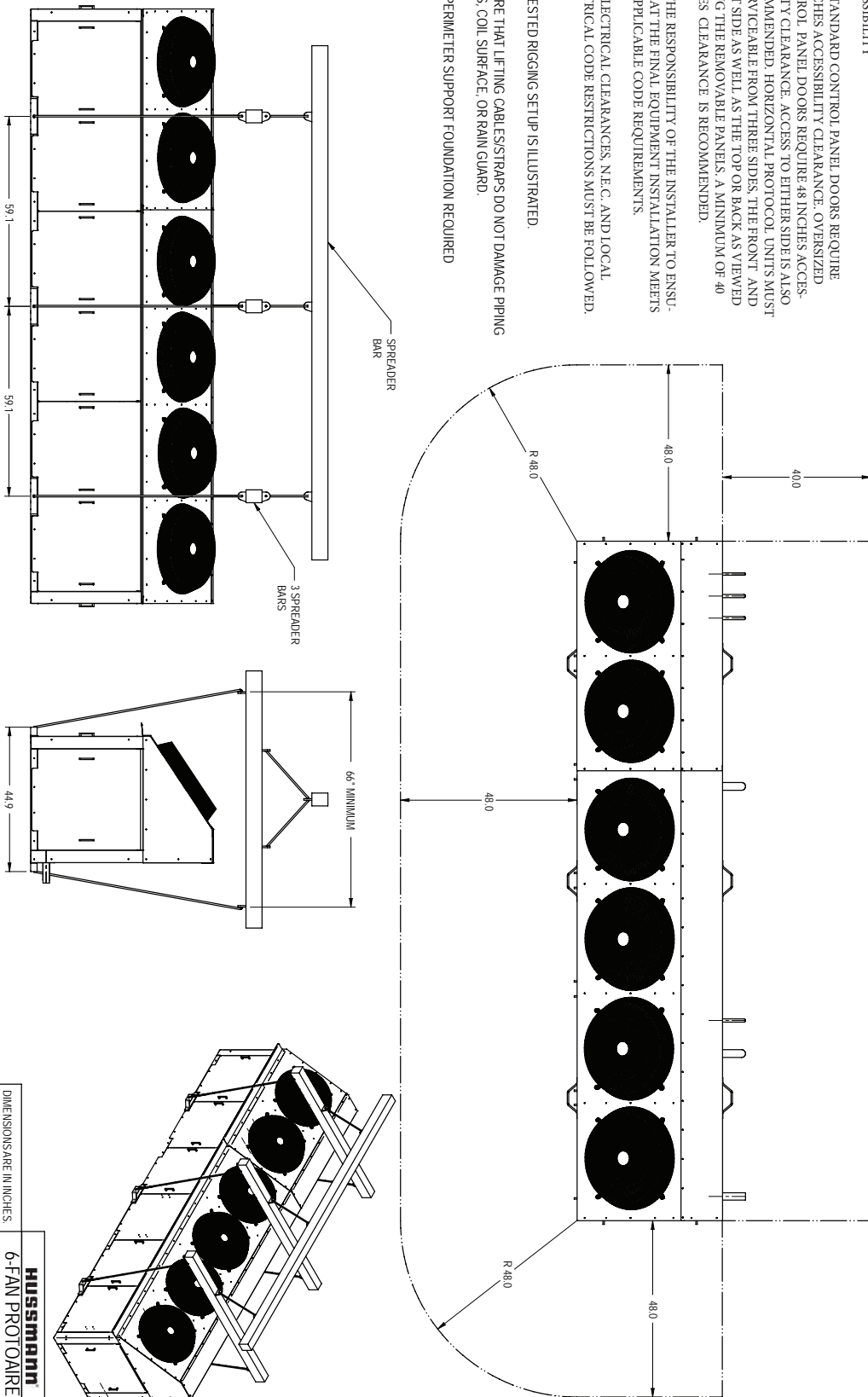
ACCESSIBILITY

ALL STANDARD CONTROL PANEL DOORS REQUIRE 40 INCHES ACCESSIBILITY CLEARANCE. OVERSIZED CONTROL PANEL DOORS REQUIRE 48 INCHES ACCESSIBILITY CLEARANCE. ACCESS TO EITHER SIDE IS ALSO RECOMMENDED. HORIZONTAL PROTOCOL UNITS MUST BE SERVICEABLE FROM THREE SIDES, THE FRONT AND RIGHT SIDE AS WELL AS THE TOP OR BACK AS VIEWED FACING THE REMOVABLE PANELS. A MINIMUM OF 40 INCHES CLEARANCE IS RECOMMENDED.

IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FINAL EQUIPMENT INSTALLATION MEETS ALL APPLICABLE CODE REQUIREMENTS. FOR ELECTRICAL CLEARANCES, N.E.C. AND LOCAL ELECTRICAL CODE RESTRICTIONS MUST BE FOLLOWED.

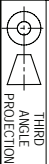
SUGGESTED RIGGING SETUP IS ILLUSTRATED. BE SURE THAT LIFTING CABLES/TRAPS DO NOT DAMAGE PIPING STUBS, COIL SURFACE, OR RAIN GUARD.

FULL PERIMETER SUPPORT FOUNDATION REQUIRED



INFORMATION SUBJECT TO CHANGE

DIMENSIONS ARE IN INCHES
DATE DRAWN - 20140516
SHEET 3 OF 3



HUSSMANN
6-FAN PROTOAIRE
WITH PULL OFF
PANELS
SUBMITTAL A

REFRIGERATION PIPING

Important: Since Hussmann has no direct control over the installation, providing freeze-burst protection is the responsibility of the installing contractor. **Always use a pressure regulator with a nitrogen tank.** Do not exceed 2 psig and vent lines when brazing. Do not exceed 350 psig for leak testing high side. Do not exceed 150 psig for leak testing low side.

Always recapture test charge in approved recovery vessel for recycling.
The Water Loop should be tested for leaks using pressurized water.
DO NOT exceed 75 psig at the lowest point in the piping.

Overview

This section details the major refrigeration components and their locations in each piping system.

Refrigeration Line Piping

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 35% silver solder for dissimilar metals.

Liquid 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 or an offset. Plan proper pitching, expansion allowance, and P-traps at the base of all suction risers. Use long radius elbows to reduce flow resistance and breakage. Avoid completely the use of 45° elbows. Install service valves at several locations for ease of maintenance and reduction of service costs. These must be UL approved for 450 psig minimum working pressure.

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

Return Gas Superheat

Return gas superheat should be 10 to 30 °F on all units.

Suction Line

1. Install a downward slope in direction of flow. A P-trap is required for all vertical risers.
2. Line may be reduced by one size after first third of case load and again after the second third. Do not reduce below evaporator connection size.
3. Suction returns from evaporators must enter at the top of the line.

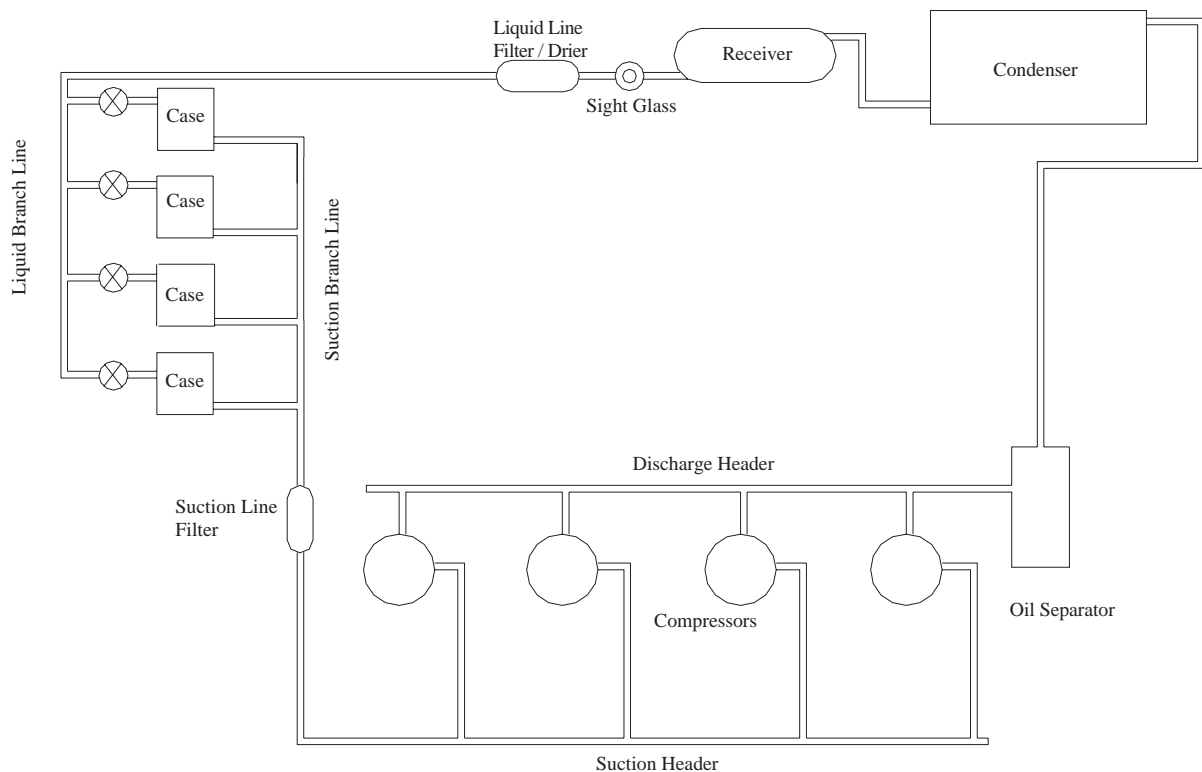
Liquid Line

1. Take-offs to evaporators must exit the bottom of the liquid line. Provide an expansion loop for each evaporator take-off (minimum 3-inch diameter).
2. Offtime and Electric Defrost may be reduced by one size after one half the case load. Do not reduce below evaporator connection size.

Refrigeration Cycle

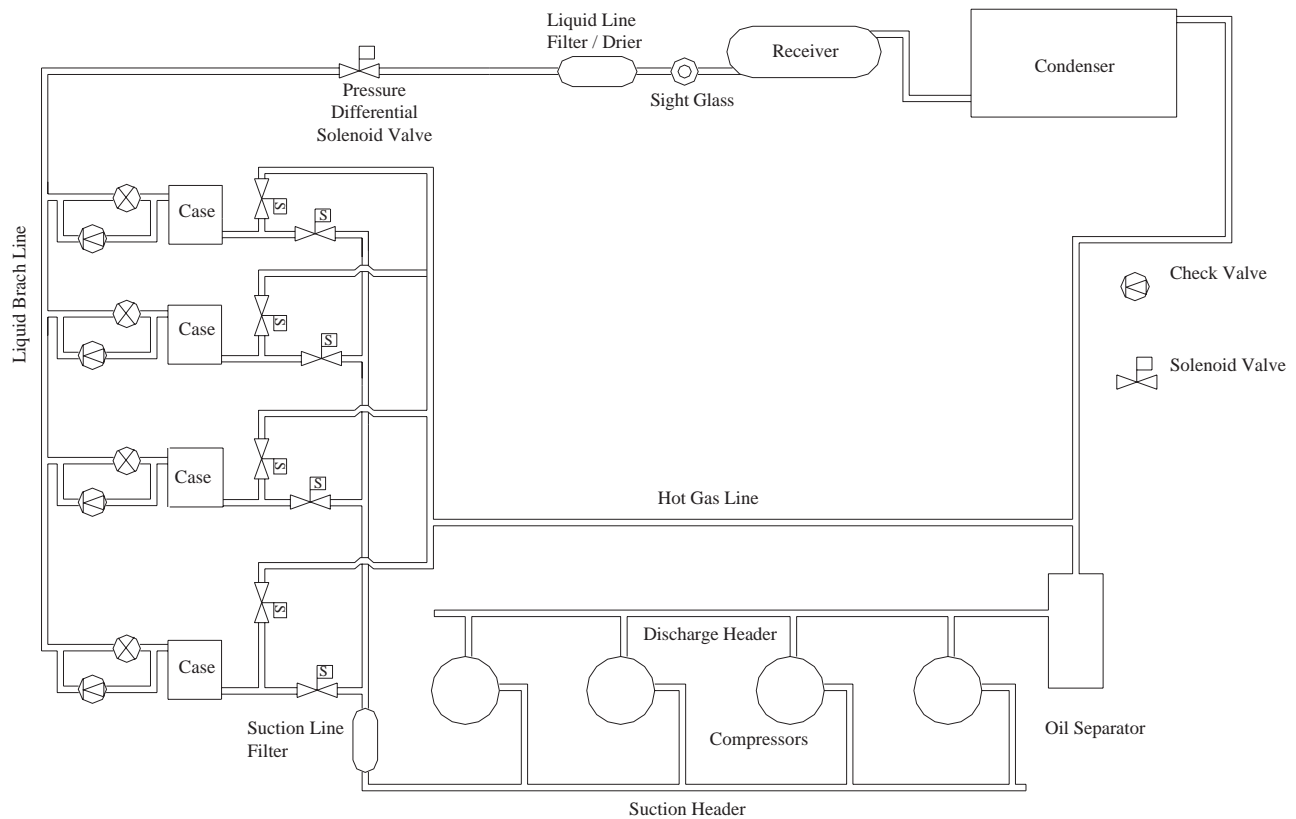
Oil Return System Not shown

Beginning with Compressors, refrigerant vapor is compressed into the Discharge Header. The oil separator effectively divides the refrigerant from the lubricant in the system. The lubricant is then returned to the compressors. The Condenser dissipates the unwanted heat from the refrigerant into either a water/ glycol, or, air condenser depending on the type used. The receiver acts as a vapor trap and supplies the Liquid Line with quality liquid refrigerant. A Liquid Line Filter/Drier removes water and other contaminants from the refrigerant. The liquid branch line supplies liquid refrigerant to the Thermostatic Expansion Valve (TXV), which in turn feed refrigerant to the cases (evaporator coils). These coils pick up heat from the product stored in the cases. A Suction Filter removes system contaminants from return vapor, which is factory supplied but field installed. It is also a good idea to install isolation valves for ease of service. The oil return system is not shown in the following illustration.



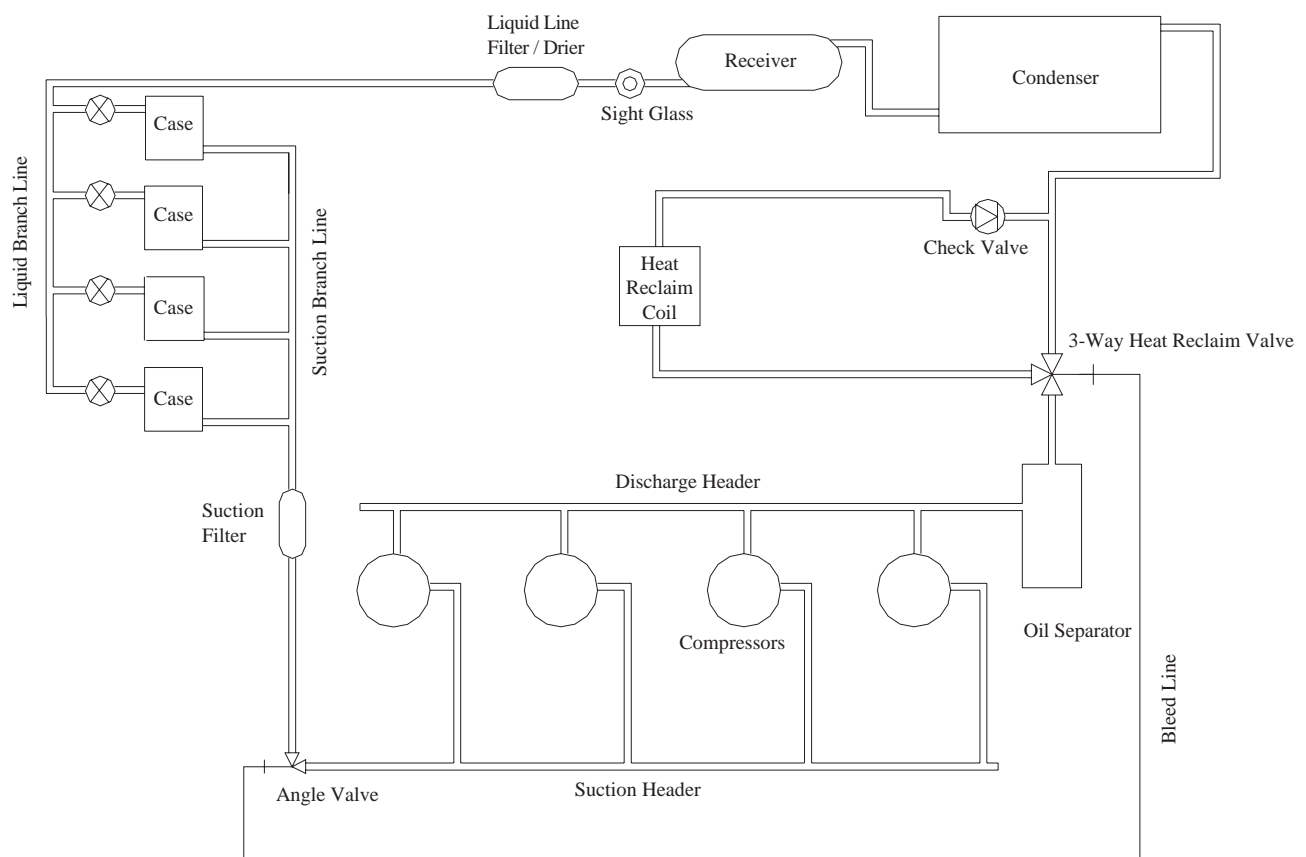
Protocol™ with 3-Pipe Gas Defrost Oil Return System Not shown

When 3-pipe gas defrost is used, hot gas is piped from the discharge line, after the oil separator, to the cases. Solenoid valves are placed in both the suction and hot gas line so that each system can be turned on or off by the controller. Place a bypass line, with a check valve ensuring that flow during defrost can bypass the TXV. A pressure differential solenoid valve needs to be installed in the main liquid line to insure proper flow during defrost. The pressure differential solenoid valve is factory installed in a vertical or horizontal Protocol™. Ensure that during defrost no more than 45 lbs or 20% of the total load is in defrost at any given time.



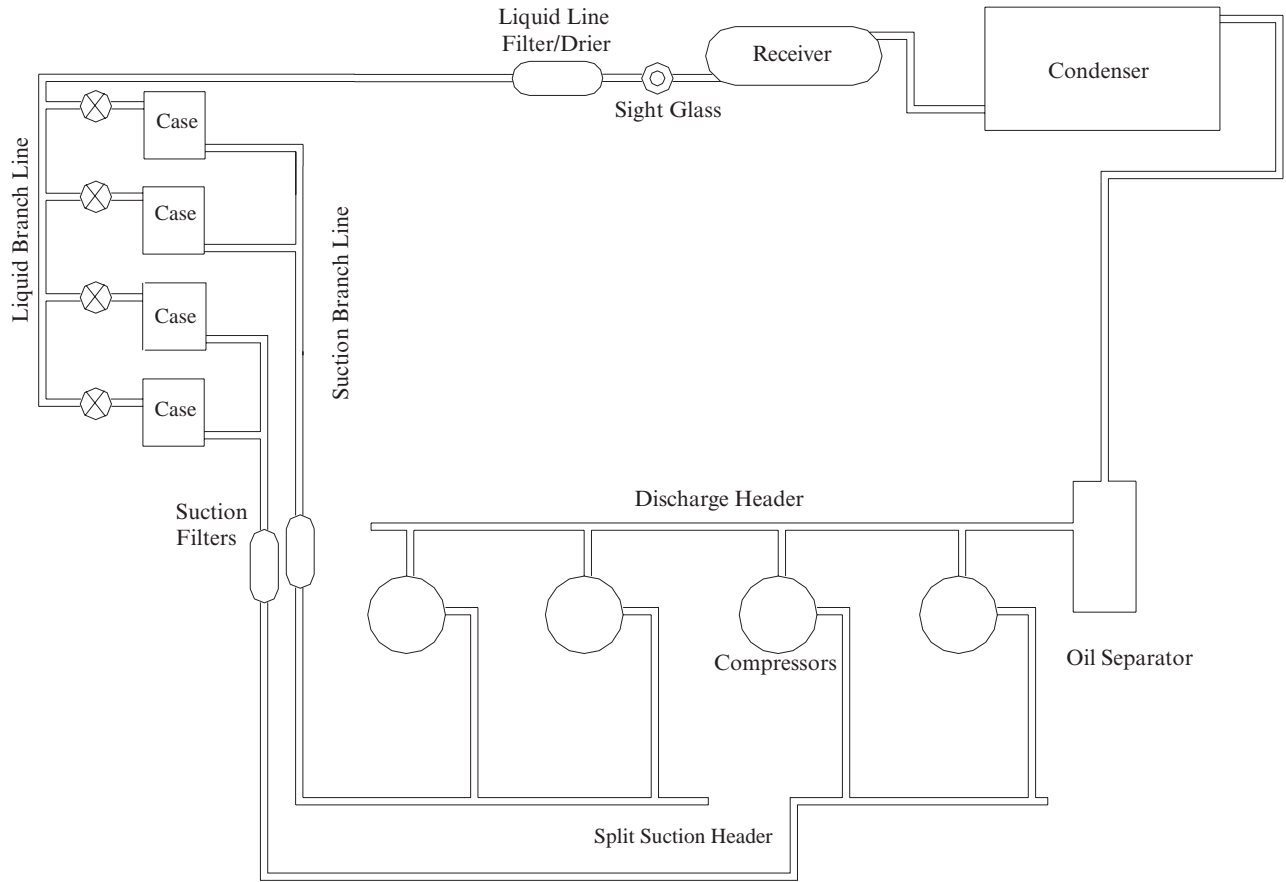
**Protocol™ with Heat Reclaim
Oil Return System Not shown**

When heat reclaim (for water or air) is used with the Protocol™ a 3-Way Heat Reclaim Valve should be installed after the oil separator. A bleed line should be installed from the heat reclaim valve to the angle valve found in the suction header. A check valve is installed in the heat reclaim return loop. This check valve ensures that back flow through the heat reclaim coil is eliminated when heat reclaim is not used. Refer to specific manufacturers guidelines for sizing reclaim coils. In the case of water heat reclaim, a 10# check valve should be used to bypass the water tank in the case that the pressure drop across the tank become excessive.



**Protocol™ with Split Suction
Oil Return System Not shown**

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

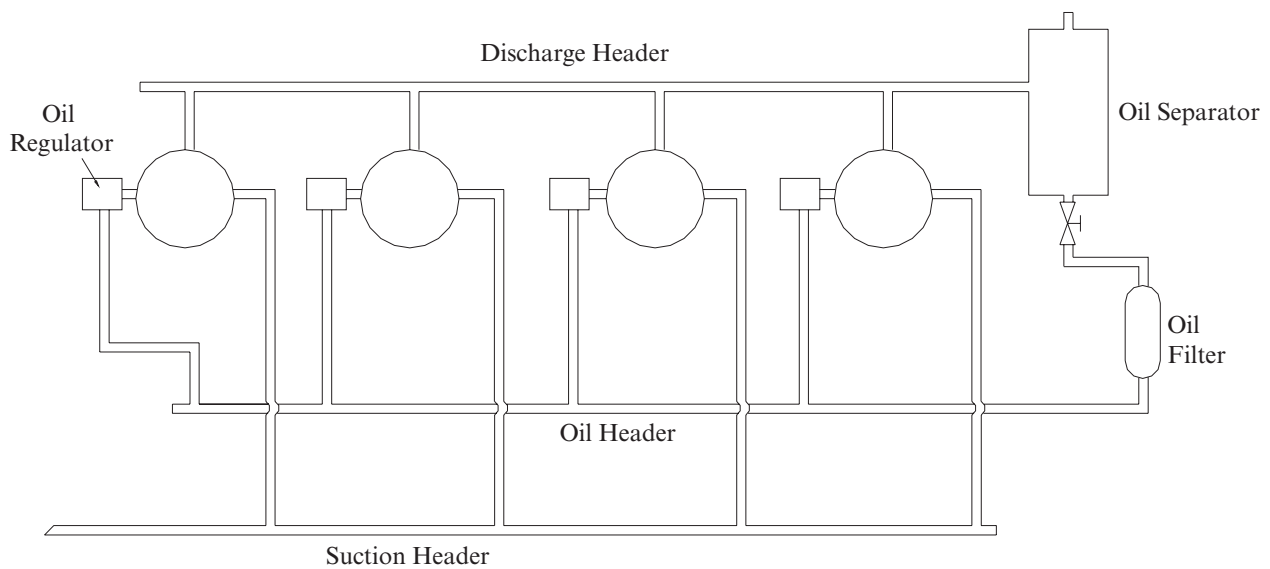


Oil Cycle

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

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

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



Compressors with Pre-Charged Oil as Standard

Systems Shipped Dry

Protocol
 OLP Protocol
 SPI & SPO Protocol
 Proto-aire

*OLP Protocol with Bitzer compressors

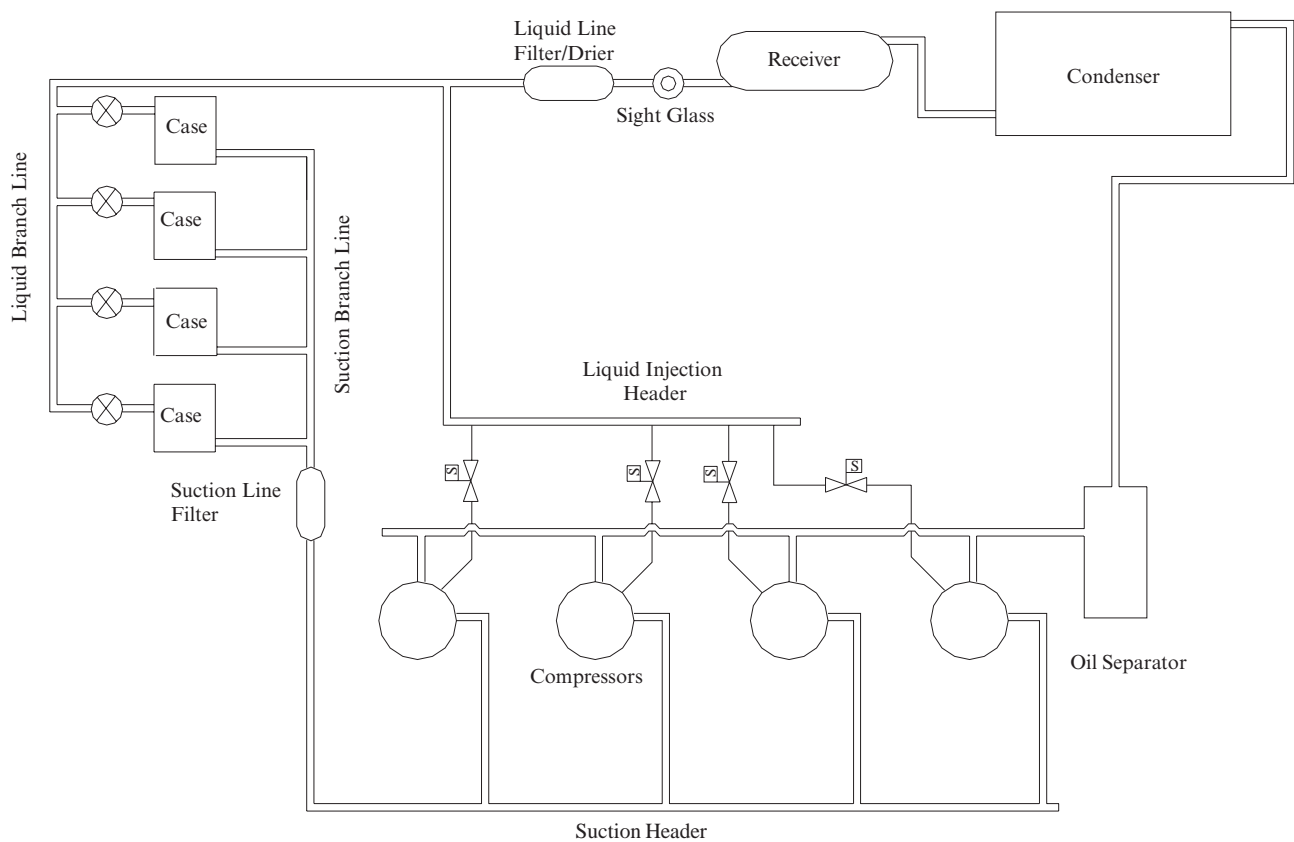
***ANY OLP PROTOCOLS SELECTED WITH BITZER COMPRESSORS WILL NOT HAVE OIL PRE-CHARGED OR INLCUED AS STANDARD, BUT CAN BE ORDERED AS AN OPTION (SHIP LOOSE).**

To resolve the exception with Bitzer compressors, ship loose oil which is available as an option should be included. One gallon per compressor would be required on OLP

Liquid Injection

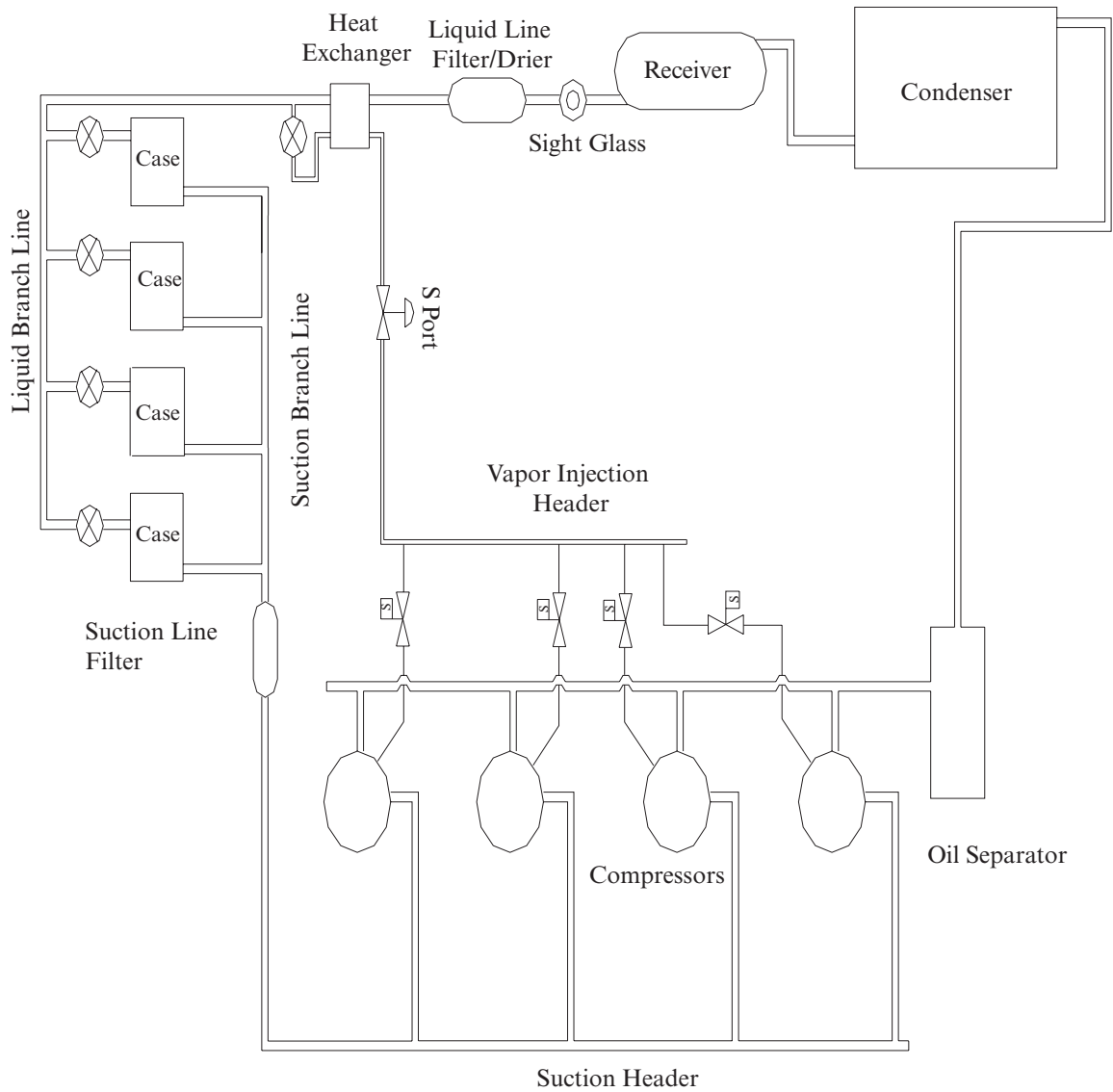
When operating at high compression ratios, injecting liquid partway through the compression process is a method of cooling the scroll compressor. A discharge temperature control (DTC) valve or an EXV (Electronic Expansion Valve) must be applied for liquid injection. The EXV valve requires an injection solenoid valve. Each compressor liquid injection line has its own shutoff valve, injection solenoid valve with EXV or DTC valve, and supply hose. When the compressor is off, the solenoid valve is de-energized via a current sensing relay mounted at the compressor contactor. If the DTC valve is used, the DTC valve will close when the compressor is off.

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



Vapor Injection

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



Water Loop Piping

Important: Since Hussmann has no direct control over the installation, providing freeze-burst protection is the responsibility of the installing contractor. **It is mandatory that glycol be added to the water loop before startup to prevent freezing. Use only non-ferrous metal or PVC for water loop piping.**

The Water Loop should be tested for leaks using pressurized water.

DO NOT exceed 75 psig

Overview

This section details major water loop components, and their locations in the piping system.

Water Loop Guidelines

Pipe Connections

PVC Plastic pipe should be solvent welded (glued) together as described on the glue can.

Pipe Fittings must be clean and dry.

Cut Pipe with a guillotine type cutter to get a clean, square cut; remove any burrs.

Use Purple Primer on both pipe and fitting before gluing.

Apply glue to both pipe and fitting and join with a twisting motion.

Hold joint together for approximately 30 seconds to allow glue to set.

Allow to dry for 24 hours before putting in to service.

Where it is necessary to connect plastic and metal pipe. **DO NOT USE A THREADED CONNECTION.** A compression type fitting should be used. For larger pipe sizes, a flanged connection may be used.

Isolation Valves

Install isolation valves at inlet and outlet of each Protocol™ unit.

It is good practice to include isolation valves at several locations throughout the piping. For example valves should be used where branches tie into main supply and return lines.

PVC plastic ball valves may be used.

Strainers

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

Air Vent Valves

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

Tie-Ins to Supply Headers

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

Pipe Supports

Pipe support should be provided as follows:

Nominal Pipe Size, inches	Distance Between Supports, feet Schedule 40 Pipe @ 100 °F	Distance Between Supports, feet Schedule 80 Pipe @ 120 °F
1.0	4.5	3.5
1.5	5.0	3.5
2.0	5.0	4.0
3.0	6.0	4.5
4.0	6.5	5.0
6.0	7.5	6.0

Do not clamp supports tightly – this restricts axial movement of the pipe. Supports should provide a smooth bearing surface that conforms to the bottom of the pipe, and should be a minimum of 2 inches wide.

Exposure to Direct Sunlight

Piping that will be exposed to direct sunlight should be shaded or covered. A thin layer of insulation is adequate for this.

Leak Check

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

Cleaning and Flushing

The pipe loop should be cleaned before the system is put into service. Fill the closed loop with a solution of 1% trisodium phosphate and (99%) water, by weight.

Circulate the detergent/water solution for 24 hours.

Drain the loop and refill with fresh water. Circulate for at least 3 hours.

Drain and refill again. Repeat until all phosphate is gone.

Filling

The water loop **MUST** have adequate corrosion protection. In most situations, using fully inhibited, industrial grade ethylene glycol or propylene glycol 30% by volume with water can

provide corrosion protection. For most installations, 30% glycol by volume will also provide **BURST** protection to –20 °F.

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

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

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

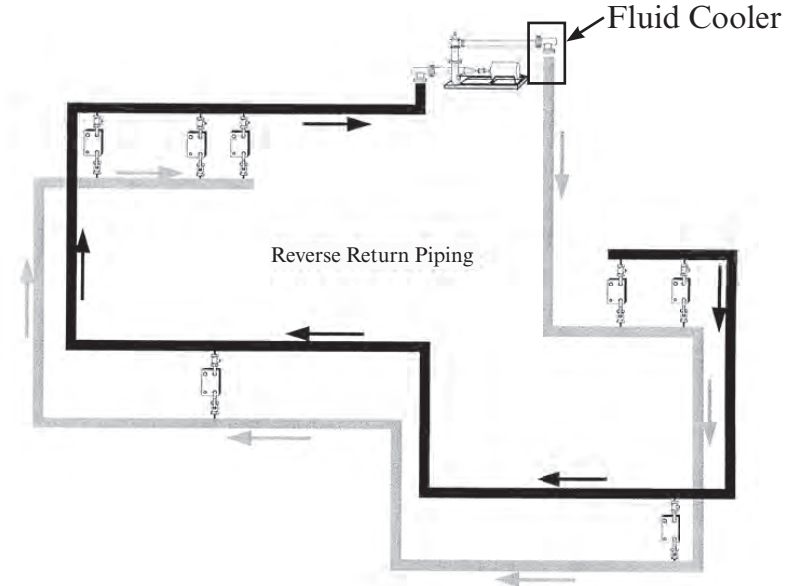
The pumping station has a low fluid pressure switch set at roughly 10 to 20 psig, which should be tied into an alarm. It is good practice to test the operation of this switch at least once a year.

Balance Valve Adjustment

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

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

Balancing the Water Loop



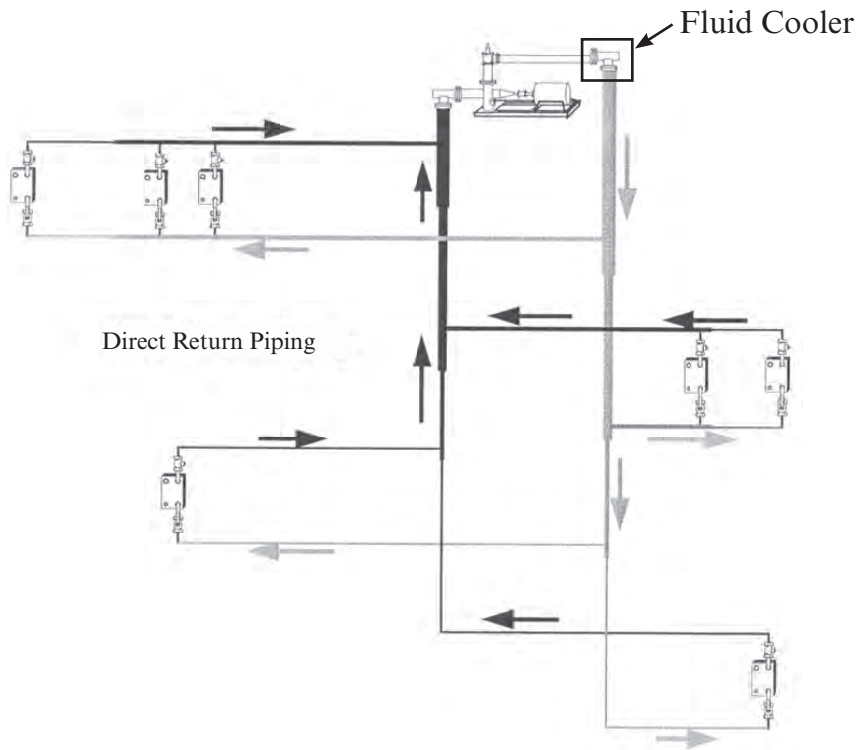
Balancing the Water Loop for Direct Return Piping

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

- 1 – Balancing to attain the correct water flow for each Protocol™; and
- 2 – Balancing the system for Piping Head Loss.

Since these factors have nearly unlimited combinations, finding the appropriate setting for each combination is unrealistic. However, if these factors are separated, their effect on the system can easily be defined.

Balancing the Water Flow



Balancing the Water Flow for Each Protocol™

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

Balancing the System for Piping Head Loss

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

By accounting for Head Loss and Flow Rate (GPM) for each Protocol™ in a system, a Preset Value for each Protocol™ unit's Circuit Setter may be established.

Since each installation is unique, all Protocol™ units must be carefully monitored during store startup. Once all Protocol™ units are running, the water loop must be checked, and final balancing performed.

Table 1 shows a proportional Closure for the Circuit Setter based on Protocol™ GPM requirements.

Table 1					
GPM	° Closure	GPM	° Closure	GPM	° Closure
58	0	42	8	26	16
57	0	41	8	25	16
56	1	40	9	24	17
55	1	39	9	23	17
54	2	38	10	22	18
53	2	37	10	21	18
52	3	36	11	20	19
51	3	35	11	19	19
50	4	34	12	18	20
49	4	33	12	17	20
48	5	32	13	16	21
47	5	31	13	15	21
46	6	30	14	14	22
45	6	29	14	13	22
44	7	28	15	12	23
43	7	27	15		

Table 2 shows a proportional Closure for the Circuit Setter based on Length of Piping Run.

Table 2	
Length of Run	° Closure
1000	0
950	1
900	2
850	3
800	4
750	5
700	6
650	7
600	8
550	9
500	10
450	11
400	12
350	13
300	14
250	15
200	16
150	17
100	18
50 and below	19

Presetting the Degree of Closure

Look up flow rate (GPM) for each Protocol™. Find the closest GPM in **Table 1**. Log the listed °Closure Value for each Protocol™ in the **Table 1 Value row**.

Establish Length of Run for each Protocol™. Find the closest Length of Run in **Table 2**. Log the listed °Closure Value for each Protocol™ in the **Table 2 value row**.

Add the two values logged for each Protocol™.

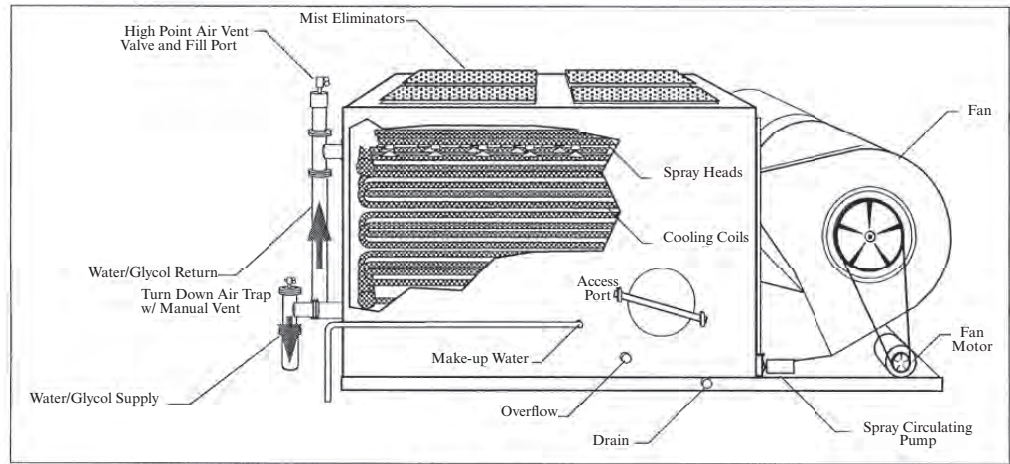
Locate the lowest **Total**. Subtract it from each Protocol™ Unit's **Total**, to get Presetting °Closure.

Important Note: Length of Run includes both the supply and return piping.

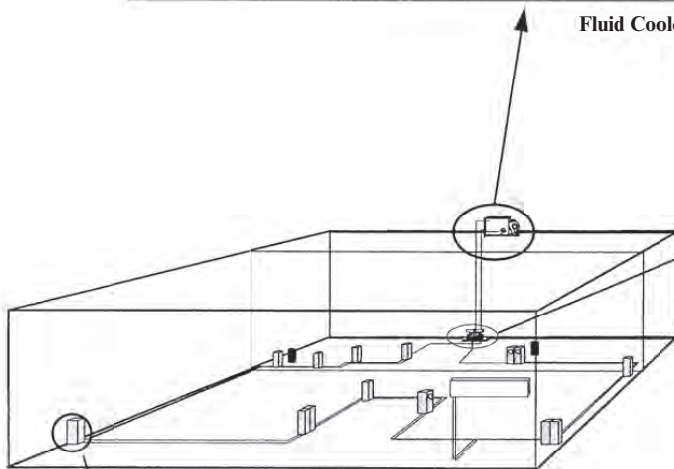
Example

Protocol™	A	B	C	D	E	F	G	H	I		
Table 1 Value (+)	11	9	14	12	15	7	15	11	8		
Table 2 Value	9	14	5	8	11	9	10	12	18		
Total (-)	20	23	19	20	26	16	25	23	26		
Lowest Total	16	16	16	16	16	16	16	16	16		
Presetting °Closure	4	7	3	4	10	0	9	7	10		

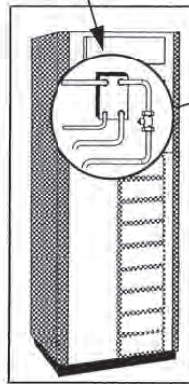
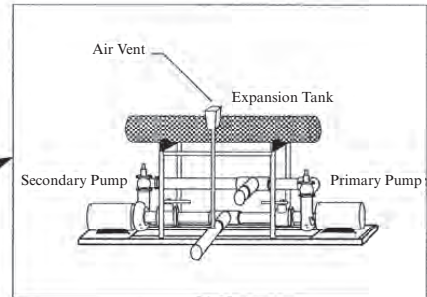
Protocol™											
Table 1 Value (+)											
Table 2 Value											
Total (-)											
Lowest Total											
Presetting °Closure											



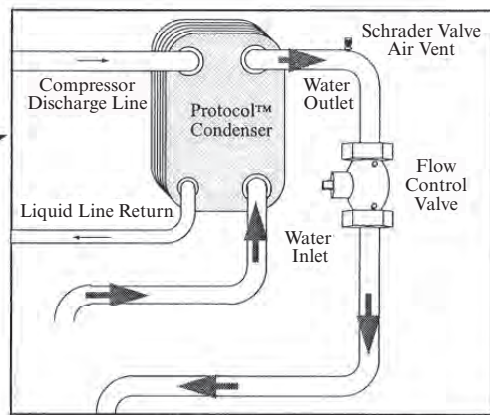
Fluid Cooler



Store Piping Layout



Protocol™



Protocol™ Condenser

Electrical

Field Wiring

Maximum Field Wire Size

Based on the total load amperes, the largest connectable wire sizes for the terminals on the convenience switch are listed below. (Wire size is based on the serial plate minimum circuit ampacity.)

Total Connected RLA	Largest Connectable Wire
200 A (max)	3 /0 per Ø
400 A (max)	2 x (3 /0) per Ø

Refer to National Electric Code for temperature derating factors.

Sizing Wire and Overcurrent Protectors

Check the legend for Minimum Circuit Ampacity (MCA), Maximum Overcurrent Protective Devices (MOPD), and total RLAs. Follow NEC guidelines.

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

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

The lugs on the convenience switch in the convenience switch box are sized for copper wire only, with 75 °C THW insulation. All wiring must be in compliance with governing codes.

For 208-230/3/60 Compressor Units:

To each Protocol™ provide:

- One 208-230/3/60 branch circuit
- One 120/1/60 neutral
- One ground wire to earth ground

For 380-460/3/60-50 Compressor Units with Remote Mounted Transformer:

To each Protocol™ provide

- One 380-460/3/60-50 branch circuit
- One ground wire to earth ground

To remote mounted transformer

- One 380-460/1 or 3/60-50 branch circuit from Protocol™ Fuse Block
- One ground wire to ground wire connection

From remote mounted transformer

One 240/1 or 3/60-50 connection to 240V convenience switch in panel
One derived neutral from transformer

For 380-460/3/60-50 Compressor Units without Remote Mounted Transformer:

To each Protocol™ provide

- One 380-460/3/60-50 branch circuit
- One ground wire to earth ground
- One 208-240/1 or 3/60-50 branch circuit
- One 120/1/60-50 neutral

For 575/3/60 Compressor units without Remote Mounted Transformer:

To each Protocol™ provide:

- One 575/3/60 branch circuit
- One ground wire to earth ground
- One 220/1/60 branch circuit

Consult factory for other voltages.

Alarm Wiring

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

Temperature Sensors and Defrost Termination Thermostats

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

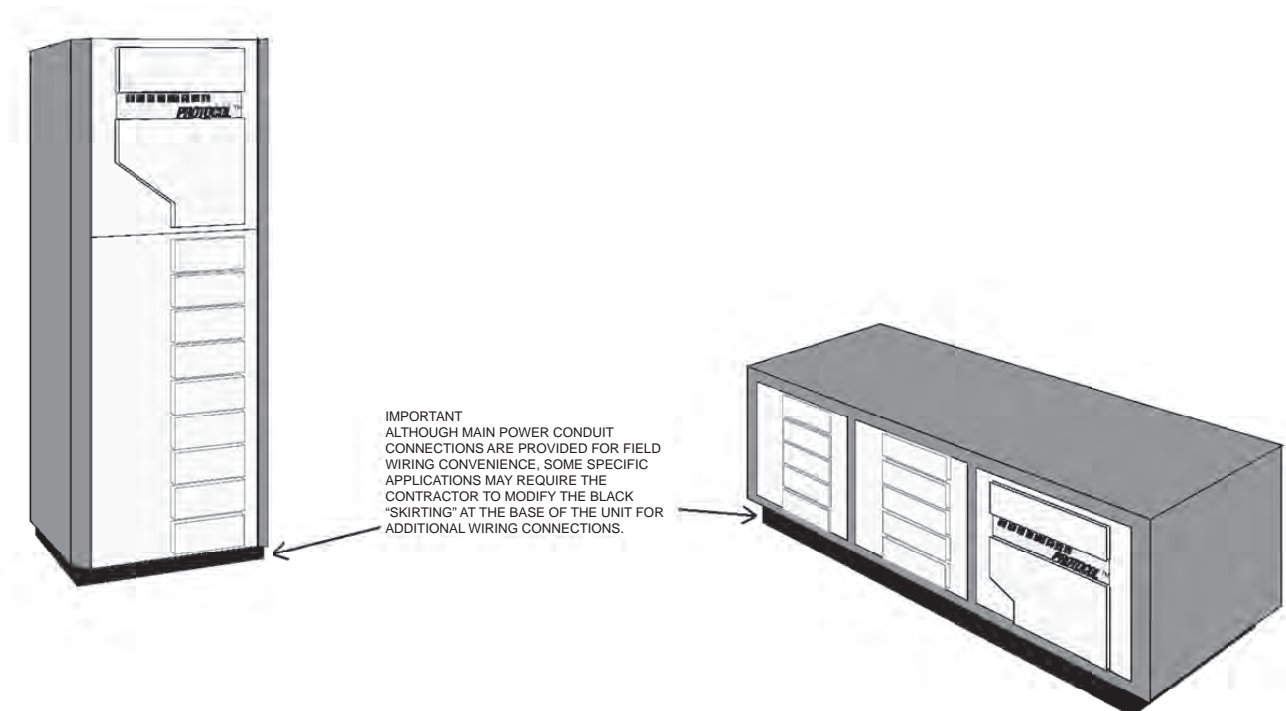
Important

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

Additional Circuits

Check the store legend for components requiring electrical circuits to the Control Panel and Case Power Distribution Box. The Protocol™ can provide power for all case electrical needs including:

- Fan and Anti-sweat Heater Circuits
- Satellite Control
- Electrical Defrost Heaters
- Case mounted refrigeration solenoid
- Case Lighting
- Unit Cooler Fan Power (electric defrost only)



Evaporator Mounted Refrigeration Solenoid

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

Cooler Door Switch Wiring

Check the store legend for door switch kits (**M115** or **M116**). The switch is mounted to the cooler doorframe, and controls the field installed liquid line solenoid and evaporator fans. For Gas Defrost applications, M116 includes a check valve to bypass the liquid line solenoid valve.

Panel Voltages

The Protocol™ Control Panels contain voltages:

24V	PC Board, POWERLINK™ Control Circuits Electronic oil level control
120V	Control Circuits
and	
208/230V	
380V	
460V or 575V	Power Supply Circuits

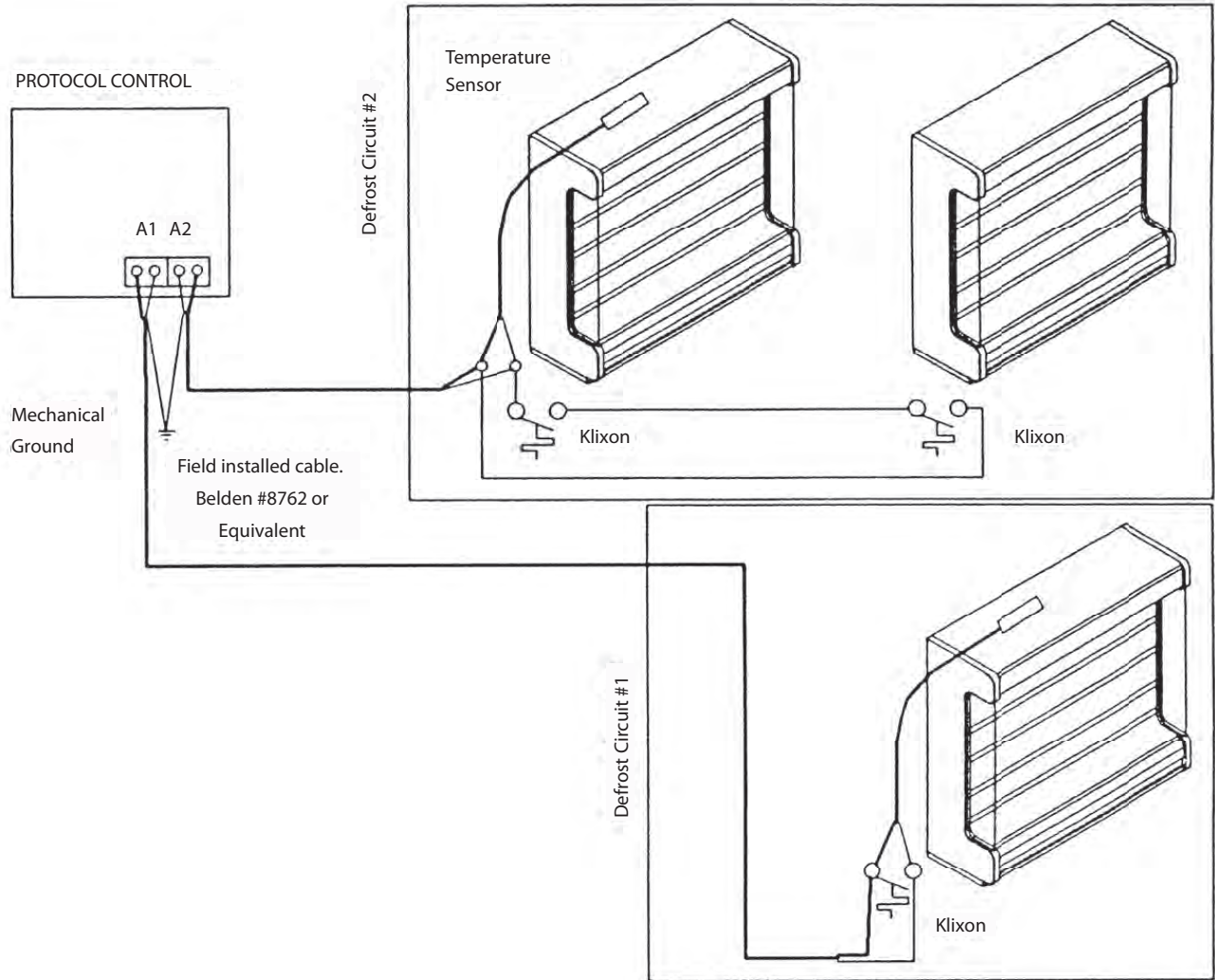
NOTE: The current draw required by an analog meter (Volt-Ohm Meters or VOMs) can permanently damage electronic equipment. Never use a VOM to check computer components or computer controlled systems. Use a Digital Multimeter (DMM) to measure voltage, amperage, milliamperes, or ohms. If a range is exceeded the display will show OL (overload).

Alarm LEDs


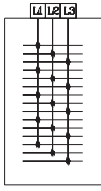

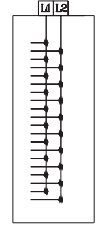





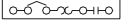

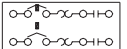

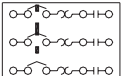

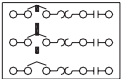

















One exterior and one interior Alarm LED assist in preliminary troubleshooting.

Alarm Light on Control Board	Alarm Relay Light	Exterior Alarm Light	Condition
ON	ON	OFF	Okay
OFF	ON	OFF	Monitoring Alarm
OFF	OFF	ON	Switchback
ON	ON	ON	Compressor Safeties Failed

Typical wiring diagram for Temperature Sensor and Klixon wiring.
 Individual wiring may vary.
 See page 102 for details on control types.



Electrical Legend

	RELAY CONTACTS NORMALLY OPEN		THREE PHASE BUSSBAR
	RELAY CONTACTS NORMALLY CLOSED		SINGLE PHASE BUSSBAR
	JUMPER		POWERLINK MOTOR
	SPLICE		POWERLINK POWER SUPPLY
	CLOSE ON RISE FAN CONTROL		SINGLE POLE POWERLINK
	CLOSE ON RISE PRESSURE CONTROL LOW PRESSURE		TWO POLE POWERLINK
	OPEN ON RISE PRESSURE CONTROL HIGH PRESSURE		THREE POLE POWERLINK
	OIL CONTROL		THREE POLE MOTORSTARTER 460V OR 575V COMPRESSORS
	LIGHT		
	COOLING FAN		
	TERMINAL BLOCK		
	THERMOSTAT OPEN ON RISE DISCHARGE TEMPERATURE OR DEFROST TERMINATION THERMOSTAT		
	THERMOSTAT CLOSE ON RISE REFRIGERATION THERMOSTAT		
#	COMPRESSOR OR CIRCUIT NUMBER		
—————	FACTORY WIRING		
- - - - -	FIELD WIRING		
	GROUND		
	120V RECEPTACLE		
	CURRENT SENSING RELAY		
	CONTACTOR		
	COMPRESSOR		
	SOLENOID (SUCTION SOLENOID, HOT GAS SOLENOID, LIQUID SOLENOID, INJECTION SOLENOID, HEAT RECLAIM SOLENOID, LIQUID DIFFERENTIAL SOLENOID, MAIN LIQUID LINE SOLENOID)		
	RELAY OR COIL (ALARM RELAY, MOTOR CONTACTOR COIL, FAN RELAY, FAN CONTACTOR, ALARM RELAY, ETC.)		
	SINGLE POLE CIRCUIT BREAKER		
	TWO POLE CIRCUIT BREAKER		
	THREE POLE CIRCUIT BREAKER		
	PHASE MONITOR		
	TRANSFORMER		
			MISC. NOMENCLATURE
			PL - POWERLINK CIRCUIT BREAKER PS - POWERLINK POWER SUPPLY AR1 - ALARM RELAY #1 GAR - GENERAL ALARM RELAY HPC - HIGH PRESS. CONTROL LPC - LOW PRESS. CONTROL OLA - OIL LEVEL ALARM PLA - PHASE LOSS ALARM SBA - SWITCHBACK ALARM RELAY LS - LIQUID SOLENOID VALVE RT - REFRIGERATION T'STAT SS - SUCTION STOP SOLENOID VALVE HGV - HOT GAS SOLENOID VALVE * - DISCONNECT TERMINAL PIN
			WIRE COLOR CODE
			B = BLACK BL = BLUE BR = BROWN O = ORANGE P = PURPLE R = RED Y = YELLOW W = WHITE G = GREEN

Terminal Connections

Protocol™ units carrying 5 and 6 compressors, or an oversized Control Panel, do not use a single-phase bussbar. Wire number assignments and corresponding terminal number assignments in the Power Distribution Box differ from the smaller panel arrangement.

120V Circuit Logic

The Protocol™ includes as standard the following 120V components:

- Service Receptacle (5 Amp Max)
- Cabinet Exhaust Fan
- 120V by 24V Transformer
- Compressor Contactor Coils
- Valve Solenoids
- External Alarm Light

24V Circuits

The printed circuit control boards with attached relay coils are 24V. The POWERLINKS™ are powered by a 24V DC supply (used to control electric defrost heaters). Each POWERLINK™ power supply will drive up to 5 POWERLINKS™ at once, and require 2 seconds to recharge an internal DC capacitor between operations. If the POWERLINK™ power supply fails, **a transformer will NOT replace it.**

Electronic Oil Level Control

A 24V transformer powers the electronic oil level control. All circuit logic including oil solenoid control is 24 volt. Only the alarm contact is 120V. See next two pages for typical wiring diagrams.

Satellite Short Cycle Control Relay

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

Liquid Injection

When operating at high compression ratios, injecting liquid partway through the compression process is a method of cooling the scroll compressor. Hussmann applies liquid injection on all units below 0 °F evaporating temperature. Each compressor has its own Direct Thermal Control (DTC) valve, which is an all-in-one injection solenoid that allows for a more energy efficient use of liquid.

Note: On units with remote air-cooled condensers, liquid refrigerant must be piped to the liquid injection header inside the Protocol™ unit.

Vapor Injection

Another method of cooling compressors is to use vapor injection. The Protocol High Efficiency (HE) series incorporates vapor injected (ZFKV) scroll compressors for low temperature applications, and the ZBKCE series of scroll compressors for medium temperature. When compared to the standard Protocol low temperature unit at typical design conditions, the HE series has 40 % more capacity and has a 20% improvement in EER. This is accomplished by the economizer cycle, which sub cools liquid refrigerant through a heat exchanger and injects vapor via a port on the compressor at a „mid-pocket” interstage pressure. The HE series is available in horizontal units and 3 wide vertical frame units with air or water cooled options. However when selecting horizontal models, they **MUST BE** accessible from the Top. When sizing EVI Low Temp compressors, **DO NOT EXCEED 90%** of capacity rating. Also Liquid Lines **MUST BE INSULATED**.

Protocol HE horizontal units must be accessible from the top. The economizer system is pre-installed on every Protocol HE unit. Factory settings for the EPR between the heat exchanger and compressor injection ports in the system should be set with a 10°F TD using midpoint properties:

However field adjustments of the EPR may be required at a later date, therefore horizontal units must be accessible from the top.

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

The subcooled liquid to the cases is designed to be approximately 50 °F leaving the heat exchanger when vapor injection is activated. When liquid temperatures entering the subcooler fall to 55 °F, the T-STAT control in the unit will open and will de-energize the vapor injection solenoid, thus disabling vapor injection. The T-STAT control will re-energize the solenoid when the condensing temperature reaches 65 °F. Consult Engineering representative if adjustment of the T-STAT control is required.

FIELD PIPING & TXV SIZING

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

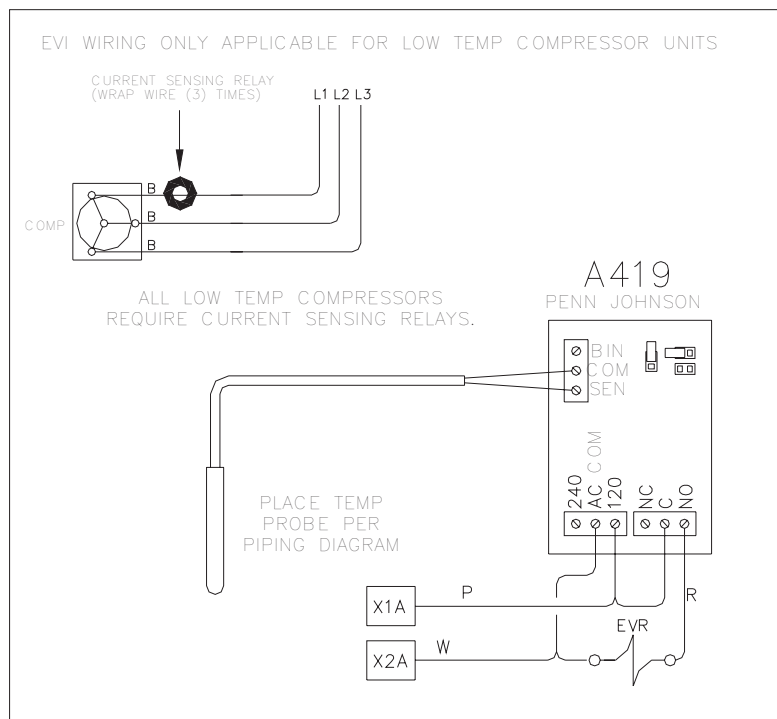
If the unit has low and medium temp suction groups, the protocol unit will have TWO liquid lines leaving the unit- one for medium temp cases and one for low temp cases. Only the liquid to the low temp cases will be subcooled to 50 °F. The liquid to the medium temp cases will be at the condensing temperature.

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

When expansion valves are selected for the cases, they should be sized for a liquid temperature of 50 °F due to subcooling.

SERVICE

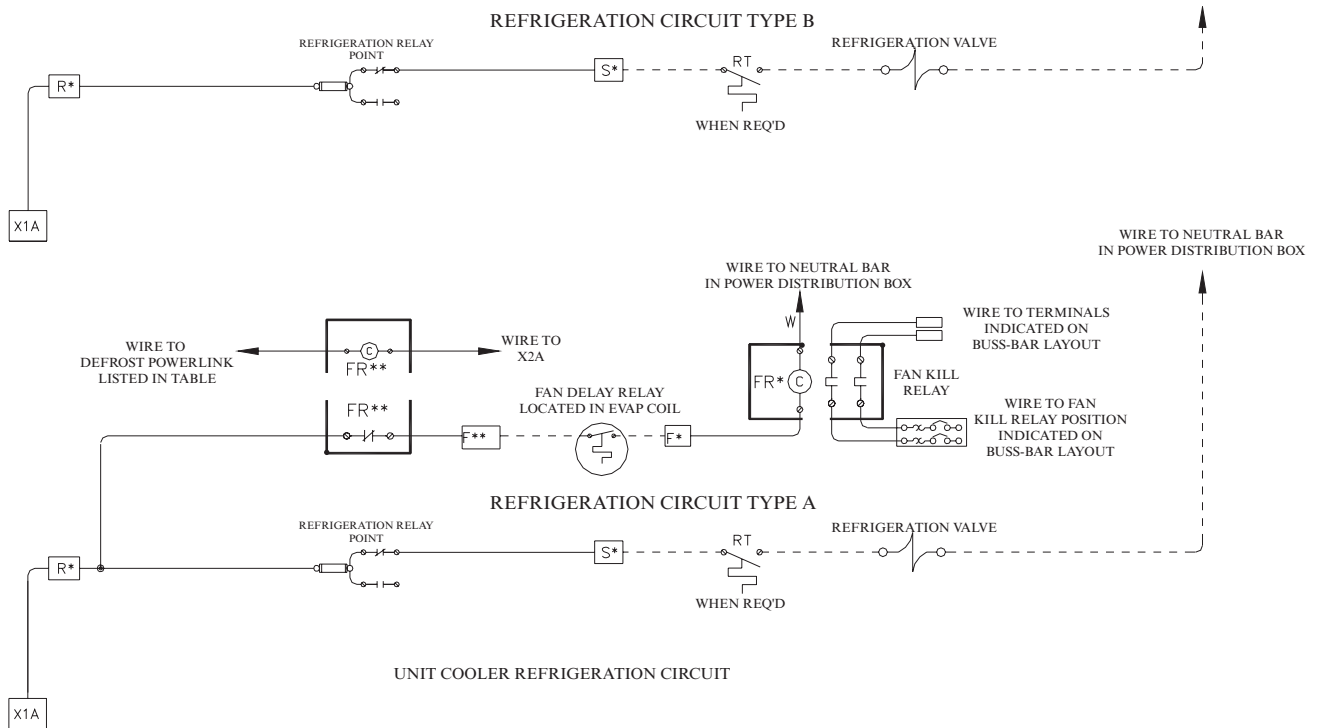
There is a shut off valve before the TXV for service of solenoids, the TXV, or the EPR in the Low Temp economizer loop. Shut off valves are also present at each compressor injection port.



Defrost Schedule

Refrigeration Circuit Control

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



Defrost Circuit Control

Off time Sequence of Operation

Control Board energizes the Defrost Board Relay Coil, which open the Main Liquid Line Solenoid circuit.

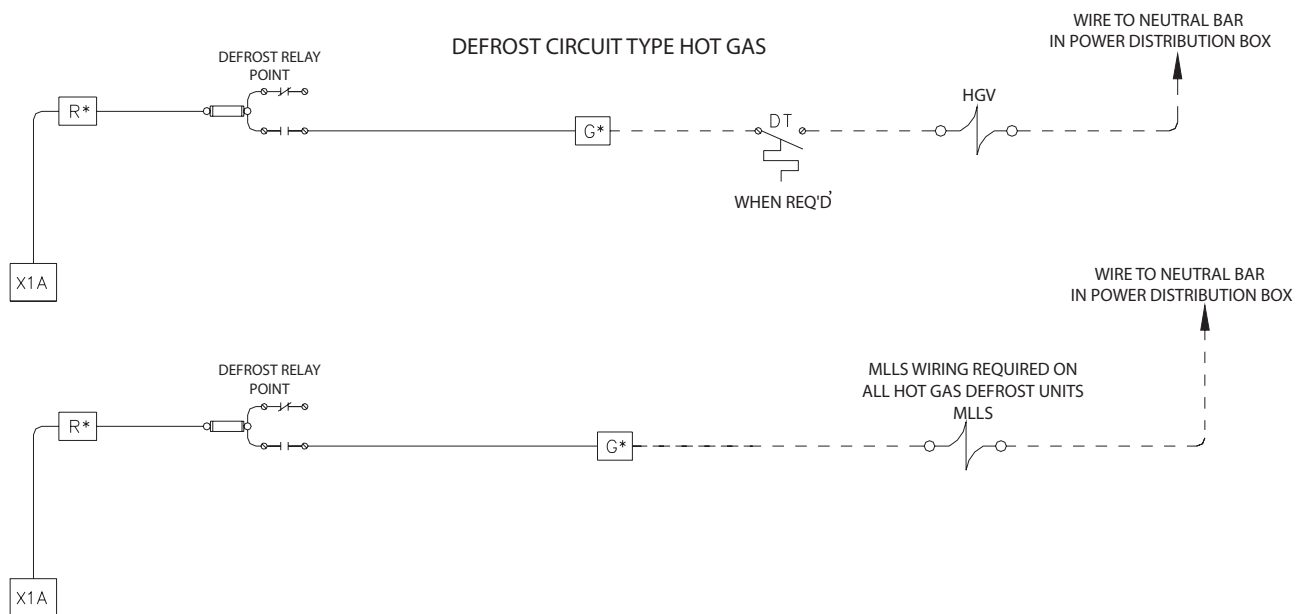
Main Liquid Line Valve closes. As evaporators empty, the compressors cycle off on Low Pressure.

Defrost may be time or temperature terminated.

Hot Gas

Control Board energizes the Aux Relay Coil, which de-energizes the Main Liquid Line Pressure Differential Solenoid. The valve reduces liquid supply line pressure. The Control Board also energizes the Defrost Relay coil, which open Hot Gas Solenoid valves and closes the Suction Solenoid valves. Each case terminates defrost through individual defrost termination thermostats, and goes into drip cycle until branch is timed off by the Control Board.

Note: Only 20% of the cases may be defrosted at once because of the requirement to keep a refrigeration load on the compressors to provide gas for defrost.

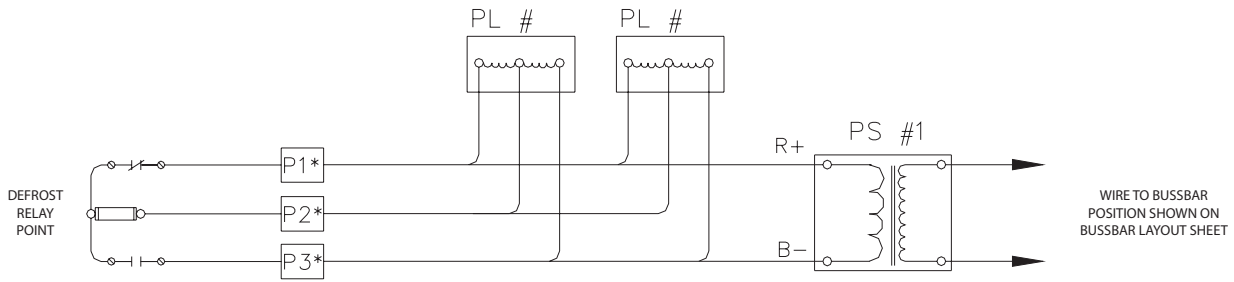


Electric Defrost

Control Board energizes two Defrost Board Relay Coils for each Defrost Circuit:

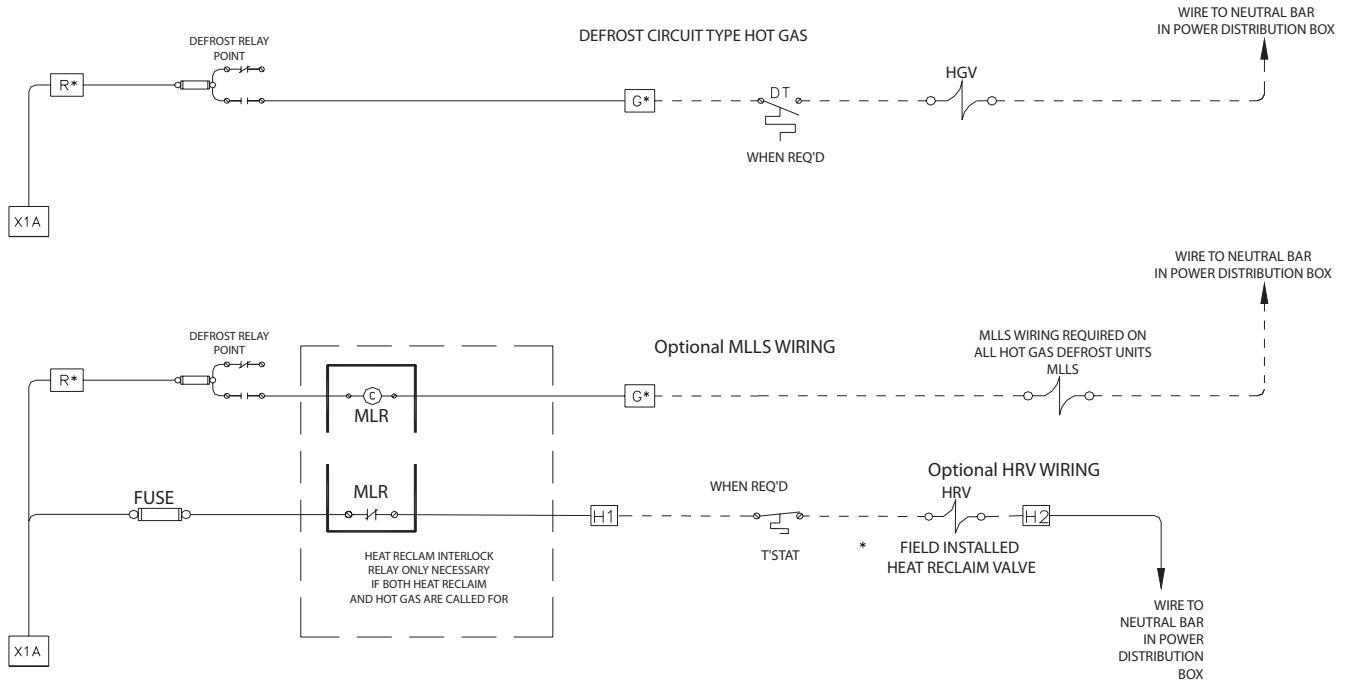
- 1) When the relay output is de-energized, the POWERLINK™ and heaters are also de-energized. Liquid line solenoids are open and refrigeration is active.
- 2) When the relay output is energized, the POWERLINK™ and heaters are energized while the liquid line solenoids are closed.
- 3) See POWERLINK™ operation diagram on Page 112. See Page 105 for further information on defrost operation.

DEFROST CIRCUIT TYPE ELECTRIC



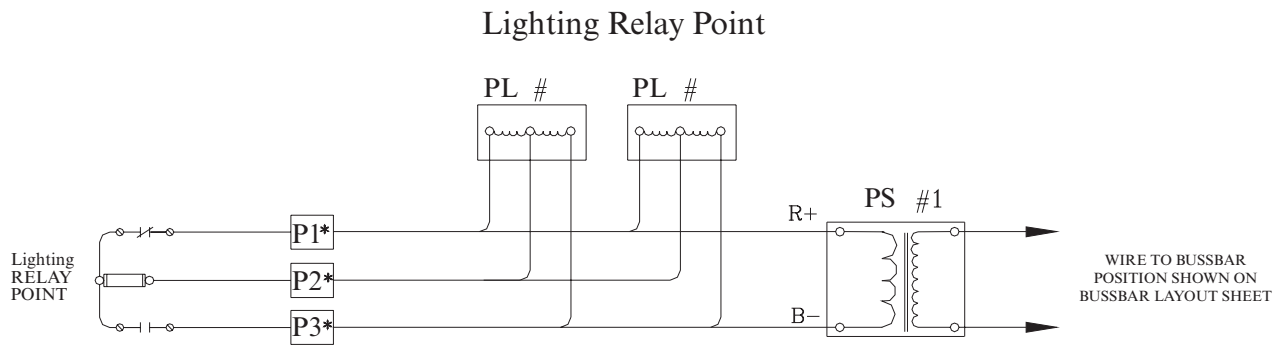
Special Case of Heat Reclaim with Hot Gas Defrost

When you have the special case of heat reclaim with hot gas it is necessary to interlock the Main Liquid Line solenoid wiring with the heat reclaim valve wiring. This wiring will ensure that heat reclaim does not take place while defrost is occurring.



Lighting Control

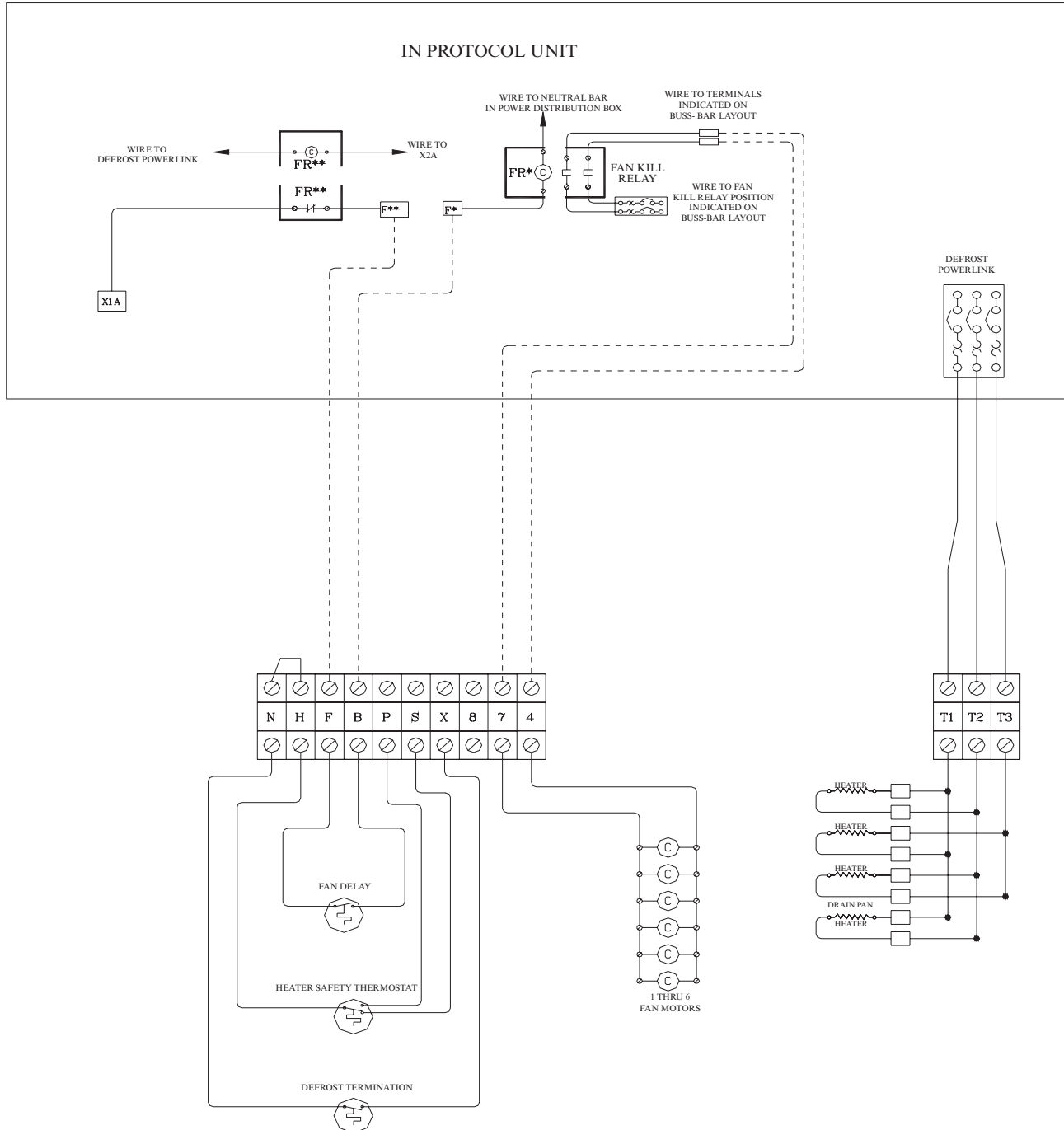
Control Board energizes one output relay for each lighting circuit. Each lighting circuit has a schedule which determines when the output is turned on and when the output turns off.



Unit Cooler Fan Wiring

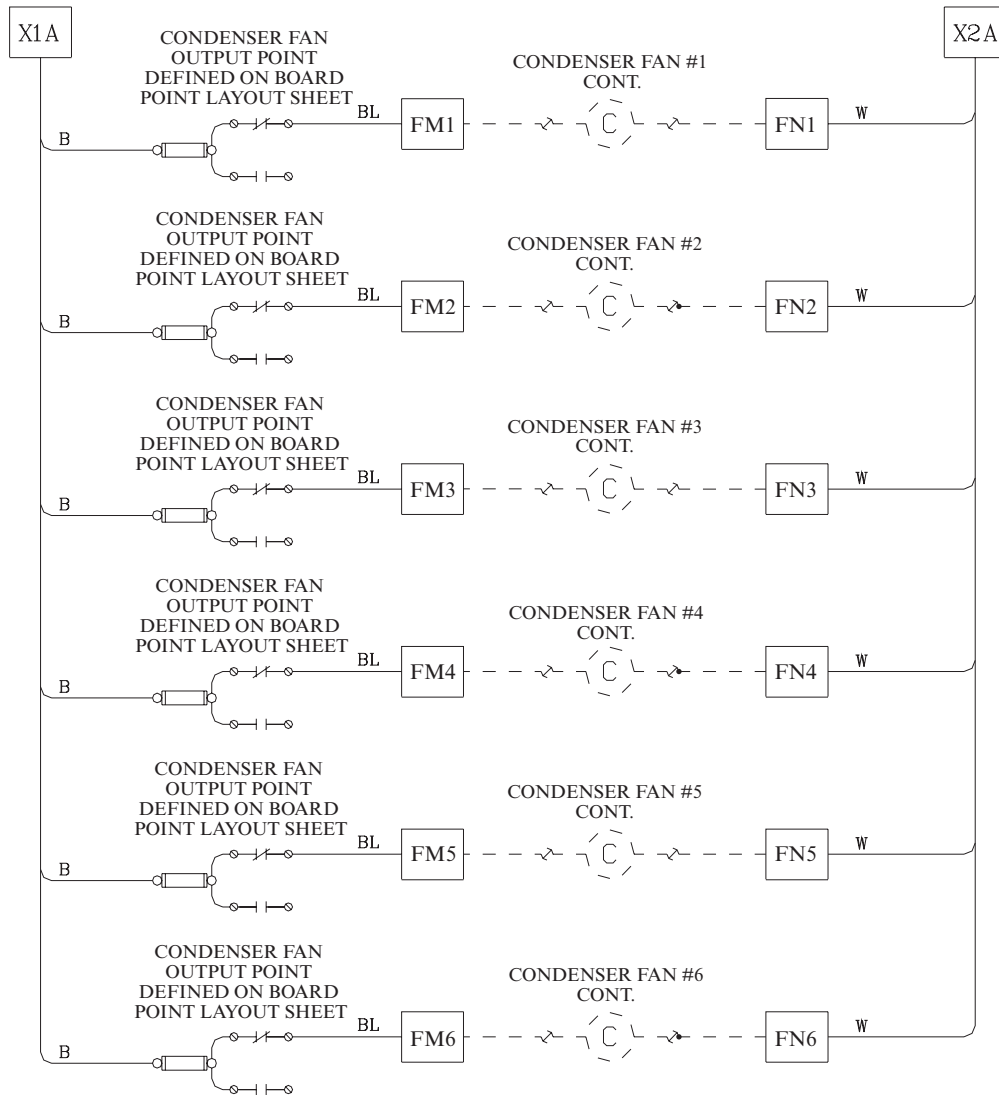
The following drawing shows the wiring to control the fans in a unit cooler. Defrost termination by Klixon may connect back to the controller relay board based on individual customer specs. See job specific board layout sheets and wiring diagrams for your individual installation.

Unit Cooler Fan Wiring



Protocol™ Remote Condenser Fan Wiring

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



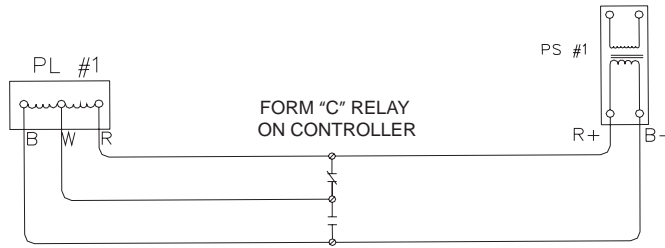
In the event that the condenser is ordered with control boards attached, these boards must be connected back to the controller with communication cable in a manner appropriate for the individual controller. The board addressing and the controller program should be checked to verify that the boards are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

Proto-Aire™ Fan Wiring

The following diagram shows the fan electrical wiring present in a Proto-Aire™. At the bottom of the diagram the receiver and crankcase heaters are shown, which are common to each type of Proto-Aire™.

POWERLINK™ Operation

POWERLINK OPERATION



IN THE OPEN POSITION
NEGATIVE POTENTIAL IS
APPLIED TO THE WHITE
WIRE AND THE POWER
LINK TURNS ON.

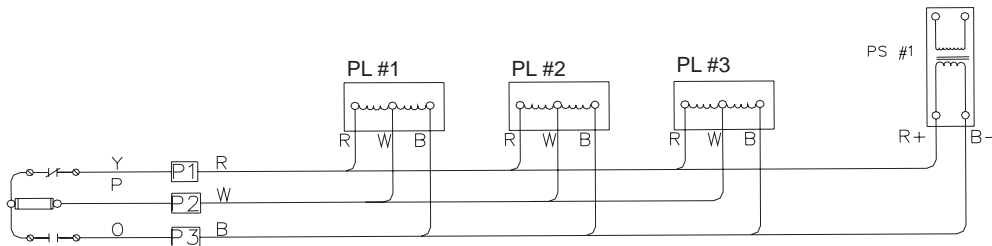
IN THE CLOSED POSITION
POSITIVE POTENTIAL IS
APPLIED TO THE WHITE
WIRE AND THE POWER
LINK SHUTS OFF.

WIRED IN THIS MANNER
THE ELECTRONIC CONTROLLER
CLOSES THE FORM "C" RELAY
WHICH TURNS THE POWER LINK(S)
ON, BEGINNING DEFROST.

AFTER DEFROST, THE CONTROL
POINT RETURNS TO THE OPEN
POSITION, DE-ENERGIZING THE
POWER LINK(S).

THE POWER LINK ACTS
LIKE A BREAKER IN THAT
ONCE IT TRIPS, IT HAS TO
BE MANUALLY RESET.

THEORY OF OPERATION



RO8 BOARD #2
OUTPUT #2

TYPICAL WIRING DIAGRAM FOR ELECTRIC DEFROST

RULES:

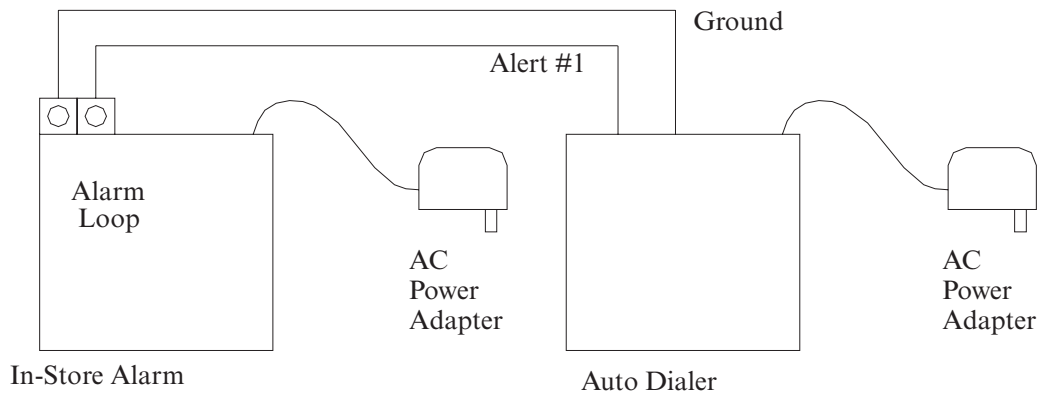
- 1.) MAXIMUM OF 5 POWER LINKS PER POWER SUPPLY.
- 2.) ALL POWER LINKS FOR A CIRCUIT MUST BE ON THE SAME POWER SUPPLY.

Wiring Optional Auto Dialer and In-Store Alarm

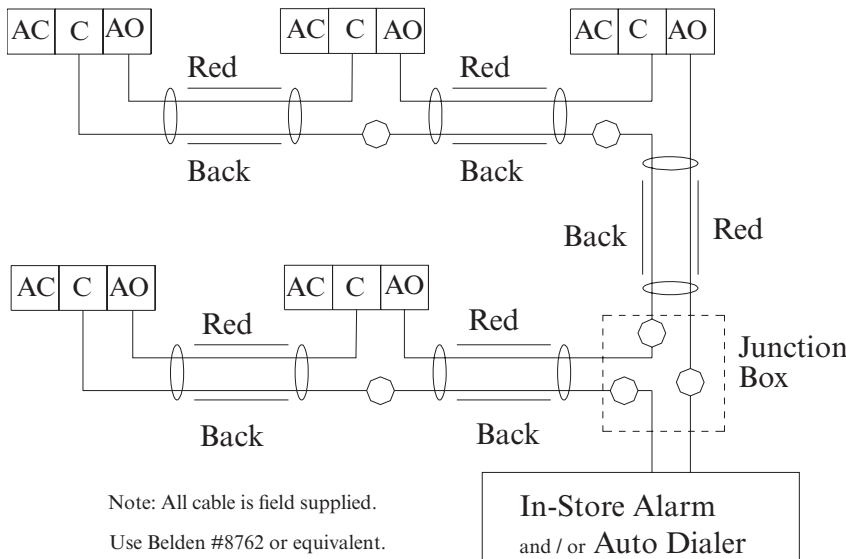
When the In-Store Alarm box and Auto dialer are used together, the correct method for wiring the alarm signals from each Protocol™ is a continuous current loop fed around the store. You will need to connect to the “COMMON” and “NORMALLY OPEN” alarm terminals located in the convenience switch box of each Protocol™ unit. See wiring diagram for proper connection methods.

IMPORTANT: The Paralleled connection between the In-Store Alarm box and the Auto Dialer is polarity sensitive. Follow the wiring connections shown.

Wiring Method Auto Dialer and In-Store Alarm



Wiring Method to Connect Alarm Loop



Startup

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

Know whether or not a circuit is open at the power supply. 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 psig and vent line when brazing. Do not exceed 350 psig for leak testing high side. Do not exceed 150 psig for leak testing low side.

Always recapture test charge in approved recovery vessel for recycling.
The Water Loop should be tested for leaks using pressurized water.
DO NOT exceed 75 psig

Startup

The closed loop system and evaporative fluid cooler must be running before starting up any Protocol™ units.

Charging the Closed Loop

The closed loop may be filled through a large ball valve at the highest point in the system. Use a funnel when pouring or pumping the glycol into the loop. Water may be added with a hose. The funnel provides an air break, and ensures no glycol contamination of the water supply. Where the high point is not accessible, glycol must be pumped into the system. Water charging from a utility supply line will require anti-backflow equipment. (A simple check valve in the supply line is not sufficient.)

Vent trapped air. Place a towel around the vent valve to catch any liquid. Any valve and hose assembly used in venting should not be used for anything else. If the loop employs reverse return piping, open each circuit setter completely. For direct return piping, adjust the circuit setter proportionally for piping head loss and GPM requirements.

Start pumps individually just long enough to check for proper rotation. If pumps are running backwards, have the field connections corrected.

Periodically vent trapped air during startup.

Charging the Refrigeration Side

Leak Testing

Visually inspect all lines and joints for proper piping practices.

Open Power Supply

Compressors – Open circuit breakers to all compressors.

Isolate

Compressors – Front seat service valves on suction and discharge.

Pressure Transducers – Close angle valves.

Open

Valves – to condenser, heat reclaim, receiver.

Liquid Line Solenoid Valve(s) – Solenoid should be energized.

Verify

Refrigerant requirements for system, compressors, and TXV's in merchandisers and coolers.

Electrical supply and component requirements.

Test Charge

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

Evacuation

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

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

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

Setup

Using an 8 CFM or larger vacuum pump, connect to the access port on both the suction and discharge header of the Protocol™ unit. Connect one micron vacuum gauge at the pump, and one at the furthest point in the system from the compressor. Plan procedures so breaking the vacuum with refrigerant will not introduce contaminants into the system. The vacuum pump must be in good condition and filled with fresh oil to achieve desired results.

Procedure – Triple Evacuation

Pull a vacuum to 1500 microns. If the vacuum fails to hold, determine the cause and correct. Begin again and pull a vacuum to 1500 microns.

Break the vacuum with refrigerant vapor to a pressure of about 2 psig. Do not exceed the micron gauge transducer's maximum pressure surge to the transducer of the micron gauge.

Pull a second vacuum to 1500 microns.

Break the vacuum with refrigerant vapor to a pressure of about 2 psig.

Pull a third 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.

Pre-charge Check List

During any of the pull downs, check:

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

Water Loop

- Electrical requirements and power supply
- Electrical connections tight and clean
- Proper pump operation
- Proper fan operation
- Thermostat or pressure settings
- Damper operation, if equipped
- Protocol™ Water valves set properly

Heat Reclaim and Other Systems

- Electrical requirements and power supply
- Electrical connections tight and clean
- Component Operation

Refrigerant Charge

Remember the condenser in the Protocol™ holds only a small amount of refrigerant. It is therefore very easy to overcharge the Protocol™ unless care is taken during the charging process.

Charging until the liquid sight glass is clear of bubbles will often overcharge the system causing head pressure alarms.

Because the HFC refrigerants are less dense than the refrigerants they replace, they will tend to “flash” or bubble more easily, even when the correct charge is in the system. Therefore, charge only until the sight glass on the receiver is covered with refrigerant when the system is operating in a balanced refrigeration mode. Protocol™ units with gas defrost should also be monitored during defrost to ensure that the receiver does not completely empty. Add enough refrigerant, if necessary, to maintain a liquid seal on the receiver outlet if the receiver empties during defrost.

Oil Charge

Charge the Oil Separator with oil.

Use only Mobil EAL Arctic 22 CC, ICI Emkarate RL 32 CF, or Copeland Ultra 22 CC
Oil Separator is shipped without oil charge.

Oil Levels

Compressor top half of the sight glass
Oil Separator between the two sight glasses

Important Notice to the Installer

The compressors and the Turba-Shed must be closely monitored during startup because the POE oil does not return from the evaporators as quickly as mineral oil

Compressor Motor Rotation

To check compressor rotation, use the following procedure:

1. Install gauges on suction and discharge headers. Be aware of Satellite and Split-Suction Protocol™ units when making hookup. A momentary compressor run should cause a drop in suction pressure and a rise in discharge pressure.
2. With convenience switch **OFF**, switch **OFF** all breakers in the control panel EXCEPT the control circuit breaker.
3. Turn ON convenience switch.
4. Look for the green light on the single-phase protector. If the light is red, turn **OFF** the convenience switch. All Protocol™ 3-phase wiring is connected L1 to T1, L2 to T2, and L3 to T3. Have the field connections corrected so the phase protector indicates phase alignment. (The light is green.)
5. Turn **ON** convenience switch.
6. Turn all compressors ON using the electronic controller.

7. Momentarily turn **ON** compressor breaker #1 and verify correct pumping direction. Check all compressors before switching any wires. If all compressors are rotating backwards, change two legs at the field side of the convenience switch. For individual compressor, change the Legs on the load side of the compressor contactor.

8. Remove Forced Conditions

Final Checks

Return Gas Superheat

Return gas superheat should be 10 to 30 °F on all units

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

- Thermostatic Expansion Valve superheat adjustment
- Electronic Pressure Regulator settings
- Defrost scheduling and timing
- Condenser flow balance
- High and low pressure controls
- Thermostat settings
- Adjustments to electronic controls
- Electronic oil level controls

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

When merchandisers are completely stocked, check the operation of the system again.

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

Caution

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

Control Settings

High Pressure Safety – 395 psig

Vacuum Pressure Safety – 0 psig

Discharge Temperature Sensor – 240 °F

It is mandatory that the mechanical low-pressure controls be set in the field

Electronic Oil Level Control

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

Auxiliary Systems

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

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

NOTE: In the following examples, the #() refers to a defrost circuit and/or Aux sensor # between 1 and 6. The same screens apply for all circuit and sensor attachments.

Temperature Termination (Digital Mode)

When an Auxiliary Sensor is used to connect a defrost termination thermostat (Klixon*) device to the control in order to terminate defrost on high temperature, the following information is required for proper operation.

(*No case temperature sensor present.)

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

Temperature Termination (Analog Mode)

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

3-Pipe Gas Defrost

Application

3-pipe gas defrost is designed to operate with different defrost schedules and durations.

Only one lineup or no more than 20 percent of the load should go into defrost at one time. As a lineup goes into defrost, the other cases will be fed liquid from the Protocol™ and from the lineup in defrost. For longer lineups, or cases with large evaporator coils, partitions may be required to split these lineups into smaller sections. All the valves, gas solenoid and suction solenoid, are located in the cases and are controlled by the Protocol™. The main liquid differential valve is located in the Protocol™ on vertical units, and field installed on horizontal units. Isolation ball valves for each lineup branch are recommended for ease of servicing.

Defrost Operation

1. When a system goes into defrost, the liquid differential valve, located in the Protocol™ on vertical units and outside the Protocol™ for horizontal units, is de-energized allowing the valve to modulate at the desired setting of 15-20 lbs. (Note: higher settings may be required if the Protocol™ unit is located above the evaporators).
2. The control board will simultaneously switch the appropriate output relay for the defrosting circuit which will de-energize the suction solenoid and energize the hot gas solenoid allowing discharge gas to flow through the coil and return through the liquid line.
3. The defrost cycle can be either temperature terminated using a thermostat or time terminated. No drip cycle has been built in.

Electric Defrost

Application

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

Defrost Operation

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

Offtime Defrost

Application

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

Defrost Operation

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

Sensor Applications

Suction Pressure Sensor

This suction pressure input provides the electronic controller the necessary information to cycle the compressors on and off to maintain an overall setpoint. You will need to program the following: Setpoint, High Alarm, Low Alarm, Range.

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

Suction Pressure Input

This suction pressure input has a dual function. It can provide the electronic controller the necessary information to cycle the compressors on and off under a split suction configuration, or it can be used to monitor the discharge pressure. If the input is used to monitor discharge pressure, you will need to program the following: High Alarm, Low Alarm, and Range (typically 500 psi).

Under split suction configuration, this input provides the electronic controller pressure signal used to cycle compressors on and off. The split suction configuration may contain multiple compressors (2 or more) or a single compressor (low or high end satellite). When two or more compressors are attached to the second suction header, you will need to program the following: Split Suction Operation (Enabled/Disabled), Number of Compressors, Split Suction Setpoint, High Alarm, Low Alarm, Range.

If only a single compressor is used (Satellite configuration), you will need to program the following: Satellite Operation (Enabled/Disabled), Satellite Setpoint, Satellite Differential, High Alarm, Low Alarm, Range.

Temperature Input

This temperature input has a dual function operation: 1) temperature input for Suction Pressure Reset feature or 2) alarming and monitoring of temperature for a display case. The Suction Pressure Reset function allows the suction pressure setpoint to float upward to reduce compressor energy consumption. The temperature sensor used with the Suction Pressure Reset function allows a setpoint to be entered for a specific display case, normally the case containing the evaporator with the lowest suction temperature. When the temperature in this case is satisfied, the suction pressure setpoint will increase by 1 psi. The following information should be programmed into the control: Suction Pressure Reset (Enable/Disable), Suction Pressure Reset Setpoint, High Alarm, Low Alarm.

When this temperature input is used to monitor and alarm on temperature of a given display case, the following information should be used: High Alarm, Low Alarm, Alarm Activation (Enabled/Disabled), Alarm Delay, Circuit Attachment.

All Additional Pressure/Temperature Inputs

This temperature input has a dual function operation: 1) pressure input for monitoring discharge pressure or 2) alarming and monitoring of temperature for a display case. Since this input can operate as a temperature or pressure, you will need to configure both the hardware (input circuitry) and software (memory settings) for proper operation. When operating as a pressure input, the following should be programmed: Input mode (Set to pressure), High Alarm, Low Alarm, Alarm Activation (Enable/Disabled).

When operating as a temperature input, the following should be programmed: Input mode (Set to temperature), High Alarm, Low Alarm, Alarm Activation (Enable/Disabled), Circuit Attachment.

Programming the Optional In-store Alarm and Auto Dialer

All alarm wiring (refer to Electronic section) must be complete before beginning the programming of the alarm dialer. The Protocol™ units and any other equipment connected on the alarm connection must not be in alarm. This normal operation state is used to allow the auto dialer to preset the non-alarm condition present on the alert inputs.

IMPORTANT: Make sure that the auxiliary batteries if required for the auto dialer are inserted before beginning programming information within the auto dialer's memory.

1. Program the ID# for the Auto Dialer. This ID# will be used to indicate which store is in alarm. If the customer wishes the auto dialer to be muted during the verbal alarm message, the MUTE key must be pressed first and then the store ID# will follow (see page 21 and 22 in Owners Manual).
2. Next, program one or all of the available phone numbers that will be dialed during an alarm condition. You will need to know if the store telephone system uses “Tone” or “Pulse” dialing (see page 15 and 16 in the Owners Manual). You will also need to include any prefix number when required, for gaining access externally through the telephone system (i.e. 9, 555, 1212).
3. Preview the above programming information by pressing the “What is” key and then the item you wish to preview.

Recommended Phone Number Programming

In many cases, it is advantageous to program the store as the first phone number dialed. This helps to avoid nuisance alarms and allows the store manager to take appropriate action during normal store hours. The second and subsequent phone numbers should be programmed to dial a phone answering service, personnel home number or answering machine, or pager. The choice and decision of phone numbers is at the customer's discretion.

Troubleshooting Guide

This section is to aid in the troubleshooting of electrical and electronic considerations of the Protocol™ Refrigeration System. The manual assumes that the reader has a working knowledge of the electronic controller communications platform used in networking the Protocol™ Electronic controls. It will be necessary to have a copy of the control manuals on hand to facilitate the troubleshooting process.

The structure of this troubleshooting guide is based on a Question/Answer format. In most cases, the electronic controller will be used to determine whether the problem lies within the electronic control, or external to the control – most likely contained in the control panel. You will need to follow the instructions carefully to ensure a quick method of solving the problem or question.

IMPORTANT

The current draw required by analog meters (Volt-Ohm Meters or VOMs) can permanently damage electronic equipment.

Never use a VOM to check computer components or computer controlled systems. Use a Digital Multimeter (DMM) to measure voltage, amperage, milliamperes, or ohms. If a range is exceeded, the display will show OL (overload).

Electrical Questions

Problem A: The compressor will not turn **ON** or will not run.

Step A1 Visually observe if the Alarm on the control board is **ON**. If it **ON**, go to step A2. If it is **OFF**, go to Step A9.

Step A2 Access the protocol and enter the Force Comp On submenu. Enter the compressor number you wish to turn ON. Visually observe if the correct compressor relay output LED on the control board is turned ON. If turned ON, go to Step A3. If it does not turn ON, go to step A7.

Step A3 If the compressor contactor is energized, verify that the compressor turned ON by cycling the compressor circuit breaker (the compressor should turn ON and OFF with the circuit breaker) or use an amp probe and measure all three phase wires between the contactor and the compressor. If the compressor contactor did not energize, go to Step A6.

Step A4 If the compressor contactor energized, but the compressor cannot be cycled with the circuit breaker, you will need to open up the compressor terminal box located on the side of the compressor, and ensure that the power wires are tightened down. **Important: you should turn the compressor circuit breaker off before implementing this check.**

Step A5 If the compressor wires are tight with the terminal box, the compressor may be damaged internally and may need to be replaced.

Step A6 Problem appears to be located in the control circuit wiring, most likely in one of the safeties. Referring to the supplied customized wiring diagram, use a digital voltmeter and determine where the circuit is being broken. The control circuit originates from the phase monitor, passes through the control board safety switch, the discharge line thermostat, and finally through the electronic oil level control safety.

Step A7 If you cannot force the compressor ON through the controller parameters:

1. No electric defrost is currently engaged. Electric defrosts implement a compressor shedding routine, which may be keeping the particular compressor you want to energize off-line.
2. The correct number of compressors is installed.
3. Check that the suction pressure is not below 2 psi activate the vacuum prevention routine which will not allow the compressors to turn ON.

Step A8 If the preceding parameters check out, you may need to replace the electronic control board.

- Step A9** At this point, it is assumed that the electronic control board is in switchback (see page 6-6 for details describing switchback). If the compressor you are trying to turn ON is not wired to the switchback control circuit (refer to the supplied customized wiring diagram), you will need to investigate the cause of this switchback condition and correct the existing problem.
- Step A10** If the compressor you are trying to turn ON is wired into the switchback control circuit, use a digital voltmeter and determine where the circuit is being broken. The switchback control circuit originates from the phase monitor, passes through the switchback relay on the control board, through the low pressure mechanical backup switch, then back through the control board relay and fuse, through the high pressure safety switch, the discharge line thermostat and finally through the electronic oil level control safety.
- Problem B:** Evaporator is not defrosting.
- Step B1** Visually observe if the Alarm Relay LED on the control board is ON. If LED is ON, go to step B2. If LED is OFF, refer to the Troubleshooting Alarms section of this document.
- Step B2** Verify that the Clock contained in the Protocol is keeping time. Access and select the Set the Clock submenu. If the clock is running, go to step B3. If the clock is not running, try changing the time to the correct setting. You may want to consult the section on Electrical Noise contained within this manual.
- Step B3** Enter the defrost circuit number you wish to turn ON and activate it. Now exit and go to the Defrost Menu. Observe the circuit you forced into defrost. If the status indicates defrost proceed to Step B4. If the status does not indicate defrost, go to Step B7.
- Step B4** Visually observe which defrost relay located on the defrost board is energized. The corresponding indicator light on the defrost board should be ON. If the indicator light is ON, proceed to Step B5. If the indicator light is OFF, proceed to Step B10.
- Step B5** At this point, we have assumed that the control is responding correctly and the problem lies within the control panel. Use a digital voltmeter to check that voltage is present at the correct terminal blocks in the power distribution box. You will need to refer to the supplied customized wiring diagram to determine which terminal blocks are providing power for the particular case load you are defrosting. If voltage is present at the terminal blocks, verify that the case is in defrost by visual inspection and then return to Step B6. If voltage is not present at the terminal blocks, go to Step B11.
- Step B6** If the status of this defrost circuit indicates it is deactivated, reactivate the circuit and verify the programming of this circuit as outlined in controller manual. If the status of this defrost circuit indicates that it is not installed, N/A, go to the Protocol™ configuration menu and access the Protocol Setup submenu. Enter

the DEFROST Setup program the control with the correct number of defrost circuits. Repeat this step to verify that the circuit is activated.

- Step B7** Verifying the defrost circuit configuration. Check the number of defrosts per day, the defrost length and defrost start times to ensure proper configuration. Go to Step B9.
- Step B8** Verifying the Defrost Output Assignments. Verify that the correct output(s) have been assigned to the appropriate defrost circuit. Now that all programming information has been verified, return to Step B3 to force the defrost on.
- Step B9** Verifying the Defrost Output Assignments. Verify that the correct output(s) have been assigned to the appropriate defrost circuit. If the correct outputs have been assigned, and the status reveals the circuit is in defrost, and check the ribbon cable between the control board and defrost board. Try replacing the ribbon cable with one from another Protocol™ to verify they cable is good or bad. If the cable is good, replace the control board. The defrost output drive chip has possibly been damaged. If the correct outputs have not been assigned, enter the correct programming and repeat this step.
- Step B10** Electrical Wiring Check. Use a digital voltmeter to verify where the circuit is being broken. Power for defrost solenoids originates from the 'X1' terminal block, passes through the fuse relay located on the defrost board, and ends at the terminal block located in the power distribution block. If the fuse on the defrost board has blown, try replacing it with another fuse and repeat the voltage checks.
- For electric defrosts, a minimum of two defrost outputs will be used for defrost: one for the solenoid and one for the defrost heaters. The power for the solenoid can be checked as described previously in this step. To verify the defrost heater wiring go to Step B12.
- Step B11** POWERLINK™ wiring. You may want to first familiarize yourself with information on POWERLINK™ Operation as detailed in this manual. Visually inspect that the circuit breaker handles of the POWERLINK™(S), located on the bus bars within the control panel, are in the ON position. If the handle is in the ON position, use a digital meter and check for voltage at the terminals of the POWERLINK™ device and again at the terminal blocks in the power distribution panel. If voltage is not present at these two points, got to Step B13.
- Step B12** POWERLINK™ Power Supply Check. Using a digital meter, inspect the POWERLINK™ Power Supply, which provides power for the POWERLINK™ device. Set your digital meter for DC voltage. There should be 24 VDC across the terminals of the POWERLINK™ Power Supply. If 24 VDC is not present, replace the POWERLINK™ Power Supply. If 24 VDC is present, go to Step B14.

Step B13 Check fuse on defrost relay board. Replace fuse if it is blown. If fuse is good, measure the voltage present at the white connector on the defrost relay board. Place the positive test lead of your meter (typically the red wire) on the normally open (N.O.) contact of the defrost relay board connector. Place the negative test lead of your meter (typically the black wire) on the common (COM) contact of the defrost relay board connector. Your digital meter should read +24 volts DC. If +24 volts DC is present, the POWERLINK™ Device must be replaced. If +24 volts DC is not present, verify that wiring is correct as compared with the supplied customized wiring diagram.

Problem C: Pressure transducer is not reading properly.

The transducer cable is shielded and should not have the bare drain wire attached to door panel liner. The mechanical ground connection is achieved through the threaded fitting on the suction and/or discharge header.

Step C1 Use a service gauge to verify the actual pressure reading. If the pressure reading of the gauge and the reading of the Hand-Held controller is more than 2 psi, check the pressure transducer offset, which is available on the electronic control.

Step C2 Verify that the transducer range is set properly. Select the pressure input you are currently having problems with and observe the transducer range. Suction transducers should be selected for a 200 psi range while discharge transducers require a 500 psi range. If the range is not set properly, make the programming change and reevaluate the transducer. If the range is set properly, go to Step C3.

Step C3 Use a digital volt meter with the scale set for DC volts to measure the excitation voltage and signal voltage of the transducer.

Step C4 If the excitation voltage is not within the limits set by the controller manufacturer.

Step C5 If the pressure reading, as indicated by the above formula matches the reading of the Hand-Held Device replace the transducer. If the pressure reading, as indicated by the above formula does not match the reading of the Hand-Held Device, replace the control board.

Step C6 Use a digital voltmeter to measure the control transformer secondary voltage. With the scale of your meter set for AC volts, remove the power plug connected to the Protocol™ control and place your test leads of the meter to the two outside pins. The voltage present at these two pins should be between 20 and 27 VAC. If the secondary voltage is within limits replace the control board. If the secondary voltage is out of limits, investigate supply voltage to the control transformer.

Problem D: Temperature Sensor is not reading properly.

The temperature sensor used on Protocol™ is typically used to sense discharge air temperatures at the evaporator load. The sensor contains a NTC (Negative Temperature Coefficient) thermistor, which will increase resistance as temperature falls and decrease resistance as temperature rises.

Trouble Shooting Alarms

The following section gives information on diagnosing specific alarms. The first step in analyzing alarms is to determine when the alarm occurred. The alarms will appear in the controller. The cause, time and date of the alarm will be shown.

There are two types of alarms: switchback and non-switchback. A switchback alarm is normally the result of some external failure as seen or interpreted by the electronic control. When a switchback alarm occurs, the electronic control removes itself from control of the compressors. Operation and cycling of the compressors will be controlled by a low pressure mechanical switch located inside the Protocol™ system, which will cycle one half of the compressors. The indication of alarm will be dependent upon which alarm device has been installed: auto dialer, in store alarm or computer system. Note that under a switchback alarm no defrosts will occur. There are three types of switchback alarms: (1) High Suction Pressure, (2) Low Suction Pressure or (3) All compressors off for more than 60 minutes.

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

Alarm: High Suction Pressure

This alarm is one of the three “switchback” alarms. The time delay for this condition is 30 minutes. High suction pressures are ignore during defrosts.

Possible Causes

One or more compressors are operational.
High alarm limit is not set properly.

Step 1 Enter the Alarm Menu. Observe the time and date of the alarm. You will be prompted as to whether or not you want to clear the current alarm.

- Step 2** Proceed to the Status Menu for this Protocol™. Observe the operation of compressors turning ON, and watch for suction pressure to come down. If the suction pressure does not come down when a compressor comes on, it is an indication that some external device is keeping the compressors off line (high pressure safety, oil safety, phase monitor, etc.) You will need to go to this Protocol™ and investigate whether or not compressors are running.

Alarm: Low Suction Pressure

This alarm is one of the three “switchback” alarms (See the paragraph describing switchback). The time delay for this condition is 30 minutes. Low suction pressures are ignored during defrost.

Possible Causes:

Low Refrigerant Charge
Low Alarm Limit is Not Set Properly

- Step 1** Enter the Alarm Menu. Observe the time and date of the alarm. You will be prompted as to whether or not you want to clear the current alarm. Press the DEL key to remove the current alarm condition.
- Step 2** Proceed to the Protocol™. Observe the operation of compressor turning ON, as indicated by X's. The Protocol™ should begin to operate the compressors and suction pressure should be maintained. If this does not occur you will need to further investigate the Protocol™ operation.

Alarm: All Compressors Off

This alarm is one of the three “switchback” alarms (See the paragraph describing switchback). The time delay for this condition is 60 minutes. When the electronic control has not turned on a compressor for one hour, this alarm will be triggered. This condition exists when the suction pressure, as read by the electronic control is above the low alarm limit and below the suction pressure setpoint.

Possible Causes:

An external influence has turned ON one or more compressors
Faulty reading from the pressure transducer

- Step 1** Enter the Alarm Menu. Observe the time and date of the alarm. You will be prompted as to whether or not you want to clear the current alarm.
- Step 2** Proceed to the Protocol™. Observe the operation of compressors turning ON, as indicated by X's. The Protocol™ should begin to operate the compressors and suction pressure should be maintained. If this does not occur you will need to further investigate the Protocol™ operation.

Service and Maintenance

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

Know whether or not a circuit is open at the power supply. 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 psig and vent lines when brazing. Do not exceed 350 psig for leak testing high side. Do not exceed 150 psig for leak testing low side.

Always recapture test charge in approved recovery vessel for recycling.

The Water Loop should be tested for leaks using pressurized water.

DO NOT exceed 75 psig.

Service

Compressor Replacement

Before beginning removal of old compressor prepare replacement compressor as follows:

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 pallet.

Disconnect Electrical Supply

Turn off motor and control panel power supplies to the Unit.

Turn off control circuit and open all compressor circuit breakers.

Tag and remove electrical wires from the compressor.

Isolate Compressor

Frontseat Suction and Discharge Service Valves.

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

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

Remove suction and discharge rotolocks.

Remove mounting bolts.

Plug holes per compressor manufacturer's specifications.

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

Replacing Drier

Shut down the system. Isolate the Drier to be replaced and bleed off pressure into an **approved recovery vessel**. Replace. Pressurize, leak test and bring back on line.

Recommended Maintenance

Husmann recommends the following maintenance for Protocol™ systems:

Twice a Month

1. Review store operating data.
 - a. Graph the various temperatures and pressures for each unit; look for unusual trends.
 - b. Look through the alarm menu of each unit.

Every Six Months

1. Check water strainers at each unit. Clean as necessary.
2. Go through Protocol™ Checklist. See sample on next page. You should duplicate the blank checklist for your use. File the completed checklists for future reference.
3. Check and keep a record of pumping station inlet and outlet pressures.
4. Review maintenance logs. ALL service must be logged.

Every Year

1. Check freezing point of glycol in closed loop; add water or glycol as required.
2. Replace Liquid, Oil, and Suction Filters.
3. Check the Alarm functions on the pumping station. The low fluid pressure, high fluid temperature, and automatic pump switching functions should be checked.
4. If equipped with air-cooled condenser, inspect and clean as necessary.

Every Two Years

Sample the closed loop fluid and have it analyzed. If this fluid contains a Dow product (Dowtherm or Dowfrost), Dow can perform the analysis. Call Dow at 1-800-447-4369 and ask for a fluid sampling kit.

Use only Mobil EAL Arctic 22 CC, ICI Emkarate RL 32CF, OR Copeland Ultra 22 CC.

Oil Separator is shipped without oil charge.

Oil Levels

Compressor – top half of the sight glass.

Oil Separator – between two sight glasses.

Sample Protocol™ Checklist								
Store: Joe's Market			Location: Anytown, USA					
Date: 6/7/2004			Time:					
Unit	K							
Model Number	PH06PK-MEMEMEMEMEMF							
Serial Number								
Factory Order Number	06542							
Manufacture Date	08/31/98							
Defrost								
Circuit NO.	1	2	3	4	5	6	7	8
Type	Off	Off	Off	Off	Off	Off		
No./Day	4	3	3	2	1	3		
Length	40m	45m	45m	45m	60m	45m		
Superheat	42°							
Suction Set Point	52 psig							
Suction Pressure	52.0 psig / 17°F Saturated							
Suction Temperature	59 °							
Split/Satellite Superheat								
Suction Set Point								
Suction Pressure								
Suction Temperature								
Oil	POE							
Oil Separator	Between Glasses							
Pressure Differential								
Condenser								
Head Pressure	214.9 psig							
Water Temperature In	OK							
Water Temperature Out	OK							
Refrigerant	404a							
Receiver Level								
Liquid Sight Glass	Foamy							
Compressor No.	1	2	3	4	5	6		
Model No.	ZF13K4	ZH13K2	ZH13K2	ZH13K2	ZF13K4	ZF15K4		
Discharge Temperature	173	166	166	165	162	165		
Amp Draw	10.2	10.7	10.8	11.2	10.2	12.5		
Shell Temp at Oil Connect	hot	hot	warm	warm	warm	warm		
Float or Oil Connect	¾	full	7/8	¾	1/2	full		
Oil Control Magnet Cond.								
Controller								
Alarms								
Time & Date Displayed								
Notes: L.L. Filter changed All valves adjusted. 4 PEXH4s, 2 C-store Reach Ins, 1 ND5 would not adjust Removed T-stats from PEXH4s, ND5s, and DM. Raised suction S.P. from 48 psig to 52 psig. All PEXH4s cleaned. 1-2 inches of slime grew there								

Protocol™ Checklist								
Store:				Location:				
Date:				Time:				
Unit								
Model Number								
Serial Number								
Factory Order Number								
Manufacture Date								
Defrost								
Circuit NO.	1	2	3	4	5	6	7	8
Type								
No./Day								
Length								
Superheat								
Suction Set Point								
Suction Pressure								
Suction Temperature								
Oil								
Oil Separator								
Pressure Differential								
Condenser								
Head Pressure								
Water Temperature In								
Water Temperature Out								
Refrigerant								
Receiver Level								
Liquid Sight Glass								
Compressor No.	1	2	3	4	5	6		
Model No.								
Discharge Temperature								
Amp Draw								
Shell Temp at Oil Connect								
Float or Oil Connect								
Oil Control Magnet Cond.								
Controller								
Alarms								
Time & Date Displayed								
Notes:								

TROUBLE SHOOTING GUIDE

SPORLAN

<http://www.sporlanonline.com>

EMERSON

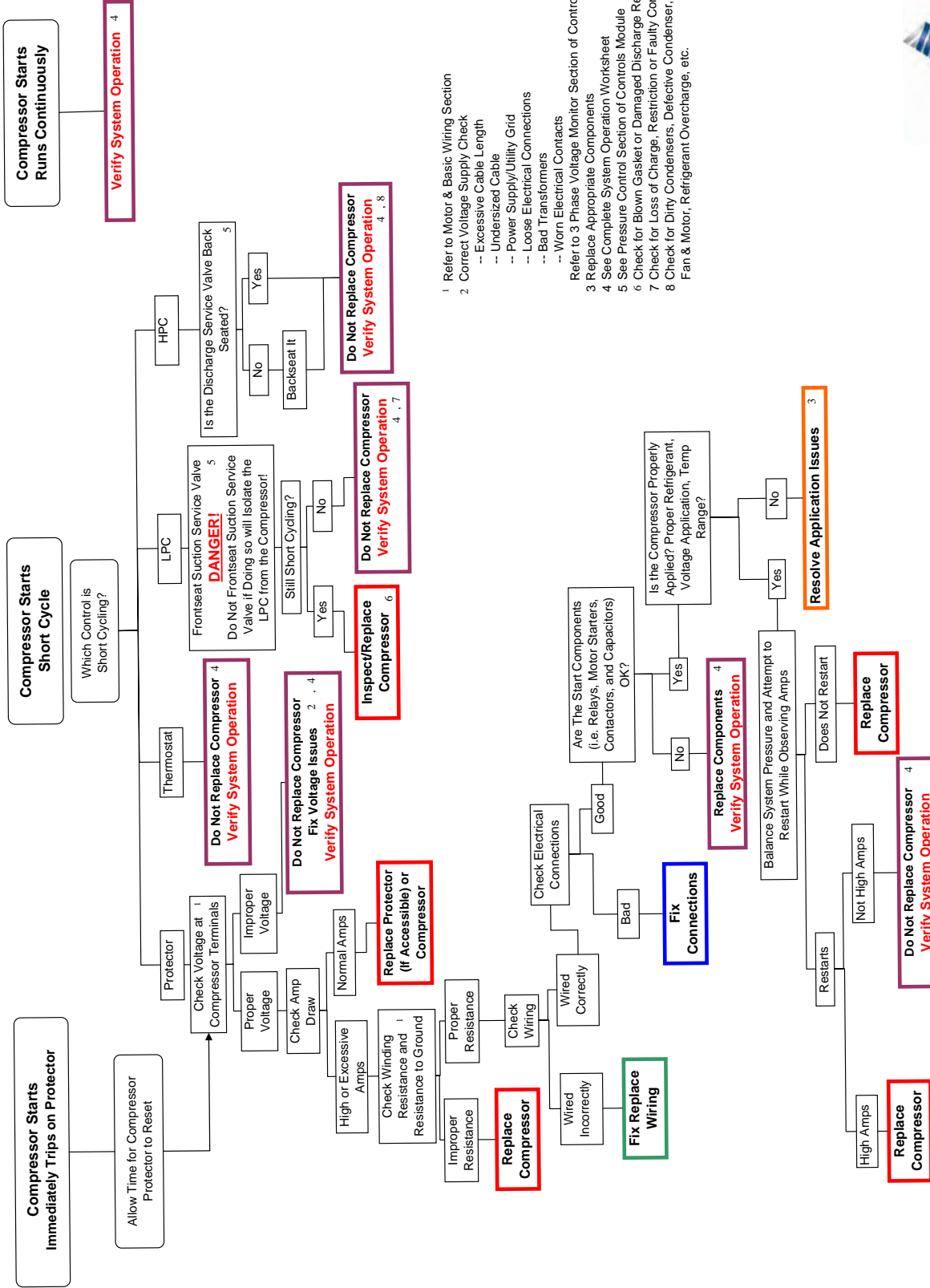
Fault Finder app

[http://www.emersonclimate.com/en-us/
Resources/Mobile Apps/Pages/mobileapps.
aspx](http://www.emersonclimate.com/en-us/Resources/Mobile_Apps/Pages/mobileapps.aspx)

SQUARE D HOTLINE

888-SQUARED (888-778-2733)

Tech Support Line. Level One provides product initial Tech Support and can connect the Caller to Level 2, if required.

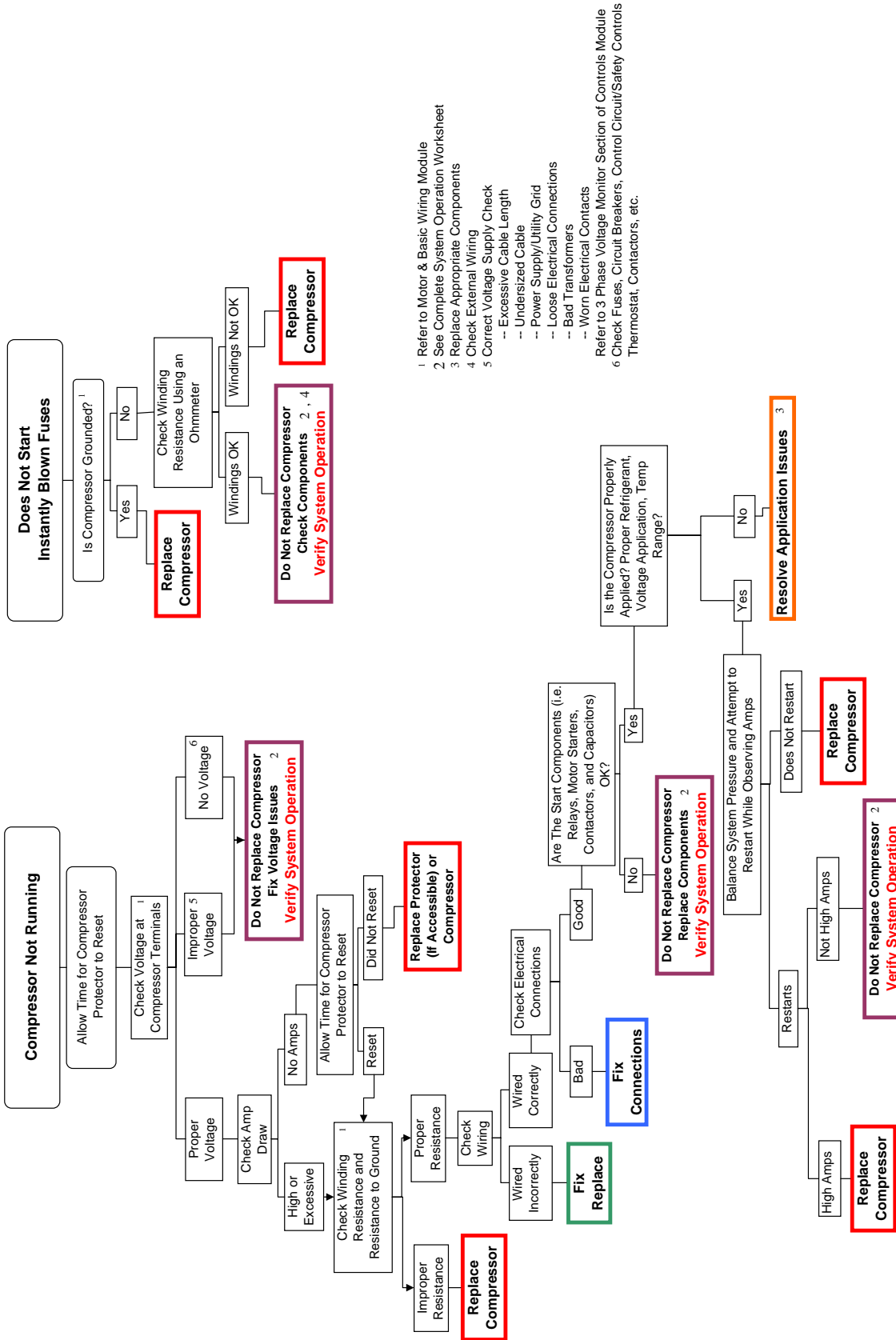


- 1 Refer to Motor & Basic Wiring Section
- 2 Correct Voltage Supply Check
 - Excessive Cable Length
 - Undersized Cable
 - Power Supply/Utility Grid
 - Loose Electrical Connections
 - Bad Transformers
 - Worn Electrical Contacts
- 3 Refer to 3 Phase Voltage Monitor Section of Controls Module
- 3 Replace Appropriate Components
- 4 See Complete System Operation Worksheet
- 5 See Pressure Control Section of Controls Module
- 6 Check for Blown Gasket or Damaged Discharge Reeds
- 7 Check for Loss of Charge, Restriction or Faulty Control
- 8 Check for Dirty Condensers, Defective Condenser, Fan & Motor, Refrigerant Overcharge, etc.



Trouble Shooting Guide





- 1 Refer to Motor & Basic Wiring Module
- 2 See Complete System Operation Worksheet
- 3 Replace Appropriate Components
- 4 Check External Wiring
- 5 Correct Voltage Supply Check
 - Excessive Cable Length
 - Undersized Cable
 - Power Supply/Utility Grid
 - Loose Electrical Connections
 - Bad Transformers
 - Worn Electrical Contacts
- 6 Refer to 3 Phase Voltage Monitor Section of Controls Module
- Check Fuses, Circuit Breakers, Control Circuit/Safety Controls Thermostat, Contactors, etc.

Trouble Shooting Guide





HUSSMANN[®]

**To obtain warranty information
or other support, contact your
Husmann representative.
Please include the model and
serial number of the product.**

Husmann Corporation, Corporate Headquarters: Bridgeton, Missouri, U.S.A. 63044-2483 01 October 2012

Hussmann Corporation
12999 St. Charles Rock Road
Bridgeton, MO 63044-2483
www.hussmann.com