OPERATION & MAINTENANCE
TRUCLIMATE 900

Commercial Solutions

60HZ CHILLERS

OMT9-0004W

C ETL LISTED US
Intertek

⚠ WARNING

WARNING: Before performing service or maintenance operations on the system, turn off main power switches to the unit. Electrical shock could cause serious personal injury.

WARNING: All WaterFurnace products are designed, tested, and manufactured to comply with the latest publicly released and available edition of UL 60335-2-40 for electrical safety certification. All field electrical connections must follow the National Electrical Code (NEC) guide standards and / or any local codes that may be applicable for the installation.

WARNING: Only factory authorized personnel are approved for startup, check test and commissioning of this unit.

INSTALLER: Please take the time to read and understand these instructions prior to any installation. Installer must give a copy of this manual to the owner.

For the User

⚠ WARNING

This appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

Keep this manual in a safe place in order to provide your serviceman with necessary information.

NOTICE

NOTICE: To avoid equipment damage, do not leave the system filled in a building without heat during cold weather, unless adequate freeze protection levels of antifreeze are used. Heat exchangers do not fully drain and will freeze unless protected, causing permanent damage.

⚠ CAUTION

This appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
Children should be supervised to ensure that they do not play with the appliance.

Maximum altitude for this equipment shall not exceed 3000 m.

For installation only in locations not accessible to the general public.

Installing and servicing air conditioning and heating equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available for all brazing operations.

NOTE: Before installing, check voltage of unit(s) to ensure proper voltage.

Definition of Warnings and Symbols

⚠ DANGER	Indicates a situation that results in death or serious injury.
⚠ WARNING	Indicates a situation that could result in death or serious injury.
⚠ CAUTION	Indicates a situation that could result in minor or moderate injury.
NOTICE	Indicates a situation that could result in equipment or property damage.

C ETL LISTED US
Intertek

All TruClimate 900 30 Ton product is Safety listed under UL60335-2-40 thru ETL
UL-60335-1 / CAN/CSA- C22.2 No. 60335-1 / UL-60335-2-40 / CAN/CSA- C22.2 No. 60335-2-40

Table of Contents

General Installation Information

NOTICE: Do not store or install units in corrosive environments or in locations subject to temperature or humidity extremes. Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life.

NOTICE: A minimum of 24 in. clearance should be allowed for access to front access panel.

NOTICE: To avoid equipment damage, DO NOT use these units as a source of heating or cooling during the construction process. The mechanical components and filters can quickly become clogged with construction dirt and debris, which may cause system damage and void product warranty.

For the Installer

If you are NOT sure how to install or operate the unit, contact your dealer.

Installing and servicing air conditioning and heating equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply.

This manual contains specific information about the required qualification of the working personnel for maintenance, service and repair operations. Every working procedure that affects safety means shall only be carried out by competent persons.

Examples for such working procedures are:

- breaking into the refrigerating circuit;
- opening of sealed components or ventilated enclosures.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available for all brazing operations. Follow all procedures to remain in compliance with national gas regulations.

Prior to beginning work on systems containing FLAMMABLE REFRIGERANTS, safety checks are necessary to ensure that the risk of ignition is minimized. Work shall be undertaken under a controlled procedure so as to minimise the risk of a flammable gas or vapor being present while the work is being performed. All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.

No person carrying out work in relation to a REFRIGERATING SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer’s technical department for assistance.

The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:

- the actual REFRIGERANT CHARGE is in accordance with the room size within which the refrigerant containing parts are installed;
- the ventilation machinery and outlets are operating adequately and are not obstructed;
- if an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant;
- marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected;
- refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

Instructions for Equipment Using R-454B Refrigerant

⚠ WARNING

- **Do NOT pierce or burn**
- **Do NOT use means to accelerate the defrosting process or to clean the equipment, other than those recommended by the manufacturer**
- **Be aware that refrigerants may not contain an odor**

⚠ WARNING

- **The Appliance should be stored so as to prevent mechanical damage and in a room without continuously operating ignition sources (example: open flames, an operating gas appliance or an operating electric heater)**

General Installation Information

⚠ WARNING

Ventilated Area: ensure that the area is in the open or that it is adequately ventilated before breaking into the system of conducting any hot work. A degree of ventilation should continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it. Keep ventilation area clear of obstructions!

⚠ WARNING

Do NOT use potential sources of ignition in searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

Installation Site

Maximum altitude for this equipment shall not exceed 3000 m. (9843 ft.) For installation only in locations not accessible to the general public.

Installation Space Requirements

NOTE: Equipment with refrigerant charge less than 64 oz does not require have a minimum floor area requirement and does not require a refrigerant leak detection sensor.
The sensor might be added as a feature.

⚠ WARNING

Equipment containing R-454B refrigerant shall be installed, operated, and stored in a room with floor area larger than the area defined in the "Minimum Floor Area" chart based on the total refrigerant charge in the system. This requirement applies to indoor equipment with or without a factory refrigerant leakage sensor.

⚠ CAUTION

This equipment requires connections to a water supply. See the "Water Quality Guidelines" section of this manual for more information on the quality of water required for this operation. If a potable water source is used for this equipment's water supply, the source water supply shall be protected against back siphonage by the equipment.

⚠ WARNING

Take sufficient precautions in case of refrigerant leakage. If refrigerant gas leaks, ventilate the area immediately.
POSSIBLE RISKS: Excessive refrigerant concentrations in a closed room can lead to oxygen deficiency

⚠ WARNING

ALWAYS recover the refrigerant. Do NOT release them directly into the environment. Follow handling instructions carefully in compliance with national regulations.

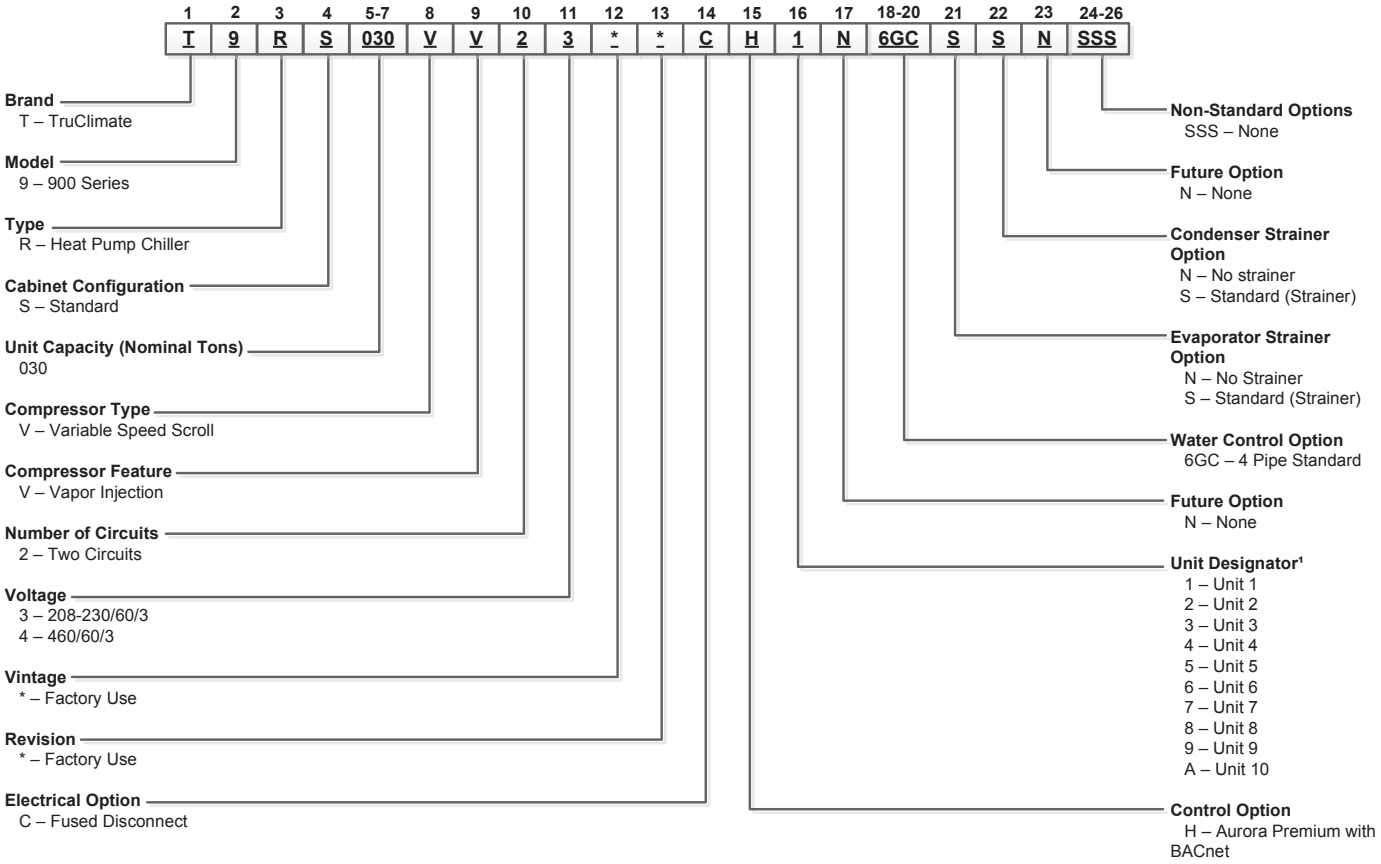
⚠ WARNING

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

See Installation Guide IGT9-0004W for installation instructions and integrated Controls Manual ICMT9-0004W for more detail on unit controls.

Nomenclatures

T9RS030VV23**CH1N6GCSSNSSS



Notes:
1. Unit Designator references units per bank. Single Point Power Disconnect will accommodate up to 8 units maximum.

Voltage Availability

Voltage	030
208-230/60/3*	•
460/60/3	•

*454B Compressor Only

09/12/23

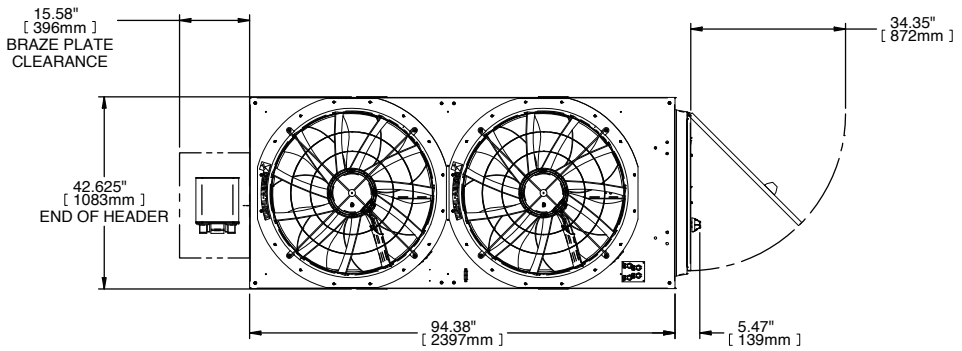
Physical Data

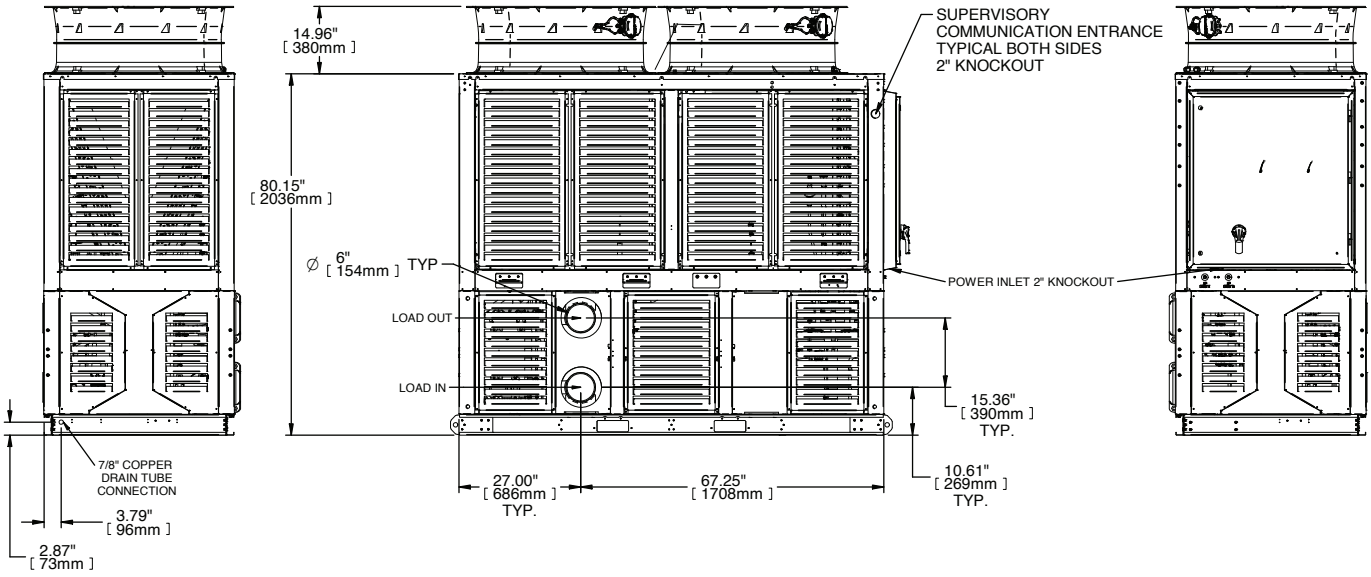
Model		R454B/208-230V	R454B/460V
Refrigerant			
	Number of Circuits	2	2
	Factory Charge Per Circuit, lbs [kg]	23.4 [10.6]	23.4 [10.6]
Compressor			
	Compressor Quantity	2	2
	Compressor Weight, lbs [kg] Each	91.9 [41.7]	88.8 [40.3]
	Oil Charge, oz [L] Per Circuit	77.8 [2.3]	77.8 [2.3]
Evaporator Circuit			
	Quantity	1	1
	Heat Exchanger Weight, lbs [kg]	127 [57]	127 [57]
	Water Volume, gal [L]	14.96 [56.62]	14.96 [56.62]
Condenser Circuit			
	Quantity	1	1
	Heat Exchanger Weight, lbs [kg]	127 [57]	127 [57]
	Water Volume, gal [L]	14.96 [56.62]	14.96 [56.62]
Unit			
	Shipping Weight, lbs [kg]	2273 [1031]	2273 [1031]

* - Charge per Circuit

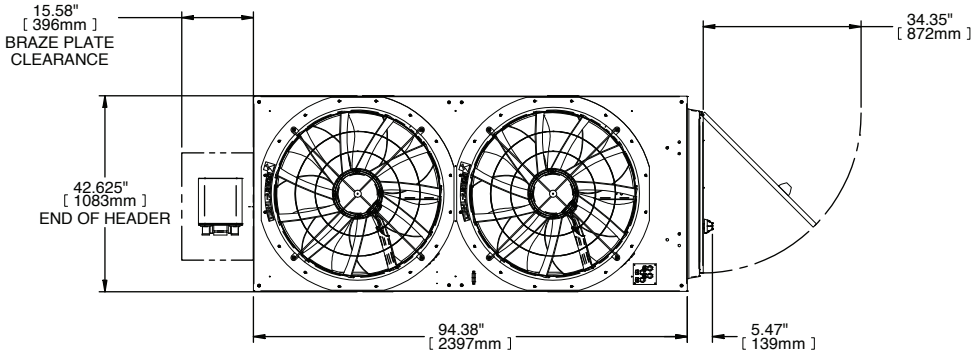
2/22/24

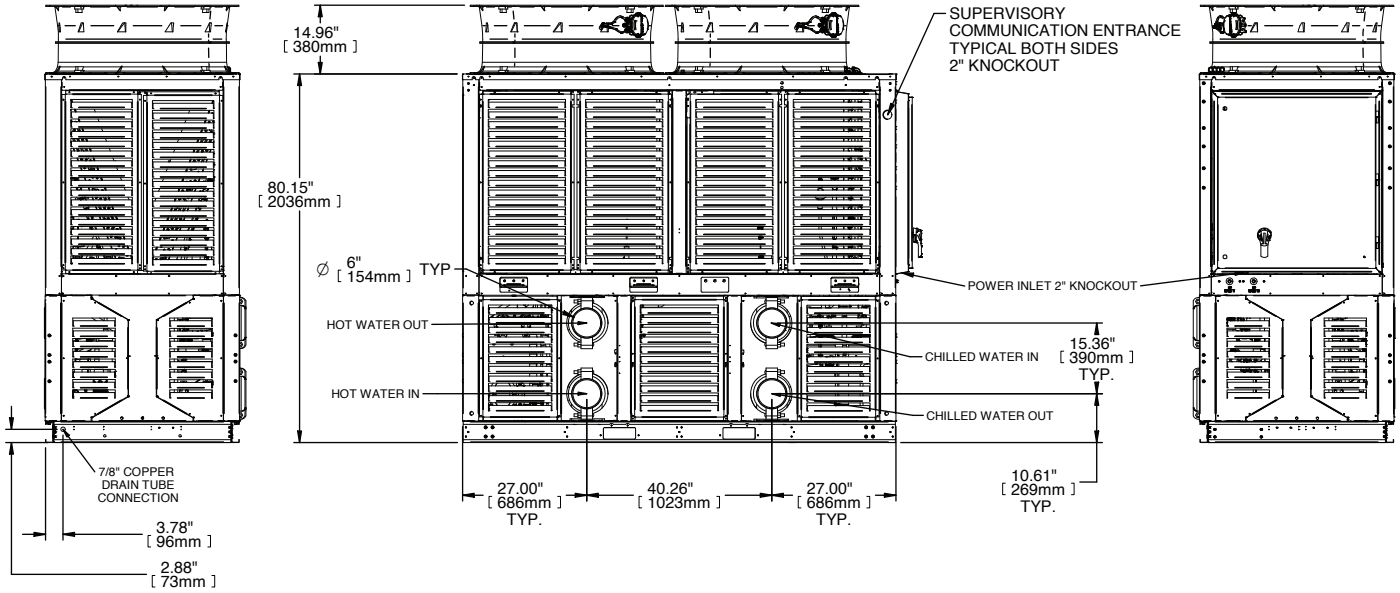
Dimensional Data: 2-Pipe Application



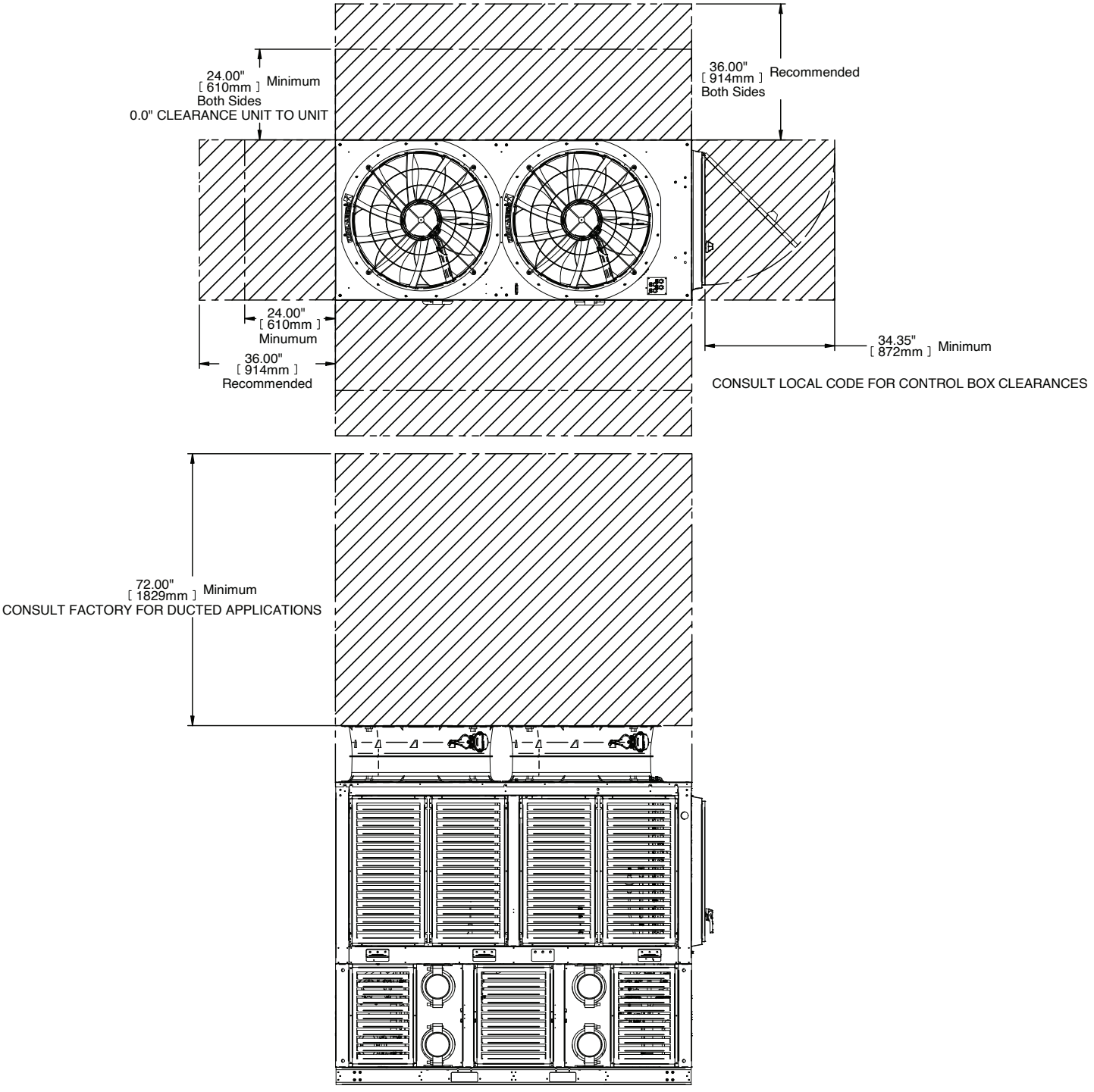


Dimensional Data: 4-Pipe Application

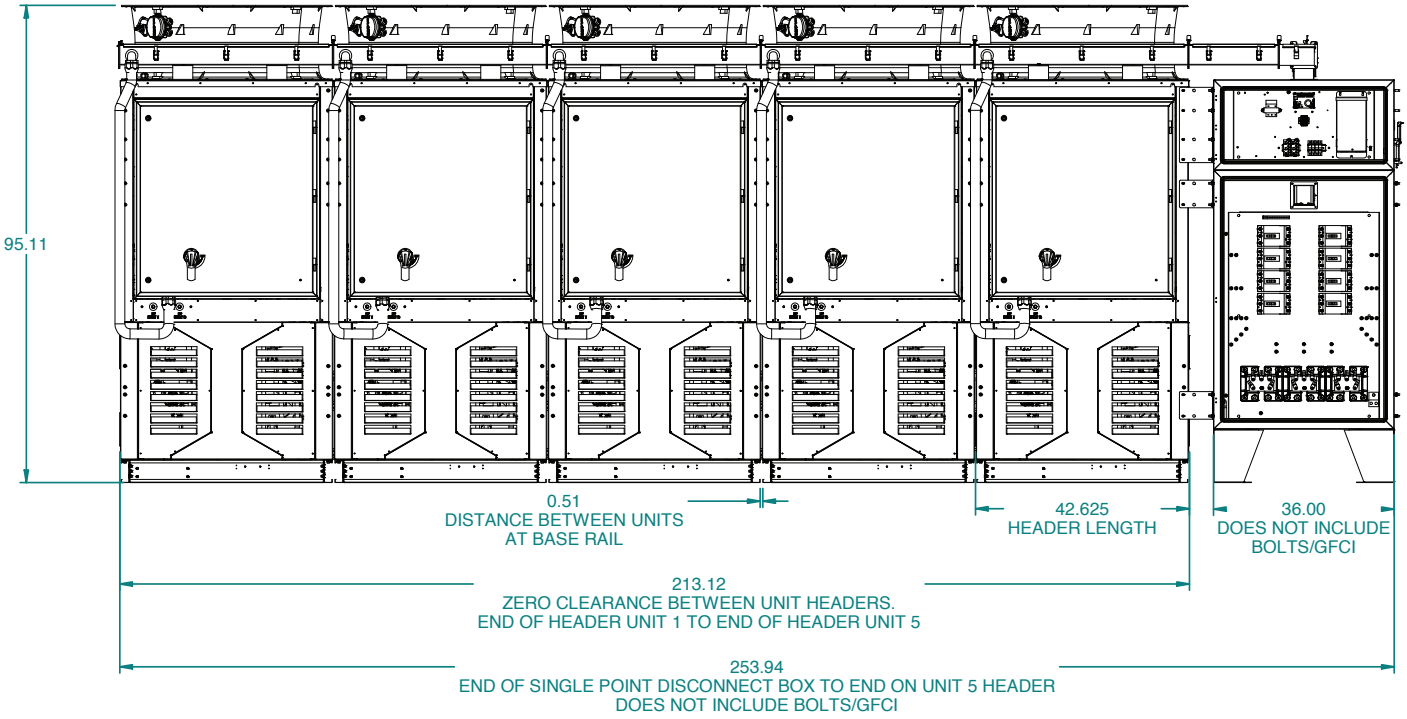




Dimensional Data: Service Clearance (All Variants)

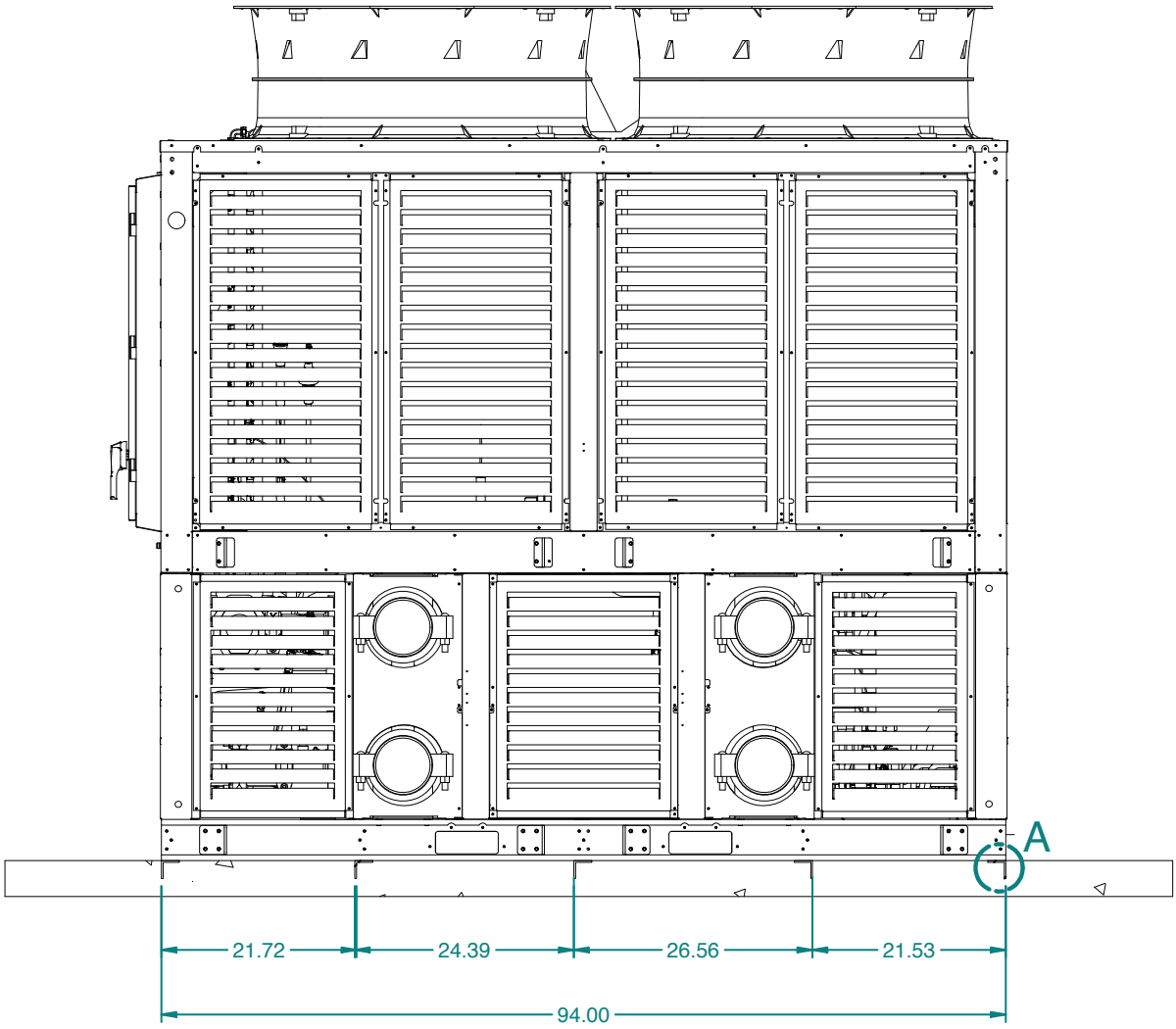


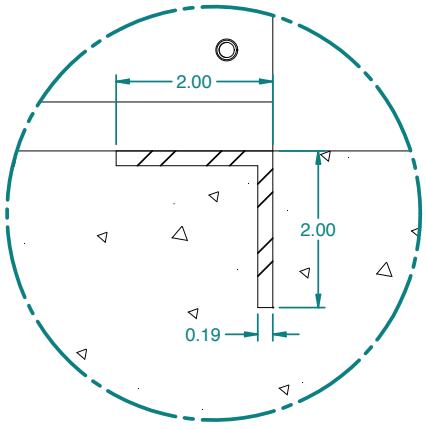
Dimensional Data: Banked Units Service Clearance (All Variants)



Note: See single unit service clearances for banked clearances.

Dimensional Data: Concrete Pad Requirements (All Variants)

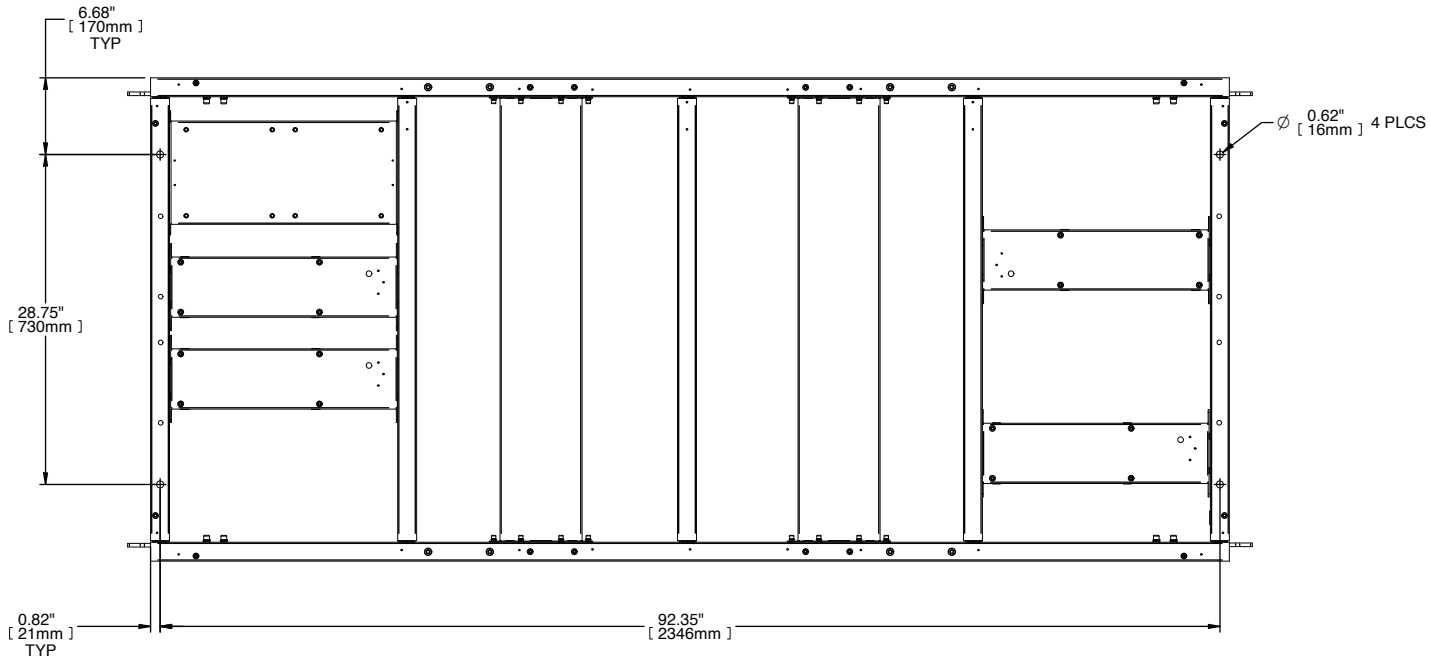




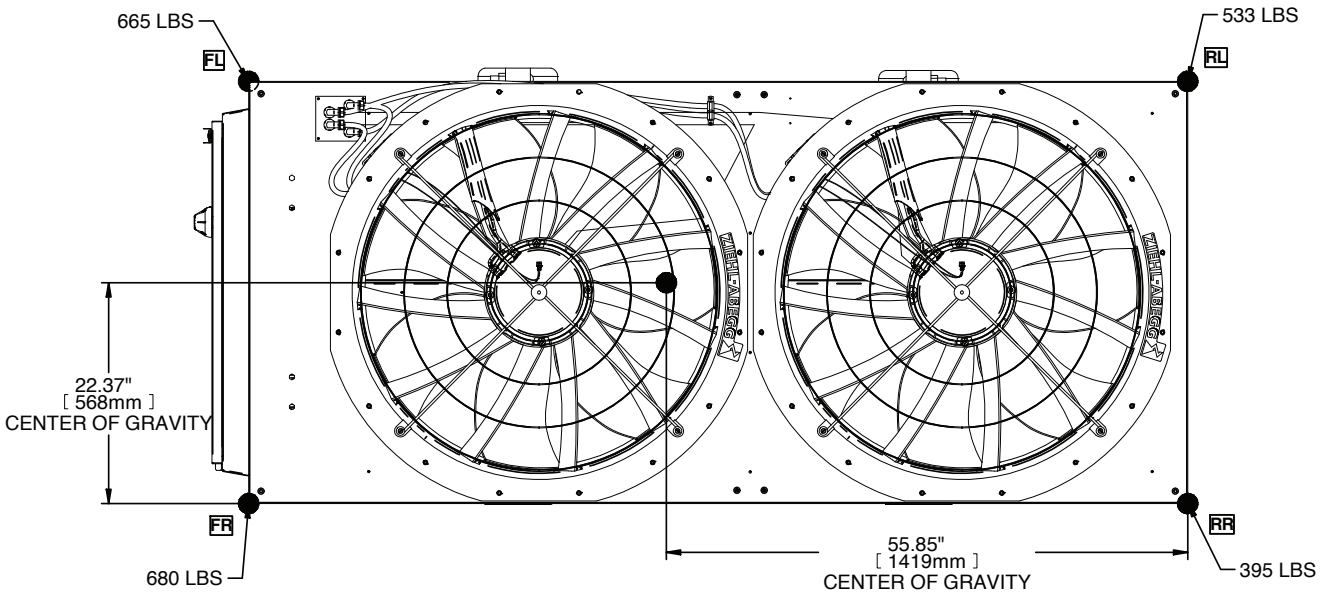
DETAIL A

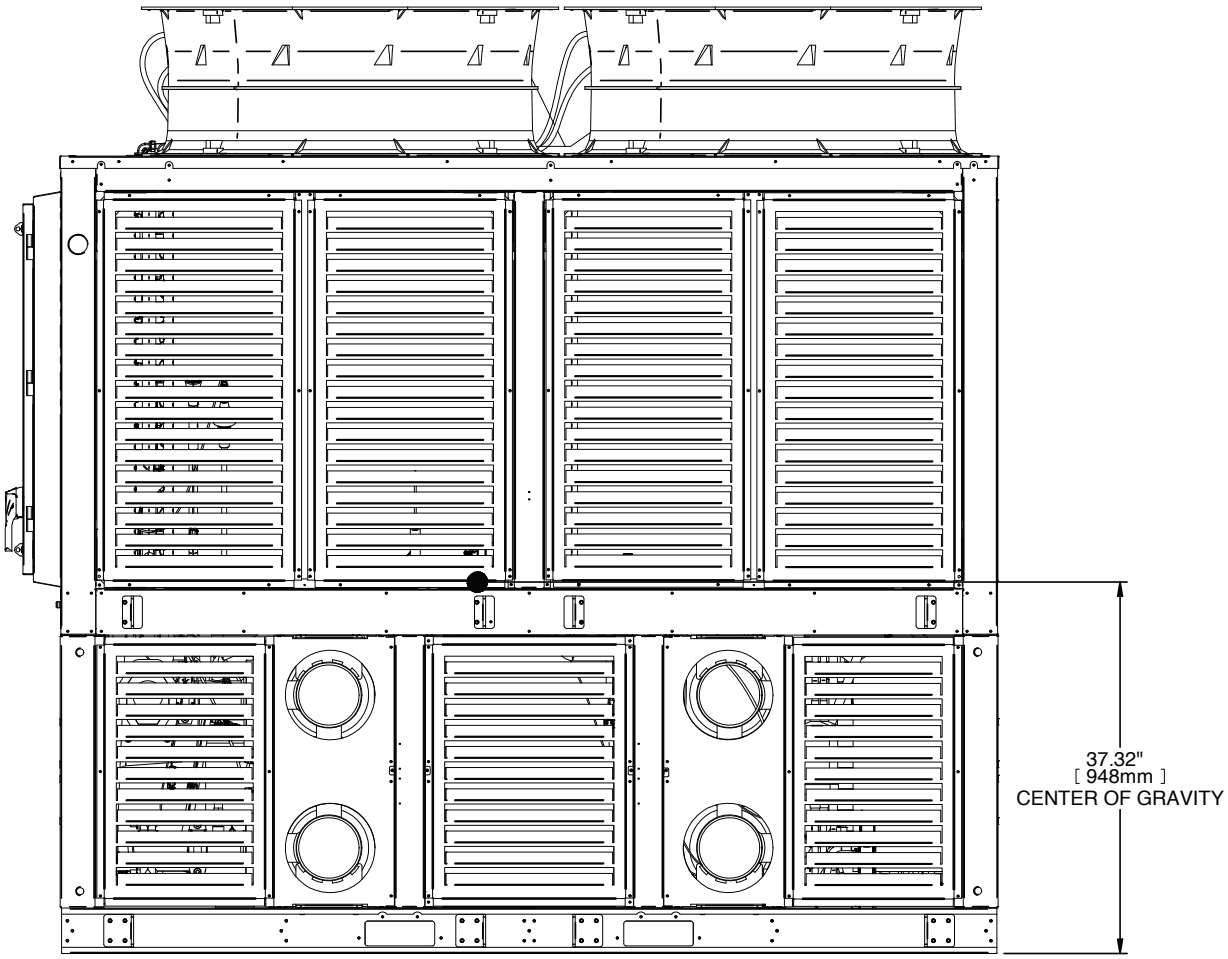
Note:
Embed 2” x 2” x 0.19” angle iron in concrete house keeping pad to ensure pipe alignment is consistent.

Dimensional Data: Frame Rail Bolt Hole Locations



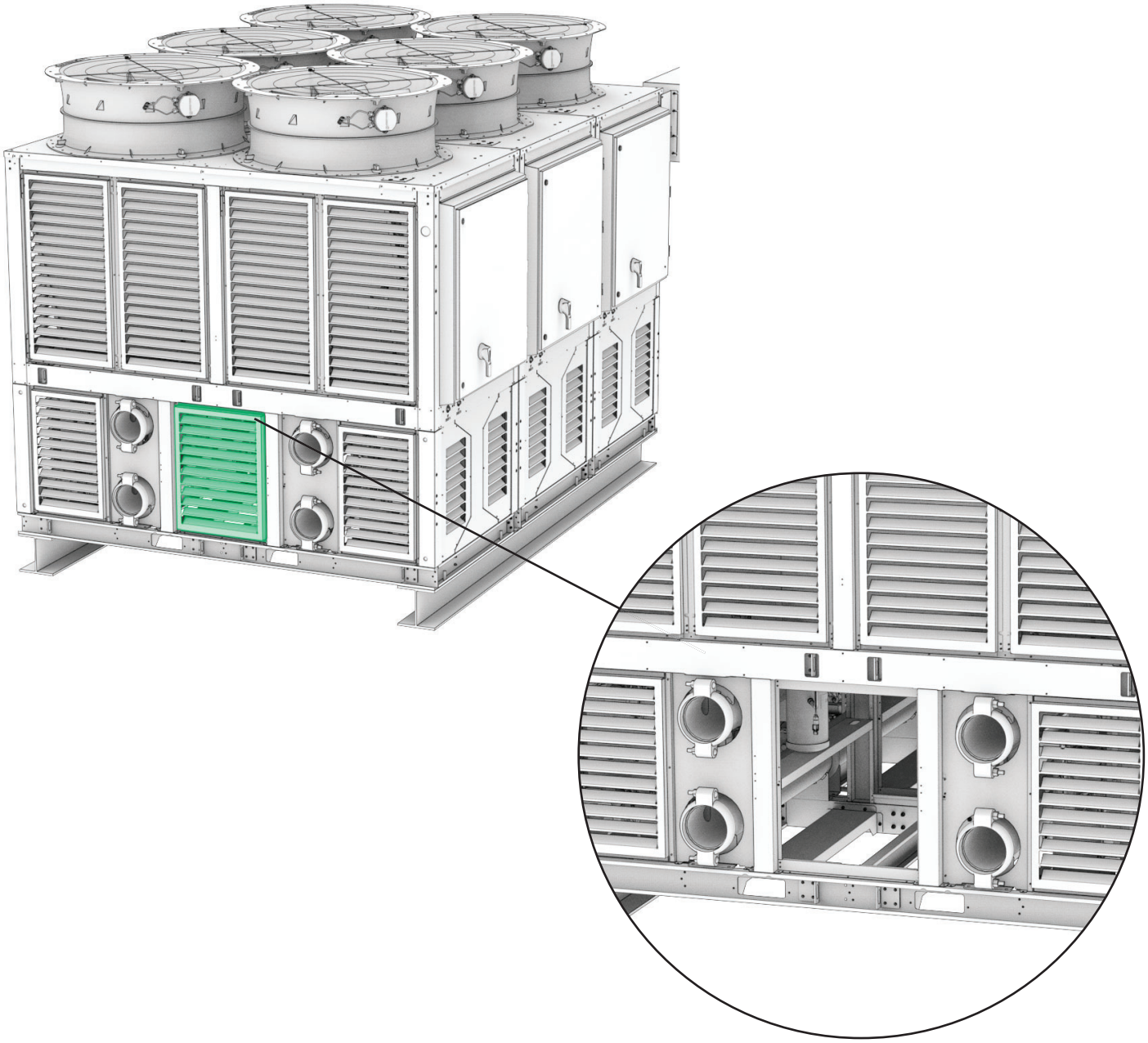
Dimensional Data: Center of Gravity (4-Pipe)





Scuttle Clearance: Multiple Units Victualic Connections

Interior victaulic connections can be accessed through the center lower side panel (shown below). Once this panel is removed, a 21” opening allows a technician to enter a bank of units and establish secure victaulic connections throughout multiple units.



HydroLink2 Aurora Controls - Overview

Overview

The HydroLink2 Aurora Control is the ultimate chiller control system that accurately controls fluid temperatures while providing technical information about the system in a simple, readable format thru a large 10" touchscreen tablet. The backbone of the system is the field proven Aurora compressor management control system. The Aurora Controls communicate using the ModBus protocols and quickly pass information from sensors up to the HydroLink2 controller. The HydroLink2 controller in turn is a powerful controller that does compressor staging and then communicates over the network via BACnet or thru the Niagara platform.

This system is the best combination of a proven, robust compressor management control coupled with a flexible yet powerful system level controller. High end, graphic browser images are hosted on the HydroLink2 controller and displayed on the factory mounted touchscreen tablet. Each chiller is equipped with a small Wi-Fi router or a hardwire Ethernet connection that offers additional connectivity options to display chiller information without tapping in the BAS network.

There are several factory installed components so that each chiller has built-in refrigeration, energy, and performance monitoring capabilities.

HydroLink2 Control

The HydroLink2 Control is a Niagara control that functions as a master control communicating to ABC "A" for compressor A and to ABC "B" for compressor B via Modbus protocol. The HydroLink2 controls all higher functions as a master control managing lead/lag, user interface and other functions of each ABC/AAB combination by communicating via Modbus. The HydroLink2 also manages all BAS and 10" color touchscreen tablet communications.

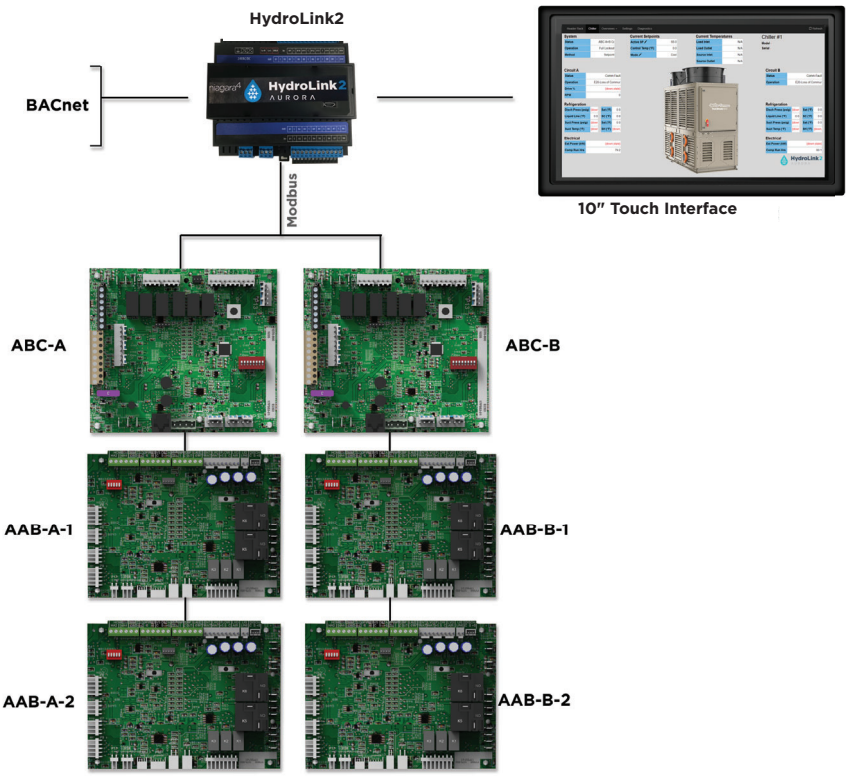
Aurora 'Base' Control (ABC)

The Base Control functions as a microprocessor compressor monitoring device and handles all compressor timings, and control. One board is dedicated to each compressor and is labeled for circuit A and B.

Aurora Air Cooled Board (AAB)

The AAB functions as an I/O expander for the ABC Most of the Circuit A I/O is for the compressor circuit however some additional sensors also function with the Source heat exchanger. The B Circuit AAB in turn handles circuit B compressor plus some I/O dedicated to the Load heat exchanger.

NOTE: Refer to the Aurora Base Control Application and Troubleshooting Guide and the Instruction Guide: Aurora Interface and Diagnostics (AID) Tool for additional information.



Controls - Overview

Before applying power ensure the DIP switch settings on the Aurora controls are correct. See table below for DIP switch factory settings.

ABC-A		Factory Setting
DIP1	Freeze Protection- ON=30F OFF=Setpoint Value	ON
DIP2	Unused	ON
DIP3	Unused	ON
DIP4	ACC Relay- ON=Track Fan Output OFF=Track Compressor Output	ON
DIP5	Refrigerant ON=R410A OFF=R454B	See Nameplate
DIP6	Unused	ON
DIP7	LO alarm output- ON=Constant Output when active OFF=Pulsed Output when active	ON
DIP8	Modbus Address ON=ABC A OFF=ABC B	ON

ABC-B		Factory Setting
DIP1	Freeze Protection- ON=30F OFF=Setpoint Value	ON
DIP2	Unused	ON
DIP3	Unused	ON
DIP4	ACC Relay- ON=Track Fan Output OFF=Track Compressor Output	ON
DIP5	Refrigerant ON=R410A OFF=R454B	See Nameplate
DIP6	Unused	ON
DIP7	LO alarm output- ON=Constant Output when active OFF=Pulsed Output when active	ON
DIP8	Modbus Address ON=ABC A OFF=ABC B	OFF

AAB-A-1		Factory Setting
DIP1	Modbus address ON=AAB-1 OFF=AAB-2	ON
DIP2	Unused	ON
DIP3	Unused	ON
DIP4	Unused	ON
DIP5	Unused	ON

AAB-B-1		Factory Setting
DIP1	Modbus address ON=AAB-1 OFF=AAB-2	ON
DIP2	Unused	ON
DIP3	Unused	ON
DIP4	Unused	ON
DIP5	Unused	ON

AAB-A-2		Factory Setting
DIP1	Modbus address ON=AAB-1 OFF=AAB-2	OFF
DIP2	Unused	ON
DIP3	Unused	ON
DIP4	Unused	ON
DIP5	Unused	ON

AAB-B-2		Factory Setting
DIP1	Modbus address ON=AAB-1 OFF=AAB-2	OFF
DIP2	Unused	ON
DIP3	Unused	ON
DIP4	Unused	ON
DIP5	Unused	ON

Controls - Overview

The Hydrolink and Aurora controls validates specific criteria is met before allowing the unit to start. This prevents the unit from running when required system conditions are not met.

When the unit is in stand-by mode the following conditions are true.

- No active heating, cooling, or SHR demand
- All solenoid valves are closed
- The reversing valve will be in the position of the last ran mode.

Before the unit starts in any mode, the following criteria must be met.

- Power must be on
- Communication must be active between Aurora and Hydrolink controllers
- Isolation valves must be open
    - Isolation valves controlled by Hydrolink
- Water flow switches must be closed
    - 5 second detection time open/closed
    - Cold Flow Switch for Cooling and SHR (DH) input (24VAC)
    - Hot flow switch for Heating and SHR (W) input (24VAC)
- Suction pressure limit must be met

Before the unit starts in Cooling, the following criteria must be met.

- There must be no active faults
- Suction pressure limit must be met
- Fans must be running
- Cold water flow sensor must be closed
- Anti-Short Cycle delay must be satisfied

Heating Start-up Conditions

- No Active Faults
- Suction pressure above Low Refrigerant Pressure Limit
- Fans must be running
- Hot water flow sensor must be closed
- Anti-short cycle delay must be satisfied

SHR Start-Up Conditions

- No Active Faults
- Suction pressure above Low Refrigerant Pressure Limit
- Hot water flow sensor must be closed
- Cold water flow sensor must be closed
- Anti-Short Cycle delay must be satisfied

Once the previous conditions are met the unit can start. Each mode has a specific start sequence that can be followed below.

- Cooling Start Procedure
    - Reversing valve is set to cooling position (0 VAC)
    - Cooling HX Solenoid valve opened (24 VAC)
    - Fans start
        - Fans stay at initial start position until start-up procedure is complete
    - Compressor ramps to 50% speed and holds there for 3 minutes
        - EEV stays at start position
        - Fans stay at start position
    - Conditional
        - DSH (Discharge Superheat) must reach a minimum temperature of 18F during the 3-minute start-up period or unit will show fault.

Controls - Overview

- After the 3-minute start-up and conditional is met, depending on load requirements, the compressor will ramp up or down to desired speed.
  - The fans will ramp to desired speed based on ambient temperature
    - Fan speed is based on a calculated offset between ambient temperature and SDT (Saturated Discharge Temperature)
  - The EEV will now control to DSH setpoint.
    - DHS setpoint is based on a compression ratio algorithm and varies based on system state points.

Heating Start-Up Procedure

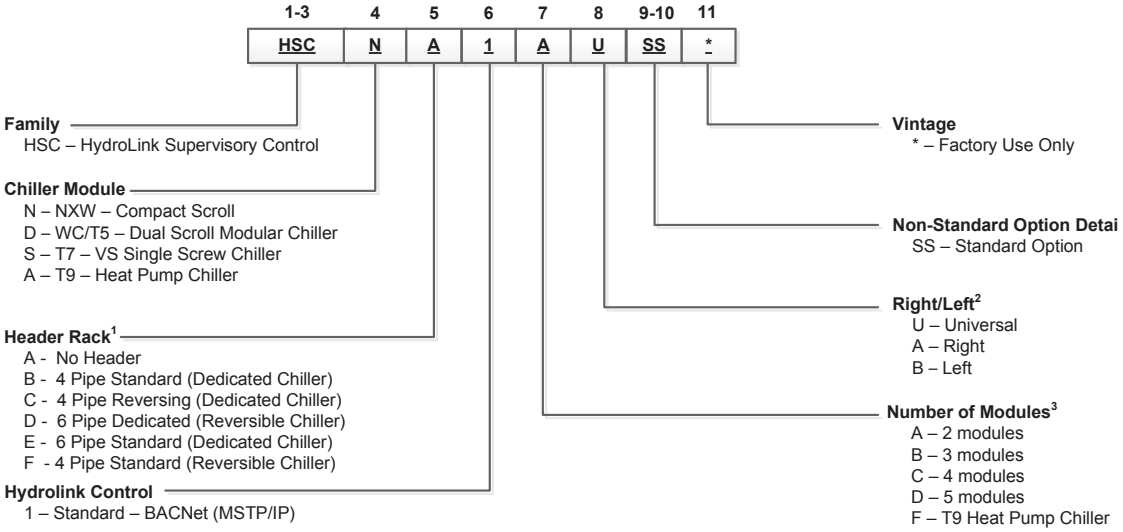
- Reversing valve moves to heating position (24 VAC)
- Heating HX Solenoid Valve opened (24 VAC)
- Fans start
  - Fans stay at initial start position until start-up procedure is complete
- Compressor ramps to 50% speed and holds there for 3 minutes
  - EEV stays at start position
  - Fans stay at start position
- Conditional
  - DSH (Discharge Superheat) must reach a minimum temperature of 18F during the 3-minute start-up period
- Compressor ramps to desired speed (After 3-minute start-up and conditional is met)
  - The fans will ramp to desired speed based on SST (Saturated Suction Temperature)
    - Fan speed is based on a calculated offset between ambient temperature and SDT (Saturated Discharge Temperature)
  - The EEV will now control to DSH setpoint.
    - DHS setpoint is based on a compression ratio algorithm and varies based on system state points.

SHR Start-Up Procedure

- Reversing valve moves to heating position (24 VAC)
- Cooling HX Solenoid Valve opened (24 VAC)
- Compressor ramps to 50% speed and holds there for 3 minutes
  - EEV stays at start position
- Conditional
  - DSH (Discharge Superheat) must reach a minimum temperature of 18F during the 3-minute start-up period
- Compressor ramps to desired speed (After 3-minute start-up and conditional is met)
  - The fans will ramp to desired speed based on SST (Saturated Suction Temperature)
    - Fan speed is based on a calculated offset between ambient temperature and SDT (Saturated Discharge Temperature)
  - The EEV will now control to DSH setpoint.
    - DHS setpoint is based on a compression ratio algorithm and varies based on system state points.

Accessory: Supervisory Control

HydroLInk Supervisory Control Nomenclature



Accessory: Single Point Power

Single Point Power Panel Nomenclature

SPLC3030L410*

SP	L	C	3	030	L	4	1	0	*

Model
SP – Single Point Disconnect Panel

Fault Current Protection[1]
L – Standard Fault Current - 5kA SCCR

Chiller Model[3]
C – T3 Series Primary VS
D – T3 Series Secondary VS
E – T3 Series Primary Fixed
F – T3 Series Secondary Fixed
H – T9 Series Primary VS
J – T9 Series Secondary VS

System Voltage
3 – 208-230/60/3
4 – 460/60/3

Unit Size
030 – 30Ton
050 – 50Ton

Configuration[2]
L – Left Configuration
R – Right Configuration
U – Universal

Vintage
* – Factory Use Only

Future Use
0 – Future Use

Number of Units Fixed[4]
0 – None
1 – Single Fixed Speed
2 – Two Fixed Speed
3 – Three Fixed Speed
4 – Four Fixed Speed
5 – Five Fixed Speed
6 – Six Fixed Speed
7 – Seven Fixed Speed
8 – Eight Fixed Speed

Number of Units VS[4]
0 – None
1 – One Variable Speed
2 – Two Variable Speed
3 – Three Variable Speed
4 – Four Variable Speed
5 – Five Variable Speed
6 – Six Variable Speed
7 – Seven Variable Speed
8 – Eight Variable Speed

Notes:

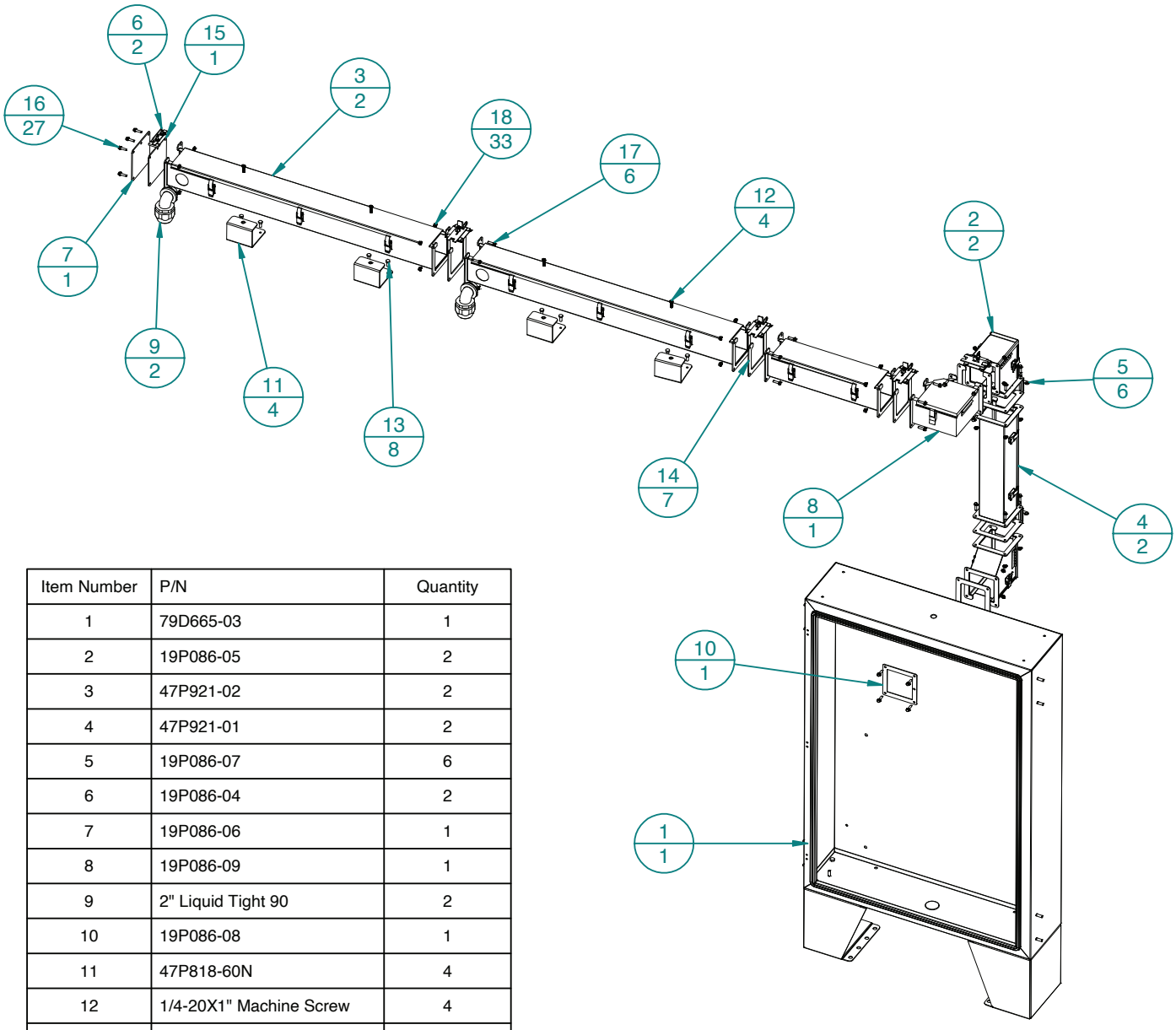
1. Standard Fault Current 5kA SCCR option includes no feeder protection and individual breakers for each chiller.

2. For T9 products, Left or Right Configuration designates the location of the single point disconnect panel with respect to the bank of units. For all other products, Universal shall apply.

3. Single Point panel is selected in conjunction with “Secondary Unit” only when a second panel is required for the bank of units.

4. For applications requiring more than 8 modules, and/or for applications requiring banks of mixed modules (fixed speed and variable speed), a Special Order must be requested.

Accessory: Single Point Power cont.



Item Number	P/N	Quantity
1	79D665-03	1
2	19P086-05	2
3	47P921-02	2
4	47P921-01	2
5	19P086-07	6
6	19P086-04	2
7	19P086-06	1
8	19P086-09	1
9	2" Liquid Tight 90	2
10	19P086-08	1
11	47P818-60N	4
12	1/4-20X1" Machine Screw	4
13	91P015A82	8
14	GASKET	7
15	GASKET	1
16	19P086-04	27
17	19P086-04	6
18	19P086-04	33

Electrical Data (All Variants)

Electrical Table

Model	Rated Voltage	Voltage Min/Max	Compressor*		FAN FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
			MCC	MRC				
030 R454B	208-230/60/3	187/253	87.7	60.8	7.2	136.0	151.2	175
	460/60/3	414/506	46.1	32.0	4.2	72.4	80.4	110

11/15/24

HACR circuit breaker in USA only

* - MCC,MRC & LRA rating per compressor / fan.FLA,MCA and Max Fuse sized for both compressors & fans.

Water Quality

1.0. Minimum Fluid Volume

A. Water-to-water heat pumps require a minimum amount of source and load side fluid volume to ensure accurate and stable temperatures during system operation. For normal air conditioning type applications, it is recommended to use at least 7 gallons/ton.

B. Applications that require more precise temperature control or low loading will occur the minimum fluid volume shall be no less than 10 gallons/ton. Installation of a buffer tank that will properly mix the fluid is recommended.

1.1. Water-to-Water Heat Pump Sizing

A. Heat pumps should be adequately sized for optimal system efficiency and run time. Oversizing by more than 15% can diminish performance resulting in higher power consumption, short cycling of compressors, and unstable conditioning temperatures.

B. In applications where the minimum load is significantly less than the design condition, it is better to install 2 smaller heat pumps for load matching rather than a single large heat pump.

1.2. Heat Pump Piping

A. Multiple heat pumps can be installed in series or parallel configurations. The preferred system design is to pipe the equipment in parallel due to its simplicity and flexibility. In parallel systems, the heat pump equipment can vary in size as long as flow rate and system volume are accounted for.

B. Piping equipment in series is not desired; however, it can be done if proper guidelines are followed. Always observe proper temperature and flow rate requirements for each unit. Sometimes this method is desired to achieve larger temperature differences.

1.3. Strainers

A. All brazed-plate heat exchangers shall have a strainer within 8 ft of the water/brine inlet. It is highly recommended to use a minimum of 60 mesh in order to provide maximum filtration. In any case, the strainers should never have a mesh size less than 20.

B. Failure to install proper stainers and perform regular service can result in serious damage to the unit, and cause degraded performance, reduced operating life and failed compressors. Improper installation of the unit (which includes not having proper strainers to protect the heat exchangers) can also result in voiding the warranty.

C. Strainers should be selected on the basis of acceptable pressure drop, and not on pipe diameter. The strainers selected should have a pressure drop at the nominal flow rate of the units; low enough to be within the pumping capacity of the pump being used.

1.4. Flow Sensing Devices

A. A flow switch or equivalent must be installed on the evaporator for each unit to be installed. If the unit is to operate as both modes (heating/cooling), a flow switch is needed on both heat exchangers.

B. A differential pressure switch can be used in place of a flow switch. The differential switch must be capable of pressure range as indicated in the pressure drop tables.

1.5. Water Quality

A. **General:** Reversible chiller systems may be successfully applied in a wide range of commercial and industrial applications. It is the responsibility of the system designer and installing contractor to ensure that acceptable water quality is present and that all applicable codes have been met in these installations.

B. **Water Treatment:** Do not use untreated or improperly treated water. Equipment damage may occur. The use of improperly treated or untreated water in this equipment may result in scaling, erosion, corrosion, algae or slime. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is required. The product warranty specifically excludes liability for corrosion, erosion or deterioration of equipment.

The heat exchangers in the units are 316 stainless steel plates with copper brazing. The water piping in the heat exchanger is steel. There may be other materials in the building's piping system that the designer may need to take into consideration when deciding the parameters of the water quality.

If an antifreeze or water treatment solution is to be used, the designer should confirm it does not have a detrimental effect on the materials in the system.

C. **Contaminated Water:** In applications where the water quality cannot be held to prescribed limits, the use of a secondary or intermediate heat exchanger is recommended to separate the unit from the contaminated water.

The following table outlines the water quality guidelines for unit heat exchangers. If these conditions are exceeded, a secondary heat exchanger is required. Failure to supply a secondary heat exchanger where needed will result in a warranty exclusion for primary heat exchanger corrosion or failure.

WARNING: Must have intermediate heat exchanger when used in pool applications.

Water Quality cont.

1.6. Insulation

A. Chillers are built with factory installed insulation on any surface that may be subject to temperatures below the dew point.

1.7. Brine Applications

A. Applications where the leaving fluid temperature goes below 40°F a suitable brine solution must be used. Failure to do so can cause immediate damage to the system. The brine must be approved for use with heat exchangers. Automotive antifreeze solutions are not suitable for use in brazed plate heat exchangers.

B. The freeze detection must be adjusted appropriately for brine applications. The brine solution concentration should be at least 15°F below the lowest leaving fluid temperature.

1.8. Heat Exchangers

The Condenser and Evaporator heat exchangers utilize a single wall design. Do not install use for potable water applications without intermediate heat exchanger.

Water Quality Guidelines

Material		Copper	90/10 Cupronickel	316 Stainless Steel
pH	**Acidity/Alkalinity**	7 - 9	7 - 9	7 - 9
Scaling	Calcium and Magnesium Carbonate	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm
Corrosion	Hydrogen Sulfide	Less than 0.5 ppm (rotten egg smell appears at 0.5 ppm)	10 - 50 ppm	Less than 1 ppm
	Sulfates	Less than 125 ppm	Less than 125 ppm	Less than 200 ppm
	Chlorine	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Chlorides	Less than 20 ppm	Less than 125 ppm	Less than 300 ppm
	Carbon Dioxide	Less than 50 ppm	10 - 50 ppm	10 - 50 ppm
	Ammonia	Less than 2 ppm	Less than 2 ppm	Less than 20 ppm
	Ammonia Chloride	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Nitrate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Hydroxide	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Sulfate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Total Dissolved Solids (TDS)	Less than 1000 ppm	1000 - 1500 ppm	1000 - 1500 ppm
	LSI Index	+0.5 to -0.5	+0.5 to -0.5	+0.5 to -0.5
Iron Fouling (Biological Growth)	Iron, FE^{2}+ (Ferrous) Bacterial Iron Potential	< 0.2 ppm	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	Less than 1 ppm, above this level deposition will occur	Less than 1 ppm, above this level deposition will occur	Less than 1 ppm, above this level deposition will occur
Erosion	Suspended Solids	Less than 10 ppm and filtered for max. of 600 micron size	Less than 10 ppm and filtered for max. of 600 micron size	Less than 10 ppm and filtered for max. of 600 micron size
	Threshold Velocity (Fresh Water)	< 6 ft/sec	< 6 ft/sec	< 6 ft/sec

NOTES: Grains = ppm divided by 17
mg/L is equivalent to ppm

2/22/12

Antifreeze Corrections

Catalog performance can be corrected for antifreeze use. Please use the following table and note the example given.

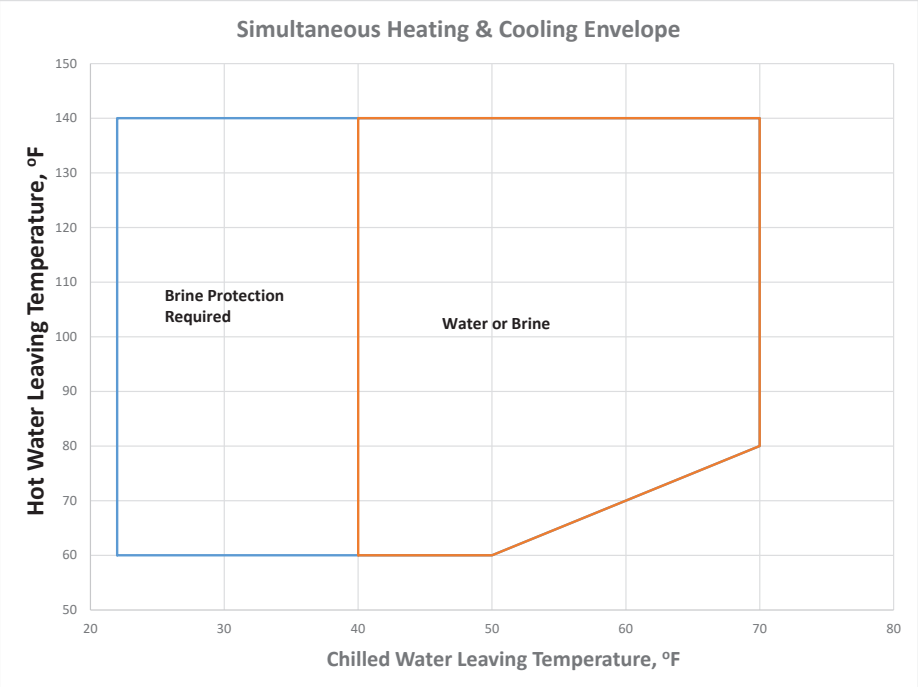
Antifreeze Type	Antifreeze % by wt	Heating		Cooling		Pressure Drop
		Load	Source	Load	Source	
EWT - °F [°C]		**90 [32.2]**	**30 [-1.1]**	**50 [10]**	**90 [32.2]**	**30 [-1.1]**
Water	0	1.000	1.000	1.000	1.000	1.000
Ethylene Glycol	10	0.991	0.973	0.975	0.991	1.075
	20	0.979	0.943	0.946	0.979	1.163
	30	0.965	0.917	0.920	0.965	1.225
	40	0.955	0.890	0.895	0.955	1.324
	50	0.943	0.865	0.870	0.943	1.419
Propylene Glycol	10	0.981	0.958	0.959	0.981	1.130
	20	0.969	0.913	0.919	0.969	1.270
	30	0.950	0.854	0.866	0.950	1.433
	40	0.937	0.813	0.829	0.937	1.614
	50	0.922	0.770	0.789	0.922	1.816
Ethanol	10	0.991	0.927	0.941	0.991	1.242
	20	0.972	0.887	0.901	0.972	1.343
	30	0.947	0.856	0.866	0.947	1.383
	40	0.930	0.815	0.826	0.930	1.523
	50	0.911	0.779	0.791	0.911	1.639
Methanol	10	0.986	0.957	0.961	0.986	1.127
	20	0.970	0.924	0.928	0.970	1.197
	30	0.951	0.895	0.897	0.951	1.235
	40	0.936	0.863	0.865	0.936	1.323
	50	0.920	0.833	0.835	0.920	1.399

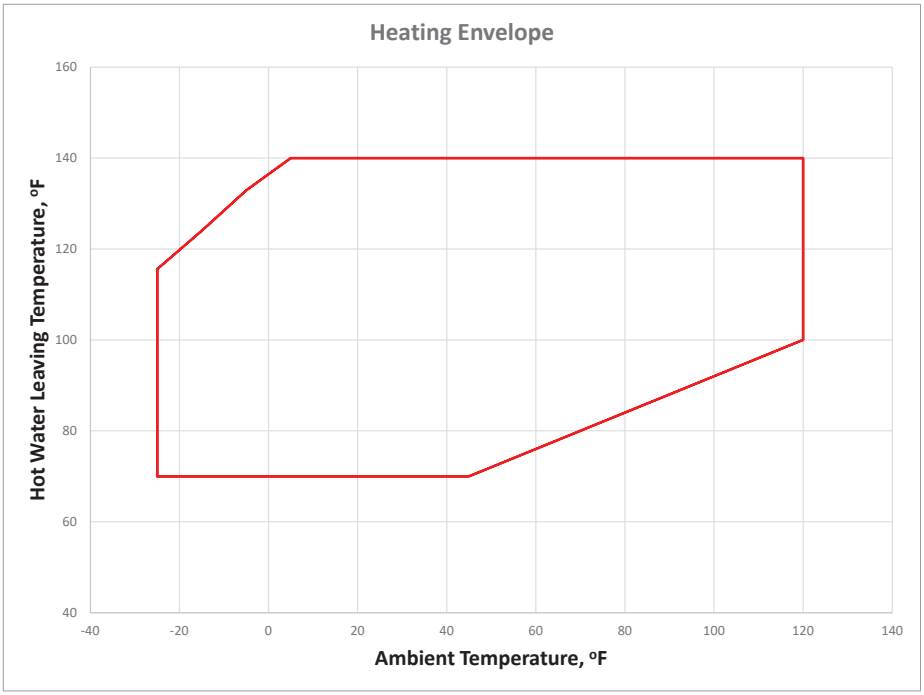
WARNING: Gray area represents antifreeze concentrations greater than 35% by weight and should be avoided due to the extreme performance penalty they represent.

Operating Limits

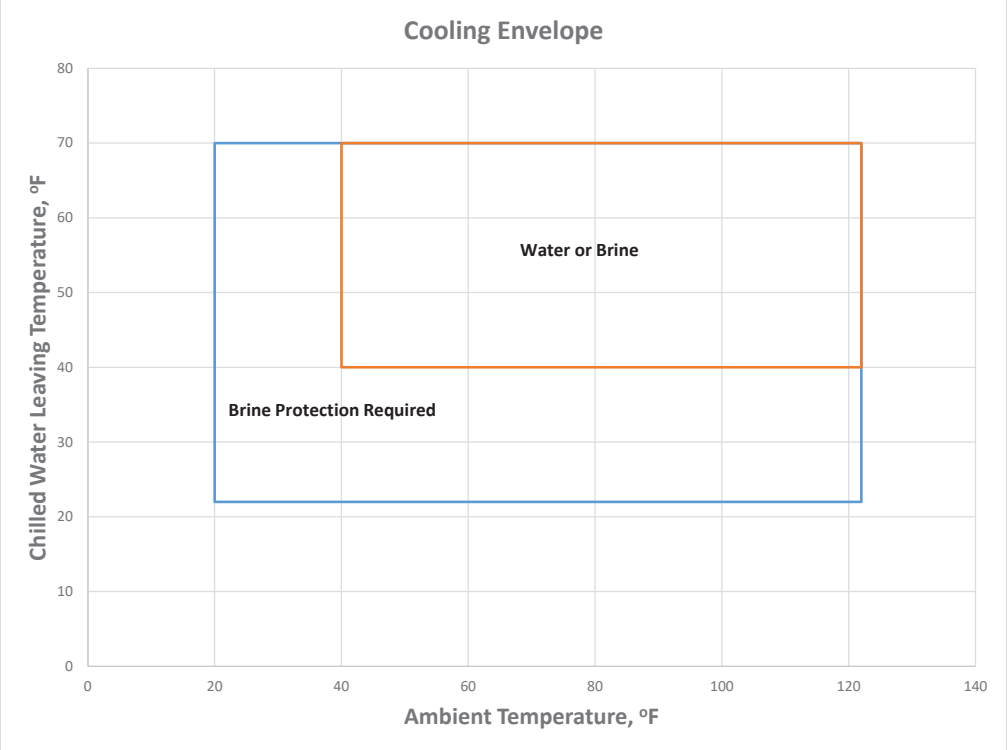
The operational limits of the chiller are presented based on leaving water temperature for the condenser and evaporator (See Leaving Water Temperature Operational Maps).

Note that certain portions of the map will require operation under head pressure control and maximum evaporator pressure control. For more details on Head Pressure Control and Maximum Evaporator control see HPC and MOP Entering Water Temperature Limits Operational Maps.





Operating Limits cont.



Thermistor and Compressor Resistance

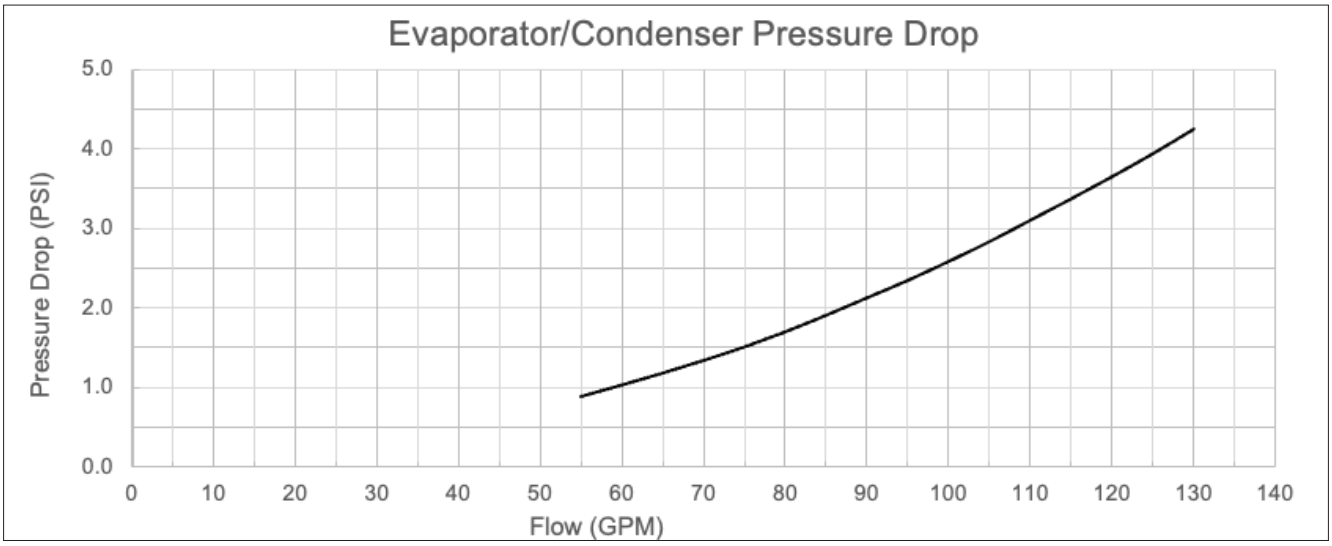
Compressor Resistance Chart

	R410A	R454B	
Model	**460**	**208-230**	**460**
030	0.16	0.070	0.119

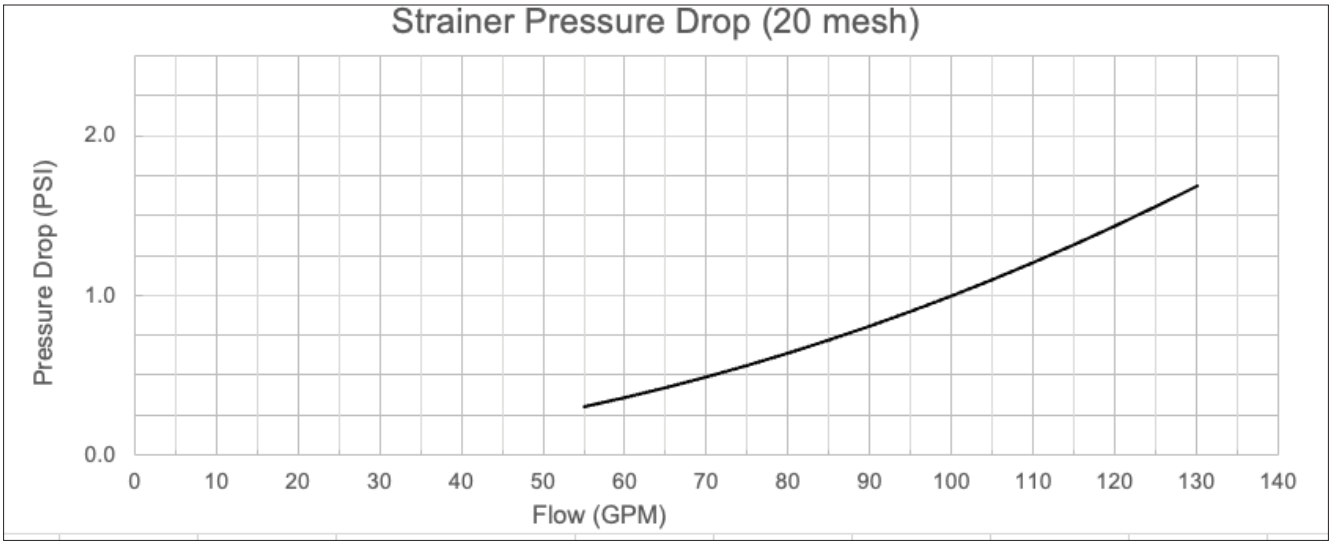
Resistance at 20°C 9/12/23

Recommended Pressure Drop and Water Velocity

Optional unit level 20 mesh strainer is included with unit.



Optional unit level strainer is available on brazed plate heat exchanger water inlet. Standard strainer is 20 mesh. If optional strainers are not installed, use Evaporator/Condenser Pressure Drop tables only.



Diameter	gpm	ft/100 ft	ft/sec
6”	800	4.03	8.89
	925	5.33	10.27
	1300	10.27	14.44

Velocity should never exceed 15 ft/s.
Noise, erosion, and water hammer will be more significant at higher velocities

Unit Startup

Verify the following:

- High voltage is correct and matches nameplate
- Fuses, breakers and wire size are correct
- Low voltage wiring and controls are complete
- Piping is complete and the water system has been cleaned and flushed and no water leaks are present
- Air is purged from piping system
- Isolation valves are open and water control valves are wired
- Pumping system is fully operable
- Service/access panels are in place
- Transformer has been switched to lower voltage tap if needed (208/230 volt units only)
- Unit controls are in “off” position
- Flow switches are installed and ready
- Ensure that a chiller startup sheet is complete for each chiller

WARNING: Verify ALL water controls are open and allow water flow PRIOR to engaging the compressor. Failure to do so can result in freezing the heat exchanger or water lines causing permanent damage to the unit.

Reference Calculations

Heating Calculations:	Cooling Calculations:
$LWT = EWT - \frac{HE}{GPM \times 500^*}$	$LWT = EWT + \frac{HR}{GPM \times 500^*}$

NOTE: * When using water.

Legend

Abbreviations and Definitions

HWR = Hot Water Return
HWS = Hot Water Supply
CWR = Cold Water Return
CWS = Cold Water Supply
HVR = Heat Recovery Return
HVS = Heat Recovery Supply
HVP = High Voltage Panel
LVP = Low Voltage Panel
TC = Total Cooling Capacity in MBTUH
MBTUH = Thousands of British Thermal Units per hour
LWT = Leaving Water Temperature
EWT = Entering Water Temperature
EER = Energy Efficiency Ratio (TC/kW)
COP = Coefficient of Performance (HC/kW x 3.413)
PSI = Pressure drop in pounds per square inch
HC = Heating Capacity in MBTUH
HE = Heat of Extraction in MBTUH
kW = kilowatt
ft hd = pressure drop in feet of head
HR = Heat of Rejection

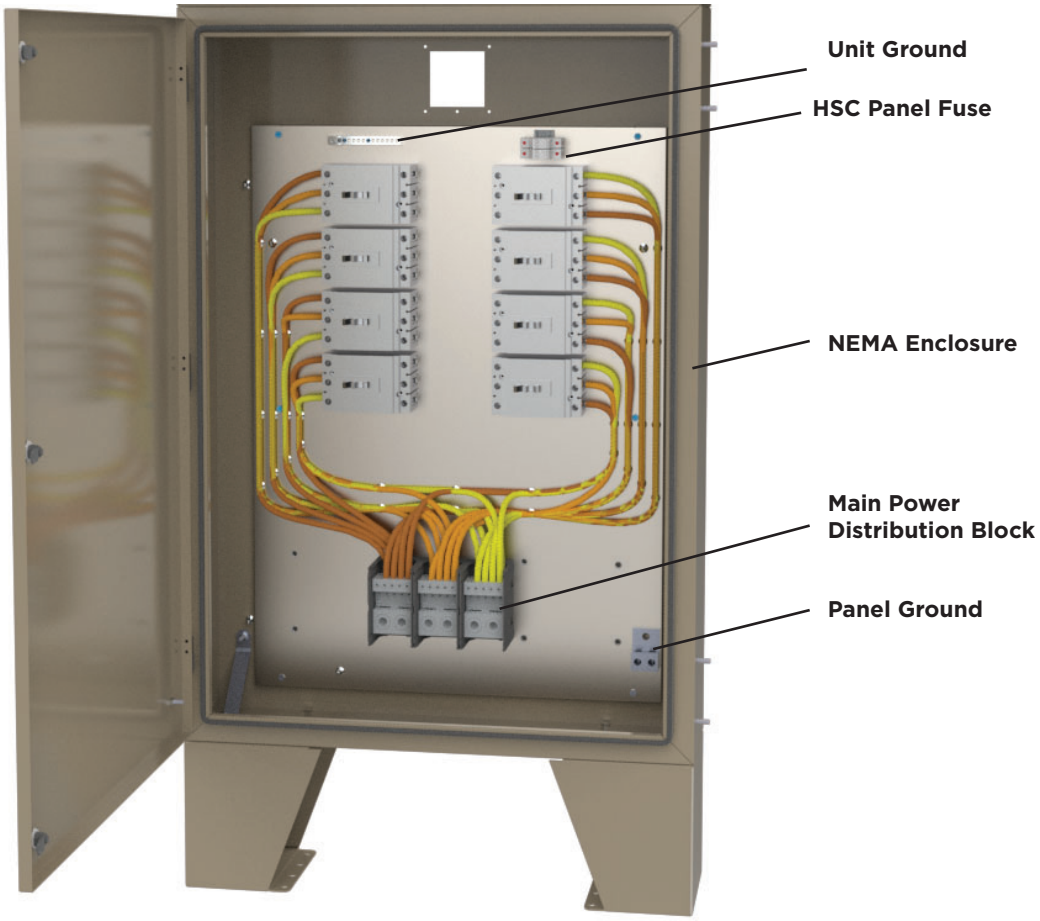
WaterFurnace Commercial Solutions	AIR COOLED CHILLER START-UP WATER TO AIR START-UP CHECKLIST

AIR SIDE CHECKS	CHECK APPROPRIATE COLUMN	
	YES	NO
AIR COIL CLEAN AND FREE OF DEBRIS?		
FAN EXHAUST FREE AND CLEAR OF DEBRIS?		
AIR SIDE PANELS INSTALLED ON CORRECT UNITS?		
VERIFY FAN BLADES INTACT AND NOT DAMAGED?		
VERIFY FAN OPERATION ON UNIT?		
PROPER VENTILATION IN AREA OF UNITS?		
DRAIN LINE CONNECTED AND RAN OUT OF UNIT?		
UNIT LEVEL AND INSTALLED SECURELY?		
ANY PONDING OR FLOODING OF WATER IN AREA?		
POTENTIAL ISSUE WITH SNOW PILING UP BY UNIT?		
ACCESS TO BACK OF UNIT FOR CLEANING OF AIR COIL?		
ACCESS TO ALL DOORS FOR CTRLS?		
ACCESS TO ALL UNIT COMPONENTS (NOT RESTRICTED)?		

AMBIENT AIR TEMPERATURE		F DEGREES
SUCTION PRESSURE		PSI
SUCTION LINE TEMPERATURE		F DEGREES
DISCHARGE LINE PRESSURE		PSI
DISCHARGE LINE TEMPERATURE		F DEGREES
DISCHARGE SUPERHEAT COMP A		F DEGREES
SUBCOOLING COMP A		F DEGREES
DISCHARGE SUPERHEAT COMP B		F DEGREES
SUBCOOLING COMP B		F DEGREES

ANY DAMAGE TO THE UNIT THAT NEEDS TO BE RECORDED AND IF SO PLEASE OBTAIN PICTURES OF THE DAMAGE TO ADD TO THE JOB FOLDER.

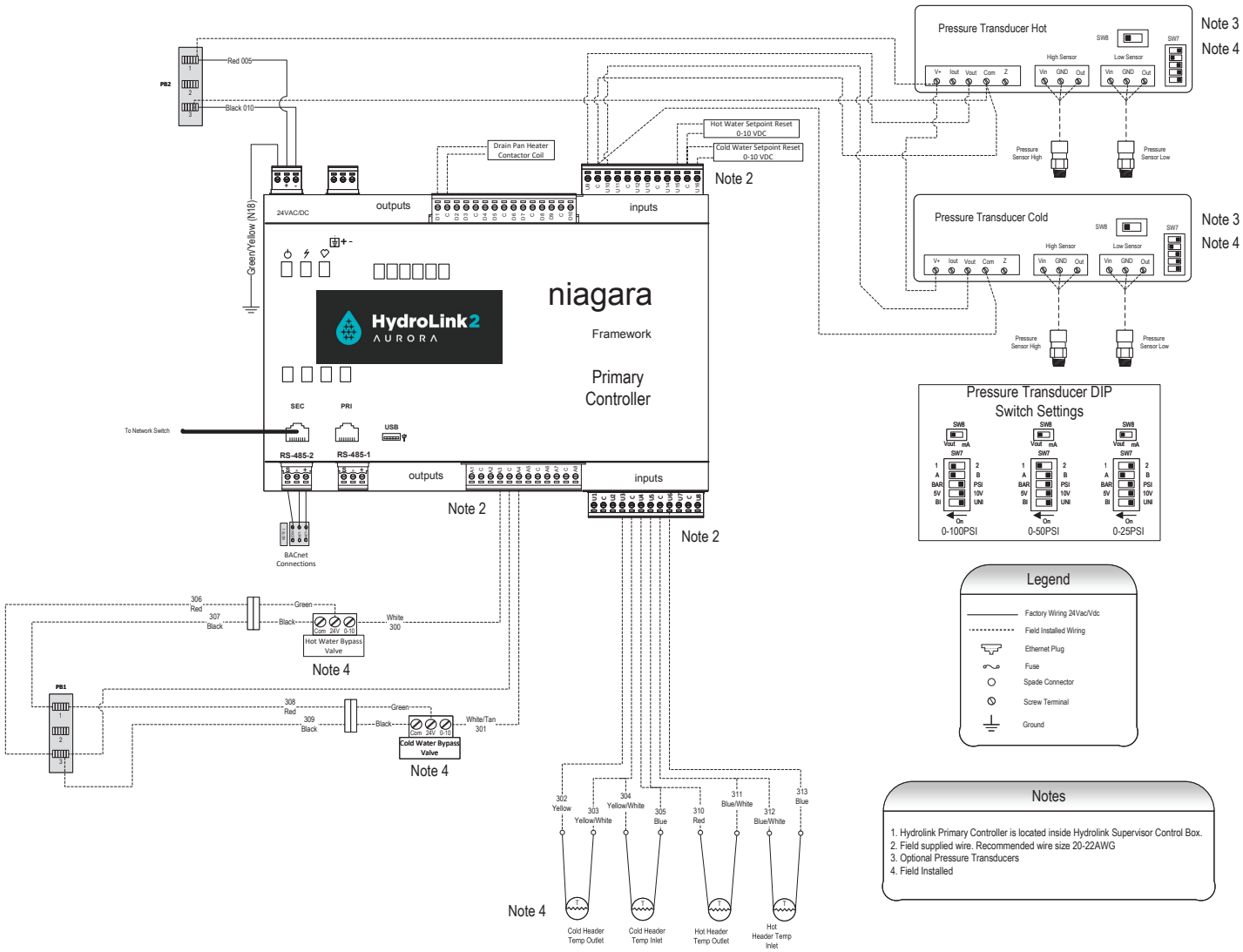
Chiller Plant with Single Point Disconnect Panel cont.



Chiller Plant Controls Wiring

Wiring Procedures

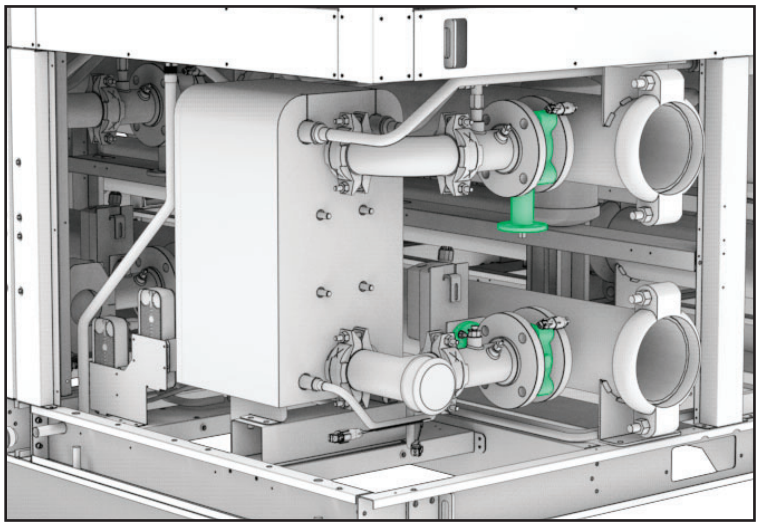
- The differential pressure sensor pressure range need to match the DIP switch settings in the sensor controller. The adjustment can be made through the Supervisory Control Box HMI.
- Use 20AWG wires size for wiring the temperature sensors and differential pressure sensors.



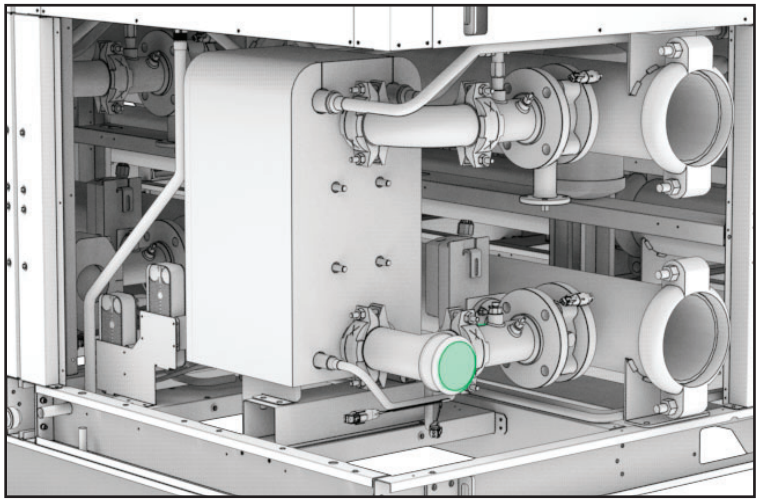
Unit Level Strainer Cleaning

1. Turn off relevant pumps

2. Close heat exchanger inlet and outlet valves to isolate heat exchanges.



3. Remove end cap to access screen.



4. Remove screen taking note of orientation when removed.

5. Clear debris from with appropriate

Brazed Plate Heat Exchanger Cleaning Procedure

Signs of Fouling such as Scaling

Temperature difference less than specified indicates signs of scaling because of the decrease in heat transfer across the plates. Increase in pressure drop indicates scaling since it restricts the channel passage, increasing velocity. It is important to note flow rate when determining the need for cleaning. Changes in flow rate affect temperature and pressure drop. Comparing two different flow rates during analysis could lead to leaving a fouled heat exchanger in service or the unnecessary cleaning of an otherwise clean heat exchanger.

Principle for Removing Scale

Chemical cleaning gives uniform removal of deposits and lowers overall operating cost. There are two steps in this process, Cleaning In Place (CIP) and Passivation. Passivation reduces the corrosion rate by coating the metal surface with a corrosion inhibiting product. Passivation is not always necessary and can, at times, be excluded.

Cleaning Fluids

Mineral acids

Mineral acids have a strong ability to dissolve scale. They include hydrochloric (HCl), sulfamic, nitric, phosphoric, and sulfuric acids. However, all mineral acids are extremely hazardous. Be aware that under certain conditions hydrochloric acid corrodes stainless steel and nitric acid corrodes copper, as do products containing ammonia. The use of corrosion inhibitors may be necessary.

Organic acids

Organic acids are weaker than mineral acids, in terms of scale-dissolving and the risk of corroding the heat exchanger material. These acids are also less hazardous, which makes them a good choice for cleaning. Organic acids include formic, acetic, and citric acids. These should be applied at concentrations between 1 and 5 percent per volume.

Bases

Bases have the ability to remove oil, grease and biological deposits from the heat exchanger surface. They can be used to supplement cleaning, or at the end of the cleaning procedure, to neutralize any acid remaining in the system. A solution of 1-2% sodium hydroxide (NaOH) or sodium bicarbonate (NaHCO3) before the final water rinse will ensure that all the acid has been neutralized.

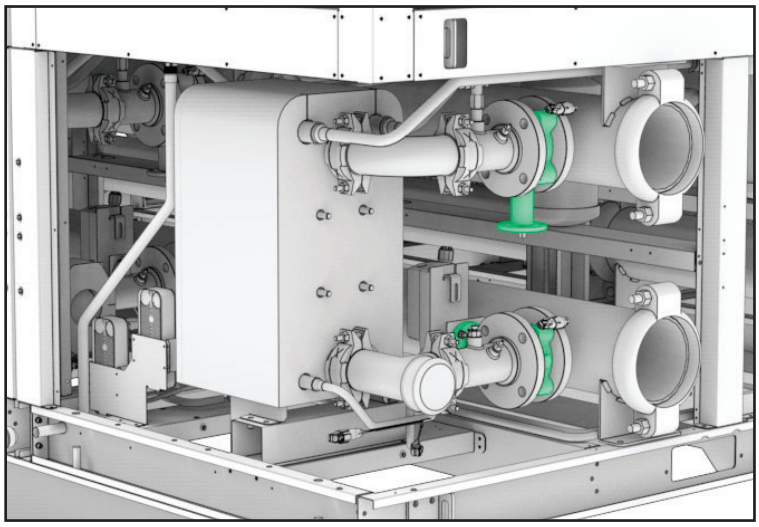
Brazed Plate Heat Exchanger Cleaning Procedure

Removing Scale

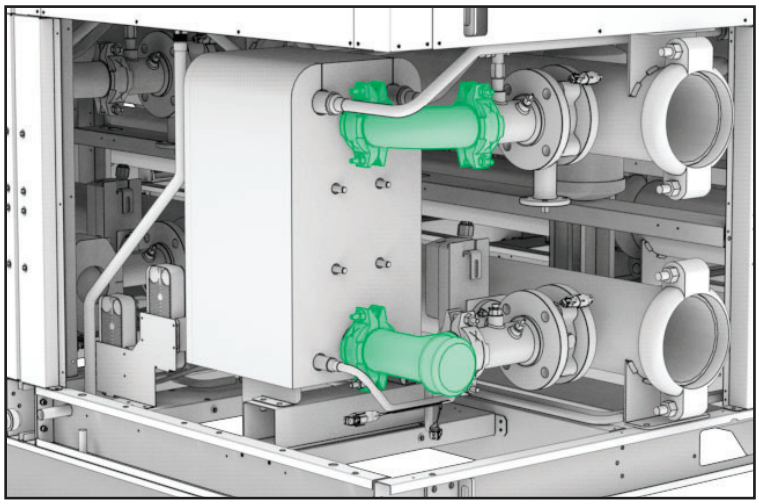
Sequence of operations

Using differential pressure (dP) sensors will enable you to monitor the cleaning process.

1. Turn off relevant pumps
2. Close heat exchanger inlet and outlet valves to isolate heat exchanges.



3. Empty water from the heat exchangers by removing the relevant water piping.



4. Connect a flush cart to the header (lower and upper front flange connections)
5. At 120˚F (50˚C) pump the cleaning solution through the heat exchanger, from the lower connection, for 30 minutes at 1.5 times the nominal flow if possible.
6. Reverse the flow every 30 minutes monitoring the pH and/or pressure drop.
7. Cleaning is finished when the pH has been constant for 30 minutes, and/or the pressure drop has returned to its initial value.
8. Drain the heat exchanger and flush it with water until the water is pH neutral.
9. The steel can be passivized after cleaning by circulating 2% phosphoric acid at 120˚F (50˚C) for 4-6 hours.
10. This will reduce the corrosion rate due to the precipitation of corrosion product on the metal surface and inhibit further corrosion from water or air.

Preventative Maintenance

Unit Heat Exchanger Maintenance

1. Keep all air out of the water or antifreeze solution.
2. Keep the system under pressure at all times. Closed loop systems must have positive static pressure or air vents may draw air into the system.

NOTES: If the installation is in an area with a known high mineral content in the water, it is best to establish with the owner a periodic maintenance schedule for checking the water-to-refrigerant heat exchanger on a regular basis. Should periodic cleaning be necessary, use standard cleaning procedures. Generally, the more water flowing through the unit, the less chance there is for scaling. Low GPM flow rates produce higher temperatures through the heat exchanger. To avoid excessive pressure drop and the possibility of metal erosion, do not exceed GPM flow rate as shown on the specification sheets for each unit.

Quarterly Checks

- Compressor oil levels
- Remove and clean all waterside strainers
- Check water flow rates and pressure drops across evaporators and condensers
- Check the brine concentration
- Verify graphical data and trending
- Properly document all data

Annual Checks

- Cleaning-In-Place of heat exchangers if suspected scaling issues or clogged
- Perform leak tests on all refrigerant circuits
- Check all water flanged connections for wear or leaks
- Check for evaporator circuit insulation for any damage
- Implement oil analysis if deemed necessary
- Verify all electrical connections are intact and no sight of electrical damage is present
- Check and test all safeties (mechanical and software)
- Verify sensor accuracy
- Properly document all data

Condenser and Evaporator Cleaning Procedure

The following instructions for Cleaning-In-Place (CIP) of the evaporator and condenser is based on the GDS-C40 or GDS-C92 CIP machine available from Goodway®. Visit www.goodway.com/waterfurnace-calculator for determining the correct amount ScaleBreak-MP descaler required for a cleaning the heat exchangers.

Procedure:

3. Disable the unit from the Primary controller HMI and turn off power to the unit from the power switching gear.
4. Close Manual Isolation valves and verify that the Actuated valves are also in the close position. If Actuated valves are still open, manual overwrite the valve position.
5. Remove the grooved elbows shown in the inlet and outlet of each unit.
6. Connect the GDS-MSA (Goodway) adapter with the bottom adapter offset is set the lowest position possible and the top adapter is set to the highest position possible. This ensures that no air pockets are created during the flushing procedure.
7. Attach the circulation hoses. Pump the descaling fluid in the low side and return through the top side.
8. Fill the heat exchanger with water and perform a hydrostatic test. If no leaks are present, proceed with the descaling procedure.
9. Bleed off enough water equal in volume to the descaling solution needed.
10. Reversed the flow every 15-20 min.
11. Circulate the Scale Break – MP solution for the recommended time frame as indicated by the calculator.
12. Once circulation time is completed, begin the flushing process.
13. Ensure that the pH levels are safe for discharge and follow your local regulations for discharge. Neutralize the solution using ScalBreak Neutralizer if pH balancing is required.
14. Turn off your circulation pump, remove the return hose and place put it in a drain.
15. Add fresh water to the pump recirculation bucket and start the pump.
16. Continue running clean water through the BPHE for 10 minutes or until the return water is running clean.
17. Disconnect your hoses and remove the adapters.
18. Reinstall the grooved pipe elbows.
19. Remove and clean the strainer baskets and re-install.
20. Power and enable the chiller.
21. Open manual isolation valves.

Replacement Procedures

When contacting the company for service or replacement parts, refer to the model number and serial number of the unit as stamped on the serial plate attached to the unit. If replacement parts are required, mention the date of installation of the unit and the date of failure, along with an explanation of the malfunctions and a description of the replacement parts required.

In-Warranty Material Return

Material may not be returned except by permission of authorized warranty personnel. Contact your local distributor for warranty return authorization and assistance.

Air Coil Cleaning Procedure

Air Coil Maintenance and Cleaning

Periodic coil cleaning maintains the efficiency of the unit. Rinse the coil with water at low pressure to prevent damage, it is recommended to clean once every one to two months.

NOTICE

If you use a water hose to clean the coil, be careful as dust or debris can get inside the coil. Completely remove any debris or dust on the surface before cleaning it with clean water.

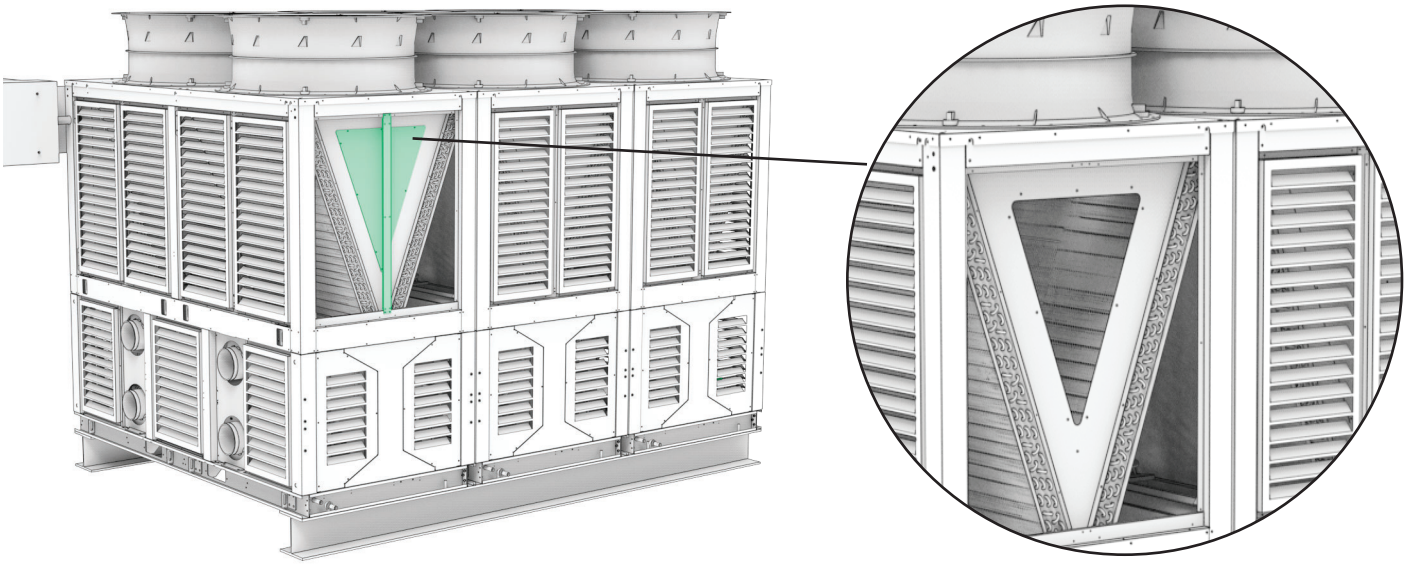
NOTICE

Never use any type of cleaner such as chemical, bleach, acid or alkali cleaner etc. on the coil. These types of cleaners can accelerate the corrosion of the coil, and could damage materials around the unit.

NOTICE

Never clean the coil using high pressure water or air. Doing so can bend the coil fins and increase the pressure drop across the coil. This can result in a loss of performance or cause the unit to fault.

Access to the aircoils is acheieved by removing the back louvered panels. Once panels are removed, locate and remove crossbar and triangular sheet metal covering in the center of the air coil.



Refrigerant Removal and Evacuation

When breaking into the refrigerant circuit to make repairs – or for any other purpose conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

- safely remove refrigerant following local and national regulations;
- evacuate;
- purge the circuit with inert gas (optional for A2L);
- evacuate (optional for A2L);
- continuously flush or purge with inert gas when using flame to open circuit; and
- open the circuit.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants.
This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems. For appliances containing flammable refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process shall be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Charging procedures

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

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

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

Refrigerant Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.

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

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

Decommissioning

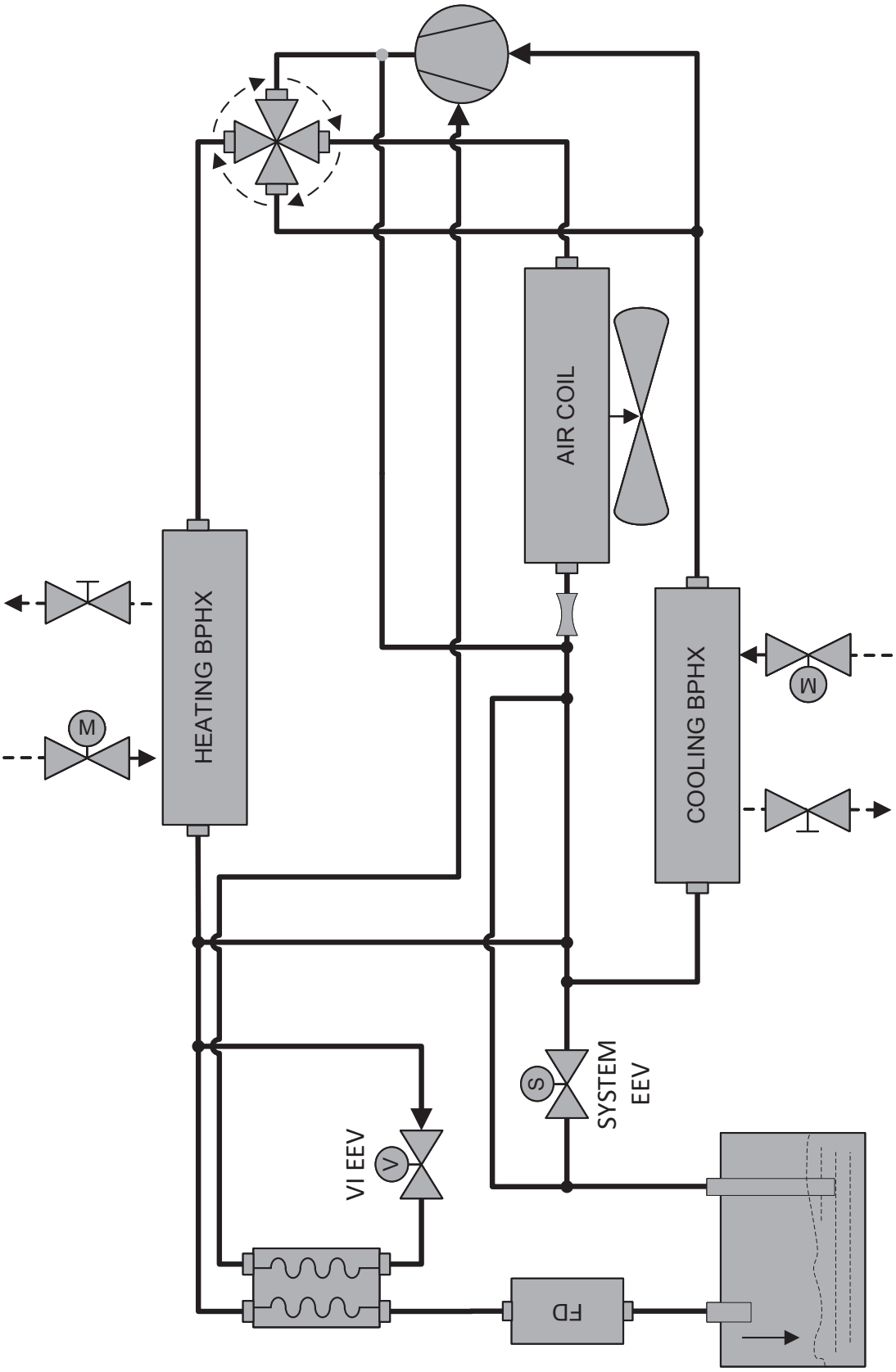
Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis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

1. Become familiar with the equipment and its operation.
2. Isolate system electrically.
3. Before attempting the procedure, ensure that:
    - mechanical handling equipment is available, if required, for handling refrigerant cylinders;
    - all personal protective equipment is available and being used correctly;
    - the recovery process is supervised at all times by a competent person;
    - recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80% volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked.

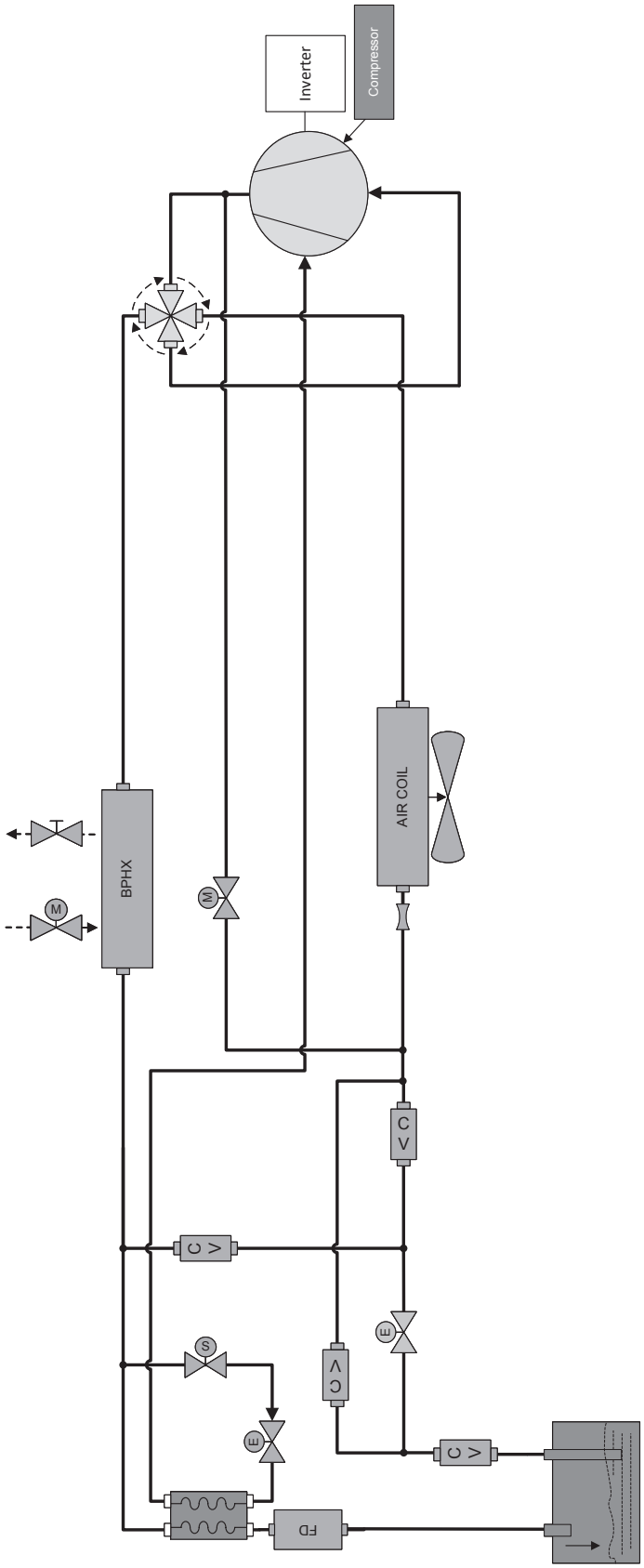
Decommissioning - Unit Labeling Requirements

Equipment shall be labelled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing FLAMMABLE REFRIGERANTS, ensure that there are labels on the equipment stating the equipment contains FLAMMABLE REFRIGERANT.

Refrigeration Cycle Analysis: 4 Pipe



Refrigeration Cycle Analysis: 2 Pipe



Troubleshooting Guideline for Refrigerant Circuit

The chart below will assist in determining if measurements taken at the unit are within factory specifications and aid in accurate diagnosis (SYMPTOM) and repair. The chart is general in nature and represents whether a symptom would result in normal, high, or low readings from the typical operating range.

Symptom	Head Pressure	Suction Pressure	Compressor Amp Draw	Superheat	Subcooling	Water Temp. Differential
Under Charged System (Possible Leak)	Low	Low	Low	High	Low	Low
Over Charged System	High	High	High	Normal	High	Normal
Low Water Flow Evaporator	Low/Normal	Low/Normal	Low	Low	High	High
Low Water Flow Condensor	High	High	High	High	Low	High
High Water Flow Evaporator	Normal	Low	Normal	High	Normal	Low
High Water Flow Condensor	Low	Low	Low	Low	High	Low
Restricted TXV (Check Service Advisory)	High	Low	Normal/Low	High	High	Low
Insufficient Compressor (Possible Bad Valves)	Low	High	Low	High	Normal/High	Low
TXV - Bulb Loss of Charge	Low	Low	Low	High	High	Low
Scaled Coaxial Heat Exchanger Evaporator	Low	Low	Low	Normal/Low	High	Low
Scaled Coaxial Heat Exchanger Condensor	High	High	High	Normal/Low	Low	Low
Restricted Filter Drier	Check temperature difference (delta T) across filter drier.					

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Revision Guide

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Manufactured by
WaterFurnace International, Inc.
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Fort Wayne, IN 46809
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Product:	**TruClimate 900**
Type:	Water-Cooled Chillers - 60 Hz
Size:	030 Tons
Document:	Operation & Maintenance Manual