CHILLBATCH

Modular Batchwater Chillers

Installation, Operation, and Maintenance

Single & Tandem Compressor Designs

20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120 Ton Configurations

CHILLER MODULE MODELS:

AMC-20 (single circuit)

AMC-30 (tandem circuit)

WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing chiller equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by and unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tabs, stickers, and labels that are attached to the equipment. Servicing should only be done with power supplies switched off and locked out.

OZONE-SAFE R410A REFRIGERANT

MADE IN U. S. A.

AMERICAN GEOTHERMAL

JULY. 2023

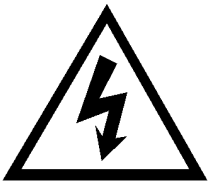
SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory−authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and current editions of the National Electrical Code (NEC) NFPA 70. In Canada, refer to current editions of the Canadian electrical code CSA 22.1.

WARNING

ELECTRICAL SHOCK HAZARD



Failure to follow this warning could result in personal injury or death. Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label

EQUIPMENT ELECTRICAL DISCONNECTS

When installing equipment, a service disconnect must be installed in the fixed wiring in accordance with local electrical code.

CLEARANCE REQUIRMENTS

When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping, and service. Allow 36 in. clearance to service end of unit and 72in. above unit without any major air flow obstructions. For proper airflow, a 48in. clearance all remaining sides must be maintained. Position so water, snow, or ice from roof or eaves cannot fall directly on unit. Never install equipment indoors or in areas with improper venting to environment.

EQUIPMENT INSTALL

Equipment MUST be installed on a level and solid surface. Failure to do so can result in improper oil distribution in compressors and will terminate factory warranty. Anchor bolts must be used in the provided locations on each of the mounting feet *(refer to fig. 1 for details)*. For hurricane tie downs, contact a local distributor for details and PE *(professional Engineer)* certification, if required by local authorities.

On rooftop applications, mount on level platform or frame. Place unit above a load−bearing wall and isolate unit and piping set from structure. Arrange supporting members to adequately support unit and minimize transmission of vibration to building. Consult local codes governing rooftop applications.

WARNING

PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIRED

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- Before installing/ servicing this unit, technicians MUST put on all PPE required for the work (Examples; cut resistant gloves/ sleeves, safety glasses, hard hat/bump cap, fall protection, electrical PPE, and arc flash clothing) ALWAYS refer to appropriate Material Safety Data Sheets and OSHA guidelines for proper PPE.
- NEVER perform any switching, disconnect, or voltage testing without proper electrical PPE and arc flash clothing. Ensure electrical meters and equipment are properly rated for intended voltage.

COMPRESSOR CRANKCASE HEATER

When equipped with a crankcase heater, furnish power to heater a minimum of 12 hrs. before starting unit. To apply power to the heater only, set low voltage breaker (CB6) to off and the compressor breakers (CB1 and CB2) to the on position. Close all cabinet covers during the waiting period to prevent burns or electrical shock.

3 - PHASE MONITOR

In 3 - phase equipment, a small circuit board is factory installed to prevent incorrect rotation of motors. A small LED will flash if a phase problem exist. Depower the equipment by switching the appropriate disconnect and interchange two of the field wiring leads on the distribution block.

WARNING

EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury, and/or property damage.

Never use air or gases containing oxygen for leak testing of operating refrigerant compressors.

Pressurized mixtures of air or gases containing oxygen can lead to an explosion.

RESPONSIBLE REFRIGERANT PRACTICES

Responsible refrigerant practices are important to the environment, our customers, and the industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the federal Clear Air Act (section 608) sets forth the requirement for handling, reclaiming, recovering and recycling certain refrigerants and the equipment that is used in the service procedures. In addition, some states or municipalities may have additional requirements must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

WARNING

QUALIFIED PERSONEL ONLY

The equipment is not to be used by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge of the equipment.

CAUTION

INSTALLATION CONSIDERATIONS

- Equipment must not be installed in altitudes greater than 6561.7 ft or 2000 meters.
- Fluid circuit pressure must not exceed 300 psi.
- Fluid circuit water temperature limitations; 32°F (0°C) minimum / 180°F (93.3°C)

INSTALLATION CHECK LIST

⇒ Equipment is installed on a level and solid surface. If installed on a roof top, all precautions have been taken when considering load bearing supports.

⇒ Equipment is properly grounded. Ground rods may be required depending on installation and application. ALL MOBLIE EQUIPMENT MUST BE GROUNDED VIA GROUND ROD.

⇒ Equipment is properly fastened to the mounting surface.

⇒ Equipment is clear of air flow obstructions.

⇒ Equipment has proper overcurrent protection, wire size, and means of electrical disconnect.

⇒ 3 Phase wiring is the correct phasing and phase monitor indicates no issues.

⇒ The appropriate plumbing connections been made with respect to the plumbing diagram in this manual.

⇒ Y-strainers have been installed on the inlet of the chiller.

⇒ Will the chiller operate below 50°F and if so, has a low ambient head pressure control been installed?

⇒ Will your chiller be exposed to harsh environments such as, salty air, alcohols, petroleum, alkalies, or acids? If so, has the condenser been coated to protect against degradation?

⇒ The proper precautions have been taken before turning on the chiller.

⇒ Has the technician set up the Fluid Out Circuit Setter. For assistance, please refer to page 20 or contact the American GeoThermal Service Dept. Failing to complete this step will nullify the manufactures warranty.

INSTALLATION NOTES:

Product Information/ Introduction

Equipment Specifications:

- Hermetic Scroll Compressors
- Remote monitoring on all models
- Working ambient temperatures (50°F - 125°F)
- Single (20 ton modules) & Tandem (30 ton modules) Compressor designs for total redundancy and customizable configurations
- Crankcase heaters on all models
- Refrigerant high & low pressure cut out
- Refrigerant discharge temperature limits
- Variable speed condenser fans for optimal efficiency and head pressure control - statically and dynamically balanced.
- Independent master control - modules can function independently by simply turning a switch.
- System run and fault condition LED lights

Additional Options:

- BACnet capabilities
- Condenser filters

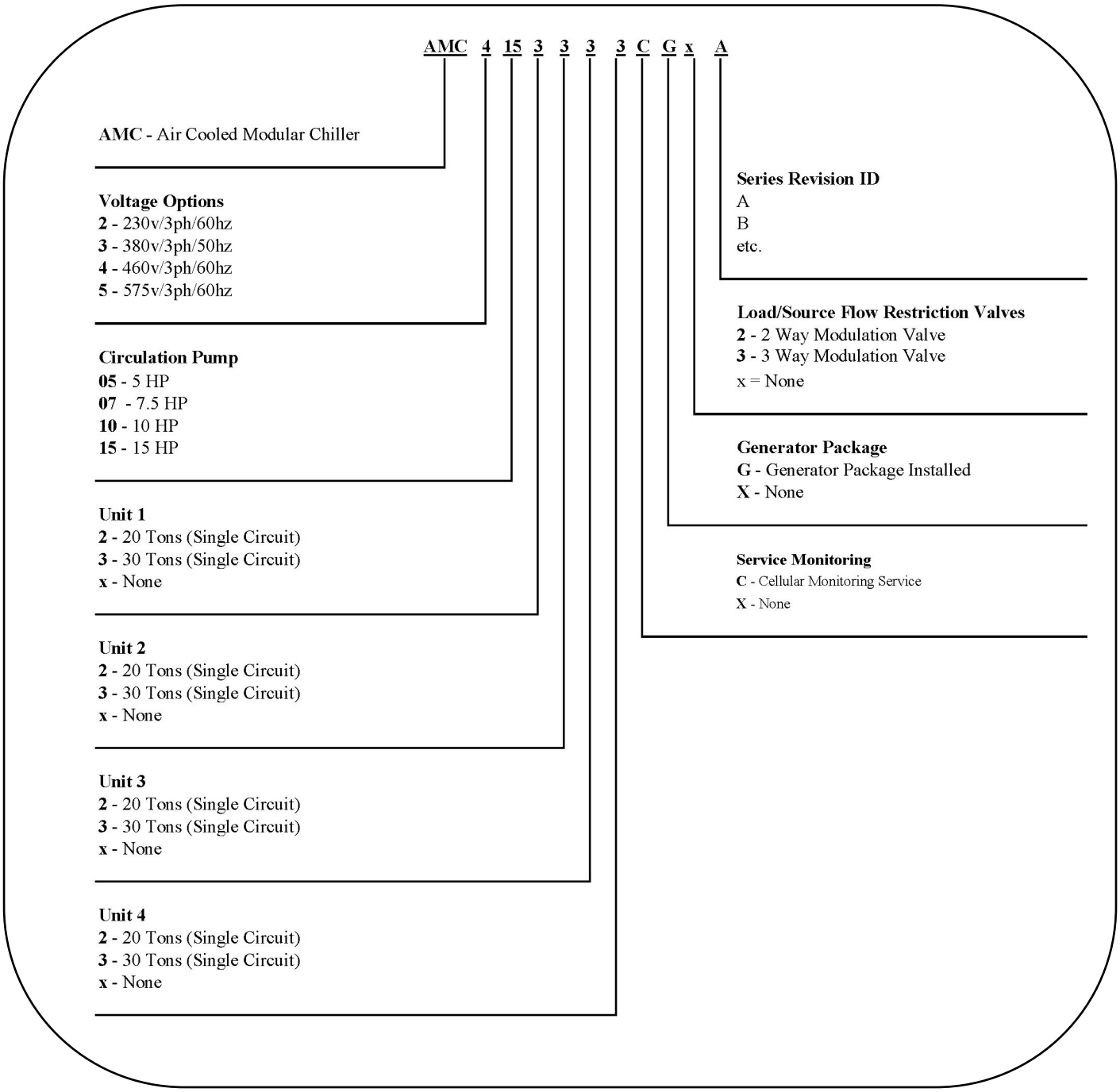
Individual Module Model Nomenclature

IDENTIFYING AND UNDERSTANDING THE EQUIPMENT MODEL NUMBER

There are two identification numbers on every bank of units in which helps identify the product.

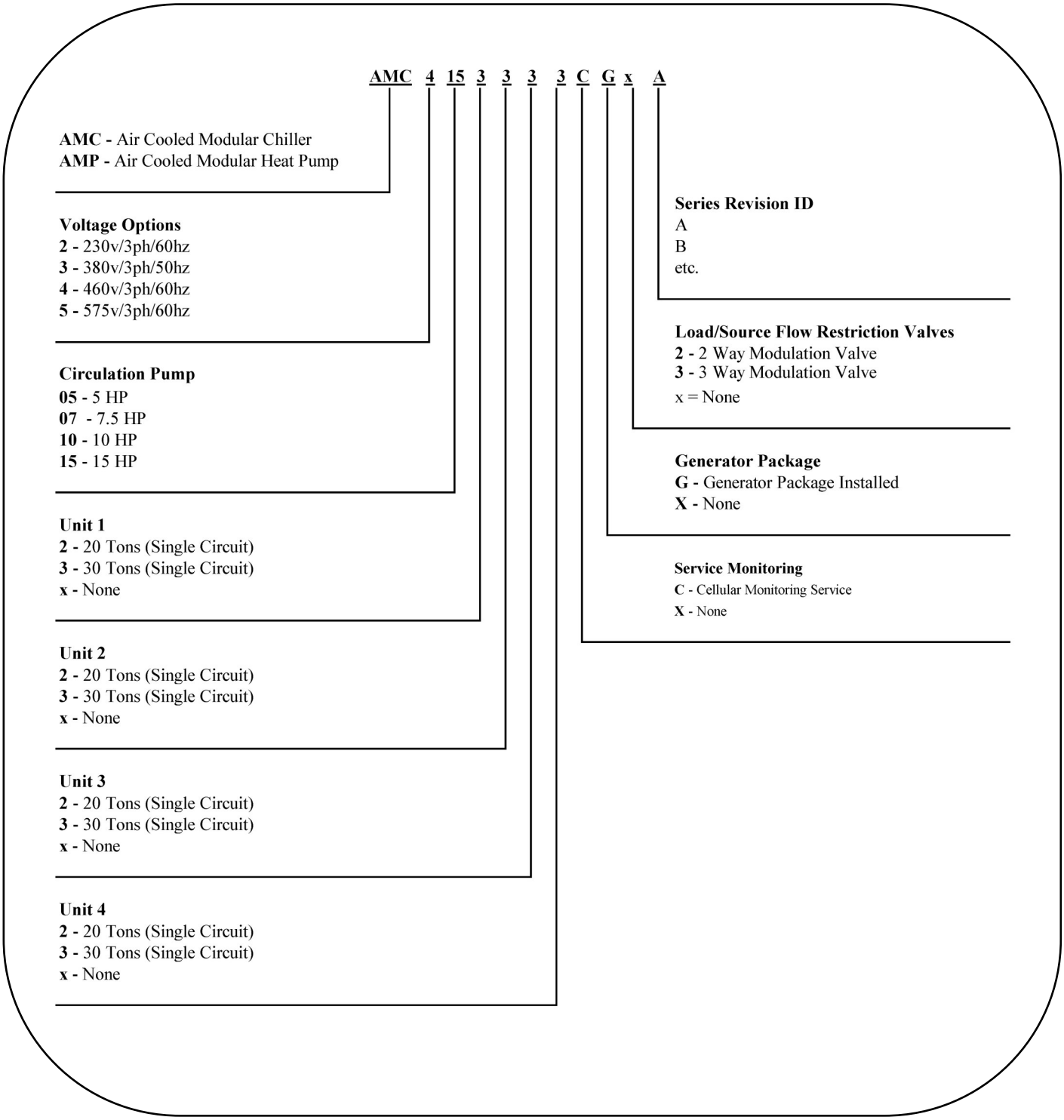
(1) **The individual module model number:** This number identifies each module as independent subparts of the whole chiller bank. Individual modules can consist of a single 20 ton compressor or a tandem 30 ton compressor design that is made up of 2, 15 ton compressors. While both are single refrigeration circuits, the 30 ton module has the capability of unloading a compressor and changing its minimum step capacity to roughly half. In some instances where the unit may be exposed to harsh environments a coil coating may be required. Refer to the Equipment Operation section of this manual for more detail. In addition, Tube and Tube exchangers are also referred to as "no clog heat exchanger" where the design is a proprietary evaporator design specifically for the concrete industry.

(2) **The Master Bank or "Total Unit Configuration ID"** as seen on the next page. This sequence of numbers showcases



Total Module Configuration ID

the configuration of individual modules, total tonnage, circulation pump size and input voltage. Banks can range between 20-120 Tons in 10 ton increments by pairing various 20 and 30 ton modules together. For example, a 70 ton bank consists of 1, 30 ton and 2, 20 ton modules. The pump size for this configuration is predetermined and selected by the factory. Refer to Table 1 & 2 for additional technical data regarding electrical and plumbing requirements.



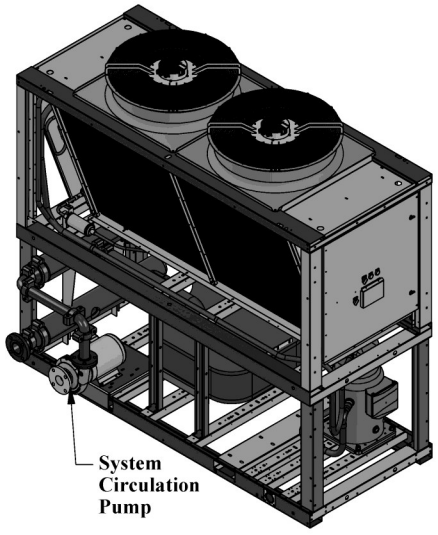
Product Information: Table 1, Physical Data 20-60 Ton Units

EQUIPMENT MODEL No.	AMCx052	AMCx053	AMCx0722	AMCx1032	AMCx1033
TOTAL NOMINAL CAPACITY *(tons)*	20	30	40	50	60
NO. MODULES	1	1	2	2	2
ELECTRICAL DATA					
Unit Rated Voltage	**208-230V/3PH/60HZ**				
Nominal Voltage	**218-230-242**				
MCA (MOP)	**127.7 (175.0)**	**187.0 (250.0)**	**216.1 (250.0)**	**281.4 (300.0)**	**340.7 (400.0)**
Unit Rated Voltage	**460V/3PH/60HZ**				
Nominal Voltage	**440-460-480**				
MCA (MOP)	**65.2 (100.0)**	**89.5 (125.0)**	**110.4 (125.0)**	**137.7 (150.0)**	**162.0 (175.0)**
FOOTPRINT DIMENSIONS *(in.)*					
Length - in. [mm] *includes circulation pump*	50-1/16 [1271.6]	50-1/16 [1271.6]	90-1/16 [2287.6]	90-1/16 [2287.6]	90-1/16 [2287.6]
Width - in. [mm]	96 [2438.4]				
Height - in. [mm]	90-1/4 [2292.35]				
APPROXIMATE WEIGHT					
Shipping/ Dry - lbs.	1860	2150	3720	4010	4300
Shipping/ Dry - kg.	843.7	975.2	1687.4	1818.9	1950.4
Wet (lbs.)					
UNIT CAPACITY					
Capacity Control - Standard Fixed Speed	Scroll				
No. Stages, (M_{stages})	1	2	2	3	4
Nominal Temperature Drop	3.2	3.3	3.2	4.0	3.3
Time Required to Lower 10K Gallons by 50° F	17.4	11.6	8.7	7.0	5.8
OUTDOOR FAN					
Type	Propeller				
Drive Type/ No. Speeds	Variable				
Ramp Range	20-100%				
Max CFM	23240	23240	46480	46480	46480
No. Motor/ Max Wattage	2/2700	2/2700	4/2700	4/2700	4/2700
Motor Max. RPM	1250				
EVAPORATOR					
Fluid Flow Rate *(gpm) 100% Loading*	110	160	220	220	318
Fluid Pump Size (HP)	5	5	7.5	7.5	10
Fluid Connections - in. [mm]	2-1/2 [63.5]	2-1/2 [63.5]	2-1/2 [63.5]	4 [101.6]	4 [101.6]
Minimum Fluid Hose Size - in. [mm] - 50 ft. max	2-1/2 [63.5]	2-1/2 [63.5]	2-1/2 [63.5]	3 [76.2]	3 [76.2]
Maximum Refrigerant Side Pressure - PSI [MPA]	650 [4.48]				
Maximum Fluid-Side Side Pressure - PSI [MPA]	450 [3.10]				

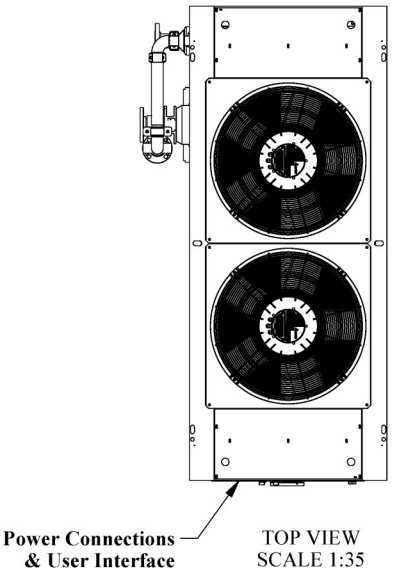
Product Information: Table 2, Physical Data 70-120 Ton Units

EQUIPMENT MODEL No.	AMCx10322	AMCx10332	AMCx10333	AMCx153322	AMCx153322	AMCx153333
TOTAL NOMINAL CAPACITY *(tons)*	70	80	90	100	110	120
NO. MODULES	3	3	3	4	4	4
ELECTRICAL DATA						
Unit Rated Voltage	**208-230V/3PH/60HZ**					
Nominal Voltage	**218-230-242**					
MCA (MOP)	**369.8 (400.0)**	**429.1 (450.0)**	**502.4 (600.0)**	**531.5 (600.0)**	**590.8 (700.0)**	**650.1 (700.0)**
Unit Rated Voltage	**460V/3PH/60HZ**					
Nominal Voltage	**440-460-480**					
MCA (MOP)	**182.9 (200.0)**	**207.2 (225.0)**	**238.5 (250.0)**	**259.5 (300.0)**	**283.8 (300.0)**	**308.1 (350.0)**
FOOTPRINT DIMENSIONS *(in.)*						
Length - in. [mm] *includes circulation pump*	130-1/16 [3303.6]	130-1/16 [3303.6]	130-1/16 [3303.6]	170-1/16" [4319.6]	170-1/16" [4319.6]	170-1/16" [4319.6]
Width - in. [mm]	96 [2438.4]					
Height - in. [mm]	90-1/4 [2292.35]					
APPROXIMATE WEIGHT						
Shipping/ Dry (lbs.)	5870	6160	6450	8020	8310	8600
Shipping/ Dry - kg.	2662.6	2794.1	2925.7	3637.8	3769.3	3900.9
Wet (lbs.)						
UNIT CAPACITY						
Capacity Control - Standard Fixed Speed	Scroll					
No. Stages, (M_{stages})	4	5	6	6	7	8
Temperature Drop	3.8	4.4	3.8	4.2	3.5	3.8
Time Required to Lower 10K Gallons by 50° F	5.0	4.3	3.9	3.5	3.2	2.9
OUTDOOR FAN						
Type	Propeller					
Drive Type/ No. Speeds	Variable					
Ramp Range	20-100%					
Max CFM	69720	69720	69720	92960	92960	92960
No. Motor/ Max Wattage	6/2700	6/2700	6/2700	8/2700	8/2700	8/2700
Motor Max. RPM	1250					
EVAPORATOR						
Fluid Flow Rate *(gpm) 100% Loading*	318	318	415	415	550	550
Fluid Pump Size (HP)	10	10	15	15	15	15
Fluid Connections - in. [mm]	4 [101.6]	4 [101.6]	4 [101.6]	4 [101.6]	4 [101.6]	4 [101.6]
Minimum Fluid Hose Size - in. [mm] - 50 ft. max	3 [76.2]	3 [76.2]	4 [101.6]	4 [101.6]	4 [101.6]	4 [101.6]
Maximum Refrigerant Side Pressure - PSI [MPA]	650 [4.48]					
Maximum Fluid-Side Side Pressure - PSI [MPA]	450 [3.10]					

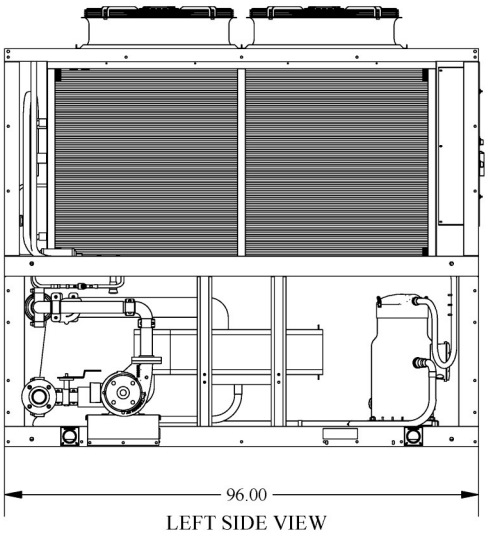
Physical Dimensions (20 & 30 Ton Units)



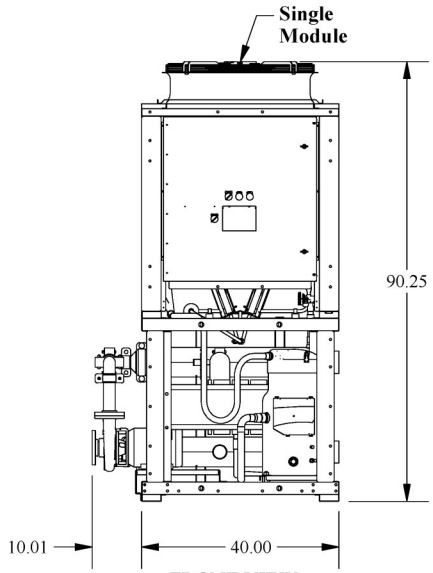
TOP LEFT ISO. VIEW
SCALE 1:40



TOP VIEW
SCALE 1:35



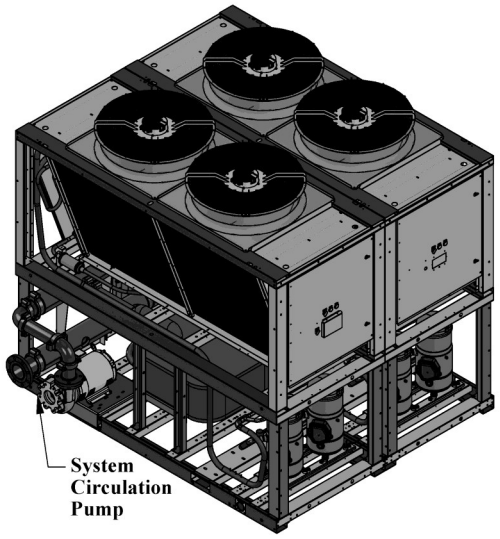
LEFT SIDE VIEW
SCALE 1:35



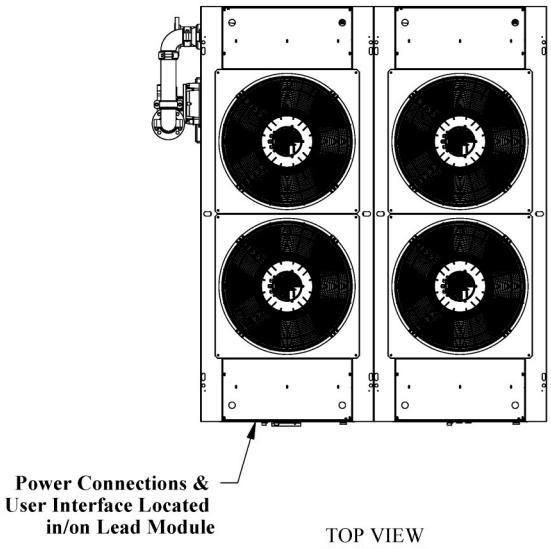
FRONT VIEW
SCALE 1:35

Figure 1, Model No.
AMCx052xxxAxxC (20 Ton)
AMCx053xxxAxxC (30 Ton)

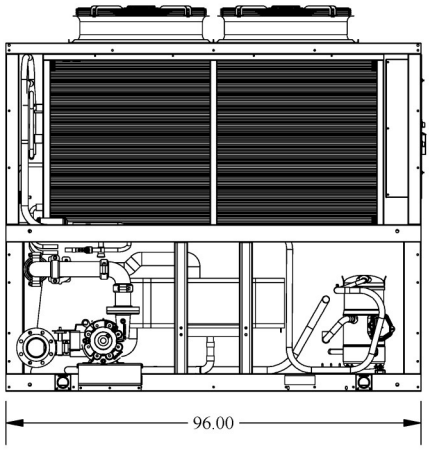
Physical Dimensions (40, 50, 60 Ton Units)



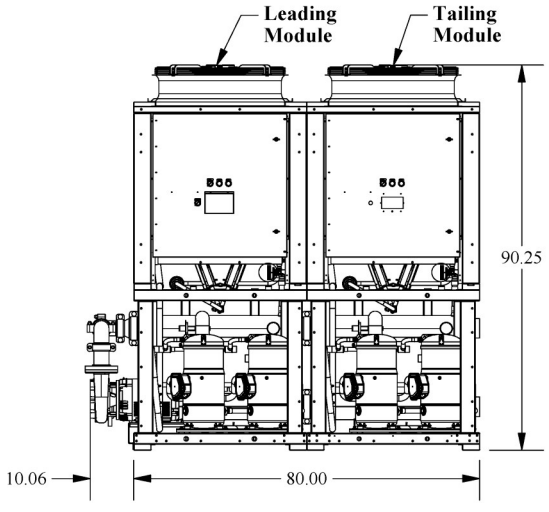
TOP LEFT ISO.VIEW
SCALE 1:45



TOP VIEW
SCALE 1:40



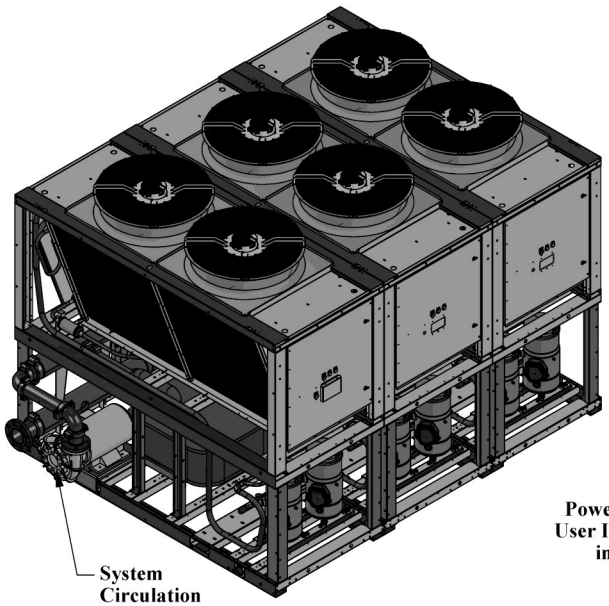
LEFT SIDE VIEW
SCALE 1:40



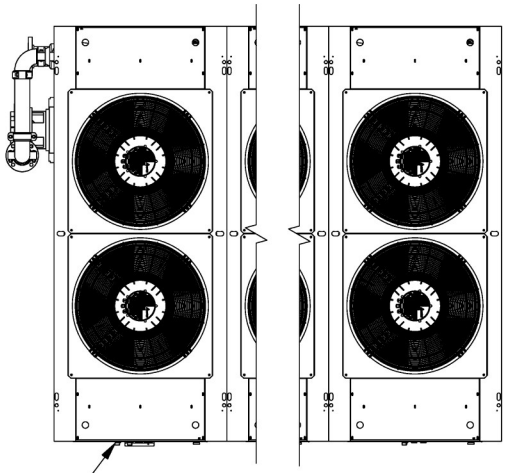
FRONT VIEW
SCALE 1:40

Figure 2, Model No.
AMCx0722xxAxxC (40 Ton)
AMCx1032xxAxxC (50 Ton)
AMCx1033xxAxxC (60 Ton)

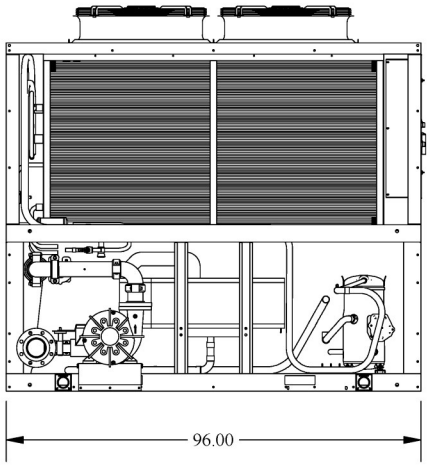
Physical Dimensions (70, 80, 90 Ton Units)



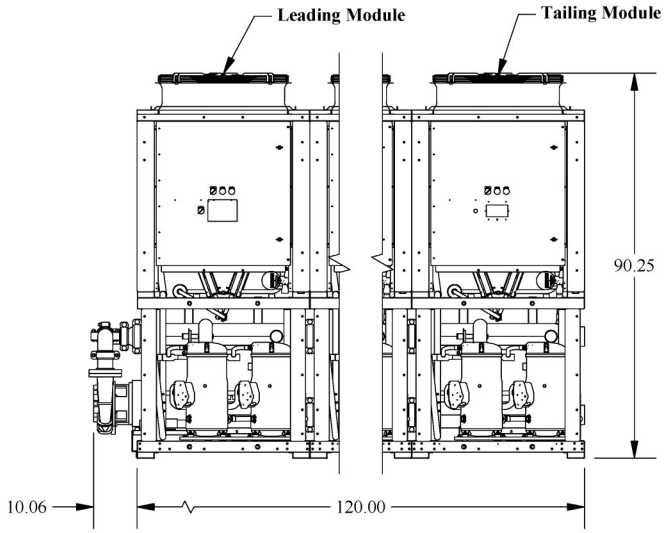
TOP LEFT ISO. VIEW
SCALE 1:45



TOP VIEW
SCALE 1:40



LEFT SIDE VIEW
SCALE 1:40



FRONT VIEW
SCALE 1:40

Figure 3, Model No.
AMCx10322xAxxC (70 Ton)
AMCx10332xAxxC (80 Ton)
AMCx15333xAxxC (90 Ton)

Physical Dimensions (100, 110, 120 Ton Units)

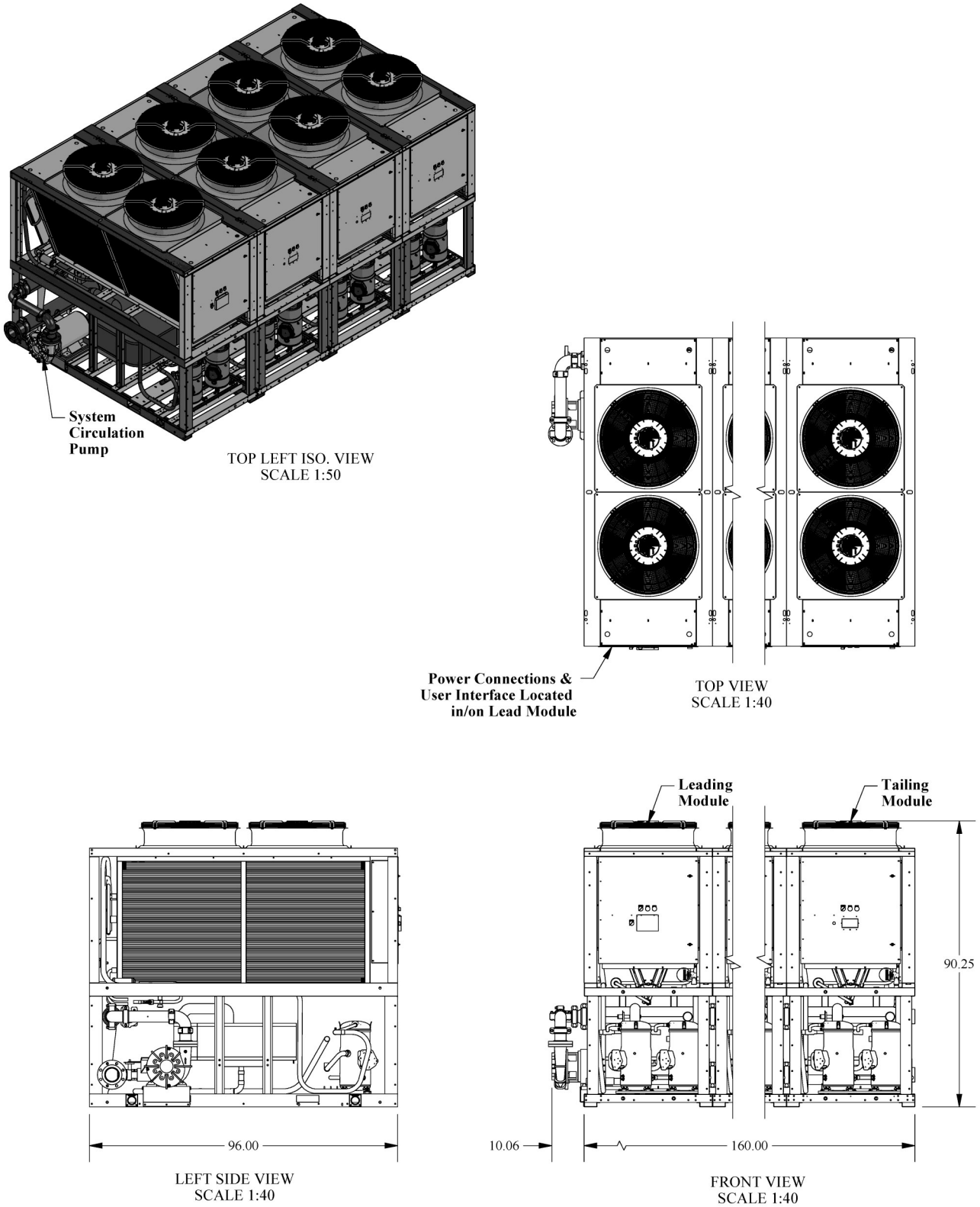


Figure 3, Model No.
AMCx153322AxxC (100 Ton)
AMCx153332AxxC (110 Ton)
AMCx153333AxxC (120 Ton)

WARNING

DO NOT ATTEMPT TO FORK LIFT EQUIPMENT FROM ANY OTHER SIDE THAN THE SPECIFIED APPROACH. (OPPOSITE OF THE FACTORY INSTALLED FLUID PUMP). LIFTING FORKS MUST EXTEND AT =MINIMUM, HALF WAY THOUGH THE LEADING UNIT.

(FAILING TO FOLLOW THIS WARNING CAN RESULT IN SERIOUS INJURY OR DEATH.)

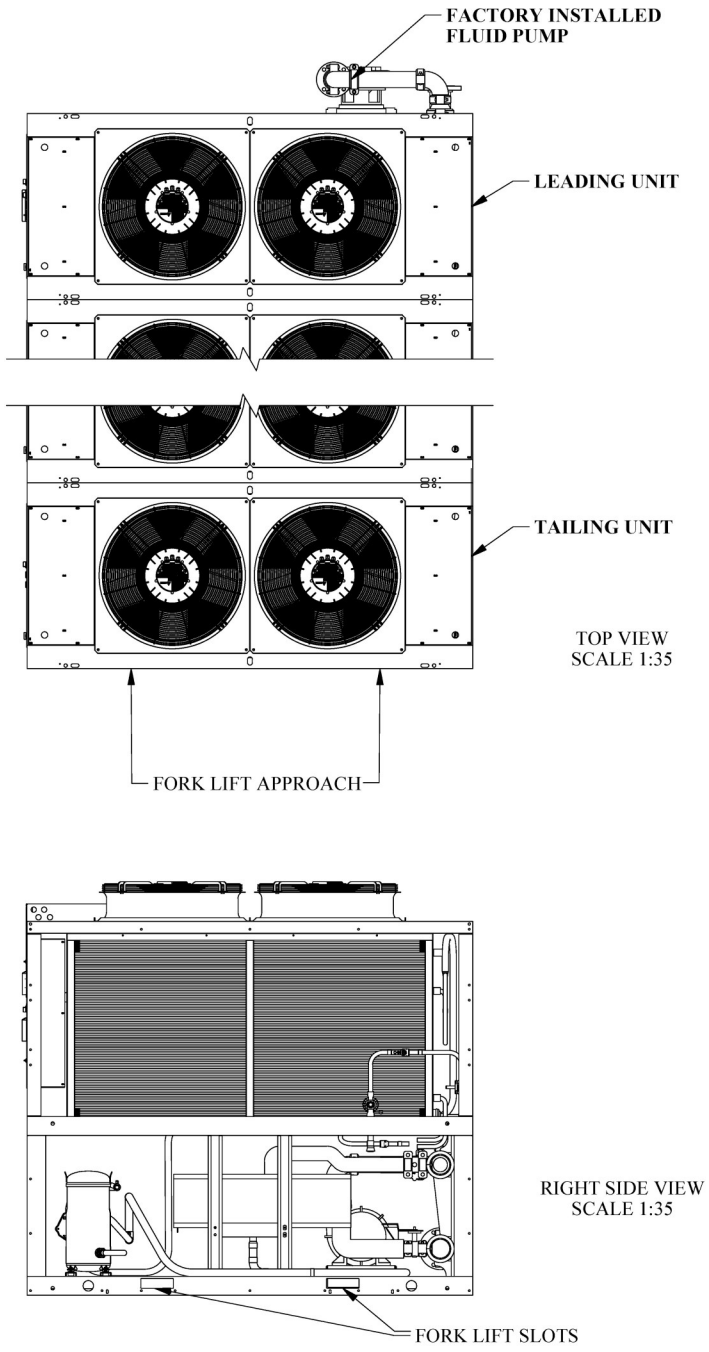


Figure 5, Fork Lifting and Moving Units

Lifting Via. Crane

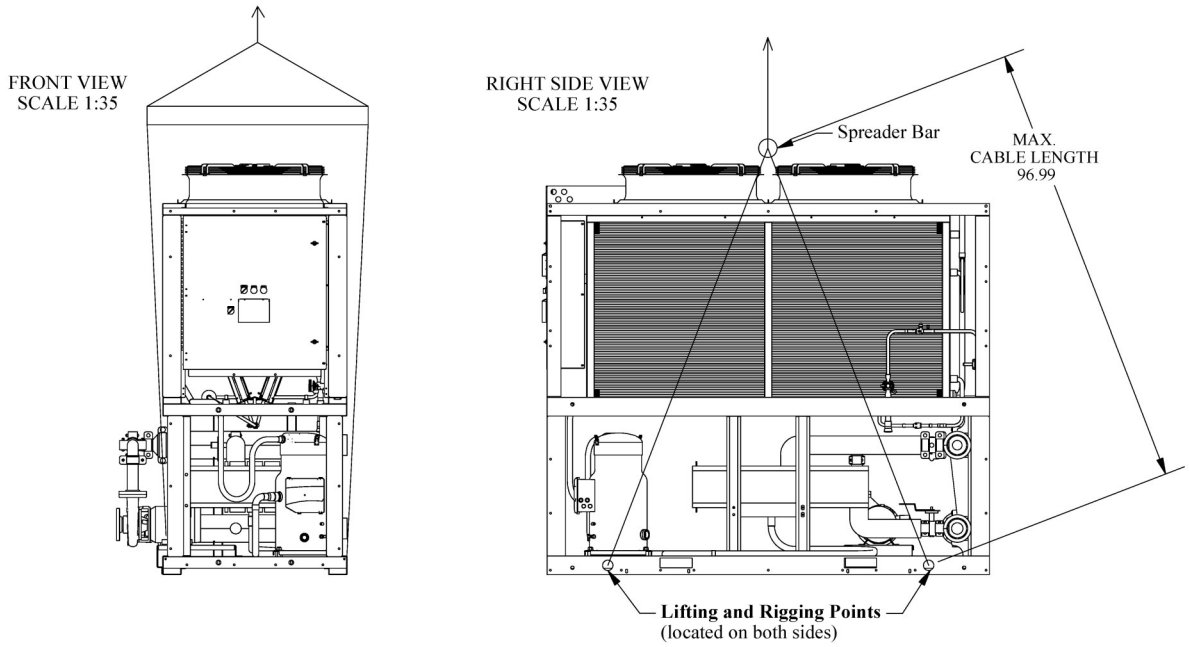


Figure 6, Lifting Units via. Crane and Spreader Bar
(single modules only)

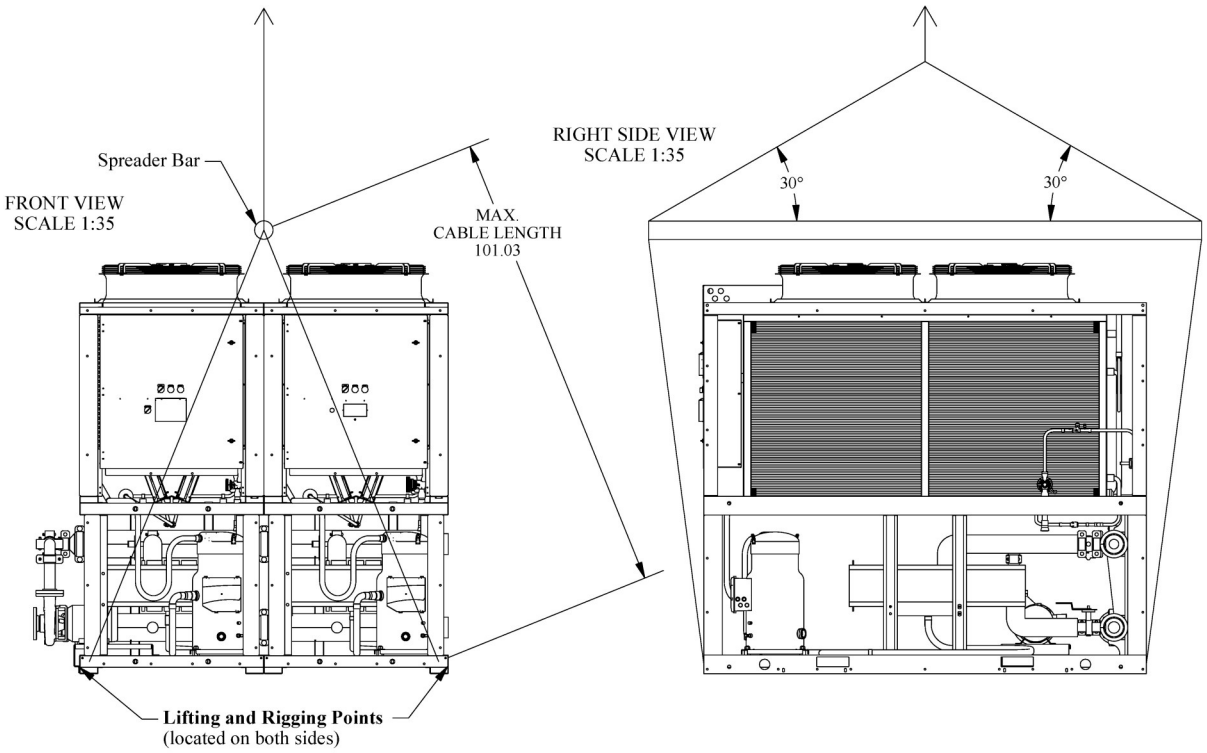


Figure 7, Lifting Units via. Crane and Spreader Bar
(two modules only)

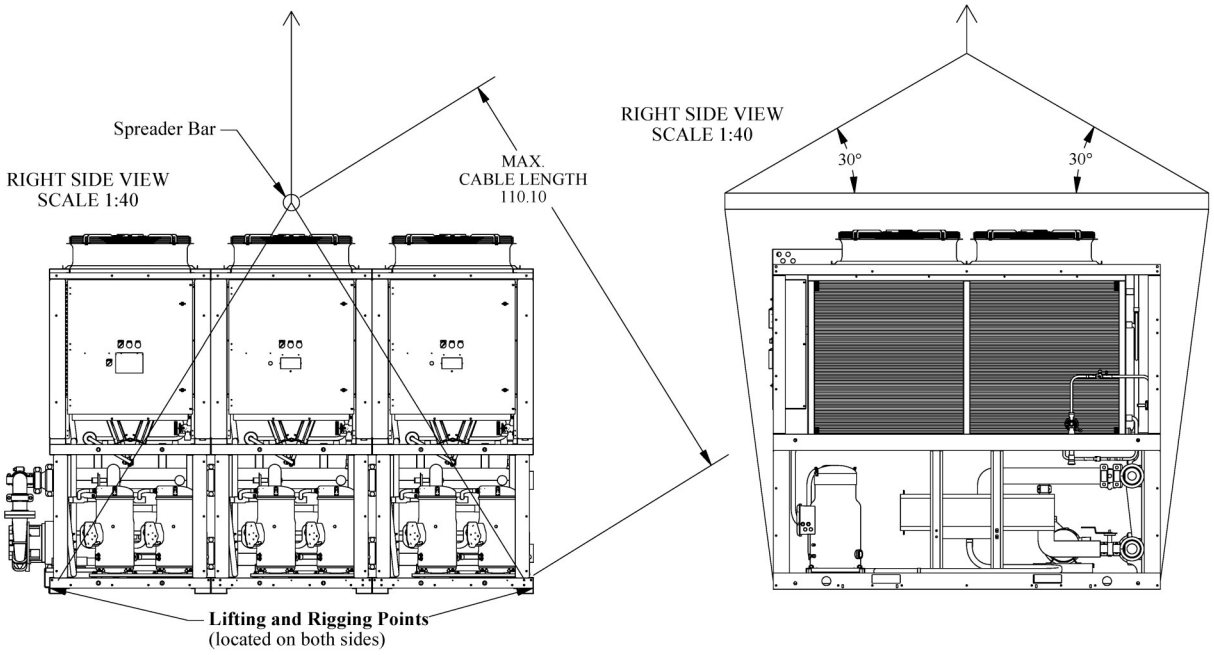


Figure 8, Lifting Units via. Crane and Spreader Bar
(three modules only)

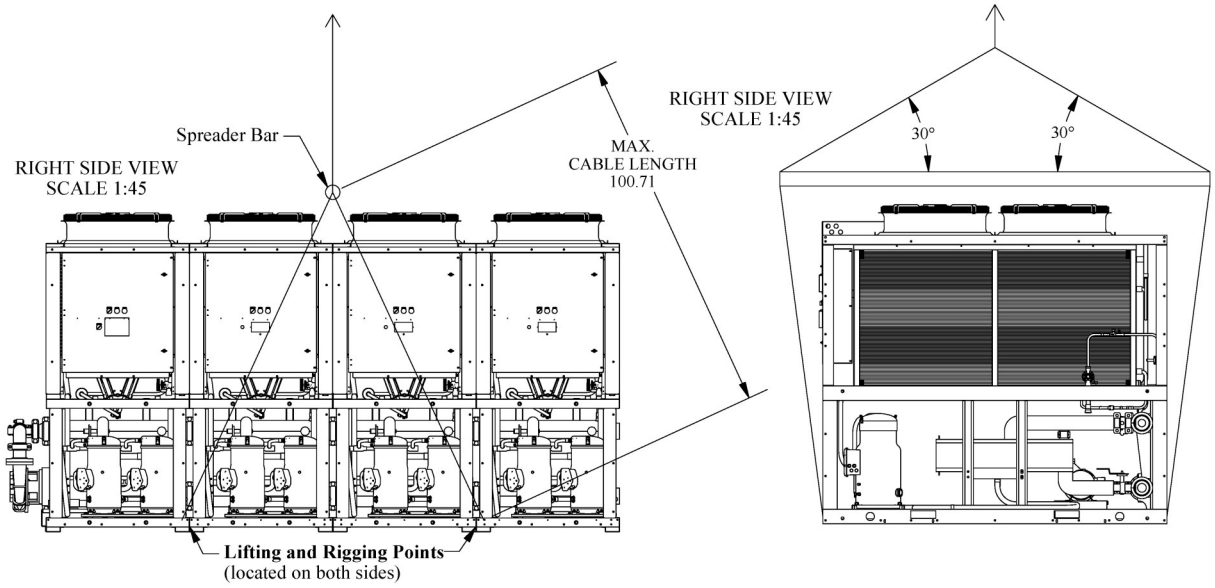
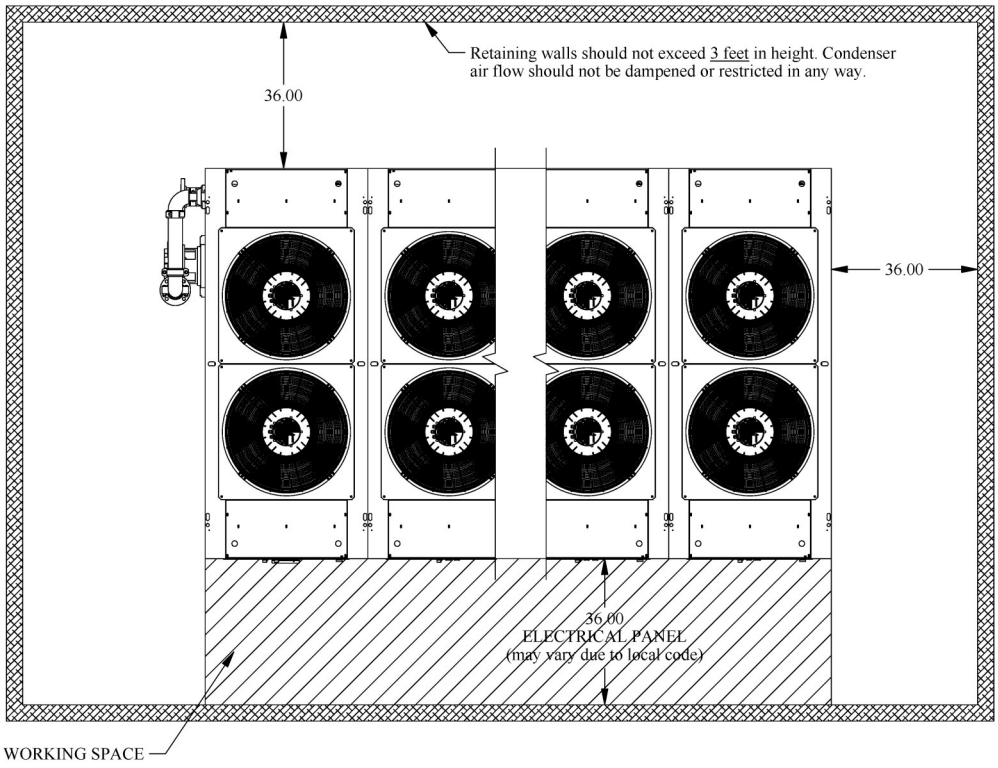


Figure 9, Lifting Units via. Crane and Spreader Bar
(four modules only)



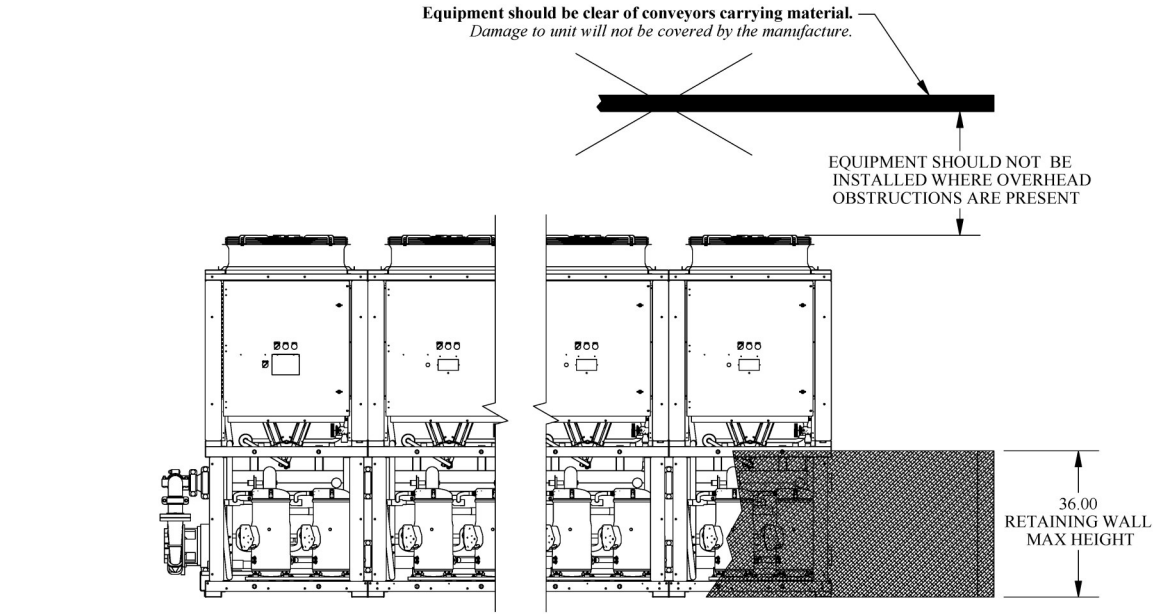


Figure 10, Equipment Clearance and Working Space

CONDENSER PROTECTION (optional)

In some conditions specifically in corrosive environments a cathodic, epoxy-type electrodeposition coating may have been applied to the microchannel coil. Such coating provides excellent resistance and durability in potentially corrosive environments due to alkalies, acids, alcohols, petroleum, seawater, salty air, etc. To confirm, refer to the equipment model number and reference the 15th digit regarding the model nomenclature on page 6 of this manual.

COMPERSSOR ANTI-SHORT CYCLE TIMER

Under all normal running conditions, a 3–minute minimum ON timer is maintained for the first compressor and a 5 second delay for every compressor thereafter. Once a compressor is turned OFF via. the thermostat or alarm conditions, it will remain OFF for a minimum of 3-minutes unless the alarm warrants a system locked out. System overrides that require immediate shutdown of the equipment, test modes, and compressor diagnostics/ protection functions can override these 3–minute timers. However for normal temperature and thermostatic-based control, these minimum ON timers are maintained.

EQUIPMENT PROTECTION DEVICES

WARNING - AT NO POINT SHOULD ANY OF THE FOLLOWING SWITCHES OR SENSORS BE JUMPERED, REMOVED, OR TAMPERED WITH IN ANY WAY. FAILING TO IGNORE THIS WARNING COULD RESULT IN EQUIPMENT DAMAGE, SERIOUS INJUSRY, OR DEATH.

a. **Tank/ Fluid In Temperature Sensor** - This sensor serves as a critical function device and can be installed one of two ways. It is imperative that the installer and startup personnel comply with the following instructions and warning regarding the tank/fluid in temperature sensor. Failing to do so could result in equipment damage and loss of the factory warranty.

   1. **Installed as a Tank Sensor -** All equipment is supplied with a 50 ft cable and a 12" thermowell/sensor assembly. The thermowell contains a 1/2" MNPT connection where the sensor can be installed directly into a tank fitting, this assembly is shipped loosely in the electrical control box. Start up personnel must extend the sensor cable from the bulk head connector mounted on the chiller to the tank (refer to the "Electrical Installation" of this manual for more information regarding the location of the bulk head connector.) Under no circumstances should the tank temperature sensor be removed during operation, this will result in compressor short cycling and could, damage critical components of the chiller - the factory warranty will be nullified as a result.

   2. **Installed as a Fluid In Sensor** - In some cases, installing the chiller sensor into the tank is either less ideal or, simply impossible. The chiller sensor can be installed into the "Fluid In" line coming from the tank. The installer must contact the factory for a new fluid in sensor assembly as the supplied 12" thermowell will not fit the installation application. Contact the factory for assistance on installation and control set up. The chiller circulation pump MUST be activated as "continuous operation" for the system to operate correctly. WARNING - Never strap the fluid in sensor to the outside of a pipe. The fluid in sensor must be installed with a thermowell assembly containing minimum length of, 0.70 x the outside diameter of the pipe to ensure the dynamic accuracy. Ignoring this waring will result in compressor short cycle due to inconsistent and inaccurate fluid in readings - the factory warranty <u>will not</u> cover damages due to incorrect fluid in or tank sensor installation.

a. **Loss of Charge Pressure Switch** - designed to cut out at 20 psig. and reopen at 40 psig. However, a loss of charge condition will result in a system lockout *(Low Lockout A Alarm)* and requires the user to physically reset the alarm by pressing and holding the caution symbol on the c.pco control for 3 seconds. If repetitive high pressure conditions occur, refer to the "trouble shooting" guide in this manual.

b. **High Pressure Switch** - designed to cut out at 650 psig. and reopen at 550 psig. This switch also locks the compressor out *(High PSI Switch A Alarm)* and requires the user to physically reset the alarm by pressing and holding the caution symbol on the c.pco control for 3 seconds. If repetitive high pressure conditions occur, refer to the trouble shooting guide in this manual.

c. **Suction Pressure Ratiometric Transducer** *(0-250 psig range)* This pressure transducer is designed to measure and display dynamic conditions of the compressors suction line and can serve as a level of protection for the compressor. In addition, this senor combined with other dynamic conditions calculates the Super Heat reading on the display. Default cut in/out values are 60/55 psig. respectively and will lock the compressor our immediately. A "Suction

Trans A Alarm" will require a physical reset by pressing and holding the caution symbol on the c.Pco control.

d. **Hight Pressure Ratiometric Transducer** *(0-650 psig range)* - This pressure transducer is designed to measure and display dynamic conditions of the compressors discharge line. In addition, the condenser fan speed is controlled by this transducer and has a factor setting to maintain 450 psig at the discharge line.. Default cut in/out values are 550/600 psig respectively *(Dis A Trans Alarm)* and can trip 3 times within 1 hour before locking out the compressor. **CONDENSER PROTECTION FILTERS** - If the equipment contains condenser filters and repetitive high pressure conditions are observed, check the filters and clean as often as necessary. Dirty filters will result in continued high refrigerant pressure conditions and can damage equipment if periodic maintenance is not maintained. Refer to the maintenance and trouble shooting sections of this manual for more details.

e. Fluid Out Temperature Sensor (NTC) - This sensor measures the dynamic temperature of the fluid leaving each module. It can be located on back of the chiller between the isolation valve and the evaporator - black cable recessing into the insulation. The default fluid out temperature cut in/out is 32.5/38°F and with continue to cycle with out limitation. However, if the fluid temperature suppresses below 32.2°F, the unit will lock out and require a physical reset by pressing and holding the caution symbol on the c.pco. control. If continued low temperature conditions are observed, check the fluid y-strainer and ensure fluid flow of the fluid circuit. Refer to the maintenance and trouble shooting sections of this manual for more details on low flow conditions and how they consequently affect the equipment.

f. Suction Temperature Sensor (NTC) - This devise is responsible for measuring the refrigerant suction temperature. This sensor is also key in deriving the Super Heat reading on the user interface. Note: The displayed Super Heat reading should never be used to set refrigerant change or service the unit in any way. *Note: The suction temperature sensor should be wrapped in cork tape to and insulated to function correctly.*

g. Entering Fluid Pressure Transducer *(0-100psig.)* - This sensor measures the dynamic conditions related to the entering fluid pressure (pump discharge pressure) and is responsible for measuring restrictions in the fluid circuit. This parameter contains read/write functionality in which must be set by the user per the installation conditions. For example, we expect the fluid pressure of a system to less when installed on a 8' diameter horizontal tank as opposed to a 27' tall vertical tank. Considering this, the factory will deliver the equipment with its run tested operation conditions however, the user will be required to set this parameter during installation. Please refer to the start up section of this manual on setting the pump pressure setpoints.

CHILLER START UP AND OPERATION

WARNING— The system start up should be performed by an certified individual whom contains the appropriate knowledge of chillers and air conditioning equipment. Damage to the equipment caused by negligent installation and/or, equipment operation will not be covered under the manufactures warranty.

a. Line Voltage Connection, refer to the "Electrical Installation and Wire Sizing Guide" for details on wire sizing and connecting line voltage. All overcurrent protection (fuses) should be class R with the appropriate voltage and current ratings.

b. Tank Temperature Sensor Connection, the tank temperature sensor must be installed in the fluid tank closest to the chiller supply connection. If installing the tank temperature sensor inside the tank is not possible and with the consent of American GeoThermal, the sensor can be installed in the chiller supply line. When doing so, the chiller must be activated to "continuous pump mode" via the c.pco control. Failing to do so can result in damage to the equipment and will nullify the manufactures warranty.

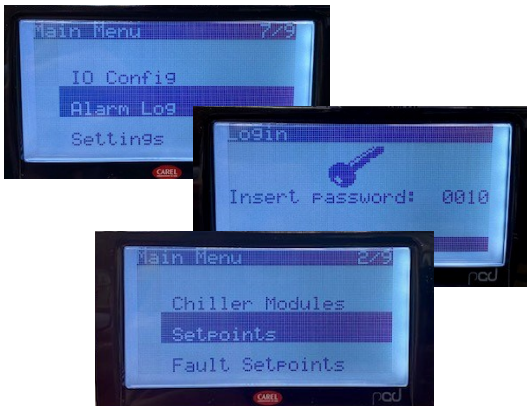
c. **Chiller Plumbing,** refer to Table 1 & 2 for standard chiller connection sizes and minimum line sizes for a 50 ft run. This line size does not account for additional 90° elbow and should only be used for flexible hose. Consult with American GeoThermal if additional elbows are required for piping, standard equipment pumps may not be applicable for said application.

d. **12 Hour Warming Period,** All units come equipped with a crankcase heaters, furnish power to heater a minimum of 12 hrs. before starting unit. To apply power to the heater only, set low voltage breaker (CB6) to off and the compressor breakers (CB1 and CB2) to the on positions. Close all cabinet covers during the waiting period to prevent burns or electrical

shock. If the waiting period is ignored, damage to the unit can occur. If the chiller is operating on a generator, contact American GeoThermal immediately for further assistance. Additional parts and set up is required for chillers operating on generators.

e. **Purging Air from the Chiller Fluid Circuit:** With all fluid valves open, turn the "Pump Bypass Switch" into the on position –the fluid pump should begin spinning. If the pump does not start, ensure that the line voltage is adequate, the pump breaker (CB12), and the transformer breakers (CB10 and CB11) are turned to the on position. While observing the "User Interface" locate the chiller "pump pressure" reading, once the pressure has stabilized, the gauge pressure should read between 20 –50 PSI. depending on installation. If the chiller is operating outside this window, contact American GeoThermal immediately!

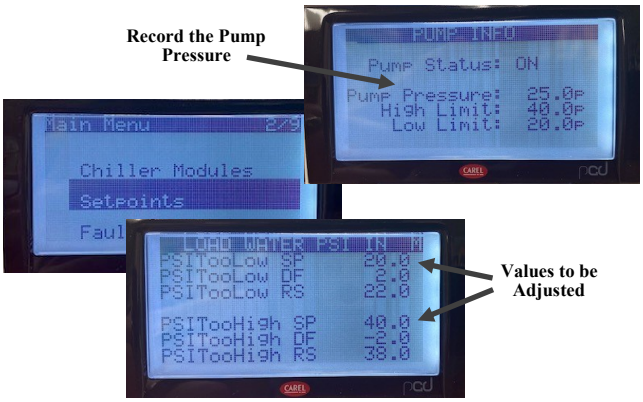
f. **Accessing the Chiller Setpoints Menu:**



- From the "Home Screen" page, press the "Target" button - once inside the main menu, select "Alarm Log." Enter 0010 as shown in the picture below and press enter to save. Once the current password has be entered, Select "Setpoints"

g. **Setting the Fluid Circuit Setter, Pump Pressure, and Tank Temperature:**

- **Setting the Fluid Out Circuit Setting** - Refer to the page 20 & 21 of this manual or contact the American GeoThermal Service Dept for assistance. Failing to complete this step will nullify the manufactures warranty.

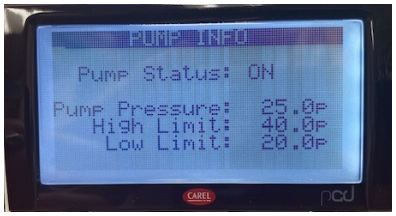


- **Setting the Pump Pressure** - From the "Home Screen" page, locate the pump info using the down arrow. Record the pump pressure displayed on the display - verify that the pump is in fact running via the over ride or the physical pump bypass switch.

- By pressing the "target" button, access the page shown below and select "setpoints." Using the down arrow key, locate the screen titled " Load Water PSI In"

- Adjust the "PSITooLow SP" and PSITooHigh SP" as shown by the arrows to 5 PSI Lower and 5 PSI Higher (respectively) than the actual "recorded pump pressure" from the pump info page.

- **When Should the Pump Pressure Set Points Be Adjusted??** Once the pump pressures are initially set during installation, they should never be adjusted unless the external installation conditions have changed i.e. the chiller has been moved to a different job site,



fluid lines have been changed, the chiller is being set up on a different size tank, etc... The "Pump Pressure Settings" play a vital roll in protecting the chiller from dynamic changes in site conditions. For example; if the fluid pressure gradually begins to drop, the y-strainer may require cleaning. Refer to the "Trouble Shooting" section of this manual if repetitive fluid pressure faults

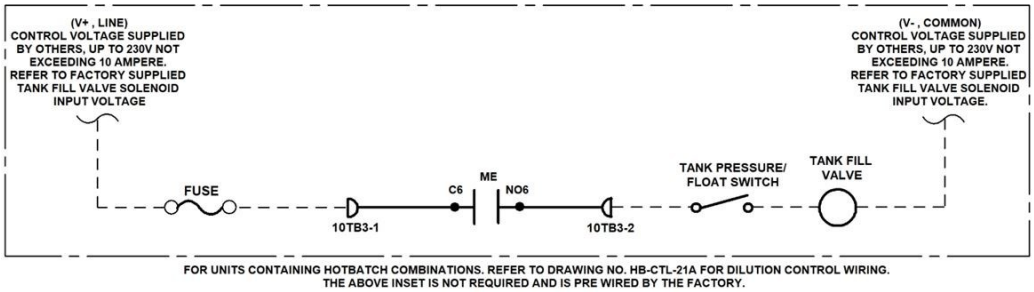


Figure 11, Total Fill Valve Control Wiring Diagram

are observed. Before adjusting any fluid pressure setpoints, contact the American GeoThermal Service Dept for assistance.

g. Adjusting the Tank Temperature Set Point: To adjust the tank temperature, simply return to the "Home Page" shown below and press the enter key. The curser will begin flashing to the right of "Tank SP," adjust the value to the desired temperature setpoint using the up and down arrow keys and press enter to save the value

h. **Auto vs Service Modes:** All chiller modules operate in two different modes - auto and service. Auto mode utilizes the master control to staging each module in such a way that optimizes motor staging to increase power efficiency. Compressor staging is set based on leaving water temperature and of course, a series of anti-short cycle timers (internal logic) to prevent repetitive cycles. Auto mode also utilizes a common fluid in temperature to determine the desired cut off limit (tank temp setpoint.) On the other hand, "service mode" should only be used in the case of component failure with in the master controls. ***Service mode should only be used with the consent of the American GeoThermal Service Dept - failing to ignore this statement will result in loss of manufactures warranty.***

i. Chiller Operation: Chiller Start Ups should only be done by a competent and qualified refrigeration technician or accompanied by an American GeoThermal Service Technician. All chiller modules should reside in the auto modes at all times unless otherwise advised by qualified person. Surrounding objects should be clear of the equipment and should not inhibit air flow in anyway - refer to the chiller installation and clearance diagram in figure 10 for installation guidelines. Turn the "Operation Switch" located on the master control box into the on position - the fluid pump should then begin flowing fluid throughout the fluid circuit. To confirm fluid flow, press the down arrow on the user interface and refer to the "PUMP INFO" page. The pump pressure should now be stabilized. The home page should also read "delay mode" in the lower left hand corner. Once the delay has been met, the indicator should then read ""cooling" and compressors should begin staging on.

TOTAL FILL VALVE CONTROL OPERATION AND APPLICATIONS:

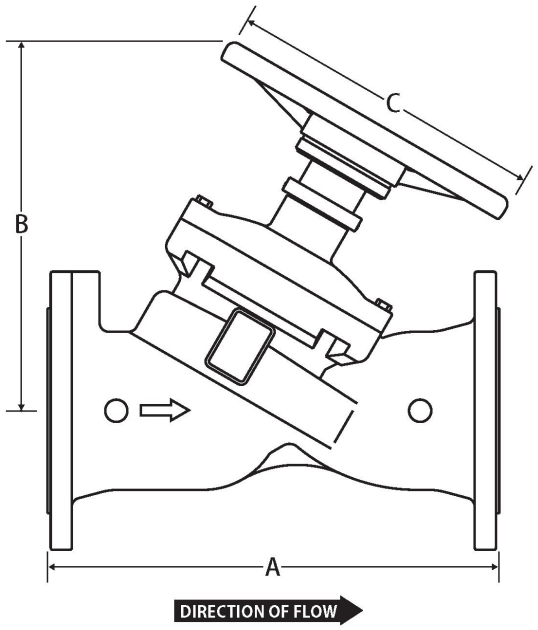
a) Overview and Operation: The Total Fill Valve Control (TFVC) formerly Dilution Control, allows the operator complete control over tank temperature and volume. APPLICABLE FOR INSTALLATIONS INCLUDING STORAGE TANKS THAT REQUIRE MAKE UP WATER ONLY . For example, when fluid is batched form the tank the volume removed is replace by some form of filling mechanism - typically a fill solenoid valve and a pressure or float switch. In turn, the tank temperature is affected in some way i.e. in cooling modes, tank temp increases. Due to this external heat load being introduced, the operator often has little control over the final temperature of the tank caused by the dilution . However in some instances, this mode of operation may not be acceptable and a different control method is required. American GeoThermal developed TFVC using state of the art temperature control software that allows the operator to set desired minimum and maximum tank temperatures for both cooling and heating modes. Once the minimum and maximum temperatures are set and the TFVC is activated, the fill solenoid valve will shut off regardless of the tank fill level to prevent dilution beyond desire. Refer to figure 11 and the electrical diagram section for more detail on field wiring the fill valve and control switch.

WARNING

DO NOT START UP EQUIPMENT WITHOUT SETTING THE FLOW BALANCING VALVE. INGNORING THIS WARNING WILL RESULT IN LOSS OF THE MANUFACTURES WARRANTY. IF EQUIPMENT IS MOVED AND EXTERNAL INSTALLATION CONDITIONS (i.e. pipe diameters, pipe length, vertical lift to the top of a tank) CHANGE, THE VALVE MUST BE RESET TO ACCOMIDATE FOR SUCH ENVIONMENTAL DIVERSITY.

PURPOSE AND DESIGN SCOPE OF THE VALVE

Circuit setters are used primarily for setting the desired flow rate of a hydronic system. In the case of chillers, heat exchangers have minimum and maximum flow rates that must be considered to prevent heat exchanger damage. Specifically, overflowing the heat exchanger will cause unwanted degradation of the construction material with in the component. On the other hand, underflowing the heat exchanger will result in the under performance of the equipment and in some instances, the desired tank temperature may not be met. For example if the flow rate is to low, the temperature change between the inlet and the outlet of the chiller will be to high. Similarly, if the flow rate is to high, the change in temperature will be to low in addition to, the velocity of the fluid can result in eroded materials.



Material Specifications

Part	Material
Body	Ductile Iron - ASTM A536
Bonnet	Ductile Iron - ASTM A536
Stem	410 Stainless Steel
Disc	EPDM Coated Ductile Iron - ASTM A536
Gland (2-1/2" - 6") (8" - 12")	Brass - C37700 Ductile Iron - ASTM A536
Stem Nut	Brass - C37700
Hand Wheel	Ductile Iron - ASTM A536
Test Valve	Brass - C35330
Orifice Insert	Brass - C37700
Packing	PTFE / EPDM

SHPPING STATE OF THE VAVLE

Valves are nominally set for the appropriate chiller size. However because of variance in installations, the start up technician must fine tune the valve for the specific piping installation. Do not assume the installed valve is operation ready.

SET UP OF THE FLOW BALANCING VALVE

Once the sections A-F have been completed in the start up section of this manual, set up of the valve can then be accomplished. Unexperienced personnel should never attempt these tasks as damage to the equipment can occur if preformed incorrectly.

1. Locate the “OPERATION” switch located on the first module and turn the switch into “PUMP” mode. Note: This is master module that contains the pump. The pump should begin circulating water though the chiller.
2. Turn all chiller modules in to the “SERVICE MODE.” Wait a brief period where the short cycle timers will begin counting down, the compressors will begin turning on. Verify that all compressors are running. Allow the chiller stabilize where its temperature differential becomes constant - this should take about 5-6 mins.
3. Located screen on the first module - under the sheet meal cover containing the hinge. While looking at the “HOME PAGE” locate the two values “Tank Temperature” & “Water Out Temperature”
4. Subtract the Water Our Temperature from the Tank Temperature, this will give a differential value. The goal is to set the circuit setter to achieve a 4 degree drop between the Tank Temperature and the Water out Temp. This can be achieved by turning the handle located on the circuit setter.

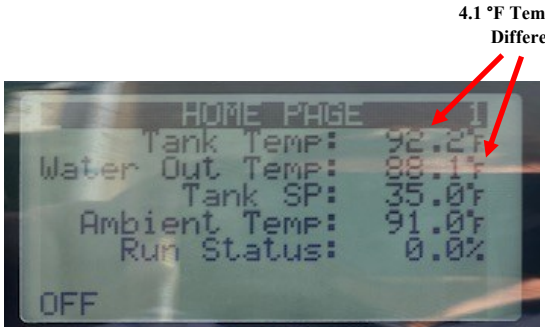
Fluid Return Circuit Setter - Flow Balancing Valve Set Up Cont.

5. Loosen the two Allen set screws located on the shaft of the valve—this is just below the handle. Refer to the figure to the right for set screw locations.
6. Turn the handle counterclockwise to decrease the temperature difference and clockwise to increase the temperature difference. Start by making one revolution at a time while waiting 3 mins. between adjustments. Check the temperature difference on the screen before adjusting again. Repeat step 6 until the 4 degree differential is achieved.

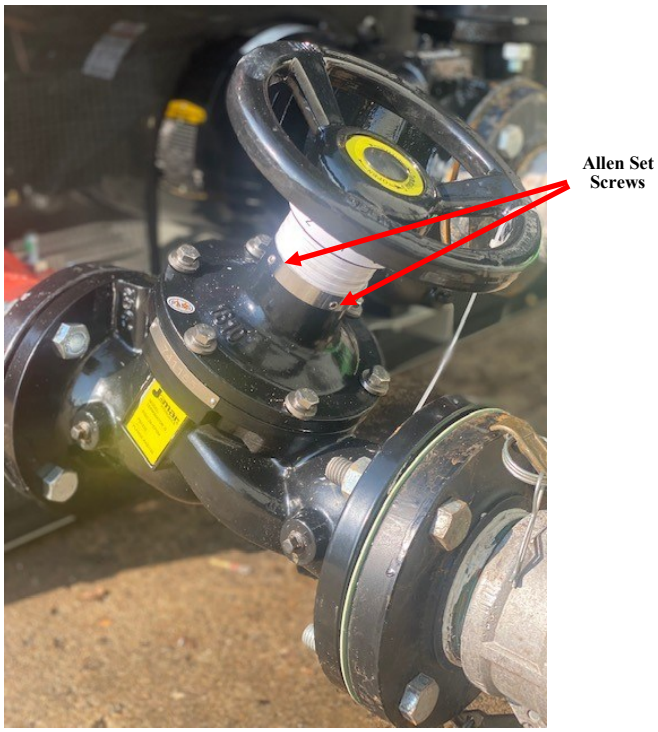
   THE VALVE IS ALL 100% OPEN AND THE TEMPERURE DROP IS GREATER THAN 4 DEGREES??? In some instances this may be the case and there are many factors of this result. First double check all valves are wide open - i.e. valves installed on the fluid holding tank. Ensure that hoses are not kinked or restricted in any way. Check the cleanliness of the Y-strainer. Note: If your fluid system does not have a Y-strainer, the factory warranty will be nullified. Refer back to the installation checklist on page 2.
7. Once the 4 degree differential is achieved, tighten the circuit setter set screws so that vibrations in the equipment don't cause the valve to change position.
8. Turn all OPERATION SWITCHS back into the OFF position, including the pump switch. All motors will begin cycling off.

NOTE: DON'T FORGET TO GO BACK AND COMPLETE PART "G" IN THE START UP SECTION.

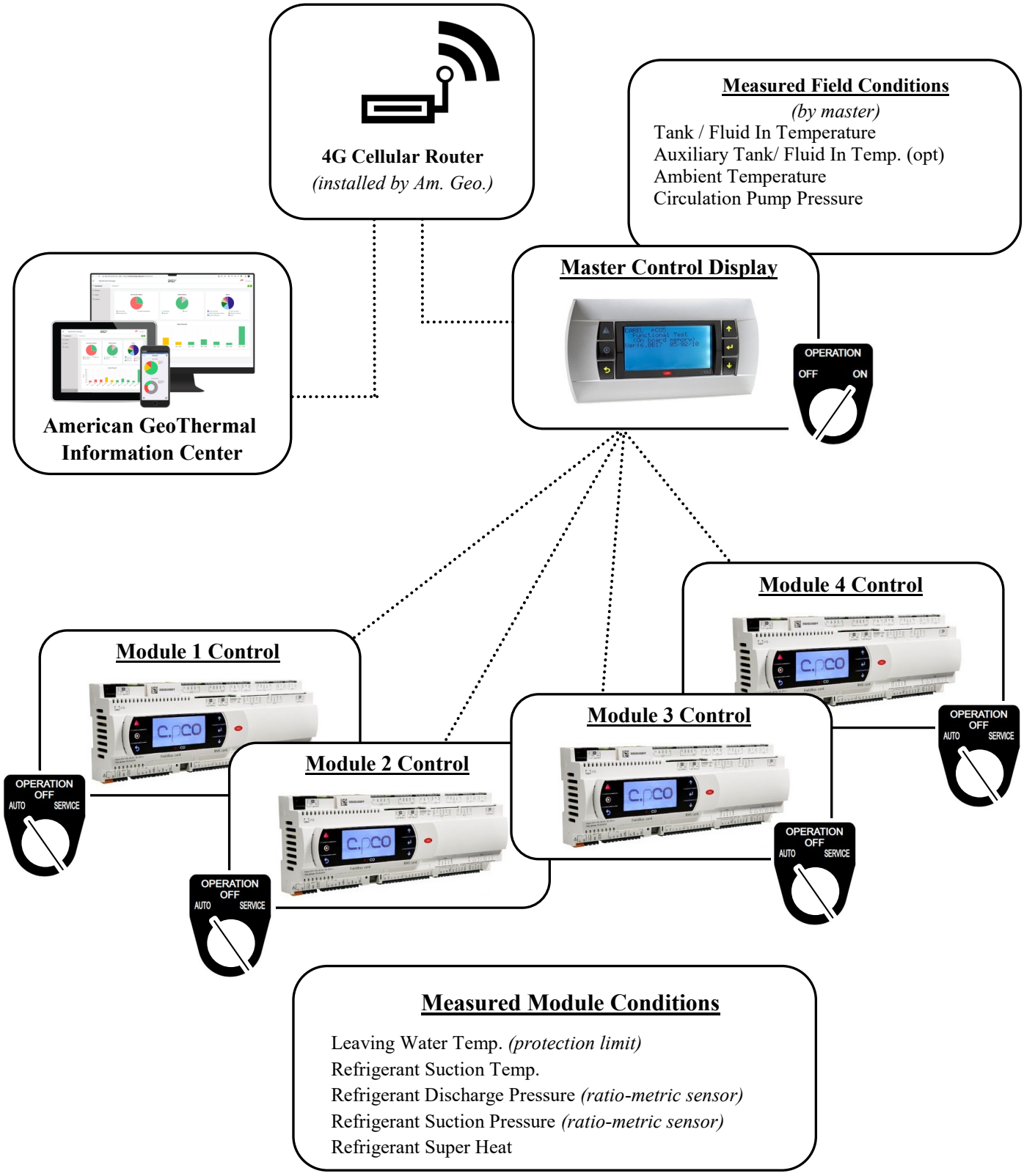
FOR FURTHER ASSISTANCE, CONTACT AMERICAN GEOTHERMAL!

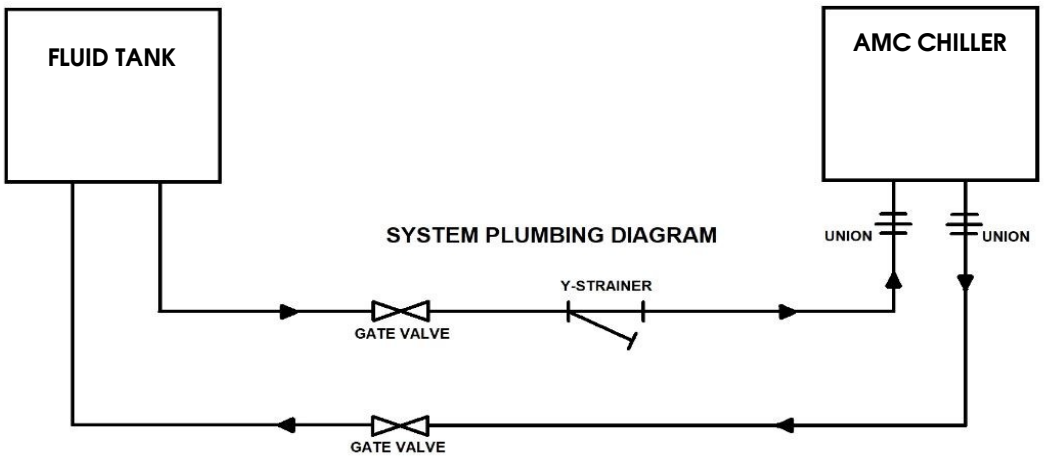


NOTE: The temperature differential can be ± 0.5 °F



Equipment Operation and Controls Overview Cont.





MINIMUM PLUMBING REQUIREMENTS FOR INSTALLATIONS THAT REQUIRE BUFFER OR STORAGE TANKS.

SYSTEM PLUMBING DETAILS AND NOTES

All plumbing connections should be made with consideration to local codes and industry standards. To reduce line loss, all plumbing should be insulated with adequate thermal resistance ratings *(R-values)* and with respect to application conditions. Before connecting the AMC chiller to an existing tank or fluid loop, the system should be flushed to remove sediment and other accumulation. Chillers should not be connected to water loops with questionable accumulation. All plumbing connections should be equip with unions easy servicing and y-strainers for evaporator protection. Note, failing to install a y-strainer on the entering fluid line of the chiller will result in the loss of the factory warranty. All strainers should contain at minimum a 30 mesh count and must be serviced biannually or quarterly if water conditions are harsh. Fluid lines should be flushed for 6 hours without any residue or build up in the strainer. If build up is observed, continue flushing until conditions are ideal. Detergents and cleaners should never be circulated through the heat exchangers unless instructed by American GeoThermal.

WATER TREATMENT REQUIREMENTS

Water supplies should meet the following requirements;

a) pH should be greater than 7 and less than 9

b) Total Dissolved Solids (TDS) must be less than 1000 ppm

c) Hardness as CaCO3 should be between 30 and 500 ppm

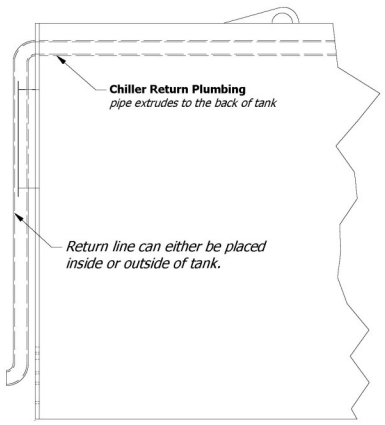
d) Alkalinity as CaCO3 should be between 30 and 500 ppm

e) Chlorides to be less than 200 ppm

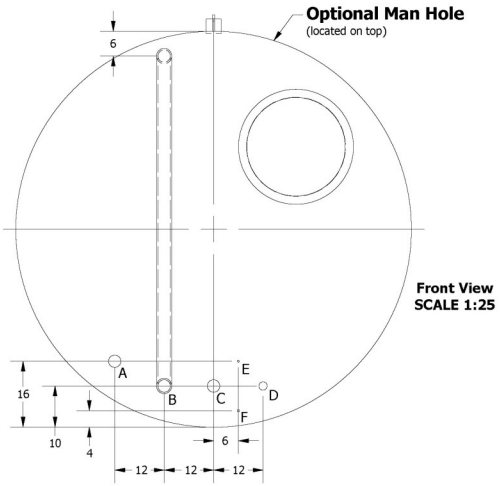
f) Sulfates to be less than 200 ppm

Note, some water treatment requirements may be ignored with the consent of American GeoThermal and the use of the no clog type heat exchanger.

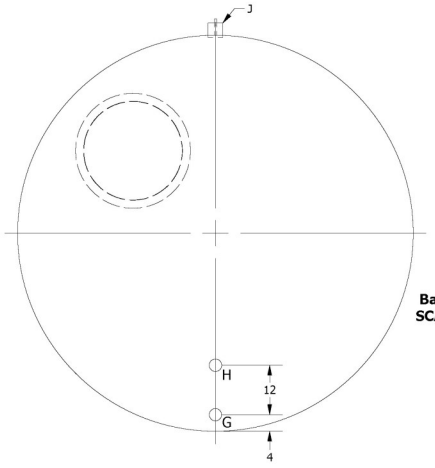
Horizontal Buffer/Storage Tank Layout



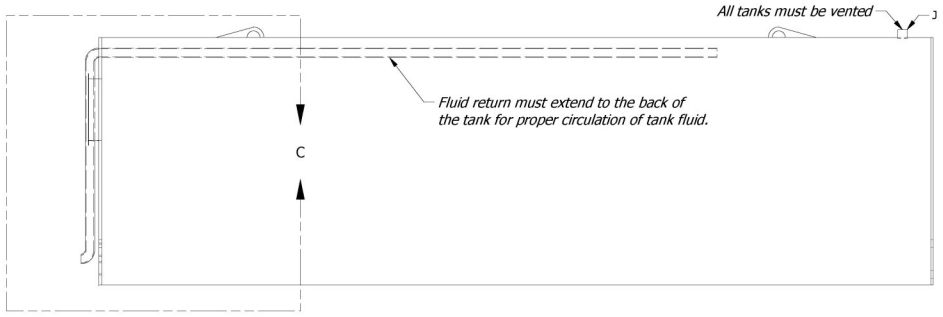
DETAIL C
SCALE 1:25



Front View
SCALE 1:25



Back View
SCALE 1:25



Right Side View
SCALE 1:40

Notes:
1. Tank vent should remain unrestricted and open at all times.
   Vent size should be equal to the area of all batch connections.

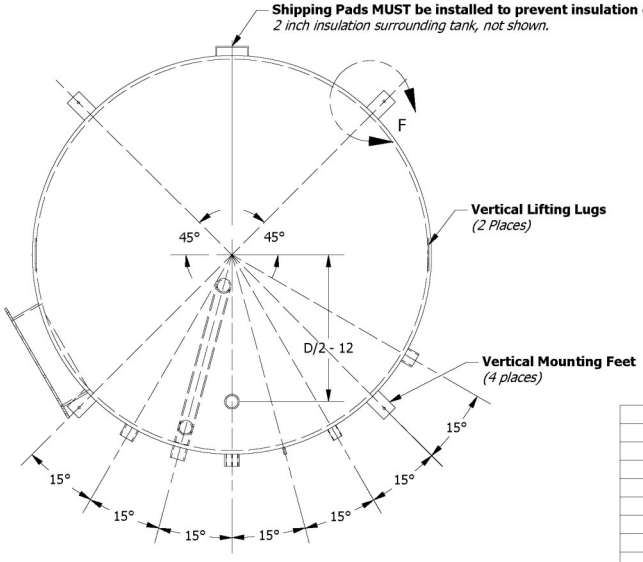
TABLE 1		
Item	Size	Dec.
A	3"	Batch Connection
B	Refer to Table 2	Chiller Return
C	Refer to Table 2	Chiller Suction
D	2"	Tank Fill Connection
E	1/2"	Dil. Control (gauge)
F	1/2"	Tank Temp. Connection
G	3'	Tank Drain
H	3"	Recirculation Return
J	Note 1	Vent
K	2-1/2"	High Limit Switch Connection (opt)

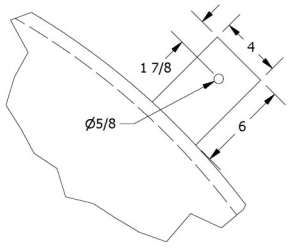
TABLE 2		
(B) Suction Size	(C) Return Sizes	Nominal Unit Size
1-1/2	1-1/2	6,10
2	2	15, 20,30 Ton
3	3	40, 50, 60 Ton
4	4	70, 80,90, Ton
4	4	100, 110, 120 Ton

Vertical Buffer/Storage Tank Layout

Notes:
1. Tank vent should remain unrestricted and open at all times.
   Vent size should be equal to the area of all batch connections.

Vertical Tank Top View
SCALE 1:30

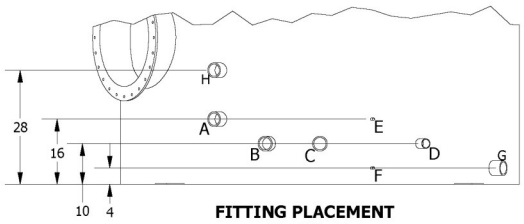




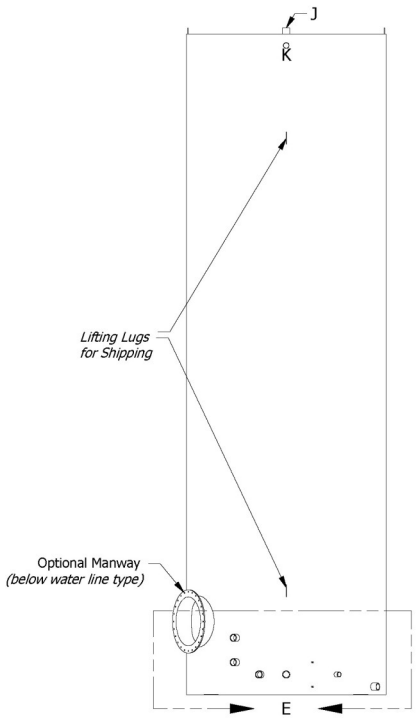
VERTICAL MOUNTING FOOT
(4 PLACES)
DETAIL F
SCALE 1:8

TABLE 1		
Item	Size	Dec.
A	3"	Batch Connection
B	Refer to Table 2	Chiller Return
C	Refer to Table 2	Chiller Suction
D	2"	Tank Fill Connection
E	1/2"	Dil. Control (gauge)
F	1/2"	Tank Temp. Connection
G	3'	Tank Drain
H	3"	Recirculation Return
J	Note 1	Vent
K	2-1/2"	High Limit Switch Connection (opt)

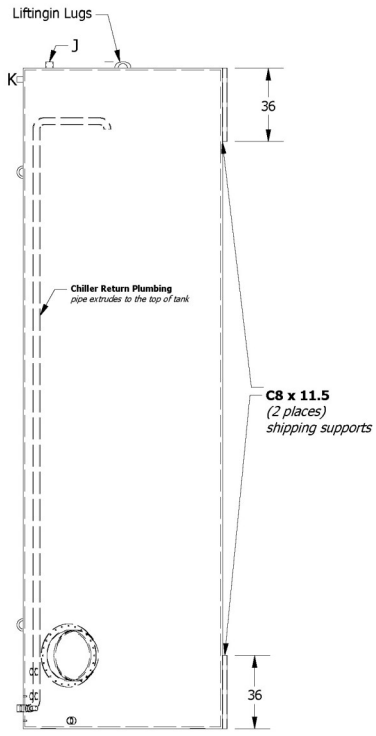
TABLE 2, MINIMUM CONNECTION SIZES		
(B) Suction Size	(C) Return Sizes	Nominal Unit Size
1-1/2	1-1/2	6,10
2	2	15, 20,30 Ton
3	3	40, 50, 60, Ton
4	4	70, 80,90, Ton
4	4	100, 110, 120



FITTING PLACEMENT
DETAIL E
SCALE 1:30



Verical Tank Front View
SCALE 1:60



Vertical Tank Right Side View
SCALE 1:60

1. **Determining the Minimum Current Ampacity (MCA),** NOTE: The data in Table-1 & 2 can be used for MCA and MOP if the equipment is standard with no variations, i.e. additional process pump wired to the chiller. Additional pumps will increase power consumption and will nullify the data on table 1 & 2. **When available, refer to the equipment data specification sheet** (this will be located on the outside of every module is field wiring independently or on the first module within a bank that contains single point elec. connections.
2. Refer to Table 2. Consider the Minimum Circuit Ampacity (MCA) to determine the appropriate wire size.

Table 3- Wiring Sizing Specifications

(Applicable codes may require different wire sizing)

MCA	3 Conductors (1 raceway)	6 Conductors (1 raceway)
65	6	-
85	4	-
100	3	-
115	2	-
130	1	-
150	1/0	-
175	2/0	-
200	3/0	-
230	4/0	-
255	250 MCM	-
285	300 MCM	1/0
300	-	2/0

NOTES:

A. All fuses should follow UL 248-12 which indicates that all fuses should be class R rated for either, 250V or 600V and current ratings under 600 Ampere.

B. If the wire pull exceeds 100 ft. Table 3 shall not be used to select wire. Proper voltage drop calculation should be considered and the wire size must be adjusted per the adjusted ampere rating.

Field Connections and Installations:
There are two main electrical field connections that must be made.

(1) **Tank Temperature Sensor.** Connect the factory supplied tank temperature sensor into the fluid tank. (if applicable)

(2) Customer Interlock. Connect a 2 wire cable to an external start stop relay for remote operations. Refer to wiring diagram for additional details (optional)

(3) Flow Switch. Connect a 2 wire cable to a field supplied/installed flow switch. Refer to unit wiring diagram for additional details. (if applicable)

(4) Total Fill Valve Control. For applications that require storage tanks with process water connections and make up fill water only. Refer to system wiring diagram for additional details. (if applicable)

(5) **The high voltage line connection.** 230-460/3ph/60hz input voltages, refer to the unit data sheet for MCA and MOP, determine the minimum wire size using Table 3.

System Service and Maintenance Periods

Service Periods	Monthly	Biannually	Annually	As Needed
Check wiring connections and torque per the device specification		X		
Check Victaulic and plumbing connections for fluid leaks		X		
Clean fluid y-strainer	X			X
Check fluid quality, refer to the "system plumbing details" section of this manual for more details on fluid quality.		X		
Check superheat reading (8-12°F)			X	
Clean condensers	X			X
Clean condenser filters	X			X
Check for blockages on fan motors, dust should be free of all fan blades without accumulation.		X		
Fill out service log	X			

Check Victaulic Connections for Leaks

Clean Condenser Filters

User Interface to Fill Out the Service Schedule

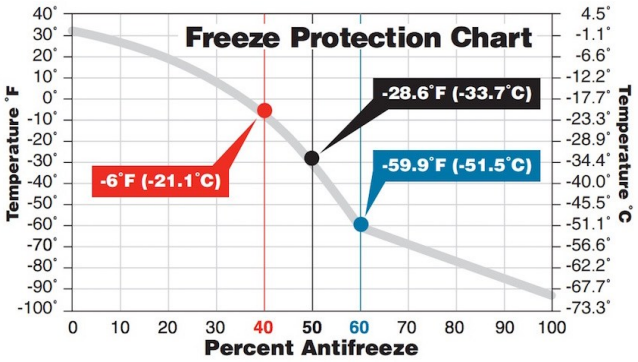
Torque Specifications for Various Electrical	
Device Code	**Torque Spec. (in lbs.)**
Carel Controller	5.3
CB1 *(20 Ton Module)*	35
CB1 & CB2 Mains *(30 Ton Module)*	18
CB1 & CB2 Aux. 1	11
CB3 & CB4	12
CC1 *(20 Ton Module)*	35.4
CC1 & CC2 *(30 Ton Module)*	22
CC1 & CC2 Coils	11
CC1 & CC2 Aux. 1	11
CB0 (large lug)	62
CB0 (small distribution lugs)	15
CB5 & CB6	17.5
TR1 & TR2	20
CP1 & CP2 (main lugs)	24
CP1 & CP2 (ground lug)	12

System Service and Maintenance Periods Cont.

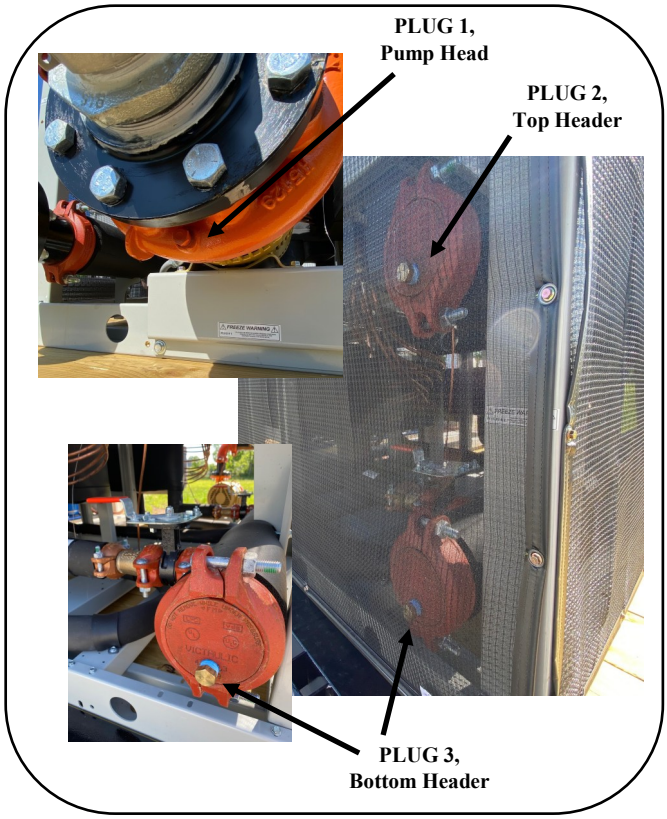
Service Schedule *(record data monthly)*								
Date	**Ambient Temperature (°F)**	**Tank Temperature (°F)**	**Fluid Out Temperature (°F)**	**Module Readings**				
				Suction Pressure	**Discharge Pressure**	**Superheat (at compressor)**	**Compressor A Ampere Reading**	**Compressor B Ampere Reading**

EQUIPMENT WINTERIZATION PROCEDURE

1. Isolate the chiller from the tank using the gate valves shown in plumbing diagram on the previous page and completely drain the fluid plumbing by removing the factory installed plugs. There are a total of 3 plugs, plug 1 is located on the head of the pump and plugs 2 & 3 are located on the opposite end of the chiller on the header caps.
2. Once the chiller has completely drained, unhook the fluid circulation lines from the chiller inlet and outlet.
3. Place a submersible pump into a container and fill with an appropriate blend of antifreeze and water to protect against the desired ambient temperature. Connect the submersible pump to the bottom header drain (plug 3 location) and a second line extending from the container to the top header drain (plug 2 location.) *Replace the plug on the pump head before circulating the fluid mixture.*

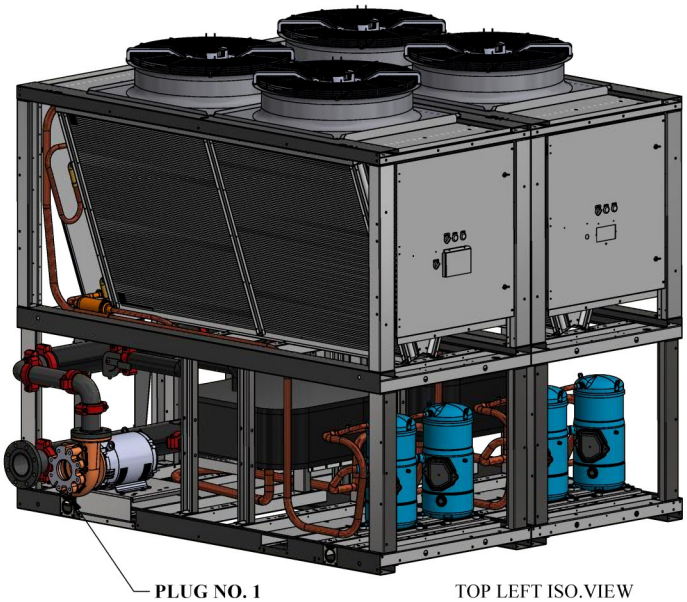


4. When the pump begins displacing the fluid from the container, continue to refill until the antifreeze mixture circulates back to the container or until the pump can run with out gulping air. Allow the mixture to circulate for 5 to 10 mins.
5. Test the newly circulated mixture with an antifreeze hydrometer to ensure protection. Add antifreeze if needed and continue circulating to hit the desired protection level.
6. Once the proper concentration is achieved, allow the mixture to drain back into a storage tank and place caps on the chiller connections. Lastly, close all valves to prevent anything from entering the fluid circuit.



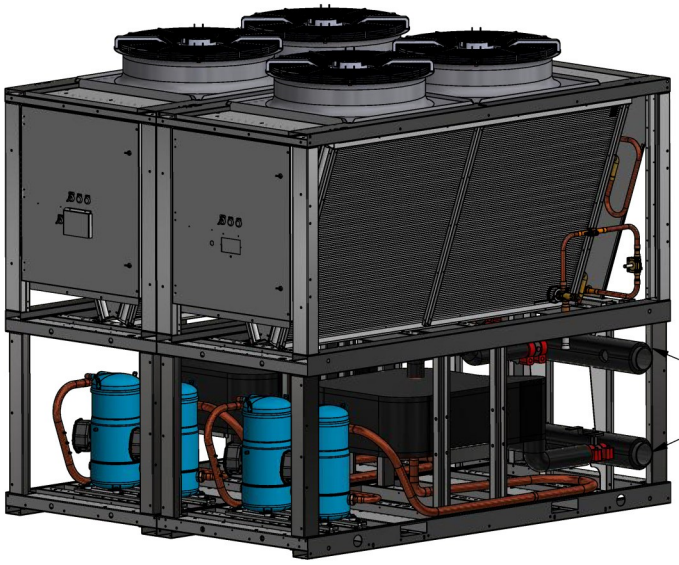
CAUTION

ALL UNIT SIZES *(20-120 TONS)* ARE COMPLETELY DRAINABLE. A TOTAL OF THREE PLUG MUST BE REMOVED TO ALLOW THE FLUID CIRCUIT TO FULLY DRAIN. FOR ADDITIONAL INFORMATION AND A COMPLETE WINTERIZING PROCEDURE, REFER TO THE WINTERIZING SECTION OF THIS EQUIPMENT MANUAL. *(FAILING TO FOLLOW THIS CAUTION CAN RESULT DAMAGE TO THE EVAPORATOR COIL OR FLUID PIPING AND WILL NOT BE COVERED BY THE FACTORY WARRANTY.)*



PLUG NO. 1
Located on the bottom of the fluid circulation pump.

TOP LEFT ISO.VIEW
SCALE 1:30



PLUG NO. 2 & 3
Located at the end of each main header pipe.

TOP RIGHT ISO.VIEW
SCALE 1:30

Warranty and Liability Clause

The warranty is extended by American Geothermal Inc. and applies to all commercial equipment and related accessories unless otherwise stated.

The Company warrants for a period of 12 months from initial start-up or 15 months from date of shipment, whichever is less, that the Company products covered by this order (1) are free from defects in material and workmanship and (2) have the capacities and ratings set forth in the Company's catalogs and bulletins, provided that no warranty is made against corrosion, erosion, or deterioration. The Company's obligations and liabilities under this warranty are limited to furnishing f.o.b. factory or warehouse at Company designated shipping point, freight allowed to Buyer's city (or port of export for shipment outside the conterminous Unites States) replacement equipment (or at the option of the Company parts therefore) for all Company products not conforming to this warranty and which have been returned to the manufacturer. The Company shall not be obligated to pay for the cost of lost refrigerant. No liability whatever shall attach to the Company until said products have been paid for and then said liability shall be limited to the purchase price of the equipment shown to be defective.

The Company make certain further warranty protection available on an optional extra-cost basis. Any further warranty must be in writing, signed by an officer of the Company.

The warranty and liability set forth herein are in lieu of all other warranties and liabilities, whether in contract or in negligence, express or implied, in law or in fact, including implied warranties of merchantability and fitness for particular use. In no event shall the Company be liable for any incidental or consequential damages.

THE WARRANTY AND LIABILITY SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRATIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR USE, IN NO EVENT SHALL WARRANTOR BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

AMERICAN GEOTHERMAL

1037 Old Salem Road Murfreesboro, TN 37127
Phone: 615-890-6985
info@amgeo.com
www.amgeo.com