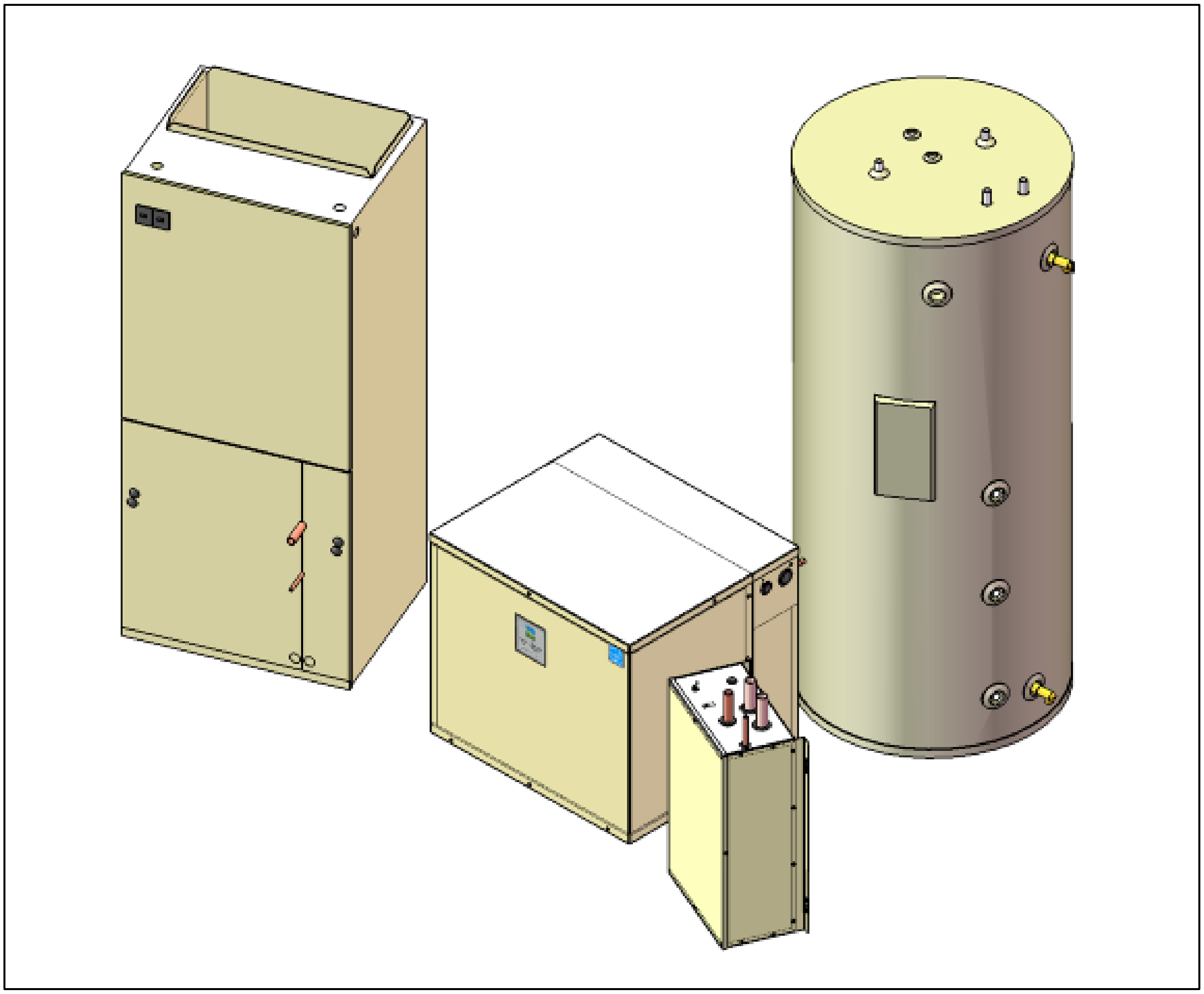
Classic Series

SC(A) Geothermal Heating and Cooling System

Quick-Start Instructions

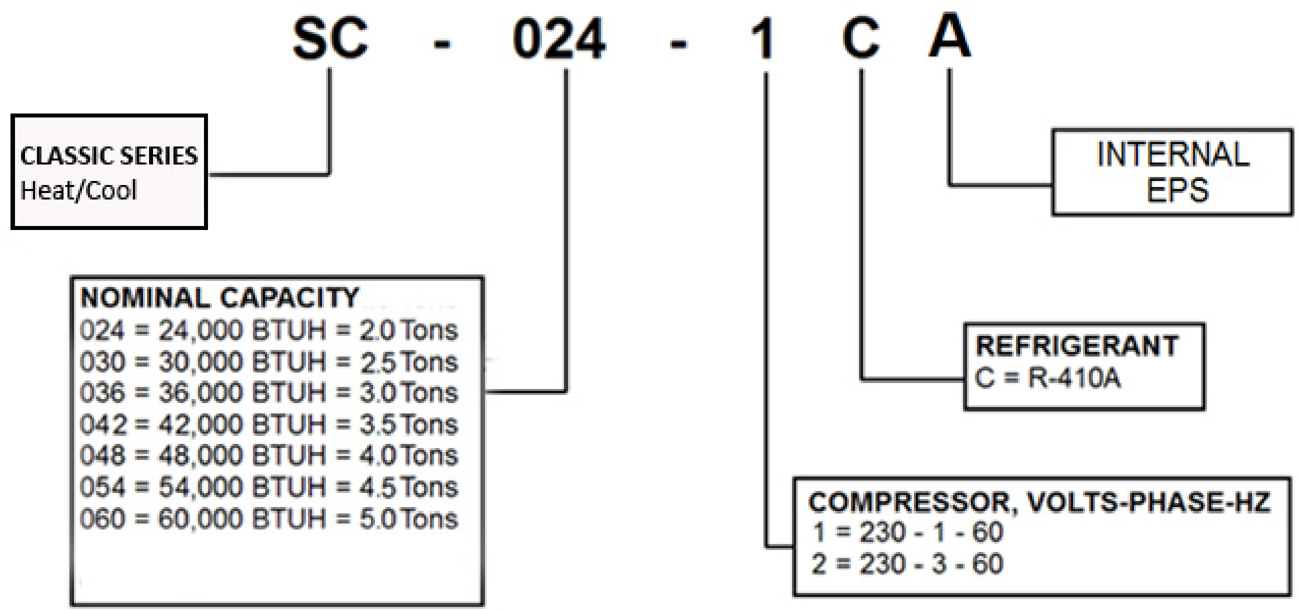


SC-410-QS(A) (06/15)

Table of Contents

List of Figures

Model Nomenclature



Disclaimer

Proper installation and servicing of the EarthLinked® Heat Pump is essential to its reliable performance. All EarthLinked® systems must be installed and serviced by a technician authorized by Earthlinked Technologies. Installation and service must be made in accordance with the instructions set forth in this manual. Failure to provide installation and service by an ETI authorized installer in a manner consistent with this manual will void and nullify the limited warranty coverage for the system.

Earthlinked Technologies shall not be liable for any defect, unsatisfactory performance, damage or loss, whether direct or consequential, relative to the design, manufacture, construction, application or installation of the field specified components.

C ETL LISTED US
Intertek
9900346

ETL LISTED
CONFORMS TO
UL STD 1995
US CERTIFIED TO CAN/CSA
STD C22.2 NO. 236-05

COMPLIES WITH
IEC 60204-1
IEC 60335-2-40
IEC 61000-3-11

Earthlinked Technologies, Inc.
4151 South Pipkin Road
Lakeland, Florida 33811
tel. 863-701-0096 ● fax 863-701-7796
info@earthlinked.com ● www.earthlinked.com

CSI # 23 80 00

Safety

Warning, Caution and Important notices appear throughout the manual. Read these items carefully before attempting installation, servicing or troubleshooting the equipment.

IMPORTANT!

Notification of installation, operation or maintenance information which is important, but which is not hazardous.

WARNING!

Indicates a hazardous situation, which if not avoided will result in serious injury or death, or equipment or property damage.

CAUTION!

Indicates a potentially hazardous situation or an unsafe practice, which if not avoided, may result in injury, or equipment or property damage.

Equipment Manuals

The following is a listing of the equipment installation manuals that are provided with each component specified for this EarthLinked® system.

IMPORTANT!

Read and follow all installation instructions in these manuals, appropriate for the EarthLinked® system being installed, BEFORE initiating the Start-Up procedure.

Series SV Service Valve and ADK Adapter Kit

Series AVS Air Handler

Series CCS Cased Coil

Model HRM-1872 Heat Recovery Module

Series HWM Hydronic Water Module

Series PW1 Pump Wire Kit

Series HCM Hybrid Cooling Module

Series GSTE Storage Water Heater

Series GST Storage Water Tank

Model HHK/CWK-1872 Temperature Control Kit

DIRECT AXXESS® Earth Loop Specification and Installation Manual

SureStart Manual

Earth Loop Protection Kit Installation Manual

Installation

Component Matching

Upon receipt of the equipment, carefully check the component model numbers by referencing Figure 1, to ensure that all components of the system match.

HEAT/COOL Applications							
Compress. Unit[1]	Air Handler[3] Var. Speed	Cased[3] Coil	TXV Kit Model[4]	Hydronic Water Module	Heat Recovery Module	Hybrid Cooling Module[3]	Earth Loop[2]
-024	AVS-0030-A	CCS-0036-A	TXV-2430CE	HWM-024C	HRM-1872	HCM-1836C	-024-C
-030	AVS-0036-A	CCS-0036-A	TXV-2430CE	HWM-030C	HRM-1872		-030-C
-036	AVS-0048-A	CCS-0048-A	TXV-3672CE	HWM-036C	HRM-1872		-036-C
-042	AVS-0048-A	CCS-0048-A	TXV-3672CE	HWM-042C	HRM-1872		-042-C
-048	AVS-0060-A	CCS-0060-A	TXV-3672CE	HWM-048C	HRM-1872	HCM-4272C	-048-C
-054	AVS-0060-A	CCS-0060-A	TXV-3672CE	HWM-054C	HRM-1872		-060-C
-060	AVS-0060-A	CCS-0060-A	TXV-3672CE	HWM-060C	HRM-1872		-060-C

1.Contained in each compressor package:
- compressor unit
- four L-shaped hold down brackets
- service valves-liquid and vapor
- adapters for service valves and earth loop line set
- product literature

2. All series Earth Loops
3. All air handlers and cased coils are delivered vertical, field convertible to horizontal. Electric heat is ordered separately and field installed.
4. TXV Kits are ordered separately and field installed.

Figure 1. Matching Component Model Numbers

Warning!

WEAR ADEQUATE PROTECTIVE CLOTHING AND PRACTICE ALL APPLICABLE SAFETEY PRECAUTIONS WHILE INSTALLING THIS EQUIPMENT. FAILURE TO DO SO MAY RESULT IN EQUIPMENT AND/OR PROPERTY DAMAGE. PERSONAL INJURY OR DEATH.

Guidelines for the general layout of the system components are shown in Figure 2. Before placing the compressor unit (outside or indoors), review the guidelines in Figure 2.

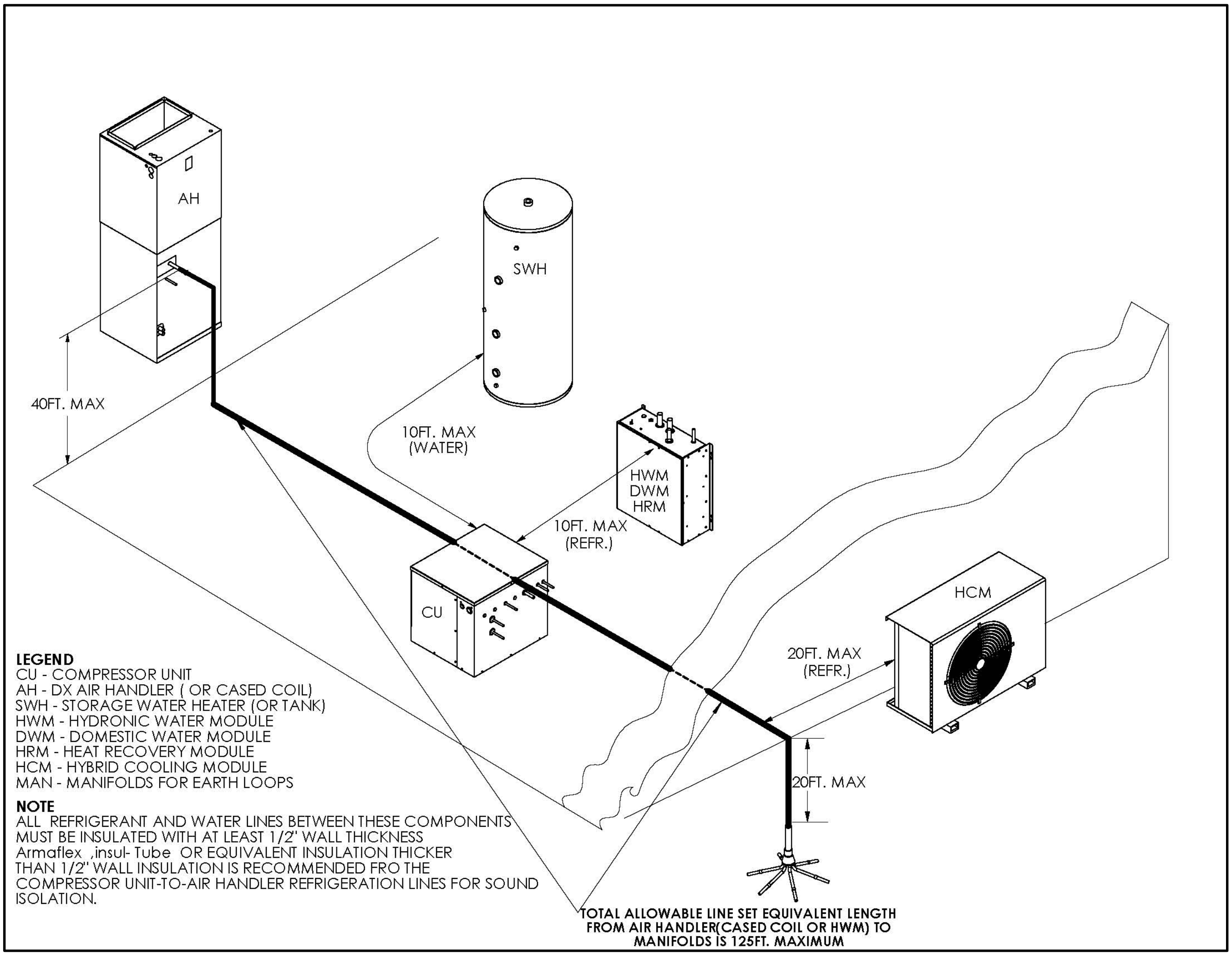


Figure 2. General Layout of System Components

Compressor Unit Placement

- EarthLinked® compressor units may be located inside or outside. If outside, place compressor unit on a standard HVAC outdoor unit pad. If inside, place it on a level, hard surface. If the compressor unit is to be fastened down, see Figure 3 for bracket installation.
- Avoid placing the compressor unit in or near the living area of the residence.
- Attic installations must include a condensate pan with drain, and suspension from rafters with suspension isolators.
- Clearance around the unit for service is illustrated in Figure 4. However, local codes and applicable regulations take precedence.
- If the compressor unit is located inside, allow 40 cubic feet of unrestricted space per ton of nominal system capacity, around the compressor unit, consistent with the acceptable refrigerant concentration limit (RCL) per ASHRAE Standards 15-2010 and 34-2010.

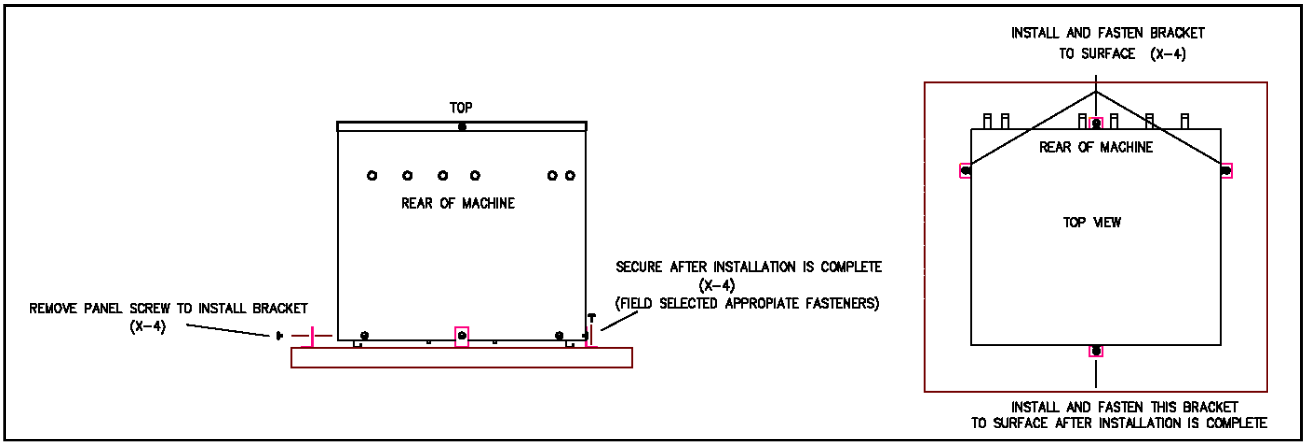


Figure 3. Compressor Unit Bracket Installation

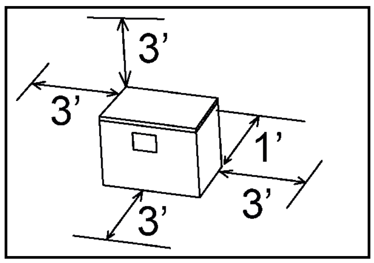


Figure 4. Compressor Unit Clearance

Placement instructions for other pieces of equipment that make up the EarthLinked® System are included with those pieces of equipment and are listed in this manual under **Equipment Manuals.**

Refrigeration

After the EarthLinked® compressor unit and other system components are placed, the refrigeration system tubing is run from the compressor unit to the other components, as appropriate. Figure 5 illustrates the refrigeration and electrical connection points for the SC(A) compressor unit.

IMPORTANT!

EarthLinked® compressor units that provide space cooling shall be equipped with an EarthLinked® Hybrid Cooling Module (HCM) when:

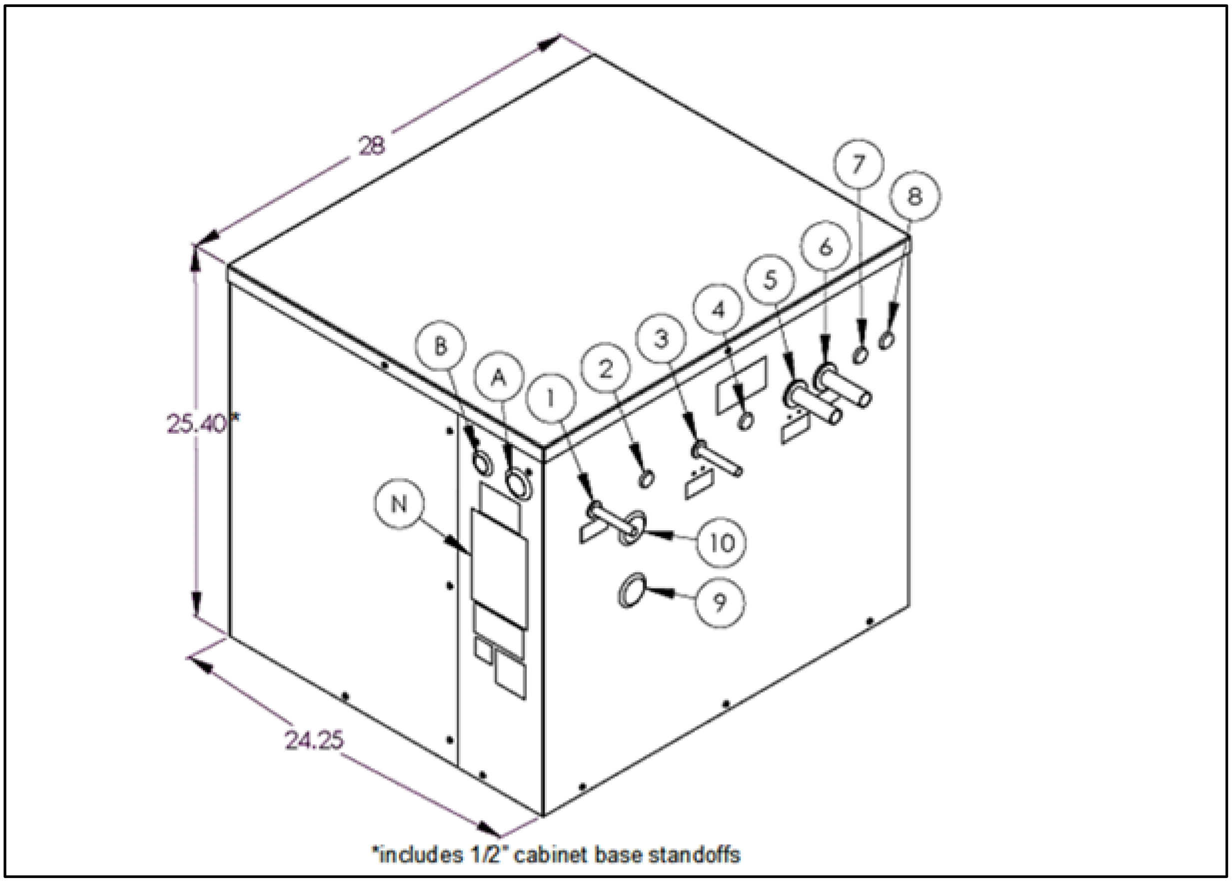
(1) Required by the performance tables OR where BOTH of the following circumstances occur:

(2) Ambient outdoor temperatures have exceeded the outdoor summer design temperature conditions for a continuous system run time of at least 7 hours, coupled with the conditions described in (3).

(3) Low thermal conductivity soils that do not effectively absorb and dissipate heat. Examples of such soils are light dry soil or dry sand, peat and organic soils dry clay soils and hardpan.

ALSO

EarthLinked® compressor units that provide space heating shall be equipped with a Heating Performance Enhancement (HPE) when required by the performance tables.



PORT	FUNCTION	TYPE OF CONNECTION	COMPRESSOR UNIT MODEL CONNECTION SIZE, INCHES						
			-024	-030	-036	-042	-048	-054	-060
A[1]	Electrical, Power	1-1/4" Hole	1	1	1	1	1	1	1
B[1,2]	Electrical, Control	7/8" Hole	3/4	3/4	3/4	3/4	3/4	3/4	3/4
1	AH/CC/HWM Liquid	Braze	1/2	1/2	1/2	1/2	1/2	1/2	1/2
2	Plugged	---	---	---	---	---	---	---	---
3	EL Liquid*	Braze	3/8	3/8	1/2	1/2	1/2	1/2	1/2
4	Anode Socket	--	---	---	---	---	---	---	---
5	EL Vapor*	Braze	5/8	3/4	3/4	3/4	7/8	7/8	7/8
6	AH/CC/HWM Vapor	Braze	3/4	3/4	3/4	7/8	7/8	7/8	7/8
7	Plugged	----	----	----	----	----	----	----	----
8	Plugged	----	----	----	----	----	----	----	----
9	Plugged	----	----	----	----	----	----	----	----
10	Plugged	----	----	----	----	----	----	----	----

N = Nameplate and other information
1: Nominal electrical connector sizes
2: Two additional electrical control ports on opposite side. Same size
*Line set sizes with provided compressor unit adapters

LEGEND
AH – Air Handler
CC – Cased Coil
EL – Earth Loop
HWM – Hydronic Water Module
DWM – Domestic Water Module
HWT – Hydronic Water Tank
DWT – Domestic Water Tank

Figure 5. SC(A) Connections

Compressor units are shipped from the factory with a low pressure nitrogen holding charge. Carefully relieve the holding charge when the compressor unit is being prepared to connect refrigerant system piping.

Caution!

This compressor unit is equipped with POE lubricant. POE lubricant absorbs significant amounts of moisture from the air very rapidly. Exposure of the POE lubricant to air must be minimized. Even a few minutes of exposure to air can be harmful to the system.

After the initial nitrogen holding charge has been released from the compressor unit, it is critical that air not be allowed to enter the compressor unit during the process of preparing compressor unit refrigerant connections (tube cutting, deburring, cleaning, brazing, etc).

To ensure air does not enter the compressor unit while preparing refrigerant connections, "trickle" dry nitrogen through the compressor unit, entering at the access port nearest the Active Charge Control (ACC), to keep airborne moisture out of the compressor unit and the POE lubricant.

Complete preparing and brazing all compressor unit refrigerant connections at one setting to minimize exposure of open connections to air. Failure to implement the above precautions will result in an extended period of time to effectively evacuate the system, and may adversely affect system performance and cause system failure.

Caution!

REFRIGERANT PIPING CONNECTIONS

Refrigerant joints are to be brazed with 15% silver content brazing alloy, utilizing the NITROGEN BRAZING PROCESS.

NITROGEN BRAZING PROCESS

PURPOSE:
Utilize the NITROGEN BRAZING PROCESS on all brazed refrigerant piping connections. This process eliminates oxidation products from inside joint surfaces.

TECHNIQUE:
"Trickle" nitrogen gas at 1-2 psi pressure through the joint area being brazed, to displace the oxygen. When oxygen has been displaced, turn off the nitrogen, and relieve the pressure at the joint to atmospheric prior to brazing.

CONSEQUENCES:
Failure to displace oxygen with nitrogen at the brazed joint will result in particulate matter being released into the system. The result is discoloration of refrigerant oil, contamination of the system and possible system failure.

The compressor unit package contains a service valve kit and an adapter kit. **The two service valves are to be installed on the earth loop vapor and liquid connections of the compressor unit,** using the adapters to right-size to the proper earth loop line set.

Installation of the service valves will provide isolation of the earth loop system from the compressor unit and provide easy access to the refrigerant system.

For the installation of system components requiring refrigeration connections, refer to Figure 6 for line set sizes and the appropriate installation manual(s) following Figure 6.

LINE SET ADAPTERS REQUIRED FOR THE AIR HANDLER, CASED COIL, HYDROINIC WATER MODULE AND DOMESTIC WATER MODULE ARE FIELD SUPPLIED. CHECK ALL APPROPRIATE COMPRESSOR UNIT STUB-OUT TUBING SIZES FOR REQUIRED FIELD SUPPLIED ADAPTERS!

EARTHLOOP, AIR HANDLER, CASED COIL LINE SETS			HWM LINE SETS		
COMPRESSOR UNIT SIZE	LINE SET O.D., INCHES		HWM MODEL	LINE SET O.D., INCHES	
	LIQUID*	VAPOR*		LIQUID*	VAPOR*
2.0 Tons (-024)	3/8	5/8	-024C	3/8	1/2
2.5 Tons (-030)	3/8	3/4	-030C	3/8	1/2
3.0 Tons (-036)	1/2	3/4	-036C	3/8	1/2
3.5 Tons (-042)	1/2	3/4	-042C	1/2	5/8
4.0 Tons (-048)	1/2	7/8	-048C	1/2	5/8
4.5 Tons (-054)	1/2	7/8	-054C	1/2	3/4
5.0 Tons (-060)	1/2	7/8	-060C	1/2	3/4

*Liquid and Vapor lines must BOTH be insulated with Armaflex® or equivalent with at least 1/2” wall thickness for the full length of the line set.

Figure 6. Line Set Sizes

Series SV Service Valve and ADK Adapter Kit

Series AVS Air Handler

Series CCS Cased Coil

Model HRM-1872 Heat Recovery Module

Series HWM Hydronic Water Module

Series HCM Hybrid Cooling Module

DIRECT AXXESS® Earth Loop Specification and Installation Manual

After installing and nitrogen brazing the HVAC system components and compressor unit service valves, turn the Service Valves to **Full Open** and pressurize the refrigeration system to 150 psig with dry nitrogen and a trace of refrigerant. Valve off the nitrogen Tank from the HVAC system components and check joints with a sensitive Electronic Leak Detector to ensure they are sealed. Repair any leaks and re-test as appropriate.

System Applications and Electrical

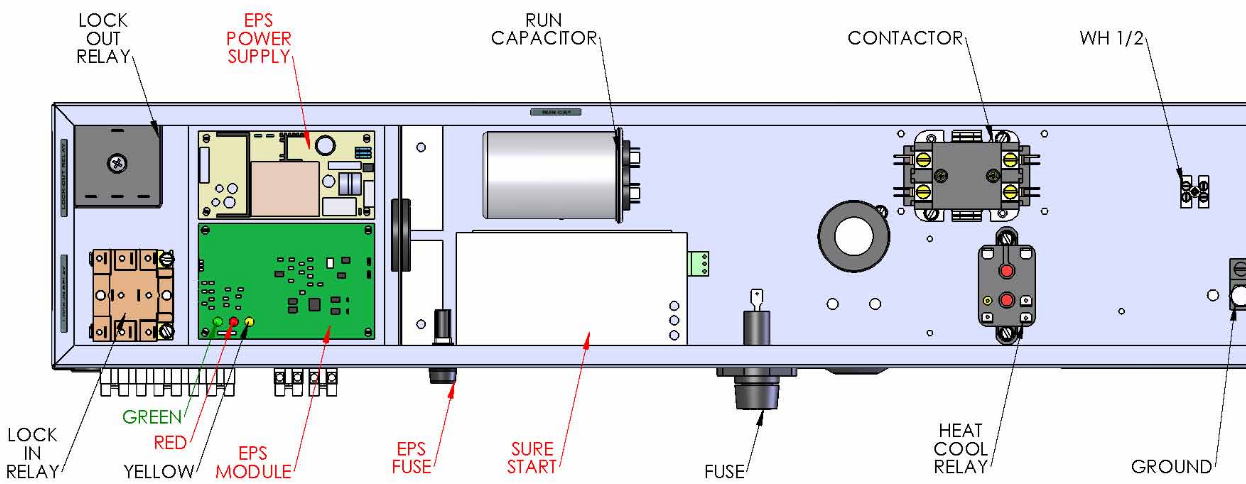
The SC(A) compressor unit electrical box major components and electric data for all compressor sizes are shown in Figure 7.

The SureStart Module is a factory installed component that (1) reduces compressor starting current and (2) reduces compressor starting torque, thus reducing stress on the compressor at start-up.

The Earth Loop Protection Control System, comprised of the EPS Power Supply, EPS Module and EPS Fuse is in the contained within the electric box. This system is factory wired and ready to be connected to the anode wire through an external electrical connection on the backside of the compressor cabinet. The anode wire connection is detailed in a later section of this manual.

SC(A) Heating and Cooling System electrical and application illustrations are as follows.

Figure 8a. SC(A) Compressor Unit Electrical Ladder Diagram, 230-1-60
Figure 8b. SC(A) Compressor Unit Electrical Schematic Diagram, 230-1-60
Figure 9a. SC(A) Compressor Unit Electrical Ladder Diagram, 230-3-60
Figure 9b. SC(A) Compressor Unit Electrical Schematic Diagram, 230-3-60
Figure 10a. SC(A) Air Heating/Cooling System Application
Figure 10b. SC(A) Air Heating/Cooling System Field Wiring Diagram
Figure 11a. SC(A) Air Heating/Cooling/Water Heating System Application
Figure 11b. SC(A) Air Heating/Cooling/Water Heating System Field Wiring Diagram
Figure 12a. SC(A) Hydronic Heating/Cooling System Application
Figure 12b. SC(A) Hydronic Heating/Cooling System Field Wiring Diagram
Figure 13a. SC(A) Hydronic Heating/Cooling/Water Heating System Application
Figure 13b. SC(A) Hydronic Heating/Cooling/Water Heating System Field Wiring Diagram



Compressor Unit Model	Compressor Model	Voltage/Phase/ Hz	Voltage		LRA	RLA	MCA	MFS
			Min.	Max.				
-024-1C (A)	ZP25K6E-PFV	230-1-60	207	253	72.5	15.0	18.0	30
-024-2C (A)	ZP25K63-TF5	230-3-60	207	253	61.4	9.8	12.0	20
-030-1C (A)	ZP31K5E-PFV	230-1-60	207	253	78.0	18.6	23.0	35
-030-2C (A)	ZP31K5E-TF5	230-3-60	207	253	73.0	11.6	14.0	20
-036-1C (A)	ZP38K5E-PFV	230-1-60	207	253	109.0	22.1	27.0	40
-036-2C (A)	ZP38K5E-TP5	230-3-60	207	253	83.1	15.1	19.0	30
-042-1C (A)	ZP44K5E-PFV	230-1-60	207	253	135.0	23.9	29.0	50
-042-2C (A)	ZP44K5E-TF5	230-3-60	207	253	98.0	16.1	20.0	30
-048-1C (A)	ZP51K5E-PFV	230-1-60	207	253	134.0	29.4	36.0	60
-048-2C (A)	ZP51K5E-TF5	230-3-60	207	253	110.0	17.8	22.0	35
-054-1C (A)	ZP57K5E-PFV	230-1-60	207	253	178.0	31.6	39.0	60
-054-2C (A)	ZP57K5E-TF5	230-3-60	207	253	136.0	21.4	26.0	40
-060-1C (A)	ZP61K5E-PFV	230-1-60	207	253	178.0	34.3	42.0	60
-060-2C (A)	ZP61K5E-TF5	230-3-60	207	253	136.0	21.9	27.0	40

LRA = Locked Rotor Amps
RLA = Rated Load Amps
MCA = Minimum Circuit Ampacity
MFS = Maximum Fuse or HACR Circuit Breaker Size (External)
AWS = Consult NEC and Local Codes

Figure 7. SC(A) Electric Box Components & Electrical Data

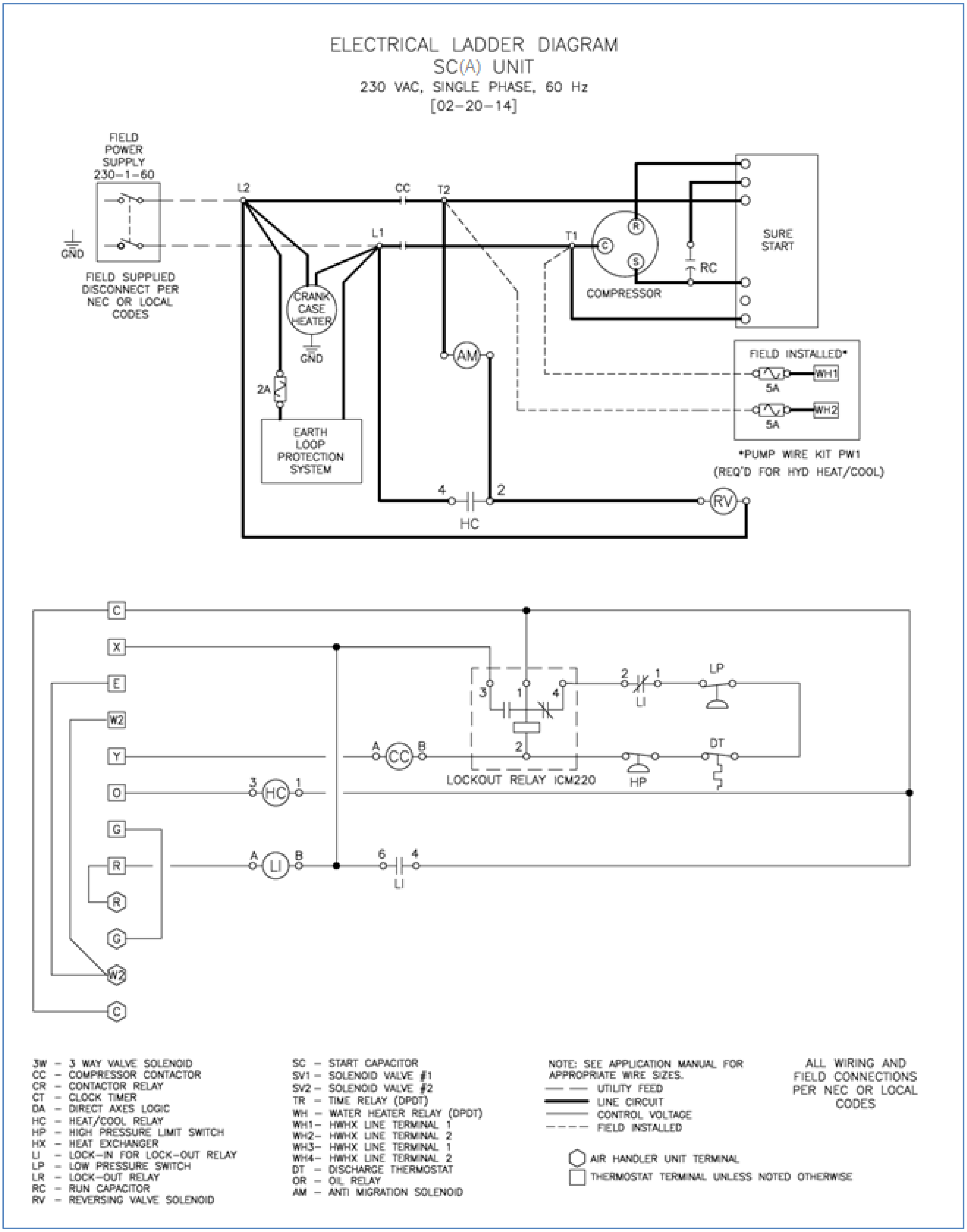


Figure 8a. SC(A) Compressor Unit Ladder Diagram, 230-1-60

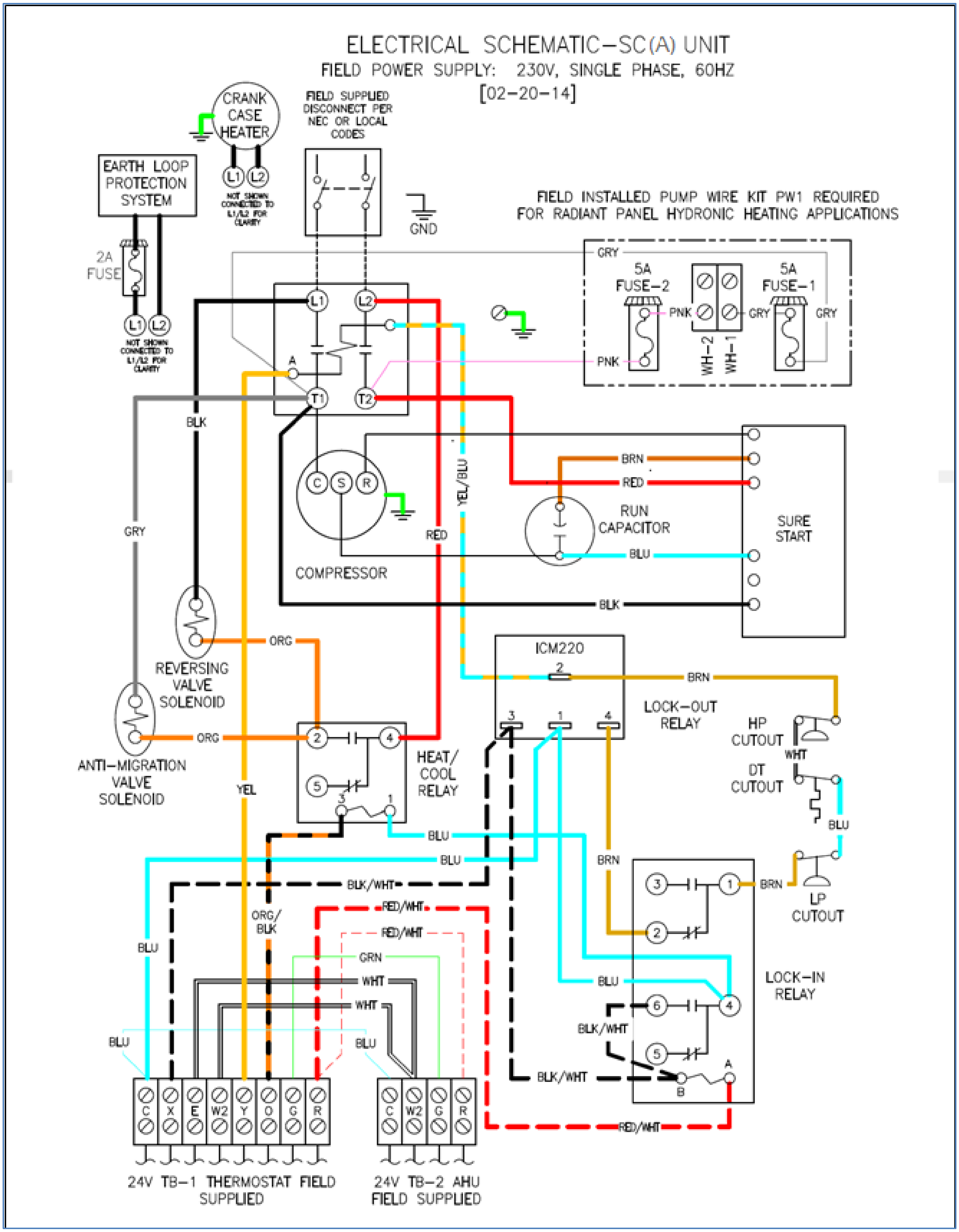


Figure 8b. SC(A) Compressor Unit Electrical Schematic Diagram, 230-1-60

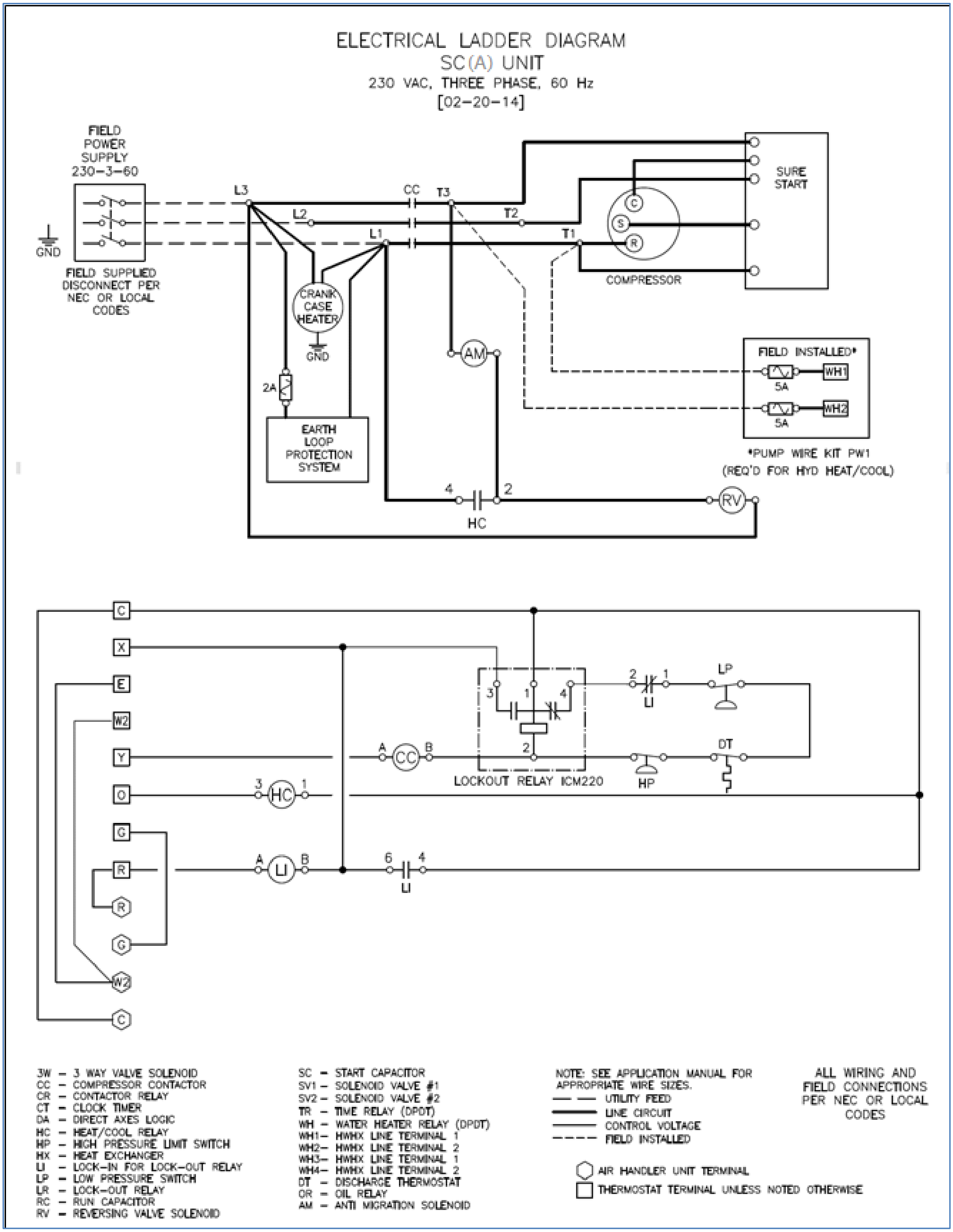


Figure 9a. SC(A) Compressor Unit Electrical Ladder Diagram, 230-3-60

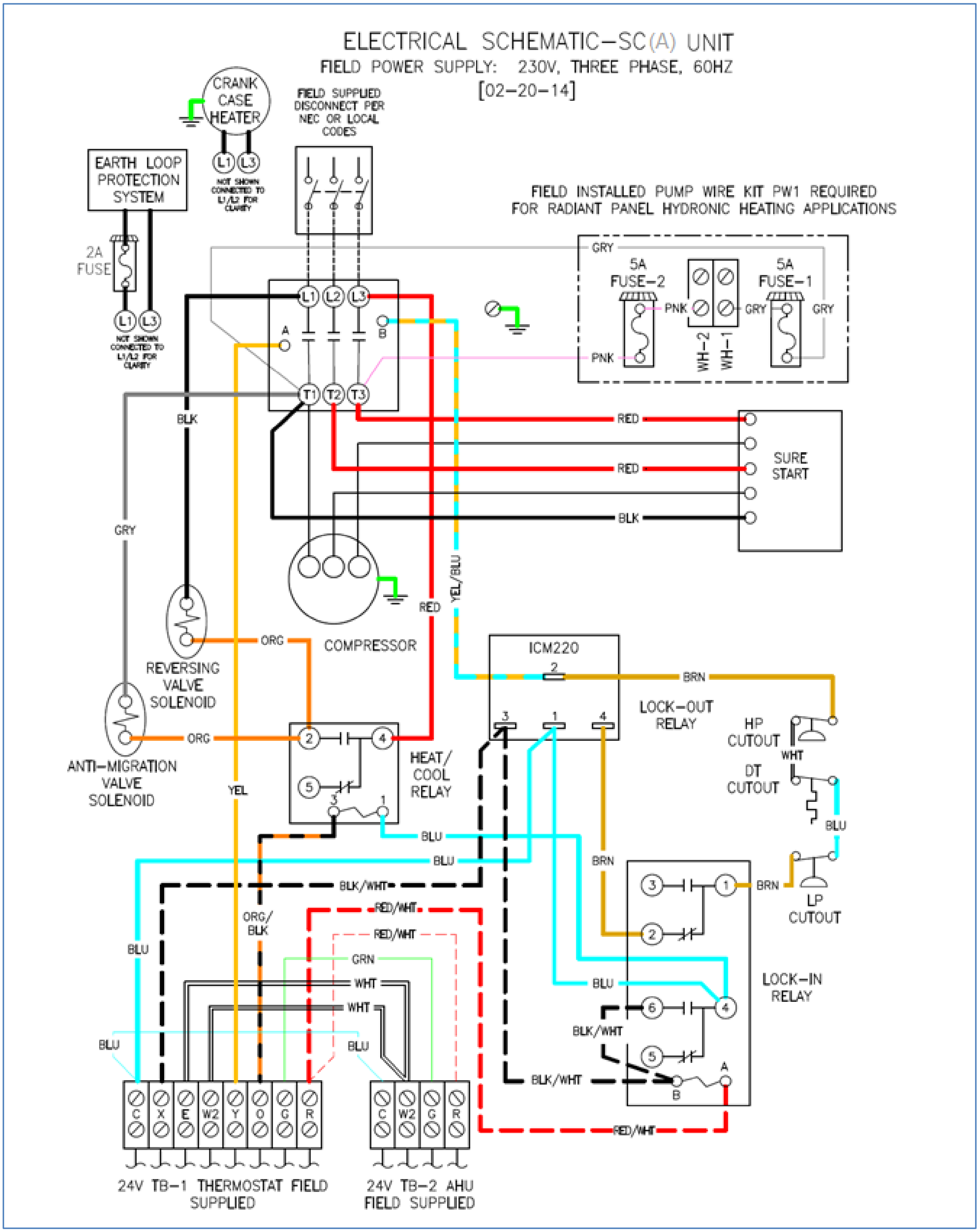


Figure 9b. SC(A) Compressor Unit Electrical Schematic Diagram, 230-3-60

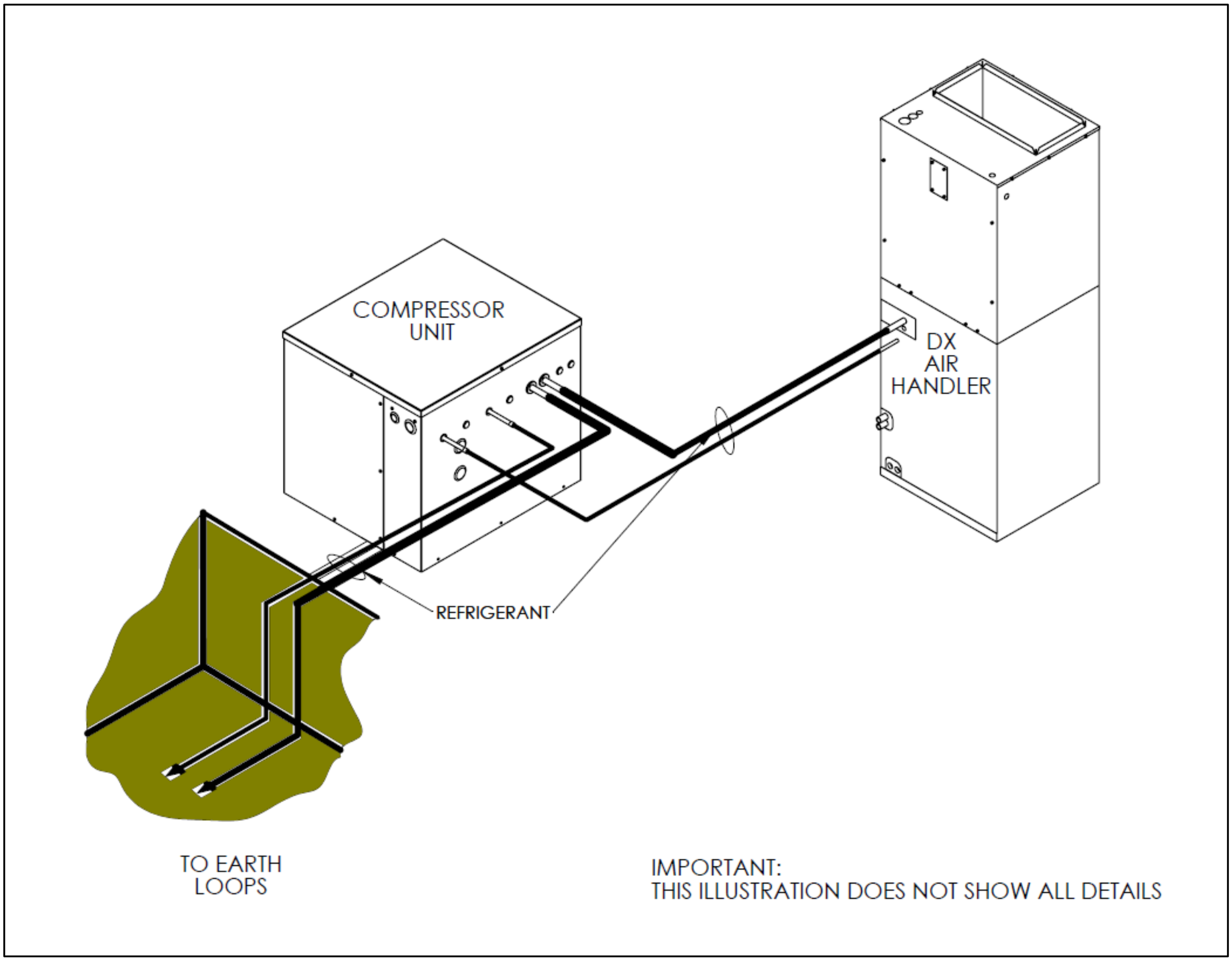


Figure 10a. SC(A) Air Heating/Cooling System Application

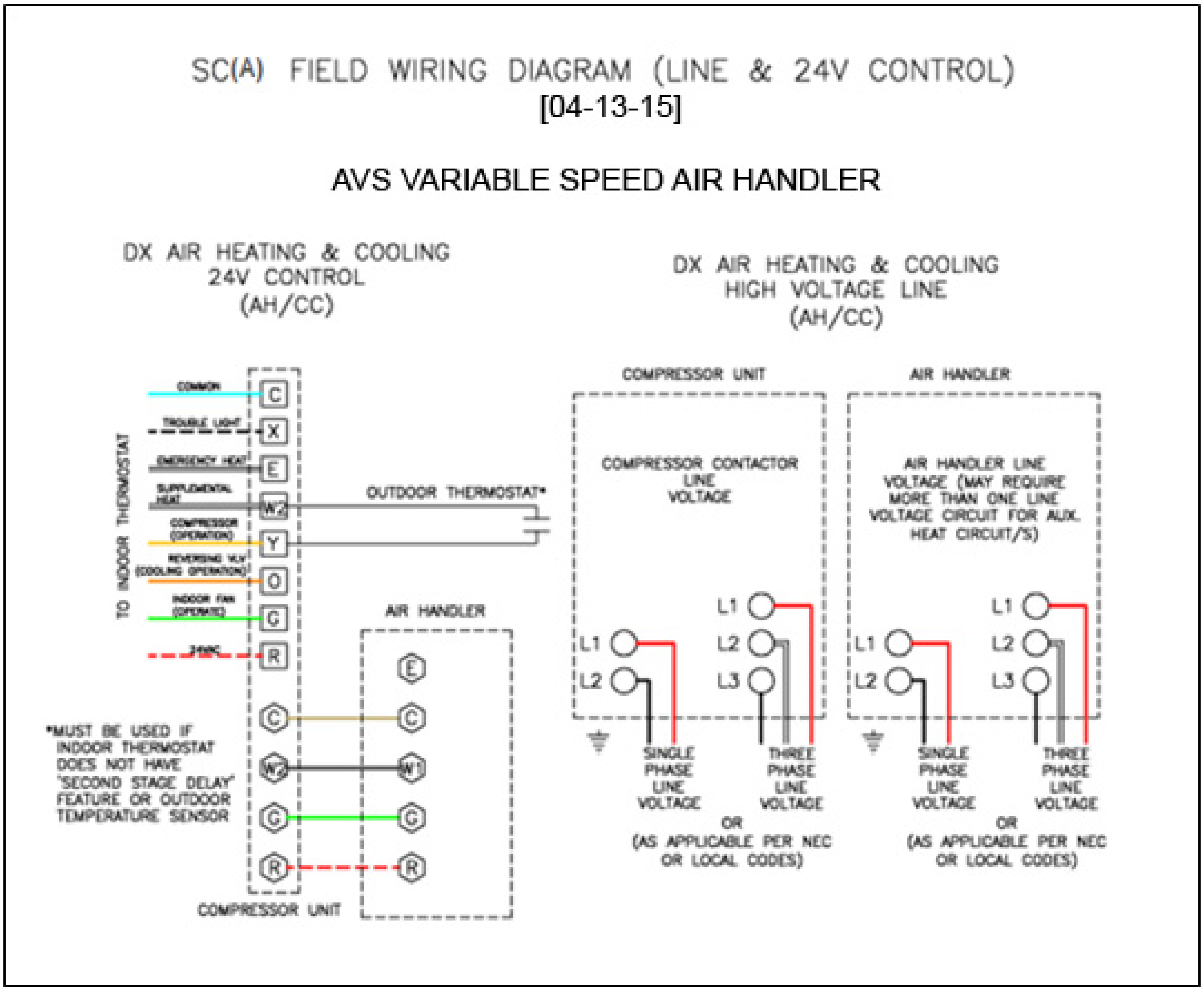


Figure 10b. SC(A) Air Heating/Cooling System Field Wiring Diagram

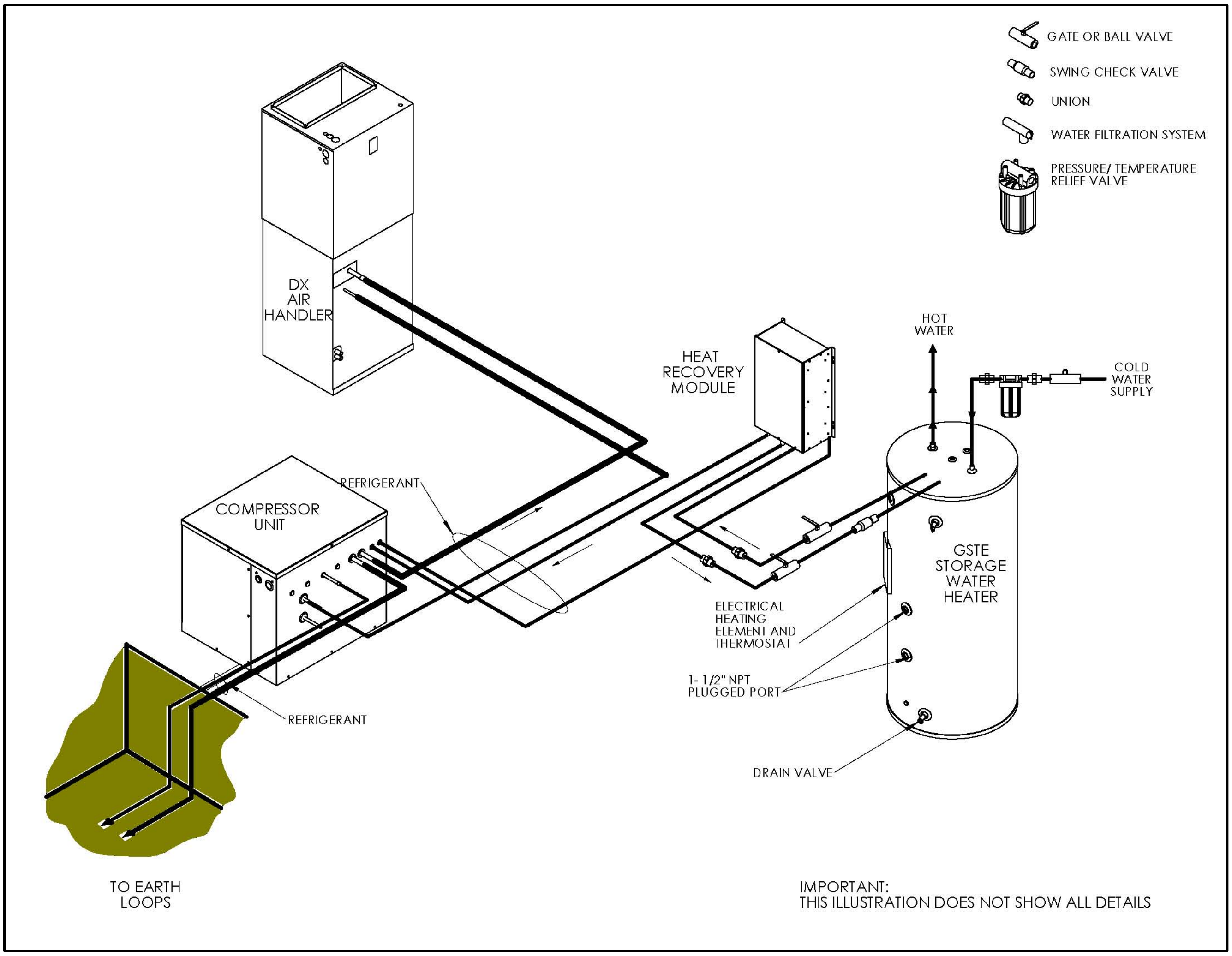


Figure 11a. SC(A) Air Heating/Cooling/Water Heating System Application

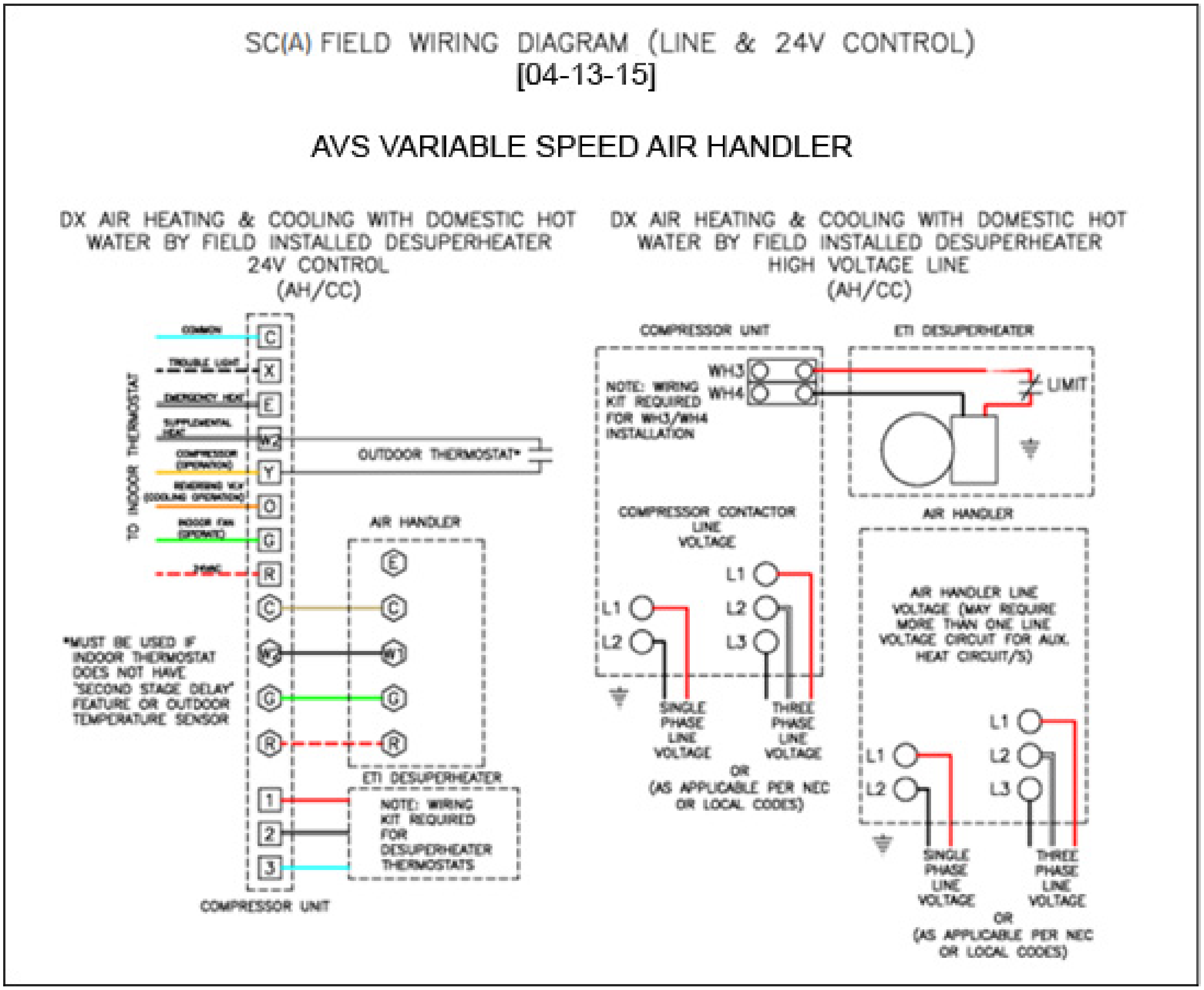


Figure 11b. SC(A) Air Heating/Cooling/Water Heating System Field Wiring Diagram

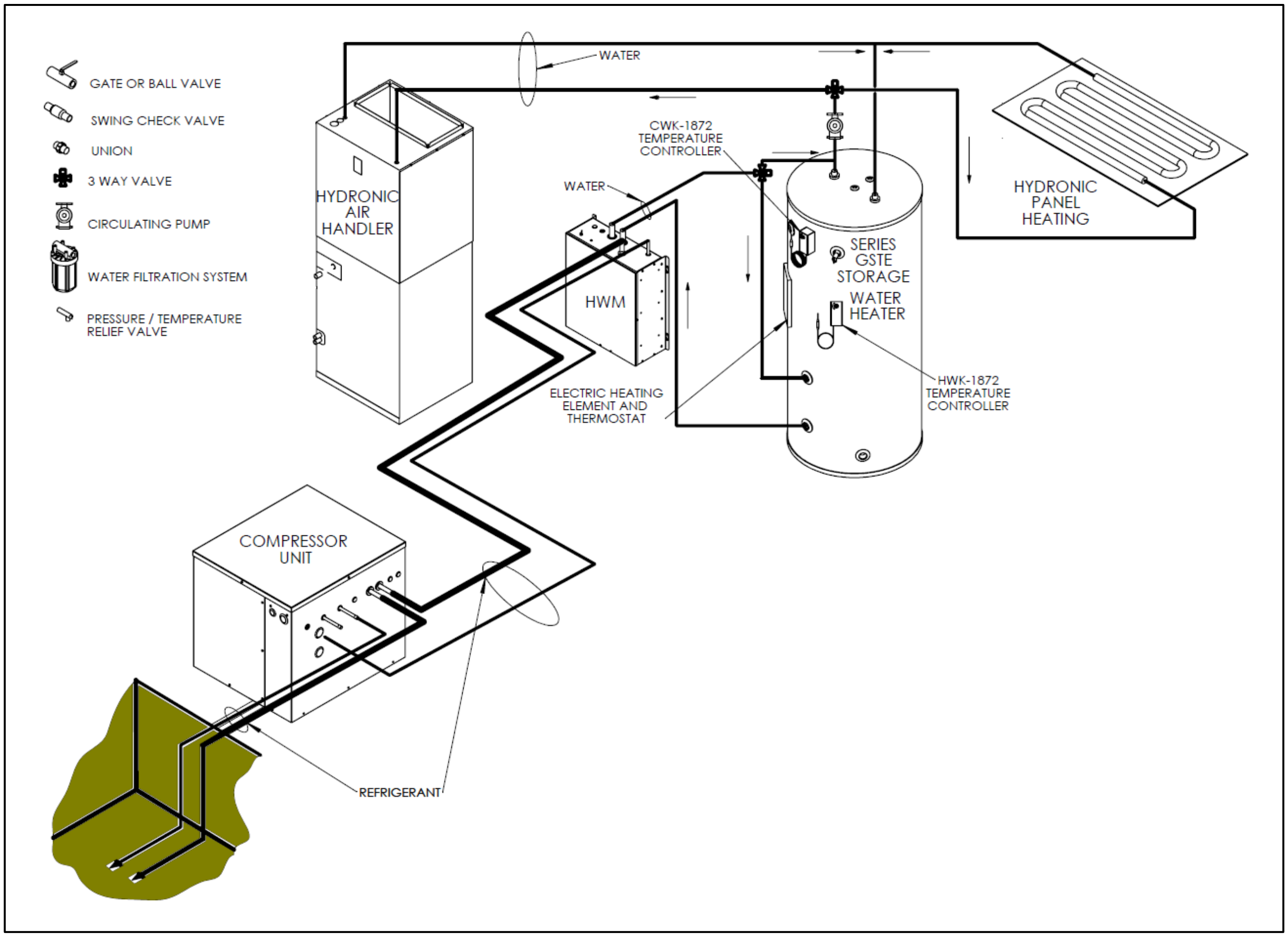


Figure 12a. SC(A) Hydronic Heating/Cooling System Application

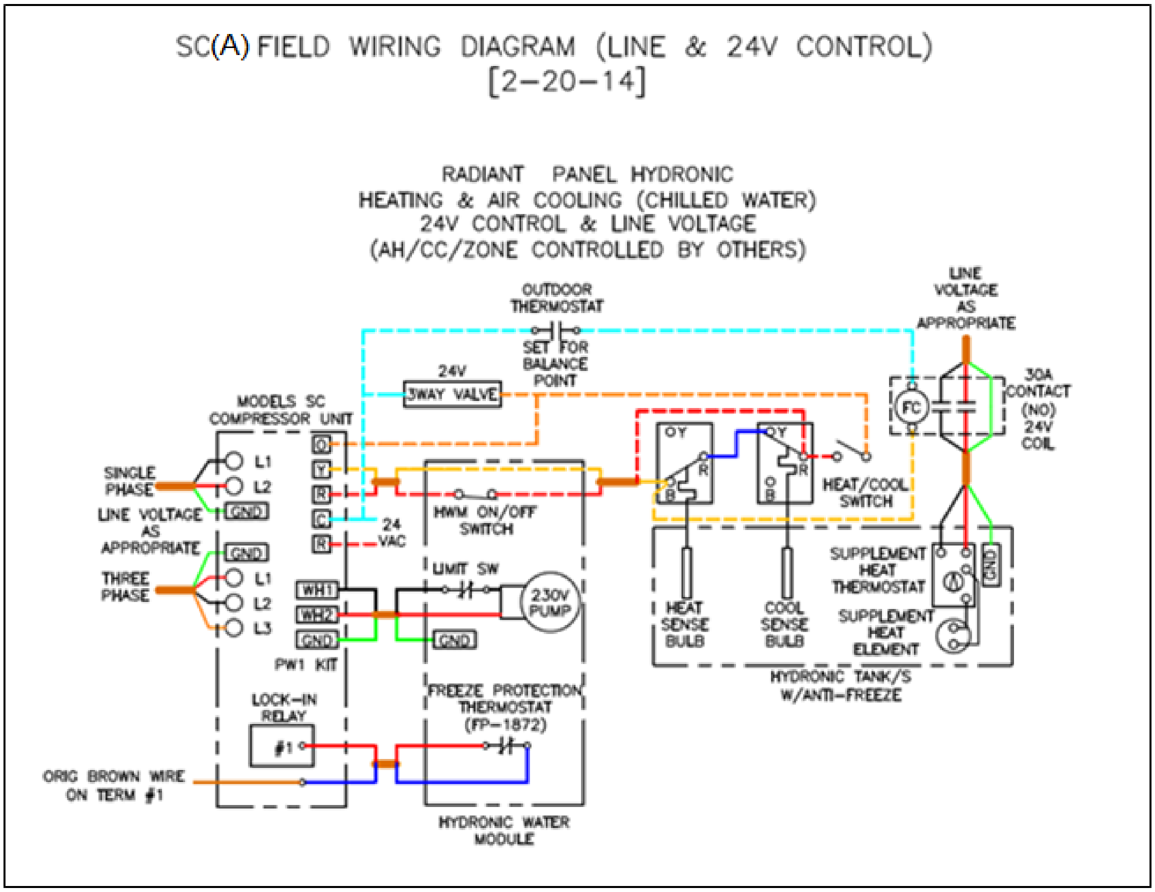


Figure 12b. SC(A) Hydronic Heating/Cooling System Field Wiring Diagram

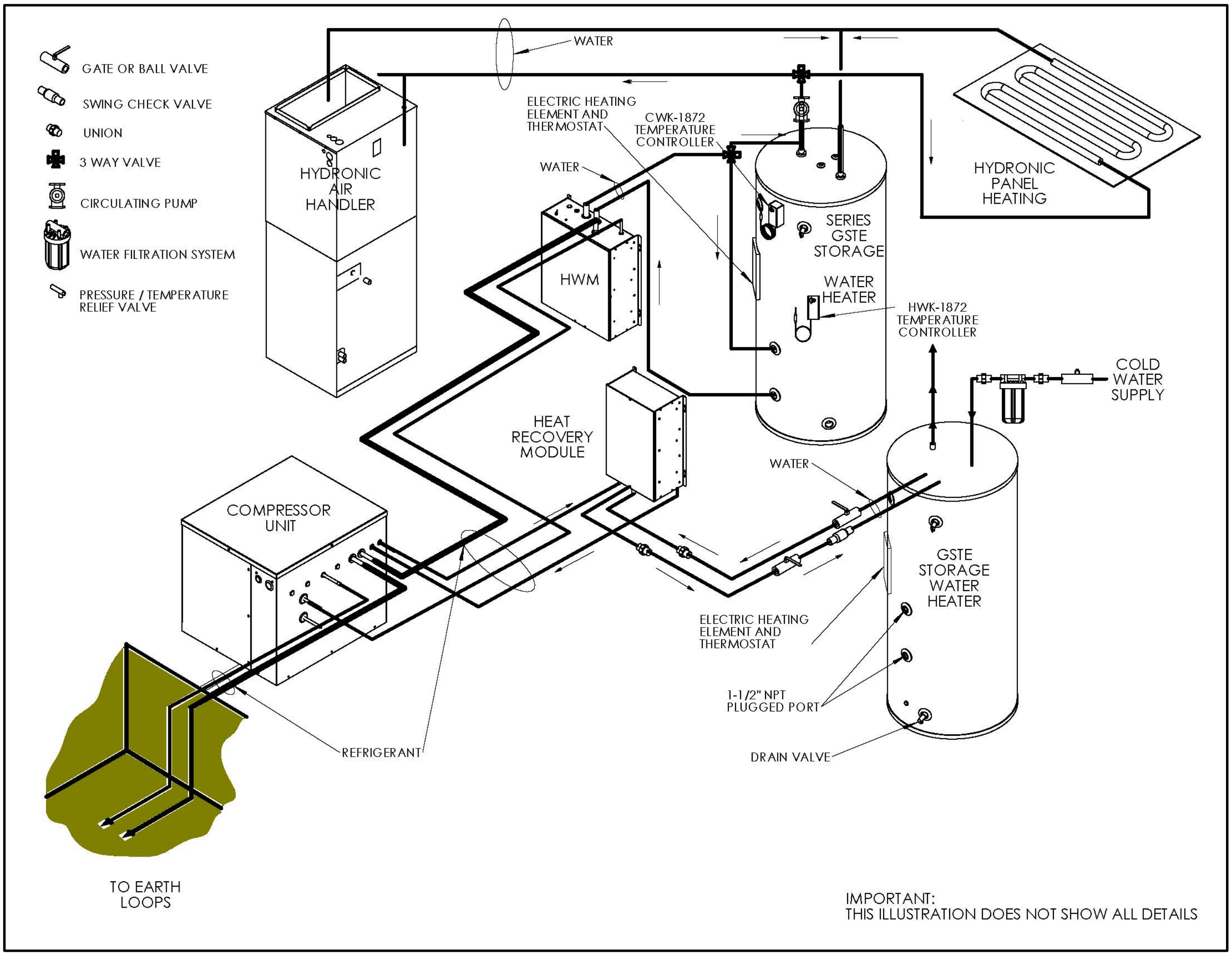


Figure 13a. SC(A) Hydronic Heating/Cooling/Water Heating System Application

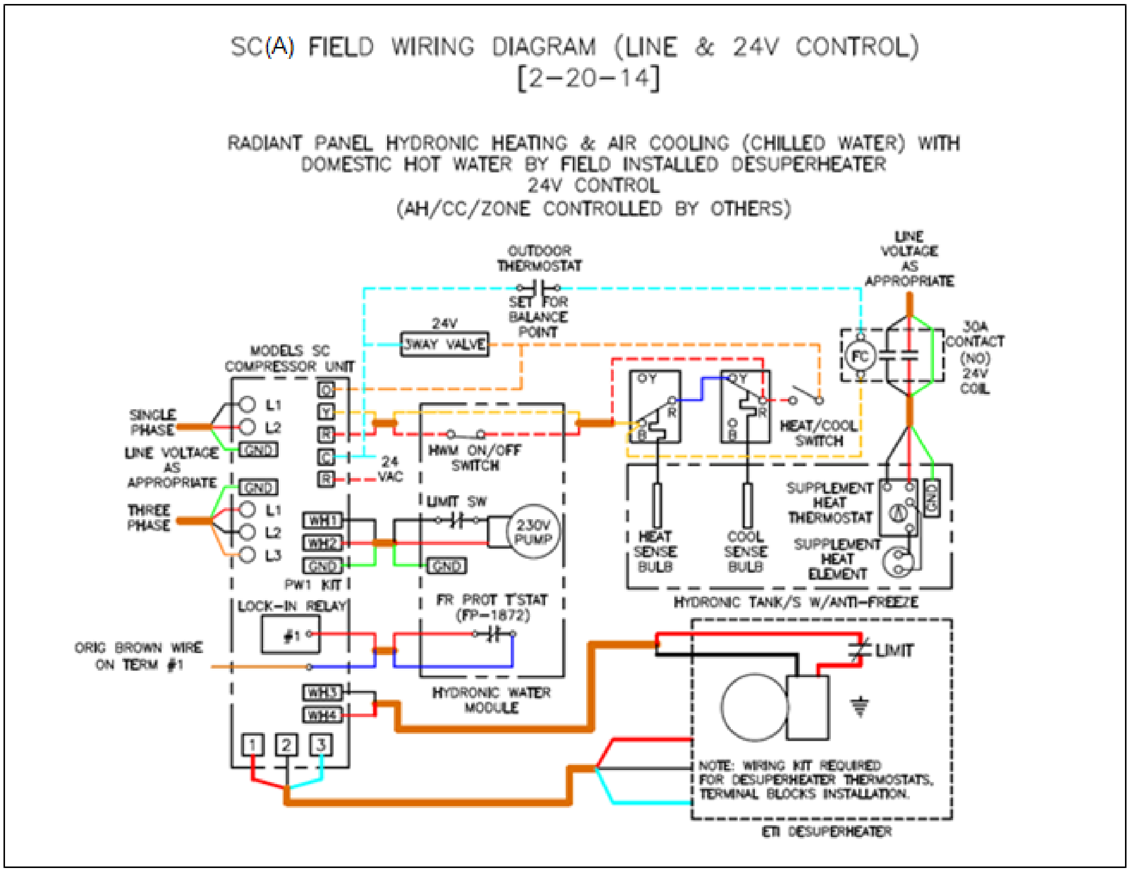


Figure 13b. SC(A) Hydronic Heating/Cooling/Water Heating System Field Wiring Diagram

Plumbing

A typical primary hydronic plumbing circuit for an SC(A) system is illustrated in Figure 13c.

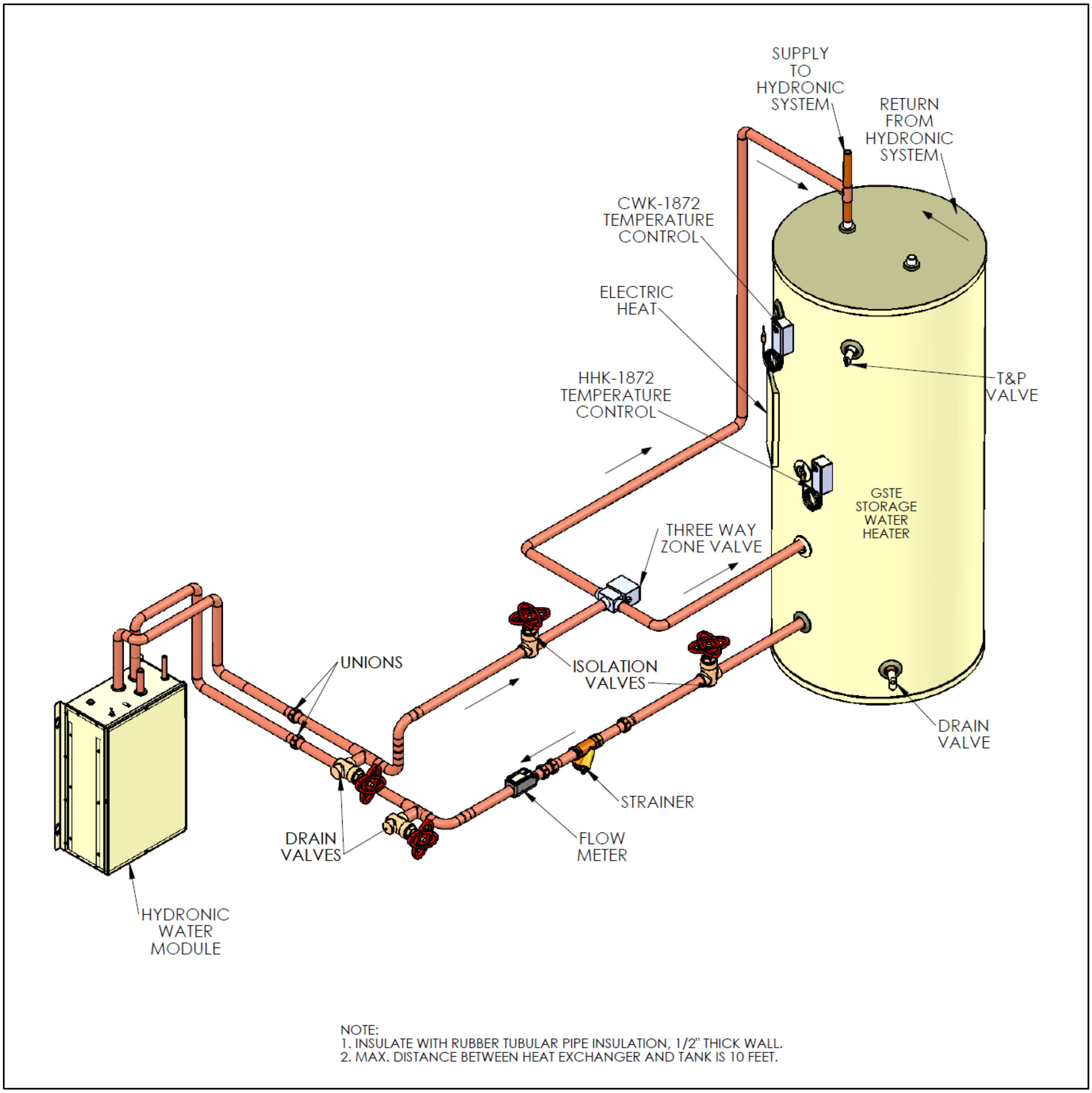


Figure 13c. Typical SC(A) Primary Hydronic Circuit Plumbing

The components are as follows:

1. **Flowmeter**: Model ETI-A1-116000-1 hydronic water/antifreeze solution flowmeter is available from ETI and is field calibrated for the specific antifreeze mixture. The kit includes calibration equipment.
2. **Three-Way Zone Valve:** This electrically operated zone valve is a commercially available hydronic system component that directs the hydronic fluid flow in response to the system operating mode, either heating or cooling.

3. **Strainer:** Models ST-1836 (for 1.5 thru 3.0 ton systems) and ST-4272 (for 3.5 thru 6.0 ton systems) are 20 mesh, brass, inline strainers, available from ETI and necessary to trap particles and maintain proper flow through the brazed plate heat exchanger channels.
4. **Temperature Controller:** Model HHK-1872 is a hydronic heating controller and Model CWK-1872 is a chilled water temperature controller. These controllers can be mounted remotely and come with a capillary tube 6 feet long, thermal bulb, thermal paste and the NPT thermal well insert and are available from ETI.
5. **Storage Water Heater:** The GSTE Series storage water heaters are available from ETI in 60, 80 and 119 US Gallon capacities, and are designed for use with the EarthLinked® geothermal systems. They are equipped with a 4.5 kW supplemental heater which satisfies the ETI requirement for a minimum of 20% supplemental heat.
6. **Other Plumbing Components and Parts:** Gate valves, unions, copper pipe, pipe insulation, etc. meeting USA industry and local code standards are commercially available through plumbing supply outlets.

All plumbing installations are to be in accordance with the applicable local and national codes.

To protect the brazed plate heat exchanger from damage during cooling operation when the heat exchanger is producing chilled water, a factory installed thermal switch at the outlet of the heat exchanger will turn the compressor OFF when the chilled water temperature drops to 38°F.

WARNING!

The heat exchanger must be isolated from the water system when the system undergoes a "superchlorination" or "shock chlorination" flushing process. Closing the isolation valves as shown in Figure 13c prior to initiating the system flushing process isolates the heat exchanger. The water entering the heat exchanger after the system flushing must not exceed a chlorine level consistent with the local municipal water purification standards. Failure to isolate the heat exchanger will damage the heat exchanger causing system failure. Allowing highly chlorinated water to enter the heat exchanger will void the EarthLinked® Limited Warranty.

Antifreeze Protection

When **HWM hydronic water modules** are applied to radiant panel hydronic heating and/or cooling systems, the water circulating system must be protected from potential damage due to freeze-up by utilizing an adequate antifreeze solution. The antifreeze protection is provided by the installer prior to the EarthLinked® system start-up.

IMPORTANT!

FAILURE OF THE INSTALLER TO PROVIDE ADEQUATE ANTIFREEZE SOLUTION PROTECTION IN EARTHLINKED® RADIANT PANEL HYDRONIC HEATING AND/OR COOLING SYSTEMS AT THE TIME OF SYSTEM START-UP WILL VOID THE EARTHLINKED® LIMITED WARRANTY FOR HEATING AND COOLING SYSTEMS.

Propylene-glycol antifreeze solution with an inhibitor is the type of antifreeze solution required for Earthlinked® products utilized in radiant panel hydronic heating and/or cooling systems. These systems shall be freeze protected consistent with the application -specific minimum temperature, as shown in the table below. Propylene-glycol antifreeze solutions should always be in the range of 20% to 50% by volume, as indicated in the table.

TEMPERATURE, °F	PROPYLENE GLYCOL, %	WATER SOLUTION MULTIPLIER FACTOR (WSMF)
18	20	x 1.03
8	30	x 1.07
-7	40	x 1.11
-29	50	x 1.16

Propylene Glycol Freeze Protection Table

IMPORTANT!

Because addition of propylene-glycol to water changes the specific heat of water, the required flow rate of propylene-glycol solution (for the same heat transfer as water) must be increased by the water solution multiplier factor shown in the table above.

WARNING!

ALWAYS REMOVE THE ANODE ROD(S) FROM THE STORAGE WATER TANK OR HEATER UTILIZED IN A RADIANT PANEL HYDRONIC HEATING AND/OR COOLING SYSTEM. IF THE ANODE ROD(S) ARE NOT REMOVED, THE PROPYLENE-GLYCOL SOLUTION WILL REACT WITH THE ANODE ROD(S) TO CREATE PARTICLES THAT BLOCK FLOW AND CAUSE SYSTEM FAILURE.

Propylene-glycol can be purchased in the straight form and mixed with an inhibitor prior to filling the system, or it can be purchased as inhibited propylene-glycol. The following are examples of manufacturers for the above:

Straight propylene-glycol: Chemical Specialties, Inc. (www.chemicalspec.com/spg.html)

Inhibitor: Nu-Calgon Products, Ty-Ion B20 (www.nucalgon.com/products)

Inhibited propylene-glycol: Houghton Chemical Corp., SAFE-T-THERM®, www.houghton.com/fluids/safe-t-therm/index.html)

General guidelines for introducing propylene glycol into the water circulating system follow. The manufacturer's specific instructions and industry standards always take precedence when introducing propylene-glycol to the system.

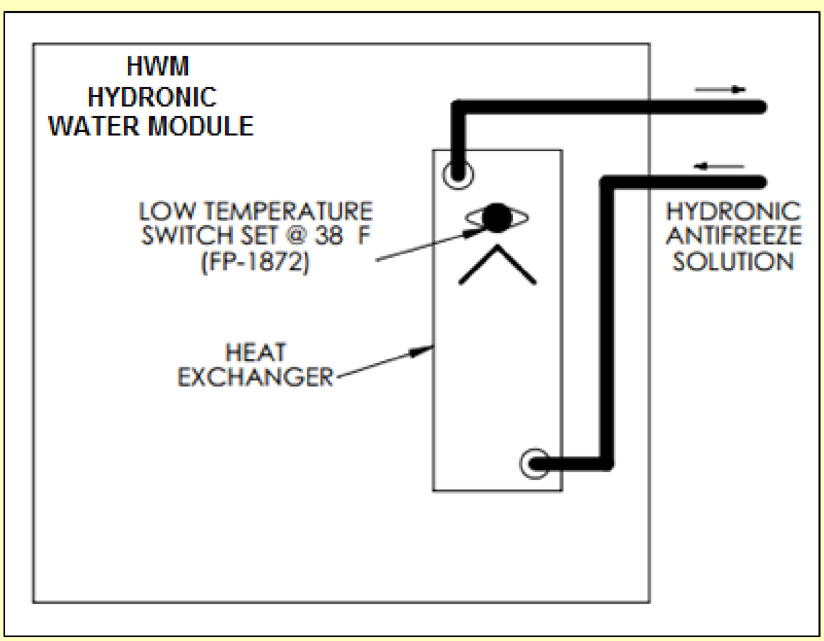
- Calculate the quantity of inhibited propylene-glycol (fluid) required to achieve the desired results.
- Introduce a sufficient quantity of water to the system and pressure check to ensure a sealed system.
- Drain some water from the system to provide enough volume for the calculated amount of fluid.
- Add the correct amount of fluid and any water needed to completely refill the system, allowing for liquid expansion due to operating temperature.
- Circulate the inhibited propylene-glycol antifreeze solution for at least 24 hours to ensure complete mixing. Check the liquid concentration to assure that the correct mixture is obtained.

IMPORTANT !

Always follow the propylene-glycol manufacturer's instructions concerning the water quality specifications before filling the water circulating system.

IMPORTANT!

Freeze protection is provided on all HWM hydronic water modules by means of a factory installed thermal switch that turns the system OFF when heat exchanger outlet water drops to 38°F.



Heat Recovery Module (HRM)

The HRM-1872 Heat Recovery Module may be field installed with the SC(A) compressor unit for the purpose of providing supplemental water heating during heating and/or cooling operation. **The HRM does not replace the standard storage water heater sized for the application.**

Use of the HRM to heat water in the heating season will increase the heating load on the space heating equipment by 2,000 BTUH for each adult and teenager occupant. This must be factored into the sizing of the space heating equipment to maintain comfort during the heating season. Operating the HRM during the heating season will reduce the cost of heating water, compared to heating water with a standard electric water heater.

Operation of the HRM during the cooling season utilizes waste heat from the cooling system and does not impose an additional load on the cooling operation.

The HRM may be plumbed into an existing standard water heater or an **ETI Series GSTE storage water heater**. The Series GSTE storage water heaters are available in 60, 80 and 119 gallon capacities and have a 4.5kW electric heating element which provides the following recovery rates for listed increases in water temperature:

ΔT	**30**	**40**	**50**	**60**	**70**	**80**	**90**
GPH	62	46	37	31	26	23	21

*ΔT in ºF; GPH in U.S. Gallons per hour.

See the ***HRM-1872 Heat Recovery Module Installation Manual*** for all details on the installation of the HRM.

Earth Loop Protection System

Anode Wire Installation

Prior to this, the below grade installation of the DIRECT AXXESS® Earth Loop System, including the Earth Loop Protection System anode and anode wire has been completed per the ***Earth Loop Protection Kit Manual***, and at this point the anode wire is ready to be connected to the compressor unit.

The earth loop protection system connection to the anode wire is on the back side of the compressor cabinet as illustrated in Figure 14, showing the electrical **socket** with the **sealing cap.**

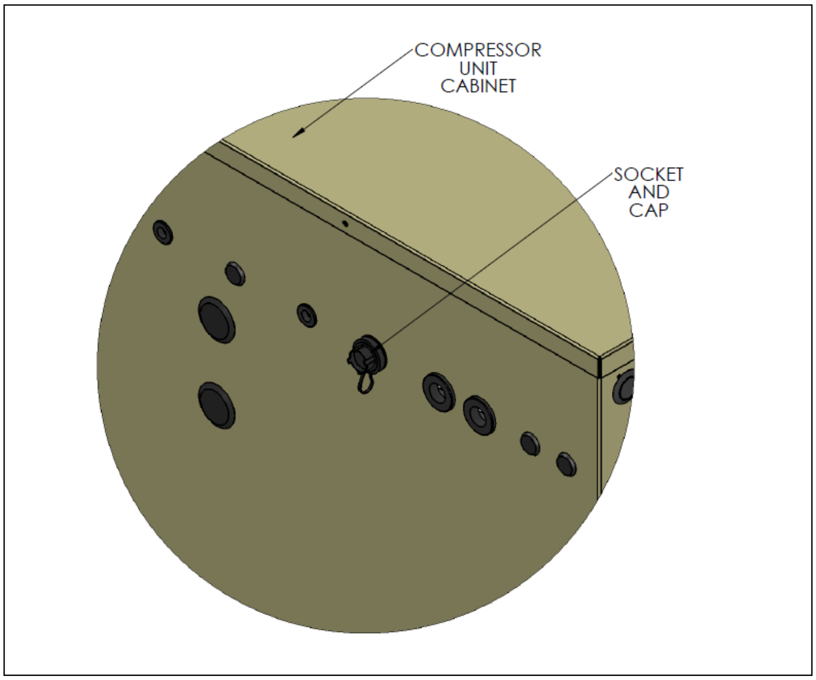


Figure 14. Compressor Cabinet Socket/Cap

The EPS-KIT contains the plug connector**, which will be field assembled and connected to the** anode wire.

WARNING!

All power of the EarthLinked® System is to be shut OFF at the disconnect while field wiring the Earth Loop Protection System. Failure to do so may result in serious injury or death, or equipment or property damage.

The steps to install the **anode wire** to the **plug connector assembly** are as follows.

Remove the **sealing cap assembly tool** from the compressor unit cabinet shown in Figure 7. Using the **sealing cap assembly tool,** as shown in Figure 15, unscrew the **locking ring** from the **plug connector assembly** to access the **plug insert.** Then, remove the **gland nut, gland cage, and gland** from the other end of the **plug body** as shown in Figure 15.

Figure 15. Disassembled Plug Connector

Strip the insulation from the multi-strand anode wire back approximately ¾ inch from the end and while keeping the strands together, push the anode wire through the **gland nut, gland cage, gland** and **plug body** as shown in Figure 16. Loosen one of the two screw terminals on the **plug insert** to receive all of the strands of anode wire on one terminal.

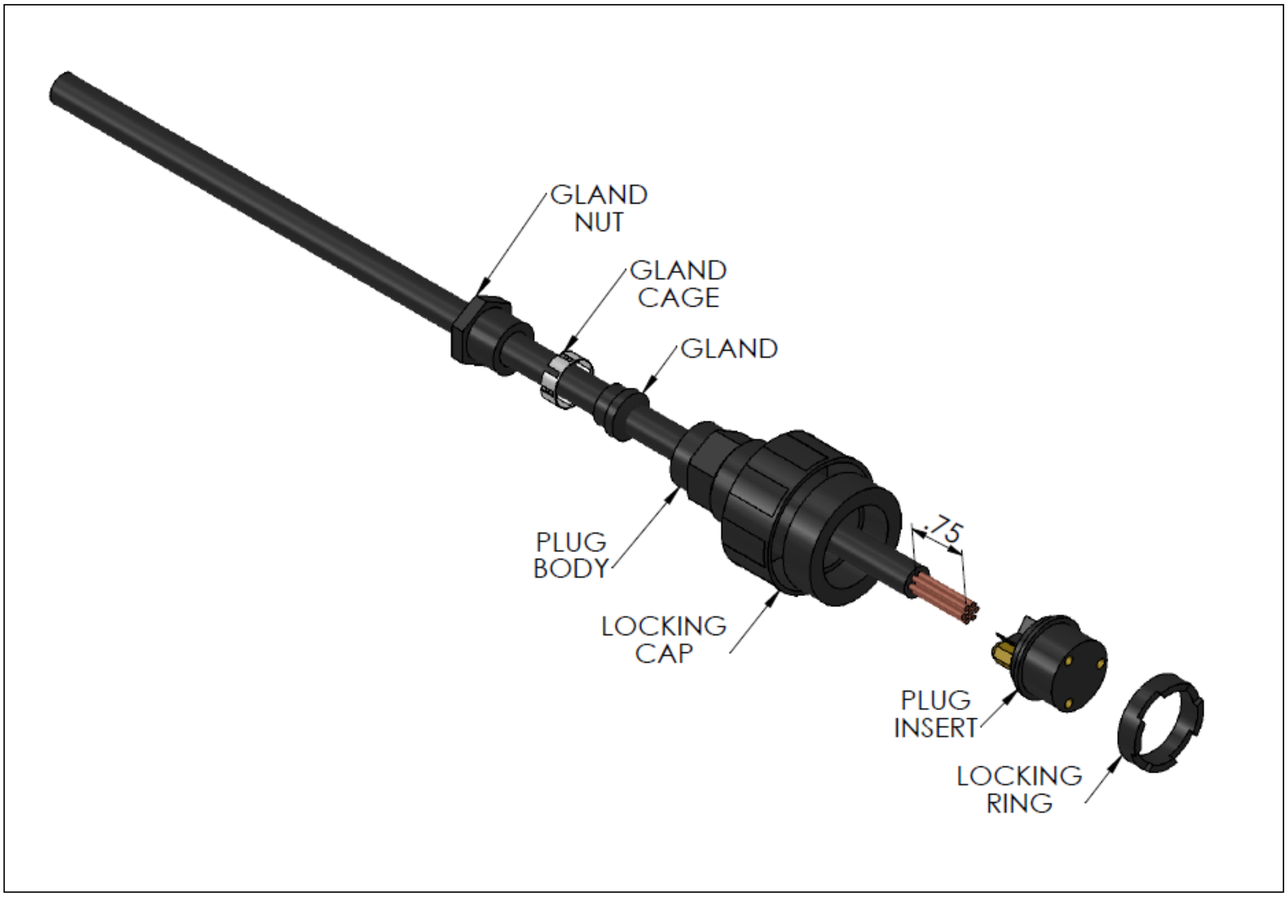


Figure 16. Anode Wire Insertion

After inserting all strands of the anode wire into one of the terminals on the **plug insert**, tighten the wire in place by tightening the screw on that terminal. Once tightened, push the **plug insert** back into the **plug body** as shown in Figure 17 until it is firmly seated. Engage the **locking ring** with threads in the **plug body** and turn clockwise with the **sealing cap assembly tool** until the **lock ring** is firmly seated and tight against the **plug insert.**

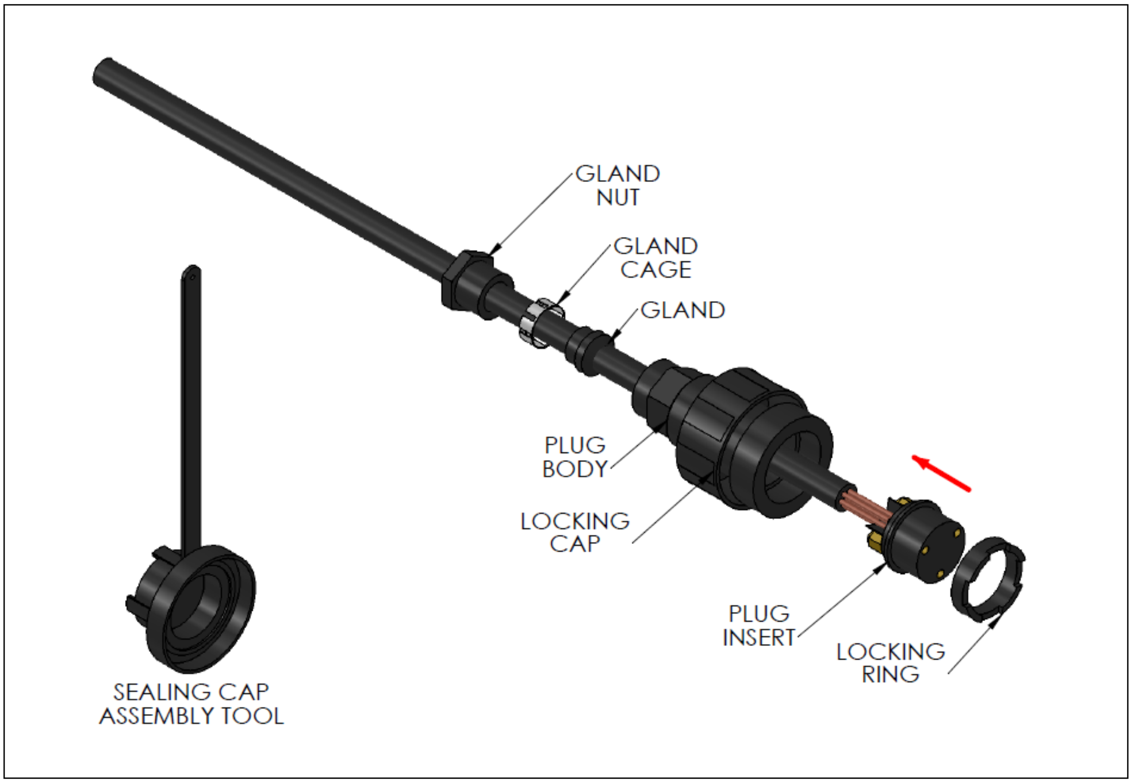


Figure 17. Install the Plug Insert

Slide the **gland** forward on the anode wire until it is firmly seated in the **plug body** as shown in Figure 18. Next, slide the **gland cage** over the **gland,** and slide the **gland nut** firmly against the **gland cage,** with the **gland nut** against the **plug body.** Engage the threads of the **gland nut** with those inside **the plug body** and manually thread the **gland nut** clockwise by hand.

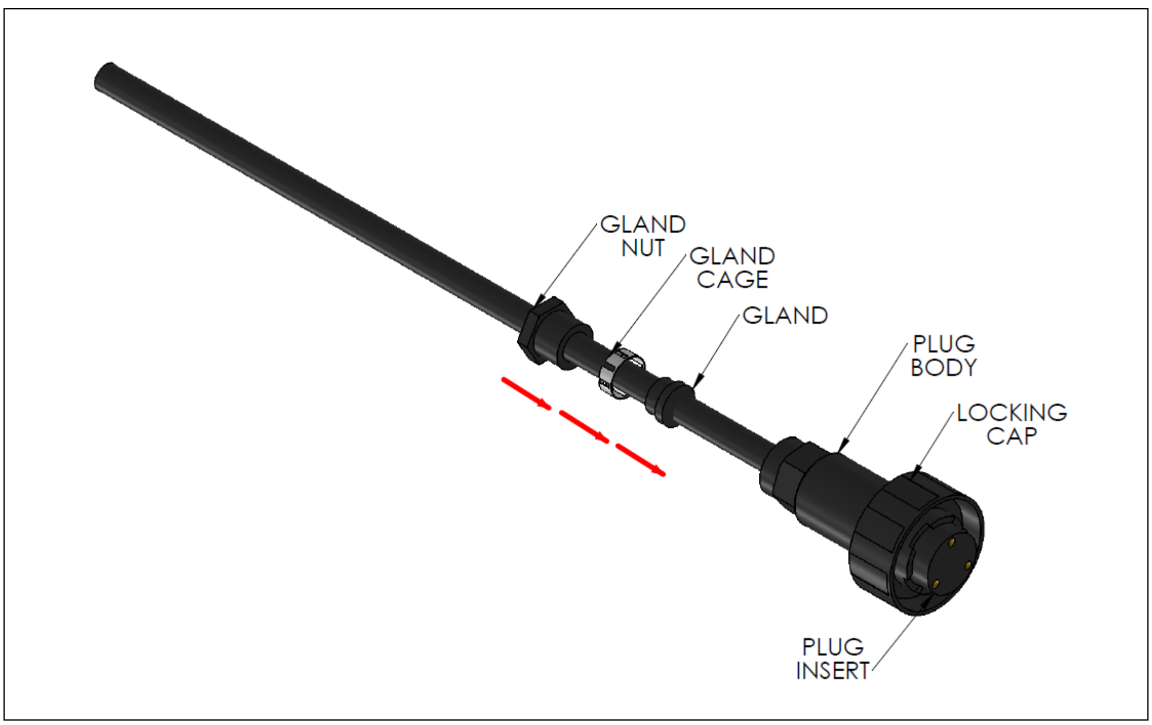


Figure 18. Engage the Gland Nut

Once the **gland nut** has been hand tightened into the **plug body,** use two adjustable wrenches to further tighten the **gland nut** until it is snug in the **plug body** as shown in Figure 19 and the anode wire is held firmly in the **plug body** and will not slip out. **Do not over-tighten the gland nut!**

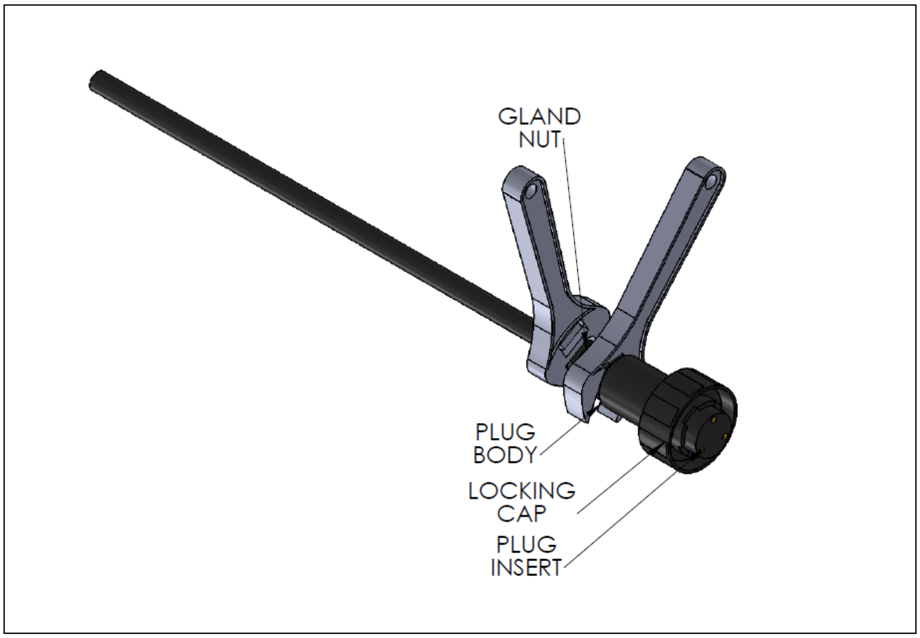


Figure 19. Secure the Anode Wire.

After the **plug** and anode wire have been assembled, re-connect the **sealing cap assembly tool** to the **socket** on the compressor unit cabinet. After aligning the electrical contact pins, manually engage the threads on the **plug locking cap** with the threads on the **socket** and turn clockwise until the **plug** is firmly hand-tightened to the **socket** as shown in Figure 20. **If the anode wire rises away from the compressor cabinet,** be sure to shape a drip loop into the contour of the anode wire near the **plug** and **socket.**

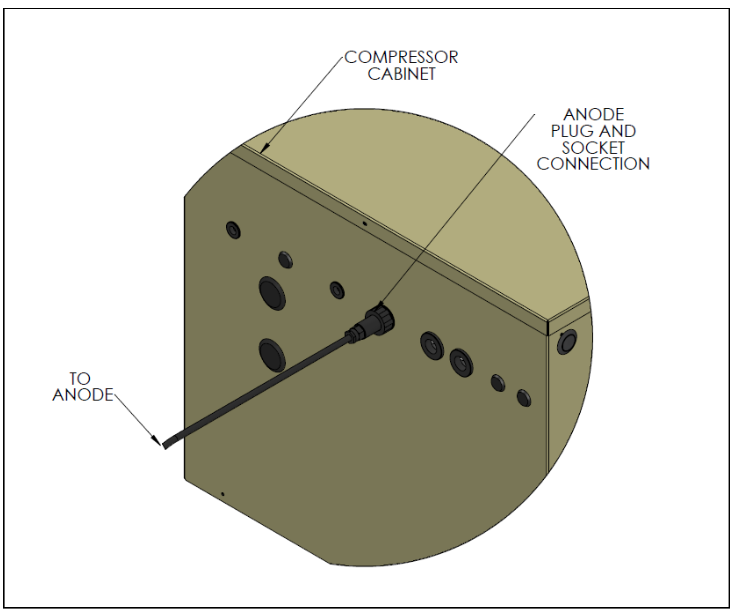


Figure 20. The Plug and Socket Joint

After the **plug** and **socket** joint is secured, the power may be turned **ON** at the disconnect.

EPS Operation and Service

Reference Figure 21 for the EPS components in the compressor unit electric box.

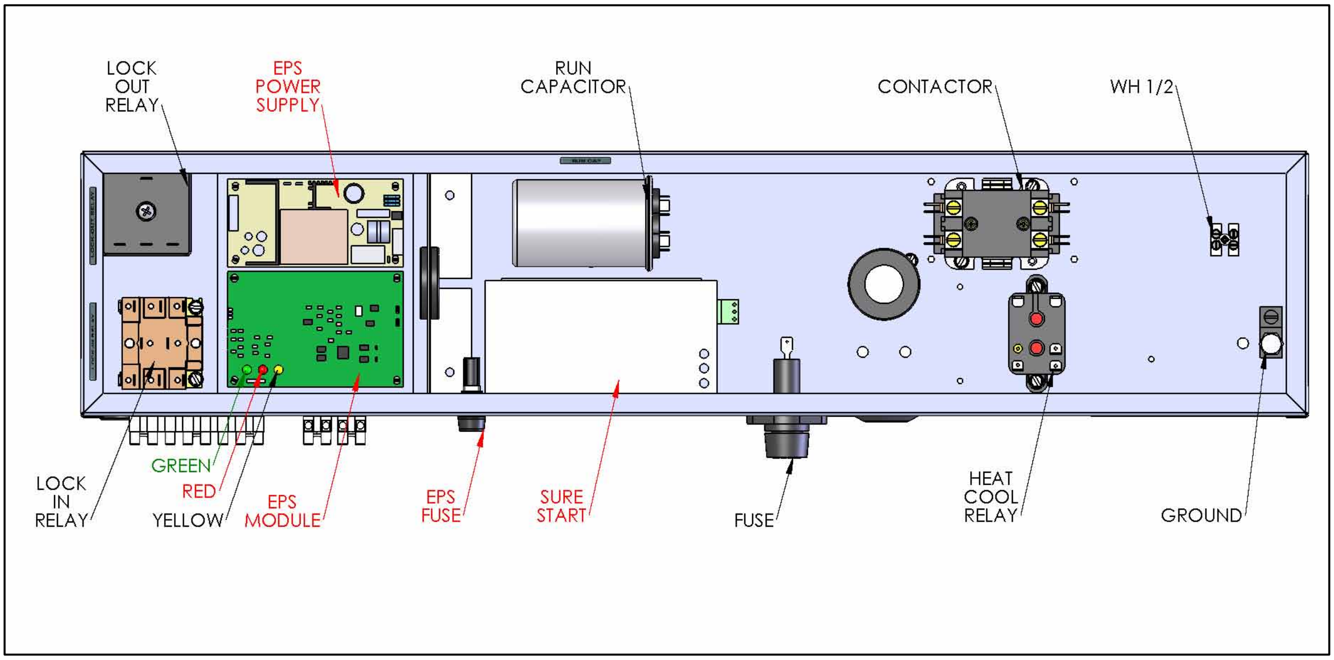


Figure 21. Electric Box with EPS Components

With power **ON**, and viewing the EPS Module in the compressor unit electric box, the EPS **green light** should be illuminated, indicating there is power to the EPS system.

If the **yellow light** is illuminated, **there is an opening** in the earth loop electrical circuit. The audible signal will also be heard. After shutting power **OFF**, all electrical connections from the EPS module to the earth loop system should be checked and adjusted as appropriate to ensure good electrical contact.

If the **red light** is illuminated, **there is a short** in the earth loop electrical circuit. The audible signal will be heard. Check and correct all wiring and connection as appropriate from the EPS module to the earth loop to ensure they are not shorting.

If **none of the lights** are illuminated, check and replace, as appropriate, the fuse for the EPS Power Supply as shown in Figure 21. For service purposes, a spare fuse has been factory supplied and is located in the electrical box. The replacement fuse is **Littlefuse 213 Series Slo-Blo® rated at 250 Volts, 2 Amperes, P/N 0213002MXP.** This is also Allied Electronics Stock Number R1090710.

If it is necessary to operate the heating and cooling system while the EPS is down for service, the EPS power may be temporarily disengaged to eliminate the audible alarm, by removing the EPS Fuse shown in Figure 21. Upon completion of servicing the EPS, replace the fuse to energize the EPS system and maintain warranty coverage.

IMPORTANT!

DO NOT troubleshoot the EPS power supply or EPS module! If the above steps do not resolve the problem, call ETI for technical service assistance at 1-863-701-0096.

Current Verification

If it is necessary to verify the current flow through the EPS system, it can be checked with a digital DC ammeter set on the Milliampere scale. The correct currents for nominal system capacities are listed in Figure 22.

Nominal System Capacity, Tons	Current Rating
1.5 thru 2.5	80 mA +/- 10%
3.0 thru 3.5	120 mA +/- 10%
4.0 thru 6.0	240 mA +/- 10%

Figure 22. EPS Curent Ratings

WARNING!

Use extreme caution when checking current through the EPS system. Turn OFF the main disconnect to the compressor unit when setting up the Ammeter for the current measurement. Turn the power supply on only after the Ammeter is in place for the measurement and hands and body are clear of all electrical circuit conductors. Turn OFF the main disconnect after the current measurement has been taken and before attempting to disengage the Ammeter and re-connect the EPS wiring. Failure to do this, could cause personal injury or death.

To check the current, disconnect the **"Loop"** wire from the EPS module as shown in Figure 23 and connect the DC ammeter as shown to measure and verify the current flow.

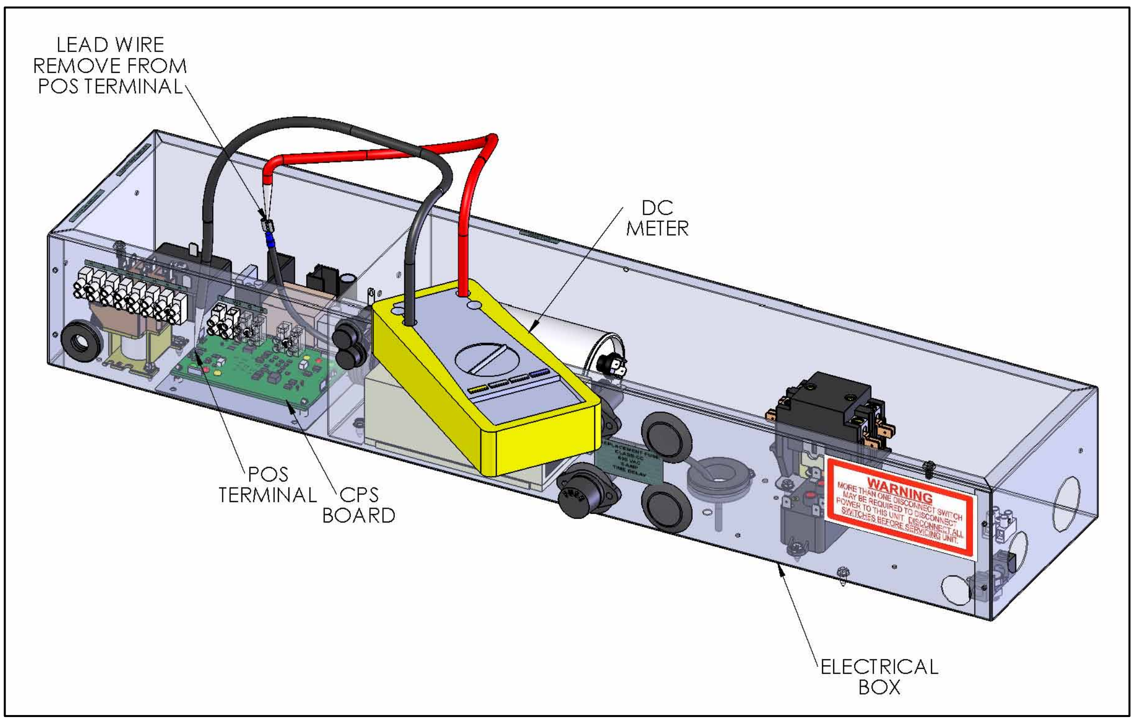


Figure 23. Test for DC Current

System Start-Up

Evacuation

CAUTION!

During the Evacuation and Initial Charging processes, be sure that <u>ALL power to the EarthLinked® System is OFF</u>. This includes the compressor unit, air handler and all other electrically powered system components.

Prior to system start-up, evacuation of the system is accomplished through the compressor unit. All of the refrigerant containing components in the compressor unit are illustrated in Figures 24 and 25. The evacuation and charging process will be done through the access and charging ports.

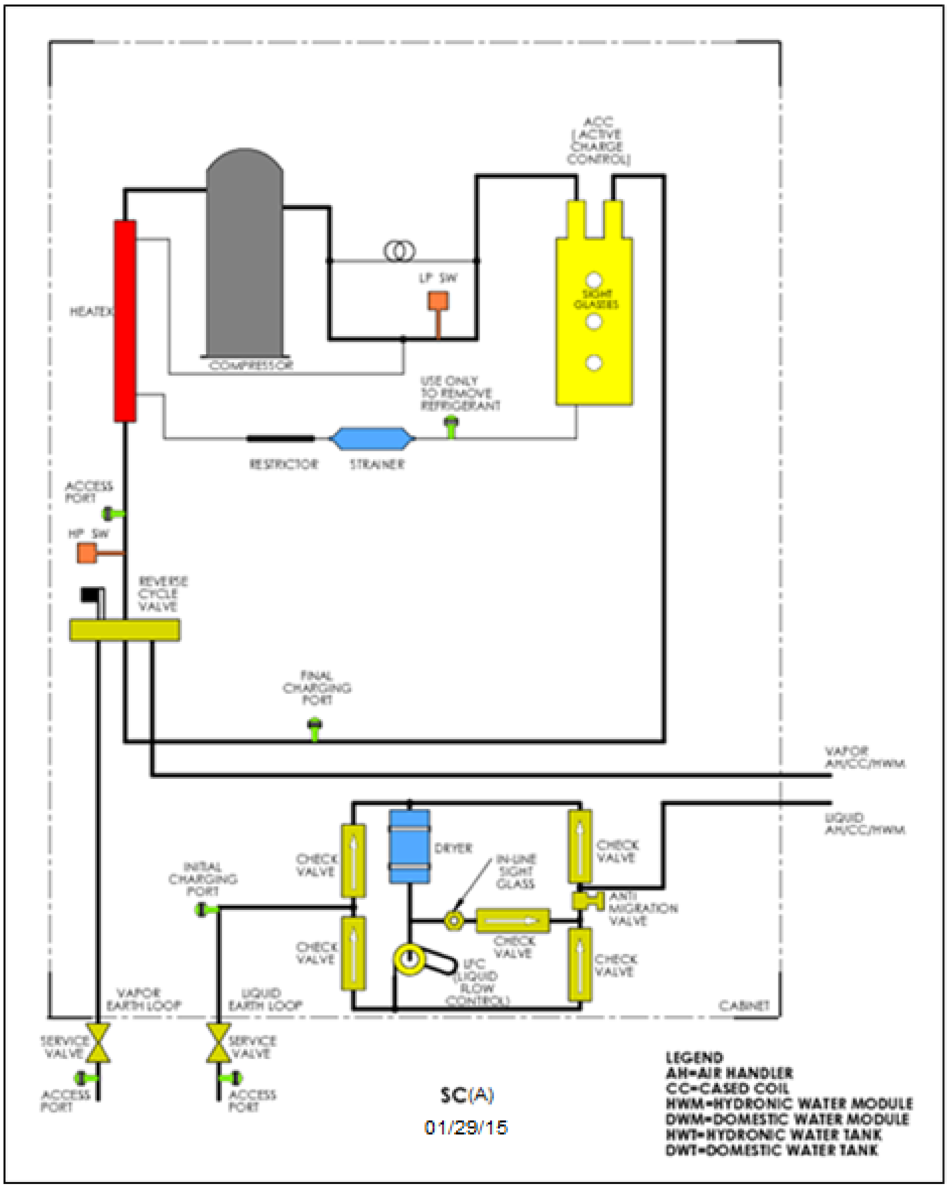


Figure 24. SC(A) Internal Flow Schematic

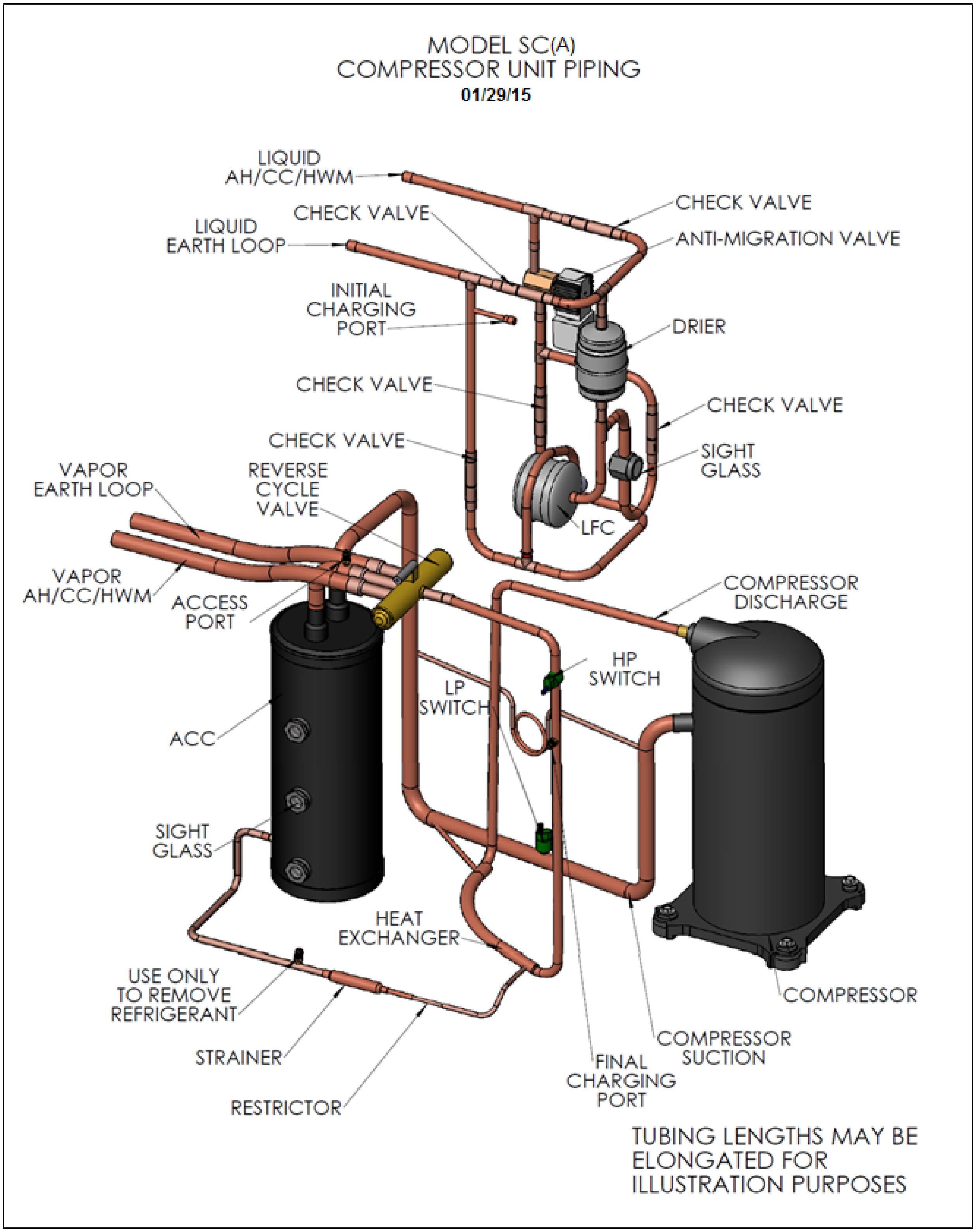


Figure 25. SC(A) Piping

Refer to Figure 26 and the following procedure:

1. Carefully vent any pressurized charge from the compressor and system..
2. After venting the pressurized system, connect the Gage Block and Hoses as shown in Figure 26. LP and HP valves are fully open. Both Service Valves are fully opened.
3. As illustrated in Figure 26, connect a good quality Digital Micron Gage to the Liquid Service Valve Access Port with an Isolation Hose/Valve. Connect a quality Vacuum Pump (at least 6 CFM capacity) to the Gage Block.

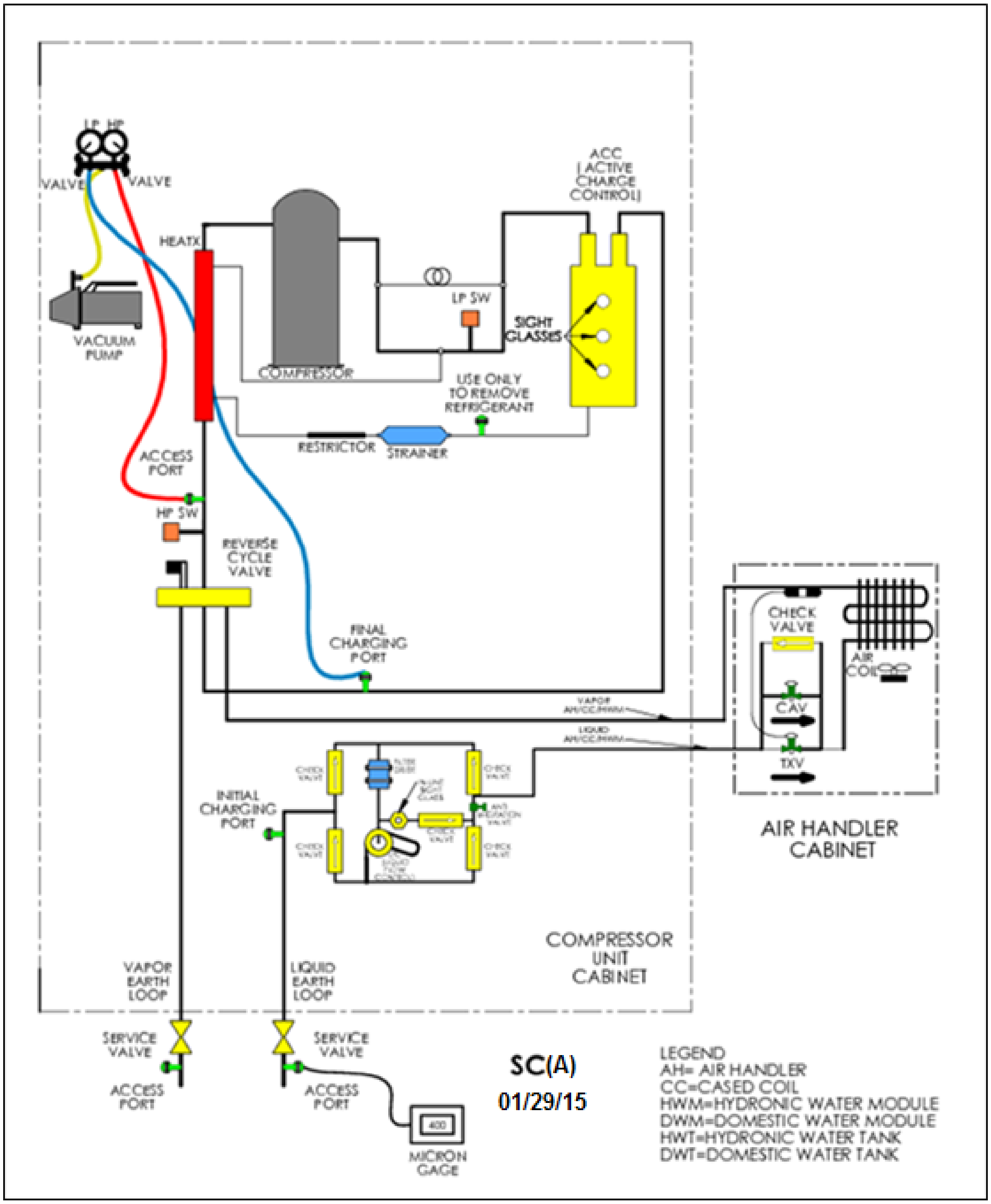


Figure 26. Evacuation of SC(A) System

IMPORTANT!

DO NOT ENERGIZE THE COMPRESSOR WHILE THE SYSTEM IS UNDER VACUUM. THIS WILL CAUSE DAMAGE TO THE COMPRESSOR.

4. Initiate the system evacuation. **Evacuate the system down to 400 MICRONS** as read on the digital micron gage. After 400 microns has been achieved, turn OFF the LP and HP valves and turn OFF the vacuum pump. **Reading the digital micron gage, the system pressure must not exceed 500 MICRONS WITHIN 30 MINUTES.** If pressure rises to greater than 500 microns, initiate the evacuation process again and until the above conditions are met.

   A procedure often used to evacuate a system to a deep vacuum level, known as the triple evacuation method, is detailed in the section of this manual entitled **Triple Evacuation**.

   Local codes may require other evacuation criteria, in which case the local codes take precedence over the evacuation requirements described above.

IMPORTANT!

DO NOT CHARGE THE SYSTEM UNTIL THE CONDITIONS OF STEP #4 ARE COMPLETED!

Initial Charge

1. Close the LP and HP valves on the gage block. Disconnect and isolate the vacuum pump and digital micron gage. Connect the refrigerant container (on the scale) to the gage block utility hose as shown in Figure 27.

WARNING!

Inhalation of high concentrations of refrigerant gas vapor is harmful and may cause heart irregularities or death. Vapor reduces oxygen available for breathing and is heavier than air. Decomposition product are hazardous. Liquid contact can cause frostbite. Avoid contact of liquid with eyes and prolonged skin exposure. Liquid and gas are under pressure. Deliberate inhalation of refrigerant gas is extremely dangerous. Asphyxiation can occur without warning due to lack of oxygen. Before using, read the material safety data sheet.

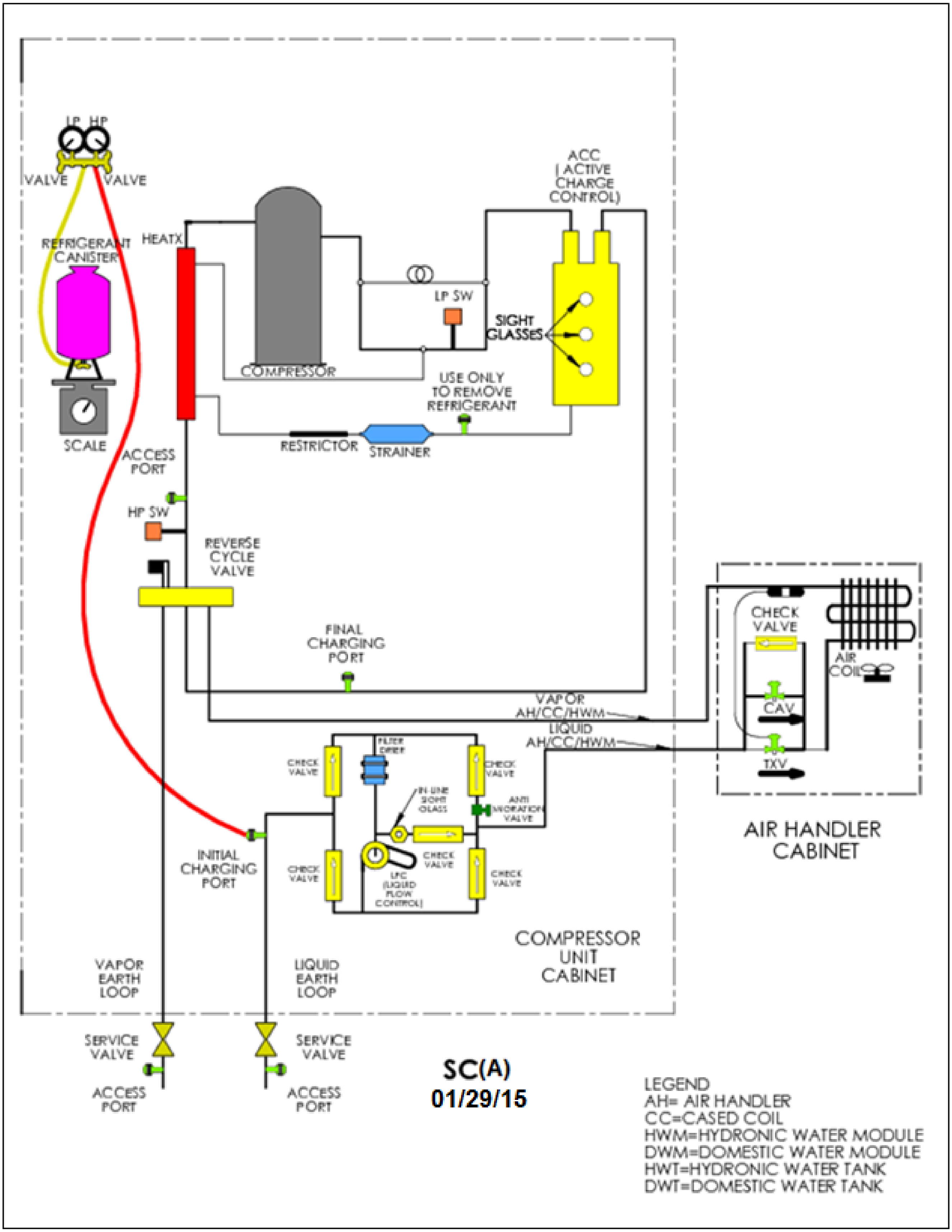


Figure 27. Initial Charge of SC(A) System

2. Open the refrigerant container valve and inject liquid refrigerant into the initial charging port as shown in Figure 27.
3. Charge with liquid refrigerant until 3 pounds of refrigerant per ton of system capacity, has entered the system.
   Liquid entering the system at the initial charging port goes directly to the system earth loops, it does not go to the compressor. Should the pressures equalize and prevent the intended charge from entering completely, terminate the process of initial charging. Note and document the amount of refrigerant.
4. When the initial refrigerant charge (see step 3 above) has entered the system, close the refrigerant container valve and disconnect the refrigerant hose from the initial charging port. Note and document the amount of refrigerant.
5. The system has now been initially charged.

Final Charge

It is critical to control the conditions under which the compressor unit operates while final charging the system. **Final charging must be done in HEAT mode.**

Air Handler Systems

The return air to the air handler during the final charging is to be maintained in the range of 70°F to 80°F. If necessary, the air can be warmed with electric supplemental heat in the air handler. (Shunt “R” to “W2” at the terminal block.)

Hydronic Systems

If heating is provided through a hydronic water module, HWM, the circulating water is to be maintained in the 95°F to 105°F range.

The final charging procedure is as follows, with the final charging set up described in Figure 28.

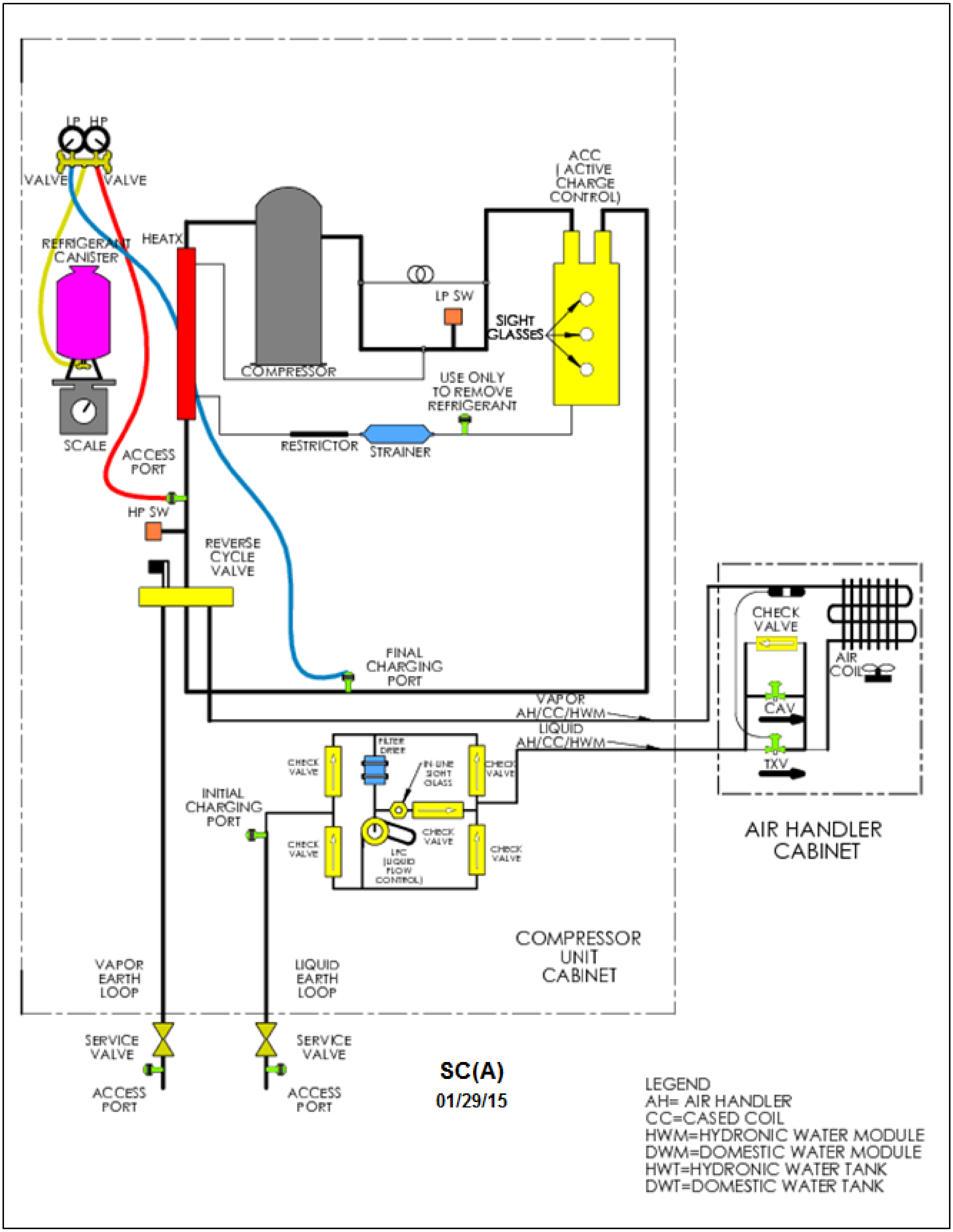


Figure 28. Final Charge of SC(A) System

1. Re-connect the red HP hose, after purging with a trickle of refrigerant, (from the initial charging port in Figure 27) to the access port as shown in Figure 28. Continue measuring the refrigerant charge weight as shown in Figure 28.
2. **Be sure that air entering the air handler is between 70°F and 80°F. If the system is a hydronic primary circuit, circulating water is to be held between 95°F and 105°F.**
3. Close the HP valve. **Then turn the system on in the HEAT mode**.
4. Initiate final charging by **SLOWLY** opening the refrigerant container valve and the gage manifold LP valve to allow liquid refrigerant to enter the final charging port **SLOWLY**.
5. Adding liquid refrigerant will raise the liquid level in the ACC. Continue to add liquid refrigerant to the system until the liquid level has reached the bottom sight glass, as shown in Figure 29.
6. **When the liquid level is at the bottom sight glass, as shown in Figure 29, turn the refrigerant container valve OFF.**

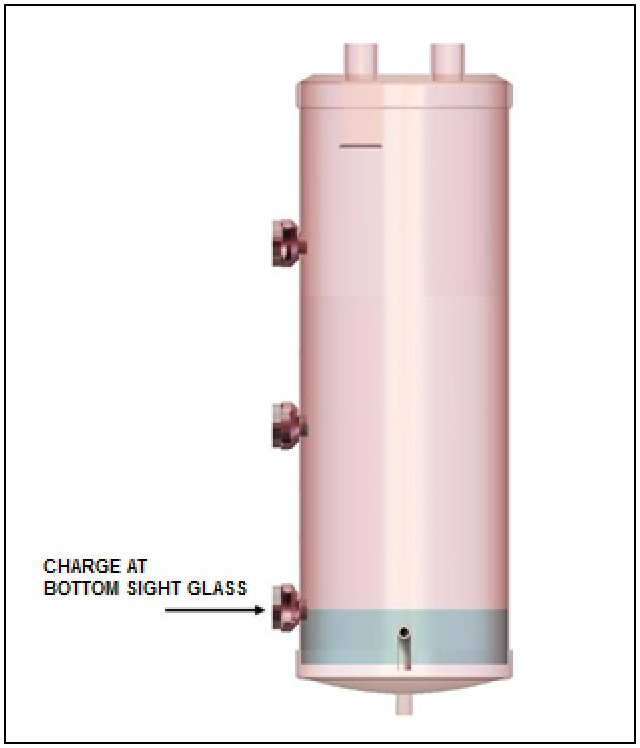


Figure 29. Charge at Bottom Sight Glass

7. When the system has run for 20 minutes (in HEAT mode), read the evaporating temperature and condensing temperature.

   The evaporating temperature can be read by attaching a thermocouple lead to the Earth Loop Vapor Line with electrical tape, then wrapped with ½" thick insulation. The condensing temperature can be read by attaching a thermocouple lead to the Air Handler/CC/HWM liquid line coming into the compressor unit with electrical tape, then wrapped with ½" thick insulation. Use an accurate temperature indicator.

For Air Systems:

In Figure 30, locate the evaporating temperature on the horizontal axis. The corresponding condensing temperature reading should fall between the upper and lower parallel lines in Figure 30.

The temperature profile in Figure 30 is valid for the air handler systems with an air flow of 400CFM per Ton. If condensing temperature is above acceptable range, the air flow is low. If condensing temperature is below the acceptable range, air flow is too high. **Adjust air flow as appropriate.**

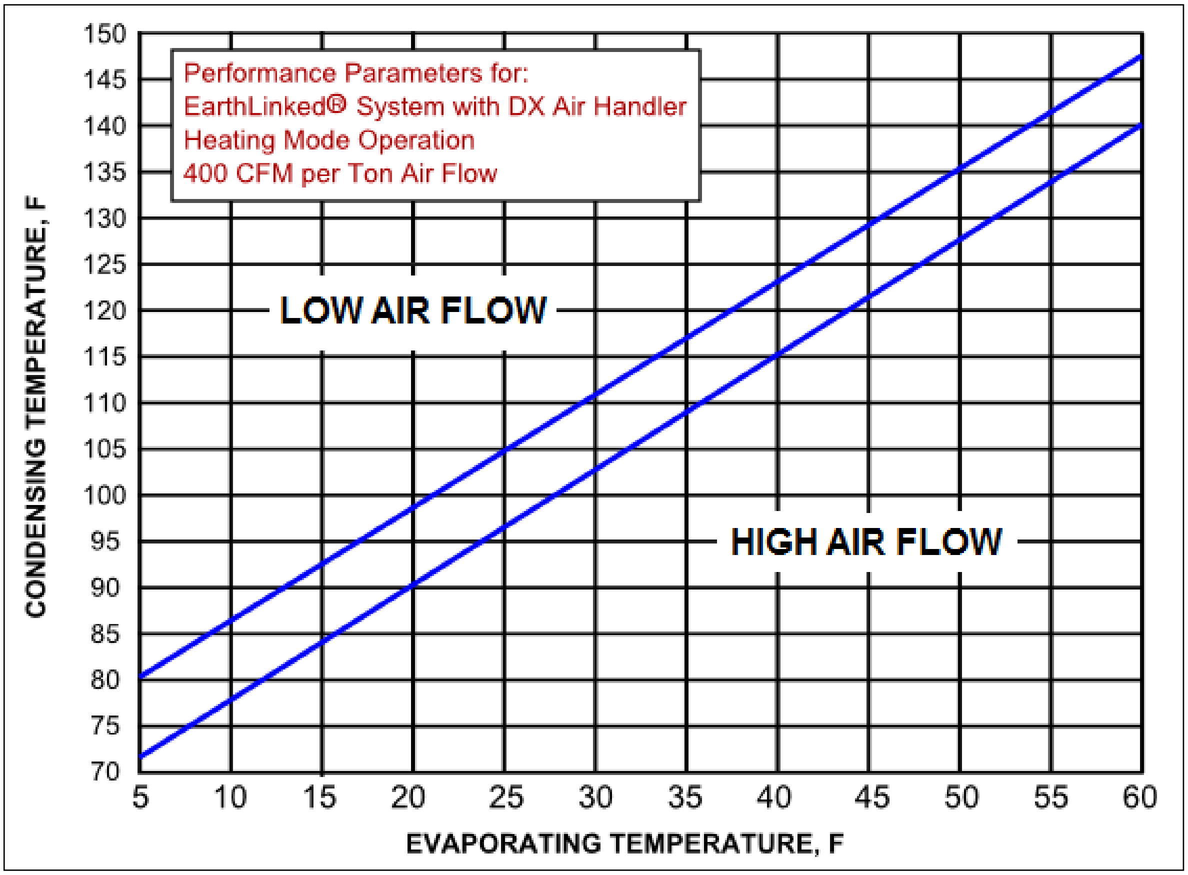


Figure 30. Air System Performance Parameters

For Hydronic Systems:

In Figure 31, locate the evaporating temperature on the horizontal axis. The corresponding condensing temperature reading should fall between the upper and lower parallel lines in Figure 31.

The temperature profile in Figure 31 is valid for hydronic systems with the correct heat exchanger water flow. If condensing temperature is above acceptable range, the water flow is low. If condensing temperature is below the acceptable range, water flow is too high. **Adjust water flow as appropriate.**

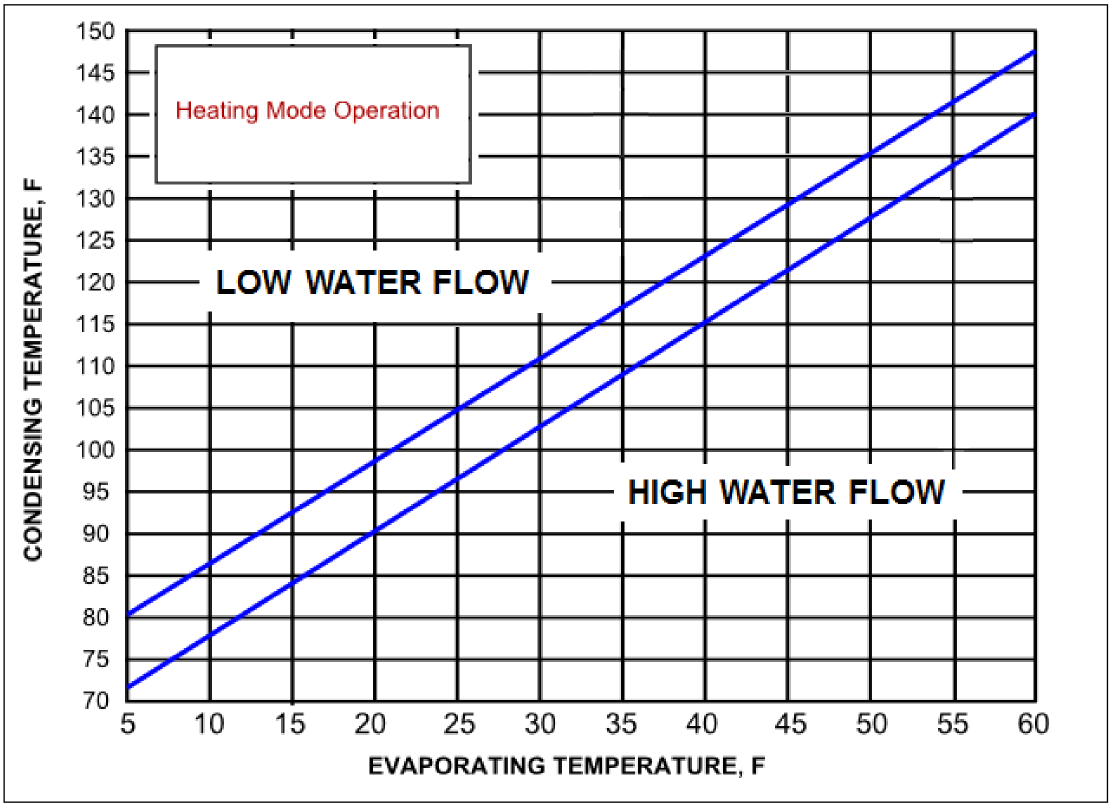


Figure 31. Hydronic System Performance Parameters

8. Check the suction saturation temperature to verify that it is within ±3°F for the measured suction pressure. The suction temperature should be approximately 15 to 20°F lower than the local earth temperature.

Cool Mode Start-Up

IMPORTANT!

Be sure the return air to the air handler is maintained in the range of 70ºF to 80ºF. If the system is hydronic, maintain the return water temperature in the range of 45ºF to 52ºF.

If site conditions prevent maintaining an air handler return air temperature between 70ºF and 80ºF, the cooling system start-up steps can be completed at a later time. If the cooling mode start-up process is delayed, the system can run in heat mode only and the cooling mode must be disabled until the cooling mode start-up process is initiated. If the cooling mode start-up process is initiated after running the system in heat only mode, the system should remain OFF for 48 hours after running in the heat mode to allow the earth temperature surrounding the earth loops to stabilize.

These following steps describe the procedure for system **start-up in the cooling mode.** This is illustrated in the process flow chart, Figure 38. **Be sure the cooling mode for the system is enabled.**

1. Close the HP valve on the gage block. **Turn the system on in COOL mode**, monitor the suction pressure, and wait for it to stabilize.

2. When suction pressure has stabilized, check the **bottom ACC sight glass** to determine if there is liquid in the ACC.

3. **If there is NO LIQUID REFRIGERANT** in the bottom sight glass, proceed to step 5.

4. **If there is LIQUID REFRIGERANT** in the bottom ACC sight glass, continue to run the system to remove the liquid refrigerant from the ACC, in accordance with the procedure described in the process flow chart, Figure 38.

5. **Monitor the suction pressure,** as shown in Figure 32. If suction pressure is not yet up to 120 psig, the INLINE sight glass (not the ACC sight glass) will show refrigerant flow with many bubbles, as illustrated in Figure 33. This indicates that the Cooling Assist Valve (CAV) has not yet closed. Monitor the suction pressure rising. As the ground warms, the suction pressure will rise and the sight glass will show fewer bubbles.

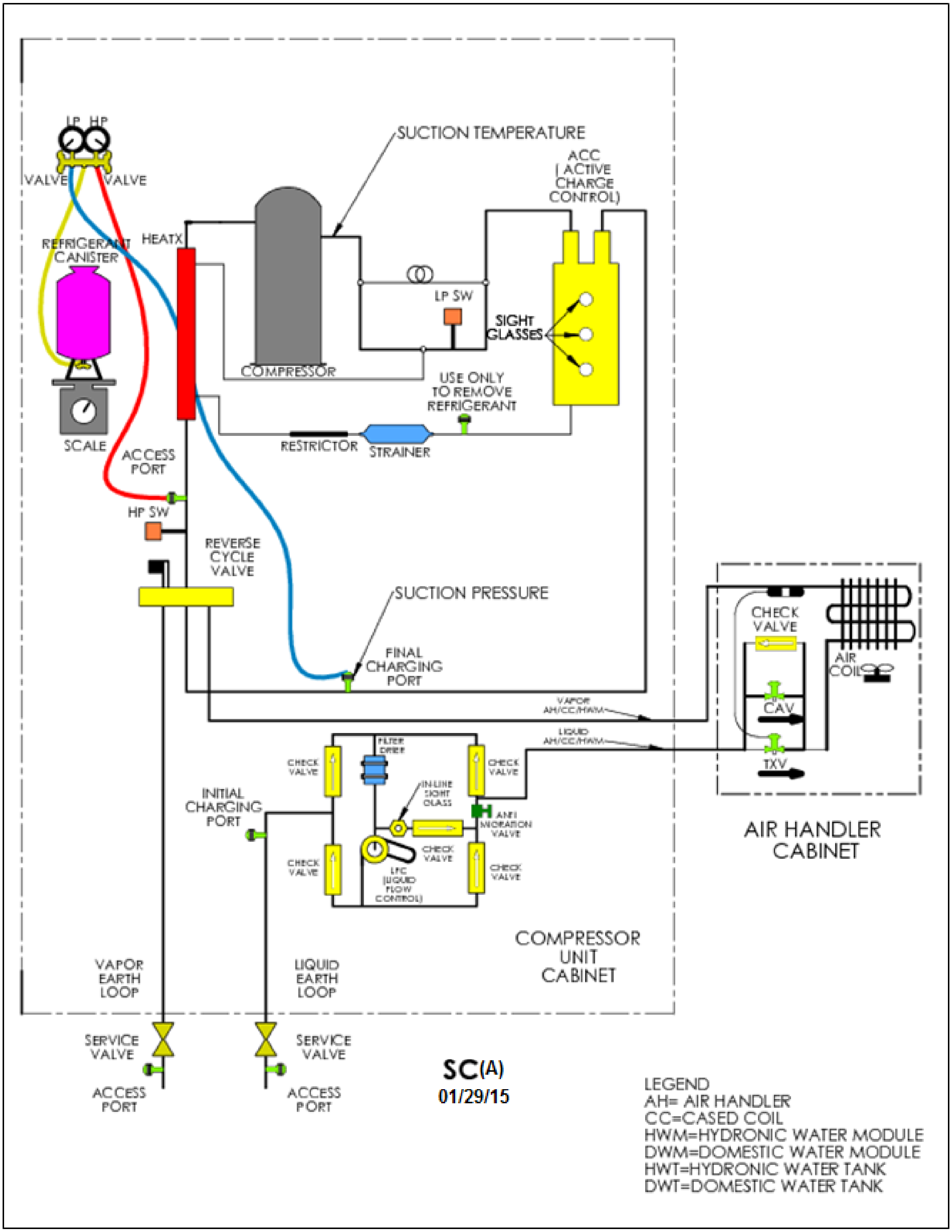


Figure 32. Suction Pressure and Temperature Measurements

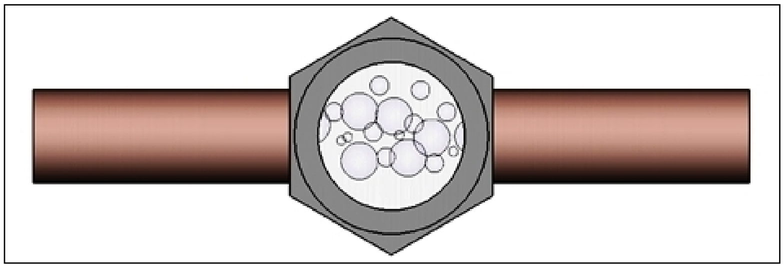


Figure 33. Many Bubbles-Inline Sight Glass

6. **When suction pressure reaches 120 psig**, observe the **INLINE** sight glass. If it is either clear as shown in Figure 34, or has a trickle of bubbles as shown in Figure 35, no additional refrigerant charge is required. Go to step 10.

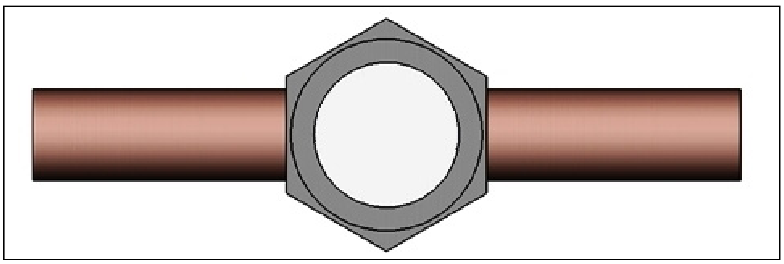


Figure 34. Clear-Inline Sight Glass

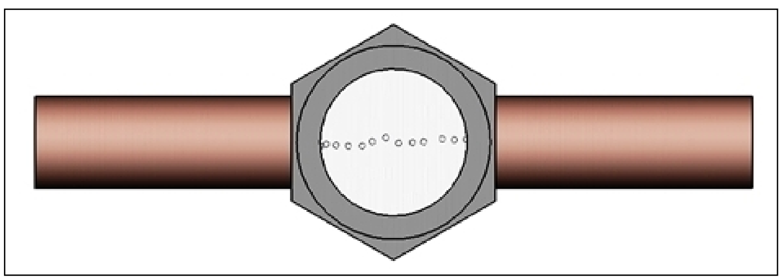


Figure 35. Trickle of Bubbles-Inline Sight Glass

7. **When suction pressure is 120 psig, there are still many bubbles in the INLINE sight glass**, as shown in Figure 33, refrigerant must be added to the system through the final charging port.

IMPORTANT!

Add refrigerant SLOWLY to the system through the final charging port. Add no more than 8 ounces of refrigerant at a time and wait 10 minutes, observing the INLINE sight glass to determine the refrigerant status, before adding more refrigerant.

8. **Observe the refrigerant flow in the INLINE sight glass.** If the sight glass has cleared, as shown in Figure 34, or there is a trickle of bubbles as shown in Figure 35, the system is fully charged.

9. **If there are many bubbles in the INLINE sight glass,** as shown in Figure 33, additional refrigerant is required. Repeat step 7 until the INLINE sight glass clears or has a trickle of bubbles as shown in Figure 34 or 35, respectively, but DO NOT ADD MORE THAN THE FOLLOWING AMOUNTS OF REFRIGERANT TO THE SYSTEM DURING THIS PROCESS:

Nominal System Tonnage	Maximum Additional Refrigerant
2.0, 2.5	6 lbs
3.0, 3.5, 4.0, 4.5, 5.0	10 lbs

10. **When the suction pressure is at least 120 psig and the INLINE sight glass shows refrigerant flow as clear or having a trickle of bubbles,** the next step is to **monitor the discharge pressure until it rises to 275 psig or greater,** as shown in Figure 36. When these conditions are met, proceed to step 11, adjustment of the TXV superheat.

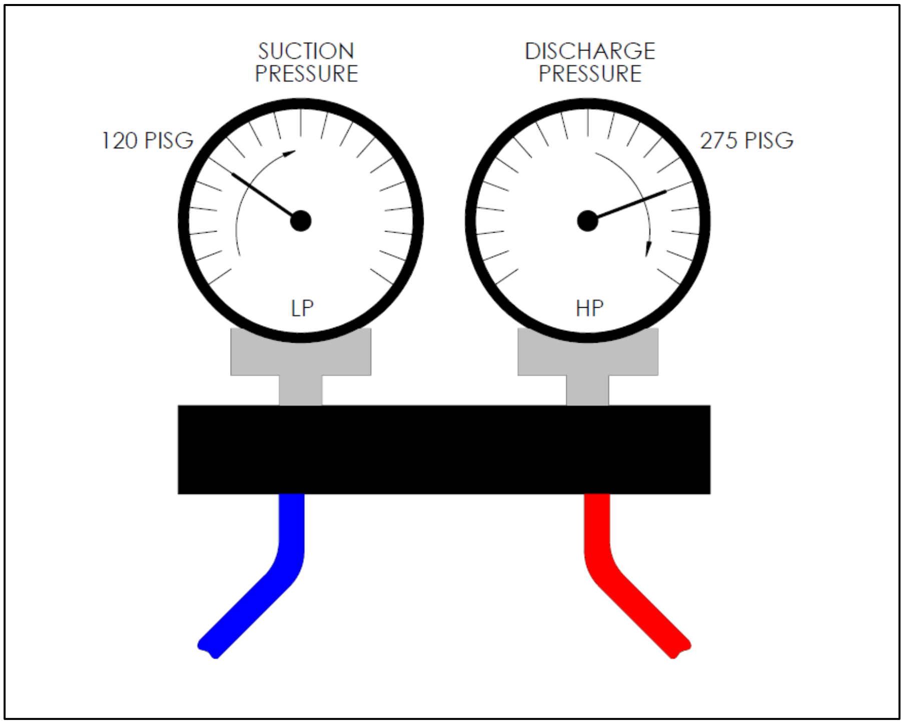


Figure 36. Minimum Suction and Discharge Pressures

11. The TXV is to be adjusted to provide 10ºF to 15ºF superheat while running in cooling mode. The first step is to utilize the final charging port and LP gage in Figure 32 to measure suction pressure. Next, apply a thermocouple at the compressor suction port as shown in Figure 32 by attaching the thermocouple lead with electrical tape, and wrapping with ½" thick insulation.

12. **Using an accurate temperature indicator, read the suction temperature at the compressor suction port.** Read the suction pressure at the final charging port on the LP gage.

13. Enter the Pressure-Temperature Table in Figure 37 and for the suction pressure read the LP gage, and determine the saturation temperature (evaporating temperature) from the chart, interpolating if necessary.

SATURATION TEMPERATURE (°F)	SUCTION PRESSURE (psig)	SATURATION TEMPERATURE (°F)	SUCTION PRESSURE (psig)
-20	26.1	70	199.2
-15	30.8	75	216.1
-10	35.9	80	234.0
-5	41.5	85	253.0
0	47.5	90	273.0
5	54.1	95	294.1
10	61.2	100	316.4
15	68.8	105	339.9
20	77.1	110	364.6
25	86.0	115	390.5
30	95.5	120	417.7
35	105.7	125	446.3
40	116.6	130	476.3
45	128.3	135	507.6
50	140.8	140	540.5
55	154.1	145	574.8
60	168.2	150	610.6
65	183.2		

Figure 37. Pressure-Temperature for R-410A

14. To determine the degrees of Superheat, subtract the saturation temperature from the suction temperature read at the compressor suction port thermocouple. The difference in the temperatures is the superheat.

(Superheat, °F) = (Suction Temp., °F) - (Saturation temp., °F)

15. The TXV must be adjusted at installation to be in the **superheat range of 10°F to 15°F.** To adjust the superheat using a 3/16” square refrigeration service wrench, **turn in the clockwise direction to increase superheat. Turn in the counterclockwise direction to reduce superheat.** One complete turn will change the superheat by approximately 3°F.

16. **Document the weight of the refrigerant charge in the system.** Write it down on the **Warranty Registration Card** and inside the compressor unit on the electrical diagram, for future reference. **This is the full system charge.**

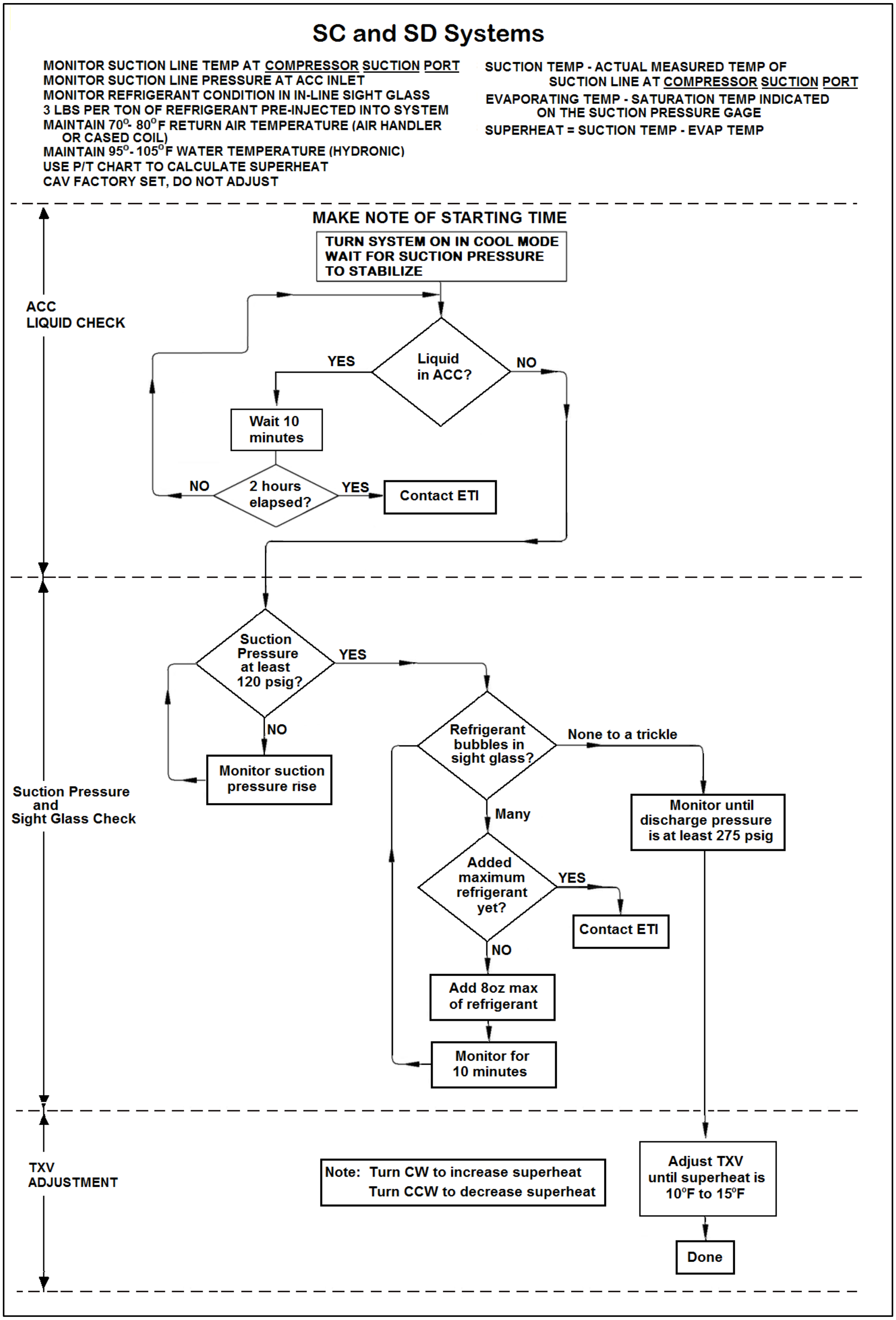


Figure 38. Cooling Mode Start-Up

Troubleshooting

CAUTION!

SERVICE MAY BE PERFORMED ONLY BY AN EARTHLINKED TECHNOLOGIES AUTHORIZED PROFESSIONAL HVAC OR REFRIGERATION SERVICE PERSON. USE ONLY SAFE AND APPROVED SERVICE TECHNIQUES.

IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, MAINTENANCE OR SERVICE CAN CAUSE 1) THE EARTHLINKED® SYSTEM OR COMPONENTS TO MALFUNCTION AND OR FAIL, 2) PROPERTY DAMAGE, INJURY OR DEATH.

IMPORTANT!

EarthLinked® Refrigerant System Safety Switches

EarthLinked® compressor units are equipped with the following three safety switches that will turn the compressor off if the following limits are exceeded.

High Pressure Switch: Located between the compressor discharge port and the reversing valve, the **cut-out pressure is 600 psig.** This is a manual reset switch.

Low Pressure Switch: Located between the ACC and the compressor suction port, the **cut-out pressure is 25 psig.** This is an automatic reset switch.

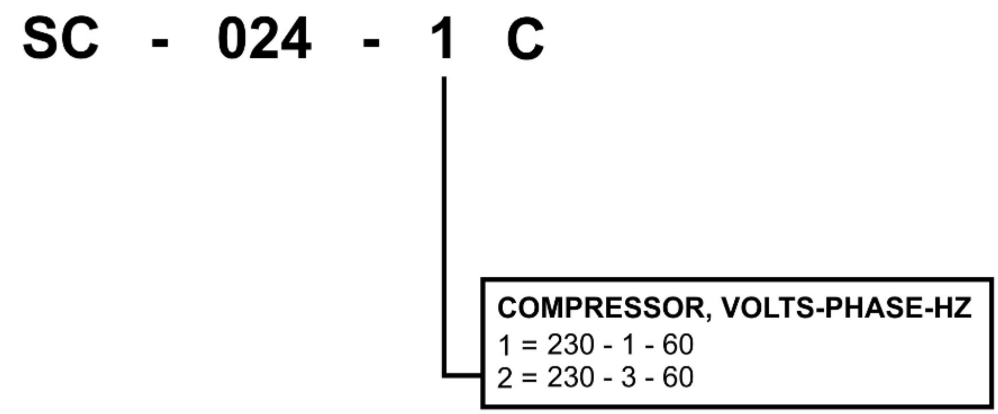
Discharge Temperature Switch: Located at the compressor discharge, the **cut-out temperature is 214°F.** This is a manual reset switch.

If you experience difficulties with the EarthLinked® system, please review the appropriate section of the manual. It may be helpful to have another professional HVAC or refrigeration service person review and check it with you.

Time and expense can be saved by taking a thoughtful and orderly approach to troubleshooting. Start with a visual check: Are there loose wires, crimped tubing, missing parts, etc?

Compressor

After setting the remote (wall) thermostat system switch to the “OFF” position and the thermostat fan switch to the “AUTO” position, proceed to check the supply voltage at (1) the line terminals to the breaker/disconnect; 2) the system side of the breaker/disconnect, and 3) the line-side of the transformer. Verify the proper voltage rating for the system. Reference Figure 39.



ACCEPTABLE VOLTAGE RANGES

Compressor Unit Nameplate Voltage	230	230
Phase	1	3
Frequency, Hz	60	60
Minimum Voltage	207	207
Maximum Voltage	253	253

Figure 39. Compressor Unit Voltage Information

The following compressor checklist is provided to analyze the compressor and determine if it is operating properly or if it is faulty:

1. **Electrical Service Panel** – turn power off.
   a. Check circuit connections for tightness
   b. Circuit breaker sized right?*
   c. Wire size correct?*
2. **Check start and run capacitors** or other start components for bulges, overheating or loose connections.
3. **Test capacitors** and start components and replace if necessary. Capacitors can be checked by substitution.
4. **Check incoming power supply voltage** to determine whether it is within acceptable voltage range.* (See Figure 39)
5. **Check voltage at compressor unit terminals** to determine whether it is within acceptable voltage range.* (See Figure 39)
6. **Running Amperage.** Connect a clip-on type ammeter to the (common) lead to the compressor. Turn on the supply voltage and energize the unit. The compressor will initially draw high amperage; it should soon drop to the RLA value (See Figure 7) or less. If the amperage stays high, check the motor winding resistance.

   Note: Feel the top of the compressor to see if it has overheated. If it is hot, the internal overload may be open. You may have to wait several hours for it to reset.

If the compressor draws a high amperage and does not start (amperage is approximately locked rotor amperage – LRA (See Figure 7)), the compressor is locked mechanically and should be removed from the system.

IMPORTANT

Turn power OFF to the compressor unit before proceeding to the next step.

7. Motor Circuit Testing

Using a digital volt-ohmmeter (VOM), measure the resistance across the compressor windings as shown in Figure 40. The power leads to the compressor must be disconnected before taking an electrical measurement. A good rule of thumb for single phase compressors is that start winding resistance (R_2) is 3 to 5 times greater than run winding resistance (R_1).

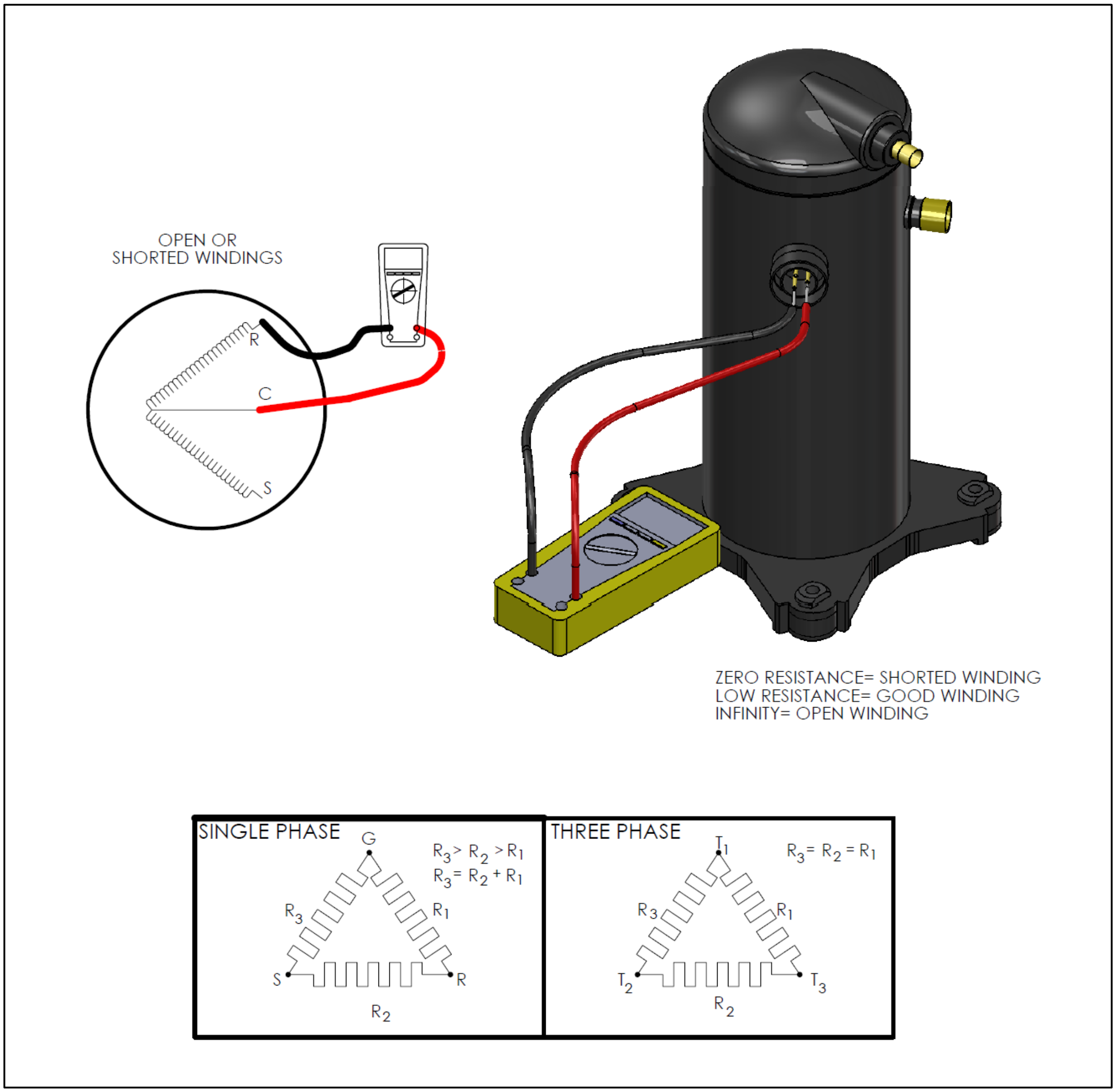


Figure 40. Compressor Motor Circuit Testing

8. **Grounded Windings**

Test the compressor motor for a grounded winding. The check should be made using an ohmmeter capable of measuring very high resistance on a VOM. The resistance between windings and the housing is one million to three million ohms for an **ungrounded** winding.

Attach on lead to the compressor case on a bare metal tube and to each compressor terminal as shown in Figure 41. A short circuit at a high voltage indicates a motor defect.

IMPORTANT
DO NOT do this test when the system is under vacuum.

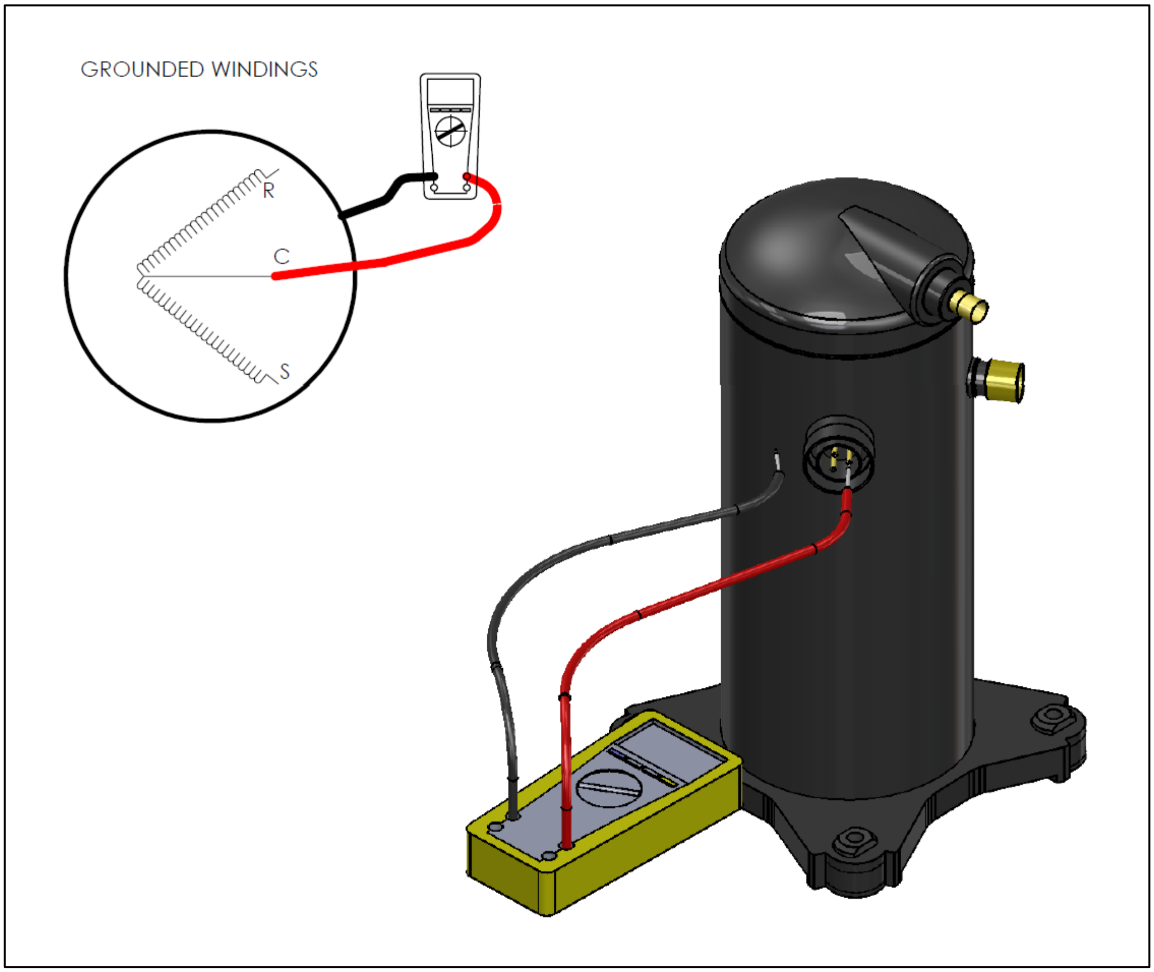


Figure 41. Compressor Motor Grounded Winding Test

9. **Compressor not pumping.**

Connect gage block hoses to the suction and discharge pressure ports in the compressor unit. Read pressure gages to affirm that system is pressurized with refrigerant. Turn on power to compressor unit and run unit. Observe pressure gages. If pressures on both gages remain the same, compressor is not pumping and there is a possible internal failure. See System Troubleshooting Chart.

System

Problem / Symptom	Likely Cause(s)	Correction
A. System does not run.	1. Thermostat fault.	1. Adjust thermostat settings. / Replace thermostat.
	2. Power supply problem (AHU / compressor unit).	2. Check power supply for adequate phase and voltage. Check wiring to system and external breakers or fuses.
Note: Some digital thermostats have a built-in five-minute time delay.	3. Control voltage problem.	3. Check for 24V on terminal strip between "R" and "C".
	4. Shut off by external thermostat or thermostat is defective.	4. Check operation of thermostat.
	5. System off on high pressure / low pressure switches or discharge temperature switch.	5. Reset limit switch. Analyze system for root cause.
	6. Internal component or connection failure.	6. Check for loose wiring. Check components for failure.
	7. Compressor contactor not pulling in.	7. Check for 24V across contactor. Trace 24V circuit and components between "Y" and "C" to locate fault. Repair or replace as necessary.
	8. Faulty run capacitor or start components.	8. Test each and replace as necessary.
	9. Compressor windings shorted or grounded.	9. See compressor diagram/ replace the compressor.
B. System runs for long period or continuously.	1. Thermostat fault.	1. Adjust thermostat settings / Replace thermostat.
	2. Refrigerant undercharged.	2. Repair leak. Evacuate and recharge system.
	3. Component failure (cooling mode).	3. Check pressures and electrical circuits for abnormalities.
	4. Outdoor thermostat not connected or failed (heating mode).	4. Check outdoor thermostat and electric supplemental heat operation. Confirm proper wiring.
	5. Reduced air flow.	5. Check air ducts for leaks and repair. Check blower operation. Check air filter(s). Remove air flow restrictions (min.400 CFM/ton).
	6. Four-way valve is short circuiting refrigerant and bypassing hot gas to suction.	6. Replace four-way valve, evacuate, recharge and start-up system.
	7. Unit undersized.	7. Contact ETI Technical Support at 863-701-0096.
C. System blows fuses or trips circuit breaker.	1. Inadequate circuit ampacity.	1. Note electrical requirement and correct as necessary.
	2. Short, loose or improper connection in field wiring.	2. Check field wiring for problems.
	3. Internal short circuit. Loose or improper connection in system.	3. Check wiring in system. See appropriate wiring schematics and diagrams. Test components, especially the compressor, for shorts and grounds.

Figure 42. System Troubleshooting Chart

C. System blows fuses or trips circuit breaker (con't)	4. Excessively high or low supply voltage or phase loss (3∅ only).	4. Note voltage range limitations specific to the compressor.
	5. Faulty run capacitor or soft start components.	5. Replace as necessary.
D. Air handler fan will not run.	1. Thermostat defective.	1. Check for 24V power on eight-post terminal strip between "C" and "G".
	2. Defective fan relay in air handler.	2. Check relay operation and continuity of terminals.
	3. Faulty motor/capacitor.	3. Refer to ECM troubleshooting.
E. System will not switch to cooling mode (continues to run in heating mode).	1. Thermostat faulty.	1. Check operation of thermostat and replace if necessary.
	2. Open heat/cool circuit (orange wire).	2. Check for 24V on eight-post terminal strip between "O" and "C".
	3. Four-way valve solenoid not energized.	3. Check for magnetism at end of valve coil. Check for 240V at coil. Check Heat/Cool Relay.
	4. Four-way valve stuck in heat mode.	4. Contact ETI Technical Support at 863-701-0096.
F. Compressor turns off on thermal overload. ***(check until compressor's temperature reaches room temperature before determining the internal overload is defective)***	1. Refrigerant leak.	1. Check for refrigerant level in ACC. Repair leak, evacuate system and recharge with refrigerant.
	2. System undercharged.	2. Charge system.
	3. Four-way valve is short circuiting refrigerant and bypassing hot gas to suction.	3. Replace four-way valve, evacuate, recharge and start-up system.
	4. Compressor valves are faulty/ bypassing.	4. Use Rubber Mallet on Scroll Comp's. before condemning. Replace compressor and evacuate, recharge and start-up system.
	5. Compressor contactor dirty or pitted. (> .5 Ohms Resistance across Contact points)	5. Replace as necessary.
	6. Faulty run capacitor or start components.	6. Replace as necessary.
	7. Compressor with locked rotor.	7. Replace as necessary.
G. Uncomfortable temperature. (Not enough heat/cold air)	1. Thermostat fault.	1. Adjust thermostat settings / Replace thermostat.
	2. Defective heating element(s). (Heating mode).	2. Check resistance element(s) for continuity.(Heating mode only)
	3. Defective heater relay. (Heating mode).	3. Check relay for proper operation. Replace if defective. (Heating mode only)
	4. Thermal limit is open. (heat kit)	4. Check continuity across thermal limit switch. (Heating mode only)
	5. Compressor fault.	5. To reset switch, turn primary power off then back on; turn thermostat system switch to OFF, then back on.
	6. Outdoor thermostat not connected or failed (heating mode).	6. Check outdoor thermostat and electric supplemental heat operation. Confirm proper wiring. (Heating mode only)

Figure 42. System Troubleshooting Chart (con't)

G. Uncomfortable temperature. (Not enough heat/cold air) (cont'd)	7. Refrigerant undercharged.	7. Check for refrigerant level in ACC.(Heating mode only) Repair leak, evacuate and recharge the system. Check In-line sight glass in cooling mode.
	8. Restriction in refrigerant circuit.	8. Check for blockage or restriction, especially in Liquid Flow Control. Assure that modification of non-ETI air handler is performed. Check valves, filter/dryer and anti-migration valve.
	9. System is locked out on high or low pressure.	9. Check low pressure and high pressure: Check limit cut-off pressures. Control is set to actuate at 5 (R-22 & 407C)/25psig (R-410A) (low pressure) and 400 (R-22 & 407C)/600 psig (R-410A) (high pressure) +10%. Check for continuity on both switches under normal pressure conditions. Refer to Unit performance table.
	10. Defective pressure control.	10. Check limit cut-off pressures. Control is set to actuate at 5 (R-22 & 407C)/25psig (R-410A) (low pressure) and 400 (R-22 & 407C)/600 psig (R-410A) (high pressure) +10%. Check for continuity on both switches under normal pressure conditions.
	11. Reduced air flow.	11. Check air ducts for leaks and repair. Check blower operation. Check air filter(s). Remove air flow restrictions (min.400 CFM/ton).
	12. Unit undersized/ oversized.	12. Contact ETI Technical Support at 863-701-0096.
H. Poor Compressor Performance (Runs, but Not pumping Refrigerant)	1. Reversing Valve stuck and Compressor will not create a pressure difference between high and low side of the system.	1a. Pinch closed the Discharge Line to verify the Compressor builds High Pressure, if so, replace Reversing Valve.
		1b. If High pressure does not build after pinching the Discharge Line closed, the Compressor has failed, replace Compressor.
	2. Bad Compressor	2. Replace after verification of Amp Draw below RLA and pinch closed the Discharge Line between the Compressor and the reversing Valve to verify pressure does not build on the high side.

Figure 42. System Troubleshooting Chart (con't)

Commissioning Document

The document that follows (LIT-170) enables verification and documentation of system component model numbers, location of underground system components and system performance for air and hydronic heating and cooling.

EARTHLINKED TECHNOLOGIES

EarthLinked® Heating & Cooling System Commissioning Document

(Please print clearly)

Owner Name: ____________________ Date: ____________
Address: ____________________ City: ____________
Province / State: ____________ ZIP: ____________
Telephone: ____________ Email: ____________

Installer Name: ____________________ License: ____________
Address: ____________________ City: ____________
Province / State: ____________ ZIP: ____________
Telephone: ____________ Email: ____________

System Start-Up Date: ____________________
Compressor Unit Model: ____________ Serial: ____________
Refrigerant Type: ____________ Charge ________ LB ________ Oz

---

Air handler / Cased Coil Model: ____________________

Earth Loop Model: ____________________

Desuperheater Model: ____________________

Domestic Water Module Model: ____________________

Hydronic Water Module Model: ____________________

Auxiliary Cooling Module Model: ____________________

Show the locations and dimensions of the Earth Loop Field, manifolds, distributors, cathodic protection system, underground refrigerant controls, earth loop to compressor unit connection, etc. Indicate the scale on the drawing. Reference the building with key dimensions. (next page)

IMPORTANT!
Be sure to identify and tag the vapor and liquid lines from the earth loop system where they enter the mechanical room, basement, etc. of the building.

System Air Flow Determination: Turn on electric heat in air handler and measure the average inlet and outlet air temperatures. Measure voltage and amperes to the electric heater.

Volts: ________ Amps: ___________ Fan Speed: Low ☐ Med ☐ Hi ☐

Power: $\frac{\text{(Volts X Amps)}}{1000}$ = ________________________ kW

Air Temperature In: ____________ °F Air Temperature Out: ___________ °F

CFM = (kW X 3413) / 1.08 X (Air Temp Out - Air Temp In) = __________ CFM

Air Heating Performance

Compressor Amps: ______________ Air Handler Fan Amps: ____________

Compressor Volts: ______________ Air Handler Fan Volts: ____________

Compressor Power: Air Handler Power:

Single Phase:

$kW_{Comp} = \frac{\text{Amps X Volts}}{1000} =$ __________ $kW_{AH} = \frac{\text{Amps X Volts}}{1000} =$ __________

Three Phase:

$kW_{comp} = \frac{\text{Amps X Volts X 1.732}}{1000} =$ _______________

Average Air Temperature out of Air Handler: __________ °F

Average Air Temperature into Air Handler: __________ °F

CFM = __________ (from above)

Heating Output = 1.08 X CFM (Air Temp Out – Air Temp In)

Heating Output = __________________ BTU/Hr

$COP = \frac{\text{Heating Output}}{\text{BTU/Hr Input}} = \frac{\text{Heating Output}}{3413\ (kW_{comp} + kW_{AH})} =$ __________

Note: When a cased coil is applied to an existing fossil fuel furnace, use kW_F in place of kW_{AH}, where kW_F is the power input to the furnace blower motor.

Hydronic Heating Performance

Compressor Amps: ____________ Circulating Pump Amps: ____________

Compressor Volts: ____________ Circulating Pump Volts: ____________

Compressor Power: Circul. Pump Power:

Single Phase:

$kW_{comp} = \frac{\text{Amps X Volts}}{1000} =$ ____________ $kW_{pmp} = \frac{\text{Amps X Volts}}{1000} =$ ____________

Three Phase:

$kW_{comp} = \frac{\text{Amps X Volts X 1.732}}{1000} =$ ________ $kW_{pmp} = \frac{\text{Amps X Volts X 1.732}}{1000} =$ ______

Water Solution Temperature out of Heat Exchanger: ____________ °F

Water Solution Temperature in to Heat Exchanger: ____________ °F

Water Solution Flow Rate (from flow meter): ____________ GPM

Water Solution Multiplier Factor (from table): ____________ WSMF

Water Solution Propylene Glycol %	Water Solution Multiplier Factor (WSMF)
20	1.03
30	1.07
40	1.11
50	1.16

$$\text{Heating Output} = \frac{\text{500 X GPM (HX Temp Out – HX Temp In)}}{\text{WSMF}}$$

Heating Output = ____________ BTU/Hr

$$\text{COP} = \frac{\text{Heating Output}}{\text{BTU/Hr Input}} = \frac{\text{Heating Output}}{3413\ (kW_{comp} + kW_{pmp})} = \_\_\_\_\_\_\_\_\_\_\_\_$$

Air Cooling Performance

Compressor Amps ________________ Air Handler Fan Amps ________________

Compressor Volts ________________ Air Handler Fan Volts ________________

Compressor Power: Air Handler Power:

Single Phase:

$Watts_{Comp}$ = Amps X Volts ___________ $Watts_{AH}$ = Amps X Volts __________

$Watts_{ACM}$ = Amps X Volts ________________________

Three Phase:

$Watts_{Comp}$= Amps X Volts X 1.732 = ___________________

Avge Air Temperatures Leaving Air Handler (Dry Bulb and Wet Bulb)

T_{LDB} = ________________ °F T_{LWB} = _______________________ °F

Total Heat Leaving (from psychometric chart) = ________________ BTU/Lb.

Avge. Air Temperatures Entering Air Handler (Dry Bulb and Wet Bulb):

T_{EDB}= ________________ °F T_{EWB}= ______________________ °F

Total Heat Entering (from psychometric chart) = ___________________ BTU/Lb.

Total Cooling Capacity = 4.5 X CFM X (TH_E-TH_L) = _________________ BTU/Hr

Where:
CFM = Air Flow Rate (from above)

TH_E = Total Heat Entering
TH_L= Total Heat Leaving

$$EER = \frac{\text{Total Cooling Capacity}}{\text{Watts Input}} = \frac{\text{Total Cooling Capacity}}{(Watts_{COMP} + Watts_{AH} + Watts_{ACM})} = \_\_\_\_\_\_\_\_\_\_\_\_$$

Chilled Water Cooling Performance

Compressor Amps: ____________ Circulating Pump Amps: ____________

Compressor Volts: ____________ Circulating Pump Volts: ____________

Auxiliary Cooling Module Model Power:

$Watts_{ACM}$ = Amps X Volts = ____________

Compressor Power: Circulating Pump Power:

Single Phase:
$Watts_{comp}$ = Amps X Volts = ____________ $Watts_{pmp}$ = Amps X Volts = ____________

Three Phase:
$Watts_{comp}$ = Amps X Volts X 1.732 = ________ $Watts_{pmp}$ = Amps X Volts X 1.732 = ______

Water Solution Temperature out of Heat Exchanger: ____________ °F
Water Solution Temperature in to Heat Exchanger: ____________ °F
Water Solution Flow Rate (from flow meter): ____________ GPM
Water Solution Multiplier Factor (from table): ____________ WSMF

Water Solution Propylene Glycol %	Water Solution Multiplier Factor (WSMF)
20	1.03
30	1.07
40	1.11
50	1.16

$$\text{Total Cooling Capacity} = \frac{500 \text{ X GPM (HX Temp In} - \text{HX Temp Out)}}{\text{WSMF}}$$

Total Cooling Capacity = ________ BTU/Hr

$$\text{EER} = \frac{\text{Total Cooling Capacity}}{\text{Watts Input}} = \frac{\text{Total Cooling Capacity}}{(Watts_{comp} + Watts_{pmp} + Watts_{ACM})} = \_\_\_\_\_\_\_\_$$

Tools and Equipment

The purpose of the following list is to highlight key pieces of equipment, tools and materials necessary for the installation, maintenance and servicing of EarthLinked® Heating and Cooling System HVAC (above ground) equipment.

The professional HVAC technician is expected to have a compliment of standard tools for the general servicing of refrigeration equipment.

Equipment, Tools and Materials

ITEM DESCRIPTION

Vacuum Pump (6 CFM minimum capacity)

Evacuation Manifold (for vacuum pump)

Digital Vacuum (micron) Gauge

Charging/Evacuating Manifold for R-410A

Charging/Hi-Vacuum Hoses (black, quantity of 6)

Digital Refrigerant Scale

Digital Thermometer

Digital Sling Psychrometer

Air Flow Meter (for air handlers)

Nitrogen Tank with 0 – 600 psig Regulator and Handtruck

Oxy-acetylene Welding Torch Set

15% Silver Brazing Alloy

Refrigerant Recovery Unit (1/2 #/minute minimum vapor capacity)

Recovery Cylinder (50# capacity)

Halogen Leak Detector

Digital VOM

Digital Clamp-on Ammeter

Digital Water Flowmeter (3 to 30 gpm)

Tubing Cutters

Tubing Benders

Nut Driver

Cordless Drill (3/8")

Swaging Kit

Deburring Tool

Drill Bit Set

Inspection Mirror

Triple Evacuation

Triple evacuation is implemented to evacuate a system to a deep vacuum. It is accomplished by evacuating a system to a vacuum of 1500 microns, and then bleeding a small amount of dry nitrogen into the system. The nitrogen is then blown out to the atmosphere. The system is then evacuated until the vacuum is again reduced to 1500 microns. This procedure is repeated three times, with the last vacuum level reaching a deep vacuum of 400 microns, which is held for 10 to 15 minutes. The following is a detailed description of the triple evacuation.

1. Attach an electronic micron gage to the system. The best place is as far from the vacuum port as possible, which would be the access port on a service valve on the EarthLinked® compressor unit.
2. Let the vacuum pump run until the micron gage reaches **1500 microns.**
3. Allow a small amount of dry nitrogen to enter the system until the vacuum shows about 20 inches of Hg on the manifold gage. This small amount of dry nitrogen will fill the system and mix with the other vapors.
4. Open the vacuum pump valve and start the vapor removal process from the system again. Let the vacuum pump run until the vacuum is again reduced to **1500 microns.**
   Repeat Step 3.
5. After nitrogen has been added to the system a **second time**, open the vacuum pump valve and again remove the vapor. Operate the vacuum pump until the vacuum on the electronic micron gage reads **400 microns.**
6. Once the micron gage reads **400 microns for 10 to 15 minutes**, isolate the micron gage and charge the system in accordance with the initial refrigerant charging procedure.