INSTALLATION INSTRUCTIONS

GEOTHERMAL HEAT PUMP COMPRESSOR SYSTEM
60 HZ

IMPORTANT

ATTENTION INSTALLERS:

It is your responsibility to know this product better than your customer. This includes being able to install the product according to strict safety guidelines and instructing the customer on how to operate and maintain the equipment for the life of the product. Safety should always be the deciding factor when installing this product and using common sense plays an important role as well. Pay attention to all safety warnings and any other special notes highlighted in the manual. Improper installation of this unit or failure to follow safety warnings could result in serious injury, death, or property damage.

These instructions are primarily intended to assist qualified individuals experienced in the proper installation of this appliance. Some local codes require licensed installation/service personnel for this type of equipment. Please read all instructions carefully before starting the installation. Return these instructions to the customer's package for future reference.

DO NOT DESTROY. PLEASE READ CAREFULLY & KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.

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IMPORTANT SAFETY INFORMATION

Please read all instructions before servicing this equipment. Pay attention to all safety warnings and any other special notes highlighted in the manual. Safety markings are used frequently throughout this manual to designate a degree or level of seriousness and should not be ignored.

WARNING indicates a potentially hazardous situation that if not avoided, could result in personal injury or death.

CAUTION indicates a potentially hazardous situation that if not avoided, may result in minor or moderate injury or property damage.

⚠ WARNING:

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury or property damage.

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- **Before servicing, disconnect all electrical power to the unit.**
- **When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.**
- **Verify proper operation after servicing.**

NOTE TO INSTALLER READ THIS BEFORE YOU DIG!

Before you begin digging, you need to have possible underground electric, gas, water, or other utilities located. Many areas have a "One Call" number that may assist in (but should not necessarily be relied upon) locating underground utilities. Some state laws require that a locate request be placed at least three (3) working days prior to any digging projects. The utilities should respond to your request by marking the approximate location of their utilities or notifying you that they have no utilities in your dig site area. After confirming utility response, you can then proceed with your excavation avoiding damages. Failure to check for, and to avoid underground utilities may result in physical injury or death.

⚠ WARNING:

Do not place combustible material on or against the unit cabinet. Do not place combustible materials, including gasoline and any other flammable vapors and liquids, in the vicinity of the unit.

⚠ WARNING:

These units are charged with holding charge of nitrogen at the factory. If repairs make it necessary for evacuation and charging, it should only be attempted by qualified, trained personnel thoroughly familiar with this equipment. Some local codes require licensed installation service personnel to service this type of equipment. Under no circumstances should the equipment owner attempt to install and/or service this equipment. Failure to comply with this warning could result in equipment damage, personal injury, or death.

⚠ WARNING:

This product contains fiberglass wool. Disturbing the insulation of this product during installation, maintenance, or repair will expose you to fiberglass wool.

- **Breathing this material may cause respiratory irritations.**
- **Fiberglass insulation may also cause eye irritation, skin sensitization, or other allergic responses in susceptible individuals.**
- **Always wear goggles, disposable gloves, long sleeved shirt, and appropriate breathing protection when working near this insulation. If contact with skin occurs, wash immediately with soap and water. In case of contact with eyes, flush immediately with water for at least 15 minutes. Contact a physician if needed.**

⚠ WARNING:

The information listed below and on the next page must be followed during the installation, service, and operation of this unit. Unqualified individuals should not attempt to interpret these instructions or install this equipment. Failure to follow safety recommendations could result in possible damage to the equipment, serious personal injury or death.

- The installer should become familiar with the units wiring diagram before making any electrical connections to the unit. See the unit wiring label or Figure 7 (page 17).
- Before beginning the installation, verify that the unit is correct for the job. The unit's model number is printed on the data label.
- Installation of equipment will require brazing operations. Installer must comply with OSHA safety codes and wear appropriate safety equipment (safety glasses & work gloves, etc.) when performing brazing operations. Have a fire extinguisher available in the event of an emergency.
- When working on any compressor, air handler, fan, contactor, capacitor, electrical breaker/fuse, cut-off switch, time delay, wiring, circuit board, or other electrical equipment, there is always a danger of bodily injury or death from electrical

shock. Do not work on electrical equipment unless you are adequately trained, qualified, and are properly licensed.
- This equipment may contain liquid and gaseous refrigerant under high pressure. Installation or servicing should only be performed by qualified trained personnel thoroughly familiar with this type equipment.
- This equipment is **NOT** to be used for temporary heating of buildings or structures under construction.
- Use caution when handling this appliance or removing components. Personal injury can occur from sharp metal edges present in all sheet metal constructed equipment.
- Follow all precautions in the literature, on tags, and on labels provided with the equipment. Read and thoroughly understand the instructions provided with the equipment prior to performing the installation and operational checkout of the equipment.
- Suggestions and procedures in this manual are general guidelines only, and must be disregarded if they in any way contradict the electrical component's equipment manufacturer's guidelines. It is the dealer's/service technician's sole responsibility to insure all electrical tests and service are performed in strict accord with all applicable codes and with the respective electrical component's manufacture's guidelines and directions.

REQUIREMENTS & CODES

- **The installer must comply with all local codes and regulations which govern the installation of this type of equipment. Local codes and regulations take precedence over any recommendations contained in these instructions. Consult local building codes and the National Electrical Code (NEC) for special installation requirements.**
- **The use of Grout 111 is only authorized with the installation of the lineset associated with the Nortek Global HVAC Geothermal System. Use of Grout 111 for any other applications is prohibited.**
- Obtain all required permits (Federal, State, and/or Local) prior to commencing work. This may include mechanical, electrical, drilling/excavation, erosion control, and grouting permits. Additionally, some subdivision developments and/or some homeowner associations have certain landscaping, etc., requirements where approvals must be obtained prior to excavation and/or equipment positioning.
- **Locate all underground utilities and objects prior to any drilling and/or excavation**. Many areas have a "One Call" number that may assist in (but should not necessarily be relied upon) locating underground utilities. Failure to comply with local laws may subject the homeowner or excavator to expensive fines, legal fees or prosecution. Failure to check for, and to avoid, underground utilities may also result in physical injury or death.
- All electrical wiring must be completed in accordance with local, state and national codes and regulations and with the National Electric Code (ANSI/NFPA 70) or in Canada the Canadian Electric Code Part 1 CSA C.22.1.
- Design the duct work according to methods described by the Air Conditioning Contractors of America (ACCA). This unit should be sized to provide the design load requirement. Load estimates can be made using approved methods available from Air Conditioning Contractors of America (Manual J); American Society of Heating, Refrigerating, and Air Conditioning Engineers; or other approved engineering methods.
- This unit is designed for indoor and outdoor installations and should be located with consideration given to the accessibility of fuel, electric power, service access, noise, shade, and drainage for the units condensate drainage. Install this unit only in a location and position as specified on page 5.
- It is the installing/servicing dealer's/authorized contractor's sole responsibility to obtain and possess, or to insure the appropriate possession of, all necessary licenses prior to installing or servicing.
- Check for full and complete compliance with all applicable local mechanical, drilling, excavation, grouting, erosion control, and building codes, and check for full and complete compliance with all applicable national codes/regulations (such as OSHA and the National Electrical Codes, the "NEC", for example).

GENERAL INFORMATION

Geothermal heating/cooling systems operate via sub-surface conductive heat transfer, using the naturally renewable temperature of the earth's crust as a heat source in the winter, and as a heat sink in the summer. Within any climate zone, the weather, and underground conditions vary from place to place. To determine your climate zone, see Figure 9 (page 19).

This geothermal heat pump system contains an earth loop that includes a vapor line, an insulated liquid line, and a bottom segment called a torpedo. See Figure 8 (page 18).

This unit has been tested for capacity and efficiency and will provide many years of safe and dependable comfort, providing it is properly installed and maintained. With regular maintenance, this unit will operate satisfactorily year after year. Abuse, improper use, and/or improper maintenance can shorten the life of the appliance and create unsafe hazards.

To achieve optimum performance and minimize equipment failure, it is recommended that periodic maintenance be performed on this unit. The ability to properly perform maintenance on this equipment requires certain tools and mechanical skills. See page 12 for additional maintenance information.

Before You Install This Unit

√ The cooling and heating load of the area to be conditioned must be calculated and a system of the proper capacity selected.

√ Check the electrical supply and verify the power supply is adequate for unit operation.

√ The indoor section (air handler, furnace, etc) should be installed before routing the refrigerant tubing. Refer to the installation instructions supplied with the air handler or furnace.

√ All units are securely packed at the time of shipment and upon arrival should be carefully inspected for damage prior to installing the equipment at the job site. Claims for damage (apparent or concealed) should be filed immediately with the carrier.

√ Please consult your dealer for maintenance information and availability of maintenance contracts. Please read all instructions before installing the unit.

System Sizing

Make sure the system has been properly sized prior to installation. The system must be sized using ACCA Manual J, or similar, load sizing criteria.

Heating Load

Heating design loads must be calculated using at least 99 % design dry bulb temperature (as listed in the ACCA Manual J Table 1A) for the desired geographic location. If a thermostat temperature setting warmer than the typical 65° F to 70° F design range is preferred, this must be taken into account as the load will be increased. The system must always be furnished with a back-up auxiliary heating system, such as electric strip heat.

Cooling Load

- Cooling design loads must be calculated using at least 1% design dry bulb temperature (in Air Conditioning Contractors of America (ACCA) Manual J Table 1) criteria for the desired geographic location. This means design temperatures should not be exceeded more than 1% of the time in the cooling mode. The system and wells must be sized with enough capacity to handle 99% of the cooling loads encountered throughout the year in any particular geographic location.
- If thermostat temperature settings cooler than 75° F range is preferred, this must be taken into account as the load will be increased.
- Short-cycling for a moderately oversized system does not present the dehumidification problems that it does for an air-source design, because of the cooler heat sink in a geothermal heat pump.

Well Seal Valve

For 4 and 5 ton systems, the compressor section is equipped with an earth loop seal valve assembly to keep most of the refrigerant in the earth loop during the off cycle. The assembly consists of a vapor line solenoid valve and a check valve for cooling mode. The solenoid valve is opened during heating mode operation.

The purpose of this assembly is to:

- Minimize the chance of refrigerant leaking indoors during the off cycle.
- Minimize the chance of leaking a large amount of refrigerant.

System Design Capacity Load

Always calculate the system's design load, for system sizing purposes, to the maximum of the greater of the heating or cooling design loads. See Example below.

EXAMPLE

If a house requires 36,000 BTUs in heating and 48,000 BTUs in cooling. Select a 4 ton system (12,000 BTUs = 1 ton).

Vertical Elevation Differential Design

The vertical elevation differential between the bottom of the earth loop and the top of the air handler **must not be greater than 125 feet per ton, with a maximum well depth of 400 feet**. If the vertical elevation exceeds this design criteria, the well depths can be shortened by adding an additional well.

Seasonal Transition

During the cooling to heating or heating to cooling transitional seasons, the operating conditions of a direct geothermal heat pump are quite different from a conventional air source heat pump. Unlike an air source heat pump, the heat will not immediately dissipate from the vicinity of the earth loop. During cooling to heating or heating to cooling transition, the earth loop may experience surround temperature conditions outside the operation range of an air source heat pump. To make smooth transition between the seasons, the compressor section is equipped with components and control logics described in the following sections.

Heating To Cooling Transition

- The compressor section includes a hot gas injection valve to ensure smooth transition from heating to cooling mode operations. See Figure 6 (page 16).
- After heating mode operation, the earth loop temperature may be below the normal underground temperature (around 58° F). As the refrigerant rises back from the well, the system pressure drop is around 40 psig per 100 feet. As a result, the refrigerant returning to the compressor section is usually in two phases. In cooling mode after 3 minutes of operation, if the suction pressure drops below 95 psig, a hot gas solenoid valve opens momentarily.
- Discharge gas is injected into the inlet end of the evaporator coil via the liquid line. This process will repeat until the suction pressure is above 95 psig.
- If after 60 hot gas injections, the suction pressure is still below 95 psig, the system will go into soft lock out mode (SL) for 60 minutes for the well to recover. See Table 7, (page 14) for status and event codes.
- After one hour, the system will restart in cooling mode. For a properly designed well or a shallow well (200 feet or below) the soft lock should rarely occur.

Cooling To Heating Transition

After cooling mode operation, the earth loop temperature may be well above the normal underground temperature (around 58 °F). If abnormally high suction or discharge pressure is detected in heating mode, the system will be turned off for 30 minutes for the well to recover. For a properly designed well, the soft lock out should rarely occur.

Locating The Equipment

- Survey the job site to determine the best location for setting the unit. Choose an appropriate location that minimizes the length of the refrigerant lines. See Figure 5 (page 16) for unit dimensions. Consideration should be given to availability of electric power, service access, and noise. If there is any question concerning the power supply, contact the local power company.
- Select a solid, level position, preferably on concrete.
- Sufficient clearance for unobstructed service to the control access panel must be maintained. See Figure 1 (page 6).

1. Locate the compressor unit in a carefully considered place (i.e. usually in basement, attic, closet, utility room, garage, or crawl space). **Installation within the actual living space is not recommended**. Basement and attic installations also require careful planning to avoid placement directly above or below bedrooms, living rooms, etc., whenever possible. Placing the unit on an appropriate mounting base (rubber, corkboard, or the like) should always be done, as this will assist in absorbing compressor vibration. If the unit is mounted in an attic, it should preferably be hung from rafters (to lessen ceiling vibration), and provisions made for an extra condensation drip pan.

   NOTE: When placing the compressor unit into position, remember there are screws in the side panels. It is recommended that the side panels of the compressor unit be placed far enough away from walls or other structures so that there is sufficient room to access the screws for future servicing.

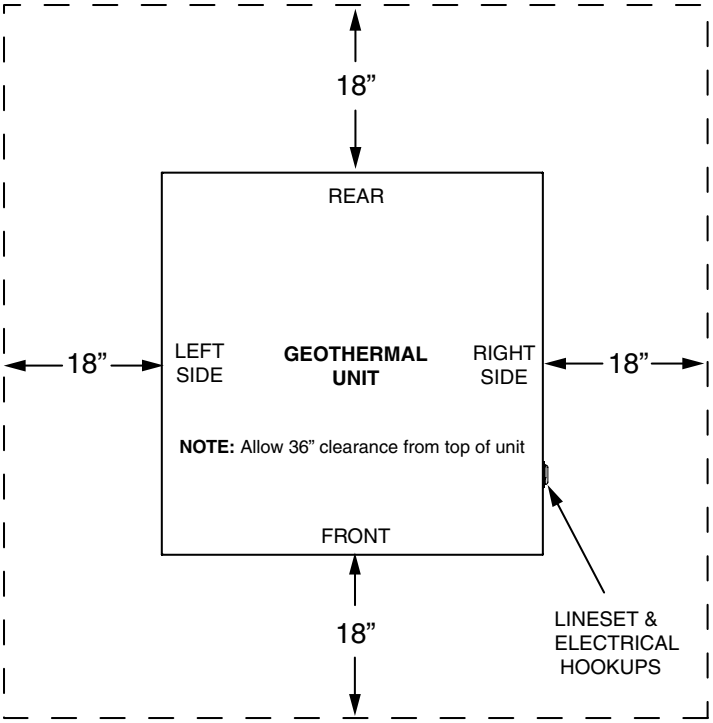


Figure 1. Service Clearances for Interior & Exterior installations

2. Clearly identify and mark each incoming line with its respective well (using colored tape and/or numbers). **NOTE:** Group all vapor lines together and all liquid lines together for runs through common trenched or walled areas. Do not mix vapor lines and liquid lines together, even when individually insulated, as this may contribute to a “short-circuiting” of heat transfer. Make sure the lines are all marked and recorded for future reference. The installing contractor should keep a copy of the location/distances sketch, and give a second copy to the property owner.
3. Remove the top and front cover of the compressor unit. Pipe connections, and electrical line access holes, are labeled on the exterior right hand side of the compressor unit.
   - The top two lines go to the air handler.
   - The lower two lines go to the borehole.
   - Insulate all such exposed hot gas refrigerant tubing with at least a 220° F rated 3/4 inch thick wall insulation, such as Armaflex, Rubatex, or Neoprene.
4. Place the compressor unit as close to the air handler as reasonably possible to limit line set distances. See Figure 1.

Line Set Sizing Between Compressor Unit & Air Handler

For line set sizing between the compressor and air handler (or other interior heat exchanger), see Table 1:

COMPRESSOR SIZE (BTU)*	LIQUID LINE	VAPOR LINE
24,000 - 36,000	1/2 inch O.D.	3/4 inch O.D.
48,000 - 60,000	1/2 inch O.D.	7/8 inch O.D.

*Compressor size is the actual compressor size in the compressor unit box, not maximum system capacity, system size, or air handler size.

Table 1. Line Set Sizing between the Compressor Unit & Air Handler

Insulating Interior Line Sets

Insulate all interior refrigerant lines and their connections. The compressor section contains the expansion valve and the liquid line is more likely to “sweat” as it condenses moisture from the interior air.

Use at least a 3/4 inch wall closed-cell insulation that is non-corrosive to copper to insulate all refrigerant lines. Use Armaflex, Neoprene, or Rubatex having at least a 220° F temperature rating for all interior vapor refrigerant lines, and for all interior liquid refrigerant lines, use Tubolit, Armaflex, Neoprene, or Rubatex having at least a 180° F liquid refrigerant temperature rating.

IMPORTANT NOTE:

Leave an air gap between the insulated vapor refrigerant line and the insulated liquid refrigerant line wherever possible. Do not tightly tape or wire tie the insulated lines together. This will short circuit the heat transfer prior to the primary heat transfer design areas in the air handler and in the ground.

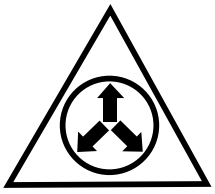
Use IsolationType Hangers

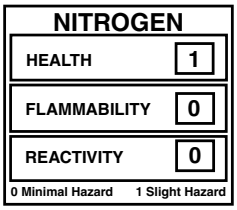
Isolate the interconnecting refrigerant tubing from the framing and/or from the duct work, as well as from where refrigerant tubing runs through stud spaces, enclosed ceilings, or pipe chases, etc. Use isolation type hangers, since rigid fastening transmits noise to the structure.

Brazing

Installation of equipment will require brazing operations. Installer must comply with safety codes and wear appropriate safety equipment (safety glasses, work gloves, fire extinguisher, etc.) when performing brazing operations.

⚠ WARNING:





When purging the system with Nitrogen, avoid direct face exposure or contact with valve when gas is escaping. Always ensure adequate ventilation is present during the depressurization process. Any uncertainties should be addressed before proceeding.

IMPORTANT NOTE:

To prevent internal oxidation and scaling from occuring, braze all connections with dry nitrogen flowing through the joints.

ELECTRICAL CONNECTIONS

⚠ WARNING:

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury or property damage.

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- **Before servicing, disconnect all electrical power to the unit.**
- **When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.**
- **Verify proper operation after servicing.**

- Electrical connections shall be in compliance with all applicable local codes and ordinances, and with the current revision of the National Electric Code (ANSI/NFPA 70).
- For Canadian installations, the electrical connections and grounding shall comply with the current Canadian Electrical Code (CSA C22.1 and/or local codes).

Pre-Electrical Checklist

- Verify the electrical wiring to the equipment is in compliance with the maximum electrical capacity listed on the equipment unit data label. This includes both the compressor unit and the air handler selected for use, as well as any other related supplemental equipment.
- Verify the circuit protection (fuse or circuit breaker size) is in compliance with the minimum circuit amp capacity listed on the unit data label. This includes both the compressor unit and the air handler selected for use, as well as any other related supplemental equipment.
- Verify all electric power wiring connections are correct and tight prior to turning on any electrical power. Make sure both the compressor section and air handler have been properly grounded and have fuses and/or circuit breakers in the primary electrical service box.
- Verify that the service provided by the utility is sufficient to handle the additional load imposed by this equipment. See the unit label or Table 9, (page 18).
- Verify factory wiring is in accordance with the unit wiring diagram Figure 7 (page 17). make sure no connections came loose during shipping or installation.

COPPER WIRE SIZE — AWG (1% VOLTAGE DROP)				
SUPPLY WIRE LENGTH-FEET				SUPPLY CIRCUIT AMPACITY
200	150	100	50	
6	8	10	14	15
4	6	8	12	20
4	6	8	10	25
4	4	6	10	30
3	4	6	8	35
3	4	6	8	40
2	3	4	6	45
2	3	4	6	50
2	3	4	6	55
1	2	3	4	60

Wire Size based on N.E.C. for 60° type copper conductors.

Table 2. Copper Wire Size

Line Voltage

- An electrical disconnect must be located within sight of and readily accessible to the unit. This switch shall be capable of electrically de-energizing the unit. See unit data label for proper incoming field wiring. Any other wiring methods must be acceptable to authority having jurisdiction.
- It is recommended that the line voltage to the unit be supplied from a dedicated branch circuit containing the correct fuse or circuit breaker for the unit.
- Overcurrent protection must be provided at the branch circuit distribution panel and sized as shown on the unit rating label and according to applicable local codes. See the unit rating plate or Table 9 for maximum circuit ampacity and maximum overcurrent protection limits.
- The installer should become familiar with the wiring diagram/ schematic before making any electrical connections to the unit. See the unit wiring label or Figure 7.
- Use only copper wire for the line voltage power supply to this unit as listed in Table 2. Use proper code agency listed conduit and a conduit connector for connecting the supply wires to the unit. Even if not required by code, use of rain tight conduit is always preferred.
- If replacing any of the original wires supplied with the unit, the replacement wire must be copper wire consisting of the same gauge and temperature rating.
- Provide power supply for the unit in accordance with the unit wiring diagram, and the unit rating plate. Use UL listed conduit and conduit connectors for connecting the supply wires to the unit and for proper grounding. Field supplied bushings for the power supply cables must be added to support and protect the power supply cables.

Grounding

⚠ WARNING:

The unit cabinet must have an uninterrupted or unbroken electrical ground to minimize personal injury if an electrical fault should occur. Do not use gas piping as an electrical ground!

This unit must be electrically grounded in accordance with local codes or, in the absence of local codes, with the National Electrical Code (ANSI/NFPA 70) or the CSA C22.1 Electrical Code. Use the grounding lug provided in the control box for grounding the unit.

Thermostat Requirements

- This system can be controlled by any industry standard thermostat. Set-back thermostats can be used, but are generally not advantageous with geothermal systems. This system has such low operational power requirements that it is counter-productive to use them because the system must work harder to bring the entire interior air space up to a preferred temperature, rather than operating on a preferred temperature “maintain” mode.
- If the system has electric strip heat back-up within the air handler, the system can operate together with the electric supplement heat, as the strip heating coils are installed downstream of the refrigerant heat exchanger. The electric strip heat is supplemental to the heat provided by the geothermal system.
- The thermostat used with this equipment must operate in conjunction with any installed accessories.

- Where local codes require that the thermostat wiring must be routed through a conduit or raceway, splices can be made inside the unit; however, all wiring must be NEC Class 1 and must be separated from incoming power leads. Recommended low voltage wire gauges and wire lengths are listed in Table 3.
- The thermostat should be mounted about 5 feet above the floor on an inside wall. DO NOT install the thermostat on an outside wall or any other location where its operation may be adversely affected by radiant heat from fireplaces, sunlight, or lighting fixtures, and convective heat from warm air registers or electrical appliances. Refer to the thermostat manufacturer's instruction sheet for detailed mounting and installation information.

Compressor Electrical

⚠ WARNING:

Turn the compressor unit OFF during installation or servicing. Also turn OFF supplemental (backup) heater power and/or fuel supply source (if applicable). Failure to follow this safety warning exactly could result in serious personal injury or death.

THERMOSTAT WIRE GAUGE	MAXIMUM RECOMMENDED THERMOSTAT WIRE LENGTH (FT)
24	25
22	45
20	70
18	110

Table 3. Thermostat Wire Gauge

REFRIGERANT CHARGING & UNIT START UP

⚠ WARNING:

ELECTRICAL SHOCK OR FIRE HAZARD

Failure to follow safety warnings exactly could result in serious injury or property damage.

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- **Before servicing, disconnect all electrical power to the unit.**
- **When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.**
- **Verify proper operation after servicing.**

⚠ WARNING:

The geothermal heat pump leaves the factory with a nitrogen holding charge. Follow all charging instructions for maximum unit performance and efficiency. Only charge the unit with the refrigerant listed on the unit rating plate. Some local codes require licensed installation/service personnel to service this type of equipment. Refrigerant charging must be done by qualified personnel familiar with safe and environmentally responsible refrigerant handling procedures. Under no circumstances should the owner attempt to install and/or service this equipment. Failure to comply with this warning could result in property damage, personal injury, or death.

⚠ CAUTION:

This unit uses R-410A refrigerant. DO NOT use any other refrigerant in this unit. Use of another refrigerant may damage the unit.

⚠ CAUTION:

This unit uses R-410A refrigerant with POE oil. When servicing, cover or seal openings to minimize the exposure of the refrigerant system to air to prevent accumulation of moisture and other contaminants.

- After refrigerant line connections are completed, it is required that you leak check and evacuate the indoor section and all line connections (using proper methods) before finalizing the full system refrigerant charge. For final charges based on matched systems and specified line lengths, see Table 4, (page 9).
- Pressure test the entire system at 400 psig with dry nitrogen prior to pulling a vacuum and charging.
- Prior to charging the system with refrigerant, make sure that a vacuum pump has been used to fully evacuate the system to at least 250 microns.

NOTE: The entire refrigerant system must be fully evacuated prior to system charging. Otherwise, moisture could be present that could cause premature system damage and/or failure.

- The refrigerant charge can be checked and adjusted through the service ports provided. Use only line sets which have a "Schrader" depression device present to actuate the valve.
- A filter dryer is provided with the unit and must be installed in the liquid line of the system. If the installation replaces a system with a filter dryer already present, the filter dryer must be replaced with the one supplied with the unit. The filter dryer must be installed in strict accordance with the manufacturer's installation instructions.

Safety Requirements for Refrigerant Charging

⚠ WARNING:

R-410A is a colorless, non-flammable material that is about 2.5 times denser than air. When leaked into a living space, R-410A will displace air and settle close to the floor. Large amount of refrigerant in a occupied space increases the risk of potential health hazards including dizziness, loss of concentration, or in very confined spaces, asphyxiation.

- **The information in this safety section is based on ANSI ASHRAE Standard 15-2010 (Standard 15) and ANSI ASHRAE Standard 34-2010 (Standard 34). According to these standards, if local codes exist, the local codes will take precedence.**
- Standard 34 defines the maximum allowed concentration of R-410A in an occupied space (without ventilation) as **25 lb./1000 ft^3**. The concentration of refrigerant in any occupied space must not exceed this limit.
- First it is necessary to determine the occupied area that has most potential for having the highest concentration of refrigerant in the event of a leak prior to installing the unit. To determine the Total Actual Occupied Volume (TAOV), use the following formula:

Average height * Average Length * Average Width

NOTE: The volume of the plenum and return/supply air ducts may also be included in the calculation. If the calculated concentration for the refrigerant being used exceeds 25 lb./1000 ft^3, the system is not permitted.

Where the average height, length, and width is the actual occupant dimensions. More detailed definitions are given in Standard 15.

- Next, estimate the Total Required Occupied Volume (TROV) needed for safe installation by using the following formula:

TROV (ft^3) = Total refrigerant charge (lb.) x 40

The examples below were calculated assuming:

- 25' single line length between well and compressor sections (L1) and 6' single line length between compressor section and air handler (L2). For the 2 ton example, the well length is 200 ft and for the 5 ton example, the well length is 400 ft. as shown in Table 4.
- The installed system is with an estimated R-410A charge, without a machinery room, and the ceiling in the house is 8 foot high.

2 TON EXAMPLE

To calculate TROV: 29.3 (lb.) of R-410A x 40 = 1172 ft^3
If the ceiling in the house is 8 foot high: 1172 ft^3 ÷ 8 = 146 $ft^{2.}$ If the TAOV measurement is less than 146 $ft^{2,}$ use any one of the 3 options below to install the unit.

5 TON EXAMPLE

To calculate TROV: 87 (lb.) of R-410A x 40 = 34802 ft^3
If the ceiling in the house is 8 foot high: 3480 ft^3 ÷ 8 = 435 $ft^{2.}$ If the TAOV measurement is less than 435 $ft^{2,}$ use any one of the 3 options below to install the unit.

Option 1: If the compressor section or air handler section are installed in a small room, a small vent (4"x8") can be installed on the bottom of the return air duct (at the air handler) no more than 6 inches from the floor.

Option 2: A 40 sq. inch square grill can be installed in the door of the small room or between the adjoining wall of the small room and a larger room no more than 6 inches from the floor. The total volume of the small room and the larger room must satisfy the TROV requirements.

Option 3: A 1" undercut is allowed on the bottom door of the small room and an adjoining larger room as long as the total volume of the small room and the larger room satisfy the TROV requirements.

2 TON		3 TON		4 TON		5 TON	
WELL LENGTH (FT.)	R-410A CHARGE OZ. (LBS)	WELL LENGTH (FT.)	R-410A CHARGE OZ. (LBS)	WELL LENGTH (FT.)	R-410A CHARGE OZ. (LBS)	WELL LENGTH (FT.)	R-410A CHARGE OZ. (LBS)
200	469 (29.3)	325	854 (53.4)	400	1,313 (82)	400	1,313 (82)
165	393 (24.6)	250	692 (43.3)	325	1,133 (70.8)	325	1,133 (70.8)
130	318 (19.9)	200	584 (36.5)	280	1,025 (64)	(x2) 250	1,553 (97)

NOTES:

- The charge amounts shown above are for total system initial charge.
- Initial charge above assumes a 6 ft line set length between the compressor unit and the air handler (L1).
- Initial charge above assumes a 25 ft line set length between the compressor unit and the earth loop (L2).
- If line set lengths are different than the default lengths of 6 ft for L1 and 25 ft for L2, make adjustments according to Table 5, (page 10).

Table 4. Recommended Initial R410-A Charges

LINE SETS	LINE SET VAPOR LINE O.D.	
	3/4”	7/8”
L1	0.86	0.96
L2	1.07	1.17

Adjustments in oz per ft if L1 or L2 do not equal the default values in Table 4 (page 9).

Table 5. Line Set Adjustments

Pulling A Vacuum

⚠ CAUTION:

Do not pull a vacuum on the the earth loop until all of the Grout 111 has cured. Failure to comply may cause damage to the copper or polyethylene tubing. Consult the installation guide supplied with the earth loop.

1. The shut off valves on the compressor unit all remain shut, and the cut-off valve(s) at the end of the liquid line assembly are opened to the field.
2. Pull a vacuum on the air handler side.
3. Pull a vacuum on the field side.
4. Pull a vacuum on the compressor unit. **NOTE:** Because of check valves/reversing valves within the compressor unit that isolate various segments, **the vacuum on the compressor unit must be pulled from 3 areas:**
   a.) The suction line to the compressor. See Figure 6 (page 16) for component locations.
   b.) The discharge line from the compressor.
   c.) And from the very top, front, insulated liquid line, (this line goes to the air handler from the compressor unit, but the vacuum must be pulled from the schrader valve to the left of the sight glass, on the compressor side of the shut-off valve to the air handler).

- After a 250 micron vacuum (minimum) has been pulled in the air handler side, immediately insert a 2 lb. holding charge of R-410A, and replace and tightly secure all schrader valve caps. Schrader valves are designed to primarily contain pressurized refrigerant, and, if left without a tightly sealed cap, will lose a vacuum.
- After a 250 micron vacuum (minimum) has been pulled in the borehole side, immediately insert a 2 lb. holding charge of R-410A, and replace and tightly secure all schrader valve caps.
- After a 250 micron vacuum (minimum) has been pulled in all three segments of the compressor unit, insert a 3 lb. holding charge of R-410A. Equally segment the 3 lb. holding charge among all three segments, and replace and tightly secure all schrader valve caps. See Example.

EXAMPLE

If a 3 lb. holding charge is used for the entire compressor unit, place 1 lb. in the suction line to the compressor, place 1 lb. in the discharge line from the compressor, and place 1 lb. in the top, front, insulated liquid line. Replace and tightly secure all schrader valve caps.

- The remaining balance of the total charge should then be inserted into the vapor line to the field.

Recommended R-410A Charging Procedure

After the installed system is evacuated and the electric wiring is in place, the system is ready to be charged with R-410A refrigerant. R-410A charging is an important part of the system installation. Too much refrigerant will flood the accumulator in heating mode causing the compressor to draw high watts. Too little refrigerant will freeze the indoor coil in cooling mode operation. **The recommended charging method is to charge refrigerant to the middle of the sight glass of the accumulator during heating operation.**

In cooling mode (with correct R-410A charge), the refrigerant returning from the well is in a saturated condition. The conventional method of charging by sub-cooling is not applicable to this system.

The recommended charging procedure includes:
1. Initial charge,
2. Start in heating and charge to the middle of the sight glass,
3. System check.

Initial Charge

- When charging the system with R-410A, always turn the refrigerant bottle upside down so that the liquid refrigerant feeds from the bottom of the tank. Table 4 lists the recommended initial R-410A charge.
- After the initial R-410A charge is determined, the initial amount of R-410A can be added to the system in OFF mode. In order to reduce the chance of over-charging the system, the initial charge is approximately 0 to 7 lbs. less than the final required charge. A refrigerant reclaimer/pump may be necessary.

When adding initial R-410A charge
1. Make sure the system is off.
2. Make sure all 4 service valves inside the compressor unit are open.
3. Add liquid R-410A to the vapor line charging port until either the total initial charge is reached or no more refrigerant can be added to the system.
4. Determine appropriate amount of charge for L1 & L2 line sets. See NOTES in Table 4.
5. Add liquid R-410A to the vapor line charging port to the air handler until the total initial charge is reached.

Starting In Heating Mode & Charging To Sight Glass

If all wiring is properly completed, the system may then be turned on, as instructed in this manual. **The system may not engage immediately because of a time delay on the control board**.

Before starting the system in heating mode, make sure the home owner is aware of the heating mode operation. Especially in the summer time, the home temperature may be uncomfortable during R-410A charging. Close all electrical disconnects to energize the system.

1. Start the system in heating mode and run for at least 15 minutes.
2. Look at the sight glass on the accumulator. If the float is at the bottom of the accumulator the system is undercharged. If the float is on the top of the accumulator, the system is over charged.
3. If the system in under charged, add liquid R-410A refrigerant slowly to the charging port on the vapor line, until the float is in the middle of the sight glass.

4. If the system is over charged, recover liquid refrigerant slowly from the charging port on the liquid line from the air handler until the float is in the middle of the sight glass.
5. Let the system run for at least 30 minutes. Make sure the float is still in the middle of the sight glass. If the float is not in the middle, repeat steps 3, 4, & 5.

System Check

After R-410A is charged to the middle of the sight glass (in heating), the discharge and suction pressure may be measured to make sure that the system is operating normally.

- The discharge pressure should be between 300 – 350 psig.
- The suction pressure should be between 100 – 150 psig.

During the summer, after charging in heating mode, the system should be shifted to cooling mode operation. Since the system just ran in heating mode, the well will be cold. The system discharge pressure is usually below 300 psig and the suction pressure is usually below 100 psig. As time passes, the well will gradually heat up and both the discharge and suction pressure will increase. In a hot summer, the discharge pressure could reach 400 psig and the suction pressure could exceed 140 psig.

If an unknown or unidentifiable restriction is observed between the high compressor discharge psig and low compressor suction psig, check the entering and exiting temperature at the oil separator. **NOTE:** The oil separator has a glass filter, which may have become clogged. The pressure drop across the oil separator should be no more than 5 psig. See Table 6.

Air Circulation - Indoor Blower

1. Set the thermostat system mode on OFF and the fan mode to ON.
2. Verify the blower runs continuously. Check the air delivery at the supply registers and adjust register openings for balanced air distribution. If insufficient air is detected, examine ductwork for leaks or obstructions.
3. Set the thermostat fan mode to AUTO and verify the blower stops running.

System Heating

1. Set the thermostat's system mode to HEAT and the fan mode to AUTO.
2. Gradually adjust the thermostat temperature setpoint above room temperature and verify that the compressor unit and the indoor blower energize.

OPERATING SEQUENCE

Cooling

1. After receiving a **Y1** and **O** input the system will begin cooling operation
2. Prior to compressor start, discharge pressure and suction pressure are checked by the system control.
   a. If the discharge pressure is above 635 psig, the system will not start.
   b. If the suction pressure is below 20 psig, the system will not start.
   c. If any temperature sensor is shorted or open, the system will not start.
   d. If any pressure sensor is open, the system will not start.
   e. If the system has run in the previous 5 minutes, a 5 minute anti-short cycle timer must expire before the system will restart.
3. If the above conditions are met the compressor will start and the reversing valve shift into position if not already in the cooling position
   a. At any time during compressor operation the system will stop if:
      – The discharge pressure exceeds 635 psig.
      – The suction pressure falls below 25 psig after 1 minute of compressor operation.
      – Any temperature sensor becomes shorted or open.
      – Any pressure sensor becomes open.
      – The **O** input is removed.
      – The **Y1** input is removed.
   b. If the suction pressure is below 95 psig, the hot gas injection valve will be opened for 10 seconds every 3 minutes until the suction pressure is above 95 psig. If this continues for 60 hot gas injection activations, the system will go into soft lock out mode (5L) for 60 minutes for the well to recover. See Table 7, (page 14) for status and event codes.
   c. While the compressor is operating in cooling mode the EXV attempts to control the superheat at the compressor inlet to 7° F +/- 3° F. The EXV fully closes when the **Y1** input is removed.

Heating

1. After receiving a **Y1** input (with no O) the system will begin heating operation
2. Prior to compressor start discharge pressure and suction pressure are checked.
   a. If the discharge pressure is above 635 psig the system will not start
   b. If the suction pressure is below 20 psig the system will not start
   c. If any temperature sensor is shorted or open, the system will not start.
   d. If any pressure sensor is open, the system will not start.
   e. If the system has run in the previous 5 minutes, a 5 minute anti-short cycle timer must expire before the system will restart
3. If the above conditions are met the compressor will start and the reversing valve shift into position if not already in the heating position.
   a. On units equipped with a Well Seal Valve, the valve will open 5 seconds prior to compressor start.
   b. At any time during compressor operation the system will stop if:
      – The discharge pressure exceeds 635 psig.
      – The suction pressure falls below 25 psig after 1 minute of compressor operation.
      – Any temperature sensor becomes shorted or open.
      – Any pressure sensor becomes open.
      – The **O** input is activated.
      – The **Y1** input is removed.
   c. After 1 minute of operation if the suction pressure exceeds 236 psig or the discharge pressure 600 psig, the system will stop for 30 minutes to allow well recovery and code 09 or 10 will appear in the two digit display.
   d. If at any time during heating operation the compressor is prevented from running due to one of the above conditions the **W2** output will be energized.
   e. When the system is operating in heating mode the EXV moves to control the discharge pressure between 300 and 346 psig. The EXV fully closes when **Y1** is removed.

In either mode, if any condition causes a compressor stoppage to occur 5 times during a single **Y1** input, the system will lock out and not operate for 1 hour to allow well recovery. See Table 7, (page 14) for status and event codes.

Creating a short across the terminal marked "TEST" will cause the system to ignore the anti-short cycle timer described above. All other functionality is the same.

UNIT MAINTENANCE

⚠ WARNING:

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury or property damage.

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- **Before servicing, disconnect all electrical power to the unit.**
- **When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.**
- **Verify proper operation after servicing.**

Proper maintenance is important to achieve optimum performance. The ability to properly perform maintenance on this equipment requires certain mechanical skills and tools. If you do not possess these skills, contact your dealer for maintenance. Consult your local dealer about the availability of maintenance contracts.

Routine maintenance should include the following:

- Visually inspect the unit at the beginning of each heating and cooling season. Remove any debris.
- Inspect the electrical connections for tightness at the beginning of each heating and cooling season. Service as necessary.
- Check pressure drop across the oil separator.
- Check temperature drop across the filter/drier.

⚠ CAUTION:

The unit should never be operated without a filter in the return air system. Replace disposable filters with the same type and size.

- Inspect and clean or replace air filters at the beginning of each heating and cooling season, or more frequently if required.

IMPORTANT NOTE:

DO NOT leave the filter/drier exposed to the exterior air. Install as soon as seals are removed. Failure to comply will impair the filter's capacity.

Filter / Drier

If the temperature drop across the filter/drier exceeds 3° F, it must be replaced.

Replacing the Oil Separator Filter

The oil separator has an internal filter which is installed at the factory. The second filter is to be used as a replacement within 24 to 48 hours of operation. These coalescent filters will pick up all dirt and particulates down to 0.3 microns. Typical filter/driers only catch 50 microns or larger.

Frequently check the pressure drop across the separator on new installations. See Figure 2 and Table 5, (page 10).

- Change the filter after an initial 24 to 48 hours of operation or if the pressure drop across the separator exceeds 5 psig.
- In the event of a compressor burn-out, use a clean-up filter and monitor the pressure drop. Install a standard filter when the pressure drop across the separator exceeds 5 psig.

After installing the new oil separator filter, replace the gasket on the top flange of the oil separator. Tighten the bolts to a torque of 20-22 ft-lbs. Close the lowest isolation valve at the front of the cabinet (the isolation valve between the check valve and the bottom of the reversing valve). Use the Schrader port on this isolation valve to evacuate the oil separator. Open all closed isolation valves after evacuation.

Adding Compressor Oil

Oil must be added whenever any of the system's oil separator or accumulators are replaced. If the oil separator is replaced, add 20 ounces of POE oil to the new oil separator prior to installation. If an accumulator is replaced, add 10 ounces of POE oil to the new accumulator prior to installation. If two accumulators are replaced, 10 ounces of oil must be added to each new accumulator.

IMPORTANT NOTE:

After adding additional oil to a replaced oil separator, wait one full hour before starting the system if oil was accidently added through the top intake refrigerant line to the oil separator. Otherwise, the filter within the oil separator may incur excessive pressure and become damaged and/or ineffective.

There are 2 ways to add additional oil:

- Slowly add oil through the schrader valve on the suction line to either the accumulator or compressor during system operation, via the use of a pressure gauge set.
- Using an oil pump, pump oil into a schrader valve in the suction side of the system's accumulator. A simple hand operated oil pump is fully adequate and easy to use. ALWAYS be careful to place the supply can of POE oil onto a refrigerant scale so that you can assure the correct amount of oil is added.

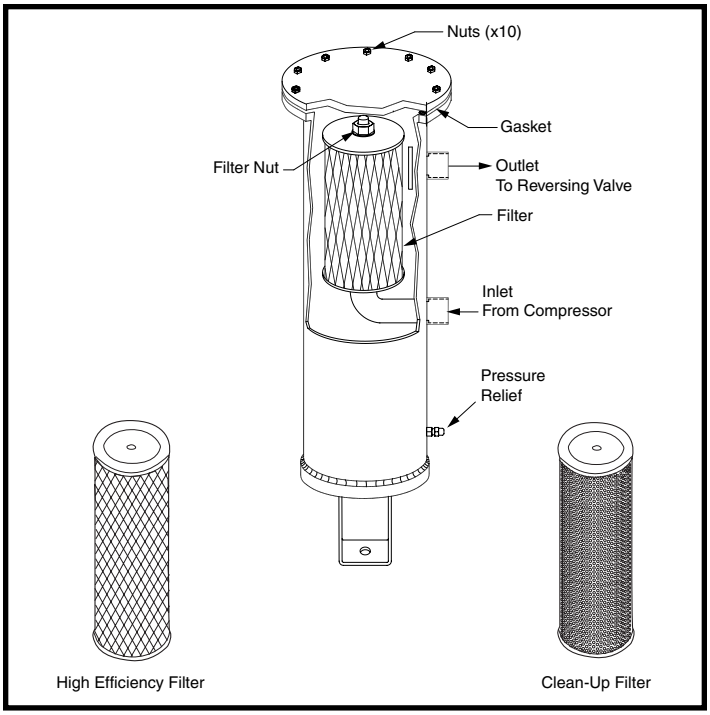


Figure 2. Filter Replacement

PRESSURE DROP	% OF FILTER LOADED	ACTION
<5 psigD - 0.34 bar	50%	Change Filter
<7 psigD - 0.48 bar	60%	Change Filter
<10 psigD - 0.69 bar	70%	Change Filter
<12 psigD - 0.83 bar	75%	Change Filter
<15 psigD - 1.03 bar	80%	Change Filter
<20 to 25 psigD - 1.4 to 1.7 bar	85%	Change Filter
<30 to 40 psigD - 2.1 to 2.8 bar	90%	Filter o-ring could dislodge
<60 to 80 psigD - 4.1 to 5.5 bar	95%	Filter could rupture

Table 6. Filter Pressure Drop

TROUBLESHOOTING

If the unit fails to operate check the following:

- Is the thermostat operating properly and is it on the proper heat/cool temperature setting?
- Is the circuit breaker tripped? Also check for a blown fuse in the air handler.
- Is the filter dirty or the return ductwork restricted?
- Did any wires from the compressor to the contactor, or between the capacitor and contactor, work loose or get damaged?
- Inspect the capacitor and make sure it is not damaged (by lightning or a power surge) and is functioning.
- In a multiple earth loop system, check the temperatures of the vapor and liquid lines. Measure and compare the temperature of each vapor line. Separately measure and compare the temperature of each liquid line.If there is a difference, there could be a restriction in one of the wells.
- Check the system pressures. If very low, there may be a refrigerant leak or the compressors internal overload is open.

Two Digit Display

This unit is equipped with a two digit display (shown in Figure 3) that communicates the status of the unit as well as current and recent events. When power is applied to the unit a series of 4 numbers are displayed separated by blinking "..". These numbers represent the firmware version.

When the unit is ready to run, it will display "- -" which indicates that the unit is in standby mode. The display will alternate between the current status and any current or recent events. See Table 7, (page 14) for status and event codes.

The display alternates between showing the current status code and the 5 most recent event codes as shown in Table 3. If an event code is flashing the conditions associated with that event code are currently true. Each code is displayed for 2 seconds with 1 second of flashing ".." between each code. An example sequence is shown in Figure 4 and Table 8, (page 14).

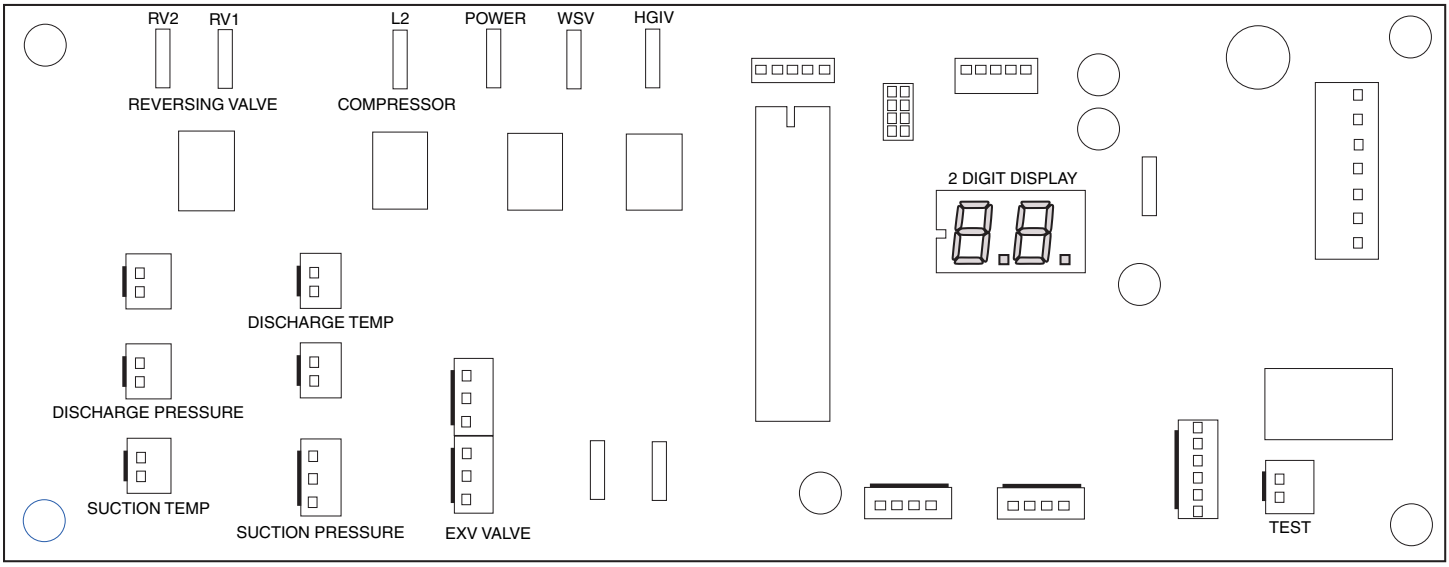


Figure 3. Control Board

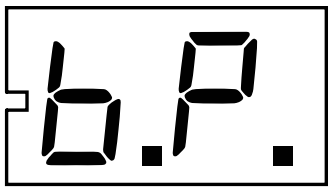


Figure 4. Example of Event Code

STATUS CODE	DESCRIPTION
C 1	Unit is running in cooling mode
H 1	Unit is running in heating mode
--	Unit is in standby, waiting for a call to operate
SL	Unit has entered a Soft Lock state due to excessive faults.
EVENT CODE	**DESCRIPTION**
Ct	The unit is delaying start because the anti-short cycle timer has not yet expired
bP	The unit has opened the Hot Gas Injection Valve
01	The unit did not start due to high discharge pressure
02	The unit has stopped due to high discharge pressure
03	The unit did not start due to low suction pressure
04	The unit has stopped due to low suction pressure
05	The suction pressure sensor has a fault
06	The suction temperature sensor has a fault
07	The discharge pressure sensor has a fault
08	The unit has stopped due to excessive Hot Gas Injection Events
09	The unit ended heating mode early due to high suction pressure
10	The unit ended heating mode early due to high discharge pressure

Table 7. Status & Event Codes

DISPLAY	DURATION (SECONDS)	INDICATES
SL	2	Current Status
..	1	
08	2	Most Recent Event
..	1	
bP	2	Next Event
..	1	
bP	2	Next Event
..	1	
bP	2	Next Event
..	1	
bP	2	Oldest Event
..	1	
Repeats		

In this example, the unit has entered soft lock mode due to excessive hot gas injection events.

Table 8. Example Sequence

Loss Of Capacity

- If the system looses capacity (does not maintain the thermostat temperature setting), either the system is under-sized, there is a malfunctioning metering device, or there is a possible refrigerant leak. **NOTE:** If a leak occurs, head and suction pressures will be low, ice will likely form on the air handler refrigerant lines (when the system is in the cooling mode), and the compressor will become very hot (usually over 200° F in the heating mode).
- If a leak has occurred, remove all refrigerant, fix the leak, and re-weigh in the correct originally recorded amount of virgin refrigerant shown in the charging instructions.
- If the system is under-sized, the problem will typically become apparent in cooling mode. As more sub-surface heat transfer tubing area exposure is required in the cooling mode than in the heating mode. If only modestly under-sized, normal supply/return temperature differentials will be close, but not at peak, and pressures will be abnormally high during the day, but will typically return to close to normal levels by the morning.

Restricted Refrigerant System

The following conditions are apparent in the cooling mode of operation. A restriction may not be evident in both the heating and the cooling modes of operation.While restrictions may result from a number of causes, the following are examples of common restrictions.

- Dirty filter/dryer
- A crimped/damaged refrigerant line.
- A mal-functioning reversing valve or expansion device.
- Debris lodged within an expansion device.
- Clogged oil separator filter

Check for crimped/damaged refrigerant lines and check the metering device. A partial restriction at the metering device can result in gurgling sounds, whereas a complete restriction will result in no sound at all because there is no refrigerant flow. If there is a restriction at the metering device, frost/icing may appear on the exterior of the suction line between the metering device and the compressor.

If there is a complete restriction, the compressor's amperage draw may be lower than normal since the compressor is running in a vacuum with no load. The compressor will eventually overheat and shut off by its own internal overload, since the motor's windings are not being cooled by refrigerant vapor.

Sand Or Dirt In The Sub-Surface Tubing

(Prior to Initial Charging)

The following steps should be performed if debris removal is required after the field lines have been connected to the liquid line assembly:

1. Recover all refrigerant from from the line set to the borehole.
2. Close off the lower two shut-off valves to the borehole at the end of the liquid line assembly.
3. Cut open the vapor lines outside the compressor section.
4. Install a shutoff valve on the top open end of the vapor line. **NOTE:** After the valve is installed, make sure it is in the closed position.
5. Starting with a full large bottle of dry nitrogen, fill the line set with 500 psig of dry nitrogen, and keep the pressure regulator open at 500 psig. Keeping a safe clearance from the end of the vapor line, point the end of the vapor line away from any object that could be damaged by exiting debris. Instantly open the shut-off valve on the vapor line,

while maintaining the full nitrogen flow rate into the liquid line. Continue to blast the full nitrogen flow until the sand or dirt is removed from the tubing.

NOTE: If the dry nitrogen purge is not successful in removing the debris, flush the tubing with one to two (depending on severity of debris) full large bottles of RX-11. This is done by attaching the RX-11 bottle to the liquid line of the sub-surface refrigerant tubing, turning the RX-11 bottle upside down, and opening the valve all the way. Let the entire bottle flow through the sub-surface tubing. Use only approved RX-11 recovery procedures when evacuating the refrigerant.

6. Remove the temporary valves and reconnect the liquid and vapor lines.
7. Evacuate and weigh in the correct initial charge listed in Table 4, (page 9).
8. Continuously operate the system in the cooling mode for at least one full hour, so that any remaining debris will be washed up with the liquid refrigerant. If there is more than a 3° F differential, install a new filter/dryer in the liquid line assembly as often as necessary until there is less than a 3° F differential.
9. Operate the system in 24 hour segments, changing the filter/dryer as often as necessary until there is no more than a 3° F differential across the filter/dryer.

NOTE: The filter/dryer may be changed by isolating the air handler segment using the shut-off valves inside the compressor unit.

Operating pressures Are Too High Or Too Low

(above 375 psig on the High pressure Side and 80 psig or less on the Low Pressure (Suction) Side)

- During heating to cooling transition, the system pressure may initially drop below 80 psig but should rise back to correct operational levels. This event is normal for this system. During cooling to heating transition, the discharge pressure may initially rise above 375 psig but should drop back to correct operational levels.
- Check the filter/dryer in the liquid line assembly. Verify there is no more than a 3° F temperature differential. See filter/drier section on page 12.
- Check the pressures across the oil separator to determine if the filter within the oil separator is dislodged or clogged.
- Check charge level as detailed in the Starting In Heating Mode & Charging To Sight Glass section (page 10).

The System Doesn't Supply Warmed Air In The Winter Or Cooled Air In The Summer

- Check system operational pressures for a potential refrigerant leak (operational pressures will be too low).

  NOTE: If pressures are too high in the summer, or too low in the winter, the geothermal heat pump exchange field may have been overstressed. This can be accomplished by either turning the system off (use your supplemental back-up heating during the winter), for only one 24 hour period, or by adjusting the thermostat setting to a higher than normal setting during the summer and to a lower than normal setting during the winter (usually for several days).

- When pressures return to normal levels, field return refrigerant temperature returns to normal operational temperatures, air supply temperatures return to normal levels, and extended system operational times return to normal, the field has recovered and the temperature settings may be returned to their preferred levels.

The Compressor Unit Will Not Start

- Check the time delay on the control board (in the electrical box) inside the compressor unit. **The unit will not start until the set time delay period (5 minutes) has expired**: after an electrical outage, after a breaker is turned back on, after switching from heating to cooling or vice versa, etc.
- The time delay period may not have expired, or the control board may be malfunctioning.
- Some air handlers may have an internal start delay that will effectively prevent total system operation until the delay time has expired.

The System Will Not Maintain The Thermostat Set Point

- Check the system charge, head and suction pressures, and air handler entering/exiting air temperature differentials. For additional charging instructions, see page 8.
- Check for restrictions in the airflow. Are filters dirty and/or is the air return blocked by furniture? Check the thermostat also.
- Check the emergency back-up heat for proper functioning if the exterior weather is below design temperatures.
- Check the return air ducts for leaks and make sure the air handler ductwork is tightly sealed. An improperly sealed air handler in an unconditioned area will directly pull in unconditioned air and overstress the system.

The Supply Temperature Is Too Cold

Below 90° F In Heating Mode

- The system has been over-stressed beyond design parameters.
- The system has been undersized.
- The CFM and/or the fan setting for the interior air handler is too high. **NOTE:** This is a very common occurrence, as the fan speed may have been set on high.

FIGURES & TABLES

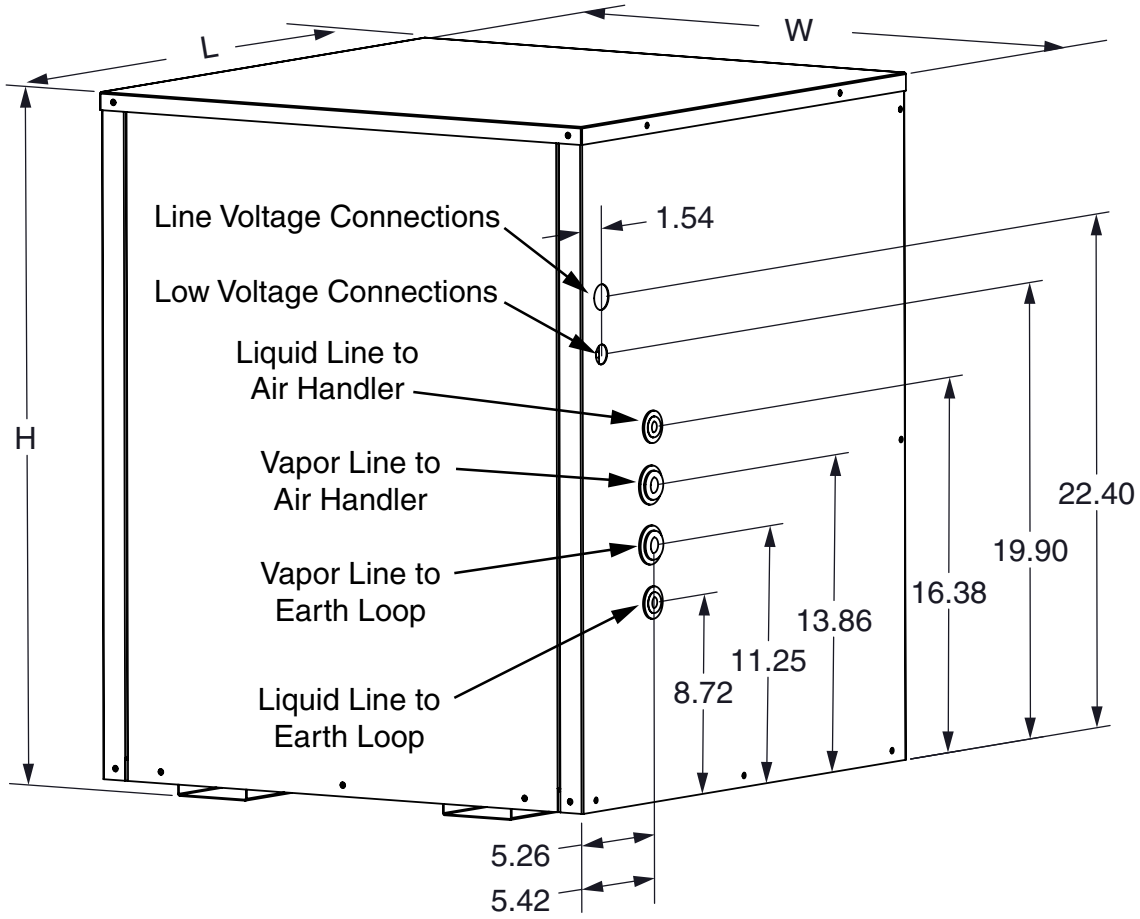


Figure 5. Dimensions

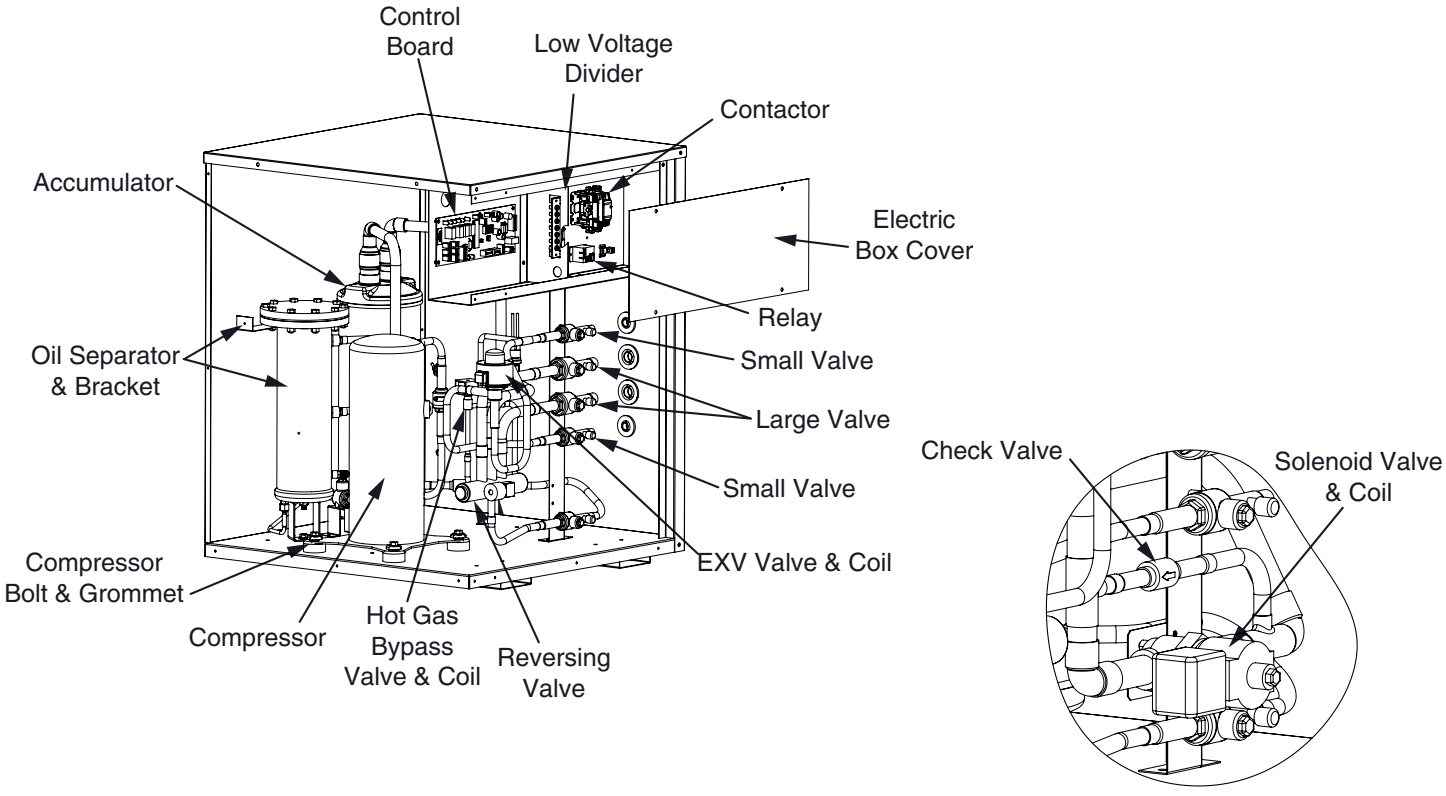


Figure 6. Components

WIRING DIAGRAM

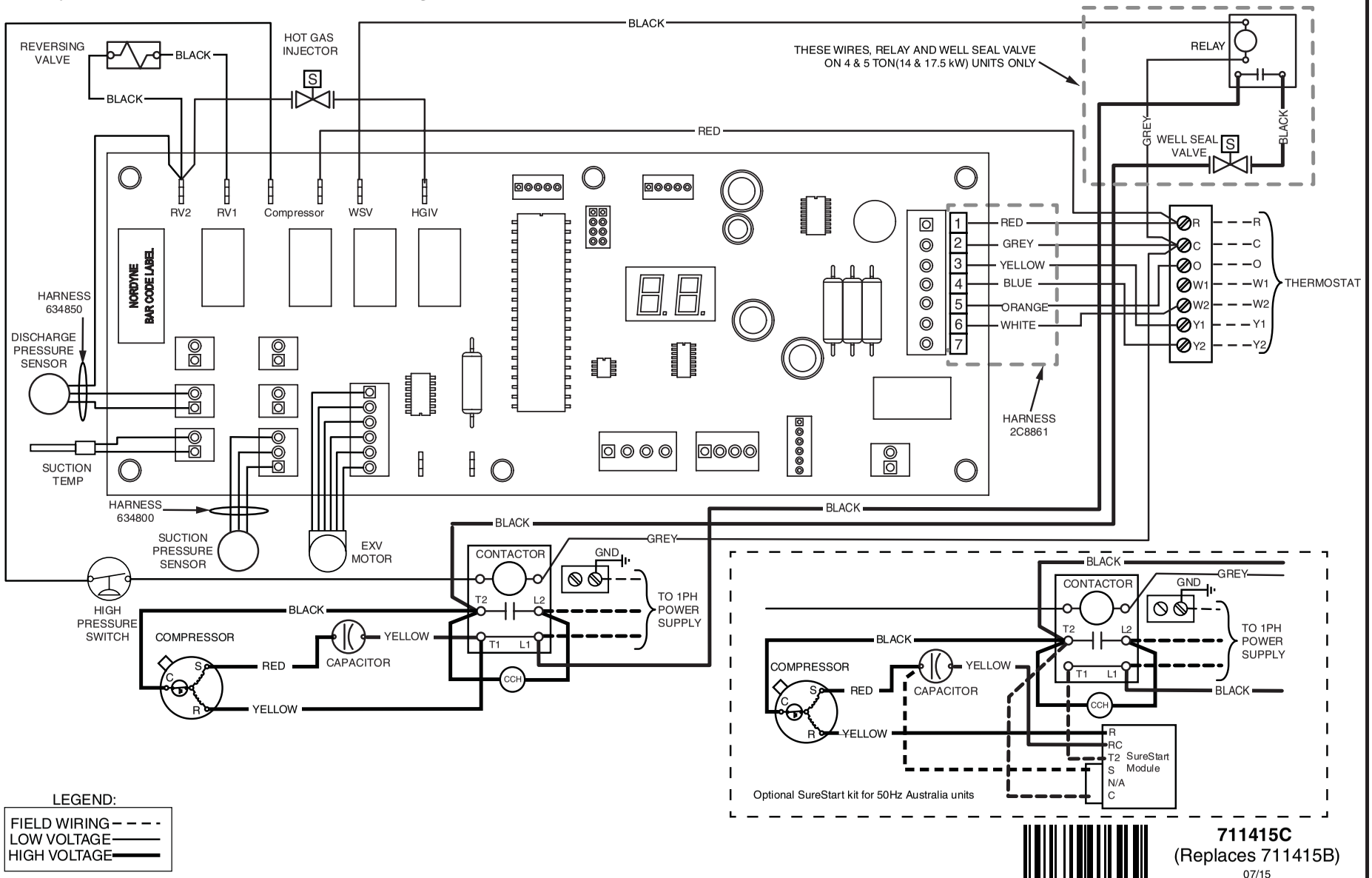
Y1SA Geothermal Heat Pump System

1 Phase

NOTES:

1. Disconnect all power before servicing.
2. For supply connections use copper conductors only.
3. Not suitable on systems that exceed 150 volts to ground.
4. For replacement wires use conductors suitable for 105 deg.
5. For ampacities and overcurrent protection, see unit rating plate.
6. Connect to 24 vac/60va/class 2 circuit. See air handler installation instructions for control circuit and optional relay/ transformer kits.

1. Couper le courant avant de faire letretien.
2. Employez uniquement des conducteurs en cuivre.
3. Ne convient pas aux installations de plus de 150 volt a la terre.



LEGEND:

FIELD WIRING - - - -
LOW VOLTAGE ——
HIGH VOLTAGE ——

711415C
(Replaces 711415B)
07/15

Figure 7. Wiring Diagram

NORDYNE GSHP GEOTHERMAL SYSTEM		Y1SA-E24K (2 TON)	Y1SA-E36K (3 TON)	Y1SA-E48K (4 TON)	Y1SA-E60K (5 TON)
Compressor Data	Volts-Cycles-Phase (1)	208/230V, 1phase, 60Hz			
	Min. Circuit Ampacity (MCA)	16	21	28	33
	Max. Overcurrent Protection (MOP)	25	35	45	50
	Rated Load Amps (RLA)	12.8	16.6	21.8	26.2
	Locked Rotor Amps (LRA)	58.3	79	117	134
	Air Handler Match	B6EMMN36K-B	B6EMMN36K-B	B6EMMN60K-C	B6EMMN60K-C
Physical Data	Length (L)	25.1	25.1	25.1	25.1
	Width (W)	25.2	25.2	25.2	25.2
	Height (H)	30.5	30.5	30.5	30.5
	Weight	165	170	215	220
Refrigerant Vapor Line O.D. (Both to air handler and earth loop)		3/4”	3/4”	7/8”	7/8”
Liquid Line O.D. (Both to air handler and earth loop)		1/2”	1/2”	1/2”	1/2”

†† Unit is shipped from factory with nitrogen holding charge.

Table 9. Electrical & Physical Data

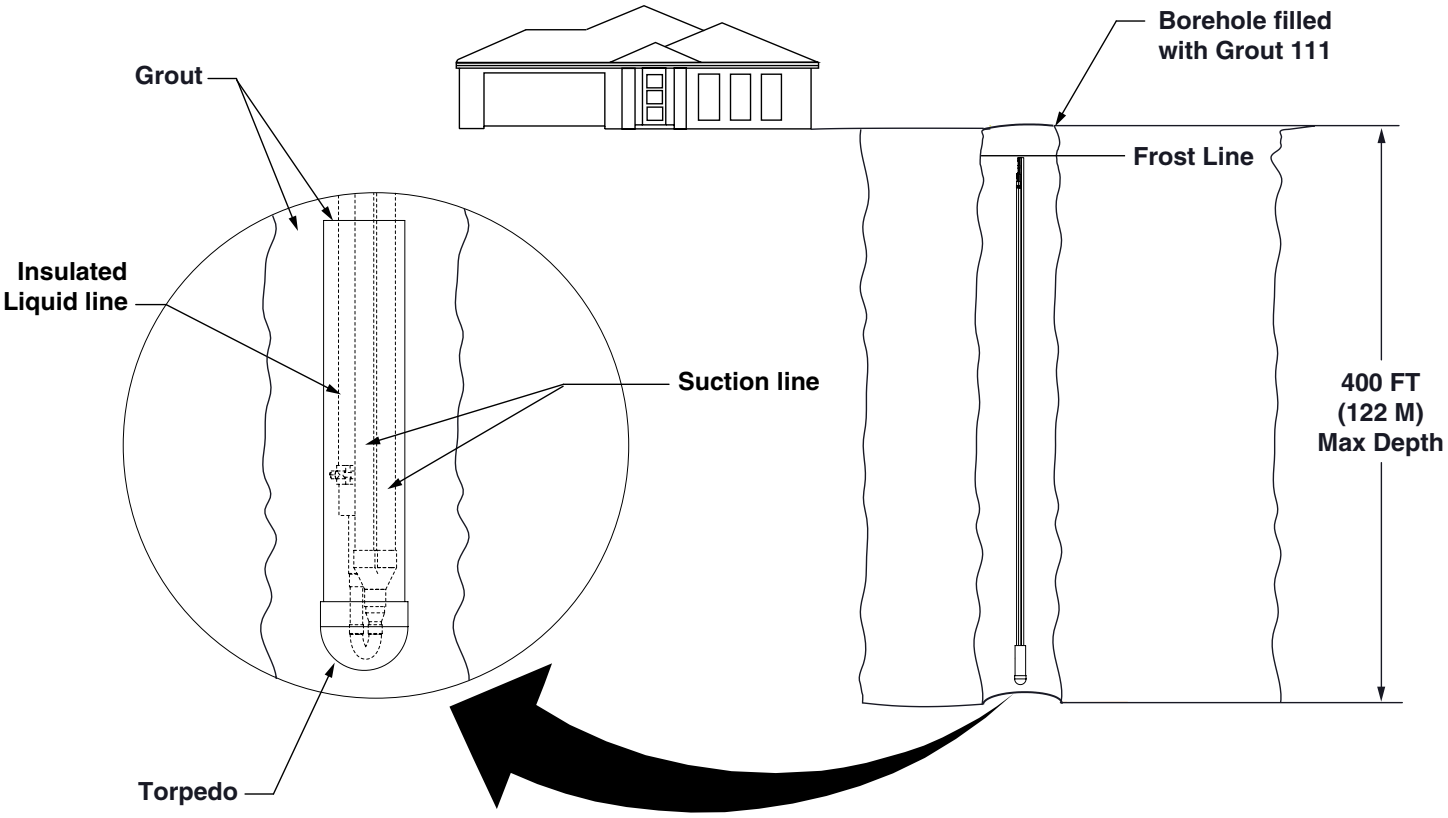


Figure 8. Vertical Borehole with Earth Loop

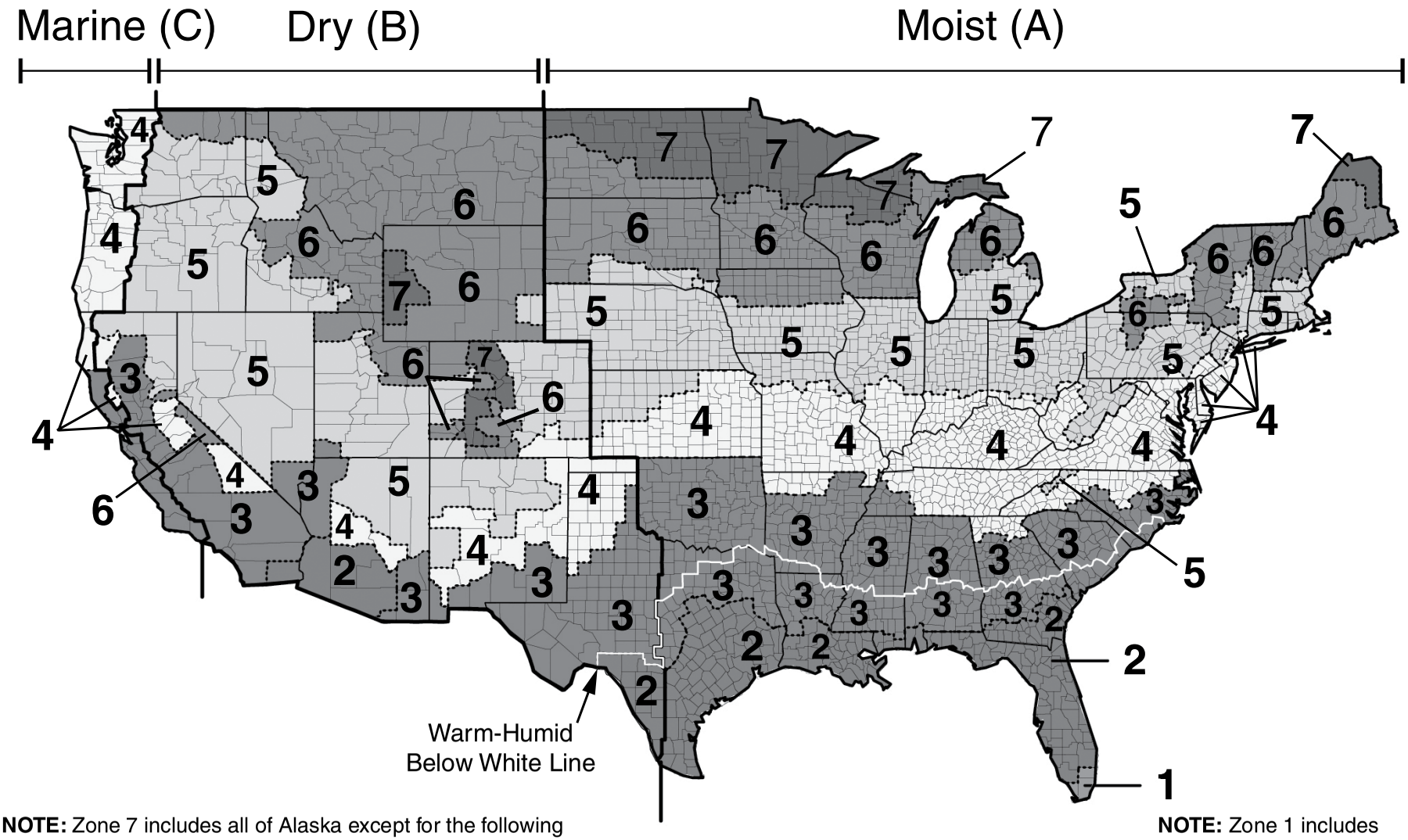


Figure 9. Climate Map

NOTE: Zone 7 includes all of Alaska except for the following burroughs in Zone 8: Bethel, Northwest Arctic, Dellingham, Southeast Fairbanks, N. Star, Wade Hampton, Nome, Yukon-Koyukuk, North Slope.

IECC ZONES	EARTH LOOP SIZE (FT/TON)
1, 2, 3A, 3B	100
3C, 4A, 4B	80
4C, 5, 6, 7, 8	65

There are exceptions to the earth loop sizes shown in this table. Within a climate zone, the weather, and underground conditions vary from place to place. The earth loop length may need to be adjusted accordingly.

Earth loop size indicated in the table assumes installation within bedrock or permanently water saturated ground.

NOTE: Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands

INSTALLATION / PERFORMANCE CHECK LIST

INSTALLATION ADDRESS:		
CITY:	STATE:	
UNIT MODEL #		
UNIT SERIAL #		
Unit Installed minimum clearances per Figure 1 (page 6)?	YES	NO
INSTALLER NAME:		
CITY:	STATE:	
Has the owner's information been reviewed with the customer?	YES	NO
Has the literature packet been left with the unit?	YES	NO

ELECTRICAL SYSTEM		
Electrical connections tight?	YES	NO
Line voltage polarity correct?	YES	NO
Has the thermostat been calibrated?	YES	NO
Is the thermostat level?	YES	NO
SINGLE PHASE UNITS		
Rated Voltage: ..... VOLTS		
L1-L2 Volts: ..... VOLTS		
3–PHASE UNITS		
Rated Voltage: ..... VOLTS		
L1-L2 Volts: ..... VOLTS		
L1-L3 Volts: ..... VOLTS		
L2-L3 Volts: ..... VOLTS		
Avg. Volts: ..... VOLTS		
Max. deviation of voltage from avg. volts: ..... VOLTS		
% Volt Imbalance: ..... VOLTS		

DUCT SYSTEM		
Filter(s) secured in place?	YES	NO
Filter(s) clean?	YES	NO

HEATING / COOLING SYSTEM		
All earth loops received, installed, and grouted according to the instructions in the earth loop installation guide?	YES	NO
Operational Compressor Amps:		
Operational Air Handler Amps:		
Compressor Suction Psig Pressure: ____ Temp. (° F) _____		
Compressor Discharge Psig Pressure: ____Temp. (° F) _____		
Total Amps: _____ Volts _____		
Fan speed: High_____ Medium _____ Low_____		
CFM Airflow:		
HEATING MODE		
Supply Air Out of Air Handler (DB): ..... (° F)		
Return Air Into Air Handler (DB): ..... (° F)		
Superheat .....(° F) at Compressor in Heating Mode		
Temperature Differential ΔT (DB) ..... (° F)		
COOLING MODE		
Supply Air Out of Air Handler (DB): ..... (° F)		
Return Air Into Air Handler (DB): ..... (° F)		
Superheat .....(° F) at Compressor in Cooling Mode		
Temperature Differential ΔT (DB) ..... (° F)		
Supply Air RH _____ % Return Air RH _____ %		
Identify each well and its respective line set location and length (between the compressor unit and well). Maintain a site diagram for future location reference in your files. Give an extra copy to the owner. Provide line set lengths, as well as liquid and vapor line tubing size in each line set (line sets should all be the same size):		
Number of borehole(s) or Earth Loop(s):_____		
Depth of each borehole or Earth Loop _____ (Ft)		
LINE SET SIZE:		
Vapor line O.D. (Inches): _____ Liquid line O.D. (inches) _____		
Line set distances to each well _____		
DISTANCE BETWEEN THE COMPRESSOR AND THE AIR HANDLER		
Distance (feet) _____		
TUBING SIZE		
Vapor line O.D. (Inches): _____ Liquid line O.D. (inches) _____		

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