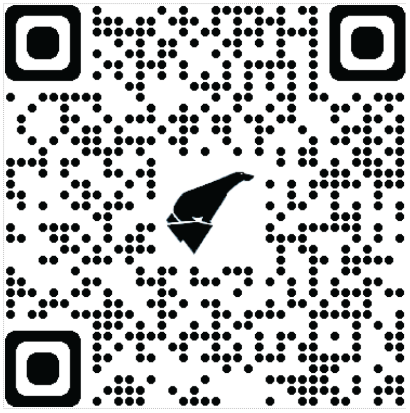
CHILLER INSTALLATION GUIDE & USER MANUAL

- VERTICAL AIR SERIES -



VERTICAL AIR CHILLER MANUAL

CONTENTS

1. INTRODUCTION

CONTACT INFORMATION & AFTER-HOURS SUPPORT

CONTACT INFORMATION

G&D Chillers, Inc.
130 E. 1st Ave.
Junction City OR, 97448

1.800.555.0973
info@gdchillers.com
Office Hours: 8 AM – 4:30 PM PST

EMERGENCY AFTER-HOURS TECHNICAL SUPPORT

Please be prepared to provide the following information:

- Chiller model
- Chiller serial number
- Name of your company
- Callback number and contact name

G&D Chillers offers 24/7 technical support. For emergency assistance after normal business hours, call the main office at 1.800.555.0973 and choose the tech support option. Your call will be directed to an on-call technician.

INSTALLATION VIDEO LINKS

Visit the following pages for additional documentation, installation video walk-throughs and FAQs:

gdchillers.com/product-manuals

gdchillers.com/installation-videos/

gdchillers.com/installation-videos/how-to-install-a-chiller

gdchillers.com/faq

NOTICE: CHILLER WARRANTY REQUIRES ACTIVATION

To activate the chiller parts and labor limited warranty, complete the Warranty Start-Up Checklist and return to G&D Chillers within 30 days.

WARNINGS AND NOTICES

Warnings, cautions and notices appear at appropriate sections throughout this literature. **Read them carefully.** Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions:

WARNING!
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury and/or catastrophic equipment damage.

CAUTION!
Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices or actions that could lead to catastrophic equipment damage.

NOTICE
Indicates considerations which, if not avoided, could result in adverse operation or equipment damage not covered under warranty.

RECEIVING YOUR CHILLER

VERIFY SHIPMENT CONTENTS

When the unit is delivered, verify that it is the correct unit and that it is properly equipped. Compare the information which appears on the unit nameplate with the ordering and submittal information.

INSPECTION CHECKLIST

Inspect all exterior components for visible damage. Report any apparent damage or material shortage to the carrier and make a "unit damage" notation on the carrier's delivery receipt. Specify the extent and type of damage found and notify the G&D sales office at 800-555-0973.

Do not proceed with installation of a damaged unit without sales office approval.

To protect against loss due to damage incurred in transit, complete the following checklist upon receipt of the unit:

- Inspect the individual pieces of the shipment before accepting the unit. Check for obvious damage to the unit or packing material.
- Inspect the unit for concealed damage as soon as possible after delivery and before it is stored. Concealed damage must be reported within 5 days.
- If concealed damage is discovered, stop unpacking the shipment. Do not remove damaged material from receiving location. Take photos of the damage, if possible. **The owner must provide reasonable evidence that the damage did not occur after delivery.**
- Notify the carrier's terminal of the damage immediately, by phone, and by mail. Request an immediate, joint inspection of the damage with the carrier and the consignee
- Notify the G&D sales representative and arrange for repair. Do not repair the unit, however, until damage is inspected by the carrier's representative.

PACKAGE CHILLER DESCRIPTION

CONDENSER

AIR-COOLED – Standard configuration. Copper tube aluminum fin vertical air condenser coil. Direct drive propeller type fans with DDP motors and built-in overload protection. Pressure tested for applicable refrigerant.

LIQUID-COOLED – Optional configuration. Brazed plate counterflow condenser with water regulation valve. Shell and tube condensers available for custom units.

EVAPORATOR

Brazed plate counterflow heat exchanger fed by electronic expansion valve (EEV).

COMPRESSOR

Semi-hermetic reciprocating-type or hermetic scroll-type compressor with oil level sight glass, Rotalock service valves (semi-hermetic only), and crankcase heater.

PUMPS

End suction centrifugal pump with trimmed impeller optimized for propylene glycol/water mixture. Base mounted. Pump fitted with union, check valve, and supply and return shut off valves for service. Variable frequency drives available upon request.

RESERVOIR TANK

Constructed of stainless steel. Insulated with ½" closed cell foam. Coolant level indicator. Auxiliary ports standard on most units.

SUPPLY & RETURN PIPING

Constructed of type M copper. Flanges provided for field connection of supply and return piping. Liquid-filled pressure gauge for discharge pressure.

DYNAMIC FLUID BYPASS VALVE

Allows for balancing of discharge pressure. Over pressure design allows circulation back to tank without damage to system or pump. Brass construction.

REFRIGERANT & PIPING

Type L ACR copper. Liquid line filter drier, sight glass/moisture indicator, and electronic expansion valve. Suction line fully insulated and designed for proper oil return with minimum friction loss. Discharge line formed of ACR tubing reformed radius fittings. All piping is leak tested and evacuated. Ships with full operating charge of refrigerant, refer to data plate for refrigerant type and charge per circuit.

FRAME & HOUSING

Fully powder coated steel frame. Durable powder coated aluminum housing rated for outdoor use. Access panels for easy service and maintenance.

POWER & CONTROLS

A single-point electrical connection is provided for terminating the chiller power wiring. All power starting controls and safety/operating controls are mounted in a weatherproof steel NEMA 3R enclosure.

Features include:

- Tera remote monitoring service
- Programmable logic controller (PLC)
- On / pump down / off door switch
- Compressor contactor and circuit breaker
- Pump contactor and circuit breaker
- Pressure-based mechanical safeties
- Flow switch interlock
- Freeze protection interlock
- High temperature alarm
- Low ambient control
- Compressor anti short cycle timer
- Variable speed drives (VFD)
- Water regulating valve (water-cooled units)

FACTORY TESTING

All chillers are charged with refrigerant, run-tested at the factory, and verified to be in perfect working order prior to shipment.

MODEL INFORMATION

OVERVIEW

G&D Vertical Air series chillers cool heat transfer fluid (HTF) utilizing reciprocating or scroll compressors, air-cooled/water-cooled condensers, and brazed plate heat exchangers. They are designed for outdoor installation. Each refrigeration circuit includes on-board controls, pumps, reservoir, evaporators, condensers, and necessary controls and safeties.

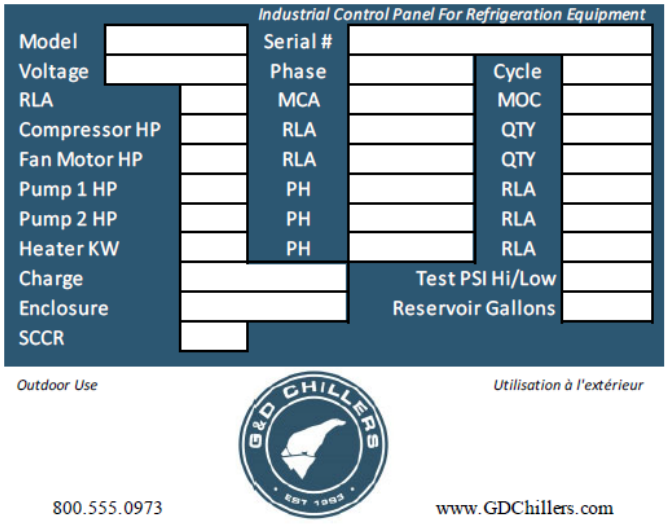
Each Vertical Air unit is a completely assembled package that is factory-piped, wired, leak-tested, dehydrated, charged and tested for proper control operations prior to shipment. The chilled fluid inlet and outlet openings are covered for shipment.

The chiller features G&D's custom chiller controls, with tunable staging for accurate and efficient temperature control. Each refrigerant circuit is provided with a removable core filter-drier, sight glass, electronic expansion valve, and charging valves. The evaporator is a brazed plate heat exchanger. The condenser is an air-cooled fin and tube coil.

UNIT NAMEPLATE

The chiller nameplate is applied to the exterior surface of the control panel door. A compressor nameplate is located on each compressor. The chiller nameplate provides the following information for the unit:

- Model and size descriptor
- Serial number
- Electrical requirements
- Correct operating charges of refrigerant
- Low side/high side design pressures



WARNING: QUALIFIED PERSONNEL ONLY!

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

NEVER ALLOW CHILDREN OR UNQUALIFIED PERSONS ACCESS TO CHILLER!

2. PRE-INSTALLATION CONSIDERATIONS

CHILLER PLACEMENT

LOCATION

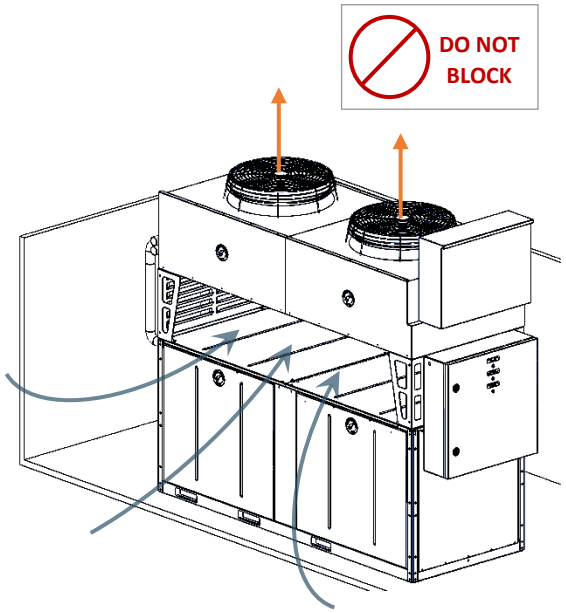
Air-cooled units must sit outside and be anchored to a solid level surface. A concrete pad is recommended. Location should be free of grass and other debris that could plug condenser fins.

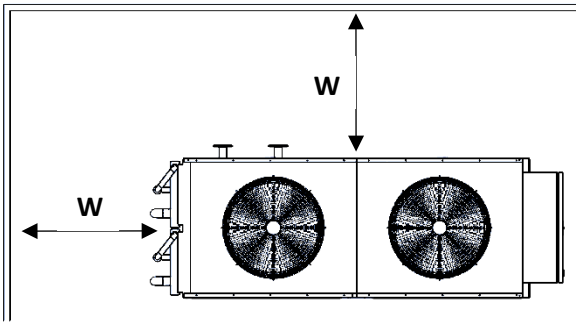
Liquid-cooled chillers may be installed on a concrete pad outdoors. A properly sized pump and liquid cooling system for the chiller condenser must be supplied by the end user. Contact G&D Chillers for additional information and assistance with sizing.

Ensure minimum clearance requirements* between condenser intake side and any buildings, walls, control panel, etc.

No walls or obstructions in front of the unit: Access side must be open to free air. Roofs or overhangs above the chiller are not allowed.

*MINIMUM CLEARANCE REQUIREMENTS (W)	
W = 45"	GD-30H, GD-35H GD-40H, GD-50H,
W = 91”	GD-70H, GD-100H, GD-140H, GD-150H, GD-160H, GD-200H

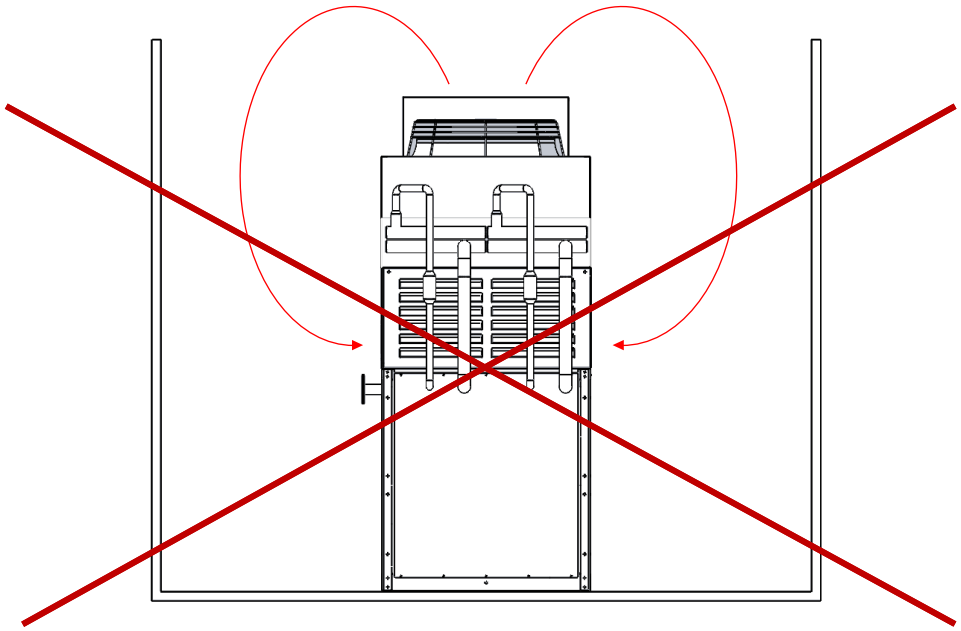




CONTROL PANEL CLEARANCES ACCORDING TO APPLICABLE SAFETY CODES

NOTICE: HOT AIR RECIRCULATION

Avoid enclosing the chiller between barriers. Recirculating hot air may result in loss of refrigeration capacity and may cause internal components to overheat or fail. No roofs or awnings above chiller are allowed.



FIELD-SUPPLIED COMPONENTS NEEDED

The following external features are not included with the chiller package:

Heat Transfer Fluid. Fluid can be purchased directly from G&D Chillers or provided by others. Refer to the chiller data sheet for reservoir holding capacity. Account for volume of heat transfer fluid needed to fill process piping before ordering.

Piping. All features external to the chiller package, including pipe, valving, insulation, and instrumentation. Refer to the "FLUID PIPING" and "INSULATION" lists in the "CONTRACTOR RESPONSIBILITIES" section (pg. 11).

Foundation. A solid level surface to which the chiller can be securely anchored. A concrete pad at ground level is recommended. Consult a structural engineer and/or architect familiar with applicable codes for anchoring requirements.

If applicable: For installations on rooftops or elevated structures, supporting pad shall be designed by others. Chiller frame must be supported at all points normally in contact with ground and securely anchored.

Power. Unit main disconnect, overcurrent protection, and power supply wiring (in conduit) per NEC.

Note: Customer wiring interface connections are shown in the electrical schematics that ship with the unit, located in a sleeve contained the electrical enclosure. Refer to the "CHILLER INSTALLATION – ELECTRICAL" section of this manual (pg. 16) for more details.

Communication. Ethernet cable (in conduit) to connect chiller PLC to internet via facility LAN router.

If applicable: Interconnecting control wiring (in conduit) for additional field-supplied devices.

CONTRACTOR RESPONSIBILITIES

Contractor responsibilities typically associated with the unit installation process are listed below:

FOUNDATION

- Meet foundation requirements
- Solid level surface
- Anchoring

RIGGING

- Safety chains
- Clevis connectors
- Lifting beam

ELECTRICAL

- Unit main disconnect
- Electrical connections to terminal blocks in electrical enclosure
- Wiring sized per NEC
- Overcurrent protection per NEC
- Ground connection(s)
- Ethernet cable for facility LAN to chiller PLC
- Optional: relays and controls wiring

FLUID PIPING

- Main line pipe
- Pressure test and fully dry all piping
- Fluid strainer
- Taps for thermometers and gauges
- Thermometers
- Fluid flow pressure gauges
- Isolation and balancing valves in fluid piping
- Vents and drains
- Pressure relief valves
- Backflow prevention valves

INSULATION

- Insulation
- Cladding
- Vapor barrier
- Sealant

HEAT TRANSFER FLUID

Standard (most) G&D Vertical Air Chillers are designed to operate using an inhibited heat transfer fluid. Standard models use 35% propylene glycol. Only use the correct concentration of heat transfer fluid (HTF) in this chiller, unless your chiller was specifically designed for a higher or lower concentration.

CAUTION: EQUIPMENT DAMAGE!

Failure to use the correct concentration of inhibited heat transfer fluid (HTF) in this chiller may result in catastrophic damage not covered by G&D Chillers' 2 Year Parts & 1 Year Labor Warranty. Only use the HTF the chiller was designed for. If you are unsure of what type and concentration to use, please contact G&D Tech Support.

3. INSTALLATION

CHILLER INSTALLATION - MECHANICAL

LOCATION REQUIREMENTS & SOUND CONSIDERATIONS

- Refer to G&D data sheet for sound data.
- Locate the unit away from sound-sensitive areas.
- Chilled fluid piping should not be supported by chiller frame.
- Seal all wall penetrations.

Note: Consult an acoustic engineer for noise critical applications.

FOUNDATION

Provide a concrete foundation of sufficient strength and mass to support the applicable operating weight (i.e., including completed piping and full operating charges of refrigerant and heat transfer fluid. Refer to the G&D spec sheet for unit operating weights. The concrete pad must fully support the footprint of the chiller unit. Once in place, the unit must be level within 1/4" (6.4 mm) over its length and width *as well as anchored to the foundation.* Reference the base rails of the chiller for leveling purposes. **G&D Chillers is not responsible for equipment problems resulting from an improperly designed or constructed foundation and/or inadequate anchoring practices.**

CLEARANCES

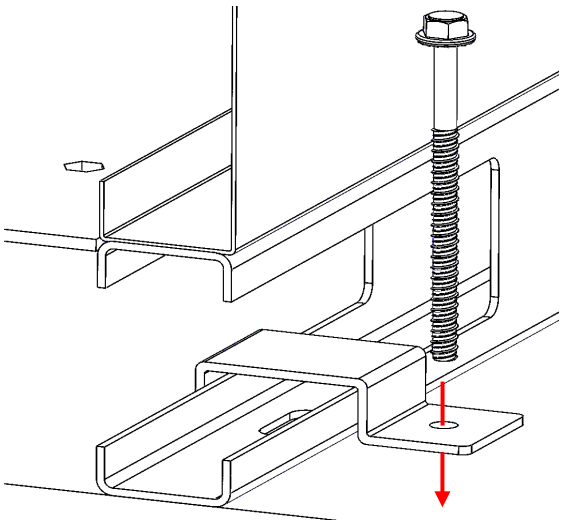
Provide enough space around the unit to allow installation and maintenance personnel unrestricted access to all service points. Observe all applicable local and national codes. Refer to submittal drawings for the unit dimensions in order to provide sufficient clearance for the opening of control panel and service doors. All sides should have clearance not less than one full width of the condenser to any obstruction. All obstructions should meet the minimum clearance distance listed in the “CHILLER PLACEMENT” section (pg. 9).

ANCHORING

Use the anchor tabs included with your chiller to affix the frame to a level concrete foundation using appropriate concrete bolts. The anchor tab is designed to clamp down onto the frame through the fork pocket.

To the right, an example is shown – it is up to the user to install bolts that are sufficient for secure mounting.

G&D Chillers is not responsible for the provisioning of foundations nor the engineering of any alternative anchoring or mounting structures. It is up to the customer to ensure that anchoring is designed by a qualified person, and meets local and national codes.



FREEZE PROTECTION

The chiller system must be protected from freezing by using the appropriate heat transfer fluid (HTF). **Standard G&D Vertical Air chillers are usually designed for use with inhibited propylene glycol**. For adequate freeze protection it must not be diluted from design specification.

During the system fill process, take care to remove residual flush water from the piping before introducing HTF into the system. Refer to the "10 EASY STEPS TO START-UP YOUR NEW G&D CHILLER" (pg. 20) section of this manual for details. If dilution or evaporation losses are suspected, use the included refractometer to verify HTF concentration.

PROCESS PIPING RECOMMENDATIONS

HTF connections should be flanged. G&D recommends using insulated copper or stainless steel for supply and return piping. PVC or ABS piping is also acceptable, but only schedule 80. Considerations must be made to compensate for thermal contraction/expansions of piping runs.

NOTICE: PVC/ABS PIPING!
Do not use PVC/ABS piping with leaving fluid temperatures below 20°F. Do not use schedule 40 PVC/ABS piping.

CHILLER PIPING COMPONENTS

Piping components include all devices and controls used to provide proper cooling system operation and unit operating safety:

- Air vents (to bleed air from system)
- HTF pressure gauges with shutoff valves
- Vibration eliminators
- Shutoff (isolation) valves
- Thermometers (if desired)
- HTF strainer

VALVES AND VENTING

A vent is provided on the top of the reservoir. Be sure to provide additional vents at high points in the piping to bleed air from the chilled fluid system. **Do not pressurize reservoir.**

EXAPNSION JOINTS AND/OR LOOPS

Expansion joints and loops are necessary in chilled HTF distribution systems to relieve stress on joints and pipes due to thermal expansion and contraction. Different materials have different rates of expansion or contraction and these values can be found online. If you are installing a specific piping system, for example GF COOL-FIT, reference the manufacturer for type and location of joints or size of loops to install. For large distribution systems a process engineer should provide stamped drawings that locate where expansion infrastructure should be installed.

HTF PRESSURE GAUGES

Install necessary pressure gauges to monitor the entering and leaving HTF pressures. Provide shutoff valves in lines to the gauges to isolate them from the system when they are not in use.

VIBRATION ELIMINATORS

Use piping vibration eliminators to prevent vibration transmission through the fluid lines. All piping must be adequately secured and supported.

SHUTOFF (ISOLATION) VALVES & THERMOMETERS

Install shutoff valves on both the entering and leaving fluid lines so that the chiller can be isolated for service. Although not required, thermometers may be added to the loop to monitor supply and return temperatures.

HEAT TRANSFER FLUID STRAINER

A 20-mesh wye strainer must be installed prior to chiller return connection. Ideally the strainer will be one pipe size larger than the return line to avoid excessive pressure drop. Place isolation valves on either side of the wye strainer to facilitate easy removal and service.

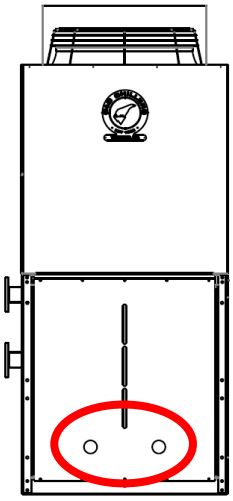
The HTF wye strainer is field supplied, field installed, and should provide taps for pressure gauges on the inlet and outlet in order to measure pressure differential across the strainer. This will help determine when it is necessary to clean the wye strainer.

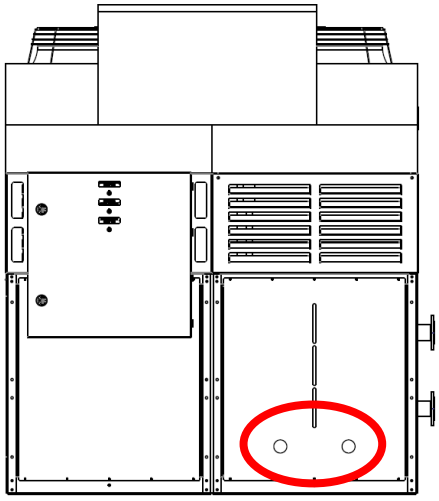
AUXILIARY RESERVOIR PORTS

Located at the front of the chiller reservoir are two NPT connections that come sealed with plugs from the factory. They allow direct connection to the chiller reservoir for expansion of the chiller's capabilities. Port size will vary by chiller capacity. As part of chiller commissioning, take the time to consider any future expansions your process might require. These ports can be used in many ways, including but not limited to:

- Dedicated plumbing for a second process
- Interconnection of a Vertical Air Expansion Module/Modular Series chiller.
- Remote reservoir/pump skid expansion

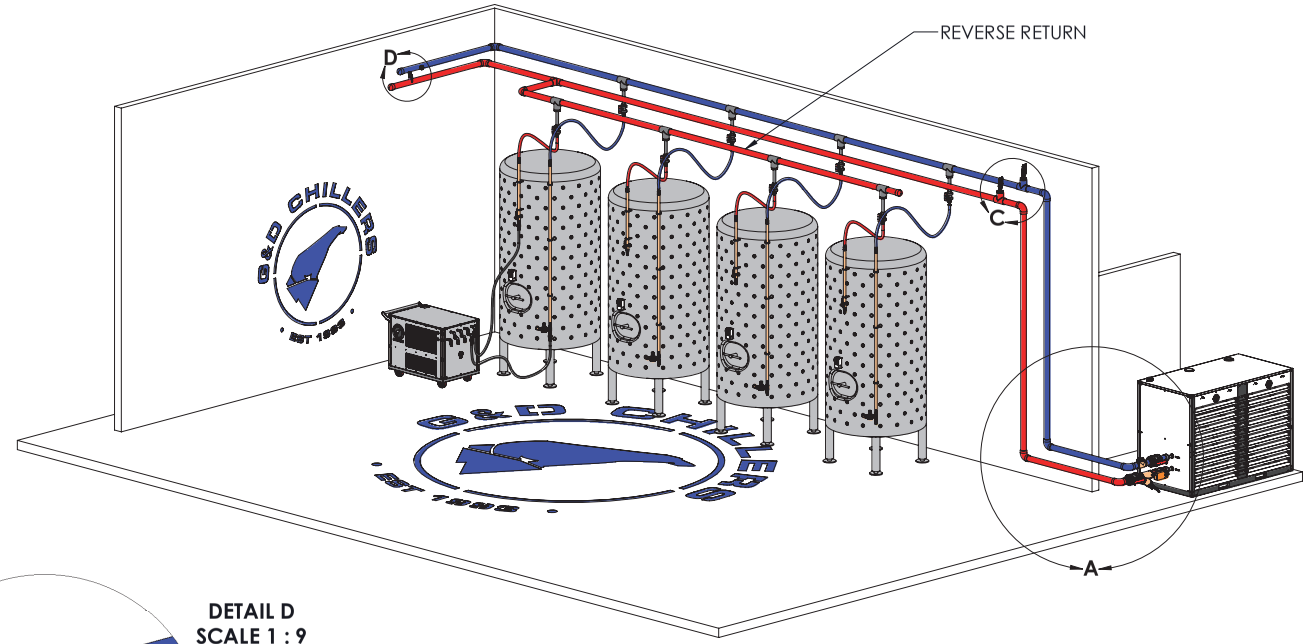
Many customers choose to utilize these auxiliary port connections post-installation. Shown below are typical locations. Contact G&D Tech Support for any auxiliary port questions and piping recommendations.

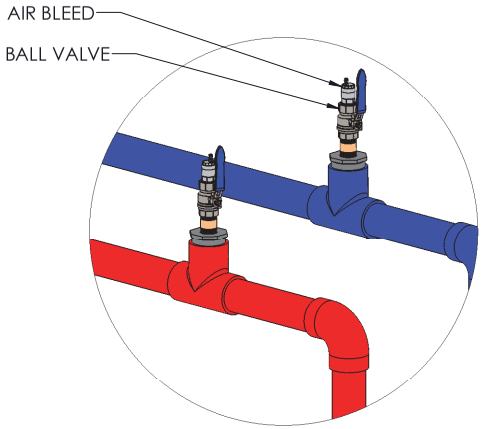




GENERAL PIPING LAYOUT

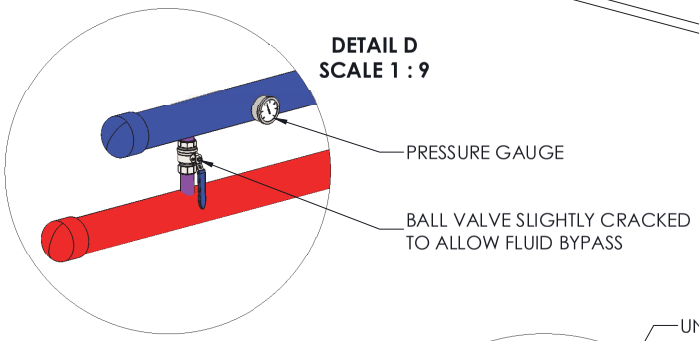
Please see the following page for a diagram of our general piping recommendations.

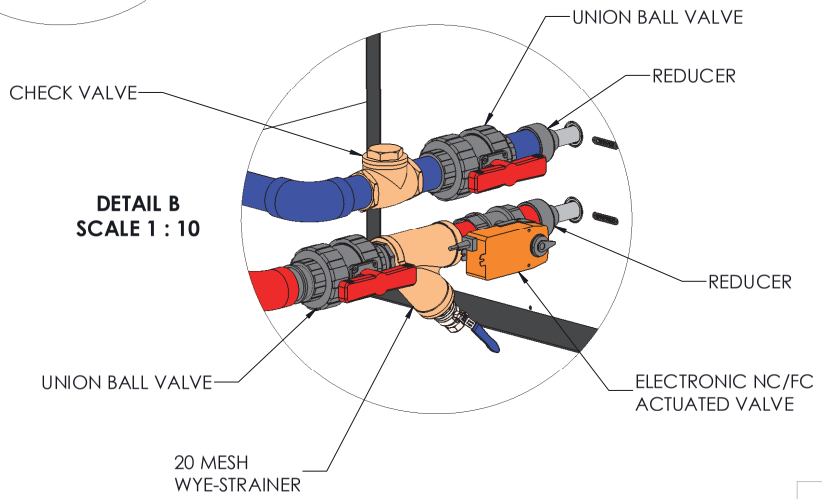




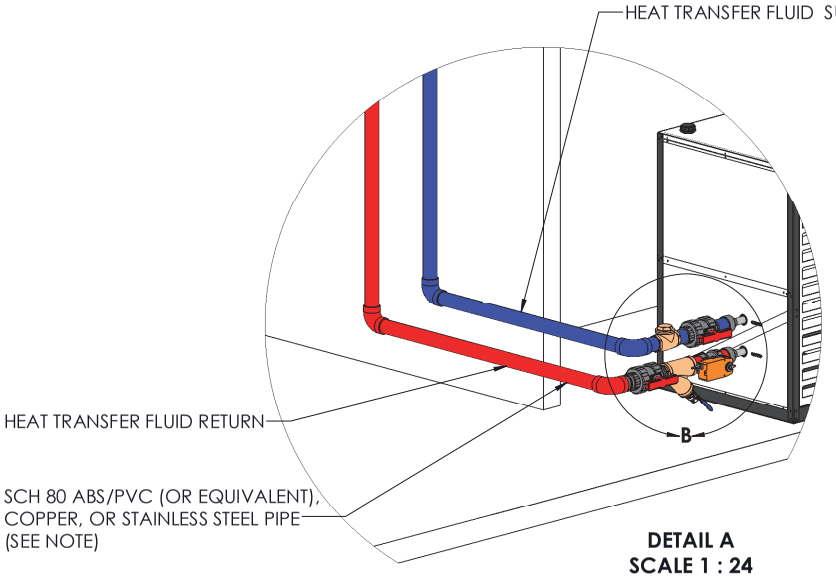
DETAIL C
SCALE 1 : 10

DETAIL D
SCALE 1 : 9





DETAIL B
SCALE 1 : 10



DETAIL A
SCALE 1 : 24

NOTE: INSTALL TAPS FOR TEMPERATURE AND PRESSURE GAUGES THROUGHOUT PIPING SYSTEM FOR MONITORING AND TROUBLESHOOTING PURPOSES
CLADDING OF PIPE INSULATION IS HIGHLY RECOMMENDED

GENERAL PIPING LAYOUT

DRAWN:	DS
APPROVED:	TH
DATE:	09/18/24

G&D CHILLERS
COMMITTED TO COLD
130 E FIRST AVE, JUNCTION CITY, OR 97448
TEL: (541) 345-3903 (800) 555-0973

CHILLER INSTALLATION - ELECTRICAL

GENERAL RECOMMENDATIONS

All wiring must comply with the National Electric Code (NEC) and any applicable local codes. Minimum circuit ampacities (MCA), maximum overcurrent protection (MOC), and other electrical data are indicated on the unit nameplate. The electrical service must be able to handle MCA as minimum and have overcurrent protection no higher than the MOC.

Specific electrical schematics and connection diagrams are shipped with the unit and can be found inside the control panel. During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components.

WARNING: LIVE ELECTRICAL COMPONENTS AND HAZARDOUS VOLTAGES!
Disconnect all electric power, including remote disconnects before servicing. Follow proper lock-out/tag-out procedures to ensure the unit cannot be inadvertently energized. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks.

Important: Do not allow conduit to interfere with other components, structural members, or equipment. To prevent control malfunctions, do not run low voltage wiring (<30 V) in conduit with conductors carrying more than 30 volts.

NOTICE: TEMPORARY PROTECTIVE COVERINGS
Components inside chiller electrical enclosure may arrive from the factory covered with tape or comparable temporary protective coverings. This is intended to prevent debris, especially metal shavings, from entering sensitive parts of the electronics during the installation process. Do not remove the tape/temporary coverings until all holes have been drilled (for power supply wiring) and the enclosure has been thoroughly cleaned of debris and shavings.

POWER SUPPLY WIRING

All power supply wiring must be sized and selected accordingly by the project engineer in accordance with NEC Table 310-16. The installing contractor must provide and install any necessary power supply wiring. It must be properly sized and equipped with the appropriate fused disconnect switches. The type and installation location(s) of the fused disconnects must comply with all applicable codes.

NOTICE: USE COPPER CONDUCTORS ONLY
Unit terminals are not designed to accept other types of conductors.

WARNING: QUALIFIED PERSONNEL ONLY!
All field-installed wiring must be completed by qualified personnel and must comply with the NEC and any applicable local codes. These actions may expose the user to dangerous voltages.

SUMMARY - ELECTRICAL INSTALLATION REQUIREMENTS

Chiller power installation requirements include, but may not be limited to, the following items. Refer to the previous page for additional details:

1. Installation must comply with NEC and applicable local codes.
2. Only allow qualified and licensed personnel to perform electrical work on this equipment.
3. Disconnect all electric power and follow proper lock-out/tag-out procedures before servicing equipment.
4. Supply unit with proper voltage and protect against power spikes. Refer to specification sticker (nameplate) on unit control panel for chiller electrical ratings.
5. Field-installed service disconnect required.
6. Use copper conductors only.
7. Reference the provided torque chart when terminating.
8. Unit must be properly grounded at the provided grounding lug. If multiple ground wires are used, all wires must be twisted together prior to tightening ground lug.
9. Use only hubs or fittings that maintain the same environmental ratings as the enclosure.
10. Once penetrations have been drilled, remove any metal shavings and debris from electrical enclosure. Remove tape/temporary covers from components inside enclosure.
11. Install ethernet cable to connect chiller PLC to facility LAN router.
12. When turning unit off for an extended length of time, leave power energized. This will leave the crankcase heater on and keep the crankcase warm for the next start-up.

TORQUE CHART	
Gauge	**lbf-in**
1000-500	550
500-4	500
350-6	375
250-6	375
4/0-6	275
2/0-14	120
#2-#3	50
#4-#6	45
#8	40
#10-#14	35

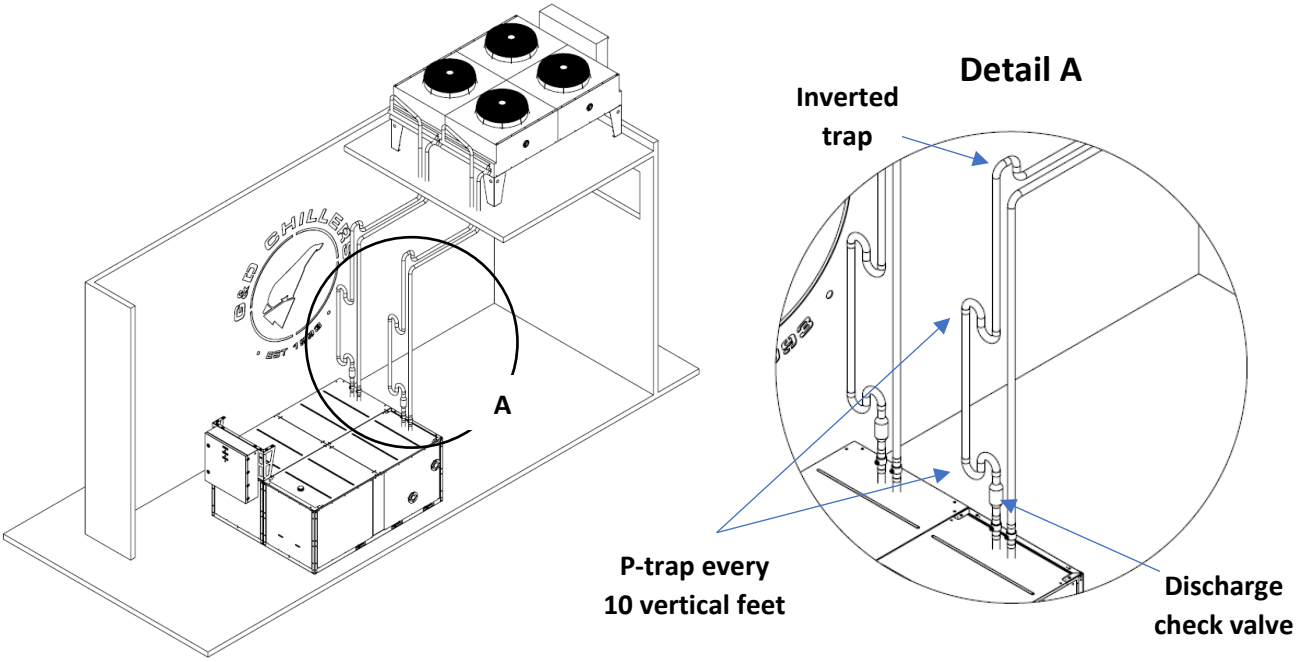
WARNING: ELECTRICAL SAFETY HAZARDS!
Obey all applicable local and national codes when installing this equipment.

CHILLER INSTALLATION - REMOTE CONDENSER

In applications where the condenser is separate from the main chiller package, extra considerations are necessary during installation and commissioning. Refrigerant lines must be correctly sized and installed to ensure proper oil return. Discharge line double risers (not shown) may also be required depending on operating conditions. In addition to the factory-supplied charge, refrigerant will need to be added to the system to compensate for the field-installed piping.

Prior to installing the interconnecting refrigerant piping or adding refrigerant, contact G&D Chillers Engineering for assistance selecting the correct line sizes and determining the extra charge needed for your chiller system.

> **NOTICE: REFRIGERANT LINE SIZING**
> Do not rely on factory-installed connections for refrigerant line sizing! Correct line sizes depend on operating conditions and must be determined on a case-by-case basis. Contact G&D Chillers Engineering for assistance: info@gdchillers.com * (800) 555-0973



Requirements for chillers with remote condensers:

A. Install check valve near compressor discharge, P-trap at bottom of vertical riser, and inverted trap at top of vertical riser
B. Total vertical riser height must not exceed 20 feet
C. Risers taller than 10 feet may require additional P-traps halfway up the line. Contact G&D Chillers Engineering for Assistance.
D. Avoid long horizontal runs. Maximum of 20 feet each direction recommended for most applications
E. Slope horizontal piping sections downwards by 1” for every 20 feet travelled in the direction of flow.
F. Long radius elbows required on drain line. Short radius elbows not allowed
G. Long radius elbows recommended on discharge line
H. Observe best piping practices:
    - Use evacuated type L ACR copper and deburr all piping prior to brazing
    - Nitrogen purge while brazing. Use +15% silver content brazing material
    - Evacuate below 500 microns before adding refrigerant

4. COMMISSIONING

PRE-START CONSIDERATIONS

Refer to the “10 EASY STEPS TO START-UP YOUR NEW G&D CHILLER” section (pg. 20) for the most current chiller start-up procedures.

CAUTION: COMPRESSOR DAMAGE!
Catastrophic damage to the compressor will occur if the isolation valves are left closed upon unit start-up. Do not operate the unit with the compressor, liquid line service valves, or manual shutoff valves in the "CLOSED" position. FAILURE TO OPEN ALL VALVES PRIOR TO STARTING THE COMPRESSOR MAY CAUSE SERIOUS DAMAGE.

CAUTION: EQUIPMENT DAMAGE!
Ensure that the oil sump heaters have been operating for a minimum of 24 hours before starting chiller. Check oil level before starting.

VOLTAGE REQUIREMENTS

Voltage to the unit must be within the range indicated on the nameplate. Measure each leg of the supply voltage at the unit's main power fused-disconnect. If the measured voltage on any leg is not within specified range, notify the power provider (utility) and correct the situation before operating the unit.

NOTICE: EQUIPMENT DAMAGE
Inadequate voltage to the unit may cause control components to malfunction and shorten the life of relay contacts, motors and contactors.

UNIT VOLTAGE IMBALANCE

Excessive voltage imbalance between the phases of a three-phase system can cause motors to overheat and eventually fail. The maximum allowable imbalance is 2 percent. Contact G&D Tech Support for assistance measuring phase imbalance.

UNIT VOLTAGE PHASING

It is important that proper rotation of the pumps be established before the unit is started. Proper motor rotation requires confirmation of the electrical phase sequence of the power supply. The motor is internally connected for clockwise rotation with the incoming power supply phased A, B, C.

For context, voltages generated in each phase of a polyphase alternator or circuit are called “phase voltages.” In a three-phase circuit, three sine wave voltages are generated differing in phase by 120°. The order in which the voltages of a three-phase system succeed one another is called “phase sequence” or “phase rotation”. To reverse the phase sequence, interchange any two of the line wires. Proper motor electrical phasing must be confirmed before starting the unit.

CAUTION: MOTOR WIRING!
If phasing needs to be corrected, only change the power wiring at the chiller’s main distribution blocks. **Never modify internal chiller wiring**.

Do not interchange any load leads internal to the chiller that are from the unit contactors or the motor terminals. Verify proper rotation at the voltage and phase monitor. Improper phasing is indicated by a "front phase reversal" alarm on the phase monitor.

MINIMUM COOLANT LEVEL

G&D Vertical Air Chillers are equipped with a reservoir sensor that will alert the user to unsatisfactory coolant levels. Take care to ensure that coolant level does not drop below half of the maximum level. While successful pump operation is possible with levels lower than this, it is not advisable.

NOTICE: PUMP DAMAGE

Inadequate reservoir levels may cause cavitation which is destructive to pump impellers, and may affect machine performance and/or lead to irreparable damage to compressors.

10 EASY STEPS TO START-UP YOUR NEW G&D CHILLER

Please see the next page for the start-up procedure.

10 Easy Steps to Start-up Your New G&D Chiller

Vertical Air Chillers: GD-30H, 35H, 40H, 50H, 70H, 100H, 140H, 150H, 160H, 200H

Tandem Scroll Chillers: GD-20T, 25T, 30T, 40T, 50T, 65T, 80T, 100T, 120T, 140T

Please view install videos online at www.gdchillers.com/installation-videos

1. **Your chiller includes one (1) free year of Tera service for remote control and monitoring**. Internet access is needed. Run an ethernet cable from facility LAN router to electrical enclosure of chiller before proceeding For more information, please visit https://www.youtube.com/watch?v=V24ZfuJPwjQ
2. **Clearance on all 4 sides of the chiller needs to be equal to one full width of the condenser**. Electrical code may dictate greater clearance. There should be no obstructions above the chiller. Anchoring required. Refer to the CHILLER CLEARANCE REQUIREMENTS page for more details.
3. Install Wye-strainer (required) one size larger than mainline and purge valve on return line at chiller.
4. With the door switches in the OFF position, ensure all breakers are in the ON position. **The chiller must then be supplied with power for at least 4 hours. Verify there is a visible oil level in compressor sight glasses before proceeding.**
5. Flush all piping lines with water, then fill reservoir and piping with a 35% glycol/water mixture. **The chiller start/stop door switch must remain OFF during this step.**
    a. Open supply valve, close return valve, and open purge valve on return line. **Ensure all glycol pump isolation valves are open.**
    b. Fill reservoir with water. Turn control power door switch ON, then process pump door switch ON, and **verify correct pump rotation.**
    c. Flush facility piping loop. Add water while flushing system (keep chiller reservoir topped-up). Once all debris has been flushed out, remove as much water from system as possible
    d. Open return valve and close purge valve on return line.
    e. Fill reservoir/piping loop with 35% propylene glycol mixture. **Inhibited glycol is required** to prevent rust and corrosion in the system.
6. Temporarily close the supply valve and **confirm glycol pressure is at 20 PSI** (refer to #10 if a lower pump pressure is required). Open supply valve and circulate glycol through entire piping loop for at least 30 minutes. Re-verify glycol mixture using a refractometer. The glycol MUST be 35%-40%. Correct as needed before proceeding.
7. **Re-verify oil levels in the compressor sight glasses. Do not proceed unless an oil level is visible in the sight glass of every compressor in the chiller.**
8. **Open all service valves/refrigerant ball valves in chiller marked with tags:** Suction/discharge of each compressor and refrigerant ball valves at receiver. Models with remote condensers will have additional valves. Contact us for more details as needed.
9. Turn chiller start/stop door switch to the RUN position. Compressors should start to run. Fans to follow shortly. Scroll chiller models only: **Verify correct scroll compressor rotation.** Use the Carel controller to check refrigerant pressures. When compressor turns on, suction pressure should decrease and discharge pressure should increase.
10. Adjusting set points on the Carel controller: Press the up/down arrows until SET displays in bottom right corner. Press enter and change temperature to desired set point. Pump pressure adjustment for the VFD is also located here. If decreasing glycol pressure is required for tank jacket ratings, do so using the Carel controller at this time.

PLEASE VISIT GDCHILLERS.COM TO VIEW OUR INSTALLATION VIDEOS & FAQS

*G&D Chillers welcomes any and all questions or concerns. We can be reached at **800-555-0973** or **541-345-3903**

POST-START CONSIDERATIONS

WARRANTY ACTIVATION

Complete the Warranty Start-Up Checklist on the following page and submit a copy to G&D Chillers Tech Support as soon as possible following the start-up of chiller.

NOTICE: CHILLER WARRANTY REQUIRES ACTIVATION

To activate the chiller parts and labor limited warranty, complete the Warranty Start-Up Checklist and return to G&D Chillers within 30 days.

OPTIMIZING REFRIGERANT CONDITIONS

This chiller utilizes a PID formula to maintain the fluid temperature as close to the setpoint as possible. At times, the compressors may continue to run even if the fluid temperature is below the setpoint. This is normal.

Once the system has been operating for approximately 30 minutes and has become stabilized, complete the remaining start-up procedures, as follows:

- Check and record the compressor refrigerant suction and discharge pressures.
- Check the liquid line sight glasses after sufficient time has elapsed to stabilize the chiller. The refrigerant flow past the sight glasses should be clear. Bubbles in the refrigerant indicate either low refrigerant charge, excessive pressure drop in the liquid line, a stuck open expansion valve, or ice formation in the evaporator. A restriction in the line can sometimes be identified by a noticeable temperature differential between the two sides of the restriction. Frost will often form on the line at this point. Proper refrigerant charges are listed on the unit nameplate.

NOTICE: SIGHT GLASS

A clear sight glass alone does not confirm that the system is properly charged. Also check system subcooling, superheat, and unit operating pressures.

A shortage of refrigerant is indicated if operating pressures are low and subcooling is also low. Refrigerant should only be added if a leak is detected. If the operating pressures, sight glass, superheat and subcooling readings indicate a refrigerant shortage, remove and weigh out remaining refrigerant charge. Recharge with amount indicated on the chiller data plate. With the unit running, add refrigerant liquid by connecting the charging line to the suction accumulator and service port until operating conditions become normal. Slowly add refrigerant.

NOTICE: LOW SUCTION/DISCHARGE PRESSURE

If both suction and discharge pressures are low but subcooling is normal, a problem other than refrigerant shortage exists. Do not add refrigerant, as this may result in overcharging the circuit.

Use only the refrigerant specified on the unit nameplate. Contact G&D for the recommended oil type or refer to the data plate on the compressor for your specific chiller. Using incorrect refrigerant or oil may cause compressor damage and or operational issues.

WARNING: HAZARDOUS VOLTAGES!

Disconnect all electric power, including remote disconnects, before servicing. Follow proper lock-out/tag-out procedures to ensure the power cannot be inadvertently energized.

WARRANTY START-UP CHECKLIST

Jobsite:		Tech Company:
Chiller Model:		Technician:
Chiller Serial #:		Start-Up Date:

FOLLOWING START-UP OF CHILLER, PLEASE SEND A COPY OF COMPLETED FORM TO G&D TECH SUPPORT

CHILLER CLEARANCES (Include photos for warranty)	FRONT:	BACK:	LEFT:	RIGHT:
CHILLER MOUNTING (Anchor required)				
HEAT TRANSFER FLUID (HTF) TYPE & MIXTURE %				
RESERVOIR LEVEL (Reservoir % Full)				
PHASE/VOLTAGE				
VOLTAGE TO GROUND (Note: High Leg to L2)	L1:	L2:	L3:	
PUMP ROTATION				
PUMP PRESSURE (PSI)				
	COMPRESSOR A	COMPRESSOR B	COMPRESSOR C	COMPRESSOR D
CRANK CASE HEATER ENERGIZED 4 HOURS				
COMPRESSOR OIL LEVEL				

RECORD THE FOLLOWING ITEMS WHEN HEAT TRANSFER FLUID REACHES DESIGN TEMPERATURE. Standard HTF design targets are 30 °F for medium temp, 50 °F for high temp, or -50 °F for ultra-low temp chillers. Custom designs are also possible – contact G&D for assistance with non-standard operating conditions.

WARNING: ENSURE FREEZE PROTECTION OF HTF TYPE/MIXTURE IS ADEQUATE BEFORE PROCEEDING! Recommended HTF concentrations can be found in the applicable chiller manual and startup documentation. Failure to use the proper HTF at the correct concentration will damage the chiller. If in doubt, contact G&D technical support: (800) 555-0973.

		COMPRESSOR A		COMPRESSOR B		COMPRESSOR C		COMPRESSOR D	
MOTOR AMPS (COMPRESSORS)	L1:								
	L2:								
	L3:								
SUPERHEAT (°F)									
SUBCOOLING (°F)									
SUCTION PRESSURE (PSIG)									
DISCHARGE PRESSURE (PSIG)									
		PUMP #1		PUMP #2		PUMP #3		PUMP #4	
MOTOR AMPS (PUMPS)	L1:								
	L2:								
	L3:								
		FAN #1	FAN #2	FAN #3	FAN #4	FAN #5	FAN #6	FAN #7	FAN #8
MOTOR AMPS (FANS)	L1:								
	L2:								
	L3:								
AMB. TEMP @ START-UP									

TERA SERVICE

We have chosen to partner with Carel, one of the largest refrigeration controls manufacturers. Their robust products are specialized to include remote monitoring communications. Unlike other chiller manufacturers, we're committed to building chillers with no proprietary parts.

Vertical Air Chillers come with one (1) free year of Tera service, which allows G&D technicians to remotely diagnose issues. An ethernet cable and internet access are required for Tera functionality.

This Offsite Remote Monitoring system can be configured to send SMS text alerts alerting the user of any abnormal conditions. The web-based interface allows you to pull up the information on your phone or computer from anywhere in the world, providing peace of mind to keep operations running smoothly.

For more information, please visit https://www.youtube.com/watch?v=V24ZfuJPwjQ

REMOTELY MONITOR YOUR CHILLER'S PERFORMANCE.

ANYTIME. ANYWHERE.

5. OPERATION

CHILLER OPERATING PRINCIPLES

This section contains an overview of the operation of air-cooled chillers equipped with thermostatic control systems.

GENERAL

The Vertical Air unit is an air-cooled liquid chiller utilizing a reciprocating or scroll-type compressor. These units are equipped with unit-mounted starters/control panel and operates with the refrigerant indicated on the nameplate.

BASIC COMPONENTS OF A G&D CHILLER UNIT:

- Unit-mounted panels containing breakers, starters, and Carel controller
- Reciprocating or scroll compressors
- Brazed plate evaporators
- Air-cooled condenser
- Electronic expansion valves
- Related interconnecting piping

STANDARD POWER UP

When power is applied to the chiller, the HMI will boot up to the main screen. The chiller will start if both the Control Power switch and the Chiller Start/Stop switch are in the ON position. This ensures automatic restart in the event of a power outage. On two pump systems, the process pump will only start if the Control Power switch and the Process Pump switch are in the ON position.

NORMAL SHUTDOWN

1. Perform the normal unit stop sequence using the chiller Stop/Start switch.
2. Verify that the chiller and process pumps are cycled off.
3. Verify that the compressor crankcase heaters are working.

Note: **Do not open the external chiller main disconnect switch.** This must remain closed to provide power to the crankcase heaters at all times.

COMPRESSOR OPERATIONAL PUMP DOWN (RECIPROCATING COMPRESSORS ONLY)

The operational pump down cycle is used to manage the refrigerant charge, prevent oil dilution/starvation, and guard against any liquid slugging into the compressors. The pump down occurs during all normal shutdown conditions. The electronic expansion valve(s) will close, and the compressor suction evacuates refrigerant from the low-pressure side. The pump down sequence ends when the suction pressure drops below the pump down pressure setpoint.

Tandem scroll compressors do not pump down.

NOTICE: REPAIR AND DIAGNOSIS
To ensure proper diagnosis and repair, contact a qualified service technician if a problem should occur.

SEQUENCE OF OPERATION (RECIPROCATING COMPRESSORS)

1. Chiller supply and return ball valves should always be open during normal operation.
2. Fluid bypass valve is factory set at 20 PSI (30 PSI with VFD) to allow minimum flow across the heat exchanger while process is not calling for cooling.
3. The process pump will be energized at all times if the “Process Pump” door switch is in the “ON” position.
4. Compressor control circuit and chiller pump will energize with the stop/start and control power switches in the “ON” position.
5. If the chiller pump fails or no flow is detected, the compressor control circuit will de-energize.
6. The programmable logic controller (PLC) will open the electronic expansion valve (EEV) to initiate the refrigeration circuits based on the leaving fluid temperature
7. Once there is a call for cooling, the PLC will energize the compressor motor starter and modulate the EEV to maintain the correct superheat.
8. If all parameters remain in a safe range, the compressor will continue to run until the PLC reaches the fluid set point.
9. Once desired set point is achieved, the EEV will close and the compressor will pump down. When completed, the compressor motor starter will de-energize and the compressor will stop.
10. Turning the Stop/Start switch off will interrupt the chilling cycle and de-energize the EEV causing the compressor to pump down, and the chiller pump to stop (as long as the minimum run timer has elapsed).
11. The PLC and crankcase heater will remain energized when all door switches are OFF. Power should remain to the terminal blocks to keep crankcase heater energized during extended off cycles.

SEQUENCE OF OPERATION (TANDEM SCROLL COMPRESSORS)

1. Chiller supply and return ball valves should always be open during normal operation.
2. Fluid bypass valve is factory set at 20 PSI for single/dual pump systems (30 PSI with VFD) to allow minimum flow across the heat exchanger while process is not calling for cooling.
3. The pump is circulating fluid at all times when the chiller control power and start/stop switch are both on.
4. Compressor control circuit is energized with the start/stop and control power switches in the ON position.
5. If pump fails or no flow is detected, the compressor control circuit will de-energize
6. PLC will open the EEV to initiate the refrigeration circuits based on the leaving fluid temperature.
7. Once there is a call for cooling, the PLC will energize the compressor motor starter and modulate the EEV to maintain the correct superheat.
8. If all the parameters remain in a safe range, the compressor will continue to run until the PLC reaches the fluid set point.
9. Once desired set point is achieved, the compressor motor starter will de-energize and the EEV will close.
10. Turning the Start/Stop switch OFF will interrupt the chilling cycle and de-energize the compressor and pump (as long as the minimum run timer has elapsed).
11. The PLC and crankcase heater will remain energized when all door switches are OFF. Power should remain to the terminal blocks to keep crankcase heater energized during extended off cycles.

REFRIGERATION CYCLE

Whether the system uses reciprocating compressors or scroll compressors, the refrigeration process is the same. There are a few key differences:

RECIPROCATING COMPRESSORS

These compressors typically use refrigerants like R448A or R404A, and operate with leaving fluid temperatures (LFTs) typically around 20°F to 40°F.

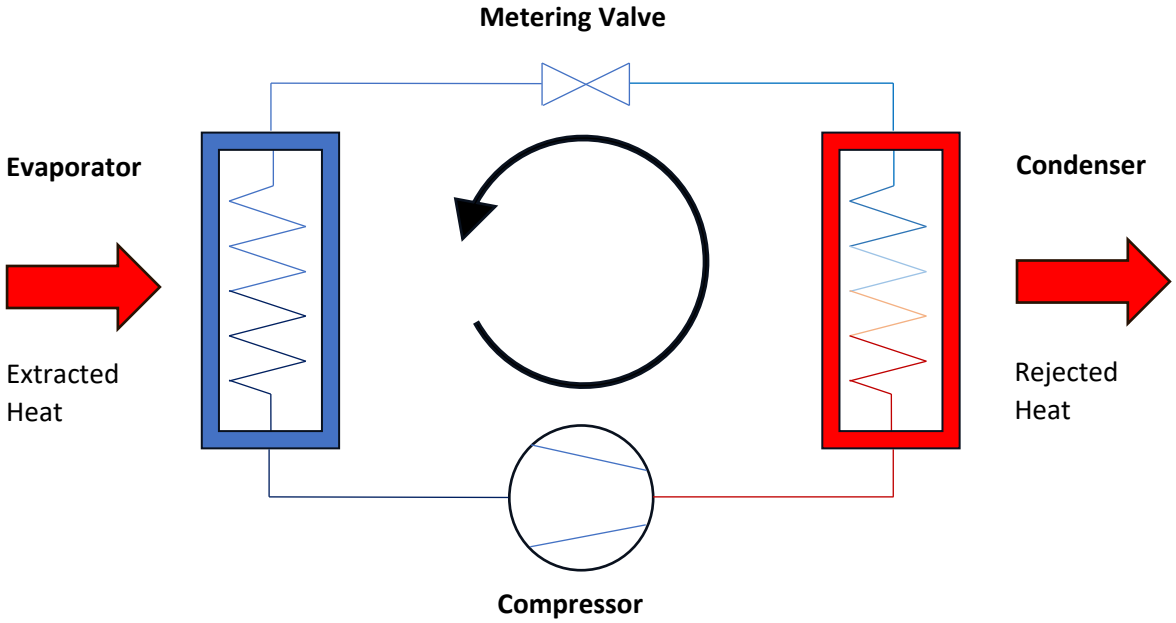
SCROLL COMPRESSORS

These compressors typically use refrigerants like R410A or R454B, and operate with typically higher LFTs, around 40°F to 60°F.

SUMMARY

The vapor-compression refrigeration cycle consists of the following processes: Refrigerant evaporation occurs in the brazed plate evaporator. Metered refrigerant vaporizes as it cools the chilled liquid flowing through the evaporator passages. The refrigerant vapor leaves the evaporator as superheated gas. The gas from the evaporator flows to the compressor suction manifold where it enters and flows across the compressor motor windings to provide cooling. The vapor is then compressed by the compressor and discharged. Oil from the compressor sump lubricates the bearings and seals the small clearances. Refrigerant vapor is discharged to the air-cooled condenser as a hot vapor. After the refrigerant vapor condenses into liquid, it is returned to the evaporator where the refrigerant again flashes into vapor and the refrigeration cycle repeats.

A simplified thermodynamic cycle is shown below:

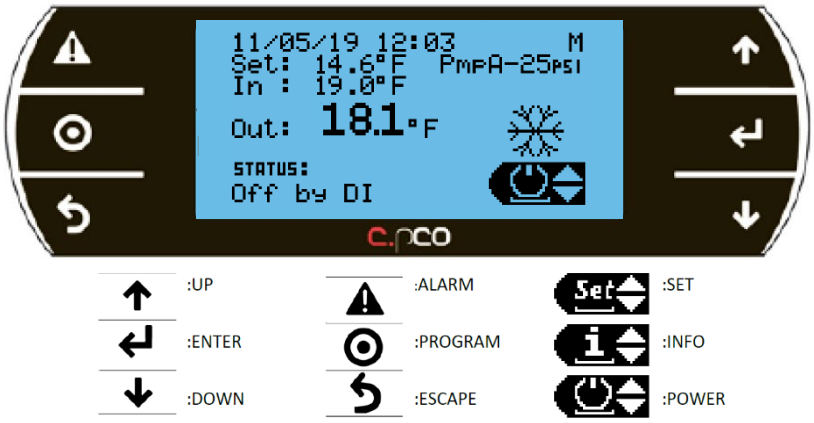


CONTROLLER AND NAVIGATION

OPERATING MAP PROTECTION

The chiller is equipped with a unit-mounted starter and control panel. The PLC-based unit control module provides accurate chilled fluid control while providing monitoring, protection and limit functions. The adaptive nature of the controls intelligently prevents the chiller from operating outside of its limits, and compensates for unusual operating conditions while keeping the system running rather than simply shutting off the chiller.

CONTROLLER MAIN SCREEN



SET SCREENS:

1. **HTF temperature setpoint:** Ensure you see Set in the bottom right of the display screen
    a. You can change options from [SET], [INFO], and [POWER] by using the [↑] and [↓] buttons.
    b. Press [ENTER] to navigate to the HTF temperature set screen.
    c. Press [ENTER] again to navigate to the numerical readout. Use the [↑] and [↓] buttons to adjust to desired setpoint.
2. **Pump pressure setpoint:** Ensure you see Set in the bottom right of the display screen.
    a. Press [↓] until you see pump pressure setpoint.
    b. Press [ENTER] to navigate to numerical readout and adjust with [↑] and [↓] to set pump pressure. Please note that pressure setpoints are preset at the factory.

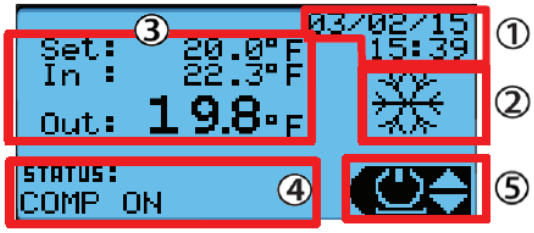
INFO SCREENS:

1. Ensure you see i in the bottom right portion of the display screen.
2. Press [ENTER] to navigate to the first information screen.
3. Use [↓] to scroll through the information screens.

ALARMS:

1. Press [ALARM].
2. Navigate with [↑] and [↓] to see current alarms.
    a. To clear the alarms, press [↑] and [↓] through alarm screen until you see a prompt saying “press [ALARM] button for 3 seconds.”
    b. To check alarm history, cycle through active alarms and press [ENTER] to view data logger.

DISPLAY



The above screen displays an example of the main screen on an active unit. Their descriptions are below:

1. Date and time
2. Current unit status

 **Summer mode (chiller)**

 **Winter mode (heat pump)**

 **Defrosting in progress (all circuits)**

 **Defrosting in progress (one circuit)**

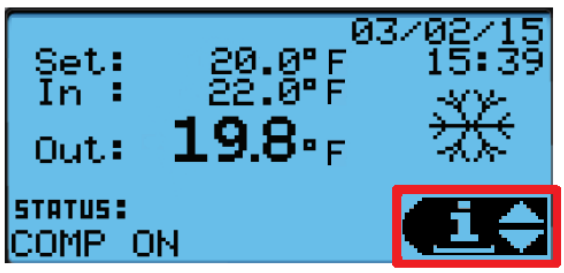
 **Full free cooling**

 **Partial Free cooling**

3. Control probes, setpoint, and reference probe
4. Status of the unit
   a. **STAND BY**
   b. **OFF BY ALARM**
   c. **OFF BY BMS**
   d. **OFF BY SCHED**
   e. **OFF BY DI**
   f. **OFF BY KEYBOARD**
   g. **OFF BY CHG-OVER**
   h. **FREECOOLING**
   i. **COMP ON**
   j. **DEFROST**
   k. **SHUTTING DOWN**
5. Indicates access to the user menu using the [↑], [↓], and [ENTER] keys to confirm

USER MENU

On the main screen, the [↑] and [↓] buttons can be used to scroll through the functions and [ENTER] used to select them. No password is needed to access and edit these parameters.

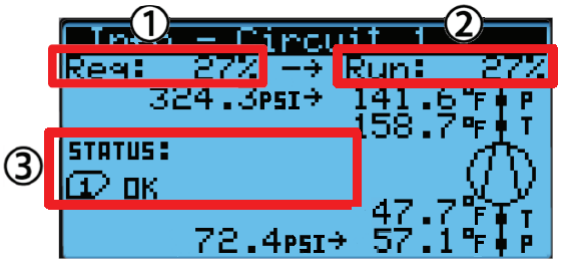


SYNOPTICS

The general synoptics of the unit can be shown from the user menu. The physical status of the inputs, device outputs, and probes are available in a menu connected to the synoptics. If an input or output is not enabled, its screen does not appear.

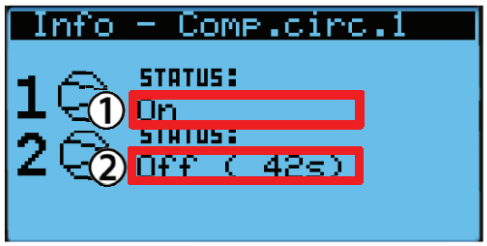
The individual screens of the synoptics are shown below:

CIRCUIT SYNOPTIC



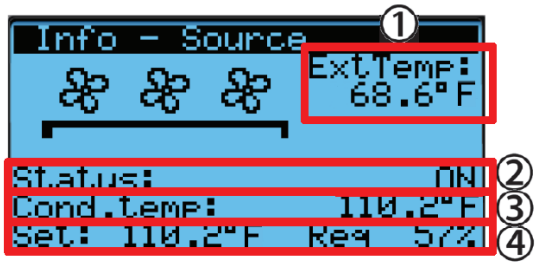
1. Call for cooling
2. Response from chiller/compressors
3. Envelope zone
   a. **1 OK** – zone within operating limits
   b. **2 HiDP** – high compression ratio
   c. **3 HiDscgP** – high condensing pressure
   d. **4 HiCurr** – high motor current
   e. **5 HiSuctP** – high suction pressure
   f. **6 LoPRat** – low compression ratio
   g. **7 LoDP** – low differential pressure
   h. **8 LoDscgP** – low condensing pressure
   i. **9 LoSuctP** – low suction pressure

COMPRESSOR SYNOPTIC



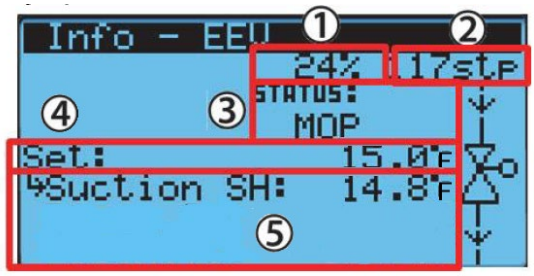
1. Status of compressor 1
2. Status of compressor 2
   a. **Off (…s)** – off, indicating, if necessary, remaining time before restarting
   b. **On (…s)** – on, indicating, if necessary, remaining time before switching off
   c. **Man On** – on manually
   d. **Man Off** – off manually
   e. **Frcd Off** – forced off by EVD driver (not yet ready for control)
   f. **Defr** – on for defrost cycle
   g. **PmpD** – pump-down in progress
   h. **Alrm** – off due to alarm

CONDENSER FAN SYNOPTIC



1. External temperature (if measured)
2. Fan operational status
    a. **Off**
    b. **On**
    c. **Speed up**
    d. **Forced by defrost**
    e. **Forced by prevent+**
    f. **Anti-frost**
    g. **Freecooling**
    h. **Manual**
    i. **Defrost**
3. Current saturated condensing temperature value
4. Control setpoints and percentage request (the percentage is shown with modulating fans only)

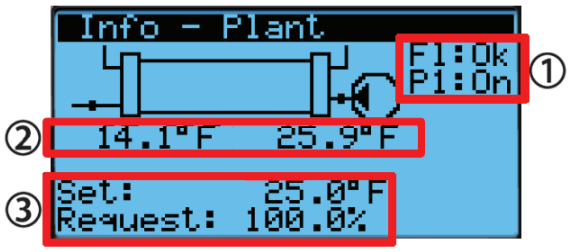
EXV SYNOPTIC



1. Valve opening percentage
2. Valve steps
3. Valve status
    a. **Init** – driver initialization
    b. **Close** – valve closed
    c. **Off** – valve in standby
    d. **Pos** – valve in positioning
    e. **Wait** – valve in activation
    f. **On** – valve in control
    g. **LoSH** – Low SH function running
    h. **LOP** – LOP function running
    i. **MOP** – MOP function running
    j. **HiTc** – HiTc function running
4. Setpoint for suction superheat
5. Active valve
    a. Suction superheat measured

The [↳] arrow indicates the reference variable for the setpoint (i.e., what control is based on – suction SH, in the figure)

PLANT SYNOPTIC



1.) Pump and flow switch status
2.) Inlet and outlet temps across evaporator
3.) Control setpoints and unit percentage request

ON-OFF

The unit can be turned on and off from the user menu (using the parameter with code **Q000**) and the status can be displayed.

The On status requires the following consensus:

- Digital input (if enabled)
- Keyboard from the On-Off menu
- Time bands (if enabled)
- BMS (if enabled)

Before switching from On to Off, there is a transitory shutting down status where the controller shuts down the compressors following the shutdown procedure and then shuts down pumps and fans.

SET

In this menu, the current setpoints in chiller mode (parameter code **Q001**) and heat pump mode (parameter code **Q002**) can be displayed and edited.

The user cannot set the setpoints outside of the minimum and maximum valves set in the Plant menu.

If the summer/winter change by keyboard is enabled, the unit operating mode (parameter code **Q003**) can also be changed in this menu.

Following a mode change, the unit will remain off with the pump on for a period of time (code **A024**) that can be set from the Plant menu to reduce working mode temperature difference in the evaporator and make the compressor restarting less problematic.

6. MAINTENANCE & TROUBLESHOOTING

GENERAL

Perform all maintenance procedures and inspections at the recommended intervals. This will prolong the life of the chiller and minimize the possibility of malfunctions. Vertical Air chillers must use inhibited propylene glycol as heat transfer fluid (HTF).

Use an "Operator's Log" to record the unit's operating history. The log serves as a valuable diagnostic tool for service personnel. By observing trends in operating conditions, an operator can anticipate and prevent problematic situations before they occur. If the unit is not operating properly during maintenance inspections, consult the "TROUBLESHOOTING" section (pg. 36) of this manual.

WEEKLY/MONTHLY MAINTENANCE

Please contact G&D Technical Support if you have any questions or concerns regarding the performance, operation, or maintenance of your chiller: **800-555-0973**

- Refer to the MAINTENANCE SCHEDULE section (pg. 34) for a complete list of maintenance tasks.
- Contract a licensed refrigeration technician to evaluate the chiller refrigeration circuit(s) regularly. These checkups should occur annually at a minimum. Every 3-6 months is recommended.

The following tasks can be performed without the need for specialized equipment or training:

- Check HTF level and condition monthly. If it is discolored, develops an odor, or you suspect water has evaporated from the system, check fluid mixture with the refractometer. Contact G&D Technical Support to verify the reading.
- Check compressor oil in sight glass at bottom of compressor monthly. Inspect for any oil leaks.
- Verify pump function quarterly. Confirm HTF supply pressure. Listen for abnormal sounds from the pump.
- Verify thermostat function quarterly. Check displayed temperature against a thermometer measurement.
- Condenser should be cleaned at least every 6 months for proper operation and efficiency. Use a garden hose and spray at an angle. If using hard water, condenser cleaner will be needed.
- See warning below. With the service disconnect in the OFF position (no power to the chiller), inspect control panel contacts on compressor and pump contactors. Contact an electrician if replacements are needed.

WARNING: HAZARDOUS VOLTAGES!
When servicing the unit, position all electrical disconnects in the "OPEN" position and lock them to prevent injury or death due to electrical shock or moving parts.

ANNUAL MAINTENANCE

Complete all weekly and monthly maintenance checks.

Check the oil level and refrigerant charge. Routine changing of oil is not required.

Contact a qualified service provider to leak test the chiller, check operating and safety controls, and to inspect electrical components for proper operation. Leak testing may be accomplished using soap solution or with electronic or ultrasonic leak detectors.

Inspect all piping components for visible damage or leaks.

Clean all fluid strainers. Clean and repaint any components that show corrosion.

Clean the condenser fans. Check the fan assemblies for proper clearance in the fan shroud openings and for motor shaft misalignment or abnormal end-play, vibration and noise.

Clean the condenser coils at least once a year. More frequent cleanings may be necessary. Refer to “CONDENSER MAINTENANCE” section below.

CONDENSER MAINTENANCE

Clean the condenser coils at least once a year or more frequently if the unit is in a "dirty" environment. A clean condenser will help maintain chiller operating efficiency. To clean the coils, use a soft brush and a sprayer such as a garden pump type or a high-pressure type. Take care not to damage the aluminum fins when cleaning.

A high-quality detergent is recommended. Follow the detergent manufacturer’s instructions to avoid damaging the condenser coils. Note: if detergent mixture is strongly alkaline (pH value greater than 8.5), an inhibitor must be added.

EVAPORATOR MAINTENANCE

G&D liquid chillers use brazed plate heat exchanger (BPHX) evaporators with electronic flow switch installed near the evaporator’s inlet/outlet HTF ports.

NOTICE: STRAINER MAINTENANCE
Strainer maintenance is critical to proper operation and reliability. Any particles larger than 1mm entering the BPHX evaporator may cause the evaporator to fail, requiring replacement.

The BPHX evaporator is difficult to clean should it become plugged with debris. Indications of a plugged evaporator include "wet" suction due to lack of heat exchange, loss of superheat control, depressed discharge superheat (superheat less than 63°F), compressor oil dilution and/or starvation and premature compressor failure.

EVAPORATOR REPLACEMENT

CAUTION: EQUIPMENT DAMAGE!
If the evaporator requires replacement, it is very important that the new evaporator be replaced correctly and with the correct refrigerant and fluid piping connections. The refrigerant inlet/liquid connection is at the bottom of the evaporator and the refrigerant outlet/suction connection is at the top of the evaporator.

WYE-STRAINER MAINTENANCE

The field-installed strainer should be equipped with a blowdown valve installed at the chiller return. The strainer must be 20 mesh or higher. For maximum efficiency, a differential pressure gauge installed across the inlet and outlet will indicate pressure loss due to clogging and may be used as a guide to determine when cleaning is required. Normally when differential pressure across the wye strainer reaches 5-10 psi, the screen must be cleaned. To clean open the blowdown valve and flush out until evacuation is complete.

REFRIGERANT HANDLING

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain chlorine, fluorine and carbon (CFCs) and those containing hydrogen, chlorine, fluorine and carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment.

NOTICE: RESPONSIBLE REFRIGERANT HANDLING

G&D advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs, HFCs, and HFOs. All technicians who handle refrigerants must be certified. Know the applicable laws for handling, reclaiming, recovering and recycling of certain refrigerants and follow them.

G&D believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning and refrigeration industries. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants.

CAUTION: REFRIGERANT INFORMATION AND SAFETY!

Refrigerants must only be charged into the unit in a liquid state! Use only manifold gauge sets designed for use with the refrigerant indicated on the nameplate. Use only refrigerant recovery units and cylinders designed for use with refrigerants and POE oil.

Liquid refrigerants must be stored in a clean, dry area out of sunlight. Never heat or allow refrigerant storage cylinder temperatures to reach 125°F or store the cylinders where temperatures will exceed 125°F. Keep cylinder valves tightly closed and valve caps in place when refrigerant cylinders are not in use.

NEVER attempt to use refrigerants in a space that is enclosed or lacks proper ventilation!

CAUTION: PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIRED!

Always refer to appropriate MSDS and OSHA guidelines when handling refrigerants. Use proper breathing, eye and body protection when handling refrigerants.

MAINTENANCE SCHEDULE

THE FOLLOWING INSPECTIONS MUST BE PERFORMED ROUTINELY:

	Weekly	Monthly	Quarterly	Yearly	Technician required?
Visual leak inspection	X				NO
Compressor oil levels	X				NO
HTF temperature	X				NO
HTF pressure	X				NO
HTF level		X			NO
HTF Mixture %		X			NO
Reservoir vent unobstructed		X			NO
Check wye strainer		X			NO
Fan function		X			NO
Pump function		X			NO
Pump rotation		X			NO
Grease motors		X			NO
Condenser integrity		X			NO
Condenser cleanliness		X			NO
HTF appearance			X		NO
Clean coils (Air-cooled units)				X	NO
Flow switch function				X	NO
Insulation integrity				X	NO
Cosmetic integrity				X	NO
Wipe down/Paint unit				X	NO
Compressor pump down			X		YES
Compressor amps			X		YES
Verify sensor calibration			X		YES
Operating pressures			X		YES
Subcooling			X		YES
Superheat			X		YES
Clear sight glass			X		YES
Contactor function			X		YES
Breaker function			X		YES
Check all capacitors			X		YES
Inspect all terminations			X		YES

Note: **Bolded inspection points** can be checked without the need for specialized equipment or training. Contact G&D Tech Support for advice specific to your chiller.

WARNING: HAZARDOUS LIVE ELECTRICAL COMPONENTS!
Do not attempt to service electrical components or make adjustments in electrical panel without proper training and lock-out/tag-out safety procedures.

MAINTENANCE LOG

Part	Model	Description	QTY	Date

Notes/Comments

TROUBLESHOOTING

	COMPLAINT	SYMPTOMS	CAUSE	SOLUTION
1	System short of capacity	Lower than expected suction and discharge pressures	Low refrigerant charge	Check for leaks, repair, and recharge. See item 5
		Higher than expected head pressure	See item 2	See item 2
		Lower than normal suction pressure	Incorrect superheat - too high	Adjust superheat
2	Head pressure too high	Tripping high pressure switch, or compressor trips on internal overload	Dirty condenser	Clean condenser
			Condenser air short circuiting or location too hot	Remove obstructions, causes for air short circuiting
			Defective condenser fan motor or blade	Replace
			Air or non-condensable gases in the system	Purge the system
			Refrigerant over charge	Remove excess refrigerant
3	Head pressure too low	Sight glass with bubbles	Refrigerant leak or system undercharged	Check for leaks, repair and recharge
			Plugged filter drier	Replace filter drier
			Insufficient subcooling	Check condenser subcooling circuit
4	Suction pressure too high	Coolant temperature will not reach setpoint	Excessive load on the system	Check load and improve conditions
		Incorrect superheat	TEV stuck open due to ice or defect	Check, repair, or re-place TEV
			Incorrect superheat setting of the expansion valve	Adjust superheat
5	Suction pressure too low	Sight glass with bubbles	See item 3	See item 3
		Warm suction line, signs of frost on the TEV and low system capacity	Plugged TEV or strainer	Clean TEV and strainer
		Compressor cycling due to low pressure cutout	See item 12	See item 12
6	Noisy compressor	Oil level below midpoint of the compressor sight glass during operation	Lack of oil	Avoid compressor short cycling or run compressor enough to return oil to crankcase, correct low load conditions. Add oil.
		Noticeable knock in compressor	Worn or scored bearings	Replace the compressor
		Frosted suction line and compressor shell	Liquid flood back	Check superheat and TEV operation

TROUBLESHOOTING [2/3]

	COMPLAINT	SYMPTOMS	CAUSE	SOLUTION
7	Compressor does not pump	Minimal difference in pressure between high side and low side of system, when compressor motor has power	Broken suction valves	Change compressor
			Broken discharge line	Change compressor
			Internal pressure safety valve stuck open	Check item 13 and change compressor if necessary
8	Compressor will not start	Blown fuse or open disconnect	Short circuit or other electrical failure	Check electrical circuit and wiring
		Tripped or damaged overload	Overheating or overcurrent	Wait 2-3 hours for overload to reset and check refrigerant charge or power quality to the compressor
		Open pressure switch	Loss of refrigerant charge	Check for leaks, repair and recharge
		Loose wires	Vibration, bad crimping or under-torque	Check terminals at compressor, contactor and wiring in general
		Motor seized	Low oil level or phase reversal	Check oil level. Restart 3-ph compressor by switching 2 phases; replace if it does not restart
9	Compressor starts but start relay does not drop out	High running current, overload trips	Incorrect wiring of start components	Check wiring
			Incorrect or defective start relay	Confirm operation, model and make
			Incorrect or defective start capacitor	Confirm integrity and specs, check if fitted with discharge resistance
			Incorrect or defective run capacitor	Confirm integrity and specs
			Low voltage	Fix undervoltage protection
10	Compressor runs but cuts out on overload	Internal overload tripping MUST WAIT 2-3 HOURS TO CHECK IF IT WILL RESET	Excessive head pressure due to dirty condenser or lack of condenser air or water flow	See item 2 above
			Low voltage or unbalanced	Fix undervoltage protection
			Faulty electrical connections causing single phasing or high current surges	Remake the connections
			Sticking start relay on single phase machines leaving start cap on circuit	Replace relay and ensure start cap is fitted with a discharge resistance

TROUBLESHOOTING [3/3]

CAREL ALARMS

	COMPLAINT	SYMPTOMS	CAUSE	SOLUTION
11	Compressor starts but cycles on overload	Internal overload tripping MUST WAIT 2-3 HOURS TO CHECK IF IT WILL RESET	Loss of charge causing insufficient motor cooling	Check for leaks, repair, and recharge
			Voltage is low or unbalanced if 3-ph	1-ph fix undervoltage protection, 3-ph correct phase imbalance
			Defective or wrong run cap	Check and replace
			Defective overload	Check current and re-place compressor if necessary
12	Compressor runs but cycles on…	…overload	See items 10 and 11	See items 10 and 11
		…thermostat	Thermostat differential set too close	Check and widen differential
		…high pressure switch	See item 2	See item 2
		…low pressure switch	See items 3 and 5	See items 3 and 5
			Leaking liquid line solenoid valve (LLSV)	Replace LLSV
			Leaking compressor valves	Replace compressor
			Undercharged system	Check for leaks and recharge
13	Internal pressure safety valve (IPRV) opens	Refrigerant trapped in compressor	Discharge service valve closed	Open discharge service valve
		Discharge pressure exceeds high pressure setting	High pressure switch malfunction	Reset or replace high pressure switch, see item 2
14	Will not start, trips on overload	Start relay damaged or burned out	Too low or too high line voltage	Correct and replace relay
			Incorrect wiring	Replace relay and rewire per compressor wiring diagram
			Excessive cycling	See item 11
15	Start capacitor damaged or burned out	Single phase compressor will not start	Incorrect relay	Check w/ manufacturer and replace
			Too high or too low line voltage	Correct and replace
			Excessive short cycling	See item 11
			Incorrect wiring	Replace and rewire per compressor manufacturer wiring diagram
			Wrong start or run capacitor	Correct and replace

CODE	DESCRIPTION	RESET	ACTION	DELAY
AL004	Unit – User inlet water temperature probe	Auto	Switch the unit off	10s
AL005	Unit – User outlet water temperature probe	Auto	Switch the unit off	10s
AL008	Unit – User pump 1 overload	Man	None	No
AL009	Unit – User pump 2 overload	Man	None	No
AL018	Unit – User 1 pump maintenance	Auto	None	Parameter A00
AL019	Unit – User 2 pump maintenance	Auto	None	Parameter A02
AL022	Unit – High chilled water temperature	Auto	None	Parameter A021/A022
AL100	Circuit 1 – Alarm discharge probe pressure	Auto	Stop circuit 1	10s
AL101	Circuit 1 – Alarm suction probe pressure	Auto	Stop circuit 1	10s
AL102	Circuit 1 – Alarm discharge probe temperature	Auto	Stop circuit 1	10s
AL103	Circuit 1 – Alarm suction probe temperature	Auto	Stop circuit 1	10s
AL105	Circuit 1 Envelope – High compression ratio	Auto	Stop circuit 1	Parameter Cb17
AL106	Circuit 1 Envelope – High discharge pressure	Man	Stop circuit 1	Parameter Cb17
AL108	Circuit 1 Envelope – High suction pressure	Auto	Stop circuit 1	Parameter Cb17
AL109	Circuit 1 Envelope – Low compression ratio	Auto	Stop circuit 1	Parameter Cb17
AL110	Circuit 1 Envelope – Low differential pressure	Auto	Stop circuit 1	Parameter Cb18
AL111	Circuit 1 Envelope – Low discharge pressure	Auto	Stop circuit 1	Parameter Cb17
AL112	Circuit 1 Envelope – Low suction pressure	Auto	Stop circuit 1	Parameter Cb17
AL113	Circuit 1 Envelope – High discharge temperature	Auto	Stop circuit 1	Parameter Cb17
AL123	Circuit 1 EVD – Offline	Auto	Stop circuit 1	No
AL165	Circuit 1 – Alarm freeze evaporation temperature	Man	Stop circuit 1	Parameter A041
AL166	Circuit 1 – Compressor 1 maintenance	Auto	None	Parameter Ca00
AL167	Circuit 1 – Compressor 2 maintenance	Auto	None	Parameter Ca02
AL173	Circuit 1 – High pressure alarm by pressure switch	Man	Stop circuit 1	No
AL174	Circuit 1 – Low pressure alarm by pressure switch	Auto w. Retry	Stop circuit 1	Parameter Ca19/Ca20
AL175	Circuit 1 – Overload compressor 1	Man	Stop compr.1 Circ.1	No
AL176	Circuit 1 – Overload compressor 2	Man	Stop compr.2 Circ.1	No
AL178	Circuit 1 – Pump-Down end for maximum time	Auto	Stop circuit 1	Parameter B035
AL200	Circuit 2 – Alarm discharge probe pressure	Auto	Stop circuit 2	10s
AL201	Circuit 2 – Alarm suction probe pressure	Auto	Stop circuit 2	10s
AL202	Circuit 2 – Alarm discharge probe temperature	Auto	Stop circuit 2	10s
AL203	Circuit 2 – Alarm suction probe temperature	Auto	Stop circuit 2	10s
AL205	Circuit 2 Envelope – High compression ratio	Auto	Stop circuit 2	Parameter Cb17
AL206	Circuit 2 Envelope – High discharge pressure	Man	Stop circuit 2	Parameter Cb17
AL208	Circuit 2 Envelope – High suction pressure	Auto	Stop circuit 2	Parameter Cb17
AL209	Circuit 2 Envelope – Low compression ratio	Auto	Stop circuit 2	Parameter Cb17
AL210	Circuit 2 Envelope – Low differential pressure	Auto	Stop circuit 2	Parameter Cb18
AL211	Circuit 2 Envelope – Low discharge pressure	Auto	Stop circuit 2	Parameter Cb17
AL212	Circuit 2 Envelope – Low suction pressure	Auto	Stop circuit 2	Parameter Cb17
AL213	Circuit 2 Envelope – High discharge temperature	Auto	Stop circuit 2	Parameter Cb17
AL223	Circuit 2 EVD – Offline	Auto	Stop circuit 2	No
AL265	Circuit 2 – Alarm freeze evaporation temperature	Man	Stop circuit 2	Parameter A041
AL266	Circuit 2 – Compressor 1 maintenance	Auto	None	Parameter Ca00
AL267	Circuit 2 – Compressor 2 maintenance	Auto	None	Parameter Ca02
AL273	Circuit 2 – High pressure alarm by pressure switch	Man	Stop circuit 2	No
AL274	Circuit 2 – Low pressure alarm by pressure switch	Auto w. Retry	Stop circuit 2	Parameter Ca19/Ca20
AL275	Circuit 2 – Overload compressor 1	Man	Stop compr.1 Circ.2	No
AL276	Circuit 2 – Overload compressor 2	Man	Stop compr.2 Circ.2	No
AL278	Circuit 2 – Pump-Down end for maximum time	Auto	Stop circuit 2	Parameter B035

VARIABLE FREQUENCY DRIVES

If any issues are encountered with factory-installed variable frequency drives, note the alarm description and call G&D Chillers technical support team.

To reset faults on a Siemens VFD:

1. From main screen, press the ESC button
2. Arrow to diagnostics and press OK
3. Arrow to ACKN ALL and press OK

To access the fault logger on a Siemens VFD:

1. From main screen, press the ESC button
2. Arrow to faults and press OK
    a. To return to the main screen press ESC
    b. Arrow to monitor and press OK

To reset faults on an ABB VFD:

1. From the main screen press the top left button indicating RESET

To access fault logger on an ABB VFD:

1. Press the menu button
2. Arrow to FAULT LOGGER
3. Press the top right button indicating ENTER

NOTICE: DEVICE FAULTS
Do not clear faults without documenting fault description and contacting G&D chillers technical support

COMPRESSOR TESTING

OIL LEVEL

To check compressor oil level, refer to the label near the compressor sight glass. The compressor(s) must be off. Wait three minutes. Compressor oil level should be within the range indicated on the sticker: close to half full. When adding oil, always use a fresh can of POE oil per the compressor data plate.

NOTICE: COMPRESSOR OIL
Never reuse oil or use oil from an unsealed container. For additional details refer to “REFRIGERANT SYSTEM OPEN TIME” (pg. 42)

OIL TESTING

Use an oil test kit purchased from a local refrigeration supply store. Note that the POE oil used in this product is very hygroscopic, meaning it easily absorbs and retains moisture. The acceptable moisture content is less than 100 ppm and acceptable acid level is less than 0.5 TAN. Note that refrigerant and moisture is very difficult to remove from this oil using a vacuum. Also note that once the seal on a container of POE oil is opened, the oil must be used. Any unused oil should be discarded.

Important: In the event of a compressor failure, always test the oil with an acid test kit and determine whether the compressor failure was mechanical or electrical. This is important because it dictates correct cleanup procedure.

COMPRESSOR MOTOR "MEGGING"

Motor "megging" determines the electrical integrity of the compressor motor winding insulation. Use a 500 volt megger. A reading of < 1 MΩ reading is acceptable and 1000 Ω per nameplate volts is required to safely start the compressor.

COMPRESSOR CURRENT IMBALANCE

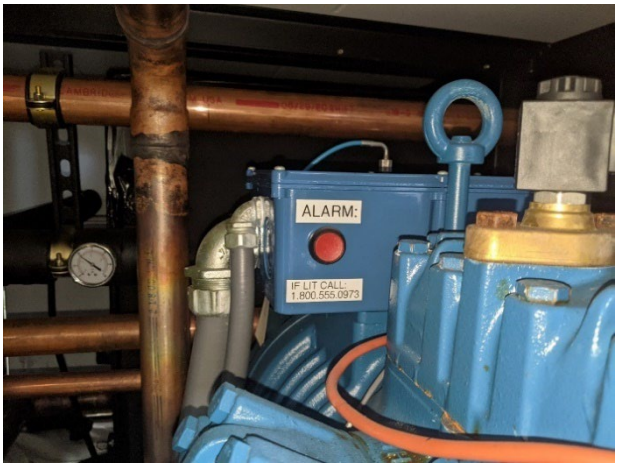
Normal current imbalance could be 4 to 15 percent with balanced voltage due to motor design. Each phase should register 0.3 to 1.0 ohms and each phase should be within 7 percent of the other two phases. Phase to ground should be open (showing infinite resistance on a multimeter).

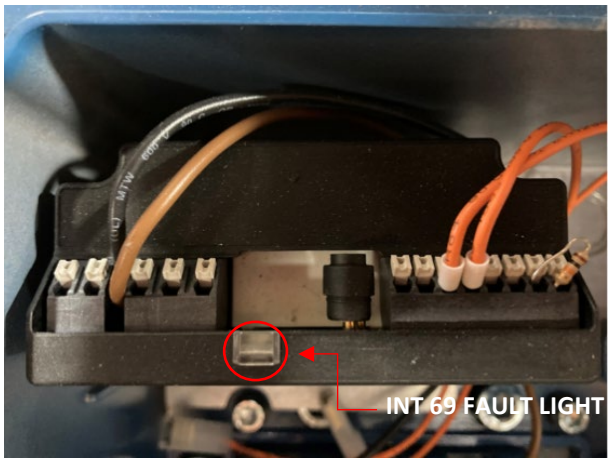
NOTICE: VOLTAGE IMBALANCE
Maximum allowable voltage imbalance is 5%.

INT69 TML COMPRESSOR PROTECTION MODULE (RECIPROCATING ONLY)

All Frascold compressors used in G&D products feature a red alarm button (depicted below). **If this button is lit up, do not press the alarm button.** Please call G&D Chillers technical support for assistance with INT69 TML flash code sequence diagnosis (located in box on top of compressor).

1st flashing sequence (red)	2nd flashing sequence (orange)	Description
1	1	Motor temperature: Static Switch-off, Permissible winding temperature exceeded
	2	Motor temperature: Dynamic switch-off, Temperature rise in the motor winding unusually fast
	3	Motor temperature: Reset delay after static switch-off
	4	Motor temperature: sensor input detected open circuit or short circuit
	5	Motor temperature: Reset delay after dynamic switch-off
3	5	General: Reset delay after "General" error
4	1	Oil: Differential pressure too low
	3	Oil: Reset delay after "Oil" error
	4	Oil: Sensor incorrectly connected
	5	Oil: Sensor input detected open circuit or short circuit
5	1	Permissible discharge gas temperature exceeded
	2	Reset delay after discharge gas error
	3	Discharge gas sensor input detected open circuit or short circuit





COMPRESSOR REPLACEMENT

If a compressor fails, consider the following information for the replacement process. Each compressor has lifting eyes. Use proper lifting techniques. Be familiar with the steps described in the “OIL TESTING” section (pg. 40) before attempting to replace a failed compressor.

MECHANICAL COMPRESSOR FAILURE

Replace the failed compressor(s) and change the refrigerant system liquid line filter drier.

ELECTRICAL COMPRESSOR FAILURE

Replace the failed compressor, add a suction filter with cleanup cores, and change the liquid line filter drier. Change filters and oil until the oil no longer tests acidic. See "OIL TESTING." Do not add a filter drier within 16 inches of the elbow of any compressor 25hp or larger.

NOTICE: PIPING CHANGES
Do not alter the refrigerant piping in any way as this can affect compressor lubrication.

REFRIGERANT SYSTEM OPEN TIME

The compressors in G&D Vertical Air Chillers use POE oil, and therefore system open time must be kept to a minimum. The following procedure is recommended:

Leave a new compressor sealed until it is ready to be installed in the unit. Maximum system open time is dependent upon ambient conditions, but do not exceed one hour of open time. Plug any open refrigerant lines to minimize moisture absorption.

If the filter drier needs replacement: remove pressure transducer and cap service ports prior to evacuating the system. Transducers will be damaged if placed in a vacuum. Evacuate the system to 500 microns or below.

NOTICE: PRESSURE TRANSDUCERS
Remove pressure transducer and cap service ports prior to evacuating system. Transducers will be damaged if placed in vacuum.

Do not leave POE oil containers open to the atmosphere. Always keep them sealed. Once the seal has been opened, the oil must be used. Any unused oil should be discarded. Never use oil from an unsealed container.

COMPRESSOR ELECTRICAL TERMINATION BOX

Be sure to protect the terminal box and all wiring when un-brazing or brazing compressor refrigerant piping connections.

REFRIGERANT PIPING

The compressor suction and discharge lines are copper. In most instances, piping may be reused. If piping is not reusable, order the correct service parts. Cut all tubing with a tubing cutter to prevent copper filings from entering the system. Cut the tubing in a straight length of pipe after the compressor connection has been un-sweated. The line can then be reinstalled using a slip coupling and brazing.

NOTICE: COMPRESSOR SUCTION LINE
The compressor suction line configuration must not be changed in any way. Changing compressor suction line configuration will compromise proper oil return to the compressor(s).

****TO ACTIVATE WARRANTY, FILL OUT STARTUP CHECKLIST (pg. 23) AND RETURN WITHIN 30 DAYS****

WARRANTY STATEMENT

TWO-YEAR LIMITED WARRANTY ON PARTS, ONE-YEAR LIMITED WARRANTY ON LABOR

G&D CHILLERS, INC. provides a limited warranty to the original purchaser of new products against defects in materials and workmanship for a period of one (1) year of normal commercial usage. For the subsequent period of one (1) year of normal commercial usage immediately following the first, this warranty is extended to cover parts only. This warranty is not transferable. If a product covered by this warranty is determined to be defective within the applicable warranty periods, G&D CHILLERS, INC. will, unless otherwise required by applicable law, either repair or exchange the product at its sole option and discretion.

EXCHANGE

Should G&D CHILLERS, INC. elect to exchange a product due to a covered defect during the warranty period, the replacement unit may, at G&D CHILLERS, INC.'s sole option and discretion, be new or one which has been recertified, reconditioned, refurbished or otherwise remanufactured from new or used parts and is functionally equivalent to the original product.

REPAIR: PARTS AND LABOR

There will be no charge for parts or labor to repair a product for a covered defect during the applicable warranty periods. Replacement parts may, at G&D CHILLERS, INC.'s sole option and discretion, be new, used, reconditioned, refurbished or otherwise remanufactured or recertified as functionally equivalent replacement parts.

REMAINING WARRANTY

Repaired or exchanged products are warranted for the remaining portion of the product's original warranty or for ninety (90) days from warranty service or exchange, whichever is longer. Any upgrade to the original product will be covered only for the duration of the original warranty period.

EXCLUSIONS

This warranty does not cover, for example: abuse, accident, acts of God, consumable parts such as batteries, cosmetic damage (e.g. scratches, dents, cracks), damage caused by use with non-G&D CHILLERS, INC. products (e.g. accessories, housing, parts, etc.), damages from shipping, improper installation or operation, improper voltage supply or power surges, lack of reasonable use, misuse, modifications or alterations, normal wear and tear or aging, as well as installation and set-up issues or any tampering or repairs attempted by anyone other than by a G&D CHILLERS, INC. authorized repair technician. This limited warranty does not cover products sold "AS IS", "FACTORY RECERTIFIED", or by a non-authorized reseller.

ASSIGNMENT OF WARRANTIES

G&D CHILLERS, INC. assigns to product purchasers any and all warranties of manufacturers and suppliers of component parts that are assignable, but G&D CHILLERS, INC. makes no representations as to the effectiveness or extent of such warranties and assumes no liability or responsibility for any third-party manufacturer or supplier's products or component parts that are sold by G&D CHILLERS, INC.

DISCLAIMER OF WARRANTY

THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE LISTED OR DESCRIBED ABOVE. EXCEPT AS SPECIFIED IN THIS WARRANTY SECTION, ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING FROM A COURSE OF DEALING, LAW, USAGE, OR TRADE PRACTICE, ARE HEREBY EXCLUDED TO THE EXTENT ALLOWED BY APPLICABLE LAW AND ARE EXPRESSLY DISCLAIMED BY G&D CHILLERS, INC.

TO THE EXTENT THAT ANY OF THE SAME CANNOT BE EXCLUDED, SUCH IMPLIED CONDITION, REPRESENTATION AND/OR WARRANTY IS LIMITED IN DURATION TO THE EXPRESS WARRANTY PERIOD REFERRED TO IN THE "LIMITED WARRANTY" SECTION ABOVE. BECAUSE SOME STATES OR JURISDICTIONS DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, THE ABOVE LIMITATION MAY NOT APPLY IN SUCH STATES. THIS WARRANTY GIVES THE CUSTOMER SPECIFIC LEGAL RIGHTS, AND THE CUSTOMER MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION.

DISCLAIMER OF LIABILITY

G&D CHILLERS, INC.'S TOTAL LIABILITY FOR ANY AND ALL LOSSES AND DAMAGES RESULTING FROM ANY CAUSE WHATSOEVER INCLUDING G&D CHILLERS, INC.'S NEGLIGENCE, ALLEGED DAMAGE, OR DEFECTIVE GOODS, WHETHER SUCH DEFECTS ARE DISCOVERABLE OR LATENT, SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OF THE PRODUCT. G&D CHILLERS, INC. SHALL NOT BE RESPONSIBLE FOR LOSS OF USE, WORK STOPPAGE, FAILURE OF OTHER EQUIPMENT TO WHICH THE PRODUCT IS CONNECTED, COMMERCIAL LOSS, LOST REVENUE OR LOST PROFITS, LOSS OF GOODWILL, LOSS OF REPUTATION, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES. NO ORAL OR WRITTEN REPRESENTATIONS MADE BY G&D CHILLERS, INC. SHALL CREATE ANY ADDITIONAL WARRANTY OBLIGATIONS, INCREASE THE SCOPE, OR OTHERWISE MODIFY IN ANY MANNER THE TERMS OF THIS LIMITED WARRANTY. TO THE EXTENT PERMITTED BY APPLICABLE LAW, G&D CHILLERS, INC. DOES NOT WARRANT THAT THE OPERATION OF ANY PRODUCTS COVERED UNDER THIS LIMITED WARRANTY WILL MEET YOUR REQUIREMENTS, OR THIRD-PARTY SERVICES, BE UNINTERRUPTED, ERROR-FREE, OR THAT DEFECTS IN THE PRODUCTS WILL BE CORRECTED. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE. THIS LIMITED WARRANTY IS SUBJECT TO CHANGE WITHOUT NOTICE. CHECK www.gdchillers.com FOR THE MOST CURRENT VERSION OF THIS WARRANTY.

SEVERABILITY

In the event that any term or provision contained in this limited warranty is found to be invalid, illegal or unenforceable by a court of competent jurisdiction, then such provision shall be deemed modified to the extent necessary to make such provision enforceable by such court, taking into account the intent of the parties. The invalidity in whole or in part of any portion of this limited warranty shall not impair or affect the validity or enforceability of the remaining provisions of this limited warranty.

HOW TO OBTAIN WARRANTY SERVICE (PRE-AUTHORIZATION REQUIRED)

To obtain warranty service, contact G&D CHILLERS, INC.:

1. Email: info@gdchillers.com
2. Phone: (800) 555-0973 from 8:00AM to 5:00PM Monday through Friday Pacific Time.
3. By mail: G&D Chillers, Inc.
   130 E. 1st Ave
   Junction City, OR 97448

G&D Chillers welcomes any and all questions or concerns
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