CHILLER INSTALLATION GUIDE & USER MANUAL

- LSX ULTRA-LOW TEMP CHILLERS -

LSX ULTRA-LOW TEMP CHILLER MANUAL

CONTENTS

1. INTRODUCTION

CONTACT INFORMATION & AFTERHOURS 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

AFTERHOURS TECHNICAL SUPPORT

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 installation video walk-throughs and FAQs:

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 condenser coil. Direct drive propeller type fans with DDP motors and built-in overload protection. Design test pressure 150 PSIG low side, 300 PSIG high side.

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

Hermetically-sealed Frascold two-stage reciprocating compressor with oil level sight glass, Rotalock service valves, and crankcase heater.

PUMPS

End suction centrifugal pump with trimmed impeller optimized for low temperature coolants. 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 closed cell foam. Coolant level indicator.

SUPPLY & RETURN PIPING

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

DYNAMIC FLUID BYPASS VALVE

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

REFRIGERANT & PIPING

Type L ACR copper. Liquid line filter drier, sight glass/moisture indicator, solenoid valve 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 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 low temperature chillers chill Dynalene HC-50 utilizing reciprocating compressors, air-cooled/water-cooled condensers, and brazed plate heat exchangers. They are designed for outdoor installation. This chiller utilizes independent condenser circuits, with one compressor per circuit. Each refrigeration circuit includes on-board controls, pumps, reservoir, evaporators, condensers, and necessary controls and safeties.

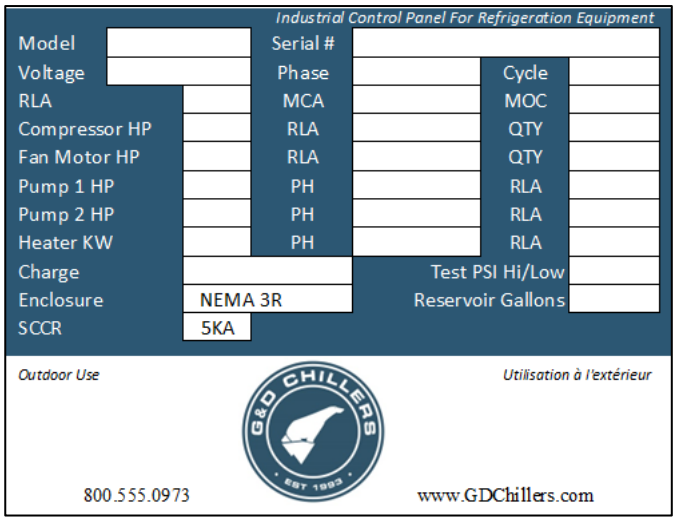
Each low temperature unit is a completely assembled package that is factory-piped, wired, leak-tested, dehydrated, charged and tested for proper control operations prior to shipment. The chilled fluid inlet and outlet openings are covered for shipment.

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

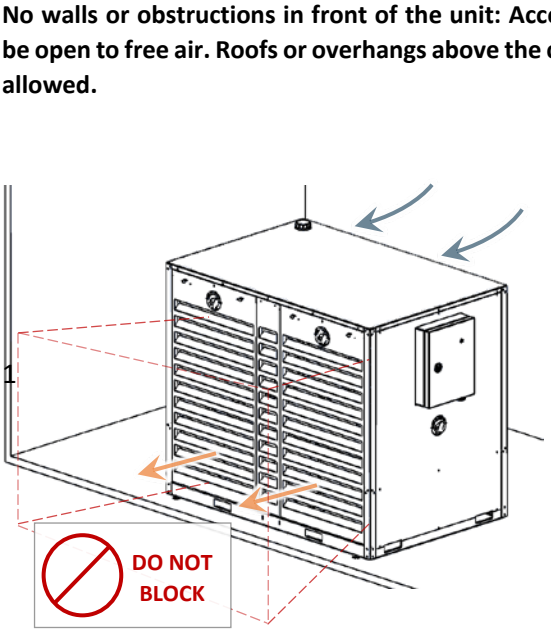
Air-cooled units must sit outside and be anchored to a solid level surface. A concrete pad is recommended. Location should be free of grass and other debris that could plug condenser fins.

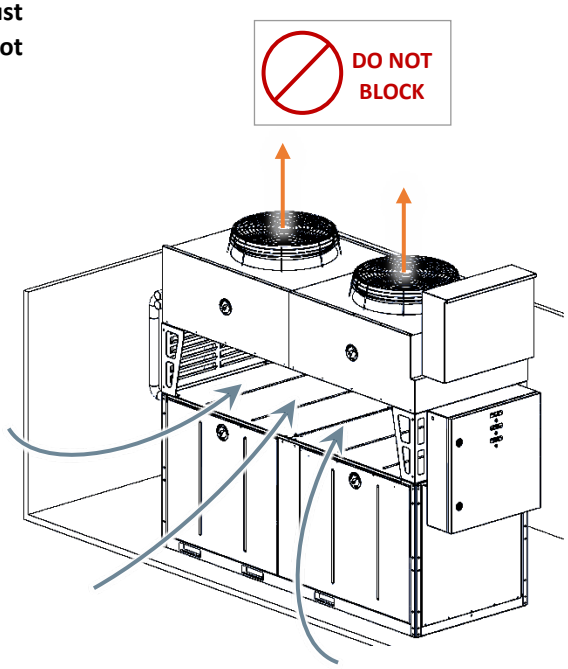
Liquid-cooled chillers may be installed on a concrete pad outdoors. A properly sized pump and liquid cooling system for the chiller condenser must be supplied by the end user. Contact G&D Chillers for additional information and assistance with sizing.

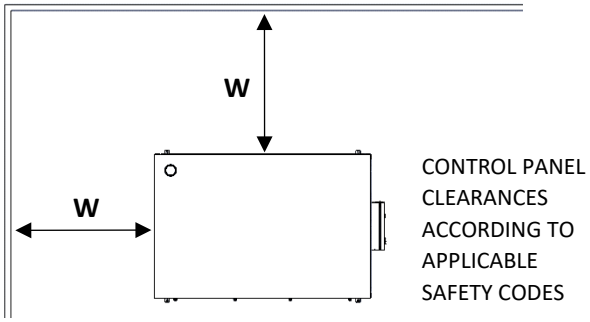
Ensure minimum clearance requirements* between condenser intake side and any buildings, walls, control panel, etc.

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.

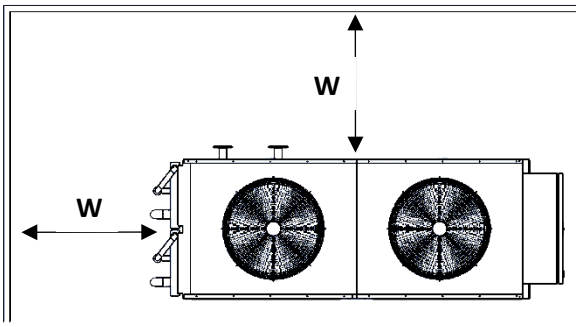
*MINIMUM CLEARANCE REQUIREMENTS (W)	
W = 48"	GD-14H-2LC, 20H-2LC, 30H-1LC, 40H-2LC, 60H-2LC
W = 45.25”	GD-7H-1LC-HA, 10H-1LC-HA





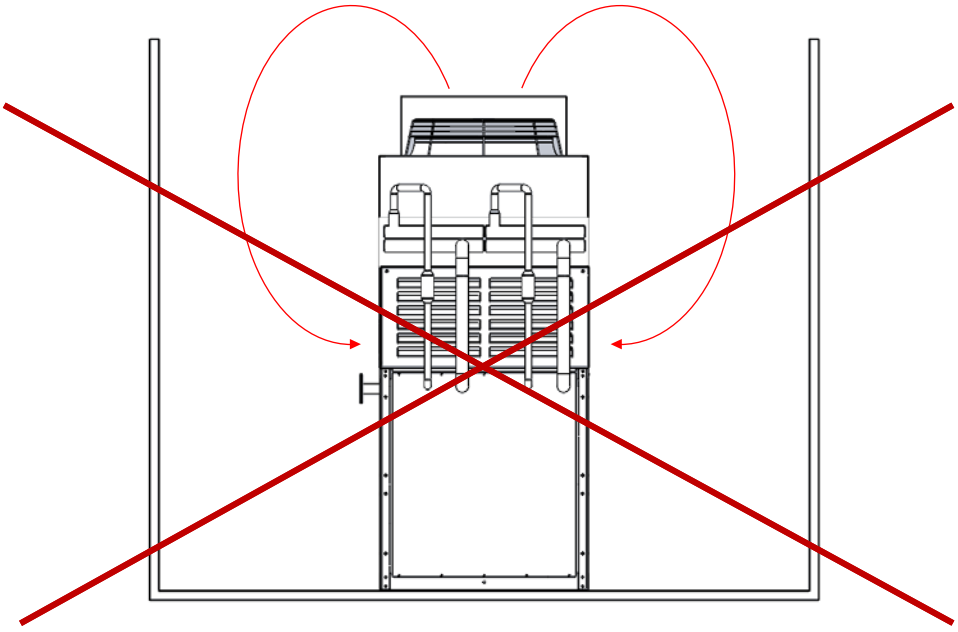


CONTROL PANEL CLEARANCES ACCORDING TO APPLICABLE SAFETY CODES



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. With the exception of the heat transfer fluid, all items must be provided by others:

Heat Transfer Fluid. Also known as "coolant," Dynalene HC-50 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 coolant 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 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

G&D Low Temperature Chillers are designed to operate using Dynalene HC-50. Only use Dynalene HC-50 as the heat transfer fluid in this chiller.

Extreme care must be taken to remove any residual flush water from the facility piping before introducing Dynalene HC-50 to the system. If you suspect it has become diluted for any reason, contact Dynalene directly for assistance: 1-877-244-5525.

CAUTION: EQUIPMENT DAMAGE!

Failure to use pure, undiluted Dynalene HC-50 in this chiller may result in catastrophic damage not covered by G&D Chillers' 2 Year parts & 1 Year Labor Warranty.

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 coolant. 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

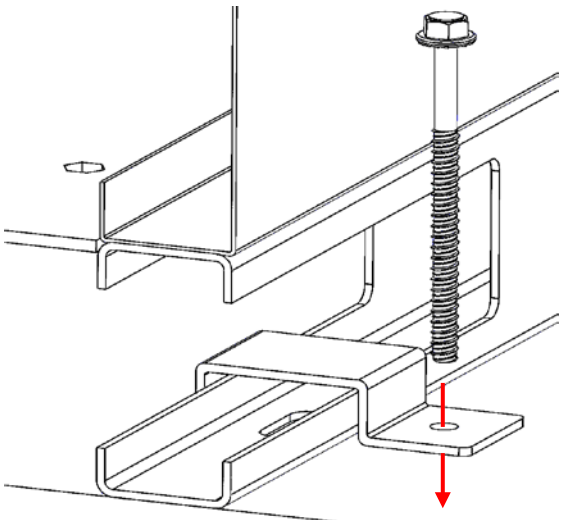
Provide enough space around the unit to allow installation and maintenance personnel unrestricted access to all service points. Observe all applicable local and national codes. Refer to submittal drawings for the unit dimensions in order to provide sufficient clearance for the opening of control panel 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. **G&D Low Temperature chillers are designed for use with Dynalene HC-50 only.** This heat transfer fluid is a pre-mixed substance. For adequate freeze protection it must not be diluted.

During the system fill process, take care to remove all residual flush water from the piping before introducing the pure Dynalene HC-50 to the system. Refer to the "START-UP PROCEDURE: G&D LOW TEMPERATURE CHILLERS" section (pg. 18) of this manual for details. If dilution is suspected, contact Dynalene directly for assistance. **Do not operate a G&D Low Temperature chiller with diluted HC-50.**

CAUTION: COOLANT!
Pure Dynalene HC-50 must be used as coolant in G&D low temperature chillers to avoid catastrophic damage.

PROCESS PIPING RECOMMENDATIONS

Thoroughly drain all facility piping intended for use with the chiller before making the final piping connections to the chiller's process and return lines.

Coolant connections should be flanged. G&D recommends using insulated stainless steel for supply and return piping. Copper piping is also acceptable.

CAUTION: PVC PIPING!
Do not use PVC piping for process and return lines as they are not rated for G&D Low Temperature chillers' coolant operating temperatures.

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)
- Coolant pressure gauges with shutoff valves
- Vibration eliminators
- Shutoff (isolation) valves
- Thermometers (if desired)
- Coolant 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.**

COOLANT PRESSURE GAUGES

Install necessary pressure gauges to monitor the entering and leaving Dynalene HC-50 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.

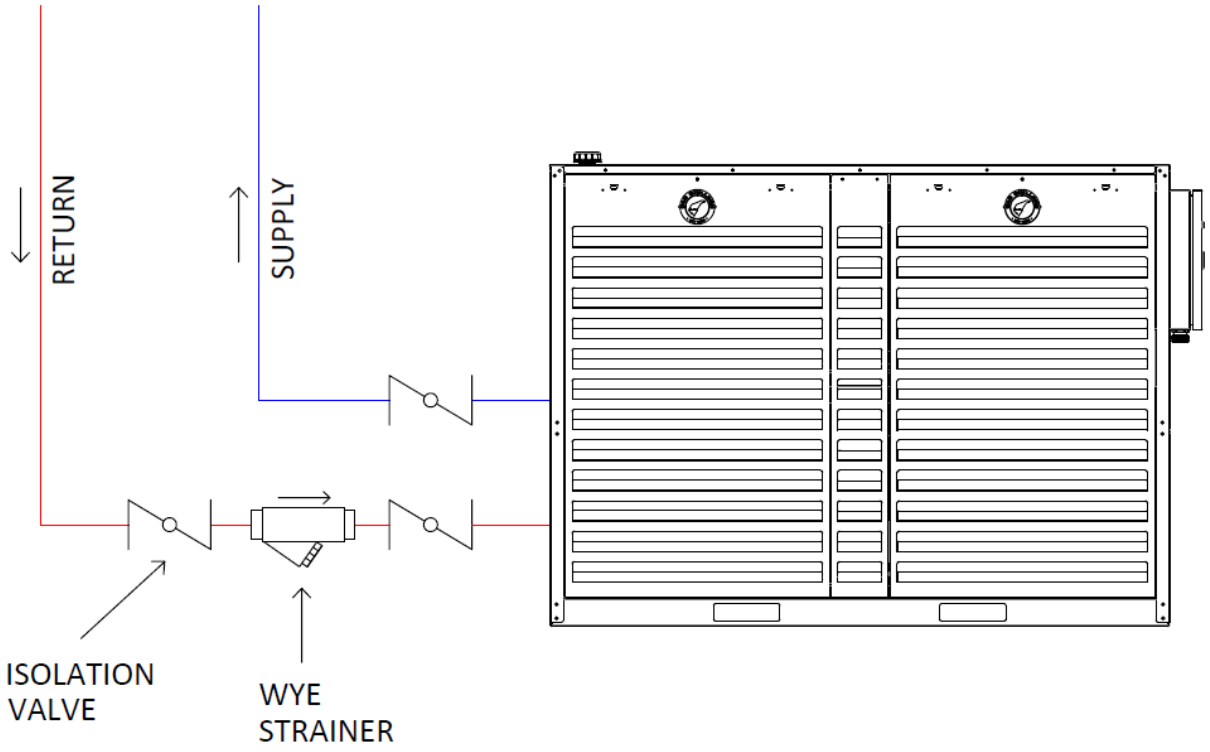
COOLANT STRAINER

G&D recommends installing a 20-mesh wye strainer (ideally 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 coolant 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 coolant strainer.

GENERAL PIPING EXAMPLE

Below is a simplified example of low temperature chiller plumbing. For clarity, not all components discussed in the previous section are shown:



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 (or electrical) 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.

4. COMMISSIONING

PRE-START CONSIDERATIONS

Refer to the “PRE-STARTUP CHECKLIST” and “START-UP PROCEDURE” sections (pg 18,19) for the most current chiller start-up procedures. Additionally, review the following pre-start considerations before putting the unit into service.

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.

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.

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!
Do not interchange any load leads 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. If phasing needs to be corrected, only change the power wiring at the chiller’s main distribution blocks. Never modify internal chiller wiring.

PRE-STARTUP CHECKLIST: G&D LOW TEMPERATURE CHILLERS

WARNING: HAZARDOUS VOLTAGE!
Compressor breaker(s) must be OFF for entire pre-startup process.

☐ **Chiller positioning**: clearance on all 4 sides of chiller must be equal to one full unit width. Electrical code may dictate greater clearance. No obstructions or roofs above chiller. Refer to "CHILLER PLACEMENT" section of this manual for more details.

☐ Your chiller comes with 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.**

☐ Electrical connections should terminate at distribution blocks in chiller electrical enclosure:
- o **Chiller Start/Stop door switch must be in the OFF position before connecting live power**
- o Licensed electrician to ensure all wiring, breakers, and service disconnect are installed per code
- o Check phase monitor for rotation (CCW arrow indicates backwards rotation)
- o If needed, swap L1 and L3 to change rotation. **Do not modify factory panel wiring to phase monitor, correct phase reversal at distribution blocks only**
- o Note: if service has high leg delta, the high leg must connect to the L2 distribution block

☐ Install 20 mesh Wye-strainer with purge valve line at chiller.

☐ **Ensure all pump isolation valves are open.** Flush all piping lines:
- o **Compressor breaker(s) inside the control panel must be in the OFF position**
- o Turn Control Power door switch ON and Chiller Start/Stop door switch ON
- o If needed, move the pump breaker to the ON position. Verify correct pump rotation
- o Proceed with flushing the system using distilled or deionized water. Do not use chlorinated tap water
- o Once all debris have been flushed out of the piping, the water must be fully drained from the system
- o **Purge using warm compressed air or nitrogen until all traces of water have been removed**

☐ **Fill reservoir/loop with Dynalene HC-50. Keep track of the amount of Dynalene HC-50 being added to the system**. Temporarily close the supply valve. Confirm Dynalene pressure shows 30 PSI using both the Carel controller and the manual pressure gauge located on the process pump discharge line. Pump discharge can be adjusted as needed using the manual bypass valve.

☐ Open the supply valve, and circulate HC-50 through the facility piping system for at least 30 minutes. **Only use pure, undiluted Dynalene HC-50 as the heat transfer fluid**. The facility piping should be completely dry and free of residual flush water before the HC-50 is circulated through it. More HC-50 may need to be added to keep the reservoir topped up.
Record final volume of HC-50 contained in system: _____

☐ **Send in a representative sample for quality testing** to ensure the Dynalene HC-50 was not diluted during this process. Follow the instructions in the testing kit provided with the chiller, and send a sample to the Dynalene testing laboratory.

☐ Turn all door switches to the OFF position.

☐ Leave main disconnect to the chiller ON in preparation for the start-up procedure.

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

START-UP PROCEDURE: G&D LOW TEMPERATURE CHILLERS

1. **COMPLETE PRE-STARTUP CHECKLIST BEFORE PROCEEDING. Confirm all following items have been completed successfully:**

- ☐ Chiller has adequate clearance on all sides
- ☐ Ethernet cable installed for remote monitoring
- ☐ Electrical service installed by licensed electrician
- ☐ Wye strainer on return line
- ☐ All piping flushed and any traces of water removed
- ☐ Reservoir filled with Dynalene HC-50
- ☐ Volume of HC-50 added to system recorded
- ☐ Pump discharge pressure set at 30 PSI
- ☐ HC-50 circulated through facility piping
- ☐ Sample of HC-50 sent to Dynalene testing laboratory
- ☐ All door switches in OFF position
- ☐ Main power disconnect left in the ON position

WARNING: DYNALENE HC-50 MIXTURE MUST BE CORRECT FOR SUCCESSFUL CHILLER START-UP

2. **The HC-50 sample test results must be received before proceeding**.
   - ✓ If the HC-50 sample tests within specification, proceed to Step 3.
   - ✗ If there are issues with the HC-50 mixture, perform the corrective actions recommended by the Dynalene laboratory, then complete the following steps. Refer to the *Pre-Startup Checklist* for more details:
     - ☐ Circulate the corrected HC-50 mixture throughout the facility piping for at least 30 minutes
     - ☐ Send another sample to the Dynalene testing laboratory for analysis

3. Using the propylene glycol scale on a refractometer, measure freezing point of the Dynalene HC-50 solution contained in the chiller reservoir.
   Record the refractometer reading: _____
   Contact G&D Chillers Technical Support to verify the refractometer reading before proceeding.

4. Verify all door switches are in the OFF position, and that the **chiller has been supplied with power for at least 4 hours**. This allows the crankcase heaters to boil off any refrigerant that may have accumulated in the compressors. Allowing the chiller to sit with power overnight is recommended.

WARNING: PROPER START-UP IS CRITICAL! Any damage due to improper start-up will not be covered under warranty. To ensure complete warranty coverage, be prepared to send G&D Chillers Tech Support copies of the completed Pre-Startup Checklist, the Dynalene HC-50 sample test results, the refractometer reading from Step 3 above, and the WARRANTY START-UP CHECKLIST below.

THE FOLLOWING STEPS MUST ONLY BE PERFORMED BY A QUALIFIED REFRIGERATION TECHNICIAN

5. Verify there is a visible oil level in compressor sight glass(es). **Do not proceed until the oil level is confirmed.**

6. **Open all service valves/refrigerant ball valves in chiller marked with tags**: Suction/discharge of each compressor and refrigerant ball valves at receivers. Models with remote condensers will have additional valves. Contact us for more details as needed: 800-555-0973.

7. **Ensure pump isolation valves are open**. Turn chiller Start/Stop door switch to the RUN position. Compressors should start to run. Fans to follow shortly.

8. Adjust setpoints with the Carel controller. Press the Up/Down arrows until SET displays in bottom right corner. Press enter and change the temperature to desired setpoint.

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. 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 improper unit operation.

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)				
GLYCOL/DYNALENE MIXTURE %				
GLYCOL/DYNALENE LEVEL (Reservoir % Full)				
PHASE/VOLTAGE				
VOLTAGE TO GROUND (Note: High Leg to L2)	L1:	L2:	L3:	
PUMP ROTATION				
HC-50 PRESSURE (PSI)				
	COMPRESSOR A	COMPRESSOR B	COMPRESSOR C	COMPRESSOR D
CRANK CASE HEATER ENERGIZED 4 HOURS				
COMPRESSOR OIL LEVEL				
MOTOR AMPS:	L1:	L1:	L1:	L1:
	L2:	L2:	L2:	L2:
	L3:	L3:	L3:	L3:
SUPERHEAT (°F) @ 30°F FLUID TEMP				
SUBCOOLING (°F) @ 30°F FLUID TEMP				
SUCTION PRESSURE @ 30°F FLUID TEMP				
DISCHARGE PRESSURE @ 30°F FLUID TEMP				
	PUMP #1	PUMP #2	PUMP #3	PUMP #4
MOTOR AMPS:	L1:	L1:	L1:	L1:
	L2:	L2:	L2:	L2:
	L3:	L3:	L3:	L3:
	FAN MOTOR #1	FAN MOTOR #2	FAN MOTOR #3	FAN MOTOR #4
MOTOR AMPS:	L1:	L1:	L1:	L1:
	L2:	L2:	L2:	L2:
	L3:	L3:	L3:	L3:
	FAN MOTOR #5	FAN MOTOR #6	FAN MOTOR #7	FAN MOTOR #8
MOTOR AMPS:	L1:	L1:	L1:	L1:
	L2:	L2:	L2:	L2:
	L3:	L3:	L3:	L3:
AMB @ START-UP (°F)				

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.

Low Temperature 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://gdchillers.com/products/remote-monitoring-communications/

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 low temperature chiller unit is an air-cooled liquid chiller utilizing a reciprocating type two stage compressor. This unit is 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 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. As with the chiller, the process pump will only start if the Control Power switch and the Chiller Stop/Start 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

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.

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

SEQUENCE OF OPERATION

1. Chiller supply and return ball valves should always be open during normal operation.
2. Fluid bypass valve is factory set at 30 PSI to allow minimum flow across heat exchanger when process is not calling for cooling.
3. Chiller pump circulates at all times when chiller control power switch is in the “ON” position.
4. Compressor control circuit is energized with chiller switch in the “START” position.
5. If pump fails or flow fails, compressor control circuit will de-energize.
6. Programmable logic controller (PLC) energizes electronic expansion valve (EEV) based on leaving fluid temperature.
7. Once refrigerant suction pressure builds up, the controller will energize the compressor starter while monitoring system pressures and flow.
8. If all parameters remain in a safe range, the compressor will continue to run until the thermostat detects that it is no longer needed. The EEV will then close and the compressor will pump down and stop.
9. Turning chiller switch to “STOP” will interrupt cycle, force compressor pump down, and de-energize compressor and chiller pump.
10. PLC and crankcase heater remain energized with all switches are off. Power to the chiller main terminal blocks should remain on at all times to keep crankcase heater energized during extended off cycles.

REFRIGERATION CYCLE

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 pistons and discharged. Oil from the compressor sump lubricates the bearings and seals the small clearances between the piston rings and cylinder walls. 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.

TWO-STAGE COMPRESSORS WITH INTERSTAGE SUBCOOLERS

The refrigeration cycle of the low temperature chiller is conceptually similar to other G&D air-cooled chiller products. The chiller uses brazed plate evaporators and an air-cooled condenser. The compressors use suction gas cooled motors and an oil management system to provide almost oil-free refrigerant to the condenser and evaporator for maximum heat transfer while lubricating and sealing compressor bearings. The lubrication system helps to assure long compressor life and contributes to quieter operation. G&D Low Temperature chillers use two-stage reciprocating compressors with interstage subcoolers, designed for refrigerant suction temperatures below -50°F.

Refrigerant condenses in the air-cooled condenser. Liquid refrigerant is metered into the brazed plate evaporators using an electronic expansion valve (EEV) to maximize chiller efficiency at full and part load operation. G&D Low Temperature chillers also utilize interstage subcooling to maximize the achievable refrigeration effect in the low temperature evaporator:

Each two-stage refrigeration circuit contains a brazed plate subcooler. The majority of the condensed refrigerant flows from the condenser through the liquid-only side of the subcooler, but a portion is also diverted through the expansion valve on the other side of the subcooler instead. This condensed refrigerant expands to the interstage pressure in the compressor, and this interstage expansion process subcools the refrigerant that flows through the liquid-only side of the subcooler. The main stream of liquid refrigerant (now subcooled) continues on to the EEV to be metered into the low temperature evaporator. The portion of refrigerant diverted through the expansion valve

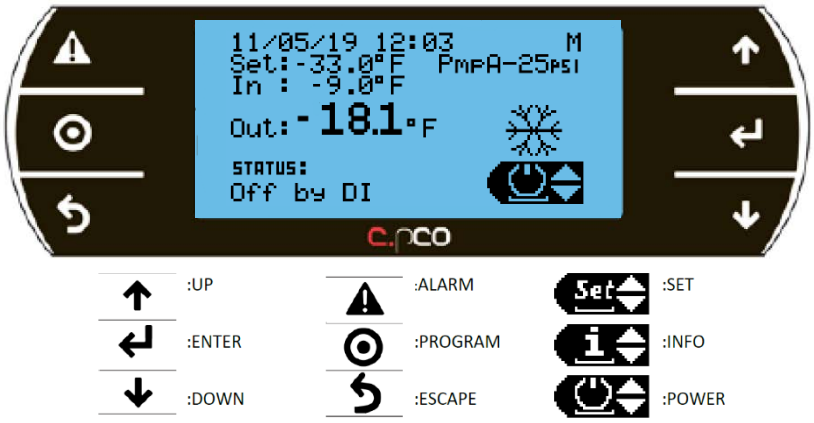
at the subcooler is pulled into the interstage manifold in the two-stage compressor. It recombines with the main refrigerant stream, which is then compressed and discharged to the condenser.

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. **Coolant 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 coolant 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.

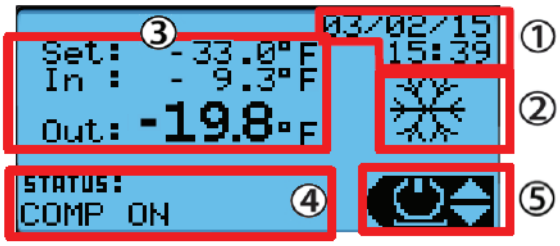
INFO SCREENS:

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:

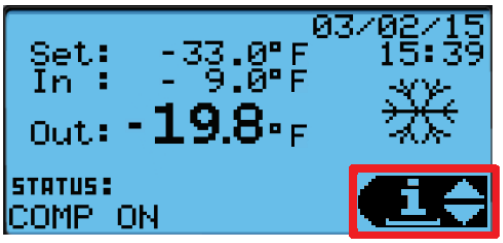
1. Date and time
2. Current unit status

	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.

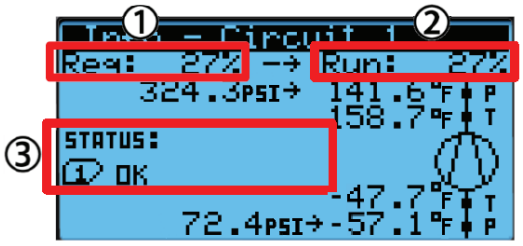


SYNOPTICS

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.

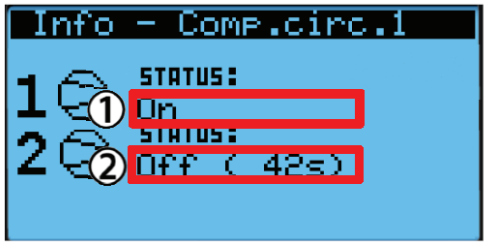
The individual screens of the synoptics are shown below:

CIRCUIT SYNOPTIC



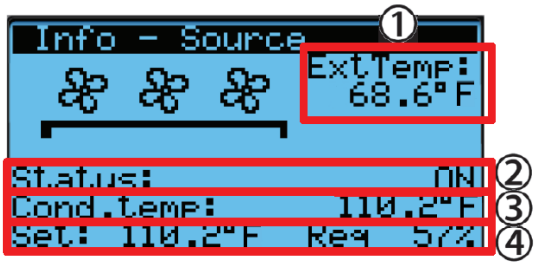
1. Call for cooling
2. Response from chiller/compressors
3. Envelope zone
   a. **1 OK** – zone within operating limits
   b. **2 HiDP** – high compression ratio
   c. **3 HiDscgP** – high condensing pressure
   d. **4 HiCurr** – high motor current
   e. **5 HiSuctP** – high suction pressure
   f. **6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

COMPRESSOR SYNOPTIC



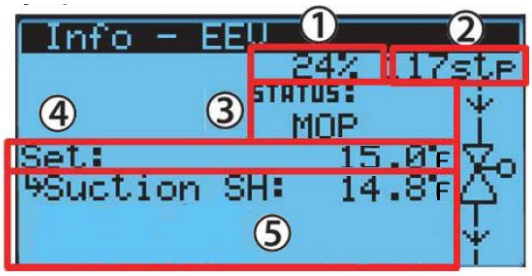
1. Status of compressor 1
2. Status of compressor 2
   a. **Off (…s)** – off, indicating, if necessary, remaining time before restarting
   b. **On (…s)** – on, indicating, if necessary, remaining time before switching off
   c. **Man On** – on manually
   d. **Man Off** – off manually
   e. **Frcd Off** – 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)

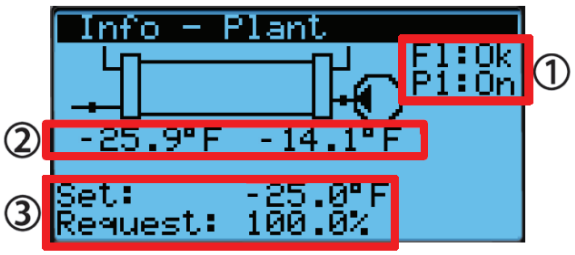
EXV SYNOPTIC



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 maximu1m 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. Low temperature chillers must use a specialized heat transfer fluid called Dynalene HC-50, which we will refer to below as “coolant.”

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. 33) 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 separate G&D Chillers Preventive Maintenance Checklist 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 coolant level and condition monthly. If Dynalene HC-50 discolors, develops an odor, or you suspect water has gotten into the system, check fluid with the refractometer. Contact G&D Technical Support to verify the reading. A sample may need to be sent to a Dynalene laboratory for testing
- Check compressor oil in sight glass at bottom of compressor monthly. Inspect for any oil leaks
- Verify pump function quarterly. Confirm coolant 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!
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 coolant ports.

Note: 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 and both are on the same side. Avoid cross-circuiting when installing the new 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.

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.

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.

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 32 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
Coolant temperature	X				NO
Coolant pressure	X				NO
Coolant level		X			NO
Reservoir vent unobstructed		X			NO
Check wye strainer		X			NO
Fan function		X			NO
Fan amps		X			NO
Pump function		X			NO
Pump amps		X			NO
Pump rotation		X			NO
Grease motors		X			NO
Condenser integrity		X			NO
Condenser cleanliness		X			NO
Coolant 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: 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	Dirty condenser	Clean. 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]

	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

CAREL ALARMS

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

AL209	Circuit 2 Envelope – Low compression ratio	A	Stop circuit 2	Parameter Cb17
AL210	Circuit 2 Envelope – Low differential pressure	A	Stop circuit 2	Parameter Cb18
AL211	Circuit 2 Envelope – Low discharge pressure	A	Stop circuit 2	Parameter Cb17
AL212	Circuit 2 Envelope – Low suction pressure	A	Stop circuit 2	Parameter Cb17
AL213	Circuit 2 Envelope – High discharge temperature	A	Stop circuit 2	Parameter Cb17
AL223	Circuit 2 EVD – Offline	A	Stop circuit 2	No
AL265	Circuit 2 – Alarm freeze evaporation temperature	M	Stop circuit 2	Parameter A041
AL266	Circuit 2 – Compressor 1 maintenance	A	None	Parameter Ca00
AL267	Circuit 2 – Compressor 2 maintenance	A	None	Parameter Ca02
AL273	Circuit 2 – High pressure alarm by pressure switch	M	Stop circuit 2	No
AL274	Circuit 2 – Low pressure alarm by pressure switch	R	Stop circuit 2	Parameter Ca19/Ca20
AL275	Circuit 2 – Overload compressor 1	M	Stop compr.1 Circ.2	No
AL276	Circuit 2 – Overload compressor 2	M	Stop compr.2 Circ.2	No
AL278	Circuit 2 – Pump-Down end for maximum time	A	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 32 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" in the "COMPRESSOR REPLACEMENT" section below.

OIL TESTING

Use the oil test kit provided or recommended by the testing laboratory. Note that the POE 32 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 vacuum. Also note that once the seal on a container of POE 32 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

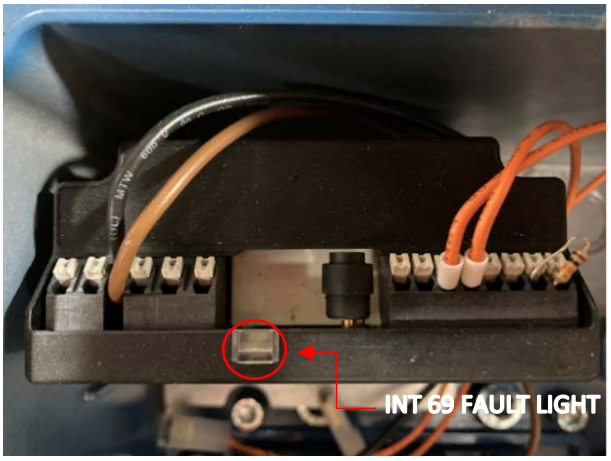
Normal current imbalance could be 4 to 15 percent with balanced voltage due to motor design. Each phase should register 0.3 to 1.0 ohms and each phase should be within 7 percent of the other two phases. Phase to ground should be open (showing infinite resistance on a multimeter).

NOTICE: VOLTAGE IMBALANCE
Maximum allowable voltage imbalance is 2%.

INT69 TML COMPRESSOR PROTECTION MODULE

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. 38) 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, change the liquid line filter drier. Change filters and oil until the oil no longer tests acidic. See "OIL TESTING."

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

Note: Do not add a filter drier within 16 inches of the elbow of any compressor 25hp or larger.

REFRIGERANT SYSTEM OPEN TIME

G&D Low Temp Chillers use POE 32 oil. This oil is highly hygroscopic and therefore refrigerant 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 open time under any conditions.

Plug the open refrigerant lines to minimize moisture absorption.

Always change the liquid line filter drier. 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 32 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 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
We can be reached at 800-555-0973 or 541-345-3903