	WATER-COOLED SCREW LIQUID CHILLERS	
INSTALLATION, OPERATION, MAINTENANCE	New Release	Form QWC4-NM1 (221)

035-28391-000

**MODEL QWC4
SINGLE COMPRESSOR
60 HZ
120 TONS TO 200 TONS**



R-134a



Issue Date:
February 28, 2021



IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in

which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized rigging, installation, and operating/service personnel. It is expected that these individuals possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood the on-product labels, this document and any referenced materials. This individual shall also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to specific situations:



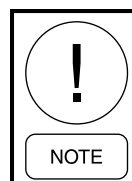
Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.



Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions are not followed.



Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.



Highlights additional information useful to the technician in completing the work being performed properly.



External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Quantech's published specifications and must be performed only by a qualified electrician. Quantech will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

CHANGEABILITY OF THIS DOCUMENT

In complying with Quantech's policy for continuous product improvement, the information contained in this document is subject to change without notice. Quantech makes no commitment to update or provide current information automatically to the manual or product owner. Updated manuals, if applicable, can be obtained by contacting the nearest Quantech Service office or accessing the Johnson Controls Knowledge Exchange website at <https://docs.johnsoncontrols.com/chillers/>.

It is the responsibility of rigging, lifting, and operating/service personnel to verify the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, rigging, lifting, and operating/service personnel should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the chiller.

ASSOCIATED LITERATURE

MANUAL DESCRIPTION	FORM NUMBER
QWC4 Chiller Installation Checklist	QWC4-CL1
QWC4 Chiller Start-up Checklist and Request for Authorized Start-up Technician	QWC4-CL3
QWC4 Renewal Parts	QWC4-RP1
Limited Warranty	QTC-NM2

Nomenclature

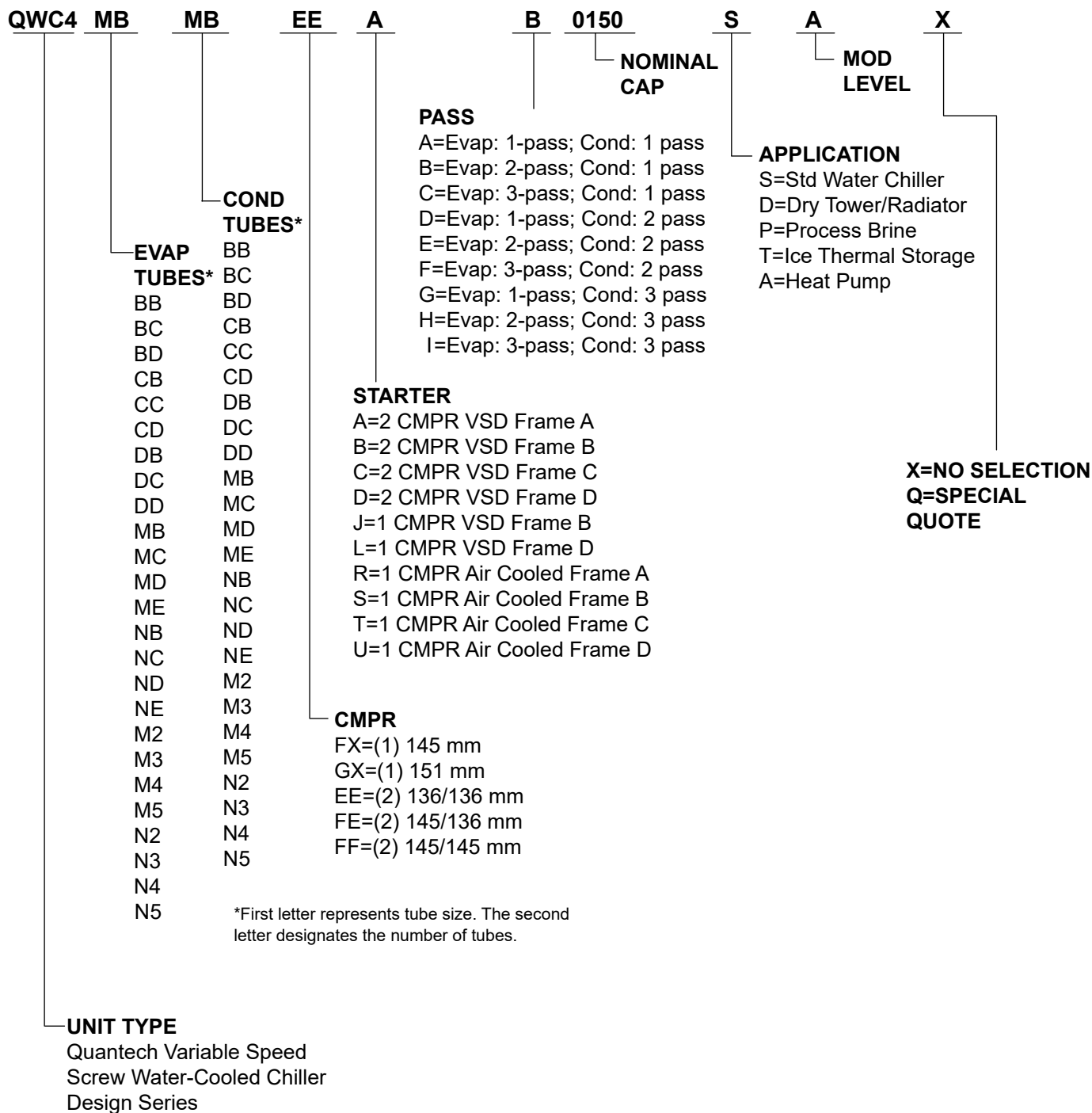


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SECTION 1 - GENERAL CHILLER INFORMATION AND SAFETY

1

INTRODUCTION

Quantech QWC4 chillers are manufactured to the highest design and construction standards to ensure high performance, reliability, and adaptability to all types of air conditioning installations.

The unit is intended for cooling water or glycol solutions, and is not suitable for purposes other than those specified in this manual.

ABOUT THIS MANUAL

This manual and any other document supplied with the unit are the property of Quantech which reserves all rights. This manual may not be reproduced, in whole or in part, without prior written authorization from an authorized Quantech representative.

In addition, this manual:

- Includes suggested best working practices and procedures, which are issued for guidance only, and they do not take precedence over the above stated individual responsibility and/or local safety regulations.
- Contains all the information required for correct installation and commissioning of the unit, together with operating and maintenance instructions.
- Should be read thoroughly before attempting to operate or service the unit.
- Contains detailed procedures, including installation, commissioning and maintenance tasks that must only be performed by suitably trained and qualified personnel.

The manufacturer is not liable for any injury or damage caused by incorrect installation, commissioning, operation or maintenance resulting from a failure to follow the procedures and instructions detailed in the manual.

WARRANTY

Quantech warrants QWC4 chillers in accordance with the Limited Warranty Engineered Systems Equipment procedure. Refer to *Limited Warranty (Form 50.05-NM2)*.

Quantech warrants all equipment and materials against defects in workmanship and materials for a period of 18 months from the date of shipment or 12 months

from the date of start-up, whichever comes first, unless labor or extended warranty has been purchased as part of the contract.

The warranty is limited to parts only replacement and shipping of any faulty part, or subassembly, which has failed due to defects in workmanship and materials. All claims must be supported by evidence that the failure has occurred within the warranty period, and that the unit was operated within the designed parameters specified.

All warranty claims must specify the unit model, serial number, order number, and run hours/starts. Model and serial number information is printed on the unit identification plate.

The unit warranty will be void if any modification to the unit is carried out without prior written approval from Quantech. For warranty purposes, the following conditions must be satisfied:

- The initial start of the unit must be carried out by trained personnel from an authorized Quantech Field Service Office.
- Only genuine Quantech approved spare parts, oils, coolants, and refrigerants must be used.
- All of the scheduled maintenance operations detailed in this manual must be performed at the specified times by suitably trained and qualified personnel.
- Failure to satisfy any of these conditions will automatically void the warranty. Refer to *Limited Warranty (Form 50.05-NM2)* for complete details.

QUALITY ASSURANCE

Units conform with the following directives:

- Equipment Directive (2006/42/EC)
- EMC Directive (2004/108/EC)
- Pressure Equipment Directive (97/23/EC)
- Low Voltage Directive (2006/95/EC)
- Safety Code for Mechanical Refrigeration (EN378-2 (2008))
- AHRI 550/590 and 551/591 - Water Chilling Packages using the Vapor Compression Cycle.

- GB/T 18430.1 - Water Chilling (Heat Pump) Packages Using The Vapor Compression Cycle - Part 1: Water Chilling (Heat Pump) Packages For Industrial & Commercial And Similar Applications.
- GB25131 - Safety Requirements For Water Chillers (Heat Pump) Using The Vapor Compression Cycle.
- GB150/151 - Steel Pressure Vessels/Tubular Heat Exchangers.
- ANSI/ASHRAE 34 - Number Designation And Safety Classification Of Refrigerants.
- ASHRAE 90.1 - Energy Standard For Buildings Except Low-Rise Residential Buildings.
- Machinery Directive (2006/42/EC)
- EMC Directive (2004/108/EC)
- Pressure Equipment Directive (97/23/EC)
- Safety Code for Mechanical Refrigeration (EN 378-2)
- Safety of machinery - Electrical Equipment of Machine (EN 60204-1)
- Manufactured in an EN ISO 9001 accredited organization
- ISO 9614 – Determination of sound power levels of noise sources using sound intensity
- Conform to CE Testing Services for construction of chillers and provide CE Listed Mark

FLUORINATED GREENHOUSE GASES

- This equipment contains fluorinated greenhouse gases covered by the Kyoto Protocol.
- The global warming potential of the refrigerant (R-134a) used in this unit is 1300. The refrigerant quantity is stated in this document.
- The fluorinated greenhouse gases in this equipment may not be vented to the atmosphere.

RESPONSIBILITY FOR SAFETY

Every care has been taken in the design and manufacture of the unit to ensure compliance with the safety requirements. However, the individual operating or working on any equipment is primarily responsible for:

- Personal safety, the safety of other personnel, and the equipment.
- Correct utilization of the equipment in accordance with the procedures detailed in the manual.

MISUSE OF EQUIPMENT

Suitability For Application

The unit is intended for cooling water or glycol solutions and is not suitable for purposes other than those specified in these instructions. Any use of the equipment other than its intended use, or operation of the equipment contrary to the relevant procedures may result in injury to the operator, or damage to the equipment. The unit must not be operated outside the design parameters specified in this manual.

Brine Applications

When the chiller is not running, cold brine must NOT be run through the evaporator. However, if there is brine running through the evaporator, there must be flow through the condenser to prevent tubes from freezing.

Structural Support

Structural support of the unit must be provided as indicated in these instructions. Failure to provide proper support may result in injury to the operator, or damage to the equipment and/or building.

Mechanical Strength

The unit is not designed to withstand loads or stresses from adjacent equipment, pipework, or structures. Additional components must not be mounted on the unit. Any such extraneous loads may cause structural failure and may result in injury to the operator, or damage to the equipment.

General Access

There are a number of areas and features, which may be a hazard and potentially cause injury when working on the unit unless suitable safety precautions are taken. Make sure access to the unit is restricted to suitably qualified personnel, who are familiar with the potential hazards and precautions necessary for safe operation and maintenance of equipment containing high temperatures, pressures, and voltages.

Pressure Systems

The unit contains refrigerant vapor and liquid under pressure, release of which can be a danger and cause injury. The user should make sure that care is taken during installation, operation, and maintenance to avoid damage to the pressure system. No attempt should be made to gain access to the component parts of the pressure system other than by suitably trained and qualified personnel.

Electrical

The unit must be grounded. No installation or maintenance work should be attempted on the electrical equipment without first switching the power off, isolating and locking-off the power supply. Servicing and maintenance on live equipment must not be attempted. No attempt should be made to gain access to the control panel or electrical enclosures during normal operation of the unit.

Components may also have sharp edges. Reasonable care should be taken when working in contact with any components to avoid risk of minor abrasions and lacerations.

Refrigerants and Oils

Refrigerants and oils used in the unit are generally non-toxic, non-flammable, and non-corrosive, and pose no special safety hazards. Use gloves and safety glasses when working on the unit. The buildup of refrigerant vapor, from a leak for example, does pose a risk of asphyxiation in confined or enclosed spaces and attention should be given to good ventilation.

Use only the refrigerant specifically designated for the unit. Any other type of refrigerant may cause damage to the equipment and will void the warranty.

High Temperature and Pressure Cleaning

High temperature and pressure cleaning methods (e.g., steam cleaning) should not be used on any part of the pressure system as this may cause operation of the pressure relief devices. Detergents and solvents, which may cause corrosion, should also be avoided.

Emergency Shutdown

In case of emergency, the control panel is fitted with an incoming supply circuit breaker with a red and yellow handle as shown below, which can be used as the emergency stop for the device. Turn the handle clockwise to shut down the chiller to the ON position.



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FIGURE 1 - EMERGENCY SHUTDOWN HANDLE

Safety Labels



For safe operation, read the instructions first.



Warning: This machine may start automatically without prior warning.



Warning: Hot surface.



Warning: Safety relief valve may discharge gas or liquid without prior warning.



Warning: Isolate all electrical sources of supply before opening or removing the cover, as lethal voltages may exist.



General attention symbol.



Warning: On isolating the supply it may take up to 300 seconds for the capacitor voltage to fall below 50 volts.

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SECTION 2 - PRODUCT DESCRIPTION

Quantech QWC4 chillers are designed for water or glycol cooling. All units are designed to be located in an equipment room unless the unit was ordered specially for outside applications.

The units are completely assembled with all interconnecting refrigerant piping and internal wiring, ready for field installation.

Before delivery, the unit is:

- Pressure tested
- Evacuated
- Fully charged with refrigerant and oil in the refrigerant circuit

All exposed power wiring is routed through liquid-tight, non-metallic conduit.

The QWC4 chiller combines the modern screw compressor design with the latest Variable Speed Drive (VSD) technology. The VSD enables the compressor speed to match the system load, and provides soft starts with no electrical inrush. The lack of heat buildup on start-up also reduces required off time between starts to two minutes.

COMPONENTS

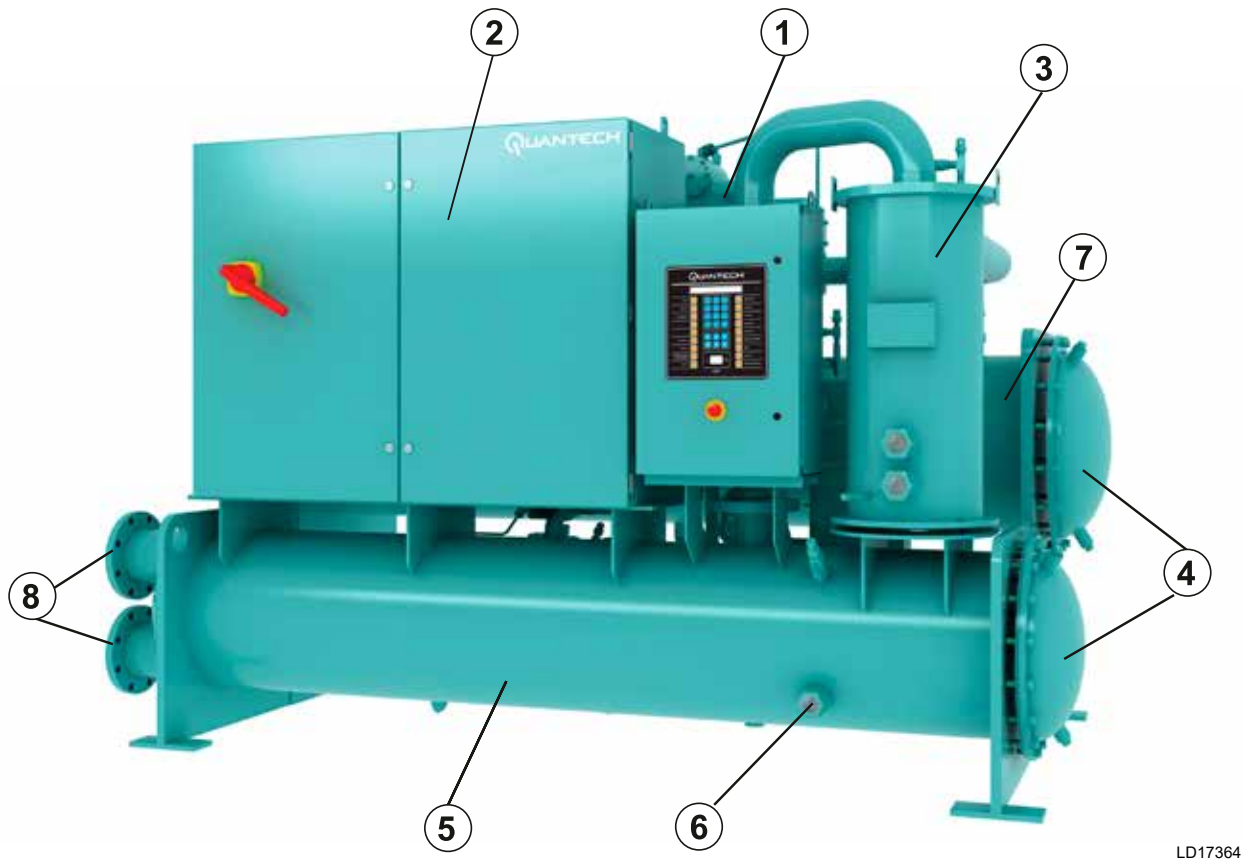
The QWC4 chiller, as shown in *Figure 2 on page 16* and *Figure 3 on page 17*, consists of:

- One screw compressors with a muffler
- A hybrid falling film evaporator
- A water-cooled condenser
- One economizer heat exchanger
- One oil separator
- VSD
- Control panel

The oil separator uses no moving parts. Oil cooling is accomplished by refrigerant leaving the eductor and flashing in the suction line, which cools the oil, motor, and compressor.

An integral liquid cooled, transistorized, pulse-width modulated (PWM) VSD is controlled by the microprocessor control panel to start/stop, and select compressor speed. Power factor is 95% at part or full load.

The chiller microprocessor communicates with the VSD logic board via a 3-wire RS-485 opto-coupled data link. The VSD logic board runs the compressor to the speed requested by the chiller microprocessor to meet the load as shown in *Figure 4 on page 18*.



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- | | |
|-------------------------------|---------------------------|
| 1. Control Panel | 5. Condenser |
| 2. Variable Speed Drive (VSD) | 6. Condenser Sight Glass |
| 3. Oil Separator | 7. Evaporator |
| 4. Return Waterbox | 8. Condenser Water Nozzle |

FIGURE 2 - QWC4 CHILLER MAJOR COMPONENTS (FRONT VIEW)

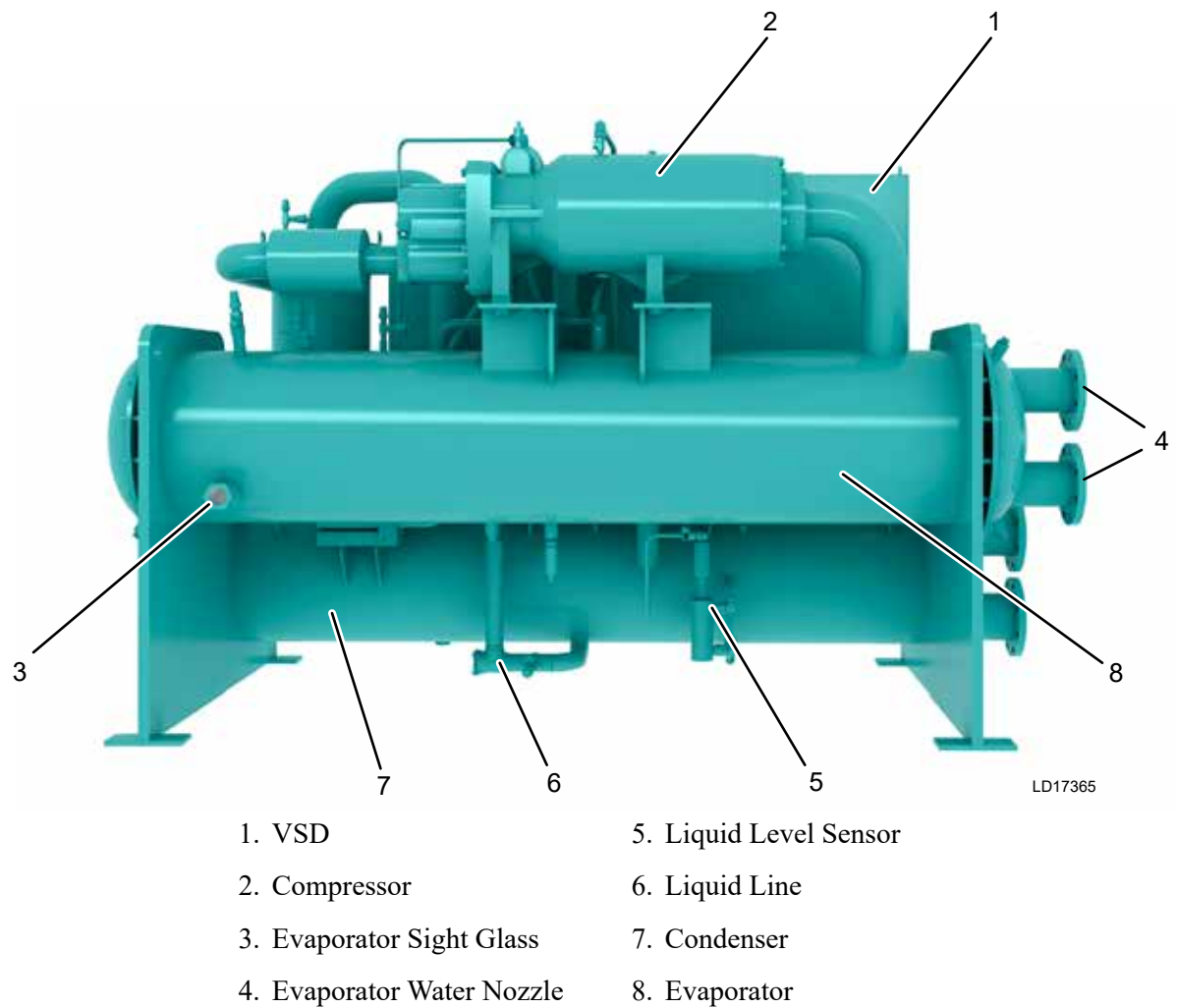
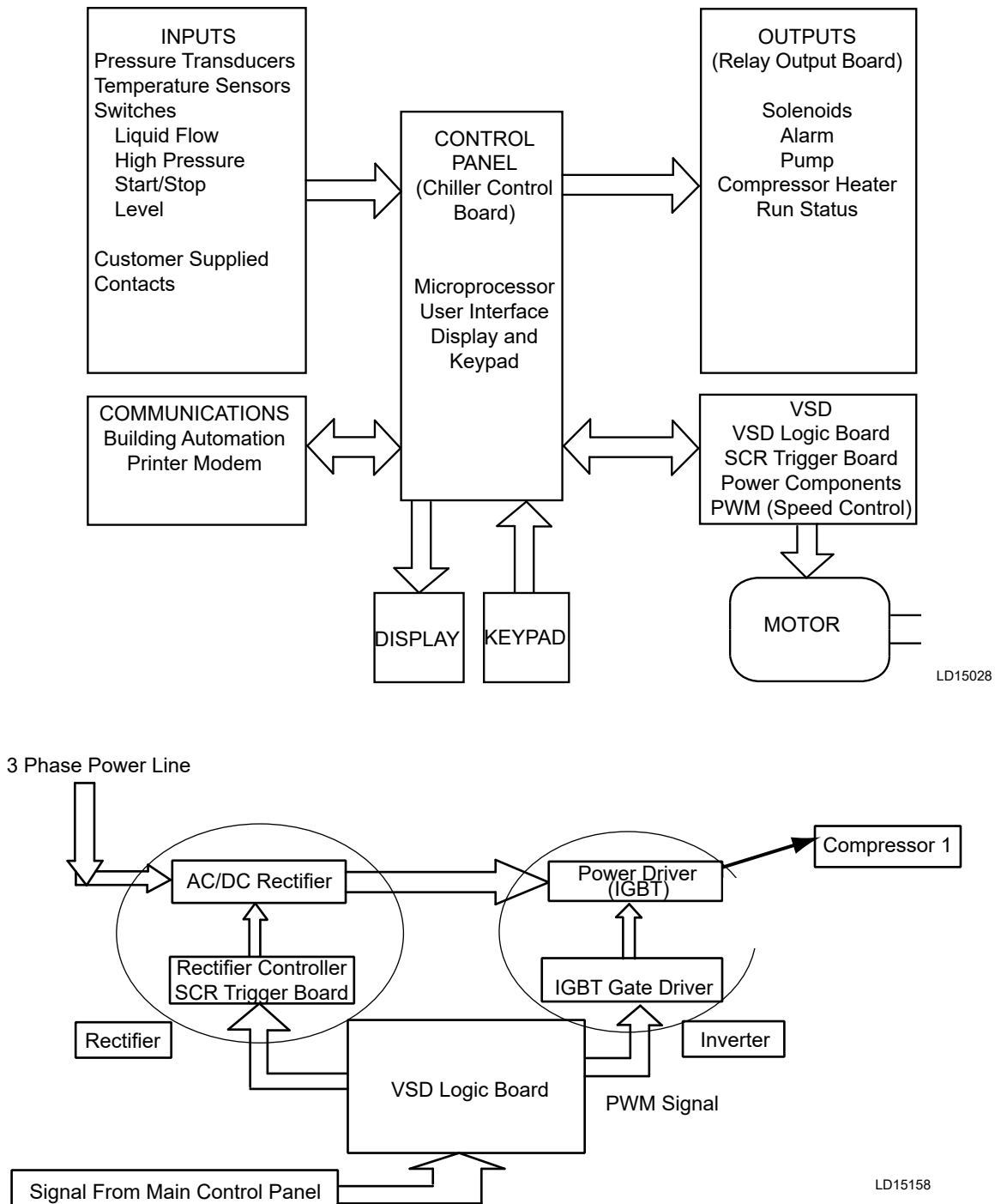


FIGURE 3 - QWC4 CHILLER MAJOR COMPONENTS (REAR VIEW)

**FIGURE 4 - BASIC SYSTEM CONTROL AND VSD SYSTEM ARCHITECTURE**

SEMI-HERMETIC QUANTECH SCREW COMPRESSORS

The direct-drive, semi-hermetic rotary screw compressor incorporates advanced technology in a rugged design. The continuous function, microprocessor controlled VSD provides smooth capacity control from 100% down to 20% chiller capacity. State-of-the-art screw compressor design and manufacturing ensures optimal efficiencies at all chiller load points. With no unloading steps or slide valves in the compressor, the QWC4 variable speed driven compressor has 50% fewer moving parts than fixed speed compressors with slide valves. The QWC4 compressor is one of the most efficient and reliable screw compressors in the industry.

EVAPORATOR

The evaporator is a shell and tube, hybrid falling film type heat exchanger. It contains a balance of flooded and falling film technology to optimize efficiency, minimize refrigerant charge, and maintain reliable control. A specifically designed distribution system provides uniform refrigerant flow for optimum performance.

CONDENSER

The condenser is a shell and tube type, with a discharge gas baffle to prevent direct high velocity impingement on the tubes. The baffle is also used to distribute the refrigerant gas flow properly for the most efficient heat transfer. An integral sub-cooler is located at the bottom of the condenser shell providing highly effective liquid refrigerant subcooling to provide the highest cycle efficiency.

REFRIGERANT CIRCUIT

The QWC4 has one independent refrigerant circuit per compressor. An electronic expansion valve (EEV), controlled by the unit panel, accommodates varying head and load conditions. The condenser shell is capable of storing the entire system refrigerant charge during servicing. Optional service valves are available to facilitate the removal of refrigerant. The sub-cooling economizer (plate heat exchanger type), controlled by the unit panel, meters some refrigerant gas to the compressor to reduce energy consumption.

COMPLETE FACTORY PACKAGE

Each unit is shipped as a complete factory package, completely assembled with all interconnecting refrigerant piping and internal wiring and ready for field installation. Before shipment, each individual chiller undergoes an extensive testing procedure, ensuring workmanship is the highest quality and that the initial start-up is trouble-free.

Before leaving the factory, each refrigerant circuit is factory pressure tested, evacuated and then fully charged with R-134a refrigerant and oil. An operational test is performed with water flowing through the evaporator and condenser to ensure each circuit functions correctly.

ELECTRICAL

All controls and motor starting equipment necessary for unit operation are factory wired and function tested. There are no surprises at start-up; the unit will start up correctly the first time and every time. The standard unit is equipped with circuit breaker for electrical connections. The chillers come with a single point power connection and are supplied with a factory mounted and wired control transformer that powers all unit controls from the main unit power supply. The transformer uses scheduled line voltage on the primary side and provides 115 V / 1 Ø on secondary. All exposed power wiring is routed through liquid-tight, UV-stabilized, non-metallic conduit.

VSD Power/Control Panel includes main power connections, VSD contactors, current overloads, and factory wiring. All display and control features can be accessed through the keypad and control display access door, eliminating the need to open the main cabinet doors.

BUILDING AUTOMATION SYSTEM CAPABILITIES

The E-Link Gateway provides an economical and versatile connection between Quantech equipment and open/standard protocols. It efficiently manages the communication protocols currently used by Quantech equipment, exposing the data in a consistent, organized, and defined fashion. A simple switch selection allows configuration of the required equipment profile and output protocol, which reduces equipment connectivity startup time.

MICROCOMPUTER CONTROL CENTER

The microcomputer control center, shown in *Figure 5 on page 20*, provides automatic control of chiller operation including compressor start/stop and load/unload anti-recycle timers, condenser and chilled water (CHW) pumps, unit alarm contacts and run signal contacts. The microcomputer control center comes online as soon as the main power switch is activated. Immediately, the microcomputer control center will begin to check all variables with a frequency ranging from 30 seconds to almost continuous monitoring.

The microprocessor controls the unit's capacity by matching the actual leaving chilled water temperature (or condenser water temperature in heat pump applications), to the user-defined setpoint. Factors that may cause the system's actual leaving chilled water temperature to fluctuate are:

- Changes in ambient temperature
- Loop flow rate
- Load
- Loop volume

The control system reacts to such changes by adjusting the number of compressors that are on, and the loading of each compressor to keep the leaving water temperature at the setpoint.

The control system logic monitors the rate at which the leaving water temperature is approaching the setpoint to ramp up or down compressor capacity as required. The VSD allows the compressor capacity to match the load.

Displayed data and programmable setpoints are detailed in *SECTION 6 - OPERATION* in this manual.

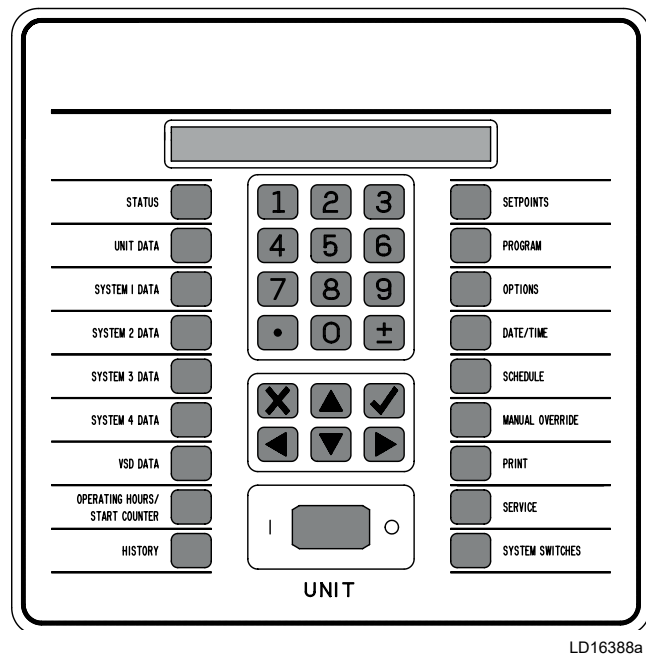


FIGURE 5 - CONTROL CENTER USER INTERFACE

Extreme Conditions – During extreme or unusual conditions, the chiller control system will avoid shutdown by varying capacity. By monitoring motor current and suction and discharge pressures, the chiller can maintain maximum available cooling output without shutting down.

Unit safeties are provided for the chiller to perform auto-reset shutdown for the specific conditions detailed in *SECTION 6 - OPERATION* in this manual.

OPTIONS

The following options are factory-mounted unless otherwise noted.

Evaporator Options

Factory Insulation – Factory-applied thermal insulation of the 3/4 in. (19 mm) flexible, closed-cell plastic type is attached with vapor-proof cement to the following components:

- Evaporator shell and tube sheets
- Suction connection
- Auxiliary tubing

Insulation can also be provided on the condenser to meet specific application needs.

Double Thick Insulation 1 1/2 in. (38 mm) insulation is available on the evaporator as a factory-installed option.

Controls Options

BAS Temperature Reset is a factory-installed option to accept a 4 mA to 20 mA or a 0 VDC to 10 VDC input. This option allows remote reset of the Leaving Chilled Liquid Temperature Setpoint (LCHLTS). The setpoint can be positively offset up to 40°F (22.2°C). This option is useful for ice storage or process applications, or for periods where higher chilled liquid temperatures are adequate for low loads, which is available alone or in combination with the BAS load limit.

BAS Load Limit is a factory-installed option that accepts a 4 mA to 20 mA or a 0 VDC to 10 VDC input. This option allows remote reset of the load limit setpoint, which can limit system demand from 30% to 100%, which is available alone, or in combination, with the BAS temperature reset.

E-Link Gateway option provides communication or BAS, including BACnet (MS/TP), Modbus, LON, and N2 between the control panel and the BAS.

General Options

Flow Switch Accessory Switch

NEMA 3R switch, 150 psig (10.3 kPa) DWP, -20°F to 250°F (-29°C to 121°C) with 1 in. NPT (IPS) connection for upright mounting in horizontal pipe. This flow switch (or equivalent) must be furnished with each unit for chilled liquid loop. The condenser liquid flow switch is optional. **(Field mounted)**

Differential Pressure Switch

This 3 psig to 45 psig (0.2 barg to 3 barg) range switch, with 1/4 in. NPTE pressure connections, is an alternative to the paddle-type flow switch. **(Field mounted)**

Dual Pressure Relief Valve

Two safety relief valves are mounted in parallel; one valve is always operational to assist in valve replacement during maintenance.

Electrical Isolation

Circuit Breaker (UL/ASME) – A unit-mounted circuit breaker with external lockable handle will be supplied to isolate the single point power voltage for

servicing. Circuit breaker is sized to provide motor branch, short circuit and ground fault protection for the motor branch-circuit conductors and control apparatus, and the motors.

Non-Fused Disconnect Switch (CE/PED) – Unit-mounted disconnect switch with external lockable handle can be supplied to isolate the unit power voltage for servicing. Separate external fusing must be supplied by the power wiring, which must comply with local codes.

Optional Special Requirement Documents

Special Requirement Document Package (SRDP) may include:

- Pressure vessel report
- Production system and final unit inspection check sheets
- Steel mill material reports for vessels
- CE certificate
- Unit run test report
- Final unit/component inspection
- Hydro, vacuum, and pneumatic tests
- Electrical safety

Vibration Isolation

Elastomeric Isolators – Use for normal installations. **(Field mounted)**

Spring Isolators (1 in (25.4 mm)) – To support the unit, spring isolators are level adjustable spring and cage isolators for mounting under the unit base rails. The nominal deflection may vary slightly by application. **(Field mounted)**

Refrigerant Isolation Valves

Optional, factory-installed isolation valves in the compressor discharge lines and refrigerant liquid line per circuit are available. The valves allow isolation and storage of the refrigerant charge in the chiller condenser during servicing, which eliminate time-consuming transfers to remote storage vessels. Both valves in each independent refrigerant circuit are positive shut-off, assuring integrity of the storage system.

Head Pressure Control

(Applicable to software version Y.WCS.31.05 or Y.WCS.41.05, and later.)

Head Pressure is the pressure difference between condenser and evaporator. It is of a crucial requirement to maintain sufficient head pressure for normal oil circulation in lubrication system.

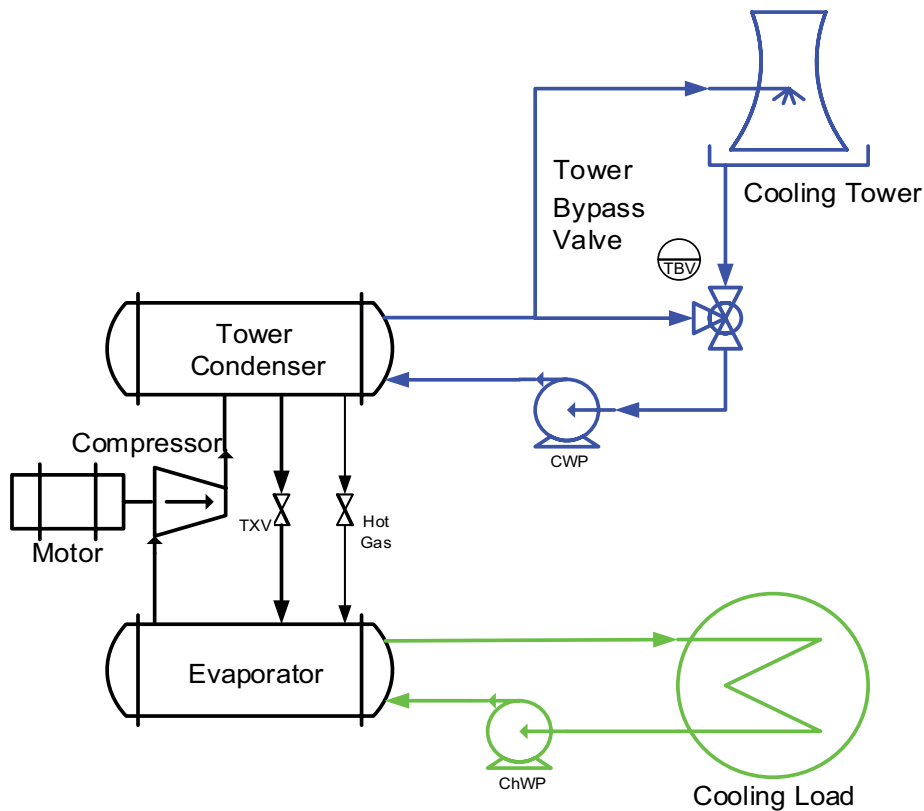
QWC4 Chillers are capable of operation within a wide range of condenser water temperatures. If condenser water temperatures meet the guidelines documented in the Engineering Guide (*Form QWC4-EG1*), then head pressure regulation is not necessary. However, chiller operational issues may occur if the condenser water temperature is colder than usual. A customer facility control may be provided to ensure adequate head pressure exists.

The preferred means is cooling tower bypass circuit, since this would maintain adequate tube velocity in the condenser, by regulating the return cooling water to the chiller. Additionally, a two-way condenser water throttling valve, a variable speed cooling tower pump, or tower fan control circuit might be employed.

The Head Pressure Control function provides an output control signal that will respond to a programmed minimum chiller differential pressure.

$$\text{DIFFERENTIAL PRESSURE} = \text{DISCHARGE PRESSURE} - \text{EVAPORATOR PRESSURE}$$

The output to the above equation will be a direct impact. An increasing head pressure differential provides more water flow to the cooling tower or less tower bypass.




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FIGURE 6 - HEAD PRESSURE CONTROL SYSTEM

SECTION 3 - HANDLING, STORAGE, INSTALLATION, AND REASSEMBLY

3




WARNING

Failure to follow these instructions could result in death, serious injury or equipment damage.

Follow all warnings and instructions in the unit's Manual(s).

<div style="display: flex; flex-direction: column; gap: 5px;"> <div>EN Installation Instructions for the technician / fitter</div> <div>PL Instrukcja instalacji dla technika / monter</div> <div>SV Installationsguide for installer / montör</div> <div>CS Pokyny k instalaci pro techniky a montéry</div> </div>	<div style="display: flex; flex-direction: column; gap: 5px;"> <div>IT Istruzioni d'installazione per il personale specializzato</div> <div>NL Installatiehandleiding voor de vakman / monteur</div> <div>DE Installationsanleitung für die Fachkraft / Monteur</div> <div>ES Instrucciones de instalación para el técnico / contratista especializado</div> </div>	<div style="display: flex; flex-direction: column; gap: 5px;"> <div>JA 一般仕様・取扱説明書</div> <div>FR Manuel d'installation pour le spécialiste / monteur</div> <div>RU Инструкция по установке для техника/монтажника</div> <div>ZH 适用于技术人员与安装人员的 安装说明书</div> </div>
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1. Follow all applicable regulations and safety practices during rigging and lifting.
2. Prepare and follow written rigging and lifting plan.
3. Rigging must be directed by trained professional rigger.
4. Spreader bars must be used and be long enough to prevent rigging from contacting unit.
5. Use all and only designated lift points according to units manual(s).
6. Locate center of gravity through trial lifts to account for possible variations in unit configuration.
7. Use rigging and lifting techniques that keep unit stable and level.
8. Keep clear of unit when lifted.

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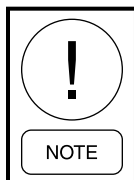


Rigging and lifting should only be done by a professional rigger in accordance with a written rigging and lifting plan. The most appropriate rigging and lifting method will depend on job specific factors, such as the rigging equipment available and site needs. Therefore, a professional rigger must determine the rigging and lifting method to be used, and it is beyond the scope of this manual to specify rigging and lifting details.

SHIPMENT AND STORAGE

To ensure consistent quality and maximum reliability, all units are tested and inspected before leaving the factory. The chiller may be ordered and shipped in any of the following forms:

- **Form 1** (shipped assembled with refrigerant charge)
- **Form 2** (shipped assembled without refrigerant charge)
- **Form 7** (shipped in split assemblies without refrigerant)
- Miscellaneous loose items are shipped with all forms.



When shipping a Form 2 or Form 7 unit, make arrangements with the nearest Quantech Field Service Office to make sure the refrigerant is on-site when the unit is ready to be charged.

Observe the following precautions:

- Notify the nearest Quantech office in ample time for a Quantech representative to observe rigging the unit to its operating position and the assembly of its components. Refer to the *QWC4 Installation Checklist (Form QWC4-CL1)* for detailed instructions. Do not dismantle or unwrap the chiller for any reason unless advised by a Quantech representative.
- Do not make final power supply connections to the compressor motor drive or control center.
- Do not open valves or connections under any circumstances.
- Do not charge the unit with refrigerant.
- Do not attempt to start the system.
- Do not run hot water (110°F/43°C max) or steam through the evaporator or condenser at any time.

Chiller Unit (Form 1)

The unit is completely assembled at the factory.

- The driveline (compressor/motor assembly) is mounted and all the necessary interconnecting piping is assembled.
- The complete unit is factory leak-tested, evacuated, and shipped charged with R-134a refrigerant.
- The Variable Speed Drive (VSD) is mounted, wired, and shipped with glycol.

Miscellaneous Items

The following items are shipped together:

- Four vibration isolation pads (or optional spring isolators and brackets)
- VSD inhibitor
- Other shipped loose items, including piping, water temperature controls, wiring, etc.

Chiller Unit (Form 2)

The unit is completely assembled at the factory.

- The driveline (compressor/motor assembly) is mounted and all the necessary interconnecting piping is assembled.
- The complete unit is factory leak-tested, evacuated, and shipped charged without R-134a refrigerant.
- The VSD is mounted, wired, and shipped with glycol.

Miscellaneous Items

The following items are shipped together:

- Four vibration isolation pads (or optional spring isolators and brackets)
- VSD inhibitor
- Other shipped loose items, including piping, water temperature controls, wiring, etc.

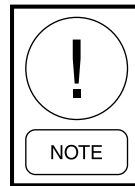
Chiller Unit (Form 7)

The unit is factory assembled, refrigerant piped, wired and leak tested and then dismantled for shipment. The close-coupled compressor/motor assembly and VSD is removed from the shells and skidded separately.

Form 7 QWC4 chillers are shipped in the following assemblies:

- The driveline (compressor/motor assembly)
- Evaporator
- Condenser
- Variable Speed Drive (VSD)
- Control Panel
- Oil Separator
- One Muffler Kit (w/ isolation ball valve)
- One Discharge Piping Kit
- Loose piping and wiring harnesses
- Miscellaneous items

Protective covering is furnished on the drivelines, control center, VSD, and unit-mounted controls. Water nozzles are capped with fitted plastic enclosures. All Form 7 components are protected with industrial-grade, reinforced shrink-wrapped covering and shipped in split assemblies without refrigerant charge.



Refrigerant charges are shipped separately. Arrangements with the local Quantech Field Service Office must be made to make sure refrigerant is on-site when the unit is ready to be charged.

One Driveline

The driveline (compressor/motor assembly) is removed from the shell and skidded.

- Motor Terminal Box and all integral wiring is left on the compressor.
- All openings on the compressor are closed and shipped charged with a 2 psig to 3 psig (115 kPa to 122 kPa) holding charge of dry nitrogen.

Shells

The evaporator and condenser are split apart at the tube sheets, and prepared for shipping separately.

- All conduit is removed from the shells.
- All wiring harnesses on the shells are removed.
- Refrigerant lines between the shells are flanged and capped, requiring no welding.
- All openings on the shells are closed and charged with a 2 psig to 3 psig (115 kPa to 122 kPa) holding charge of dry nitrogen.
- Hardware is added to the package with the miscellaneous nuts, bolts, and fittings.

Variable Speed Drive

The VSD is removed, and prepared for shipping separately.

- All wiring harnesses are coiled and secured.
- Cooling hoses are removed.
- Hardware is added to the package with the miscellaneous nuts, bolts and fittings.

Discharge Isolation Valves

If equipped, the discharge isolation valves are removed and shipped loose.

Miscellaneous Items

The following items are shipped together:

- Four vibration isolation pads (or optional spring isolators and brackets)
- VSD inhibitor
- Other shipped loose items, including piping, water temperature controls, wiring, etc.

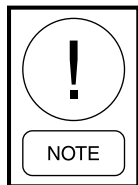
INSPECTION, DAMAGE, AND SHORTAGE

Inspection

Check each unit on arrival to ensure all major components, boxes and crates are received, undamaged, and compared to the packing list.

Damage

Before unloading, inspect each unit for any visible signs of damage while still on the trailer or rail car. Report any damage or signs of possible damage to the transportation company immediately for the company's inspection.



Quantech will not be responsible for any damage or loss of parts in shipment or at job site.

Shortage

After inspecting the assemblies, all containers should be opened and contents checked against the packing list. Any material shortage should be reported to Quantech immediately. Refer to *Shipping Damage Claims (Form 50.15-NM)*.

Storage

Units are shipped without export crating unless crating has been specified on the sales order. Observe the following precautions, if the unit is to be stored before installation:



If the temperature is outside of the 40°F to 110°F (4°C to 43°C) range, make sure the waterboxes and VSD heat exchanger are completely drained of all liquid, which could freeze. Make sure the condenser and evaporator tubes are completely dry. The VSD coolant must be drained and replaced with anti-freeze solution.

- The chiller must be blocked under the end sheets.
- Ensure that all openings, such as water connections, are securely capped.
- Store the unit in a location where:
 - It will NOT be exposed to ambient air temperatures exceeding 110°F (43°C).
 - There is minimal activity to limit the risk of accidental physical damage.
 - It is protected from rain or mist. Cover with a tarp, if the unit will be located outside.
- If the unit is stored longer than six months, follow the requirements from *Long-Term Storage Periodic Checklist and Logs for QWC4 Screw Chillers (Form 50.20-NM9)*.
- Inspect the unit periodically during storage.
- To prevent inadvertent operation of the pressure relief devices, the unit must not be steam cleaned.

LIFTING WEIGHTS

A lifting diagram is placed on the chiller and the shipping package. For detailed unit weights and weight distribution, refer to the data shipped in the chiller information packet and unit nameplate.

TABLE 1 - UNIT WEIGHT

APPROXIMATE UNIT WEIGHT									
COMPRESSOR CODE 9,10)	SHELL CODE (PIN 5,7)	SHIPPING WEIGHT RANGE MIN - MAX		OPERATING WEIGHT RANGE MIN - MAX		REFRIGERANT CHARGE RANGE MIN - MAX		LOADING PER ISOLATOR MIN - MAX	
		LB	KG	LB	KG	LB	KG	LB	KG
FX	B-B	7694– 8329	3490– 3778	8254– 8995	3744– 4080	276–298	125–135	2064– 2249	936– 1020
	C-C	8263– 8519	3748– 3864	8915– 9306	4044– 4221	331–353	150–160	2229– 2326	1011– 1055
	D-D	8922– 9228	4047– 4186	9667– 10135	4385– 4597	386–408	175–185	2416– 2533	1096– 1149
GX	B-B	7981– 8616	3620– 3908	8541– 9281	3874– 4210	298–320	135–145	2134– 2321	968– 1053
	C-C	8549– 8805	3878– 3994	9202– 9592	4174– 4351	353–375	160–170	2299– 2399	1043– 1088
	D-D	9209– 9515	4177– 4316	9954– 10421	4515– 4727	408–430	185–195	2489– 2606	1129– 1182

NOTE: Weights shown for base unit; selected options and tube count variations may add weights and/or refrigerant charge quantity to unit. Contact your nearest Quantech Sales Office for weight data.

MOVING THE CHILLER FOR FORMS 1 AND 2

Before moving the unit, make sure that the installation site is suitable for installing the unit and is easily capable of supporting the weight of the unit and all associated services.

The unit is designed to be lifted using chains or cables. The unit is provided with lifting eyes in the corners of the end sheets, which can be attached directly using shackles or safety hooks as shown in *Figure 7*.



Improper Unit/Component Lift! Test lift the unit/component approximately 24 in. (610 mm) to verify the proper center of the gravity lift point. To avoid dropping the unit/component, reposition the lifting point if the unit/component is not level. Failure to properly lift the unit/component could result in death or serious injury or possible equipment or property-only damage.

RIGGING

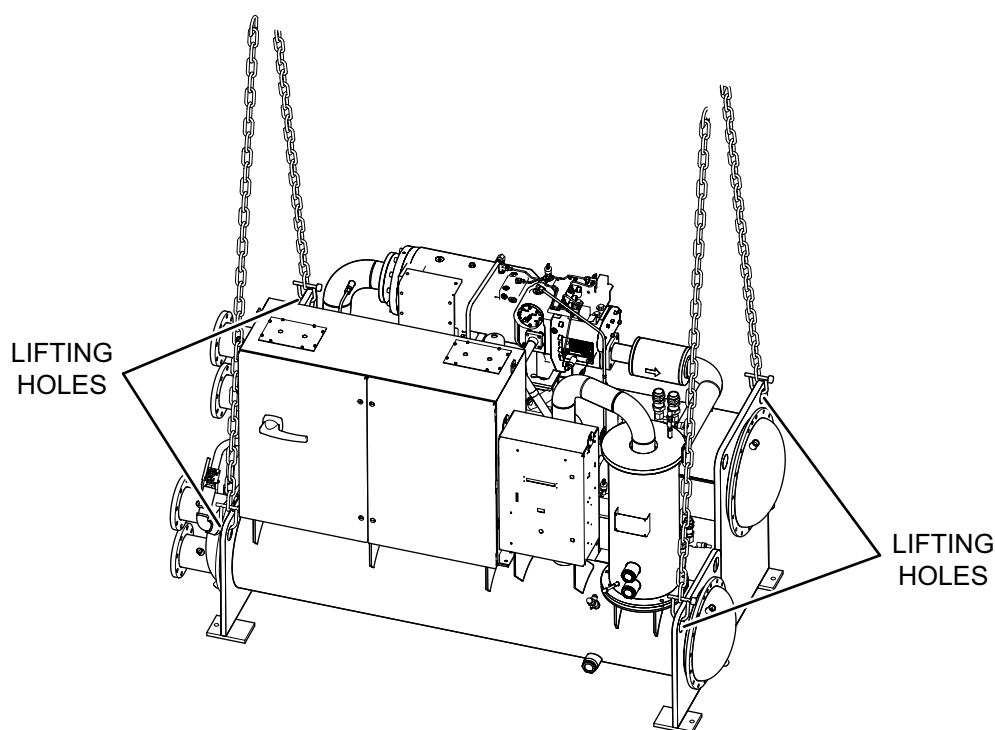
The complete standard unit (Forms 1 and 2) is shipped without skids. When optional skids are used, it may be necessary to remove the skids so that the riggers skates can be used under the unit end sheets to reduce the overall height.

Each unit has provided lifting holes (two on each end sheet), which should be used to lift the unit. Be careful during rigging and handling to avoid damage to the unit and its external connections. Lift only using the holes specified.

The unit must be special ordered if it is necessary to rig a unit on one end to permit lifting or dropping it through a vertical passageway (for example, an elevator shaft).



Never lift the entire unit with slings around the compressor/motor assembly or by the eyebolts in the tapped holes of the compressor/motor assembly. Do not turn the unit on its side for rigging or rig it with the driveline in a vertical orientation.



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FIGURE 7 - UNIT RIGGING FOR FORMS 1 AND 2

LOCATION

Locate the chiller in an indoor location with temperature ranges from 40°F to 110°F (4°C to 43°C) and adequate ventilation that meets the all ANSI, state, and local codes.

FOUNDATION

A level floor, foundation, or a customer supplied house-keeping pad must be provided by the customer, which is capable of supporting the unit operating weight.

CLEARANCE FOR SERVICE

To ensure adequate space for servicing the unit, adhere to the following clearances as shown in *Figure 8 on page 28* for single and dual compressor configuration:

- Rear and top of unit – 2 ft (610 mm)
- Front of unit – 3 ft 6 in. (1067 mm)
- Tube removal (See *Table 2 on page 28* for Clearance)

TABLE 2 - SERVICE CLEARANCE REQUIREMENTS

SHELL CODE (PIN 5,7)	TUBE REMOVAL SPACE		ADD MARINE WATERBOXES	
	ft-in	mm	ft-in	mm
B	10-1	3073	2-2	660
C	12-1	3683	2-2	660
D	14-1	4293	2-2	660

If optional shipping skids are used, remove them before lowering the unit to its mounting position. Use an overhead lift to rig the unit to its final location on the floor or mounting pad by lifting the unit, and lowering it to its mounting position.

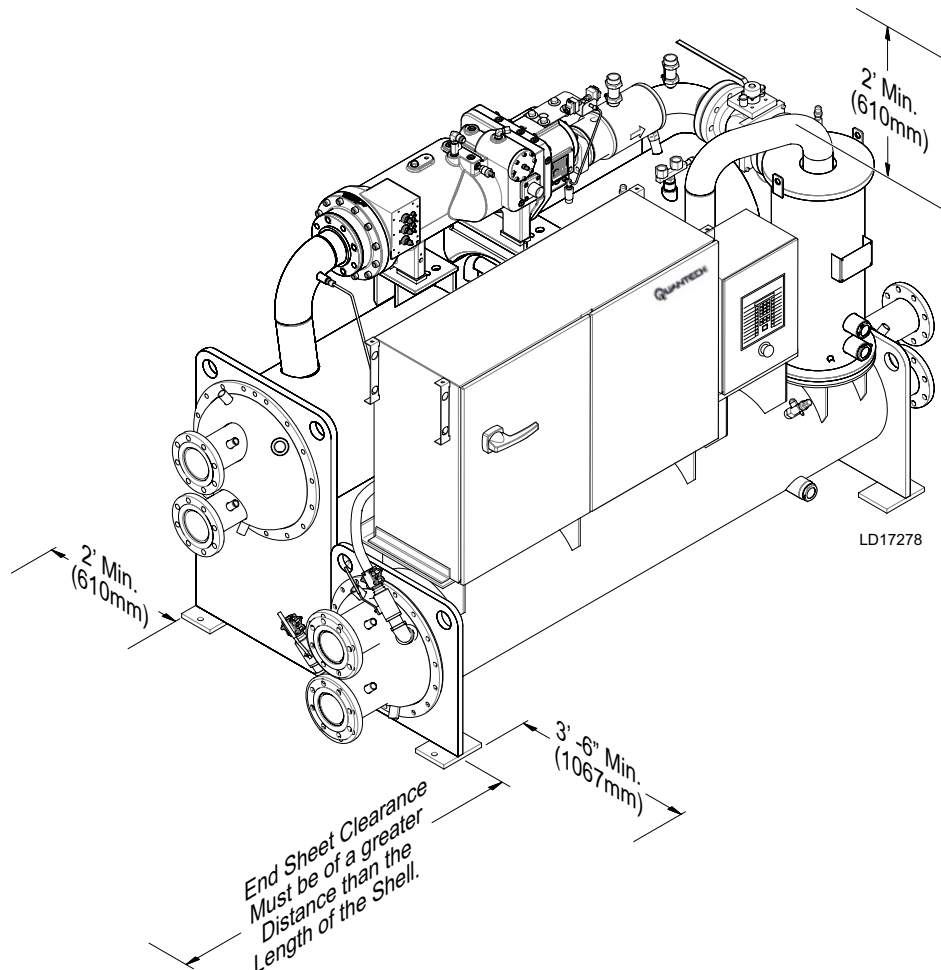


FIGURE 8 - SERVICE CLEARANCE REQUIREMENTS

INSTALLING ELASTOMERIC VIBRATION ISOLATOR PADS

Locate the elastomeric vibration isolator pads as shown in *Figure 9 on page 29*. After placing the isolator pads into position on the floor, lower the unit onto the pads. Make sure the pads are even with the edges of the mounting feet. When the unit is in place, check that the chiller is level, longitudinally and transversely.

Checking Unit Alignment

Check the longitudinal alignment by placing a level on the top center of the evaporator shell under the compressor/motor assembly. Check the transverse alignment by placing a level on top of the shell end sheets at each end of the unit.

The unit should be level within 0.25 in. (6 mm) from one end to the other end, and from front to the rear. If the chiller is not level within the amount specified, lift it and place as many shims as needed between the isolation pad and the end sheets.

Checking the Isolator Pad Deflection

Check all isolator pads for the proper deflection, which is approximately 0.15 in. (4 mm). If an isolator pad is under-deflected, place the shims between the unit end sheet and the top of the pad to equally deflect all pads.

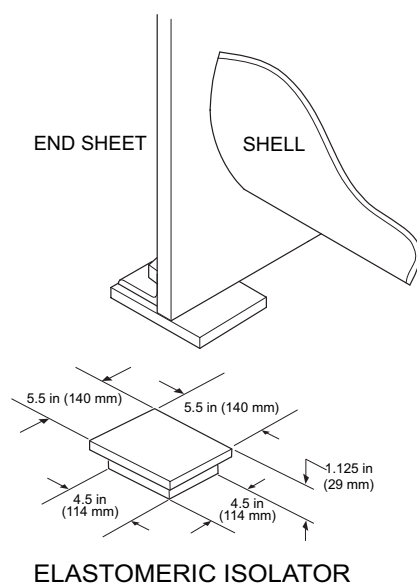
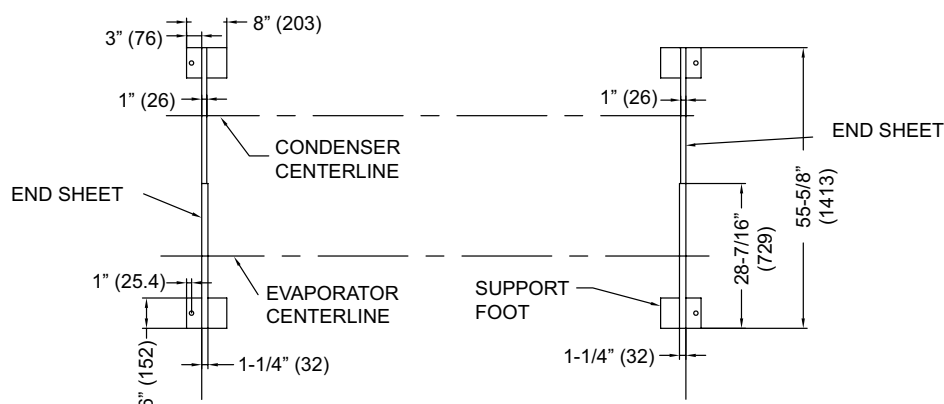
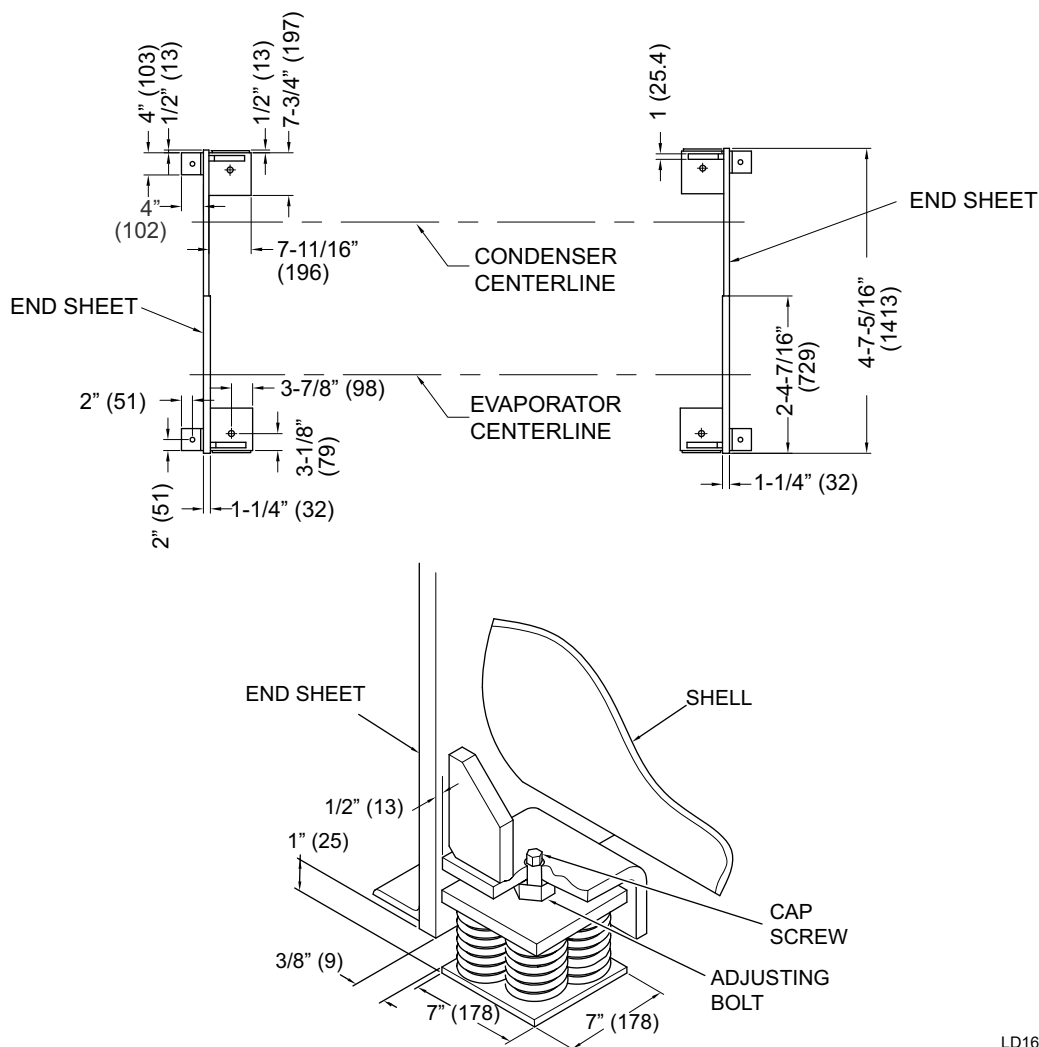


FIGURE 9 - ELASTOMERIC VIBRATION ISOLATOR PAD MOUNTS (STANDARD) - INCHES (MM)

INSTALLING OPTIONAL SPRING ISOLATORS

If ordered, four identical spring type isolator assemblies are furnished with the unit as shown in *Figure 10 on page 30*. Use the following instructions to install the optional spring isolators:

1. While the unit is suspended by the rigging, bolt the isolators to the unit by inserting the cap screws through the holes in the mounting bracket into the tapped hole in the top of the isolator leveling bolts. Then the unit can be lowered onto the floor.
2. Rotate the leveling bolts one turn at a time, in sequence, until the unit end sheets are clear of the floor according to the dimensions.
3. Check that the unit is level, both longitudinally and transversely. If the leveling bolts are not long enough to level unit due to an uneven or sloping floor or foundation, add as many shims as necessary (grouted, if necessary) under the isolator.
4. After the unit is leveled, wedge and shim under each corner to solidly support the unit in this position while:
 - Piping connections are being made.
 - Pipe hangers are adjusted and tightened.
 - Connections are checked for alignment and tightness.
5. Fill the unit with water and check for leaks.
6. Adjust the leveling bolts, and remove the shims. The unit should now be in a correctly leveled position, clear of the floor or foundation, and without any effect from the weight of the piping.



LD16471b

FIGURE 10 - SPRING ISOLATORS, IN. (MM)

FORM 7 REASSEMBLY

Complete the following steps to reassemble the chiller:

1. Determine the final location. Verify that the final location meets all of the minimum required clearances. See *Figure 8 on page 28*.
2. Rig the evaporator and place in the final location (see *Figure 11 on page 33*).
3. Rig the condenser, place it next to the evaporator, and bolt the condenser and evaporator together (see *Figure 12 on page 34*).
4. Level the evaporator and condenser (see *Figure 12 on page 34*).
5. Install the isolator pads or optional spring isolators to the condenser and evaporator end sheets (see *on page 36*).
6. Install the heat exchanger piping (see *Figure 15 on page 37*).
7. Install the liquid injection and oil return piping (see *Figure 16 on page 38*).
8. Install the driveline (compressor/motor) assembly (see *Figure 18 on page 39*).
9. Install the economizer piping to the compressor (see *page 39*).
10. Mount the oil separator (see *Figure 18 on page 36*).
11. Install the oil separator discharge muffler piping (see *Figure 18 on page 36*). (Only required with Isolation Valve)
12. Install compressor oil piping (see *Figure 20 on page 42*).
13. Install oil supply piping (see *Figure 21 on page 42*).
14. Mount the VSD (see *Figure 22 on page 44*).
15. Connect the VSD cooling lines (see *Figure 24 on page 45*).
16. Mount and connect the Control Panel (see *Figure 23 on page 45*).

Additional Instructions for Form 7 Reassembly

1. When installing the refrigerant piping, see *Piping Joint Assembly on page 46*.
2. For wiring connections, refer to *Field Connections and Control Wiring for QWC4 Chiller (QWC4-PW2)*.
3. For torque procedure and specifications, see *Table 4 on page 32*.
4. Evacuate and charge the unit with refrigerant, see *Refrigerant Charging on page 137*.
5. Pressure leak test. Remain below the relief valve lift pressure indicated on the valve tags, see *Checking System for Leaks on page 138*.
6. Charge the oil separator with the proper type and quantity of Quantech oil, see *Adding Compressor Oil on page 134*.
7. Remove shipping antifreeze from VSD cooling system and replace with coolant, see *Checking VSD Coolant Level on page 144*.

TABLE 3 - EVAPORATOR AND CONDENSER WEIGHT, LB (KG)

SHELL CODE	EVAPORATOR (PIN 5,6)	CONDENSER (PIN 7,8)
BB	2258/1024	1526 (692)
BC	2313/1049	1578 (716)
BD	2800/1270	1795 (814)
CB	2542/1153	1772 (804)
CC	2610/1184	1836 (833)
CD	2683/1217	1887 (856)
DB	2848/1292	2041 (926)
DC	2930/1329	2121 (926)
DD	3016/1368	2180 (989)

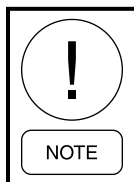
NOTE: The component weights listed in *Table 3 on page 31* through 41 are approximate, and could vary from unit to unit. Waterbox weights are NOT included.

TABLE 4 - TORQUE SPECIFICATION

UNIT							
ITEM		DESCRIPTION	QUANTECH PART NUMBER	SAP NUMBER	QUANTITY	TORQUE VALUE	
						FT-LBS.	N-M
END SHEETS (CON-EVAP ASSY)							
A	-	HCS5 0.625-11 X 2.500 GR 5 ZN	021-32010-020	616904	8	154	209
HEAT EXCHANGER PIPING							
B	24	HCS5 0.500-13 X 2.000 GR 5 ZN	021-32008-503	847455	8	50	68
COMPRESSOR MOUNTING							
C	21	HCS5 0.750-10 X 2.500 GR 5 ZN	021-32012-501	616916	8	50	68
D	18	HCS5 0.375-16 X 2.500 GR 5 ZN	021-32006-020	730823	4	50	68
COMPRESSOR PIPING							
E	36	HCS5 0.375-16 X 1.500 GR 5 ZN	021-32006-012	730819	10	50	68
F	13	HCS5 0.625-11 X 3.000 GR 5 ZN	021-32010-024	616905	4	50	68
H	30	Elbow 3/4 O.D.Tube 90 Deg Male	023-21937-000	146081	See Table 11 on page 47 and Table 12 on page 47 for Torque Specifications		
	94	Tee UNF(F) 0.750in UNF(F) 0.750in UNF	023-25549-000	827494			
J	31	Elbow 1/2 O.D.Tube 90 Deg Male	023-18982-000	146248			
OIL SEPARATOR MOUNTING							
P	18	HCS5 0.375-16 X 2.500 Gr 5 Zn	021-32006-020	730823	4	50	68
OIL SEPARATOR PIPING							
G	24	HCS5 0.625-11 X 3.000 GR 5 ZN	021-32010-024	616905	8	50	68
O	31	Elbow 1/2 O.D.Tube 90 Deg Male	023-18982-000	146248	See Table 11 on page 47 and Table 12 on page 47 for Torque Specifications		
R	10	HCS5 0.750-10 x 4 GR5 Zn	021-32012-032	730852			
LIQUID INJECTION PIPING							
K	22	Elbow 3/8 O.D.Tube 90 Deg Male	023-18981-000	146247	See Table 11 on page 47 and Table 12 on page 47 for Torque Specifications		
L	51	Nut 3/8 O.D. Tube	023-18977-000	146243			
EDUCTOR PIPING							
M	23	Adapter Straight 1 -14 Un-2B	023-19030-000	146209	See Table 11 on page 47 and Table 12 on page 47 for Torque Specifications		
N	47	Sleeve 3/4 O.D. Tube	023-18284-000	146273			
ENCLOSURE MOUNTING							
Q	8	HCS5 0.375-16 X 1.500 GR 5 ZN	021-32006-012	730819	8	50	68

Installing the Evaporator

Use the following instructions to install the evaporator as shown in *Figure 11* on page 33.



The lifting chains along the axis of the evaporator/condenser shells should not exceed 90° +/- 10°. A spreader bar may be required to achieve the +/- 10°.



One chain is required per each lifting point.

Use lifting chains with working load limit each at least 40% of the total shell weight.

1. Attach the rigging chains from the overhead lift to the four lifting holes of the evaporator (two at the top of each end sheet).
2. Lift the evaporator by means of an overhead lift to the unit's final location on the floor or housekeeping pad.

For information about clearance requirements, see *Table 2* on page 28.

TABLE 5 - EVAPORATOR DIMENSIONS, IN. (MM)

SHELL CODE (PIN 5)	LENGTH	WIDTH	HEIGHT
B	96 (2438)	28.7 (729)	66.3 (1685)
C	120 (3048)	28.7 (729)	66.3 (1685)
D	144 (3658)	28.7 (729)	66.3 (1685)

NOTE: See *Table 3* on page 31 for the approximate weight and water capacity of the evaporator.

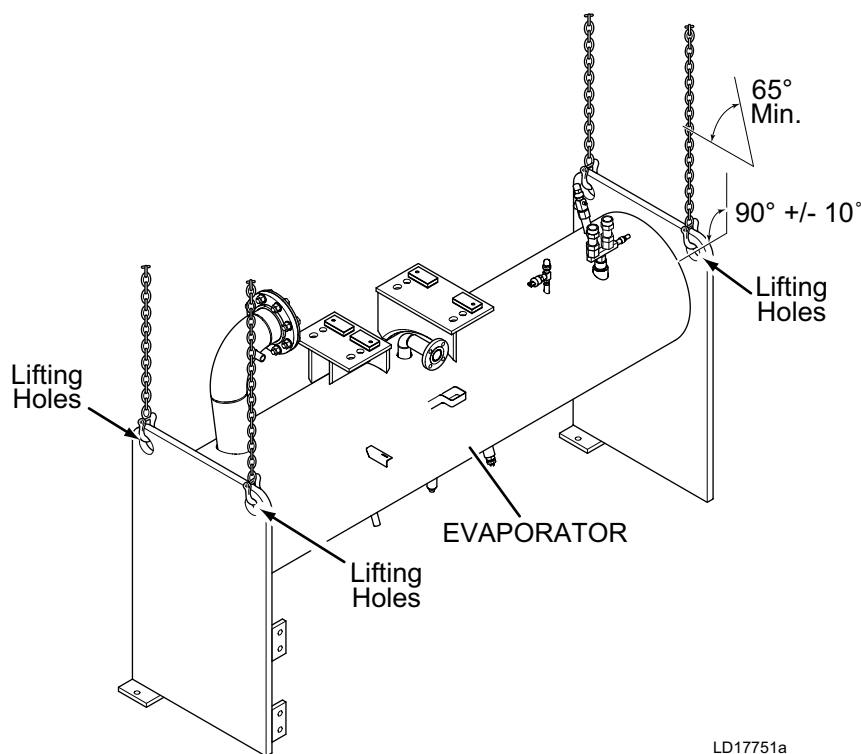
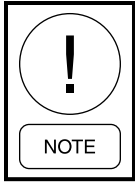


FIGURE 11 - RIGGING THE EVAPORATOR

Rigging and Installing the Condenser

Use the following instructions to install the condenser as shown in *Figure 12* on page 34.



The lifting chains along the axis of the evaporator/condenser shells should not exceed 90° +/- 10°. A spreader bar may be required to achieve the +/- 10°.



One chain is required per each lifting point.

Use lifting chains with working load limit each at least 40% of the total shell weight.

1. Attach the rigging chains from the overhead lift to the four lifting holes of the condenser (two at the top of each end sheet).
2. Lift the condenser and place next to the evaporator.
3. Bolt the end sheets of the evaporator and condenser together. Note that the outside surfaces of the tube sheets must be flush.

Leveling the Evaporator and Condenser

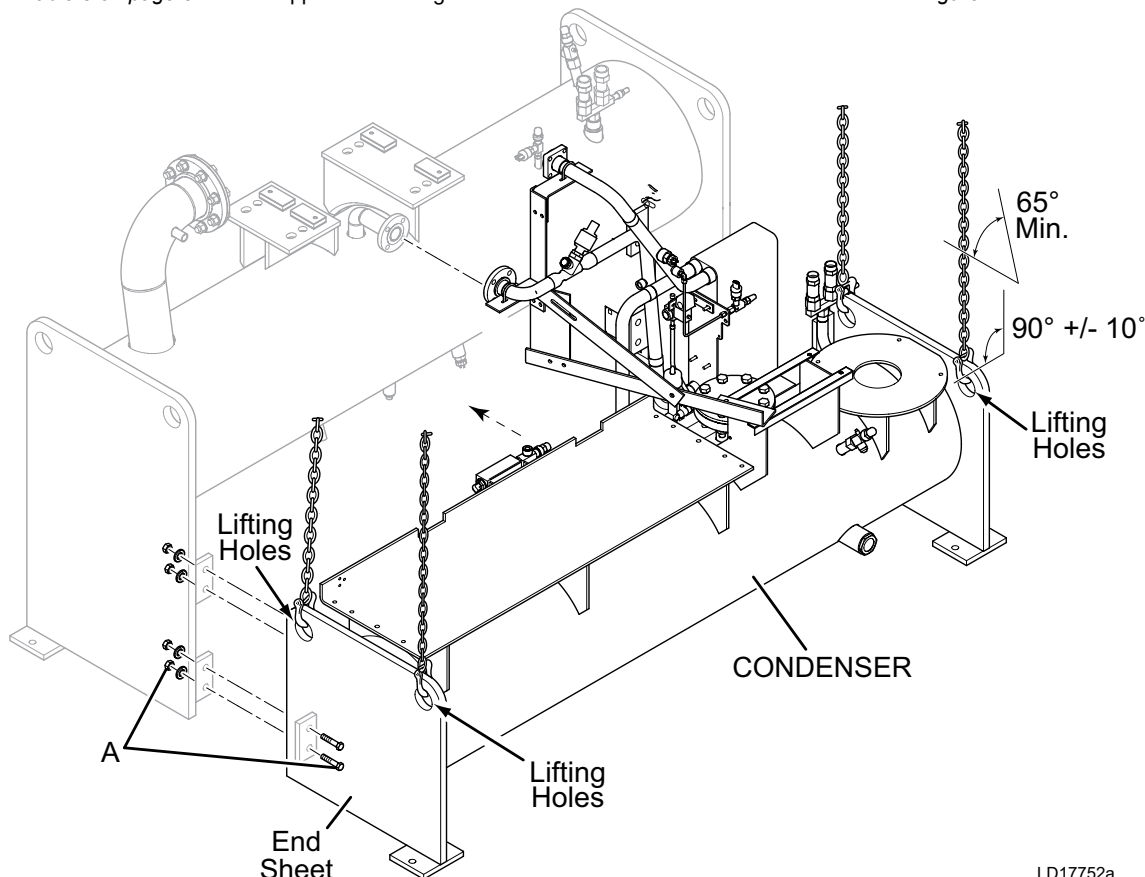
Use the following instructions to level the evaporator and condenser in both directions within 1/4 in. (6 mm).

1. Check the alignment of the shell by placing a level on the top of the shell, next to the discharge connection.
2. Check the alignment by placing a level on the tops of both end sheets.

TABLE 6 - CONDENSER DIMENSIONS, IN. (MM)

SHELL CODE (PIN 7)	LENGTH	WIDTH	HEIGHT
B	96 (2438)	28.2 (716)	35.3 (896)
C	120 (3048)	28.2 (716)	35.3 (896)
D	144 (3658)	28.2 (716)	35.3 (896)

NOTE: See *Table 3* on page 31 for the approximate weight of the condenser. Waterboxes are not shown in *Figure 12*.



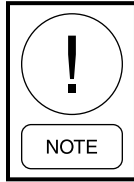
LD17752a

FIGURE 12 - CONDENSER RIGGING

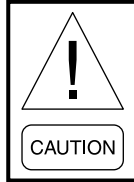
Installing the Pads or Spring Isolators

Use the following instructions to install the elastomeric pads or optional spring isolators as shown on page 36.

1. Attach the rigging chains from the overhead lift to the four lifting holes.



The lifting chains along the axis of the evaporator/condenser shells should not exceed 90° +/- 10°. A spreader bar may be required to achieve the +/- 10°.

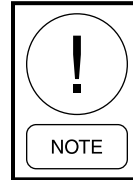


One chain is required per each lifting point.

Use lifting chains with working load limit each at least 40% of the total shell weight.

2. With an adequate lifting device lift the unit slightly off the ground to determine adjustments necessary to keep the unit level. Make adjustments as necessary to level the unit.

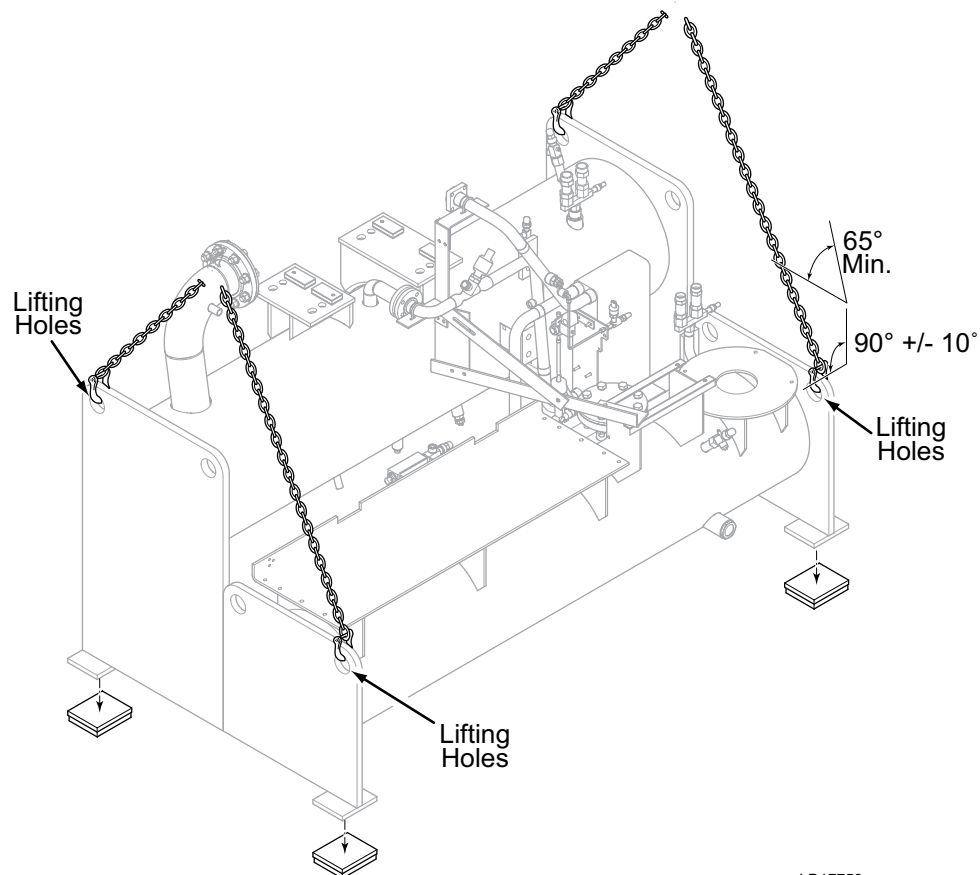
3. Lift the unit to provide adequate clearance to install the pads or spring isolators.



See Installing Elastomeric Vibrations Isolator Pads on Figure 9 on page 29, or Installing Optional Spring Isolators on page 30 for additional details.

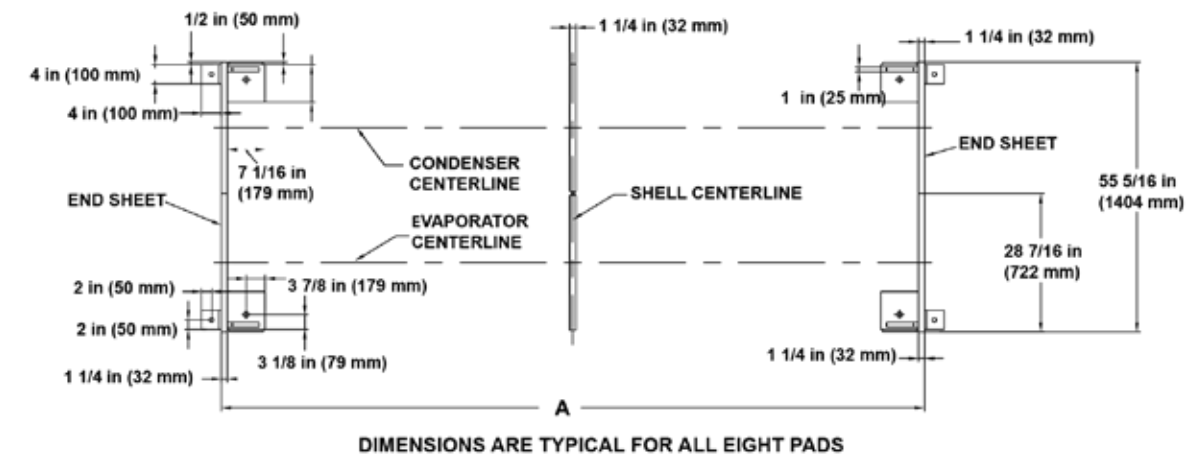
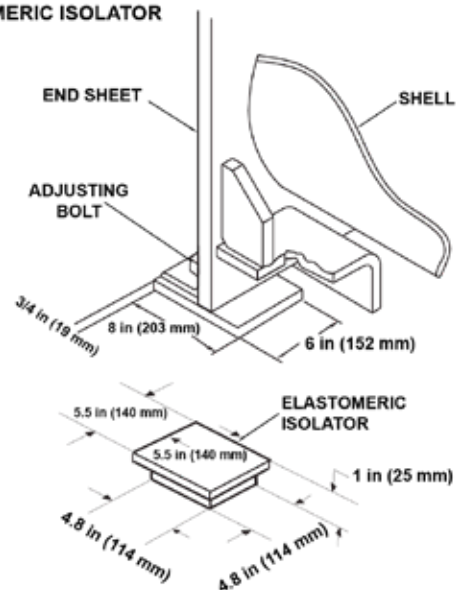
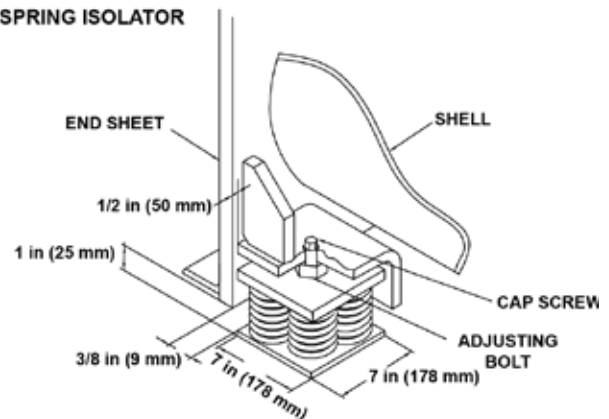
4. When the isolators are mounted, place the unit in the final location.

5. Verify the alignment is still within 1/4 in. (6 mm) tolerance. If the unit is not level within the amount specified, lift the chiller and place shims where needed to level within specification.



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FIGURE 13 - ISOLATOR INSTALLATION

**ELASTOMERIC ISOLATOR****SPRING ISOLATOR**

LD16471

FIGURE 12 - ISOLATOR INSTALLATION (CONT'D)

Installing the Heat Exchanger Piping

Use the following instructions after the temporary shipping brackets supporting the heat exchanger piping has been removed as shown in *Figure 14 on page 37*.

Connect the economizer heat exchanger liquid outlet pipes to the economizer on the evaporator, using the proper gaskets and hardware as shown in *Figure 15 on page 37*.

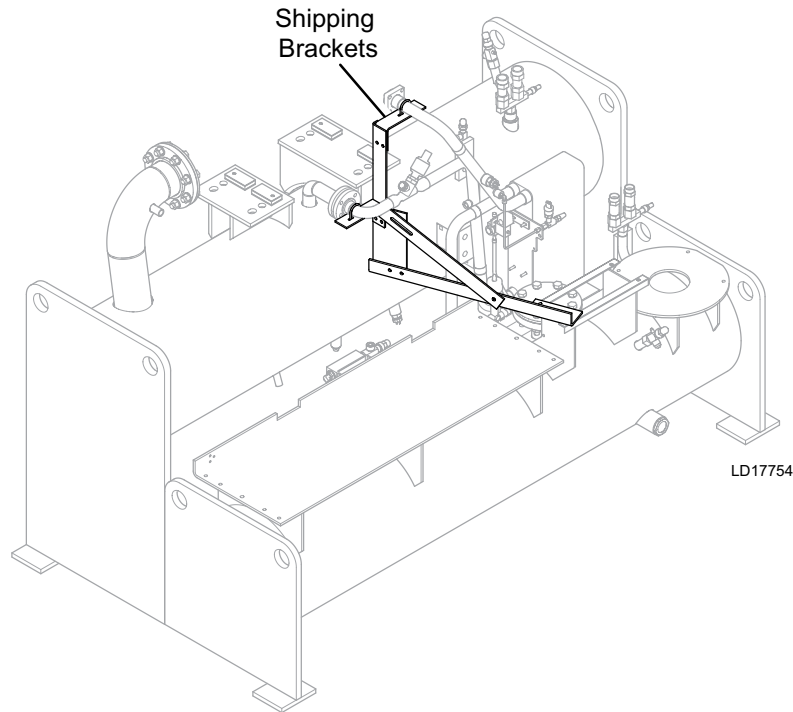
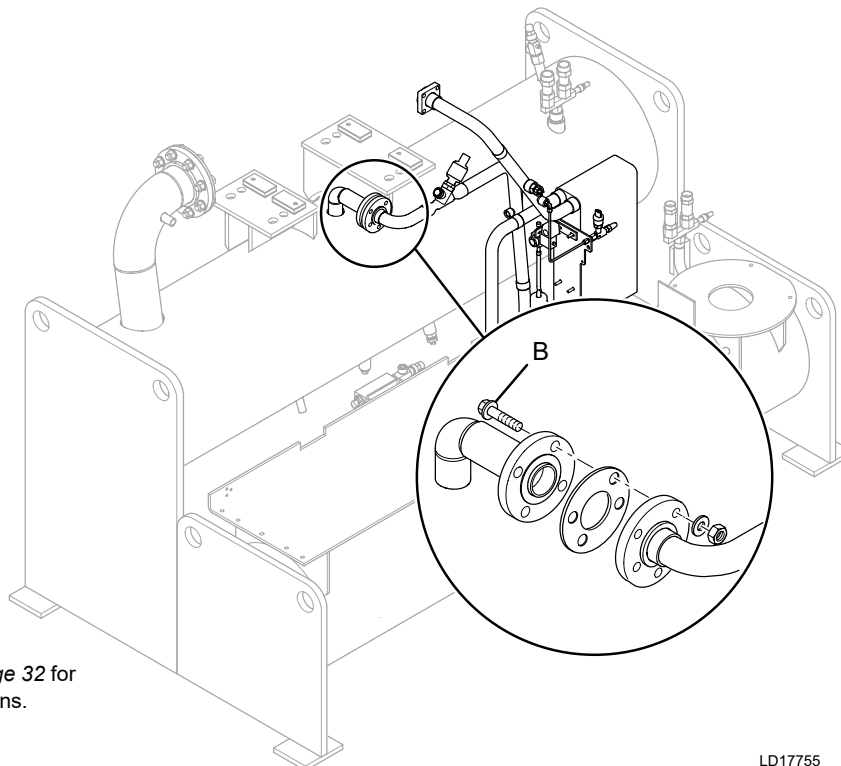


FIGURE 14 - HEAT EXCHANGER SHIPPING BRACKETS



See *Table 4 on page 32* for
Torque Specifications.

FIGURE 15 - HEAT EXCHANGER PIPES

Installing the Liquid Injection Piping

If equipped, install the optional liquid injection piping to the suction line on the evaporator and to the heat exchanger piping on each side of the chiller, using the proper o-rings and hardware as shown in *Figure 16 on page 38*.

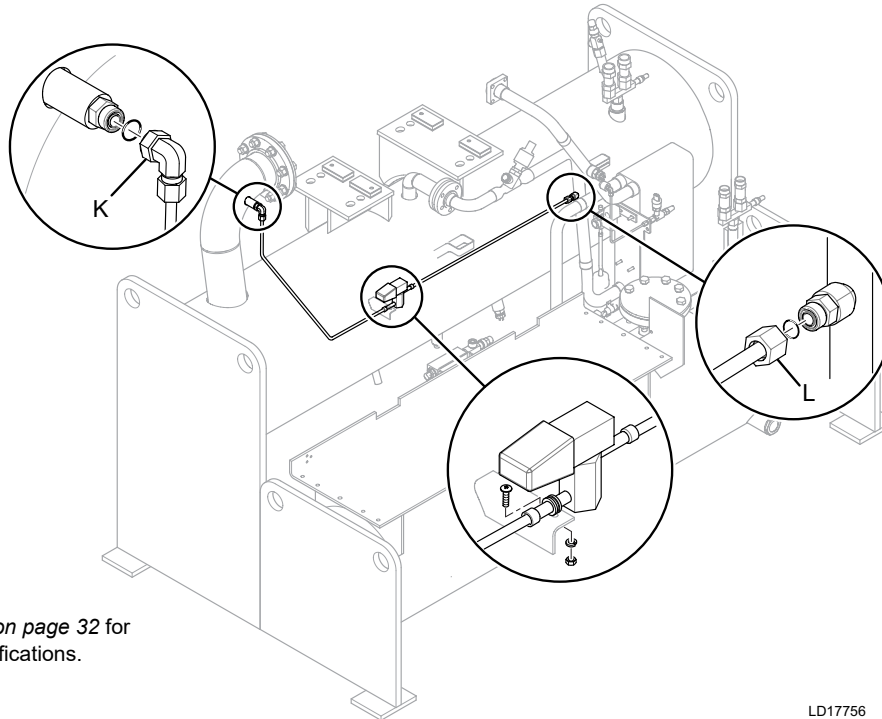


FIGURE 16 - LIQUID INJECTION PIPING

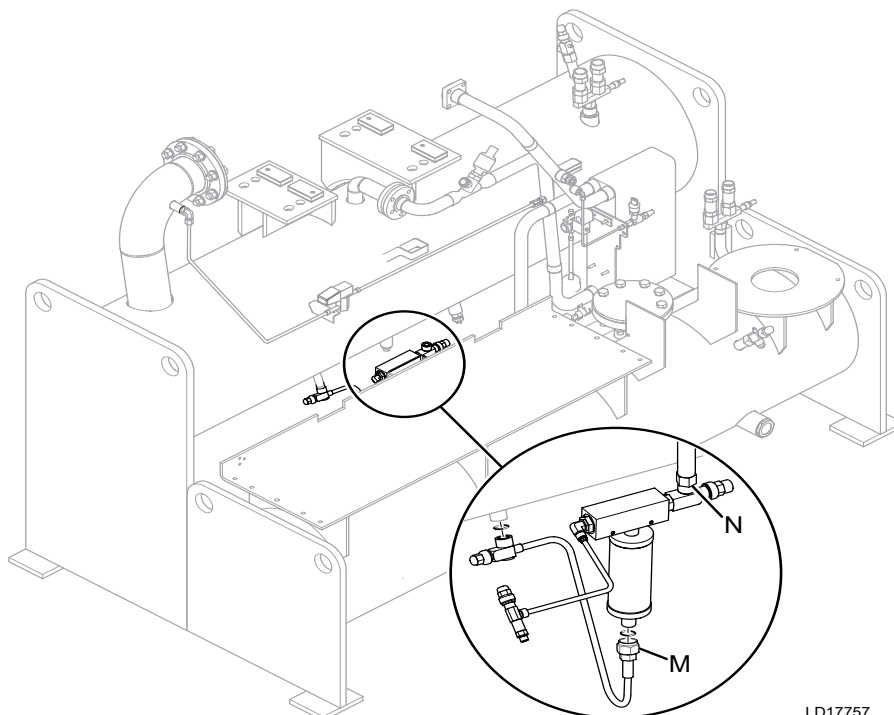
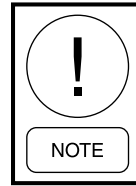


FIGURE 17 - FILTER DRIER AND PIPING

Installing Driveline Assembly

Use the following instructions to install the driveline (compressor/motor) assembly as shown in *Figure 18* on page 39.

1. Lift the compressor/motor assembly and remove packing materials. Clean all sealing surfaces.
2. Carefully lower the compressor/motor assembly onto the supports on the evaporator.
3. Install the suction gasket and loosely fasten the compressor to the suction line.
4. Loosely fasten the compressor/motor assembly to the supports on the evaporator with the proper hardware. Do not tighten the bolts until all connections are made to the compressor.



Specific shim pads will be bolted to the compressor supports to satisfy the alignment between the compressor and system piping.

Installing Economizer Piping to Compressor

Use the following instructions to install the piping to the compressor as shown in *Figure 18* on page 39.

1. Remove the shipping closures on the economizer pipes, and clean all sealing surfaces.
2. Lubricate and install the new o-ring on this piping at the compressor port end.

TABLE 7 - COMPRESSOR WEIGHT AND DIMENSIONS

PIN 9	COMPRESSOR SIZE (IN./MM)	WEIGHT (LB/KG)	LENGTH (IN./MM)	WIDTH (IN./MM)	HEIGHT (IN./MM)
F	5.7 (145)	1113 (505)	42 (1064)	18.9 (480)	18.3 (466)
G	5.9 (151)	1405 (637)	46 (1168)	18.9 (480)	19.03 (483)

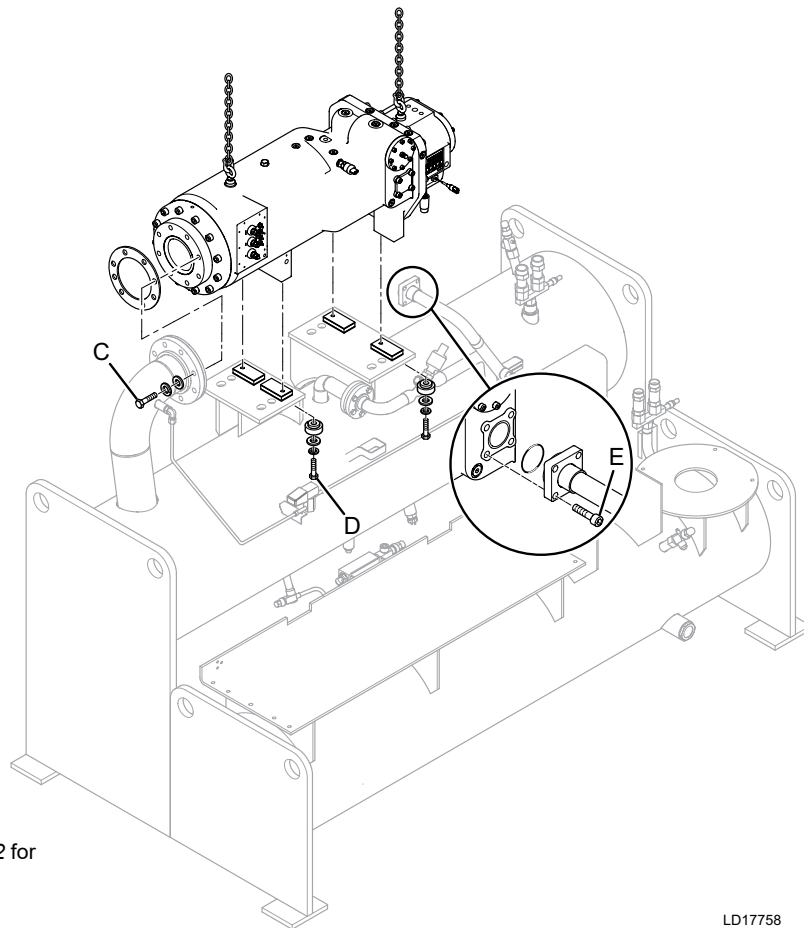


FIGURE 18 - DRIVELINE (COMPRESSOR/MOTOR) ASSEMBLY

Installing Oil Separator

Use the following instructions to install the oil separator, as shown in *Figure 19 on page 41*.

1. Attach the rigging chains from the overhead lift to the two lifting holes on top of the oil separator.
2. Remove all cover closures from the oil separator flanges and wipe all connection surfaces clean.
3. Install the oil separator isolator pads.
4. Lower the oil separator carefully, keeping it level to the mounting isolators on the condenser shell.
5. Align the oil separator inlet connection with the expected location of the compressor discharge and the mounting holes in the pad on the condenser shell.
6. Loosely fasten the oil separator to the condenser shell mounting pad through the isolators, using the correct hardware.

Installing Discharge Muffler Line

Use the following instructions to install the discharge line as shown in *Figure 19 on page 41*

1. Lift the line (with muffler) and remove the packing materials. Clean all sealing surfaces.

2. Bolt the line to the flange on the oil separator and to compressor discharge using the proper gaskets and hardware.
3. Align the flanges between compressor, suction, oil separator, and condenser using the proper torque sequence and values. Make sure that all flanges are parallel and give even gasket compression.

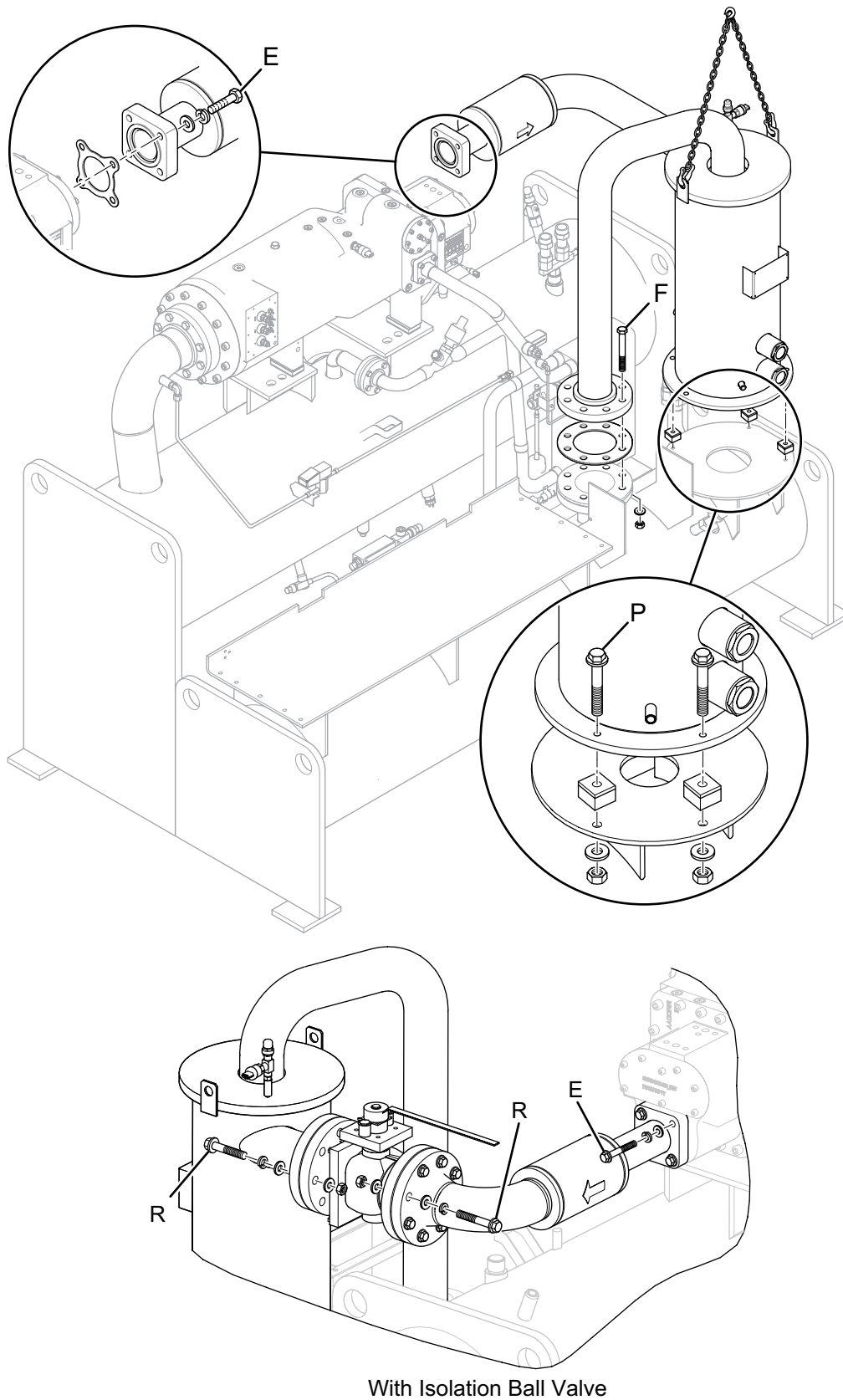
Installing Oil Separator Discharge Piping

Use the following instructions to install the discharge piping as shown in *Figure 19 on page 41*.

1. Remove the shipping covers from the flanges, clean all sealing surfaces.
2. If the unit is equipped with an isolation valve, place a gasket on the condenser flange, set the valve on top of the gasket, and place another gasket on top of the isolation valve.
3. Install the the discharge piping from the oil separator outlet to the isolation valve face. Use the proper gaskets at the flanges. Loosely bolt the flanges, so final fit-up can be done to the compressor.

TABLE 8 - OIL SEPARATOR WEIGHT AND DIMENSIONS ON SINGLE COMPRESSOR UNITS

COMPRESSOR (PIN 9)	WEIGHT (LB/KG)	LENGTH (IN./MM)	WIDTH (IN./MM)
F & G	340 (155)	36 (914)	22.4 (569)

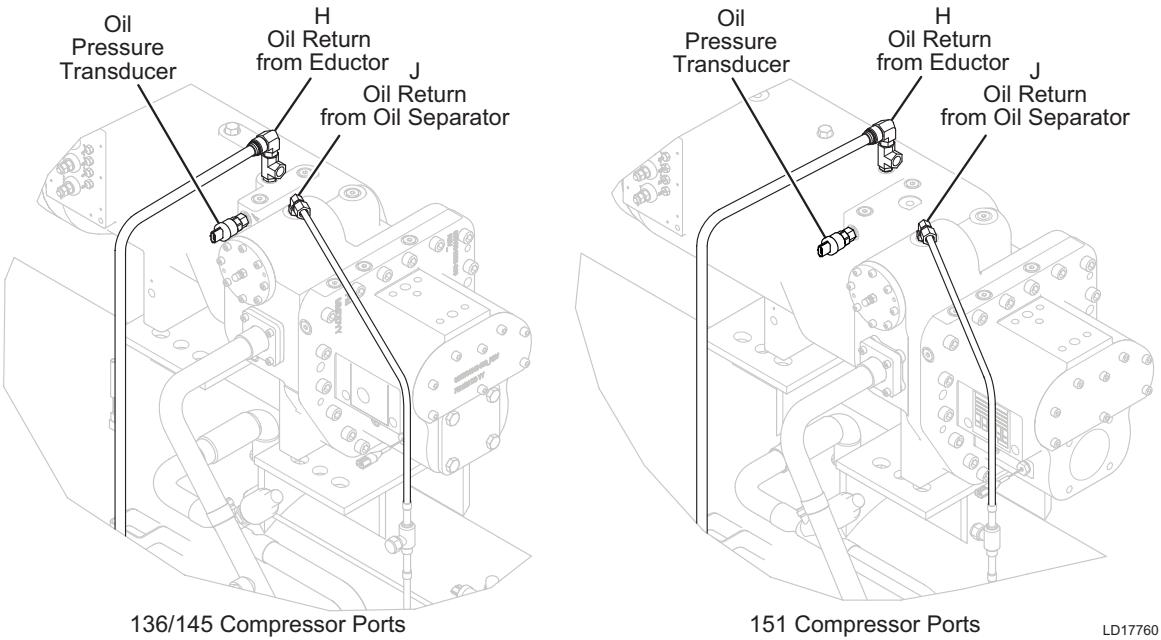


With Isolation Ball Valve

See Table 4 on page 32 for Torque Specifications.

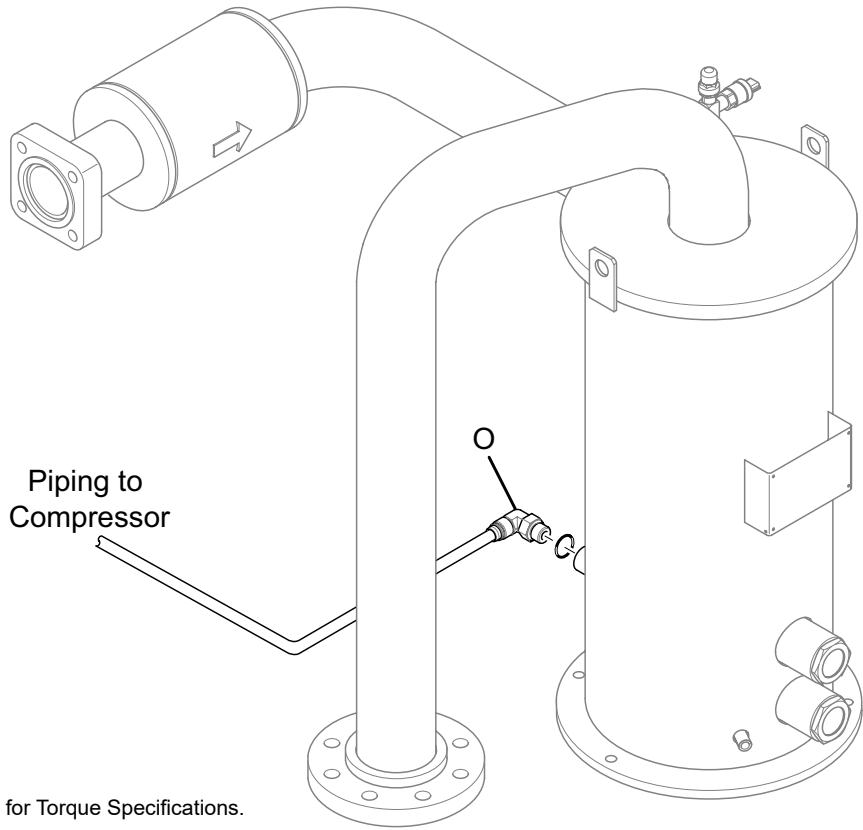
LD17759

FIGURE 19 - OIL SEPARATOR DISCHARGE PIPING ON SINGLE COMPRESSOR UNITS



See Table 4 on page 32 for Torque Specifications.

FIGURE 20 - TRANSDUCER, EDUCTOR AND OIL RETURN PIPING



See Table 4 on page 32 for Torque Specifications.

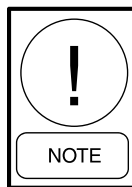
FIGURE 21 - OIL SUPPLY PIPING

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Installing Variable Speed Drive (VSD)

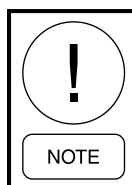
Use the following instructions to install the VSD as shown in *Figure 22 on page 44*.

1. Attach the rigging chains from the overhead lift to the two lifting holes (one at the top of each end) of the VSD.
2. Lift the VSD by means of an overhead lift to the condenser. Carefully lower the VSD onto the support on the condenser.



Use a spreader bar to ensure that the lifting chains do not bend the lifting tongs on the VSD.

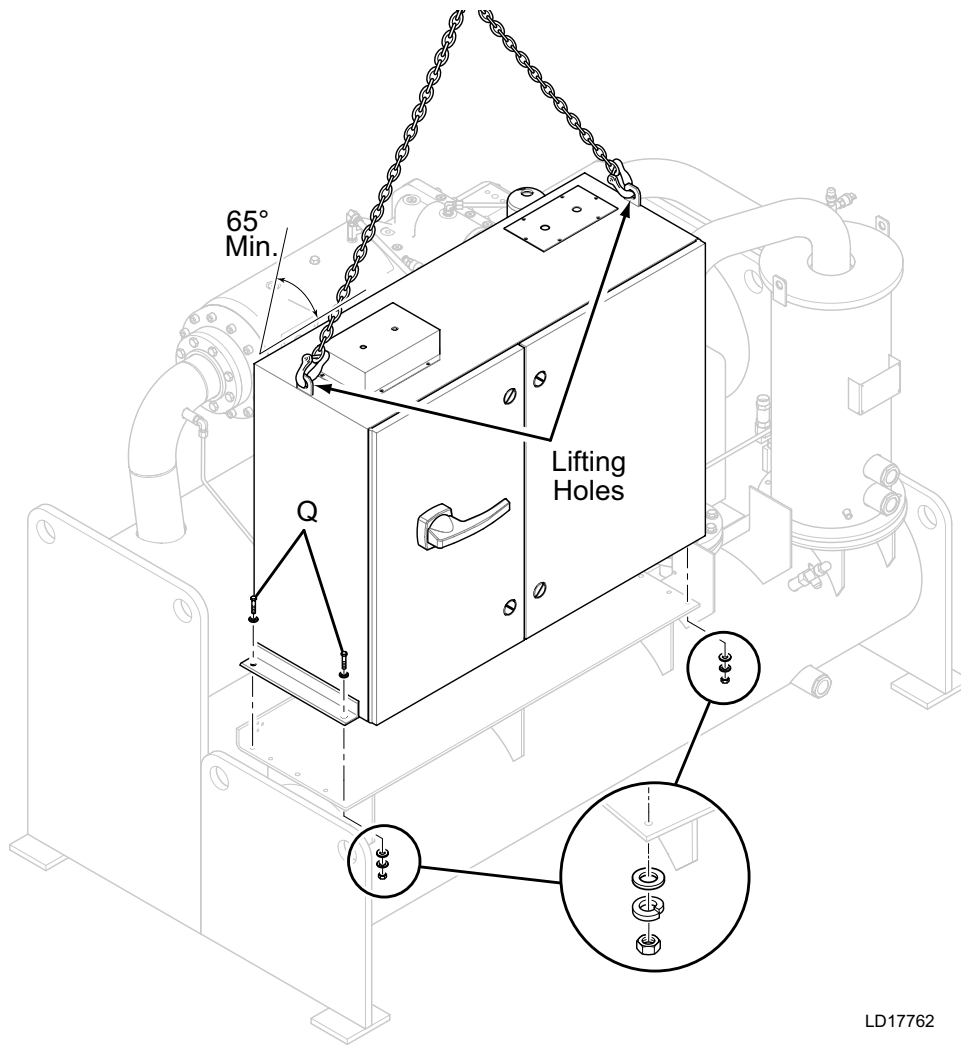
3. Install the VSD to the plate with the proper hardware.



Ensure that enough bare surface has been exposed for the VSD mounting plate to provide an electrical ground.

TABLE 9 - VSD WEIGHT AND DIMENSIONS

PIN 11	HARMONIC FILTER PIN 23	WEIGHT (LB/KG)	LENGTH (IN./MM)	WIDTH (IN./MM)	HEIGHT (IN./MM)
J	X	780 (354)	54 (1372)	19 (483)	41 (1041)
J	F	944 (429)	54 (1372)	19 (483)	41 (1041)
L	X	871 (396)	54 (1372)	19 (483)	41 (1041)
L	F	1101 (500)	54 (1372)	19 (483)	41 (1041)



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See Table 4 on page 32 for
Torque Specifications.

FIGURE 22 - VARIABLE SPEED DRIVE (VSD)

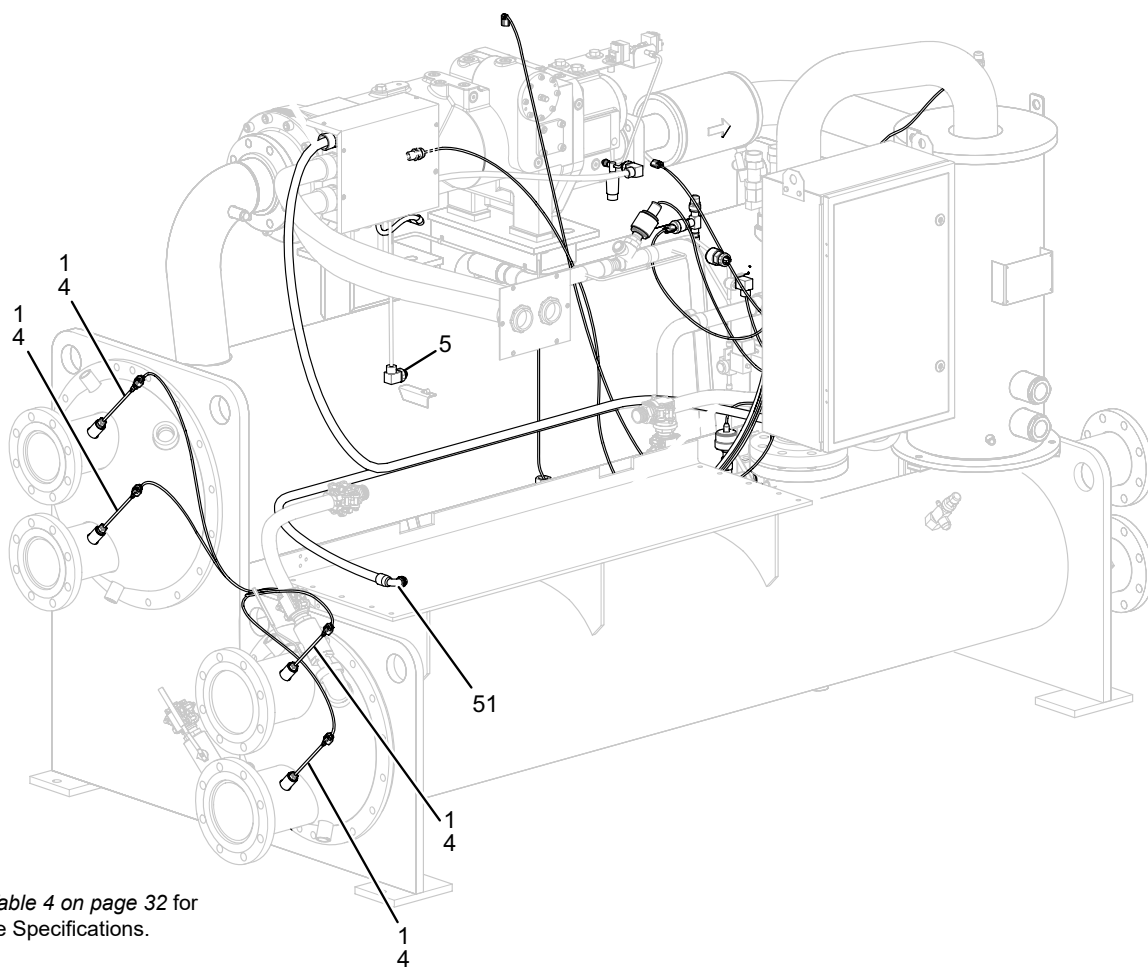
Installing Control Panel

Use the following instructions to install the Control Panel as shown in *Figure 23 on page 45*.

1. Attach the rigging chains from the overhead lift to the two lifting holes (one at the top of each end) of the Control Panel.
2. Lift the Control Panel by means of an overhead lift to the condenser. Carefully lower the Control Panel onto the support on the condenser.
3. Install the Control Panel to the plate with the proper hardware.

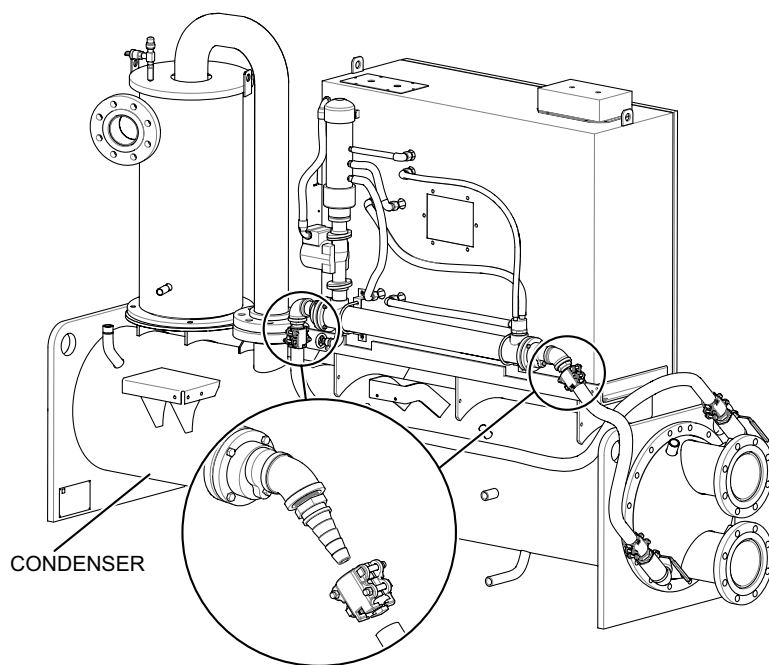
Connecting VSD Cooling Hoses

Connect the cooling hoses from the VSD to the water-boxes on both ends of the heat exchanger as shown in *Figure 24 on page 45*.



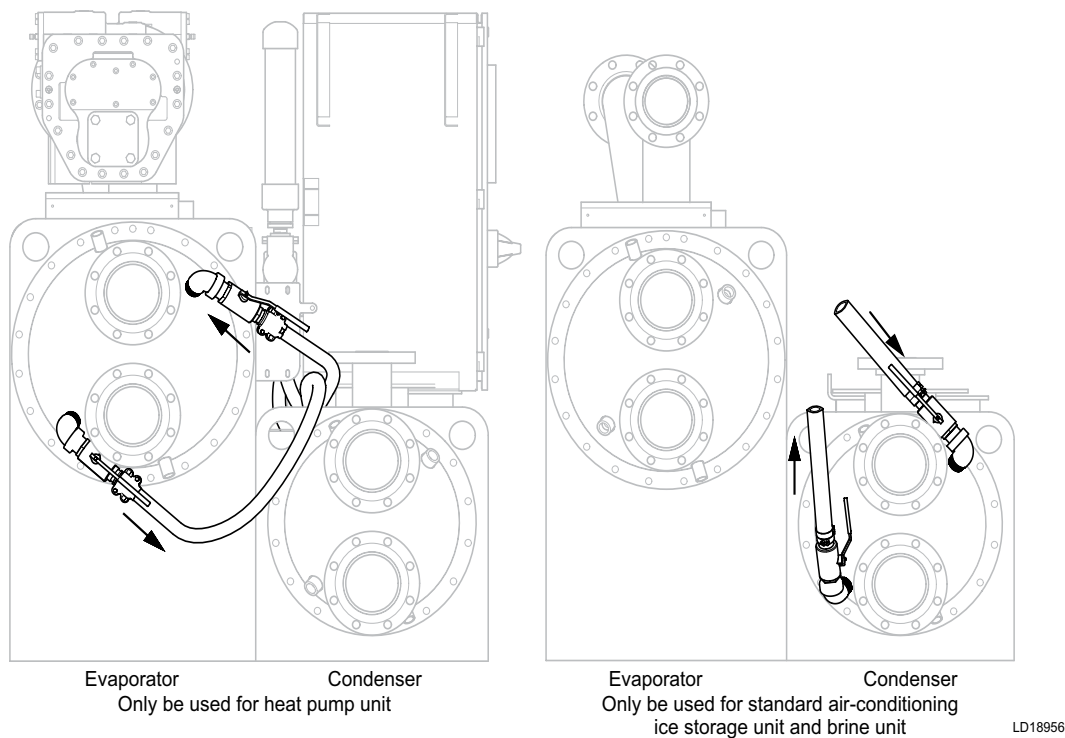
See Table 4 on page 32 for
Torque Specifications.

FIGURE 23 - CONTROL PANEL



LD17763

FIGURE 24 - VSD COOLING HOSES

**FIGURE 25 - ALTERNATE PIPING FOR VSD****TABLE 10 - ASSEMBLY COMPOUNDS**

LOCTITE GRADE	DESCRIPTION	ESG P/N	CONTAINER SIZE
243	Blue Threadlocker Studs, Threadlocking, Flare fittings	013-01678-000	50 mL
554	Red Refrigerant Sealant Pipe Threads – Permanent, Refrigerant service	013-03089-000	10 mL
		013-02894-000	250 mL
565	White Thread Sealant Pipe Threads – Non-permanent, refrigerant service Pipe Threads –Water or coolant service	013-02023-000	250 mL
		013-03090-000	50 mL
7070	Cleaner	013-02899-000	16 oz
N7649	General Purpose Primer	013-02982-000	1 gal
		013-01753-000	1.75 oz

PIPING JOINT ASSEMBLY

Assembly of Fasteners and Piping

PIPE THREAD JOINTS

Use the following information to add primer to the pipe thread joints.

1. Use primer with dissimilar metals.
2. Use primer on both male and female components of pipe threads 3 in. (25 mm) and larger.
3. A small amount may be placed on the threads of the male portion of the fitting.
4. Use primer on both male and female components of pipe threads 2 in. (25 mm) and larger.
5. Loctite 554 is to be used on all pipe thread fittings with the following exceptions: straight thread O-ring fittings, and refrigerant level sensors.
6. Refrigerant level sensors require Loctite 565.
7. Care must be taken to not use excessive material, which may result in unnecessary contamination of the refrigeration system.

PROCEDURES

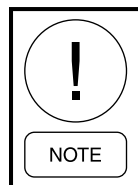
Cleaning

Clean the parts visually contaminated with oil, grease, or dirt with a generous spray of cleaner 7070. Wipe them dry with a clean towel while they are still wet.

Priming

Use the following steps to prime the joints.

1. If required, use N7649 general purpose primer. Primers are generally required when assembling dissimilar metals. In this case, apply primer to the inactive surface.
 - a. Active surfaces (Primer optional): Brass, copper, bronze, iron, soft steel, and nickel.
 - b. Inactive surfaces (Primer required): Aluminum, stainless steel, magnesium, zinc, black oxide, cadmium, titanium, and others.
2. After application, allow the primer to visibly dry (3-5 minutes) before assembling the joint.
3. Primer can also be used at the discretion of the facility to accelerate curing of sealer on any surface, which is often helpful in low temperature conditions.



Primer will accelerate the cure time for the sealant. Complete joint assembly quickly, if primer is used.

GASKET JOINTS

Assembling Gasket Joints

Use the following instructions to assemble the gasket joints.

1. Clean and lubricate all screw threads, unless plated, before tightening. All threaded fasteners (bolts, nuts or cap screws) shall be tightened per sequence shown in *Figure 26 on page 47* for an eight fastener joint. Use a similar sequence for joints with a greater number of bolts.
2. Apply the torque evenly in gradual increments until the required torque limit is reached, to make sure the proper amount is applied to the gasket loading.
3. Relaxation of the gasket after tightening, in a properly torqued gasketed joint, is expected. Before final testing and start-up, retighten the bolts for refrigerant joints to eliminate gasket relaxation.

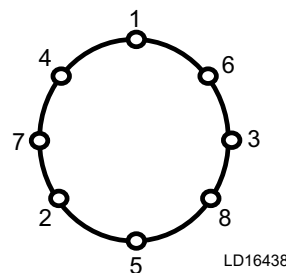


FIGURE 26 - TORQUE PATTERN

TABLE 11 - ANSI 150 LB FLANGE TORQUE SPECIFICATIONS

NOM. SIZE (IN.)	BOLT SIZE (IN.)	QUANTITY	APPLIED TORQUE IN FT-LB		APPLIED TORQUE IN NM	
			MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
1-1/4	1/2-13	4	24	108	33	146
1-1/2	1/2-13	4	32	120	43	163
5	3/4-10	8	110	415	149	563

TABLE 12 - ANSI 300 LB FLANGE TORQUE SPECIFICATIONS

NOM. SIZE (IN.)	BOLT SIZE (IN.)	QUANTITY	APPLIED TORQUE IN FT-LB		APPLIED TORQUE IN NM	
			MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
3-1/2	3/4-10	8	97	329	132	446
4	3/4-10	8	122	417	165	565

NOTE: Torque > 1000 use value plus 10% for range.

Torque Values

All threaded fasteners shall be torqued to the values shown in *Table 13 on page 48* for the appropriate bolt materials and gaskets. Values are applicable only to fiber reinforced, graphite impregnated, teflon, spiral, jacketed and solid metal gaskets. Cork and low seating stress gaskets, below 150 psi (1034kPA), are normally over-bolted and require less torque.

Sealing of the joints, utilizing bulb gaskets, requires control of the gasket squeeze. For a gasket extending 3/8 in. above the groove, the squeeze is limited by maintaining the gap between the surfaces at 3/6 in. +/- 1/16 in. Use the same torque for metal-to-metal contact outside of the bolt circle. Use the same torque for O-ring gaskets.

REFRIGERANT TUBING REASSEMBLY

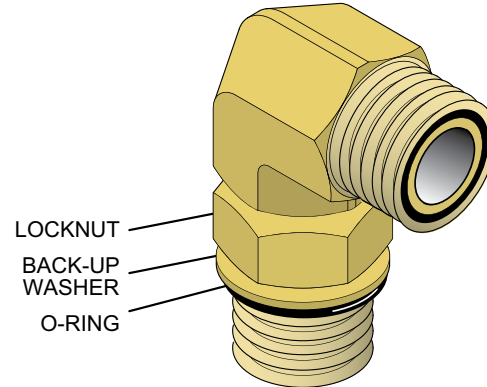
The following is a step-by-step procedure to be used to reassemble the chiller refrigerant piping.

Assembly of Straight Thread O-ring Port Fittings

The male and female ends of SAE and ISO 6149 straight thread O-ring ports have UN/UNF or metric straight threads. An elastomeric O-ring is fitted to the male end. During assembly, the O-ring is firmly sandwiched between the angular sealing surface of the female port and the shoulder of the male end.

Sealing is thus affected and maintained by the O-ring compression which results from the clamping force generated by tightening. The straight threads do NOT offer sealing action; they provide the resistance (holding power) for service pressure.

Adjustable End Assembly



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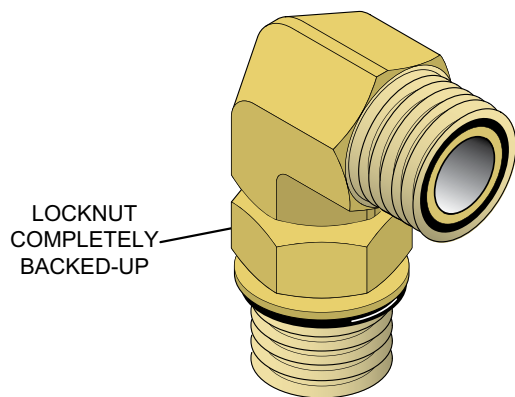
FIGURE 27 - ADJUSTABLE END FITTING

1. Inspect to ensure that both matching parts are free of burrs, nicks, scratches or any foreign particles.
2. Install O-ring on port end of fitting, if it is NOT pre-installed, take care NOT to nick the O-ring.
3. Lubricate O-ring with a light coat of synthetic Polyolester (POE) oil or POE grease.

TABLE 13 - SAE J429 GR 5 BOLTS TORQUE SPECIFICATIONS

HI-STRESS HEAVY DUTY NUTS													
BOLT SIZE (IN)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2
Threads/in.	13	11	10	9	8	8	8	8	8	8	8	8	8
Thread Root Area	0.126	0.202	0.302	0.419	0.551	0.728	0.929	1.155	1.405	1.680	1.980	2.304	2.652
LUBRICATION STATUS BOLT TORQUE - TORQUE STATED IN FT-LB													
BOLT SIZE (IN)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2
Threads & Surface	20-30	40-50	55-65	90-105	140-160	190-210	270-305	375-420	500-555	—	—	—	—
Threads only	25-35	45-55	65-75	105-120	165-185	220-245	315-350	430-470	575-635	—	—	—	—
Dry - No lubricant	35-45	60-70	90-105	145-165	220-245	295-330	420-465	575-635	770-850	—	—	—	—

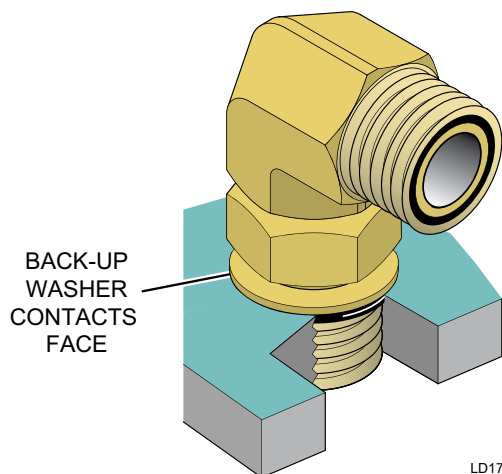
Back off locknut as far as possible. Make sure back-up washer is NOT loose and is pushed up as far as possible. This ensures the O-ring is completely at the back of the land so it remains in the land area when the fitting is turned out at Step 6.



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FIGURE 28 - BACK OFF LOCKNUT

4. Screw fitting into port until the back-up washer contacts the face of the port. Light wrenching may be necessary.

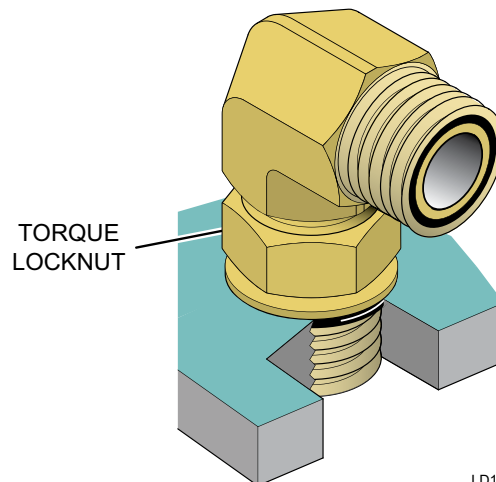


LD17271

FIGURE 29 - SCREW FITTING INTO PORT

5. To align the tube end of fitting to accept incoming tube or hose assembly, unscrew by required amount, but NOT more than one full turn. More than one turn makes the locknut push the O-ring into the machine threads beyond the fitting land area during step 7.
6. Using two wrenches, hold fitting in required position and tighten locknut to the appropriate torque value shown in *Table 14 on page 50 or Table 15 on page 51*.

7. Inspect to ensure that O-ring is NOT pinched and the back-up washer seats flat on face of port.

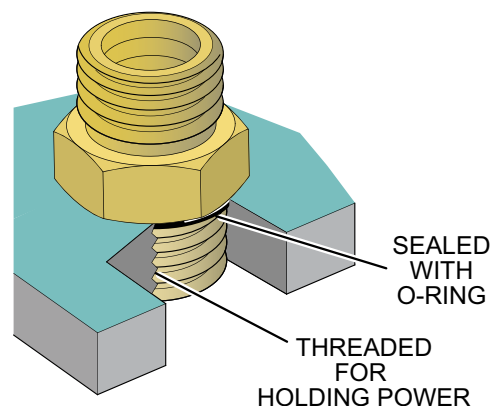


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FIGURE 30 - TORQUE FITTING

Straight Non-Adjustable End Assembly

1. Inspect to ensure that both matching parts are free of burrs, nicks, scratches or any foreign particles.
2. Install O-ring on port end of fitting, if it is NOT pre-installed, use care NOT to nick the O-ring.
3. Lubricate O-ring with a light coat of synthetic Polyolester (POE) oil or POE grease.
4. Screw fitting into port until the hex flat contacts the port face. Light wrenching may be necessary.
5. Tighten to give torque for the specified size as specified in *Table 14 on page 50 or Table 15 on page 51*.



LD17273

FIGURE 31 - SAE OR ISO 6149 STRAIGHT THREAD O-RING PORT

Assembly of O-ring Face Seal Fittings

The male end and female nut of face seal fittings have UN/UNF straight threads. An elastomeric O-ring is fitted into the grooved male end. During assembly, the O-ring is firmly sandwiched between the sealing surfaces. Sealing is thus affected and maintained by the O-ring compression which results from the clamping force generated by tightening the nut. The straight threads do NOT offer sealing action; they provide the resistance (holding power) for service pressure.

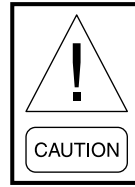
O-ring Face Seal Assembly

1. Inspect to ensure that both matching parts are free of burrs, nicks, scratches, or any foreign particles.
2. Install O-ring in grooved face seal end of fitting, if it is NOT pre-installed, use care NOT to nick the O-ring.
3. Lubricate O-ring with a light coat of synthetic Polyolester (POE) oil or POE grease.
4. Thread the nut by hand, and tighten nut to the appropriate torque value shown in *Table 14 on page 50* or *Table 15 on page 51*.

TABLE 14 - ASSEMBLY TORQUE METRIC FOR METRIC TUBE FITTINGS

FITTING SIZE	PORT THREAD SIZE	TORQUE	
		FT-LB	N-M
M10	M10 x 1	17	23
M12	M12 x 1.5	24	33
M14	M14 x 1.5	34	46
M16	M16 x 1.5	46	63
M18	M18 x 1.5	61	83
M22	M22 x 1.5	94	127
M27	M27 x 2	139	189
M30	M30 x 2	167	226
M33	M33 x 2	194	263
M42	M42 x 2	265	359
M48	M48 x 2	302	410
M60	M60 x 2	359	487

BRAZED JOINTS



For personnel safety: Do not perform any brazing or heat working unless the refrigerant is removed and inert gas is installed into the system.

Assembling Brazed Joints

Tubing ends shall be cut square to permit full insertion into the female part of the joint, shall have circular cross-section and shall be free of flat spots, dents, or wrinkles. Fitting cups shall be circular cross-section and free of flat spots. Joint insertion depth shall conform to dimensions shown in *Table 16 on page 51* except for butt joints using filler metal suitable for a butt joint.

TABLE 15 - O-RING ASSEMBLY TORQUE SPECIFICATIONS

TUBE SIZE (IN.)	SAE STRAIGHT THREAD SIZE (O-RING P/N)	SAE STRAIGHT THREAD TORQUE (FT-LB)	FACE SEAL TUBE-SIDE THREAD SIZE (O-RING P/N)	FACE SEAL TUBE-SIDE TORQUE (FT-LB)
1/4	7/16-20 (028-12961-001)	25	9/16-18 (028-12961-011)	18
3/8	9/16-18 (028-12961-003)	35	11/16-16 (028-12961-012)	30
1/2	3/4-16 (028-12961-004)	60	13/16-16 (028-12961-013)	40
5/8	7/8-14 (028-12961-005)	100	1-14 (028-12961-014)	60
3/4	1 1/16-12 (028-12961-006)	135	1-3/16-12 (028-12961-015)	85
1	1 5/16-12 (028-12961-008)	200	1-7/16-12 (028-12961-016)	110
1 1/4	1 5/8-12 (028-12961-017)	250	1-11/16-12 (028-12961-022)	140
1 1/2	1 7/8-12 (028-12961-020)	305	2-12-UN2A (028-12961-019)	180
**	2 1/4-12 (028-12961-036)	225	—	—

TABLE 16 - BRAZED JOINTS

ACTUAL O.D. TUBE SIZE (IN.)	MALE END			FEMALE END		
	OUTSIDE DIAMETER A (IN.)		LENGTH K (IN.)	INSIDE DIAMETER F (IN.)		DEPTH G (IN.)
	MINIMUM	MAXIMUM	MINIMUM	MINIMUM	MAXIMUM	MINIMUM
1/4	0.248	0.251	0.38	0.252	0.256	0.31
3/8	0.373	0.376	0.38	0.377	0.381	0.31
1/2	0.497	0.501	0.44	0.502	0.506	0.38
5/8	0.622	0.626	0.56	0.627	0.631	0.50
3/4	0.747	0.751	0.69	0.752	0.756	0.62
7/8	0.872	0.876	0.81	0.877	0.881	0.75
1 1/8	1.122	1.127	0.97	1.128	1.132	0.91
1 3/8	1.372	1.377	1.03	1.378	1.382	0.97
1 5/8	1.621	1.627	1.16	1.628	1.633	1.09
2 1/8	2.121	2.127	1.41	2.128	2.133	1.34
2 5/8	2.621	2.627	1.53	2.268	2.633	1.47
3 1/8	3.121	3.127	1.72	3.128	3.133	1.66
3 5/8	3.621	3.627	1.97	3.628	3.633	1.91
4 1/8	4.121	4.127	2.22	4.128	4.133	2.16
5 1/8	5.121	5.127	2.72	5.128	5.133	2.66
6 1/8	6.121	6.127	3.22	6.128	6.133	3.09
8 1/8	8.119	8.127	4.09	8.128	8.133	3.97

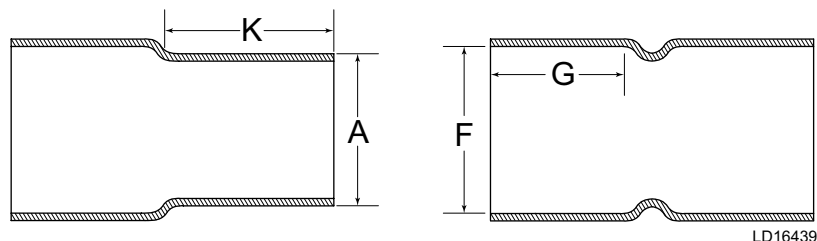


FIGURE 32 - BRAZED JOINTS

PIPING CONNECTIONS

After the unit is leveled (and wedged in place for optional spring isolators) the piping connections may be fabricated. Arrange the piping with offsets for flexibility, and are adequately supported and braced independently of the unit to avoid strain on the unit and vibration transmission. Hangers must allow for alignment of pipe. Isolators (by others) in the piping and hangers are highly desirable, and may be required per specifications.

CHECK FOR PIPING ALIGNMENT

When piping is complete, check for alignment. Open a connection in each line, as close to the unit as possible, by removing the flange bolts or coupling. If any bolt is bound in its hole, or if the connection springs are out of alignment, correct the misalignment by properly supporting the piping or by applying heat to anneal the pipe.

It may be necessary to weld chilled or condenser water piping directly to the water pipe nozzles. Since chilled and condenser water temperature sensor wells are often in close proximity to these connection points, sensors in the wells may often see temperatures of several hundred degrees, which can potentially damage them. Establish a good clean welding ground connection near the point of weld to prevent stray current from damaging other sensors or chiller control wiring. Any damage will likely show up as error in the sensor.



As a precautionary measure, remove the sensors from the wells during the welding process. If the sensor is removed, make sure that it bottoms out when it is placed back in the well.

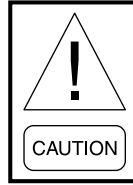


If the piping is annealed to relieve stress, clean the scale out of the pipe before it is bolted in place.

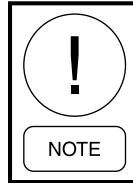
CONDENSER AND CHILLED LIQUID PIPING

General Requirements

The following piping recommendations are intended to ensure satisfactory operation of the unit. Failure to follow these recommendations could cause damage to the unit, and may invalidate the warranty.



The maximum flow rate and pressure drop for the condenser and evaporator must not be exceeded at any time. The liquid must enter the waterbox at the inlet connection, which is typically the lower connection.



A flow switch must be installed in the customer piping at the outlet of the cooler, and the condenser and wired back to the control panel, using shielded cable.

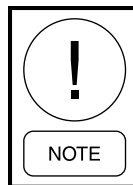
Arrange a straight run of piping of at least five pipe diameters on either side of the flow switch. The chilled liquid flow switch should be wired to Terminals 2 and 13 on the 1TB Terminal Block, and is required to prevent damage to the cooler caused by the unit operating without adequate liquid flow.

The condenser flow switch, which lets the chiller shut down to avoid excess head until flow is restored, should be wired to Terminals 2 and 12 on the 1TB Terminal Block.

The flow switches must have gold plated contacts for low voltage/current operation. Paddle type flow switches suitable for 150 psig (10 kPa) working pressure that have a one in NPT connection can be obtained from Quantech as an accessory for the unit. Alternatively, a differential pressure switch fitted across an orifice plate may be used, preferably of the high/low limit type.

The liquid pump installed in the piping systems should discharge directly into the unit. The pumps may be controlled by the chiller controls or external to the unit.

Piping and fittings immediately next to the chiller should be readily demountable to enable cleaning before operation, and to facilitate visual inspection of the exchanger nozzles.



The tubes must be protected by a strainer, preferably 40 mesh, and must fit as close as possible to the liquid inlet connection, and be provided with a means of local isolation.

The chiller must not be exposed to flushing velocities or debris released during flushing. Install a suitably sized bypass and valve arrangement to allow flushing of the piping system. The bypass can be used during maintenance to isolate the heat exchanger without disrupting flow to other units.

Connections

Thermometer and pressure gauge connections should be provided on the inlet and outlet connections of each cooler. Gauges and thermometers are not provided with the unit, and are to be furnished by others.

Drain and air vent connections should be provided at all low and high points in the piping to permit drainage of the system and to vent any air in the pipes.

Stop valves may be provided (by others) in the piping adjacent to the unit to facilitate maintenance.



Any debris left in the water piping between the strainer and evaporator could cause serious damage to the tubes in the chiller and must be avoided. Be sure the piping is clean before connecting it to the water-boxes. Keep nozzles and chilled liquid piping capped before installation to make sure construction debris is not allowed to enter.



Make sure that the water quality in circulation is adequate, without any dissolved gases, which can cause oxidation of steel or copper parts within the chiller.

Condenser Water Circuit

To properly operate the unit, condenser refrigerant pressure must be maintained above evaporator pressure. If operating conditions will fulfill this requirement, do not attempt to control condenser water temperature by means of automatic valves, cycling of the cooling tower fan, or other means. QWC4 chillers are designed to function efficiently when condenser water is allowed to seek its own temperature level at reduced loads, and at off-peak seasons of the year. QWC4 chillers can be operated with entering condensing water temperature that is less than design conditions.



Operating the chiller below its minimum ECW could result in low oil differential shutdowns. Different methods are used to maintain minimum ECW; however, the most effective method is to install a three-part bypass valve in the leaving condenser water line.



Operating below the minimum entering condensing water will not provide energy savings, and will result in oil management problems. However, if the entering water temperature can go below the required minimum, the condenser water temperature must be maintained equal to, or slightly higher than the required minimum.

Checking Piping Circuits and Venting Air

After the water piping is completed, but before any waterbox insulation is applied, tighten and torque the nuts on the liquid head flanges (to maintain between 30 ft-lb to 60 ft-lb (41 N•m to 81 N•m)). Gasket shrinkage and handling during transit may cause nuts to loosen. If water pressure is applied before this is done, the gaskets may be damaged and must be replaced. Fill the chilled and condenser water circuits, operate the pumps manually and carefully check the evaporator and condenser water heads and piping for leaks. Repair leaks as necessary.

WATER TREATMENT

The unit performance provided in the design guide is based on a fouling factor that is AHRI-specified. Dirt, scale, grease and certain types of water treatment will adversely affect the heat exchanger surfaces, and therefore the unit's performance.

Foreign matter in the water systems can increase the heat exchanger pressure drop, which can reduce the flow rate and can cause potential damage to the heat exchanger tubes.

Do not use aerated, brackish, or saltwater in the water systems. Consult a water treatment specialist to determine if the proposed water composition will adversely affect the evaporator materials of carbon steel and copper. The pH value of the water flowing through the evaporator must be kept between 7 and 8.5.

PIPEWORK ARRANGEMENT

Piping arrangement vary according to design and facility application. *Figure 33 on page 54* is a suggested piping arrangement for single unit installations. For multiple unit installations, each unit could be piped as shown below.

MINIMUM WATER VOLUME

Include as much water volume as possible in a chilled water loop, which increases the thermal mass and fly-wheel effect within the system. More water promotes stable water temperature control and increases reliability by reducing compressor cycling.

TABLE 17 - WATER VOLUME FOR APPLICATIONS

APPLICATION	GALLON/TON RATIO	L/KW Ratio
Air Conditioning	5–8 (min of 5)	5.5–8.8 (min of 3.3)
Process	7–11 (min of 7)	7.7–12.3 (min of 4.4)

Install a tank or increase pipe sizes to provide sufficient water volume.

TABLE 18 - EVAPORATOR AND CONDENSER WATER CAPACITY (GAL/L)

SHELL CODE	EVAPORATOR (PIN 5,6) GAL (L)		CONDENSER (PIN 7,8) GAL (L)	
BB	24	92	77	20
BC	27	103	87	23
BD	29	111	99	26
CB	29	111	93	25
CC	33	124	10	3
CD	36	135	121	32
DB	34	130	110	29
DC	39	146	126	33
DD	42	158	144	38

2 pass arrangement compact waterbox

LEAVING WATER TEMPERATURE OUT OF RANGE

The QWC4 chiller line has a maximum leaving water temperature of 60°F (15.6°C). Where process applications require a chilled water temperature higher than what the chiller provides, a simple piping change can fix the problem. By using a mixture of chiller-cooled water and returning process water, the chilled water entering the process can be held at the required temperature as shown in *Figure 34 on page 55*. A tank can also be used to meet high leaving liquid temperature requirements.

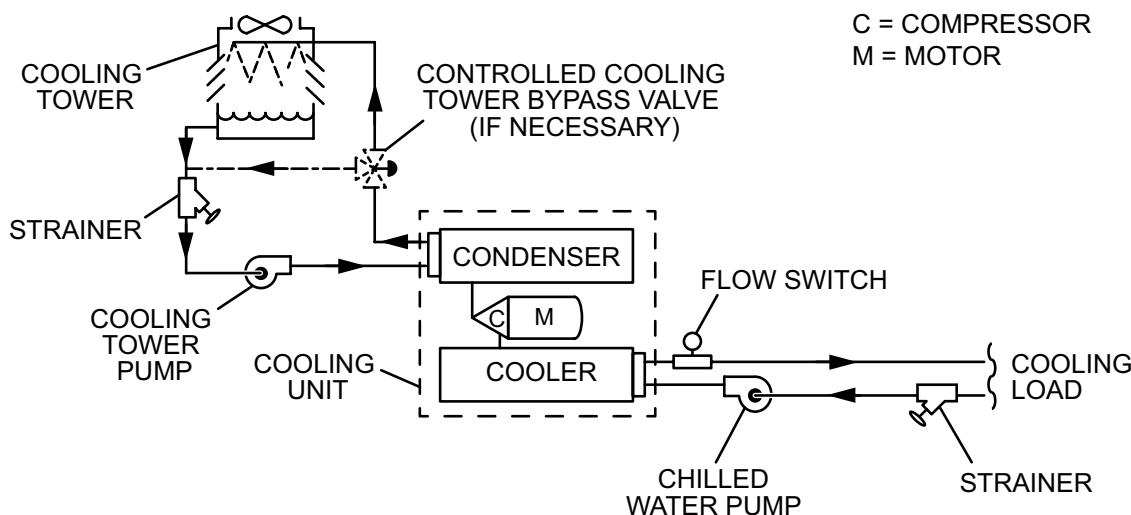


FIGURE 33 - SCHEMATIC OF A TYPICAL PIPING ARRANGEMENT

LD07069

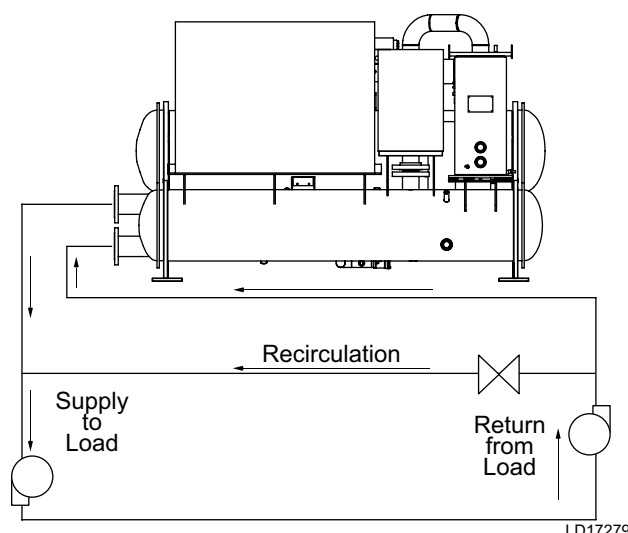


FIGURE 34 - LEAVING WATER TEMPERATURE OUT-OF-RANGE SUGGESTED LAYOUT

VARIABLE PRIMARY FLOW

Use a maximum 10% per minute flow rate of change, based on design flow, for variable primary flow applications. Provide 8 gal to 10 gal per chiller ton (8.6 L to 10.8 L per cooling KW) system water volume. Insufficient system volume and rapid flow changes can cause control problems or chiller shutdowns. There are many other design issues to evaluate with variable primary flow systems. Consult the Quantech Sales Office for more information about successfully applying QWC4 chillers.

NOZZLE CONNECTIONS

Standard chilled liquid connections on all coolers and condensers are the grooved type as shown in the following figure.

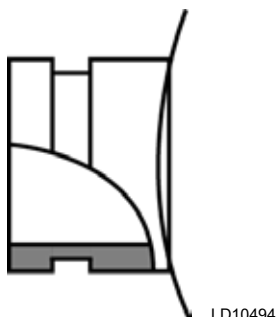


FIGURE 35 - GROOVED NOZZLE

OPTIONS FOR FLANGES

Two types of flanges may be fitted, depending on the customer or local pressure vessel code requirements as shown in *Figure 36 on page 55*. Weld flanges are supplied loose or ready-fitted; grooved adapters are supplied loose.

The flange dimensions are to ISO 7005 - NP10.

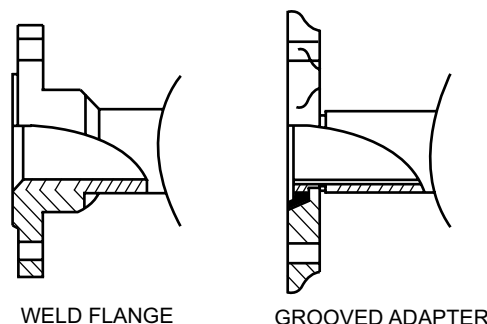


FIGURE 36 - FLANGE ATTACHMENT

REFRIGERANT RELIEF PIPING

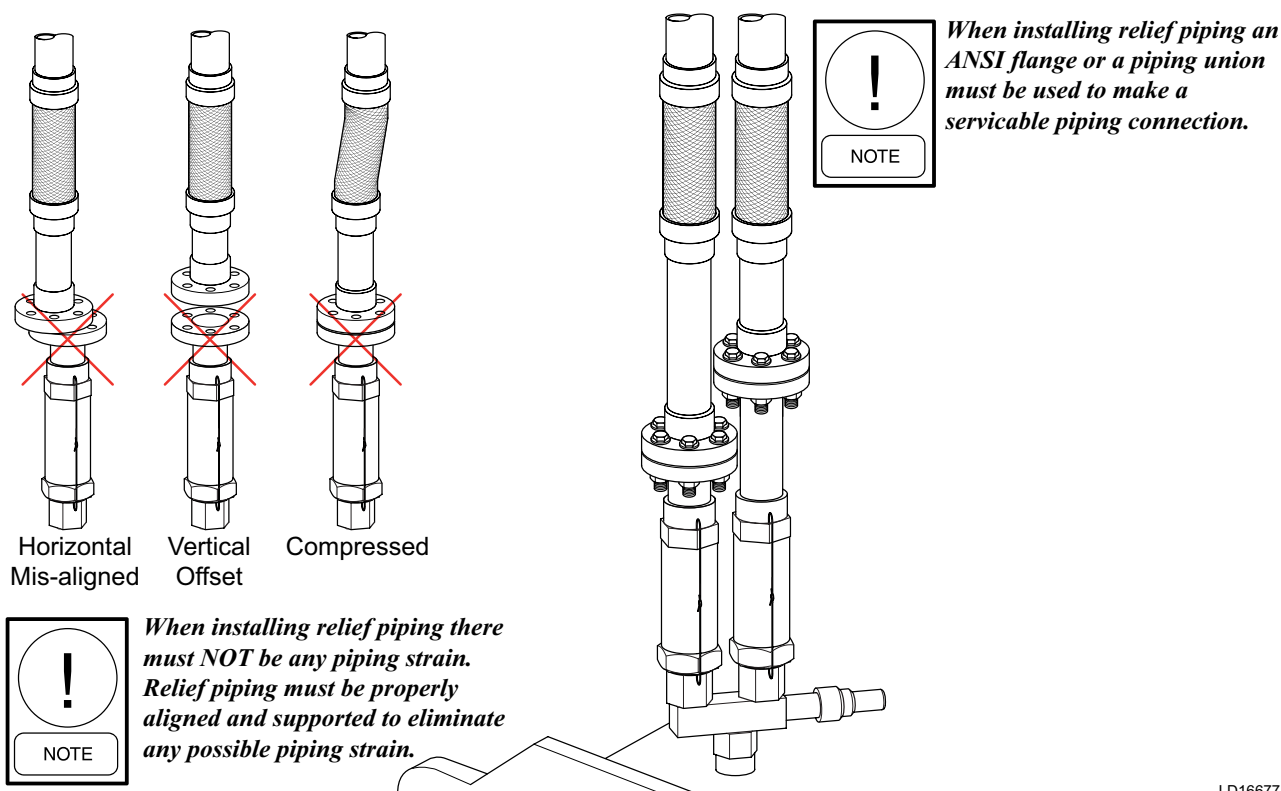
In case of an emergency, each unit is equipped with a relief valve on the evaporator, condenser and oil separator discharge line to quickly relieve excess pressure of the refrigerant charge to the atmosphere. The relief valves are furnished in accordance with the American Society of Heating, Refrigeration and Air Conditioning Engineers Standard 15 (ASHRAE 15) in North America, or PED code in Europe. Valve specifications are shown in *Table 19 on page 56*.

Refrigerant relief vent piping (by others), from the relief valves to the outside of the building, is required by code, and must be installed on all units as shown in *Figure 37 on page 56*. For additional information on relief valve discharge line sizing, refer to ASHRAE 15 Addendum 15C and 15D-2000, Section 9.7.8.5.

If relief piping is common to more than one valve, its cross-sectional area must be at least the total required by each valve. Valve types should not be mixed on a common pipe. Take precautions to make sure that the outlets of relief valves or relief valve vent pipes remain clear of obstructions at all times.



Piping must be properly supported to prevent any strain on relief valve mounting.

**FIGURE 37 - TYPICAL COMPONENTS OF RELIEF PIPING****TABLE 19 - REFRIGERANT RELIEF CHARACTERISTICS (PER VALVE)**

COMPONENT	DESIGN PRESSURE PSIG (BAR)	AIRFLOW CAPACITY LB/MIN (KG/S)	OUTLET CONNECTION
EVAPORATOR	235 (16.2)	55.9 (0.423)	1 in. NPTF
CONDENSER	235 (16.2)	55.9 (0.423)	1 in. NPTF
CONDENSER (HEAT PUMP OPTION)	388 (26.8)	90.3 (0.681)	1 in. NPTF

NOTES:

1. Dual relief valve consists of one three-way shut-off valve and two single relief valves. The valve configuration will not allow both valves to be shut off at the same time, and valves are sized such that each relief valve has sufficient discharge capacity when used alone, which permits safe removal of either relief valve for repair or replacement, while maintaining vessel protection.
2. Above information is for pressure vessels designed in accordance with ASME Boiler and Pressure Vessel Code.

UNIT PIPING

Compressor lubricant piping and system refrigerant piping are factory installed on all units shipped assembled. On units shipped dismantled, the lubricant piping and system oil return should be completed under the supervision of a Quantech representative, using furnished material.

ELECTRICAL CONNECTION

The following connection recommendations are intended to make sure the unit is operated safely. Failure to follow these recommendations could cause harm to persons or damage the unit, and may invalidate the warranty.



Do not mount additional controls (relays, etc.) in the control panel. Power and control wiring not connected to the control panel should not be run through the control panel. If these precautions are not followed, it could lead to a risk of electrocution. In addition, electrical noise could cause malfunctions or damage the unit and its controls.



After wiring the power connection, do not switch on main power to the unit. Some internal components are live when the main power is switched on, which must only be done by authorized persons familiar with starting, operating, and troubleshooting this type of equipment.

POWER WIRING

All electrical wiring should be carried out in accordance with local regulations. Route properly sized cables to cable entries on the unit.

In accordance with local codes, NEC codes, UL and CE standards, it is the user's responsibility to install over current protection devices between the supply conductors and the power supply terminals on the unit.

To ensure that no eddy currents are set up in the power panel, the cables forming the 3-phase power supply must enter via the same cable entry.



All sources of supply to the unit must be taken via a common point of isolation (not supplied by Quantech).

Use copper power wiring only for supplying power to the chiller. This is to avoid safety and reliability issues resulting from connection failure at the power connections to the chiller. Aluminum has thermal characteristics that may cause loose terminations resulting from the contraction and expansion of the wiring. Aluminum oxide may also build up at the termination, which may cause hot spots and eventual failure. If aluminum wiring is used to supply power to the chiller, install Al-Cu compression fittings to transition from aluminum to copper. Install the transition in an external box separate to the power panel. Run the copper conductors from the box to the chiller.



Caulk power and control wiring conduit entering the power panel to ensure that moist air from the building cannot enter the panel.

POWER SUPPLY WIRING

Units require one three-phase supply, plus earth. Connect:

- The three-phase supplies to the circuit breaker located in the panel.
- A suitably sized earth wire to the PE terminal in the panel.

115 VAC CONTROL SUPPLY TRANSFORMER

A 2-wire high voltage to 115 VAC supply transformer is standard in the chiller. This transformer is mounted in the cabinet and steps down the high voltage supply to 115 VAC to be used by the controls, VSD, feed and drain valve controller, valves, solenoids, heaters, etc.

The high voltage for transformer primary is taken from the chiller input. Fusing is provided for transformer.



Removing high voltage power to the chiller will remove the 115 VAC supply voltage to the control panel circuitry.

CONTROL WIRING

All control wiring utilizing contact closures to the control panel terminal block is nominal 115 VAC and must be run in shielded cable, with the shield grounded at

the panel end only, and run in water tight conduit. Run shielded cable separately from mains cable to avoid electrical noise pick-up. Use the control panel cable entry to avoid the power cables.

Voltage-Free Contacts

Voltage-free contacts connected to the panel must be suitable for 115 VAC 10 mA, for example, gold contacts. If the voltage-free contacts form part of a relay or contactor, the coil of the device must be suppressed using a standard R/C suppressor such as P/N 031-00808-000. The above precautions must be taken to avoid electrical noise, which could cause a malfunction or damage to the unit and its controls.

Chilled Liquid and Condenser Pump Starter

Terminals 23 and 24 on 1TB close to start the chilled liquid and/or condenser water pumps. This contact can be used as a master start/stop for the pumps in conjunction with the daily start/stop schedule.

Run Contact

Terminals 21 and 22 on 1TB close to indicate that a system is running.

Alarm Contacts

The system has a single voltage-free contact, which will operate to signal an alarm condition whenever any system locks out, or there is a power failure. To obtain the system alarm signal, connect the alarm circuit to voltage-free Terminals 25 and 26.

SYSTEM INPUTS

The circuitry for the following system inputs is a 115 VAC circuit. Contacts must be gold and rated for low current (5 mA). Connect the switches per instructions below. See *Table 20 on page 58* for the terminal connections.

Chilled Liquid Flow Switch

Connect this switch between Terminals 2 and 13 of 1TB to provide protection against loss of liquid flow, which will cause evaporator freeze-up, if the chiller is permitted to run.

Condenser Liquid Flow Switch

This switch is expected across Terminals 2 and 12 of 1TB to indicate loss of liquid flow, which can result in a rapid high head transient on the chiller.

Remote Run Permissive

A remote run permissive input is available and requires a dry contact to start and stop. Remote dry contacts are connected between Terminals 2 and 15 of 1TB. If remote run permissive is not used, place a jumper across the terminals to allow the system to run.

Remote Print

Closure of suitable contacts connected to Terminals 2 and 14 of 1TB will cause a hard copy of Operating Data/Fault History to be printed, if an optional serial printer is connected to the RS-232 port.

Optional Heat Pump Remote Mode Selection

A remote mode selection input is available when the chiller is purchased with heat pump option. If the option is enabled and remote mode selection is required, connect a switch across Terminals 10 and 41 of 1TB to switch between chiller and heat pump operation remotely.

- Contacts Open = Chiller Mode
- Contacts Closed = Heat Pump Mode

TABLE 20 - SYSTEM INPUT CONNECTIONS

INPUT	1TB TERMINALS
Chilled Liquid Flow Switch	2 and 13
Condenser Liquid Flow Switch	2 and 12
Remote Run Permissive	2 and 15
Remote Print	2 and 14
Remote Heat Pump Mode	10 and 41

Optional Remote Setpoint Offset

The control panel provides for external input to reset:

- Compressor current limits
- Liquid temperature setpoints for Leaving Chilled Liquid, and Heat Pump Leaving Condenser Liquid.

ANALOG INPUTS

The circuitry for the following analog inputs is for 10 VDC or 20 mA current inputs when remote setpoint control options are purchased and enabled.

Leaving Chilled Liquid Temperature Reset Control

Install input for Leaving Chilled Liquid Temperature Control remote reset across Terminals 17 (+) and 18 (-) of the 1TB Terminal Block.

How To Receive Voltage Or Current Signal

The control board JUMPER JP4 must be positioned correctly to receive a voltage (0-10 VDC or 2-10 VDC) or a current (0 mA to 20 mA or 4 mA to 20 mA) signal. Place the jumper in the *V* position for a *voltage* signal, or *mA* for a *current* signal. Configure the software under the OPTIONS key for the specific type of input signal to be used.

The maximum temperature reset (100%) is achieved at either 10 VDC or 20 mA. Sending the minimum signal (0 VDC or 2 VDC, 0 mA or 4 mA, based on the OPTIONS key) causes the setpoint to revert back to its local programmed value. If the setpoint reset causes the setpoint to go over the maximum programmable value, it will be set to the maximum programmable setpoint.

0 VDC to 10 or 2 VDC to 10 VDC Reset Input

A 0 VDC or 2 VDC signal produces a 0°F (0°C) reset. A 10 VDC signal produces a 100% (max.) reset (SETPOINTS key). The setpoint reset is ramped linearly between these limits as the input varies between 0 or 2 VDC and 10 VDC. For this input to work properly, the Remote Temperature Reset must be programmed for 0 VDC to 10 VDC or 2 VDC to 10 VDC input (OPTIONS key) and control board JUMPER JP4 placed in the *V* position.

0 mA to 20 mA or 4 mA to 20 mA Reset Input

A 0 mA or 4 mA signal produces a 0°F (0°C) reset. A 20 mA signal produces 100% (max.) reset (SETPOINTS key). The setpoint reset is ramped linearly between these limits as the input varies between 0 mA or 4 mA and 20 mA. In order for this input to work properly, program the Remote Temperature Reset for 0 mA to 20 mA or 4 mA to 20 mA input (OPTIONS) and control board JUMPER JP4 placed in the *mA* position.

Leaving Condenser Liquid Temperature Reset Control

The same input used for Leaving Chilled Liquid Temperature Reset is used for Leaving Condenser Liquid Temperature Reset when the heat pump option is installed. The function of the input is controlled by selecting the operating mode described in *SECTION 6 - OPERATION* in this manual.

Current Limit Reset Control

Install input for Current Limit Reset Control across Terminals 19 (+) and 20 (-) of the 1TB Terminal Block.

How to Receive Voltage or Current Signal

The control board JUMPER JP5 must be positioned correctly to receive a voltage (0 VDC to 10 VDC or 2 VDC to 10 VDC) or a current (0 mA to 20 mA or 4 mA to 20 mA) signal. Place the jumper in the *V* position for a voltage signal or *mA* for a current signal. Configure the software under the OPTIONS key for the type of input signal to be used.

The minimum current limit setpoint is achieved at either 10 VDC or 20 mA. Sending the minimum signal (0 VDC or 2 VDC, 0 mA or 4 mA, based on the OPTIONS key) causes the current limit to revert back to its maximum value.

0 VDC to 10 VDC or 2 VDC to 10 VDC Reset Input

A 0 VDC or 2 VDC signal produces a 0°F (0°C) reset. A 10 VDC signal produces a 100% (max.) reset (SETPOINTS key). The setpoint reset is ramped linearly between these limits as the input varies between 0 VDC or 2 VDC and 10 VDC. In order for this input to work properly, the Remote Temperature Reset must be programmed for 0VDC to 10 VDC or 2 VDC to 10 VDC input (OPTIONS key) and control board JUMPER JP5 placed in the *V* position.

0 mA to 20 mA or 4 mA to 20 mA Reset Input

A 0 mA or 4 mA signal produces a 0°F (0°C) reset. A 20 mA signal produces 100% (max.) reset (SETPOINTS key). The setpoint reset is ramped linearly between these limits as the input varies between 0 mA or 4 mA and 20 mA. In order for this input to work properly, the program the Remote Temperature Reset for 0 mA to 20 mA or 4 mA to 20 mA input (OPTIONS key) and control board JUMPER JP5 placed in the *mA* position.

INSTALLATION CHECKLIST—REQUEST FOR START-UP SERVICE

When all items on the *Installation Checklist and Request for Authorized Start-up Technician (Form QWC4-CL1)* (North America Only) are completed satisfactorily, and before any attempt is made to start the unit, contact the Quantech Field Service Office to schedule the start-up service.

New Release

Form QWC4-CL1 (221)

**MODEL – QWC4****INSTALLATION CHECKLIST AND REQUEST FOR AUTHORIZED START-UP TECHNICIAN**

CUSTOMER: _____ JOB NAME: _____
 ADDRESS: _____ LOCATION: _____
 PHONE: _____ CUSTOMER ORDER NO: _____
 QTC TEL NO: _____ QTC ORDER NO: _____ QTC CONTRACT NO: _____

CHILLER MODEL NO: _____ UNIT SERIAL NO: _____

The work (as checked below) is in process and will be completed by: _____ / _____ / _____
 Month Day Year

The following work must be completed in accordance with installation instructions:

A. QUANTECH CHILLER

1. Unit checked for shipping damage..... ☐

NOTE: Any damage MUST be reported to Quantech immediately for inspection.

Initials: _____

Company Name: _____

Date: _____

2. Unit assembled (if shipped dismantled) and refrigerant piping installed..... ☐
 3. Vibration isolator mounted so that the unit is level and isolators are equally deflected..... ☐
 4. If applicable, monitoring alarm is installed, functional, and operational ready for service..... ☐

B. WATER PIPING

1. Condenser water piping installed between condenser, pumps and cooling tower..... ☐
 2. Chilled water piping installed between cooler, pumps, and cooling coils..... ☐
 3. Make-up and fill lines installed to cooling tower and chilled water system..... ☐
 4. All water piping checked for strain.
NOTE: Piping should not spring at unit..... ☐
 5. Water piping leak tested and flushed; water systems filled with water and trapped air is vented..... ☐
 6. Chilled and condenser water flow available to meet unit design requirements..... ☐
 7. Verify the chilled and condenser liquid systems have been connected correctly, and commissioned with the correct direction of water flow. The inlet should be at the bottom connection on a two-pass shell. Purge air from the top of the waterbox, using the plugged air vent, mounted on the top of the waterbox..... ☐

C. REFRIGERANT RELIEF PIPING (When required)

1. Refrigerant relief piping installed from unit to atmosphere (per local building code)..... ☐

D. ELECTRICAL WIRING

1. Variable Speed Drive (VSD):
 a. Main power supply available..... ☐
 b. Wiring completed from main power supply up to VSD.
NOTE: DO NOT cut to length or connect to drive without Quantech supervision..... ☐
 2. External control wiring completed according to the wiring diagram shipped with the unit..... ☐
 3. Power available, wiring completed, and rotation checked to the following drives and motors:
 a. Chilled water pump(s)..... ☐
 b. Condenser water pump(s)..... ☐
 c. Cooling tower fan..... ☐
NOTE: DO NOT check compressor motor.
 4. Megohm tester available for checking motor windings. Tester not necessary unless start-up indicates a motor winding short..... ☐
 5. Connect the following system inputs to their respective terminals of 1TB Terminal Box:..... ☐
 a. Chilled Liquid Flow Switch - Terminals 2 and 13..... ☐
 b. Condenser Liquid Flow Switch - Terminals 2 and 12..... ☐
 c. System 1 Remote Run Permissive - Terminals 2 and 15..... ☐
 d. System 2 Remote Run Permissive - Terminals 2 and 16..... ☐
NOTE: If remote run permissive is not used, place a jumper across the terminals to allow the system to run.
 e. Remote Print - Terminals 2 and 14..... ☐

6. Connect the following optional analog inputs to their respective terminals of 1TB Terminal Block
- a. Leaving Chilled and Condenser Temperature Reset Control - Terminals 17 and 18
- b. Current Limit Reset Control - Terminals 19 and 20
- c. Remote Mode Selection (Optional Heat Pump) - Terminals 40 and 41

F. CONDITIONS

1. Type L oil for compressor available.....
2. Cooling load available for testing and operating unit
3. Personnel available for final wiring connections
4. Personnel available for start-up and testing.....

Owner's operating personnel:

Name: _____ Phone _____

Name: _____ Phone _____

E. TESTING, EVACUATION AND CHARGING (Under Quantech supervision)

NOTE: This section does not apply for chillers shipped with refrigerant installed at the factory.

1. R-134a/R-513A available for testing
2. Dry nitrogen available for testing (Grade B or better).....
3. A high vacuum pump available to evacuate and dehydrate system.....
4. Refrigerant (supplied by Quantech) is available for charging
5. Unit has been or is ready to be been pressure tested, evacuated, dehydrated, and charged.....

CONTRACTOR'S RESPONSIBILITIES AND INSTRUCTIONS TO USE FORM

This installation checklist provides a quick way to check if all necessary installation work was completed in accordance with all applicable installation instructions in the unit Installation, Operation and Maintenance manual, and when completed, acts as a request for Quantech to furnish start-up supervision.

Complete this form as follows:

- Fill out the top of the page.
- Check off each item as required. Cross out (x) items that do not apply.
- Enter names, initials, and date of the operating personnel who completed the checklist.
- Bottom of Form:** Enter the date that the Quantech start-up technician should be at the job site and the name(s) of the supervisor(s) to be contacted. Retain one copy in files and send one copy to customer.

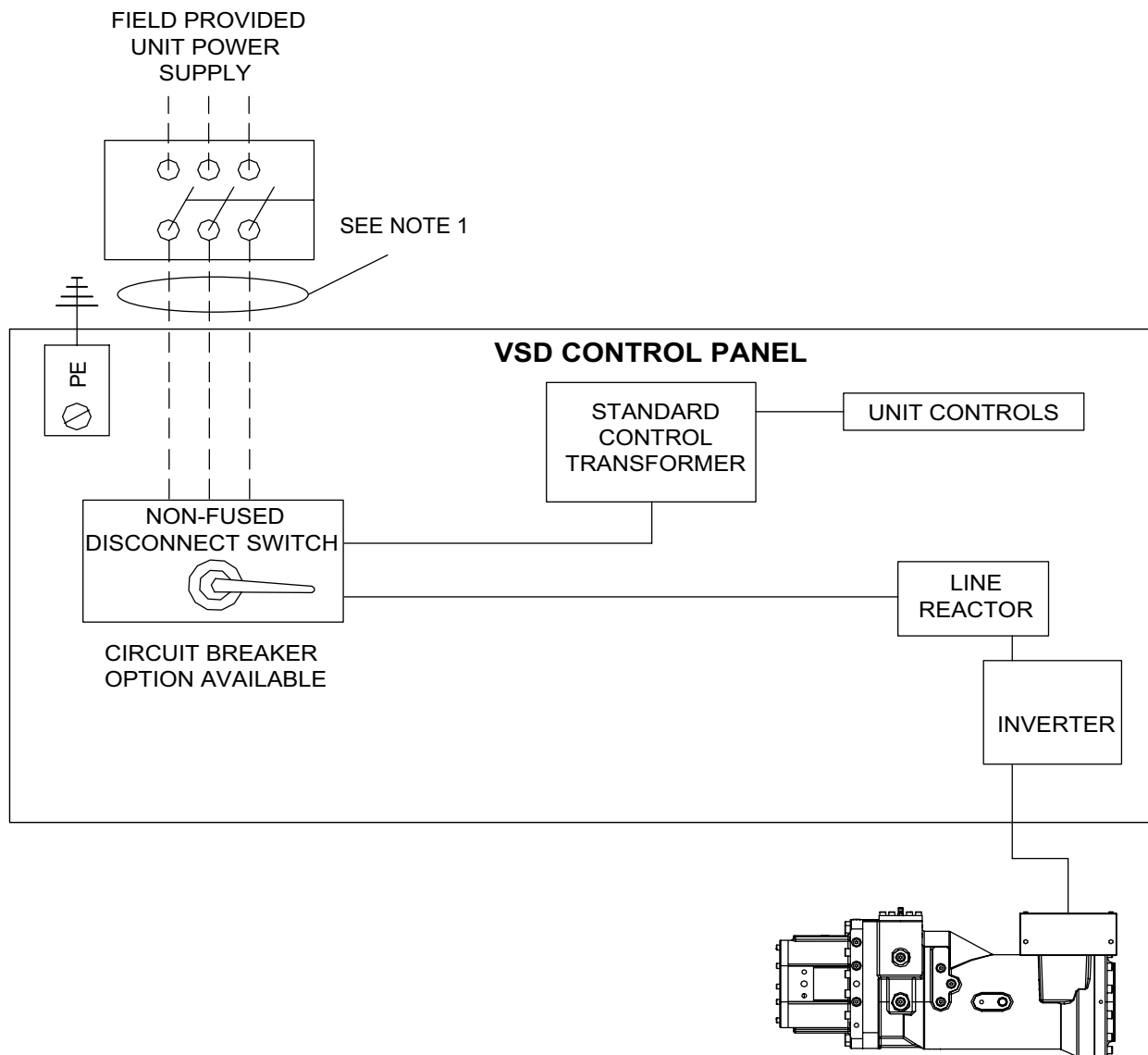
With reference to the terms of the above contract, we are requesting the presence of your Quantech Authorized Representative at the job site on

_____/_____/_____ to start the system and instruct operating personnel. Have the Quantech representative contact: _____
Month Day Year Name/Phone

We understand that the services of the Quantech Authorized Representative will be furnished in accordance with the contract for a period of time of not more than _____ consecutive normal working hours, and we agree that a charge of _____ per diem plus travel expenses will be made to Quantech if services are required for longer than _____ consecutive normal hours or if repeated calls are required, through no fault of Quantech.

Customer/Contractor Signature: _____ **Title:** _____

Form Completed by: _____ **Date:** _____

**NOTES:**

1. ----- Dashed Line = Field Provided Wiring

LD16428A

FIGURE 38 - POWER CONNECTIONS

TABLE 21 - LUG DATA (UL/ASME) - PIN 22/POWER FIELD

VSD DETAILS			TERMINAL BLOCK			CIRCUIT BREAKER			NON-FUSED DISCONNECT SWITCH		
VSD FRAME (PIN 11)	INPUT VOLTS	INPUT FREQ.	LUG/ PHASE	WIRES PER LUG	LUG WIRE RANGE	LUG/ PHASE	WIRES PER LUG	LUG WIRE RANGE	LUG/ PHASE	WIRES PER LUG	LUG WIRE RANGE
J	380	60	1	2	#2 AWG–600 kcmil	1	2	#1/0 AWG–500 kcmil	1	2	#2 AWG–600 kcmil
	460	60	1	2	#2 AWG–600 kcmil	1	2	#1/0 AWG–500 kcmil	1	2	#2 AWG–600 kcmil
L	380	60	1	3	#2 AWG–600 kcmil	1	2	#4/0 AWG–500 kcmil	2	2	#2 AWG–600 kcmil
	460	60	1	3	#2 AWG–600 kcmil	1	2	#3/0 AWG–400 kcmil	2	2	#2 AWG–600 kcmil

TABLE 22 - VOLTAGE VARIATIONS

FREQ.	RATED VOLTAGE VAC	INPUT FREQ. Hz	OPERATING VOLTAGE VAC	
			MIN.	MAX
60 Hz	380	60	342	402
	460	60	414	508

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SECTION 4 - TECHNICAL DATA

TABLE 23 - COMPLETE PIN NUMBER DESCRIPTION

PIN	DESCRIPTION	OPTIONS	OPTIONS DESCRIPTION
1-4	MODEL	QWC4	Quantech
5-6	EVAPORATOR MODEL	BB	Evaporator Sizes
		BC	
		BD	
		CB	
		CC	
		CD	
		DB	
		DC	
		DD	
7-8	CONDENSER MODEL	BB	Condenser Sizes
		BC	
		BD	
		CB	
		CC	
		CD	
		DB	
		DC	
		DD	
9-10	COMPRESSOR DRIVELINE	FX	WTS45/CTS45
		GX	WTS51/CTS51
11	STARTER	J	Starter Size
		L	
12	PASS ARRANGEMENT	A	Evap: 1pass; Cond: 1pass
		B	Evap: 2pass; Cond: 1pass
		C	Evap: 3pass; Cond: 1pass
		D	Evap: 1pass; Cond: 2pass
		E	Evap: 2pass; Cond: 2pass
		F	Evap: 3pass; Cond: 2pass
		G	Evap: 1pass; Cond: 3pass
		H	Evap: 2pass; Cond: 3pass
		I	Evap: 3pass; Cond: 3pass
13-16	NOMINAL CAPACITY	####	Nominal Design Capacity
17	APPLICATION	S	Standard Water Chiller
		T	Ice Thermal Storage Chiller
		A	Heat Pump
18	MODIFICATION LEVEL	A	Chiller Modification Level
19	PIN 19	X	No Selection
		Q	Special Quote

TABLE 24 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

PIN	DESCRIPTION	OPTIONS	OPTIONS DESCRIPTION
20-21	VOLTAGE	40	380/3/60
		46	460/3/60
		65	380/3/50
		50	400/3/50
		68	415/3/50
22	POWER FIELD	D	Lockable NF Disconnect Switch
		B	Lockable Circuit Breaker
		S	Supply Terminal Block
		Q	Special Quote
23	HARMONIC FILTER	X	No Selection
		F	Harmonic filter
24	SYSTEM PARAMETER	X	No Selection
		Q	Special Quote
25	CONTROL PANEL AND VSD ENCLOSURE TYPE	S	Ctrl & VSD:N1/IP20, AT:N1/IP20
		E	Ctrl & VSD:IP33
		Q	Special Quote
26	UNIT NEMA TYPE	S	UNIT: NEMA1 OR IP20
		Q	Special Quote
27	VSD COOLING SOURCE	X	No selection
		S	Condenser liquid
		H	Evaporator liquid
		Q	Special Quote
28	PANEL OPTIONS	X	No Selection
		Q	Special Quote
29	BAS RESET / OFFSET	X	No Selection
		B	BAS/EMS Temp, Cur Reset/Offset
		C	BAS/EMS Current Reset/Offset
		T	BAS/EMS Temp Reset/Offset
		A	BACnet Elink (factory mounted)
		M	Modbus Elink (factory mounted)
		L	LON Elink (factory mounted)
		N	N2 Elink (factory mounted)
		Q	Special Quote
30	LANGUAGE/DISPLAY	A	English
		F	French
		S	Spanish
		G	German
		P	Portuguese
		I	Italian
		H	Hungarian
		L	Polish
		E	Chinese, Simplified
		Q	Special Quote

TABLE 24 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

PIN	DESCRIPTION	OPTIONS	OPTIONS DESCRIPTION
31	SAFETY CODE	G	Chinese Safety Code (GB)
		C	European Safety Code (CE)
		L	NA Safety Code (cUL/cETL)
		Q	Special Quote
32-35	FUTURE OPTIONS	X	No Selection
		Q	Special Quote
36	PIPING CODE	X	Single relief valve
		R	Dual relief valves
		Q	Special Quote
37	FUTURE OPTIONS	X	No Selection
		Q	Special Quote
38	VALVE OPTIONS	X	N/A
		B	Condenser isolation valves
		Q	Special Quote
39	HOT GAS BYPASS	X	No Selection
		Q	Special Quote
40	LIQUID INJECTION KIT	X	No Selection
		L	Liquid injection kit
		Q	Special Quote
41	REFRIGERANT	A	R-134a
42	COMPRESSOR VARIATION	W	Standard compressor
		S	High head compressor
		V	Optimized high head compressor
		Q	Special Quote
43-45	COMPRESSOR FREQUENCY	###	Nominal compressor frequency
		QQQ	Special Quote
46	ECONOMIZER	E	Standard
		Q	Special Quote
47	FUTURE OPTIONS	X	No Selection
		Q	Special Quote
48	FLOW SWITCH OPTIONS	X	None
		S	One flow switch
		T	Two flow switches
		D	One diff pressure switch
		E	Two diff pressure switches
		G	One thermal dispersion switch
		H	Two thermal dispersion switch
		Q	Special Quote

TABLE 24 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

PIN	DESCRIPTION	OPTIONS	OPTIONS DESCRIPTION
49	THERMAL INSULATION	X	None
		S	3/4 in. insulation evaporator
		D	1 1/2 in. insulation evaporator
		E	3/4 in. insulation evap and cond
		C	1 1/2 in. ins evap and 3/4 in. cond
		Q	Special Quote
50	PRESSURE VESSEL CODE	G	GB Pressure Vessel Codes
		E	PED Pressure Vessel Codes
		A	ASME Pressure Vessel Codes
		Q	Special quote
51	FUTURE OPTION	X	No Selections
		Q	Special Quote
52-53	EVAPORATOR LEAVING WATER TEMP	##	LCHWT Temperature
		QQ	Special Quote
54-56	EVAPORATOR TUBE TYPE	321	0.75 in. x 0.025 in. Wall
		322	0.75 in. x 0.028 in. Wall
		323	0.75 in. x 0.035 in. Wall
		QQQ	Special Quote
57	EVAPORATOR WATERBOX TYPE	C	Compact
		M	Marine
58	EVAPORATOR COATING	X	N/A
		C	Coating
		Q	Special Quote
59	EVAPORATOR WATERBOX HINGES	X	No Selection
		Q	Special Quote
60	EVAPORATOR WATERSIDE DWP	1	150 psig
		3	300 psig
61	EVAPORATOR NOZZLE ARRANGEMENT	A	Evaporator nozzle arrangement options
		H	
		C	
		K	
		G	
		P	
		Q	Special Quote
62	EVAPORATOR WATER CONNECTION	G	Groove
		D	DIN / PN weld flanges (field)
		P	DIN / PN weld flanges(factory)
		A	ANSI welded flanges (field)
		N	ANSI welded flanges (factory)
		H	HG welded flanges (factory)
		V	DIN / PN Vict flanges (field)
		C	ANSI grooved flanges (field)
		Q	Special Quote

TABLE 24 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

PIN	DESCRIPTION	OPTIONS	OPTIONS DESCRIPTION
63	EVAPORATOR FLUID	W	Water
		C	Calcium Chloride
		S	Sodium Chloride
		E	Ethylene Glycol
		P	Propylene Glycol
		Q	Special Quote
64	FUTURE OPTIONS	X	No Selection
		Q	Special Quote
65-66	CONDENSER LEAVING WATER TEMP	##	CLWT Temperature
		QQ	Special Quote
67-69	CONDENSER TUBE TYPE	201	0.75 in. x 0.028 in. Copper Nickel
		203	0.75 in. x 0.035 in. Copper Nickel
		260	0.75 in. x 0.025 in. Copper
		261	0.75 in. x 0.028 in. Copper
		262	0.75 in. x 0.035 in. Copper
		162	0.75 in. x 0.028 in. Titanium
		QQQ	Special Quote
70	CONDENSER WATERBOX TYPE	C	Compact
		M	Marine
71	CONDENSER COATING	X	N/A
		C	Coating
		C	Special Quote
72	CONDENSER WATERBOX HINGES	X	No Selections
		Q	Special Quote
73	CONDENSER WATERSIDE DWP	S	150 psig
		H	300 psig
		Q	Special Quote
74	CONDENSER NOZZLE ARRANGEMENT	A	
		H	
		C	
		K	
		G	
		P	
		Q	Special Quote
75	CONDENSER WATER CONNECTION	G	Groove
		D	DIN / PN weld flanges (field)
		P	DIN / PN weld flanges(factory)
		A	ANSI welded flanges (field)
		N	ANSI welded flanges (factory)
		H	HG welded flanges (factory)
		V	DIN / PN Vict flanges (field)
		C	ANSI grooved flanges (field)
		Q	Special Quote

TABLE 24 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

PIN	DESCRIPTION	OPTIONS	OPTIONS DESCRIPTION
76	CONDENSER FLUID	W	Water
		C	Calcium Chloride
		S	Sodium Chloride
		E	Ethylene Glycol
		P	Propylene Glycol
		Q	Special Quote
77	CONDENSER SHELL SIDE DESIGN PRESSURE	L	235 psig (1.62 MPa)
		H	388 psig (2.68 MPa)
78	SOUND REDUCTION KIT	X	No Selection
		B	Sound Kit 1
		C	Sound Kit 2
		Q	Special Quote
79	VIBRATION ISOLATION KITS	X	No selection
		E	Elastomeric pad
		I	1-inch deflection spring isol
		F	Feet (without elastomeric pad)
		Q	Special Quote
80	PAINT OPTIONS	S	Caribbean Blue
		Q	Special Quote
81	STRUCTURAL MODIFICATION	X	No Selection
		Q	Special Quote
82	FUTURE OPTIONS	X	No Selection
		Q	Special Quote
83	SHIPPING	X	No cont reqd, w Bag
		A	Buy America Act Compl w Bag
		B	Amer Act & Cont w/o Bag (Prep)
		C	Cont Ship w/o Bag (Load US)
		D	Cont Ship w Bag (Load US)
		E	Cont Ship w Bag (Load Mex)
		F	Cont Ship w Bag (Fact Prep)
		G	Amer Act & Cont w Bag (Prep)
		M	Cont Ship w/o Bag (Load Mex)
		N	No Cont w/o Bag
		P	Cont Ship w/o Bag (Fact Prep)
		U	Buy America Act Compl w/o Bag
		Q	Special Quote
84	FORM	1	Form 1
		2	Form 2
		7	Form 7
		Q	Special Quote
85	PIN 85	X	No Selection
		Q	Special Quote

TABLE 24 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

PIN	DESCRIPTION	OPTIONS	OPTIONS DESCRIPTION
86	SR DOCUMENTS	X	No SR Documents
		B	Monterrey base document
		M	Monterrey base & materials doc
		S	Sabadell base document
		P	Sabadell base & optional doc
		W	Wuxi base document
		E	Wuxi base & elec safe test rep
		V	Wuxi base & vacuum test doc
		A	Wuxi all document
		Q	Special Quote
87	FACTORY TESTS	X	No Factory Tests
		F	Function witness (incl ctrl)
		P	Perf test without witness
		W	Customer perf witness test
		T	Tube side hydrostatic witness
		S	Shell side pneumatic witness
		V	Vacuum witness test
		A	Perf & tube side hydro witness
		B	Perf & shell side pneum witnss
		C	Perf, tube hydro & shell pneum
		D	Performance & vacuum witness
		E	Perf,tube hydro,shell pneu,vac
		Q	Special Quote
88	FUTURE OPTIONS	X	No Selection
		Q	Special Quote

SINGLE COMPRESSOR UNIT DIMENSIONS

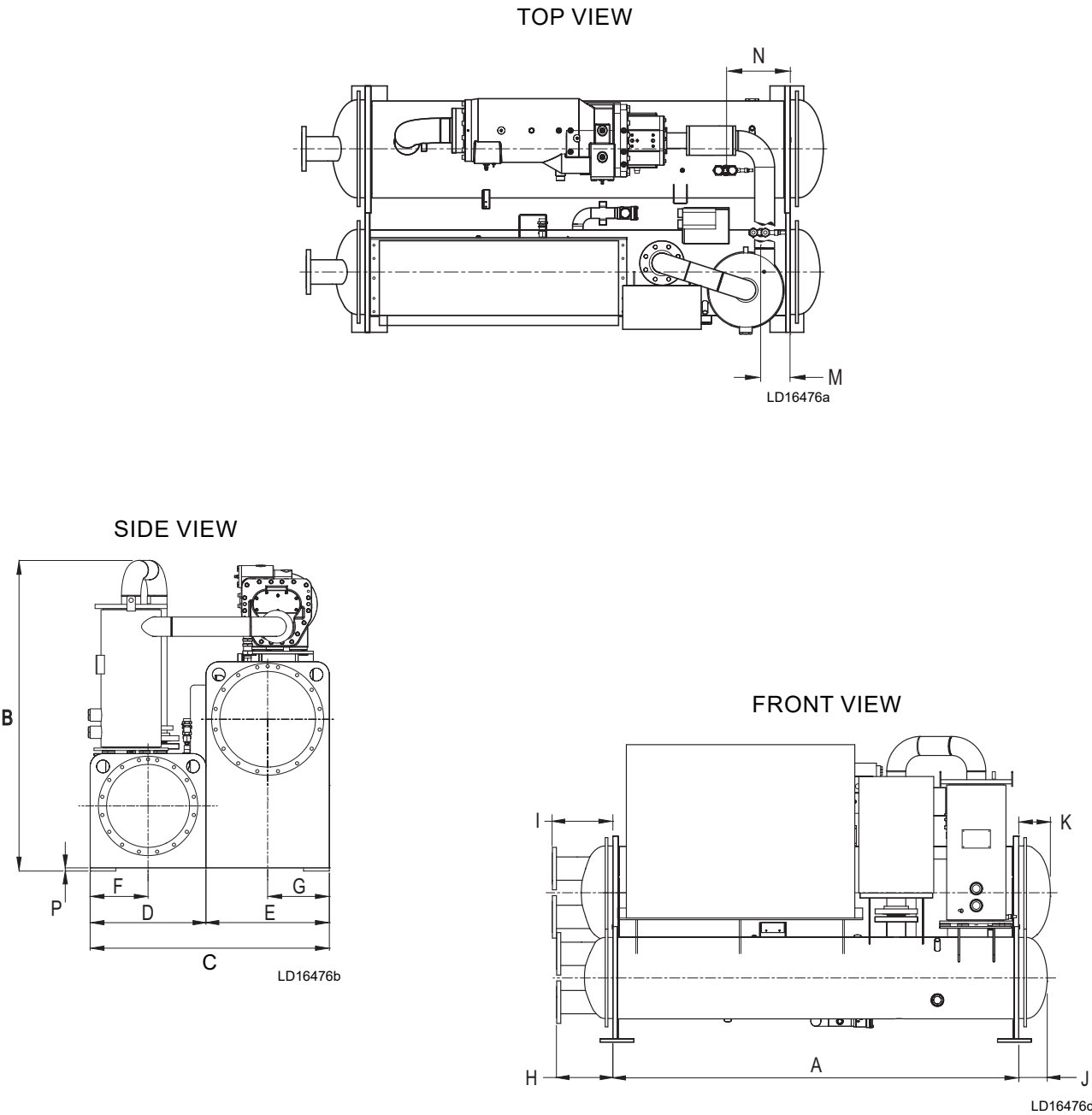


FIGURE 39 - SINGLE COMPRESSOR UNIT DIMENSIONS

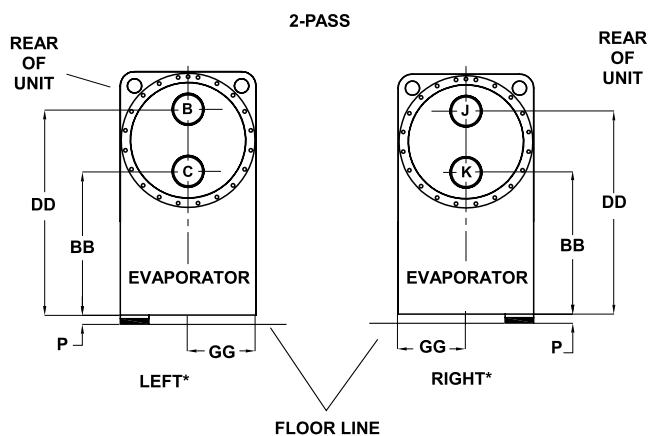
DIMENSIONS	EVAPORATOR AND CONDENSER SHELL CODES IN (MM)				
	SINGLE 145/151			DUAL 136/145	
	B-B	C-C	D-D	M-M	N-N
A	8' (2438)	10' (3048)	12' (3658)	12' (3658)	14' (4268)
B	6'-11/16" (1846)	6'-11/16" (1846)	6'-11/16" (1846)	6'-3/4" (1844)	6'-3/4" (1844)
C	4'-7 5/8" (1413)	4'-7 5/8" (1413)	4'-7 5/8" (1413)	4'-7-5/16" (1405)	4'-7-5/16" (1405)
D	2'-2 15/16" (684)	2'-2 15/16" (684)	2'-2 15/16" (684)	2'-2-7/8" (683)	2'-2-7/8" (683)
E	2'-4 11/16" (729)	2'-4 11/16" (729)	2'-4 11/16" (729)	2'-4-3/8" (722)	2'-4-3/8" (722)
F	1'-1 15/32" (342)	1'-1 15/32" (342)	1'-1 15/32" (342)	1'-1-3/8" (342)	1'-1-3/8" (342)
G	1'-2 11/32" (365)	1'-2 11/32" (365)	1'-2 11/32" (365)	1'-2-3/16" (361)	1'-2-3/16" (361)
M	6' 21/32" (169)	1'-6 21/32" (474)	2'-6 21/32" (779)	4-3/4" (123)	10-3/4" (275)
N	1'-2 17/32" (369)	2'-2 17/32" (674)	3'-2 17/32" (979)	5'-6" (1678)	6' (1830)

WATERBOX DIMENSIONS IN (MM)											
DIM.	EVAPORATORS B, C & D			EVAPORATORS M, N		CONDENSER B, C & D			CONDENSERS M, N		
	1 PASS	2 PASS	3 PASS	2-PASS	3-PASS	1 PASS	2 PASS	3 PASS	1-PASS	2-PASS	3-PASS
H	—	—	—	—	—	1'-1 17/32" (344)	1'-1 17/32" (344)	1'-1 17/32" (344)	14'-1/2" (369)	14'-1/2" (369)	14'-1/2" (369)
I	—	1'-2 3/8" (369)	1'-2 3/8" (369)	16-3/32" (409)	16-3/32" (409)	—	—	—	—	—	—
DIM.	REAR HEAD 2 PASS			REAR HEAD 2-PASS		REAR HEAD 2 PASS			REAR HEAD 2-PASS		
J	—					6'-29/32" (176)			5'-3/4" (146)		
K	7'-21/32" (195)			6'-5/32" (156)		—					

ADDITIONAL OPERATING HEIGHT IN (MM)	
CLEARANCE TO FLOOR	P
TYPE OF CHILLER MOUNTING	
NEOPRENE PAD ISOLATORS	1-3/4" (44.5)
SPRING ISOLATORS 1" DEFLECTION	1" (25.4)
DIRECT MOUNT	3/4" (19.1)

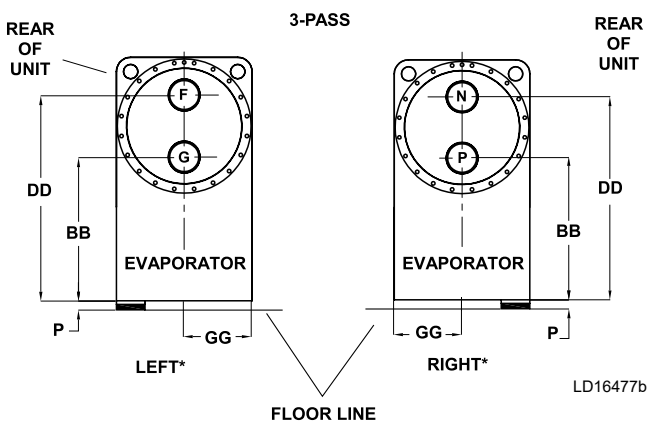
NOTES:

1. All dimensions are approximate. Certified dimensions are available on request.
2. Evaporator and condenser water nozzles can be located on either end of unit.
3. Standard 150 psi (10.3 barg) design pressure boxes shown.
4. To determine overall height, add dimension "P" for the appropriate isolator type.
5. Front of unit is defined as side of chiller where control center is mounted.
6. In order to achieve rated performance, condenser liquid must enter the waterbox through the bottom connection for proper operation of the sub-cooler.
7. Connected piping should allow for the removal of the compact waterboxes for tube access and cleaning.

DIMENSIONS OF EVAPORATOR NOZZLE ARRANGEMENTS

LD16477a

NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	EVAPORATOR (PIN 5,6)	
	IN	OUT
2	C	B
	K	J

FIGURE 40 - EVAPORATORS - COMPACT WATERBOXES (2-PASS)

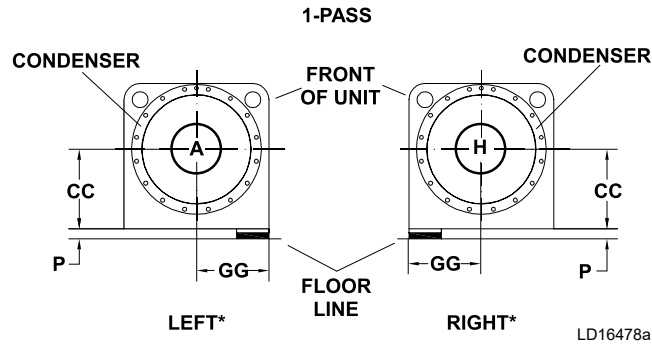
LD16477b

NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	EVAPORATOR (PIN 5,6)	
	IN	OUT
3	G	N
	P	F

FIGURE 41 - EVAPORATORS - COMPACT WATERBOXES (3-PASS)**TABLE 24 - EVAPORATOR NOZZLE DIMENSIONS, IN. (MM)**

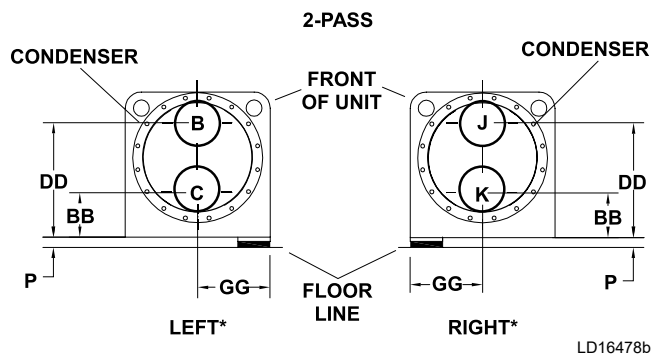
EVAPORATOR SHELL CODE (PIN 5)	NOZZLE PIPE SIZE			EVAPORATOR NOZZLE DIMENSIONS ft - in (mm)					
	NO. OF PASSES			2-PASS			3-PASS		
	1	2	3	BB	DD	GG	BB	DD	GG
B, C, D	8"	5"	5"	2'-4-27/32" (733)	3'-4-9/32" (1023)	1'-2-11/32" (365)	2'-4-27/32" (-733)	3'-4-9/32" (1023)	1'-2-11/32" (365)

DIMENSIONS OF CONDENSER NOZZLE ARRANGEMENTS



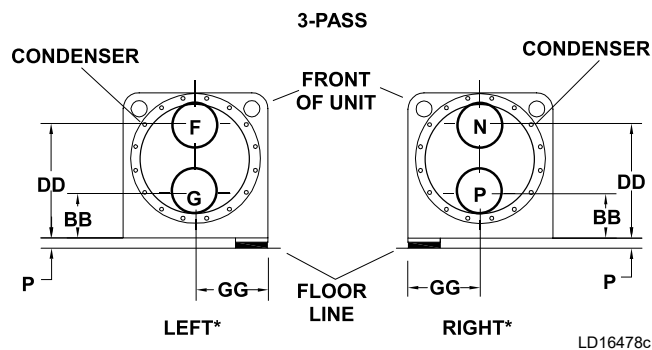
NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	CONDENSER (PIN 7,8)	
	IN	OUT
1	A	H
	H	A

FIGURE 42 - CONDENSERS - COMPACT WATERBOXES (1-PASS)



NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	CONDENSER (PIN 7,8)	
	IN	OUT
2	C	B
	K	J

FIGURE 43 - CONDENSERS - COMPACT WATERBOXES (2-PASS)



NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	CONDENSER (PIN 7,8)	
	IN	OUT
3	G	N
	P	F

FIGURE 44 - CONDENSERS - COMPACT WATERBOXES (3-PASS)

TABLE 25 - CONDENSER NOZZLE DIMENSIONS, IN. (MM)

CONDENSER SHELL CODE (PIN 7)	NOZZLE PIPE SIZE			CONDENSER							
				NOZZLE DIMENSIONS ft - in (mm)							
	NO.OF PASSES			1-PASS		2-PASS			3-PASS		
	1	2	3	CC	GG	BB	DD	GG	BB	DD	GG
B,C,D	8"	5"	5" (127)	1'-2-13/32" (366)	1'-1-15/32" (366)	8'-11/16" (366)	1'-8-1/8" (366)	1'-1-11/32" (366)	8'-11/16" (366)	1'-8-1/8" (366)	1'-1-11/32" (366)

TABLE 26 - WATER FLOW RATE LIMITS GPM (L/S) (BASED UPON STANDARD TUBES AT DESIGN FULL LOAD CONDITIONS)

PIN 5, 6	EVAPORATOR				PIN 7, 8	CONDENSER					
	2 PASS		3 PASS			1 PASS		2 PASS		3 PASS	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX	MIN	MAX
BB	240 (15)	750 (47)	160 (10)	490 (31)	BB	390 (25)	1560 (98)	190 (12)	780 (49)	130 (8)	520 (33)
BC	280 (18)	870 (55)	190 (12)	570 (36)	BC	440 (28)	1780 (112)	220 (14)	890 (56)	150 (9)	590 (37)
BD	330 (21)	910 (57)	220 (14)	660 (42)	BD	480 (30)	1950 (123)	240 (15)	910 (57)	—	—
CB	240 (15)	750 (47)	160 (10)	490 (31)	CB	390 (25)	1560 (98)	190 (12)	780 (49)	130 (8)	520 (33)
CC	280 (18)	870 (55)	190 (12)	570 (36)	CC	440 (28)	1780 (112)	220 (14)	890 (56)	150 (9)	590 (37)
CD	330 (21)	910 (57)	220 (14)	660 (42)	CD	480 (30)	1950 (123)	240 (15)	910 (57)	—	—
DB	240 (15)	750 (47)	160 (10)	490 (31)	DB	390 (25)	1560 (98)	190 (12)	780 (49)	130 (8)	520 (33)
DC	280 (18)	870 (55)	190 (12)	570 (36)	DC	440 (28)	1780 (112)	220 (14)	890 (56)	150 (9)	590 (37)
DD	330 (21)	910 (57)	220 (14)	660 (42)	DD	480 (30)	1950 (123)	240 (15)	910 (57)	—	—

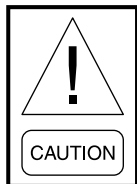
The expected waterside pressure drop at design flow is provided on the particular chiller sales order form header. When rated in accordance with AHRI-550 standard, the actual pressure drop for clean tubes is permitted to be lower than or 15% greater than the stated value.

To determine flow or waterside pressure drop at conditions other than sales order design, use the following relationship and solve for the unknown parameter. Be sure to use consistent units of measure:

$$\frac{\text{Design Flow}}{\sqrt{\text{Design Pressure Drop}}} = \frac{\text{Actual Flow}}{\sqrt{\text{Actual Pressure Drop}}}$$

SECTION 5 - COMMISSIONING

PREPARATION



Commissioning of this unit should only be carried out by Quantech authorized personnel. Proper electrical lock out/tag out procedures must be followed.

Make sure all checks are completed in the *Start-up Checklist (Form QWC4-CL3)* on the next page. The chiller is then ready to be placed into operation.

Commissioning personnel should be thoroughly familiar with the information contained in this document before starting the unit.

For helpful tips about commissioning the unit, see the following information.

Refrigerant Charge

Packaged units are normally shipped as standard with a full refrigerant operating charge. See the following instructions to make sure the refrigerant is handled correctly.

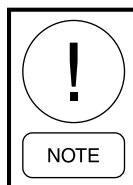
- Do not evacuate or liquid charge with static water in the cooler or condenser.
- Turn on the pumps.
- Vapor charge until the system pressure is above the saturated temperature for freezing of the fluid in the evaporator and condenser.
- Liquid charge slowly to avoid excessive thermal stress at the charging point, and to make sure the refrigerant temperature does not go below the freezing point with liquid refrigerant in the evaporator and condenser.
- Evacuation and charging should always be done according to *SECTION 7 - MAINTENANCE*.

Service and Oil Line Valves

If valves are of the back-seat type, open them fully (counterclockwise), then close one turn of the stem.

Compressor Oil

While the compressor is running at design speed, the oil level should be visible between the bottom of the lower and middle of the upper sight glass of the oil separator.



Make sure that the compressor heaters have been energized at least 24 hours before starting the chiller.

FIRST TIME START-UP



During the commissioning period, there should be sufficient heat load to run the unit under stable full load operation to enable the unit controls, and system operation to be set up correctly, and a commissioning log taken.

When a compressor is running, the controller monitors oil pressure, motor current, and various other system parameters, such as discharge pressure, chilled liquid temperature, etc. Should any problems occur; the control system will immediately take appropriate action and display the nature of the fault.

Loading

Once the unit has been started, all operations are fully automatic. After an initial period at minimum capacity, the control system will adjust the unit load depending on the chilled liquid temperature and rate of temperature change. If a high heat load is present, the controller will increase the speed of the compressor.

Supersedes: New Release

Form: QWC4-CL3 (221)

**MODEL – QWC4****START-UP CHECKLIST**

CUSTOMER: _____ JOB NAME: _____
 ADDRESS: _____ LOCATION: _____
 PHONE: _____ CUSTOMER ORDER NO: _____
 QTC TEL NO: _____ QTC ORDER NO: _____ QTC CONTRACT NO: _____

CHILLER MODEL NO: _____ UNIT SERIAL NO: _____

The work (as checked below) is in process and will be completed by: _____ / _____ / _____
 Month Day Year

The following work must be completed in accordance with start-up instructions contained in the Installation, Operation, and Maintenance Manual (Form QWC4-NM1):

A. GENERAL:

The following basic checks should be made with the customer power to the unit switched off.

1. Review the Installation Checklist (Form QWC4-CL1). _____ ☐
2. Inspect the unit for installation damage that may have occurred. If damage is found, take action and/or repair as appropriate. _____ ☐
3. Water connection inlet and outlet are at proper locations, have hangers nearby that would support their weight and show no visible strain on chiller nozzles. _____ ☐
4. Wiring is complete (power feed terminations in the VSD), and all sources of electrical supply to the unit are taken from a single point of isolation per QWC4-PW2. _____ ☐
5. Confirm any field control wiring modifications are in accordance with Form QWC4-PW2. _____ ☐
6. Verify the chiller is charged with refrigerant (pressures match R-134a/R-513A saturation for ambient temp). _____ ☐
7. Verify that the unit's protective ground terminal(s) are properly connected to a suitable grounding point. Ensure that all unit internal ground connections are tight. _____ ☐
8. Verify that the following isolation valves are open.
 - a. Compressor discharge (optional) _____ ☐
 - b. Condenser subcooler outlet (optional) _____ ☐
 - c. Main oil supply inline ball valve _____ ☐
 - d. Condenser pressure transducer _____ ☐
 - e. Condenser gas to oil eductor _____ ☐
 - f. Evaporator pressure transducer _____ ☐
 - g. Evaporator oil return to eductor _____ ☐
 - h. Oil return eductor to compressor _____ ☐
 - i. Liquid injection to compressor (optional) _____ ☐
 - j. Economizer pressure transducer _____ ☐
9. Verify the shipping anti-freeze solution has been drained from the VSD, and replaced with the proper amount of inhibited water coolant that shipped loose with the chiller. Refer to SECTION 7 - MAINTENANCE in the QWC4-NM1 for filling process. _____ ☐
10. Verify electrical connections in the VSD are tight, especially motor leads to terminals. _____ ☐
11. If the VSD provides an optional circuit breaker at the incoming power connection to the VSD, make sure the settings are properly set per the information on the next page.
12. Find your VSD model from the list below, and set the adjustments to the setting values in the following table. If your model is not listed below, look for it in the next table of drive model numbers with the ratings plug value.
 - a. TVP1CMPRBW_-50B
 - b. TVP1CMPRBW_-65B
 - c. TVP1CMPRBW_-68B

(Continued on following page)

ADJUSTMENT	SETTING VALUE
Long Time Pickup IR~	G
Long Time Delay TLD(S) LONG	2
Short Time Delay ISD(XIR) SHORT	2
Ground Fault Pickup IG(XIN) GND	0.2
Ground Fault Delay TSD/TG(MS) SHORT/GND	J

Find your model from the list below, check the ratings plug values in the first table, and set the setting values for the adjustments listed in the second table:

DRIVE MODEL NO.	RATINGS PLUG VALUE
TVP1CMPRBW_-50B	600
TVP1CMPRBW_-65B	600
TVP1CMPRBW_-68B	600

ADJUSTMENT	SETTING VALUES
Short Delay Pick-up	2
Short Delay Time	INST
Ground Fault Pick-up	1
Ground Fault Time	150



The settings for the circuit breaker should not be changed from the settings. The warranty will be voided if the breaker settings are changed.

13. Check the chiller for refrigerant leaks at joints or water piping leaks. ☐
14. Make sure 9 liters of compressor oil were added to both circuits. ☐
15. Make sure the control panel is free of foreign material (wires, metal chips, tools, documents, etc.). Check for signs of water or moisture. ☐
16. Make sure the leaving liquid temperature sensor is coated with the heat conductive compound (P/N 013-00890-000), and is inserted to the bottom of the water outlet sensor well in the cooler. This sensor must always be fully inserted in the water outlet sensor well. ☐
17. Make sure the flow switches are connected between Terminals 2 and 12 and 2 and 13 on Terminal Block 1TB in the control panel. ☐
18. Check whenever the pump contacts are used, the coil of the pump starter should be suppressed with an RC suppressor (P/N 031-00808-000). ... ☐

B. START-UP

Panel Check



Only qualified individuals are permitted to service this product, and are to be knowledgeable of, and adhere to, all safe work practices as required by local codes. Use proper personal protection where and when required.

1. Verify that the voltage supply corresponds to the unit requirement, and is within the limits as specified in SECTION 4 - TECHNICAL DATA in Form QWC4-NM1. ☐
2. Make sure the unit switch at the bottom of the keypad is in the OFF (O) position. ☐
3. Apply 3-phase power to the chiller. Turn on the optional panel circuit breaker, if supplied. ☐
4. Verify the control panel display is illuminated. To prevent the compressors from starting, make sure that the SYSTEM SWITCHES key is off for both systems. ☐
5. Use a clamp-on ammeter to make sure the both compressor heaters are turned on. Heater current draw is approximately 3A. ☐
6. Confirm that the compressor overload current settings have been correctly adjusted by the factory. These are not normally required to be re-set. Use the VSD DATA key on the control panel, navigate to the COMP1 MOTOR OVERLOAD = ### AMPS and COMP2 MOTOR OVERLOAD = ### AMPS screens. The values should match the values on the overload setting label, which is located inside of the VSD cabinet. If the values do not match, an adjustment is required inside the VSD cabinet by qualified service personnel. ☐
7. Record the overload settings below:
System 1: _____ Amps



Setting the motor overload potentiometers incorrectly may cause damage to the equipment.

8. Press the STATUS key. If the following UNIT WARNING message appears, immediately contact QuanTech Product Technical Support to request the password to reprogram the serial number, and any other important factory programmed information that was lost. ☐
9. If the unit is equipped with SC-EQ, set up per 450.50-N1 Section 2. ☐

**UNIT WARNING: INVALID SERIAL NUMBER
ENTER UNIT SERIAL NUMBER**

(Continued on following page)

Programmed Options

Program the required options in the control panel for the desired operating requirements, then record the values below. Refer to the PROGRAM key in SECTION 6 - OPERATION in Form QWC4-NM2 for more information:

1. Display Language = _____
2. Chilled Liquid Mode = _____
3. Local/Remote Mode = _____
4. Display Units = _____
5. Remote Temp Reset = _____
6. Remote Current Reset = _____
7. Compressor Selection = _____
8. Operating Mode (Heat Pump) = _____

Programmed Operating Values

Program the required operating values into the microprocessor, then record them below. Refer to the PROGRAM key in SECTION 6 - OPERATION in QWC4-NM1 for low and high limits, and default values.

1. Chilled Liquid Leaving Temperature Cutout = _____ °F (°C)
2. Motor Current Limit = _____ % FLA
3. Pulldown Motor Current Limit = _____ % FLA
4. Pulldown Motor Current Limit Time = _____ MIN
5. Motor Temp Unload = _____ °F (°C)
6. Unit ID Number = _____
7. Condenser Liquid Ref Level = _____

Liquid Control Setpoint

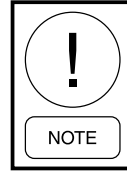
Program the chilled and condenser liquid (optional heat pump) setpoints and ranges, then record them below:

1. Leaving Chilled Liquid Temp Setpoint = _____ °F (°C)
2. Leaving Chilled Liquid Temp Control Range = _____ °F (°C)
3. Maximum Leaving Chilled Liquid Remote Temp Reset = _____ °F (°C)
4. Leaving Condenser Liquid Temp Setpoint = _____ °F (°C)
5. Leaving Condenser Liquid Temp Control Range = _____ °F (°C)
6. Maximum Leaving Condenser Liquid Remote Temp Reset = _____ °F (°C)

Date/Time and Daily Schedule

1. Program the date and time by making sure that the CLK Jumper JP2 on the control board is in the ON position. Press the DATE/TIME key to set the date and time. ☐

2. Program the daily and holiday start/stop by pressing the SCHEDULE key. ☐

C. CHILLER SYSTEM

After completion of the following checks when the system is running correctly, stop the unit, switch all applicable switches ON, and restart the unit.

1. Ensure power is on the chiller to energize the compressor heaters 24 hours prior to start-up. ... ☐
2. Ensure the SYSTEM SWITCHES key is OFF for both systems. ☐
3. Turn the unit switch to the ON position. ☐
4. If the chilled and condenser liquid pumps are manually operated, start the pumps. The control center will not allow the chiller to start unless flow is established through the unit. If the pumps are wired to the control center, override the contact to start the pumps to verify the flow. ☐
5. Throttle back flow to make sure the flow switch opens with a loss of flow. If the pump is turned off during chiller operation, it is recommended that auxiliary pump contacts be placed in series with the flow switch for additional protection. ☐
6. Evaluate cooler and condenser water flow indication compared to design information found on the sales order. If shell pressure drop is used, it should be within +/- 15% of the rating information. ☐
7. If the chilled water and condenser pump run contacts on the chiller were overridden to check flow, remove overrides. Pumps will get start command when chiller initiates run. ☐
8. Press the SYSTEM SWITCHES key, and turn on the System SWITCH. There may be a few seconds delay before the compressor starts because of the anti-recycle timer. Be ready, when the compressor starts, to switch the UNIT switch to the OFF position immediately, if any unusual noises or other adverse conditions develop. ☐

(Continued on following page)

9. When the compressor starts, press the relevant System Pressures key to verify that oil differential pressure develops immediately. If oil pressure does not develop, the automatic controls will shut down the compressor. Under no circumstances should a restart attempt be made on a compressor, which does not develop oil pressure immediately. Switch the UNIT switch to the OFF position. ☐
10. Adjust condenser refrigerant liquid level setpoint to a value that covers the subcooler top and provides proper evaporator performance with the chiller running steady. ☐
11. After the chiller is at full load at Design Leaving Chilled Liquid Temperature, capture the operating data to print or save to text file. ☐

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SECTION 6 - OPERATION

OPERATING CONTROLS

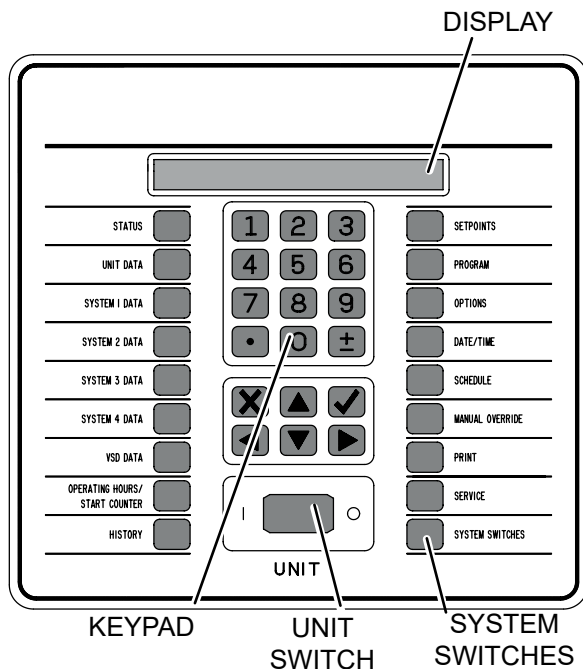


FIGURE 45 - KEYPAD AND DISPLAY

LD19539

Unit Switch

A double pole single throw ON/OFF rocker switch on the front of the control panel is used to turn the entire chiller on and off as shown in *Figure 45 on page 83*.

When the switch is placed in the OFF (O) position, the system shuts down immediately, and all systems will be disabled. When the switch is ON (I), the switch pole has continuity through it for the 115VAC run signal from the control relay board to the VSD board.



Except in emergencies, always use the SYSTEM SWITCH to turn off the compressor, which allows the compressor to go through a controlled shutdown. Avoid using the UNIT SWITCH to turn off the compressor.

Keypad

An operator keypad allows complete control of the system from a central location.

Access the following command keys on the left and right side of the keypad:

- Displays
- Program setpoints
- History data, and
- To initiate system commands.

Use the following keys in the center to enter data in the various program modes:

- 0-9 is a NUMERIC KEYPAD allows keying numeric values into memory.
- PERIOD/DECIMAL allows keying a decimal point into numeric values.
- +/- (PLUS/MINUS) allows making numeric values negative or positive.
- ✓ (ENTER) stores program changes into memory.
- ✕ (CANCEL) cancels the data entry operation, and returns the programmed value to the original value, before any programming changes were made or when an error is made.
- ▲ (UP) and ▼ (DOWN) ARROW allow scrolling (▲) backward and (▼) forward under keys such as:
- PROGRAM
- OPTIONS
- UNIT or SYSTEM DATA
- HISTORY
- ◀ (LEFT) and ▶ (RIGHT) ARROW keys allow scrolling between non-numeric program choices under the OPTION, DATE/TIME, and SCHEDULE keys. The ◀ key allows programming the default value when programming numeric values. For changing numeric values, the ▶ key has no function. Pressing the ◀ key moves the display in the opposite direction. The arrow keys also allow fast scrolling through subgroups of data under keys, such as HISTORY.

Use the ▲, ▼, ◀, and ▶ keys to see the multiple displays under a key. Once the ▲ ▼ keys are pressed and used for scrolling, pressing the original data key will return to the first display message displayed under the data keys.

The keypad uses an overlay to convert the keypad to various languages.

Keypad Data Entry Mode

Enter Data Entry Mode

For numeric programmable items, enter DATA ENTRY by pressing any numbered key, the decimal point, or the +/- key. The data will be entered, and the cursor will appear under the position where the data is being entered.

For non-numeric programmable items, enter DATA ENTRY by pressing the ◀ or ▶ key. The cursor will appear under the first position of the non-numeric string. Press the ◀ or ▶ key to change the programmable choice.

Exit DATA ENTRY Mode

To exit DATA ENTRY, press the ✓ key or X, then the cursor will disappear. If the user presses any other key while in DATA ENTRY, the user has two seconds to accept or cancel the change.

XXXXXXXXXXXX PRESS ✓ TO ACCEPT VALUE OR
X TO CANCEL DATA ENTRY

If the ✓ key was pressed while in DATA ENTRY, and the numeric value entered was out of range, the following message will appear for two seconds followed by the original data display.

XXXXXXXXXXXX OUT OF RANGE TRY AGAIN!
XX

Display

The 80-character (two lines of 40 characters) display is a Liquid Crystal Display (LCD) used for displaying unit, system parameters, and operator messages. The display has an LED backlight for night viewing, and is viewable in direct sunlight.

BASIC OPERATING SEQUENCE

Start Sequence and Loading

To start the chiller, the following conditions must be satisfied before the VSD DC BUS PRECHARGE will take place:

- Unit switch must be ON.
- System switch is ON.
- Run permissive and flow switch inputs have closed switches to Terminal 2.
- No unit faults or start inhibits exist.
- System is not faulted or inhibited.
- Daily schedule calls for the chiller to run.
- Leaving chilled liquid setpoint is above the setpoint high limit (setpoint plus cooling range).

Once the anti-recycle timer times out, the chiller control system will select the compressors to start, pre-charge the VSD, and begin operating the compressor. The compressor speed will be ramped to the minimum start frequency and will increase speed as needed in an effort to regulate the Leaving Chilled Liquid Temperature to meet the required setpoint. In optional HEAT PUMP MODE, the Leaving Condenser Liquid Temperature is regulated to setpoint.

Anti-Recycle Timer

The anti-recycle timer will be set for 120 seconds when:

- The control panel is powered up. The timer must time out before a compressor is allowed to start.
- A system starts. The timer will count down from the time the motor starts, and it must time out before another compressor is allowed to start.
- A system shuts down. The timer must time out before the system is allowed to restart.

Evaporator and Condenser Pump Control

The evaporator and condenser pump dry contacts are energized when any of the following conditions are true:

- A low leaving chilled liquid temperature fault occurs.
- The VSD is requested to precharge for a run.
- The DAILY SCHEDULE is on and the UNIT SWITCH is on.
- The leaving condenser liquid temperature is less than ($<$) 36°F ($<$ 2.2°C).

Regardless if any condition (above) is true, the pump will not run if the control panel has been powered up for less than 30 seconds, or if it has run in the last 30 seconds to prevent the pump motor from overheating.

Compressor Heater Control

The compressor has its own heater. The purpose of the heater is to make sure refrigerant does not condense in the compressor. There is no oil sump, but refrigerant could possibly condense in the rotors or the motor housing. The heater will be off whenever the compressor is running. As soon as the compressor shuts off, the heater will turn on as long as all motor temperature sensors in the compressor read less than 93°F (33.9°C). The heater will turn off, if any internal compressor motor temperature sensor reads more than 95°F (35.0°C).

Alarms

The system has its own alarm contacts for customer remote communication. The alarm output is on (dry contact closed) when no fault condition is present and off (dry contact open) to indicate an alarm situation. The alarm will be activated (contacts open), if any condition below is true.

- Unit is faulted or inhibited from starting for more than five seconds.
- Unit is locked out.
- Power is removed from the chiller.

Chiller Run Contact

The chiller run dry contact is closed whenever the compressor is running, and open when the compressor is shut off.

Chilled and Condenser Liquid Flow Switches

The chilled and condenser liquid flow switches must have electrical continuity to Terminal 2 to permit the chiller to run.

Remote Run Permissive Input

The run permissive switches must have electrical continuity to Terminal 2 to permit the chiller to run.

Load Limiting

Load limiting controls exist and continually supervise the operation to avoid a system from reaching a safety trip level. Load limiting controls act when any parameter listed in *Table 28 on page 86* approaches its safety shutdown threshold to prevent additional loading by the capacity control logic. Override unload controls act when a parameter goes beyond the load limit threshold and is close to the safety shutdown threshold to unload the chiller regardless of the capacity control logic. All of these controls are active immediately at start-up. The following graph in *Figure 46 on page 85* represents the control operation.

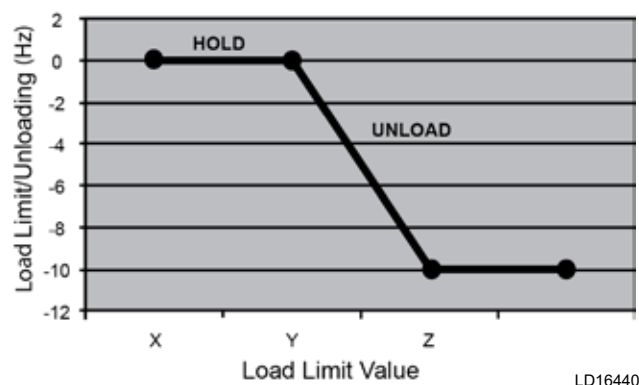


FIGURE 46 - CONTROL OPERATION

The normal operating region of the parameter is to the left of the X point, with the value of the parameter approaching its limit heading right toward Y and Z. For example, increasing condenser pressure, or decreasing evaporator pressure is represented moving to the right. Before reaching the X point capacity control is not limited, and is allowed to load and unload as needed.

Load limiting prevents capacity control from loading when the parameter value is between the X and Y points. Capacity control is still allowed to unload as needed. When the value is between the Y and Z points, capacity control is overridden and the compressor is unloaded by the load limiting function based on a linear ramp between the two points. The thresholds for each parameter is provided in *Table 28 on page 86*.

TABLE 27 - LOAD LIMITING VALUES

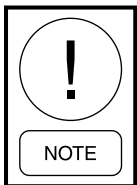
PARAMETER (X AXIS UNITS)	X POINT	Y POINT	Z POINT
MOTOR CURRENT (%FLA)	Active Current Limit Setting – 2% FLA	Active Current Limit Setting	Active Current Limit Setting + 5% FLA
DISCHARGE PRESSURE	High Discharge Pressure Cutout – 15 psig	High Discharge Pressure Cutout – 15 psig	High Discharge Pressure Cutout
EVAPORATOR PRESSURE	Low Evaporator Pressure Cutout + 10 psig	Low Evaporator Pressure Cutout + 5 psig	Low Evaporator Pressure Cutout
VSD INTERNAL AMBIENT TEMP	VSD Internal Ambient Cutout – 3°F	VSD Internal Ambient Cutout – 2°F	VSD Internal Ambient Cutout
VSD BASEPLATE TEMP	VSD Baseplate Temp – 8°F	VSD Baseplate Temp – 4°F	VSD Baseplate Temp
LEAVING CHILLED LIQUID TEMPERATURE (HEAT PUMP MODE ONLY)	Low Leaving Chilled Liquid Temp Cutout – + 4°F	Low Leaving Chilled Liquid Temp Cutout – +2°F	Low Leaving Chilled Liquid Temp Cutout – +2°F

NOTE: All of the controls above are active immediately at start-up.

Pulldown Current Limit Setpoint

Set this setpoint under the PROGRAM key, which is only active on start-up for the time defined by the PULLDOWNCURRENTLIMITTIME. After the run time has exceeded this time, the PULLDOWN CURRENT LIMIT setpoint is ignored.

This control is useful in limiting current pulldown demand during peak usage periods where electric costs are highest.



Limiting current may interfere with capacity control, pulling down chilled liquid temperatures on hot water starts, and maintaining chilled liquid setpoints.

If there are questions about the following reset controls, contact a Quantech BAS representative for details on BAS controls and capabilities.

Leaving Chilled Liquid Temperature (LCHLT) Reset Control

The LCHLT RESET CONTROL is used to reset the actual LCHLT setpoint used in capacity control. See the three methods below to reset the LCHLT setpoint:

- **Local Cooling Reset:** Reprogram the local cooling setpoint under the SETPOINTS key, which is the value to which the unit will control the LCHLT, if no other method is active.

REMOTE TEMPERATURE LIMIT RESET is only possible if the option is enabled by selecting OPTIONS key, and programmable password protected UNIT SETUP MODE from the factory.

- **Remote BAS Comms Reset:** Set the LCHLT setpoint via the BAS COMMS. The control panel will only accept a remote setpoint from the BAS, if the control panel is in REMOTE CONTROL mode (under OPTIONS). If the control panel is in LOCAL CONTROL mode, the BAS setpoint will be ignored, and the remote LCHLT setpoint is set to the local setpoint. The minimum and maximum allowable reset values will be the same as those allowable programmable values for the local setpoint. If these values are exceeded by the BAS, the minimum or maximum value will be used.
- **Remote Analog Reset:** Set the remote LCHLT setpoint via the REMOTE TEMPERATURE RESET analog input. A zero signal input (0%) equates to a 0°F (0°C) offset to the local setpoint. A full scale signal input (100%) equates to a positive offset to the local setpoint equal to the programmable maximum REMOTE TEMP RESET. The offset is linear and may be adjusted between 0% and 100% points. The maximum setpoint allowed is the maximum programmable local setpoint, which will be capped at this value, if the calculated setpoint with temperature offset exceeds this value.

This input may be used either in LOCAL or REMOTE CONTROL mode, which will only operate if enabled under the UNIT SETUP mode and the OPTIONS key. The input will be ignored if the REMOTE TEMP RESET is disabled under the OPTIONS key, or if there are valid BAS

COMMS while in REMOTE CONTROL mode.

Once a change to the input is registered, a timer is set to the value of the REMOTE INPUTS SERVICE TIME as programmable under the UNIT SETUP mode at the factory for the 15 minutes (default). The low limit is five minutes and the high limit is 60 minutes. The remote input will be ignored until this timer expires. The timer assures that rapid changes in a remote reset signal don't result in poor temperature control or excessive compressor cycling. In most instances, this timer will not need to be changed, since resetting it more often than every 15 minutes will create problems with chilled liquid temperature control. A Quantech Factory Service Center should be contacted if a timer change is required.

Optional Heat Pump Mode Selection

If the chiller was purchased with the heat pump option, there are two ways to toggle operation between the controlling leaving chilled liquid temperature to setpoint in chiller mode, or controlling leaving condenser liquid temperature to setpoint in heat pump mode.

Local Heat Pump Mode: Use the OPTIONS key to set the operating mode to CHILLER or HEAT PUMP.

Remote Heat Pump Mode: In the REMOTE MODE only, select Chiller Mode (OPEN CONTACTS) or Heat Pump Mode (CLOSED CONTACTS) using external contacts across control panel Terminals 40 and 41 in Terminal Block 1TB.

Optional Heat Pump Leaving Condenser Liquid Temperature (LCLT) Reset Control

LCLT Reset Control is used to reset the actual LCLT setpoint used in capacity control. See the three methods below to reset the LCLT setpoint:

- **Local Condenser Reset:** Reprogram the local cooling setpoint under the SETPOINTS key, which is the value to which the unit will control the LCLT, if no other method is active.

REMOTE TEMPERATURE LIMIT RESET is only possible if the option is enabled by selecting OPTIONS key, and programmable password protected UNIT SETUP MODE from the factory.

- **Remote BAS Comms Reset:** Set the LCLT setpoint via the BAS COMMS. The control panel will only accept a remote setpoint from the BAS, if the control panel is in REMOTE CONTROL

MODE (under the OPTIONS key). If the control panel is in LOCAL CONTROL MODE, the BAS setpoint will be ignored, and the LCLT setpoint is set to the local setpoint.

The minimum and maximum allowable reset values will be the same as those allowable programmable values for the local setpoint. If these values are exceeded by the BAS, the minimum or maximum value will be used.

- **Remote Analog Reset:** Set the remote LCLT via the REMOTE TEMPERATURE RESET analog input. A zero signal input (0%) equates to a 0°F (0°C) offset to the local setpoint. A full scale signal input (100%) equates to a negative offset to the local setpoint equal to the programmable minimum REMOTE TEMP RESET. The offset is linear and may be adjusted between 0% and 100% points. The minimum setpoint allowed is the minimum programmable local setpoint, which will be capped at this value, if the calculated setpoint with temperature offset exceeds this value.

Current Limit Reset Control

CURRENT LIMIT RESET is used to reset the actual CURRENT LIMIT setpoint used in current limit control. See the three methods below to reset the current limit setpoint:

- **Local Current Limit Reset:** Reprogram the LOCAL CURRENT LIMIT setpoint under the PROGRAM key. This is the value to which the unit will control the current limit and override capacity control, if none of the other methods is active.

REMOTE CURRENT LIMIT RESET is only possible, if the option is enabled by selecting both the OPTIONS key, while in the factory programmable password protected UNIT SETUP MODE.

- **Remote BAS Current Limit Reset:** Set the BAS CURRENT LIMIT via the BAS COMMS. The control panel will only accept a CURRENT LIMIT setpoint from the BAS if the control panel is in REMOTE CONTROL MODE (OPTIONS key). If the control panel is in LOCAL CONTROL MODE, the BAS setpoint will be ignored. The minimum and maximum allowable values will be the same as the minimum and maximum allowable reset values for the CURRENT LIMIT setpoint under the PROGRAM key. If these

values are exceeded, the minimum or maximum value will be used.

- **Remote Current Limit Analog Reset:** Set the CURRENT LIMIT setpoint via the REMOTE CURRENT LIMIT analog input. A zero signal input (0%) equates to the maximum current limit setpoint as defined under the PROGRAM key CURRENT LIMIT setpoint. A full scale signal input (100% input) equates to the minimum current limit setpoint as defined under the PROGRAM key CURRENT LIMIT setpoint. The current limit value is linear and may be adjusted anywhere between the maximum and minimum points of 0% (no offset) and 100% (max. current limiting).

This input may be used in LOCAL or REMOTE CONTROL MODE. This input will be ignored if the REMOTE CURRENT LIMIT is disabled under the OPTIONS key. Once a change to the input is registered, a timer is set to the value of the REMOTE INPUTS SERVICE TIME as programmable under the UNIT SETUP MODE at the factory for the default value of 15 minutes. The low limit is five minutes, and the high limit is 60 minutes.

The remote input will be ignored until this timer expires. The timer assures that rapid changes in a remote reset signal don't result in poor temperature control or excessive compressor cycling.

In most instances, this timer will not need to be changed, since reset more often than 15 minutes will create problems with chilled liquid temperature control. Contact a Quantech Factory Service Center if a timer change is required.

USER INTERFACE

The keys, detailed in the following pages, provide various displays of unit related data. Press the ▲ or ▼ key repeatedly to select multiple display messages. The display messages that contain a number symbol (#) will be replaced with the chiller's present value, which are listed below:

- ###.# °F = Temperature Data
- #####.# % = Percent (0% to 100%)
- ### = :
 - Time Data, i.e. seconds (SEC)
 - PSIG/PSID = Pressure Gauge/
Pressure Difference
 - Hz = Hertz
 - AMPS = Amperage
 - FLA = Full Load Amperage

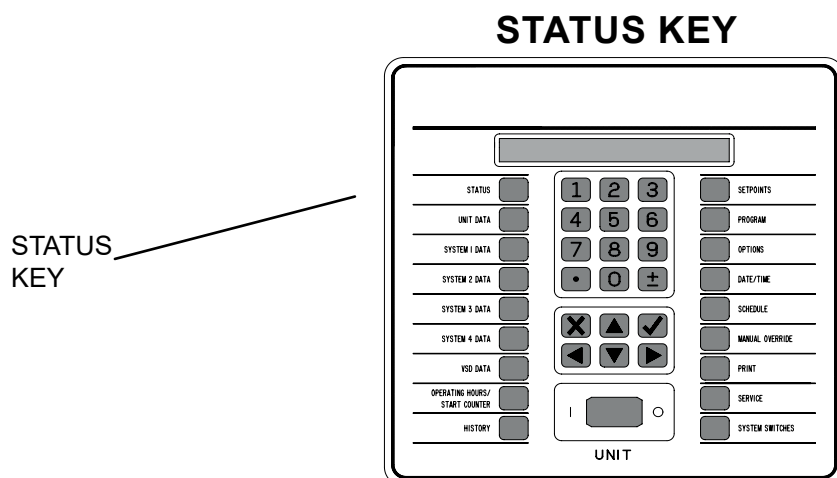


FIGURE 47 - STATUS KEY

LD19539

Press the STATUS key to display the current whole or individual system's operational status, which includes:

- Running status
- Cooling demand
- General or fault status
- External device and unit/system switches status
- Load limiting

The display will show the highest priority message as determined by the microprocessor.

When power is first applied to the control panel, the following message displaying Quantech, EPROM version, date, and time will be displayed for two seconds, followed by the general status message:

(C)2012 QUANTECH
C.XXX.XX.XX 12-JAN-2012 12:45: AM

Unit status messages occupy two lines of the status message display. If no unit status message applies, individual system status messages will be displayed.

Anytime the STATUS key is pressed, or after the EPROM message disappears at power-up, a display indicating chiller or system status will appear.

Multiple STATUS messages may appear, and can be viewed by pressing the STATUS key repeatedly to allow scrolling through up to three messages, which could be displayed at any time on a one-compressor chiller. STATUS messages fall into two categories: GENERALUNITANDSYSTEMSTATUS or FAULT STATUS messages, which are listed below.

General Unit and System Status Messages

UNIT STATUS
MANUAL OVERRIDE

Manual override is activated by the keypad, and is a priority message and cannot be overridden by any other STATUS message. When in this mode, no other STATUS messages can be seen.

UNIT STATUS
UNIT SWITCH OFF

Unit is not allowed to run because the unit switch is in the OFF position.

UNIT STATUS
DAILY SCHEDULE SHUTDOWN

The programmed daily or holiday schedule is keeping the chiller from running.

UNIT STATUS
REMOTE CONTROLLED SHUTDOWN

BAS is not allowing the unit to run.

UNIT STATUS
CHILLED LIQUID FLOW SWITCH SHUTDOWN

The flow switch is open, which is preventing the unit from running. There is a one second delay until the unit shuts down.

UNIT STATUS**CONDENSER LIQUID FLOW SWITCH SHUTDOWN**

The flow switch is open, which is preventing the unit from running. There is a one second delay until the unit shuts down.

UNIT STATUS**VSD COOLING SHUTDOWN**

The chiller is shutdown, but is running the auxiliary coolant pump, to bring the VSD ambient temperature down to an acceptable level before allowing the unit to start.

REMOTE RUN CONTACT IS OPEN

The system remote run permissive input is open, preventing that system from running. There is a one second delay until the unit shuts down.

SYSTEM SWITCH IS OFF

The system is prevented from running by selecting OFF with the SYSTEM SWITCHES key.

COOLING DEMAND SHUTDOWN

This message is only displayed in NORMAL SHUTDOWN HISTORY to indicate a capacity controlled shutdown based on cooling and heating demand.

COMPRESSOR RUNNING

The system is running due to demand.

SHUTTING DOWN

The system is ramping down to shut down. This message is displayed after the software run signal is disabled until the VSD notifies the control board that the compressor is no longer running.

ANTI-RECYCLE TIMER = ### SEC

The amount of time remaining on the anti-recycle timer is shown, and the system is unable to start due to the timer being active.

OPD MITIGATION

OPD is Oil Pressure Differential. Condenser level control is repositioning the level setpoint to reduce evapo-

rator pressure and overcome low differential pressure to maintain oil flow.

Load or Unloading Limit Messages

The following messages show that the designated load limit or unloading is in effect.

DISCHARGE PRESSURE LIMITING**EVAPORATOR PRESSURE LIMITING****MOTOR CURRENT LIMITING****PULLDOWN MOTOR CURRENT LIMITING****CURRENT LIMITING**

The motor current load limit or unloading is in effect through the use of the BAS setpoint offset. The BAS current limit must be activated for this function to operate.

REMOTE MOTOR CURRENT LIMITING

The motor current load limit or unloading is in effect through the use of the remote setpoint offset, which may be offset using a remote voltage or a current signal. The remote current limit must be activated for this function to operate.

VSD BASEPLATE TEMP LIMITING

The VSD baseplate temperature is high, resulting in load limiting or unloading.

VSD INTERNAL AMBIENT TEMP LIMITING

The VSD internal ambient temperature is high, resulting in load limiting or unloading.

CHILLED LIQ LEAVE TEMP LIMITING

Applicable in HEAT PUMP mode only.

FAULT MESSAGES

A number of possible fault messages may appear when the STATUS key is pressed. Whenever a fault message appears, the safety thresholds on the unit have been exceeded, the unit will be shut down, and, in some cases, locked out. The shutdown thresholds and associated information relating to each fault are explained in the UNIT WARNINGS, UNIT SAFETIES (FAULTS) and SYSTEM SAFETIES (FAULTS) sections.

Unit Warnings

Unit warnings, as shown in *Table 31 on page 95*, are caused when a condition is present requiring operator intervention to restart the unit. Check all setpoints, program values, and options before operating the unit. Warnings are not logged into the history buffer. If a unit warning is in effect, the message will be displayed when the operator presses the STATUS key.

MICROBOARD (331-03478-XXX)

The 331-03478-xxx microboard was developed as a direct replacement for the 031-02478-xxx line of microboards. No adapter harness is required when replacing a 02478 with the new 03478. The 03478 uses the IPUII processor card and provides some new features for the chillers that the 02478 did not have. The 03478 program resides in flash memory instead of EPROM. Program updates are accomplished by loading the new program from an SD card inserted into the SD card reader/writer. This same SD card reader/writer also allows the user to datalog the operating parameters to an SD card every 5 seconds. This information is invaluable when troubleshooting unit and system

problems since it allows the service technician to view operating parameters before a unit fault. Details on the new datalogging capability are explained in the OPTIONS Key area of this manual. A Real Time Clock/BRAM keeps time and setpoints during power outages.

Power Supplies and LEDs

The 03478 has LEDs to indicate various states of operation of the microboard.

STATUS – Flashes every ½ second to indicate that the base board processor is running its program.

POWER – On solid indicates that the base board +12V and +5 V power supplies are operational.

TX1 – Red LED flashes when transmitting data out Port 1 TB3 (Future native communications BAS port)

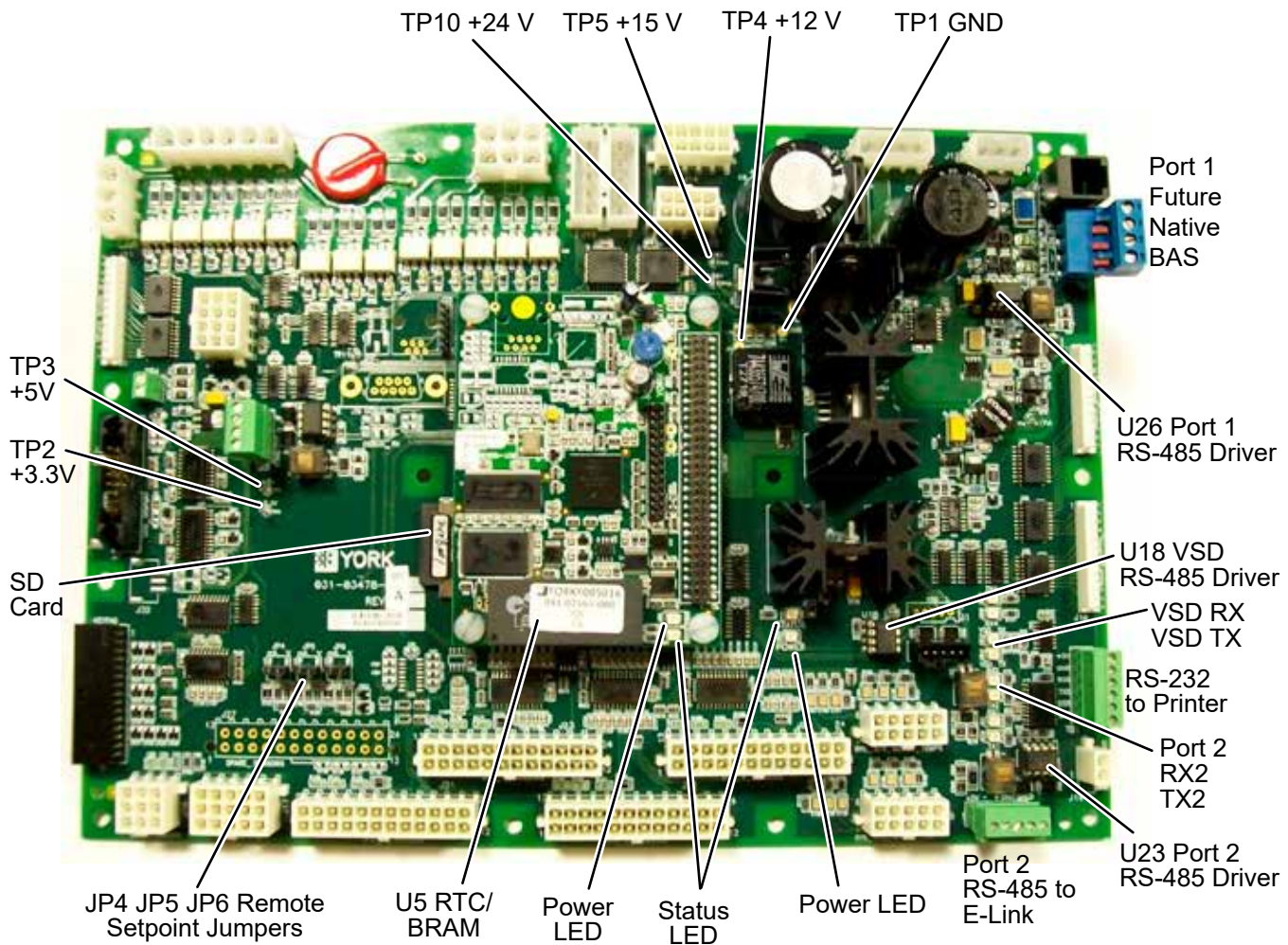
RX1 – Green LED flashes when receiving data in Port 1 TB3 (Future native communications BAS port)

TX2 – Red LED that flashes when transmitting data out Port 2 (E-Link TB2 or printer TB1)

RX2 – Green LED that flashes when receiving data in Port 2 (E-Link TB2 or printer TB1)

VSD_TX – Red LED that flashes when transmitting data out Port 3 to the VSD Logic board

VSD_RX – Green LED that flashes when receiving data in Port 3 from the VSD Logic board



LD19331

FIGURE 48 - NEW 331-03478-XXX MICROBOARD

24 VAC power is applied to the 331-03478-xxx microboard connector J12 and is then used to create the various DC power sources required by the microboard circuitry. If the chiller control is malfunctioning, the power supply test points should be measured to determine the status of the microboard.

Power Supply Test Points

TP1 GND (Measure TP2, TP3, TP4 and TP5 in reference to this Test Point)

TP2 +3.3 V [3.2 VDC to 3.4 VDC] provides power to the processors

TP3 +5 V [4.8 VDC to 5.2 VDC] power communication ports 2,3 and 4 and analog sensors

TP4 +12 V [11.64 VDC to 12.36 VDC] powers the display and backlight and is regulated to become the +5V

TP5 +15 V [11.3 VDC to 16.6 VDC] powers the analog outputs to the EEV valves

Configuration Jumpers

The same configuration jumpers that existed on the 02478 are provided on the 03478.

JP4 Remote Temp Reset jumper position Pins 1 to 2 (left) = 4 mA to 20 mA, Pins 2 to 3 (right) = 0 VDC to 10 VDC

JP5 Remote Current Limit jumper position Pins 1 to 2 (left) = 4 mA to 20 mA, Pins 2 to 3 (right) = 0 VDC to 10 VDC

JP6 Remote Sound Limit jumper position (Pins 1 to 2 (left) = 4 mA to 20 mA, Pins 2 to 3 (right) = 0 VDC to 10 VDC

Communication Ports

TB3 Port 1 Future Native BAS RS-485.

SW1 RS-485 Biasing Switch for Port. Set to ON if Chiller is in an End Of Line position on the network.

U26 is the Port 1 RS-485 Driver Chip. It is socketed to allow field replacement. RX1 and TX1 LEDs illuminate to indicate Port 1 communications activity.

E-Link

SW2 RS-485 Biasing Switch for E-link Port 2, should be in the OFF position.

TB2 is the Port 2 RS-485 E-Link Communications Port. RX2 and TX2 LEDs illuminate to indicate the Port 2 communications activity. U23 is the Port 2 RS-485 Driver Chip. It is socketed to allow field replacement. J16 provides +12 VDC to power the E-Link.

VSD

J2 VSD#1 and J1 VSD#2 connections headers for RS-485 communications to the Variable Speed Drives.

VSD RX and VSD TX LEDs illuminate to indicate the VSD communications activity. U18 is the VSD Port RS-485 Driver Chip. It is socketed to allow field replacement.

PROGRAM UPDATE

The Application software and BACnet database are stored in the IPU II Flash memory. Copying a new version of software and/or database from the SD Flash card changes the IPU II Flash. The new application software must be named SOFTWARE.BIN. The new BACnet database must be named DATABASE.BIN. These files must be located in the root directory of the SD Flash card. The software can be updated without updating the database. In this case, the existing database will be used with the new software. The database cannot be updated without updating the software.

To update the Program:

1. Copy the new software in to the root directory of the SD card.
2. Rename this new program file SOFTWARE.BIN.

3. Turn the Unit Switch OFF.
4. Insert the SD card in to the SD card Reader/Writer slot.
5. Press the OPTIONS Key and then press the Down Arrow Key until FLASH CARD UPDATE DISABLED is displayed.
6. Press the RIGHT ARROW Key to change the DISABLED to ENABLED
7. Press the ENTER Key to start the update. Once the ENTER Key is pressed the message FLASH CARD

UPDATING PLEASE WAIT... is displayed until the update has been completed. The keypad and display will not respond during the flash update.



Do not reset or power down the chiller until the update is finished. Interrupting the Flash Update procedure can corrupt the program file and render the control board inoperative.

8. After the software is finished updating, the controller will automatically reboot.
9. If an error occurs during the update, an error message will be displayed where XXXX is the Error Code

TABLE 28 - FLASH CARD UPDATE ERROR XXXXX

FLASH CARD UPDATE ERROR CODE	DEFINITION
0	Okay
10	Flash card not found.
11	SOFTWARE.BIN file not found
14	SOFTWARE.BIN file larger than expected.
15	RAM to IPU Flash transfer of DATABASE.BIN failed.
16	RAM to IPU Flash transfer of SOFTWARE.BIN failed.
17	Could not allocate sufficient memory to read or write file.
99	Internal software error.

10. After the update is completed and the controller reboots, the keypad and display will return to full functionality. The SD card may be left in place for datalogging or else replaced with another SD card dedicated for datalogging.

11. To remove the SD card, GENTLY press the card in slightly then release the pressure. The card should then pop out slightly to allow removal.

DATA LOGGING

A 2GB SD card (p/n 031-03466-000) may be inserted into the 03478 IPUII SD card slot to record the chiller operating parameters at 5 second intervals. The data is stored in a folder named RMYYYMM where YYYY is the year and MM is the month the data was recorded. The controller creates a file for each day within this folder with the format YYYYMMDD.csv where DD equals the day of the month in addition to the Y Year and M Month fields. For example: The folder named RM201503 is a folder created in March of 2015. Within this folder would be a file for each day of that month that the datalogging is running. If a review of the History Report shows that an abnormal event occurred on March 3rd at 2:05pm, the user can import the 20150303.csv file into Excel and look at the system parameter details leading up to the 2:05pm event.



Follow all QuantechSafety Directives when inserting or removing the SD card since the card is located inside the control cabinet.

To start the Data Logging, insert the SD card into the SD card slot on the 03478 IPUII board. The label on the SD card should be facing outwards.

Once the SD card is inserted and the unit is powered up, press the OPTIONS key. Then press the Down Arrow key to advance to the DATA LOG TO FLASH-CARD selection.

Next press the Right Arrow key to select ON then press the ENTER key to start the Data Log. A 2GB SD card will hold about 8 months worth of data. A smaller card may be used that will hold less data but should be tested for compatibility. The controller operating system does not support SD cards larger than 2GB. When the SD card becomes full, the oldest date file is automatically deleted and a new day log file is written in its place.

To stop the data logging and retrieve the SD card, press the OPTION key and then the Down Arrow key to display the DATA LOG TO FLASHCARD option and then use the Right Arrow key to select OFF then press the ENTER key.

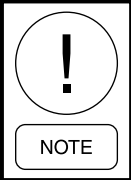
Again, follow the Quantech Safety Directives to stop the chiller, power off the unit and open the control cabinet door to retrieve the SD card.

Once inside the control cabinet, lightly press in on the SD card and then release the pressure. The SD card should pop out slightly to allow removal. You may then copy the files to a PC for analysis or email the file to someone. The files are saved as a CSV format which can be read by Excel. Below is a sample of some of the data imported from a QTC Chiller. Once the file is read in to Excel, you can hide unrelated columns or plot required parameters to analyze the data.

TABLE 29 - DATA LOGGING

HOUR	MIN	SEC	SYS 1 SUCT PRESS	SYS 1 DSCH PRESS	SYS 1 OIL PRESS	SYS 1 SUCT TEMP	SYS 1 SAT SUCT TEMP	SYS 1 SUCT SHEAT	SYS 1 MTR CURR FLA	SYS 1 DSCH TEMP	SYS 1 SAT DSCH TEMP	SYS 1 DSCH SHEAT	SYS 1 OIL TEMP	SYS 1 COMP STATUS	SYS 1 ECON	SYS 1 FAN STAGE	SYS 1 MOTOR TEMP1
			PSIG	PSIG	PSIG	°F	°F	°F	AMPS	°F	°F	°F	°F				°F
0	0	10	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	0	15	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	22	20	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	22	25	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	22	30	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	22	35	82.5	84.4	84.4	93	77.4	15.6	0	83	78.6	4.4	82	OFF	OFF	0	107.9

TABLE 30 - UNIT WARNINGS

MESSAGE	DESCRIPTION
OIL FILTER CLOGGED	This message alerts low oil flow, possibly from a clogged oil filter. A system will not shutdown when its HIGH OIL FILTER DIFFERENTIAL PRESSURE (Oil Pressure - Discharge Pressure) rises above the programmable setpoint (10 psid to 100 psid, default 20 psid). The message will be cleared when the pressure drops below setpoint or the compressor is stopped.
INVALID NUMBER OF COMPRESSORS SELECTED	<p>This message, which will be displayed indefinitely, checks a jumper in the VSD wiring harness, which indicates the number of compressors. The message will occur after the VSD has been initialized on power-up, if no jumpers are installed, or if more than one jumper is installed. To clear this warning, turn off the control panel and VSD control voltage, and install the jumpers properly in the VSD wiring harness.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p><i>These jumpers are factory installed in the wire harness plug and should not require changes.</i></p> </div> </div>
INVALID SERIAL NUMBER	If this message appears, which indicates an invalid letter or number exists in a location in the serial number string, the chiller may have lost important factory programmed information. Contact Quantech Product Technical Support immediately to get the password to enter the serial number using the SERVICE key. Bypass this status message to view additional messages by pressing the STATUS key repeatedly. Up to three STATUS messages can be displayed at any time.
LOW BATTERY	On power-up, the control system checks the RTC battery to see if it is still operational. If it is, normal unit operation is allowed. If the battery voltage is low, the warning message is displayed indefinitely. If a low battery condition exists, all programmed setpoints, program values, time, schedule, and history buffers were lost, which will be reset to their default values, which may not be the required operating values. Once a bad battery is detected, the unit will be prevented from running until the MANUAL OVERRIDE key is pressed. After the key is pressed, the anti-recycle timers will reset to allow the operator sufficient time to check setpoints, program values, etc. If a low battery is detected, replace it as soon as possible. The unit will be prevented from running on the next power interruption.

Unit Safeties (Faults)

Unit safeties (faults), as shown in *Table 32 on page 97*, are:

- Faults that cause the running compressor to be shut down, if a safety threshold is exceeded for three seconds.
- Recorded in the history buffer along with all unit data and system operating conditions.
- Auto reset faults where the unit will be allowed to restart automatically after the fault condition is no longer present.

The only exception is any VSD related unit fault. If any combination of three VSD unit faults occur within 90 minutes, the unit will be locked out on the last fault. A VSD lockout condition requires a manual reset, using the SYSTEM SWITCHES key on the keypad. They must be cycled off and on to clear a VSD unit lockout fault. If a unit safety is in effect, the message will be displayed when the STATUS key is pressed.

Shutdowns due to faults are one of two types:

- Immediate - Power to run the compressor is stopped immediately.
- Ramped - The speed of the compressor is ramped to zero quickly, and then power is stopped immediately.

VSD Fault Data

When a VSD fault has occurred, three types of fault data are captured by the VSD logic board. This data is stored in the board battery-backed RAM for safekeeping and is transferred to the panel via the communications link.

First Fault Code

The first fault code will be set for the fault that initiated the system shutdown.

All Fault Bits

Any faults, which occur within the communications transmission time frame, following the inception of the first fault, is stored and transmitted to the panel together with the first fault data, as ALL FAULT information.

Fault Data

A snapshot of the operating parameters of the unit is continuously updated in the battery-backed memory once every program loop. Upon receipt of a first fault code, a snapshot of the operating parameters, which are stored in memory, is transmitted to the panel as the fault data.

If a control panel safety occurs after the VSD fault, but before the fault is reset, the control panel fault is added as an ALL FAULT of the VSD fault, meaning it will be registered in the history because it occurred while the VSD was shutting down, or while the systems were shut down. ALL FAULTS do not store operating data at the time of the fault.

If a VSD fault occurs during the fault rampdown or while the systems are shut down, the VSD fault will be registered as a new fault because any VSD fault needs to be registered with a full account of the systems data at the time of the fault.

TABLE 31 - UNIT SAFETIES (FAULTS)

MESSAGE	DESCRIPTION
UNIT YYYYYYY DC BUS VOLTAGE IMBALANCE	Software-Initiated Fault - The voltage magnitude of each half of the DC bus shall remain within +/- 100 VDC of the total DC bus voltage divided by two. If the magnitude exceeds the +/- 100 volt window the unit shall initiate a shutdown. This safety will lock out on the first occurrence. The VSD shutdown type is immediate. YYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
UNIT YYYYYYY HIGH DC BUS VOLTAGE TRIP	Hardware-Initiated Fault - The high DC bus over voltage trip level is determined by hardware on the logic board, and it is designed to trip the unit if the DC bus exceeds 766 +/- 30 VDC. This is an auto-restart safety that will lock out on the third fault in 90 minutes. The VSD shutdown type is immediate. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
UNIT YYYYYYY HIGH LEAVING CONDENSER LIQUID TEMP	This fault protects the chiller from a high pressure cutout. This situation could occur under low flow/high head conditions or if the control setpoint values are improperly programmed. Any time the leaving condenser liquid temperature (water or brine) increases above the programmable cutout point, the chiller will shutdown. Restart can occur, if demand allows, when condenser leaving liquid temperature falls 4°F (2.2 °C) below the cutout. This fault cannot cause a lockout. The unit will be inhibited from starting if the leaving condenser liquid temp is above the cutout plus 4°F (2.2 °C). YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out.
UNIT YYYYYYY HIGH VSD INTERNAL AMBIENT TEMP	Software-Initiated Fault - The VSD logic board contains a temperature sensor, which monitors the unit's internal ambient temperature. The magnitude of the unit's internal temperature is compared to a limit of 158°F (70°C). If this limit is exceeded, the unit initiates a shutdown. The VSD cooling fan and water pump will remain energized until the internal temperature drops below 148°F (64.4°C) at which time the unit will be allowed to restart. The VSD cooling fan and water pump are de-energized when the internal temperature drops below 143°F (61.6°C). This fault will not cause a lockout. The VSD shutdown type is ramped. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out.
UNIT YYYYYYY LOW DC BUS VOLTAGE	Software-Initiated Fault - The DC bus under voltage trip level is dependent on the configuration of the VSD is as follows: Shutdown is set at 500 VDC on 460V, 60 Hz VSD, or 414 VDC on 380 V 50/60 Hz and 400/415 V 50 Hz VSD. This is an auto-restart safety that will lock out on the third fault in 90 minutes. The VSD shutdown type is immediate. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
UNIT YYYYYYY LOW LEAVING CHILLED LIQUID TEMP	This fault helps to protect the chiller from an evaporator freeze-up should the chilled liquid temperature drop below the freezing point. This situation could occur under low flow conditions or if the setpoint values are improperly programmed. Any time the leaving chilled liquid temperature (water or brine) drops below the programmable cutout point, the chiller will fault and shut down with a ramped shutdown. The water trip temperature is 36° F (2.2°C) or programmable for brine from 5°F to 36°F, default 36.0°F (-15°C to 2.2°C, default is 2.2°C). Restart can occur, if demand allows, when the chilled liquid temperature rises 4°F (2.2°C) above the cutout. This fault does not cause a lockout. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out.
UNIT YYYYYYY MOTOR CURRENT OVERLOAD	Hardware-Initiated Fault - This fault compares the highest of the three phases of motor current per compressor to the compressor's 105% FLA ADJUST (overload) potentiometer setting. If the current exceeds the setting continuously for 30 seconds, all compressors will shut down. This safety will lockout a system on the first occurrence. The VSD shutdown type is immediate. YYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.

TABLE 32 - UNIT SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION
UNIT YYYYYYY PRE-CHARGE DC BUS VOLTAGE IMBALANCE	The voltage magnitude of each half of the DC bus shall remain within +/- 100 VDC of the total DC bus voltage divided by two. If the magnitude exceeds the +/- 100 volt window the unit shall initiate a shutdown. This safety will lock out on the first occurrence. YYYYYYY will show LOCKOUT, and will not restart until the operator clears the condition using the keypad
UNIT YYYYYYY PRE-CHARGE LOW DC BUS VOLTAGE	Software-Initiated Fault - This fault protects the chiller from conditions outside of the tolerances required to produce proper output power to the compressor motor. Several conditions must be met during the pre-charge operation. The DC bus voltage shall reach at least: 41 VDC within four seconds after the pre-charge signal has been asserted for 50 Hz and 60 Hz VSD, 500 VDC within 19 seconds after the pre-charge signal has been asserted on the 460V, 60Hz VSD, and 414 VDC within 19 seconds on the 380V 50/60 Hz and 400/415 V, 50 Hz VSD. If the unit fails to make pre-charge, the signal shall be deasserted for 10 seconds, during which time the units fans and water pumps shall remain energized. Following this 10-second period, the pre-charge shall again be initiated. The unit shall attempt to make pre-charge three consecutive times. If the unit fails to make pre-charge on three consecutive times, the unit shall shut down and lock out. YYYYYYY will show LOCKOUT, and will not restart until the operator clears the condition using the keypad
UNIT YYYYYYY SINGLE PHASE INPUT VOLTAGE	Hardware-Initiated Fault - The VSD's SCR trigger control board contains circuitry that checks the three phase mains for the presence of all three-line voltages. If any line voltage is not present, the unit initiates a shutdown. The unit shall remain in shutdown until all voltage on all three phases is present. This fault will not cause a lockout. The VSD shutdown type is immediate. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out.
UNIT YYYYYYY VSD COMMUNICATIONS FAILURE	This fault prevents the unit from trying to run, if the control board never initializes communications with the VSD logic board. The unit will also shut down with a ramped shutdown, if the control board loses communications with the VSD logic board while the chiller is operating. On power-up, the microprocessor board will attempt to initialize communications with the VSD logic board. The control panel will request data from the VSD, which includes the number of compressors and the VSD software version. Once these data points have been received by the control board, and successfully initialized, the control board will not request them again. If the communications connection fails to occur and a reply from the VSD logic board does take place in eight seconds, the control board will prevent the chiller from operating, and a fault message will be displayed. During normal operation, if the control board receives no valid response to messages for eight seconds, the unit will shut down all compressors. The control board will continue to send messages to the VSD while faulted. The unit will be inhibited from starting until communications are established. The fault will automatically reset when the control board receives a valid response from the VSD for a data request. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out.
UNIT YYYYYYY VSD CT PLUG FAULT	Hardware-Initiated Fault - Jumpers are located in each CT plug on the VSD logic board to feedback a digital signal to indicate if all of the plugs are installed. If a plug is not installed, a low value is read on the digital input, and the unit will trip. This auto-restart safety will lock out on the third fault in 90 minutes. The VSD shutdown type is immediate. YYYYYYY will show FAULT to indicate that a system is in a FAULT condition, and will restart when the condition clears; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
UNIT YYYYYYY VSD LOGIC BOARD FAULT	Upon receipt of the voltage and frequency commands, the VSD PWM generator shall acknowledge receipt of the command by toggling a port on the system microprocessor. If the system microprocessor does not receive the handshake within 1.5 seconds of issuing the command (due to the TEST mode of operation) the unit shall initiate a trip. This auto-restart safety will lock out on the third fault in 90 minutes. The VSD shutdown type is immediate. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.

TABLE 32 - UNIT SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION
UNIT YYYYYYY VSD LOGIC BOARD POWER SUPPLY	Hardware-Initiated Fault - The various DC power supplies which power the logic board are monitored via hardware located on the logic board. If any power supply falls outside its allowable limits, the unit initiates a shutdown. This auto-restart safety will lock out on the third fault in 90 minutes. The VSD shutdown type is immediate. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.

System Safeties (Faults)

System safeties (faults), as shown in *Table 33 on page 99*, are:

- Faults that cause the compressor to be shut down, if a safety threshold is exceeded for three seconds.
- Recorded in the history buffer along with all unit data and system operating conditions.

- Auto reset faults where the unit will be allowed to restart automatically after the fault condition is no longer present.

If any combination of three faults on the same system occurs within 90 minutes, that system will be locked out on the last fault, which requires a manual reset using the system switches on the keypad and must be cycled off and on to clear the lockout fault.

TABLE 32 - SYSTEM SAFETIES (FAULTS)

MESSAGE	DESCRIPTION
YYYYYYY CONTROL VOLTAGE	This fault alerts the user that the system's control voltage is not present, which could be due to a blown or missing control fuse. This safety will shut down a system if the unit switch input is low and the other system's unit input is high. A shutdown will not occur if both systems' unit switch inputs are low. This fault occurs immediately, and does not wait for three seconds. This safety will not cause a lockout. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, will restart when the condition clears, and the 120-second anti-recycle timer times out.
YYYYYYY EDUCTOR CLOG	This fault is designed to detect low flow of oil in the oil return eductor line. This safety will shut down the unit if the eductor temperature rises above the saturated evaporator temperature more than the programmed setpoint (5.0°F to 50.0°F, default 5.0°F (2.7°C to 27.7°C, default 2.7°C)) for the programmed eductor safety time (one to 1000 minutes, default 10 minutes). This fault causes a lockout on the first occurrence. YYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
YYYYYYY GATE DRIVER FAULT	Hardware-Initiated Fault - The VSD IGBT gate driver control board monitors the saturation voltage drop across each IGBT while it commands it gated on. If the IGBT's saturation voltage exceeds the prescribed limit, the gate driver shall determine that a short circuit is present, which causes a system shutdown. Also, if the gate driver board's power supply voltage falls below its permissible limit, this same fault is generated. This auto-restart safety will lock out on the third fault in 90 minutes. The VSD shutdown type is immediate. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
YYYYYYY HIGH DIFF OIL PRESSURE	The high differential oil pressure cutout protects the compressor from low oil flow, possibly from a clogged oil filter. The system will shutdown when its differential oil to discharge pressure rises above the cutout of 65 psid (4.5 kPa). This safety is ignored for the first 90 seconds of run time. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, will restart when the condition clears, and the 120-second anti-recycle timer times out. If three faults occur within 90 minutes, LOCKOUT will appear, and will not restart until the operator clears the fault using the keypad.

TABLE 33 - SYSTEM SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION
YYYYYYY HIGH DISCHARGE PRESSURE	Software-Initiated Fault - A system will fault and shut down with a ramped shutdown when the high discharge pressure rises above 333 psig (2300 kPa) for 0.5 seconds. The system will be allowed to restart when the discharge pressure falls to 293 psig (20.2 kPa). The system will also be inhibited from starting if the pressure is above 293 psig (2020 kPa). YYYYYYYY will show FAULT to indicate a system is in a FAULT condition, will restart when the condition clears, and the 120-second anti-recycle timer times out. If three faults occur within 90 minutes, LOCKOUT will appear, and will not restart until the operator clears the fault using the keypad.
YYYYYYY HIGH DISCHARGE TEMP	This fault protects the motor and compressor from overheating. A system will fault and shut down with a ramped shutdown when its discharge temperature rises above 225°F (107°C). A system will be inhibited from starting, if the discharge temperature is above 175°F (79°C). YYYYYYYY will show FAULT to indicate a system is in a FAULT condition, will restart when the condition clears, and the 120-second anti-recycle timer times out; or YYYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
YYYYYYY HIGH MOTOR CURRENT	Hardware-Initiated Fault - The three output lines to the compressor motor are monitored via three current transformers within the drive. The unit's three phases of instantaneous output current are compared to a prescribed limit, contained in hardware. The nominal peak current trip level is dependent on the configuration of the VSD as follows: 460 V 60 Hz, VSD Frames, A and B shutdown is 575.5 amps (554 amps (min.) 597 amps (max)), 380 V 50/60 Hz and 400/415 V 50 Hz, VSD Frames A and B shutdown is 649.5 amps (626 amps (min.), 674 amps (max)), and 380V 50/60 Hz and 400/415 V 50 Hz, VSD Frames C and D, and 460V 60 Hz Frame D shutdown is 863.3 amps (831 amps (min.), 896 amps (max)). This auto-restart safety will lock out on the third fault in 90 minutes. The VSD shutdown type is immediate. YYYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
YYYYYYY HIGH MOTOR TEMP Z	This fault prevents a compressor from running when its motor temperature is too high. A system will shut down when any of its two or three compressor motor temperature sensors rises above 250°F (115 °C). The system will be inhibited from starting if any of its motor temperature sensors is above 240°F (120°C). This fault causes a lockout on the third fault in 90 minutes. If any motor temperature sensor is being ignored (as selectable under UNIT SETUP MODE) that sensor will not be used in evaluating the high motor temperature safety and start inhibit. YYYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad. Z is the MOTOR TEMP SENSOR NO.
YYYYYYY HIGH VSD BASEPLATE TEMP	Software-Initiated Fault - The VSD phase bank assembly contain one heat sink to cool both the inverter power modules and the converter SCR/Diode modules. Each module contains an internal temperature sensor (5K ohm at 0°F (25°C)) to monitor its baseplate temperature. The inverter power module's baseplate temperatures on the Compressor is compared in software to a limit dependent on the VSD configuration as follows. When the limit is exceeded the unit is shut down: 218°F (103.3°C) for Frames A and B, and 226°F (103.3°C) for Frames C and D. This auto-restart safety will lock out on the third fault in 90 minutes. The VSD shutdown type is ramped.

TABLE 33 - SYSTEM SAFETIES FAULTS (CONT'D)

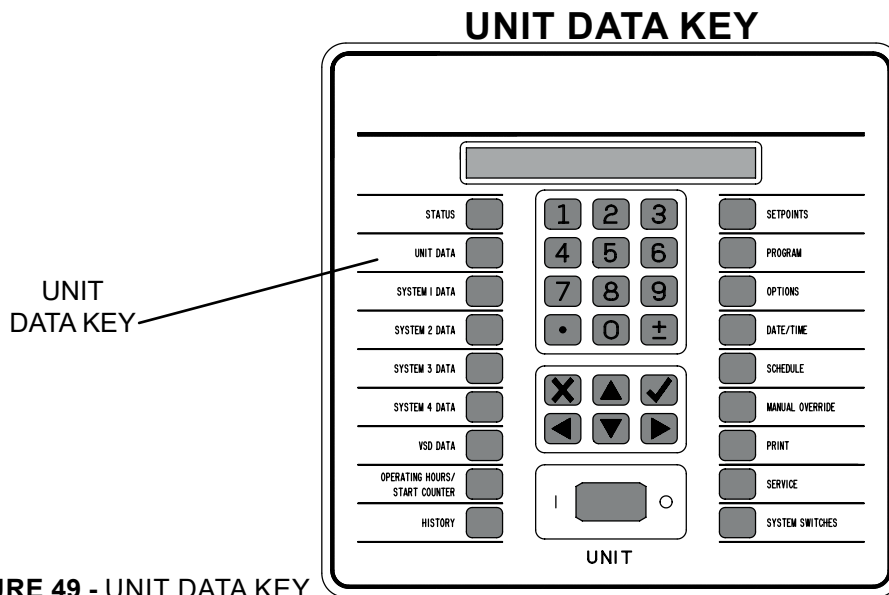
MESSAGE	DESCRIPTION																													
YYYYYYY HPCO	Hardware-Initiated Fault - The mechanical High Pressure Cutout (HPCO) protects the system from experiencing dangerously high discharge pressure. A system will fault and shut down immediately when the mechanical high pressure cutout contacts open. The fault will occur immediately and not wait three seconds. The HPCO is wired in series with the VSD run signal and will only be checked by the control board when the system is running.																													
	TABLE 33 - HPCO MECHANICAL CUTOUTS																													
	<table><tr><th rowspan="2">HPCO DESCRIPTION</th><th colspan="2">OPEN</th><th colspan="2">CLOSE</th></tr><tr><th>PSIG (MPa)</th><th>+ / -</th><th>PSIG (MPa)</th><th>+ / -</th></tr><tr><td>025-39956-001</td><td>337 (2.32)</td><td>8 (0.05)</td><td>230 (1.58)</td><td>10 (0.07)</td></tr><tr><td>025-39956-002</td><td>299 (2.06)</td><td>7 (0.05)</td><td>200 (1.37)</td><td>10 (0.07)</td></tr><tr><td>025-39956-003</td><td>341 (2.35)</td><td>7 (0.05)</td><td>200 (1.37)</td><td>10 (0.07)</td></tr><tr><td>025-39956-004</td><td>204 (1.40)</td><td>7 (0.05)</td><td>120 (0.82)</td><td>10 (0.07)</td></tr></table>	HPCO DESCRIPTION	OPEN		CLOSE		PSIG (MPa)	+ / -	PSIG (MPa)	+ / -	025-39956-001	337 (2.32)	8 (0.05)	230 (1.58)	10 (0.07)	025-39956-002	299 (2.06)	7 (0.05)	200 (1.37)	10 (0.07)	025-39956-003	341 (2.35)	7 (0.05)	200 (1.37)	10 (0.07)	025-39956-004	204 (1.40)	7 (0.05)	120 (0.82)	10 (0.07)
	HPCO DESCRIPTION		OPEN		CLOSE																									
		PSIG (MPa)	+ / -	PSIG (MPa)	+ / -																									
	025-39956-001	337 (2.32)	8 (0.05)	230 (1.58)	10 (0.07)																									
	025-39956-002	299 (2.06)	7 (0.05)	200 (1.37)	10 (0.07)																									
	025-39956-003	341 (2.35)	7 (0.05)	200 (1.37)	10 (0.07)																									
	025-39956-004	204 (1.40)	7 (0.05)	120 (0.82)	10 (0.07)																									
	YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.																													
YYYYYYY LOW DIFF OIL PRESSURE	This fault protects the compressor from low oil flow causing insufficient lubrication. A system will fault and shut down with a ramped shutdown when its differential between oil and suction pressure falls below the fault. The safety is ignored for the first 60 seconds of run time. If restart transition has occurred, the timer is set according to <i>Table 35 on page 101</i> with a maximum limit of 73 seconds. The timer calculation allows for 60 seconds of run time after the time it takes to ramp the running compressor from its existing speed to shutdown speed.																													
	TABLE 34 - TIMER SETTINGS																													
	<table><tr><th>CURRENT FREQUENCY</th><th>INCREASE TIMER BY:</th></tr><tr><td>>100 Hz</td><td>60 s + (100 Hz - 5 Hz)/30.4 Hz/s + 9.5 s</td></tr><tr><td>< or = 100 Hz</td><td>60 s + (Current freq - 5 Hz)/10 Hz/s</td></tr></table>	CURRENT FREQUENCY	INCREASE TIMER BY:	>100 Hz	60 s + (100 Hz - 5 Hz)/30.4 Hz/s + 9.5 s	< or = 100 Hz	60 s + (Current freq - 5 Hz)/10 Hz/s																							
	CURRENT FREQUENCY	INCREASE TIMER BY:																												
	>100 Hz	60 s + (100 Hz - 5 Hz)/30.4 Hz/s + 9.5 s																												
< or = 100 Hz	60 s + (Current freq - 5 Hz)/10 Hz/s																													
NOTE: 9.5 s = (100 Hz-5 Hz/10 Hz s), the time it takes to ramp from 100 Hz to 5 Hz.																														
After the timer expires, the fault is linearly ramped from 0 psid (0 kPa) to the programmable threshold (20 psid to 60 psid, default 25 psid (137 kPa to 413 kPa, default 172 kPa) in 10 minutes. If the VSD frequency is less than 50 Hz when the differential pressure falls below the limit, the three second start-up bypass time will be increased to 30 seconds. Under these conditions, the slow speed of the running compressor causes the oil differential to become very low, especially if the water temperature and the suction pressure are high. The bypass make sure the compressor will not trip on a nuisance low oil differential fault. This auto-restart safety will lock out on the third fault in 90 minutes. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.																														
YYYYYYY LOW DISCHARGE SUPERHEAT	This fault protects against excessive liquid refrigerant carryover from the evaporator, in cases which may be a result of overcharge of refrigerant or another refrigerant inventory problem. It also protects the compressor from liquid refrigerant flooding back from the economizer feed line, in cases where the economizer valve fails to close. This safety is ignored for the first 10 minutes of system run time. If the discharge superheat falls below 5.0°F (2.8°C) for ten minutes, the system will shutdown. This fault causes a lockout on the third fault in 90 minutes. YYYYYYY will show FAULT to indicate a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.																													

TABLE 33 - SYSTEM SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION
YYYYYYY LOW ECONOMIZER SUPERHEAT FAULT	This fault protects against excessive liquid refrigerant carryover from the economizer, in cases which may be a result of EEV, sensor or other problems. It also protects the system compressor from liquid refrigerant flooding back from the economizer feed line, in cases where the economizer valve fails to close. This safety is ignored for the first five minutes of system run time. If the economizer superheat falls below a programmable setpoint (0°F to 20°F, default 5°F (0°C to 11°C, default 2.7°C)) for five minutes, the system or unit will shutdown. This fault causes a lockout on the third fault in 90 minutes. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
YYYYYYY LOW EVAP PRESS	This fault protects against operation with low refrigerant charge, which helps protect the chiller from an evaporator freeze-up, should the system attempt to run with a pressure below freezing for the application. When SMART FREEZE POINT PROTECTION is disabled, this safety fault is set whenever the evaporator pressure is less than or equal to the programmable cutout, and is released when the evaporator pressure becomes greater than the programmable cutout. This fault causes a lockout on the third fault in 90 minutes. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad. When SMART FREEZE POINT PROTECTION is enabled, this safety fault is set whenever the evaporator refrigerant temperature is less than 25.0°F, and is released when the evaporator refrigerant temperature becomes greater than or equal to 25.0°F. This fault causes a lockout on the first fault. YYYYYYY will show LOCKOUT and will not restart until the operator clears the fault using the keypad.
YYYYYYY LOW EVAP PRESS LCHLT	This safety fault causes a lockout on the first fault, and is bypassed for the first 10 minutes of chiller run time. It is set if the leaving chilled liquid temperature is less than the evaporator saturation temperature by at least 2.5°F or greater than the evaporator saturation temperature by at least 25.0°F for at least 10 consecutive minutes. This fault is released when the chiller stops running, or the leaving chilled liquid temperature is within - 2.5° F and + 25.0°F of evaporator saturation temperature. YYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
YYYYYYY LOW EVAP PRESS REFRIG TEMP	This safety fault is bypassed for the first ten minutes of chiller run time and is available only whenever the SMART FREEZE PROTECTION is enabled. This fault is disabled for glycol applications. This fault causes a lockout on the first fault. This fault is set when the evaporator refrigerant temperature or the evaporator saturation temperature is less than 32°F (0°C) and the evaporator refrigerant temperature is at least 3.0°F (-16°C) above or below the evaporator saturation temperature for at least 60 consecutive seconds. This fault is released when any of the following is true: Chiller stops running, SMART FREEZE PROTECTION is disabled, Evaporator refrigerant temperature is greater than 32°F (0°C), Evaporator saturation temperature is greater than 32°F (0°C), and evaporator refrigerant temperature is within 3.0°F (-16°C) (plus or minus) of the evaporator saturation temperature. YYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.
YYYYYYY LOW MOTOR CURRENT	This fault shuts the system down with a ramped shutdown when the microprocessor detects the absence of motor current (less than 10% FLA), indicating the compressor is not running. This safety is ignored for the first 10 seconds of operation. YYYYYYY will show FAULT to indicate a system is in a FAULT condition, will restart when the condition clears, and the 120-second anti-recycle timer times out. If three faults occur within 90 minutes, LOCKOUT will appear, and will not restart until the operator clears the fault using the keypad.

TABLE 33 - SYSTEM SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION
YYYYYYY LOW EVAP PRES SMART FREEZE	<p>This fault is considered active when SMART FREEZE is turned on via the enable/disable setting, and the active LCHLT control setpoint is less than or equal to 38.0°F (3.3°C). SMART FREEZE can only be enabled or disabled while the chiller is stopped, and is only available in water applications. It is a lockout fault on the first occurrence. While Smart Freeze Point Protection is enabled, a timer starts incrementing when any system evaporator saturation temperature is less than 32.8°F (0.44°C) and decrementing when all system evaporator saturation temperatures are greater than 32.8°F (0.44°C). The timer is reset to zero when Smart Freeze is inactive. The system will be able to start after the evaporator temperature is greater than freeze threshold or the timer is less than the calculated time to freezing. The number of seconds it will take the water in the evaporator tubes to freeze is calculated from the system evaporator saturation temperature and the freeze threshold of 32.8°F (0.44°C) as follows:</p> $\text{Time (seconds) to freezing} = (4053.7) / (\text{freeze threshold} - \text{lowest system evaporator saturation temperature})$ <p>If the lowest system evaporator saturation temperature is 26.0 °F, water in the evaporator would freeze in nine minutes and 56 seconds. YYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.</p>
YYYYYYY LOW OIL LEVEL	<p>This fault is only active when the oil level switch control is enabled under the PROGRAM key with a service password. It senses when voltage is removed from control board input J5-1. These inputs are designated for future use for proposed oil level switches that are currently not included in this design. This fault prevents the system from starting. YYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.</p>
YYYYYYY MOTOR CURRENT OVERLOAD	<p>Software-Initiated Fault - This fault compares the highest of the three phases of motor current per compressor to the compressor's 105% FLA ADJUST (overload) potentiometer setting. If the current exceeds the setting continuously for 20 seconds, the compressor will shut down. This safety will lockout a system on the first occurrence. The VSD shutdown type is immediate. YYYYYYY will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.</p>
YYYYYYY SENSOR FAIL: ZZZZZZZZZZZZ	<p>This fault prevents the system/unit from running when critical sensors are not functioning properly or are reading out of range. This safety is reviewed on start-up and the system or unit will be inhibited from starting, if one of the sensors inputs is out of range. This fault will shutdown the unit if any of the sensor inputs goes out of range. Ranges are: evaporator, condenser, oil, discharge and economizer pressure transducer: < 0.3 V or > 4.7 V, level sensor: < 3.0 mA or > 21 mA, eductor temperature sensor: < 0.86 V (~ -5°F) or > 4.67 V (~ 161°F), Motor temperature sensors reads greater than 1015 AD counts, which will prevent the unit from starting or running if a motor temp sensor is unplugged or has failed to open. If any motor temperature sensor is being ignored (under UNIT SETUP MODE) that sensor will not be used in evaluating this safety. The display will indicate which sensor failed in the ZZZZZZZ field as follows: EVAP PRESS, OIL PRESS, COND PRESS, DISCH PRESS, ECONO PRESS, COND LEVEL, and MOTOR TEMP. Z is the MOTOR TEMP SENSOR NO.</p>
YYYYYYY VSD RUN RELAY	<p>Software-Initiated Fault - The control sends the VSD logic board a start command over communications and over hardwire run. Upon receipt of the two types of run commands (hardwire or communications) a five second timer starts timing. The other run signal must be asserted within the five second window or the system will shut down. If either run signal is disabled while the VSD is running, the remaining run signal must be disabled within five seconds after the VSD has shut down or the system will shut down. This is an auto-restart safety that will lock out on the third fault in 90 minutes. YYYYYYY will show FAULT to indicate a FAULT condition, and will restart when the 120 second anti-recycle timer times out; or will show LOCKOUT, and the system will not restart until the operator clears the fault using the keypad.</p>

**FIGURE 49 - UNIT DATA KEY**

The UNIT DATA key displays unit temperatures, and related data. Select the displays, which are listed sequentially, by repeatedly pressing the UNIT DATA, or the ▲ or ▼ key.

UNIT CHILLED LIQUID **LEAVE=####F**
ENTER = ###.# °F

UNIT CONDENSER LIQUID **LEAVE = ###.# °F**
ENTER = ###.# °F

UNIT **LOAD TIMER = ### SEC**
UNLOAD TIMER = ### SEC

UNIT **TEMP ERROR = ###.# °F**
RATE = ###.# °F/M

The message (above) displays the error in temperature between the actual leaving chilled liquid and setpoint temperatures. RATE = ###.#°F/M shows the rate of change of the chilled liquid temperature.

UNIT **LEAD SYSTEM NUMBER = 1 OR 2**

UNIT **CHILLED LIQUID FLOW SW = ON OR OFF**
CONDENSER LIQUID FLOW SW = ON OR OFF

UNIT **EVAP/COND PUMP RUN = ON OR OFF**
VSD COOLANT AUX PUMP = ON OR OFF

If the control is enabled, the VSD coolant aux pump messages will display ON or OFF.

UNIT ACTIVE REMOTE CONTROL=ACTIVE OR NONE
TYPE: BAS CURR TEMP MODE

If ACTIVE REMOTE CONTROL is NONE, the items on the second line (TYPE) are blank. If ACTIVE REMOTE CONTROL is ACTIVE, the following items will be displayed, and are listed below:

- NONE - No remote control is active; however, remote monitoring may be active.
- BAS - remote mode
- CURR - Remote Current Limiting is enabled.
- TEMP - Remote Temperature Reset is enabled.
- MODE - Remote MODE SELECT (REMOTE MODE).

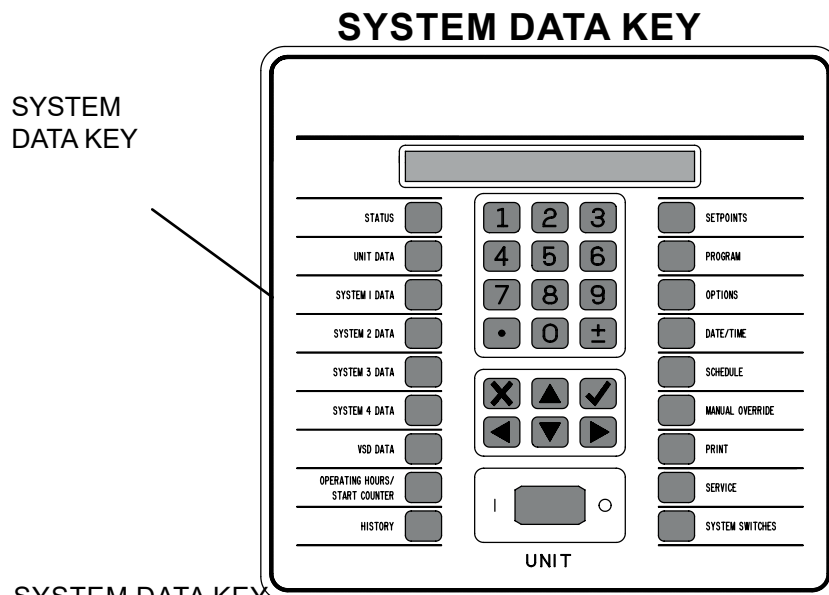


FIGURE 50 - SYSTEM DATA KEY

System Data Key Operation

The SYSTEM DATA key gives access to SYSTEM operating parameters. The following list shows the data in the order in which they appear.

Pressure Messages

PRESSURES OIL = ### PSIG
EVAP = ###.# PSIG OIL DIFF = ### PSID

PRESSURES CONDENSER = ### PSIG
DISCH = ### PSIG ECONOMIZER = ### PSIG

If the condenser transducer is removed, the display will show as below.

PRESSURES
DISCH = ### PSIG ECONOMIZER = ### PSIG

Temperature Messages

ECONOMIZER TEMP = ###.# °F
SUPERHEAT = ###.# °F SAT TEMP = ###.# °F

SUBCOOLED LIQ REEF TEMP = ###.# °F

This message will be skipped if the subcooled liquid refrigerant temperature sensor is removed.

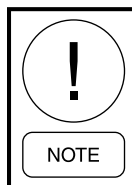
EVAPORATOR TEMP = ###.# °F
SUPERHEAT = ###.# °F SAT TEMP = ###.# °F

If the evaporator refrigerant temperature sensor is removed, the display will show as below.

EVAPORATOR SAT TEMP = ###.# °F

DISCHARGE TEMP = ###.# °F
SUPERHEAT = ###.# °F SAT TEMP = ###.# °F

MOTOR TEMPS T1 = ###.# °F
T2 = ###.# °F T3 = ###.# °F



If any motor temp sensor is being ignored, (select under UNIT SETUP MODE), that sensor's value will be displayed as #####.

Miscellaneous Messages

COMPRESSOR SPEED = ###.# %
LIQ INJ = ON OR OFF HEATER = ON OR OFF

Display LIQUID INJECTION, if control is enabled.

CONDENSER LEVEL = ###.# %
VALVE = ###.# % ACTIVE SETP = ###.# %

ECONOMIZER SUPERHEAT = ###.# °F
DRAIN SOLND = ON/OFF EEV OPEN = ###.# %

Display, if control is enabled.

VI STEP SOLENOID 1 = ON OR OFF
VI STEP SOLENOID 2 = ON OR OFF

RUN TIME

DAYS ## HOURS ## MINUTES ## SECONDS

RUN SIGNALS

RELAY = ON OR OFF

RUN PERM = ON OR OFF SOFTWARE = ON OR OFF

EDUCTOR TEMP

= ###.# °F

Sensor Displays

Table 36 on page 106 lists all the sensors attached to the control board associated with SYSTEM DATA keys. The minimum and maximum values displayed are provided. If these values exceed the limits, a < (less than) or > (greater than) sign will be displayed.

TABLE 35 - SENSOR MINIMUM/MAXIMUM OUTPUTS

SENSOR/INPUT	TYPE	MINIMUM VALUE	MAXIMUM VALUE
*Condenser Pressure	Transducer	0 psig/0 kPa	400.0 psig (2.76 MPa)
Discharge Pressure	Transducer	0 psig/0 kPa	400.0 psig (2.76 MPa)
Oil Pressure	Transducer	0 psig/0 kPa	400.0 psig (2.76 MPa)
Economizer Pressure	Transducer	0 psig/0 kPa	275 psig (1.89 MPa)
Evaporator Pressure	Transducer	0 psig/0 kPa	125.0 psig (.086 MPa)
Cond Liquid Refrig Level	Capacitance	0%	100%
Economizer Temp	3 K Ω Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Leaving Condenser Liquid Temp	3 K Ω Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Entering Condenser Liquid Temp	3 K Ω Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Leaving Chilled Liquid Temp	3 K Ω Thermistor	-19.1°F (-28.49°C)	110.2°F (43.4°C)
Entering Chilled Liquid Temp	3 K Ω Thermistor	-19.1°F (-28.49°C)	110.2 °F (43.4°C)
Compressor Motor Temp	10 K Ω Thermistor	-30.2°F (-34.56°C)	302.0° F (150°C)
Discharge Temp	50 K Ω Thermistor	40.3°F (4.61°C)	302.0° F (150°C)
*Evaporator Temp	3 K Ω Thermistor	-4.87°F (-20.3°C)	158.34°F (70.2°C)
*Subcooled Liquid Refrig Temp	3 K Ω Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Remote Temp Reset	4–20 mA / 2–10 V 0–20 mA / 0–10 V	0%	100%
Remote Current Limit	4–20 mA / 2–10 V 0–20 mA / 0–10V	0%	100%
Condenser Hot Water Leaving Temp	3 K Ω Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Condenser Hot Water Entering Temp	3 K Ω Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Remote Heat Recovery Temp Reset Option	4–20 mA / 2–10 V 0–20 mA / 0–10 V	0%	100%
Eductor Temp	3 K Ω Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)

* Based on engineering assessment, the "Condenser Transducer", "Evaporator Thermistor" and "Subcooled Liquid Refrigerant Thermistor" are redundant and can be removed. if these 3 sensors are not physically available, they should be disabled in "SETUP MODE", generally these setups have been done in plant before shipment, however service people shall re-set them per the description of section "PROGRAM KEY" under some circumstance such as a controller replaced or software updated.

VSD DATA AND OPERATING HOURS/START COUNTER KEYS

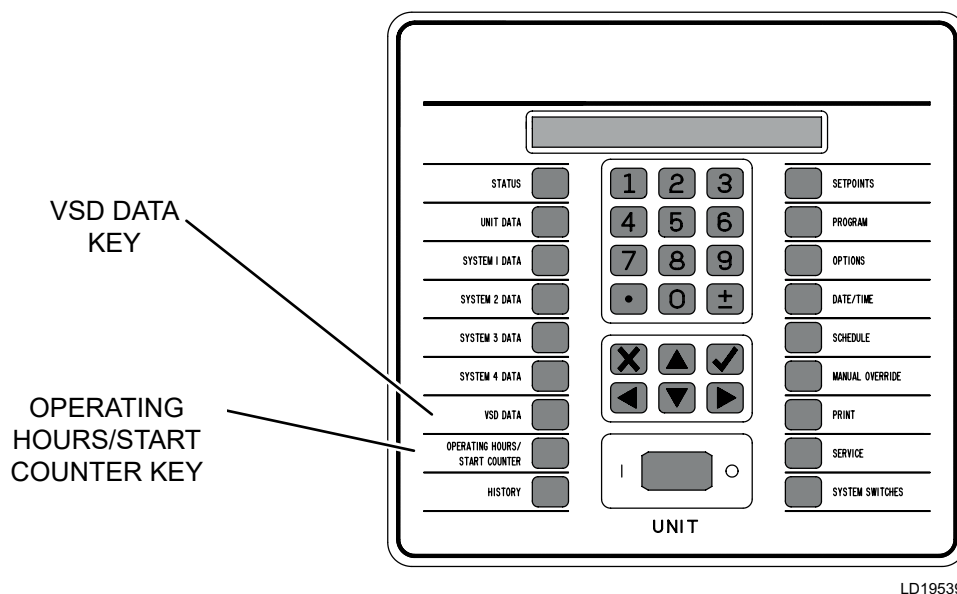


FIGURE 51 - VSD DATA AND OPERATING HOURS/START COUNTER KEYS

The VSD DATA key provides multiple displays of VSD operating data, such as voltages and currents. Press the VSD DATA, or ▲ or ▼ key to view multiple messages, which are explained below.

**VSD FREQUENCY ACTUAL = ###.# HZ
COMMAND = ###.# HZ**

VSD COMP = ### AMPS = ### % FLA

This key displays the calculated COMPRESSOR motor currents.

**VSD CURRENT LIMIT LOCAL = ### %FLA
BAS = ### REMOTE = ### %FLA**

CURRENT LIMIT displays the current limit values as set under the PROGRAM key, remotely by a BAS, and REMOTE CURRENT LIMIT input. Inactive current limits will display XX instead of a numeric value.

VSD DC BUS VOLTAGE = ### VDC

**VSD INTERNAL AMBIENT TEMP = ###.# °F
COOLING SYSTEM STATUS = ON OR OFF**

**VSD IGBT BASEPLATE TEMPS T1 = ### °F
T2 = ### °F**

VSD PRECHARGE SIGNAL = ON OR OFF

VSD COMP MOTOR OVERLOAD = ### AMPS

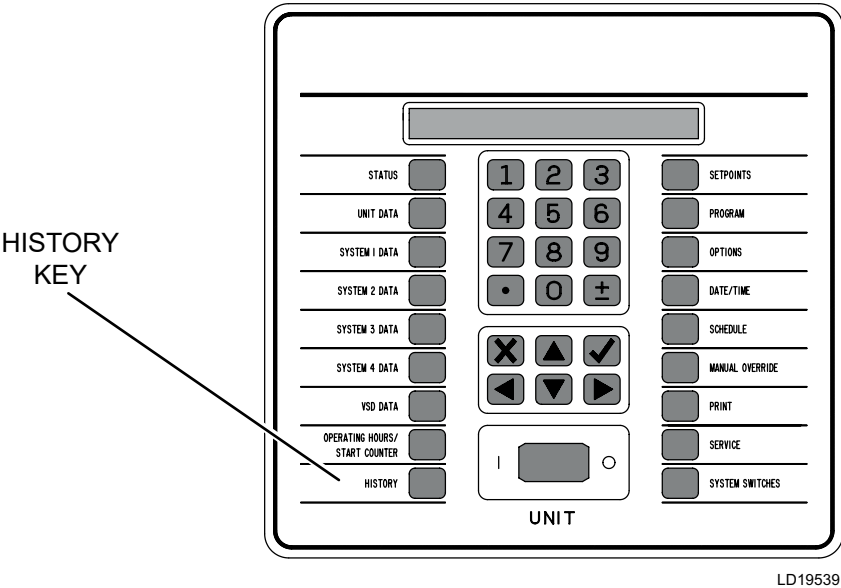
This message (above) displays the setting of the VSD's 105% FLA potentiometer for the Compressors. The settings are determined by the adjustment of the overload potentiometers on the VSD logic board, which are factory set, and should not require changing unless the circuit board is replaced.

Operating Hours/Start Counter Key

**HOURS 1=###, 2=###
START 1=###, 2=###**

Compressor operating HOURS and STARTS are displayed with a single key press. The maximum value is 99,999, at which point both values roll over to zero.

HISTORY KEY



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FIGURE 52 - HISTORY KEY

To access the HISTORY FAULT or NORMAL SHUT-DOWN information, use the following steps:

- 1. Press the HISTORY key to display the initial history message (above). FAULT SHUTDOWN appears under CHOOSE HISTORY TYPE.

HISTORY

CHOOSE HISTORY TYPE

◀ ▶

FAULT SHUTDOWN

- 2. To choose NORMAL SHUTDOWNS, use the ◀ key.

HISTORY

CHOOSE HISTORY TYPE

◀ ▶

NORMAL SHUTDOWN

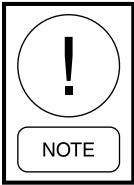
To return to FAULT SHUTDOWN, use the ▶ key.

- 3. Press the ✓ key. If FAULT HISTORY is selected, the screen (below) will be displayed.

FAULT HIST ## 18-MARCH-2012 10:34:58 AM

YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY

The FAULT HISTORY contains data from the last 10 shutdowns, where ## is the history buffer number between one and 10, and YYYY is the fault description. Buffer 01 gives the most recent fault information, and 10 is the oldest fault shutdown saved.



For all faults generated by the control panel, a snapshot of all system data will be stored immediately before shutting down. For VSD generated faults, the VSD captures and transmits the VSD data, and the control panel saves the control panel data when the VSD opens the fault relay.

To access the next FAULT HISTORY buffer number, use the ▶ key; to return to the previous buffer number, use the ◀ key.

To scroll backwards and forwards through the FAULT HISTORY SHUTDOWN data, press the ▼ key. The first screen will show the status of the SYSTEM. See the example below:

SYSTEM COMPRESSOR RUNNING

The next press the ▼ key displays the ALL FAULTS screen. The list below explains the configurations:

- ## is the FAULT HISTORY number.
- YYY is the ALL FAULT description.
- ZZ is the ALL FAULT number .
- WW is the total number of ALL FAULTS for the current history.

If there are no ALL FAULTS for the current history, the following message will be displayed for the ALL FAULTS screen.

FAULT HIST ## ALL FAULTS
NONE

Use the ▲ ▼ keys to scroll forwards and backwards through the FAULT HISTORY SHUTDOWN data within each section, i.e. UNIT.

- UNIT *on page 104*
 - Chilled Liquid
 - Compressor etc.
- SYSTEM *on page 105*
 - Oil Pressure
 - Condenser Pressure Message, etc.
- VSD *on page 107*
 - Frequency
 - VSD Current
- SETPOINTS *on page 110*
 - Local Cooling Setpoint
 - Local Cooling Range, etc.
- OPERATING HOURS/START COUNTER *on page 107*
 - Day of Week
 - Day of Month, etc.

- OPTIONS *on page 118*
 - Display Language
 - Liquid Type, etc.
- PROGRAM *on page 112*
 - Chilled Liquid Leaving Temp Cutout
 - Motor Current Limit, etc.

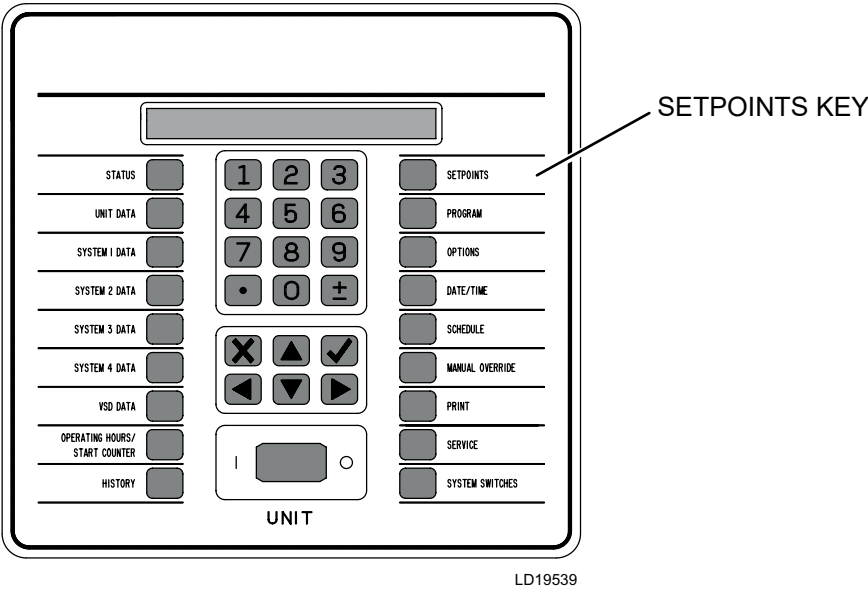
See the specific section of this manual for a complete list of messages.

NORM HIST ## 12-APRIL-2014 02:10:58 AM
 YY

If NORMAL SHUTDOWNS is selected, the NORM HIST ## will be displayed, where ## is the normal shutdown number. YYYY explains the reason for the shutdown. The normal shutdown history contains limited data from the last 20 normal (non-fault) shutdowns.

From the initial NORMAL HISTORY SHUTDOWN screen, the ► key scrolls to the initial screen of the next buffer, and the ◀ key to the initial screen of the last buffer. Buffer 01 is the most recent fault shutdown, and 20 is the oldest fault shutdown saved.

SETPOINTS KEY



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FIGURE 53 - SETPOINTS KEY

Press the SETPOINTS key to program:

- Non-heat pump application cooling setpoints and ranges.
- Heat pump application cooling/heating setpoints and ranges.

Table 37 on page 111 contains the allowable temperature ranges for both applications. English units are exact values while the metric units are approximate.

The SETPOINT entry screen is shown below. DEF shows the chiller default, LO/HI show minimum and maximum acceptable values. Press the SETPOINTS or the ▼ key to display the next message.

Non-Heat Pump Applications

SETPOINTS ◀DEF ##### LO ##### HI #####
LOCAL COOLING SETPOINT = ###.# °F

SETPOINTS ◀DEF ##### LO ##### HI #####
LOCAL CONTROL RANGE = +/- #.# °F

SETPOINTS REMOTE SETPOINT = ###.# °F
REMOTE CONTROL RANGE = +/- #.# °F

This message (above) will display the remote setpoint and control, which automatically updates. If there is no remote setpoint or range, these values will display as ###.

SETPOINTS ◀DEF ##### LO ##### HI #####
MAXIMUM REMOTE TEMP RESET = ###.#°F

Heat Pump Applications

SETPOINTS ◀DEF ##### LO ##### HI #####
LOCAL HEATING SETPOINT = ###.# °F

SETPOINTS ◀DEF ##### LO ##### HI #####
LOCAL HEATING CONTROL RANGE = +/- #.# °F

SETPOINTS REMOTE SETPOINT = ###.# °F
REMOTE HEATING CONTROL RANGE = +/- #.# °F

This message (above) displays the remote setpoint and hot water range, which automatically update. If there is no remote setpoint or range, these values will display as ###.

SETPOINTS ◀DEF ##### LO ##### HI #####
MAX. REMOTE HEATING TEMP RESET = ###.#°F

Minimum, maximum, and default values allowed are listed in Table 37 on page 111.

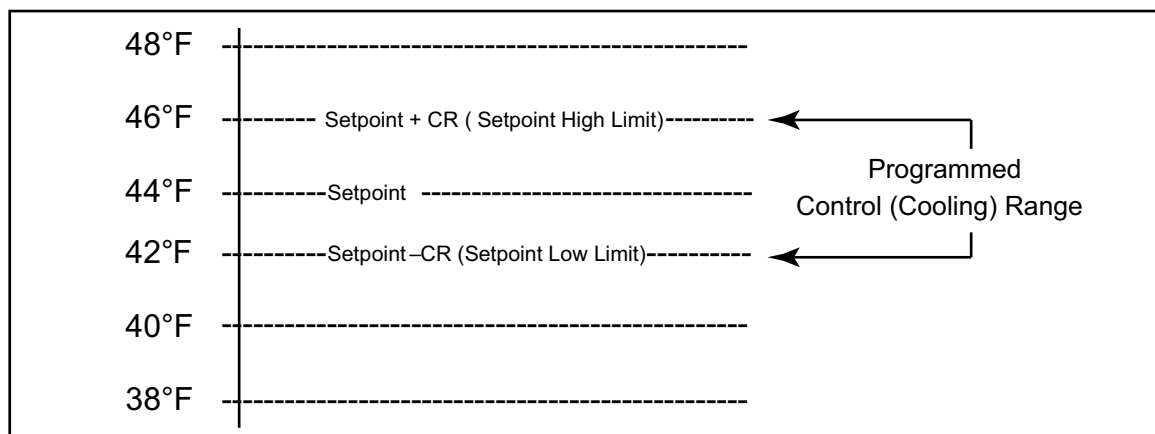
TABLE 36 - SETPOINT VALUES

PROGRAM VALUE	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Leaving Chilled Liquid Temp Setpoint	Water Cooling	38.0°F	60.0°F	44.0°F
		3.3°C	15.6°C	6.7°C
	Glycol Cooling	14.0°F	70.0°F	44.0°F
		-10.0°C	15.6°C	6.7°C
Leaving Chilled Liquid Temp Control Range	Cooling	1.5°F	2.5°F	2.0°F
		0.8°C	1.4°C	1.1°C
Maximum Remote Temp Reset	Cooling	2°F	40°F	20°F
		1°C	22°C	11°C
Leaving Condenser Liquid Temp Setpoint	Heat Pump	86°F	160.0°F	131°F
		30°C	71.1°C	55°C
Leaving Condenser Liquid Temp Control Range	Heat Pump	1.5°F	38.0°F	2.0°F
		0.8°C	3.3°C	1.1°C
Maximum Remote Temp Reset	Heat Pump	2°F	40°F	20°F
		1°C	22°C	11°C

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The chiller intent is to control LCHLT (or Leaving Condenser Water Temperature in the heat pump application), to the operator-programmable setpoint. The programmable range depends whether the chiller is set for water cooling or glycol (brine) cooling. The chiller uses a proportion and rate control in effort to maintain LCHLT exactly at setpoint. The compressor VSD speed is manipulated by the control to achieve this.

Another operator-programmable setpoint, control range (CR), defines how far above and below the LCHLT setpoint the chiller will stop compressors, or the entire unit, and restart them to maintain LCHLT within the range. The programmable CR defines the setpoint high and low limits as shown in *Figure 54 on page 111*. In this example, LCHLT setpoint is 44°F (6.6°C) and the CR is 2°F (-16.6°C).



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FIGURE 54 - SETPOINT HIGH AND LOW LIMITS DEFINED BY CONTROL RANGE (CR)

PROGRAM KEY

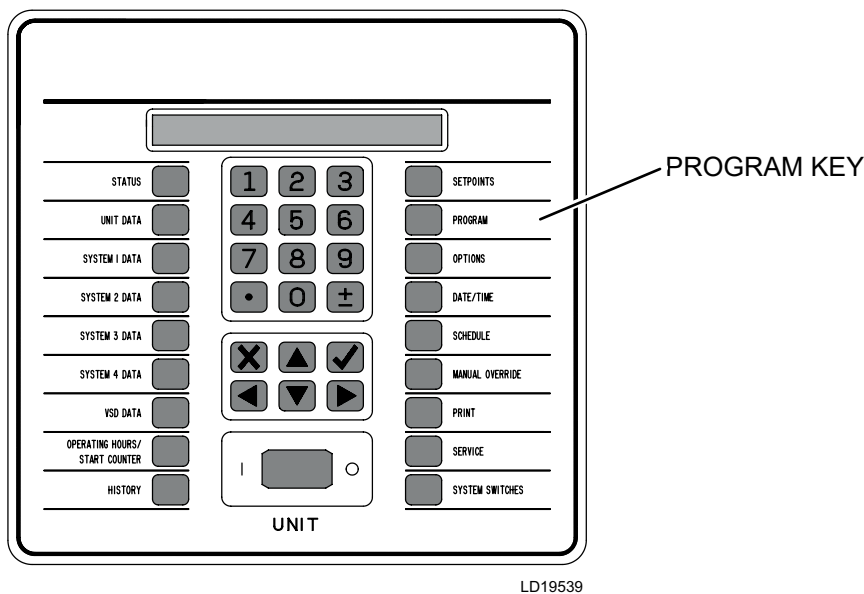


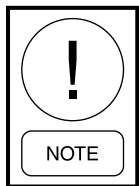
FIGURE 55 - PROGRAM KEY

Press the PROGRAM key to modify the following numeric operating parameters, which are displayed when this key is pressed.

Service Mode Access:

Service level password access to the Operator keypad can be achieved by following the steps below:

PROGRAM MODE ####
PRESS ENTER KEY TO CONTINUE



Unit switch must be in the off position.

Press the PROGRAM key to change display to allow numerical access. Press the ✓ key (ENTER) to allow final access.

PROGRAM MODE ####
PRESS ENTER KEY TO CONTINUE

Press the ✓ key to display the first programmable selection, where DEF is the default, LO is the low limit, and HI is the high limit. See Table 38 on page 113 for the programmable operating parameters.

PROGRAM ◀DEF 36.0 LO 5.0 HI 36.0
CHILLED LIQ LEAVE TMP CUTOUT = ##.##°F

PROGRAM ◀DEF 103 LO 30 HI 103
MOTOR CURRENT LIMIT = ###% FLA

PROGRAM ◀DEF 100 LO 30 HI 100
PULLDOWN CURRENT LIMIT = ###% FLA

PROGRAM ◀DEF 0 LO 0 HI 255
PULLDOWN CURRENT LIMIT TIME = ### MIN

PROGRAM ◀DEF 240.0 LO 150.0 HI 250.0
MOTOR TEMPERATURE UNLOAD = ###.##°F

PROGRAM ◀DEF 33.0 LO 20.0 HI 80.0
SYS CONDENSER LEVEL SETP = ##.## %

PROGRAM ◀DEF 0 LO 0 HI 7
REMOTE UNIT ID NUMBER = #

PROGRAM HEAD PRESSURE CONTROL
◀▶ XXXXXXXXXXXXXXXXXXXXXXXXXXXX

PROGRAM ◀DEF XXXXX LO XXXXX HI XXXXX
HEAD PRESSURE SETPOINT = XX.X PSID

PROGRAM ◀DEF 5.0 LO 0.1 HI 50.0
HPC KP = XX.X SEC

PROGRAM ◀DEF 50 LO 10 HI 1000
HPC TI = XX.X SEC

PROGRAM ◀DEF 0 LO 0 HI 60
HPC TD = XX.X SEC

PROGRAM HPC DIRECTION
◀▶ XXXXXXXXXXXXXXXXXXXXXXXXXXXX

PROGRAM ◀DEF 0.0% LO 0.0% HI 100.0%
HPC SHUTDOWN POSITION = XX.X

PROGRAM ◀DEF 0.0% LO 0.0% HI 100.0%
HPC MINIMUM POSITION = XX.X

TABLE 37 - PROGRAM LIMITS

PROGRAM VALUE	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Chilled Liquid Leaving Temperature Cutout	Water Cooling	—	—	36.0°F
		—	—	2.2°C
	Glycol Cooling	5.0°F	36.0°F	36.0°F
		15.0°C	2.2°C	2.2°C
Motor Current Limit	—	30% FLA	100% FLA	100% FLA
Pulldown Motor Current Limit	—	30% FLA	100% FLA	100% FLA
Pulldown Motor Current Limit Time	—	0 min	255 min	0 min
Motor Temperature Unload	—	150.0°F	250.0°F	240.0°F
		65.6°C	121.1°C	115.6°C
Sys 1 Condenser Level Control Setpoint	—	20.0%	80.0%	33.0%
Sys 2 Condenser Level Control Setpoint (Not displayed on tandem circuit units)	—	20.0%	80.0%	33.0%
Unit ID Number	—	0	7	0
Head Pressure Control	—	DISABLED	ENABLED	DISABLED
Head Pressure Setpoint	HPC Enabled	25.0 psid (1.72 bard)	35.0 psid (2.41 bard)	28 psid (1.93 bard)
HPC Kp	HPC Enabled	0.1	50.0	5.0
HPC Ti	HPC Enabled	10 s	1000 s	50 s
HPC Td	HPC Enabled	0 s	60 s	0 s
HPC Direction	HPC Enabled	DIRECT	REVERSE	DIRECT
HPC Minimum Position	HPC Enabled	0.0%	100.0%	0.0%
HPC Shutdown Position	HPC Enabled	0.0%	100.0%	0.0%

With service level password access, navigate to the following setup parameters and set them properly to maintain approximately 1 in. coverage above the top of the condenser subcooler in accordance with the refrigerant charge level description in *SECTION 7 - MAINTENANCE* in this manual.

Default Values

A listing of the low and high limits, and default programmable values is noted in each display and can be found in *Table 38 on page 113*. The English units are exact values while the metric units are approximate.

Unit "SETUP MODE" will allow the programming all of the programmable values that the user should never change. These will either be programmed at the factory or by service personnel on the job. This mode may be entered by pressing the PROGRAM key, entering the password "4245", and pressing ✓ (ENTER) key.

Table 39 on page 116 - Setup Mode Programmable Values lists the values that can be programmed in this mode. This table is for single circuit unit.

Some new items added to SETUP MODE list, Service people can Enable or Disable these functions based on field conditions or engineering guidance. These functions include "SOFT SHUTDOWN", 2 "FREQUENCY SKIP", "CONDENSER TRANSDUCER REMOVAL", "EVAPORATOR TEMPERATURE SENSOR REMOVAL" and "SUBCOOLED LIQUID REFRIGERANT TEMPERATURE SENSOR REMOVAL".

SETUP MODE ◀DEF 0	LO 0	HI 99999	COMP OPERATING HOURS = #####
SETUP MODE ◀DEF 0	LO 0	HI 99999	COMP STARTS = #####
SETUP MODE ◀DEF 0	LO 0	HI 99999	TOTAL KILOWATT HOURS = #####
SETUP MODE ◀▶	CLEAR HISTORY BUFFERS? NO		
SETUP MODE ◀▶	REMOTE TEMP RESET DISABLED		
SETUP MODE ◀▶	REMOTE CURRENT LIMIT DISABLED		
SETUP MODE ◀DEF 15	LO 5	HI 60	REMOTE INPUTS SERVICE TIME = ## MIN
SETUP MODE ◀DEF 170	LO 140	HI 203	MAX COMPRESSOR SPEED = ###.# HZ
SETUP MODE ◀DEF 50	LO 50	HI 100	MINIMUM RUNNING SPEED = ###.# HZ
SETUP MODE ◀▶	SYS MOTOR SENSOR TO IGNORE NONE		
SETUP MODE ◀DEF 73.0	LO 60.0	HI 90.0	SYS VI DIFF TEMP SETP = ###.# °F
SETUP MODE ◀DEF 4.0	LO 2.0	HI 10.0	VI DEADBAND = ###.# °F
SETUP MODE ◀DEF 24.0	LO 2.0	HI 40.0	VI DIFF TEMP OFFSET = ###.# °F
SETUP MODE ◀DEF 50.0	LO 50.0	HI 95.0	MIN VSD FREQ SETP = ###.# HZ

SETUP MODE ◀DEF 50.0	LO 50.0	HI 95.0	MIN START FREQ SETP = ###.# HZ
SETUP MODE ◀DEF 30.0	LO 20.0	HI 60.0	SYS LOW DIF OIL PRS SETP = ###.# PSID
SETUP MODE ◀DEF 5.0	LO 0.0	HI 20.0	SYS LOW ECON SHEAT SETP = ###.# °F
SETUP MODE ◀DEF 20.0	LO 20.0	HI 60.0	MIN OIL PUMP DIFF SETP = ###.# PSID
SETUP MODE ◀DEF 25.0	LO 5.0	HI 36.0	EVAPORATOR PRESSURE CUTOUT = ###.# PSIG
SETUP MODE ◀DEF 113.0	LO 113.0	HI 159.8	HIGH LEAVING COND TMP CUTOUT = ###.# °F
SETUP MODE ◀DEF 15.0	LO 5.0	HI 50.0	EDUCTOR TEMPERATURE DIFF = ###.# °F
SETUP MODE ◀DEF 30	LO 1	HI 1000	EDUCTOR SAFETY TIME = #### MIN
SETUP MODE ◀DEF 13.0	LO 8.0	HI 50.0	SYS ECONO SUPERHEAT SETP = ###.# °F
SETUP MODE ◀DEF 10.0	LO 5.0	HI 30.0	LIQUID REF INJ VALVE CLOSE = ###.# °F
SETUP MODE ◀DEF 212.0	LO 135.0	HI 240.0	LIQUID REF INJECT VALVE OPEN = ###.# °F
SETUP MODE ◀DEF 2.0	LO 0.0	HI 50.0	SYS ECON HOLD POS SETP = ###.# %
SETUP MODE ◀DEF 240.0	LO 150.0	HI 250.0	SYS ECON MAX MTR TEMP = ###.# °F
SETUP MODE ◀DEF 50	LO 50	HI 204	ECONOMIZER ON FREQUENCY = ### HZ
SETUP MODE ◀DEF 45	LO 45	HI 203	ECONOMIZER OFF FREQUENCY = ### HZ
SETUP MODE ◀DEF 20.0	LO 10.0	HI 100.0	HIGH OIL FILTER PRS SETP = ###.# PSID
SETUP MODE ◀DEF 24.0	LO 20.0	HI 30.0	OIL DIFF COND LVL CTRL SETP = ###.# PSID
SETUP MODE ◀DEF 2.0	LO 0.1	HI 10.0	LVL CTRL DECREMENT 1 SETP = ###.# %
SETUP MODE ◀DEF 0.5	LO 0.1	HI 10.0	LVL CTRL DECREMENT 2 SETP = ###.# %

SETUP MODE ◀DEF 2.0 LO 0.1 HI 10.0
LVL CTRL INCREMENT 1 SETP = ###.# %

SETUP MODE ◀DEF 0.5 LO 0.1 HI 10.0
LVL CTRL INCREMENT 2 SETP = ###.# %

SETUP MODE ◀DEF 0.7 LO 0.5 HI 3.0
LEVEL CNTRL STARTUP KP = #.#

SETUP MODE ◀DEF 115 LO 75 HI 250
LEVEL CNTRL STARTUP TN = 115 SEC

SETUP MODE SMART FREEZE
◀▶ DISABLED

SETUP MODE OIL PUMP
◀▶ DISABLED

SETUP MODE OIL LEVEL SW
◀▶ DISABLED

SETUP MODE VSD AUX COOLANT PUMP
◀▶ DISABLED

SETUP MODE HOT GAS BYPASS
◀▶ DISABLED

SETUP MODE ◀DEF 0.0 LO 0.0 HI 2.0
HOT GAS BYPASS SETP OFFSET = #.# °F

SETUP MODE ◀DEF 1.0 LO 1.0 HI 5.0
HOT GAS BYPASS SETP = #.# °F

SETUP MODE ◀DEF 30 LO 5 HI 50
COND VLV STARTUP POS = ## %

SETUP MODE ◀DEF 5 LO 0 HI 10
COND VLV CTRL START DLY = ## MIN

SETUP MODE REFRIG INJ
◀▶ ENABLED

SETUP MODE VI STEP VALVE
◀▶ ENABLED

SETUP MODE ◀DEF 195.0 LO 195.0 HI 333.0
HIGH DISCHARGE PRESS CUTOUT = ###.# PSIG

SETUP MODE COMPRESSOR TYPE
◀▶ XXXXXXXX

SETUP MODE DROP LEG REFRIG TEMP SENSOR
◀▶ DISABLED

SETUP MODE CONDENSER PRESSURE SENSOR
◀▶ DISABLED

SETUP MODE EVAP REFRIG TEMP SENSOR
◀▶ DISABLED

SETUP MODE UNIT SOFT SHUTDOWN OPERATION
◀▶ DISABLED

SETUP MODE SKIP FREQ 1
◀▶ DISABLED

SETUP MODE ◀DEF 56 LO 50 HI 199
SKIP FREQ 1 LOW LIMIT = ### HZ

SETUP MODE ◀DEF 68 LO 57 HI 68
SKIP FREQ 1 HIGH LIMIT = ## HZ

SETUP MODE SKIP FREQ 2
◀▶ DISABLED

SETUP MODE ◀DEF 88 LO 70 HI 202
SKIP FREQ 2 LOW LIMIT = ### HZ

SETUP MODE ◀DEF 100 LO 89 HI 100
SKIP FREQ 2 HIGH LIMIT = ### HZ

SETUP MODE LINE VOLTAGE
◀▶ ### V

SETUP MODE ◀DEF 160.5 LO 160.5 HI 535.0
JOB FULL LOAD AMPS = ###.# AMPS

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TABLE 38 - SETUP MODE PROGRAMMABLE

SETUP MODE VALUE	LOW LIMIT	HIGH LIMIT	DEFAULT
Compressor 1 Operating Hours	0	99999	0
Compressor 1 Starts	0	99999	0
Total Kilowatt Hours	0	99999	0
Clear History Buffers	NO	YES	—
Remote Temperature Reset	DISABLED	ENABLED	DISABLED
Remote Current Limit	DISABLED	ENABLED	DISABLED
Remote Inputs Service Time	5 min	60 min	15 min
Maximum Compressor Speed	140 Hz	203 Hz	170 Hz
Minimum Running Speed	50 Hz	100 Hz	50 Hz
System Motor Sensor To Ignore	Temp Sensor T1 / T2 / T3		None
System VI Differential Temp Setpoint (CTS)	60.0°F 33.3°C	90.0°F 50.0°C	73.0°F 40.5°C
System VI Differential Temp Setpoint (WTS)	25.0°F 13.8°C	60.0°F 33.3°C	30.0°F 16.6°C
VI Dead band (CTS and WTS)	2.0°F 1.1°C	10.0°F 5.5°C	4.0°F 2.2°C
VI Differential Temp Setpoint Offset	2.0°F 1.1°C	40.0°F 22.2°C	24.0°F 13.3°C
Minimum VSD Frequency	50 Hz	95 Hz	50 Hz
Minimum Start Frequency	50 Hz	95 Hz	50 Hz
System Low Differential Oil Pressure Setpoint	20 psid 1.37 barg	60 psid 4.14 barg	30 psid 2.07 barg
System Low Economizer Superheat	0.0°F 0.0°C	20.0°F 11.1°C	5.0°F 2.8°C
Min Oil Pump Diff Setpoint	20 psid 1.37 barg	60 psid 4.14 barg	20 psid 1.37 barg
Evaporator Pressure Cutout	24.0 psig 1.65 barg	36.0 psig 2.48 barg	25.0 psig 1.72 barg
	5.0 psig 0.34 barg	36.0 psig 2.48 barg	25.0 psig 1.72 barg
High Leaving Condenser Liquid Temperature Cutout	113.0°F 45.0°C	159.8°F 71.0°C	113.0°F 45.0°C
Eductor Temperature Differential	5.0°F 2.7°C	50.0°F 27.7°C	15.0°F 8.3°C
Eductor Safety Time	1 min	1000 min	30 min
System Economizer Superheat Setpoint	8.0°F 4.4°C	50.0°F 27.8°C	13.0°F 7.2°C
Liquid Ref Injection Valve Close Threshold	5.0°F 2.8°C	30.0°F 16.67°C	10.0°F 5.6°C
Liquid Ref Injection Valve Open Setpoint	135.0°F 57.2°C	240.0°F 115.6°C	212.0°F 100.0°C
System Economizer EEV Hold Position	0.00%	50.00%	2.00%
System Economizer Max Motor Temp Setpoint	150.0°F 65.6°C	250.0°F 121.1°C	240.0°F 115.6°C
Economizer On Frequency	50 Hz	204 Hz	50 Hz
Economizer Off Frequency	45 Hz	203 Hz	45 Hz
High Oil Filter Differential Pressure Setpoint	10.0 psid	100.0 psid	20 psid

TABLE 39 - SETUP MODE PROGRAMMABLE (CONT'D)

SETUP MODE VALUE	LOW LIMIT	HIGH LIMIT	DEFAULT
Oil Differential Condenser Level Control Setpoint	20.0 psid	30.0 psid	24 psid
Level Control Decrement 1	0.10%	10.00%	2.00%
Level Control Decrement 2	0.10%	10.00%	0.50%
Level Control Increment 1	0.10%	10.00%	2.00%
Level Control Increment 2	0.10%	10.00%	0.50%
Level Control Startup Kp	0.5	3	0.7
Level Control Startup Tn	75	250	115
Smart Freeze	DISABLED	ENABLED	DISABLED
Oil Pump	DISABLED	ENABLED	DISABLED
Oil Level Switch	DISABLED	ENABLED	DISABLED
VSD Aux Coolant Pump	DISABLED	ENABLED	DISABLED
Hot Gas Bypass	DISABLED	ENABLED	DISABLED
Hot Gas Bypass Setpoint Offset	0.0°F 0.0°C	2.0°F 1.1°C	0.0°F 0.0°C
Hot Gas Bypass Setpoint	1.0°F 0.6°C	5.0°F 2.8°C	1.0°F 0.6°C
Condenser Level Control Valve Startup Position	5%	50%	30%
Condenser Level Control Startup Delay	0 min	10 min	5 min
Condenser Level Ramp Up Time	0 min	10 min	5 min
Refrigerant Injection	DISABLED	ENABLED	DISABLED
VI Step Valve	DISABLED	ENABLED	DISABLED
High Discharge Pressure Cutout	195 psig 14.46 barg	333 psig 23.97 barg	195 psig 14.46 barg
Compressor Type	WTS	CTS	WTS
Drop Leg Refrigerant Temperature Sensor	DISABLED	ENABLED	ENABLED
Condenser Pressure Sensor	DISABLED	ENABLED	ENABLED
Evaporator Refrigerant Temperature Sensor	DISABLED	ENABLED	ENABLED
Unit Soft Shutdown Operation	DISABLED	ENABLED	DISABLED
Skip Frequency 1	DISABLED	ENABLED	DISABLED
Skip Frequency 1 Low Limit	50 Hz	199 Hz	56 Hz
Skip Frequency 1 High Limit	57 Hz	68 Hz	68 Hz
Skip Frequency 2	DISABLED	ENABLED	DISABLED
Skip Frequency 2 Low Limit	70 Hz	202 Hz	88 Hz
Skip Frequency 2 High Limit	89 Hz	100 Hz	100 Hz
Line Voltage	380/415 V	460 V	460 V
Job Full Load Amperage	160.5 A	535.0 A	160.5 A

OPTIONS KEY

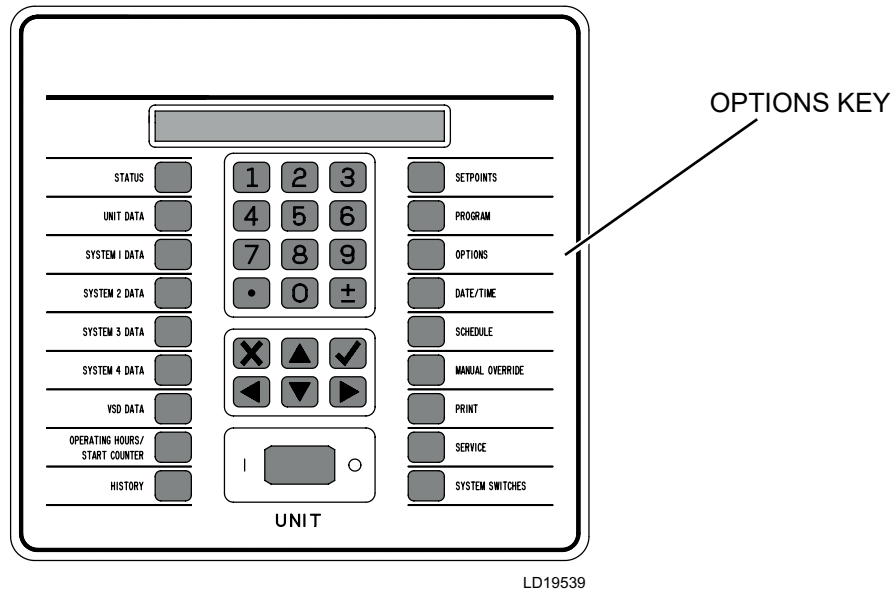


FIGURE 56 - OPTIONS KEY

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The **OPTIONS** key displays unit configuration and the capability to modify it. To view the current settings, press this key. Press the **▲** or **▼** key to scroll to the next option, and the **◀** and **▶** keys to change the options, then the **✓** key to save the changes. Each message is explained below.

OPTIONS	DISPLAY LANGUAGE
◀ ▶	#####

Choose English, French, Italian, German, Spanish, Portuguese, Polish, or Hungarian; default is English.

OPTIONS	LIQUID TYPE
◀ ▶	WATER OR GLYCOL COOLING

OPTIONS	LOCAL/REMOTE CONTROL MODE
◀ ▶	LOCAL OR REMOTE CONTROL

OPTIONS	DISPLAY UNITS
◀ ▶	ENGLISH OR SI

Remote Temperature Reset Input

The display will only appear if the **TEMP RESET** option is enabled under **UNIT SETUP MODE**. Choose one **RESET INPUT** below, default is **DISABLED**:

OPTIONS	REMOTE TEMP RESET INPUT
◀ ▶	DISABLED

OPTIONS	REMOTE TEMP RESET INPUT
◀ ▶	0.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE TEMP RESET INPUT
◀ ▶	2.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE TEMP RESET INPUT
◀ ▶	0.0 TO 20.0 MILLIAMPS

OPTIONS	REMOTE TEMP RESET INPUT
◀ ▶	4.0 TO 20.0 MILLIAMPS

Remote Current Limit Input

Choose one LIMIT INPUT below, default is DISABLED:

OPTIONS	REMOTE CURRENT LIMIT INPUT
◀ ▶	DISABLED

OPTIONS	REMOTE CURRENT LIMIT INPUT
◀ ▶	0.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE CURRENT LIMIT INPUT
◀ ▶	2.0 TO 10 VOLTS DC

OPTIONS	REMOTE CURRENT LIMIT INPUT
◀ ▶	0.0 TO 20.0 MILLIAMPS

OPTIONS	REMOTE CURRENT LIMIT INPUT
◀ ▶	4.0 TO 20.0 MILLIAMPS

OPTIONS	COMPRESSOR SELECT
◀ ▶	WITHOUT VI STEP OR WITH VI STEP

The display (above) will only appear if the CURRENT LIMIT option is enabled under the UNIT SETUP MODE.

OPTIONS	OPERATING MODE
◀ ▶	CHILLER OR HEAT PUMP

If the heat pump option is enabled, choose between chiller and heat pump operating mode.

DATE/TIME AND SCHEDULE KEY

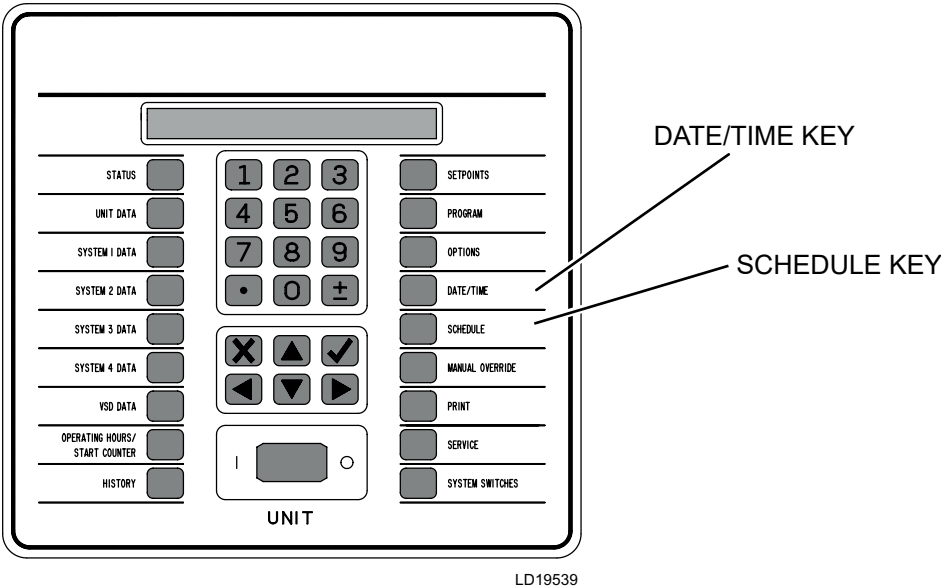


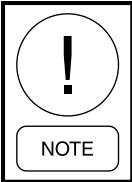
FIGURE 57 - DATE/TIME AND SCHEDULE KEY

CLOCK FRI 13-APR-2012 10:15:33 AM
DAY OF WEEK ◀ ▶ = ###

Press DATE/TIME key to display the DATE and TIME, which is required for using the DAILY SCHEDULE. It is a valuable troubleshooting tool to determine the time of the fault, which is stored in the history memory buffers. Press this key to display CLOCK and DAY OF WEEK.

Press the ▼ ▲ keys to go to the next or previous item. Press the ✓ key to store the data.

CLOCK FRI APR-2012 10:15:33 AM
DAY OF MONTH = ###



Type a zero to select dates for days one through nine.

CLOCK FRI APR-2012 10:15:33 AM
YEAR = ###

CLOCK FRI APR-2012 10:15:33 AM
HOUR = ###

CLOCK FRI APR-2012 10:15:33 AM
MINUTE = ###

CLOCK FRI APR-2012 10:15:33 AM
AM/PM ◀ ▶ = ###

CLOCK FRI APR-2012 10:15:33 AM
TIME FORMAT ◀ ▶ = ###

Schedule Key Operation

SCHEDULE CHOOSE SCHEDULE TYPE
◀ ▶ UNIT OPERATING SCHEDULE

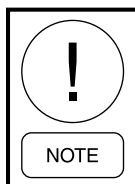
Press this key (above) to access the UNIT OPERATING SCHEDULE (default).

The message enables/disables the chiller unit based on time of day. The chiller can be enabled and disabled once each day or it can be programmed to run continuously. When the daily or holiday schedule shuts the chiller down, the running systems will go through a controlled ramped shutdown.

SCHEDULE UNIT OPERATING
MON START = 06:00 AM STOP = 10:00 PM

The line under the zero is the cursor. If the start time is wrong, change it by keying in the new time from the numeric keypad. Once the correct values for the START hour and minute are entered, press the ✓ key. The cursor will move to the AM/PM selection. Change the meridian (AM/PM) value with the ◀ or ▶ key, and enter by pressing the ✓ key. Repeat this process for STOP. Once a schedule is entered, the schedule for the next day will appear. The start and stop time of each day may be programmed differently.

To view the schedule without making a change, press the SCHEDULE key until the day appears. The ▲ key will scroll to the previous screen.



If the schedule is changed for Monday, all other days will change to the Monday schedule, which means if the Monday times are not applicable for the whole week, then the exceptional days need to be reprogrammed to the required schedule.

SCHEDULE	UNIT OPERATING
HOL START = 00:00 AM STOP = 00:00 PM	

To program the chiller for 24-hour operation, program the start and stop times of each day at 00:00.

After the SUN (Sunday) schedule appears on the display,, a ▲ key will display the holiday schedule, which is a two-part display. The first display reads:

SCHEDULE	UNIT OPERATING
S M T W T F S HOLIDAY NOTED BY *	

Set the holiday times using the same procedure described for the days of the week. Press the ✓ key after setting the HOL START and STOP times to save the

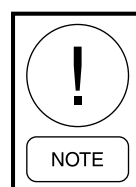
change in memory. Press the SCHEDULE key a second time to show the individual days:

The line below the empty space is the cursor, which will move to the next or previous empty space when the ◀ or ▶ key is pressed.

To set a day for the HOLIDAY NOTED BY:

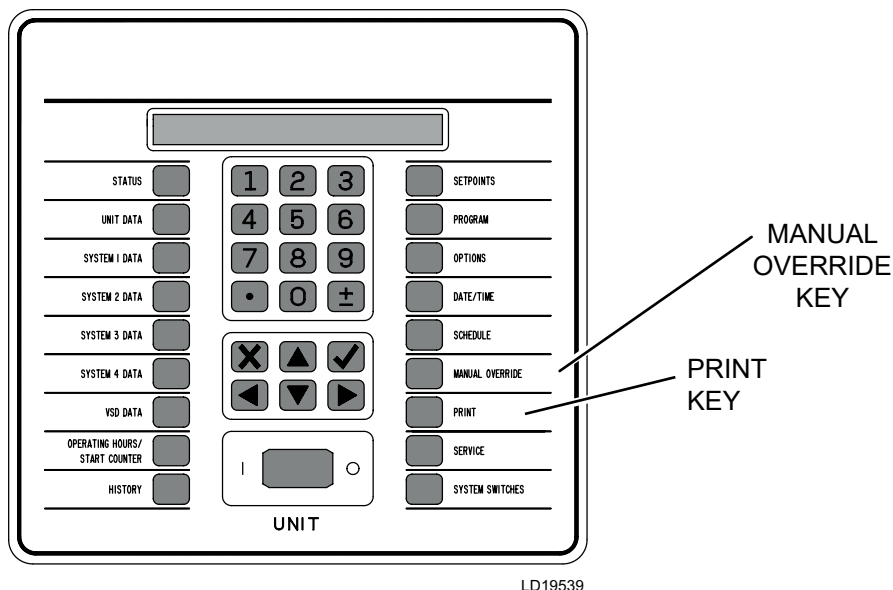
1. Move the cursor to the space following the day of the week.
2. Press the asterisk (*) key, and an * will appear in the space signifying that day as a holiday.

The holiday schedule must be programmed weekly. If there is no holiday, use the * key to delete the *. Use the ✓ key to accept the holiday schedule for the entire week.



The HOLIDAY SCHEDULE is temporary. Once the schedule is executed, the selected holidays will be cleared from memory for the following week.

MANUAL OVERRIDE AND PRINT KEY



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FIGURE 58 - MANUAL OVERRIDE AND PRINT KEY

MANUAL OVERRIDE

If this key is pressed during a scheduled shutdown, the STATUS key will display MANUAL OVERRIDE, which indicates that the DAILY SCHEDULE is being ignored, and the chiller will start when chilled liquid temperature allows; REMOTE CONTACTS, UNIT SWITCH and SYSTEM SWITCHES permitting. This is a priority message which cannot be overridden by anti-recycle or fault messages. Only use this key in emergencies or for servicing, which will automatically disable itself after 30 minutes.

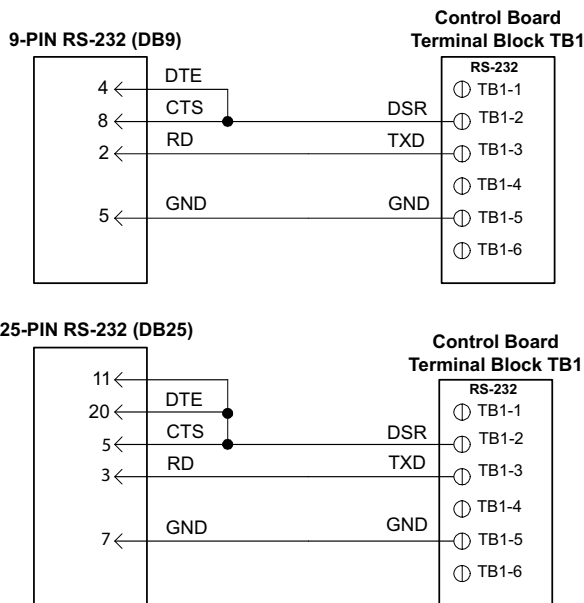
PRINT CHOOSE PRINT REPORT

◀ ▶ XXXXXXXXXXXXXXXXXXXXXXXX

PRINT is used to print any of the following:

- Current operating data (real time data)
- A complete history of all history (fault) buffers
- All normal shutdowns (compressor cycling, chiller shutdown, etc.)
- History (fault) data of a specific fault. History Buffer 1 will always be the most recent fault history printout.

Use the following connections to set up the chiller to print to a computer as shown in *Figure 59 on page 122* or to a printer as shown in *Figure 60 on page 123*.



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FIGURE 59 - PRINTER CABLE CONNECTION FROM QWC4 CHILLER TO A COMPUTER

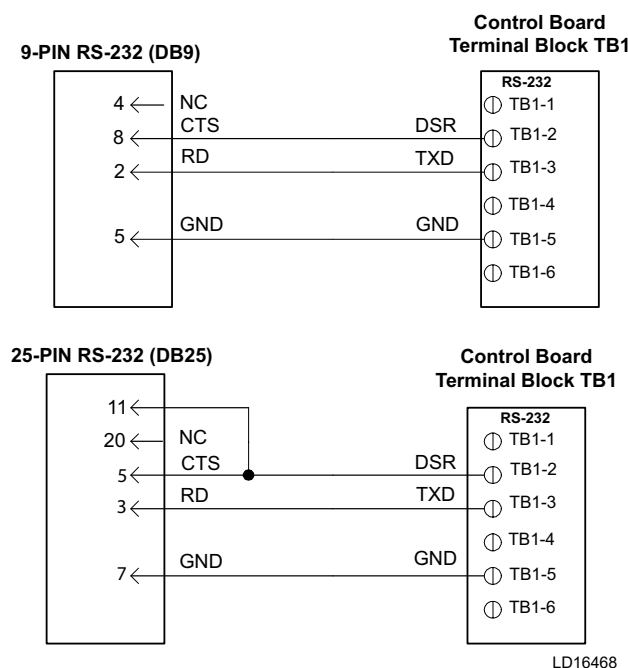


FIGURE 60 - PRINTER CABLE CONNECTION FROM QWC4 CHILLER TO A SERIAL PRINTER

ACCEPTABLE PRINTERS

The following printer can be used. Printers must be equipped with an RS-232 serial interface.

Okidata OKIPOS 441 Printer

- Dimensions:
6.9 in. wide x 9.64 in. deep x 5.98 in. high
- Paper: 3.0 in. wide
- Type: Dot Matrix Impact
- Purchase: 800-OKIDATA
Spare printer Ribbon Okidata 52119001 Black

The control center provides the required formatting control codes for the printers above when the printer is selected on the PRINTER screen in the instructions below. These codes are transmitted through the serial interface to the printer to provide a proper print format.

Different printers require different formatting control codes. Other printers might provide proper operation when connected to the control center. However, the print format may not be correct or as required.

Proceed with caution, and use the following guidelines if an unlisted printer is selected:

1. All printers must be capable of RS-232 serial communications.
2. The primary differences between printers involve the formatting control codes required by the printer, which are sent from the control center to the printer. For example, Weigh-Tronix printers require a control code to select 40-column width. This same code is interpreted by the Okidata printer as an instruction to print wide characters. In some instances, a printer will ignore a code it cannot interpret.
3. The control center requires a busy signal from the printer when the printer receive buffer is full, which causes the control center to momentarily terminate the data transmission until the printer can accept more data. The busy signal polarity must be asserted low when busy.

PRINTER CONNECTIONS

Connect the printers to the control center microboard as follows. Only one printer can be connected at a time.

TABLE 39 - OKIDATA OKIPOS 441

MICROBOARD	PRINTER	FUNCTION
TB1-3	PIN 3	TX (Data to Printer)
TB1-2	PIN 20	DSR (Busy Signal from Printer)
TB1-5	PIN 7	Ground
Cabinet		Shield

Required Hardware:

Cable

- #18 AWG stranded 50 ft maximum length.

Connectors

Microboard

- None. Strip 1/4 in. insulation from wire and insert into screw terminal block.

Printers

- Okidata: 25 pin plug DB-25P or equivalent; Shell DB-C2-J9 or equivalent.

PRINTER SETUP

The selected printer must be configured as follows. Refer to the manual provided by the printer manufacturer.

Okidata OKIPOS 441 Printer

1. With the printer power turned off, remove the two screws, which hold the RS-232 Interface Module.
2. Pull the RS-232 Interface Module out of the printer.
3. Set the DIP switch SW2-2 to OFF to select 19200 BPS. Do not change any other switch settings.
4. Reinstall the RS-232 Interface Module and two mounting screws.
5. Load paper and install the printer ribbon into the printer.
6. Connect the printer cable to the printer and the microboard.
7. Connect the printer power cable to the printer and plug into a 100 VAC to 240 VAC power source.

Cancel printing by selecting the CANCEL PRINTING option. CHOOSE PRINT REPORT will display when the PRINT key is pressed.

PRINTING A REPORT

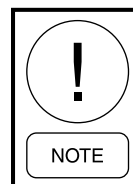
After pressing the PRINT key, press the ◀ or ▶ key until the required printout is displayed. The available printout types are listed in *Table 41 on page 124*.

TABLE 40 - PRINTOUT TYPES

PRINTOUT TYPES
Operating Data (Default)
All History Buffers
Normal Shutdowns
History Buffer 1
History Buffer 2
History Buffer 3
History Buffer 4
History Buffer 5
History Buffer 6
History Buffer 7
History Buffer 8
History Buffer 9
History Buffer 10
Cancel Printing

Press the ✓ key to initiate the printout.

When OPERATING DATA is selected, the data at that instant will be temporarily stored in memory, and then transmitted through the print port. HISTORY BUFFER data is captured at the instant of that particular fault, and the selected buffer data is then transmitted through the print port. See the operating data printout in *Figure 61 on page 125*



Bold italic text below a line of print is not on the actual printout. It indicates information that may not be available on all printouts, or is additional information to help explain the difference in a two -circuit printout.

Operating Data Printout

```

OPERATING DATA
2:04:14 PM  9 MAR 12
SYS 1          COMPRESSOR RUNNING

OPTIONS
CHILLED LIQUID          WATER
CHILLED MODE            CHILLER
LOCAL/REMOTE MODE       REMOTE

REMOTE TEMP RESET       DISABLED
REMOTE CURRENT LIMIT     0 TO 10 V
SMART FREEZE            DISABLED
OIL PUMP CONTROL         DISABLED
VSD AUX PUMP CONTROL     DISABLED
OIL LEVL SW CONTROL      DISABLED
REFRIG INJ CONTROL      DISABLED

PROGRAM VALUES
EVAP PRESS CUTOOUT      44 Psig
MOTOR CURRENT LIMIT     100 %FLA
PULLDOWN CURRENT LIMIT  100 %FLA
PULLDOWN LIMIT TIME     0 MIN
MOTOR TEMP UNLOAD       250.0 DEGF
UNIT ID NUMBER          0
EDUCTOR DIFFERENTIAL    50.0 DEGF
EDUCTOR SAFETY TIME     10 MIN

UNIT DATA
LEAVING WATER TEMP      49.0 DEGF
RETURN WATER TEMP       58.2 DEGF
TEMP RATE               XXX.X DEGF/MIN
COOLING RANGE           42.0+/-2.0 DEGF
REMOTE SETPOINT         44.0 DEGF

CHILLED LIQUID FLOW SW  ON
CONDENSER LIQUID FLOW SW ON
EVAP/COND PUMP RUN      ON
VSD AUX COOLANT PUMP RUN ON
(if control enabled)
LEAVE COND LIQUID TEMP  49.0 DEGF
ENTER COND LIQUID TEMP  58.2 DEGF
ACTIVE REMOTE CONTROL    NONE
OPERATING HOURS         1=XXXXX, 2=XXXXX

```

FIGURE 61 - SAMPLE PRINTOUT

```

START COUNTER          1=XXXXX, 2=XXXXX
SOFTWARE VERSION        C.WCS.30.00
UNIT SERIAL NUMBER      YYYY XXXZZZ

VSD DATA
ACTUAL FREQUENCY        XXX.X HZ
COMMAND FREQUENCY       XXX.X HZ
DC BUS VOLTAGE           XXX VDC
INTERNAL AMBIENT TEMP    XXX.X DEGF
COOLING SYSTEM STATUS    XXX
BASEPLATE TEMPS         XXX XXX DEGF
PRE-CHARGE SIGNAL       XXX
MOTOR OVERLOADS 1/2     XXX XXX AMPS
SOFTWARE VERSION        C.VSD.XX.00

SYSTEM 1 DATA
COMPRESSOR STATUS       OFF
RUN TIME                0- 0- 0- 0 D-H-M-S
MOTOR CURRENT           0 AMPS 0 %FLA
EVAPORATOR PRESSURE     125 Psig
DISCHARGE PRESSURE      131 Psig
OIL PRESSURE            130 Psig
CONDENSER LIQUID TEMP   68.4 DEGF
DISCHARGE TEMPERATURE   68.8 DEGF
CONDENSER PRESSURE      71.8 DEGF
SUBCOOLING              3.4 DEGF
EVAP TEMP              120.3 DEGF
MOTOR TMP               XXX.XXXX.XXXX.X
COMPRESSOR SPEED        XXX.X %
COND LEVEL % OPEN       XXX.X %
ECONOMIZER % OPEN       XXX.X %
ECONOMIZER TEMP         120.3 DEGF
ECONOMIZER PRESSURE     71.7 PSIG
COMPRESSOR HEATER       OFF
VI STEP SOLENOID 1      OFF
(if control enabled)
VI STEP SOLENOID 2      OFF
(if control enabled)
LIQUID REF INJ          OFF
(if control enabled)
HOT GAS BYPASS          OFF
(if control enabled)
OIL PUMP                ON
(if control enabled)
OIL LEVEL SWITCH        ON
(if control enabled)
RUN PERMISSIVE          ON
VSD RUN RELAY           OFF

```

FIGURE 61 - SAMPLE PRINTOUT (CONT'D)

```
VSD SOFTWARE RUN SIGNAL      OFF
EDUCTOR TEMPERATURE         68.8 DEGF
```

UNIT OPERATING SCHEDULE

```
S M T W T F S      *=HOLIDAY
MON START=00:00AM    STOP=00:00AM
TUE START=00:00AM    STOP=00:00AM
WED START=00:00AM    STOP=00:00AM
THU START=00:00AM    STOP=00:00AM
FRI START=00:00AM    STOP=00:00AM
SAT START=00:00AM    STOP=00:00AM
HOL START=00:00AM    STOP=00:00AM
```

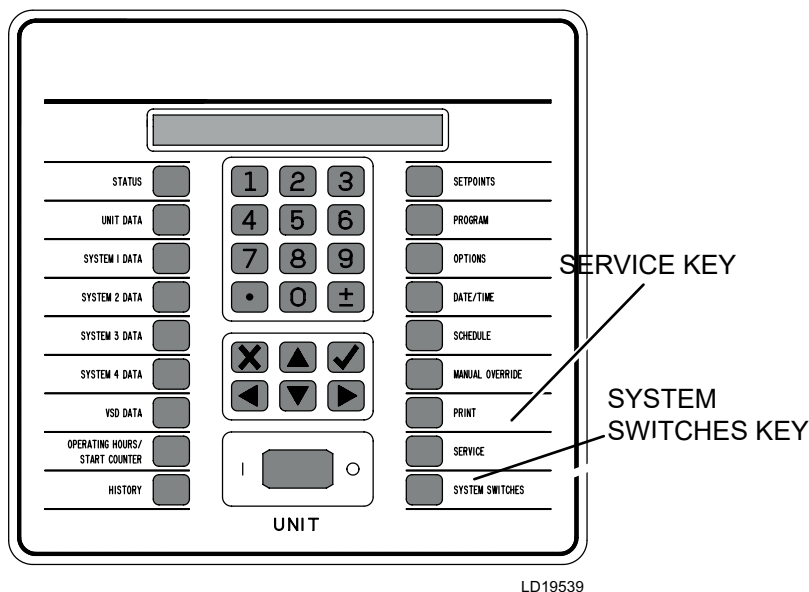
FIGURE 61 - SAMPLE PRINTOUT (CONT'D)**History Data Printout**

History printouts provide stored data relating to all specific system and chiller operating conditions at the time of the fault, regardless if a lockout occurred. Whenever any fault occurs, all system operating data is stored in battery-backed memory on the control board at the instant of the fault, and is not affected by power failures or resetting of the faults. The history printout is the same as the operating data printout except for the header information shown below:

```
Quantech
QWC4 SCREW CHILLER
HISTORY NUMBER 1
2:04:14 PM 30 APR 12
SYS 1 YYYYYYYY
HIGH DSCH PRESS SHUTDOWN
STATUS AT TIME OF SHUTDOWN
SYS 1 XXXXXXXXXXXXXXXXXXXXXXXXXXXX
SYS 2 XXXXXXXXXXXXXXXXXXXXXXXXXXXX
ALL FAULTS
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The most recent fault will always be stored as HISTORY BUFFER #1.

SYSTEM SWITCHES AND SERVICE KEY



LD19539

FIGURE 62 - SYSTEM SWITCHES AND SERVICE KEYS

SYSTEM SWITCHES ON / OFF / RESET
◀ ▶ = ON OR OFF OR RESET

Use the SYSTEM SWITCHES key to enable/disable the chiller. In addition, safety lockouts can be cleared under this key. Pressing this key returns to the first SYSTEM SWITCHES screen. The ▼ and ▲ keys will scroll to the next or previous item. Use the ◀ or ▶ keys to scroll through the choices for each item and the ✓ key to accept the new item setting.

If RESET (LOCKOUT) is selected, a lockout fault on that system will be cleared, but the state of that system's switch will remain unchanged (ON or OFF).

SYSTEM SWITCHES ON / OFF / RESET
◀ ▶ = ON OR OFF OR RESET

Use the ◀ or ▶ key to scroll through the message:

- SYSTEM OFF (default)
- SYSTEM ON
- RESET (LOCKOUT)

Press the ✓ key to enter the switch selection into memory.

If RESET (LOCKOUT) is selected and accepted, it will not change the position of the switch (ON or OFF).



Except in emergencies, always use the SYSTEM SWITCH to turn off the compressor, which allows the compressor to go through a controlled shutdown. Avoid using the UNIT SWITCH to turn off the compressor.

Service Key

The SERVICE key allows the programming of the programmable values that the user should never change. They will be programmed at the factory or by qualified service personnel.

BAS COMMUNICATIONS

Quantech Talk 2 Communications

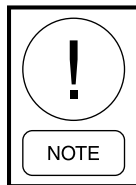
Received Data (Control Data)

The unit receives eight data values from the E-Link Gateway as shown in *Figure 63 on page 128*. The first four are analog values and the last four are digital values. These eight data values are used as control parameters when in REMOTE mode. When the unit is in LOCAL mode, these eight values are ignored. If the unit receives no valid Quantech Talk 2 transmission for five minutes, it will revert back to all local control values. The QWC4 Communications Data Map lists the control parameters.

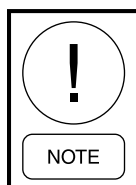
Transmitted Data

After receiving a valid transmission from the E-Link Gateway, the unit will transmit operational data or history buffer data depending on the HISTORY BUF-

FER REQUEST. Data must be transmitted for every page under Feature 54. If there is no value to be sent to a particular page, a zero will be sent to the QWC4 Communications Data Map.



The most current data map information is listed on the Quantech/Quantech Equipment Integration [website](#) or [Knowledge Exchange](#). The map is QWC4 BAS 1 Circuit.



A reboot is required (cycle power) after the settings are changed.

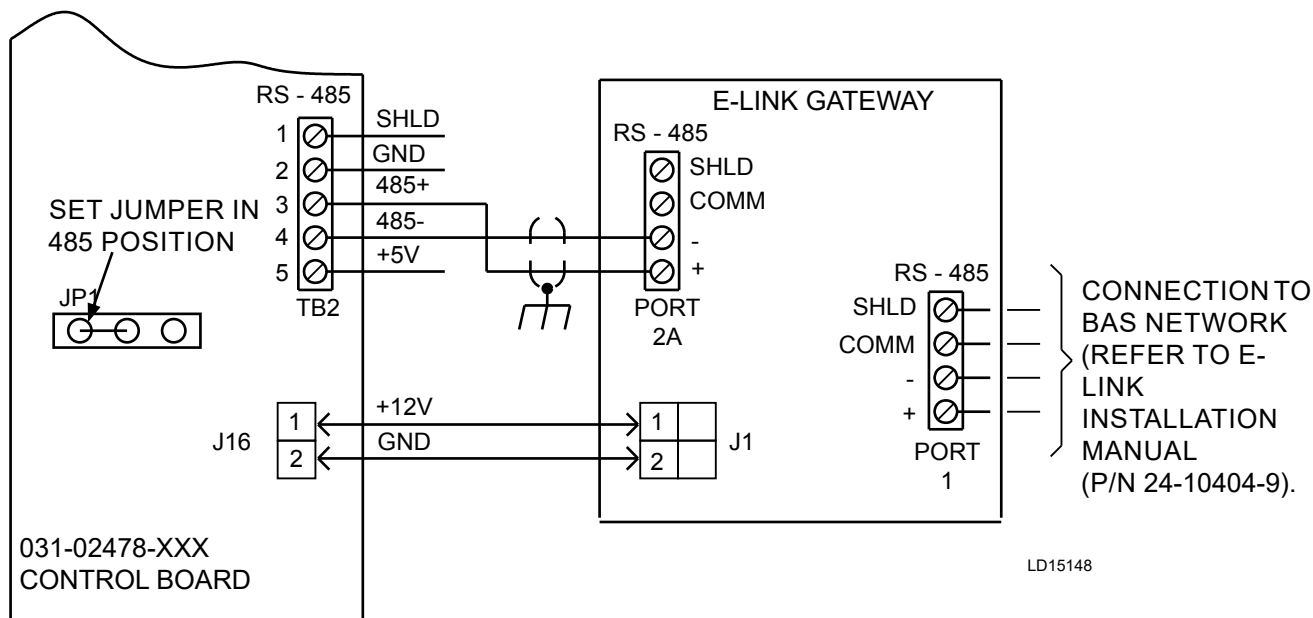


FIGURE 63 - E-LINK GATEWAY OPTION

TABLE 41 - REAL TIME NUMBER ERRORS

ERROR NUMBER (##)	DESCRIPTION
0	ALL OK
1	DATUM TYPE OK TEST FAILED
2	ENGLISH TEXT TOO LONG
3	FLOATING POINT EXCEPTION
4	GET PACKET FAILED
5	GET TYPE FAILED
6	INVALID UNIT CONVERSION
7	INVALID HARDWARE SELECTION
8	REAL TIME FAULT
9	SPANISH TEXT TOO LONG
10	THREAD EXITED
11	THREAD FAILED
12	THREAD STALLED
13	I/O BOARD RESET
14	BRAM INVALID
15	BACnet SETUP FAILED

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SECTION 7 - MAINTENANCE

GENERAL REQUIREMENTS

The maintenance requirements for QWC4 chillers are shown below. The procedure is in the left-hand column and the required frequency is marked with an *X* in the right-hand column. See the notes at the bottom of the table to maintain warranty validation.

Compressor vibration analysis is not prescribed. Due to the compressor design, a typical vibration analysis can be misleading.

Avoid periodic oil filter changes. Change the oil, filter, and filter driers only when an oil analysis indicates a moisture issue.

TABLE 42 - OPERATION/INSPECTION /MAINTENANCE REQUIREMENTS FOR QWC4 CHILLERS

PROCEDURE	DAILY	WEEKLY	MONTHLY	ANNUALLY
Record operating conditions (on applicable log form)	X			
Check oil level in oil level sight glass	X			
Check refrigerant levels		X		
Check oil return system operation			X	
Check operation of motor starter			X	
Check oil heater operation			X	
Check 3-phase voltage and current balance			X	
Check programmable operating setpoints and safety cutouts. Make sure they are correct for the application.				X
Verify condenser and evaporator liquid flows			X	
Check and repair leaks as needed ¹			X	
Check and tighten all electrical connections				X
Check the motor windings resistance				X
Clean or back flush VSD heat exchanger				X ¹
Replace VSD coolant (after cleaning heat exchanger)				X
Perform oil analysis on compressor lube oil				X ¹
Perform refrigerant analysis				X
Perform Eddy current testing and inspect tubes				X ²
Clean evaporator and condenser tubes				X ²

For operating and maintenance requirements listed above, refer to appropriate service literature, or contact a local Quantech Field Service Office.

¹ This procedure must be performed at the specified time interval by an industry certified technician, who has been trained and qualified to work on this type of Quantech equipment. A record of this procedure being successfully carried out must be maintained on file by the equipment owner should proof of adequate maintenance be required at a later date for warranty validation purposes.

² More frequent service may be required, depending on local operating conditions or relaxed with good engineering controls (water quality).

DAILY OPERATING INSPECTIONS

Routine Inspections

Avoid serious operating difficulties by conducting regular inspections. Use the following list of daily inspections and procedures as a guide.

Check or verify the following:

1. Control center displays.
2. If the compressor is in operation,
 - c. Check the oil pressure.
 - d. Check the oil level in the oil reservoir.
 - e. Drain or add oil, as necessary.
3. Entering and leaving condenser water pressure and temperatures for comparison with job design conditions.
4. Entering and leaving chilled liquid temperatures and evaporator pressure for comparison with job design conditions.
5. Condenser saturation temperature (based upon condenser pressure sensed by the condenser transducer).
6. Signs of dirty or fouled condenser tubes. (The temperature difference between water leaving condenser and condenser refrigerant saturation should not exceed the difference recorded for a new unit by more than 4°F (2°C)).
7. Compressor discharge temperature. During normal operation, discharge temperature should not exceed 212°F (100°C).
8. Compressor motor voltage and current (amps) on the control center display.
9. Proper water treatment.

Press the STATUS key whenever the display indicates to do so, which allows any warning messages to be displayed.

COMPRESSOR OIL

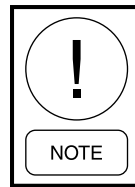
Check Operational Oil Level

The compressor requires 2.4 gal (9 L) of YORK L oil.

Oil Level

The QWC4 chiller DOES NOT HAVE an oil pump. System oil flow is dependent on the pressure differential between the condenser and evaporator. Therefore, the oil flow rate, and oil level in the separator will vary as the system pressures and compressor speeds change. It is normal for the oil level to be at the bottom of the lower sight glass, or near the top of the upper sight glass on the oil separator, depending on conditions.

Do not add oil unless the oil level cannot be seen in the lower sight glass when the compressor is operating at least 100 Hz. At lower loads, oil level may be below the lower sight glass, but with the proper amount of oil in the chiller, an adequate amount of oil is provided to compressor at those loads even with partial refrigerant in the stream. Oil should not be removed unless the oil level is above the upper sight glass. If oil needs to be added, use the procedure below to manage the oil level.



Do not add oil unless the oil level cannot be seen in the lower sight glass, or removed unless the oil level is above the upper sight glass. If oil needs to be added, use the procedure below to manage the oil level.

Start-Up

1. **Oil level cannot be seen in the lower or upper sight glass:** For chillers shipped with a factory charge of oil and refrigerant with no oil level obvious at start-up, a qualified technician should add only enough oil to create a visible level in the bottom of the lower sight glass.

Start the chiller and run a load condition between 65% and 80% FLA for a minimum of one hour and observe the oil level. The oil level should become visible in the lower or upper sight glass, depending on conditions. A qualified technician should then remove the approximate amount added to start the chiller.

2. **Oil level is above the upper sight glass:** Conditions can exist where the evaporator pressure is higher than the condenser pressure, which occurs when the evaporator (or chilled) water loop is warmer than the condenser (or cooling tower) water loop, which can cause refrigerant in the oil separator to condense, creating a liquid level (oil and refrigerant mixture) that exceeds the top of the upper sight glass.

When the chiller motor is not running, a quali-

fied technician should confirm the compressor oil heater is working properly, and is energized. If it is the first start-up for the cooling season, the technician should confirm the oil heater has been energized for at least 24 hours before start-up. During start-up, the chiller should be manually unloaded until a discharge superheat temperature (displayed on the SYSTEM DATA key) of 18°F (10°C) or greater is maintained and liquid level drops below the top of the upper sight glass on the oil separator. The chiller should continue to be held in part-load operation until the foaming in the oil separator is minimized. The chiller can then be returned to the position or load control to meet the cooling load requirements.

Operation

1. **Oil level should be visible in or below the upper sight glass:** If the chiller operates in a low discharge superheat condition for an extended period of time, refrigerant can condense in the oil separator. Unload and hold the chiller at a capacity that allows the discharge superheat to increase above 18°F (10°C), and until the level drops below the top of the upper sight glass and foaming is minimized. The chiller can then be loaded normally as the building/process load requires.
2. If there is no visible oil in either sight glass, a problem may exist with the oil return system. If load is such that the compressor is operating at least 100 Hz, the oil should be present in the sight glass. At lower loads, oil level may be below the lower sight glass. If the proper amount of oil is in the chiller, the bearings will be adequately lubricated. The chiller should be loaded when validating oil capacity in the chiller. A qualified technician should add only enough oil to create a visible level in the bottom of the lower sight glass.

Start the chiller and run a load condition between 65% and 80% FLA for a minimum of one hour, and then observe the oil level. The oil level should become visible in either the lower or upper sight glass, depending on conditions. A qualified technician should then remove the approximate amount added to start the chiller.

Oil Analysis

Complete an annual oil analysis to verify the continued use of the compressor oil.



The oil sample should not be exposed to the atmosphere for more than 15 minutes because it will absorb moisture from the atmosphere and may yield erroneous results.

Change the compressor oil when the oil analysis indicates that the oil has moisture, and the acid numbers exceed the limits set in *Table 44 on page 133*.

TABLE 43 - COMPRESSOR OIL LIMITS

MOISTURE YORK OIL TYPE	MOISTURE CONTENT (KARL FISHER METHOD) PPM	TAN (TOTAL ACID NUMBER) MGKOH/ML
L	< 300	< 0.5

The QWC4 chiller compressors use rolling element bearings (ball and roller bearings); no sleeve bearings are used. Oil analysis that include metals, such as iron, copper, titanium, zinc, lead, tin and silicon, may cause confusion when the results are compared to other equipment that use different bearing types. Ignore these metals in the oil analysis because they are acceptable if < 100 ppm. If an oil analysis indicates >300 ppm of iron, combined with > 50 ppm of chromium and nickel, consult the Quantech Field Service Office because these amounts could indicate bearing damage and wear.

Removing the Compressor Oil

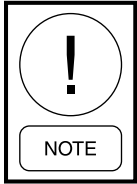
Use the following instructions to remove the compressor oil. Drain the existing oil in the oil separator, which is under positive pressure at ambient temperature, into an approved refrigerant recovery container.

1. Connect one end of a refrigeration charging hose to the service valve located at the bottom of the oil separator; connect the other end to an approved container.
2. Open the valve, and drain the existing oil from the oil separator.
3. Additional oil is in the compressor that can be drained through the plug under the motor housing.

Adding Compressor Oil

Add the new YORK oil into the oil separator with the YORK oil charging pump (P/N 470-10654), and proceed as follows :

1. Shut down the unit.



If adding oil restores the correct level, the unit may keep operating.

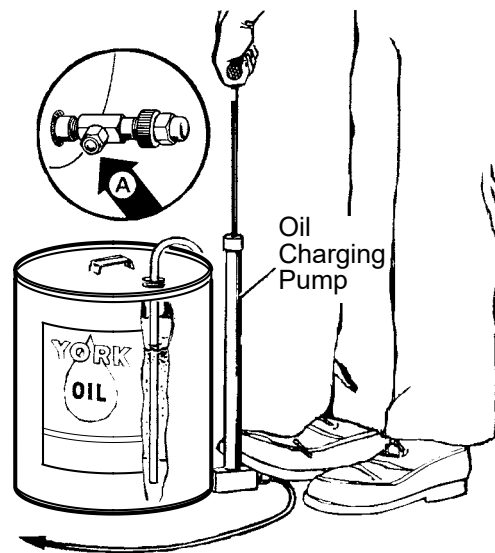
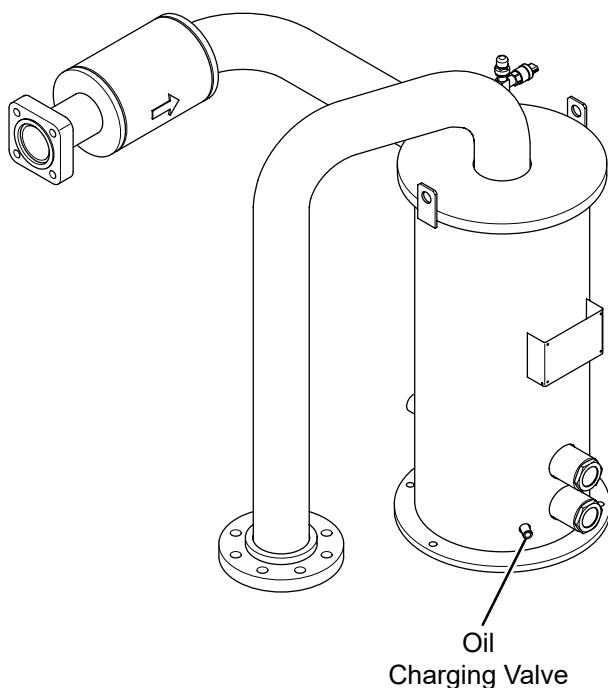
2. Immerse the suction connection of the oil charging pump in a clean container of new oil. Connect the pump discharge connection to the oil charging valve. Do not tighten the connection at the valve until after the air is forced out by pumping a few strokes of the oil pump, which fills the lines with oil and prevents air from being pumped into the system as shown in *Figure 64 on page 134*.

3. Open the oil charging valve and pump oil into the system until the oil level in the oil separator is about midway in the upper sight glass, and then, close the charging valve and disconnect the hand oil pump as shown in *Figure 64 on page 134*.
4. As soon as oil charging is complete, close the power supply to the VSD to energize the compressor oil heater, which will keep the refrigerant concentration in the oil to a minimum.
5. The compressor oil heater will maintain the oil temperature below 160°F (71°C).

Oil Filter

A single oil filter, a replaceable 3-micron cartridge, is provided in each compressor. Use only YORK approved oil filter elements.

The oil filter element should only be changed if a problem exists. Always replace the oil filter element and O-ring together.



LD17765

FIGURE 64 - CHARGING OIL

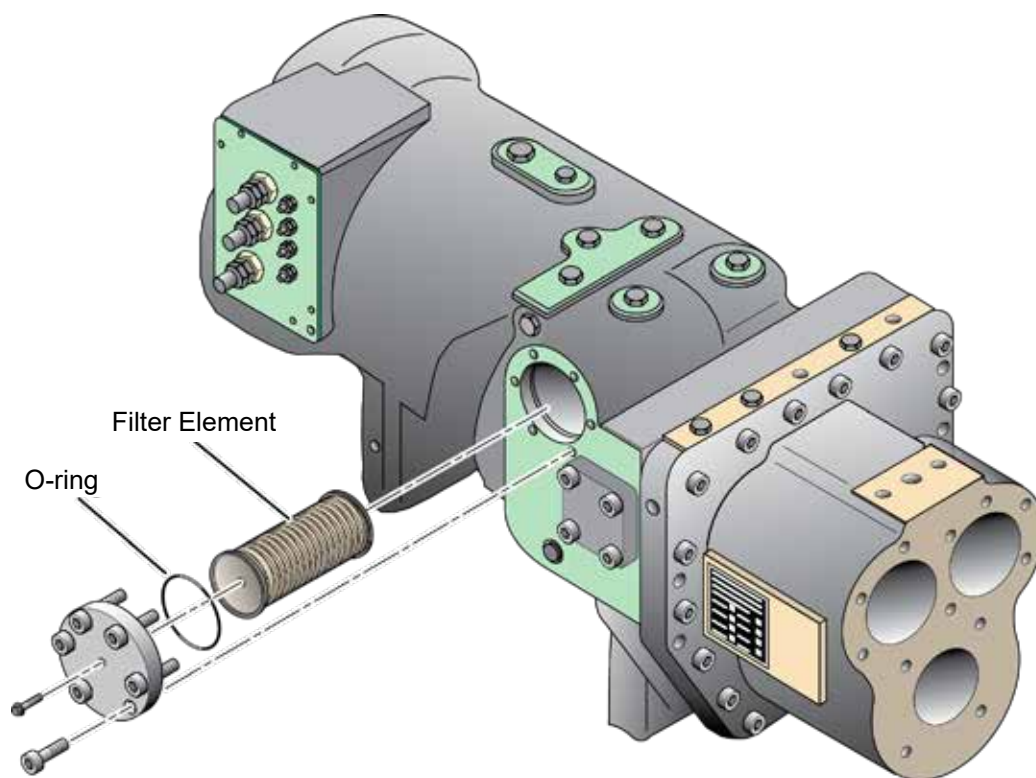
The control panel will automatically display the message HIGH OIL FILTER DPSI when the differential pressure reaches the programmable setpoint across the oil filter (10-100 psid, default 65 psid (69-690 kPa, default 448 kPa)). A safety shutdown will initiate.

OIL FILTER REPLACEMENT

Use the following instructions to replace the oil filter.

1. Turn off the chiller, and secure it from starting by using the standard lock out/tag out procedure.
2. Isolate and remove the refrigerant from the compressor.
3. Bring the compressor up to atmospheric pressure with dry nitrogen.
4. Remove the six cap screws that secure the oil filter cover to the compressor housing as shown in *Figure 65 on page 135*.

5. Remove the oil filter housing cover and O-ring seal.
6. Remove the oil filter. Examine any debris from the filter, which could indicate wear in the compressor or other parts of the unit.
7. Replace the oil filter element and the cover O-ring with new parts. Refer to *Model QWC4 Renewal Parts (Form QWC4-RP1)* to get the new part numbers. Seat the element and properly to prevent filter bypass. Lightly lubricate the O-ring with compressor oil.
8. Reinstall the oil filter housing cover, and torque the cap screws to 18 ft-lb (24.4 Nm).
9. Leak check the cover by pressurizing the system.
10. Evacuate the isolated compressor and applicable portions of the chiller. Reinstall refrigerant.



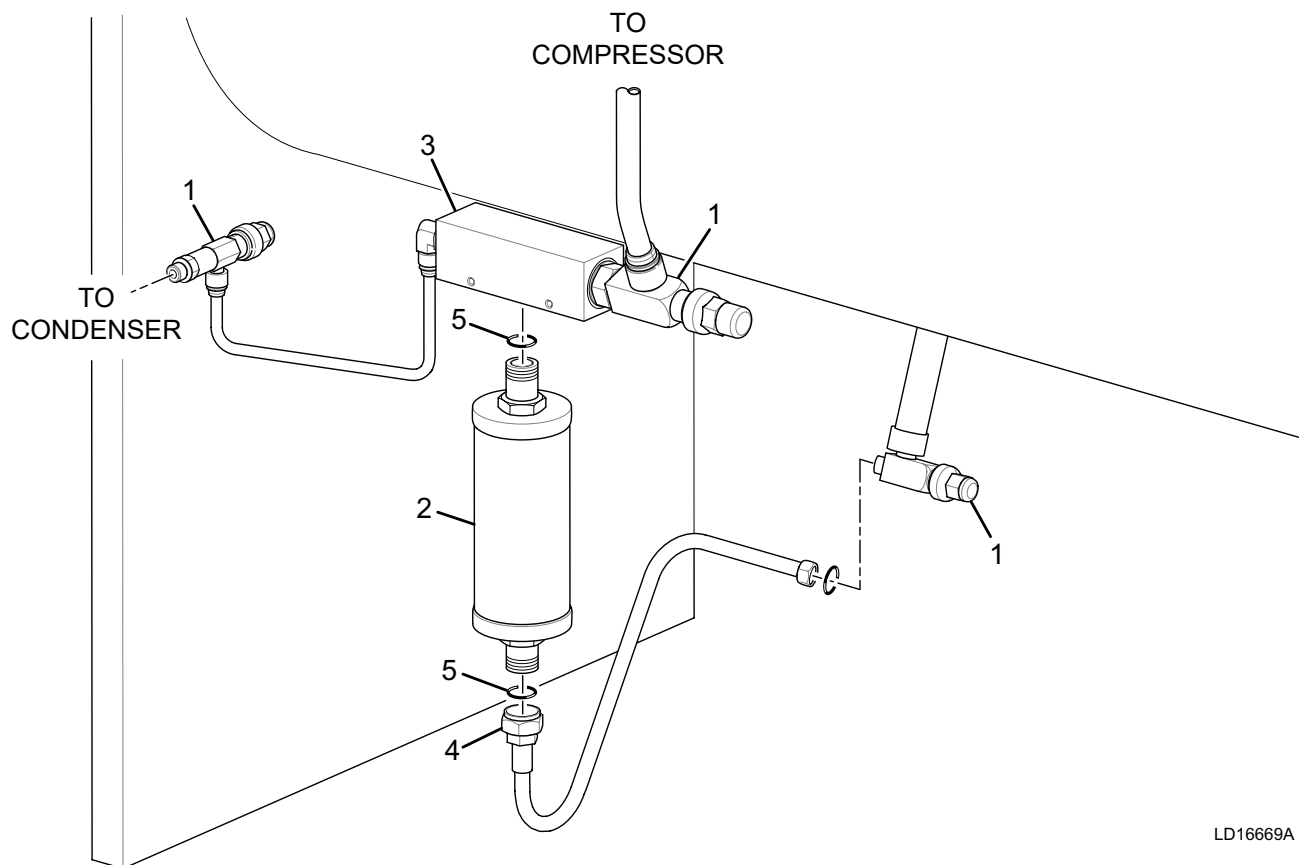
LD16152

FIGURE 65 - OIL FILTER ASSEMBLY

Replacing the Filter Drier

If the eductor flow seems restricted by high eductor outlet temperatures or if the oil is replaced, replace the filter using the following instructions to replace the drier as shown in *Figure 66 on page 136*.

1. Power down the chiller.
2. Close all 3 service isolation valves (items 1).
3. Carefully remove any insulation on the filter drier (item 2), located at the eductor block (item 3).
4. Relieve the pressure from the circuit into a suitable refrigerant recovery container. Filter drier (item 2) contains a Schraeder valve for this purpose.
5. Loosen the roto lock nut (item 4) at the piping end of the filter drier (item 2).
6. Remove the filter drier from the eductor block and discard filter drier and Teflon seals (item 5).
7. Install the new Teflon seals (items 5) and filter drier (item 2).
8. Torque nuts (items 4) at each end of filter drier (item 2) to 60 ft-lb (81 Nm), and replace the filter drier insulation.
9. Evacuate the air from the lines to 500 microns.
10. Open all 3 service isolation valves (items 1).
11. Restore power to the chiller, the chiller is now ready to be placed back into service.



LD16669A

FIGURE 66 - OIL EDUCTOR ASSEMBLY

Determining Correct Refrigerant Charge Level

The refrigerant charge level is correct when the condenser level is about 1 in. above the subcooler, and the measured Evaporator Approach and Discharge Refrigerant Gas Superheat are at the design values for the condition. The equations (below) define these parameters.



The chiller must be at design operating conditions and full load operation before the correct refrigerant charge level can be properly determined.

Equations:

- Evaporator Approach = (SET) - (LELT)
- Discharge Superheat = (CDGT) - (SCT)

Definitions Of Temperatures:

- SET = Saturated Evaporator Temperature
- LELT = Leaving Evaporator Liquid Temperature
- CDGT = Compressor Discharge Gas Temperature
- SCT = Saturated Condensing Temperature

The parameters can be obtained from the control center.

Liquid refrigerant will be visible in the evaporator sight glass, but the refrigerant level cannot be properly determined by viewing the liquid refrigerant level in the evaporator sight glass.

Form 1 QWC4 chillers are charged with the correct amount of refrigerant. Under some operating conditions, the chiller may appear to be overcharged or undercharged with refrigerant. Consult with a Quantech Field Service Office before removing or adding refrigerant.

REFRIGERANT CHARGING

If necessary, add refrigerant charge to the QWC4 chiller until the evaporator approach and discharge superheat values are within design values.

A charging valve is located in the liquid line below the evaporator. The charging connection is a 3/4 in. male flare. Purge air and non-condensables from the charging hose. Add only new refrigerant, or refrigerant that has been tested and certified to meet American Refrigeration Institute Standard (ARI-700).

HANDLING REFRIGERANT FOR DISMANTLING AND REPAIRS

If it becomes necessary to open any part of the refrigerant system for repairs, remove the charge first.

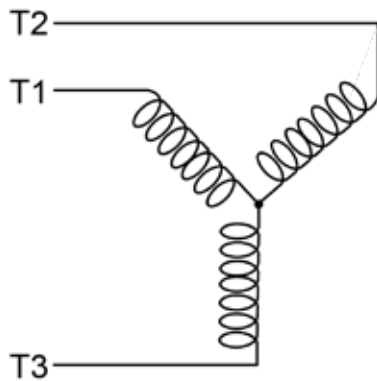
To avoid the possibility of freezing liquid within the evaporator tubes when charging an evacuated system, only refrigerant vapor from the top of the drum or cylinder must be admitted to the system until the system pressure is raised above the point corresponding to the freezing point of the evaporator liquid. For water, the pressure corresponding to the freezing point is 29 psig (20 kPa) for R-134a (at sea level).

While charging, take every precaution to prevent air from entering the system. Make up a suitable charging connection from new copper tubing or approved refrigerant hose to fit between the system charging valve and the fitting on the charging cylinder. This connection should be as short as possible but long enough to permit sufficient flexibility for changing cylinders. The charging connection should be purged each time a full container of refrigerant is connected and changing containers should be done as quickly as possible to minimize the loss of refrigerant.

Checking the Motor Windings

Make sure the motor power leads are marked and disconnect them from the output terminals in the VSD.

- Use a resistance meter to measure the winding resistance phase-to-phase as shown in *Figure 67 on page 138*. The nominal values are listed below, but the preventive maintenance program should trend the values for gross changes.
 - 400 VAC application: 24 mΩ for T1-T2, T2-T3, T3-T1.
 - 460 VAC application: 40 mΩ for T1-T2, T2-T3, T3-T1.



LD16148

FIGURE 67 - MOTOR WINDINGS DIAGRAM

- Use a reliable battery-powered megohm tester, which provides a consistent test voltage to test winding resistance to ground.
 - Test no greater than 500 V.
 - Always test with refrigerant or nitrogen pressure in the motor.
 - Never test in a vacuum.
 - Values should be above 5 megohm.
 - Trend readings for gross changes.

If values indicate a potential problem, remove the external leads from the motor, and repeat the test directly at the motor terminals.



Never have power on the input to the VSD. Do not perform megohm testing with the motor in a vacuum.

CHECKING SYSTEM FOR LEAKS

Leak Testing During Operation

The refrigerant side of the system is carefully pressure tested and evacuated at the factory.

After the system is in operation under load, the high pressure components should be carefully leak tested with a leak detector to make sure all joints are tight. If a leak exists, the refrigerant will be lost.

REFRIGERANT LEAK CHECKING

Check for refrigerant leaks regularly as part of a comprehensive maintenance program.

- Leak check the entire chiller, using a calibrated electronic leak detector.
- If leaks are detected, use a soap solution to confirm leaks that were found by the leak detector.
- Check refrigerant relief valve piping and evaporator and condenser tube rolled joints.

PRESSURE CONNECTIONS

All threaded pressure connections used on the QWC4 chillers are SAE straight thread, O-ring face seal fittings or Primore Roto lock fittings.

The O-ring straight thread and face seal fittings are designed and used in accordance with SAE J1926 and J1453. When a fitting is removed, replace the O-rings. Use only elastomeric replacement O-rings, which can be ordered from the local Quantech Field Service Office.

Pipe sealant compounds are not required with SAE O-ring fittings. The O-ring seal accomplishes the pressure sealing. Lubricate the O-ring with compressor oil before assembly.

All filter driers and angle shutoff valves use roto lock fittings, which use a teflon fiber seal washer. Replace the washers when the filter driers are changed.

If any leaks are indicated, repair them immediately. Usually, leaks can be stopped by tightening the flare nuts or flange bolts. However, if it is necessary to repair a welded joint, the refrigerant charge must be removed.

Conduct R-134a Pressure Test

With the R-134a charge removed and all known leaks repaired, charge the system with a small amount of R-134a mixed with dry nitrogen so that a halide torch or electronic leak detector can be used to detect any leaks too small to be found using the soap test.

To test with R-134a, proceed as follows:

1. With no pressure in the system, charge R-134a gas and dry nitrogen into the system through the charging valve to a pressure of 150 psig (10 kPa).

2. To make sure that the concentration of refrigerant reached all parts of the system, slightly open the oil charging valve and test for the presence of refrigerant with a leak detector.
3. Test around each joint and factory weld carefully and thoroughly.
4. To check for refrigerant leaks in the evaporator and condenser, open the vents in the evaporator and condenser heads and test for the presence of refrigerant. If no refrigerant is present, the tubes and tube sheets may be considered tight. If refrigerant is detected at the vents, remove the heads, locate the leak, (using the soap test or leak detector) and repair.
5. When system is absolutely tight, blow the nitrogen and refrigerant mixture through the charging valve.

TESTING FOR EVAPORATOR AND CONDENSER TUBE LEAKS

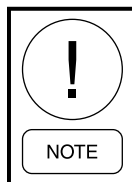
Evaporator and condenser tube leaks in R-134a systems may result in refrigerant leaking into the water circuit, or into the shell, depending on the pressure levels.

If refrigerant is leaking into the water, it can be detected at the liquid head vents after a period of shutdown. If water is leaking into the refrigerant, system capacity and efficiency will drop off sharply.

If a tube is leaking and water has entered the system, the evaporator and condenser should be valved off from the rest of the water circuit and drained immediately to prevent severe rusting and corrosion. The refrigerant system should then be drained and purged with dry nitrogen to prevent severe rusting and corrosion. If a tube leak is indicated, determine the exact location of the leak using the following information:

1. Remove the heads and listen at each section of the tubes for a hissing sound that would indicate gas leakage, which will help locate the section of the tubes to be further investigated. If the probable location of the leaky tubes has been determined, treat that section in the following manner (if the location is not definite, investigate all of the tubes).

2. Wash off both tube heads and the ends of all tubes with water.



Do not use carbon tetrachloride for this purpose since its fumes give the same flame discoloration that the refrigerant does.

3. With nitrogen or dry air, blow out the tubes to clear them of traces of refrigerant laden moisture from the circulation water. As soon as the tubes are clear, a cork should be driven into each end of the tube. Pressurize the dry system with 50 psig to 100 psig (345 kPa to 690 kPa) of nitrogen. Repeat this process with all of the other tubes in the suspected section or, if necessary, with all the tubes in the evaporator or condenser. Allow the evaporator or condenser to remain corked up to 12 hours to 24 hours before proceeding. Depending upon the amount of leakage, the corks may blow from the end of a tube, indicating the location of the leakage. If not, it will be necessary to make a very thorough test with the leak detector.
4. After the tubes have been corked for 12 hours to 24 hours, two people working at both ends of the evaporator must carefully test each tube – one person removing corks at one end and the other at the opposite end to remove corks and handle the leak detector. Start with the top row of tubes in the section being investigated. Remove the corks at the ends of one tube simultaneously and insert the exploring tube for five seconds – this should be long enough to draw into the detector any refrigerant gas that might have leaked through the tube walls. A fan placed at the end of the evaporator opposite the detector will assure that any leakage will travel through the tube to the detector.
5. Mark any leaking tubes for later identification.
6. If any of the tube sheet joints are leaking, the leak should be indicated by the detector. If a tube sheet leak is suspected, its exact location may be found by using a soap solution. A continuous buildup of bubbles around a tube indicates a tube sheet leak.

EVACUATION AND DEHYDRATION OF UNIT

Make sure the power is removed from the input side of the VSD at all times when the chiller is under vacuum (less than atmospheric pressure). The VSD maintains voltage to ground on the motor when the chiller is off while voltage is available to the VSD. Insulating properties in the motor are reduced in vacuum and may not insulate this voltage sufficiently.

Vacuum Dehydration

If the chiller is opened to the atmosphere for lengthy repair or service, follow these guidelines to ensure that all air, moisture and non-condensable gases are removed before placing the chiller into service.

The equipment required to complete this method of dehydration consists of:

- a wet bulb indicator or vacuum gauge
- and a vacuum pump capable of pumping a suitable vacuum on the system.

See Table 45 on page 140 to see the relation between dew point temperature and system pressure in inches of mercury (vacuum).

Dehydration of a refrigerant system can be completed by this method because the water present in the system reacts like refrigerant. Pulling down the pressure in the system where its saturation temperature is below room temperature, heat will flow from the room through the walls of the system and vaporize the water, allowing a percentage of it to be removed by the vacuum pump. The length of time necessary to dehydrate a system depends on the following:

- Size or volume of the system
- Capacity and efficiency of the vacuum pump
- Room temperature
- And quantity of water present in the system.

TABLE 44 - SYSTEM PRESSURES

*GAUGE	ABSOLUTE			DEW POINT TEMPERATURES OF WATER °F
In OF MERCURY (HG) BELOW ONE STANDARD ATMOSPHERE	PSIA	MILLIMETERS OF MERCURY (HG)	MICRONS	
0	14.696	760	760,000	212
10.24"	9.629	500	500,000	192
22.05"	3.865	200	200,000	151
25.98"	1.935	100	100,000	124
27.95"	0.968	50	50,000	101
28.94"	0.481	25.0	25,000	78
29.53"	0.192	10.0	10,000	52
29.67"	0.122	6.3	6,300	40
29.72"	0.099	5.0	5,000	35
29.842"	0.039	2.0	2,000	15
29.882"	0.019	1.0	1,000	+1
29.901"	0.010	0.5	500	-11
29.917"	0.002	0.1	100	-38
29.919"	0.001	0.05	50	-50
29.9206"	0.0002	0.01	10	-70
29.921"	0	0	0	0

WATER
FREEZES

*One standard atmosphere = 14.696 psia
= 760 mm Hg. absolute pressure at 32°F
= 29.921 in Hg. absolute at 32°F

NOTE: psig = Lb per sq. in. gauge pressure
= Pressure above atmosphere
psia = Lb per sq. in. absolute pressure
= Sum of gauge plus atmospheric pressure

Improve Dehydration

Circulate hot water (not to exceed 125°F (52°C)) through the evaporator and condenser tubes to thoroughly dehydrate the shells. If a source of hot water is not readily available, use a portable water heater. **DO NOT USE STEAM.** A temperature should be brought up slowly so that the tubes and shell are heated evenly to avoid causing leaks.

1. Connect a hose between the source of hot water under pressure and evaporator head drain connection.
2. Maneuver the hose out of the evaporator vent connection.
3. Maneuver the hose into the condenser head drain.
4. Maneuver the house out of the condenser vent.

If the system has been pressure tested and found to be tight before evacuation, then the saturation temperature recordings should follow a curve similar to the typical saturation curve as seen in *Figure 68 on page 141*.

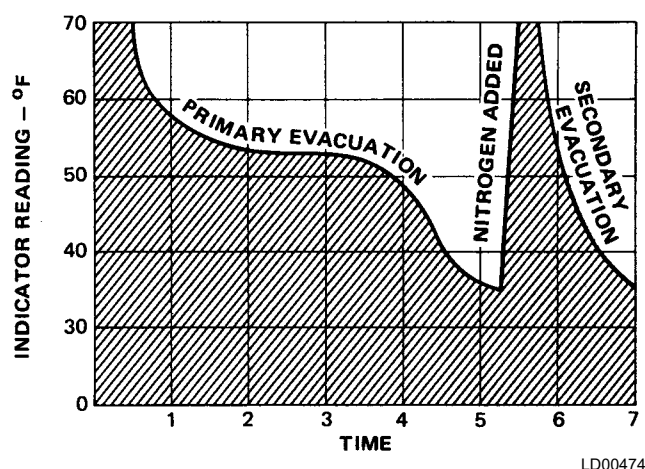


FIGURE 68 - SATURATION CURVE

Remaining System Moisture

The temperature of the water in the chiller will drop as the pressure decreases, until the boiling point is reached, at which point the temperature will level off and remain at this level until all of the water in the shell is vaporized. When this final vaporization has taken place the pressure and temperature will continue to drop until eventually a temperature of 35°F (1.6°C) or a pressure of 5 mm Hg is reached.

When this point is reached, most of the air has been evacuated from the system, but there is a small amount of moisture left. To provide a medium for carrying this residual moisture to the vacuum pump, introduce nitro-

gen into the system to bring it to atmospheric pressure and the indicator temperature will return to approximately ambient temperature. Close off the system again, and start the second evacuation.

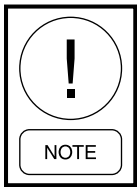
The small amount of moisture left will be carried out through the vacuum pump and the temperature or pressure shown by the indicator should drop uniformly until it reaches a temperature of 35°F (1.6°C) or a pressure of 5 mm Hg. When the vacuum indicator registers this temperature or pressure, it is a positive sign that the system is evacuated and dehydrated to the recommended limit. If this level cannot be reached, there is a leak somewhere in the system, which must be corrected before the indicator can be pulled down to 35°F (1.6°C) or 5 mm Hg in the primary evacuation.

During the primary pulldown, carefully watch the wet bulb indicator temperature, and do not let it fall below 35°F (1.6°C). If the temperature is allowed to fall to 32°F (0°C), the water in the test tube will freeze, and the result will be a faulty temperature reading.

Vacuum Testing

After completing the pressure test, the vacuum test should be conducted as follows:

1. Connect a high capacity vacuum pump, with indicator, to the system charging valve or shell service valve and start the pump. See *Evacuation and Dehydration of Unit on page 140*.
2. Open wide all system valves, including the purge and gauge valves. Be sure all valves to the atmosphere are closed.
3. Operate the vacuum pump in accordance with *Vacuum Dehydration* until a wet bulb temperature of 32°F (0°C) or a pressure of 5 mm Hg is reached. See *SECTION 3 - HANDLING, STORAGE, INSTALLATION, AND REASSEMBLY* for corresponding values of pressure.
4. Close the system charging valve and the stop valve between the vacuum indicator and the vacuum pump, then disconnect the vacuum pump leaving the vacuum indicator in place.
5. Hold the vacuum wet bulb temperature obtained in Step 3 in the system for eight hours; the slightest rise in pressure indicates a leak or the presence of moisture, or both. If, after eight hours the wet bulb temperature in the vacuum indicator has not risen above 40°F (4.4°C) or a pressure of 6.3 mm Hg, the system may be considered tight.



Be sure the vacuum indicator is valved off while holding the system vacuum. Open the valve between the vacuum indicator and the system when checking the vacuum after eight hours.

6. If the vacuum does not hold for eight hours within the limits specified in Step 5, find and repair the leak.

CONDENSERS AND EVAPORATORS MAINTENANCE

General

Maintenance of the condenser and evaporator shells is important to provide trouble free operation of the unit. The waterside of the shell tubes must be kept clean and free from scale. Proper maintenance, such as tube cleaning, is covered on the following pages.

Chemical Water Treatment

Since the mineral content of the water circulated through evaporators and condensers varies with almost every supply source, the water being used may corrode the tubes or deposit heat resistant scale in them.

Reliable water treatment companies are available in most large cities who can supply a water treating process, which will greatly reduce the corrosive and scale forming properties of almost any type of water.

As a preventive measure against scale and corrosion and to prolong the life of the evaporator and condenser tubes, a chemical analysis of the water should be made, before the system is installed. Consult a reliable water treatment company to determine if water treatment is necessary, and if so, to furnish the proper treatment for the particular water condition.

CLEANING EVAPORATOR AND CONDENSER TUBES

The condenser and evaporator tubes in a QWC4 chiller are made of copper with mild carbon steel waterboxes.



If the equipment is located in an unheated area susceptible to freezing, drain the water from the condenser and evaporator to prevent the tubes from freezing.

Condenser Tubes

Proper condenser water treatment can eliminate or significantly reduce the formation of scale on the waterside of the condenser tubes.

Maintain a minimum condenser water flow rate through the tubes of at least 3.33 ft/s (1 m/s). Tube water velocity should not exceed 12 ft/s (3.6 m/s).

Condenser tubes must be maintained to provide proper chiller operation. The condenser approach temperature, which is the difference between the condenser leaving water and the saturated condenser temperatures, is a useful tool to monitor the performance of the condenser. Recording and logging the condenser approach temperature, as part of the chiller maintenance program, warns the operator that the waterside condenser tubes are fouled and require cleaning.

If the approach increases more than 4°F (2°C) above the approach when the tubes were clean, or during the annual condenser inspection the tubes are observed to be fouled, the tubes require cleaning.

In a condenser, a problem due to fouled tubes is usually indicated by:

- A steady rise in head pressure over a period of time
- A steady rise in condensing temperature
- Noisy operation

Tube Fouling

Fouling of the tubes can be due to two types of deposits:

1. **Rust or sludge** – which finds its way into the tubes and accumulates there. This material usually does not build up on the inner tube surfaces like scale, but does interfere with the heat transfer. Remove the rust or sludge from the tubes using a thorough brushing process.
2. **Scale** – due to mineral deposits. These deposits, although thin and scarcely detectable upon physical inspection, are highly resistant to heat transfer. Remove the scale by circulating an acid solution through the tubes.

Non-condensable Gas

Non-condensable gas that seeped into the chiller during incorrect evacuation or charging will also cause high condenser approach conditions. Purge the refrigerant vapor from the condenser into a refrigerant container to reveal non-condensable gas.

Evaporator Tubes

Maintain evaporator water or brine flow rates through the evaporator tubes for which the chiller was designed. Refer to the engineering data on the sales order form for the correct flow rates.

Generally, the water or brine that is circulated through the evaporator is part of a closed loop circuit that is treated with chemicals to prevent the formation of scale and debris.

The evaporator's lack of performance is indicated by cooling capacity decreases and the approach (temperature difference between the water leaving the evaporator and the refrigerant temperature in the evaporator) increases. It is difficult to determine if the lack of performance is due to fouled tubes alone or due to a combination of problems, such as:

- Refrigerant leaks from the system.
- A shortage of refrigerant charge.
- An excessive quantity of oil in the evaporator.

Waterside Tube Cleaning Procedure

Two methods are used for waterside tube cleaning to remove scale: chemical or mechanical. The scale composition will determine which method is most effective to remove the scale and dirt.

Contact a Quantech Field Service Office for a recommended method that is used locally.

Chemical Cleaning Procedure

Acid Cleaning of Tubes – If the tubes are fouled with a hard scale deposit, they may require acid cleaning. Before acid cleaning, clean the tubes by the brushing process described earlier. If the loose foreign material is removed before the acid cleaning, the acid solution will clean the tubes more efficiently, and in a shorter amount of time.

Chemical cleaning is an effective method to remove scale from internally enhanced copper tubes. However, a company knowledgeable with the chemical cleaning procedure should be contracted or consulted. Follow the chemical cleaning company guidance concerning solution cleaning strength and time duration of the cleaning process.

Commercial Acid Cleaning – If acid cleaning is required, use a commercial organization that offers a special service to acid clean evaporators and condensers, such as the Dow Industries Service Division, Dow Chemical Co., Tulsa, OK, which has branches in principal cities.

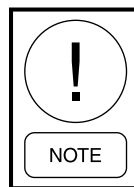


Serious damage to the condenser tubes will result if the chemical cleaning procedure is improperly applied.

When chemical cleaning of the tubes is required, calculate the internal volume of the waterside condenser tubes with the following equation to properly mix the correct concentration of cleaning solution.

$$\text{Vol (gal)} = [\text{Nominal tube size (in)}] \times 3.14 \times \text{shell length (ft)} \times \text{number of tubes} / 77$$

Contact a Quantech Field Service Office for the size and number of tubes.



Mechanical tube cleaning must always follow a chemical cleaning procedure.

Mechanical Tube Cleaning Procedure

1. Drain the water from the condenser.
2. Remove the waterboxes from both ends of the condenser with proper lifting equipment. Use caution not to damage the threads on the mounting studs that are welded to the tube sheet.
3. Select a tube cleaning brush for 5/8 in. ID copper condenser tubes. If tubes other than those with 5/8 in. ID are used, select a tube cleaning brush that is made for the tube size. Generally, brushes made of hard plastic or brass bristled wires are preferred for cleaning copper tubes. **DO NOT** use a steel bristle brush.
4. Attach the tube cleaning brush to the end of a cleaning machine or rod.
5. Flush the condenser with clean water to remove the debris.
6. Replace the waterbox gasket with a new gasket, and reassemble the waterbox onto the condenser.

COMPRESSOR MAINTENANCE

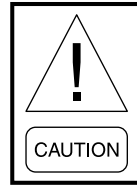
To perform maintenance on the compressor assembly, complete the following:

1. Check the operation of the oil return system and change the dehydrator.
2. Check and change the oil, and oil filters.
3. Check the operation of the oil heater.
4. Observe the operation of the compressor.

Internal wearing of compressor parts could be a serious problem caused by improper lubrication, brought about by restricted oil lines, passages, or dirty oil filters. If the unit is shutting down on low oil pressure (LOP), change the oil filter element and examine it for foreign material. If foreign material is noticeable and the same conditions continue to stop the unit operation after a new filter element is installed, contact a Quantech Field Service Office.

ELECTRICAL CONTROLS

For information covering the control center operation, see *SECTION 6 - OPERATION* in this manual, and *Field Connections and Control Wiring for QWC4 Chiller (Form QWC4-PW2)*.

Checking VSD Coolant Level

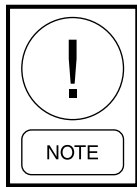
Never run the coolant pump without coolant! Running the coolant pump without coolant may damage the pump seals.

Always fill the system with approved Quantech coolant to avoid damage to the pump seals and the chiller.

The chiller is shipped with a 50/50 mix of Propylene Glycol and Quantech Corrosion Inhibitors. This type of coolant is being used to protect the cooling loop from damage due to freezing conditions during the shipping process. This coolant mixture does not have the thermodynamic properties required by the variable speed drive, and must be removed. Drain the coolant from the variable speed drive.

This 50/50 mixture must be drained and replaced with Quantech Corrosion Inhibitor as specified below.

1. Drain the coolant from the variable speed drive.
2. Fill the coolant loop using Quantech's Corrosion Inhibitor, part number 013-04129-000. Pour the solution into the top of the header pipe until the level is within a 1/2 inch of the top.
3. Then manually run the pump to remove pockets of air. Observe the level in the fill-pipe, and more coolant as necessary to bring the level back to approx.. 1/2 from the top of the pipe.
4. Continue to run the pump manually for 15 minutes, adding more coolant as needed. Then reinstall the pipe plug in the header pipe using teflon tape to assure coolant does not evaporate through the pipe threads. Do not wrap the threads with more than 2 wraps of Teflon tape. Too much tape can cause the fill pipe to crack.

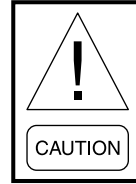


The pipe plug has straight threads, and could fall into the reservoir.

5. Remove the cap on the fill tube and run the coolant pump to verify the level in the fill tube.
6. Make sure the coolant level in the VSD cooling system is 1/2 in. (2 cm) from the top of the fill tube while running.
7. Run the pump by placing the chiller in SERVICE mode. See *SECTION 6 - OPERATION*.
8. Add new coolant, if necessary.
9. Reinstall the cap before stopping the coolant pump to avoid overflowing the fill tube when the coolant pump is turned off. The coolant system holds about 2 gal (7.6 L) of coolant.

Preventive Maintenance

It is the owner's responsibility to fulfill the necessary daily, monthly and yearly system maintenance requirements to keep the unit operating at its peak efficiency. Follow the maintenance schedule in *Table 43 on page 131*.



If a unit fails due to improper maintenance during the warranty period, Quantech will NOT be liable for costs incurred to return the system to satisfactory operation.

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SECTION 8 - TROUBLESHOOTING

Successful troubleshooting requires an organized approach to define the problem, identify the cause, and make the proper corrections. Sometimes two relatively obvious problems combine to provide a set of symptoms that can mislead the troubleshooter. Be aware of this possibility and avoid repairs that do not solve the problems. See *Table 46 on page 148* for specific troubleshooting information.

ABNORMAL OPERATION, ANALYSIS AND CORRECTION

Use the following steps to analyze an operational problem effectively and make the necessary corrections:

1. Define the problem and its limits.
2. Identify all possible causes.
3. Test each cause until the source of the problem is found.
4. Make the necessary corrections.

When an operating problem develops, compare all operating information on the OPERATING DISPLAY key with normal operating conditions. If an operating log has been maintained, the log can help determine what constitutes normal operation for the compressor unit in that particular system.

TROUBLESHOOTING THE COMPRESSOR AND OIL SEPARATION SYSTEM

Troubleshooting the compressor is limited to identifying the probable cause. If a mechanical problem is suspected, contact the Quantech Field Service Office. **DO NOT DISASSEMBLE THE COMPRESSOR.**



The VSD contains voltages that could cause injury or death. Follow all NFPA-70E safety rules. Before performing any troubleshooting procedures, place the compressor switch in the stop position. Wait 5 minutes. Ensure that the DC BUS voltage is 50 VDC or less on the display of the chiller control panel.

This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

TABLE 45 - TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	ACTION
No Display on Control Panel. Unit Will NOT Run	Electric supply to the panel is missing.	High voltage to the chiller is missing.
		Check 1FU, 2FU, 3FU, 4FU, 5FU, 14FU, 15FU, 17FU, or 19FU.
		Check 2T or 10T Transformer.
	Line fuse is blown.	Check fuses.
	Control board is defective.	Replace control board.
	Display board is defective.	Replace display board.
Line Fuse Blows	VSD assembly is defective.	Replace VSD components diagnosed to be the cause.
Chiller Fault: Low Leaving Chilled Liquid Temperature	Leaving chilled liquid temperature drops faster than the unit can unload.	Check for restricted flow.
		Check for rapid flow changes.
		Water loop is too small.
		Flow is below minimum for chiller.
	Chilled water sensor is defective.	Check sensor against temperature gauge in water line.
		Check sensor for intermittent operation.
		Check wiring for shorts or opens.
System Fault: Control Voltage	System fuse is blown.	Check respective system Fuse 20FU or 21FU.
System Fault: Abnormally High Discharge Temperature	Discharge temperature sensor is defective.	Check sensor.
	Condenser tubes are dirty or scaled.	Check and clean tubes. Check water conditioning.
	Condenser water flow low.	Check site pumps, valves, and strainers. Increase quantity of water through the condenser to the proper value.
	Condenser water too warm.	Check tower fan motor/blade, valve, and water circulation.
	Compressor issue.	Measure superheat with gauges and thermocouple. Determine cause.
	Air in condenser.	Purge unit and clean the charge.
System Fault: High Motor Temperature	High motor temperature input from one of the sensors.	Refrigerant charge low. Check evaporator approach.
		Excess charge in system. High discharge pressure. Check superheat.
		High superheat. Feed valves NOT controlling. Isolate cause.
		Motor sensor reading incorrectly. Program panel to ignore a single sensor.
System Fault: Abnormally Low Suction Pressure	Low charge.	Check evaporator approach.
	Transducer reads incorrectly.	Check transducer against a gauge.
	Suction temperature sensor reads incorrectly.	Check sensor against a thermocouple.
	Insufficient refrigerant charge.	Check for leaks and charge refrigerant into system.
	Low flow.	Check flow.
	Feed or flow valve defective.	Repair or replace valve or control.
	Evaporator tubes dirty or restricted.	Clean evaporator tubes.
	Insufficient load for system capacity.	Check setting of low water temperature cutout.

TABLE 46 - TROUBLESHOOTING GUIDE (CONT'D)

PROBLEM	POSSIBLE CAUSE	ACTION
System Fault: Motor Current Limiting	High motor current has activated current limiting.	Ambient temperature is high. Normal response from controller
		Remote or panel limiting is in effect. Normal response.
		Excess charge in system. Adjust charge.
VSD Fault: High Baseplate Temperature	Coolant level low.	Add coolant.
	Coolant pump is defective.	Replace coolant pump.
	VSD board is defective.	Replace VSD logic board.
	Sensor is defective.	Replace defective sensor.
VSD Fault: Low DC Bus Voltage	Line voltage sag.	Evaluate indicators of power feed at time of event.
	SCR or trigger board is defective.	Check VSD.
System Fault: High Evaporator Pressure	System overload.	Make sure the compressors are loaded (without overloading the motor) until the load decreases.
System Fault: 1. Compressor Starts 2. Normal Oil Pressure Develops 3. Pressure Fluctuates 4. Compressor Stops on Oil Pressure Fluctuation	Unusual starting conditions exist, i.e., oil foaming in reservoir and piping, due to lowered system pressure.	Drain the oil from the oil separator and charge new oil into the oil separator.
	Burned out compressor heater.	Replace compressor heater.
System Fault: Oil Pressure Gradually Decreases	Oil filter is dirty.	Change oil filter.
	Extreme bearing wear.	Call Quantech Field Service Office to evaluate compressor.
System Fault: Oil Return System Ceases to Return an Oil Refrigerant Sample	Filter in oil return system dirty.	Replace old oil filter with a new filter.
	Oil return eductor jet or orifice is clogged.	Remove eductor, inspect for dirt. Remove dirt, using solvent and replace.
System Fault: System Fails to Deliver Oil Pressure	Faulty oil pressure transducer. Faulty wiring/connectors.	Replace oil pressure transducer.
Excessive Noise and Vibration	Bearing damage or excessive wear.	Call Quantech Field Service Office to evaluate compressor.
	Refrigerant flood back.	Correct system problem.
	Chiller vibration isolators installed improperly	Install isolators properly according to instructions in this manual.
	Room acoustics are poor.	Evaluate sound attenuation.
	Piping supports not supporting load.	Adjust piping supports.
Gradual Oil Loss with an Oil Level in the Separator Sight Glass	Oil level is too high.	Lower oil level.
	Refrigerant carryover or liquid injection overfeeding.	Adjust refrigerant level setpoint. Check control valves.

NOTE: Always turn OFF power to the chiller and make sure the DC Bus voltage has bled off when opening the VSD cabinet.

TABLE 46 - 3K TEMPERATURE SENSOR

TEMP (°F)	VOLTAGE
18.83	1.6113
21.22	1.6895
23.57	1.7676
25.89	1.8457
28.2	1.9238
30.49	2.002
32.76	2.0801
35.03	2.1582
37.3	2.2363
39.58	2.3145
41.85	2.3926
44.14	2.4707
46.45	2.5488
48.78	2.627
51.13	2.7051
53.52	2.7832
55.94	2.8613
58.41	2.9395
60.93	3.0176
63.5	3.0957
66.13	3.1738
68.84	3.252
71.64	3.3301
74.52	3.4082
77.52	3.4863
80.63	3.5645
83.86	3.6426
87.28	3.7207
90.85	3.7988
94.63	3.877
98.68	3.9551
103	4.0332
107.64	4.1113
112.72	4.1895
118.28	4.2676
124.45	4.3457
131.45	4.4238
139.5	4.502
149.01	4.5801
160.64	4.6582
175.61	4.7363

NOTE: Leaving/Entering Condenser Liquid Temperature Sensor
Subcooled Liquid Refrigerant Temperature Sensor
Eductor Temperature Sensor
Economizer Outlet Temperature Sensor

TABLE 47 - 3K TEMPERATURE SENSOR - EVAPO-RATOR REFRIGERANT AND EDUCTOR TEMPERA-TURE SENSOR

TEMP (°F)	VOLTAGE
-4.87	1.2305
-2.31	1.3086
0.17	1.3867
2.59	1.4648
4.97	1.543
7.29	1.6211
9.57	1.6992
11.82	1.7773
14.05	1.8555
16.25	1.9336
18.44	2.0117
20.62	2.0898
22.79	2.168
24.96	2.2461
27.13	2.3242
29.32	2.4023
31.51	2.4805
33.72	2.5586
35.95	2.6367
38.2	2.7148
40.48	2.793
42.8	2.8711
45.16	2.9492
47.57	3.0273
59.03	3.1055
52.56	3.1836
55.15	3.2617
57.82	3.3398
60.59	3.418
63.45	3.4961
66.43	3.5742
69.53	3.6523
72.8	3.7305
76.24	3.8086
79.87	3.8867
83.73	3.9648
87.88	4.043
92.34	4.1211
97.21	4.1992
102.58	4.2773
108.54	4.3555
115.26	4.4336
123.06	4.5117
132.29	4.5898
143.62	4.668
158.34	4.7461

TABLE 48 - PRESSURE TRANSDUCER

EVAP PRESSURE (125 PSIG)		ECONOMIZER PRESSURE (275 PSIG)				DISCHARGE, CONDENSER, OIL PRESSURE (400 PSIG)			
PRESSURE	VOLTAGE	PRESSURE	VOLTAGE	PRESSURE	VOLTAGE	PRESSURE	VOLTAGE	PRESSURE	VOLTAGE
0	0.5	0	0.5	180	3.12	0	0.5	180	2.3
5	0.66	5	0.57	185	3.19	5	0.55	185	2.35
10	0.82	10	0.65	190	3.26	10	0.6	190	2.4
15	0.98	15	0.72	195	3.34	15	0.65	195	2.45
20	1.14	20	0.79	200	3.41	20	0.7	200	2.5
25	1.3	25	0.86	205	3.48	25	0.75	205	2.55
30	1.46	30	0.94	210	3.55	30	0.8	210	2.6
35	1.62	35	1.01	215	3.63	35	0.85	215	2.65
40	1.78	40	1.08	220	3.7	40	0.9	220	2.7
45	1.94	45	1.15	225	3.77	45	0.95	225	2.75
50	2.1	50	1.23	230	3.85	50	1	230	2.8
55	2.26	55	1.3	235	3.92	55	1.05	235	2.85
60	2.42	60	1.37	240	3.99	60	1.1	240	2.9
65	2.58	65	1.45	245	4.06	65	1.15	245	2.95
70	2.74	70	1.52	250	4.14	70	1.2	250	3
75	2.9	75	1.59	255	4.21	75	1.25	255	3.05
80	3.06	80	1.66	260	4.28	80	1.3	260	3.1
85	3.22	85	1.74	265	4.35	85	1.35	265	3.15
90	3.38	90	1.81	270	4.43	90	1.4	270	3.2
95	3.54	95	1.88	275	4.5	95	1.45	275	3.25
100	3.7	100	1.95			100	1.5	280	3.3
105	3.86	105	2.03			105	1.55	285	3.35
110	4.02	110	2.1			110	1.6	290	3.4
115	4.18	115	2.17			115	1.65	295	3.45
120	4.34	120	2.25			120	1.7	300	3.5
125	4.5	125	2.32			125	1.75	305	3.55
		130	2.39			130	1.8	310	3.6
		135	2.46			135	1.85	315	3.65
		140	2.54			140	1.9	320	3.7
		145	2.61			145	1.95	325	3.75
		150	2.68			150	2	330	3.8
		155	2.75			155	2.05	335	3.85
		160	2.83			160	2.1	340	3.9
		165	2.9			165	2.15	345	3.95
		170	2.97			170	2.2	350	4
		175	3.05			175	2.25	355	4.05

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SECTION 9 - DECOMMISSIONING, DISMANTLING, AND DISPOSAL



Never release refrigerant to the atmosphere when emptying the refrigerating circuits. Suitable retrieval equipment must be used. If reclaimed refrigerant cannot be reused, it must be returned to the manufacturer.



Never discard used compressor oil, as it contains refrigerant in solution. Return used oil to the oil manufacturer.

Unless otherwise indicated, the operations described below can be performed by any properly trained maintenance technician.

1. Isolate all sources of electrical supply to the unit, including any control system supplies switched by the unit. Make sure that all points of isolation are secured in the off position.
2. Disconnect and remove the supply cables. For connection points, see *SECTION 3 - HANDLING, STORAGE, INSTALLATION, AND REASSEMBLY*.
3. Remove all refrigerant from the system into a suitable container, using a refrigerant reclaim or recovery unit. This refrigerant may then be reused, if appropriate, or returned to the manufacturer for disposal. Under NO circumstances should refrigerant be vented to the atmosphere.
4. Drain the refrigerant oil from the system into a suitable container and dispose of according to local laws and regulations. Any spilled oil should be mopped up and similarly disposed of.
5. Isolate the unit heat exchanger from the external water systems and drain the heat exchanger section of the system. If no isolation valves are installed it may be necessary to drain the complete system.

6. If glycol was used in the water system, or chemical additives are contained, dispose of the solution in a suitable and safe manner. Under NO circumstances should any system containing glycol be drained directly into domestic waste or natural water systems.

7. After draining, disconnect and remove the waterlines.

8. Remove the packaged units in one piece after disconnecting the unit. Remove fixing down bolts, and then lift the unit from position, using the points provided and equipment with adequate lifting capacity.

See *SECTION 3 - HANDLING, STORAGE, INSTALLATION, AND REASSEMBLY* for unit installation instructions, and *SECTION 7 - MAINTENANCE* for unit weights.

Units which cannot be removed in one piece after disconnection must be dismantled in position. Handle each component carefully. Where possible, dismantle units in the reverse order of installation.

Make sure that while components are being removed, the remaining parts are supported in a safe manner.



Only use lifting equipment of adequate capacity.

After removing the unit from position, dispose the unit parts according to local laws and regulations. The following factors can be used to convert from English to the most common metric values.

The following factors can be used to convert from English to the most common SI Metric values.

TABLE 49 - SI METRIC CONVERSION

MEASUREMENT	MULTIPLY ENGLISH UNIT	BY FACTOR	TO OBTAIN METRIC UNIT
Capacity	Tons Refrigerant Effect (ton)	3.516	Kilowatts (kW)
Power	Horsepower	0.7457	Kilowatts (kW)
Flow Rate	Gallons / Minute (gpm)	0.0631	Liters / Second (L/s)
Length	Feet (ft)	0.3048	Meters (m)
	Inches (in)	25.4	Millimeters (mm)
Weight	Pounds (lb)	0.4536	Kilograms (kg)
Velocity	Feet / Second (fps)	0.3048	Meters / Second (m/s)
Pressure Drop	Feet of Water (ft)	2.989	Kilopascals (kPa)
	Pounds / Square Inch (psi)	6.895	Kilopascals (kPa)

TEMPERATURE

To convert degrees Fahrenheit (°F) to degrees Celsius (°C), subtract 32° and multiply by 5/9 or 0.5556.

Example: $(45.0^{\circ}\text{F} - 32^{\circ}) \times 0.5556 = 7.22^{\circ}\text{C}$

To convert a temperature range (i.e., a range of 10°F) from Fahrenheit to Celsius, multiply by 5/9 or 0.5556.

Example: $10.0^{\circ}\text{F range} \times 0.5556 = 5.6^{\circ}\text{C range}$

NOTES

