



WATER-COOLED SCREW LIQUID CHILLERS

INSTALLATION, OPERATION, AND MAINTENANCE

Supersedes: 201.30-ICOM2 (312)

Form 201.30-ICOM2 (412)

035-23322-100
745703

MODEL YVWA Dual Compressor - Style A 50 Hz and 60 Hz 200 - 300 Tons 703 - 1055 kW



LD16421

R-134a



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IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During installation, operation maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: 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 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 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 this document and any referenced materials. This individual shall also be familiar with and comply with all applicable 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 Johnson Controls' published specifications and must be performed only by a qualified electrician. Johnson Controls 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

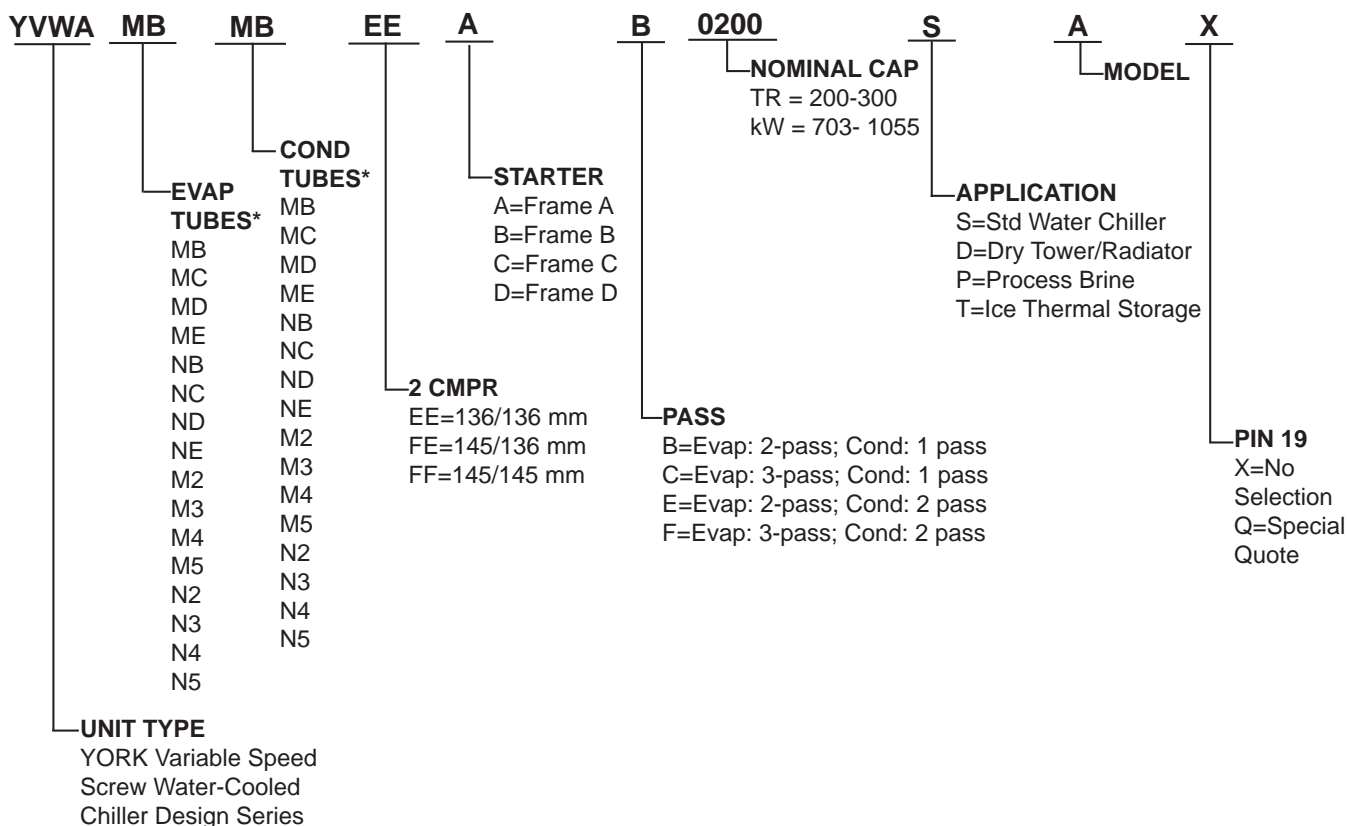
In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual owner. Updated manuals, if applicable, can be obtained by contacting the nearest Johnson Controls Service office.

Operating/service personnel maintain responsibility for the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, the technician 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
Wiring and Field Connections for YVWA Chiller	201.30-PW2
YVWA Unit Renewal Parts	201.30-RP1
YVWA Chiller Installation Checklist	201.30-CL1
YVWA Chiller Start-up Checklist and Request for Authorized Start-up Technician	201.30-CL2
Long-Term Storage Requirements-Field Preparations for YR, YS, and YVWA Screw Chillers	50.20-NM9
Limited Warranty	50.05-NM2
Shipping Damage Claims	50.15-NM
Long-Term Storage Periodic Checklist and Logs for YR, YS, and YVWA Screw Chillers	50.20-CL9

NOMENCLATURE



*First letter represents tube size. The second letter designates the number of tubes.

VARIABLE SPEED DRIVE NOMENCLATURE

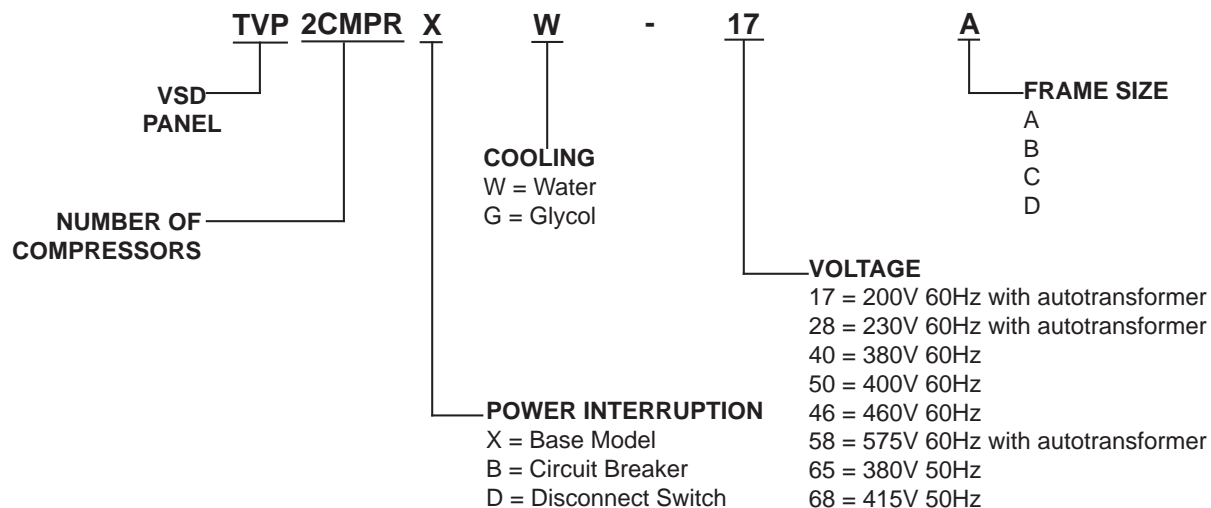


TABLE OF CONTENTS

SECTION 1 - GENERAL CHILLER INFORMATION AND SAFETY	11
Introduction.....	11
About This Manual.....	11
Warranty	11
Quality Assurance	12
Fluorinated Greenhouse Gases	12
Responsibility For Safety.....	12
Misuse Of Equipment	12
Suitability For Application	12
Brine Applications.....	12
Structural Support	12
Mechanical Strength	12
General Access	12
Pressure Systems	12
Electrical.....	12
Refrigerants and Oils.....	13
High Temperature and Pressure Cleaning	13
Emergency Shutdown	13
Safety Labels.....	13
SECTION 2 - PRODUCT DESCRIPTION.....	15
Evaporator.....	19
Condenser.....	19
Refrigerant Circuit	19
Electrical.....	19
Building Automation System (BAS) Capabilities	19
Microcomputer Control Center	20
Options	20
Evaporator Options	20
Controls Options.....	21
General Options	21
Relief Valves	21
Electrical Isolation	21
Vibration Isolation.....	21
SECTION 3 - HANDLING, STORAGE, AND INSTALLATION	23
Delivery and Storage.....	23
Forms 1 and 2	23
Form 2	23
Chiller Unit.....	23
Miscellaneous Items.....	23
Form 7 (Special Order).....	23
Inspection, Damage, and Shortage	23
Lifting Weights.....	23
Moving the Chiller.....	24
Location.....	25
Foundation	25
Clearance For Service	25
Locating and Installing Neoprene Vibration Isolator Pads.....	26

TABLE OF CONTENTS (CONT'D)

Installing Optional Spring Isolators	27
Piping Connections	28
Check for Piping Alignment	28
Condenser and Chilled Liquid Piping	28
General Requirements	28
Piping Connections	29
Condenser Water Circuit	29
Checking Piping Circuits and Venting Air	30
Water Treatment.....	30
Pipework Arrangement	30
Minimum Water Volume	31
Leaving Water Temperature Out Of Range	31
Variable Primary Flow	31
Nozzle Connections	31
Options For Flanges.....	31
Refrigerant Relief Piping	32
Unit Piping	34
Electrical Connection.....	34
Power Wiring	34
Power Supply Wiring	34
115VAC Control Supply Transformer.....	34
Control Wiring.....	34
Chilled Liquid and Condenser Pump Starter	35
Run Contact	35
Alarm Contacts.....	35
System Inputs.....	35
Chilled Liquid Flow Switch.....	35
Condenser Liquid Flow Switch	35
Remote Run Permissive.....	35
Remote Print	35
Optional Heat Pump Remote Mode Selection.....	35
Optional Remote Setpoint Offset.....	35
Analog Inputs	35
Leaving Chilled Liquid Temperature Reset Control	35
How To Receive Voltage Or Current Signal	35
0-10 or 2-10 VDC Reset Input	36
0-20 or 4-20 mA Reset Input.....	36
Leaving Condenser Liquid Temperature Reset Control	36
Current Limit Reset Control.....	36
How to Receive Voltage or Current Signal.....	36
0-10 or 2-10 VDC Reset Input	36
0-20 or 4-20 mA Reset Input.....	36
SECTION 4 - TECHNICAL DATA	43
Compressor Unit Dimensions.....	52
Dimensions Of Evaporator Nozzle Arrangements.....	53
Dimensions Of Condenser Nozzle Arrangements.....	54
SECTION 5 - COMMISSIONING	57

TABLE OF CONTENTS (CONT'D)

Preparation	57
Refrigerant Charge	57
Service and Oil Line Valves	57
Compressor Oil	57
First Time Start-up	57
SECTION 6 - OPERATION	63
Operating Controls	63
Unit Switch	63
Keypad	63
Keypad Data Entry Mode	64
Display	64
Basic Operating Sequence	64
Start Sequence and Loading	64
Anti-Recycle Timer	64
Evaporator And Condenser Pump Control	64
Alarms	65
Chiller Run Contact	65
Pull-down Current Limit Setpoint	66
Leaving Chilled Liquid Temperature (LCHLT) Reset Control	66
Optional Heat Pump Mode Selection	67
Optional Heat Pump Leaving Condenser Liquid Temperature (LCLT) Reset Control	67
Current Limit Reset Control	67
User Interface	68
Status Key	69
General Unit and System Status Messages	69
Load or Unloading Limit Messages	70
Fault Messages	71
Unit Warnings	71
Low Battery	71
Unit Safeties (Faults)	72
Vsd Fault Data	72
First Fault Code	72
All Fault Bits	72
Fault Data	72
System Safeties	75
Multiple Systems	75
Unit Data Key	80
System Data Keys (1-4)	81
System 1 Data Key Operation	81
System 2 Data Key Operation	82
Sensor Displays	82
VSD Data and Operating Hours/Start Counter Keys	83
Operating Hours/Start Counter Key	83
History Key	84
Setpoints Key	86
Program Key	88
Default Values	88
Options Key	90

TABLE OF CONTENTS (CONT'D)

Date/Time and Schedule Keys	92
Schedule Key Operation	92
Manual Override and Print Keys	94
History Data Printout	97
System Switches and Service Keys	98
Service Key	98
BAS Communications	99
YORKtalk 2 Communications	99
SECTION 7 - MAINTENANCE	105
General Requirements	105
Daily Operating Inspections	106
Compressor Oil	106
Check Operational Oil Level	106
Oil Level	106
Start-Up	106
Operation	107
Oil Analysis	107
Removing the Compressor Oil	107
Adding Compressor Oil	108
Oil Filter	108
Oil Filter Replacement	109
Replacing The Filter Drier	110
Determining Correct Refrigerant Charge Level	111
Refrigerant Charging	111
Handling Refrigerant For Dismantling and Repairs	111
Checking System For Leaks	112
Refrigerant Leak Checking	112
Pressure Connections	112
Testing For Evaporator and Condenser Tube Leaks	113
Evacuation and Dehydration of Unit	114
Condensers and evaporators	116
General	116
Chemical Water Treatment	116
Cleaning Evaporator And Condenser Tubes	116
Condenser Tubes	116
Tube Fouling	116
Non-condensable Gas	117
Evaporator Tubes	117
Maintaining Compressor	118
Electrical Controls	118
SECTION 8 - TROUBLESHOOTING	119
Troubleshooting Guide	119
Abnormal Operation, Analysis and Correction	119
Troubleshooting the Rotary Screw Compressor and Oil Separation System	119
SECTION 9 - DECOMMISSIONING, DISMANTLING, AND DISPOSAL	123
Temperature	125

LIST OF FIGURES

FIGURE 1 - Emergency Shutdown Handle	13
FIGURE 2 - YVWA Chiller Major Components (Front View)	16
FIGURE 3 - YVWA Chiller Major Components (Rear View)	17
FIGURE 4 - Chiller Control System	18
FIGURE 5 - Control Center User Interface	20
FIGURE 6 - Unit Rigging	25
FIGURE 7 - Standard Neoprene Vibration Isolator Pad Mounts - Dimensions in Inches (mm)	26
FIGURE 8 - Optional Spring Isolators - Dimensions in Inches (mm)	27
FIGURE 9 - Schematic of a Typical Piping Arrangement	30
FIGURE 10 - Leaving Water Temperature Out of Range Suggested Layout.	31
FIGURE 11 - Victaulic Groove	31
FIGURE 12 - Flange Attachment	31
FIGURE 13 - Typical Components of Relief Piping	32
FIGURE 14 - Power Connections	39
FIGURE 15 - Compressor Unit Dimensions	52
FIGURE 16 - Evaporators - Compact Water Boxes (2-Pass)	53
FIGURE 17 - Evaporators - Compact Water Boxes (3-Pass)	53
FIGURE 18 - Condensers - Compact Water Boxes (1-Pass)	54
FIGURE 19 - Condensers - Compact Water Boxes (2-Pass)	54
FIGURE 20 - Condensers - Compact Water Boxes (3-Pass)	54
FIGURE 21 - Keypad and Display	63
FIGURE 22 - Control Operation	65
FIGURE 23 - Status Data Key on Control Panel	69
FIGURE 24 - Unit Data Key	80
FIGURE 25 - System Data Keys (1-4)	81
FIGURE 26 - VSD Data and Operating Hours/Start Counter Keys	83
FIGURE 27 - History Key	84
FIGURE 28 - Setpoints Key	86
FIGURE 29 - Setpoint High and Low Limits Defined By Control Range (CR)	87
FIGURE 30 - Program Key	88
FIGURE 31 - Options Key	90
FIGURE 32 - Date/Time and Schedule Key	92
FIGURE 33 - Manual Override and Print Key	94
FIGURE 34 - Printer Cable Connection From YVWA Chiller To A Computer	94
FIGURE 35 - Printer Cable Connection From YVWA Chiller To A Serial Printer	95
FIGURE 36 - Sample Printout	96
FIGURE 37 - System Switches and Service Key	98
FIGURE 38 - E-Link Gateway Option	99
FIGURE 39 - Charging Oil	108
FIGURE 40 - Oil Filter Assembly	109
FIGURE 41 - Oil Eductor Assembly	110
FIGURE 42 - Motor Windings Diagram	111
FIGURE 43 - Saturation Curve	115

LIST OF TABLES

TABLE 1 - Approximate Unit Weight	24
TABLE 2 - Service Clearance Requirements	25
TABLE 3 - Water Volume for Applications.....	31
TABLE 4 - Refrigerant Relief Characteristics (Per Valve)	33
TABLE 5 - System Input Connections.....	35
TABLE 6 - Lug Data (UL/ASME/CE).....	40
TABLE 7 - Lug Data - GB.....	41
TABLE 8 - Voltage Variations	41
TABLE 9 - Complete Pin Number Description	43
TABLE 10 - Evaporator nozzle dimensions - in(mm)	53
TABLE 11 - Condenser Nozzle Dimensions - in (mm)	54
TABLE 12 - Water Flow Rate Limits (GPM/L/S) (Based On Standard Tubes At Design Full Load Conditions).....	55
TABLE 13 - Load Limiting Values	66
TABLE 14 - Unit Warnings	71
TABLE 15 - Unit Safeties (Faults).....	73
TABLE 16 - System Safeties (Faults)	75
TABLE 17 - Timer Settings.....	77
TABLE 18 - Sensor Minimum/Maximum Outputs	82
TABLE 19 - Setpoint Values.....	87
TABLE 20 - Programmable Operating Parameters.....	89
TABLE 21 - Printout Types.....	95
TABLE 22 - Real Time Number Errors.....	100
TABLE 23 - YVWA Communications Data Map	101
TABLE 24 - Operation/Inspection /Maintenance Requirements For YVWA Chillers.....	105
TABLE 25 - Compressor Oil Limits	107
TABLE 26 - System Pressures	114
TABLE 27 - Troubleshooting guide	119
TABLE 28 - Metric Conversion.....	125

SECTION 1 - GENERAL CHILLER INFORMATION AND SAFETY

INTRODUCTION

YORK YVWA 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 Johnson Controls which reserves all rights. This manual may not be reproduced, in whole or in part, without prior written authorization from an authorized Johnson Controls 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 will not be 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

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

Johnson Controls 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 Johnson Controls. 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 Johnson Controls Field Service Center.
- Only genuine YORK 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 European 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))

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, 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 should 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 of gloves and safety glasses is recommended when working on the unit. The build-up 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.

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 device(s). 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 in *Figure 1 on page 13*, which can be used as the emergency stop the device. When operated, it removes the electrical supply to the inverter, fans, and control circuit, thus shutting down the unit.



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FIGURE 1 - EMERGENCY SHUTDOWN HANDLE

Safety Labels



White symbol on blue background.
For safe operation, read the instructions first.



Black symbol on yellow background.
Warning: This machine may start automatically without prior warning



Black symbol on yellow background.
Warning: Hot surface.



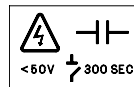
Black symbol on yellow background.
Warning: Safety relief valve may discharge gas or liquid without prior warning.



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



Black symbol on yellow background.
General attention symbol.



Black symbol on yellow background.
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

YORK YVWA 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.

Prior to delivery, the unit is:

- Pressure tested,
- Evacuated, and
- Fully charged with refrigerant and oil in each independent refrigerant circuit.

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

The YVWA 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 build-up on start-up also reduces required off time between starts to two minutes.

COMPONENTS

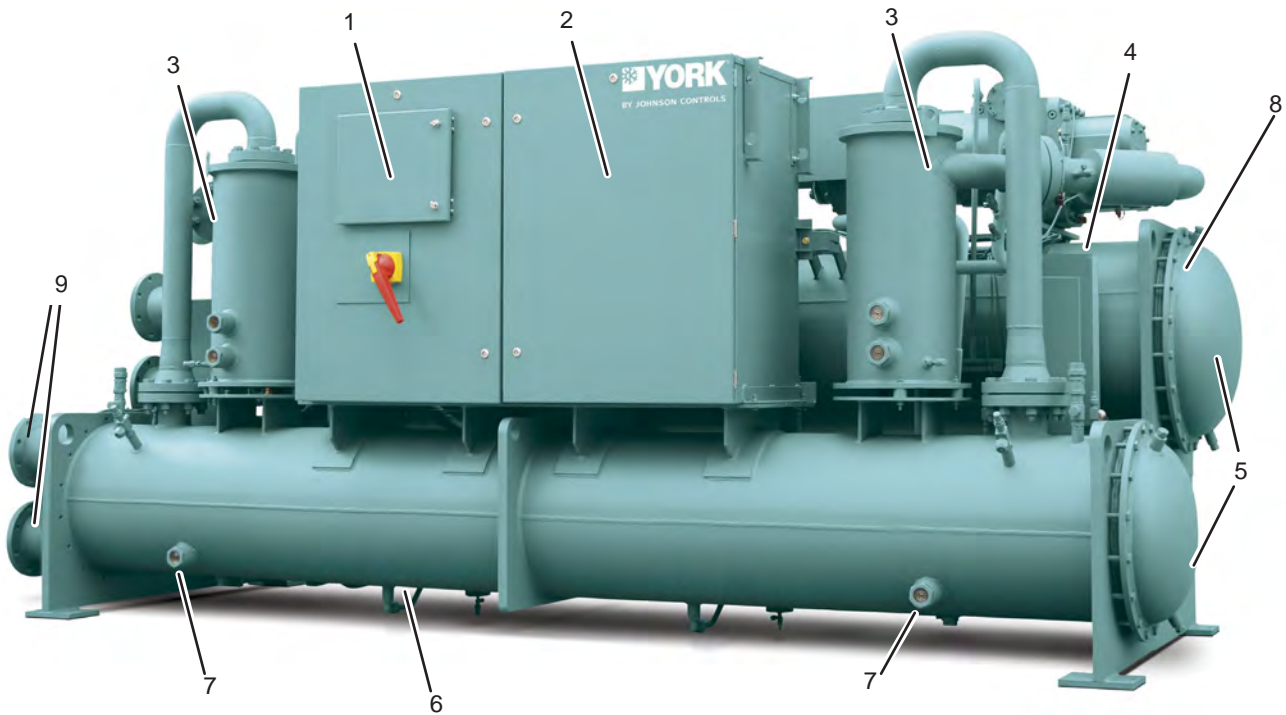
The YVWA chiller, as shown in *Figure 2 on page 16*, consists of:

- Two screw compressors with mufflers
- A hybrid falling film evaporator
- A water-cooled condenser
- Two economizer heat exchangers
- Two oil separators
- VSD with control panel

Oil separators utilize no moving parts, and are rated for 388 psig (2.68 MPa) design pressure. Oil cooling is accomplished by refrigerant leaving the eductor 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, select compressors to run, and select compressor speed. Power factor is 95% at part or full load.

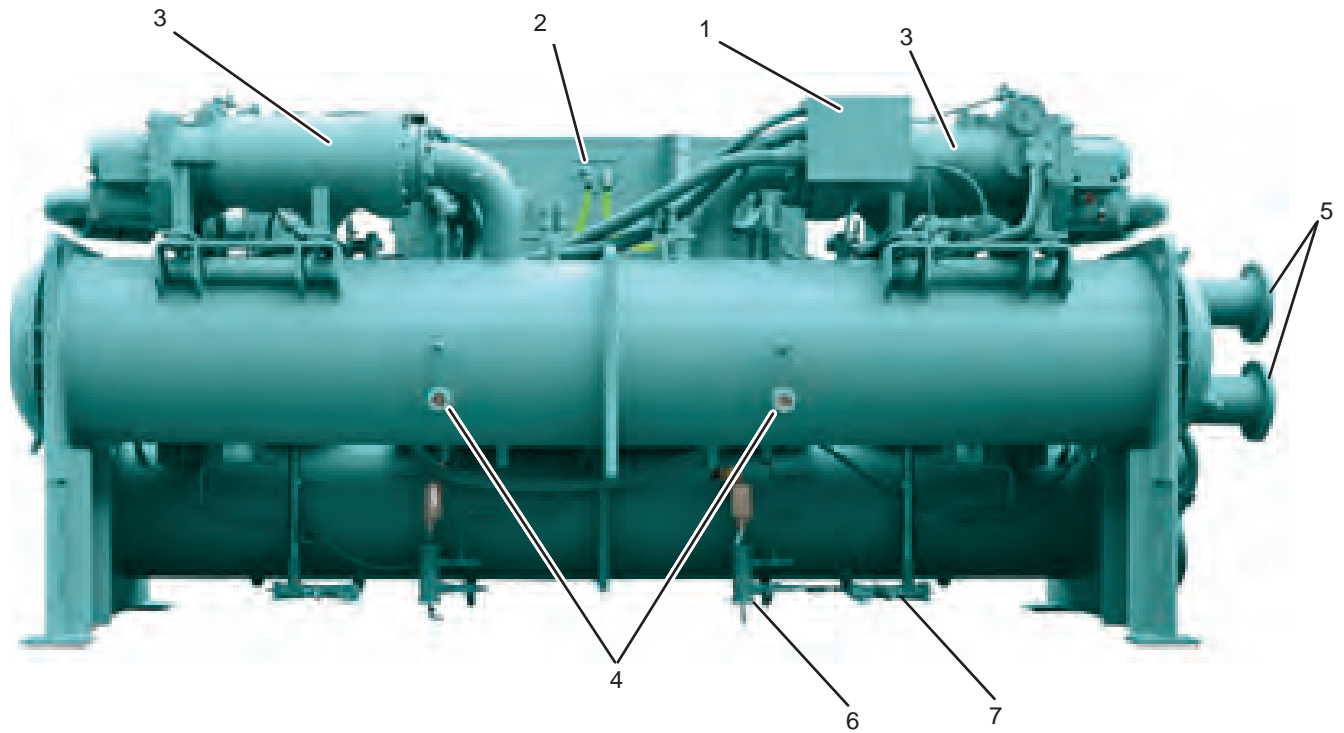
The chiller microprocessor communicates with the VSD logic board via a 3-wire RS-485 opto-coupled data link. The VSD logic board runs one or both compressors to the speed requested by the chiller microprocessor to meet the load as shown in *Figure 4 on page 18*.



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- | | |
|-------------------------------|--------------------------|
| 1. Control Panel | 6. Condenser |
| 2. Variable Speed Drive (VSD) | 7. Condenser Sight Glass |
| 3. Oil Separator | 8. Evaporator |
| 4. Economizer Heat Exchanger | 9. Condenser Nozzle |
| 5. Water Box | |

FIGURE 2 - YVWA CHILLER MAJOR COMPONENTS (FRONT VIEW)



- 1. Terminal Box
- 2. Coolant Piping
- 3. Compressor
- 4. Evaporator Sight Glass

- 5. Evaporator Nozzle
- 6. Liquid Level Sensor
- 7. Liquid Line

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FIGURE 3 - YVWA CHILLER MAJOR COMPONENTS (REAR VIEW)

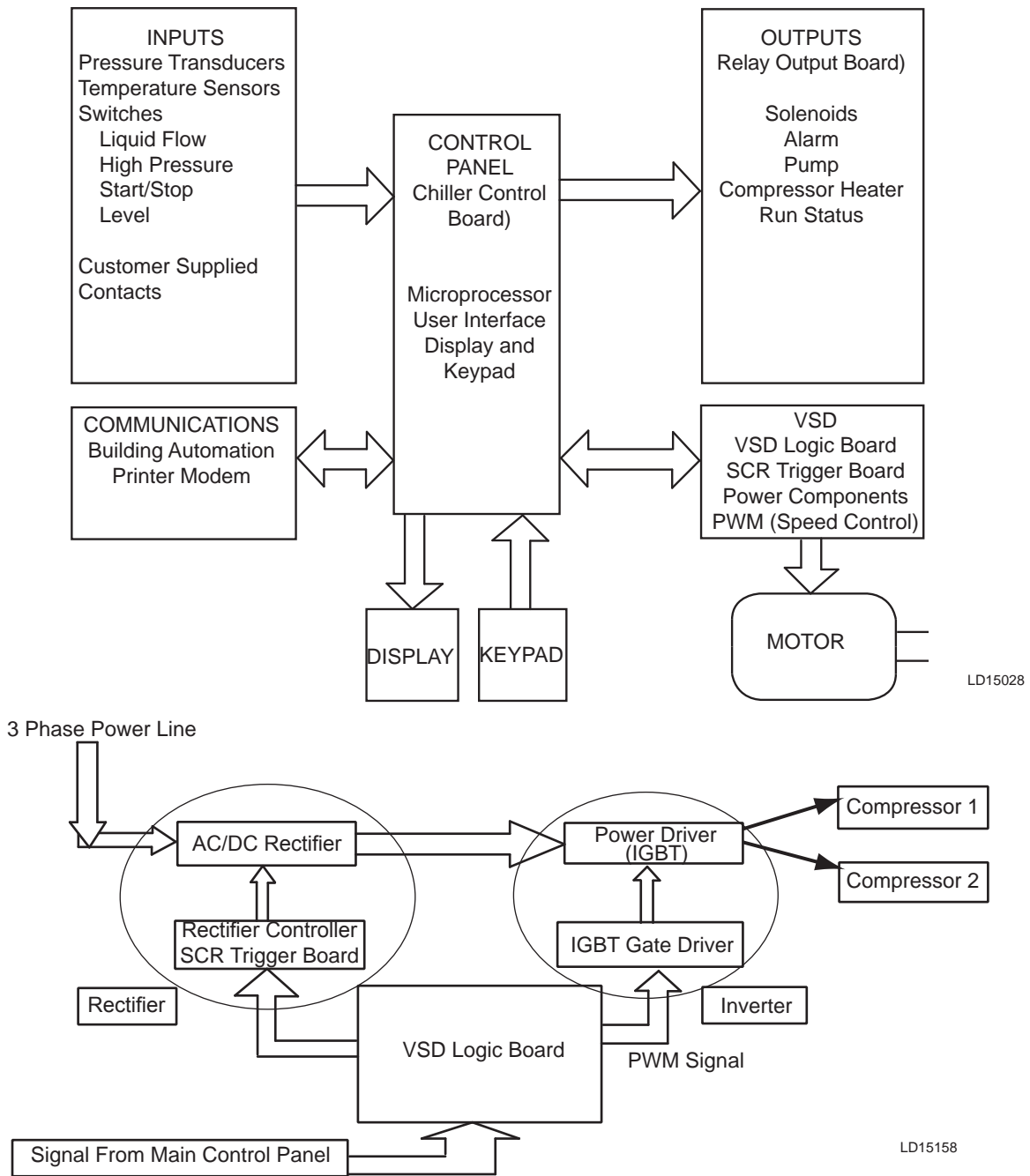


FIGURE 4 - CHILLER CONTROL SYSTEM

The basic system control and VSD system architecture.

COMPRESSORS

The two compressors are direct drive, semi-hermetic type, and have rotary twin screws as shown in *SECTION 3 - HANDLING, STORAGE, AND INSTALLATION*, which include:

- Muffler
- Temperature actuated, off-cycle heater
- IP55 terminal board
- Precision machined cast iron housing
- Gas-cooled, high efficiency, accessible hermetic compressor motor
- Full suction gas flow through mesh screen filter with inherent internal thermal overload protection and external current overload

EVAPORATOR

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

CONDENSER

The condenser is a shell and tube type, equipped with:

- **Discharge gas baffle** used to deflect the refrigerant gas from the tubes, and distribute the refrigerant gas flow properly.
- **Integral subcoolers**, located at the bottom of the condenser shell, provide highly effective liquid refrigerant subcooling to provide the highest cycle efficiency.
- **Dual refrigerant relief valves** set at 388 psig (26.8 kPa).
- **Removable steel waterboxes that:**
 - Have design working pressure of 150 psig (10.3 kPa).
 - Are tested at 225 psig (15.5 kPa).
 - Contain welded steel water baffles.
 - Have welded stub-out water nozzle connections with ANSI/AWWA C-606 grooves, and are capped for shipment.

- Have plugged 3/4 in (19 mm) drain and vent connections provided in each waterbox.

REFRIGERANT CIRCUIT

An independent refrigerant circuit is provided for each compressor. Each circuit uses copper refrigerant pipe formed on computer-controlled bending machines to reduce the number of brazed joints.

In addition, the refrigerant circuit has:

- Two external oil separators, with no moving parts, and designed for minimum oil carryover, are mounted in the discharge line of the compressor.
- An economizer heat exchanger is located in each refrigerant circuit to improve refrigeration effect in the evaporator for increased chiller efficiency.

ELECTRICAL

Incoming single point power is standard, utilizing:

- Lockable circuit breaker, terminal block, or non-fused disconnect
- 115VAC control transformer
- VSD with control panel

Standard design includes powder painted steel cabinet with hinged, latched, and gasket sealed outer doors, equipped with wind struts for safer servicing. The panel includes a control display that can be accessed without opening the main cabinet doors.

All exposed wiring is routed through a liquid-tight, UV stabilized, non-metallic conduit.

BUILDING AUTOMATION SYSTEM (BAS) CAPABILITIES

The E-Link Gateway provides an economical and versatile connection between chiller equipment and open/standard protocols.

This gateway:

- Efficiently manages the communication protocols currently used by YORK equipment, exposing the data in a consistent, organized, and defined fashion.
- Is available as a factory-installed option. A simple switch selection allows configuration of the required equipment profile and output protocol, which reduces equipment connectivity start-up time.

MICROCOMPUTER CONTROL CENTER

The microcomputer control center, located on the VSD panel door as 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 – Double thick (1-1/2 in (28 mm) insulation on the evaporator is used for glycol cooling.

Controls Options

BAS Temperature Reset is a factory-installed option to accept a 4-20mA or a 0-10VDC 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 4-20mA or a 0-10VDC input. This option allows remote reset of the load limit setpoint, which can limit system demand from 30-100%, 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 inch 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 3-45 psig (0.2-3 kPa) range switch, with 1/4 inch NPTE pressure connections, is an alternative to the paddle-type flow switch. **(Field mounted)**

Relief Valves

The following types of relief valves are used to quickly relieve excess pressure of the refrigerant charge to the atmosphere:

- **Chicago Code Relief Valve** – Special relief valves per Chicago code.
- **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 – Recommended 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.

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SECTION 3 - HANDLING, STORAGE, AND INSTALLATION

DELIVERY 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 complete)
- Form 2 (shipped complete without refrigerant charge)
- Form 7 (shipped in split assemblies without refrigerant, which can be ordered as a special order)

Forms 1 and 2

A YVWA chiller shipped as Form 1 includes the refrigerant charge. Refrigerant charge is shipped separately for Form 2 YVWA chillers. Miscellaneous loose items are shipped with both forms.

Form 2

Make arrangements with the Johnson Controls Field Service Office to make sure refrigerant is on-site when unit is ready to be charged.

Chiller Unit

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 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.

Form 7 (Special Order)

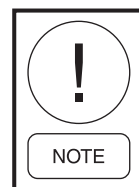
The chiller is shipped in split assemblies without the refrigerant charge, and can be specially ordered.

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 prior to installation:

- The chiller must be blocked under 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, the requirements from *Long-Term Storage Periodic Checklist and Logs for YR, YS, and YVWA Screw Chillers (Form 50.20-NM9)* must be followed.
- Inspect the unit periodically during storage.
- To prevent inadvertent operation of the pressure relief devices, the unit must not be steam cleaned.

INSPECTION, DAMAGE, AND SHORTAGE

The unit shipment should be checked on arrival to see that all major pieces, boxes and crates are received. Each unit should be checked on the trailer or rail car when received, before unloading, for any visible signs of damage. Any damage or signs of possible damage must be reported to the transportation company immediately for their inspection.



JOHNSON CONTROLS WILL NOT BE RESPONSIBLE FOR ANY DAMAGE OR LOSS OF PARTS IN SHIPMENT OR AT JOB SITE. Refer to Shipping Damage Claims Form (Form 50.15-NM).

LIFTING WEIGHTS

For detailed unit weights and weight distribution, refer to the data shipped in the chiller information packet and unit nameplate.

TABLE 1 - APPROXIMATE UNIT WEIGHT

COMPRESSORS	SHELLS	SHIPPING WEIGHT RANGE MIN - MAX		OPERATING WEIGHT RANGE MIN - MAX		REFRIGERANT CHARGE RANGE MIN - MAX		LOADING PER ISOLATOR MIN - MAX	
		(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)
EE	M-M	10,541 - 11,693	4,782 - 5,304	11,497 - 12,950	5,215 - 5,874	573 - 595	260 - 270	2,875 - 3,279	1,304 - 1,469
	N-N	12,180 - 12,450	5,525 - 5,647	13,251 - 13,880	6,011 - 6,296	617 - 639	280 - 290	3,314 - 3,370	1,503 - 1,574
FE	M-M	10,610 - 11,762	4,813 - 5,335	11,566 - 13,019	5,246 - 5,905	584 - 606	265 - 275	2,892 - 3,254	1,312 - 1,476
	N-N	12,248 - 12,519	5,556 - 5,678	13,319 - 13,948	6,042 - 6,327	628 - 650	285 - 295	3,329 - 3,428	1,510 - 1,582
FF	M-M	10,678 - 11,830	4,844 - 5,366	11,634 - 13,087	5,277 - 5,396	595 - 617	270 - 280	2,908 - 3,272	1,319 - 1,484
	N-N	12,317 - 12,587	5,587 - 5,709	13,388 - 14,017	6,073 - 6,358	639 - 661	290 - 300	3,347 - 3,503	1,518 - 1,589

NOTE: Weights are shown for base unit; selected options tube count variations, and/or quantity of refrigerant charge may add weight to unit.

MOVING THE CHILLER

Prior to 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 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.



Lift the unit by the end sheets ONLY at the points provided. Never lift the unit using a forklift truck.

Each unit has four lifting holes (two on each end) in the end sheets, 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 provided.

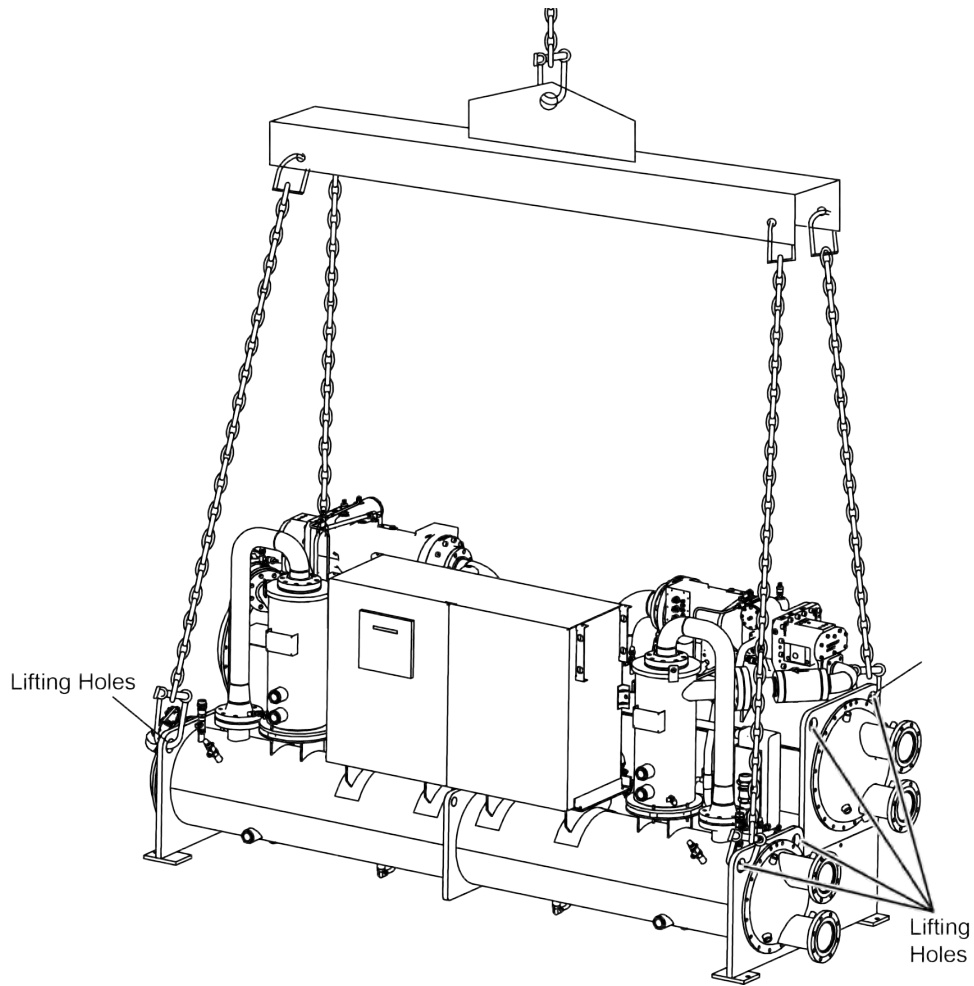
If necessary to rig a unit by one end to permit lifting or dropping through a vertical passageway, such as an elevator shaft, the unit must be special ordered.



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

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.



LD16424

FIGURE 6 - UNIT RIGGING

LOCATION

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

FOUNDATION

A level floor, mounting pad, or foundation 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:

- Rear, ends, and top of unit – 2 ft (610 mm)
- Front of unit – 3 ft (914 mm)
- Tube removal (See *Table 2 on page 25* for clearance)

TABLE 2 - SERVICE CLEARANCE REQUIREMENTS

SHELL CODE	TUBE REMOVAL SPACE		ADD MARINE WATER BOXES	
	ft-in	mm	ft-in	mm
M	12-1	3683	2-2	660
N	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.

LOCATING AND INSTALLING NEOPRENE VIBRATION ISOLATOR PADS

Locate the neoprene vibration isolator pads as shown in *Figure 7 on page 26*. 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, remove the rigging equipment, and check that the chiller is level, longitudinally and transversely.

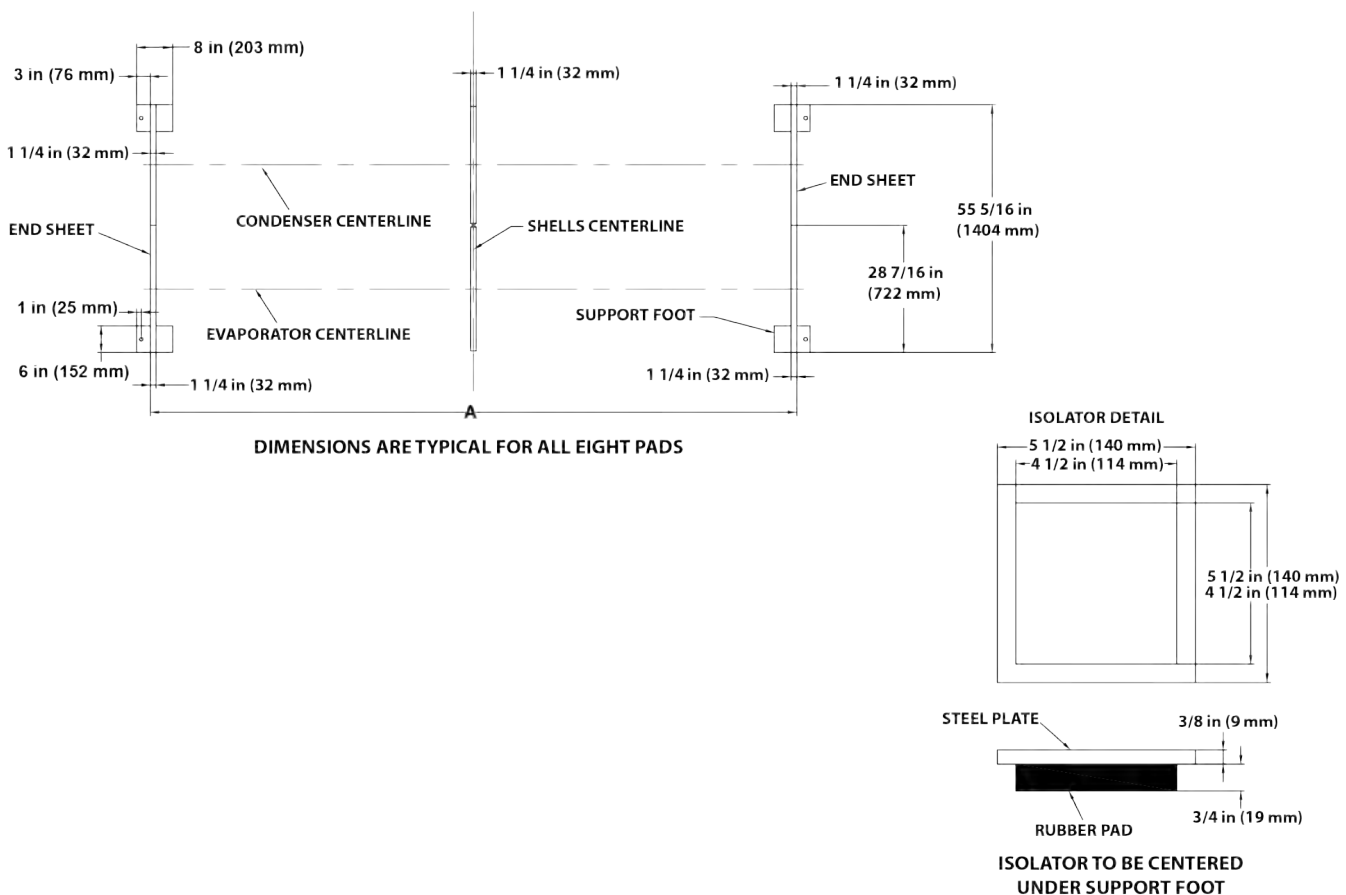
Check the Unit Alignment

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.

Check 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, shims should be placed between the unit end sheet and the top of the pad to equally deflect all pads.



LD16425

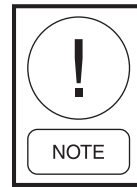
FIGURE 7 - STANDARD NEOPRENE VIBRATION ISOLATOR PAD MOUNTS - DIMENSIONS IN INCHES (MM)

INSTALLING OPTIONAL SPRING ISOLATORS

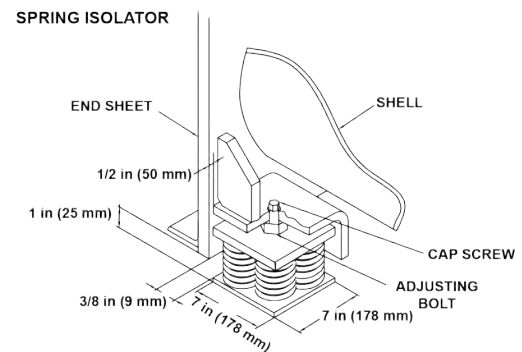
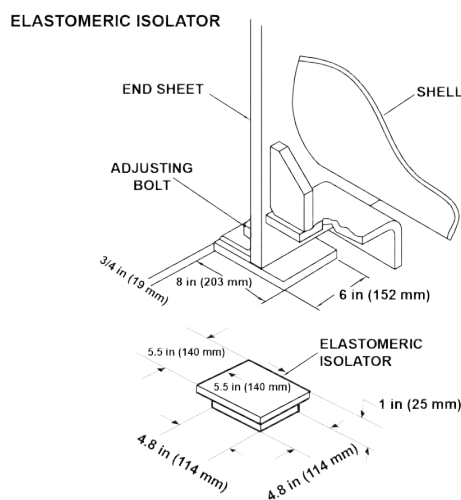
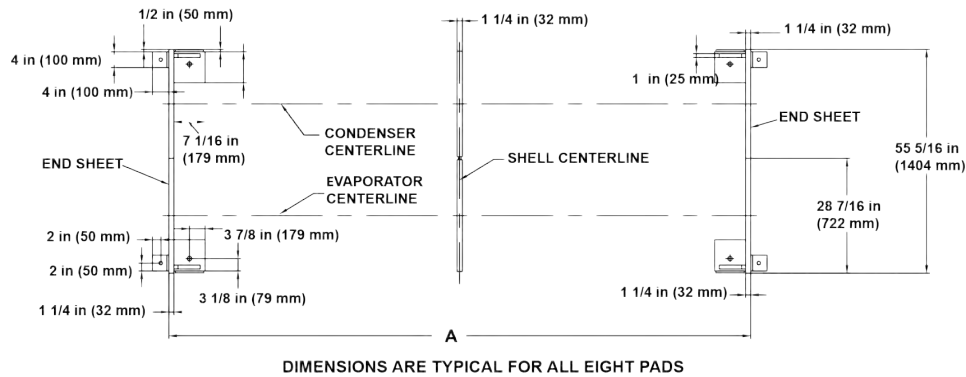
If ordered, four identical spring type isolator assemblies are furnished with the unit as shown in *Figure 8 on page 27*. Use the following instructions to install the optional isolators:

1. While the unit is suspended by the rigging, bolt the isolators to the unit by inserting the cap screw(s) through the hole(s) in the mounting bracket into the tapped hole in the top of the isolator leveling bolt(s). 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) beneath 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.
 - Connections are checked for alignment.
5. Fill the unit with water and check for leaks.
6. Adjust the leveling bolts and the 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.



Spring isolators are used in ASME applications; elastomeric isolators are available. Refer to Figure 8 on page 27.



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FIGURE 8 - OPTIONAL SPRING ISOLATORS - DIMENSIONS IN INCHES (MM)

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.

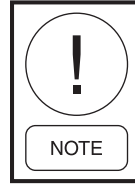
CONDENSER AND CHILLED LIQUID PIPING

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 cooler must not be exceeded at any time. The liquid must enter the water box 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.

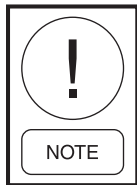
A straight run of piping of at least five pipe diameters is recommended on either side of the flow switch. The chilled liquid flow switch should be wired to Terminals 2 and 13 on the 1TB Terminal Block, and is required to prevent damage to the cooler caused by the unit operating without adequate liquid 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 Johnson Controls 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 system(s) should discharge directly into the unit. The pump(s) 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.

Piping 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 cooler 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 prior to 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. YVWA 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. YVWA 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 water box insulation is applied, tighten and torque the nuts on the liquid head flanges (to maintain between 30-60 ft-lb (41-81 Nm)). 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 have to 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

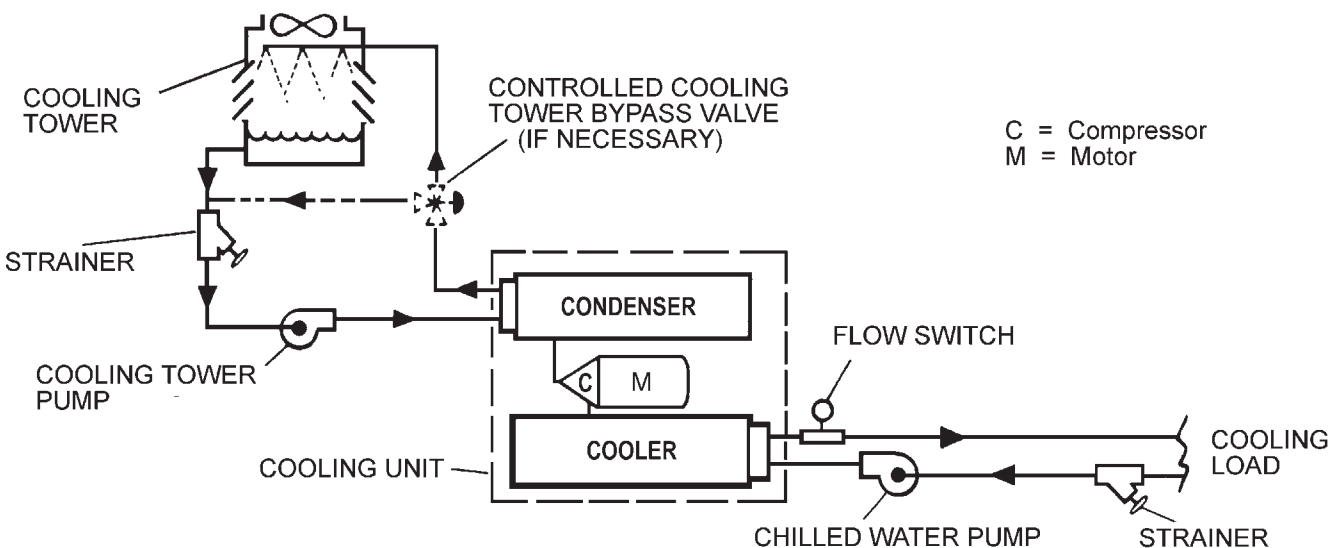
The unit performance provided in the design guide is based on a fouling factor that is AHRI-specified. Dirt, scale, grease and certain types of water treatment will adversely affect the heat exchanger surfaces, and therefore the unit's performance.

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

Aerated, brackish, or salt water is not recommended for use in the water system(s). Johnson Controls recommends that a water treatment specialist should be consulted to determine whether 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 9 on page 30* is a suggested piping arrangement for single unit installations. For multiple unit installations, each unit could be piped as shown below.



LD07069

FIGURE 9 - SCHEMATIC OF A TYPICAL PIPING ARRANGEMENT

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 3 - WATER VOLUME FOR APPLICATIONS

APPLICATION	GALLON/TON RATIO
Air Conditioning	5-8 (minimum of 3)
Process	7-11 (minimum of 6)

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

LEAVING WATER TEMPERATURE OUT OF RANGE

The YVWA 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 desired temperature as shown in *Figure 10 on page 31*. A tank can also be used to meet high leaving liquid temperature requirements.

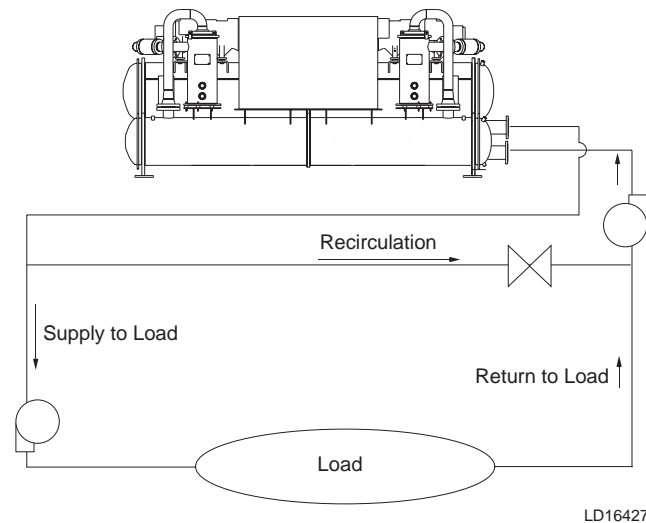


FIGURE 10 - LEAVING WATER TEMPERATURE OUT OF RANGE SUGGESTED LAYOUT.

VARIABLE PRIMARY FLOW

Johnson Controls recommends a maximum 10% per minute flow rate of change, based on design flow, for variable primary flow applications. Provide 8-10 gallons per chiller ton (8.6-10.8 liter 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 Johnson Controls Sales Office for more information about successfully applying YVWA chillers.

NOZZLE CONNECTIONS

Standard chilled liquid connections on all coolers and condensers are the victaulic groove type as shown in *Figure 11 on page 31*.

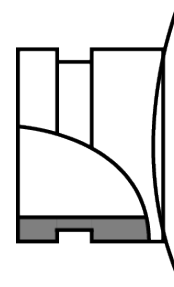


FIGURE 11 - VICTAULIC GROOVE

OPTIONS FOR FLANGES

Two types of flanges may be fitted, depending on the customer or local pressure vessel code requirements as shown in *Figure 12 on page 31*:

- Victaulic adapters are supplied loose.
- Weld flanges are supplied loose or ready-fitted.

The flange dimensions are to ISO 7005 - NP10.

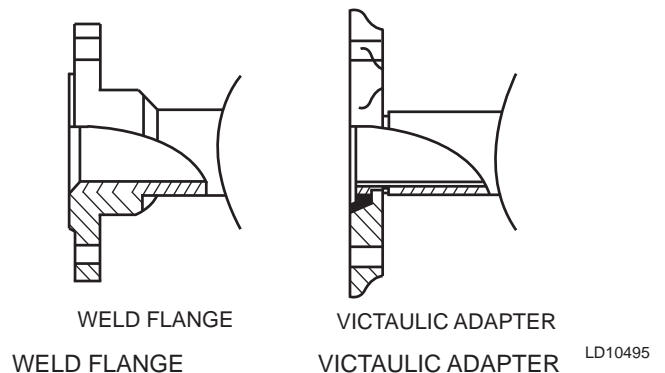


FIGURE 12 - FLANGE ATTACHMENT

REFRIGERANT RELIEF PIPING

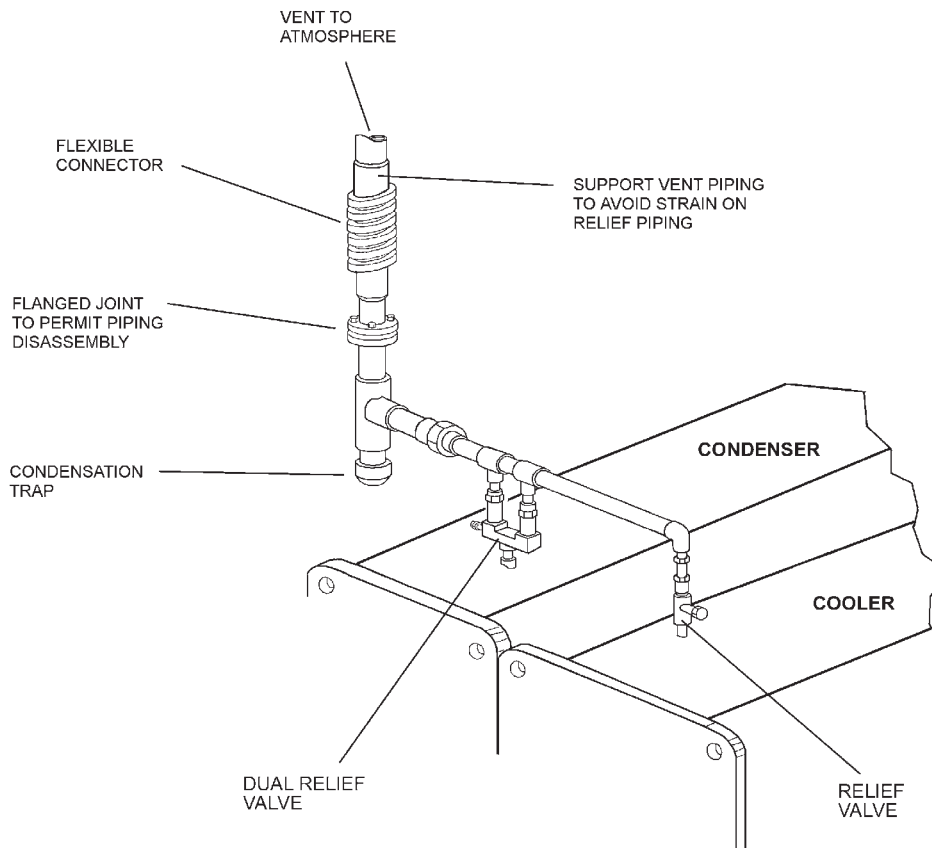
In case of an emergency, each unit is equipped with a relief valve on the evaporator, condenser and oil separator discharge line to quickly relieve excess pressure of the refrigerant charge to the atmosphere. The relief valves are furnished in accordance with the American Society of Heating, Refrigeration and Air Conditioning Engineers Standard 15 (ASHRAE 15) in North America, or PED code in Europe. Valve specifications are shown in *Table 4 on page 33*.

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 13 on page 32*. For additional information on relief valve discharge line sizing, refer to ASHRAE 15 Addendum 15C and 15D-2000, Section 9.7.8.5.



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

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.



LD16470

FIGURE 13 - TYPICAL COMPONENTS OF RELIEF PIPING

TABLE 4 - REFRIGERANT RELIEF CHARACTERISTICS (PER VALVE)

EVAPORATOR				
SHELL CODE	PIN 50/VESSEL CODE	PRESSURE	LBS AIR PER MIN	OUTLET SIZE
M, N	G = GB	1.55 MPa	42.8	1 1/4 in-12 UNF-2B
M, N	E = PED, A = ASME	235 PSIG	39.6	3/4 in NPTF
CONDENSER				
SHELL CODE	PIN 50/VESSEL CODE	PRESSURE	LBS AIR PER MIN	OUTLET SIZE
M, N	G = GB	2.65 MPa	71.6	1 1/4 in-12 UNF-2B
M, N	E = PED, A = ASME	388 PSIG	69.4	3/4 in NPTF
DISCHARGE				
SHELL CODE	PIN 50/VESSEL CODE	PRESSURE	LBS AIR PER MIN	OUTLET SIZE
M, N	G = GB	2.65 MPa	71.6	1 1/4 in-12 UNF-2B
M, N	E = PED without Refrigerant Isolation	388 PSIG	59.4	3/4 in NPTF
M, N	A = ASME, E PED with Refrigerant Isolation	388 PSIG	90.3	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. ASHRAE 15-1994 Section 9.8 and Appendix F describe relief requirements for positive displacement compressors, which means the unit must be equipped with a relief device suitable for relieving the entire compressor capacity.
3. For PED with refrigerant isolation option selected, three sets of valves (single or dual) are used to meet flow requirements for the discharge relief.

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 Johnson Controls 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.



No additional controls (relays, etc.) should be mounted 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 Johnson Controls).

POWER SUPPLY WIRING

Units require one 3-phase supply, plus earth. Connect:

- The 3-phase supplies to the circuit breaker located in the panel.
- A suitably sized earth wire to the PE terminal in the panel.

115VAC CONTROL SUPPLY TRANSFORMER

A 3-wire high voltage to 115VAC supply transformer is standard in the chiller. This transformer is mounted in the cabinet and steps down the high voltage supply to 115VAC to be used by the controls, VSD, feed and drain valve controller, valves, solenoids, heaters, etc.

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



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

CONTROL WIRING

All control wiring utilizing contact closures to the control panel terminal block is nominal 115VAC 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 115VAC 10 mA (gold contacts recommended). 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. 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

Each 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 (Sys 1), Terminals 27 and 28 (Sys 2) of 1TB.

SYSTEM INPUTS

The circuitry for the following system inputs is a 115VAC circuit. Contacts must be gold and rated for low current (5mA). Connect the switches per instructions below. Refer to *Table 5 on page 35* 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 for each system, and requires a dry contact to start and stop each system. System 1 remote dry contacts are connected between Terminals 2 and 15 of 1TB, and System 2 dry contacts are connected between Terminals 2 and 16 of 1TB. If remote run permissive is not utilized, 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 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 is enabled. If the option is enabled and remote mode selection is desired, connect a switch across Terminals 40 and 41 of 1TB to switch between chiller and heat pump operation remotely.

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

TABLE 5 - SYSTEM INPUT CONNECTIONS

INPUT	1TB TERMINALS
Chilled Liquid Flow Switch	2 and 13
Condenser Liquid Flow Switch	2 and 12
Remote Run Permissive	System 1: 2 and 15
Remote Run Permissive	System 2: 2 and 16
Remote Print	2 and 14
Remote Heat Pump Mode	40 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 20mA 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 (0-20 mA or 4-20 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 or 2 VDC, 0 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.

0-10 or 2-10 VDC Reset Input

A 0 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 0–10 or 2-10 VDC input (OPTIONS key) and control board JUMPER JP4 placed in the *V* position.

0–20 or 4-20 mA Reset Input

A 0 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 0–20 mA or 4-20 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 Reset 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 (0-10VDC or 2-10VDC) or a current (0-20mA or 4-20mA) 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 or 2 VDC, 0 or 4 mA, based on the OPTIONS key) causes the current limit to revert back to its maximum value.

0-10 or 2-10 VDC Reset Input

A 0 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. In order for this input to work properly, the Remote Temperature Reset must be programmed for 0–10 or 2-10 VDC input (OPTIONS key) and control board JUMPER JP5 placed in the *V* position.

0–20 or 4-20 mA Reset Input


A 0 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 0–20 mA or 4-20 input (OPTIONS) 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 201.30-CL1)* are completed satisfactorily, and before any attempt is made to start the unit, contact the Johnson Controls Field Service Office to schedule the start-up service.

NEW RELEASE

Form 201.30-CL1 (312)

 YORK BY JOHNSON CONTROLS		MODEL – YVWA
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INSTALLATION CHECKLIST AND REQUEST FOR AUTHORIZED START-UP TECHNICIAN

CUSTOMER: _____ JOB NAME: _____
 ADDRESS: _____ LOCATION: _____
 PHONE: _____ CUSTOMER ORDER NO: _____
 JCI TEL NO: _____ JCI ORDER NO: _____ JCI 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. YORK CHILLER

1. Unit checked for shipping damage

NOTE: Any damage MUST be reported to Johnson Controls 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 water box, using the plugged air vent, mounted on the top of the water box.

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 JCI 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

E. TESTING, EVACUATION AND CHARGING (Under Johnson Controls Supervision)

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

1. R-134a available for testing

2. Dry nitrogen available for testing

3. A high vacuum pump available to evacuate and dehydrate system

4. Refrigerant (supplied by Johnson Controls) is available for charging

5. Unit has been or is ready to be been pressure tested, evacuated, dehydrated, and charged

F. CONDITIONS

1. YORK 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 _____

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 Form 201.30-ICOM2, and when completed, acts as a request for Johnson Controls to furnish start-up supervision.

Complete this form as follows:

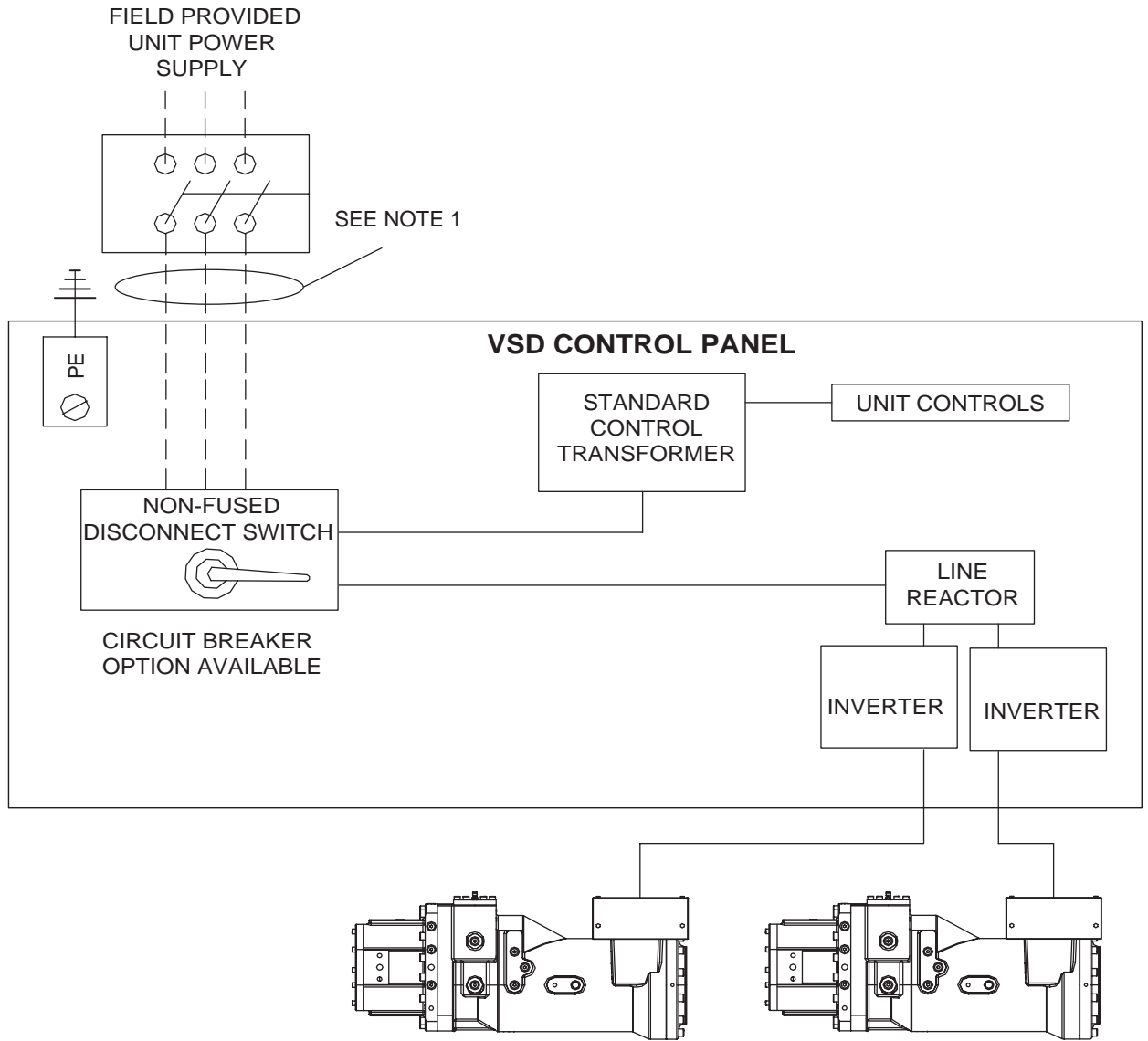
1. Fill out the top of the page.
2. Check off each item as required. Cross out (x) items that do not apply.
3. Enter names, initials, and date of the operating personnel who completed the checklist.
4. **Bottom of Form:** Enter the date that the Johnson Controls start-up technician should be at the job 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 JCI Authorized Representative at the job site on _____ / _____ / _____ to start the system and instruct operating personnel. Have the JCI representative contact: _____
Month Day Year Name/Phone

We understand that the services of the Johnson Controls 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 Johnson Controls if services are required for longer than _____ consecutive normal hours or if repeated calls are required, through no fault of Johnson Controls.

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

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



NOTES:

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

LD16428

FIGURE 14 - POWER CONNECTIONS

TABLE 6 - LUG DATA (UL/ASME/CE) - PIN 22/POWER FIELD

VSD DETAILS			TERMINAL BLOCK			CIRCUIT BREAKER			NON-FUSED DISCONNECT SWITCH		
VSD FRAME	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
A	200	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	230	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	380	60	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-400KCMIL	1	2	#2 AWG - 600kcmil
	380	50	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-400KCMIL	1	2	#2 AWG - 600kcmil
	400	50	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-400KCMIL	1	2	35-300 mm ²
	415	50	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-400KCMIL	1	2	#2 AWG - 600kcmil
	460	60	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-500KCMIL	1	2	#2 AWG - 600kcmil
	575	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B	200	60	1	4	#2 AWG - 600kcmil	1	4	#4/0AWG-500KCMIL	N/A	N/A	N/A
	230	60	1	4	#2 AWG - 600kcmil	1	4	#4/0AWG-500KCMIL	N/A	N/A	N/A
	380	60	1	2	#2 AWG - 600kcmil	1	2	#1/0AWG-500KCMIL	1	2	#2 AWG - 600kcmil
	380	50	1	2	#2 AWG - 600kcmil	1	2	#1/0AWG-500KCMIL	1	2	#2 AWG - 600kcmil
	400	50	1	2	#2 AWG - 600kcmil	1	2	#1/0AWG-500KCMIL	1	2	35-300 mm ²
	415	50	1	2	#2 AWG - 600kcmil	1	2	#1/0AWG-500KCMIL	1	2	#2 AWG - 600kcmil
	460	60	1	2	#2 AWG - 600kcmil	1	2	#1/0AWG-500KCMIL	1	2	#2 AWG - 600kcmil
	575	60	1	2	#2 AWG - 600kcmil	1	2	#1/0AWG-500KCMIL	1	2	#2 AWG - 600kcmil
C	200	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	230	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	380	60	1	3	#2 AWG - 600kcmil	1	3	#3/0AWG-400KCMIL	2	2	#2 AWG - 600kcmil
	380	50	1	3	#2 AWG - 600kcmil	1	3	#3/0AWG-400KCMIL	2	2	#2 AWG - 600kcmil
	400	50	1	3	#2 AWG - 600kcmil	1	3	#3/0AWG-400KCMIL	2	2	35-300 mm ²
	415	50	1	3	#2 AWG - 600kcmil	1	3	#3/0AWG-400KCMIL	2	2	#2 AWG - 600kcmil
	460	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	575	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 6 - LUG DATA (UL/ASME/CE) (CONT'D) - PIN 22/POWER FIELD

VSD DETAILS			TERMINAL BLOCK			CIRCUIT BREAKER			NON-FUSED DISCONNECT SWITCH		
VSD FRAME	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
D	200	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	230	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	380	60	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-400KCMIL	1	2	#2 AWG - 600kcmil
	380	50	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-400KCMIL	1	2	#2 AWG - 600kcmil
	400	50	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-400KCMIL	1	2	35-300 mm ²
	415	50	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-400KCMIL	1	2	#2 AWG - 600kcmil
	460	60	1	2	#2 AWG - 600kcmil	1	2	#2/0AWG-500KCMIL	1	2	#2 AWG - 600kcmil
	575	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3

TABLE 7 - LUG DATA - GB - PIN 22/POWER FIELD

VSD DETAILS			NON-FUSED DISCONNECT SWITCH		
VSD FRAME	INPUT VOLTS	INPUT FREQ.	LUG/ PHASE	WIRES PER LUG	LUG WIRE RANGE
A	380	50	1	2	1/0 AWG - 500kcmil
	400	50	1	2	1/0 AWG - 500kcmil
	415	50	1	2	1/0 AWG - 500kcmil
B	380	50	1	2	1/0 AWG - 500kcmil ²
	400	50	1	2	1/0 AWG - 500kcmil
	415	50	1	2	1/0 AWG - 500kcmil
C	380	50	1	2	1/0 AWG - 500kcmil ²
	400	50	1	2	1/0 AWG - 500kcmil
	415	50	1	2	1/0 AWG - 500kcmil
D	380	50	1	2	1/0 AWG - 500kcmil ²
	400	50	1	2	1/0 AWG - 500kcmil
	415	50	1	2	1/0 AWG - 500kcmil

TABLE 8 - VOLTAGE VARIATIONS

FREQ.	RATED VOLTAGE VAC	INPUT FREQ. Hz	OPERATING VOLTAGE VAC	
			MIN	MAX
60 Hz	380	60	342	402
	460	60	414	508
50 Hz	380	50	342	402
	400	50	360	440
	415	50	374	456

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SECTION 4 - TECHNICAL DATA

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
CONTRACT	Contract Number	NUM	Contract Number = {contract/num}
ORDER	Order Quantity	QTY	Order quantity = {ord/qty}
USA	USA Origin	N	USA origin not required
		Y	USA origin required
TLOC	Test Location	M	Test @ Monterrey factory
		S	Test @ San Antonio factory
		G	Test @ Grantley factory
		W	Test @ San Wuxi factory
		E	Test @ Sabadell factory
		N	Test @ Nantes factory
		A	Test @ alternate location
ASHRAE	ASHRAE 90.1 Compliance	Y	90.1 compliant as per YW
		N	Not 90.1 compliant as per YW
SYS1RLA	System 1 Rated Loaded Amps	A	System 1 YW RLA = {sys1rla/a}
SYS2RLA	System 2 Rated Loaded Amps	A	System 2 YW RLA = {sys2rla/a}
OPER WT	Operating Weight	LBS	Operating Weight = {lbs}
		KG	Operating Weight = {kg}
SHIP WT	Shipping Weight	LBS	Shipping Weight = {lbs}
		KG	Shipping Weight = {kg}
MODEL	Model (PIN 1)	Y	YORK
COMPRTYP	Compressor Type (PIN 2)	V	Variable Speed Screw
CHILLERTYP	Chiller Type (PIN 3)	W	Water-Cooled Chiller
DESIGNER	Design Series (PIN 4)	A	Design Series

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
EVAPTUBES Evaporator Tube Count (PIN 5, 6)		MB	12 ft (3.6 m) x 24 in (610 mm), 160 x 0.75 in (19 mm)
		MC	12 ft (3.6 m) x 24 in (610 mm), 200 x 0.75 in (19 mm)
		MD	12 ft (3.6 m) x 24 in (610 mm), 230 x 0.75 in (19 mm)
		ME	12 ft (3.6 m) x 24 in (610 mm), 260 x 0.75 in (19 mm)
		NB	14 ft (4.2 m) x 24 in (610 mm), 160 x 0.75 in (19 mm)
		NC	14 ft (4.2 m) x 24 in (610 mm), 200 x 0.75 in (19 mm)
		ND	14 ft (4.2 m) x 24 in (610 mm), 230 x 0.75 in (19 mm)
		NE	14 ft (4.2 m) x 24 in (610 mm), 260 x 1 in (25 mm)
		M2	12 ft (3.6 m) x 24 in (610 mm), 80 x 1 in (25 mm)
		M3	12 ft (3.6 m) x 24 in (610 mm), 95 x 1 in (25 mm)
		M4	12 ft (3.6 m) x 24 in (610 mm), 110 x 1 in (25 mm)
		M5	12 ft (3.6 m) x 24 in (610 mm), 129 x 1 in (25 mm)
		N2	14 ft (4.2 m) x 24 in (610 mm), 80 x 1 in (25 mm)
		N3	14 ft (4.2 m) x 24 in (610 mm), 95 x 1 in (25 mm)
		N4	14 ft (4.2 m) x 24 in (610 mm), 110 x 1 in (25 mm)
	N5	14 ft (4.2 m) x 24 in (610 mm), 129 x 1 in (25 mm)	
CONDTUBES Condenser Tube Count (PIN 7, 8)		MB	12 ft (3.6 m) x 20 in (508 mm), 162 x 0.75 in (19 mm)
		MC	12 ft (3.6 m) x 20 in (508 mm), 191 x 0.75 in (19 mm)
		MD	12 ft (3.6 m) x 20 in (508 mm), 211 x 0.75 in (19 mm)
		ME	12 ft (3.6 m) x 20 in (508 mm), 248 x 0.75 in (19 mm)
		NB	14 ft (4.2 m) x 20 in (508 mm), 162 x 0.75 in (19 mm)
		NC	14 ft (4.2 m) x 20 in (508 mm), 191 x 0.75 in (19 mm)
		ND	14 ft (4.2 m) x 20 in (508 mm), 211 x 0.75 in (19 mm)
		NE	14 ft (4.2 m) x 20 in (508 mm), 248 x 0.75 in (19 mm)
		M2	12 ft (3.6 m) x 20 in (508 mm), 72 x 1 in (25 mm), 18 x 0.75 in (19 mm)
		M3	12 ft (3.6 m) x 20 in (508 mm), 90 x 1 in (25 mm), 18 x 0.75 in (19 mm)
		M4	12 ft (3.6 m) x 20 in (508 mm), 107 x 1 in (25 mm), 18 x 0.75 in (19 mm)
		M5	12 ft (3.6 m) x 20 in (508 mm), 123 x 1 in (25 mm), 18 x 0.75 in (19 mm)
		N2	14 ft (4.2 m) x 20 in (508 mm), 72 x 1 in (25 mm), 18 x 0.75 in (19 mm)
		N3	14 ft (4.2 m) x 20 in (508 mm), 90 x 1 in (25 mm), 18 x 0.75 in (19 mm)
		N4	14 ft (4.2 m) x 20 in (508 mm), 107 x 1 in (25 mm), 18 x 0.75 in (19 mm)
	N5	14 ft (4.2 m) x 20 in (508 mm), 123 x 1 in (25 mm), 18 x 0.75 in (19 mm)	
CMPR	Compressor Driveline (PIN 9, 10)	EE	2 CMPR (136mm/136mm)
		FE	2 CMPR (145mm/136mm)
		FF	2 CMPR (145mm/145mm)
		QQ	Special Quote
STARTER	Starter (PIN 11)	A	2 CMPR Frame A
		B	2 CMPR Frame B
		C	2 CMPR Frame C
		D	2 CMPR Frame D
		Q	Special Quote
PASS	Pass Arrangement (PIN 12)	B	Evap: 2pass; Cond: 1pass
		C	Evap: 3pass; Cond: 1pass
		E	Evap: 2pass; Cond: 2pass
		F	Evap: 3pass; Cond: 2pass
		H	Evap: 2pass; Cond: 3pass
		I	Evap: 3pass; Cond: 3pass
		Q	Special Quote

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
NOMCAP	Nominal Capacity (PIN 13, 14, 15, 16)	ASIA	Asia Region
		####	kW for Europe
		####	TR for NA Region
APPL	Application (PIN 17)	S	Standard water chiller
		D	Dry tower
		P	Process brine
		T	Ice thermal storage
		A	Heat pump(<55C/131F)
		F	Heat recovery(<55C/131F)
		I	Process brine and dry tower
Q	Special Quote		
MODLVL	Modification Level A (PIN 18)	A	Modification Level A
PIN19	PIN19	X	No Selection
		Q	Special Quote
VOLTS	Voltage (PIN 20, 21)	17	200/3/60
		28	230/3/60
		40	380/3/60
		46	460/3/60
		65	380/3/50
		50	400/3/50
		68	415/3/50
		58	575/3/60
Q	Special Quote		
POWER	Power Field (PIN 22)	SX	NF Disconnect Switch, Lockable
		BX	Circuit Breaker, Lockable
		SS	Supply Terminal Block
		CS	Special Quote
FILTER	Harmonic Filter (PIN 23)	X	No Selection
		Q	Special Quote
SYSPARM	System Parameter (PIN 24)	X	No Selection
		Q	Special Quote
CONTENCL	Control Panel and VSD Enclosure Type (PIN 25)	S	Ctrl/VSD:N1/IP33, AT:N1/IP33
		Q	Special Quote
NEMA	Unit NEMA Type (PIN 26)	S	Unit: NEMA1 or IP10
		Q	Special Quote
VSDCOOL	VSD Cooling Source (PIN 27)	X	No Selection
		S	Std VSD Cooling (via Condenser)
		H	Hi-temp VSD Cooling (via Evaporator)
		Q	Special Quote
		X	No Selection

4

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
PANEL	Panel Options (PIN 28)	X	No Selection
		Q	Special Quote
BAS	BAS Interface (PIN 29)	X	No BAS Reset/Offset required
		T	BAS/EMS Temp Reset/Offset
		C	BAS/EMS Current Reset/Offset
		B	BAS/EMS Both Temp and Current Reset/Offset
		Q	Special BAS Reset/Offset required
LANGDESP	Language Display (PIN 30)	X	English
		S	Spanish
		F	French
		G	German
		I	Italian
		P	Portuguese
		L	Polish
		H	Hungarian
SAFETY	Safety Code (PIN 31)	L	China Safety Code (GB)
		C	European Safety Code (CE)
		Q	N American Safety Code (cUL/cETL)
		Q	Special Quote
REMOTEPNL	Remote Ctrl Panel (PIN 32)	X	Special Remote
		Q	Special Quote
SEQ	Sequence Kit (PIN 33)	X	No Selection
		Q	Special Quote
UNLOAD	PIN 34	X	No option required
		Q	Special Quote
PIN35	PIN 35	X	No Option Required
		Q	Special Quote
PIPING	Piping Code (PIN 36)	X	No Selection
		R	Dual relief valves
		C	Chicago relief code
		Q	Special Quote
METERDEV	Metering Device (PIN 37)	E	EEV
		Q	Special Quote
VALVE	Valve Options (PIN 38)	X	No Selection
		B	Condenser isolation valves
		Q	Special Quote
BYPASS	Hot Gas Bypass (PIN 39)	X	No Selection
		Q	Special quote
PIN40	PIN 40	X	No Selection
		Q	Special Quote
REF	R-134a (PIN 41)	X	No Selection

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
CPRVAR	Compressor Variation (PIN 42)	W	2.3 Vi compressor
		C	Optimized 2.3 Vi compressor
		S	Standard 3.2 Vi compressor
		V	Optimized 3.2 Vi compressor
		Q	Special Quote
CPRFQ	Compressor Frequency (PIN 43, 44, 45)	X	Compressor Frequency
		Q	Special Quote
ECON	Economizer (PIN 46)	E	Economizer
		Q	Special Quote
		X	No Selection
PIN47	PIN 47	X	No Selection
		Q	Special Quote
FLOW	Flow Switch per Chiller (PIN 48)	X	No Selection
		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 switches
		Q	Special Quote
INS	Thermal Insulation (PIN 49)	X	No Selection
		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
VESSEL	Vessel Codes (PIN 50)	G	GB Pressure Vessel Codes
		E	PED Pressure Vessel Codes
		A	ASME Pressure Vessel Codes
		Q	Special Quote
PIN51	PIN 51	X	No Selection
		Q	Special Quote
TEMP	Evaporator Water Temp (PIN 52, 53)	##	Lvg Evap Wat Temp = {LWT} deg
		QQ	Special Quote
EVAPTUBETYPE	Evaporator Tube Type (PIN 54, 55, 56)	321	R-1158 .025 Wall MT#321
		322	R-1158 .028 Wall MT#322
		323	R-1158 .035 Wall MT#323
		326	R-1158 .025 Wall MT#326
		327	R-1158 .028 Wall MT#327
		328	R-1158 .035 Wall MT#328
		QQQ	Special Quote

4

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
EVAPWB	Evaporator Water Box Type (PIN 57)	C	Compact water boxes
		Q	Special Quote
EVAPCOAT	Evaporator Epoxy Coating (PIN 58)	C	Compact water boxes
		Q	Special Quote
EVAPHG	Evaporator Hinges (PIN 59)	X	No Selection
		Q	Special Quote
EVAPDWP	Evaporator Waterside DWP (PIN 60)	1	150 psig DWP waterside
EVAPPARR	Evaporator Nozzle Arrangement (PIN 61)	A	AH
		H	HA
		C	CB
		K	KJ
		G	GN
		P	PF
		Q	Special Quote
EVAPWBCON	Evaporator Water Connection (PIN 62)	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 Victaulic flanges (field)
		Q	Special Quote
EVPPFL	Evaporator Fluid (PIN 63)	W	Water
		C	Calcium Chloride
		S	Sodium Chloride
		E	Ethylene Glycol
		P	Propylene Glycol
		Q	Special Quote
PIN64	PIN 64	X	No Selection
		Q	Special Quote
CTEMP	Condenser Leaving Water Temperature (PIN 65, 66)	X	No Option
		1	Cond Lvg Wat Temp = {CLWT} deg
		S	Special Quote

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
CONDTUBETYPE	Condenser Tube Type (PIN 67, 68, 69)	201	R-1077 .028 Wall MT#201
		203	R-1077 .035 Wall MT#203
		260	R-1130 .025 Wall MT#260
		261	R-1130 .028 Wall MT#261
		262	R-1130 .035 Wall MT#262
		266	R-1130 .025 Wall MT#266
		267	R-1130 .028 Wall MT#267
		268	R-1130 .035 Wall MT#268
		162	R-1118 .025 Wall MT#162
		QQQ	Special Quote
CONDWB	Condenser Water Box Type (PIN 70)	C	Compact water boxes
		Q	Special Quote
CONDCOAT	Condenser Epoxy Coating (PIN 71)	X	No Selection
		Q	Special Quote
CONDHG	Condenser Hinges (PIN 72)	X	No Selection
		Q	Special Quote
CONDDWP	Condenser Waterside DWP (PIN 73)	C	150 psig DWP waterside
		K	Special Quote
CNDARR	Condenser Nozzle Arrangement (PIN 74)	A	AH
		H	HA
		C	CB
		K	KJ
		G	GN
		P	PF
		Q	Special Quote
CONDWBCON	Condenser Water Box Connection (PIN 75)	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 Victaulic flanges (field)
		Q	Special Quote

4

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
CONPFL	Condenser Fluid (PIN 76)	W	Water
		C	Calcium Chloride
		S	Sodium Chloride
		E	Ethylene Glycol
		P	Propylene Glycol
		Q	Special Quote
PIN 77	PIN 77	X	Elastomeric pad
		Q	1-in deflection spring isol
NOISERDCT	Noise Reduction Kit (PIN 78)	X	Special Quote
		B	Caribbean Blue
		Q	Special Quote
ISOL	Vibration Isolation (PIN 79)	X	No selection
		E	Elastomeric pad
		1	1-in deflection spring isol
		Q	Special Quote
PAINT	Paint Options (PIN 80)	S	Caribbean Blue
		Q	Special Quote
STRMOD	Structural Modification (PIN 81)	X	No Selection
		Q	Special Quote
PIN 82	PIN 82	X	No Selection
		Q	Special Quote
SHIP	Ship Instructions (PIN 83)	E	Special Quote
		1	Buy America Act Compl w Bag
		Q	Amer Act and Cont w/o Bag (Prep)
		S	Cont Ship w/o Bag (Load US)
		Q	Cont Ship w Bag (Load US)
		X	Cont Ship w Bag (Load Mex)
		Q	Cont Ship w Bag (Fact Prep)
		G	Amer Act and 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

TABLE 9 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	DESCRIPTION	OPTION	DESCRIPTION
FORM	Form Shipment Options (PIN 84)	1	Form 1
		2	Form 2
		3	Form 3
		7	Form 7
		Q	Special Quote
PIN 85	PIN 85	X	No Selection
		Q	Special Quote
SRDOCS	SR Documents (PIN 86)	X	No Selection
		B	Monterrey base document
		M	Monterrey base and materials doc
		S	Sabadell base document
		P	Sabadell base and optional doc
		W	Wuxi base document
TEST	Factory Tests (PIN 87)	V	Wuxi base and vacuum test doc
		A	Wuxi all document
		Q	Special Quote
		W	Customer perf witness test
		T	Tube side hydrostatic witness
		S	Shell side pneumatic witness
		V	Vacuum witness test
		A	Perf and tube side hydro witness
		B	Perf and shell side pneum witness
		C	Perf, tube hydro & shell pneum
		D	Performance and vacuum witness
		E	Perf, tube hydro, shell pneu, vac
		Q	Special Quote
PIN 88	PIN 88	X	No Selection
		Q	Special Quote

4

COMPRESSOR UNIT DIMENSIONS

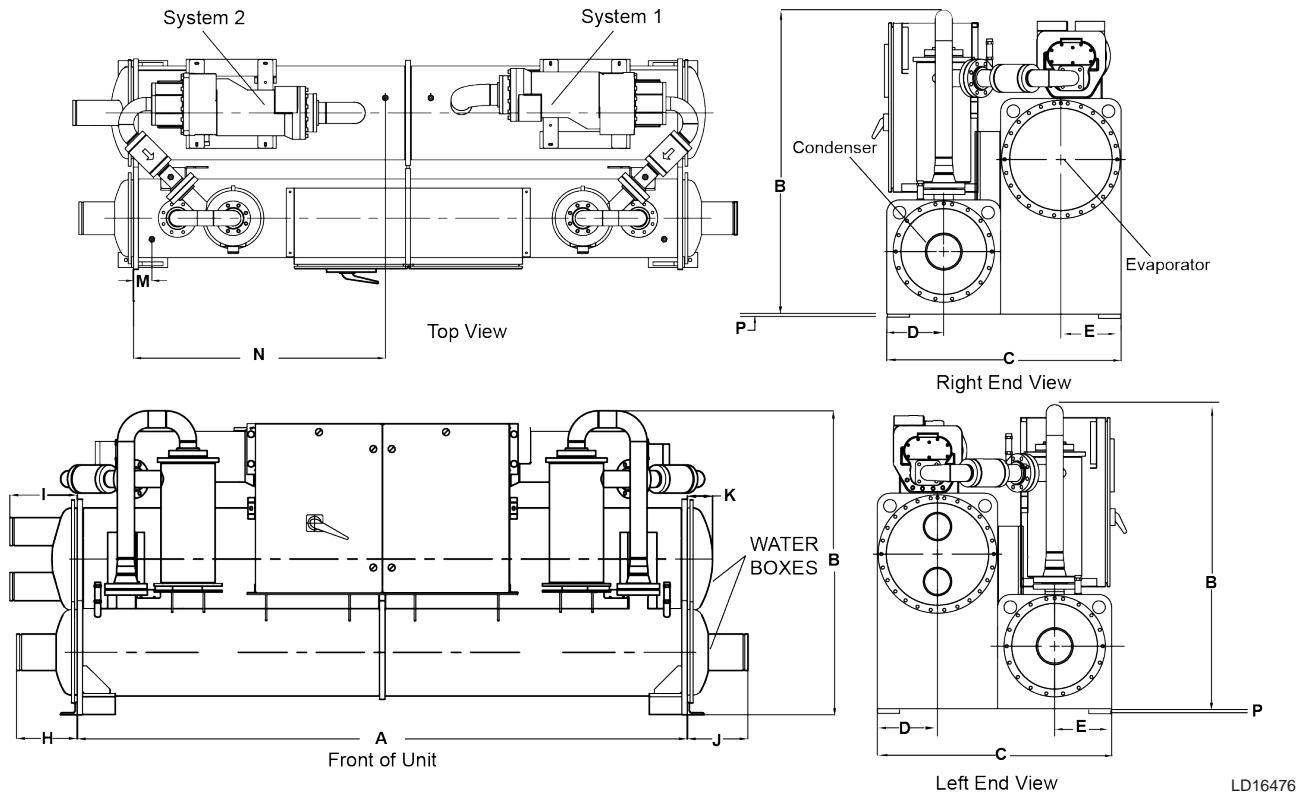


FIGURE 15 - COMPRESSOR UNIT DIMENSIONS

DIM.	COMPRESSOR (PINS 9 AND 10)	
	EVAPORATORS (PINS 5 AND 6) AND CONDENSERS (PINS 7 AND 8)	
	M-M	N-N
A	12 ft (3657 mm)	14 ft (4267 mm)
B	6 ft (1824 mm)	6 ft (1824 mm)
C	55-5/16 in (1405 mm)	55-5/16 (1405 mm)
D	13-3/8 in (342 mm)	13-3/8 in (342 mm)
E	14-3/16 in (361 mm)	14-3/16 in (361 mm)
M	4-3/4 in (123 mm)	10 3/4 (275 mm)
N	5 1/2 ft (1678 mm)	6 ft (1524 mm)

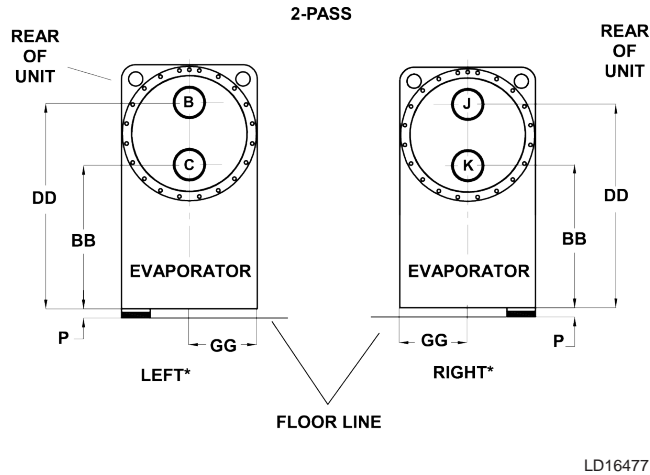
ADDITIONAL OPERATING HEIGHT FOR VIBRATION ISOLATION - IN (MM)	
TYPE OF CHILLER MOUNTING	P
Neoprene Pad Isolators	1-3/4 (44)
Spring Isolators Deflection	1 (25)
Direct Mount	3/4 (19)

NOTES:

1. All dimensions are approximate. Certified dimensions are available upon request.
2. Water nozzles are located on either end of unit.
3. Standard 150 PSI (10.3 kPa) design pressure boxes shown.
3. Front of unit is defined as side where control center is mounted.
4. Evaporator and condenser water must enter the water box through the bottom connection to achieve rated performance.
5. Connected piping should allow for the removal of the compact water boxes for tube access and cleaning.
6. To determine overall height, add Dimension P to the appropriate isolator type.

WATER BOX DIMENSIONS (MM)					
DIM.	EVAPORATORS (M, N)		CONDENSERS (M, N)		
	2-PASS	3-PASS	1-PASS	2-PASS	3-PASS
H	—	—	14 1/2 (369)	14 1/2 (369)	14 1/2 (369)
I	16 (409)	16 (409)	—	—	—
J	—	—	14 1/2 (369)	5 3/4 (146)	14 1/2 (369)
K	6 (156)	16 (409)	—	—	—

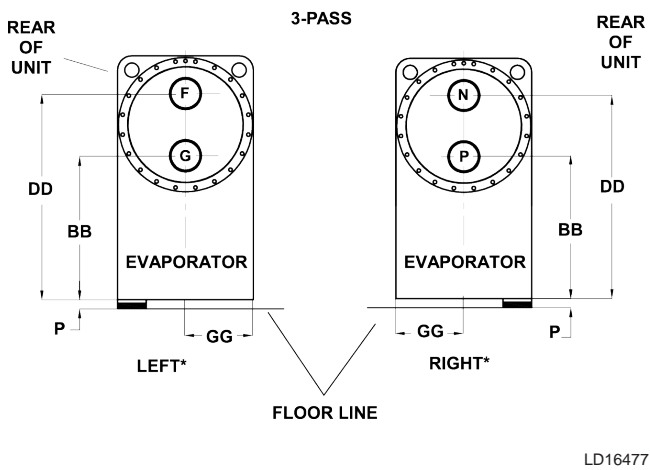
DIMENSIONS OF EVAPORATOR NOZZLE ARRANGEMENTS



NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	EVAPORATOR	
	IN	OUT
2	C	B
	K	J

LD16477

FIGURE 16 - EVAPORATORS - COMPACT WATER BOXES (2-PASS)



NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	EVAPORATOR	
	IN	OUT
3	G	N
	P	F

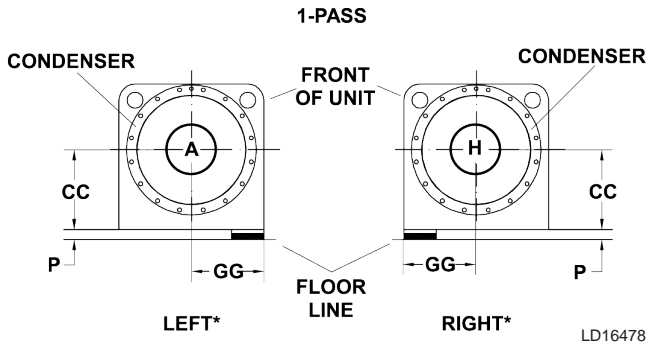
LD16477

FIGURE 17 - EVAPORATORS - COMPACT WATER BOXES (3-PASS)

TABLE 10 - EVAPORATOR NOZZLE DIMENSIONS - IN(MM)

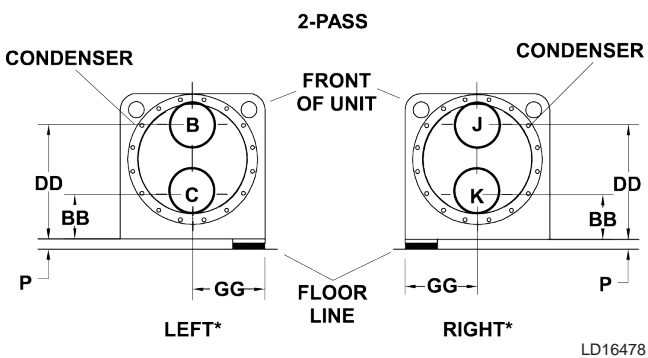
EVAPORATOR SHELL CODE (PINS 5 AND 6)	EVAPORATOR NOZZLE DIMENSIONS (in)		2-PASS			3-PASS		
	2-PASS	3-PASS	BB	DD	GG	BB	DD	GG
M OR N	6	6	30 (762)	43 (1092)	14-7/32 (362)	30 (762)	43 (1092)	14-7/32 (362)

DIMENSIONS OF CONDENSER NOZZLE ARRANGEMENTS



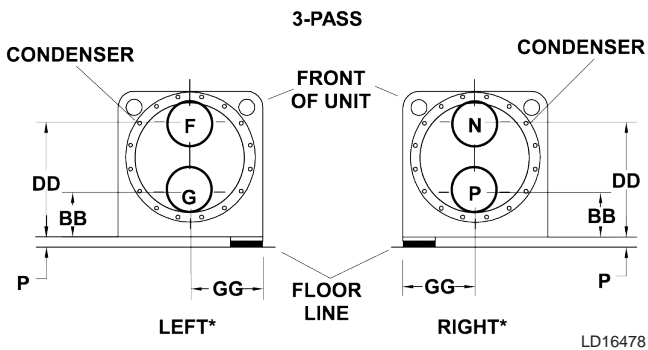
NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	CONDENSER	
	IN	OUT
1	A	H
	H	A

FIGURE 18 - CONDENSERS - COMPACT WATER BOXES (1-PASS)



NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	EVAPORATOR	
	IN	OUT
2	C	B
	K	J

FIGURE 19 - CONDENSERS - COMPACT WATER BOXES (2-PASS)



NOZZLE ARRANGEMENTS		
NUMBER OF PASSES	CONDENSER	
	IN	OUT
3	G	N
	P	F

FIGURE 20 - CONDENSERS - COMPACT WATER BOXES (3-PASS)

TABLE 11 - CONDENSER NOZZLE DIMENSIONS - IN (MM)

CONDENSER SHELL CODE (PIN 7 AND 8)	CONDENSER NOZZLE DIMENSIONS (in)			1-PASS		2-PASS			3-PASS		
	1-PASS	2-PASS	3-PASS	CC	GG	BB	DD	GG	BB	DD	GG
M OR N	8	6	6	14-3/4 (375)	13-7/16 (342)	8-3/32 (210)	21-1/4 (540)	13-7/16 (342)	8-3/32 (210)	21-1/4 (540)	13-7/16 (342)

TABLE 12 - WATER FLOW RATE LIMITS (GPM/L/S) (BASED ON STANDARD TUBES AT DESIGN FULL LOAD CONDITIONS)

EVAP CODE	EVAPORATOR				COND CODE	CONDENSER					
	2 PASS		3 PASS			1 PASS		2 PASS		3 PASS	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX	MIN	MAX
MB/NB	230 (15)	910 (57)	160 (10)	600 (38)	MB/NB	470 (30)	1850 (117)	240 (15)	920 (58)	160 (10)	610 (38)
MC/NC	290 (18)	1140 (72)	190 (12)	750 (47)	MC/NC	550 (35)	2190 (138)	280 (18)	1090 (69)	190 (12)	720 (45)
MD/ND	330 (21)	1310 (83)	220 (14)	870 (55)	MD/ND	610 (38)	2420 (153)	310 (20)	1200 (76)	210 (13)	800 (50)
ME/NE	380 (24)	1490 (94)	250 (16)	980 (62)	ME/NE	720 (45)	2840 (179)	360 (23)	1420 (90)	240 (15)	940 (59)
M2/N2	230 (15)	890 (56)	150 (9)	580 (37)	M2/N2	460 (29)	1820 (115)	230 (15)	890 (56)	160 (10)	600 (38)
M3/N3	270 (17)	1050 (66)	180 (11)	690 (44)	M3/N3	560 (35)	2220 (140)	280 (18)	1100 (69)	190 (12)	740 (47)
M4/N4	310 (20)	1230 (78)	210 (13)	800 (50)	M4/N4	660 (42)	2600 (164)	330 (21)	1300 (82)	220 (14)	850 (54)
M5/N5	370 (23)	1460 (92)	250 (16)	960 (61)	M5/N5	750 (47)	2960 (187)	380 (24)	1480 (93)	250 (16)	980 (62)

4

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SECTION 5 - COMMISSIONING

PREPARATION



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

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

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

For helpful tips about commissioning the unit, refer to the following information.

Refrigerant Charge

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

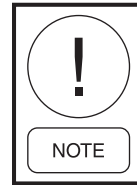
- Do not evacuate or liquid charge with static water in the cooler or condenser.
- Turn the pumps on.
- Liquid charge slowly to avoid excessive thermal stress at the charging point, and to make sure the refrigerant temperature does not go below the freezing point with liquid refrigerant in the evaporator 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 oil 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(s).

Supersedes: 201.30-CL2 (312)

Form 201.30-CL2 (412)



MODEL – YVWA

START-UP CHECKLIST

CUSTOMER: _____ JOB NAME: _____
ADDRESS: _____ LOCATION: _____
PHONE: _____ CUSTOMER ORDER NO: _____
JCI TEL NO: _____ JCI ORDER NO: _____ JCI 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 201.30-ICOM2):

A. GENERAL:

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

1. Review the Installation Checklist (Form 201.30-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 201.30-PW2.
5. Confirm any field control wiring modifications are in accordance with Form 201.30-PW2
6. Verify the chiller is charged with refrigerant (pressures match R-134a 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 the following isolation valves are open.
 - a. Compressor 1 discharge (optional)
 - b. System 1 condenser subcooler outlet (optional)
 - c. System 1 condenser pressure transducer
 - d. System 1 condenser gas to oil eductor
 - e. System 1 evaporator pressure transducer
 - f. System 1 evaporator oil return to eductor
 - g. System 1 oil return eductor to compressor
- h. System 1 liquid injection to compressor (optional)
- i. System 1 economizer pressure transducer
- j. Compressor 2 discharge (optional)
- k. System 1 condenser subcooler outlet (optional)
- l. System 2 condenser pressure transducer
- m. System 2 condenser gas to oil eductor
- n. System 2 evaporator pressure transducer
- o. System 2 evaporator oil return to eductor
- p. System 2 oil return eductor to compressor
- q. System 2 liquid injection to compressor (optional)
- r. System 2 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 201.30-ICOM2 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.

Find your VSD model from the list on the next page, and set the adjustments to the setting values in the following table. If your model is not listed below, look for it in the table of drive model numbers in the table with the ratings plug value.

(Continued on following page)

- a. TV2CMPRBW-40A
- b. TV2CMPRBW-65A
- c. TV2CMPRBW-50C
- d. TV2CMPRBW-68A
- e. TV2CMPRBW-46A

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
TV2CMPRBW-40B	600
TV2CMPRBW-40C	800
TV2CMPRBW-65B	600
TV2CMPRBW-65C	800
TV2CMPRBW-50B	600
TV2CMPRBW-50C	800
TV2CMPRBW-68B	600
TV2CMPRBW-68C	800
TV2CMPRBW-46B	600
TV2CMPRBW-58B	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.

- 12. Check the chiller for refrigerant leaks at joints or water piping leaks.
- 13. Make sure 9 liters (2.38 gallons) of compressor oil were added to both circuits.
- 14. Make sure the control panel is free of foreign material (wires, metal chips, tools, documents, etc.). Check for signs of water or moisture.

- 15. 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.
- 16. Make sure the flow switches are connected between Terminals 2 and 12 and 2 and 13 on Terminal Block 1TB in the control panel.
- 17. 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 201.30-ICOM2.
- 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 reset. 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
 System 2: _____ Amps

(Continued on following page)



Setting the potentiometers incorrectly may cause damage to the equipment.

- Press the STATUS key. If the following UNIT WARNING message appears, immediately contact Johnson Controls Product Technical Support to request the password to reprogram the serial number, and any other important factory programmed information that was lost.

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

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 201.30-ICOM2 for more information:

- Display Language = _____
- Chilled Liquid Mode = _____
- Local/Remote Mode = _____
- Display Units = _____
- Lead/Lag Control = _____
- Remote Temp Reset = _____
- Remote Current Reset = _____
- Compressor Selection = _____
- 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 201.30-ICOM2 for low and high limits, and default values.

- Chilled Liquid Leaving Temperature Cutout = _____ °F (°C)
- Motor Current Limit = _____ % FLA
- Pulldown Motor Current Limit = _____ % FLA
- Pulldown Motor Current Limit Time = _____ MIN
- Motor Temp Unload = _____ °F (°C)
- Unit ID Number = _____
- Sys 1 Condenser Liquid Ref Level = _____
- Sys 2 Condenser Liquid Ref Level = _____

Liquid Control Setpoint

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

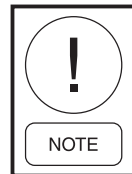
- Leaving Chilled Liquid Temp Setpoint = _____ °F (°C)

- Leaving Chilled Liquid Temp Control Range = _____ °F (°C)
- Maximum Leaving Chilled Liquid Remote Temp Reset = _____ °F (°C)
- Leaving Condenser Liquid Temp Setpoint = _____ °F (°C)
- Leaving Condenser Liquid Temp Control Range = _____ °F (°C)
- Maximum Leaving Condenser Liquid Remote Temp Reset = _____ °F (°C)

Date/Time and Daily Schedule

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

C. CHILLER SYSTEM



After completion of the following checks for System 1, switch off the System 1 switch on the keypad and repeat the process for System 2. When both systems are running correctly, stop the unit, switch all applicable switches ON, and restart the unit.

- Ensure power is on the chiller to energize the compressor heaters 24 hours prior to start-up. ...
- Ensure the SYSTEM SWITCHES key is OFF for both systems.
- Turn the unit switch to the ON position.
- 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.
- 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.
- 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.

(Continued on following page)

FORM 201.30-CL2
ISSUE DATE: 4/18/2012

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 System 1 or 2 SWITCH. There may be a few seconds delay before the compressor starts because of the anti-recycle timer. Be ready, when each compressor starts, to switch the UNIT switch to the OFF position immediately, if any unusual noises or other adverse conditions develop.
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. As the chiller is started, verify the refrigerant level sensor tracks level from empty condenser to fully flooded level sensor probe over the range of less than 10% to almost 100%.
11. Adjust condenser refrigerant liquid level setpoint to a value that covers the subcooler top and provides proper evaporator performance with the chiller running steady.
12. 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

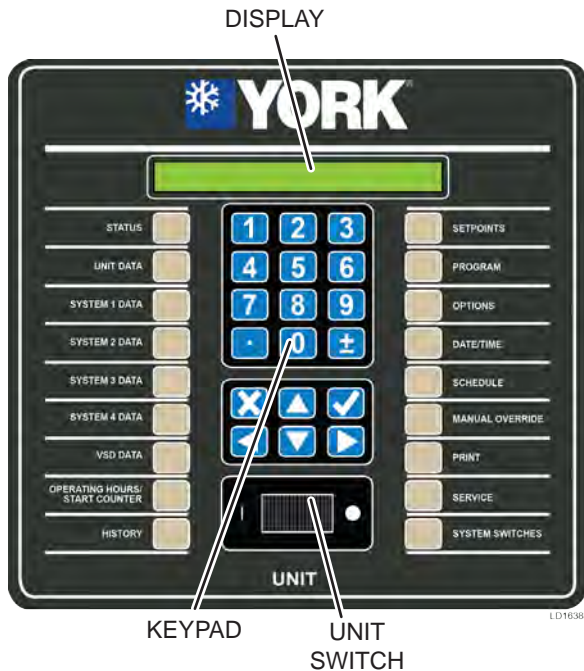


FIGURE 21 - KEYPAD AND DISPLAY

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 21 on page 63*.

When the switch is placed in the OFF (O) position, the system shuts down immediately, and all systems will be disabled. One unit switch pole is for System 1, and the other is for System 2. When the switch is ON (I), both systems have continuity through it for the 115VAC run signal from the control relay board to the VSD board. A secondary circuit for each system also gets power here for an input to the control to indicate that the UNIT SWITCH 1 or 2 is ON.

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 which 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
 - OPTIONS
- ◀ (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. The ◀ ▶ keys also allow scrolling sideways between the same displays on System 1 and System 2. Press the ▶ key to move the display to System 2. 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 utilizes 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.

XXXXXXXXXX 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.

XXXXXXXXXX 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.
- At least one system switch is on.
- Run permissive inputs have closed switches to Terminal 2.

- No unit faults or start inhibits exist.
- At least one system is not faulted or inhibited.
- Daily schedule calls for the chiller to run.
- Flow switch input has closed switches to Terminal 2.
- 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 number of compressors to start, precharge the VSD, and begin operating the compressors. The compressor(s) 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 desired setpoint. In optional HEAT PUMP MODE, the Leaving Condenser Liquid Temperature is regulated to setpoint. In automatic LEAD/LAG control, the logic leads with the compressor with the lowest run time.

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 pump motor overheating.

Compressor Heater Control

Each 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 respective 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 158°F (70°C). The heater will turn off, if any internal compressor motor temperature sensor reads more than 160°F (71.1°C).

Alarms

Each 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.

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

Chiller Run Contact

The chiller run dry contact is closed whenever any compressor is running, and open when all compressors are 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. Refer to *SECTION 3 - HANDLING, STORAGE, AND INSTALLATION*.

Remote Run Permissive Input

The System 1 and System 2 run permissive switches must have electrical continuity to Terminal 2 to permit the chiller to run. Refer to *SECTION 3 - HANDLING, STORAGE, AND INSTALLATION*.

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 of the five parameters listed in *Table 14 on page 71* 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 22 on page 65* represents the control operation.

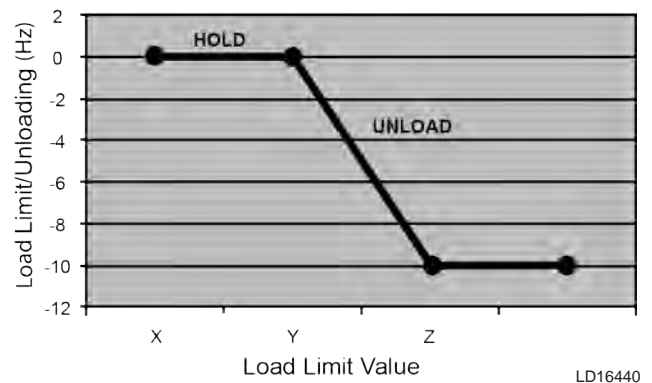


FIGURE 22 - CONTROL OPERATION

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. Prior to 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 of the five parameters is provided in *Table 13 on page 66*.

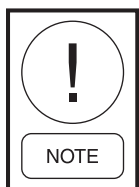
TABLE 13 - LOAD LIMITING VALUES

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 – 20 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

Pulldown Current Limit Setpoint

Set this setpoint under the PROGRAM key, which is only active on start-up for the time defined by the PULLDOWN CURRENT LIMIT TIME. 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 Johnson Controls 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. Refer to 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:** Reset 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 min. 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 Johnson Controls 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. Refer to 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 remote 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:** Reset 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. Refer to 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, and 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 al-

lowable 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 Johnson Controls 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:

- SYS X = 1 or 2
- ###.# °F = Temperature Data
- #####.# % = Percent (0 to 100%)
- ### = :
 - Time Data, i.e. seconds (SEC)
 - PSIG/PSID = Pressure
 - Hz = Hertz
 - AMPS = Amperage
 - FLA = Full Load Amperage

Status Key

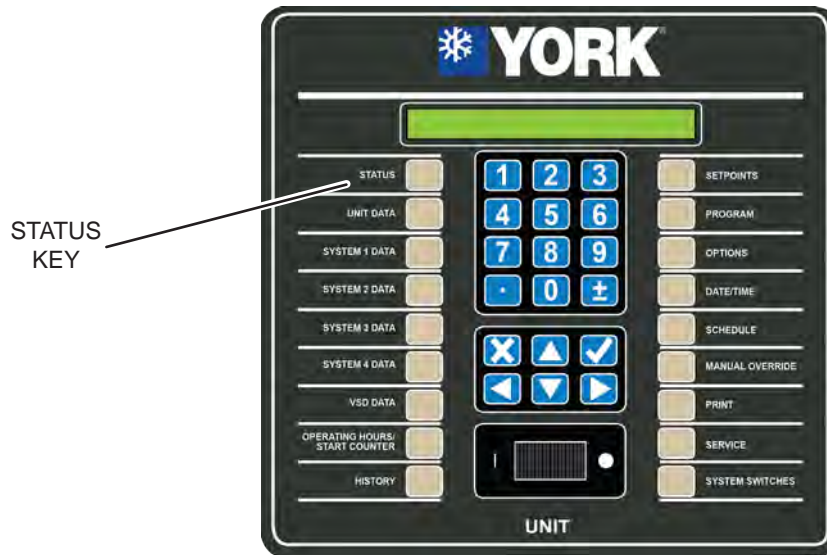


FIGURE 23 - STATUS DATA KEY ON CONTROL PANEL

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

- 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 Johnson Controls, EPROM version, date, and time will be displayed for two seconds, followed by the general status message:

```
(C)2012 JOHNSON CONTROLS
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 two-compressor chiller. STATUS messages fall into two categories: GENERAL UNIT AND SYSTEM STATUS 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.

SYS X 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.

SYS X SYSTEM SWITCH IS OFF

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

SYS X NOT RUNNING

The chilled or condenser liquid temperature is below the setpoint, or the microprocessor has not loaded the lead system far enough into the loading sequence to bring on the lag system. This message will be displayed on the lag system until the loading sequence is ready for the lag system to start. This message also applies to the Leaving Condenser Liquid Temperature and setpoint in the HEAT PUMP MODE.

SYS X COOLING DEMAND SHUTDOWN

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

SYS X COMPRESSOR RUNNING

The system is running due to demand.

SYS X 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.

SYS X 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.

SYS X OPD MITIGATION

Condenser level control is repositioning level setpoint to reduce evaporator 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.

SYS X DISCHARGE PRESSURE LIMITING

SYS X EVAPORATOR PRESSURE LIMITING

SYS X MOTOR CURRENT LIMITING

SYS X PULLDOWN MOTOR CURRENT LIMITING

SYS X BAS 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.

SYS X 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.

SYS X VSD BASEPLATE TEMP LIMITING

SYS X VSD INTERNAL AMBIENT TEMP LIMITING

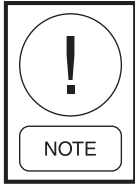
FAULT MESSAGES

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 or a single system 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 14 on page 71* 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 to the history buffer. If a unit warning is in effect, the message will be displayed when the operator presses the STATUS key.

TABLE 14 - UNIT WARNINGS

MESSAGE	DESCRIPTION
OIL FILTER CLOGGED	<p>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 to 100 psid, default 20 psid). The message will be cleared when the pressure drops below setpoint or the compressor is stopped. The message, SYS X, applies to System 1 or 2.</p>
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 data-bbox="488 1020 621 1203" style="border: 1px solid black; padding: 5px; display: inline-block;">  <p style="text-align: center;">NOTE</p> </div> <p><i>These jumpers are factory installed in the wire harness plug and should not require changes.</i></p>
INVALID SERIAL NUMBER	<p>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 Johnson Controls 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.</p>
LOW BATTERY	<p>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 desired 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.</p>

Unit Safeties (Faults)

Unit safeties, as shown in *Table 15 on page 73*, are:

- Faults that cause all running compressors 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 15 - 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 380V 50/60Hz and 400/415V 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° (-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 15 - 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 LOCK-OUT, 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 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 50/60Hz and 400/415V, 50Hz VSD. If the unit fails to make pre-charge, the signal shall be deasserted for 10 seconds, during which time the units fan(s) and water pump(s) 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 COMMUNICA- TIONS 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 15 - 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, as shown in *Table 16 on page 75*, are:

- Faults that cause all running compressors 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.

Multiple Systems

When multiple systems are operating and a system fault occurs, the running systems will ramp down and the faulted system will be shut off. The previously operating system will restart, if required, after the fault clears and/or the 120-second anti-recycle timer times out.

If a system safety is in effect, the message will be displayed when the operator presses the STATUS key.

TABLE 16 - SYSTEM SAFETIES (FAULTS)

MESSAGE	DESCRIPTION
SYS 1 or 2 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.
SYS 1 or 2 YYYYYYY EDUCTOR CLOG	This fault is designed to detect low flow of oil in the oil return eductor line. This safety will shut down a system or unit if the eductor temperature rises above the saturated evaporator temperature more than the programmed setpoint (5.0 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.
SYS 1 or 2 YYYYYYY GATE DRIVER FAULT	Hardware-Initiated Fault - The VSD IGBT gate driver control board (one per compressor VSD) 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.

TABLE 16 - SYSTEM SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION
SYS 1 or 2 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. 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.
SYS 1 or 2 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 (23 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 (20.2 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.
SYS 1 or 2 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.
SYS 1 or 2 YYYYYYY HIGH MOTOR CURRENT	Hardware-Initiated Fault - The three output lines to each 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: 460V 60Hz, VSD Frames, A and B shutdown is 575.5 amps (554 amps (min), 597 amps (max)), 380V 50/60Hz and 400/415V 50Hz, VSD Frames A and B shutdown is 649.5 amps (626 amps (min), 674 amps (max)), and 380V 50/60 Hz and 400/415V 50Hz, 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 ramped. 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.
SYS 1 or 2 YYYYYYY HIGH MOTOR TEMP Z	This fault prevents a system 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.
SYS 1 or 2 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 highest of the two inverter power module's baseplate temperatures on Compressors 1 and 2 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 16 - SYSTEM SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION						
<p>SYS 1 or 2 YYYYYYY HPCO</p>	<p>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. The mechanical cutout opens at 333 to 348 psig (2.3 MPa to 2.4 MPa) and closes at 197 psig ± 10 psig (1.36 MPa ± 0.07 MPa). 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.</p>						
<p>SYS 1 or 2 YYYYYYY LOW DIFF OIL PRESSURE</p>	<p>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 17 on page 77</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.</p> <p>TABLE 17 - TIMER SETTINGS</p> <table border="1" data-bbox="492 747 1125 957"> <thead> <tr> <th data-bbox="492 747 724 814">CURRENT FREQUENCY</th> <th data-bbox="724 747 1125 814">INCREASE TIMER BY:</th> </tr> </thead> <tbody> <tr> <td data-bbox="492 814 724 884">>100 Hz</td> <td data-bbox="724 814 1125 884">60 sec. + (100 Hz - 5 Hz)/30.4 Hz/sec + 9.5 sec.</td> </tr> <tr> <td data-bbox="492 884 724 957">< or = 100 Hz</td> <td data-bbox="724 884 1125 957">60 sec. + (Current freq - 5 Hz)/10 Hz/sec</td> </tr> </tbody> </table> <p>Note: 9.5 sec = (100 Hz-5 Hz/10 Hz sec), the time it takes to ramp from 100 Hz to 5 Hz.</p> <p>After the timer expires, the fault is linearly ramped from 0 psid (0 kPa) to the programmable threshold (20-60 psid, default 25 psid (137-413 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. This is to prevent false tripping during a startup or shutdown restart needed under conditions where another compressor is being brought on due to load requirements, and the running compressor is being ramped down to 5 Hz to add the additional compressor. Under these conditions, the slow speed of the running compressor(s) 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(s) 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.</p>	CURRENT FREQUENCY	INCREASE TIMER BY:	>100 Hz	60 sec. + (100 Hz - 5 Hz)/30.4 Hz/sec + 9.5 sec.	< or = 100 Hz	60 sec. + (Current freq - 5 Hz)/10 Hz/sec
CURRENT FREQUENCY	INCREASE TIMER BY:						
>100 Hz	60 sec. + (100 Hz - 5 Hz)/30.4 Hz/sec + 9.5 sec.						
< or = 100 Hz	60 sec. + (Current freq - 5 Hz)/10 Hz/sec						
<p>SYS 1 or 2 YYYYYYY LOW DISCHARGE SUPERHEAT</p>	<p>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 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 10 minutes of system run time if the economizer feed valve position is 0%, and for the first five minutes of system run time if the economizer valve position is greater than 0%. If the discharge superheat falls below 5.0°F (2.8°C) for five minutes, the system 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.</p>						

TABLE 16 - SYSTEM SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION
SYS 1 or 2 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 15°F (0°C to 11°C, default 8.3°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.
SYS 1 or 2 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.
SYS 1 or 2 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.
SYS 1 or 2 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.
SYS 1 or 2 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 that a 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 16 - SYSTEM SAFETIES FAULTS (CONT'D)

MESSAGE	DESCRIPTION
<p>SYS 1 or 2 YYYYYYY LOW EVAP PRES SMART FREEZE</p>	<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>
<p>SYS 1 or 2 YYYYYYY LOW OIL LEVEL</p>	<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 (System 1) or J52 (System 2). 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>
<p>SYS 1 or 2 YYYYYYY MOTOR CURRENT OVERLOAD</p>	<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, 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.</p>
<p>SYS 1 or 2 YYYYYYY SENSOR FAIL: ZZZZZZZZZZZZ</p>	<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 a system or unit if any of the sensor inputs goes out of range. Ranges are: evaporator, condenser, oil, discharge and economizer pressure transducer: < 0.3V or > 4.7V, level sensor: < 3.0mA or > 21mA, eductor temperature sensor: < 0.86V (~ -5°F) or > 4.67V (~ 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>
<p>SYS 1 or 2 YYYYYYY VSD RUN RELAY</p>	<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 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.</p>

Unit Data Key

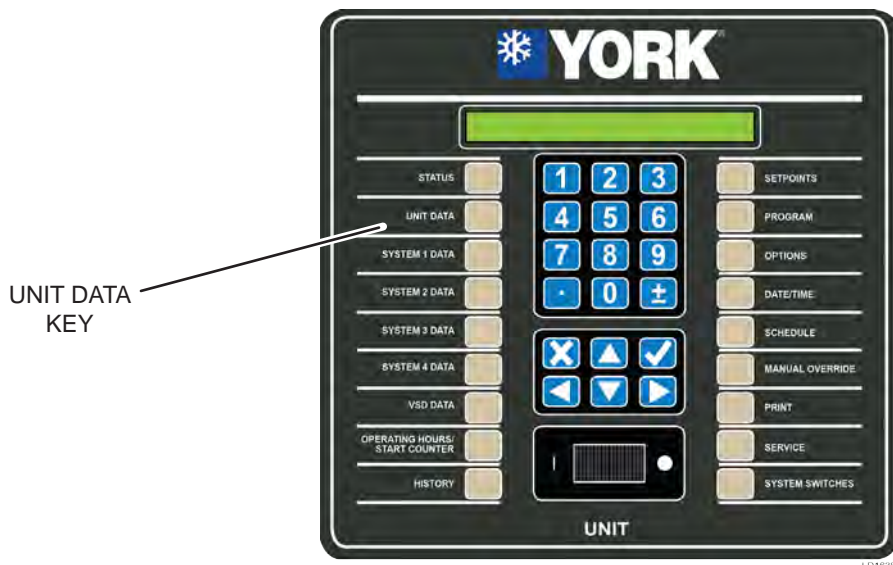


FIGURE 24 - UNIT DATA KEY

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 - YORKTalk via BAS (REMOTE MODE).
- CURR - REMOTE CURRENT LIMITING is enabled.
- TEMP - REMOTE TEMPERATURE RESET is enabled.
- MODE - REMOTE MODE SELECT. (REMOTE MODE)

System Data Keys (1-4)

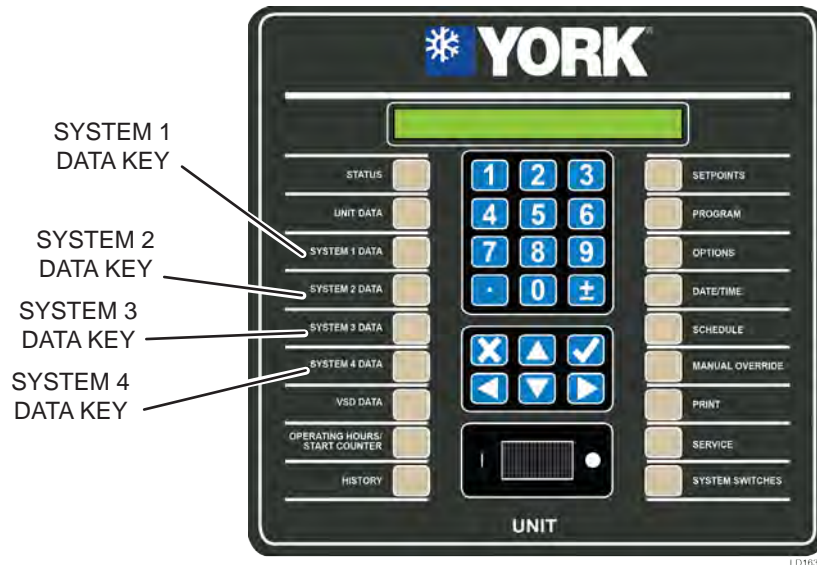


FIGURE 25 - SYSTEM DATA KEYS (1-4)

System 1 Data Key Operation

The SYSTEM 1 DATA key gives access to SYSTEM 1 operating parameters. The following list shows the data in the order in which they appear.

Pressure Messages

SYS 1 PRESSURES OIL = ### PSIG
EVAP = ###.# PSIG OIL DIFF = ### PSID

SYS 1 PRESSURES CONDENSER = ### PSIG
DISCH = ### PSIG ECONOMIZER = ### PSIG

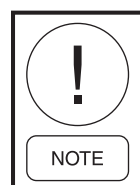
Temperature Messages

SYS 1 ECONOMIZER TEMP = ###.# °F
SUPERHEAT = ###.# SAT TEMP = ###.# °F

SYS 1 SUBCOOLED LIQ REF TEMP = ###.# °F
EVAPORATOR REFRIG TEMP = ###.# °F

SYS 1 DISCHARGE TEMP = ###.# °F
SUPERHEAT = ###.# SAT TEMP = ###.# °F

SYS 1 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

SYS 1 COMPRESSOR SPEED = ###.# %
LIQ INJ = ON OR OFF HEATER = ON OR OFF

Display LIQ INJ, if control is enabled.

SYS 1 CONDENSER LEVEL = ###.# %
LEVEL CONTROL VALVE OPEN = ###.# %

SYS 1 ECONOMIZER SUPERHEAT = ###.# °F
FEED VALVE = %

Display, if control is enabled.

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

SYS 1 OIL FILTER = ### PSID

SYS 1 RUN TIME
DAYS ## HOURS ## MINUTES ## SECONDS

SYS 1 RUN SIGNALS RELAY = ON OR OFF
RUN PERM = ON OR OFF SOFTWARE = ON OR OFF

SYS 1 EDUCTOR TEMP = ###.# °F

System 2 Data Key Operation

SYSTEM 2 keys function the same as the SYSTEM 1 DATA keys except that it displays data for System 2.

SYS 3 DATA NOT AVAILABLE

SYS 4 DATA NOT AVAILABLE

On a two compressor system, SYSTEMS 3 and 4 data keys will display NOT AVAILABLE.

Sensor Displays

Table 18 on page 82 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 18 - 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 Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Leaving Condenser Liquid Temp	3 K Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Entering Condenser Liquid Temp	3 K Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Leaving Chilled Liquid Temp	3 K Thermistor	-19.1°F (-28.49°C)	110.2°F (43.4°C)
Entering Chilled Liquid Temp	3 K Thermistor	-19.1°F (-28.49°C)	110.2 °F (43.4°C)
Compressor Motor Temp	10 K Thermistor	-30.2°F (-34.56°C)	302.0° F (150°C)
Discharge Temp	50 K Thermistor	40.3°F (4.61°C)	302.0° F (150°C)
Evaporator Temp	3 K Thermistor	-4.87°F (-20.3°C)	158.34°F (70.2°C)
Subcooled Liquid Refrig Temp	3 K Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)
Remote Temp Reset	4-20mA/2-10V 0-20mA/0-10V	0%	100%
Remote Current Limit	4-20mA/2-10V 0-20mA/0-10V	0%	100%
Condenser Hot Water Leaving Temp	3 K Thermistor	0%	100%
Condenser Hot Water Entering Temp	3 K Thermistor	0%	100%
Remote Heat Recovery Temp Reset Option	4-20mA/2-10V 0-20mA/0-10V	0%	100%
Eductor Temp	3 K Thermistor	18.83°F (-7.31°C)	175.61°F (79.7°C)

History Key

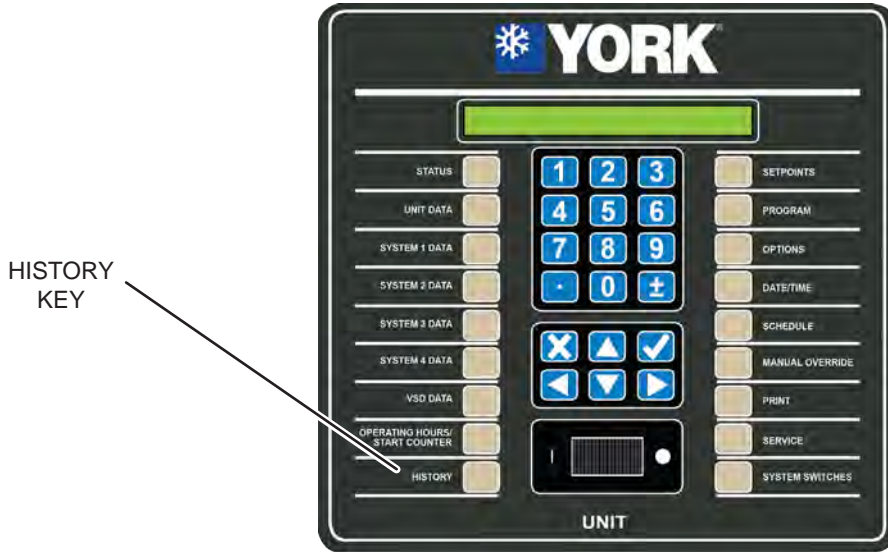
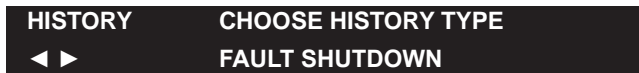


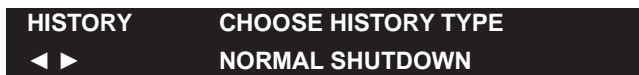
FIGURE 27 - HISTORY KEY

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

1. Press the HISTORY key (see Figure 27 on page 84) to display the initial history message (above). FAULT SHUTDOWN appears under CHOOSE HISTORY TYPE.

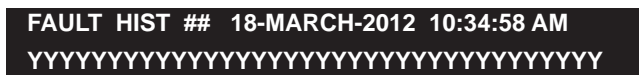


2. To choose NORMAL SHUTDOWNS, use the ◀ key.

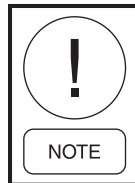


To return to FAULT SHUTDOWN, use the ▶ key.

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



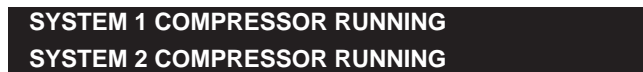
The FAULT HISTORY contains data from the last 10 shutdowns, where ## is the history buffer number between one and 10, and YYYY is the fault description. Buffer 01 gives the most recent fault information, and 10 is the oldest fault shutdown saved.



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 SYSTEM 1 and SYSTEM 2. Refer to the example below:



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 80*
 - Chilled Liquid
 - Compressor 1 and 2, etc.
- SYSTEM 1 OR 2 *on page 81*
 - Oil Pressure
 - Condenser Pressure message, etc.
- VSD *on page 83*
 - Frequency
 - VSD Current
- SETPOINTS *on page 86*
 - Local Cooling Setpoint
 - Local Cooling Range, etc.
- OPERATING HOURS/START COUNTER *on page 83*
 - Day of Week
 - Day of Month, etc.
- OPTIONS *on page 90*
 - Display Language
 - Liquid Type, etc.
- PROGRAM *on page 88*
 - Chilled Liquid Leaving Temp Cutout
 - Motor Current Limit, etc.

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

```
NORM HIST ## 18-JUN-2011 10:34:58 AM
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

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

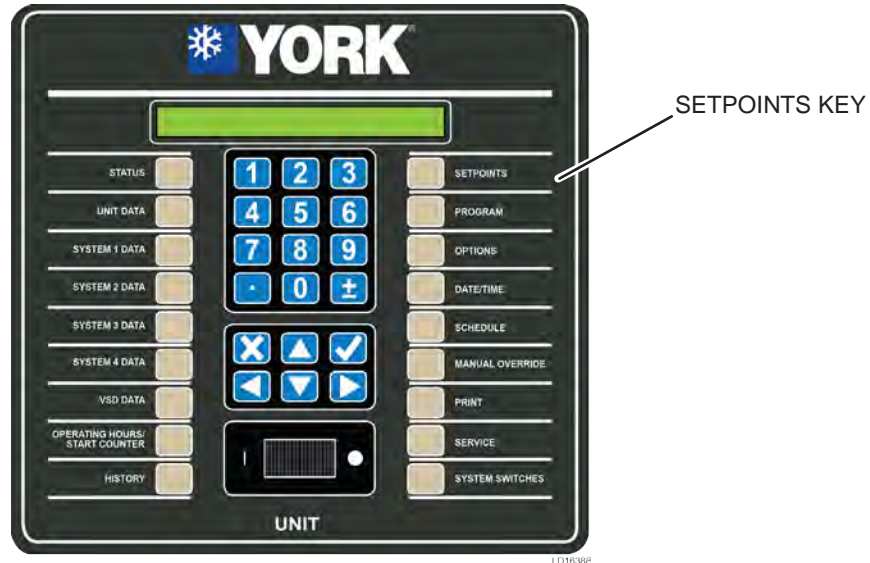


FIGURE 28 - SETPOINTS KEY

Press the SETPOINTS key to program:

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

Table 19 on page 87 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 19 on page 87.

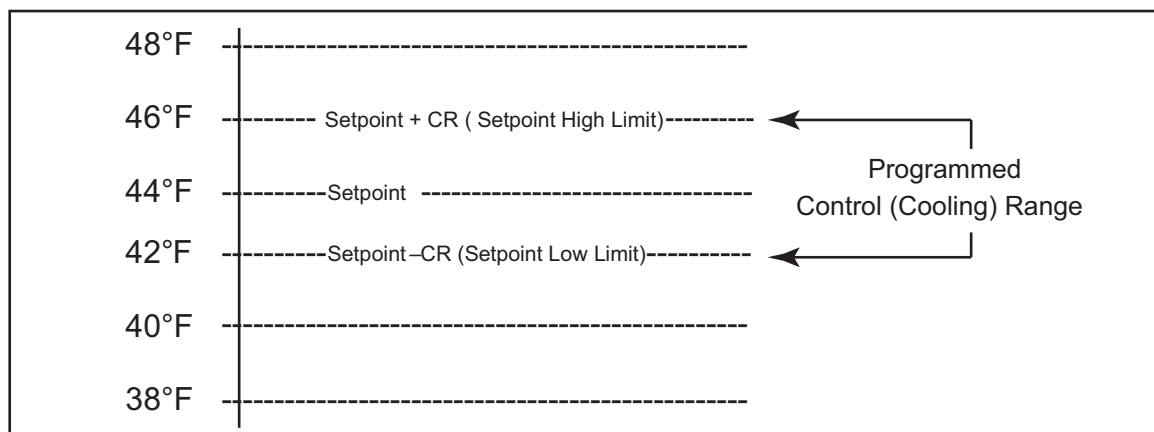
TABLE 19 - SETPOINT VALUES

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	8.0°F	70.0°F	44.0°F
		-13.3°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

6

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 29 on page 87*. In this example, LCHLT setpoint is 44°F (6.6°C) and the CR is 2°F (-16.6°C).



LD16433

FIGURE 29 - SETPOINT HIGH AND LOW LIMITS DEFINED BY CONTROL RANGE (CR)

Program Key

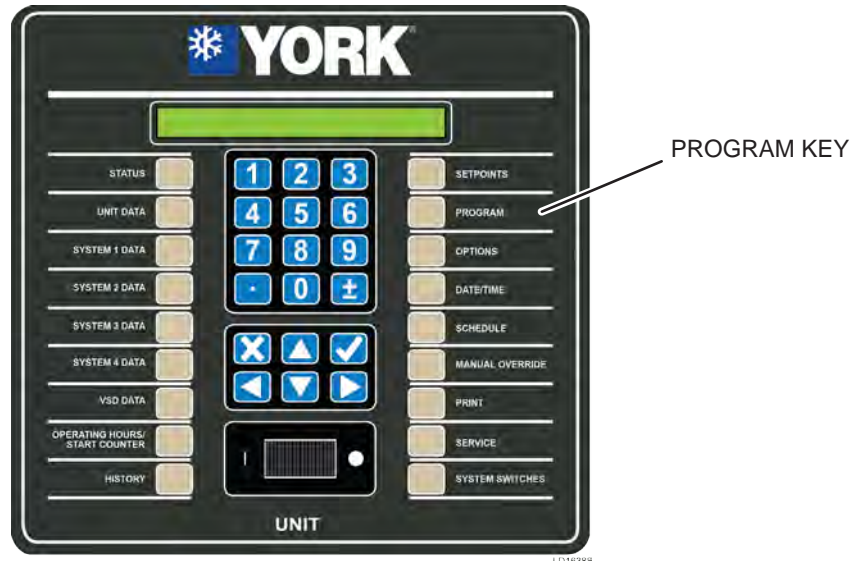


FIGURE 30 - PROGRAM KEY

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

**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. Refer to *Table 20 on page 89* for the programmable values.

**PROGRAM ◀DEF #### LO #### HI ####
CHILLED LIQUID LEAVING TEMP CUTOUT = ##.# °F**

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

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

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

**PROGRAM ◀DEF XXXXX LO XXXXX HI XXXXX
MOTOR TEMPERATURE UNLOAD = ### °F**

**PROGRAM ◀DEF ### LO ### HI ###
REMOTE UNIT ID NUMBER = #**

With service level password access, navigate to the following setup parameters and set them properly to maintain approximately 1 inch coverage above the top of the condenser subcooler in accordance with the refrigerant charge level description in *SECTION 7 - MAINTENANCE* in this manual. Service technicians refer to *Service Manual (Form 201.30-M1)* for instructions to access these setpoints.

**PROGRAM ◀DEF XXXXX LO XXXXX HI XXXXX
SYS 1 CONDENSER LIQUID REF LEVEL = ###**

**PROGRAM ◀DEF XXXXX LO XXXXX HI XXXXX
SYS 2 CONDENSER LIQUID REF LEVEL = ###**

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 20 on page 89*. The English units are exact values while the metric units are approximate.

TABLE 20 - PROGRAMMABLE OPERATING PARAMETERS

PROGRAM VALUE	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Chilled Leaving Chilled Liquid Temp. Cutout: Sets the threshold for the system safety shutdown.	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: Sets the local motor current limit threshold.	-	30% FLA	103% FLA	103% FLA
Pulldown Motor Current Limit: Sets the % FLA limit used by the start-up pulldown routine to limit current draw to this value for customer peak energy control.	-	30% FLA	100% FLA	100% FLA
Pulldown Motor Current Limit Time: Sets the time period that the pulldown current limit is in effect upon start-up. At the end of this period, the pulldown motor current limit is released to 100% FLA.	-	0 Min	255 Min	0 Min
Motor Temperature Unload: Sets a threshold that activates the liquid refrigerant injection system if enabled on high motor temperature. The liquid refrigerant injection valve opens when any Motor Temp > (Motor Temp Unload - 10°F) and discharge superheat is > 18°F. This valve is permitted to close when all Motor Temps < Motor Temp Unload - 30°F.	-	150.0°F	250.0°F	240°F
		65.6°C	121.1°C	115.6°C
Unit ID Number: Sets a unit identification number, which will show on the output reports and delineate multiple chillers on single communication networks.	-	0	7	0

6

Options Key

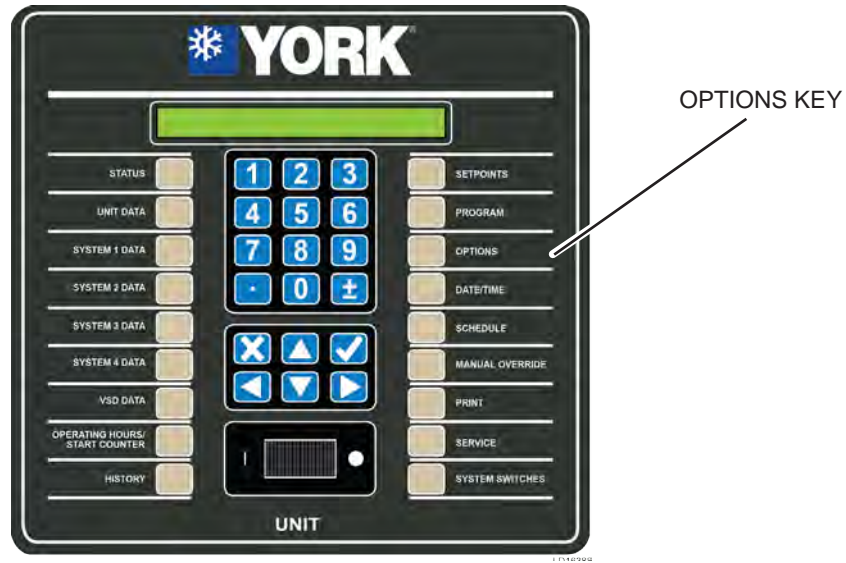


FIGURE 31 - OPTIONS KEY

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

System Lead/Lag Control Mode Selection

Choose one **MODE** below:

OPTIONS LEAD / LAG CONTROL MODE
◀▶ AUTOMATIC

Automatic leads are based on the lowest run time.

OPTIONS LEAD / LAG CONTROL MODE
◀▶ MANUAL SYS 1 LEAD

OPTIONS LEAD / LAG CONTROL MODE
◀▶ MANUAL SYS 2 LEAD

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 Keys

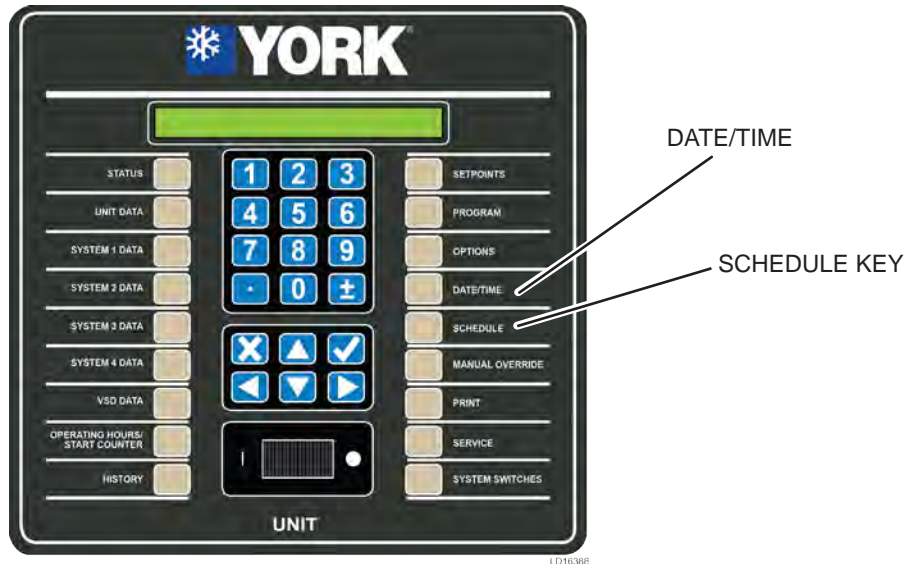


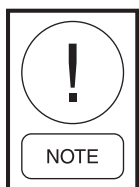
FIGURE 32 - DATE/TIME AND SCHEDULE KEY

```
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 18-JUN-2011 10:15:33 AM
YEAR = ###
```

```
CLOCK FRI 18-JUN-2011 10:15:33 AM
HOUR = ###
```

```
CLOCK FRI 18-JUN-2011 10:15:33 AM
MINUTE = ###
```

```
CLOCK FRI 18-JUN-2011 10:15:33 AM
AM/PM ◀ ▶ = ###
```

```
CLOCK FRI 18-JUN-2011 10:15:33 AM
TIME FORMAT ◀ ▶ = ###
```

Schedule Key Operation

```
SCHEDULE CHOOSE SCHEDULE TYPE
◀ ▶ UNIT OPERATING SCHEDULE
```

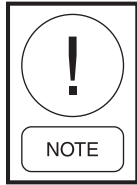
Press this key (above) to access the UNIT OPERATING SCHEDULE (default).

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 system(s) 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 desired 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 *

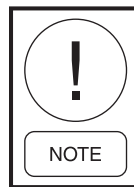
Set the holiday times using the same procedure described for the days of the week. Press the ✓ key after setting the HOL START and STOP times to save the change in memory. Press the SCHEDULE key a second time to show the individual days:

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 Keys

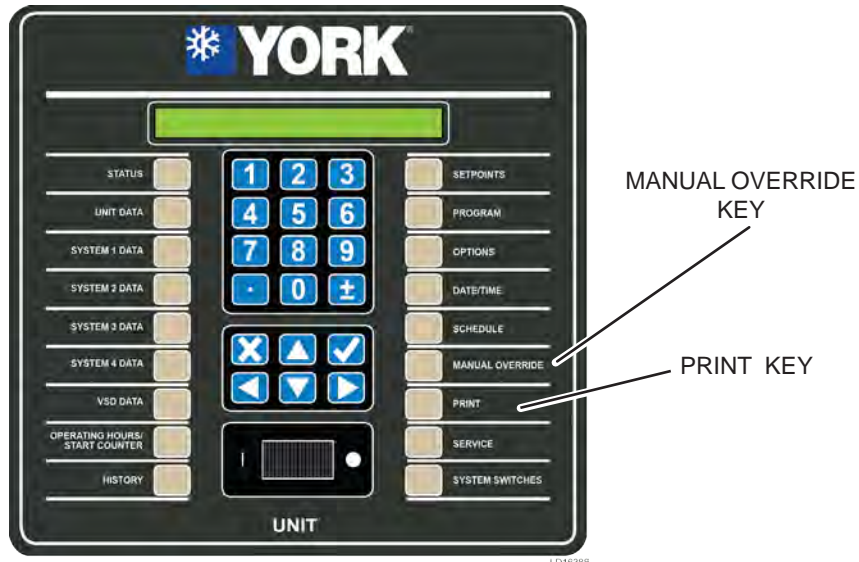


FIGURE 33 - MANUAL OVERRIDE AND PRINT KEY

MANUAL OVERRIDE

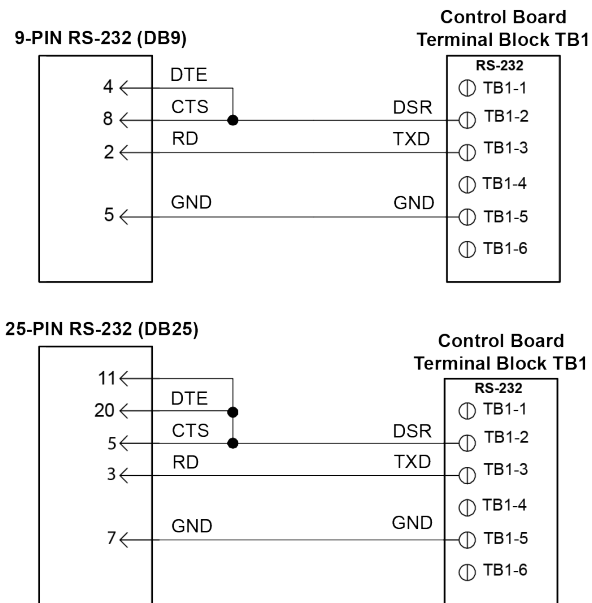
If this key is pressed during a scheduled shutdown, the STATUS key will display MANUAL OVERRIDE, which indicates that the DAILY SCHEDULE is being ignored, and the chiller will start when chilled liquid temperature allows; REMOTE CONTACTS, UNIT SWITCH and SYSTEM SWITCHES permitting. This is a priority 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
◀ ▶ XXXXXXXXXXXXXXXXXXXXXXXXXXXX

PRINT is used to print:

- 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 (see Figure 34 on page 94 or printer (see Figure 35 on page 95).



LD16479

FIGURE 34 - PRINTER CABLE CONNECTION FROM YVWA CHILLER TO A COMPUTER

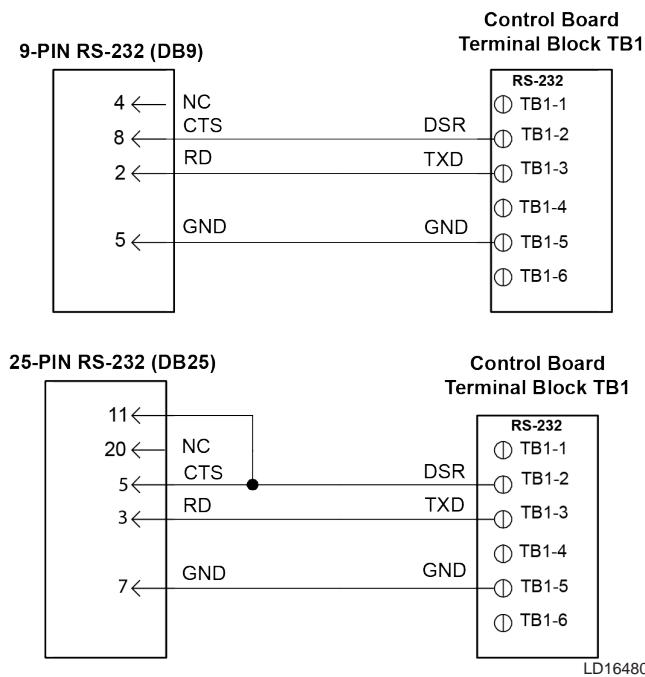


FIGURE 35 - PRINTER CABLE CONNECTION FROM YVWA CHILLER TO A SERIAL PRINTER (WEIGHTRONIX)

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

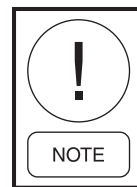
After pressing the PRINT key, press the ◀ or ▶ key until the desired printout is displayed. The available printout types are listed in *Table 21 on page 95*.

TABLE 21 - 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 selected buffer data is then transmitted through the print port. Refer to the example of the information includes in these printouts as shown in *Figure 36 on page 96*.



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

```

Johnson Controls
YVWA SCREW CHILLER
OPERATING DATA
2:04:14 PM 9 MAR 12

SYS 1                NOT RUNNING
SYS 2                COMPRESSOR RUNNING

OPTIONS

CHILLED LIQUID      WATER
CHILLED MODE        CHILLER
LOCAL/REMOTE MODE   REMOTE
LEAD/LAG CONTROL    AUTOMATIC
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 CUTOUT   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
LEAD SYSTEM         SYS 2
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=XXXXXX, 2=XXXXXX

```

```

START COUNTER       1=XXXXXX, 2=XXXXXX
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 36 - SAMPLE PRINTOUT (CONT'D)**FIGURE 36 - SAMPLE PRINTOUT**

```

VSD SOFTWARE RUN SIGNAL          OFF
EDUCTOR TEMPERATURE              68.8 DEGF

      SYSTEM 2 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
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
    
```

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:

```

Johnson Controls
YVWA 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 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
SYS 2 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
ALL FAULTS
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    
```

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

FIGURE 36 - SAMPLE PRINTOUT (CONT'D)

System Switches and Service Keys

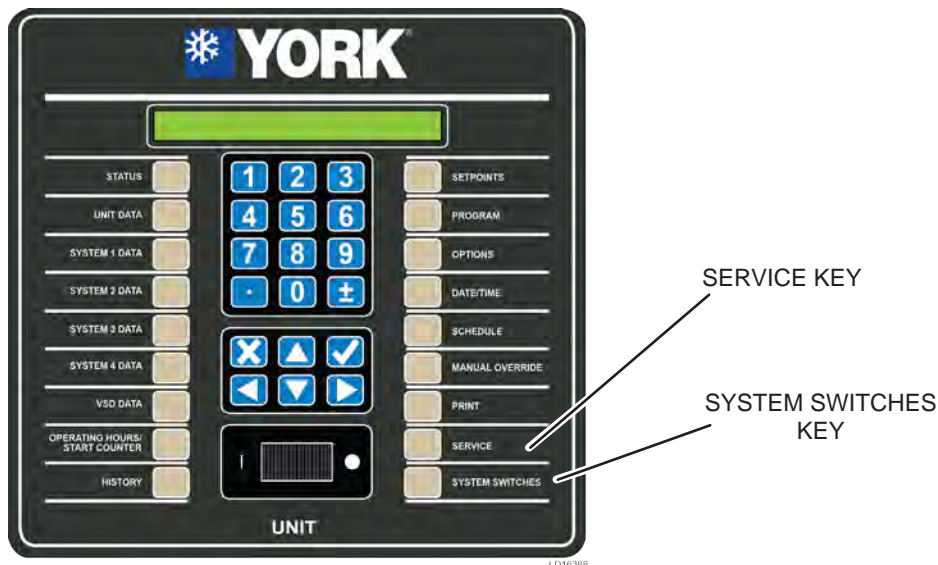


FIGURE 37 - SYSTEM SWITCHES AND SERVICE KEY

SYSTEM SWITCHES **SYS 1 ON / OFF / RESET**
◀ ▶ = ON OR OFF OR RESET

Use the SYSTEM SWITCHES key to enable/disable System 1 or 2 on 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).

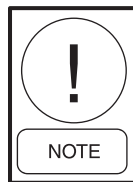
SYSTEM SWITCHES **SYS 2 ON / OFF / RESET**
◀ ▶ = ON OR OFF OR RESET

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 1 or 2 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 compressors.

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

YORKtalk 2 Communications

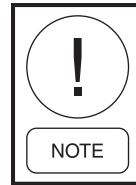
Received Data (Control Data)

The unit receives eight data values from the E-Link Gateway as shown in *Figure 38 on page 99*. 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 YORKTalk 2 transmission for five minutes, it will revert back to all local control values. YVWA Communications Data Map in *Table 23 on page 101* lists the control parameters.

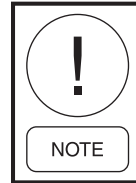
Transmitted Data

After receiving a valid transmission from the E-Link Gateway, the unit will transmit operational data or history buffer data depending on the HISTORY BUFFER

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 YVWA Communications Data Map in *Table 23 on page 101* that shows the data values and page listings for this unit.



The most current data map information is listed on the Johnson Controls/York Equipment Integration web site. A copy of the data map can also be obtained by contacting a local Johnson Controls Field Service Office.



Reboot is required (cycle power) after settings are changed.

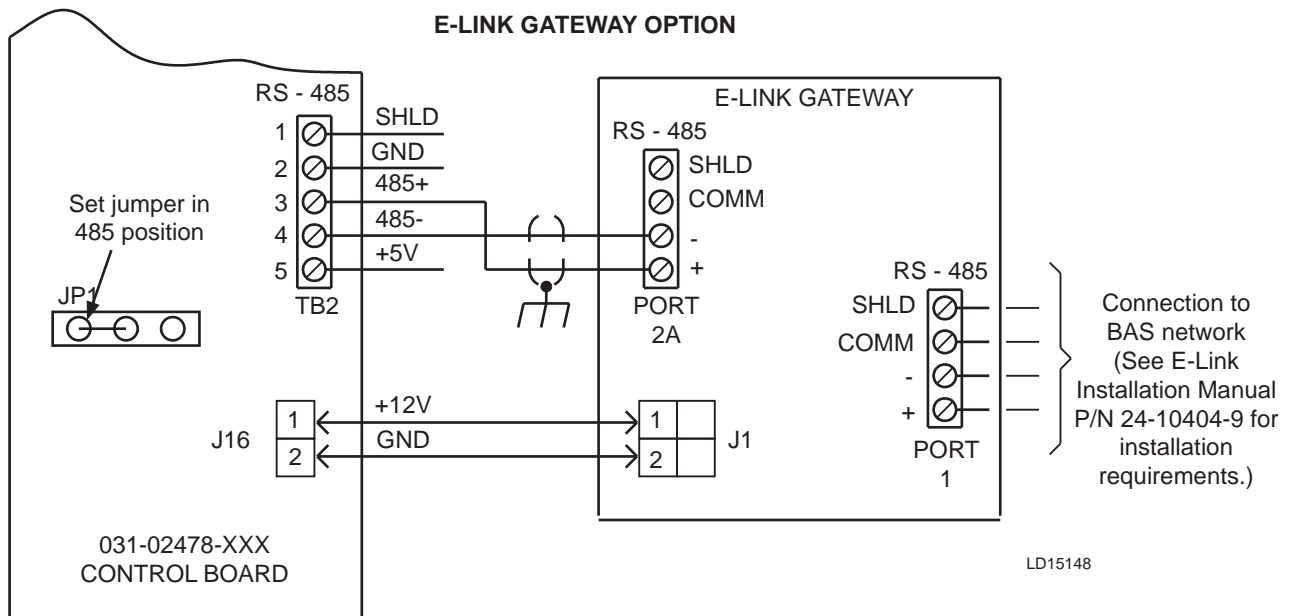


FIGURE 38 - E-LINK GATEWAY OPTION

TABLE 22 - 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	IO BOARD RESET
14	BRAM INVALID
15	BACnet SETUP FAILED

TABLE 23 - YVWA COMMUNICATIONS DATA MAP

3/6/2012

YVWA		2 Circuit Water Cooled		SECTION 1		ELINK		YORK TALK 2		Micro Board: 031-02478-xxx									
Item Ref.	Version	Date	YORK P N	Checksum	Baud	COMMENTS													
ENG PAGE Ref	BACnet Object Type/Ins	Object Name	LON Profile Name	LON SNVT Type	N2 Metasys	MODBUS Address	Scale	ENG UNITS	POINT LIST DESCRIPTION	N = NOT AVAILABLE									
								Imperial		1	2	3	4	5	6	7	8	9	10
P03	AV1	Y12_S01_P03	nvYTS01p003	SNVT count f (51)	ADF 1	0001	Div 10	°F	Setpoint										
P04	AV2	Y12_S01_P04	nvYTS01p004	SNVT count f (51)	ADF 2	0002	Div 10	°F	Setpoint (Start command must be active to take effect)										
P05	AV3	Y12_S01_P05	nvYTS01p005	SNVT count f (51)	ADF 3	0003	Div 10	%	BAS Current Limit (Start command must be active to take effect)										
P06	AV4	Y12_S01_P06	nvYTS01p006	SNVT count f (51)	ADF 4	0004	Div 10	°F	Heatpump Setpoint										
P07	BV1	Y12_S01_P07	nvYTS01p007	SNVT switch (95)	BD 1	0061	N/A	0/1	Start / Stop Command										
P08	BV2	Y12_S01_P08	nvYTS01p008	SNVT switch (95)	BD 2	0062	N/A												
P09	BV3	Y12_S01_P09	nvYTS01p009	SNVT switch (95)	BD 3	0063	N/A												
P10	BV4	Y12_S01_P10	nvYTS01p010	SNVT switch (95)	BD 4	0064	N/A	0/1	History Buffer-1 Request										
P11	AV5	Y12_S01_P11	nvYTS01p011	SNVT count f (51)	ADF 5	0005	X 10	°F	Leaving Chilled Liquid Temp										
P12	AV6	Y12_S01_P12	nvYTS01p012	SNVT count f (51)	ADF 6	0006	X 10	°F	Entering Chilled Liquid Temp										
P13	AV7	Y12_S01_P13	nvYTS01p013	SNVT count f (51)	ADF 7	0007	X 10	°F	VSD Internal Ambient Temp										
P14	AV8	Y12_S01_P14	nvYTS01p014	SNVT count f (51)	ADF 8	0008	X 10	°F	Leaving Condenser Liquid Temp Sensor										
P15	AV9	Y12_S01_P15	nvYTS01p015	SNVT count f (51)	ADF 9	0009	X 10	°F	Sys 1 Discharge Temperature										
P16	AV10	Y12_S01_P16	nvYTS01p016	SNVT count f (51)	ADF 10	0010	X 10	°F											
P17	AV11	Y12_S01_P17	nvYTS01p017	SNVT count f (51)	ADF 11	0011	X 10	°F	Entering Condenser Liquid Temp Sensor										
P18	AV12	Y12_S01_P18	nvYTS01p018	SNVT count f (51)	ADF 12	0012	X 10	PSI	Sys 1 Oil Pressure										
P19	AV13	Y12_S01_P19	nvYTS01p019	SNVT count f (51)	ADF 13	0013	X 10	PSI	Sys 1 Evaporator Pressure										
P20	AV14	Y12_S01_P20	nvYTS01p020	SNVT count f (51)	ADF 14	0014	X 10	PSI	Sys 1 Discharge Pressure										
P21	AV15	Y12_S01_P21	nvYTS01p021	SNVT count f (51)	ADF 15	0015	X 10	%	Sys 1 Compressor % Full Load Amps										
P22	AV16	Y12_S01_P22	nvYTS01p022	SNVT count f (51)	ADF 16	0016	X 1*	hrs	Sys 1 Total Run Hours										
P23	AV17	Y12_S01_P23	nvYTS01p023	SNVT count f (51)	ADF 17	0017	X 1*	count	Sys 1 Total Number of Starts										
P24	AV18	Y12_S01_P24	nvYTS01p024	SNVT count f (51)	ADF 18	0018	X 10	°F	Sys 1 Highest Motor Temp										
P25	AV19	Y12_S01_P25	nvYTS01p025	SNVT count f (51)	ADF 19	0019	X 10	°F	Sys 2 Highest Motor Temp										
P26	AV20	Y12_S01_P26	nvYTS01p026	SNVT count f (51)	ADF 20	0020	X 10	°F											
P27	AV21	Y12_S01_P27	nvYTS01p027	SNVT count f (51)	ADF 21	0021	X 10	PSI	Sys 2 Oil Pressure										
P28	AV22	Y12_S01_P28	nvYTS01p028	SNVT count f (51)	ADF 22	0022	X 10	PSI	Sys 2 Evaporator Pressure										
P29	AV23	Y12_S01_P29	nvYTS01p029	SNVT count f (51)	ADF 23	0023	X 10	PSI	Sys 2 Discharge Pressure										
P30	AV24	Y12_S01_P30	nvYTS01p030	SNVT count f (51)	ADF 24	0024	X 1	%	Sys 2 Compressor % Full Load Amps										
P31	AV25	Y12_S01_P31	nvYTS01p031	SNVT count f (51)	ADF 25	0025	X 1*	hrs	Sys 2 Total Run Hours										
P32	AV26	Y12_S01_P32	nvYTS01p032	SNVT count f (51)	ADF 26	0026	X 1*	count	Sys 2 Total Number of Starts										
P33	AV27	Y12_S01_P33	nvYTS01p033	SNVT count f (51)	ADF 27	0027	X 1*	hz	VSD Output Frequency										
P34	AV28	Y12_S01_P34	nvYTS01p034	SNVT count f (51)	ADF 28	0028	X 1	%	Sys 1 Condenser Level Control Valve % Open										
P35	AV29	Y12_S01_P35	nvYTS01p035	SNVT count f (51)	ADF 29	0029	X 10	%	Sys 2 Condenser Level Control Valve % Open										
P36	BV5	Y12_S01_P36	nvYTS01p036	SNVT switch (95)	BD 5	0065	N/A	0/1	Chiller Run										
P37	BV6	Y12_S01_P37	nvYTS01p037	SNVT switch (95)	BD 6	0066	N/A	0/1	Chiller Alarm. (0 = alarm, 1 = no alarm)										
P38	BV7	Y12_S01_P38	nvYTS01p038	SNVT switch (95)	BD 7	0067	N/A	0/1	VSD Aux Coolant Pump										
P39	BV8	Y12_S01_P39	nvYTS01p039	SNVT switch (95)	BD 8	0068	N/A	0/1	Evaporator/Condenser Pump Status										
P40	BV9	Y12_S01_P40	nvYTS01p040	SNVT switch (95)	BD 9	0069	N/A	0/1	Evaporator/Condenser Pump Status										
P41	BV10	Y12_S01_P41	nvYTS01p041	SNVT switch (95)	BD 10	0070	N/A	0/1	Sys 1 Compressor Run Status										
P42	BV11	Y12_S01_P42	nvYTS01p042	SNVT switch (95)	BD 11	0071	N/A	0/1	Sys 2 Compressor Run Status										
P43	BV12	Y12_S01_P43	nvYTS01p043	SNVT switch (95)	BD 12	0072	N/A	0/1	Sys 1 VI Step Solenoid Valve 1 Status										

TABLE 23 - YVWA COMMUNICATIONS DATA MAP (CONT'D)

3/6/2012

ENG PAGE	Operational Code	ENG PAGE	Fault/Inhibit Code	ENG PAGE	Fault/Inhibit Code (cont)
P56,58	C. OPER.CODE	P57,59	C. FAULT.CODE	P57,59	C. FAULT.CODE
63	Manual Override	1	Reserved 1	52	Low Economizer Superheat
64	Daily Schedule Shutdown	2	Reserved 2	53	Oil Level Low
65	Unit Switch OFF	3	Low Chilled Evap Water Temperature	54	Reserved 54
66	Remote Controlled Shutdown	4	Smart Freeze Point Protection	55	Reserved 55
67	Loss of External Communications	5	Low RTC Battery Voltage	56	Reserved 56
68	Chilled Evap Water Flow Switch Shutdown	6	Invalid Number of Compressors Selected	57	Reserved 57
69	VSD Cooling Shutdown	7	VSD Communications Failure	58	Reserved 58
70	Serial Number Shutdown	8	Pre-charge Low DC Bus Voltage	59	Reserved 59
71	Condenser Water Flow Switch Shutdown	9	Pre-charge DC Bus Voltage Imbalance	60	Reserved 60
72	Reserved 72	10	High DC Bus Voltage	61	Reserved 61
73	Reserved 73	11	Low DC Bus Voltage	62	Reserved 62
74	No Run Permissive	12	DC Bus Voltage Imbalance		
75	Anti-Recycle Timer Active	13	High VSD Ambient Temperature		
76	System Switch OFF	14	Single Phase Input		
77	System Not Running	15	VSD Power Supply Fault		
78	System Running	16	VSD Logic Board Fault		
79	Discharge Pressure Limiting	17	Motor Current Overload (Hardware)		
80	Evaporator Pressure Limiting	18	CT Plug Fault		
81	Motor Current Limiting	19	Reserved 19		
82	Reserved 82	20	Reserved 20		
83	BAS Motor Current Limiting	21	Reserved 21		
84	Remote Motor Current Limiting	22	Reserved 22		
85	System Pumping Down	23	Reserved 23		
86	VSD PreCharging	24	Reserved 24		
87	VSD Baseplate Temp Limiting	25	Reserved 25		
88	VSD Internal Ambient Temp Limiting	26	Reserved 26		
89	Reserved 89	27	High Discharge Pressure		
90	Reserved 90	28	High Oil Filter Differential Pressure		
91	Reserved 91	29	Low Differential Oil Pressure		
92	Pulldown Motor Current Limiting	30	Low Evaporator Pressure		
93	Cooling Demand Shutdown	31	High Discharge Temperature		
94	Reserved 94	32	High Leaving Condenser Temperature		
95	Reserved 95	33	Eductor Clog Fault		
96	Reserved 96	34	Sensor Failure		
97	Reserved 97	35	Low Motor Current		
98	Reserved 98	36	High Motor Temperature		
99	Reserved 99	37	Pre-charge Low DC Bus Voltage		
100	Reserved 100	38	Pre-charge DC Bus Voltage Imbalance		
		39	High DC Bus Voltage		
		40	Low DC Bus Voltage		
		41	DC Bus Voltage Imbalance		
		42	High Motor Current		
		43	Motor Current Overload (Software)		
		44	IGBT Gate Driver Fault		
		45	High Baseplate Temperature		
		46	Single Phase Input to Phase Input		
		47	VSD Run Signal Fault		
		48	High Discharge Press (Hardware - HPCO)		
		49	Reserved 49		
		50	Control Voltage Fault		
		51	Low Discharge Superheat		

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SECTION 7 - MAINTENANCE

GENERAL REQUIREMENTS

The maintenance requirements for YVWA 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. Refer to 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.

Periodic oil filter changes are not recommended. Change the oil, filter, and filter driers only when an oil analysis indicates a moisture issue.

TABLE 24 - OPERATION/INSPECTION /MAINTENANCE REQUIREMENTS FOR YVWA 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 cut-outs. 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 your local Johnson Controls Field Service Office.

¹This 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 YORK 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.

²More 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,
 - a. Check the oil pressure.
 - b. Check the oil level in the oil reservoir.
 - c. 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

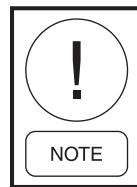
Check Operational Oil Level

The compressor requires 9 liters (2.4 gallons) of YORK L oil per system.

Oil Level

The YVWA 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.

Oil should NOT be added 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 sightglass, 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.



Oil should NOT be added 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 greater than 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 qualified 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 prior to 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.
- 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

An annual oil analysis is recommended 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 25 on page 107*.

TABLE 25 - COMPRESSOR OIL LIMITS

MOISTURE YORK OIL TYPE	MOISTURE CONTENT (KARL FISHER METHOD) PPM	TAN (TOTAL ACID NUMBER) MGKOH/ML
L	< 300	< 0.5

The YVWA 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 utilize 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 Johnson Controls Field Service Office because these amounts could indicate bearing damage and wear.

Removing the Compressor Oil

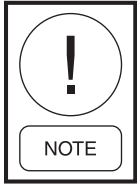
Use the following instructions to remove the compressor oil. Drain the existing oil in the oil separator, which is under positive pressure at ambient temperature, into an approved refrigerant recovery container.

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 L 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 39 on page 108*.

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 39 on page 108*.
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.

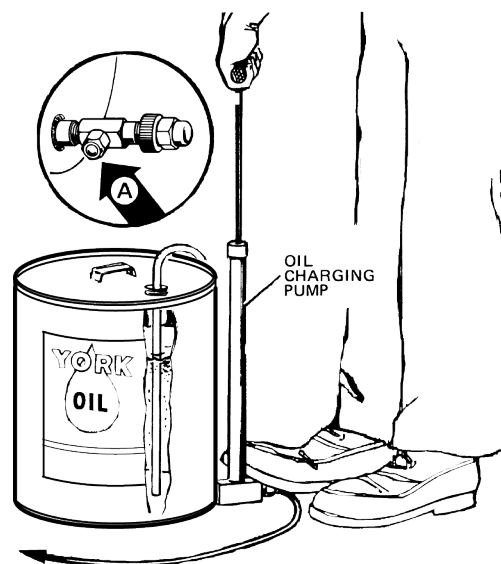
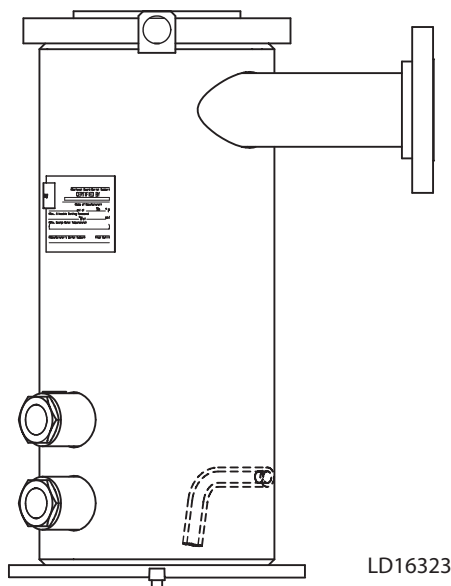


FIGURE 39 - CHARGING OIL

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

Turn off the chiller, and secure it from starting by using the standard lock out/tag out procedure.

1. Isolate and remove refrigerant from the compressor.
2. Bring the compressor up to atmospheric pressure with dry nitrogen.
3. Remove the six cap screws that secure the oil filter cover to the compressor housing.
4. Remove the oil filter housing cover and O-ring seal.
5. Remove the oil filter. Examine any debris from the filter, which could indicate wear in the compressor or other parts of the unit.
6. Replace the oil filter element and the cover O-ring with new parts. Refer to *Model YVWA Renewal Parts (Form 201.30-RP1)* to get the new part numbers. Seat the element and properly to prevent filter bypass. Lightly lubricate the O-ring with compressor oil.
7. Reinstall the oil filter housing cover, and torque the cap screws to 18 ft-lb (24.4 Nm).
8. Leak check the cover by pressurizing the system.
9. Evacuate the isolated compressor and applicable portions of the chiller. Reinstall refrigerant.

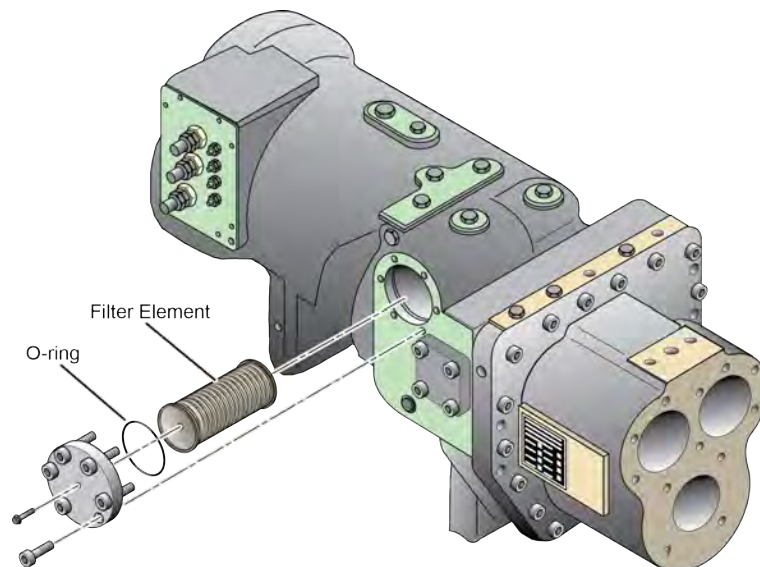


FIGURE 40 - OIL FILTER ASSEMBLY

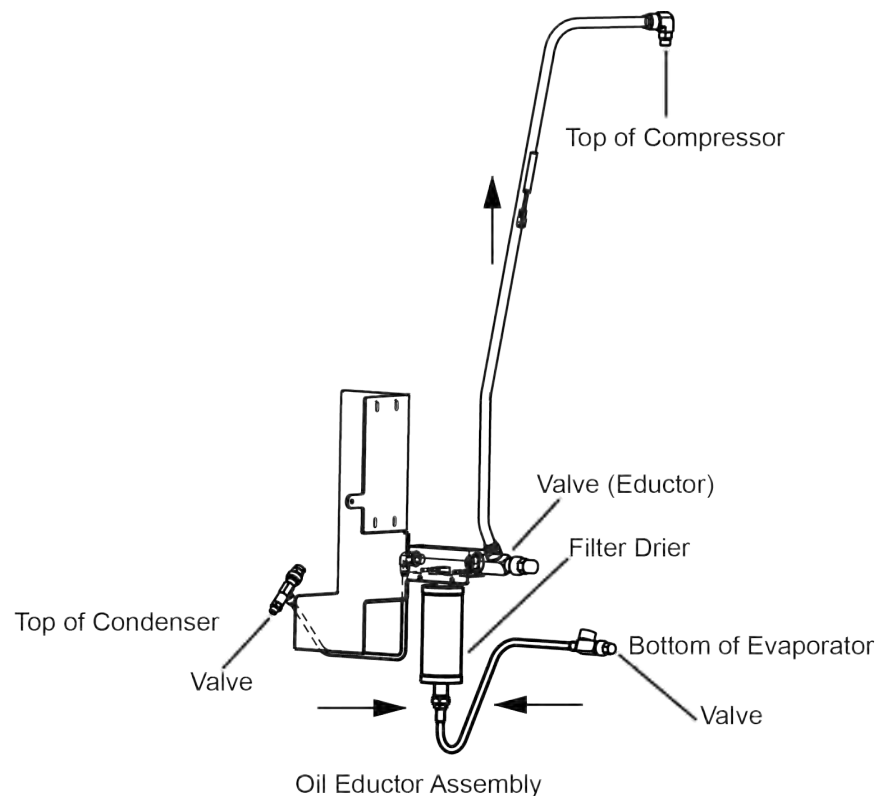
Replacing The Filter Drier

If excessive acid is indicated in the refrigerant or oil charge, use the following instructions to replace the drier.

1. Turn off the chiller.
2. Close the service isolation valves identified in *Figure 41 on page 110*.
3. Carefully remove any insulation on the filter driers located at the eductor block.
4. Relieve the pressure from the circuit into a suitable refrigerant recovery container. Filter driers should contain a Schraeder valve on the end for this purpose.

5. Loosen the roto lock nuts at each end of the filter driers. Remove the filter driers.
6. Replace the teflon seal washers when the filter driers are replaced.
7. Torque the roto lock nuts at each end of the three filter driers to 60 ft-lb (81 Nm).
8. Evacuate the air from the lines to 500 microns.
9. Open the three hand isolation valves.

The chiller is now ready to be placed back into service.



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FIGURE 41 - OIL EDUCTOR ASSEMBLY

Determining Correct Refrigerant Charge Level

The refrigerant charge level is correct when the condenser level is about 1 inch 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 YVWA 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 Johnson Controls office prior to removing or adding refrigerant.

REFRIGERANT CHARGING

If necessary, add refrigerant charge to the YVWA 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).

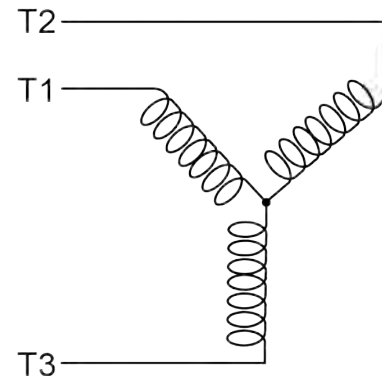
HANDLING REFRIGERANT FOR DISMANTLING AND REPAIRS

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



LD16148

FIGURE 42 - MOTOR WINDINGS DIAGRAM

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. The nominal values are listed below, but the preventive maintenance program should trend the values for gross changes.
 - 400VAC application: 24 mΩ for T1-T2, T2-T3, T3-T1.
 - 460VAC application: 40 mΩ for T1-T2, T2-T3, T3-T1.
- Use a reliable battery-powered megohm tester, which provides a consistent test voltage to test winding resistance to ground.
 - Test no greater than 500 volts.
 - 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, nor 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 YVWA 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-ring(s). Use only neoprene replacement O-rings, which can be ordered from the local Johnson Controls 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 prior to 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 water leaking 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, frequent purging will be necessary and 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. If a tube leak is indicated, the exact location of the leak may be determined as follows:

1. Allow the system to warm up until a substantial pressure is reached for testing. Dry nitrogen (pressure not to exceed 12 psig [83 kPa]) may be admitted to the unit to increase pressure in the shell. Remove the heads and listen at each tubes' section for a hissing sound that would indicate gas leakage, which will help to find the section that needs to be further investigated. If the location of the leaky tubes has been found, treat that section using the following instructions. If the location is not definite, investigate all of the tubes.
 - a. Wash off both tube heads and ends with water.



Do not use carbon tetrachloride to wash the tubes because its fumes give the same flame discoloration that the refrigerant does.

- b. 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, drive a cork into each end of the tube. Repeat this process with 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 to 12-24 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 halide torch.
- c. After the tubes have been corked for 12-24 hours, two men working at both ends of the evaporator carefully test each tube – one man removes corks at one end and the other at the opposite end removes the corks and handles the test torch. 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.
- d. Mark any leaking tubes for later identification.
- e. 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 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 the guidelines to ensure that all air, moisture and non-condensable gases are removed prior to placing the chiller into service.

The equipment required to follow this method of dehydration consists of a wet bulb indicator or vacuum gauge, a table showing the relation between dew point temperature and pressure in of mercury (vacuum) as shown in Table 26 on page 114.

Dehydration of a refrigerant system can be obtained by this method because the water present in the system reacts much as a refrigerant would. By pulling down the pressure in the system to a point where its saturation temperature is considerably below that of room temperature, heat will flow from the room through the walls of the system and vaporize the water, allowing a large 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
- Quantity of water present in the system.

TABLE 26 - SYSTEM PRESSURES

*GAUGE In OF MERCURY (HG) BELOW ONE STANDARD ATMOSPHERE	ABSOLUTE			DEW POINT TEMPERATURES OF WATER °F
	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: PSIA = Lbs. per sq. in. gauge pressure
= Pressure above atmosphere
PSIA = Lbs. per sq. in. absolute pressure
= Sum of gauge plus atmospheric pressure

To improve evacuation, 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 suggested method is to connect a hose between the source of hot water under pressure and the evaporator head drain connection, out the evaporator vent connection, into the condenser head drain and out the condenser vent. To avoid causing leaks, the temperature should be brought up slowly so that the tubes and shell are heated evenly.

If the system has been pressure tested and found to be tight prior to evacuation, then the saturation temperature recordings should follow a curve similar to the typical saturation curve as seen in *Figure 43 on page 115.*

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 nitrogen 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.

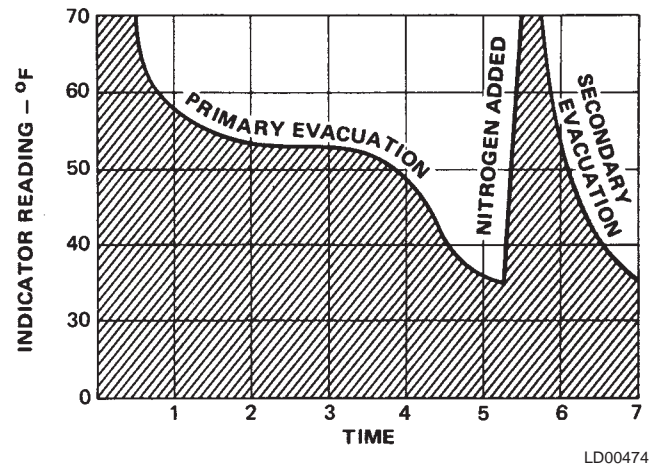
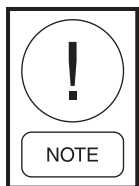


FIGURE 43 - SATURATION CURVE

Vacuum Testing

After the 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. Refer to the *Vacuum Dehydration* section on the previous page.
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. Refer to *SECTION 3 - HANDLING, STORAGE, AND INSTALLATION* 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.

- If the vacuum does not hold for eight hours within the limits specified in Step 5, find and repair the leak.

CONDENSERS AND EVAPORATORS

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

Standard construction materials for YVWA chiller condensers and evaporator are copper tubes and mild carbon steel water boxes.



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/second (1 meter/second). Tube water velocity should not exceed 12 ft/second (3.6 meter/second).

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, or 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:

- 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.
- 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 Johnson Controls 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 recommendations concerning solution cleaning strength and time duration of the cleaning process.

Commercial Acid Cleaning – If acid cleaning is required, Johnson Controls recommends using 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.

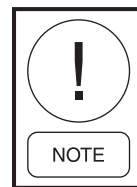


Serious damage to the condenser tubes will result if the chemical cleaning procedure is improperly applied.

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.

$$\text{Vol (gal)} = [\text{Nominal tube size (1 in)}] \\ \times 3.14 \times \text{shell length (ft)} \times \text{number of tubes.}$$

Contact a Johnson Controls 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 water boxes 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 inch ID copper condenser tubes. If tubes other than those with 5/8 inch 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 water box gasket with a new gasket, and reassemble the water box onto the condenser.

MAINTAINING COMPRESSOR

Perform maintenance on the compressor assembly by:

1. Checking the operation of the oil return system and changing the dehydrator.
2. Checking and changing the oil, and oil filters.
3. Checking the operation of the oil heater.
4. Observing 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 Johnson Controls Field Service Office.

ELECTRICAL CONTROLS

For information covering the control center operation, refer to *SECTION 6 - OPERATION* in this manual, and *Field Connections and Control Wiring for YVWA Chiller (Form 201.30-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 YORK coolant to avoid damage to the pump seals and the chiller.

1. Remove the cap on the fill tube and run the coolant pump to verify the level in the fill tube.
2. 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.
3. Run the pump by placing the chiller in SERVICE mode. Refer to *SECTION 6 - OPERATION*.
4. Add new coolant, if necessary.
5. 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 3.5 gallons (13.2 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 24 on page 105*.



If a unit fails due to improper maintenance during the warranty period, Johnson Controls will NOT be liable for costs incurred to return the system to satisfactory operation.

SECTION 8 - TROUBLESHOOTING

TROUBLESHOOTING GUIDE

Successful problem solving 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. Refer to *Table 27 on page 119* 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 ROTARY SCREW COMPRESSOR AND OIL SEPARATION SYSTEM

Troubleshooting the compressor is limited to identifying the probable cause. If a mechanical problem is suspected, contact the Johnson Controls Field Service Office. **DO NOT DISASSEMBLE COMPRESSOR.**

TABLE 27 - 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 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.

TABLE 27 - TROUBLESHOOTING GUIDE (CONT'D)

PROBLEM	POSSIBLE CAUSE	ACTION
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.	
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.	Check defective sensor.

TABLE 27 - TROUBLESHOOTING GUIDE (CONT'D)

PROBLEM	POSSIBLE CAUSE	ACTION
VSD Fault: Low DC Bus Voltage	Live 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 oil heater.	Replace oil heater.
System Fault: Oil Pressure Gradually Decreases	Oil filter is dirty.	Change oil filter.
	Extreme bearing wear.	Johnson Controls 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.	Johnson Controls 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.
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.

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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, refer to *SECTION 3 - HANDLING, STORAGE, AND INSTALLATION*.
3. Remove all refrigerant from each 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 each 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 water.
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.

Refer to *SECTION 3 - HANDLING, STORAGE, AND INSTALLATION* 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.

NOTES

The following factors can be used to convert from English to the most common metric values.

TABLE 28 - 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 (lbs)	0.4538	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: $(45.0^{\circ}\text{F} - 32^{\circ}) \times 0.5556 = 27.2^{\circ}\text{C}$

To convert a temperature range (i.e., a range of 10°F) from Fahrenheit to Celsius, multiply by 5/9 or 0.5556.

Example: $10.0^{\circ}\text{F range} \times 0.5556 = 5.6^{\circ}\text{C range}$



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