| YORK BY JOHNSON CONTROLS | WATER-COOLED SCREW LIQUID CHILLERS | |
|---|---|---|
| **INSTALLATION** | NEW RELEASE | Form 201.30-N1 (412) |

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


LD16421

## R-134a

Issue Date:
April 3, 2012

# 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.

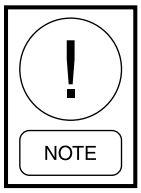
### SAFETY SYMBOLS

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 and 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

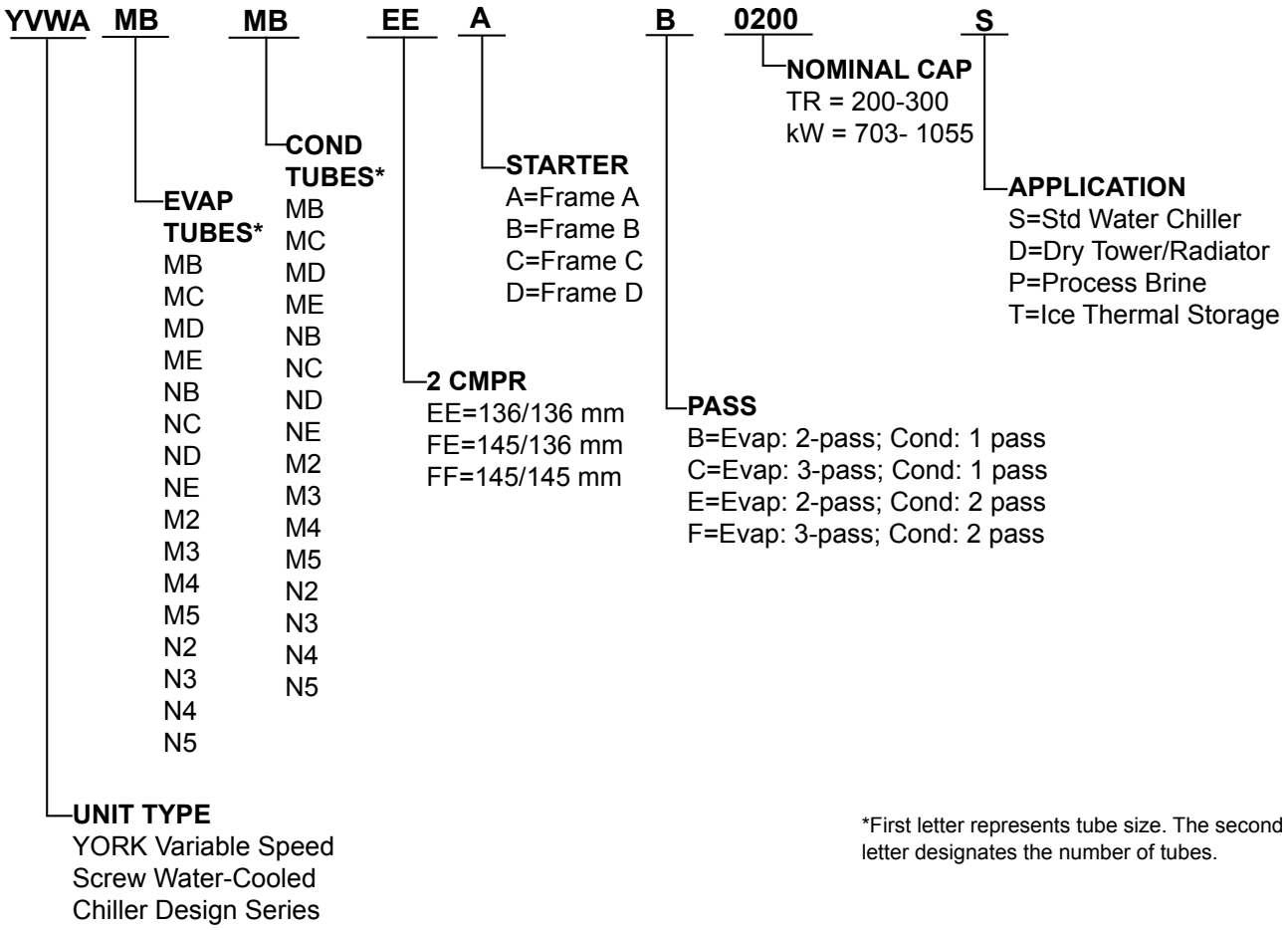
In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual owner. Updated manuals, if applicable,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

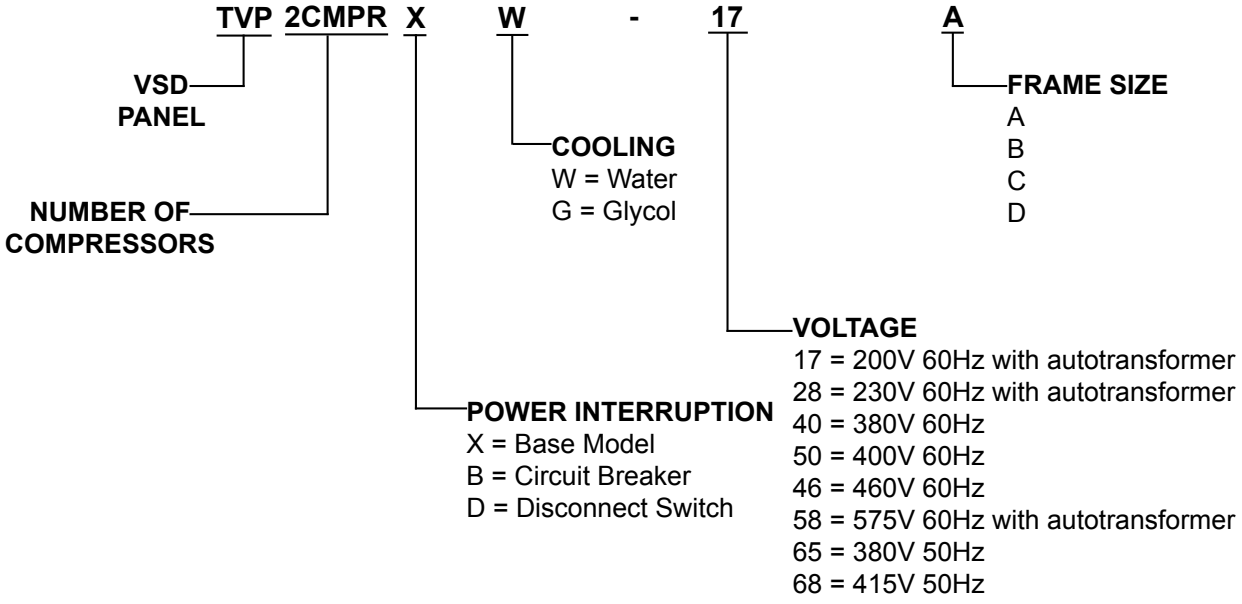
| MANUAL DESCRIPTION | FORM NUMBER |
|---|---|
| YVWA Installation, Operation, and Maintenance | 201.30-ICOM2 |
| YVWA Wiring and Field Connections | 201.30-PW2 |
| YVWA Unit Renewal Parts | 201.30-RP1 |
| YVWA Chiller Installation Checklist | 201.30-CL1 |
| YVWA Chiller Start-up Checklist and Request 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 Form | 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



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# SECTION 1 - 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.

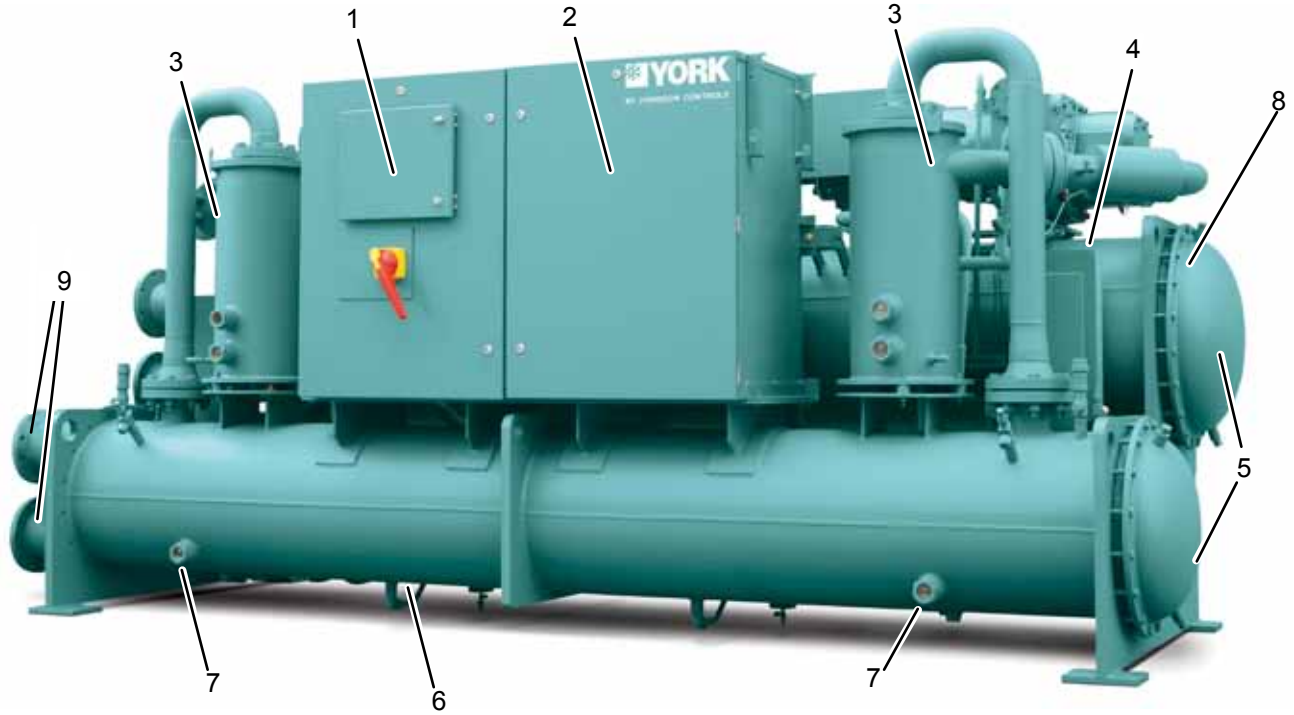
## COMPONENTS

The YVWA chiller, as shown in *Figure 1 on Page 10,* 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 (26.8 kPa) 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.

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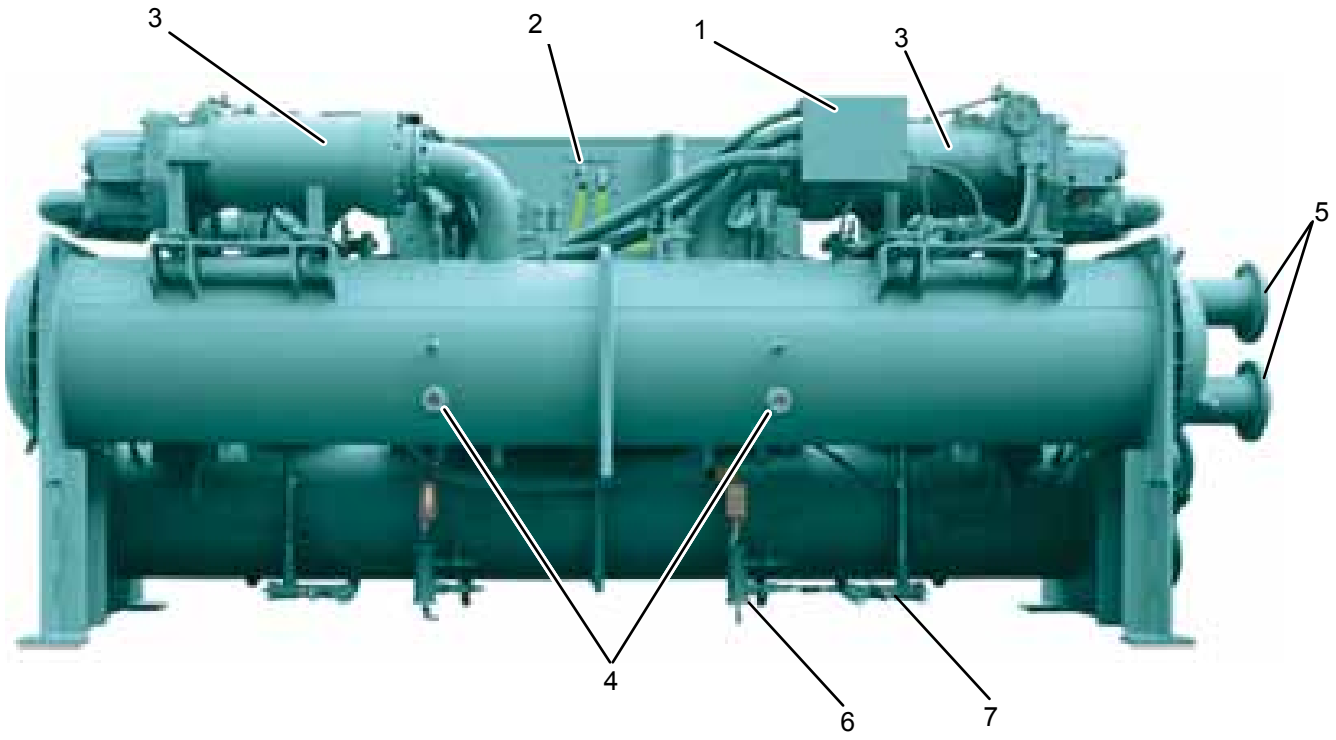
1. Control Panel
2. Variable Speed Drive (VSD)
3. Oil Separator
4. Economizer Heat Exchanger
5. Water Box
6. Condenser
7. Condenser Sight Glass
8. Evaporator
9. Condenser Nozzle

**FIGURE 1 -** 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 2 -** YVWA CHILLER MAJOR COMPONENTS (REAR VIEW)

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# SECTION 2 - 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)

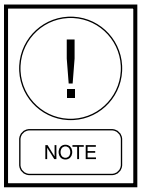
The chiller is shipped in split assemblies without the refrigerant charge, and can be specially ordered.

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.***

## RIGGING

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

Each unit has 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.***

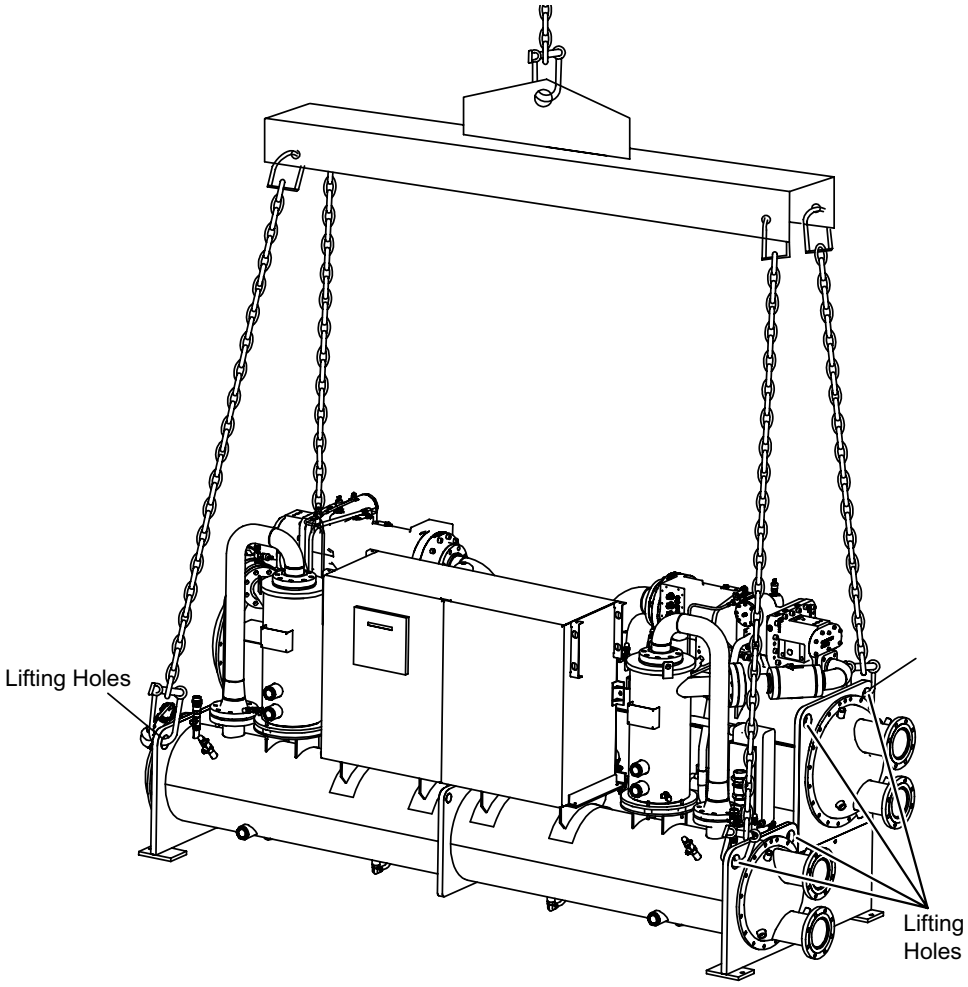



**FIGURE 3 -** UNIT RIGGING

## 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 15* 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 4 on Page 16*. 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.

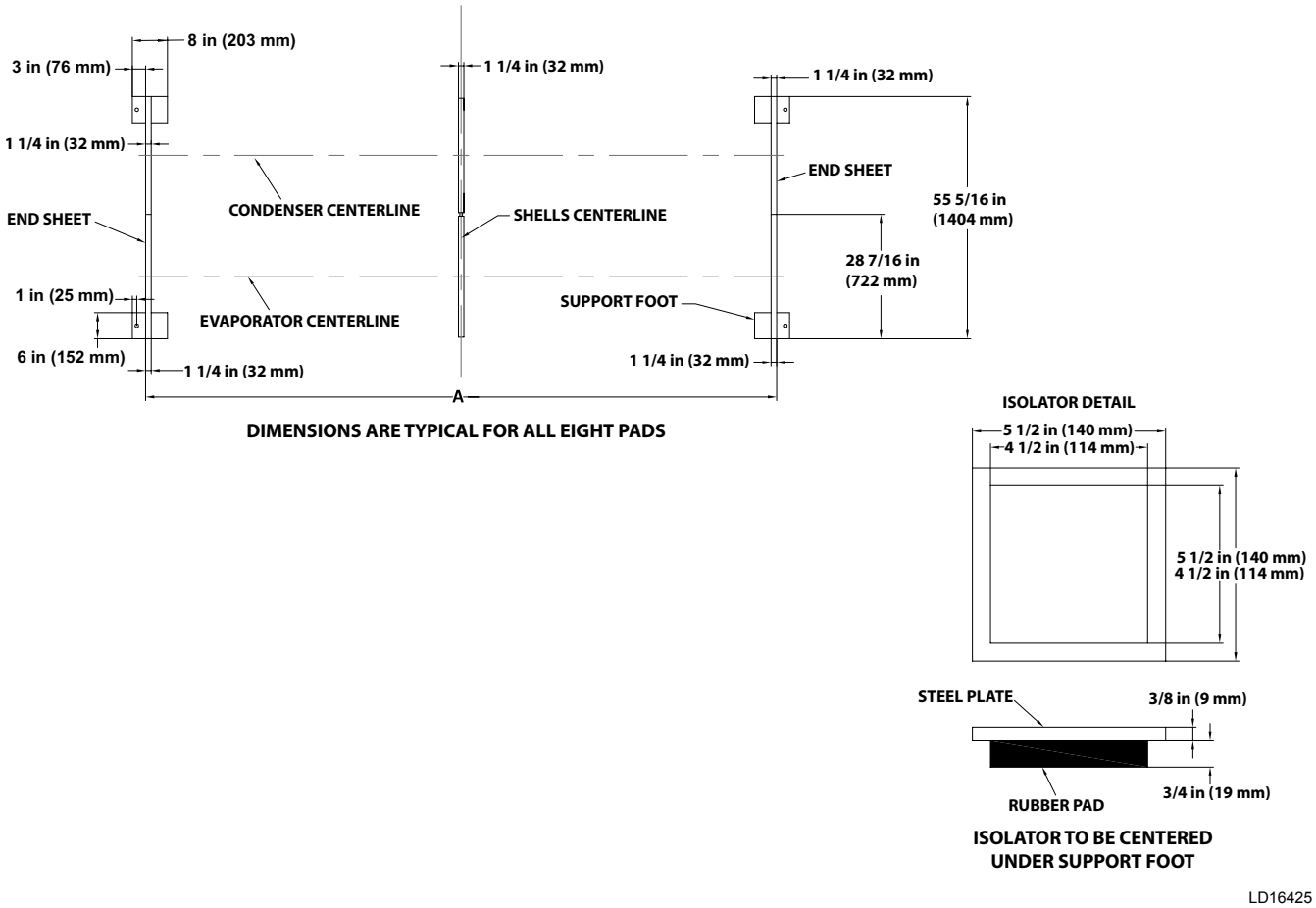



**FIGURE 4 -** STANDARD NEOPRENE VIBRATION ISOLATOR PAD MOUNTS - DIMENSIONS IN INCHES (MM)

## INSTALLING OPTIONAL SPRING ISOLATORS

If ordered, four identical spring type isolator assemblies are furnished with the unit as shown in *Figure 5 on Page 17*. 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.

NOTE

***Spring isolators are used in ASME applications; elastomeric isolators are available. Refer to*** *Figure 5 on Page 17***.**

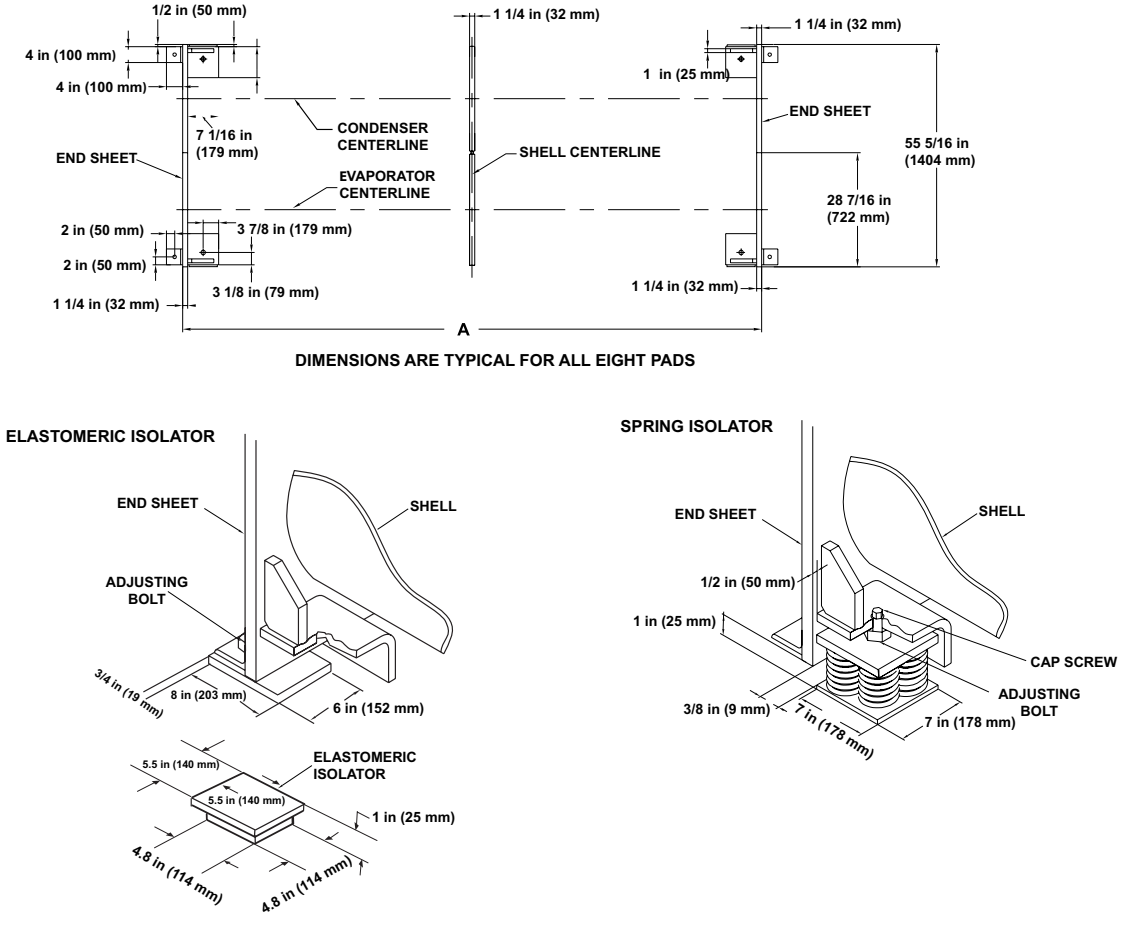



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**FIGURE 5 -** OPTIONAL SPRING ISOLATORS - DIMENSIONS IN INCHES (MM)

## 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.

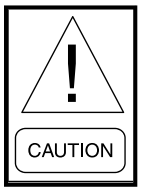

***As a precautionary measure, remove the sensors from the wells during the welding process. If the sensor is removed, make sure that it bottoms out when it is placed back in the well.***


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

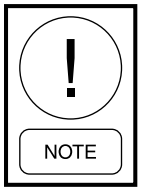
## CONDENSER AND CHILLED LIQUID PIPING

### 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.***

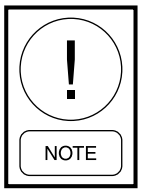
A straight run of piping of at least five pipe diameters is recommended on either side of the flow switch. The chilled liquid flow switch should be wired to Terminals 2 and 13 on the 1TB Terminal Block, and is required to prevent damage to the cooler caused by the unit operating without adequate liquid 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 6 on Page 20* is a suggested piping arrangement for single unit installations. For multiple unit installations, each unit could be piped as shown below.

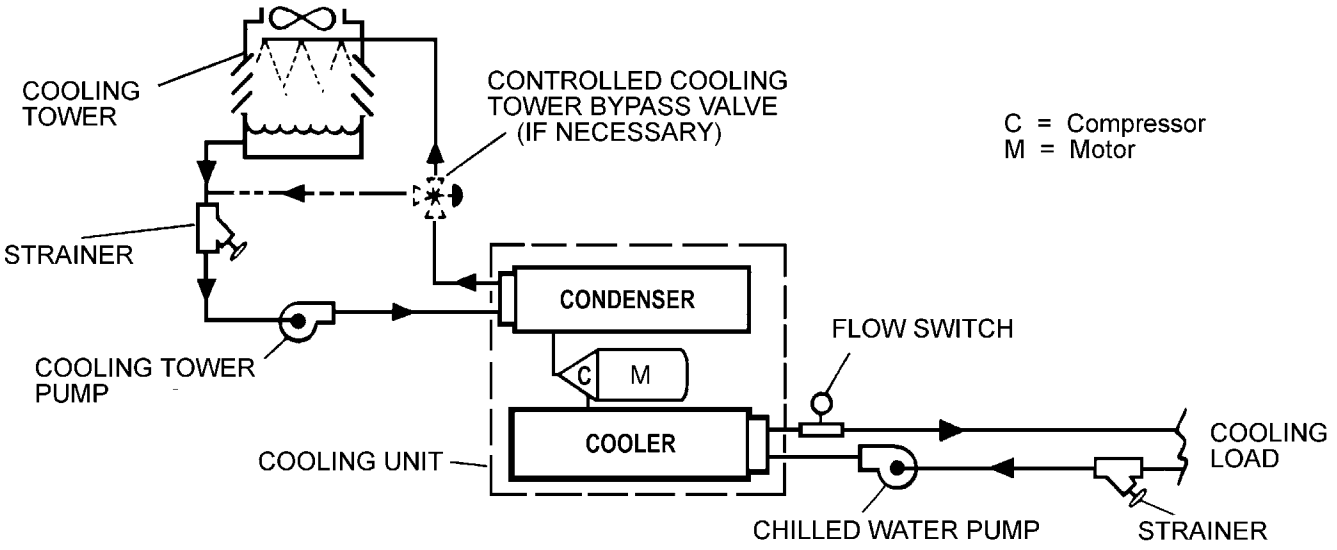



**FIGURE 6 -** SCHEMATIC OF A TYPICAL PIPING ARRANGEMENT

## MINIMUM WATER VOLUME

Include as much water volume as possible in a chilled water loop, which increases the thermal mass and flywheel 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 7 on Page 21*. A tank can also be used to meet high leaving liquid temperature requirements.

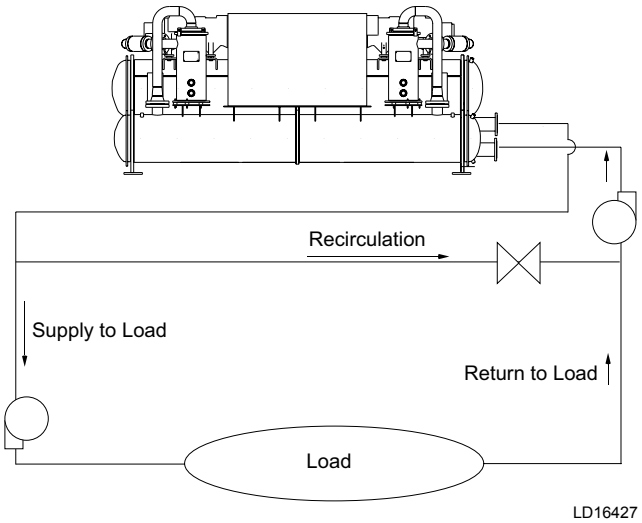



**FIGURE 7 -** LEAVING WATER TEMPERATURE OUT OF RANGE SUGGESTED LAYOUT.

## 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.

3

## NOZZLE CONNECTIONS

Standard chilled liquid connections on all coolers and condensers are the victaulic groove type as shown in *Figure 8 on Page 21*.

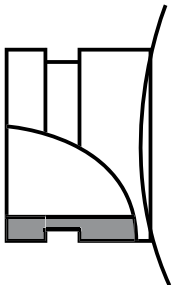



**FIGURE 8 -** VICTAULIC GROOVE

## OPTIONS FOR FLANGES

Two types of flanges may be fitted, depending on the customer or local pressure vessel code requirements as shown in *Figure 9 on Page 21*:

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

The flange dimensions are to ISO 7005 - NP10.

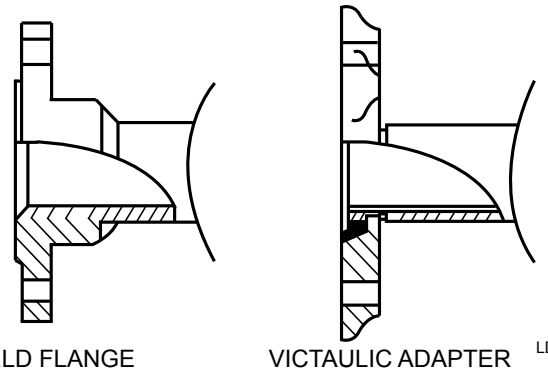



**FIGURE 9 -** FLANGE ATTACHMENT

## REFRIGERANT RELIEF PIPING

In case of an emergency, each unit is equipped with a relief valve on the evaporator, condenser and oil separators 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 23*.

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 10 on Page 22*. 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.

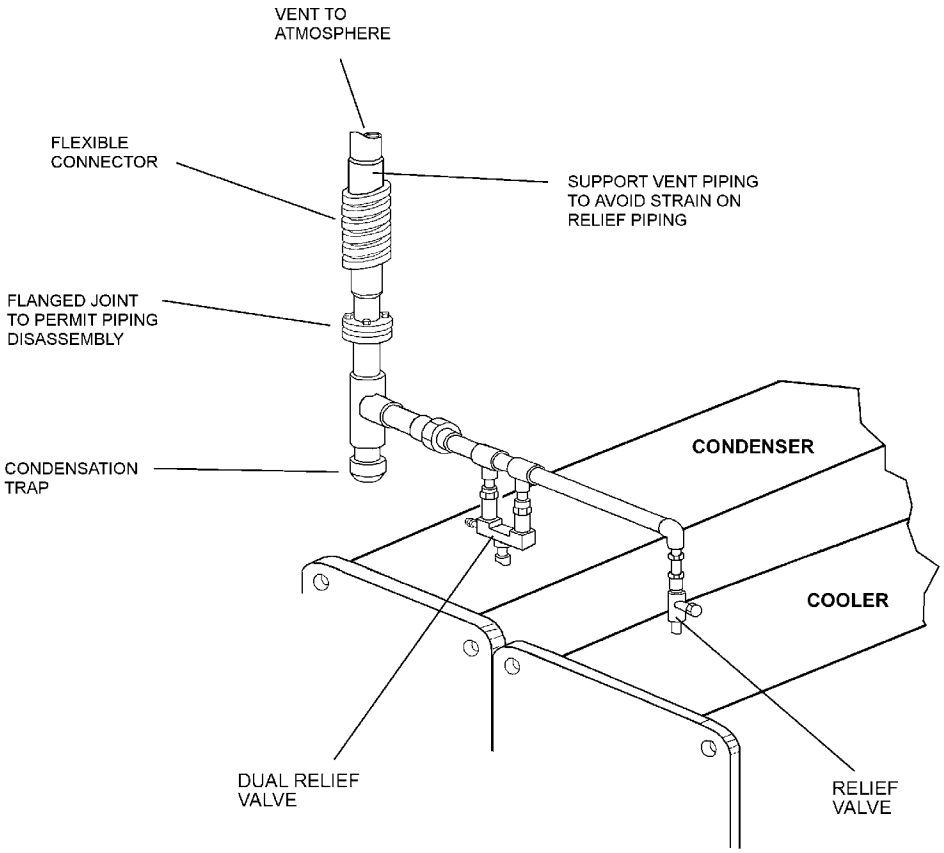



**FIGURE 10 -** TYPICAL COMPONENTS OF RELIEF PIPING

**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 25* 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 *Model YVWA Installation, Operation, and Maintenance Manual (Form 201.30-ICOM2)*.

### 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**

## 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.

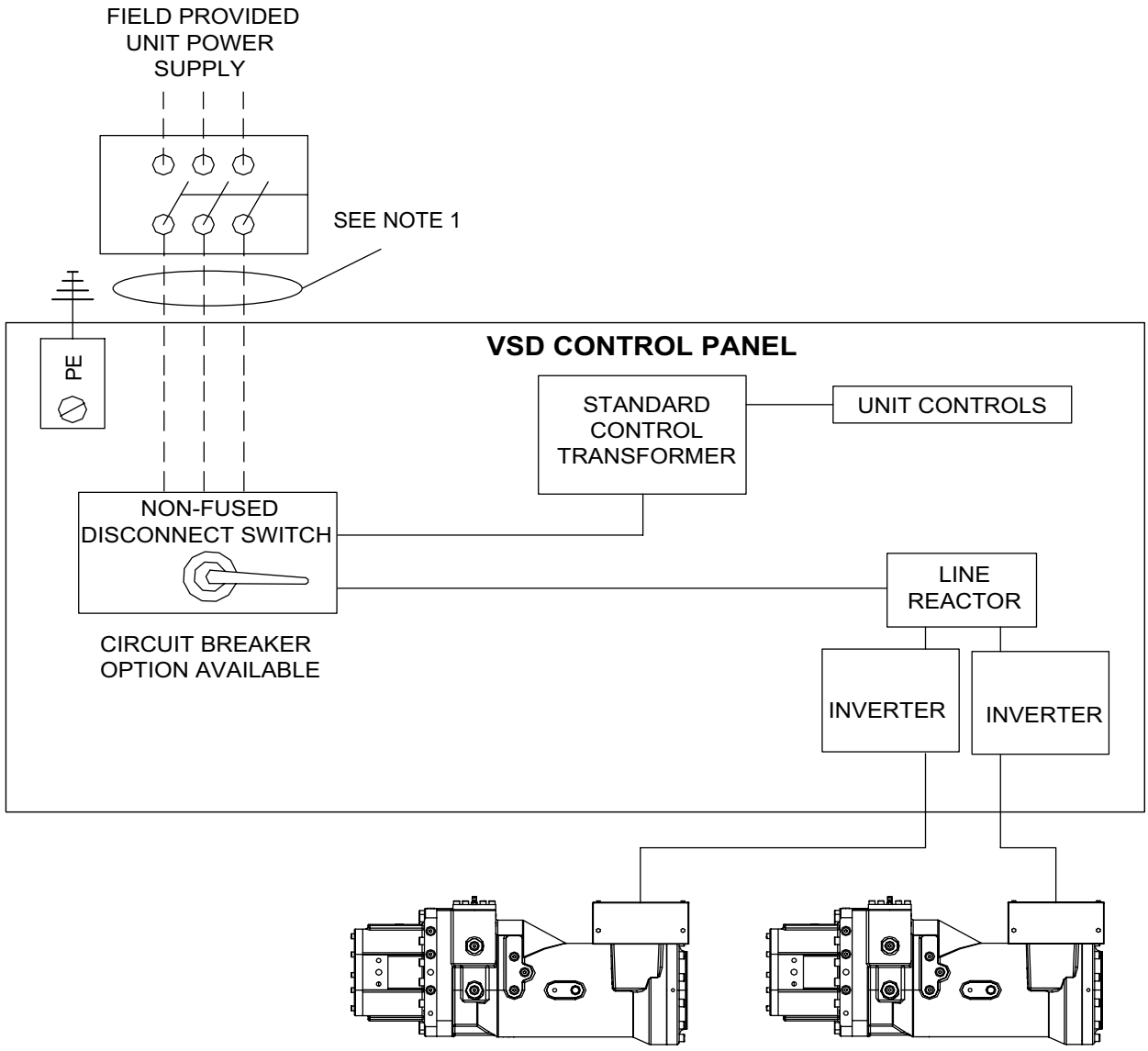
---

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 11 -** 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 mm² |
| | 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 mm² |
| | 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 mm² |
| | 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 mm² |
| | 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 |

**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 - 500kcmil² |
| | 400 | 50 | 1 | 2 | 1/0 AWG - 500kcmil |
| | 415 | 50 | 1 | 2 | 1/0 AWG - 500kcmil |
| C | 380 | 50 | 1 | 2 | 1/0 AWG - 500kcmil² |
| | 400 | 50 | 1 | 2 | 1/0 AWG - 500kcmil |
| | 415 | 50 | 1 | 2 | 1/0 AWG - 500kcmil |
| D | 380 | 50 | 1 | 2 | 1/0 AWG - 500kcmil² |
| | 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 |

# NOTES

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

**TABLE 9 -** 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°F - 32°) x 0.5556 = 27.2°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°F range x 0.5556 = 5.6 °C range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