Twin - Screw Compressor Liquid Chiller

YR

YORK®
BY JOHNSON CONTROLS

Johnson Controls

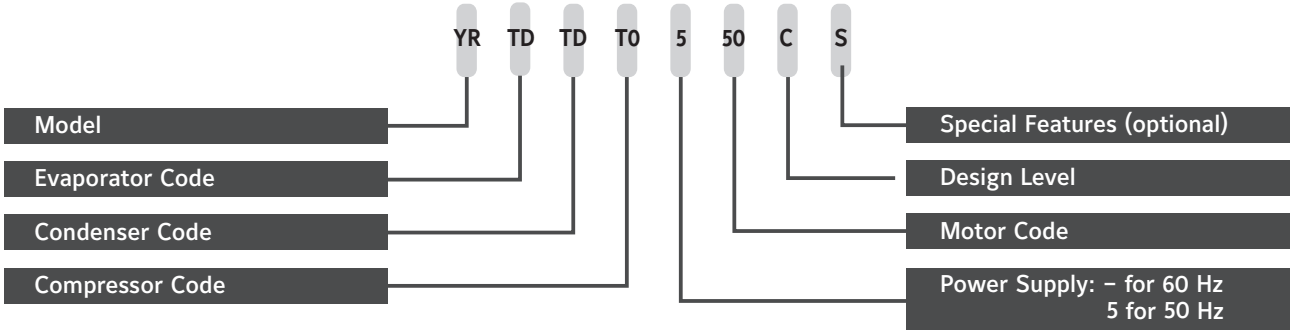
TABLE OF CONTENT

YR Chiller Design Level C - for Wuxi Production

200 through 430 tons (60Hz)
700 through 1500 kw (60Hz)
170 through 450 tons (50Hz)
600 through 1580 kw (50Hz)
Utilizing HFC - 134a

NOMENCLATURE

The model number denotes the following characteristics of the unit:



INTRODUCTION

The YORK YR Chiller offers a complete combination of features for total owner satisfaction.

MATCHED COMPONENTS MAXIMIZE EFFICIENCY

Actual chiller efficiency cannot be determined by analyzing the theoretical efficiency of any one chiller component. It requires a specific combination of heat exchanger, compressor, and motor performance to achieve the optimized system performance (IPLV/NPLV). YORK YR chiller technology matches chiller system components to provide maximum chiller efficiency under actual –not just theoretical – operating conditions.

REAL-WORLD ENERGY PERFORMANCE

"Real-World Energy" illustrates the energy-saving potential of focusing on chiller performance during off-design conditions. Off-design is not only part-load, but full-load operation as well, with reduced entering condenser water temperatures (ECWTs). This is where chillers operate 99% of the time, and where operating costs add up.

The YR chillers are the only screw chillers designed to operate on a continuous basis with reduced ECWT and full condenser flow at all load points, taking full advantage of Real-World weather conditions. This type of operation benefits the cooling tower as well; reducing cycling of the fan motor and ensuring good coverage of the cooling fill.

YORK YR chillers offer the most efficient Real-World operation of any chiller, meaning lower operating costs and an excellent return on your chiller investment.

HIGH-EFFICIENCY OIL SEPARATOR

YR Screw Chillers utilize high-efficiency oil separation, limiting oil carry-over to less than 500 ppm. Oil is vital in screw compressors for lubrication, rotor sealing and cooling. However, oil in the evaporator can lead to reduced heat transfer and reduced system performance. The high-efficiency oil separator keeps the oil in the lube circuit and maximizes heat transfer efficiency.

HIGH-EFFICIENCY HEAT EXCHANGERS

YR chiller heat exchangers offer the latest technology in heat transfer surface design to give you maximum efficiency and compact design. Waterside and refrigerant-side design enhancements minimize both energy consumption and tube fouling. The "skip-fin" design at all intermediate tube supports provides maximum tube wall thickness at the support area to extend tube life.

FACTORY PACKAGING REDUCES FIELD LABOR COSTS

YORK YR screw chillers are designed to keep installation costs low. Where installation access is not a problem, the unit can be shipped completely packaged, requiring minimal piping and wiring to complete the installation.

For those units utilizing a factory installed, the three power leads provide all power to the chiller and its auxiliaries.

TAKE ADVANTAGE OF COLDER COOLING TOWER WATER TEMPERATURES

YORK YR screw chillers are designed to take full advantage of colder cooling tower water temperatures, which are naturally available during most operating hours. Considerable energy savings are available by letting tower water temperature drop, rather than artificially holding it above 75°F (23.9°C), especially at low load, as some chillers require.

THIRD PARTY ACCEPTANCE – YOUR ASSURANCE OF RELIABILITY

YORK YR screw chillers are approved by QS and MS certifcations for mainland China and CE certification required for European Union. Recognition of safety and reliability is your assurance of trouble-free performance in day-to-day building operation.

RATINGS

Rated in accordance with the latest issue of AHRI Standard 550/590

AHRI CERTIFICATION PROGRAM

The performance of YORK YR chillers is certified to the Air Conditioning and Refrigeration Institute (AHRI) complying with the certification sections of the latest issue of AHRI Standard 550/590. Under this Certification Program, chillers are regularly tested in strict compliance with this Standard. This provides an independent, thirdparty verification of chiller performance.

YORK YR screw chillers are designed to comply with ASHRAE Standard 90.1- 00 (and earlier editions). The superior part-load performance of the YORK YR chillers far exceeds the IPLV/NPLV requirements of ASHRAE 90.1, providing superior Real World Energy savings for efficiency conscious owners.

COMPUTERIZED PERFORMANCE RATINGS

Each chiller is custom-matched to meet the individual building load and energy requirements. A large number of standard heat exchangers and pass arrangements are available to provide the best possible match.

It is not practical to provide tabulated performance for each combination, as the energy requirements at both full- and part-load vary significantly with each heat exchanger and pass arrangement. Computerized ratings are available through each Johnson Controls sales office. These ratings can be tailored to specific job requirements, and are part of the AHRI Certification Program.

OFF-DESIGN PERFORMANCE

Since the vast majority of its operating hours are spent at off-design conditions, a chiller should be chosen not only to meet the fullload design, but also for its ability to perform efficiently at lower loads and lower tower water temperatures. It is not uncommon for chillers with the same full-load kW/TON to have an operating cost difference of over 10% due to part-load operation.

Part-load information can be easily and accurately generated by computer. And because it is so important to an owner's operating budget, this information is now standard within the ARI Certification Program in the form of an Integrated Part-Load Value (IPLV), and Non-Standard Part-Load Value (NPLV).

The IPLV/NPLV formulas from AHRI Standard 550/590 closely track chiller operations, and provide a more accurate indication of chiller performance than the previous IPLV/NPLV formula. A more detailed analysis must take into account actual building load profiles, and local weather data. Part-load performance data should be obtained for each job using its own design criteria.

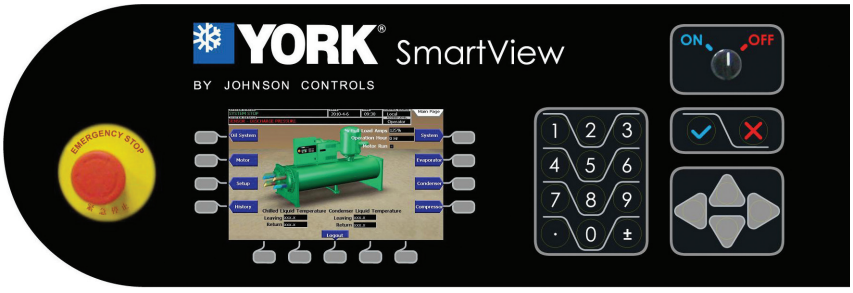
SMARTVIEW CONTROL CENTER

The YORK SmartView Graphic Display Control Center, furnished as standard on each chiller, provides the ultimate in efficiency, monitoring, data recording, chiller protection and operating ease. The control center is a factory-mounted, wired and tested state-of-the-art microprocessor based control system for R-134a screw chillers. The panel is configured with a 7 inch diagonal color liquid Crystal Display(LCD) surrounded by "soft" keys, which are redefined with one keystroke based on the screen display at that time. This revolutionary development makes chiller operation quicker and easier than ever before. Instead of requiring keystroke after keystroke to hunt for information on a small monochrome LCD screen, a single button reveals a wide array of information on a large, full-color illustration of the appropriate component, which makes performance and operation easier to monitor. This is all mounted in the middle of a keypad interface and installed in a locked enclosure.

The LCD display allows graphic animated display of the chiller, chiller sub-systems and system parameters; this allows the presentation of several operating parameters at once. In addition, the operator may view a graphical representation of the historical operation of the chiller as well as the present operation. A Status Bar is displayed at all times on all screens. It contains the System-Status Line and Details Line, the Control Source, Access Level, Date and Time.

During the Start Sequence and System Lockout Delay, the system status will include a countdown timer indicating the time remaining. The control panel is compatible with the YORK Solid State Starter (optional), Electro-mechanical (E-M) starter, or any customer supplied E-M starter that complies with the Johnson Controls R-11 1 standard. The locations of various chiller parameters are clearly marked and instructions for specific operations are provided. The panel verbiage is available in English or Chinese. Data can be displayed in either English or Metric units, plus Number key to enter setpoint or Up Down key to change setpoint value.

Security access is provided to prevent unauthorized change of setpoints. This is accomplished with three different levels of access and passwords for each level. There are screens, displayed values, programmable setpoints and manual controls only available with service level access to the chiller.



They are only displayed when logged in at the service access level. The Advanced Diagnostics and troubleshooting information for the chiller and the panel is also included at this access level.

The panel is fused through a 1-1/2 KVA transformer in the compressor motor starter to provide individual over-current protected power for all controls. Numbered terminal strips for wiring such as Remote Start/Stop, Flow Switch, Chilled Water Pump and Local or Remote Cycling Device are provided. The Panel also provides field interlocks that indicate the chiller status. These contacts include a Remote Mode Ready To Start, a Cycling Shutdown, a Safety Shutdown and a chiller Run Contact. Pressure transducers sense system pressures and thermistors sense system temperatures. The output of each transducer is a DC voltage that is analogous to the pressure input. The output of each thermistor is a DC voltage that is analogous to the temperature it is sensing.

SmartView Control Center is standard with MODBUS protocol internally. Setpoints can be changed from a remote location via contact closures or through serial communications. The adjustable remote reset range [up to 20°F (11.1°C)] provides flexible, efficient use of remote signal depending on reset needs. Serial data interface to the Johnson Controls Metasys System (BAS) is required through a micro gateway.

The operating program is stored in nonvolatile memory to eliminate chiller failure due to AC power failure.Programmed setpoints are retained in non-volatile memory RTC memory for 5 years minimum.

Thermal ice storage systems are based on the concept of using off-peak, lower cost electricity to build ice for handling the cooling load during peak hours. The most efficient way to build ice is to maximize chiller load and minimize run time. Standard chiller control systems are not designed for this operating mode. In a typical application, chillers will load and unload to maintain a leaving chilled liquid setpoint. When the YORK YR chiller operates in the thermal storage control mode, the unit will remain at 100% load until the setpoint shutdown temperature is reached. To add greater operating flexibility and eliminate unnecessary chiller cycling, two different Low Water (Liquid) Temperature Restart Thresholds can be programmed, one for the ice mode and one for the standard cooling mode. This control enhancement is standard on all YR chillers. The chiller can also be left in the standard control mode for temperatures ranging between 20 and 70°F (-6.7 and 21.1°C), for applications involving a process or comfort cooling duty that requires leaving chilled liquid temperature setpoint control.

When power is applied to the chiller, the HOME screen is displayed. This screen displays a visual representation of the chiller and a collection of data detailing important operations and parameters. When the chiller is running, the flow of chilled liquid is animated by the alternating shades of color moving in and out of the pipe nozzles. The primary values that need to be monitored and controlled are shown on this screen. They are as follows:

Display Only:

- Chilled Liquid Temperature – Leaving
- Chilled Liquid Temperature – Return
- Condenser Liquid Temperature – Return
- Condenser Liquid Temperature – Leaving
- Motor Run (LED)
- % Full-load Amps
- Operating Hours

With the "soft" keys the operator is only one touch away from the 8 main screens that allow access to the major information and components of the chiller. The 8 screens are the SYSTEM, EVAPORATOR, CONDENSER, COMPRESSOR, OIL SYSTEM, MOTOR,

SETUP, and the HISTORY. Also on the Home Screen is the ability to Log IN and Log OUT. Log In and Log Out is the means by which different security levels are accessed.

The SYSTEM screen gives a general overview of common chiller parameters for both shells. This is an end view of the chiller with a 3-D cutaway of both the shells. The following can be viewed from this screen:

Display Only:

- Discharge Temperature
- Chilled Liquid Temperature – Leaving
- Chilled Liquid Temperature – Return
- Evaporator Pressure
- Evaporator Saturation Temperature
- Condenser Liquid Temperature – Leaving
- Condenser Liquid Temperature – Return
- Condenser Pressure
- Condenser Saturation Temperature
- Differential Oil Pressure
- % Full-load Amps
- Current Limit

The EVAPORATOR screen displays a cutaway view of the chiller evaporator. All setpoints relating to the evaporator side of the chiller are maintained on this screen. Animation of the evaporation process indicates whether the chiller is presently in RUN condition (bubbling) and liquid flow in the pipes is indicated by alternating shades of color moving in and out of the pipes. Adjustable limits on the low water temperature setpoints allow the chiller to cycle on and off for greater efficiency and less chiller cycling. The chiller cycles off when the leaving chilled water temperature is below setpoint and is adjustable from 1°F (0.55°C) below to a minimum of 39°F (21.6° C). Restart is adjustable from setpoint up to a max. of 80°F (26.6°C). The Panel will check for flow to avoid freezeup of the tubes. If flow is interrupted, shutdown will occur after a minimum of two seconds. The following can also be performed through this screen:

Display Only:

- Chilled Liquid Flow Switch (Open/Closed)
- Chilled Liquid Pump (Run/Stop)
- Evaporator Pressure
- Evaporator Saturation Temperature
- Return Chilled Liquid Temperature
- Leaving Chilled Liquid Temperature
- Small Temperature Difference
- Leaving Chilled Liquid Temperature Setpoints – Setpoint
- Leaving Chilled Liquid Temperature Setpoints – Shutdown
- Leaving Chilled Liquid Temperature Setpoints – Shutdown Offset
- Leaving Chilled Liquid Temperature Setpoints – Restart
- Leaving Chilled Liquid Temperature Setpoints – Restart Offset

Programmable:

- Local Leaving Chilled Liquid Temperature – Setpoint
- Leaving Chilled Liquid Temperature Cycling Offset – Shutdown
- Leaving Chilled Liquid Temperature Cycling Offset – Restart

The CONDENSER screen displays a cutaway view of the chiller condenser. The liquid flow is animated to indicate flow through the condenser. All setpoints relating to the condenser side of the chiller are maintained on this screen. With the proper access level this screen also serves as a gateway to controlling the Refrigerant Level. The following can also be viewed through this creen:

Display Only:

- Leaving Condenser Liquid Temperature
- Return Condenser Liquid Temperature
- Condenser Pressure
- Condenser Saturation Temperature
- Small Temperature Difference
- High Pressure Switch (Open/Closed)
- Condenser Liquid Flow Switch
- Condenser Liquid Pump (Run/Stop)

Programmable:

- High Pressure Warning Threshold
- Freeze Warning(enable/disable)

The COMPRESSOR screen displays a cutaway view of the chiller compressor, revealing the rotary screw, and shows all conditions associated with the compressor. The slide valve positioning is animated and with the proper Access level, it can be manually controlled. Animation of the compressor rotors indicates whether the chiller is presently in a RUN condition. This screen also serves as a gateway to sub-screens for calibrating the slide valve or configuring the optional Hot Gas Bypass. From this screen you can view the following:

Display Only:

- Differential Oil Pressure
- Oil Temperature
- Discharge Temperature
- Discharge Superheat
- Low Superheat Event
- Low Superheat Run Time
- Oil Return Solenoid (LED)
- Liquid Injector (LED)
- Oil Return Solenoid (LED)
- Full-load Amps
- Slide Valve Control mode

Programmable:

- Slide Valve Load (Manual)
- Slide Valve Hold (Manual)
- Slide Valve Unload (Manual)
- Slide Valve Auto
- Max. Load Temperature
- Minimum Load FLA
- Liquid Injector threshold

The HOT GAS BYPASS screen, accessed from the COMPRESSOR screen(only Hot gas bypass is enable), displays a pictorial of the bypass line and solenoid valve location on the chiller. The Hot Gas ON and OFF Setpoints are programmed on this screen and system parameters pertinent to Hot Gas Bypass operation are displayed. An LED illuminates when the Hot Gas solenoid is ON. If the chiller is equipped with the Hot Gas Bypass option, operation must be enabled on the OPERATIONS screen. From this screen you can perform the following:

Display Only:

- Return Chilled Liquid Temperature
- Leaving Chilled Liquid Temperature Setpoint
- Hot Gas Solenoid (LED)

Programmable:

- on setpoint
- off setpoint

The OIL SYSTEM screen displays a close-up view of the chiller oil separator/sump.

Display Only:

- Discharge Temperature
- Discharge Superheat
- Oil Pressure
- Discharge Pressure
- Differential Oil Pressure
- Differential Filter Pressure
- Oil Return Solenoid (LED)
- Evaporator Pressure
- Condenser Pressure
- Condenser Saturation

Programmable:

- Auto Zero

The MOTOR “soft” key on the HOME

screen, when pressed, shows a picture of either a YORK Electro-Mechanical Starter or a Solid State Starter, depending on chiller configuration. The Programmable pulldown demand to automatically limit motor loading can be used to minimize building demand charges. Pulldown time period control over four hours, and verification of time remaining in pulldown cycle from display readout. Separate digital setpoint for current limiting between 30 and 100%.

The ELECTRO-MECHANICAL STARTER (E-M) screen displays a picture of the starter and the following values. The ones below are common among both offerings and the values will be displayed on both types of starter screens. From this screen you can perform the following:

Display Only:

- Motor Run (LED)
- Motor Current % Full-load Amps
- Current Limit Setpoints

Programmable:

- Current Limit
- Pulldown Demand Limit
- Pulldown Demand Time

The SOLID STATE STARTER (SSS) screen displays a picture of the starter and the following values, which are displayed in addition to the common ones listed above. From this screen, you can perform the following:

Display Only:

- Input Power kW
- kW Hours
- Starter Model
- Voltage – Phase A, B, C
- Current – Phase A, B, C
- Temperature – Phase A, B, C

Programmable:

- Full-load Amps
- Voltage Range
- Starting Current
- Open SCR
- Shorted SCR
- kWH Reset

The SETUP is the top level of the general configuration parameters. It allows programming of the time and date. From this screen you can perform the following:

Display Only:

- Refrigerant Selection (Displays R134A or R22)
- Liquid Type (Displays Water or Brine)
- Chilled Liquid Pump Operation (Displays Standard or Enhanced)
- Motor Drive Type (Displays EM or SSS)
- Anti-Recycle (Displays Disabled or Enabled)
- Metric Or English (Displays English or Metric)
- Phase Rotation Protection (Displays Disable or Enable)
- Right time limit (Displays Disable or Enable)

Programmable:

- Set Date
- Set Time
- Ctrl Field(Local/Remote)

The following Seven subscreens can be accessed from the SETUP screen:

The SCHEDULE screen contains more programmable values than a normal display screen. Each programmable value is not linked to a specific button; instead, the select key is used to enable the cursor arrows and check key to program the Start/Stop times for any day of the week. The user has the ability to define a standard set of Start/Stop times that are utilized every week or specify exceptions to create a special week.

Programmable:

- Sch Enable (Enable/Disable)
- Repeat(Enable/Disable)
- Repeat Sunday Schedule
- Reset All Exception Days
- Select

The USER screen allows definition of custom User ID's and matching passwords. This allows the building administrator to administrator to assign custom passwords to those who are authorized to maintain the chiller.

Programmable:

- Change user

The COMMS screen allows the user to define communications parameters.

Programmable:

- Config Net
- Chiller ID

The SALES ORDER screen allows definition of the order parameters. Note: This information is loaded at the factory or by the installation service technician.

Display Only:

- Commissioning Date
- Job Name
- Job Location
- Model Number
- York Order number
- Panel Serial Number
- Chiller Serial Number
- Model Number
- Voltage
- Phase
- Frequency(Hz)
- LRA
- Full Load Amps
- Inrush Amps
- Passes
- Working Pressure
- Fouling Factor
- Pressure Drop
- Nozzle Arrangement In
- Nozzle Arrangement Out
- Leaving Temperature
- Return Temperature
- GPM
- Refrigerant
- Tons
- Gear Code
- Liquid Type
- Brine Percent
- VSD/SSS/EM
- KW Input

The DIAGNOSTICS screen allows diagnostic capability of AI, DI and DO.

Programmable:

- DO Test

The OPERATOR screen permits definition of parameters pertaining to operation of the chiller.

Programmable:

- Work Hour
- Language (English/Chinese)
- Hot Gas (Disable/Enable)
- Level Ctrl (Disable/Enable)
- Start Times
- Restore Default

The HISTORY screen allows the user to browse through the last fifty faults; either safety or cycling shutdowns with the conditions, while the chiller is running or stopped.

Display Only

- Last Normal Shutdown
- Last Fault While Running
- Last Fifty Faults

Programmable:

- History record
- List Fault
- Trend
- SD Copy
- Update Order
- Last Page
- Next Page

Also under the HISTORY screen is the TRENDING screen, accessible by the key marked the same. On this screen, up to ten appointed parameters, can be plotted in an X/Y graph format. The graph can be customized to record points once every second up to once every hour. The single screen chart collects data for one screen width (450 data points across the X-axis), then stops. For ease of identification, each plotted parameter, title and associated Y-axis labeling is color coordinated.

Display Only:

- This screen allows the user to view the graphical trending of the selected parameters and is a gateway to the graph setup screens.

Programmable:

- Start
- Stop
- Time Cycle
- X Position
- Y Position
- Select Cur

DISPLAY MESSAGES

The Control Center continuously monitors the operating system, displaying and recording the cause of any shutdowns (Safety, Cycling or Normal). The condition of the chiller is displayed at the System Status line that contains a message describing the operating state of the chiller; whether it is stopped, running, starting or shutting down. A System Details Line displays Warning, Cycling, Safety, Start Inhibit and other messages that provide further details of the Status Bar messages. Messages are colorcoded: Green – Normal Operations; Yellow – Warnings; Orange – Cycling Shutdowns; and Red – Safety Shutdowns to aid in identifying problems quickly.

Status messages include:

- System Ready To Start
- Cycling Shutdown – Auto Restart
- Safety Shutdown – Manual Restart
- Start Sequence Initiated
- System Run (with countdown timers)
- Start Inhibit
- Slide Valve Closing Before Shutdown
- System Lockout Delay

Run Messages include:

- Leaving Chilled Liquid Control
- Motor Pulldown Limit
- Motor – High Current Limit

Start Inhibit Messages include:

- Motor Current >15% FLA
- LCSSS – High-Temperature Phase X - Stopped

Warning Messages include:

- Real Time Clock Failure
- Setpoint Override
- Condenser – High Pressure Limit
- Evaporator – Low Pressure Limit
- Freeze Threat, Condenser Flow Switch Open
- Low Discharge Superheat Limit
- Low Discharge Superheat Detected
- Maximum Load – Load Limit
- Minimum Load – Load Limit
- Oil – Dirty Filter
- Oil – High Temperature

Routine Shutdown Messages Include:

- Remote Stop
- Local Stop
- Place Compressor Switch In Run Position

Cycling Shutdown Messages Include:

- Multiunit Cycling – Contacts Open
- System Cycling – Contacts Open
- Control Panel – Power Failure
- Leaving Chilled Liquid – Low Temperature
- Leaving Chilled Liquid – Flow Switch Open
- Condenser – Flow Switch Open
- Motor Controller – Contacts Open
- Motor Controller – Loss of Current
- Power Fault
- Control Panel – Schedule

Solid State Starter Only (LCSSS)

- Initialization Failed
- Serial Communications
- Requesting Fault Data
- Stop Contacts Open
- Power Fault
- Low Phase (X) Temperature Sensor
- Run Signal
- Invalid Current Scale Selection
- Phase Locked Loop
- Low Supply Line Voltage
- High Supply Line Voltage
- Logic Board Processor
- Logic Board Power Supply
- Phase Loss

Safety Shutdown Messages include:

- Evaporator – Low Pressure
- Evaporator – Transducer or Leaving Liquid Probe
- Evaporator – Transducer or Temperature Sensor
- Condenser – High Pressure Contacts Open
- Condenser – High Pressure
- Condenser – Pressure Transducer Out of Range
- Auxiliary Safety – Contacts Closed
- Discharge – High Temperature
- Discharge – Low Temperature
- Oil – Low Differential Pressure
- Oil or Condenser Transducer Error
- Oil – Clogged Filter
- Oil – High Pressure
- Control Panel – Power Failure
- Watchdog – Software Reboot

Solid State Starter Only (LCSSS)

- Shutdown – Requesting Fault Data . . .
- High Instantaneous Current
- High Phase (X) Heatsink Temperature – Running
- 105% Motor Current Overload
- Motor or Starter – Current Imbalance
- Open SCR
- Phase Rotation

MECHANICAL SPECIFICATIONS

GENERAL

Each YORK YR Screw Chiller will be completely factory-packaged including evaporator, condenser, compressor, motor, SmartView control center and all interconnecting unit piping and wiring. The chiller will be painted prior to shipment and will be packaged to protect the unit during shipment.

Performance will be certified in accordance with AHRI Standard 550/590.

The initial charge of refrigerant and oil will be supplied for each unit.

DRIVELINE

The compressor will be twin-screw, rotaryscrew type. The compressor housing will be of cast iron, precision machined to provide minimal clearance for the rotors. The rotors will be manufactured from forged steel and use asymmetric profiles operating at a maximum speed of 570 RPM (60 Hz) or 975 RPM (50 Hz). The compressor will incorporate a complete anti-friction bearing design to reduce power and increase reliability; cylindrical roller bearings to handle radial loads; and point angular contact ball bearings to handle axial loads. The compressor will have an internal oil reservoir to assure a constant supply of oil to the bearings at all times. A check valve will be incorporated to prevent rotor backspin during shutdown.

Capacity control will be achieved by use of a slide valve to provide fully modulating control from 100% to 0% of full-load. The slide valve will be actuated by system differential pressure, controlled by external solenoid valves through the SmartView control center. The unit will be capable of operating with off-design cooling tower water during part-load operation in accordance with AHRI Standard 550/590.

The motor will be -pole, continuous-duty, cage-induction type, and will utilize suction gas cooling (semi-hermetic design). Motor full-load amperes at design conditions will not exceed chiller nameplate (FLA). Motor will be designed for use with the type starter specified.

LUBRICATION SYSTEM

An adequate supply of oil will be available to the compressor at all times. During operation, oil will be delivered by positive system pressure differential.

An immersion oil heater will be provided, (temperature actuated), to effectively remove refrigerant from the oil during the chiller off-cycle. An external, replaceable cartridge, oil filter will be provided, along with manual isolation stop valves for ease of servicing. An oil eductor will be provided to automatically remove oil which may have migrated to the evaporator, and return it to the compressor. The oil separator will be of a vertical design with no moving parts, and will provide high-efficiency oil separation before the refrigerant enters the heat exchangers. The oil separator will be designed, tested in accordance with China pressure vessel standards. Liquid refrigerant injection will be provided to maintain satisfactory oil temperatures and allow operation of the chiller over the full range of conditions.

EVAPORATOR

The evaporator is a shell and tube type with customer process fluid flowing inside the tubes and refrigerant removing heat on the shell side via evaporation. Evaporators with T0/T1/T2/T3 and R2/R3 60Hz compressor are flooded type. The heat exchanger tubes are located in the lower half of the shell, along with the refrigerant liquid distribution system. This offers uniform liquid distribution of refrigerant, throughout the shell length, to yield optimum refrigerant side heat transfer. To remove the liquid droplets from the vapor, the space above the tube bundle is for liquid vapor separation; it contains a baffled suction chamber with slots in the baffle, controlling the vapor flow into the suction connection.

Evaporators with R2/R3/T4 50Hz compressor utilize a hybrid falling film design. It contains a balance of flooded and falling film technology to optimize efficiency, minimize refrigerant charge, and maintain reliable control. A specifically designed spray distributor provides uniform distribution of refrigerant over the entire length to yield optimum heat transfer. The hybrid falling film evaporator design has suction baffles around the sides and above the falling film section to prevent liquid refrigerant carryover into the compressor.

The shell is fabricated from carbon steel, rolled plate, with fusion welded seams, or for the smaller sizes, carbon steel pipe; it has carbon steel tube sheets with drilled, and reamed holes to accommodate the heat exchanger tubes; 1/2 inches (12.7mm) thick, carbon steel, intermediate tube supports, spaced no more than four feet (1.22m) apart, are provided to support

the tubes between the tube sheets. The refrigerant side is designed for a maximum working pressure of 5 psig (1620 kPa); it is designed, tested in accordance with China pressure vessel standards. The cooler shell will have a refrigerant relief valve assembly, to meet the requirements of GB151 code. Heat exchanger tubes are high efficiency, internally and externally enhanced type of seamless copper alloy; tubes have plain copper lands at all intermediate support, to provide maximum wall thickness at all the supported tube area. Tubes are 0.75 inch (19.1 mm) O.D., nominal 0.025 inches (0.635 mm) wall thickness and are individually replaceable. Each tube is roller expanded, into a 1-1/2 inch (3.79 cm) thick steel tube sheet, providing a leak proof seal. Water velocity through the tubes will not exceed 12 ft. per sec (3.66 m/sec). A 2-1/4 inch (5.72 cm) diameter, glass sight port is located on the side of the shell, to aid in establishing the R-134A liquid level, for the proper YR Unit refrigerant charge. The R-134A, 3/4 inch (19.1 mm) charging valve is located in the liquid line below the evaporator.

Water boxes will be removable to permit tube cleaning and replacement. Stubout water connections having flanges provided. Vent and drain connections with plugs will be provided on each water box.

CONDENSER

Condenser will be horizontal shell and tube type, with a discharge gas baffle to prevent direct high velocity gas impingement on the tubes, and distribute the gas flow. An integral refrigerant sub-cooler is located under the condensing tube bundle section for improved thermodynamic cycle efficiency. Baffles direct the liquid refrigerant flow back-and-forth, across the sub-cooler tubes, as it travels the length of the shell. The shell if fabricated from carbon steel, rolled plate, with fusion welded seams, or for the smaller sizes, carbon steel pipe; it has carbon steel tube sheets with drilled, and reamed holes to accommodate the heat exchanger tubes; 3/8 inch (9.53 mm) thick, carbon steel, intermediate condenser tube supports, spaced no more than four feet (1.22 m) apart, are provided to support the tubes between the tube sheets. The refrigerant side is designed for a maximum working pressure of 235 psig (1620 kPa), it is designed, tested in accordance with China pressure vessel standards. The condenser shell will have a refrigerant relief valve assembly, to meet the requirements of GB151 code. Heat exchanger tubes are high efficiency, internally and externally enhanced types of seamless copper alloy; tubes have plain copper lands at all intermediate tube supports, to provide maximum wall thickness at the supported tube area. Tubes are 0.75 inch (19.1 mm) O.D., nominal 0.025 inch (0.635 mm) wall thickness and are individually replaceable. Each tube is roller expanded, into one inch (2.54 cm) thick steel tube sheet, providing a leak proof seal. Water velocity through the tubes will not exceed 12 ft. per sec. (3.66 m/sec.).

WATER BOXES

The compact style water boxes for the cooler, and condenser heat exchangers, are removable (bolted-on) at the tube sheet, to permit direct access for tube inspection, mechanical tube cleaning, and tube replacement. To suit the project's water range, and pressure drop requirements, most water boxes are available with 1, 2, or 3 - passes, and with a variety of nozzle arrangments. Stub-out water connections are provided with a flange and capped for shipment. Each nozzle is furnished with a copper thermo-well, to allow the SmartView control center to control and/or read the fluid's temperature. The subcooler is located below the condensing tube bundle in the condenser; the entering (inlet) condenser water nozzle, which has the coldest temperature, and must physically be the lowest connection, to supply the coldest water to the sub-cooler on the first pass. The outlet chilled water connection must always leave at the top of the evaporator tube bundle, where the refrigerant temperature is coldest. Plugged 3/4 inch (19.1 mm) drain and vent connections are furnished on each water box. Compact boxes are fabricated from carbon steel wtih necessary integral steel pass baffles, and gaskets, for the water flow circuit; boxes are 150 psig (1034 kPa) design working pressure, and hydro pressure tested at 1.5 times the DWP.

REFRIGERANT SYSTEM

A modulating variable orifice controlled by the SmartView Control Center to accommodate varying head and load conditions will meter refrigerant flow to the evaporator.

The condenser shell will be capable of storing the entire system refrigerant charge during servicing. The optional service valves need to be selected to facilitate removal of refrigerant charge from the system.

The unit will be equipped with a suction strainer to prevent any foreign debris introduced to the system during maintenance or service to be allowed into the motor housing. Motors cooled by refrigerant must be protected by means of filter or strainer to protect the motor and prolong motor life.

SMARTVIEW CONTROL CENTER

General

The chiller will be controlled by a standalone microprocessor based control center. The chiller control panel will provide control of chiller operation and monitoring of chiller sensors, actuators, relays and switches.

Control Panel

The control panel will include a 7 inch diagonal color liquid crystal display (LCD) surrounded by "soft" keys which are redefined based on the screen displayed at that time. It will be mounted in the middle of a keypad interface and installed in a locked enclosure. The screen will detail all operations and parameters, using a graphical representation of the chiller and its major components. Panel verbiage is available in both Chinese and English. Data can be displayed in either English or Metric units. When needed, Hot Gas Bypass is available as an option. The panel displays countdown timer messages so the operator knows when functions are starting and stopping. Every programmable point will have a popup screen with the allowable ranges, so that the chiller can not be programmed to operate outside of its design limits.

The control panel is provided with a thermal ice storage control mode to enhance system performance during ice building operation. In the thermal storage control mode, the chiller will stay at 100% load until the setpoint shutdown temperature is reached. To add greater operating flexibility and eliminate unnecessary chiller cycling, two different Low Water (Liquid) Temperature Restart Thresholds are programmable, one for the ice mode and one for the standard cooling mode. The chiller has the capability to remain in the standard control mode for temperatures between 0 to 70°F (-6.6 to 21.1℃) for applications involving a process or comfort cooling duty that requires leaving chilled liquid temperature setpoint control.

STARTUP AND OPERATOR TRAINING

The services of a factorytrained, field service representative will be provided to supervise the initial startup and conduct concurrent operator instruction.

CODES AND STANDARDS

For Wuxi made YR products, the following codes and standards will be applied:

- AHRI Standard 550/590
- GB/T18430.1- Water chilling (heat pump) packages using the vapor compression cycle--Water chilling (heat pump) packages for industrial & commercial and similar application
- GB25131 – Safety requirements for water chillers (heat pump) using the vapor compression cycle
- GB150 – Pressure vessels
  GB151 – Tubular heat exchangers

ASME and PED are optional for Wuxi YR products, if selected, below code will be applied:

- ASME Boiler and Pressure Vessel Code – Section VIII Division 1.

ISOLATION MOUNTING PADS

Four vibration isolator pads provide the YR unit's foot print. The floor contact area size depends upon the specific unit operating weight. These mounts are located at the four corners of the unit, under the heat exchanger tube sheets; welded to the bottom of the tube sheets are 5/8 inch (15.9 mm) thick steel foot supports (which spreads the weight). The mounts consist of 3/4 inch (19.05 mm) thick, bridge bearing neoprene pads, adhesive bonded to 3/8 inch (9.53 mm) thick steel plates. The mounts are shipped loose, for field mounting under the heat exchanger foot supports. Galvanized shims are provided to level the unit. The neoprene pad, rated load, static deflection is 0.10 inches (2.54 mm). The pads are suitable for typical equipment rooms located on the ground floor. No provisions for anchoring to the floor are required. (For upper floor installations, one inch (2.54 cm) deflection, spring isolator mounts are applied–see Accessories)

REFRIGERANT CONTAINMENT

The standard unit has been designed as a complete and compact factory packaged chiller. As such, it has minimum joints from which refrigerant can leak. The entire assembly has been thoroughly leak tested at the factory prior to shipment. The YORK chiller includes service valves conveniently located to facilitate transfer of refrigerant to a remote refrigerant storage/recycling system. Optional condenser isolation valves permit storage of the charge in the condenser.

PAINT

Exterior surfaces are protected with one coat of Caribbean blue, durable alkydmodified, vinyl enamel, machinery paint.

SHIPMENT

The unit shall be completely assembled, with all main, auxiliary, and control piping installed, controls wired, leak tests completed, functional run tests completed, and refrigerant charge in place. The oil charge, relief device and other miscellaneous materials shall be packed separately.

Protective covering is furnished on the Control Center and unit-mounted controls. The entire unit is then shrinkwrapped with high-quality reinforced plastic to provide maximum protection during transit. Water nozzles are capped with fitted enclosures.

ACCESSORIES AND MODIFICATIONS

SOLID STATE STARTER

The Solid State Starter is a reduced voltage starter that controls and maintains a constant current flow to the motor during startup. It is compact and mounted on the chiller at the motor terminals. Power and control wiring is factory supplied. Available for 200-600 volts, the starter enclosure is NEMA-1 with a hinged access door with lock and key. Electrical lugs for incoming power wiring are provided.

Standard features include: digital readout at the SmartView Control Center of the following:

Display Only:

- 3-phase voltage A, B, C
- 3-phase current A, B, C
- Input power (kW)
- kW Hours
- Starter Model
- Motor Run (LED)
- Motor Current % Full-load Amps
- Current Limit Setpoints
- Pulldown Demand Time Left

Programmable:

- Local Motor Current Limit
- Pulldown Demand Limit
- Pulldown Demand Time

Other features include: low line voltage; 115-volt control transformer; threeleg sensing overloads; phase rotation and single-phase failure protection; high temperature safety protection; motor current imbalance and undervoltage safeties; open and close SCR protection; momentary power interruption protection. The LCSSS is cooled by a closed-loop, fresh water circuit consisting of a water-towater heat exchanger and 1/25 HP circulating pump. All interconnecting water piping is factory nstalled and rated for 150 PSIG working pressure. Optional unit-mounted circuit breaker includes ground fault protection and provides 65,000 amp short-circuit withstand rating in accordance with UL Standard 508. A non-fused disconnect switch is also available. Both options are padlockable.

BAS REMOTE CONTROL

By a translating micro gateway, a communication interface permitting complete exchange of chiller data with Johnson Controls Metasys system (BAS) or other BAS systems. It also allows BAS system to issue commands to the chiller to control its operation.

FACTORY INSULATION OF EVAPORATOR

Factory-applied thermal insulation of the flexible, closedcell plastic type, 3/4" (19mm) thick is attached with vaporproof cement to the evaporator shell, flow chamber, evaporator tube sheets, suction connection, and (as necessary) to the auxiliary tubing. This insulation will normally prevent condensation in environments with relative humidities up to 75% and dry bulb

temperatures ranging from 50° to 90°F (10° to 32°C). 1-1/2" (38mm) thick insulation is also available for relative humidities up to 90% and dry bulb temperatures ranging from 50° to 90°F (10° to 32°C).

WATER FLANGES

Four 150 lb. Flanges, for condenser and evaporator water connections, are factory welded to water nozzles. Companion flanges, bolts, nuts and gaskets are not included.

SPRING ISOLATION MOUNTING

For all upper floor locations, four spring-type vibration isolator mounts must be used, instead of the standard heat exchangers foot supports, and neoprene mounting pads. These spring-type isolator mounts offer about ten times more static deflection than neoprene pads; this increases the "isolation efficency". Thus, reducing the vibration force being transmitted to the building floor. Spring isolator mounts can also be applied to ground floor locations, if desired. The spring isolator mount capacity & size, with related foot print or floor contact area, depends upon the specific unit operating weight. The spring isolator mounts are located at the four corners of the YR unit, on the backside of the heat exchangers tube sheets. For each specific size (to carry the unit operating weight) spring isolator mount, four heght saving brackets are factory furnished, and welded to the back of the tube sheets. These un-housed spring vibration isolator mounts have a one-inch (2.54 cm) static deflection, at rated load; a 1/4 inch (6.35 mm) thick, acoustical non-skid pad on the bottom; and features a level adjusting bolt. The four mounts are shipped loose for field installation. No provisions for anchoring to the floor are required. Equipment room floor spans over twenty feet (6.1 mm), will typically need special higher deflection isolation mounts.

WATER FLOW SWITCHES

Paddle-type, vapor-proof water flow switches suitable for 150 psig (1034 kPa) DWP for chilled and condenser water circuits. Switch for 115V-1-50/60 Hz service. A chilled water flow switch is required.

FLOOR MOUNTED STAR-DELTA STARTER (CLOSED)

A field installed, electro-mechanical compressor motor starter is available, selected for proper size and type for job requirements and in accordance with Johnson Controls Engineering Standard R-1131 for Starters.

UNIT MOUNTED STAR-DELTA STARTER (CLOSED)

A unit mounted, factory installed, star-delta compressor motor starter is available, selected for proper size and type by product model and in accordance with Johnson Controls Engineering Standard R-1131 for Starters. (Only available for 50Hz 380/400/415V.)

OPTIVIEW CONTROL CENTER

The YORK OptiView Graphic Display Control Center, available as option, provides the ultimate in efficiency, monitoring, data recording, chiller protection and operating ease. The control center is a factory-mounted, wired and tested state-of-the-art microprocessor based control system for R-1 a screw chillers. The panel is configured with a 10.4 inch diagonal color Liquid Crystal Display (LCD) surrounded by "soft" keys, which are redefined with one keystroke based on the screen display at that time. The panel erbiage is available in other languages as an option, with English always available.

MARINE WATER BOXES

Marine water boxes allow service access for cleaning of the heat exchanger tubes without the need to break the water piping. Bolted-on covers are arranged for convenient access. Flange connections are standard. Marine water boxes are available for condenser and/or evaporator.

REFRIGERANT ISOLATION VALVE

The condenser shell will be capable of storing the entire system refrigerant charge during servicing. The optional isolation valve makes it possible to facilitate removal of refrigerant charge from the system.

KNOCK-DOWN SHIPMENT

The chiller can be shipped knocked-down into major assemblies (evaporator, condenser, driveline, etc.) as required to rig into tight spaces. This is particularly convenient for existing buildings where equipment room access does not allow rigging a factory packaged chiller.

REFRIGERANT STORAGE/RECYCLING SYSTEM

A refrigerant storage/recycling system is a self-contained package consisting of a refrigerant compressor with oil separator, storage receiver, water-cooled condenser, filter drier and necessary valves and hoses to remove, replace and distill refrigerant. All necessary controls and safety devices are a permanent part of the system. Typically not required if unit isolation valves are provided.

SI METRIC CONVERSION

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

MEASUREMENT	MULTIPLY THIS *ENGLISH VALUE*	BY	TO OBTAIN THIS *METRIC VALUE*
CAPACITY	TONS REFRIGERANT EFFECT (ton)	3.516	KILOWATTS (kW)
POWER	KILOWATTS (kW)	NO CHANGE	KILOWATTS (kW)
	HORSEPOWER (hp)	0.7457	KILOWATTS (kW)
FLOW RATE	GALLONS / MINUTE (gpm)	0.0631	LITERS / SECOND (L/s)
LENGTH	FEET (ft)	304.8	MILLIMETERS (mm)
	INCHES (in)	25.4	MILLIMETERS (mm)
WEIGHT	POUNDS (lb)	0.4536	KILOGRAMS (kg)
VELOCITY	FEET / SECOND (fps)	0.3048	METERS / SECOND (m/s)
PRESSURE DROP	FEET OF WATER (ft)	2.989	KILOPASCALS (k Pa)
	POUNDS / SQ. INCH (psi)	6.895	KILOPASCALS (k Pa)

Integrated Part Load Value (IPLV)

In the English I-P system, IPLV is calculated by the following formula. A full explanation is shown on page 4:

$$IPLV^* = \frac{1}{\frac{0.01}{A} + \frac{0.42}{B} + \frac{0.45}{C} + \frac{0.12}{D}}$$

Where: A = kW / ton at 100% Load @ 85°F ECFT
B = kW / ton at 75% Load @ 75°F ECFT
C = kW / ton at 50% Load @ 65°F ECFT
D = kW / ton at 25% Load @ 65°F ECFT

In SI Metric, the formula is:

$$IPLV^* = 0.01A + 0.42B + 0.45C + 0.12D$$

Where: A = COP at 100% Load @ 29.4°C ECFT
B = COP at 75% Load @ 23.9°C ECFT
C = COP at 50% Load @ 18.3°C ECFT
D = COP at 25% Load @ 18.3°C ECFT

NOTE:

* The Non-Standard Part-Load Value (NPLV) uses the IPLV formula with the following exceptions: the ECFT for part-load points varies linearly from the selected EFT to 65°F (18.3° C) from 100% to 50% loads, and fixed at 65°F (18.3°C) for 50% to 0% loads.

APPLICATION DATA

The following is a user's guide in the application and installation of YR Chillers, and will ensure the reliability and trouble-free life for which this equipment was designed. While this guide is directed towards normal, water-chilling applications, the Johnson Controls sales represen-tatives can provide complete recommendations on other types of applications.

Location

YR Chillers are virtually vibration-free and generally can be located at any level in a building where the con- struction will support the total system operating weight.

The unit site must be a floor, mounting pad or founda-tion which is level within 1/4" (6.4 mm) and capable of supporting the operating weight of the chiller.

Sufficient clearance to permit normal service and maintenance work should be provided all around and above the unit. Additional space should be provided at one end of the unit to permit cleaning of evaporator and condenser tubes as required. A doorway or other properly located opening may be used.

The chiller should be installed in an indoor location where temperatures range from 40°F to 110°F (4.4°C to 43.3°C).

Water Circuits

Flow Rate – For normal water chilling duty, evaporator flow rates are permitted at water velocity levels in the heat exchangers tubes of between 3 ft./second and 12 ft./sec- ond (0.91 m/s and 3.66 m/s). Condenser flow rates are permitted between 3.33 ft./sec. and 12 ft./ sec. (1.01 m/s and 3.66 m/s). Variable flow applications are possible, and initial chiller selections should be made accordingly to permit proper range of flow while maintaining the mini- mum velocity noted above. Variable flow in the condenser is not recommended, as it generally raises the energy consumption of the system by keeping the condenser pressure high in the chiller. Additionally, the rate of fouling in the condenser will increase at lower water velocities associated with variable flow, raising system maintenance costs. Cooling towers typically have narrow ranges of operation with respect to flow rates, and will be more effective with full design flow. Ref. Table 1 for chiller flow limits.

Temperature Ranges – For normal water chilling duty, leaving chilled water temperatures may be selected between 38°F (3.3°C) and 70°F (21.1°C) for water temperature ranges between 3°F and 30°F (1.7°C and 16.7°C).

Water Quality – The practical and economical application of liquid chillers requires that the quality of the water supply for

TABLE 1 – WATER FLOW RATE LIMITS – GPM (L/s)

SHELL CODE	PASS	EVAPORATOR				CONDENSER			
		MINIMUM		MAXIMUM		MINIMUM		MAXIMUM	
TA	1	325	(20.5)	1295	(81.7)	534	(33.7)	1920	(121.1)
	2	162	(10.2)	647	(40.8)	267	(16.8)	960	(60.6)
	3	123	(7.8)	417	(26.3)	178	(11.2)	638	(40.3)
TB,VB	1	398	(25.1)	1587	(100.1)	613	(38.7)	2204	(139.1)
	2	200	(12.6)	780	(49.2)	307	(19.4)	1102	(69.5)
	3	133	(8.4)	502	(31.7)	205	(12.9)	734	(46.3)
TC,VC	1	485	(30.6)	1943	(122.6)	683	(43.1)	2455	(154.9)
	2	243	(15.3)	941	(59.4)	342	(21.6)	1225	(77.3)
	3	162	(10.2)	601	(37.9)	228	(14.4)	818	(51.6)
TD,VD	1	495	(31.2)	2370	(149.5)	771	(48.6)	2773	(174.9)
	2	296	(18.7)	1120	(70.7)	386	(24.4)	1355	(85.5)
	3	198	12.5	613	(38.7)	----	----	----	----
WA	1	641	(40.4)	2567	(162.0)	778	(49.1)	2807	(177.1)
	2	322	(20.3)	1150	(72.6)	389	(24.5)	1336	(84.3)
	3	214	(13.5)	756	(47.7)	260	(16.4)	882	(55.6)
WB,XB	1	720	(45.4)	2885	(182.0)	895	(56.5)	3228	(203.7)
	2	360	(22.7)	1287	(81.2)	448	(28.3)	1521	(96.0)
	3	240	(15.1)	845	(53.3)	299	(18.9)	1005	(63.4)
WC,XC	1	855	(53.9)	3423	(216.0)	1118	(70.5)	4035	(254.6)
	2	428	(27.0)	1510	(95.3)	559	(35.3)	1860	(117.3)
	3	282	(17.8)	992	(62.6)	373	(23.5)	1230	(77.6)
WD,XD	1	1025	(64.7)	3945	(248.9)	1395	(88.0)	5036	(317.7)
	2	513	(32.4)	1781	(112.4)	698	(44.0)	2248	(141.8)
	3	342	(21.6)	1178	(74.3)	----	----	----	----
V2	1	453	(28.7)	1,824	(115.4)	----	----	----	----
	2	227	(14.4)	912	(57.7)	----	----	----	----
	3	151	(9.6)	608	(38.5)	----	----	----	----
V3	1	601	(38.0)	2,417	(153.0)	----	----	----	----
	2	301	(19.0)	1,209	(76.5)	----	----	----	----
	3	200	(12.7)	806	(51.0)	----	----	----	----
V4	1	678	(42.9)	2,725	(172.5)	----	----	----	----
	2	339	(21.4)	1,362	(86.2)	----	----	----	----
	3	226	(14.3)	908	(57.5)	----	----	----	----
VE	1	483	(30.6)	1,944	(123.0)	----	----	----	----
	2	242	(15.3)	972	(61.5)	----	----	----	----
	3	161	(10.2)	648	(41.0)	----	----	----	----
VF	1	539	(34.1)	2,167	(137.1)	----	----	----	----
	2	269	(17.0)	1,083	(68.6)	----	----	----	----
	3	180	(11.4)	722	(45.7)	----	----	----	----
WE	1	603	(38.2)	2,426	(153.6)	----	----	----	----
	2	302	(19.1)	1,213	(76.8)	----	----	----	----
	3	201	(12.7)	809	(51.2)	----	----	----	----
WF,XF	1	665	(42.1)	2,674	(169.2)	----	----	----	----
	2	332	(21.0)	1,337	(84.6)	----	----	----	----
	3	222	(14.0)	891	(56.4)	----	----	----	----
WG,XG	1	748	(47.3)	3,008	(190.4)	----	----	----	----
	2	374	(23.7)	1,504	(95.2)	----	----	----	----
	3	249	(15.8)	1,003	(63.5)	----	----	----	----
W1,X1	1	770	(48.8)	3,098	(196.1)	----	----	----	----
	2	385	(24.4)	1,549	(98.1)	----	----	----	----
	3	257	(16.3)	1,033	(65.4)	----	----	----	----
W2,X2	1	852	(53.9)	3,428	(217.0)	----	----	----	----
	2	426	(27.0)	1,714	(108.5)	----	----	----	----
	3	284	(18.0)	1,143	(72.3)	----	----	----	----
W3,X3	1	945	(59.8)	3,802	(240.6)	----	----	----	----
	2	473	(29.9)	1,901	(120.3)	----	----	----	----
	3	315	(19.9)	1,267	(80.2)	----	----	----	----
XH	1	911	(57.7)	3,664	(231.9)	----	----	----	----
	2	456	(28.8)	1,832	(116.0)	----	----	----	----
	3	304	(19.2)	1,221	(77.3)	----	----	----	----

the condenser and evaporator be analyzed by a water treatment specialist. Water quality may affect the performance of any chiller through corrosion, deposition of heat-resistant scale, or sedimentation or organic growth. These will degrade chiller performance and increase operating and maintenance costs. Normally, performance may be maintained by corrective water treatment and periodic cleaning of tubes. If water conditions exist which cannot be corrected by proper water treatment, it may be necessary to provide a larger allowance for fouling, and/or to specify special materials of construction.

General Piping – All chilled water and condenser water piping should be designed and installed in accordance with accepted piping practice. Chilled water and condenser water pumps should be located to discharge through the chiller to assure positive pressure and flow through the unit. Piping should include offsets to provide flexibility and should be arranged to prevent drainage of water from the evaporator and condenser when the pumps are shut off. Piping should be adequately supported and braced inde- pendently of the chiller to avoid the imposition of strain on chiller components. Hangers must allow for alignment of the pipe. Isolators in the piping and in the hangers are highly desirable in achieving sound and vibration control.

Convenience Considerations – To facilitate the performance of routine maintenance work, some or all of the following steps may be taken by the purchaser. Evaporator and condenser water boxes are equipped with plugged vent and drain connections. If desired, vent and drain valves may be installed with or without piping to an open drain. Pressure gauges with stop cocks, and stop valves, may be installed in the inlets and outlets of the condenser and chilled water line as close as possible to the chiller. An overhead monorail or beam may be used to facilitate servicing.

Connections – The standard chiller is designed for 150 psig (1034 kPa) design working pressure in both the chilled water and condenser water circuits. The connections (water nozzles) to these circuits are furnished with flanges. Piping should be arranged for ease of disassembly at the unit for tube cleaning. All water piping should be thoroughly cleaned of all dirt and debris before final connections are made to the chiller.

Chilled Water – Units are equipped with flow switches (Field wiring). A water strainer of maximum 1/8" (3.2 mm) perforated holes must be field-installed in the chilled water inlet line as close as possible to the chiller. If located close enough to the chiller, the chilled water pump may be protected by the same strainer. The loss or severe reduction of water flow could seriously impair the chiller performance or even result in tube freeze-up.

Condenser Water – Units are equipped with flow switches (Field wiring). The chiller is engineered for maximum efficiency at both design and part-load operation by taking advantage of the colder cooling tower water temperatures which naturally occur during the winter months. Appreciable power savings are realized from these reduced heads.

The minimum entering condenser water temperature for other full and part-load conditions is provided by the following equation:

Min ECWT = LCHWT + 16 + [(% load/100) x
(10 - full-load condenser water ΔT)]

Where: ECWT = entering condenser water temperature
LCHWT = leaving chilled water temperature

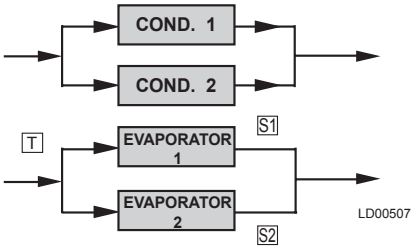
MULTIPLE UNITS

Selection – Many applications require multiple units to meet the total capacity requirements as well as to provide flexibility and some degree of protection against equipment shutdown or routine maintenance. There are several common unit arrangements for this type of application. The YR chiller has been designed to be readily adapted to the requirements of these various arrangements.

Parallel Arrangement (Refer to Fig. 1) – Chillers may be applied in multiples with chilled and condenser water circuits connected in parallel between the units. Fig. 1 represents a parallel arrangement with two chillers. Parallel chiller arrangements may consist of equally or unequally sized units. When multiple units are in operation, they will load and unload at equal percentages of design full-load for the chiller.

Depending on the number of units and operating characteristics of the units, loading and unloading schemes should be designed to optimize the overall efficiency of the chiller plant. It is recommended to use an evaporator bypass piping arrangement to bypass fluid around evapo-rator of any unit which has cycled off at reduced load conditions. It is also recommended to alternate the chiller cycling order to equalize chiller starts and run hours.

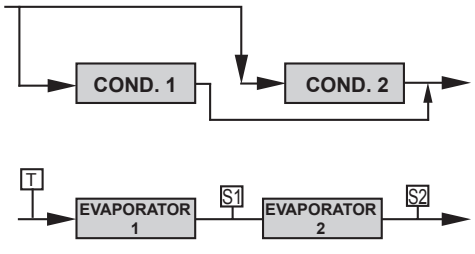
Series Arrangement (Refer to Fig. 2 & Fig. 3) – The chillers may be applied in pairs with chilled water circuits connected in series and condenser water circuits connected in series or parallel. All of the chilled water flows through both coolers with each unit handling approximately one-half of the total load. When the load decreases to a customer selected load value, one of the units will be shut down by a sequence control. Since all water is flowing through the operating unit, that unit will cool the water to the desired temperature.



S TEMPERATURE SENSOR FOR CHILLER CAPACITY CONTROL

T THERMOSTAT FOR CHILLER SEQUENCING CONTROL

FIG. 1 – PARALLEL EVAPORATORS PARALLEL CONDENSERS



S TEMPERATURE SENSOR FOR CHILLER CAPACITY CONTROL

T THERMOSTAT FOR CHILLER SEQUENCING CONTROL

FIG. 2 – SERIES EVAPORATORS PARALLEL CONDENSERS

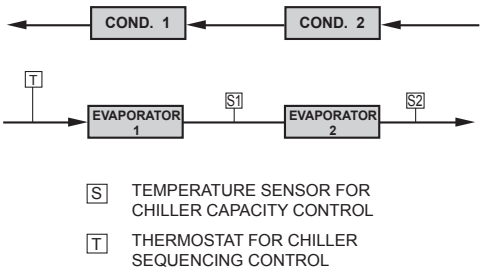


FIG. 3 – SERIES COUNTERFLOW LD00509

BRINE APPLICATIONS

The YR Screw Chiller is a good match for the high head requirements of low temperature brine applications. This is particularly true of thermal ice storage systems, typically requiring 22°F (–5.6°C) to 24°F (–4.4°C) leaving brine temperatures. This performance is enhanced with the standard thermal storage control mode described on page 5.

Various types of brine can be used in both the evaporator and condenser in lieu of water. The SmartView Control panel is programmed in the factory to allow extending the evaporator leaving brine temperature setpoint below 36°F (2.2°C). The low evaporator pressure cutout is factory programmed to the appropriate value depending on the percent (%) concentration and type of brine solution.

When the chiller is not running, 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. In brine applications the condenser pump control will close when the condenser saturation temperature reaches 30°F (-1.11°C) and the pump will shut off when the temperature increases to 35°F (1.67°C). This is applicable if tied to the condenser pump control.

REFRIGERANT RELIEF PIPING

Each chiller is equipped with pressure relief devices. The purpose of the relief devices is to quickly relieve excess pressure of the refrigerant charge to atmosphere, as a safety precaution in the event of an emergency such as a fire. They are set to relieve at an internal pressure of 235 psig (1620 kPa) and are located on the condenser, evaporator and oil separator; and are provided in accordance with China pressure vessel code. Under these circumstances the relief devices may be relief valves, overflow valves or type tested Safety Pressure switches or a combination of these devices.

Sized to the requirements of applicable codes, a vent line must run from the relief device to the outside of the building. This refrigerant relief piping must include a cleanable, vertical-leg dirt trap to catch vent-stack condensation. Vent piping must be arranged to avoid imposing a strain on the relief connections and should include one flexible connection.

SOUND AND VIBRATION CONSIDERATIONS

A YR chiller is not a source of objectionable sound and vibration in normal air conditioning applications. Neoprene isolation mounts are furnished as standard with each unit. Optional level-adjusting spring isolator assemblies designed for 1" static deflection are available.

YR chiller sound pressure level ratings will be furnished upon request.

Control of sound and vibration transmission must be taken into account in the equipment room construction as well as in the selection and installation of the equipment.

THERMAL INSULATION

No appreciable operating economy can be achieved by thermally insulating the chiller. However, the chiller's cold surfaces should be insulated with a vapor barrier insulation sufficient to prevent condensation. A chiller can be factory insulated with 3/4" (19mm) or 1-1/2" (38mm) thick insulation, as an option. This insulation will normally prevent condensation in environments with dry bulb temperatures of 50°F to 90°F (10°C to 32°C) and relative humidities up to 75% [3/4" (19mm) thickness] or 90% [1-1/2" (38mm) thickness]. The insulation is painted and the surface is flexible and reasonably resistant to wear. It is intended for a chiller installed indoors and, therefore, no protective cover-ing of the insulation is usually required. If insulation is applied to the water boxes at the job site, it must be removable to permit access to the tubes for routine maintenance.

VENTILATION

The ASHRAE Standard 15 Safety Code for Mechanical Refrigeration requires that all machinery rooms be vented to the outdoors utilizing mechanical ventilation by one or more power-driven fans. This standard, plus National Fire Protection Association Standard 90A, state, local and other related codes should be reviewed for specific requirements.

In addition, the ASHRAE Standard 15 requires a refrigerant vapor detector to be employed for all refrigerants. It is to be located in area where refrigerant from a leak would be likely to concentrate. An alarm is to be activated and the mechanical ventilation started at a value no greater than the TLV (Threshold Limit Value) of the refrigerant.

ELECTRICAL CONSIDERATIONS

Motor Voltage – Low voltage motors (200 - 600 volts) are furnished with six leads. Motor circuit conductor size must be in accordance with the National Electrical Code (NEC), or other applicable codes, for the motor full-load amperes (FLA). Flexible conduit should be used for the last several feet to the chiller in order to provide vibration isolation. Table 2 lists the allowable variation in voltage supplied to the chiller motor. The unit nameplate is stamped with the specific motor voltage and frequency for the appropriate motor.

FREQ.	RATED VOLTAGE	NAMEPLATE VOLTAGE	OPERATING VOLTAGE	
			MIN.	MAX.
60 HZ	380	380	342	415
	460	440/460/480	414	508
50 HZ	380	380/400	342	423
	415	415	374	440

Starters – The chiller is available with a factory-mounted and wired YORK Solid State Starter for 200 - 600 volt applications. Other types of remote and unit mounted starters are available. Unit mounted starter is for 50Hz, 380/400/415V only. These electro-mechanical starters must be furnished in accordance with YORK Standard R1131. Specification. This will ensure that starter components, controls, circuits, and terminal markings will be suitable for required overall system performance.

Controls – A 115 volt, single phase, 60 or 50 Hertz (4.5 kVa) power supply must be furnished to the chiller from a separate, fused disconnect or from a control transformer included as an option with electro-mechanical starters. No field control wiring is required, when the YORK SSS is supplied.

Copper Conductors – Only copper conductors should be connected to compressor motors and starters. Aluminum conductors have proven to be unsatisfactory when connected to copper lugs. Aluminum oxide and the difference in thermal conductivity between copper and aluminum cannot guarantee the required tight connection over a long period of time.

Power Factor Correction Capacitors – Capacitors can be applied to a chiller for the purpose of power factor correction. For remote-Mounted and unit mounted Electro-Mechanical Starters, the capacitors should be located on the load side of the starter. For YORK SSS, the capacitors must be located on the line side of the starter. The capacitors must be sized and installed to meet the National Electrical Code (NEC) and be verified by JOHNSON CONTROLS.

Ampacity on Load Side of Starter – Electrical power wire size to the chiller is based on the minimum unit ampacity. For YORK SSS, this wiring is done at the factory. For remote starters, the National Electrical Code defines the calculation of ampacity, as summarized below. More specific information on actual amperage ratings will be supplied with the submittal drawings.

- Six-lead type of starting (Star-Delta)

  Minimum circuit ampacity per conductor (1 of 6):
  Ampacity = .721 x compressor motor amps.

- Three-lead type of starting
  (Across-the-Line, Autotransformer and Primary Reactor)

  Minimum circuit ampacity per conductor (1 of 3):
  Ampacity = 1.25 x compressor motor amps.

Ampacity on Line Side of Starter – The only additional load on the circuit for the chiller would be the control transformer, unless it is supplied by a separate source.

$$\text{Min. Circuit Ampacity} = \frac{\text{125\% of compr. motor amps}}{} + \frac{\text{FLA of all other loads on the circuit}}{}$$

Branch Circuit Overcurrent Protection – The branch circuit overcurrent protection device(s) should be a timedelay type, with a minimum rating equal to the next standard fuse/breaker rating above the calculated value. It is calculated taking into account the compressor motor amps and may also include control transformer. Refer to submittal drawings for the specific calculations for each application.

MOTOR ELECTRICAL DATA

The full-load amperes (FLA) listed in Tables 3 and 4 are maximum values and correspond to the maximum motor kW listed. When the Input power (kW) is less than maximum motor kW, the FLA should be reduced using the following equation:

$$\frac{\text{Motor kW}}{\text{Max. Motor kW}} \times \frac{\text{100\%Load PF}}{\text{PF@\%Load}} \times \text{Max. Motor FLA}$$

Example:

$$\frac{151\text{ kW}}{253\text{ kW}} \times \frac{88.2}{84.3} \times 821 = 515\text{ FLA}$$

The benefit from the FLA correction is the possible use of smaller power wiring and/or starter size.

The locked rotor amperes (LRA) are read directly from Tables 3 and 4 for specific Motor Code and voltage. This is because the LRA is dependent only on motor size and voltage and is independent of input power (kW).

Inrush amperes (IRA) depend on LRA and the type of starter applied. The inrush can be calculated using a percentage of LRA shown in Table 5.

TABLE 3 – 60 HZ ELECTRICAL DATA

COMP.	NAME-PLATE VOLT.	AMP (MAX)		MOTOR DATA																		MAX. KW (hp)
				100%		90%		80%		70%		60%		50%		40%		30%		20%		
		FLA	LRA	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	
T0/T1	200	821	3850	88.2	94.8	87.8	95.2	87.3	95.5	85.8	95.7	84.3	95.9	80.4	96.0	76.5	96.0	65.8	95.2	55.1	94.4	253.0 (321)
	208	3850	3875	86.6	95.0	85.6	95.3	84.6	95.5	82.6	95.7	80.5	95.9	75.5	95.8	70.5	95.7	59.0	94.8	47.4	93.8	
	230	804	2969	89.2	94.5	89.1	95.0	89.0	95.4	88.2	95.7	87.3	96.0	84.5	96.1	81.6	96.2	72.4	95.6	63.1	94.9	
	240	684	3104	88.2	94.9	87.7	95.2	87.2	95.5	85.8	95.8	84.3	96.0	80.4	96.0	76.5	96.0	65.8	95.2	55.0	94.4	
	380	430	1850	89.3	94.6	89.3	95.0	89.2	95.4	88.5	95.7	87.8	96.0	85.1	96.1	82.4	96.2	73.5	95.6	64.6	95.0	
	440	372	1419	89.6	94.2	89.8	94.7	90.0	95.2	89.6	95.6	89.2	95.9	87.2	96.1	85.2	96.3	77.7	95.9	70.1	95.4	
	460	356	1488	89.2	94.6	89.1	95.0	88.9	95.4	88.1	95.7	87.3	96.0	84.5	96.1	81.6	96.2	72.4	95.6	63.1	94.9	
	480	342	1555	88.2	94.9	87.7	95.2	87.2	95.5	85.8	95.8	84.3	96.0	80.4	96.0	76.5	96.0	65.8	95.2	55.0	94.4	
	575	285	1190	89.2	94.6	89.1	95.0	88.9	95.4	88.1	95.7	87.3	96.0	84.4	96.1	81.5	96.2	72.3	95.6	63.1	95.0	
	600	274	1243	88.2	94.9	87.7	95.3	87.2	95.6	85.8	95.8	84.3	96.0	80.4	96.0	76.5	96.0	65.8	95.3	55.0	94.5	
T2/T3 R2/R3	200	896	4500	88.6	95.0	87.9	95.3	87.1	95.6	85.5	95.8	83.8	95.9	79.8	95.9	75.8	95.8	65.0	94.9	54.1	93.9	275.1 (352)
	208	883	4687	86.4	95.2	85.1	95.4	83.8	95.6	81.4	95.7	78.9	95.8	73.7	95.1	68.4	94.4	57.0	93.8	45.5	93.1	
	230	795	4204	86.6	95.3	85.4	95.5	84.2	95.7	81.9	95.8	79.5	95.9	74.5	95.8	69.4	95.6	58.0	94.5	46.6	93.3	
	240	795	4392	83.2	95.5	81.2	95.6	79.2	95.7	75.9	95.7	72.6	95.7	66.4	95.4	60.1	95.0	48.8	93.6	37.5	92.1	
	380	496	2715	84.2	85.8	82.4	90.8	80.6	95.7	77.6	95.7	74.5	95.7	68.5	95.5	62.5	95.2	51.1	93.8	39.7	92.4	
	440	405	2008	88.9	95.1	88.3	95.4	87.7	95.6	86.3	95.8	84.8	96.0	81.1	96.0	77.3	95.9	66.8	95.0	56.2	94.1	
	460	398	2102	86.6	95.3	85.4	95.5	84.2	95.7	81.9	95.8	79.5	95.9	74.5	95.8	69.4	95.6	57.9	94.5	46.4	93.3	
	480	398	2196	83.2	95.5	81.2	95.6	79.2	95.7	75.9	95.7	72.6	95.7	55.1	93.9	37.5	92.1	37.5	92.1	37.5	92.1	
	575	318	1681	86.7	95.3	85.5	95.5	84.2	95.7	81.9	95.8	79.6	95.9	74.5	95.7	69.4	95.5	58.0	94.4	46.5	93.2	
	600	318	1756	83.2	95.4	81.3	95.5	79.3	95.6	76.0	95.6	72.6	95.6	66.4	95.3	60.2	95.0	48.9	93.5	37.6	92.0	

NOTE: FLA = Full-load Amps; LRA = Locked Rotor Amps; PF = Power Factor; EFF = Motor Efficiency
100% Loading is Percentage of Maximum Motor Load; not of Specific Application

TABLE 4 – 50 HZ ELECTRICAL DATA

COMP.	NAME-PLATE VOLT.	AMP (MAX)		MOTOR DATA																		MAX. KW (hp)
				100%		90%		80%		70%		60%		50%		40%		30%		20%		
		FLA	LRA	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	PF	EFF	
T0/T1	380	364	1416	89.3	93.7	89.2	94.3	89.1	94.8	88.4	95.2	87.7	95.6	84.9	95.8	82.1	95.9	73.3	95.3	64.5	94.7	253.0 (321)
	400	348	1488	88.2	94.1	87.7	94.6	87.2	95.0	85.9	95.3	84.5	95.6	80.4	95.7	76.3	95.7	65.6	94.9	54.9	94.1	
	415	333	1358	89.2	93.8	89.1	94.4	88.9	94.9	88.1	95.3	97.3	95.6	84.3	95.8	81.3	95.9	72.2	95.3	93.1	94.6	
T2/T3 R2/R3	380	397	2037	87.5	94.8	86.45	95.05	85.4	95.3	83.25	95.5	81.1	95.7	76.35	95.65	71.6	95.6	60.2	94.6	48.8	93.6	275.1 (352)
	400	395	2148	83.5	95	81.6	95.15	79.7	95.3	76.35	95.35	73	95.4	66.8	95.15	60.6	94.9	49.25	93.5	37.9	92.1	
	415	363	1840	87.9	94.8	87	95.05	86.1	95.3	84.05	95.5	82	95.7	77.55	80.65	73.1	65.6	61.8	79.65	50.5	93.7	
T4	380	572.2	2682.0	87.6	94.8	89.0	94.7	90.3	94.6	90.0	95.5	89.7	96.3	88.2	96.4	86.6	96.5	79.9	95.6	73.1	94.7	329.8 (417)
	400	543.4	2682.0	87.6	94.8	88.0	94.7	88.5	94.6	89.0	95.5	88.6	96.3	88.0	96.4	85.2	96.5	78.1	95.6	72.2	94.7	
	415	512.7	2362.0	89.5	92.3	94.5	93.3	90.5	94.4	91.0	94.5	91.4	94.6	89.4	94.8	87.4	95.1	79.6	94.1	71.7	93.1	

NOTE: FLA = Full-load Amps; LRA = Locked Rotor Amps; PF = Power Factor; EFF = Motor Efficiency
100% Loading is Percentage of Maximum Motor Load; not of Specific Application

TABLE 5 – MOTOR STARTERS

TYPE STARTER	SOLID STATE STARTER	STAR DELTA		AUTO TRANSFORMER			ACROSS THE LINE
60HZ	200-600	200-600	200-600	200-600	200-600	200-600	200-600
50 HZ	380-415	380-415	380-415	380-415	380-415	380-415	380-415
TRANSITION % TAP	NONE	CLOSED	OPEN	CLOSED	CLOSED	CLOSED	—
INRUSH	—	—	—	57.7	65	80	—
AS A % OF LRA	45	33	33	33	42.3	64	100

TABLE 6 – AVAILABLE COMPRESSOR/SHELL COMBINATIONS

COMPRESSOR	EVAPORATOR SHELL	CONDENSER SHELL
T0,T1	TA,TB,TC,TD	TA,TB,TC,TD
	VB,VC,VD	VB,VC,VD
T1	WA,WB,WC,WD	WA,WB,WC,WD
T2*	VB,VC,VD	VB,VC,VD
T2/T3/R2★/R3★	WA,WB,WC,WD	WA,WB,WC,WD
	XB,XC,XD	XB,XC,XD
R2*	VE,VF,V2,V3,V4	VB,VC,VD
R2*/R3*/T4*	WE,WF,WG,W1,W2,W3	WA,WB,WC,WD
	XF,XG,XH,X1,X2,X3	XB,XC,XD

* 50Hz.Only
★ 60Hz.Only

WEIGHTS

COMP.	SHELLS	SHIPPING WEIGHT		OPERATING WEIGHT		REFRIGERANT CHARGE		LOADING PER ISOLATOR	
		(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)
T0	TATA	12954	5876	13558	6150	675	306	3,390	1,537
	TATB	13036	5913	13673	6202	675	306	3,418	1,550
	TATC	13098	5941	13763	6243	675	306	3,441	1,561
	TATD	13187	5981	13889	6300	675	306	3,472	1,575
	TBTA	13044	5917	13680	6205	650	295	3,420	1,551
	TBTB	13126	5954	13795	6257	650	295	3,449	1,564
	TBTC	13188	5982	13885	6298	650	295	3,471	1,575
	TBTD	13277	6022	14011	6355	650	295	3,503	1,589
	TCTA	13144	5962	13820	6269	635	288	3,455	1,567
	TCTB	13226	5999	13935	6321	635	288	3,484	1,580
	TCTC	13288	6027	14025	6362	635	288	3,506	1,590
	TCTD	13377	6068	14151	6419	635	288	3,538	1,605
	TDTA	13259	6014	13982	6342	600	272	3,496	1,586
	TDTB	13341	6051	14097	6394	600	272	3,524	1,599
	TDTC	13403	6079	14187	6435	600	272	3,547	1,609
	TDTD	13492	6120	14313	6492	600	272	3,578	1,623
	VBVB	14412	6537	15249	6917	900	408	3,812	1,729
	VBVC	14513	6583	15393	6982	900	408	3,848	1,746
	VBVD	14628	6635	15557	7056	900	408	3,889	1,764
	VCVB	14565	6606	15456	7011	875	397	3,864	1,753
	VCVC	14665	6652	15600	7076	875	397	3,900	1,769
	VCVD	14780	6704	15764	7150	875	397	3,941	1,788
	VDVB	14748	6690	15706	7124	835	379	3,927	1,781
	VDVC	14849	6735	15850	7190	835	379	3,963	1,797
	VDVD	14964	6787	16014	7264	835	379	4,004	1,816
T1	TATA	13129	5955	13733	6229	675	306	3,433	1,557
	TATB	13211	5992	13848	6281	675	306	3,462	1,570
	TATC	13273	6021	13938	6322	675	306	3,485	1,581
	TATD	13362	6061	14064	6379	675	306	3,516	1,595
	TBTA	13219	5996	13855	6284	650	295	3,464	1,571
	TBTB	13301	6033	13970	6337	650	295	3,493	1,584
	TBTC	13363	6061	14060	6377	650	295	3,515	1,594
	TBTD	13452	6102	14186	6435	650	295	3,547	1,609
	TCTA	13319	6041	13995	6348	635	288	3,499	1,587
	TCTB	13401	6079	14110	6400	635	288	3,528	1,600
	TCTC	13463	6107	14200	6441	635	288	3,550	1,610
	TCTD	13552	6147	14326	6498	635	288	3,582	1,625
	TDTA	13434	6094	14157	6421	600	272	3,539	1,605
	TDTB	13516	6131	14272	6474	600	272	3,568	1,618
	TDTC	13578	6159	14362	6514	600	272	3,591	1,629
	TDTD	13667	6199	14488	6572	600	272	3,622	1,643
	VBVB	14587	6617	15424	6996	900	408	3,856	1,749
	VBVC	14688	6662	15568	7062	900	408	3,892	1,765
	VBVD	14803	6714	15732	7136	900	408	3,933	1,784
	VCVB	14740	6686	15631	7090	875	397	3,908	1,773
	VCVC	14840	6731	15775	7156	875	397	3,944	1,789
	VCVD	14955	6783	15939	7230	875	397	3,985	1,807
	VDVB	14923	6769	15881	7204	835	379	3,970	1,801
	VDVC	15024	6815	16025	7269	835	379	4,006	1,817
	VDVD	15139	6867	16189	7343	835	379	4,047	1,836
	WAWA	16008	7261	17125	7768	1035	470	4,281	1,942

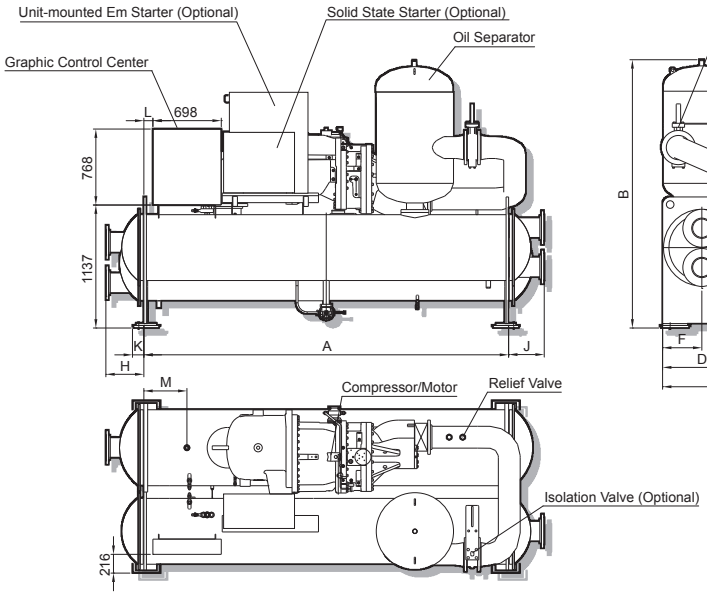
COMP.	SHELLS	SHIPPING WEIGHT		OPERATING WEIGHT		REFRIGERANT CHARGE		LOADING PER ISOLATOR	
		(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)
T1	WAWB	16153	7327	17328	7860	1035	470	4,332	1,965
	WAWC	16425	7450	17712	8034	1035	470	4,428	2,008
	WAWD	16758	7601	18183	8248	1035	470	4,546	2,062
	WBWA	16125	7314	17284	7840	1035	470	4,321	1,960
	WBWB	16220	7357	17487	7932	1035	470	4,372	1,983
	WBWC	16542	7503	17871	8106	1035	470	4,468	2,027
	WBWD	16875	7654	18342	8320	1035	470	4,586	2,080
	WCWA	16307	7397	17537	7955	1015	461	4,384	1,989
	WCWB	16452	7462	17740	8047	1015	461	4,435	2,012
	WCWC	16724	7586	18124	8221	1015	461	4,531	2,055
	WCWD	17057	7737	18595	8435	1015	461	4,649	2,109
	WDWA	16537	7501	17858	8100	990	450	4,465	2,025
	WDWB	16682	7567	18061	8192	990	450	4,515	2,048
	WDWC	16954	7690	18445	8366	990	450	4,611	2,092
	WDWD	17287	7841	18916	8580	990	450	4,729	2,145
T2	VBVB	17091	7752	17932	8134	900	408	4,483	2,033
	VBVC	17178	7792	18060	8192	900	408	4,515	2,048
	VBVD	17309	7851	18242	8274	900	408	4,561	2,069
	VCVB	17232	7816	18128	8223	875	397	4,532	2,056
	VCVC	17319	7856	18256	8281	875	397	4,564	2,070
	VCVD	17450	7915	18437	8363	875	397	4,609	2,091
	VDVB	17403	7894	18365	8330	835	379	4,591	2,083
	VDVC	17490	7933	18493	8388	835	379	4,623	2,097
	VDVD	17621	7993	18675	8471	835	379	4,669	2,118
	WAWA	18723	8493	19840	8999	1035	470	4,960	2,250
	WAWB	18868	8558	20043	9091	1035	470	5,011	2,273
	WAWC	19140	8682	20427	9265	1035	470	5,107	2,316
	WAWD	19473	8833	20898	9479	1035	470	5,225	2,370
	WBWA	18840	8546	19999	9071	1035	470	5,000	2,268
	WBWB	18985	8611	20202	9163	1035	470	5,051	2,291
	WBWC	19257	8735	20586	9338	1035	470	5,147	2,334
	WBWD	19590	8886	21057	9551	1035	470	5,264	2,388
	WCWA	19022	8628	20252	9186	1015	461	5,063	2,297
	WCWB	19167	8694	20455	9278	1015	461	5,114	2,320
	WCWC	19439	8817	20839	9452	1015	461	5,210	2,363
	WCWD	19772	8968	21310	9666	1015	461	5,328	2,417
	WDWA	19252	8733	20573	9332	990	450	5,143	2,333
	WDWB	19397	8798	20776	9424	990	450	5,194	2,356
	WDWC	19669	8922	21160	9598	990	450	5,290	2,399
	WDWD	20002	9073	21631	9812	990	450	5,408	2,453
	XBXB	21187	9610	22523	10216	1520	689	5,631	2,554
	XBXC	21559	9779	23054	10457	1520	689	5,764	2,614
	XBXD	22019	9988	23712	10756	1520	689	5,928	2,689
	XCXB	21451	9730	22882	10379	1450	685	5,721	2,595
	XCXC	21823	9899	23413	10620	1450	685	5,853	2,655
	XCXD	22283	10107	24072	10919	1450	685	6,018	2,730
	XDXB	21787	9882	23340	10587	1350	612	5,835	2,647
	XDXC	22159	10051	23871	10828	1350	612	5,968	2,707
	XDXD	22619	10260	24529	11126	1350	612	6,132	2,782
T3	WAWA	18985	8611	20102	9118	1035	470	5,026	2,280
	WAWB	19130	8677	20305	9210	1035	470	5,076	2,303
	WAWC	19402	8801	20689	9384	1035	470	5,172	2,346
	WAWD	19735	8952	21160	9598	1035	470	5,290	2,399
	WBWA	19102	8664	20261	9190	1035	470	5,065	2,298
	WBWB	19247	8730	20464	9282	1035	470	5,116	2,321
	WBWC	19519	8854	20848	9456	1035	470	5,212	2,364
	WBWD	19852	9005	21319	9670	1035	470	5,330	2,418
	WCWA	19284	8747	20514	9305	1015	461	5,129	2,326
	WCWB	19429	8813	20717	9397	1015	461	5,179	2,349
	WCWC	19701	8936	21101	9571	1015	461	5,275	2,393
	WCWD	20034	9087	21572	9785	1015	461	5,393	2,446
	WDWA	19514	8851	20835	9451	990	450	5,209	2,363
	WDWB	19659	8917	21038	9543	990	450	5,260	2,386
	WDWC	19931	9041	21422	9717	990	450	5,356	2,429
	WDWD	20264	9192	21893	9930	990	450	5,473	2,483
	XBXB	21449	9729	22785	10335	1520	689	5,696	2,584
	XBXC	21821	9898	23316	10576	1520	689	5,829	2,644
	XBXD	22281	10106	23974	10875	1520	689	5,994	2,719
	XCXB	21713	9849	23144	10498	1450	658	5,786	2,625
	XCXC	22085	10017	23675	10739	1450	658	5,919	2,685
	XCXD	22545	10226	24334	11038	1450	658	6,083	2,759
	XDXB	22049	10001	23602	10705	1350	612	5,900	2,676
	XDXC	22421	10170	24133	10946	1350	612	6,033	2,737
	XDXD	22881	10379	24791	11245	1350	612	6,198	2,811

COMP.	SHELLS	SHIPPING WEIGHT		OPERATING WEIGHT		REFRIGERANT CHARGE		LOADING PER ISOLATOR	
		(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)
T4	WEWA	20,873	9,468	21,602	9,798	789	358	5,400	2,450
	WEWB	21,010	9,530	21,797	9,887	780	354	5,449	2,472
	WEWC	21,272	9,649	22,172	10,057	765	347	5,543	2,514
	WEWD	21,601	9,798	22,639	10,269	747	339	5,660	2,567
	WFWA	20,983	9,518	21,747	9,864	814	369	5,437	2,466
	WFWB	21,120	9,580	21,942	9,953	805	365	5,485	2,488
	WFWC	21,382	9,699	22,316	10,123	789	358	5,579	2,531
	WFWD	21,709	9,847	22,782	10,334	769	349	5,695	2,583
	WGWA	21,124	9,582	21,934	9,949	829	376	5,484	2,487
	WGWB	21,261	9,644	22,130	10,038	820	372	5,532	2,509
	WGWC	21,523	9,763	22,504	10,208	805	365	5,626	2,552
	WGWD	21,850	9,911	22,970	10,419	785	356	5,742	2,605
	W1WA	21,620	9,807	22,443	10,180	827	375	5,611	2,545
	W1WB	21,757	9,869	22,638	10,269	818	371	5,660	2,567
	W1WC	22,020	9,988	23,013	10,438	802	364	5,753	2,610
	W1WD	22,346	10,136	23,478	10,650	783	355	5,870	2,662
	W2WA	21,744	9,863	22,612	10,257	864	392	5,653	2,564
	W2WB	21,878	9,924	22,805	10,344	853	387	5,701	2,586
	W2WC	22,141	10,043	23,180	10,514	838	380	5,795	2,629
	W2WD	22,469	10,192	23,648	10,726	820	372	5,912	2,682
	W3WA	21,872	9,921	22,792	10,338	897	407	5,698	2,585
	W3WB	22,009	9,983	22,988	10,427	888	403	5,747	2,607
	W3WC	22,271	10,102	23,362	10,597	873	396	5,841	2,649
	W3WD	22,597	10,250	23,828	10,808	853	387	5,957	2,702
	XFXB	22,696	10,295	23,792	10,792	928	421	5,948	2,698
	XFXC	23,053	10,457	24,299	11,022	913	414	6,075	2,755
	XFXD	23,497	10,658	24,927	11,307	895	406	6,232	2,827
	XGXB	22,886	10,381	24,044	10,906	950	431	6,011	2,727
	XGXC	23,243	10,543	24,551	11,136	935	424	6,138	2,784
	XGXD	23,686	10,744	25,179	11,421	917	416	6,295	2,855
	XHXB	23,254	10,548	24,534	11,128	1,001	454	6,134	2,782
	XHXC	23,611	10,710	25,041	11,358	985	447	6,260	2,840
	XHXD	24,054	10,911	25,669	11,643	968	439	6,417	2,911
	X1XB	23,283	10,561	24,457	11,094	948	430	6,114	2,773
	X1XC	23,640	10,723	24,964	11,324	933	423	6,241	2,831
	X1XD	24,083	10,924	25,593	11,609	915	415	6,398	2,902
	X2XB	23,444	10,634	24,680	11,195	996	452	6,170	2,799
	X2XC	23,801	10,796	25,186	11,424	981	445	6,297	2,856
	X2XD	24,244	10,997	25,815	11,710	963	437	6,454	2,927
	X3XB	23,622	10,715	24,924	11,305	1,047	475	6,231	2,826
	X3XC	23,979	10,877	25,430	11,535	1,032	468	6,358	2,884
	X3XD	24,420	11,077	26,057	11,819	1,012	459	6,514	2,955
R2	V2VB	15,044	6,824	15,698	7,121	800	363	3,925	1,780
	V2VC	15,136	6,866	15,832	7,181	794	360	3,958	1,795
	V2VD	15,256	6,920	16,002	7,259	787	357	4,001	1,815
	V3VB	15,247	6,916	15,998	7,256	825	374	3,999	1,814
	V3VC	15,339	6,958	16,131	7,317	818	371	4,033	1,829
	V3VD	15,458	7,012	16,302	7,394	811	368	4,075	1,849
	V4VB	15,308	6,944	16,110	7,307	796	361	4,027	1,827
	V4VC	15,401	6,986	16,243	7,368	789	358	4,061	1,842
	V4VD	15,520	7,040	16,413	7,445	783	355	4,103	1,861
	VEVB	15,245	6,915	15,918	7,221	717	325	3,980	1,805
	VEVC	15,339	6,958	16,054	7,282	712	323	4,013	1,820
	VEVD	15,456	7,011	16,222	7,358	703	319	4,056	1,840
	VFVB	15,364	6,969	16,074	7,291	741	336	4,018	1,823
	VFVC	15,456	7,011	16,207	7,351	734	333	4,052	1,838
	VFVD	15,575	7,065	16,378	7,429	728	330	4,094	1,857
	WEWA	16,645	7,550	17,373	7,880	798	362	4,343	1,970
	WEWB	16,781	7,612	17,569	7,969	789	358	4,392	1,992
	WEWC	17,044	7,731	17,943	8,139	774	351	4,486	2,035
	WEWD	17,372	7,880	18,411	8,351	756	343	4,603	2,088
	WFWA	16,755	7,600	17,518	7,946	822	373	4,380	1,987
	WFWB	16,892	7,662	17,713	8,035	814	369	4,428	2,009
	WFWC	17,154	7,781	18,088	8,205	798	362	4,522	2,051
	WFWD	17,482	7,930	18,556	8,417	780	354	4,639	2,104
	WGWA	16,896	7,664	17,706	8,031	838	380	4,426	2,008
	WGWB	17,033	7,726	17,901	8,120	829	376	4,475	2,030
	WGWC	17,295	7,845	18,276	8,290	814	369	4,569	2,072
	WGWD	17,624	7,994	18,743	8,502	796	361	4,686	2,125
	W1WA	17,392	7,889	18,215	8,262	836	379	4,554	2,065
	W1WB	17,529	7,951	18,410	8,351	827	375	4,602	2,088
	W1WC	17,791	8,070	18,784	8,520	811	368	4,696	2,130

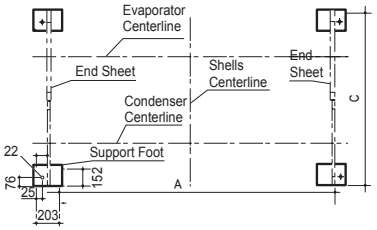
COMP.	SHELLS	SHIPPING WEIGHT		OPERATING WEIGHT		REFRIGERANT CHARGE		LOADING PER ISOLATOR	
		(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)	(LBS)	(KG)
R2	W1WD	18,120	8,219	19,252	8,733	794	360	4,813	2,183
	W2WA	17,515	7,945	18,384	8,339	873	396	4,596	2,085
	W2WB	17,652	8,007	18,579	8,427	864	392	4,645	2,107
	W2WC	17,915	8,126	18,954	8,597	849	385	4,738	2,149
	W2WD	18,243	8,275	19,421	8,809	831	377	4,855	2,202
	W3WA	17,646	8,004	18,566	8,421	908	412	4,642	2,105
	W3WB	17,784	8,067	18,764	8,511	902	409	4,691	2,128
	W3WC	18,047	8,186	19,138	8,681	886	402	4,785	2,170
	W3WD	18,375	8,335	19,606	8,893	869	394	4,901	2,223
	XFXB	18,472	8,379	19,568	8,876	941	427	4,892	2,219
	XFXC	18,832	8,542	20,077	9,107	928	421	5,019	2,277
	XFXD	19,275	8,743	20,706	9,392	911	413	5,176	2,348
	XGXB	18,664	8,466	19,822	8,991	966	438	4,955	2,248
	XGXC	19,021	8,628	20,329	9,221	950	431	5,082	2,305
	XGXD	19,464	8,829	20,957	9,506	933	423	5,239	2,377
	XHXB	19,037	8,635	20,317	9,215	1,021	463	5,079	2,304
	XHXC	19,394	8,797	20,823	9,445	1,005	456	5,206	2,361
	XHXD	19,837	8,998	21,452	9,730	988	448	5,363	2,433
	X1XB	19,061	8,646	20,236	9,179	963	437	5,059	2,295
	X1XC	19,418	8,808	20,742	9,409	948	430	5,186	2,352
	X1XD	19,861	9,009	21,371	9,694	930	422	5,343	2,423
	X2XB	19,224	8,720	20,460	9,281	1,014	460	5,115	2,320
	X2XC	19,581	8,882	20,967	9,510	999	453	5,242	2,378
	X2XD	20,024	9,083	21,595	9,796	981	445	5,399	2,449
	X3XB	19,405	8,802	20,706	9,392	1,067	484	5,177	2,348
	X3XC	19,762	8,964	21,213	9,622	1,052	477	5,303	2,406
	X3XD	20,205	9,165	21,842	9,907	1,034	469	5,460	2,477
R3	WEWA	16,870	7,652	17,598	7,982	794	360	4,400	1,996
	WEWB	17,006	7,714	17,794	8,071	785	356	4,448	2,018
	WEWC	17,269	7,833	18,168	8,241	769	349	4,542	2,060
	WEWD	17,597	7,982	18,636	8,453	752	341	4,659	2,113
	WFWA	16,980	7,702	17,743	8,048	818	371	4,436	2,012
	WFWB	17,116	7,764	17,938	8,137	809	367	4,485	2,034
	WFWC	17,379	7,883	18,313	8,307	794	360	4,578	2,077
	WFWD	17,707	8,032	18,780	8,519	776	352	4,695	2,130
	WGWA	17,121	7,766	17,931	8,133	833	378	4,483	2,033
	WGWB	17,258	7,828	18,126	8,222	825	374	4,531	2,055
	WGWC	17,520	7,947	18,501	8,392	809	367	4,625	2,098
	WGWD	17,848	8,096	18,968	8,604	791	359	4,742	2,151
	W1WA	17,617	7,991	18,439	8,364	831	377	4,610	2,091
	W1WB	17,754	8,053	18,635	8,453	822	373	4,659	2,113
	W1WC	18,016	8,172	19,009	8,622	807	366	4,752	2,156
	W1WD	18,344	8,321	19,477	8,835	789	358	4,869	2,209
	W2WA	17,740	8,047	18,609	8,441	869	394	4,652	2,110
	W2WB	17,877	8,109	18,804	8,529	860	390	4,701	2,132
	W2WC	18,139	8,228	19,179	8,699	844	383	4,795	2,175
	W2WD	18,468	8,377	19,646	8,911	827	375	4,912	2,228
	W3WA	17,870	8,106	18,791	8,523	904	410	4,698	2,131
	W3WB	18,007	8,168	18,986	8,612	895	406	4,747	2,153
	W3WC	18,269	8,287	19,361	8,782	880	399	4,840	2,195
	W3WD	18,598	8,436	19,828	8,994	862	391	4,957	2,248
	XFXB	18,697	8,481	19,793	8,978	937	425	4,948	2,244
	XFXC	19,054	8,643	20,300	9,208	922	418	5,075	2,302
	XFXD	19,497	8,844	20,928	9,493	904	410	5,232	2,373
	XGXB	18,887	8,567	20,045	9,092	959	435	5,011	2,273
	XGXC	19,244	8,729	20,551	9,322	944	428	5,138	2,330
	XGXD	19,687	8,930	21,180	9,607	926	420	5,295	2,402
	XHXB	19,257	8,735	20,537	9,315	1,012	459	5,134	2,329
	XHXC	19,614	8,897	21,044	9,545	996	452	5,261	2,386
	XHXD	20,057	9,098	21,672	9,830	979	444	5,418	2,458
	X1XB	19,281	8,746	20,456	9,279	955	433	5,114	2,320
	X1XC	19,641	8,909	20,965	9,510	941	427	5,241	2,377
	X1XD	20,084	9,110	21,594	9,795	924	419	5,398	2,449
	X2XB	19,445	8,820	20,680	9,381	1,005	456	5,170	2,345
	X2XC	19,804	8,983	21,189	9,611	992	450	5,297	2,403
	X2XD	20,245	9,183	21,816	9,896	972	441	5,454	2,474
	X3XB	19,623	8,901	20,924	9,491	1,056	479	5,231	2,373
	X3XC	19,982	9,064	21,433	9,722	1,043	473	5,358	2,431
	X3XD	20,426	9,265	22,062	10,007	1,025	465	5,516	2,502

NOTE: Above weights base on floor mounted star-delta starter, if unit-mounted star-delta starter selected, 200kgs should be added to shipping and operating weights; For solid state starter, 100kgs added.
Above T0, T1, T2, T3 unit weights base on San Antonio production units; For accurate unit weights of Wuxi production, please contact with Wuxi CSD or refer to Wuxi shipped unit drawings.

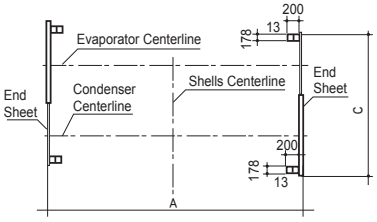
DIMENSIONS



Neoprene Isolators Floor Layout



Spring Isolators Floor Layout



T0-T4, R2, R3 Compressors - Evaporator, Condenser Dimensions

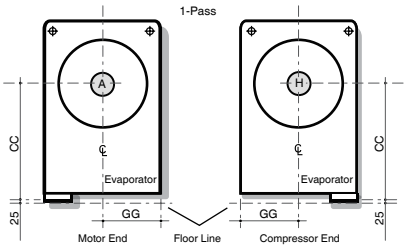
DIM. mm	T0,T1		T1	T2, R2	T2, T3, R2, R3		T4	
	Evaporator-Condenser Shell Codes							
	T - T	V - V	W - W	V - V	W - W	X - X	W - W	X - X
A	3048	4267	3658	4267	3658	4877	3658	4877
B	2270	2270	2327	2270	2639	2639	2639	2639
C	1549	1550	1676	1550	1735	1735	1735	1735
D	762	762	787	762	787	787	787	787
E	787	787	889	787	889	889	889	889
F	381	381	394	381	394	394	394	394
G	394	394	445	394	445	445	445	445
L	70	679	70	226	70	679	70	679
M	381	991	432	534	432	1042	432	1042

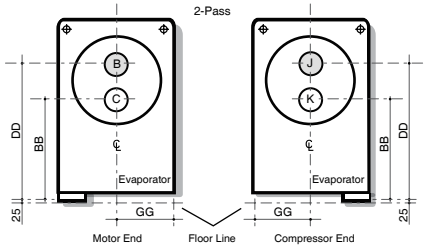
Nozzle Dimensions

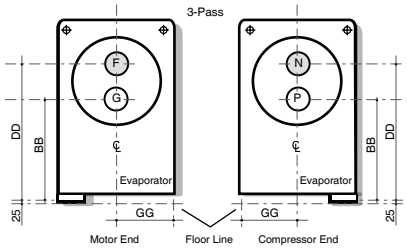
DIM. mm	Water Box Dimensions											
	Evaporator T&V			Condenser T&V			Evaporator W&X			Condenser W&X		
	1-Pass	2-Pass	3-Pass	1-Pass	2-Pass	3-Pass	1-Pass	2-Pass	3-Pass	1-Pass	2-Pass	3-Pass
H	378	343	343	-	-	-	423	371	365	-	-	-
J	-	-	-	343	360	357	-	-	-	365	362	364
K	-	215	-	-	190	-	-	240	-	-	215	-

NOZZLE ARRANGEMENT DIMENSIONS

Evaporator – Compact Water Boxes







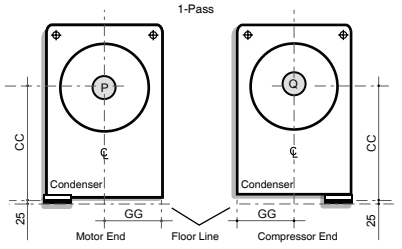
Nozzle Arrangements		
No. of Passes	Evap.	
	In	Out
1	A	H
	H	A

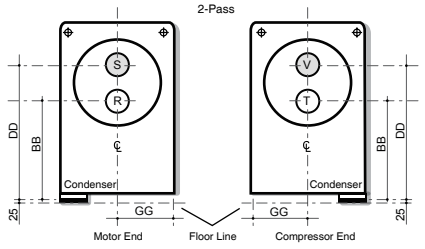
Nozzle Arrangements		
No. of Passes	Evap.	
	In	Out
2	C	B
	K	J

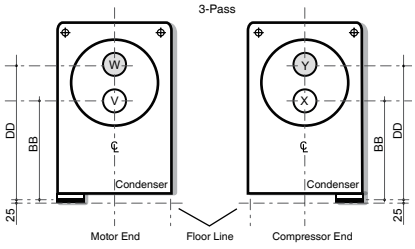
Nozzle Arrangements		
No. of Passes	Evap.	
	In	Out
3	G	N
	P	F

Evaporator Shell Code	Nozzle Pipe Size			Evaporator Nozzle Dimensions							
	No. of Passes			1-Pass		2-Pass			3-Pass		
	1	2	3	CC²	GG	BB²	DD²	GG	BB²	DD²	GG
T,V	200	150	100	579	394	376	782	394	376	782	394
W,X	250	200	150	630	445	408	852	445	408	852	445

Condenser – Compact Water Boxes







Nozzle Arrangements		
No. of Passes	Cond.	
	In	Out
1	P	Q
	Q	P

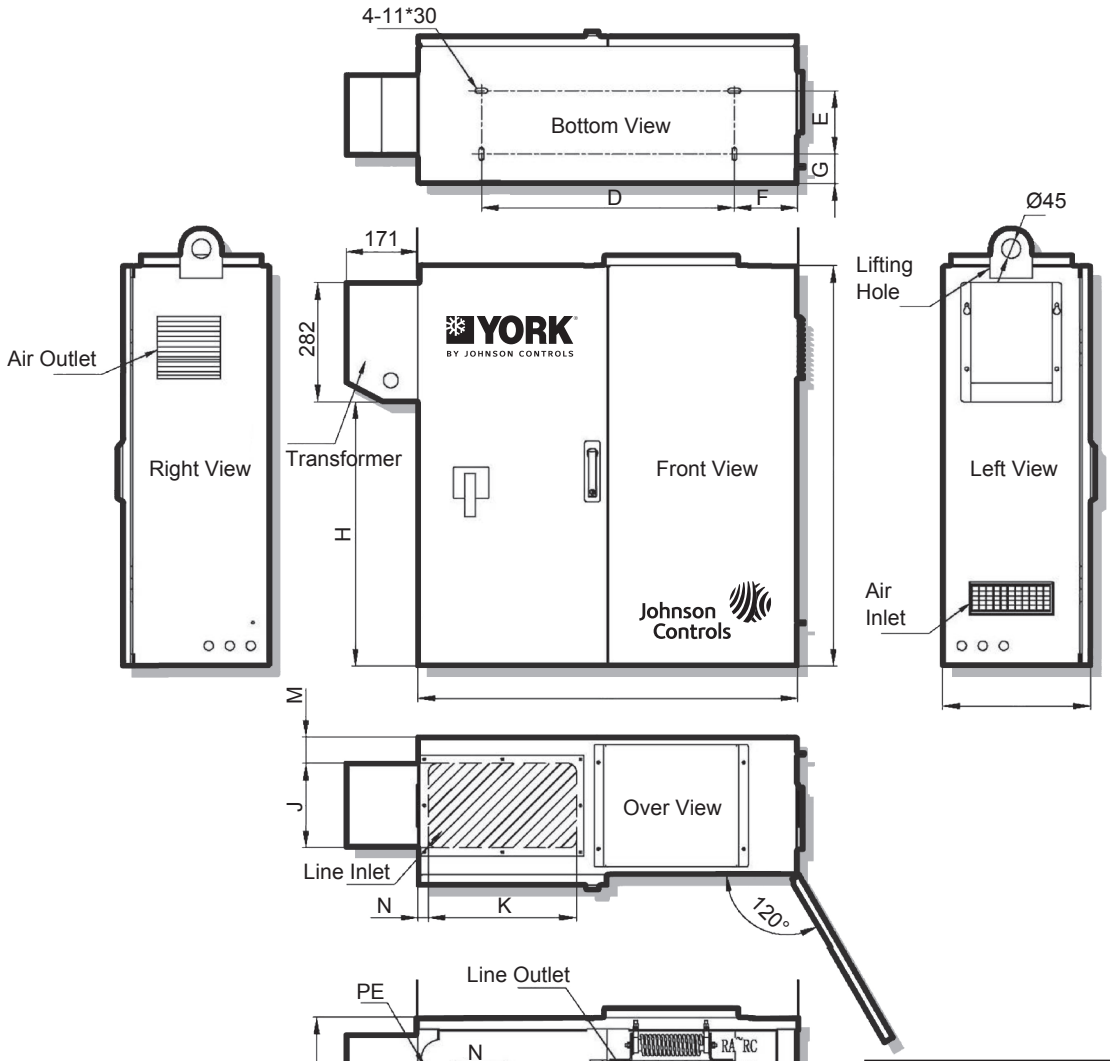
Nozzle Arrangements		
No. of Passes	Cond.	
	In	Out
2	R	S
	T	V

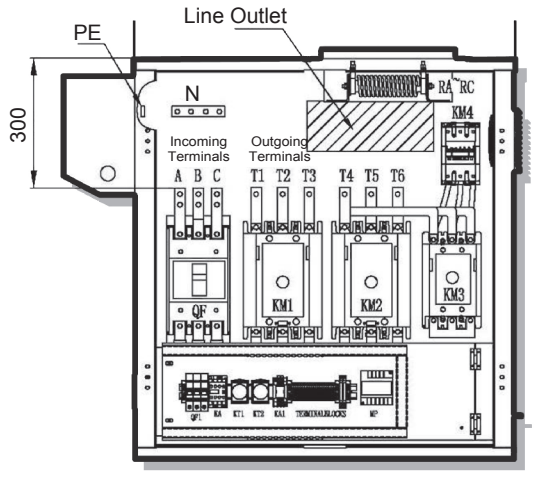
Nozzle Arrangements		
No. of Passes	Cond.	
	In	Out
3	V	Y
	X	W

Condenser Shell Code	Nozzle Pipe Size			Condenser Nozzle Dimensions							
	No. of Passes			1-Pass		2-Pass			3-Pass		
	1	2	3	CC²	GG	BB²	DD²	GG	BB²	DD²	GG
T,V	250	150	150	731	381	566	896	381	566	896	381
W,X	300	200	150	782	394	591	973	394	585	979	394

NOTE: 1. Standard water nozzles are furnished as flanges, allowing the option of welding stub-outs with Victaulic grooves, or use of Victaulic couplings. Companion flanges, nuts, bolts, and gaskets are not furnished.
2. Add 25mm for isolators as shown.
3. One-, two- and three-pass nozzle arrangements are available only in pairs shown and for all shell codes. Any pair of evaporator nozzles may be used in combination with any pair of condenser nozzles.
4. Connected piping should allow for removal of compact water boxes for tube access and cleaning.
5. Rear of unit is defined as side of chiller opposite control center.

UNIT MOUNTED STAR-DELTA STARTER (380V/400V/415V 50Hz)

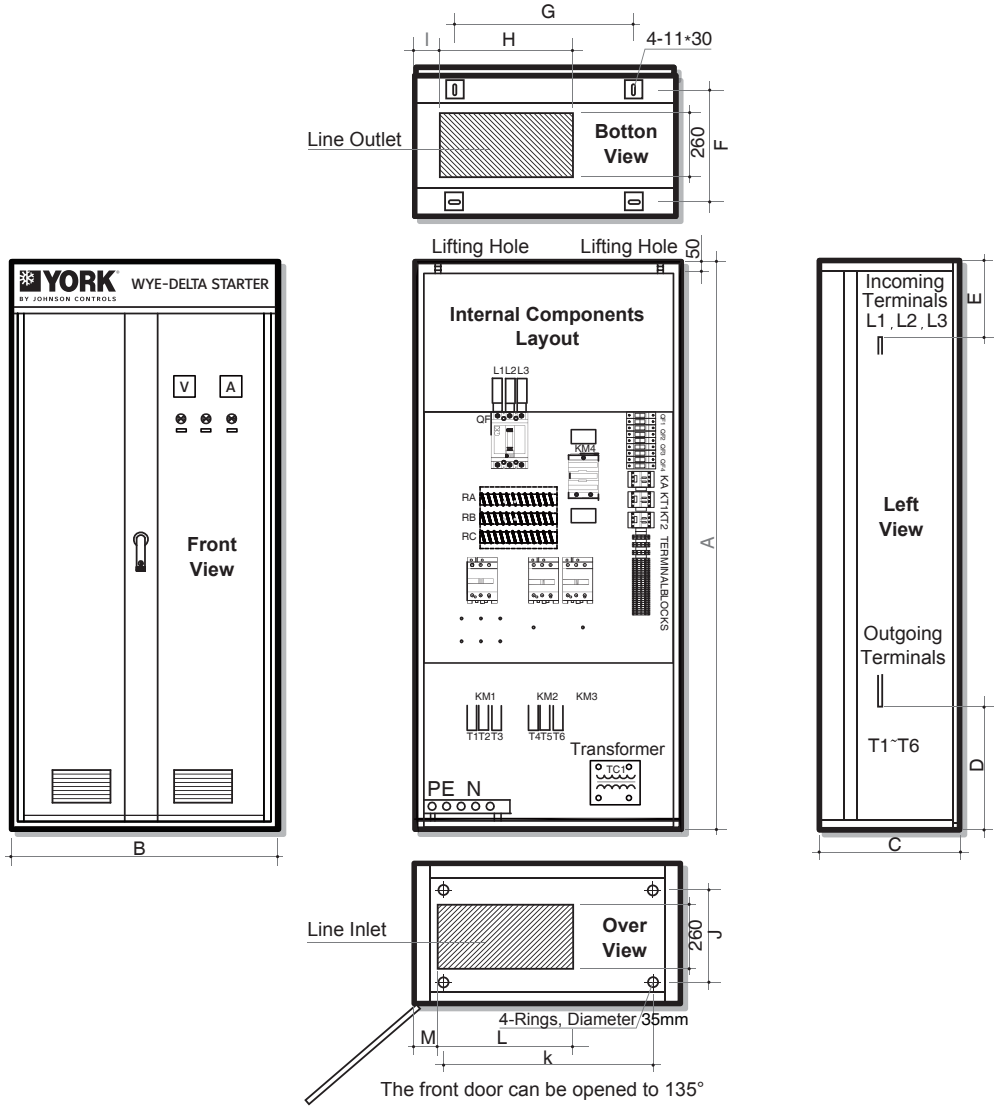




Internal Components Layout

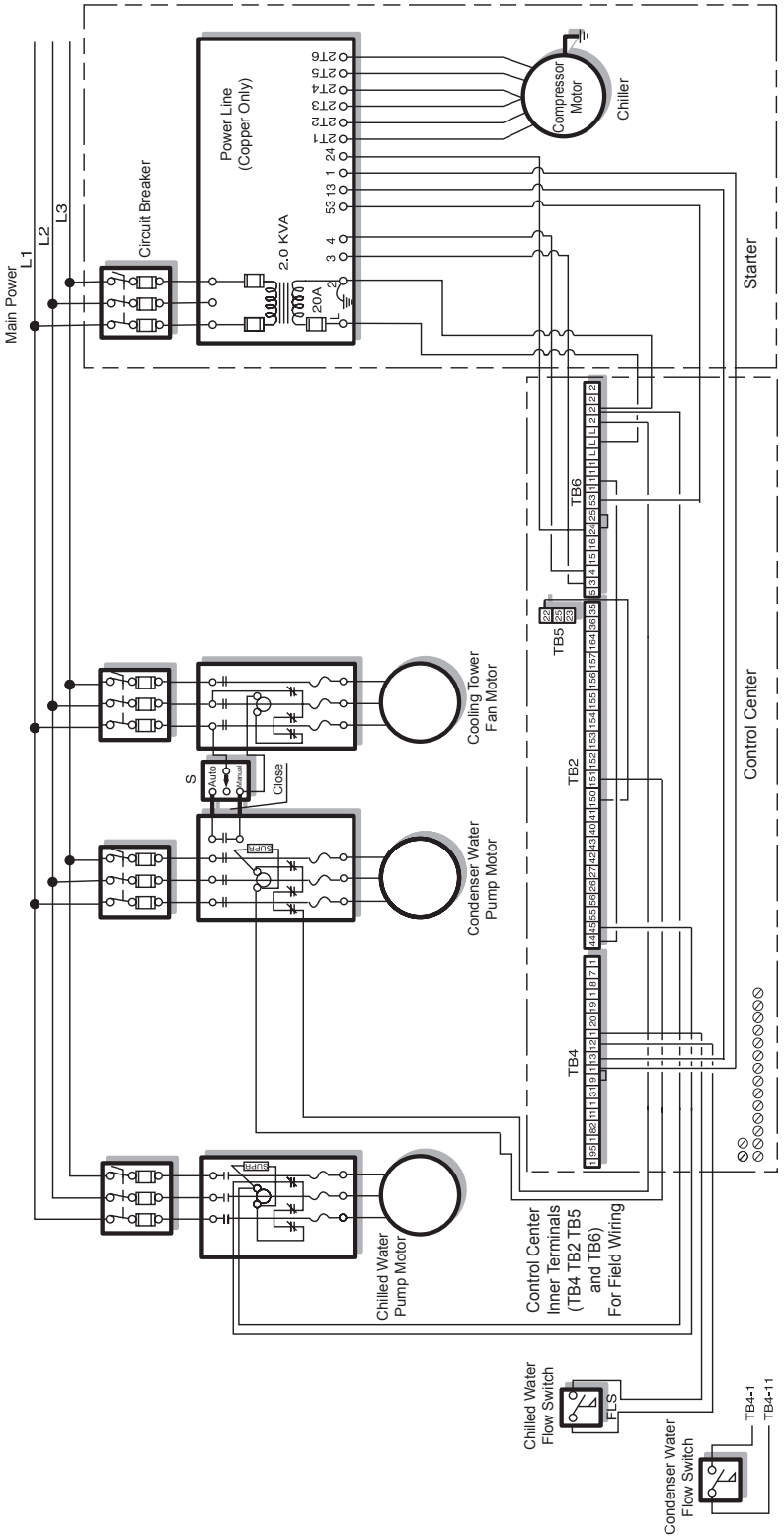
Compressor Code	T0, T1	T2,R2	T3, T4, R3
Starter Model	UMS501-1E	UMS501-2E	UMS501-4E
A (H)	900		950
B (W)	770		900
C (D)	350		350
D	500		600
E	150		150
F	135		150
G	70		70
H	580		630
J	200		200
K	300		350
M	62.5		62.5
N	25		25

FLOOR MOUNTED STAR-DELTA STARTER (BELOW 660V, 50Hz & 60Hz)



Range (FLA)	0~495A	496~741A	742~1150A	1151~1350A
A (H)	1700	2000	2100	2200
B (W)	800	900	1100	1200
C (D)	450	550	550	550
D	265	300	350	250
E	240	250	250	250
F	335	435	435	435
G	500	600	800	900
H	380	440	440	490
I	92	92	142	142
J	235	325	325	325
K	636	726	926	926
L	480	480	480	530
M	82	82	82	82

FIELD WIRING DIAGRAM (YR WITH STAR-DELTA STARTER)



NOTE: 1. If unit-mounted star-delta starter is selected, it is wired in factory, if floor-mounted star-delta is selected, it is wired at field.
2. For unit-mounted star-delta starter, the circuit breaker is optional, for floor-mounted star-delta starter, circuit breaker is standard.

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