YORK®

MAXE™

Centrifugal Liquid Chillers

MODEL YT Design Level J

00613VIP

150 THROUGH 850 TONS
(527 through 2989 kW)
Utilizing HCFC-123

Metric Conversions

Rated in Accordance with the latest edition of ARI STANDARD 550/590

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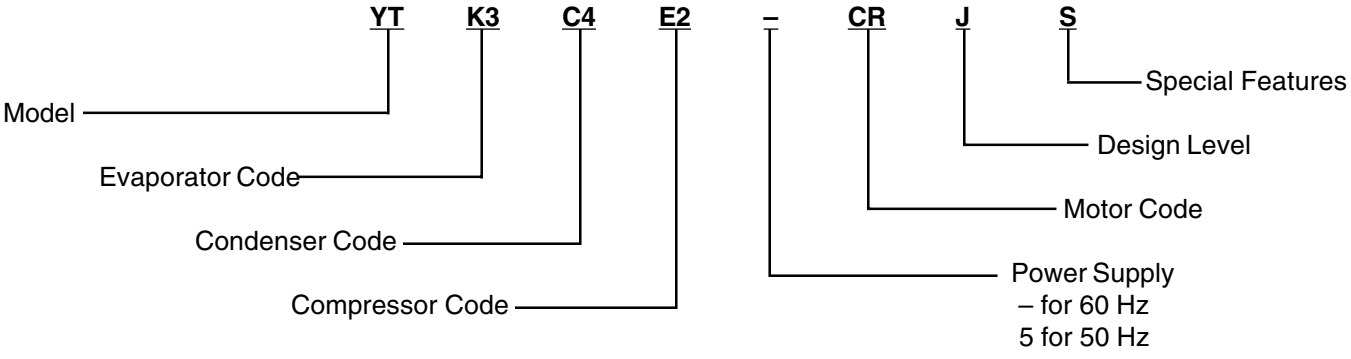
NOMENCLATURE

The model number denotes the following characteristics of the unit.



Introduction

The YORK **MAXE™** YT Chillers offer 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 lowest system kW/Ton. YORK MAXE chiller technology matches chiller system components to provide maximum chiller efficiency under actual – not just theoretical – operating conditions.

REAL-WORLD ENERGY PERFORMANCE

YORK pioneered the term "Real-World Energy" to illustrate 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 YK MAXE chillers are the only chillers designed to operate on a continuous basis with cold ECWT and full condenser flow at all load points, taking full advantage of Real-World 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 MAXE chillers offer the most efficient Real-World operation of any chiller, meaning lower operating costs and an excellent return on your chiller investment.

OPEN DRIVE DESIGN

Hermetic-motor burnout can cause catastrophic damage to a chiller. The entire chiller must be cleaned, and the refrigerant replaced. YORK MAXE centrifugal chillers eliminate this risk by utilizing air-cooled motors. Refrigerant never comes in contact with the motor, preventing contamination of the rest of the chiller.

Insurance companies that offer policies on large air conditioning equipment often consider air-cooled motors a significant advantage over hermetic refrigerant-cooled units.

HIGH-EFFICIENCY HEAT EXCHANGERS

MAXE chiller heat exchangers offer the latest technology in heat transfer surface design to give you maximum efficiency and compact design. Water-side and refrigerant-side design enhancements minimize both energy consumption and tube fouling.

SINGLE-STAGE COMPRESSOR DESIGN AND EFFICIENCY PROVEN IN THE MOST DEMANDING APPLICATIONS

Designed to be the most reliable chillers we've ever made, YORK MAXE chillers incorporate single-stage compressor design. With fewer moving parts and straight-forward, efficient engineering, YORK single-stage compressors have proven durability records in hospitals, chemical plants, gas processing plants, the U.S. Navy, and in other applications where minimal downtime is a crucial concern.

In thousands of installations worldwide, YORK single-stage compressors are working to reduce energy costs. Lightweight, high strength aluminum compressor impellers feature backward-curved vanes for high efficiency. Airfoil shaped pre-rotation vanes minimize flow disruption for the most efficient part-load performance. Precisely positioned and tightly fitted they allow the compressor to unload smoothly from 100% to minimum load for minimum air conditioning applications.

FACTORY PACKAGING REDUCES FIELD LABOR COSTS

YORK MAXE centrifugal 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 Variable Speed Drive or a factory installed Solid-State Starter, the three power leads provide all power to the chiller and its auxiliaries.

TAKE ADVANTAGE OF COLDER COOLING TOWER WATER TEMPERATURES

YORK MAXE centrifugal chillers have been 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.

U.L. ACCEPTANCE – YOUR ASSURANCE OF RELIABILITY

YORK MAXE centrifugal chillers are approved for listing by Underwriter's Laboratories for the United States and Canada. Recognition of safety and reliability is your assurance of trouble-free performance in day-today building operation.

Ratings

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

ARI CERTIFICATION PROGRAM

The performance of YORK MAXE chillers has been certified to the Air Conditioning and Refrigeration Institute (ARI) as complying with the certification sections of the latest issue of ARI Standard 550/590. Under this Certification Program, chillers are regularly tested in strict compliance with this Standard. This provides an independent, third-party verification of chiller performance.

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 YORK sales office. These ratings can be tailored to specific job requirements, and are part of the ARI Certification Program.

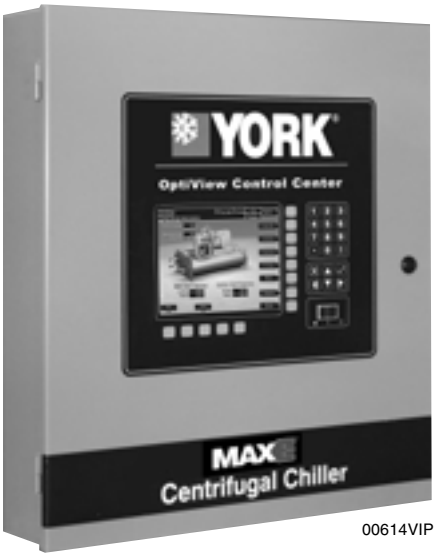
OFF-DESIGN PERFORMANCE

Since the vast majority of its operating hours are spent at off-design conditions, a chiller should be chosen not only to meet the full-load 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 use of the computer. And because it is so important to an owner's operating budget, this information has now been standardized 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 ARI Standard 550/590 much more closely track actual chiller operations, and provide a more accurate indication of chiller performance than the previous IPLV / APLV 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.

OptiView Control Center



00614VIP

The YORK OptiView 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 HCFC-123 centrifugal chillers. The panel is configured with a 10.4-in. diagonal color Liquid Crystal Display (LCD) surrounded by “soft” keys, which are redefined with one keystroke based on the screen displayed 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 mono-chrome LCD screen, a single button reveals a wide array of information on a large, full-color illustration of the appropriate component, which makes information easier to interpret. This is all mounted in the middle of a keypad interface and installed in a locked enclosure.

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, Time and Date. All date representations and calculations use four digits for the year to provide Year 2000 compliance.

During prelube and coastdown, the system status will include a countdown timer indicating the time remaining. The control panel is compatible with the YORK Solid State Starter (optional); YORK Variable Speed Drive (VSD) (Optional), Electro-Mechanical (E-M) starter or any customer supplied E-M starter that complies with the YORK R-1051 standard. The locations of various chiller parameters are clearly marked and instructions for specific operations are provided on many of the screens. The panel verbiage is available in other languages as an option with English always available. Data can be displayed in either English or Metric units plus keypad entry of setpoints to 0. 1 increments.

Security access is provided to prevent unauthorized changes of setpoints. This is accomplished with three different levels of access and passwords for each level. There are certain screens, displayed values, programmable setpoints and manual controls not shown that are for servicing the chiller. They are only displayed when logged in at service access level. Included in this is the Advanced Diagnostics and troubleshooting information for the chiller and the panel.

The control center is supplied 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 Switches, Chilled Water Pump and Local or Remote Cycling devices 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.

Setpoints can be changed from a remote location via 0-10VDC, 4-20mA, 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 YORK ISN Building Automation System (BAS) is through the optional General Protocol Interface Card (GPIC), which can be mounted inside the control center.

This printed circuit board requests the required data from the Micro Board and makes it available for the YORK ISN network. This optional board is available through the YORK BAS group. The operating program is stored in non-volatile memory (EPROM) to eliminate chiller failure due to AC power failure/battery discharge. Programmed setpoints are retained in lithium battery-backed RTC memory for 11 years minimum.

Smart Freeze Point Protection will run the chiller at 36°F (2.22°C) leaving chilled water temperature, and not have nuisance trips on Low Water Temperature. The sophisticated program and sensor will monitor the chiller water temperature to prevent freeze up. Every programmable point has a pop-up screen with the allowable ranges, so that the chiller can not be programmed to operate outside of its design limits.

When the 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
- Input Power (kW) (VSD Only)

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 SUMP, MOTOR, SETPOINTS** and the **HISTORY.** Also on the Home screen is the ability to **Log IN, Log Out** and **Print.** 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. From this screen you can view the following:

Display Only

- Discharge Temperature
- Chilled Liquid Temperature – Leaving
- Chilled Liquid Temperature – Return
- Chilled Liquid Temperature – Setpoint
- Evaporator Pressure
- Evaporator Saturation Temperature
- Condenser Liquid Temperature - Leaving
- Condenser Liquid Temperature - Return
- Condenser Pressure
- Condenser Saturation Temperature
- Oil Sump Temperature
- 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 allows the chiller to cycle on and off for greater efficiency and less cycling. The chiller cycles off when the leaving chilled water temperature is below setpoint and adjustable from 1°F (.55°C) below to a minimum of 36°F (2.2°C). Restart is adjustable from setpoint up to a maximum of 80°F (44.4°C). The Panel will check for flow to avoid freeze up of the tubes. If flow is interrupted, shutdown will occur after a minimum of two seconds. From this screen you can perform the following:

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
- Evaporator Refrigerant Temperature

- Small Temperature Difference
- Leaving Chilled Liquid Temperature Setpoints – Setpoint
- Leaving Chilled Liquid Temperature Setpoints – Shutdown
- Leaving Chilled Liquid Temperature Setpoints – Restart

Programmable

- Local Leaving Chilled Liquid Temperature – Range
- 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. From this screen you can view the following:

Display Only

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

The **PURGE** screen displays a cutaway view of the purge tank, where all setpoints relating to the purge system are maintained on this screen. LEDs depict the state of the Float switches, Oil Valve solenoid, Air Valve solenoid and the Purge exhaust count is displayed. From this screen you can view the following:

Display Only

- Air Valve Solenoid (LED)
- Top Float Switch (LED)
- Bottom Float Switch (LED)
- Oil Valve Solenoid (LED)
- Pressure
- Exhaust Count
- Exhaust Window
- Bypass Time Left

Programmable

- Maximum Purges/Hour

The **COMPRESSOR** screen displays a cutaway view of the compressor, this reveals the impeller and shows all the conditions associated with the compressor. When the compressor impeller is spinning this indicates that the chiller is presently in RUN condition. With the proper access level, the pre-rotation vanes may be manually controlled. This screen also serves as a gateway to sub-screens for calibrating the prerotation vanes, the proximity probe, configuring the Hot Gas By-Pass, or providing advanced control of the compressor motor Variable Speed Drive. From this screen you can view the following:

Display Only

- Oil Pressure
- Oil Sump Temperature
- Discharge Temperature
- Superheat Temperature
- Vane Motor Switch (LED)
- Vent Line Solenoid (LED)

The **OIL SUMP** screen displays a close-up view of the chiller oil sump and provides all the necessary setpoints for maintaining the Variable Speed Oil Pump (VSOP). This screen also allows manual control of the Frequency Command sent to the VSOP. From this screen you can perform the following:

Display Only

- Oil Sump Temperature
- Oil Pressure
- Oil Pump Run Output (LED)
- Manual Oil Pump Operation Time Left

Programmable

- Manual Pump

1. The MOTOR “soft” key on the Home screen when pressed, shows a picture of either a YORK Electro-Mechanical Starter, Solid State Starter or a Variable Speed Drive Screen depending on chiller configuration. Programmable pulldown demand to automatically limit motor loading for minimizing

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 all three offerings and the values will be displayed on all 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
- Pulldown Demand Time Left

Programmable

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

The **SOLID STATE STARTER** – (SSS) screen displays a picture of the starter and following values that are displayed in addition to the common ones listed above.

Display Only

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

The **VARIABLE SPEED DRIVE** – (VSD) screen displays a picture of the VSD and the following values that are in addition to the common ones listed above. From this screen you can view the following:

Display Only

- Output Voltage
- Output Frequency
- Current – Phase A, B, C
- Input Power
- kW Hours
- Pre-Rotation Vane Position
- Harmonic Filter Data (Filter option only)
  - Supply KVA
  - Total Power Factor
  - Voltage Total Harmonic Distortion – L1, L2, L3
  - Supply Current Total Demand Distortion – LI, L2, L3

There are two additional screens (Sub-Screens) that have further VSD information. From these screens you can view the following:

1) Variable Speed Drive Details

Display Only

- Water Pump Output (LED)
- Precharge Relay Output (LED)
- Trigger SCR Output (LED)
- DC Bus Voltage
- DC Inverter Link Current
- Internal Ambient Temperature
- Converter Heatsink Temperature
- Heatsink Temperature – Phase A, B, C
- Motor HP
- 100% Full Load Amps

2) Harmonic Filter Details (Filter option only)

Display Only

- Operating Mode (Run/Stop)
- DC Bus Voltage
- Supply Contactor (LED)
- Precharge Contactor (LED)
- Phase Rotation
- Total Supply KVA
- Heatsink Temperature (Harmonic Filter)
- Voltage Peak (N-L1, N-L2, N-L3)
- RMS Voltage (L1, L2, L3)
- Voltage Total Harmonic Distortion (L1, L2, L3)
- RMS Filter Current (L1, L2, L3)
- Supply Current Total Demand Distortion
- RMS Supply Current (L1, L2, L3)

The **SETPOINTS** screen provides a convenient location for programming the most common setpoints involved in the chiller control. The Setpoints are shown on other individual screens but to cut down on needless searching they are on this one screen. This screen also serves as a gateway to a sub-screen for defining the setup of general system parameters. From this screen you can perform the following:

Display Only

- Leaving Chilled Liquid Temperature – Setpoint
- Leaving Chilled Liquid Temperature Cycling – Shutdown
- Leaving Chilled Liquid Temperature Cycling – Restart
- Current Limit Setpoint

Programmable

- Local Leaving Chilled Liquid Temperature – Range
- Local Leaving Chilled Liquid Temperature – Setpoint
- Leaving Chilled Liquid Temperature Cycling Offset – Shutdown
- Leaving Chilled Liquid Temperature Cycling Offset – Restart
- Remote Analog Input Range
- Local Motor Current Limit
- Pulldown Demand Limit
- Pulldown Demand Time
- Print

The **SETUP** is the top level of the general configuration parameters. It allows programming of the time and date, along with specifications as to how the time will be displayed. In addition, the chiller configuration as determined by the micro board program jumpers and program switches is displayed. From this screen you can perform the following.

Display Only

- Chilled Liquid Pump Operation: (Displays Standard or Enhanced)
- Motor Type: (Displays Fixed Speed or Variable Speed)
- Refrigerant Selection: (Displays R-123)
- Anti-Recycle: (Displays Disable or Enabled)
- Power Failure Restart: (Displays Manual or Automatic)
- Liquid Type: (Water or Brine)
- Coastdown: (Displays Standard or Enhanced)
- Pre-Run: (Displays Standard or Extended)
- Power Line Frequency (VSD only): (Displays 60 Hz or 50 Hz)

Programmable

- Set Date
- Set Time
- Clock (Enabled/Disabled)
- 12/24 Hr.

The following 6 sub-screens 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 up to **6 weeks** in advance. 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

- Exception Start/Stop Times
- Schedule (Enable/ Disabled)
- Repeat Sunday Schedule
- Standard Week Start/Stop Times
- Reset All Exception Days
- Select
- Print

The **USER** screen allows definition of the language for the chiller to display and defines the unit of measure.

Programmable

- System Language
- English / Metric Units

The **COMMS** screen allows definition of the necessary communications parameters.

Programmable

- Chiller ID
- Com 2 Baud Rate
- Com 2 Data Bit(s)
- Com 2 Parity Bit(s)
- Com 2 Stop Bit(s)
- Printer Baud Rate
- Printer Data Bit(s)
- Printer Parity Bit(s)
- Printer Stop Bit(s)

The **PRINTER** screen allows Definition of the necessary communications Parameters for the printer.

Display Only

- Time Remaining Until Next Print

Programmable

- Log Start Time
- Output Interval
- Automatic Printer Logging (Enabled/Disabled)
- Print Type
- ACC Auto Map Print (Enable/Disabled)
- ACC Map Report
- Print Report
- Print All Histories

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

- Model Number
- Panel Serial Number
- Chiller Serial Number
- YORK Order Number
- System Information
- Condenser and Evaporator Design Load Information
- Nameplate Information

The **OPERATIONS** screen allows definition of parameters having to do with operation of the chiller. What is defined is whether the control of the chiller will be Local, Digital Remote, Analog Remote, Modem Remote or ISN Remote.

Programmable

- Control Source

The **HISTORY** screen allows the user to browse through the last ten faults; either safety or cycling shutdowns with the conditions while the chiller is running or stopped. The faults are color coded for ease in determining the severity at a glance, recording the date, time and description. **(See Display Messages for Color Code meanings.)**

Display Only

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

Programmable

- Print History
- Print All Histories

By pressing the **VIEW DETAILS** key you will move to the **HISTORY DETAILS** screen. From these screens you are able to see an on-screen printout of all the system parameters at the time of the selected shutdown.

Display Only

- History Printout

Programmable

- Page Up
- Page Down
- Print History

Also under the **History** screen is the **TRENDING** screen, accessible by the key marked the same. On this screen up to 6 operator-selected parameters selected from a list of over 140, 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. There are two types of charts that can be created: a single or continuous screen. The single screen collects data for one screen width (450 data points across the x-axis) then stops. The continuous screen keeps collecting the data but the oldest data drops off the graph from left to right at the next data collection interval. 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
- y-axis
- x-axis

The **TREND SETUP** screen is used to configure the trending screen. The parameters to be trended are selected from the Trend Common Slots Screen accessed from the Slot #s button or the Master Slot Numbers List found in the operating manual. The interval at which all the parameters are sampled is selected under the Collection Interval button. The data point minimum and maximum values may be adjusted closer within the range to increase viewing resolution.

Programmable

- Chart Type (select Continuous or One Screen)
- Collection Interval

- Select
- Data Point Slot # (1-6)
- Data Point Min (1-6)
- Data Point Max (1-6)

The **TREND COMMON SLOTS** screen displays the Master Slot Numbers List of the monitored parameters.

Display Only

- Slot Numbers

Programmable

- Page Up
- Page Down

DISPLAY MESSAGES

The control center continually 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 Status Bar messages. Messages are color-coded 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
- System Prelube (with countdown timers)
- System Run (with countdown timers)
- System Coastdown (with countdown timers)
- Start Inhibit
- Vanes Closing Before Shutdown

Run Messages include:

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

Start Inhibit Messages include:

- Anti-Recycle XX Min/Sec
- Vane Motor Switch Open
- Motor Current >15% FLA
- LCSSS – High Temperature Phase X - Stopped

Warning Messages include:

- Real Time Clock Failure
- Condenser or Evaporator Transducer Error
- Setpoint Override
- Condenser – High Pressure Limit
- Evaporator – Low Pressure Limit
- Vanes Uncalibrated – Fixed Speed (VSD option only)
- Purge – High Pressure
- Purge – Float Switch Error
- Purge – Excess Purge
- Vanes Uncalibrated (Hot Gas Bypass Option Only)
- External I/O – Serial Communications

(Filter option only)

- Harmonic Filter – Operation Inhibited
- Harmonic Filter – Data Loss
- Harmonic Filter – Input Frequency Range

Routine Shutdown Messages include:

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

Cycling Shutdown Messages include:

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

LCSSS Only

- Initialization Failed
- Serial Communications
- Shutdown – 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
- Phase Rotation / Loss
- Logic Board Power Supply

Compressor Motor Variable Speed Drive: Cycling Shutdown Messages include (VSD only):

- VSD Shutdown – Requesting Fault Data
- VSD – Stop Contacts Open
- VSD Initialization Failed
- VSD – High Phase A, B, C Instantaneous Current
- VSD – Phase A, B, C Gate Driver
- VSD – Single Phase Input Power
- VSD – High DC Bus Voltage
- VSD – Logic Board Power Supply
- VSD – Low DC Bus Voltage
- VSD – DC Bus Voltage Imbalance
- VSD – Precharge – DC Bus Voltage Imbalance
- VSD – High Internal Ambient Temperature
- VSD – Invalid Current Scale Selection
- VSD – Low Phase A, B, C Inverter Heatsink Temperature
- VSD – Low Converter Heatsink Temperature
- VSD – Precharge – Low DC Bus Voltage
- VSD – Logic Board Processor
- VSD – Run Signal
- VSD – Serial Communications

(Filter option only)

- Harmonic Filter – Logic Board or Communications
- Harmonic Filter – High DC Bus Voltage
- Harmonic Filter – High Phase A, B, C Current
- Harmonic Filter – Phase Locked Loop
- Harmonic Filter – Precharge – Low DC Bus Voltage
- Harmonic Filter – Low DC Bus Voltage
- Harmonic Filter – DC Bus Voltage Imbalance
- Harmonic Filter – 110% Input Current Overload
- Harmonic Filter – Logic Board Power Supply
- Harmonic Filter – Run Signal
- Harmonic Filter – DC Current Transformer 1
- Harmonic Filter – DC Current Transformer 2

Safety Shutdown Messages include:

- Evaporator – Low Pressure
- Evaporator – Low Pressure – Smart Freeze
- 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 – High Temperature
- Oil – Low Differential Pressure
- Oil – High Differential Pressure
- Control Panel – Power Failure
- Watchdog – Software Reboot

LCSSS Only

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

Compressor Motor VSD: Safety Shutdown Messages include: (VSD only)

- VSD Shutdown – Requesting Fault Data
- VSD Stop contacts Open
- VSD – 105% Motor Current Overload
- VSD – High Phase A, B, C Inverter Heatsink Temperature
- VSD – High Converter Heatsink Temperature
- VSD – Precharge Lockout

(Filter option only)

- Harmonic Filter – High Heatsink Temperature
- Harmonic Filter – High Total Demand Distortion

Mechanical Specifications

GENERAL

The YORK MAXE Centrifugal Liquid Chiller is completely factory-packaged including evaporator, condenser, sub-cooler, compressor, motor, lubrication system, control center, and all interconnecting unit piping and wiring.

The initial charge of refrigerant and oil is supplied for each unit. Oil is shipped in the chiller. Refrigerant HCFC-123 is shipped to the jobsite in cylinders at the time of installation.

The services of a YORK factory-trained, field service representative are included to supervise or perform the final leak testing, charging, the initial start-up, and concurrent operator instructions.

COMPRESSOR

The compressor is a single-stage centrifugal type powered by an open-drive electric motor. The casing is fully accessible with vertical circular joints and fabricated of close-grain cast iron. The complete operating assembly is removable from the compressor and scroll housing. Compressor castings are designed for 15 PSIG working pressure and hydrostatically pressure tested at 50 PSIG.

The rotor assembly consists of a heat-treated alloy steel drive shaft and impeller shaft with a lightweight, high strength, cast aluminum, fully shrouded impeller. The impeller is designed for balanced thrust and is dynamically balanced and overspeed tested for smooth, vibration free operation.

The insert type journal and thrust bearings are fabricated of aluminum alloy and are precision bored and axially grooved.

The specially engineered, single helical gears with crowned teeth are designed so that more than one tooth is in contact at all times to provide even distribution of compressor load and quiet operation. Gears are integrally assembled in the compressor rotor support and are film lubricated. Each gear is individually mounted in its own journal and thrust bearings to isolate it from impeller and motor forces.

The open-drive compressor shaft seal consists of a spring-loaded, precision carbon ring, high temperature elastomer “O” ring static seal, and stress-relieved, precision lapped collars. The seal features a small face area and low rubbing speed. It provides an efficient seal under high pressure conditions. The seal is oil-flooded at all times and is pressure-lubricated during compressor operation.

CAPACITY CONTROL

Pre-rotation vanes (PRV) modulate chiller capacity from 100% to 10% of design for normal air conditioning applications. Operation is by an external, electric PRV actuator which automatically controls the vane position to maintain a constant leaving chilled liquid temperature. Rugged air-foil shaped cast manganese bronze vanes are precisely positioned by solid vane linkages connected to the electric actuator.

LUBRICATION SYSTEM

Lubrication oil is force-fed to all bearings, gears and rotating surfaces by an oil pump which operates prior to startup, continuously during operation and during coastdown. A gravity-fed oil reservoir is built into the top of the compressor to provide lubrication during coastdown in the event of a power failure.

An oil reservoir, separate from the compressor, contains the submersible oil pump, minimum 3/4 HP pump motor and 1000 watt immersion-type oil heater. The oil heater is thermostatically controlled to remove refrigerant from the oil.

Oil is filtered by an externally mounted 1/2-micron replaceable cartridge oil filter equipped with service valves. Oil passes through a refrigerant-cooled oil evaporator located in the evaporator shell before entering the compressor. An automatic oil return system removes any oil that may have migrated to the evaporator. Oil piping is completely factory installed and tested.

MOTOR DRIVELINE

The compressor motor is an open drip-proof, squirrel cage, induction type constructed to YORK design specifications. 60 hertz motors operate at 3570 rpm. 50 hertz motors operate at 2975 rpm. The open motor is provided with a D-flange, and is factory mounted to a cast iron adaptor mounted on the compressor. This unique design allows the motor to be rigidly coupled to the compressor to provide factory alignment of motor and compressor shafts. It also provides a ready access to the motor for repair without first removing refrigerant from the chiller.

Motor drive shaft is directly connected to the compressor shaft with a flexible disc coupling. Coupling has all metal construction with no wearing parts to assure long life, and no lubrication requirements to provide low maintenance.

For units utilizing remote electro-mechanical starters, a large steel terminal box with gasketed front access cover

is provided for field connected conduit. There are six terminals (three for medium voltage) brought through the motor casing into the terminal box. Jumpers are furnished for three-lead types of starting. Motor terminal lugs are not furnished. Overload/overcurrent transformers are furnished with all units. For units furnished with factory packaged Solid State Starters or Variable Speed Drive, refer to the Accessories and Modifications Section.

HEAT EXCHANGERS

Shells

Evaporator and condenser shells are fabricated from rolled carbon steel plates with fusion welded seams. Carbon steel tube sheets, drilled and reamed to accommodate the tubes, are welded to the end of each shell. Intermediate tube supports are fabricated from carbon steel plates, drilled and reamed to eliminate sharp edges, and spaced no more than four feet apart. The refrigerant side of each shell is designed for 15 PSIG design working pressure, tested at 30 PSIG.

Tubes

Heat exchanger tubes are state-of-the-art, high efficiency, internally enhanced type to provide optimum performance. Tubes in both the evaporator and condenser are 3/4" O.D. copper alloy and utilize the “skip-fin” design, providing a smooth internal and external surface at each intermediate tube support. This provides extra wall thickness (up to twice as thick) and non-work hardened copper at the support location, extending the life of the heat exchangers. Each tube is roller expanded into the tube sheets providing a leak-proof seal, and are individually replaceable. Tubes are 3/4" OD copper alloy, having plain lands at all tube sheets and intermediate tube supports.

Evaporater

The evaporator is a shell and tube, flooded type heat exchanger. A distributor trough provides uniform distribution of refrigerant over the entire shell length to yield optimum heat transfer. Highly efficient, aluminum mesh eliminators are located above the tube bundle to prevent liquid refrigerant carryover into the compressor. A 1-1/2" liquid level sight port is conveniently located on the side of the shell to aid in determining proper refrigerant charge. A 1" refrigerant charging valve is provided.

Condenser

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

Water Boxes

The removable water boxes are fabricated of steel. The design working pressure is 150 PSIG (1034 kPa) and the boxes are tested at 225 PSIG (1551 kPa). Integral steel water baffles are located and welded within the water box to provide required pass arrangements. Stub-out water nozzle connections with Victaulic grooves are welded to the water boxes. These nozzle connections are suitable for Victaulic couplings, welding or flanges, and are capped for shipment. Plugged 3/4" drain and vent connections are provided in each evaporator water box. Plugged 1/2" drain and vent connections are provided in each condenser water box.

REFRIGERANT FLOW CONTROL

Refrigerant flow to the evaporator is controlled by a single fixed-orifice with no moving parts. An optional microprocessor controlled variable orifice is available to ensure optimum refrigerant levels for varying load and head conditions.

BURSTING DISC

A 2" NPTI frangible carbon bursting disc relief device is located in the compressor suction line.

HIGH-EFFICIENCY TURBOGUARD PURGE UNIT

This automatic, self-contained, compressorless, high efficiency purge unit uses high pressure oil as a fluid piston to collect and compress non-condensable gases. A refrigerant-cooled heat exchanger condenses the refrigerant from the non-condensable gases to assure minimal loss of refrigerant. Purge unit includes a high/low oil level float switch assembly, oil boost pump, a replaceable oil and refrigerant filter-drier, all necessary valves and piping, and manual service valves to provide purge unit isolation from the chiller. The Turboguard purge is factory assembled, mounted, piped and wired and functions continually while the chiller is operating.

The Turboguard purge system assures high efficiency at all load conditions as oil pressures (90 PSIA) and refrigerant temperatures (approximately 40°F) remain relatively constant during compressor operation. It operates automatically and only while the chiller is in operation. It cannot be accidentally left on to operate while the machine is shut down, a time when purge efficiency would be so low refrigerant would be pumped to the atmosphere.

Purge exhaust cycles are monitored, and if excessive, provide warning of system leaks to the control center.

OPTIVIEW CONTROL CENTER

General

The chiller is controlled by a stand-alone microprocessor based control center. The chiller control panel provides control of chiller operation and monitoring of chiller sensors, actuators, relays and switches.

Control panel

The control panel includes a 10.4-in. diagonal color liquid crystal display (LCD) surrounded by "soft" keys which are redefined based on the screen displayed at that time, mounted in the middle of a keypad interface and installed in a locked enclosure. The screen details all operations and parameters, using a graphical representation of the chiller and its major components. Panel verbiage is available in other languages as an option, with English always available. Data can be displayed in either English or Metric units. Smart Freeze Point Protection will run the chiller at 36°F (20°C) leaving chilled water temperature, and not have nuisance trips on low water temperature. The sophisticated program and sensor monitors the chiller water temperature to prevent freeze-up. 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 has a pop-up screen with the allowable ranges, so that the chiller can not be programmed to operate outside of its design limits.

The chiller control panel also provides:

1. System operating information including:
   a. return and leaving chilled liquid temperature
   b. return and leaving condenser liquid temperature
   c. evaporator and condenser saturation temperature
   d. differential oil pressure
   e. percent motor current
   f. evaporator and condenser saturation temperature
   g. compressor discharge temperature
   h. oil reservoir temperature
   i. operating hours, and
   j. number of compressor starts

2. Digital programming of setpoints through the universal keypad including:
   a. leaving chilled liquid temperature
   b. percent current limit
   c. pull-down demand limiting
   d. six-week schedule for starting and stopping the chiller, pumps and tower
   e. remote reset temperature range

3. Status messages indicating:
   a. system ready to start
   b. system running
   c. system coastdown
   d. system safety shutdown – manual restart
   e. system cycling shutdown – auto restart
   f. system prelube
   g. start inhibit

4. The text displayed within the system status and system details field is displayed as a color-coded message to indicate severity: red for safety fault, orange for cycling faults, yellow for warnings, and green for normal messages.

5. Safety shutdowns enunciated through the display and the status bar, and consist of system status, system details, day, time, cause of shutdown, and type of restart required. Safety shutdowns with a fixed speed drive include:
   a. evaporator – low pressure
   b. evaporator – transducer or leaving liquid probe
   c. evaporator – transducer or temperature sensor
   d. condenser – high pressure contacts open
   e. condenser – high pressure
   f. condenser – pressure transducer out of range
   g. auxiliary safety – contacts closed
   h. discharge – high temperature
   i. discharge – low temperature
   j. oil – high temperature
   k. oil – low differential pressure
   l. oil – high differential pressure
   m. oil – sump pressure transducer out of range
   n. oil – differential pressure calibration
   o. control panel – power failure
   p. motor or starter – current imbalance
   q. watchdog – software reboot

5.1 Safety shutdowns with a VSD include:
   a. VSD shutdown – requesting fault data
   b. VSD – stop contacts open
   c. VSD – 105% motor current overload
   d. VSD – high phase A, B, C inverter heatsink temp.
   e. VSD – high converter heatsink temperature

Mechanical Specifications *(continued)*

(Filter Option Only)

f. harmonic filter – high heatsink temperature
g. harmonic filter – high total demand distribution

6. Cycling shutdowns enunciated through the display and the status bar, and consists of system status, system details, day, time, cause of shutdown, and type of restart required.

   Cycling shutdowns with a fixed speed drive include:
   a. multiunit cycling – contacts open
   b. system cycling – contacts open
   c. oil – low temperature differential
   d. oil – low temperature
   e. control panel – power failure
   f. leaving chilled liquid – low temperature
   g. leaving chilled liquid – flow switch open
   h. motor controller – contacts open
   i. motor controller – loss of current
   j. power fault
   k. control panel – schedule
   l. starter – low supply line voltage
   m. starter – high supply line voltage

6.1 Cycling shutdowns with a VSD include:
   a. VSD shutdown – requesting fault data
   b. VSD – stop contacts open
   c. VSD – initialization failed
   d. VSD – high phase A, B, C instantaneous current
   e. VSD – phase A, B, C gate driver
   f. VSD – single-phase input power
   g. VSD – high DC bus voltage
   h. VSD – pre-charge DC bus voltage imbalance
   i. VSD – high internal ambient temperature
   j. VSD – invalid current scale selection
   k. VSD – low phase A, B, C inverter heatsink temp.
   l. VSD – low converter heatsink temperature
   m. VSD – pre-charge – low DC bus voltage
   n. VSD – logic board processor
   o. VSD – run signal
   p. VSD – serial communications

(Filter Option Only)

   q. harmonic filter – logic board or communications
   r. harmonic filter – high DC bus voltage
   s. harmonic filter – high phase A, B, C current
   t. harmonic filter – phase locked loop
   u. harmonic filter – precharge – low DC bus voltage
   v. harmonic filter – DC bus voltage imbalance
   w. harmonic filter – 110% input current overload
   x. harmonic filter – logic board power supply
   y. harmonic filter – run signal
   z. harmonic filter – DC current transformer 1
   aa. harmonic filter – DC current transformer 2

7. Security access to prevent unauthorized change of setpoints, to allow local or remote control of the chiller, and to allow manual operation of the pre-rotation vanes and oil pump. Access is through ID and password recognition, which is defined by three different levels of user competence: view, operator, and service.

8. Trending data with the ability to customize points of once every second to once every hour. The panel will trend up to 6 different parameters from a list of over 140, without the need of an external monitoring system.

9. The operating program stored in non-volatile memory (EPROM) to eliminate reprogramming the chiller due to AC power failure or battery discharge. Programmed setpoints are retained in lithium battery-backed RTC memory for a minimum of 11 years with power removed from the system.

10. A fused connection through a transformer in the compressor motor starter to provide individual overcurrent protected power for all controls.

11. A numbered terminal strip for all required field interlock wiring.

12. An RS-232 port to output all system operating data, shutdown/cycling message, and a record of the last 10 cycling or safety shutdowns to a field-supplied printer. Data logs to a printer at a set programmable interval. This data can be preprogrammed to print from 1 minute to 1 day.

13. The capability to interface with a building automation system to provide:
    a. remote chiller start and stop
    b. remote leaving chiller liquid temperature adjust
    c. remote current limit setpoint adjust
    d. remote ready to start contacts
    e. safety shutdown contacts
    f. cycling shutdown contacts
    g. run contacts

CODES AND STANDARDS

- ASME Boiler and Pressure Vessel Code – Section VIII Division 1.
- ARI Standard 550/590
- c/U.L. – Underwriters Laboratory
- ASHRAE15 – Safety Code for Mechanical Refrigeration
- ASHRAE Guideline 3 – Reducing Emission of Halogenated Refrigerants in Refrigeration and Air-Conditioning Equipment and Systems
- N.E.C. – National Electrical Code
- OSHA – Occupational Safety and Health Act

ISOLATION MOUNTING

The unit is provided with four vibration isolation mounts consisting of 1" thick neoprene isolation pads for field mounting under the steel mounting pads located on the tube sheets. Suitable for ground floor installations.

REFRIGERANT CONTAINMENT

The standard unit has been designed as a complete and compact factory packaged chiller. As such, it has minimal sources for leaks. The entire assembly has been thoroughly leak tested at the factory prior to shipment. Unit-mounted storage and transfer systems on an operating chiller provide many additional sources for leaks including piping, shutoff valves and relief piping. The YORK chiller includes service valves conveniently located to facilitate transfer of refrigerant to a remote refrigerant storage/recycling system.

PAINT

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

SHIPMENT

Protective covering is furnished on the motor, control center, purge unit and unit-mounted controls. Water nozzles are capped with fitted plastic enclosures.

Accessories and Modifications

VARIABLE SPEED DRIVEN

A 460 V - 3 ph - 60 Hz or 380 V - 3 ph - 50 Hz variable speed drive is factory packaged and mounted on the MAXE chiller. It is designed to vary the compressor motor speed by controlling the frequency and voltage of the electrical power to the motor. The adaptive capacity control logic automatically adjusts motor speed and compressor pre-rotation vane position independently for maximum part-load efficiency by analyzing information fed to it by sensors located throughout the chiller.

The variable speed drive is mounted in a NEMA-1 enclosure with all power and control wiring between the drive and chiller factory installed. Electrical lugs for incoming power wiring are provided, and the entire chiller package is U.L. listed.

Standard features include: a door interlocked padlockable circuit breaker; U.L. listed ground fault protection; overvoltage and undervoltage protection; 3-phase sensing motor overcurrent protection; single phase protection; insensitive to phase rotation; overtemperature protection; digital readout at the MAXE chiller control panel of:

- Output Frequency
- Output Voltage
- 3-phase output current
- Input Kilowatts (kW)
- Self diagnostic service parameters
- Kilowatt hours (kWH)

An optional EPRI funded harmonic filter limits electrical power supply distortion from the variable speed drive to comply with the guidelines of IEEE Std. 519-1992. The filter is unit mounted within the same NEMA-1 enclosure and is U.L. listed. The following digital readout is standard with the optional filter:

- Input KVA
- Total power factor
- 3-phase input voltage
- 3-phase input current
- 3-phase input voltage total harmonic distortion (THD)
- 3-phase input current total demand distortion (TDD)
- Self diagnostic service parameters

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 between the starter and chiller are factory installed. 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 OptiView 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; three-leg-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-to-water heat exchanger and 1/25 hp circulating pump. All interconnecting water piping is factory installed 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 U.L. Standard 508. A non-fused disconnect switch is also available. Both options are padlockable.

BAS REMOTE CONTROL

A communication interface permitting complete exchange of chiller data with any BAS System is available with optional ISN translator. ISN translator also allows BAS System to issue commands to the chiller to control its operation. ISN translators come in two models, controlling up to 4 chillers and 8 chillers respectively.

FACTORY INSULATION OF EVAPORATOR

Factory-applied thermal insulation of the flexible, closed-cell plastic type, 3/4" (19 mm) thick is attached with vapor-proof cement to the evaporator shell, flow chamber, tube sheets, suction connection, and (as necessary) to the auxiliary tubing. Not included is the insulation of water boxes and nozzles. This insulation will normally prevent sweating in environments with relative humidities up to 75% and dry bulb temperatures ranging from 50° to 90°F (10° to 32.2°C). 1-1/2" (38 mm) thick insulation is also available for relative humidities up to 90% and dry bulb temperatures ranging from 50° to 90°F (10° to 32.2°C).

WATER FLANGES

Four 150 lb. ANSI raised-face 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

Spring isolation mounting is available instead of standard isolation mounting pads when desired. (Four) level-adjusting, spring-type vibration isolator assemblies with non-skid pads are provided with mounting brackets for field installation. Isolators are designed for one-inch (25.4 mm) deflection.

WATER FLOW SWITCHES

These are 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 service. A chilled water flow switch is required. Condenser water flow switch is optional.

SEQUENCE CONTROL KIT

For two, three or four units with chilled water circuits connected in series or parallel, the kit consists of return water thermostat, lead-lag selector switch for sequence starting, and time delay relay, with NEMA-1 enclosures, designed for 115V-1-50/60 service.

STARTER – FIELD INSTALLED

A field installed, electro-mechanical compressor motor starter is available, selected for proper size and type for job requirements and in accordance with YORK Engineering Standard (R-1051) for Starters.

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. Victaulic nozzle connections are standard; flanges are optional. Marine water boxes are available for condenser and/or evaporator.

KNOCK-DOWN SHIPMENT

The chiller can be shipped knocked down into major subassemblies (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, heater, water-cooled condenser, filter drier and necessary valves and hoses to remove, replace and distill HCFC-123. All necessary controls and safety devices are a permanent part of the system. The complete system is portable, being mounted on swivel casters with lock brakes.

Application Data

The following discussion is a user's guide in the application and installation of MAXE chillers to ensure the reliable, trouble-free life for which this equipment was designed. While this guide is directed towards normal, water-chilling applications, the YORK sales representative can provide complete recommendations on other types of applications.

LOCATION

MAXE Chillers are virtually vibration free and may generally be located at any level in a building where the construction will support the total system operating weight.

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

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 - 104°F (4.4 - 40°C).

WATER CIRCUITS

Flow Rate – For normal water chilling duty, evaporator and condenser flow rates are permitted at water velocity levels in the heat exchangers tubes of between 3 ft./sec. and 12 ft./sec. (0.91 m/s and 3.66 m/s). Variable flow applications are possible, and initial chiller selections should be made accordingly to allow proper range of flow while maintaining the minimum 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 flow limits.

Temperature Ranges – For normal water chilling duty, leaving chilled water temperatures may be selected between 38°F (3.3°C) [36°F (2.2°C) with Smart Freeze enabled] and 70°F for water temperature ranges between 3°F and 30°F (1.7°C to 16.7°C).

Water Quality – The practical and economical application of liquid chillers requires that the quality of the water supply for 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, 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 independently 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 achiev0ing 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 grooves for Victaulic couplings. Piping should be arranged for ease of disassembly at the unit for performance of such routine maintenance as tube cleaning. All water piping should be thoroughly cleaned of all dirt and debris before final connections are made to the chiller.

Chilled Water – A flow switch must be installed in the chilled water line of every unit. The switch must belocated in the horizontal piping close to the unit, where the straight horizontal runs on each side of the flow

switch are at least five pipe diameters in length. The switch must be electrically connected to the chilled water interlock position in the control center. 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 flow switch and strainer assure chilled water flow during unit operation. The loss or severe reduction of water flow could seriously impair the chiller performance or even result in tube freezeup.

Condenser Water – 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:

$$\text{Min. ECWT} = \text{LCHWT} - \text{C RANGE} + 5 + \left(\frac{15 \times \%\text{LOAD}}{100}\right)$$

where:
ECWT = entering condensing water temperature
LCHWT = leaving chilled water temperature
C RANGE = condensing water temperature range

At initial startup, entering condensing water temperature may be as much as 25°F colder than the standby chilled water temperature. Cooling tower fan cycling will normally provide adequate control of entering condenser water temperature on most installations.

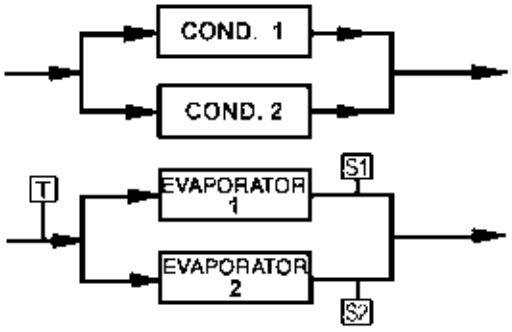
MULTIPLE UNITS

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. There are several common unit arrangements for this type of application. The MAXE 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 chiller plant. It is recommended to use an evaporator bypass piping arrangement to bypass fluid around evaporator 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) – The chillers may be applied in pairs with chilled water circuits connected in series and condenser water circuits connected in parallel. All of the chilled water flows through both evaporators 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

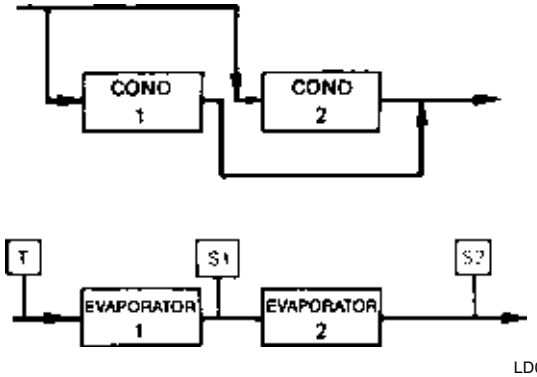


LD07222

S – Temperature Sensor for Chiller Capacity Control

T – Thermostat for Chiller Capacity Control

FIG. 1 – PARALLEL EVAPORATORS
PARALLEL CONDENSERS



LD07223

S – Temperature Sensor for Chiller Capacity Control

T – Thermostat for Chiller Capacity Control

FIG. 2 – SERIES EVAPORATORS
PARALLEL CONDENSERS

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.

REFRIGERANT RELIEF PIPING

Each chiller is equipped with a frangible carbon bursting disc assembly. The purpose of the relief device is to quickly relieve excess pressure of the refrigerant charge to the atmosphere, as a safety precaution in the event of an emergency such as a fire. It is set to relieve at an internal pressure of 15 PSIG and located on the compressor suction line. It is provided in accordance with ASHRAE 15 Safety Code and ASME or applicable pressure vessel code.

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 vertical-leg dirt trap to catch vent-stack condensation. Vent piping must be arranged to avoid imposing a strain on the relief connection and should include one flexible connection.

The discharge of the purge system is also governed by the same rules as pressure relief devices and may be piped in conjunction with these devices.

SOUND AND VIBRATION CONSIDERATIONS

A MAXE 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.

MAXE chiller sound pressure level ratings will be furnished on 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" (19 mm) or 1-1/2" (38 mm) 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" (19 mm) thickness] or 90% [1-1/2" (38 mm) 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 covering of the insulation is usually required. If insulation is applied to the water boxes at the jobsite, 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 any other related codes should be reviewed for specific requirements. Since the MAXE chiller motor is air-cooled, ventilation should allow for the removal of heat from the motor.

In addition, the ASHRAE Standard 15 requires a refrigerant vapor detector be employed for all refrigerants. It is to be located in an area where refrigerant from a leak is 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 to 600 volts) are furnished with six leads. Medium voltage (2300 to 4160 volts) motors have three leads. Motor circuit conductor size must be in accordance with the National Electrical Code (N.E.C.), 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 name plate is stamped with the specific motor voltage, and frequency for the appropriate motor.

Starters – A separate starter is not required if the chiller is equipped with a Variable Speed Drive (VSD). The MAXE chillers are also available with a factory-mounted and wired YORK Solid State Starter for 600 volts and up to 900 HP (671 kW). Other types of remote mounted starters are available. These electro-mechanical starters must be furnished in accordance with YORK Standard Specifications (R-1051). This will ensure that starter components, controls, circuits, and terminal markings will be suitable for required overall system performance.

TABLE 1 - WATER FLOW RATE LIMITS (GPM)

EVAPORATOR CODE	PASS	EVAPORATOR	
		MINIMUM	MAXIMUM
G0	1	651	2,347
	2	326	1,173
	3	217	782
G1	1	755	2,722
	2	378	1,361
	3	252	907
G3	1	964	3,473
	2	482	1,737
	3	321	1,158
H1	1	1,045	3,766
	2	523	1,883
	3	348	1,255
H3	1	1,228	4,423
	2	614	2,212
	3	409	1,474
J1	1	1,335	4,811
	2	667	2,405
	3	445	1,604
K4	1	1,345	4,846
	2	672	2,423
	3	448	1,615
J3, K6	1	1,576	5,679
	2	788	2,840
	3	525	1,893
K1, K7	1	1,706	6,148
	2	853	3,074
	3	569	2,049
K3, K9	1	2,012	7,251
	2	1,006	3,626
	3	671	2,417
L1, L4	1	2,182	7,861
	2	1,091	3,931
	3	727	2,620
L3, L6	1	2,556	9,210
	2	1,278	4,606
	3	852	3,070

EVAPORATOR CODE	PASS	CONDENSER	
		MINIMUM	MAXIMUM
A1	1	735	2,647
	2	367	1,324
A2	1	837	3,018
	2	419	1,509
A3	1	959	3,455
	2	479	1,728
A4	1	1,099	3,960
	2	549	1,980
B1	1	1,264	4,555
	2	632	2,277
B2	1	1,407	5,071
	2	703	2,535
B3	1	1,569	5,654
	2	784	2,827
B4	1	1,753	6,316
	2	876	3,158
C1, C5	1	1,351	4,869
	2	675	2,434
C2, C6	1	1,494	5,385
	2	747	2,692
C3, C7	1	1,656	5,968
	2	828	2,984
C4, C8	1	1,840	6,630
	2	920	3,315
D1, D5	1	2,045	7,370
	2	1,022	3,685
D2, D6	1	2,276	8,200
	2	1,137	4,100
D3, D7	1	2,534	9,131
	2	1,267	4,566
D4, D8	1	2,827	10,186
	2	1,413	5,093

Application Data *(continued)*

TABLE 1A - WATER FLOW RATE LIMITS (L/S)

EVAPORATOR CODE	PASS	EVAPORATOR	
		MINIMUM	MAXIMUM
G0	1	41.1	148.1
	2	20.6	74.0
	3	13.7	49.3
G1	1	47.6	171.8
	2	23.9	85.9
	3	15.9	57.2
G3	1	60.8	219.1
	2	30.4	109.6
	3	20.3	73.1
H1	1	65.9	237.6
	2	33.0	118.8
	3	22.0	79.2
H3	1	77.5	279.1
	2	38.7	139.6
	3	25.8	93.0
J1	1	84.2	303.6
	2	42.1	151.8
	3	28.1	101.2
K4	1	84.9	305.8
	2	42.4	152.9
	3	28.3	101.9
J3, K6	1	99.4	358.3
	2	49.7	179.2
	3	33.1	119.4
K1, K7	1	107.6	387.9
	2	53.8	194.0
	3	35.9	129.3
K3, K9	1	127.0	457.5
	2	63.5	228.8
	3	42.3	152.5
L1, L4	1	137.7	496.0
	2	68.8	248.0
	3	45.9	165.3
L3, L6	1	161.3	581.2
	2	80.6	290.6
	3	53.8	193.7

EVAPORATOR CODE	PASS	CONDENSER	
		MINIMUM	MAXIMUM
A1	1	46.4	167.0
	2	23.2	83.5
A2	1	52.8	190.4
	2	26.4	95.2
A3	1	60.5	218.0
	2	30.2	109.0
A4	1	69.3	249.9
	2	34.6	124.9
B1	1	79.8	287.4
	2	39.9	143.7
B2	1	88.8	320.0
	2	44.4	160.0
B3	1	99.0	356.8
	2	49.5	178.4
B4	1	110.6	398.5
	2	55.3	199.3
C1, C5	1	85.2	307.2
	2	42.6	153.6
C2, C6	1	94.3	339.8
	2	47.1	169.9
C3, C7	1	104.5	376.6
	2	52.2	188.3
C4, C8	1	116.1	418.4
	2	58.1	209.2
D1, D5	1	129.0	465.0
	2	64.5	232.5
D2, D6	1	143.6	517.4
	2	71.7	258.7
D3, D7	1	159.9	576.2
	2	79.9	288.1
D4, D8	1	178.4	642.7
	2	89.2	321.4

Controls – A 115 volt, single-phase, 60 or 50 Hertz, 1-1/2 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 Variable Speed Drive (VSD) or Solid State Starter (SSS) is supplied.

TABLE 2 - MOTOR VOLTAGE VARIATIONS

FREQ.	RATED VOLTAGE	NAMEPLATE VOLTAGE	OPERATING VOLTAGE	
			MIN.	MAX.
60 HZ	200	200/208	180	220
	230	220/240	208	254
	380	380	342	415
	416	416	375	457
	460	440/460/480	414	508
	575	575/600	520	635
	2300	2300	2070	2530
	3300	3300	2970	3630
	4000	4000/4160	3600	4576
50 HZ	346	346	311	381
	380	380/400	342	423
	415	415	374	440
	3300	3300	2970	3630

Oil Pump Power Supply – A separate 3-phase power supply with a fused disconnect for the factory mounted oil pump motor starter is required unless the VSD or SSS is supplied. Power can also be supplied through an electro-mechanical starter. Standard oil pump motor is 3/4 HP for 60 Hertz with B, C and E compressors; and 1 HP for F compressor and all 50 Hertz applications.

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 Capacitors – When the chiller is equipped with a VSD, automatic power factor correction to a minimum of 0.95 is provided at all operating conditions, so additional capacitors are not required. For other starting methods, capacitors can be applied to a chiller for the purpose of power factor correction. For remote mounted electro-mechanical starters, the capacitors should be located on the load side of the starter. For YORK Solid State Starters, 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 and be verified by YORK.

Ampacity on Load-Side of Starter – Electrical power wire size to the chiller is based on the minimum unit ampacity. For YORK SSS or VSD, 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 and oil pump motor unless they are supplied by a separate source.

125% of compressor motor amps
+ FLA of all other loads on the circuit
= Minimum Circuit Ampacity

Branch Circuit Overcurrent Protection – The branch circuit overcurrent protection device(s) should be a time-delay 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 and oil pump motor. Refer to submittal drawings for the specific calculations for each application.

MOTOR ELECTRICAL DATA

The smallest motor available which equals or exceeds the input power (kW) from the chiller rating program is selected from Tables 3 and 4. The full load amperes (FLA) listed in the tables 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 per the following equation:

$$FLA = \frac{\text{Motor kW}}{\text{Max. Motor kW}} \times \text{Max. Motor FLA}$$

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 percentage of LRA shown in Table 5.

Application Data *(continued)*

TABLE 3 – 60 HZ ELECTRICAL DATA

MOTOR CODE		CF	CG	CH	CJ	CK	CL	CM	CN	CP	CR	CS	CT	CU
KW (MAX)		125	144	161	190	214	240	257	276	302	333	368	395	435
SHAFT HP		154	177	201	237	270	302	327	351	385	424	468	503	554
FL EFF.-%		92	92	93	93	94	94	95	95	95	95	95	95	95
VOLTS		AMPERES (MAX.)												
200	FLA	405	465	527	618	707	781	831	921	1014	1085	1208	—	—
	LRA	2598	3111	3111	3810	4550	4900	5470	5780	5780	7350	7794	—	—
208	FLA	389	447	507	594	680	757	799	886	975	1043	1162	—	—
	LRA	2702	3235	3235	3962	4732	5096	5689	6011	6011	7644	8106	—	—
230	FLA	352	404	464	540	610	685	749	804	882	944	1050	1130	—
	LRA	2598	2598	2865	3460	3788	4260	4755	5162	5780	5780	6900	7400	—
240	FLA	337	387	445	518	585	656	718	771	845	905	1006	1083	—
	LRA	2711	2711	3120	3610	3953	4445	4962	5386	6031	6031	7200	7722	—
380	FLA	217	249	285	336	378	421	453	487	534	571	636	684	756
	LRA	1385	1385	1730	2153	2500	2577	2955	3254	3637	3810	4179	4480	4671
416	FLA	199	228	260	307	346	385	412	445	488	522	581	625	691
	LRA	1385	1385	1638	1967	2190	2356	2700	2976	3536	3637	3810	3810	4270
440	FLA	184	211	238	281	319	358	392	397	461	493	549	591	646
	LRA	1177	1301	1320	1655	1865	2037	2485	2485	2976	2976	3300	3644	3644
460	FLA	176	202	228	269	305	342	375	380	441	472	525	565	618
	LRA	1230	1360	1380	1730	1950	2130	2598	2598	3111	3111	3450	3810	3810
480	FLA	169	194	219	258	292	328	359	364	423	452	503	541	592
	LRA	1283	1419	1440	1805	2053	2223	2711	2711	3246	3246	3600	3976	3976
575	FLA	141	162	185	216	250	247	300	318	353	377	420	452	500
	LRA	909	909	1100	1384	1556	1700	1900	2066	2078	2413	2760	2960	3089
600	FLA	135	155	177	207	240	263	288	305	338	361	403	433	479
	LRA	949	949	1148	1444	1624	1774	1983	2156	2168	2518	2880	3089	3223
2,300	FLA	36	41	46	54	61	68	74	79	87	95	105	113	124
	LRA	240	267	298	340	397	435	480	520	53	570	669	719	791
3,300	FLA	25	29	32	38	43	48	52	55	61	66	73	79	86
	LRA	160	175	210	240	280	310	310	343	382	383	466	501	551
4,000	FLA	21	24	27	31	36	40	43	46	50	54	60	65	71
	LRA	135	154	166	195	230	240	260	283	315	315	384	413	455
4,160	FLA	20	23	26	30	34	38	41	44	48	52	58	63	68
	LRA	140	160	173	203	239	250	270	294	328	328	399	430	473

TABLE 4 – 50 HZ ELECTRICAL DATA[1]

MOTOR CODE		5CC	5CD	5CE	5CF	5CG	5CH	5CI	5CJ	5CK	5CL	5CM	5CN	5CO	5CP	5CQ
KW (MAX)		121	136	160	180	201	215	231	254	280	309	332	366	402	432	455
SHAFT HP		148	168	198	225	252	272	292	321	353	390	419	462	507	546	575
FL EFF.-%		91.1	92.4	92.4	93.4	93.4	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2
VOLTS		AMPERES (MAX.)														
346	FLA	224	258	302	340	380	417	437	481	528	584	630	692	578	816	860
	LRA	1385	1721	1790	2208	2467	2598	2840	3081	3350	3706	3810	4177	4830	4944	5373
380	FLA	204	235	275	309	346	379	398	438	481	532	572	630	690	743	783
	LRA	1385	1385	1640	1890	2144	2464	2590	2806	3050	3375	3700	3810	4400	4500	4892
400	FLA	194	223	261	294	329	360	378	416	457	505	543	599	656	706	744
	LRA	1458	1458	1726	1990	2257	2594	2726	2954	3211	3553	3895	4011	4632	4737	5149
415	FLA	187	215	252	284	317	347	364	401	441	487	526	577	632	680	717
	LRA	1283	1385	1490	1700	2031	2175	2366	2569	2794	3088	3402	3478	3810	4117	4480
3,300	FLA	24	27	32	36	41	44	47	50	56	62	66	73	80	87	91
	LRA	159	162	209	236	241	274	294	318	317	388	423	455	499	516	572

NOTE: 1. Chiller performance for 50 Hertz applications is outside the scope of the ARI Certification Program.

CV	CW	CX	CY	CZ	CA	CB	MOTOR CODE	
478	514	542	578	617	660	703	KW (MAX.)	
608	655	690	740	790	845	900	SHAFT HP	
95	95	95	95.5	95.5	95.5	95.5	FL EFF.-%	
AMPERES (MAX.)							VOLTS	
—	—	—	—	—	—	—	FLA	200
—	—	—	—	—	—	—	LRA	
—	—	—	—	—	—	—	FLA	208
—	—	—	—	—	—	—	LRA	
—	—	—	—	—	—	—	FLA	230
—	—	—	—	—	—	—	LRA	
—	—	—	—	—	—	—	FLA	240
—	—	—	—	—	—	—	LRA	
817	879	942	997	1065	1126	1200	FLA	380
5326	5780	6782	5780	6644	7106	7513	LRA	
747	810	860	911	973	1029	1096	FLA	416
4869	5640	5780	5694	6069	6489	6863	LRA	
706	579	813	861	920	973	1036	FLA	440
4209	4783	5367	4783	5249	5529	5529	LRA	
675	726	778	824	880	931	991	FLA	460
4400	5000	5600	5000	5488	5780	5780	LRA	
647	696	746	790	843	892	950	FLA	480
4591	5217	5843	5217	5727	6031	6031	LRA	
540	581	622	659	704	744	793	FLA	575
3550	4039	4440	4300	4200	4694	4963	LRA	
518	557	596	632	675	713	760	FLA	600
3704	4215	4633	4484	4383	4898	5179	LRA	
135	146	154	165	176	186	198	FLA	2,300
867	935	960	1008	1100	1172	1244	LRA	
94	102	108	115	123	130	138	FLA	3,300
576	652	682	719	744	744	863	LRA	
78	84	89	95	101	107	114	FLA	4,000
499	538	540	554	631	674	713	LRA	
75	81	85	91	97	103	110	FLA	4,160
519	560	562	576	656	701	742	LRA	

5CR	5CS	5CT	5CU	5CV	MOTOR CODE	
481	518	554	591	630	KW(MAX.)	
608	658	704	750	800	SHAFT HP	
94.2	94.7	94.7	94.7	94.7	FL EFF.-%	
AMPERES (MAX.)					VOLTS	
909	982	1051	1107	1181	FLA	346
5780	5780	6615	6931	7356	LRA	
841	895	957	1008	1075	FLA	380
5600	5491	5491	6313	6694	LRA	
799	850	909	958	1021	FLA	400
5895	5780	5780	6645	7046	LRA	
764	819	876	923	985	FLA	415
5130	5108	5512	5780	6131	LRA	
96	103	110	116	124	FLA	3,300
614	644	693	725	744	LRA	

TABLE 5 – MOTOR STARTERS

TYPE STARTER	SOLID STATE STARTER	STAR DELTA	AUTO TRANSFORMER			ACROSS THE LINE	PRIMARY REACTOR	
VOLTAGE	LOW	LOW	LOW	LOW/HIGH	LOW/HIGH	LOW/HIGH	HIGH	HIGH
60 HZ	460, 575	200-600	200-600	200-4160	200-4160	200-4160	2300-4160	2300-4160
50 HZ	380-415	346-415	346-415	346-3300	346-3300	346-3300	2300-3300	2300-3300
TRANSITION	—	CLOSED	CLOSED	CLOSED	CLOSED	—	CLOSED	CLOSED
% TAP	—	—	57.7	65	80	—	65	80
INRUSH AS A % OF LRA	45	33	33	42.3	64	100	65	80

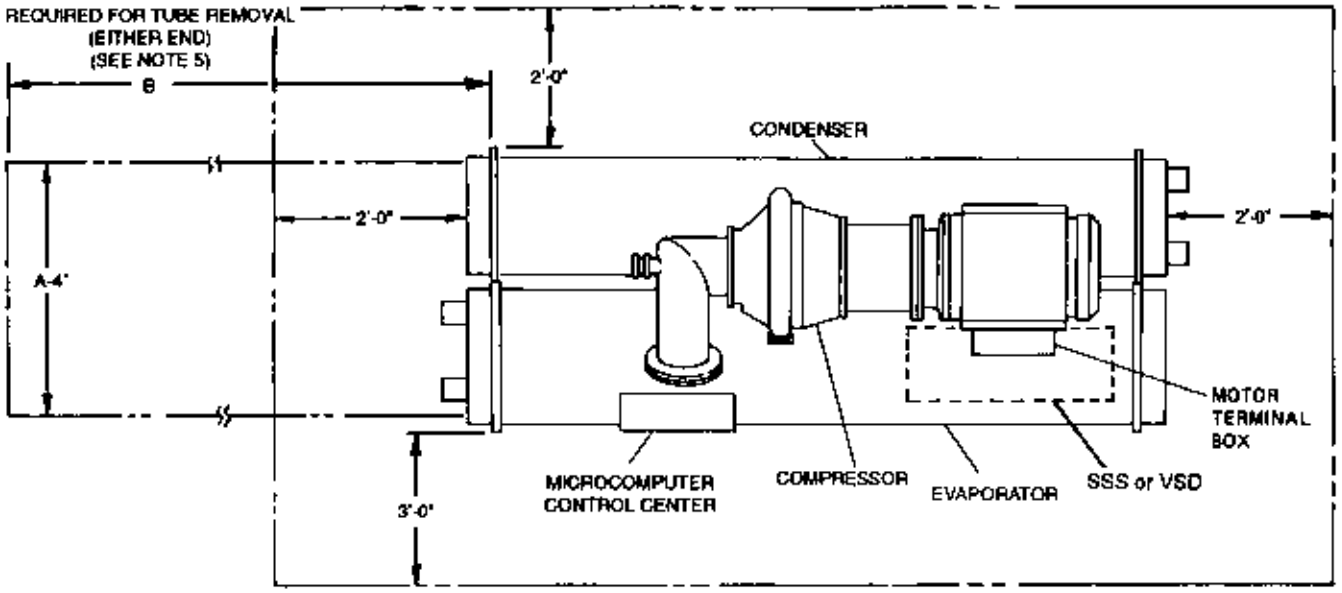
NOTE: Inrush less than 100% of full load amps (FLA).

TABLE 6 – AVAILABLE COMPRESSOR/SHELL/MOTOR COMBINATIONS

COMPRESSOR CODE	EVAPORATOR	CONDENSER	MOTOR CODES	
			60 HZ	50 HZ
B1, B2	G0, G1, G3	A1, A2, A3, A4	CF Thru CN	5CC Thru 5CL
C1, C2, C3	G1, G3	A1, A2, A3, A4	CK Thru CP	5CG Thru 5CL
	H1, H3	A1, A2, A3, A4, B1, B2, B3, B4		
	J1, J3	A1, A2, A3, A4, B1, B2, B3, B4		
	K1, K3	B1, B2, B3, B4		
E1, E2, E3	G1, G3	A1, A2, A3, A4	CN Thru CX	5CK Thru 5CR
	H1, H3	A1, A2, A3, A4, C1, C2, C3, C4		
	J1, J3	A1, A2, A3, A4, C1, C2, C3, C4		
	K1, K3	C1, C2, C3, C4, D1, D2, D3, D4		
	L1, L3	C1, C2, C3, C4, D1, D2, D3, D4		
F1	K4, K6, K7, K9	C5, C6, C7, C8, D5, D6, D7, D8	CS Thru CZ	5CN Thru 5CV
F2	L4, L6	C5, C6, C7, C8, D5, D6, D7, D8	CA Thru CB	

00613VIP

Dimensions (Ft. - In.)



*REQUIRED SERVICE CLEARANCE

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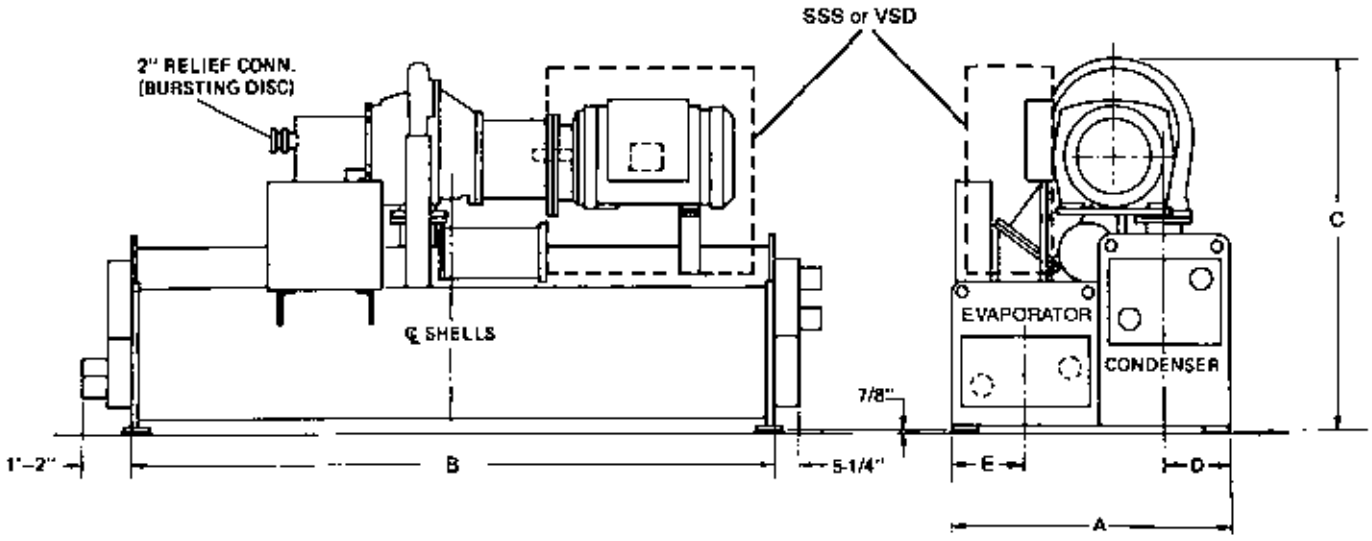

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NOTES:

1. All dimensions are approximate. Certified dimensions are available on request.
2. For compact water boxes (shown above), determine overall unit length by adding water box depth to tube sheet length. For marine water boxes, refer to pages 36-37.
3. Water nozzles can be located on either end of unit. Add 1/2" to nozzle length for flanged connections.
4. To determine overall installed height, add 7/8" for isolators.
5. A doorway or other properly located opening may be used for tube removal.

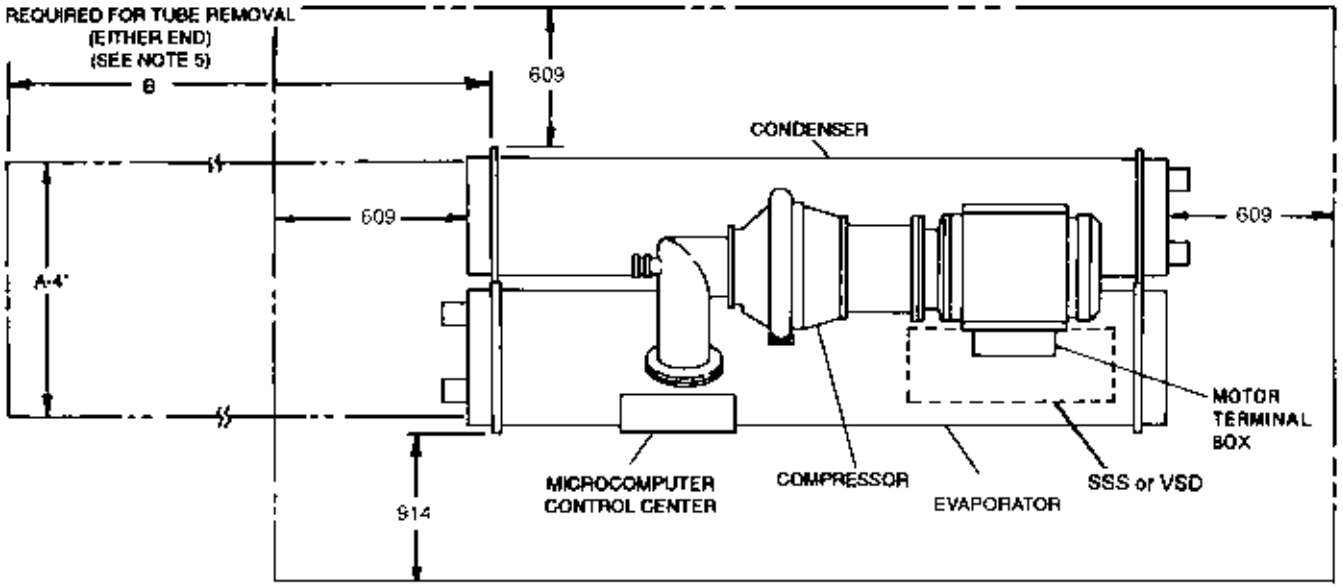
B COMPRESSOR EVAPORATOR – CONDENSER SHELL	
DIM.	**G-A**
A	5' 7-3/4"
B	13' 0"
C	7' 6-1/8"
D	1' 4"
E	1' 5-7/8"

C COMPRESSORS EVAPORATOR – CONDENSER CODES						
DIM.	**G-A**	**H-A**	**H-B**	**J-A**	**J-13**	**K-B**
A	5' 7-3/4"	5' 10-1/2"	6' 3-1/2"	6' 1-1/2"	6' 6-1/2"	6' 10-1/2"
B	13' 0"	13' 0"	13' 0"	13' 0"	13' 0"	13' 0"
C	8' 1-1/4"	8' 1-1/4"	8' 4-3/4"	8' 1-1/4"	8' 4-3/4"	8' 4-3/4"
D	1' 4"	1' 4"	1' 6-1/2"	1' 4"	1' 6-1/2"	1' 6-1/2"
E	1' 5-7/8"	1' 7-1/4"	1' 7-1/4"	1' 8-3/4"	1' 8-3/4"	1' 10-3/4"

E COMPRESSORS EVAPORATOR – CONDENSER CODES									
DIM.	**G-A**	**H-A**	**H-C**	**J-A**	**J-C**	**K-C**	**K-D**	**L-C**	**L-D**
A	5' 7-3/4"	5' 10-1/2"	6' 3-1/2"	6' 1-1/2"	6' 6-1/2"	6' 10-1/2"	7' 4"	7' 0-1/2"	7' 6"
B	13' 0"	13' 0"	13' 0"	13' 0"	13' 0"	13' 0"	13' 0"	13' 0"	13' 0"
C	9' 0-1/8"	9' 0-1/8"	9' 5-3/8"	9' 0-1/8"	9' 5-3/8"	9' 5-3/8"	9' 6-1/8"	9' 5-3/8"	9' 6-1/8"
D	1' 4"	1' 4"	1' 6-1/2"	1' 4"	1' 6-1/2"	1' 6-1/2"	1' 9-1/4"	1' 6-1/2"	1' 9-1/4"
E	1' 5-7/8"	1' 7-1/4"	1' 7-1/4"	1' 8-3/4"	1' 8-3/4"	1' 10-3/4"	1' 10-3/4"	1' 11-3/4"	1' 11-3/4"

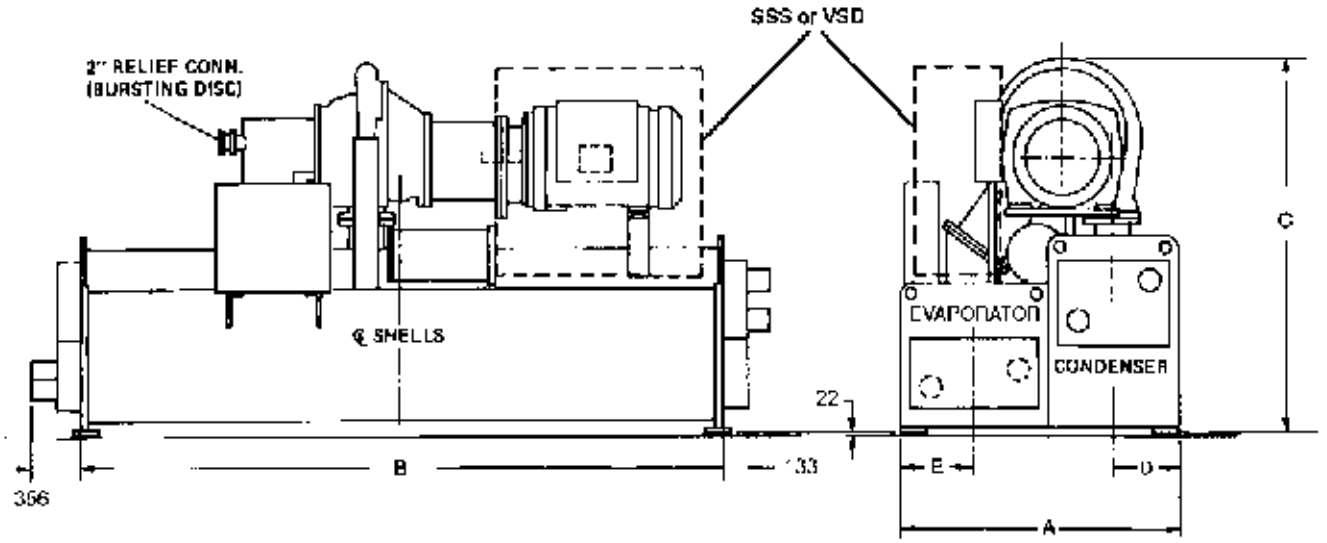
F COMPRESSORS EVAPORATOR – CONDENSER CODES				
DIM.	**K-C**	**K-D**	**L-C**	**L-D**
A	6' 10-1/2"	7' 4"	7' 0-1/2"	7' 6"
B	15' 0"	15' 0"	15' 0"	15' 0"
C	9' 10"	10' 2-1/2"	9' 10"	10' 2-1/2"
D	1' 6-1/2"	1' 9-1/4"	1' 6-1/2"	1' 9-1/4"
E	1' 10-3/4"	1' 10-3/4"	1' 11-3/4"	1' 11-3/4"

Dimensions (mm)



*REQUIRED SERVICE CLEARANCE

LD07225



LD07226

NOTES:

1. All dimensions are approximate. Certified dimensions are available on request.
2. For compact water boxes (shown above), determine overall unit length by adding water box depth to tube sheet length. For marine water boxes, refer to pages 40-41.
3. Water nozzles can be located on either end of unit. Add 12 mm to nozzle length for flanged connections.
4. To determine overall installed height, add 22 mm for isolators.
5. A doorway or other properly located opening may be used for tube removal.

B COMPRESSOR EVAPORATOR – CONDENSER SHELL	
DIM.	**G-A**
A	1721
B	3962
C	2284
D	406
E	454

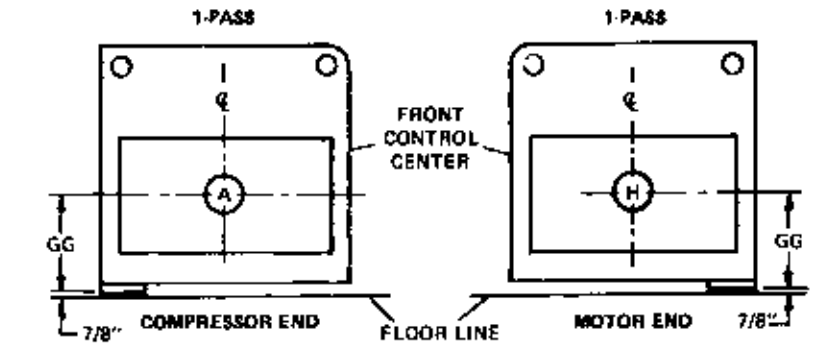
C COMPRESSORS EVAPORATOR – CONDENSER CODES						
DIM.	**G-A**	**H-A**	**H-B**	**J-A**	**J-13**	**K-B**
A	1721	1791	1918	1867	1994	2095
B	3962	3962	3962	3962	3962	3962
C	2470	2470	2559	2470	2559	2559
D	406	406	470	406	470	470
E	454	489	489	527	527	578

E COMPRESSORS EVAPORATOR – CONDENSER CODES									
DIM.	**G-A**	**H-A**	**H-C**	**J-A**	**J-C**	**K-C**	**K-D**	**L-C**	**L-D**
A	1721	1791	1918	1867	1994	2095	2235	2146	2286
B	3962	3962	3962	3962	3962	3962	3962	3962	3962
C	2746	2746	2880	2746	2880	2880	2880	2899	2899
D	305	305	470	305	470	470	540	470	540
E	454	489	489	527	527	578	273	603	603

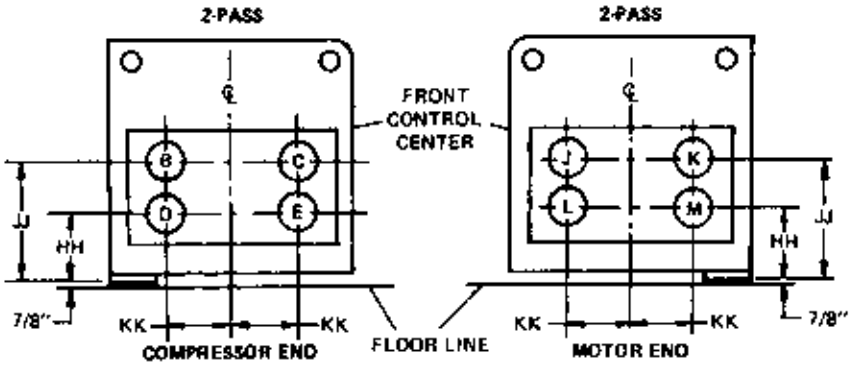
F COMPRESSORS EVAPORATOR – CONDENSER CODES				
DIM.	**K-C**	**K-D**	**L-C**	**L-D**
A	2095	2235	2146	2286
B	4572	4572	4572	4572
C	2997	3111	2997	3111
D	470	540	470	540
E	578	578	603	603

Dimensions (Ft. - In.) – Nozzle Arrangements

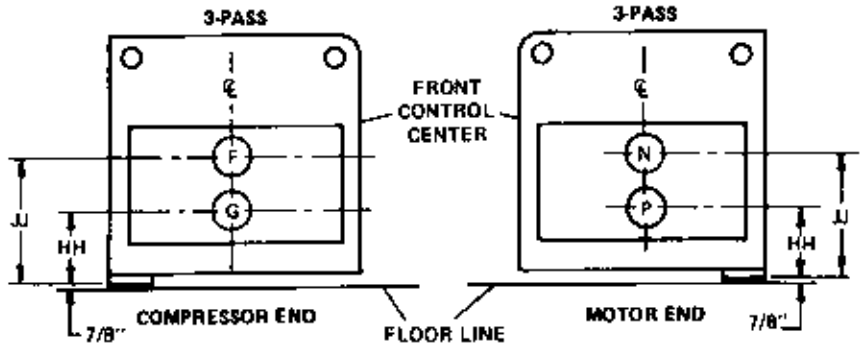
EVAPORATORS – COMPACT WATER BOXES



NOZZLE ARRANGEMENTS	
NO. OF PASSES	EVAPORATOR IN-OUT
1	A-H
	H-A



NOZZLE ARRANGEMENTS	
NO. OF PASSES	EVAPORATOR IN-OUT
2	E-B
	D-C
	M-J
	L-K



NOZZLE ARRANGEMENTS	
NO. OF PASSES	EVAPORATOR IN-OUT
3	P-F
	G-N

LD07227

EVAP. SHELL CODE	NOZZLE PIPE SIZE NO. OF PASSES			EVAPORATOR NOZZLE DIMENSIONS					
				GG	JJ		HH		KK
	1	2	3	1-PASS	2-PASS	3-PASS	2-PASS	3-PASS	2-PASS
G	10"	8"	6"	11-1/2"	1' 2-3/8"	1' 3-1/2"	8-5/8"	7-1/2"	8-3/4"
H	12"	8"	6"	1' 0-5/8"	1' 3-3/8"	1' 4-5/8"	9-7/8"	8-5/8"	10"
J	14"	10"	8"	1' 1-3/8"	1' 5-1/8"	1' 6-1/4"	9-5/8"	8-1/2"	9"
K	14"	10"	8"	1' 3-1/8"	1' 6-1/8"	1' 7-1/8"	1' 0-1/8"	11-1/8"	10"
L	16"	12"	10"	1' 4-7/8"	1' 7-7/8"	1' 8-7/8"	1' 1-7/8"	1' 0-7/8"	10-1/2"

NOTES:

1 . Standard water nozzles are furnished as welding stub-outs with Victaulic grooves, allowing the option of welding, flanges, or use of Victaulic couplings. Factory installed, class 150 (ANSI B16.5, round slip-on, forged carbon steel with 1/16" raised face), water flanged nozzles are optional. Companion flanges, nuts, bolts and gaskets are not furnished.

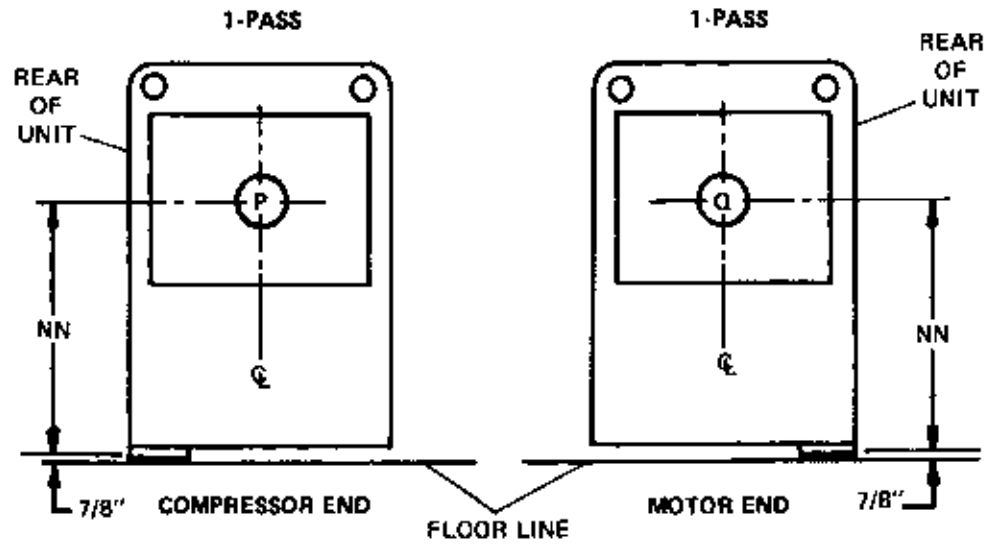
2. Add 7/8" for isolators as shown.

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.

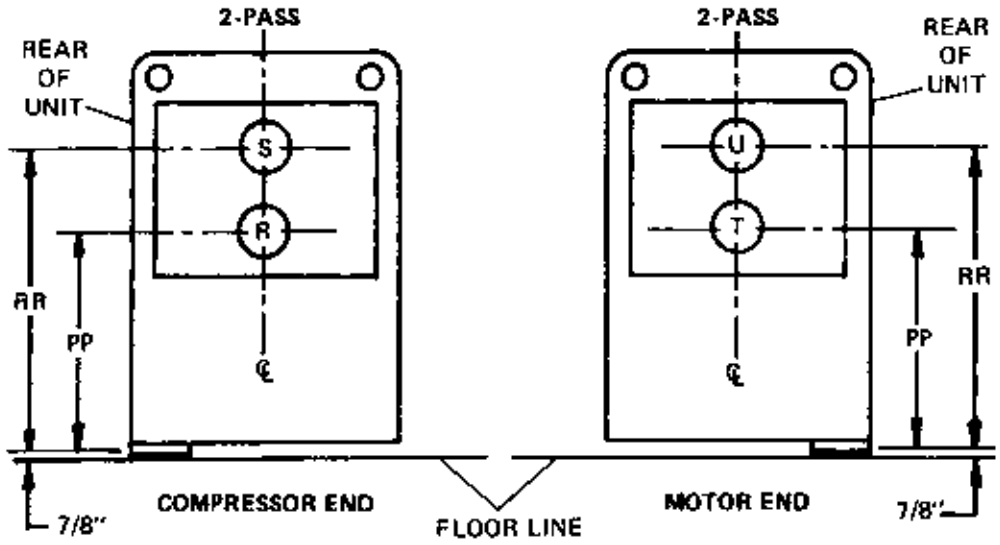
4. Evaporator and condenser water must enter the water box through the bottom connection to achieve rated performance.

5. Connected piping should allow for removal of compact water boxes for tube access and cleaning.

CONDENSERS – COMPACT WATER BOXES



NOZZLE ARRANGEMENTS*	
NO. OF PASSES	EVAPORATOR IN-OUT
1	P-Q
	Q-P



NOZZLE ARRANGEMENTS*	
NO. OF PASSES	EVAPORATOR IN-OUT
2	R-S
	T-U

LD07228

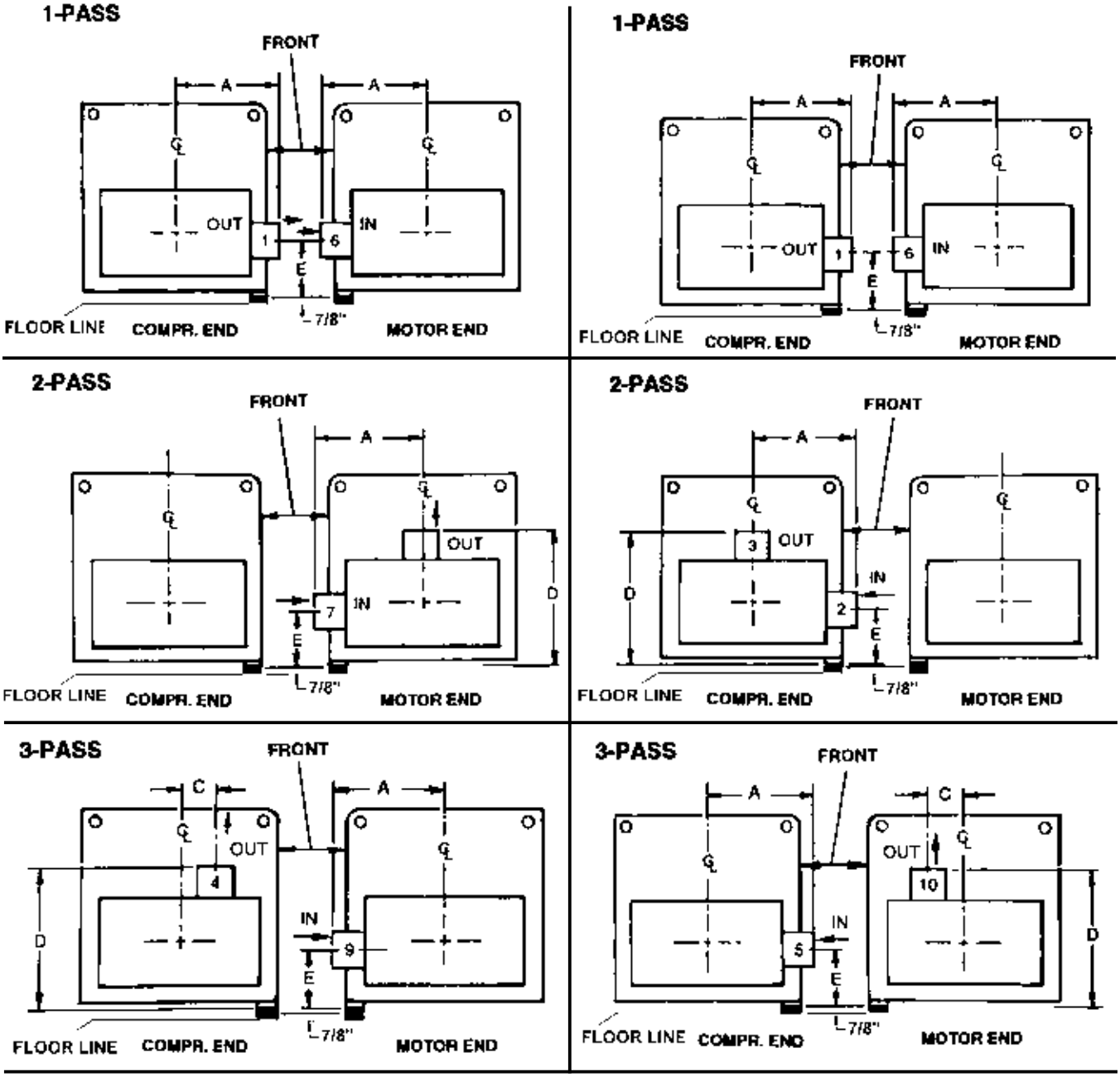
CONDENSER SHELL CODE	NOZZLE PIPE SIZE		CONDENSER NOZZLE DIMENSIONS		
	NO. OF PASSES		NN	PP	RR
	1	2		2-PASS	2-PASS
A	12"	8"	2' 3-1/2"	1' 8-1/2"	2' 10-1/2"
B	14"	10"	2' 3-1/4"	1' 7"	2' 11-1/2"
C	14"	10"	2' 3-1/4"	1' 7"	12' 11-1/2"
D	16"	12"	2' 7-5/8"	1' 9-3/4"	3' 5-1/2"

NOTES: See page 34.

One and Two Pass Nozzle Arrangements are available only in pairs shown and for all shell codes. Any pair of evaporator nozzles maybe used in combination with any pair of condenser nozzles.

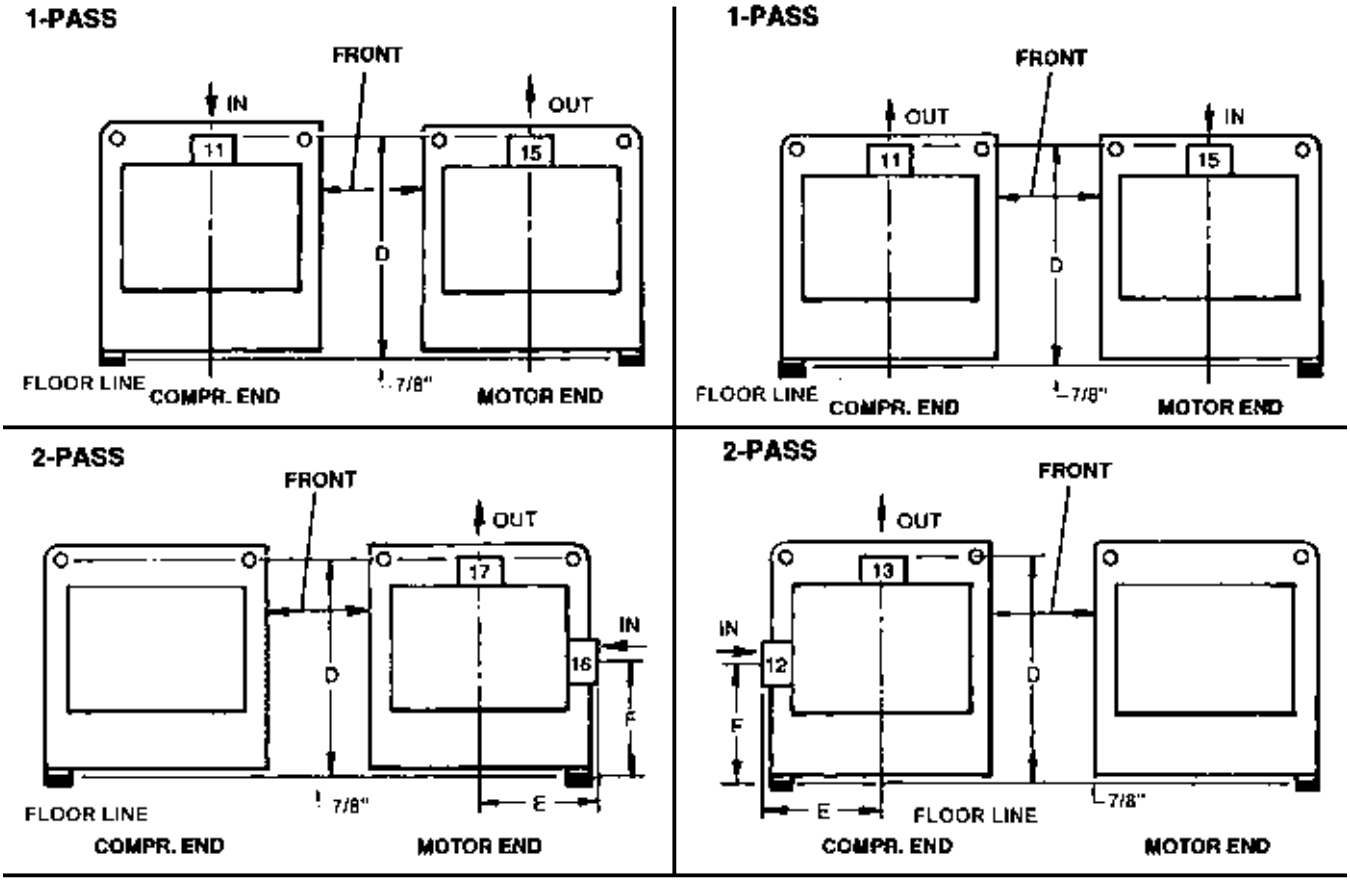
Dimensions (Ft. - In.) – Nozzle Arrangements

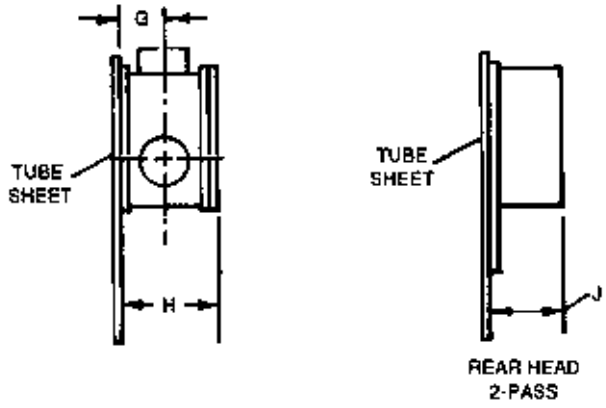
EVAPORATORS – MARINE WATER BOXES



EVAP. SHELL CODE	A	C	D	E			F			G			H
				1-PASS	2-PASS	3-PASS	1-PASS	2-PASS	3-PASS	1-PASS	2-PASS	3-PASS	BackHead
G	2' 0-3/8"	6"	2' 4-5/8"	10-1/8"	9"	8"	9-1/4"	8-1/4"	7-1/4"	1' 7-5/8"	1' 5-5/8"	1' 3-5/8"	5-3/8"
H	2' 2-1/8"	4-1/2"	2' 5-3/4"	1' 0-5/8"	10-1/8"	9-1/8"	10-1/2"	8-1/4"	7-1/4"	1' 10-1/8"	1' 5-5/8"	1' 3-5/8"	5-3/8"
J	2' 3-3/8"	11"	2' 8-1/2"	11"	10"	9"	10-1/2"	9-1/4"	8-1/4"	1' 10-3/8"	1' 7-7/8"	1' 5-7/8"	5-3/8"
K	2' 5-5/8"	1' 0-1/2"	2' 10"	1' 1-1/8"	1' 0-1-1/8"	11-1/8"	10-1/2"	9-1/4"	8-1/4'	1' 10-3/8"	1' 7-7/8"	1' 5-7/8"	6-1/2"
L	2' 6"	9"	3' 0-7/8"	1' 2-3/8"	11-518"	10-5/8"	11"	11"	9-3/4"	1' 11-5/8"	1' 11-5/8"	1' 9-1/8"	6-3/4"

CONDENSERS – MARINE WATER BOXES



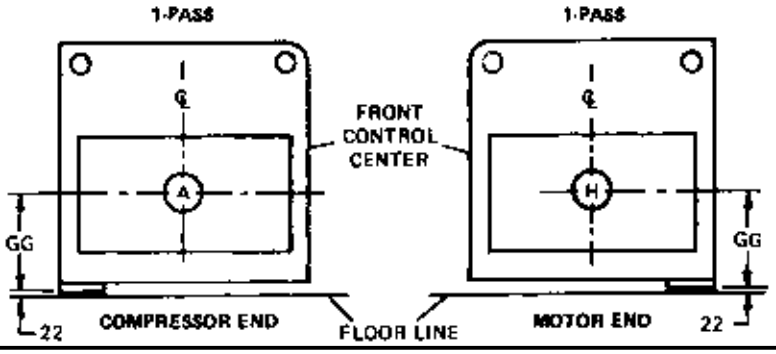


LD05365

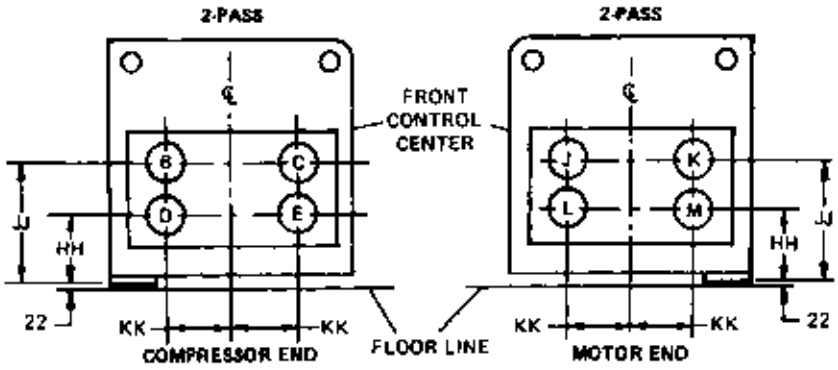
CONDENSER SHELL CODE	D	E	F	G		H		2-PASS
				1-PASS	2-PASS	1-PASS	2-PASS	
A	4' 2-1/4"	1' 10-3/4"	1' 10-5/8"	11-1/8"	8-5/8"	1' 11-5/8"	1' 6-5/8"	5-1/2"
B	4' 4-1/2"	2' 1-1/4"	1' 9-1/4"	1' 0-1/8"	9-5/8"	2' 1 -7/8"	1' 8-7/8"	5-3/4"
C	4' 4-1/2"	2' 1-1/4"	1' 9-1/4"	1' 0-1/8"	9-5/8"	2' 1-7/8"	1' 8-7/8"	5-3/4"
D	4' 11-5/8"	2' 4"	1' 11-3/4"	1' 0-1/4"	11-1/4"	2' 2-3/8"	2' 0-3/4"	6"

Dimensions (mm) – Nozzle Arrangements

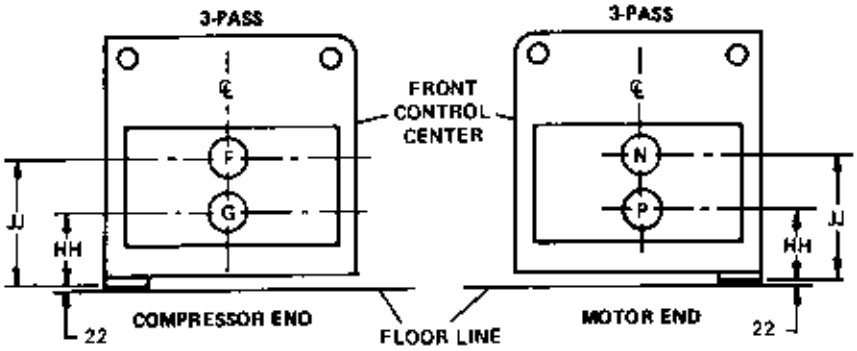
EVAPORATORS – COMPACT WATER BOXES



NOZZLE ARRANGEMENTS	
NO. OF PASSES	EVAPORATOR IN-OUT
1	A-H
	H-A



NOZZLE ARRANGEMENTS	
NO. OF PASSES	EVAPORATOR IN-OUT
2	E-B
	D-C
	M-J
	L-K



NOZZLE ARRANGEMENTS	
NO. OF PASSES	EVAPORATOR IN-OUT
3	P-F
	G-N

LD07229

EVAP. SHELL CODE	NOZZLE PIPE SIZE NO. OF PASSES			EVAPORATOR NOZZLE DIMENSIONS					
				GG	JJ		HH		KK
	1	2	3	1-PASS	2-PASS	3-PASS	2-PASS	3-PASS	2-PASS
G	10"	8"	6"	292	365	394	219	190	222
H	12"	8"	6"	321	390	346	251	219	254
J	14"	10"	8"	340	435	463	244	216	229
K	14"	10"	8"	340	460	486	308	282	254
L	16"	12"	10"	429	505	530	352	327	267

NOTES:

1 . Standard water nozzles are furnished as welding stub-outs with Victaulic grooves, allowing the option of welding, flanges, or use of Victaulic couplings. Factory installed, class 150 (ANSI B16.5, round slip-on, forged carbon steel with 1/16" raised face), water flanged nozzles are optional. Companion flanges, nuts, bolts and gaskets are not furnished.

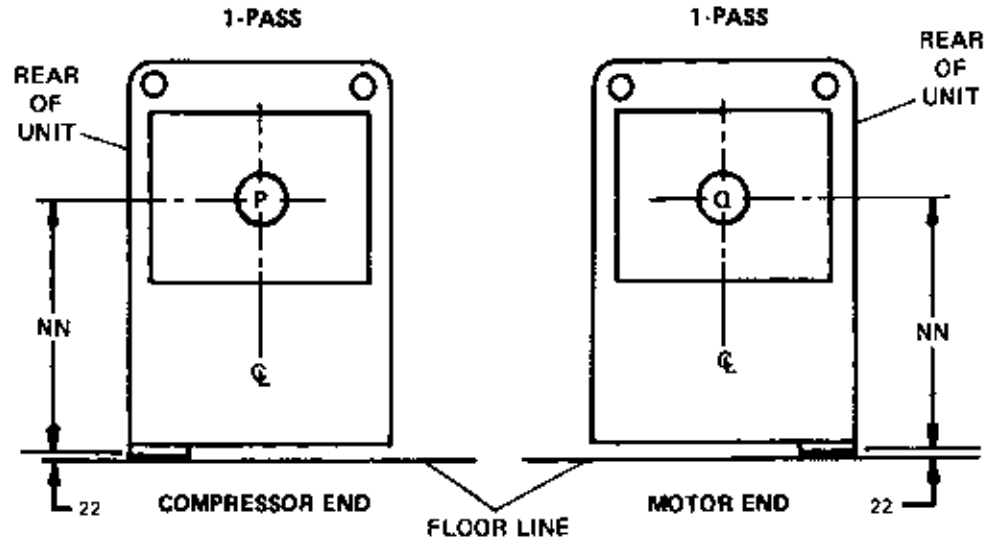
2. Add 22 mm for isolators as shown.

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.

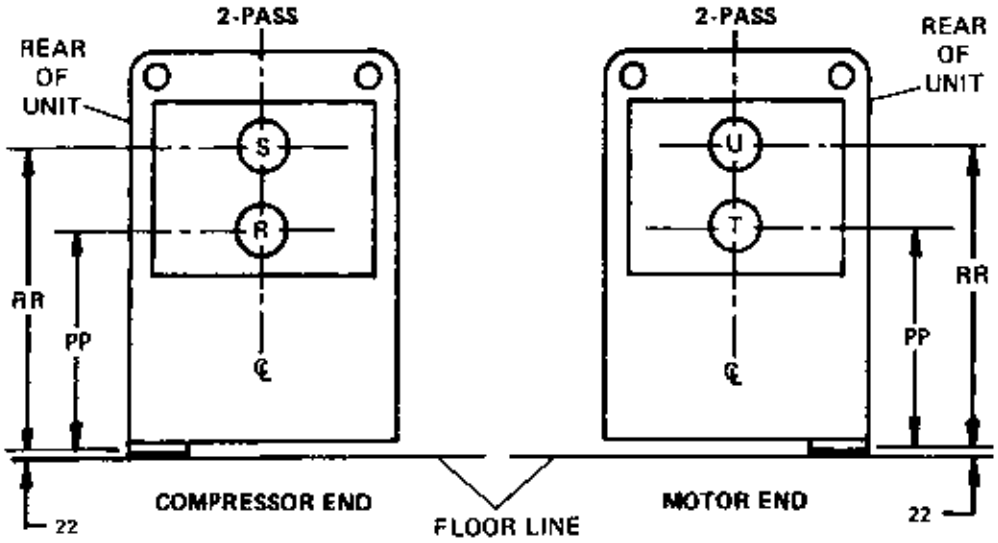
4. Evaporator and condenser water must enter the water box through the bottom connection to achieve rated performance.

5. Connected piping should allow for removal of compact water boxes for tube access and cleaning.

CONDENSERS – COMPACT WATER BOXES



NOZZLE ARRANGEMENTS*	
NO. OF PASSES	EVAPORATOR IN-OUT
1	P-Q
	Q-P



NOZZLE ARRANGEMENTS*	
NO. OF PASSES	EVAPORATOR IN-OUT
2	R-S
	T-U

LD07230

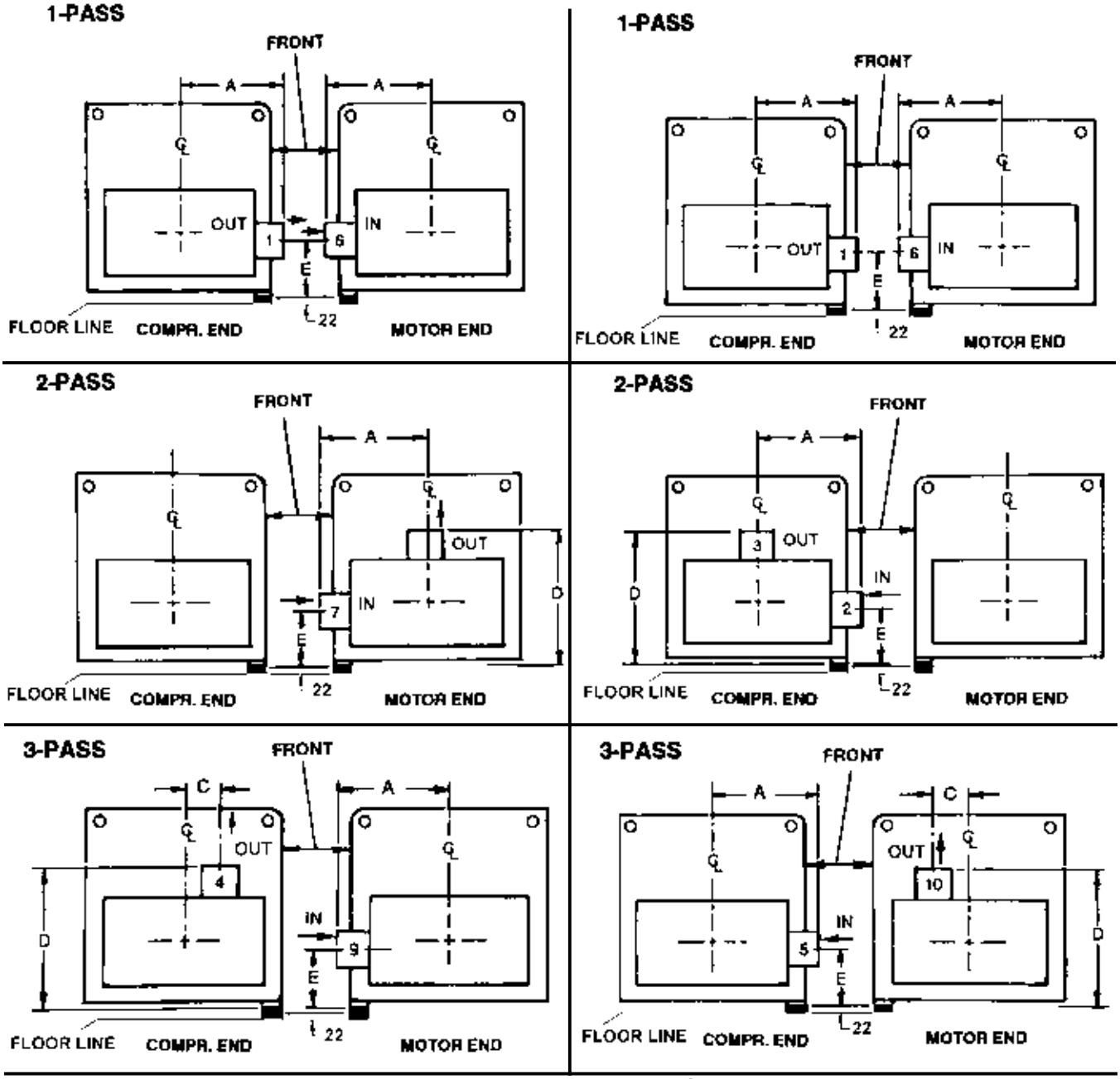
CONDENSER SHELL CODE	NOZZLE PIPE SIZE		CONDENSER NOZZLE DIMENSIONS		
	NO. OF PASSES		NN	PP	RR
	1	2		2-PASS	2-PASS
A	12"	8"	698	521	876
B	14"	10"	692	483	902
C	14"	10"	692	483	902
D	16"	12"	803	552	1054

NOTES: See page 38.

One and Two Pass Nozzle Arrangements are available only in pairs shown and for all shell codes. Any pair of evaporator nozzles maybe used in combination with any pair of condenser nozzles.

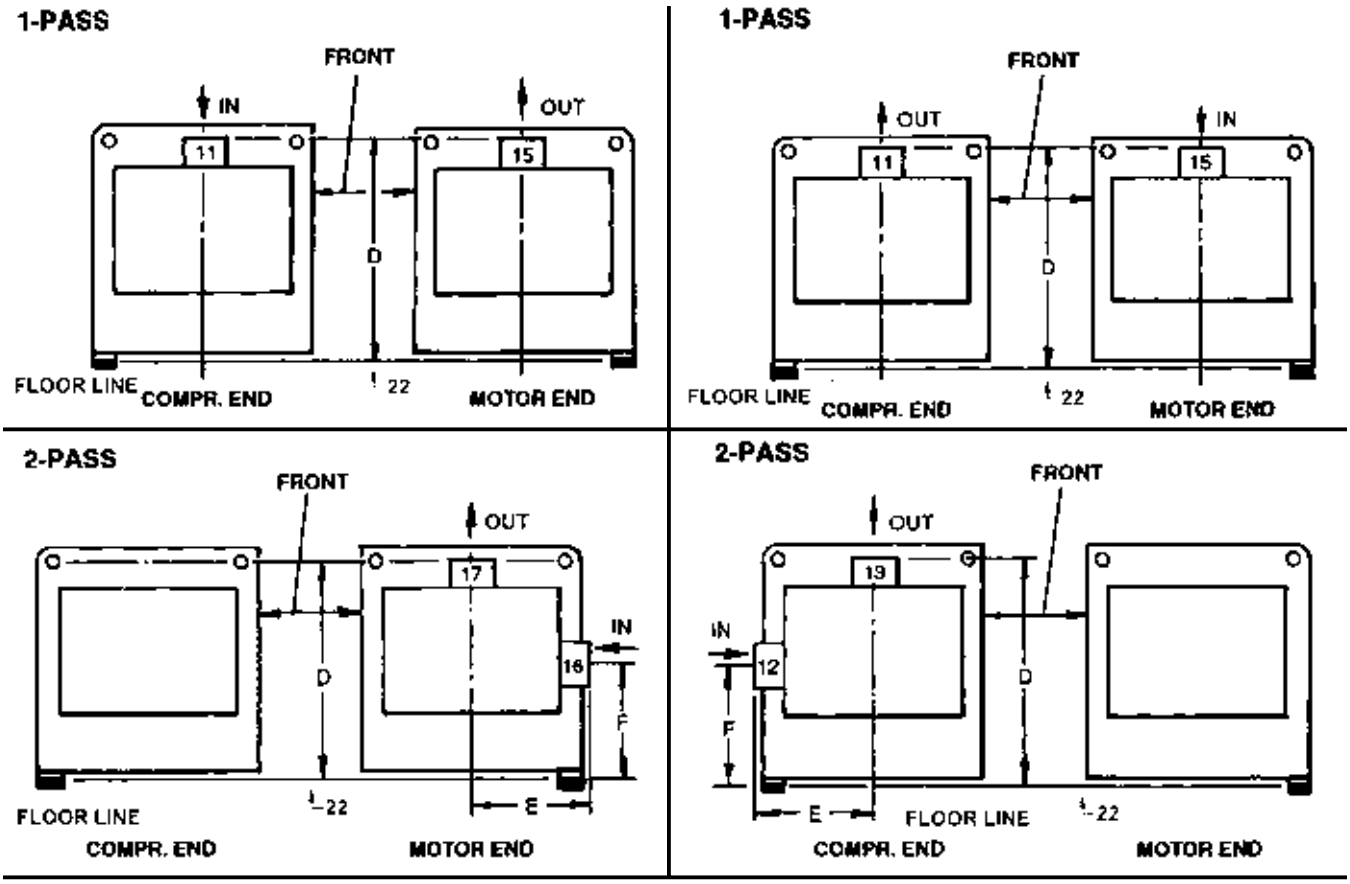
Dimensions (mm) – Nozzle Arrangements

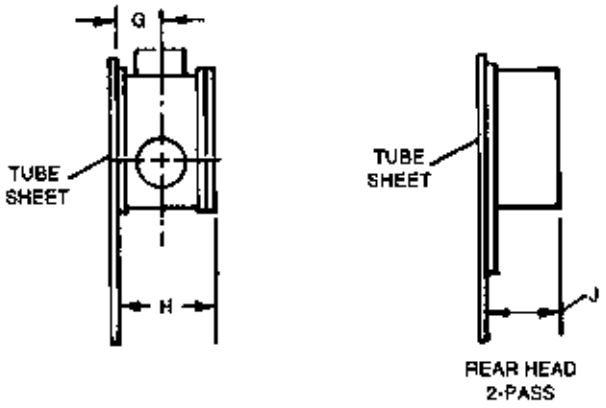
EVAPORATORS – MARINE WATER BOXES



EVAP. SHELL CODE	A	C	D	E			F			G			H
				1-PASS	2-PASS	3-PASS	1-PASS	2-PASS	3-PASS	1-PASS	2-PASS	3-PASS	BackHead
G	2' 0-3/8"	6"	2' 4-5/8"	250	229	203	235	209	184	498	448	397	136
H	2' 2-1/8"	4-1/2"	2' 5-3/4"	321	257	232	267	209	184	562	448	397	136
J	2' 3-3/8"	11"	2' 8-1/2"	279	254	229	267	235	209	568	505	454	136
K	2' 5-5/8"	1' 0-1/2"	2' 10"	333	308	282	267	235	209	568	505	454	165
L	2' 6"	9"	3' 0-7/8"	365	295	270	279	279	248	600	600	536	171

CONDENSERS – MARINE WATER BOXES





LD05365m

CONDENSER SHELL CODE	D	E	F	G		H		J
				1-PASS	2-PASS	1-PASS	2-PASS	2-PASS
A	1276	578	575	282	219	600	473	140
B	1334	641	540	308	219	657	530	146
C	1334	641	540	308	219	657	530	146
D	1514	737	603	311	286	670	629	152

Weights – Lbs.

TABLE 7 – CHILLER WEIGHTS (LESS MOTOR)
B COMPRESSOR

SHELL CODES	REFRIGERANT CHARGE (LBS.)	CHILLER SHIPPING (LBS.)	CHILLER OPERATING (LBS.)
G0A1	890	11,090	13,015
G0A2	890	11,250	13,230
G0A3	890	11,435	13,480
G0A4	890	11,645	13,770
G1A1	890	11,238	13,220
G1A2	890	11,394	13,430
G1A3	890	11,578	13,680
G1A4	890	11,792	13,970
G3A1	890	11,536	13,630
G3A2	890	11,692	13,840
G3A3	890	11,876	14,090
G3A4	890	12,090	14,380

NOTES:

1. Shipping weights are for a unit including Control Center but DO NOT include weight of motor, refrigerant, thermal insulation, marine water boxes or shipping skids. See Table 11 for motor weights. See Form 160.55-PA1 for other additional weights.
2. Operating weights shown include unit (less motor weight), Control Center, oil, water, refrigerant operating charge and factory insulation of evaporator. Add motor weights per Table 11.
3. Loading per isolator equals operating weight divided by 4.
4. If optional marine type water boxes are furnished, increase unit weights per Form 160.55-PA1.

TABLE 8 – CHILLER WEIGHTS (LESS MOTOR)
C COMPRESSOR

SHELL CODES	REFRIGERANT CHARGE (LBS.)	CHILLER SHIPPING (LBS.)	CHILLER OPERATING (LBS.)
G1A1	890	11,815	13,795
G1A2	890	11,970	14,010
G1A3	890	12,155	14,260
G1A4	890	12,370	14,540
G3A1	890	12,112	14,205
G3A2	890	12,248	14,400
G3A3	890	12,452	14,665
G3A4	890	12,665	14,955
H1A1	970	12,590	14,810
H1A2	970	12,745	15,020
H1A3	970	12,930	15,270
H1A4	970	13,145	15,560
H3A1	970	12,850	15,170
H3A2	970	12,990	15,365
H3A3	970	13,190	15,630
H3A4	970	13.410	15,925
H1B1	970	14,276	16,780
H1B2	970	14,496	17,075
H1B3	970	14,740	17,410
H1B4	970	15,020	17,790
H3B1	970	14,540	17,145
H3B2	970	14,755	17,440
H3B3	970	15,000	17,770
H3B4	970	15.282	18,150
J1A1	1,130	13,110	15,485
J1A2	1,130	13,250	15,840
J1A3	1,130	13,450	15,945
J1A4	1,130	13,665	16,395
J3A1	1,130	13,465	16,130
J3A2	1,130	13,600	16,320
J3A3	1,130	13,805	16,590
J3A4	1,130	14.020	16,880
J1B1	1,130	14,796	17,620
J1B2	1,130	15,015	17,915
J1B3	1,130	15,260	18,245
J1B4	1,130	15,540	18,625
J3B1	1,130	15,150	18,100
J3B2	1,130	15,368	18,400
J3B3	1,130	15,615	18,730
J3B4	1,130	15,895	19,110
K1B1	1,270	16,715	20,040
K1B2	1,270	16,935	20,335
K1B3	1,270	17,180	20,670
K1B4	1,270	17,460	21,050
K3B1	1,270	17,145	20,630
K3B2	1,270	17,362	20,925
K3B3	1,270	17,610	21,260
K3B4	1,270	1 7890	21,640

Weights – Lbs.

TABLE 9 – CHILLER WEIGHTS (LESS MOTOR)
E COMPRESSOR

SHELL CODES	REFRIGERANT CHARGE (LBS.)	CHILLER SHIPPING (LBS.)	CHILLER OPERATING (LBS.)
G1A1	890	14,880	16,860
G1A2	890	15,035	17,070
G1A3	890	15,220	17,325
G1A4	890	15,415	17,595
G3A1	890	15,210	17,305
G3A2	890	15,365	17,515
G3A3	890	15,550	17,765
G3A4	890	15,745	18,035
H1A1	970	15,550	17,765
H1A2	970	15,710	17,985
H1A3	970	15,890	18,230
H1A4	970	16,085	18,500
H3C1	970	15,810	18,125
H3C2	970	15,965	18,340
H3C3	970	16,150	18,590
H3C4	970	16,345	18,860
H1C1	970	17,590	20,140
H1C2	970	17,810	20,440
H1C3	970	18,055	20,775
H1C4	970	18,335	21,155
H3C1	970	17,850	20,500
H3C2	970	18,070	20,800
H3C3	970	18,316	21,135
H3C4	970	18,595	21,515
J1A1	1,130	16,460	18,995
J1A2	1,130	16,616	19,205
J1A3	1,130	16,800	19,455
J1A4	1,130	16,995	19,725
J3A1	1,130	16,805	19,470
J3A2	1,130	16,960	19,680
J3A3	1,130	17,145	19,930
J3A4	1,130	17,340	20,200
J1C1	1,130	18,512	21,380
J1C2	1,130	18,730	21,675
J1C3	1,130	18,976	22,010
J1C4	1.130	19.255	22,390
J3C1	1,130	18,860	21,860
J3C2	1,130	19,075	22,150
J3C3	1,130	19,322	22,490
J3C4	1,130	19,600	22.865
K1C1	1,270	20,075	23,445
K1C2	1,270	20,290	23,740
K1C3	1,270	20,540	24,075
K1C4	1,270	20,815	24,450
K3C1	1,270	20,500	24,030
K3C2	1,270	20,720	24,330
K3C3	1,270	20,965	24,665
K3C4	1,270	21,245	25,045
K1D1	1,270	22,085	25,830
K1D2	1,270	22,435	26,310
K1D3	1,270	22,825	26,840
K1D4	1,270	23,270	27,440
K3D1	1,270	22,510	26,420
K3D2	1,270	22,861	26,895
K3D3	1,270	23,253	27,430
K3D4	1,270	23,700	28,035
L1C1	1,390	21,175	24,800
L1C2	1,390	21,395	25,220
L1C3	1,390	21,640	25,550
L1C4	1.390	21,919	25,930
L3C1	1,390	21,700	25,650
L3C2	1,390	21,920	25,950
L1C3	1,390	22,165	26,285
L1C4	1,390	22,443	26,660
L1D1	1,390	23,180	27,300
L1D2	1,390	23,530	27,780
L1D3	1,390	23,921	28,310
L1D4	1,390	24,365	28,915
L3D1	1,390	23,700	28,030
L3D2	1,390	24,060	28,515
L3D3	1,390	24,450	29,045
L3D4	1,390	24,890	29,645

TABLE 10 – CHILLER WEIGHTS (LESS MOTOR)
F COMPRESSOR

SHELL CODES	REFRIGERANT CHARGE (LBS.)	CHILLER SHIPPING (LBS.)	CHILLER OPERATING (LBS.)
K4C5	1,390	22,190	26,845
K4C6	1,390	22,440	26,185
K4C7	1,390	22,725	26,685
K4C8	1,390	23,050	27,010
K6C5	1,390	22,535	26,335
K6C6	1,390	22,790	26,680
K6C7	1,390	23,075	27,066
K6C8	1,390	23,400	27,505
K7C5	1,530	22,840	26,720
K7C6	1,530	23,095	27,065
K7C7	1,530	23,380	27,450
K7C8	1,530	23,700	27,885
K9C5	1,530	23,340	27,415
K9C6	1,530	23,595	27,760
K9C7	1,530	23,880	28,145
K9C8	1.530	24,200	28,580
K4D5	1,390	24,476	28,565
K4D6	1,390	24,880	29,115
K4D7	1,390	25,340	29,400
K4D8	1,390	25,850	30,430
K6D5	1,390	24,825	29,060
K6D6	1,390	25,225	29,600
K6D7	1,390	25,680	30,220
K6D8	1,390	26,200	30,925
K7D5	1,530	25,130	29,445
K7D6	1,530	25,530	29,990
K7D7	1,530	25,990	30,610
K7D8	1,530	26,850	31,655
K9D5	1,530	25,630	30,140
K9D6	1,530	26,037	30,690
K9D7	1,530	26,490	31,305
K9D8	1,530	27,000	32,000
L4C5	1,590	24,114	28,355
L4C6	1,590	24,340	28,670
L4C7	1,590	24,655	28,780
L4C8	1,590	24,980	29,525
L6C5	1,590	24,715	29,190
L6C6	1,590	24,970	29,540
L6C7	1,590	25,255	29,925
L6C8	1,590	25,580	30,365
L4D5	1,590	26,345	31,020
L4D6	1,590	26,750	31,570
L4D7	1,590	27,200	32,180
L4D8	1,590	27,720	32,885
L6D5	1,590	26,945	31,860
L6D6	1,590	27,350	32,410
L6D7	1,590	27,800	33,020
L6D8	1,590	28,320	33,722

TABLE 11 – MOTOR WEIGHTS - LBS.

60 HZ				50 HZ			
MOTOR CODE	TYPICAL MOTOR WEIGHT	MOTOR CODE	TYPICAL MOTOR WEIGHT	MOTOR CODE	TYPICAL MOTOR WEIGHT	MOTOR CODE	TYPICAL MOTOR WEIGHT
CF	940	CU	2,635	5CC	940	5CO	2,635
CG	940	CV	2,635	5CD	940	5CP	2,930
CH	940	CW	2,930	5CE	940	5CQ	2,930
CJ	940	CX	2,930	5CF	1,440	5CR	2,930
CK	1,440	CY	2,930	5CG	1,440	5CS	2,930
CL	1,440	CZ	2,930	5CH	1,700	5CT	5,750
CM	1,700	CA	5,750	5CI	1,700	5CU	5,750
CN	1,700	CB	5,750	5CJ	1,700	5CV	5,750
CP	1,700			5CK	1,700		
CR	1,700			5CL	2,635		
CS	2,635			5CM	2,635		
CT	2,635			5CN	2,635		

NOTE:

1. Motor weight shown in Table 11 is typical of 200 thru 600 volt motors; high voltage motors may be heavier – contact YORK.

Weights – Kg

TABLE 7A – CHILLER WEIGHTS (LESS MOTOR)
B COMPRESSOR

SHELL CODES	REFRIGERANT CHARGE (Kg)	CHILLER SHIPPING (Kg)	CHILLER OPERATING (Kg)
G0A1	404	5030	5404
G0A2	404	5103	6001
G0A3	404	5187	6114
G0A4	404	5282	6246
G1A1	404	5097	5996
G1A2	404	5168	6092
G1A3	404	5252	6205
G1A4	404	5349	6337
G3A1	404	5233	6182
G3A2	404	5303	6281
G3A3	404	5387	6391
G3A4	404	5484	6523

NOTES:

1. Shipping weights are for a unit including Control Center but DO NOT include weight of motor, refrigerant, thermal insulation, marine water boxes or shipping skids. See Table 11A for motor weights. See Form 160.55-PA1 for other additional weights.
2. Operating weights shown include unit (less motor weight), Control Center, oil, water, refrigerant operating charge and factory insulation of evaporator. Add motor weights per Table 11A.
3. Loading per isolator equals operating weight divided by 4.
4. If optional marine type water boxes are furnished, increase unit weights per Form 160.55-PA1.

TABLE 8A – CHILLER WEIGHTS (LESS MOTOR)
C COMPRESSOR

SHELL CODES	REFRIGERANT CHARGE (Kg)	CHILLER SHIPPING (Kg)	CHILLER OPERATING (Kg)
G1A1	404	5360	6257
G1A2	404	5429	6355
G1A3	404	5513	6468
G1A4	404	5611	6595
G3A1	404	5494	6443
G3A2	404	5556	6532
G3A3	404	5648	6652
G3A4	404	5745	6783
H1A1	440	5711	6718
H1A2	440	5781	6813
H1A3	440	5865	6926
H1A4	440	5962	7058
H3A1	440	5829	6881
H3A2	440	5892	6969
H3A3	440	5983	7089
H3A4	440	6083	7223
H1B1	440	6475	7611
H1B2	440	6575	7745
H1B3	440	6686	7897
H1B4	440	6813	8069
H3B1	440	6595	7777
H3B2	440	6693	7911
H3B3	440	6804	8060
H3B4	440	6932	8238
J1A1	512	5947	7024
J1A2	512	6010	7185
J1A3	512	6101	7233
J1A4	512	6198	7437
J3A1	512	6108	7316
J3A2	512	6169	7403
J3A3	512	6262	7525
J3A4	512	6359	7657
J1B1	512	6711	7992
J1B2	512	6811	8126
J1B3	512	6922	8276
J1B4	512	7049	8448
J3B1	512	6872	8210
J3B2	512	6971	8346
J3B3	512	7083	8496
J3B4	512	7210	8668
K1B1	576	7582	9090
K1B2	576	7682	9224
K1B3	576	7793	9376
K1B4	576	7920	9548
K3B1	576	7777	9358
K3B2	576	7875	9491
K3B3	576	7988	9643
K3B4	576	8115	9816

Weights – Kg

TABLE 9A – CHILLER WEIGHTS (LESS MOTOR)
E COMPRESSOR

SHELL CODES	REFRIGERANT CHARGE (Kg)	CHILLER SHIPPING (Kg)	CHILLER OPERATING (Kg)
G1A1	404	6750	7648
G1A2	404	6820	7743
G1A3	404	6904	7859
G1A4	404	6992	7981
G3A1	404	6899	7850
G3A2	404	6970	7945
G3A3	404	7053	8058
G3A4	404	7142	8181
H1A1	440	7053	8058
H1A2	440	7126	8158
H1A3	440	7208	8269
H1A4	440	7296	8392
H3C1	440	7171	8222
H3C2	440	7242	8319
H3C3	440	7326	8432
H3C4	440	7414	8555
H1C1	440	7979	9136
H1C2	440	8079	9272
H1C3	440	8190	9424
H1C4	440	8317	9596
H3C1	440	8097	9299
H3C2	440	8197	9435
H3C3	440	8308	9587
H3C4	440	8435	9759
J1A1	513	7466	8616
J1A2	513	7537	8711
J1A3	513	7620	8825
J1A4	513	7709	8947
J3A1	513	7623	8832
J3A2	513	7693	8927
J3A3	513	7777	9040
J3A4	513	7,865	9,163
J1C1	513	8,397	9,698
J1C2	513	8,496	9,832
J1C3	513	8,608	9,984
J1C4	513	8,734	10,156
J3C1	513	8,555	9,916
J3C2	513	8,652	10,047
J3C3	513	8,764	10,201
J3C4	513	8,891	10,372
K1C1	576	9,106	10,635
K1C2	576	9,204	10,768
K1C3	576	9,317	10,920
K1C4	576	9,442	11,091
K3C1	576	9,299	10,900
K3C2	576	9,399	11,036
K3C3	576	9,510	11,188
K3C4	576	9,637	11,360
K1D1	576	10,018	11,716
K1D2	576	10,177	11,934
K1D3	576	10,353	12,175
K1D4	576	10,555	12,447
K3D1	576	10,211	11,984
K3D2	576	10,370	12,200
K3D3	576	10,548	12,442
K3D4	576	10,750	12,717
L1C1	631	9,605	11,249
L1C2	631	9,705	11,440
L1C3	631	9,816	11,589
L1C4	631	9,942	11,762
L3C1	631	9,843	11,635
L3C2	631	9,943	11,771
L1C3	631	10,054	11,923
L1C4	631	10,180	12,093
L1D1	631	10,514	12,383
L1D2	631	10,673	12,601
L1D3	631	10,851	12,841
L1D4	631	11,052	13,116
L3D1	631	10,750	12,714
L3D2	631	10,914	12,934
L3D3	631	11,091	13,175
L3D4	631	11,290	13,447

TABLE 10A – CHILLER WEIGHTS (LESS MOTOR)
F COMPRESSOR

SHELL CODES	REFRIGERANT CHARGE (Kg)	CHILLER SHIPPING (Kg)	CHILLER OPERATING (Kg)
K4C5	631	10,065	12,177
K4C6	631	10,179	11,877
K4C7	631	10,308	12,104
K4C8	631	10,455	12,252
K6C5	631	10,222	11,946
K6C6	631	10,338	12,102
K6C7	631	10,467	12,277
K6C8	631	10,614	12,476
K7C5	694	10,360	12,120
K7C6	694	10,476	12,277
K7C7	694	10,605	12,451
K7C8	694	10,750	12,649
K9C5	694	10,587	12,435
K9C6	694	10,703	12,592
K9C7	694	10,832	12,767
K9C8	694	10,977	12,964
K4D5	631	11,102	12,957
K4D6	631	11,286	13,207
K4D7	631	11,494	13,336
K4D8	631	11,726	13,803
K6D5	631	11,261	13,182
K6D6	631	11,442	13,427
K6D7	631	11,648	13,708
K6D8	631	11,884	14,028
K7D5	694	11,399	13,356
K7D6	694	11,580	13,603
K7D7	694	11,789	13,885
K7D8	694	12,179	14,359
K9D5	694	11,626	13,672
K9D6	694	11,810	13,921
K9D7	694	12,016	14,199
K9D8	694	12,247	14,515
L4C5	721	10,938	12,862
L4C6	721	11,041	13,005
L4C7	721	11,184	13,055
L4C8	721	11,331	13,393
L6C5	721	11,211	13,241
L6C6	721	11,326	13,399
L6C7	721	11,456	13,574
L6C8	721	11,603	13,774
L4D5	721	11,950	14,071
L4D6	721	12,134	14,320
L4D7	721	12,338	14,597
L4D8	721	12,574	14,917
L6D5	721	12,222	14,452
L6D6	721	12,406	14,701
L6D7	721	12,610	14,978
L6D8	721	12,846	15,296

TABLE 11A - MOTOR WEIGHTS - Kg

60 HZ				50 HZ			
MOTOR CODE	TYPICAL MOTOR WEIGHT	MOTOR CODE	TYPICAL MOTOR WEIGHT	MOTOR CODE	TYPICAL MOTOR WEIGHT	MOTOR CODE	TYPICAL MOTOR WEIGHT
CF	426	CU	1,195	5CC	426	5CO	1,195
CG	426	CV	1,195	5CD	426	5CP	1,329
CH	426	CW	1,329	5CE	426	5CQ	1,329
CJ	426	CX	1,329	5CF	653	5CR	1,329
CK	653	CY	1,329	5CG	653	5CS	1,329
CL	653	CZ	1,329	5CH	771	5CT	2,608
CM	771	CA	2,608	5CI	771	5CU	2,608
CN	771	CB	2,608	5CJ	771	5CV	2,608
CP	771			5CK	771		
CR	771			5CL	1,195		
CS	1,195			5CM	1,195		
CT	1,195			5CN	1,195		

NOTE:

1. Motor weight shown in Table 11A is typical of 200 thru 600 volt motors; high voltage motors may be heavier – contact YORK.

Guide Specifications

GENERAL

Furnish and install where indicated on the drawings____ YORK MAXE Centrifugal Liquid Chilling-Unit(s). Each unit shall produce a capacity of ____ tons, cooling ____ GPM of ____ from ____ °F to ____ °F when supplied with ____ GPM of condenser water at ____ °F. Power input shall not exceed ____ kW with an IPLV (NPLV) of ____ . The evaporator shall be selected for____ fouling factor and a maximum liquid pressure drop of ____ ft. Water side shall be designed for 150 PSIG working pressure. The condenser shall be selected for ____ fouling factor and maximum liquid pressure drop of ____ ft. Water side shall be designed for 150 PSIG working pressure. Power shall be supplied to the compressor motor at ____ volts – 3-phase – (60)(50) Hertz and controls at 115 volts – 1-phase –(60) (50). The chiller shall use HCFC-123.

(or)

Furnish and install where indicated on the drawings ___ YORK MAXE Centrifugal Liquid Chilling-Unit(s). Each unit shall produce a capacity of ____ kW, cooling ____ L/S of ____ from ____ °C to ____ °C when supplied with ____ L/S of condenser water at ____°C. Power input shall not exceed ____ kW with an IPLV (NPLV) of ____. The evaporator shall be selected for ____m^2 C/W fouling factor and maximum liquid pressure drop of ____kPa. Water side shall be designed for 10.3 bar g working pressure. The condenser shall be selected for ____ fouling factor and maximum liquid pressure drop of ____ kPa. Water side shall be designed for 10.3 bar g working pressure. Power shall be supplied to the compressor motor at ____ volts – 3-phase – 50 Hertz and controls at 115 volts – 1-phase – 50 Hertz.

Performance shall be certified or rated in accordance with the latest edition of ARI Standard 550/590 as applicable. Only chillers that are listed in the ARI Certification Program for Water Chilling Packages using the Vapor Compression Cycle are acceptable.

The unit shall be capable of continuous, reliable operation with low ECWT at all load conditions as outlined on the equipment schedule. An external electric actuator shall automatically control prerotation vane position.

Each unit shall be completely factory-packaged including evaporator, condenser, sub-cooler, compressor, open motor, lubrication system, OptiView Control Center, Variable Speed Drive or Solid State Starter, and all interconnecting unit piping and wiring. The chiller shall be painted prior to shipment.

The initial charge of oil shall be shipped inside the chiller; and refrigerant HCFC-123 shall be supplied, shipped in containers and cylinders for field installation.

(Alternatively, the chiller shall be shipped with the compressor and control panel removed (Form 3) or also with the shells separated (Form 7) to allow rigging into the equipment room. All units that ship disassembled shall be assembled and factory run tested prior to disassembly and shipment.)

COMPRESSOR

The compressor shall be a single-stage centrifugal type powered by an open-drive electric motor. The housing shall be fully accessible with vertical circular joints, with the complete operating assembly removable from the compressor and scroll housing. Compressor castings shall be designed for 15 PSIG working pressure and hydrostatically pressure tested at 50 PSIG. The rotor assembly shall consist of a heat-treated alloy steel drive shaft and impeller shaft with a cast aluminum, fully shrouded impeller. The impeller shall be designed for balanced thrust, dynamically balanced and overspeed tested for smooth, vibration-free operation. Insert-type journal and thrust bearings shall be fabricated of aluminum alloy, precision bored and axially grooved.

Internal single helical gears with crowned teeth shall be designed so that more than one tooth is in contact at all times to provide even distribution of compressor load and quiet operation. Each gear shall be individually mounted in its own journal and thrust bearings to isolate it from impeller and motor forces. The shaft seal shall be a spring-loaded carbon ring with precision lapped collar cooled by oil during operation. A gravity-fed oil reservoir shall be built into the top of the compressor to provide lubrication during coastdown in the event of a power failure.

Capacity control shall be achieved by use of pre-rotation vanes to provide fully modulating control from 100% to 10% of full load. The unit shall be capable of operating with lower temperature cooling tower water during partload operation in accordance with ARI Standard 550/590. If the unit cannot operate at the minimum load, the manufacturer shall provide a hot-gas-bypass system to allow operation at 10% load, and advise the minimum load and power input of the unit at the point hot-gas-bypass is actuated. Prerotation vane position shall be automatically controlled by an external electric actuator to maintain constant leaving chilled water temperature.

LUBRICATION SYSTEM

Lubrication oil shall be force-fed to all bearings, gears and rotating surfaces by an oil pump which operates prior to startup, continuously during operation and during coastdown. An oil reservoir, separate from the com-

pressor, shall contain a minimum 3/4 HP submersible oil pump and 1000 watt immersion-type oil heater, thermostatically controlled to remove refrigerant from the oil.

Oil shall be filtered by an externally mounted 1/2 micron replaceable cartridge oil filter equipped with service valves and cooled by a refrigerant-cooled oil cooler before entering the compressor. The oil side of the oil cooler shall be provided with service valves. Oil piping shall be completely factory installed and tested.

MOTOR DRIVELINE

The compressor motor shall be an open drip-proof, squirrel cage, induction type operating at 3570 rpm (2975 rpm for 50 Hz operation).

The open motor shall be provided with a D-flange, to allow it to be rigidly coupled to the compressor to provide factory alignment of motor and compressor shafts, and to allow access to motor for repair without first removing refrigerant charge from the chiller.

Motor drive shaft shall be directly connected to the compressor shaft with a flexible disc coupling. Coupling shall have all-metal construction with no wearing parts to assure long life, and no lubrication requirements to provide low maintenance.

For units utilizing remote electro-mechanical starters, a large steel terminal box with gasketed front access cover shall be provided for field connected conduit.

Overload/overcurrent transformers shall be furnished with all units. (For units furnished with factory packaged Solid State Starters or Variable Speed Drive, refer to the “Options” section.)

EVAPORATOR

Evaporator shall be of the shell-and-tube, flooded type designed for 15 PSIG (103 kPa) working pressure on the refrigerant side, and be tested at 20 PSIG (138 kPa). Shell shall be fabricated from rolled carbon steel plate with fusion welded seams; have carbon steel tube sheets, drilled and reamed to accommodate the tubes; and intermediate tube supports spaced no more than four feet apart. Tubes shall be high-efficiency, internally enhanced type having plain copper lands at all intermediate tube supports to provide maximum tube wall thickness at the support area. Each tube shall be roller expanded into the tube sheets providing a leak-proof seal, and be individually replaceable. Water velocity through the tubes shall not exceed 12 FPS. A liquid-level sight glass shall be located on the side of the shell to aid in determining proper refrigerant charge. Aluminum mesh eliminators shall be located above the tube bundle to prevent liquid refrigerant carryover to the compressor. Water boxes shall be removable to permit tube cleaning and replacement. Stubout water connections having Victaulic grooves shall be provided. Water boxes shall be designed for 150 PSIG (1034 kPa) design working pressure and be tested at 225 PSIG (1551 kPa). Vent and drain connections with plugs shall be provided on each water box.

CONDENSER

Condenser shall be of the shell-and-tube type, designed for 15 PSIG (103 kPa) working pressure on the refrigerant side, and be tested at 20 PSIG (138 kPa). Shell shall be fabricated from rolled carbon-steel plate with fusion welded seams; have carbon steel tube sheets, drilled and reamed to accommodate the tubes; and intermediate tube supports spaced no more than four feet apart. A refrigerant subcooler shall be provided for improved cycle efficiency. Tubes shall be high-efficiency, internally enhanced type having plain copper lands at all intermediate tube supports to provide maximum tube wall thickness at the support area. Each tube shall be roller expanded into the tube sheets providing a leak-proof seal, and be individually replaceable. Water velocity through the tubes shall not exceed 12 FPS.

Water boxes shall be removable to permit tube cleaning and replacement. Stubout water connections having Victaulic grooves shall be provided. Water Boxes shall be designed for 150 PSIG (1034 kPa) design working pressure and be tested at 225 PSIG (1551kPa). Vent and drain connections with plugs shall be provided on each water box.

REFRIGERANT RELIEF DEVICE

A frangible carbon bursting disc relief device, sized to meet the requirements of the ASHRAE 15 Safety Code for Mechanical Refrigeration, shall be provided on the chiller.

REFRIGERANT FLOW CONTROL

Refrigerant flow to the evaporator shall be controlled by a single fixed-orifice with no moving parts.

HIGH EFFICIENCY PURGE UNIT

The chiller shall be supplied with a factory mounted purge unit providing a positive means for collection and removal of non-condensibles from the system. It shall be capable of removing refrigerant from the non-con-

densibles and returning it to the chiller. It shall have high efficiency in recapturing the refrigerant at all load and head conditions. It shall operate automatically and only while the chiller is operating to maintain its high efficiency. Manual operation of the purge unit while the chiller is shut down shall not be allowed. A message shall be provided on the control panel which will alert the operator at occurrence of excessive purging, indicating an abnormal air leak into the unit. The purge unit shall include necessary operating controls, piping, and refrigerant service valves to isolate the purge unit from the chilling unit. The purge unit shall be refrigerant cooled to provide a constant low temperature source for high efficiency purging.

OPTIVIEW CONTROL CENTER

General – The chiller shall be controlled by a stand-alone microprocessor based control center. The chiller control center shall provide control of chiller operation and monitoring of chiller sensors, actuators, relays and switches.

Control center – The control center shall include a 10.4-in. (264 mm) diagonal color liquid crystal display (LCD) surrounded by "soft" keys which are redefined based on the screen displayed at that time. This shall be mounted in the middle of a keypad interface and installed in a locked enclosure. The screen shall detail all operations and parameters, using a graphical representation of the chiller and its major components. Panel verbiage shall be available in other languages as an option with English always available. Data shall be displayed in either English or Metric units. Smart Freeze Point Protection shall run the chiller at 36°F (2.2°C) leaving chilled water temperature, and not have nuisance trips on low water temperature. The sophisticated program and sensor shall monitor the chiller water temperature to prevent freezeup. When needed, Hot Gas Bypass is available as an option. The panel shall display countdown timer messages so the operator knows when functions are starting and stopping. Every programmable point shall have a pop-up screen with the allowable ranges, so that the chiller can not be programmed to operate outside of its design limits.

The chiller control center shall also provide:

1. System operating information including:
   a. return and leaving chilled liquid temperature
   b. return and leaving condenser liquid temperature
   c. evaporator and condenser saturation temp.
   d. differential oil pressure
   e. percent motor current
   f. evaporator and condenser saturation temperature
   g. compressor discharge temperature
   h. oil reservoir temperature
   i. compressor thrust bearing positioning and oil temperature
   j. operating hours
   k. number of unit starts

2. Digital programming of setpoints through the universal keypad including:
   a. leaving chilled liquid temperature
   b. percent current limit
   c. pull-down demand limiting
   d. six-week schedule for starting and stopping the chiller, pumps and tower
   e. remote reset temperature range

3. Status messages indicating:
   a. system ready to start
   b. system running
   c. system coastdown
   d. system safety shutdown-manual restart
   e. system cycling shutdown-auto restart
   f. system prelube
   g. start inhibit

4. The text displayed within the system status and system details field shall be displayed as a color coded message to indicate severity: red for safety fault, orange for cycling faults, yellow for warnings, and green for normal messages.

5. Safety shutdowns enunciated through the display and the status bar, and consist of system status, system details, day, time, cause of shutdown, and type of restart required. Safety shutdowns with a fixed speed drive shall include:
   a. evaporator – low pressure
   b. evaporator – transducer or leaving
   c. evaporator – transducer or temperature sensor
   d. condenser – high pressure contacts open
   e. condenser – high pressure
   f. condenser – pressure transducer out of range
   g. auxiliary safety – contacts closed
   h. discharge – high temperature
   i. discharge – low temperature
   j. oil – high temperature

k. oil – low differential pressure
l. oil – high differential pressure
m. oil – sump pressure transducer out of range
n. oil – differential pressure calibration
o. control center – power failure
p. motor or starter – current imbalance
q. watchdog – software reboot

5.1 Safety shutdowns with a Solid State Starter (LCSSS) shall include:
a. shutdown – requesting fault data...
b. high instantaneous current
c. high phase (X) heatsink temperature – running
d. 105% motor current overload
e. motor or starter – current imbalance
f. phase (X) shorted SCR
g. phase rotation

5.2 Safety shutdowns with a VSD Shall include:
a. VSD shutdown – requesting fault data
b. VSD – stop contacts open
c. VSD – 105% motor current overload
d. VSD – high phase A, B, C inverter heatsink temp.
e. VSD – high converter heatsink temperature

(Filter Option Only)

f. harmonic filter – high heatsink temperature
g. harmonic filter – high total demand distribution

6. Cycling shutdowns enunciated through the display and the status bar, and consists of system status, system details, day, time, cause of shutdown, and type of restart required. Cycling shutdowns with a fixed speed drive shall include:
a. multi unit cycling – contacts open
b. system cycling – contacts open
c. oil – low temperature differential
d. oil – low temperature
e. control center – power failure
f. leaving chilled liquid – low temperature
g. leaving chilled liquid – flow switch open
h. motor controller – contacts open
i. motor controller – loss of current
j. power fault
k. control center – schedule
l. starter – low supply line voltage
m. starter – high supply line voltage

6.1 Cycling shutdowns with a Solid State Starter (LCSSS) shall included:
a initialization failed
b serial communications
c. requesting fault data
d. stop contacts open
e. power fault
f. low phase (X) temperature sensor
g. run signal
h. invalid current scale selection
i. phase locked loop
j. low supply line voltage
k. high supply line voltage
l. logic board processor
m. logic board power supply
n. phase loss

6.2 Cycling shutdowns with a VSD shall include:
a. VSD shutdown –- requesting fault data
b. VSD – stop contacts open
c. VSD initialization failed
d. VSD – high phase A,B,C instantaneous current
e. VSD – phase A,B,C gate driver
f. VSD – single phase input power
g. VSD – high DC bus voltage
h. VSD – pre charge DC bus voltage imbalance
i. VSD – high internal ambient temperature
j. VSD – invalid current scale selection
k. VSD – low phase A, B, C inverter heatsink temp.
l. VSD – low converter heatsink temperature
m. VSD – pre-charge – low DC bus voltage
n. VSD – logic board processor
o. VSD – run signal
p. VSD – serial communications

(Filter Option Only)

q. harmonic filter – logic board or communica-tions
r. harmonic filter – high DC bus voltage
s. harmonic filter – high phase A, B, C current
t. harmonic filter – phase locked loop
u. harmonic filter – precharge – low DC bus voltage
v. harmonic filter – DC bus voltage imbalance

w harmonic filter – 110% input current overload
x. harmonic filter – logic board power supply
y. harmonic filter – run signal
z. harmonic filter – DC current transformer 1
aa. harmonic filter – DC current transformer 2

7. Security access to prevent unauthorized change of setpoints, to allow local or remote control of the chiller, and to allow manual operation of the prerotation vanes and oil pump. Access shall be through ID and password recognition, which is defined by three different levels of user competence: view, operator, and service.

8. Trending data with the ability to customize points of once every second to once every hour. The panel shall trend up to 6 different parameters from a list of over 140, without the need of an external monitoring system.

9. The operating program stored in non-volatile memory (EPROM) to eliminate reprogramming the chiller due to AC power failure or battery discharge. Programmed setpoints shall be retained in lithium battery-backed RTC memory for a minimum of 11 years with power removed from the system.

10. A fused connection through a transformer in the compressor motor starter to provide individual over-current protected power for all controls.

11. A numbered terminal strip for all required field interlock wiring.

12. An RS-232 port to output all system operating data, shutdown / cycling message, and a record of the last 10 cycling or safety shutdowns to a field-supplied printer. Data logs to a printer at a set programmable interval.This data can be preprogrammed to print from 1 minute to 1 day.

13. The capability to interface with a building automation system to provide:
    a. remote chiller start and stop
    b. remote leaving chiller liquid temperature adjust
    c. remote current limit setpoint adjust
    d. remote ready to start contacts
    e. safety shutdown contacts
    f. cycling shutdown contacts
    g. run contacts

VARIABLE SPEED DRIVE
(OPTION 460V – 3 HP – 60 HZ THROUGH 1050 HP)
(OPTION 400V – 3 HP – 50 HZ THROUGH 90 HP)

A variable speed drive shall be factory installed on the chiller. It shall vary the compressor motor speed by controlling the frequency and voltage of the electrical power to the motor. The adaptive capacity control logic shall automatically adjust motor speed and compressor pre-rotation vane position independently for maximum part-load efficiency by analyzing information fed to it by sensors located throughout the chiller.

Drive shall be PWM type utilizing IGBTs with a power factor of 0.95 or better at all loads and speeds.

The variable speed drive shall be unit mounted in a NEMA-1 enclosure with all power and control wiring between the drive and chiller factory installed, including power to the chiller oil pump. Field power wiring shall be a single-point connection and electrical lugs for incoming power wiring shall be provided. The entire chiller package shall be U.L. listed.

The following features shall be provided: a door interlocked circuit breaker, capable of being padlocked; U.L. listed ground fault protection; overvoltage and undervoltage protection; 3-phase sensing motor overcurrent protection; single phase protection; insensitive to phase rotation; overtemperature protection; digital readout at the chiller unit control panel of:

- Output Frequency
- Output Voltage
- 3-phase output current
- Input Kilowatts (kW) and Kilowatt-hours (kWH)
- Self diagnostic service parameters

Separate meters for this information are not acceptable.

(Optional) A harmonic filter that limits electrical power supply distortion for the variable speed drive to comply with the guidelines of IEEE Std. 519-1992 shall be provided. The filter shall be unit mounted within the same NEMA-11 enclosure and shall be U.L. listed. The following digital readouts shall be provided at the chiller unit control panel as part of the filter package:

- Input KVA
- Total power factor
- 3-phase input voltage
- 3-phase input current

Guide Specifications (continued)

- 3-phase input voltage total harmonic distortion (THD)
- 3-phase input current total demand distortion(TDD)
- Self diagnostic service parameters

Separate meters for this information shall not be acceptable.

FACTORY-INSTALLED COMPRESSOR MOTOR STARTER (OPTION 200-600 VOLTS)

The chiller manufacturer shall furnish a reduced-voltage Solid State Starter for the compressor motor. Starter shall be factory-mounted and wired on the chiller. The starter shall provide, through the use of silicon controlled rectifiers, a smooth acceleration of the motor without current transitions or transients. The starter enclosure shall be NEMA 1, with a hinged access door with lock and key. Electrical lugs for incoming power wiring shall be provided.

Standard features include: digital readout at the OptiView 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; three-leg-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-to-water heat exchanger and 1/25 hp circulating pump. All interconnecting water piping is factory installed 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 U.L. Standard 508. A non-fused disconnect switch is also available. Both options are padlockable.

REMOTE ELECTRO-MECHANICAL COMPRESSOR MOTOR STARTER (OPTION)

A remote electro-mechanical starter of the ____ type shall be furnished for each compressor motor. The starter shall be furnished in accordance with the chiller manufacturer's starter specifications (R-1051) and as specified elsewhere in these specifications.

PORTABLE REFRIGERANT STORAGE/ RECYCLING SYSTEM (OPTION)

A portable, self-contained refrigerant storage/recycling system shall be provided consisting of a refrigerant compressor with oil separator, storage receiver, heater, water-cooled condenser, filter drier and necessary valves and hoses to remove, replace and distill HCFC-123. All necessary controls and safety devices shall be a permanent part of the system. The complete system shall be mounted on swivel casters with lock brakes.

STARTUP AND OPERATOR TRAINING

The chiller manufacturer shall include the services of a factory-trained, field service representative to supervise the final leak testing, charging and the initial startup and concurrent operator instruction.

SI Metric Coversion

Values provided in this manual are in the English inch-pound (I-P) system. 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 (lbs.)	0.4536	KILOGRAMS (kg)
VELOCITY	FEET / SECOND (fps)	0.3048	METERS / SECOND (m/s)
PRESSURE DROP	FEET OF WATER (ft.)	2.989	KILOPASCALS (kPa)
	POUNDS / SQ. INCH (psi)	6.895	KILOPASCALS (kPa)

TEMPERATURE

To convert degrees Fahrenheit (°F) to degrees Celsius (°C), subtract 32° and multiply by 5/9 or 0.5556.

To convert a temperature range (i.e., 10°F or 12°F chilled water range) from Fahrenheit to Celsius, multiply by 5/9 or 0.5556.

EFFICIENCY

In the English I-P system, chiller efficiency is measured in kW /ton:

$$\text{kW / ton} = \frac{\text{kW input}}{\text{tons refrigerant effect}}$$

In the SI Metric system, chiller efficiency is measured in Coefficient of Performance (COP).

$$\text{COP} = \frac{\text{kW refrigeration effect}}{\text{kW input}}$$

kW / ton and COP are related as follows:

$$\text{kW / ton} = \frac{3.516}{\text{COP}}$$

$$\text{COP} = \frac{3.516}{\text{kW / ton}}$$

INTEGRATED PART LOAD VALUE (IPLV)

In the English I-P system, IPLV is calculated by the following formula.

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

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:

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

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 exception: 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% t0 0% loads.*

FOULING FACTOR

ENGLISH I-P (ft^2 °F hr / Btu)	EQUIVALENT SI METRIC (m^2 k / kW)
0.0001	.018
0.00025	.044
0.0005	.088
0.00075	.132

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