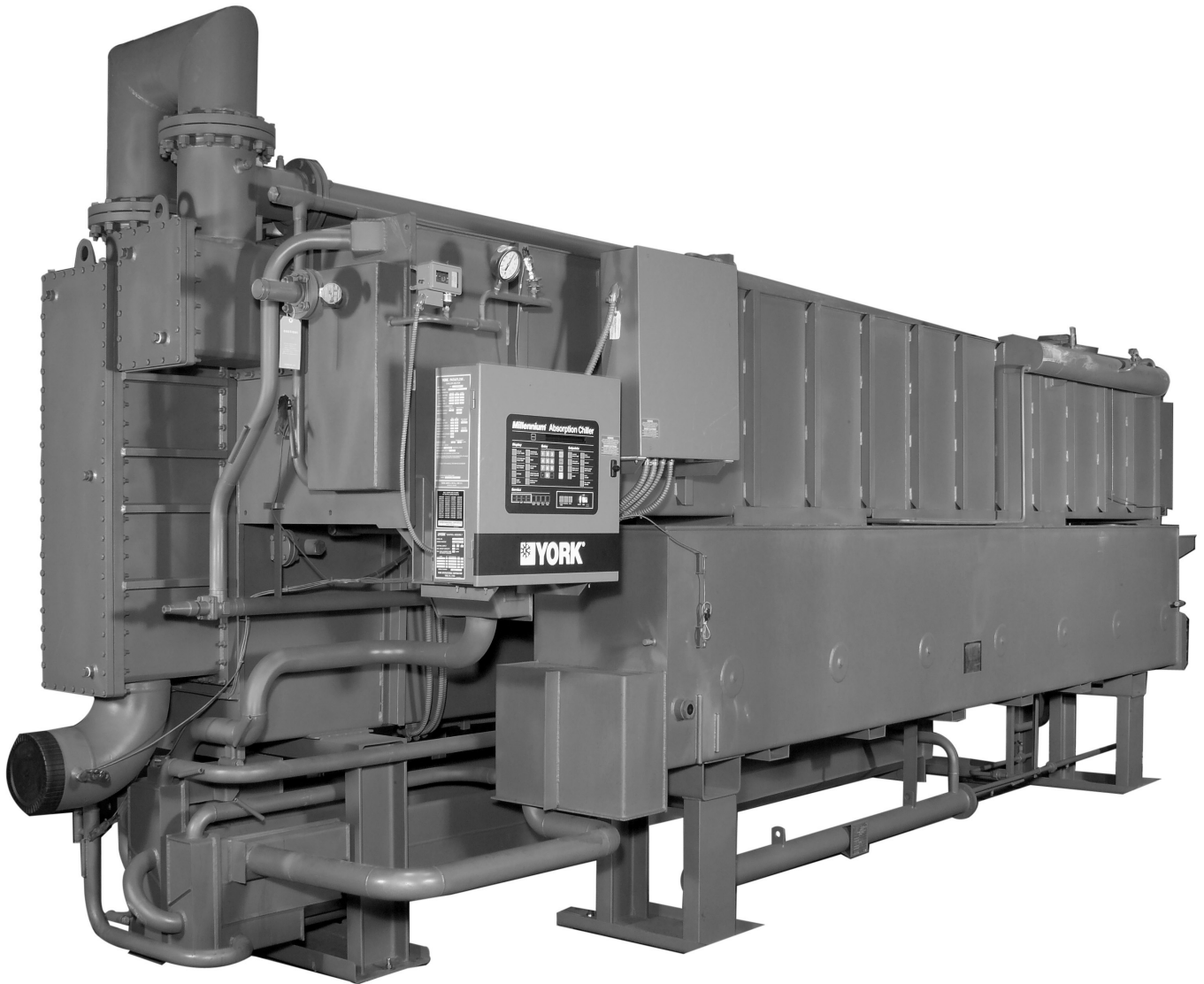




BY JOHNSON CONTROLS



***Model YPC Two-Stage Steam-Fired Absorption Chiller  
Style D***

**Models YPC-ST-14SC through YPC-ST-19S  
300 through 675 Tons  
1050 through 2372 kW**

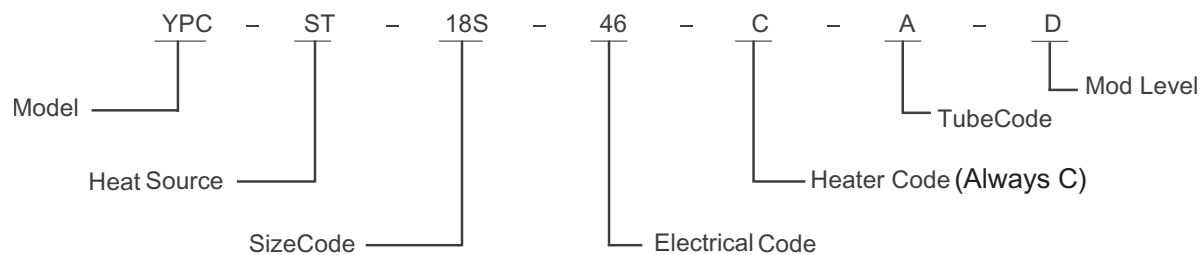
# Table of Contents

---

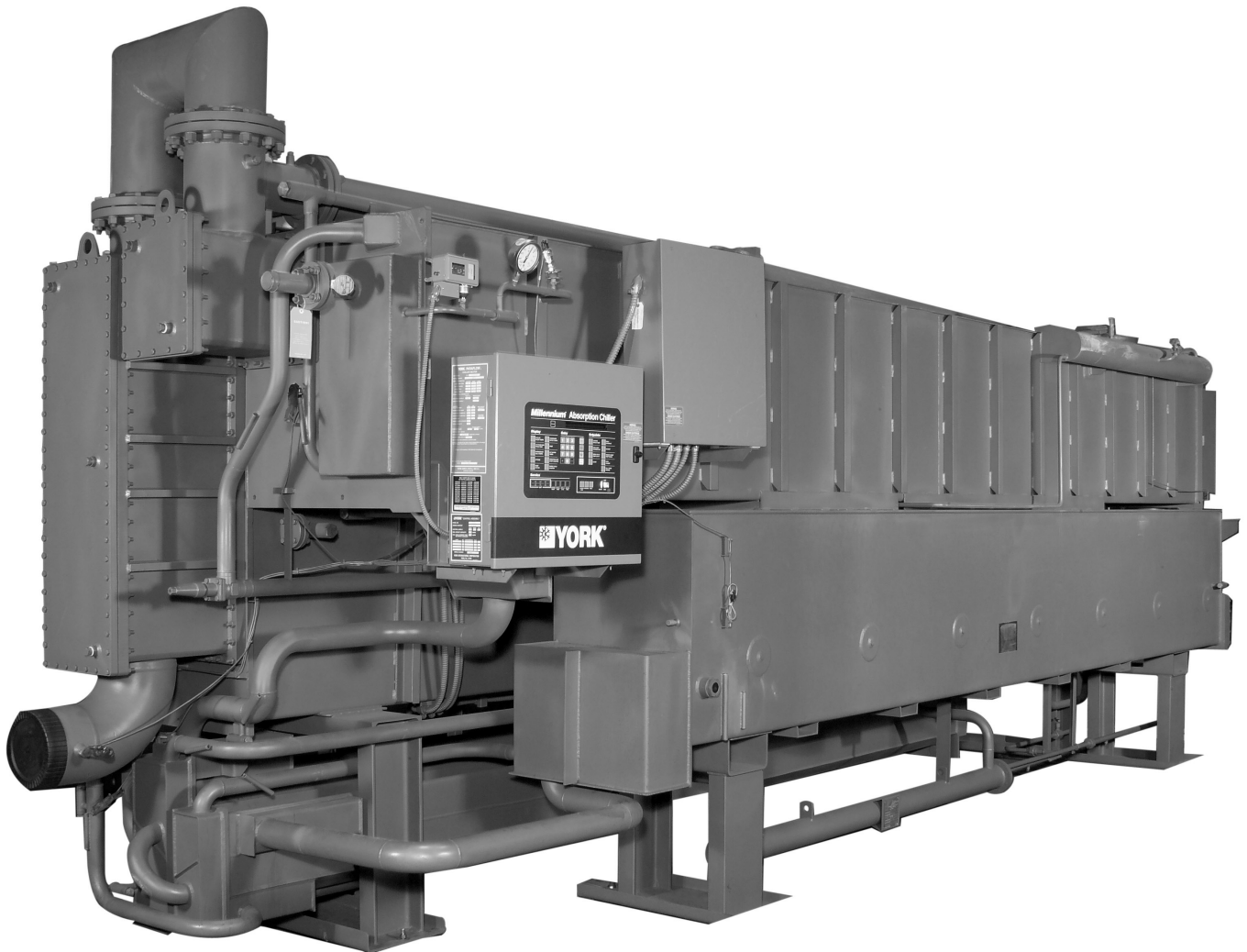
<b>FORM 155.19-EG3 (1011)</b> .....	<b>1</b>
<b>Introduction</b> .....	<b>3</b>
<b>How It Works</b> .....	<b>4</b>
<b>Ratings</b> .....	<b>5</b>
<b>MicroComputer Control Center</b> .....	<b>6</b>
<b>Mechanical Specifications</b> .....	<b>8</b>
<b>Optional Features</b> .....	<b>11</b>
<b>Application Data</b> .....	<b>12</b>
<b>Dimensions</b> .....	<b>17</b>
<b>Nozzle Arrangement 14SC</b> .....	<b>18</b>
<b>Nozzle Arrangement 16SL and Larger</b> .....	<b>19</b>
<b>Guide Specifications</b> .....	<b>20</b>

## NOMENCLATURE

The model number denotes the characteristic of the unit



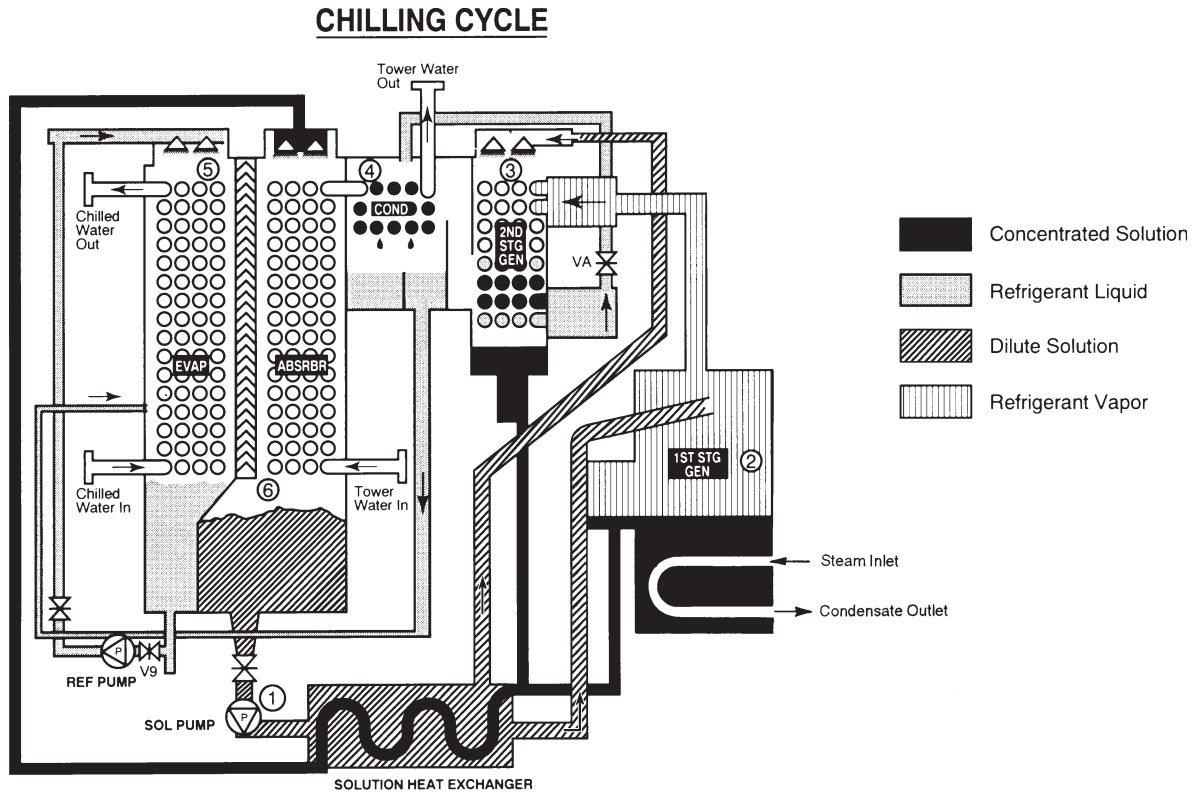
## Model YPC Two-Stage Steam Absorption Chillers



*The YORK YPC Two-Stage Steam-Fired Absorption Chiller represents the world's most efficient commercially available absorption technology. The unique Two-Stage design requires a remarkably low steam input rate of 9.8 lbs. per ton-hour (1.26 kg per kW-hour), which equates to a COP of approximately 1.19. With today's energy and environmental considerations, the YORK YPC Two-Stage Steam Absorption Chiller is the ideal choice for a wide range of applications.*

*YPC Steam Chillers come equipped with the same sophisticated microprocessor controls found throughout Johnson Controls' line of large tonnage chillers, making the YPC Steam Chiller the smartest and most efficient absorber on the market today.*

*With its high efficiency, "smart controls," proven reliability and guaranteed quality, YPC units are the ideal choice for today's demanding specifications.*



## STEAM MACHINES

YPC Two-Stage Absorption's remarkably efficient two-stage absorption refrigeration cycle uses water as the refrigerant and lithium-bromide (LiBr) as the absorbent. It is the strong affinity these two substances have for each other that makes the cycle work. The entire process occurs in hermetic vessels in an almost complete vacuum.

The large diagram above indicates the complete chilling cycle. The six steps are detailed below, with corresponding numbers in the diagram to show where each step takes place. YPC's absorption chilling cycle is continuous; however, for the sake of clarity and simplicity, it is divided into six steps.

### 1. Solution Pump/Heat Exchangers

A dilute solution (58.3%) of LiBr and water descends from the Absorber to the Solution Pump. This flow of dilute solution is split into two streams and pumped through heat exchangers to the First-Stage Generator and to the Second-Stage Generator.

YPC's exclusive two-way split of solution flow virtually eliminates the possibility of crystallization (solidification) by allowing the unit to operate at much lower solution concentration and temperatures than series flow systems.

### 2. First-stage Generator

An outside steam source heats dilute LiBr (58.3%) coming from the Solution Pump/Heat Exchangers. This produces hot refrigerant vapor which is sent to the Second-Stage Generator, leaving a concentrated solution (63.8%) that is returned to the Heat Exchangers.

### 3. Second-Stage Generator

The energy source for the production of refrigerant vapor in the Second-Stage Generator is the hot refrigerant vapor produced by the First-Stage Generator.

This is the heart of the remarkably efficient two-stage absorption effect. The refrigerant vapor produced in the first-stage Generator is increased by 40% – at no additional expense of fuel. The result is much higher efficiency than in conventional systems.

This additional refrigerant vapor is produced when dilute solution from the Heat Exchanger is heated by refrigerant vapor from the First-Stage Generator. The additional concentrated solution that results is returned to the Exchanger. The refrigerant vapor from the first-stage Generator condenses into liquid giving up its heat, and continues to the Condenser.

#### 4. Condenser

Refrigerant from two sources – (1) liquid resulting from the condensing of vapor produced in the First-Stage Generator and (2) vapor produced by the Second- Stage Generator enters the Condenser. As the liquid refrigerant enters the low pressure of the condenser, it flashes to vapor. The two sources of refrigerant vapor combine and condense to liquid as they are cooled by the condenser water. The liquid then flows down to the Evaporator.

#### 5. Evaporator

Refrigerant liquid from the Condenser passes through a metering valve and flows down to the Refrigerant Pump, where it is pumped up the the top of the Evaporator. Here the liquid is sprayed out as a fine mist over the Evaporator tubes. Due to the extreme vacuum (6 mm Hg) in the Evaporator, some of the refrigerant liquid evaporator, creating the refrigerant effect. (This vacuum is created by hygroscopic action-the strong affinity LiBr has for water-in the Absorber directly below.)

The refrigerant effect cools the returning system chilled water in the Evaporator tubes. The refrigerant liquid/vapor

picks up the heat of the returning chilled water, cooling it from 54°F (12.2°C) to 44°F (6.6°C). The chilled water is then supplied back to the system.

#### 6. Absorber

As the refrigerant liquid/vapor descends to the Absorber from the Evaporator, a concentrated solution coming from the Heat Exchanger is sprayed out into the flow of descending refrigerant. The hygroscopic action between LiBr and water, and the related changes in concentration and temperature, result in the creation of an extreme vacuum in the Evaporator directly above. The dissolving of the LiBr in water gives off heat, which is removed by condenser water entering from the cooling tower at 85°F (29.4°C) and leaving from the Condenser at 92°F (33.3°C). The resultant dilute LiBr solution collects in the bottom of the Absorber, where it flows down to the Solution Pump.

The chilling cycle is now completed and begins again at Step 1.

## Ratings

### Computerized Performance Ratings

Each chiller selection is custom-matched to meet the individual application requirements. It is not practical to provide tabulated information for all possible combinations. Computerized performance ratings are available through each Johnson Controls sales office.

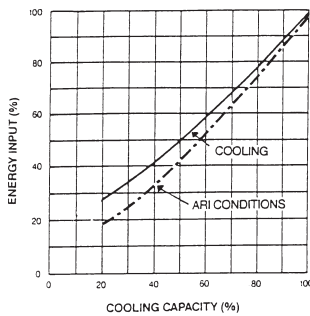


FIGURE 1 – ENERGY INPUT VS. OUTPUT

Shows the part load performance of the YPC Chiller. The highest efficiency is achieved between 50 and 100 percent chilling capacity. Valid for leaving chilled water temperature 41°F-52°F (5.0°C-11.1°C).

JOHNSON CONTROLS

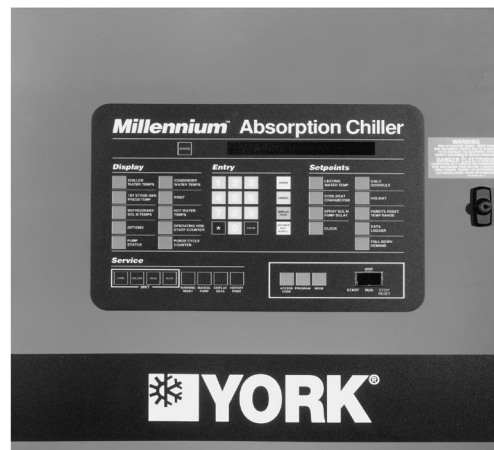
Figure 1 details the high efficiency part load performance of the YPC Absorption Chiller. At both constant tower water temperatures and ARI adjusted entering tower temperatures, the unique Two-Stage design delivers superior economy at low loads. Table 1 details the YPC machine's superior IPLV according to ARI 560-2000.

TABLE 1 - IPLV ANALYSIS

LOAD (%)	ENTERING CONDENSER WATER TEMP		COP	WEIGHTING FACTOR (FROM ARI 560-2000)	WEIGHTED AVERAGE COP
	°F	°C			
100	85.0	29.44	1.19	0.01	0.012
75	77.5	25.28	1.32	0.42	0.554
50	70.0	21.11	1.46	0.45	0.657
25	70.0	21.11	1.3	0.12	0.156

IPLV (expressed as a COP) = 1.38





The MicroComputer Control Center is designed for the very best chiller protection and overall system efficiency. As standard equipment on all Millennium YPC Two-Stage Absorption chillers, the Control Center is a major development in absorption chiller technology, providing the most precise and reliable control available in the industry.

## INFORMATION DISPLAY

Vital chiller operating information can be shown on the 40 character alphanumeric display. All information is in the English language with numeric data provided in English or metric units. Information provided standard on all units includes:

- Chilled water temperatures, entering and leaving
- Tower water temperatures, entering and leaving
- First-stage generator pressure and temperature
- Refrigerant temperature
- Solution temperature
- Operating hours
- Number of starts
- Number of purge cycles (last 7 days and lifetime total)
- Steam valve position (in %)
- Indication of each pump's operation

In addition, all operating and setpoint information can be transmitted to an optional remote printer through the RS232 port to obtain data logs:

- At any time by pressing the PRINT button
- At set time intervals by programming the panel
- After a safety shutdown to list the cause of the shutdown and the operational parameters just prior to shutdown
- For a complete history printout of the last four shutdowns and operational parameters just prior to shutdown.

## CAPACITY CONTROL

When automatic capacity control is desired, the Micro-Computer Control Center automatically varies the steam flow rate to maintain the programmed leaving chilled water setpoint for cooling loads ranging from 20% to 100% of design.

- Digital keypad entry of setpoint to 0.1°F (0.1°C)
- Verify actual vs. setpoint temperature via alphanumeric display
- Remote reset of setpoint (up to 20°F (or 11.1°C) range) with a 1 to 11 second PWM signal (optional 4-20mA, 0-10VDC or contact closure).

When automatic control is not desired, the input steam flow rate is also manually adjustable for the MicroComputer Control Center panel to any setting between minimum and maximum, provided steam input is not inhibited by a specific operating condition (e.g. safety).

## STEAM LIMITING CONTROLS

- Manual limiting available from 20% to 100% of capacity.
- Programmable pull down demand limiting to automatically limit steam source loading at start-up.
- Remote limiting of steam input from 30% to 100% with a 1 to 11 second PWM signal.

## SYSTEM CYCLING CONTROLS

- Programmable seven day time clock for automatic start/stop of chiller and chilled condenser water pumps.
- Separate schedule input strictly for holidays
- Remote cycling contacts available for other field supplied signals
- Multi-unit cycling contact input terminals for field supplied signals

## WARNING CONDITIONS/INHIBITED UNIT LOADING

The MicroComputer Control Center provides a warning annunciation and, when beneficial to the machine, will limit heat input to 30% to 60% when operating conditions indicate the unit is moving towards a safety shutdown. This gives the operator the opportunity to fix a problem before it leads to a complete safety shutdown. Warnings include the following:

- Low refrigerant temperature
- High generator pressure or temperature
- High or low entering condenser water temperature
- Purge pump current overload
- Faulty solution dilution temperature sensor

## SAFETY SHUTDOWN CONTROLS

The following conditions will lead to unit shutdown. After a shutdown, the reason for the shutdown is displayed in English on the alphanumeric display. Each annunciation details the day, time, reason for shutdown and the type of restart required.

**Cycling** – those controls which automatically reset and permit auto restart of the system.

- Loss of condenser water flow
- Low leaving chilled water temperature
- Power failure (when automatic restart is selected)

**Safety** – those controls which (when employed) require a manual operation to restart the system.

- Solution pump thermal or current overload
- Refrigerant pump thermal or current overload
- Low refrigerant temperature
- First-stage generator high temperature
- First-stage generator high pressure
- Loss of chilled water flow
- Power failure (when automatic restart not used)
- Incomplete dilution cycle due to any of the following:
  - Power failure
  - Solution/refrigerant pump overloads
  - Low refrigerant temperature
  - Loss of chilled water flow
  - Auxiliary safety shutdown terminals for field supplied signals

## CONCENTRATION CALCULATOR

The micropanel monitors the first-stage generator concentration to prevent operation at an unsafe concentration. Concentration is tied into both the Warning Conditions and Safety Shutdown systems discussed in this section. Also included is an operator interface concentration calculator.

When in the **PROGRAM** mode, an operator can use the concentration calculator to determine concentration by inputting set of conditions. The operator must input any two of three parameters (bromide solution temperature, saturation temperature, and pressure) and the micropanel will display the concentration. The display will also indicate if the input are in the crystallization zone.

## CONTROL MODE SELECTION

The Two-Stage Control Center includes secure program and servicing capabilities. There are three keys for the selection of the Control Center modes:

- **ACCESS CODE** permits access to the Control Center **PROGRAM** button when the proper password is given
- **PROGRAM** permits operator to program the set-points and select desired **MODE**:
- **LOCAL** allows manual unit start and purging.
- **REMOTE** allows purging as well as remote start and stop of the unit and remote reset of the chilled water temperature and steam limit.
- **SERVICE** allows manual operation of the steam valve, including **LOAD, UNLOAD, HOLD, and AUTO** keys. Manual operation of all pumps is also included.

## ENERGY MANAGEMENT INTERFACE

By connecting with the Metasys network, the MicroComputer Control Center can communicate all data accessible from the keypad (including all temperatures, pressures, alarms and operating data) to a remote DDC processor through a single shielded cable. In **REMOTE** mode, the DDC processor may issue all operating commands available at the keypad to the Control Center through the same shielded cable. With a Metasys network, other BAS systems can receive this same information.

The MicroComputer Control Center also provides a direct hard wire interface capability with other building automation systems using a 1-11 PWM standard signal (4-20mA, 0-10VCD or contact closure optional) including the following:

- Remote unit start/stop
- Remote chilled water temperature reset
- Remote steam limit input
- Remote read out of status including:
  - Unit ready to start
  - Unit operating
  - Unit safety shutdown
  - Unit cycling shutdown

# Mechanical Specifications

## GENERAL

The YORK YPC Two-Stage Steam Fired Absorption Liquid Chiller is completely factory-packaged, including a first-stage (high temperature) generator, solution heat exchangers, main shell, microprocessor controls and all interconnecting unit piping and wiring.

All models are shipped as a single piece with a nitrogen charge to eliminate the possibility of air entering the machine during shipment. LiBr solution, de-ionized water (refrigerant), purge pump, chilled water flow switch, and steam control valve shall ship loose for field installation.

The purchase price includes services of a Johnson Controls factory-trained, field service representative to supervise the initial start-up of the machine.

## SOLUTION FLOW

The solution flow is divided into two parallel paths, one leading to the first-stage generator and one to the second-stage generator. In this way, each stream is concentrated only once, allowing for a more safe and efficient operation. The balance of flow between the two streams is factory-set ensuring maximum efficiency for any given application.

## MAIN SHELL

The main shell consists of four separate shell and tube heat exchangers: the absorber, evaporator, condenser and second-stage (low temperature) generator, all housed in a single carbon steel shell divided into low pressure and intermediate pressure sections. The shell is fabricated from formed carbon steel plates with fusion welded seams. Carbon steel tube sheets, drilled and reamed to accommodate the tubes, are welded to the end of the shell. Intermediate tube supports are fabricated of carbon steel plates. Each tube is roller expanded into the tube sheets to provide a leak tight seal; each tube is individually replaceable. The solution side of the shell is designed for a working pressure of 60 mm Hg absolute.

The portion of the main shell opposite the generator houses the low pressure section of the machine which includes the evaporator and the absorber. Both the absorber and the evaporator are drip-type heat exchangers with 5/8" (16 mm) OD, 0.025" (0.635 mm) wall, copper tubing for the 14SC and 3/4" (19 mm) OD, .028" (0.71 mm) wall copper tubing for the 16SL and larger. Tubes are externally enhanced where necessary to achieve desired capacity. The absorber and evaporator are separated by finned eliminator baffles designed to allow only water in the vapor state to pass to the absorber.

The side of the main shell closer to the generator contains the intermediate pressure section of the machine consist-

ing of the condenser and second-stage generator. The second-stage generator is a drip-type heat exchanger with 5/8" (16 mm), 0.025" (0.6 mm) wall, copper tubing for the 14SC, and 3/4" (19 mm) OD, 0.028" (0.7 mm) wall for the 16SL and larger. Generator and condenser are separated by baffling which prevents liquid carryover to the condenser. Condenser tubing is 5/8" (15.9 mm) 0.025" (0.6 mm) wall copper tubing for the 14SC, and 3/4" (19.05 mm) OD, 0.028" (0.7 mm) wall for the 16SL and larger.

The removable compact water boxes are fabricated of steel. The design working pressure is 150 PSIG (10.3 bar) and the boxes are tested at 195 PSIG (13.4 bar). Integral steel water baffles are located and welded within the water box to provide the required pass arrangements. Stub-out water nozzle connections with ANSI/AWWA C-606-style grooves are welded to the water boxes. These nozzles are suitable for ANSI/AWWA C-606 couplings, welding or flanges, and are capped for shipment. Plugged vent and drain connections and lifting lugs are provided on each water box.

## FIRST-STAGE GENERATOR

The first-stage generator is a single flooded shell and tube heat exchanger. The shell side is fabricated from carbon steel plate with fusion welded seams, and is designed for a working pressure of 13.5 psia (0.9 bar) (the unit bursting disk is designed to fail at 10 PSIG (0.7bar)). Carbon steel eliminator baffles laid out in a serpentine fashion prevent solution carryover over with the refrigerant vapor. The generator has a single drilled and reamed carbon steel tube sheet and uses a "U" shaped tube bundle to minimize thermal stress. The "U" tubes are 5/8" (16 mm) OD, .035" (0.9 mm) wall, 70/30" cupro-nickel and are roller expanded into the tube sheets. The tube side of the generator is designed for working pressures up to 150 PSIG (10.3 bar) and is ASME approved and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII. The high temperature generator contains a solution float valve which controls the level of solution in the generator. This limits the amount of sensible heating at part load conditions, resulting in much better performance.

## SOLUTION HEAT EXCHANGER

The solution heat exchanger is a shell and tube design with geometrically-enhanced 5/8" (16 mm) OD for the 14SC and 0.58" (14.7 mm) OD for the 16SL and larger, 90/10 cupro-nickel tubing. The shell is formed from carbon steel plate with fusion welded seams. Tubes are roller expanded into carbon steel tube sheets.

## DRAIN COOLERS

YPC Absorption steam units come equipped with a condensate drain cooler, eliminating the need for a separate



condensate cooler on the job site. Each drain cooler is a shell and tube heat exchanger with a tube side DWP of 150 PSIG (10.3 bar) and a shell side DWP of 29 PSIG (2 bar). The drain cooler is fabricated from rolled carbon steel plate with welded seams. Tubes are 5/8" (16 mm) OD, .030" (0.8 mm) wall, 90/10 cupro-nickel and are geometrically enhanced to minimize heat stress. Each tube is roller expanded into a drilled and reamed carbon steel tube sheet.

## PUMPS

Solution and refrigerant pumps are hermetically sealed, self-lubricating, totally enclosed, liquid cooled, factory-mounted, wired and tested. Motor winding are not exposed to LiBr or water. The suction and discharge connections for each pump are fully welded to the joint piping to minimize the opportunity for leaks. Suction and discharge connections are also equipped with factory installed isolation valves to permit quick and easy servicing of pumps. All YPC units include two solution pumps and a refrigerant pump. Pumps are designed to operate for a total of 55,000 operating hours between service inspections.

## VALVES

All valves used for adjusting the solution are fully welded or brazed to prevent leakage of air into the unit. Valve operators are covered with a seal cap to eliminate the possibility of air leakage through the stem. Additionally, all connections of valves to unit piping are fully welded.

## SOLUTION AND REFRIGERANT

Each YPC unit is charged with LiBr solution with non-toxic lithium molybdate (ADVAGuard™ 750) as a corrosion inhibitor. Refrigerant is deionized water. A small amount of 2-ethyl hexanol is added as a heat and mass transfer enhancer.

**ADVAGuard™ 750 Corrosion Inhibitor** – is an environmentally friendly inorganic corrosion inhibitor that provides superior corrosion protection. Corrosion inhibitors promote the formation of an oxide film on the surfaces of the chiller that are in contact with LiBr solution. ADVAGuard 750 corrosion inhibitor creates a highly stable magnetite layer resulting in lower hydrogen generation and only an eighth of the corrosion as compared with other traditional inhibitors.

## PURGE SYSTEM

The purge system automatically and constantly removes noncondensable vapors generated in the absorption process through the use of a eductor. Noncondensibles are then stored in a purge chamber until they can be removed

through the use of a purge pump. The purge pump is an oil, rotary, two-stage vacuum pump with a 1/4 HP, 3-Phase, ODP motor.

The chiller control panel includes a SmartPurge system that will automatically sense the amount of non-condensibles in the purge chamber and empty the tank whenever necessary. The SmartPurge system eliminates the need for an operator to ever manually empty the purge chamber. In addition, the control panel monitors the frequency of purge cycles and alerts the chiller operator through a unique control panel warning message if the number of purges exceeds normal levels.

## CAPACITY CONTROL

Capacity control is accomplished by modulating the steam valve position. The YPC Steam-Fired unit is capable of modulating capacity from 20% to 100%.

The YPC chiller design incorporates a float valve that limits solution flow to the generator as the cooling load decreases. This maintains optimum solution level throughout the operating range. In addition, manual control valves are used by Johnson Controls technicians in the factory and/or at start-up to fine tune solution and refrigerant flows to match the job site needs at peak efficiency.

## POWER PANEL

The power panel enclosure includes the following: single point wiring connection for the incoming power supply; non-fused disconnect switch; motor starters, complete with current and thermal-overload protection for solution pump(s), refrigerant pump, and purge pump (current overloads only); 115VAC 50/60 Hz control power transformer.

## MICROCOMPUTER CONTROL CENTER

The microprocessor-based control center is factory-mounted, wired and tested. The electronic panel automatically controls the operation of the unit in meeting system cooling requirements while minimizing energy usage. Chiller operating parameters are sensed by either thermistors or transducers and displayed on the keypad. All pressures are taken as absolute to alleviate typical gauge pressure inaccuracies. Temperatures and pressures can be displayed in English (F, PSIA) or metric (C, KPa) units depending on the application. Display of all information is shown in the English language on a 40-character alphanumeric display.

Available operating information includes return/leaving chilled water temperatures, return/leaving tower water temperatures, first-stage generator pressure and temperature, refrigerant and solution temperatures, operating

## Mechanical Specifications - continued

hours, steam valve position and number of starts and purges.

**Warning Conditions** – The MicroComputer Control Center provides a warning annunciation, when appropriate, limits heat input under the following conditions: low refrigerant temperature, high generator pressure or temperature, high or low entering condenser water temperature, purge pump current overload, faulty solution dilution temperature sensor.

**Safety Controls** – The Control Center includes unique safety logic designed to protect the Two-Stage chiller from damaging malfunctions. Complete safety annunciation is displayed for each shutdown by pressing the status key. This information includes day, time and reason for shutdown. These include: solution – or refrigerant – pump thermal or current overload, low refrigerant temperature, first-stage generator high pressure or temperature, loss of chilled water flow, power failure, auxiliary safety shutdown, incomplete dilution cycle and power failure if manual re-start after power failure is selected.

**Operating Controls** – Background messages are displayed while the unit is running to signal operator of controlling conditions such as leaving chilled water temperature control and noncritical sensor error. System cycling messages display day, time, cause of cycling shutdown, and autostart indication. These include loss of condenser water (or hot water) flow, low-leaving chilled water (or high leaving hot water) temperature, and power failure (when autostart is selected).

Digital programming of operating setpoints from the keypad include leaving chilled water (or hot water) temperature, pulldown demand limiting, remote steam demand limit, remote reset temperature range, and daily start/stop scheduling of chiller and water pumps with separate holiday schedule.

Security access code is provided for operator to program setpoints or to choose local, remote, or service modes of operation. Manual control of the steam valve position and all pumps is provided through separate buttons in the service mode of operation.

**Data Logging** – All operating and setpoint information can be transmitted to a remote printer (by others) through

the RS232 port in the control center to obtain data logs. This can be accomplished at any time by pressing the “Print” button on the control center, or automatically at predetermined intervals by programming the panel’s data logger. The printer will automatically record time and cause of any safety or cycling shutdown along with all chiller operating data monitored by the panel just prior to shutdown. A “History Print” button also allows the printout of the last four causes of cycling or safety shutdowns plus operating data for each shutdown.

**BAS Interface** – The MicroComputer Control Center is compatible with remote Building Automation Systems (BAS). The standard design allows remote start and stop; leaving chilled-water temperature reset and steam demand limit through PWM signal; and “ready-to-start,” “unit running,” “safety” and “cycling” shutdown status contact. For designed-in features and reliability, Johnson Controls provides a full line of BAS controls.

### FACTORY LEAK TEST

Each YPC unit is subjected to a series of four rigorous leak tests, culminating in a vacuum leak test measured by a mass spectrometer and conducted while the unit is immersed in an atmosphere of low-density helium.

### CODES AND STANDARDS

- ASME Boiler and Pressure Vessel Code - Section VIII Division 1
- ARI 560-92
- NEC – National Electrical Code
- OSHA – Occupational Safety and Health Act

### PAINT

Exterior surfaces are protected by an initial coat of red oxide primer with a single finish coat of Caribbean-blue air-drying, high-solids, enamel machinery paint.

### SHIPMENT

Protective covering is furnished on the microprocessor controls, burner and other electric devices. Water nozzles are capped prior to shipment.

## Optional Features

### SPECIAL TUBE MATERIALS AND WALL THICKNESS

Millennium YPC Absorption units are designed for long life with the standard tube materials and wall thicknesses in each heat exchanger. For special applications where different tube specifications are required, Johnson Controls offers copper tubing with .028" (0.7 mm) (where .025" (0.6 mm) is standard) and .035" (0.9 mm) wall thicknesses. Also, 90/10 cupro-nickel tubes are available for the absorber, evaporator, and condenser in both the standard and the above-listed optional tubewall thickness.

### WATER FLANGES

150 lb. ANSI raised-faced flanges for the evaporator and/or absorber/condenser water connection are factory welded to water nozzles. Companion flanges, bolts, nuts and gaskets are not included.

### WATER FLOW SWITCH

This is a paddle-type, vapor-proof water flow switch suitable for 150 PSIG (10.3 bar) DWP (300 PSIG (20.7bar) available) for the absorber/condenser water circuit (chilled-water flow switch is standard).

### FACTORY PERFORMANCE TEST

After assembly, chillers can be individually performance tested at the conditions specified by the customer. A complete performance test report, signed by the resident engineer, is furnished to the customer and includes the following:

- Water flow rates and temperatures
- Steam consumption rate

- System operating temperatures and pressures
- Absorber solution concentrations
- All liquid levels in the sightglasses
- Exact solution and refrigerant charge amount

### SPARE PUMPS

A complete set of replacement solution and refrigerant pumps ships alongside the unit for local spare parts inventory.

### REMOTE RESET CONTROLS

Two optional boards allow for continuous reset of either leaving chiller-water temperature or remote steam limit using a 4 to 20mA, 10 to 10Vdc, or contact closure as opposed to the standard 1 to 11 second PWM signal. These signals may be wired directly to the panel terminal block on the card file without any external interfacing.

### 300 PSIG COMPACT WATERBOXES

300 PSIG compact waterboxes are available for applications that require above 150 PSIG design working pressures for the evaporator, absorber, and condensers. Additionally, 450 PSIG compact waterboxes are available for some unit sizes.

### 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. ANSI/AWWA C-606 nozzle connections are standard; flanges are optional. Marine water boxes are available for the evaporator or the absorber/condenser circuits. Marine water boxes are only available for circuits with 150 PSIG (10.34 bar) working pressures.

# Application Data

The following discussion is a user guide in the application and installation of YPC Absorption Steam Chillers to ensure the reliable, trouble-free life for which this equipment was designed. While this guide is directed towards normal water-chilling applications, your local Johnson Controls sales representative can provide complete recommendations on other types of applications.

## LOCATION

YPC units make very little noise or vibration and may be generally located at any level in a building where the construction will support the total system operating weight. The unit site should be a floor, mounting pad or foundation which is level and capable of supporting the operating weight of the YPC chiller. The YPC unit will operate properly and produce maximum output only if it is installed level within 1/1000 of the unit length in the lengthwise direction and 1/1000 of unit width in the widthwise direction.

Leave between 46 and 60 inches (1.17-1.52 meters) of space around the machine for servicing, reading instruments, and performing tests. If there are flammable materials near the machine, leave at least 20 inches (0.5 m) of space above the machine and at least 40 inches (1.02 m) above the first-stage generator. Tube pull clearance is one unit length on either end with 60" (1.52 m) clearance on the opposite end.

Absorption chillers are not suitable for outdoor installation. The machine room must be enclosed, well lighted and properly ventilated to keep its temperature no higher than 104°F (40°C) and no lower than 35°F (1.7°C).

## WATER CIRCUITS

**Flow Rate** – For normal water chilling duty, chilled and tower water flows are permitted at any velocity between 3.3 and 10 fps (1.0 and 3.05 m/s). YPC chillers are designed for constant flow systems. Applications involving chilled and condenser water flow rates which vary by more than +/- 10% from design will require special consideration. Contact your Johnson Controls representative.

**Temperature Ranges** – For normal chilling duty, leaving chilled water temperatures may be selected between 41°F and 60°F (5.0°C and 15.55°C) for water temperature ranges between 8°F and 20°F (4.4°C and 11.1°C).

**Water Quality** – The practical and economical application of liquid chillers requires that the quality of the water supply for the evaporator and the absorber/condenser be analyzed by a water treatment specialist. Water quality may affect the performance of any chiller through corrosion, depositions of heat-resistant scale, sedimentation or

organic growth. These will hurt 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 specify special material of construction.

**General Water Piping** – All chilled water and tower water piping should be designed and installed in accordance with accepted piping practice. Chilled water and tower water pumps should be located to discharge through the YPC unit 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 cooler and condenser when the pumps are shut down. Piping should be adequately supported and braced independent of the chiller to avoid imposition of strain on chiller components. Hangers must allow for alignment of the pipe. Isolators in the piping and in the hangers are highly desirable in achieving sound and vibration control.

**Convenience Considerations** – With a view to facilitating the performance of routine maintenance work, some or all of the following steps may be taken by the purchaser. Evaporator, absorber 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 stopcocks, and stop valves, may be installed in the inlets and outlet of the tower and chilled water lines as close as possible to the chiller. An overhead monorail or beam may be used to facilitate servicing.

**Connections** – The standard YPC unit is designed for 150 PSIG (10.3 bar) design working pressure in both the chilled and tower water circuits. The connections (water nozzles) to these circuits are furnished with grooves for ANSI/AWWA C-606 couplings (ANSI flanges are optional). Piping should be arranged for ease of disassembly at the unit for performance of such routine maintenance as tube cleaning. A crossover pipe is shipped loose to route the tower water from the absorber up into the condenser. All water piping should be thoroughly cleaned of all dirt and debris before final connections are made to the YPC machine.

**Pump On/Off Control** – Contacts are provided in the YORK MicroComputer Control Center to start/stop chilled and tower water pumps. The contacts can be used to supply 115V power to a pump motor starter relay, or as dry contacts to signal a building automation system to start/stop flow through the chiller. Johnson Controls recommends that these contacts be used for all installations



whether they directly control the pumps or they are used as inputs that tell the building automation system when to supply flow. Absorption chillers require flow at shut-down to perform a dilution cycle that will vary in length depending on operating conditions at shutdown. Without flow, the dilution cycle will terminate early, which can lead to crystallization.

**Chilled Water** – The chilled water circuit should be designed for constant flow. A flow switch, provided standard with the unit, must be installed in the chilled water line of every unit. The switch must be located 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 unit control center. A water strainer, of maximum 1/8" mesh should 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 YPC unit performance or even result in tube freeze-up.

**Condenser Water** – Like the chilled water circuit, the tower water circuit requires a means of proving flow. The recommended method of proving flow is a tower water flow switch (not in standard supply scope, but available from Johnson Controls) installed in the tower water piping in the same manner as the chilled water flow switch (above).

The YPC 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 in the winter months. In its standard configuration, YPC absorbers can tolerate entering tower water temperatures as low as 68°F (20°C). Because the unit flow rates must be maintained, the recommended method of tower water temperature control is a three way mixing valve.

At the initial startup, entering tower water temperature may be as low as 59°F (15°C), provided the water temperature rises to 68°F (20°C) within twenty minutes.

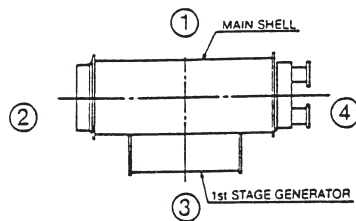
**LOW LEAVING CHILLED WATER ON/OFF CYCLING**

Once the chiller reaches its minimum operating load, if the cooling load decreases, the leaving chilled water temperature will fall below the setpoint. When the leaving chilled water temperature falls 3°F (1.7°C) below the setpoint, the chiller will cycle off. During a cycling shutdown the micropanel continues to monitor the leaving chilled water temperature; when that temperature rises 1°F (0.55°C) above the setpoint the chiller will cycle on. The on/off cycling band used causes no noticeable effect for most cooling applications. To prevent wear damage associated with starting and stopping, it is recommended that installations be designed to prevent the two-stage absorption chiller from cycling more than twice per hour.

**RUPTURE DISK PIPING**

All YPC chillers ship with a rupture disk(s) designed to fail at 12 PSIG (0.83 bar). The purpose of the rupture disk is to quickly relieve excess pressures as a precaution in the event of an emergency such as a fire. All models have 4" (101.6 mm) rupture disks (large tonnage units may have more than one rupture disk, refer to factory submittal).

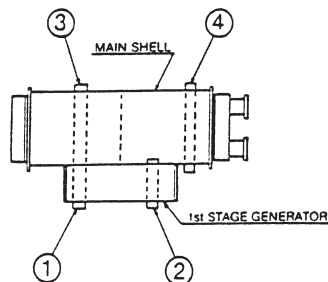
**NOISE LEVEL**



UNIT: dB AT-1 METER DISTANCE FROM THE MACHINE

NOISE / LOCATION NO.	1	2	3	4
A SCALE	81	82	82	81

**VIBRATION LEVEL**



UNIT: (microns)

VIBRATION / LOCATION NO.	1	2	3	4
HORIZONTAL	2	2	2	2
VERTICAL	4	4	4	2
AXIAL	4	5	2	2

**FIG. 2 – TYPICAL NOISE AND VIBRATION LEVELS**



A CPVC or fiberglass discharge pipe should run from the rupture disk to a drain. Steel is not recommended unless extra care is taken to support piping and isolate any stress from the rupture disk. The discharge pipe must support independent of the Two-Stage unit.

## SOUND AND VIBRATION CONSIDERATIONS

Since the YPC unit generates very little vibration, vibration eliminating mounts are not usually required. However, when the machine is installed where even mild noise is a problem, mounts or pads should be used (see Fig. 2, p. 13). The use of anchoring bolts on the machine legs is not normally necessary.

## THERMAL INSULATION

YPC units require thermal insulation (by others) on both hot and cold surfaces in order to achieve maximum efficiency and prevent sweating. Required insulation area is tabulated on page 17.

## STEAM

**General** – The YPC unit is nominally rated for dry steam with minimal superheat, and a pressure of 115 PSIG (7.93 bar) (at the steam valve). The inlet steam must not have a temperature higher than 363°F (183.9°C) and cannot have a saturation pressure higher than 128 PSIG (8.83 bar).

**Pressure** – Since a lower steam saturation pressure corresponds to a lower temperature in the generator, a YPC chiller’s available capacity varies with the steam pressures at the steam valve. Fig. 3 on p. 14 graphically depicts the relationship between steam saturation pressure and available capacity.

**Piping** – The steam piping must follow the diagram found in Fig. 4 on p. 15. Beginning at the steam supply, a steam separator should be installed to ensure the unit receives

only dry steam. A steam trap below the separator will allow draining of only condensate. Beyond the separator, a #50 mesh strainer removes foreign matter from the steam. A regulator is only necessary if the steam supply pressure to the unit will exceed 128 PSIG (8.8 bar). The pressure relief valve should be set to open at 128 PSIG (8.83 bar). The Johnson Controls-supplied steam control valve must be no further than 200 inches (5 m) from the first-stage generator steam inlet flange in order to minimize the pressure drop from the valve exit to the generator inlet.

Dimension H1 is specified to prevent condensate back-flow from the generator into the steam piping. Dimension H2 is specified to prevent excessive backpressure to the drain cooler. During factory testing, the unit is calibrated to provide design condensate flow to a condensate system operating at 15.0 PSIG (1 bar) (as measured immediately downstream of the Drain Solenoid Valve). To duplicate this condition in the field, an adjustable Condensate System Backpressure Valve (by others) must be installed such that:

$$\Delta PH2 + \Delta PPIPING + \Delta PVALVE = 15.0 \text{ PSIG (1 bar)}$$

Where:

$\Delta PH2$  = Pressure drop due to height, H2

$\Delta PPIPING$  = Pressure drop due to condensate piping, elbows, bends, etc.

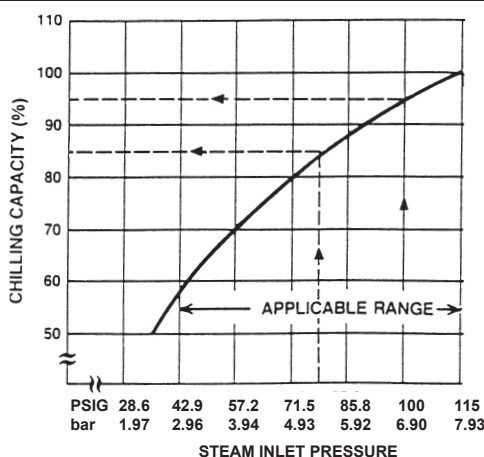
$\Delta PVALVE$  = Pressure drop due to Condensate System Backpressure Valve

The drain cooler installed on the unit effectively eliminates the need for an additional condensate cooler or a steam trap. The drain solenoid valve is a factory installed device to insure zero steam flow through unit during shutdown. All steam piping should be adequately supported and braced independent of the Two-Stage chiller. The support system must account for the expansion and contraction of steam piping, avoiding the imposition of strain on the chiller components.

**Control Valve Sizing** – Control valves are sized for each job based upon the available steam pressure, required steam pressure at the unit, and the full load required steam flow. During start-up, Johnson Controls technicians establish the minimum load steam valve position (20%) and set the limit switch accordingly, eliminating possible problems at start up.

## ELECTRICAL DATA

Table 2 contains unit electrical data. Total kW includes power requirements for the system solution and refrigerant pumps. All models have one solution pump, one solution



**FIG. 3 – CAPACITY VS. INLET STEAM PRESSURE AVAILABLE**

spray header pump and one refrigerant pump.

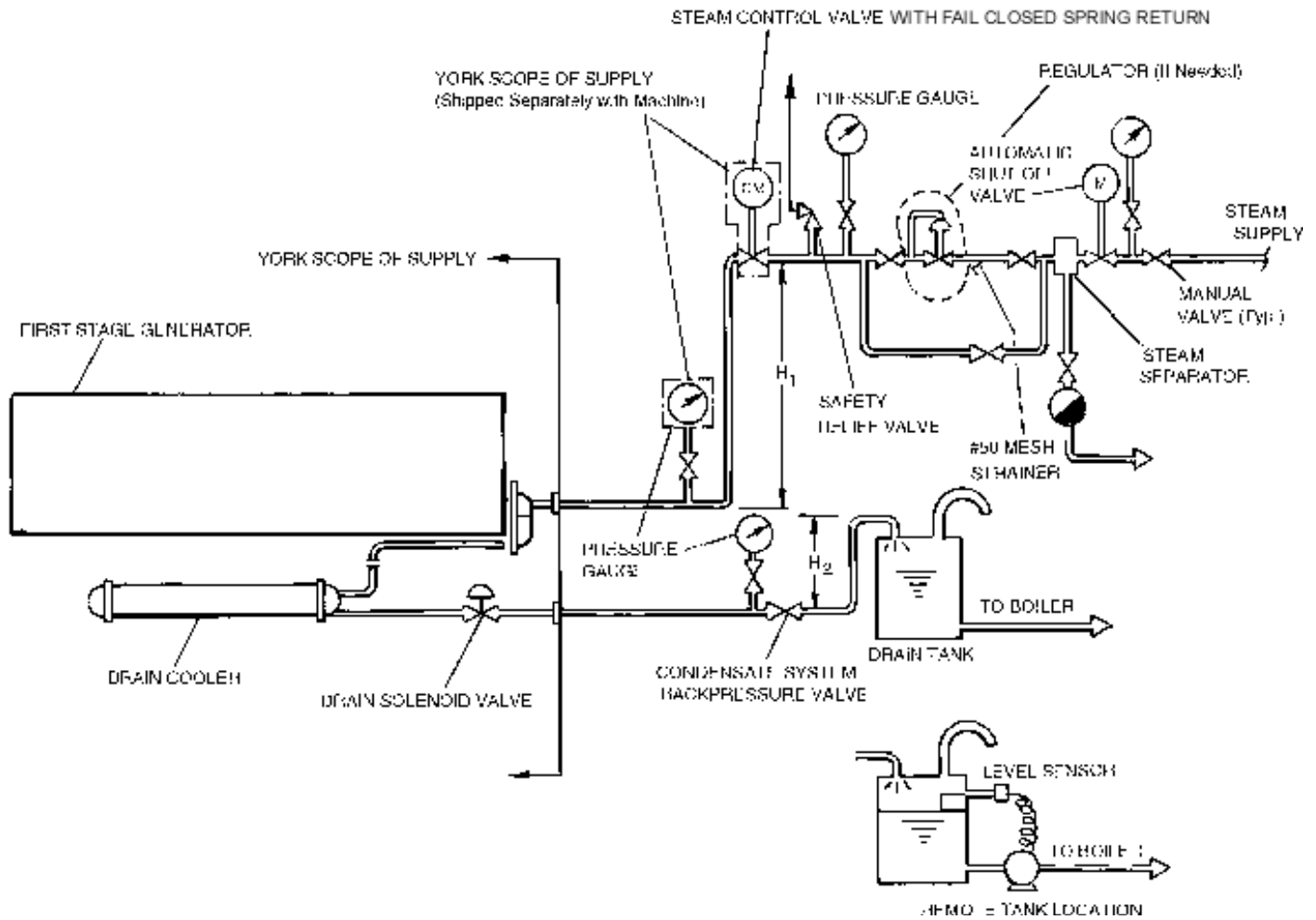


FIG. 4 – PIPING LAYOUT

**NOTES:**

1.  $H_1 = 15$  in. (381 mm) minimum to prevent condensate backflow.
2.  $H_2 = 32.8$  ft. (10 m) maximum to prevent excessive back pressure.
3. Condensate leaves drain cooler at approximately 15 PSIG (1 bar), 180°F (82.2°C).
4. Maximum inlet steam pressure 128 PSIG (8.83 bar).
5. Automatic shutoff valve to be failsafe type.
6. Both the steam supply and condensate drain pipes must be properly sized and pitched to prevent hammering.
7. Steam control valve to be installed within 200 inches (5 m) of the first-stage generator steam inlet flange.

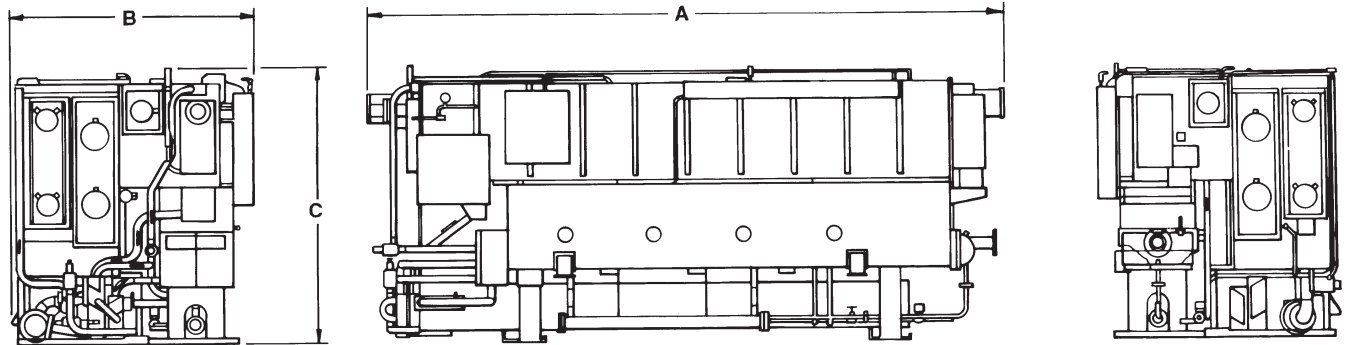
**TABLE 2 – ELECTRICAL DATA**

CHILLER MODEL	VOLT. CODE	VOLTAGE	WIRE AMPACITY	NON-FUSED DISCONNECT SWITCH	MAX DUAL ELEMENT FUSE	SOLUTION PUMP FLA	SPRAY PUMP FLA	REFRIG PUMP FLA	PURGE PUMP FLA	ELEC PANEL FLA	TOTAL CURRENT	TOTAL KW
<b>14SC</b>	-17	200/208V-3PH-60Hz	43.7	60A/240V	60/250V	22	—	6.2	1.7	5	34.9	7.4
	-28	230-3PH-60Hz	39.4	60A/240V	50/250V	20	—	5.6	1.5	4.3	31.4	7.4
	-50	380V-3PH-50Hz	22.3	30A/480V	30/600V	11.2	—	3.1	0.9	2.6	17.8	7.5
	-46	460V-3PH-60Hz	19.8	30A/480V	25/600V	10	—	2.8	0.8	2.2	15.8	7.4
<b>16SL, 17S 18S</b>	-17	200/208V-3PH-60Hz	76.7	100A/240V	125A/250V	36.8	12	12	1.7	5	67.5	15.5
	-28	230-3PH-60Hz	75.8	100A/240V	100A/250V	36.8	12	12	1.5	4.3	66.6	15.5
	-50	380V-3PH-50Hz	41.3	60A/480V	60A/600V	19	7	7	0.9	2.6	36.5	16.2
	-46	460V-3PH-60Hz	38	60A/480V	50A/600V	18.4	6	6	0.8	2.2	33.4	15.5
<b>19S</b>	-17	200/208V-3PH-60Hz	94.7	200A/240V	125A/250V	36.8	30	12	1.7	5	85.5	20.1
	-28	230-3PH-60Hz	93.8	100A/240V	125A/250V	36.8	30	12	1.5	4.3	84.6	20.1
	-50	380V-3PH-50Hz	51.3	60A/480V	60A/600V	19	17	7	0.9	2.6	46.5	21.2
	-46	460V-3PH-60Hz	47	60A/480V	60A/600V	18.4	15	6	0.8	2.2	42.4	20.1

**NOTES:**

1. Incoming wire to chiller must be copper only. Aluminum wiring is not permitted.
2. Lugs in Power Panel will accept incoming wire range of #14 AWG through #1 AWG.
3. Electrical system must be securely guarded.
4. Field wiring must conform to NEC and all other applicable local codes.

# Dimensions



Johnson Controls is committed to a policy of continuous product improvement. Dimensions subject to change without notice. Consult factory-submitted drawings.

UNIT TYPE	LENGTH <sup>1</sup> (IN.) A	WIDTH (IN.) B	HEIGHT (IN.) C	RIGGING WEIGHT		OPERATING WEIGHT (LBS.)	STEAM <sup>2</sup> INLET PIPE (IN.)	CONDEN- SATE <sup>2</sup> OUTLET PIPE	INSULATION AREAS	
				LBS. NO CHARGE	LBS. SHIPPED W/ CHARGE				INLET PIPE (IN.)	OUTLET PIPE (IN.)
<b>14SC</b>	201	74	88	20900	22500	24300	2.5	3/4		
<b>16SL</b>	235	89	103	30200	34150	37800	4.0	3/4	172	398
<b>17S</b>	235	89	103	31000	34950	38600	4.0	3/4	172	398
<b>18S</b>	274	90	109	36900	41600	45800	4.0	3/4	205	474
<b>19S</b>	314	90	109	44500	49600	54900	4.0	3/4	237	506

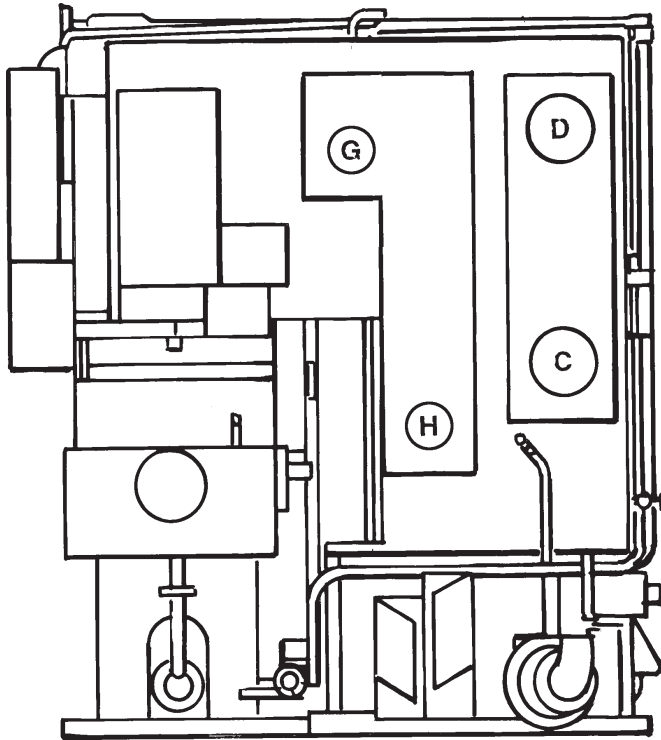
UNIT TYPE	LENGTH <sup>1</sup> (mm) A	WIDTH (mm) B	HEIGHT (mm) C	RIGGING WEIGHT		OPERATING WEIGHT (kg)	STEAM <sup>2</sup> WEIGHT (kg) INLET PIPE (mm)	CONDEN- SATE <sup>2</sup> OUTLET PIPE (mm)	INSULATION AREAS	
				kg NO CHARGE	kg SHIPPED W/CHARGE				COLD AR- EAS (m <sup>2</sup> )	HOT AREAS (m <sup>2</sup> )
14SC	5106	1880	2236	9480	10206	11022	63.5	19.1	11	24
16SL	5969	2261	2616	13698	15490	17146	101.6	19.1	16	37
17S	5969	2261	2616	14061	15853	17509	101.6	19.1	16	37
18S	6960	2286	2769	16738	18869	20775	101.6	19.1	19	44
19S	7976	2286	2769	20185	22498	24902	101.6	19.1	22	47

**NOTES:**

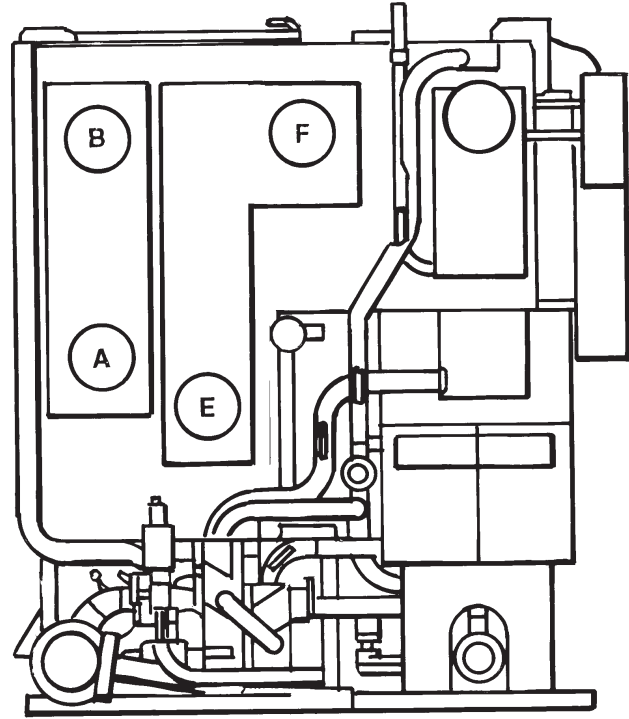
1. Tube pull space for the main shell is equal to the unit length on either end of the machine. first-stage generator tube pull space is required on the end opposite the steam inlet.
2. Steam inlet and condensate outlet are 150 PSIG raised face flanged.

# Nozzle Arrangement 14SC

## STEAM INLET



## OPPOSITE END



### TOWER WATER NOZZLE ARRANGEMENTS

NO. OF ABS. PASSES	NOZZLE ARRANGEMENT	ABSORB. (IN)	COND. (OUT)
1,3	C1	E	F
	C2	H	G
2	C3	E	G
	C4	H	F

### EVAPORATOR NOZZLE ARRANGEMENTS

NO. OF PASSES	NOZZLE ARRANGEMENT	(IN)	(OUT)
3	E1	A	D
	E4	C	B
2,4	E5	A	B
	E7	C	D

### NOZZLE SIZES

YPC-ST	EVAPORATOR			ABS./COND.		
	NUMBER OF PASSES					
	2	3	4	1*	2*	3*
14SC	6"	6"	4"	6"	6"	4"

\*Number of passes refers to the number of absorber passes only. The condenser is always one pass with nozzle sizes that match the absorber.

#### NOTES:

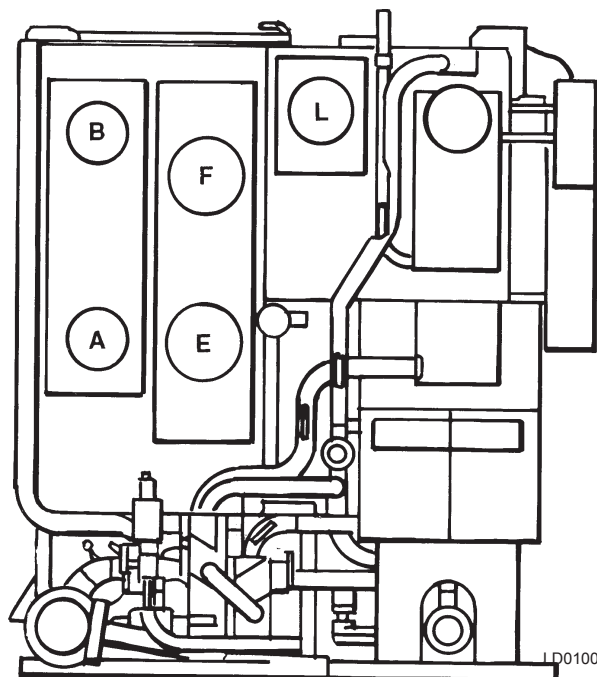
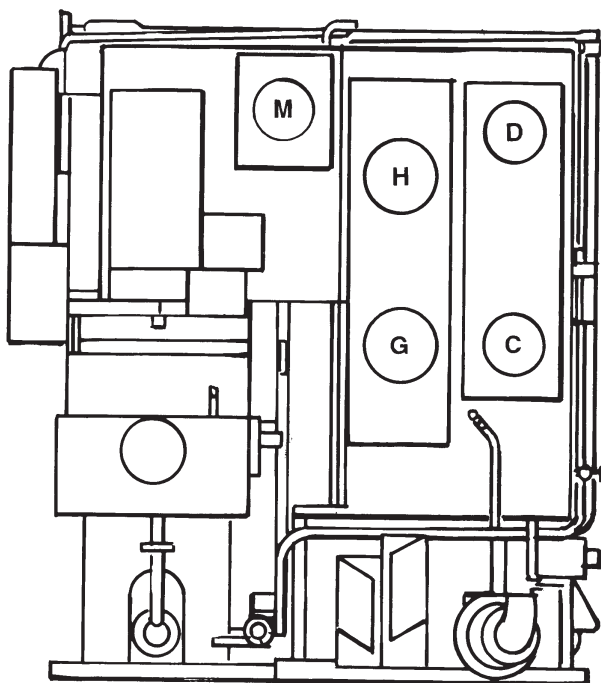
1. Choose desired nozzle arrangement – water boxes are not interchangeable.
2. Standard water nozzles are furnished as welding stub-outs with Victualic grooves, allowing the option of welding, flanges, or the use of Victualic couplings. Factory installed, class 150 (ANSI B16.5, round slip on, forged carbon steel with 1/16" raised face), water flanged nozzles are optional. Companion flanges, nuts, bolts, and gaskets are not furnished.
3. Connected piping should allow for removal of compact water box for tube access and cleaning.
4. Tower water must enter the absorber first for proper performance.



# Nozzle Arrangement 16SL and Larger

STEAM INLET

OPPOSITE END



EVAPORATOR NOZZLE ARRANGEMENTS

TOWER WATER NOZZLE ARRANGEMENTS

NO. OF PASSES	NOZZLE ARRANGEMENT	(IN)	(OUT)
3	E1	A	D
	E4	C	B
2,4	E5	A	B
	E7	C	D

NO. OF ABS. PASSES	NOZZLE ARRANGEMENT	ABSORB.		COND.	
		IN	OUT	IN	OUT
1	C1	F	H	M	L
	C2	H	F	L	M
2	C3	E	F	L	M
	C4	G	H	M	L
3	C1	E	H	M	L
	C2	G	F	L	M

### NOZZLE SIZES

UNIT	EVAPORATOR			ABS./COND.		
	NUMBER OF PASSES					
	2	3	4	1*	2*	3*
16SL & 17S	8"	6"	6"	12"	10"	8"
18S	8"	6"	6"	12"	10"	8"
19S	8"	6"	6"	12"	10"	8"

\*Number of passes refers to the number of absorber passes only. The condenser is always one pass with nozzle sizes that match the absorber.

**NOTES:**

1. Choose desired nozzle arrangement – water boxes are not interchangeable.
2. Standard water nozzles are furnished as welding stub-outs with ANSI/AWWA C-606 grooves, allowing the option of welding, flanges, or the use of ANSI/AWWA C-606 couplings. Factory installed, class 150 (ANSI B16.5, round slip-on, forged carbon steel with 1/16" inch raised face), water flanged nozzles are optional. Companion flanges, nuts, bolts, and gaskets are not furnished.
3. Connected piping should allow for removal of compact water box for tube access and cleaning.
4. Tower water must enter the absorber first for proper performance.

# Guide Specifications

## GENERAL

Provide YORK Millennium YPC Two-Stage Absorption Steam-Fired Chiller(s) capable of producing chilled water per the capacities shown on drawings and schedules.

Each chiller shall be of hermetic design, leak tested, and factory performance tested.

Chiller shall ship as a one-piece assembly ready for connection to the building water, fuel, and electrical systems. Purge pump, chilled-water flow switch, LiBr solution, deionized water (refrigerant), and steam valve shall be shipped loosed for field installation.

Chiller to ship with a nitrogen gas holding charge to eliminate the possibility of air entering unit during transport and to permit the verification of a leak-tight unit upon delivery.

Purchase price to include parts and labor warranty for a period of one year from start up or eighteen months from delivery, whichever occurs first.

## CONSTRUCTION

The chiller-heater unit to consist of one first-stage (high temperature) generator, solution heat exchangers, and main shell. The main shell shall include the condenser, second-stage (low temperature) generator, evaporator, and absorber.

Crossover routing cooling water from the absorber to the condenser shall be shipped loose from the factory, eliminating the need for a customer supplied crossover pipe. The flow of solution shall be initiated by a hermetic solution pump, located beneath the absorber, and shall be divided into two parallel paths, one leading to the first-stage generator and the other to the second-stage generator. This parallel flow design shall permit each stream of solution to be concentrated only once in order to limit the maximum concentration of LiBr and thus minimize the risk of crystallization.

## TUBE MATERIALS

The first-stage generator tubes shall be 70/30 cupro-nickel, 0.035 inch (0.89 mm) wall thickness and shall be "U-shaped" to minimize thermal stress, prolong tube life, and increase unit efficiency. The drain cooler tubes shall be 90/10 cupro-nickel, .030" (0.76 mm) wall thickness. The second-stage generator evaporator, absorber, and condenser shall be seamless copper 5/8" (15.875 mm), OD, 0.025" (0.635 mm) wall, copper tubing for the 14SC, and 3/4" (19.05 mm) OD, 0.028" (0.71 mm) wall for the 16SL and larger, with enhanced surface as required to meet given capacity.

## WATER BOXES

Water boxes shall be removable to permit tube cleaning and replacement. Water-circuit tubing to be replaceable from either end of the chiller-heater unit. Stubout water connections having ANSI/AWWA C-606 grooves shall be provided as standard (ANSI flanged connections are optional). All water boxes and associated water-circuit nozzles and tube bundles shall be designed for 150 PSIG (1MPa) working pressure and shall be hydrostatically tested to 195 PSIG (1.3 MPa). Vent and drain connections shall be provided on each water box.

## SIGHT GLASSES

Unit shall be equipped with no fewer than six (6) sight glasses to permit exact adjustment of solution and refrigerant levels under full load conditions to ensure efficient and trouble free operation. Sight glasses to be located as follows: upper evaporator, lower evaporator, first-stage generator, second-stage generator, absorber, oil trap.

## SPRAY DISTRIBUTION

Solution and refrigerant distribution shall be accomplished by use of a drip apparatus which produces a fine, laminar film on the outside of the tube bundles.

## PUMPS

Solution and refrigerant pumps shall be hermetically sealed, self lubricating, totally enclosed, liquid-cooled, factory-mounted, wired and tested. Suction and discharge connections of solution and refrigerant pumps shall be welded to chiller-heater unit piping. Flanged pump connections are not acceptable. Pumps shall be designed for a total of 55,000 hours between service inspections.

## ISOLATION VALVES

Suction and discharge connections for the solution and refrigerant pumps shall be equipped with factory welded isolation valves to permit the servicing of hermetic pump assemblies without any loss of solution or leakage of air into the chiller-heater.

## SOLUTION VALVES

Valves used for adjusting solution flow shall be fully welded or brazed to prevent leakage of air into unit. Valve operator shall be covered with a seal cap to eliminate the possibility of stem leakage. Fittings between valve body and unit piping to be welded. Threaded valve connections are not acceptable.

## PURGING SYSTEM

Chiller-heater shall be equipped with a purge system which will constantly remove noncondensable vapors

from the unit during operation using an eductor. Non-condensibles shall be stored in a purge chamber until they can be removed through the use of a purge pump.

The Control Panel shall include a Smart-Purge system that will automatically sense the amount of non-condensibles in the purge chamber and empty the tank whenever necessary. The SmartPurge system shall eliminate the need for an operator to ever manually empty the purge chamber. In addition, the control panel shall monitor the frequency of purge cycles and alert the chiller operator, through a unique control panel warning message, if the number of purges exceeds normal levels.

Purge systems that utilize a palladium cell (for venting hydrogen) on the purge chamber to prolong the time between emptying the purge chamber shall not be acceptable, since the vented hydrogen is the major byproduct of the corrosion caused by a leak. If a system with a palladium cell is offered, the purchase price must include a contract for quarterly leak checking of the machine.

The purge pump shall be of an oil, rotary, two-stage design. It shall be furnished complete with a 1/3 HP, 3 Phase, ODP motor, and all required accessories including base, pulleys, and belt guard. Purge pump shall be equipped with stainless steel vanes.

#### **LITHIUM-BROMIDE AND REFRIGERANT CHARGE**

The LiBr solution shall contain a corrosion inhibitor additive, lithium-molybdate, to minimize the rate of copper and ferrous metal corrosion on the solution side of the unit. The corrosion inhibitor, when applied at the concentrations prescribed by the unit manufacturer, shall not cause the inhibited lithium-bromide solution to be classified as a hazardous waste under the Resource Conservation and Recovery Act. Lithium-bromide solutions containing chromates or arsenites as corrosion inhibitors shall not be acceptable. If systems are bid that include LiBr solutions containing chromate or arsenate inhibitors, the purchase price shall include a contract supplying disposal services for removal of bromide as a result of regular service or when the machine is being taken out of commission.

#### **STEAM VALVE**

Chiller-heater shall be furnished with a steam control valve, linkage, and actuator motor. This assembly shall be shipped loose for installation by others. Valve/linkage/actuator motor assembly to be sized by the unit manufacturer in accordance with the specified steam pressure and flow requirements.

The steam valve shall be a cage type valve incorporating a carbon steel body and a teflon seat. Valve/linkage/actuator motor assembly shall be capable of modulating steam flow in a linear fashion from 20% to 100% of maximum

design chiller steam input. Valve shall be equipped with 150 lb ANSI flanged connections.

The actuator motor shall be 120V/1 Ph/60Hz, and shall be powered from the chiller's microcomputer control panel. The MicroComputer Control Center shall communicate the valve position via a 4-20 mA signal.

#### **UNIT CONTROLS**

Each unit shall be furnished complete with a factory mounted and prewired control system. Unit controls to be furnished shall include a total of two (2) enclosures: a Power Panel, and an MicroComputer Control Center Panel.

**Power Panel** – The Power Panel enclosure shall be NEMA 1 and shall house the following components: single-point wiring connection for incoming power supply; non-fused disconnect switch; motor starters, complete with current and thermal protection, for solution pump, refrigerant pump, and purge pump (current overloads only); and a 115VAC 50/60 Hz Control Power Transformer.

**MicroComputer Control Center Panel** – The Micro-Computer Control Center enclosure shall be NEMA 1 and be equipped with hinged access door with lock and key. All temperature sensors, pressure transducers, and other control devices necessary to sense unit operating parameters to be factory-mounted and wired to panel. The ISN Two-Stage Control Center Panel shall include a 40 character alphanumeric display showing all system parameters in the English language with numeric data in English (or metric) units (°F, PSIA or °C, KPa respectively).

The 115V/1Ø control voltage will be supplied through a 1 KVA power transformer located in the Power Panel and will be factory wired to the MicroComputer Control Center Panel.

Terminal blocks will be provided for all external safety and control interlocks.

The operating program shall be stored in non-volatile memory (EPROM) to eliminate chiller failure due to AC power failure/battery discharge. In addition, programmed setpoints shall be retained in lithium battery-backed RTC memory for a minimum of 5 years.

All wiring and control interlocks between the MicroComputer Control Center Panel and the Burner Control

Panel shall be factory installed and tested prior to unit shipment.

**System Operating Information** – During normal operation the following operating parameters shall be accessible

## Guide Specifications - continued

via the MicroComputer Control Center Panel:

- Return and leaving chilled water temperatures
- Return and leaving condenser water temperatures
- first-stage generator pressure
- Refrigerant temperature
- Solution temperature
- Indication of refrigerant/solution/purge pump operation
- Operating hours
- Number of starts
- Number of Purge Cycles (last 7 days and total cumulative)
- first-stage generator temperature
- Steam valve actuator potentiometer position (in %)

**Capacity Control** – The MicroComputer Control Center Panel shall automatically control the input steam flow rate to maintain the programmed leaving chilled water setpoint for cooling loads ranging from 20% to 100% of design. The input steam flow rate shall also be adjustable manually from the MicroComputer Control Center Panel to any setting between minimum and maximum when automatic operation is not desired and when steam input is not being inhibited by a specific operating condition.

**Safety Shutdowns** – Panel shall be pre-programmed to shut the unit down and close “safety shutdown” contacts under any of the following conditions:

- Refrigerant or solution pump thermal or current overload
- Low refrigerant temperature
- first-stage generator high temperature or pressure
- Loss of chilled water flow
- Power failure (when “Automatic Restart after Power Failure” option is not utilized)
- Incomplete dilution cycle operation due to one of the following conditions:
  - Power failure
  - Solution/refrigerant pump overloads
  - Low refrigerant temperature
  - Loss of chilled water flow
  - External auxiliary safety shutdown

All safety shutdowns will require unit to be manually restarted.

Whenever a safety shutdown occurs, the Millennium Control Panel shall record the following information and store it in memory (or communicate it to remote printer): day and time of shutdown; reason for shutdown; type of

restart required (automatic restart is displayed, manual restart is implied); all system operating information displayed just prior to shutdown.

**Warning Conditions** – MicroComputer Control Center Panel shall close warning contacts and generate a unique warning message whenever one of the following operating conditions is detected:

- Low refrigerant temperature
- High generator temperature or pressure
- High or low entering condenser water temperature
- Purge pump current overload
- Faulty solution dilution temperature sensor

**Cycling Shutdowns** – Control Center Panel shall be pre-programmed to shut unit down whenever one of the following conditions is detected:

- Loss of condenser water flow
- Low leaving chilled water temperature
- Power failure (when “Automatic Restart after Power Failure” option is selected)

Cycling shutdowns shall permit unit to automatically restart when pre-programmed thresholds are reached. Following a cycling shutdown, cycling shutdown contacts shall close and cycling shutdown messages shall be displayed and recorded in a similar fashion as safety shutdown messages.

**Programmable Setpoints** – The following parameters shall be programmable directly from the key pad:

- Leaving chilled water temperature in 0.1°F (0.1°C) increments
- Remote reset chilled water temperature range (see detail below)
- 7 day schedule for unit start/stop (see detail below)
- Holiday schedule for unit start/stop (see detail below)
- Pull down demand (see detail on following page)
- Time clock/calendar date

Remote reset signals for leaving chilled water temperature setpoint shall be 1 to 11 second pulse width modulated (PWM) as standard. An optional field installed card file and card shall be available to permit the following reset signals to be used in lieu of a 1 to 11 second PWM signal: 4-20mA, DC, 0-10VDC, contact closure 7-day scheduling shall permit one unit start and stop to be made each day at discrete times as desired over a seven day calendar basis through the use of an integral timeclock. In addition, a separate holiday schedule shall be programmable up to one week in advance.

All major system components such as chilled water pumps and condenser water pumps shall be able to be controlled from the control center panel to start and stop with the chiller (except as required for safety shutdowns) to minimize system energy usage.

The pull down demand feature shall permit ramp loading of input steam flow rate upon unit startup. Programmable inputs include initial input steam flow rate (30% to maximum) final input steam flow rate (30% to maximum), and duration of pull down demand period (0 to 255 minutes).

**Remote Steam Limit Input** – The remote steam limit input feature shall permit the limiting of input steam flow rate when the unit is operating in the remote mode at any time from 30% to maximum based upon a remote 1 to 11 second pulse width modulated (PWM) signal. An optional field installed card file and card shall be available to permit the following remote pull down demand signals to be used in lieu of a 1 to 11 second PWM signal: 4-20mA DC; 0-10VDC; contact closure.

**Concentration Calculator** – The micropanel shall monitor the first-stage generator concentration to prevent operation at an unsafe concentration. Concentration shall be tied into both the Warning Conditions and Safety Shutdown systems. Also included shall be an operator interface concentration calculator. An operator shall be able to use the concentration calculator to determine concentration by inputting a set of conditions. When an operator inputs any two of three parameters (bromide solution temperature, saturation temperature, and pressure), the micropanel shall display the concentration. The display shall also indicate if the input conditions are in the crystallization zone.

**Data Logging** – The MicroComputer Control Center Panel shall contain an RS 232 port to enable the transmission of all operating setpoint and shutdown information to a remote printer (printer supplied by others). This transmission can occur as needed or automatically on predetermined intervals (0.1 to 25.5 hrs). In the case of a safety or cycling shutdown, the RS-232 port shall transmit all operating data detected prior to the shutdown as well as the time and cause of the shutdown to a remote printer (printer supplied by others). In addition, a history of the last four safety or cycling shutdowns and operating data, with the exception of power failures, shall be retained in memory and can be printed as well.

## BAS REMOTE CONTROL

A communication interface permitting complete exchange of chiller data with any BAS System is available with an optional Metasys™ translator. The Metasys™ translator also allows BAS System to issue commands to the chiller

to control its operation. Metasys™ translators come in two models, controlling up to 4 chillers and 8 chillers respectively.

The ParaFlow MicroComputer Control Center Panel shall be able to communicate all data accessible from the keypad to a remote integrated DDC processor through a single shielded cable. This information will include all unit temperatures, pressures, safety alarms, and status readouts for complete integrated plant control, data logging, and local/remote display of operator information. The single shielded cable shall also allow the remote integrated DDC processor to issue operating commands to the ParaFlow MicroComputer Control Center including but not limited to the following:

- Remote unit start/stop
- Remote chilled-water temperature reset
- Remote hot-water temperature reset

The ParaFlow MicroComputer Control Center Panel shall also be capable of providing a limited interface to other building automation systems in order to permit the following operations:

- Remote unit start/stop
- Remote chilled-water temperature reset
- Remote hot-water temperature reset
- Remote readout of status including
  - Unit ready to start
  - Unit operating
  - Unit safety shutdown
  - Unit cycling shutdown



Printed on recycled paper

Form 155.19-EG3 (1011) Supersedes: 155.19-EG3 (311)

© 2011 Johnson Controls, Inc. P.O. Box 423, Milwaukee, WI 53201 Printed in USA

[www.johnsoncontrols.com](http://www.johnsoncontrols.com)

