



BY JOHNSON CONTROLS

## YPC Steam-Fired Absorption Chiller Guide Specifications

### GUIDE SPECIFICATIONS

Supersedes: 155.19-GS1 (112)

Form 155.19-GS1 (113)

#### GENERAL

Provide YORK Millennium YPC Two-Stage Absorption Steam-Fired Chiller-Heater(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-heater shall ship as a one-piece assembly ready for connection to the building water, fuel, and electrical systems. Purge pump, chilled-water flow switch and steam valve shall be shipped loosed for field installation.

Chiller to ship complete with factory-balanced lithium-bromide (LiBr) and refrigerant precharged in unit in order to simplify and expedite field start up. Unit shall 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.

Manufacturer shall have a minimum of 25 years of experience in designing, manufacturing, and servicing absorption chillers. Equipment manufacturer must offer continuous customer operation, maintenance, and control panel training, at a minimum, on an annual basis. Training must be provided either in English or the native language where the equipment is installed.

#### 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 maxi-

mum 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 (10.3 bar) working pressure and shall be hydrostatically tested to 225 PSIG (16 bar). 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.

Solution and refrigerant pumps shall be hermetically sealed, self-lubricating and designed for 75,000 hours of operation between service intervals. Fully welded disposable pump/motors shall not be acceptable. Pump isolation valves shall be provided on the suction and discharge lines of each solution and refrigerant pump to prevent air intrusion during pump servicing.

Fully welded disposable pump/motors shall not be acceptable. In case of welded, hermetic pumps, the manufacturer shall supply spare pumps along with the chiller.

If the chiller is not equipped with chiller isolation valves, the manufacturer shall provide monthly inspections, service parts, and include a 10 year warranty on the pumps provided. In addition, the manufacturer shall provide a storage system that can hold the complete LiBr solution during service.

### **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 non-condensable vapors from the unit during operation using an eductor. Non-condensables 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-condensables 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 1/4 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**

Lithium-bromide 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 lithium-bromide 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.

In case of molybdate inhibitors, all tubes shall be of minimum 0.028" thickness.

### **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. Actuator motor position to be communicated to the MicroComputer Control Center through a 0 - 135 ohm feed back control 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 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.

**Energy Management Interface** – When connected to an Integrated System Network provided by the chiller manufacturer, the 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 control center including, but not limited to, the following:

- Remote unit start/stop
- Remote chilled water temperature reset
- Remote steam limit input

The MicroComputer Control Center Panel shall also provide 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 steam limit input
- Remote readout of status including
  - Unit ready to start
  - Unit operating
  - Unit safety shutdown
  - Unit cycling shutdown





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