Guide Specifications

Hot Water fired Adsorption Liquid Chillers

Bry-Air Adsorption Chiller

Overview

The chiller shall be a **Bry-Air ADC series**. The chiller shall consist of a robust, compact, packaged chiller suitable for indoor or outdoor installation. Proprietary desiccant gel shall be used as the adsorbent, and standard tap water shall be used as the refrigerant. The desiccant gel shall be regenerated by low temperature 50°C to 96°C (120°F to 205°F) hot water. The chiller shall include electronic controls capable of stand-alone operation.

The main components of the Adsorption Chiller shall be comprised of two adsorbent chamber/heat exchangers, an evaporator for chilled water, and a water-cooled condenser. Leak testing, charging with refrigerant, and performance testing of each adsorption chiller shall be completed in the factory prior to shipment.

Quality

a. Chiller shall be tested in accordance with ARI standard 560-2000.

b. Chiller shall be manufactured in accordance with ANSI/ASHRAE 15 Safety Code for Mechanical Refrigeration.

c. Each chiller shall undergo a series of factory tests during production to ensure that the unit is hermetically sealed for operating under vacuum, electrical connections are properly made, all components operate as intended, and the proper level of quality production standards are maintained as directed by ISO 9001.

d. The chiller shall be leak tested using helium gas.

e. Model number, serial number, and manufacturing date shall be shown on the chiller.

Delivery, Storage, and Handling

a. The unit shall ship as one piece.

b. The chiller shall be stored and handled according to the manufacturer's installation and rigging instructions.

c. If stored outdoors, the unit shall be protected from corrosive environments and to prevent condensation inside the control panel or other electrical cabinets.

Warranty

The chiller shall carry a 12 month parts warranty from the date of manufacture, or 18 months from the date of shipment, whichever comes first. This warranty does not include labour.

Equipment

a. The chiller shall be designed to produce chilled water using a double chamber adsorption / regeneration process fueled by low grade hot water. The chiller shall consist of an evaporator, dual adsorption chambers, condenser, refrigerant piping and pump(s), and a vacuum purge system.

b. The chiller shall be factory charged with desiccant gel and water.

c. The unit shall not require any field installation of refrigerant, chemicals, or additional start up procedures such as removing nitrogen gas or operating a vacuum pump for an extended length

of time. As an option to reduce shipping weight, the chiller may ship without refrigerant water. Tap water then shall be required to be added on site to function as refrigerant.

d. The unit shall operate with low grade, regeneration hot water temperatures of 50°C to 96°C (120°F to 205°F). Solar thermal and condensing boiler heat recovery shall be optimized for operation at 96°C (160°F) or lower hot water temperature.

e. Condenser water shall range from 10°C to 39°C. The chiller shall be able to operate at reduced capacity with condenser water up to 54°C (130°F) without damage.

f. Chilled water shall range from 3°C to 20°C (37°F to 68°F).

g. Condenser, adsorber, and evaporator heat transfer surfaces shall be copper tubes rated for 10 bar (150 psig) pressure.

h. NIH waterboxes shall be provided rated for 4.82 bar (70 psig). Waterboxes shall be provided with vent and drain connections. Waterboxes shall be painted with a protective finish able to withstand installation in an outdoor, non-corrosive environment.

   ANSI 150 psig flanged connections shall be furnished on all waterbox nozzle connections.

i. The cycling process will be achieved by the use of 12 pneumatically operated butterfly valves on the hot water and condenser water lines. The life of the valve seats shall not be less than 200,000 cycles. A source of constant air pressure at 5 to 8 bar (72-115 psig) at the air pressure regulator/filter inlet shall be required. An air compressor shall be a factory option.

j. A hermetic pump shall be provided to return the excess refrigerant from the evaporator to the distribution header. A bearing monitor shall be provided factory installed on the pump.

k. A vacuum pump shall be provided to evacuate non-condensable gases from the chiller. The vacuum pump shall operate one hour per 40 hours of machine operation.

l. Production of flammable hydrogen gas shall not occur; therefore, a palladium cell shall not be provided for the removal of hydrogen gas.

m. Eyebolts for lifting the chiller shall be provided.

n. Functional witness testing shall be provided in the factory with customer representatives in attendance. Travel costs shall the responsibility of the customer. Performance testing shall be done at site.

o. Chiller electrical consumption shall be less than 1.5 kW for units up to 250 tonnes of capacity.

Options

1. Standard waterside ratings are 4.82 bar (70 psig).
2. Chillers may be ordered with critical application configuration to eliminate shutdown during safety alarms. The warranty shall be voided if this option is selected.
3. As an option, the chiller may be configured for outdoor installation.
4. An air compressor may be factory installed to actuate the pneumatic valves.
5. Shipment without refrigerant.
6. Control and vacuum cabinets may be mounted on the side or rear of the unit depending on site space constraints.
7. Touch-screen display shall be optional.
8. NEMA 4X control cabinet shall be optional.
9. Extended factory testing at part load conditions of the customer’s choosing shall be optional.

10. Power supplies other than 208-3-50 shall be optional with the use of a factory provided transformer and inverter.

Controls

a. The chiller shall include a factory-installed and factory-wired microprocessor control system with modular component construction. The controls shall be of the PID type and shall continuously monitor the operation of the chiller and perform self-diagnostic checks to maintain control limits. The controls shall be housed in a NEMA 4 control panel for indoor use. As an option, a NEMA 4X panel shall be available for outdoor use in harsh environments.

b. The control system shall be open source with an Ethernet protocol for integration to the Building Management System.

c. Operator display shall include English language textual outputs for programming and alarm signals. The display shall indicate power on, run status, safety circuit, and alarm status.

d. An Ethernet port shall be provided to communicate with the PLC controller to view status, setpoint, and make any changes in the field. A human-machine interface featuring a touch panel monitor as an option.

e. The following inputs shall be monitored:

    a. Hot water tank level
    b. Chilled water level
    c. Condenser water level
    d. Air pressure level
    e. Float level
    f. Vacuum pump operation
    g. Vacuum level
    h. Inverter operation
    i. Evaporator temperature
    j. Refrigerant level
    k. Refrigerant pump
    l. Chilled water entering temperature
    m. Chilled water leaving temperature
    n. Evaporator temperature
    o. Condenser water temperature
    p. Cycle time
    q. Chilled water flow

f. The refrigeration capacity of the adsorption chiller shall have seven steps of unloading controlled by inlet chilled water temperature. This control shall modify the cycle time so that only the required hot water flows through the adsorption chiller when cooling is required. Multiple adsorption chiller installations (piped in series or parallel) shall be controlled to operate at the most effective cycle time by the control panel.

g. Three way valves shall not be required to control capacity.

h. The cooling tower fan shall be controlled by an on/off switch in the control panel so that it cycles ON at any design temperature. The sensor for the cooling water temperature shall be in the

cooling water outlet of the adsorption chiller. Three way valves for the cooling water shall not be required to control capacity.

i. The chiller shall run no risk of crystallizing the desiccant since no liquid desiccants (including lithium bromide) are used.

j. The user shall be able to select between two different modes of operation. The first mode shall optimize the cycle time to produce the maximum chiller capacity. The second mode of operation shall optimize the cycle time to produce the maximum efficiency (COP). The user shall be able to select the mode of operation at the control panel.

k. The following safeties shall be monitored. Faults shall be displayed with an English language error code.

   An abnormal condition of the following faults shall shut down the operation of the chiller and create an alarm:

   a) Hot water tank level abnormal (high or low)
   b) Chilled water level abnormal
   c) Condenser water level abnormal
   d) Air pressure level abnormal
   e) Inverter operation abnormal
   f) Evaporator temperature abnormal
   g) Refrigerant level abnormal
   h) Refrigerant pump abnormal

   The following fault shall shut down the operation of the chiller and create an alarm and shut down the chilled water pump regardless of chiller operating status:

   a) Float level abnormal

   The following faults shall provide an alarm signal only. The chiller will continue to run if it is in operating status:

   a) Vacuum pump abnormal
   b) Vacuum level abnormal

l. A chilled water flow switch shall be factory installed. If flow is not present, the chiller shall not operate so as to prevent freezing the evaporator.

m. The contractor shall field install factory provided float level switches on the field provided and field installed hot water tank (by others).

n. Start-up shall be instantaneous with no delay. An extended startup sequence shall not be acceptable. Full capacity shall be reached within 10 minutes following a shutdown.

Electrical

1. Power supply to the unit shall be 3 ph, 50 Hz, 415 voltages. If power supply exceeds 415 volts, a stepdown transformer shall be required. 60 Hz frequency shall be available as an option.
2. Power supply to the unit shall be the responsibility of the installing contractor.
3. Installation of external controls, safeties, switches, and sensors shall be the responsibility of the installing contractor.
4. A control transformer shall be provided to supply power to the control panel.
5. The chiller shall have single point power supply.

Piping Requirements

1. Installation of external piping shall be provided by the installing contractor.
2. A rupture disk shall not be required since no hydrogen gas is produced by an adsorption chiller, and the refrigerant used is water. Any costs associated with the installation of a rupture disk and required piping to an exterior building penetration (if installed indoors) shall be the responsibility of the installing contractor.
3. No refrigerant detectors or refrigerant piping shall be required since the refrigerant in use is potable water.

Sound Level

1. The overall sound pressure level of the chiller shall not exceed 80 dB (A) when measured per ARI standard 575-1994.

Installation

1. The adsorption chiller shall be installed on a level surface. The leveling bolts shall be placed on the mounting plates and adjusted for longitudinal and transverse alignment of the chiller shell. If the chiller is not installed level, the refrigerant will not properly wet the entire evaporator heat exchanger surface, thus reducing the chiller capacity.
2. Each adsorption chiller shall be installed in a location where there is access to all side and top panels. A minimum of 30 inches clearance shall be provided in front of the equipment. The piping configuration shall allow clear access to the adsorption chiller for service.
3. Installation of balancing valves shall not be required.
4. Three-way control valves shall not be necessary in any water line.
5. Insulation of the external surfaces of the evaporator, refrigerant pump, chilled water, condenser water, hot water piping, and headers shall be field supplied by the installing contractor and installed on the machine. Refer to product literature for insulation quantities recommended.

Start Up

1. Start-up services shall be provided by a factory-trained representative to perform and/or supervise start-up procedures as recommended in the Bry-Air Chiller Installation, Operation, and Maintenance manual. The contractor shall provided personnel familiar with the system design and controls to assist during the startup.
2. Owner training shall be provided immediately following startup for a period of four hours.
3. The following documentation shall be provided:
    a. Installation, Operation, and Maintenance Manuals
    b. Submittals
    c. Wiring diagrams

Maintenance

1. The maintenance required by the end user shall be to check the oil level in the vacuum pump and replace it as needed.
2. The belt for the vacuum pump shall be checked annually and replaced as needed.
3. The valve seats for the pneumatic butterfly valves shall be replaced as needed. For a chiller in continuous operation, this is estimated at year 5. For a seasonal application, this is estimated at year 10 or longer.

4. No chemical analysis, warm-up time, dilution period, or other intensive daily maintenance shall be required.
5. Vacuum level in the chiller shall be checked periodically by placing the vacuum pump into Manual mode for 10 minutes and confirming the vacuum level at that time using the gauge in the vacuum cabinet. The vacuum pump must then be returned to Automatic mode.
6. A visual inspection of the refrigerant water quality shall be made through the multiple sight glasses on the chiller.
7. If an open circuit cooling tower is used, the customer may brush the tubes annually to remove any tube buildup that may be present.

The water quality in the chilled water, cooling water, and heat medium circuits shall be maintained to prevent scale formation and tube corrosion.