CHILLER UNIT SPECIFICATION

OM75P-4VIHD

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

COOLING CAPACITY: 75 tons [900,000 BTU/H] at 45° F leaving water temperature and 55° F returning water temperature. Chiller unit flow rate will be approximately 225 gpm. Condenser flow rate (each) is to be approximately 75 gpm entering at a maximum temperature of 90° F. All ratings are at a fouling factor of 0.0005 .

HEATING CAPACITY: 42 Kw [143,430 BTU/H] of total heating capacity at 120° F leaving water temperature and 100° F returning water temperature.

CONSTRUCTION & RATINGS: The chiller unit shall be constructed in accordance with ARI Standard 590-86 and shall comply with all applicable NEC and ASME codes for water cooled chillers. **The entire unit will be constructed in such a way that it can be disassembled at the job site, carried into the vessel and reassembled in place. Instructions for the recommended disassembly method will be included.**

COMPRESSORS: The chiller unit will have four, 18.75 ton Bitzer semi-hermetic compressors. Each compressor will be equipped with suction and discharge valves. Input voltage to the compressor motor will be 208-3-60. Power consumption of each compressor is approximately 16 kw each. Refrigerant to be used is R-22 .

CAPACITY CONTROL: Chiller unit capacity control will be achieved through the use of four variable frequency drive (VFD) units, one for each compressor. The VFD will vary the compressor motor speed from a maximum of 100% of capacity to a minimum of 70%. The VFD requires an input power supply of 208-3-60. The maximum output power will be 208-3-60 to the compressor motor. The VFD output will be regulated by a 4-20ma signal to the VFD from the PLC. The VFD voltage/frequency output will be varied based upon chilled water outlet temperature. The VFD will also control the compressor motor so that there is no current inrush, during starting, above the motor's standard running amperage.

COOLER: The unit is equipped with four plate style heat exchangers, each of 18.75 tons capacity. Each plate heat exchanger has a single water and refrigerant circuit. Construction of the unit is of #316 stainless steel. The material used to braze the plates together is copper. Maximum test pressure for both circuits is 635 psig. Each plate will be individually insulated with 1/2" thick closed cell insulation.

CONDENSER: The unit is equipped with four shell and tube marine condensers. The shell is constructed of ASME spec SA-53 steel pipe. Shells are shot blasted and cleaned before assembly. Tubes are high performance enhanced surface seamless 90/10 Cupro-Nickel tubes to ASME spec SB-359. Tubes are roller expanded into double grooved tubesheets to assure tight joints. Tubesheets are 90/10 Cupro-Nickel to ASME spec SB-171 Alloy 706. Tube supports are quality steel plug welded to the shell. Heads are cast bronze with integral pass partitions, ASME spec SB-62. Gaskets are die-cut providing effective sealing between tubesheets and machined heads. The refrigerant side is constructed and tested in accordance with Section VIII, Division 1 of ASME Code for unfired pressure vessels. Shell side design pressure (refrigerant side) is 350 psig at 250° F. Tube side (water side) is 150 psig at 150° F. Every condenser is tested per ASME Code prior to shipment. Seawater connections are 2" Class 150 PVC schedule 80 flanges. Water flow to the condenser will be regulated by using VFD's to modulate the speed of the seawater pumps based upon the individual compressor discharge pressure. This provides for less system erosion and better discharge pressure control. It also eliminates the large brass water regulating valves that are inherently problematic in the seawater circuit. A pressure relief valve (set for 350 psig) on the shell is standard.

IMMERSION HEATER ELEMENTS: The unit is equipped with a three stage, 18 element, 42 kW 5" flange style immersion heating element. The heater elements are rated at full wattage on 208-3-60 power input. The elements are constructed of copper with a maximum watt density of 50 watts per square inch. The element heater tank will be constructed of steel pipe to ASME specifications. All welds will be by MIG welding procedure. The tank will be equipped with a 5" 150lb ANSI raised face welding neck flange to accept the 5" flange style immersion heater. The tank design rating pressure is 150 psig at 200° Fahrenheit. The tank will be equipped with a ASME water pressure relief valve.

REFRIGERANT CIRCUIT: Each of the four refrigerant circuits shall include a discharge line check valve, liquid line ball valve, replaceable core liquid line filter drier with access fitting for refrigerant charging, combination moisture indicator and sight glass, liquid line solenoid and thermal expansion valve. All suction lines will be covered with a minimum of 1/2" closed cell insulation. All refrigerant pressure transducers, switches and controls will be installed with isolation valves.

CONTROL PANEL / ELECTRICAL BOX: The unit will have a NEMA 12 type enclosure for all of the electrical components. The chiller unit will be controlled by a programmable logic controller (PLC). The user interface for this PLC will consist of a touch screen mounted on the front of the electrical box. This touch screen will perform the following switching functions:

System mode switch
Compressor On-Off switch (4)
Heating stage On-Off Switch (3)

The touch screen will also display the following information

Digital refrigerant pressure readouts (suction and discharge) for each compressor
Digital temperature display, in Fahrenheit, for the chillwater inlet and outlet temperatures
Digital temperature display, in Fahrenheit, for the seawater outlet temperatures on each condenser
Elapsed time meters showing the run times for all compressors, pumps and heater stages
Chillwater pump motor fault indication
Compressor inverter operational (4)
Cooling stage engaged (4)
Cooling mode
Chiller freeze thermostat engaged
Low chillwater flow through the chiller
Low compressor refrigerant pressure (4)
High compressor refrigerant pressure (4)
Compressor motor overload (4)
High compressor discharge temperature (4)
Compressor inverter fault indicator (4)
Heating mode
Heating stage engaged (3)

As a precautionary measure there will be a hard-wired fail-safe emergency backup system. This will enable the engineer to operate the chiller unit in case of a failure of the PLC system.

Circuit breakers will be provided for the compressors (4), seawater pumps (4), heater stages (3), chillwater pump and control circuitry. All wiring on the unit external to the electrical box will be enclosed in liquid-tite conduit or other approved protective sheathing.

The control panel will be built in two sections: control circuit components (PLC, DC power supplies, control relays, etc.) on the left and main power feed components (circuit breakers and contactors) on the right side.

The control panel will have quick-connect electrical connectors for all control circuit items external to the control panel. This will eliminate any wiring problems during the assembly phase at the shipyard and also significantly decrease the overall number of labor hours necessary to install the unit. All main power feeds for compressors, pumps and heaters will still need to be hardwired.

FRAME: The frame for the unit will be constructed of appropriately sized steel channel, square tube and angle. All welds will be by MIG welding procedure. Completed frame will be primed with a red lead based primer and then painted to meet 500 hour salt spray requirement. Color will be the standard Aqua-Air white enamel finish. Stainless steel drain pans with a non-corrosive internal coating will be installed under any condensate producing components. The compressors will be enclosed in an aluminum sound shield to reduce the noise from the compressors. **The frame will be built in such a way as to allow it to be disassembled and carried into the vessel through the standard ship's doorways.**

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