AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

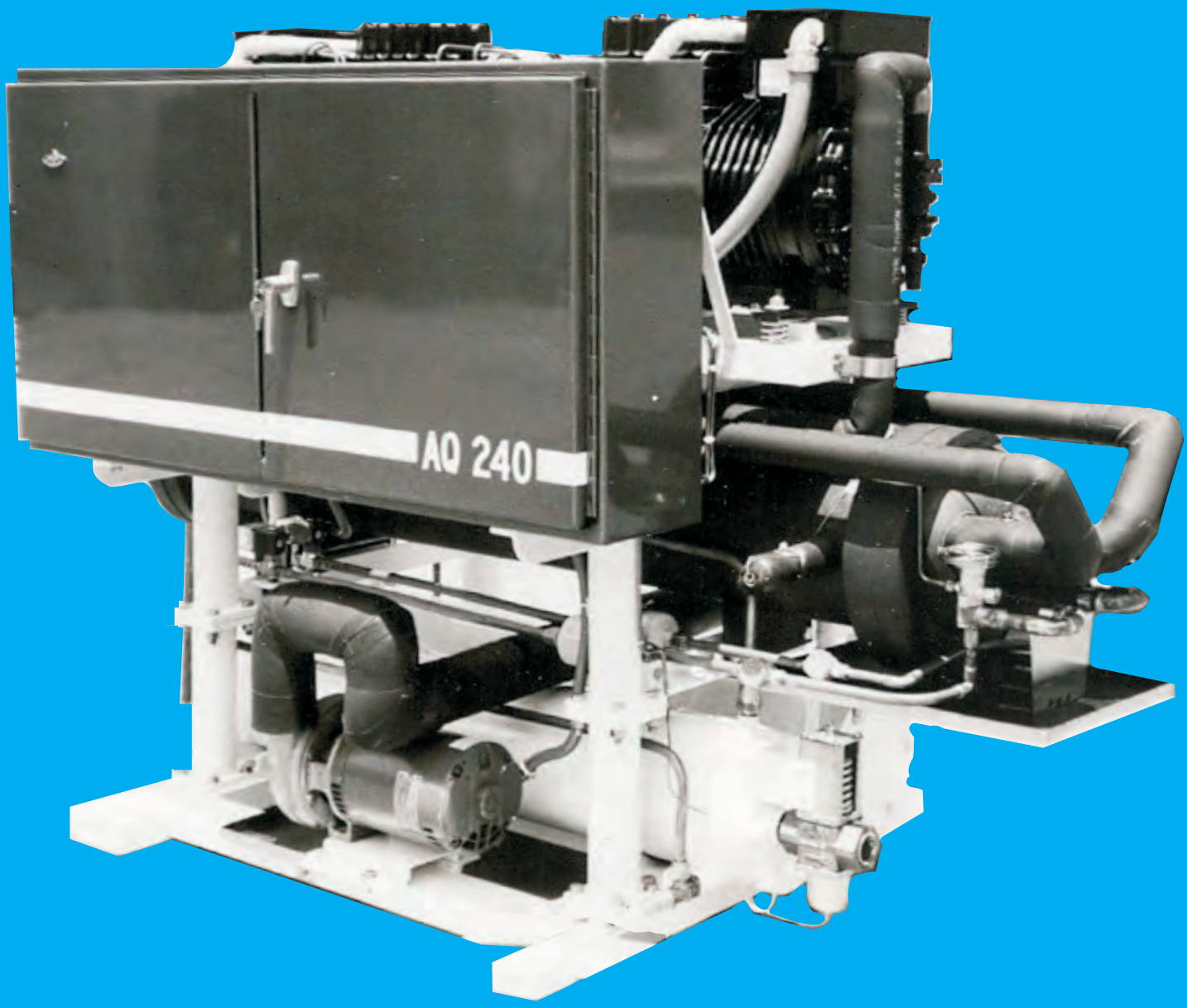
High Capacity Chiller Systems

AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

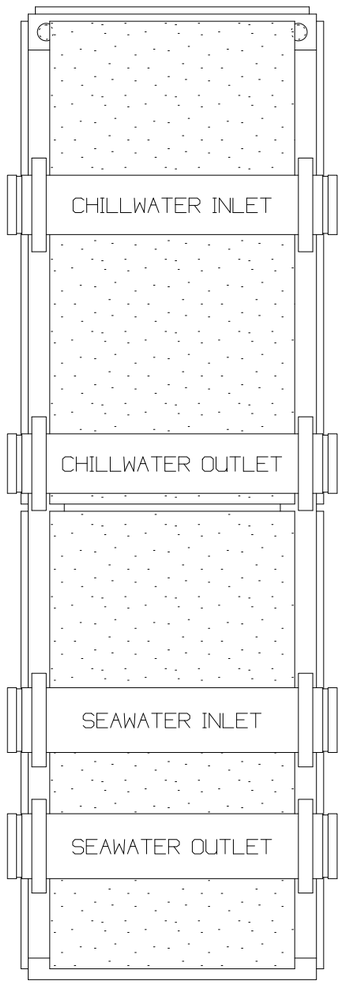
20 Ton Chillers

A20-1E
20 Ton (240,000 BTU/H)
Single Stage Open Drive Compressor
Custom designed for use by the
Brazilian Navy
2 Units / Frigate

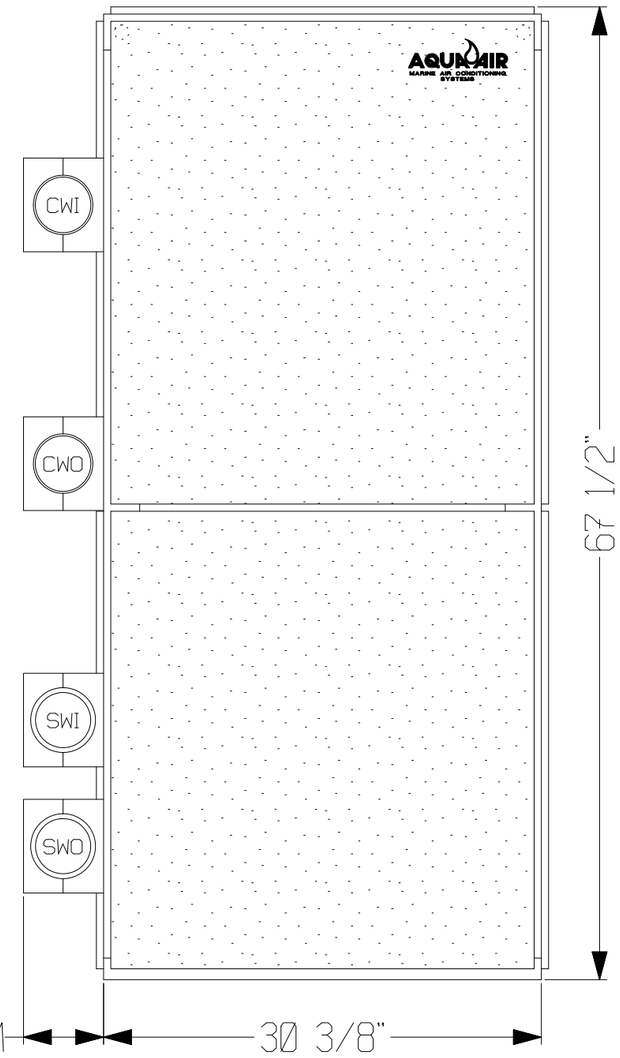


AQ-240
20 Ton (240,000 BTU/H)
2 Stage Semi-hermetic Compressors

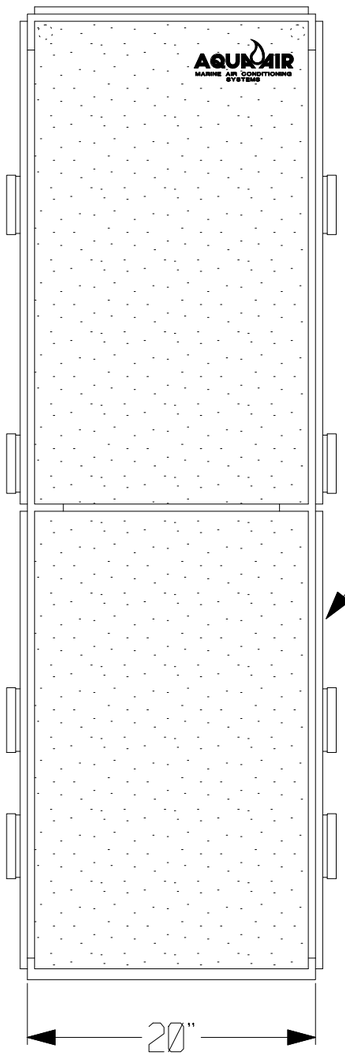
REAR VIEW



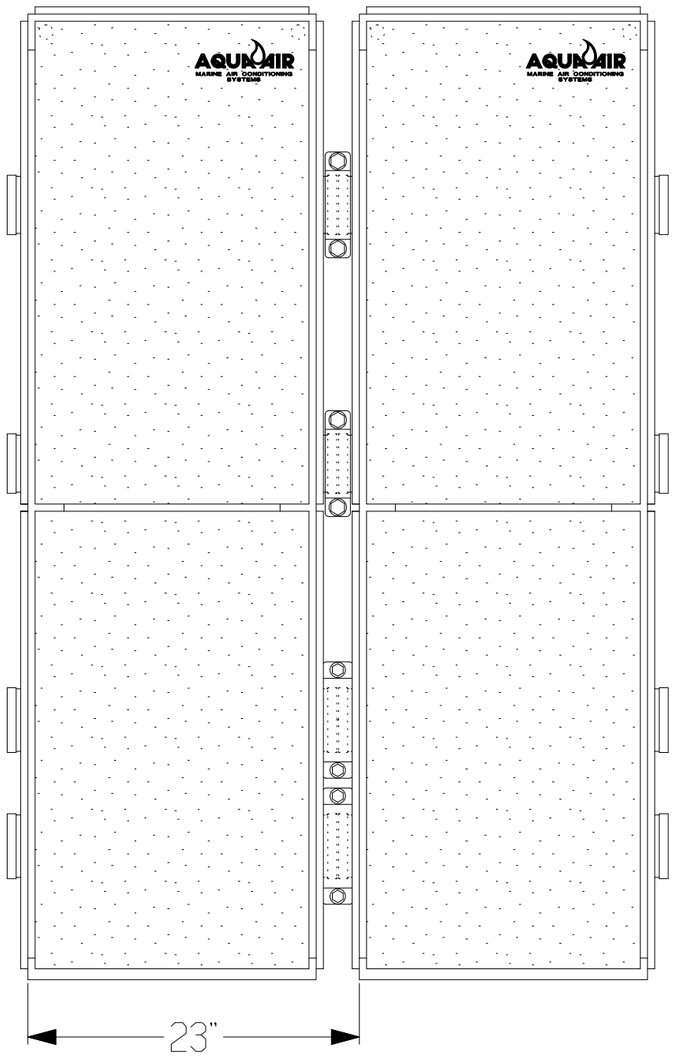
LEFT VIEW



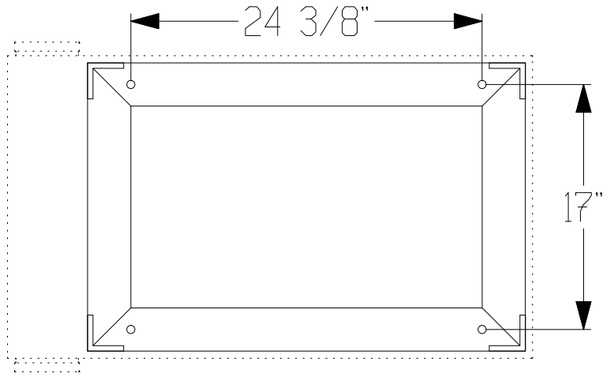
FRONT VIEW



FRONT VIEW MULTI-CHILLER SYSTEM



SPACING BETWEEN CHILLERS WHEN MANIFOLDED TOGETHER IN A MULTI-CHILLER SYSTEM



NOTE
MANIFOLDS SHOWN ARE 4" . GOOD UP TO 60 TONS OF MANIFOLDED CHILLER (M=6") LARGER CAPACITIES WILL REQUIRE LARGER MANIFOLDS. PLEASE CONSULT THE FACTORY FOR EXACT "M" DIMENSIONS BASED ON SPECIFIC APPLICATIONS

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

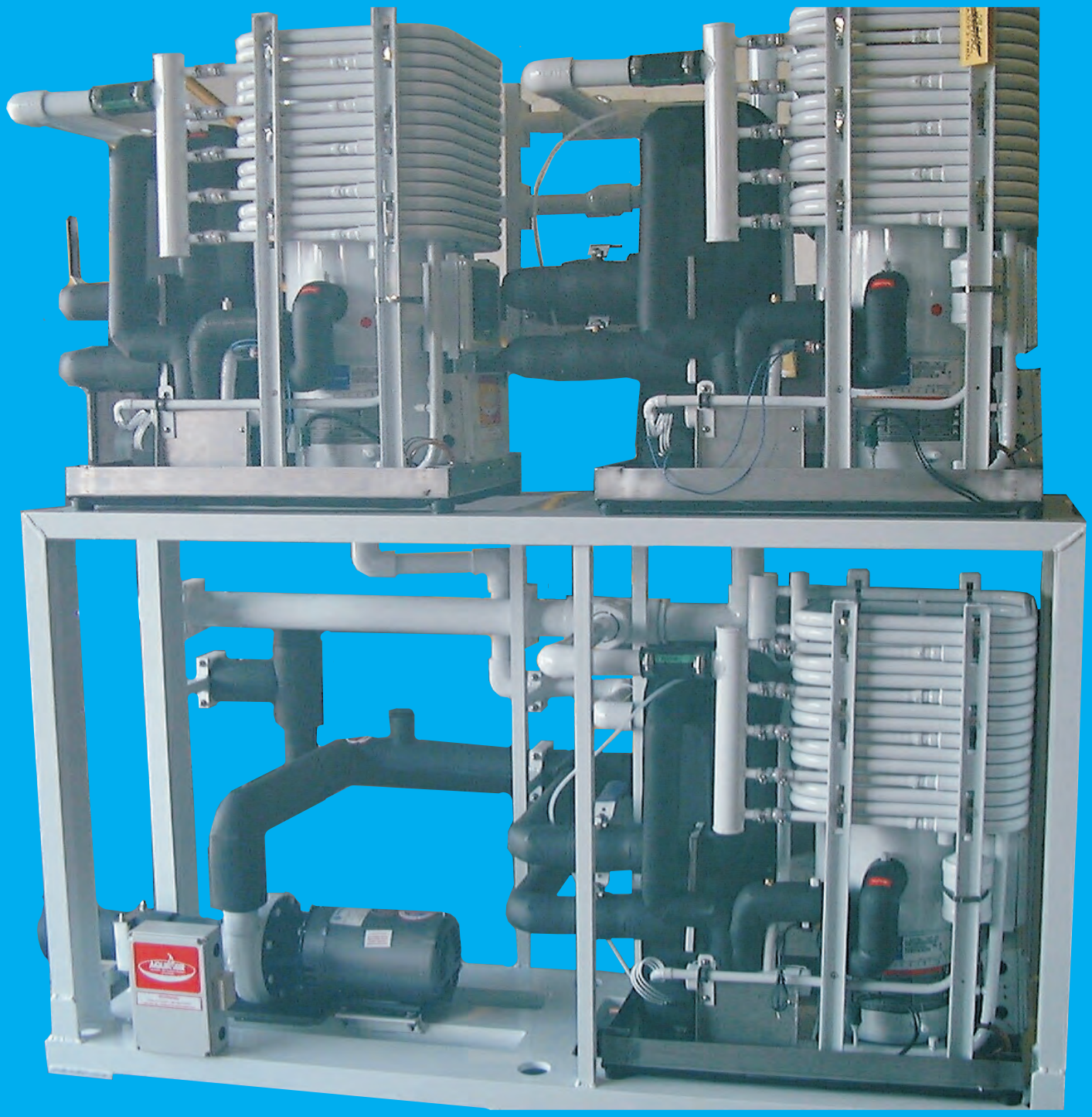
AST-20 MODULAR CHILLER
20 TONS (240,000 BTU/H)

DRAWING NUMBER AST-20D	DRAWN BY DN	DATE 20040608	
SCALE FULL	APPROVED BY	REVISION DATE	REV A

AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

30 Ton Chillers



AV30P3-1VHD
30 Ton (360,000 BTU/H)
3x10 Ton AC10HD Series Chillers with Integral Chillwater Pump

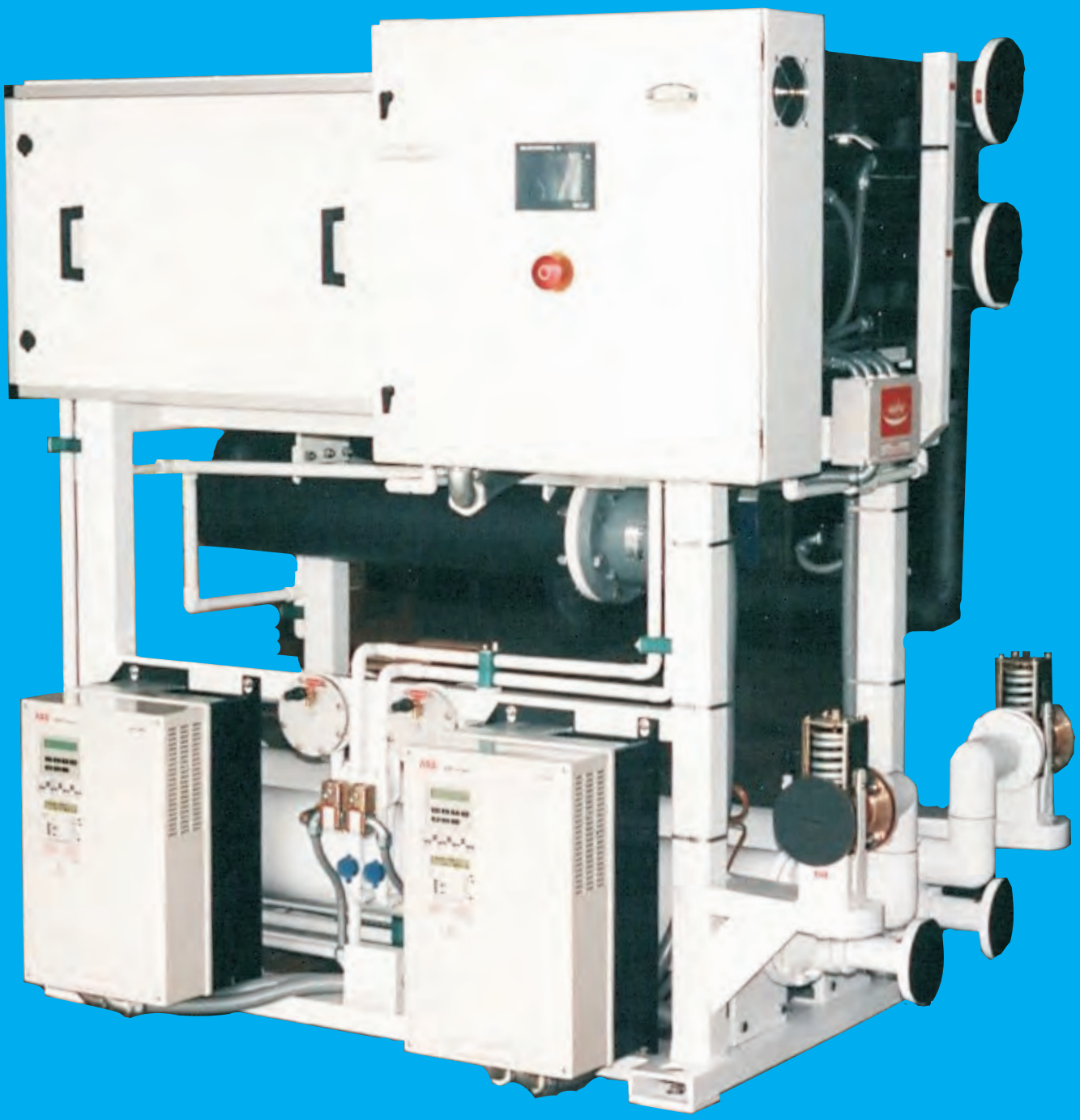
AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

40 Ton Chillers

AV40P4-VHD
40 Ton (480,000 BTU/H)
4x10 Ton AC10HD Series
Chiller Modules

OM40-2VIHD
40 Ton (480,000 BTU/H)
2 Stage Semi-hermetic Compressors
Integral Immersion heater



OM40P2-VIHD
40 Ton (480,000 BTU/H)
2 Stage Semi-hermetic Compressors
PLC / Touchscreen Control
Integral Immersion Heater

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MARINE AIR CONDITIONING SYSTEMS

60 Ton Chillers

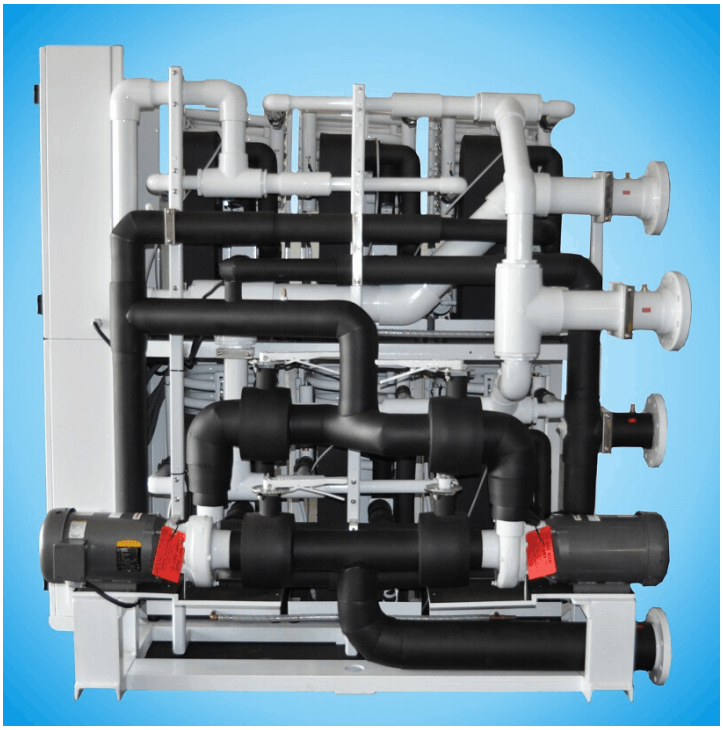
AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

AV60P6-2VHGD 60 Ton Rack Chiller Unit

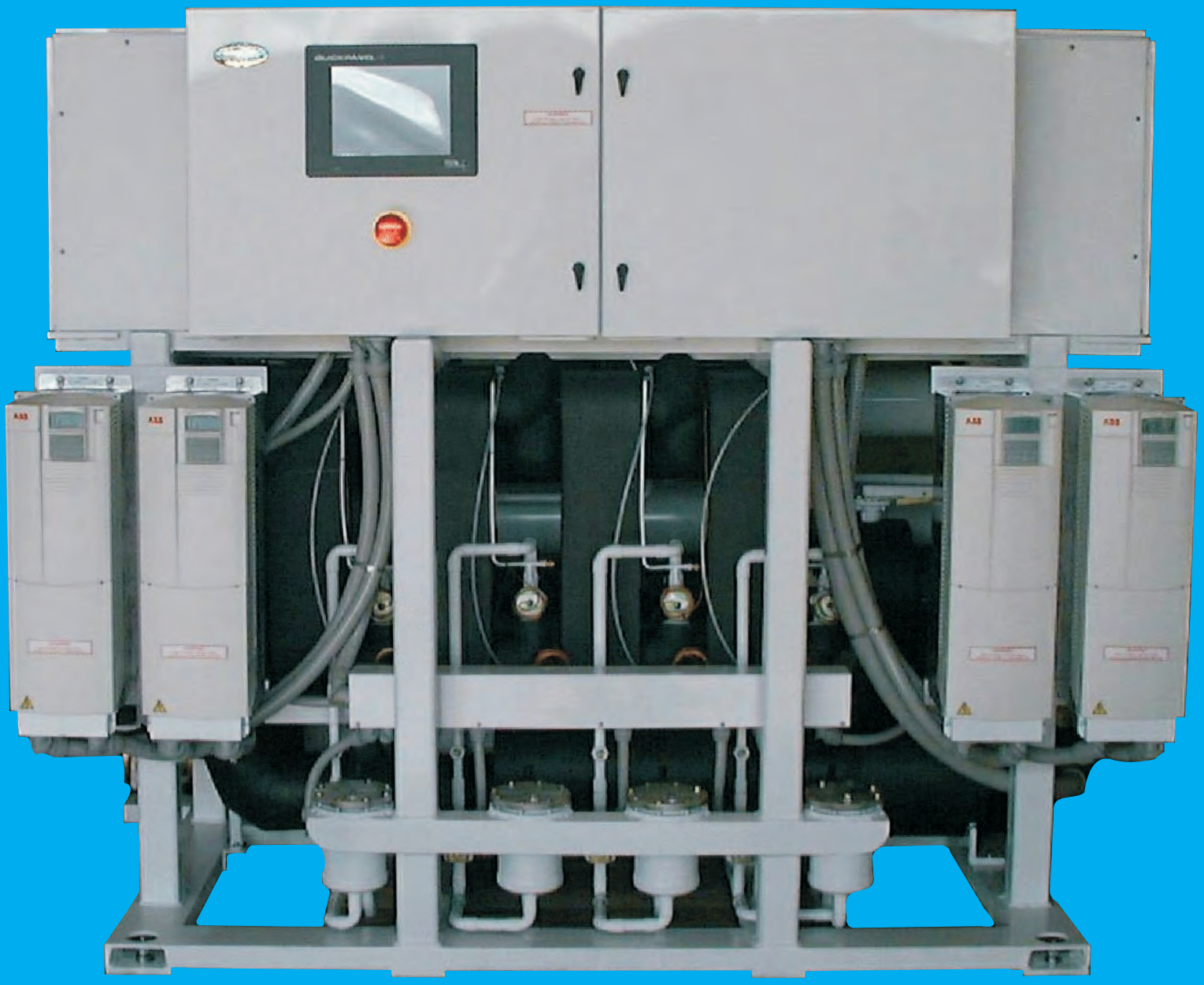
Aqua-Air Manufacturing 1050 E. 9th Street, Hialeah, FL 33010 USA
Toll Free 800-328-1043 Phone 305-884-8363 Fax 305-883-8549
www.aquaair.com Email: sales@aquaair.com

Specifications

Cooling Capacity	**60 tons, 720,000 BTU/H**
Heating Capacity	**Reverse cycle, 900,000 BTU/H**
Modules	**6 x 120,000 BTU/H Alpha Series Chillers**
Dimensions	**53" deep x 76" wide x 75" high**
Power	**208-3-60**
Current draw	**186 amps at 208-3-60**
Power draw	**59321 watts**
Refrigerant	**R-407C (Environmentally Friendly)**
Chillwater Connections	**4" Flange Inlet & Outlet**
Seawater Connections	**4" Flange Inlet & Outlet**
Compressors	**Copeland Scroll, 10 ton each**
Control	**PLC**
Interface	**Touchscreen**
Drives	**6 x 15 HP Variable Frequency Drives for Surgeless Start**
	1 x 5 HP VFD for modulation of the Seawater Pump
Circuit breakers	**6-Compressor, 1-C/W Pump, 1-S/W Pump, 1-Control Circuit**
Materials	**Frame-Steel, Drain pans-Stainless Steel (coated internally)**
Paint	**Awlgrip Matterhorn White**
Chillwater Pump	**Integral (2) XT200I-50-50F, 5 HP each**
Flow Switch	**Mounted on chillwater inlet line**



AQ-720
60 Ton (720,000 BTU/H)
4 Stage Semi-hermetic Compressors



A60P4-VIHD
60 Ton (720,000 BTU/H)
4 Stage, Semi-hermetic Compressors
PLC / Touchscreen Control
Variable Frequency Drives
Integral Immersion Heater

CHILLER UNIT SPECIFICATION

OM60-4VIHD

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

COOLING CAPACITY: 60 tons [720,000 BTU/H] [180,000 KCAL/H] at 45˚ F (7.2˚ C) leaving water temperature and 55˚ F (12.8˚ C) returning water temperature. Chiller unit flow rate will be approximately 180 gpm. Condenser flow rate (each) is to be approximately 60 gpm entering at a maximum temperature of 90˚ F (32˚ C). All ratings are at a fouling factor of 0.0005 .

HEATING CAPACITY: 54 Kw [184,410 BTU/H] [46,103 KCAL/H] of total heating capacity at 120˚ F (48.9˚ C) leaving water temperature and 100˚ F (37.8˚ C) 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.

COMPRESSORS: The chiller unit will have four, 15 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 14.1 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 15 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 a compressor discharge pressure actuated water regulating valve. 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, 54 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.

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

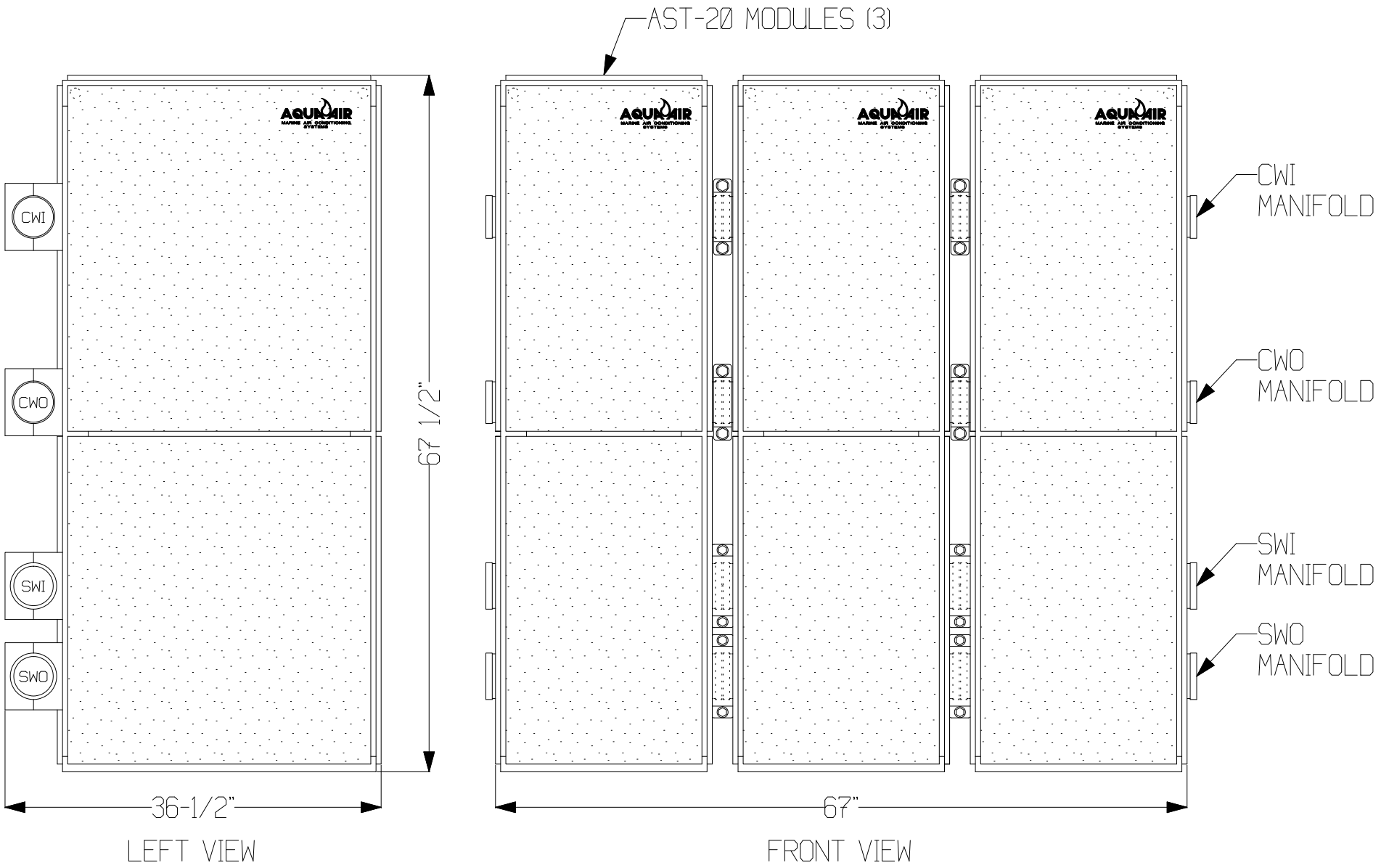
Elapsed time meters showing the run times for all compressors, pumps and heater stages
Chillwater pump motor fault indication
Compressor inverter operational (4)
Cooling stage engaged (4)
Cooling mode
Chiller freeze thermostat engaged
Low chillwater flow through the chiller
Low compressor refrigerant 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)

A phone communication modem will be included that will allow the PLC to be accessed remotely for diagnostic purposes.

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.

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. Paint to be used will be Awlgrip Matterhorn White. Stainless steel drain pans with a non-corrosive internal coating will be installed under any condensate producing components.

AQUA-AIR MANUFACTURING, division of the James D. Nall Co., Inc.
1050 East 9th Street, Hialeah, Florida 33010 U.S.A.
Ph. 305-884-8363 Fax 305-883-8549 E-mail sales@aquaair.com

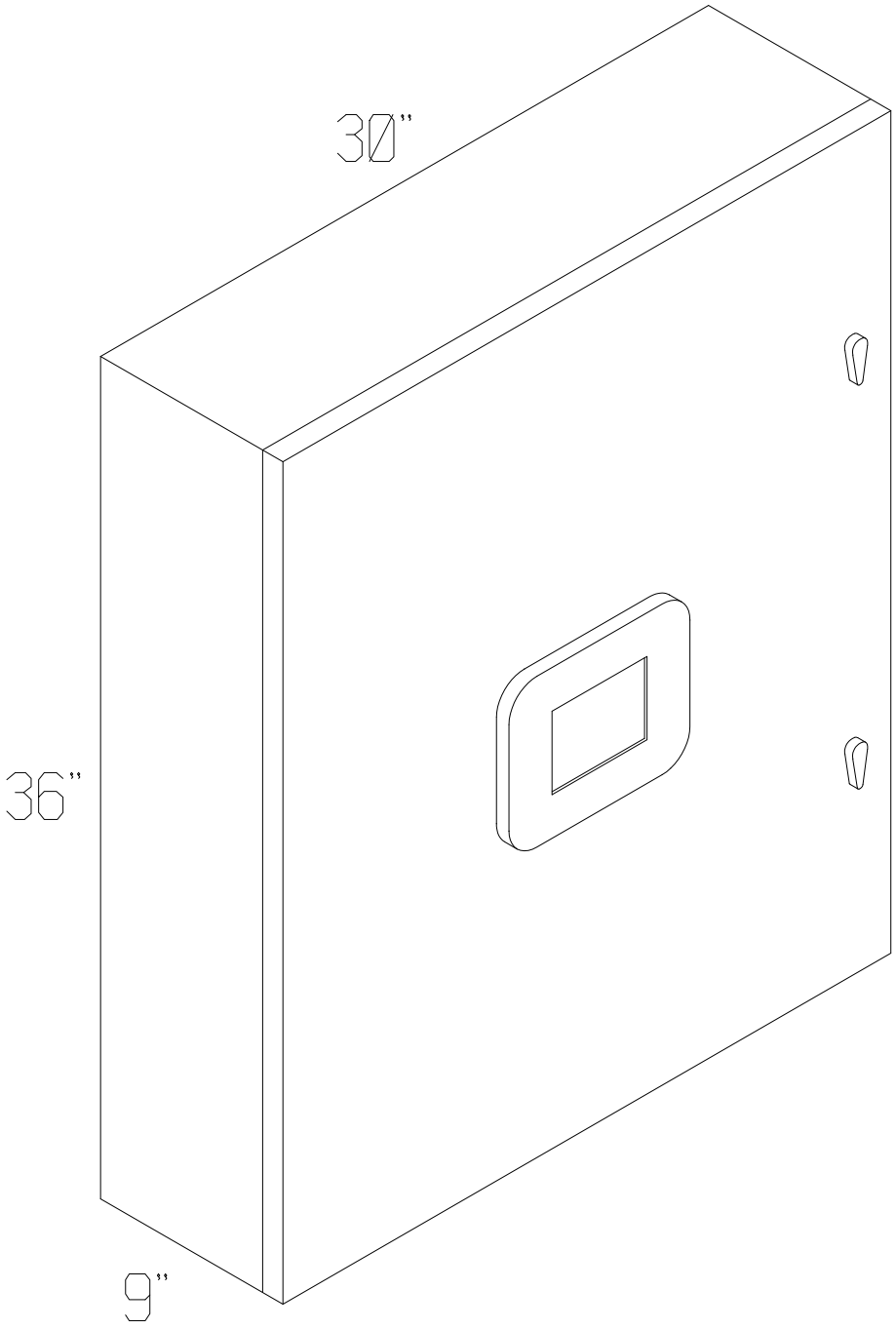


AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

AST60-3 CHILLER SYSTEM
60 TON 3 STAGE

DRAWING NUMBER	DRAWN BY	DATE
AST-20D	DN	20040608

SCALE	APPROVED BY	REVISION DATE	REV
FULL			A



AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

AST60-3V CHILLER CONTROL PANEL
w/ VFD's & PLC/TOUCHSCREEN

DRAWING NUMBER	DRAWN BY	DATE
AST-20D	DN	20040608

SCALE	APPROVED BY	REVISION DATE	REV
FULL			A

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

CHILLER UNIT SPECIFICATION
OM60P-2VEK

COOLING CAPACITY: 60 tons (720,000 BTU/H) { 211 kW } at 45˚ F { 7.2˚ C } leaving water temperature and 55˚ F { 12.8˚ C } returning water temperature. Chiller unit flow rate will be approximately 180 gpm { 41 m^3h }. Condenser flow rate (each) is to be approximately 120 gpm { 27 m^3h } entering at a maximum temperature of 90˚ F { 32˚ C }. All ratings are at a fouling factor of 0.0005

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.

COMPRESSORS: The chiller unit will have two, 30 ton {155 kW} Bitzer semi-hermetic compact screw compressors. Each compressor will be equipped with suction and discharge valves. Input voltage to the compressor motor will be 400-3-50. This will be achieved through the use of Variable Frequency Drives. Power consumption of each compressor is approximately 28 kW each. Refrigerant to be used is R-407C .

CAPACITY CONTROL: Infinite capacity control of each compressor will be achieved through the use of four unloaders on each compressor. These unloaders will be regulated by the PLC to maintain a consistent set point under changing load conditions. The unloaders will also allow the compressor to be started unloaded.
Each compressor will be connected to a Variable Frequency Drive (VFD). The VFD will control the compressor motor so that there is no current inrush, during starting, above the motor's standard running amperage. The VFD requires an input power supply of 400-3-50. The maximum output power will be 400-3-00 to the compressor motor. The VFD's will be located in a dedicated cabinet that is environmentally maintained at 80˚ F {26.6˚ C} under all conditions.

COOLER: The unit is equipped with two plate style heat exchangers, each of 30 tons {155 kW} 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" {13mm} thick closed cell insulation. Water flow through each plate will be 108 gpm { 24.5 m^3h } at a pressure drop of 7.20 psi {0.50 bar }. The water in the chillwater loop will require a 20% glycol mixture. A stainless steel drain pan will be mounted under the plates to catch any associated condensation.

CONDENSER: The unit is equipped with two 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 2-1/2" NPT. 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.

REFRIGERANT CIRCUIT: Each of the two refrigerant circuits shall include a liquid line ball valve, replaceable core liquid line filter drier with access fitting for refrigerant charging, combination moisture indicator and sight glass, refrigerant pressure transducers 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. The system will utilize Electronic Expansion Valves for precise refrigerant metering to the evaporators under all conditions.

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 touchscreen mounted on the front of the electrical box. This touchscreen will perform the following main switching functions in addition to numerous other minor controls:

System On-Off Switch
Compressor On-Off Switch (2)
Chillwater Pump Selector Switch (Primary/Secondary)

The touch screen will also display the following information

> Digital refrigerant pressure readouts (suction and discharge) for each compressor
> Digital temperature display for the chillwater inlet and outlet temperatures

> Digital temperature display for the seawater outlet temperatures on each condenser and seawater inlet for the system.

> Elapsed time meters showing the run times for all compressors and pumps

> Chillwater pump motor fault indication
> Compressor inverter operational (2)
> Cooling stage engaged (2)
> Chiller freeze thermostat engaged (2)
> Low chillwater flow through the chiller
> Low compressor refrigerant pressure (2)
> High compressor refrigerant pressure (2)
> Compressor motor overload (2)
> High compressor discharge temperature (2)
> Compressor inverter fault indicator (2)

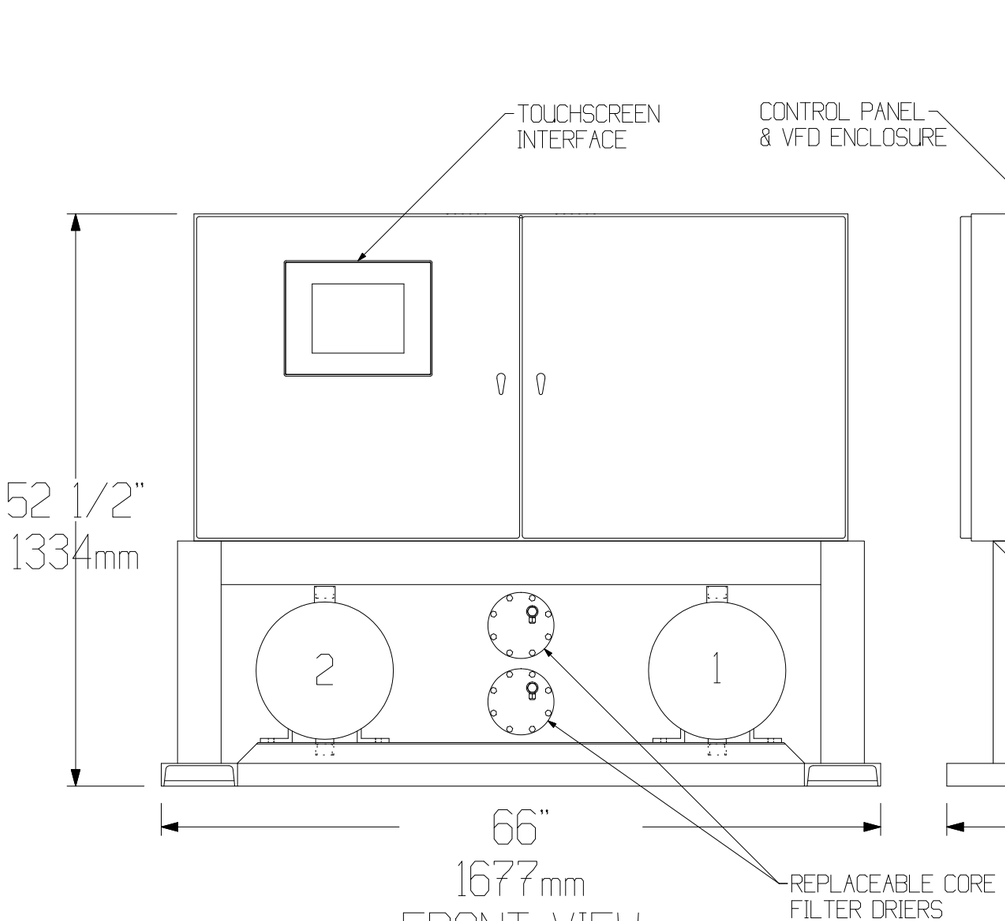
A sample of the touchscreen displays (used on a four stage system) is included as an example.

All of the PLC parameters can be remotely read by the ship's monitoring system through the MODBUS protocol via a RS-485 connection. This connection to the ship's network will also enable us to remotely monitor the system through the ship's internet connection.

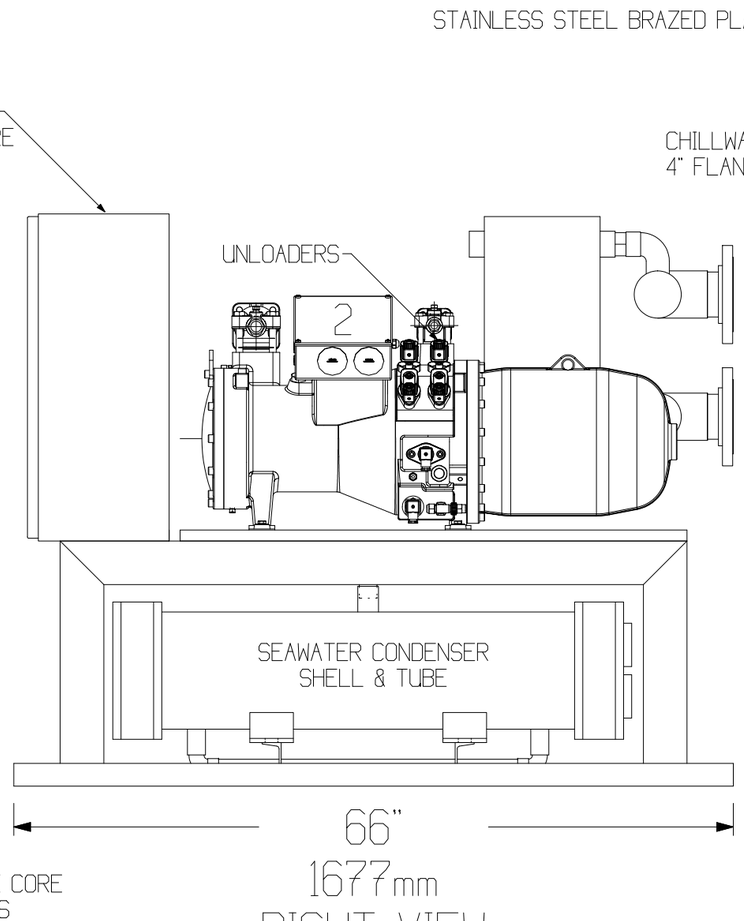
As a precautionary measure there will be a hard-wired fail-safe emergency backup system. This will enable the engineer to operate the chiller unit in case of a failure of the PLC system.

Circuit breakers will be provided for the compressors (2), seawater pumps (2), 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.

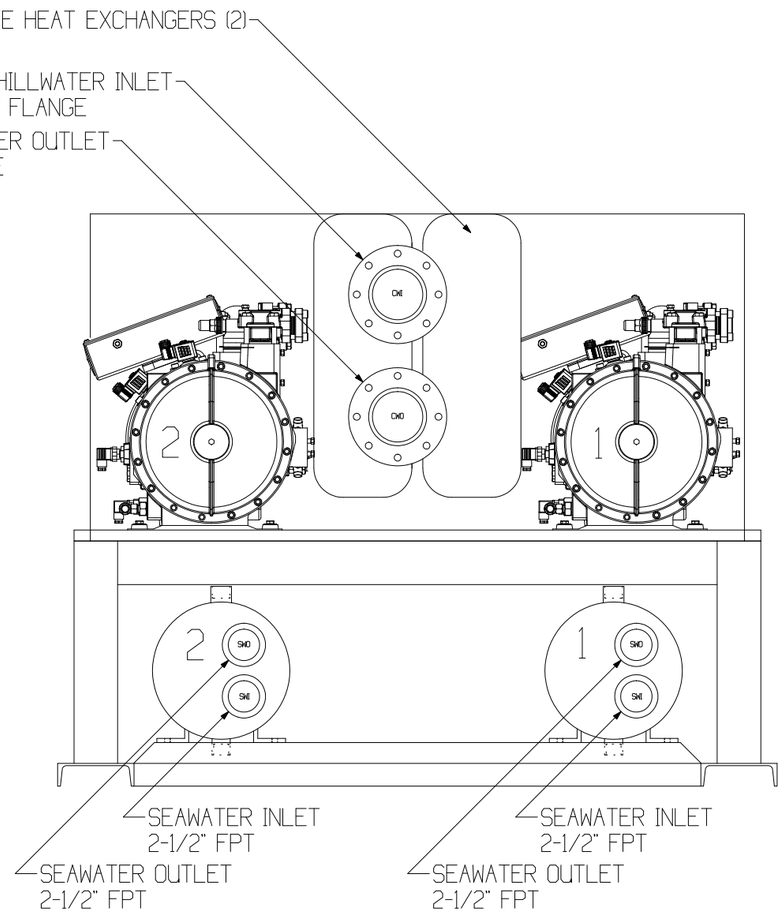
FRAME: The frame for the unit will be constructed of appropriately sized steel channel, square tube and angle. All welds will be by MIG welding procedure. Completed frame will be primed with a Awlgrip primer and then painted to meet 500 hour salt spray requirement. Paint will include a final topcoat of Awlgrip Matterhorn White. Stainless steel drain pans with a non-corrosive internal coating will be installed under any condensate producing components.



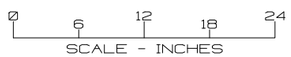
FRONT VIEW



RIGHT VIEW



REAR VIEW



AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM60P-2VEK
60 TON CHILLER 400-3-50

DRAWING NUMBER OM60P2VEK	DRAWN BY DN	DATE 10-15-11	
SCALE FULL	APPROVED BY	REVISION DATE	REV. A

AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

75 Ton Chillers

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

OM75P-4VIHD
75 ton Chiller

In April of 2008, Aqua Air Manufacturing was commissioned by the owners of a 172' motoryacht to provide a replacement chiller for the existing 15 year old Aqua-Air AQ900HD 75 ton, 4 stage chiller unit.

Aqua-Air has project records dating back to the early 1980's detailing the equipment that we have supplied for all of our large projects. One of the requirements of this project was for the chiller to fit in the same exact position and connect up to the existing chillwater piping. With our extensive CAD drawings for this project it was very easy to be assured this unit would fit exactly!

The Omega Series OM75P-4VIHD Chiller Unit is the culmination of many years experience in the design and manufacture of large tonnage yacht chiller systems.

Some of the OM75P-4VIHD notable features are semi-hermetic compressors, stainless steel plate heat exchangers, shell and tube condensers, variable frequency drives for compressors and seawater pumps, three stage immersion heater, touchscreen control interface, PLC control and remote monitoring capability.

The unit is also equipped with a highly innovative Manual Bypass System for the PLC which allows the crew to still control the chiller in the unlikely event that there is a catastrophic failure of the touchscreen or PLC. You can see more pictures and read a complete specification on our website www.aquaair.com

Touchscreen Main Screen

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

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Toll Free 800-328-1043
Fax 305-883-8549
Email sales@aquaair.com

www.aquaair.com

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.

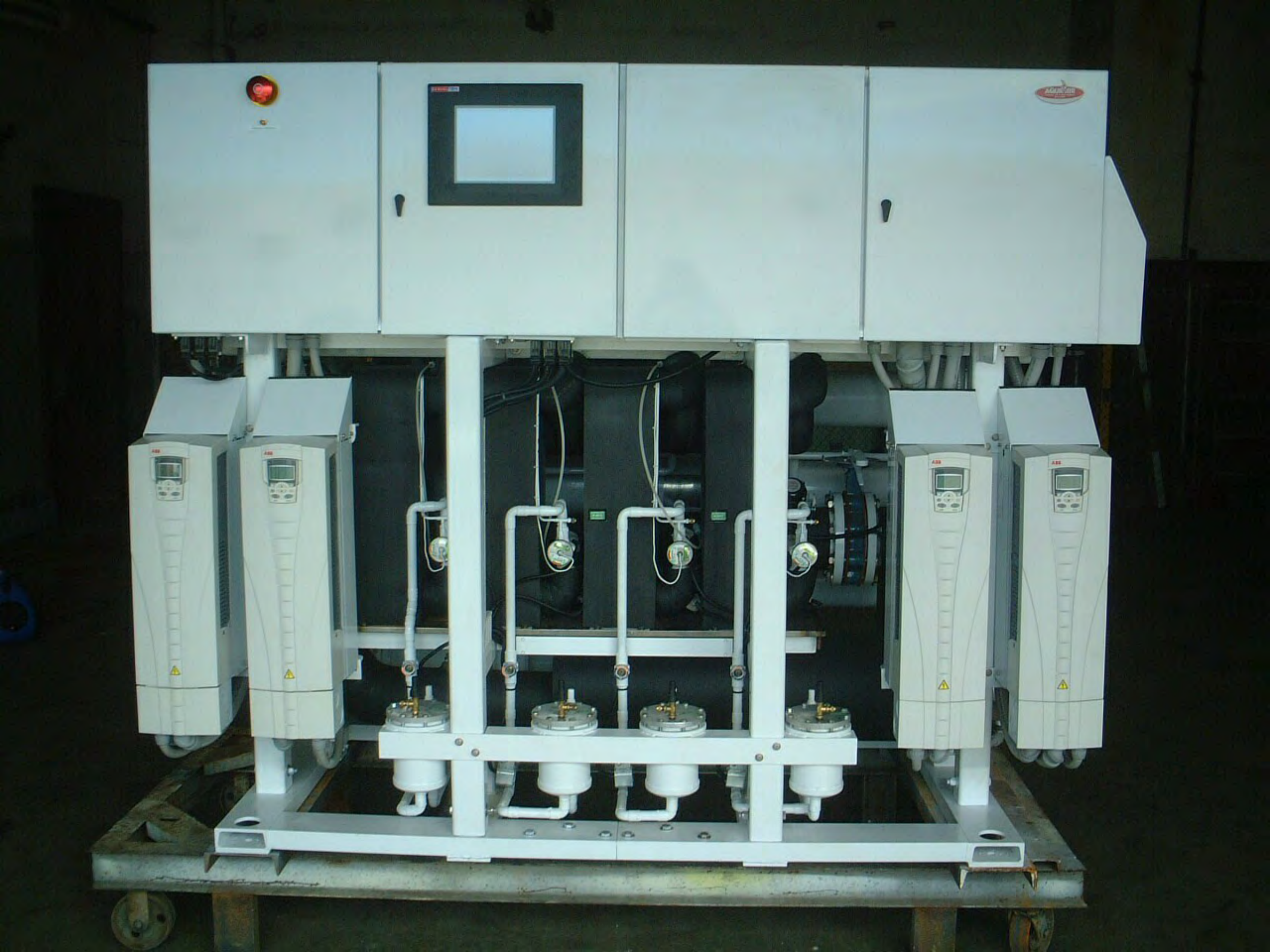
The control panel will be built in two sections: control circuit components (PLC, DC power supplies, control relays, etc.) on the left and main power feed components (circuit breakers and contactors) on the right side.

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.

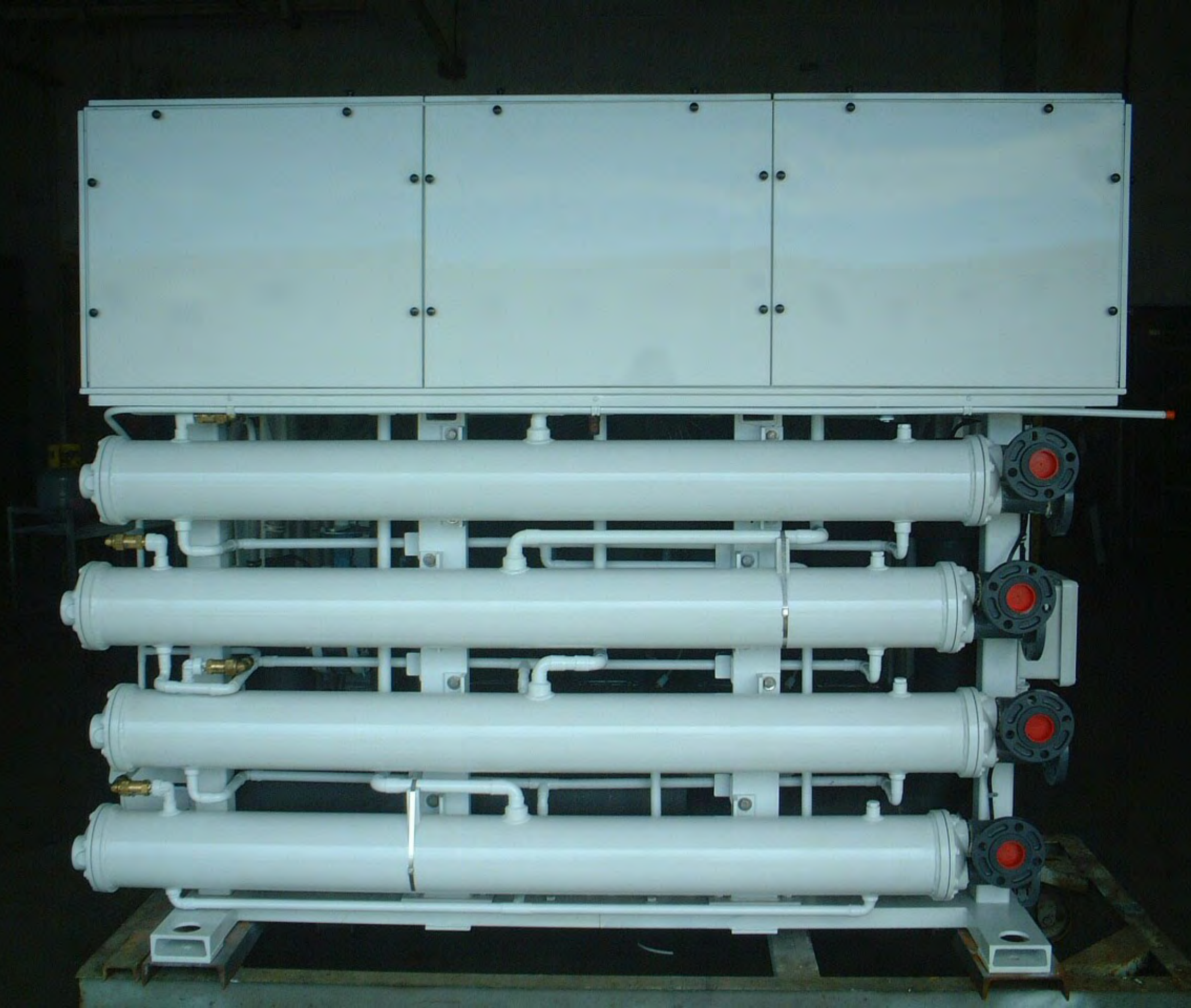
FRAME: The frame for the unit will be constructed of appropriately sized steel channel, square tube and angle. All welds will be by MIG welding procedure. Completed frame will be primed with a red lead based primer and then painted to meet 500 hour salt spray requirement. Color will be the standard Aqua-Air 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.**

i:\wordpfct\aq900hdr2008c.wpd

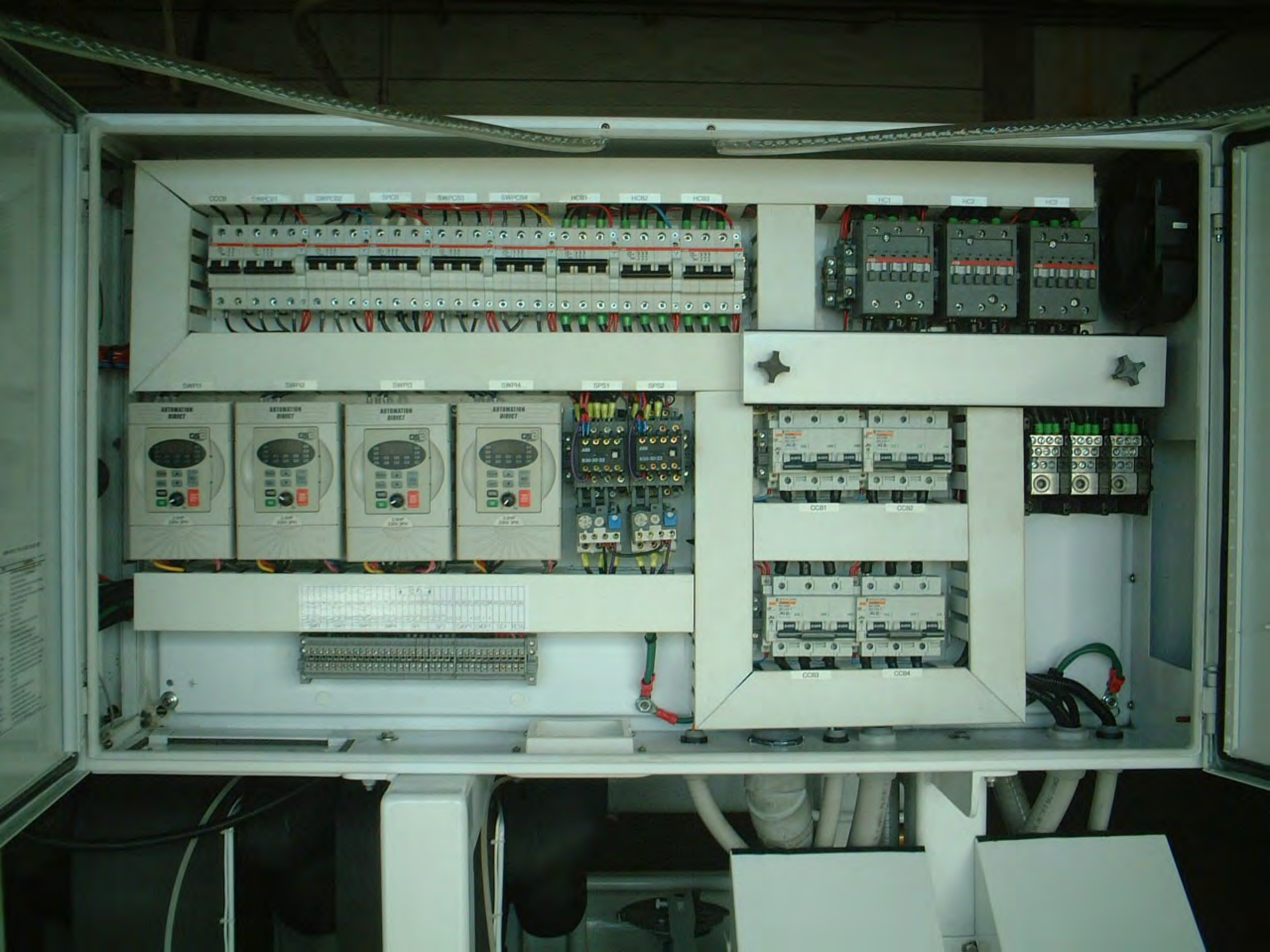
AQUA-AIR MANUFACTURING, division of the James D. Nall Co., Inc.
1050 East 9th Street, Hialeah, Florida 33010 U.S.A.
Ph. 305-884-8363 Fax 305-883-8549 E-mail sales@aquaair.com




AQUAIR




COOLING
HEATING
MANUAL BYPASS SYSTEM
Honeywell
Honeywell
ABB
ABB


CCB1
SWPCB1
SWPCB2
SPCB
SWPCB3
SWPCB4
HCB1
HCB2
HCB3
HC1
HC2
HC3
SWP1
SWP2
SWP3
SWP4
SPS1
SPS2
CC81
CC82
CC83
CC84


EMERGENCY STOP SWITCH
STAGE
SEAWATER PUMP BYPASS
COMPRESSOR
COOLING STAGE
FREEZE FAULT
OIL PRESSURE FAULT
LOW REFRIGERANT PRESSURE FAULT
HIGH REFRIGERANT PRESSURE FAULT
COMPRESSOR ON
COOLING
1
2
3
4
OFF
ON
HEATING
STAGE
HEATER
HEATING STAGE
HEATER ON
MANUAL BYPASS SYSTEM
SYSTEM PUMPS
PLC
MAN
HEATING FLOW
SYSTEM MODE
HEAT
COOL
COOLING FLOW
FAULT
PLC0
FZT1
FZT2

AQUAIR

MARINE AIR CONDITIONING SYSTEMS

INSTALLATION
OPERATION
MAINTENANCE

M/Y “Gallant Lady”
DeVries 651
OM75P-4VIHD
Chiller Retrofit
Touchscreen

ALARM HISTORY TOTAL OF 0 ALARMS

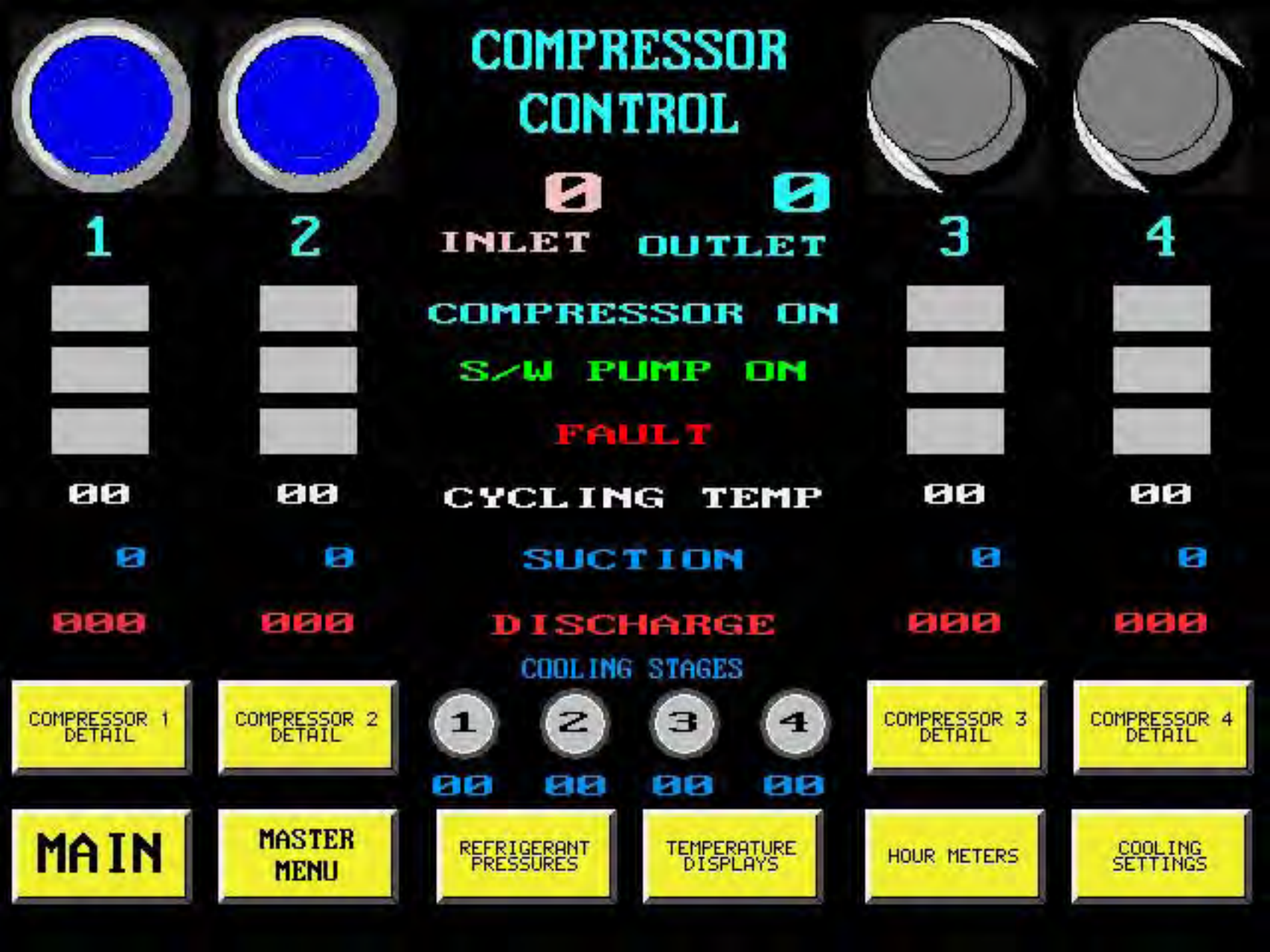
ENTRY	MESSAGE

ALARM COUNT	PAGE UP	PAGE DOWN	LINE UP	LINE DOWN	DETAILS	CLEAR ALL	EXIT

COMPRESSOR ALTERNATING SEQUENCE SETTINGS

0.0	ALTERNATING PERIOD, HOURS
MANUAL	ALTERNATING SEQUENCE MODE
0	CURRENT LEAD COMPRESSOR
0000	CURRENT ALTERNATING SEQUENCE
0.0	TIME REMAINING IN CURRENT SEQUENCE, HOURS
0	MAXIMUM NUMBER OF COMPRESSORS THAT CAN BE OPERATED

MAIN | MASTER MENU | REFRIGERANT PRESSURES | TEMPERATURE DISPLAYS | HOUR METERS | COMPRESSOR CONTROL


COMPRESSOR CONTROL
0
0
INLET
OUTLET
1
2
3
4
COMPRESSOR ON
S/W PUMP ON
FAULT
00
00
CYCLING TEMP
00
00
0
0
SUCTION
0
0
000
000
DISCHARGE
000
000
COOLING STAGES
1
2
3
4
00
00
00
00
COMPRESSOR 1 DETAIL
COMPRESSOR 2 DETAIL
COMPRESSOR 3 DETAIL
COMPRESSOR 4 DETAIL
MAIN
MASTER MENU
REFRIGERANT PRESSURES
TEMPERATURE DISPLAYS
HOUR METERS
COOLING SETTINGS


COMPRESSOR 1
COMPRESSOR RUNNING
INVERTER MODULATING COMPRESSOR OUTPUT
LIQUID LINE SOLENOID ON
CRANKCASE HEATER ON
COMPRESSOR THERMAL OVERLOAD MODULE ON
COMPRESSOR INVERTER FAULT
COMPRESSOR CIRCUIT BREAKER OFF
FREEZE THERMOSTAT FAULT
COMPRESSOR HIGH TEMPERATURE FAULT
LOW REFRIGERANT PRESSURE FAULT
LOW LUBE OIL PRESSURE FAULT
HIGH REFRIGERANT PRESSURE FAULT
POWER
MAIN
MASTER MENU
<< BACK
S/W PUMP RUNNING
S/W PUMP INVERTER FAULT
S/W PUMP CIRCUIT BREAKER OFF
S/W CONDENSER INLET TEMP
000
S/W CONDENSER OUTLET TEMP
000
CYCLING TEMPERATURE
00
SUCTION PRESSURE
0
DISCHARGE PRESSURE
000
LUBE OIL PRESSURE
000
SYSTEM INLET TEMPERATURE
0
SYSTEM OUTLET TEMPERATURE
0
PLATE CHILLER OUTLET TEMPERATURE
0

COMPRESSOR 2

COMPRESSOR RUNNING

INVERTER MODULATING COMPRESSOR OUTPUT

LIQUID LINE SOLENOID ON

CRANKCASE HEATER ON

COMPRESSOR THERMAL OVERLOAD MODULE ON

COMPRESSOR INVERTER FAULT

COMPRESSOR CIRCUIT BREAKER OFF

FREEZE THERMOSTAT FAULT

COMPRESSOR HIGH TEMPERATURE FAULT

LOW REFRIGERANT PRESSURE FAULT

LOW LUBE OIL PRESSURE FAULT

HIGH REFRIGERANT PRESSURE FAULT

POWER

MAIN

MASTER MENU

<< BACK

S/W PUMP RUNNING

S/W PUMP INVERTER FAULT

S/W PUMP CIRCUIT BREAKER OFF

S/W CONDENSER INLET TEMP 000

S/W CONDENSER OUTLET TEMP 000

CYCLING TEMPERATURE 00

SUCTION PRESSURE 0

DISCHARGE PRESSURE 000

LUBE OIL PRESSURE 000

SYSTEM INLET TEMPERATURE 0

SYSTEM OUTLET TEMPERATURE 0

PLATE CHILLER OUTLET TEMPERATURE 0

COMPRESSOR 3

COMPRESSOR RUNNING

INVERTER MODULATING COMPRESSOR OUTPUT

LIQUID LINE SOLENOID ON

CRANKCASE HEATER ON

COMPRESSOR THERMAL OVERLOAD MODULE ON

COMPRESSOR INVERTER FAULT

COMPRESSOR CIRCUIT BREAKER OFF

FREEZE THERMOSTAT FAULT

COMPRESSOR HIGH TEMPERATURE FAULT

LOW REFRIGERANT PRESSURE FAULT

LOW LUBE OIL PRESSURE FAULT

HIGH REFRIGERANT PRESSURE FAULT

POWER

MAIN

MASTER MENU

<< BACK

S/W PUMP RUNNING

S/W PUMP INVERTER FAULT

S/W PUMP CIRCUIT BREAKER OFF

S/W CONDENSER INLET TEMP 000

S/W CONDENSER OUTLET TEMP 000

CYCLING TEMPERATURE 00

SUCTION PRESSURE 0

DISCHARGE PRESSURE 000

LUBE OIL PRESSURE 000

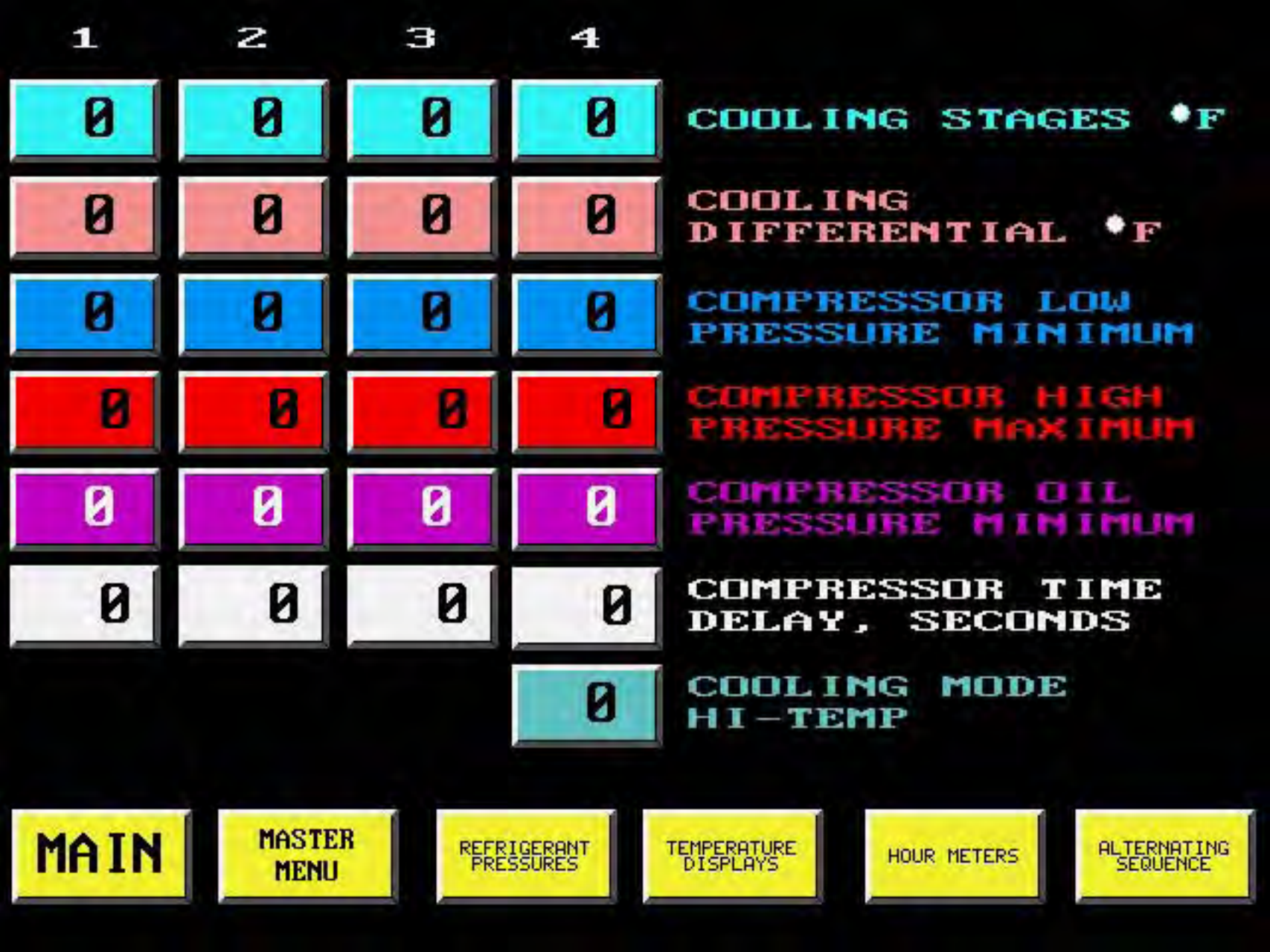
SYSTEM INLET TEMPERATURE 0

SYSTEM OUTLET TEMPERATURE 0

PLATE CHILLER OUTLET TEMPERATURE 0


COMPRESSOR
4
COMPRESSOR RUNNING
INVERTER MODULATING COMPRESSOR OUTPUT
LIQUID LINE SOLENOID ON
CRANKCASE HEATER ON
COMPRESSOR THERMAL OVERLOAD MODULE ON
COMPRESSOR INVERTER FAULT
COMPRESSOR CIRCUIT BREAKER OFF
FREEZE THERMOSTAT FAULT
COMPRESSOR HIGH TEMPERATURE FAULT
LOW REFRIGERANT PRESSURE FAULT
LOW LUBE OIL PRESSURE FAULT
HIGH REFRIGERANT PRESSURE FAULT
POWER
MAIN
MASTER MENU
<< BACK
S/W PUMP RUNNING
S/W PUMP INVERTER FAULT
S/W PUMP CIRCUIT BREAKER OFF
S/W CONDENSER INLET TEMP
000
S/W CONDENSER OUTLET TEMP
000
CYCLING TEMPERATURE
00
SUCTION PRESSURE
0
DISCHARGE PRESSURE
000
LUBE OIL PRESSURE
000
SYSTEM INLET TEMPERATURE
0
SYSTEM OUTLET TEMPERATURE
0
PLATE CHILLER OUTLET TEMPERATURE
0


MODULATE INVERTER OUTPUT
RAMP DOWN START TEMP deg F & 0-4095
INVERTER SPEED REF H2 & 0-4095
INVERTER MODULATION INFORMATION
1
OFF
00
00.0
0000
0000
2
OFF
00
00.0
0000
0000
3
OFF
00
00.0
0000
0000
4
OFF
00
00.0
0000
0000
MAIN
MASTER MENU
COMPRESSOR CONTROL
COOLING SETTINGS


1
2
3
4
0
0
0
0
COOLING STAGES °F
0
0
0
0
COOLING DIFFERENTIAL °F
0
0
0
0
COMPRESSOR LOW PRESSURE MINIMUM
0
0
0
0
COMPRESSOR HIGH PRESSURE MAXIMUM
0
0
0
0
COMPRESSOR OIL PRESSURE MINIMUM
0
0
0
0
COMPRESSOR TIME DELAY, SECONDS
0
COOLING MODE HI-TEMP
MAIN
MASTER MENU
REFRIGERANT PRESSURES
TEMPERATURE DISPLAYS
HOUR METERS
ALTERNATING SEQUENCE

FACTORY SETTINGS

1	2		3	4
		BYPASS THE LP-HP-OP TRANSDUCERS		
		COMPRESSOR MANUAL RUN		

UNIT INLET SENSOR (UIS) BYPASS

0

BYPASS SETTING

UNIT OUTLET SENSOR (UOS) BYPASS

0

BYPASS SETTING

0 LOW REFRIGERANT PRESSURE TIME DELAY, secs

0 LUBE OIL PRESSURE TIME DELAY, secs

0 NUMBER of DEGREES IN MODULATING STAGE

FACTORY DEFAULT SETTINGS

PRESS TO LOAD

MAIN

MASTER MENU

ADJUST TIME & DATE

11:30
25-SEP-08

HEATER CONTROL

1 2 3

OFF OFF OFF

HEATERS

HEATING STAGES

SYSTEM INLET 0

1 2 3

000 000 000

SYSTEM OUTLET 0

MAIN | MASTER MENU | TEMPERATURE DISPLAYS | HOUR METERS | HEATING SETTINGS

HEATER SETTINGS

1	2	3	
0	0	0	HEATING STAGES °F
0	0	0	HEATING DIFFERENTIAL °F
0	0	0	HEATER TIME DELAY, secs
		0	HEATING MODE LOW TEMPERATURE ALARM

MAIN | MASTER MENU | HEATING CONTROL | TEMPERATURE DISPLAYS | HOUR METERS

HOUR METER DISPLAY & ADJUSTMENT

POWER

AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

COOL MODE
HEAT MODE

SYSTEM PUMPS

S/W PUMPS

COMPRESSORS

HEATERS

COMPRESSOR CONTROL SCREEN

HEATER CONTROL SCREEN

TEMPERATURE DISPLAY SCREEN

SYSTEM PUMPS

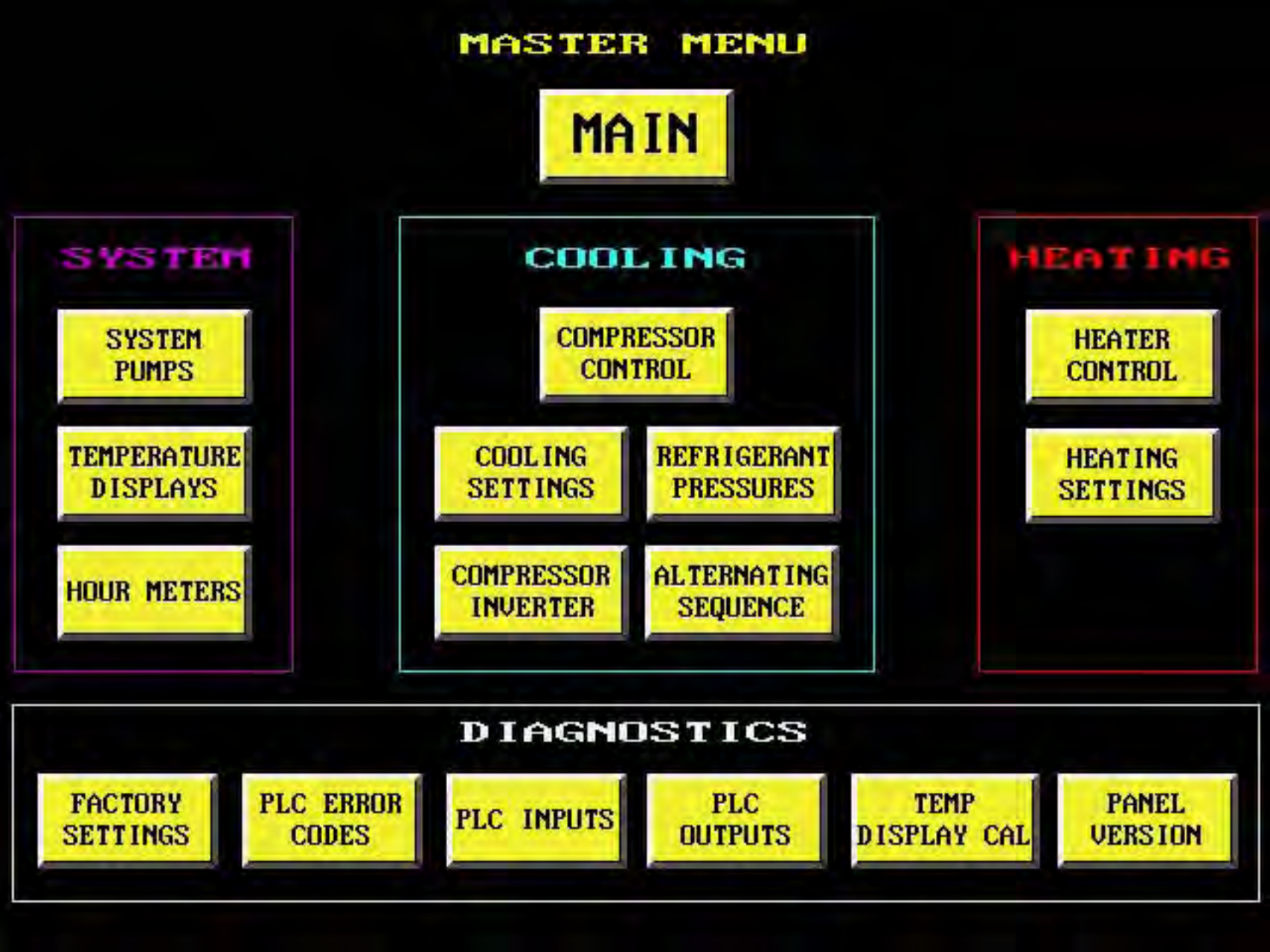
ALARM HISTORY

MASTER MENU

INLET

SYSTEM TEMPERATURES °F

OUTLET


MASTER MENU
MAIN
SYSTEM
SYSTEM PUMPS
TEMPERATURE DISPLAYS
HOUR METERS
COOLING
COMPRESSOR CONTROL
COOLING SETTINGS
REFRIGERANT PRESSURES
COMPRESSOR INVERTER
ALTERNATING SEQUENCE
HEATING
HEATER CONTROL
HEATING SETTINGS
DIAGNOSTICS
FACTORY SETTINGS
PLC ERROR CODES
PLC INPUTS
PLC OUTPUTS
TEMP DISPLAY CAL
PANEL VERSION

AQUA-AIR MANUFACTURING
1050 E. 9th St. Hialeah, Florida 33010

305-884-8363 800-328-1043
www.aquaair.com

Version EZA10.1 Project 08020401

MASTER MENU

PLC CPU INFORMATION

0000 FATAL ERROR CODE V7755

0000 MAJOR ERROR CODE V7756

00000000 MODULE ERROR - BASE & SLOT NUMBER V7760

0000 MODULE ERROR - ERROR CODE V7762

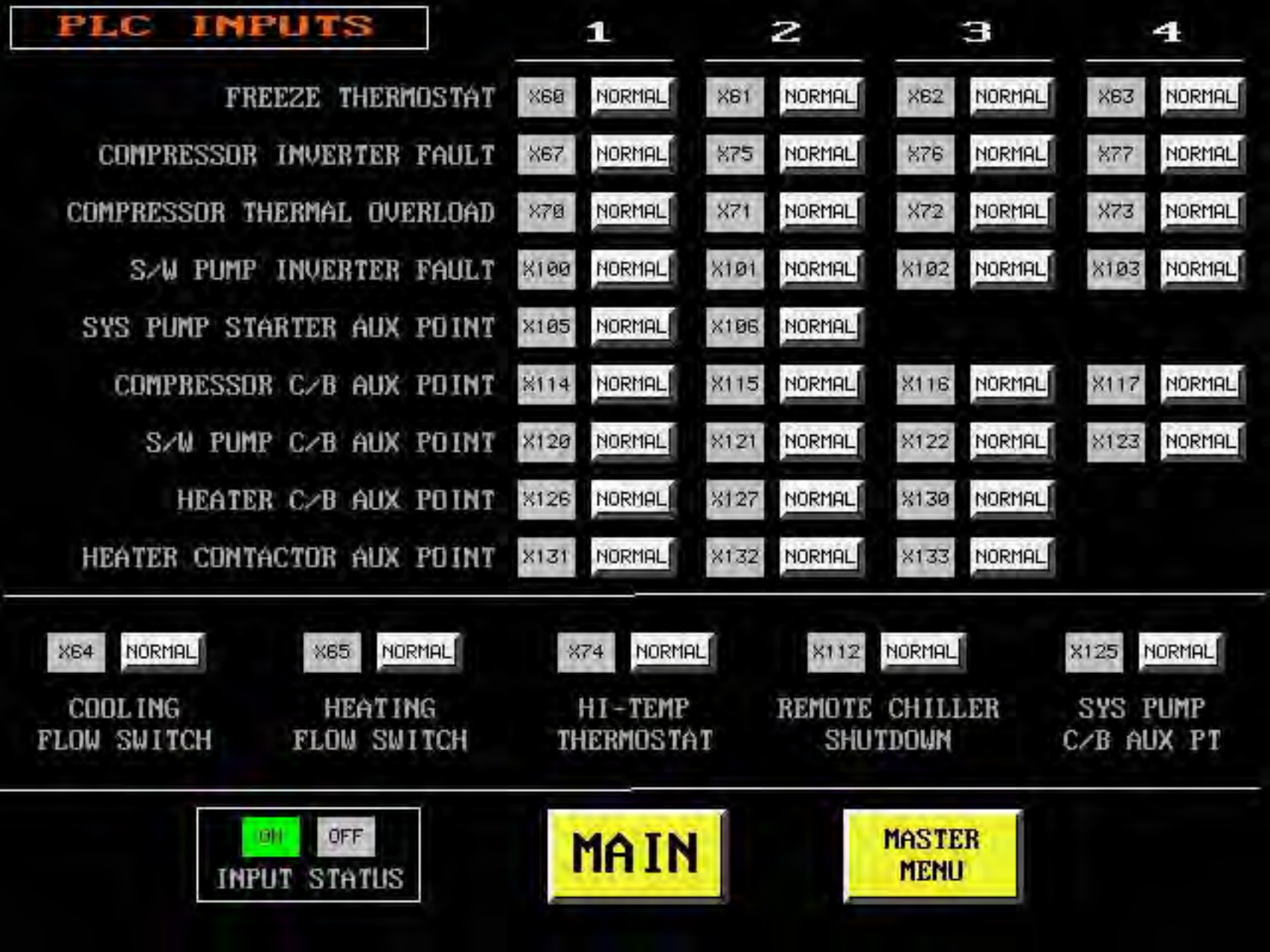
0000 CURRENT SCAN TIME, ms V7775

0000 MINIMUM SCAN TIME, ms V7776

0000 MAXIMUM SCAN TIME, ms V7777

MAIN

MASTER MENU


PLC INPUTS
1
2
3
4
FREEZE THERMOSTAT
X60 NORMAL
X61 NORMAL
X62 NORMAL
X63 NORMAL
COMPRESSOR INVERTER FAULT
X67 NORMAL
X75 NORMAL
X76 NORMAL
X77 NORMAL
COMPRESSOR THERMAL OVERLOAD
X70 NORMAL
X71 NORMAL
X72 NORMAL
X73 NORMAL
S/W PUMP INVERTER FAULT
X100 NORMAL
X101 NORMAL
X102 NORMAL
X103 NORMAL
SYS PUMP STARTER AUX POINT
X105 NORMAL
X106 NORMAL
COMPRESSOR C/B AUX POINT
X114 NORMAL
X115 NORMAL
X116 NORMAL
X117 NORMAL
S/W PUMP C/B AUX POINT
X120 NORMAL
X121 NORMAL
X122 NORMAL
X123 NORMAL
HEATER C/B AUX POINT
X126 NORMAL
X127 NORMAL
X130 NORMAL
HEATER CONTACTOR AUX POINT
X131 NORMAL
X132 NORMAL
X133 NORMAL
X64 NORMAL
COOLING FLOW SWITCH
X65 NORMAL
HEATING FLOW SWITCH
X74 NORMAL
HI-TEMP THERMOSTAT
X112 NORMAL
REMOTE CHILLER SHUTDOWN
X125 NORMAL
SYS PUMP C/B AUX PT
ON
OFF
INPUT STATUS
MAIN
MASTER MENU

PLC OUTPUTS

	1		2		3		4	
LIQUID LINE SOLENOIDS	Y0	NORMAL	Y1	NORMAL	Y2	NORMAL	Y3	NORMAL
HEATER CONTACTORS	Y4	NORMAL	Y5	NORMAL	Y6	NORMAL		
CRANKCASE HEATERS	Y10	NORMAL	Y11	NORMAL	Y12	NORMAL	Y13	NORMAL
COMPRESSOR OVERLOAD	Y14	NORMAL	Y15	NORMAL	Y16	NORMAL	Y17	NORMAL
GENERAL CHILLER ALARM OUTPUT	Y20	NORMAL						
S/W PUMP INVERTER START RELAY	Y21	NORMAL	Y22	NORMAL	Y23	NORMAL	Y24	NORMAL
SYSTEM PUMP STARTER	Y26	NORMAL	Y27	NORMAL				
COMPRESSOR INVERTER START RELAY	Y30	NORMAL	Y31	NORMAL	Y32	NORMAL	Y33	NORMAL

MAIN

MASTER MENU

REFRIGERANT PRESSURES

	SUCTION PRESSURE	DISCHARGE PRESSURE	OIL PRESSURE	
1	OFF	OFF	OFF	1
2	OFF	OFF	OFF	2
3	OFF	OFF	OFF	3
4	OFF	OFF	OFF	4

MAIN

MASTER MENU

COMPRESSOR CONTROL

SYSTEM PUMPS

0000

SUCTION
PRESSURE

0000

DISCHARGE
PRESSURE

MAIN

MASTER
MENU

COMPRESSOR
CONTROL

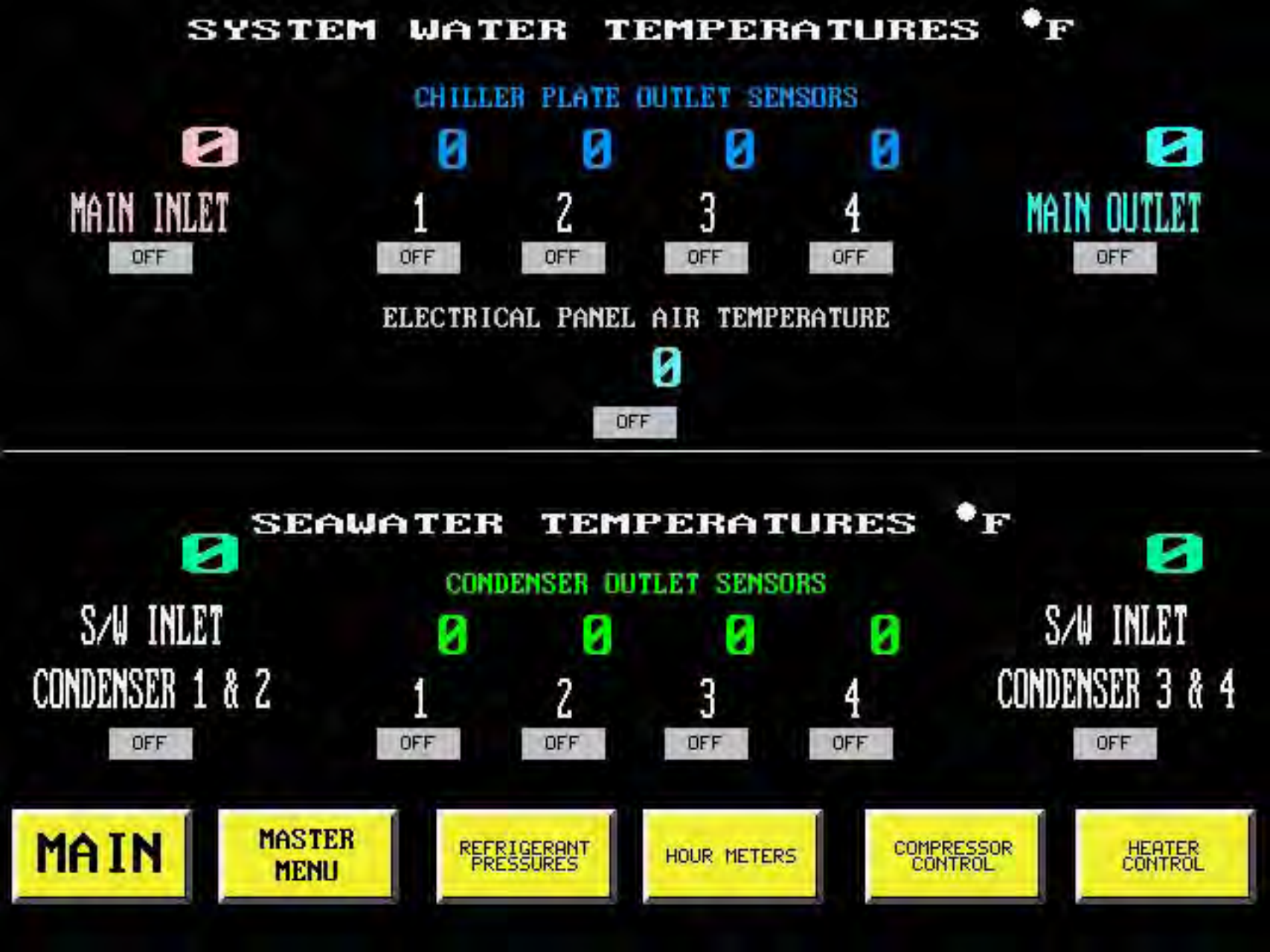
HEATER
CONTROL

SYSTEM WATER TEMPERATURE SENSOR CALIBRATION

	ACTUAL SENSOR TEMP		AMOUNT TO ADD		AMOUNT TO SUBTRACT		DISPLAYED TEMPERATURE
MAIN INLET OFF	0	+	0	−	0	=	0
MAIN OUTLET OFF	0	+	0	−	0	=	0

ALL TEMPERATURES DISPLAYED ARE IN °F

MAIN | MASTER MENU | TEMPERATURE DISPLAYS


SYSTEM WATER TEMPERATURES °F
CHILLER PLATE OUTLET SENSORS
0
0
0
0
MAIN INLET
1
2
3
4
MAIN OUTLET
OFF
OFF
OFF
OFF
OFF
OFF
ELECTRICAL PANEL AIR TEMPERATURE
0
OFF
SEAWATER TEMPERATURES °F
CONDENSER OUTLET SENSORS
0
0
0
0
S/W INLET
CONDENSER 1 & 2
1
2
3
4
S/W INLET
CONDENSER 3 & 4
OFF
OFF
OFF
OFF
OFF
OFF
MAIN
MASTER MENU
REFRIGERANT PRESSURES
HOUR METERS
COMPRESSOR CONTROL
HEATER CONTROL

TIME AND DATE ADJUSTMENT

TIME

00000000

ENTER THE NEW TIME HERE IN THE FOLLOWING FORMAT:
00HHMMSS

00 = 00 (2 ZEROES, NOT USED)
HH = HOUR, 1-23
MM = MINUTES, 1-59
SS = SECONDS, 1-59

EXAMPLES
10:13am 00101300
4:49pm 00164900

Press to Update TIME

CURRENT TIME
13:17:52
09/25/08
CURRENT DATE

MAIN

MASTER MENU

DATE

00000000

ENTER THE NEW DATE HERE IN THE FOLLOWING FORMAT:
YYMMDDdw

YY = YEAR, 0-99
MM = MONTH, 1-12
DD = DAY, 1-31
dw = Day of Week, 0-6 (0=Sunday, 1=Monday, 2=Tuesday), etc

EXAMPLE
Friday, August 22, 2008 = 08082205

Press to Update DATE

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

CHILLER UNIT SPECIFICATION
OM72P-2VEK

COOLING CAPACITY: 72 tons (864,000 BTU/H) { 253 kW } at 45˚ F { 7.2˚ C } leaving water temperature and 55˚ F { 12.8˚ C } returning water temperature. Chiller unit flow rate will be approximately 216 gpm { 49 m^3h }. Condenser flow rate (each) is to be approximately 144 gpm { 33 m^3h } entering at a maximum temperature of 90˚ F { 32˚ C }. All ratings are at a fouling factor of 0.0005

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.

COMPRESSORS: The chiller unit will have two, 36 ton {127 kW} Bitzer semi-hermetic compact screw compressors. Each compressor will be equipped with suction and discharge valves. Input voltage to the compressor motor will be 460-3-60. This will be achieved through the use of Variable Frequency Drives. Power consumption of each compressor is approximately 34 kW each. Refrigerant to be used is R-407C .

CAPACITY CONTROL: Infinite capacity control of each compressor will be achieved through the use of four unloaders on each compressor. These unloaders will be regulated by the PLC to maintain a consistent set point under changing load conditions. The unloaders will also allow the compressor to be started unloaded.
Each compressor will be connected to a Variable Frequency Drive (VFD). The VFD will control the compressor motor so that there is no current inrush, during starting, above the motor's standard running amperage. The VFD requires an input power supply of 400-3-50. The maximum output power will be 460-3-60 to the compressor motor. The VFD's will be located in a dedicated cabinet that is environmentally maintained at 80˚ F {26.6˚ C} under all conditions.

COOLER: The unit is equipped with two plate style heat exchangers, each of 36 tons {127 kW} 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" {13mm} thick closed cell insulation. Water flow through each plate will be 108 gpm { 24.5 m^3h } at a pressure drop of 7.20 psi {0.50 bar }. The water in the chillwater loop will require a 20% glycol mixture. A stainless steel drain pan will be mounted under the plates to catch any associated condensation.

CONDENSER: The unit is equipped with two 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 2-1/2" NPT. 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.

REFRIGERANT CIRCUIT: Each of the two refrigerant circuits shall include a liquid line ball valve, replaceable core liquid line filter drier with access fitting for refrigerant charging, combination moisture indicator and sight glass, refrigerant pressure transducers 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. The system will utilize Electronic Expansion Valves for precise refrigerant metering to the evaporators under all conditions.

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 touchscreen mounted on the front of the electrical box. This touchscreen will perform the following main switching functions in addition to numerous other minor controls:

System On-Off Switch
Compressor On-Off Switch (2)
Chillwater Pump Selector Switch (Primary/Secondary)

The touch screen will also display the following information

> Digital refrigerant pressure readouts (suction and discharge) for each compressor
> Digital temperature display for the chillwater inlet and outlet temperatures

> Digital temperature display for the seawater outlet temperatures on each condenser and seawater inlet for the system.

> Elapsed time meters showing the run times for all compressors and pumps

> Chillwater pump motor fault indication
> Compressor inverter operational (2)
> Cooling stage engaged (2)
> Chiller freeze thermostat engaged (2)
> Low chillwater flow through the chiller
> Low compressor refrigerant pressure (2)
> High compressor refrigerant pressure (2)
> Compressor motor overload (2)
> High compressor discharge temperature (2)
> Compressor inverter fault indicator (2)

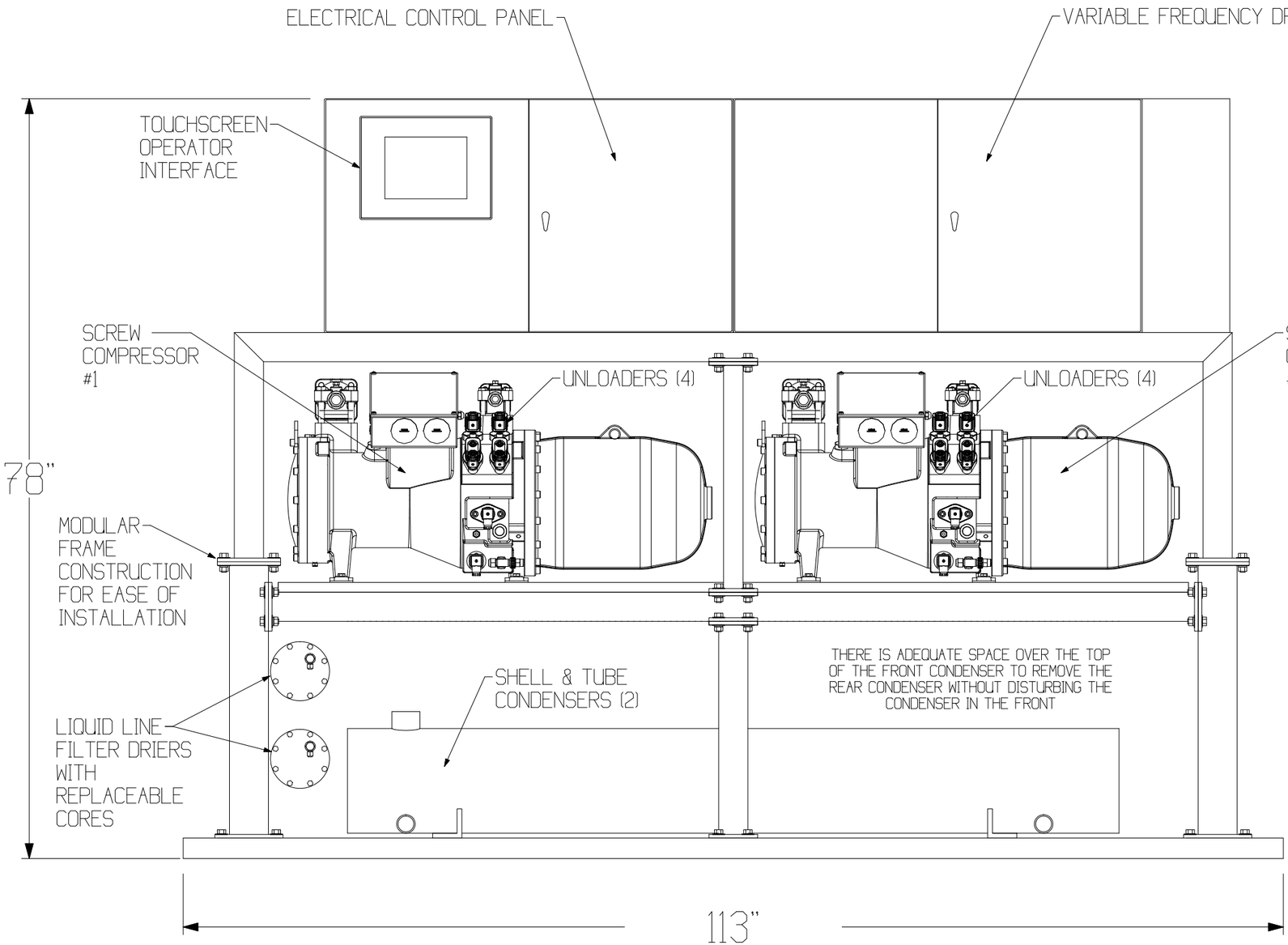
A sample of the touchscreen displays (used on a four stage system) is included as an example.

All of the PLC parameters can be remotely read by the ship's monitoring system through the MODBUS protocol via a RS-485 connection. This connection to the ship's network will also enable us to remotely monitor the system through the ship's internet connection.

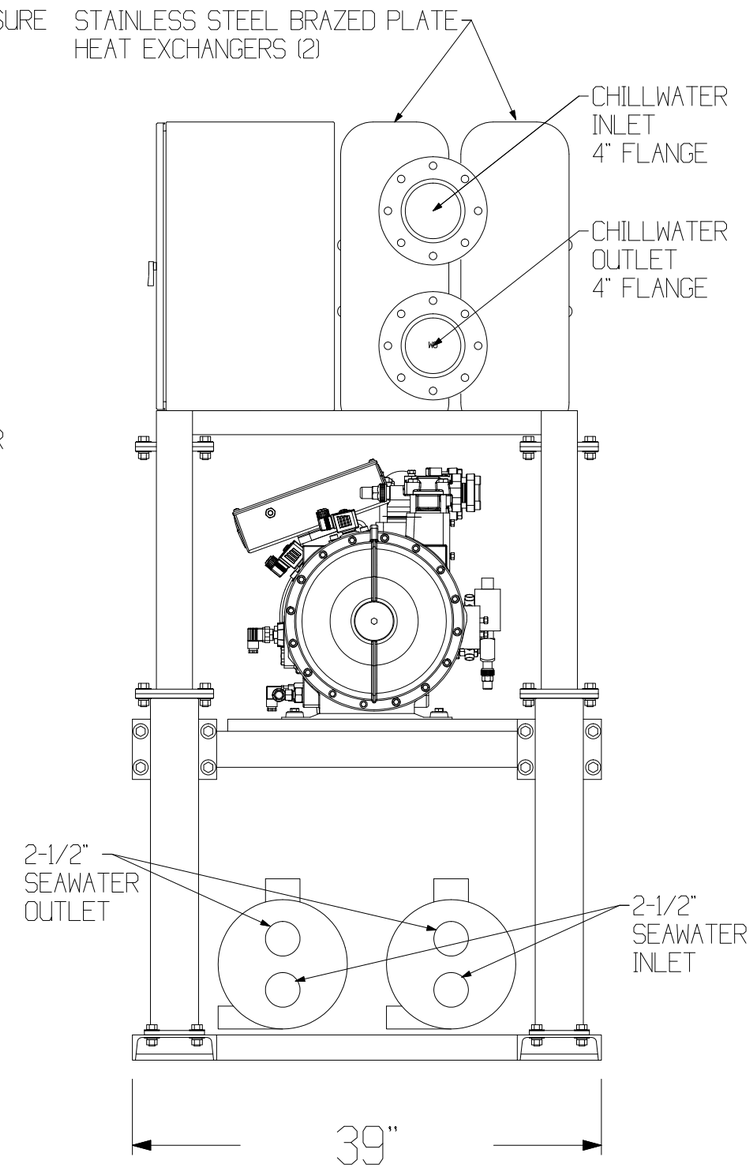
As a precautionary measure there will be a hard-wired fail-safe emergency backup system. This will enable the engineer to operate the chiller unit in case of a failure of the PLC system.

Circuit breakers will be provided for the compressors (2), seawater pumps (2), 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.

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 Awlgrip primer and then painted to meet 500 hour salt spray requirement. Paint will include a final topcoat of Awlgrip Matterhorn White. Stainless steel drain pans with a non-corrosive internal coating will be installed under any condensate producing components.



FRONT VIEW



RIGHT VIEW

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM72P-2VEK

72 TON 2 STAGE CHILLER 400-3-50

DRAWING NUMBER OM72P2VEK	DRAWN BY DN	DATE 9-30-11	
SCALE FULL	APPROVED BY	REVISION DATE	REV A

POWER

AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

COOL MODE
HEAT MODE

SYSTEM PUMPS

S/W PUMPS

COMPRESSORS

HEATERS

COMPRESSOR CONTROL SCREEN

HEATER CONTROL SCREEN

TEMPERATURE DISPLAY SCREEN

SYSTEM PUMPS

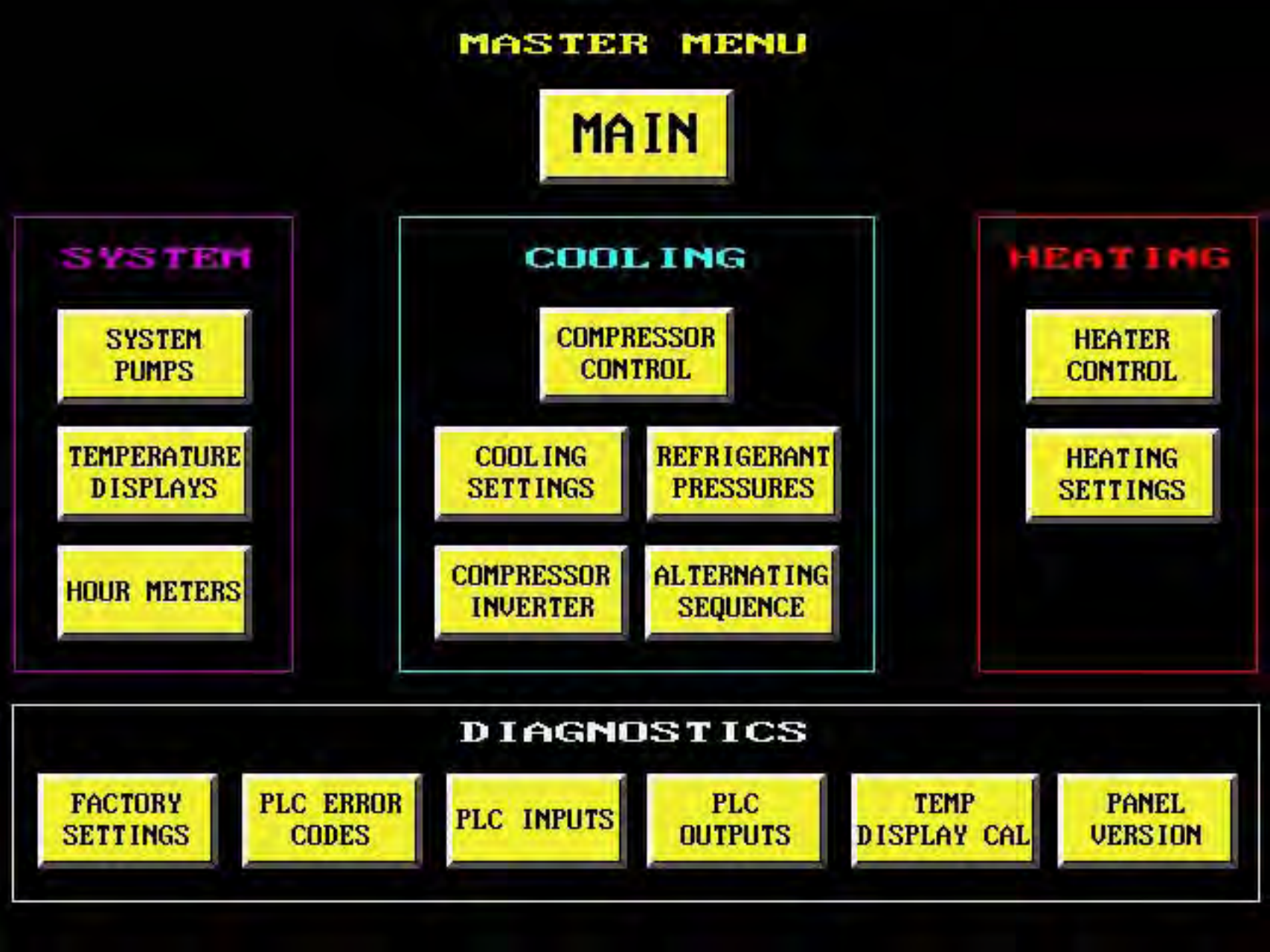
ALARM HISTORY

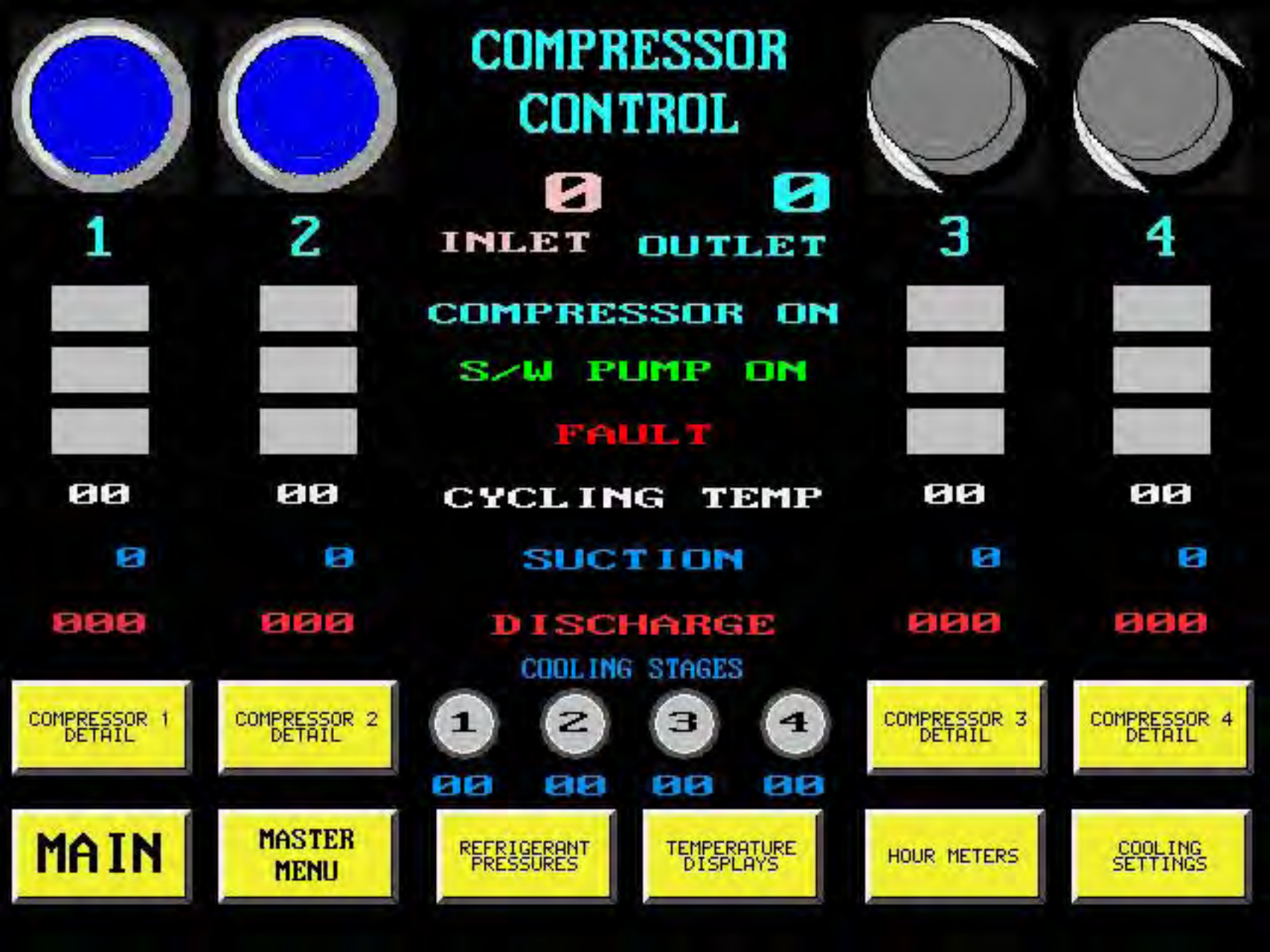
MASTER MENU

INLET

SYSTEM TEMPERATURES °F

OUTLET


MASTER MENU
MAIN
SYSTEM
SYSTEM PUMPS
TEMPERATURE DISPLAYS
HOUR METERS
COOLING
COMPRESSOR CONTROL
COOLING SETTINGS
REFRIGERANT PRESSURES
COMPRESSOR INVERTER
ALTERNATING SEQUENCE
HEATING
HEATER CONTROL
HEATING SETTINGS
DIAGNOSTICS
FACTORY SETTINGS
PLC ERROR CODES
PLC INPUTS
PLC OUTPUTS
TEMP DISPLAY CAL
PANEL VERSION


COMPRESSOR CONTROL
0
0
INLET
OUTLET
1
2
3
4
COMPRESSOR ON
S/W PUMP ON
FAULT
00
00
CYCLING TEMP
00
00
0
0
SUCTION
0
0
000
000
DISCHARGE
000
000
COOLING STAGES
1
2
3
4
00
00
00
00
COMPRESSOR 1 DETAIL
COMPRESSOR 2 DETAIL
COMPRESSOR 3 DETAIL
COMPRESSOR 4 DETAIL
MAIN
MASTER MENU
REFRIGERANT PRESSURES
TEMPERATURE DISPLAYS
HOUR METERS
COOLING SETTINGS


COMPRESSOR 1
COMPRESSOR RUNNING
INVERTER MODULATING COMPRESSOR OUTPUT
LIQUID LINE SOLENOID ON
CRANKCASE HEATER ON
COMPRESSOR THERMAL OVERLOAD MODULE ON
COMPRESSOR INVERTER FAULT
COMPRESSOR CIRCUIT BREAKER OFF
FREEZE THERMOSTAT FAULT
COMPRESSOR HIGH TEMPERATURE FAULT
LOW REFRIGERANT PRESSURE FAULT
LOW LUBE OIL PRESSURE FAULT
HIGH REFRIGERANT PRESSURE FAULT
POWER
MAIN
MASTER MENU
<< BACK
S/W PUMP RUNNING
S/W PUMP INVERTER FAULT
S/W PUMP CIRCUIT BREAKER OFF
S/W CONDENSER INLET TEMP
000
S/W CONDENSER OUTLET TEMP
000
CYCLING TEMPERATURE
00
SUCTION PRESSURE
0
DISCHARGE PRESSURE
000
LUBE OIL PRESSURE
000
SYSTEM INLET TEMPERATURE
0
SYSTEM OUTLET TEMPERATURE
0
PLATE CHILLER OUTLET TEMPERATURE
0

COMPRESSOR 2

COMPRESSOR RUNNING

INVERTER MODULATING COMPRESSOR OUTPUT

LIQUID LINE SOLENOID ON

CRANKCASE HEATER ON

COMPRESSOR THERMAL OVERLOAD MODULE ON

COMPRESSOR INVERTER FAULT

COMPRESSOR CIRCUIT BREAKER OFF

FREEZE THERMOSTAT FAULT

COMPRESSOR HIGH TEMPERATURE FAULT

LOW REFRIGERANT PRESSURE FAULT

LOW LUBE OIL PRESSURE FAULT

HIGH REFRIGERANT PRESSURE FAULT

POWER

MAIN

MASTER MENU

<< BACK

S/W PUMP RUNNING

S/W PUMP INVERTER FAULT

S/W PUMP CIRCUIT BREAKER OFF

S/W CONDENSER INLET TEMP 000

S/W CONDENSER OUTLET TEMP 000

CYCLING TEMPERATURE 00

SUCTION PRESSURE 0

DISCHARGE PRESSURE 000

LUBE OIL PRESSURE 000

SYSTEM INLET TEMPERATURE 0

SYSTEM OUTLET TEMPERATURE 0

PLATE CHILLER OUTLET TEMPERATURE 0

COMPRESSOR 3

COMPRESSOR RUNNING

INVERTER MODULATING COMPRESSOR OUTPUT

LIQUID LINE SOLENOID ON

CRANKCASE HEATER ON

COMPRESSOR THERMAL OVERLOAD MODULE ON

COMPRESSOR INVERTER FAULT

COMPRESSOR CIRCUIT BREAKER OFF

FREEZE THERMOSTAT FAULT

COMPRESSOR HIGH TEMPERATURE FAULT

LOW REFRIGERANT PRESSURE FAULT

LOW LUBE OIL PRESSURE FAULT

HIGH REFRIGERANT PRESSURE FAULT

POWER

MAIN

MASTER MENU

<< BACK

S/W PUMP RUNNING

S/W PUMP INVERTER FAULT

S/W PUMP CIRCUIT BREAKER OFF

S/W CONDENSER INLET TEMP 000

S/W CONDENSER OUTLET TEMP 000

CYCLING TEMPERATURE 00

SUCTION PRESSURE 0

DISCHARGE PRESSURE 000

LUBE OIL PRESSURE 000

SYSTEM INLET TEMPERATURE 0

SYSTEM OUTLET TEMPERATURE 0

PLATE CHILLER OUTLET TEMPERATURE 0


COMPRESSOR
4
COMPRESSOR RUNNING
INVERTER MODULATING COMPRESSOR OUTPUT
LIQUID LINE SOLENOID ON
CRANKCASE HEATER ON
COMPRESSOR THERMAL OVERLOAD MODULE ON
COMPRESSOR INVERTER FAULT
COMPRESSOR CIRCUIT BREAKER OFF
FREEZE THERMOSTAT FAULT
COMPRESSOR HIGH TEMPERATURE FAULT
LOW REFRIGERANT PRESSURE FAULT
LOW LUBE OIL PRESSURE FAULT
HIGH REFRIGERANT PRESSURE FAULT
POWER
MAIN
MASTER MENU
<< BACK
S/W PUMP RUNNING
S/W PUMP INVERTER FAULT
S/W PUMP CIRCUIT BREAKER OFF
S/W CONDENSER INLET TEMP
000
S/W CONDENSER OUTLET TEMP
000
CYCLING TEMPERATURE
00
SUCTION PRESSURE
0
DISCHARGE PRESSURE
000
LUBE OIL PRESSURE
000
SYSTEM INLET TEMPERATURE
0
SYSTEM OUTLET TEMPERATURE
0
PLATE CHILLER OUTLET TEMPERATURE
0

COMPRESSOR ALTERNATING SEQUENCE SETTINGS

0.0	ALTERNATING PERIOD, HOURS
MANUAL	ALTERNATING SEQUENCE MODE
0	CURRENT LEAD COMPRESSOR
0000	CURRENT ALTERNATING SEQUENCE
0.0	TIME REMAINING IN CURRENT SEQUENCE, HOURS
0	MAXIMUM NUMBER OF COMPRESSORS THAT CAN BE OPERATED

MAIN | MASTER MENU | REFRIGERANT PRESSURES | TEMPERATURE DISPLAYS | HOUR METERS | COMPRESSOR CONTROL

SYSTEM PUMPS

0000

SUCTION
PRESSURE

0000

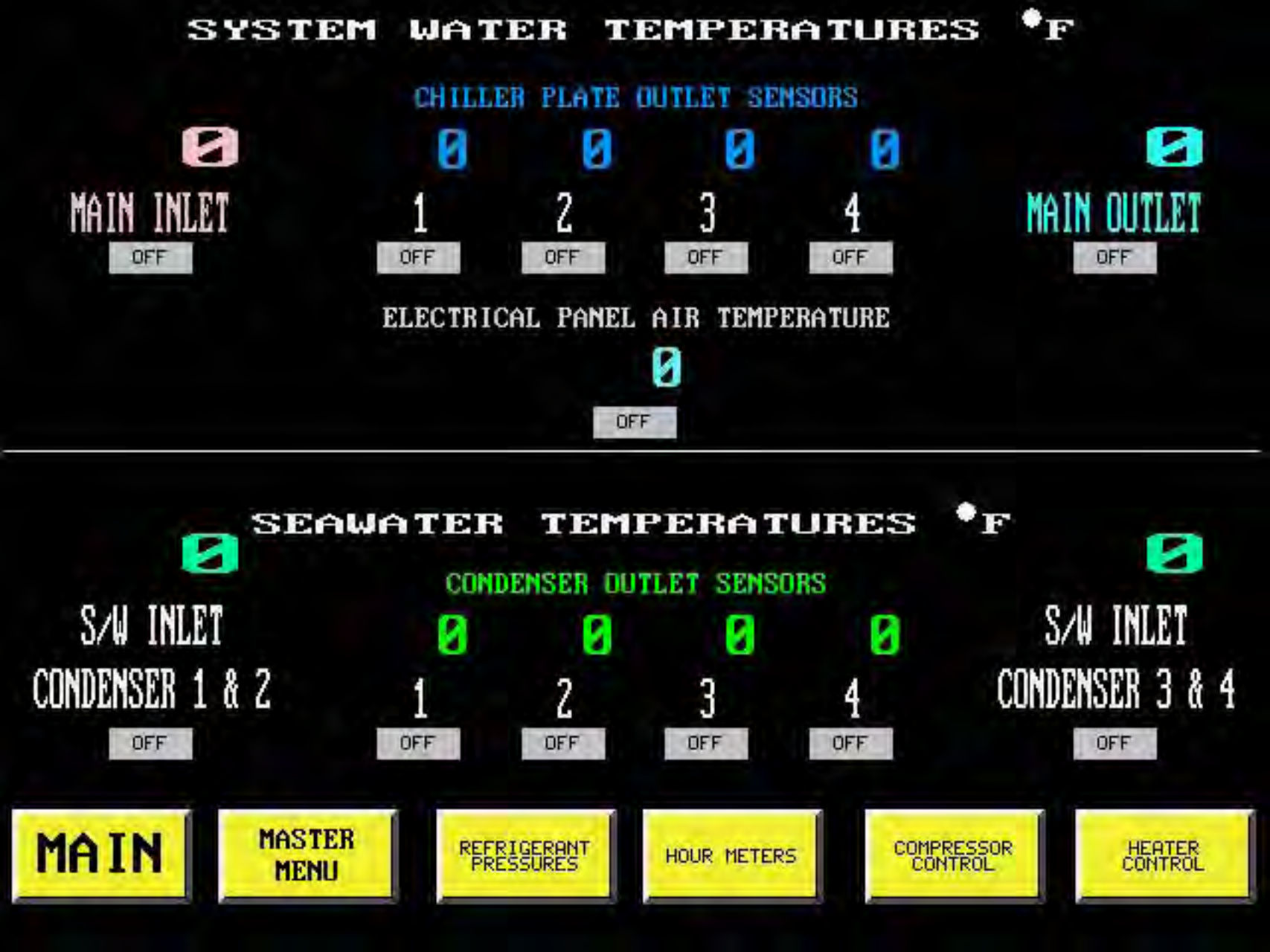
DISCHARGE
PRESSURE

MAIN

MASTER
MENU

COMPRESSOR
CONTROL

HEATER
CONTROL


SYSTEM WATER TEMPERATURES °F
CHILLER PLATE OUTLET SENSORS
0
0
0
0
MAIN INLET
1
2
3
4
MAIN OUTLET
OFF
OFF
OFF
OFF
OFF
OFF
ELECTRICAL PANEL AIR TEMPERATURE
0
OFF
SEAWATER TEMPERATURES °F
CONDENSER OUTLET SENSORS
0
0
0
0
S/W INLET
CONDENSER 1 & 2
1
2
3
4
S/W INLET
CONDENSER 3 & 4
OFF
OFF
OFF
OFF
OFF
OFF
MAIN
MASTER MENU
REFRIGERANT PRESSURES
HOUR METERS
COMPRESSOR CONTROL
HEATER CONTROL

HOUR METER DISPLAY & ADJUSTMENT

REFRIGERANT PRESSURES

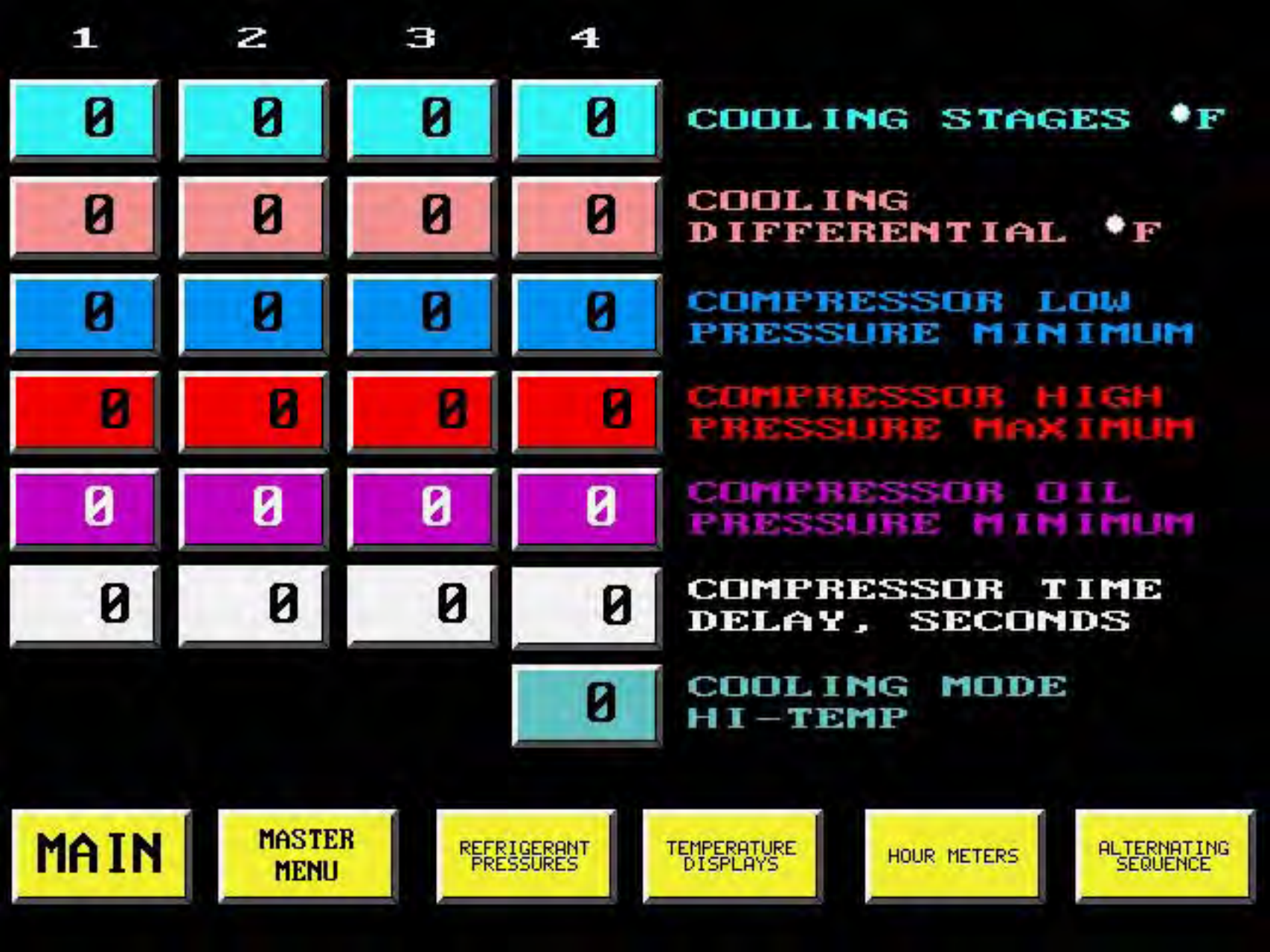
	SUCTION PRESSURE	DISCHARGE PRESSURE	OIL PRESSURE	
1	OFF	OFF	OFF	1
2	OFF	OFF	OFF	2
3	OFF	OFF	OFF	3
4	OFF	OFF	OFF	4

MAIN

MASTER MENU

COMPRESSOR CONTROL


MODULATE INVERTER OUTPUT
RAMP DOWN START TEMP deg F & 0-4095
INVERTER SPEED REF H2 & 0-4095
INVERTER MODULATION INFORMATION
1
OFF
00
00.0
0000
0000
2
OFF
00
00.0
0000
0000
3
OFF
00
00.0
0000
0000
4
OFF
00
00.0
0000
0000
MAIN
MASTER MENU
COMPRESSOR CONTROL
COOLING SETTINGS


1
2
3
4
0
0
0
0
COOLING STAGES °F
0
0
0
0
COOLING DIFFERENTIAL °F
0
0
0
0
COMPRESSOR LOW PRESSURE MINIMUM
0
0
0
0
COMPRESSOR HIGH PRESSURE MAXIMUM
0
0
0
0
COMPRESSOR OIL PRESSURE MINIMUM
0
0
0
0
COMPRESSOR TIME DELAY, SECONDS
0
COOLING MODE HI-TEMP
MAIN
MASTER MENU
REFRIGERANT PRESSURES
TEMPERATURE DISPLAYS
HOUR METERS
ALTERNATING SEQUENCE

HEATER CONTROL

1 2 3

OFF OFF OFF

HEATERS

HEATING STAGES

SYSTEM INLET 0

1 2 3

000 000 000

SYSTEM OUTLET 0

MAIN | MASTER MENU | TEMPERATURE DISPLAYS | HOUR METERS | HEATING SETTINGS

HEATER SETTINGS

1	2	3	
0	0	0	HEATING STAGES °F
0	0	0	HEATING DIFFERENTIAL °F
0	0	0	HEATER TIME DELAY, secs
		0	HEATING MODE LOW TEMPERATURE ALARM

MAIN | MASTER MENU | HEATING CONTROL | TEMPERATURE DISPLAYS | HOUR METERS

ALARM HISTORY TOTAL OF 0 ALARMS

ENTRY	MESSAGE

ALARM COUNT	PAGE UP	PAGE DOWN	LINE UP	LINE DOWN	DETAILS	CLEAR ALL	EXIT

FACTORY SETTINGS

1	2		3	4
		BYPASS THE LP-HP-OP TRANSDUCERS		
		COMPRESSOR MANUAL RUN		

UNIT INLET SENSOR (UIS) BYPASS

0

BYPASS SETTING

UNIT OUTLET SENSOR (UOS) BYPASS

0

BYPASS SETTING

0 LOW REFRIGERANT PRESSURE TIME DELAY, secs

0 LUBE OIL PRESSURE TIME DELAY, secs

0 NUMBER of DEGREES IN MODULATING STAGE

FACTORY DEFAULT SETTINGS

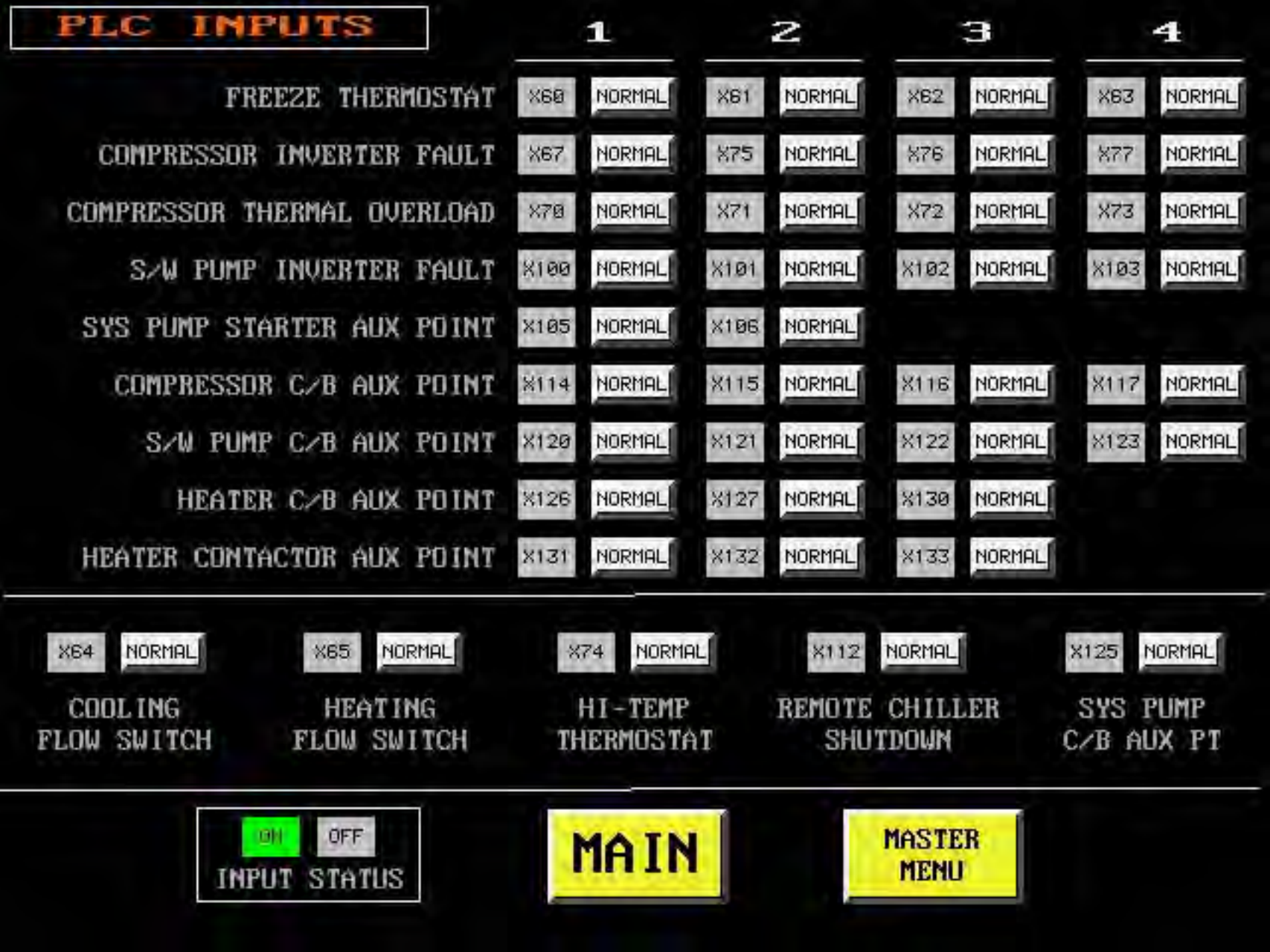
PRESS TO LOAD

MAIN

MASTER MENU

ADJUST TIME & DATE

11:30
25-SEP-08


PLC INPUTS
1
2
3
4
FREEZE THERMOSTAT
X60 NORMAL
X61 NORMAL
X62 NORMAL
X63 NORMAL
COMPRESSOR INVERTER FAULT
X67 NORMAL
X75 NORMAL
X76 NORMAL
X77 NORMAL
COMPRESSOR THERMAL OVERLOAD
X70 NORMAL
X71 NORMAL
X72 NORMAL
X73 NORMAL
S/W PUMP INVERTER FAULT
X100 NORMAL
X101 NORMAL
X102 NORMAL
X103 NORMAL
SYS PUMP STARTER AUX POINT
X105 NORMAL
X106 NORMAL
COMPRESSOR C/B AUX POINT
X114 NORMAL
X115 NORMAL
X116 NORMAL
X117 NORMAL
S/W PUMP C/B AUX POINT
X120 NORMAL
X121 NORMAL
X122 NORMAL
X123 NORMAL
HEATER C/B AUX POINT
X126 NORMAL
X127 NORMAL
X130 NORMAL
HEATER CONTACTOR AUX POINT
X131 NORMAL
X132 NORMAL
X133 NORMAL
X64 NORMAL
COOLING FLOW SWITCH
X65 NORMAL
HEATING FLOW SWITCH
X74 NORMAL
HI-TEMP THERMOSTAT
X112 NORMAL
REMOTE CHILLER SHUTDOWN
X125 NORMAL
SYS PUMP C/B AUX PT
ON
OFF
INPUT STATUS
MAIN
MASTER MENU

PLC OUTPUTS

	1		2		3		4	
LIQUID LINE SOLENOIDS	Y0	NORMAL	Y1	NORMAL	Y2	NORMAL	Y3	NORMAL
HEATER CONTACTORS	Y4	NORMAL	Y5	NORMAL	Y6	NORMAL		
CRANKCASE HEATERS	Y10	NORMAL	Y11	NORMAL	Y12	NORMAL	Y13	NORMAL
COMPRESSOR OVERLOAD	Y14	NORMAL	Y15	NORMAL	Y16	NORMAL	Y17	NORMAL
GENERAL CHILLER ALARM OUTPUT	Y20	NORMAL						
S/W PUMP INVERTER START RELAY	Y21	NORMAL	Y22	NORMAL	Y23	NORMAL	Y24	NORMAL
SYSTEM PUMP STARTER	Y26	NORMAL	Y27	NORMAL				
COMPRESSOR INVERTER START RELAY	Y30	NORMAL	Y31	NORMAL	Y32	NORMAL	Y33	NORMAL

MAIN

MASTER MENU

SYSTEM WATER TEMPERATURE SENSOR CALIBRATION

	ACTUAL SENSOR TEMP		AMOUNT TO ADD		AMOUNT TO SUBTRACT		DISPLAYED TEMPERATURE
MAIN INLET OFF	0	+	0	−	0	=	0
MAIN OUTLET OFF	0	+	0	−	0	=	0

ALL TEMPERATURES DISPLAYED ARE IN °F

MAIN | MASTER MENU | TEMPERATURE DISPLAYS

TIME AND DATE ADJUSTMENT

TIME

00000000

ENTER THE NEW TIME HERE IN THE FOLLOWING FORMAT:
00HHMMSS

00 = 00 (2 ZEROES, NOT USED)
HH = HOUR, 1-23
MM = MINUTES, 1-59
SS = SECONDS, 1-59

EXAMPLES
10:13am 00101300
4:49pm 00164900

Press to Update TIME

CURRENT TIME
13:17:52
09/25/08
CURRENT DATE

MAIN

MASTER MENU

DATE

00000000

ENTER THE NEW DATE HERE IN THE FOLLOWING FORMAT:
YYMMDDdw

YY = YEAR, 0-99
MM = MONTH, 1-12
DD = DAY, 1-31
dw = Day of Week, 0-6 (0=Sunday, 1=Monday, 2=Tuesday), etc

EXAMPLE
Friday, August 22, 2008 = 08082205

Press to Update DATE

PLC CPU INFORMATION

0000 FATAL ERROR CODE V7755

0000 MAJOR ERROR CODE V7756

00000000 MODULE ERROR - BASE & SLOT NUMBER V7760

0000 MODULE ERROR - ERROR CODE V7762

0000 CURRENT SCAN TIME, ms V7775

0000 MINIMUM SCAN TIME, ms V7776

0000 MAXIMUM SCAN TIME, ms V7777

MAIN

MASTER MENU

AQUA-AIR MANUFACTURING
1050 E. 9th St. Hialeah, Florida 33010

305-884-8363 800-328-1043
www.aquaair.com

Version EZA10.1 Project 08020401

MASTER MENU

James D. Nall Company Inc.

AQUA-AIR
MARINE AIR CONDITIONING SYSTEMS

COMPANY HISTORY

- Formed in 1941, the James D. Nall Company, Inc. is the oldest name in marine air conditioning with a 66 year history of providing marine air conditioning products and services. It is also the 2nd largest manufacturer of marine air conditioning systems in North America. The company has distributed and installed innovative Direct Expansion (DX) systems of its own design and manufacture since its inception. In 1973 under the trade name of **Aqua-Air**, the company designed and introduced chillwater technology to the yachting community. The chillwater product designed and manufactured by **Aqua-Air**, along with direct expansion products supplied by Cruisair were distributed by the company until 1983 when the Cruisair product was replaced with a full line of newly designed, **Aqua-Air** brand direct expansion products. Since that time, the most diverse and complete lines of direct expansion and chillwater marine air conditioning products, designed for the yacht builders and servicing dealers, have been manufactured and distributed by **Aqua-Air**.

- Quality and innovation have been the hallmark of the company making the **Aqua-Air** brand the preferred product throughout the mega yacht segment of the market. **Aqua-Air** boasts a larger installed base of product on the world's mega yachts than the sum total of all the other brands combined. Some of the technologies that are commonplace throughout the industry were the **Aqua-Air** innovations that moved the company and the industry forward. The Fresh Air Make Up System, Digital Thermostat, Racked System, Automatic Compressor Rotation, PLC Control and the use of Variable Frequency Drives were just a few of the past technological advancements fostered by **Aqua-Air**. Continuing R&D has yielded recent innovations; the new R-407C refrigerant products to take the industry into compliance under the strict environmental protections of the Montreal Protocol, and the "World's Smallest" self contained system.

- Operating from our 65,000 square foot manufacturing facility in the Miami suburb of Hialeah, **Aqua-Air** supplies a worldwide network of boat builders and dealers. All products are built and rated to ASHRAE standards and comply with ABYC and CE guidelines. Each and every unit built by **Aqua-Air** undergoes rigid testing and quality control both during the production process and prior to packaging. Our exclusive 3 stage process tests for refrigerant circuit and condenser coil integrity under simulated field conditions. Our warranty program and extensive servicing dealer base provide the end user with quick service in the event of a problem. The service network is backed up by the best technical support in the industry.

- Our capabilities run from the 'world's smallest' 5,000 BTU ***mini-kool*** self contained kit for the consumer to install on his small boat, all the way to the 210 ton (2,520,000 BTU) Chillwater system installed in the 316' "LIMITLESS" launched from Lurssens in 1997. Most of the world renowned Naval Architects and most **Aqua-Air** owners insist on **Aqua-Air** systems. Today, as it has been for over 70 years, our commitment is to be the best.

PRODUCT LINE

- **Chilled Water Systems** – Our Alpha Chiller is the largest selling chiller in the megayacht industry today. Ranging in size from 2 ton to 6 ton, and featuring a stainless steel chassis, scroll compressors and AWLGRIP coatings. Compared to other brands, the Alpha Chiller is 22% lighter and 38% smaller in volume. If a vessel's requirements exceed 6 ton, multiple Alpha Chillers are racked together, manifolded on the seawater and chillwater circuits to form capacities up to 30 ton. Units are available with reverse cycle or cooling only, up to six stages and variable frequency drives to provide surgeless compressor startup. The units are protected with chillwater flow switch and freeze stats on each chiller module, along with a variety of other features. This proven product is simply the best on the market today. In addition, we have the technical expertise and experience, to design and produce large (up to 300 ton) custom chillers incorporating the proven engineering concepts of the Alpha Chiller line, and refined over the years.
- **Split Systems** – We offer a complete line of split DX systems, in capacities of 5,000 to 60,000 BTU. Each of the units is equipped with reverse cycle heat and piston or scroll compressors. Along with the condensing units we also offer a matching line of DX fan coils in a wide array of sizes and configurations insuring that every boat owner has versatility of installation.
- **Self Contained Systems** – For the smaller boats, we have a complete line of self-contained units, including the smallest unit on the market, the Aqua-Air Minikool. The product line includes capacities from 5,000 to 24,000 BTU, and the compact size, quiet operation and efficient design lends itself to installation under a berth, in a closet or any other underutilized area. All units with the exception of the Minikool come standard with reverse cycle heat.
- **Accessories** – This is a supporting product line that includes all the miscellaneous components that are available for use with our core products, such as ducting, grilles, pumps, thermostats and controls, relays, transition boxes, filters, line sets and various installation kits.

PRODUCT DOCUMENTATION

- Bills of Material – All models have been computerized and an updated bill of material is available on demand from the computer network.
- Drawings and Specifications – Although some of the older drawings are still in hard copy format, all of the newer drawings (after 1994) are CAD generated.
- History (manuals) – The Company has maintained over the years, an installation/ operation manual on each yacht that carries our chillwater equipment. This manual includes an equipment list, wiring diagrams and product specification sheets on all products and accessories supplied to that particular vessel. All new manuals are being generated and stored electronically.

TERMS

- Terms for international orders are 50% with the order and the remainder before shipment (generally wire transfer).
- Self Contained & DX systems – Small orders (less than $5K) normally do not require a deposit, but payment in full is required before shipment.

WEBSITE

- The company website was designed in house and can be accessed at www.aquaair.com

James D. Nall Co., Inc.
Aqua-Air Manufacturing
Limited Warranty

I. GENERALLY

A. This limited Warranty applies to any products manufactured by the James D. Nall Co., Inc., herein sometimes referred to as "COMPANY," "MANUFACTURER" or "AQUA-AIR." The Company furnishes this written notice that its products and systems are under a limited warranty to be free from design and manufacturing defects in material and workmanship under normal use and service or as otherwise authorized by the Manufacturer. The obligation of the Company is limited to replacing or repairing any component which will disclose defects within the time frames defined in section II (Warranty Period) and which, upon examination, may appear to the satisfaction of the Company to be defective or not as specified for its performance. Within thirty (30) days of the discovery a claim must be filed with the Company and the faulty component must be returned, transportation prepaid, to the Company. At the specific option of the Company it may, as an alternative to the return of the component, examine and inspect it in place at its usual location. Nothing herein contained will create any obligation of the Company to so examine or inspect the component away from the premises of the Manufacturer.

B. This Warranty will not apply to:
1. Failures resulting from abuse, fire or submergence.
2. Any part manufactured by the Company which will have been altered so as to impair original characteristics.
3. Any parts which fail as a result of misuse, improper application or improper installation.
4. Items not manufactured by the company, i.e., items which are purchased from another manufacturer and supplied as received by the Company without alteration or modification. The Company will disclose the existence of any warranty, limited or otherwise, if any, given by the manufacturer of any items not made by Aqua-Air.
5. Components or parts used by or applied by the purchaser as an integral part of products not manufactured by the Company.
6. The failure of the buyer to give the required notice or to comply with other conditions of this limited warranty.

C. This limited warranty is made in lieu of all other express warranties, obligations or liabilities on the part of Aqua-Air. In addition, Aqua-Air disclaims, without limitation, any liabilities arising from incidental or consequential damages except as may occur while the product is being operated by and under the control of the Company. In such instances where a cash refund is made, the refund will effect the cancellation of the contract of sale with no subsequent reservations of rights being retained by the purchaser. The terms and conditions of this limited warranty will be governed by the laws of the State of Florida.

D. No dealer is the agent for Aqua-Air except for the purpose of administering this limited warranty to the extent herein provided. Aqua-Air does not authorize any dealer or other person to assume for Aqua-Air any liability in connection with this limited warranty or any liability or expense incurred in the replacement or repair of its products other than those expressly authorized herein.

E. The Company reserves the right to improve its products through changes in design or material without being obligated to incorporate such changes in products of prior manufacture and to make changes at any time in design, materials or part of units of any one year model, without obligation or liability to owners of units of the same year's model of prior manufacture.

F. This warranty gives you, the purchaser, specific legal rights. You also have implied warranty rights, including an implied warranty of merchantability, which means that your product must be fit for the ordinary purpose for which such goods are used. The duration of this implied warranty is limited to the duration of the expressed warranty as found in section II, WARRANTY PERIOD.

G. This warranty extends only to the original purchaser (other than for purposes of resale) of Aqua-Air warranty equipment and any other such person who is entitled, under applicable State law, to enforce against the warrantor the obligations of the warranty.

II. WARRANTY PERIOD

A. The limited warranty covers the following periods (whichever comes first):

1. Twelve (12) months from the date that the selling dealer puts the system into operation or

2. Eighteen (18) months from the date that the system is sold to the original purchaser.

In the case of factory installed equipment, the warranty period begins when the selling dealer first puts the equipment into operation. The warranty beginning date may be prior to the date of delivery to the retail purchaser. No warranty claim can be honored unless the owners' registration form is on file with the Company. This form, which is enclosed, should therefore be returned to Aqua-Air immediately upon purchase of items covered by this warranty.

B. All Aqua-Air components have a name plate on which there is a model and serial number. The serial number is date coded, indicating when the unit was originally sold.

C. To determine whether or not any Aqua-Air component is in warranty you may contact Aqua-Air at:

Aqua-Air Manufacturing, division of the James D. Nall Co., Inc
1050 E. 9th St., Hialeah, FL 33010
Phone: 305-884-8363 Fax: 305-883-8549 Email: service@aquaair.com

III. WARRANTY COVERAGE

The Aqua-Air warranty covers the basic component units manufactured by Aqua-Air. Installation and application of Aqua-Air components are not warranted by Aqua-Air because Aqua-Air has no control or authority over the selection, location, application or installation of these components. The following are installation or application considerations not covered by the Aqua-Air warranty:

1. Flare or solder joint leaks in the connecting copper tubing.
2. Condensate leakage resulting from the inadequately insulated connecting tubing or improperly installed condensate drains.
3. Water flow problems resulting from the improper plumbing considerations or inadequate filters or strainers.
4. Low voltage or loss of power as a result of inadequate wiring, circuit breakers, fuses or wire connectors.
5. Low capacity output resulting from improperly sized or located air grilles, vents, ducts, plenums or cooling units.
6. Inadequate cooling or heating capacity resulting from the selection of undersized equipment. Aqua-Air may make recommendations as to the capacity of the equipment for a specific installation, however, the final decision concerning exactly what equipment will be used and the responsibility for the effectiveness of the equipment selected lies solely with the purchaser. The only exception and only case in which Aqua-Air would assume full responsibilities would be in the event Aqua-Air were retained under a separate contract to make such determinations.
7. Inadequate cooling or heating resulting from systems being improperly charged with refrigerant gas.
8. Pump seal leakage due to the pumps being run with insufficient water in the head.

IV. LIMITED WARRANTY ALLOWANCES

Limited warranty allowances as outlined in publications F-104 and F-110 are also available to defer expenses incurred in the repair or replacement of all such components for the period of the system warranty. Replacement parts and components for out-of-warranty systems are also warranted for one year but no allowance to defer expenses incurred in the repair or replacement of such components is available. Components or parts not used as an integral part of an Aqua-Air system are not covered by the Company warranty.

AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

100 Ton Chillers

CHILLER UNIT SPECIFICATION
OM100-4E

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

COOLING CAPACITY: 100 tons [1,200,000 BTU/H] [300,000 KCAL/H] at 40˚ F (7.2˚ C) leaving water temperature and 50˚ F (12.8˚ C) returning water temperature. Chiller unit flow rate will be approximately 300 gpm. Condenser flow rate (each) is to be approximately 100 gpm entering at a maximum temperature of 90˚ F (32˚ C). All ratings are at a fouling factor of 0.0005 .

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.

COMPRESSORS: The chiller unit will have four, 25 ton Bitzer semi-hermetic reciprocating compressors. Each compressor will be equipped with suction and discharge valves. Input voltage to the compressor motor will be 460-3-60. Power consumption of each compressor is approximately 21.1 kW each. Refrigerant to be used is R-22

CHILLER BARREL: The unit is equipped with a four circuit, 100 ton shell and tube chiller barrel. The shell is constructed of steel per ASME specification SA-53, Grade B. The shells are shot blasted and cleaned before assembly. The tubes are high performance seamless copper tube to ASME specs. Tubes are roller expanded into double grooved tube sheets. The tube sheets are ASME grade carbon steel. The baffles are hot rolled steel, terne plated for added corrosion resistance. The heads are ASME grade steel fabricated ring and cover type steel heads. Gaskets are die-cut medium density elastomer in conformance with relevant specifications. The chillwater connections are 5" 150lb ANSI raised face flanges (2). The refrigerant side is constructed in accordance with the latest edition of Section VIII, Division I of ASME Code for pressure vessels and stamped accordingly. Tube side (refrigerant side) design pressure is 200 PSIG at 100 ˚F. Shell side (fluid side) design pressure is 150 PSIG at 120 ˚F. The entire shell is covered with 3/4" (19mm) thick Armaflex foam rubber insulation.

CONDENSERS: The unit is equipped with four 25 ton 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" FPT.

Water flow to the condenser will be regulated by a discharge pressure actuated water regulating valve. A pressure relief valve (set for 350 psig) on the shell is standard.

REFRIGERANT CIRCUIT: Each of the four refrigerant circuits shall include a liquid line ball valve, replaceable core liquid line filter drier with access fitting for refrigerant charging and refrigerant isolation valves, 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.

***CONTROL PANEL / ELECTRICAL BOX*:** The unit will have a single NEMA 12 type electrical box. The panel will be comprised of the following main components:

- Main Control:Hydro-Matic microprocessor based control system with the following primary features:
- On-Off control of chiller compressors
- Display of chillwater inlet and outlet temperatures for the entire unit
- Display of seawater outlet temperatures for each fifteen ton module
- Monitors refrigerant high and low pressure faults, freeze thermostats and flow switch
- Automatic sequencing of compressors to achieve equal run times
- Service LED indicates fault condition
- Temperatures can be displayed in either Fahrenheit or Celsius
- Compressor LED's indicate operating status of each compressor

CONTROL PANEL / ELECTRICAL BOX (cont)

- Incoming power is checked for low and high voltage conditions

Motor starters will be provided for the compressors, chillwater and seawater pumps (2). A selector switch will be provided on the front of the panel to select between the primary and standby seawater pumps.

Circuit breakers will be provided for each compressor (5), seawater pump, chillwater pump and control circuitry. Circuit breakers will be rated for use on 480/3/60 power input.

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 and then painted to meet 500 hour salt spray requirement using ***Awlgrip Matterhorn White paint.*** Stainless steel drain pans with a non-corrosive internal coating will be installed under any condensate producing components.

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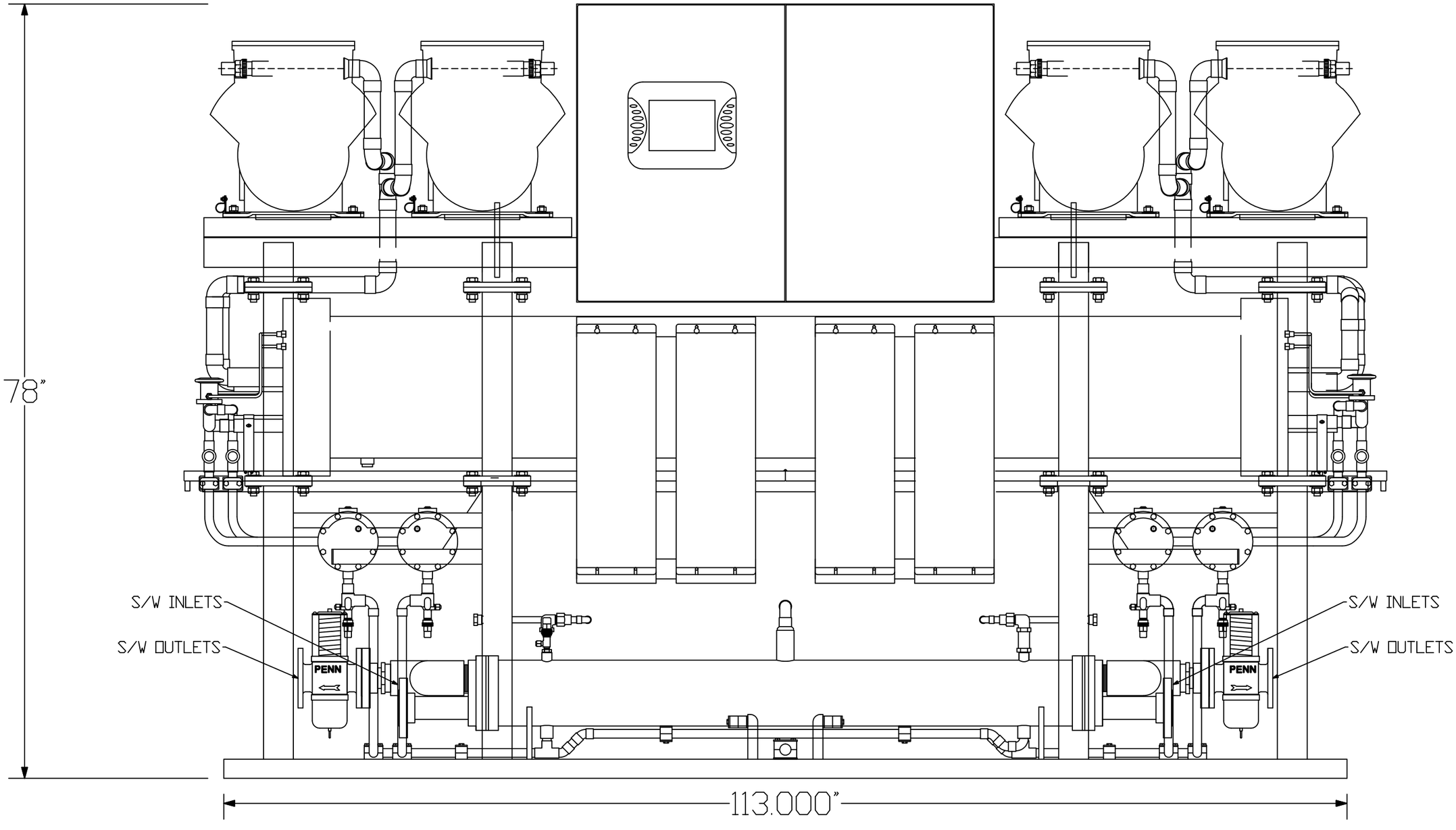
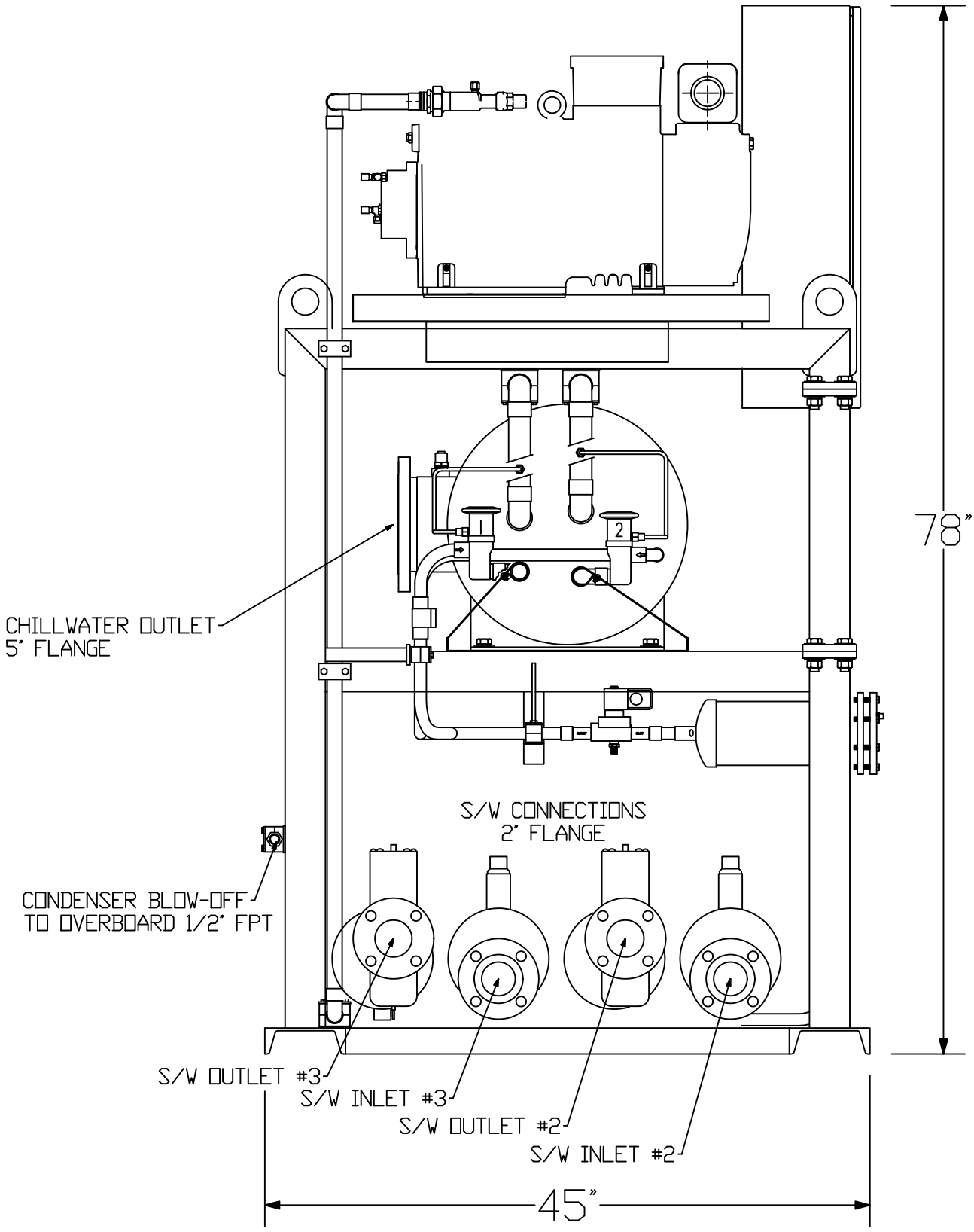


AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM100P4VEK CHILLER UNIT
100 TON, 4 STAGE 380-3-50

DRAWING NUMBER OM100P4VEK6	DRAWN BY DN	DATE 11-13-03	
SCALE FULL	APPROVED BY	REVISION DATE	REV A



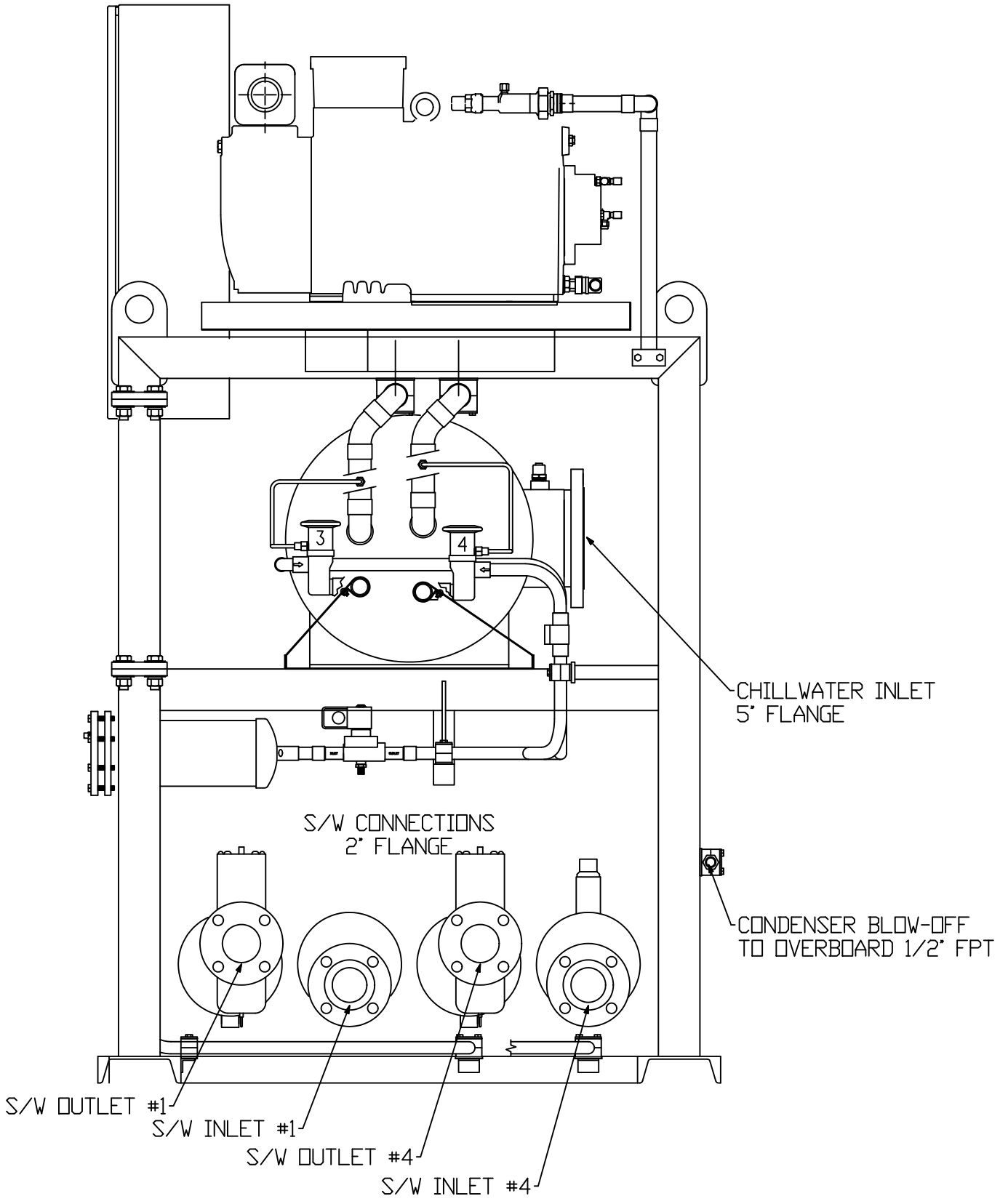
LEFT
VIEW

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM100P4VEK CHILLER UNIT
100 TON, 4 STAGE 380-3-50

DRAWING NUMBER	DRAWN BY	DATE
OM100P4VEKa	DN	11-13-03

SCALE	APPROVED BY	REVISION DATE	REV
FULL			A



RIGHT
VIEW

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM100-4VIHE CHILLER UNIT
100 TON, 4 STAGE 380-3-50

DRAWING NUMBER	DRAWN BY	DATE
OM100P4VEKc	DN	11-13-03

SCALE	APPROVED BY	REVISION DATE	REV
FULL			A

CHILLER UNIT SPECIFICATION

OM100-4VIHE

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

COOLING CAPACITY: 100 tons [1,200,000 BTU/H] [300,000 KCAL/H] at 40˚ F (7.2˚ C) leaving water temperature and 50˚ F (12.8˚ C) returning water temperature. Chiller unit flow rate will be approximately 300 gpm. Condenser flow rate (each) is to be approximately 100 gpm entering at a maximum temperature of 90˚ F (32˚ C). All ratings are at a fouling factor of 0.0005 .

HEATING CAPACITY: 108 kW [368,511 BTU/H] [92,863 KCAL/H] of total heating capacity at 140˚ F (60˚ C) leaving water temperature and 120˚ F (48.8˚ C) 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.

COMPRESSORS: The chiller unit will have four, 25 ton Bitzer semi-hermetic reciprocating compressors. Each compressor will be equipped with suction and discharge valves. Input voltage to the compressor motor will be 460-3-60. Power consumption of each compressor is approximately 21.1 kW each. Refrigerant to be used is R-407C .

CAPACITY CONTROL: Chiller unit capacity control will be achieved through the use of three 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 460-3-60. The maximum output power will be 460-3-60 to the compressor motor. The VFD output will be regulated via the RS-485 network between the VFD and the chiller unit 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.

CHILLER BARREL: The unit is equipped with a four circuit, 100 ton shell and tube chiller barrel. The shell is constructed of steel per ASME specification SA-53, Grade B. The shells are shot blasted and cleaned before assembly. The tubes are high performance seamless copper tube to ASME specs. Tubes are roller expanded into double grooved tube sheets. The tube sheets are ASME grade carbon steel. The baffles are hot rolled steel, terne plated for added corrosion resistance. The heads are ASME grade steel fabricated ring and cover type steel heads. Gaskets are die-cut medium density elastomer in conformance with relevant specifications. The chillwater connections are 5" 150lb ANSI raised face flanges (2). The refrigerant side is constructed in accordance with the latest edition of Section VIII, Division I of ASME Code for pressure vessels and stamped accordingly. Tube side (refrigerant side) design pressure is 200 PSIG at 100 ˚F. Shell side (fluid side) design pressure is 150 PSIG at 120 ˚F. The entire shell is covered with 3/4" (19mm) thick Armaflex foam rubber insulation.

CONDENSERS: The unit is equipped with four 25 ton 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" FPT.

Water flow to the condenser will be regulated by a discharge pressure actuated water regulating valve. A pressure relief valve (set for 350 psig) on the shell is standard.

IMMERSION HEATER ELEMENTS: The unit is equipped with a three stage, 12 element, 108 kW immersion heating tank assembly. The heater elements are rated at full wattage on 460-3-60 power input. The elements are constructed of Incoloy with a maximum watt density of 100 watts per square inch. The element heater tank will be constructed of plate steel to ASME specifications. All welds will be by MIG welding procedure. 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 liquid line ball valve, replaceable core liquid line filter drier with access fitting for refrigerant charging and refrigerant isolation valves, 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.

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

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)

A complete description of the functions of the PLC / Touchscreen system can be found in the document following this specification.

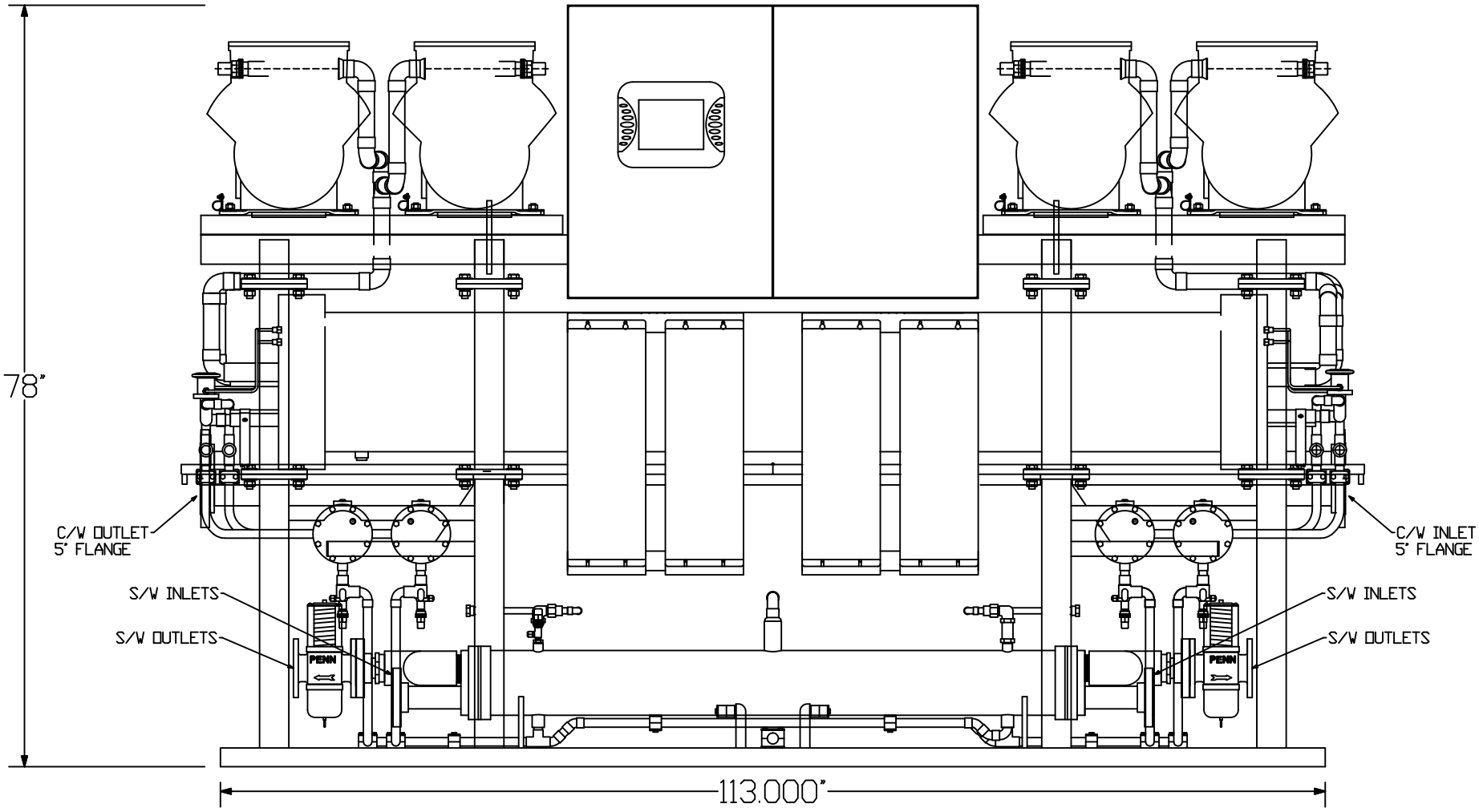
A phone communication modem will be included that will allow the PLC to be accessed remotely for diagnostic purposes.

An Ethernet card will allow communication (via MODBUS) between the chiller and the five air handler control panels as well as with the ships' monitoring 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.

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 and then painted to meet 500 hour salt spray requirement using Awlgrip Matterhorn White paint. Stainless steel drain pans with a non-corrosive internal coating will be installed under any condensate producing components.

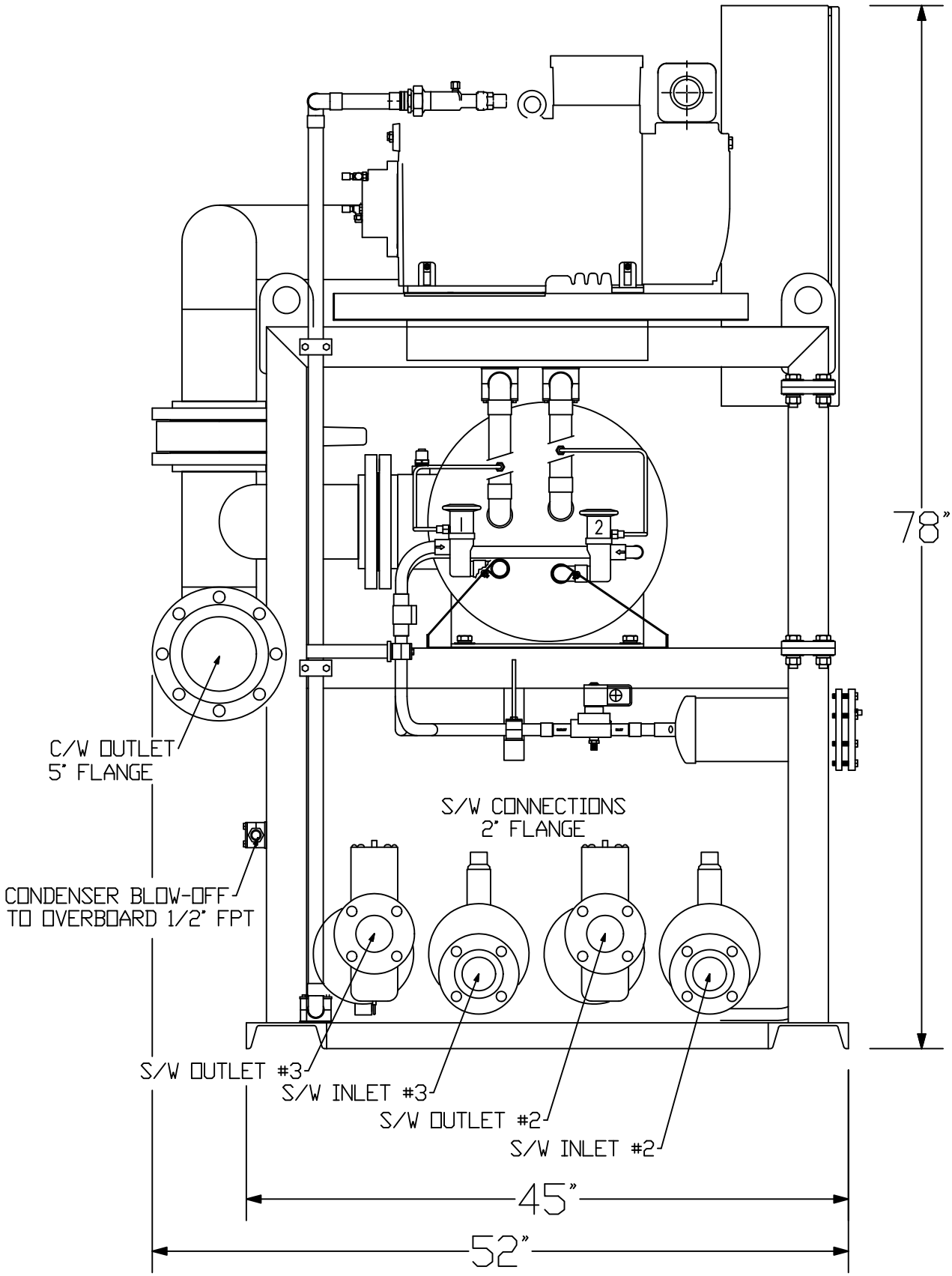
AQUA-AIR MANUFACTURING, division of the James D. Nall Co., Inc.
1050 East 9th Street, Hialeah, Florida 33010 U.S.A.
Ph. 305-884-8363 Fax 305-883-8549 E-mail sales@aquaair.com



AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM100-4VIHE CHILLER UNIT
100 TON, 4 STAGE w/ 108 kW IMMERSION HEAT

DRAWING NUMBER: OM100-4VIHE6	DRAWN BY: DN	DATE: 03-17-03
SCALE: FULL	APPROVED BY:	REVISION DATE:
		REV: A



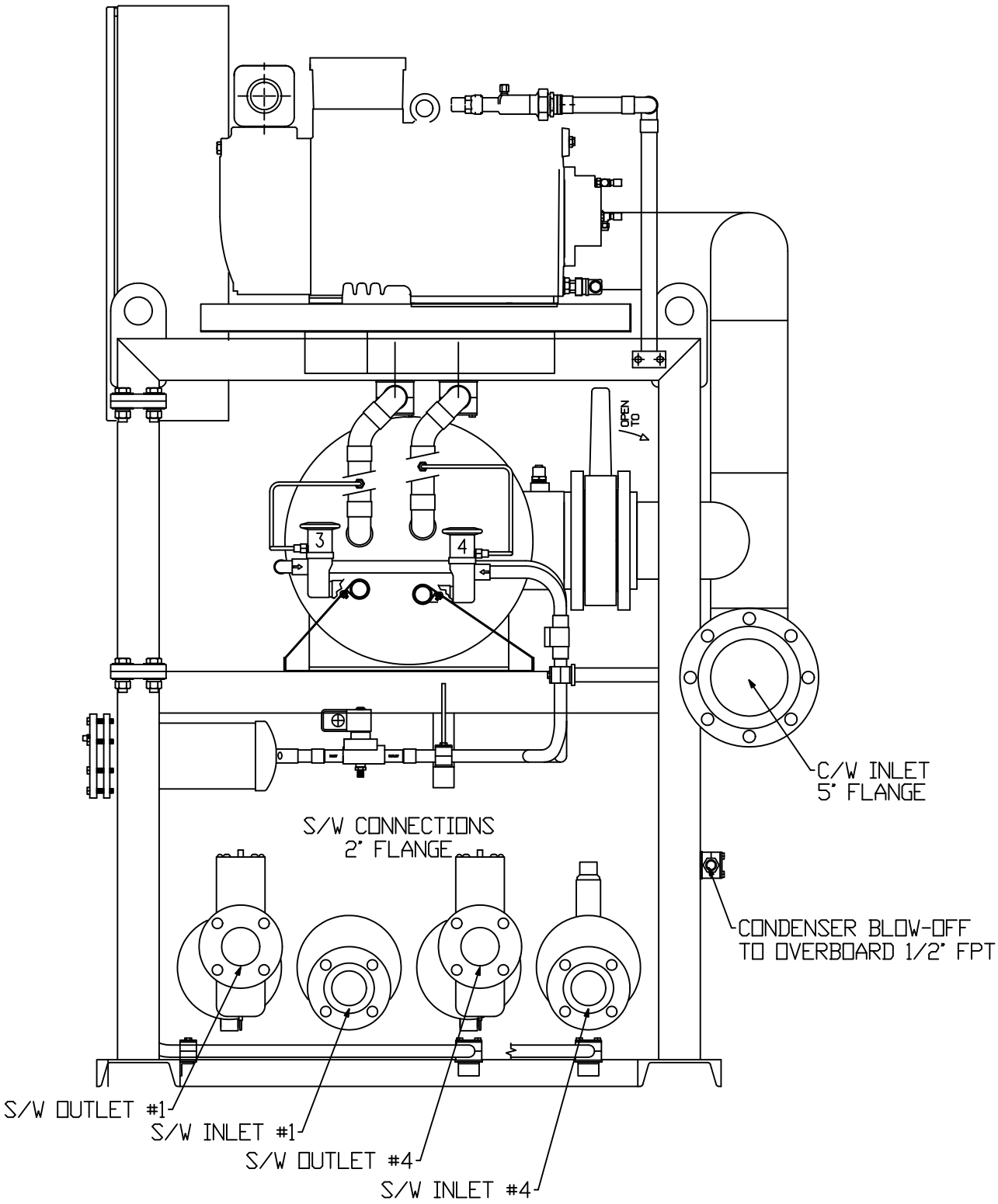
LEFT VIEW

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM100-4VIHE CHILLER UNIT
100 TON, 4 STAGE w/ 108 kW IMMERSION HEAT

DRAWING NUMBER	DRAWN BY	DATE
OM100-4VIHEa	DN	3-17-03

SCALE	APPROVED BY	REVISION DATE	REV
FULL			A



RIGHT VIEW

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM100-4VIHE CHILLER UNIT
100 TON, 4 STAGE w/ 108 kW IMMERSION HEAT

DRAWING NUMBER	DRAWN BY	DATE
OM100-4VIHEc	DN	3-17-03

SCALE	APPROVED BY	REVISION DATE	REV
FULL			A

AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

170 Ton Chillers

CHILLER UNIT SPECIFICATION

OM170P-2VEK

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

COOLING CAPACITY: 170 tons (2,040,000 BTU/H) { 600 kW } at 35° F { 2° C } leaving water temperature and 45° F { 7° C } returning water temperature. Chiller unit flow rate will be approximately 418 gpm { 95 m^3h }. Condenser flow rate (each) is to be approximately 340 gpm { 77 m^3h } entering at a maximum temperature of 90° F { 32° C }. All ratings are at a fouling factor of 0.0005

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.

COMPRESSORS: The chiller unit will have two, 85 ton {300 kW} Bitzer semi-hermetic compact screw compressors. Each compressor will be equipped with suction and discharge valves. Input voltage to the compressor motor will be 380-3-50. Power consumption of each compressor is approximately 91 kW each. Refrigerant to be used is R-407C .

CAPACITY CONTROL: Infinite capacity control of each compressor will be achieved through the use of four unloaders on each compressor. These unloaders will be regulated by the PLC to maintain a consistent set point under changing load conditions. The unloaders will also allow the compressor to be started unloaded.
Each compressor will be connected to a Variable Frequency Drive (VFD). The VFD will control the compressor motor so that there is no current inrush, during starting, above the motor's standard running amperage. The VFD requires an input power supply of 380-3-50. The maximum output power will be 380-3-50 to the compressor motor.

COOLER: The unit is equipped with two plate style heat exchangers, each of 85 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" {13mm} thick closed cell insulation. Water flow through each plate will be 209 gpm { 47.5 m^3h } at a pressure drop of 7.20 psi {0.50 bar }. The water in the chillwater look will require a 10% glycol mixture. Dowtherm SR-1 is recommended.

CONDENSER: The unit is equipped with two 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 3" NPT. 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.

REFRIGERANT CIRCUIT: Each of the two refrigerant circuits shall include a suction line ball valve, suction line filter, 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, refrigerant pressure transducers 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 touchscreen mounted on the front of the electrical box. This touchscreen will perform the following main switching functions in addition to numerous other minor controls:

System On-Off Switch
Compressor On-Off Switch (2)
Chillwater Pump Selector Switch

The touch screen will also display the following information

Digital refrigerant pressure readouts (suction and discharge) for each compressor

Digital temperature display for the chillwater inlet and outlet temperatures

Digital temperature display for the seawater outlet temperatures on each condenser

Elapsed time meters showing the run times for all compressors and pumps

Chillwater pump motor fault indication
Compressor inverter operational (2)
Cooling stage engaged (2)
Chiller freeze thermostat engaged
Low chillwater flow through the chiller
Low compressor refrigerant pressure (2)
High compressor refrigerant pressure (2)
Compressor motor overload (2)
High compressor discharge temperature (2)
Compressor inverter fault indicator (2)

A sample of the touchscreen displays (used on a four stage system) is included as an example.

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.

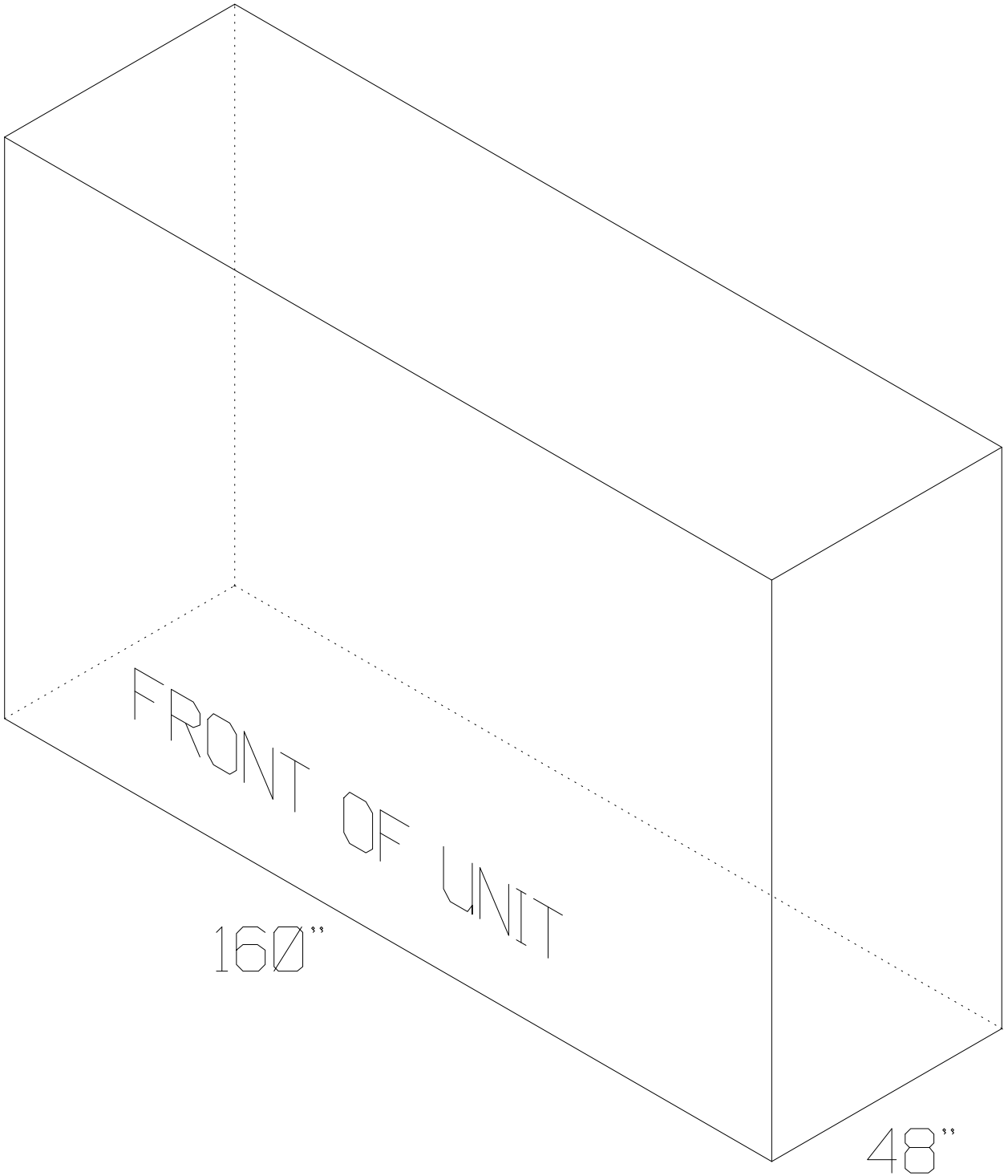
Circuit breakers will be provided for the compressors (2), seawater pumps (2), chillwater pump and control circuitry. All wiring on the unit external to the electrical box will be enclosed in liquid-tite conduit or other approved protective sheathing.

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. Paint will include a final topcoat of Awlgrip Matterhorn White. Stainless steel drain pans with a non-corrosive internal coating will be installed under any condensate producing components.

NET PRICE: The net price for each OM170P-2VEK is **$373,256.00** each. All prices are FOB our plant in Miami, FL. Delivery for each chiller is 16 weeks after receipt of order and deposit.

i:\wordpfct\OM170P-2VEK Sterling Yacht Vega 85m.wpd

AQUA-AIR MANUFACTURING, division of the James D. Nall Co., Inc.
1050 East 9th Street, Hialeah, Florida 33010 U.S.A.
Ph. 305-884-8363 Fax 305-883-8549 E-mail sales@aquaair.com



AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

OM170P-2VEK
OVERALL DIMENSIONS

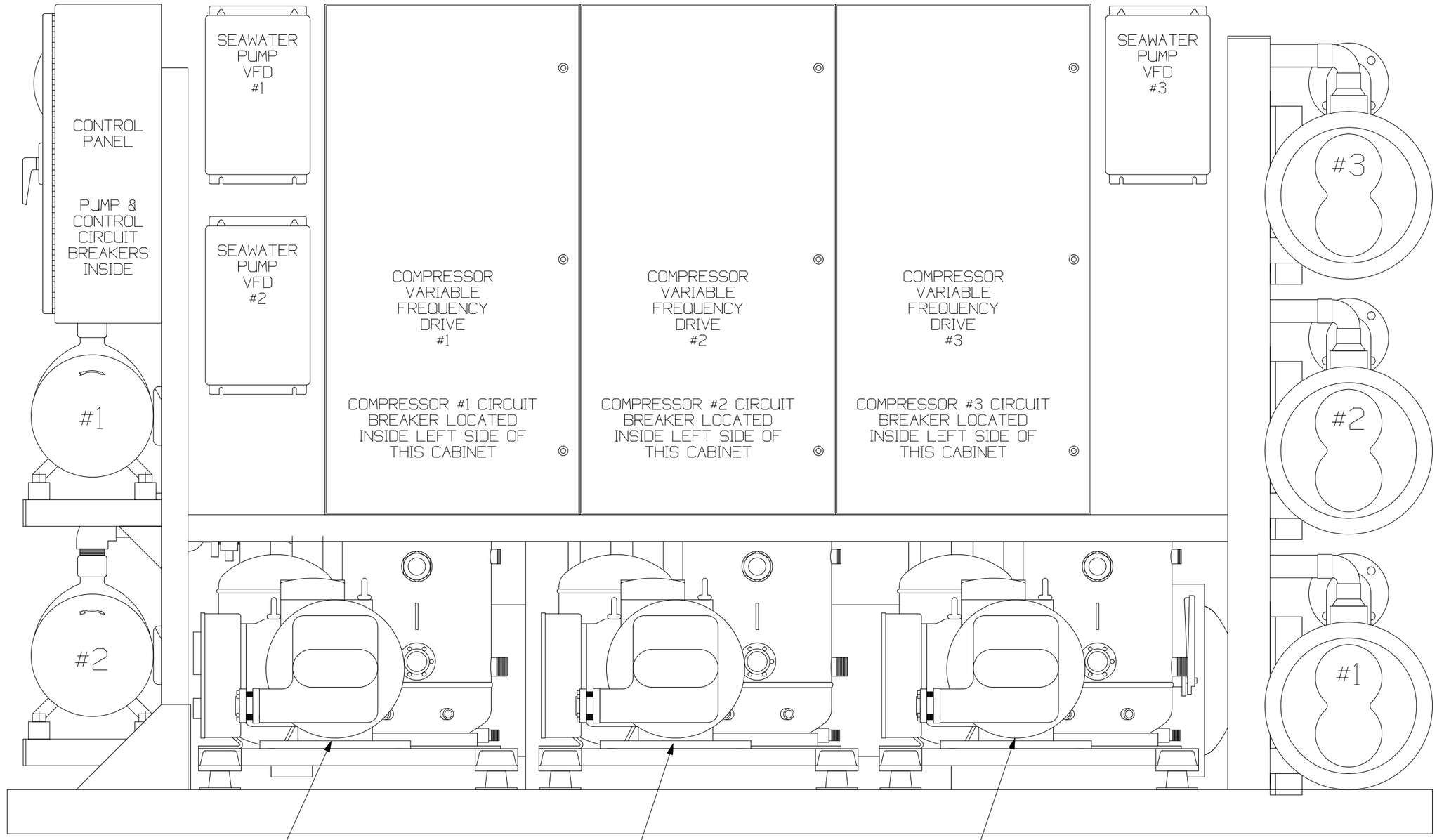
DRAWING NUMBER	DRAWN BY	DATE
OM170P-2VEK	DN	081204

SCALE	APPROVED BY	REVISION DATE	REV
FULL			A

AQUAAIR

MARINE AIR CONDITIONING SYSTEMS

210 Ton Chillers



0 6 12 18 24

SCALE - INCHES

0 200 400 600 800

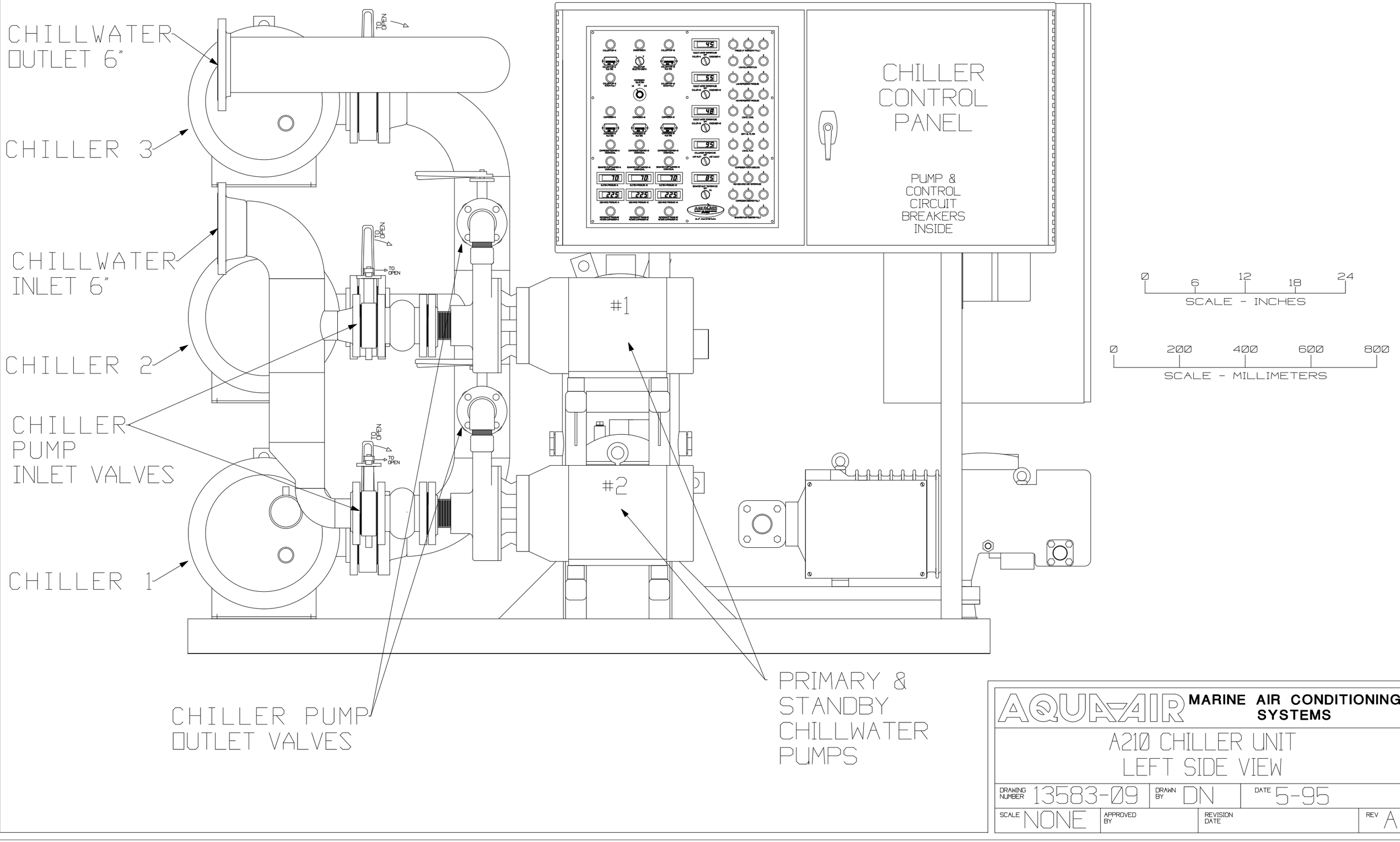
SCALE - MILLIMETERS

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

A210 CHILLER UNIT
FRONT VIEW

DRAWING NUMBER	DRAWN BY	DATE
13583-09	DN	5-95

SCALE	APPROVED BY	REVISION DATE	REV
NONE			A



0 6 12 18 24

SCALE - INCHES

0 200 400 600 800

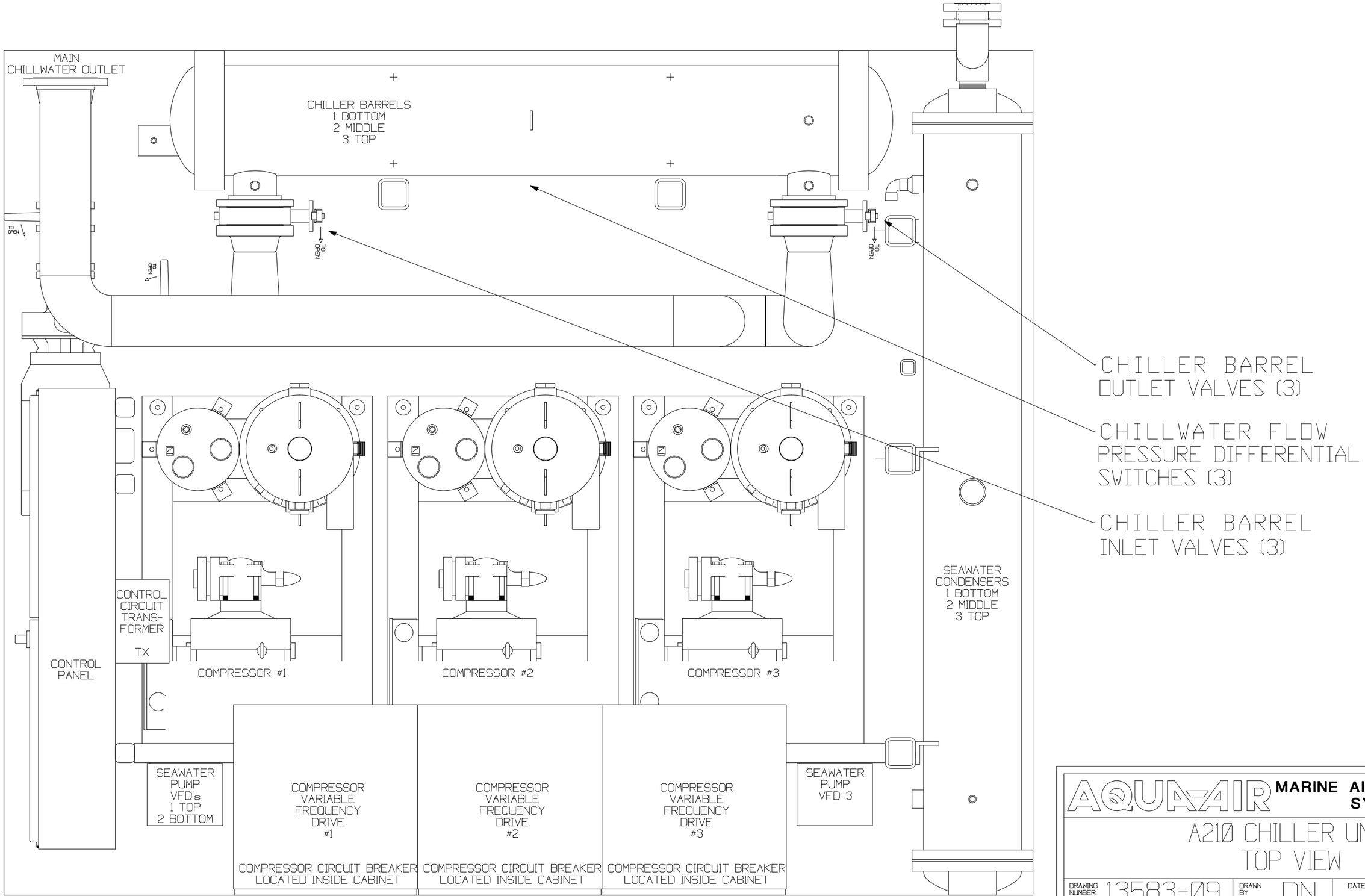
SCALE - MILLIMETERS

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

A210 CHILLER UNIT
LEFT SIDE VIEW

DRAWING NUMBER	DRAWN BY	DATE
13583-09	DN	5-95

SCALE	APPROVED BY	REVISION DATE	REV
NONE			A



AQUA-AIR **MARINE AIR CONDITIONING SYSTEMS**

A210 CHILLER UNIT
TOP VIEW

DRAWING NUMBER	DRAWN BY	DATE
13583-09	DN	5-95

SCALE	APPROVED BY	REVISION DATE	REV
NONE			A

CHILLER PUMP #1

SYSTEM SWITCH

CHILLER PUMP #2

CHILLER PUMP #1 RUN TIME

1 2

CHILLER PUMP SELECTOR SWITCH

CHILLER PUMP #2 RUN TIME

CHILLER PUMP #1 MOTOR FAULT

COMPRESSOR SELECTOR

1-2 1-3 2-3

CHILLER PUMP #2 MOTOR FAULT

COMPRESSOR #1

COMPRESSOR #2

COMPRESSOR #3

COMPRESSOR #1 RUN TIME

COMPRESSOR #2 RUN TIME

COMPRESSOR #3 RUN TIME

COMPRESSOR INVERTER #1 OPERATIONAL

COMPRESSOR INVERTER #2 OPERATIONAL

COMPRESSOR INVERTER #3 OPERATIONAL

SEAWATER PUMP INVERTER #1 OPERATIONAL

SEAWATER PUMP INVERTER #2 OPERATIONAL

SEAWATER PUMP INVERTER #3 OPERATIONAL

70

SUCTION PRESSURE #1

70

SUCTION PRESSURE #2

70

SUCTION PRESSURE #3

225

DISCHARGE PRESSURE #1

225

DISCHARGE PRESSURE #2

225

DISCHARGE PRESSURE #3

REFRIGERANT PRESSURE METERS COMPRESSOR #1

REFRIGERANT PRESSURE METERS COMPRESSOR #2

REFRIGERANT PRESSURE METERS COMPRESSOR #3

45

OUTLET WATER TEMPERATURE

OFF

CHILLER #1 CONDENSER #1

55

OUTLET WATER TEMPERATURE

OFF

CHILLER #2 CONDENSER #2

48

OUTLET WATER TEMPERATURE

OFF

CHILLER #3 CONDENSER #3

95

CHILLWATER TEMPERATURE

OFF

UNIT INLET UNIT OUTLET

85

SEAWATER INLET TEMPERATURE

OFF ON

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

div. of James D. Nall Co. Inc.

1 2 3

FREEZE-UP THERMOSTAT FAULT

LOW CHILLWATER FLOW

LOW REFRIGERANT PRESSURE

HIGH REFRIGERANT PRESSURE

LOW OIL LEVEL

DIRTY OIL FILTER

LOW OIL FLOW

COMPRESSOR MOTOR OVERLOAD

HIGH DISCHARGE GAS TEMPERATURE

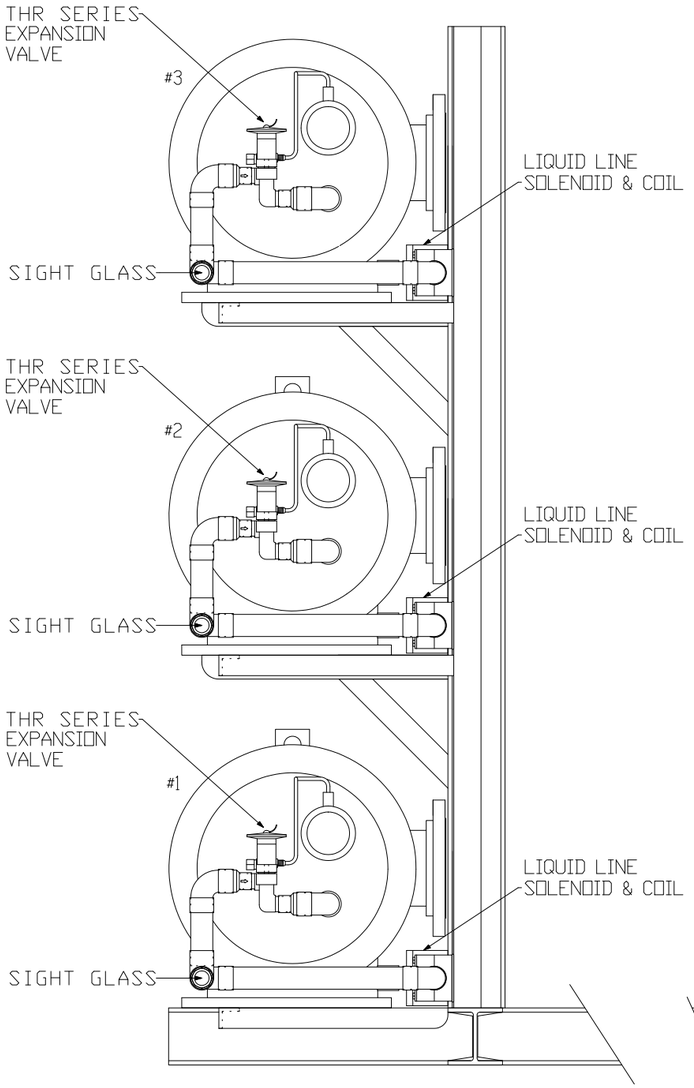
COMPRESSOR INVERTER FAULT

SEAWATER PUMP INVERTER FAULT

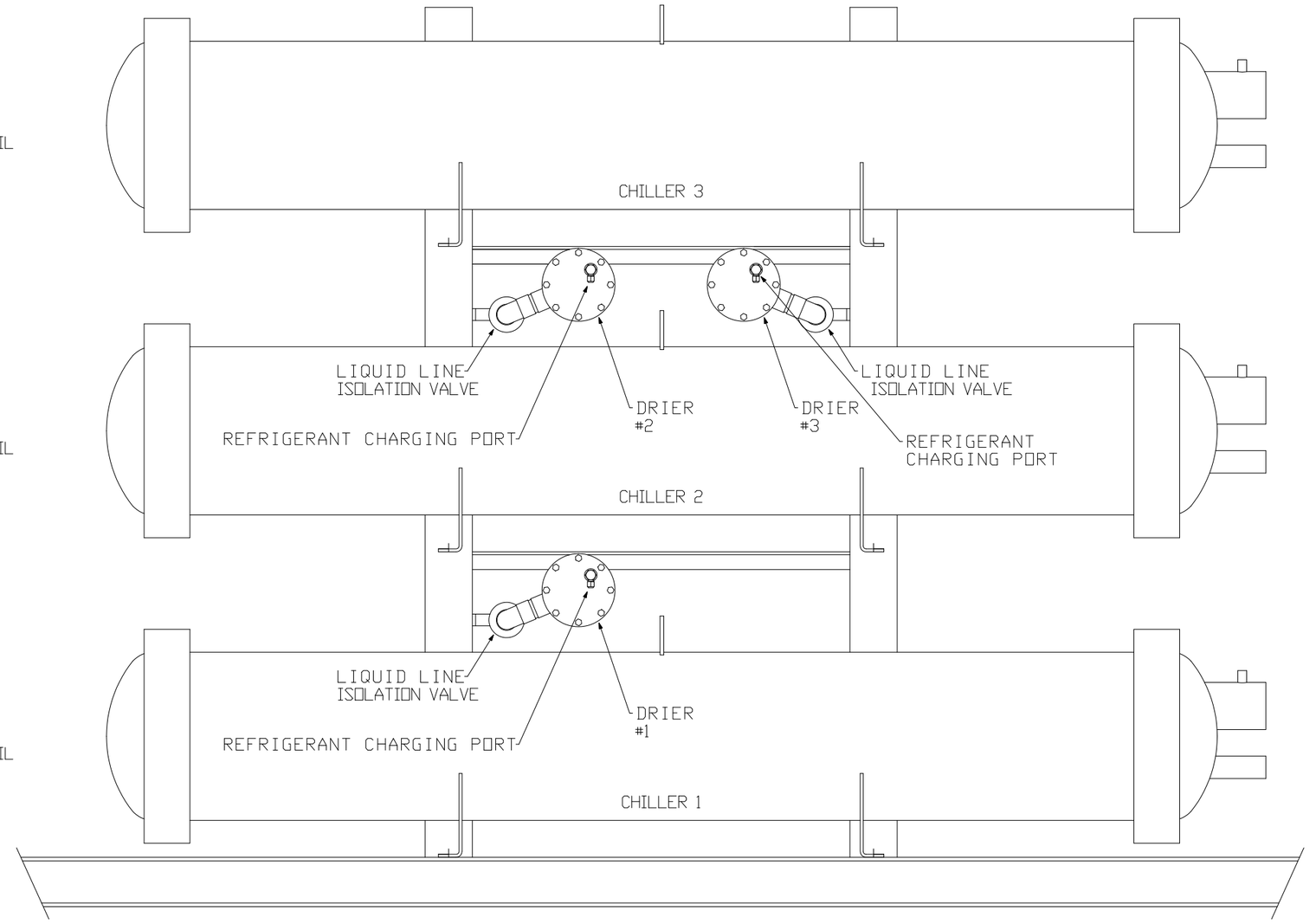
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

A210 CONTROL PANEL ITEM IDENTIFICATION

DRAWING NUMBER 13583-09	DRAWN BY DN	DATE 5-95	
SCALE NONE	APPROVED BY	REVISION DATE	REV A



LEFT VIEW



REAR VIEW

0 6 12 18 24

SCALE - INCHES

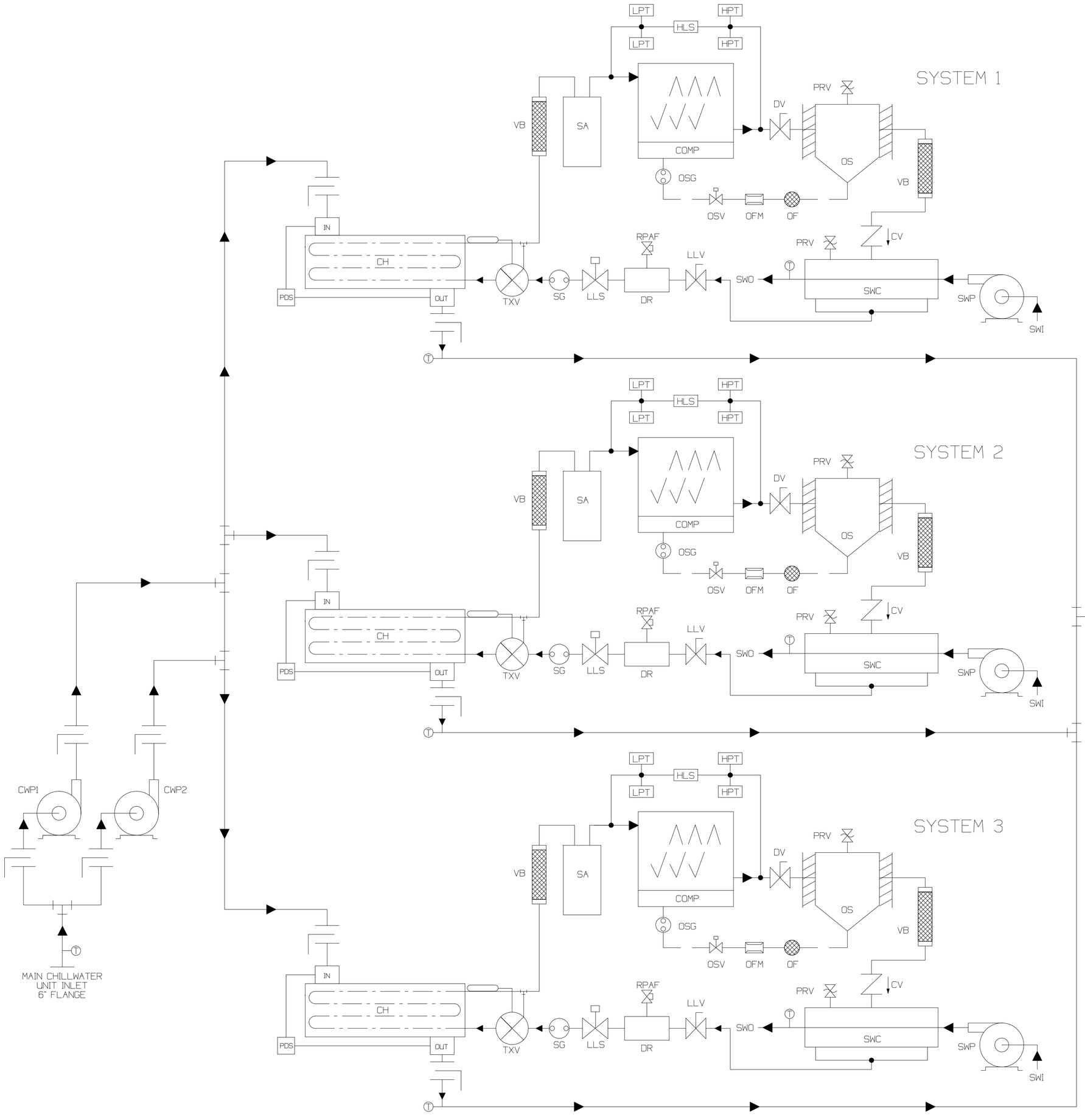
0 200 400 600 800

SCALE - MILLIMETERS

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

A210 DRIER, TXV, SIGHT GLASS AND LIQUID LINE SOLENOID LOCATIONS

DRAWING NUMBER 13583-27	DRAWN BY DN	DATE 5-95	
SCALE NONE	APPROVED BY	REVISION DATE	REV A



CH	CHILLER BARREL
COMP	COMPRESSOR
CV	CHECK VALVE
CWP	CHILLWATER PUMP
DR	DRIER
DV	DISCHARGE VALVE
HLS	HI-LO PRESSURE SWITCH
HPT	HIGH PRESSURE TRANSDUCER
LLS	LIQUID LINE SOLENOID
LLV	LIQUID LINE VALVE
LPT	LOW PRESSURE TRANSDUCER
OF	OIL FILTER
OFM	OIL FLOW METER
OS	OIL SOLENOID
OSG	OIL SIGHT GLASS
OSV	OIL SOLENOID VALVE
PDS	PRESSURE DIFFERENTIAL SWITCH
PRV	PRESSURE RELIEF VALVE
RPAF	REFRIGERANT PRESSURE ACCESS
SA	SUCTION ACCUMULATOR
SG	SIGHT GLASS
SWC	SEAWATER CONDENSER
SWI	SEAWATER INLET
SWO	SEAWATER OUTLET
SWP	SEAWATER PUMP
T	TEMPERATURE SENSOR
TXV	THERMOEXPANSION VALVE
VB	VIBRATION ABSORBER

AQUA-AIR MARINE AIR CONDITIONING SYSTEMS

LURSSEN 13583 M/Y "LIMITLESS" A210-3 WATER & REFRIGERANT PIPING SCHEMATIC

DRAWING NUMBER 13583-58	DRAWN BY DN	DATE 2-95	
SCALE NONE	APPROVED BY	REVISION DATE	REV A