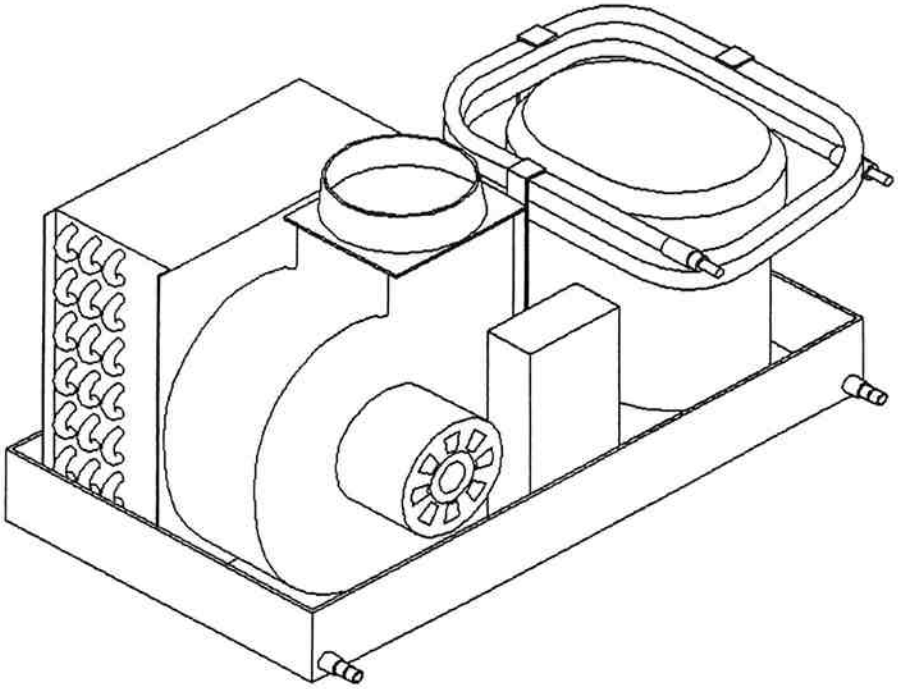
AQUAAIR

MARINE AIR CONDITIONING SYSTEMS



Self Contained
Marine Air Conditioning System
Installation, Operation & Maintenance

Table of Contents

I. Introduction

Thank you for purchasing an Aqua-Air® Self Contained Marine Air Conditioning System.

The purpose of this manual is to inform you of the different components that you will need to install a fully operational self contained air conditioning system on your boat and to give you the basic information necessary to correctly install all of the components that comprise the self contained air conditioning system.

The Aqua-Air® self contained units have been specifically designed for use in the marine environment. Systems are available in a range of capacities from 5-24,000 BTU/H in either 115/1/60 or 230/1/60 voltage inputs (the 5,000 BTU/H unit is only available in 115/1/50-60 and the 24,000 BTU/H unit is only available in 230/1/50-60). All systems are rated for full capacity on 60 Hz power, however, they can be operated on 50 Hz power sources with a corresponding 17% decrease in capacity. The 50 Hz power sources would normally be 100/1/50 and 200-220/1/50. All of the systems are reverse cycle except for the 5,000 BTU/H unit which is cooling only.

II. General Description of Basic Components

There are six basic components that make up a typical Aqua-Air® marine self contained system:

A. Self Contained Unit
B. Thermostat
C. Seawater Pump
D. Pump Relay
E. Ducting, Grilles and Transition Boxes
F. Seawater Kit

Following is a description of each major component.

A. Self Contained Unit

The self contained unit is a refrigerant to air heat exchanger located in the area that is to be either cooled or heated. The basic unit is made up of the following major components:

1. Evaporator
2. Capillary tube refrigerant metering device
3. Squirrel cage blower and motor
4. Refrigerant compressor
5. Suction accumulator
6. Receiver
7. Reversing valve (if it is a heat pump model)
8. Service ports

9. Condenser
10. Electrical starting components for the compressor

In the self contained unit, refrigerant is circulated through the system in the cooling mode as follows:The refrigerant is pumped from the compressor as a high pressure, high temperature gas through the reversing valve to the seawater condenser. In the seawater condenser, the gas gives up the heat acquired during compression and from the system load to the seawater passing through the condenser. As this heat is rejected to the water the gas changes state from a gas to a liquid.This liquid then passes through the receiver to the capillary tube(s). The liquid refrigerant passes through capillary tube(s) where it experiences a decrease in pressure. As the lower pressure liquid refrigerant exits the capillary tube into the evaporator it begins to absorb the heat contained in the air that is drawn across the evaporator by the squirrel cage blower, thereby 'cooling' the air that is then blown into the room. As the refrigerant absorbs the heat from the air it begins to change state from a liquid back to a gas. This gas then passes through the the reversing valve and the suction accumulator back to the compressor where the cycle begins again.

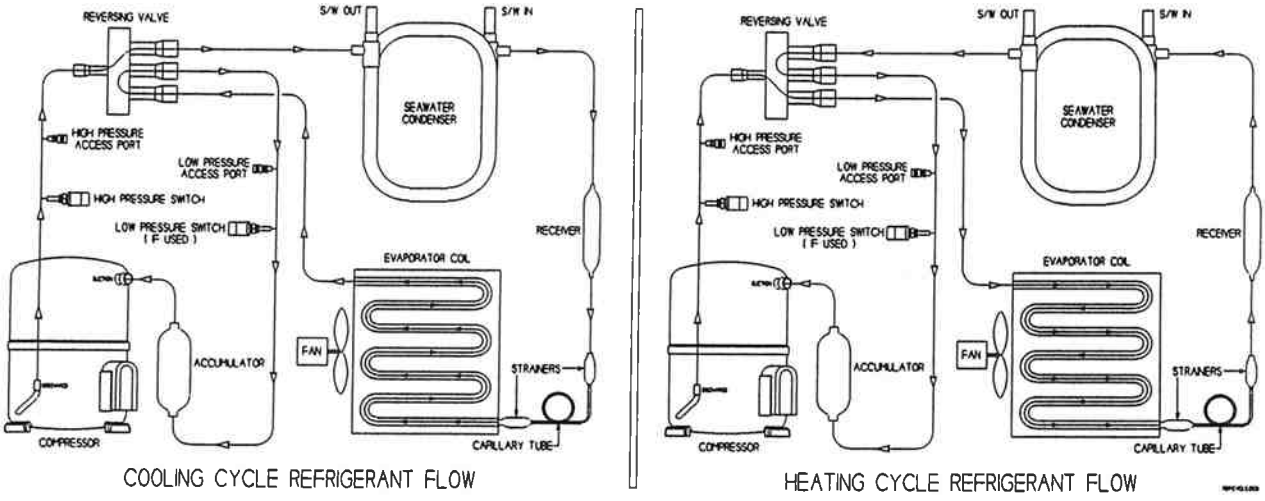


Figure 1

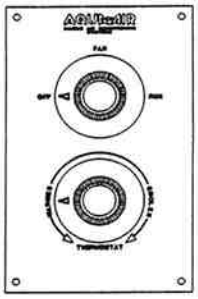
In the heating mode the reversing valve solenoid is energized and the solenoid changes position. This causes the flow of refrigerant to change. The evaporator is now the heat exchanger to reject the heat of the unit and the seawater condenser is used as the evaporator to absorb the heat that is available in the seawater. The hot gas from the compressor is pumped through the reversing valve to the evaporator coil (which now is acting as the refrigerant condenser). Air is drawn across the evaporator coil and then blown into the room, producing the desired heating effect. Upon exiting the evaporator (condenser) the refrigerant passes through the capillary tube(s) where a drop in refrigerant pressure occurs. The liquid/gas mixture then passes through the receiver

into the condenser (which is now acting as the refrigerant evaporator). Here, the liquid refrigerant begins to absorb the heat of the water that is passing through the condenser (evaporator). As it absorbs this heat it begins to change state from a liquid to a gas. This gas then passes through the reversing valve and then the suction accumulator on its way back to the compressor where the cycle begins again. The refrigerant circuits for cooling and heating are shown in Figure 1.

B. Thermostat

The thermostat / controller used to operate the unit can be provided in one of four different configurations:

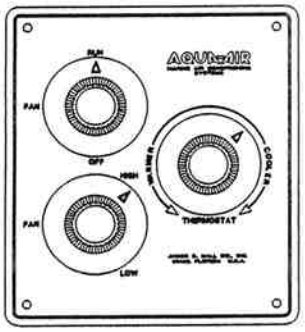
1. Two knob manual thermostat (AQS1-BP thermostat). The thermostats main components are:



Off-Fan-Run mode switch
Thermostat
Polarized plug wire harness

This thermostat is mounted within 10' of the self contained unit and is connected to the self contained unit via the polarized plug wire harness. This thermostat can only be used with the Mini-Kool MC-05 self contained unit.

2. Three knob manual thermostat (AQS3 series thermostat). The thermostats main components are:

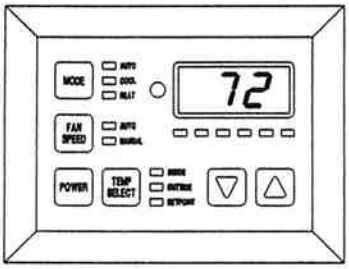


Off-Fan-Run mode switch
Fan speed control
Thermostat
Polarized plug wire harness

This thermostat is mounted within 10' of the self contained unit and is connected to the self contained unit via the polarized plug wire harness. This thermostat can be used with the AQSC-07H(C) to AQSC-24HC self contained units.

3. Tempwise 2001 digital thermostat (TW2P series). The thermostats main components are:

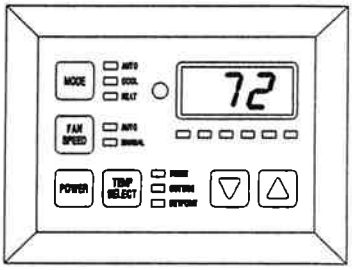
Display Panel
Control Module
Temperature Sensor
Display Cable
Polarized plug wire harness



This thermostat is mounted within 10' of the self contained unit and is connected to the self contained unit via the polarized plug wire harness. This thermostat can be used with the AQSC-07H(C) to AQSC-24HC self contained units.

4. Tempwise 2001 digital thermostat (TW2-01) when used with the 'T' series self contained unit. The thermostats main components are:

Display Panel
Control Module (factory mounted & pre-wired to the self contained unit)
Temperature Sensor (factory mounted on the self contained unit)
Display Cable



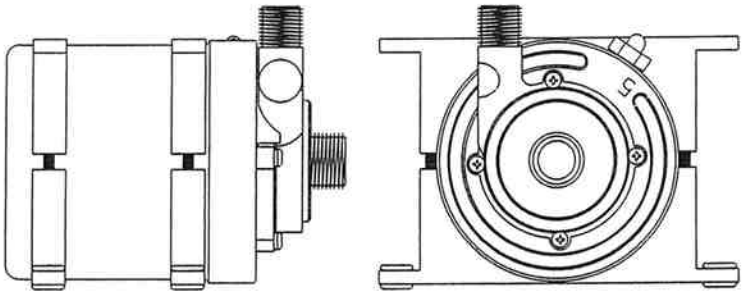
The display panel and display cable are the only items that need to be installed as the control module and temperature sensor are already mounted on the self contained unit. This display panel can only be used with the AQSC-07HT(C) thru AQSC-24HTC series self contained units.

C. Seawater Pump

The seawater pump is used to circulate seawater through the condenser on the self contained unit(s). These are all centrifugal pumps and are NOT self priming. This makes it necessary for the pump to be mounted below the ships running water line (under all conditions).

A self contained unit requires approximately 250 GPM (946 LPH) for every 12,000 BTU/H in capacity. Table 1 summarizes the amount of water necessary for a given capacity.

CP-05 Seawater Pump



Self Contained Unit Required Seawater Flow Rates		
Unit Capacity, BTU/H	**Seawater Flow In GPH / LPH**	**Seawater Pump**
5,000 to 12,000	250 / 946	CP-02
12,001 to 24,000	500 / 1,892	CP-05
24,001 to 48,000	1,000 / 3,784	CP-10
48,001 to 72,000	1,500 / 5,677	CD100B-36-03C
72,001 to 144,000	3,000 / 11,353	CD100B-40-05C

Table 1

D. Pump Relays

A pump relay is necessary when two or more self contained units are supplied water from a single seawater pump. Aqua-Air® offers three different pump relays:

AQP2R — Designed for use with two self contained units and one seawater pump. Both self contained units must be on the same shore line. No external power source is needed. This relay is not ignition protected and therefore must not be used on a gasoline powered boat.

AQP6R — This relay is a solid state module which will control a single seawater pump from as many as six separate self contained units. This relay requires an external power source. Because it is solid state it is ignition protected.

AQP8R — This relay is a solid state module which will control a single seawater pump from as many as eight separate self contained units. A separate trigger (PEC-115 or 230) must be installed in the relay for each self contained unit used. This relay requires an external power source. Because it is solid state it is ignition protected.

E. Ducting, Grilles & Transition Boxes

To transfer the air flow from the self contained unit to the area that you want to heat or cool you will need insulated flex duct, supply and return grilles, grille to flex duct transition boxes and possibly adapter tees. These items can be purchased in kit form from Aqua-Air®. We offer the Economy Duct Kit series (DKE) which includes plastic grilles or the Premium Duct Kit series (DKP) which includes wood (teak) framed grilles. A complete description of these duct kits is available in the DK Series Grille & Duct Kit brochure, # 81890.

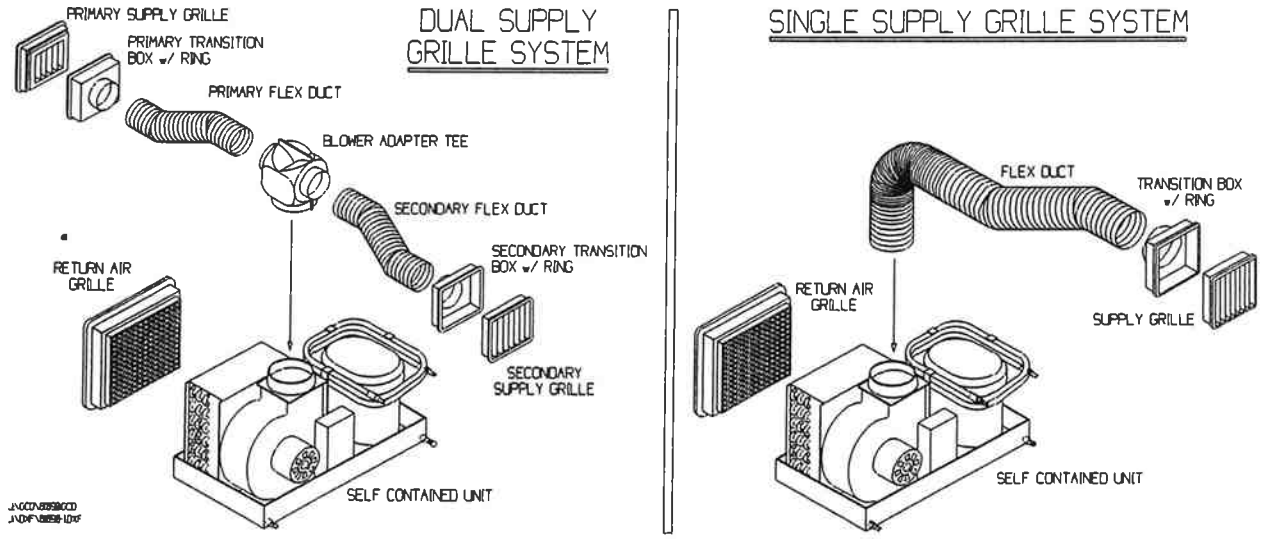


Figure 2

F. Seawater Kits

All of the components necessary to install the seawater circuit (except the seawater pump itself) are included in a seawater kit. There are two kits available:

1. SWK-05 Seawater Kit for use with the CP-02 pump and the Mini-Kool MC-05 self contained unit.
2. SWKU Seawater Kit for use with the CP-02, 05 and 10 pumps and a single AQSC-07H(T)(C) thru AQSC-24H(T)C self contained unit.

Included in the kits are a seawater inlet thru hull with a speed scoop, ball valve, seawater strainer, overboard thru hull, 25' of hose, hose clamps and necessary PVC fittings to complete the average installation. See Aqua-Air® brochure "Seawater Kits / SWK Series" #80625 for a complete description of all of the components included in these kits.

III. Installation of Basic Components

★ ★ ★ WARNING ★ ★ ★

FAILURE TO COMPLY WITH THE INSTALLATION INSTRUCTIONS CONTAINED IN THIS MANUAL COULD PRODUCE HAZARDOUS CONDITIONS RESULTING IN THE INJURY OR DEATH OF THE OCCUPANTS AND THE DESTRUCTION OF THE BOAT. MAKE SURE THAT THE WARNINGS ON THE LAST PAGE OF THE MANUAL ARE FULLY UNDERSTOOD AND FOLLOWED.

ALL INSTALLATION TECHNIQUES SHOULD COMPLY WITH THE ABYC "STANDARDS FOR RECOMMENDED PRACTICES FOR SMALL CRAFT" SECTION A-6 and E-8.

IF THERE ARE ANY PARTS OF THIS MANUAL THAT ARE NOT CLEAR PLEASE CONTACT Aqua-Air® FOR FURTHER ASSISTANCE.

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A. Self Contained Unit

Self contained units are ideally suited for installations in closets, under bunks or seats.

THEY SHOULD NEVER BE MOUNTED IN THE ENGINE ROOM OR BILGE AREA WHERE THEY COULD DRAW TOXIC FUMES INTO THE UNIT AND THEN DISCHARGE THEM INTO THE LIVING AREA.

In all applications the self contained unit should be installed so that the air discharge is at least three feet above the floor. The best possible location is to have the air discharging at or near the ceiling level. The reason for mounting the air discharge as high as possible is because cold air is denser than ambient air and its natural tendency is to fall to the lowest point in the room after leaving the discharge grille.

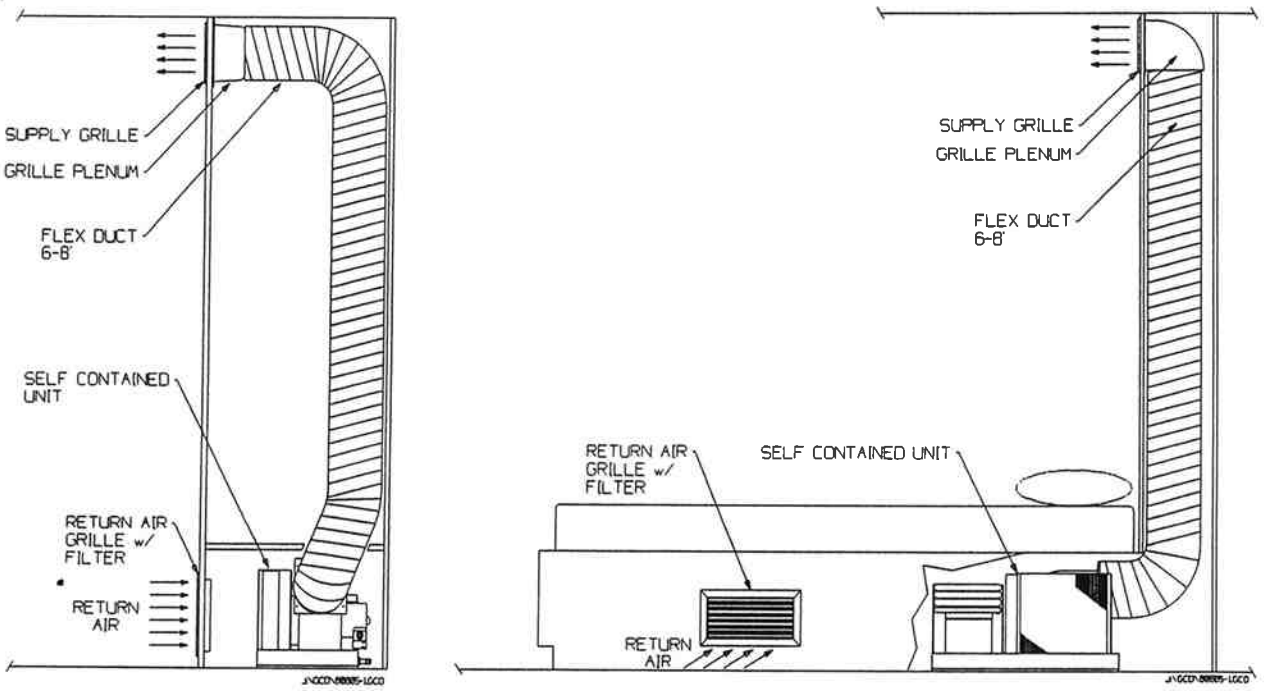


Figure 3 Typical Self Contained Unit Installations

The unit should be securely fastened to the deck using the four mounting clips provided. Please see Figure 4 showing the mounting clip and how it should be used to hold the unit down. The unit must be mounted with the drain pan at the bottom of the unit as condensate from the evaporator (and from the condenser in the heating mode) is collected here. There are four possible locations for the drain outlet fittings (one on the 5,000 BTU/H unit). These fittings can be removed and relocated to any of the four locations. A 5/8" ID hose should be run from the two fittings into a common tee then either overboard or into a shower sump. It is not advisable to run the drain lines into the bilge where the condensate can become stagnant and foul smelling when mixed with seawater. On a hot, humid day several pints of water can be removed from the air by the self contained unit.

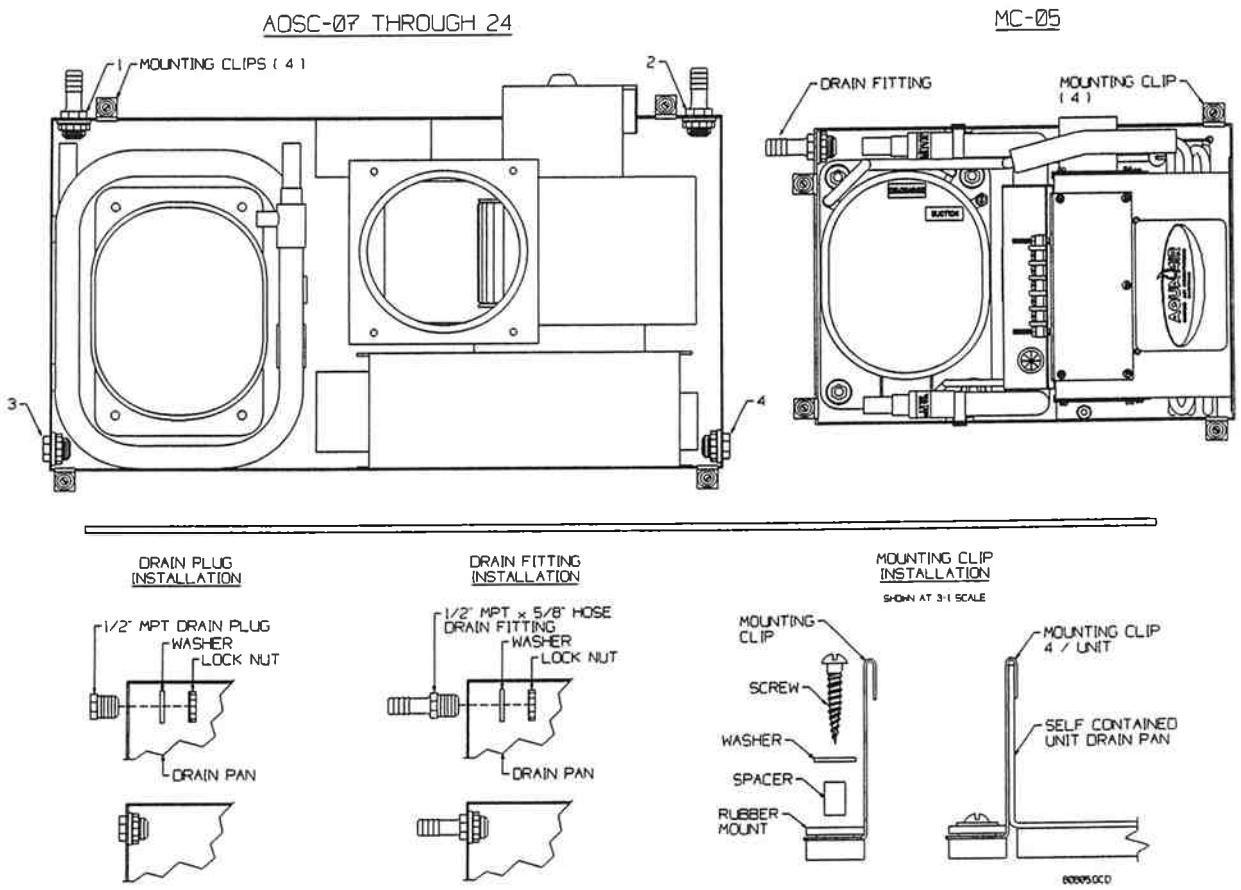


Figure 4 Drain Fitting Locations and Unit Mounting Details

The blowers on all of the self contained units can be rotated (on the 5,000 BTU/H unit there are three possible fixed air discharge locations). This will allow for either horizontal or vertical air discharge from a single unit. To rotate the blower loosen the hose clamp holding the fan motor and remove the screw at the top of the connecting collar between the blower and the evaporator housing. Rotate the blower to the desired position and tighten the hose clamp. Drill a 1/8" pilot hole through the existing hole in the top of the connecting collar. Replace the screw in this hole and tighten.

Insulated flex duct should be connected to the plastic blower discharge collar by first pulling back about two inches of the insulation on the end of the flex duct that you are going to attach to the blower. Slip the inner duct over the collar so that at least one of the duct reinforcing wires is up against the flat part of the collar. Install three sheet metal screws around the perimeter of the collar to hold the duct in place. Wrap a piece of duct tape around the duct that is on the collar. Slip the duct insulation back over the duct that is attached to the collar and duct tape in place.

The correct minimum grille sizes for each self contained unit are shown in Table 2. Return air grilles can be larger than listed (this is one case where bigger is better), however, supply grilles should not be any larger than 25% over the recommended sizes. A supply grille that is too large will not properly disperse the air into the room causing hot spots. In either case the grilles must NOT be any smaller than the minimums listed. Small grilles cause decreases in system performance, evaporator coil icing or (in the heating mode) unit shut down due to high head pressures.

Minimum Grille and Flex Duct Sizes			
Unit Capacity BTU/H	**Supply Grille in^2 / cm^2**	**Return Grille in^2 / cm^2**	**Minimum Duct Diameter, in/mm**
5,000	32 / 206	64 / 412	4" / 100mm
7,000	40 / 258	72 / 464	5" / 125mm
10,000	48 / 309	100 / 645	5" / 125mm
12,000	60 / 387	120 / 774	6" / 150mm
16,000	72 / 464	144 / 929	6" / 150mm
24,000	120 / 774	200 / 1290	7" / 175mm

Table 2

It is very important that there is adequate space for air to return to the self contained unit. While the evaporator of the self contained unit does not have to be directly behind the return air grille there must be an air path of the same area between the return air grille and the self contained unit. Never mount the front of the unit any closer than two inches from a bulkhead as this will restrict the air flow into the evaporator coil.

A return air filter must be in place in the return air grille. This will prevent dirt and lint from being drawn into the evaporator coil, reducing performance. The most common type of filter material is an expanded aluminum type. This is the type used on all return air grilles supplied by Aqua-Air® that have return air filters. These filters should be checked on a monthly basis, during normal usage, and cleaned as necessary.

The self contained unit is connected to the seawater hoses coming from the seawater pump and going to the seawater overboard fitting. The hose should be (at a minimum) 5/8" ID, single braid hose. Insert the hoses on the seawater condenser tubes a minimum of 1-1/2" and clamp in place with a stainless steel hose clamp.

WARNING

TO AVOID AN ELECTRICAL SHOCK FROM A PIECE OF EQUIPMENT THAT HAS DEVELOPED AN INTERNAL SHORT ALWAYS GROUND ANY AQUA-AIR® SYSTEM IN THE MANNER DESCRIBED BELOW:

1. USE SUITABLE SIZED WIRE (SEE TABLE 3) WITH A GROUND WIRE TO FEED POWER TO THE SELF CONTAINED UNIT TERMINAL STRIP. MAKE SURE THAT THE GROUND WIRE IS CONNECTED ON THE OTHER END AT THE CIRCUIT BREAKER PANEL.
2. CONNECT A GROUND WIRE FROM THE SEAWATER PUMP TO THE SELF CONTAINED GROUND LUG.
3. CHECK FOR CONTINUITY BETWEEN ALL OF THE ABOVE POINTS.
4. USE CORRECTLY SIZED WIRE TERMINALS FOR ALL CONNECTIONS. USE ONLY WIRE CRIMPING TOOLS THAT ARE MANUFACTURER APPROVED FOR THE WIRE TERMINALS USED.
5. ALL WIRING SHOULD COMPLY WITH THE ABYC "STANDARDS FOR RECOMMENDED PRACTICES FOR SMALL CRAFT" SECTION E-8.

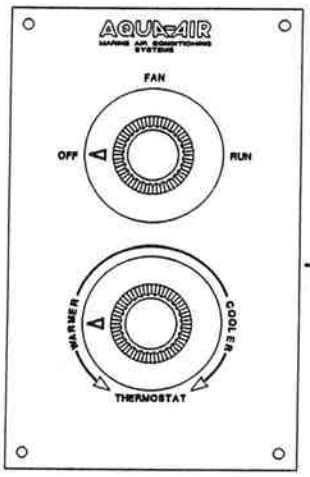
FAILURE TO COMPLY WITH THE ABOVE INSTRUCTIONS CAN RESULT IN SERIOUS INJURY OR DEATH

B. Thermostats

1. AQS1-BP or AQS3 Series Thermostat / Switch Assemblies

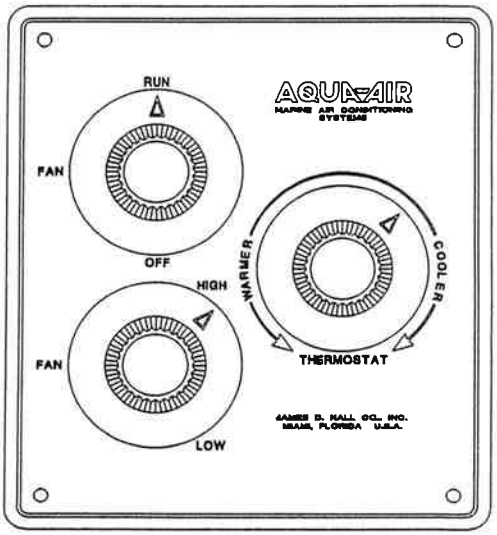
The thermostat switch assembly is the central distribution point for the self contained units electrical power.

The control panel should be mounted over a suitably sized hole (see templates in the back of the manual) using four screws. The plastic cover for the rear of the control must be installed to prevent someone from accidentally touching the exposed electrical connections.



AQS1-BP
Thermostat

AQS3
Series
Thermostat



The plug end of the wire harness should now be connected to the plug on the self contained unit. Verify that the two plugs are solidly connected. A loose plug connection can cause the unit to malfunction.

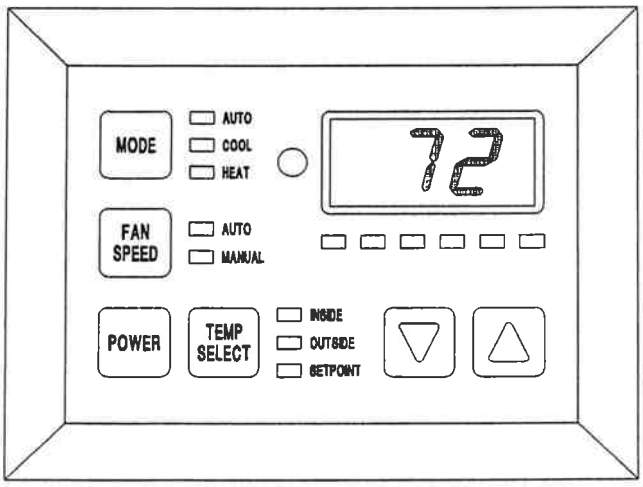
The copper temperature sensing bulb must be mounted in the return air flow to the self contained unit. There are two plastic clips on the face of the self contained unit evaporator that are specifically for mounting this sensor. The sensing bulb must never be mounted with the bulb in direct contact with the self contained unit. The bulb should not be mounted on a surface that would be warmer than the surrounding air (i.e. an engine room bulkhead or the hull side).

2. *Tempwise 2001 TW2P Digital Thermostat*

The display panel should be mounted over a suitably sized hole (see templates in the back of the manual) using the double-sided tape provided.

The control module box must be mounted within 10' of the self contained unit. The plug end of the wire harness should now be connected to the plug on the self contained unit. Verify that the two plugs are solidly connected. A loose plug connection can cause the unit to malfunction.

TW2 Tempwise 2001
Display Head



The temperature sensor must be mounted in the return air flow to the self contained unit. There are two plastic clips on the face of the self contained unit evaporator that are specifically for mounting this sensor. The sensor must never be mounted in direct contact with the self contained unit. The sensor should not be mounted on a surface that would be warmer than the surrounding air (i.e. an engine room bulkhead or the hull side).

Install the display cable phone wire connecting the display panel to the control module box.

3. *Tempwise 2001 TW2-01 Digital Thermostat Display Head with 'T' Series Self Contained Units*

The control module and temperature sensor for the digital thermostat are already factory mounted on the self contained unit.

The display panel should be mounted over a suitably sized hole (see templates in the back of the manual) using the double-sided tape provided.

Install the display cable phone wire connecting the display panel to the control module box located on the self contained unit.

Recommended Wire and Circuit Breaker Sizes			
Unit Capacity BTU/H	**Voltage**	**Wire Size AWG**	**Circuit Breaker Rating, Amps**
5,000	115	14	10
7,000	115	14	15
10,000	115	12	20
12,000	115	12	20
16,000	115	10	30
7,000	230	14	10
10,000	230	12	15
12,000	230	12	15
16,000	230	12	20
24,000	230	12	20

Table 3

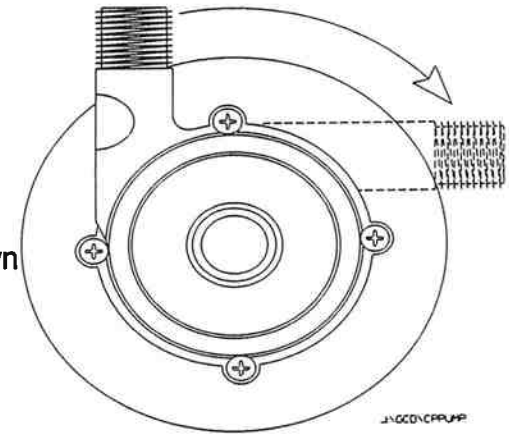
C. Seawater Pumps

The seawater pumps supplied by Aqua-Air® are all centrifugal, non-self priming pumps. They must be installed in the following manner:

1. The pump must be mounted securely at a point in the hull that is beneath the waterline of the boat under ALL conditions (at rest, under way or in a heavy sea). The position of the pump should be as close as possible to the centerline of the boat, no further forward than the front of the engine compartment and no further aft than the propeller stuffing boxes or aft engine compartment bulkhead. Mount the pump as low as possible in the hull. The pump should always be mounted in a horizontal position and never on its head or end. See Figure 5 below.

Figure 5

Seawater Pumps can be mounted in any horizontal position (within the range shown at right) and will still be self-purging.



2. To make the system self purging there must be a steady uphill run from the seawater inlet to the seawater strainer through the pump up to the self contained unit condenser and then overboard (See Figure 6). This will allow any air that enters the seawater inlet to bleed off naturally through the seawater system.

3. Connect the pump wire to the self contained unit according to the applicable wiring diagram. The ground wire must be connected to the green ground lug.

4. On a system with more than one self contained unit connected to a single seawater pump the pump will be wired to the pump relay.

5. The seawater pumps CANNOT be run without a supply of water. If they are run dry internal damage will be caused voiding the pumps warranty.

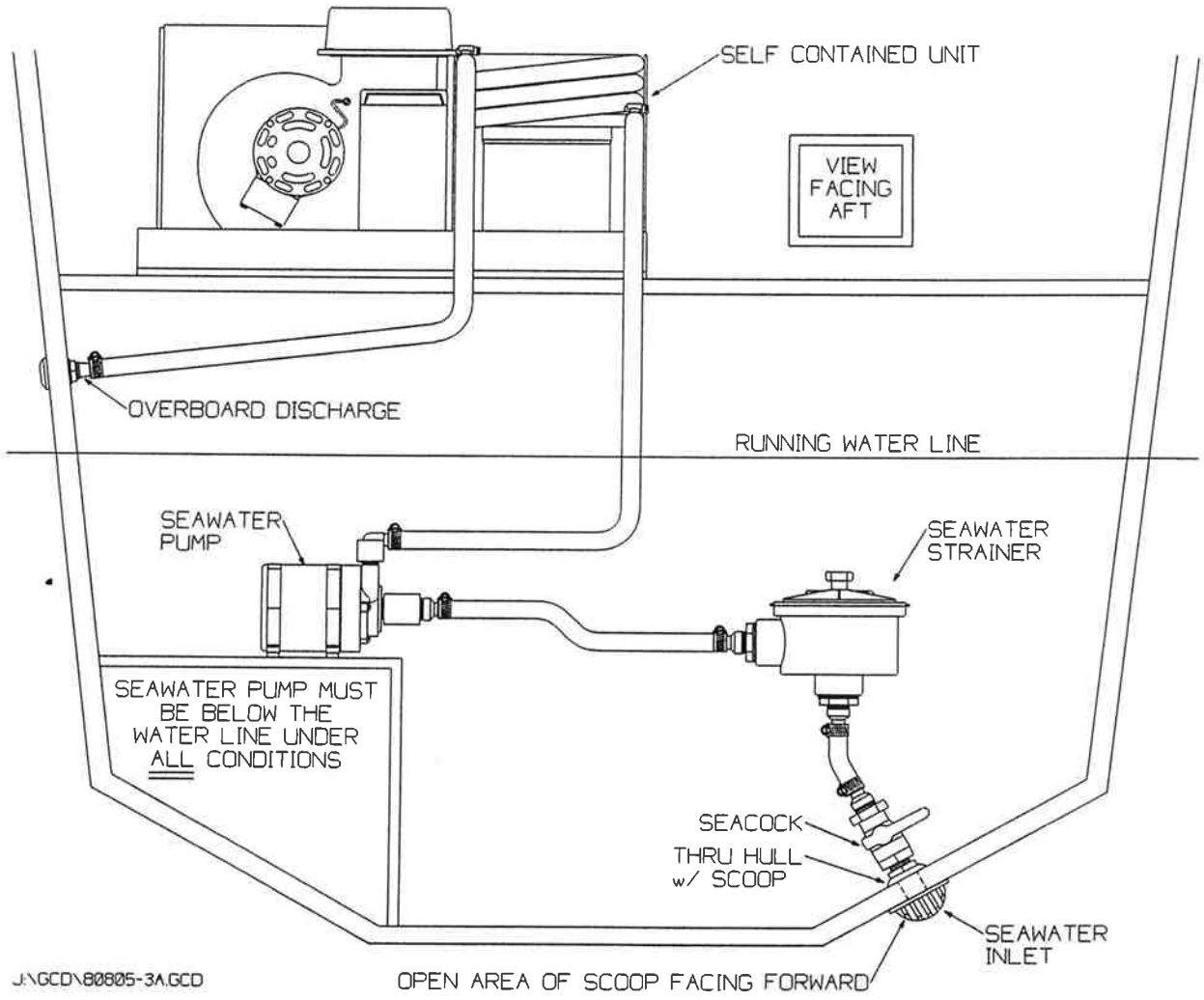


Figure 6 Typical Seawater Plumbing Circuit

IV. Before Starting the System for the First Time

Below is a preliminary check list that should be verified before operating the system for the first time:

1. The self contained unit is securely fastened in place.
2. The supply and return air grilles meet the minimum area requirements
3. There is a return air filter installed
4. The insulated duct is installed with a minimum of bends and without any kinks that would restrict the air flow.

5. All electrical covers (either on the thermostat or the self contained unit) are in place.
6. The thermostat temperature sensing bulb or sensor is in the return air flow but not touching the evaporator coil or housing.
7. The self contained unit is draining properly. This can be checked by pouring water into the pan and verifying that it drains.
8. All wire harnesses or phone wires connecting the thermostat or display head are properly connected to the unit or the control module box.
9. The electrical power wire is correctly connected to the self contained unit. CAUTION: MAKE SURE THAT A PROPERLY SIZED TIM E DELAY TRIP CIRCUIT BREAKER IS USED IN THE CIRCUIT BREAKER PANEL.
10. The pump and/or pump relay wires are correctly connected to the self contained unit.
11. The seawater system is piped in the recommended many so as to be self purging of air.
12. The pump is mounted well below the waterline of the boat.
13. There should be a properly sized seawater strainer between the seawater inlet and the pump.
14. The seawater inlet is a scoop type with the open portion of the scoop facing forward.
15. There should be a separate overboard fitting for each self contained unit. It should be mounted no more than 2" above the waterline.
16. The seawater inlet should be no further than 6" from the centerline of the boat.

V. System Operation

1. MC-05 Self Contained Units Using the AQS1-BP Thermostat

1. Verify that the OFF-FAN-RUN switch is in the OFF position.
2. Turn the unit circuit breaker ON.
3. Turn the thermostat to the desired setting (colder or warmer).
4. Verify that the seawater inlet valve is ON and the seawater strainer is clean.
5. Turn the OFF-FAN-RUN to the FAN position. This will start the fan motor and seawater pump. Look over the side of the boat and verify that seawater is coming out of the seawater overboard. If it does not after 15 seconds, put the OFF-FAN-RUN in the OFF position and find out why there is no seawater flow.
6. Turn the OFF-FAN-RUN switch to the RUN position. The compressor will now start and begin either cooling or heating.

7. To set the thermostat to maintain a certain temperature, turn the thermostat toward the center position until a single click is heard. The thermostat is now set to maintain the current room temperature. To change the room temperature by a few degrees rotate the knob about 1/8" at a time and then wait 15 minutes for the room temperature to adjust.
8. It is not advisable to turn the system on and off rapidly. It is usually a good idea after turning the system off to allow at least five minutes to pass before starting the unit again.
9. To turn the system OFF turn the OFF-FAN-RUN switch to the OFF position.

B. Systems Using the AQS3 Series Thermostat

1. Verify that the OFF-FAN-RUN switch is in the OFF position.
2. Turn the unit circuit breaker ON.
3. Turn the thermostat to the desired setting (either cooling or heating).
4. Set the fan speed control to HIGH
5. Verify that the seawater inlet valve is ON and the seawater strainer is clean.
6. Turn the OFF-FAN-RUN to the FAN position. This will start the fan motor and seawater pump. Look over the side of the boat and verify that seawater is coming out of the seawater overboard. If it does not after 15 seconds, put the OFF-FAN-RUN in the OFF position and find out why there is no seawater flow.
7. Turn the OFF-FAN-RUN switch to the RUN position. The compressor will now start and begin either cooling or heating.
8. To set the thermostat to maintain a certain temperature, turn the thermostat toward the center position until a single click is heard. The thermostat is now set to maintain the current room temperature. To change the room temperature by a few degrees rotate the knob about 1/8" at a time and then wait 15 minutes for the room temperature to adjust.
9. Set the fan speed control to the desired setting. On the heating cycle run the fan on low speed for about 15 minutes and then increase to medium speed. This will allow the unit to build up temperature. In the cooling cycle the fan can be run at any speed. In either mode unit capacity decreases as fan speed decreases.
10. It is not advisable to turn the system on and off rapidly. It is usually a good idea after turning the system off to allow at least five minutes to pass before starting the unit again.

11. To turn the system OFF turn the OFF-FAN-RUN switch to the OFF position.

C. Systems Using the Tempwise 2001 Digital Thermostat

1. Verify that the seawater inlet valve is ON and the seawater strainer is clean.
2. Turn the unit circuit breaker ON.
3. Press the POWER button on the face of the Tempwise 2001 one time. The LED display will now indicate the current room temperature.
4. Press and release the MODE button until the desired operating mode is reached (AUTOmatic operation, COOLing only, HEATing only or MOISTURE CONTROL mode).
5. View the current thermostat set point by momentarily pressing either the ▲ (increase temperature) or ▼ (decrease temperature) key. To change the set point continue to press the ▲ or ▼ key until the desired set point is reached.
6. Fan speed operation initially is in the AUTO(matic) mode. This means that the fan speed will be automatically selected based upon how close the room temperature is to set point. The fan speed will be at its lowest setting at set point. To change the fan speed setting press the FAN key until the desired fan speed is achieved. Continuing to hold the FAN key will scroll through the six fan speeds and then return to the AUTOmatic mode.
7. For further operating information on the TW2 thermostat please refer to the thermostat operation manual.

D. Reverse Cycle Systems

All Aqua-Air® units are reverse cycle (with the exception of the 5,000 BTU/H unit) heat pump units. This type of system derives its heat from the seawater that is pumped through the seawater condenser. When the water temperature reaches 40°F there is an approximate 50% loss in heating capacity. As the water temperature reaches 35°F there will be little or no heating available. This should be kept in mind when considering the practicality of a reverse cycle system for the area that you will be operating in during the winter months.

VI. Maintenance

A. Self Contained Unit

1. The fan motors should be lubricated on a yearly basis with SAE 20 oil
2. The drain pans should be checked for proper drainage by pouring a quart of water into the pan. The water should drain within thirty seconds.
3. Clean all return air filters at the beginning of the boating season and then regularly on a monthly (or sooner as use dictates) basis.

B. Seawater System

4. The seawater pump requires no maintenance
5. The seawater strainer should be cleaned at the beginning of the boating season and then regularly on a monthly (or sooner as use dictates) basis.

VII. Winterizing

Self Contained Unit.

Turn the seawater inlet off. Remove the seawater hose from the seawater pump outlet. This will allow the water to drain from the unit as long as the system is piped correctly.

Seawater Pump

With the seawater inlet off loosen the screws on the front of the pump. This will allow any water in the pump head to drain.

Seawater Strainer

Drain and clean the strainer

Seawater Inlet

Remove the hose at the inlet valve and remove as much water from the valve as possible.

Seawater Outlet

Remove the hose at the seawater outlet. Install a cap over the fitting to prevent any water from entering the fitting.

★★★ WARNING ★★★

Aqua-Air Manufacturing (a division of the James D. Nall Company, Inc.) hereafter referred to as the "Manufacturer" makes the following warnings in regard to the use of its products. Even though these warnings are comprehensive in nature, there are certain dangers that might arise which, at this time, are unforeseeable. A thorough understanding of the dangers outlined below will help as a guide for spotting other potentially dangerous situations. This understanding is very important in assuring your safety.

Electricity
Aqua-Air® products operate on voltages ranging from 24 to 480 volts of alternating current (A.C.) Power. Because of the danger involved with these voltages, all metal components (bases, cabinets, units) must be grounded in some manner to the ship's grounding system. Some of the relays, switches and thermostats used in the Aqua-Air® systems are not ignition protected. Because of this, the ventilation blower on a boat should be run for five minutes prior to and during the operation of any Aqua-Air® product or system. All electrical connections must be sealed or covered in such a way as to prevent contact by unauthorized personnel. Such contact could lead to permanent injury or death.

Electrolysis
Any electrical leakage of a component can cause electrolysis. This could lead to a deterioration of a thru-hull which could cause leakage of water into the boat which could result in sinking the boat. All Aqua-Air® products must be kept clean and dry. They should be periodically inspected for electrical leakage. If detected, the faulty component should either be repaired or replaced.

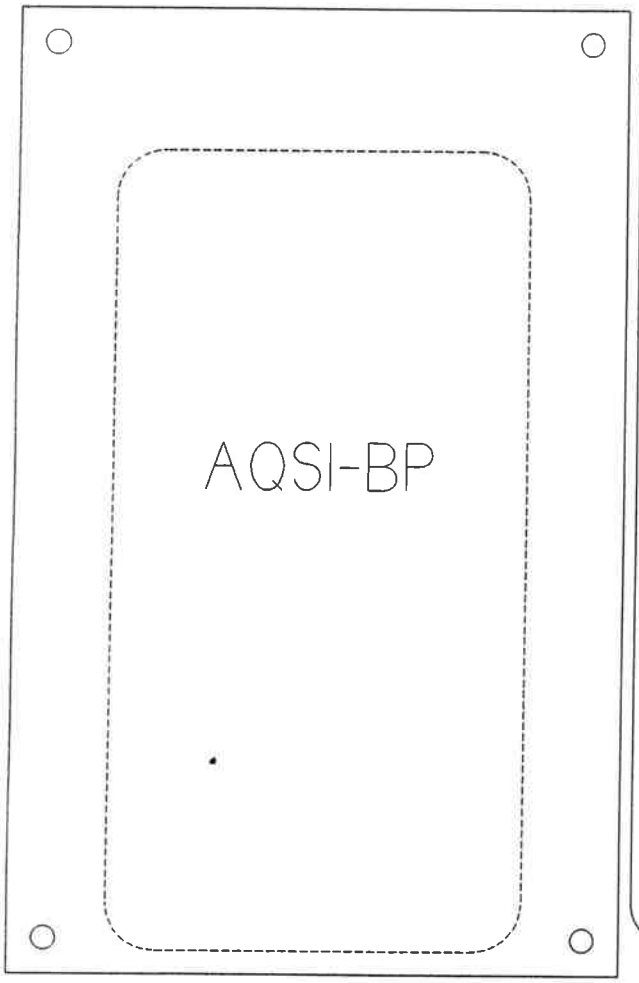
Refrigerant
All Aqua-Air® products utilize refrigerant 22 (monochlorodifluoromethane). This refrigerant is non-toxic and non-flammable. This refrigerant contains no oxygen and will therefore no support life. When burned this refrigerant deteriorates into potentially lethal gases. If a refrigerant leak is discovered, evacuate all personnel from the are and prohibit the use of any item using an open flame. Due to the high pressures involved in refrigeration systems, eye protection, gloves and long-sleeved clothes should be worn during servicing of a system. Extensive frost burns can occur to the eyes and skin if they come into contact with liquid refrigerant.

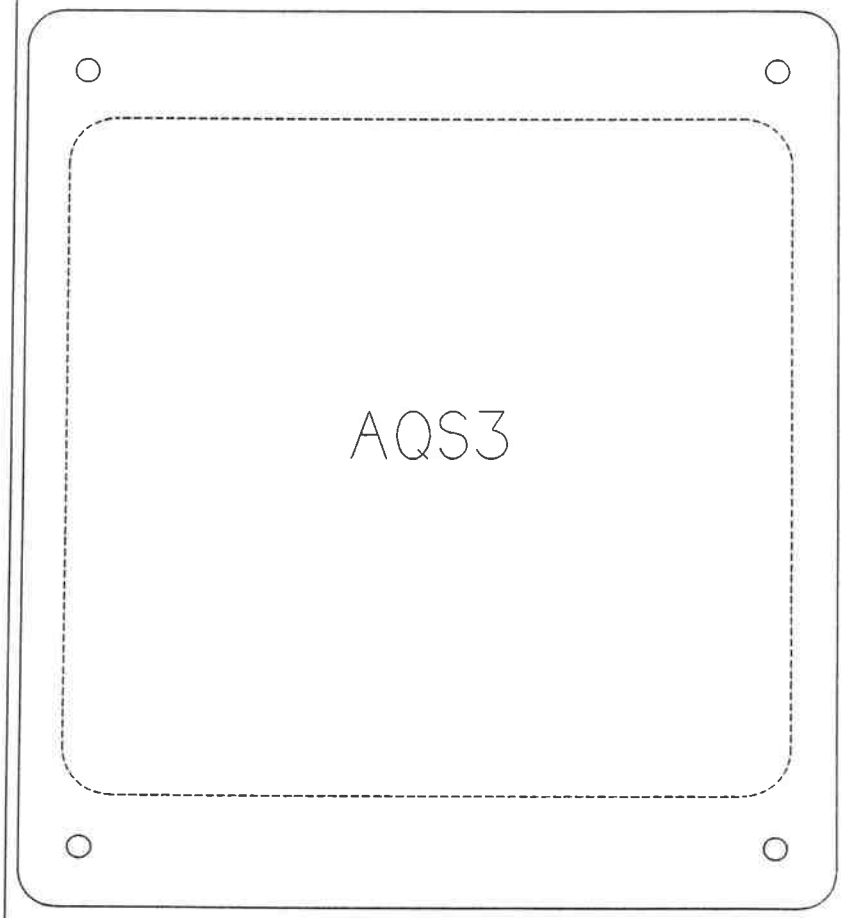
Ventilation
To either cool or heat air, Aqua-Air® systems move air through a heat exchanger by means of either a propeller fan or blower system. This process naturally causes a suction on one side of the unit and a pressurized area on the other. These heat exchangers or "cooling units" as they are referred to in our brochures must be installed so that this suction-pressure action does not (1) pressure an area to the extent of causing structural failure of the area which could cause injury and does not (2) cause a suction in an area where vapors from batteries, fuel or other operating equipment exist. If a cooling unit were installed in this way then these vapors could possibly be discharged into a living space where they could be hazardous. The best way to prevent the introduction of dangerous gases into a living space is to make sure all living spaces are carefully sealed from all other spaces. It is never advisable to completely seal an area without some sort of auxiliary ventilation in the event of lethal gas or fumes escaping from any source.

Condensate
All Aqua-Air® direct expansion cooling units and self contained units produce condensate when operated in the cooling mode. The self contained units and condensing units can produce condensate during operation in the heating mode. This water must be drained overboard. If allowed to drip on a wood, dry rot can form causing structural failure. If allowed to drip on electrical components, deterioration of the components can occur. When the cooling unit is in operation, a negative pressure is exerted on the condensate line. Always locate condensate outlets as far as possible from sources of fumes or dangerous gases. These fumes or gases could be drawn into the system due to this negative pressure resulting in a potentially hazardous situation.

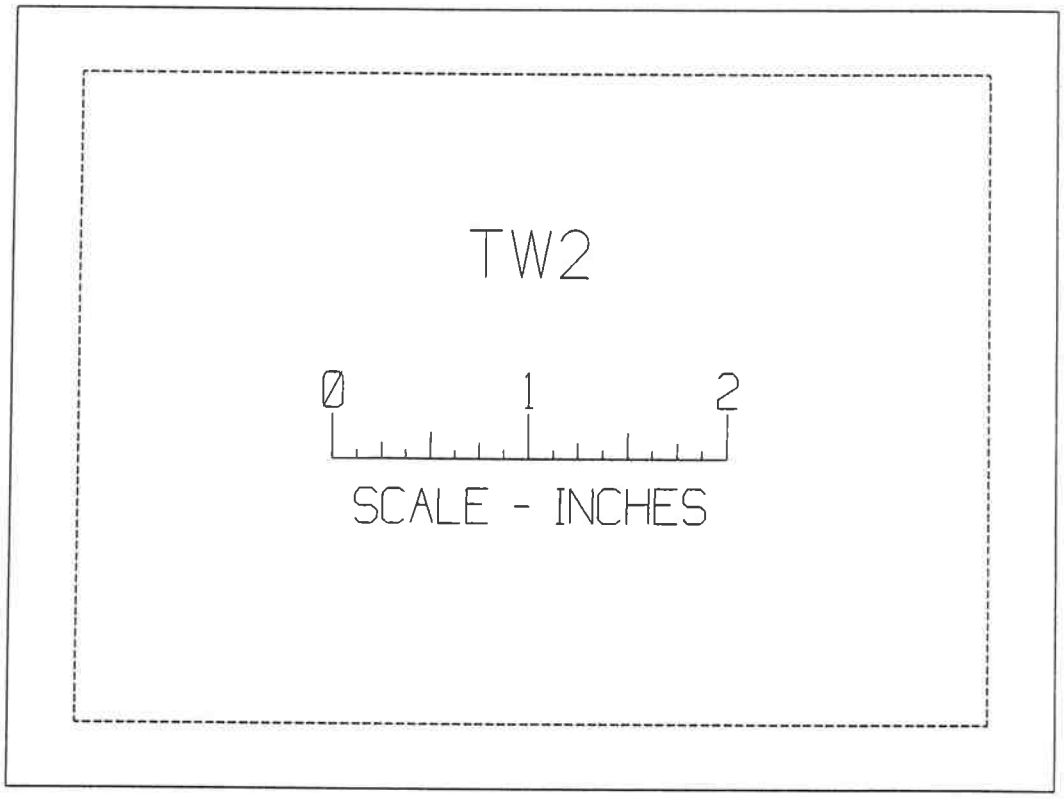
★★★ WARNING ★★★

Never sleep in an enclosed area in a boat when any equipment, which functions as a direct result of the combustion of a volatile fuel, is in operation (such as engines, generators, oil-fired heaters, etc.). At any time their exhaust system could fail leading to a build-up of dangerous gases within the enclosed area.

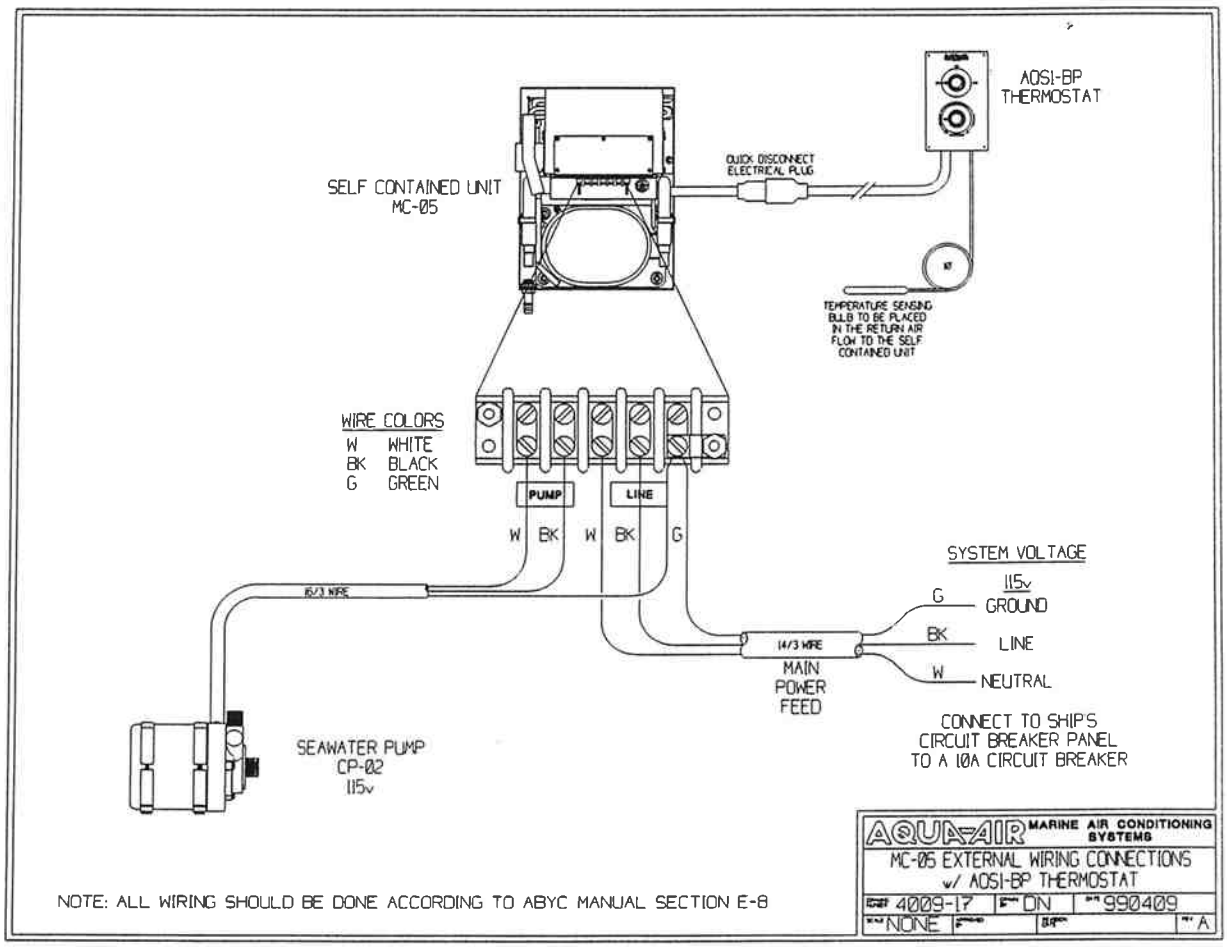


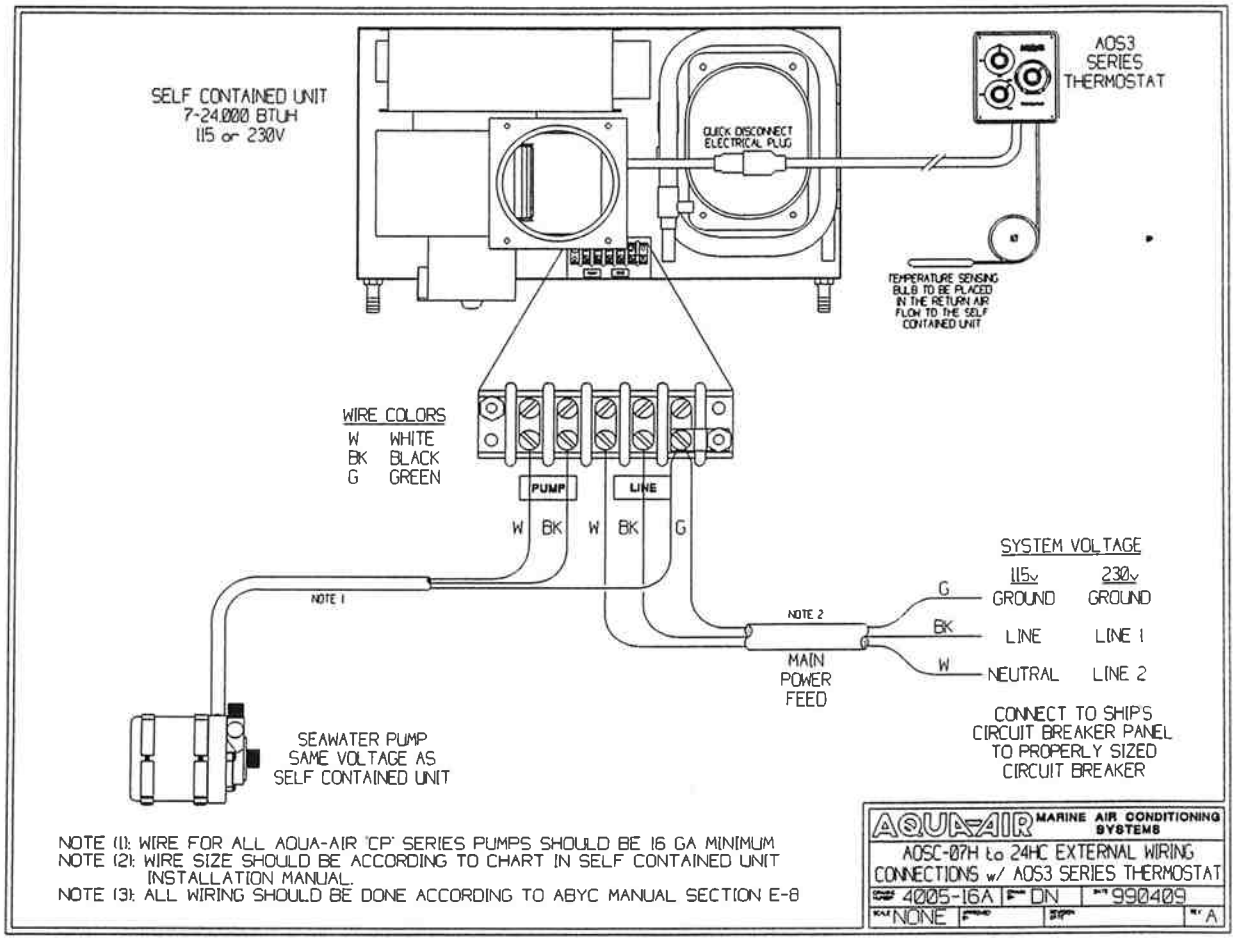


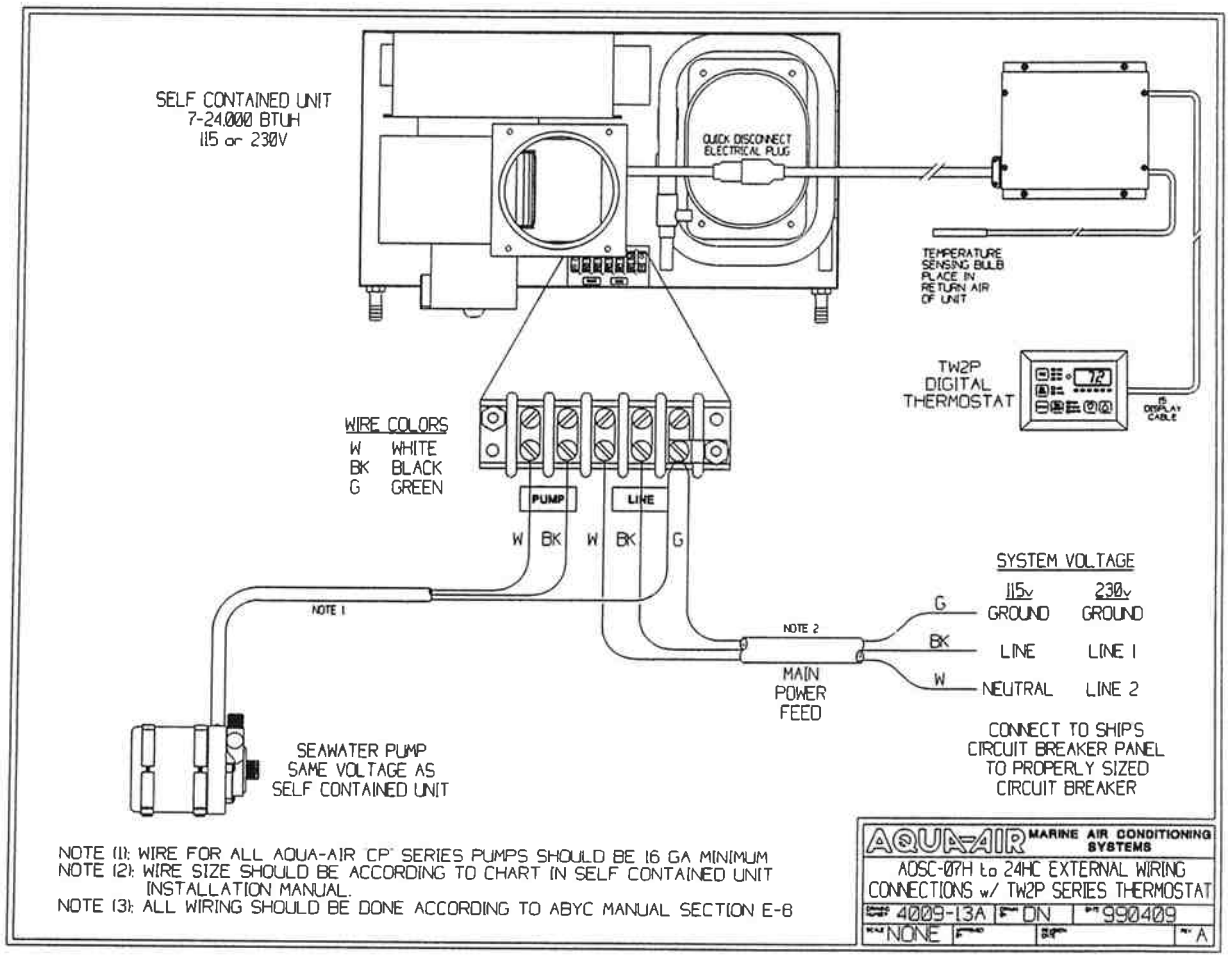
TEMPLATES
FOR
THERMOSTATS

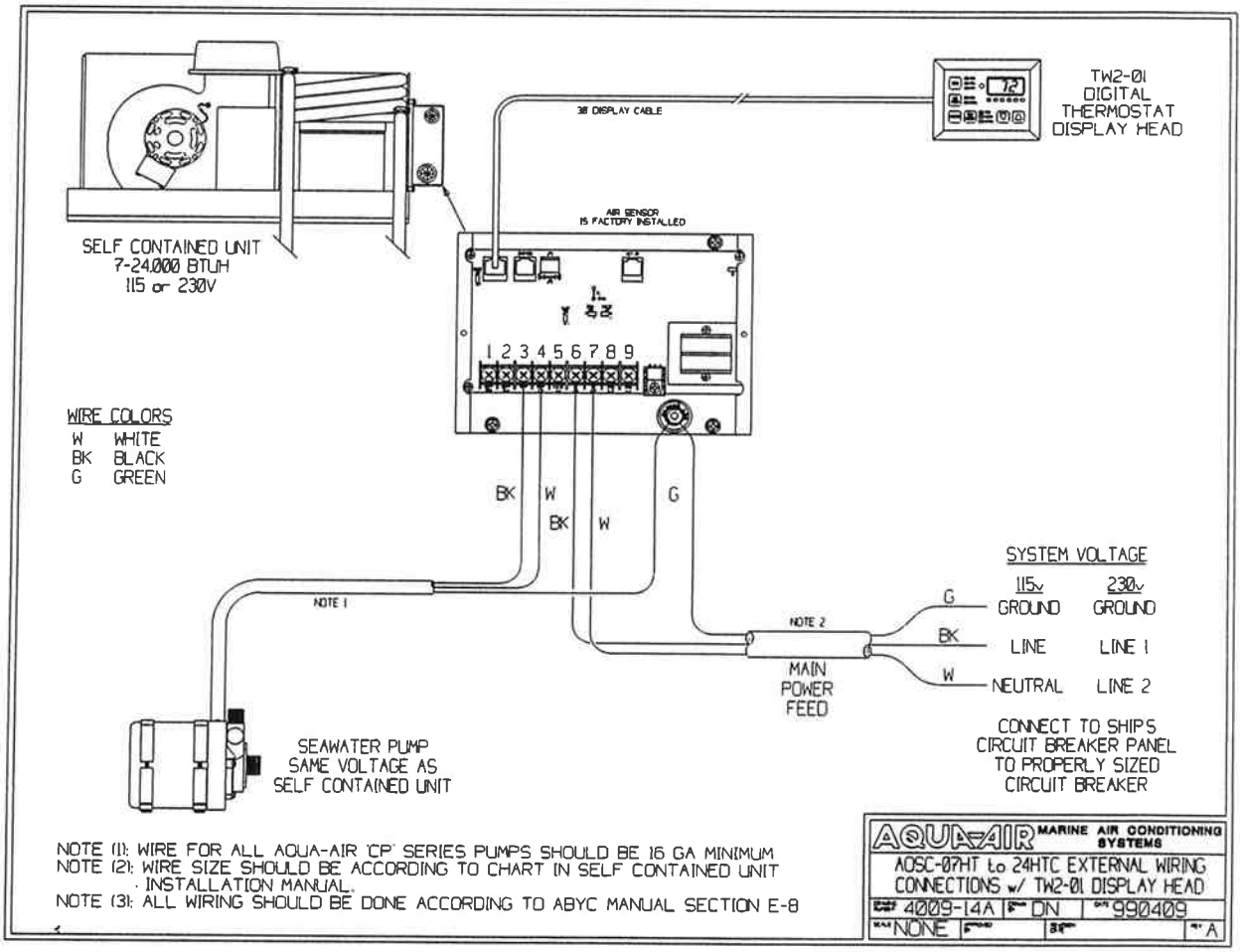


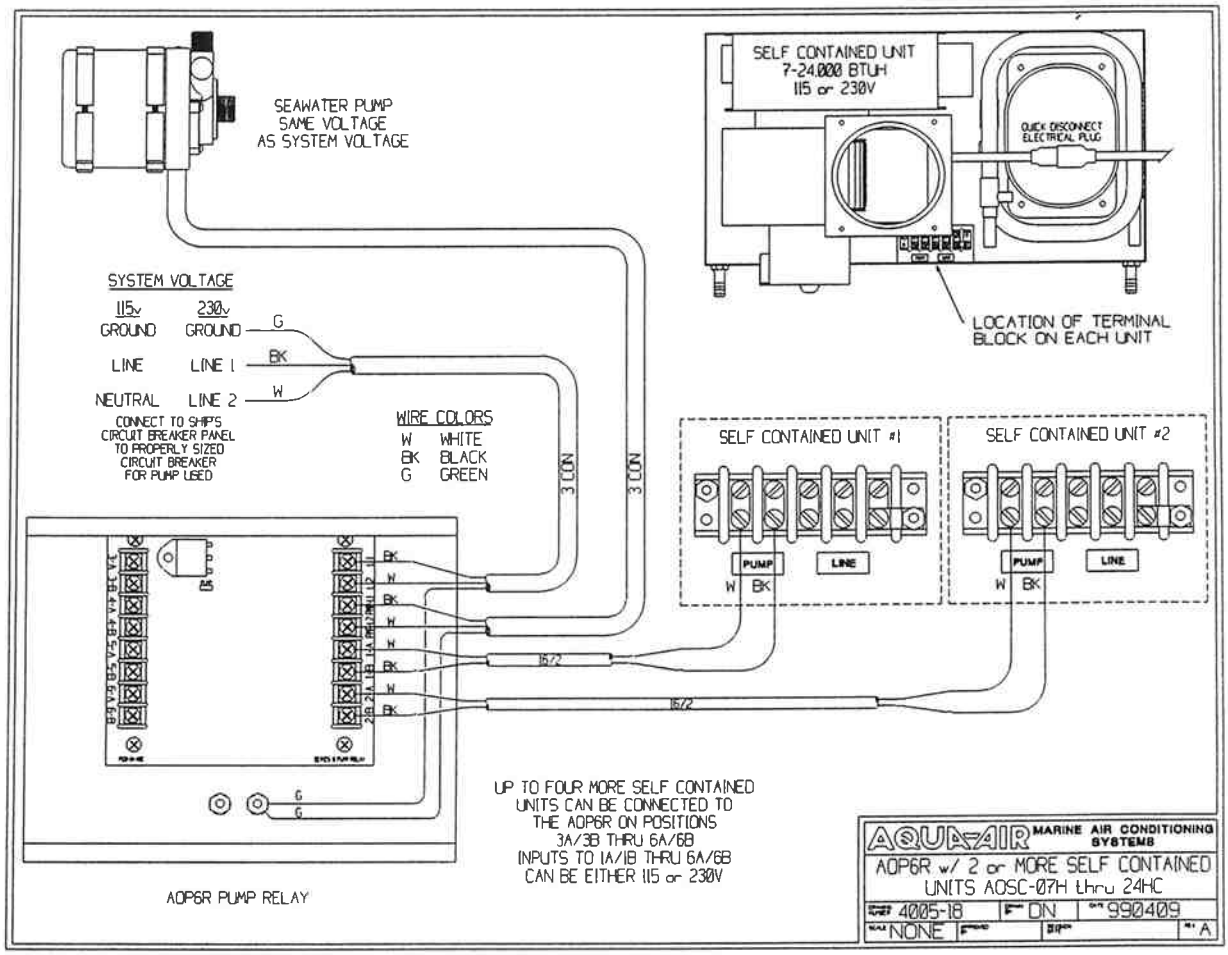
J:\GCD\TEMPLATE

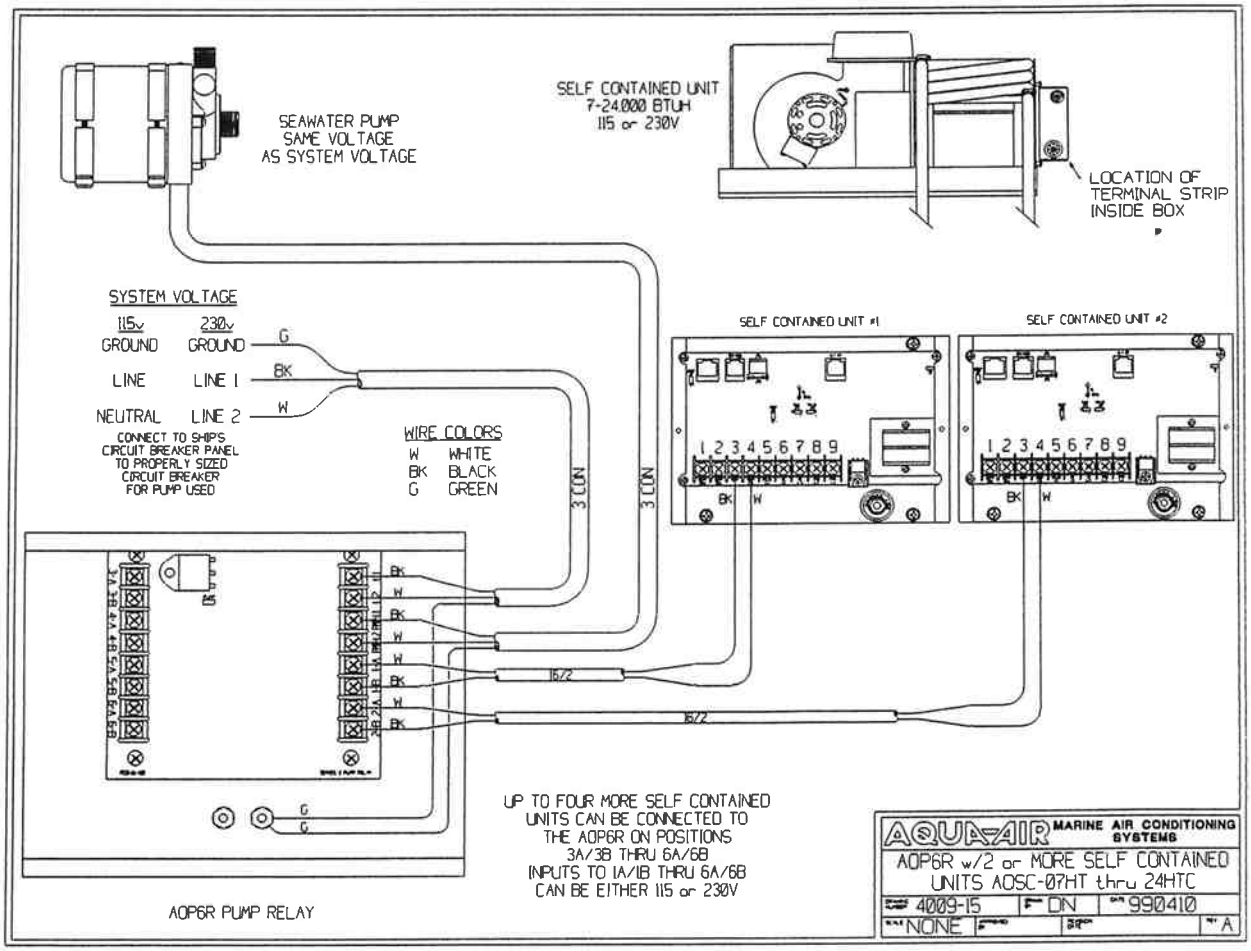

AOSI-BP
THERMOSTAT
SELF CONTAINED UNIT
MC-05
QUICK DISCONNECT
ELECTRICAL PLUG
TEMPERATURE SENSING
BULB TO BE PLACED
IN THE RETURN AIR
FLOW TO THE SELF
CONTAINED UNIT
WIRE COLORS
W WHITE
BK BLACK
G GREEN
PUMP
LINE
W BK W BK G
SYSTEM VOLTAGE
115v
G GROUND
BK LINE
W NEUTRAL
14/3 WIRE
MAIN
POWER
FEED
SEAWATER PUMP
CP-02
115v
CONNECT TO SHIP'S
CIRCUIT BREAKER PANEL
TO A 10A CIRCUIT BREAKER
NOTE: ALL WIRING SHOULD BE DONE ACCORDING TO ABYC MANUAL SECTION E-8
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
MC-05 EXTERNAL WIRING CONNECTIONS
w/ AOSI-BP THERMOSTAT
4009-17
DN
990409
NONE
A

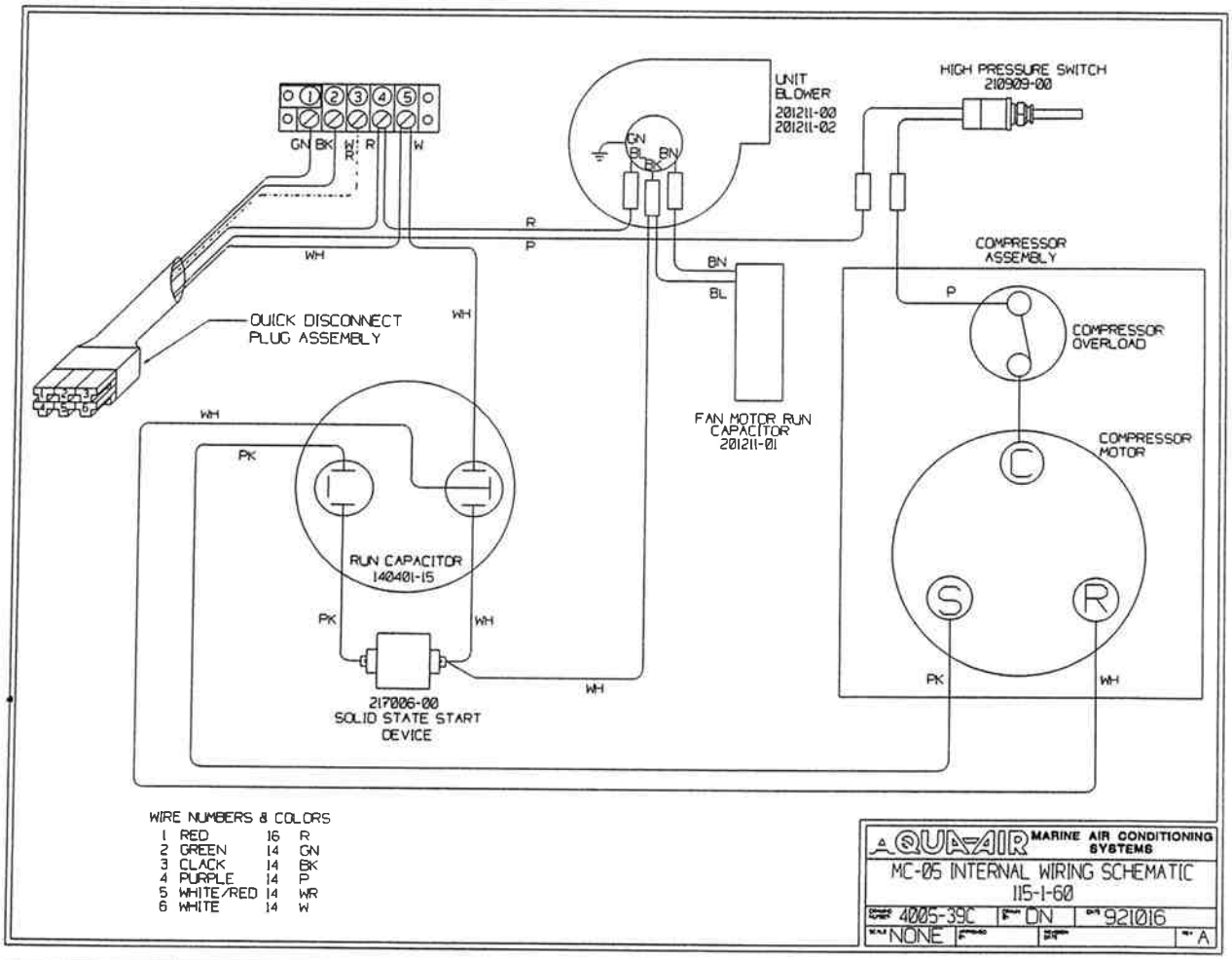

AOS3
SERIES
THERMOSTAT
SELF CONTAINED UNIT
7-24,000 BTUH
115 or 230V
QUICK DISCONNECT
ELECTRICAL PLUG
TEMPERATURE SENSING
BULB TO BE PLACED
IN THE RETURN AIR
FLOW TO THE SELF
CONTAINED UNIT
WIRE COLORS
W WHITE
BK BLACK
G GREEN
PUMP
LINE
W BK W BK G
NOTE 1
NOTE 2
SYSTEM VOLTAGE
115v
230v
G GROUND GROUND
BK LINE LINE 1
W NEUTRAL LINE 2
MAIN
POWER
FEED
SEAWATER PUMP
SAME VOLTAGE AS
SELF CONTAINED UNIT
CONNECT TO SHIP'S
CIRCUIT BREAKER PANEL
TO PROPERLY SIZED
CIRCUIT BREAKER
NOTE (1): WIRE FOR ALL AQUA-AIR 'CP' SERIES PUMPS SHOULD BE 16 GA MINIMUM
NOTE (2): WIRE SIZE SHOULD BE ACCORDING TO CHART IN SELF CONTAINED UNIT
INSTALLATION MANUAL.
NOTE (3): ALL WIRING SHOULD BE DONE ACCORDING TO ABYC MANUAL SECTION E-8
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AOSC-07H to 24HC EXTERNAL WIRING
CONNECTIONS w/ AOS3 SERIES THERMOSTAT
4005-16A
DN
990409
NONE
A

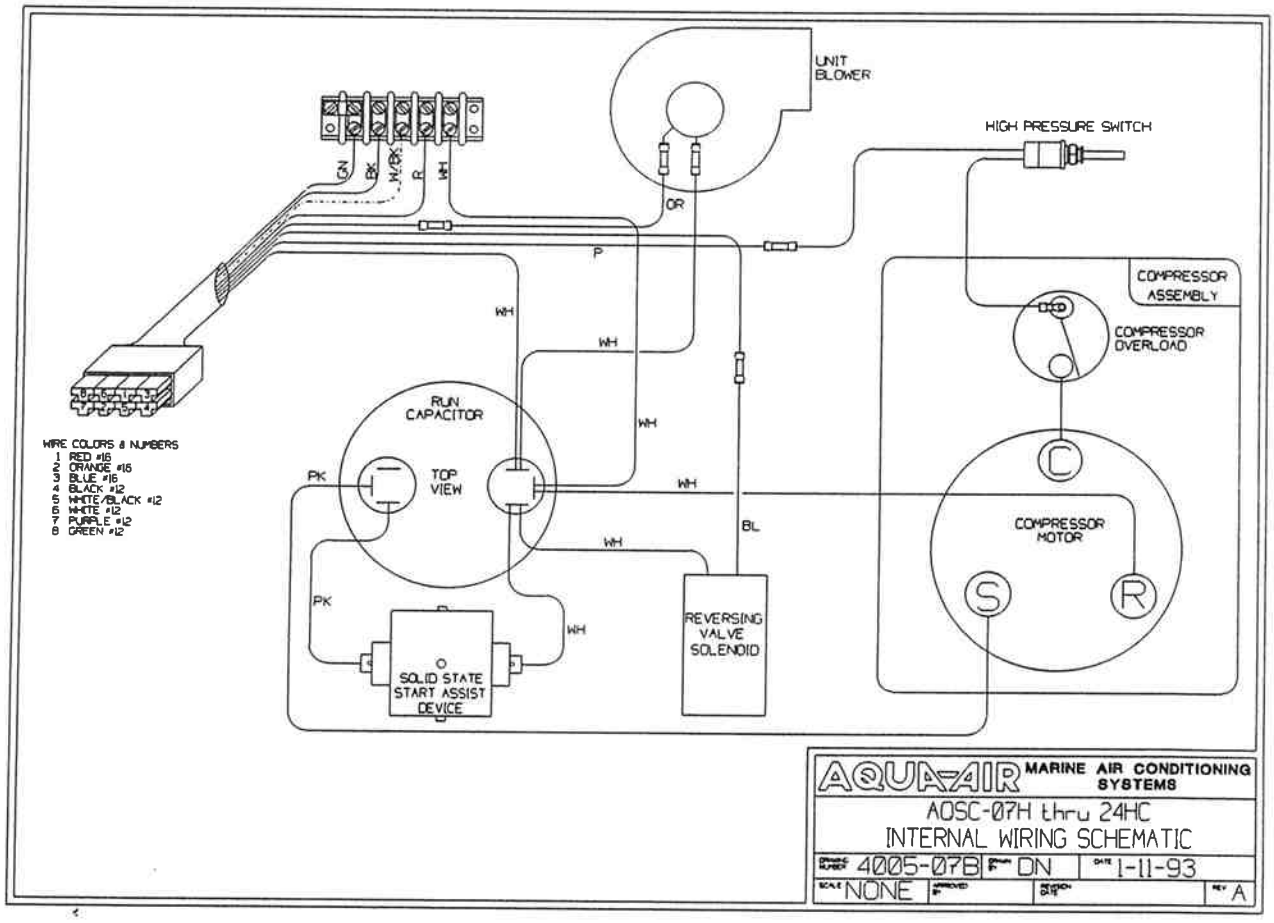

SELF CONTAINED UNIT
7-24,000 BTUH
115 or 230V
QUICK DISCONNECT ELECTRICAL PLUG
TEMPERATURE SENSING BULB PLACE IN RETURN AIR OF UNIT
TW2P DIGITAL THERMOSTAT
25' DISPLAY CABLE
WIRE COLORS
W WHITE
BK BLACK
G GREEN
PUMP
LINE
W BK W BK G
NOTE 1
NOTE 2
MAIN POWER FEED
SYSTEM VOLTAGE
115v 230v
G GROUND GROUND
BK LINE LINE 1
W NEUTRAL LINE 2
CONNECT TO SHIPS CIRCUIT BREAKER PANEL TO PROPERLY SIZED CIRCUIT BREAKER
SEAWATER PUMP SAME VOLTAGE AS SELF CONTAINED UNIT
NOTE (1): WIRE FOR ALL AQUA-AIR 'CP' SERIES PUMPS SHOULD BE 16 GA MINIMUM
NOTE (2): WIRE SIZE SHOULD BE ACCORDING TO CHART IN SELF CONTAINED UNIT INSTALLATION MANUAL.
NOTE (3): ALL WIRING SHOULD BE DONE ACCORDING TO ABYC MANUAL SECTION E-8
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AOSC-07H to 24HC EXTERNAL WIRING CONNECTIONS w/ TW2P SERIES THERMOSTAT
4009-13A DN 990409
NONE A

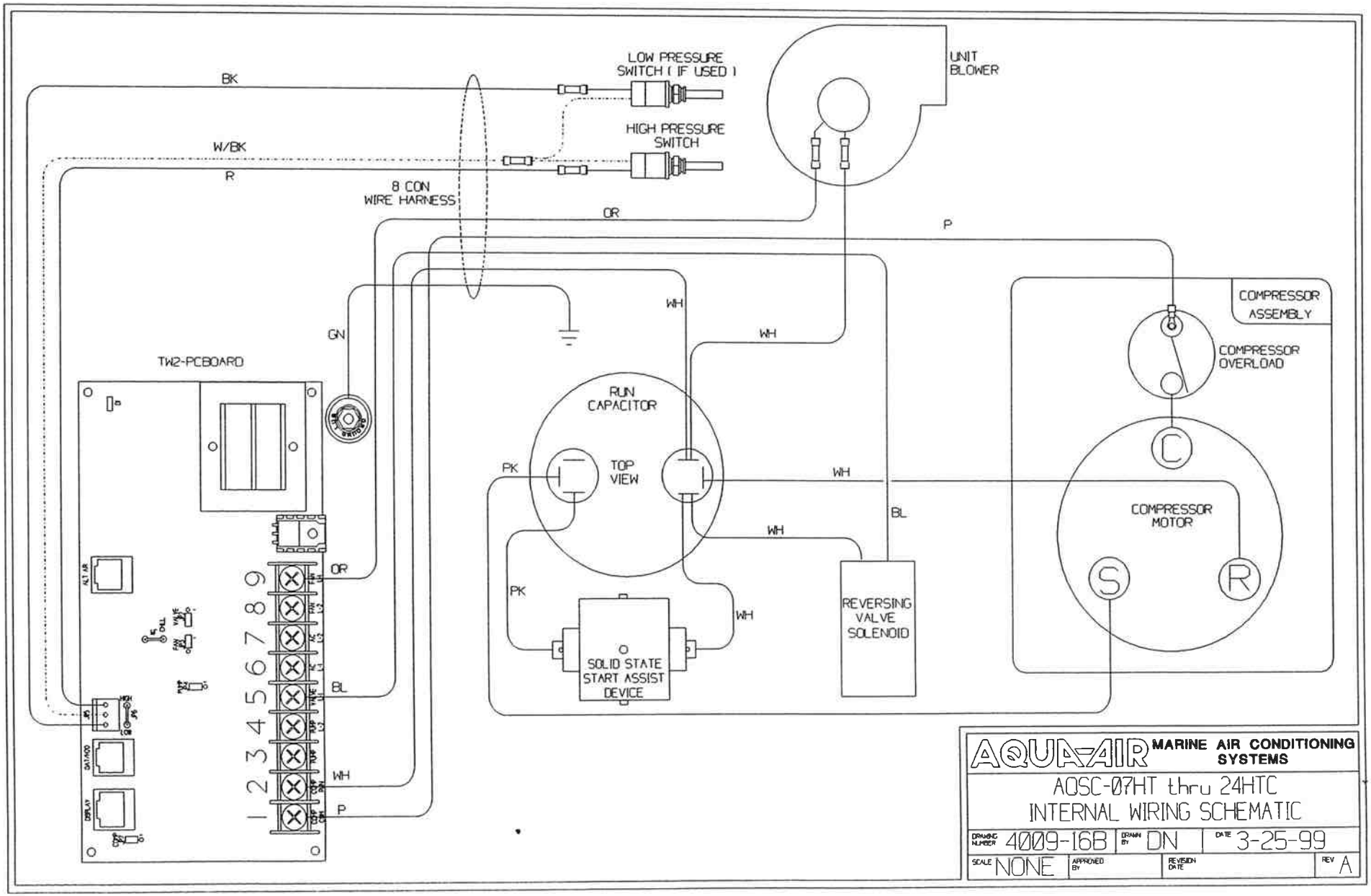

SELF CONTAINED UNIT
7-24,000 BTUH
115 or 230V
25' DISPLAY CABLE
TW2-01 DIGITAL THERMOSTAT DISPLAY HEAD
AIR SENSOR IS FACTORY INSTALLED
1 2 3 4 5 6 7 8 9
WIRE COLORS
W WHITE
BK BLACK
G GREEN
BK W BK W G
NOTE 1
NOTE 2
MAIN POWER FEED
SYSTEM VOLTAGE
115v 230v
G GROUND GROUND
BK LINE LINE 1
W NEUTRAL LINE 2
CONNECT TO SHIPS CIRCUIT BREAKER PANEL TO PROPERLY SIZED CIRCUIT BREAKER
SEAWATER PUMP SAME VOLTAGE AS SELF CONTAINED UNIT
NOTE (1): WIRE FOR ALL AQUA-AIR 'CP' SERIES PUMPS SHOULD BE 16 GA MINIMUM
NOTE (2): WIRE SIZE SHOULD BE ACCORDING TO CHART IN SELF CONTAINED UNIT INSTALLATION MANUAL.
NOTE (3): ALL WIRING SHOULD BE DONE ACCORDING TO ABYC MANUAL SECTION E-8
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AOSC-07HT to 24HTC EXTERNAL WIRING CONNECTIONS w/ TW2-01 DISPLAY HEAD
4009-14A DN 990409
NONE A

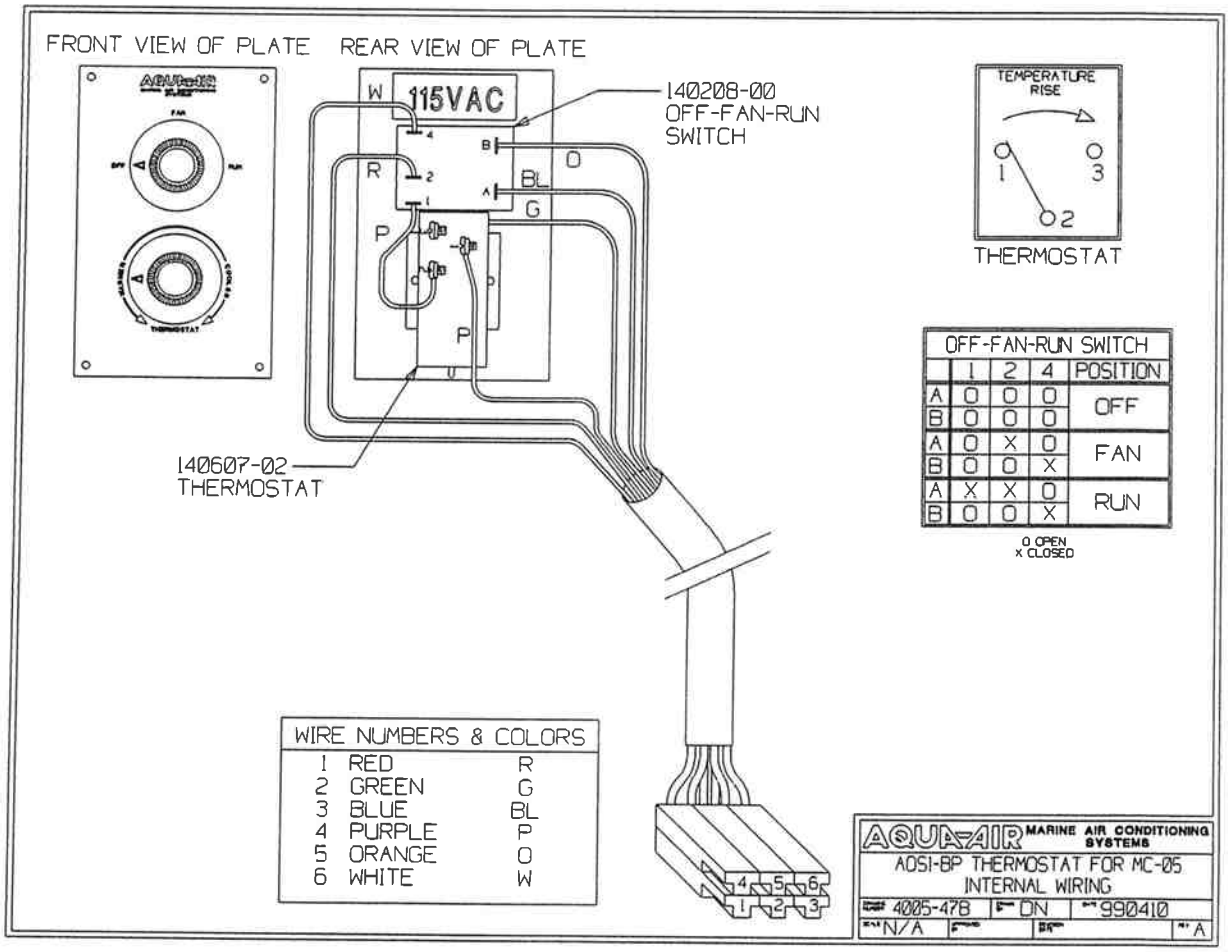

SEAWATER PUMP
SAME VOLTAGE
AS SYSTEM VOLTAGE
SELF CONTAINED UNIT
7-24,000 BTUH
115 or 230V
QUICK DISCONNECT ELECTRICAL PLUG
LOCATION OF TERMINAL BLOCK ON EACH UNIT
SYSTEM VOLTAGE
115v 230v
GROUND GROUND G
LINE LINE 1 BK
NEUTRAL LINE 2 W
CONNECT TO SHIP'S CIRCUIT BREAKER PANEL TO PROPERLY SIZED CIRCUIT BREAKER FOR PUMP USED
WIRE COLORS
W WHITE
BK BLACK
G GREEN
3 CON
3 CON
SELF CONTAINED UNIT #1
SELF CONTAINED UNIT #2
PUMP
LINE
W BK
16/2
16/2
UP TO FOUR MORE SELF CONTAINED UNITS CAN BE CONNECTED TO THE AOP6R ON POSITIONS 3A/3B THRU 6A/6B
INPUTS TO 1A/1B THRU 6A/6B CAN BE EITHER 115 or 230V
AOP6R PUMP RELAY
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AOP6R w/ 2 or MORE SELF CONTAINED UNITS AOSC-07H thru 24HC
4005-18
DN
990409
NONE
A

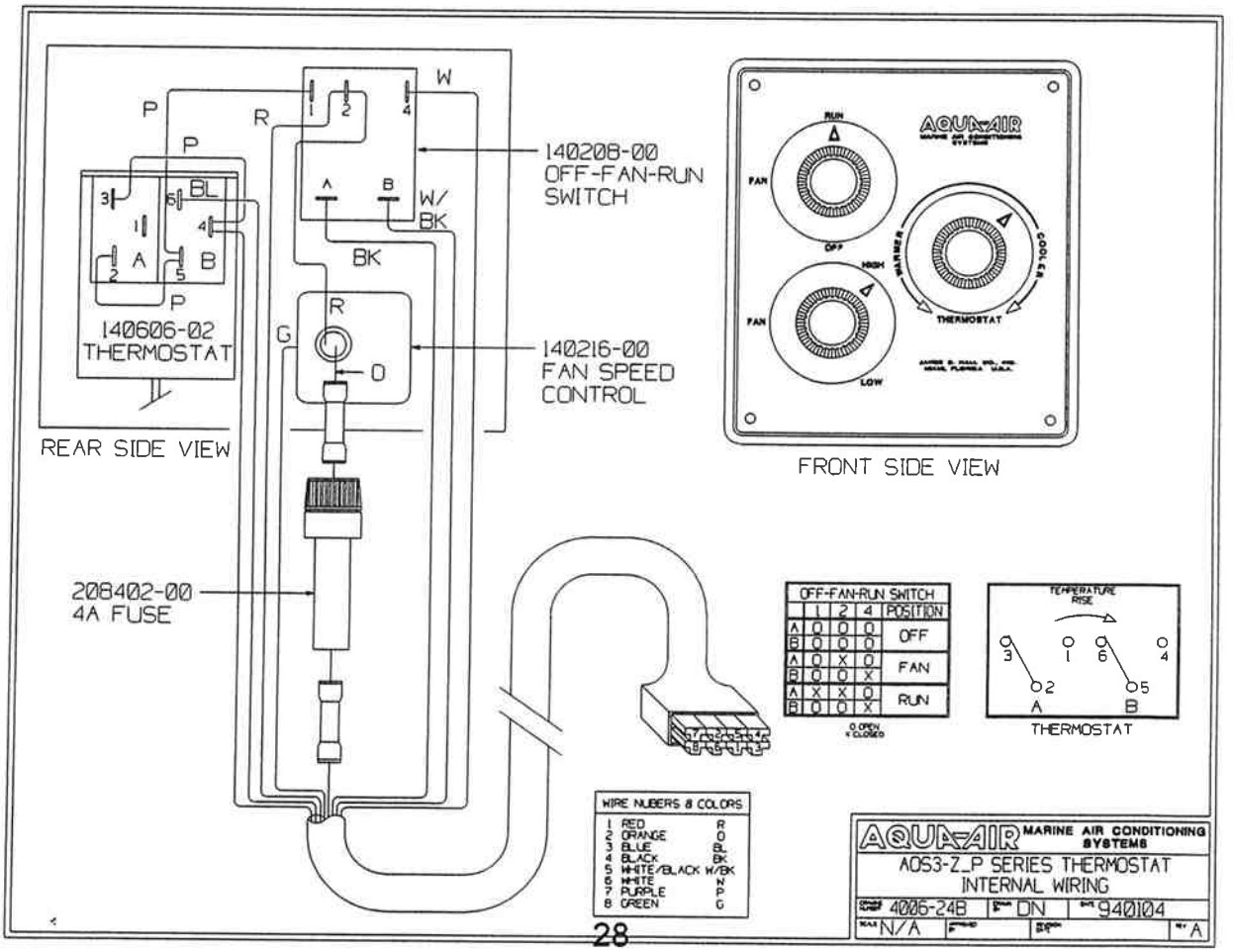

SEAWATER PUMP
SAME VOLTAGE
AS SYSTEM VOLTAGE
SELF CONTAINED UNIT
7-24,000 BTUH
115 or 230V
LOCATION OF TERMINAL STRIP INSIDE BOX
SYSTEM VOLTAGE
115v 230v
GROUND GROUND G
LINE LINE 1 BK
NEUTRAL LINE 2 W
CONNECT TO SHIP'S CIRCUIT BREAKER PANEL TO PROPERLY SIZED CIRCUIT BREAKER FOR PUMP USED
WIRE COLORS
W WHITE
BK BLACK
G GREEN
3 CON
3 CON
SELF CONTAINED UNIT #1
SELF CONTAINED UNIT #2
1 2 3 4 5 6 7 8 9
BK W
16/2
16/2
UP TO FOUR MORE SELF CONTAINED UNITS CAN BE CONNECTED TO THE AOP6R ON POSITIONS 3A/3B THRU 6A/6B
INPUTS TO 1A/1B THRU 6A/6B CAN BE EITHER 115 or 230V
AOP6R PUMP RELAY
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AOP6R w/2 or MORE SELF CONTAINED UNITS AOSC-07HT thru 24HTC
4009-15
DN
990410
NONE
A


UNIT BLOWER
201211-00
201211-02
HIGH PRESSURE SWITCH
210909-00
GN BK W/BK R W
GN BL BN BK
R
P
WH
BN
BL
COMPRESSOR ASSEMBLY
QUICK DISCONNECT PLUG ASSEMBLY
COMPRESSOR OVERLOAD
COMPRESSOR MOTOR
FAN MOTOR RUN CAPACITOR
201211-01
RUN CAPACITOR
140401-15
C
S
R
217006-00
SOLID STATE START DEVICE
WIRE NUMBERS & COLORS
1 RED 16 R
2 GREEN 14 GN
3 CLACK 14 BK
4 PURPLE 14 P
5 WHITE/RED 14 WR
6 WHITE 14 W
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
MC-05 INTERNAL WIRING SCHEMATIC
115-1-60
4005-39C
DN
921016
NONE
A


UNIT BLOWER
HIGH PRESSURE SWITCH
GN BK W/BK R WH
OR
P
WH
COMPRESSOR ASSEMBLY
COMPRESSOR OVERLOAD
RUN CAPACITOR
PK
TOP VIEW
BL
COMPRESSOR MOTOR
C
S
R
REVERSING VALVE SOLENOID
SOLID STATE START ASSIST DEVICE
WIRE COLORS & NUMBERS
1 RED #16
2 ORANGE #16
3 BLUE #16
4 BLACK #12
5 WHITE/BLACK #12
6 WHITE #12
7 PURPLE #12
8 GREEN #12
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AOSC-07H thru 24HC
INTERNAL WIRING SCHEMATIC
4005-07B
DN
1-11-93
NONE
A


LOW PRESSURE
SWITCH (IF USED)
HIGH PRESSURE
SWITCH
UNIT
BLOWER
BK
W/BK
R
8 CON
WIRE HARNESS
OR
P
GN
WH
TW2-PCBOARD
RUN
CAPACITOR
PK
TOP
VIEW
BL
SOLID STATE
START ASSIST
DEVICE
REVERSING
VALVE
SOLENOID
COMPRESSOR
ASSEMBLY
COMPRESSOR
OVERLOAD
C
COMPRESSOR
MOTOR
S
R
1 2 3 4 5 6 7 8 9
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AQSC-07HT thru 24HTC
INTERNAL WIRING SCHEMATIC
DRAWING NUMBER 4009-16B
DRAWN BY DN
DATE 3-25-99
SCALE NONE
APPROVED BY
REVISION DATE
REV A


FRONT VIEW OF PLATE
REAR VIEW OF PLATE
115VAC
140208-00
OFF-FAN-RUN
SWITCH
140607-02
THERMOSTAT
TEMPERATURE RISE
THERMOSTAT
OFF-FAN-RUN SWITCH
POSITION
OFF
FAN
RUN
O OPEN
X CLOSED
WIRE NUMBERS & COLORS
1 RED R
2 GREEN G
3 BLUE BL
4 PURPLE P
5 ORANGE O
6 WHITE W
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AOSI-8P THERMOSTAT FOR MC-05
INTERNAL WIRING
4005-478
DN
990410
N/A
A


140606-02
THERMOSTAT
REAR SIDE VIEW
140208-00
OFF-FAN-RUN
SWITCH
140216-00
FAN SPEED
CONTROL
208402-00
4A FUSE
FRONT SIDE VIEW
OFF-FAN-RUN SWITCH
POSITION
OFF
FAN
RUN
O OPEN
X CLOSED
TEMPERATURE RISE
THERMOSTAT
WIRE NUBERS & COLORS
1 RED R
2 ORANGE O
3 BLUE BL
4 BLACK BK
5 WHITE/BLACK W/BK
6 WHITE W
7 PURPLE P
8 GREEN G
AQUA-AIR MARINE AIR CONDITIONING SYSTEMS
AOS3-Z_P SERIES THERMOSTAT
INTERNAL WIRING
4006-248
DN
940104
N/A
A

AQUA AIR
MARINE AIR CONDITIONING SYSTEMS

DX PRODUCT LIMITED WARRANTY PERIODS

The warranty period on all Aqua-Air DX (Direct Expansion) products is **one year**. Parts and labor are covered per warranty allowance schedules.

For new Aqua-Air DX system installations using **TW 2** microprocessor controls, parts will be warranted for an additional year. All equipment in the system, including pumps, pump relays and associated parts will be covered for **two years**.

The TW2 microprocessor controls used in a retrofit on Aqua-Air or any other manufacturer's marine air conditioning equipment will carry a one year warranty. New TW2 controls or components of the microprocessor control system purchased to replace out of warranty controls or components will have a one year warranty.

Non-warranty replacement parts and components, other than TW2 controls or components, will be warranted for a period of 90 days. This warranty is for parts only, no labor is included. The exception to this category is replacement compressors which carry a one year warranty, including parts and labor from the date they were sold.

Parts and components supplied by Aqua-Air Manufacturing for replacement on any Aqua-Air unit under warranty will be warranted for the remainder of the original warranty period only.

Replacement parts or components used on competitors equipment will have a 90 day warranty. The exception is those parts used in the refrigeration circuit of any competitive brand of air conditioning equipment, which will carry no warranty.

All warranties begin when the customer takes possession of the equipment. The warranty is extended to all owners of the equipment commencing the date the original owner takes possession of it. Verification of original purchase will be required. All warranties are limited to the terms and periods set forth here. Any and all implied warranties are excluded.

Fuses and MOV's are used as safety devices to protect Aqua-Air equipment against over-voltage conditions caused by induced lightning or inductive switching environments. These are not covered under warranty.

Aqua-Air will repair or replace, at its option, components found to be defective due to faulty materials or workmanship, after the component has been examined by Aqua-Air or its authorized servicing dealer. Additionally, Aqua-Air will pay labor costs, as outlined in its Schedule of Limited Allowances, for the removal and replacement of the component. This limited warranty extends to Aqua-Air DX products that have been installed, operated and maintained in accordance with written guidelines available from Aqua-Air.

Aqua-Air reserves the right to change its warranty policies and procedures as well as its warranty allowances without notice.

Aqua-Air equipment is designed and manufactured for long term, trouble free operation when properly operated and maintained. It is strongly recommended that you read your owners manual and fully understand the operations of your Aqua-Air equipment. Any questions you have regarding the operations of your Aqua-Air system or warranty coverage can be directed to your authorized Aqua-Air dealer or to Tech Support at Aqua-Air Manufacturing (800) 457-3928.

80805-1a, 2

AQUA-AIR MANUFACTURING, division of the James D. Nall Co., Inc.
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Ph. 305-884-8363 Fax 305-883-8549 Email sales@aquaair.com