Tempered Water A/C Systems

❖ INSTALLATION GUIDE

Dometic® Cruisair®

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CE

For LP-14

WARNING

This manual contains essential safety information concerning the operation and maintenance of your Cruisair system. It is very important that you read and understand the contents of this manual thoroughly before using the equipment, and you should keep it on your boat for future reference. If there are any statements in this manual that you do not understand, contact the Dometic Corporation Service Department or your local dealer for assistance.

NOTICE

Your Cruisair air conditioning system uses a refrigerant gas known as R-22. Federal law forbids the intentional release of the refrigerant gas to the environment. You should make certain that any field service is performed by a competent specialist with the proper equipment to prevent any loss of R-22 during servicing.

IMPORTANT

Cruisair tempered water components are well engineered and built, and thoroughly tested at the factory. However, a circulated water system will only perform as well as the quality of the installation. This consists mainly of plumbing and wiring, which can be handled by most boatyards; but each aspect of the installation should be thoroughly planned to minimize time consuming mistakes and maximize performance.

One of the most common source of problems with these systems is the water plumbing. Always be sure to double check connections for correct placement and tightness. A simple rule about water connections would be that the return lines are above the supply. This is so that any air in the system will travel upwards with the water flow.

When selecting the site for a piece of equipment, try to choose a location which will keep noise to a minimum, but also allow for future servicing. The Dometic Corporation Applications department is available to help with the design of the system, or to answer any specific questions one may have about either the equipment or the installation.

Table Of Contents

INSTALLATION GUIDE

INSTALLATION GUIDE: Modular Tempering Unit Installation

Location
The tempering unit is usually located in the engine room, or other mechanical space. When choosing a location keep in mind this is an electromechanical piece of equipment and on occasion may need maintenance, repair or replacement. Always provide adequate visual and physical access.

Lifting
When lifting framed units, do not lift by the upper part of the frame. Only lift by the base. Some units have eye-bolts which can be used for lifting.

Mounting
Individual modular units are contained in a condensate pan, which is then secured to the boat. Mount the unit securely on a horizontal surface of sufficient strength to withstand both static load and dynamic forces when boat is in motion. Secure the unit on all four corners using pre-installed mounting brackets (shown in figure 1). Do not bolt through bottom of pan.

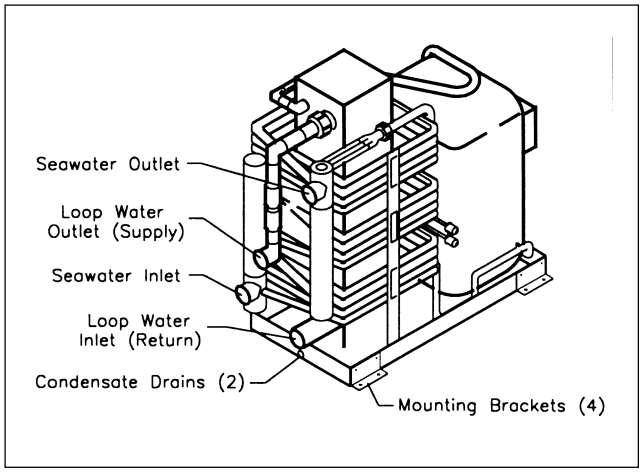

Figure 1. Modular Tempering Unit

The pan of the unit has two 3/8 FPT condensate drains, one at each end. Connect these outlets to proper tubing and route to an appropriate location such as an overboard fitting or sump. Do not permit condensate to puddle in the bilge.

Mounting Frames
Holes are provided in the base rails to secure the frames. If stacking one frame on top of another, the frames will overlap and the units should be bolted together. Be sure to secure the top of the frame to prevent movement.

Water Connections
Figure 1 shows water connection locations. Unions and service valves should be used on the water connections for ease of servicing in the future. Always use full flow ball valves.

The loop water connections are the bronze fittings, with the inlet being the lower, and the outlet is the upper.

The sea water pipes connect to the plastic headers in the same fashion, lower inlet and upper outlet. Note that the seawater fittings can be changed so the connections are on the top and bottom of the unit, instead of on the end, as from the factory.

Support all the piping by the boat's structure and do not rely on the equipment for support. Figure 2 shows the water connection sizes.

Water Headers

See figure 3 for water manifold connection sizes. Also, it is a good practice to use reverse returns on seawater plumbing to ensure equal water distribution to all tempering units.

Wiring

The wiring for the modular tempering unit is very simple. The control wires have polarized plugs which mate with plugs on the wire leads from the control panel.

On single phase units, the compressor power lead from the control panel connects to the terminal strip in the electrical box mounted on the tempering unit.

The power wiring for three phase models will simply have leads from the control panel that connect directly to the compressor. Figure 3 shows a typical, two-unit system, wiring schematic.

Note that the air handling units are not electrically connected to the tempering unit or panel control.

Tempering Units	Seawater Fittings*	Loop Water Fittings*
3 or 4 ton	1"	1"
5 or 6 ton	1"	1 1/4"
Multiple Units	**Headers**	**Headers**
2 Units	1 1/2"	1 1/2"
3 Units (Up to 144,000 BTU/hr)	1 1/2"	1 1/2"
3 Units (Over 144,000 BTU/hr)	2"	2"
4 Units	2"	2"
* All fittings are FPT.		

Figure 2. Tempering Unit Water Connections

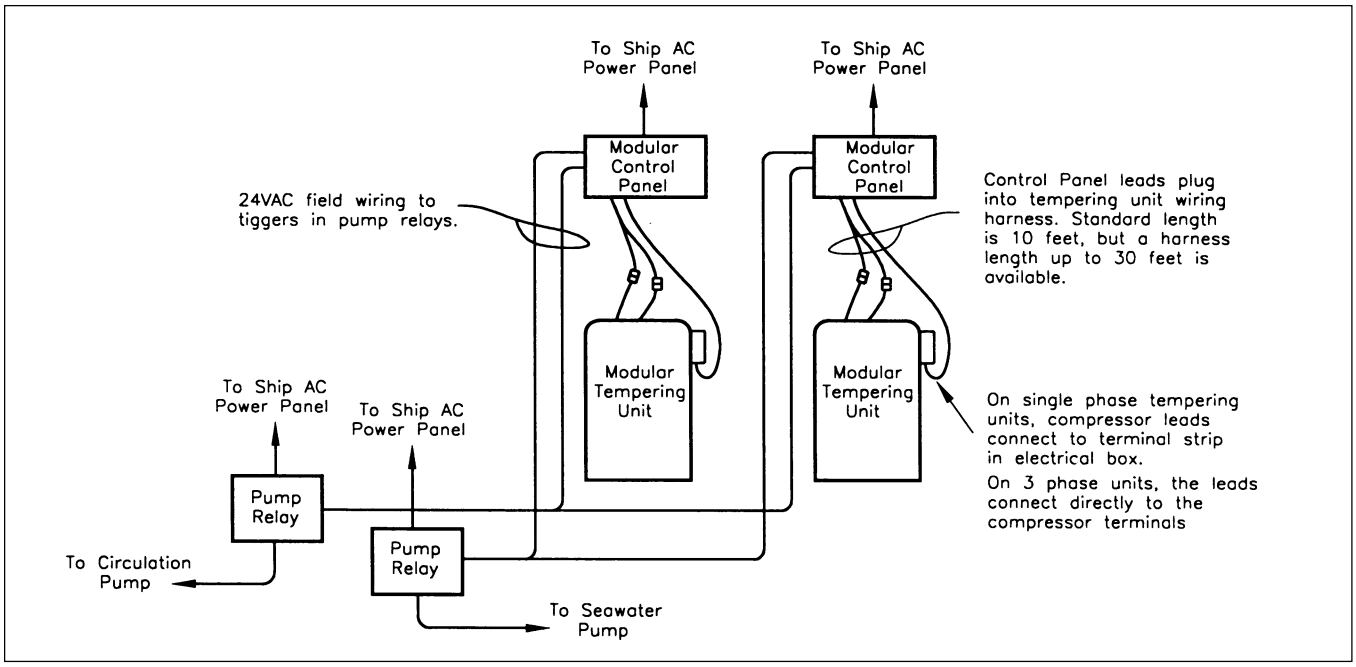

Figure 3. Typical Wiring Schematic For Tempered Water Systems.

INSTALLATION GUIDE: Modular Control Panels

Location
The control panel contains all of the necessary controls to operate the tempering unit. Mount the panel to a flat vertical surface.(See figure 4). The location chosen should be free from water spray and heavy moisture and should also provide adequate access both visual and physical. The location should also be close enough so the factory connected leads will reach the tempering unit. The panel comes standard with 10' of wire to connect to the tempering unit. Longer leads can be provided on special request.

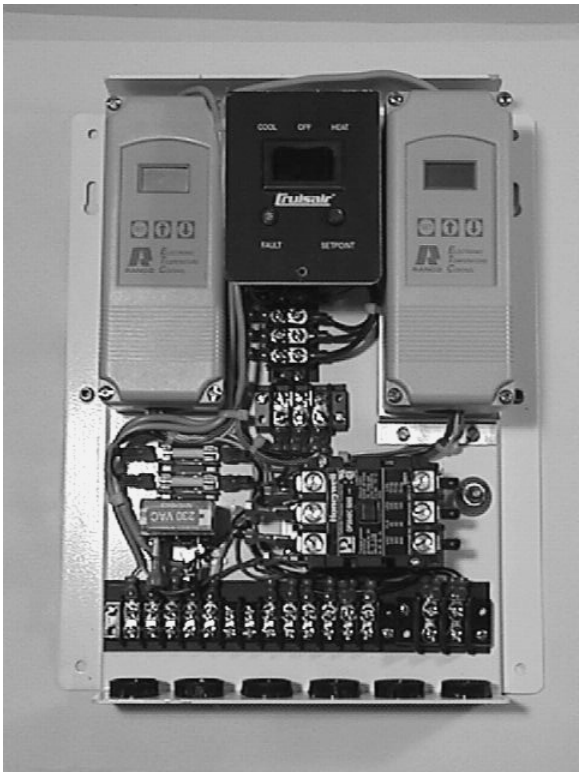

Figure 4. Modular Unit Panel.

Multi-Modular Panels
Multi-unit control panels will follow the same guidelines as the single panel. If multiple tempering units are provided in a frame, the panel can be mounted on the frame itself.

Single Panel Wiring
The wiring of the control panel will consist of connecting the pre-wired leads to the tempering unit, connecting field installed power wiring to the power input terminal strip, and connecting field installed control signal to the seawater and circulating pump relays. All field wiring should only be done by qualified people and the correct wire size and proper terminals should always be used. See figure 4 for general wiring schematic.

Multi-Unit Panel Wiring
Multi-unit control panels are similar to the single panels in that all control leads are provided with the panel, and plug directly to the tempering units. The compressor leads are also the same as on the single units, whether single or three phase systems. If pump relays are incorporated into the control panel, then the pump leads will be field wired from the proper terminal strip in the control panel to the appropriate pump.

Temperature Sensors
The multi-unit panel will have temperature sensors for sensing return and supply loop water temperature. The return loop water temperature sensor is for sensing stage temperature setpoint. The supply loop water temperature sensor is for sensing freeze and high limit temperature conditions. Each sensor is labeled. These should be placed as close to the tempering units, on the main water headers, as possible so that true temperature is measured. Also, if CPVC piping is used, a sensor mount (such as MDC # A-416 or A-417) should be used, since the plastic pipes will not transfer heat well enough for accurate sensing. Insulate the piping and sensor mount together.

Owner's Control

The MSC-1KCB owner's control for single control panels is mounted in a convientient location, and conductor wire is run to terminal strip on control panel. The owner's control can only operate one panel.

For the owner's control used with a combo-panel (MSAH-1MHAB), the momentary switch is mounted where desired, with 5 conductor control wiring run to the terminal strip on the combo-panel. Multiple owner's controls can be installed, if desired.

There is also a model available with digital temperature display of the Supply and Return Loop water.

Pump Relays

There are numerous types of relays that may be used, but there are a few general guidelines that should always be followed. The location should be free of water spray and heavy moisture, and adequate accessibility should be provided to allow for inspection of fuses or breakers. 24 VAC triggers should always be used.

The relay will only need to receive control wire from the modular control panel and the power wiring will be field installed from the boat's power distribution and then on to the pump. All field wiring should only be done by qualified people and the correct wire size and proper terminals should always be used.

Circuit Breakers

Breakers are sized for short circuit protection of current carrying conductors. Curve 10 breakers should be used for the tempering units due to the starting loads of the compressors. Always check with regulation codes (ABYC, section E8) for final sizing of breakers or wiring.

Variable Frequency Drives

These units should be mounted close to the compressors, in an accessible place. The wiring from the control panel will feed to the VFD, and then on to the tempering unit. The tempering unit must have a 3 phase compressor, but the VFD can use either 1 or 3 phase input power. The control panel should match the ship's power, whether 1 or 3 phase. See the instruction sheet for specific wiring details, or contact the Dometic Corporation - Cruisair, Applications Department.

INSTALLATION GUIDE: Seawater System

Through Hull Fitting

A separate through-hull fitting and seacock should be used for each air conditioning seawater pump.

Special attention should be given to the location of the inlet through-hull fitting. A dedicated through-hull for the air conditioning system should be located no more than six inches from the keel, and ahead of the stuffing box and engine intake through-hull. Do not attempt to draw seawater from the engine or generator through-hull fitting. If a sea chest arrangement is used, special precautions must be taken to ensure that the tempering unit will have adequate raw water flow.

A scoop-type through-hull is preferred for most installations, especially on faster boats. It should be facing forward and located near the keel or centerline, where it will always be underwater whenever the air conditioner is running. Beware of the change of location of the through-hull fitting relative to the waterline, given the motion of the boat. Special attention should be given to sail boat applications, as the extreme heel angles they experience could result in the through-hull fitting coming out of the water and air locking the pump.

Strainer

The in-line basket type strainer should be placed in the seawater line between the seacock and the pump. It should be situated to provide easy access for regular cleaning. Make certain the seawater strainer is oriented properly. The arrow on the strainer housing should point in the direction of the water flow, toward the seawater pump.

Centrifugal Pumps

The seawater pump must be placed in a location that is below the water line whenever the air conditioning system is running, and typically near the tempering unit. The centrifugal pump is not self-priming and water must flow freely to it. The pump may become air locked if air is drawn into the seawater system. Once again, sailboats may require special considerations to prevent air locking when heeling.

Bolt the pump securely on a horizontal surface with the discharge connection as the highest point. The pump should be installed with resilient mounts to prevent vibrations from being transmitted to the structure of the boat. Make certain that the pump is easily accessible for service.

The orientation of the pump head should always have the discharge pointing upward with a straight run of vertical pipe leaving the pump. This will help prevent air from becoming trapped in the pump head. Trapped air is a common nuisance that prevents proper flow and may even damage the pump. Be sure the location chosen will not allow the pump to be stepped on or hit by other moving machinery.

The fittings connecting the pipe to the pump should provide valves and unions to allow removal the pump for maintenance and repair. Note that the piping is determined by the volume of the water flow, not the connection sizes on the pump head.

The immediate pipe to the inlet of the pump head should be straight for a length of at least 12" so a uniform flow of water enters the pump.

Do not install any type of check valve in the seawater system as this can cause the pump to air lock if any air gets into the system.

Pump Wiring

The only wire to be connected to the pump will be the power wires from the output of the pump relay. Pay close attention to the wiring schematic label on the side of the pump motor. Many of the pumps used in Cruisair systems are dual voltage. Determine the supply voltage, and connect the pump accordingly. Connecting the wiring incorrectly could destroy the motor. There are some cases where the pump is supplied with a dual rotation motor. Be sure that the pump is rotating in the proper direction, usually indicated by an arrow on the pump head. All field wiring should only be done by qualified people and the correct wire size and proper terminals should always be used.

INSTALLATION GUIDE: Importance of a Self-Draining Seawater System

Whenever a centrifugal-type seawater pump is used, it is imperative that the seawater plumbing be routed continually uphill, without loops and dips, from the pump to a high point between the condenser assembly and the overboard discharge. The system is said to be self-draining because if the boat were to be lifted out of the water, all of the water would drain out of the system. This will help prevent air lock if air is ever drawn into the system, and also makes winterizing the system much easier.

A properly plumbed system is absolutely necessary. Air can easily get into the system if the boat is in heavy seas or makes a sharp turn. If this air is not expelled, it can become trapped in the pump. With air in the pump, no pressure can be produced and the water flow stops.

Figure 5 shows a properly plumbed system. In this drawing, the high point of the system is at the overboard discharge. This will allow any air which may be drawn into the system to escape.

If the discharge must be lower than the tempering units, there should only be one high point. This way, when the seawater pump cuts off, the water in the system will drain out (to the water line), preventing the system from becoming air locked.

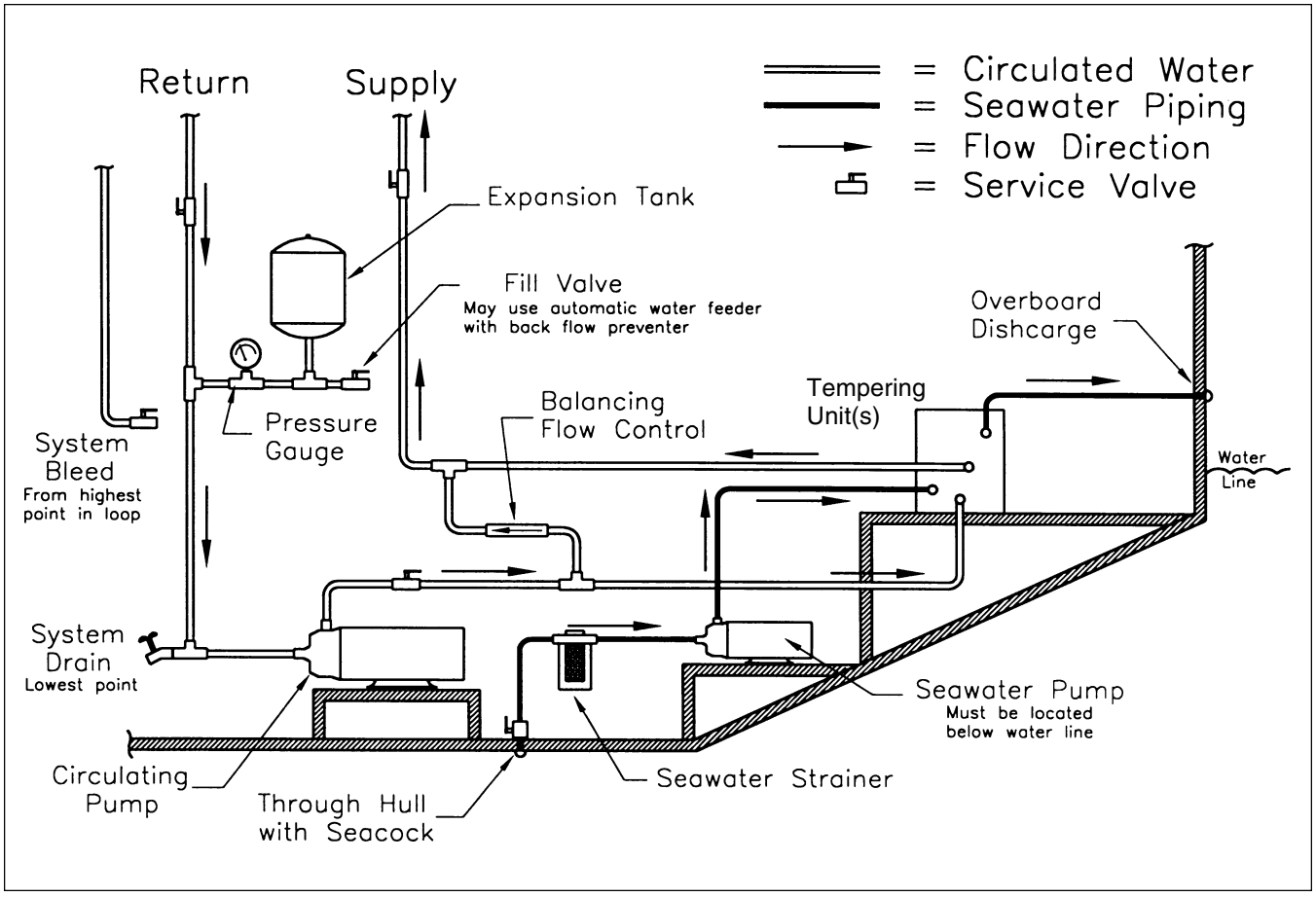

Figure 5. Typical Tempered Water Piping Layout.

Seawater Piping

The seawater cooling system consists of a through-hull fitting, water shut-off valve or seacock, strainer, seawater pump, water pipe (schedule 80 CPVC or cupro-nickle) or marine grade hose, and overboard discharge fitting. Piping should be secured firmly with the correct fittings.

Route the plumbing in a constant uphill to prevent water trapping. Avoid loops, dips and kinks in the seawater pipe. Secure the piping well, as neither the pump nor the tempering unit is designed to support the weight of the piping and water.

If you are using a single seawater pump to supply multiple tempering units, that are not already framed and plumbed together, special attention must be given to ensure even water distribution to each unit. Be careful to avoid loops and dips at this location. Reverse returns should be used whenever possible to ensure equal seawater flow to all units.

Always double clamp hose connections.

Pipe Sizing

See figure 6 for recommended pipe sizing. If the hose or pipe size is a long run or with many fittings, use the next larger size.

Seawater Pipe Sizing Chart

Tempering Unit Capacity Range (BTU/hr X 1000)	Pipe or Hose Size (ID)
24 - 30	3/4"
30 - 72	1"
72 - 144	1 1/4"
144 - 180	1 1/2"
180 - 360	2"
360 - 720	2 1/2"

Figure 6. Seawater Pipe Sizes.

Overboard Discharge

A separate overboard discharge should be used for each tempering unit, but a manifold and a common overboard will work if properly sized. Overboard discharge fittings should be located one or two inches above the vessel's level water line. This will allow visual checking of the water flow, and will be close enough to the water's surface to prevent excessive splashing noise. If the discharge is fitted below the heeled water line, a seacock should be fitted per ABYC standards 4-27 4a.

Spare Pumps

When a back-up pump is to be installed along with the main pump, there are some special considerations which should be followed to ensure proper operation.

The backup pump should be installed in parallel with the main pump, with full flow valves on the inlet and outlet of both pumps to allow total isolation of either pump. A power transfer switch must be provided to select which pump operates. This should be located near pumps to lessen the chance of running a dry pump, which could damage the pump and/or compressor.

To ensure that the spare pump will operate when needed, the main and back-up pumps should be switched at regular intervals so they are run evenly. Another option would be to completely "winterize" the back-up pump (i.e. keep it dry). This should help keep the pump seals in good condition and prevent the pump impeller from freezing up.

Labels identifying the switch and valves in the system would help prevent operator error, and a note on the pumps to tell the user to keep both of the valves on the inactive pump closed might stop a well meaning person from opening all valves which would just circulate water in the pump loop.

An easier and less expensive method might be to install the main pump with cut off valves and unions on the intake and discharge. This would allow a failed pump to be easily replaced with a spare carried aboard. The spare pump could have union fittings attached for quicker a installation, if desired.

INSTALLATION GUIDE: Circulated Water Loop Installation

Guidelines
A typical system will have the circulating pump as the lowest point in the water loop (or as low as possible), with the tempering unit being the next highest piece of equipment followed by the air handlers. Ideally, the only changes in the vertical direction will occur at the air handlers where the built in vents can bleed any trapped air.

Pipe
MDC only recommends “L” type copper or schedule 80 CPVC. The use of any other pipe is the installer’s decision. Always follow manufacturer’s directions when installing piping.

Main Vent
A main vent should be installed at the highest point in the system, with it’s discharge routed back to the engine room so as to allow the system to be filled and vented at the same time. (1/2" piping is sufficient)

System Drain
The system drain is placed at the lowest point in the loop to allow for easy servicing.

Air Traps
A vent should be installed wherever an air trap is possible. All of our air handling units and tempering units have manual vents to bleed air from the system. All piping should be installed so that the air handlers are local high points, with constant inclining and declining slopes. Any time the piping reverses the vertical direction, an air or water trap is created. Air traps can cause noise, and even stop the flow of water; and therefore must have a means of venting the air. They are a real nuisance when trying to fill and bleed a system. A water trap will prevent complete draining of the system (for repair or winterizing), so there must be a drain at the trap.

Support
All piping must be secured to support its own weight (including the water in the system.) Neither the tempering unit nor the air handlers are designed to support the weight of the piping.

Insulation
All piping should be thoroughly insulated to prevent secondary condensation. Improper insulation is a common problem with tempered water systems, and very difficult to find and correct, even after the water damage is noticed. A gap in the insulation will produce condensation on the pipes, which can run down inside the insulation to a different location.

We recommend 3/4" thick insulation on the pipes. Supply and return piping should always be insulated individually.

When putting the recommended closed cell foam insulation over the pipes, cover the ends of the piping to prevent foreign material and moisture from getting inside the piping. After checking for leaks, insulate the connections and tee-joints to prevent secondary condensation. Any exposed pipe can sweat and cause water damage so it is very important to insulate the piping thoroughly.

If using split insulation, seams should be closed tightly, sealed with glue or tape. All water fittings, connections, valves, etc. in the system should be well insulated, after the system is leak tested.

Leak Testing

It is a good practice to leak test the loop plumbing throughout the installation of the system, as well as after the installation is complete. This is especially important when joints will be concealed and therefore very difficult to get to in case of a leak.

A simple procedure of pressurizing the pipes with air will indicate whether that section of plumbing is sound. The piping should be able to hold 75 psi over a 12 hour period (minimum). Note that fluctuations in pressure may be noticed due to temperature changes, but a drop of over 5 psi indicates a leak, which should be found and fixed.

Large leaks will be easily heard, but small leaks can be difficult to find. There are several ways of locating small leaks:

• Add some water to the system before pressurizing with air. The water will travel to the leak and add to the noise as it escapes, as well as creating a wet spot.

• If a joint is suspected to be leaking, a liquid leak detector (such as soap bubbles) can be applied to pinpoint the problem.

• Electronic devices are available which can help identify leaks by “listening” for high frequency noises characteristic of a leak.

Finding leaks before the initial filling of the loop with water will save you from having to drain an entire system to fix leaks, as well as avoiding expensive water damage to a completed vessel.

Pipe Sizing

See figures 7 and 8 to select the proper pipe sizes. These recommended sizes are designed to keep pressure losses to a minimum.
The next larger pipe should be used whenever the capacity being served is near the upper limit of the range and any of the following is true:
• The pipe run has numerous bends.
• The run is an extremely long distance.
• There is a large vertical rise.
• Possibility of adding more capacity.

Note that over sizing pipes can be harmful too. The drastic changes in water velocity can cause extra losses and noise in the system. It can also make it difficult to remove air.

Circulated Water Pipe Sizing Chart	
Capacity Range (BTU/hr X 1000)	Pipe Size (ID)
3 - 12	1/2"
12 - 24	3/4"
24 - 48	1"
48 - 96	1 1/4"
96 - 180	1 1/2"
180 - 360	2"
360 - 660	2 1/2"

Figure 7. Loop Pipe Sizing

Circulation Pump

The circulating pump should be located near the tempering unit, pumping water into the tempering unit first, and then through the loop. This will help ensure that the tempering unit is not starved for water.

The pump discharge should be directed in a vertically upward position, with a straight run of vertical pipe leaving the pump, to prevent air from becoming trapped in the pump head. Trapped air is a common problem which can prevent proper flow causing flow switch shut downs, and can eventually damage the pump.

The immediate pipe to the inlet of the pump head should be straight for a length of at least 12" so a uniform flow of water enters the pump.

The pump should be protected from being stepped on or hit by other objects and all connecting piping should be well supported so as not to put any undue stress on the pump head. Resilient pump mounts should be used to prevent excess vibration from being transmitted to the boat structure.

The fittings connecting the pipe to the pump should provide valves and unions to allow removal the pump for maintenance and repair. Always use full flow ball valves.

Note that the size of the system piping is determined by the volume of the water flow, not the connection sizes on the pump head.

Reference Point	Selection Computation	Capacity Served (BTU/hr)	Pipe Size
Ⓐ	CBB12C	12,000	1/2"
Ⓑ	CBBX15C	15,000	3/4"
Ⓒ	CBLBL18C	18,000	3/4"
Ⓓ	CBBX6C	6,000	1/2"
Ⓔ	BPAH24C	24,000	3/4"
Ⓕ	Ⓒ + Ⓓ	24,000	3/4" or 1"
Ⓖ	Ⓐ + Ⓑ	27,000	1"
Ⓗ	Ⓖ + Ⓕ	51,000	1−1/4"
Ⓘ	Ⓗ + Ⓔ	75,000	1−1/4"

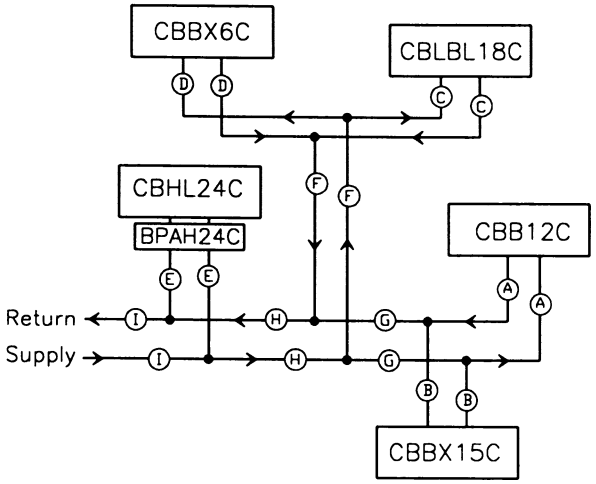

Figure 8. Circulated Water Piping.

Expansion Tank

The expansion tank, pressure gauge, and fill valve should all be connected on the return side of the loop, at the inlet of the circulating pump. The tank should be fastened securely so as not to put any stress on the connecting pipe and can be mounted in any position. The gauge should be located to allow good visibility when operating the fill valve.

It is a good idea to install a service valve at the expansion tank to ease future maintenance. However, the valve handle should be removed to prevent the tank from being isolated from the main loop.

When the fill valve is connected permanently to the potable water supply, a proper back flow preventer must be installed, per ABYC.

If an electric or a fuel fired water heater is used to heat the loop, a 30 psi relief valve must be installed and the discharge plumbed to a safe location.

Balancing Flow Control

The balancing flow control is a flow regulator that is used in a system where the total air handler capacity is different from the tempering units. Because CRUISAIR tempered water components use flow controls to regulate the flow through each unit, a "balanced" system can be achieved which eliminates the need to manually adjust the flow with valves.

Typically, the air handlers have a larger capacity than the tempering units. In this case, the BFC is installed in parallel with the tempering unit and balances the loop by allowing only a certain amount of water to bypass the unit.

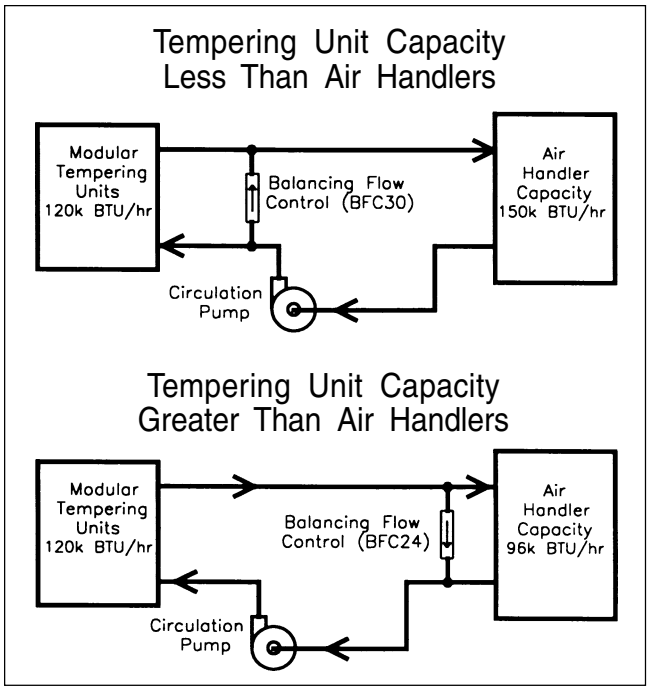

Figure 9. Balancing Flow Control Installations.

In the case of the tempering units having more capacity than the air handlers; the BFC is installed in parallel with the air handlers so enough water flows through the tempering unit. See figure 9.
Balancing flow controls are available in many different capacities. Connections range from 1/2" FPT to 1 1/4" FPT.

Two Pump Systems

When larger systems are installed, (tempering unit capacity over 20 tons) often two circulating pumps are used to ensure proper water flow. One pump (sized to loop capacity) will serve the air handlers , and a second pump (sized to tempering unit needs) will draw water from the air handler loop and supply the tempering units.

The balancing pipe allows both pumps to provide the correct water flow to each side of the loop. This is a self balancing system, and a BFC is not needed. See figure 10.

A full flow valve can be installed in this balancing pipe which will allow one pump to supply the entire system, providing at least partial operation in the case of a pump failure.

The minimum size of the balancing pipe can be figured from figure 10 by using the difference in capacities to select pipe size.

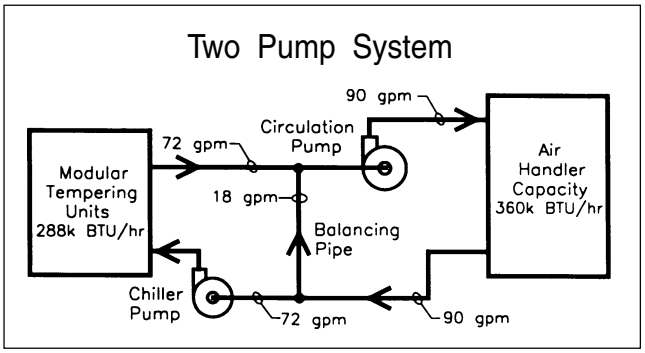

Figure 10.. Typical Two-Pump Installation

INSTALLATION GUIDE: Air Handler Installation

Location

In general, tempered water air handlers follow the same installation guidelines as direct expansion cooling units.

Because of the diversity of available air handler models, you have a great deal of flexibility in selecting the location. All CRUISAIR air handlers use squirrel-cage blowers which are more efficient air movers than fan units.

Blow-through models are used when the air handler is to be mounted directly behind the discharge grill without ducts. These can also be used beneath a flybridge or other overhead space, for direct discharge downward into the compartment below.

Draw-through units provide better circulation, and more flexibility, as the discharge can be ducted to one or more discharge grills, located a further distance from the return air grill. On draw-through units, the blower can be rotated to provide the easiest air path for discharge.

Figure 11 shows typical ducted air handler installation.

Ideally, the air handler discharge grill should be as high as possible in the compartment, with three feet above the floor being a minimum.

On draw-through models, it is not necessary that the coil be placed directly behind the return air grill; but an unobstructed path, with at least 2" of air space around the units, must be provided for the air to get to the coil. The area housing the air handler must be sealed from engine room and bilge area.

The unit must be accessible for service and maintenance, and oriented so the water connections can easily be reached. The air filter should be checked and cleaned regularly.

It is always good to mount power logic boxes (for SMX controls) in an easily accessible place, for future servicing. In the case of units with integrated power logic boxes (such as CBBX models), the box can be removed from the air handler and remote mounted for easier access.

You should measure carefully for horizontal and vertical clearance prior to proceeding with installation. It is a good practice to place each component physically in the area you have selected to be sure that there is enough space and that connections can be easily made.

Mounting

Locate the air handler on a suitable horizontal surface. CRUISAIR air handlers are provided with rubber isolation mounts. Secure all four mounts to the surface.

Mount the air handler so that the condensate pan will drain properly. All air handling models have integrated mounting frames or the condensate pan itself is the base of the unit.

Route the condensate drain hose steadily downhill so that the condensate flows freely to an overboard fitting or sump. Do not permit condensate to puddle in the bilge. Most CRUISAIR air handlers have two condensate drains, one at each end. It is recommended that you use both drains for best results. In the case of sail boats, where heel angles could cause spillage or a back flow, it is best to route the drains to opposite sides of the boat.

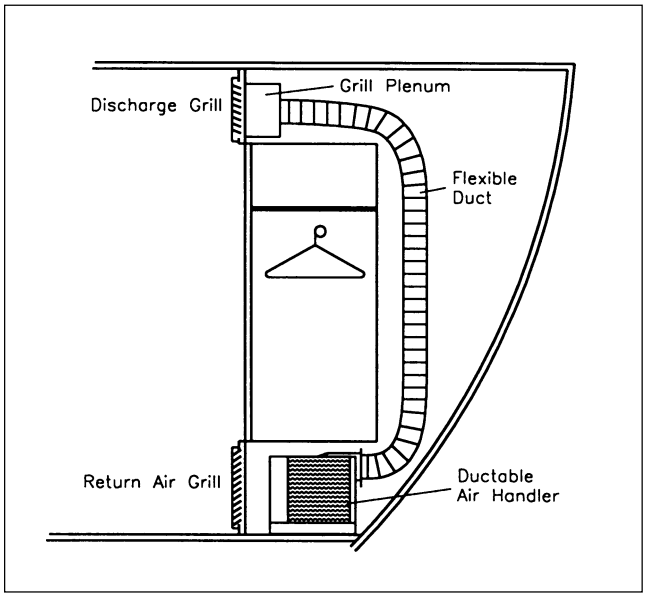

Figure 11. Typical CBB Type Installation.

Water Connections

All Cruisair air handlers have female pipe thread connections. Units of 12,000 BTU/hr and smaller use 1/2" FPT; and units 15,000 - 24,000 BTU/hr use 3/4" FPT. The piping must slope upward to the air handler to encourage air to travel to the vent. The lower connection is the inlet or supply, and the upper connection is the outlet or return.

One improperly connected air handler can affect the performance of the entire system.

The fittings used to connect the air handlers must include valves and unions for service and removal of the air handler. Use full flow ball valves.

Auxiliary Electric Heating

Refer to figure 12 for correct mounting positions of electric, in-line, duct heaters. The safety devices may not work correctly if mounting position is incorrect..

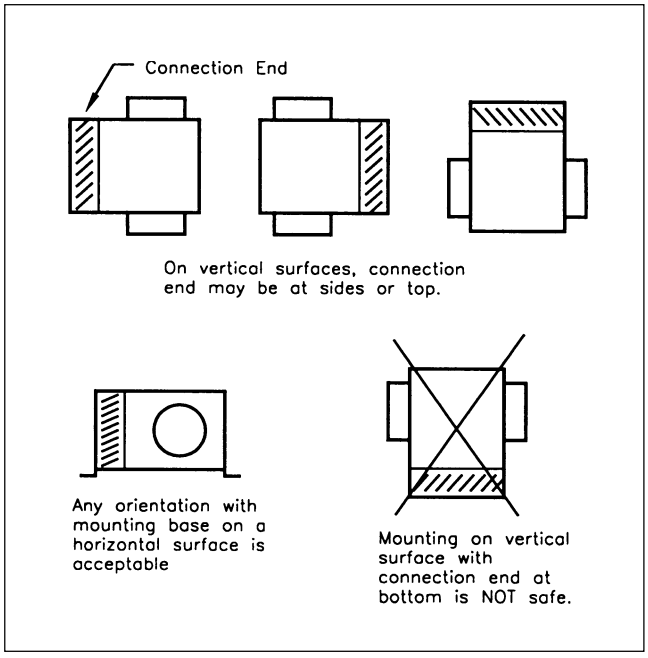

Figure 12. Correct Mounting of In-line Duct Heaters.

Air Handler Wiring

The air handlers will receive power from a source separate from the tempering units. Multiple air handlers can often be on one breaker, but when installing units with integrated electric heat, separate breakers should be used.

Return Air Grills

Refer to air handler specification sheets for guidance on selecting the proper grill size. Too small of a grill will restrict the blower, limiting the capacity of the air handler.

The return air grill should be located so there is unobstructed airflow to the units coils. Return air ducts between the return air grill and the air conditioning unit is not normally necessary, and should be avoided. The evaporator coil need not be located directly in front of the return air grill, as long as airflow from the grill to the coil is unobstructed (2" of air space is sufficient). This allows installation of the unit such that discharge air can be directed in the most efficient manner. Be sure that the enclosure is sealed so that air is not drawn from unwanted areas.

Most air handling units are supplied with a lint screen or filter to prevent the coil from collecting dirt or lint. A filter can be located at the return grill, should the filter on the coil be inaccessible for cleaning. However, the filter on the coil should be removed when using a filter on the return grill, so that only one filter is used.

Discharge Grills

Refer to air handler specification sheets for guidance in selecting the proper size grill. It is important to select the proper size and design of grill to ensure good airflow, with minimum noise. Also, wood grills are less likely to “sweat” than metal grills.

Some air handler models are supplied with hose adapter fittings; others require an adapter be purchased separately. Always use the proper size grills and ducting. If in doubt, slightly bigger is better. When two or more air handlers are run in parallel off one fan speed control, the ducting should be kept as equal as possible for better fan speed control.

When used with flexible ducts, a plenum chamber should be incorporated behind the discharge grill. Location of this grill should be as high as possible in the cabin, and oriented so that air flow between discharge and return encompasses as large an area as possible in the cabin. Care should be taken to avoid short cycling, a situation where the conditioned air is returned to the coil without being mixed thoroughly with the cabin air.

Ducting

Insulated flexible ducts, or built-in duct work may be used to route air from the draw-through air handlers to the discharge grill.

When flexible ducts are used, there should be as few bends and turns as possible. Pull all of the ducting tightly to prevent kinking and collapsing of the duct. Attach duct to grill plenum and hose adapter securely with no air leaks. Plenums are used with flexible ducts to direct air in the proper direction. Figure 13 shows several typical plenum configurations.

When built-in or rigid ducts are used, they should be insulated and there should be a flexible transition (marriage band) between the duct and blower.

Blow-through type air handlers can be installed directly behind the discharge grill, and ducts are unnecessary. For an overhead installation, air can be discharged directly into the compartment using marriage bands.

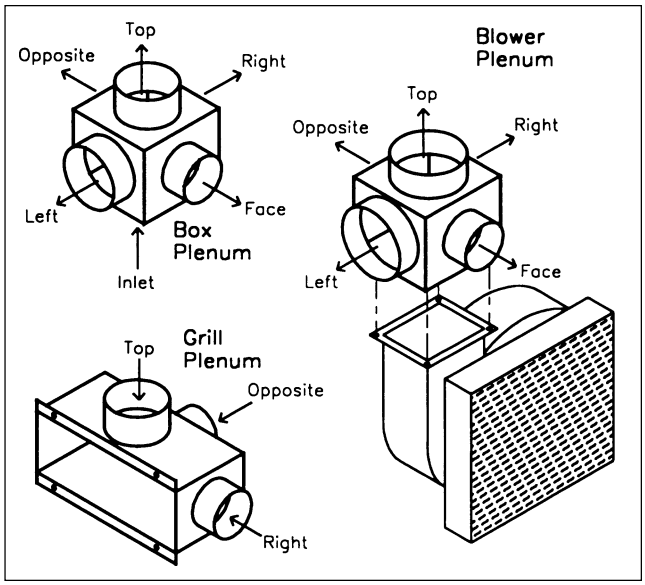

Figure 13. Typical Plenum Configurations

Air Handler Duct And Minimum Grill Sizes			
Air Handler Capacity	Duct SIze	Discharge (in^2/cm^2)	Return (in^2/cm^2)
CBB Type			
3,000	5"	40/260	70/450
4,500	5"	40/260	70/450
6,000	5"	40/260	70/450
7,500	6"	60/390	100/650
9,000	6"	60/390	100/650
12,000	7"	80/520	140/900
15,000	8"	100/650	200/1300
18,000	8"	100/650	200/1300
24,000	9"	140/900	260/1680
CBLB Type			
18,000	2x 6"	2x 60/390	200/1300
24,000	2x 7"	2x 80/520	260/1680
CBH Type			
6,000	-	70/450	70/450
12,000	-	140/900	140/900
18,000	-	200/1300	200/1300
24,000	-	260/1680	260/1680

Figure 14. Duct and Grill Sizes

INSTALLATION GUIDE: Installing Cabin Controls

Rotary Switch Location

The control unit should be mounted on a convenient bulkhead where it can be easily reached by the operator. There should be rear access, with sufficient clearance behind the unit for the electrical wiring connections, the protective cover, and ventilation.

The unit should be close enough to the air handler so the temperature sensing bulb can be placed in the path of the return air. In most cases the bulb is attached behind the return air grill or directly to the air handler. Be sure the bulb is not touching any metallic surfaces.

For switch assemblies with two sensing bulbs, the large one goes in the return air path, and the smaller one in the discharge air.

SMX Series Keypad Location

Select a location on a vertical surface; this can be an inside or outside wall, partition, or other permanent structure, with rear access for wiring. The control operates on low voltage and is certified ignition-protected, so the wiring poses no hazard. The space behind the keypad does not have to be ventilated since the control does not produce heat.

SMX Keypad Installation

To be operated satisfactorily, the keypad control should be installed so it is both visible and accessible. Overhead locations are discouraged since they make operation difficult. In staterooms, the control should be installed so it is visible, and if possible, accessible from the bed.

Cut the hole for the keypad control. Check that the fit is correct, and make sure the printed circuit board is clear of the bulkhead and no objects of any kind are in a position to contact the SMX circuitry.

Plug in the interconnect (CX) cable, which is routed to the power/logic box. Refit the keypad and secure with four No. 6 x 3/8 screws. Hook the plastic cover at the top, press it flat from the top down, and snap it in place at the bottom.

Warning: Make sure all LED's are lined up correctly with the holes in the plate before snapping on the plastic cover. If an LED is not properly positioned, it will break.

SMX Power/Logic Box Installation

The SMX power/logic board is ignition-protected, enclosed, and can operate in ambient temperatures up to 130° F. The P/L box is NOT waterproof and must be placed where it will NOT get wet. Also, the components produce heat during operation, and must be installed in a ventilated location.

The box may be installed in any position, although a horizontal surface is best for shock resistance if the equipment is operated in rough seas. In selecting a location for the power/logic box, keep in mind that access should be easy for trouble shooting.*

* On air handlers with an integrated power/logic box (CBBX type), the power/logic board will be pre-wired, with a wire loom connecting to the electrical box on the air handler. If an air handler is in a location which is difficult to access, it is often a good idea to remove the box from the air handler and remote mount it, to simplify future servicing.

After selecting a suitable location, where it is accessible for wiring as well as for service, secure the box with the appropriate screws and flat washers.

TSE Installation

The temperature sensing element (TSE) is a thermistor which is used to measure air temperature. The actual sensor is 1" long by 1/4" diameter and is connected to a shielded cable of different lengths.

For best results, the sensor should be placed in the return air path, usually behind the return air grill. It also may be placed in front of the air handler coil (as on air handlers with integrated P/L box). Under no circumstances should the sensor touch the coil, or any metallic objects as the air temperature reading will not be correct. Also, do not place the sensor in the discharge air.

The SMX system can be programmed for intermittent fan operation if desired (the fan cycles off when the temperature is satisfied). However, the thermistor moved from the return air path, and wall mounted on an inside surface, not subject to any heat from outside the area (including direct sunlight). Operating in this mode will result in larger temperature swings than when the fan is constantly circulating air.

The TSE cable simply plugs into the 3-prong connector on the power/logic board. Pay particular attention to pin alignment when plugging in cord.

Outside TSE (Online only)
When installing the optional TSE outside thermistor, a standard TSE, available in many different lengths, is used. Only one is needed for the entire system, since the data is communicated around the loop.

The TSE is waterproof, and should be installed in the outside air, but under an overhang or coaming where it is shaded from the sun. Also, it should not be touching any metallic surfaces. The TSE plugs into the "OUTSIDE" plug connection on the Online P/L box.

CX Cable
The interconnect cable is a shielded cable, with 4 pin plugs on both ends. This cable is available in lengths from 10 to 60 feet.
Route the cable, which carries low voltage DC, from the keypad to the P/L box. Plug in at both ends.

Net Cables
The NET cables (CN) are connected to each P/L box in the system The cable plugs to the output of one P/L box to the input of the next box. Each P/L box should be connected in line with the others.

Convenience Panel
The convenience panel connects to a Online keypad with a ribbon cable. The ribbon cable is available in 2 and 4 foot lengths. A system can have as many convenience panels as keypads.

Power Connections
The SMX can be used with 115 or 230 volt systems, but the correct P/L box should be used. The internal voltage plug or slide switch should be set for the system voltage. If the voltage of a board must be changed, and aux. heat is to be used, the load resistor used on the aux. heat relay circuit must also be changed to the correct size. Contact the MDC applications department.

Air Handler Connections
The ORANGE and WHITE/RED wires as well as a ground wire should be connected to the blower motor on the air handler. If a two speed blower is used, the ORANGE wire is high speed, the YELLOW wire is low speed, and the WHITE/RED is N or L2.

Bypass Valve
The BLUE and WHITE/RED wires, and a ground, should be connected to the correct terminals on the bypass valve.

Change Over Thermostat
The twisted pair of WHITE wires are run from the LOW PRESS terminals on the P/L board to a change-over thermostat. The thermostat should be open when cold, and closed when hot.

Auxiliary Heat
The YELLOW and WHITE/RED wires, and a ground, should be run to the auxiliary heat relay. Make sure the relay draws no more than .2 amps, or the P/L board can be damaged. (Cruisair air handlers with integrated aux. heat use a triac which can handle up to 20 amps.)

Humidistat
A humidistat can be connected to the HI PRESS terminals on the P/L board, and the unit can be programmed to control the humidity in the area. Contact the MDC applications department.

INSTALLATION GUIDE: Final Inspection

Prior to starting the system, conduct a final inspection, using the following checklist.

Seawater System

• Is the seawater pump properly sized for the system? (See Specification Manual for correct pump capacities.)

• Is the pump wired for proper voltage, correct motor and rotation?

• Is the pump oriented correctly and mounted securely?

• Is the centrifugal seawater pump located so as to be below the water line at all times?

• Are the inlet and outlet thru-hulls secure, properly sealed and properly oriented?

• Are all seawater hoses double clamped?

• Are the inlet and outlet pipes connected to the correct fittings on the tempering unit?

• Are there any loops or dips in the seawater plumbing that might cause the system to become air locked?

• Is the strainer located between the seacock and the pump, and is it correctly oriented?

• Are the appropriate valves open?

Tempering Units

• Is the tempering unit mounted securely?

• Are the water connections accessible if it is necessary to remove the unit for service later?

• Are condensate drains properly routed to an overboard discharge or sump?

• Is all wiring connected properly?

• Is the balancing flow control the correct size and properly installed?

• Are the appropriate valves open?

Air Handlers

• Are the units securely mounted?

• Are condensate drains properly routed to an overboard discharge or sump?

• If only one condensate drain is used, have any other drain holes in the condensate pan been plugged?

• Are the inlet and outlet pipes connected properly?

• Are isolation valves open?

Loop Plumbing

• Are joints tightened?

• Are joints and tees properly insulated?

• Are pipes individually insulated?

• Are pipes fastened securely to the boat as needed throughout their length?

• Leak test loop with air and repair any problems.

Air Distribution System

• Is there unobstructed airflow from the return air grill to the coil?

• Is there a lint screen or filter in the return air path where it is accessible for regular cleaning?

• Have flexible ducts been pulled tight to remove bends and constrictions?

• Are grills and ducts correctly sized for the system?

Controls And Wiring

• Is the thermostat sensor or thermistor properly located and secured in the return air path and not in direct contact with any metal objects? (For switch assemblies with two sensing bulbs, the large one goes in the return air path and the small one in the discharge air path.)

• Are all wiring harnesses properly secured?

• Are wiring connections made, color to color, correctly at terminal strips?

• Are plugs and pins properly aligned and securely connected?

• Are all components properly grounded?

• Are proper sized circuit breakers used?

• Are terminal strips located in a dry, safe place and properly covered?

• Check high voltage wiring.

• Check low voltage wiring.

Notes

WARNING

Dometic Corporation (Dometic) manufacturers of Cruisair, Grunert, Marine Air and Sentry Products, makes the following safety warnings concerning the application, installation, use and care of its products. Although these warnings are extensive, there may be specific hazards which may arise out of circumstances which we have not outlined herein. Use this as a guide for developing an awareness of potential hazards of all kinds. Such an awareness will be a key factor in assuring your SAFETY and comfort.

ELECTRICITY - Many Dometic products operate on 115, 230 or 440 volt AC power. Such voltages can be LETHAL; therefore, the chassis, cabinets, bases, etc., on all components must be grounded together and connected to the vessel's grounding system. Sparks can occur as switches, thermostats and relays open and close in the normal operation of the equipment. Since this is the case, ventilating blowers for the removal of hazardous fumes or vapors should be operated at least 5 minutes before and during operation of any Dometic product or group of Dometic products. All electrical connections must be covered and protected so accidental contact cannot be made by persons using the equipment, as such contact could be LETHAL.

ELECTROLYSIS - Electrical leakage of any component can cause electrolytic deterioration (electrolysis) of thru-hull components which could result in leakage serious enough to sink a vessel which could result in loss of life. All Dometic components must be kept clean and dry and checked periodically for electrical leakage. If any electrical leakage is detected, the component should be replaced or the fault causing the leakage corrected before the component is put back into service.

GAS - CRUISAIR, MARINE AIR and GRUNERT components utilize R134a refrigerant, tetrafluoro-ethane or R404A, R125/R143a/R134 (44%/52%/47%) which are non-toxic, non-flammable gases; however, these gases contain no oxygen and will not support life. Refrigerant gas tends to settle in the lowest areas of the compartment. If you experience a leak, evacuate all personnel, and ventilate area. Do not allow open flames in the area of leaks because refrigerant gas, when burned, decomposes into other potentially LETHAL gases. Refrigerant components operate at high pressure and no servicing should be attempted without gloves, long-sleeved clothing and eye protection. Liquid refrigerant gas can cause severe frost burns to the skin and eyes.

VENTILATION - To cool or heat air, CRUISAIR, MARINE AIR and GRUNERT components are designed to move air through a heat exchanger by a blower or propeller fan. This design necessarily produces a suction on one side of the air handling component and a pressure on the other side. Air handling components must be installed so that the suction-pressure action does not: (1) pressurize an area to the extent that structural failure occurs which could cause harm to occupants or bystanders, or (2) cause a suction or low pressure in an area where hydrogen gas from batteries, raw fuel vapor from fuel tanks, carbon monoxide from operating propulsion engines, power generators or heaters, methane gas from sewage holding tanks, or any other dangerous gas or vapor could exist. If an air handling unit is installed in such a manner that allows potentially lethal gases or vapors to be discharged by the air handling unit into the living space, this could result in loss of life.

Maximum protection against the introduction of dangerous gases or vapors into living spaces can be obtained by providing living spaces which are sealed from all other spaces by use of airtight bulkheads and decks, etc., and through the introduction of clean air into the living space. Bear in mind that the advent of air conditioning, whether it be for cooling or for heating, naturally leads to the practice of closing a living space tightly. Never close all windows and doors unless auxiliary ventilating systems, which introduce clean outside air into the living space, are used. Always leave enough window and door openings to provide adequate ventilation in the event potentially lethal gases or fumes should escape from any source.

CONDENSATE - All cooling units produce water condensate when operating on the cooling cycle. This water must be drained from the cooling unit overboard. If condensate is allowed to drip on a wooden structure, rotting or decay and structural failure may occur which could result in loss of life. If condensate is allowed to drip on electrical components, deterioration of the electrical components could result in hazardous conditions. When an air conditioning system is in operation, condensate drains may be subjected to negative pressure. Always locate condensate drains as far as possible from points where engine waste and other dangerous gases are exhausted so no such dangerous gases can be drawn into the condensate drains.

Warning

Never sleep in a closed area on a boat when any equipment, which functions as a result of the combustion of a volatile fuel, is in operation (such as engines, generators, power plants, or oil-fired heaters, etc.) At any time, the exhaust system of such devices could fail, resulting in a build-up of LETHAL gases within the closed area.

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