Tempered Water A/C Systems ❖ OPERATION & TROUBLE SHOOTING

English

Cruisair®

Tempered Water Systems
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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 Environmental 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 Environmental 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.

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INTRODUCTION

Tempered water (or circulated water) air conditioning systems use a two-stage process of heat transfer, in which circulated water acts as the initial heat transfer medium. In the cooling mode, the water flows through a closed loop from central tempering units to a number of air handling units, picks up heat from the compartments as it flows through the air handling units, and carries it back to the tempering units. The heat is then transferred from the circulated water to the R-22 refrigerant in the tempering unit's plate coil heat exchanger. The refrigerant then transfers the heat into the seawater through the coaxial raw water heat exchanger.

The Cruisair tempered water system is a reverse cycle heat pump, so it provides heating as well as cooling. The flow of refrigerant is just reversed in the heating mode. Heat is absorbed from the seawater and used to warm the water circulating through the boat. This heated water is then used to warm the air as it passes through the air handling units into the compartments.

The tempering units are controlled by the modular control panel. A system may have single panels; one for each tempering unit, or there may be a multi-modular panel controlling up to 6 tempering units. Both panels control the tempering units by sensing the circulated water temperature. If the water temperature deviates from the set point range on the control panel, the tempering unit will cycle on. If there is no load on the loop water from the air handlers, then the tempering units will not need to run.

The control panel has a switch which allows the user to change the tempering unit's operational mode, either COOLING, HEATING, or OFF. Circuit breakers on the panel allow individual units to be turned off for flexible load management of the system. Multi-unit control panels may also have circuit breakers and relays for one or more system pumps.

Typically, each air handler has a three-way bypass valve which routes the circulated water around the air handler when the desired temperature in the room is correct. If the thermostat senses that the room temperature is not in the desired range, it supplies power to the bypass valve and the circulated water is allowed to flow into the air handler coil to either heat or cool the air.

The air handler control, either three-knob or SMX series, automatically cools or heats the area, depending on the mode that the tempering units are in. A change-over thermostat on the air handler senses loop water temperature and tells the control to open the bypass valve on a temperature rise (cooling) or a temperature fall (heating).

Normal Operation

The following steps should be followed when starting the system.

1. Switch on all circuit breakers for the air conditioning system at the boat's main distribution panel. Be sure to include the breakers for any pump relays.

2. Open the seawater inlet valve and make sure the seawater strainer is clean.

3. Check to see that all service valves in the circulated water system are open and that 15-20 psi of static water pressure is indicated on the circulated water loop.

4. Switch on the circuit breaker(s) on the control panel(s) for each tempering unit that is to be operated.

5. Switch on any pump breakers (multi-modular panel or TPR type pump relay).

6. On single panels, flip the rocker switch to cooling (or heating). For multi-panel operation, a momentary switch is used to toggle through the modes; the sequence is COOLING - OFF - HEATING - OFF - COOLING... On either panel, the COOLING (or HEATING) light should come on, along with the circulation pump (if installed with a relay). The FAULT light may stay on a few seconds until flow is established through the tempering units. The tempering unit and seawater pump will then come on following the set time delay.

7. Verify that seawater is flowing from the overboard discharge(s).

8. Each room control can be adjusted as desired.

The tempering units operate entirely by sensing loop water temperature, and will cycle off when set point is reached, at which time the SET POINT light will come on. When the loop water temperature changes more than the set differential (due to the air handlers adding or removing heat from the water), the tempering unit will cut back on.

If you have a remote owner's control, operation is exactly the same as on the control panel. Note that with single control panels, and the MSC-1KCB, the rocker switch on the single unit panel must be in the OFF position for the remote owner's control to operate. On multi-unit panels, the momentary switch will cycle the unit through it's modes, from any number of owner's controls, or the panel.

Load and Power Management

One of the main advantages of a tempered water system is the ability to manage the heat loads by shifting capacity to certain air handlers through out the boat. This happens under normal operation as the boat cools down and the air handlers shut off at set point. But in cases where the tempering units can only be operated at reduced capacity (such as a power supply problem or a unit down for repair), the system operator can effectively utilize the available capacity by turning off air handlers in areas not occupied, or changing the set points so they have longer off cycles. This "shifts" the capacity to the desired areas.

With multiple tempering units, the control panel or panels will normally be set in stages based on loop water temperature, so that only the required number of units will operate to keep the loop water in the desired range. In the case of limited power availability, individual units can be shut down by turning off their circuit breakers. This will not affect the operation of the other tempering units.

Seawater Temperature

In extreme seawater temperatures, your Cruisair system may experience a reduction in capacity. In the cooling mode, the best efficiency is achieved when the water temperature is below 80° F (27° C). At higher water temperatures, the cooling capacity will be reduced, but should continue to provide cooling even in seawater temperatures up to 110° F (43° C).

In the heating mode, the opposite is true. As the water gets colder than 55°F (13° C), heating capacity diminishes. However, the unit will continue to provide some heat with seawater temperatures as low as 40° F (4°C). We do not recommend operating in temperatures less than 40° F (4° C).

Filling and Bleeding

The loop requires filling and bleeding before initial startup, and after any servicing which requires draining of the system. The water should be clean, such as potable water, and warm, if possible, so as to lessen the amount of air dissolved in the water. Check the system thoroughly for leaks after the initial fill.

1. Locate the main system vent (or the highest air handler vent if a main system vent is not provided) and open the valve (or vent tube) at this location. If this valve can not be operated from the location of the fill valve, a second person will be required to conduct this procedure. Open the fill valve and allow water to enter the system until it spills out of the vent line with no visible air bubbles.

2. Close the vent line and allow the static pressure to build to approximately 20 psi ,and then close the fill valve.

3. Begin bleeding air from the tempering unit and each of the air handlers, starting with the lowest and working toward the highest. It may be necessary to add more water if the pressure drops much during the bleeding process. After this initial bleeding is complete, open the fill valve and recharge the system back to 20 psi.

4. Turn the power on to the tempering unit, circulating pump, seawater pump and all the air handlers.

5. Adjust the temperature setting of the cabin controls to insure that the bypass valves will remain activated in the heating mode.

6. Switch the control switch to the heating mode (air separates better from warm water). The circulating pump should start immediately and the red heating control light should illuminate. The tempering unit will not start immediately due to a built in time delay. If the fault light remains on, the system may have to be shut down and bled again in order to establish flow through the tempering units. Once the system is running, allow the water to heat to set point.

7. After the system has operated in the heating mode for several minutes, shut it off by switching the control switch to the off position (no lights should be lit on the panel).

8. Let the water come to rest and then begin bleeding the equipment again, working from the lowest to the highest.

9. Restart the system and observe each air handler's air discharge temperature to confirm adequate air temperature difference. If there are some that are not acceptable, they may require additional bleeding.

10. In most cases, the bleeding process will have to be repeated after the system has been in operation for several weeks.

Antifreeze

Antifreeze should be added to the water after the bleeding process is complete and any leaks have be fixed. The recommendation is 20% by volume of non-toxic propylene glycol, such as Dowfrost brand by Dow Chemicals. The antifreeze not only prevents damage in the event of circulated water freezing in the loop, but additives in the antifreeze protect the system from corrosion and deposit build-up which would lower the system's efficiency.

An easy way to add the antifreeze is to drain the system just enough to release the static pressure. At the highest air handler in the loop, open the vent tube and place in a container of antifreeze. Carefully open the system drain again so that the draining water siphons the antifreeze into the loop through the vent tube.

Expansion Tank

The expansion tank is pre-charged with air (about 12 psi), and the tank pressure should match the static pressure of the system. A Shrader (tire) valve on the tank allows the pressure to be measured and adjusted.

The static pressure should be high enough so that the system pressure at the circulation pump inlet stays above 10 psi when running. Usually 12-20 psi static is enough.

If the air pressure needs to be adjusted, the system must be drained until there is no pressure, and then air can be added or removed from the expansion tank until the tank pressure reaches the desired static pressure.

USER'S GUIDE: Modular Control Panel Set Up

Compressor Time Delay

Each compressor in a system with multiple tempering units should have the time delays set so as to prevent simultaneous starts which could overload the electrical system. The time delay can be adjusted to individual preferences. This time delay will operate whenever the compressor is to start, whether under normal cycling, initial power up, or a fault cut off.

The compressor time delay relay is easily accessed under the cover of the modular control panel. The potentiometer is turned with a small screwdriver to change the delay time. A clockwise turn will increase the time delay, and a counterclockwise turn will decrease the delay.

Run Time

Ideally, all tempering units in the system would run an equal amount of time, and therefore get equal wear. But with single control panels, the lead compressor in a system will end up running longer than others. Multi-modular control panels have automatic lead stage switching to help ensure even run time.

A couple ways to equalize the run time for each compressor in a single panel system are:

a) Set up the units so the compressor which leads in cooling is the last to run in heating.

b) If the system doesn't operate in heating (or cooling) often, then periodically reversing the set points would help even out the run times.

Temperature Controls

	NORMAL LOAD					
	COOLING			HEATING		
Stage	Off	Diff	On	Off	Diff	On
1	45	3	48	110	5	105
2	50	3	53	105	5	100

All temperatures are °F.

The Heat/Cool temperature controls monitor the loop water temperature and cut off the compressor when satisfied. An adjustable differential (pre-set at 5° F for heat and 3° F for cool) will determine at what loop temperature the compressor will come back on.

Under low load situations, increasing the differential can help prevent the compressor from short cycling, or a smaller differential may help stage the units. The Heat/Cool temperature controls will allow you to adjust set points accurately, and monitor the temperature using the system water sensors. A typical system, with 2 stages, could be set up as on the following chart.

We have found that spreading the temperature set points over more than three stages creates too broad of a differential, allowing the loop to operate at too high of an average water temperature. This greatly reduces the overall performance of the system. Also, if less than one third of the tempering unit capacity is allocated to the final stage, the units will not be able to reach set point, and will run for extended cycles. Each system will be different, so there will be a certain amount of learning involved to operate the system in a manner suited to the use of the vessel.

USER'S GUIDE: Multi-Modular Control Panel Set Up

Compressor Time Delay
The time delays for multi-modular control panels are set exactly the same as on single panels. Each compressor will have it's own adjustable time delay.

Run Time
Multi-modular control panels have automatic lead stage switching to help ensure even run time.

Temperature Controls
Each Heat/Cool temperature control is used for each stage. For example, if you have a 3-stage system, then there will be 3 Heat/Cool temperature controls. Temperature setpoints and differential can be adjusted via buttons on the cover of the temperature control.

Each stage control also has a differential adjustment which is set the same as on single panels.

Circuit Breakers
Each tempering unit will have a breaker, as well as any pumps controlled by the panel. The breakers allows any unit to be cut off, with the overall panel's operation not being affected.

Two Stage Systems (2 or 4 units)

	NORMAL LOAD					
	COOLING			HEATING		
Stage	Off	Diff	On	Off	Diff	On
1	45	3	48	110	5	105
2	50	3	53	105	5	100

All temperatures are °F.

Three Stage Systems (3,5, or 6 units)

	NORMAL LOAD					
	COOLING			HEATING		
Stage	Off	Diff	On	Off	Diff	On
1	45	10	50	110	10	110
2	42	10	52	118	10	108
3	45	10	55	115	10	105

USER'S GUIDE: Air Handler Controls

TSE - Rotary Knob Switch Assembly

1. Set fan speed control to high.
2. Turn the top knob to RUN.
3. Set the thermostat to either WARMER or COOLER. Air handler will cool or heat depending on the mode the system is in.
4. When area reaches desired temperature, turn the thermostat knob back toward the center until you hear it click once. This will maintain current temperature.
5. Set fan speed control to desired speed.

The mode switch can be set to FAN to allow air circulation without conditioning the air.

SMX Series Controls

For more detailed operation and programming instructions, refer to the SMX Series Operation Manual for Tempered Water Systems.

1. To set temperature, press the SET POINT button. The LED above the button will light, and the set point will be displayed. Adjust temperature to desired setting using the HIGHER and LOWER buttons.

2. Room temperature can be viewed by pressing the TEMPERATURE button. On SMX Online controls, the TEMPERATURE button will cycle the display between SETPOINT, INSIDE and OUTSIDE temperatures. The appropriate LED will light to indicate what temperature is displayed.

3. Press the RUN button to cool or heat area. The LED above the RUN button will light. The air handler senses water temperature and will cool or heat the cabin, depending on what mode the tempering units are in. An LED adjacent to the temperature display will light to indicate that the air handler is either COOLING or HEATING the air.

4. The AUX HEAT button will use an electric auxiliary heater (if installed) to heat the air directly. The circulated water will not flow through air handler. The LED above the AUX HEAT button will light.

5. Press the OFF button to turn the SMX control off.

6. Pressing the FAN button will switch from automatic to manual fan modes. In automatic mode, the fan speed decreases as the set point temperature is approached. In manual mode (LED above FAN button lit) the fan speed can be adjusted by using the SLOW and FAST buttons.

The air handler control (either SMX or 3-knob) will switch automatically between heating and cooling by sensing the circulated water temperature. So when the tempering unit's operational mode is changed, the air handlers will keep the room at the desired set point without further adjustment.

USER'S GUIDE: Routine Maintenance

1. AIR FILTERS: At least once a month, check the lint screen or filter behind the return air grill or on the face of the air handler and clean if necessary.

2. SEAWATER STRAINER: Check the seawater strainer daily. Remove any debris. If you are in waters where jellyfish or other debris are a problem, you may find it necessary to add a strainer on the outside of the through-hull fitting.

3. SYSTEM PRESSURE: There should be a pressure gauge at the inlet of the circulation pump, near the fresh water fill valve, which shows the loop water pressure. If the system pressure has dropped below 12-15 psi (typical) with the circulation pump off, then more water needs to be added to bring the pressure up to desired setting. Do not overfill as the expansion tank will not work properly. If the system pressure drops frequently, then there may be a leak which should be located and fixed. Check all air handler and tempering unit bleed valves for leaks and tighten as needed.

4. CONDENSATE DRAINS: Every three months, check the air handler and tempering unit condensate drains for obstructions by pouring a quart of water rapidly into the condensate pan. If it does not drain completely within 30 seconds, check the drain outlets for clogging. Remember that many Cruisair systems have two drains, one at each end of the unit.

5. SEAWATER CONNECTIONS: Verify that all seawater connections are tight, and check for water flow from the overboard discharge.

6. PUMPS: On centrifugal pumps, routine maintenance is not usually needed, other than an occasional visual inspection of the pump for leaks. On some larger pumps, the motor may have oil ports or grease fittings which may require lubrication once a year. If the system has backup pumps installed, the pumps should be alternated regularly to ensure both stay operational.

7. REFRIGERANT: The modular tempering unit is pre-charged charged with R-22 refrigerant gas at the factory and is adequate for the life of the system. Routine “seasonal” charging of the system is not necessary. If the refrigerant charge is low, there is a leak which should be fixed before resuming operation.

8. WINTERIZING: Check for the proper amount of antifreeze in the circulated water loop, especially in extremely cold weather. If the unit is not going to be operated in cold weather, the seawater system should be drained, including the pump head, seawater strainer, and all pipes to and from the tempering unit.

USER'S GUIDE: Make-Up Air System

The make-up air system is designed to improve air quality by supplying a percentage of fresh air to various areas in the boat. Outside air is drawn in by the make-up air handlers, where it is conditioned, and then delivered via ducting to individual cabins throughout the vessel. The make-up air handlers are part of the circulated water system and will cool (and dehumidify), or heat the incoming fresh air, depending on the tempering unit's mode of operation. The dehumidification of hot, humid air is the system's most difficult job.

Controls

Different switches are available to control different types of make-up air handlers. The switch may have one or two rotary knobs, with either variable or 2-speed fan control.

A single knob switch has three positions; OFF, LOW, and HIGH. This make-up air handler will not have a bypass valve, which means that the circulated water will always be flowing through the make-up air handler's coil.

• OFF - Fan is not running.

• LOW - Fan runs at slow speed. Fresh air is conditioned.

• HIGH - Fan runs at fast speed. Fresh air is conditioned.

On a two knob switch, the top knob is the mode of operation, either; OFF, FAN, or RUN, and the bottom knob is fan speed, either variable or two speed, depending on the type of make-up air handler.

• OFF - Fan is not running, and bypass valve (if equipped) diverts circulated water around coil.

• FAN - Fan runs at speed designated by the bottom knob. (On units with a bypass valve, the introduced fresh air is not conditioned.)

• RUN - Fan on, and bypass valve (if equipped) directs water into coil to condition the air. On units without a bypass valve, the air is conditioned in both FAN and RUN modes.

Operation

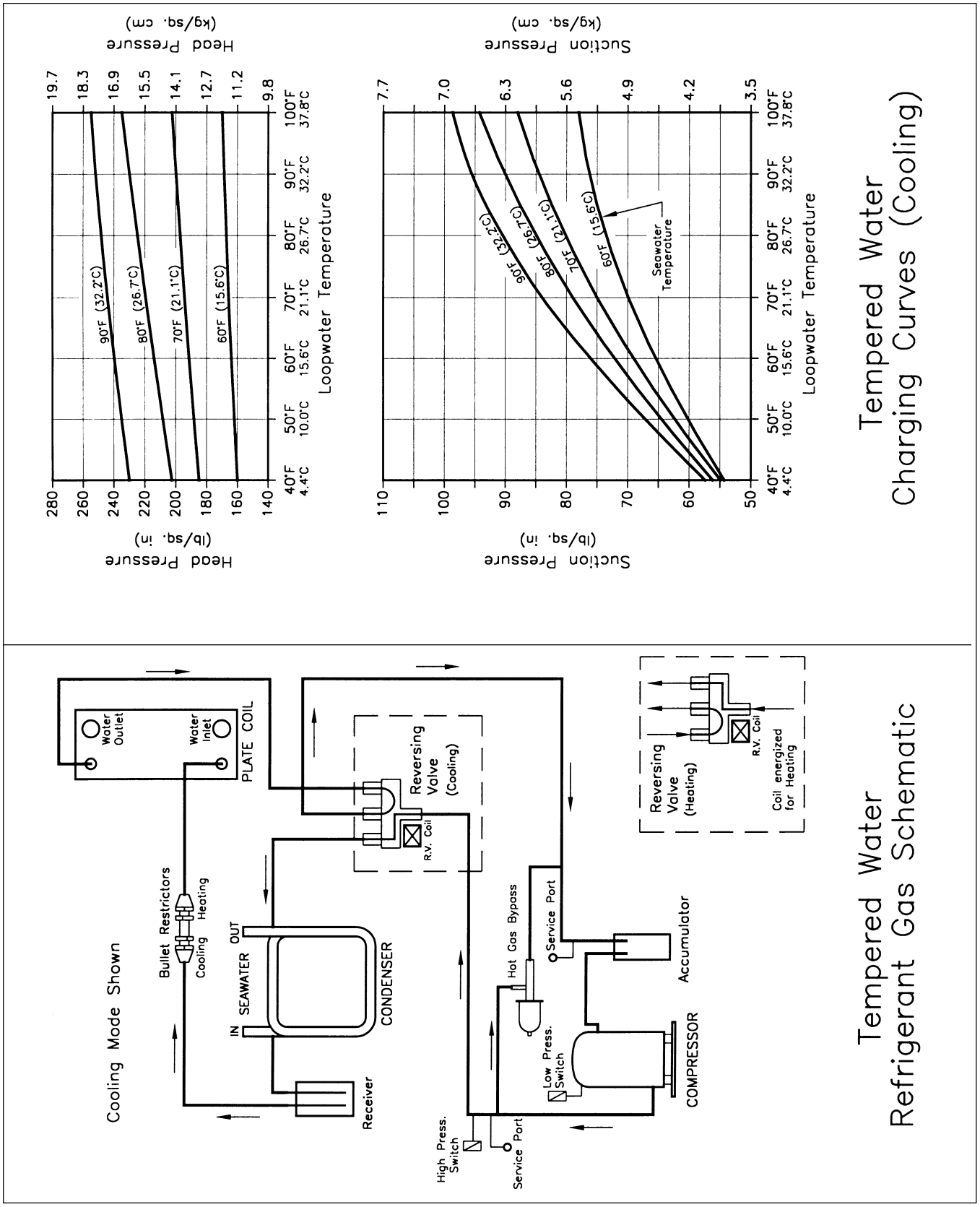
In most cases, the fan should be set at the highest speed, with the bypass valve open. This will allow the maximum amount of fresh air to be exchanged throughout the boat.
When outside conditions are so extreme (hot and humid) that the make-up air system can not completely condition the air, the fan speed should be turned down, allowing the coil more time to draw moisture out of the air.

On dry, mild days, it may be possible to introduce fresh air without conditioning it first by just running the fan (only possible on units with bypass valves).

Maintenance

Each air handler has an air filter which should be checked regularly, and cleaned or replaced as needed. Also check the condensate drains to make sure they are flowing freely.

Because the air handlers are water coils, there is the possibility of cold outside air causing the circulated water to freeze, which would likely burst the coil's tubing. One way to avoid this is to never turn on the make-up air system fans in freezing weather without the circulating pump is running and the bypass valve (if equipped) is letting water flow through the coil. Also check that the proper amount of antifreeze is mixed with the circulating water (20% by volume).


Tempered Water
Charging Curves (Cooling)
Suction Pressure
(lb/sq. in)
Suction Pressure
(kg/sq. cm)
Loopwater Temperature
Seawater Temperature
90°F (32.2°C)
80°F (26.7°C)
70°F (21.1°C)
60°F (15.6°C)
Head Pressure
(lb/sq. in)
Head Pressure
(kg/sq. cm)
Loopwater Temperature
Tempered Water
Refrigerant Gas Schematic
Cooling Mode Shown
Water Outlet
Water Inlet
PLATE COIL
Bullet Restrictors
Cooling
Heating
IN
SEAWATER
OUT
CONDENSER
Receiver
Reversing Valve (Cooling)
R.V. Coil
Reversing Valve (Heating)
R.V. Coil
Coil energized for Heating
Hot Gas Bypass
Service Port
Low Press. Switch
High Press. Switch
Service Port
Accumulator
COMPRESSOR

TROUBLE SHOOTING GUIDE: Tempered Water Systems

Trouble Shooting Air Handlers

If an individual air handler does not seem to be cooling properly, check the performance by measuring the air temperature drop (in cooling) between the inlet and outlet grills, with fan speed set at high.

If the TD is less than 18° F (10° C), then there is probably a water flow problem:	• May be air locked. Bleed air handler. If air handler has to be bled regularly, check for leaks. Make sure bleed valve is tightly closed. • Bypass valve motor may not be operating. Valve bypass lever should move to open position if system It can be done manually. • Check for blockage in piping. • Inspect ducting for restrictions.
If the TD is more than 18°F (10°C) or the total performance seems to be lacking, check for a restricted air flow:	• Clean return air filter; may be on grill or on air handler. • Check air handler coil and clean if necessary. • Inspect ducting for restrictions.
Noisy air handler:	• A gurgling sound indicates air in system. Bleed. • Air noise may be from ducting problems, or a bad blower. • A clicking sound with air handler fan off, but circulation pump running, may be a bad flow control valve, or even a circulation pump problem.

TROUBLE SHOOTING GUIDE: Tempered Water Systems

Trouble Shooting Modular Tempering Units

FAULT LIGHT:

There are five safety devices on the tempering unit which will cause the fault circuit to shut down an individual tempering unit, and indicate a fault. They are:

1. FLOW SWITCH
2. LOW PRESSURE SWITCH
3. HIGH PRESSURE SWITCH
4. FREEZE OR LOW LIMIT CONTROL
5. HIGH LIMIT CONTROL

The three switches are normally closed, so simply jumping out the wires at the switch or in the control panel can help pinpoint the problem area.

• When starting the system, it is normal for the fault light to come on for a few seconds, until flow is established through the tempering units. If the light stays on, and the compressor doesn't start, the flow switch is likely the problem.

• The loop water temperature differential through the coil should be around 8° F (4.4° C) in cooling, or 10° F (5.6° C) in heating. If the differential is greater than this, there is a flow problem.

• If the fault light comes on after the compressor starts, then check the pressure switches.

• If the freeze control is causing the compressor to shut down, the shut down will last for several minutes and then restart.

CAUTION: Do not leave any of these switches jumped out for an extended time. They are safety devices, designed to protect the system. Damage to the tempering units could result if the safety devices are not working.

TROUBLE SHOOTING GUIDE: Tempered Water Systems

Trouble Shooting Modular Tempering Units

FLOW SWITCH:

1. CIRCULATING PUMP: The circulating pump should come on as soon as the system is put in either cooling or heating mode. If not, check:

• AC power panel breakers

• Pump relay circuit

2. AIR IN LOOP: Air in the system can block water flow through tempering units. If the fault light flicks on and off, it is probably air in the system. Refer to Filling and Bleeding section in Operation manual. Also check: if the circulating pump is air locked, especially if pump outlet isn't in vertical position. A bleed screw may need to be installed if not already fitted.

3. PLUMBING: Is water getting to the tempering units? Check:

• All valves in loop are open.

• Spare pump (if installed) is valved OUT of loop.

• Water flowing in proper direction

• Pipe sizes are correct

4. WATER STRAINER: If the circulated water strainer is clogged with debris, the tempering unit may not be getting enough water flow.

5. FLOW SWITCH OPERATION: All of the above checks assume the flow switch is working properly, and that there is no flow through unit. Otherwise, check the switch as follows:

• Correct micro-switch position is away from plate coil; the normally open position (NO).

• Arrow on flow switch should point away from plate coil.

• If sliding the micro-switch towards the coil (NC) turns off fault light, and there is flow through the unit, then the paddle in the switch may be stuck.

HIGH AND LOW PRESSURE SWITCHES:

Connect refrigeration gauges to tempering unit and check if switches are bad. The low pressure switch should open at 35 PSI and reset at 55 PSI. The high pressure switch should open at 425 PSI and reset at 350 PSI.

High pressure can occur with:

• Loss of seawater in cooling mode.

• Loss of circulated water in heating mode.

• Refrigerant over charge.

Low pressure can occur due to loss of refrigerant charge, or:

• Loss of circulated water in cooling mode.

• Loss of seawater in heating mode.

• Extremely cold seawater.

A properly charged system running at normal operating loop water temperatures should have a cold and sweaty return line to the compressor. A reciprocating compressor should be cool on top, and warm (not hot) on the bottom. A scroll compressor should be warm (not hot) on top and cool on the bottom.

TROUBLE SHOOTING GUIDE: Tempered Water Systems

Trouble Shooting Modular Tempering Units

LOW/HIGH LIMIT CONTROL:

The Low/High Limit control unit acts as the relay for the entire fault circuit for each individual tempering unit. If the limit control senses a water temperature below 36°F (.6° C) or above 130°F, it will shut down the unit and indicate a fault.

If the limit control circuit is suspected, follow the steps below:

1. Measure the circulated water temperature differential between the plate coil inlet and outlet. In the cooling mode, a temperature drop greater than 10° F (5.6° C) indicates a restricted water flow through the unit. THIS MUST BE CORRECTED AS COIL WILL BE DESTROYED IF WATER IS ALLOWED TO FREEZE!! Note that the flow switch should have caught this, so there may be a flow switch problem also.

2. Check for power into the limit control. You should have 24VAC between the small terminals labeled 24V and COM. This power is coming through the fault circuit. If no power here, then the fault circuit (either the pressure switches or flow switch) is the problem.

3. The low/high limit controls are locked to prevent tampering and the temperature and differential set points have been factory set.

4. Check if the sensors are plugged up correctly, and working. See wire schematic of fault circuit.

• If you unplug the limit sensor, the control will think the water is in ambient temperature, and the unit will stay on.

• The temperature sensors can be checked by measuring resistance at a given temperature. At 68°F (27°C), resistance should be about 39.3 Kilo Ohms.

5. Check for power through the limit control relays. This closes the compressor contactor to run the unit; or is routed to fault light if control senses low/high limit condition or power is cut to control by the fault circuit.

6. To bypass the entire fault circuit, jump between terminals COM and NO on bottom terminal block. Note that if there is a fault sensed in the circuit, the fault light could still be on. This is only a testing procedure. Do not run unit for an extended period with fault circuit jumped out, and only if you are sure that the water in the coil IS NOT FREEZING!!

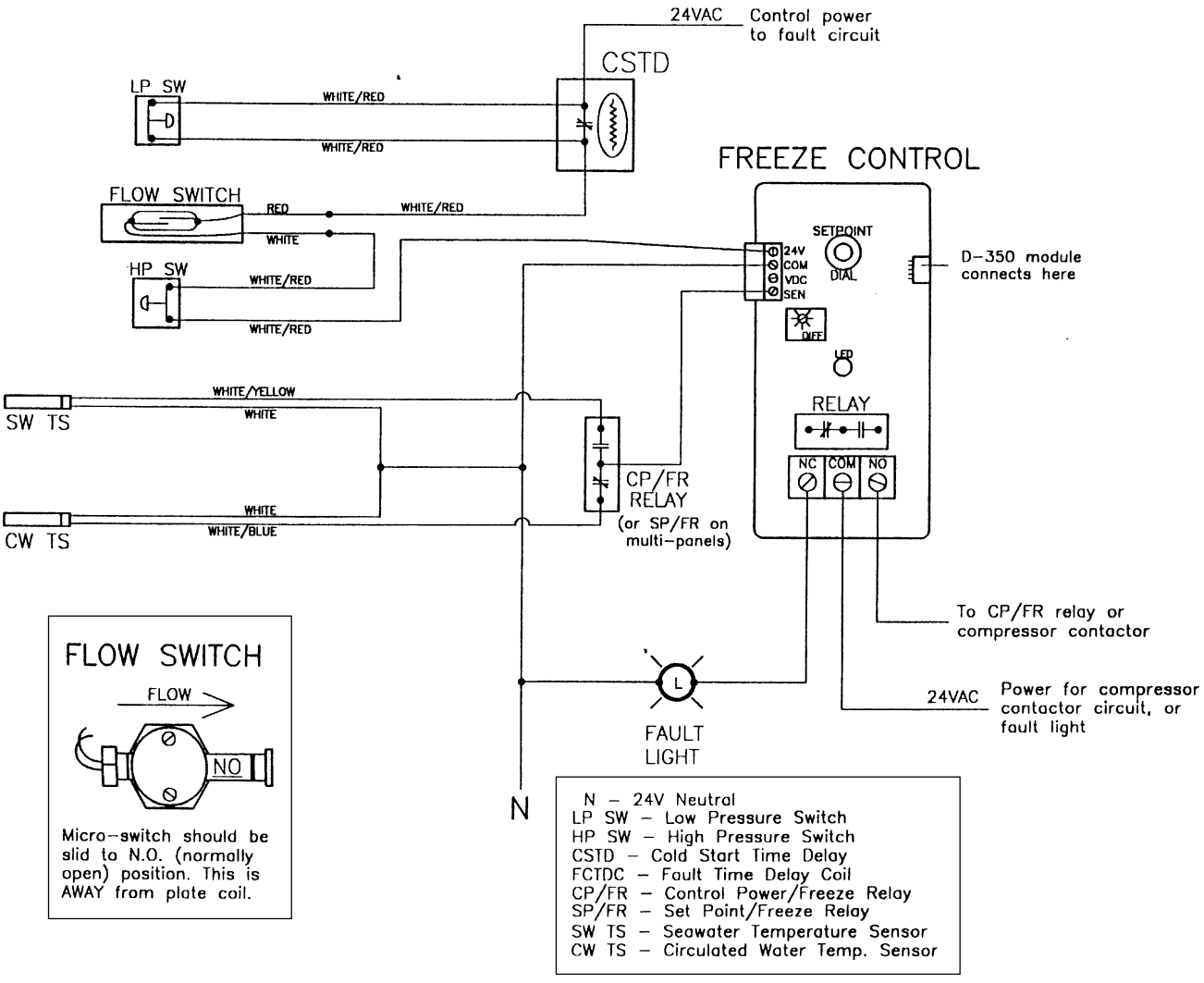
On systems with a multi-modular control panel, the final stage compressor may experience a freeze control fault occasionally. This is due to the location of the freeze control sensor on the tempering unit, versus the temperature staging sensors on the common loop water manifold. If this happens often, check that the freeze control set point is adjusted to the lowest safe setting, 36° F (1.7° C).

Notes

Fault Circuit

The Cold Start Time Delay is normally closed, bypassing the low pressure switch. The relay opens about 30 seconds after compressor starts, putting the LP switch back into the fault circuit. Note that on early panels, the high pressure switch, and possibly the flow switch, may also be timed out by the CSTD.01

On multi-unit panel schematics, the CSTD may be referred to as a Fault Control Time Delay.



Notes

WARNING

Dometic Environmental 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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