



Annual Cleaning Procedure for Shut-down of MULTISTACK Chillers

MULTISTACK Chillers utilize Heat Exchangers that differ greatly in design, construction and performance from other types of heat exchangers (e.g., shell and tube design), and have completely different fouling characteristics. For best performance, MULTISTACK recommends taking the first step in fighting fouling: **PREVENTION**.

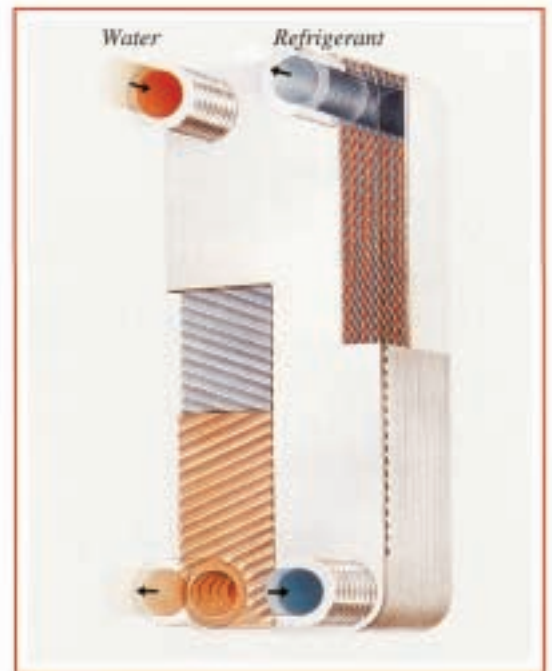
Preventative Maintenance



Brazed plate heat exchangers make each MULTISTACK module highly efficient. This side view of a module, without cabinetry, shows the location of the heat exchangers.



The evaporator system is shown in this illustration. A complex series of channels within each heat exchanger gives rise to vigorous turbulence, ensuring maximum heat transfer.



FACTORS AFFECTING FOULING

- Temperature
- Velocity
- Surface Finish
- Turbulence
- Flow Distribution
- Water Quality

TYPES OF FOULING: Scaling and Particulate

Scaling

Scaling is caused by substances dissolved in the heat transfer medium which deposit on the heat transfer surface. To prevent or minimize scaling, a proper water treatment program designed by a competent water treatment professional is recommended.

Particulate

Particulate fouling is caused by solids in the heat transfer medium such as mud, silt, sand or other particles. Particulate fouling is affected by velocity, distribution of the medium, roughness of the heat transfer surface and the size of the particles. Particles can enter the heat exchanger through old rusty pipes or through the cooling tower.

To reduce particulate fouling, MULTISTACK recommends a good filtration system (i.e., strainers, sand filters, mechanical/centrifugal separators).

Note: A Teflon Coated Stainless Steel cartridge filter for the evaporator and condenser header is supplied with all MULTISTACK modules to remove particles. If required, other types of filtration systems can be added to meet specific filtration parameters.

Laminar vs. Turbulent Flow

Laminar

When a fluid passes through a tube the greatest velocity is at the center of the tube. The tube wall has no turbulence to keep particles in the fluid in suspension. These particles are allowed to precipitate out and collect on the tube wall which causes fouling of the heat transfer surface. Conventional types of heat exchangers are very sensitive to low velocities and easily get into the laminar region.

Turbulent Flow

The opposite of laminar is turbulent flow. Operating with turbulent flow is the best way to avoid fouling in the heat exchangers.

MULTISTACK Chillers dispense a high degree of turbulence to the fluid which keeps particles in the fluid in suspension, and actually performs a scouring action to help keep the heat transfer surface clean. This is accomplished by the unique design of the MULTISTACK Heat Exchanger. As the water passes through the channels it is constantly changing direction and velocity, disturbing the boundary layer and creating turbulent flow even at low velocities. Therefore, the MULTISTACK Modular Water Chiller will always operate with fully developed turbulence.



PREVENTIVE MAINTENANCE

Annual cleaning of the heat exchangers is recommended. If the chiller is shut down for a non-cooling season, the following cleaning procedure should be performed at time of shut down:

1. Isolate chiller (both condenser and chilled water circuits).
2. Drain chiller.
3. Backflush chiller with water to remove foreign materials.
4. Fill chiller with clean water.

WARNING: Do not use hydrochloric or sulfuric acid for cleaning any MULTISTACK Heat Exchangers. Make sure any chemicals used are compatible with copper and stainless steel.

NOTE: Operating conditions may indicate more frequent cleaning is required. A rise in discharge pressure to above 260 psi (at normal condenser water temperature) or a reduction in evaporator heat transfer, low suction pressure, and low chilled water temperatures are examples of such indicators.

If the above procedure does not restore normal operating conditions, consult the *MULTISTACK Heat Exchanger Cleaning Procedures*.



CORROSION RESISTANCE

Corrosion is a complex process influenced by many different factors. Although stainless steels are considered corrosive resistance, AISI 316 and 316L stainless steel are not resistant to chloride concentrations above 300 parts per million (ppm). MULTISTACK Heat Exchangers are made of stainless steel plates brazed together with copper (99.9%).

CAUTION: Knowing the chloride content of your supply water is essential. A qualified water treatment professional should test your water for chloride levels and treat the water accordingly.

CAUTION: Chloride concentrations above 300 ppm will damage stainless steel heat exchangers.

CAUTION: Do not add any chemicals to the water without consulting with a water treatment professional to make sure that treatment is compatible with all materials in the system including copper and stainless steel. Do not use sulfuric or hydrochloric acid.

MULTISTACK TROUBLESHOOTING GUIDE

SOURCE OF CONTAMINANTS	POSSIBLE SOLUTION
<p>Water Impurities</p> <p>Oil <i>Oil film build-up in the condenser or evaporator will reduce the transfer.</i></p> <p>Chlorides <i>Chlorides entering the condenser or evaporator will corrode the brazed plate heat exchangers.</i></p> <p>pH-Level <i>High acid levels entering the condenser or evaporator will cause corrosion.</i></p> <p>Calcium <i>Calcium build-up in the condenser will reduce the heat transfer, as well as water flow through the system.</i></p>	<ol style="list-style-type: none"> Organic materials can be removed with detergent cleaning. Maintain chloride levels below 300 ppm. pH levels should be maintained between 7 and 9. Inorganic contaminants can be removed by mild cleaning with phosphoric or sulfamic acid (e.g. Nu-Calgon Imperial Scale Remover Part Number 4360-84). <i>DO NOT USE HYDROCHLORIC OR SULFURIC ACID</i> Have a water treatment contractor test your water and recommend a proper treatment plan. Make sure the contractor is familiar with the components of the system (e.g., 316 stainless steel heat exchanger, and copper brazing material).
<p>System Impurities</p> <p>Rust Pipe Scale Welding Slag and Other Debris</p> <p>Internal contaminants present in the water pipes can enter the MULTISTACK condenser or evaporator, plugging up the filters and ultimately the heat exchangers.</p>	<ol style="list-style-type: none"> When installing a new chiller, acid wash the condenser and evaporator water loop systems before connecting the water pipes to the MULTISTACK unit. During normal system operation, observe the discharge pressure and clean filters if head pressures approach 280 psi (high pressure cut out trips at 290 psi).
<p>Cooling Tower Impurities</p> <p>Grass Algae Tower Fill Air-born Soot and Dirt Insects Cottonwood Seeds Construction Debris</p> <p>External contaminants enter the condenser of the MULTISTACK module through the cooling tower.</p>	<ol style="list-style-type: none"> A filter (polyester or wire mesh) over the air inlet to the cooling tower will help prevent external contaminants from entering the cooling tower. Drain and clean cooling towers as required. Whenever possible, avoid placing cooling towers in close proximity to trees, smoke stacks or outside lights.

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