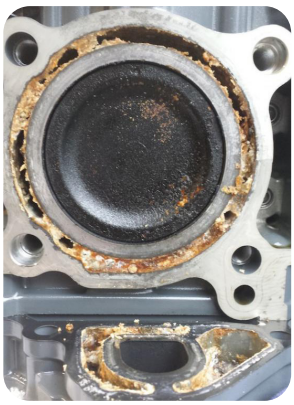
DEFINING THE PROBLEM

There are three primary consequences of using raw seawater in cooling networks:



- **CORROSION** - Mechanical systems incorporate many types of materials in their construction, including metals and alloys which are dissimilar in nature. For example, modern marine diesel engines can incorporate iron, carbon steel, titanium, aluminum, zinc, copper and other metallic components that are all connected together to form the engine. Raw water systems will often push seawater through a network comprised of a combination of these metals. Because seawater water is heavy in electrolytes (especially dissolved ions such as Sodium Chloride (NaCl), galvanic corrosion and surface degradation occurs any time the metallic surfaces are left to soak in seawater.
- **MINERAL SCALE** - When a seawater cooling system (raw water network) is turned off and the flow of raw coolant water ceases, any seawater inside the heat exchangers will absorb the remaining heat that is still trapped in the engine. As the seawater temperature rises inside the heat exchanger(s), dissolved minerals trapped in the seawater precipitate out and adhere to the heat exchanger surfaces as hard scale deposits. Every time the engines are cycled, this buildup of scale progresses, and begins to impede raw water flow through heat exchangers, degrading the ability of the heat exchangers to remove heat from the engine. This results in higher engine operation temperatures and reduced performance.
- **BIOLOGICAL FOULING (BIOFOULING)** - Seawater has a high concentration of biological organisms and minerals; therefore, raw water networks are highly susceptible to biofouling and particulate/scale buildup on surfaces within cooling networks. Biological growth is unavoidable given the flow of nutrient and oxygen-rich water into the cooling network, and as the buildup of biofouling progresses, and begins to impede raw water flow through heat exchangers. Lower GPM flow degrades the ability of the heat exchangers to remove heat from the engine, causing higher operation temperatures and reduced performance.

Corrosion and Biofouling are consequences of the following:

- Operating conditions
- Exposure duration
- Temperature
- Salinity
- Biology

Mineral Scale is typically a consequence of the following:

- Operating water composition
- System run cycles

The simplest method for maintaining a raw water network is the freshwater flush after every run cycle, but delivering on this task is burdensome.

THE DEFINITION OF A "CORRECT" FRESHWATER FLUSH

There are three criteria that must be factored in when performing ANY Freshwater Flush:

1. **Executed immediately at the termination of ANY run cycle**
2. **Sufficient duration to reduce Total Dissolved Solids (TDS) in seawater to ≤1500 PPM**
3. **Pickles "wet" heat exchangers and critical components with fresh water during periods of inactivity**

There are many methods available to reduce the hassle of the "manual" FWF process using quick-connects or flush sequencers for multi-engine configurations, but these merely shift the time and labor burdens toward "less time" or "less labor", and do not address the most common challenge of performing a proper FWF...

The LOGISTICS:

- **Access to a hose within the critical time window**
- **Water resources & management**
- **Time & labor investment**

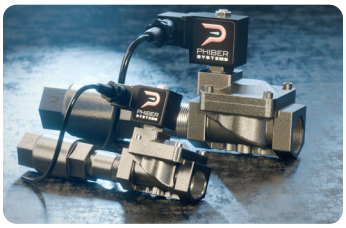
PRESSURIZED HYDRO INJECTION for BRINE EVACUATION & REMEDIATION (PHIBER)

PHIBER Systems provide "preservative maintenance" for raw water networks... at the Touch of a Button. They maximize the performance of raw water systems, and minimize the traditional physical maintenance required to protect them.

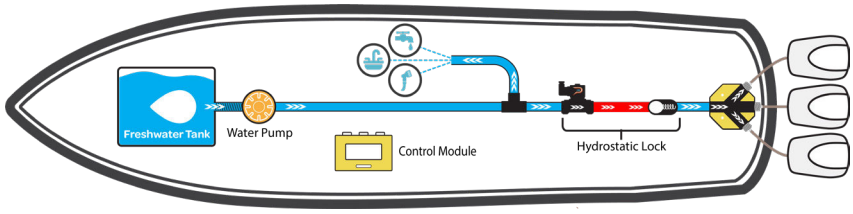
PHIBER Systems guarantee a safe and correct Freshwater Flush at the end of every operation cycle. It is an engineered system that is SCIENTIFICALLY PROVEN TO BE THE MOST EFFECTIVE METHOD to mitigate biofouling, mineral scale, and corrosion.

The PHIBER System comprises two main components that operate in concert:

Control Module: This is the 'brain' behind the Flush, and is universally installed into every PHIBER FWF System. The Module's programming is tailored to a vessel's specific requirements and system functions, ensuring that a safe and proper freshwater flush occurs at the optimal time, interval, and duration for maximum effectiveness. It also tracks and records flushing maintenance data for demonstrable compliance with OEM standards.



Hydrostatic Lock: The Lock is installed between a vessel's fresh water and raw water systems, allowing fresh water to be used for routine flushing maintenance of the raw water network. Its unique design guarantees the integrity of both networks, under any condition.



PHIBER FWF Manifolds revolutionize how traditional raw water networks operate, and have a flexible architecture that streamlines installation and minimizes the physical "footprint".

A "SCIENTIFIC" FLUSH... AT THE PUSH OF A BUTTON

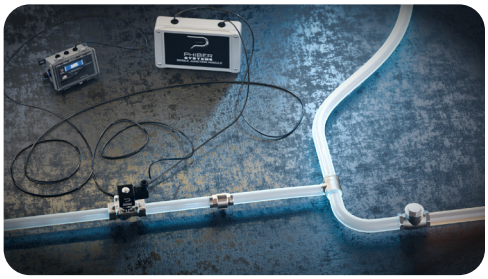
PHIBER Freshwater Flush Systems are unique. The proprietary design can be configured to provide a safe and effective flush for nearly ANY application, including inboard engines with both wet and dry exhaust, vessel gyroscopic stabilization systems, desalination systems, and more. It is purchased as a flexible kit which, during installation, is tailored and programmed for the specific application, providing a precision flush (timing, duration, and flow) for a particular system.

PHIBER Systems use two metrics to achieve a "proper" flush:

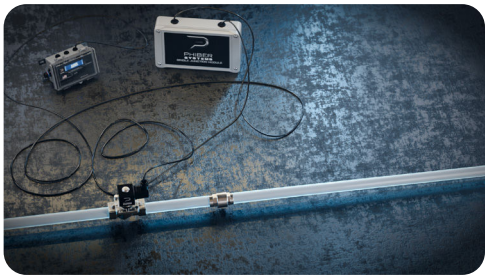
- **Timing** - executing a flush immediately after the run cycle is complete
- **Parts-per-Million** (PPM) - calibrating flush durations and flow to achieve ≤1000 PPM of total dissolved solids (TDS) inside the network

Seawater has (on average) about 35,000 "parts-per-million" (PPM) of dissolved solids (salt, minerals, etc) in it. Once the seawater has been purged and the PPM of dissolved solids drops to less than 1000, the FWF is technically complete and the full benefit of FWF is realized.

The Inboard Manifold



The Overboard Manifold



PROFESSIONAL INSTALLATION IS RECOMMENDED