

## **Industrial Chillers, Laboratory Chillers, Process Chillers - Fluid Corrosion Issues in Cooling Systems**

Pure water (H<sub>2</sub>O) is colorless, tasteless, and odorless. It is composed of hydrogen and oxygen. Because water becomes contaminated by the substances with which it comes into contact, it is not available for use in its pure state. To some degree, water can dissolve every naturally occurring substance on the earth. Because of this property, water has been termed a "universal solvent." Although beneficial to mankind, the solvency power of water can pose a major threat to industrial chillers, laboratory chillers, process chillers and other cooling systems. Corrosion reactions cause the slow dissolution of metals by water. Deposition reactions, which produce scale on heat transfer surfaces, represent a change in the solvency power of water as its temperature is varied. The control of corrosion is a major focus of water treatment technology for all chiller systems.

Facilities managers, lab personnel, and maintenance engineers often ignore corrosion issues; however, because closed cooling systems are much like car radiators, they don't attract much attention until they spring a leak. Overall, the water used in a chiller system should be of the best quality available. As a general rule, demineralized water is better than soft water, which is better than hard water. Some users resist the use of demineralized water because of the common belief that it is more aggressive or corrosive than raw or softened water. Although it is true that untreated, oxygenated demineralized water is very corrosive, corrosion inhibitors passivate metal surfaces and remove dissolved oxygen resulting in final system water that is noncorrosive.

Corrosion control in cooling systems requires a change in either the metal or the environment. The first approach, changing the metal, is expensive. Also, highly alloyed materials, which are very resistant to general corrosion, are more prone to failure by localized corrosion mechanisms such as stress corrosion cracking.

The second approach, changing the environment, is a widely used, practical method of preventing corrosion. In aqueous systems, there are three ways to effect a change in environment to inhibit corrosion:

1. Form a protective film of calcium carbonate on the metal surface using the natural calcium and alkalinity in the water
2. Remove the corrosive oxygen from the water, either by mechanical or chemical deaeration
3. Add corrosion inhibitors

A corrosion inhibitor is any substance which effectively decreases the corrosion rate when added to an environment. An inhibitor can be identified most accurately in relation to its function: removal of the corrosive substance, passivation, precipitation, or adsorption. Passivation works best for industrial chillers, laboratory chillers, process chillers and for other cooling systems. Passivating inhibitors form a protective oxide film on the metal surfaces. They are the best inhibitors because they can be used in economical concentrations, and their protective films are tenacious and tend to be rapidly repaired if damaged. In addition to selecting the proper corrosion inhibitor the user should be aware that some applications require low conductivity fluid used for cooling and need to plan accordingly when the inhibitor is selected. If bacteria, algae, or biological growth is present in the cooling system you should contact your chiller manufacturer for recommendations.

**OPTISHIELD®** "Original" formula, distributed by **Opti Temp**, has been formulated to control corrosion in cooling systems circulating fluid to industrial machines such as lasers, welders, machine tools and other process equipment. It provides broad corrosion protection for cooling systems with a range of materials including copper, brass, aluminum, tin, ferrous metals, lead, and other yellow metals. OPTISHIELD® "Original" formula is pH basic and provides an unfriendly environment for algae. When used as directed, OPTISHIELD® "Original" formula is a safe, effective solution for most general industry applications.

From the OPTISHIELD® **directions for use manual**: OPTISHIELD® is a liquid water additive, formulated to provide corrosion protection for a broad range of materials in "closed circuit" re-circulating systems. OPTISHIELD® is suitable for use in most "new" and "existing" cooling systems, when used in accordance with directions. However when used with existing cooling systems which may contain excess scale, oxidation, and sediment, it may be advisable to first flush the system with a mild cleaning agent. Contact your equipment manufacturer and/or OPTI TEMP for recommendations on appropriate cleaners.

**Caution:** Some cleaners and/or additives can be harmful to certain cooling system components. Check with the equipment manufacturer for compatibility with the system before using OPTISHIELD® or any other additives. Use of unapproved products may void your equipment warranty.

**Filtration:** It is strongly recommended that particle filtration be installed on all re-circulating systems, particularly for those cooling systems where corrosion, scale, and other containments may already exist. Use of OPTISHIELD® will tend to loosen and free containments over time. **TO PROTECT PUMPS, SEALS, AND OTHER COMPONENTS**

**INSTALL FILTERS ON THE RETURN SIDE OF THE SYSTEM!** Please note that filter type and minimum recommended particle sizes may vary by application. Contact your equipment manufacturer or OPTI TEMP engineers for more information and recommendations.

#### **Directions for New Systems “First Time Use”**

Note: If system is an existing system with a known corrosion problem, the cooling system should first be treated and flushed with a mild cleanser. Contact OPTI TEMP for more details.

1. Flush cooling circuit with distilled water.
2. Calculate system capacity/volume in gallons. Fill cooling system with a 5% solution of OPTISHIELD® and distilled water. (Example: 1 gallon of OPTISHIELD® to 19 gallons of water for first “coating cycle”)
3. Circulate this solution for about 30 minutes.
4. Drain fluid\*. **DO NOT RINSE!**
5. Fill cooling system with a 10% solution of OPTISHIELD® and distilled water. (Example: 1 gallon of OPTISHIELD® to 9 gallons of water)
6. Change fluid as directed by OPTI TEMP INC.

#### **Directions “After First Time Use”**

1. Drain used fluid from system\*.
2. Fill cooling system with a 10% solution of OPTISHIELD® and distilled water. (Example: 1 gallon of OPTISHIELD® to 9 gallons of water)
3. The system is ready for use.

#### **WHEN DO I CHANGE THE OPTISHIELD® SOLUTION?**

OPTI TEMP INC. recommends changing the OPTISHIELD® solution annually. **Failing to change the solution when prescribed can lead to serious corrosion problems.** Please follow all directions.

The time between successive changes generally depends on three main factors:

1. The types of dissimilar metals in the system.
2. The temperatures encountered by the solution.
3. The number of hours per day the fluid is circulated at the above temperatures.

OPTI TEMP, INC. can recommend a schedule for your system.

#### **HOW AND WHEN DO I CHECK THE OPTISHIELD® SOLUTION?**

During the first 4 weeks it is best to check the system weekly, if not more often, for CLARITY. This can be done by taking a small sample of the fluid and holding it up to the light to make sure there are no precipitates (solids) in the solution. If any precipitates (or a cloudy solution) are found, the solution should be drained following the “Directions For Use of OPTISHIELD®”.

The solution should also be tested for pH level. The pH should not fall below pH=9. If the pH=9 or less, drain the system and follow the “Directions For Use of OPTISHIELD®”.

If, after one year (or the prescribed time OPTI TEMP recommended for your special application) your solution is still clear and the pH=9 or above, we recommend that the fluid still be changed out. The clarity and pH tests are to be used as guidelines for solutions that need to be changed before the specified time period.

#### **CONDUCTIVITY REQUIREMENTS**

If your system has low electrical conductivity requirements, please contact OPTI TEMP INC. for recommended concentrations of OPTISHIELD® and other applicable products.

The OPTISHIELD web address: <http://www.optishield.net>

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