

# Anti-Corrosion Priorities In GRP

*For Open Recirculation Loop Cooling Systems*



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By Sanjeev Srivastava

Cooling systems are crucial components of many Power, Processing and Manufacturing plants. It is essential to maintain these systems and keep them in good working condition. One of the problems faced in their maintenance is corrosion induced maintenance. Corrosion mitigation is both time consuming and costly, and more often un-predictable.

The goal of this paper is to make designers aware of GRP pipes for cooling water circuit in all re-circulating loops, barring the actual heat transfer surfaces, so as to minimize the need for maintenance and make certain that the only focus of treatment are heat transfer equipments.

## Challenges & Remedies

Cooling tower is a heat rejection device/heat-transfer unit, used to eliminate heat from water-cooled systems.

The cooled water is then re-circulated (and also, recycled) back into the system. The cooling potential of a wet surface is much better compared to a dry one, consequently using metals such as; Cu, Fe and Al and alloys have been among the best choices for Heat Exchange Engineers, when designing heat transfer equipments such as condensers, heat exchangers etc.

Cooling systems contain several types of metals including: copper, steel, galvanized steel, and aluminum. Galvanizing (the coating of zinc onto steel), is widely used in open loop cooling

systems for its ability to protect steel from corrosion and its cost-effectiveness. This material offers 20 years or more life expectancy when maintained properly.

However, when pH is over 8.2, corrosion may begin and the appearance of ‘white rust’ is seen. This indicates that the oxidized zinc is no longer protecting the steel and the lifespan of the metal system will therefore be reduced significantly.

Vapor-phase Corrosion Inhibitors (VpCI) are a type of inhibitor used for combating corrosion problems faced by water treatment providers. VpCIs have been used for a long time; however, some of them could be aggressive to non-ferrous metals —especially yellow metals. In a majority of cases, corrosion protection of yellow metals is achieved by using triazole based inhibitors. Their protection mechanism and effectiveness were studied by many researches, but lately environmental regulations based on toxicity data has revealed concerns regarding triazoles usage.

## The Catalysts

While the above relation of metallurgy and water chemistry is well understood and managed, open re-circulating cooling systems being exposed to environment bring in added troubles, that I often call catalysts to corrosion. The chief external species that are not welcome in the system are:



Figure 1: GRP Pipes Discharge

1. Dust and dirt
2. Biological species —bacteria's
3. Corrosion products (in case of metal piping)

### The GRP Piping System

Depending upon the system design and layout of the plant, there could be 90–95% surface in a open re-circulating cooling system that we term as carrier and barely 5-10% that is actually involved in the transference of heat. This raises a question —do we really need metal pipes to bring water to heat transfer surfaces?

So far, metal pipes, have been used vastly, in spite of being associated with many problems i.e. corrosion, fouling due to deposition of dust and dirt as well as severe bio-film formation in low velocity zones or crevices.

But, today, GRP pipes are demonstrating the advantages of Glass Re-enforced Fiber. A material with limitless possibilities and potentially inert to the aggressive environment of open re-circulating cooling systems: TDS, low pH, high chlorides, bacteria, bio-film, corrosion and also to all chemicals and formulations injected to protect the costly metal of heat exchange surfaces.

### System Concept

All the piping components of open re-circulating cooling systems today are designed with GRP:



Figure 2: GRP Pipes Suction

- a) Cooling Water Suction Header
- b) Cooling Water Discharge Header
- c) Cold Water Pipe from CT to Heat Transfer Equipment
- d) Hot Water Return to CT Deck
- e) Side Stream Pipes including Frontals for AVGF

This ensures several benefits in the modern design of a CT system including:

- Friction free piping, which leads to reduced energy consumption.
- No anchor blocks in pipe design: using bell and spigot joints result in restrained joints that allow greater flexibility in pipe routes.



Figure 3: GRP Pipes Construction Site.

Attribute	GRP Pipe Systems	Metal Pipe
Corrosion Resistance	Excellent. Qualified for transmission of Highly corrosive substances	Poor. Corrosion and leakage easily formed.
Service Life cycle	Long 30 to 50 Years	Short. Only 5 to 10 years
General Energy Consumption	50% GEC of steel pipe of same diameter and flow	High GEC
Friction Resistance	Smooth internal wall: low friction; low scale and low paraffin formation	Rough Internal wall; high friction; high scale; and high paraffin formation
Thermal Insulation Performance	Low electrical conductivity: good insulation; little thermal heat loss	Poor insulation Value, high thermal heat loss and subject to line freezing; electrical conductivity
Installation	Less weight; easy transportation and installation; transportation cost saving	Costly transportation and installation; needs large hoisting equipments on site for installation
Environmental	No secondary pollution or leakage during the operation	Likely to result in secondary pollution during operation and numerous examples of leakage with subsequent environmental pollution impact
Cost	Low installing cost. Better Value. Enduring performance	Maintenance and repair costs. Downtime costs in operations.

Table 1 : GRP vs. Metal

- 100% air tight pipes, no joints, no leaks.
- Smooth internal surfaces and virtually no bio-films in pipes.
- Inert chemistry with water and its constituents. No reaction.
- No external protection like painting required ever, not for the entire plant life.

### World Wide Acceptance

Today, engineers have widely accepted this new innovation, with over 200 installations all across the world. Most of these installations are in the Middle East and in desalination projects where high ambient temperatures and harsh external environment (proximity to sea water salinity) is witness to the

fact that GRP is a strong, robust and versatile material of the future.

In India, the first project is on fast track development with a Power Major in Orissa and its acceptance has opened a whole new dimension to the cooling water management in Indian industry and provided comfort to water treatment chemists who can now focus on internal conditioning with precision and control.

#### About The Author



Sanjeev Srivastava is the Associate Vice President – Developments, Doshion Limited. He is an engineer from IIT, Roorkee and has been involved with water and wastewater management technologies for the past 21 years. He can be reached at [technology@doshion.com](mailto:technology@doshion.com)