HydroChem

Technical Bulletin

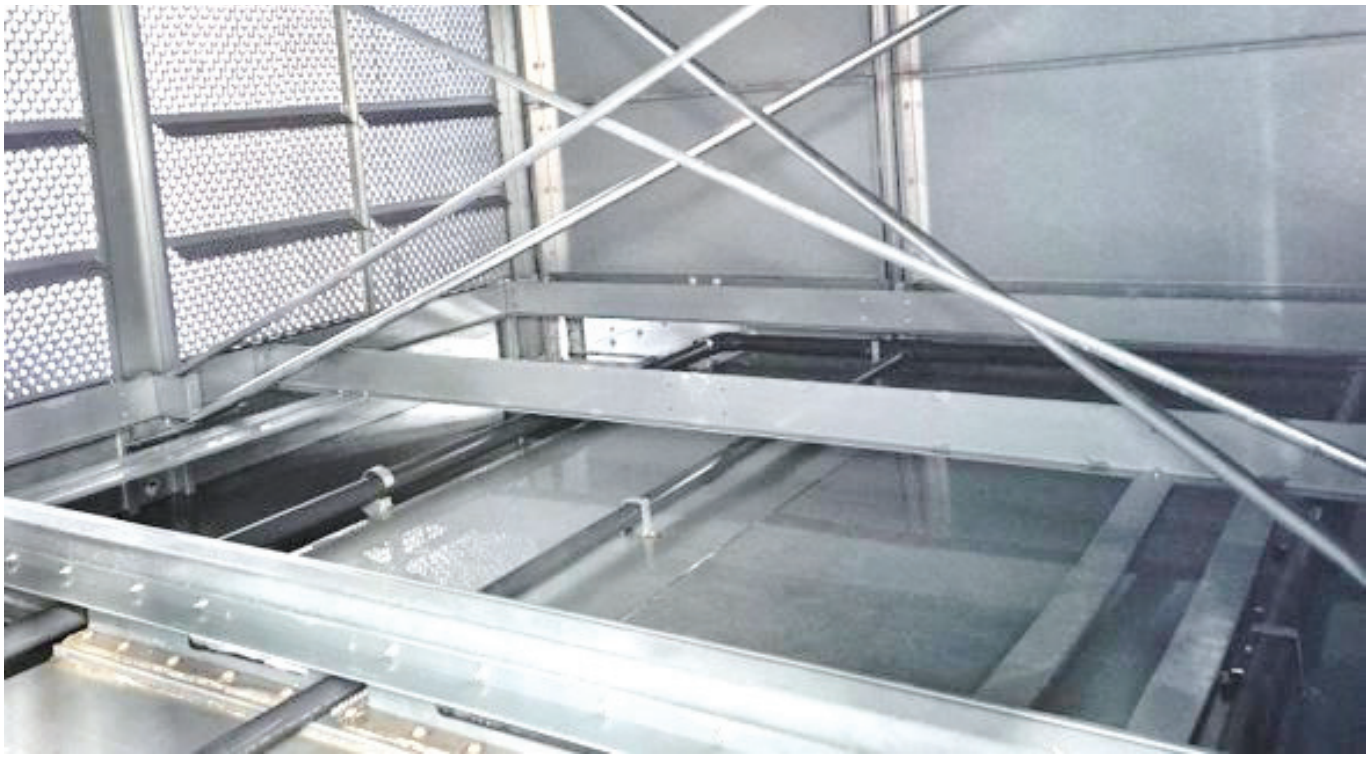
Passivating Galvanised Cooling Towers For Durability

Why we passivate

As a cost-effective and durable construction material, galvanised steel has long been used in the manufacture of evaporative cooling plant and equipment.

Passivating this equipment during its commissioning phase is a step that should not be skipped or inappropriately accelerated. The formation of a passive metal surface is critical to extending the service life of galvanised equipment.

When done correctly, passivation forms a passive and durable layer on the surface of galvanised steel that protects it from corrosion and the onset of white rust.



How we passivate

Newly galvanised equipment is susceptible to corrosion and physical damage.

The passivation process converts the zinc oxide layer to zinc carbonate. Once the zinc is converted to zinc carbonate it 'hardens off' to a more tolerant metal surface.

Water chemistry is critical to the passivation process. Water chemical parameters must remain within defined ranges for the duration of the specified passivation period. Changes in TDS or temperature will negatively impact the process. Throughout this period, it is important to operate the newly galvanised equipment without load – which would impact the temperature and water chemistry.

It is important that other equipment sharing the system loop is compatible with the chemicals that are introduced. Regular inspections of both the newly galvanised equipment and ancillary equipment, such as the coils, should be noted in the passivation plan.

A visual indicator of a successful passivation process is the change in colour of the original bright galvanised steel to dull grey.

Deakin University partnership

Melbourne's Deakin University partnered with HydroChem to explore the benefits of correctly passivating galvanised cooling tower equipment during commissioning. This research took the form of an independent testing project that ran over a two-year period.

The project has resulted in a deeper understanding of the timelines required to passivate and the best formulations to introduce into the cooling tower system. Ultimately, the research demonstrates best practice and delivers a unique opportunity to promote industry-wide best practice.

How can HydroChem help?

We have developed a series of scientifically engineered products designed to protect galvanised steel cooling equipment in even the most challenging of applications and environments.

Our research and development team have worked with material suppliers, equipment manufacturers and researchers for a number of years to find the correct balance of time and product to deliver the best passivation outcomes possible.

The bespoke range of HydroChem passivation products ensures that our local teams offer an unparalleled service when it comes to commissioning galvanised steel equipment for an extended lifecycle.

Galvanised steel after 12 weeks of untreated exposure (at 50x magnification)

What is white rust?

White rust is a white, chalky substance that forms on galvanised steel if it is not appropriately passivated. White rust is an indication the zinc oxide surface coating has failed. Once the galvanised coating fails, cooling system water comes into contact with bare steel.

The passivation process converts a newly galvanised surface, zinc oxide, to zinc carbonate. In contrast, white rust is zinc hydroxide – not zinc carbonate.

How does white rust form?

White rust forms when water that is not within the appropriate parameters comes into contact with a newly galvanised surface before it is passivated. The chemical interaction between water and zinc oxide forms zinc hydroxide or white rust.

Is white rust preventable?

The formation of white rust can be avoided by following a passivation process during commissioning. Galvanised equipment that comes into constant contact with system water, such as cooling towers, need to develop a stable protective coating on the galvanised steel.