

Tech Note 34: Commissioning CuNiFe

TN.34

Applicable Products:

- AusPress Copper Nickel Press-Fit, diameters 15 to 108mm.

Related Documents:

- Tech Note TN.03 AusPress Press-Fit Media Suitability Guide
- Tech Note TN.30 Flow Rates & Pressure Loss (Press-Fit)

Copper Nickel needs certain conditions for the protective passivation layer to be formed, and maintained, as part of the material.

- The passive layer is mainly made up of copper oxide and is improved by additional nickel and iron.
- The initial layer forms quickly within the first few days but needs up to three months to form fully, at temperatures 15-17°C. Higher temperatures, such as 27°C, accelerates this process. The presence of oxygen is required in this process (5.5 – 7.5 mg/l).
- The passive layer requires a flow of water (not stagnant) between 1 and 3m/s.

Normally, a salt solution (ie clean, not ocean water) is run through the system. This is why additives such as Ferrous Sulphate are used for commissioning however, concentrations and contact time should be carefully controlled to prevent bulky scale. Simultaneous treatment with ferrous ions and chlorine is not recommended due to possible re-actions of chlorine with ferrous ions to form ferric chloride. It is recommended to stop the treatment with ferrous ions one hour before chlorination. Sodium Sulfate solution may be an alternative option.

Type of Treatment	Dosage Regime	Fe2+ Conc (ppm)	S- Conc (ppm)	Notes
Simulated Anode	Continuous	0.01 - 0.2	0.01 - 0.1	No appreciable effect of 0.01 S- on general corrosion, but increased localised attack. The corrosion was significantly reduced by ferrous ion treatment but not completely eliminated; the pitting was eliminated after 90 days.
Ferrous Sulphate	Continuous	5	0.1	Build up of sludge.
Ferrous Sulphate	2 h/day	1	0.01	20 to 40 days were necessary for inhibitor to achieve the full effectiveness.
Ferrous Sulphate	Continuous	0.1	0.05	90 days of exposure were necessary for full counter-action of inhibitor.
Ferrous Sulphate	Continuous	2 – 3	See notes	The treatment is recommended during commissioning period to accelerate the formation of protective film.
Ferrous Sulphate	1 h/day	5	See notes	The treatment is recommended during commissioning period to accelerate the formation of protective film.
Ferrous Sulphate	Continuous	0.18	0.08	In combination with sponge ball cleaning to control the heat exchanger efficiency the treatment achieved best results in an extensive project.
Ref: Typical Failures of CuNi 90/10 Seawater Tubing Systems and How to Avoid Them, W. Schleich.				

The passive layer will form with the flow of seawater inside the CuNi pipework between 1.0 and 3.0 m/s flow speed.

Sitting idle, dry or seawater full, the passive layer will not form or repair and not recommended to occur (including during construction).

3 months is the optimum period for the 'full thickness' of passive protection to form. The reaction actually commences immediately, and pipework use can commence and is preferred to start immediately after commissioning (ie flushing, purging and testing).

Key points to consider:

- Clean seawater will likely be fine; seawater with contaminants or pollution the CuNiFe material may suffer damage.
- Using the chemical based treatments is preferred but seawater can do similar if the former is not possible. Best practice vs what can be achieved onsite.
- Weld seams are the most vulnerable locations.
- Long stagnant holding of water within the system is to be avoid (ie 3-4 days max).
- Pipework must be purged of air to prevent any pockets of air/water exposure internally.
- Avoid the intake of debris, biological matter and solids with the seawater source.

Chlorination of Seawater (Anti-Biofouling)

For continuous and intermittent chlorine additions, the concentrations of 0.3 and 0.5 ppm respectively are recommended.

Erosion corrosion (sand & debris)

Maintain sand concentrations below 1000 ppm, less than 200 ppm is preferred.

Further Reading

https://www.copper.org/applications/marine/cuni/applications/seawater_system_design/heat_exchangers_piping/heat_exchangers_and_piping.html

Not sure?

Please contact us before installation so we can offer advice and suitability.