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TREATMENT AND MAINTENANCE OF CUNIFER

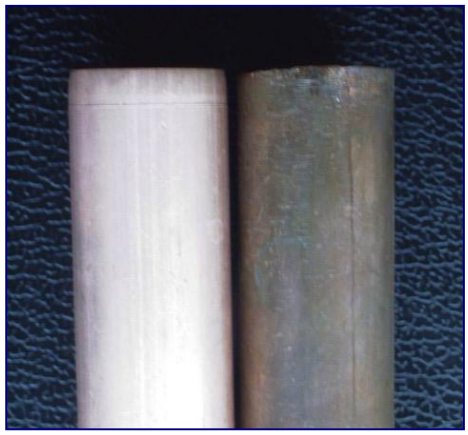
The material Cunifer is an alloy. The name is derived from the three principal alloying elements copper (Cu) nickel (Ni) and iron (Fe). The two most prevalent Cunifer types are often referred to as 90/10 and 70/30 and specify the ratio copper to nickel (see table 1).

The alloy Cunifer has been developed especially for applications involving contact with seawater. Cunifer has a high corrosion resistance in general and is particularly resistant to pit and crack corrosion by chlorides. Cunifer also has the distinguishing feature that organisms adhere very poorly to its surface. This means that it requires fewer periodic cleaning services to remove biological accretions than other material types and the requirement for biocides is less.
This makes the material eminently suitable for, for example, heat exchangers in ships and other areas of the offshore industry.
The corrosion resistance to seawater results from the fact that a copper-nickel alloy forms a thin, protective film when in contact with clean seawater. This film has a complex composition and consists, among other components, of copper oxides in combination with nickel oxides, iron oxides and copper hydroxychloride. The formation of the protective film is however critically dependent on the Cunifer material being in contact with clean seawater before usage.

Despite the fact that Cunifer has excellent corrosion resistance and even retains its high corrosion resistance after welding, chemical treatments are applied to Cunifer. There are a number of reasons for applying this chemical treatment. We shall cite four:

1. Periodic cleaning to remove biological fouling.
While occurring less frequently than for other types of material Cunifer may in the course of time be beset by biological foulings, for example shells that cause calcium deposits. These foulings are easy to remove with a mineral acid, for example Descalant HD (inhibited hydrochloric acid).

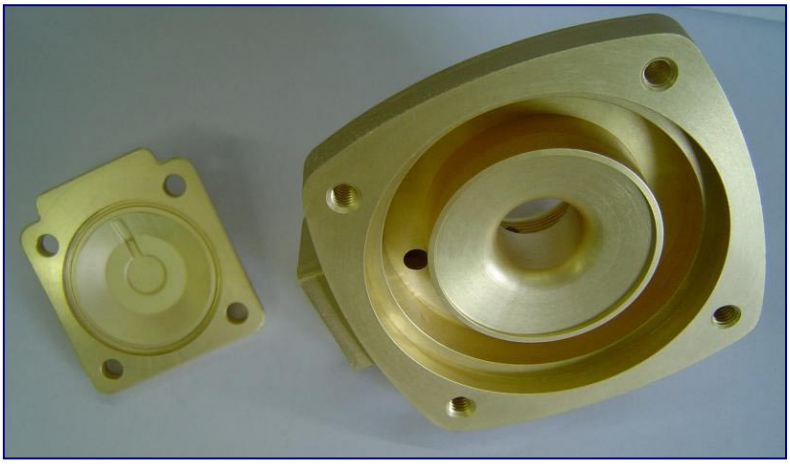
2. The removal of undesirable oxides.
After thermal treatment undesirable oxides may form on the surface. These undesirable oxides are generally removed by a pickling treatment. Cunifer can be pickled in a mixture of nitric acid and fluoric acid. An extremely short pickling time must however be observed as the material may be susceptible to fluoride corrosion as a result of thermal treatment. This means that only immersion or spraying will be suitable for pickling treatment.


Pickled (left) and not pickled (right) Cunifer tube

3. Improvement of the corrosion resistance by passivation.
Some applications of Cunifer (90/10) are subject to more stringent requirements with regard to the corrosion resistance of the material. The German navy for example passivates as standard procedure pipework that comes into contact with seawater. This passivation is carried out using the substance SDMC (sodium diethyldimercaptocarbonate). The substance SDMC forms a passive and protective sulphur complex with the Cunifer surface through a mechanism that may be characterized as inhibition. This results in an even greater increase of the corrosion resistance of the material.

4. Aesthetic reasons.

Cunifer is not often chosen as material for aesthetic reasons because it is, like most copper alloys, very susceptible to staining. This staining is due to the formation for example of oxides that may colour red or brown. It is however possible despite this to set some requirements for its appearance. Treatment with a chromate based cleaning agent will provide copper alloys with a very attractive matte, gold-tinted and uniform appearance. Some drawbacks associated with this treatment are the costs of the product and its toxicity, which requires expensive waste treatment of chromate, meaning that it may be applied only in exceptional cases.



Copper alloy pickled with chromate

Table 1: Comparison of Cunifer 90/10 and 70/30

Alloy	**90Cu-10Ni** **Cunifer 10**	**70Cu-30Ni** **Cunifer 30**
UNS No	C70600	C71500
Active substance number	2.0872	2.0882
Corrosion by ammonia	Less resistant	More resistant
Corrosion by sand (erosion)	Lower tolerance	Higher tolerance
Formation of biological foulings	Higher resistance	Lower resistance

Sources consulted:
CA Powel, HT Michels, *Copper-Nickel for Seawater Corrosion resistance and antifouling,* Corrosion 2000, annual conference Orlando Florida
Bundesamt fur Whertechnik und Beschaffung, Rohrleitungen aus kupfer-nickel-legierungen, 1985

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