

PITTING CORROSION ON STAINLESS STEEL **ECOSS STAINLESS STEEL EVAPORATIVE CONDENSER**

Stainless steels are alloys of iron (Fe), carbon (C) and chromium (Cr) with a minimum of 10.50% Cr. Other metal elements also integrate these alloys, however Cr is considered the most important element, as it provides stainless steels with a high corrosion resistance.

Corrosion is the destruction or deterioration of a material due to a chemical or electrochemical reaction with its medium. The metals that make up the stainless steels react quite easily. One of them, in particular Cr, makes it possible to form films that protect these alloys from subsequent attacks. This phenomenon, by which the metal or alloy ceases to be corroded is known as passivity.

Stainless steels and media containing chlorides

One of the problems faced by austenitic steels is that of the corrosive action caused by the chloride anion, Cl⁻. In media containing chloride anion, stainless steels are at risk of experiencing localized forms of corrosion. Depending on the concentration of chlorides in the medium, the temperature and the pH, three forms of corrosion can occur pitting corrosion, shown by Figure 1.

Figure 1 – Pitting corrosion



The chloride solutions that most often cause corrosion in austenitic stainless steels can lead to some non-compliance in the equipment, such as leaks.

Stainless steels are susceptible to corrosion located only at certain points on the surface and the corrosive attack, once initiated, progresses mainly in depth, sometimes causing holes so deep that they can go through all the metal.

In pitting corrosion, the attack will cause metal gaps in the passive film according to Figure 2. The speed of creating gaps increases with the concentration of chlorides in the medium. The base metal migrates occupying these gaps, eliminating them. The concentration of metal gaps will depend on their creation and elimination

speeds. If the speed of creating gaps is predominant, the passive film loses cohesion and ends up suffering localized ruptures.

Figure 2 - Pitting corrosion mechanism.

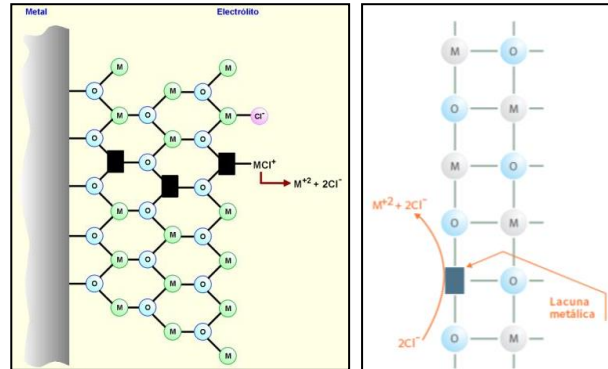
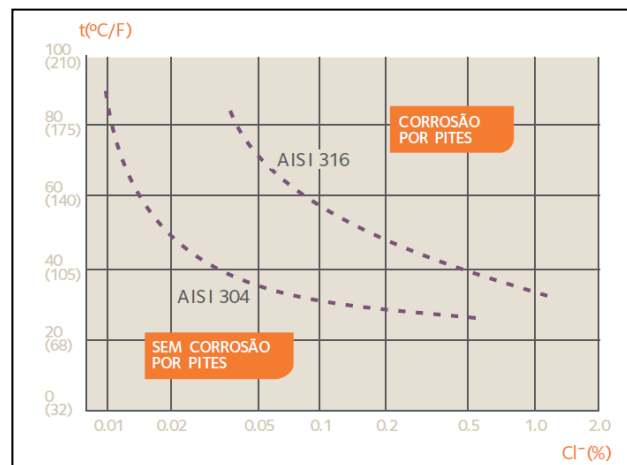


Figure 3 shows the acceptable chloride concentrations for the use of steels 304 and 316. The acidification of the medium (decrease in pH), the increase in temperature and the increase in the concentration of chlorides favor pitting corrosion (the potential of pit becomes lower, more active). As in all corrosion charts, it should be noted that there may be changes due to other contaminants present in the medium.

Figure 3 - Acceptable chloride concentrations for alloys 304 and 316.



Actions that influence a pitting corrosion

- Failure to bleed;
- Analytical parameters of the tray water and feed non-compliant with the recommended by the manual;
- Non-cleaning of spray nozzles;
- Presence of halogens in the tray water and feed;
- Non-cleaning of the coil;
- Lack of water in the system (dry working).

Pitting corrosion is a combination of factors, for this reason it is necessary to follow the recommendations of the equipment manual and carry out the maintenance plan.

Therefore, the steps of periodic cleaning of the equipment and bleed are necessary to avoid excessive concentrations of salts and scale formations, together with a water treatment program, carrying out the maintenance plan of the equipment is of extreme importance for the conservation of the equipment and should be adopted as prevention habits.

Instructions for carrying out the maintenance plan:**Technical manual of the equipment**

- Chapter 12 - Bleed and chemical treatment of water
- Chapter 11 – Maintenance

Technical Bulletins

- BT-002 - Spray nozzles
- BT-003 - Manual Bleed
- BT-004 - Chemical treatment of water
- BT-006 - Pitting corrosion on stainless steel
- BT-014 - Chemical cleaning - Scale removal
- BT-022 - Softeners for pretreatment of water

Important!

Pitting corrosion does not characterize a manufacturing failure. It is the responsibility of the customer to carry out the maintenance plan, adapting its operation.

The water circulation must remain active, regardless of the need to use the condenser.

For more information, refer to our technical department.