CORROSION

CORROSION RESISTANCE OF ZINC IN WATER

TECHNICAL BULLETIN CTB-5

Rev 4, November 2003
This issue supersedes all previous issues

Corrosion rates of zinc in natural fresh water are dependant on the type and condition of the water. Some of the variables which affect the corrosion rate are as follows:

1. Hard waters are normally less corrosive than soft waters due to protective calcium and magnesium based compounds which are deposited on the metal surface as scale.

2. As with other common metals the corrosion rate of zinc increases with aeration of the water. Dissolved oxygen and carbon dioxide both increase the corrosion rate of zinc.

3. Corrosive anion loading *(such as chlorides and sulphates)* will accelerate related corrosion mechanisms.

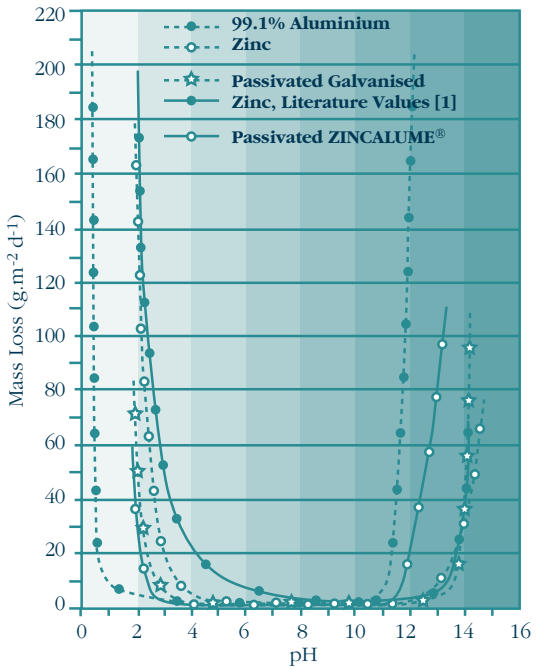
4. Agitation or stirring of water leads to increased corrosion, but attack is uniform. Under stagnant conditions or conditions of limited oxygen availability attack may be localised in the form of pits.

5. Zinc offers good corrosion resistance in water having a pH near neutral. The corrosion rate is low over the pH range 6.5 - 12 but increases rapidly towards the acid and alkaline sides of this range. See Figure 1. Most natural potable waters have a pH range from 5.0 to 8.5.

6. Figure 2 shows that as the temperature of still water rises above approximately 50˚C the corrosion rate of zinc increases sharply and reaches a maximum at about 70˚C, whereafter the rate decreases rapidly.

The increase in corrosion rate followed by a decrease is attributed to a change in the character of the corrosion product. A gelatinous adherent film is formed in the temperature range 20°-50°C, a granular flaky or non-adherent film between 50°-70°C and a compact dense film above 75°C, which becomes even more adherent with a further rise in temperature. At temperatures above 70°C a reversal of polarity can occur in aerated solutions. That is when the steel substrate is exposed, such as at a cut edge, it will actually begin to corrode to protect the zinc coating.

Figure 1: Effect of pH value on the corrosion rate of various metals.

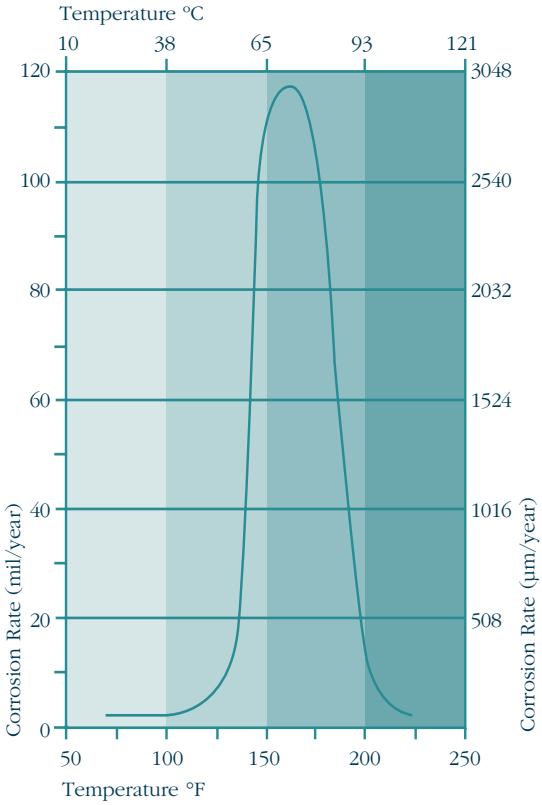


BLUESCOPE STEEL

As a result of the variable nature of most natural waters due to increases in acid rain and salinity levels BlueScope Steel Limited only recommend the use of AQUAPLATE® polymer – coated steel to contain water. This product consists of a food grade polymer which is bonded to a galvanized steel substrate. Specific installation and design requirements have been made to cover the use of this product and these are contained in: Technical Bulletin TB-3 "The Manufacture of AQUAPLATE® Steel Water Tanks".

ZINCALUME® zinc/aluminium alloy-coated steel and COLORBOND® prepainted steel, should not be used for the containment of water.

Figure 2: Effect of Water Temperature on the corrosion rate of zinc



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