CORROSION TECHNICAL BULLETIN 5

BLUESCOPE

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This issue supersedes all previous issues

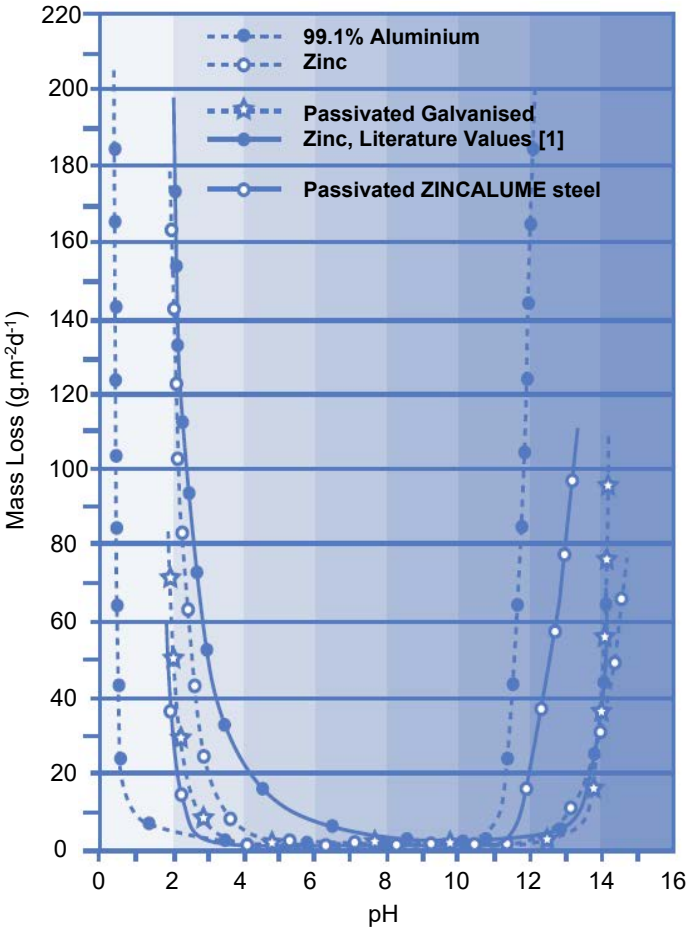
Corrosion resistance of zinc in water

Corrosion rates of zinc in natural fresh water are dependent upon 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 the 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 carbo 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 attachk is uniform. Under stagnant conditions or condirions 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 range 6.5-12 but increase rapidly towards acid and alkaline sides of this range. See Figure 1. Most neutral potable waters have a pH range from 5.0-8.5.
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 more adherent with a further rise in temeprature. At temperatures above 70°C a reversal of polarity can occur in aerated solutions. That is when the steel substrate is exposed, such that as at a cut esge, it will actually begin to corrode to protect the zinc coating.

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



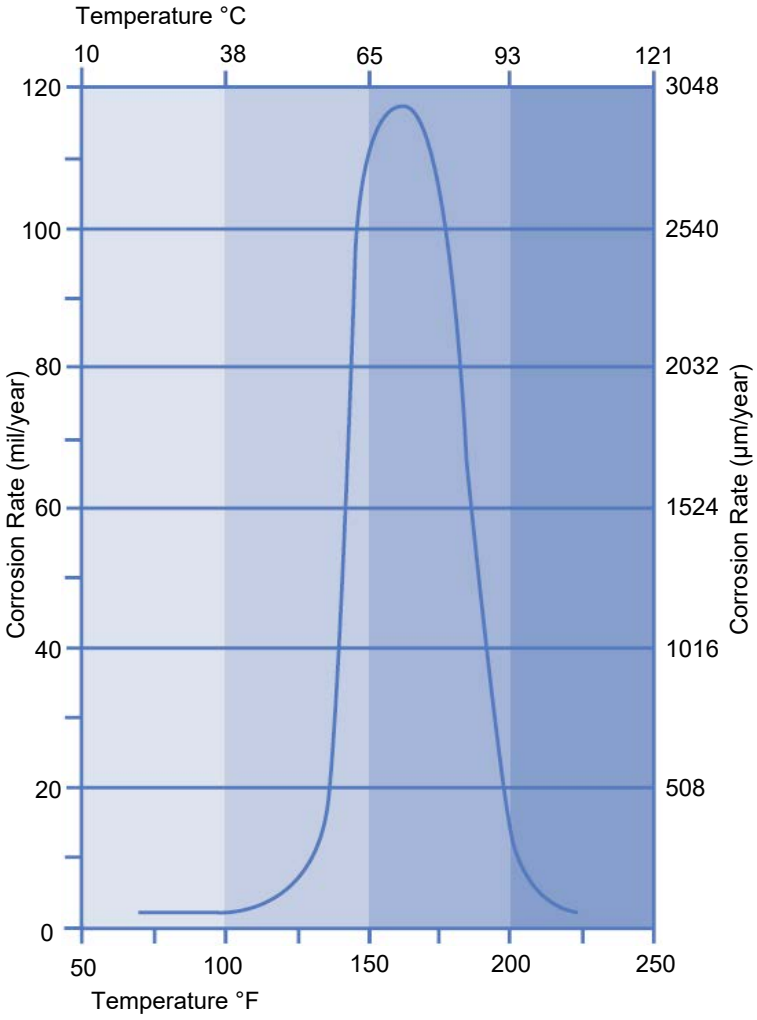
As a result of the variable nature of most natural waters due to increases in acid rain and salinity levels BlueScope only recommend the use of AQUAPLATE® steel polymer coated steel to contain water. This product consists of a food grade polymer which is bonded to a galvanised steel substrate. Specific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

ZINCALUME® steel and COLORBOND® steel should not be used for the containment of water.

RELATED BLUESCOPE STEEL TECHNICAL BULLETINS

Technical Bulletin TB-3
AQUAPLATE® steel for water tanks

Figure 2: Effect of water temperature on the corrosion of zinc.



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