

Metals used in cooling towers



General

In many cases, as part of the cooling tower specifications, the manufacturer is asked to use certain metals. "Stainless steel 316 / 304 / 904", and "hot-dipped galvanized" commonly appear in specs. Herein, we explain briefly the differences between metal types and common reasons for their respective uses.

Types of metals used in cooling towers

Metal is a solid characterized by electricity and heat conductivity. Iron, in common use, has a high hardness and is inexpensive. These properties render it suitable for machinery, ships, and buildings. The drawback of iron and steel (iron containing 0.5%-1.5% carbon) is that they rust and corrode. Because of the operating principle behind cooling towers, the conditions inside it are extremely humid and therefore untreated steel is unsuitable for cooling tower construction. As an alternative, we can choose non-metals such as fiberglass or coat metals with zinc (hot dip galvanization). Or, we can use rust- and corrosion-resistant alloys. Adding chrome at a proportion of 11.5% and above makes steel characterized as stainless steel, or "SS".

Stainless steel's rust resistance is due to a thin layer, or passivation, that is produced when chrome is exposed to oxygen. This layer is impenetrable to water and air, thereby protecting the metal underneath it, and is invisible to the naked eye.

It is customary to classify the stainless steels into several groups according to unique properties that change as per their respective levels of chrome and nickel. The group commonly used in cooling towers is iron-rich stainless steels containing at least 16% chrome and 6% nickel. SS 316 and SS 304 belongs to this group. Adding "L" indicates that the metal is easy for welding. In this group, the 904 is highly resistant to chloride (such as seawater), as well as environmental sulfurs and phosphates.

At the apex of the stainless steel pyramid are the supermetals such as Alloy 20, which has maximum resistance to acids. The higher the water temperature, the lower its resistance to corrosion.

The main reason for using stainless steel in cooling towers:

Chloride level in the water is the factor that most strongly influences corrosion. Chloride levels in Israel's tap water range from 250 to 600 ppms. Because of evaporation in cooling towers, the chloride levels in cooling tower water are from 2 to 10 times this level, depending on the water treatment program and number of concentration cycles.

The table below shows metals' resistance by chloride levels and different temperatures. for example, at 30° C. and 600 ppms of chloride, the optimum metal for use is SS316. At chloride levels above 1,200 ppms and temperatures above 40° C., the best metal is SS904. Supermetals are used in cooling towers normally when the water contains hydrofluoric acid at a significant level or in the event that seawater is used.

