Blaser Swisslube AG
CH-3415 Hasle-Rüegsau • T +41 34 460 01 01 • contact@blaser.com • blaser.com

WHY MACHINE TOOL BUILDERS SHOULD AVOID ZINC COATINGS

Zinc coatings prevent steel from corrosion – but only in normal atmospheric conditions
A zinc coating on steel (galvanized steel) is a highly effective rust prevention in normal atmospheric conditions, particularly in conjunction with a paint coating. The exposed zinc reacts with the environment and forms an oxidation layer, which reduces the corrosion speed significantly. The effectiveness of such a corroded zinc layer depends on three factors: thickness of the layer, humidity, and environmental conditions in general (e.g. acidic rain accelerates the corrosion process).

However, as soon as even only small parts of the underlying steel are exposed to humidity through a porous or damaged zinc coating or exposed steel edges, the zinc layer will start to dissolve. The reason for this is that zinc is a less noble metal than steel, meaning that it will always corrode first in a zinc-steel combination. In the marine industry, it is therefore common practice to use “sacrificial zinc anodes” to protect the steel structures from corrosion. In galvanized steel, the zinc is also used as sacrificial coating to protect the underlying steel, but its corrosion protection ends when a sufficient area of steel is exposed.

Zinc always corrodes with water-miscible coolants
With normal exposure to air and humidity, exposed zinc provides sufficient protection, as it only corrodes slowly (with a zinc layer erosion of <0.1 to ~8µm per year depending on the location). In machines using water-miscible coolants, the erosion of zinc happens much more quickly. The main reasons are: constant exposure to water (including salts), mechanical damage by metal chips, pH-adjusted coolants, and chemical reactions with ingredients that are required for the performance of the metalworking fluid. These reactions can cause residues or discolorations on the zinc-coated steel parts, and with some delay lead to deposits on other parts of the machine. Zinc especially reacts with anti-wear additives – additives that are essential for cutting performance, as they protect both workpiece and cutting tool during machining. Together with the dissolving zinc, these additives often form so-called “zinc soaps”, which usually end up as sticky residues.

Blaser Swisslube has examined the zinc corrosion in machines thoroughly. Our finding is that it happens with all water-miscible coolants (emulsifiable oils, semi and full synthetics). Just the speed and appearance may vary. The corrosion is more visible with clear coolants than with milky emulsions. Emulsions containing mineral oil may mask the zinc corrosion so that it is not as apparent, but it is still happening. The more additives the coolant contains, the more likely it is that it starts reacting with the zinc coatings.

Are you experiencing corrosion in your machines?
We have noticed that zinc-coated parts are increasingly used by machine tool builders, replacing parts made of stainless steel. If you are experiencing corrosion in your machines, please contact your machine tool builder to check whether your machine contains any zinc-coated parts.

You can also contact your Blaser Swisslube representative in case of questions or concerns. However, we do not know of any chemical solution that prevents the corrosion of zinc coatings in machines operated with water-miscible coolants, as it is a desired process to prevent the steel parts from corroding.

Our recommendation to machine tool builders is to avoid zinc coatings altogether on parts that are in contact with water-miscible metalworking fluids.