



CORROSION INTERCEPT



By Appointment
to Her Majesty Queen Elizabeth II
Suppliers of Conservation Storage,
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Technical Bulletin 11 Corrosion Intercept Corrosion of Copper

Copper is a Non-Ferrous metal (non-iron based), therefore it corrodes or tarnishes by reaction with corrosive gases. The most reactive corrosive gases are Chlorine or Sulfur based (COS, HCl, SO₂, and H₂S). These gases are formed from decaying vegetation, burning fossil fuels, from manufacturing processes, ocean surfaces, swamp lands, and from other natural sources (geysers, hot springs, volcanoes, etc.). These gases are extremely reactive, so they quickly react with exposed metal surfaces. When these gases contact a Copper surface the metal undergoes a rapid chemical reaction and changes from pure Copper to a Copper salt. Silver or Copper sulfides and chlorides are black, which is why tarnish on Silver or Copper is typically black. You may ask why Copper outdoors turns green (old Copper roofs or the Statue of Liberty). Copper exposed to weather undergoes a very slow chemical process. Most of the Copper sulfides and chlorides easily wash off in the rain, however what forms on the surface is actually crystallized Copper salts. The green color, or patina, only forms after years of gas exposure and weather.

In either indoor or outdoor applications the corrosive gases react quickly with the outer surface of the metal, however the reaction does not stop with the surface; the corrosion keeps going deeper and deeper into the base metal. In the case of Aluminum, the oxide layer that forms rapidly on the surface protects the Aluminum from any further corrosion. Unfortunately, Silver and Copper do not form that impervious outer layer and the corrosion, or transformation from pure Copper to Copper salts (Copper salts are insulative and substantially weaker than the pure metal), continues to go deeper into the metal. So to protect metal the corrosive gases need to be kept away from the surface. That is where **Static and Corrosion Intercept** come in.

Static Intercept uses a chemically altered, highly reactive form of Copper as the main way that it prevents corrosion. The Copper is reacted into the polymer structure and essentially fills in all of the holes or gaps in the plastic. What is produced is a plastic film that has a tortuous path that the gases must go through before they can contact the surface of the material being protected. This tortuous path makes it statistically improbable that any corrosive gas can migrate through the film before it comes in contact with the Copper in the film at which point the gas is quickly reacted with and permanently neutralized. Bell Labs has designed a product that can protect Non-Ferrous metals for at least 10 years per mil of Intercept (under normal corrosive gas levels).

Static Intercept has been put through both accelerated and real time aging tests. The accelerated tests, performed by Dupont and Lucent Technologies Bell Labs, show effective corrosion protection in excess of the 10 years per mil that we discuss. The real time testing is even more interesting. Almost 8 years ago several sets of Beryllium Copper (the form of Copper most often used in electronics, and also a form of Copper that is extremely susceptible to corrosion) bus bars were attached together using steel screws and Bronze washers and stored inside Static Intercept bags. When we recently reviewed the bags many were torn, due to numerous moves and mishandling by lab workers, yet when they were opened the parts were pristine, even though there should have been some serious galvanic corrosion (the corrosion that occurs whenever two dissimilar metals are joined). Intercept is the only product on the market that protects against Ferrous and Non-Ferrous corrosion as well as preventing galvanic corrosion.

Attached please find a technical paper that talks about the way that Static Intercept protects metals from corrosion. Intercept is particularly adapted to protecting metals from reactions with acids, as most of the corrosive gases are as well as the chemicals found in car batteries. However, the protection that Intercept offers is not restricted to just preventing reactions with acids, Intercept also works against basic materials (such as Ammonia and Nitrous groups) as well as Ozone.

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TELEPHONE
+44 (0)1234 853 555

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+44 (0)1234 852 334

E-MAIL
info@conservation-by-design.co.uk

WEB SITE
http://
www.conservation-by-design.co.uk

CONSERVATION BY DESIGN
TIMECARE WORKS
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