Electro-tin plating

Technical information

Tin plating – or electro-tinning as the process is also called – is a surface treatment process, which produces a metallic coating of tin on the surface of metal components. The coating is produced in an aqueous solution (electrolyte) consisting of tin salts, as tin ions that are reduced to a metallic tin coating on the surface of the components by means of an external power source.

The tin plating process is carried out on both large objects suspended from a rack (rack plating) and on small objects which are processed in barrel installations (barrel plating).

The information below covers the characteristics and application of the tin coating, and guides you through the ordering process of tin plating at Midtjydsk Fornikling A/S.

Application of tin plating

Tin plating is mostly used for functional applications, but for some applications the appearance of the surface is also important, and tin coatings have good resistance to oxidation in moderately corrosive environments. Tin coating is applied for surface treatment of equipment and machines used in the food industry. The main application of the tin coating is, however, used for surfaces on which soldering is necessary as well as electric contacts and outlets.
The soft character and corrosion durability of the tin coating result in low and stable contact resistance – as opposed to e.g. copper and brass surfaces where the contact resistance with time increases due to the formation of a thin layer of corrosion products.

Tin coatings, which are deposited directly on zinc rich copper-alloys such as e.g. brass, have poor solderability because the tin coating diffuses into the zinc rich areas of the brass. This also decreases the resistance of the coating to oxidation. This diffusion of the tin coating can be avoided by applying a nickel plating barrier layer before the tin plating.

Tin coatings can under certain circumstances spontaneously form long, thin (1-3 µm) threads of tin – the so-called *whiskers* – which can create difficulties with current-division or short-circuiting in electronics. An under coat of nickel applied before the tin coating counteracts the formation of *whiskers*.

Application data for tin (Sn)

Melting point: 232° C
Boiling point: 2600° C
Molar weight: 118,7 g/molar
Volume weight: 7,3 g/cm^3
Max application temperature for tin: 100° C

Specification of tin coatings

The application of tin plating at Midtjydsk Fornikling is carried out in accordance with the standards ISO 2093 (1986), or DIN 50965 (1982). The standards are for substantial parts identical.

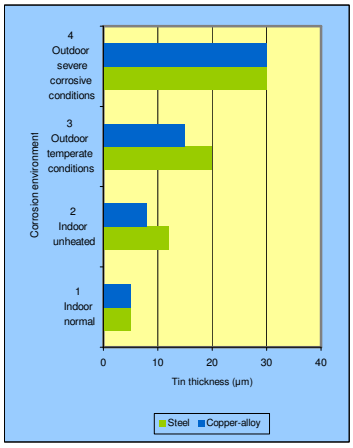

***Figure 1**: Recommended tin layer thickness on steel and copper-alloy according to the different environmental classes stated in ISO 2093. DIN 50965 deviate slightly from the ISO 2093 standard because this standard state 4 µm as the tin layer thickness for copper and steel in environmental class 1.*

The standards make suggestions for tin layer thickness on copper, copper-alloy and/or steel components depending on the use environment which can be seen in figure 1.

By way of example the specification of 8 µm tin plating on brass with a 5 µm under coating of nickel is; ISO 2093 – Cu/Ni 5 Sn 8.

The specification of a tin coating on steel in environmental class 1 is; ISO 2093 – Fe/Sn 5.

The requirements on coating thickness must be complied with in respect of the significant surfaces of the components. These surfaces are as covered by DIN 50965 - unless agreed otherwise – the areas of the components that can come into contact with a 20 mm ball.

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According to ISO 2093 the significant surfaces are those areas that are essential for the use and/or appearance of the components which has to be specified when placing an order at Midtjydsk Fornikling.

The requirement on layer thickness only apply to the outer surfaces of the components and not inner surfaces such as voids and pipes a.o. because these areas are electrically shielded during electrolysis and, therefore, do not get coated.

Furthermore, when ordering tin plating at Midtjydsk Fornikling a specification of the basic metal of the components must be provided in order to determine the required pre-treatment.

Corrosion behaviour of tin coatings

Metallic tin can at temperatures below 13° C turn into a grey, powdery tin – so-called tin pest. The risk of tin pest increases at application temperatures below 0° C. The change, however, normally does not occur to a visible extent.

Tin is normally a base metal compared to copper, copper-alloy and nickel and, therefore, is capable of protecting these metals where minor damages and perforations occur in the tin coating. The principal is known as cathodic protection.

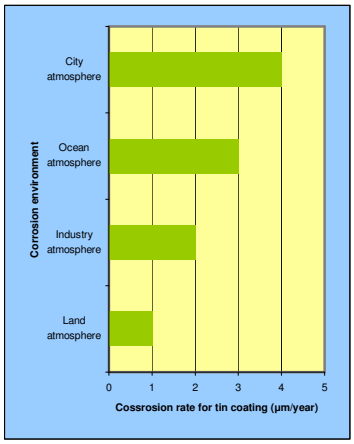

***Figure 2**: Guiding corrosion rate for tin coatings exposed to atmospheric conditions*

The tin coating is more noble metal than steel under atmospheric conditions. Damage and voids that penetrate the tin coating will, therefore, result in galvanic corrosion and form rust on the steel surface where it is exposed to the environment. High tin thickness or undercoats of nickel reduce the amount of porosity to base metal of the coating. However, under highly corrosive conditions and/or requirements of long service life it is recommended that the components are manufactured in a corrosion-resistant material. The extent of porosity of the tin coating on steel can be tested by means of salt fog exposure according to ISO 9227 or DIN 50021 – SS.

In an alkaline environment and when in contact with certain fruit-acids the tin plating is a basic (anodic) compared to steel and can, therefore, protect against corrosion in voids and damaged areas.

We offer

Rack plating:
1 rack plating lines, max length of components:
1200 x 500 x 300 mm

Barrel plating:
1 barrel plating line

Receive a no-obligation consultant visit or call us for more information.

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