



Datasheet – tinplating

Tinplating is a surface treatment process where metal items are given a coating of tin. The technique is mostly used with a functional purpose but also when appearance matters since the tin coating tolerates tarnishing well in corrosive environments.

Tin plating is used mainly for surfaces to be soldered and for electrical outlets and plugs as well as devices and machinery in the food industry. The soft and anti-corrosive properties of the tin coating provide a low and stable contact resistance, contrary to for example copper and brass coatings whose contact resistance will gradually increase and destabilize due to the formation of corrosive agents.

Tin coatings precipitated directly onto tin-containing brass alloys, such as brass, are characterized by poor soldering properties because diffusion causes the zinc to penetrate the tin coating. Furthermore, the zinc content of the tin coating may reduce its tolerance to tarnishing. Diffusion of zinc into the tin coating can be avoided by nickel-plating the item before tinplating it.

Under certain conditions, tin coatings may grow spontaneous long, thin (1-3 μm) tin threads, the so-called *whiskers*, which might cause leakage currents or short-circuits in electronics. A base layer of nickel before nickel-plating will prevent the formation of whiskers.

Specification

MFF specifies tinplating in accordance with the *ISO 2093* standard. This standard concerns base metals such as iron/steel, copper and brass. The standard also details a number of possible coating thicknesses depending on the local environment, categorized as class 1-4. These classes are used to specify the degree of corrosion protection required.

1. Mild – Indoors, in dry air or applications where soldering is the predominant requirement
2. Moderate – Indoors where condensation might occur
3. Difficult – Outdoors, typically in temperate environments
4. Very difficult – Outdoors, in highly corrosive environments or when in contact with food and beverages

As an example, the specification of the tinplating of a steel item characterized by condition no. 2 and a minimum layer thickness of 12 μm shiny tin:

ISO 2093 - Fe/Sn 12 b

Another example could be tinplating of a brass item characterized by condition no. 3, a base layer of 4 μm nickel and a minimum layer thickness of 15 μm dull tin:

ISO 2093 - Cu/Ni 4 Sn 15 m

The below table lists several examples of coatings and coating thickness according to the condition numbers. X denotes minimum layer thickness of the nickel base layer. This is often between 2 and 10 μm . Tin coatings can also be only 1-2 μm if requested by the customer.

Table 1 – List of coating types offered by MFF

Class no.	Specification	Designation
ISO standard ISO 2093:1986 (E)		
1	Fe/Sn 5 b/m	5 µm shiny/dull tin on iron/steel
	Cu/Sn 5 b/m	5 µm shiny/dull tin on copper/brass
	Fe/Ni X Sn 5 b/m	X µm nickel + 5 µm shiny/dull tin on iron/steel
	Cu/Ni X Sn 5 b/m	X µm nickel + 5 µm shiny/dull tin on copper/brass
2	Fe/Sn 12 b/m	12 µm shiny/dull tin on iron/steel
	Cu/Sn 8 b/m	8 µm shiny/dull tin on copper/brass
	Fe/Ni X Sn 12 b/m	X µm nickel + 12 µm shiny/dull tin on iron/steel
	Cu/Ni X Sn 8 b/m	X µm nickel + 8 µm shiny/dull tin on copper/brass
3	Fe/Sn 20 b/m	20 µm shiny/dull tin on iron/steel
	Cu/Sn 15 b/m	15 µm shiny/dull tin on copper/brass
	Fe/Ni X Sn 20 b/m	X µm nickel + 20 µm shiny/dull tin on iron/steel
	Cu/Ni X Sn 15 b/m	X µm nickel + 15 µm shiny/dull tin on copper/brass
4	Fe/Sn 30 b/m	30 µm shiny/dull tin on iron/steel
	Cu/Sn 30 b/m	30 µm shiny/dull tin on copper/brass
	Fe/Ni X Sn 30 b/m	X µm nickel + 30 µm shiny/dull tin on iron/steel
	Cu/Ni X Sn 30 b/m	X µm nickel + 30 µm shiny/dull tin on copper/brass

* Please refer to the standard for a more detailed description.

Corrosion protection

Tin provides cathodic protection to protect copper, copper alloys, including brass, and nickel. Consequently, tin is capable of protecting such metal surfaces despite minor defects and pores penetrating the tin coating. Tin, however, offers less protection of iron/steel. As a result of this, defects and pores that penetrate the tin coating will result in galvanic corrosion and form rusty patches on the steel surface when this is exposed to humidity.

A thick layer of tin or a base layer of nickel will reduce the number of penetrating pores in the coating; however, for items to be used in highly corrosive environments and where long life is required the items should preferably be manufactured in a corrosion-proof material.

At temperatures below 13°C, metallic tin can be transformed to powdery, grey tin, so-called tin pest. The risk of this occurring is more eminent in applications below 0°C, although the transformation will normally not be visible.

The required layer thickness or the required protection against rust formation due to corrosion must be observed at the significant surface of the item. If not otherwise agreed, this is made up by the part of the item which can be touched by a 20mm ball. This requirement concerns only the exposed surface of the items. This means that the requirement does not apply to internal surfaces in piping or internal cavities which are electrically shielded during plating and hence not plated with tin.

For further information, please contact our technical department.

Table 2- Tin properties and tin coating properties

Typical composition	100% Sn
Typical layer thickness	5 – 30 µm
Mol weight	118.7 g/mol
Density, white tin	7.3 g/cm ³
Fusing point	232°C
Boiling point	2602°C
Max. operating temperature	100°C

MFF offers to provide items in the sizes listed in Table 3 with electroplating.

Table 3 - Maximum dimensions

	Facility no.	Max. item size	Max. weight
Hanging	57	1200 x 500 x 300 mm	Varying
Drum	57	Varying	Varying

To arrange a non-binding visit by consultants please contact Midtjysk Fornikling or call us for further information.