

Datasheet – chrome-plating and nickel-plating



Chrome-plating – also known as decorative chrome-plating – is a surface treatment process where metal items are given a metallic coating of nickel and chrome. The nickel coating is applied first and makes up most of the layer. As the next step, chrome is deposited in a 0.3 μm thin layer which covers the surface of the nickel coating thereby achieving a light, metallic, shiny and decorative surface.

Midtjydske Fornikling (MFF) uses trivalent chrome baths, which ensures a process that is better for the ambient environment and the working environment than the conventional hexavalent procedure.

Satin chrome coating

An alternative to the well-known chrome-plating technique, which provides a bright and glossy surface, is satin chrome-plating. The properties and durability of such surfaces are equivalent to that of chrome-plating.

Nickel-plating is applied as the only coating and as the coating under chrome-plating. Generally, nickel-plating is a functional coating resulting in slightly yellowish surfaces compared with chrome-plated surfaces. Nickel-plated surfaces are characterized by low tolerance towards the effects of air pollution, salts, finger prints and other forms of impact. As a result of this, the surface acquires a dull appearance within a relative short time and, depending on the type of pollution, often with dark staining. This can be avoided by using chrome-plating since the chrome coating provides a very corrosion resistant surface which stays shiny and decorative for a long time, even under very corrosive conditions.

MFF recommends to order a reference test prior to the application of these coatings since the visual appearance might differ between coating suppliers.

Specification

MFF specifies nickel-plating and chrome-plating in accordance with the *DS/EN ISO 1456* standard. This standard concerns base metals such as iron/steel, copper and brass. The standard also details a number of possible coating combinations depending on the local environment, categorized as class 1-5. These classes are used to specify the degree of corrosion protection required.

1. Mild – Indoors in a warm, dry atmosphere (office furniture)
2. Moderate – Indoors where condensation might occur (bathroom/kitchen components)
3. Severe – Outdoors where rain and dew is likely to occur (bicycles/hospital equipment)
4. Very severe – Outdoors in very wet conditions (cars/boat components)
5. Exceptionally severe – Constant long-term exposure (>10 years) to a wet environment (car components)

As an example, the standard chrome-plating on a steel item is specified as class 2, (b) minimum layer thickness 20 μm nickel and (r) minimum layer thickness 0.3 μm chrome as follows:

DS/EN ISO 1456 - Fe/Ni20b/Crr.

There are several different types of nickel and chrome coatings. The most widely used nickel coating is (b) which provides a decorative shiny surface. The most widely used chrome coating is (r) which is characterized by a minimum layer thickness of 0.3 μm .

Table 1 lists several examples of coatings and coating thickness according to classes. Table 1 also lists the ISO minimum requirements to protection against the formation of rust in a salt spray test.

Table 1 – List of coating types offered by MFF

Class no.	Specification	Designation	Minimum test hours
			Rust formation
<i>ISO standard DS/EN ISO 1456:2009(E)</i>			
1	Fe/Ni10b	10 μm nickel on iron/steel	8
	Fe/Ni10b/Crr	10 μm nickel + 0.3 μm chrome on iron/steel	
	Cu/Ni8b	8 μm nickel on copper/brass	
	Cu/Ni8b/Crr	8 μm nickel + 0.3 μm chrome on copper/brass	
2	Fe/Ni20b	20 μm nickel on iron/steel	48
	Fe/Ni20b/Crr	20 μm nickel + 0.3 μm chrome on iron/steel	
	Cu/Ni15b	15 μm nickel on copper/brass	
	Cu/Ni12b/Crr	12 μm nickel + 0.3 μm chrome on copper/brass	
3	Fe/Ni35b	35 μm nickel on iron/steel	96
	Fe/Ni35b/Crr	35 μm nickel + 0.3 μm chrome on iron/steel	
	Cu/Ni25b	25 μm nickel on copper/brass	
	Cu/Ni20b/Crr	20 μm nickel + 0.3 μm chrome on copper/brass	
4	Fe/Ni40b/Crr	40 μm nickel + 0.3 μm chrome on iron/steel	8
	Cu/Ni30b/Crr	30 μm nickel + 0.3 μm chrome on copper/brass	

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

Corrosion protection

Due to recurrent impact from water and humidity, nickel and chrome coatings will gradually change appearance. With time, the base metal will be exposed to galvanic corrosion and rusty patches will form around pores and cracks penetrating the coatings. The thickest nickel coatings and delicately machined surfaces will result in the least number of pores. However, in practice it is impossible to produce a chrome-plated surface completely without pores. Frequent cleaning and perhaps also application of wax will add to the durability; although under strongly corrosive conditions, the items should preferably be manufactured in an anti-corrosive material, such as brass, if very long life is a requirement.

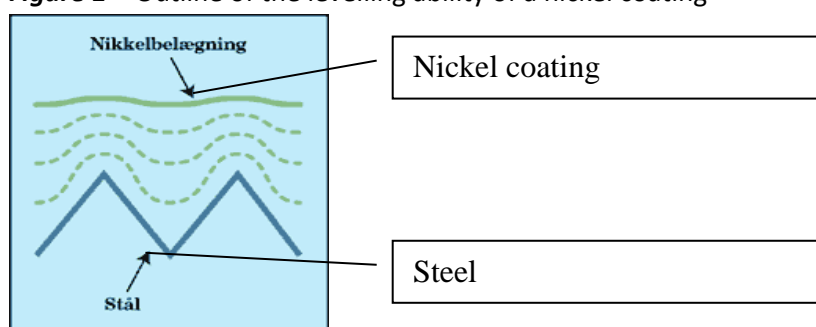
The required layer thickness or the required protection against rust formation in corrosion testing must be observed at the significant surface of the item. If not otherwise agreed, this is made up by the part of the item which can be touched by a 20mm ball. This requirement concerns only the exposed 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 nickel or chrome.

Generally, MFF's trivalent chrome spreads better – meaning its ability to form coatings in internal corners, cavities etc. where the flow density is low – compared with the hexavalent chrome. And yet items to be chrome-plated should, however, be given a design where surfaces of relevance to the appearance are not covered and without electric shielding. If this is not the case, yellowish or dull patches might be generated where the chrome-plating is unable to cover the nickel layer.

Conversely, nickel is characterized by a certain levelling ability, which is the ability to even out minor rough patches left in the surface by the grinding or machining procedures used to form a very smooth surface on the item, as shown in Figure 1.

The best results are achieved for items with a surface roughness corresponding to fine grinding or better.

Figure 1 – Outline of the levelling ability of a nickel coating



In a chrome-plating procedure, the nickel coating serves to remove the surface roughness of the items, leaving a smooth surface. When subjected to wet conditions, the nickel coating must also provide a seal to protect the underlying base metal against corrosion.

MFF performs the salt spray test in accordance with *DS/EN ISO 9227* and tests the various coatings on a regular basis. For items coated by MFF, the lifetime is typically considerably longer than required by the standard.

For further information, please contact our technical department.

Table 2 – The properties of nickel and chrome coatings

Nickel – Ni	
Typical composition	100% Ni
Typical layer thickness	5 – 40 µm
Mol weight	58.7 g/mol
Density	7.8 – 8.9 g/cm ³
Fusing point	1455°C
Max. operating temperature	400°C
Chrome – Cr	
Typical composition	100% Cr
Typical layer thickness	0.3 – 0.5 µm
Mol weight	52.0 g/mol
Density	6.3 – 7.2 g/cm ³
Fusing point	1907°C
Max. operating temperature	450°C

MFF offers to provide items in the sizes listed in Table 3 with nickel and chrome coatings.

Table 3 – Maximum dimensions

	Facility no.	Max. item size	Max. weight
Hanging	46	3000 x 1450 x 600 mm	750 kg
	46	400 dm ² per rod	750 kg
Drum	57	Varying	Varying

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