

## 1. Purpose

This specification establishes the standards for chemical- and electro-plated coatings used as corrosion protection on parts.

This specification is not valid for fasteners - in this case, the standard DIN EN ISO 4042 is valid.

## 2. Terms used in this specification

### 2.1 Chemical plating

With this process, a metallic coating is obtained on a metallic part from an aqueous solution of metallic salt. The coating is deposited without the use of an external electrical current. At Bühler Alzenau, a Nickel-Phosphorus alloy (9÷12% P) is specified as coating material for chemical plating.

### 2.2 Electroplating

With this process, a metallic coating is obtained on a part (of electrically conductive material or with a conductive coating) from an electrolyte. The coating is deposited with the use of an external electrical current.

At Bühler Alzenau chrome is specified as coating material for electroplating.

## 3. Notations

The structure of the notations used in this specification is described in the standard DIN EN 1403.

For the chemical nickel-plating process, the standard DIN EN ISO 4527 is valid. For electroplating of chrome the standard DIN EN ISO 1456 applies.

Examples of Notations:

### Chemical Nickel-Plating:

Plating of a part made of steel (Fe) with 8µm of Nickel-Phosphorus alloy (11%P) is specified according to DIN EN ISO 4527 by the term:

*Plating DIN EN ISO 4527 - Fe/Ni P (11) 8.*

### Electro-plated Chrome:

Plating of a part made of steel (Fe) with 8 µm of chrome (Cr8) is specified according to DIN EN ISO 1456 by the term:

*Plating DIN EN ISO 1456 - Fe/Cr 8.*

## 4. Differences in the two processes

### 4.1 Chemical Nickel-Plating

All surfaces of the metallic part that are immersed in the metallic solution will be plated. If the inner surfaces of the part have to be plated, it is imperative to ensure by adequate design that a proper circulation of the solution is possible.

<b>Standardisation</b>	Edited: Roese	Edition				
	Checked: Meßenzehl	Okt. 13			120020E.doc	

Areas of the part, which are not to be plated, shall be covered during the process and all boreholes shall be closed.

This process is particularly used for flat parts with complex structures and where the introduction of an anode would be rather complicated.

#### 4.2 Electro-plating of Chrome

The current flows from the anode (which is immersed in the electrolytic bath) to the surface of the part to be coated. The latter being the cathode. Only surfaces of the part exposed to a sufficient current density will be plated. Plating of inner surfaces of the part is difficult to achieve with this process.

The process is particularly used for smooth and cylindrical parts, as the design of an anode for achieving proper current distribution is relatively easy for such kind of parts. It is in certain cases not necessary to cover surfaces that are not to be plated.

### 5. Characteristics of the part

Parts to be coated shall not have any material, manufacturing or surface defects.

#### Chemical Nickel-plating:

Any inherent cracks in the part will adversely affect its final outward finish if these cracks are wettable.

The corrosion protection is fully maintained if the cracks are wettable.

If the crack is not wettable, corrosion protection can deteriorate as during the plating process, the solution used, will not enter the crack and therefore not form a protective layer.

#### Electro-plating of Chrome:

Any inherent cracks in the part will adversely affect its final outward finish and in addition corrosion protection will deteriorate as the walls of cracks will not be coated (electrical current will not flow to the inner walls of a crack but to the surface).

### 6. Coating

#### 6.1 Quality of the Surface Coating

#### Chemical nickel-plating:

Cracks in the surface of the coated layer will not reach down to the surface of the part to be coated. This is due to the laminar structure of the plating.

Any abrupt change of the part geometry, e.g. sharp edges, could however increase the probability of crack formation.

#### Electroplating of Chrome:

A crack in the surface of the coated layer normally will reach right down to the part surface if the coating thickness is  $< 80\mu\text{m}$ .

Standardisation	Edited: Roese	Edition				
	Checked: Meßenzehl	Okt. 13			120020E.doc	

## 6.2 Thickness of the Surface Coating

### 6.2.1 General

Indicated in the drawing is the nominal value of the thickness of the surface coating.

By the **chemical nickel-plating** process, an absolute tolerance of  $\pm 2\mu\text{m}$  is reached without special provisions. The coating is uniformly distributed over the contours of the part.

For **electroplating of chrome**, the surface coating thickness can differ from one point to the other. This is due to the fact that different electrical field-strengths exist at these points. The coating formation on the outer edges will normally be much more thicker than that on inner edges of the surface.

### 6.2.2 Design rules

A **corrosion protection** surface coating will be specified with a **nominal thickness of  $8\mu\text{m}$** . If the chemical nickel-plating process is used, threads that are  $< M5$  should be avoided in the design, if not they must be covered in order to protect them from being coated.

For the **protection against wear and tear** of the part, the surface coating thickness is determined, depending on the specific case of its use.

The surface roughness before coating must be  $R_z \leq 25 \mu\text{m}$ .

## 7. Entries in drawings (excerpts from DIN 50960-2)

All information regarding the plating process that should be used shall be given in the form of a symbol, which is defined in the standard DIN EN ISO 1302, together with additional data taken from the notation mentioned in chapter 3 of this specification - the word "plating" is omitted.

Example:



### 7.1 "Complete Coating"

This type of coating shall be indicated by the symbol shown above placed near to the header of the drawing.

### 7.2 "Partial Coating"

Those areas that are to be coated shall be marked by dash-and-dot lines (0.5 mm thickness). All boreholes, threaded-holes, grooves, etc. within this area are areas to be coated also. On all areas that are not marked by dash-and-dot lines, there shall be no coating.

The specification of the coating shall be written on the dash-and-dot line.

<b>Standardisation</b>	Edited: Roese	Edition				
	Checked: Meßenzehl	Okt. 13				120020E.doc

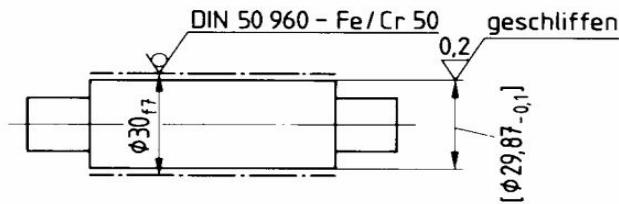
### 7.3 Pre-determined Coating Thickness

A coating to obtain a tolerated dimension must be specially specified in the drawing. The drawing must show the dimensions of the part before the plating process as well as the final dimensions of the part after the plating process. According to DIN 406 Part 10 the dimensions of the part before the coating process shall be shown in square brackets.

Example:

New: DIN EN ISO 1456-Fe/Cr50

geschliffen = grinded

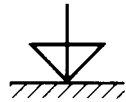


**Remark:** In this case, it is important to fix the dimensions of the parts before the plating process, so that after it has been coated with the pre-determined thickness of coating, the final dimensions will be met.

While fixing the dimensions of the parts before the plating process, it is imperative to keep in mind that there could be large differences in the coating thickness on the surface of the part depending on the geometric form of the part.

### 7.4 Measurement of the Coating Thickness

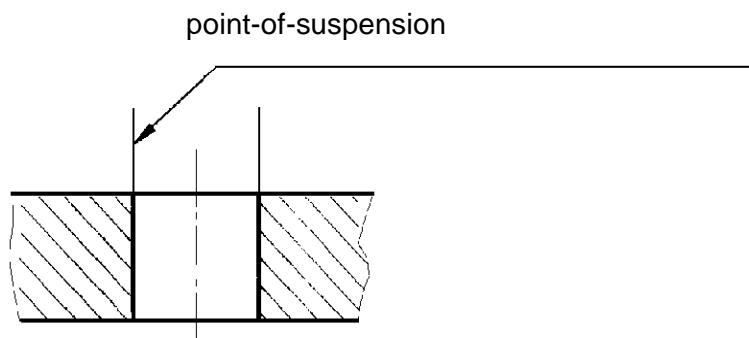
If the coating thickness has to be measured at certain points on the surface of the part, then these points shall be indicated in the drawing with the following symbol:



### 7.5 Suspension of the part in the bath

The point on the part, from where the part will be suspended or supported in the electrolyte bath during the galvanizing process, shall be shown in the drawing. It should be taken into consideration that at this location, the corrosion protection for the surface may be reduced.

The point of suspension or support of the part shall be shown as follows:



**Remark:** Boreholes and threaded-holes are especially suited for this purpose

Standardisation	Edited: Roese	Edition				
	Checked: Meßenzehl	Okt. 13				120020E.doc

### 8. Desorption Rates

	Chemical Nickel-Plating	Electroplating of Chrome
Steel plate	$3 \times 10^{-8} \text{ mbar} \times \text{l} \times \text{s}^{-1} \times \text{cm}^{-2}$	$4 \times 10^{-8} \text{ mbar} \times \text{l} \times \text{s}^{-1} \times \text{cm}^{-2}$
After pumping 1 hour; relative humidity 60%; 25°C		

### 9. Quoted Standards

DIN 406-10	ENGINEERING DRAWING PRACTICE - DIMENSIONING - CONCEPTS AND GENERAL PRINCIPLES
DIN 50960-2:	ELECTROPLATED COATINGS - PART 2: INDICATIONS ON TECHNICAL DRAWINGS
DIN EN ISO 1302	GEOMETRICAL PRODUCT SPECIFICATIONS (GPS) - INDICATION OF SURFACE TEXTURE IN TECHNICAL PRODUCT DOCUMENTATION
DIN EN ISO 1456	METALLIC AND OTHER INORGANIC COATINGS - ELECTRODEPOSITED COATINGS OF NICKEL, NICKEL PLUS CHROMIUM, COPPER PLUS NICKEL AND OF COPPER PLUS NICKEL PLUS CHROMIUM
DIN EN ISO 2064:	METALLIC AND OTHER NON-ORGANIC COATINGS - DEFINITIONS AND CONVENTIONS CONCERNING THE MEASUREMENT OF THICKNESS
DIN EN ISO 3882:	METALLIC AND OTHER INORGANIC COATINGS - REVIEW OF METHODS OF MEASUREMENT OF THICKNESS
DIN EN ISO 4042:	FASTENERS - ELECTROPLATED COATINGS
DIN EN ISO 4287:	SURFACE ROUGHNESS; TERMINOLOGY; SURFACE & ITS PARAMETERS
DIN EN ISO 4527:	METALLIC COATINGS - AUTOCATALYTIC (ELECTROLESS) NICKEL-PHOSPHORUS ALLOY COATINGS - SPECIFICATIONS AND TEST METHODS
DIN EN ISO 27830:	METALLIC AND OTHER INORGANIC COATINGS - GUIDELINES FOR SPECIFYING METALLIC AND INORGANIC COATINGS (ISO 27830:2008)

<b>Standardisation</b>	Edited: Roese	Edition				
	Checked: Meßenzehl	Okt. 13				120020E.doc