1 Scope

The specification refers to the corrosion protection on parts of ferrous materials that are exposed to the outdoor atmosphere (direct outdoor weathering). All coatings must be free from Hexavalent Chromium.

With regard to the requirements there are the following types:

**JED-256-0** for parts exposed to moderate corrosive conditions. Coatings of zinc (Zn) with passivation are allowed. In addition the use of the coatings listed under JED-256-1, -4 and -5 is allowed. Because of the level of corrosion protection this type must not be used for external parts in new designs.

**JED-256-1** for parts exposed to very severe corrosive conditions. Coatings of zinc (Zn) or zinc-iron (Zn/Fe) coatings with subsequent black or colour-less thick-layer passivation are allowed. An additional sealing is allowed if the function of the parts is not negatively influenced.

**JED-256-2** for silver colour of the coating. Only zinc (Zn) coatings with colour-less thick-layer passivation are allowed. The requirements on corrosion protection according to JED-256-0 are valid. Because of the level of corrosion protection this type must not be used for external parts in new designs.

**JED-256-3** for black colour of the coating. Only zinc-iron (Zn/Fe) coatings with black thick-layer passivation are allowed. An additional sealing is allowed if the function of the parts is not negatively influenced. The requirements on corrosion protection according to JED-256-1 are valid.

**JED-256-4** for parts exposed to very severe corrosive and thermal conditions. Coatings of zinc (Zn) or zinc-iron (Zn/Fe) with subsequent black or colour-less thick-layer passivation are allowed. An additional sealing is mandatory.

**JED-256-5** for parts exposed to severe corrosive conditions. Coatings of zinc (Zn) or zinc-iron (Zn/Fe) with subsequent black or colour-less thick-layer passivation are allowed. An additional sealing is allowed if the function of the parts is not negatively influenced.

**JED-256-6** for parts exposed to severe corrosive conditions with silver colour of the coating. Only zinc (Zn) coatings with colour-less thick-layer passivation are allowed. An additional...
sealing is allowed if the function of the parts is not negatively influenced. The requirements on corrosion protection according to JED-256-5 are valid.

**JED-256-7** for **parts exposed to severe corrosive conditions** with **electrical conductivity of the surface** of the coating. Coatings of zinc (Zn) or zinc-iron (Zn/Fe) with black or colour-less thick-layer passivation are allowed. An additional **sealing is not allowed**. The requirements on corrosion protection according to JED-256-5 are valid. This type has to be used if electrical contact has to be assured.

If JED-256 is indicated on the drawing, JED-256-0 shall be applied.

**The supplier is obliged to use zinc-iron (Zn/Fe) coating if he is not capable to reach the proper corrosion resistance with zinc (Zn).**

**Remark:** Zinc (JED-256-2, -4 or -5) has to be preferred as a galvanic coating for iron castings. The safe application process of other galvanic coatings on iron castings requires high technical expenditure.

Thermal range of application of the surface protected parts:

<table>
<thead>
<tr>
<th>JED-256-0 to -3, -5, -6 and -7:</th>
<th>-60 °C to +80 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>JED-256-4:</td>
<td>-60 °C to +120 °C</td>
</tr>
</tbody>
</table>

Normative reference:

- ISO 2081   Metallic coatings – Electroplated coatings of zinc on iron or steel
- ISO 4042   Threaded components – Electroplated coatings

## 2 Requirements

### 2.1 Requirements on the substrate

The parts to be protected shall be free from surface, treatment, or other defects adversely affecting the corrosion protection or the adhesion of the coating to the substrate. These are for instance slag inclusions, laps, score marks with a depth of more than 0,2 mm, pore clusters, sink marks, weld marks, whirls and bubbles.

Parts with cracks or with material separations transversal to the force shall not be used.

### 2.2 Requirements on the coating

The **significant surfaces** of the parts shall have a dense and homogeneous coating. Significant surfaces are areas of the surface for which the specified coating is essential for serviceability and appearance, and that can be touched by a ball 20 mm in diameter.

Zn/Fe coatings are **alloyed coatings** on the basis of zinc containing 0,4 to 1,0 % iron.

**Organic and inorganic coatings** consist of organic and inorganic binders which usually contain zinc or zinc and aluminium particles. These coatings are baked at temperatures specific to type. The baking temperature has to be such that the strength of the parts is not reduced.

The coatings shall not have any defects affecting corrosion protection, as for instance pores, cracks, roughness, stains or damages. The coatings shall firmly adhere to the substrate and shall not spall in case of slight deformation.
The process conditions shall be chosen so as to not affect the usability of the finished part. Parts with an electroplated coating and a strength of more than 1000 N/mm² (Corresponding hardness: 30 HRC, 295 HV, 280 HB) shall be heat treated prior to chromating to avoid hydrogen embrittlement.

The parts surface protection included shall be within the tolerances provided on the standard sheets or drawings, with special consideration given to the thread dimensions.

The coating thicknesses specified on the following pages apply to the significant surfaces defined above.

**Measuring areas for the coating thickness on screws and nuts**

The significant surface on screws is the approximate center of the head surface or the approximate center of the end provided that the coating thickness in these areas approximates that in the first turn of the thread for screws with a length exceeding 5\(d\) (figures 1 to 5).

If necessary, special agreements shall be reached concerning the measuring areas for screws the length of which exceeds 5\(d\), and for special parts.

In case of screws with internal drive the coating thickness is measured in the center of the remaining head surface or in the approximate center of the end (figures 2 to 5).

The coating thickness on nuts is measured in the center of a wrench surface (figure 6).

**Examples of measuring areas:**

![Measuring areas](image)

**Note**

There are no requirements for the thickness of the protective coating for areas which cannot be measured by means of a ball 20 mm in diameter because a controllable coating cannot be achieved under normal conditions.

### 2.3 Coefficients of friction of threaded parts

On threaded parts to be used with preformed threads in the counterpart, plating shall be carried out in such a way that total coefficients of friction from 0,12 to 0,18, if measured according to ISO 16047, are met. This does not apply to thread-forming screws (see JED-836 and 837). In cases where a different coefficient range is defined in the drawing, that has to be used. Uneven, rough or too thick coatings shall be avoided in the threaded area.

Coatings with a thickness of more than 8 µm usually peel when the screw is tightened. This leads to uncontrollable extreme coefficients of friction and to insufficient prestress within the screwed joint.

The coefficients of friction of screws and nuts shall be measured using screw testing equipment that permits uniform slow tightening and release of the screwed connection.
2.4 Requirements for the protection against corrosion

2.4.1 Test of passivation coating inclusive sealing if applicable

<table>
<thead>
<tr>
<th>Corrosion protection requirements</th>
<th>Test method</th>
</tr>
</thead>
<tbody>
<tr>
<td>JED-256-0</td>
<td>( \geq 72 , \text{h} )</td>
</tr>
<tr>
<td>JED-256-1 and -4</td>
<td>( \geq 200 , \text{h} )</td>
</tr>
<tr>
<td>JED-256-5, -6 and -7</td>
<td>( \geq 96 , \text{h} ) for threaded parts and drum parts ( \geq 168 , \text{h} ) for unthreaded rack parts</td>
</tr>
<tr>
<td></td>
<td>no zinc corrosion</td>
</tr>
<tr>
<td></td>
<td>max. of 3 % zinc corrosion permitted if treated in drums</td>
</tr>
<tr>
<td>After 24 h heat storage in air at +120 °C:</td>
<td></td>
</tr>
<tr>
<td>JED-256-4</td>
<td>( \geq 200 , \text{h} )</td>
</tr>
<tr>
<td></td>
<td>max. of 3 % zinc corrosion permitted</td>
</tr>
</tbody>
</table>

2.4.2 Test of complete coating (inclusive testing time according to 2.4.1)

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Unthreaded rack parts</th>
<th>Threaded parts and drum parts</th>
<th>Test method</th>
</tr>
</thead>
<tbody>
<tr>
<td>JED-256-0</td>
<td>( \geq 192 , \text{h} ) (120)</td>
<td>( \geq 120 , \text{h} ) (72)</td>
<td>ISO 9227 NSS test</td>
</tr>
<tr>
<td>JED-256-1 and -4</td>
<td>( \geq 500 , \text{h} )</td>
<td>( \geq 400 , \text{h} )</td>
<td>ISO 9227 NSS test</td>
</tr>
<tr>
<td>JED-256-5, -6 and -7</td>
<td>( \geq 360 , \text{h} )</td>
<td>( \geq 240 , \text{h} )</td>
<td>ISO 9227 NSS test</td>
</tr>
</tbody>
</table>

no corrosion of the basis metal

For type JED-256-4 the requirements are valid as well after heat storage of 24 h in air at +120 °C.

(): exceptional requirements

Parts being subject to the exceptional requirements:

- shank and threaded area on screws with a thread pitch \( \leq 1 \)
- shank and threaded area on screws with a length exceeding 10 x d
- areas that were formed after surface treatment

2.5 Thickness of the coating

In general, the required resistance is achieved with the nominal thicknesses specified below:

<table>
<thead>
<tr>
<th>Parts, not subsequently sealed</th>
<th>Parts, subsequently sealed (only zinc and zinc alloys)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unthreaded parts</td>
<td>( \geq 11 , \text{µm} )</td>
</tr>
<tr>
<td>Threaded parts</td>
<td>( \geq 7 , \text{µm} )</td>
</tr>
<tr>
<td></td>
<td>( \geq 5 , \text{µm} )</td>
</tr>
</tbody>
</table>
2.6  Test for hexavalent chromium

Hexavalent Chromium must not be present in the coating. The test to prove that no hexavalent chromium is present has to be done according to EN 15205 “Determination of hexavalent chromium in corrosion protection layers”. If the concentration of hexavalent chromium is below 0.1 µg/cm² according to this test, the parts are regarded as being free from hexavalent chromium.

2.7  Resistance to media

Zinc and zinc alloy coatings according to this specification are not resistant to acids and strong alkaline materials, as for instance cleansing agents.

2.8  Test of brittle fracture tendency

The parts are subjected to a mechanical load approximating or exactly corresponding to the type of load intended. In this condition, the part is exposed to -40 °C for 24 hours. Fracture shall not occur.

2.9  Test of adhesion

The parts are stored 30 minutes at +220 °C ± 10 °C in air and immediately afterwards immersed in water with a temperature of +15 °C to +25 °C. No spalling or blistering of the coating may occur.

2.10 Colour of coating

A silver colour is defined for type JED-256-2 and -6 and a black colour is defined for JED-256-3. For types JED-256-4 and JED-256-5 the colour “silver” may in addition be defined in the drawing. A slight yellow, blue or green coloration is accepted for silver colour. There are no requirements for the gloss. All mentioned colours can have yellow, blue or green iridescence. Identical parts from one process must have a homogeneous appearance.

3  Guarantee

3.1  General

The manufacturer is obliged to prove by regular random test that the requirements specified in chapter 2 are observed, and to keep the inspection documents accessible to the customer.

3.2  Initial sample

Together with each initial delivery several initial samples and the initial sample inspection report shall be submitted for the inspection of dimensions and material.

3.3  Guarantee

The current supplies must conform to the released sample, to the requirements defined in this specification and to the drawings.

The Engineering Department and the Quality Assurance must be informed about any modifications. This applies also to planned modifications of the pretreatment and of the types of electrodes. In these cases, a new sampling and written release is required.