E.ON Energidistribution AB
Technical requirements for

Hot dip galvanizing of steel for overhead lines and substations

INNEHÅLLSFÖRTECKNING

1 General

1.1 Scope

These requirements cover the general demands of E.ON Energidistribution AB for hot dip galvanizing of steel for overhead lines and outdoor substations.

The steel referred to is:

1. Rolled steel section, e.g. L-section, sheet, round bar, I-section
2. Forged steel parts, e.g. socket tongue, shackle, rock eyebolt
3. Threaded steel parts

Cast iron parts and malleable iron castings are not included.

These requirements are a translation from the Swedish requirements D10-0015653. If the content of this document differs from the Swedish version, the Swedish requirements shall prevail.

1.2 Standards and regulations

The following standards for coating thickness, procedure and testing shall be met. If the information in these technical requirements varies from the standards, then the technical requirements take precedence.

SS-EN ISO 8501-3:2007	Behandling av stålytor före beläggning med färg eller liknande produkter Del3: Förbehandlingsgrader för svetsar, kanter och andra områden med defekter.
SS-EN ISO 1461:2009	Hot dip galvanized coatings on fabricated iron and steel articles- Specifications and test methods.
SS-EN ISO 14713-2:2020	Oorganiska ytbeläggningar - Zinkbeläggningar - Rekommendationer för korrionsskydd av järn och stål i konstruktioner - Del 2: Varmförzinkning
SS-EN ISO 10684:2004	Fasteners-Hot dip galvanized coatings
SS-EN ISO 2178:2016	Non magnetic coatings on magnetic substrates-Measurement of coating thickness-Magnetic method.
SS-EN ISO 1463:2004	Measurement of coating thickness-Microscopical method.

SS-EN 50341-2-18	Overhead electrical lines exceeding AC 45 kV
SS-EN 10021:2007	General technical delivery requirements for iron and steel products.
SS 20130	Sampling procedures and tables for inspection by attributes.

2 Changes compared to earlier version

Changes from the previous issue are marked with a vertical line in the right-hand margin.

3 Technical demands

3.1 General

All steel parts for overhead lines and outdoor substations shall be hot dip galvanized unless otherwise specified in the design drawings.

EN ISO 14713-2 shall be considered in the design and manufacture of parts to be galvanized.

3.2 Pretreatment

All steel to be galvanized or provided with another coating must in terms of welds, edges, steel defects, etc meet the pretreatment level P3 according to EN ISO 8501-3:2007.

3.3 Coating thickness

All steel which shall be hot dip galvanized, is given a zinc coating with thicknesses as shown below in table 1 and according to SS-EN 1461.

The stipulations for coating thickness are based on measurements obtained by magnetic method using a reluctance-type instrument in accordance with SS-ISO 2178. Pure zinc and non-magnetic iron zinc alloy are defined as protective coating. (It should be noted that this gives a greater thickness of zinc than when regard is paid only to zinc weight – about 10-20% with silicone killed steel).

Category	Type	Example	Thickness mm	Local coating thickness (minimum) µm	Average coating thickness (minimum) µm
Category Fe/Zn 215	Applies to parts of rolled steel section, for installation in soil or water.	Frame members and diagonals of L-section, ground rod of L-section, Tubular poles	>6	190	215
			≤6	115	140
Category Fe/Zn 115	Applies to parts of rolled steel section in air.	Crossarm of U-section, flat section, Tubular poles, support of VKR-section, rock eyebolts, blade dowels.	>6	100	115
			≤6	85	95
Category Fe/Zn 95	Applies mainly to forged parts in air.	Fittings for insulator strings.	>6	85	95
			≤6	70	85
Steel parts with external threads.	Applies to steel parts with external threads.*	U-bolt for crossarm, stirrup bolt, check screw, bolt for steel structures, footsteps.		55	45

Table 1. Coating thickness

*) For parts which are only threaded on a minor part, eg. eye staylinks and eye staylinks for rock eyebolts, then this zinc thickness applies only to the threaded portion.

3.4 Surface quality

Requirements shall be met in accordance with SS-EN ISO 1461:2009.

The zinc coating shall be of uniform thickness and adhere well to the steel surface. Hard zinc accumulations must not occur. There should be no roughness or zinc accumulations of such size that it could impair fitting and joining in holes and on contact surfaces.

After treatment it should be possible to screw threaded parts together by hand without any difficulty. There should be no blocking of holes for bolts. Lumps that can be removed by pressure from some hard object and leave spots with a considerably thinner coating should not occur,

nor should there be pores or salt inclusions that are visible to the naked eye. Dark grey spots (not rust coloured) can be tolerated.

Individual scratches on the zinc surface caused during the construction handling can be repaired by application of zinc-rich paint such as “galvanopasta”.

4 Procedure

To fulfill the given demands on the zinc coating silicon killed steel is as a rule required. For steel which shall be hot dip galvanized, a charge analysis report should be presented in accordance with SS-EN 10021. SIS-standardised silicon contents should be kept.

5 Testing and inspection

After galvanizing, the quality, adherence and thickness of the zinc coating should be checked in the manufacturer’s/galvanizer’s workshop in the presence of the customer. The inspection will be done at random on units of all sizes and qualities which are included in the delivery. The customer will choose these test samples at random from the whole batch in accordance with SS 20130.

Number of units for test shall be according to table 2 and 3.

Number of units supplied of the same design	Eg. at reduced check of the same design
Structural steel, sections, round bars, sheet:	Random test, number of units
< 15	2
16-25	3
26-90	5
91-150	8
151-280	13
281-500	20
501-1200	32
1201-3200	50

Table 2. number of units

Number of units supplied of the same design	Eg. at reduced check of the same design (Class 1)
Structural steel, sections, round bars, sheet:	Random test, number of units
< 25	2
26-150	3
151-1200	5
1201-35000	8
35001-	13

Table 3. number of units

The quality and adherence of the zinc coating is tested through ocular inspection and with a hammer. The coating should be sufficiently firm so that it can´t be scraped off with a fingernail after it has been hit with a small nail hammer until small but clear marks appear.

The thickness of the coating should be checked with an instrument, type Elcometer. On each unit the coating thickness is measured at 10 points spaced evenly over all the larger areas of the object. Measuring points must be at least 10 mm from the nearest edge, corner or angle. The measuring conditions in SS-ISO 2178 shall be followed. Calibration can be done with a plane, unplated steel standard of the same quality as the object to be measured.

For smaller steel parts, e.g. round bars, greater accuracy can be obtained by measuring by the microscope method in accordance with SS-ISO1463:2004. The zinc thickness can also be measured directly by using a micrometer on a small test area.

6 Delivery

6.1 Packaging

Unassembled smaller units should be well wrapped and packed. Unassembled sectional bars should be bundled, if possible with bars belonging to the same assembly being in the same bunch. If necessary an intermediate wooden spacer should be used between the bars and between the bundles to decrease the damage. The protective spacer should be used so that loading and unloading can be done with a fork-lift truck without causing any damage to the goods.

6.2 Marking of packaging

The packaging should be clearly marked according to the instructions from the customer.

6.3 Transportation

When loading and unloading, the goods should not be subjected to knocks or blows to such a degree or lifted in such a way that members are bent or that the zinc coating is damaged.

When stacking goods on a lorry or at the storage place, make sure that the members at the bottom are not bent through overloading. Between each layer there should be a row of wooden spacers, placed closely enough to each other to prevent the sections from bending.

The storage place should be plane and the goods stacked in such a way that they do not come into contact with ground, acidic wood or similar.

7 Information from customer

The design drawings should state steel quality and thickness in μm of the zinc coating.

8 Information from supplier

Chemical composition should be shown in the form of a charge analysis report in accordance with SS-EN 10021:2007.

The test report concerning coating thickness measurements should also show if there are any variations from these technical requirements.