

# INTERNATIONAL STANDARD

# ISO 3575

Second edition  
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## Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock-forming and drawing qualities

iTeh STANDARD PREVIEW

*(Tôles en acier au carbone galvanisées en continu par immersion à chaud,  
de qualité commerciale, pour pliage et agrafage et pour emboutissage)*

ISO 3575:1996

<https://standards.itih.ai/catalog/standards/sist/f0cdc0bf-8bfl-44fa-a9c6-0825094f5b43/iso-3575-1996>



Reference number  
ISO 3575:1996(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 3575 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

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This second edition cancels and replaces the first edition (ISO 3575:1976), of which it constitutes a technical revision.

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# Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock-forming and drawing qualities

## 1 Scope

**1.1** This International Standard applies to carbon steel sheet of commercial, lock-forming and drawing qualities coated by a continuous hot-dip zinc coating process. Zinc-coated sheet is suitable for applications where resistance to corrosion is of prime importance and is produced according to coating designations as shown in table 2. Under atmospheric conditions the protection afforded by the coating is directly proportional to the mass of coating per unit area. The mass of coating specified shall be compatible with the desired service life, thickness of the base metal and with the forming requirements involved. The coating is expressed as the total coating on both surfaces in grams per square metre. Various types of zinc coating (see 3.2) are available depending on the application.

**1.2** Commercial quality zinc-coated sheet (quality 01) is intended for general fabricating purposes where sheet is used in the flat, or for bending or moderate forming. It is produced in thicknesses from 0,25 mm to 5 mm inclusive after zinc coating, and in widths 600 mm and over in coils and cut lengths.

**1.3** Lock-forming quality zinc-coated sheet (quality 02) is intended for lock-seaming and other similar applications and has better formability than commercial quality. It is produced in thicknesses from 0,25 mm to 5 mm inclusive after zinc coating, and in widths 600 mm and over in coils and cut lengths. The coating designation shall not exceed 350.

**1.4** Drawing quality zinc-coated sheet (qualities 03, 04, 05 and 06) is intended for drawing or severe forming. It is produced in thicknesses from 0,4 mm to 5 mm inclusive after zinc coating, and in widths 600 mm and over in coils and cut lengths. It is fur-

nished to all the requirements of this International Standard, or, with agreement when ordered, to fabricate an identified part, in which case the mechanical properties of table 3 do not apply. The coating designation shall not exceed 275.

Drawing qualities are identified as follows:

- 03: Drawing quality
- 04: Deep drawing quality
- 05: Deep drawing quality special killed
- 06: Extra deep drawing quality stabilized

**1.5** Zinc-coated sheet less than 600 mm wide may be slit from wide sheet and will be considered as sheet.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1460:1992, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area.*

ISO 6892:1984, *Metallic materials — Tensile testing.*

ISO 7438:1985, *Metallic materials — Bend test.*

### 3 Definitions

For the purposes of this International Standard, the following definitions apply.

#### 3.1 General

**3.1.1 continuous hot-dip zinc-coated<sup>1)</sup> steel sheet:** A product obtained by hot-dip zinc coating cold-reduced sheet coils or hot-rolled descaled sheet coils on a continuous zinc-coating line to produce either zinc-coated coils or zinc-coated cut lengths. The zinc content of the bath metal shall be at least 98 %.

**3.1.2 breakage allowance:** Previously agreed upon level of acceptable die breakage not subject to claim.

#### 3.2 Types of zinc coating

**3.2.1 spangle coating:** A coating formed as a result of unrestricted growth of zinc crystals during normal solidification. This coating has a metallic lustre and is the type normally furnished for a wide variety of applications.

**3.2.2 minimized spangle coating:** A coating obtained by restricting normal spangle formation during the solidification of the zinc. This product may have some lack of uniformity in surface appearance within a coil or from coil to coil. It is normally furnished in coating designation 350, 275 and 200, in the six qualities listed in table 1 and in the range of thicknesses 0,5 mm to 3 mm inclusive. This finish is normally specified for cosmetic considerations.

**3.2.3 zinc-iron alloy coating:** A coating produced by processing the zinc-coated steel sheet so that the coating formed on the base metal is composed of zinc-iron alloys. This product is not spangled, is normally dull in appearance, and for some applications may be suitable for immediate painting without further treatment, except normal cleaning. Zinc-iron alloy coatings may powder during severe forming.

**3.2.4 differential coating:** A coating having a specified coating mass on one surface, and a significantly lighter coating mass on the other surface. The surface with the smaller coating mass may have a different appearance than the surface with the greater coating mass.

### 4 Designation

The designation shall consist of the following:

1) Sometimes referred to as galvanized.

- a) the letter Z to indicate a zinc coating, or the letters ZF to indicate a zinc-iron alloy coating;
- b) the coating designation given in table 2;
- c) one of the following letters to indicate surface coating condition;
  - N: normal coating (as produced),
  - S: normal coating (skin passed),
  - M: minimized spangle (as produced),
  - E: minimized spangle (skin passed),
- d) the base metal quality designation given in table 1.

Examples of the complete designation:

Z275N02 and ZF001S04

### 5 General information

#### 5.1 Skin pass

A light cold-rolling of the zinc-coated steel sheet. If the material is required skin passed, it shall be ordered with an "Extra Smooth" finish. The purposes of skin passing are one or more of the following:

- a) To produce a higher degree of surface smoothness for sheet supplied in coating designations 350, 275, 200, 180, 100 and 001, and to improve appearance or suitability for decorative painting.

The process may adversely affect the ductility of the base metal, particularly with qualities 01 and 02.

Zinc coating defined in 3.2 may be variable in appearance and not suitable for decorative painting.

- b) To minimize temporarily the occurrence of the condition known as stretcher strain (Lüder's lines) or fluting during fabrication of finished parts.

#### 5.2 Strain ageing

Zinc-coated steel sheet (except quality 05 and 06, extra smooth) tends to strain age, and this may lead to the following:

- a) surface markings from stretcher strain or fluting when the steel is formed;

b) deterioration in ductility.

Because of these factors, it is essential that the period between final processing at the mill and fabrication be kept to a minimum. Rotation of stock, by using the oldest material first, is important. Stocking of such steels for extended periods of time shall be avoided and for optimum performance shall not exceed four weeks.

For skin-passed sheet, reasonable freedom from stretcher strain can be achieved by effective roller levelling immediately prior to fabrication at the purchaser's plant. Freedom from stretcher strain for a period of six months can be achieved by the supply of skin-passed non-ageing steels. Quality 05 or 06 shall be specified in such cases where Lüder's lines are not acceptable and where roller levelling is not possible.

### 5.3 Mill passivation

A chemical treatment is normally applied to zinc coatings to minimize the hazard of wet storage stain (white rust) during shipment and storage. However, the inhibiting characteristics of the treatment are limited and if a shipment is received wet, the material shall be used immediately or dried. This treatment is not usually applied to zinc-iron alloyed coatings because it interferes with the adhesion of most paints. The mill will passivate other types of zinc coatings, except extra smooth surface, as a normal procedure.

### 5.4 Mill phosphating

Zinc-coated steel sheet may be processed chemically at the manufacturer's mill to prepare all types of coatings for painting without further treatment except normal cleaning.

### 5.5 Oiling

The zinc-coated steel sheet as produced may be oiled to minimize wet storage stain. When the zinc-coated sheet has received a passivating treatment, oiling will further minimize the hazard of wet storage stain.

### 5.6 Painting

Hot-dip zinc-coated steel sheet is a suitable base for paint but the first treatment may be different from those used on mild steel. Pre-treatment primers, chemical conversion coatings (chromate, phosphate or oxide type) and some paints specially formulated for direct application to zinc surfaces are all appropriate first treatments for hot-dip zinc-coated sheet. In drawing up a painting schedule, consideration shall be

given to whether the hot-dip zinc coated sheet shall be ordered passivated or not passivated.

## 6 Conditions of manufacture

### 6.1 Steelmaking

The processes used in making the steel and in manufacturing zinc-coated sheet are left to the discretion of the manufacturer.

### 6.2 Chemical composition

The chemical composition (cast analysis) shall not exceed the values given in table 1.

**Table 1 — Chemical composition (cast analysis), %**

Base metal quality		C	Mn	P	S	Ti <sup>1)</sup>
Designation	Name	max.	max.	max.	max.	max.
01	Commercial	0,15	0,60	0,05	0,05	
02	Lock forming	0,12	0,60	0,04	0,04	
03	Drawing	0,12	0,50	0,04	0,04	
04	Deep drawing	0,10	0,45	0,03	0,03	
05	Deep drawing special killed	0,08	0,45	0,03	0,03	
06	Extra deep drawing stabilized	0,02	0,25	0,020	0,020	0,3

1) Titanium may be replaced totally or partially by niobium or vanadium. Carbon and nitrogen shall be completely stabilized.

### 6.3 Chemical analysis

#### 6.3.1 Cast analysis

A cast analysis of each cast of steel shall be made by the manufacturer to determine the percentage of carbon, manganese, phosphorus and sulfur. On request, this analysis shall be reported to the purchaser or his representative.

#### 6.3.2 Verification analysis

A verification analysis may be made by the purchaser to verify the specified chemical composition of the

semi-finished or finished steel and shall take into consideration any normal heterogeneity. Non-killed steels (such as rimmed or capped) are not technologically suited to verification analysis, except for copper analysis when copper-bearing steel is specified. For killed steels, or when copper-bearing steel is specified, the sampling method and deviation limits shall be agreed upon between the interested parties at the time of ordering.

## 6.4 Zinc-coating mass

The mass of coating shall conform to the requirements in table 2 for the specific coating designation. The mass of coating is the total amount of zinc on both surfaces of the sheet, expressed in grams per square metre ( $\text{g}/\text{m}^2$ ) of sheet. The coating mass of differentially coated material shall be agreed on between the interested parties. If a maximum coating mass is required, the manufacturer shall be notified at the time of ordering. Methods of checking that the material complies with this International Standard are given in 9.2 and 10.

**Table 2 — Mass of coating (total both sides)**

Coating designation	Minimum check limit	
	Triple spot test $\text{g}/\text{m}^2$ (of sheet)	Single spot test $\text{g}/\text{m}^2$ (of sheet)
Z700	700	595
Z600	600	510
Z450	450	385
Z350	350	300
Z275	275	235
Z200	200	170
Z180	180	150
Z100	100	85
Z001	No minimum <sup>1)</sup>	No minimum <sup>1)</sup>
ZF180	180	150
ZF100	100	85
ZF001	No minimum	No minimum

Because of the many variables and changing conditions that are characteristic of continuous zinc coating, the mass of coating is not always evenly divided between the two surfaces of a zinc-coated sheet: neither is the zinc coating evenly distributed from edge to edge. However, it can normally be expected that not less than 40 % of the single-spot check limit will be found on either surface.

1) "No minimum" means that there are no established minimum check limits for triple and single spot tests.

## 6.5 Weldability

The product is suitable for welding if appropriate welding methods and procedures are used with spe-

cial attention to the heavier coatings. Zinc-iron alloyed coatings (ZF) are usually more suitable than other coatings (Z) for resistance welding.

## 6.6 Application

It is desirable that zinc-coated steel sheet be identified for fabrication by the name of the part or by the intended application. Zinc-coated steel sheet of drawing qualities (03, 04, 05 and 06) may be produced to make an identified part according to a performance criteria or within a properly established breakage allowance, which shall be previously agreed upon between the interested parties. In these cases, the part name, the details of fabrication, and special requirements (such as freedom from stretcher strain or fluting) shall be specified and the mechanical properties in table 3 do not apply.

## 6.7 Mechanical properties

Except when ordered according to an identified part as explained in 6.6, at the time that the steel is made available for shipment, the mechanical properties shall be as stated in table 3 when they are determined on test pieces obtained in accordance with requirements of 8.1.

NOTE 1 Prolonged storage of the sheet can cause a change in mechanical properties (increase in hardness and decrease in elongation), leading to a decrease in drawability. To minimize this effect, quality 05 or 06 should be specified.

## 6.8 Adhesion of coating

The adhesion of the coating shall be such that when the sheet is subjected to bending using the diameters specified in 9.2.3, it shall show no signs of flaking. Crazeing, roughening and dusting of the zinc-iron (ZF) alloy coatings are permissible.

## 7 Dimensional tolerances

Dimensional tolerances applicable to zinc-coated steel sheet shall be as given in tables 4 to 13 inclusive.

## 8 Sampling

### 8.1 Mechanical property tests

#### 8.1.1 Tensile test

One representative sample for the tensile test required in table 3 shall be taken from each lot of sheet for shipment. A lot consists of 50 tonnes or less of



sheet of the same quality rolled to the same thickness and condition.

### 8.1.2 Bend test

One representative sample for the bend test (only applicable to qualities 01 and 02) shall be taken from each lot of sheet for shipment. A lot consists of 50 tonnes or less of sheet of the same quality rolled to the same thickness and condition.

## 8.2 Coating tests

### 8.2.1 Mass of coating

For coils and cut lengths in coils, test specimens shall be taken from a sample piece approximately 300 mm in length on the as-coated width. The purchaser may verify the mass of coating using the following sampling method.

Three specimens shall be cut, one from the mid-width position, and one from each side not closer than 25 mm to the side edge. The minimum specimen area shall be 2 000 mm<sup>2</sup>.

### 8.2.2 Bend test (applicable only to qualities Z01 and Z02)

One representative sample shall be taken from each lot of sheet for shipment. The test pieces shall be taken for the coated bend test, not closer than 25 mm from the side edge. The minimum test piece width shall be 50 mm.

## 9 Test methods

### 9.1 Mechanical property tests (base metal)

#### 9.1.1 Tensile test

The tensile test shall be carried out in accordance with ISO 6892. Transverse test pieces shall be taken mid-way between the centre and edge of the sheet as rolled. Since the tensile test is for determination of properties of the base metal, ends of test pieces shall be stripped of the coating to measure base metal thickness for calculation of cross-sectional area.

#### 9.1.2 Bend test (applicable only to qualities 01 and 02)

The transverse bend test piece, stripped of coating in a suitably inhibited acid, shall withstand being bent through 180° in the direction shown in figure 1, around the inside diameter as shown in table 3, without

cracking on the outside of the bent portion. The bend test is to be performed at ambient temperature and as described in ISO 7438.

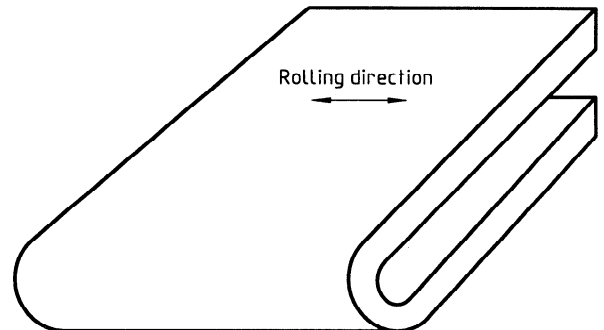


Figure 1 — Transverse bend test piece (after bending)

## 9.2 Coating tests

Unless the frequency is agreed upon at the time of ordering, the manufacturer shall make such tests and measurements as he deems necessary to ensure that the material supplied complies with the values in table 2 and the coating adhesion performance specified in 9.2.3.

### 9.2.1 Triple spot test

The triple spot test result shall be the average coating mass found on the three specimens taken according to 8.2.1. The test is normally carried out by stamping out a known area of sheet and calculating the coating mass from the loss in mass after removing the zinc in suitably inhibited acid. ISO 1460 may be used as a reference method.

### 9.2.2 Single spot test

The single spot test result shall be the minimum coating mass found on any one of the three specimens used for the triple spot test. Material which has been slit from wide coil shall be subject to a single spot test only.

### 9.2.3 Bend test (coating)

Bend test pieces taken after coating (before additional processing) shall withstand being bent through 180° in either direction without flaking of the coating on the outside of the bend. The radius ( $D/2$ ) of the bend is determined by the number of pieces of the same thickness (or mandrel equivalent) shown as follows:

- $D = 0$ , for coating Z001 to Z275;
- $D = 1 \times a$  ( $a$  = product thickness), for coating Z350;
- $D = 2 \times a$ , for coatings Z450 to Z700.

When pressing together the two legs of the specimen, care shall be taken to ensure that the coating is not damaged. The test is invalidated if breakage occurs in the base metal. Flaking of coating within 7 mm from the edge of the test piece shall not be cause for rejection.

## 10 Retests

If a test does not give the required results, two more tests shall be carried out at random on the same lot. Should either of these tests fail to meet the specified requirements, the material shall be considered not to comply with the requirements of this International Standard.

## 11 Workmanship

The zinc-coated steel sheet in cut lengths shall be free from laminations, surface flaws and other imperfections that are detrimental to subsequent appropriate processing. Processing for shipment in coils does not afford the manufacturer the opportunity to observe readily or to remove defective portions, as can be carried out on the cut length product.

## 12 Inspection and acceptance

**12.1** While not usually required for products covered by this International Standard, when the purchaser specifies that inspection and tests for acceptance be observed prior to shipment from the manufacturer's works, the manufacturer shall afford the purchaser's inspector all reasonable facilities to determine that the steel is being furnished in accordance with this International Standard.

**12.2** Steel that is reported to be defective after arrival at the user's works shall be set aside, properly and correctly identified and adequately protected. The supplier shall be notified in order that he may properly investigate.

## 13 Coil size

When zinc-coated steel sheet is ordered in coils, a minimum inside diameter (I.D.) or range of acceptable inside diameters shall be specified. In addition, the

maximum outside diameter (O.D.) and maximum acceptable coil mass shall be specified.

## 14 Marking

Unless otherwise stated, the following minimum requirements for identifying the steel shall be legibly stencilled on the top of each lift or shown on a tag attached to each coil or shipping unit:

- a) the manufacturer's name or identifying brand;
- b) the number of this International Standard;
- c) the quality designation;
- d) the coating designation;
- e) the order number;
- f) the product dimensions;
- g) the lot number;
- h) the mass.

## 15 Information to be supplied by the purchaser

To specify requirements adequately according to this International Standard, inquiries and orders shall include the following information:

- a) the number of this International Standard;
- b) the name and designation of the material, for example, hot-dip zinc-coated steel sheet, Z275N02 (see 1.2 to 1.4, clause 4 and tables 1 and 2);
- c) the dimensions of the product (the thickness includes the coating) in the sequence, thickness, width, length and mass, and the quantity required;
- d) the application (name of part) if possible (see 6.6);
- e) for drawing qualities 03, 04, 05 and 06, whether ordered to mechanical properties (see 6.7) or to fabricate an identified part (see 6.6);
- f) whether oiled or not (see 5.5);
- g) whether mill passivated or not (see 5.3);
- h) whether mill phosphated or not (see 5.4);
- i) extra smooth, if required (see 5.1);



- j) the coil size requirements (see clause 13);
- k) the report of the cast analysis (see 6.3.1), if required;
- l) inspection and tests for acceptance prior to shipment from the manufacturer's works, if required (see 12.1).

NOTE 2 A typical ordering description is as follows:

International Standard ISO 3575, hot-dip zinc-coated steel sheet, Z275N02, 0,46 × 1 200 × 2 400 mm, 20 000 kg, to fabricate drawn shells, part=7 201, mill passivation and oiled, maximum lift 4 000 kg.

When zinc-coated is specified to stretcher-levelled standard of flatness and not resquared, the allowances over specified dimensions in width and length given in table 13 apply. Under these conditions, the allowances for width and length are added by the manufacturer to the specified width and length and the tolerances given in tables 6 and 7 apply on the basis of the new size established. The camber tolerances in table 7 do not apply.

When sheet is not to have grip or entry marks within the specified length, the purchaser shall specify "grip or entry marks outside specified length". When sheet may have grip or entry marks within the specified length, the purchaser shall specify "grip or entry marks inside specified length".

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