

# **ELECTROLYTICALLY GALVANISED STEEL STRIP**

## **BY voestalpine**

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## INTRODUCTION

Electrolytically galvanised steel strip is cold-rolled with a zinc coating (ZE) on one or both sides. Since 1985, **voestalpine Stahl** has produced almost 5 million tons of electrolytically galvanised steel strip.

These Technical Terms of Delivery present the production possibilities at our electrolytically galvanizing plant and provide our customers information on ordering and processing procedures of our electrolytically galvanised steel strip product line.

Cold-rolled steel strip from our cold-rolling mills serves as base material that has been generally defined for final applications which correspond to the specific mechanical properties and surface conditions. For this reason we also refer you to our Technical Terms of Delivery for Cold-Rolled steel strip for more information.

After an extensive multi-stage cleaning process, the actual electrolytic refining takes place according to the Gravitel process. The coating metal is dissolved in a solution that contains sulphuric acid, the electrolyte,

and is deposited on the steel strip by means of an electric current. The required high flow speed is achieved by utilising gravity. The zinc coating can be deposited either on one or both sides by quickly adapting the electroplating cells. Marking and inspection are carried out after a variety of post-treatment steps before the packaged product is made available for dispatch and/or undergoes further processing.

Any requirements above and beyond the Technical Terms of Delivery or typical applications as well as inquiries regarding processing properties are analysed by the responsible technical department. Your contact partners in the sales departments and/or technical areas are available at any time to answer your questions.

## STEEL GRADES

We deliver cold-rolled, electrolytically galvanised steel strips in the steel grades described in the overview table. Regarding general descriptions and definitions of chemical analysis, we refer you to our Technical Terms of Delivery for cold-rolled steel strip as well as to the corresponding definitions in European Standards or comparable material specifications. Information on age resistance as well as warranties for freedom of flow lines is found in this documentation.

If there is a need for other steel grades not listed here, we ask you to make an inquiry by contacting us. In general we deliver in accordance with conventional standards as well upon special request of the customer. Conditions may be negotiated separately. A listing of various standard designations as well as hot-dip coated and galvanised grades is appended.

## OVERVIEW OF STEEL GRADES AND GUARANTEED MECHANICAL PROPERTIES

Steel grade	0.2 %- Yield Point R <sub>p0.2</sub> [MPa]	Tensile Strength R <sub>m</sub> [MPa]	Fracture elongation A <sub>80</sub> [%] (min)	Vertical Anisotropy r <sub>90</sub> (min)	Work hardening exponent n <sub>10-20</sub> (UE) (min)	Bake hardening Value BH <sub>2</sub> [MPa] (min)	Sample Direction
<b>MILD STEELS</b>							
DC01+ZE	140-280	270-410	28	-	-		cross
DC03+ZE	140-240	270-370	34	1.3	-		cross
DC04+ZE	140-210	270-350	38	1.6	0.18		cross
DC05+ZE	140-180	270-330	40	1.9	0.20		cross
DC06+ZE	120-180	270-350	38	1.8 (rm)	0.22 (nm)		cross
DC07+ZE	120-150	260-330	42	2.0 (rm)	0.23 (nm)		cross
<b>MICROALLOYED STEELS</b>							
H260LA+ZE	260-330	350-430	26				cross
H300LA+ZE	300-380	380-480	23				cross
H340LA+ZE	340-420	410-510	21				cross
H380LA+ZE	380-480	440-560	19				cross
H420LA+ZE	420-520	470-590	17				cross
<b>PHOSPHORUS-ALLOYED STEELS</b>							
H220P+ZE	220-270	320-400	32	1.3	0.16		cross
H260P+ZE	260-320	360-440	29	-	-		cross
H300P+ZE	300-360	400-480	26	-	-		cross
<b>BAKE-HARDENING STEELS</b>							
H180B+ZE	180-230	300-360	34	1.6	0.17	40	cross
H220B+ZE	220-270	320-400	32	1.5	0.16	35	cross
H260B+ZE	260-320	360-440	29	-	-	35	cross
H300B+ZE	300-360	400-480	26	-	-	30	cross
<b>HIGHER-STRENGTH IF STEELS</b>							
H180Y+ZE	180-230	340-400	36	1.7	0.19		cross
H220Y+ZE	220-270	350-420	34	1.6	0.18		cross
H260Y+ZE	260-320	380-440	32	1.4	0.17		cross
<b>ISOTROPIC STEELS</b>							
H220I+ZE	220-270	300-380	34		0.18		cross
H260I+ZE	260-310	320-400	32		0.17		cross
<b>DUAL PHASE STEELS</b>							
HT450X+ZE	250-330	≥ 450	27		0.16	30	longitudinal
HT500X+ZE	290-370	≥ 500	24		0.15	30	longitudinal
HT600X+ZE	330-410	≥ 600	21		0.14	30	longitudinal
HT800X+ZE	420-550	≥ 780	15		-	30	longitudinal
HT1000X+ZE	550-700	≥ 980	10		-	30	longitudinal
<b>PARTIALLY MARTENSITIC STEELS</b>							
(HT600C+ZE)	350-470	≥ 600	16		-	30	longitudinal
(HT800C+ZE)	500-640	≥ 780	10		-	30	longitudinal
(HT900C+ZE)	580-740	≥ 880	8		-	30	longitudinal
(HT1000C+ZE)	660-860	≥ 980	6		-	30	longitudinal
<b>TRIP STEELS</b>							
HT600T+ZE	380-480	≥ 600	26		0.20	40	longitudinal
HT700T+ZE	410-510	≥ 700	24		0.19	40	longitudinal
HT800T+ZE	440-560	≥ 780	22		0.18	40	longitudinal
(HT1000T + ZE)	upon request	≥ 980	18		0.14	40	longitudinal

Steel grades in (...) are available upon request.

Additional detailed remarks and limitations to the mechanical properties dependent on the product thickness are found in the

respective footnotes of these Technical Terms of Delivery for cold-rolled strip.

## ZINC-COATED GROUPS

Zinc coatings are designated as a tenfold value of the nominal coating in  $\mu\text{m}$ , separated into sides. The available zinc coating groups and their respective minimum values are shown in the following table.

### AVAILABLE ZINC COATING GROUPS

Designation <sup>1)</sup>		Nominal zinc coating on one side <sup>2)</sup>		Minimum zinc coating value on one side	
Coating on both sides	Coating on one side	Thickness $\mu\text{m}$	Weight $\text{g/m}^2$	Thickness $\mu\text{m}$	Weight $\text{g/m}^2$
ZE 25/25	ZE 25/0	2.5	18	1.7	12
ZE 50/50	ZE 50/0	5.0	36	4.1	29
ZE 75/75	ZE 75/0	7.5	54	6.6	47
ZE 100/100	ZE 100/0	10.0	72	9.1	65

<sup>1)</sup> Other zinc coatings than those in the table and different coatings per side (differently galvanised) can be ordered separately.

<sup>2)</sup> A coating thickness of 1  $\mu\text{m}$  corresponds to a coating weight of roughly 7.1  $\text{g/m}^2$ .

If not otherwise agreed, the non-galvanised side is located on the outside of the strip. In the event of differential galvanisation, this applies to the side of the strip with a lower zinc coating.

The zinc coating is continually monitored with the beta backscatter method on each side and across the entire width of the strip.

# SURFACE

## SURFACE CONDITIONS

### Type of Surface

Electrolytically galvanised steel strip is delivered with one of the two surface types: A or B. A comparison of these surface types for designations previously common can be found in the section entitled Comparison of Standards (Appendix).

### SURFACE TYPE A

All defects are permissible such as pores, small score marks, small warts, small scratches and imprints as well as slight discolouration, as long as these do not hinder the suitability of the material with respect to forming and regarding the adhesion of surface coatings.

### SURFACE TYPE B

The better side must be free of defects to such a degree that the uniform appearance of a quality paint coat is not negatively impacted. In the event of galvanization only on one side, this applies to the non-galvanised side. Slight discoloration as well as optical marbling that derives from crush and drying processes do not affect the quality with regard to uniformity of the surface appearance after the painting process and are permitted. The other side of the material must at least meet the requirements of Surface Type A.

If not otherwise agreed, the better side of the material is located on the outside of the strip.

### Surface Quality

A mat surface with permissible median roughness Ra ranging from 0.6 to 1.9  $\mu\text{m}$  is the default delivery standard. Other values for the surface finish may be negotiated for special final applications at the time the order is placed.

Determination of the median roughness value Ra is subject to a wavelength limit of 2.5 mm in accordance with prEN 10049 (standard measuring length of 12.5 mm).

## SUBSEQUENT SURFACE TREATMENT

Because of the heightened risk of white rust occurring during transport and storage, electrolytically galvanised steel strips are delivered solely with one of the following subsequent treatments. The subsequent treatment code is made up of letters as designated. Delivery in non-subsequently-treated condition is only in exceptional cases or if the customer explicitly accepts the risk regarding corrosion from the time the material is made ready for dispatch.

The type of subsequent treatment must be indicated at the time the order is placed. To the extent that no other instructions are provided at the time of the order, electrolytically galvanised steel strips are delivered in oiled condition (O). The only exception to the above is electrolytically galvanised steel strip with coating group ZE 25/25 that are delivered with a phosphatised and chemically passivated surface (PC) as a default delivery standard.

### Oiled O

Oiling is performed with an anticorrosive oil which can be easily removed with conventional cleaning agents that do not damage zinc (such as alkaline degreasing). Depending on the stress during treatment, the following types of oil application possibilities are available.

#### Amounts of oil

slightly oiled	approx. 0.7 g/m <sup>2</sup> per side
oiled	approx. 1.2 g/m <sup>2</sup> per side
heavily oiled	approx. 1.6 g/m <sup>2</sup> per side

Other oil applications ranging between 0.5 and 2.0 g/m<sup>2</sup> per side can be agreed upon at the time of ordering. In the event that no other data are provided at the time of the order, 1.2 g/m<sup>2</sup> will be applied per side. Although the oil is distributed evenly, a certain degree of oil distribution occurring across the length and width of the strip is technically unavoidable during transportation and storage.

### Phosphatised P

In addition to a temporary protection against white rust, a phosphate layer also provides an optimum bonding layer for further organic coating. In combination with an applicable lubricant (such as PO that was after-treated with phosphate and oil) the phosphatisation improves formability. Differentially pronounced grey shadings within a strip as well as from delivery to delivery may occur. However, these do not affect the product quality characteristics. Electrolytically galvanised and phosphatised steel strip can only be delivered with a zinc coating on both sides.

# AVAILABLE SHAPES AND DIMENSIONS

## GENERAL DIMENSIONAL LIMITATIONS

With respect to the deliverable dimensions of the individual steel grades, we refer you to our Technical Terms of Delivery for cold-rolled steel strip. Furthermore, the following additional general dimensional limitations for electrolytically galvanised steel strips must also be taken into consideration:

### GENERAL DIMENSIONAL LIMITATIONS

Electrolytically galvanised steel strip by voestalpine

Steel Type	Thickness [mm]	Width [mm]
Mild steels for cold forming	0.50–1.80	600–1600 <sup>1) 2)</sup>
	1.81–2.00	600–1400 <sup>2)</sup>
Higher-strength steels suited to cold forming	0.50–1.80	600–1600 <sup>1) 2)</sup>
	1.81–2.00	600–1300 <sup>2)</sup>

<sup>1)</sup> With limited width tolerance 1580 mm maximum.

<sup>2)</sup> Width range between > 785 and < 900 mm upon request.

## AVAILABLE SHAPES

voestalpine Stahl delivers electrolytically galvanised steel strips in the following roll diameters and maximum coil weights:

### COIL DIAMETER, MAXIMUM COIL WEIGHT

Electrolytically galvanised steel strip by voestalpine

Outer diameter [mm] (max)	Inner diameter <sup>1)</sup> [mm] (approximately)	Coil weight [t] (max)
2000	600	32

<sup>1)</sup> Approximately 500 mm upon request

In addition, electrolytically galvanised steel strips can be further refined with organic coatings in our strip coating line. Longitudinally slit strips and cut plates are offered by our subsidiary voestalpine Stahl Service Centre.

# TEST CERTIFICATES

## GENERAL INFORMATION ON QUALITY INSPECTIONS

An essential characteristic of our quality management system are the ongoing quality tests that are conducted in accordance with international testing methods. The selection and the extent of the tests are in accordance with the demands placed on electrolytically galvanised steel strip.

## MATERIAL TEST CERTIFICATES

Test certificates defined in EN 10204 can be issued upon request.

## TEST UNIT AND SCOPE OF TEST

Specific tests are restricted to a test unit of 20 tons or a portion of 20 tons of electrolytically galvanised steel strip from the same rolling unit. In the case of strip, a coil of more than 20 t may be considered as a test unit.

For each test unit, experiments to determine the following values must be carried out:

- mechanical Properties
- adhesion of the coating
- coating weight

## TAKING SAMPLES AND METHOD OF TESTING

Taking samples and applying methods of testing are in accordance with the stipulations of EN 10152. Repeat tests are subject to the stipulations of EN 10021.

In general, the zinc coating is determined from a continuous non-destructive test. In arbitrary cases, the method described in attachment A of EN 10152 is taken into consideration.

## PROCESSING INSTRUCTIONS

Electrolytically galvanised steel strip can be processed in the same way as uncoated cold-rolled steel strip. In practical application, chemical-physical peculiarities of the zinc coating result in additional issues that must be considered in processing by forming, joining and coating.

### FORMING

The selection of materials depends on the demands on formability as well as the component-specific requirements. The modified sliding behaviour of a zinc surface can make an adjustment of the forming parameters necessary, such as lifting the hold-down force. Phosphating as a subsequent treatment possibility during steel manufacturing improves formability and leads to a reduction of the slightly increased cold weldability of the zinc surface.

### JOINING

Conventional thermal and mechanical joining technologies as well as adhesive technologies can be used as methods of connecting. Preferably mechanical joining technologies, such as screwing, riveting, crimping, flanging, clinching are applied that conserve the treat anticorrosive characteristics of the zinc coating with respect. However, also conventional welding methods, such as soft and hard soldering, are applicable for joining. Adjustment of the welding parameter, dependent on the zinc coating, is necessary in the event of resistance welding (spot, projection or stitch welding). Furthermore, the influence of the subsequent phosphating treatment on the welding parameters must be taken into consideration.

The significance of metal gluing is increasing in combination with other methods of joining. Connections of a high strength are achievable with modern adhesives, even when surfaces are oiled. An examination of the surface systems, possible treatment processes and the adhesives themselves is advisable. In general, metal bonding is facilitated by phosphating. When different materials are combined it is necessary to consider possible problems of contact corrosion.

### CLEANING AND COATING

Electrolytically galvanised steel strip is a suitable surface for organic coatings. Commercial degreasing agents within a pH range from 5 to 9 are suitable for cleaning before coating. As a bonding agent for organic coatings, a pre-treatment adjusted to galvanised surfaces is recommended. In case of subsequent phosphating (P, PO, PC or PCO), the chemical conversion treatment can be forgone because this treatment is performed by the manufacturer. Please note that chemical passivation performed by the manufacturer can adversely affect a subsequent phosphating treatment performed by the customer.