

PRE-PAINTED



Relevant steelmaking regulation
EUROPEAN STANDARD: UNI EN 10169 : 2010

Areas of use

- Construction industry
- Home appliances
- Automotive (transmission systems, seat belts)
- Packaging
- Civil and industrial construction
- Sheet metal work
- Covers
- Coatings

Flat steel products continuously coated with organic material (coated strips)

These products consist of a steel substrate to which an organic coating in the form of paint (or powder) is applied by a continuous method (coil coating). This allows these products to encompass a huge variety of features: the different mechanical properties provided by the steel substrate, the highest levels of corrosion resistance, the availability of multiple colors, the variability of gloss and surface finish, environmental compatibility, and economic and energy savings in the overall manufacturing process.

The material that makes up the substrate is a steel product with or without metal coating, depending on the use:

GALVANIZED: this is the most commonly used substrate, as the zinc coating protects the steel from corrosion

COLD LAMINATE: never used if there is a risk of corrosion (so typically only for interiors).

The choice of organic coatings depends on the end use. A certain organic coating may be present :

1. On each of the two surfaces of the laminate, in the same way;
2. Only on one surface (usually the upper surface), while the other is left uncoated (though still subjected to pre-treatment);
3. On one surface, while the other (the lower or back surface) is coated with any organic coating with no special requirements.

The system constituting the coating can be single-layer, with certain requirements, or applied as a primer in preparation for later applications.

It can be multilayer, comprising a base layer, possibly one or more intermediate layers and a finishing layer with all the necessary requirements.

Technical supply conditions

The standard specifies the requirements of flat steel products continuously coated with organic material (coated strips). In particular, it specifies their performance requirements.

The products considered are wide strips, sheets cut from wide strips, sheared wide strips, rolled strips less than 600 mm wide, and the strips (made from sheets or strips).

The name of these steels shall include the full description of the steel substrate, the type and weight of the metal coating (where present), the symbol for the organic material applied to the top surface, and, where required, for that applied to the bottom surface, the nominal thickness in μm of the organic coating applied to the top surface and, where required, that applied to the bottom surface.

It is always necessary to specify whether the nominal thickness of the desired prepainted steel is inclusive of the organic coating applied to the two faces or whether it is instead to be understood as the thickness of the substrate and metal coating excluding the organic coating (as the standard prescribes).

Other technical data needed to define the required product are:

1. Color and/or color difference (it is recommended to refer to the RAL chart)
2. Specular shine at 60° ; possible ranges according to the standard are:
 - matte
 - lackluster
 - satin
 - semi-shiny
 - shiny
 - polished

Instead, they are ancillary but often very useful requirements, especially when choosing materials:

1. Hardness to pencil/hardness to impression/scratch test
2. Adhesion strength after drawing/Flexibility of coating (T-bending at 180°)/Adhesion under rapid deformation action
3. Neutral salt spray resistance/Artificial weathering/Natural weathering exposure
4. Other characteristics determined by the specific use

Tolerances on nominal coating thickness



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The standard applies to flat products with a coating applied by continuous hot dipping of zinc (Z), zinc-iron alloy (ZF), zinc-aluminum alloy (ZA), aluminum-zinc alloy (AZ), and aluminum-silicon alloy (AS), of cold-forming high-strength low-carbon steels, and of structural steels with a minimum thickness of 0.20 mm and a maximum thickness of 6.50 mm

Tolerance on nominal coating thickness

1

Nominal thickness range	> 10 ≤ 20	> 20 ≤ 25	> 25 ≤ 35	> 35 ≤ 60	> 60 ≤ 100	> 100 ≤ 150	> 150 ≤ 500	> 500 ≤ 800
Negative tolerance on the average of three measurements	3	4	6	8	15	20	30	40
Negative tolerance on single measurement	4	5	8	12	20	25	35	50

Tolerances on specular shine

2

Shine unit range	Shine range	Nominal shine tolerance
≤ 10	matte	± 3
>10 ≤ 20	lackluster	± 4
> 20 ≤ 40	satin	± 6
> 40 ≤ 60	semi-shiny	± 8
> 60 < 80	shiny	± 10
≥ 80	polished	minimum lucidity 80

^a Informational directions

Minimum bending radius for the T-bend test

3

Range of flexibility	Minimum bending radius
High flexibility for severe forming conditions	0 T, IT
Standard flexibility	2 T, 3 T, 4 T, 5 T, 6 T
No flexibility requirement	No test required

^a T nominal product thickness

Test duration for moisture resistance test

4

Corrosion protection (internal) category (CPI)	CP12	CP13	CP14	CP15
Duration of the test, h	500	1000	1500	1500

Note: For corrosion protection coatings (internal) category CP15, additional testing may be required when ordering

Tolerances on nominal coating thickness

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Relationship between corrosion resistance categories, corrosivity categories, and types of atmosphere-typical environment in a moderate climate (see also EN ISO 12944-2)

5

Requirements for outdoor natural corrosion resistance testing

6

Requirements for UV resistance for natural and artificial test conditions

7

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Corrosion resistance category	Corrosivity category ^a	Types of atmosphere					
		Rural	Urban	Industrial	Marine	Pollution and moisture	Waterfront
RC1	C1-very low (no requirement)						
RC2	C2-low						
RC3	C3-medium			SO ₂ low	low salinity		
RC4	C4-high			High SO ₂	moderate salinity		
RC5	C5-I-very high			High SO ₂			
	C5-M-very high				high salinity		high salinity

^a In accordance with EN ISO 12944-2, on the behavior of low carbon steels

Corrosivity resistance corrosion	Durability testing years	Delamination average edge mm	Damage on the curve	Blistering
RC2	1	≤10	c	2 (S4)
RC3	2	≤5	c	2 (S4)
RC4	2	≤2	d	2 (S2)
RC5	≥2	≤2	d	2 (S2)

Requirements (duration: two years for natural UV radiation, 2000 hours for artificial UV radiation)	UV resistance category			
	R _{uv2}	R _{uv3}	R _{uv4}	
Maximum color change ΔE* before and after test (CIELab units)	5	3	3	2
Minimum shine retained after test (R _{Gb}),%	30	50	60	80

Tolerances by size and shape



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Thickness tolerances for steels with minimum specified yield strength R_e or $R_{p0.2} < 260$ MPa



Nominal thickness t	Normal tolerance for nominal width w			Special tolerance (S) for nominal width w		
	≤ 1200	$1200 < w \leq 1500$	>1500	≤ 1200	$1200 < w \leq 1500$	>1500
0.20 < t \leq 0.40	± 0.04	± 0.05	± 0.06	± 0.030	± 0.035	± 0.040
0.40 < t \leq 0.60	± 0.04	± 0.05	± 0.06	± 0.035	± 0.040	± 0.045
0.60 < t \leq 0.80	± 0.05	± 0.06	± 0.07	± 0.040	± 0.045	± 0.050
0.80 < t \leq 1.00	± 0.06	± 0.07	± 0.08	± 0.045	± 0.050	± 0.060
1.00 < t \leq 1.20	± 0.07	± 0.08	± 0.09	± 0.050	± 0.060	± 0.070
1.20 < t \leq 1.60	± 0.10	± 0.11	± 0.12	± 0.060	± 0.070	± 0.080
1.60 < t \leq 2.00	± 0.12	± 0.13	± 0.14	± 0.070	± 0.080	± 0.090
2.00 < t \leq 2.50	± 0.14	± 0.15	± 0.16	± 0.090	± 0.100	± 0.110
2.50 < t \leq 3.00	± 0.17	± 0.17	± 0.18	± 0.110	± 0.120	± 0.130
3.00 < t \leq 5.00	± 0.20	± 0.20	± 0.21	± 0.15	± 0.16	± 0.17
5.00 < t \leq 6.50	± 0.22	± 0.22	± 0.23	± 0.17	± 0.18	± 0.19

Thickness tolerances for steels with minimum specified yield strength $260 \text{ MPa} \leq R_{p0.2} \leq 360$ MPa and for DX51D and S550GD qualities



Nominal thickness t	Normal tolerance for nominal width w			Special tolerance (S) for nominal width w		
	≤ 1200	$1200 < w \leq 1500$	>1500	≤ 1200	$1200 < w \leq 1500$	>1500
0.20 < t \leq 0.40	± 0.05	± 0.06	± 0.07	± 0.035	± 0.040	± 0.045
0.40 < t \leq 0.60	± 0.05	± 0.06	± 0.07	± 0.040	± 0.045	± 0.050
0.60 < t \leq 0.80	± 0.06	± 0.07	± 0.08	± 0.045	± 0.050	± 0.060
0.80 < t \leq 1.00	± 0.07	± 0.08	± 0.09	± 0.050	± 0.060	± 0.070
1.00 < t \leq 1.20	± 0.08	± 0.09	± 0.11	± 0.060	± 0.070	± 0.080
1.20 < t \leq 1.60	± 0.11	± 0.13	± 0.14	± 0.070	± 0.080	± 0.090
1.60 < t \leq 2.00	± 0.14	± 0.15	± 0.16	± 0.080	± 0.090	± 0.110
2.00 < t \leq 2.50	± 0.16	± 0.17	± 0.18	± 0.110	± 0.120	± 0.130
2.50 < t \leq 3.00	± 0.19	± 0.20	± 0.20	± 0.130	± 0.140	± 0.150
3.00 < t \leq 5.00	± 0.22	± 0.24	± 0.25	± 0.17	± 0.18	± 0.19
5.00 < t \leq 6.50	± 0.24	± 0.25	± 0.26	± 0.19	± 0.20	± 0.21

Tolerances by size and shape



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Thickness tolerances for steels with minimum specified yield strength $360 \text{ MPa} \leq R_{p0.2} \leq 420 \text{ MPa}$

4

Nominal thickness t	Normal tolerance for nominal width w			Special tolerance (S) for nominal width w		
	≤ 1200	$1200 < w \leq 1500$	>1500	≤ 1200	$1200 < w \leq 1500$	>1500
$0.35 < t \leq 0.40$	± 0.05	± 0.06	± 0.07	± 0.040	± 0.045	± 0.050
$0.40 < t \leq 0.60$	± 0.06	± 0.07	± 0.08	± 0.045	± 0.050	± 0.060
$0.60 < t \leq 0.80$	± 0.07	± 0.08	± 0.09	± 0.050	± 0.060	± 0.070
$0.80 < t \leq 1.00$	± 0.08	± 0.09	± 0.11	± 0.060	± 0.070	± 0.080
$1.00 < t \leq 1.20$	± 0.10	± 0.11	± 0.12	± 0.070	± 0.080	± 0.090
$1.20 < t \leq 1.60$	± 0.13	± 0.14	± 0.16	± 0.080	± 0.090	± 0.110
$1.60 < t \leq 2.00$	± 0.16	± 0.17	± 0.19	± 0.090	± 0.110	± 0.120
$2.00 < t \leq 2.50$	± 0.18	± 0.20	± 0.21	± 0.120	± 0.130	± 0.140
$2.50 < t \leq 3.00$	± 0.22	± 0.22	± 0.23	± 0.140	± 0.150	± 0.160
$3.00 < t \leq 5.00$	± 0.22	± 0.24	± 0.25	± 0.17	± 0.18	± 0.19
$5.00 < t \leq 6.50$	± 0.24	± 0.25	± 0.26	± 0.19	± 0.20	± 0.21

Thickness tolerances for steels with minimum specified yield strength $420 \text{ MPa} \leq R_{p0.2} \leq 900 \text{ MPa}$

5

Nominal thickness t	Normal tolerance for nominal width w			Special tolerance (S) for nominal width w		
	≤ 1200	$1200 < w \leq 1500$	>1500	≤ 1200	$1200 < w \leq 1500$	>1500
$0.35 < t \leq 0.40$	± 0.06	± 0.07	± 0.08	± 0.045	± 0.050	± 0.060
$0.40 < t \leq 0.60$	± 0.06	± 0.08	± 0.09	± 0.050	± 0.060	± 0.070
$0.60 < t \leq 0.80$	± 0.07	± 0.09	± 0.11	± 0.060	± 0.070	± 0.080
$0.80 < t \leq 1.00$	± 0.09	± 0.11	± 0.12	± 0.070	± 0.080	± 0.090
$1.00 < t \leq 1.20$	± 0.11	± 0.13	± 0.14	± 0.080	± 0.090	± 0.110
$1.20 < t \leq 1.60$	± 0.15	± 0.16	± 0.18	± 0.090	± 0.110	± 0.120
$1.60 < t \leq 2.00$	± 0.18	± 0.19	± 0.21	± 0.110	± 0.120	± 0.140
$2.00 < t \leq 2.50$	± 0.21	± 0.22	± 0.24	± 0.140	± 0.150	± 0.170
$2.50 < t \leq 3.00$	± 0.24	± 0.25	± 0.26	± 0.170	± 0.180	± 0.190
$3.00 < t \leq 5.00$	± 0.26	± 0.27	± 0.28	± 0.23	± 0.24	± 0.26
$5.00 < t \leq 6.50$	± 0.28	± 0.29	± 0.30	± 0.25	± 0.26	± 0.28

Tolerances by size and shape



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Tolerance on sheet and strip width ≥ 600 mm

6

Nominal width w	Normal tolerance	Special tolerance (s)
$600 \leq w \leq 1200$	+5 0	+2 0
$1200 < w \leq 1500$	+6 0	+2 0
$1500 < w \leq 1800$	+7 0	+3 0
$w > 1800$	+8 0	+3 0

Tolerance on strip width less than 600 mm

7

Tolerance class	Nominal thickness t	Nominal width			
		w < 125	125 ≤ w < 250	250 ≤ w < 400	400 ≤ w < 600
Normal	t < 0.6	+0.4 0	+0.5 0	+0.7 0	+1.0 0
	0.6 ≤ t < 1.0	+0.5 0	+0.6 0	+0.9 0	+1.2 0
	1.0 ≤ t < 2.0	+0.6 0	+0.8 0	+1.1 0	+1.4 0
	2.0 ≤ t ≤ 3.0	+0.7 0	+1.0 0	+1.3 0	+1.6 0
	3.0 < t ≤ 5.0	+0.8 0	+1.1 0	+1.4 0	+1.7 0
	5.0 < t ≤ 6.5	+0.9 0	+1.2 0	+1.5 0	+1.8 0
Special (s)	t < 0.6	+0.2 0	+0.2 0	+0.3 0	+0.5 0
	0.6 ≤ t < 1.0	+0.2 0	+0.3 0	+0.4 0	+0.6 0
	1.0 ≤ t < 2.0	+0.3 0	+0.4 0	+0.5 0	+0.7 0
	2.0 ≤ t ≤ 3.0	+0.4 0	+0.5 0	+0.6 0	+0.8 0
	3.0 < t ≤ 5.0	+0.5 0	+0.6 0	+0.7 0	+0.9 0
	5.0 < t ≤ 6.5	+0.6 0	+0.7 0	+0.8 0	+1.0 0

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Length tolerances

8

Nominal length	Normal tolerance	Special tolerance (s)
< 2000	+6 0	+3 0
≥ 2000 and ≤ 8000	+0.3 of the length 0	+0.15% of the length 0
> 8000	by agreement	

Flatness tolerances for steels with minimum specified yield strength R_e or $R_{p0.2} < 260$ MPa

9

Tolerance class	Nominal width w	Maximum wave height for nominal thickness t			
		t < 0.7	0.7 ≤ t < 1.6	1.6 ≤ t < 3.0	3.0 ≤ t ≤ 6.5
Normal	w < 1200	10	8		15
	1200 ≤ w < 1500	12	10		18
	w ≥ 1500	17	15		23
Special (FS)	w < 1200	5	4	3	8
	1200 ≤ w < 1500	6	5	4	9
	w ≥ 1500	8	7	6	12

Flatness tolerance for steels with minimum specified yield strength $260 \text{ MPa} \leq R_{p0.2} \leq 360$ MPa and for DX51D and S550GD degrees

10

Tolerance class	Nominal width w	Maximum wave height for nominal thickness t			
		t < 0.7	0.7 ≤ t < 1.6	1.6 ≤ t < 3.0	3.0 ≤ t ≤ 6.5
Normal	w < 1200	13	10		18
	1200 ≤ w < 1500	15	13		25
	w ≥ 1500	20	19		28
Special (FS)	w < 1200	8	6	5	9
	1200 ≤ w < 1500	9	8	6	12
	w ≥ 1500	12	10	9	14

Tolerances by size and shape



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Out-of-square tolerance

11

The **out-of-square (u)** is the orthogonal projection of the transverse side along the longitudinal side (see Figure 1).

Out-of-square must not exceed 1% of the sheet width.

Lapping tolerance

12

The **lapping (q)** is the maximum distance between the longitudinal edge and a reference straight side (see Figure 1).

The lapping should be measured on the concave side. The base of the measurement should be 2 meters, taken on any point on the concave edge.

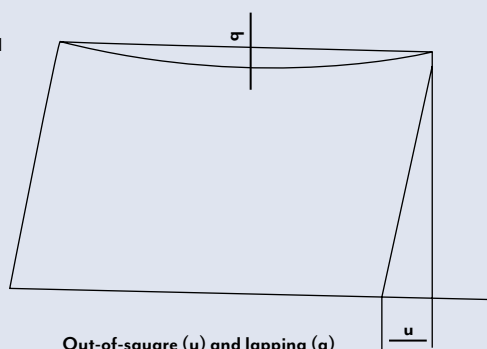
If the metal sheet has a length of less than 2 meters, the base of the measurement should be equal to its length.

Lapping should not exceed 5 mm over a length of 2 meters. For lengths of less than two meters, the lapping should not exceed 0.25 percent of the length itself.

For strips less than 600 mm wide, a special lapping tolerance (CS) of maximum 2 mm on a length of 2 meters can be specified.

This special tolerance is not applicable to strips with minimum yield strength $R_{p0.2} \geq 280$ MPa.

Figure 1



Out-of-square (u) and lapping (q)