ELECTROGALVANIZED

USIMINAS

USIMINAS

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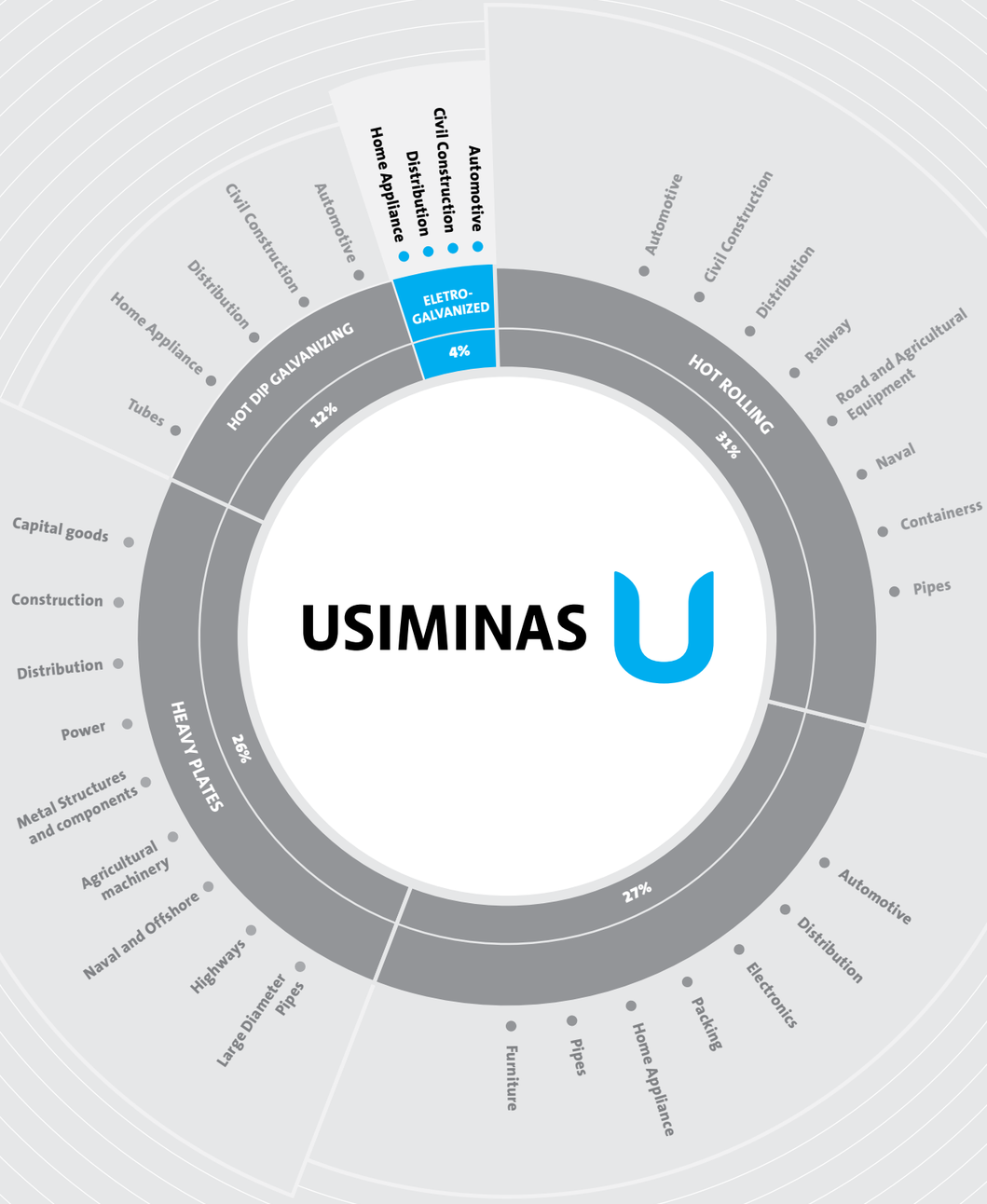


COMPLETE **SOLUTIONS IN STEEL**

WHEN THE STEEL IS FROM USIMINAS, QUALITY COMES FIRST.

Usiminas is a leading producer of flat steel in the Americas. There are units in six states of the country working on an integrated basis to deliver differentiated products and services.

A broad portfolio – from plates to coated steel - adds value to various strategic sectors of the economy, such as automotive, marine, oil and gas, civil construction, machinery and equipment, home appliance, distribution, among others.

They are innovative steels, developed in line with market trends, from Usiminas' historical vocation to technological research.

In the segment of **Cold Rolled Steel**, Usiminas offers a wide range of products to its customers, which cover from the simplest to last generation of Advanced High Strength Steels, AHSS, having the phase transformation as its main mechanism of hardening.

As the base of everything, a team trained to make steel more than a product, a solution.

ELECTROGALVANIZED STEEL

Electrogalvanized steels are cold-rolled steel, coated with a uniform, adherent layer of zinc crystals. The steel obtained by this process shows excellent atmospheric corrosion resistance, besides having excellent painting behavior .

The dimensions available are 0.40 mm to 2.00 mm thick and 750 mm to 1,650 mm wide and are supplied in the form of coils or sheets.

The electrolytic galvanizing line can provide products that are coated on one or both sides. If applied on two sides, the layer mass can be equal or differentiated.

Layer mass

- 1 side: 20 g/m² to 140 g/m²²
- 2 sides (same weight per side): 20/20 g/m² to 70/70 g/m²
- 2 sides (differentiated weight per side): upper side + lower side < 140 g/m²

Another supply option, electrogalvanized steel may be produced with phosphating post-treatment. The phosphate layer functions as a solid lubricant, reducing sheet/tooling friction, thereby contributing to improved forming performance.

The best performance of the electrogalvanized product, regarding atmospheric corrosion resistance, is achieved in association with the appropriate painting procedure.

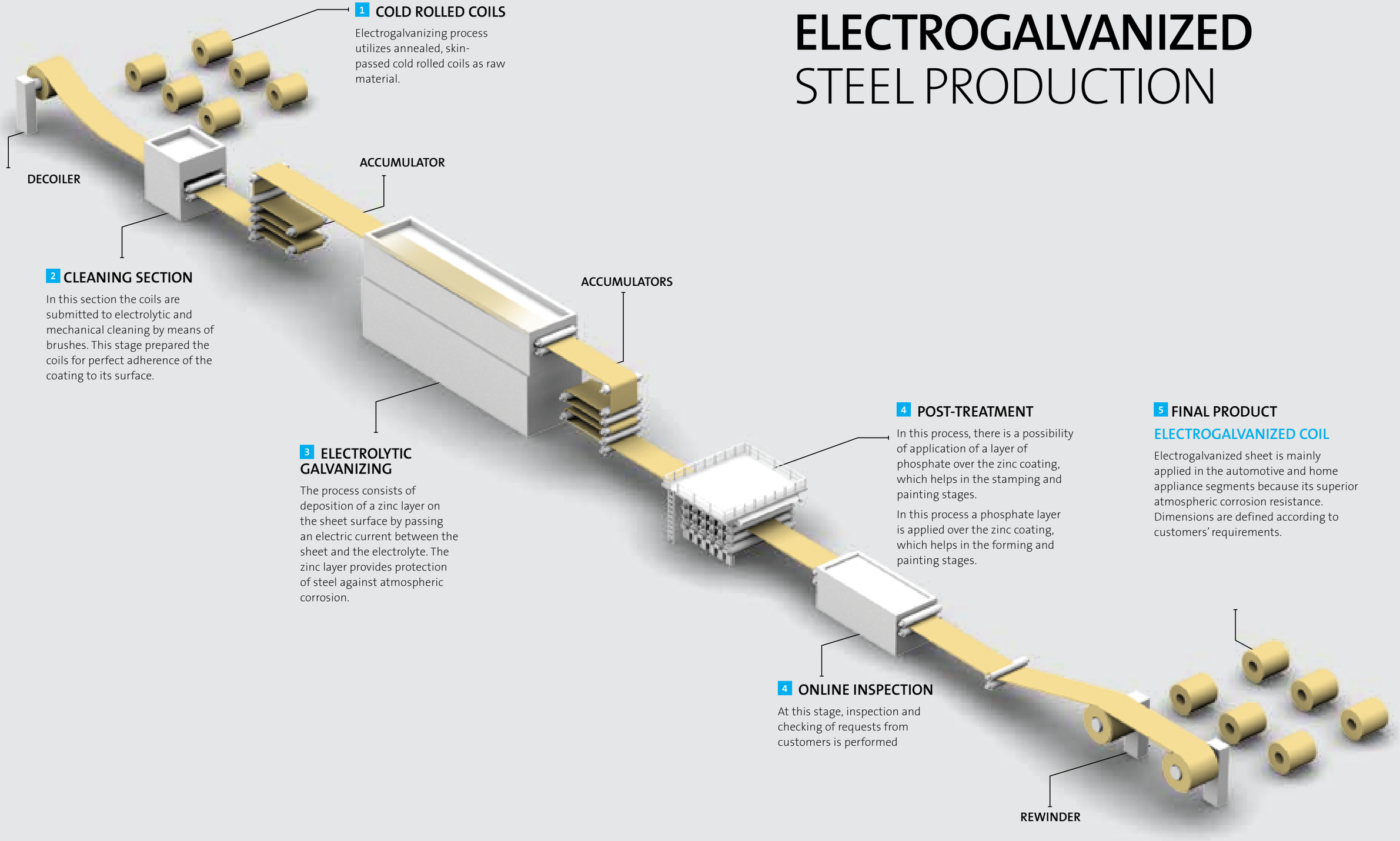
STANDARDS AND SPECIFICATIONS

Usiminas supplies materials with each customer's specifications or specific standards, with the most commercial ones being:

Usiminas	USI
American Society for Testing and Materials	ASTM
European Standard	EN
Japanese Industrial Standard	JIS
Brazilian Standard	NBR
Society of Automotive Engineers	SAE

This catalogue describes electrogalvanized steel by its chemical and mechanical characteristics, produced according to Usiminas' specifications, and national and international standards. However, the catalogue brings only basic information of the standards, which are not sufficient to completely describe the product. Thus, customer detailing is necessary when opting for one of them.

ELECTROGALVANIZED
STEEL PRODUCTION



1 COLD ROLLED COILS

Electrogalvanizing process utilizes annealed, skin-passed cold rolled coils as raw material.

2 CLEANING SECTION

In this section the coils are submitted to electrolytic and mechanical cleaning by means of brushes. This stage prepared the coils for perfect adherence of the coating to its surface.

3 ELECTROLYTIC GALVANIZING

The process consists of deposition of a zinc layer on the sheet surface by passing an electric current between the sheet and the electrolyte. The zinc layer provides protection of steel against atmospheric corrosion.

4 POST-TREATMENT

In this process, there is a possibility of application of a layer of phosphate over the zinc coating, which helps in the stamping and painting stages.

In this process a phosphate layer is applied over the zinc coating, which helps in the forming and painting stages.

4 ONLINE INSPECTION

At this stage, inspection and checking of requests from customers is performed

5 FINAL PRODUCT

ELECTROGALVANIZED COIL

Electrogalvanized sheet is mainly applied in the automotive and home appliance segments because its superior atmospheric corrosion resistance. Dimensions are defined according to customers' requirements.

COMMERCIAL GRADE STEEL

These include steels with guarantee of chemical composition, with no mechanical property restrictions.

Their use is indicated where only corrosion resistance is necessary and forming are not a main requirement such as civil construction, small pipes, home appliance and general use. When specified, hardness in ranges can be guaranteed.

(1) There is no specification for the Al, Si, N, and B elements; however, their contents must be reported.
(2) When the application requires aluminum-killed steel, the grade may be manufactured with a minimum 0.01% Al content.
(3) If the Cu content is specified, this is the minimum value allowed. If the Cu content is specified, this is the maximum value allowed.
(4) At Usiminas' discretion, the maximum 0.025% p/p Cr is optional, provided that C is < 0.05%.
(5) For steels with C > 0.02%, at Usiminas' discretion, the maximum Ti must be 0.025% or calculated by the formula 3.4N + 1.5S.
(6) When the Cu content is specified, a 0.20% minimum is usually the value used.
(7) For the 1006 and 1008 grades applied to structural profiles, strips, welded plates and tubes, the maximum Mn content shall be, respectively, 0.45% p/p and 0.50%, without any minimum value.
(8) The presented mechanical properties are not mandatory and are intended to simply guide the customer as to the steel specification appropriate to his needs. Values outside these ranges may occur.

Standard	Grade	Thickness Range (mm	Chemical Composition (% p/p)						Mechanical Propertie					
			C	Mn	Al	P	S	Other	Tensile Test Direction	YS (MPa)	Elongation			
											Thickness (mm)	GL (mm)	% min	Hardness (HRB)
Usiminas	USIGALVE-QC	0.40 ~ 2.00	0.15 max.	0.60 max.	-	0.040 max.	0.40 max.	-	-	-	-	-	-	-
	USIGALVE-QC-40													40~55
	USIGALVE-QC-45													45~60
	USIGALVE-QC-50													50~65
ASTMA879 (2012)	CS-A (1) (8)		0.10 max.	0.60 max.	(2)	0.030 max.	0.035 max.	Cu: 0.20 (3) Ni: 0.20 max. Cr: 0.15max. (4) Mo: 0.06 max. V: 0.008 max. Nb: 0.008 max. Ti: 0.025 max. (5)	Longitudinal	140~275	-	50	30	-
	CS-B (1) (8)		0.02 ~ 0.15			0.10 max.								
	CS-C (1) (8)		0.08 max.											
JISG3313 (2010)	SECC		0.15 max.	0.60 max.	-	0.10 max.	0.050 max.	-	-	-	0.40 < E < 0.60	50	34	-
											0.60 < E < 1.0		36	
											1.0 < E < 1.6		37	
											1.6 < E < 2.50		38	
											E > 2.50		39	
SAEJ403 (2009)	1006 (7)		0.08 max.	0.25 ~ 0.40	-	0.030 max.	0.050 max.	(6)	-	-	-	-	-	-
	1008 (7)		0.10 max.	0.30 ~ 0.50										
	1010 (7)		0.08 ~ 0.13	0.30 ~ 0.60										
NBR6658 (2009)			0.15 max.	0.60 max.	-	0.040 max.	0.050 max.	-	-	-	-	-	-	-

DRAWING STEEL

This steel can be supplied with low carbon (with no alloying elements added) or as ultra-low carbon (with addition of titanium and/or niobium) for fixing carbon and nitrogen.

Drawing electrogalvanized steels are supplied with guarantee of mechanical properties, with values of yield strength (YS), tensile strength (TS) and elongation (E) being specified. For steel with greater formability requirements, minimum values of anisotropy (r) and strain hardening (n) coefficients are specified.

Their use is preferably indicated for medium to extra-critical stamping processes where ductility and atmospheric corrosion resistance are required. This steel is used in the automotive industry, home appliance, civil construction, among others.

Standard	Grade	Thickness Range (mm)	Chemical Composition (% p/p)						Mechanical Properties (3)									
			C	Mn	Al	P	S	Other	Tensile Test Direction	Thickness (mm)	YS (MPa)	TS (MPa)	Elongation			R	n	Hardness (HRB)
													Thickness (mm)	GL (mm)	% min			
Usiminas	USIGALVE-EM	0.40 ~ 2.00	0.12 max.	0.50 max.	-	0.040 max.	0.040 max.	-	Transversal	-	-	390 max.	≤ 0.60	50	30	-	-	65 max. (10)
													> 0.60		31			
	USIGALVE-EP	0.45 ~ 2.00	0.10 max.	0.45 max.	-	0.030 max.	0.030 max.	-		< 0.90	280 max.	370 max.	≤ 0.60		34			57 max. (10)
										≥ 0.90	260 max.		> 0.60		35			
	USIGALVE-EEP		0.08 max.		0.020 min.	0.025 max.	0.025 max.	-		-	130 ~ 230	350 max.	≤ 0.60		36			50 max. (10)
	USIGALVE-EEP-PC	0.60 ~ 2.00	0.06 max.	0.35 max.	0.020 ~ 0.090	0.020 max.	0.020 max.	-		-	130 ~ 200	250 ~ 350	> 0.60		37			
	USIGALVE-IF		0.02 max.		0.010 min.		0.020 max.	Ti: 0.300 max.		-	140 ~ 180	270 ~ 350	-		39	2.1 min. (7)	0.22 min. (7)	
ASTMA879 (2012)	DS-A (2) (11)	0.40 ~ 2.00	0.08 max.	0.50 max.	0.01 min.	0.020 max.	0.030 max.	Cu: 0.20 min. Mo: 0.06 max. V: 0.008 max. Nb: 0.008 max. Ti: 0.025 max. (4) Ni: 0.20 max. Cr: 0.15 max. (3)	Longitudinal	-	150 ~ 240	-	-	50	36	1.3 ~ 1.7 (1)	0.17 ~ 0.22 (1)	-
	DS-B (2) (11)		0.02 ~ 0.08		0.02 min.													
	DDS (2) (11)		0.06 max.		0.01 min.		0.025 max.				115~200				38	1.4 ~ 1.8 (1)	0.20 ~ 0.25 (1)	
	EDDS (2) (11)		0.02 max.	0.40 max.			0.020 max.	(5)			105 ~ 170				40	1.7 ~ 2.1 (1)	0.23 ~ 0.27 (1)	

CONTINUED

Standard	Grade	Thickness Range (mm)	Chemical Composition (% p/p)						Mechanical Properties (3)										
			C	Mn	Al	P	S	Other	Tensile Test Direction	Thickness (mm)	YS (MPa)	TS (MPa)	Elongation			R	n	Hardness (HRB)
													Thickness (mm)	GL (mm)	% min			
EN10152 (2003)	DC01+ZE	0.40 ~ 2.00	0.12 max.	0.60 max.		0.045 max.	0.045 max.		Transversal	≤ 0.50	140 ~ 320	270 ~ 410	≤ 0.50	80	24	-	-	-
										0.50 < E ≤ 0.70	140 ~ 300		0.50 < E ≤ 0.70		26			
										> 0.70	140 ~ 280		> 0.70		28			
	DC03+ZE	0.45 ~ 2.00	0.10 max.	0.45 max.		0.035 max.	0.035 max.			≤ 0.50	140 ~ 280	270 ~ 370	≤ 0.50		30	1.3 min. (7) (9)	-	
										0.50 < E ≤ 0.70	140 ~ 260		0.50 < E ≤ 0.70		32			
										> 0.70	140 ~ 240		> 0.70		34			
	DC04+ZE		0.08 max.	0.40 max.	-	0.030 max.	0.030 max.	-		≤ 0.50	140 ~ 260	270 ~ 350	≤ 0.50		33	1.6 min. (7) (9)	0.16 min. (7) (9)	-
										0.50 < E ≤ 0.70	140 ~ 240		0.50 < E ≤ 0.70		35			
										> 0.70	140 ~ 220		> 0.70		37			
	DC05+ZE	0.60 ~ 2.00	0.06 max.	0.35 max.		0.025 max.	0.025 max.			≤ 0.50	140 ~ 230	270 ~ 330	≤ 0.50		33	1.9 min. (7) (9)	0.19 min. (7) (9)	
										0.50 < E ≤ 0.70	140 ~ 210		0.50 < E ≤ 0.70		35			
										> 0.70	140 ~ 190		> 0.70		37			
	DC06+ZE		0.02 max.	0.25 max.		0.020 max.	0.020 max.	Ti: 0.3 max. (6)		≤ 0.50	120 ~ 230	270 ~ 350	≤ 0.50		37	1.8 min. (1) (9)	0.20 min. (1) (9)	
										0.50 < E ≤ 0.70	120 ~ 210		0.50 < E ≤ 0.70		39			
										> 0.70	120 ~ 190		> 0.70		41			
	SECCT		0.15 max.	0.60 max.		0.10 max.	0.050 max.						0.40 ≤ E < 0.60		34			
													0.60 ≤ E < 1.00		36			
													1.00 ≤ E < 1.60		37			
													1.60 ≤ E < 2.00		38			
JISG3313 (2010)	SECD	0.40 ~ 2.00	0.12 max.	0.50 max.	-	0.040 max.	0.040 max.	-	Longitudinal	-	-	270 mín.	0.40 ≤ E < 0.60	50	36	-	-	-
													0.60 ≤ E < 1.00		38			
													1.00 ≤ E < 1.60		39			
													1.60 ≤ E < 2.00		40			
	SECE		0.10 max.	0.45 max.		0.030 max.	0.030 max.						0.40 ≤ E < 0.60		38			
													0.60 ≤ E < 1.00		40			
													1.00 ≤ E < 1.60		41			
													1.60 ≤ E < 2.00		42			
NBR5915 (2013)	EM	0.40 ~ 2.00	0.12 max.	0.60 max.	0.010 min.	0.030 max.	0.030 max.	-	Transversal	≤ 0.50	140 ~ 320	270 ~ 390	≤ 0.50	50	26	-	-	65 max. (10)
										0.50 < E ≤ 0.70	140 ~ 300		0.50 < E ≤ 0.70		28			
										> 0.70	140 ~ 280		> 0.70		30			
	EP	0.45 ~ 2.00	0.10 max.	0.45 max.						≤ 0.50	140 ~ 300	270 ~ 370	≤ 0.50		31	1.3 min (7) (9)	0.16 min (7) (9)	57 max. (10)
										0.50 < E ≤ 0.70	140 ~ 280		0.50 < E ≤ 0.70		33			
										> 0.70	140 ~ 260		> 0.70		35			
	EEP Grau 1		0.08 max.							≤ 0.50	140 ~ 270	270 ~ 350	≤ 0.50		34	1.7 min (7) (9)	0.19 min. (7) (9)	50 max. (10)
										0.50 < E ≤ 0.70	140 ~ 250		0.50 < E ≤ 0.70		36			
										> 0.70	140 ~ 230		> 0.70		38			
	EEP Grau 2	0.60 ~ 2.00	0.06 max.			0.025 max.				≤ 0.50	140 ~ 250	270 ~ 350	≤ 0.50		35	1.9 min (7) (9)	0.20 min. (7) (9)	
										0.50 < E ≤ 0.70	140 ~ 230		0.50 < E ≤ 0.70		37			
										> 0.70	140 ~ 210		> 0.70		39			
	EEP Grau 3		0.007 max.	0.35 max.		0.020 max.	0.020 max.	Ti: 0.20 max. (8)		0.60 < E ≤ 0.70	140 ~ 200	270 min.	0.60 < E ≤ 0.70		38	2.1 min (7) (9)	0.22 min. (7) (9)	48 max. (10)
										> 0.70	140 ~ 180		> 0.70		40			

(1) Average value of test performed in three directions.
(2) There is no specification for the Si, N, and B elements; however, their contents must be reported.
(3) At Usiminas' discretion. the maximum 0.025% Cr is optional, provided that C is < 0.05% p/p.
(4) For steels with C > 0.02%, at Usiminas' discretion, the maximum Ti must be 0.025% or calculated by the formula 3.4N + 1.5S.
(5) Maximum specified contents (% p/p): Cu: 0.10/ Ni: 0.10/ Cr: 0.15/ Mo: 0.03/ V: 0.10/ Nb: 0.10/ Ti: 0.15.
(6) Ti may be replaced by Nb; C and N should be completely stabilized.
(7) Value measured in the transverse direction.
(8) Nb can also replace Ti, totally or in part. In this case, the maximum allowed value for the Ti and Nb content sum will be 0.30% p/p.
(9) The r and n values are only valid for product thickness > 0.50mm.
(10) Hardness values for information only and they may be guaranteed by prior arrangement.
(11) The presented mechanical properties are not mandatory and are intended to simply guide the customer as to the steel specification appropriate to his needs. Values outside these ranges may occur.

BAKE HARDENING STEEL

Its main characteristic is increased mechanical strength observed after paint baking. It futures high strain aging hardenability by deformation at a temperature range of 100°C to 200°C, in addition to moderate to deep drawing characteristics, and atmospheric corrosion resistance.

Bake hardening steel is used in the automotive industry, mainly in closing panels, such as hoods, trunk lids, doors and fenders, providing good dent resistance to the part, even with low formability levels, which are typical of these parts.

Standard	Grade	Thickness Range (mm)	Chemical Composition (% p/p)						Tensile Test Direction	Mechanical Properties							
			C	Mn	Al	P	S	Other		YS (MPa)	TS (MPa)	Elongation			r	n	Min. value BH (MPa)
												Thickness (mm)	GL (mm)	% min			
Usiminas	USIGALVE-BH-180	0.60 ~ 2.30	0.040 max.	0.70 max.	0.015 min.	< 0.060 max.	0.025 max.	Si: 0.50 max.	Transversal	180 ~ 240	300 ~ 360	-	50	34	1.6 min. (4)	0.15min. (4)	30
	USIGALVE-BH-220		0.060 max.			< 0.080 max.				220 ~ 280	340 ~ 400			32	1.5 min. (4)	0.15min. (4)	
ASTMA879 (2012)	BHS180(1)		0.12 max.	1.50 max.	-	0.12 max.	0.030 max.	Cu: 0.20 (2) Ni: 0.20 max. Cr: 0.15max. Mo: 0.06 max. V: 0.008 max. (3) Nb: 0.008 max. (3) Ti: 0.008 max. (3)	Longitudinal	180 min.	300 min.	-	50	30	-	-	25
	BHS210(3)									210 min.	320 min.			28			
SAEJ2340 (1999)	210B		-	-	-	0.05 max.	0.015 max.	Cu: 0.200 max. Ni: 0.200 max. Cr: 0.150max. Mo: 0.060 max.	Longitudinal	180 min.	300 min.	-	50	-	-	0.19 min. (5)	30
										210 min.	320 min.					0.17 min. (5)	

(1) There is no specification for the Al, Si, and N elements; however, their contents must be reported.
(2) If Cu is specified, this is the minimum value allowed. If Cu is not specified, this is the maximum value allowed.
(3) For C contents < 0.02%, V, Nb, or Ti, or a combination of these, is allowed for element stabilization, at Usiminas' discretion. In these cases, the maximum limits for V and Nb shall be 0.10% and for Ti, 0.15%.
(4) Value measured in the transverse direction.
(5) Average value of test performed in three directions.

ISOTROPIC STEEL

These are medium to high strength titanium and/or boron microalloyed steels, which have good formability, even for high yield strength levels. Their isotropic characteristic allows uniform flow of the material, regardless of forming direction, reducing the effect known as earing on the forming parts.

The use of this steel allows the optimization of blank size, and gives the final parts high resistance against indentation and atmospheric corrosion. These steels are used in the automotive industry, preferably in closing panels, such as doors, hoods, trunk lids and roofs.

Standard	Grade	Thickness Range (mm)	Chemical Composition (% p/p)						Mechanical Properties								
			C	Mn	Al	P	S	Other	Tensile Test Direction	YS (MPa)	TS (MPa)	Elongation			r90	n 90	Δ R
												Thickness (mm)	GL (mm)	% min			
Usiminas	USIGALVE-220-I	0.60 ~ 2.00	0.07 max.	0.50 max.	0.015 min.	0.050 max.	0.025 max.	Ti: 0.005 min. (1)	Transversal	220 ~ 280	300 ~ 400	-	80	34	0.8 ~ 1.4	0.18min.	+/- 0.15
	USIGALVE-260-I									260 ~ 320	320 ~ 420			32		0.17min.	

(1) The B element can be used for replacing Ti, totally or in part.

MEDIUM AND HIGH STRENGTH STEEL

This series includes products that conciliate the attributes of high mechanical strength, good formability and resistance to atmospheric corrosion. Mechanical strength is obtained especially by solid solution hardening, presence of manganese and/or phosphorus. Medium and high strength steels are mainly used in the automotive industry.

(1) There is no specification for the Al, Si, and N elements; however, their results may be reported.
(2) If Cu is specified, this is the minimum value allowed. If Cu is not specified, this is the maximum value allowed.
(3) For C contents ≤ 0.02%, V, Nb, or Ti, or a combination of these, is allowed for element stabilization, at Usiminas' discretion. In these cases, the maximum limits for V and Nb shall be 0.10% and for Ti, 0.15%.

Standard	Grade	Thickness Range (mm)	Chemical Composition (% p/p)						Mechanical Properties							
			C	Mn	Al	P	S	Other	Tensile Test Direction	YS (MPa)	TS (MPa)	Elongation			r90 min.	r90 min.
												Thickness (mm)	GL (mm)	% min		
Usiminas	USIGALVE-HSS-260	0.60 ~ 2.00	0.08 max.	0.80 max.	0.015min.	<0.10 max.	0.030 max.	Si: 0.5 max.	Transversal	260 ~ 320	380 ~ 460	-	50	28	-	-
ASTMA879 (2012)	SHS180(1)	0.60 ~ 2.00	0.12 max.	1.5 max.	-	0.12 max.	0.030 max.	Cu: 0.20 (2) Ni: 0.20 max. Cr: 0.15max. Mo: 0.06 max. V:0.008 max. (3) Nb:0.008max. (3) Ti: 0.008 max. (3)	Longitudinal	180 min.	300 min.	-		32	-	-
	SHS210(1)									210 min.	320 min.			30		
	SHS240 (1)									240 min.	340 min.			26		
	SHS280 (1)									280 min.	370 min.			24		
	SHS300 (1)									300 min.	390 min.			22		
JISG3313 (2010)	SEFC340	0.60 ~ 2.00	-	-	-	-	-	-	Transversal	175 min.	340 min.	0.60 ≤ E < 1.00		34	-	-
												1.60 ≤ E ≤ 2.00		35		
	SEFC370									205 min.	370 min.	0.60 ≤ E < 1.00		32		
												1.60 ≤ E ≤ 2.00		33		
SAEJ2340 (1999)	300S	0.60 ~ 2.00	0.13 max.	-	-	0.100 max.	0.020 max.	Cu: 0.20 max. Ni: 0.20 max. Cr: 0.15 max. Mo: 0.06 max.	Longitudinal	300 ~ 400	390 min.	-		24	-	-
	340S									340 ~ 440	440 min.			22		

MEDIUM AND HIGH STRENGTH MICROALLOYED STEEL

These steels have high mechanical strength associated with adequate ductility and resistance against atmospheric corrosion. Their greatest resistance is provided by the addition of alloy elements, such as titanium and/or niobium, which, together with controlled thermo-mechanical process, promote steel hardening due to fine precipitates and ferrite grain refinement. This group of steels is suitable for vehicle parts that do not require high formability, such as structural or reinforcement parts.

The high mechanical strength allows mass reduction of vehicles if small thickness higher strength steels were introduced in substitution of low strength steels.

Standard	Grade	Thickness Range (mm)	Chemical Composition (% p/p)						Mechanical Properties					
			C	Mn	Al	P	S	Others	Tensile Test Direction	YS (MPa)	TS (MPa)	Elongation		
												Thickness (mm)	GL (mm)	% min
Usiminas	USIGALVE-HSLA-340	0.60 ~ 2.00	0.10 max.	1.30 max.	0.015 min. (1)	0.030 max.	0.025 max.	Si: 0.6 max. (1) Nb: 0.09 max. (3) Ti: 0.22 max. (3)	Transversal	340 min.	450 min.	-	50	22
	USIGALVE-HSLA-360									355 min.	420 min.			20
ASTMA879 (2012)	HSLAS310 (4)		0.22 max.	1.65 max.	-	0.040 max.	0.040 max.	Cu: 0.20 (2) Ni: 0.20 max. Cr: 0.15 max. Mo: 0.06 max. V: 0.005 min. Nb: 0.005 min. Ti: 0.005 min.	Longitudinal	310 min.	410 min.	-		22
	HSLAS340 (4)		0.23 max.							340 min.	450 min.			20
	HSLAS380 (4)		0.25 max.							380 min.	480 min.			18
	HSLAS410 (4)		0.26 max.							410 min.	520 min.			16
	HSLAS450 (4)									450 min.	550 min.			15
JISG3313 (2010)	SEFC440		-	-	-	-	-	-	Longitudinal	265 min.	440 min.	0.60 ≤ E < 1.00		26
												1.60 ≤ E ≤ 2.00		27
	SEFC490									295 min.	490 min.	0.60 ≤ E < 1.00		23
												1.60 ≤ E ≤ 2.00		24
	SEFC540									325 min.	540 min.	0.60 ≤ E < 1.00		20
												1.60 ≤ E ≤ 2.00		21
SAEJ2340 (1999)	300Y		0.13 max.	0.060 max.	-	0.060 max.	0.015 max.	V: 0.005 min. Nb: 0.005 min.	Transversal	300 ~ 400	400 min.	-		21
	340Y									340 ~ 440	440 min.			20
	380Y									380 ~ 480	480 min.			18
	420Y									420 ~ 520	520 min.			16

(1) There is no specification for the Al, Si, and N elements; however, their contents must be reported.
(2) If Cu is specified, this is the minimum value allowed. If Cu is not specified, this is the maximum value allowed.
(3) Ti and Nb may be used alone or in combination, within the aforementioned limit. However, the sum of these two elements shall not exceed 0.022%.
(4) Class 1.

DUAL PHASE STEEL

The term dual phase is related to steel microstructure, which is predominantly formed by islands of a hard martensitic phase, dispersed in a ferrite matrix. The presence of these constituents and their respective volumetric fractions in the microstructure directly influence the mechanical properties of these steels. This structure provides excellent ductility, high strain hardening, (WH effect – work hardening) and painting cure (BH effect – bake hardening effect).

They are especially recommended in the automotive industry for structural and reinforcement parts, providing weight reduction through thickness reduction. They have exceptional impact absorption capacity due to their high ductility/resilience.

However, the lower mechanical grades can be applied in cover panels of vehicles with noteworthy denting resistance.

Standard	Grade	Thickness Range (mm)	Chemical Composition (% p/p)						Mechanical Properties					
			C	Mn	Si	P	S	Other	Tensile Test Direction	YS (MPa)	TS (MPa)	Elongation		
												Thickness (mm)	GL (mm)	% min
Usiminas	USIGALVE-DP-450	0.80 ~ 2.00	0.15 max.	2.50 max.	2.0 max.	0.09 max	0.040 max.	-	Transversal	250 ~ 330	450 min.	-	80	27
	USIGALVE-DP-590									305 ~ 450	590 min.			20
	USIGALVE-DP-780	0.80 ~ 1.80	0.18 max.	3.30 max.						380 ~ 580	780 min.			13
	USIGALVE-DP-980 (1)		0.23 max							550 ~730	980 min.			8

(1) Available on request.

TRIP STEELS
TRANSFORMATION INDUCED PLASTICITY

Trip steel is a product that combines high mechanical strength and high formability. Its characteristics are assigned to a typical microstructure consisting of a ferritic matrix containing a distribution of bainite, martensite and retained austenite. When deformed, retained austenite is transformed into martensite, which is responsible for higher formability. Another feature of this material, in addition to excellent ductility and corrosion resistance, is the increase in mechanical strength due to bake hardenability.

The high elongation and the homogeneous strain hardening coefficient, n, in the sheet plane allow the blank be positioned in any direction of sheet without adversely affecting application.
They are especially suitable for the automotive industry, for structural and reinforcement parts providing reduction in weight through the reduction in thickness, as well as remarkable ability of impact absorption, due to its high ductility.

Standard	Grade	Thickness Range (mm)	Chemical Composition (% p/p)					Mechanical Properties					
			C	Mn	Si	P	S	Tensile Test Direction	YS (MPa)	TS (MPa)	Elongation		
											Thickness (mm)	GL (mm)	% min
Usiminas	USIGALVE -TRIP -780 (1)	1.00 ~ 1.80	0.30 max.	2.50 max.	2.20 max.	0.090 max.	0.015 max.	Longitudinal	440 ~ 560	780 min.	-	80	20 min.

(1) Available on request.

FINISHING **AND SUPPLY CONDITIONS**

SURFACE FINISHING

The surface aspect of the products should be defined according to the options below, as per standard NBR11888.

GRADE A SURFACE: adequate for very demanding applications, for example, in exposed parts.

GRADE B SURFACE: adequate for less demanding applications, also for exposed parts.

GRADE C SURFACE: normally recommended for applications with lesser demand of surface aspect of the steel sheet, such as in non-exposed parts and general applications.

TYPE OF OILING

Cold rolled products are supplied oiled to avoid atmospheric corrosion. Protective oils used are: Solvent Base, Oil Base or Prelube, which aids in the drawing/stamping process and DOS, that can be painted after baking with no need for degreasing. According to the customer's need, different amounts of oil can be applied. Please consult Usiminas for further clarifications.

EDGE FINISHING

Products can be supplied with or without sheared edges in the finishing lines.

TYPES OF PACKING AND IDENTIFICATION

Usiminas has diverse types of packing, either for supply products such as sheets or coils. Consult Usiminas for further information.

DIMENSIONAL TOLERANCES

Usiminas guarantees dimensional limits under several specifications, such as Standards NBR11888, ASTMA568/A924 and EN10131. Consult Usiminas for further information.

OTHER

Dimensional precision, shape and other specifications not contained in the standards adopted should also be mentioned in the order.

USEFUL INFORMATION
ON USAGE

STOCKING AND SHIPPING

- The storage of steel coils or sheets bundles should be made in the appropriate place, with use of supports or pallets in good condition, avoiding denting which may damage the coil or sheet surface. Piling of coils is not recommended when the specified surface condition is A or B.

- Contact with water during storage or shipping can cause white and/or red rust in cold rolled products. Thus, handling of these products in the rain, or under conditions when condensation may occur should be avoided. Preferentially, the storage place should have low relative humidity (lower than 60% is recommended), with good air circulation and with low particulate/ hygroscopic/acid substances in the air

- Damaged packaging should be immediately repaired.

- In case of contact with water, the sheet should be immediately dried and used as quickly as possible.

- Very long storage time associated with high environment temperatures may, for certain products, alter mechanical properties.

DEGREASING OPERATIONS

The use of neutral or slightly alkaline degreasing agents is recommended. Specific organic solvents may also be used for sheet degreasing.

HANDLING DURING FORMING OPERATIONS

- The sheets should be carefully handled in such a way as to avoid surface damage that impedes their application.

- The presence of sweat or fingerprints may alter the surface of drawn parts, making painting difficult. Thus, the use of gloves for sheet handling is recommended

- Some types of additives in stamping lubricants can cause corrosion of the zinc layer. Therefore, it is necessary to evaluate the compatibility of the stamping lubricant with electro galvanized sheets. If the use of non-compatible additives is inevitable, they should immediately be degreased with suitable products and subjected to phosphating process.

USIMINAS

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