HOT STRIPS

USIMINAS

USIMINAS

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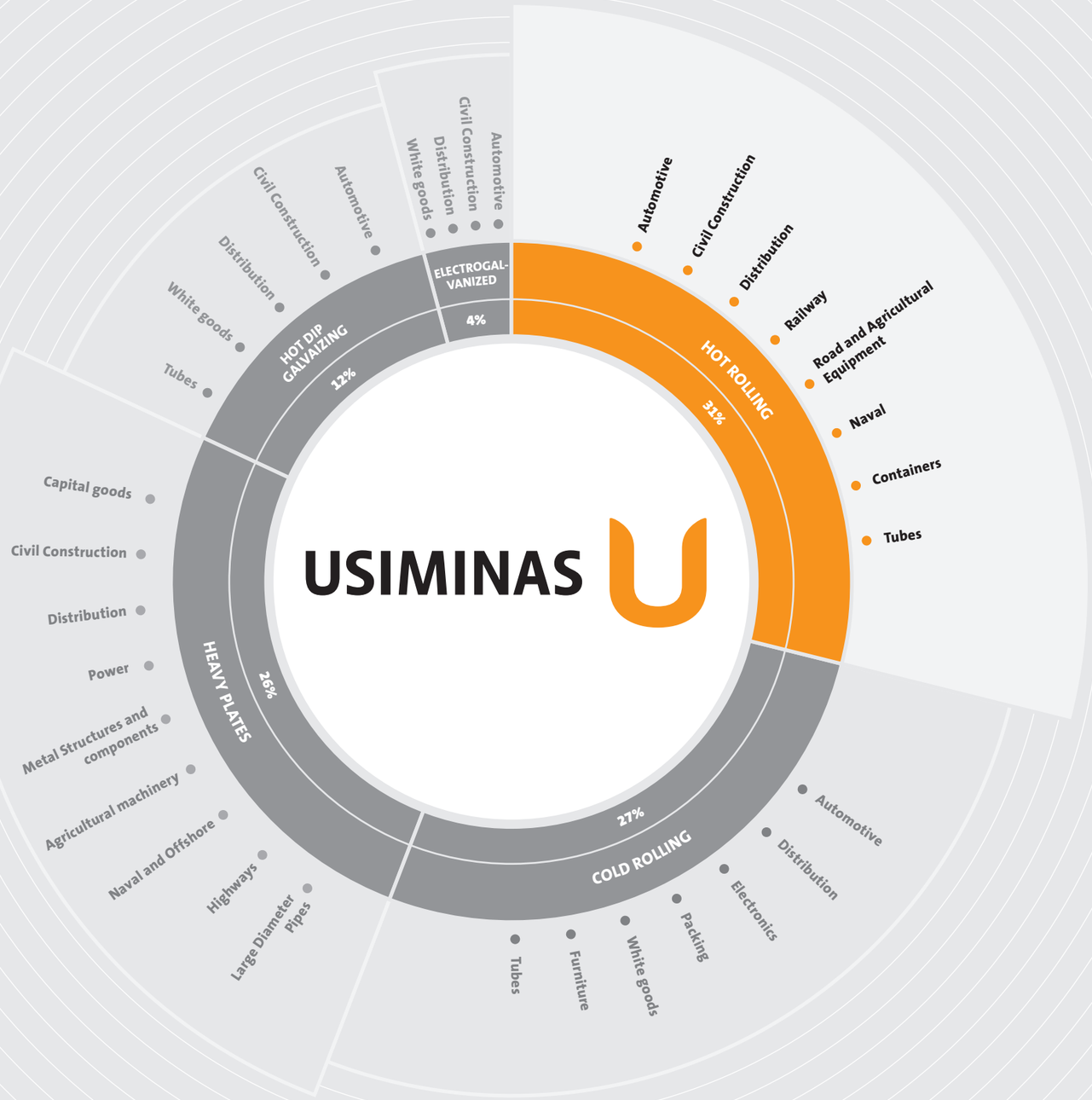


COMPLETE **SOLUTIONS IN STEEL**

WHEN THE STEEL IS FROM USIMINAS, QUALITY COMERS 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, white goods, distribution, among others.

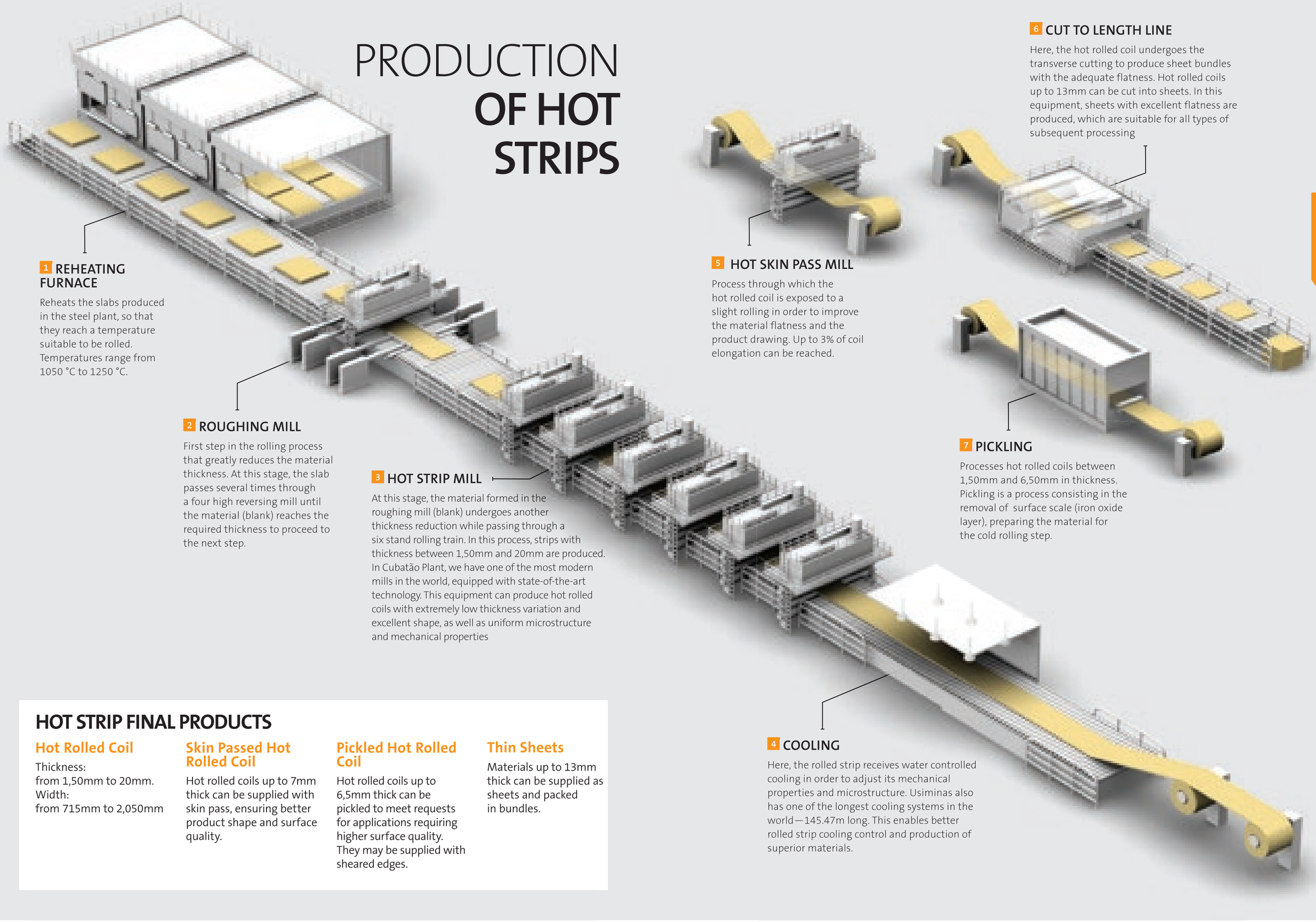
They are innovative steels, developed in line with market trends, from Usiminas' historical vocation to technological research.

The lines of **Hot Strips** from Usiminas have modern equipment that ensure the supply of products with the characteristic of flatness, and proper mechanical properties, according to the final application.

One example of this is the Hot Strip Mill of Cubatão Plant. The equipment, one of the most modern in the world is responsible for producing a wide range of coils dimensions, with thickness up to 20mm and width up to 2.050mm. It has a production capacity of 2.3 million tons/year, and allows the supply of products aimed at markets of higher added value.

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

PRODUCTION **OF HOT STRIPS**



1 REHEATING FURNACE

Reheats the slabs produced in the steel plant, so that they reach a temperature suitable to be rolled. Temperatures range from 1050 °C to 1250 °C.

2 ROUGHING MILL

First step in the rolling process that greatly reduces the material thickness. At this stage, the slab passes several times through a four high reversing mill until the material (blank) reaches the required thickness to proceed to the next step.

3 HOT STRIP MILL

At this stage, the material formed in the roughing mill (blank) undergoes another thickness reduction while passing through a six stand rolling train. In this process, strips with thickness between 1,50mm and 20mm are produced. In Cubatão Plant, we have one of the most modern mills in the world, equipped with state-of-the-art technology. This equipment can produce hot rolled coils with extremely low thickness variation and excellent shape, as well as uniform microstructure and mechanical properties

4 COOLING

Here, the rolled strip receives water controlled cooling in order to adjust its mechanical properties and microstructure. Usiminas also has one of the longest cooling systems in the world—145.47m long. This enables better rolled strip cooling control and production of superior materials.

5 HOT SKIN PASS MILL

Process through which the hot rolled coil is exposed to a slight rolling in order to improve the material flatness and the product drawing. Up to 3% of coil elongation can be reached.

6 CUT TO LENGTH LINE

Here, the hot rolled coil undergoes the transverse cutting to produce sheet bundles with the adequate flatness. Hot rolled coils up to 13mm can be cut into sheets. In this equipment, sheets with excellent flatness are produced, which are suitable for all types of subsequent processing

7 PICKLING

Processes hot rolled coils between 1,50mm and 6,50mm in thickness. Pickling is a process consisting in the removal of surface scale (iron oxide layer), preparing the material for the cold rolling step.

HOT STRIP FINAL PRODUCTS

Hot Rolled Coil

Thickness:
from 1,50mm to 20mm.
Width:
from 715mm to 2,050mm

Skin Passed Hot Rolled Coil

Hot rolled coils up to 7mm thick can be supplied with skin pass, ensuring better product shape and surface quality.

Pickled Hot Rolled Coil

Hot rolled coils up to 6,5mm thick can be pickled to meet requests for applications requiring higher surface quality. They may be supplied with sheared edges.

Thin Sheets

Materials up to 13mm thick can be supplied as sheets and packed in bundles.

GENERAL USE STEEL

A category composed of carbon-manganese type steel, without the addition of any alloy elements with chemical composition guarantee.

Specification (*)	Grade	Thickness range (mm)	Chemical composition (%)			
			C	Mn	P	S
SAE-J403 (2009)	1006	1.50~20.00	0.08 máx.	0.45 máx.	0.030 máx.	0.050 máx.
	1008		0.10 máx.	0.50 máx.		
	1009		0.15 máx.	0.60 máx.		
	1010		0.08~0.13	0.30~0.60		
	1012		0.10~0.15			
	1015		0.13~0.18			
	1017		0.15~0.20			
	1019		0.15~0.20	0.70~1.00		
	1020		0.18~0.23	0.30~0.60		
	1021			0.60~0.90		
	1022			0.70~1.00		
	1023		0.20~0.25	0.30~0.60		
	1025		0.22~0.28	0.30~0.60		
	1026		0.22~0.28	0.60~0.90		
	1030		0.28~0.34	0.60~0.90		
	1035		0.32~0.38	0.60~0.90		
	1040		0.37~0.44	0.60~0.90		
	1045		0.43~0.50	0.60~0.90		
	1050	2.00~12.70	0.48~0.55	0.60~0.90		
	1524		0.19~0.25	1.35~1.65		

NOTE:
* Standard quoted for reference only. For additional information, refer to the standard or contact our sales team.

STRUCTURAL STEEL

These are steels with guarantee of chemical composition and mechanical properties used in bridges, sheds, transmission towers, truck buckets, metal structures used in civil works, and general equipment components for the primary industry. Materials with good cutting, bending, and weldability characteristics applied to structural components.

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical properties								
									Tensile Test			Elongation			Bending a 180°	Charpy-V	
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.		Temp. (°C)	Absorbed Energy (J)
USI-CIVIL	300	1.50 ~ 20.00	0.25 máx.	1.35 máx.	1.50 máx.	0.060 máx.	0.020 máx.	-	Transversal	300 mín.	400 ~ 550	1.50 ~ 5.00	50	22	-		
												5.01 ~ 20.00	200	18			
	350		0.20 máx.	0.60 ~ 1.35						350 mín.	500 ~ 650	2.00 ~ 20.00	200	16 (1)			
USI-SAR	50 (2)	2.00 ~ 13.00	0.18 máx.	≤ 1.50	0.10 ~ 0.55	0.030 máx.	0.030 máx.	Nb+V ≤ 0.12	Longitudinal	330 mín.	500 ~ 620	2.00 ~ 5.00	50	20	2.0 E		
												5.01 ~ 13.00	200	17			
	55 (2)			1.20 ~ 1.50	0.55 máx.	0,035 máx.	0.040 máx.			380 mín.	550 ~ 630	2.00 ~ 5.00	50	19			
												5.01 ~ 13.00	200	15			
	60 (2)			0.90 ~ 1.50		0.030 máx.	0.030 máx.			460 mín.	600 ~ 720	2.00 ~ 5.00	50	18	3.0 E		
												> 5.00	200				
ASTM-A-36 (2012)	-	4.57 ~ 13.00	0.25 máx.	-	0.40 máx.	0.040 máx.	0.050 máx.	-	Transversal	250 mín.	400 ~ 550	4.57~13.00	200	22 (1)	-	-	
ASTM-A-283 (2013)	C	4.57 ~ 13.00	0.24 máx.	0.90 máx.	0.40 máx.	0.030 máx.	0.030 máx.	-	Transversal	205 mín.	380 ~ 515	4.57 ~ 13.00	200	18 (1)	-		
	D		0.27 máx.							230 mín.	415 ~ 550			20 (1)			
ASTM-A-572 (2013)	42	4.57 ~ 9.53	0.21 máx.	0.50 ~ 1.35 (3)	0.40 máx.	0.040 máx.	0.050 máx.	Tipo 01: Nb 0.005~0.050 Tipo 02: V 0.10~0.150	Transversal	290 mín.	415 mín.	-	200	18 (1)	-		
		9.54 ~ 10.00		0.80 ~ 1.35 (3)											-		
	50	4.57 ~ 9.53	0.23 máx.	0.50 ~ 1.35 (3)	0.40 máx.	0.040 máx.	0.050 máx.			345 mín.	450 mín.	-		16 (1)			
		9.54 ~ 10.00		0.80 ~ 1.35 (3)													
	65	4.57 ~ 9.53		0.50 ~ 1.35	0.40 máx.	0.040 máx.	0.050 máx.	Tipo 01: Nb 0.005 ~ 0.050 Tipo 02: V 0.10~0.150	Transversal	450 mín.	550 mín.	4.57 ~ 10.00	200	12 (1)	-		
		9.54 ~ 10.00		0.80 ~ 1.65								200	200				

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Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical properties								
									Tensile Test			Elongation			Bending a 180°	Charpy-V	
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.		Temp. (°C)	Absorbed Energy (J)
ASTM-A-1011 (2014)	SS30	1.50 ~ 5.84	0.25 máx.	0.90 máx.	-	0.035 máx.	0.040 máx.	-	Longitudinal	205 mín.	340 mín.	E ≤ 2.46	50	24	-	-	-
												E > 2.46		25			
													200	19			
	SS33									230 mín.	360 mín.	E ≤ 2.46	50	22			
												E > 2.46		23			
													200	18			
	SS36-1									250 mín.	365 mín.	E ≤ 2.46	50	21			
												E > 2.46		22			
													200	16			
	SS36-2			1.35 máx. (4)						250 mín.	400~550	E ≤ 2.46	50	20			
												E > 2.46		21			
													200	16			
	SS40			0.90 máx.						275 mín.	380 mín.	E ≤ 2.46	50	20			
												E > 2.46		21			
													200	16			
	SS45-1			1.35 máx. (4)						310 mín.	410 mín.	E ≤ 2.46	50	18			
												E > 2.46		19			
													200	14			
	SS50									340 mín.	450 mín.	E ≤ 2.46	50	16			
												E > 2.46		17			
													200	12			
	HSLAS45	2.00 ~ 5.84	0.22 máx.	1.35 máx. (4)	-	0.040 máx.	0.040 máx.	V ou Nb ou Ti: 0.005 mín.		310 mín.	410 mín.	E ≤ 2.46	50	23			
												E > 2.46		25			
	HSLAS-50-1		0.23 máx.							340 mín.	450 mín.	E ≤ 2.46	50	20			
												E > 2.46		22			
	HSLAS-55-1		0.25 máx.							380 mín.	480 mín.	E ≤ 2.46	50	18			
												E > 2.46		20			
	HSLAS-60-1		0.26 máx.	1.50 máx.						410 mín.	520 mín.	E ≤ 2.46	50	16			
												E > 2.46		18			
ASTM-A-1018 (2010)	SS30	5.85 ~ 20.00	0.25 máx.	1.50 máx.	-	0.035 máx.	0.040 máx.	-	Transversal	205 mín.	340 mín.	-	50	22	-	-	-
													200	17			
	SS33									230 mín.	360 mín.		50	22			
													200	16			
	SS36-1									250 mín.	365 mín.		50	21			
													200	15			
	SS36-2			-						250 mín.	400~550		50	21			
													200	18			
	SS 40			1.50 máx.						275 mín.	380 mín.		50	19			
													200	14			
	HSLAS-50-1		0.23 máx.			0.40 máx.		V ou Nb ou Ti: 0.005 mín.		340 mín.	450 mín.		50	20			
													200	16			

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Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical properties									
									Tensile Test			Elongation			Bending a 180°	Charpy-V	
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.		Temp. (°C)	Absorbed Energy (J)
EN-10025-2 (2005)	S235JR	1.50~20.00	0.17 máx.	1.40 máx.	-	0.035 máx.	0.035 máx.	-	Transversal	235 mín.	360~510	E ≤ 2.00	80	17	-	-	
												2.00 < E ≤ 2.50		18			
												2.00 < E < 3.00		19			
												E ≥ 3.00	5.65√A	24			
	S235J0	1.80~16.00				0.030 máx.	0.030 máx.				360~510	E ≤ 2.00	80	17		0	27 mín. (5)
												2.00 < E ≤ 2.50		18			
												2.00 < E < 3.00		19			
												E ≥ 3.00	5.65√A	24			
	S275JR	1.50~20.00	0.21 máx.	1.50 máx.	-	0.035 máx.	0.035 máx.	-	Transversal	275 mín.	E < 3.00	430~580	E ≤ 2.00	80	15	-	-	
													2.00 < E ≤ 2.50		16			
											E ≥ 3.00	410~560	2.00 < E< 3.00		17			
													E ≥ 3.00	5.65√A	21			
	S275J0	2.00~16.00	0.18 máx.			0.030 máx.	0.030 máx				E < 3.00	430~580	E ≤ 2.00	80	15	0	27 mín. (5)	
													2.00 < E ≤ 2.50		16			
											E ≥ 3.00	410~560	2.00 < E < 3.00		17			
													E ≥ 3.00	5.65√A	21			
	S355JR	2.00~20.00	0.24 máx.	1.60 máx.	0.55 máx.	0.035 máx.	0.035 máx.	-	Transversal	355 mín.	E < 3.00	510~680	E ≤ 2.00	80	14	-	-	
													2.00 < E ≤ 2.50		15			
											E ≥ 3.00	470~630	2.00 < E < 3.00		16			
													E ≥ 3.00	5.65√A	20			
	S355J0		0.20 máx.			0.030 máx.	0.030 máx.				E < 3.00	510~680	E ≤ 2.00	80	14	0	27 mín. (5)	
													2.00 < E ≤ 2.50		15			
											E ≥ 3.00	470~630	2.00 < E< 3.00		16			
													E ≥ 3.00	5.65√A	20			
	S355J2		0.20 máx.			0.025 máx.	0.025 máx.	-			E < 3.00	510~680	E ≤ 2.00	80	14	-20	27 mín. (5)	
													2.00 < E ≤ 2.50		15			
											E ≥ 3.00	470~630	2.00 < E < 3.00		16			
													E ≥ 3.00	5.65√A	20			
IRAM IAS-U500-42 (2003)	F-22	2.00 ~ 12.70	0.21 máx.	-	0.35 máx.	0.030 máx.	0.035 máx.	-	Transversal	215 mín.	310~460	-	50	26	2.0 E	-	-	
	F-24									235 mín.	360~510			24	2.5 E			
	F-26									250 mín.	400~550			23	2.5 E			
	F-30									295 mín.	550~600			22	3.0 E			
	F-36		0.22 máx.		0.50 máx.					355 mín.	490~640			22	3.0 E			

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Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical properties								
									Tensile Test			Elongation			Bending a 180°	Charpy-V	
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.		Temp. (°C)	Absorbed Energy (J)
JIS-G-3101 (2004)	SS-330	2.00 ~ 16.00	-	-	-	0.050 máx.	0.050 máx.	-	Longitudinal	205 mín.	330~430	E ≤ 5.00	50	26	1.0 E	-	-
												E > 5.00	200	21			
	SS-400	2.00 ~ 12.70								245 mín.	400~510	E ≤ 5.00	50	21	3.0 E		
												E > 5.00	200	17			
	SS-490									285 mín.	490~610	E ≤ 5.00	50	19	4.0 E		
												E > 5.00	200	15			
	SS-540		0.30 máx.	1.60 máx.		0.040 máx.	0.040 máx.			400 mín.	540 mín.	E ≤ 5.00	50	16	4.0 E		
												E > 5.00	200	13			
NBR-6648 (2004)	CG-210	5.00 ~ 16.00	0.20 máx.	1.00 máx.	0.40 máx.	0.035 máx.	0.030 máx.	-	Transversal	210 mín.	340 ~ 490	-	50	27	1.0 E	-	-
													200	23			
	CG-250		0.25 máx.	1.20 máx.						250 mín.	400 ~ 550.		50	23	2.0 E		
													200	20			
	CG-280		0.25 máx.		0.50 máx.					280 mín.	450 ~ 600		50	22	2.5 E		
													200	19			
NBR-6650 (2014)	CFQ-210	2.00 ~ 5.00	0.15 máx.	0.60 máx.	0.040 máx.	0.035 máx.	0.030 máx.	-	Longitudinal	210 mín.	340 ~ 390	E < 3.00	50	22	1.0 E	-	-
												E ≥ 3.00		25			
	CFQ-250		0.20 máx.	1.00 máx.	0.040 máx.	0.040 máx.				250 mín.	400 ~ 550	E < 3.00		20	2.0 E		
												E ≥ 3.00		21			
	CFQ-280		0.25 máx.	1.20 máx.	0.040 máx.	0.040 máx.				280 mín.	400 ~ 590	E < 3.00		17	2.5 E		
												E ≥ 3.00		21			
	CFQ-300		0.28 máx.	1.50 máx.	0.060 máx.	0.060 máx.				300 mín.	400 ~ 600	E < 3.00		16	3.0 E		
												E ≥ 3.00		19			

NOTES:
* Standard quoted for reference only. For additional information, refer to the standard or contact our sales team.
(1) Elongation value reductions are applicable as per the ASTM-A6.
(2) They can be supplied with Charpy impact guarantee for thicknesses greater than 6.00 mm upon request.
(3) For each 0.01% reduction on the specified maximum carbon, a 0.06% increase is allowed over the maximum Mn specified value, up to a 1.60% maximum.
(4) For each 0.01% reduction on the specified maximum carbon, a 0.06% increase is allowed over the maximum Mn specified value, up to a 1.50% maximum.
(5) The Charpy-V impact test is carried out only in thicknesses of 6mm or greater. For a nominal thickness lower than 12mm, reduced specimens are used with absorbed energy values proportional to the specimen cross section.

STEEL FOR **FRAMES AND WHEELS**

These are products with good cold drawing, weldability, and fatigue strength performance, used in automotive components.

Due to their characteristics, USI-RW steels are mainly produced for the automotive wheel industry.

The USI-LN series steels also have good fatigue performance and may be subjected to moderate drawing. All grades in this family are supplied with a guaranteed of tensile and transverse bending mechanical properties. The LN/LNE-380, LN/LNE-500 and LN/LNE-600 grades are designed as High Strength/Low Alloy (HSLA) steels subjected to controlled rolling, allowing to obtain high mechanical strength values with relatively low equivalent carbon.

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical Properties						
									Tensile Test			Elongation			Bending 180°
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.	
USI-LN	380	2.00 ~ 13.00	0.12 máx.	1.10 máx.	0.30 máx.	0.030 máx.	0.030 máx.	-	Transversal	380~540	460~620	-	5.65√A	20	0.0 E
	500			1.50 máx.	0.40 máx.		0.020 máx.			500~620	560~700			18	
	600		0.15 máx.	2.00 máx.			0.015 máx.			≥ 600	≥ 680			14	
	700	2.00 ~ 10.00		2.10 máx.	0.55 máx.					≥ 700 (1)	≥ 750			12	
USI-RW	300	1.80 ~ 16.00	0.10 máx.	0.50 máx.	0.10 máx.	0.025 máx.	0.020 máx.	Al 0.010~0.060	Longitudinal	E ≤ 5.00 200~340	E ≤ 5.00 310~430	E ≤ 5.00	50	30	2.0 E
										E > 5.00 190~340	E > 5.00 300~430	5.00 < E ≤ 9.00	200	24	
												E > 9.00	200	27	
	340		0.08~0.13	0.30~0.60			0.015 máx.			E ≤ 5.00 210~360	E ≤ 5.00 360~460	E ≤ 5.00	50	28	1.0 E
										E > 5.00 200~360	E > 5.00 350~460	5.00 < E ≤ 9.00	200	23	
												E > 9.00	200	24	
	350		0.10~0.15	0.30~0.60			0.015 máx.			E ≤ 5.00 230~340	E ≤ 5.00 360~470	E ≤ 5.00	50	26	1.0 E
										E > 5.00 210~340	E > 5.00 350~470	E > 5.00	200	21	
										230 ~ 380	E ≤ 5.00 400~520	E ≤ 5.00	50	22	2.0 E
											E > 5.00 390~510	E > 5.00	200	20	
	390	2.00 ~ 16.00	0.12~0.18	0.30~0.80			0.025 máx.			350 ~ 450	450 ~ 570	E ≤ 5.00	50	25	0.0 E
												E > 5.00	200	20	
	450	2.00 ~ 13.00	0.12 máx.	E ≤ 5.00 0.80 máx E > 5.00 1.10 máx			0.015 máx.	Nb 0.016 mín. Al 0.010 ~ 0.070	Transversal	460 ~ 570	552 ~ 670	E ≤ 5.00	50	23	1.0 E
	550-A	2.00 ~ 5.00	0.15 máx.	1.65 máx.	0.20 máx.		0.010 máx.	Nb 0.020 mín. Al 0.005~0.060		460 ~ 570	552 ~ 670	E ≤ 5.00	50	23	1.0 E
	550-D			1.65 máx.	0.10 máx.		0.010 máx.	-		320 ~ 470	550 ~ 680	E ≤ 5.00	5.65√A	24	-
	600-CR	3.00 ~ 5.50	0.12 máx.	1.60 máx.	0.15 máx.	0.090 máx.	0.010 máx.	Cr 1.20 máx.							

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Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical Properties						
									Tensile Test			Elongation			Bending 180°
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.	
USI-STAR	450	2.00 ~ 6.00	0.18 máx.	1.30 máx.	0.50 máx.	0.035 máx.	0.030 máx.	-	Transversal	350 mín.	415 ~ 560	–	50	22	0.00 E
	500									380 mín.	450 ~ 580		50	24	
EN-10149-2 (2013)	S315MC	1.50 ~ 20.00	0.12 máx.	1.30 máx.	0.50 máx.	0.025 máx.	0.020 máx.	Al 0.015 Mín.	Longintudinal	315 mín.	390 ~ 510	E < 3.00	80	20	0.0 E
												E ≥ 3.00	5.65√A	24	
	S355MC			1.50 máx.						355 mín.	430 ~ 550	E < 3.00	80	19	0.5 E
												E ≥ 3.00	5.65√A	23	
	S420MC	2.00 ~ 20.00		1.60 máx.						420 mín.	480 ~ 620	E < 3.00	80	16	0.5 E
												E ≥ 3.00	5.65√A	19	
	S460MC			1.60 máx.			0.015 máx.			460 mín.	520 ~ 670	E < 3.00	80	14	1.0 E
												E ≥ 3.00	5.65√A	17	
	S500MC	2.00 ~ 13.00		1.70 máx.						500 mín.	550 ~ 700	E < 3.00	80	12	1.0 E
												E ≥ 3.00	5.65√A	14	
	S550MC			1.80 máx.						550 mín.	600 ~ 760	E < 3.00	80	12	1.5 E
												E ≥ 3.00	5.65√A	14	
NBR-6656 LNE (2008)	200	2.00 ~ 16.00	0.12 máx.	0.60 máx.	0.35 máx.	0.025 máx.	0.025 máx.	Al 0.015 Mín.	Transversal	200~330	280 ~ 410	-	5.65√A	35	0.0 E
	230			0.80 máx.						230~360	330 ~ 460			30	
	260		0.15 máx.	1.00 máx.						260~390	370 ~ 500			30	
	280									280~430	410 ~ 540			30	
	380	2.00 ~ 13.00	0.12 máx.	1.10 máx.						380~530	460 ~ 600			23	
	400		0.15 máx.	1,40 máx.						400~530	520 ~ 650			23	
	420		0.12 máx.	1.60 máx.			0.015 máx.			420~540	520 ~ 650			22	E ≤ 10.00 0.0 E E > 10.00 0.5 E
	460									460~580	540 ~ 680			18	E ≤ 10.00 0.5 E E > 10.00 1.0 E
	500			1.50 máx.						500~620	560 ~ 700			18	E ≤ 10.00 0.5 E E > 10.00 1.0 E
	550		0.15 máx.	1.90 máx.						550~670	600 ~ 760			15	E ≤ 10.00 1.5 E
	600									600~720	680 ~ 810			14	E > 10.00 1.5 E

CONTINUA

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical Properties						
									Tensile Test			Elongation			Bending 180°
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.	
ASTM-A-1011-HSLAS-F (2014)	50	2.00~5.84	0.15 máx.	1.65 máx.	–	0.020 máx.	0.025 máx.	V ou Nb ou Ti: 0.005 mín.	Longitudinal	340 mín.	410 mín.	E < 2.50	50	22	–
												E ≥ 2.50		24	
JIS-G-3113-SAPH (2006)	310	1.80~14.00	–	–	–	0.040 máx.	0.040 máx.	–	Longitudinal	1.80 ≤ E < 8.00	310 mín.	1.80 ≤ E < 2.00	50	33	0.00 E
												2.00 ≤ E <2.50		34	2.0 E
												2.50 ≤ E < 3.15		36	
												3.15 ≤ E < 4.00		38	
										8.00 ≤ E ≤ 14.00	175 mín.	4.00 ≤ E < 6.30		40	
												6.30 ≤ E ≤ 14.00		41	
	370									1.80 ≤ E < 8.00	370 mín.	1.80 ≤ E < 2.00		32	1.0 E
												2.00 ≤ E <2.50		33	2.0 E
												2.50 ≤ E < 3.15		35	
												3.15 ≤ E < 4.00		36	
										8.00 ≤ E ≤ 14.00	215 mín.	4.00 ≤ E < 6.30		37	
												6.30 ≤ E ≤ 14.00		38	
	400									1.80 ≤ E < 8.00	400 mín.	1.80 ≤ E < 2.00		31	2.0 E
												2.00 ≤ E <2.50		32	
												2.50 ≤ E < 3.15		34	
												3.15 ≤ E < 4.00		35	
										8.00 ≤ E ≤ 14.00	235 mín.	4.00 ≤ E < 6.30		36	
												6.30 ≤ E ≤ 14.00		37	
	440	2.00~14.00								2.00 ≤ E < 6.00	440 mín.	2.00 ≤ E < 2.50		30	2.0 E
												2.50 ≤ E < 3.15		32	
												3.15 ≤ E < 4.00		33	
										6.00 ≤ E < 8.00	295 mín.	4.00 ≤ E < 6.30		34	
										8.00 ≤ E ≤ 14.00	275 mín.	6.30 ≤ E ≤ 14.00		35	

* Standard quoted for reference only. For additional information, refer to the standard or contact our sales team.
(1) For thicknesses > 8mm, the minimum yield strength may be 20MPa lower.

STRUCTURAL STEEL
FOR DRAWING

Drawn parts, such as compressor body, engine mount, etc. These drawn or stretched steel sheets are supplied at a medium (EM), deep (EP), and extra-deep (EPA) drawing grade.

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical Properties						
									Tensile Test			Elongation			Bending 180°
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.	
USI	EM	1.80~6.50	0.10 máx.	0.50 máx.	-	0.040 máx.	0.045 máx.	-	Longitudinal	-	280 mín.	1.80 ≤ E ≤ 5.00	50	26	0.0E
												5.00 < E ≤ 6.50	200	18	
	EP		0.08 máx.			0.035 máx.	0.035 máx.					1.80 ≤ E ≤ 2.30	50	29	
												2.30 < E ≤ 3.20		32	
												3.20 ≤ E < 4.50		34	
												4.50 ≤ E ≤ 5.00		36	
												5.00 < E ≤ 6.50	200	20	
	EPA					0.030 máx.	0.030 máx.	Al 0.020 mín.				1.80 ≤ E ≤ 2.30	50	29	
												2.30 < E ≤ 3.20		32	
												3.20 ≤ E < 4.50		34	
												4.50 ≤ E ≤ 5.00		36	
												5.00 < E ≤ 6.50	200	20	

CONTINUA

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical Properties						
									Tensile Test			Elongation			Bending 180°
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.	
ASTM-A-1011 (2014)	DS-A	1.50 ~ 5.84	0.08 máx.	0.50 máx.	-	0.020 máx.	0.030 máx.	Al 0.010 mín.	-	-	-	-	-	-	-
	DS-B		0.02 ~ 0.08												
EN10111 (2008)	DD11	1.50 ~ 11.00	0.12 máx.	0.60 máx.	-	0.045 máx.	0.045 máx.	-	Transversal	1.50 < E < 2.00	170~360	1.50 < E < 2.00	80	23	0.00 E
										2.00 ≤ e ≤ 11.00	170~340	2.00 ≤ E < 3.00	80	24	
												3.00 ≤ E ≤ 11.00	5.65√A	28	
	DD12		0.10 máx.	0.45 máx.		0.035 máx.	0.035 máx.			1.50 < E < 2.00	170~340	1.50 < E < 2.00	80	25	
										2.00 ≤ e ≤ 11.00	170~320	2.00 ≤ E < 3.00	80	26	
												3.00 ≤ E ≤ 11.00	5.65√A	30	
	DD13		0.08 máx.	0.40 máx.		0.030 máx.	0.030 máx.			1.50 < E < 2.00	170~330	1.50 < E < 2.00	80	28	
										2.00 ≤ e ≤ 11.00	170~310	2.00 ≤ E < 3.00	80	29	
												3.00 ≤ E ≤ 11.00	5.65√A	33	
	DD14	2.00 ~ 11.00		0.35 máx.		0.025 máx.	0.025 máx.			1.50 < E < 2.00	170~310	1.50 < E < 2.00	80	31	
										2.00 ≤ e ≤ 11.00	170~290	2.00 ≤ E < 3.00	80	32	
												3.00 ≤ E ≤ 11.00	5.65√A	36	
	SPHC	1.80 ~ 14.00	0.12máx.	0.60 máx.		0.045 máx.	0.035 máx.			-	-	< 2.50		29	1.0 E
												2.50 ≤ E < 3.20		31	
												3.20 ≤ E < 4.00			
JISG3131 (2010)												E ≥ 4.00			
	SPHD		0.10 máx.	0.45 máx.	-	0.035 máx.	0.035 máx.	-	Longitudinal			< 2.50		33	-
												2.50 ≤ E < 3.20	50	35	
												3.20 ≤ E < 4.00		37	
												E ≥ 4.00		39	
	SPHE	2.00 ~ 8.00	0.08 máx.	0.40 máx.		0.030 máx.	0.030 máx.					< 2.50		39	-
												2.50 ≤ E < 3.20			
												3.20 ≤ E < 4.00		40	
												E ≥ 4.00		42	
NBR-5906 (2008)	EM	1.80 ~ 10.00	0.10 máx.	0.45 máx.	-	0.040 máx.	0.040 máx.	-	Transversal	-	-	E ≤ 2.00	450 máx.	E ≤ 2.00	0.00 E
												2.00 < E < 3.00		25	
												E ≥ 3.00		28	
												2.00 < E < 3.00	430 máx.	30	
	EP	2.00 ~ 5.00	0.08 máx.	0.40 máx.	-	0.030 máx.	0.030 máx.	Al 0.020 mín.		E ≤ 2.00	320 máx.	E ≥ 3.00		27	
										2.00< E < 3.00	300 máx.	E ≤ 2.00	410 máx.	30	-
										E ≥ 3.00	300 máx.			34	
										E ≤ 2.00	300 máx.	2.00 < E < 3.00	420 máx.	30	
	EPA		0.08 máx.	0.35 máx.	-	0.025 máx.	0.025 máx.			2.00< E < 3.00	290 máx.	E ≥ 3.00	400 máx.	33	
										E ≥ 3.00	280 máx.			35	

NOTES:
* Standard quoted for reference only. For additional information, refer to the standard or contact our

STRUCTURAL STEEL **FOR SHIPBUILDING**

Steels applied to ship hulls and components, offshore platforms, barges, and other vessels, following the specifications by the main classification institutes. During processing, this is a highly productive steel due to its excellent weldability.

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)					Other	Mechanical properties					
									Tensile Test			Elongation		
			C	Mn	Si	P	S		Direction	LE (MPa)	LR (MPa)	Thickness (mm)	GL (mm)	% min.
ABS (2014)	A	2.00~12.70	0.21 máx.	2.5C mín.	0.50 máx.	0.035 máx.	0.035 máx.	C + Mn/6 = 0.40 máx.	Transversal	235 mín.	400~520	-	5.65√A	22
ASTMA131 (2013)	A	4.57~13.00											50	24 (1)
	A												20	21 (1)
BV-NR216 (2014)	A	2.00~12.70											5.65√A	22
LR (2014)	A	2.00~12.70						-					5.65√A	22

NOTES:
* Standard quoted for reference only. For additional information, refer to the standard or contact Usiminas' sales team.
(1) Elongation value reductions are applicable as per the ASTMA6.

STEEL **FOR PRESSURE VESSELS**

Steels with good drawing capacity and weldability, recommended for use in liquefied product storage containers, LPG (Liquefied Petroleum Gas) bottles/cylinders, and air compressor cylinders.

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical properties						
									Tensile Test			Elongation			Bending 180°
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness (mm)	GL (mm)	% mín.	
JISG3116 (2010)	SG 255	2.00 ~ 6.00	0.20 máx.	0.30 máx.	-	0.030 máx.	0.030 máx.	-	Longitudinal	255 mín.	400 mín.	-	50	28	2.0 E
	SG 295			2.00 máx.	0.35 máx.					295 mín.	440 mín.			26	3.0 E
	SG 325			1.50 máx.	0.35 máx.					325 mín.	490 mín.			22	3.0 E
	SG 365			1.50 máx.	0.55 máx.					325 mín.	490 mín.			20	3.0 E
NBR-7460 (2013)	GL-1	2.00 ~ 5.00	0.18 máx.	0.85 máx.	0.30 máx.	0.030 máx.	0.035 máx.	-	Transversal	190 mín.	340 mín.	-	5.65√A	28	0.0E
	GL-2		0.22 máx.	1.20 máx.			0.035 máx.			230 mín.	380 mín.			24	1.0E
	GL-3		0.24 máx.	1,25 máx.			0.035 máx.			270 mín.	420 mín.			22	1.5E
	GL-4		0.18 máx.	1.20 máx.			0.035 máx.			310 mín.	440 mín.			21	1.5E

NOTE:
* Standard quoted for reference only. For additional information, refer to the standard or contact our sales team.

STEEL **FOR TUBES AND PIPES**

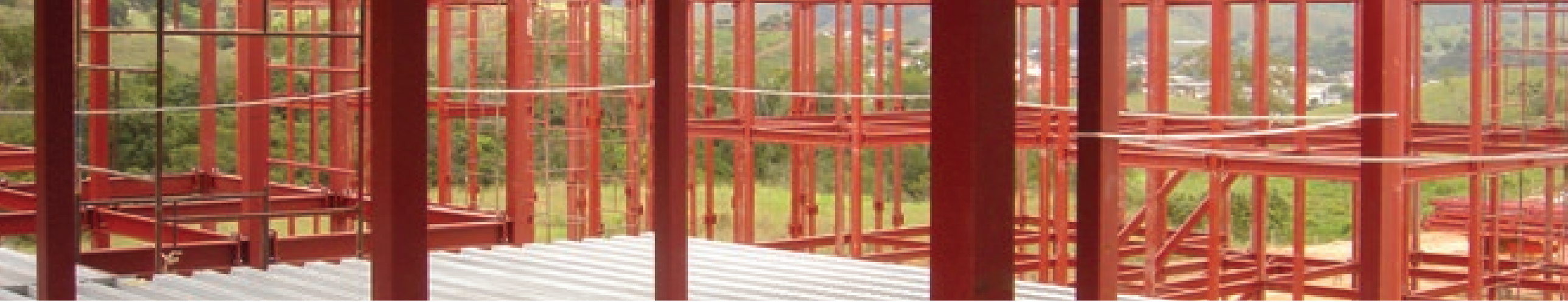
Used in furniture manufacturing, civil construction, mechanical and automotive industries, oil pipelines, and ore pipelines.

The USITB series steels are suitable for manufacturing tubes, welded by the electric resistance process. The steels have good drawability and excellent results when evaluated for their internal quality by non-destructive methods, such as ultrasound and eddy current.

Upon request, Usiminas also provides coils and steel sheets to meet large diameter pipes standards, such as API-5L and ASTM A423. These pipes are used for transporting various fluids under pressure, such as oil and its derivatives, natural gas, and ore. The rolled coils to meet these standards are appropriate for manufacturing welded tubes by the high frequency electrical resistance process and by the submerged arc process.

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical properties								
									Tensile Test			Elongation			Dureza (HRB)	Bending 180°	
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness (mm)	GL (mm)	% mín.			
USITB	1	2.00~8.00	0.03~0.10	0.50 máx.	0.10 máx.	0.035 máx.	0.035 máx.	-	Longitudinal	160 mín.	270~390	-	50	32	-	-	
	2		0.08~0.13	0.30~0.60						220 mín.	350~460	E ≤ 5.00	50	28			
												E > 5.00	200	24			
USITB	C	2.00~6.00	0.29 máx.	1.70 máx.	0.50 máx.	0.030 máx.	0.015 máx.	-	Transversal	300 mín.	500 mín.	-	50	20	-	-	
JIS-G-3132 (2011)	SPHT-1	1.80~12.50	0.10máx.	0.50 máx.	0.35 máx.	0.040 máx.	0.040 máx.	-	Longitudinal	-	270 mín.	1.80 ≤E < 3.00	50	32	-	E ≤ 3.00	0.0 E
												3.00 ≤ E < 6.00		35		E > 3.00	1.0 E
												E ≥ 6.00		37			
	SPHT-2		0.18máx.	0.60 máx.							340 mín.	1.80 ≤E < 3.00		27	-	E ≤ 3.00	2.0 E
												3.00 ≤ E < 6.00		30		E > 3.00	3.0 E
												E ≥ 6.00		32			
	SPHT-3		0.25máx.	0.30~0.90							410 mín.	1.80 ≤E < 3.00		22	-	E ≤ 3.00	3.0 E
												3.00 ≤ E < 6.00		25		E > 3.00	4.0E
												E ≥ 6.00		27			
	SPHT-4	2.00~6.80	0.30 máx.	0.30~1.00							490 mín.	2.00 ≤ E < 3.00		18	-	E ≤ 3.00	3.0 E
												3.00 ≤ E < 6.00		20		E > 3.00	4.0 E
												E ≥ 6.00		22			
API5L	A e B	Upon request, Usiminas can manufacture coils and steel sheets to meet the API pipe standards.															
	X42 a X80	Upon request, Usiminas can manufacture coils and steel sheets to meet the ASTM A423 pipe standard 423.															
ASTMA423	-																

NOTE:
* Standard quoted for reference only. For additional information, refer to the standard or contact Usiminas' sales team.



STRUCTURAL ATMOSPHERIC CORROSION AND FIRE **RESISTANT** STEEL

These steels have good atmospheric corrosion resistance and are intended mainly for civil construction and railway cars. Basically, these steels have good weldability and can be used unpainted.

USISAC series structural steels are resistant to atmospheric corrosion. With the addition of alloy elements, such as copper (Cu), chromium (Cr), silicon (Si), and phosphorus (P), they develop a highly protective oxide layer in contact with the environment, resulting in excellent resistance to atmospheric corrosion. The main advantages of their use is the increased useful life of components, improved rigidity and mechanical strength of the assembled units, and also the good benefits for civil construction projects and the industry in general.

USISAC series structural steels are available in the SAC-300 and SAC-350 grades, corresponding to the minimum yield strength ranges, between 300 MPa and 350 MPa, respectively.

In addition to high resistance to atmospheric corrosion, USIFIRE350 has the unique property of maintaining yield strength at high temperatures—at 600°C, 67% of the yield strength specified for room temperature is guaranteed. The material is suitable for the construction of buildings, thus allowing reduced use of antithermal coatings.

Specification(*)	Grade	Thickness range (mm)	Chemical composition (%)						Mechanical properties						
									Tensile Test			Elongation			Bending 180°
			C	Mn	Si	P	S	Other	Direction	LE (MPa)	LR (MPa)	Thickness. (mm)	GL (mm)	% mín.	
USIFIRE	350	2.0 ~ 12.70	0.15 máx.	1.60 máx.	0.60 máx.	0.030 máx.	0.020 máx.	Pcm 0.26 máx. (1)	Transversal	325 mín. (Temperatura Ambiente)	490 ~ 640	2.00 ≤ E ≤ 5.00	50	17	1.5 E
												5.00 < E ≤ 12.70	200	17	
USISAC	300	1.50 ~ 16.00	0.18 máx.	1.30 máx.	0.50~1.50	0.010 ~ 0.060	0.030 máx.	Cu 0.05~0.40	Transversal	300 mín.	400 ~ 550	2.00 ≤ E ≤ 5.00	50	19	1.5 E
												5.00 < E ≤ 16.00	200	19	
	350	2.00 ~ 16.00		1.40 máx.						350 mín.	500 ~ 650	2.00 ≤ E ≤ 5.00	50	16	1.5 E
												5.00 < E ≤ 16.00	200	16	
ASTM A242 (2013)	1	4.57 ~ 12.70	0.15	1.00 máx.	-	0.15 máx.	0.05 máx.	Cu 0,20 mín. I ≥ 6.0 (2)	Transversal	345 mín.	480 mín.	(3)	50	19	-
													200	16	
ASTM A606 (2009)	4	2.00 ~ 5.84	0.22 máx.	1.25 máx. (4)	-	-	0.040 máx.	I ≥ 6.0 (2)	Transversal	340 mín.	480 mín.	-	50	22	-
													200	12	

NOTES:
* Standard quoted for reference only. For additional information, refer to the standard or contact Usiminas' sales team.
(1) Pcm = C + Si/30 + (Mn + Cu + Cr)/20 + Ni/60 + Mo/5 + V/10 + 5B.
(2) I = corrosion resistance index as per ASTMG101.
(3) Elongation value reductions are applicable as per the ASTMA6.
(4) For steels with 0.15 max. C content, the Mn content may be 1.40 max.
(5) In case P used as alloy element, the content should be 0.020 to 0.150.
(6) A minimum 0.20% Cu content may be specified.

STEEL SHEETS AND COILS FOR **FLOORING**

Sheets and coils are supplied with the chemical composition guarantee specified in the table of this page. Upon request, standards for structural steels, with strength limit equal to or below 490 MPa, can be supplied. The mechanical property values (YS and TS) are in accordance with the commercial standard but there is no elongation guarantee.

The bending test, when specified as an additional requirement, will be guaranteed in the parallel direction to the rolling (longitudinal), with a shim equal to three times the thickness.

The dimensional tolerances are met as per NBR-6841. However, Usiminas can provide the products according to the following international tolerance standards: JISG3193, ASTMA568, and ASTMA635.

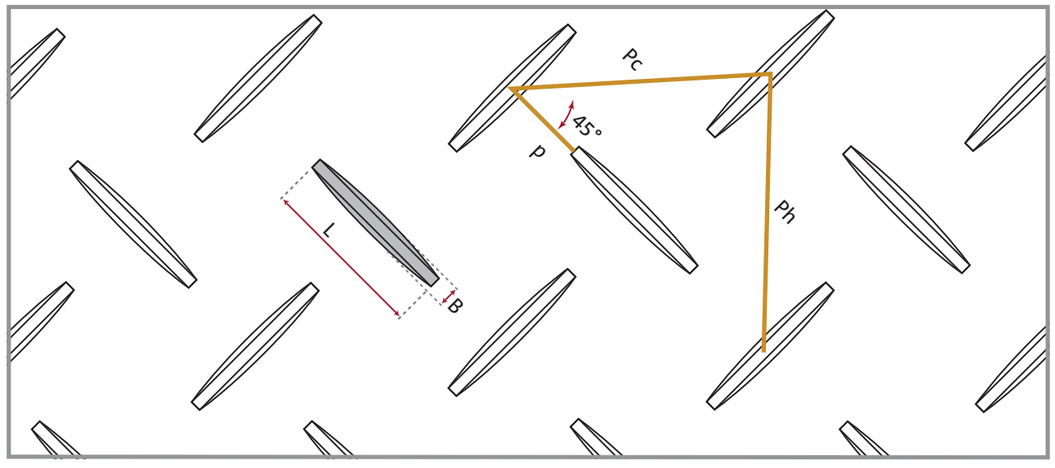
Usiminas' steel for flooring stands out due to its excellent weldability. When using the coated electrode arc welding process, good quality weld beads are obtained.

However, this is a low productivity process. For increased productivity, it is recommended to use the MIG/MAG welding process, which, compared to the coated electrode arc welding process, has the following advantages: Higher welding speed, high deposition rates, greater weld bead penetration, and lower weld bead cleaning requirement, due to lower slag generation.

For painting steel sheets in general, there are recommendations according to environmental requirements and the working conditions to which they will be subjected. Having the best paint scheme is not enough. Preparing the surface to be painted is a determining factor for good system performance. For floor painting, some additional aspects should be considered, such as the external mechanical stress to which it will be subjected, anti-slipping properties, and exposure to chemically aggressive products or environments.

Thickness range (mm)	Products available	C	Si	Mn	Ceq (1)	
					Thickness (mm)	%
2.50 ≤ E ≤ 13.00	Chapas e bobinas	0.19máx.	0.30 máx.	0.70máx.	2.00 <= E <= 5.00	0.20 máx.
					> 3.10	0.40 máx.

Nota: (1) Ceq = C + Mn/6 + Si/4



Pc Step	Ph Step	P step	Width B	Length L	Ledge Height
37.0 a 38.0	36,5 a 39,5	1,4 a 2,0	3,9 a 5.0	28,0 a 37.0	1,87

There is no guarantee for such dimensions. The values above are for reference only, due to the cylinder marking. (measurements in "mm")

USIMINAS

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