Temporada de webinars

Diseño de acero

El uso de perfiles laminados en la construcción: aspectos generales y principales ventajas

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Fotografía cortesía de Acero Estrella

Organiza

ACIES
ASOCIACION COSTARRICENSE DE INGENIERIA ESTRUCTURAL Y SISMICA

ArcelorMittal

Costa Rican Group IABSE

Patrocinan

CIC
COLEGIO DE INGENIEROS CIVILES DE COSTA RICA

IABSE
International Association for Bridge and Structural Engineering
NG Chile | NG Colombia | NG Costa Rica | NG Ecuador | NG Mexico

Consideraciones iniciales

- Nos complace poder charlar a la comunidad técnica costarricense (Arquitectos, Ingenieros, Constructores, Profesores, Estudiantes y demás).
- El objetivo principal de la conferencia es que el auditorio pueda conocer un poco más acerca de estos productos, familiarizándose con aspectos referentes a producción, normas y entendiendo mejor sus posibles alcances.
- Se espera que el asistente pueda ampliar su visión acerca de la construcción en acero, conociendo más las ventajas de estos sistemas constructivos.

Agenda de la conferencia

Parte 1 – Ing. Carlos Berrocal

- ArcelorMittal: quienes somos & actuación en Costa Rica
- Proceso productivo

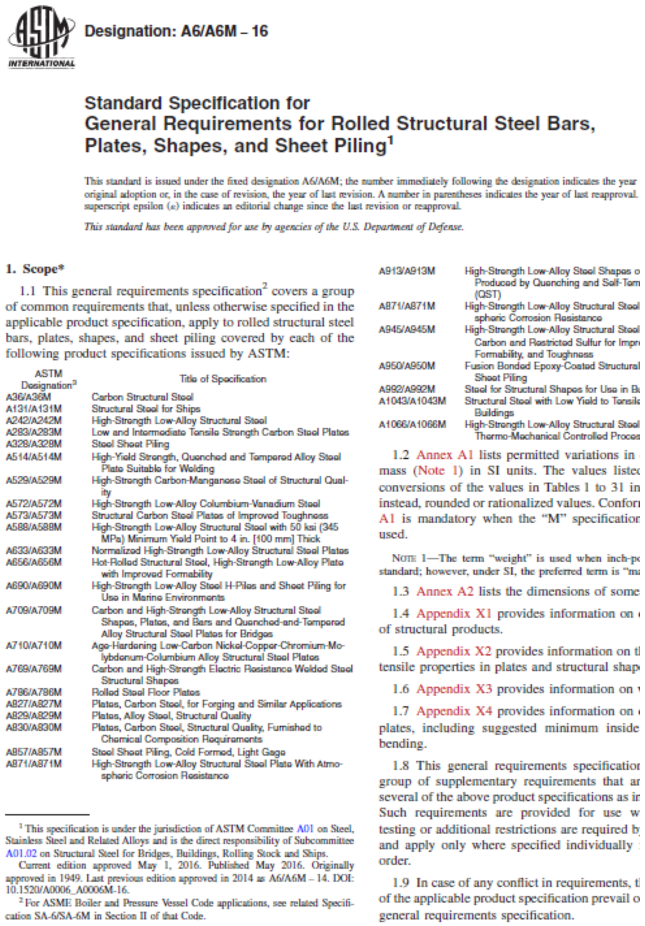
Parte 2 – Ing. Daniel Silvério

- Visión general acerca de las normativas (EUR x EEUU) → Geometría x Calidad
- Las ventajas de la construcción en acero estructural
- Aceros de Alta Resistencia según la norma ASTM A913 (HISTAR)

Normas para perfiles laminados

Suministro regular en Latinoamérica:

- Normas Americanas → ASTM
- Normas Europeas → EN



Designation: A6/A6M – 16

Standard Specification for
General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling[1]

This standard is issued under the fixed designation A6/A6M; the number immediately following the designation indicates the year original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This general requirements specification[2] covers a group of common requirements that, unless otherwise specified in the applicable product specification, apply to rolled structural steel bars, plates, shapes, and sheet piling covered by each of the following product specifications issued by ASTM:

ASTM Designation[3]	Title of Specification
A36/A36M	Carbon Structural Steel
A131/A131M	Structural Steel for Ships
A242/A242M	High-Strength Low-Alloy Structural Steel
A283/A283M	Low and Intermediate Tensile Strength Carbon Steel Plates
A328/A328M	Steel Sheet Piling
A514/A514M	High-Yield Strength, Quenched and Tempered Alloy Steel Plate Suitable for Welding
A529/A529M	High-Strength Carbon-Manganese Steel of Structural Quality
A572/A572M	High-Strength Low-Alloy Columbium-Vanadium Steel
A573/A573M	Structural Carbon Steel Plates of Improved Toughness
A588/A588M	High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. [100 mm] Thick
A633/A633M	Normalized High-Strength Low-Alloy Structural Steel Plates
A656/A656M	Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability
A690/A690M	High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments
A709/A709M	Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
A710/A710M	Age-Hardening Low-Carbon Nickel-Copper-Chromium-Molybdenum-Columbium Alloy Structural Steel Plates
A769/A769M	Carbon and High-Strength Electric Resistance Welded Steel Structural Shapes
A786/A786M	Rolled Steel Floor Plates
A827/A827M	Plates, Carbon Steel, for Forging and Similar Applications
A829/A829M	Plates, Alloy Steel, Structural Quality
A830/A830M	Plates, Carbon Steel, Structural Quality, Furnished to Chemical Composition Requirements
A857/A857M	Steel Sheet Piling, Cold Formed, Light Gage
A871/A871M	High-Strength Low-Alloy Structural Steel Plate With Atmospheric Corrosion Resistance
A913/A913M	High-Strength Low-Alloy Steel Shapes o Produced by Quenching and Self-Tem (QST)
A871/A871M	High-Strength Low-Alloy Structural Steel spheric Corrosion Resistance
A945/A945M	High-Strength Low-Alloy Structural Steel Carbon and Restricted Sulfur for Impr Formability, and Toughness
A950/A950M	Fusion Bonded Epoxy-Coated Structural Sheet Piling
A992/A992M	Steel for Structural Shapes for Use in B
A1043/A1043M	Structural Steel with Low Yield to Tensile Buildings
A1066/A1066M	High-Strength Low-Alloy Structural Steel Thermo-Mechanical Controlled Proces

1.2 Annex A1 lists permitted variations in mass (Note 1) in SI units. The values listed conversions of the values in Tables 1 to 31 in instead, rounded or rationalized values. Confor A1 is mandatory when the "M" specification used.

NOTE 1—The term "weight" is used when inch-p standard; however, under SI, the preferred term is "m

1.3 Annex A2 lists the dimensions of some

1.4 Appendix X1 provides information on of structural products.

1.5 Appendix X2 provides information on t tensile properties in plates and structural shap

1.6 Appendix X3 provides information on

1.7 Appendix X4 provides information on plates, including suggested minimum inside bending.

1.8 This general requirements specificatio group of supplementary requirements that a several of the above product specifications as i Such requirements are provided for use w testing or additional restrictions are required b and apply only where specified individually order.

1.9 In case of any conflict in requirements, t of the applicable product specification prevail o general requirements specification.

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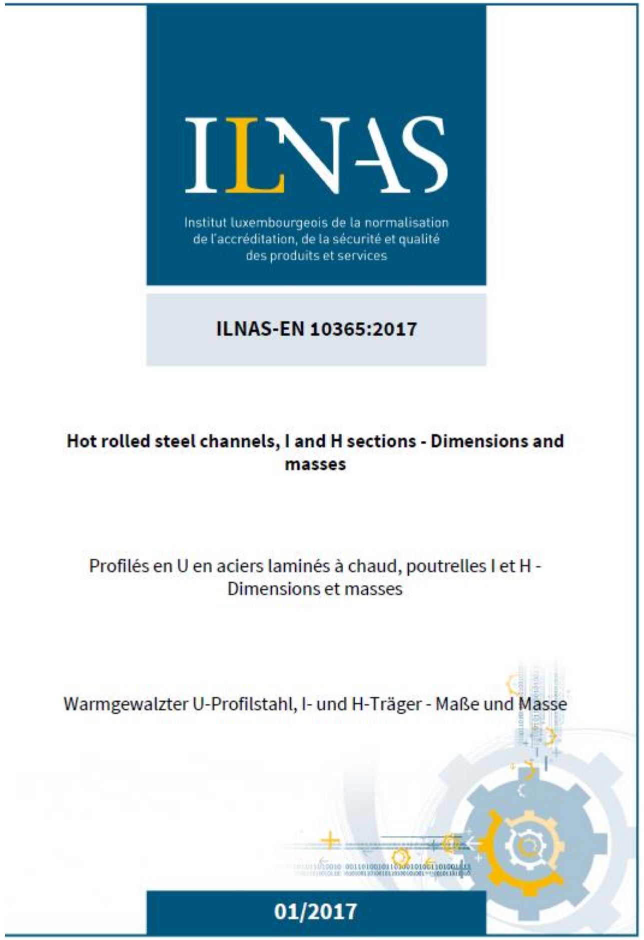
[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.02 on Structural Steel for Bridges, Buildings, Rolling Stock and Ships.

Current edition approved May 1, 2016. Published May 2016. Originally approved in 1949. Last previous edition approved in 2014 as A6/A6M – 14. DOI: 10.1520/A0006_A0006M-16.

[2] For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-6/SA-6M in Section II of that Code.



ILNAS

Institut luxembourgeois de la normalisation
de l'accréditation, de la sécurité et qualité
des produits et services

ILNAS-EN 10365:2017

Hot rolled steel channels, I and H sections - Dimensions and masses

Profilés en U en aciers laminés à chaud, poutrelles I et H - Dimensions et masses

Warmgewalzter U-Profilstahl, I- und H-Träger - Maße und Masse

01/2017

Normas para perfiles laminados

NORMAS DE DEFINICIÓN GEOMÉTRICA

Series Dimensiones

Tolerancias

Surface Condition

NORMAS DE CALIDAD

Composición Química

Propiedades Mecánicas

Normas de Definición Geométrica

DESCRIPCIÓN	EEUU	EUROPA
SERIES Y DIMENSIONES	ASTM A6/A6M-16	EN 10365:2017
TOLERANCIAS	ASTM A6/A6M-16	EN 10034 (I/H) o EN 10024 (alas inclinadas)
SURFACE CONDITION	ASTM A6/A6M-16	EN 10163-3:2004

Norma única

Segmentación

Series y dimensionales

EN 10365:2017

- Secciones con patines paralelos - IPE
- Vigas de alas anchas - HE

EN 10365:2017 (E)

1 Scope

This European standard specifies the nominal dimensions and masses of the hot rolled steel channels, I and H sections.

The following shapes are covered by this standard:

Sections:

— Parallel flange I sections IPE;

— Wide flange beams HE;

— Extra wide flange beams HL and HLZ;

— Wide flange columns HD;

— Wide flange bearing piles HP and UBP;

— Universal beams UB;

— Universal columns UC;

— Taper flange I sections IPN and J.

Channels:

— Parallel flange channels UPE and PFC;

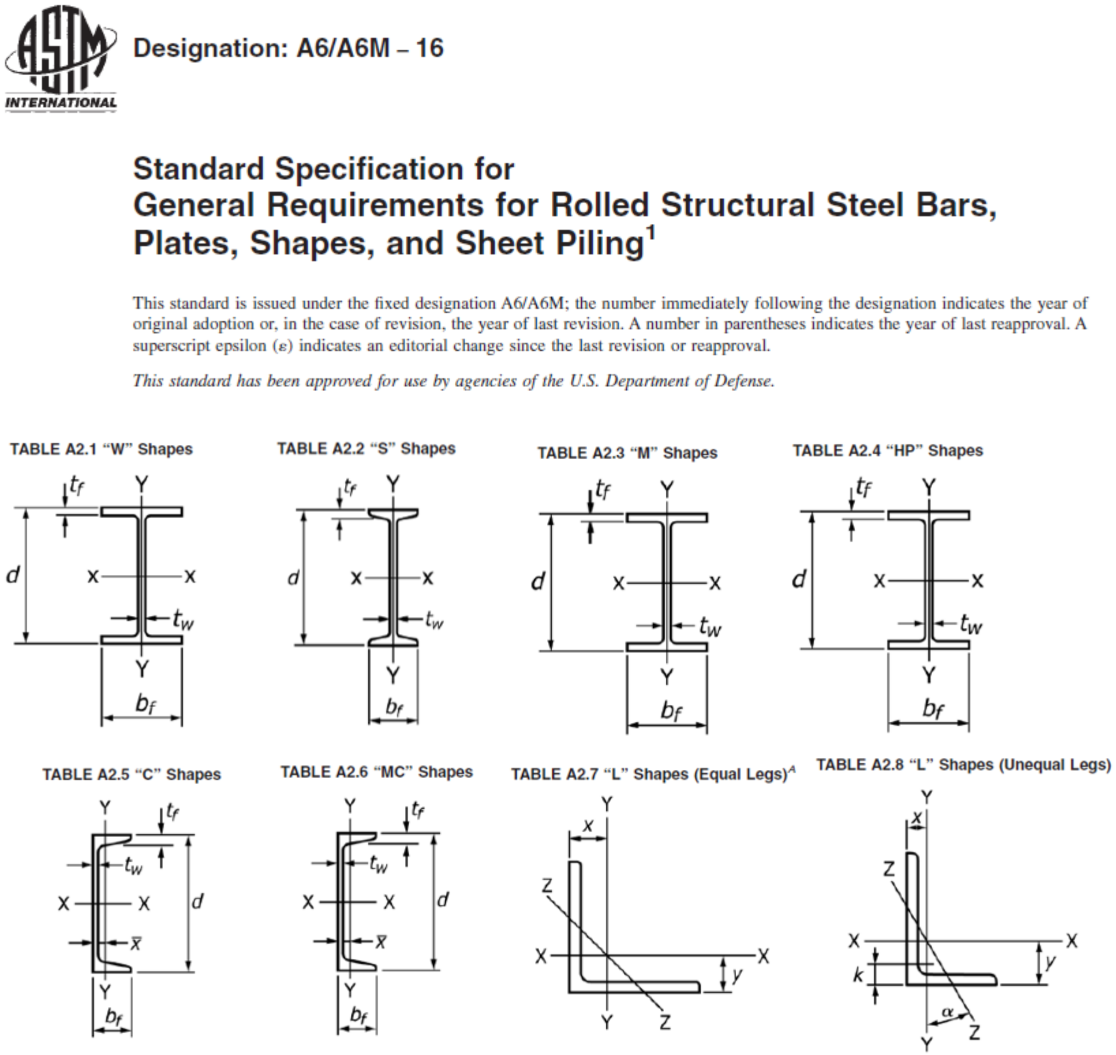
— Taper flange channels UPN, U and CH.

These requirements do not apply to hot rolled steel channels, I and H sections from stainless steel.

Series y dimensionales

ASTM A6/A6M-16

- American Wide Flange Beams - W
- Bearing Piles - HP



Designation: A6/A6M – 16

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TABLE A2.1 "W" Shapes

TABLE A2.2 "S" Shapes

TABLE A2.3 "M" Shapes

TABLE A2.4 "HP" Shapes

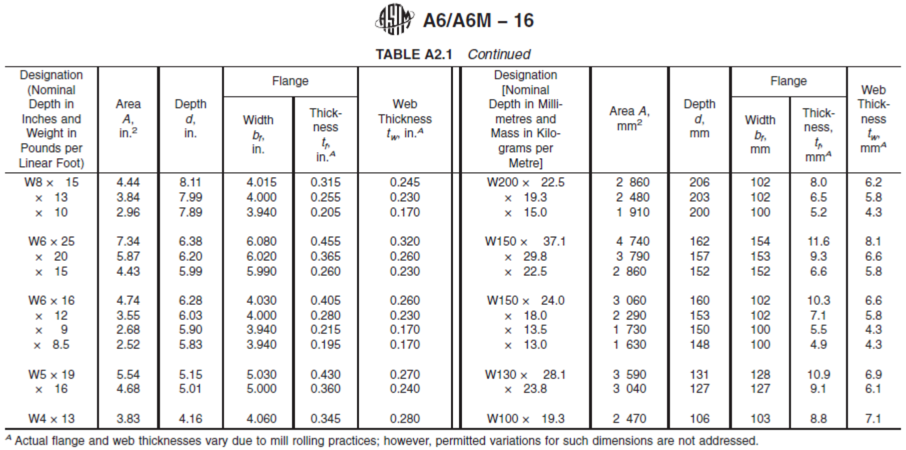
TABLE A2.5 "C" Shapes

TABLE A2.6 "MC" Shapes

TABLE A2.7 "L" Shapes (Equal Legs)[A]

TABLE A2.8 "L" Shapes (Unequal Legs)

Series y dimensionales



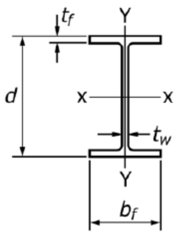
A6/A6M – 16

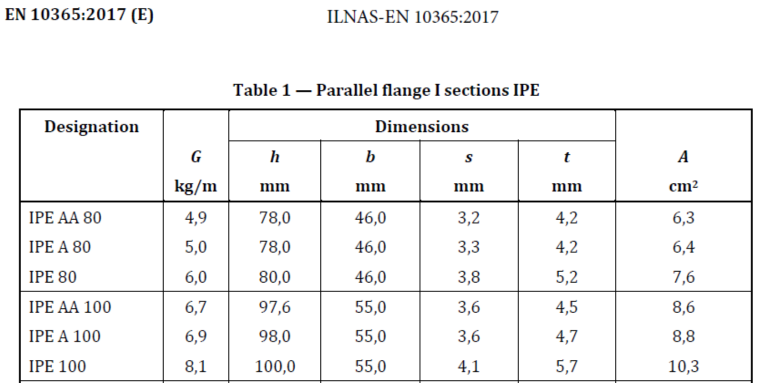
TABLE A2.1 *Continued*

Designation (Nominal Depth in Inches and Weight in Pounds per Linear Foot)	Area A, in.^{2}	Depth d, in.	Flange		Web Thickness t_w, in.^{A}	Designation [Nominal Depth in Millimetres and Mass in Kilograms per Metre]	Area A, mm^2	Depth d, mm	Flange		Web Thickness t_w, mm^A
			Width b_f, in.	Thickness t_f, in.^{A}					Width b_f, mm	Thickness, t_f, mm^A	
W8 × 15	4.44	8.11	4.015	0.315	0.245	W200 × 22.5	2 860	206	102	8.0	6.2
× 13	3.84	7.99	4.000	0.255	0.230	× 19.3	2 480	203	102	6.5	5.8
× 10	2.96	7.89	3.940	0.205	0.170	× 15.0	1 910	200	100	5.2	4.3
W6 × 25	7.34	6.38	6.080	0.455	0.320	W150 × 37.1	4 740	162	154	11.6	8.1
× 20	5.87	6.20	6.020	0.365	0.260	× 29.8	3 790	157	153	9.3	6.6
× 15	4.43	5.99	5.990	0.260	0.230	× 22.5	2 860	152	152	6.6	5.8
W6 × 16	4.74	6.28	4.030	0.405	0.260	W150 × 24.0	3 060	160	102	10.3	6.6
× 12	3.55	6.03	4.000	0.280	0.230	× 18.0	2 290	153	102	7.1	5.8
× 9	2.68	5.90	3.940	0.215	0.170	× 13.5	1 730	150	100	5.5	4.3
× 8.5	2.52	5.83	3.940	0.195	0.170	× 13.0	1 630	148	100	4.9	4.3
W5 × 19	5.54	5.15	5.030	0.430	0.270	W130 × 28.1	3 590	131	128	10.9	6.9
× 16	4.68	5.01	5.000	0.360	0.240	× 23.8	3 040	127	127	9.1	6.1
W4 × 13	3.83	4.16	4.060	0.345	0.280	W100 × 19.3	2 470	106	103	8.8	7.1

[A] Actual flange and web thicknesses vary due to mill rolling practices; however, permitted variations for such dimensions are not addressed.

TABLE A2.1 "W" Shapes





EN 10365:2017 (E)

ILNAS-EN 10365:2017

Table 1 — Parallel flange I sections IPE

Designation	G	Dimensions				A
	kg/m	h mm	b mm	s mm	t mm	cm²
IPE AA 80	4,9	78,0	46,0	3,2	4,2	6,3
IPE A 80	5,0	78,0	46,0	3,3	4,2	6,4
IPE 80	6,0	80,0	46,0	3,8	5,2	7,6
IPE AA 100	6,7	97,6	55,0	3,6	4,5	8,6
IPE A 100	6,9	98,0	55,0	3,6	4,7	8,8
IPE 100	8,1	100,0	55,0	4,1	5,7	10,3

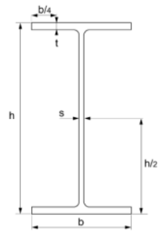


Figure 1 — IPE, HE, HL, HD, HP, UBP, UB and UC parallel flange sections

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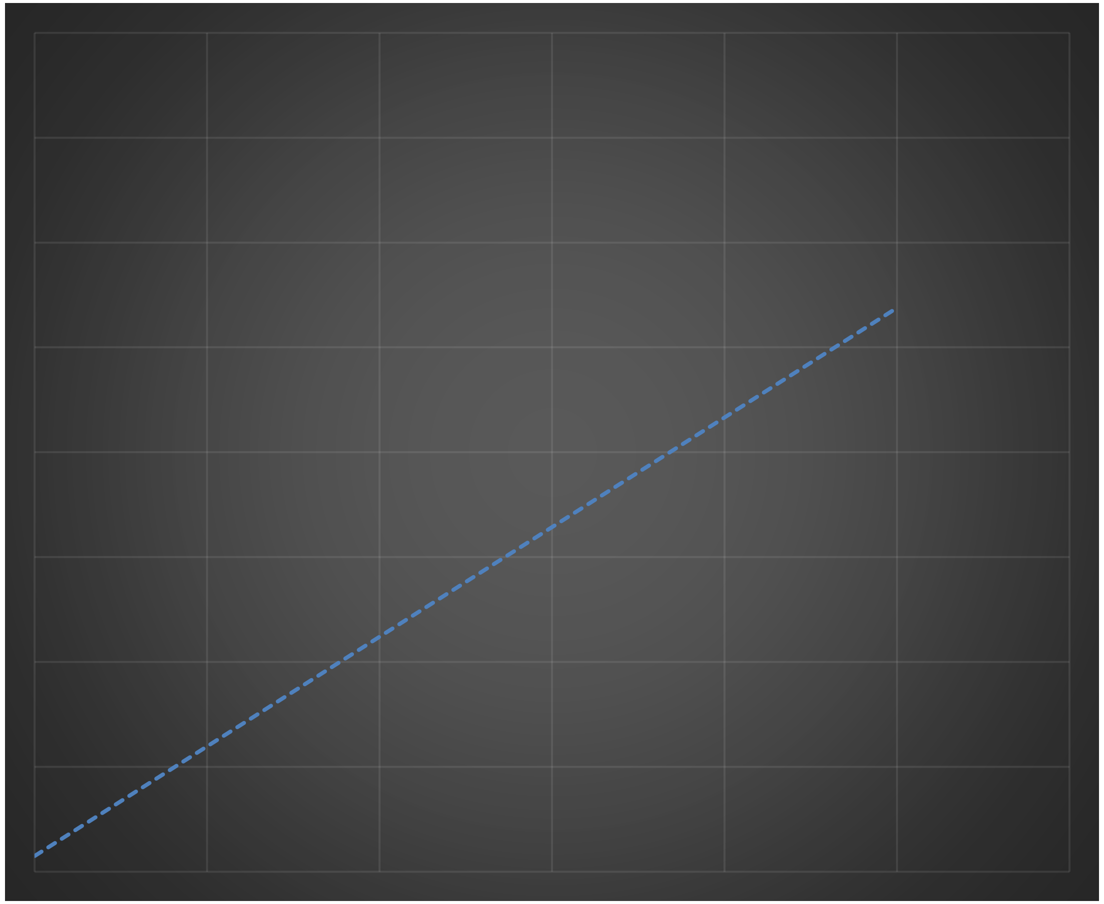
ArcelorMittal

Costa Rican Group
IABSE

Tolerancias

MÁXIMOS DESVÍOS ADMISIBLES PARA LAS DIMENSIONES

- Altura
- Ancho
- Espesores
- Masa
- Rectitud
- Paralelismo



Tolerancias

ALTURA

	EEUU (W y HP)	EUROPA
≤ 180mm	+3.2mm / -3.2mm	+3mm / -2mm
180mm < h ≤ 400mm		+4mm / -2mm
400mm < h ≤ 700mm		+5mm / -3mm
> 700mm		+5mm / -5mm

Tolerancias

ANCHO

	EEUU (W y HP)	EUROPA
≤ 110mm	+6.4mm / -4.8mm	+4mm / -1mm
110mm < h ≤ 210mm		+4mm / -2mm
210mm < h ≤ 325mm		+4mm / -4mm
> 325mm		+6mm / -5mm

Tolerancias

ESPESORES DEL ALMA

	EEUU (W y HP)	EUROPA
< 7mm	NO DEFINIDO	± 0,7mm
7mm ≤ tw (s) < 10mm		± 1,0mm
10mm ≤ tw (s) < 20mm		± 1,5mm
20mm ≤ tw (s) < 40mm		± 2,0mm
40mm ≤ tw (s) < 60mm		± 2,5mm
> 60mm		± 3,0mm

Tolerancias

ESPESORES DE LOS PATINES

	EEUU (W y HP)	EUROPA
< 6,5mm	NO DEFINIDO	+1,5mm / -0,5mm
6,5mm ≤ tw (s) < 10mm		+2,0mm / -1,0mm
10mm ≤ tw (s) < 20mm		+2,5mm / -1,5mm
20mm ≤ tw (s) < 30mm		+2,5mm / -2,0mm
30mm ≤ tw (s) < 40mm		+2,5mm / -2,5mm
40mm ≤ tw (s) < 60mm		+3,0mm / -3,0mm
> 60mm		+4,0mm / -4,0mm

Tolerancias

RESUMEN → Tabla 14 del Catálogo de Perfiles de ArcelorMittal

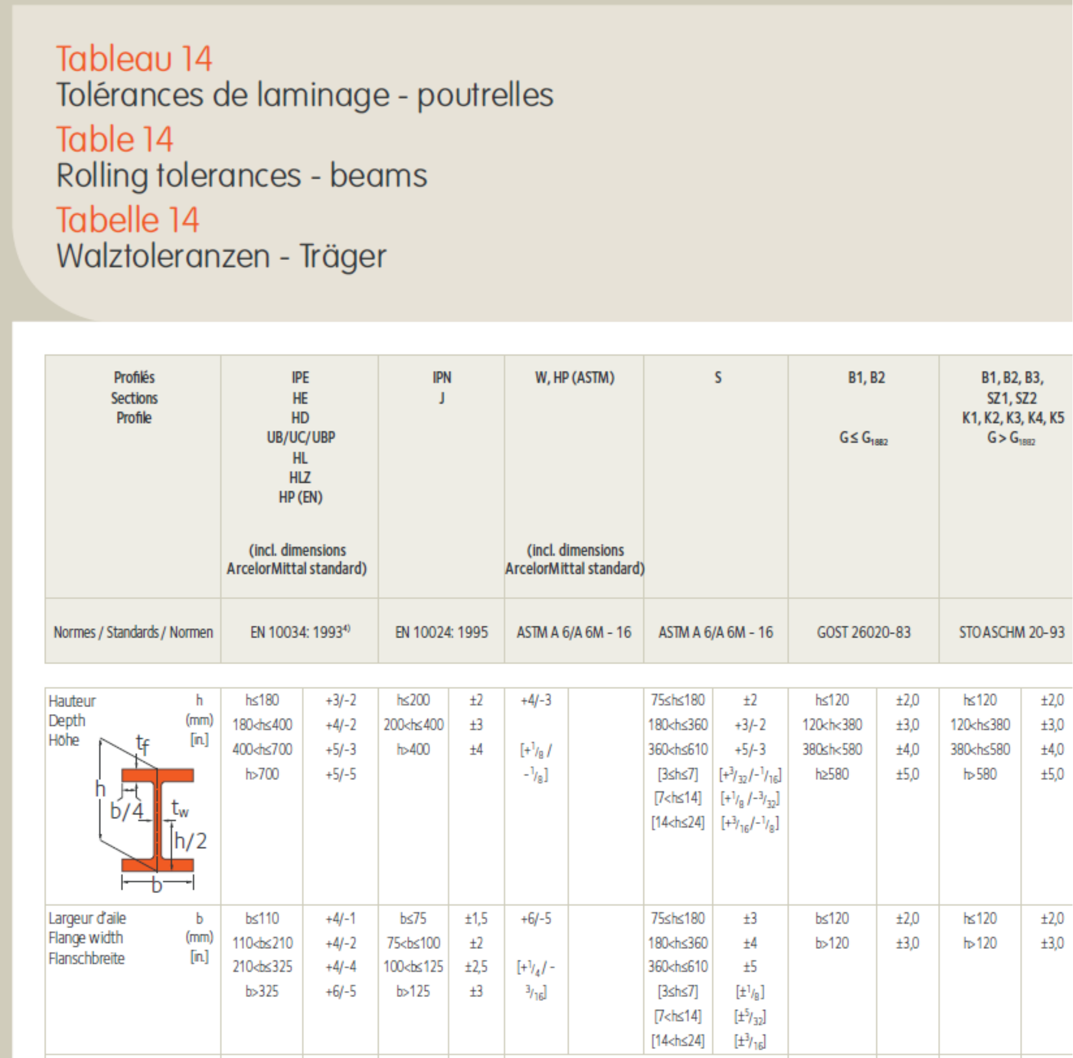


Tableau 14
Tolérances de laminage - poutrelles

Table 14
Rolling tolerances - beams

Tabelle 14
Walztoleranzen - Träger

Profilés Sections Profile	IPE HE HD UB/UC/UBP HL HLZ HP (EN) (incl. dimensions ArcelorMittal standard)		IPN J		W, HP (ASTM) (incl. dimensions ArcelorMittal standard)		S		B1, B2 $G \le G_{1882}$		B1, B2, B3, SZ1, SZ2 K1, K2, K3, K4, K5 $G > G_{1882}$	
Normes / Standards / Normen	EN 10034: 1993[4)]		EN 10024: 1995		ASTM A 6/A 6M - 16		ASTM A 6/A 6M - 16		GOST 26020-83		STO ASCHM 20-93	
Hauteur Depth Höhe h (mm) [in.]	h≤180 180<h≤400 400<h≤700 h>700	+3/-2 +4/-2 +5/-3 +5/-5	h≤200 200<h≤400 h>400	±2 ±3 ±4	+4/-3 $[+^1/_8 / -^1/_8]$		75≤h≤180 180<h≤360 360<h≤610 [3≤h≤7] [7<h≤14] [14<h≤24]	±2 +3/-2 +5/-3 $[+^3/_{32}/-^1/_{16}]$ $[+^1/_8/-^3/_{32}]$ $[+^3/_{16}/-^1/_8]$	h≤120 120<h<380 380≤h<580 h≥580	±2,0 ±3,0 ±4,0 ±5,0	h≤120 120<h≤380 380<h≤580 h>580	±2,0 ±3,0 ±4,0 ±5,0
Largeur d'aile Flange width Flanschbreite b (mm) [in.]	b≤110 110<b≤210 210<b≤325 b>325	+4/-1 +4/-2 +4/-4 +6/-5	b≤75 75<b≤100 100<b≤125 b>125	±1,5 ±2 ±2,5 ±3	+6/-5 $[+^1/_4 / -^3/_{16}]$		75≤h≤180 180<h≤360 360<h≤610 [3≤h≤7] [7<h≤14] [14<h≤24]	±3 ±4 ±5 $[\pm^1/_8]$ $[\pm^5/_{32}]$ $[\pm^3/_{16}]$	b≤120 b>120	±2,0 ±3,0	h≤120 h>120	±2,0 ±3,0

Normas de Calidad

ASTM

- A36
- A572
- A992
- A709
- A588
- A913

EN 10025

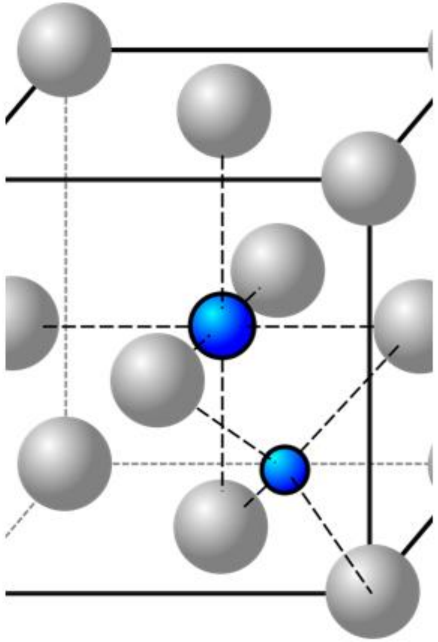
- Section 2
- Section 4
- Section 5

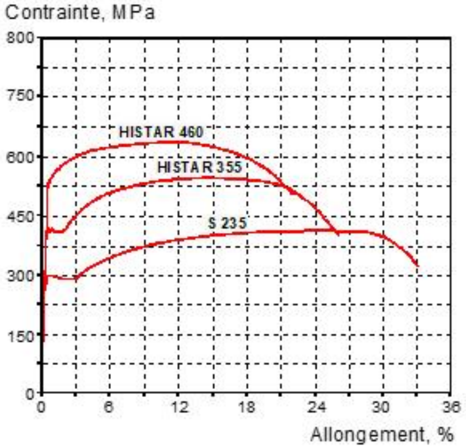
Segmentación

Norma única

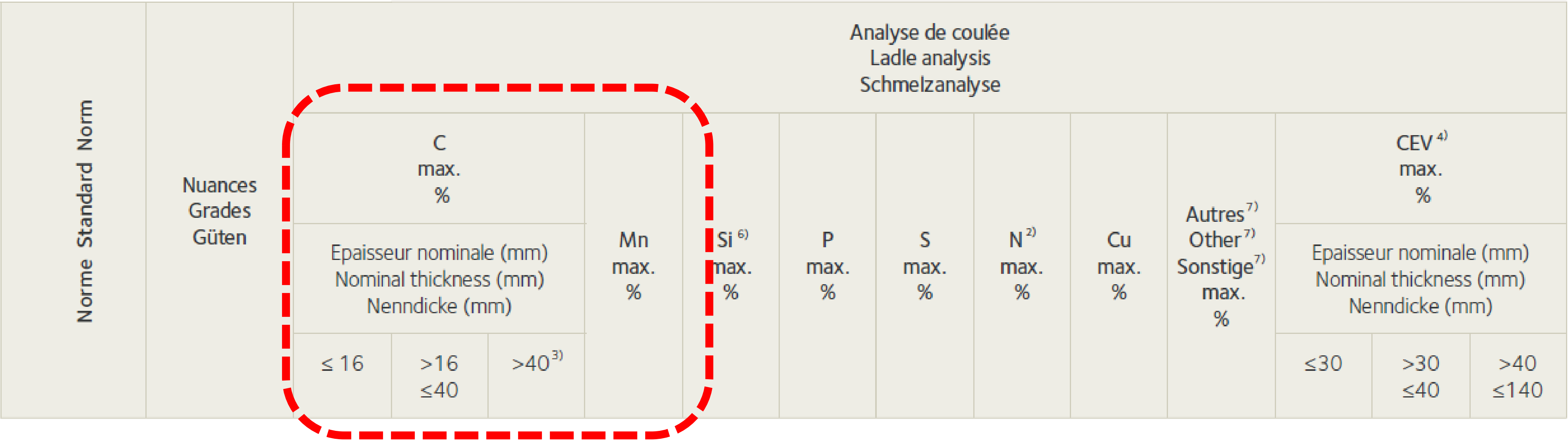
Normas de Calidad

MANEJAR LA COMPOSICIÓN QUÍMICA PARA LOGAR BUENAS PROPIEDADES MECÁNICAS





Composición química



Norme Standard Norm	Nuances Grades Güten	Analyse de coulée Ladle analysis Schmelzanalyse												
		C max. %			Mn max. %	Si[6] max. %	P max. %	S max. %	N[2] max. %	Cu max. %	Autres[7] Other[7] Sonstige[7] max. %	CEV[4] max. %		
		Epaisseur nominale (mm) Nominal thickness (mm) Nenndicke (mm)										Epaisseur nominale (mm) Nominal thickness (mm) Nenndicke (mm)		
		≤ 16	>16 ≤40	>40[3]								≤30	>30 ≤40	>40 ≤140

↑ C Mn → ↑ Resistencia ↓ Soldabilidad

$$CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15$$

Propiedades Mecánicas

PUNTOS FUNDAMENTALES

- Límite de cedencia → fy (grado de acero)
- Ductilidad → Elongación
- Tenacidad → CVN

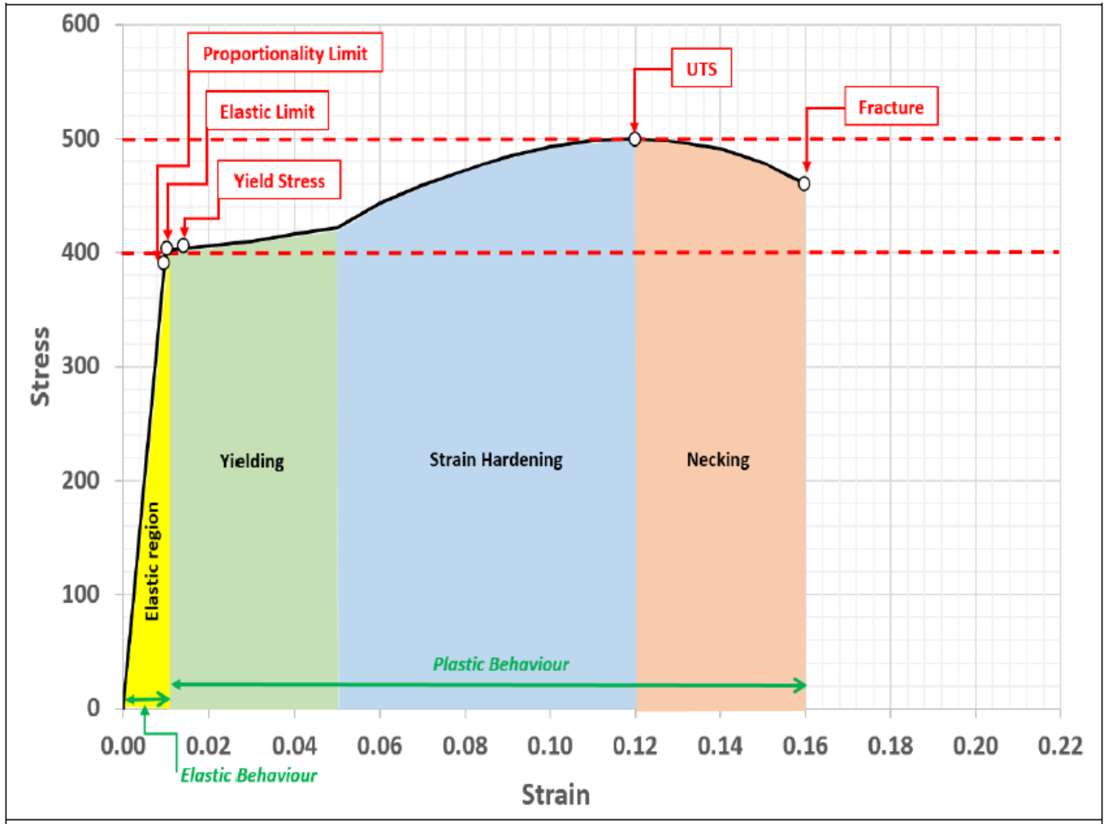
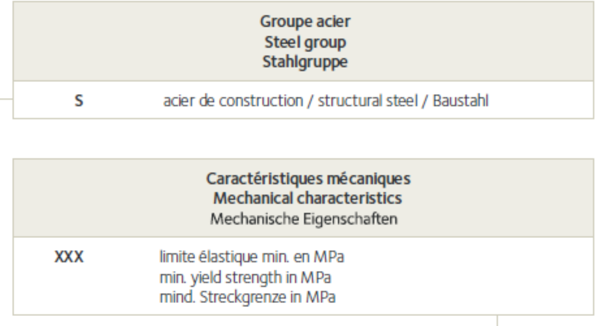


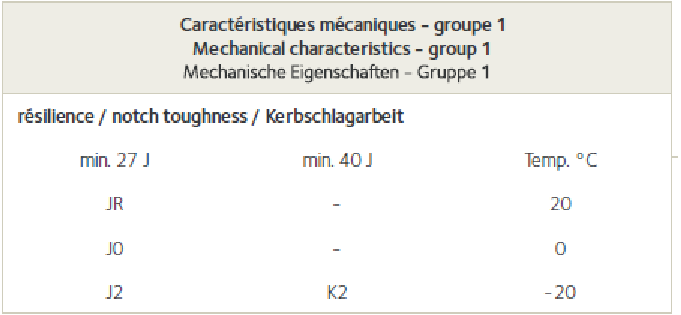
Fig 5: Typical Stress Strain Curve.

Grados de acero



Groupe acier Steel group Stahlgruppe	
S	acier de construction / structural steel / Baustahl

Caractéristiques mécaniques Mechanical characteristics Mechanische Eigenschaften	
XXX	limite élastique min. en MPa min. yield strength in MPa mind. Streckgrenze in MPa



Caractéristiques mécaniques – groupe 1 Mechanical characteristics – group 1 Mechanische Eigenschaften – Gruppe 1		
résilience / notch toughness / Kerbschlagarbeit		
min. 27 J	min. 40 J	Temp. °C
JR	-	20
J0	-	0
J2	K2	-20

EN 10025-2:2019 S 355 J2

ASTM A913 gr.50

$$50 \times \sim 6{,}9 = 345\ MPa$$

Ejemplos de designación

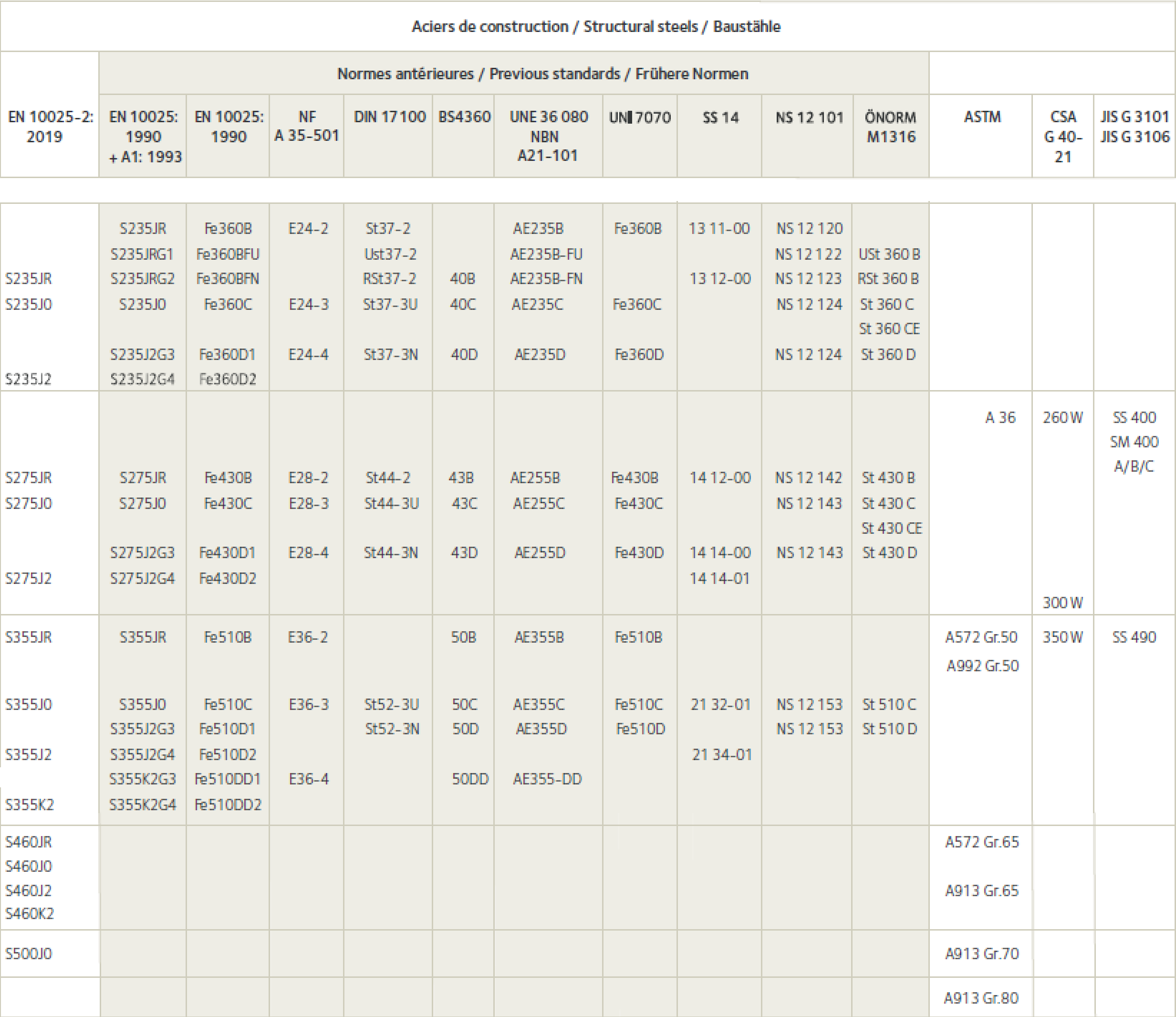
DESIGNACIONES TÍPICAS

- EN
- ASTM

	EUROPA	EEUU
Norma Def. Geométrica	EN 10365:2017	ASTM A6/A6M-16
Medida	HE 200 M	W8x8x67(W200x200x100)
Norma de Calidad	EN 10025-2:2019	ASTM A992
Grado del Acero	S355 JR	fy=50 ksi =345 MPa

Equivalencia entre estándares

Equivalencia no es igualdad



Aciers de construction / Structural steels / Baustähle													
	Normes antérieures / Previous standards / Frühere Normen												
EN 10025-2: 2019	EN 10025: 1990 + A1: 1993	EN 10025: 1990	NF A 35-501	DIN 17100	BS4360	UNE 36 080 NBN A21-101	UNI 7070	SS 14	NS 12 101	ÖNORM M1316	ASTM	CSA G 40-21	JIS G 3101 JIS G 3106
	S235JR	Fe360B	E24-2	St37-2		AE235B	Fe360B	13 11-00	NS 12 120				
	S235JRG1	Fe360BFU		Ust37-2		AE235B-FU			NS 12 122	USt 360 B			
S235JR	S235JRG2	Fe360BFN		RSt37-2	40B	AE235B-FN		13 12-00	NS 12 123	RSt 360 B			
S235J0	S235J0	Fe360C	E24-3	St37-3U	40C	AE235C	Fe360C		NS 12 124	St 360 C			
										St 360 CE			
	S235J2G3	Fe360D1	E24-4	St37-3N	40D	AE235D	Fe360D		NS 12 124	St 360 D			
S235J2	S235J2G4	Fe360D2											
											A 36	260 W	SS 400
													SM 400
													A/B/C
S275JR	S275JR	Fe430B	E28-2	St44-2	43B	AE255B	Fe430B	14 12-00	NS 12 142	St 430 B			
S275J0	S275J0	Fe430C	E28-3	St44-3U	43C	AE255C	Fe430C		NS 12 143	St 430 C			
										St 430 CE			
	S275J2G3	Fe430D1	E28-4	St44-3N	43D	AE255D	Fe430D	14 14-00	NS 12 143	St 430 D			
S275J2	S275J2G4	Fe430D2						14 14-01					
												300 W	
S355JR	S355JR	Fe510B	E36-2		50B	AE355B	Fe510B				A572 Gr.50	350 W	SS 490
											A992 Gr.50		
S355J0	S355J0	Fe510C	E36-3	St52-3U	50C	AE355C	Fe510C	21 32-01	NS 12 153	St 510 C			
	S355J2G3	Fe510D1		St52-3N	50D	AE355D	Fe510D		NS 12 153	St 510 D			
S355J2	S355J2G4	Fe510D2						21 34-01					
	S355K2G3	Fe510DD1	E36-4		50DD	AE355-DD							
S355K2	S355K2G4	Fe510DD2											
S460JR											A572 Gr.65		
S460J0													
S460J2											A913 Gr.65		
S460K2													
S500J0											A913 Gr.70		
											A913 Gr.80		

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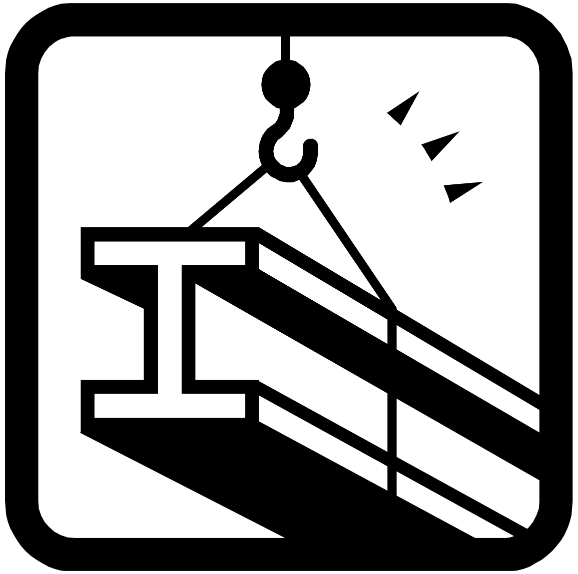
¿POR QUÉ DEBO UTILIZAR PERFILES LAMINADOS?



Alto control tecnológico en producción

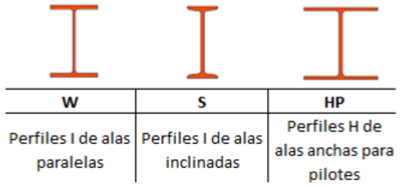
- Buenas propiedades Mecánicas
- Alta confiabilidad
- Trazabilidad
- Óptima Relación Resistencia x peso
- Excelente Ductilidad y Tenacidad → buena performance frente a cargas de origen dinámico

Elevada precisión

- Molino
- Taller

Amplia gama

- 4” (100mm) ~ 44” (1100mm)
- Espesores de hasta 140mm para los patines
- Pesos unitarios de hasta 1400 Kg/m
- ASTM A6: W, S, HP
- EN: IPE, HE, HD

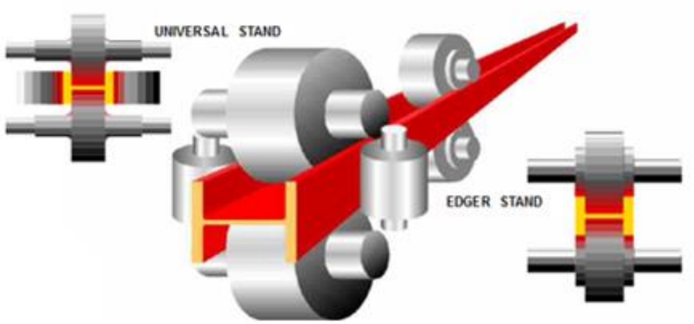


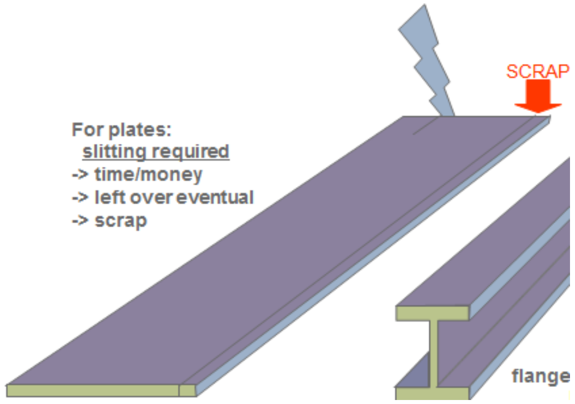
W	S	HP
Perfiles I de alas paralelas	Perfiles I de alas inclinadas	Perfiles H de alas anchas para pilotes

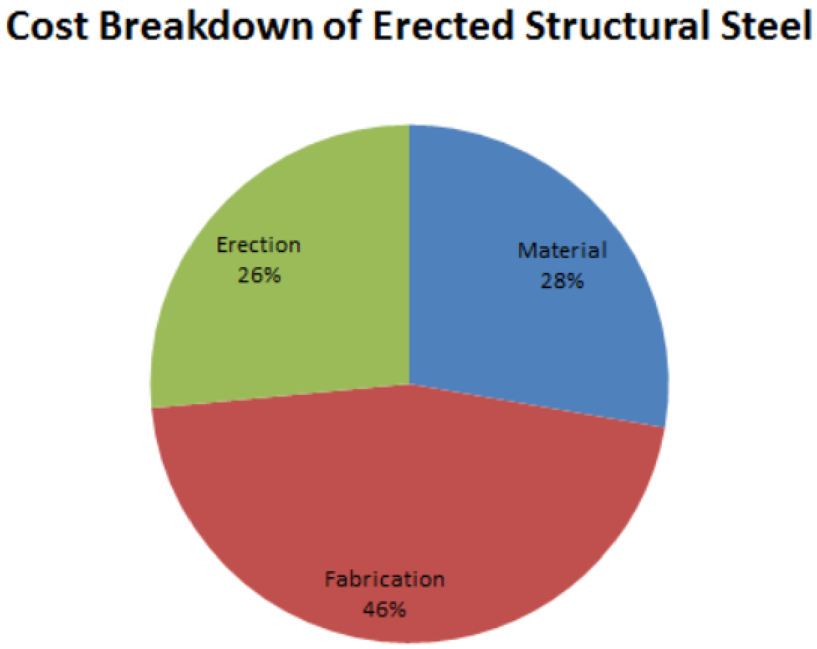
IPE	IPN	HE	HL	HD	HP
Perfiles I de alas paralelas	Perfiles I de alas inclinadas	Perfiles H de alas anchas	Perfiles H de alas muy anchas	Perfiles H de alas anchas para pilares	Perfiles H de alas anchas para pilotes

Menores costos de fabricación

- USD 300 ~ 500 / MT






Cost Breakdown of Erected Structural Steel

Versatilidad geométrica

Flexibilidad geométrica global

Excelente performance estética

Luces amplias y peraltes reducidos

Ahorro de espacio en planta

⇒ long spans
⇒ flexible interior arrangements

Customerfriendly car parks shall have no columns in the the parking spaces !

Better solution!

Buena interface con las demás disciplinas

Disminución de apuntalamientos y reducción de residuos

Adaptabilidad

- Arreglos
- Refuerzos / Expansiones

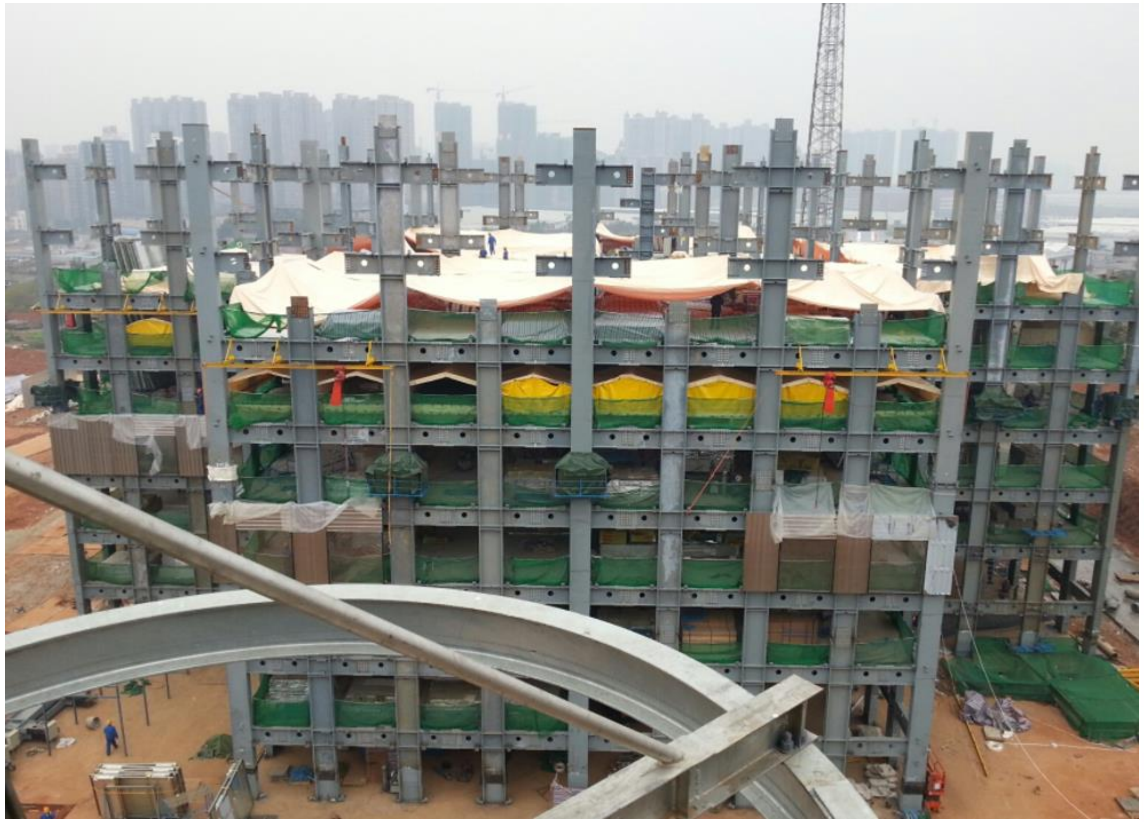
Edificio Parqueos Paseo La Galeria

Ligereza

- Reducción de la carga sísmica
- Alivio de cargas en las cimentaciones

Velocidad de Montaje

- Luces más grandes nos brindan una menor cantidad de piezas
- Utilización de uniones apernadas in situ
- Precisión en Molino y taller
- Reducción/eliminación de apuntalamientos y encofrados
- Facilidad de manejar la interface con las demás disciplinas (pisos, fachadas, cerramientos, tuberías, etc.)



Mini Sky City (China)
10000 toneladas
57 pisos
19 días

Sostenibilidad

- Efectiva Reciclabilidad (Cradle-to-Cradle Life Cycle)
- Bajo consumo de agua en el proceso productivo
- Baja generación de residuos a lo largo de toda cadena
- Reducción de la huella de Carbono

- **Taza de reciclabilidad promedio → 98%**
- **Más de 90% del contenido → Chatarra**

Los perfiles son amigables al medio ambiente

- EPD
- LEED

ENVIRONMENTAL PRODUCT DECLARATION
as per ISO 14025 and EN 15804

Owner of the Declaration	ArcelorMittal Europe - Long Products
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ARM-20170033-IBD1-EN
Issue date	21.02.2017
Valid to	20.02.2022

Structural steel sections in HISTAR® grades
ArcelorMittal

www.ibu-epd.com / https://epd-online.com

1. General Information

ArcelorMittal	**Structural steel sections in HISTAR® grades**
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the Declaration** ArcelorMittal Europe-Long Products Differdange plant Rue Emile Mark L-4503 Differdange Luxembourg
Declaration number EPD-ARM-20170033-IBD1-EN	**Declared product / Declared unit** 1 ton of structural steel in HISTAR® grades
This Declaration is based on the Product Category Rules: Structural steels, 07.2014 (PCR tested and approved by the SVR)	**Scope:** The declaration applies to 1 ton of structural steel produced by ArcelorMittal Europe - Long Products. The Life Cycle Assessment is based on data collected from the ArcelorMittal Differdange plant. It covers 100% of the annual production from 2014. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 21.02.2017	
Valid to 20.02.2022	**Verification** The CEN Norm /EN 15804/ serves as the core PCR Independent verification of the declaration according to /ISO 14025/ ☐ internally ☒ externally
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	
Dr. Burkhart Lehmann	Dr. Frank Werner

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential

What Should a LEED Project Accomplish?

- contribution to climate change
- Enhance human health and wellbeing
- Protect and restore water resources
- Protect biodiversity and ecosystem
- Promote sustainable and regenerative
- Build a greener economy
- Enhance Community, Social Equity, Env. Justice & Quality of Life

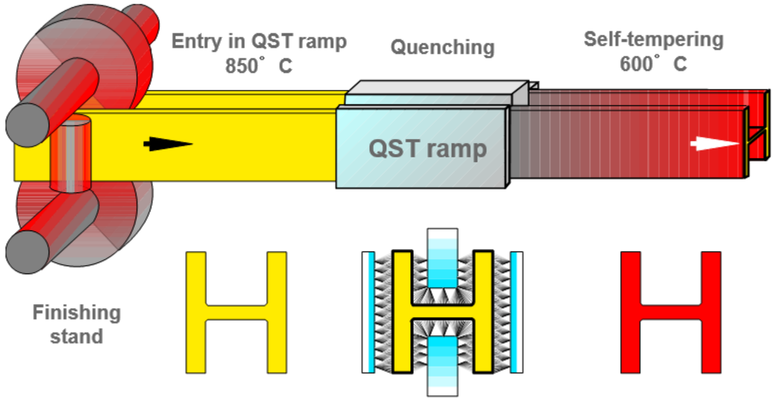
Figure 2: An illustration of how the impact categories are used to evaluate each credit in the rating system

¿TODAS ESTAS VENTAJAS TODAVÍA NO DAN BASTO?

Aceros de alta resistencia bajo ASTM A913

HISTAR (High Strength ArcelorMittal Steel)

- Mediados de los años 1990 → innovación en el proceso de producción: el QST
- Proceso “In-Line”: laminación termo mecánica + templado y auto revenido
- Refino de la estructura de granos
- Alta Resistencia Mecánica
- Buena ductilidad, tenacidad y soldabilidad



QST (Quenching and Self-Tempering)

Aceros de alta resistencia bajo ASTM A913

- ***Alta resistencia mecánica:*** grados 50, 60, 65, 70 y 80 ksi
- ***Buena soldabilidad:*** no es necesario soldar con precalentamiento, siempre y cuando electrodos con bajo hidrógeno (H8) sean utilizados
- ***Adecuada Tenacidad:*** ASTM A913 determina un nivel promedio mínimo de tenacidad CVN de 54J a temperatura de 21°C, lo que no es un requisito estándar en las normas ASTM A36, A572, ni en la A992

GRADO	fy,min	fu,min	Emin	Emin	CE max	CVN
			200mm	50mm		ASTM A673
50	345 MPa	450 MPa	18%	21%	0.38%	54 J a 21°C
60	415 MPa	520 MPa	16%	18%	0.40%	54 J a 21°C
65	450 MPa	550 MPa	15%	17%	0.43%	54 J a 21°C
70	485 MPa	620 MPa	14%	16%	0.45%	54 J a 21°C
80	550 MPa	655 MPa	13%	15%	0.49%	54 J a 21°C

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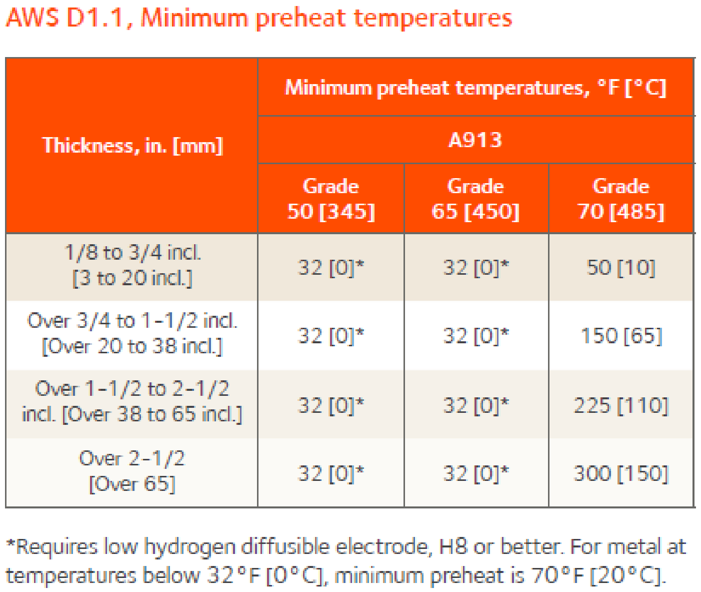
Aceros de alta resistencia bajo ASTM A913

MEJOR SOLDABILIDAD → Suavización de las demandas de precalentamiento

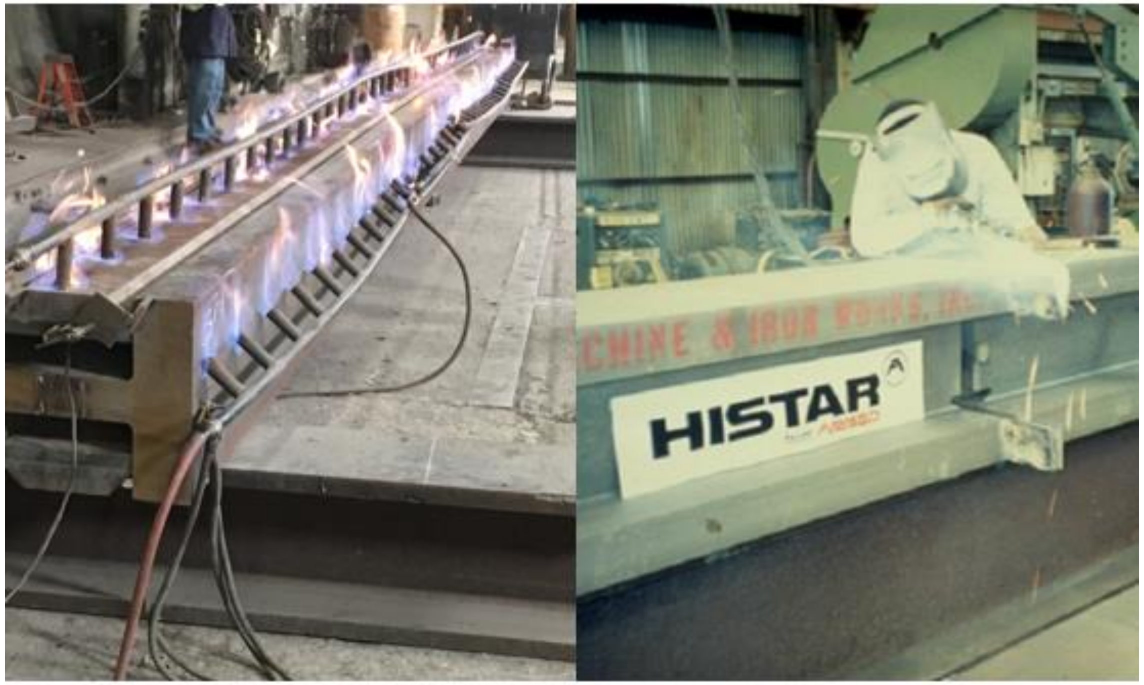
- Estricto control del CE
- Material de aporte con baja taza de deposición de Hidrógeno (H8)



AWS D1.1, Minimum preheat temperatures

Thickness, in. [mm]	Minimum preheat temperatures, °F [°C]		
	A913		
	Grade 50 [345]	Grade 65 [450]	Grade 70 [485]
1/8 to 3/4 incl. [3 to 20 incl.]	32 [0]*	32 [0]*	50 [10]
Over 3/4 to 1-1/2 incl. [Over 20 to 38 incl.]	32 [0]*	32 [0]*	150 [65]
Over 1-1/2 to 2-1/2 incl. [Over 38 to 65 incl.]	32 [0]*	32 [0]*	225 [110]
Over 2-1/2 [Over 65]	32 [0]*	32 [0]*	300 [150]

*Requires low hydrogen diffusible electrode, H8 or better. For metal at temperatures below 32°F [0°C], minimum preheat is 70°F [20°C].



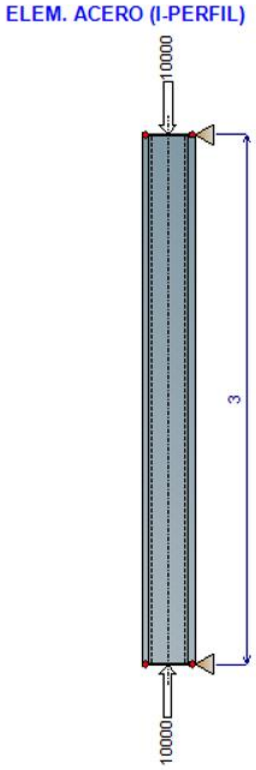
Aceros de alta resistencia bajo ASTM A913

MAYOR RESISTENCIA MECÁNICA → OPTIMIZACIÓN DE ESTRUCTURAS

- Estricto control del CE
- Material de aporte con baja taza de deposición de Hidrógeno (H8)

ORIGINAL (gr.50)	ASTM A913 (gr.65)	ASTM A913 (gr.70)	ASTM A913 (gr.80)
W14x370 (W360x551)	W14x311 (W360x463)	W14x283 (W360x421)	W14x257 (W360x382)
100%	84%	76%	69%

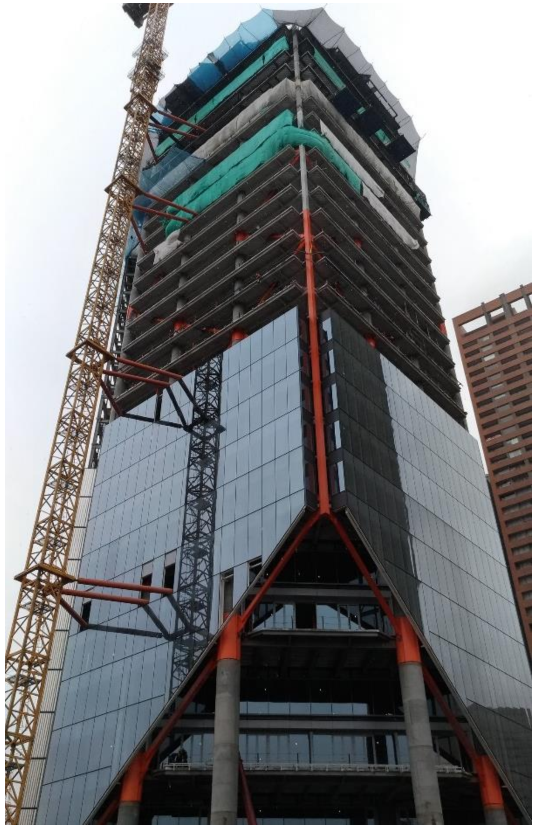
-31%



Aceros de alta resistencia bajo ASTM A913

ALGUNOS CASOS EXITOSOS

- Puente Metro Mall / Fuerzas Armadas | Tegucigalpa (Honduras)
- Edificio ACAP | Santiago de los Caballeros (República Dominicana)
- Torre Atrio | Bogotá (Colombia)



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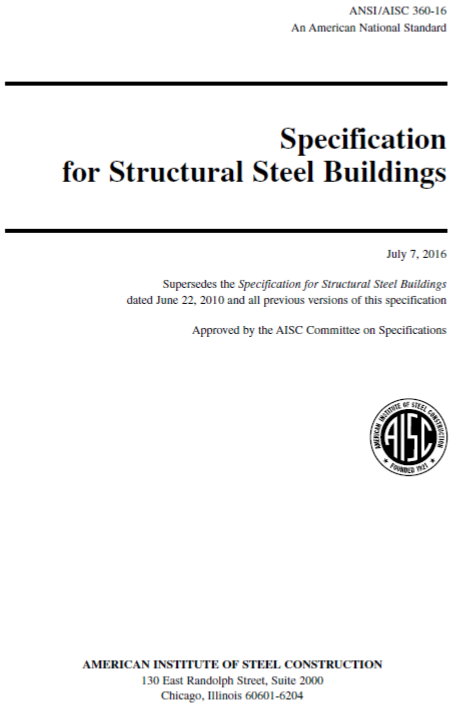
Consideraciones finales

PRÓXIMAMENTE…

- Sistemas de piso (AISC 360-16)
- Sistemas Sismorresistentes (AISC 341-16)
- Conexiones precalificadas a momento (AISC 358-16)



ANSI/AISC 360-16
An American National Standard

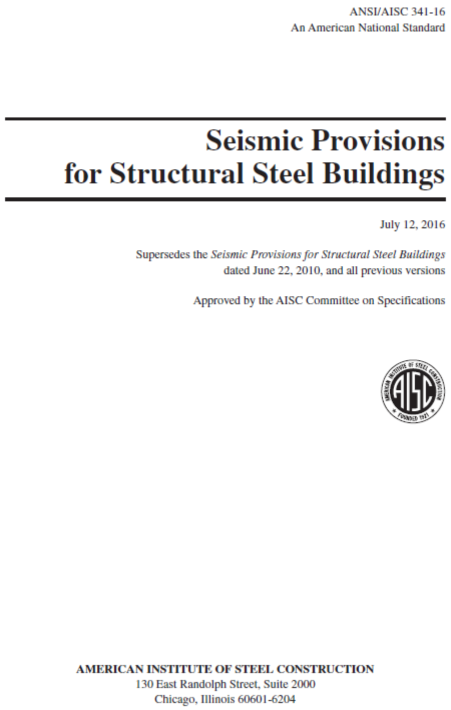
**Specification
for Structural Steel Buildings**

July 7, 2016

Supersedes the *Specification for Structural Steel Buildings*
dated June 22, 2010 and all previous versions of this specification

Approved by the AISC Committee on Specifications

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
130 East Randolph Street, Suite 2000
Chicago, Illinois 60601-6204



ANSI/AISC 341-16
An American National Standard

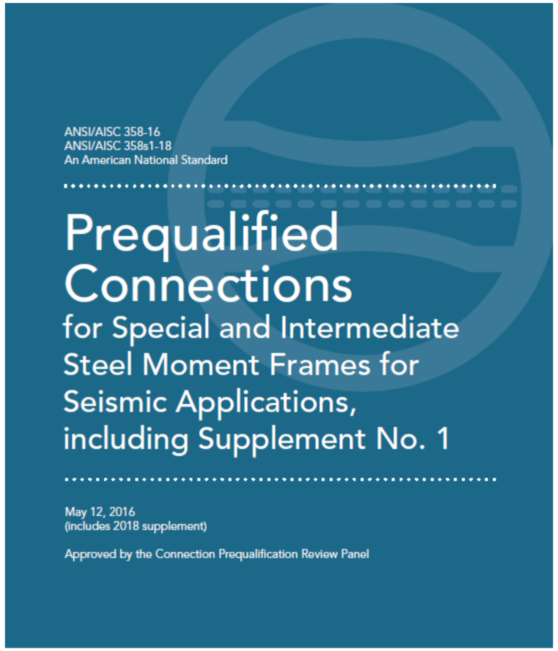
**Seismic Provisions
for Structural Steel Buildings**

July 12, 2016

Supersedes the *Seismic Provisions for Structural Steel Buildings*
dated June 22, 2010, and all previous versions

Approved by the AISC Committee on Specifications

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
130 East Randolph Street, Suite 2000
Chicago, Illinois 60601-6204



ANSI/AISC 358-16
ANSI/AISC 358s1-18
An American National Standard

**Prequalified
Connections
for Special and Intermediate
Steel Moment Frames for
Seismic Applications,
including Supplement No. 1**

May 12, 2016
(includes 2018 supplement)

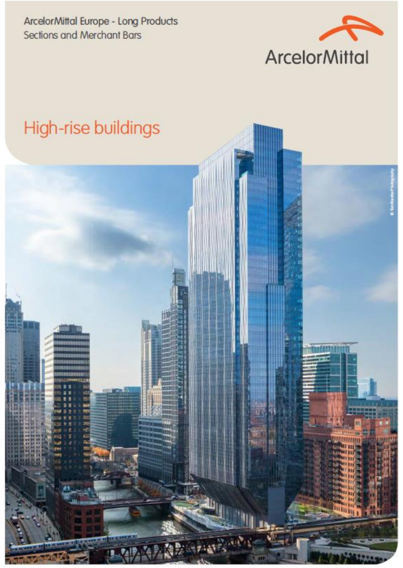
Approved by the Connection Prequalification Review Panel

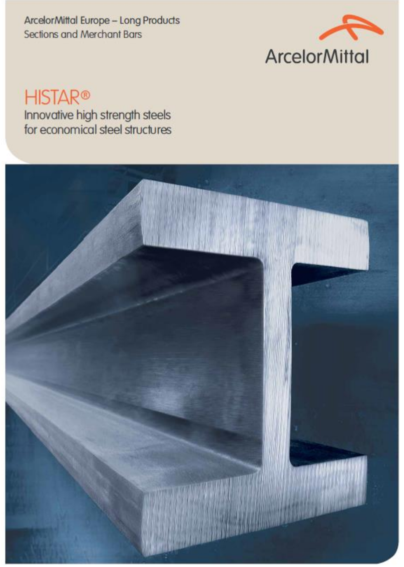
¡Muchas gracias por su atención!

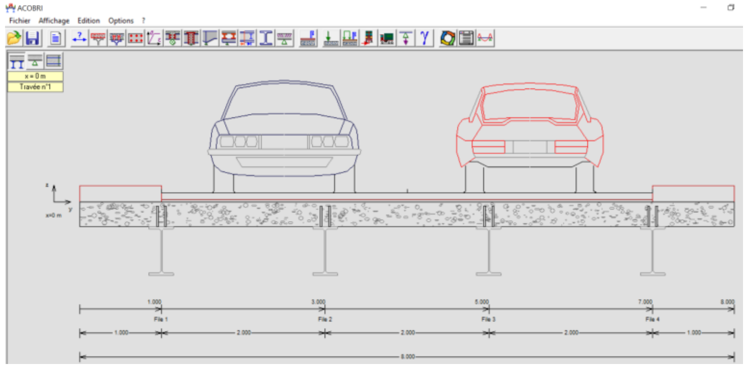
DESCARGA DE MATERIAL DE APOYO
Catálogos
Folletos
Softwares de prediseño

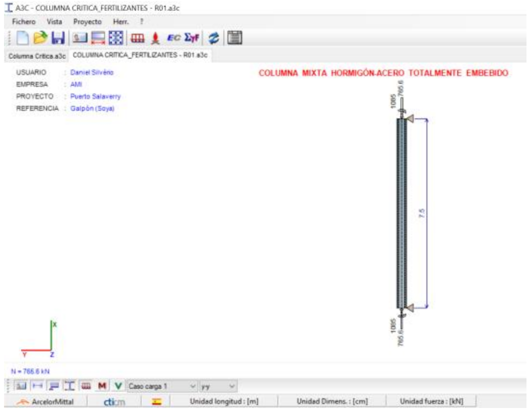
sections.arcelormittal.com


ArcelorMittal Europe
Long Products
ArcelorMittal
Profilés et Aciers Marchands
Sections and Merchant Bars
Profil- und Stabstahl
Programme de Vente / Sales Programme / Verkaufsprogramm
New
steel grades
A913 (2019) Grade 80
EN 10025:2019
S500M
S460W


ArcelorMittal Europe - Long Products
Sections and Merchant Bars
ArcelorMittal
High-rise buildings


ArcelorMittal Europe – Long Products
Sections and Merchant Bars
ArcelorMittal
HISTAR®
Innovative high strength steels
for economical steel structures




A3C - COLUMNA CRITICA_FERTILIZANTES - R01.a3c
Columna Critica.a3c
COLUMNA CRITICA_FERTILIZANTES - R01.a3c

USUARIO : Daniel Silvério
EMPRESA : AMI
PROYECTO : Puerto Salaverry
REFERENCIA : Galpón (Soya)

COLUMNA MIXTA HORMIGÓN-ACERO TOTALMENTE EMBEBIDO

N = 765.6 kN
Caso carga 1
y-y
Unidad longitud : [m]
Unidad Dimens. : [cm]
Unidad fuerza : [kN]

INFORMACIÓN DE CONTACTO
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daniel.Silverio@arcelormittal.com.br
+55 11 94511 6438

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Preguntas y Respuestas