

04

SPECIFICATIONS

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Overview

The purpose of a structural steelwork specification is to state what materials and products should be used and how work (fabrication and erection) should be carried out, in order to ensure that the completed structure meets the designer's assumptions and the client's needs. The complete 'execution specification' for a structure comprises a range of contractual documents, including drawings, a general specification with technical requirements for supply of materials and products and for workmanship, and project-specific requirements for the individual structure.

Having identified the steel product in terms of its standards reference and grade identification it is often necessary to establish its availability. To find out more about a specific grade or for any queries on the range of steel specifications supplied, please contact us. At Alpine Metals, we are able to offer guidance on steel specifications and applications.

Steel specifications vary from country to country and can be based on differing criteria, majority of them being defined in the terms of the chemical composition or mechanical properties of the steel.

The term 'steel specification' is very often closely related to standards and is often used interchangeably, although their meaning is not really identical. German steel specifications often start with the letters DIN, Japanese with JIS, international with ISO etc.

The most widely used standard steel specifications are the Euronorms (EN) and those published by ASTM; these steel specifications represent a consensus drawn from producers, fabricators and users of steel mill products.

Many of the ASTM specifications have been adopted by the American Society of Mechanical Engineers (ASME) with slight or no modifications. ASME uses the prefix S with the ASTM specifications; for example, ASME SA213 and ASTM A213 are the same. SAE/AISI designations for the chemical compositions of carbon and alloy steels are sometimes included in the ASTM specifications for bars, wires, and billets for forging. Some ASTM specifications for sheet products incorporate SAE-AISI designations for chemical composition.

EN (Euronorm) is a harmonized system of European countries. Although it is accepted and effectively used in all European countries, 'obsolete' national systems, such as German DIN, British BS, French AFNOR and Italian UNI can steel often be found in many documents.

The subsequent pages briefly outline the specified chemistry and mechanical properties of some commonly used steels. The information presented here is based on the latest published specifications.

Comparison of Typical Steel Grades

The available structural steel grades according to European, American, Russian and Japanese standards are shown in the subsequent pages. These summary tables show the main requirements of the standards regarding the mechanical characteristics and the chemical composition of the steel grades.

A brief overview showing the corresponding designations between the European standards grades with those from the American, Canadian, Japanese and the former national European standards are also listed below.

EN 10025-2: 2004	EN 10025: 1993	Discontinued standards			ASTM	CSA G 40-21	JIS G3101 JIS G3106	
		DIN 17100	BS4360	UNI 7070				
S235JR S235J0 S235J2	S235JR	St37-2	40B 40C 40D	Fe360B	A283 Gr C		SS 330	
	S235JRG1	Ust37-2						
	S235JRG2	Rst37-2						
	S235J0	St37-3U		Fe360C				
	S235J2G3	St37-3N		Fe360D				
	S235J2G4							
S275JR S275J0 S275J2	S275JR	St44-2	43B	Fe430B	A36	260W	SS 400 SM 400	
	S275J0	St44-3U	43C	Fe430C				
	S275J2G3	St44-3N	43D	Fe430D				
	S275J2G4							
S355JR S355J0 S355J2 S355K2	S355JR	St52-3U St52-3N	50B	Fe510B	A572 Gr. 50 A992 Gr. 50	300W 350W	SS 490	
	S355J0		50C	Fe510C				
	S355J2G3		50D	Fe510D				
	S355J2G4		50DD					
	S355K2G3							
	S355K2G4							

Structural Grades According to European Standard

Grade designation systems

The designation systems used in the new standard are similar but not identical to EN 10025:1993.

The symbols used in EN 10025-2:2004 non-alloy structural steels designate:

S - Structural steel

E - Engineering steel

235 - Minimum yield strength (R_{eH}) in MPa at 16mm

JR - Longitudinal Charpy V-notch impacts 27 J at + 20°C

J0 - Longitudinal Charpy V-notch impacts 27 J at 0°C

J2 - Longitudinal Charpy V-notch impacts 27 J at - 20°C

K2 - Longitudinal Charpy V-notch impacts 40 J at - 20°C

+AR - Supply in as rolled conditions

+N - Supply in normalized/normalized rolled conditions

Mechanical properties

Stand- ard	Grades	Minimum yield strength R_{eH} Mpa						Tensile strength R_m MPa		Minimum elongation %				Notch impact test, longitudinal	
		≤16	>16 ≤40	>40 ≤63	>63 ≤80	>80 ≤100	>100 ≤140	≥3 ≤100	>100 ≤140	≥3 ≤40	>40 ≤63	>63 ≤100	>100 ≤140	°C	J
EN 10025- 2:2004	S235JR													+20	27
	S235J0	235	225		215		195	360-510	350-500	26	25	24	22	0	27
	S235J2													-20	27
	S275JR													+20	27
	S275J0	275	265	255	245	235	225	410-560	400-540	23	22	21	19	0	27
	S275J2													-20	27
	S355JR													+20	27
	S355J0	355	345	335	325	315	295	470-630	450-600	22	21	20	18	0	27
	S355J2													-20	27
	S355K2													-20	40

Chemical properties

Stand- ard	Grades	Ladle analysis											
		C max. %			Mn max. %	Si max. %	P max. %	S max. %	N max. %	Cu max. %	CEV max. %		
		≤16	>16 ≤40	>40							≤30	>30 ≤40	>40 ≤140
EN 10025- 2:2004	S235JR	0.17	0.17	0.20	1.40	-	0.040	0.040	0.012	0.55	0.35	0.35	0.38
	S235J0	0.17	0.17	0.17	1.40	-	0.035	0.035	0.012	0.55	0.35	0.35	0.38
	S235J2	0.17	0.17	0.17	1.40	-	0.030	0.030	-	0.55	0.35	0.35	0.38
	S275JR	0.21	0.21	0.22	1.50	-	0.040	0.040	0.012	0.55	0.40	0.40	0.42
	S275J0	0.18	0.18	0.18	1.50	-	0.035	0.035	0.012	0.55	0.40	0.40	0.42
	S275J2	0.18	0.18	0.18	1.50	-	0.030	0.030	-	0.55	0.40	0.40	0.42
	S355JR	0.24	0.24	0.24	1.60	0.55	0.040	0.040	0.012	0.55	0.45	0.47	0.47
	S355J0	0.20	0.20	0.22	1.60	0.55	0.035	0.035	0.012	0.55	0.45	0.47	0.47
	S355J2	0.20	0.20	0.22	1.60	0.55	0.030	0.030	-	0.55	0.45	0.47	0.47
	S355K2	0.20	0.20	0.22	1.60	0.55	0.030	0.030	-	0.55	0.45	0.47	0.47

Structural Grades According to American Standards

Mechanical properties

Standards	Grades	Yield strength R_{eH}	Tensile strength R_m	Minimum elongation %		Notch impact test, longitudinal	
		MPa [ksi]	MPa [ksi]	min. 200mm	min. 50mm	°C [°F]	J [ft-lbf]
A283	Grade A	≥ 165 [24]	310-415 [45-60]	27	30	-	-
	Grade B	≥ 185 [27]	345-450 [45-60]	25	28	-	-
	Grade C	≥ 205 [30]	380-515 [55-70]	22	25	-	-
	Grade D	≥ 230 [33]	415-550 [60-80]	20	23	-	-
A36	Grade 36	≥ 250 [36]	400-550 [58-80]	20	21	-	-
A572	Grade 42	≥ 290 [42]	≥ 415 [60]	20	24	-	-
	Grade 50	≥ 345 [50]	≥ 450 [65]	18	21	-	-
	Grade 55	≥ 380 [55]	≥ 485 [70]	17	20	-	-
	Grade 60	≥ 415 [60]	≥ 520 [75]	16	18	-	-
	Grade 65	≥ 450 [65]	≥ 550 [80]	15	17	-	-
A588	Grade B	≥ 345 [50]	≥ 485 [70]	18	21	-	-
A709	Grade 36	≥ 250 [36]	400-550 [58-80]	20	21	-	-
	Grade 50	≥ 345 [50]	≥ 450 [65]	18	21	-	-
	Grade 50S	345-450 [50-65]	≥ 450 [65]	18	21	-	-
A992	Grade 50	345-450 [50-65]	≥ 450 [65]	18	21	-	-

Chemical properties

Standards	Grades	Ladle analysis											
		C max. %	Mn %	S max. %	P max. %	Si %	Cu %	Ni %	Cr %	Mo max. %	Nb max. %	V %	CE max. %
A283	Grade A	0.14	0.90	0.04	0.035	≤ 0.40							
	Grade B	0.17	0.90	0.04	0.035	≤ 0.40							
	Grade C	0.24	0.90	0.04	0.035	≤ 0.40							
	Grade D	0.27	0.90	0.04	0.035	≤ 0.40							
A36	Grade 36	0.26		0.05	0.04	≤ 0.40							
A572	Grade 42	0.21	≤ 1.35	0.05	0.04	≤ 0.40							
	Grade 50	0.23	≤ 1.35	0.05	0.04	≤ 0.40							
	Grade 55	0.25	≤ 1.35	0.05	0.04	≤ 0.40							
	Grade 60	0.26	≤ 1.35	0.05	0.04	≤ 0.40							
	Grade 65	0.23	≤ 1.65	0.05	0.04	≤ 0.40							
A588	Grade B	0.20	0.75-1.35	0.05	0.04	0.15-0.50	0.20-0.40	≤ 0.5	0.40-0.70			0.01-0.10	
A709	Grade 36	0.26		0.05	0.04	≤ 0.40							
	Grade 50	0.23	≤ 1.35	0.05	0.04	≤ 0.40							
	Grade 50S	0.23	0.50-1.60	0.045	0.035	≤ 0.40	≤ 0.60	≤ 0.45	≤ 0.35	0.15	0.05	≤ 0.15	0.45
A992	Grade 50	0.23	0.50-1.60	0.045	0.035	≤ 0.40	≤ 0.60	≤ 0.45	≤ 0.35	0.15	0.05	≤ 0.15	0.45

Structural Grades According to Japanese Standards

Mechanical properties

Standards	Grades	Minimum yield strength R _{eH} Mpa					Tensile strength R _m MPa		Minimum elonga- tion %			Notch impact test, longitudinal	
		≤16	>16 ≤40	>40 ≤75	>75 ≤100	>100 ≤140	≤100	>100 ≤140	>5 ≤16	>16 ≤40	>40	°C	J
JIS G3106	SM 400 A					205						-	-
	SM 400 B	245	235	215	215		400-510	400-510	18	22	24	0	27
	SM 400C					-						0	47
	SM 490 YA	365	355	335	325	-	490-610	-	15	19	21	-	-
	SM 490 YB											0	27
JIS G3101	SS 400	245	235	215	215	205	400-510	400-510	17	21	23		
	SS 490	285	275	255	255	245	490-610	490-610	15	19	21		

Chemical properties

Standards	Grades	Ladle analysis						
		C max. %			Mn	Si max.	P max.	S max.
		≤50	>50 ≤100	>100 ≤140	%	%	%	%
JIS G3106	SM 400 A	0.23	0.25	0.25	2.5 x C min.	-	0.035	0.035
	SM 400 B	0.20	0.22	0.22	0.60-1.50	0.35	0.035	0.035
	SM 400C	0.18	0.18	-	0.60-1.50	0.35	0.035	0.035
	SM 490 YA	0.20	0.20	-	1.65 max.	0.55	0.035	0.035
	SM 490 YB							
JIS G3101	SS 400					-	0.050	0.050
	SS 490					-	0.050	0.050

Marine and Offshore Grades

Mechanical properties

Standards	Grades	Yield strength R _{eH}	Tensile strength R _m	Minimum elongation	Notch impact test, longitudinal	
		MPa [ksi]	MPa [ksi]	%	°C [°F]	J [ft-lbf]
ABS LR BV DNV	A	≥235 [34]	400-520 [58-75]	22	+20 [68]	27 [20]
	B				0 [32]	27 [20]
	D				-20 [-4]	27 [20]
	E				-40 [-40]	27 [20]
	AH 32	≥315 [46]	440-590 [64-85]	22	0 [32]	31 [23]
	DH 32				-20 [-4]	31 [23]
	EH 32				-40 [-40]	31 [23]
	FH 32				-60 [-76]	31 [23]
	AH 36	≥355 [51]	490-620 [71-90]	21	0 [32]	34 [25]
	DH 36				-20 [-4]	34 [25]
	EH 36				-40 [-40]	34 [25]
	FH 36				-60 [-76]	34 [25]
	AH 40	≥390 [57]	510-650 [74-94]	20	0 [32]	39 [29]
	DH 40				-20 [-4]	39 [29]
	EH 40				-40 [-40]	39 [29]
	FH 40				-60 [-76]	39 [29]

Chemical properties

Standards	Grades	Ladle analysis												
		C max. %	Mn %	S max. %	P max. %	Si %	Nb %	V %	Ti %	Cu max. %	Cr	Ni	Mo	Ca
ABS LR BV DNV	A	0.21	2.5 x C	0.035	0.035	0.50								
	B	0.21	0.80	0.035	0.035	0.35								
	D	0.21	0.60	0.035	0.035	0.10-0.35								
	E	0.18	0.70	0.035	0.035	0.10-0.35								
AH/DH/EH 32, AH/DH/EH 36 & AH/DH/EH 40		0.18	0.90-1.60	0.035	0.035	0.10-0.50	0.02-0.05	0.05-0.10	0.02	0.35	0.20	0.40	0.08	0.005
FH 32/36/40		0.16	0.90-1.60	0.025	0.025	0.10-0.50	0.02-0.05	0.05-0.10	0.02	0.35	0.20	0.80	0.08	0.005

Boiler and Pressure Vessel Grades

Mechanical properties

Standards	Grades	Minimum yield strength R _{eH} Mpa [ksi]					Tensile strength R _m MPa [ksi]		Minimum elongation %		Notch impact test, longitudinal	
		≤16	>16 ≤40	>40 ≤60	>60 ≤100	>100 ≤150	≤100	>100 ≤150	min. 200mm	min. 50mm	°C	J
ASTM A285	Grade A			≥165 [24]			310-450 [45-65]		27	30		
	Grade B			≥185 [27]			345-485 [50-70]		25	28		
	Grade C			≥205 [30]			380-515 [55-75]		23	27		
ASTM A516	Grade 55			≥205 [30]			380-515 [55-75]		23	27		
	Grade 60			≥220 [32]			415-550 [60-80]		21	25		
	Grade 65			≥240 [35]			450-585 [65-85]		19	23		
	Grade 70			≥260 [38]			485-620 [70-90]		17	21		
EN 10028-2:2009	P235GH	235	225	215	200	185	360-480	350-480	24		-20	27
	P265GH	265	255	245	215	200	410-530	400-530	22		0	34
	P295GH	295	290	285	260	235	460-580	440-570	21			
	P355GH	355	345	335	315	295	510-650	490-630	20		+20	40

Chemical properties

Standards	Grades	Ladle analysis									
		C max. %					Mn %		Si max. %	P max. %	S max. %
		≤12.5	>12.5 ≤50	>50 ≤100	>100 ≤200	>200	≤12.5	>12.5			
ASTM A285	Grade A			0.17			0.90			0.035	0.035
	Grade B			0.22			0.90			0.035	0.035
	Grade C			0.28			0.90			0.035	0.035
ASTM A516	Grade 55	0.18	0.20	0.22	0.24	0.26	0.60-0.90	0.60-1.20	0.15-0.40	0.035	0.035
	Grade 60	0.21	0.23	0.25	0.27	0.27	0.60-0.90	0.85-1.20	0.15-0.40	0.035	0.035
	Grade 65	0.24	0.26	0.28	0.29	0.29	0.85-1.20	0.85-1.20	0.15-0.40	0.035	0.035
	Grade 70	0.27	0.28	0.30	0.31	0.31	0.85-1.20	0.85-1.20	0.15-0.40	0.035	0.035
EN 10028-2:2009	P235GH			≤0.16			0.60 - 1.20		≤0.35	0.025	0.015
	P265GH			≤0.20			0.80 - 1.40		≤0.40	0.025	0.015
	P295GH			0.08 - 0.20			0.90 - 1.50		≤0.40	0.025	0.015
	P355GH			0.10 - 0.22			1.10 - 1.70		≤0.60	0.025	0.015

Tube and Pipe Specifications According to Use

Some of the commonly available specifications of pipes are listed below as per their certified application.

Type	Manufacturing method	Specificalton	Application
Ordinary piping	ERW and Seamless	ASTM A53	Steel pipes for steam, air, water, oil and gas etc. with relatively low pressure
	ERW	ASTM A135	
	ERW	EN 10255 (BS1387), 10217-1	
	Seamless	EN 10216-1	
	ERW	JIS G3452, G3442	
	SAW	ASTM A134, A139, A671,	
	SAW	JIS G3457	
Pressure service	ERW, SAW and Seamless	ASTM A53, A106	Steel pipes for application at a temperature of 400°C or less
		EN 10216-2, 10217-2 API 5L	
Structural purpose	ERW and Seamless	ASTM A333	Steel pipes for application at a temperature of up to -195°C
	ERW, SAW and Seamless	ASTM A500, A501, A618	Steel pipes for application for structures such as civil works, architecture, steel tower, scaffolding, piles, fence and post etc.
		EN 10210, 10219	
		JIS G3444, G3466	
	ERW, SAW and Seamless	ASTM A252	Steel pipes for foundation civil works, piling, architectures etc.
		JIS A5525	
	ERW	ASTM A513, A519	Steel pipes for application for mechanical parts such as machinery, automobiles, bicycles, furniture and fixtures etc.
	Seamless	ASTM A511	
	ERW	EN 10296	
	Seamless	EN 10297, 10305	
	ERW and Seamless	JIS G3445	
Line pipe	SAW	API 2B	Offshore structure
	ERW, SAW and Seamless	API 5L	Steel pipes for transportation of petroleum and natural gas
OCTG	ERW and Seamless	API 5CT	Steel pipes for development for petroleum and natural gas
Boiler & heat exchanger	ERW	ASTM A178, A214	Water pipes for boiler, connection pipe, overheat engine, air preheating pipe, condenser and heat exchange pipes
	Seamless	ASTM A179	
	ERW and Seamless	JIS G3461	
Firefighting	ERW and Seamless	ASTM A795	Steel pipes suitable for use in fire protection systems.
	ERW	EN10255	

Tubing Grades According to European Standards

Grade designation systems

The designation systems used in European standards are identical to that of EN 10025:2004.

The only addition being of the capital letter H added to the end of the grade to indicate hollow sections

Mechanical properties

Standards	Grades	Minimum yield strength R _{eH}						Tensile strength R _m			Minimum elongation %				Notch impact test	
		Mpa						MPa								
		≤16	>16 ≤40	>40 ≤63	>63 ≤80	>80 ≤100	>100 ≤120	≤3	>3 ≤100	>100 ≤120	≤40	>40 ≤63	>63 ≤100	>100 ≤120	°C	J
EN 10210-1:2006	S235JRH	235	225	215	215	215	195	360-510	360-510	350-500	26	25	24	22	20	27
	S275J0H	275	265	255	245	235	225	430-580	410-560	400-540	23	22	21	19	0	27
	S275J2H														-20	27
	S355J0H														0	27
	S355J2H	355	345	335	325	315	295	510-680	470-630	450-600	22	21	20	18	-20	27
	S355K2H														-20	40
EN 10219-1:2006	S235JRH	235	225					360-510	360-510		24				20	27
	S275J0H	275	265					430-580	410-560		20				0	27
	S275J2H														-20	27
	S355J0H														0	27
	S355J2H	355	345					510-680	470-630		20				-20	27
	S355K2H														-20	40
EN 10255:2004	S195T				195				320-520			20				

Chemical properties

Standards	Grades	Ladle analysis										
		C max. %		Mn max. %	Si max. %	P max. %	S max. %	N max. %	CEV max. %			
		≤40	>40 ≤120						≤16	>16 ≤40	>40 ≤65	>65 ≤120
EN 10210-1:2006	S235JRH	0.17	0.20	1.40		0.040	0.040	0.009	0.37	0.39	0.41	0.44
	S275J0H	0.20	0.22	1.50		0.035	0.035	0.009	0.41	0.43	0.45	0.48
	S275J2H	0.20	0.22	1.50		0.030	0.030		0.41	0.43	0.45	0.48
	S355J0H	0.22	0.22	1.60	0.55	0.035	0.035	0.009	0.45	0.47	0.50	0.53
	S355J2H	0.22	0.22	1.60	0.55	0.030	0.030		0.45	0.47	0.50	0.53
	S355K2H	0.22	0.22	1.60	0.55	0.030	0.030		0.45	0.47	0.50	0.53
EN 10219-1:2006	S235JRH	0.17		1.40		0.040	0.040	0.009	0.35			
	S275J0H	0.20		1.50		0.035	0.035	0.009	0.40			
	S275J2H	0.20		1.50		0.030	0.030		0.40			
	S355J0H	0.22		1.60	0.55	0.035	0.035	0.009	0.45			
	S355J2H	0.22		1.60	0.55	0.030	0.030		0.45			
	S355K2H	0.22		1.60	0.55	0.030	0.030		0.45			
EN 10255:2004	S195T	0.20		1.40		0.035	0.030					

Tubing Grades According to American Standards

Mechanical properties

Standards	Grades	Minimum Yield strength R_{eH}	Tensile strength R_m	Minimum elongation, long. %
		MPa [ksi]	MPa [ksi]	min. 50mm
A53	Grade A	205 [30]	≥ 330 [48]	22
	Grade B	240 [35]	≥ 415 [60]	18
A135	Grade A	205 [30]	≥ 330 [48]	35
	Grade B	330 [48]	≥ 415 [60]	30
A106	Grade A	205 [30]	≥ 330 [48]	28
	Grade B	240 [35]	≥ 415 [60]	22
	Grade C	275 [40]	≥ 485 [70]	20
A500	Grade A	Round 228 [33] Shape 269 [39]	≥ 310 [45]	25
	Grade B	Round 290 [42] Shape 317 [46]	≥ 400 [58]	23
	Grade C	Round 317 [46] Shape 345 [50]	≥ 427 [62]	21
	Grade D	Round 250 [36] Shape 250 [36]	≥ 400 [58]	23
A795	Grade A			
	Grade B			

Chemical properties

Standards	Grades	Ladle analysis									
		C max. %	Mn %	S max. %	P max. %	Si %	Cu %	Ni %	Cr %	Mo max. %	V %
A53	Grade A	0.25	≤ 0.95	0.045	0.05		≤ 0.40	≤ 0.40	≤ 0.40	0.15	≤ 0.08
	Grade B	0.30	≤ 1.20	0.045	0.05		≤ 0.40	≤ 0.40	≤ 0.40	0.15	≤ 0.08
A135	Grade A	0.25	≤ 0.95	0.035	0.035						
	Grade B	0.30	≤ 1.20	0.035	0.035						
A106	Grade A	0.25	0.27-0.93	0.035	0.035	≥ 0.10	≤ 0.40	≤ 0.40	≤ 0.40	0.15	≤ 0.08
	Grade B	0.30	0.29-1.06	0.035	0.035	≥ 0.10	≤ 0.40	≤ 0.40	≤ 0.40	0.15	≤ 0.08
	Grade C	0.35	0.29-1.06	0.035	0.035	≥ 0.10	≤ 0.40	≤ 0.40	≤ 0.40	0.15	≤ 0.08
A500	Grade A	0.26		0.035	0.035						
	Grade B	0.26		0.035	0.035						
	Grade C	0.23	≤ 1.35	0.035	0.035						
	Grade D	0.26		0.035	0.035						
A795	Grade A	0.25	≤ 0.95	0.035	0.035						
	Grade B	0.30	≤ 1.20	0.035	0.035						

Tubing Grades According to Japanese Standards

Mechanical properties

Standards	Grades	Minimum yield strength R_{eH} Mpa	Tensile strength R_m MPa	Minimum elongation, long. % min. 40mm
JIS G3452	SGP		≥ 290	30
JIS G3444	STK 290		≥ 290	30
	STK 400	235	≥ 290	23
	STK 500	355	≥ 290	15
	STK 490	315	≥ 290	23
	STK 540	390	≥ 540	20
JIS G3466	STKR 400	245	≥ 400	23
	STKR 490	325	≥ 490	23

Chemical properties

Standards	Grades	Ladle analysis				
		C max. %	Mn %	Si max. %	P max. %	S max. %
JIS G3452	SGP				0.040	0.040
JIS G3444	STK 290				0.050	0.050
	STK 400	0.25			0.040	0.040
	STK 500	0.24	0.30-1.30	0.35	0.040	0.040
	STK 490	0.18	≤ 1.50	0.55	0.040	0.040
	STK 540	0.23	≤ 1.50	0.55	0.040	0.040
JIS G3466	STKR 400	0.25			0.040	0.040
	STKR 490	0.18	≤ 1.50	0.55	0.040	0.040

Line Pipe Grades According to API

Mechanical properties

Standard	Grades	Yield strength R _{eH} MPa [ksi]		Tensile strength R _m MPa [ksi]		Minimum elon- gation, long. %
		min.	max. (PSL 2)	min.	max. (PSL 2)	min. 50mm
PSL 1						
API 5L	A25	172 [25]		310 [45]		23
	A	207 [30]		331 [48]		22
	B	241 [35]		414 [60]		18
	X42	290 [42]		414 [60]		18
	X46	317 [46]		434 [63]		17
	X52	359 [52]		455 [66]		16
	X56	386 [56]		490 [71]		15
	X60	414 [60]		517 [75]		15
	X65	448 [65]		531 [77]		14
	X70	483 [70]		565 [82]		14
PSL 2						
API 5L	B	241 [35]	448 [65]	414 [60]	758 [110]	18
	X42	290 [42]	496 [72]	414 [60]	758 [110]	18
	X46	317 [46]	524 [76]	434 [63]	758 [110]	17
	X52	359 [52]	531 [77]	455 [66]	758 [110]	16
	X56	386 [56]	544 [79]	490 [71]	758 [110]	15
	X60	414 [60]	565 [82]	517 [75]	758 [110]	15
	X65	448 [65]	600 [87]	531 [77]	758 [110]	14
	X70	483 [70]	621 [90]	565 [82]	758 [110]	14
	X80	552 [80]	690 [100]	621 [90]	827 [120]	12

Line Pipe Grades According to API

Chemical properties

Standard	Grades	Ladle analysis				
		C max. %	Mn max. %	S max. %	P min. %	P max. %
PSL 1, Seamless						
API 5L	A25, Cl I	0.21	0.60	0.030	0.045	0.030
	A25, CL II	0.21	0.60	0.030		0.080
	A	0.22	0.90	0.030		0.030
	B	0.28	1.20	0.030		0.030
	X42	0.28	1.30	0.030		0.030
	X46, X52, X56	0.28	1.40	0.030		0.030
	X60, X65, X70	0.28	1.40	0.030		0.030
PSL 1, Welded						
API 5L	A25, Cl I	0.21	0.60	0.030	0.45	0.030
	A25, CL II	0.21	0.60	0.030		0.080
	A	0.22	0.90	0.030		0.030
	B	0.26	1.20	0.030		0.030
	X42	0.26	1.30	0.030		0.030
	X46, X52, X56	0.26	1.40	0.030		0.030
	X60	0.26	1.40	0.030		0.030
	X65	0.26	1.45	0.030		0.030
	X70	0.26	1.65	0.030		0.030
PSL 2, Seamless						
API 5L	B	0.24	1.20	0.015		0.025
	X42	0.24	1.30	0.015		0.025
	X46, X52, X56	0.24	1.40	0.015		0.025
	X60, X65, X70, X80	0.24	1.40	0.015		0.025
PSL 2, Welded						
API 5L	B	0.22	1.20	0.015		0.025
	X42	0.22	1.30	0.015		0.025
	X46, X52, X56	0.22	1.40	0.015		0.025
	X60	0.22	1.40	0.015		0.025
	X65	0.22	1.45	0.015		0.025
	X70	0.22	1.65	0.015		0.025
	X80	0.22	1.85	0.015		0.025