



# LINE PIPE



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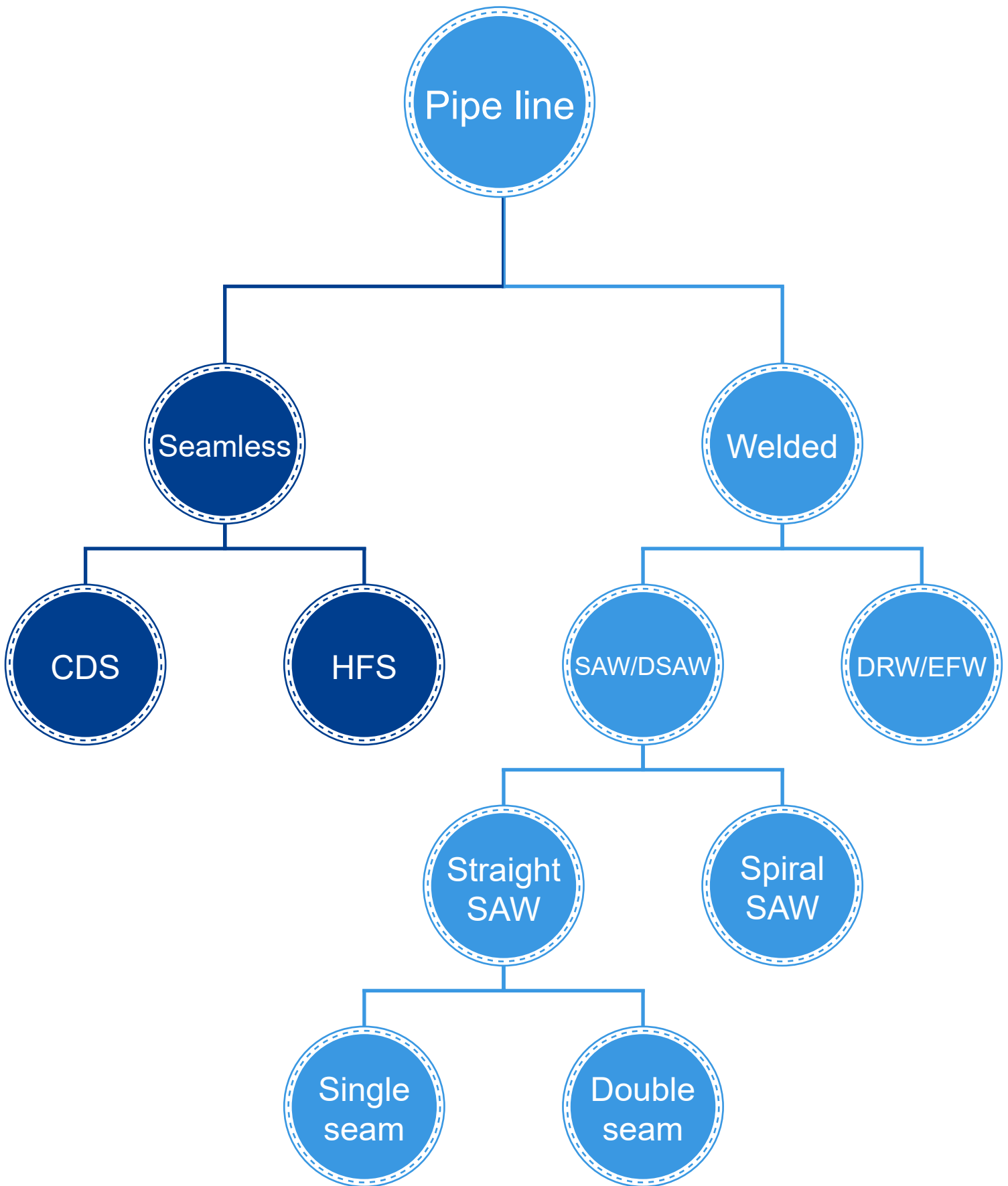
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## Seamless Carbon Steel pipe

Seamless steel pipe is a tubular section or hollow cylinder, usually but not necessarily of circular cross-section, used mainly to convey substances which can flow — liquids and gases (fluids), slurries, powders and masses of small solids.

Seamless Pipe (and tubing) is made by extruding a steel block or by drilling a solid steel bar. Next, the extrusion or the drilled steel bar is cold drawn through a die to achieve the diameter and thickness needed. Because this process can cause mechanical hardening, sometimes the material is annealed and straightened as a final process. Seamless Pipe & Tubing is subdivided as:

**Cold Drawn Seamless, or CDS**, exhibits precise tolerances and a good surface finish.

**Hot Finished Seamless, or HFS**, has less critical tolerances and somewhat scaly finish and is not as strong as CDS.

For Drawn over Mandrel, or DOM tubing, the first stages of manufacturing are identical to ones used to make electric resistance welded tubing, but in the finishing stages the entire flash weld is taken out and the tube is cold drawn over a mandrel. A mandrel is a round object against which material can be forged or shaped. The cold drawn process provides the tube with better dimensional tolerances, improved surface finish and the strongest weld strength achievable.





## API 5L LINE PIPE

**API 5L LINE PIPE:** Specification for Line Pipe For conveying gas, water and oil either in the oil or natural gas industries Application: Oil, Gas and water delivery; Refinery, Boiler and Mechanical equipment manufacturer; structure construction; drilling, ship building and etc.

### API 5L-PSL 1 Chemical Requirements

Grade	Composition %							
	C	Mn	P		S	V	Nb	Ti
	max	max	min	max	max	max	max	max
B	0.28	1.2	-	0.03	0.03	c,d	c,d	d
X42	0.28	1.3	-	0.03	0.03	d	d	d
X46	0.28	1.4	-	0.03	0.03	d	d	d
X52	0.28	1.4	-	0.03	0.03	d	d	d
X56	0.28	1.4	-	0.03	0.03	d	d	d
X60	0.28	1.4	-	0.03	0.03	f	f	f
X65	0.28	1.4	-	0.03	0.03	f	f	f
X70	0.28	1.4	-	0.03	0.03	f	f	f

### API 5L-PSL 2 Chemical Requirements

Grade	Composition, %								
	C	Si	Mn	P	S	V	Nb	Ti	Other
BN	0.24	0.4	1.2	0.025	0.015	c	c	0.04	e,l
X42N	0.24	0.4	1.2	0.025	0.015	0.06	0.06	0.04	e,l
X46N	0.24	0.4	1.4	0.025	0.015	0.07	0.07	0.04	d,e,l
X52N	0.24	0.45	1.4	0.025	0.015	0.1	0.1	0.04	d,e,l
X56N	0.24	0.45	1.4	0.025	0.015	0.1	0.1	0.04	d,e,l
X60N	0.24	0.45	1.4	0.025	0.015	0.1	0.1	0.04	g,h,l
BQ	0.18	0.45	1.4	0.025	0.015	0.05	0.05	0.04	e,l
X42Q	0.18	0.45	1.4	0.025	0.015	0.05	0.05	0.04	e,l
X46Q	0.18	0.45	1.4	0.025	0.015	0.05	0.05	0.04	e,l
X52Q	0.18	0.45	1.5	0.025	0.015	0.05	0.05	0.04	e,l
X56Q	0.18	0.45	1.5	0.025	0.015	0.07	0.07	0.04	d,e,l
X60Q	0.18	0.45	1.7	0.025	0.015	g	g	g	h,l
X65Q	0.18	0.45	1.7	0.025	0.015	g	g	g	h,l
X70Q	0.18	0.45	1.8	0.025	0.015	g	g	g	h,l

### API 5L-PSL 1 Mechanical Properties

Grade	Yield Strength Mpa	Tensile Strength Mpa	Elongation
B	245	415	c
X42	290	415	c
X46	320	435	c
X52	360	460	c
X56	390	490	c
X60	415	520	c
X65	450	535	c
X70	485	570	c

### API 5L-PSL 2 Mechanical Properties

Grade	Yield Strength Mpa		Tensile Strength Mpa		Raito	Elongation
	min	max	min	max	max	min
BN	245	450	415	655	0.93	f
BQ						
X42N	290	495	415	655	0.93	f
X42Q						
X46N	320	525	435	655	0.93	f
X46Q						
X52N	360	530	460	760	0.93	f
X52Q						
X56N	390	545	490	760	0.93	f
X56Q						
X60N	415	565	520	760	0.93	f
X60Q						
X65Q	450	600	535	760	0.93	f
X70Q	485	635	570	760	0.93	f



**ASTM A106 & A53**

**ASTM A106:** American society for Testing and Materials Seamless Carbon Steel Pipe for High-Temperature Service

Application: Oil, Gas and water delivery; Refinery, Boiler and Mechanical equipment manufacturer; structure construction; drilling, ship building and etc.



**ASTM A53 :**American society for Testing and Materials Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

Application: Oil, Gas and water delivery; Refinery, Boiler and Mechanical equipment manufacturer; structure construction; drilling, ship building and etc.

**ASTM A106 Chemical Requirements**

Grade	Composition, %							
	C	Mn	P	S	Si	Cr	Mo	Others
	max		max	max	min	max	max	
A	0.25	0.27–0.93	0.035	0.035	0.1	0.4	0.15	...
B	0.3	0.29–1.06	0.035	0.035	0.1	0.4	0.15	...
C	0.35	0.29–1.06	0.035	0.035	0.1	0.4	0.15	...

**Mechanical Properties**

	Grade		
	A	B	C
Tensile strength, min:			
ksi	48	60	70
Mpa	330	415	485
Yield strength, min:			
ksi	30	35	40
MPa	205	240	275

Elongation Requirements: As per standard



## ASTM A53 Chemical Requirements

Type	Grade	Composition %						
		C	Mn	P	S	Cr	Mo	Others
S	A	0.25	0.95	0.05	0.045	0.4	0.15	...
	B	0.30	1.20	0.05	0.045	0.4	0.15	...
E	A	0.25	0.95	0.05	0.045	0.4	0.15	...
	B	0.30	1.20	0.05	0.045	0.4	0.15	...
F	A	0.30	1.20	0.05	0.045	0.4	0.15	...

## Mechanical Properties

Grade		
	A	B
Tensile strength, min:		
ksi	48	60
Mpa	330	415
Yield strength, min:		
ksi	30	35
MPa	205	240

Elongation Requirements: As per standard



## ASTM A333

**ASTM A333: American Society for Testing and Materials**  
**Seamless Steel Pipe for Low-Temperature Service**  
**Application: Oil, Gas and water delivery; Refinery, Boiler and Mechanical equipment manufacturer; structure construction; drilling, ship building and etc.**

### Chemical Requirements

Grade	Composition, %							
	C	Mn	P	S	Si	Cr	Mo	Others
	max		max	max			max	
1	0.3	0.40–1.06	0.025	0.025	...	...	...	...
3	0.19	0.31–0.64	0.025	0.025	0.18–0.37	...	...	...
4	0.12	0.50–1.05	0.025	0.025	0.08–0.37	0.44–1.01	...	...
6	0.3	0.29–1.06	0.025	0.025	0.10 min	0.30 max	0.12	...
7	0.19	0.90 max	0.025	0.025	0.13–0.32	...	...	...
8	0.13	0.90 max	0.025	0.025	0.13–0.32	...	...	...
9	0.2	0.40–1.06	0.025	0.025	...	...	...	...
10	0.2	1.15–1.50	0.035	0.015	0.10–0.35	0.15 max	0.05	...
11	0.1	0.60 max	0.025	0.025	0.35 max	0.50 max	0.50 max	...

### Mechanical Properties

Grade									
	1	3	4	6	7	8	9	10	11
Tensile strength, min:									
ksi	55	65	60	60	65	100	63	80	65
Mpa	380	450	415	415	450	690	435	550	450
Yield strength, min:									
ksi	30	35	35	35	35	75	46	65	35
MPa	205	240	240	240	240	515	315	450	240

Elongation Requirements: As per standard



**ASTM A210**

ASTM A210: American Society for Testing and Materials Standard Specification for Seamless Medium-Carbon Steel Boiler and Superheater Tubes.  
 Application: Power plant; Chemical Fertilizer; Petrochemicals; Offshore Oils; Gas Productions; Refineries and etc.

**Chemical Requirements**

Element	Composition %	
	Grade A-1	Grade C
Carbon, max	0.27	0.35
Manganese	0.93 max	0.29-1.06
Phosphorus, max	0.035	0.035
Sulfur, max	0.035	0.035
Silicon, min	0.1	0.1

**Mechanical Properties**

	Grade C	Grade D
Tensile strength, min,ksi [Mpa]	60 [415]	70 [485]
Yield strength, min,ksi [Mpa]	37 [255]	40 [275]
Elongation in 2 in. or 50 mm, min %	30	30
For longitudinal strip tests a deduction for each 1-32 in. [0.8 mm] decrease in wall thickness below 5 -16 in. [8mm] from the basic min elongation of the following % points	1.5	1.5
When standard round 2-in. or 50-mm gage length or smaller proportionally sized specimen with the gage length equal to 4D (four times the diameter) is used	22	20



**ASTM A179**

ASTM A179: American Society for Testing and Materials Standard Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes.

Application: Oil, Gas and water delivery; Refinery, Boiler and Mechanical equipment manufacturer; structure construction; drilling, ship building and etc.

**Chemical Requirements**

C %	Mn %	P	S
		max %	max %
0.06-0.18	0.27-0.63	0.035	0.035

**Mechanical Properties**

Tensile strength, min, ksi [MPa]	47 [325]
Yield strength, min, ksi [MPa]	26 [180]
Elongation in 2 in. or 50 mm, min, %	35



## EN10210 & EN10216

### EN10210; EN10216: BRITISH STANDARDS

Hot finished structural hollow sections of non-alloy and fine grain steels;

Seamless steel tubes for pressure purposes-Technical delivery conditions

Application: Oil, Gas and water delivery; Refinery, Boiler and Mechanical equipment manufacturer; structure construction; drilling, ship building and etc.

### Chemical analysis [%]

Steel Grade	C	Si	Mn	P	S	N
	max	max	max	max	max	max
S235JRH	0.17	-	1.4	0.04	0.04	0.009
S275J0H	0.2	-	1.5	0.035	0.035	0.009
S275J2H	0.2	-	1.5	0.03	0.03	-
S355J0H	0.22	0.55	1.6	0.035	0.035	0.009
S355J2H	0.22	0.55	1.6	0.03	0.03	-
S355K2H	0.22	0.55	1.6	0.03	0.03	-

### Chemical Composition & Mechanical property (EN10216-1)

Standard	Grade	Chemical Composition							Mechanical Property			
		C	Si	Mn	P≤	S≤	Cr≤	Mo	(MPa)	(MPa)	L	t
				min	max	max	max	min		min		
EN10216-1	P195TR1	≤0.13	≤0.35	≤0.70	0.025	0.02	0.3	≤0.08	320~440	≥195	≥27	≥25
	P235TR1	≤0.16	≤0.35	≤1.20	0.025	0.02	0.3	≤0.08	360~500	≥235	≥25	≥23
	P265TR1	≤0.20	0.4	1.4	0.025	0.02	0.3	≤0.08	410~570	≥265	≥23	≥19

### EN10210 Mechanical properties

Steel Grade	ReH min [MPa]	Rm min [MPa]	Elongation [%]
S235JRH	235	360-510	26
S275J0H	275	419-560	23
S275J2H	275	410-560	23
S355J0H	355	510-680	22
S355J2H	355	510-680	22
S355K2H	355	510-680	22





JIS G3454 JIS G 3455 JIS G3456 JIS G3461

JIS G3454, JIS G3455, JIS G3456, JIS G3461: Japanese Industrial Standard

Carbon steel pipes for high temperature service for conveying oil, gas and other fluid

Application: Oil, Gas and water delivery; Refinery, Boiler and Mechanical equipment manufacturer; structure construction; drilling, ship building and etc.

Grade and Chemical Composition ( % )

Standard	Grade	C	Si	Mn		S
		min	min		min	min
JIS G3454	STPG 370	0.25	0.35	0.30-0.90	0.04	0.04
	STPG 410	0.3	0.35	0.30-1.00	0.04	0.04
JIS G3455	STS 370	0.25	0.10-0.35	0.30-1.10	0.035	0.035
	STS410	0.3	0.10-0.35	0.30-1.40	0.035	0.035
	STS480	0.33	0.10-0.35	0.30-1.50	0.035	0.035
JIS G3456	STPT 370	0.25	0.10-0.35	0.30-0.90	0.035	0.035
	STPT 410	0.3	0.10-0.35	0.30-1.00	0.035	0.035
	STPT 480	0.33	0.10-0.35	0.30-1.00	0.035	0.035

Mechanical Property

Standard	Grade	Tensile strength (Mpa)	Yield strength (Mpa)
		min	min
JIS G3454	STPG 370	215	370
	STPG 410	245	410
JIS G 3455	STS 370	215	370
	STS 410	245	410
	STS 480	275	480
JIS G 3456	STPT 370	215	370
	STPT 410	245	410
	STPT 480	275	480



## DIN 2391 & 1629

DIN 2391 & 1629: German standard  
 Precision cold drawn seamless steel tube & Seamless  
 Circular Tubes of Non Alloys Steels With Special Quality  
 Requirements;  
 Application: Oil, Gas and water delivery; Refinery, Boiler  
 and Mechanical equipment manufacturer; structure  
 construction; drilling, ship building and etc.

### DIN2391 Chemical Composition

Grade	C	Si	Mn	P	S	Ni	Cr	Mo
	max	max	max	max	max	max	max	max
St35	0.17	0.35	0.4	0.05	0.05	-	-	-
St45	0.21	0.35	0.4	0.05	0.05	-	-	-
St52	0.22	0.55	1.6	0.05	0.05	-	-	-

### DIN2391 Mechanical Property

Grade	Tensile Test MPa	
	Min Yields point	Tensile Strength
St35	215	340 - 470
St45	255	440 - 570
St52	350	490 - 630

### Chemical Composition & Mechanical property (DIN1629)

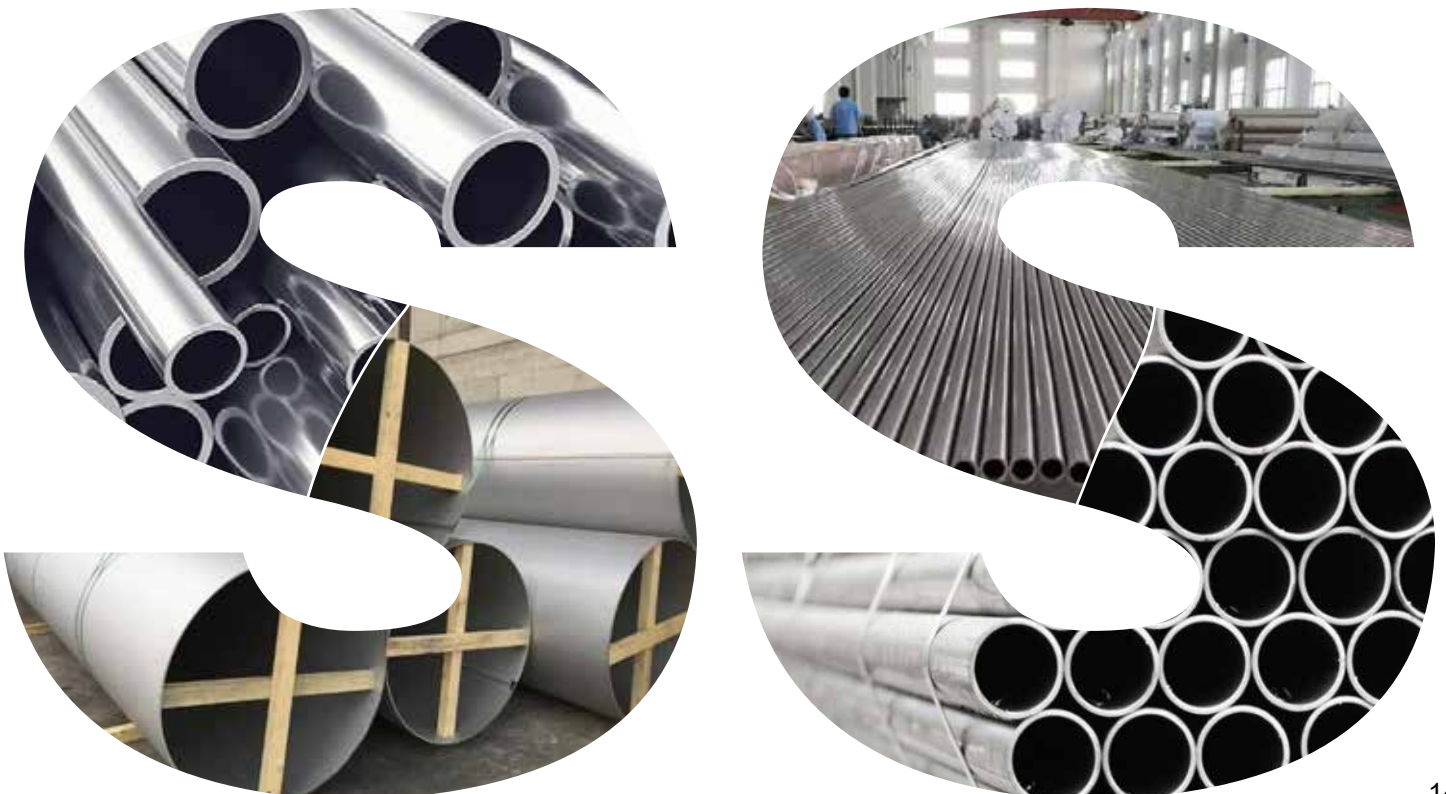
Standard	Grade	Chemical Composition							Mechanical Properties		
		C min	Si min	Mn min	P max	S max	Cr	Mo	(MPa)	(MPa) min	(%) min
DIN1629	St35.8/St37.5	0.17	/	/	0.04	0.04	/	/	350~480	235	25
	St52.0/St52.3	0.22	0.55	0.17	0.04	0.04	/	/	500~560	270	21

# Stainless Steel Pipe

Stainless steel is a versatile material comprised of a steel alloy and a small percentage of chromium — the addition of chromium adds to the material's corrosion resistance, a trait that earned stainless steel its name. Because stainless steel is also low-maintenance, oxidation resistant, and doesn't affect other metals it comes in contact with, it is frequently used in a large array of applications, especially in piping and tubing manufacturing.

## Material stainless steel grades

304/304L Stainless Steel	316/316L Stainless Steel	310S Stainless Steel
317L Stainless Steel	321/321H Stainless Steel	410 Stainless Steel
Duplex 2205 (UNS S31803)	Duplex 2507 (UNS S32750)	DUPLEX UNS S32760
SA 269	SA 249 Stainless Steel	904L Stainless steel





**ASTM A312**

ASTM A312: American Society for Testing and Materials Seamless and Welded Austenitic Stainless Steel Pipes.  
 Application: Refineries; Nuclear Plant; Aerospace Industry; Chemical Fertilizer; Petrochemicals' Oli & Gas and etc.

**Chemical Requirements**

Grade	C	Mn	P	S	Si	Cr	Mo	Ti	N	V	Cu	Ce
TP304	0.08	2	0.045	0.03	1	18.0-20.0	8.0-11.0	-	-	-	-	-
TP304L	0.035	2	0.045	0.03	1	18.0-20.0	8.0-13.0	-	-	-	-	-
TP304H	0.04-0.10	2	0.045	0.03	1	18.0-20.0	8.0-11.0	-	-	-	-	-
TP316	0.08	2	0.045	0.03	1	16.0-18.0	11.0-14.0	2.00-3.00	-	-	-	-
TP316L	0.035	2	0.045	0.03	1	16.0-18.0	10.0-14.0	2.00-3.00	-	-	-	-
TP316H	0.04-0.10	2	0.045	0.03	1	16.0-18.0	11.0-14.0	2.00-3.00	-	-	-	-
TP321	0.08	2	0.045	0.03	1	17.0-19.0	-	G	-	-	0.1	-
TP347	0.08	2	0.045	0.03	1	17.0-19.0	9.0-13.0	-	-	-	-	-
TP347H	0.04-0.10	2	0.045	0.03	1	17.0-19.0	9.0-13.0	-	-	J	-	-

**Tensile Requirements**

Grade	UNS Designation	Tensile Strength, min ksi [Mpa]	Yield Strength, min ksi [Mpa]
TP304	S30400	75 [515]	30 [205]
TP304L	S30403	70 [485]	25 [170]
TP304H	S30409	75 [515]	30 [205]
TP316	S31600	75 [515]	30 [205]
TP316L	S31603	70 [485]	25 [170]
TP316H	S31609	75 [515]	30 [205]
TP310S	S31008	75 [515]	30 [205]
TP310H	S31009	75 [515]	30 [205]
TP321	S32100	75 [515]	30 [205]
TP321H	S32109	75 [515]	30 [205]
TP347	S34700	75 [515]	30 [205]
TP347H	S34709	75 [515]	30 [205]



## ASTM A358

ASTM A358: American Society for Testing and Materials Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe For High-Temperature Service and General Applications

Application: Refineries; Nuclear Plant; Aerospace Industry; Chemical Fertilizer; Petrochemicals' Oli & Gas and etc.

### ASTM A358 Chemical Composition

Grade	C	Mn	P	S	Si	Cr	Ni	Mo	N	Cu
TP304	0.08	2	0.045	0.03	0.75	18.0-20.0	8.0-10.5	-	0.1	-
TP304L	0.03	2	0.045	0.03	0.75	18.0-20.0	8.0-12.0	-	0.1	-
TP304H	0.04-0.10	2	0.045	0.03	0.75	18.0-20.0	8.0-10.5	-	-	-
TP316	0.08	2	0.045	0.03	0.75	16.0-18.0	10.0-14.0	2.00-3.00	0.1	-
TP316L	0.03	2	0.045	0.03	0.75	16.0-18.0	10.0-14.0	2.00-3.00	0.1	-
TP316H	0.04-0.10	2	0.045	0.03	0.75	16.0-18.0	10.0-14.0	2.00-3.00	-	-
TP321	0.08	2	0.045	0.03	0.75	17.0-19.0	9.0-12.0	-	0.1	-
TP347	0.08	2	0.045	0.03	0.75	17.0-19.0	9.0-13.0	-	-	-
TP347H	0.04-0.10	2	0.045	0.03	0.75	17.0-19.0	9.0-13.0	-	-	-

### ASTM A358 Mechanical Property

Grade	Tensile Strength, min		Yield Strength, min		Elongation (mm)
	ksi	Mpa	ksi	Mpa	
TP304	75	515	30	205	40
TP304L	70	485	25	170	40
TP304H	75	515	30	205	40
TP316	75	515	30	205	40
TP316L	70	485	25	170	40
TP316H	75	515	30	205	40
TP321	75	515	30	205	40
TP347	75	515	30	205	40
TP347H	75	515	30	205	40





## ASTM A928

ASTM A928: American Society for Testing and Materials Ferritic/Austenitic(Duplex) Stainless Steel Pipe Electric Fusion Welded with Addition of Filler Metal.  
 Application: Refineries; Nuclear Plant; Aerospace Industry; Chemical Fertilizer; Petrochemicals' Oli & Gas and etc.

### Chemical Composition

UNS Designation	C	Mn	P	S	Si	Cr	Ni	Mo	N	Cu
	max	max	max	max	max					
S31803	0.03	2	0.03	0.02	1	21.0-23.0	4.5-6.5	2.5-3.5	0.08-0.20	-
S32205	0.03	2	0.03	0.02	1	22.0-23.0	4.5-6.5	3.0-3.5	0.14-0.20	-
S32750	0.03	1	0.03	0.01	1	24.0-26.0	6.0-8.0	3.0-4.0	0.20-0.30	0.50-1.00

### Mechanical Properties

UNS Designation	Tensile Strength, min		Yield Strength, min		Elongation (mm)
	ksi	Mpa	ksi	Mpa	
S31803	90	620	65	450	25
S32205	90	620	65	450	25
S32750	116	795	80	550	15



**ASTM A789 & A790**

ASTM A789 & A790 : American Society for Testing and Materials  
 Standard specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service  
 Application: Refineries; Nuclear Plant; Aerospace Industry; Chemical Fertilizer; Petrochemicals' Oli & Gas and etc.

**A789 Chemical Composition**

UNS Designation	C	Mn	P	S	Si	Ni	Cr	Mo	N	Cu
	max	max	max	max	max					
S31803	0.03	2	0.03	0.02	1	4.5-6.5	21.0-23.0	2.5-3.5	0.08-0.20	-
S31500	0.03	1.20-2.00	0.03	0.03	1.40-2.00	4.25-5.25	18.0-19.0	2.5-3.00	0.05-0.1	-
S32750	0.03	1.2	0.035	0.02	0.8	6.0-8.0	24.0-26.0	3.0-5.0	0.24-0.32	0.5max

**A790 Chemical Composition**

UNS Designation	C max	Mn max	P max	S max	Si max	Ni	Cr	Mo	N	Cu
S31803	0.03	2	0.03	0.02	1	4.5-6.5	21.0-23.0	2.5-3.5	0.08-0.20	-
S32205	0.03	2	0.03	0.02	1	4.5-6.5	22.0-23.0	3.0-3.5	0.14-0.20	-
S32750	0.03	1.2	0.035	0.02	0.8	6.0-8.0	24.0-26.0	3.0-5.0	0.24-0.32	0.5max

**A789 Mechanical Properties**

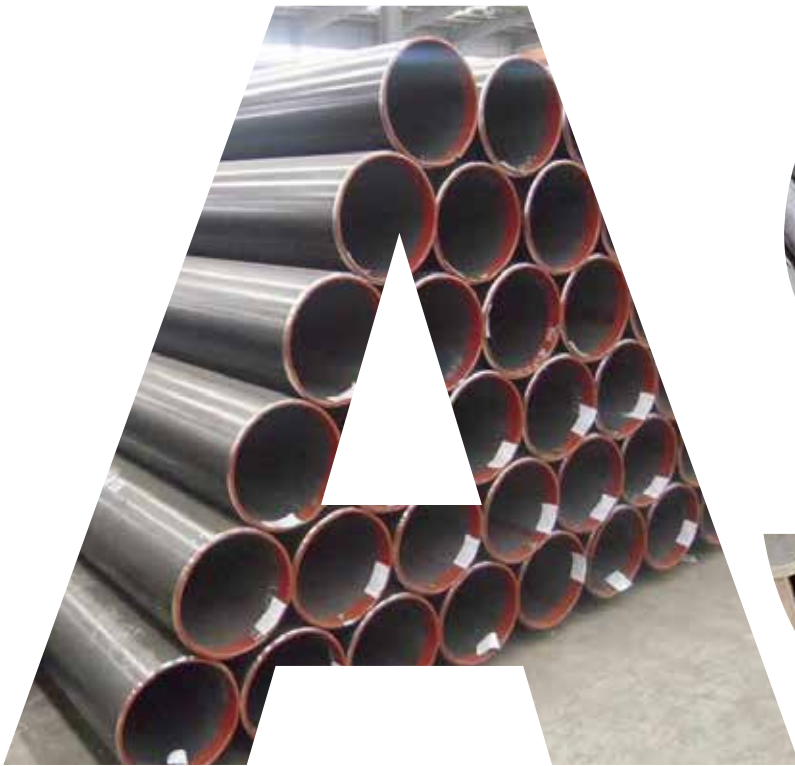
UNS Designation	Tensile Strength, min ksi [Mpa]	Yield Strength, min ksi [Mpa]	Elongation in 2 in. or 50 mm, min, %
S31803	90 [620]	65 [450]	25
S31500	92 [630]	64 [440]	30
S32750	116 [800]	80 [550]	15

**A790 Mechanical Properties**

UNS Designation	Tensile Strength, min ksi [Mpa]	Yield Strength, min ksi [Mpa]	Elongation in 2 in. or 50 mm, min, %
S31803	90 [620]	65 [450]	25
S32205	90 [620]	65 [450]	25
S32750	116 [800]	80 [550]	15

## Alloy Steel Pipe & Tube

Alloy steel pipe is a kind of seamless steel pipe, its performance is much higher than the general seamless steel pipe, because this steel pipe inside containing Cr, high temperature resistance, low temperature, corrosion-resistant performance of other non-pipe joints not match, so the more extensive use of alloy tube in the petroleum, aerospace, chemical, electric power, boiler, military, and other industries.





**ASTM A335**

ASTM A335: American Society for Testing and Materials  
 Seamless Alloy-Steel Pipe for High-Temperature Service  
 Application: Power plant; Chemical Fertilizer;  
 Petrochemicals; Offshore Oils; Gas Productions;  
 Refineries and etc.

**Chemical Requirements**

Grade	UNS Designation A	Composition %							
		C	Mn	P	S	Si	Cr	Mo	Others
				max	max				
P1	K11522	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	...	0.44-0.65	...
P2	K11547	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	0.44-0.65	...
P5	K41545	0.15max	0.30-0.60	0.025	0.025	0.50max	4.00-6.00	0.45-0.65	...
P9	S50400	0.15max	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	0.90-1.10	...
P11	K11597	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	...
P12	K11578	0.05-0.15	0.30-0.61	0.025	0.025	0.50max	0.80-1.25	0.44-0.65	...
P22	K21590	0.05-0.15	0.30-0.60	0.025	0.025	0.50max	1.90-2.60	0.87-1.13	...
P91	K91560	0.08-0.12	0.30-0.60	0.02	0.01	0.20-0.50	8.00-9.50	0.85-1.05	V 0.18-0.25
									N 0.030-0.070
									Ni 0.40max
									Al 0.02max
									Cb 0.06-0.10
									Ti 0.01 max
Zr 0.01max									

## Mechanical Properties

Grade							
	P1,P2	P5	P9	P11	P12	P22	P91
Tensile strength, min:							
ksi	55	60	60	60	60	60	85
Mpa	380	415	415	415	415	415	585
Yield strength, min:							
ksi	30	32	30	30	32	30	60
MPa	205	205	205	205	220	205	415

Elongation Requirements: As per standard





**ASTM A213**

ASTM A213: American Society for Testing and Materials  
 Seamless Ferritic and Austenitic Alloy-Steel  
 Boiler, Superheater, and Heat-Exchanger Tubes  
 Application: Power plant; Chemical Fertilizer;  
 Petrochemicals; Offshore Oils; Gas Productions;  
 Refineries and etc.

**Chemical Requirements**

Grade	UNS Designation	Composition %							
		C	Mn	P	S	Si	Cr	Mo	Others
				max	max				
T2	K11547	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	0.44-0.65	...
T5	K41545	0.15max	0.30-0.60	0.025	0.025	0.50max	4.0-6.0	0.45-0.65	...
T9	K90941	0.15max	0.30-0.60	0.025	0.025	0.25-1.00	8.0-10.0	0.90-1.10	...
T11	K11597	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.0-1.5	0.44-0.65	...
T12	K11562	0.05-0.15	0.30-0.61	0.025	0.025	0.50max	0.80-1.25	0.44-0.65	...
T22	K21590	0.05-0.15	0.30-0.60	0.025	0.025	0.50max	1.9-2.6	0.87-1.13	...
T91	K90901	0.07-0.14	0.30-0.60	0.02	0.01	0.20-0.50	8.0-9.5	0.85-1.05	V 0.18-0.25
									N 0.030-0.070
									Ni 0.4
									Al 0.02max
									Ti 0.01 max
									Zr 0.01max

## Mechanical Properties

Grade							
	T2	T5	T9	T11	T12	T22	T91
Tensile strength, min:							
ksi	60	60	60	60	60	60	85
Mpa	415	415	415	415	415	415	585
Yield strength, min:							
ksi	30	30	30	30	30	30	60
MPa	205	205	205	205	220	205	415

Elongation Requirements: As per standard

## Welded Carbon Steel Pipe

Welded steel pipe (steel pipe manufactured with a weld) is a tubular product made out of flat plates, known as skelp, that are formed, bent and prepared for welding.

**Electric Resistance Welded, often abbreviated as ERW**, is a process that uses specific machinery to shape the pipe and tubing. A continuous steel sheet is unwound from a coil and shaped using contoured rollers, forcing the edges together under pressure. These edges are then welded together by heating the material to over 2,000 degrees. After welding, the pipe or tubing is cut into the exact size needed.

SAW is normally operated in the automatic or mechanized mode, however, semi-automatic (hand-held) SAW guns with pressurized or gravity flux feed delivery are available.

SAW pipe is made of hot rolled coiled steel by automatic submerged arc weld under normal atmospheric temperature. All the pipes are produced according to API Spec 5L, GB/T9711.1, GB/T9711.2, ASTM A252-89 standard. These pipes mainly used in petroleum and natural gas industry to transport flammable and non-flammable liquid and steel construction.

SAW means submerged arc weld ,it can be classified into **LSAW** and **SSAW**





## API 5L Welded

API 5L: Gr.B, X42, X52, X60, X65, X70, X80,  
Application: Oil, Gas and water delivery; Refinery, Boiler and Mechanical equipment manufacturer; structure construction; drilling, ship building and etc.

### API 5L-PSL 1 Welded pipe Chemical Requirements

Grade	Composition %							
	C max	Mn max	P		S	V	Nb	Ti
			min	max	max	max	max	max
B	0.26	1.2	-	0.03	0.03	c,d	c,d	d
X42	0.26	1.3	-	0.03	0.03	d	d	d
X46	0.26	1.4	-	0.03	0.03	d	d	d
X52	0.26	1.4	-	0.03	0.03	d	d	d
X56	0.26	1.4	-	0.03	0.03	d	d	d
X60	0.26	1.4	-	0.03	0.03	f	f	f
X65	0.26	1.45	-	0.03	0.03	f	f	f
X70	0.26	1.65	-	0.03	0.03	f	f	f

### API 5L-PSL 2 Welded pipe Chemical Requirements

Grade	Composition %								
	C	Si	Mn	P	S	V	Nb	Ti	Other
B	0.22	0.45	1.2	0.025	0.015	0.05	0.05	0.04	e,l
X42	0.22	0.45	1.3	0.025	0.015	0.05	0.05	0.04	e,l
X46	0.22	0.45	1.3	0.025	0.015	0.05	0.05	0.04	e,l
X52	0.22	0.45	1.4	0.025	0.015	d	d	d	e,l
X56	0.22	0.45	1.4	0.025	0.015	d	d	d	e,l
X60	0.12	0.45	1.6	0.025	0.015	g	g	g	h,l
X65	0.12	0.45	1.6	0.025	0.015	g	g	g	h,l
X70	0.12	0.45	1.7	0.025	0.015	g	g	g	h,l

### API 5L-PSL 1 Welded pipe Mechanical Properties

Grade	Yield Strength Mpa	Tensile Strength Mpa	Elongation
B	245	415	c
X42	290	415	c
X46	320	435	c
X52	360	460	c
X56	390	490	c
X60	415	520	c
X65	450	535	c
X70	485	570	c

### API 5L-PSL 2 Welded pipe Mechanical Properties

Grade	Yield Strength Mpa		Tensile Strength Mpa		Raito	Elongation
	min	max	min	max	max	min
BN	245	450	415	655	0.93	f
BQ						
X42N	290	495	415	655	0.93	f
X42Q						
X46N	320	525	435	655	0.93	f
X46Q						
X52N	360	530	460	760	0.93	f
X52Q						
X56N	390	545	490	760	0.93	f
X56Q						
X60N	415	565	520	760	0.93	f
X60Q						
X65Q	450	600	535	760	0.93	f
X70Q	485	635	570	760	0.93	f





## ASTM A671

**ASTM A671: American Society for Testing and Materials Electric-Fusion-Welded Steel Pipe for Atmospheric and Lower Temperatures**

**Application: Power plant; Chemical Fertilizer; Petrochemicals; Offshore Oils; Gas Productions; Refineries and etc.**

### Chemical Requirements

Pipe	Grade	Composition %											
		C max					Mn			P	S	Si	Others
		<=1in (25mm)	>1~2in (25~50mm)	>2~4in (50-100mm)	>4~8in (100~200mm)	>8in (200mm)	<=1/2in (12.5mm)	>1/2in (12.5mm)	max	max			
CB	60	0.24	0.21	0.29	0.31	0.31	0.98max		0.035	0.035	0.13~0.45	...	
	65	0.28	0.31	0.33	0.33	0.33	0.98max		0.035	0.035	0.13~0.45	...	
	70	0.31	0.33	0.35	0.35	0.35	1.30max		0.035	0.035	0.13~0.45	...	
CC	60	0.21	0.23	0.25	0.27	0.27	0.55~0.98	0.79~1.30	0.035	0.035	0.13~0.45	...	
	65	0.24	0.26	0.28	0.29	0.29	0.79~1.30	0.79~1.30	0.035	0.035	0.13~0.45	...	
	70	0.27	0.28	0.30	0.31	0.31	0.79~1.30	0.79~1.30	0.035	0.035	0.13~0.45	...	

### Mechanical Properties

Grade						
	CB60	CB65	CB70	CC60	CC65	CC70
<b>Tensile strength, min:</b>						
ksi	60	65	70	60	65	70
Mpa	415	450	485	415	450	485
<b>Yield strength, min:</b>						
ksi	32	35	38	32	35	38
MPa	220	240	260	220	240	260



## ASTM A672

**ASTM A672: American Society for Testing and Materials Electric-Fusion-Welded for High-Pressure Service at Moderate Temperatures**  
**Application: Power plant; Chemical Fertilizer; Petrochemicals; Offshore Oils; Gas Productions; Refineries and etc.**

### Chemical Requirements

Pipe	Grade	Composition, %										
		C					Mn		P	S	Si	Others
		max							max	max		
		<=1in (25mm)	>1~2in (25~50mm)	>2~4in(50-100mm)	>4~8in (100~200mm)	>8in (200mm)	<=1/2in (12.5mm)	>1/2in (12.5mm)				
	60	0.24	0.21	0.29	0.31	0.31	0.98max		0.035	0.035	0.13~0.45	...
	65	0.28	0.31	0.33	0.33	0.33	0.98max		0.035	0.035	0.13~0.45	...
	70	0.31	0.33	0.35	0.35	0.35	1.30max		0.035	0.035	0.13~0.45	...
C	55	0.18	0.20	0.22	0.24	0.26	0.55~0.98	0.55~1.30	0.035	0.035	0.13~0.45	...
	60	0.21	0.23	0.25	0.27	0.27	0.55~0.98	0.79~1.30	0.035	0.035	0.13~0.45	...
	65	0.24	0.26	0.28	0.29	0.29	0.79~1.30	0.79~1.30	0.035	0.035	0.13~0.45	...
	70	0.27	0.28	0.30	0.31	0.31	0.79~1.30	0.79~1.30	0.035	0.035	0.13~0.45	...

### Mechanical Properties

Grade							
	B60	B65	B70	C55	C60	C65	C70
Tensile strength, min:							
ksi	60	65	70	55	60	65	70
Mpa	415	450	485	380	415	450	485
Yield strength, min:							
ksi	32	35	38	30	32	35	38
MPa	220	240	260	205	220	240	260

Elongation Requirements: As per standard



## BS EN 10219-1

BS EN 10219-1: British Standard  
Cold formed welded structural hollow sections of  
non-alloy and fine grain steels  
Application: Power plant; Chemical Fertilizer;  
Petrochemicals; Offshore Oils; Gas Productions;  
Refineries and etc.

### Chemical Requirements

Steel name	Steel number	Composition, % ,max				
		C	Mn	P	S	Others
S235JRH	1.0039	0.17	-	0.040	0.040	...
S275J0H	1.0149	0.20	-	0.035	0.035	...
S275J2H	1.0138	0.20	-	0.030	0.030	...
S355J0H	1.0547	0.22	0.55	0.035	0.035	...
S355J2H	1.0576	0.22	0.55	0.030	0.030	...
S355K2H	1.0512	0.22	0.55	0.030	0.030	...

### Mechanical Properties

Grade								
			S235JRH	S275J0H	S275J2H	S355J0H	S355J2H	S355K2H
Tensile strength,:								
Mpa	Specified thickness mm	< 3	360-510	430-580		510-680		
		≥ 3 ≤ 40	360-510	410-560		470-630		
Yield strength:								
MPa	Specified thickness mm	≤ 16	235	275		355		
		> 16 ≤ 40	225	265		355		

Elongation Requirements: As per standard



**LINE PIPE**

