

API 5L X70 SpecificationLSAW Steel Pipe

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What is API 5L Grade X70 Material?



- API 5L X70 (L485) is a type of steel pipe used in the oil and gas industry for pipeline transportation systems, named after its minimum yield strength of 70,300 psi (485 MPa), and consists of both seamless and welded pipe forms and is divided into two product specification levels, PSL1 and PSL2. In PSL1, X70 is the highest grade, while in PSL2 it is also one of the higher grades of steel pipe.
- API 5L X70 steel pipe is particularly suited to the demands of long-distance, high-pressure transportation because of its high strength and pressure resistance. In order to withstand higher pressures, X70 steel pipe is often designed with thicker walls to ensure adequate strength and durability.



About Us



Botop Steel is a professional manufacturer of thick-walled large-diameter

double-sided submerged arc LSAW steel pipe located in China.

- Location: Cangzhou City, Hebei Province, China;
- Total Investment: 500 million RMB;
- Factory area: 60,000 square meters;
- Annual production capacity: 200,000 tons of JCOE LSAW steel pipes;
- Equipment: Advanced production and testing equipment;
- Specialization: LSAW steel pipe production;
- Certification: API 5L certified.



Delivery Conditions



Depending on the PSL level and delivery condition, X70 can be categorized as

follows:

PSL1: X70 (L485);

PSL2: X70Q (L485Q) and X70M (L485M);

PSL	Delivery Condition	Pipe Grade/Steel Grade		
PSL1	As-rolled, normalizing rolled, thermomechanical rolled, thermomechanical formed, normalizing formed, normalized and tempered or quenched and tempered	X65	80 ⁴⁰⁰ L485	
PSL2	Quenched and tempered	X70Q X70M	L485Q L485M	

PSL2 suffix letters Q and M stand for respectively:

- **Q**: Quenched and tempered;
- **M**: Thermomechanical rolled or thermomechanical formed;

API 5L X70 Acceptable Process of Manufacture



The X70 manufacturing process includes both seamless and welded forms, which can be categorized as:

API 5L PSL1 X70	SMLS	LFW	HFW	LW	SAWL	SAWH	COWL	COWH
API 5L PSL2 X70	SMLS		HFW	Botop	SAWL 📎	SAWH	COWL	сожн

Of these, **SAWL** (**LSAW**) is the most common process used in the production of X70 welded processes and is advantageous in the production of large-diameter, thick-walled dimensional steel pipe.



API 5L X70 Acceptable Process of Manufacture



Although seamless steel pipes are still considered the preferred choice due to their characteristics under certain extreme conditions, the maximum diameter of seamless steel pipes produced is usually limited to 660 mm. This size limitation can be problematic when faced with large long-distance transportation pipeline projects.

In contrast, the LSAW process is capable of producing tubes with diameters up to 1,500 mm and wall thicknesses up to 80 mm. And the price can be more cost-effective than seamless steel.



LSAW is also often referred to as **DSAW** because of the double-sided welding process used in the welding process. It is important to note that DSAW refers to the welding technique and does not specifically refer to the shape or direction of the weld. It can be either a straight seam or a spiral seam.

Pipe End Types for API 5L X70



PSL1 Steel Pipe End: Belled end or Plain end;

PSL2 Steel Pipe End: Plain end;

For plain pipe ends the following requirements should be followed:

The end faces of t \leq 3.2 mm (0.125 in) plain end pipe shall be square cut.

Plain-end tubes with t > 3.2 mm (0.125 in) shall be beveled for welding. The bevel

angle should be 30-35° and the width of the root face of the bevel should be 0.8 -

2.4 mm (0.031 - 0.093 in).



API 5L X70 Chemical Composition



Chemical Composition for PSL 1 Pipe with $t \le 25.0$ mm (0.984 in.)

and the second second			Mass Fraction,Based on Heat and Product Analyses ^{ag} ,%						
Steel Grade	Ріре Туре	С	Mn	Р	S	V	Nb	Ti	
		max ^b	max ^b	max	max	max	max	max	
X70 (L485)	Seamless Pipe	0.28 ^e	1.40 ^e	0.03	0.03	f	f	,∂ f	
X70 (L485)	Welded Pipe	0.26 ^e	1.65 ^e	0.03	0.03	Botopsie	BotopSt	f Botop	
a Cu ≤ 0.50 %: N	Cu < 0.50 %· Ni < 0.50 %· Cr < 0.50 % and Mo < 0.15 %								

b For every 0.01 % decrease in carbon content from the specified maximum carbon content, the permitted manganese content is increased by 0.05 % from the specified maximum manganese content. For Grade B, the maximum manganese content is 1.65 %;

e Unless otherwise agreed.

Unless otherwise agreed,Nb + V + Ti ≤ 0.15%.

g No deliberate addition of B is permitted and the residual $B \le 0.001 \%$.

Chemical Composition for PSL 2 Pipe with $t \le 25.0$ mm (0.984 in.)

Steel Grade	Pipe Type			Ma	ass Fraction,Bas	ed on Heat and % max	Product Analys	ses			Carbon Equivalent ^ª %max		
		C ^b	Si	Mn ^b	Р	S	v	Nb	Ті	Other	CE	CE _{pem}	
X70Q (L485Q)	Seamless and Welded Pipe	0.18	0.45 1	1.80	0.025	0.015	g	Botov	Botor	^{sotov} h,l	0.43	0.25	
X70M (L485M)	Welded Pipe	0.12 ^f	0.45 ^f	1.70 ^f	0.025	0.015	g	g	g	h,l	0.43	0.25	
a Based on product a b For every 0.01 % of 1.65 %. f Unless otherwise a g Unless otherwise a h Unless otherwise a	a Based on product analysis for seamless pipe with t>20.0 mm (0.787 in.), the CE limits shall be as agreed; the CEIIw limits apply if C > 0.12 % and the CE _{sem} limits apply if C < 0.12 %. For every 0.01 % decrease in carbon content from the specified maximum carbon content, the permitted manganese content is increased by 0.05 % from the specified maximum manganese content. For Grade B, the maximum manganese content is 1.65 %. Unless otherwise agreed, Nb + V + Ti ≤ 0.15%. h Unless otherwise agreed, Cu ≤ 0.50 %; Ni ≤ 0.50 % and Mo ≤ 0.50 %.												

For PSL2 steel pipe products analyzed with a carbon content of ≤0.12%, the

carbon equivalent CEpcm can be calculated using the following formula:

$$CEpcm = C + \frac{Si}{30} + \frac{Mn}{20} + \frac{Cu}{20} + \frac{Ni}{60} + \frac{Cr}{20} + \frac{Mo}{15} + \frac{V}{15} + 5B$$

API 5L X70 Chemical Composition



For PSL2 steel pipe products analyzed with a carbon content > 0.12%, the carbon equivalent CE_{IIw} can be calculated using the formula below:

$$CEllw = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$$

Chemical Composition with t > 25.0 mm (0.984 in.)

It shall be determined by negotiation and modified to a suitable composition based on the chemical composition requirements above.

API 5L X70 Mechanical Properties



Tensile Properties

PSL1 X70 Tensile Properties

Botop Steel	Botop Steel Pipe B	ody of Seamless and Weld	ed Pipe	Weld Seam of EW, LW, SAW, and COW Pipe
Pipe Grade	Yield Strength R _{to5} psi(MPa), min	Tensile Strength R _m psi(MPa), min	Elongation (on 50 mm or 2 in.) A _r %, min	Tensile Strength R _m psi(MPa), min
X70 (L485)	50 ¹⁰⁰ 70,300 (485) 50 ¹⁰⁰	82,700 (570)	Bo ^{toP Soto} Note Bo ^{to}	82,700 (570) 80 ⁰⁰⁰

PSL2 X70 Tensile Properties



Note: The specified minimum elongation, Af shall be as determined using the

following equation:

$$A_f = C \times (A_{xc}^{0.2}/U^{0.9})$$

API 5L X70 Mechanical Properties



Other Mechanical Experiments

The following experimental program applies to SAW steel pipe types only.

Weld guide bending test;

Cold-formed welded pipe hardness test;

Macro inspection of welded seam;

and only for PSL2 steel pipe: CVN impact test and DWT test.

Test items and test frequencies for other pipe types can be found in Tables 17

and 18 of the API 5L standard.

Hydrostatic Test



Test Time

All sizes of seamless and welded steel tubes with $D \le 457$ mm (18 in.): test time \ge

5s;

Welded steel pipe D > 457 mm (18 in.): test time \geq 10s.

Test Frequency

Each steel pipe and there shall be no leakage from the weld or pipe body during

the test.

Test pressures

The hydrostatic test pressure P of a plain-end steel pipe can be calculated by using the formula.

P = 2St/D

 $\boldsymbol{\mathsf{S}}$ is the hoop stress. the value is equal to the specified minimum yield strength of

the steel pipe x a percentage, in MPa (psi);

	Specified Outside Diameter	Percentage of Specified Minimum Yield Strength for Determination of S					
Pipe Grade	ש – mm (in.)	Standard Test Pressure	Alternative Test Pressure				
	≤ 141.3 (5.563)	60 ^b	75 [°]				
op steel	> 141.3 (5.563) to 219.1 (8.625)	75 ^b top Steel	75°5°°				
X70 🐠	> 219.1 (8.625) to 508 (20)	85 ^b	85 °				
	≥ 508 (20)	90 ^b	90 °				
b It is not necessary that c For $D \le 406.4$ mm (16.0 the test pressure exceed	the test pressure exceed 20.5 MPa (2970 ps 000 in.), it is not necessary that the test pres 25.0 MPa (3630 psi).	si). ssure exceed 50.0 MPa (7260 psi); for D :	> 406.4 mm (16.000 in.), it is not necessary that				

Hydrostatic Test



t is the specified wall thickness, expressed in millimeters (inches);

D is the specified outside diameter, expressed in millimeters (inches).



Nondestructive Inspection



For SAW tubes, two methods, UT (ultrasonic testing) or RT (radiographic

testing), are usually used.

ET (electromagnetic testing) is not applicable to SAW tubes.

Welded seams on welded pipes of grades ≥ L210/A and diameters ≥ 60.3 mm

(2.375 in) shall be nondestructively inspected for full thickness and length (100 %)

as specified.



API 5L Pipe Schedule Chart



For ease of viewing and use, we have organized the relevant schedule PDF files.

You can always download and view these documents if needed.

API 5L Pipe Schedule Chart

Specify Outside Diameter and Wall Thickness



Standardized values for specified outside diameters and specified wall

thicknesses of steel pipe are given in **ISO 4200** and **ASME B36.10M**.

Permissible Spec	ified Outside Diameter and Specifie	ed Wall Thickness
Specified Outside Diameter D	Specified Wa f mm	all Thickness t (in.)
mm (in.)	Special Light Sizes ^a	Regular Sizes
≥ 10.3 (0.405) to < 13.7 (0.540)	Botop Botop 2	≥ 1.7 (0.068) to ≤ 2.4 (0.094)
≥ 13.7 (0.540) to < 17.1 (0.675)		≥ 2.2 (0.088) to ≤ 3.0 (0.118)
≥ 17.1 (0.675) to < 21.3 (0.840)	—	≥ 2.3 (0.091) to ≤ 3.2 (0.125)
≥ 21.3 (0.840) to < 26.7 (1.050)	creel - creel	≥ 2.1 (0.083) to ≤ 7.5 (0.294)
≥ 26.7(1.050) to < 33.4 (1.315)	BotopsiBotopsi	≥ 2.1 (0.083) to ≤ 7.8 (0.308)
≥ 33.4(1311}5) to < 48.3 (1.900)	_	≥ 2.1 (0.083) to ≤ 10.0 (0.394)
≥ 48.3 (1.900) to < 60.3 (2.375)		≥ 2.1 (0.083) to ≤ 12.5 (0.492)
≥ 60.3 (2.375) to < 73.0 (2.875)	≥ 2.1 (0.083) to ≤ 3.6 (0.141)	> 3.6 (0.141) to ≤ 14.2 (0.559)
≥ 73.0 (2.875) to < 88.9 (3.500)	≥ 2.1 (0.083) to ≤ 3.6 (0.141)	> 3.6 (0.141) to ≤ 20.0 (0.787)
≥ 88.9 (3.500) to < 101.6 (4.000)	≥ 2.1 (0.083) to ≤ 4.0 (0.156)	> 4.0 (0.156) to ≤ 22.0 (0.866)
≥ 101.6(4.000) to < 168.3 (6.625)	≥ 2.1 (0.083) to ≤ 4.0 (0.156)	> 4.0(0.156) to ≤ 25.0 (0.984)
≥ 168.3 (6.625) to < 219.1 (8.625)	≥ 2.1 (0.083) to ≤ 4.0 (0.156)	> 4.0 (0.156) to ≤ 40.0(1.575)
≥ 219.1 (8.625) to < 273.1 (10.750)	≥ 3.2 (0.125) to ≤ 4.0 (0.156)	> 4.0 (0.156) to ≤ 40.0 (1.575)
≥ 273.1 (10.750) to < 323.9 (12.750)	≥ 3.6 (0.141) to ≤ 5.2 (0.203)	> 5.2 (0.203) to ≤ 45.0 (1.771)
≥ 323.9 (12.750) to < 355.6 (14.000)	≥ 4.0 (0.156) to ≤ 5.6 (0.219)	> 5.6 (0.219) to ≤ 45.0 (1.771)
≥ 355.6 (14.000) to < 457 (18.000)	≥ 4.5 (0.177) to ≤ 7.1 (0.281)	> 7.1 (0.281) to ≤ 45.0 (1.771)
≥ 457 (18.000) to < 559 (22.000)	≥ 4.8 (0.188) to ≤ 7.1 (0.281)	> 7.1 (0.281) to ≤ 45.0(1.771)
≥ 559 (22.000) to < 711 (28.000)	≥ 5.6 (0.219) to ≤ 7.1 (0.281)	> 7.1 (0.281) to ≤ 45.0 (1.771)
≥ 711 (28.000) to < 864 (34.000)	≥ 5.6 (0.219) to ≤ 7.1 (0.281)	> 7.1 (0.281) to ≤ 52.0 (2.050)
≥ 864 (34.000) to < 965 (38.000)	land - land	≥ 5.6 (0.219) to ≤ 52.0 (2.050)
≥ 965 (38.000) to < 1422 (56.000)	Rotop 21- Rotop 21-	≥ 6.4 (0.250) to ≤ 52.0 (2.050)
≥ 1422 (56.000) to < 1829 (72.000)	_	≥ 9.5 (0.375) to ≤ 52.0 (2.050
≥ 1829 (72.000) to < 2134(84.000)		≥ 10.3 (0.406) to ≤ 52.0 (2.050)

a Pipe having the combination of specified outside diameter and specified wall thickness is defined as special light size pipe;other combinations given in this table are defined as regular size pipe.



Tolerances for Diameter and Out-of-roundness ...

The diameter of a steel pipe is defined as the circumference of the pipe in any

circumferential plane divided by π .

Specified		Diameter Toleran mm (in.)	ces		Out-of-round mn	ness Tolerances n (in.)
Diameter		Pipe Except the End ^a	Pipe I	End ^{a,b,c}		
mm (in.)	SMLS Pipe	Welded Pipe	SMLS Pipe	Welded Pipe	Pipe Except the End *	Pipe End ^{a,b,c}
< 60.3 (2.375)	00	-0.8 (0.031) to +0.4 (0.016) -0.8 (0.031) to +0.4 (0.016)		1.2 (0.048)	1.2 (0.036)	
≥ 60.3 (2.375) to 168.3 (6.625)	top Steel	±0.0075D -0.4 (0.016) to +1.6 (0.063)		0.020D for D/t \leq 75; by agreement for D/t > 75	0.015D for D/t \leq 75; by agreement for D/t > 75	
≥168.3 (6.625) to 610 (24.000)	±0.0075D	±0.0075D, but maximum of ±3.2 (0.125)	±0.005D, but maxi	imum of ±1.6 (0.063)	0.020D	0.015D
≥610 (24.000) to 1422 (56.000)	±0.01D	±0.005D, but maximum of ±14.0 (0.063)	±2.0 (0.079) ± 1.6 (0.063)		0.015D, but maximum of 15 (0.6) for D/t ≤ 75; by agreement for D/t > 75	0.01D, but maximum of 13 (0.5) for D/t \leq 75; by agreement for D/t $>$ 75
> 1422 (56.000)	As agreed Contraction of Contraction Contr					

a The pipe end includes a length of 100 mm (4.0 in.) at each of the pipe extremities. b For SMLS pipe, the tolerances apply for t < 25.0 mm (0.984 in.), and the tolerances for thicker pipe shall be as agreed. c For expanded pipe with D ≥ 219.1 mm (8.625 in.) and for nonexpanded pipe, the diameter tolerance and the out-of-roundness tolerance may be determined using the calculated inside diameter (the specified outside diameter minus two times the specified wall thickness) or measured inside diameter rather than the specified outside diameter (see 10.2.8.3).



Tolerances for Wall Thickness

	Wall Thickness	a de la compañía de l	Tolerances ^a				
	ر mm (in.)		mm	(in.)			
		SMLS Pipe ^b					
steel	≤ 4.0 (0.157)	cteel	+0.6 -0.5	(0.024) (0.020)	ctee		
Botop	> 4.0 (0.157) to < 25.0 (0.984)	Botop	Botop +0 -0).150t	Botop		
	≥ 25.0 (0.984)		+3.7 (0.146) or +0.1t, whichever is the greater -3.0 (0.120) or -0.1t, whichever is the greater				
top Steel		Welded Pipe ^{c, d}			top Steel		
30	≤ 5.0 (0.197)	Boos	±0.5	6 (0.020)	Bor		
	> 5.0 (0.197) to < 15.0 (0.591)	×	<u>+</u>	:0.1t			
Botop Steel	8000 ≥ 15.0 (0.591) 8000 Steel	Botop Steel	Botop Steet ±1.5	6 (0.060)	BotopStee		
a If the purch tolerance for b For pipe w tolerance for c The plus to d See 9 13 2	hase order specifies a minus tolerance for w wall thickness shall be increased by an am ith $D \ge 355.6$ mm (14.000 in.) and $t \ge 25.0$ wall thickness by an additional 0.05t, provid plerance for wall thickness does not apply to the for additional restrictions	vall thickness small ount sufficient to ma mm (0.984 in.), the ded that the plus tol o the weld area.	er than the applicable v aintain the applicable to wall thickness toleranc erance for mass (see 9	value given in this ta blerance range. e locally may exceed 0.14) is not exceede	able, the plus ed the plus ed.		



Tolerance for Length

Approximate lengths shall be delivered within a tolerance of ±500 mm (20 in.).

Tolerances for random length:

Rando	m Length Designation m (ft)	Minimum Length m (ft)	Minimum Avera	age Length for Each m (ft)	order Item	Maximum Lengt m (ft)	h Selection
		Th	readed-and-coupled	l Pipe			
a	6 (20)	4.88 (16.0)	a	5.33 (17.5)	a	6.86 (22.5)	
Ster	9 (30)	4.11 (13.5)	top Stee	8.00 (26.2)	stop Stee	10.29 (33.8)	90%
	12 (40)	6.71 (22.0)	80.	10.67 (35.0)	Bon	13.72 (45.0)	Bo
			Plain-end Pipe				
steel	6 (20)	2.74 (9.0)	steel	5.33 (17.5)	steel	6.86 (22.5)	
5	9 (30)	4.11 (13.5)	Botop	8.00 (26.2)	Botop	10.29 (33.8)	Botof
	12 (40)	4.27 (14.0)		10.67 (35.0)		13.72 (45.0)	
	15 (50)	5.33 (17.5)		13.35 (43.8)		16.76 (55.0)	
steel	18 (60)	مرو ^ک 6.40 (21.0)	steel	16.00 (52.5)	steel	19.81 (65.0)	
	24 (80)	8.53 (28.0)	Botop	21.34 (70.0)	BotoP	25.91 (85.0)	Botof

Tolerance for Straightness

Straightness deviation over the entire length of the tube: \leq 0.200 L;





Straightness deviation of 1.5 m (5.0 ft) pipe end of steel pipe: \leq 3.2mm (0.125 in.).



Key

1 straight line

2 pipe

Figure 2—Measuring End Straightness

Tolerance for Straightness

The out-of-squareness shall be < 1.6 mm (0.063 in.). The out-of-squareness is

measured as the gap between the end of the pipe and the pipe end leg.





Tolerances for the Weld Seam

Maximum Permissible Radial Offset for SAW and COW Pipe.

	Specified Wall Thickness t mm (in)		Maximum Permissible Radial Offset ^a				
				mm (in.)			
steel			steel	1.5 (0.060)		4	
3406	> 15.0 (0.590) to 25.0 (0.984)	Botop	Botop	80 ^{t0P} 0.1t	Botop	Botop	
	> 25.0 (0.984)			2.5 (0.098)			
a These limit	s apply also to strip/plate end welds	sotop Steel	sotop Steel	antop Steel	entop Steel	antop St	

Maximum Permissible Weld Bead Height for SAW and COW Pipe (Except at

Pipe Ends).

Specified Wall Thickness		Weld Bead Height mm (in.) maxim
mm (in.)	Internal Bead	External Bead
≤13.0 (0.512)	3.5 (0.138)	3.5 (0.138)
>13.0 (0.512)	3.5 (0.138)	4.5 (0.177)

The weld shall have a smooth transition to the surface of the adjacent steel pipe. Pipe end welds are to be ground to a length of 100 mm (4.0 in.) with a residual weld height of ≤ 0.5 mm (0.020 in.).



Tolerances for Mass

Each steel pipe:

- a) for special light size pipe: -5.0% +10.0%;
- b) for pipe in Grade L175, L175P, A25, and A25P: -5.0% +10.0%;
- c) for all other pipes: -3.5% +10.0%.

Pipe per lot (\geq 18 tons (20 tons) for order lot):

- a) for grades L175, L175P, A25, and A25P: -3.5 %;
- b) for all other grades: -1.75 %.

Common Defects and Repairs



For SAW tubes, the following defects are commonly found: nibbled edges, arc

burns, delamination, geometric deviations, hard lumps, etc.

Deficiencies found by visual inspection shall be verified, categorized, and disposed of as follows.

- Depth ≤ 0.125t, and does not affect the minimum allowable wall thickness of the defect shall be determined as acceptable defects and shall be disposed of in accordance with the provisions of C.1.
- Defects >0.125t in depth that do not affect the minimum allowable wall thickness shall be judged to be defects and shall be removed by resharpening in accordance with C.2 or disposed of in accordance with C.3.
- A defect affecting the minimum permissible wall thickness shall be recognized as a defect and shall be disposed of in accordance with C.3.

What is X70 Steel Equivalent to?



- ISO 3183 L485: This is a pipeline steel under international standards and is similar in properties to API 5L X70.
- CSA Z245.1 GR 485: This is a Canadian Standards Association steel grade for oil and gas pipelines.
- EN 10208-2 L485MB: This is a pipeline steel under the European Standard for the manufacture of pipelines for the transportation of oil and gas.

Our Supply Range



- ★ Standard: API 5L or ISO 3183;
- ★ PSL1: X70 or L485;
- PSL2: X70Q, X70M or L485Q, L485M;
- ★ Pipe Type: Welded Carbon Steel Pipe;
- ★ Manufacturing Process: LSAW, SAWL or DSAW;
- ★ Outer Diameter: 350 1500;
- ★ Wall Thickness: 8 80mm;
- Length: Approximate lengths or random length;
- Pipe Schedules: SCH10, SCH20, SCH30, SCH40, SCH60, SCH80, SCH100, SCH120, SCH140 and SCH160.
- ★ Identification: STD, XS, XXS;
- Coating: Paint, varnish, 3LPE, FBE, 3LPP, HDPE, galvanized, epoxy zinc-rich, cement weighted, etc.
- Packing: Waterproof cloth, wooden case, steel belt or steel wire bundling, plastic or iron pipe end protector, etc. Customized.
- Matching Products: Bends, flanges, pipe fittings, and other matching products are available.

Our Supply Range



In addition to high quality API 5L X70 steel pipe, we can also provide a wide range of pipe coatings to meet the needs of different projects.



Our Supply Range

Several different packaging methods for steel tubes:

sales@botopsteel.com