WELDED AND SEAMLESS PIPES

A312 & A358 STAINLESS STEEL PIPES

ASTM A312 governs the specification that covers both seamless and welded stainless steel pipes that are used for high temperature and/or corrosive service. In terms of dimensions, it would be referenced to ASME B36.10 and ASME B36.19. The standard ASME dimensional charts will show the typical combinations of pipe nominal size (NB) and wall thickness (Schedule Rating) that is available in the market. There are also sizes outside of the chart range that can be produced on special request.

A312 Welded pipes are manufactured by cold-forming a flat sheet of stainless steel into a cylindrical shape and then finally joint on the extremities on both ends electrically via a process know as electric fusion weld. The welding seam will be visible in the inner surface of the pipe itself.

A312 Seamless pipes on the other hand are manufactured from stainless steel billets. In simplified terms, the billet is heated and then perforated to create the seamless pipe. Seamless pipes as the name implies, refers to the absence of a welding seam.

Along the years, with advancement of technology, so has the methodologies for welding been improving with improvements made along the way to reduce the technical superiority of seamless pipes versus welded pipes. In some cases, welded pipes might provide a suitable substitute to seamless pipes in applications that have low to medium pressure and temperature. One such is the A358 Class 1 specification which employs a double weld using filler metal together with a 100% radiography test of their weld seam to detect any defects during production.

WELDED PIPE VERSUS SEAMLESS PIPE

We often hear the question of "should I use a welded or seamless pipe?". Although that is a question for your engineering team, we can look at certain general pros and cons for each usage:

ERW PIPES PROS AND CONS:

- Welded pipes are cheaper compared to seamless pipes. A common size would typically see around a 50% difference in terms of pricing between the two.
- Shorter lead times due to easier production methods and larger base of manufacturers
- Presence of a welding seam might prove as a weakness factor for mid to high pressure pipelines.

SEAMLESS PIPES PROS AND CONS:

- Seamless pipes are manufactured from a solid block of stainless steel and thus, do not have a welding seam
- Longer deliveries and a much higher cost are associated with the use of seamless pipes. Seamless pipes usually have extensive testing and manufacturing requirements as compared to seamless pipes.
- Varying wall thicknesses due to the standard tolerance of +/- 12.5%.

AVAILABLE SIZE RANGE

Here at HH Stainless, we carry a vast range of welded pipes with ready stock in Singapore:

PIPES	TYPES	304/L	316/L	SIZE RANGE IN NB (NOMINAL BORE - NB)
AUSTENITIC STEEL - A312 SEAMLESS PIPES	SCH 10S	●	●	0.375" - 16.00"
	SCH 40S / STD	●	●	0.125" - 12.00"
	SCH 80S / XS	●	●	0.125" - 16.00"
	SCH 80	●	●	12.00" - 16.00"
	SCH 120		●	4.00" - 8.00"
	SCH 160	●	●	0.50" - 10.00"
	SCH XXS	●	●	0.50" - 6.00"
AUSTENITIC STEEL - A312 & A358 CL 1 WELDED PIPES	SCH 10S	●	●	0.50" - 24.00" (Up to 30" for SS304)
	SCH 30		●	14.00" - 24.00"
	SCH 40S / STD	●	●	0.50" - 24.00"
	SCH 60		●	12.00" - 16.00"
	SCH 80S / XS	●	●	0.50" - 24.00"
	SCH 100		●	12.00" - 18.00"

DUPLEX PIPES

WHAT IS DUPLEX STAINLESS STEEL?

Duplex Stainless Steel is characterized by its superior corrosion resistance, high mechanical strength and high resistance to stress corrosion cracking. This is made possible due to duplex stainless steel having an approximate 50% ferrite and 50% austenite microstructure. This allows them to combine the many benefits that are tied to both ferritic and austenitic stainless steels.

With almost double the mechanical strength of the common grades stainless steel (304 & 316), duplex has been picking up speed in terms of global usage due to the cost savings one might get due to the reduction of thickness requirements and as well as overall life cycle replacement cost savings due to its superior corrosion resistance. The corrosion resistance of these materials is commonly measured for comparison against their PREN number.

WHAT IS PREN?

PREN refers to Pitting Resistance Equivalent Number, the higher the number, the better is the material's pitting corrosion resistance. While not absolute, PREN provides a simple way to compare the various alloys and their ability to withstand pitting corrosion. Below are the standard formulas for the calculation of PREN, the second one being that for items with Tungsten content.

- PREN = %Cr + (3.3 x %Mo) + (16 x %N)
- PREN = %Cr + 3.3 x (%Mo + 0.5%W) + 16 x %N

While there are various sources of pitting corrosion, these usually looks like tiny little dots on the surface of the material. Duplexes have one of the highest ratings of pitting corrosion resistance under PREN.

01 DUPLEX UNS 31803 / UNS32205 SEAMLESS PIPE ASTM A790

Duplex S31803 / S32205 is the most commonly used grade of duplex. The most noticeable disparity between both grades is the presence of Nitrogen in S32205 which provides additional protection against corrosive elements. This is usually produced in dual specifications to meet the requirements for both specifications. The most noticeable use of this grade in Singapore, is our Helix Bridge located at Marina Bay Sands. These materials were supplied via Outokumpu which we are one of the approved distributors here in Singapore.

02 DUPLEX UNS 31803 / UNS32205 WELDED PIPE ASTM A928 CLASS 1

Similar to the ASTM A790 duplex pipe, this is the welded variant that we carry for our duplex pipes. There are 5 Classes to differentiate their processes ranging from Class 1 to 5, with 1 being the highest. Class 1 pipes are double welded by processes using filler metal in all passes and are radiographed completely upon completion. In comparison, a class 5 pipe is only spot radiographed.

03 SUPER DUPLEX UNS 32750 ASTM A790 SEAMLESS PIPE

Super Duplex has similar benefits as Duplex materials but only better. Comparing against Duplex, it has improved corrosion resistance, greater mechanical strength and stress corrosion cracking. Between the two grades of F53 and F55 super duplex, these are fairly similar except the addition of Tungsten and Copper in F55 but overall, both grades have a mixture of chemical compositions that work out to at least a PREN of 42.

AVAILABLE SIZE RANGE

Here at HH Stainless, we keep the following grades of duplexes in the form of pipes for both seamless and welded types.

PIPES	TYPES	31803/ 2205	32750	SIZE RANGE IN NB (NOMINAL BORE - NB) D - DUPLEX SD - SUPER DUPLEX
DUPLEX & SUPER DUPLEX A790 SEAMLESS PIPES	SCH 10S	●	●	D: 0.50" - 6.00" SD: 2.00" - 4.00"
	SCH 40S / STD	●	●	D: 0.50" - 8.00" SD: 0.50" - 8.00"
	SCH 80S / XS	●	●	D: 0.50" - 12.00" SD: 0.50" - 8.00"
	SCH 160	●		D: 1.00" - 8.00"
	SCH XXS	●		D: 1.00" - 6.00"
DUPLEX A928 CLASS 1 WELDED PIPES	SCH 10S	●		D: 8.00" - 16.00"
	SCH 40S / STD	●		D: 8.00" - 16.00"
	SCH 80S / XS	●		D: 10.00" - 16.00"

PIPES SCHEDULE

DIMENSION (METRIC) ASME-B36.19
UNIT WEIGHT

NPS	OD MM	SCH. 5	SCH. 10	SCH. 20	SCH. 30	SCH. 40	SCH. STD	SCH. 60	SCH. 80	SCH. XS	SCH. 100	SCH. 120	SCH. 140	SCH. 160	SCH. XXS
1/8″	10.287	0.089	1.24	–	–	1.73	1.73	–	2.41	2.41	–	–	–	–	–
		0.21	0.28			0.37	0.37		0.47	0.47					
1/4″	13.716	1.24	1.65	–	–	2.24	2.24	–	3.02	3.02	–	–	–	–	–
		0.38	0.49			0.63	0.63		0.8	0.8					
3/8″	17.145	1.24	1.65	–	–	2.31	2.31	–	3.2	3.2	–	–	–	–	–
		0.49	0.63			0.84	0.84		1.1	1.1					
1/2″	21.34	1.65	2.11	–	–	2.77	2.77	–	3.73	3.73	–	–	–	4.78	7.47
		0.8	1			1.62	1.62		0.8	0.8				1.95	2.55
3/4″	26.67	1.65	2.11	–	–	2.87	2.87	–	3.91	3.91	–	–	–	5.56	7.82
		1.03	1.28			1.69	1.69		2.2	2.2				2.9	3.64
1″	33.401	1.65	2.77	–	–	3.38	3.38	–	4.55	4.55	–	–	–	6.35	9.09
		1.3	2.09			2.5	2.5		3.24	3.24				4.24	5.45
1 1/4″	42.164	1.65	2.77	–	–	3.56	3.56	–	4.85	4.85	–	–	–	6.35	9.7
		1.65	2.7			3.39	3.39		4.47	4.47				5.61	7.77
1 1/2″	48.26	1.65	2.77	–	–	3.68	3.68	–	5.08	5.08	–	–	–	7.14	10.15
		1.91	3.11			4.05	4.05		5.41	5.41				7.25	9.56
2″	60.325	1.65	2.77	–	–	3.91	3.91	–	5.54	5.54	–	–	–	8.74	11.07
		2.4	3.93			5.44	5.44		7.48	7.48				11.11	13.44
2 1/2″	73.025	2.11	3.05	–	–	5.16	5.16	–	7.01	7.01	–	–	–	9.53	14.02
		3.69	5.26			8.63	8.63		11.41	11.41				14.92	20.39
3″	88.9	2.11	3.05	3.96	4.78	5.49	5.49	–	7.62	7.62	–	–	–	11.13	15.24
		4.51	6.45	8.29	9.92	11.29	11.29		15.27	15.27				21.35	27.68
3 1/2″	101.6	2.11	3.05	–	–	5.74	5.74	–	8.08	8.8	–	–	–	–	16.15
		5.18	7.4			13.57	13.57		18.63	18.63					34.2
4″	114.3	2.11	3.05	4.78	5.56	6.02	6.02	7.14	8.56	8.56	–	11.13	–	13.49	17.12
		5.84	8.36	12.91	14.91	16.07	16.07	18.87	22.32	22.32		28.32		33.54	41.03
5″	141.3	2.77	3.4	4.78	5.56	6.55	6.55	7.14	9.53	9.53	–	12.7	–	15.88	19.05
		9.47	11.57	16.09	18.61	21.77	21.77	23.62	30.97	30.97		40.28		49.11	57.43
6″	168.275	2.77	3.4	4.78	6.35	7.11	7.11	9.53	10.97	10.97	12.7	14.27	–	18.26	21.95
		14.78	19.96	33.31	36.81	42.55	42.55	53.08	64.64	64.64	75.92	90.44	100.27	111.27	107.92
10″	273.05	3.4	4.19	6.35	7.8	9.27	9.27	12.7	15.09	12.7	18.26	21.44	25.4	28.58	25.4
		22.63	27.78	41.77	51.03	60.31	60.31	81.55	96.01	81.55	114.75	133.06	155.15	172.33	155.15

NPS	OD MM	SCH. 5	SCH. 10	SCH. 20	SCH. 30	SCH. 40	SCH. STD	SCH. 60	SCH. 80	SCH. XS	SCH. 100	SCH. 120	SCH. 140	SCH. 160	SCH. XXS
12″	323.85	3.96	4.57	6.35	8.38	10.31	9.53	14.27	17.48	12.7	21.44	25.4	28.58	33.32	25.4
		31.25	36	49.73	65.2	79.73	73.88	108.96	132.08	97.46	169.91	186.97	208.14	238.76	186.97
14″	355.6	3.96	6.35	7.92	9.53	11.13	9.53	15.09	19.05	12.7	23.83	27.79	31.75	35.71	–
		34.36	54.69	67.9	81.33	94.55	81.33	126.71	158.1	107.39	194.96	224.65	253.56	281.7	
16″	406.4	4.19	6.35	7.92	9.53	12.7	9.53	16.66	21.44	12.7	26.19	30.96	36.53	40.49	–
		41.56	62.64	77.83	93.27	123.3	93.27	160.12	203.53	123.3	245.66	286.64	333.19	365.35	
18″	457.2	4.19	6.35	7.92	11.13	14.27	9.53	19.05	23.83	12.7	29.36	34.93	39.67	45.24	–
		46.81	70.57	87.71	122.38	155.8	105.16	205.74	254.55	139.15	309.62	363.56	408.26	459.37	
20″	508	–	6.35	9.53	12.7	15.09	9.53	20.62	26.19	12.7	32.54	38.1	44.45	50.01	–
			78.55	117.15	155.12	183.42	117.15	247.83	311.17	155.12	381.53	441.49	508.11	564.81	
22″	558.8	–	6.35	9.53	12.7		9.53	22.23	28.58	12.7	34.93	41.28	47.63	53.98	–
			86.54	129.13	171.09		129.13	294.25	373.83	171.09	451.42	527.02	600.63	672.26	
24″	609.6	–	6.35	9.53	14.27	17.48	9.53	24.61	30.96	12.7	38.89	46.02	52.37	59.54	–
			94.53	141.12	209.64	255.41	141.12	355.26	442.08	187.06	547.71	640.03	720.15	808.22	
26″	660.4	6.35	7.92	–	–	–	9.53	10.31		12.7	14.27	–	–	–	–
		102.36	127.36				152.87	165.18		202.72	227.23				
28″	711.2	6.35	7.92	–	–	–	9.53			12.7	–	–	–	–	–
		110.34	137.32				164.85			218.69					
30″	762	6.35	7.92	12.7	15.88	–	9.53	10.31	11.13	12.7	–	–	–	–	–
		118.31	147.28	234.67	292.18		176.84	191.11	206.09	234.67					
32″	812.8	6.35	7.92	–	–	–	9.53	10.31	11.13	12.7	–	–	–	–	–
		126.31	157.24				188.82	204.08	220.08	250.64					
34″	863.6	6.35	7.92	–	–	–	9.53	10.31	11.13	12.7	–	–	–	–	–
		134.3	167.2				200.31	217.05	234.08	266.61					
36″	914.4	6.35	7.92	12.7	15.88	19.05	9.53	10.31	11.13	12.7	–	–	–	–	–
		142.13	176.96	282.27	351.7	420.42	212.56	229.76	247.31	282.27					
40″	1016	–	–	–	–	–	9.53			12.7	–	–	–	–	–
							236.53			314.22					
42″	1066.8	7.92	–	–	–	–	9.53			12.7	–	–	–	–	–
		207.92					248.52			330.19					
48″	1219.2	–	–	–	–	–	9.53			12.7	–	–	–	–	–
							284.24			377.79					