



We pursue innovation  
We create new value for a better environment

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## **Pipes & tubes of Kawasaki Steel corporation**



Kawasaki Steel Corporation has produced and sold a complete range of steel products and has served every need in Japan and overseas for over a long period of time as a comprehensive steel manufacturer.

In the pipe and tube unit, we have the latest production facilities that can cover all products, such as those involving electric resistant rolling, butt welding, as well as a product control system based on non-destructive inspection using computers.

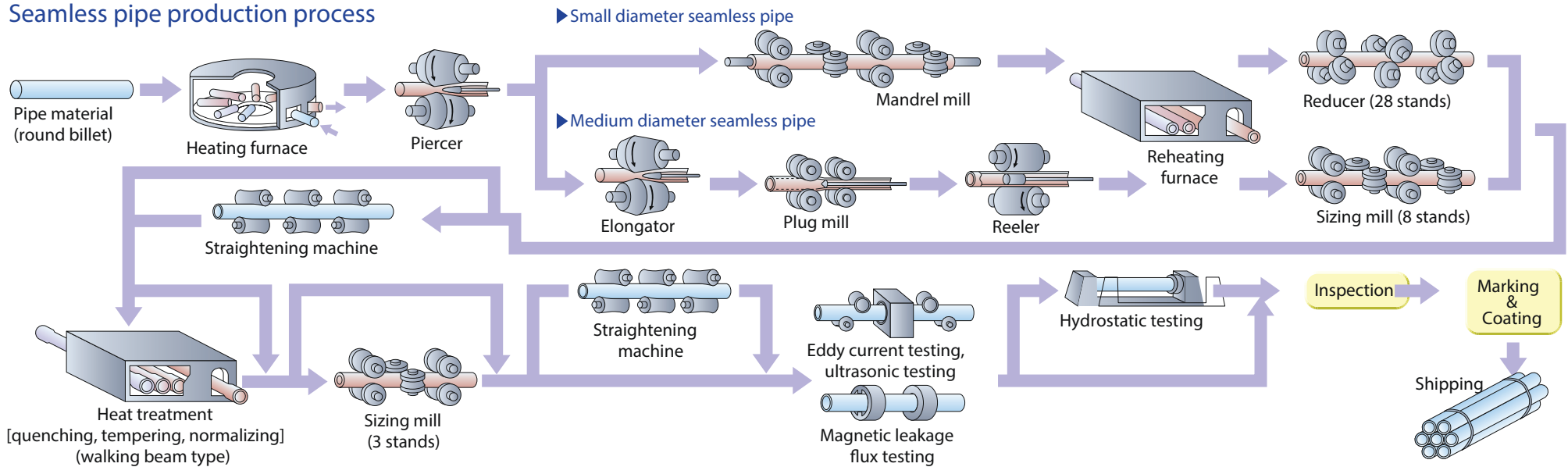
In addition, the comprehensive unique capabilities of Kawasaki Steel include application technologies and construction technologies varying from high grade pipes for lines, oil wells, and power generation, etc. to general pipes & tubes such as those for piping and structures. We believe that such technologies will serve you and your needs.

We would like to gain your interest in the pipe & tube products of Kawasaki Steel Corporation.



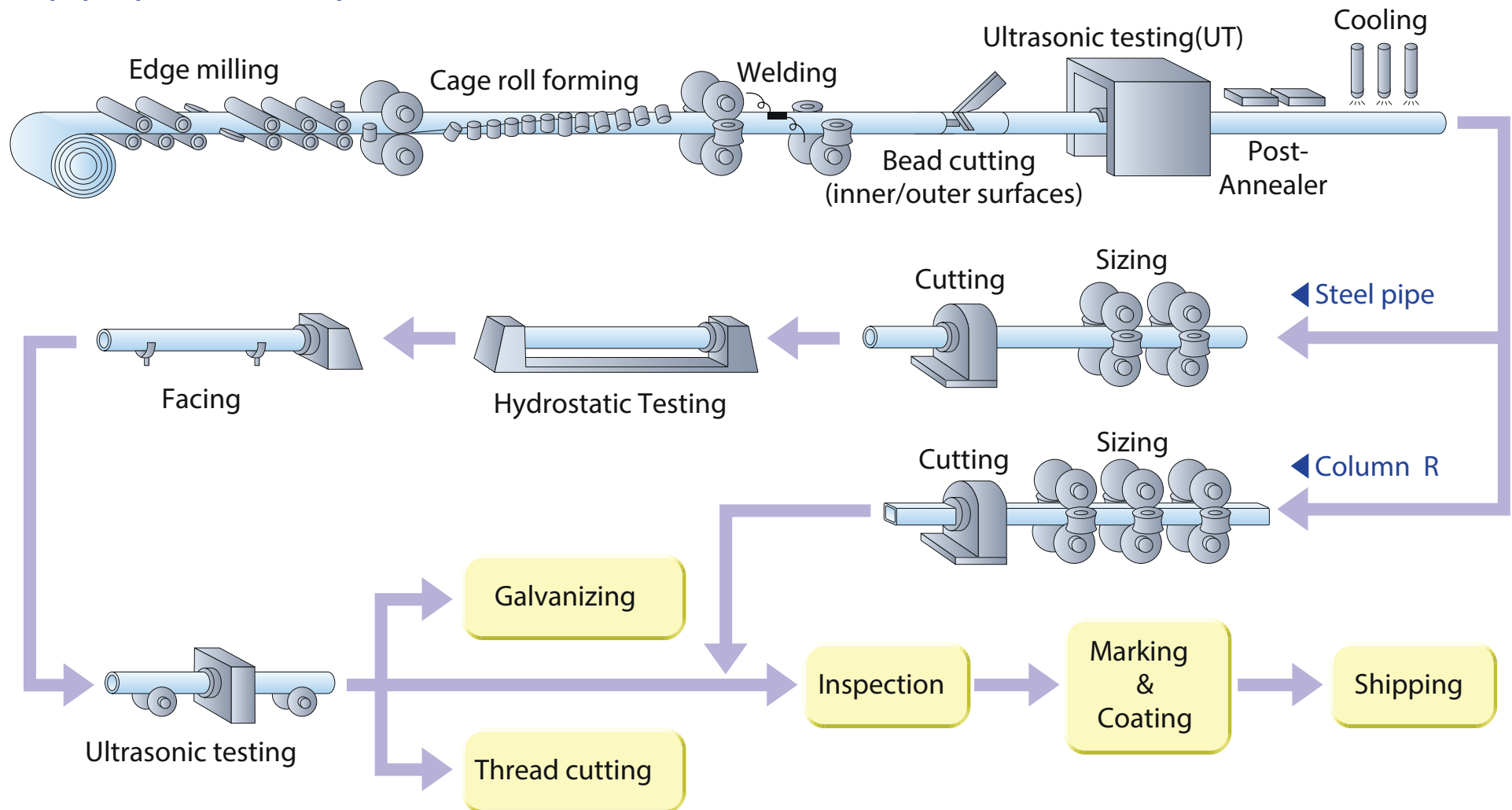
# Manufacturing Flowchart

## Seamless pipe production process



# Manufacturing Flowchart

## ERW pipe production process





# Pipes Manufactured (CS/MS)

Seamless & Electric Resistance Welded

## Seamless Pipes

Product Range

1/2" to 24" (12.7mm to 600mm)

Product Specification / Applicable Standards

ASTM A106 Gr.B / Gr.A

API 5L 5LX

ASTM A53

ASTM A106

ASTM A333

ASTM A335

JIS 3455 / JIS 3456 / JIS 3429

# Pipe Manufactured (CS/MS)

Seamless & Electric Resistance Welded

## Electric Resistance Welded Pipes (ERW)

Product Range

1/2" to 72" (12.7mm to 1800mm)

Product Specification / Applicable Standards

API 5L Gr.B / Gr.A

5LX /ASME SA53/SA53M

ASTM A53

A135

ASTM A252/A333

JIS 3454

# DIMENSIONS AND MASS

DIMENSIONS SHOWN ARE TO ASME B36.10

Nominal Size		Outside Diameter mm (inch)	Wall Thickness mm	Inside Diameter mm	Plain End Mass kg/m	Identification	
NPS	DN					Standard (STD) X-Strong (XS) XX-Strong (XXS)	Schedule Number
1/8	6	10.3	1.73	6.8	0.37	STD	40
		(0.405)	2.41	5.5	0.47	XS	80
1/4	8	13.7	2.24	9.2	0.63	STD	40
		(0.540)	3.02	7.7	0.80	XS	80
3/8	10	17.1	2.31	12.5	0.84	STD	40
		(0.675)	3.20	10.7	1.10	XS	80
1/2	15	21.3 (0.840)	2.77	15.8	1.27	STD	40
			3.73	13.9	1.62	XS	80
			4.78	11.8	1.95	-	60
			7.47	6.4	2.55	XXS	-
3/4	20	26.7 (1.050)	2.87	20.9	1.69	STD	40
			3.91	18.9	2.20	XS	80
			5.56	15.5	2.90	-	60
			7.82	11.0	3.64	XXS	-
1	25	33.4 (1.315)	3.38	26.6	2.50	STD	40
			4.55	24.3	3.24	XS	80
			6.35	20.7	4.24	-	60
			9.09	15.2	5.45	XXS	-
1 1/4	32	42.2 (1.660)	3.56	35.1	3.39	STD	40
			4.85	32.5	4.47	XS	80
			6.35	29.5	5.61	-	60
			9.70	22.8	7.77	XXS	-
1 1/2	40	48.3 (1.900)	3.68	40.9	4.05	STD	40
			5.08	38.1	5.41	XS	80
			7.14	34.0	7.25	-	60
			10.15	27.9	9.55	XXS	-
2	50	60.3 (2.375)	3.91	52.5	5.44	STD	40
			5.54	49.2	7.48	XS	80
			8.74	42.9	11.11	-	60
			11.07	38.2	13.44	XXS	-
2 1/2	65	73.0 (2.875)	5.16	62.7	8.63	STD	40
			7.01	59.0	11.41	XS	80
			9.53	54.0	14.92	-	60
			14.02	45.0	20.39	XXS	-

NPS: ASME term.

DN: SI Metric term.

Nominal Size		Outside Diameter mm (inch)	Wall Thickness mm	Inside Diameter mm	Plain End Mass kg/m	Identification	
NPS	DN					Standard (STD) X-Strong (XS) XX-Strong (XXS)	Schedule Number
3	80	88.9 (3.500)	5.49	77.9	11.29	STD	40
			7.62	73.7	15.27	XS	80
			11.13	66.7	27.68	-	160
3 1/2	90	101.6 (4.000)	5.74	90.1	13.57	STD	40
			8.08	85.4	18.64	XS	80
4	100	114.3 (4.500)	6.02	102.3	16.08	STD	40
			8.56	97.2	22.32	XS	80
			11.13	92.1	28.32	-	120
			13.49	87.3	33.54	-	160
			17.12	80.1	41.03	XXS	-
5	125	141.3 (5.563)	6.55	128.2	21.77	STD	40
			9.53	122.3	30.97	XS	80
			12.70	115.9	40.28	-	120
			15.88	109.6	49.12	-	160
			19.05	103.2	57.43	XXS	-
6	150	168.3 (6.625)	7.11	154.1	28.26	STD	40
			10.97	146.3	42.56	XS	80
			14.27	139.7	54.21	-	120
			18.26	131.8	67.57	-	160
			21.95	124.4	79.22	XXS	-
8	200	219.1 (8.625)	6.35	206.4	33.32	-	20
			7.04	205.0	36.82	-	30
			8.18	202.7	42.55	STD	40
			10.31	198.5	53.09	-	60
			12.70	193.7	64.64	XS	80
			15.09	188.9	75.92	-	100
			18.26	182.6	90.44	-	120
			20.62	177.8	100.93	-	140
			22.23	174.6	107.93	XXS	-
			23.01	173.1	111.27	-	160
10	250	273.1 (10.75)	6.35	260.3	41.76	-	20
			7.80	257.5	51.01	-	30
			9.27	254.5	60.29	STD	40
			12.70	247.7	81.53	XS	60
			15.09	242.9	95.98	-	80
			18.26	236.5	114.71	-	100
			21.44	230.2	133.01	-	120
			25.40	222.3	155.10	XXS	140
			28.58	215.9	172.27	-	160

All dimensions are nominal



# DIMENSIONS AND MASS

DIMENSIONS SHOWN ARE TO ASME B36.10

Nominal Size		Outside Diameter mm (inch)	Wall Thickness mm	Inside Diameter mm	Plain End Mass kg/m	Identification				
NPS	DN					Standard (STD) X-Strong (XS) XX-Strong (XXS)	Schedule Number			
12	300	323.9 (12.75)	6.35	311.1	49.71	-	20			
			8.38	307.1	65.19	-	30			
			9.53	304.8	73.86	STD	-			
			10.31	303.2	79.71	-	40			
			12.70	298.5	97.44	XS	-			
			14.27	295.3	108.93	-	60			
			17.48	288.9	132.05	-	80			
			21.44	281.0	159.87	-	100			
			25.40	273.1	186.92	XXS	120			
			28.58	266.7	208.08	-	140			
			33.32	257.2	238.69	-	160			
			14	350	355.6 (14.00)	6.35	342.9	54.69	-	10
7.92	339.8	67.91				-	20			
9.53	336.6	81.33				STD	30			
11.13	333.3	94.55				-	40			
11.91	331.8	100.95				-	-			
12.70	330.2	107.40				XS	-			
15.09	325.4	126.72				-	60			
19.05	317.5	158.11				-	80			
23.83	307.9	194.98				-	100			
27.79	300.0	224.66				-	120			
31.75	292.1	253.58				-	140			
35.71	284.2	281.72				-	160			
16	400	406.4 (16.00)	6.35	393.7	62.65	-	10			
			7.92	390.6	77.83	-	20			
			9.53	387.4	93.27	STD	30			
			12.70	381.0	123.31	XS	40			
			16.66	373.1	160.13	-	60			
			21.44	363.5	203.54	-	80			
			26.19	354.0	245.57	-	100			
			30.96	344.5	286.66	-	120			
			36.53	333.3	333.21	-	140			
			40.49	325.4	365.38	-	160			
			18	450	457 (18.00)	6.35	444.5	70.57	-	10
						7.92	441.4	87.71	-	20
9.53	438.2	105.17				STD	-			
11.13	434.9	122.38				-	30			
12.70	431.8	139.16				XS	-			
14.27	428.7	155.81				-	40			
19.05	419.1	205.75				-	60			
23.83	409.5	254.57				-	80			
29.36	398.5	309.64				-	100			
34.93	387.4	363.58				-	120			
39.67	377.9	408.28				-	140			
45.24	366.7	459.39				-	160			

NPS: ASME term.

DN: SI Metric term.

All dimensions are nominal

Nominal Size		Outside Diameter mm (inch)	Wall Thickness mm	Inside Diameter mm	Plain End Mass kg/m	Identification				
NPS	DN					Standard (STD) X-Strong (XS) XX-Strong (XXS)	Schedule Number			
20	500	508 (20.00)	6.35	495.3	78.56	-	10			
			9.53	489.0	117.15	STD	20			
			12.70	482.6	155.13	XS	30			
			15.09	477.8	183.43	-	40			
			20.62	466.8	247.84	-	60			
			26.19	455.6	311.19	-	80			
			32.54	442.9	381.55	-	100			
			38.10	431.8	441.52	-	120			
			44.45	419.1	508.15	-	140			
			50.01	408.0	564.85	-	160			
			22	550	559 (22.00)	6.35	546.1	86.55	-	10
						9.53	539.8	129.14	STD	20
12.70	533.4	171.10				XS	30			
22.23	514.4	294.27				-	60			
28.58	501.7	373.85				-	80			
34.93	489.0	451.45				-	100			
41.28	476.2	527.05				-	120			
47.63	463.5	600.67				-	140			
53.98	450.8	672.30				-	160			
24	600	610 (24.00)				6.35	596.9	94.53	-	10
						9.53	590.6	141.12	STD	20
						12.70	584.2	187.07	XS	-
			14.27	581.1	209.65	-	30			
			17.48	574.6	255.43	-	40			
			24.61	560.4	355.28	-	60			
			30.96	547.7	442.11	-	80			
			38.89	531.8	547.74	-	100			
			46.02	517.6	640.07	-	120			
			52.37	504.9	720.19	-	140			
			59.54	490.5	808.27	-	160			
			26	650	660 (26.00)	7.92	644.6	127.36	-	10
9.53	641.4	152.88				STD	-			
12.70	635.0	202.74				XS	20			
28	700	711 (28.00)	7.92	695.4	137.32	-	10			
			9.53	692.2	164.86	STD	-			
			12.70	685.8	218.71	XS	20			
30	750	762 (30.00)	7.92	746.2	147.29	-	10			
			9.53	743.0	176.85	STD	-			
			12.70	736.6	234.68	XS	20			
36	900	914 (36.00)	7.92	898.6	176.97	-	10			
			9.53	895.4	212.57	STD	-			
			12.70	889.0	282.29	XS	20			
42	1050	1067 (42.00)	7.92	1047.8	248.53	STD	-			
			9.53	1041.4	330.21	XS	-			
			12.70	1041.4	330.21	XS	-			

FORMULA TO ATTAIN APPROXIMATE MASS IN KILOGRAMS PER METRE (kg/m) FOR STEEL ROUND PIPE AND TUBING

$$M = (D - T) T \times 0.02466$$

Where: m = mass to the nearest 0.01 kg/m.

D = Outside Diameter in millimetres (mm).

(To nearest 0.1mm for O.D. up to 406.4mm)

(To nearest 1.0mm for O.D. 457mm and above)

t = Wall Thickness to nearest 0.01mm

EXAMPLE

NOMINAL SIZE: NPS-12. DN-300

O. D. = 323.9mm W.T. = 9.53mm

Step 1. 323.9 - 9.53 = 314.37

Step 2. 314.37 x 9.53 = 2995.9461

Step 3. 2995.9461 x 0.02466 = 73.88 kg/m

# PRESSURE/TEMPERATURE RATINGS

PRESSURE/TEMPERATURE RATINGS											
SEAMLESS CARBON STEEL PIPE. GRADE B, with plain ends. ASTM A106, API 5L & ASTM A53											
Nominal Size	Temp. °C			-29 to 38	205	260	350	370	400	430	450
	Stress (SE) in kPa			137800	137800	130221	117130	115752	89570	74412	59943
DN MM	Wall Thickness			MAXIMUM ALLOWABLE PRESSURE/TEMPERATURE RATINGS IN kPa FOR CHEMICAL PLANT AND PETROLEUM REFINERY PIPING SYSTEMS TO ANSI/ASME							
		Sched. No.	mm								
15	STD	40	2.77	34416	34416	32528	29255	28910	22372	18589	14972
	XS	80	3.73	48092	48092	45446	40878	40396	31260	25969	20918
		160	4.78	62830	62830	59378	53404	52777	40837	33926	27333
		XXS		7.47	98245	98245	92836	83507	82522	63857	53053
20	STD	40	2.87	28070	28070	26526	23860	23578	18245	15158	12209
	XS	80	3.91	39418	39418	37247	33506	33106	25617	21283	17142
		160	5.56	58152	58152	54955	49429	48843	37799	31398	25293
		XXS		7.82	83107	83107	78539	70643	69809	54024	44881
25	STD	40	3.38	26251	26251	24804	22310	22048	17060	14173	11417
	XS	80	4.55	36283	36283	34285	30862	30474	23584	19595	15785
		160	6.35	52481	52481	49594	44606	44082	34112	28339	22827
		XXS		9.09	77030	77030	72793	65476	64704	50070	41595
32	STD	40	3.56	21614	21614	20421	18369	18155	14049	11672	9404
	XS	80	4.85	30178	30178	28518	25651	25348	19616	16295	13125
		160	6.35	40596	40596	38364	34505	34099	26389	21924	17659
		XXS		9.70	64601	64601	61045	54906	54266	41988	34884
40	STD	40	3.68	19444	19444	18375	16529	16329	12636	10500	8454
	XS	80	5.08	27402	27402	25900	23295	23019	17811	14800	11919
		160	7.14	39783	39783	37599	33816	33416	25858	21483	17308
		XXS		10.16	58779	58779	55547	49966	49374	38205	31742
50	STD	40	3.91	16378	16378	15468	13925	13759	10645	8847	7124
	XS	80	5.54	23653	23653	22351	20105	19871	15378	12774	10287
		160	8.74	38866	38866	36731	33037	32652	25266	20987	16908
		XXS		11.07	50793	50793	48003	43173	42670	33017	27429
65	STD	40	5.16	17914	17914	16929	15227	15048	11644	9674	7793
	XS	80	7.01	24818	24818	23447	21097	20849	16129	13401	10797
		160	9.53	34615	34615	32714	29420	29076	22503	18693	15055
		XXS		14.02	53081	53081	50159	45116	44585	34498	28662
80	STD	40	5.49	15558	15558	14696	13222	13063	10108	8399	6766
	XS	80	7.62	21986	21986	20780	18693	18472	14290	11871	9563
		160	11.13	33079	33079	31253	28111	27780	21497	17859	14386
		XXS		15.24	46976	46976	44392	39928	39459	30536	25369



# PRESSURE/TEMPERATURE RATINGS

SEAMLESS CARBON STEEL PIPE. GRADE B, with plain ends. ASTM A106, API 5L & ASTM A53											
Nominal Size DN MM	Temp. °C		-29 to 38	205	260	350	370	400	430	450	
	Stress (SE) in kPa		137800	137800	130221	117130	115752	89570	74412	59943	
	Wall Thickness		MAXIMUM ALLOWABLE PRESSURE/TEMPERATURE RATINGS IN kPa FOR CHEMICAL PLANT AND PETROLEUM REFINERY PIPING SYSTEMS TO ANSI/ASME								
	Sched. No.	mm									
400	STD	10	6.35	3810	3810	3603	3238	3197	2474	2060	1660
		20	7.92	4768	4768	4507	4051	4004	3100	2577	2074
		30	9.53	5746	5746	5429	4885	4830	3734	3100	2501
		40	12.70	7703	7703	7283	6545	6470	5009	4162	3349
		60	16.66	10176	10176	9618	8654	8550	6614	5498	4430
	XS	80	21.44	13208	13208	12478	11224	11093	8585	7131	5746
		100	26.19	16274	16274	15378	13835	13670	10576	8785	7076
		120	30.96	19409	19409	18341	16481	16302	12616	10480	8440
		140	36.53	23130	23130	21855	19657	19430	15034	12492	10059
		160	40.49	25824	25824	24404	21952	21697	16784	13945	11238
450	STD	10	6.35	3383	3383	3197	2873	2839	2198	1826	1474
		20	7.92	4230	4230	3996	3597	3555	2749	2287	1839
		30	9.53	5099	5099	4816	4334	4286	3314	2756	2219
		40	11.13	5967	5967	5643	5071	5016	3879	3225	2598
		60	14.27	7696	7696	7276	6545	6463	5002	4155	3349
	XS	80	19.05	10349	10349	9784	8799	8695	6725	5588	4499
		100	23.83	13043	13043	12326	11086	10955	8475	7042	5670
		120	29.36	16219	16219	15323	13787	13622	10542	8757	7055
		140	34.93	19464	19464	18389	16543	16350	12650	10507	8468
		160	39.67	22282	22282	21056	18941	18713	14483	12030	9694
500	STD	10	6.35	3038	3038	2873	2584	2556	1977	1640	1323
		20	7.92	4582	4582	4327	3893	3852	2976	2474	1991
		30	9.53	5139	5139	5801	5216	5154	3989	3314	2666
		40	12.70	6139	6139	5801	5216	5154	3989	3314	2666
		60	15.09	7317	7317	6911	6215	6146	4754	3948	3183
	XS	80	20.62	10080	10080	9522	8564	8468	6552	5443	4382
		100	26.19	12898	12898	12188	10962	10831	8385	6966	5608
		120	32.54	16171	16171	15287	13746	13580	10514	8730	7035
		140	38.10	19085	19085	18038	16226	16033	12409	10307	8802
		160	44.45	22475	22475	21242	19106	18879	14614	12140	9777
600	STD	10	6.35	2529	2529	2391	2150	2129	1647	1364	1102
		20	7.92	3810	3810	3603	3238	3197	2474	2060	1660
		30	9.53	5097	5097	4816	4334	4286	3314	2756	2219
		40	12.70	5739	5739	5423	4878	4823	3734	3100	2494
		60	17.48	7055	7055	6670	5994	5925	4589	3810	3066
	XS	80	24.61	10018	10018	9467	8516	8420	6511	5409	4361
		100	30.96	12691	12691	12002	10783	10659	8254	6856	5519
		120	38.89	16102	16102	15220	13690	13525	10466	8695	7007
		140	46.02	19223	19223	18168	16336	16150	12491	10383	8864
		160	52.37	22048	22048	20835	18741	18520	14331	11906	9591
		59.54	25279	25279	23888	21489	21235	16433	13649	10996	

# MATERIAL SPECIFICATIONS FOR PIPING COMPONENTS

## PIPING COMPONENT SPECIFICATIONS

This page shows comparable ASTM and API specifications for the basic components of welded piping systems. Specification numbers and material grades are shown; for example, ASTM specification A106 Grade B is indicated in the table as A106-B. Other specifications exist and may be required for special piping systems. Materials shown are those most frequently used today.

Also tabulated are the permissible raw material specifications which are used in the manufacture of welding fittings. Selection from these is at the discretion of the fitting manufacturer.

MATERIAL		PIPING COMPONENTS			RAW MATERIAL FOR WELDING FITTINGS	
		Pipe	Welding Fittings *	Flanges	Pipe	Forgings
Carbon Steel	Grade B	A53-B A106-B A135-B A139-B API-5L-B	A234-WPB	A105	A106-B	A105
	Grade C	A106-C	A234-WPC	A105	A106-C	
	Low Temperature	A333-6	A420-WPL6	A350-LF2	A333-6	A350-LF2
	High Yield	A381-35	Grade WPY35 § II	A105	A106-B	A105
API-5LX-X42, X46, X52		Grade WPY42 § II Grade WPY52 § II	A182-F1 -	A381-42 A381-52	182-F1 -	
Carbon Moly-Steel	1/2 Mo	A155-CM70	A234-WP1	A182-F1	A335-P1	A182-F1
		A335-P1 A369-FP1				
Chrome Moly-Steel	1/2Cr- 1/2Mo	A155- 1/2CR A335-P2 A369-FP2	Grade WP2 §	A182-F2	A335-P2	A182-F2
	1Cr- 1/2Mo	A155-1CR A335-P12 A369-FP12	A234-WP12	A182-F12	A335-P12	A182-F12
	1 1/4Cr- 1/2Mo	A155-1 1/4CR A335-P11 A369-FP11	A234-WP11	A182-F11	A335-P11	A182-F11
	2 1/4Cr-1Mo	A155-2 1/4CR A335-P22 A369-FP22	A234-WP22	A182-F22	A335-P22	A182-F22
	5Cr- 1/2Mo	A155-5CR A335-P5 A369-FP5	A234-WP5	A182-F5	A335-P5	A182-F5
	7Cr- 1/2Mo	A335-P7 A369-FP7	Grade WP7	A182-F7	A335-P7	A182-F7
	9Cr-1Mo	A335-P9 A369-FP9	Grade WP9	A182-F9	A335-P9	A182-F9
Low Temp Ferritic Steel	3 1/2Ni	A333-3	A420-WPL3	A350-LF3	A333-3	A350-LF3
	Cu-Ni Low Alloy Steel	A333-9	A420-WPL9	A350-LF9	A333-9	A350-LF9

- \* When fittings are of welded construction, the fitting manufacturer shall supplement the grade symbol marking with the letter "W".  
No ASTM specification has been written. The welding fitting grade symbol is that recommended by MSS Standard SP-25, and the raw material specifications shown are commonly used.
- II The numerals in these grade symbols are the first two numbers of the minimum guaranteed yield strength of the fittings. Fittings having other minimum yield strengths may be similarly designated by using the applicable numerals.

## MANUFACTURING SITES

### Wakayama Steel Works

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Wakayama Steel Works is the integrated supply center for seamless pipes. The Steel billets are produced by a blast furnace, converter, and continuous casting machine. Then three seamless pipe mills roll the billets into seamless pipes. Above all the medium size seamless pipe mill is the most advanced in the world that is directly connected to a round CCM, combined with a cone type piercer with high cross angle, a mandrel mill and an inline heat treatment furnace.



### Amagasaki Steel Tube Works

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The steel tube works was established in 1919 as the first integrated mill in Japan for the production of high quality tubes and pipes.

## CHEMICAL AND MECHANICAL PROPERTIES

(Seamless)

### CHEMICAL COMPOSITION(%)

		*1	C	Si	Mn	P	S	Cu	Cr	Ni	Mo	Ti	V	Nb	B	Ca	*U4	*N	*V1	*CEQ	
					*2						*2		*2		*2						
SPEC.	MIN.	R	-	10	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	MAX.	R	19	-	100	20	8	15	25	25	15	-	2	-	1	6	100	6	15	38	
		L	18	28	92	13	5	1	4	2	1	8	0	10	0	1	8	1	2	35	
		P	17	26	90	12	5	2	4	2	2	8	0	8	0	1	10	1	2	33	
		P	16	26	90	12	5	2	4	2	2	8	0	9	0	1	10	1	2	32	
		P	17	26	90	12	5	2	4	2	2	7	0	9	0	1	10	1	2	33	
		P	16	26	90	12	5	2	4	2	2	8	0	8	0	1	10	1	2	32	

\*1 R:LADLE & PRODUCT ANALYSIS L:LADLE ANALYSIS P:PRODUCT ANALYSIS \*2:X1000 OTHER:X100 \*U4:Ca+Ni+Cr+Mo+V  
 \*N:Nb+V \*V1:Nb+V+Ti \*CEQ:(C+Mn/6+(Cr+Mo+V)/5+(Cu+Ni))/15

### TENSILE TEST

		*1	*2	YS	TS	EL
				*3	*3	%
SPEC.	MIN.	L	B	P 42.1	P 60.2	30
	MAX.	L	B	P -	P -	-
		L	B	P 56.4	P 77.4	58
		L	B	P 56.4	P 77.3	59

TYPE OF SPECIMEN:FULL SECTION \*1 SAMPLING DIRECTION L:LONGITUDINAL \*2 SAMPLING POSITION B:BASE METAL  
 \*3 UNIT P:ksi GAGE LENGTH:2.0in. KIND OF YS:0.5% EXTENSION UNDER LOAD

## CHEMICAL AND MECHANICAL PROPERTIES

(ERW)

### CHEMICAL COMPOSITION(%)

		*1	C	Si	Mn	P	S	Cu	Cr	Ni	Mo	Ti	V	Nb	Ca	*04	*VN	*VI	*CEQ
						*2	*2					*2		*2	*2				
SPEC. MIN.	R	R	-	10	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAX.	R	R	20	-	110	20	10	40	40	40	15	-	8	-	6	100	6	15	42
	L	L	18	30	111	16	7	2	4	2	1	0	0	21	1	9	2	2	38
	P	P	18	31	110	15	7	1	4	2	1	0	0	20	2	8	2	2	38

\*1 R:LADLE & PRODUCT ANALYSIS L:LADLE ANALYSIS P:PRODUCT ANALYSIS \*2:X1000 OTHER:X100 \*04:Cu+Ni+Cr+Mo+V  
 \*VN:Nb+V \*VI:Nb+V+Ti \*CEQ:C+Mn/6+(Cr+Mo+V)/5+(Cu+Ni)/15

\*MAXIMUM MANGANESE CONTENT IS PERMISSIBLE, UP TO A MAXIMUM OF SPECIFIED CONTENT ACCORDING TO RULE OF STANDARD.

### TENSILE TEST

		*1 *2	YS	TS	EL
			*3	*3	%
SPEC. MIN.	L B	L B	P 42.1	P 60.2	30
MAX.	L B	L B	P -	P -	-
	L B	L B	P 57.9	P 80.1	43

WIDTH \*1 SAMPLING DIRECTION L:LONGITUDINAL \*2 SAMPLING POSITION B:BASE METAL  
 \*3 UNIT P:ksi GAUGE LENGTH:2.0in. KIND OF YS:0.5% EXTENSION UNDER LOAD

### HARDNESS TEST( HV 10 )

		*1*2	*3
SPEC. MIN.	B C	B C	-
MAX.	B C	B C	248
			(1) (2) (3)
	B C	B C	162 164 165

\*1 SAMPLING POSITION B:BASE METAL \*2 LOCATION C:CROSS SECTION \*3 EACH



### Chemical Compositions(%):

Standard	Grade	C	Si	Mn	P	S
JIS G3454	STPG370	≤0.25	≤0.35	0.30-0.90	≤0.040	≤0.040
	STPG410	≤0.30	≤0.35	0.30-1.00	≤0.040	≤0.040
JIS G3455	STS370	≤0.25	0.10-0.35	0.30-1.10	≤0.035	≤0.035
	STS410	≤0.30	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	STPT370	≤0.25	0.10-0.35	0.30-0.90	≤0.035	≤0.035
	STPT410	≤0.30	0.10-0.35	0.30-1.00	≤0.035	≤0.035
	STPT480	≤0.33	0.10-0.35	0.30-1.00	≤0.035	≤0.035

### Mechanical Properties:

Standard	Grade	Yield Strength (Mpa)	Tensile Strength (Mpa)	Elongation (%)
JIS G3454	STPG370	≥216	≥370	≥30
	STPG410	≥245	≥410	≥25
JIS G3455	STS370	≥216	≥370	≥30
	STS410	≥245	≥410	≥25
	STS480	≥275	≥480	≥25
JIS G3456	STPT370	≥216	≥370	≥30
	STPT410	≥245	≥410	≥25
	STPT480	≥275	≥480	≥25

## ***Range of application:***

- Industrial Piping
- Mechanical Structures
- Marine Structures
- General Structures
- Oil & Gas Casing and Tubing
- Oil & Gas Line Pipes

***And Other General Piping Applications...***



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