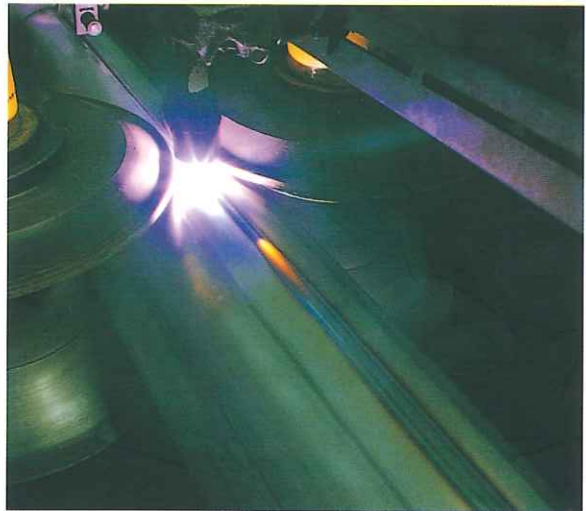


***S*ainless Steel Welded Pipes & Tubes**

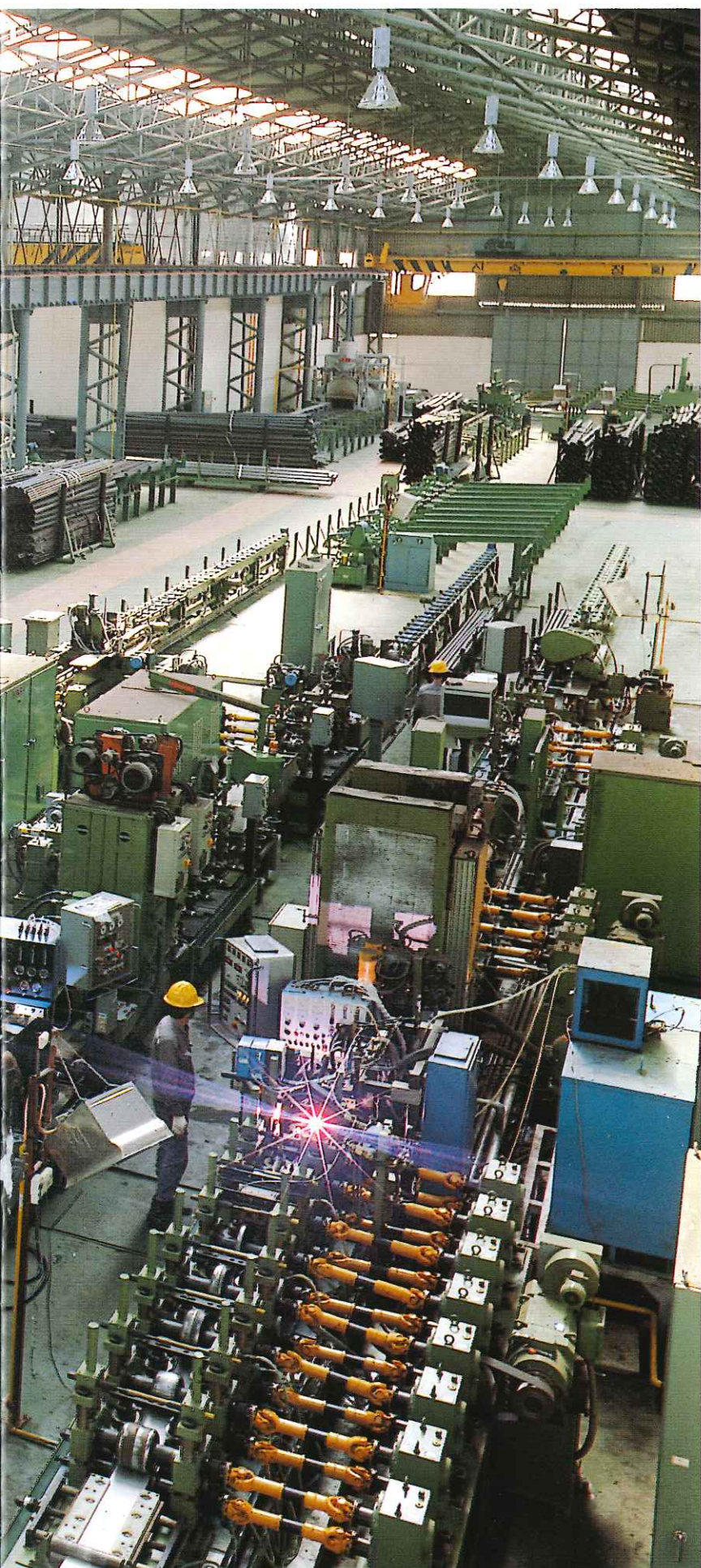




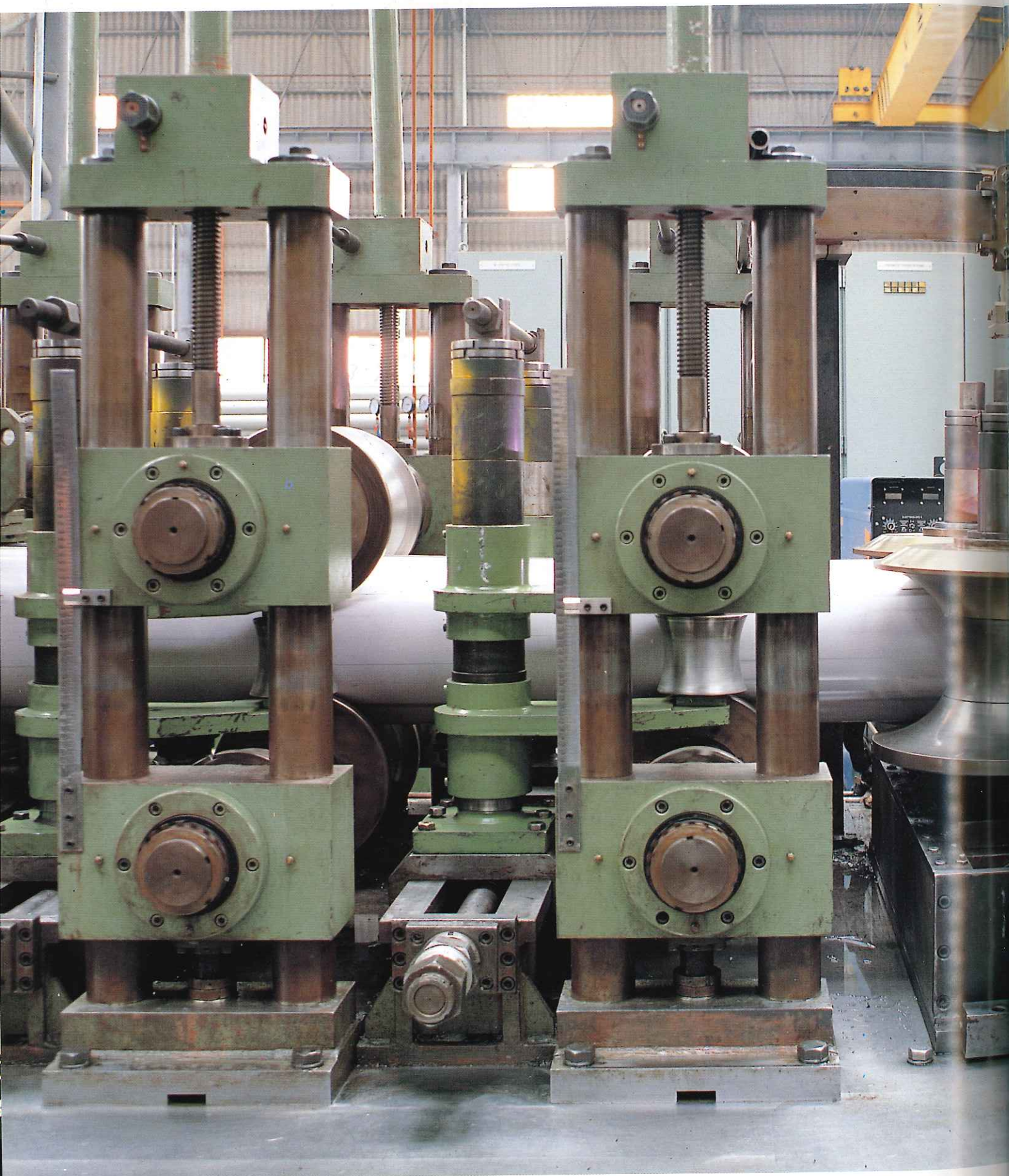
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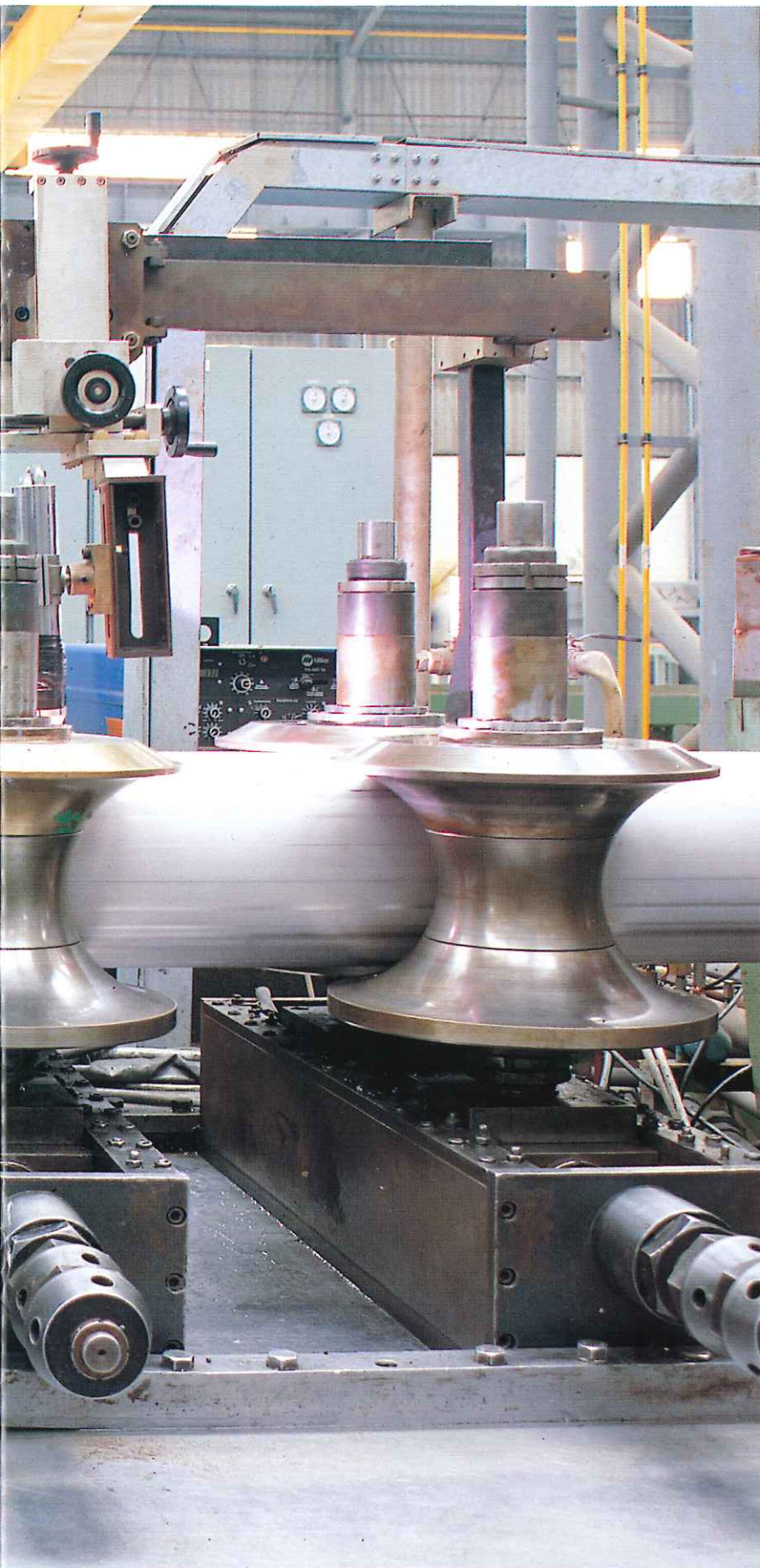
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Inside view of factory





FEATURES

- 1. Superb corrosion & heat resistance**
High resistance against corrosion and heat makes it possible to use under the severe environments typically found in the chemical industry.
- 2. Uniform Quality**
State-of-the-art manufacturing facilities give uniform quality products by using continuous forming, welding and heat-treating process.
- 3. Special Internal Bead Treatment**
Boiler and heat exchanger tubes with the inside bead removed are available using our special bead rolling process.
- 4. Accurate Dimensions**
Our specially designed tube mill and computer controlled cut-off system enable us to provide high precision products.
- 5. New Technology of Welded Pipes and Tubes**
Products of high quality and consistent standards are the result of the latest production equipment and advanced production techniques together with strict quality control from the selection of materials to the final products.

16" tube mill

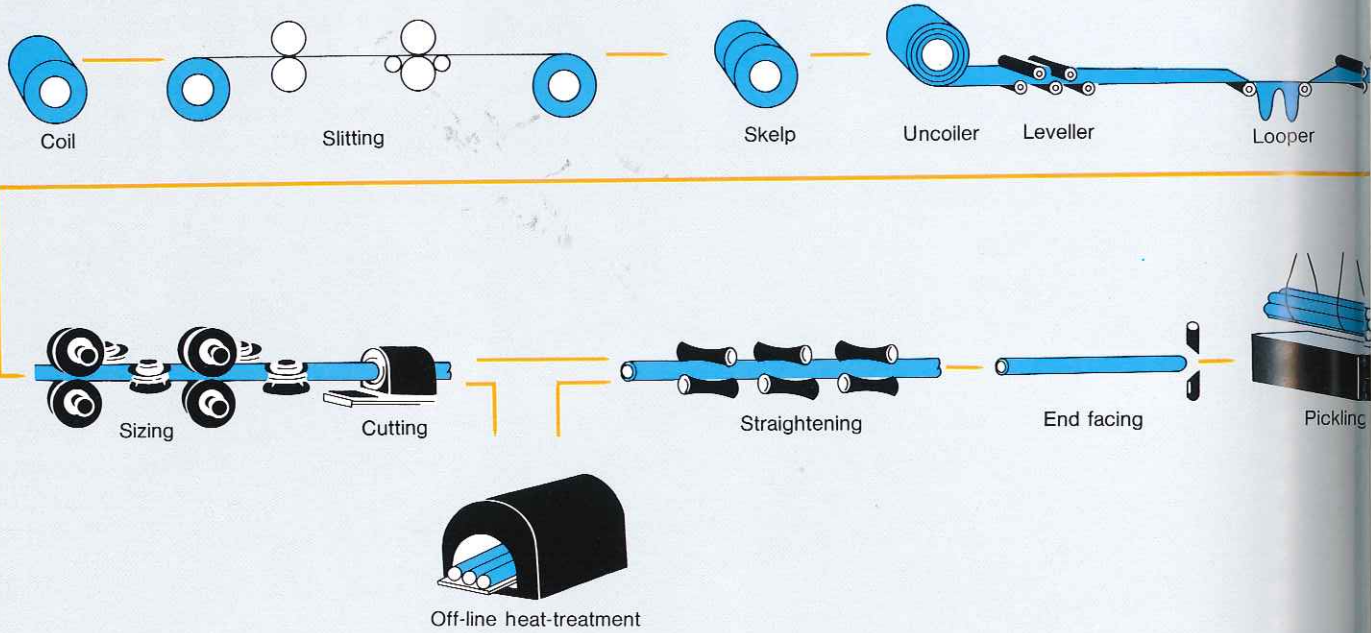
MANUFACTURING PROCESS



Slitting



Forming



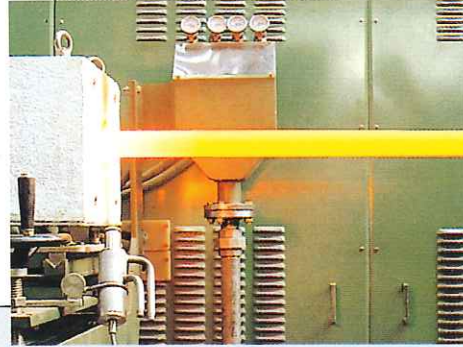
Off-line heat-treatment



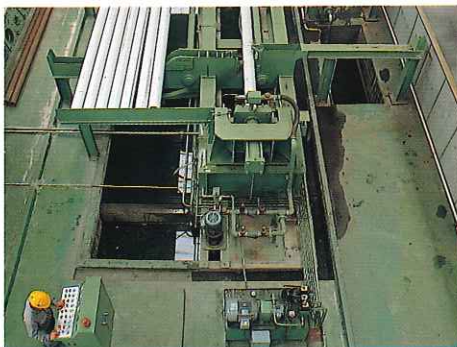
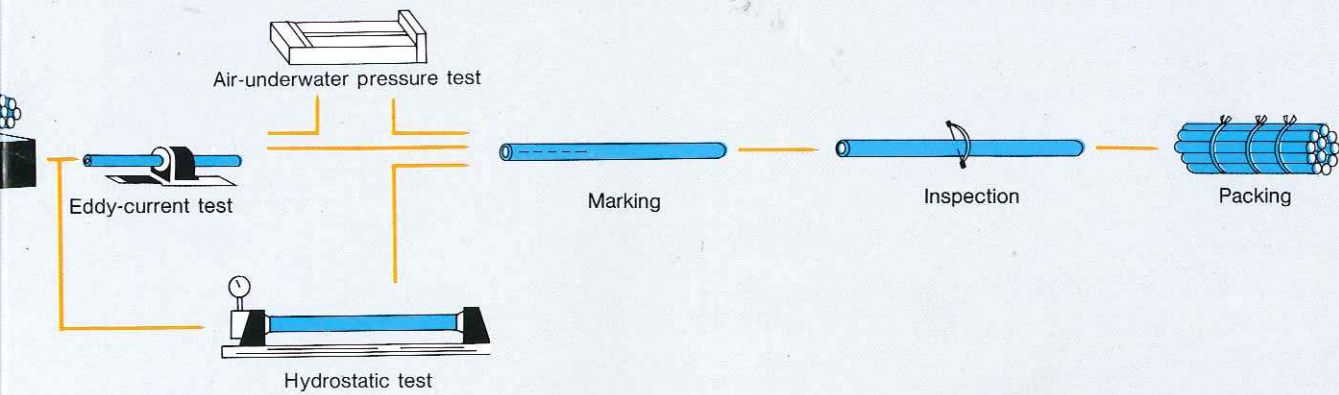
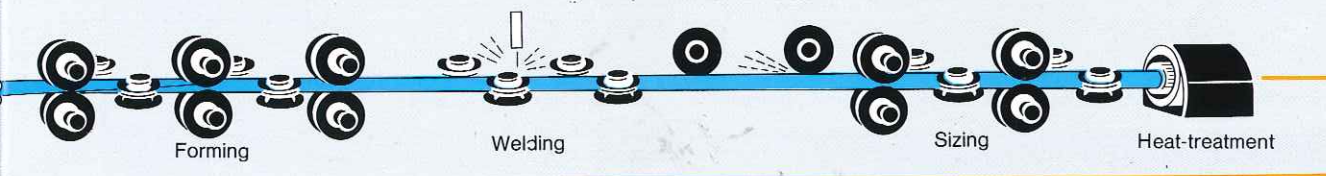
Eddy-current test



Welding



Heat-treatment



Hydrostatic test



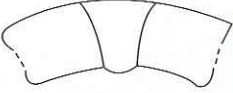
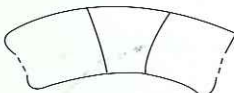
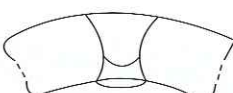
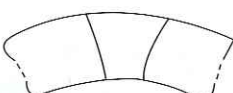
Inspection

AVAILABLE SPECIFICATIONS

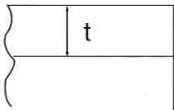
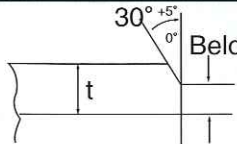
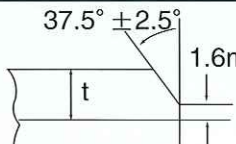
Application	KS	JIS	ASTM
General piping	D3576	G3459	A312/A999
Large diameter pipes	D3588	G3468	A358/A999, A409/A999
Sanitary tubing	D3585	G3447	A270/A450
Boiler & heat exchanger tubes	D3577	G3463	A249/A450
Ordinary (in house) piping	D3595	G3448	A269/A450
Machine & structural purposes	D3536	G3446	-



SHAPES OF WELDING ZONE & QUALITY

Classification	Outside bead removal	Inside & outside bead removal	Inside & outside welding	Drawing tube
Shapes of welding zone				
Characteristics	Ordinary pipe manufactured by the Tig, plasma welding	Inside bead remove cold rolling	Inside & outside welding at the same time	High quality tube by Inside & outside drawing
Production processes	Forming ↓ Welding ↓ Solution heat-treatment ↓ Straightening ↓ Pickling	Forming ↓ Welding ↓ Inside bead rolling ↓ Solution heat-treatment ↓ Straightening ↓ Pickling	Forming ↓ Inside & outside welding ↓ Solution heat-treatment ↓ Straightening ↓ Pickling	Forming ↓ Welding ↓ Solution heat-treatment ↓ Cold drawing ↓ Solution heat-treatment ↓ Straightening ↓ Pickling
Recommendable applications	For general piping materials and boiler, heat exchanger	For Sanitary, boiler, heat exchanger	For general piping material, fittings	For boiler, heat exchanger, machine structural

END FACING

Plain end	Bevel end
	 30° ± 5° Below 2.4mm KS D3576, JIS G3459 KS D3588, JIS G3468  37.5° ± 2.5° 1.6mm ± 0.8mm ANSI B 16.25 Fig. 4. wall thickness over 0.12" (3mm) to 0.38" (10mm)

PRODUCTION RANGE

Wall Thickness Outside Diameter	0.7	0.8	1.0	1.2	1.5	1.65	1.8	2.0	2.1	2.3	2.5	2.6
10.5	0.171	0.193	0.237	0.278	0.336							
12.7	0.209	0.237	0.291	0.344	0.418	0.454						
13.72	0.227	0.257	0.317	0.374	0.457	0.496	0.534	0.584	0.608	0.654		
13.8	0.228	0.259	0.319	0.377	0.460	0.499	0.538	0.588	0.612	0.659		
15.88	0.265	0.301	0.371	0.439	0.537	0.585	0.631	0.692	0.721	0.778	0.833	
16.0	0.267	0.303	0.374	0.442	0.542	0.590	0.637	0.697	0.727	0.785	0.841	
17.15	0.287	0.326	0.402	0.477	0.585	0.637	0.688	0.755	0.787	0.851	0.912	
17.3	0.289	0.329	0.406	0.481	0.590	0.643	0.695	0.762	0.795	0.859	0.922	
19.0	0.319	0.363	0.448	0.532	0.654	0.713	0.771	0.847	0.884	0.957	1.03	1.06
21.34	0.360	0.409	0.507	0.602	0.741	0.809	0.876	0.964	1.01	1.09	1.17	1.21
21.7	0.366	0.416	0.516	0.613	0.755	0.824	0.892	0.981	1.03	1.11	1.20	1.24
22.22	0.375	0.427	0.529	0.628	0.774	0.845	0.916	1.01	1.05	1.14	1.23	1.27
25.4	0.431	0.490	0.608	0.723	0.893	0.976	1.06	1.17	1.22	1.32	1.43	1.48
26.67			0.639	0.761	0.940	1.03	1.12	1.23	1.29	1.40	1.51	1.56
27.2			0.653	0.777	0.960	1.05	1.14	1.26	1.31	1.43	1.54	1.59
28.58			0.687	0.818	1.01	1.11	1.20	1.32	1.39	1.51	1.62	1.68
31.8			0.767	0.915	1.13	1.24	1.35	1.48	1.55	1.69	1.83	1.89
33.4			0.807	0.963	1.19	1.30	1.42	1.56	1.64	1.78	1.92	1.99
34.0			0.822	0.980	1.21	1.33	1.44	1.59	1.67	1.82	1.96	2.03
38.1			0.924	1.10	1.37	1.50	1.63	1.80	1.88	2.05	2.23	2.30
42.16			1.03	1.22	1.52	1.67	1.81	2.00	2.10	2.28	2.47	2.56
42.7			1.04	1.24	1.54	1.69	1.83	2.03	2.12	2.32	2.50	2.60
45.0			1.10	1.31	1.63	1.78	1.94	2.14	2.24	2.45	2.65	2.75
48.26			1.18	1.41	1.75	1.92	2.08	2.30	2.41	2.63	2.85	2.96
48.6			1.19	1.42	1.76	1.93	2.10	2.32	2.43	2.65	2.87	2.98
50.8			1.24	1.48	1.84	2.02	2.20	2.43	2.55	2.78	3.01	3.12
54.0			1.32	1.58	1.96	2.15	2.34	2.59	2.72	2.96	3.21	3.33
60.33				1.77	2.20	2.41	2.62	2.91	3.05	3.32	3.60	3.74
60.5				1.77	2.20	2.42	2.63	2.91	3.05	3.33	3.61	3.75
63.5				1.86	2.32	2.54	2.77	3.06	3.21	3.51	3.80	3.94
73.0				2.15	2.67	2.93	3.19	3.54	3.71	4.05	4.39	4.56
76.3				2.25	2.80	3.07	3.34	3.70	3.88	4.24	4.60	4.77
88.90					3.27	3.59	3.91	4.33	4.54	4.96	5.38	5.59
89.1					3.27	3.59	3.91	4.34	4.55	4.97	5.39	5.60
101.6					3.74	4.11	4.48	4.96	5.21	5.69	6.17	6.41
114.3						4.63	5.04	5.60	5.87	6.42	6.96	7.23
139.8								6.87	7.20	7.88	8.55	8.89
141.30								6.94	7.28	7.96	8.64	8.98
165.2								8.13	8.53	9.33	10.1	10.5
168.28								8.28	8.69	9.51	10.3	10.7
216.3											13.3	13.8
219.08											13.5	14.0
267.4												
273.05												
318.5												
323.85												
355.6												
406.4												
457.2												
508.0												
558.8												
609.6												
660.4												
711.2												
762.0												
812.8												
863.6												
914.4												
965.2												
1016.0												
1066.8												
1117.6												
1168.4												
1219.2												

Weight Calculation

Grade	Density(g/cm³)	Formular
AISI 304, 304L, 321	7.93	$W=0.02491t(D-t)$
AISI 316, 316L, 347	7.98	$W=0.02507t(D-t)$
AISI 410	7.75	$W=0.02435t(D-t)$
AISI 430	7.70	$W=0.02419t(D-t)$

W : Weight(kg/m), t : Wall Thickness(mm), D : Outside Diameter(mm)

* Please consult with us for sizes not listed here

■ Bead Remove Range for Sanitary Tubes

■ Bead Remove Range for Boiler Tubes (Unit : Size, mm/weight, kg/m)

2.8	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	8.0	9.0	10.0
1.13												
1.29	1.37											
1.32	1.40											
1.36	1.44											
1.58	1.67											
1.66	1.77	2.02										
1.70	1.81	2.07										
1.80	1.91	2.19										
2.02	2.15	2.47	2.77									
2.13	2.27	2.61	2.93	3.24								
2.18	2.32	2.66	2.99	3.31								
2.46	2.62	3.02	3.40	3.77								
2.75	2.93	3.37	3.80	4.22								
2.78	2.97	3.42	3.86	4.28								
2.94	3.14	3.62	4.09	4.54								
3.17	3.38	3.90	4.41	4.91	5.39							
3.19	3.41	3.93	4.44	4.94	5.43							
3.35	3.57	4.12	4.66	5.19	5.70							
3.57	3.81	4.40	4.98	5.55	6.10							
4.01	4.28	4.95	5.61	6.26	6.89	7.51						
4.02	4.30	4.97	5.63	6.28	6.91	7.54						
4.23	4.52	5.23	5.93	6.61	7.29	7.94						
4.90	5.23	6.06	6.88	7.68	8.47	9.25						
5.13	5.48	6.35	7.20	8.05	8.88	9.70						
6.01	6.42	7.45	8.46	9.46	10.4	11.4						
6.02	6.43	7.46	8.48	9.48	10.5	11.5						
6.89	7.37	8.55	9.73	10.9	12.0	13.2	14.3					
7.78	8.32	9.66	11.0	12.3	13.6	14.9	16.2					
9.56	10.2	11.9	13.5	15.2	16.8	18.4	20.0	21.6				
9.66	10.3	12.0	13.7	15.3	17.0	18.6	20.2	21.8				
11.3	12.1	14.1	16.1	18.0	20.0	21.9	23.8	25.7	27.6			
11.5	12.4	14.4	16.4	18.4	20.3	22.3	24.3	26.2	28.1			
14.9	15.9	18.6	21.2	23.7	26.3	28.9	31.4	34.0	36.5	41.5		
15.1	16.1	18.8	21.4	24.1	26.7	29.3	31.8	34.4	37.0	42.1		
	19.8	23.0	26.2	29.5	32.7	35.9	39.1	42.2	45.4	51.7	57.9	64.1
	20.2	23.5	26.8	30.1	33.4	36.7	39.9	43.2	46.4	52.8	59.2	65.5
	23.6	27.5	31.3	35.2	39.0	42.9	46.7	50.5	54.3	61.9	69.4	76.8
	24.0	27.9	31.9	35.8	39.7	43.6	47.5	51.4	55.2	62.9	70.6	78.2
			35.0	39.4	43.7	48.0	52.3	56.5	60.8	69.3	77.7	86.1
			40.1	45.1	50.0	54.9	59.8	64.8	69.6	79.4	89.1	98.7
			45.2		56.3		67.4		78.5	89.5	100.5	111.4
			50.2		62.6		75.0		87.3	99.6	111.9	124.1
			55.3		69.0		82.6		96.2	109.8	123.3	136.7
			60.3		75.3		90.2		105.1	119.9	134.6	149.4
			65.4		81.6		97.8		113.9	130.0	146.0	162.0
			70.5		88.0		105.4		122.8	140.1	157.4	174.7
			75.5		94.3		113.0		131.6	150.3	168.8	187.3
					100.6		120.6		140.5	160.4	180.2	200.0
					106.9		128.2		149.4	170.5	191.6	212.6
					113.3		135.8		158.0	180.6	203.0	225.3
					119.6		143.4		167.1	190.8	214.4	238.0
					126.0		151.0		176.0	200.9	225.8	250.6
					132.2		158.5		184.8	211.0	237.1	263.2
					138.6		166.1		193.7	221.1	248.5	276.0
					144.9		173.7		202.5	231.2	260.0	288.6
					151.2		181.3		211.4	241.4	271.3	301.2

□ Bead remove available (full finished)

STAINLESS STEEL PIPES

■ SCOPE : For high-temperature, general corrosive service (KS D3576, JIS G3459, ASTM A312)

• Dimension

(Unit : mm)

Nominal Diameter		Outside Diameter(mm)		Nominal Wall Thickness SCH(mm)								
				5S		10S		20S	40S		80S	
A	B	KS(JIS)	ASTM	KS(JIS)	ASTM	KS(JIS)	ASTM	KS(JIS)	KS(JIS)	ASTM	KS(JIS)	ASTM
8	1/4	13.8	13.72	1.2	-	1.65	1.65	2.0	2.2	2.24	-	-
10	3/8	17.3	17.15	1.2	-	1.65	1.65	2.0	2.3	2.31	-	-
15	1/2	21.7	21.34	1.65	1.65	2.1	2.11	2.5	2.8	2.77	3.7	3.73
20	3/4	27.2	26.67	1.65	1.65	2.1	2.11	2.5	2.9	2.87	3.9	3.91
25	1	34.0	33.40	1.65	1.65	2.8	2.77	3.0	3.4	3.38	4.5	4.55
32	1 1/4	42.7	42.16	1.65	1.65	2.8	2.77	3.0	3.6	3.56	4.9	4.85
40	1 1/2	48.6	48.26	1.65	1.65	2.8	2.77	3.0	3.7	3.68	5.1	5.08
50	2	60.5	60.33	1.65	1.65	2.8	2.77	3.5	3.9	3.91	5.5	5.54
65	2 1/2	76.3	73.03	2.1	2.11	3.0	3.05	3.5	5.2	5.16	-	-
80	3	89.1	88.90	2.1	2.11	3.0	3.05	4.0	5.5	5.49	-	-
90	3 1/2	101.6	101.60	2.1	2.11	3.0	3.05	4.0	5.7	5.74	-	-
100	4	114.3	114.30	2.1	2.11	3.0	3.05	4.0	6.0	6.02	-	-
125	5	139.8	141.30	2.8	2.77	3.4	3.40	5.0	6.6	6.55	-	-
150	6	165.2	168.28	2.8	2.77	3.4	3.40	5.0	7.1	7.11	-	-
200	8	216.3	219.08	2.8	2.77	4.0	3.76	6.5	8.2	8.18	-	-
250	10	267.4	273.05	3.4	3.40	4.0	4.19	6.5	9.3	9.27	-	-
300	12	318.5	323.85	4.0	3.96	4.5	4.57	6.5	10.3	9.53	-	-
350	14	355.6	355.6	4.0	3.96	5.0	4.78	8.0	11.1	11.13	-	-
400	16	406.4	406.4	4.5	4.19	5.0	4.78	8.0	12.7	12.7	-	-

• Tolerance

(Unit : mm)

		KS D3576 (JIS G3459)		ASTM A312	
Tolerance	Outside Diameter	D < 30	±0.3	10.29 ≤ D ≤ 48.26	+ 0.40 - 0.80
		D ≥ 30	±1%	48.26 < D ≤ 114.3	±0.80
				114.3 < D ≤ 219.08	{ + 1.60 - 0.80
	Wall Thickness	t < 2	± 0.2	All size	+ - 12.5%
		t ≥ 2	± 10 %		
	Length	Shall be the specified length or more		All size	+ 6.4mm - 0
Straightness		Shall be reasonably straight		Shall be reasonably straight	

LARGE DIAMETER PIPES FOR HIGH TEMPERATURE SERVICE

• KS D3588 (JIS G3468), ASTM A358

Nominal Diameter		Outside Diameter(mm)		Nominal Wall Thickness SCH(mm)				
				5S		10S		20S
A	B	KS (JIS)	ASTM	KS (JIS)	ASTM	KS (JIS)	ASTM	KS (JIS)
150	6	165.2	168.28	2.8	2.77	3.4	3.40	5.0
200	8	216.3	219.08	2.8	2.77	4.0	3.76	6.5
250	10	267.4	273.05	3.4	3.40	4.0	4.19	6.5
300	12	318.5	323.85	4.0	3.96	4.5	4.57	6.5
350	14	355.6	355.6	4.0	3.96	5.0	4.78	8.0
400	16	406.4	406.4	4.5	4.19	5.0	4.78	8.0
450	18	457.2	457.2	4.5	4.19	5.0	4.78	8.0
500	20	508.0	508.0	5.0	4.78	5.5	5.54	9.5
550	22	558.8	558.8	5.0	4.78	5.5	5.54	9.5
600	24	609.6	609.6	5.5	5.54	6.5	6.35	9.5
650	26	660.4	660.0	5.5	5.54	8.0	6.35	12.7
700	28	711.2	711.0	5.5	5.54	8.0	6.35	12.7
750	30	762.0	762.0	6.5	6.35	8.0	7.92	12.7
800	32	812.8	813.0	6.5	6.35	8.0	7.92	12.7
850	34	863.6	864.0	6.5	6.35	8.0	7.92	12.7
900	36	914.4	914.0	6.5	6.35	8.0	7.92	12.7
950	38	-	965.0	-	6.35	9.5	7.92	12.7
1000	40	1016.0	-	6.5	6.35	9.5	7.92	14.3

• Tolerance

(Unit : mm)

		KS D3588(JIS G3468)		ASTM A358(A530)	ASTM A409(A530)	
Tolerance	Outside Diameter	D≤300A	±1%	Based on circumferential measurement, ±0.5%	t < 4.8	±0.20%
		D≥350A	±0.5%		t ≥4.8	±0.40%
		Based on circumferential measurement			Based on circumferential measurement	
	Wall Thickness	D≤500A	+ 15%	0.3mm under the nominal thickness	0.46mm under the nominal thickness	
		t < 8	- 12.5%			
		D ≥550A				
		t < 8	+ - 12.5%			
		t ≥8	+ - 10%			
Length	Shall be the specified length or more		Agreement			
Straightness		—		3.2mm/3,000mm		4.8mm/3,000mm

BOILER & HEAT EXCHANGER STAINLESS STEEL TUBES

■ Scope : Boiler, superheater, heat exchanger, condensor tubes (KS D3577, JIS G3463, ASTM A249)

• Dimension

(Unit : kg/m)

Wall Thickness (mm) Outside Diameter (mm)	1.2	1.6	2.0	2.3	2.6	2.9	3.2	3.5	4.0	4.5	5.0	5.5	6.0	6.5
15.9	0.439	0.570	0.692	0.779										
19.0	0.532	0.693	0.847	0.957	1.06									
21.7	0.613	0.801	0.981	1.11	1.24	1.36								
25.4	0.723	0.949	1.17	1.32	1.48	1.63								
27.2	0.777	1.02	1.26	1.43	1.59	1.76	1.91	2.07						
31.8	0.915	1.20	1.49	1.69	1.89	2.09	2.28	2.47	2.77					
34.0	0.980	1.29	1.59	1.82	2.03	2.25	2.46	2.66	2.99	3.31				
38.0	1.10	1.45	1.79	2.05	2.29	2.54	2.77	3.01	3.39	3.76				
42.7	1.24	1.64	2.03	2.32	2.60	2.88	3.15	3.42	3.86	4.28				
45.0	1.31	1.73	2.14	2.45	2.75	3.04	3.33	3.62	4.09	4.54				
48.6	1.42	1.87	2.32	2.65	2.98	3.30	3.62	3.93	4.44	4.94	5.43			
50.8	1.48	1.96	2.43	2.78	3.12	3.46	3.79	4.12	4.66	5.19	5.70			
54.0	1.58	2.09	2.59	2.96	3.33	3.69	4.05	4.40	4.98	5.55	6.10			
57.1		2.21	2.75	3.14	3.53	3.92	4.30	4.67	5.29	5.90	6.49			
60.3		2.34	2.90	3.32	3.74	4.15	4.55	4.95	5.61	6.25	6.89	7.51		
63.5		2.47	3.06	3.51	3.94	4.38	4.81	5.23	5.93	6.61	7.29	7.94		
65.0		2.53	3.14	3.59	4.04	4.49	4.93	5.36	6.08	6.78	7.48	8.15		
70.0		2.73	3.39	3.88	4.37	4.85	5.32	5.80	6.58	7.34	8.10	8.84		
76.2		2.97	3.70	4.23	4.77	5.30	5.82	6.34	7.19	8.04	8.87	9.69		
88.9			4.33	4.96	5.59	6.21	6.83	7.45	8.46	9.46	10.4	11.4		
101.6			4.96	5.69	6.41	7.13	7.84	8.55	9.73	10.9	12.0	13.2	14.3	
114.3			5.60	6.42	7.23	8.05	8.86	9.66	11.0	12.3	13.6	14.9	16.2	

• Tolerance

(Unit : mm)

		KS D3577 (JIS G3463)			ASTM A249 (A450)	
Tolerance	Outside Diameter	D < 60		±0.25	D < 25.4	±0.10
		60 ≤ D < 80		±0.30	25.4 ≤ D ≤ 38.1	±0.15
		80 ≤ D < 100		±0.40	38.1 < D < 50.8	±0.20
		100 ≤ D < 120		+0.40 −0.60	50.8 ≤ D < 63.5 63.5 ≤ D < 76.2	±0.25 ±0.30
		120 ≤ D < 160		+0.40 −0.80	76.2 ≤ D ≤ 101.6 101.6 < D ≤ 190.5	±0.38 +0.38, −0.64
	Wall Thickness	D < 40	t < 2	+0.4 −0	All size	±10% or +18% −0
			t ≥ 2	+20% −0		
		D ≥ 40	All wall thickness	+22% −0		
	Length	D ≤ 50	l ≤ 7,000	+7.0	D < 50.8	(+3.17, −0)
			l > 7,000	+10.0		
		D > 50	l ≤ 7,000	+10.0	D ≥ 50.8	(+4.76, −0)
			l > 7,000	+13.0		
Straightness		Shall be reasonably straight			Below 0.8/900	
Shape of Inside Bead		—			Inside bead removed	

ORDINARY (In house) STAINLESS STEEL PIPES

■ Scope : General corrosion-resisting and low-high temperature service(KS D3595, JIS G3448, ASTM A269)

• Dimension and tolerance

Nominal Diameter	Outside Diameter(mm)		Wall Thickness(mm)		Weight(kg/m)	
					STS 304 TPD	STS 316 TPD
Su	Size	Tolerance	Thickness	Tolerance	Thickness	Thickness
8	9.52	+0 -0.37	0.7	±0.12	0.154	0.155
10	12.70		0.8		0.237	0.239
13	15.88		0.8		0.301	0.303
17	19.05		0.8		0.364	0.366
20	22.22		1.0		0.529	0.532
25	28.58	±0.34	1.0	±0.15	0.687	0.691
30	34.0		1.2		0.980	0.986
40	42.7		1.2		1.24	1.25
50	48.6		1.2		1.42	1.43
60	60.5	±0.60	1.5	±0.30	2.20	2.21
75	76.3		1.5		2.79	2.81
80	89.1		2.0		4.34	4.37
90	101.6		2.0		4.96	4.99
100	114.3	±1%	2.0	±0.40	5.59	5.63
125	139.8		2.0		6.87	6.91
150	165.2		3.0		12.1	12.2
200	216.3		3.0		15.9	16.0
250	267.4		3.0		19.8	19.9
300	318.5		3.0		23.6	23.8

SANITARY STAINLESS STEEL TUBES

■ Scope : Dairy and food industry (KS D3585, JIS G3447, ASTM A270)

• Dimension and Tolerance

KS D3585 (JIS G3447)						ASTM A270 (except pharmaceutical tubing)						
Outside Diameter		Wall Thickness		Length		Outside Diameter(t≥1.24)				Thickness Tolerance	Length Tolerance	
Size	Tolerance	(mm)	Tolerance (mm)	(m)	Tolerance (mm)	Size		Tolerance			(inch)	(mm)
(mm)	(mm)					(mm)	(inch)	(mm)	(inch)			
25.4	±0.15	1.2	±10%	4 6	+10 -0	25.4	1	+0.05 -0.20	+0.002 -0.008	±12.5%	+1/8 -0	+3.2 -0
31.8	±0.16	1.2				—	—	—	—			
38.1	±0.19	1.2				38.1	1½	+0.05 -0.20	+0.002 -0.008			
50.8	±0.25	1.5				50.8	2	+0.05 -0.28	+0.002 -0.011			
63.5	±0.25	2.0				63.5	2½	+0.05 -0.28	+0.002 -0.011			
76.3	±0.25	2.0				76.2	3	+0.08 -0.30	+0.003 -0.012			
89.1	+0.30 -0.40	2.0				—	—	—	—			
101.6	+0.35 -0.40	2.0				101.6	4	+0.08 -0.38	+0.003 -0.015			

MUFFLER TUBING

■ Scope : Muffler tubing for automobile

• Dimension and Weight

(Unit : kg/m)

Outside Diameter (mm)	Wall Thickness (mm)		
	1.2	1.5	2.0
42.7	1.210	1.505	1.982
45.0	1.280	1.589	2.094
48.6	1.385	1.720	2.270
50.8	1.449	1.801	2.377

* Please consult with us for sizes not listed here.

• Tolerance

(Unit : mm)

		Tolerance
Outside Diameter	$42.7 \leq D \leq 48.6$	± 0.18
	$50.8 \leq D \leq 54.0$	± 0.20
Wall Thickness	$42.7 \leq D \leq 50.8$	± 0.15
Length	Shall be the specified length or more	
Straightness	Shall be reasonably straight	

• Flaring Rate and Reducing Rate

Outside Diameter (mm)	Wall Thickness (mm)	Flaring Rate (%)	Reducing Rate (%)
42.7	1.2	20	—
	1.5	—	—
	2.0	22 (only apply to SUS 304)	—
45.0	1.2	20	20
	1.5	12 (only apply to SUS 304)	—
	2.0	18 (only apply to SUS 304)	—
48.6	1.2	20	—
	1.5	12	—
	2.0	12	10
50.8	1.2	—	—
	1.5	11	—
	2.0	11 (only apply to SUS 304)	—

MARKING & PACKING

MARKING

1) Letter size on pipe body marking

(1) Over 4" : 1/2"

(2) To 4", incl. : 3/8", 1/4"

2) Marking standard

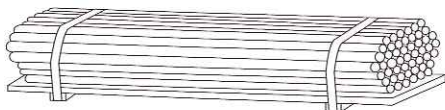
SĕAH STEEL	2" x SCH 10S x 20'	TP304/L	ASTM A312/SA312	SB02Z2011	WELDED
Logo & Mill Name	Size	Material Grade	Spec	Heat No. (Lot No.)	Manufacturing Method

PACKING

1. Ordinary Bundle



2. Steel Band



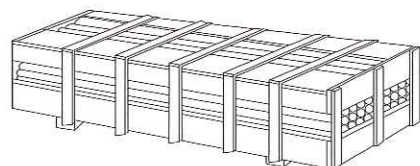
3. P.V.C Cap



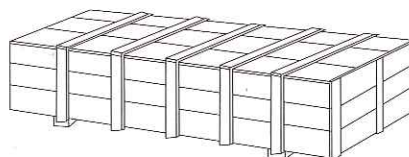
4. Steel Band + P.P Wrapping



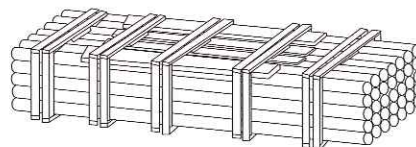
5. Wooden Box (Opened Type)



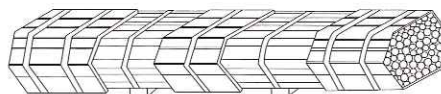
6. Wooden Box (Closed Type)



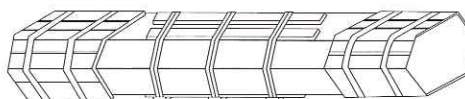
7. Wooden Crate + P.P Wrapping



8. Wooden Crate (Hexagonal Type)



9. Wooden Crate (Ends Reinforcement Type)



* Mill Standard Type

1. Wooden Box : Picture No.5

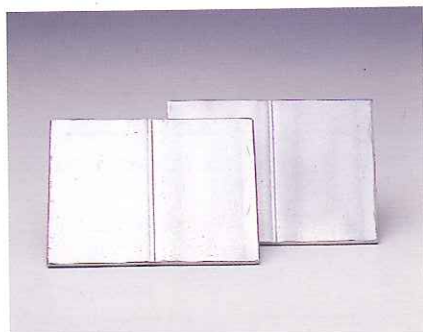
2. Wooden Crate : Picture No.7

INSPECTION AND TESTS



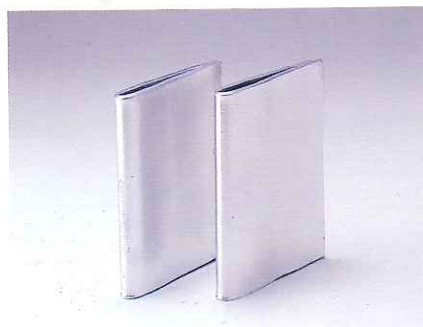
1. Flattening test

This test is conducted to check the strength of the welded section by subjecting it to extreme compression stress. If the test piece withstands the specified compression stress without cracking, it is determined to be acceptable.



2. Reverse flattening test

The photo on the left shows an expanded view of a pipe interior. There are no cracks or blow holes can be observed on the welded section.



3. Reverse bending test

The test piece subjected to the reverse flattening test is reversely bent at the welded section. There are no defects can be observed on the bent section.



4. Flaring test

The standard procedure for this test is to flare the end of the pipe to a diameter 1.2 times the outside diameter. As shown in the photo on the left, no cracks are to be found at flared parts.



5. Flange test

The photo on the left shows a test piece subjected to the flange test. There are no cracks on the welded section or on the base metal.

6. Hydrostatic/pneumatic pressure test

Each length of finished pipe is subjected to the hydrostatic or pneumatic pressure test. Each pipe must withstand the pressure without leakage.



7. Corrosion test

This test is conducted only when specifically requested.



8. Chemical composition analysis

This test is conducted when specifically requested.



9. Other test device



Rockwell hardness tester



Universal testing machine



Metallurgical microscope

STANDARD MATERIAL SPECIFICATIONS

Classification	Steel grade					Chemical compositions(%)										Mechanical property			
	KS	JIS	ASTM (UNS)	DIN		C	Si	Mn	P	S	Ni	Cr	Mo	Other	Y.P	T.S	El.	Hardness	
				Material No	Code No										N/mm²	N/mm²	%	HRB	
Austenite	STS 304	SUS 304				≤0.08	≤1.00	≤2.00	≤0.040	≤0.030	0.80 ~11.00	18.00 ~20.00			≥206	≥520	≥35	≤90	
			304 (S30400)			≤0.08	≤0.75	≤2.00	≤0.040	≤0.030	0.80 ~11.00	18.0 ~20.0			≥205	≥515	≥35		
				1.4301	×5CrNi 1810	≤0.07	≤1.00	≤2.00	≤0.045	≤0.030	8.5 ~10.5	17.0 ~19.00			≥195	≥500 ~720	≥40		
	STS 304L	SUS 304L				≤0.030	≤1.00	≤2.00	≤0.040	≤0.030	9.00 ~13.00	18.00 ~20.00			≥177	≥481	≥35	≤90	
			304L (S30403)			≤0.035	≤0.75	≤2.00	≤0.040	≤0.030	8.00 ~13.00	18.00 ~20.00			≥170	≥485	≥35		
				1.4306	×2CrNi 1911	≤0.030	≤1.00	≤2.00	≤0.045	≤0.030	10.0 ~12.5	18.0 ~20.0			≥180	460 ~690	≥40		
	STS 310S	SUS 310S				≤0.08	≤1.50	≤2.00	≤0.040	≤0.030	19.00 ~22.00	24.00 ~26.00			≥206	≥520	≥35	≤90	
			310S (S31008)			≤0.08	≤0.75	≤2.00	≤0.045	≤0.030	19.00 ~22.00	24.0 ~26.0	≤0.75		≥205	≥515	≥35		
	STS 316	SUS 316				≤0.08	≤1.00	≤2.00	≤0.040	≤0.030	10.00 ~14.00	16.00 ~18.00	2.00 ~3.00		≥206	≥520	≥35		
			316 (S31600)			≤0.08	≤0.75	≤2.00	≤0.040	≤0.030	10.00 ~14.00	16.0 ~18.0	2.00 ~3.00		≥205	≥515	≥35		
				1.4401	×5CrNi Mo17122	≤0.07	≤1.00	≤2.00	≤0.045	≤0.030	10.5 ~13.5	16.5 ~18.5	2.0 ~2.5		≥205	≥510 ~710	≥40		
	STS 316L	SUS 316L				≤0.030	≤1.00	≤2.00	≤0.040	≤0.030	12.00 ~16.00	16.00 ~18.00	2.00 ~3.00		≥177	≥481	≥35		
			316L (S31603)			≤0.035	≤0.75	≤2.00	≤0.040	≤0.030	10.00 ~15.00	16.0 ~18.0	2.00 ~3.00		≥170	≥485	≥35		
				1.4404	×2CrNi Mo17132	≤0.030	≤1.0	≤2.0	≤0.045	≤0.030	11.0 ~14.0	16.5 ~18.5	2.0 ~2.5		≥190	490 ~690	≥40		
	STS 317	SUS 317				≤0.08	≤1.00	≤2.00	≤0.040	≤0.030	11.00 ~15.00	18.00 ~20.00	3.00 ~4.00		≥206	≥520	≥35	≤90	
			317 (S31700)			≤0.08	≤0.75	≤2.00	≤0.040	≤0.030	11.00 ~14.00	18.0 ~20.0	3.00 ~4.00		≥205	≥515	≥35		
	STS 317L	SUS 317L				≤0.030	≤1.00	≤2.00	≤0.040	≤0.030	11.00 ~15.00	18.00 ~20.00	3.00 ~4.00		≥206	≥481	≥35	≤90	
			317L (S31703)			≤0.035	≤0.75	≤2.00	≤0.040	≤0.030	11.00 ~15.00	18.0 ~20.0	3.00 ~4.00		≥205	≥515	≥35		
	STS 321	SUS 321				≤0.080	≤1.00	≤2.00	≤0.040	≤0.030	9.00 ~13.00	17.00 ~19.00		Ti≥ 5×C	≥206	≥520	≥35		
			321 (S32100)			≤0.080	≤0.75	≤2.00	≤0.040	≤0.030	9.00 ~13.00	17.0 ~20.5		5×C≤Ti <0.70	≥205	≥516	≥35		
				1.4541	×6Cr NiTi1810	≤0.08	≤1.00	≤2.00	≤0.045	≤0.030	9.0 ~12.0	17.0 ~19.0		Ti≥ 5×C	≥200	500 ~730	≥35		
	STS 347	SUS 347				≤0.080	≤1.00	≤2.00	≤0.040	≤0.030	9.00 ~13.00	17.00 ~19.00		Nb≥ 10×C	≥206	≥520	≥35	≤90	
			347 (S34700)			≤0.080	≤0.75	≥2.00	≤0.040	≤0.030	9.00 ~13.00	17.0 ~20.0		10×C≤ Nb<10C	≥205	≥515	≥35		
				1.4550	×6Cr NiNb1810	≤0.08	≤1.00	≤2.00	≤0.045	≤0.030	9.0 ~12.0	17.0 ~19.0		Nb≥ 10×C%	≥205	≥510 ~740	≥35		
Ferrite	STS 430	SUS 430				≤0.12	≤0.75	≤1.00	≤0.040	≤0.030	(≤0.60)	16.00 ~18.00			≥205	≥450	≥22	≤80	
			430 (S43000)			≤0.12	≤0.75	≤1.00	≤0.040	≤0.030	≤0.50	16.00 ~18.00							
				1.4016	×6Cr17	≤0.08	≤1.00	≤1.00	≤0.045	≤0.030		15.5 ~17.5							
Martensite	STS 410	SUS 410				≤0.15	≤1.00	≤1.00	≤0.040	≤0.030	(≤0.60)	11.50 ~13.50			≥205	≥440	≥20	≤88	
			410 (S11000)			≤0.15	≤0.75	≤1.00	≤0.040	≤0.030	≤0.50	11.5 ~13.5							
				1.4006	×10Cr13	≤0.08 ~0.12	≤1.0	≤1.00	≤0.045	≤0.030		12.0 ~14.0							
				1.4024	×15Cr13	≤0.12 ~0.17	≤1.0	≤1.0	≤0.045	≤0.030		12.0 ~14.0							

DEGREES OF CORROSION IN VARIOUS SOLUTIONS

Solutions	Concentration	Temperature	STS304	STS316	STS410	STS430
Nitric acid	5%	20°C	A	A	A	A
	20%	20°C	A	A	A	A
	50%	Boiling	A	A	—	A
	Concentrated	Boiling	D	D	E	D
Sulfuric acid	5%	20°C	C	B	—	C
	5%	Boiling	E	C	—	E
	50%	20°C	D	C	—	—
	50%	Boiling	E	D	—	E
Hydrochloric acid	Concentrated	20°C	A	A	—	A
		Boiling	D	D	—	D
Phosphoric acid	1%	20°C	E	E	E	E
Oxalic acid	5%	20°C	#A	#A	#A	#A
	5%	20°C	A	A	A	A
	10%	20°C	C	A	D	D
Acetic acid	5%	20°C-Boi.	A	A	B	A
	10%	Boiling	D	C	—	—
Formic acid	5-10%	20°C	A	A	A	A
	20-100%	20°C	C	B	C	B
	50%	Boiling	C	A	—	—
Butyric acid	5%	20-65°C	B	A	C	D
Lactic acid	5%	20°C	A	A	C	B
	5%	65°C	B	A	C	B
	10%	Boiling	B	A	—	—
Butyric acid	5%	20-65°C	A	A	A	A
Citric acid	5%	20-65°C	A	A	A	A
	15%	Boiling	A	A	—	B
Chromic acid	5%	20°C	A	A	—	B
	10%	Boiling	C	B	—	D
Iodine			E	D	—	E
Fluorine			E	E	E	E
Chlorine gas		20°C	E	E	E	E
		20°C	C	B	—	C
Bromine carbon disulfide		20°C	D	C	—	D
		20°C	E	D	—	E
Carbon tetrachloride		20°C	A	A	—	A
		20°C	*C	*B	—	*C
Carbonic acid	Pureness	20°C	A	A	—	A
Tartaric acid	5-10%	20°C	A	A	—	A
Oleic acid		20°C	A	A	C	C
Ammonia water		20°C	*A	A	—	*B
Ammonia gas		20°C	A	A	—	A
Calcium hydroxide		50°C	—	D	—	D
		Boiling	A	A	—	A
Soda casein	10-20%	Boiling	C	B	—	—
Soda carbonate	50%	Boiling	A	A	—	A
Soda bicarbonate	5%	20-65°C	A	A	—	A
Soda thiosulfate	All Conc.	20°C	A	A	A	A
Ammonia sulfate	5-10%	20-65°C	A	A	—	C
Sodium chloride	1-5%	20°C	A	A	B	A
Zinc chloride	5-20%	20-65°C	A	A	A	A
	Stauration	Boiling	*A	A	*B	*B
Zinc sulfate	5%	20°C	B	A	—	—
Ferrous chloride	2-Stauration	20°C	*A	*A	—	*A
	1%	20°C	A	A	—	A
Ethyl alcohol	5%	20°C	#B	*A	—	—
		20°C	#D	*C	—	—
Methyl alcohol		20°C-Boiling	A	A	—	A
Acetone		20°C	A	A	—	A
		65°C	*C	B	—	C
Ether		R.T	A	A	—	A
Benzol		R.T	A	A	—	A
Carbonated water		R.T	A	A	—	A
Vinegar			A	A	A	A
Sea water		20°C	*A	A	A	A
Milk			*A	*A	—	*C
Theriac		65°C	A	A	B	A
Volatile oil			A	A	—	A
Juice			A	A	A	A
Mayonnaise			A	A	A	A
Glycerin		20°C	*A	A	—	—
Ketchup			A	A	A	A
Coffee		20°C	*A	A	*A	*A
Beer		Boiling	A	A	A	A

Notes: A: Good corrosion resistance (0.0089mm/month and less)

— proper for use

B: Fairly good corrosion resistance (0.0089-0.089mm/month)

— possible for use

C: Poor corrosion resistance (0.089-0.25mm/month)

— not recommendable for use

D: Very poor corrosion resistance (0.25-0.89mm/month)

— improper for use

E: Bad corrosion resistance (0.89mm/month and more)

— impossible for use

*: Easy to corrode against hydrochloric acid

#: Easy to pit corrosion if let alone and be dried

COMPARISON TABLE OF ASTM & KS (JIS) STANDARDS

Applicable Standards			ASTM A312 (A530)				KS D3576 (JIS G3459)							
Applications			Pipe				Pipe							
Manufacturing Method			Seamless, Automatic welding without filler metal				Seamless, Automatic arc welding and electric resistance welding							
Types of Steel			304	304N	316L	317	347	XM-10	XM-29	SUS..... TP				
			304H	309		317L	347L	XM-11		304	309S	316H	321H	347H
			304L	310		321	347H	XM-15		304H	310S	316L	329J1	317
			304LN	316		321H	348	XM-19		304L	316	321	347	317
				316H			348H							
Heat Treatment			Other than type H steel Rapid quenching at 1,038℃ or above 321H, 347H, 348H ColdRapid quenching at 1,100℃ or above Hot.....Rapid quenching at 1,050℃ or above 304H, 316H ColdRapid quenching at 1,040℃ or above HotRapid quenching at 1,040℃ or above				304, 304L, 316, 316L ...Rapid quenching at 1,010℃ or above 309S, 310SRapid quenching at 1,030℃ or above 304H, 316HRapid quenching at 1,040℃ or above 347Rapid quenching at 980℃ or above 329J1Rapid quenching at 950℃ or above 321Rapid quenching at 920℃ or above 321H, 347H ColdRapid quenching at 1,095℃ or above HotRapid quenching at 1,050℃ or above							
Items	Analysis		(1) Ladle analysis (2) Check analysis on request				Ladle analysis							
	Mechanical Test	Tension Test (N/mm², %)	1piece/lot (lots of not more than 100 pipes) Y.S. T.S. EI				1piece/50pipes Y.S. T.S. EI							
			304L ≥ 170 ≥ 485 Longitudinal direction				304N							
			316L ≥ 35				304L ≥ 176 ≥ 480 ≥ 25, 35							
			304N ≥ 240 ≥ 550				316L							
		316N Lateral direction				329J1 ≥ 370 ≥ 590 ≥ 13,18								
		Others ≥ 205 ≥ 515 ≥ 25				Others ≥ 176 ≥ 520 ≥ 25, 35								
		Flattening Test	5% (specimen of two lengths and over) $H = \frac{(1+e)t}{e+t/D}$ e:0.09				1pcs/50pipes $H = \frac{(1+e)t}{e+t/D}$ e:0.09 (e=0.07 for 329J1)							
			Flaring Test				—							
	Flange Test				—									
	Reverse Flattening Test				—									
	Reverse Bending Test				—									
	Bending Test				—									
	Hydrostatic/Air-Underwater Pressure Test		Each pipe $P = \frac{2St}{D}$ S : Specified minimum Y.S. × 0.5 P: Hydrostatic test pressure				Each pipe Unless otherwise specified : 15kg/cm² ~ 200kg/cm² $P = \frac{200St}{D}$ S : Specified minimum Y.S. × 0.6 P: Hydrostatic test pressure							
	Other Test		If specified, corrosion test according to ASTM A262, Practice "E,"				321H.....Average particle size of austenitic crystal ≥ No.7 If specified, corrosion test							
	Tolerance for Outside Diameter		Outside Diameter (mm)		Tolerance (mm)		Outside Diameter (mm)		Tolerance					
			10.29 ≤ ≤ 48.26		+0.40 -0.8		< 30		±0.3mm					
48.26 < ≤ 114.30			±0.80											
114.30 < ≤ 219.08			+1.6 -0.8											
219.08 < ≤ 457.2			+2.4 -0.8		30 ≤		±1%							
457.2 < ≤ 660.4		+3.2 -0.8												
660.4 < ≤ 863.6		+4.0 -0.8												
Tolerance for Ellipes and Circle		—				—								
Tolerance for Wall Thickness		Not be more than 12.5% under the nominal wall thickness				Less than 2mm : ±0.2mm 2mm or above : ±10%								
Tolerance for Straightness		Metal are weld pipe 3.2/3,000mm or less				—								
Tolerance for Length		Outside Diameter : 220mm or less Length: 7,280mm or shorter +6.4mm, -0 Others : As per mutual negotiation				Not less than specified length								
Height of Bead		—				—								
Remarks		(1) Low-temperature characteristics : Not less than 2.07m-kg at-196℃ (2) Length of test piece subjected to flattening test : Over 63.5mm				—								

ASTM A358 (A530)					ASTM A409 (A530)					KS D3588 (JIS G3468)				
Large-diameter pipe					Large-diameter pipe Outside diameter : 355.6 - 762mm Wall thickness : 5S - 10S					Large-diameter pipe				
(1) Single or double welding (2) Welding procedure : ASME sec. —IX (3) Automatic and manual welding (4) Welding with filler metal and deposited metal					Automatic and manual electric welding Welding Procedure : ASME sec. —IX					Automatic arc welding with filler metal				
304	304N	316H	321	XM-29	304	309	316	317	347	SUS		TPY		
304H	309	316L	347		304	309	316	317	347	304	309S	316	321	317
304L	310	316LN	348		304L	310	316L	321	348	304L	310S	316L	347	317L
304LN	316	316N	XM-19							329J1				
(1) Rapid quenching at 1,040℃ or above (2) ㉔ Indicate "HT-O" for products Not subjected to heat treatment ㉔ Indicate "HT" for products subjected to heat treatment					(1) Rapid quenching at 1,040℃ or above (2) However, certain types of pipes are Heat-treated at lower than 1,040℃ for special applications.					Without heat treatment as a rule, however, Heat treatment is performed on request				
(1) Ladle analysis (2) Product analysis (including the beads)					(1) Ladle analysis (2) Product analysis on request					—				
1 piece(including beads)/60m(lot) Test piece for base metal : ASME sec. —IX					1 piece (including beads)/60m(lot) Y.S. ≥ 205 T.S. ≥ 520 } except for 304L, 316L					(1) 1 piece for up to 120m(welding zone tension test) (2) 1 piece for up to 120m STS(SUS) 304, 309S, 310S, 316, 317 321, 347 Y.S ≥ 206 T.S ≥ 520 EI ≥ 35 SUS 304L, 316L Y.S ≥ 177 T.S ≥ 481 EI ≥ 35 317L Y.S ≥ 206 T.S ≥ 481 EI ≥ 35				
—					—					—				
—					—					—				
—					—					—				
—					—					—				
—					—					—				
2 pcs./lot Face Bend, Root Bend					2 pcs./lot Face Bend, Root Bend					—				
—					—					—				
Each pipe $P = \frac{2St}{D}$ S : specified minimum Y.S. × 0.5 P : Hydrostatic test pressure					Each pipe 7kg/cm²(Air, gas) Leak test with soap solution					5S : 15kgf/cm² 10S : 20kgf/cm² 20 - 40S : 25kgf/cm²				
Class 1, 3, 4 : X-ray radiographic examination over entire length of beads. If specified, ferrite amount and liquid penetrant test					Electric nondestructive test X-ray radiographic examination, corrosion test and quantitative analysis for ferrite shall also be conducted upon request					If specified, corrosion test				
Outside diameter(mm)		Tolerance			Outside diameter(mm)		Tolerance			Outside diameter(mm)		Tolerance		
Determine outside diameter by measuring circumference		± 0.5%			355.6 ≤ ≤ 762 (Determine outside diameter by measuring circumference)		Wall thickness less than 4.8mm : ± 0.2% over 4.8mm incl. : ± 0.4%			300A or less Over 350A incl.		± 1% ± 0.5% (Determine O.D by measuring circumference)		
$\frac{\text{Max. O.D} - \text{Min. O.D}}{\text{Nominal O.D}} = \text{No greater than 1.0\%}$					$\frac{\text{Max. O.D} - \text{Min. O.D}}{\text{Nominal O.D}} = \text{No greater than 1.5\%}$					—				
Not be more than 0.3mm under the nominal thickness					Not be more than 0.46mm under the nominal thickness					500A or less ＜ 8mm + 15 - 12.5% ≥ 8mm + 15 - 10% Over 550A incl. ＜ 8mm + not specified - 12.5% ≥ 8mm + not specified - 10%				
3.2/3,000mm or less					4.8/3,000mm or less					—				
As per mutual negotiation					As per mutual negotiation					Not less than specified length				
—					—					—				
Height of reinforcement : 3.2mm or less Any weld reinforcement may be removed at the manufacturer's option or by agreement between the manufacturer and purchaser.					Height of reinforcement : 1.6mm or less Any weld reinforcement may be removed at the manufacturer's option or by agreement between the manufacturer and purchaser.					—				

COMPARISON TABLE OF ASTM & KS (JIS) STANDARDS

Applicable Standards		ASTM A249 (A450)	KS D3577 (JIS G3463)
Applications		Heat-exchanger	Heat-exchanger
Manufacturing Method		(1) Automatic welding without filler metal (2) Cold worked either in both weld and base metal or in weld metal only	Seamless, automatic, automatic arc welding and electric resistance welding
Types of Steel		201 304L 309H 316L 317L 347H XM-19 202 304LN 310H 316LN 321 348 XM-29 304 304N 316 316N 321H 348H 304H 305 316H 317 347 XM-15 309S 310S	SUSTB 410 304H 321H 316L 347 430 304L 316 390S 347H 304 321 316H 310S 329J1
Heat Treatment		Same as ASTM A312 However, 304L, 316L, 321, 347, and 348 are stress relieved on request Annealed at 845~900℃	Same as KS D3576 (JIS G3459) However, annealing at 700℃ or above for 410 and 430
Item	Analysis		(1) Ladle analysis
	Mechanical Test	Tension Test (N/mm ²)	1 piece/lot (50 tubes or less) 2 piece/lot (more than 50 tubes) Others : Same as ASTM A312
		Flattening Test	1 piece/lot $H = \frac{(1+e)t}{e+t/D}$ e : 0.09
		Flaring Test	1 piece/50 pipes $H = \frac{(1+e)t}{e+t/D}$ e : 0.09 (However, e=0.07 for 410, 430 and 329J1)
		Flange Test	1 piece/50 pipes Flaring width : D × 1.2 (However, D × 1.14 for 410, 430 and 329J1)
		Reverse Flattening Test	1 piece/100 pipes
		Reverse Bending Test	—
		Bending Test	—
		Hardness Test	Batch type furnace : 5% (not less than 5 pcs.) /lot Continuous annealing furnace: 1% / lot, ≤ 90HRB
	Hydrostatic/Air-Underwater Pressure Test		Each pipe P=220.6t/D
	Other Test		Electric nondestructive test (alternatively hydrostatic test) Intergranular corrosion test & Weld decay test (when specified)
	Tolerance for Outside Diameter		Outside diameter(mm) Tolerance (mm)
	Tolerance for Ellipse and Circle		—
	Tolerance for Wall Thickness		± 10% (Minimum wall thickness + 18%, - 0)
	Tolerance for Straightness		0.8/900mm or less
	Tolerance for Length		Outside diameter Less than 50.8mm { +3.17mm - 0 } Length ≤ 7.3m 50.8mm or above { +4.76mm - 0 } 3.2mm for each additional length of 3,000mm, in case of above 7,300mm(Max. allowable tolerance : 12.7mm)
	Height of Bead		Tube welded by electric resistance welding Outside diameter > 50.8mm or Wall thickness > 3.44mm } 0.25mm or less Outside diameter ≤ 50.8mm and Wall thickness ≤ 3.44mm } 0.15mm or less
	Remarks		Tolerance for weight (all sizes) : - 0, + 10%

ASTM A270 (A450)		KS D3585 (JIS G3447)				ASTM A269 (A450)				
Sanitary use Outside diameter : 101.6mm or less Finish : # 80, 120, 180, R, T		Sanitary use				General tubing Inner diameter : 6.35mm or above Wall thickness : 0.508mm or greater				
Seamless and welded tubing		Seamless, automatic arc welding and electric resistance welding, laser welding				Seamless and welded tubing				
304	304L 316 316L	SUS 304	TBS 304L	304L 316	316L 316L	304 321 304LN	316 XM-10 316LN	317 XM-19 347	348 XM-11	XM-15 XM-29
Rapid quenching at 1,040°C or above		Rapid quenching at 1,010°C or above				Rapid quenching at 1,040°C or above However, 304L, 316L, 321, 347 and 348 are stress relieved on request. Annealed at 845°C ~ 900°C				
(1) Ladle analysis (2) Product analysis		(1) Ladle analysis (2) Product analysis on request				(1) Ladle analysis (2) Product analysis				
—		1piece/lot (when specified) T.S E.L 304 } ≥ 520 ≥ 35 316 } 304L } ≥ 480 ≥ 35 316L }				—				
—		—				—				
—		—				Only seamless tubes				
—		—				1 piece/lot, Flange width : D × 15%				
1 piece/457m(for welded tubes only)		1 piece/lot				1 piece/460mm				
—		—				—				
—		—				—				
—		—				2 piece/lot ≤ 192 HB/200HV or ≤ 90HRB				
Each pipe P=220.6t/D		Each pipe 25kg/cm² (Hydrostatic pressure) or 6kg/cm² (Air-underwater pressure)				Each pipe P=220.6t/D				
Electric nondestructive (alternatively, Hydrostatic test) When specified, corrosion test		If specified, intercrystalline corrosion test				Electric nondestructive test (Alternatively, Hydrostatic test)				
Outside diameter(mm)	Tolerance(mm)	Outside diameter	Tolerance	Outside diameter	Tolerance	Outside diameter(mm)		Tolerance(mm)		
25.4	t ≥ 1.24 +0.05 -0.20	25.4	±0.15	114.3	+0.40 -0.60	12.7 ≤ < 12.7		±0.13		
38.1	+0.05 -0.20	31.8	±0.16	139.8	+0.40 -0.80	38.1 ≤ < 38.1		±0.13		
50.8	+0.05 -0.28	38.1	±0.19	165.2	+0.40 -1.20	88.9 ≤ < 88.9		±0.25		
63.5	+0.05 -0.28	50.8	±0.25			139.7 ≤ < 139.7		±0.38		
76.2	+0.08 -0.30	63.5	±0.25			203.2 ≤ < 203.2		±0.76		
101.6	+0.08 -0.38	76.3	±0.25							
same as above	t < 1.24 As per mutual negotiation	89.1	+0.30 -0.40							
		101.6	+0.35 -0.40							
—		—				Outside diameter, wall thickness, tolerance (Tolerance for outside diameter × 2) 12.7 to 38.1 excl. 1.6 or less ±0.254 38.1 to 88.9 excl. 2.41 or less ±0.508 88.9 to 139.8 excl. 3.81 or less ±0.762				
±12.5%		All sizes : ±10%				Outside diameter { Less than 12.7mm ±15% 12.7mm or above ±10%				
Reasonably straight		Must be straight				No bending allowed				
All size { +3.2mm -0mm		4m, 6m { +10mm -0mm				Outside diameter Less than 38.1mm +3.2mm -0mm } Length ≤ 7.3m 38.1mm or above +4.8mm -0mm 3mm for each additional length of 3,000mm, in case of above 7,300mm(Max. allowable tolerance : 12.7mm)				
—		—				—				
—		Normally both the inner and outside surface are buffed with #400 belt. However, the surfaces to be finished and finished conditions may be designated by the purchaser's option.				—				

LICENCES

Status of the Approval	Approved Date	Scope	Grade	Issued by
ISO 9002	'95. 10	Stainless Steel Pipes and Titanium - Tubes	-	DNV
JIS	'96. 05	Stainless Steel Pipes (JIS G3459) Stainless Steel Boiler and Heat Exchanger Tubes (JIS G3463)	Austenite	NIPPON TSUSHO SANGYOSHO
	'02. 12	Light gauge Stainless Steel Tubes for Ordinary Piping (JIS G 3448)		KSA
KR	'96. 06	Stainless Steel Pipes (WELDED)	304/304L 316/316L	KOREA Register of Shipping
NK	'96.06	Stainless Steel Pipes	304/304L 316/316L	NIPPON KAIJI KYOKAI
DNV	'96.07	Longitudinally Welded Austenitic Stainless Steel Tubes and Pipes	304/304L 316/316L	DNV Classification
L/R	'97.07	Welded Pipes and Tubes Austenitic Stainless Steel	304L 316L	LLOYD'S Registers
BV	'97.08	Longitudinally Welded Stainless Steel Pipes	304/304L 316/316L	Bureau Veritas



																			
日本工業規格表示承認書																			
承認番号 KR9658																			
株式会社 世亜製鋼 殿																			
工業標準化法第25条の2第1項の規定により																			
日本工業規格の表示について下記のように承認する																			
平成8年5月24日																			
通商産業大臣 塚原 俊平																			
																			
記 <table border="1"> <tr> <td>承認工場又は事業場の名称</td> <td>株式会社世亜製鋼 昌原工場</td> </tr> <tr> <td>所在地</td> <td>大韓民國慶尙南道昌原市麻南洞50</td> </tr> <tr> <td>表示承認品目</td> <td>ステンレス鋼管</td> </tr> <tr> <td>日本工業規格の番号</td> <td>名 称</td> </tr> <tr> <td>JIS G3459</td> <td>配管用ステンレス鋼管</td> </tr> <tr> <td>JIS G3463</td> <td>ボイラ・熱交換器用ステンレス鋼管</td> </tr> <tr> <td></td> <td>等級又は種類</td> </tr> <tr> <td></td> <td>オーステナイト系</td> </tr> <tr> <td></td> <td>オーステナイト系</td> </tr> </table>		承認工場又は事業場の名称	株式会社世亜製鋼 昌原工場	所在地	大韓民國慶尙南道昌原市麻南洞50	表示承認品目	ステンレス鋼管	日本工業規格の番号	名 称	JIS G3459	配管用ステンレス鋼管	JIS G3463	ボイラ・熱交換器用ステンレス鋼管		等級又は種類		オーステナイト系		オーステナイト系
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	等級又は種類																		
	オーステナイト系																		
	オーステナイト系																		



DET NORSKE VERITAS QUALITY SYSTEM CERTIFICATE

Certificate No. QSC - 4421 Rev.2

*This is to certify that
the Quality System
of*

**S&AH STEEL CORPORATION
CHANGWON PLANT**

at
50, Uongnam-Dong, Changwon-City, Kyungnam, Korea

*Has been found to conform to the Quality System Standard:
ISO 9002: 1994, KS A 9002: 1995*

This Certificate is valid for the following product or service ranges:

**MANUFACTURE OF STAINLESS STEEL PIPES & TUBES
AND TITANIUM TUBES**

Place and date:
Rotterdam, August 22nd, 1997

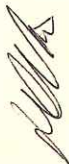
This Certificate is valid until:
October 18th, 1998



for the Accredited Unit:
DNV CERTIFICATION B.V.,
THE NETHERLANDS

Accredited
by the RVA

Original Certification date:
October 18th, 1995



Ron J. Meijer
Management Representative

Chul-Hee Han
Lead Auditor

Lack of fulfilment of conditions as set out in the Appendix may render this Certificate invalid.

ISO 9002 CERTUS 9716

DNV CERTIFICATION B.V., Haarweistraat 7, 3079 DG Rotterdam, The Netherlands. TEL INT: +31 10 2922 688 FAX: +31 10 4796 768

ClassNK

NIPPON KAIJI KYOKAI
4-7, KIOI-CHO, CHIYODA-KU,
TOKYO 100, JAPAN

TEL: 03-3230-1201
FAX: 03-3230-3524
TELEX: J22975 CLASSNK
2324280 CLASSNKJ
CABLE CLASSNK TOKYO

SeAH Steel Corporation
Changwon Plant

Our Ref. : 96EW327ROL
Date : 27 JUNE 1996

50, Uongnam-Dong, Changwon-City
Kyungnam-Do, Korea

Dear Sirs,

Approval of Manufacturing Process on Stainless Steel Pipes

We have the pleasure of informing you that, in view of the satisfactory results of the approval tests and examination of the relevant documents, we approve your manufacturing process on stainless steel pipes under the following conditions :

1. Works : SeAH Steel Corporation, Changwon Plant
2. Kind of Product : Welded Stainless Steel Pipes
3. Grades : K304TP, K304LTP, K316TP and K316LTP
4. Supply Conditions :
 - (1) Diaension : Outside Dia. : Max. 406.4mm ϕ
Thickness : Max. 7.11mm
 - (2) Heat Treatment : Solution Treatment
 - (3) Welding Method : Tig, Plasma and Electric-resistance Welding
 - (4) Stainless steel strips are to be manufactured by the maker approved by the Society.

(to be cont.)



KSA

日本工業規格表示認定書

認定番號 : KSKR0212

(株)世亞製鋼 昌原工場

大韓民國慶尚南道昌原市熊南洞50番地

韓國標準協會は日本工業標準化法の第25條の2第1項の規定により
日本工業規格の表示について下記のように認定する

日本工業規格の番號及び名稱

JIS G 3448 : 一般配管用ステンレス鋼管

表示認定品目

ステンレス鋼鋼管

等級又は種類

2002年 12月 04日



韓國標準協會長

29



CERTIFICATE NO. MAT/04/KRA/084

This is to certify that

SeAH Steel Corporation
Changwon
Korea

has been approved in accordance with the requirements of Lloyd's Register for the manufacture of:-

Welded pipes and tubes in grades 304L and 316L austenitic stainless steel
(maximum outside diameter 410mm)
(maximum wall thickness 8mm)

This approval is subject to compliance with the Rules for the Manufacture, Testing and Certification of Materials.

Lloyd's Register is to be notified of any change of plant, formulation, or quality control routines introduced during the validity of this Certificate.

This Certificate is issued to the above manufacturer and is valid until the date given below.

Valid Until 11 July 1999

Date of Issue 27 August 1996

Lloyd's Register of Shipping
71 Fenchurch Street, London EC3M 4BS

NOTICE—This certificate is subject to the terms and conditions overleaf

[Signature]
Lloyd's Register



**BUREAU
VERITAS**
MARINE DIVISION

Published in NG 383

Cert. No.

P 1 2 5 5 1 4 B 0 0

File No.: PRO 170/002/01

PROCESS APPROVAL CERTIFICATE

Considering the data supplied at the date of this certificate, BUREAU VERITAS declares to accept that the process defined hereafter be brought into effect on board ships or offshore installations classed with the Society:

PROCESS CATEGORY: MANUFACTURE OF LONGITUDINALLY WELDED STAINLESS STEEL PIPES

APPLIED BY : SeAH STEEL CORP. (Korea)

PROCESS DESCRIPTION—APPLICATION—LIMITATIONS OF USE:

MANUFACTURE OF AUSTENITIC STAINLESS STEEL TUBES, LONGITUDINALLY WELDED, FOR LNG and LPG CARGO PIPING.

- Steel grades:..... 304-304L-316-316L
- Wall thickness:..... from 0.8 up to 7.1 mm
- Outside diameters:..... from 12.7 up to 406 mm
- Minimum design temperature:..... -163°C (LNG)
- Manufacturing process:..... Longitudinal welding using automatic TIG process without filler metal, according to SWG24-SWG25 SW618 and SW605 dated 10/01/1996 - from SeAH Steel Corp.
- No postweld heat treatment.

It remains understood that the stainless steel tubes delivered within the scope of the present approval, must comply with the requirements set in Bureau Veritas Materials Rules, and be inspected as specified in these Rules by a Bureau Veritas Surveyor.

The drawings of the tubes manufactured under this process must be reviewed for each particular application.

The approval implies that the process is brought into effect by qualified personnel and every certificate issued will be subject to the conditions of the Society. Surveys, inspections and tests must be carried out in accordance with the Rules of the Society, or follow in service, or changes of applicable test methods.

THE APPROVAL IS VALID UNTIL: 31st AUGUST 2000

At Paris - La Defense, on 30th AUGUST 1996



[Signature]
A. BENOIT
For the Secretary

Any person who is not the holder of this certificate is deemed not to be a client of BUREAU VERITAS for any liability arising out of errors or omissions which may be contained in said document, or for any negligence committed by personnel of the Society or of the Agents in the establishment or issuance of this document, and in connection with any activities to which it may provide.

The latest published Rules of BUREAU VERITAS and the Marine Division General Conditions stated overleaf are applicable.

Bureau Veritas - 17 bd. Place des Relais - La Defense 2 - 92400 Courbevoie - Tel. 33 (1) 42 91 52 91 - Telex 515376 F BVOCN - Fax 33 (1) 42 91 53 20

SeAH Steel Corporation

■ HEADQUARTERS

10, Bongnae-Dong 1Ga, Jung-Gu, Seoul, Korea
TEL : (02) 3783-8114 FAX : (02) 3783-8181~2

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