NKK

NKK SEAMLESS PIPE AND TUBE

NKK Corporation was incorporated in 1912 as the first Japanese steelmaker to produce seamless steel tubes and since the company has expanded its product mix to include literally all types of steel products. Backed with such a long history in the production of steel tubular products and by constantly replacing production facilities with the most modern ones, and besides by keeping a close relation with its customers for technical aspects of steel pipe and tube, the company is able to supply every grade and type of steel pipe and tube to satisfy the need of its customers in various fields.

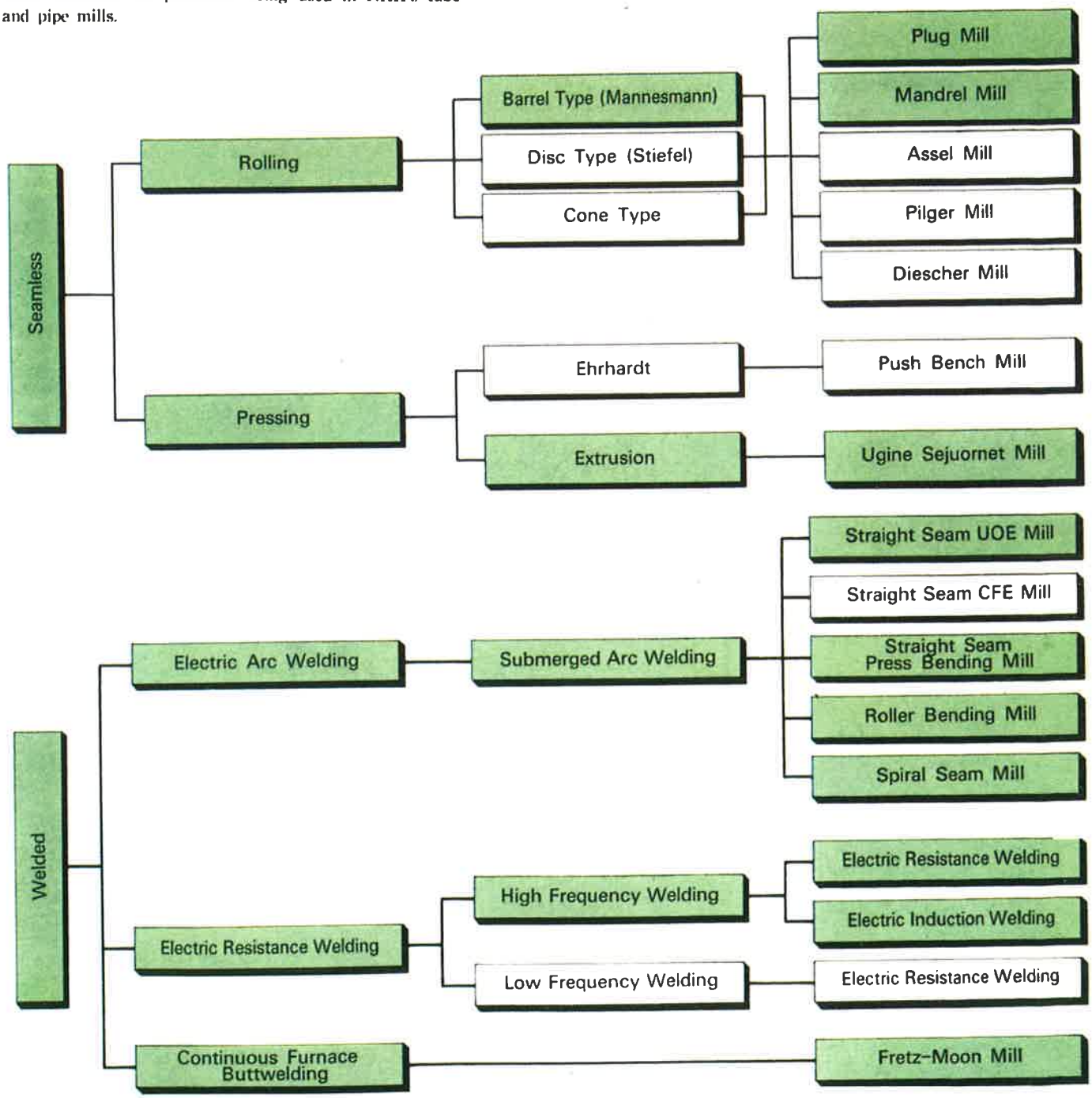
This booklet is to introduce the facilities used by the company to produce seamless pipe and tube.

Kinds of seamless (SMLS) pipe and tube produced by integrated technology of NKK include those for use in thermal electric power, nuclear power, oil refineries and petro-chemical plants-such as furnace tube, heat exchanger tube, condenser tube and ultra high pressure tube—, mechanical structure—for use in such as construction, industrial machinery, machine tool, marine construction, ship and automobiles—, and oil well—such as casing, drill pipe, tubing and line pipe. In short, NKK's Seamless (SMLS) pipe and tube are used in many and varied fields with high reputation.

Contents

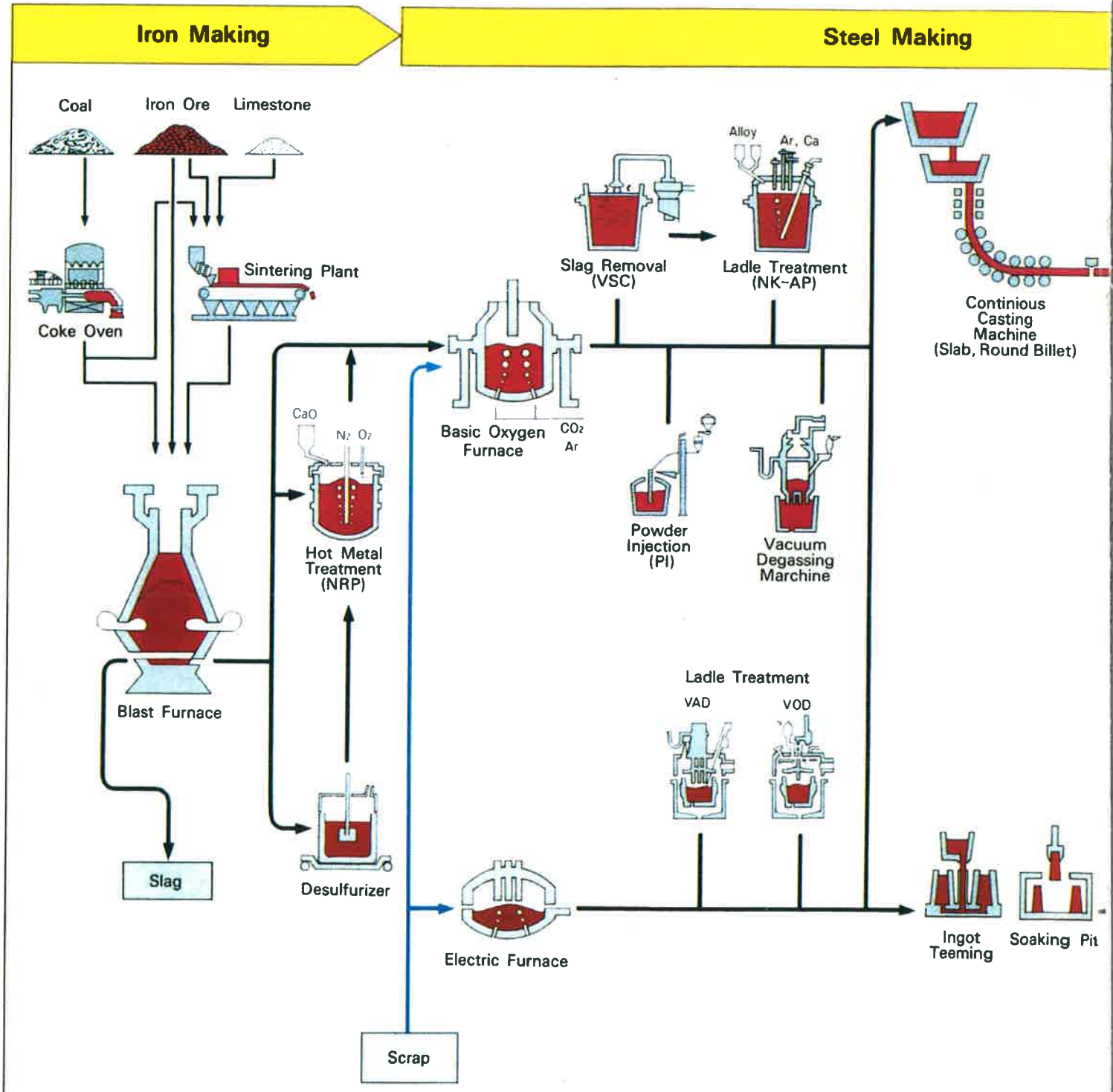
Manufacture of Steel Tubular Products

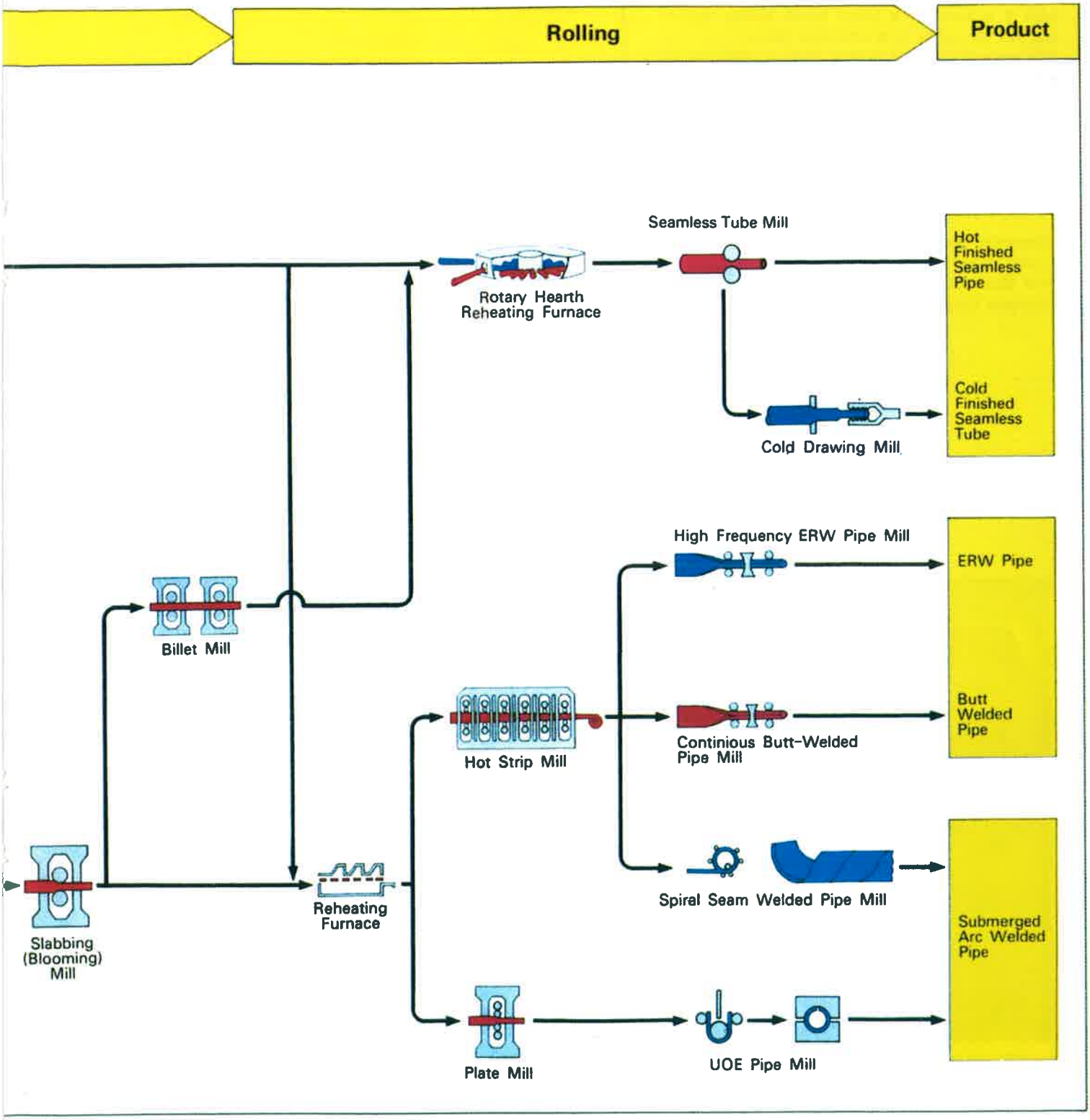
Steel tubular products are manufactured by either seamless or welding processes. Those processes are further divided into several processes as shown in the following diagram. Color indicates the processes being used in NKK's tube and pipe mills.



Integrated Production of Steel Tubular Products at NKK

NKK CORPORATION has two steel-making complexes, the Keihin Works in the Tokyo-Yokohama Industrial Area and the Fukuyama Works in Hiroshima Prefecture. The two works are integrated steelmaking complexes having an annual crude steel capacity of 15 million tons.




Rolling
Product
Seamless Tube Mill
Rotary Hearth
Reheating Furnace
Hot
Finished
Seamless
Pipe
Cold
Finished
Seamless
Tube
Cold Drawing Mill
High Frequency ERW Pipe Mill
ERW Pipe
Billet Mill
Butt
Welded
Pipe
Hot Strip Mill
Continious Butt-Welded
Pipe Mill
Spiral Seam Welded Pipe Mill
Submerged
Arc Welded
Pipe
Slabbing
(Blooming)
Mill
Reheating
Furnace
Plate Mill
UOE Pipe Mill

Manufacturing Processes

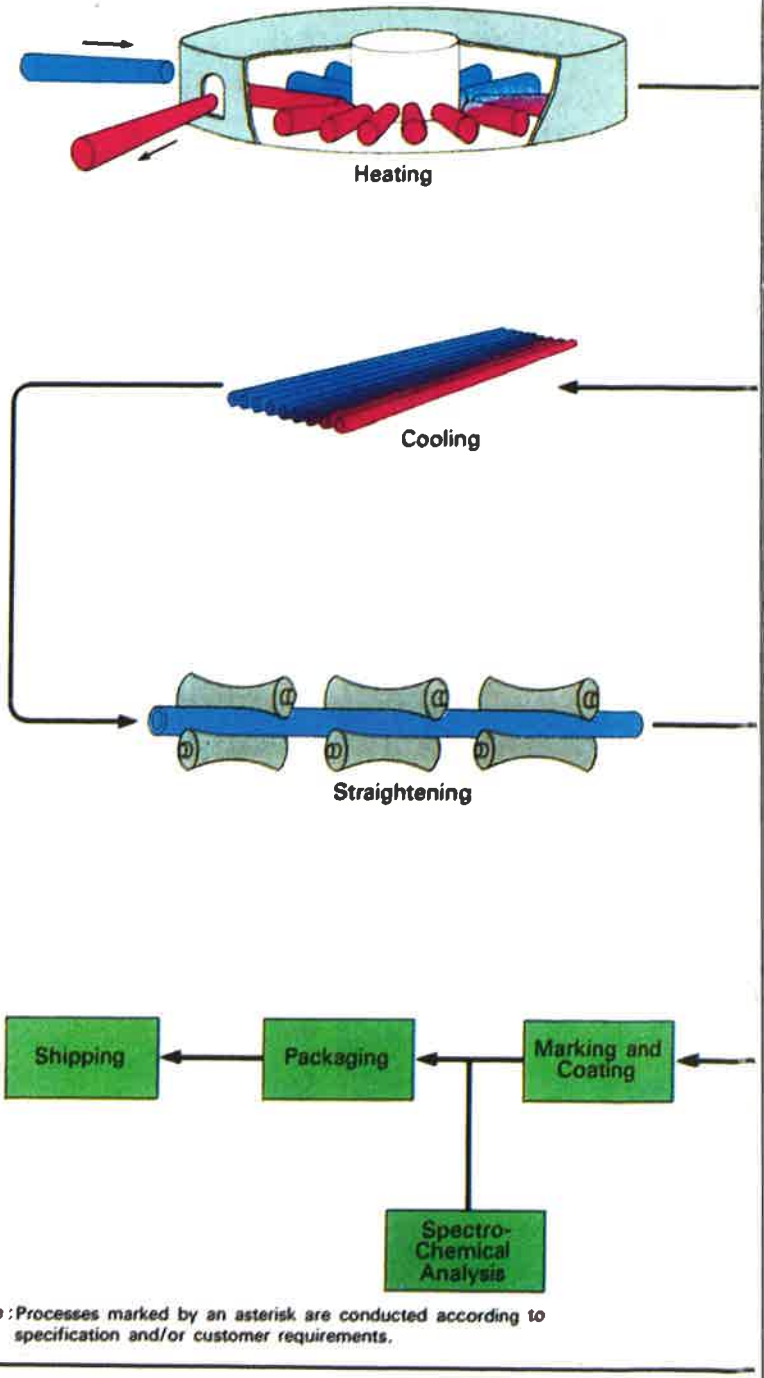
Mandrel Mill–Seamless, Hot Finishing

In the mandrel mill process, a solid round (billet) is used. It is heated in a rotary hearth heating furnace and then pierced by a Mannesmann piercer.
The pierced billet or hollow shell is rolled by an 7-stand mandrel mill to reduce the outside diameter and wall thickness which forms a multiple length mother tube. The mother tube is reheated and fur -ther reduced to specified dimensions by the stretch reducer. The tube is then cooled, straightened, cut, and subjected to finishing and inspection processes before shipment.

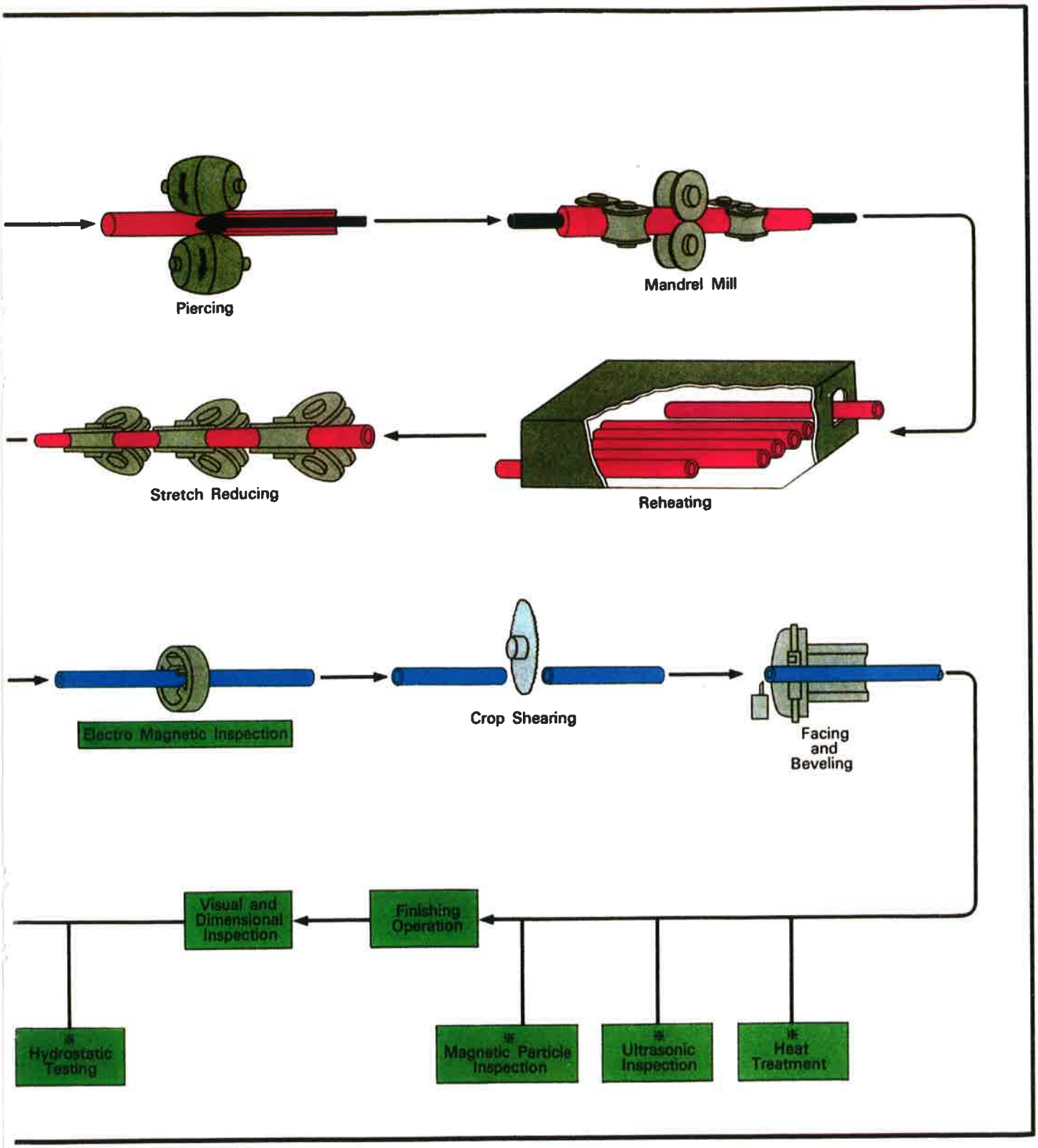
Dimension Range
Outside Diameter : 1.071~6.051in (27.2~153.7mm)
Wall Thickness : 0.098~1.850in (2.5~47.0mm)
Maximum Length : 44ft (13,500mm)

Mandrel mill

Sequence of Mandrel Mill Operation



Note : Processes marked by an asterisk are conducted according to specification and/or customer requirements.


Piercing
Mandrel Mill
Reheating
Stretch Reducing
Electro Magnetic Inspection
Crop Shearing
Facing and Beveling
Visual and Dimensional Inspection
Finishing Operation
Hydrostatic Testing
Magnetic Particle Inspection
Ultrasonic Inspection
Heat Treatment

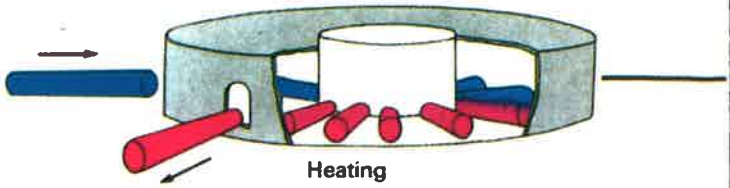
Mannesmann Plug Mill—Seamless, Hot Finishing

In the plug mill process, a solid round (billet) is also used. It is uniformly heated in the rotary hearth heating furnace and then pierced by a Mannesmann piercer. The pierced billet or hollow shell is roll-reduced in outside diameter and wall thickness. The rolled tube is simultaneously burnished inside and outside by a reeling machine. The reeled tube is then sized by a sizing mill to the specified dimensions. From this step the tube goes through the straightener. This process completes the hot working of the tube. The tube (referred to as a mother tube) after finishing and inspection, becomes a finished product.

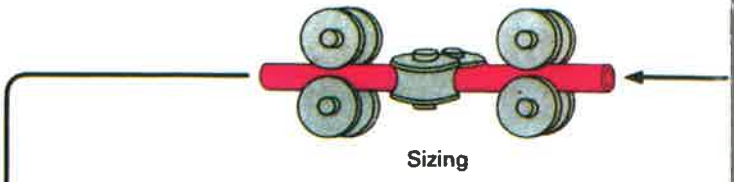
Dimension Range
Outside Diameter : 6.260~17.000in (159.0~431.8mm)
Wall Thickness : 0.217~2.559in (5.5~65.0mm)
Maximum Length : 44ft (13,500mm)

Mannesmann piercer

Sequence of Plug Mill Operation

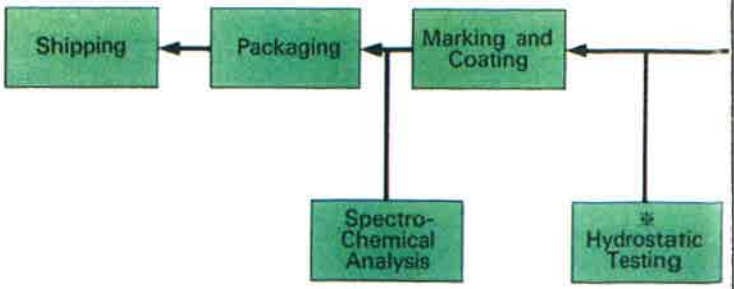


Heating



Sizing

Cooling



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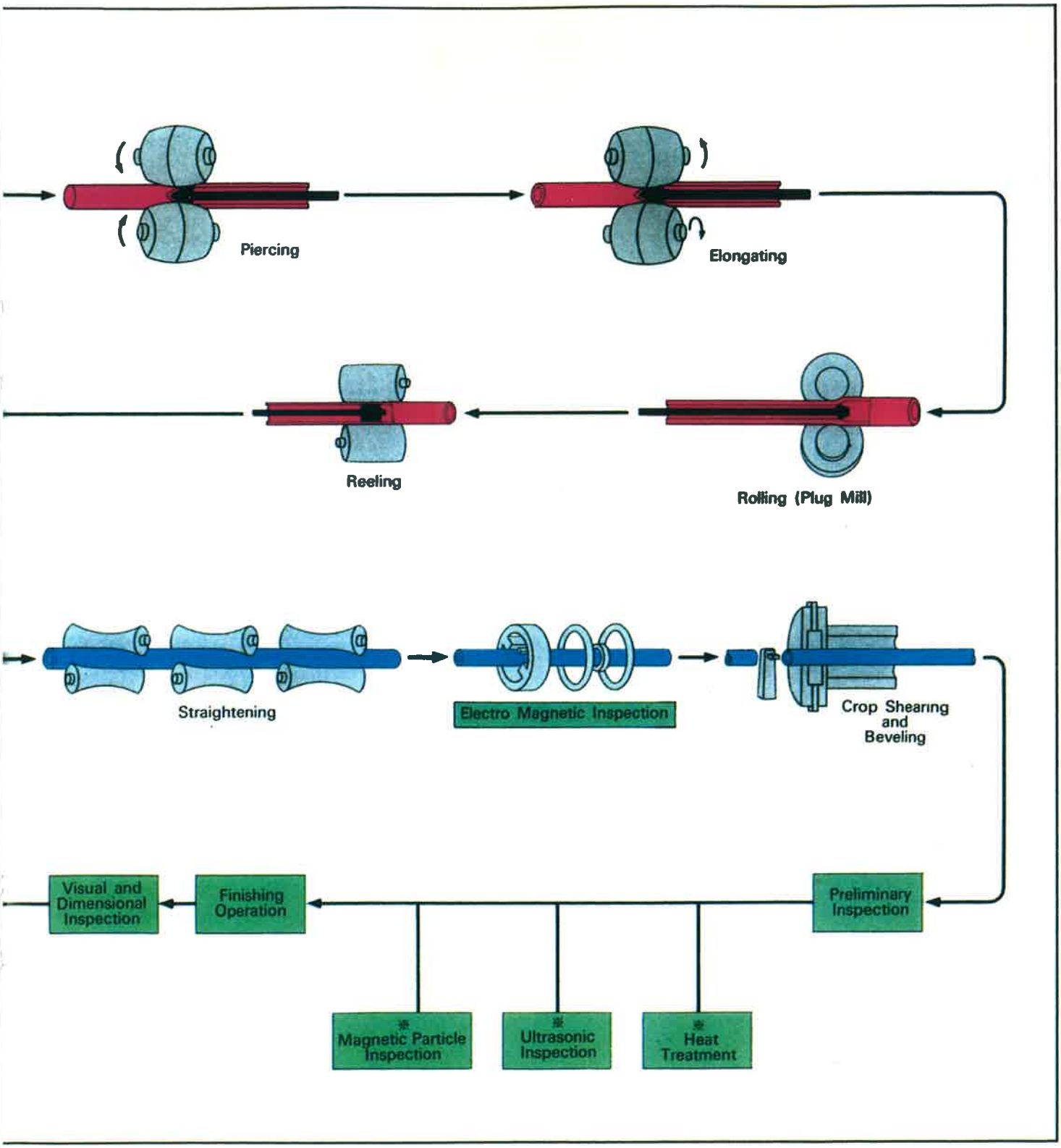
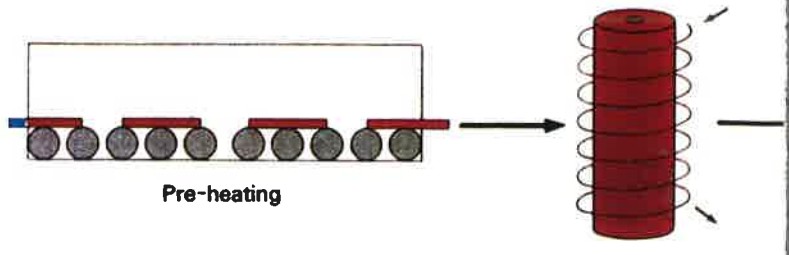

Piercing
Elongating
Reeling
Rolling (Plug Mill)
Straightening
Electro Magnetic Inspection
Crop Shearing and Beveling
Visual and Dimensional Inspection
Finishing Operation
Preliminary Inspection
Magnetic Particle Inspection
Ultrasonic Inspection
Heat Treatment

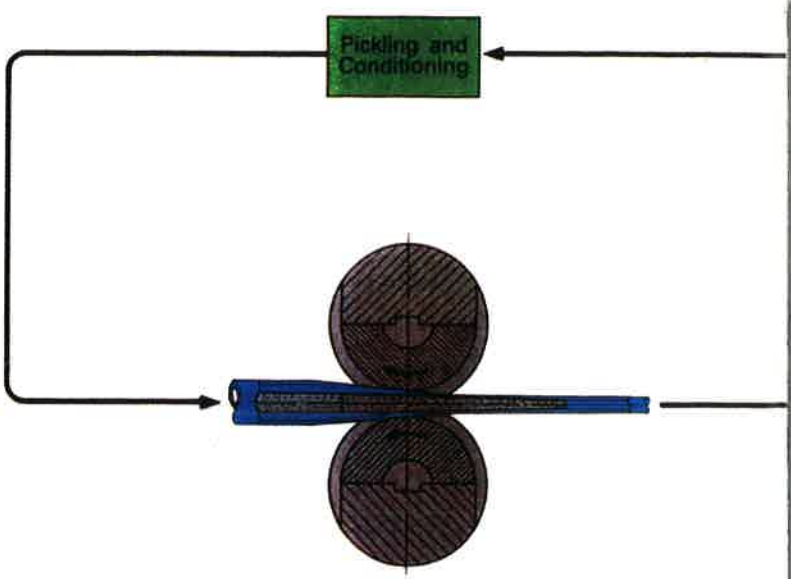
SANYO SPECIAL STEEL Co., Ltd.

NKK subcontracts the manufacturing of cold finished stainless steel pipes and tubes to SANYO SPECIAL STEEL Co., Ltd.
SANYO SPECIAL STEEL Co., Ltd. has two Ugine Sejuornet type hot extrusion presses (1,250 tons and 2,000 tons) in Himeji Works. The Ugine Sejuornet type hot extrusion press is used mainly to produce stainless tubing. In the preheating furnace, a billet is heated at about 700 ℃. The preheated billet is reheated in the induction furnace and then extruded by an extrusion press at one stroke to specified product dimensions. In the cold rolling process, a hot finished seamless tube is used as the material (mother tubes). The mother tube is cold rolled at the cold pilger mill to the specified outside diameter and wall thickness. The tube is further processed in the finishing operation and inspected.

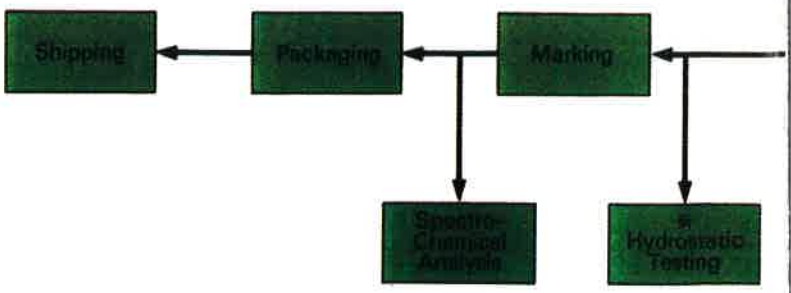
Dimension Range (Stainless)
Hot Finished
Outside Diameter : 0.854~5.188in (21.7~130.0mm)
Wall Thickness : 0.118~0.866in (3.0~22.0mm)
Maximum Length : 32ft (9,800mm)
Cold Finished
Outside Diameter : 0.748~3.508in (19.0~89.1mm)
Wall Thickness : 0.063~0.630in (1.6~16.0mm)
Maximum Length : 47.9ft (14,600mm)



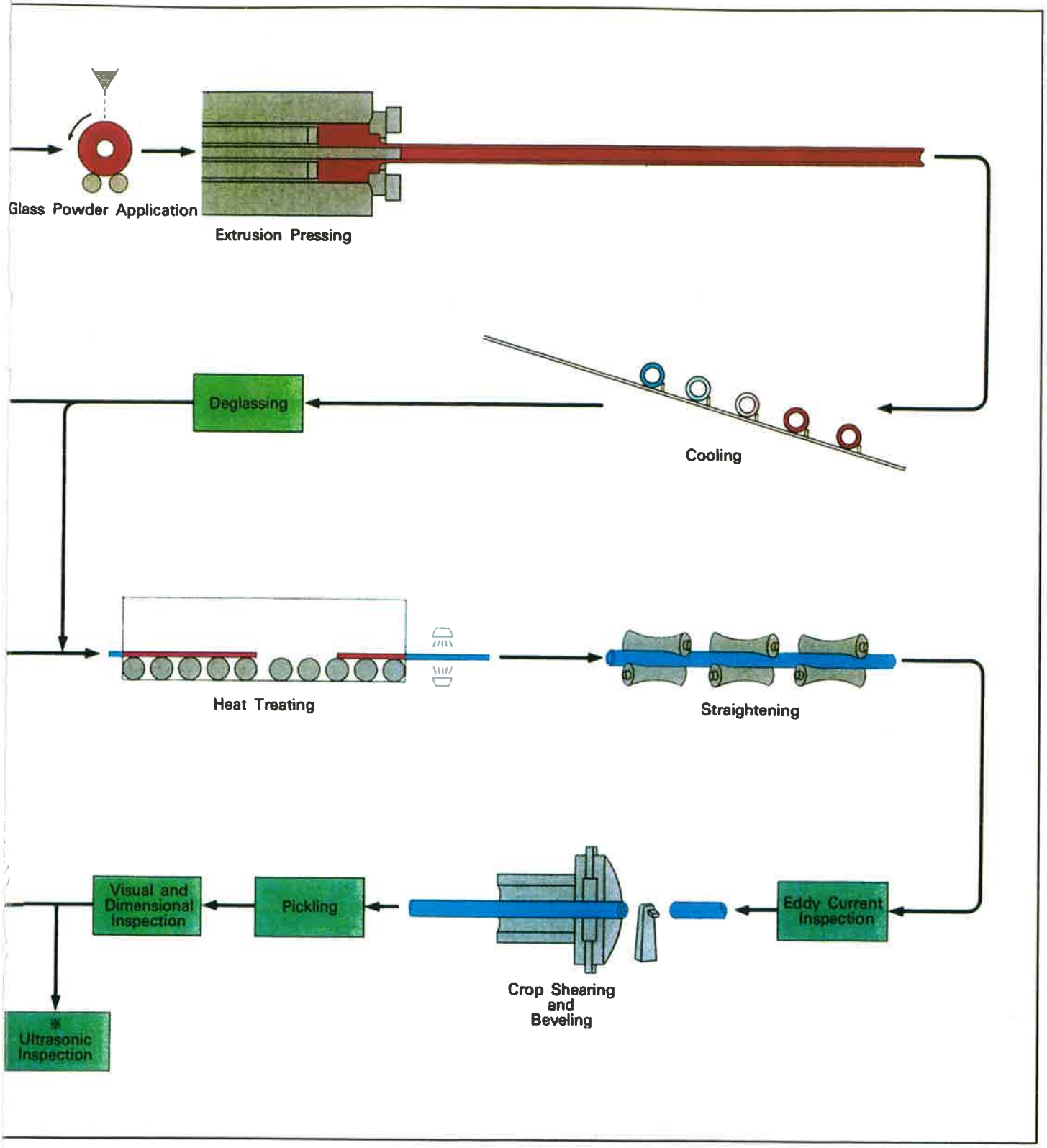
Induction Heating



Cold Pilger Rolling



Note : Processes marked by an asterisk are conducted according to specification and/or customer requirements.

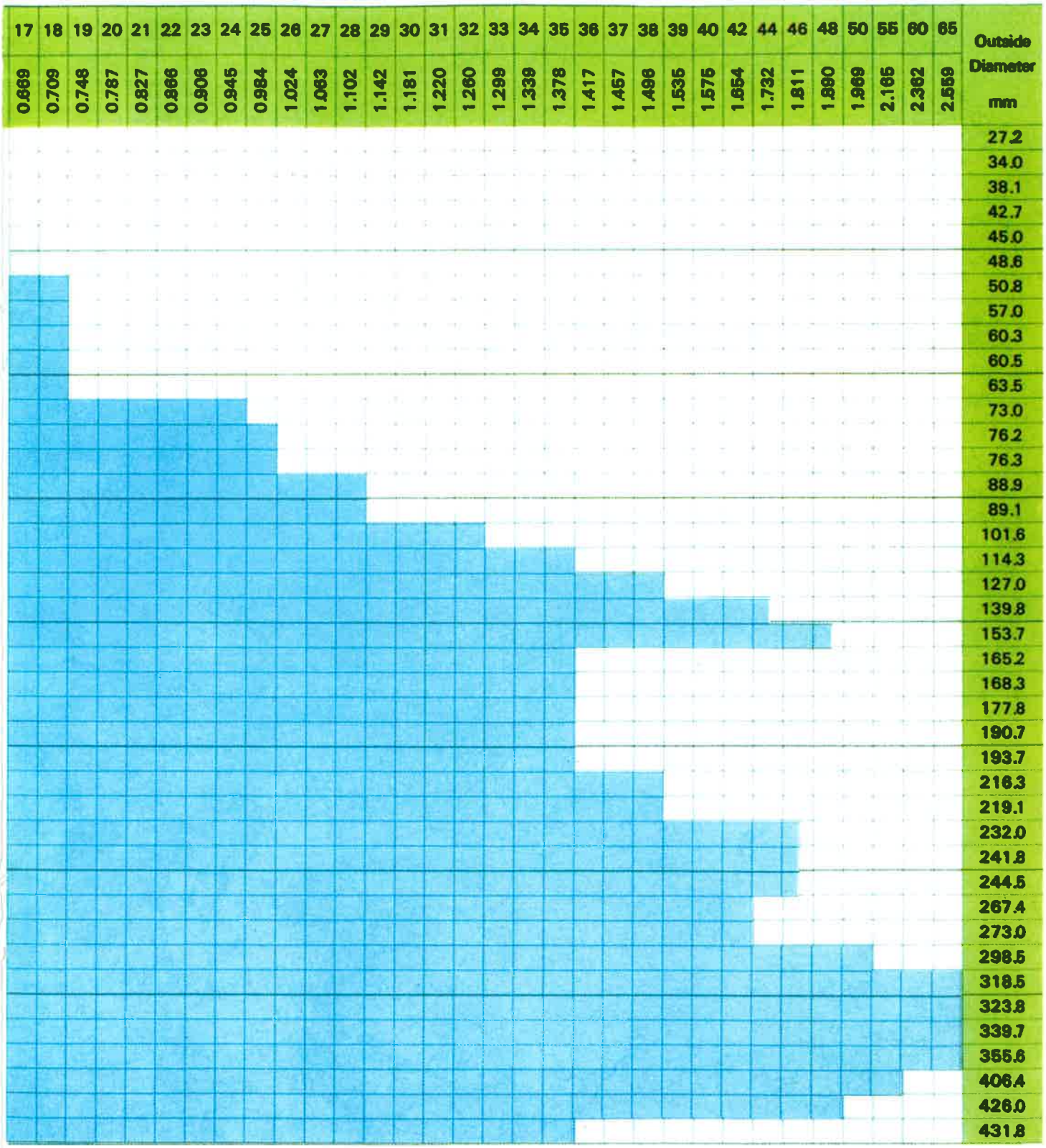

Glass Powder Application
Extrusion Pressing
Cooling
Deglassing
Heat Treating
Straightening
Eddy Current Inspection
Crop Shearing and Beveling
Pickling
Visual and Dimensional Inspection
Ultrasonic Inspection

Manufacturing Ranges by Processes and Dimensions

Hot Finished Seamless Tube

Outside Diameter mm	Outside Diameter in	Nominal Pipe Size	Wall Thickness mm	2.5	2.9	3.0	3.1	3.2	3.5	4.0	4.5	5.0	5.5	5.8	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10	11	12	13	14	15	16
			in	0.098	0.114	0.118	0.122	0.126	0.138	0.157	0.177	0.197	0.217	0.228	0.236	0.256	0.276	0.295	0.315	0.335	0.354	0.374	0.394	0.433	0.472	0.512	0.551	0.591	0.630
27.2				■	■	■	■	■	■	■	■	■	■	■	■	■	■												
34.0		1				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
38.1	1 1/2					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
42.7		1 1/4				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
45.0						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
48.6		1 1/2				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
50.8	2					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
57.0							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
60.3	2 3/8							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
60.5		2						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
63.5									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
73.0	2 7/8								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
76.2	3								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
76.3		2 1/2							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
88.9	3 1/2								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
89.1		3							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
101.6	4	3 1/2							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
114.3	4 1/2	4							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
127.0	5								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
139.8	5 1/2	5							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
153.7	6										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
165.2		6									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
168.3	6 5/8										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
177.8	7										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
190.7											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
193.7	7 5/8										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
216.3		8									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
219.1	8 5/8										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
232.0												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
241.8												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
244.5	9 5/8											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
267.4		10											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
273.0	10 3/4												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
298.5	11 3/4												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
318.5		12											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
323.8	12 3/4													■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
339.7	13 3/8													■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
355.6	14	14												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
406.4	16	16													■	■	■	■	■	■	■	■	■	■	■	■	■	■	
426.0																■	■	■	■	■	■	■	■	■	■	■	■	■	
431.8	17															■	■	■	■	■	■	■	■	■	■	■	■	■	

Notes: 1. Available size range for carbon steel.
2. Maximum length of tube is 13,500mm(44ft). However, please consult us for particulars.
3. Sizes other than those shown in the table are supplied subject to negotiation.


17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 42 44 46 48 50 55 60 65
0.669 0.709 0.748 0.787 0.827 0.866 0.906 0.945 0.984 1.024 1.063 1.102 1.142 1.181 1.220 1.260 1.299 1.339 1.378 1.417 1.457 1.496 1.535 1.575 1.654 1.732 1.811 1.890 1.969 2.165 2.362 2.559
Outside Diameter mm
27.2
34.0
38.1
42.7
45.0
48.6
50.8
57.0
60.3
60.5
63.5
73.0
76.2
76.3
88.9
89.1
101.6
114.3
127.0
139.8
153.7
165.2
168.3
177.8
190.7
193.7
216.3
219.1
232.0
241.8
244.5
267.4
273.0
298.5
318.5
323.8
339.7
355.6
406.4
426.0
431.8

ASTM Std. A53 /API 5L/A-106 SEAMLESS STEEL PIPE

Available Sizes (Dimensions and Weights) and Mill Hydraulic Test

NPS Designator	Outside Diameter		Wall Thickness		Weight Class	Schedule No.	Plain End Weight			Thread & Coupling Weight		
	in.	mm	in.	mm			lb/ft	kg/ft	kg/m	lb/ft	kg/ft	kg/m
3/8	0.675	17.1	0.091	2.31	STD	40	0.57	0.26	0.84	–	–	–
			0.126	3.20	XS	80	0.74	0.34	1.10	–	–	–
1/2	0.840	21.3	0.109	2.77	STD	40	0.85	0.39	1.27	0.85	0.39	1.27
			0.147	3.73	XS	80	1.09	0.49	1.62	1.09	0.49	1.62
			0.188	4.78	–	160	1.31	0.59	1.95	–	–	–
			0.294	7.47	XXS	–	1.71	0.78	2.55	1.72	0.78	2.54
3/4	1.050	26.7	0.113	2.87	STD	40	1.13	0.51	1.69	1.13	0.51	1.69
			0.154	3.91	XS	80	1.47	0.67	2.20	1.48	0.67	2.21
			0.219	5.56	–	160	1.94	0.88	2.90	–	–	–
			0.308	7.82	XXS	–	2.44	1.11	3.64	2.44	1.11	3.64
1	1.315	33.4	0.133	3.38	STD	40	1.68	0.76	2.50	1.68	0.76	2.50
			0.179	4.55	XS	80	2.17	0.98	3.24	2.18	0.99	3.25
			0.250	6.35	–	160	2.84	1.29	4.24	–	–	–
			0.358	9.09	XXS	–	3.66	1.66	5.45	3.66	1.66	5.45
1¼	1.660	42.2	0.140	3.56	STD	40	2.27	1.03	3.39	2.28	1.04	3.40
			0.191	4.85	XS	80	3.00	1.36	4.47	3.02	1.37	4.49
			0.250	6.35	–	160	3.76	1.71	5.61	–	–	–
			0.382	9.70	XXS	–	5.21	2.36	7.77	5.22	2.37	7.76
1½	1.900	48.3	0.145	3.68	STD	40	2.72	1.23	4.05	2.73	1.24	4.04
			0.200	5.08	XS	80	3.63	1.65	5.41	3.66	1.66	5.39
			0.281	7.14	–	160	4.86	2.21	7.25	–	–	–
			0.400	10.16	XXS	–	6.41	2.91	9.56	6.41	2.91	9.56
2	2.375	60.3	0.154	3.91	STD	40	3.65	1.66	5.44	3.68	1.67	5.46
			0.218	5.54	XS	80	5.02	2.28	7.48	5.07	2.30	7.55
			0.344	8.74	–	160	7.46	3.39	11.11	–	–	–
			0.436	11.07	XXS	–	9.03	4.10	13.44	9.03	4.10	13.44
2½	2.875	73.0	0.203	5.16	STD	40	5.79	2.63	8.63	5.82	2.64	8.67
			0.276	7.01	XS	80	7.66	3.47	11.41	7.73	3.51	11.52
			0.375	9.52	–	160	10.01	4.54	14.90	–	–	–
			0.552	14.02	XXS	–	13.70	6.21	20.39	13.70	6.22	20.39
3	3.500	88.9	0.125	3.18	–	–	4.51	2.05	6.72	–	–	–
			0.156	3.96	–	–	5.57	2.53	8.29	–	–	–
			0.188	4.78	–	–	6.65	3.02	9.92	–	–	–
			0.216	5.49	STD	40	7.58	3.44	11.29	7.62	3.46	11.35
			0.250	6.35	–	–	8.68	3.94	12.93	–	–	–
			0.281	7.14	–	–	9.66	4.38	14.40	–	–	–
			0.300	7.62	XS	80	10.25	4.65	15.27	10.33	4.69	15.39
			0.438	11.13	–	160	14.32	6.50	21.35	–	–	–
			0.600	15.24	XXS	–	18.58	8.43	27.68	18.57	8.43	27.66

Note : ○Sizes outside the above size range are on an inquiry basis.

Pressure

Plain End						Thread and Coupling					
Test Pressure						Test Pressure					
Butt Welded		Grade A		Grade B		Butt Welded		Grade A		Grade B	
psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa
700	4830	700	4830	700	4830	–	–	–	–	–	–
850	5860	850	5860	850	5860	–	–	–	–	–	–
700	4830	700	4830	700	4830	700	4830	700	4830	700	4830
850	5860	850	5860	850	5860	850	5860	850	5860	850	5860
900	6210	900	6210	900	6210	–	–	–	–	–	–
1000	6890	1000	6890	1000	6890	1000	6890	1000	6890	1000	6890
700	4830	700	4830	700	4830	700	4830	700	4830	700	4830
850	5860	850	5860	850	5860	850	5860	850	5860	850	5860
950	6550	950	6550	950	6550	–	–	–	–	–	–
1000	6890	1000	6890	1000	6890	1000	6890	1000	6890	1000	6890
700	4830	700	4830	700	4830	700	4830	700	4830	700	4830
850	5860	850	5860	850	5860	850	5860	850	5860	850	5860
950	6550	950	6550	950	6550	–	–	–	–	–	–
1000	6890	1000	6890	1000	6890	1000	6890	1000	6890	1000	6890
1000	6890	1200	8270	1300	8960	1000	6890	1000	6890	1100	7580
1300	8960	1800	12410	1900	13100	1300	8960	1500	10340	1600	11030
1350	9310	1900	13100	2000	13790	–	–	–	–	–	–
1400	9650	2200	15170	2300	15860	1400	9650	1800	12410	1900	13100
1000	6890	1200	8270	1300	8960	1000	6890	1000	6890	1100	7580
1300	8960	1800	12410	1900	13100	1300	8960	1500	10340	1600	11030
1350	9310	1950	13440	2050	14130	–	–	–	–	–	–
1400	9650	2200	15170	2300	15860	1400	9650	1800	12410	1900	13100
1000	6890	2300	15860	2500	17240	1000	6890	2300	15860	2500	17240
1300	8960	2500	17240	2500	17240	1300	8960	2500	17240	2500	17240
1400	9650	2500	17240	2500	17240	–	–	–	–	–	–
1400	9650	2500	17240	2500	17240	1400	9650	2500	17240	2500	17240
1000	6890	2500	17240	2500	17240	1000	6890	2500	17240	2500	17240
1300	8960	2500	17240	2500	17240	1300	8960	2500	17240	2500	17240
1400	9650	2500	17240	2500	17240	–	–	–	–	–	–
1400	9650	2500	17240	2500	17240	1400	9650	2500	17240	2500	17240
800	5520	1290	8890	1500	1030	–	–	–	–	–	–
1000	6890	1600	11030	1870	12890	–	–	–	–	–	–
1000	6890	1930	13310	2260	15580	–	–	–	–	–	–
1000	6890	2220	15310	2500	17240	1000	6890	2200	15170	2500	17240
1300	8960	2500	17240	2500	17240	–	–	–	–	–	–
1300	8960	2500	17240	2500	17240	–	–	–	–	–	–
1300	8960	2500	17240	2500	17240	1300	8960	2500	17240	2500	17240
–	–	2500	17240	2500	17240	–	–	–	–	–	–
–	–	2500	17240	2500	17240	–	–	2500	17240	2500	17240

ASTM Std. A53 /API 5L/A-106 SEAMLESS STEEL PIPE

Available Sizes (Dimensions and Weights) and Mill Hydraulic Test

NPS Designator	Outside Diameter		Wall Thickness		Weight Class	Schedule No.	Plain End			Thread & Coupling		
							Weight			Weight		
	in.	mm	in.	mm			lb/ft	kg/ft	kg/m	lb/ft	kg/ft	kg/m
3½	4.000	101.6	0.125	3.18	–	–	5.17	2.35	7.72	–	–	–
			0.156	3.96	–	–	6.40	2.90	9.53	–	–	–
			0.188	4.78	–	–	7.65	3.47	11.41	–	–	–
			0.226	5.74	STD	40	9.11	4.13	13.57	9.20	4.18	13.71
			0.250	6.35	–	–	10.01	4.54	14.92	–	–	–
			0.281	7.14	–	–	11.16	5.06	16.63	–	–	–
			0.318	8.08	XS	80	12.51	5.67	18.63	12.63	5.73	18.82
4	4.500	114.3	0.125	3.18	–	–	5.84	2.65	8.71	–	–	–
			0.156	3.96	–	–	7.24	3.28	10.78	–	–	–
			0.188	4.78	–	–	8.66	3.98	12.91	–	–	–
			0.219	5.56	–	–	10.01	4.54	14.91	–	–	–
			0.237	6.02	STD	40	10.79	4.89	16.07	10.89	4.94	16.23
			0.250	6.35	–	–	11.35	5.15	16.90	–	–	–
			0.281	7.14	–	–	12.66	5.74	18.87	–	–	–
			0.312	7.92	–	–	13.98	6.33	20.78	–	–	–
			0.337	8.56	XS	80	14.98	6.79	22.32	15.17	6.89	22.60
			0.438	11.13	–	120	19.00	8.62	28.32	–	–	–
			0.531	13.49	–	160	22.51	10.21	33.54	–	–	–
			0.674	17.12	XXS	–	27.54	12.49	41.03	27.58	12.52	41.09
5	5.563	141.3	0.156	3.96	–	–	9.01	4.09	13.41	–	–	–
			0.188	4.78	–	–	10.79	4.89	16.09	–	–	–
			0.219	5.56	–	–	12.50	5.67	18.61	–	–	–
			0.258	6.55	STD	40	14.62	6.43	21.77	14.81	6.72	22.07
			0.281	7.14	–	–	15.85	7.19	23.62	–	–	–
			0.312	7.92	–	–	17.50	7.94	26.05	–	–	–
			0.344	8.74	–	–	19.17	8.70	28.57	–	–	–
			0.375	9.52	XS	80	20.78	9.43	30.94	21.09	9.57	31.42
			0.500	12.70	–	120	27.04	12.27	40.28	–	–	–
			0.625	15.88	–	160	32.96	14.95	49.11	–	–	–
			0.750	19.05	XXS	–	38.55	17.49	57.43	–	–	–
6	6.625	168.3	0.188	4.78	–	–	12.92	5.86	19.27	–	–	–
			0.219	5.56	–	–	14.98	6.79	22.31	–	–	–
			0.250	6.35	–	–	17.02	7.72	25.36	–	–	–
			0.280	7.11	STD	40	18.37	8.60	28.26	19.18	8.71	28.58
			0.312	7.92	–	–	21.04	9.54	31.32	–	–	–
			0.344	8.74	–	–	23.08	10.47	34.39	–	–	–
			0.375	9.52	–	–	25.03	11.35	37.28	–	–	–
			0.432	10.97	XS	80	28.57	12.96	42.56	28.89	13.12	43.05
			0.562	14.27	–	120	36.39	16.52	54.20	–	–	–
			0.719	18.26	–	160	45.35	20.57	67.56	–	–	–
			0.864	21.95	XXS	–	53.16	24.11	79.22	–	–	–

Note : ○ Sizes outside the above size range are on an inquiry basis.

Pressure

Plain End						Thread and Coupling					
Test Pressure						Test Pressure					
Butt Welded		Grade A		Grade B		Butt Welded		Grade A		Grade B	
psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa
800	5520	1120	7720	1310	9030	–	–	–	–	–	–
1000	6890	1400	9650	1640	11310	–	–	–	–	–	–
1200	8270	1690	11650	1970	13580	–	–	–	–	–	–
1200	8270	2030	14000	2370	16340	1200	8270	2000	13790	2400	16550
1300	8960	2250	15510	2500	17240	–	–	–	–	–	–
1500	10340	2500	17240	2500	17240	–	–	–	–	–	–
1700	11720	2800	19310	2800	19310	1700	11720	2800	19310	2800	19310
800	5520	1000	6890	1170	8070	–	–	–	–	–	–
1000	6890	1250	8620	1460	10070	–	–	–	–	–	–
1200	8270	1500	10340	1750	12070	–	–	–	–	–	–
1200	8270	1750	12070	2040	14070	–	–	–	–	–	–
1200	8270	1900	13100	2210	15240	1200	8270	1900	13100	2200	15170
1300	8960	2000	13790	2330	16060	–	–	–	–	–	–
1400	9650	2250	15110	2620	18060	–	–	–	–	–	–
1600	11030	2500	17240	2800	19310	–	–	–	–	–	–
1700	11720	2700	18620	2800	19310	1700	11720	2700	18620	2800	19310
–	–	2800	19310	2800	19310	–	–	–	–	–	–
–	–	2800	19310	2800	19310	–	–	–	–	–	–
–	–	2800	19310	2800	19310	–	–	2800	19310	2800	19310
–	–	1010	6960	1180	8140	–	–	–	–	–	–
–	–	1220	8410	1420	9790	–	–	–	–	–	–
1000	6890	1420	9790	1650	11380	–	–	–	–	–	–
1200	8270	1670	11510	1950	13440	1200	8270	1700	11720	1900	13100
1200	8270	1820	12550	2120	14620	–	–	–	–	–	–
–	–	2020	13930	2360	16270	–	–	–	–	–	–
–	–	2230	15380	2600	17930	–	–	–	–	–	–
–	–	2430	16750	2800	19310	–	–	2400	16550	2800	19310
–	–	2800	19310	2800	19310	–	–	–	–	–	–
–	–	2800	19310	2800	19310	–	–	–	–	–	–
–	–	2800	19310	2800	19310	–	–	–	–	–	–
–	–	1020	7030	1190	8200	–	–	–	–	–	–
–	–	1190	8200	1390	9580	–	–	–	–	–	–
–	–	1360	9380	1580	10890	–	–	–	–	–	–
–	–	1520	10480	1780	12270	–	–	1500	10340	1800	12410
–	–	1700	11720	1980	13650	–	–	–	–	–	–
–	–	1870	12890	2180	15030	–	–	–	–	–	–
–	–	2040	14070	2380	16410	–	–	–	–	–	–
–	–	2350	16200	2740	18890	–	–	2300	15860	2700	18620
–	–	2800	19310	2800	19310	–	–	–	–	–	–
–	–	2800	19310	2800	19310	–	–	–	–	–	–
–	–	2800	19310	2800	19310	–	–	–	–	–	–

ASTM Std. A53 /API 5L/A-106 SEAMLESS STEEL PIPE

Available Sizes (Dimensions and Weights) and Mill Hydraulic Test

NPS Designator	Outside Diameter		Wall Thickness		Weight Class	Schedule No.	Weight		
	in.	mm	in.	mm			lb/ft	kg/ft	kg/m
8	8.625	219.1	0.188	4.78	–	–	16.94	7.69	25.26
			0.203	5.16	–	–	18.26	8.29	27.22
			0.219	5.56	–	–	19.66	8.93	29.28
			0.250	6.35	–	20	22.36	10.15	33.31
			0.277	7.04	–	30	24.70	11.21	36.31
			0.312	7.92	–	–	27.70	12.58	41.24
			0.322	8.18	STD	40	28.55	12.96	42.55
			0.344	8.74	–	–	30.42	13.81	45.34
			0.375	9.52	–	–	33.04	15.00	49.20
			0.406	10.31	–	60	35.64	16.18	53.08
			0.438	11.13	–	–	38.30	17.39	57.08
			0.500	12.70	XS	80	43.39	19.70	64.64
			0.594	15.09	–	100	50.95	23.13	75.92
			0.719	18.26	–	120	60.71	27.56	90.44
			0.812	20.62	–	140	67.76	30.76	100.92
			0.875	22.22	XXS	–	72.42	32.88	107.88
			0.906	23.01	–	160	74.69	33.91	111.27
10	10.750	273.0	0.188	4.78	–	–	21.21	9.63	31.62
			0.203	5.16	–	–	22.87	10.38	34.08
			0.219	5.56	–	–	24.63	11.18	36.67
			0.250	6.35	–	20	28.04	12.73	41.75
			0.279	7.09	–	–	31.20	14.16	46.49
			0.307	7.80	–	30	34.24	15.54	51.01
			0.344	8.74	–	–	38.23	17.36	56.96
			0.365	9.27	STD	40	40.48	18.38	60.29
			0.438	11.13	–	–	48.19	21.88	71.87
			0.500	12.70	XS	60	54.74	24.85	81.52
			0.594	15.09	–	80	64.43	29.25	95.97
			0.719	18.26	–	100	77.03	34.97	114.70
			0.844	21.44	–	120	89.29	40.54	133.00
			1.000	25.40	XXS	140	104.13	47.28	155.09
			1.125	28.57	–	160	115.65	52.51	172.21
12	12.750	323.8	0.203	5.16	–	–	27.20	12.35	40.55
			0.219	5.56	–	–	29.31	13.31	43.63
			0.250	6.35	–	20	33.38	15.15	49.71
			0.281	7.14	–	–	37.42	16.99	55.75
			0.312	7.92	–	–	41.45	18.82	61.69
			0.330	8.38	–	30	43.77	19.87	65.18
			0.344	8.74	–	–	45.58	20.69	67.90
			0.375	9.52	STD	–	49.56	22.50	73.78
			0.406	10.31	–	40	53.52	24.30	79.70
			0.438	11.13	–	–	57.59	26.15	85.82
			0.500	12.70	XS	–	65.42	29.70	97.43
			0.562	14.27	–	60	73.15	33.21	108.92
			0.688	17.48	–	80	88.63	40.24	132.04
			0.844	21.44	–	100	107.32	48.72	159.86
			1.000	25.40	XXS	120	125.49	56.97	186.91
			1.125	28.57	–	140	139.68	63.41	208.00
			1.312	33.32	–	160	160.27	72.76	238.68
14	14.000	355.6	0.210	5.33	–	–	30.93	14.04	46.04
			0.219	5.56	–	–	32.23	14.63	47.99
			0.250	6.35	–	10	36.71	16.67	54.69
			0.281	7.14	–	–	41.17	18.69	61.35
			0.312	7.92	–	20	45.61	20.71	67.90
			0.344	8.74	–	–	50.17	22.78	74.76
			0.375	9.52	STD	30	54.57	24.77	81.25
			0.438	11.13	–	40	63.44	28.80	94.55
			0.469	11.91	–	–	67.78	30.77	100.94
			0.500	12.70	XS	–	72.09	32.73	107.39
			0.594	15.09	–	60	85.05	38.61	126.71
			0.750	19.05	–	80	106.13	48.18	158.10
			0.938	23.83	–	100	130.85	57.41	194.96
			1.094	27.79	–	120	150.79	68.46	224.65
			1.250	31.75	–	140	170.22	77.28	253.56
			1.406	35.71	–	160	189.11	85.86	281.70
16	16.000	406.4	0.219	5.56	–	–	36.91	16.76	54.96
			0.250	6.35	–	10	42.05	19.09	62.64
			0.281	7.14	–	–	47.17	21.42	70.30
			0.312	7.92	–	20	52.27	23.73	77.83
			0.344	8.74	–	–	57.52	26.11	85.71

Pressure

Test Pressure			
Grade A		Grade B	
psi	kPa	psi	kPa
780	5380	920	6340
850	5860	1000	6890
910	6270	1070	7380
1040	7170	1220	8410
1160	7800	1350	9310
1300	8960	1520	10480
1340	9240	1570	10820
1440	9930	1680	11580
1570	10820	1830	12620
1700	11720	2000	13790
1830	12620	2130	14690
2090	14410	2430	16750
2500	17240	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
630	4340	730	5030
680	4690	800	5520
730	5030	860	5930
840	5790	980	6760
930	6410	1090	7520
1030	7100	1200	8270
1150	7930	1340	9240
1220	8410	1430	9860
1470	10140	1710	11790
1670	11510	1950	13440
1990	13720	2320	16000
2410	16620	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
570	3930	670	4620
620	4270	720	4960
710	4900	820	5650
790	5450	930	6410
880	6070	1030	7100
930	6410	1090	7520
970	6690	1130	7790
1060	7310	1240	8550
1150	7930	1340	9240
1240	8550	1440	9930
1410	9720	1650	11380
1590	10960	1850	12760
1940	13380	2270	15650
2390	16480	2780	19170
2800	19310	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
540	3720	630	4340
560	3860	660	4550
640	4410	750	5170
720	4960	840	5790
800	5520	940	6480
880	6070	1030	7100
960	6620	1120	7720
1130	7790	1310	9030
1210	8340	1410	9720
1290	8890	1500	10340
1530	10550	1790	12340
1930	13310	2250	15510
2410	16620	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
490	3380	570	3930
560	3860	660	4550
630	4340	740	5100
700	4830	820	5650
770	5310	900	6210

Note:
○Sizes outside the above size range are on an inquiry basis.

ASTM Std. A53 /API 5L/A-106 SEAMLESS STEEL PIPE

Available Sizes (Dimensions and Weights) and Mill Hydraulic Test

NPS Designator	Outside Diameter		Wall Thickness		Weight Class	Schedule No.	Weight		
	in.	mm	in.	mm			lb/ft	kg/ft	kg/m
16	16.000	406.4	0.375	9.52	STD	30	62.58	28.41	93.17
			0.438	11.13	–	–	72.80	33.05	108.49
			0.469	11.91	–	–	77.79	35.32	115.86
			0.500	12.70	XS	40	82.77	37.58	123.30
			0.656	16.66	–	60	107.50	48.81	160.12
			0.844	21.44	–	80	136.62	62.03	203.53
			1.031	26.19	–	100	164.82	74.83	245.56
			1.219	30.96	–	120	192.43	87.36	286.64
			1.438	36.53	–	140	223.64	101.53	333.19
			1.594	40.49	–	160	245.25	111.34	365.35
18	18.000	457.2	0.250	6.35	–	10	47.39	21.52	70.60
			0.281	7.14	–	–	53.18	24.14	79.24
			0.312	7.92	–	20	58.94	26.76	87.75
			0.344	8.74	–	–	64.87	29.44	96.66
			0.375	9.52	STD	–	70.59	32.05	105.10
			0.406	10.31	–	–	76.29	34.64	113.62
			0.438	11.13	–	30	82.15	37.30	122.43
			0.469	11.91	–	–	87.81	39.87	130.78
			0.500	12.70	XS	–	93.45	42.43	139.20
			0.562	14.27	–	40	104.67	47.52	155.87
			0.750	19.05	–	60	138.17	62.73	205.83
			0.938	23.83	–	80	170.92	77.60	254.67
			1.156	29.36	–	100	207.96	94.41	309.76
			1.375	34.92	–	120	244.14	110.84	363.64
			1.562	39.67	–	140	274.22	124.50	408.45
			1.781	45.24	–	160	308.50	140.06	459.59
20	20.000	508.0	0.250	6.35	–	10	52.73	23.94	78.55
			0.281	7.14	–	–	59.18	26.87	88.19
			0.312	7.92	–	–	65.60	29.78	97.67
			0.344	8.74	–	–	72.21	32.78	107.60
			0.375	9.52	STD	20	78.60	35.68	117.02
			0.406	10.31	–	–	84.96	38.57	126.53
			0.438	11.13	–	–	91.51	41.55	136.37
			0.469	11.91	–	–	97.83	44.41	145.70
			0.500	12.70	XS	30	104.13	47.28	155.12
			0.594	15.09	–	40	123.11	55.89	183.42
			0.812	20.62	–	60	166.40	75.55	247.83
			1.031	26.19	–	80	208.87	94.83	311.17
			1.281	32.54	–	100	256.10	116.27	381.53
			1.500	38.10	–	120	296.37	134.55	441.49
			1.750	44.45	–	140	341.10	154.86	508.11
			1.969	50.01	–	160	379.10	172.11	564.81
24	24.000	609.6	0.250	6.35	–	10	63.41	28.79	94.46
			0.281	7.14	–	–	71.18	32.32	106.08
			0.312	7.92	–	–	78.93	35.83	117.51
			0.344	8.74	–	–	86.91	39.46	129.50
			0.375	9.52	STD	20	94.62	42.96	140.88
			0.406	10.31	–	–	102.31	46.45	152.37
			0.438	11.13	–	–	110.22	50.04	164.26
			0.469	11.91	–	–	117.86	53.51	175.54
			0.500	12.70	XS	–	125.49	56.97	186.94
			0.562	14.27	–	30	140.68	63.87	209.50
			0.688	17.48	–	40	171.29	77.77	255.24
			0.938	23.83	–	–	231.03	104.89	344.23
			0.969	24.61	–	60	238.85	108.44	355.02
			1.219	30.96	–	80	296.58	134.65	441.78
			1.531	38.89	–	100	367.39	166.80	547.33
			1.812	46.02	–	120	429.39	194.94	639.58
			2.062	52.37	–	140	483.12	219.34	719.63
			2.344	59.54	–	160	542.14	246.13	807.63
26	26.000	660.4	0.250	6.35	–	–	68.75	31.21	102.42
			0.281	7.14	–	–	77.18	35.04	115.02
			0.312	7.92	–	10	85.60	38.86	127.43
			0.344	8.74	–	–	94.26	42.79	140.45
			0.375	9.52	STD	–	102.63	46.59	152.80
			0.406	10.31	–	–	110.96	50.38	165.28
			0.438	11.13	–	–	119.57	54.28	178.20
			0.469	11.91	–	–	127.88	58.06	190.46
			0.500	12.70	XS	20	136.17	61.82	202.85
			0.562	14.27	–	–	152.68	69.32	227.37

Pressure

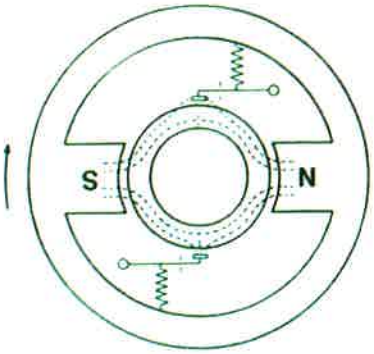
Test Pressure			
Grade A		Grade B	
psi	kPa	psi	kPa
840	5790	980	6760
990	6830	1150	7930
1060	7310	1230	8480
1120	7720	1310	9030
1480	10200	1720	11860
1900	13100	2220	15310
2320	16000	2710	18680
2740	18890	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
500	3450	580	4000
560	3860	660	4550
620	4270	730	5030
690	4760	800	5520
750	5170	880	6070
810	5580	950	6550
880	6070	1020	7030
940	6480	1090	7520
1000	6890	1170	8070
1120	7720	1310	9030
1500	10340	1750	12070
1880	12960	2190	15100
2310	15930	2700	18620
2750	18960	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
450	3100	520	3590
510	3520	590	4070
560	3860	660	4550
620	4270	720	4960
680	4690	790	5450
730	5030	850	5860
790	5450	920	6340
850	5860	950	6550
900	6210	1050	7240
1170	8070	1250	8620
1460	10070	1710	11790
1860	12820	2170	14960
2310	15930	2690	18550
2700	18620	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
380	2620	440	3030
420	2900	490	3380
470	3240	550	3790
520	3590	600	4140
560	3860	660	4550
610	4210	710	4900
660	4550	770	5310
700	4830	820	5650
750	5170	880	6070
840	5790	980	6760
1030	7100	1200	8270
1410	9720	1640	11310
1450	10000	1700	11720
1830	12620	2130	14690
2300	15860	2680	18480
2720	18750	2800	19310
2800	19310	2800	19310
2800	19310	2800	19310
350	2410	400	2760
390	2690	450	3100
430	2960	500	3450
480	3310	560	3860
520	3590	610	4210
560	3860	660	4550
610	4210	710	4900
650	4480	760	5240
690	4760	810	5580
780	5380	910	6270

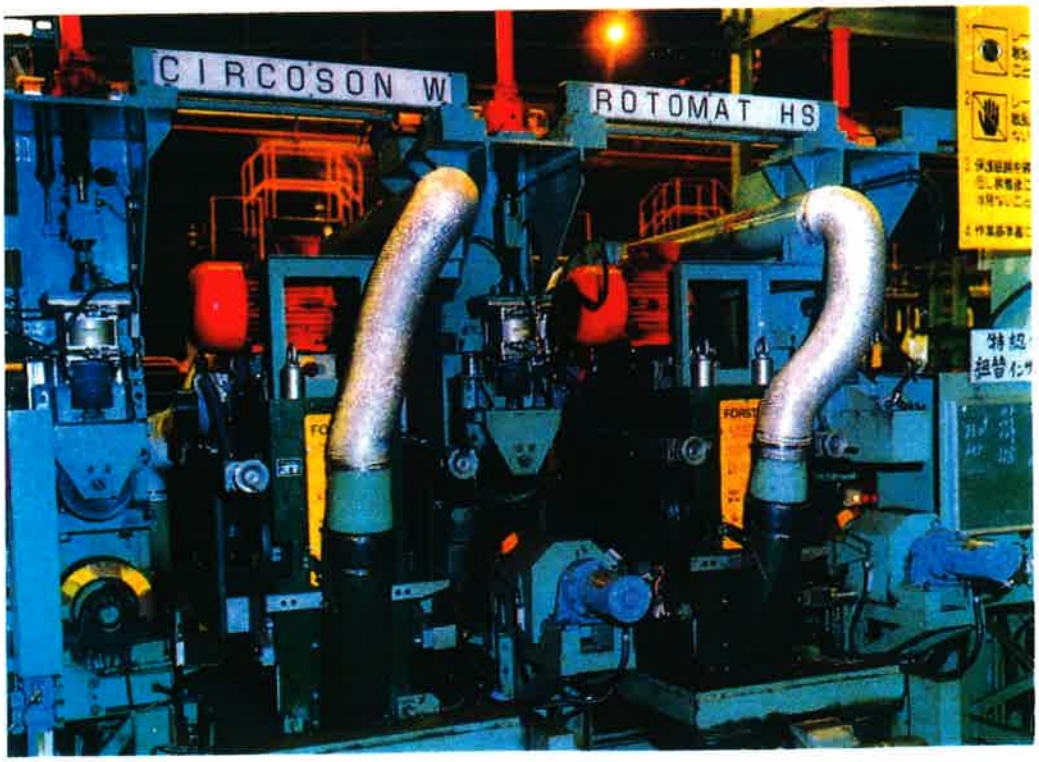
Note:
- ▭ Indicates availability subject to prior consultation.
- Sizes outside the above size range are on an inquiry basis.

· Inspection and Test

Magnetic Leakage Flux Inspection ROTOMAT

The ROTOMAT HS tests non-destructively in accordance with the magnetic constant field leakage-flux method. As they pass through the transmitter system, tubes are magnetized by two magnetization coils lying opposite each other. Also displased by 180°, two test heads with the test probe systems are located between the pole shoes which guide the magnetic field. The magnetization coils and test heads rotate around the tube as it moves through the transmitter system, the test probes continuously scan the tube surface helically. The leakage flux caused at flaw locations is picked up by the test probes and passed on to the testing electronics equipment for evaluation.



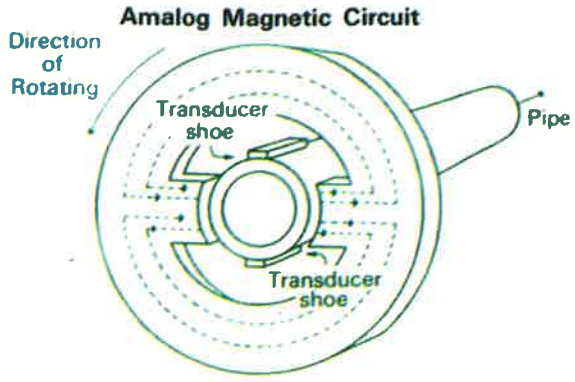


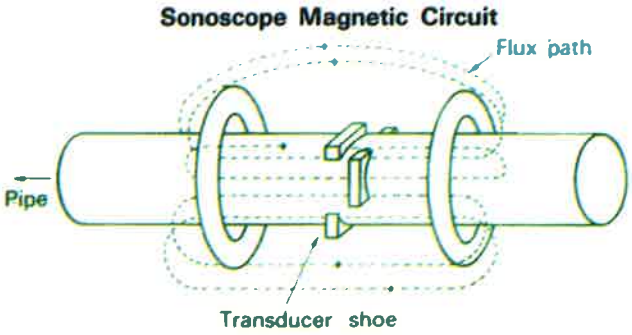
Electromagnetic Inspection Amalog-Sonoscope

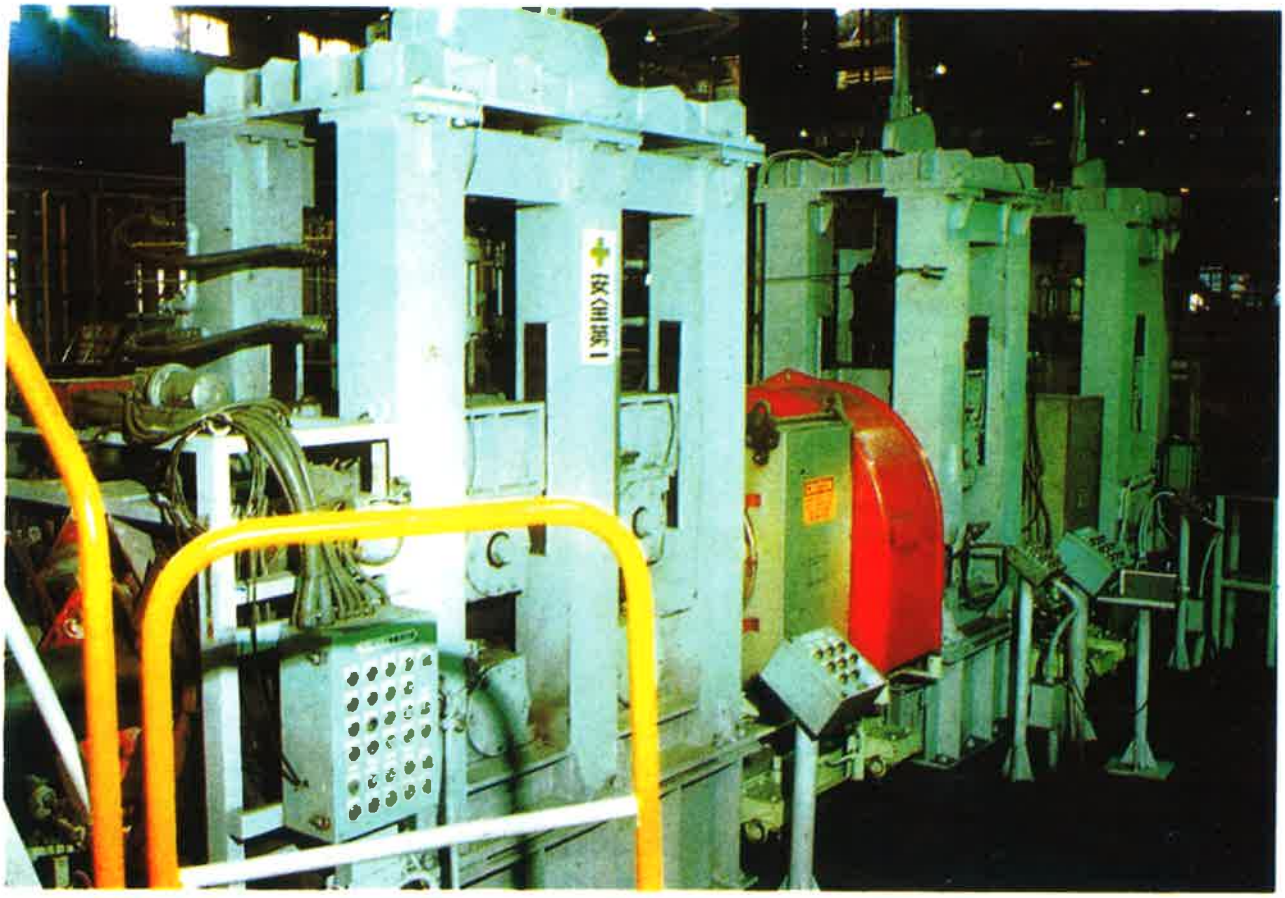
NKK's plug mill is equipped with an Amalog-Sonoscope, electromagnetic inspection unit.

The Amalog-Sonoscope pipe inspection system detects defects using flux leakage induced by electromagnetic induction in the search coil.

Amalog magnenetic circuits detect longitudinal defects in both the inside and outside surfaces. Sonoscope magnetic circuits detect circumferential defects.



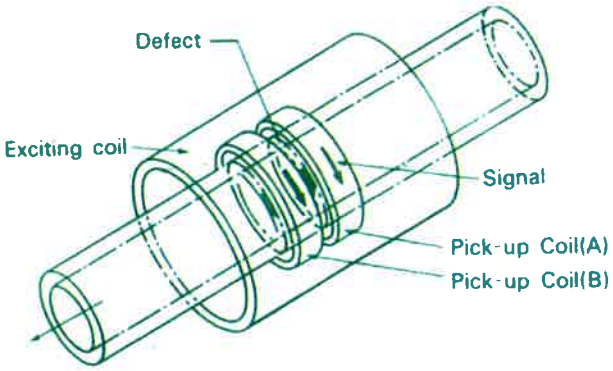


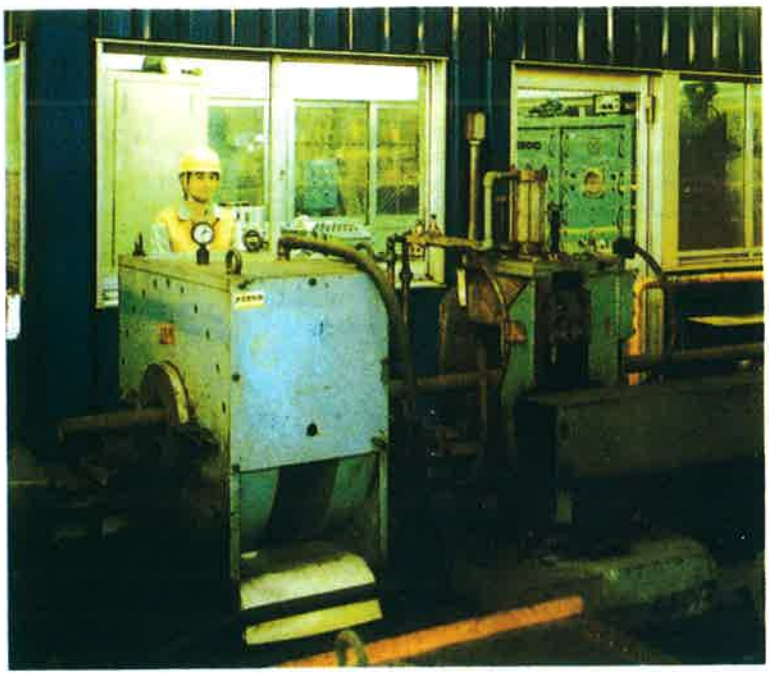


Eddy Current Inspection

A test coil assembly forcibly generates a strong eddy current in the tube section under test. the presence of flaws disturbs the eddy current and is sensed by a detecting coil.

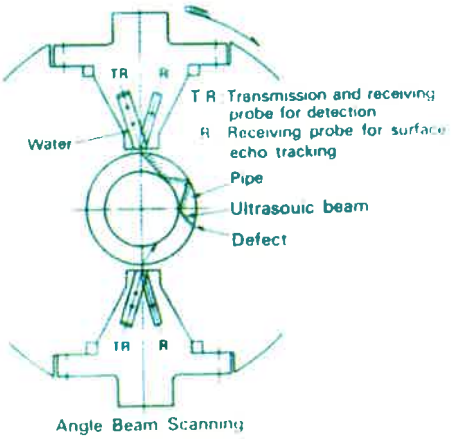
The apparatus is equipped with an automatic warning, marking and recording systems.



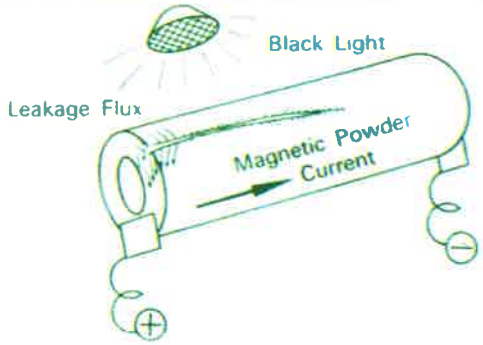


Rotary probe Ultrasonic Inspection

Ultramodern rotating rotor type automated ultrasonic testing system using the pulse reflection method was installed. This system enables high-accuracy and high-efficiency inspection of axial defects and circumferential defects on the inner and outer surfaces of seamless tube and in the tube wall. By use of the staight-beam probe provided in the same rotating probe device, wall thickness checking and lamination inspection can be made continuously. As a series of these NDT systems is highly efficient and highly accurate, it holds an extremely important position among quality assurance systems.

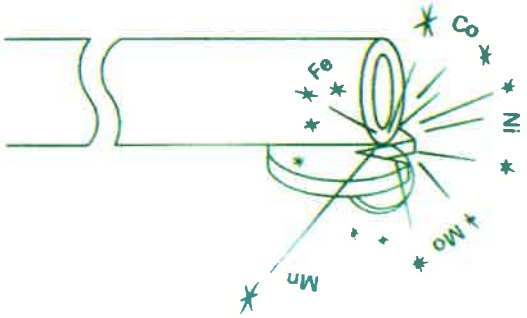


Magnetic Particle Inspection

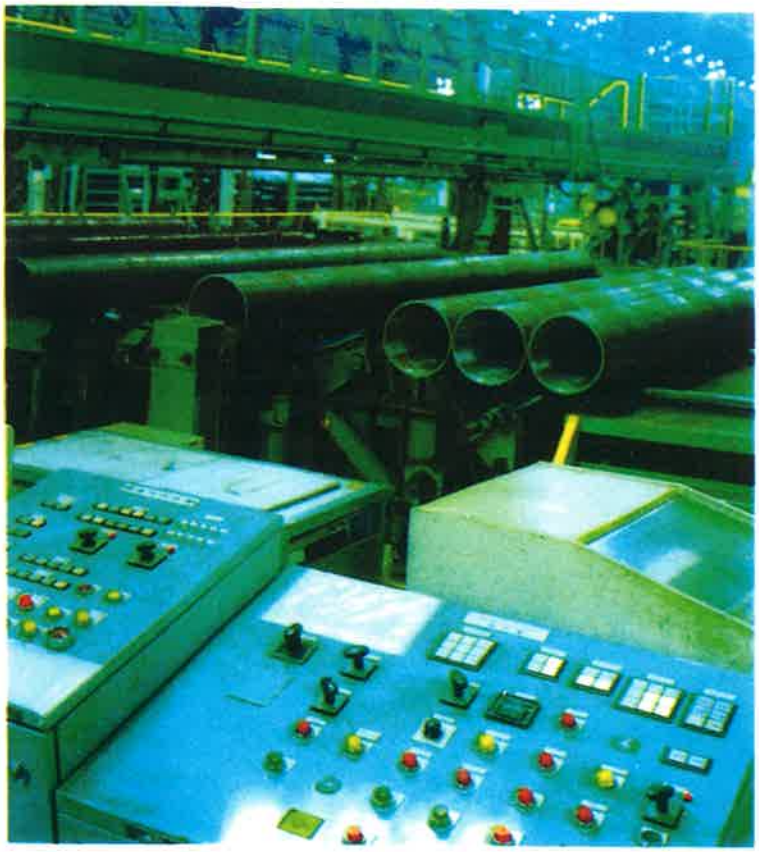


The tube is magnetized and provided with magnetic particles (mostly fluorescent magnetic particles). The presence of flaws creates a magnetic flux which shows changes in fluorescent brilliance under black light. The change is detected visually.

Spectro-Chemical Analysis



The tube is subjected to arc discharge. Sparks created by this method have their own spectrums according to the metal elements. Such spectrums are analysed to determine the chemical composition of the tube, quantitatively and qualitatively.



Hydrostatic Test

Each length of tube is subjected to hydrostatic test.

Information Required with Enquiries & Orders

It is desired that the following information be included in enquiries and orders.

1. Type of tube and applicable specification
2. Dimensions (Nominal or outside diameter, wall thickness, length. In case of requirements other than those stipulated in internationally recognized specifications, dimensional tolerances.)
3. Quantity (total length or number of tubes and total weight)
4. Intended end use and service conditions in detail.
5. Manufacturing method (hot finished seamless, cold finished seamless or electric induction welded)
6. Tube end finish (plain, threaded, beveled or upset)
7. Inspection (mill inspection or third party's inspection)
8. Shipping destination
9. Other information including marking, coating and packaging.

Cat. No. 141−035

NKK SEAMLESS PIPE AND TUBE

NKK CORPORATION

HEAD OFFICE
1-1-2 Marunouchi, Chiyoda-ku, Tokyo 100-8202, Japan
Seamless Pipe Export Dept
Tel:03(3217)2232 Fax:03(3214)8419
Product Design and Quality Control, Seamless Pipe
Tel:044(322)1036 Fax:044(322)1649

Overseas Offices & Affiliates

〈Asia〉

Beijing
NKK CORPORATION Beijing Office
1720, Beijing Fortune Building, Chaoyang District,
Beijing, People's Republic of China.
Tel: 86-10-6590-9051 Fax: 86-10-6590-9056

Shanghai
NKK CORPORATION Shanghai Office
Room 208, Shanghai International Trade Centre, Shanghai 200335
People's Republic of China
Tel: 86-21-6270-1980 Fax: 86-21-6270-1977

Taipei
NKK CORPORATION Taipei Office
502B 5th Floor, Chia Hsin Bldg. No.96, Sec. 2,
Chung Shan North Rd., Taipei, Taiwan,
Tel: 886-2-2537-1369 Fax: 886-2-2537-1344

Hong Kong
NKK CORPORATION Hong Kong Office
402 Fairmont House, 8 Cotton Tree Drive, Central,
Hong Kong Special Administrative Region, People's Republic of China
Tel: 852-2810-0604 Fax: 852-2810-4262

Bangkok
NKK CORPORATION Bangkok Regional Office
11 th Floor, Ramaland Building, 952 Rama IV Rd.,
Bangrak, Bangkok 10500, Thailand
Tel: 66-2-6329270 Fax: 66-2-6329272

Yangon
NKK YANGON BRANCH
Yuzana Tower, 3rd Floor, 189/195 Pansodan St., Kyaukdadar
Township, Yangon, MYANMAR
Tel/Fax: 95-1-243125

Singapore
NKK CORPORATION Singapore Office
78 Shenton Way #15-03 S-079120, Republic of Singapore
Tel: 65-221-7277 Fax: 65-224-4568

Jakarta
JAKARTA REPRESENTATIVE OF NKK CORPORATION
Midplaza II, 17th Floor, JL. Jend. Sudirman, KAV.10-11.
Jakarta 10220 INDONESIA
Tel: 62-21-5707572 Fax: 62-21-5703294 Telex: 65637(PMK IA)

〈Middle East〉

Al-Khobar
NKK CORPORATION Al-Khobar Office
P.O.BOX 216, Dhahran Airport 31932, Saudi Arabia
Tel: 966-3-857-6284 Fax: 966-3-857-7084

〈Europe〉

London
NKK EUROPE LTD London Office
4th Floor, West Block, 11 Moorfields, High Walk,
London EC2Y 9DE, U.K.
Tel: 44-171-628-2161 Fax: 44-171-638-1374
Telex: 886310(NKK LN G) 887602(NKK LN G)

Düsseldorf
NKK EUROPE LTD Düsseldorf Office
Immermannstrasse 43, 40210 Düsseldorf, Germany
Tel: 49-211-353481 Fax: 49-211-361-3589

Amsterdam
NKK NETHERLANDS B.V.
Transpolis Commerce Center Polarisavenue 83A
P.O. Box 2033 2130 GE Hoofddorp THE NETHERLANDS
Tel: 31-23-568-5060 Fax: 31-23-568-5069

〈North America〉

New York
NKK AMERICA INC. New York Office
450 Park Avenue, New York, N.Y. 10022, U.S.A.
Tel: 1-212-826-6250 Fax: 1-212-826-6358
Telex: 233495(NKK UR)

Washington
NKK AMERICA INC. Washington D.C.Branch Office
1215 17th Street, N.W., Washington D.C.20036, U.S.A.
Tel: 1-202-467-8010 Fax: 1-202-452-8075

Vancouver
NKK CORPORATION Vancouver Office
P.O.Box 49168, Four Bentall Centre, Suite 3394-1055
Dunsmuir Street, Vancouver, B.C.V7X-1J1, Canada
Tel: 1-604-687-0091 Fax: 1-604-688-7020

〈Central & South America〉

Mexico City
NKK CORPORATION DE MEXICO S.A.
Homero 136-703 Col. Chapultepec Morales
C.P. 11570 Mexico D.F. Mexico
Tel: 52-5-531-7492 Fax: 52-5-531-7494

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