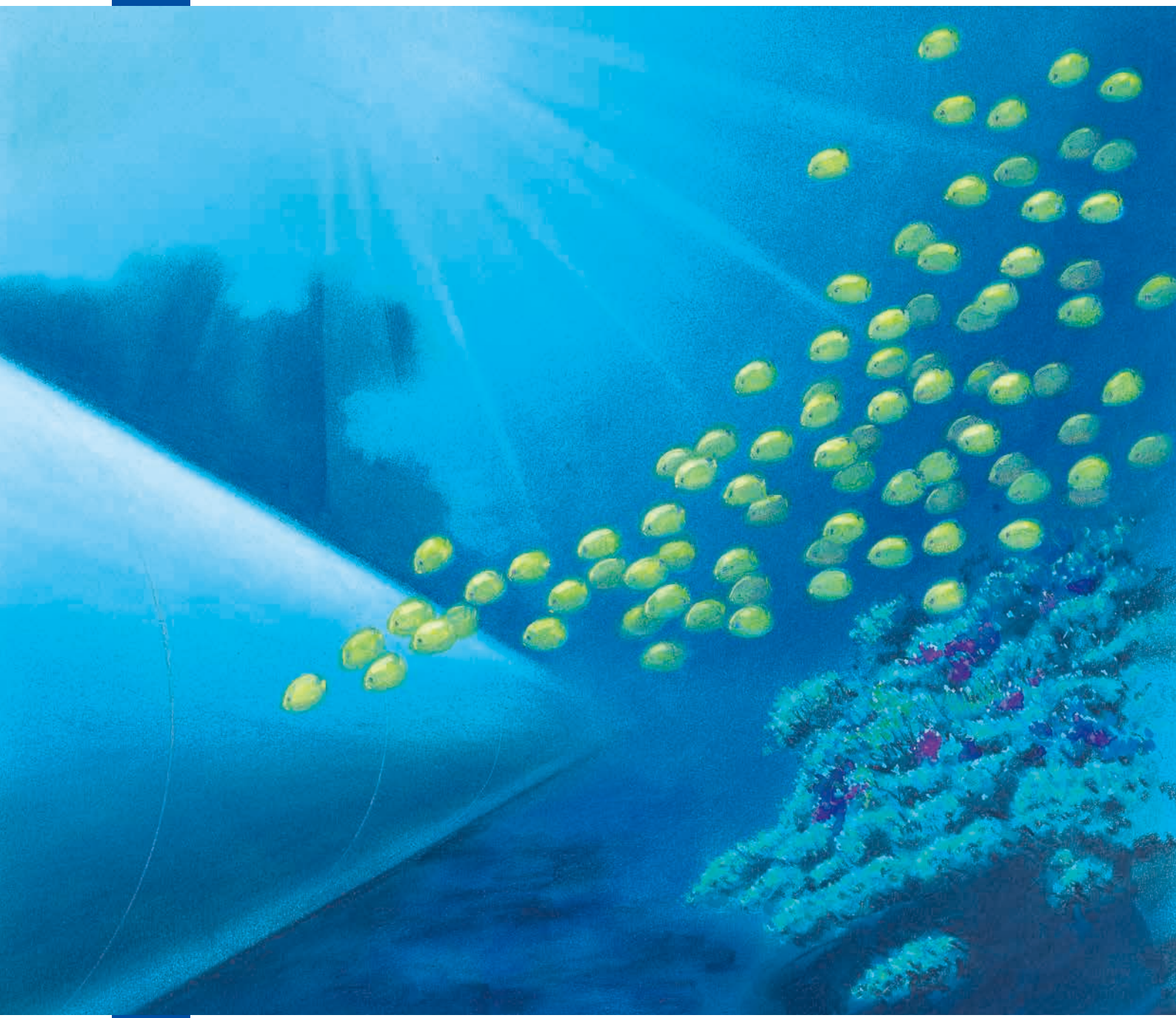
JFE

JFE LINE PIPE



JFE Steel Corporation

Introduction

JFE Steel Corporation, one business segment of JFE group, is a world leading steel making company in Japan.
Under the policy of prioritizing the global environment and human safety,
JFE Steel Corporation produces various steel products based on the worldwide superior quality
control system certified by ISO 9001 and API Q1 standards.
JFE Steel Corporation has the world's most innovative technology,
processing equipment and promotes R&D challenges.
JFE Steel Corporation's facilities include 2 integrated Steel works-one in Western Japan;
West Japan Works (Fukuyama) and (Kurashiki), the other in Eastern Japan near Tokyo;
East Japan Works (Chiba) and (Keihin),
and specialized pipe and tube production mill in middle Japan (Chita Works).
JFE Line Pipe is manufactured at these works in high volume, and high quality.
Products available include UOE (Straight seam double submerged arc welded pipe),
HFW (High frequency welded pipe), SMLS (Seamless pipe) and many other products
made by various manufacturing processes.
This catalogue introduces JFE Line Pipe made by each of these processes,
with information on material preparation, pipe manufacturing, testing & inspection, coating and shipping.

CONTENT

Features of JFE Line Pipe

1 Package Supply Available in Wide Size Range and Large Quantity

JFE Line Pipe can be supplied with such varieties as UOE Pipe, High Frequency Welded (HFW) Pipe and Seamless Pipe (SMLS), realizing high availability in a wide size range and in large quantity.

UOE : available from 16in. up to 64in. OD (world's largest)
HFW : available up to 26in. OD, with wall thickness up to 1in. (world's largest)
SMLS : available up to 16-3/4in. OD

Note : 64in. OD over and heavy wall thickness can be supplied as Press Bending and Roll Bending Procees.

2 Excellent Quality and Abundant Variety

JFE can supply superior Quality High strength, High Toughness, Homogeneous material and Corrosion Resistant Line Pipes for various special service such as offshore and sour services.

UOE line pipe can be supplied as high strength line pipe up to Grade X100, and high toughness line pipe for low-temperature services and corrosive gas or crude oil service.

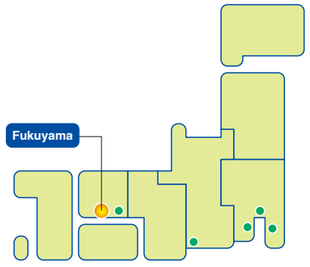
HFW line pipe can be supplied as high strength API grade line pipe up to 5L X80, and high grade line pipe for sour gas service and offshore service.

SMLS line pipe can be supplied with corrosion resistant alloy pipe (Martensitic Stainless Steel 12% Cr Line Pipe) and high strength API grade line pipe up to 5L X80 for crude oil, gas, water and slurry service.

JFE Works

West Japan Works (Fukuyama)

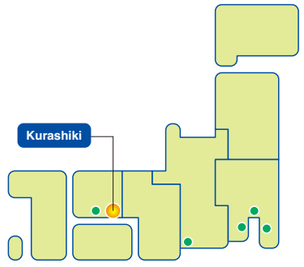
West Japan Works (Fukuyama) has the largest capacity of any integrated steelworks in the world.
Since construction in 1965, Fukuyama continues to set the pace in introducing new concepts in steelmaking and environmental protection.

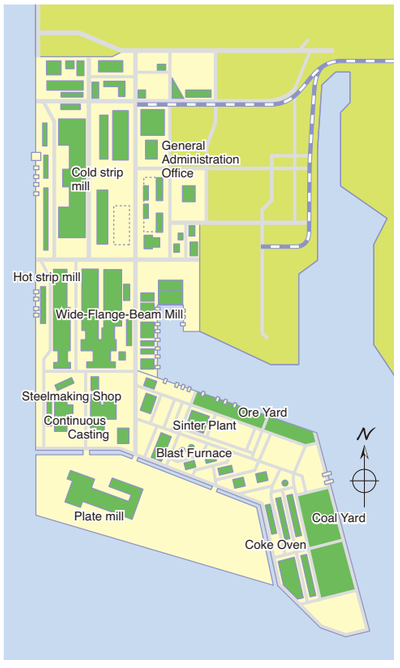


Plant Area : 3,514 acres (14,220,000m^2)

West Japan Works (Kurashiki)

With its start in 1960, Kurashiki is particularly noted for its most advanced production system supported by highly sophisticated computerization and rational plant arrangement.
Kurashiki efficiently produces a great variety of steel products with the best technology and energy conservation promoting recirculation of natural resources.

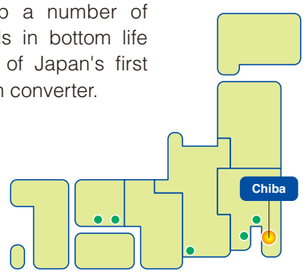




Plant Area : 2,795 Acres (11,310,000m^2)

East Japan Works (Chiba)

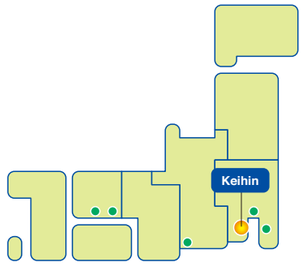
Built in 1951, Chiba played a brilliant role as a new leading force more than 50 years, especially in the modernization of the steel industry.
With equipment modernization and rationalization efforts continuing to keep abreast with the times, Chiba maintains a stable production level backed by care for environmental preservation.
Challenging a new role of lifting the horizon of steelmaking technology, Chiba has established in its steel making shop a number of world records in bottom life and hit rate of Japan's first bottom blown converter.

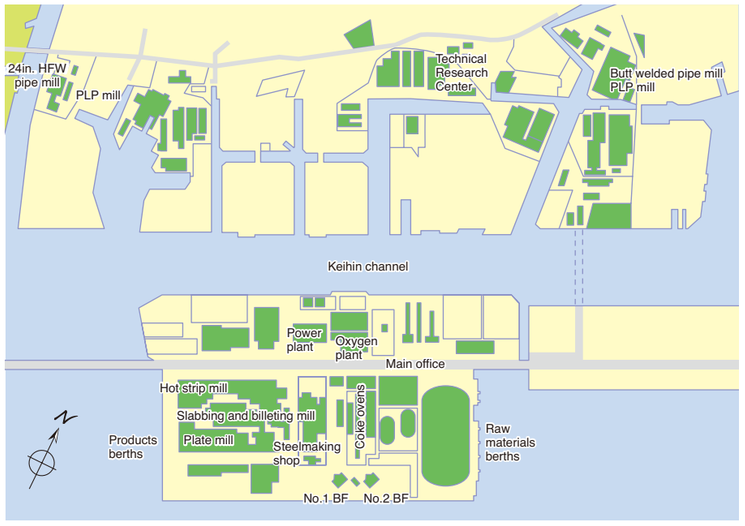


Plant Area 2,035 acres (8,235,000m^2)

East Japan Works (Keihin)

The Ohgisima Complex at Keihin was designed and built in the 1970s with the latest equipment for energy conservation and comprehensive environmental protection.
Computer control is used at unprecedented levels with the best known technology incorporated at every production stage.

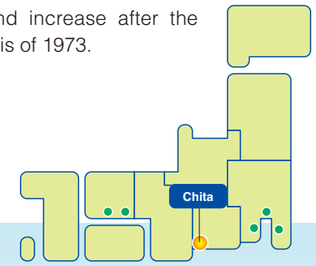




Plant Area 2,333 Acres (9,440,000m^2)

Chita Works

Established in 1943 primarily for special steel production, this Works used to manufacture only high-grade iron and steel castings.
In 1961, a spiral weld pipe mill was added to meet a growing demand for steel pipe and tubes, paving the way for various other pipe mills to be built here in succeeding years equipped with complete mass production systems for all kinds of pipe and tubular products, Chita today is one of the foremost tubular products centers in the world.
It supplies high-grade OCTG and other products for which the demand increase after the oil crisis of 1973.



Plant Area 577 acres (2,340,000m²)

Facts About JFE Steel Corporation

Integrated Steelmaking Complexes

Annual crude steel capacity	30.3 million metric tons
West Japan Works	
(Fukuyama)	12.6 million metric tons
(Kurashiki)	9.6 million metric tons
East Japan Works	
(Chiba)	4.1 million metric tons
(Keihin)	4.0 million metric tons

Annual Production Capacity by Major Products

Submerged arc welded pipe	1,320,000 metric tons
High frequency welded tubular products	940,000 metric tons
Butt-welded pipe	360,000 metric tons
Seamless tubular products	912,000 metric tons
Heavy and medium plates	5,570,000 metric tons
Hot rolled sheets and coils	21,800,000 metric tons
Cold rolled sheets and coils	11,048,000 metric tons
Surface-treated sheets and coils	5,558,000 metric tons
Wide flange beam, sheet piling, rails, bars, wire rods	3,330,000 metric tons

Production Capacity of Welded Pipe and Seamless Pipe

Mill	Production Capacity (t./yr.)	Pipe OD Min.-Max., in. (mm)	Mill Location
UOE Pipe Mill	540,000	20 (508.0) ～64 (1,626.0)	Chiba
	580,000	15.7 (400) ～56 (1422.0)	Fukuyama
Spiral Weld Pipe Mill	120,000	15.7 (400) ～102.4 (2600)	Chiba
	80,000	23.6 (600) ～100 (2540.0)	Fukuyama
High Frequency Weld Pipe Mill	640,000	0.840 (21.3) ～26 (660.0)	Chita
	300,000	7.5 (190.7) ～24 (610.0)	Keihin
Continuous Butt Weld Pipe Mill	360,000	0.840 (21.3) ～4 1/2 (114.3)	Keihin
Seamless Pipe Mills	912,000	1.000 (25.4) ～16 3/4 (426.0)	Chita

Size Availability

Size range for products

CARBON STEEL PIPE

UOE Pipe

Pipe length: 12.2m (40ft)

O.D. (in.)	O.D. mm	Wall thickness in.	0.24	0.25	0.28	0.31	0.34	0.38	0.41	0.44	0.47	0.50	0.56	0.63	0.69	0.75	0.81	0.88	0.94	1.00	1.06	1.13	1.19	1.25	1.31	1.34	1.38	1.42	1.44	1.50	1.56	1.63	1.69	1.75	1.88	2.00	Wall thickness mm	O.D. (in.)
		mm	6.0	6.4	7.1	7.9	8.7	9.5	10.3	11.1	11.9	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8	25.4	27.0	28.6	30.2	31.8	33.3	34.1	34.9	36.1	36.5	38.1	39.7	41.3	42.9	44.5	47.7	50.8		
16	406.4		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	○																				406.4	16
18	457.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	△	□	□	□	□													457.0	18
20	508.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	○	△	□	□	□	◇	◇	◇	◇								508.0	20
21	533.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	○	○	△	□	□	□	□	◇	◇								533.0	21
22	559.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	○	○	△	□	□	□	◇	◇								559.0	22
24	610.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	○	○	△	△	△	△	□	□	◇	◇	◇	▽	▽	610.0	24
26	660.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	○	△	△	△	△	□	□	□	◇	◇	▽	▽	660.0	26
28	711.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	○	○	△	△	△	□	□	□	◇	◇	▽	▽	711.0	28
30	762.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	○	○	△	△	□	□	□	◇	▽	▽	762.0	30
32	813.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	◇	▽	▽	813.0	32
34	864.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	◇	▽	▽	864.0	34
36	914.0		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□	▽	▽	914.0	36
38	965.0				☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□	▽	▽	965.0	38
40	1016.0				☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□	▽	▽	1016.0	40
42	1067.0				☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□	▽	▽	1067.0	42
44	1118.0					☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□	▽	▽	1118.0	44
46	1168.0						☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□	▽	▽	1168.0	46
48	1219.0						☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□	▽	▽	1219.0	48
50	1270.0								☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□			1270.0	50
52	1321.0							☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□			1321.0	52
54	1372.0									☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□	□			1372.0	54
56	1422.0									☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□	□				1422.0	56
58	1473.0										☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□	□					1473.0	58
60	1524.0										☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△	□						1524.0	60
62	1575.0											☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△							1575.0	62
64	1626.0											☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	◎	◎	◎	○	○	△							1626.0	64

Note 1 ☆ Gr.×80 ◎ Gr.×70 ○ Gr.×65 △ Gr.×60 □ Gr.×52 ◇ Gr.×42 ▽ Gr.5LA
(×○○: minimum specified yield strength, ksi)
2 Available length: 60ft (18.3m) length
3 Please consult with us about production ability before placing an order or at an inquiry, when any of the following pipes are required.
1) Heavy wall thickness pipes (t≧1.250in. For 22in. O.D., t≧1.562in. For 24in. O.D. and larger)
2) Long length pipe having an unit weight of around 19 ton or larger
3) Critical grade pipe of thicker side in the above table, having a length over 40ft
4) Pipe in intermediate wall thickness and out side diameter.

HFW Pipe

O.D. (in.)	Wall thickness mm	in.	0.083	0.109	0.115	0.126	0.134	0.141	0.145	0.154	0.156	0.173	0.177	0.188	0.193	0.203	0.219	0.237	0.250	0.258	0.281	0.300	0.312	0.318	0.331	0.344	0.375	0.406	0.438	0.469	0.500	0.531	0.562	0.594	0.625	0.635	0.688	0.719	0.750	0.812	0.844	0.875	0.938	1.000	Wall thickness mm	O.D. (in.)
		mm	2.1	2.8	2.9	3.2	3.4	3.6	3.7	3.9	4.0	4.4	4.5	4.8	4.9	5.2	5.6	6.0	6.4	6.6	7.1	7.6	7.9	8.1	8.4	8.7	9.5	10.3	11.1	11.9	12.7	13.5	14.3	15.1	15.9	16.1	17.5	18.3	19.1	20.6	21.4	22.2	23.8	25.4		
0.840	21.3																																												21.3	0.840
0.854	21.7																																													21.7	0.854
1.050	26.7																																													26.7	1.050
1.071	27.2																																													27.2	1.071
1.315	33.4		◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇																											33.4	1.315
1.339	34.0		◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇																											34.0	1.339
1.660	42.2		◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇																			42.2	1.660
1.681	42.7		◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇																			42.7	1.681
1.900	48.3		◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇																			48.3	1.900
1.913	48.6		◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇																			48.6	1.913
2.375	60.3		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇																	60.3	2.375
2.382	60.5		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇																	60.5	2.382
2.875	73.0		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇	◇	◇	◇	◇																	73.0	2.875
3.000	76.3		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇	◇	◇	◇	◇																	76.3	3.000
3.500	88.9		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇	◇	◇	◇	◇	◇															88.9	3.500
3.508	89.1		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇	◇	◇	◇	◇	◇															89.1	3.508
4.000	101.6		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇	◇	◇	◇															101.6	4.000
4.500	114.3		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇	◇															114.3	4.500
5.504	139.8		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇															139.8	5.504
5.563	141.3		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇	◇	◇															141.3	5.563
6.504	165.2		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇															165.2	6.504
6.625	168.3		◇	◇	◇	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	◇	◇															168.3	6.625
8.516	216.3					◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○	○										216.3	8.516
8.625	219.1					◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○	○										219.1	8.625
10.528	267.4					○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○										267.4	10.528
10.750	273.1					○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○										273.1	10.750
12.539	318.5					◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	□	□	◇							318.5	12.539
12.750	323.8					◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	⬠	⬠	◇							323.8	12.750
13.375	339.7					◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	⬠	⬠	◇							339.7	13.375
14.000	355.6					□	□	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○	⬠	⬠	◇	◇				355.6	14.000
16.000	406.4					□	□	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○	⬠	⬠	⬠	◇				406.4	16.000
18.000	457.0					□	□	□	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	⬠	⬠	⬠	⬠				457.0	18.000
18.625	473.1					□	□	□	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	⬠	⬠	⬠	⬠				473.1	18.625
20.000	508.0								◇	◇	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	⬠	⬠	⬠	⬠	⬠			508.0	20.000
20.866	530.0								◇	◇	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	⬠	⬠	⬠	⬠	⬠			530.0	20.866
22.000	559.0									◇	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	⬠	⬠	⬠	⬠			559.0	22.000
24.000	610.0										○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	⬠	⬠	⬠	⬠			610.0	24.000
26.000	660.0										○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	⬠	⬠	⬠	⬠			660.0	26.000

Note 1 ◎ Gr.×70 ○ Gr.×65 ⬠ Gr.×56 □ Gr.×52 ◇ Gr.(×42×○○: minimum specified yield strength, ksi)

2 Available length: 18ft (5.5m) to 66ft (20m)

3 Please consult with us about production ability before placing an order or at an inquiry, when any of the following pipes are required.

1) Pipe in intermediate wall thickness and out side diameter.

2) Grade ×80.

3) Special requirement at low temperature toughness, sour gas use and critical hydrostatic test.

Seamless Pipe

O.D. (in.)	Wall thickness mm	in.	0.079	0.091	0.094	0.102	0.114	0.118	0.130	0.134	0.138	0.157	0.188	0.197	0.236	0.250	0.268	0.276	0.295	0.311	0.315	0.354	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748	0.787	0.984	1.181	1.260	1.378	1.575	1.772	1.969	Wall thickness mm	O.D. (in.)
		mm	2.0	2.3	2.4	2.6	2.9	3.0	3.3	3.4	3.5	4.0	4.8	5.0	6.0	6.4	6.8	7.0	7.5	7.9	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	25.0	30.0	32.0	35.0	40.0	45.0	50.0		
0.748	19.0		■	■	■	■	■	■	■	■	■																														19.0	0.748
0.750	19.1		■	■	■	■	■	■	■	■	■																														19.1	0.750
0.839	21.3																																								21.3	0.839
0.843	21.4		■	■	■	■	■	■	■	■	■	■	■																													21.4	0.843
0.854	21.7		■	■	■	■	■	■	■	■	■	■	■																													21.7	0.854
0.906	23.0		■	■	■	■	■	■	■	■	■	■	■																													23.0	0.906
0.984	25.0		■	■	■	■	■	■	■	■	■	■	■																													25.0	0.984
0.990	25.2		■	■	■	■	■	■	■	■	■	■	■																													25.2	0.990
1.000	25.4			■	■	■	■	■	■	■	■	■	■	■	■	■	■																									25.4	1.000
1.051	26.7																																									26.7	1.051
1.071	27.2			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																							27.2	1.071
1.252	31.8			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																					31.8	1.252
1.315	33.4				■																		■	■	■																	33.4	1.315
1.339	34.0				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																	34.0	1.339
1.496	38.0					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																38.0	1.496
1.500	38.1					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																38.1	1.500
1.575	40.0					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																40.0	1.575
1.654	42.0					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																42.0	1.654
1.661	42.2					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																42.2	1.661
1.681	42.7					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																42.7	1.681
1.772	45.0					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											45.0	1.772
1.902	48.3					■																																				48.3	1.902
1.913	48.6					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											48.6	1.913
2.000	50.8						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											50.8	2.000
2.008	51.0						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											51.0	2.008
2.216	54.0						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											54.0	2.216
2.244	57.0						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											57.0	2.244
2.248	57.1						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											57.1	2.248
2.374	60.3						■																																			60.3	2.374
2.382	60.5						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											60.5	2.382
2.500	63.5								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											63.5	2.500
2.874	73.0																																									73.0	2.874
3.004	76.3										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										76.3	3.004
3.500	88.9										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									88.9	3.500
3.508	89.1										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									89.1	3.508
3.669	93.2										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									93.2	3.669
4.000	101.6										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							101.6	4.000
4.500	114.3										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							114.3	4.500
5.000	127.0										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							127.0	5.000
5.118	130.0										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							130.0	5.118
5.236	133.0										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							133.0	5.236
5.374	136.5										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							136.5	5.374
5.504	139.8										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							139.8	5.504
5.563	141.3											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							141.3	5.563
6.504	165.2											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						165.2	6.504
6.620	168.3											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						168.3	6.620
7.000	177.8											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						177.8	7.000
7.508	190.7												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					190.7	7.508
7.626	193.7												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					193.7	7.626
7.657	194.5												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					194.5	7.657
8.516	216.3													■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			216.3	8.516
8.626	219.1																																										219.1	8.626
9.134	232.0														■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			232.0	9.134
9.626	244.5														■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			244.5	9.626
10.000	254.0														■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			254.0	10.000
10.528	267.4														■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			267.4	10.528
10.752	273.1																																										273.1	10.752
11.791	299.5															■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			299.5	11.791
12.539	318.5															■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			318.5	12.539
12.748	323.8															■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			323.8	12.748
13.374	339.7																			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			339.7	13.374
14.000	355.6																			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			355.6	14.000
16.000	406.4																			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			406.4	16.000
16.496	419.0																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			419.0	16.496
16.772	426.0																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			426.0	16.772

Note 1 ■ schedule size
2 ■ cold drawn size
3 Available grade is up to ×80
4 Please consult with us about production ability before placing an order or at an inquiry, when any of the following pipes are required.
1) Pipe in intermediate wall thickness and out side diameter.
2) X grade.
3) Special requirement at low temperature toughness, sour gas use and critical hydrostatic test.

CARBON STEEL PIPE

Bending Pipe

O.D. (in.)	Wall thickness mm	in.	0.394	0.787	11.811	1.575	1.969	2.362	2.756	3.150	3.150	3.543	3.937	4.331	4.724	5.118	5.512	5.906	Wall thickness mm	O.D. (in.)
	200																		200	
8	216.3																		216.3	8
10	267.4		L. MAX. 6m																267.4	10
	300																		300	
12	318.5																		318.5	12
14	355.6																		355.6	14
	400					L. MAX. 8m													400	
16	406.4																		406.4	16
18	457.0																		457.0	18
	500																		500	
20	508.0				L. MAX. 9m														508.0	20
22	559.0		L. MAX. 12m																559.0	22
	600						L. MIN. 9m												600	
24	610.0						MAX. 12m												610.0	24
26	660.0																		660.0	26
	700																		700	
28	711.0																		711.0	28
30	762.0																		762.0	30
	800																		800	
32	813.0																		813.0	32
34	854.0																		854.0	34
	900																		900	
36	914.0		L. MAX. 15m																914.0	36
38	965.0								L. MIN. 6m										965.0	38
	1000							L. MIN. 9m	MAX. 9m					L. MIN. 3m					1000	
40	1016.0							MAX. 12m						MAX. 6m					1016.0	40
42	1067.0																		1067.0	42
	1100																		1100	
44	1118.0																		1118.0	44
46	1168.0																		1168.0	46
	1200																		1200	
48	1219.0																		1219.0	48
	1300																		1300	
52	1321.0																		1321.0	52
54	1372.0																		1372.0	54
	1400																		1400	
56	1422.0																		1422.0	56
	1500																		1500	
60	1524.0																		1524.0	60
	1600				L. MAX. 12m														1600	
64	1625.0																		1625.0	64
66	1676.0																		1676.0	66
	1700																		1700	
68	1727.0																		1727.0	68
	1800																		1800	
72	1829.0																		1829.0	72
	1900																		1900	
76	1930.0																		1930.0	76
	2000																		2000	
80	2032.0																		2032.0	80
	2100																		2100	
84	2134.0																		2134.0	84
	2200																		2200	
88	2235.0																		2235.0	88
	2300																		2300	
92	2337.0																		2337.0	92
	2400																		2400	
96	2438.0				L. MAX. 4m														2438.0	96
	2500																		2500	
100	2540.0																		2540.0	100
	2600																		2600	
104	2642.0																		2642.0	104
	2700																		2700	
108	2743.0																		2743.0	108
	2800																		2800	
112	2845.0																		2845.0	112
	2900																		2900	
118	2997.0																		2997.0	118
	3000																		3000	
122	3099.0																		3099.0	122
	3100																		3100	
126	3200																		3200	126

Note 1 TS400MPA~TS490MPA 1 Seam Heavy Wall Thickness by Hot Forming

Note 2 Size exceeding above diagram may be supplied to special arrangement Note 3 MAX. Weight 30tons

ALLOY PIPE
(Stainless Steel Pipe)

Welded Pipe

O.D. (in.)	O.D. mm	Wall thickness in.	Wall thickness mm	0.250	6.4	0.281	7.1	0.312	7.9	0.344	8.7	0.375	9.5	0.406	10.3	0.438	11.1	0.500	12.7	0.563	14.3	0.625	15.9	0.688	17.5	0.750	19.1	0.812	20.6	0.875	22.2	0.938	23.8	1.000	25.4	1.062	27.0	1.125	28.6	1.189	30.2	1.250	31.8	1.311	33.3	1.457	37.0	Wall thickness mm	Wall thickness O.D. (in.)
16	406.4			☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○																				406.4	16
18	457.0			☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○																				457.0	18
20	508.0			☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○																508.0	20
22	559.0			☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○												559.0	22
24	610.0			☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○										610.0	24
26	660.0			☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○								660.0	26
28	711.0			☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○						711.0	28
30	762.0			○		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○						762.0	30
32	813.0					○		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○						813.0	32
34	864.0					○		○		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○						864.0	34
36	914.0					○		○		○		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○						914.0	36
38	965.0					○		○		○		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○						965.0	38
40	1016.0							○		○		○		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		☆		○		○		○						1016.0	40
42	1067.0							○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○						1067.0	42
44	1118.0											○		○		○		○		○		○		○		○		○		○																1118.0	44
46	1168.0													○		○		○		○		○		○		○		○		○		○		○		○		○		○						1168.0	46
48	1219.0															○		○		○		○		○		○		○		○		○		○		○		○		○						1219.0	48
52	1321.0															○		○		○		○		○		○		○		○		○		○		○		○		○						1321.0	52
56	1422.0															○		○		○		○		○		○		○		○		○		○		○		○		○						1422.0	56

Note 1 ☆ is available 22% Cr steel, type 304 and 316 steels
○ is available type 304 and 316 steels
2 Maximum length is 12.2m

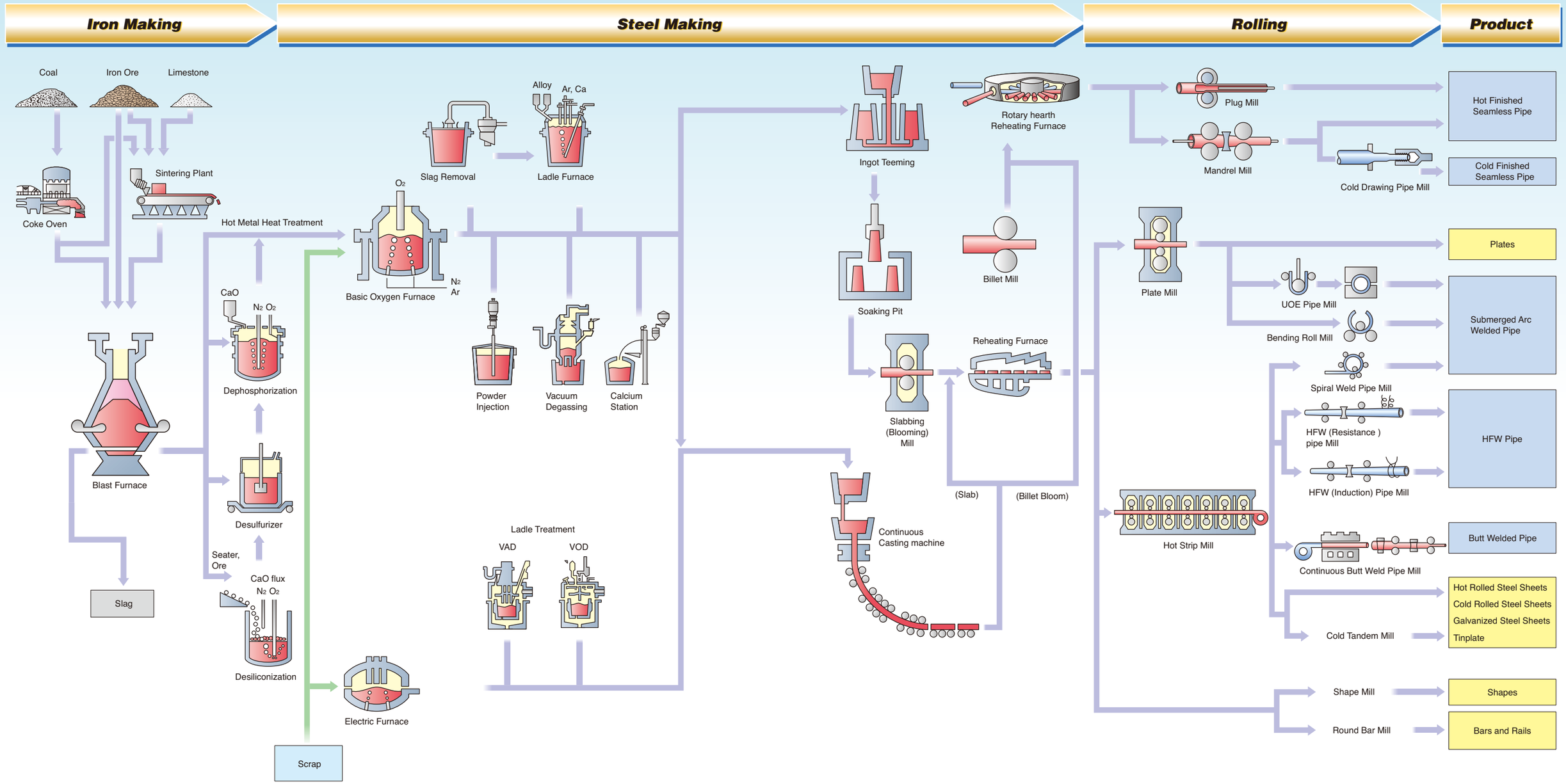
Seamless Pipe

O.D. (in.)	O.D. mm	Wall thickness in.	Wall thickness mm	0.197	5.0	0.217	5.5	0.236	6.0	0.256	6.5	0.276	7.0	0.315	8.0	0.354	9.0	0.394	10.0	0.433	11.0	0.453	11.5	0.472	12.0	0.512	13.0	0.551	14.0	0.591	15.0	0.630	16.0	0.670	17.0	0.709	18.0	0.787	20.0	0.984	25.0	1.603	27.0	1.102	28.0	1.181	30.0	1.220	31.0	1.260	32.0	1.299	33.0	1.417	36.0	1.496	38.0	Wall thickness mm	Wall thickness O.D. (in.)
2.374	60.3			○		○		○		○		○		○		○		○		○		○																												60.3	2.374
2.382	60.5			○		○		○		○		○		○		○		○		○		○																												60.5	2.382
2.500	63.5			○		○		○		○		○		○		○		○		○		○		○		○		○																				63.5	2.500
2.874	73.0			○		○		○		○		○		○		○		○		○		○		○		○		○		○																		73.0	2.874
3.500	88.9					○		○		○		○		○		○		○		○		○		○		○		○		○																		88.9	3.500
3.508	89.1					○		○		○		○		○		○		○		○		○		○		○		○		○																		89.1	3.508
3.669	93.2					○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○										93.2	3.669
4.000	101.6					○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○								101.6	4.000
4.500	114.3					○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○								114.3	4.500
5.000	127.0							○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○						127.0	5.000
5.118	130.0							○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○						130.0	5.118
5.236	133.0									○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○						133.0	5.236
5.374	136.5									○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○						136.5	5.374
5.504	139.8									○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○						139.8	5.504
5.563	141.3									○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○						141.3	5.563
6.626	168.3									○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○				168.3	6.626
7.000	177.8									○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○				177.8	7.000
7.626	193.7											○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○				193.7	7.626
7.657	194.5													○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○				194.5	7.657
8.516	216.3													○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		216.3	8.516
8.626	219.1													○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		219.1	8.626
9.626	244.5													○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		244.5	9.626
10.000	254.0															○		○		○		○		○		○		○		○		○		○		○		○		○								254.0	10.000
10.528	267.4															○		○		○		○		○		○		○		○		○		○		○		○		○								267.4	10.528
10.752	273.1															○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		273.1	10.752
11.791	299.5																	○		○		○		○		○		○		○		○		○		○		○		○		○		○				299.5	11.791
12.539	318.5																	○		○		○		○		○		○		○		○		○		○		○		○		○		○		○		318.5	12.539
12.748	323.8																	○		○		○		○		○		○		○		○		○		○		○		○		○		○				323.8	12.748
13.374	339.7																			○		○		○		○		○		○		○		○		○		○		○		○		○				339.7	13.374
14.000	355.6																			○		○		○		○		○		○		○		○		○		○		○		○		○		○		355.6	14.000
16.000	406.4																							○		○		○		○		○		○		○		○		○		○		○		○		406.4	16.000

Note 1 ○ available size range of Martensitic Stainless Steel 12% Cr
2 ○ schedule size range of Martensitic Stainless Steel 12% Cr

Integrated Steelworks

Backed by nearly 100 years of steelmaking experience, JFE Steel Corporation manufactures a complete line of steel and steel products.
Principal production facilities include 2 integrated steel works, one is West Japan Works (Fukuyama) and (Kurashiki), the other is East Japan Works (Keihin) and (Chiba) and specializing pipe making Works (Chita Works).
JFE annual crude steel capacity of 30.3 million tons, is one of the world's largest steelmaker. JFE leads the world with in advanced techniques at every stage of iron-making, steel-making and rolling processes.



Principal Integrated Steelmaking Facilities and Equipment

West Japan Works (Fukuyama)

Blast furnace

Basic oxygen furnace

Secondary refining

Continuous caster

Plate mill

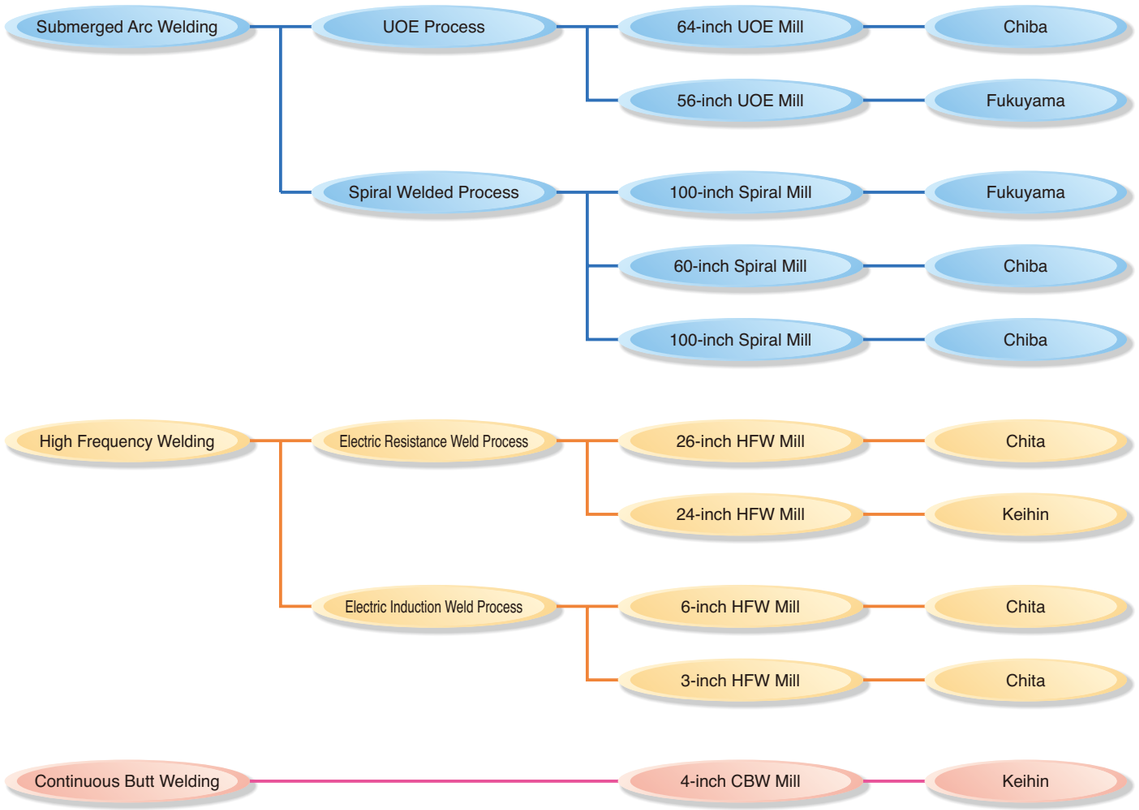
Hot strip mill

Manufacturing Processes

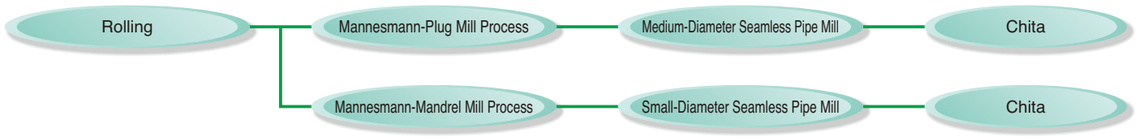
Manufacturing Methods for JFE Line Pipe

JFE has started pipe production in 1912. Backed by our long experience and advanced technology, we can meet any customer requirements and specifications.
At presents we operate 10 welded pipe mills, two pipe-coating mills and two seamless pipe mills.
The following diagrams show the manufacturing processes used at JFE pipe and tube mills, including both the welded and seamless processes.

Welding Processes



Seamless Process

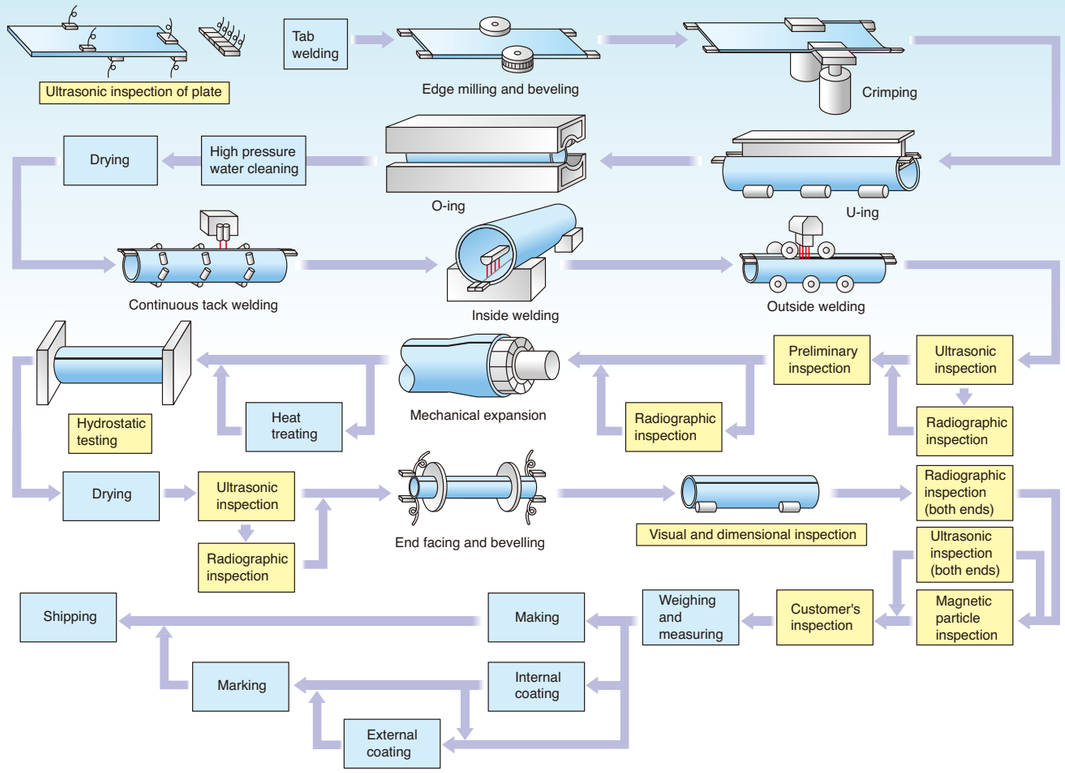


UOE Pipe Mill

UOE Pipe is manufactured in two works, West Japan Works (Fukuyama) and East Japan Works (Chiba).
This flow diagram is an example of Fukuyama mill.
Each plate is subjected to ultrasonic inspection as deemed necessary before being transferred to the pipe mill.
In the pipe mill, plate is trimmed and beveled on both longitudinal edges, then processed into a cylindrical shape by crimping, U-ing and O-ing press successively.
The open can is washed inside and outside with high pressure water, then dried.
Next it is passed to continuous tack welding facilities.
Subsequently, the seam is welded by automatic four-electrode submerged arc welding method first on the inside, then on the outside.
The following step in the pipe fabrication process includes mechanical expansion and hydrostatic testing. The welded seam is inspected ultrasonically and radiographically.
JFE also manufactures high grade line pipe, structural pipe and stainless steel pipe. If necessary, heat treatment is applied to pipes including quenching and tempering, normalizing, stress relieving and solution treatment.

Location	Capacity (t./yr.)	Size Range		
		OD	WT	Length
Fukuyama	580,000	15.7～56in. (400.0～1422.0mm)	0.236～2in. (6～50.8mm)	Max. 60ft (Max. 18.3m)
Chiba	540,000	20～64in. (508.0～1626.0mm)	0.250～1.75in. (6.35～44.5mm)	Max. 60ft (Max.18.3m)

Fukuyama UOE Pipe



HFW Pipe Mill

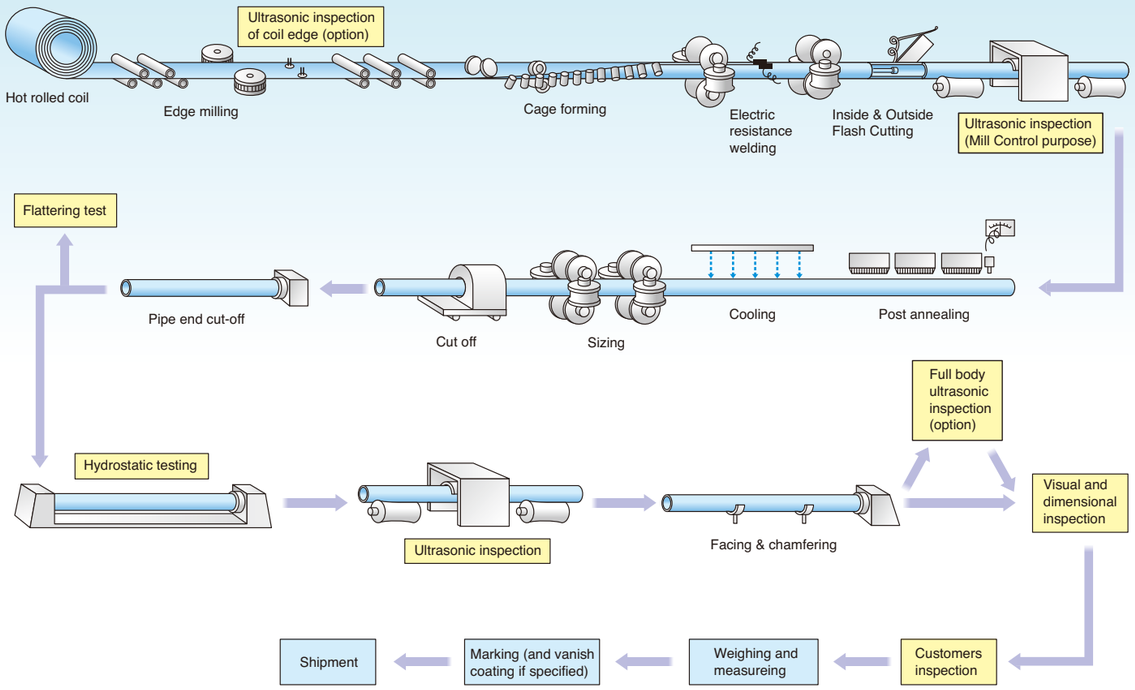
HFW Pipe is manufactured in two works., East Japan Works (Keihin) and Chita Works.

This flow diagram is a standard process of Chita Works 26in mill.

High frequency weld pipe is made from strip in coil form.
After being uncoiled, flat strip is trimmed by an edge miller, then progressively rounded by a number of cage rolls before welding.
Large diameter pipes are welded by the high frequency electric resistance method.
Continuously welded pipe is cut to the specified length by a milling cut off machine, with each length going through hydrostatic and ultrasonic inspection equipment before being the final product.

Location		Capacity (t./yr.)	Size Range		
			OD	WT	Length
Keihin	24in mill	300,000	7～24in. (177.8～610.0mm)	0.188～0.752in (4.8～19.1mm)	Max. 60ft (Max. 18.3m)
Chita	26in mill	450,000	12.539～26in. (318.5～660.0mm)	0.188～1.00in (4.8～25.4mm)	18～66ft (5.5～20m)

Medium-Diameter (26-in) HFW Pipe

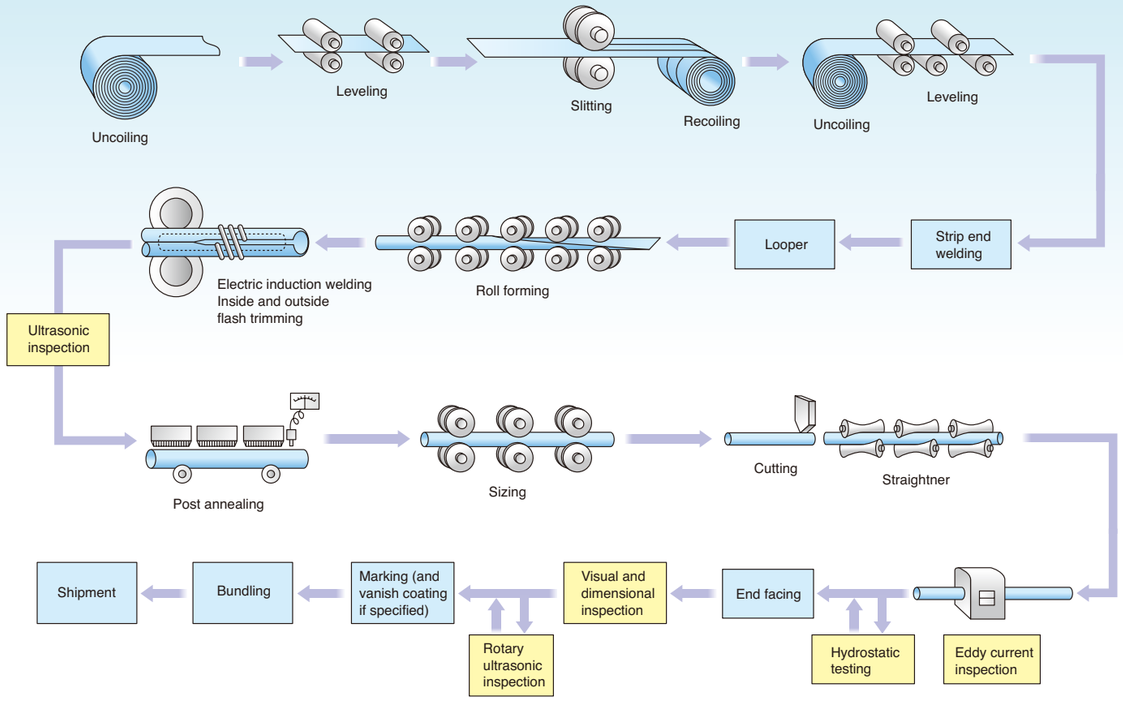


This flow diagram is a standard process of Chita Works 6in. mill.

Steel strip in coil, which has been slit into the required width from wide strip, is shaped by a series of forming rolls into a round shape.
Longitudinal edges are then continuously joined by high frequency induction welding.
The weld of the pipe is then heat treated electrically, sized and cut off to specified lengths by a flying cut-off machine.
The cut pipe is straightened and followed by non-destructive inspection and hydrostatic testing.

Location		Capacity (t./yr.)	Size Range		
			OD	WT	Length
Chita	6in mill	190,000	2.382～6.626in. (60.5～168.3mm)	0.071～0.5in (1.8～12.7mm)	13～52ft (4～16m)
	3in mill		1.315～3.004in. (33.4～76.3mm)	0.024～0.5in (0.6～12.7mm)	13～59ft (4～18m)

Small-Diameter (6-in) HFW Pipe

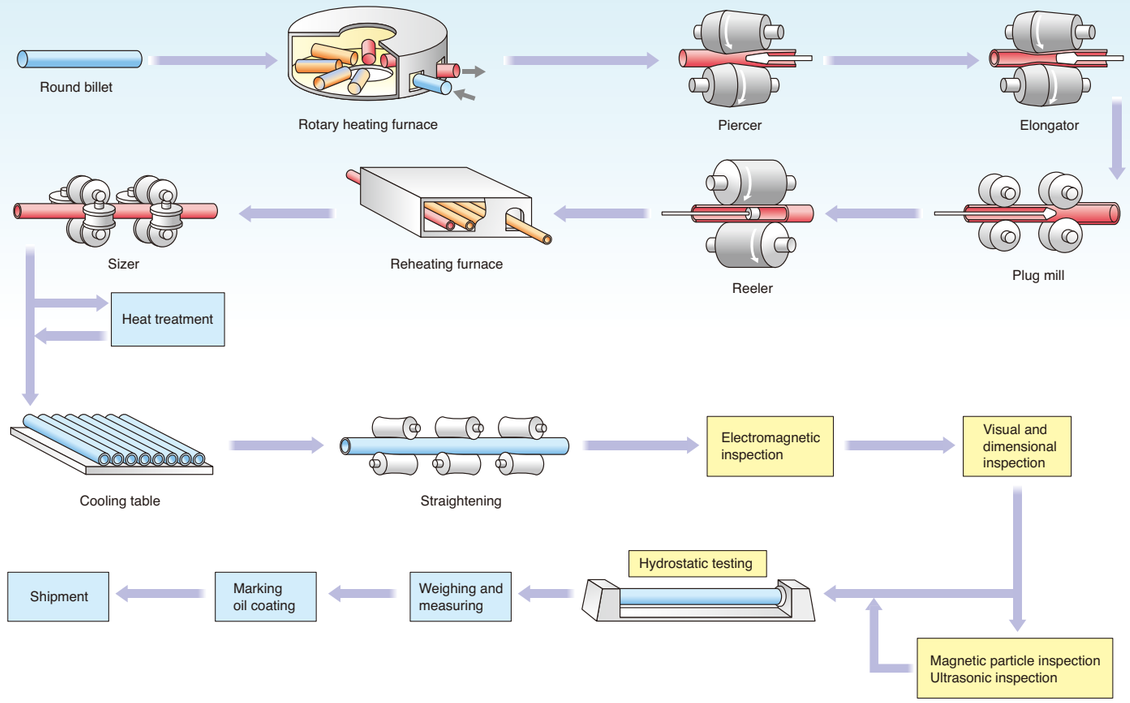


Seamless Pipe Mill

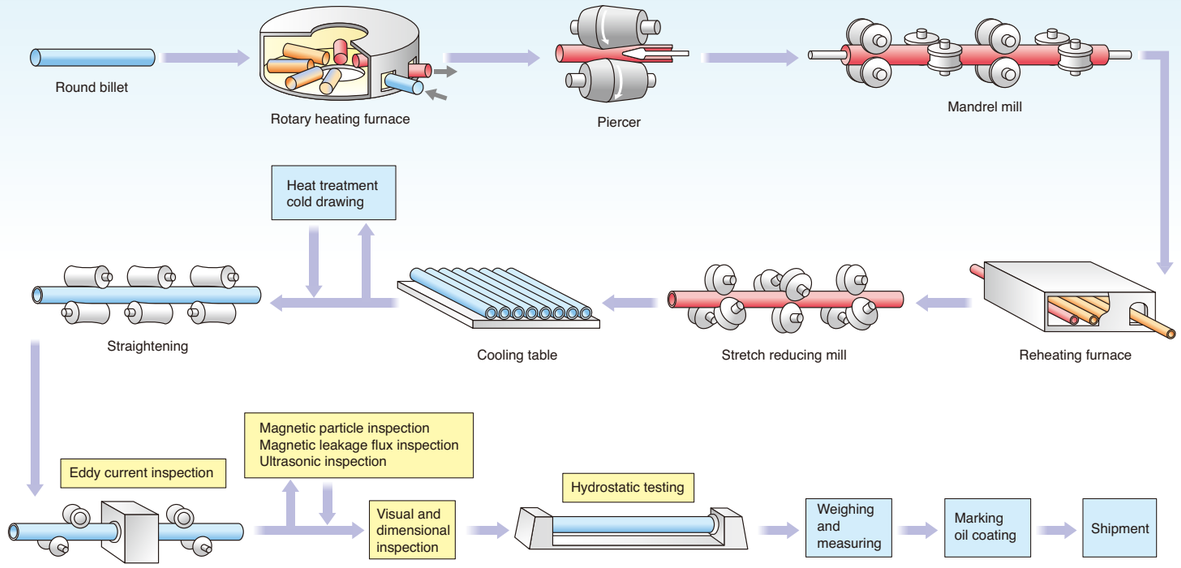
Seamless pipe and tubes are produced either by the plug rolling mill or the mandrel mill in Chita Works.
The former process is used for producing medium-diameter pipe and the latter for small-diameter pipe.
On either type of mill, a heated billet is pierced through its center on the piercing mill.
The pierced billet, then, moves to the plug rolling or mandrel mill where it is rolled with a plug or a mandrel bar inserted inside.
After the plug or the mandrel is withdrawn, the rolled shell is reheated before the process on a sizing mill or a stretch reducing mill where the desired OD and wall thickness are obtained.
During transportation of oil and gas, occurrence of CO_2 corrosion becomes increasingly common due to the impurity of oil and gas.
To respond to this major problem, JFE has developed a martensitic stainless steel for line pipe applications, and successfully established its production technology based on the Mannesmann piecing process.
In addition to these hot rolled pipe and tubes, JFE also manufactures cold drawn pipe and tubes for the use where closer dimensional tolerances are required.
To consistently ensure high quality, the company conducts thorough testing and inspection by employing eddy current, ultrasonic, magnetic leakage flux and other advanced equipment.

Location		Capacity (t./yr.)	Size Range		
			OD	WT	Length
Chita	Medium diameter pipe mill	468,000	7～16 3/4in. (177.8～426mm)	0.19～2.16in. (4.8～55mm)	18～44.6ft (5.5～13.6m)
	Small diameter pipe mill	444,000	1～7in. (25.4～177.8mm)	0.09～1.38in. (2.3～35mm)	13～50ft (4～15.3m)

Medium-Diameter Seamless Pipe



Small-Diameter Seamless Pipe



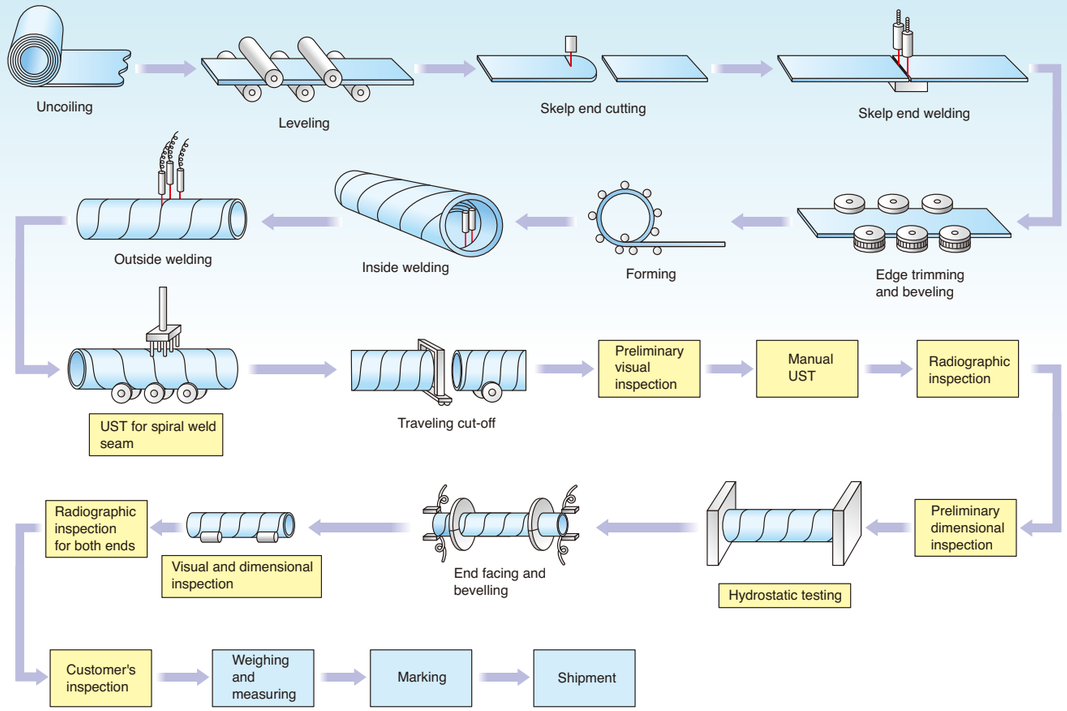
Spiral Weld Pipe Mill

Spiral welded pipe is manufactured in three works of JFE, West Japan Works (Fukuyama) and East Japan Works (Chiba).
This flow diagram is an example of West Japan Works (Fukuyama). Hot coil produced on a powerful, precision-rolling hot strip mill is uncoiled, and its leading end is joined to the trailing end of preceding strip by tandem electrode submerged arc welder to form an endless strip.
The endless strip is continuously passed through a leveler, an edge trimming and beveling machine and then into a forming stand.
The forming case shapes the strip into a cylindrical shell with a spiral seam, which is welded by tandem SAW equipment first inside, and then outside.
The welded pipe is cut to the required length by a traveling cut-off machine with a plasma torch.
Features of this mill, include a planer type edge preparing machine and a traveling plasma cutter.

Location	Capacity (t./yr.)	Size Range*		
		OD	WT	Length
Fukuyama	80,000	23.6～100in. (600～2540mm)	0.236～1.188in. (6.00～30.2mm)	Max. 114ft 8in (35m)
Chiba	120,000	15.7～102.4in. (400～2600mm)	0.177～1.181in. (4.5～30mm)	20～131ft (6～40m)

*Please consult with us before placing an order.

Fukuyama Spiral Pipe



Roll and Press Bending Pipe Mill

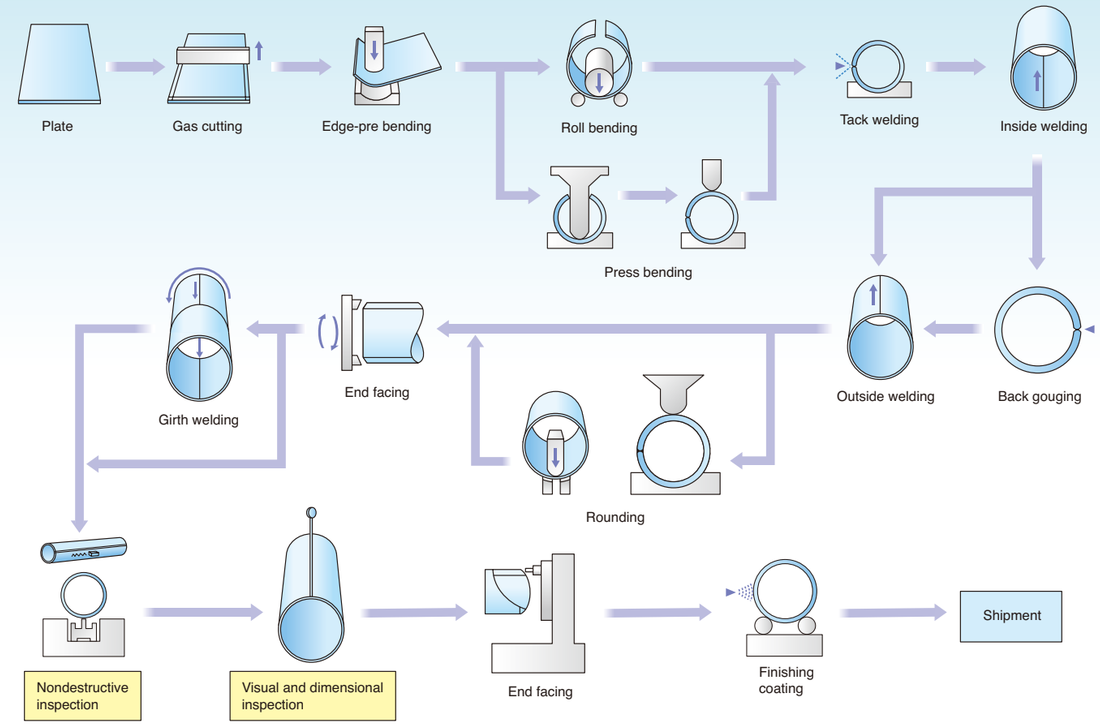
Roll Bending Pipe Mill

Roll bending pipe mill specializes in large diameter, heavy wall structural pipe up to 1.22in. (31mm).
In this mill, plate is gas cut on both longitudinal edges, and processed into a cylindrical shape by the three bending roll process.
Open can is tack welded and subsequently seam welded by submerged arc welding method, first on the inside and then on the outside. Welded seam receives radiographic, dimensionall and visual inspections.

Press Bending Pipe Mill

This mill specializes in large diameter, heavy wall structural pipe up to 5.9in. (150mm).
In this mill, plate is beveled on both longitudinal edges, and processed into a cylindrical shape by the press bending process.
Open can is track welded and subsequently seam welded by submerged arc welding method, first on the inside and then on the outside.
The step that follows in pipe fabrication process includes rounding, nondestructive inspection of seam weld by both ultrasonic and radiographic, end facing and finishing.

Roll and Press Bending Pipe

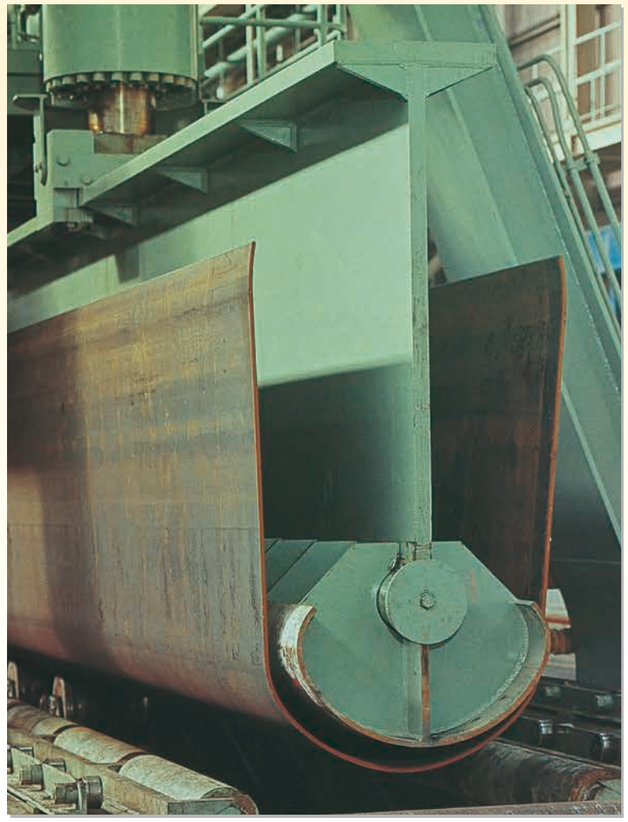


UOE Pipe Mill
West Japan Works (Fukuyama)


Crimping press

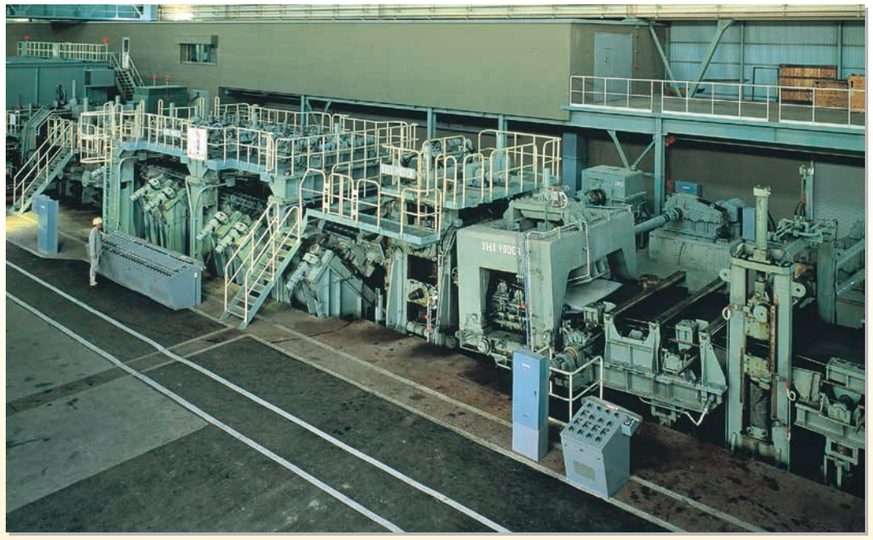

O-ing press

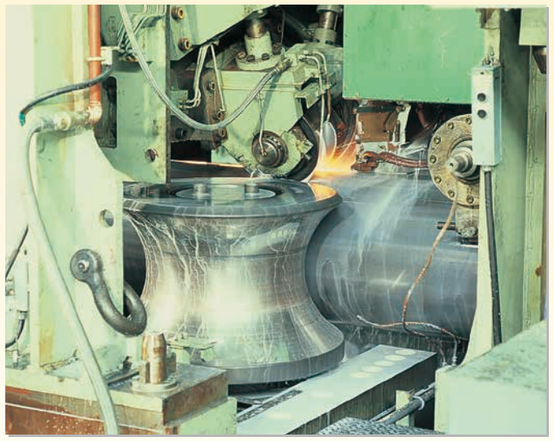

Automatic inside submerged arc welder

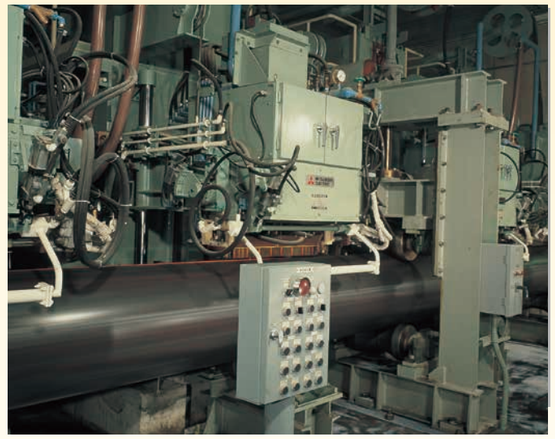

U-ing press


Automatic outside submerged arc welders

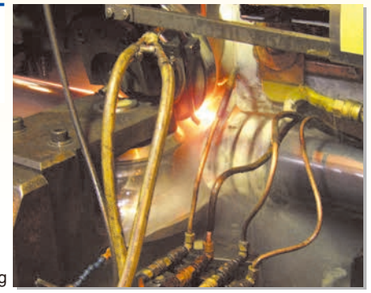
26in. High Frequency Weld Pipe Mill
(Chita Works)


Forming Stand

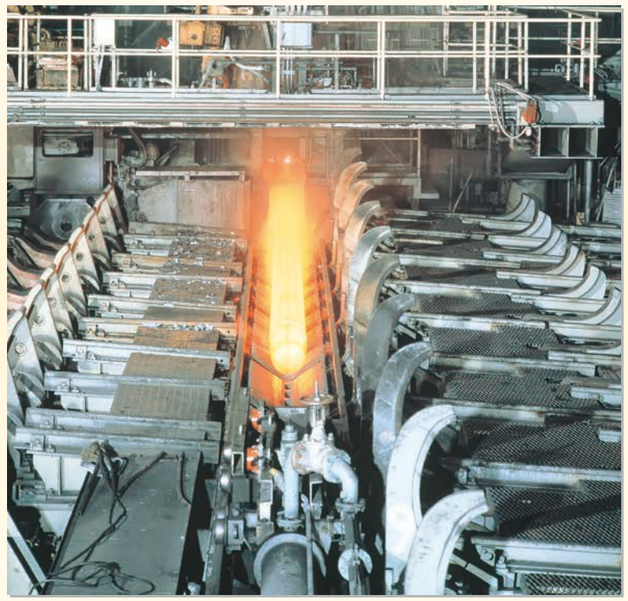

Electric Resistance Welding

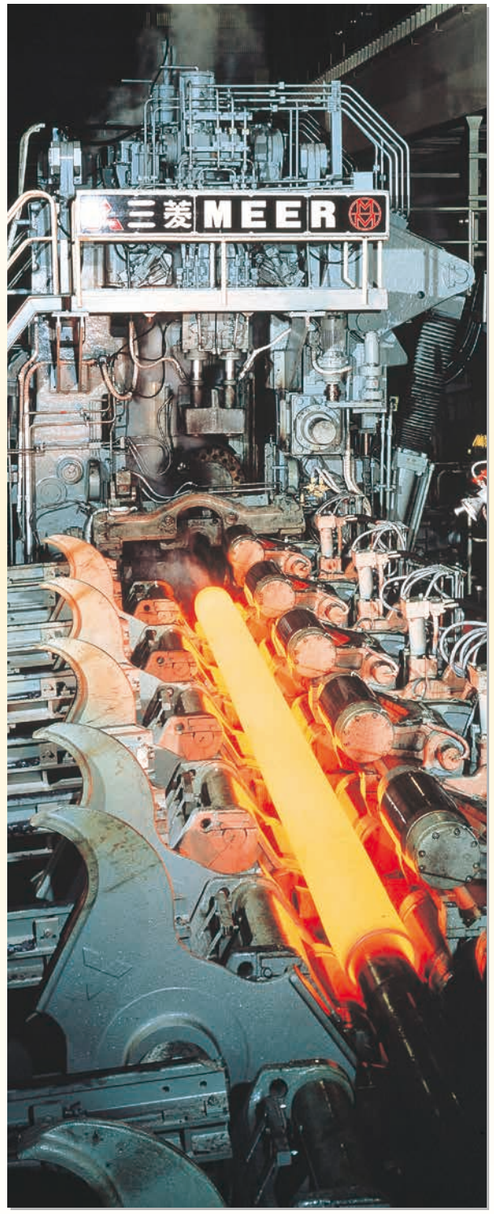

Seam Heat Treatment

6in. High Frequency Weld Pipe Mill
(Chita Works)


Electric Induction Welding

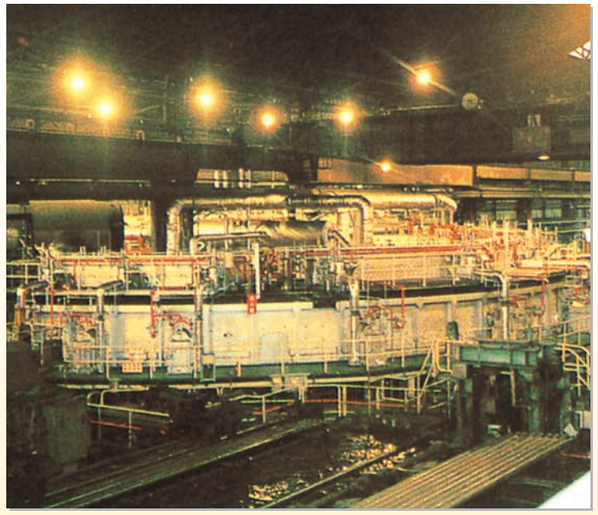
Seamless Pipe (Plug Mill)
(Chita Works)

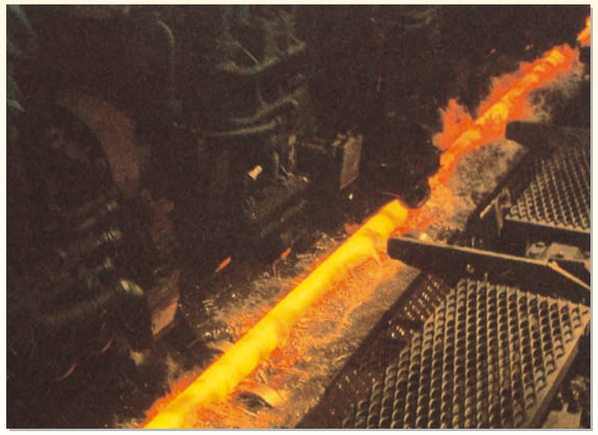

Plug mill



Elongator

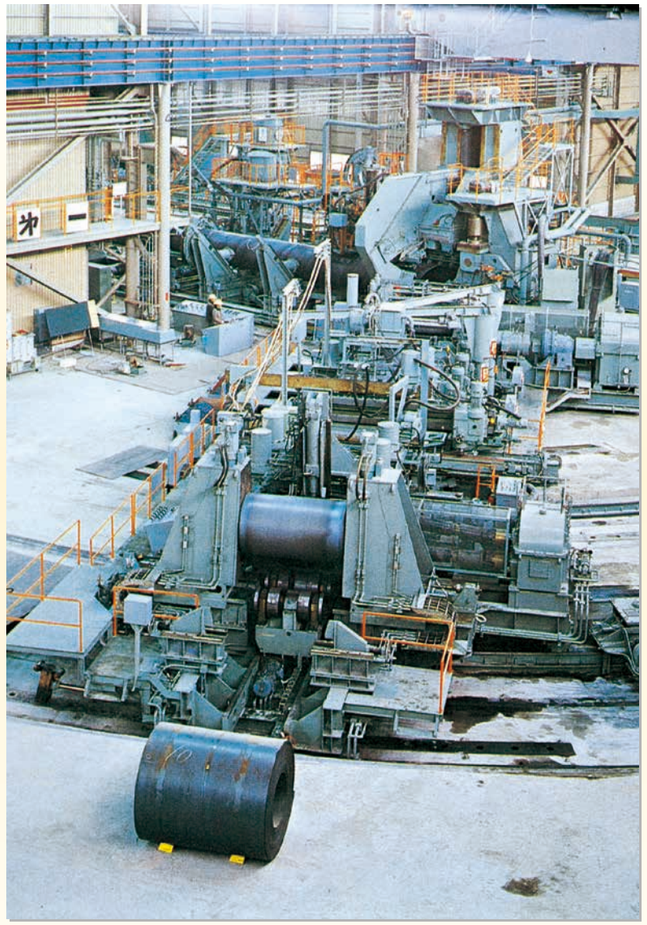
Seamless Pipe (Mandrel Mill)
(Chita Works)


Rotary Furnace


QT line

Mandrel Mill

Spiral Weld Pipe Mill
West Japan Works (Fukuyama)



Entry line

Forming stand

Traveling cut-off machine

Nondestructive Inspections

Nondestructive Inspection
Plate Mill at West Japan Works (Fukuyama)

Nondestructive inspection is an integral part of pipe production.
The table below lists the various types of nondestructive inspection equipment for the purpose of reliable pipe quality.

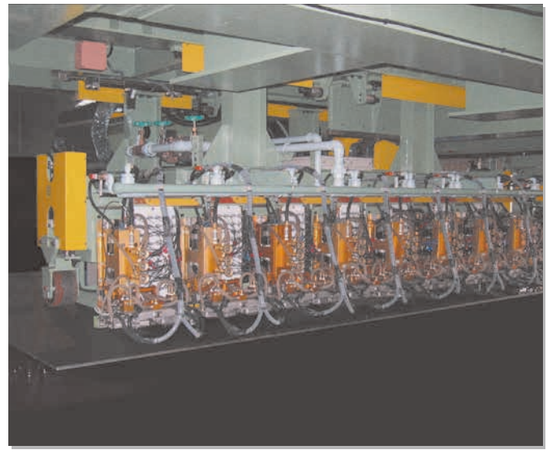
■Main Nondestructive Inspection Equipment for Welded Line Pipe

Application	Inspection Method	Name of Equipment	Number of units	Location
UOE	Ultrasonic inspection	Plate UST	1	Fukuyama
			1	Kurashiki
			1	Keihin
		Weld UST	3	Fukuyama
			2	Chiba
	Radiographic inspection	X-Ray inspection facility	3	Fukuyama
			1	Chiba
		Pipe-end X-Ray inspection facility	2	Fukuyama
			1	Chiba
	Magnetic particle inspection	Magnetic particle inspection facility	2	Fukuyama
			2	Chiba
HFW	Ultrasonic inspection	Coil UST	1	Keihin
		Weld UST	2	Keihin
			3	Chita
		Full body UST	2	Chita
	Eddy current inspection	Eddy current tester	1	Chita
	Magnetic particle inspection	Magnetic particle inspection facility	1	Chita
Seamless	Ultrasonic inspection	Full body UST	6	Chita
		End area UST	1	
	Electromagnetic inspection	Full body EMT	5	Chita
	Eddy current inspection	Full body Eddy current tester	4	Chita
	Magnetic particle inspection	Full body MPI	3	Chita
		End area MPI	3	

Ultrasonic Inspection
Plate Mill at West Japan Works (Fukuyama)

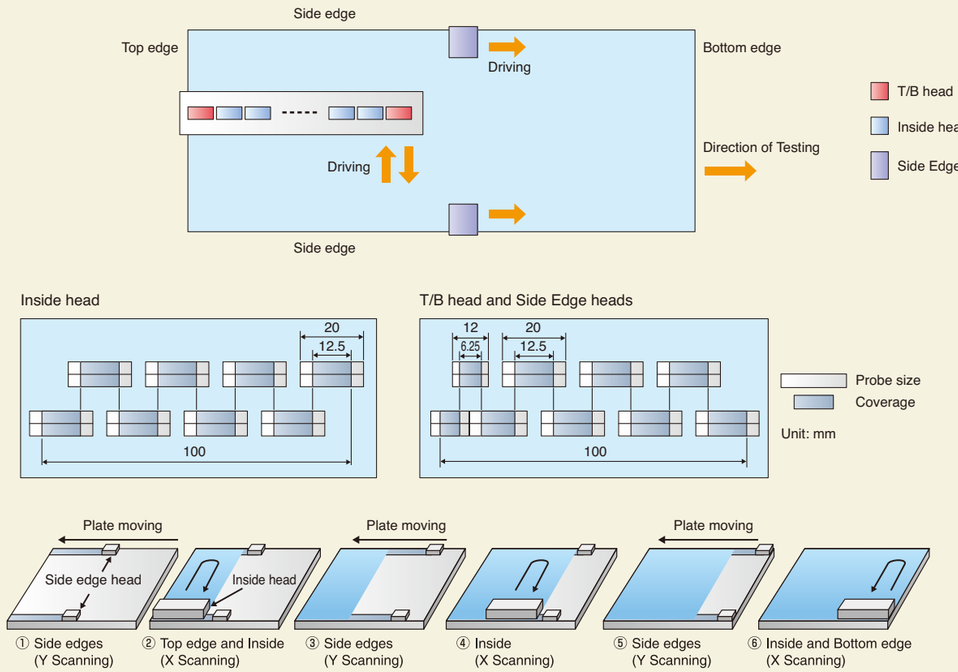
Every plate is ultrasonically checked for its internal soundness in accordance with customer's specification or mill's standard.
This device can inspect the whole volume of the plate at high sensitivity.
The fully automated tester graphically displays the quality of the plate and records each result by computer output.

Function
- Thickness : 6.0mm to 60.0mm
- Width : 1.0m to 4.5m
- Length : 3.0m to 25.0m
- Probe:
  - Inside :112ch (8 transducer x 14)
  - Top &Bottom edges :18ch (9 transducer x 2)
  - Side edges :18ch (9 transducer x 2)
- Scanning method:
  - Side edges : Y scanning
  - Inside & Top & Bottom edges : X scanning
- Be able to coverage for 100% of plate surface.


Ultrasonic tester for plate

Probe arrangement and layout.

●*Probe arrangement*

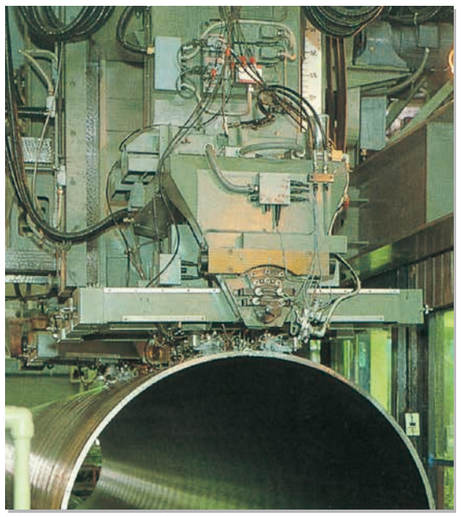


Ultrasonic Inspection of Weld Seam

UOE Pipe Mill at West Japan Works (Fukuyama)

JFE uses the ultrasonic and radiographic methods for nondestructive inspection of submerged arc welded seams. Shown below are probe arrangement. This is capable of dectecting longitudinal and transverse imperfections.
Coupling checks linked to an audible warning device are used for a continual check of probe detection efficiency.
If there is any indication that weld or adjacent areas are substandard, the following devices are automatically activated - audible alarm, marking and chart recording.

Function
- Diameter: 406.4mm to 1422.4mm
- Wall thickness: 6.0~50.8mm
- Probes: Max probes ·····20 probes

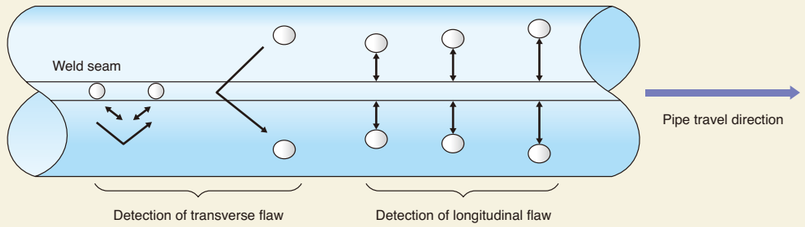


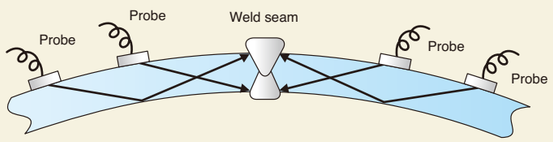
Ultrasonic tester for pipe welds

●*Probe arrangement*

WT*≦12.7mm ·····6 probes
(Longi: 2, Trans: 2,OB**: 2)
12.7mm＜WT≦25.4mm ·····8 probes
(Longi: 4, Trans: 2, OB: 2)
25.4mm＜WT ·····10 probes
(Longi: 6, Trans: 2, OB: 2)

*WT: Wall thickness
**OB: Transverse flaw detection using probes on weld seam





X-Ray Inspection of Weld Seam

UOE Pipe Mill at West Japan Works (Fukuyama)

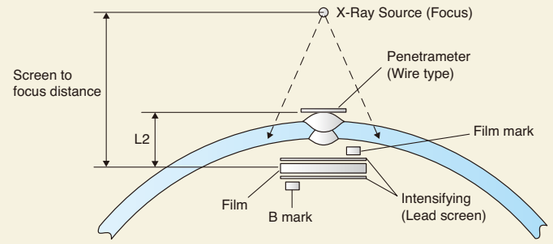
Any portion showing substandard indications in ultrasonic inspection is double checked with radiographic equipment.
JFE uses a special radiographic device desingned exclusively for the examination of pipe end welds.

Function
- generators
  - Pipe ends: 4 sets at 2 stations
  - Middle portion: 9 sets at 3 stations
  - (Before expansion: 3 sets, After expansion: 6 sets)
- Amperage of the tubes: 30 mA Max.
- Voltage of the tubes: 320 KVP Max.
- Focus size: 4x4 mm Max.

X-Ray equipment for pipe ends

X-Ray equipment for middle portion

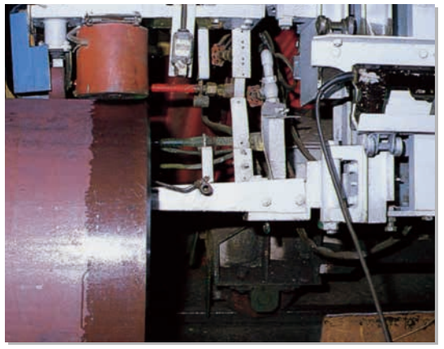
●*X-Ray radiography Arrangement*



Magnetic Particle Inspection

UOE Pipe Mill at West Japan Works (Fukuyama)

Pipe end (bevel surface and weld seam) are magnetiezed and provided with magnetic particles.
The presence of flaws creates a magnetic flux which shows changes in fluorescent brilliance under black light.
The change is detected visually.



Magnetic particle test

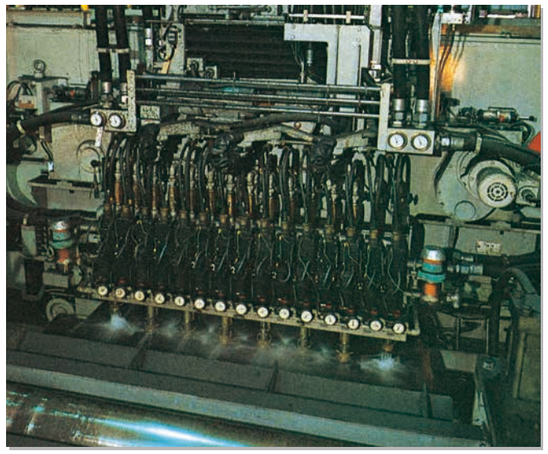
Ultrasonic Inspection of Coil

24in. HFW Pipe Mill at East Japan Works (Keihin)

Strip is automatically inspected by an ultrasonic detector installed before the strip edge milling.
Edges of strip are examined to a width of at least 1 inch (25.4mm). Other parts of strip are examined by the probes which are arranged at intervals down to 4 inches and scan in a sinusoidal pattern. Usually a pulse reflection type detector is used.
Results of inspection are automatically recorded on the chart for each coil and paint-marked on the indicated portion.

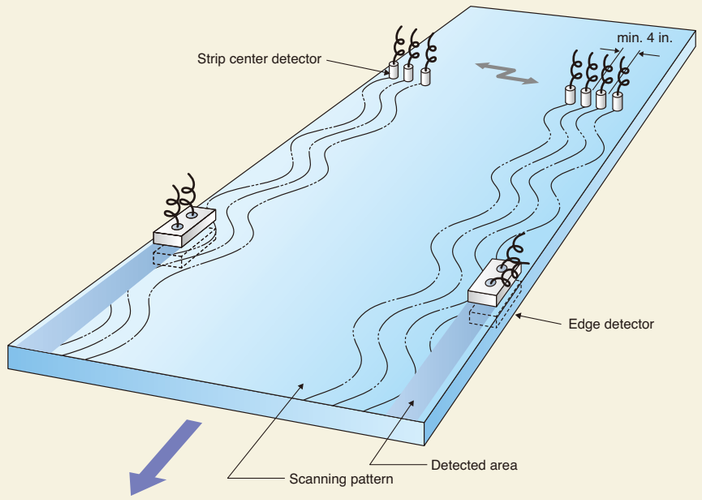
Function
- Width: Max. 1950mm
- Probes: Edge 8, Inside 20
- Frequency: 5kHz

Note: Coil ultrasonic inspection is applied according to customer's requirement.



Ultrasonic tester for coils

●*Coil Ultrasonic Tester*

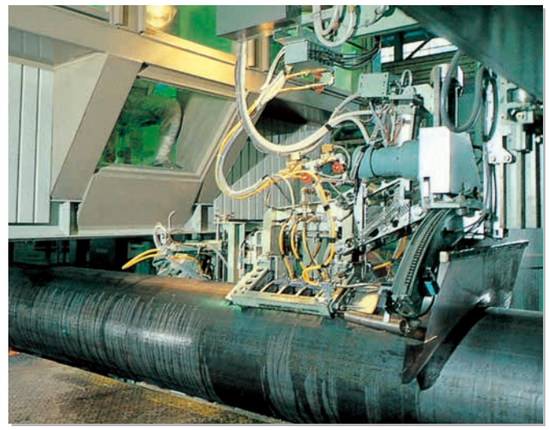


Ultrasonic Inspection of Weld Seam

26in. HFW Pipe Mill at Chita Works

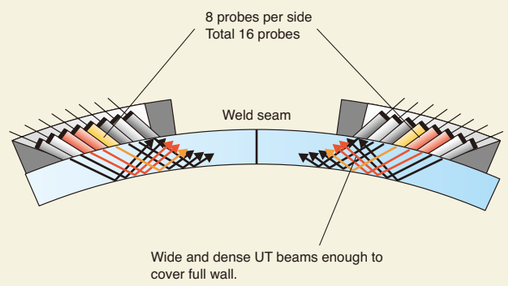
For the critical usage of such as line pipe. HFW weld seam reliability is the most important point. After the hydrostatic test, continuous ultrasonic inspection is performed on the full length of weld seam of each pipe with automatic weld-seam centering equipment.
The portion having any injurious imperfection that produces a signal greater than the acceptance limit is automatically marked and pipe is rejected.
JFE has been developed and applied most advanced ultrasonic system as a "multi-probe system" to 26in. HFW mill.
JFE's new "multi-probe system" consists of eight ultrasonic sender/receiver probes at one side (16 probes in total) arranged as Figure 1. 8 probes are set in one line with no gap and all probes will pulse and receive flaw signals at once. Therefore wider and more dense ultrasonic beams would be made through thickness and it can detect imperfections embedded in any portion of weld seam (Figure 2).
This new system enhances the reliability of JFE's HFW pipe to a highest level that no other mill can.

Function
- Wall thickness: 4.0mm to 25.4mm
- Diameter: 323.9mm to 660.4mm
- Probes: 8 probes/side, Total 16 probes
- Refraction angle: 45 degree
- Transducer: 10mm×5mm
- Frequency: 2kHz/probes

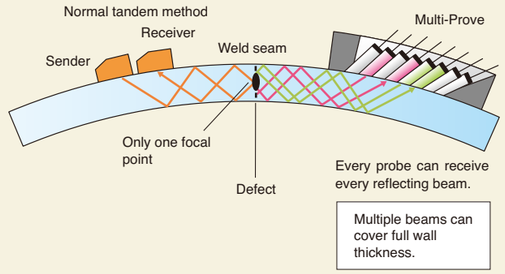


Ultrasonic tester for weld-seam

●*JFE Multi-probe UT equipment (Fig 1)*



●*Comparison of coverage of wall thickness (Fig 2)*

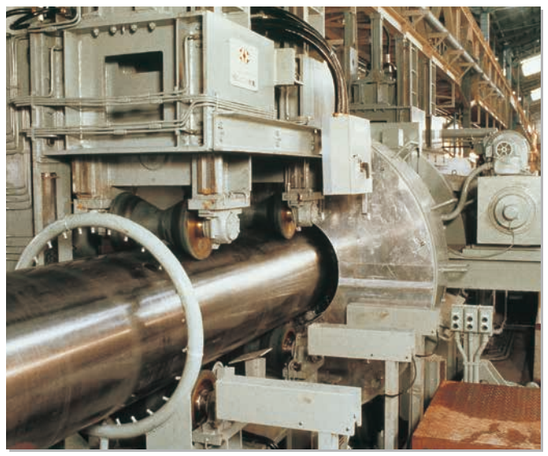


Full Body Ultrasonic Inspection

26in. HFW Pipe Mill at Chita Works

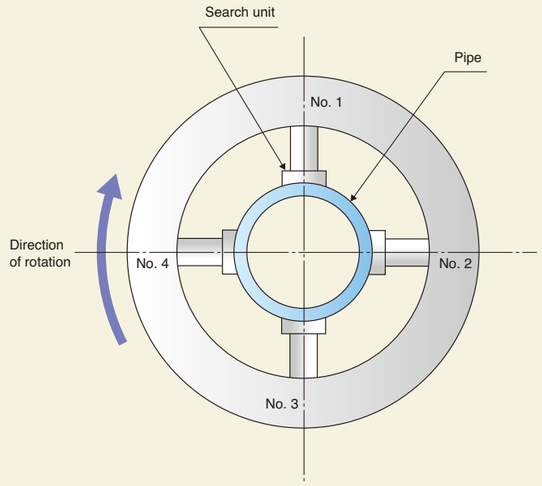
Lamination in full body can be inspected ultrasonically after hydrostatic testing.
The pipe of inspection is covered linearly and search unit for detection revolves around the pipe.
Longitudinal flaws in full body can also be inspected ultrasonically by Full Body Ultrasonic Tester.

Function
- Wall thickness: 4.0mm to 25.4mm
- Diameter: 165.2mm to 660.4mm
- Pulse repetition frequency: Max. 10kHz
- Probe Number: Max. 12 probes



Rotary type Ultrasonic tester for Full body

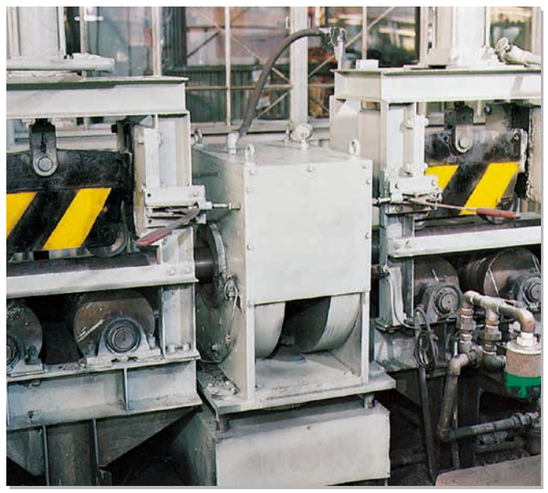
●*Probe arrangement of Full Body Ultrasonic Tester*



Eddy Current Inspection

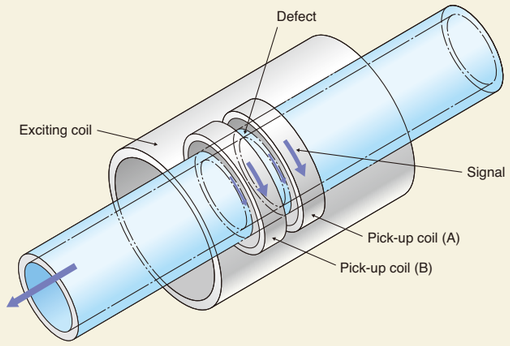
6in. HFW Pipe Mill at Chita Works

A coil in test coil assembly induces an eddy current around the circumference of the pipe as it passes through the assembly. Flaws disturb eddy current and are thus sensed by a pick-up coil in assembly.
The apparatus is equipped with automatic warning, marking and chart recording systems.

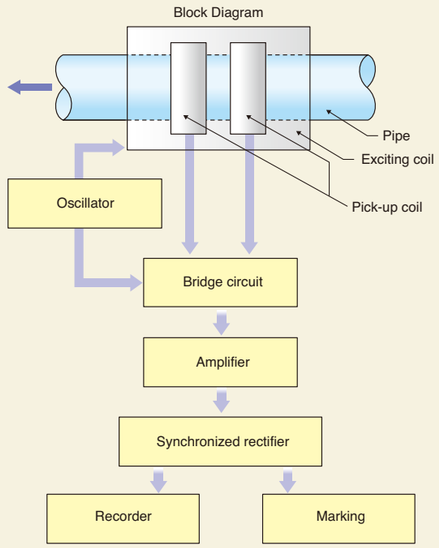


Eddy current tester

●*Eddy current inspection*



●*Eddy current tester*



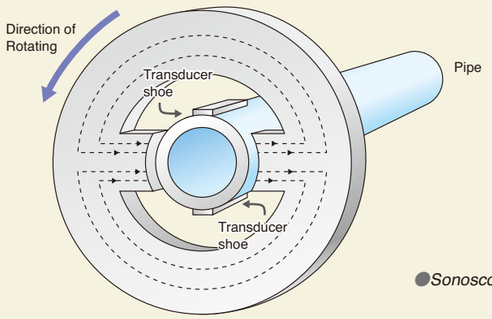
Electromagnetic Inspection

Medium-diameter Seamless Pipe Mill at Chita Works

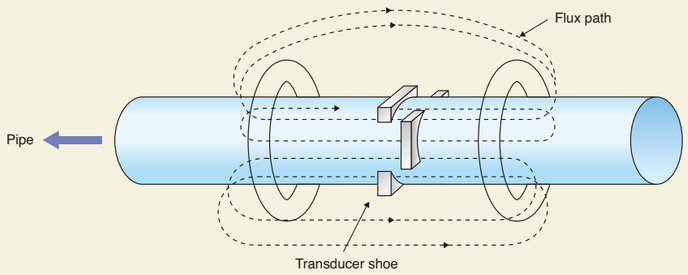
Plug mill is equipped with an Amalog-Sonoscope, electromagnetic inspection units after heat treatment.
The Amalog-Sonoscope pipe inspection system detects defects by using flux leakage by electromagnetic induction in search coil.
Amalog magnetic circuits detect longitudinal defects in both the inside and outside surface.
Sonoscope magnetic circuits detect circumferential defects.

Electro magnetic tester

●*Amalog Magnetic Circuit*



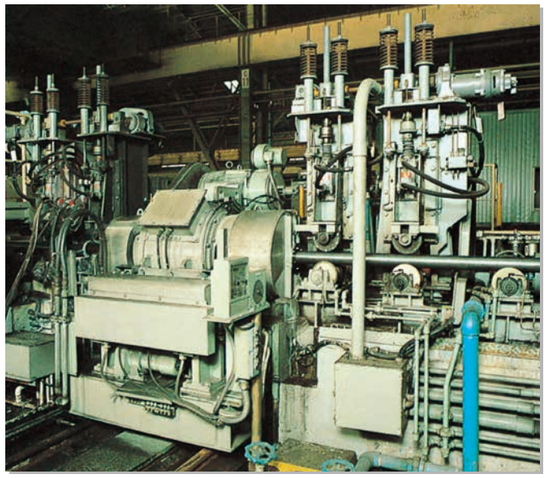
●*Sonoscope Magnetic Circuit*



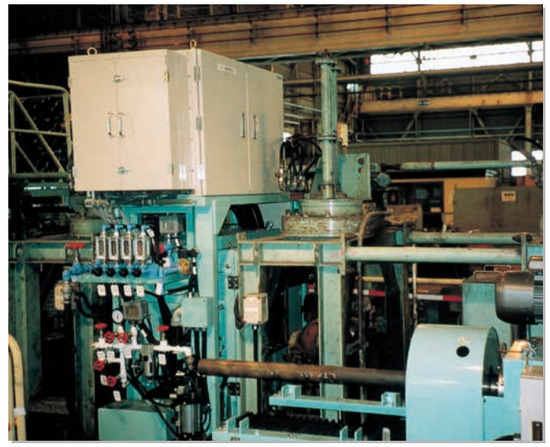
Ultrasonic Inspection

Small-diameter Seamless Pipe Mill at Chita Works

Ultrasonic inspection is in accordance with pulse-echo method using water gap method.
Flow detection is performed by angle beam technique to date longitudinal and transverse flow on the inner and outer surface of pipe, and wall thickness measurement is performed by normal beam technique.
The pipe, which is conveyed helically through the testing device, is inspected.

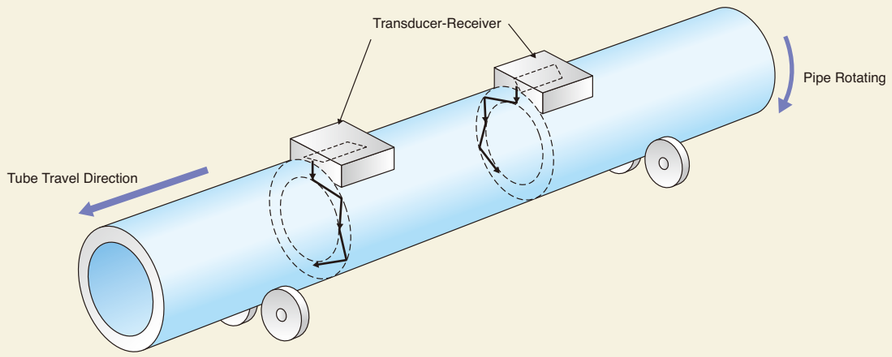


Rotary type UST



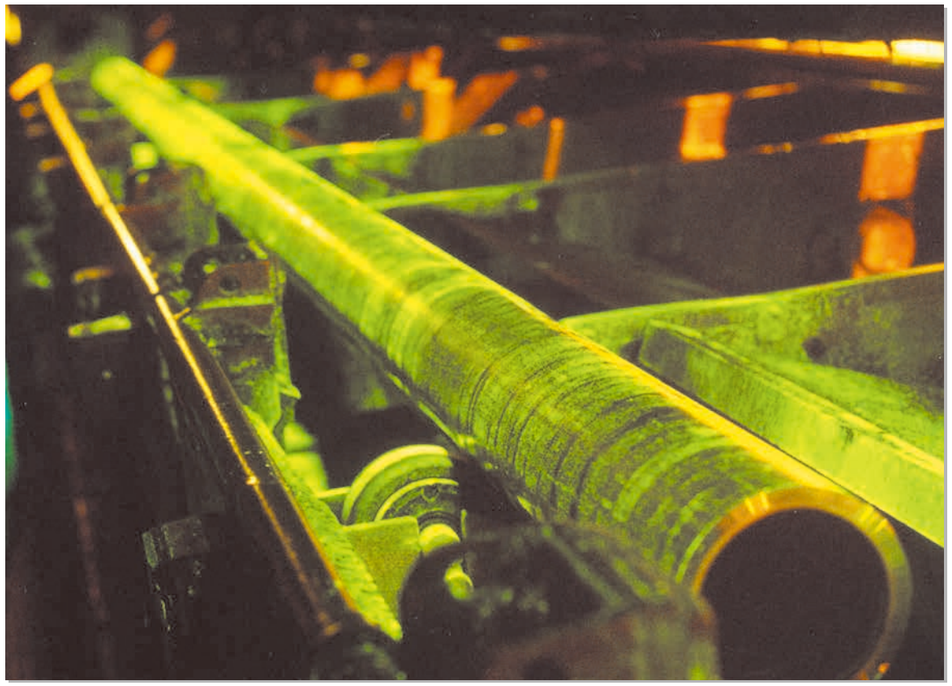
Stationary type UST

●*Stationary type, pulse-echo method*



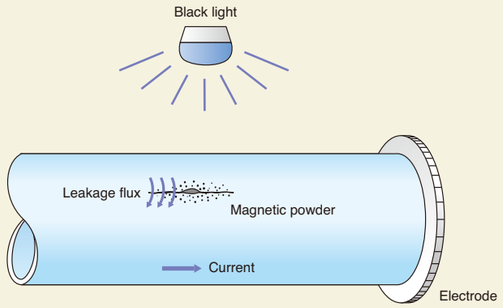
Magnetic Particle Inspection (Seamless Mill)

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



Magnetic Particle Test

●*Magnetic Particle Inspection*



Material Testing

Physical and Mechanical Testing

An Example of Apparatus for Physical and Mechanical Testing on West Japan Works (Fukuyama) and Chita Works.

West Japan Works (Fukuyama)

Equipment	Type		Capacity	Number of Units
Tensile Tester	Amsler		2000KN	1
			1000KN	4
			500KN	1
			250KN	1
			200KN	1
Bending Tester	Amsler		3000KN	1
			2000KN	1
			500KN	1
Charpy Impact Tester	Pendulum	JIS	490J	2
		ASTM	490J	2
Drop Weight Tear Tester	Drop Weight Pendulum		39200Nm	1
Hardness Tester	Vickers		490N	2
	Brinell		29400N	1
	Rockwell		1470N	1
	Micro Vickers		9.8N	2
Profile Projector	Nikon Model-12		X100	1
Sulfide Stress Corrosion Tester	Constant load		20KN	12
Hydrogen Induced Cracking Tester			20ℓ	17
CTOD			-	1
Burst Tester			-	1

Chita Works

Equipment	Type	Capacity	Number of Units
Tensile Tester	Amsler	2000KN	1
		1000KN	1
		500KN	1
		100KN	1
Bending Tester	Amsler	2000KN	1
Charpy Impact Tester	Pendulum	490J	2
Drop Weight Tear Tester	Drop Weight Pendulum	39200Nm	1
Hardness Tester	Vickers	490N	2
	Brinell	29400N	1
	Rockwell	1470N	2
Profile Projector	Nikon Model-V12	X100	2
Optical Microscope	Union Optical-UNIMET	X1000	1
	Union Optical-VERSAMET	X1000	1
	OLYMPUS BX60M	X1000	1
Sulfide Stress Corrosion Cracking Tester		10KN	36
Hydrogen Induced Cracking Tester		20ℓ	12
Scanning Electron Microscope		-	1
CTOD		-	1

Chemical Analysis

An Example of Apparatus for Chemical Analysis on West Japan Works (Fukuyama) and Chita works.

West Japan Works (Fukuyama)

Classification	Apparatus	Number of Units
Instrument Analysis	Vacuum Spectrometer	5
	X-ray Fluoresent Spectrometer	2
Chemical Analysis	Chemical Analysis Apparatus	
	For Carbon in Steel	4
	For Sulfur in Steel	3
	For Nitrogen in Steel	2
	For Oxygen in Steel	2
	For Hydrogen in Steel	2
	Atomic Absorption Spectrophotometer	2

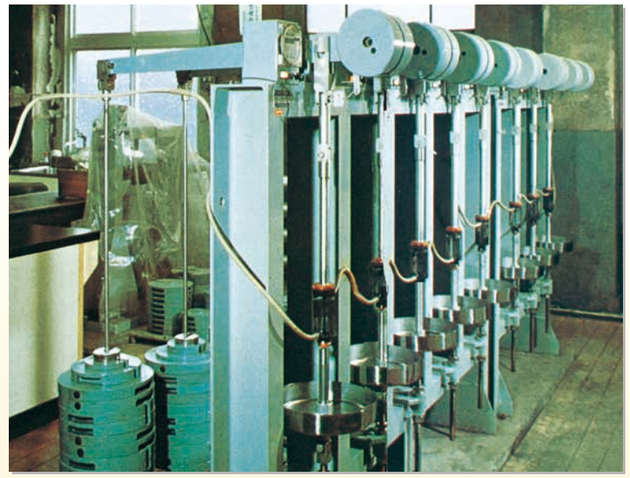
Chita Works

Apparatus for Chemical Analysis

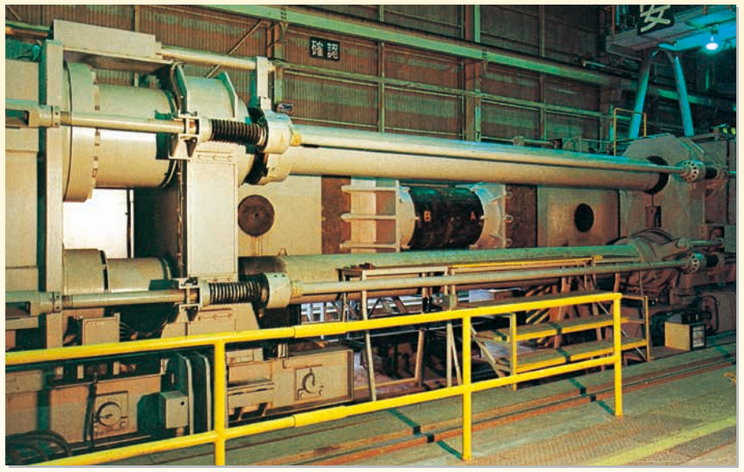
Classification	Apparatus	Number of Units
Instrument Analysis	Vacuum Spectrometer	1
	X-ray Fluoresent Spectrometer	1
Chemical Analysis	Chemical Analysis Apparatus	
	For Carbon in Steel	1
	For Sulfur in Steel	1
	For Nitrogen in Steel	2
	For Oxygen in Steel	1
	For Hydrogen in Steel	1
	Atomic Absorption Spectrophotometer	2
	Spectrophotometer	1

Typical Testing Machines

Large-scale impact tester (for DWTT and DT-test)

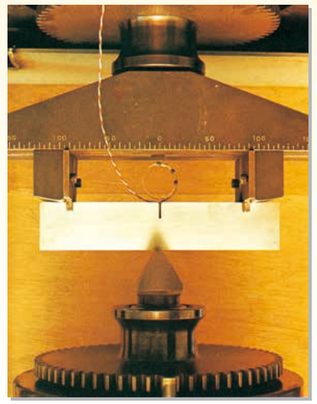


Sulfide stress corrosion cracking tester



5,000-ton tester for structures

Burst tester



COD (Crack Opening Displacement) tester

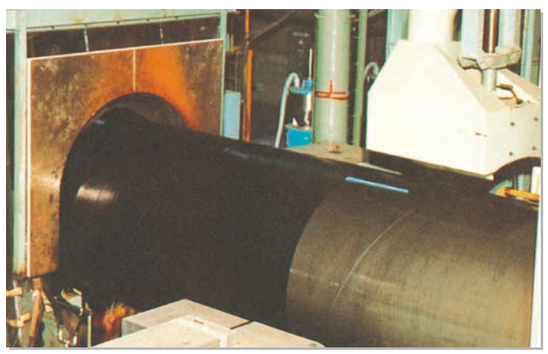
Coating and Shipment

PLP for Large Diameter Pipes

PLP is the trade name of pipe with an external plastic coating that gives superior corrosion resistance.
Plastic sheet is helically wrapped around the outside of the pipe and pressed against it as the rotates while travelling in the direction of its axis.
Any rust on the pipe is removed before application of the plastic sheet.
With this method, it is possible to coat pipe with relatively thick plastic coatings.
Moreover, with the proper adhesive layer this method can provide line pipe with heat resistance high enough for operating temperatures up to 110˚C (230˚F)
Pipe coated with plastic by this method combines excellent mechanical properties and stable chemical and electrical characteristics.

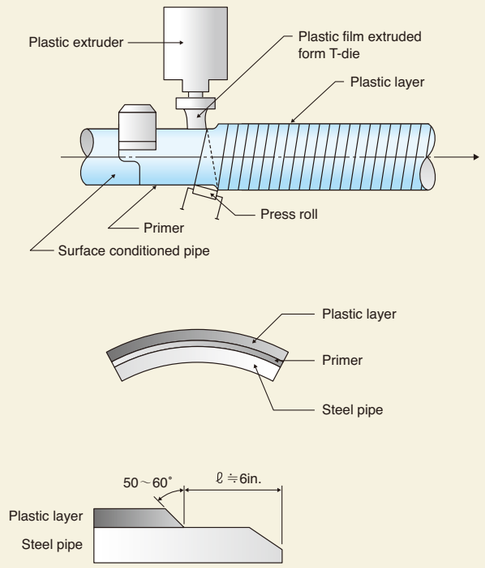
Applications
Plastic coating is designed for use in the following:
- General underground service
- Highly corrosive soil service
- Under water service
- High and low temperature service

Applicable Plastic: Polyethylene, Polypropylene
Method: Liquid primer, Powder epoxy primer



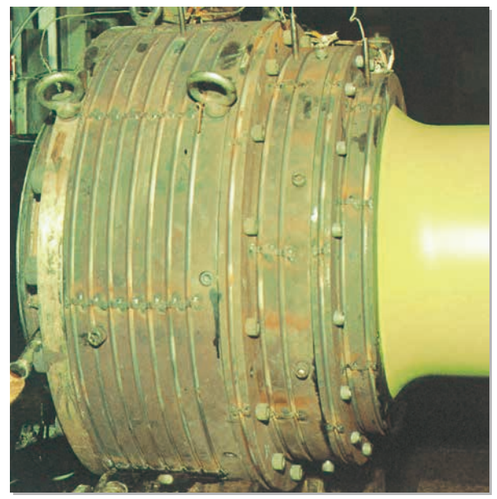
Location	Capacity (t./yr.)	Size Range		
		OD	Pipe Length	Standard coating thickness
Fukuyama	580,000	16～64in. (406.4～1625.6mm)	20～62ft (6～19m)	0.1～0.12in. (2.5～3.0mm)

●*Coating Method*



PLP for Small & Medium Diameter Pipes

PLP coating gives superior corrosion resistance.
It is ideal for applications where asphalt-wrapped pipe or coal tar enamel-wrapped pipe has been used. The pipe, removed any rust by blasting, is coated first with primer and next plastic film extruded from circular die continuously (in the case of double layer type, 2 times)
PLP is also highly recommended for use where perfect pipeline reliability is required, such as in gas and fuel pipeline, for operating temperature up to 110℃ (230˚F). In addition to the product, we can offer field installation know-how for PLP.

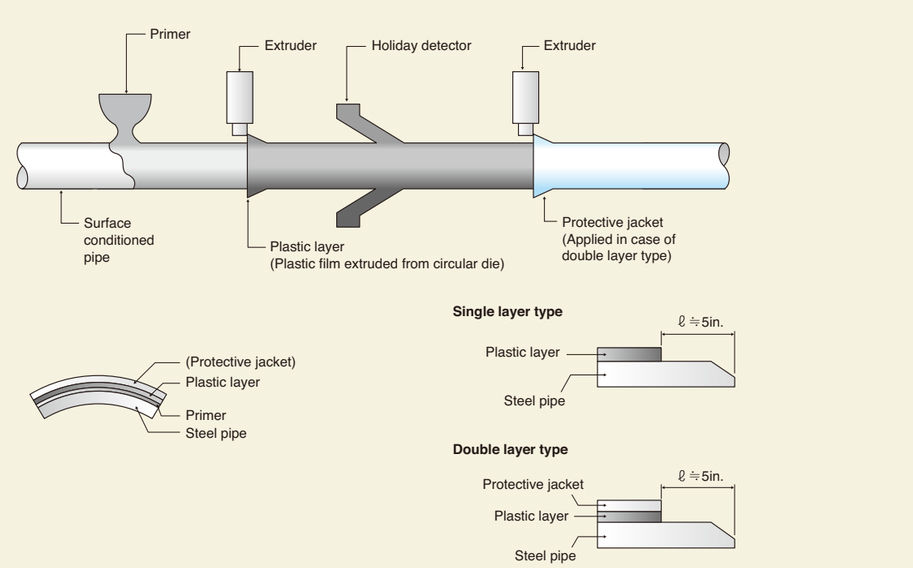


Applications
Plastic coating is designed for use in the following:
- General underground service
- Highly corrosive soil service
- Under water service

Applicable Plastic: Polyethylene, Polypropylene

Location	Capacity (t./yr.)	Size Range		
		OD	Pipe Length	Standard coating thickness (Plastic layer)
Keihin	140,000	1/2～24in. (21.7～609.6mm)	20～40ft (6～12m)	0.06～0.1in. (1.5～2.5mm)

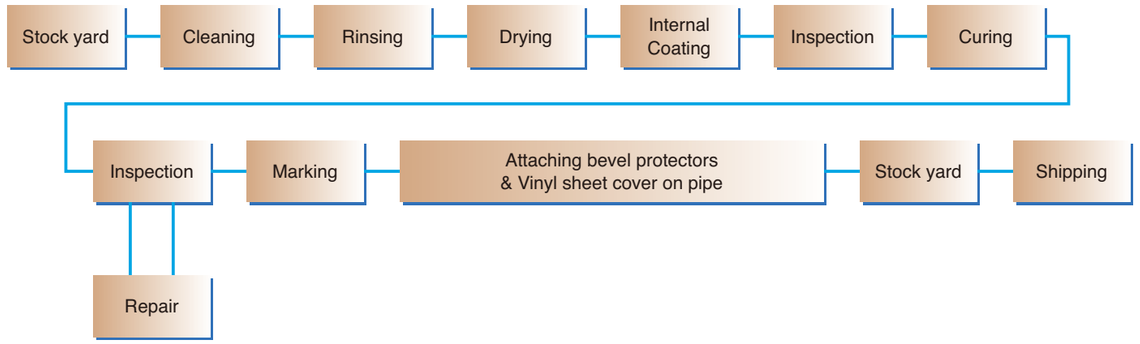
●*Coating Method*



Internal Coating

An epoxy resin coating effectively reduces the friction resistance between the fluid and the pipe.
JFE has both the equipment and the technology to line the inside with the type of resin best suited to the intended application for the pipe, doing everything from descaling of the pipe surface before coating to the shipment of the finished product.
Thus around the world internally lined pipe from JFE enjoys an excellent reputation for its stable performance.
For transporting various other liquids from drinking water to crude oil, JFE can also supply pipe lined with the material that best matches the specific application.

Manufacturing Process



Location	Capacity (t./yr.)	Size Range		
		OD	Length	Thickness of coating epoxy film
Fukuyama	180,000	16～56in. (406.4～1422.4mm)	20～62ft (6～19m)	0.1～0.12in. (2.5～3.0mm)

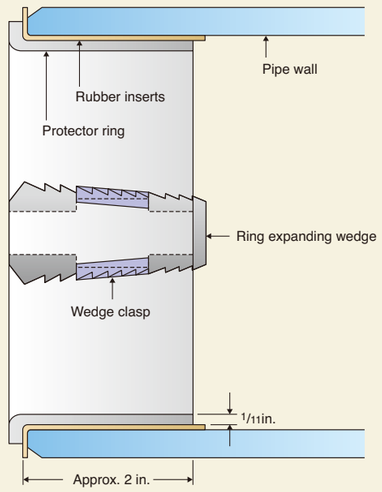
Internal coating


Internally coated pipe ready for shipment

Bevel Protectors

The photographs show how bevel protector is installed.
The protector is made of a steel strip forming into a circular shape.
The abutting ends of the ring are fitted with steel wedge clasps.
Bevel protectors of the type shown in the photographs are used for large diameter line pipe.
The wedge, which has either machined reverse teeth or plain edges, is inserted into the claps and tapped into place to expand the protector inside the pipe end.
This protects the vulnerable root face and bevel against damage during subsequent handling from mill shipment to arrival at the job site.

Example of Bevel Protector




Installation of bevel protector (in sequence from top to bottom)

Handling, Storage and Loading Tiers

Improper practices or careless handling are likely to result in pipe damage of the following types:

(a) Denting, ovalling — caused by use of improper supports or stacking to excessive heights.
(b) End damage — caused by use of improper end hooks for lifting or by rough handling in which the pipe end is struck.
(c) Fatigue cracking — caused by vertical vibrations during transportation as a result of excessive static and cyclic loads.
(d) Abrasion, scratching — caused by the pipe wall being rubbed or struck against other objects.

Handling

Hooks

Hooks shall be designed to prevent end damage and shall be lined with rubber. They shall also have sufficient width and depth to fit the inside of the pipe.

Lifting

Lifting shall be carried out so as to prevent impact loads that could cause local denting or out-of-roundness of the pipe body or pipe ends.

Bevel protecting

Bevel protectors which are loose or missing shall be reattached to the pipe end before the pipe is handled.

Storage

The surface on which the pipe will be laid or stacked shall be flat and free of protrusions. Bearing strips shall be carefully leveled to provide uniform load distribution.

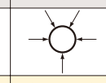
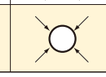
Pipe loading

Loading Tiers and Bottom Dunnage

The maximum allowable number of loading tiers the stowage of steel pipe cargoes (with D/t over 50) is calculated by the following formulas:

(1) $n = P \times 10^4 \sigma_Y \times \frac{t}{(D-t)^2}$

n = Loading tires
P = Stowage method/length of vessel

P	Length / Vessel — Stowage Method	120m ~ 160m	160m ~ 180m	180m ~ 200m	Over ~ 200m	Remarks
a.		5.65	6.05	6.25	6.78	Theoretical figure. not suitable for calculation.
b.		3.07	3.29	3.54	3.69	In case of 1 point support.
c.		17.19	18.40	19.82	20.62	Theoretical figure. not suitable for calculation.
d.		6.85	7.33	7.90	8.21	In case of 2 point support.

D = Outside diameter (mm)
t = Thickness of pipe (mm)
σ_Y = Minimum yield point (kg/mm²)

(2) Variations in (n) occurring with the use of bottom dunnage.

$n = 1 + \frac{0.5\,(L-BW)}{B}$

L = Pipe length (m)
B = Number of pieces of bottom dunnage
W = Width of bottom dunnage (m)

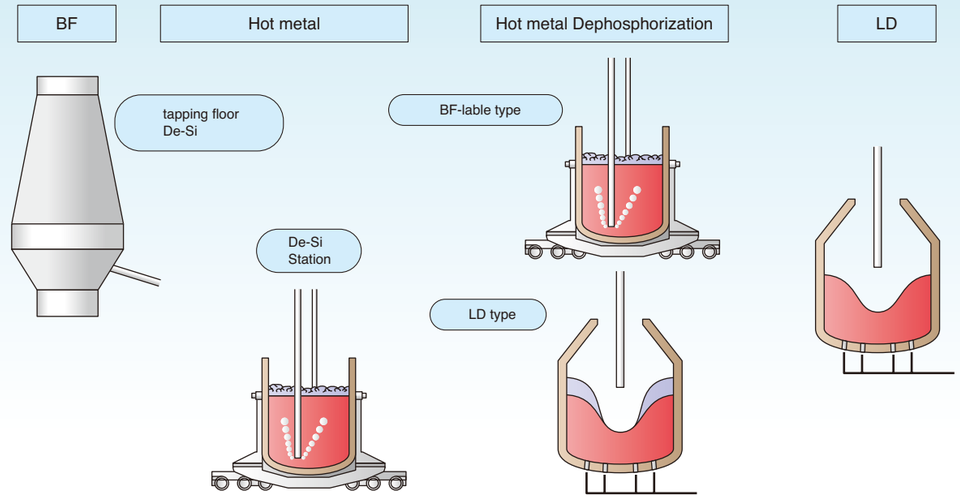
Yard-to-ship loading facility

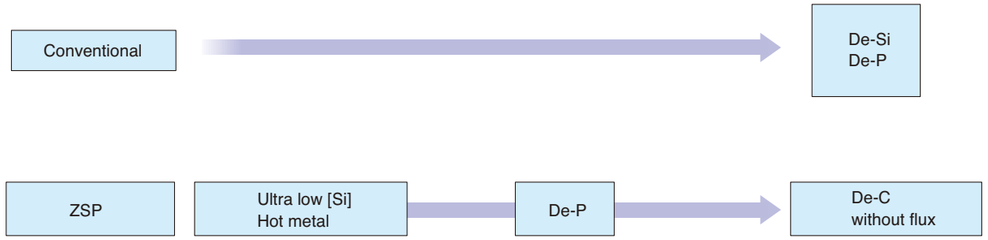
Zero-Slag Process

Features

- Ultra low [Si] Hot metal
- Stable dephosphorization performance
- De-C without flux

Minimum slag generation process

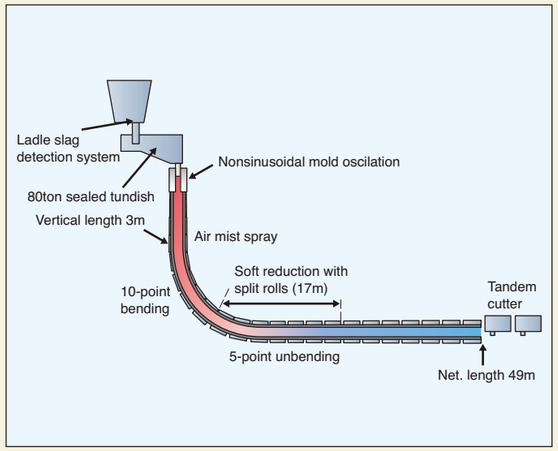




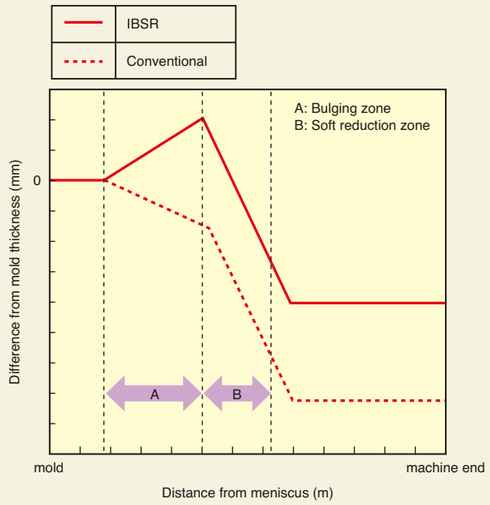
IBSR

Improvement of Center-line Segregation by IBSR (Intentional Bulging and Soft Reduction)

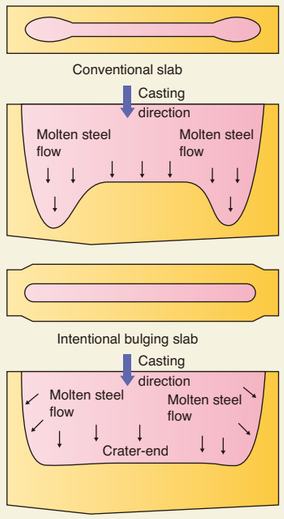
●*Schematic diagram of technology for Continuous casting Machine*



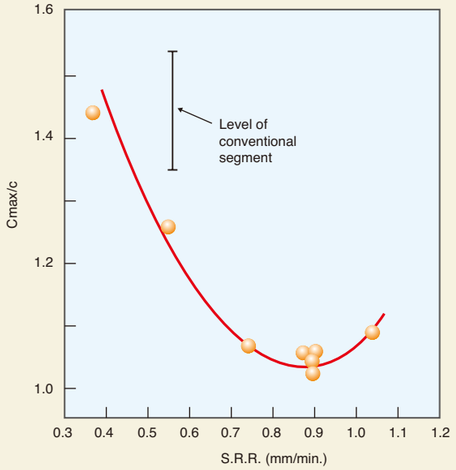
●*Roll gap profile of IBSR*



●*Improvement of crater end Profile by IBSR*



●*Effect of soft reduction ratio on center line segregation*



Super - OLAC

Thermo mechnainical Controlled Process with Super-OLAC (Super On Line Accelerated Cooling)

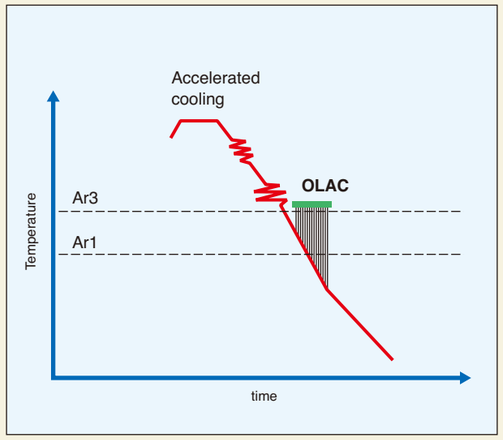
Features

Ultimate cooling rate	***High strength with low Ceq. (Good weldability)***
Uniform temperature profile	***Homogeneous properties and flatness***

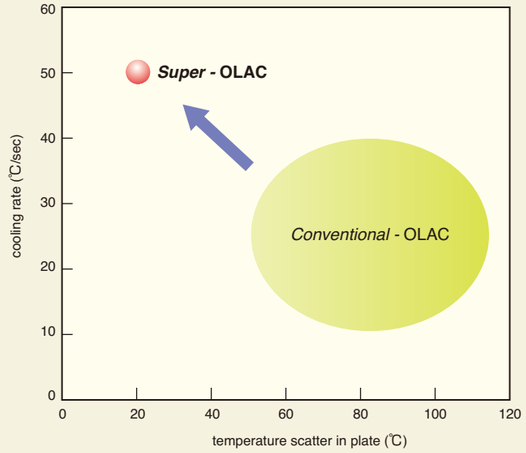
Major application

- Sour resistance line pipe
- High strength line pipe (up to X100)
- Heavy wall pipe

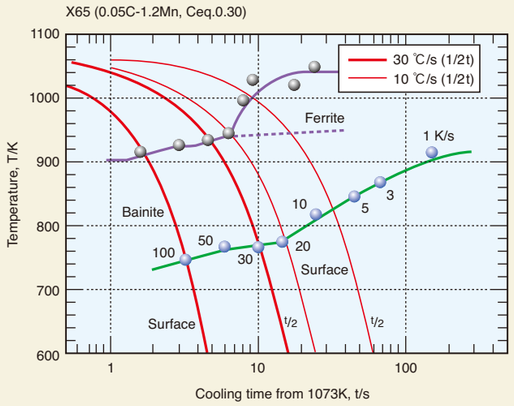
●*Process of Plate Rolling*



●*Characteristies of Super - OLAC*

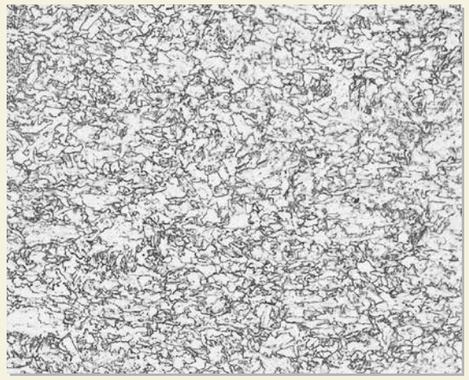


●*Homogeneous microstructure through thickness*



Continuous cooling transformation diagram of 0.05%C-1.2%Mn steel after hot deformation.

●*Fine bainitic microstructure*



Microstructures of the middle thickness position of the 0.05%C-1.2%Mn steel AcC cooled with 30℃/s.

Martensitic Stainless Steel 12% Cr Seamless Linepipe

In the development of oil and gas, transportation of CO_2 corrosive oil and gas will become an increasingly common occurrence.
To handle this major problem JFE has developed a Martensitic Stainless Steel for lilepipe applications, JFE's Martensitic Stainless Steel 12% Cr.

Features
1. Good weldability as compared with conventional 13% Cr.
2. Excellent toughness in low temperature services
3. Excellent corrosion resistance to CO_2 as good as OCTG13CR

Typical application and chemistry design

JFE-12HP1-X80	Light sour condition	LowC-12Cr-5Ni-2Mo

Characteristics

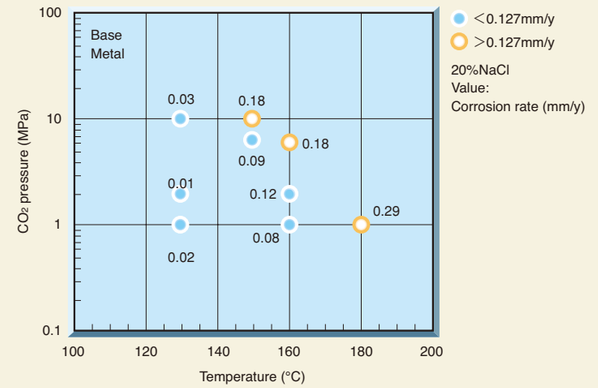
1 Mechanical Properties

	JFE-12HP1-X80
Yield strength at 20℃ (68˚F)	550-750 (MPa) 80.0-108.5 (ksi)
Tensile strength (MPa) at 20˚C (68˚F)	700-900 (MPa) 101.5-130.5 (ksi)
Elongation (%) at 20˚C (68˚F)	20
Absorbed Energy of Charpy-V impact Test at -20˚C (-4˚F)	≧75J (Ave.) 56J (Single) ≧55ft-lb (Ave.) 41ft-lb (Single)
Young's Modulus (MPa) at 20˚C (68˚F)	211000
Coefficent of Thermal Expansion α ($X10^{-6}$ C^{-1})	12
Maximum Hardness Value of Base Metal	310 (HV10) 31.0 (HRC) 294 (HB)

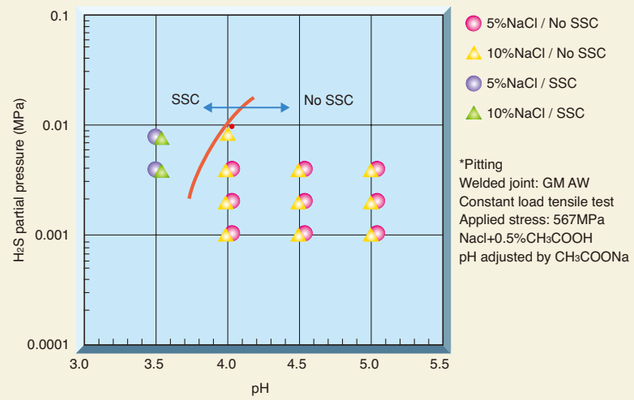
2 Size Availability

Outside Diameter: From 2in. to 16in.

3 CO_2 Corrosion Resistance



4 H_2S Corrosion Resistance



5 Field Welding

GTAW (Gas Tungsten Arc Welding) and GMAW (GAS Metal Arc Welding) method are both available.

Specifications

Applicable specifications

JFE Steel Corporation produces tubular products to the specifications listed below.
Other specifications can be also supplied.

Specification		Title		Manufacturing Method			
				Arc Welding	High frequency Welding	Seamless	Butt welding
API	5L	Line pipe		○	○	○	○
ASTM	A53	Welded and Seamless Steel Pipe			○	○	○
	A106	Seamless Carbon Steel Pipe for High-Temperature Service				○	
	A134	Electric-Fusion (Arc)-Welded Steel Plate Pipe		○			
	A135	Electric-Resistance-Welded Steel Pipe			○		
	A139	Electric-Fusion (Arc)-Welded Steel Pipe		○			
	A333	Seamless and Welded Steel Pipe for Low-Temperature Service			○	○	
	A334	Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service			○	○	
	A335	Seamless-Ferritic Alloy Steel Pipe for High-Temperature Service				○	
	A671	Electric-Fusion-Welded Steel Pipe for Atmospheric and Lower Temperature		○			
	A672	Electric-Fusion-Welded Steel Pipe for High Pressure Service at Moderate Temperature		○			
BS	1387	Steel Tubes and Tubulars Suitable for Screwing to BS21 Pipe Thread			○		○
	3601	Steel Pipes and Tubes for Pressure Purpose Carbon Steel: Ordinary Duties		○	○	○	○
	3602	Steel Pipes and Tubes for Pressure Purpose Carbon Steel High Duties		○	○	○	
	3603	Steel Pipes and Tubes for Pressure Purpose Carbon and Alloy Steel: Low Temperature Duties			○	○	
	3604	Steel Pipes and Tubes for Pressure Purpose Low and Medium-alloy Steel		○	○	○	
DIN	2440	Steel Tubes Medium weight Type Suitable for Screwing			○		○
	1626	Welded Circular Unalloyed Steel Tubes Subject to special requirement		○	○	○	
	1628	High performance Welded Circular Unalloyed Steel Tube		○	○		
	1629	Seamless Circular Unalloyed Steel Tubes Subject to special requirement				○	
	17172	Steel Pipes for Pipe lines for the Transport of Combustible Fluids and Gases Technical Conditions of Delivery		○	○	○	
JIS	G3452	Carbon Steel Pipes for Ordinary Piping			○		○
	G3454	Carbon Steel Pipes for Pressure Service			○	○	
	G3455	Carbon Steel Pipes for High Pressure Service				○	
	G3456	Carbon Steel Pipes for High Temperature Service			○	○	
	G3457	Electric-Arc-Welded Carbon Steel Pipe		○			
	G3458	Alloy Steel Pipes				○	
	G3460	Steel Pipes for low Temperature Service			○	○	
CSA	Z245.1	General Requirements for Plain-End Welded and Seamless Steel Line Pipe		○	○	○	
AWWA	C200	Steel Water Pipe 6 Inches and Larger		○	○	○	
Gost	10704	Electric-Welded Steel Tubes		○	○		
	8731	Seamless Hot-Rolled Steel Tubes. Technical Requirement				○	
	8732	Seamless Hot-Rolled Steel Tubes. Range				○	
ISO	3183-1	Petroleum and natural gas industries-steel pipe for pipelines-Technical delivery condition Part1: Pipe of requirement class A		○	○	○	○
	3183-2	Petroleum and natural gas industries-steel pipe for pipelines-Technical delivery condition Part2: Pipe of requirement class B		○	○	○	
	3183-3	Petroleum and natural gas industries-steel pipe for pipelines-Technical delivery condition Part3: Pipe of requirement class C		○	○	○	
DNV	OS-F101	Submarine Pipeline Systems		○	○	○	

Chemical and Physical Requirements

■API (American Petroleum Institute)

Specification	Grade	PSL (Product Specification Level)	Process of manufacture S : Seamless W : Weld	Chemical requirements %							Tensile Requirements				
				C[a]	Mn[a]	P	S	Ti	Other		Yield Strength, min.		Tensile Strength, min.		Elongation, %, min.
				Max.	Max.	Max.	Max.	Max.	Max.		psi	MPa	psi	MPa	GL=2in. (50.8mm)
5L (2004)	A25 Class Ⅰ / Class Ⅱ	PSL1	S, W	0.21	0.6	0.030 / 0.045-0.080	0.030	-	-		25,000	172	45,000	310	U.S. Customary Unit Equation $e=625{,}000\ \frac{A^{0.2}}{U^{0.9}}$ SI Unit Equation $e=1{,}944\ \frac{A^{0.2}}{U^{0.9}}$ e=minimum elongation in 2in. (50.8mm) in per cent rounded to nearest per cent A= cross sectional area of the tensile test specimen ($in.^2$) (mm^2) U= specified tensile strength (psi)(MPa)
	A	PSL1	S, W	0.22	0.90	0.030	0.030	-	-		30,000	207	48,000	331	
	B	PSL1	S	0.28	1.20	0.030	0.030	0.04	b c d		35,000	241	60,000	414	
			W	0.26											
		PSL2	S	0.24		0.025	0.015		d e		35,000-65,000	241-448	60,000-110,000	414-758	
			W	0.22											
	X42	PSL1	S	0.28	1.30	0.030	0.030	0.04			42,000	290	60,000	414	
			W	0.26											
		PSL2	S	0.24		0.025	0.015				42,000-72,000	290-496	60,000-110,000	414-758	
			W	0.22											
	X46	PSL1	S	0.28	1.40	0.030	0.030	0.04			46,000	317	63,000	434	
			W	0.26											
		PSL2	S	0.24		0.025	0.015				46,000-76,000	317-524	63,000-110,000	434-758	
			W	0.22											
	X52	PSL1	S	0.28	1.40	0.030	0.030	0.04			52,000	359	66,000	455	
			W	0.26											
		PSL2	S	0.24		0.025	0.015				52,000-77,000	359-531	66,000-110,000	455-758	
			W	0.22											
	X56	PSL1	S	0.28	1.40	0.030	0.030	0.04	c d		56,000	386	71,000	490	
			W	0.26											
		PSL2	S	0.24		0.025	0.015				56,000-79,000	386-544	71,000-110,000	490-758	
			W	0.22											
	X60	PSL1	S[f]	0.28	1.40	0.030	0.030	0.04			60,000	414	75,000	517	
			W[f]	0.26											
		PSL2	S[f]	0.24		0.025	0.015				60,000-82,000	414-565	75,000-110,000	517-758	
			W[f]	0.22											
	X65	PSL1	S[f]	0.28	1.40	0.030	0.030	0.06			65,000	448	77,000	531	
			W[f]	0.26	1.45										
		PSL2	S[f]	0.24	1.40	0.025	0.015				65,000-87,000	448-600	77,000-110,000	531-758	
			W[f]	0.22	1.45										
	X70	PSL1	S[f]	0.28	1.40	0.030	0.030	0.06			70,000	483	82,000	565	
			W[f]	0.26	1.65										
		PSL2	S[f]	0.24	1.40	0.025	0.015				70,000-90,000	483-621	82,000-110,000	565-758	
			W[f]	0.22	1.65										
	X80	PSL2	S[f]	0.24	1.40	0.025	0.015	0.06			80,000-100,000	552-690	90,000-120,000	621-827	
			W[f]	0.22	1.85										

Notes: a For each reduction of 0.01% below the specified maximum carbon content, an increase of 0.05% above the specified maximum manganese content is permissible up to a maximum of 1.50% for grades X42 through X52 up to a maximum of 1.65% for grades higher than X52 but less than X70, and up to 2.00% for Grade X70 and higher.

b The sum of Columbium (niobium) and vanadium contents shall not exceed 0.03%, except that, by agreement between the purchaser and manufacturer, an alternative maximum may be established.

c Columbium (niobium), vanadium, titanium, or combinations there of may be used at the discretion of the manufacturer.

d The sum of the columbium (niobium), vanadium, and the titanium contents shall not exceed 0.15%.

e The sum of Columbium (niobium) and vanadium contents shall not exceed 0.06%, except that, by agreement between the purchaser and manufacturer, an alternative maximum may be established.

f Other chemical compositions may be furnished by agreement between purchaser and manufacturer, providing that limits of Footnotes d, and the tabular limits for phosphorus and sulfur are met.

ISO 3183-3 (1999)

Non-sour Service Applications

Steel name	C	Si	Mn [a]	P	S	V	Nb	Ti	other [b]	CEV [c]	Pcm [de]		pipe body [m] (seamless and welded pipe)				Weld seam [m]		Charpy V-Notch impact energy				
													Yield Strength	Tensile Strength	Ratio	Elongation [q]	Tensile Strength	D of mandrel for bend test T = wall thickness	Test Temperature thickness (t) mm			Average of three test pieces	Min. individual Value
													$R_{t0.5}$ N/mm²	R_m N/mm² min.	$R_{t0.5}/R_m$ [np] max.	$L_0=5.65\sqrt{S_0}$ A % min.			t≦20	20<t≦30	t>30	J	J
L245NC	0.14	0.40	1.35	0.020	0.010				f	0.36	0.19		245 to 440	415	0.90	22	415	3T	TD-10℃	TD-20℃	TD-30℃	27	22
L290NC	0.14	0.40	1.35	0.020	0.010	0.05	0.05	0.04	f	0.36	0.19		290 to 440	415	0.90	21	415	3T	TD-10℃	TD-20℃	TD-30℃	30	24
L360NC	0.16	0.45	1.65	0.020	0.010	0.10	0.05	0.04	gh	0.43	0.22		360 to 510	460	0.90	20	460	4T	TD-10℃	TD-20℃	TD-30℃	36	30
L290QC	0.14	0.40	1.35	0.020	0.010	0.04	0.04	0.04	f	0.34	0.19		290 to 440	415	0.90	21	415	3T	TD-10℃	TD-20℃	TD-30℃	30	24
L360QC	0.16	0.45	1.65	0.020	0.010	0.07	0.05	0.04	gh	0.39	0.20		360 to 510	460	0.90	20	460	4T	TD-10℃	TD-20℃	TD-30℃	36	30
L415QC	0.16	0.45	1.65	0.020	0.010	0.08	0.05	0.04	gh	0.41	0.22		415 to 565	520	0.92	18	520	5T	TD-10℃	TD-20℃	TD-30℃	42	35
L450QC	0.16	0.45	1.65	0.020	0.010	0.09	0.05	0.06	gh	0.42	0.22		450 to 570	535	0.92	18	535	6T	TD-10℃	TD-20℃	TD-30℃	45	38
L485QC	0.17	0.45	1.75	0.020	0.010	0.10	0.05	0.06	gh	0.42	0.23		485 to 605	570	0.92	18	570	6T	TD-10℃	TD-20℃	TD-30℃	50	40
L555QC	0.17	0.45	1.85	0.020	0.010	0.10	0.06	0.06	by agreement				555 to 675	625	0.92	18	625	6T	TD-10℃	TD-20℃	TD-30℃	56	45
L290MC	0.12	0.40	1.35	0.020	0.010	0.04	0.04	0.04	f	0.34	0.19		290 to 440	415	0.90	21	415	3T	TD-10℃	TD-20℃	TD-30℃	30	24
L360MC	0.12	0.45	1.65	0.020	0.010	0.05	0.05	0.04	h	0.37	0.20		360 to 510	460	0.90	20	460	4T	TD-10℃	TD-20℃	TD-30℃	36	30
L415MC	0.12	0.45	1.65	0.020	0.010	0.08	0.06	0.06	gh	0.38	0.21		415 to 565	520	0.92	18	520	5T	TD-10℃	TD-20℃	TD-30℃	42	35
L450MC	0.12	0.45	1.65	0.020	0.010	0.10	0.06	0.06	gh	0.39	0.22		450 to 570	535	0.92	18	535	6T	TD-10℃	TD-20℃	TD-30℃	45	38
L485MC	0.12	0.45	1.75	0.020	0.010	0.10	0.06	0.06	gh	0.41	0.23		485 to 605	570	0.92	18	570	6T	TD-10℃	TD-20℃	TD-30℃	50	40
L555MC	0.14	0.45	1.85	0.020	0.010	0.10	0.06	0.06	by agreement				555 to 675	625	0.92	18	625	6T	TD-10℃	TD-20℃	TD-30℃	56	45

Sour Service Applications

Steel name	C	Si	Mn [a]	P	S [i]	V	Nb	Ti	other [jk]	CEV [c]	Pcm [de]		pipe body [m] (seamless and welded pipe)				Weld seam [m]		Charpy V-Notch impact energy				
													Yield Strength	Tensile Strength	Ratio	Elongation [q]	Tensile Strength	D of mandrel for bend test T = wall thickness	Test Temperature thickness (t) mm			Average of three test pieces	Min. individual Value
													$R_{t0.5}$ N/mm²	R_m N/mm² min.	$R_{t0.5}/R_m$ [np] max.	$L_0=5.65\sqrt{S_0}$ A % min.			t≦20	20<t≦30	t>30	J	J
L245NCS	0.14	0.40	1.35	0.020	0.003					0.36	0.19		245 to 440	415	0.90	22	415	3T	TD-10℃	TD-20℃	TD-30℃	27	22
L290NCS	0.14	0.40	1.35	0.020	0.003	0.05	0.05	0.04		0.36	0.19		290 to 440	415	0.90	21	415	3T	TD-10℃	TD-20℃	TD-30℃	30	24
L360NCS	0.16	0.45	1.65	0.020	0.003	0.10	0.05	0.04	g	0.43	0.22		360 to 510	460	0.90	20	460	4T	TD-10℃	TD-20℃	TD-30℃	36	30
L290QCS	0.14	0.40	1.35	0.020	0.003	0.04	0.04	0.04		0.34	0.19		290 to 440	415	0.90	21	415	3T	TD-10℃	TD-20℃	TD-30℃	30	24
L360QCS	0.16	0.45	1.65	0.020	0.003	0.07	0.05	0.04	g	0.39	0.20		360 to 510	460	0.90	20	460	4T	TD-10℃	TD-20℃	TD-30℃	36	30
L415QCS	0.16	0.45	1.65	0.020	0.003	0.08	0.05	0.04	gl	0.41	0.22		415 to 565	520	0.92	18	520	5T	TD-10℃	TD-20℃	TD-30℃	42	35
L450QCS	0.16	0.45	1.65	0.020	0.003	0.09	0.05	0.06	gl	0.42	0.22		450 to 570	535	0.92	18	535	6T	TD-10℃	TD-20℃	TD-30℃	45	38
L290MCS	0.10	0.40	1.25	0.020	0.002	0.04	0.04	0.04		0.34	0.19		290 to 440	415	0.90	21	415	3T	TD-10℃	TD-20℃	TD-30℃	30	24
L360MCS	0.10	0.45	1.45	0.020	0.002	0.05	0.05	0.04		0.37	0.20		360 to 510	460	0.90	20	460	4T	TD-10℃	TD-20℃	TD-30℃	36	30
L415MCS	0.10	0.45	1.45	0.020	0.002	0.08	0.06	0.06	g	0.38	0.21		415 to 565	520	0.92	18	520	5T	TD-10℃	TD-20℃	TD-30℃	42	35
L450MCS	0.10	0.45	1.55	0.020	0.002	0.10	0.06	0.06	gl	0.39	0.22		450 to 570	535	0.92	18	535	6T	TD-10℃	TD-20℃	TD-30℃	45	38
L485MCS	0.10	0.45	1.55	0.020	0.002	0.10	0.06	0.06	gl	0.41	0.23		485 to 605	570	0.92	18	570	6T	TD-10℃	TD-20℃	TD-30℃	50	40

NOTE
- a For each reduction of 0.01% below the maximun carbon content, an increase of 0.05% manganese above the specified maximun value is permitted, with a maximun increase of 0.2%
- b Al total<0.006; N≦0.012; Al:N≧2:1(not available to titanium-killedsteels)
- c Ceq (=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15
- d Pcm=C+V/10+Mo/15+(Cr+Mn+Cu)/20+Si/30+Ni/60+5B
- e For seamless pipe, Pcm values 0.03 higher than the tabulated value are permitted, up to a maximun of 0.25
- f Cu≦0.35; Ni≦0.30; Mo≦0.10; B≦0.0005
- g The sum of V, Nb, Ti shall not exceed 0.15%
- h Cu≦0.50; Ni≦0.50; Cr≦0.50; Mo≦0.5; B≦0.0005
- i For seamless pipe, sulfur content up to 0.008% is permitted
- j Al total<0.006; N≦0.012; Al:N≧2:1(not available to titanium-killedsteels); Cu≦0.35(by agreement≦0.10); Ni≦0.30; Cr≦0.30; Mo≦0.10; B≦0.0005
- k For welded pipe where calcium is intentionally added, Ca/S shall be≧1.5 when S>0.0015%. For all type of pipe (seamless and welded) Ca shall be resistric to 0.006%
- l For these steel grades, a molybdenum content up to 0.35% may be agreed
- m Mechanical properties apply for wall thickness up to 25mm and shall be agreed for larger wall thicknesses.
- n The value for the yield strength ratio apply to the product "pipe". They cannot be required for the starting material. For grades L415MCS, L450MCS and L485MCS, the ratio may be increased by agreement to 0.93. For seamless pipe manufactured by a process of quenching and temperring, Rt0.5/Rm ratio greater than the tabulated values may be agreed.
- p The Rt0.5/Rm ratio for M grades applies to transverse test pieces only.
- q These values apply to transverse test pieces taken from the pipe body. If longitudinal test pieces are tested, the values of elongation shall be 2 units higher.

DNV OS-F101 (2000)

Welded C-Mn steel line pipe [1) 2) 3) 4)]

SMYS	C [5)]	Si	Mn [5)]	P	S	Cu	Ni	Mo	Cr [6)]	T Al [7)]	Nb [8) 9)]	V [8)]	Ti [8)]	N [7)]	B [10)]		CE [11)]	Pcm [12)]	Yield Strength	Tensile Strength	Ratio	Max. Hardness	Elongation	Charpy V-Notch properties							
																								Gas			Liquid			Charpy V-notch energy (KVT) min. J [16)]	
																			MPa (T+L) [13)]	MPa (T) [14)]	YS (Rt0.5) / UTS (Rm) max (an)(T)[15)]	(HV10) BM, WM HAZ	As Min. % (T+L)	Test Temperature thickness (t) mm			Test Temperature thickness (t) mm			Mean	Single
																								t≦20	20<t≦40	t>40	t≦20	20<t≦40	t>40		
245	0.14	0.40	1.35	0.020	0.010	0.35	0.30	0.10	0.30	0.06	-	-	-	0.010	0.0005		0.36	0.19	245	370	0.90	270	22	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		27	22
290	0.12	0.40	1.65	0.020	0.010	0.35	0.30	0.10	0.30	0.06	0.04	0.04	0.04	0.010	0.0005		0.34	0.19	290	415	0.90	270	21	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		30	24
360	0.12	0.45	1.65	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.05	0.05	0.04	0.010	0.0005		0.37	0.20	360	460	0.90	270	20	To=Tmin-10	To=Tmin-20	to be agreed in each case	To=Tmin	To=Tmin-10	to be agreed in each case	36	30
415	0.12	0.45	1.65	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.06	0.08	0.06	0.010	0.0005		0.38	0.21	415	520	0.92	270	18	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		42	35
450	0.12	0.45	1.65	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.06	0.10	0.06	0.010	0.0005		0.39	0.22	450	535	0.92	270	18	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		45	38
485	0.12	0.45	1.75	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.06	0.10	0.06	0.010	0.0005		0.41	0.23	485	570	0.92	270	18	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		50	40
555	0.14	0.45	1.85	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.06	0.10	0.06	0.010	0.0005		0.44	0.25	555	625	0.92	300	18	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		56	45

Seamless C-Mn steel line pipe [1) 2) 4)]

SMYS	C [5)]	Si	Mn [5)]	P	S	Cu	Ni	Mo	Cr [6)]	T Al [7)]	Nb [8)]	V [8)]	Ti [8)]	N [7)]	B [10)]		CE [11)]		Pcm [12)]		Yield Strength	Tensile Strength	Ratio	Max. Hardness	Elongation	Charpy V-Notch properties							
																									GAS			Liquid			Charpy V-notch energy (KVT) min. J [16)]	
																									Test Temperature thickness (t) mm			Test Temperature thickness (t) mm				
																	t≦15	15<t<26	t≦15	15<t<26	Mpa (T+L) [13)]	Mpa (T) [14)]	YS (Rt0.5) / UTS (Rm) max (an)(T)[15)]	(HV10) BM, WM HAZ	As Min. % (T+L)	t≦20	20<t≦40	t>40	t≦20	20<t≦40	t>40	Mean	Single
245	0.14	0.40	1.35	0.020	0.010	0.35	0.30	0.10	0.30	0.06	-	-	-	0.010	0.0005		0.34	0.35	0.20	0.21	245	370	0.90	270	22	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		27	22
290	0.14	0.40	1.65	0.020	0.010	0.35	0.30	0.10	0.30	0.06	0.04	0.04	0.04	0.010	0.0005		0.34	0.35	0.20	0.21	290	415	0.90	270	21	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		30	24
360	0.14	0.45	1.65	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.05	0.07	0.04	0.010	0.0005		0.37	0.38	0.21	0.22	360	460	0.90	270	20	To=Tmin-10	To=Tmin-20	to be agreed in each case	To=Tmin	To=Tmin-10	to be agreed in each case	36	30
415	0.14	0.45	1.65	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.05	0.08	0.04	0.010	0.0005		0.39	0.40	0.22	0.23	415	520	0.92	270	18	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		42	35
450	0.15	0.45	1.65	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.05	0.09	0.06	0.010	0.0005		0.40	0.41	0.23	0.24	450	535	0.92	270	18	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		45	38
485	0.16	0.45	1.75	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.05	0.10	0.06	0.010	0.0005		0.41	0.42	0.24	0.25	485	570	0.92	300	18	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		50	40
555	0.16	0.45	1.85	0.020	0.010	0.50	0.50	0.50	0.50	0.06	0.06	0.10	0.06	0.010	0.0005		0.43	0.44	0.26	0.27	555	625	0.92	300	18	To=Tmin-10	To=Tmin-20		To=Tmin	To=Tmin-10		56	45

Note 1) Chemical composition applies for wall thickness up to 35mm and shall be subject to agreement for larger wall thickness
2) When scrap material is being used in steel production, the amount of the following residual elements shall be determind and reported and the lebels shall not exceed: 0.03%As, 0.01%Sb, 0.02%Sn, 0.01%Pb, 0.01%Bi and 0.006%Ca.
3) When calcium is intentionally added, the Ca/S ratio shall be≧1.5 when S＞0.0015
4) Except for deoxidation elements, other elements than those mentioned in this table shall not be intentionally added if not specifically agreed.
5) For each reduction of 0.01% carbon below the maximun specified value, an increase of 0.05% manganese above the specified maximun value is permitted with a maximun increase of 0.1%.
6) 0.5-1.0% Cr may be used subject to agreement.
7) Al:N≧2:1 (not applicable for titanium killed steels)
8) (Nb＋V＋Ti)% maximun: 0.12%. This value may be increased to maximun 0.15% subject to agreement.
9) For SMYS≧485Mpa and for cladded material, the Nb content may be increased to 0.10% subject to agreement.
10) Boron (max. 30ppm) may be added subject to agreement.
11) CE＝C＋Mn/6＋(Cr＋Mo＋V)/5＋(Cu＋Ni)/15
12) Pcm＝C＋Si/30＋(Mn＋Cu＋Cr)/20＋Ni/60＋Mo/15＋V/10＋5B
13) The actual yield strength in the longitudinal direction shall not exceed SMYS by more than 120Mpa.
14) SMYS in the longitudinal direction, can be 5% less than the required values in transverse direction.
15) The YS/UTS ratio in the longitudinal direction shall not exceed the maximun specified value in the transverse direction, by more than 0.020 for standard material, and more than 0.030 for sour service material.
16) The KVL value (when tested) shall be 50% higher than the required KVT values.

Dimensional Tolerances

Item		API 5L (2004)			ISO3183-3 (1999)		DNV OS-F101 (2000)	
Outside Diameter	Pipe Body Welded Pipe	OD＜2 3/8in. (60.3mm) ≧2 3/8in. (60.3mm) and＜20in. (508.0mm) ≧20in. (508.0mm) and＞36in. (914.0mm) ＞36in. (914.0mm)	+0.016in. (+0.41mm)−0.031in. (−0.8mm) ±0.75% +0.75%, −0.25% 1/4in. (+6.4mm), −1/8in. (−3.2mm)		D≦610mm 610＜D≦1430mm D＞1430mm	±0.5mm or ±0.75%D but max. ±3mm ±0.5%D but max. ±4mm by agreement	D≦610mm D＞610mm	±0.5mm or ±0.75%D but max. ±3mm ±0.5%D but max. ±4mm
	Pipe Body Seamless Pipe	OD＜2 3/8in. (60.3mm) ≧2 3/8in. (60.3mm) and＜20in. (508.0mm) ≧20in. (508.0mm)	+0.016in, (+0.41mm)−0.031in (−0.8mm) ±0.75% ±1.00%		D≦610mm 610＜D≦1430mm D＞1430mm	±0.5mm or ±0.75%D ±1%D by agreement	D≦610mm D＞610mm	±0.5mm or ±0.75%D ±1%D
	Pipe Ends (a) OD＞20in. (with diameter tape)	OD≦10 3/4in. (273.1mm) ＞10 3/4in. (273.1mm) and≦20in. (508.0mm) ＞20in. (508.0mm) and≦42in. (1067.0mm) ＞42in. (1067.0mm)	+1/16in. (1.6mm), −1/64in. (0.4mm) +3/32in. (2.4mm), −1/32in., (0.8mm) +3/32in. (2.4mm), −1/32in., (0.8mm) +3/32in. (2.4mm), −1/32in., (0.8mm)		D≦610mm 610＜D≦1430mm D＞1430mm	±0.5mm or ±0.5%D but max. ±1.6mm welded pipe: ±1.6mm seamless pipe: ±2.0mm by agreement	D≦610mm D＞610mm	±0.5mm or±0.5% D but max. ±1.6mm welded pipe: ±1.6mm: seamless pipe: ±2.0mm:
Wall Thickness			Grade B or Lower　GradeX42 or Higher		SAW pipe			
	Welded Pipe	OD≦2 7/8in. (73.0mm) ＞2 7/8in. (73.0mm) and＜20in. (508.0mm) ≧20in. (508.0mm)	+20.0%, −12.5%　+15.0%, −12.5% +15.0%, −12.5%　+15.0%, −12.5% +17.5%, −12.5%　+19.5%, −8.0%		T≦6mm 6＜T≦15mm 15＜T≦20mm T＞20mm	±0.5mm ±0.75mm ±1.00mm +1.50mm −1.00mm	T≦15mm 15＜T＜20mm T≧20mm	±0.75mm ±1.0mm ±1.5mm -1.0mm
	Seamless Pipe	OD≦2 7/8in. (73.0mm) ＞2 7/8in. (73.0mm) and＜20in. (508.0mm) ≧20in. (508.0mm)	+20.0%, −12.5%　+15.0%, −12.5% +15.0%, −12.5%　+15.0%, −12.5% +15.0%, −12.5%　+17.5%, −10.0%		T＜4mm 4≦T＜10mm 10≦T＜25mm T＞25mm	+0.6mm/−0.5mm +15%/−12.5% +12.5%/−12.5% (for D≧273mm and D/T＞20; +15%/−12.5%) +3.75mm or +10%, −3.0mm or −10%	T≦15mm 15＜T＜20mm T≧20mm	±12.5%t ±12.5%t 10%t but max. ±3mm
Weight	Single Length	Special plain-end pipe or A25 pipe Other pipes	+10.0%, −5.0% +10.0%, −3.5%			+10% or −3.5%		+10%/-3.5%
	Carloads	Grade A25, 40,000lb (18144kg) or more Other than Grade A25, 40,000lb (18144kg) or more All grade, less than 40,000lb (18145kg)	−2.5% −1.75% −3.5%					
Straightness		OD≧4 1/2in. (114.3mm)	max. 0.2% of the length		total deviation local deviation	≦0.15% of whole pipe length ＜3mm/m		≦0.15%L
Out of Roundness	Diameter, Axis Tolerance	OD＞20in. (508.0mm)	±1%		D≦60mm 60＜D≦610mm	included in the diameter tolerance	Greatest difference in pipe diameter between pipe ends	±12.5%
	Max. Differential between Min. and Max. Diameter (Applies only to pipe with D/t≦75)	≧20in. (508.0mm) and≦42in. (1067.0mm) ＞42in. (1067.0mm)	≦0.500in. (12.7mm) ≦0.625in. (15.9mm)		pipe end; pipe except the end; 610＜D≦1430mm pipe end; pipe except the end; D＞1430mm pipe end; pipe except the end;	1.5% (offshore pipelay: 1.0%) 2.0% (offshore pipelay: 1.5%) 1.0% for D/T＜75 (offshore pipelay: 0.75%) 1.5% for D/T＞75 (offshore pipelay: by agreement) 1.5% but max. 15mm (offshore pipelay: 1%but max 5mm) 2.0% for D/T＞75 (offshore pipelay: by agreement) by agreement 1.5% but max. 15mm (offshore pipelay: 1% but max 5mm) 2.0% for D/T＞75 (offshore pipelay: by agreement)	local out-of-roundness D/t≦75mm pipe end; pipe body D/t＞75mm pipe end; pipe body	＜0.55D but max. 2.5mm 1.0%D but max 7.5mm 1.5%D but max. 15.0mm 1.5%D but max. 7.5mm 2.0%D but max. 15.0mm
Pipe End Preparation	Bevel angle Root face Squareness		30˚, +5˚ −0˚ 1/16in. (1.6mm), ±1/32in. (0.8mm) max.1/16in. (1.6mm)			30˚, +5˚ −0˚ 1.6mm, ±0.8mm D≦220mm: 1mm D＞220mm 0.005D but max. 1.6mm		1.6mm from true 90˚
Length						+100mm. -0mm		purchse order

Note (a) The average diameter (as measured with a diameter tape) of one end of pipe shall not differ by more than 3/32in. (2.4mm) from that of the other end.

For Inquiring and Ordering

All inquiries and orders should contain the following information.

1. Designation
Specification, edition, grade, type and part No.
Purchaser's own specification covers requirements not included in the referenced specification, and/or modifies, replaces, (or supersedes) valid specification should be attached to first inquiry and/or given at revision.

2. Specific requirements
(1) Method of manufacture
(Seamless, electric-resistance welded, continuous butt welded, submerged arc welded with straight seam or spiral seam)
(2) Type of manufacture
(Hot-finished or cold drawn)
(3) Type of end finish
Square-cut or beveled*
(*Special requirements on bevel angle and root face stipulated other than the specification should be mentioned in the inquiry.)
Threaded & coupled*
(*Requirements different from the specification should be mentioned.)

3. Dimensions
(1) Outside diameter [O.D] or nominal pipe size [NPS] with abbreviation.
(2) Wall thickness
Nominal or minimum wall thickness, nominal weight or schedule number.
(3) Length
Specific* or random
(*In case of specific length, length tolerance should be specified if necessary.)

4. Quantity
Feet, meters or number of lengths
*Delivery allowance should be specified.

5. Inspection
Specify the name of an inspection agent when the inspector representing the purchaser should inspect.

6. Finish and coating
Black, galvanized, polyethylene, mill varnish coating or external and/or internal corrosion protective coating. *
(*Consult with us before placing an order, when corrosion protective coating is required.)

7. Marking requirement
When a marking other than that stipulated in the specification is required, give a detailed description of such marking.

8. Packaging requirement
Bundled or loose*
(*Any special packaging should be so instructed if specified other than the specification.)

9. Delivery requirements
Time, place and shipping instructions

10. End use
Commodities to be transported, location, on-land or off-shore, operation pressure and temperature, when available.

11. Consult with us before placing an order or at an inquiry, when any of the following items are required.
(1) Intermediate grade, wall thickness
(2) Special and/or supplemental requirements in chemistry
(3) Special and/or supplemental mechanical properties
(4) Special or alternative hydrostatic pressure
(5) Closer tolerance on sizes
(6) Additional and/or alternative nondestructive inspection
(7) Any alternative and/or additional conditions

Overseas Offices

Cat.No.E1E-001-05

JFE Steel Corporation

http://www.jfe-steel.co.jp/en/

TOKYO HEAD OFFICE Hibiya Kokusai Building, 2-3 Uchisaiwaicho 2-chome, Chiyodaku, Tokyo 100-0011, Japan
Phone : (81)3-3597-3111 Fax : (81)3-3597-4860

NEW YORK OFFICE JFE Steel America, Inc.
600 Third Avenue, 12th Floor, New York, NY 10016, U.S.A.
Phone : (1)212-310-9320 Fax : (1)212-308-9292

HOUSTON OFFICE JFE Steel America, Inc., Houston Office
10777 Westheimer, Suite 230, Houston, TX 77042, U.S.A.
Phone : (1)713-532-0052 Fax : (1)713-532-0062

BRISBANE OFFICE JFE Steel Australia Resources Pty Ltd.
Level 28, 12 Creek Street, Brisbane, QLD 4000, Australia
Phone : (61)7-3229-3855 Fax : (61)7-3229-4377

RIO DE JANEIRO OFFICE JFE Steel do Brasil LTDA / JFE Steel Corporation, Rio de Janeiro Office
Praia de Botafogo, 228 Setor B, Salas 508 & 509, Botafogo, CEP 22250-040, Rio de Janeiro-RJ, Brazil
Phone : (55)21-2553-1132 Fax : (55)21-2553-3430

LONDON OFFICE JFE Steel Europe Limited
15th Floor, The Broadgate Tower, 20 Primrose Street, London EC2A 2EW, U.K.
Phone : (44)20-7426-0166 Fax : (44)20-7247-0168

DUBAI OFFICE JFE Steel Corporation, Dubai Office
P.O.Box 261791 LOB19-1208, Jebel Ali Free Zone Dubai, U.A.E.
Phone : (971)4-884-1833 Fax : (971)4-884-1472

NEW DELHI OFFICE JFE Steel India Private Limited
1101, 11th Floor, Unitech's Signature Tower, Tower-A, South City-I, NH-8, Gurgaon, Haryana, 122002, India
Phone : (91)124-426-4981 Fax : (91)124-426-4982

MUMBAI OFFICE JFE Steel India Private Limited Mumbai Office
308, A Wing, 215 Atrium, Andheri - Kurla Road, Andheri (East), Mumbai - 400093, Maharashtra, India
Phone : (91)22-3076-2760 Fax : (91)22-3076-2764

SINGAPORE OFFICE JFE Steel Asia Pte. Ltd.
16 Raffles Quay, No. 15-03, Hong Leong Building, 048581, Singapore
Phone : (65)6220-1174 Fax : (65)6224-8357

BANGKOK OFFICE JFE Steel (Thailand) Ltd.
22nd Floor, Abdulrahim Place 990, Rama IV Road, Bangkok 10500, Thailand
Phone : (66)2-636-1886 Fax : (66)2-636-1891

VIETNAM OFFICE JFE Steel Vietnam Co., Ltd.
Unit 1401, 14th Floor, Kumho Asiana Plaza , 39 Le Duan Street, Dist 1, HCMC, Vietnam
Phone : (84)8-3825-8576 Fax : (84)8-3825-8562

JAKARTA OFFICE JFE Steel Corporation, Jakarta Office
6th Floor Summitmas II, JL Jendral Sudirman Kav. 61-62, Jakarta 12190, Indonesia
Phone : (62)21-522-6405 Fax : (62)21-522-6408

MANILA OFFICE JFE Steel Corporation, Manila Office
23rd Floor 6788 Ayala Avenue, Oledan Square, Makati City, Metro Manila, Philippines
Phone : (63)2-886-7432 Fax : (63)2-886-7315

SEOUL OFFICE JFE Steel Korea Corporation
6th Floor, 410, Teheran-ro, Gangnam-gu, Seoul, 135-570, Korea
(Geumgang-Tower, Daechi-dong)
Phone : (82)2-3468-4130 Fax : (82)2-3468-4137

BEIJING OFFICE JFE Steel Corporation Beijing
1009 Beijing Fortune Building No.5, Dongsanhuan North Road, Chaoyang District, Beijing, 100004, P.R.China
Phone : (86)10-6590-9051 Fax : (86)10-6590-9056

SHANGHAI OFFICE JFE Consulting (Shanghai) Co., Ltd.
Room 801, Building A, Far East International Plaza, 319 Xianxia Road, Shanghai 200051, P.R.China
Phone : (86)21-6235-1345 Fax : (86)21-6235-1346

GUANGZHOU OFFICE JFE Consulting (Guangzhou) Co., Ltd./ JFE Steel Corporation, Guangzhou Office
Room 3901, Citic Plaza, 233 Tian He North Road, Guangzhou 510613, P.R.China
Phone : (86)20-3891-2467 Fax : (86)20-3891-2469

1503P(1005)1-0.3 JTR
Printed in Japan