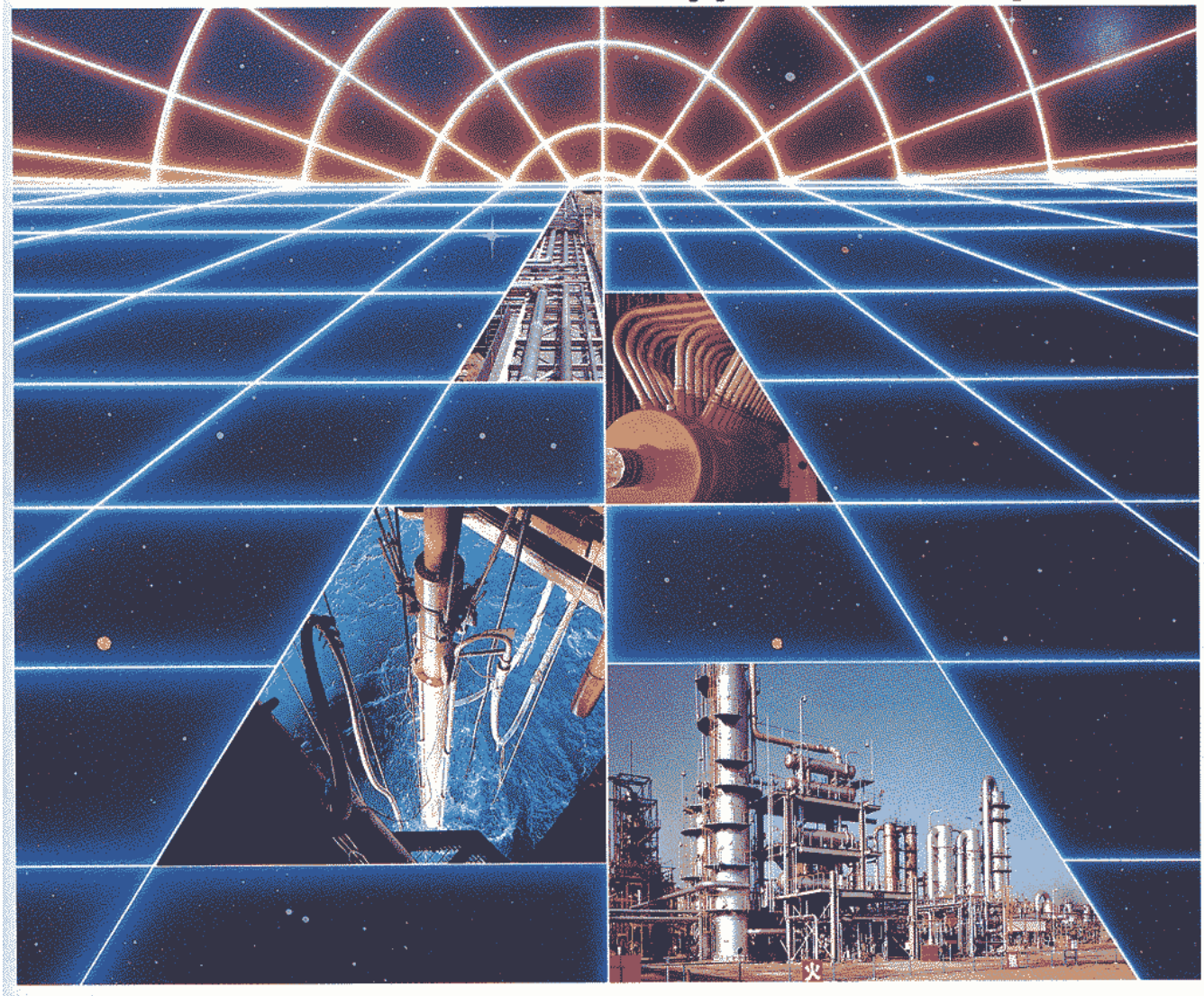
STAINLESS STEEL PIPE AND TUBES

Nippon Steel Corporation



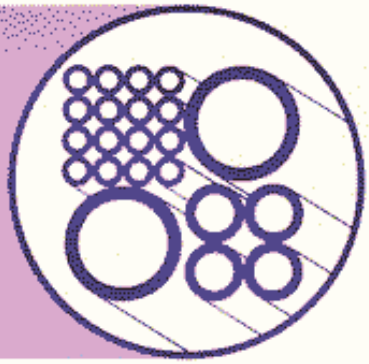
Features

안정된 품질

제강에서 최종 완제품의 생산공정에 전직원의 앞선 공학적인 노하우와 오랜경험, 엄격한 품질 제어 시스템에 의해 제어되는 공정을 통해 생산된 Nippon Steel's products의 제품은 아주 안정된 품질과 최고의 신뢰도에 의해 높은 평판을 얻어왔다.

광범위한 사이즈

Nippon Steel은, 다양한 사이즈의 PLATE를 생산할 수 있기 때문에 용접관은 구경과 두께를 포함 자유로운 치수선택이 가능하다.



다양한 생산품

JIS, ASTM, 기타 표준을 만족하는 철강 외에 Nippon Steel은 자체기술력에 입각하여 개발된 YUS series의 철강 재료를 제공한다.

엄격한 공정제어와 신뢰할 만한 서비스 시스템

모든 생산공정은 엄격한 프로세스 제어 시스템 아래 모든 제품을 생산하면서 Nippon Steel은 가장 정확한 납기와 고객의 욕구를 충족시킬 수 있다. 또한 전문가의 조언과 많은 경험, 기술개발을 기초로 하여 고객에게 믿을 수 있는 기술적인 서비스를 제공한다.

Available Grades of Stainless Steel

현재 가능한 등급과 규격을 아래 표에서 참조바라며, 아래 표 이외의 등급과 제조방법은 Nippon Steel에게 문의바랍니다.

JIS	AISI	DIN	GOST	BS	Manufacturing Method
SUS 304	TP 304	1.4301	08 X 18H 10	304 S18, S25	S, A, E
SUS 304L	TP 304L	1.4306	04 X 18H 10	304 S12, S22	S, A
SUS 304H	TP 304H	—	12 X 18H 9	304 S59	S
SUS 309S	TP 309S	—	—	—	S
SUS 310S	TP 310S	1.4845	10 X 23H 18	—	S
SUS 316	TP 316	1.4401	—	316 S18, S25	S, A
SUS 316L	TP 316L	1.4404	—	316 S14, S22	S, A
SUS 316H	TP 316H	—	—	316 S59	S
(316 Ti)	—	1.4571	10 X 17H 13M 2T	—	S
SUS 317	TP 317	—	—	317 S16	S, A
SUS 317L	TP 317L	1.4438	—	317 S12	S, A
SUS 321	TP 321	1.4541	12 X 18H 10T	321 S18, S22	S, A
SUS 321H	TP 321H	—	12 X 18H 12T	321 S59	S
SUS 347	TP 347	1.4550	—	347 S17, S18	S
SUS 347H	TP 347H	—	08 X 18H 12Б	347 S59	S
SUS 405	TP 405	1.4002	—	405 S17	S
SUS 410	TP 410	1.4000	08 X 13	410 S21	S, E
SUS 409	TP 409	1.4512	—	—	S, E
SUS 430	TP 430	1.4016	12 X 17	430 S15	S, E
SUS 444	TP 444	—	—	—	S
SUS 329 J3L	S 31803	1.4462	—	—	S, A
—	S 31254	—	—	—	S, A

Remarks: 1) In the "Manufacturing method" column, S: seamless ; A: electric fusion welding ; and E: electric resistance welding.
2) Electric resistance welding applies to steel pipe and tubes for structural uses only.

Available Standards

Standards	Standards Number
JIS	G3459, G3463, G3467, G3468
ASTM	A213, A268, A269, A312, A358, A409, A789, A790
DIN	17440, 17458
GOST	9941
BS	3059, 3605, 3606

Nippon Steel's New Stainless Steels

Steel	Type	Characteristics	Typical Applications	Chemical			
				C max.	Si max.	Mn max.	P max.
Austenitic Stainless	YUS 170	Excellent pitting, crevice corrosion and intergranular corrosion resistance. High strength both at room and elevated temperatures.	Super heaters of recovery boiler's. Heat exchangers. Anti-pollution equipment.	0.060	1.50	2.00	0.040
	YUS 304UL	Excellent intergranular corrosion resistance thanks to extremely low carbon content.	Heat exchangers. Nuclear fuel processing equipment.	0.020	1.00	2.00	0.040
	YUS 316UL	Improved intergranular corrosion resistance over AISI 316L due to extremely low carbon content.	Heat exchangers. Nuclear fuel processing equipment.	0.020	1.00	2.00	0.040
	YUS 270	Excellent corrosion resistance to chlorides and sulfuric acid. Excellent resistance to stress corrosion cracking.	Seawater piping. Desalination plant piping. High-salinity food processing piping.	0.020	0.80	1.00	0.030
	NF709R	The highest creep strength between 20% to 25% Cr containing autenitic stainless boiler tubes. Good corrosion resistance.	Superheater and reheater tubes for power plants and incineration boilers.	0.100	1.00	1.50	0.030
	XA704	Much higher creep strength over TP347H. Good corrosion resistance. Good weldability over TP304.	Superheater and reheater tubes for power plants boilers.	0.050	1.00	2.00	0.040
Ferritic Stainless	YUS 490D	Improved deformability and weldability over ASIS 409.	Automobile mufflers and exhausts. Catalytic converters.	0.030	1.00	1.00	0.040
	YUS 436S	Improved corrosion resistance and excellent deformability.	Automobile mufflers and exhausts.	0.010	0.14	0.20	0.040
	YUS 180	High corrosion resistance and excellent deformability.	Automobile exhaust manifold.	0.020	1.00	1.00	0.040
	YUS 190	Improved corrosion resistance, workability and weldability over AISI 434 for cold finished tube and sheet.	Water heaters. Heat exchangers.	0.015	0.50	0.50	0.040
Duplex Stainless	YUS DX-1	Excellent pitting- and crevice corrosion resistance. Good weldability same as TP304.	Chemical plant piping and heat exchanger tubes.	0.030	1.00	2.00	0.030

Composition %						Mechanical Properties (JIS 13B)				AISI Equivalent Grade	Available Forms		
S max.	Ni	Cr	Mo	Cu	Others	Yield Strength 0.2% Offset min. N/mm²	Tensile Strength min. N/mm²	Elongation min. %	Hardness (Vickers) max.		Pipe & Tubes	Sheet	Plate
0.030	12.00~16.00	23.00~26.00	0.50~1.20	—	N 0.25~0.40	345	690	40	263	—	○	○	○
0.030	9.00~13.00	18.00~20.00	—	—	—	175	480	40	196	—	○	○	○
0.030	12.00~16.00	16.00~18.00	2.00~3.00	—	—	175	480	40	196	—	○	○	○
0.010	17.50~18.50	19.50~20.50	6.00~6.50	0.50~1.00	N 0.18~0.22	310	675	35	—	S31254	○	○	○
0.010	24.00~26.00	19.00~23.00	1.00~2.00	—	Nb 0.10~0.40 Ti 0.20max. B 0.0020~0.0010 N 0.10~0.25	270	640	30	—	—	○	—	—
0.030	8.00~11.00	17.00~20.00	—	—	Nb 0.25~0.50 W 1.50~2.60 V 0.20~0.50 N 0.10~0.25	270	650	30	—	—	○	—	—
0.030	—	10.50~11.45	—	—	Ti 6xC~0.75	175	360	28	180	AISI 409	○	○	—
0.006	—	17.00~18.00	1.00~1.50	—	Ti 10(C+N)~0.35 N≤0.0150	205	390	≧25	Hv ≦170	(SUS 436L)	○	○	—
0.006	≦0.60	19.00~21.00	—	0.30~0.60	Nb≧19(C+N) and 0.30~0.80 N≦0.02	205	450	≧22	Hv ≦220	(SUS 430J1L)	○	○	—
0.030	—	18.00~20.00	1.75~2.25	—	(Ti+Nb) ≧ 16(C+N)	205	450	22	200	AISI 444	○	○	—
0.020	4.50~6.50	21.00~23.00	2.50~3.50	—	N 0.08~0.20	450	620	25	290	S31803	○	○	○

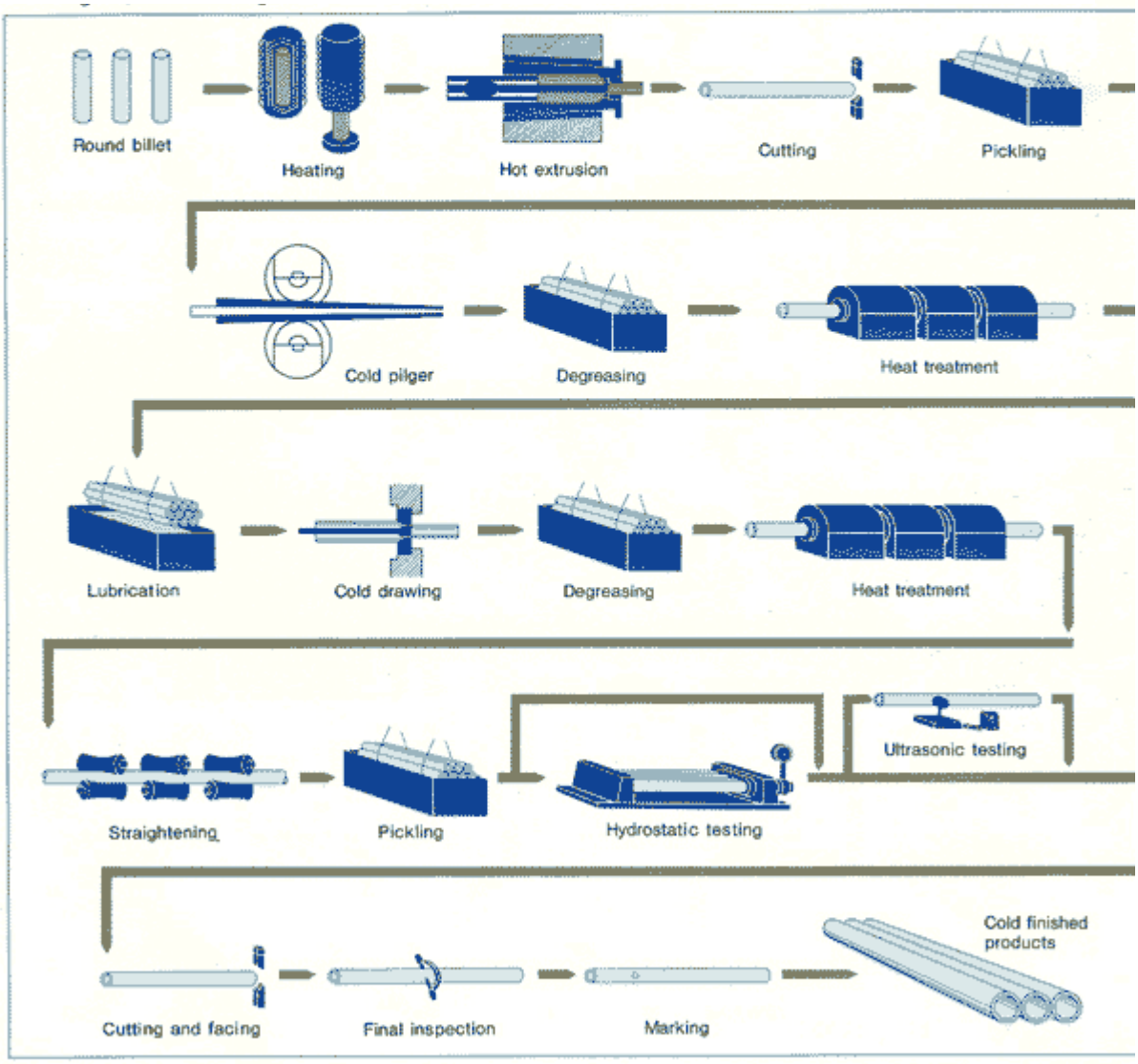
Manufacturing Process

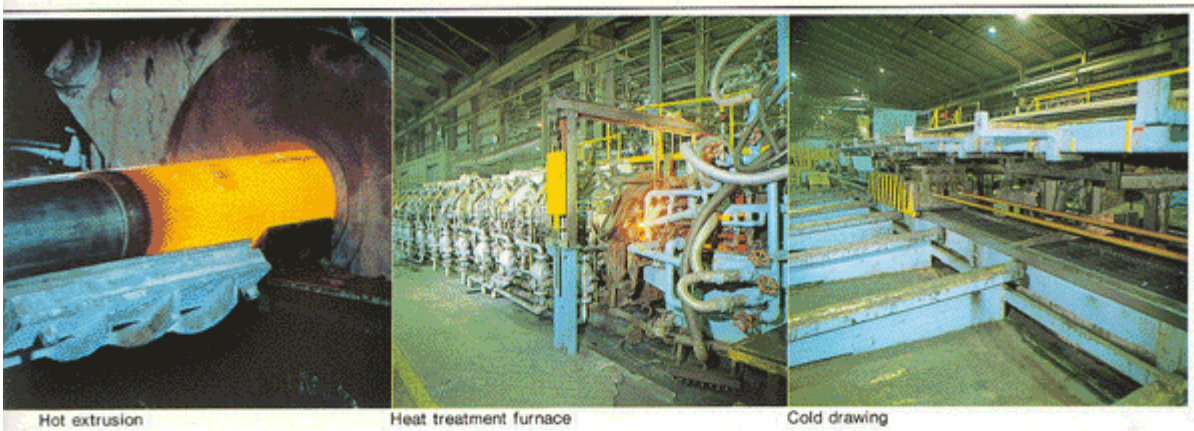
열간 압출 seamless stainless steel pipe and tubes

외경과 두께를 필요로 Seamless tubes는 라운드 빌렛트 으로 Ugine Sejournet 열간 압출프로세스에 의하여 생산된다. 이렇게 생산된 열간튜브를 cold 범위에서 작업하여 부족한 외경을 정확하게 교정하고 표면을 좀더 조밀하게 향상시켜 보일러,열교환기,난방장치등에 pipe라인에 제공한다.

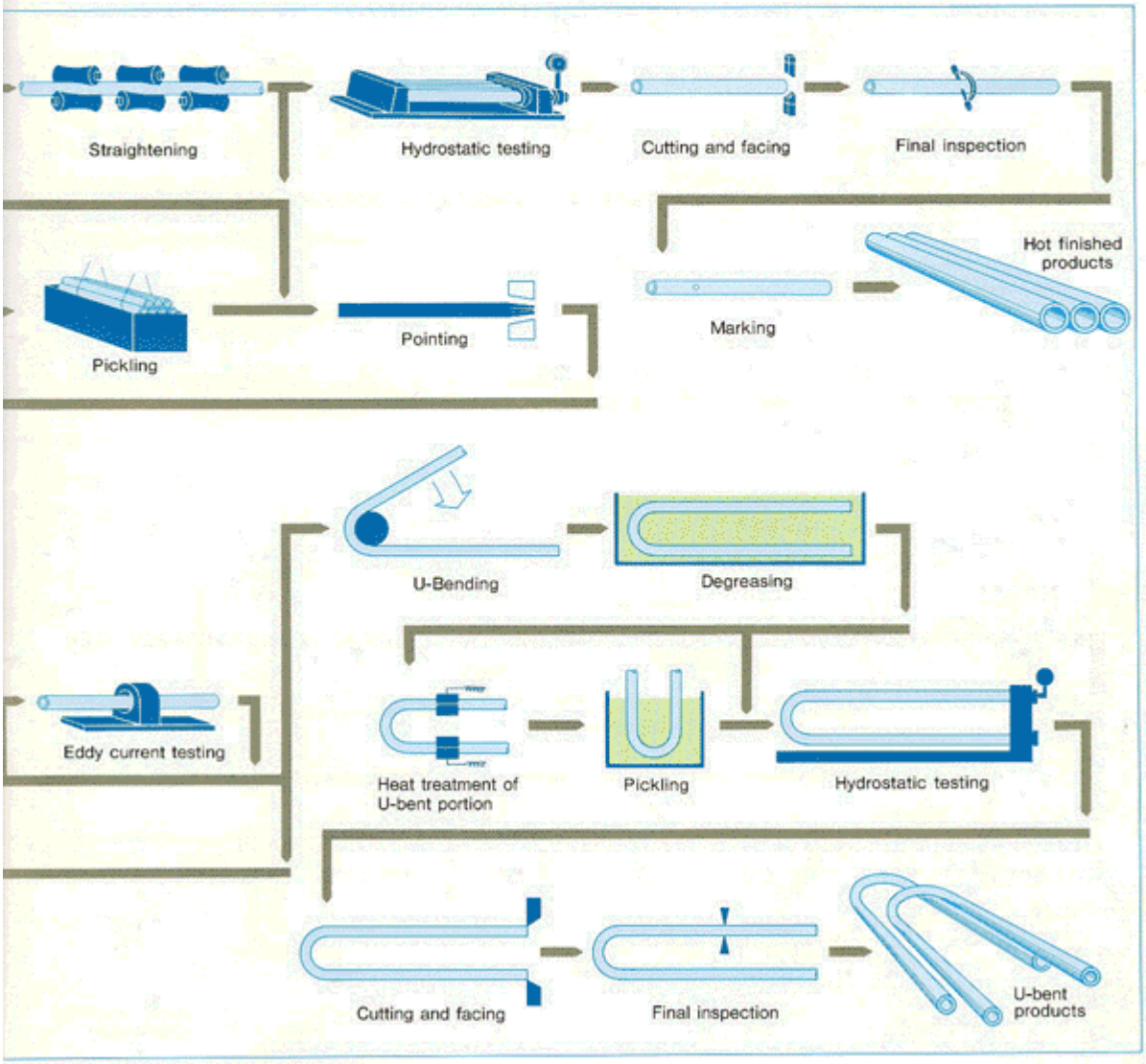
Ugine Sejournet Process

열간압출 후속으로 가열된 빌렛이 고압에 저항력이 있는 실린더에 끼워 넣어 지고 그리고 바로그때 프레스에 연결된 램을 사용하면서 컨테이너에서 밀어낸다. 다이와 멘드레일 같이 요구 외경과 두께를 맞추면서 작동한다. 이렇게 열간압출공정은 스테인레스 스틸이나 합금강 열간으로 하기에 어려운 합금강튜브생산에 대단히 적합하다.



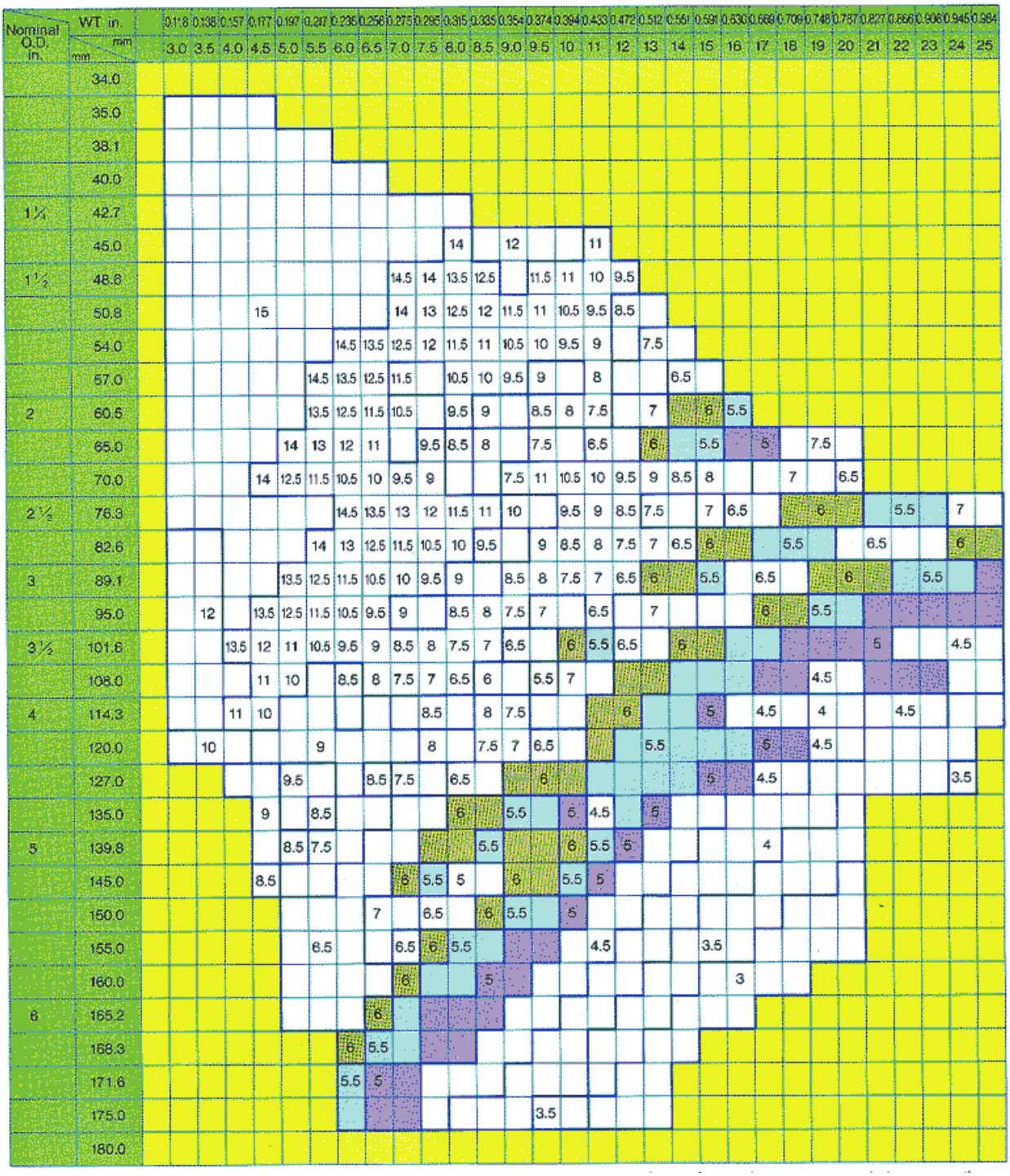


Hot extrusion | Heat treatment furnace | Cold drawing



Size Availability

Hot Finished Seamless Stainless Steel Pipe and Tubes

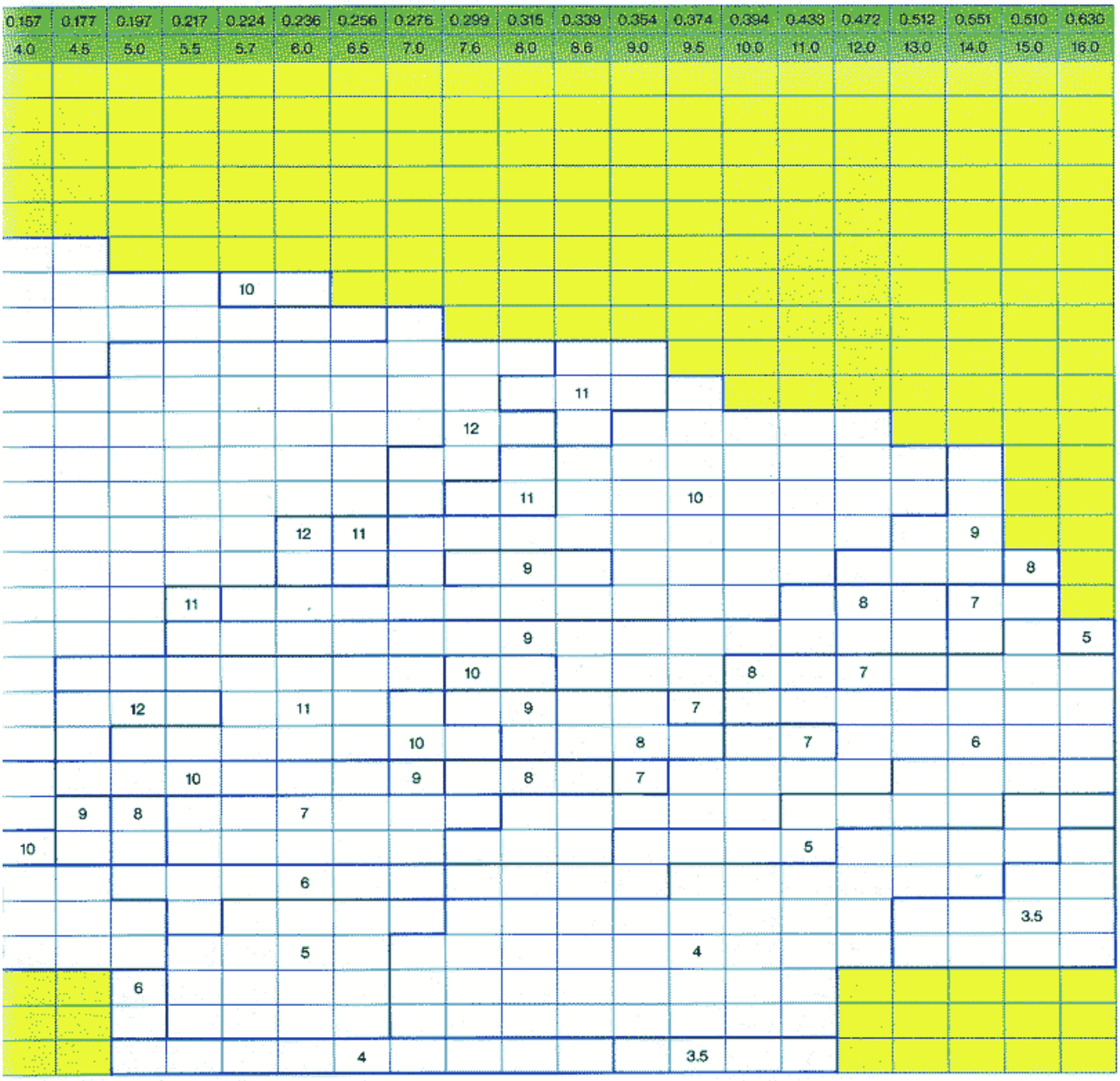


각 경계가 이루어 진 범위는 SUS 304 심레스 스테인레스 파이프와 튜브의 size를 보여주는 것이고 그안의 숫자는 그 범위의 위치에서 대응하는 사이즈의 제조의 범위가 대응한 외경과 두께에서 생산가능한 최고길이를 나타낸 것이다.

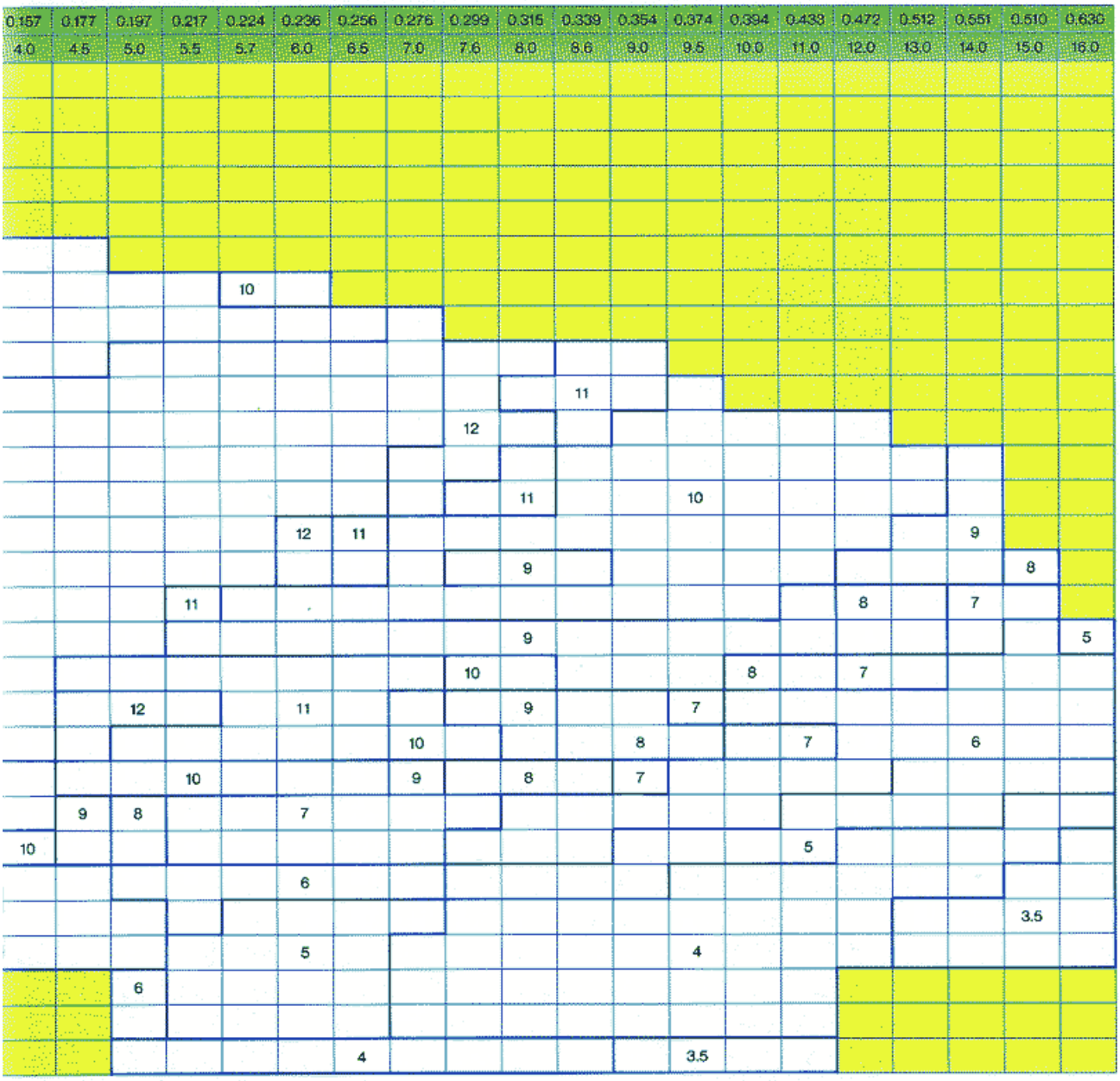
Cold Finished Seamless Stainless Steel Pipe and Tubes

Nominal O.D. in.	WT in. / mm	0.035 / 0.9	0.039 / 1.0	0.047 / 1.2	0.059 / 1.5	0.067 / 1.7	0.079 / 2.0	0.098 / 2.5	0.118 / 3.0	0.126 / 3.2	0.134 / 3.4	0.138 / 3.5	0.146 / 3.7
	6.0												
	8.0												
⅛	10.5				8								
¼	13.8												
⅜	17.3												
½	21.7												
	27.2							15					
1	34.0												
	38.1												
1¼	42.7												
	45.0												
1½	48.6												
	50.8												
	54.0										12.5		
	57.1												
2	60.5												
	63.5												
	65.0												
	70.0												
2½	76.3												
	82.9												
3	89.1									12			
3½	101.6												11
4	114.3						10		8				
	127.0												7
5	139.8												
	152.4												
6	165.2												
	168.3												

Notes: 1. Each bordered area indicates the range of manufacture of SUS 304 stainless steel pipe and tubes of the corresponding sizes shown in the top and left-hand columns, and each framed figure indicates the maximum pipe length (m) for the corresponding outside diameter and wall thickness.



2. The range of manufacture becomes somewhat narrower than shown above for pipe and tubes other than those of SUS 304 stainless steel.



2. The range of manufacture becomes somewhat narrower than shown above for pipe and tubes other than those of SUS 304 stainless steel.

.154	0.157	0.177	0.193	0.197	0.200	0.205	0.217	0.224	0.236	0.256	0.260	0.276	0.280	0.299	0.315	0.319	0.323	0.339	0.354	0.366	0.374	0.406	0.433	0.472	0.512	0.551	0.510
3.9	4.0	4.5	4.9	5.0	5.1	5.2	5.5	5.7	6.0	6.5	6.6	7.0	7.1	7.6	8.0	8.1	8.2	8.6	9.0	9.3	9.5	10.3	11.0	12.0	13.0	14.0	15.0
										12	12	11															
										12	12	11	11	10	10	10	10	10	10	10	10	10	10	10	8		
						12	12	11	11	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	8		
						12	12	11	10	9	9	9	9	9	10	10	10	10	10	10	9	9	9	8	8		
			11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	8	8	7	7		
			9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	8	7	6		
11	11	11	11	11	11	11	11	11	11	11	11	10	10	9	9	9	9	9	9	9	8	7	7	7	6		
12	12	12	12	11	11	11	11	11	10	9	9	9	9	9	8	8	7	7	6	6	6	6	6	6	6		
12	12	11	11	11	11	11	11	11	10	10	10	10	9	8	8	8	8	8	7	7	7	6	6	6	6		
10	10	10	10	10	10	10	10	10	9	9	9	8	8	8	8	7	7	6	6	6	6	6	6	5	5		
10	9	8	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	6	6	6	5	5	5	5	5		
9	9	8	7	7	7	7	7	7	7	7	7	6	6	6	6	5	5	5	5	5	5	5	4	4	4		
	7	6	6	6	6	6	6	6	6	6	6	5	5	5	5	5	5	4	4	4	4	4	4	4	3		
		7	6	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	3	3	3						
							5	4.5	4.5	4	4	4	4	4	4	4	4	4									

2. Seamless stainless steel pipe and tubes in the lengths shown in the bordered area can be manufactured subject to prior consultation for each order.
3. The figure with asterisk indicates the developed length of U-bent tubes. The maximum length of straight pipe and tubes is 15m.
4. The thickly bordered area ▭ indicates the range of manufacture of welded stainless steel pipe and tubes in a maximum length of 15 m. However, U-bent tubes can be manufactured to a maximum developed length of 17.5 m.
5. Wall thickness is indicated in nominal value.

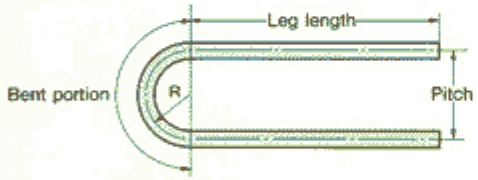
U-Bent Tubes for Heat Exchangers

U-bent stainless steel tubes for heat exchangers are manufactured, in principle, to have an outside diameter of 16.0 mm, 19.0 mm, 25.4 mm, or 31.8 mm, and the following tolerances are applied unless otherwise specified.

Item	Tolerance
Working method	Cold bending
*Leg length	Less than 7,500 mm
Radius of bend	More than 1.5 times the nominal outside diameter
Pitch allowance	R≤5D: ±1.0 mm R>5D: ±1.5 mm
** Flattening ratio of bent portion	1.5≤R<2D: Within ±10% R>2D: Within 6%
Thickness reduction of bent portion	Less than 0.15 × t_s (=minimum allowable initial thickness)
Hydraulic test	Conducted on all U-bent tubes
Heat treatment of bent portion	Conducted on request

* We are ready to consult with customers for manufacture of U-bent tubes with a parallel portion length of more than 7,500 mm.

** Flattening ratio of bent portion $= \frac{\text{Major (minor) dia.} - \text{Nominal dia.}}{\text{Nominal dia.}} \times 100\%$



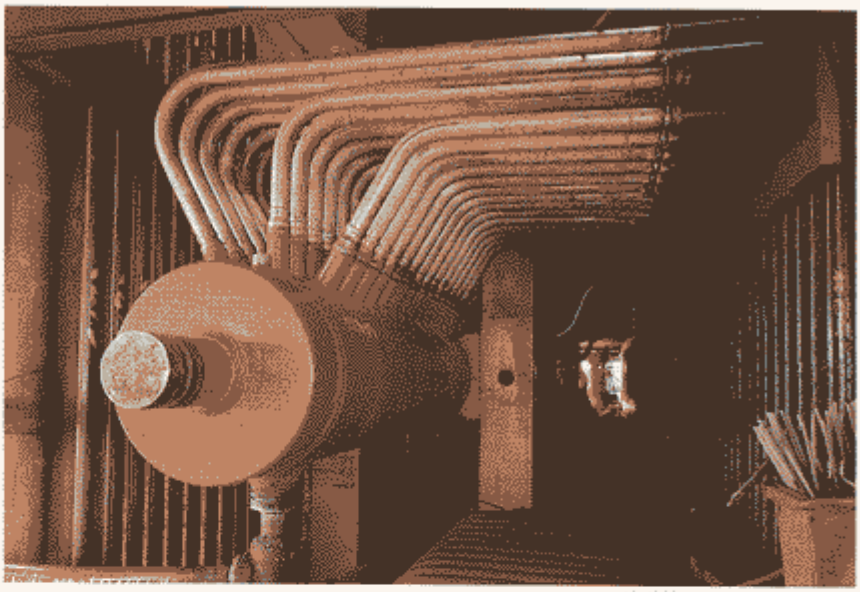
U-bend process

Electric-Resistance Welded Stainless Steel Mechanical Tubing

Outside Diameter (mm)	Wall Thickness (mm) 1.0	1.5	2.0	2.5
31.8				
34.0				
35.0				
38.1				
40.0				
42.7				
45.0				
48.6				
50.8				
54.0				
60.5				
70.0	0.8			
80.0		1.2		
85.0				

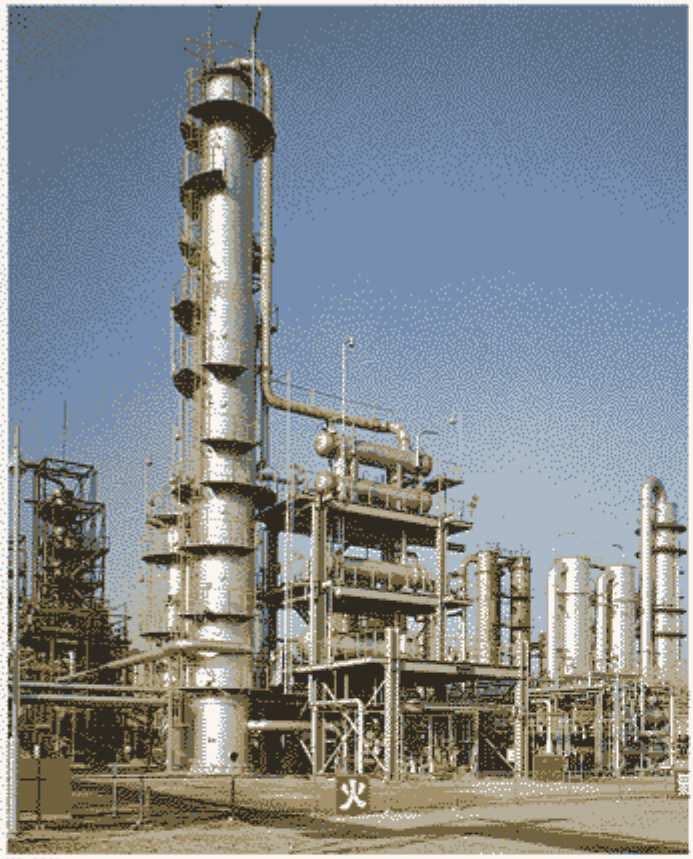
Applications

Boiler Tubes

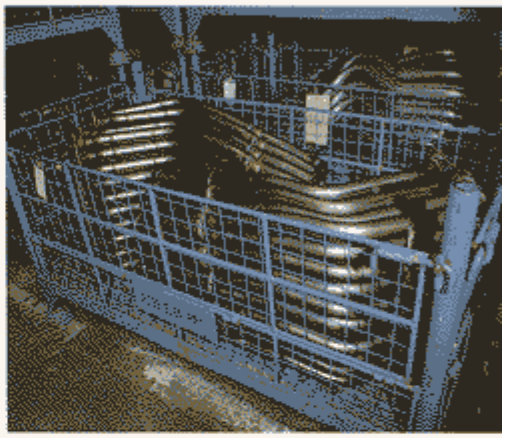


Pipelines

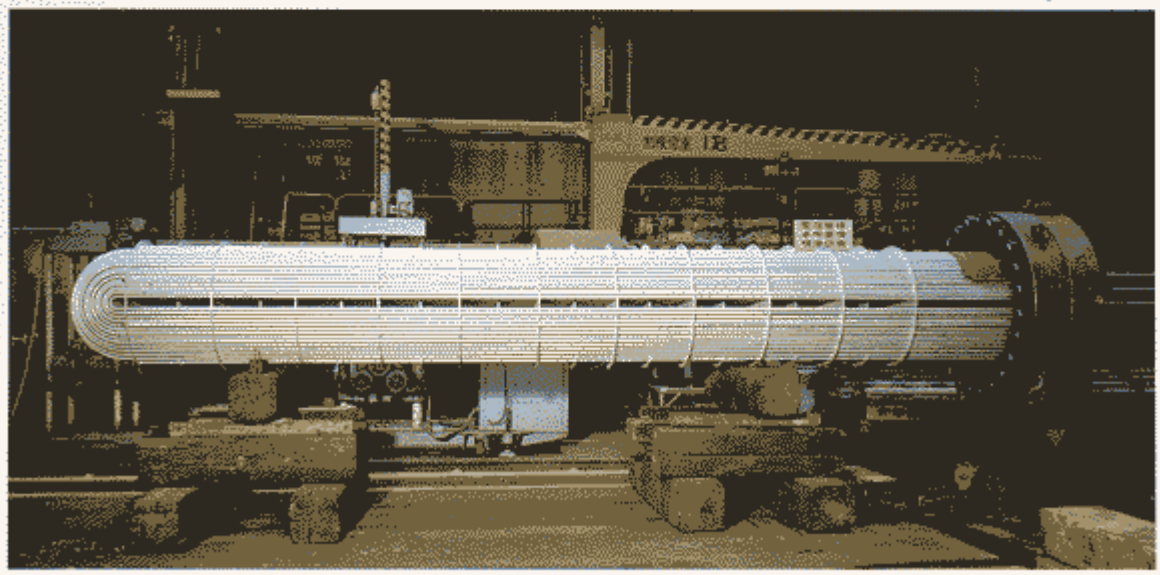
Petrochemical Plants



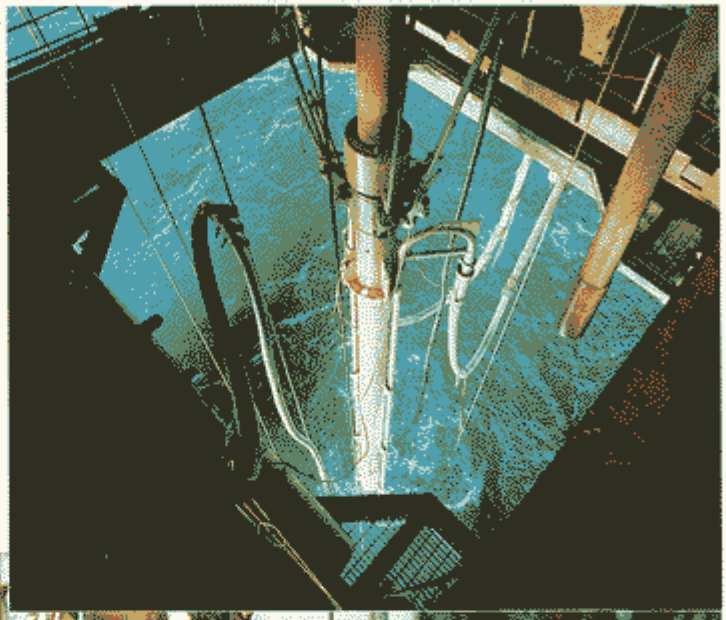
Mechanical Tubes



Heat Exchanger Tubes



Oil Well Casing & Tubing



생산공정의 제어 및 품질관리

NSC의 최첨단 장비와 전문가와 생산기술은 고객의 요구를 완벽히 충족시키는 제품의 생산이 가능하게 합니다. 전 공정의 통합적인 생산관리, 정확한 공정제어와 품질관리시스템은 효과적이며 모든 제품의 국제규격에 정확히 부합하여 납품 전 철저히 관리된다. 원소재로부터 완제품의 납품까지 컴퓨터제어방식의 생산제어와 모든 공정의 품질관리에 첨단의 기술을 채택하여 요구사양과 사용목적에 정확히 부합하는 제품을 생산하고 있습니다. 특수목적에 맞게 검사시스템을 갖추고 있습니다. 예를 들어 초음파, 와류탐상시험, 엑스레이 및 자기테스트 등의 비파괴검사를 통해 더 넓고 효과적인 검사가 가능합니다. 모든 고객의 주문은 도쿄 본사의 전산시스템에 사용목적에 맞는 상세사양과 함께 입력이 되어 관리되며 이러한 모든 데이터는 가장 적합한 위치에 있는 제조공장으로 전송되어 진행됩니다. 주문요구사항에 가장 적합한 품질계획과 공정설계를 채택하고 있습니다.

Research and Development

Integrated Research Activities

Research on Steelmaking Technologies

Research Laboratories for Steelmaking Processes and Products

1. Ironmaking Technology Lab.
2. Steelmaking Technology Lab.
3. Plate, Bar, Shape & Wire Rod Research Lab.
4. Sheet & Coil Research Lab.
5. Surface Treatment Research Lab.
6. Electrical Steel Research Lab.
7. Stainless Steel Research Lab.
8. Pipe & Tube Research Lab.

Research Related to Diversification

Research Laboratories for New Materials and New Energies

1. Chemicals Research Lab.
2. Materials Research Lab.— I
3. Materials Research Lab.— II
4. Materials Research Lab.— III
5. Energy Technology Lab.

Research Laboratories Specializing in Basic or Peripheral Technologies

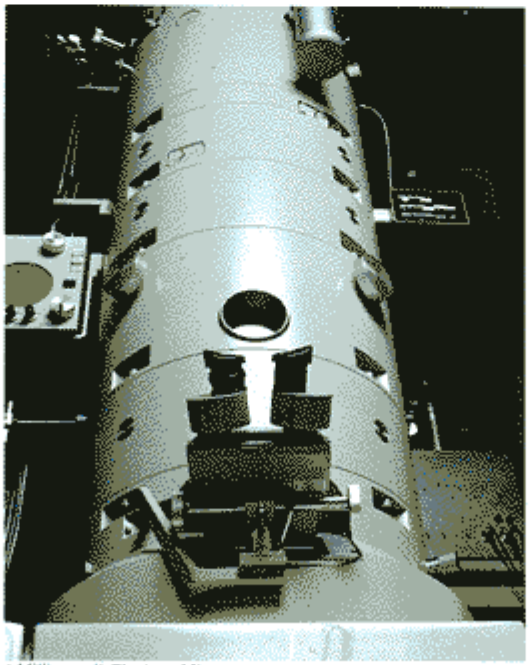
1. Welding Technology Lab.
2. Instrumentation & Control System Research Lab.
3. Analysis Research Lab.
4. Heat Technology Lab.
5. Material Forming Process Reseach Lab.

Research on Basic or Peripheral Technologies

Research Laboratories for Theoretical or Advanced Studies

1. Fundamental Research Lab.— I (Physical Metallurgy)
2. Fundamental Research Lab.— II (Process Metallurgy)
3. Fundamental Research Lab.— III (Surface Science)

Basic Research

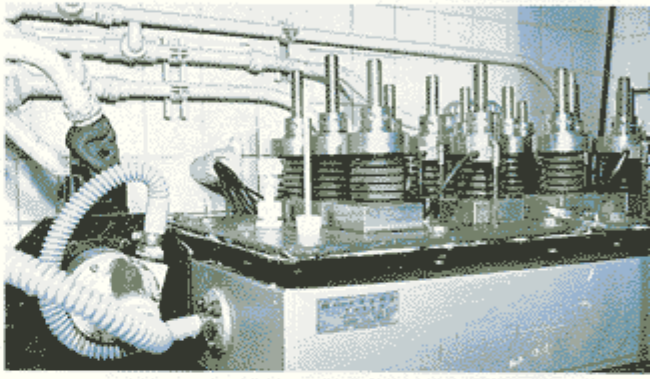


1 Million-volt Electron Microscope

Auger Electron Spectrometer

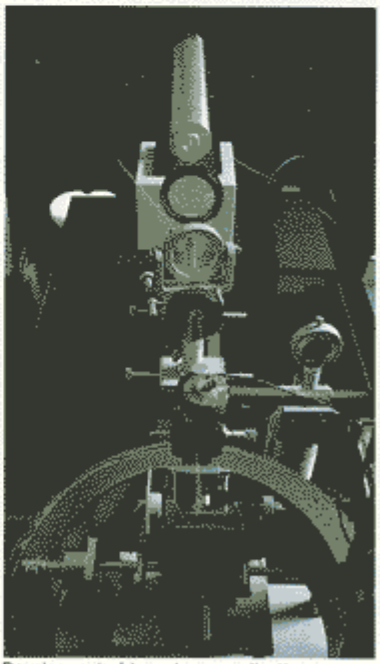
SSRT

Spring Roading SCC Tester



Autoclave Tester

Multicreep Tester

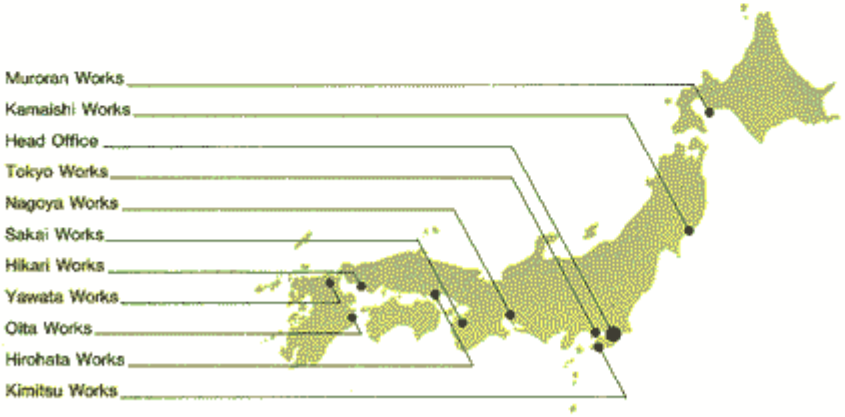


Development of laser-beam application technology

Pipe Mills of Nippon Steel

Nippon Steel's Pipe Making Facilities and Product Sizes

Mills			Location of Mills	Size Outside Diameter (in.) 1 2 4 6 8 10 12 14 16 20 56 200
Seamless	Mannesmann-Plug Mill Stretch Reducer	Hot Fin.	Tokyo	1.315 – 6.625
		Cold Fin.		0.236 – 6.000
	Ugine-Sejournet Hot Extrusion	Hot Fin.	Hikari	1.378 – 6.625
		Cold Fin.		0.236 – 5.500
HF-ERW	24″ HF-ERW	Thermatool	Hikari	8.625 – 24
	16″ HF-ERW	Thermatool	Nagoya	4.500 – 16
	4″ HF-ERW + Stretch Reducer	Induction	Hikari	0.413 – 1.661 (Pipe in Coil)
	4″ HF-ERW	Induction	Nagoya	1.492 – 4.500
	4″ HF-ERW	Induction	Kimitsu	3.750 – 4.500
	2″ HF-ERW (2 mills)	Induction	Nagoya	0.850 – 2.559
CW	Continuous Butt Weld		Kimitsu	0.840 – 4.500
SAW	UO Process Longitudinal Weld		Kimitsu	18 – 56
	Spiral Weld (2 mills)		Yawata	16 – 64
	Spiral Weld (2 mills)		Kimitsu	16 – 100
	Bending Roll Process Longitudinal Weld (4 mills)		Subsidiary Company	16 – 200
TIG	Tungsten inert-Gas Weld	Hot Fin.	Hikari	1.660 – 2.375
		Cold Fin.		0.236 – 3.248
EFW	Electric Fusion Weld (Welded Stainless Steel Pipe)		Subsidiary Company	0.500 – 48



STAINLESS STEEL PIPE AND TUBES

석유와 가스탐사, 정유산업,석유화학,발전소,LNG 산업 같은 최근의 놀랍도록 진취적이고 다양한 산업분야에서 사용되는 스테인레스 스틸 파이프, 튜브의 더 높은 부식 저항능력과 내열 및 저온환경에 견디는 등 이 제품들의 성능의 발전에 대한 요구는 급격하게 증가되어 왔다.

Nippon steel이 늘어나고 있는 seamless stainless steel pipe and tubes의 성능요구를 충족시키는 데 정열을 다해 노력해왔고 1960년 Ugine Sejournet process의 도입 이후 앞선 기술과 풍부한 경험을 토대로 종합제철회사로서 도약했다.

최근에 Nippon Steel은 EFW 오스테나이트 stainless steel pipe and tubes를 위한 생산 시스템을 세웠다.

Nippon Steel'stainless steel pipe and tubes는 앞선 기술과 모든 프로세스를 원재료부터 품질관리를 통해 생산한 완제품을 고객에 인도 함으로서 고객들 사이에서 높은 호응을 얻고 있다. 그러나 Nippon Steel은 항상 최고라고 생각하지 않고 고객에 의하여 만들어진 공학적인 진보와 보조를 맞추기 위해 끊임없이 우리가 더 좋은 품질의 강철관으로 된 stainless steel products을 개발하고 폭넓은 연구개발에 매진하고 있다.