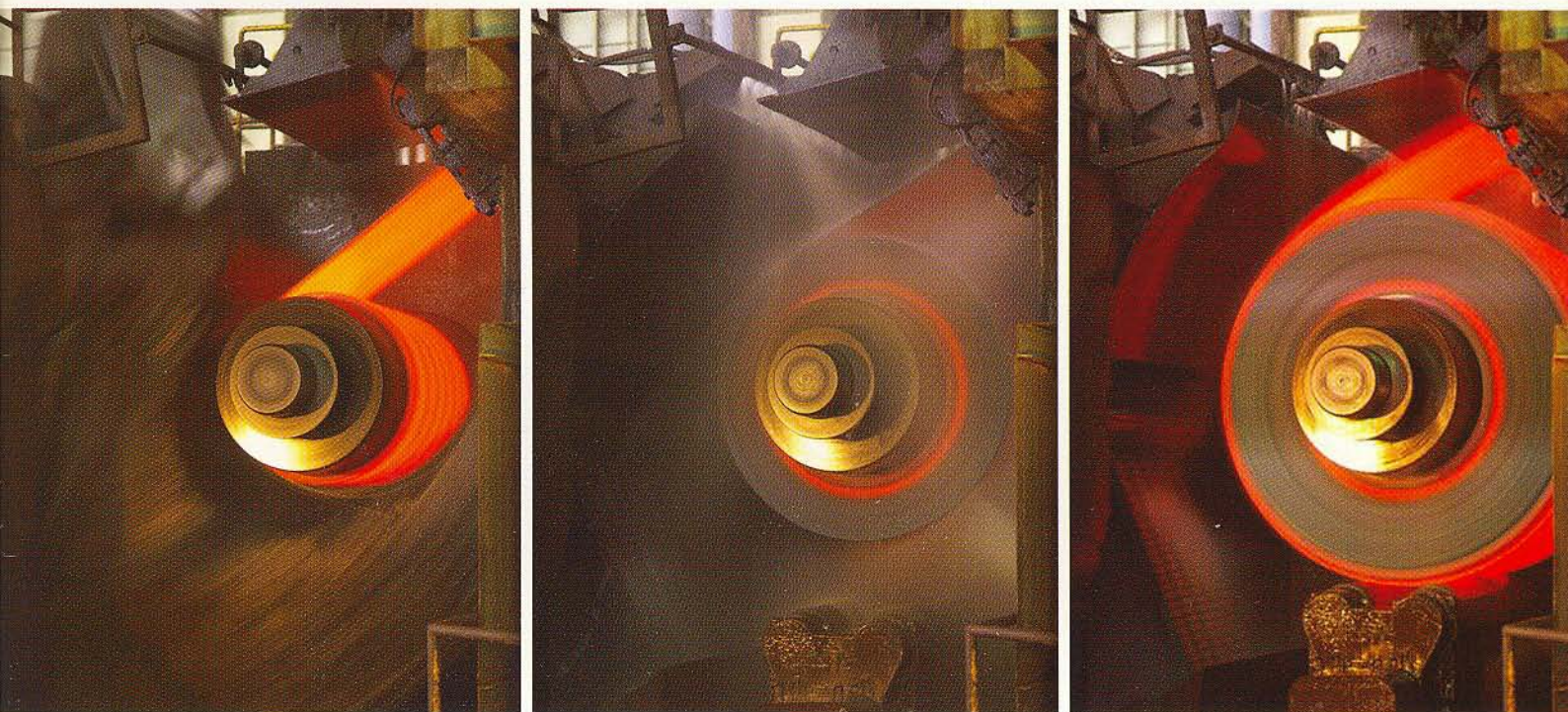
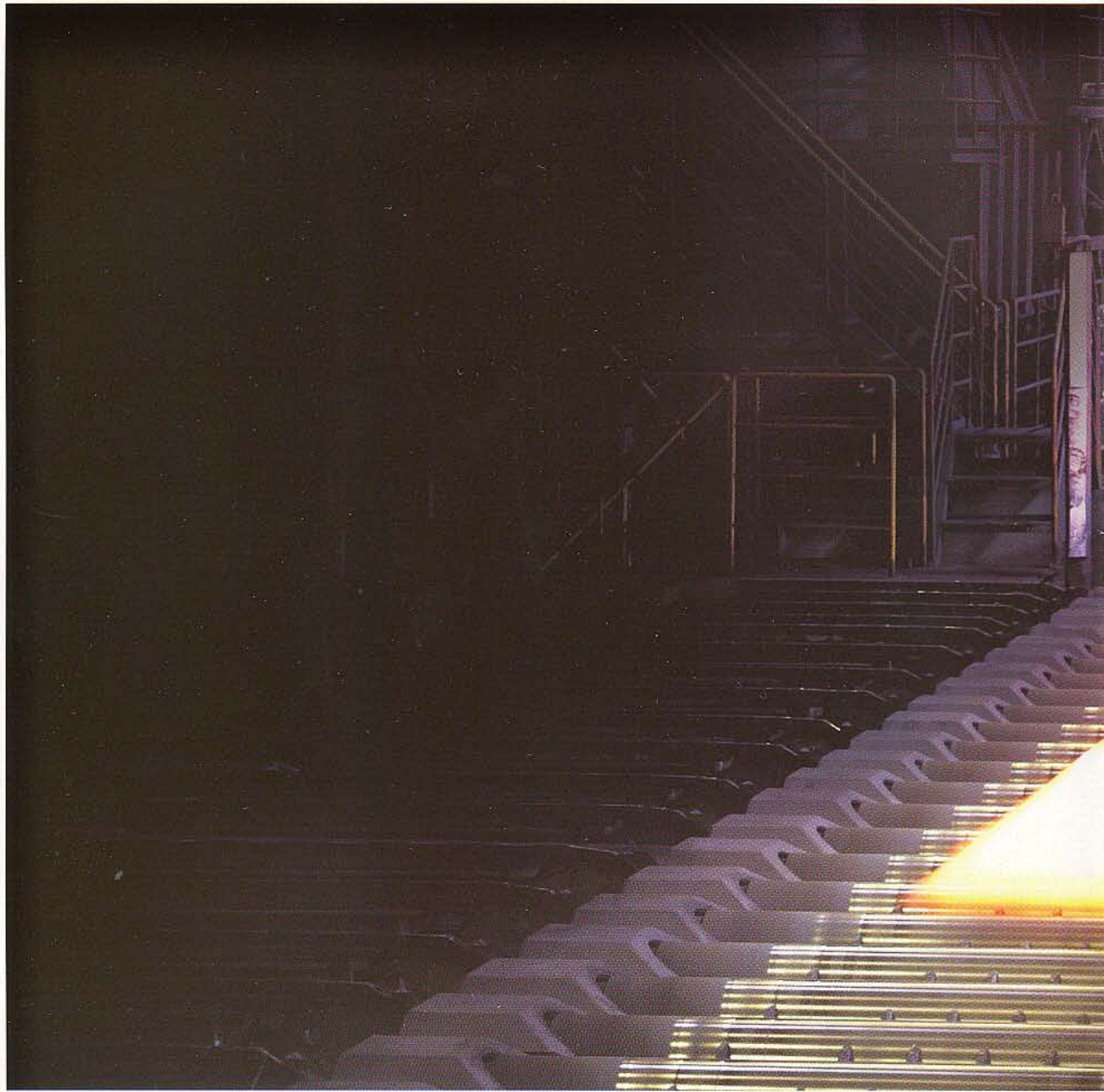


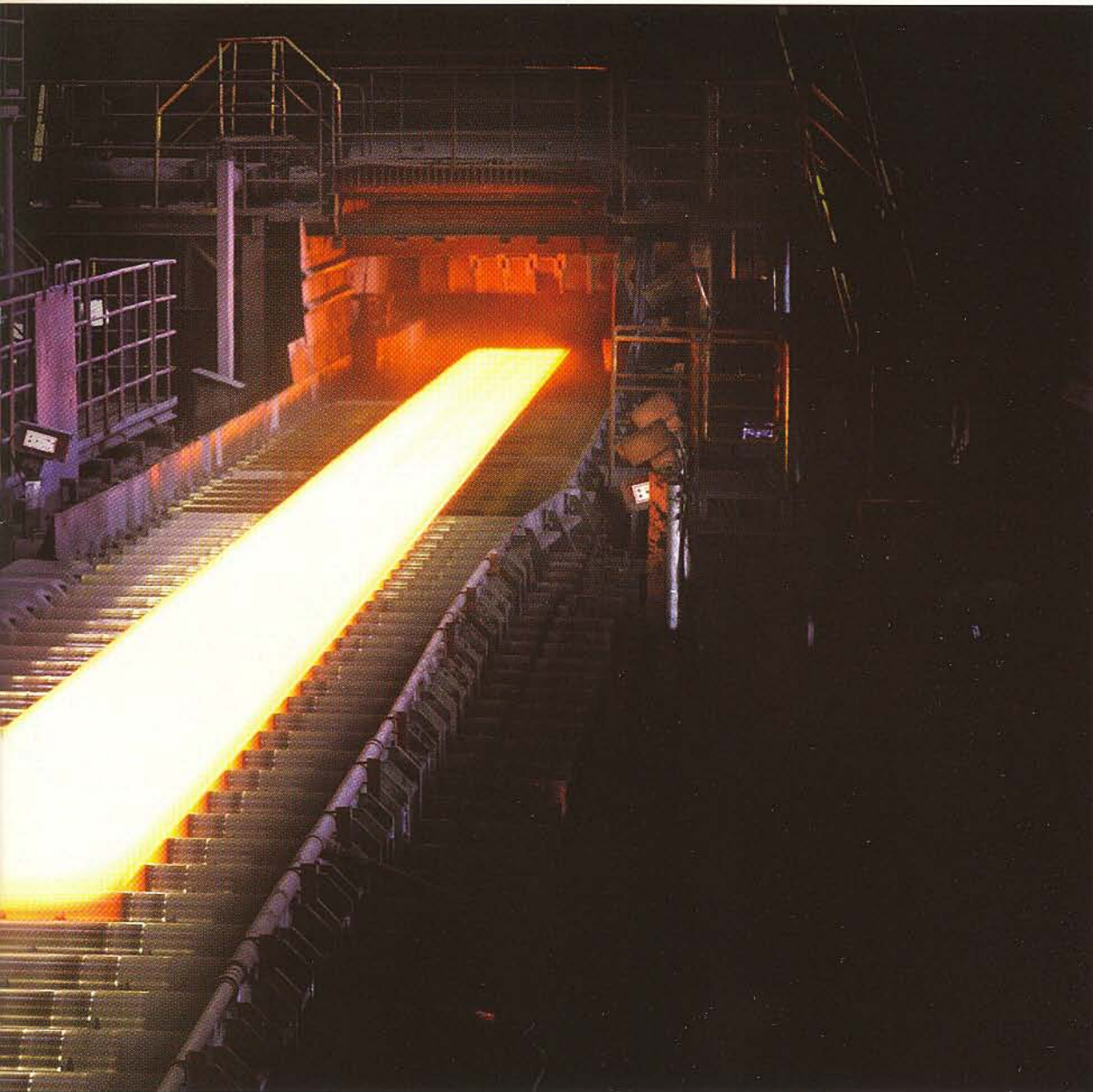
High-performance alloy & Stainless steel

NIPPON YAKIN KOGYO GROUP





Creating Novel Stainless Steels and High-Performance Alloys from a New Perspective
————— *The Mission of Nippon Yakin Kogyo*



Nippon Yakin Kogyo was established in 1925. Since the commercialization of 18-8 stainless steel (SUS 304) in 1935, the company has continued to research ways of manufacturing high-grade stainless steels and super alloys from nickel ore. Over the years, the company has systematically developed outstanding technologies and sophisticated production facilities under a comprehensive quality assurance system. And the company's products have earned a high reputation among customers.

Nippon Yakin Kogyo, as the leading stainless steel manufacturer in Japan, is now expanding confidently its business field to manufacture high-performance alloys for new applications together with conventional stainless steels aiming at a "new special stainless steel manufacturer," applying the sophisticated production technologies we have acquired through years of stainless steel manufacturing.

Yakin Kawasaki Co., Ltd. ——— **Excellent Research and Development Capabilities,
and Outstanding Production Technologies**

Nippon Yakin

Acquired ISO14001 Certification in March 1999
Acquired ISO9002 : 1994 Certification in December 1994
Transferred to ISO9001 : 2000 in October 2003

Product

Within the Nippon Yakin Kogyo Group, Yakin Kawasaki manufactures special stainless steels, Fe-Ni alloys and high Ni alloys, which are called high-performance alloys with advanced production technologies and high R&D potential. Ultra-modern facilities covering melting and refining, continuous casting, hot rolling, cold rolling are in operation, built on the core technologies of Yakin Kawasaki.

Yakin Kawasaki Co., Ltd.

*The two major production bases, Yakin Kaw
Yakin Kogyo which undertakes planning and
Yakin Kawasaki which conducts developmen
core technologies, and Yakin Oheyama whic
smelting technologies, these three companie
synergies and forge a dynamic corporate grou*



Yakin Kawasaki

Yakin Oheyama Co., Ltd. ——— **Manufacturing raw materials of specialty steels for the Nippon Yakin Kogyo Group**

Kogyo Co., Ltd.

Acquired ISO14001 Certification in November 2001

Product

Yakin Oheyama Co., Ltd.

Yakin Oheyama Co., Ltd. and Yakin Oheyama, support Nippon Yakin Kogyo Group sales as the head of the Group. Together with other companies in the group, they are engaged in sales and manufacturing using their outstanding technology and supplies raw materials with their top-class quality. They work hard in close partnership to deliver products with better cost performance.

Yakin Oheyama is located near the Oheyama mountain range as well as Amano Hashidate, considered one of the three most beautiful places in Japan. Yakin Oheyama manufactures ferro-nickel which is an essential starting material of specialty steels for the Nippon Yakin Kogyo Group. By giant rotary kilns, the company smelts nickel ore from overseas to manufacture the base materials for products with better cost performance.

Yakin Oheyama





Core Technologies of the Nippon Yakin Kogyo Group:

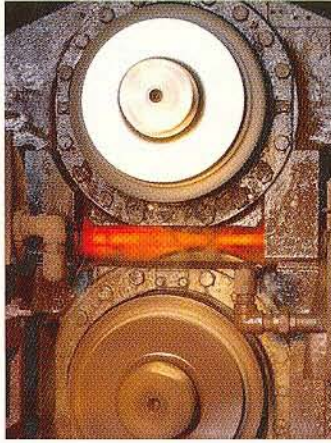
- 1. Refining technologies to produce ultra-clean alloys***
- 2. Continuous casting technologies of alloy steels and high nickel alloys***
- 3. Thermo-mechanical treatment of high nickel alloys***
- 4. Welding of high nickel alloys***
- 5. Technology of surface control***

Five Core Technologies for the Production of High-Performance Alloys

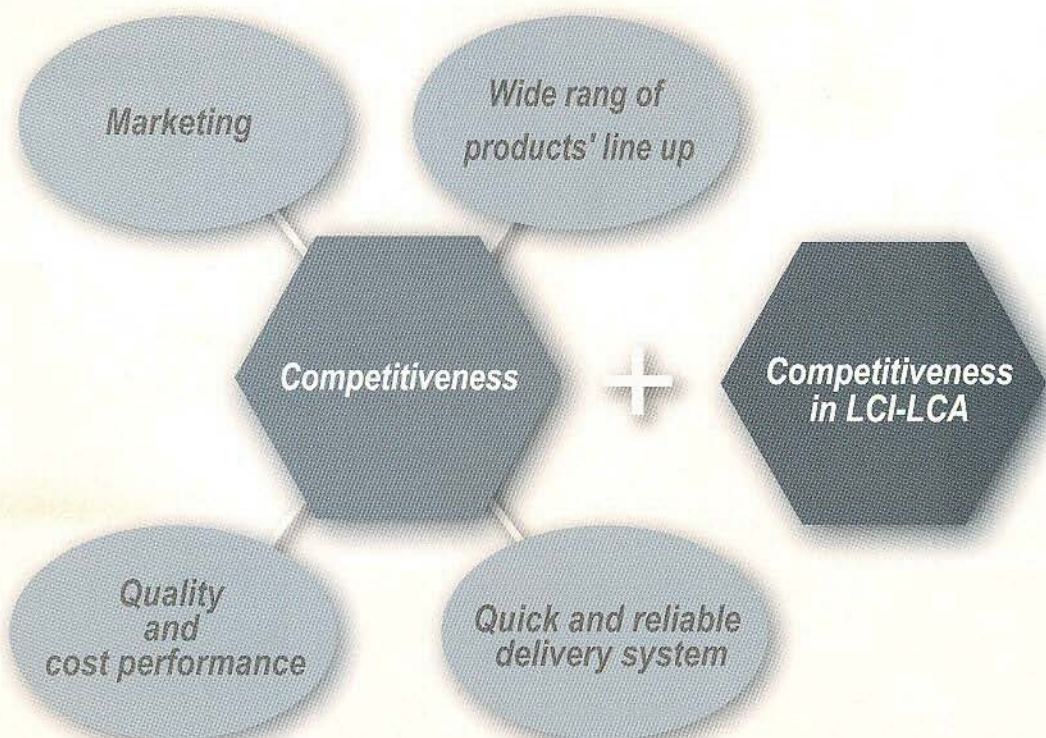
High-performance alloys are manufactured by the same facilities as those for stainless steels.

Technologies required include: refining that assures high cleanliness; casting for high Ni-alloys by a vertical continuous casting machine; thermo-mechanical treatment through hot rolling in Steckel mill; welding for practical applications of the products; and surface treatment to increase the corrosion resistance.

Together with these production technologies, various energy-saving technologies that have already satisfied the CO₂ reduction target specified in the First Kyoto Protocol are contributing to an environmentally-sustainable society.



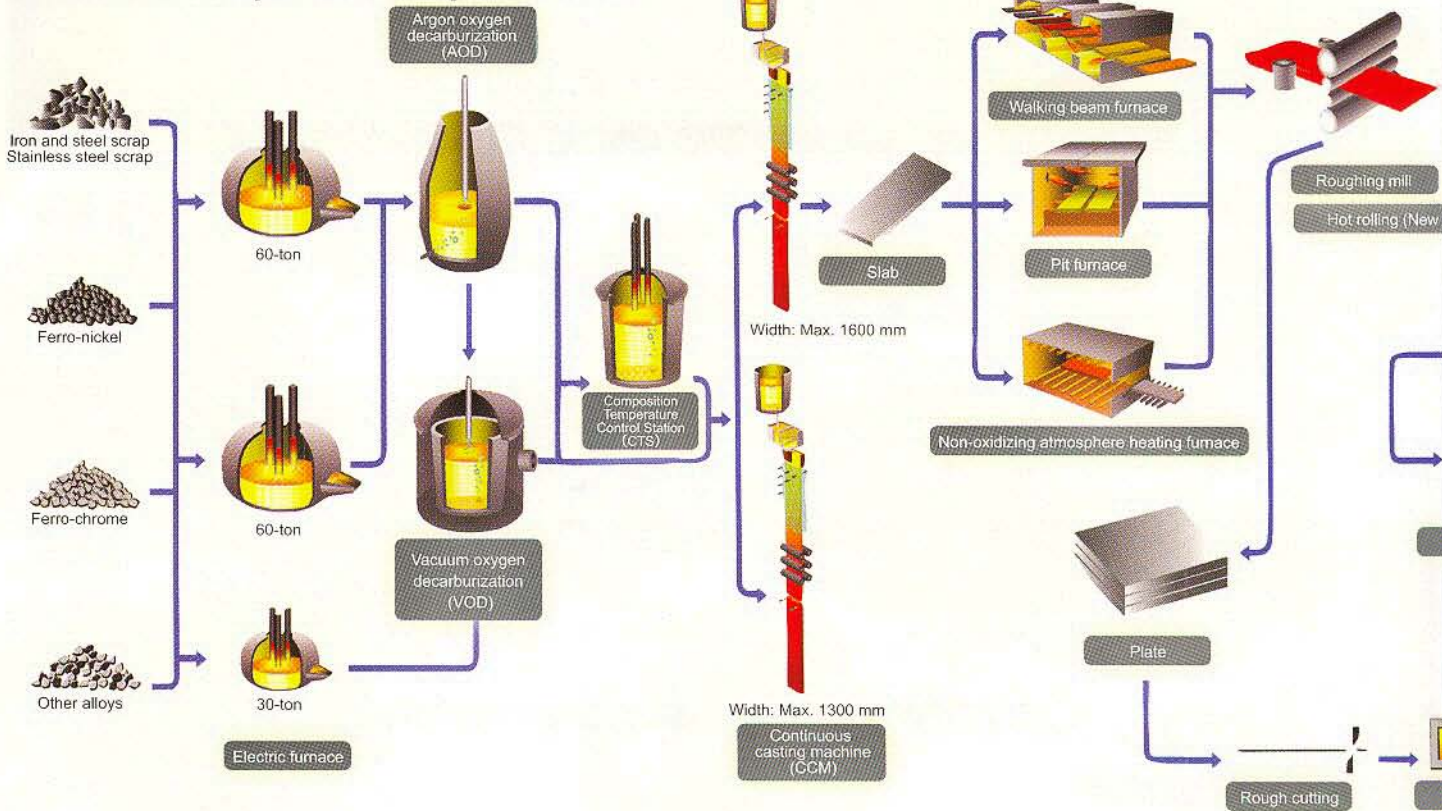
Knowledge, Experience, and Ideas — *Core elements underpin all our technologies*



With supremely reliable facilities and optimized production processes, we deliver

The Nippon Yakin Kogyo Group is continually challenging the frontiers of technology, delivering special stainless steel products that satisfy customers' needs, and its mission to help build a creative society. Based on the concept, the Nippon Yakin Kogyo Group strives to establish and standardize production and inspection technologies that answer customers' needs, and to improve product quality.

Flow chart of production processes



Argon oxygen decarburization



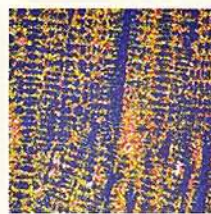
Satisfactory quality cannot be obtained by a simple process of melting and solidifying the raw materials such as scrap metals and various ores. Impurities in the raw metallic materials must be strictly controlled. To reduce and regulate the carbon, sulfur, and gas constituents which inevitably remain after controlling impurities, refining is required. It is also important to control other trace constituents and non-metallic inclusions. Our unparalleled technology for controlling non-metallic inclusions is famed worldwide, and the technology acquired the John Chipman Award from the American Iron and Steel Institute in 2002.



Continuous casting machine



Two vertical continuous casting machines, each as tall as a 7-story building, are in operation. Since high-performance alloys contain many kinds of elements, cracks tend to occur if the slab largely bends during continuous casting as it cools and solidifies. The vertical facility, however, generates no non-uniform force to the slab, making it ideal for producing high-performance alloys.



Yakin Kawasaki has developed a leading-edge technology to suppress segregation, resulting in products that customers trust.

Hot roughing mill



Among NCH hot rolling mills, the roughing mill plays a big role. The mill performs both rough bar rolling for strip (down to 25 mm in thickness) and rolling for wide plate. The mill is equipped with edgers and a hydraulic AGC.

Optimum rolling schedule is set up by a computer or each product.

Main specifications

- Roughing mill : 4-high reverse mill
- Rolling force : max. 4,000 ton
- Rolling speed : max. 314 rpm
- Rolling-size range
- Thickness : 6.0~220 mm
- Width : max. 2,500 mm

Hot finishing mill

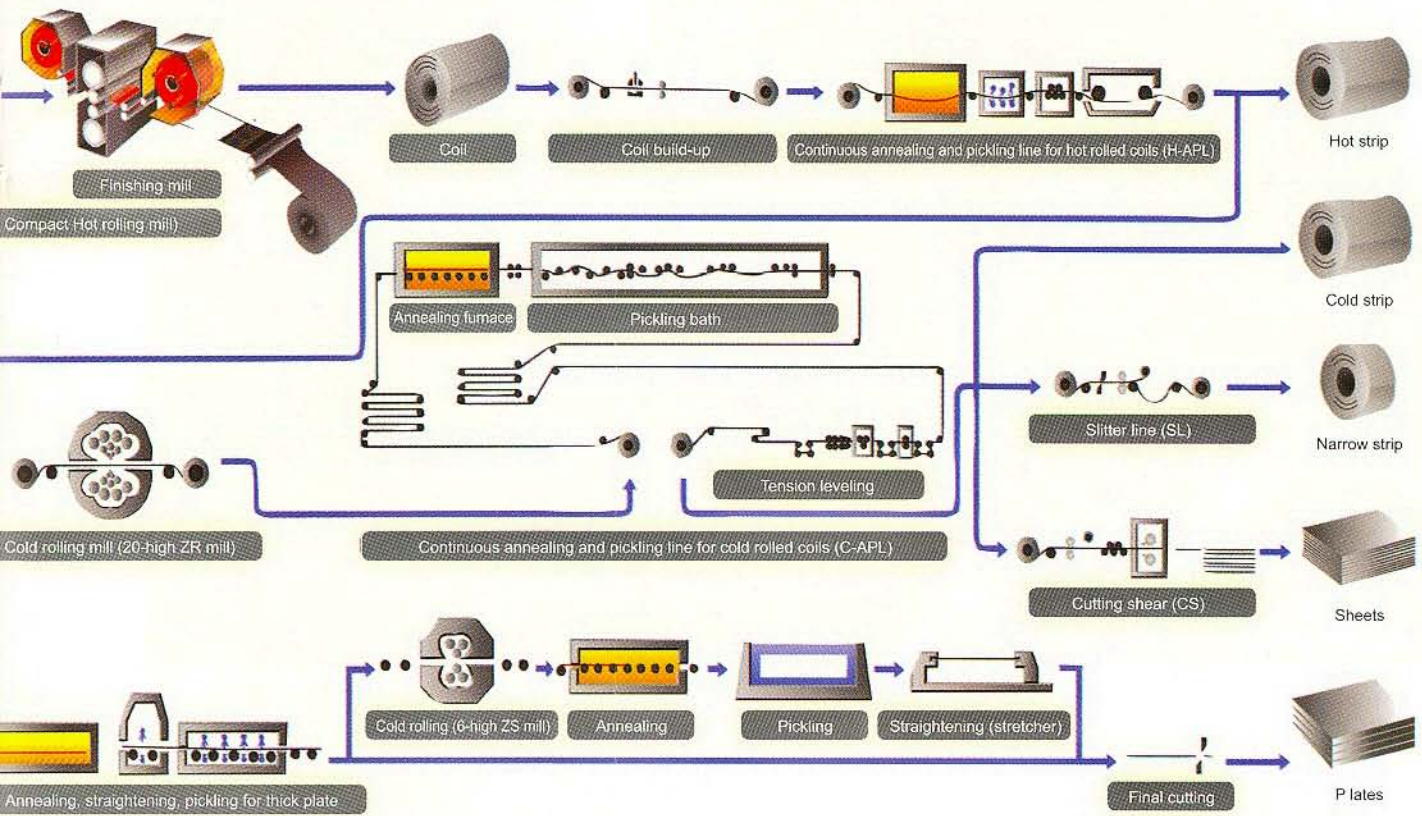


The finishing mill is a type capable of producing longitudinal/cross section strip thickness, surface quality of strip. The mill allows ordinarily difficult to roll resistance alloys. Hot rolling furnace with slab temperature depending on the product manufacturing high-performance in-depth expertise in the heat treatment, such as chromium (Cr), such heating while suppressing oxidizing atmosphere. This is advantageous for heating magnetic alloys.

Main specifications

- Finishing mill : 4-high
- Rolling force : max.
- Rolling speed : max.
- Rolling-size range
- Thickness : 2.0~25
- Width : max. 1

high-quality products to customers.



...pe of Steckel mill to be product with excellent al, profile accuracy of quality and internal quality the rolling of alloys and high deformation ing starts from a heating tures as high as 1200°C uct requirements. For mance alloys, we have ating of alloys containing as the technology for oxidation using a non- e furnace is particularly g Invar alloys and soft

Cold rolling mill



Three sets of 20-high Sendzimir cold rolling mill - to meet diverse range of rolling requirements.

Continuous annealing and pickling line



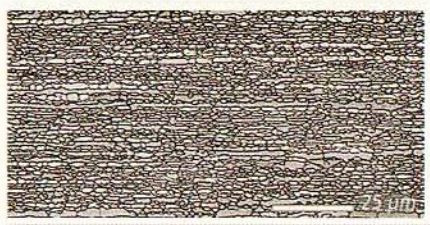
Five lines are in operation, offering a wide range of production conditions to suit the types and sizes of products. This allows us to fine tune our response to various requirements. (Photo shows No. 5 Annealing and Pickling line.)

Annealing furnace for thick plate



Two thick plate annealing furnaces conduct heat treatment under optimum conditions for products of every type and size, and supplying top-quality products.

4,000 ton
836 mpm
mm
600 mm



Duplex stainless steel structure of NAS 64, finely recrystallized by annealing



Delivery of products in various shapes for individual needs and uses



The all-purpose and special high-grade stainless steels of Nippon Yakin Kogyo are manufactured by an integrated production system.

The company has systematized excellent technologies and advanced production facilities, developed over many years and backed by a comprehensive quality assurance system, enabling it to offer recognized NAS special stainless steel products to customers.

The broad range of high-quality stainless steels is sure to meet all requirements in terms of corrosion resistance, heat resistance, weather resistance, acid resistance, high strength, machinability, and formability. All these products have earned strong reputations among customers.



Certifications for the Works

1 Certifications of Japanese Industrial Standards

- JIS G4303 Stainless steel bars
- JIS G4304 Hot rolled stainless steel plates, sheets and strip
- JIS G4305 Cold rolled stainless steel plates, sheets and strip
- JIS G4311 Heat-resisting steel bars
- JIS G4312 Heat-resisting steel plates and sheets

2 ISO Certifications

- JIS Q9001:2000/ISO 9001:2000
- JIS Q14001:1996/ISO 14001:1996

3 Other certifications

- Nippon Kaiji Kyokai (NK)

Rolled stainless steel plates

- Lloyd's Register

1. Stainless Steel Plates and Strip
2. Fe-Ni alloys Plates and Strip
3. Forgings in Austenitic Stainless Steel

- DET NORSKE VERITAS (DNV)

Austenitic Stainless Steel and Fe-36Ni

- BUREAU VERITAS (BV)

1. Mode II

(Stainless Steel Products & Special Alloy Products)

2. Stainless Steel Strips and Plates

3. Special Alloy Strips, Sheets and Plates
(Fe-36%Ni)

- TÜV Rheinland Japan Ltd.

1. AD2000-Merkblatt WO/TRD100

· Stainless Steel Strip, Plate, Sheet, Forging and Bar

2. PED 97/23/EC Annex I.4.3

· Stainless Steel Strip, Sheet, Plate, Forging and Bar

· Nickel and Nickel Alloy Strip, Sheet and Plate



Certified marking



Registered marking



Certified marking

Yakin Kawasaki has registered company for JIS 9001:2000 and ISO 9001:2000.

Registration: Design, development, manufacture, and related services for:

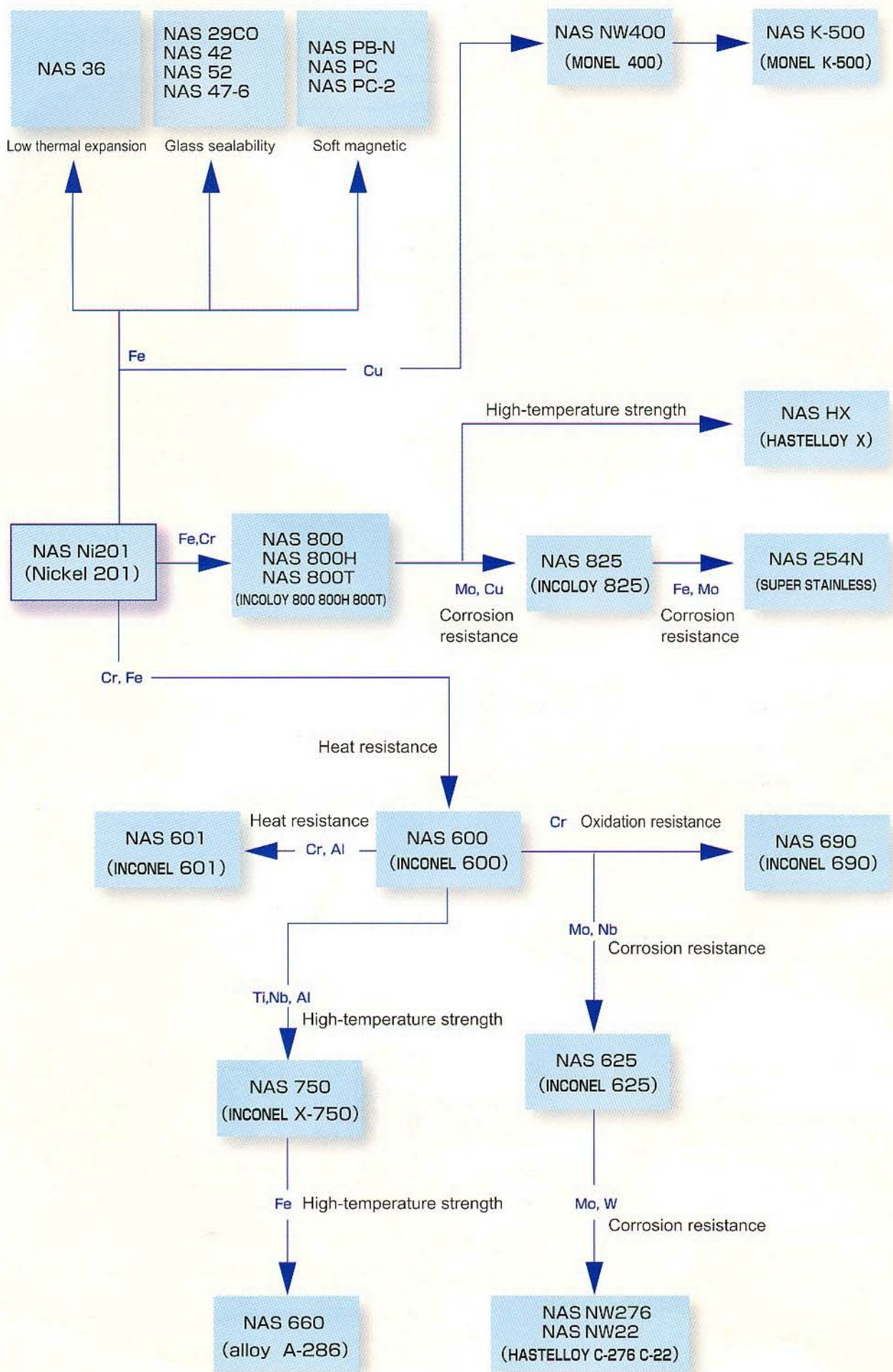
Hot rolled sheets

: Hot rolled strip

: Cold rolled sheets

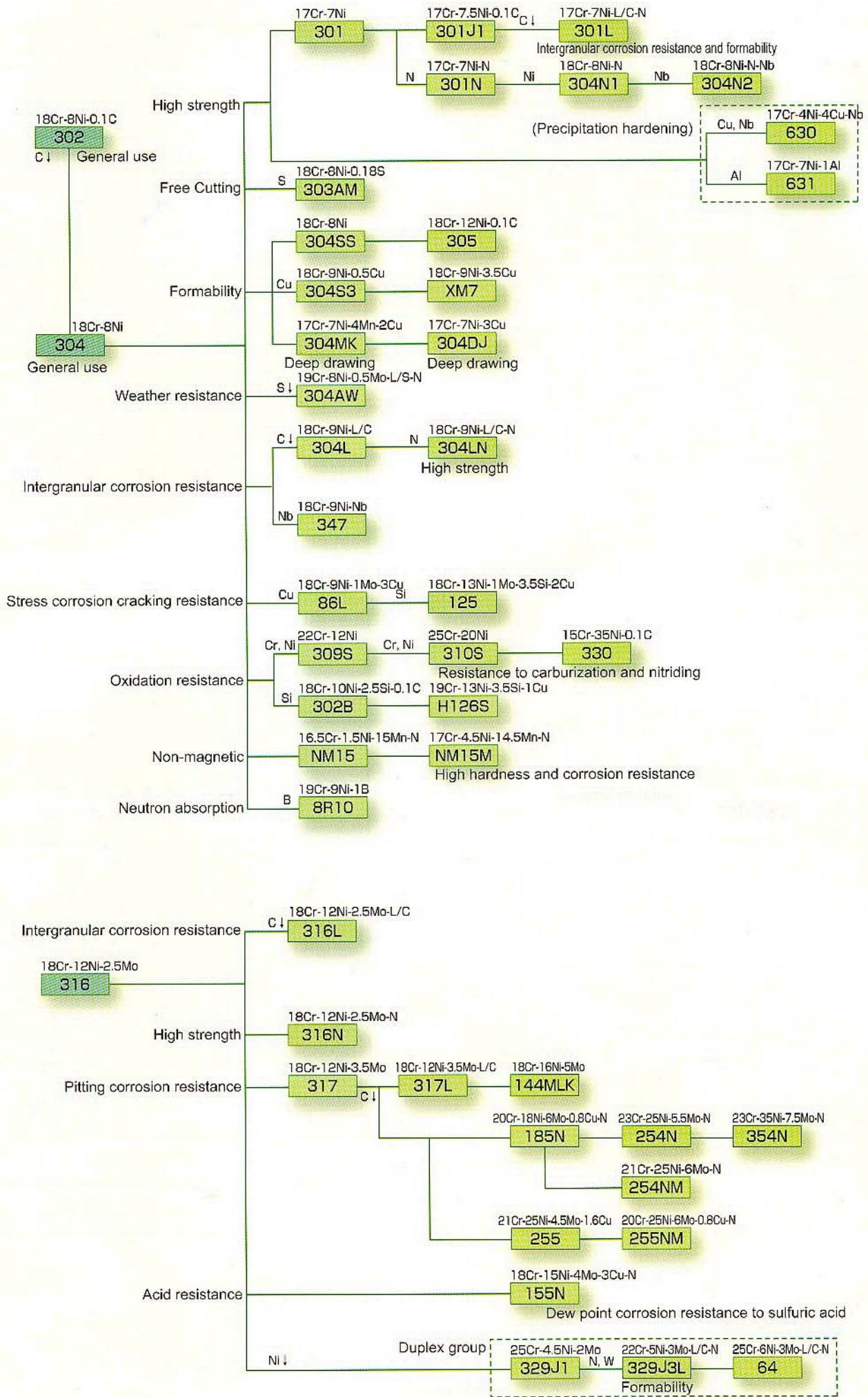
: Cold rolled strip and forged parts

Systematic layout of high Ni alloy products



• INCOLOY, INCONEL, MONEL, 800HT are the trade marks of the Special Metals Corporation group of companies.
 • HASTELLOY, C-22 are the trade marks of the Haynes International.

Systematic layout of stainless steel products



High-Performance Alloys Products Overview (grades, chemical co

Type							Chemical composition					
Class	NAS	JIS	UNS Number	Standard			C	Si	Mn	Ni	Cr	Mo
				ASME	ASTM	AMS						
Corrosion Resistant Alloys	NAS 155N	—	S 31727	—	A 240	—	≤0.030	≤1.00	≤1.00	14.50~16.50	17.50~19.00	3.80 ~4.50
	NAS 185N	—	S 31254	SA-240	A 240	—	≤0.030	≤0.80	≤1.00	17.50~18.50	19.50~20.50	6.00 ~6.50
	NAS 254N	SUS 836L	S 32053	Code Case 2445	A 240	—	≤0.020	≤1.00	≤1.00	24.00~26.00	22.00~24.00	5.00 ~6.00
	NAS 254NM	—	N 08367	SB-688	B 688	—	≤0.030	≤1.00	≤2.00	23.50~25.50	20.00~22.00	6.00 ~7.00
	NAS 255	SUS 890L	N 08904	SB-625	B 625	—	≤0.020	≤1.00	≤2.00	23.00~28.00	19.00~23.00	4.00 ~5.00
	NAS 255NM	—	N 08926	SB-625	B 625	—	≤0.020	≤0.50	≤2.00	24.00~26.00	19.00~21.00	6.00 ~7.00
	NAS 354N	—	N 08354	—	B 625	—	≤0.030	≤1.00	≤1.00	34.00~36.00	22.00~24.00	7.00 ~8.00
	NAS 329J3L	SUS 329J3L	S 32205	SA-240	A 240	—	≤0.030	≤2.00	≤1.00	4.50~6.50	21.00~24.00	2.50 ~3.50
	NAS 64	SUS 329J4L	S 32506	—	A 240	—	≤0.030	≤0.90	≤1.00	5.50~7.20	24.00~26.00	3.00 ~3.50
	NAS 825	NCF 825	N 08825	SB-424	B 424	—	≤0.050	≤0.50	≤1.00	38.00~46.00	19.50~23.50	2.50 ~3.50
	NAS 690	NCF 690	N 06690	SB-168	B 168	—	≤0.05	≤0.50	≤0.50	≥58.0	27.00~31.00	—
	NAS NW22	NW 6022	N 06022	SB-575	B 575	—	≤0.015	≤0.08	≤0.50	Bal	20.00~22.50	12.50 ~14.5
	NAS NW276	NW 0276	N 10276	SB-575	B 575	—	≤0.010	≤0.08	≤1.00	Bal	14.50~16.50	15.0 ~17.0
	NAS NW400	NW 4400	N 04400	SB-127	B 127	4544	≤0.30	≤0.5	≤2.0	≥63.0	—	—
Heat Resistant Alloys	NAS 800	NCF 800	N 08800	SB-409	B 409	5871	≤0.10	≤1.00	≤1.50	30.00~35.00	19.00~23.00	—
	NAS 800H	NCF 800H	N 08810	SB-409	B 409	—	0.06~0.10	≤1.00	≤1.50	30.00~35.00	19.00~23.00	—
	NAS 800T	—	N 08811	SB-409	B 409	—	0.06~0.10	≤1.00	≤1.50	30.00~35.00	19.00~23.00	—
	NAS H840	—	S 33400	SA-240	A 240	—	≤0.08	≤1.00	≤1.00	18.00~22.00	18.00~22.00	—
	NAS 600	NCF 600	N 06600	SB-168	B 168	5540	≤0.15	≤0.50	≤1.00	≥72.00	14.00~17.00	—
	NAS 601	NCF 601	N 06601	SB-168	B 168	5870	≤0.10	≤0.50	≤1.00	58.00~63.00	21.00~25.00	—
	NAS 660	SUH 660	S 66286	—	—	5525	≤0.08	≤1.00	≤2.00	24.00~27.00	13.50~16.00	1.00 ~1.50
	NAS HX	NW 6002	N 06002	SB-435	B 435	5536	0.05~0.15	≤1.00	≤1.00	Bal	20.50~23.00	8.00 ~10.00
NAS 750	NCF 750	N 07750	SB-637	B 637	5542	≤0.08	≤0.50	≤1.00	≥70.00	14.00~17.00	—	
High-strength Stainless Steels	NAS 630	SUS 630	S 17400	SA-693	A 693	5604	≤0.07	≤1.00	≤1.00	3.00~5.00	15.00~17.50	—
	NAS 631	SUS 631	S 17700	SA-693	A 693	5528	≤0.09	≤1.00	≤1.00	6.50~7.75	16.00~18.00	—
	NAS NM15M	—	—	—	—	—	0.040~0.090	≤0.90	14.00~15.00	4.00~4.60	16.50~17.50	—
Controlled Expansion Alloys	NAS 36	—	K 93600	—	B 753	—	≤0.05	≤0.30	≤0.80	35.0~37.0	—	—
	NAS 42	—	K 94100	—	B 753	—	≤0.03	≤0.30	≤0.80	40.0~43.0	≤0.25	—
	NAS 52	—	N 14052	—	F 30	—	≤0.01	≤0.10	≤0.40	50.0~51.0	≤0.10	—
	NAS 21-6	—	—	—	—	—	≤0.03	≤0.35	0.5~1.0	20.0~21.5	5.0~6.0	—
	NAS 22-3	—	—	—	—	—	≤0.08	≤0.35	0.4~1.0	21.5~22.5	3.0~4.0	—
	NAS 236MN	—	—	—	—	—	≤0.10	≤0.25	5.0~6.0	22.5~23.5	≤0.3	—
	NAS 29CO	—	K 94610	—	F 15	7728	≤0.04	≤0.20	≤0.50	29.00~30.00	≤0.20	≤ 0.20
	NAS 42-6	—	K 94760	—	F 31	—	≤0.02	≤0.30	≤0.25	41.0~43.0	5.60~6.40	—
NAS 47-6	—	—	—	—	—	≤0.02	≤0.30	≤0.25	46.5~48.0	5.7~6.6	—	
Soft Magnetic Alloys	NAS PB-N	—	K 94500	—	A 753	—	≤0.01	≤0.2	≤1.0	45.0~48.0	—	—
	NAS PC	—	N 14076	—	—	—	≤0.05	≤0.50	≤1.5	75.0~78.0	≤0.30	3.0 ~4.5
	NAS PC-2	—	N 14080	—	A 753	—	≤0.05	≤0.50	≤0.80	79.0~82.0	≤0.30	3.5 ~6.0
Ni	NAS Ni201	NW 2201	N 02201	SB-162	B 162	5553	≤0.02	≤0.3	≤0.3	≥99.0	—	—
Neutron Absorption Material	NAS 8R10	—	—	—	—	—	≤0.08	≤1.00	≤2.00	8.00~10.50	18.00~20.00	—

* NAS 329J3L can be also used as S 31803

Composition, characteristics, mechanical properties

Composition (%)		Characteristics	Mechanical properties						
Cu	other		Yield Strength	Tensile Strength	Elongation	Hardness			
			N/mm ²	N/mm ²	%	HRB	HV	HB	
2.80~4.00	N 0.15~0.21	Resistance to sulfuric acid	≥245	≥550	≥35	≤95	≤220	≤217	
0.50~1.00	N 0.18~0.22	Highly corrosion-resistant super stainless steel	≥310	≥655	≥35	≤96	—	≤223	
—	N 0.17~0.22	Super stainless Steel for high-temperature seawater (developed by Nippon Yakin Kogyo)	≥295	≥640	≥40	≤96	≤230	≤217	
—	N 0.18~0.25	Highly corrosion-resistant super stainless steel	≥310	≥655	≥30	—	—	≤240	
1.00~2.00	—	Higher acid resistance than NAS 329J1	≥215	≥490	≥35	≤90	≤200	≤187	
0.50~1.50	N 0.15~0.25	Highly corrosion-resistant super stainless steel	≥295	≥650	≥35	—	—	—	
—	N 0.17~0.24	Highly corrosion-resistant super stainless steel (developed by Nippon Yakin Kogyo)	≥295	≥640	≥35	≤96	≤230	≤217	
—	N 0.08~0.20	NAS 329J1 + pitting corrosion resistance, crevice corrosion resistance, lower proof stress than NAS 64	≥450	≥620	≥18	HRC≤32	≤320	≤302	
—	N 0.08~0.20, W 0.05~0.30	NAS 329J1 + pitting corrosion resistance, crevice corrosion resistance (developed by Nippon Yakin Kogyo)	≥450	≥620	≥18	HRC≤32	≤320	≤302	
1.50~3.00	Ti 0.60~1.20 Al ≤0.20	Highly corrosion-resistant alloy	≥235	≥580	≥30	≤96	≤214	≤207	
≤0.50	Fe 7.00~11.00	Highly corrosion-resistant alloy	≥240	≥590	≥30	—	—	—	
—	Fe 2.0~4.0, W 2.5~3.5, V ≤0.35, Co ≤2.5	Acid-resistant alloy (for hydrochloric acid, sulfuric acid, phosphoric acid, chloride, etc.) also used as a heat-resistant alloy.	≥240	≥660	≥35	—	—	—	
—	Co ≤2.5, Fe ≤4.0~7.0, W 3.0~4.5, V ≤0.35	Acid-resistant alloy (for hydrochloric acid, sulfuric acid, phosphoric acid, chloride, etc.) also used as a heat-resistant alloy.	≥275	≥690	≥40	—	—	—	
28.0~34.0	Fe ≤2.5	Highly corrosion-resistant Ni-Cu alloy, resistant to sea water	≥195	≥480	≥35	—	—	—	
≤0.75	Ti 0.15~0.60, Al 0.15~0.60	Good general corrosion resistance; also used as an acid-resistant steel	≥205	≥520	≥30	≤89	≤182	≤179	
≤0.75	Ti 0.15~0.60, Al 0.15~0.60, Fe ≥39.5	Good general corrosion resistance; also used as an acid-resistant steel	≥175	≥450	≥30	≤86	≤171	≤167	
≤0.75	Ti 0.15~0.60, Al 0.15~0.60, Fe ≥39.5	Good general corrosion resistance; also used as an acid-resistant steel	≥175	≥450	≥30	—	—	—	
—	Ti 0.15~0.60, Al 0.15~0.60	Good general corrosion resistance; also used as an acid-resistant steel	≥170	≥485	≥30	≤92	—	—	
≤0.50	Fe 6.00~10.00	Superior in high-temperature strength, good also in high-temperature corrosion resistance	≥245	≥550	≥30	≤89	≤182	≤179	
≤1.00	Al 1.00~1.70	Excellent high-temperature strength; having anti-oxidation, anti-carburization, and anti-sulfurizing properties	≥195	≥550	≥30	—	—	—	
—	Ti 1.90~2.35, V 0.10~0.50 Al ≤0.35, B 0.001~0.010	Precipitation hardening austenitic steel	S	—	≥730	≥25	≤91	≤202	≤192
—	Fe 17.00~20.00, Co 0.5~2.5, W 0.2~1.0	High-temperature strength; high oxidation performance	(H-treatment)	≥590	≥900	≥15	HRC≤24	≥261	≥248
—	Fe 17.00~20.00, Co 0.5~2.5, W 0.2~1.0	High-temperature strength; high oxidation performance	—	≥240	≥655	≥35	—	—	—
≤0.50	Al 0.40~1.00, Ti 2.25~2.75	High-temperature strength; high oxidation performance	—	≤890	≥40	HRC≤35	≤335	≤321	
3.00~5.00	Nb 0.15~0.45	Precipitation hardening martensitic steel; for steel belt, H900 treatment	≥1175	≥1310	≥5	HRC≥40	≥375	—	
—	Al 0.75~1.50	Precipitation hardening martensitic steel, having cold formability and cold work-hardenability	S	≤380	≤1030	≥20	≤92	≤200	≤192
—	Al 0.75~1.50	Precipitation hardening martensitic steel, having cold formability and cold work-hardenability	TH1050 treatment	≥960	≥1140	≥3 (3.0t or thinner) ≥5 (thicker than 3.0)	HRC≥35	≥345	—
—	Al 0.75~1.50	Precipitation hardening martensitic steel, having cold formability and cold work-hardenability	RH950 treatment	≥1030	≥1230	Not specified (3.0t or thinner) ≥4 (thicker than 3.0)	HRC≥40	≥392	—
—	N 0.30~0.35	Outstanding non-magnetization even under high degree of working	≥390	≥690	≥30	≤98	≤228	≤228	
—	—	Low thermal expansion material	—	—	—	—	—	—	
—	—	Glass sealing alloy	—	—	—	—	—	—	
—	—	Glass sealing alloy	—	—	—	—	—	—	
—	—	High thermal expansion material for bimetal and trimetal	—	—	—	—	—	—	
—	—	High thermal expansion material for bimetal and trimetal	—	—	—	—	—	—	
—	—	High thermal expansion material for bimetal and trimetal	—	—	—	—	—	—	
≤0.20	—	Glass sealing alloy	—	—	—	—	—	—	
—	—	Glass sealing alloy	—	—	—	—	—	—	
—	—	Glass sealing alloy	—	—	—	—	—	—	
—	—	Soft-magnetic material	—	—	—	—	—	—	
4.0~6.0	—	Soft-magnetic material	—	—	—	—	—	—	
≤0.30	—	Soft-magnetic material	—	—	—	—	—	—	
≤0.2	Fe ≤0.4	Good corrosion resistance to high temperature and high concentration of alkali, chlorine gas, etc.	≥80	≥345	≥30 (thicker than 0.5 and not thicker than 1.2) ≥35 (thicker than 1.2 and not thicker than 2.7)	—	—	—	
—	B 1.00~1.25	Neutron absorption material (developed by Nippon Yakin Kogyo)	≥205	≥520	≥10	≤100	—	—	

Stainless Steel Products Overview (grades, chemical composition,

		Type			Chemical Composition (%)						
Class	NAS	Corresponding Standard		C	Si	Mn	Ni	Cr	Mo		
		JIS	AISI etc.								
Austenitic Stainless Steel	Standard Type	NAS 301	SUS 301	-	≤0.15	≤1.00	≤2.00	6.00~8.00	16.00~18.00	-	
		NAS 304	SUS 304	-	≤0.08	≤1.00	≤2.00	8.00~10.50	18.00~20.00	-	
		NAS 305	SUS 305	-	≤0.12	≤1.00	≤2.00	10.50~13.00	17.00~19.00	-	
		NAS 316	SUS 316	-	≤0.08	≤1.00	≤2.00	10.00~14.00	16.00~18.00	2.00 ~3.00	
		NAS 317	SUS 317	-	≤0.08	≤1.00	≤2.00	11.00~15.00	18.00~20.00	3.00 ~4.00	
	Weather Proofing	NAS 304AW	SUS 304N1	-	≤0.08	≤1.00	≤0.50	8.00~10.50	18.00~20.00	0.20 ~0.60	
	Intergranular Corrosion Resistance	NAS 301L	SUS 301L	-	≤0.030	≤1.00	≤2.00	6.00~8.00	16.00~18.00	-	
		NAS 304L	SUS 304L	-	≤0.030	≤1.00	≤2.00	9.00~13.00	18.00~20.00	-	
		NAS 347	SUS 347	-	≤0.08	≤1.00	≤2.00	9.00~13.00	17.00~19.00	-	
		NAS 316L	SUS 316L	-	≤0.030	≤1.00	≤2.00	12.00~15.00	16.00~18.00	2.00 ~3.00	
		NAS 317L	SUS 317L	-	≤0.030	≤1.00	≤2.00	11.00~15.00	18.00~20.00	3.00 ~4.00	
	Stress Corrosion cracking Resistance	NAS 86L	SUS 315J1	-	≤0.030	0.50~1.00	≤0.50	8.50~9.50	18.00~19.00	0.50 ~1.00	2.80
		NAS 125	SUS 315J2	-	≤0.08	2.50~4.00	≤2.00	12.00~14.00	17.00~19.00	0.50 ~1.50	1.50
	High Ni and High Corrosion Resistance	NAS 144MLK	SUS 317J1	-	≤0.040	≤1.00	≤2.50	15.00~17.00	16.00~19.00	4.00 ~6.00	
	For Forming	NAS 304MK	SUS 304J2	-	≤0.030	≤1.00	3.60~5.00	6.50~8.00	15.50~17.00	-	1.50
		NAS 304DJ	SUS 304J1	-	0.04~0.08	≤1.70	≤3.00	6.50~7.50	16.00~18.00	-	2.00
		NAS 304SS	SUS 304	-	≤0.08	≤1.00	≤2.00	8.00~10.50	18.00~20.00	-	
		NAS XM7	SUS XM7	-	≤0.08	≤1.00	≤2.00	8.50~10.50	17.00~19.00	-	3.00
	Free-Machining	NAS 303AM	SUS 303	-	≤0.08	≤1.00	≤2.00	8.00~10.00	18.00~19.00	-	
	High Strength	NAS 301N	(SUS 301)	-	≤0.15	0.80~1.00	≤2.00	6.00~8.00	16.00~18.00	-	
NAS 304N2		SUS 304N2	-	≤0.08	≤1.00	≤2.50	7.50~10.50	18.00~20.00	-		
Non-Magnetic and High Strength	NAS NM15	-	(AISI 205)	0.12~0.25	≤1.00	14.00~16.00	1.00~3.00	16.00~18.00	-		
Heat Resistance	NAS 302B	SUS 302B	-	≤0.15	2.00~3.00	≤2.00	8.00~10.00	17.00~19.00	-		
	NAS 309S	SUS 309S	-	≤0.08	≤1.00	≤2.00	12.00~15.00	22.00~24.00	-		
	NAS 310S	SUS 310S	-	≤0.08	≤1.50	≤2.00	19.00~22.00	24.00~26.00	-		
Ferritic Stainless Steel	Formability	NAS 409	SUH 409	-	≤0.08	≤1.00	≤1.00	-	10.50~11.75	-	
		NAS 409L	SUH 409L	-	≤0.030	≤1.00	≤1.00	-	10.50~11.75	-	
		NAS 410L	SUS 410L	-	≤0.030	≤1.00	≤1.00	-	11.00~13.50	-	
	Weldability	NAS 410S	SUS 410S	-	≤0.08	≤1.00	≤1.00	-	11.50~13.50	-	
		NAS 430	SUS 430	-	≤0.12	≤0.75	≤1.00	-	16.00~18.00	-	
	Standard Type	NAS 430LX	SUS 430LX	-	≤0.030	≤0.75	≤1.00	-	16.00~19.00	-	
		NAS 430LM	SUS 430J1L	-	≤0.025	≤0.75	≤1.00	0.30~0.50	16.00~19.00	0.20 ~0.50	0.30
		NAS 436J1L	SUS 436J1L	-	≤0.025	≤1.00	≤1.00	-	17.00~20.00	0.40 ~0.80	
	Corrosin Resistance	NAS 436LS	SUS 436L	-	≤0.010	≤0.10	≤0.50	-	17.00~18.00	0.75 ~1.50	
		NAS 444	SUS 444	-	≤0.025	≤1.00	≤1.00	-	17.00~20.00	1.75 ~2.50	
NAS 445AM		SUS 445J2	-	≤0.025	≤0.60	≤0.50	-	21.0~23.0	1.75 ~2.50		
NAS 445AM		SUS 445J2	-	≤0.025	≤0.60	≤0.50	-	21.0~23.0	1.75 ~2.50		

characteristics, mechanical properties)

		Characteristics	Mechanical properties					
Cu	Other		Yield Strength	Tensile Strength	Elongation	Hardness		
			N/mm ²	N/mm ²	%	HRB	HV	HB
-	-	Room temperature strength and work hardenability are better than NAS 304.	≥205	≥520	≥40	≤95	≤218	≤207
-	-	General corrosion resistance	≥205	≥520	≥40	≤90	≤200	≤187
-	-	NAS 304 + cold workability (non-magnetic)	≥175	≥480	≥40	≤90	≤200	≤187
-	-	Corrosion resistance and pitting corrosion resistance to diluted sulfuric acid, sulfurous acid, acetic acid, and various organic acids	≥205	≥520	≥40	≤90	≤200	≤187
-	-	Better corrosion resistance than NAS 316	≥205	≥520	≥40	≤90	≤200	≤187
-	N 0.120~0.170, S ≤ 0.0010	Weather resistance equivalent to NAS 316 (developed by Nippon Yakin Kogyo)	≥275	≥550	≥35	≤95	≤220	≤217
-	N ≤ 0.20	NAS 301 + corrosion resistance	≥215	≥550	≥45	≤95	≤218	≤207
-	-	NAS 304 + resistance to intergranular corrosion	≥175	≥480	≥40	≤90	≤200	≤187
-	Nb ≥ 10xC	NAS 304 + resistance to intergranular corrosion; also used at high temperatures up to 650°C	≥205	≥520	≥40	≤90	≤200	≤187
-	-	NAS 316 + resistance to intergranular corrosion	≥175	≥480	≥40	≤90	≤200	≤187
-	-	NAS 317 + resistance to intergranular corrosion	≥175	≥480	≥40	≤90	≤200	≤187
~3.20	N 0.08~0.14	Material for preventing stress corrosion cracking by hot water (developed by Nippon Yakin Kogyo)	≥205	≥520	≥40	≤90	≤200	≤187
~2.50	-	NAS 86L + corrosion resistance and resistance to stress corrosion cracking	≥205	≥520	≥40	≤90	≤200	≤187
-	-	NAS 144M + resistance to intergranular corrosion	≥175	≥480	≥40	≤90	≤200	≤187
~2.00	-	Deep drawing steel; equivalent to corrosion resistance NAS 304 (developed by Nippon Yakin Kogyo)	155~255	450~600	≥55	≤80	≤155	≤187
~3.00	-	For deep drawing and stretch forming	≥155	≥450	≥55	≤90	≤200	≤187
-	-	For deep drawing and stretch forming	≥205	≥520	≥40	≤90	≤200	≤187
~4.00	-	Cold workability (non-magnetic)	≥175	≥480	≥40	≤90	≤200	≤187
-	S ≥ 0.15	NAS 304 + free-machining ability	≥205	≥520	≥40	≤90	≤200	≤187
-	N 0.03~0.07	NAS 301 + high strength	≥245	≥690	≥38	≤95	≤220	-
-	N 0.15~0.30, Nb ≤ 0.15	NAS 304 + high strength	≥345	≥690	≥30	≤100	≤260	≤248
-	N 0.30~0.40	High strength and non-magnetic	≥390	≥690	≥30	≤90	-	≤200
-	-	Resistance to high-temperature oxidation is between NAS 304 and NAS 310.	≥205	≥520	≥40	≤95	≤218	≤207
-	-	Formability and weldability are better than NAS 309; used also as acid-resistant steel	≥205	≥520	≥40	≤90	≤200	≤187
-	-	Formability and weldability are better than NAS 310; used also as acid-resistant steel	≥205	≥520	≥40	≤90	≤200	≤187
-	Ti 6xC~0.75	General to high-temperature oxidation resistance	≥175	≥360	≥22	≤80	≤175	≤162
-	Ti 6xC~0.75	For automobile exhaust gas	≥175	≥360	≥25	≤80	≤175	≤162
-	-	General to high-temperature oxidation resistance; for automobile exhaust gas	≥195	≥360	≥22	≤88	≤200	≤183
-	-	General corrosion resistance; for tableware and receptacles	≥205	≥410	≥20	≤88	≤200	≤183
-	-	General corrosion resistance	≥205	≥450	≥22	≤88	≤200	≤183
-	Nb 0.10~1.00	NAS 430 + weldability and formability	≥175	≥360	≥22	≤88	≤200	≤183
~0.70	(Ti+Nb) 8x(C+N)~0.80	NAS 430LX + corrosion resistance (developed by Nippon Yakin Kogyo)	≥205	≥390	≥22	≤90	≤200	≤192
-	Nb 8(C+N)~0.80, N ≤ 0.025	NAS 430LX + corrosion resistance	≥245	≥410	≥20	≤90	≤200	≤192
-	Ti 10x(C+N)~0.40, N ≤ 0.010	NAS 430LM + corrosion resistance and workability	245~325	≥410	≥25	-	≤200	-
-	Nb 8(C+N)~0.80, N ≤ 0.025	NAS 436L + corrosion resistance	≥245	≥410	≥20	≤96	≤230	≤217
-	Nb 8(C+N)~0.80, N ≤ 0.025	Weather resistance	≥245	≥410	≥20	≤96	≤230	≤217

High-performance alloys for various uses

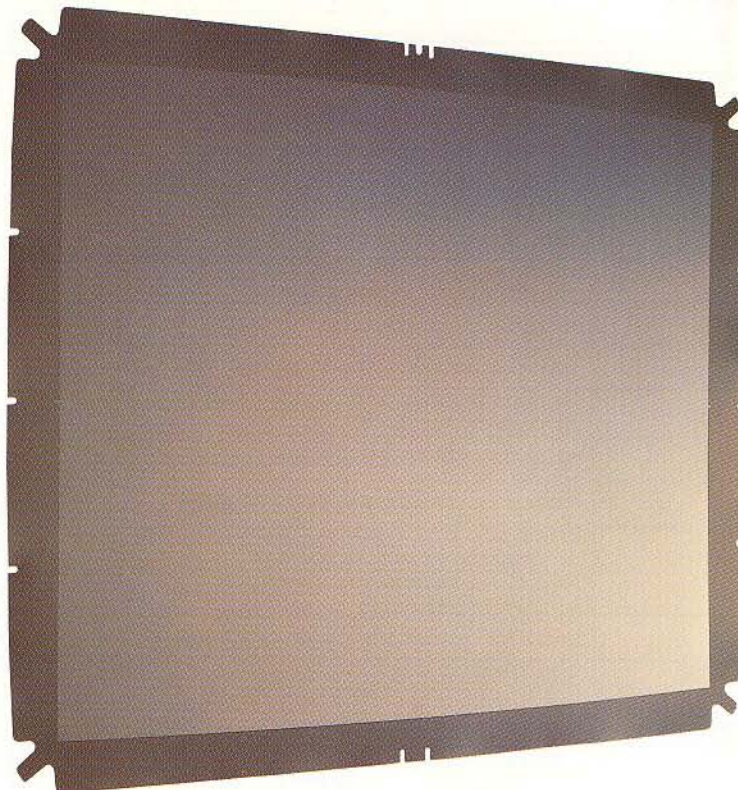
Resembling each other in appearance and shape with different performances

Materials used in our surroundings, such as metals and alloys, generate particular reactions according to external stimulations.

These reactions are manifested in changes in appearance or touch, such as hard, cool, rust-free, magnetic, or non-magnetic.

The reactions are examples of the functionality of materials. High-performance alloys feature distinctive functions that are inherent to the materials themselves.

Even if we cannot observe or feel their functions, high-performance alloys offer advanced electric, magnetic or radiation-shielding properties.



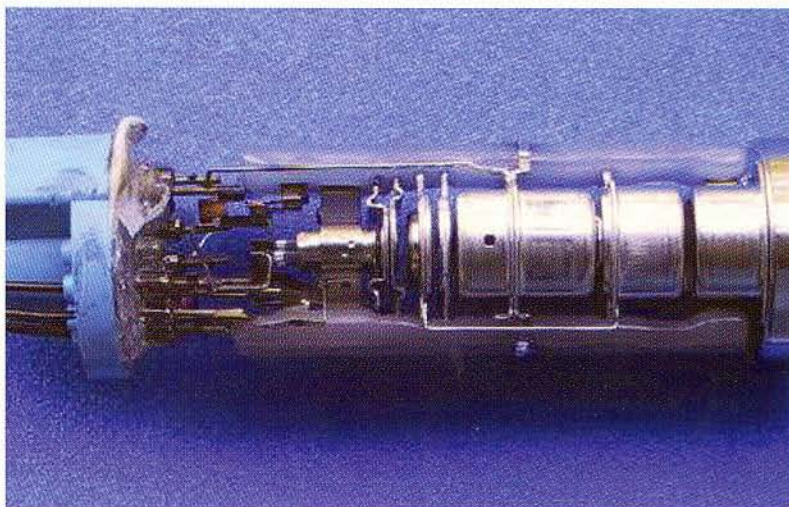
▲ In the color cathode-ray tube used in TV sets and PC screens, the shadow mask is an essential component to prevent irregular coloring of images and to assure beautiful images.

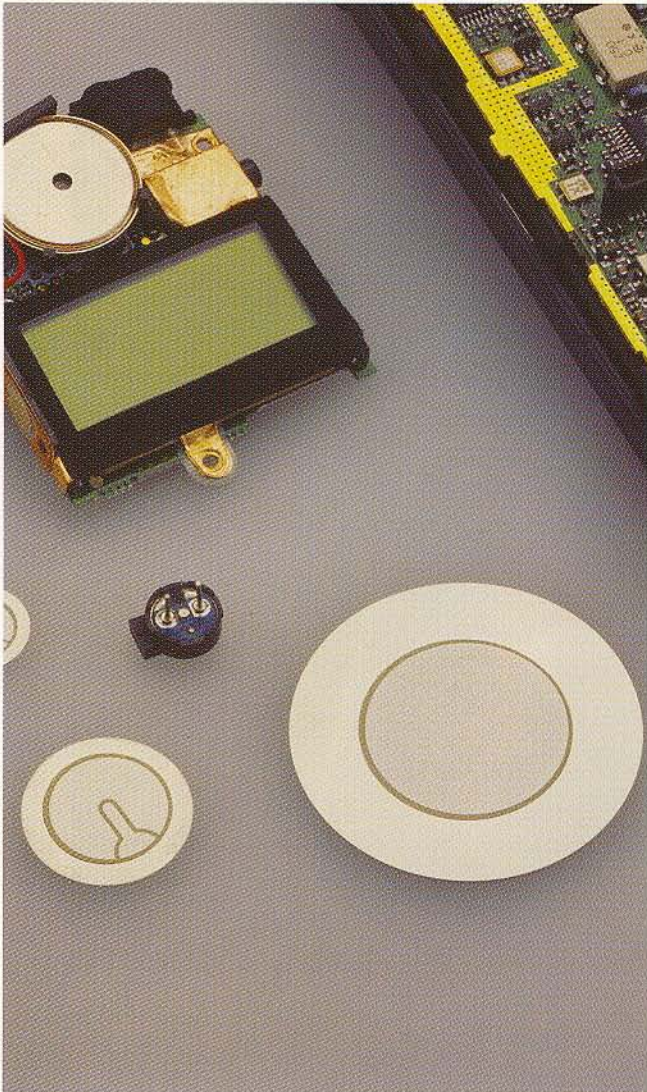
To allow millions of microscopic holes to be made, the material quality must be excellent.

Displays

NAS 36 is an alloy that has a very small coefficient of thermal expansion, ranging from low temperatures to room temperature.

▼ The electron gun in the cathode-ray tube consists of a cathode assembly and a component called the "grid." NAS 42 or NAS 600 is used for the grid, because low thermal expansion is required.





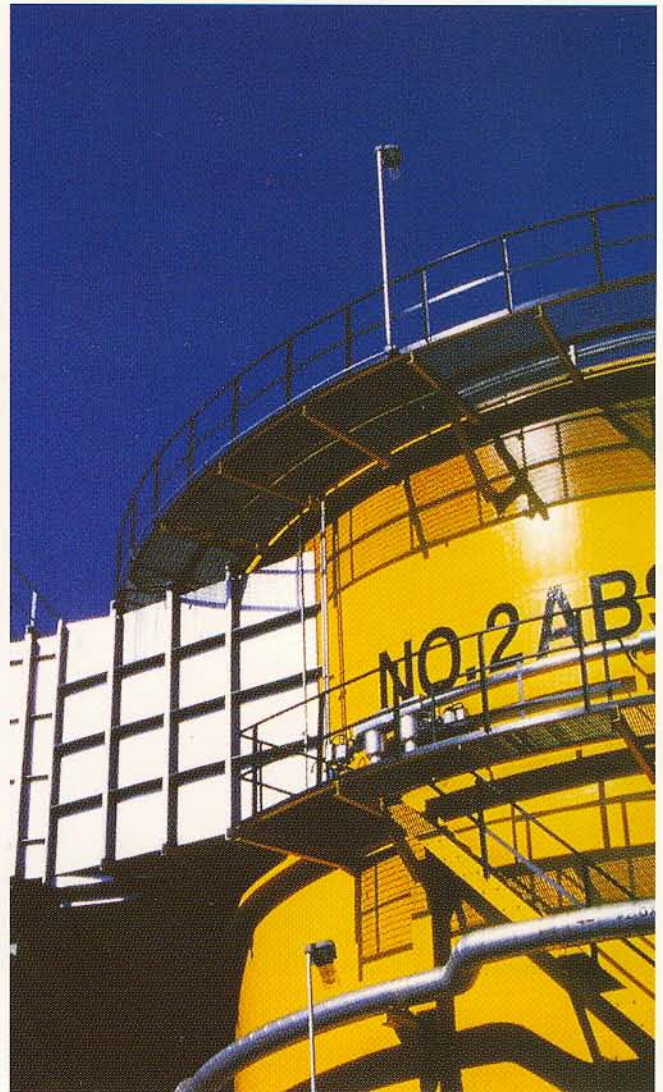
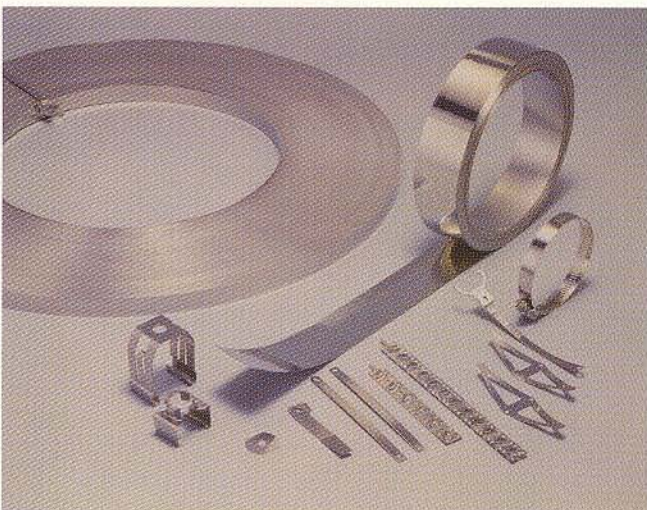
Electronic parts
/Precision machinery parts

▲ Buzzers used in telephones, various household electric appliances, and office equipments use the flexural oscillation of a diaphragm as the sound source. The diaphragm is fabricated by laminating a piezoelectric element and a metallic sheet.

The flexural oscillation is induced by the driving force of a magnetic field which is created by a magnet, thus generating sound.

Soft magnetic materials, such as NAS 42, NAS PB-N, and NAS 52, are best suited for the diaphragm.

▼ The material on the high thermal expansion side of the bimetal is NAS 21-6, NAS 22-3, and NAS 236Mn, while that on the low thermal expansion side is NAS 36.



The desulfurization unit is auxiliary facilities of thermal power plants designed to prevent air pollution.

In the flue gas desulfurization unit at coal fired power generation plants, chlorine in the fuel condenses to create a corrosive environment of high concentration chloride.

Environment

In environments where the chlorine ion concentration exceeds 10,000 ppm, the super stainless steels NAS 254N and NAS 354N, and highly corrosion-resistant Ni alloys NAS NW276 and NAS NW22 are used to reduce the cost and to extend the service life of the unit.



High-performance alloys serving quietly in various situations.



Marine structures

▲ Since marine structures are exposed to harsh environments, super stainless steels which contain rich amounts of Cr, Ni, Mo, and N are used instead of standard grade stainless steels.

NAS 245N developed by Nippon Yakin Kogyo shows high cost performance during its life cycle for marine structures, providing excellent corrosion resistance, long service life and easy maintenance.

The overlay is generally constructed by welding or bolting. NAS 254N is applicable to both methods.





Energy

LNG tankers are an essential means of transporting natural gas by sea from the country of production.

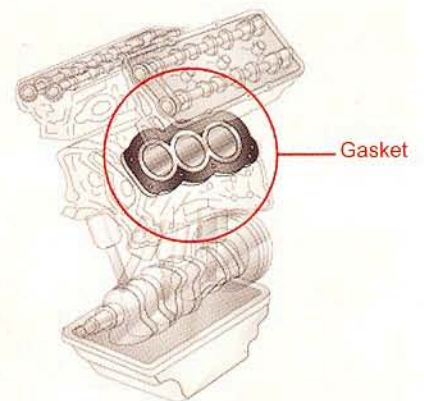
An LNG tanker, which stores liquefied natural gas at very low temperature, has a tank structure capable of holding very low temperatures and providing thermal insulation to minimize vaporization of the gas.

NAS 36LG, which was developed for the lining of box-shaped membrane tanks, suppresses the thermal stress caused by temperature variations as it has a very low coefficient of thermal expansion.

NAS 36LG plays an important role in the safe transportation of liquefied natural gas.

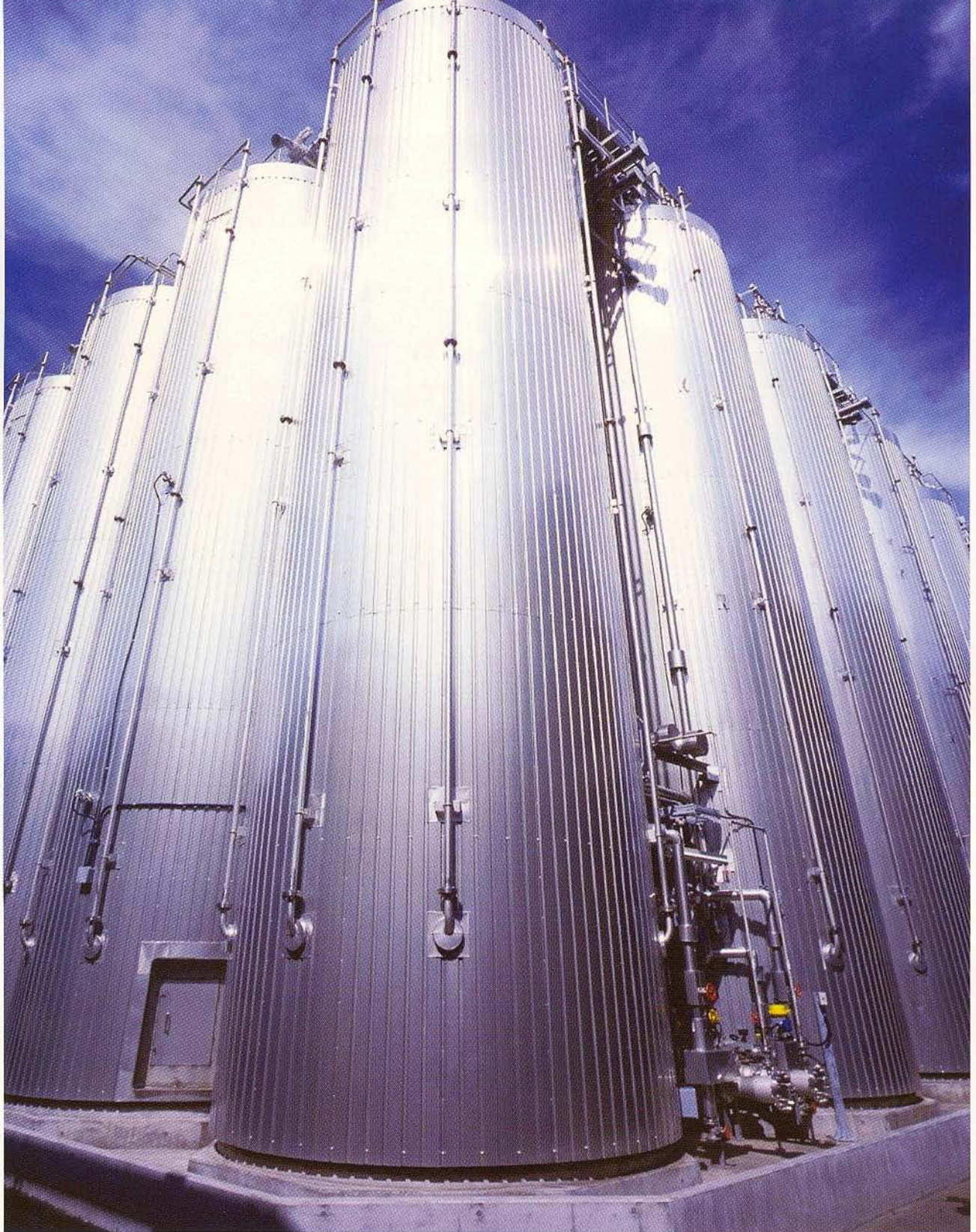


Cylinder head gasket
(NAS 301, NAS 304)



Automotive parts

Stainless steel spring plate, which has excellent heat resistance and spring characteristics, is used for cylinder head gasket (NAS 301, NAS 304) and exhaust manifold gasket (NAS 310S) of automobiles.



▲ Soy sauce moromi tanks

Food processing plants

"Soy sauce moromi tank" (Photo: top)

In the past, soy sauce moromi tanks were lined with resin or FRP. To reduce maintenance and operational cost, however, these tanks have been recently replaced by super stainless steel tanks.

Since moromi contains very high concentrations of salt, standard grade stainless steels would suffer pitting corrosion, crevice corrosion, and stress corrosion cracking. Super stainless steel, however, offers excellent corrosion resistance even under such severe environments.

"Salt mirin tank" (Photo: left)

Standard grade stainless steels have been used for tanks for brewing beer and wine which do not contain salt and which are processed at relatively low temperature. However, the tanks for seasoning which contains large quantities of chloride are exposed to a severe corrosive environment owing to the reduction in pH and the increase in temperature, so standard grade stainless steel cannot be used.

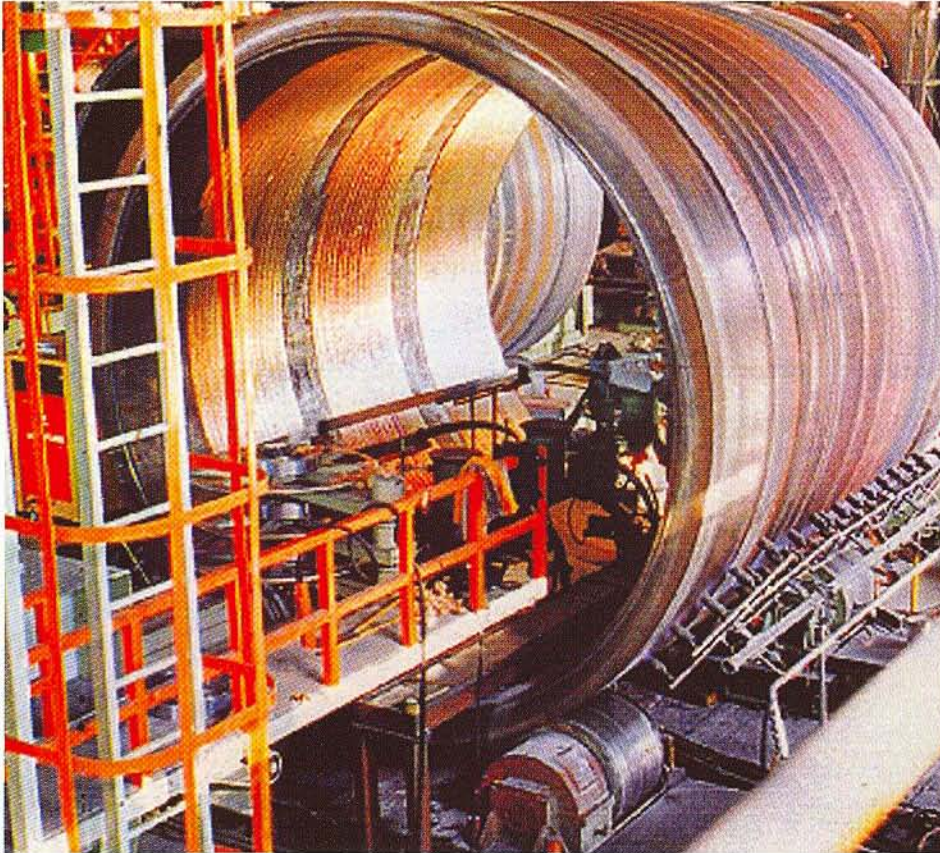


▲ Salt mirin tanks

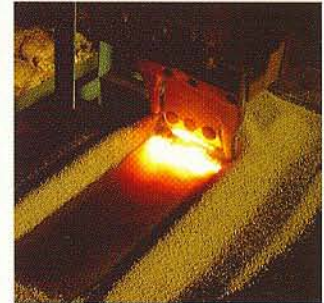


▲ Miniature model tank made of NAS 254N

The excellent corrosion resistance of the super stainless steel NAS 254N can withstand severe usage environments, and extends the life of the food processing plant.



Weld metal



Welding

A hoop coil for weld overlay Stainless steel band hoop material (weld material of narrow strip shape) used in chemical plants tends to crack during welding owing to its metallic structure. To overcome this, the quantity of δ -ferrite has to be increased. However, increasing the quantity of δ -ferrite induces cracks during hot rolling which is a key process for manufacturing stainless steel, so it has been difficult to manufacture band hoop material containing a large quantity of δ -ferrite.

Nippon Yakin Kogyo has therefore established a process for manufacturing band hoop material containing a large quantity of δ -ferrite by adjusting the composition and improving the production processes. Sales of the product as a high-performance alloy have increased steadily.

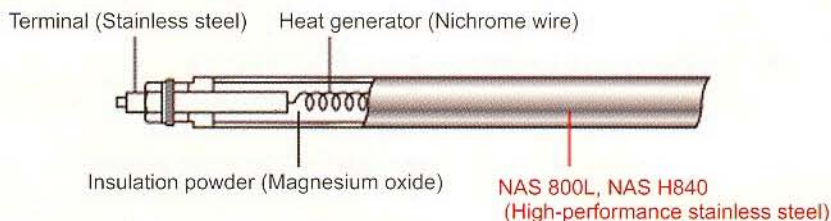
Surely functions under severe environments, Thanks to the performance of high-function materials

Energy

The sheathed heater generates heat in household electric appliances such as electric ovens, electric stoves, and air conditioners, and also industrial apparatuses such as driers, train heaters, etc., yet invisibly to users.

The sheathed heater is fabricated by forming a heat-generating wire into a spiral shape, which is held at the center of a metallic pipe made of NAS 800L or NAS H840, then filling and compacting an insulation material into the pipe to surround the wire.

Since the sheath itself is heated to high temperatures, it is made of NAS 800L or NAS H840 which has excellent resistance to high-temperature oxidation and high-temperature creep.





Origin of the name "NAS stainless steel"

"NAS" is an abbreviation of Nippon Yakin Austenite Stainless steel.

"Austenite" is a typical structure of stainless steel.

N: Nippon Yakin

A: Austenite

S: Stainless steel

Stainless steels in various fields and for various applications

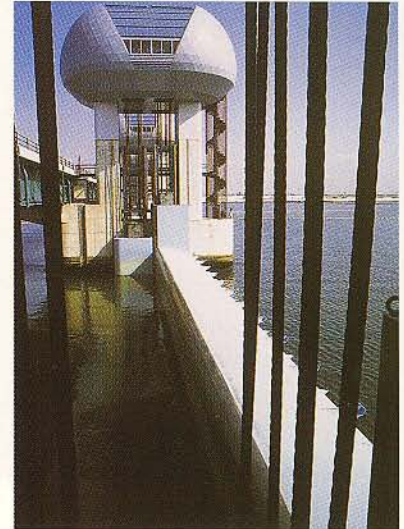
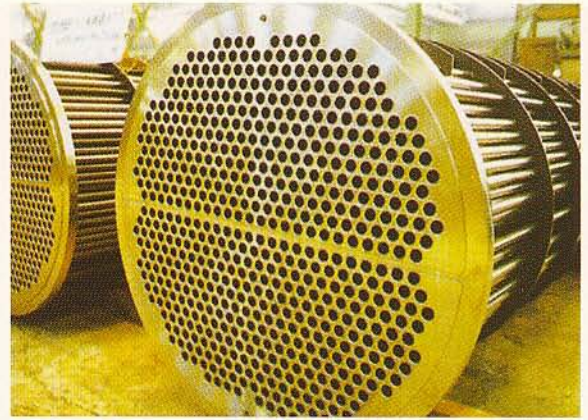
Ordinary steels sometimes show tendency of rusting. Compared to that, stainless steels resist against corrosion in our daily life. This resistance owes to film structures on their surface, which occasionally called "passive film".

Stainless steels are rust-resistant and beautiful, and offer a long service life and ease of working.

Stainless steels are a key material used in daily life and industry to meet the emerging needs of the information-oriented 21st-century society.

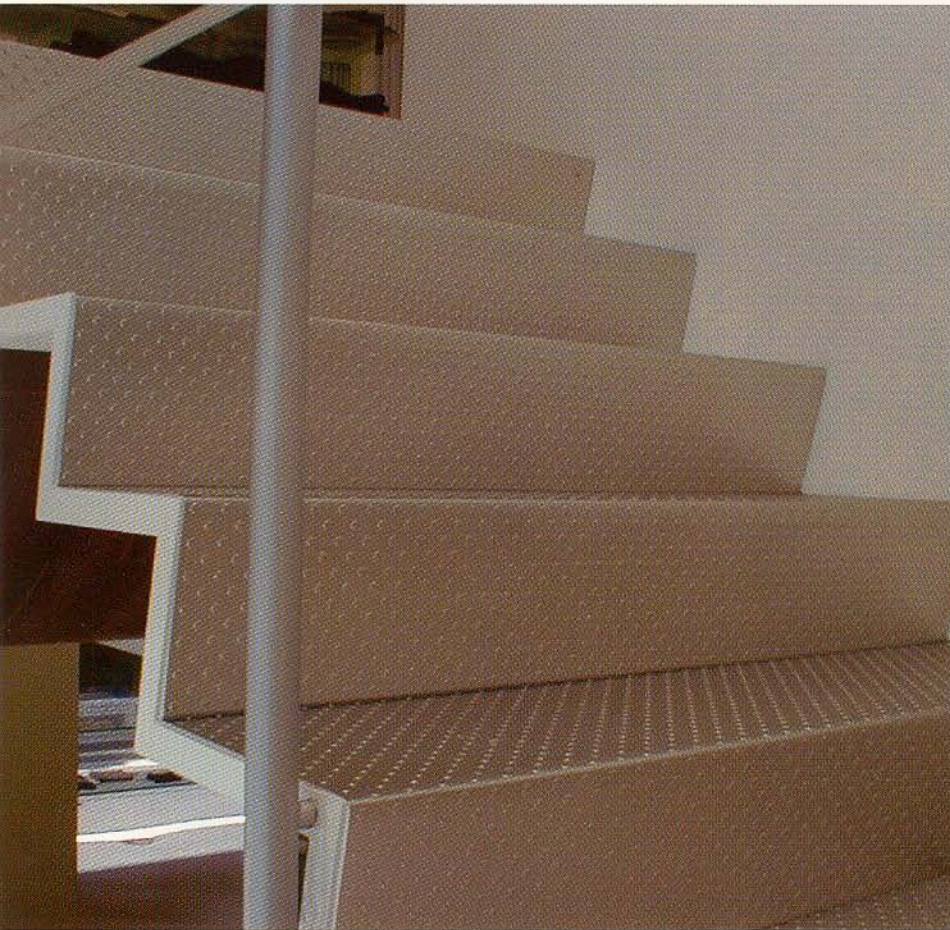
THE NIPPON YAKIN KOGYO GROUP'S
CORPORATE PROFILE

It's YAKIN



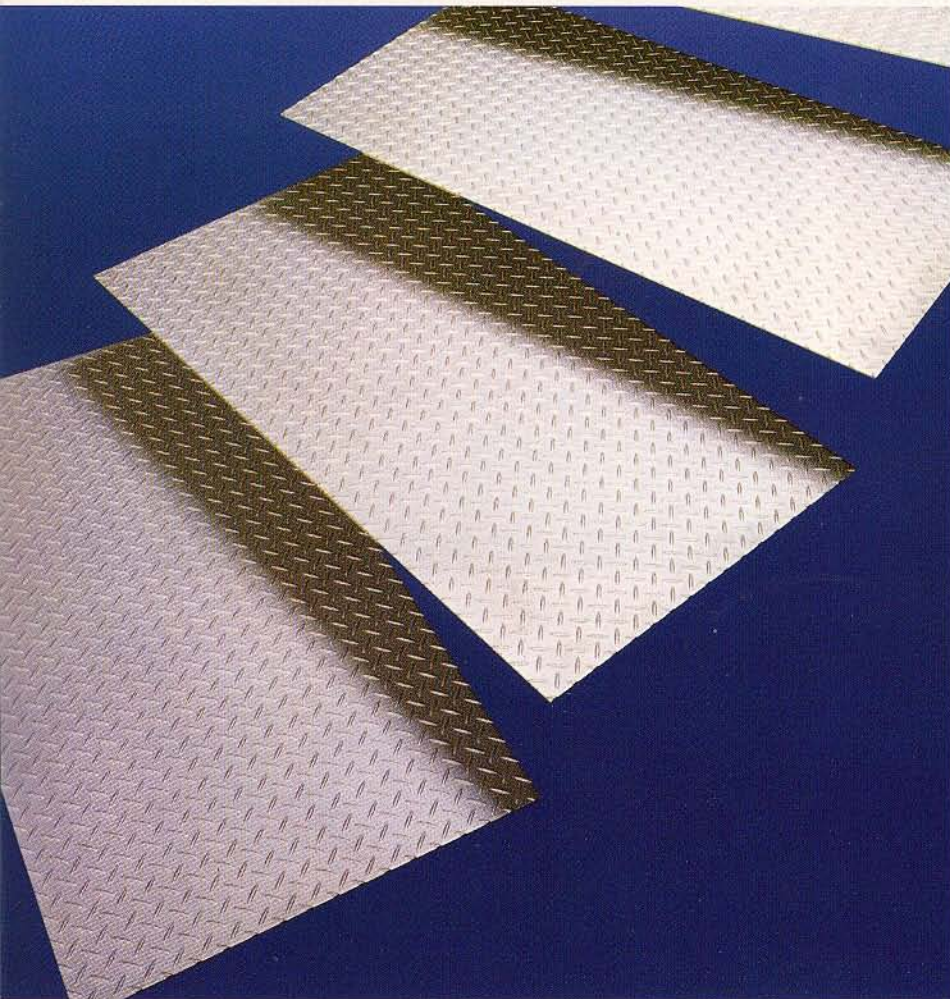
Our high-performance stainless steels enhance your life.





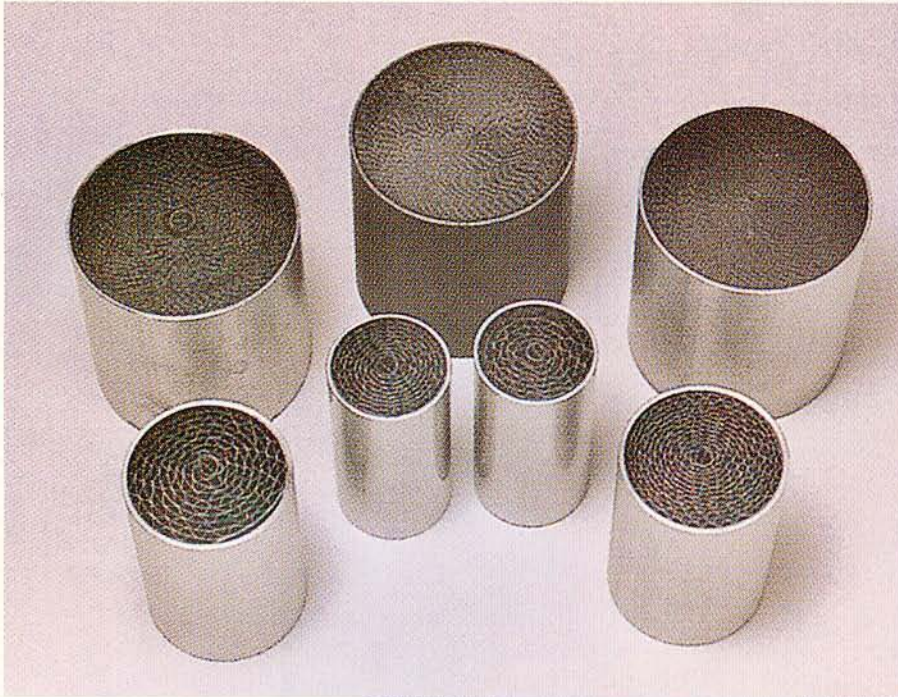
NAS Polka-Dot Plate

- NAS Polka-Dot Plate is a NAS 304-based stainless steel plate for flooring, having excellent corrosion resistance, heat resistance, durability, and workability.
- The surface morphology resists slip and is easy for walking.
- Without excessive protrusions, cleaning and draining are easy.
- Round protrusions give a softer appearance than conventional checkered plate.
- Applicable fields are wide, including floors, stairways, frames, pit covers, and landscape materials



NAS Checkered Plate

- NAS Checkered Plate is a NAS 304-based stainless steel plate for flooring.
- The plate has excellent corrosion resistance, heat resistance, low temperature resistance, strength and durability.
- The surface shows the inherent beauty of stainless steel.
- The workability is good, equivalent to general stainless steel plates.
- Wear of protrusions is small (one seventh that of Al), and no painting is required.
- Suitable uses include places where ordinary steel lacks corrosion resistance, where a beautiful appearance for a long time is required, and where non-magnetic property is needed.
- Applications include vehicles, ships, buildings, civil engineering, and electric-related uses.



**NAS Metal Honeycomb
(Catalyst carrier)**

- As a catalyst carrier, NAS Metal Honeycomb has excellent performance and durability.
- Since the core foil is as thin as 30 to 100 μ m, the back pressure of exhaust gas can be lowered, thus giving a high output with wide reactive surface area in a compact form.
- The core joint adopts Ni brazing using the dispenser process, which is our unique technology having registered patents in Japan, the U.S., Taiwan, and other countries. The method provides superior durability to ordinary immersion brazing over the whole area.
- The product is used as the catalyst carrier in: catalytic converters of automobile and motorcycle engines, and general-purpose engines for lawn mowers, etc.; and deodorizing units of garbage treatment units and portable toilets, etc.

Various Products Fabricated by Stainless Steel with High Added Value



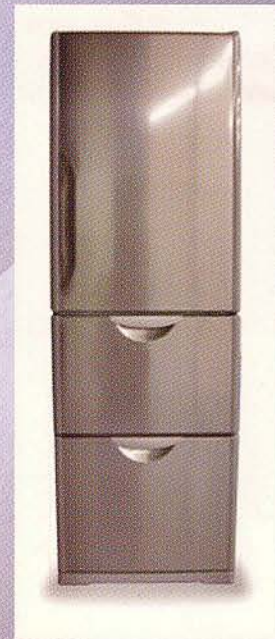
NAS Coat Clean (Fancy-finish steel plate)

- NAS Coat Clean is a clear coat stainless steel plate that stays clean.
- NAS Coat Clean has excellent resistance against heat, water, acid, alkali and detergent.
- NAS Coat Clean is a stainless steel sheet whose performance is optimized for the external surfaces of kitchen electric appliances such as refrigerators and rice cookers.
- NAS Coat Clean allows diverse designs, such as clear-color and clear-pearl finishes.



Rear side epoxy resin coat material, conductive epoxy resin coat material

- The rear side epoxy resin coat material and the conductive epoxy resin coat material are stainless steel plates suitable for lining with foamed polyurethane panels or for joining with wood panels or plasterboards, thereby assuring good heat insulation.
- The conductive epoxy resin stainless steel plate can be spot-welded, unlike ordinary coated stainless steels.
- The epoxy resin offers excellent adhesion to foamed polyurethane.
- Even when adhered to wood panel or plasterboard, no peeling occurs.

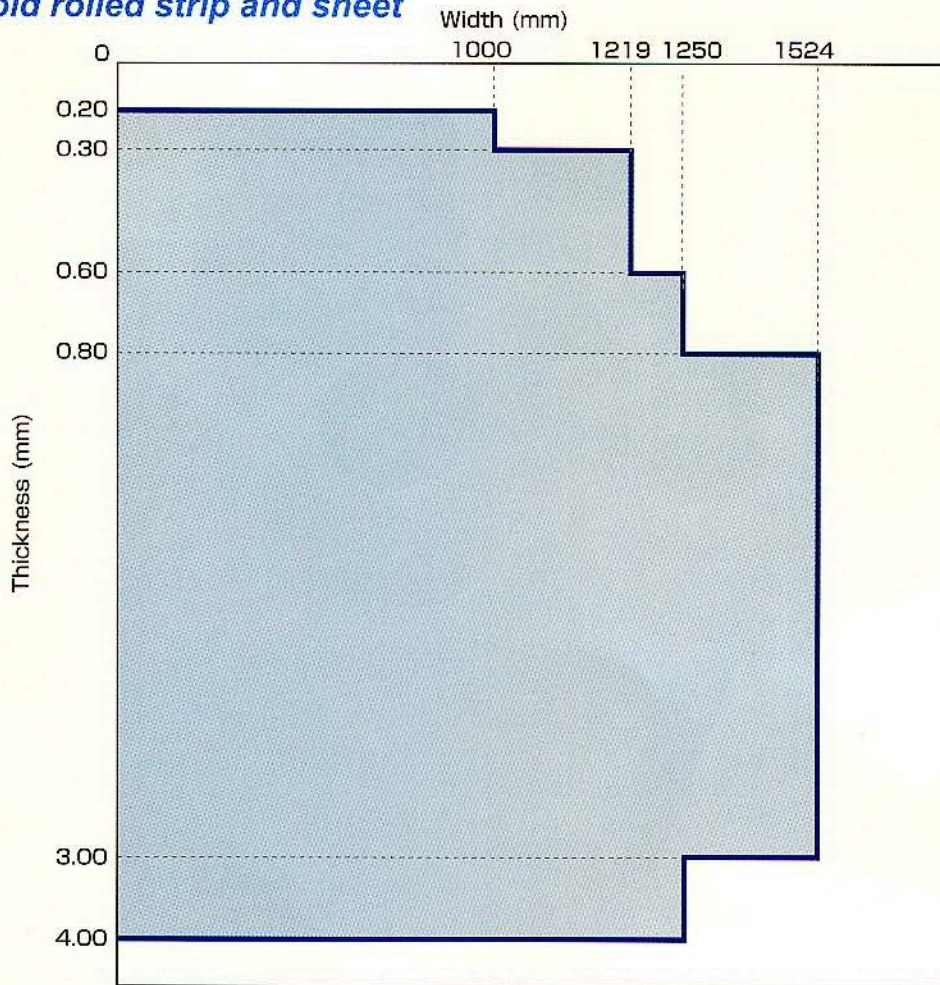


**NAS GS Clear
(Hard Clear Coating)**

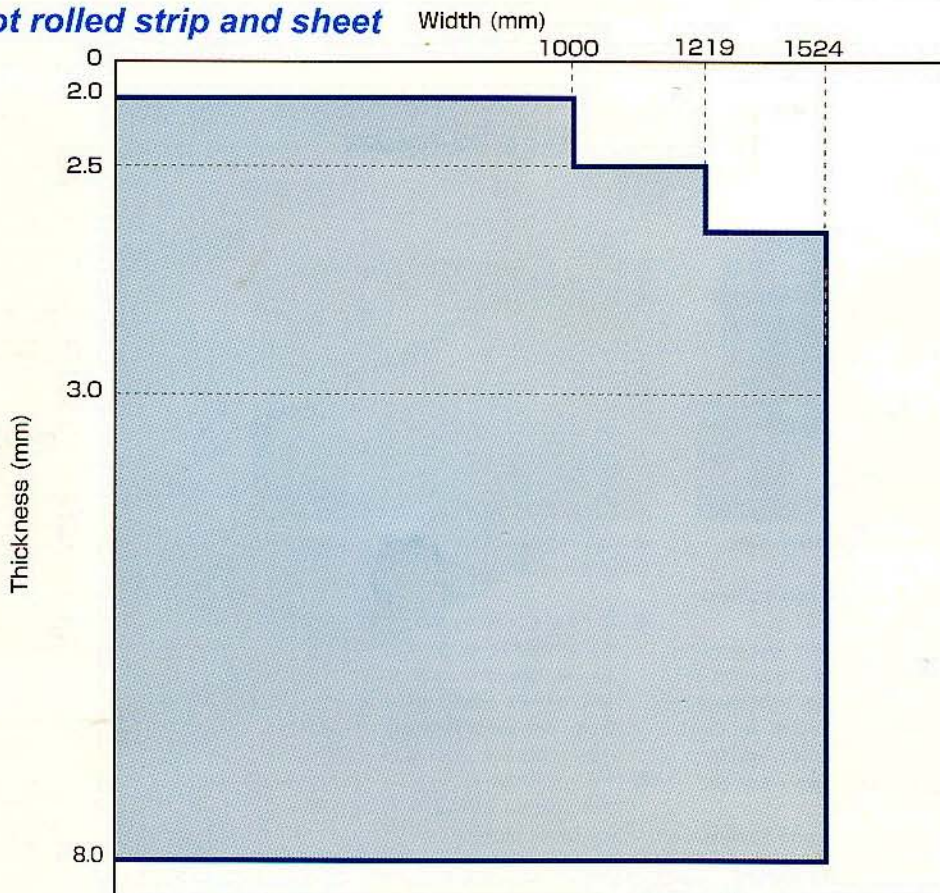
- NAS GS Clear is a hard coat specification of NAS Coat Clean.
- In addition to its fancy-finish surface, NAS GS Clear improves anti-marking performance (higher than 3H grade by pencil hardness test).
- Acrylic resin finish and fluorocarbon resin finish are available.

Available product size range - 1

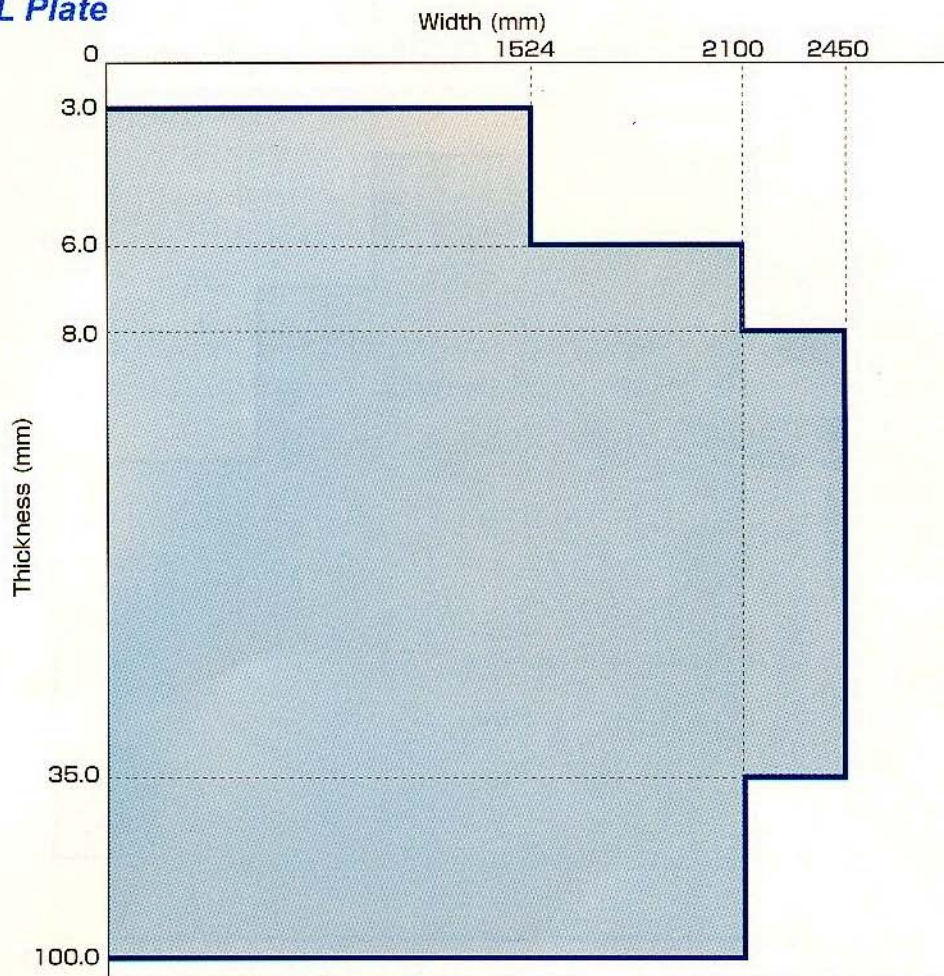
SUS 304 Cold rolled strip and sheet



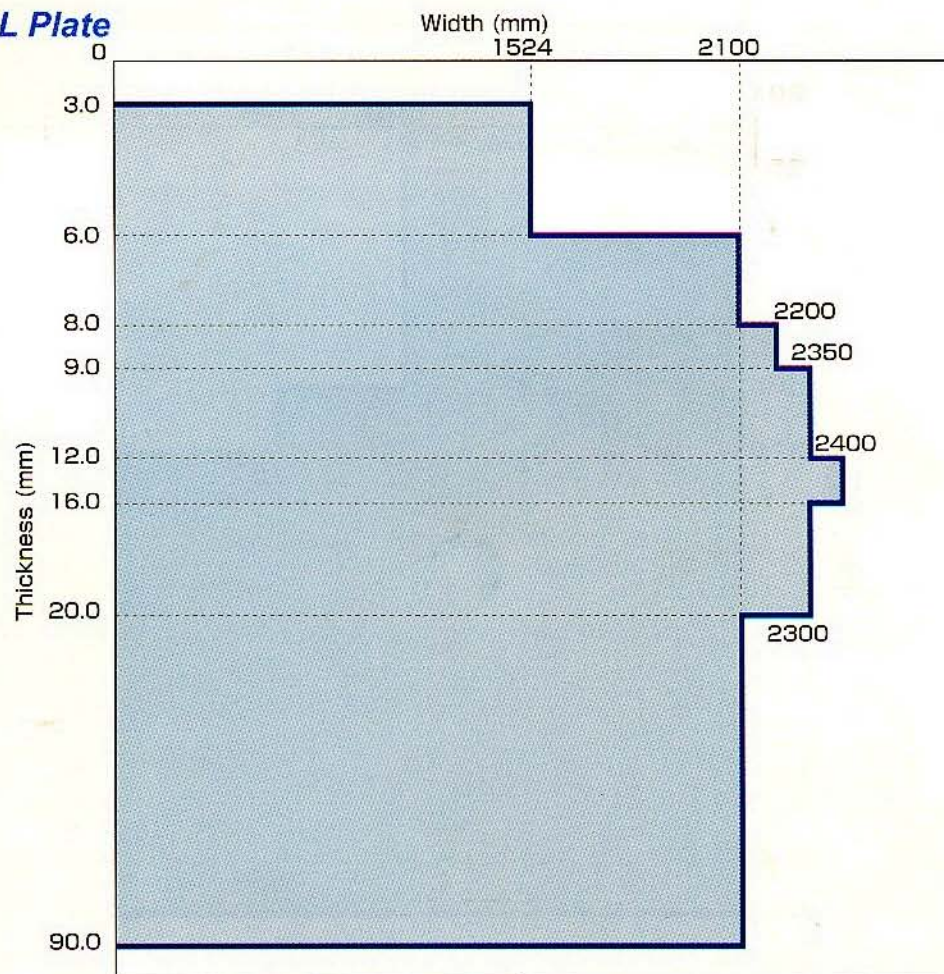
SUS 304 Hot rolled strip and sheet



SUS 304, 304L Plate

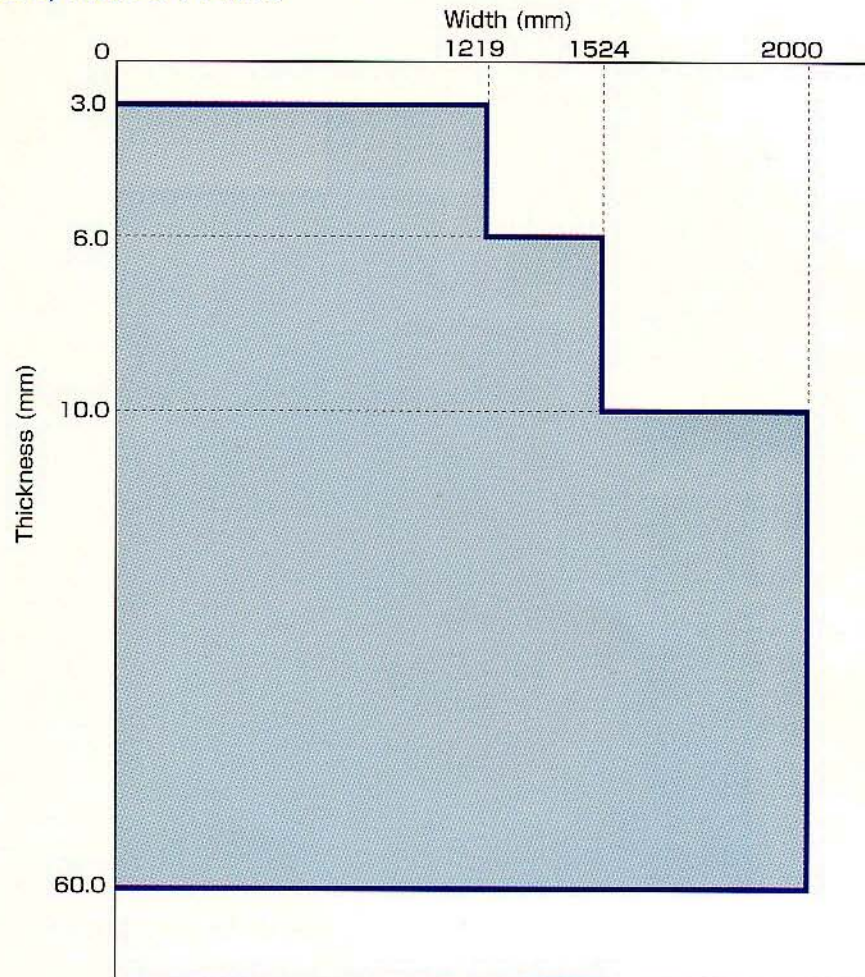


SUS 316, 316L Plate



Available product size range - 2

NAS 329J3L, NAS 64 Plate



NAS 254N Plate

