On the Leading Edge:Nippon Steel

NIPPON STEEL

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STEEL PLATES
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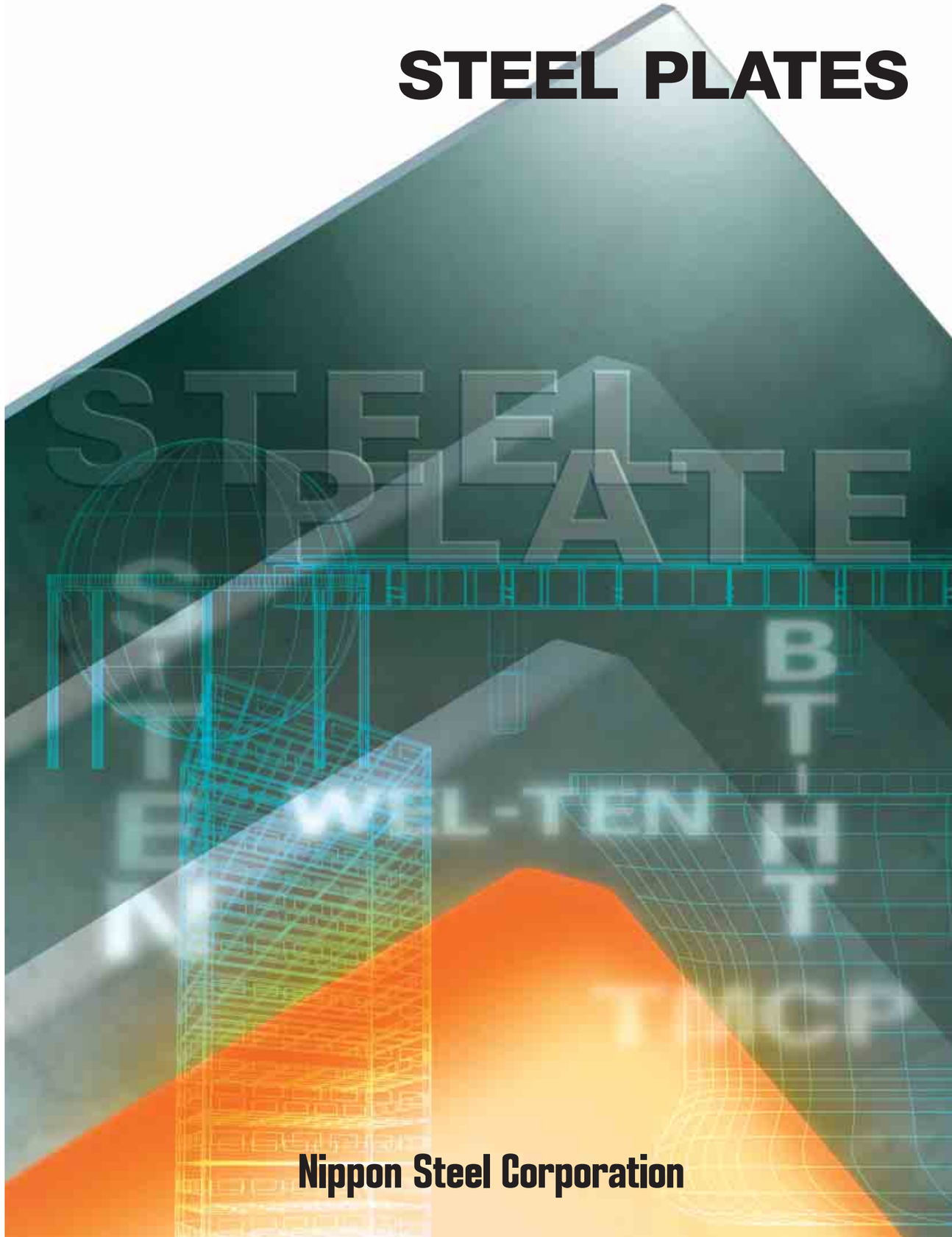
STEEL PLATES



Nippon Steel Corporation

Features

Nippon Steel Corporation produces steel plates in all the grades prescribed in JIS and other international standards as well as to its own specifications. In producing all these plates, Nippon Steel avails itself of modern facilities and advanced technology-fruits of its long steelmaking experience and constant research.

Nippon Steel plates are widely used in ships, offshore structures, bridges, buildings, constructions, equipment, industrial, machinery, penstock, vessels, nuclear reactors, thermal power generation plants, and various other fields, in all of which Nippon Steel plates have attained a solid reputation for their excellent quality.

Nippon Steel has all the resources to meet the most severe quality and delivery requirements. It also offers a full spectrum of technical services related to plate application.

Wide Product Availability

Nippon Steel plates are produced to all international specifications. They are also available in special steels including weldable high-strength steel, atmospheric corrosion resistant steel, and low-temperature service steel. If required, Nippon Steel plates can be supplied shot-blasted and prime-coated. Also available are extra heavy plates for use in nuclear reactors, pressure vessels, and thermal power plants and floor plates for decks, platforms, and stairs.

Flawless Surface

Plated produced under strict quality control are descaled by means of high-pressure water jets and further the latest type equipment is used for plate transfer and heat treatment for rendering each Nippon Steel plate a flawless surface.

Technical Services

Nippon Steel offers technical services related to Nippon Steel plates as well as consultation regarding plate properties, applications, fabrication and other matters.

Stable Quality

Strict quality control, combined with the full benefit of modern facilities, advanced technology and vast experience, ensures consistent quality in every Nippon Steel plate.

On-time Delivery

Computerized process control assures that orders are shipped on schedule. The seaside locations of Nippon Steel steelworks further expedite fast ontime shipments.

Wide Range of Sizes

Steel plates are available in a wide range of sizes. Thickness is available from 6 mm to a maximum of 560 mm, width up to 5,200 mm, and length up to 28 m. Extra-heavy thick steel plates are available in thicknesses up to 560 mm.

Plate Mills

Works	Operation start	Mill	Type	Work roll diameter (mm)	Backup roll diameter (mm)	Roll length (mm)	Mill arrangement
Nagoya	Feb. 1975	Roughing	4-high reversing	1,200	1,900	4,800	HSB+VE+4H+4H
	Mar. 1968	Finishing	4-high reversing	1,020	1,830 (with bending roll)	4,700	
Kimitsu	Mar. 1968	Roughing	4-high reversing	1,000	2,000	4,724	HSB+VE+4H+4H
		Finishing	4-high reversing	1,000	2,000	4,724	
Oita	Jan. 1977	Finishing	4-high reversing	1,200	2,400	5,500	HSB+VE+4H

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Available Grades

Nippon Steel manufactures various types of plate in accordance with various standards. The types of plate and the applicable standards are shown in the table below.

Plates based on Nippon Steel standards are shown on page 20 to 33. Catalogs for individual plates are available.

Type of Steel \ Standard	Nippon Steel Specificaion	JIS Specification	Overseas Standards
Steels for general structures	———	JIS G 3101 (Rolled Steel for General Structures): SS (330, 400, 490, 540)	<U.S.A.> ASTM A283, ASME SA283 <Germany> DIN17100
Steels for welded structures	———	JIS G 3106 (Rolled Steel for Welded Structures): SM (400A, 400B, 400C, 490A, 490B, 490C, 490YA, 490YB, 520B, 520C) JIS G 3140 (Higher Yield Strength Steel Plates for Bridges): SBHS500,SBHS700	<U.S.A.> ASTM (A36, A440, A441, A529, A572, A633, A709) ASME (Equivalent to ASTM standards shown above) API (5LA, 5LB, 5L X42, 5L X52, 5L X60, 5L X65, 2H42, 2H50, 2W50, 2W60) <U.K.> BS4360, BS7191 <Germany> DIN17102 <Canada> CSA (G40.21), (Z245.1) <ISO> 630 <EN> 10025, 10225 <India> IS2062, IS8500, IS2002 <Australia> AS3678
Steels for building structures	BT-HT325 (B, C), 355 (B, C), 325 (B,C)-FR, 355 (B,C)-FR, 400C,440 (B,C), 440 (B,C)-SP, 500C, 630 (B,C), BT-LYP®100, 225 NSFR®400, 490, 520, 490-TMC, 520-TMC, 400W, 490W	JIS G 3136 (Rolled Steel for Building Structures): SN (400A, 400B, 400C, 490B, 490C)	<U.S.A.> ASTM A1043
Steels for ships	HIAREST®	———	NK, LR, AB, BV, CR, GL, NV, KR, CCS RINA Plates for hulls and boilers <U.S.A.> ASTM A131
Weldable high-strength steels	WEL-TEN®590RE, 590, 590CF, 590SCF, 610, 610CF, 610SCF, 690RE-A, 690RE-B, 690, 690C, 780RE 780, 780C, 780E, 950, 950RE, 950PE	JIS G 3106 (Rolled Steel for Welded Structures): SM570 JIS G 3128 (690 N/mm²-Class High Yield-Point Plate for Welded Structures): SHY685, SHY685N, SHY685NS	<U.S.A.> ASTM (A537, A514, A517, A710, A841) ASME (Equivalent to ASTM standards shown above) API (5L X70, 5L X80) <ISO> 4950/3
Low-temperature steels	N-TUF 295N, 325N, 325, 365, 490, 570, N-TUFCR®130, N-TUFCR®196	JIS G 3126 (Carbon Steel Plate for Low-temperature Pressure Vessels): SLA (235A, 235B, 325A, 325B, 360) JIS G 3127 (Nickel Steel Plate for Low-temperature Pressure Vessels): SL2N255, SL3N (255, 275, 440) SL9N (520, 590)	<U.S.A.> ASTM (A537, A841, A203, A353,A553, A645, A844) ASME (Equivalent to ASTM standards shown above) NK, LR, AB, NV, GL, RINA Low-temperature steel plates
Medium-to-high-temperature steels	———	JIS G 3103 (Carbon Steel Plate and Molybdenum Steel Plate for Boilers and Pressure Vessels): SB (410, 450, 480, 450M, 480M) JIS G 3119 (Manganese-Molybdenum Steel Plate and Manganese-Molybdenum-Nickel Steel Plate for Boilers and Pressure Vessels): SBV (1A, 1B, 2, 3) JIS G 3120 (Manganese-Molybdenum Steel Plate and Manganese-Molybdenum-Nickel Alloy Steel Plate Quenched and Tempered Pressure Vessels): SQV (1A, 1B, 2A, 2B, 3A, 3B) JIS G 4109 (Chrome-Molybdenum Steel Plate for Boilers and Pressure Vessels): SCMV (1, 2, 3, 4, 5, 6)	<U.S.A.> ASTM (A204, A225, A299, A302, A387, A442, A515, A533, A542, A543, A537, A517, A710) ASME (Equivalent to ASTM standards shown above) <U.K.> BS1501 <Germany> DIN17155 <France> NF A36-206 <EN> 10028 <Australia> AS1548 NK, LR, AB, BV, CR, GL, NV, KR, CCS RINA Plates for boilers

Type of Steel \ Standard	Nippon Steel Specification	JIS Specification	Overseas Standards
Intermediate temperature steels	———	JIS G 3115 (Plate for Pressure Vessels): SPV (235, 315, 355, 450, 490) JIS G 3118 (Carbon Steel Plate for Normal to Medium-temperature Pressure Vessels): SGV (410, 450, 480)	<U.S.A.> ASTM (A285, A455, A516, A537) ASME (equivalent to ASTM standards shown above) <U.K.> BS1501 <Germany> DIN17155 <France> NF A36-205 <EN> 10028
Atmospheric corrosion resistant steels	COR-TEN®: Corrosion-resisting for non-coated welded structures: COR-TEN®{490 (A, B, C)*,570*} NAW®-K400 (A, B, C)* Highly corrosion-resisting steel: COR-TEN® O* General-purpose corrosion-resisting steel: NAW® (400, 490) Ni-Added weathering steel* ※ In case of uncoated use, please select the product with the mark *.	JIS G 3114 (Hot-rolled Corrosion-resisting Steel for Welded Structures): SMA 400 A/B/C W/P SMA 490 A/B/C W/P SMA 570 W/P 1) JIS G 3125 (Highly Corrosion-resisting Steel): SPA-H JIS G 3140 (Higher Yield Strength Steel Plates for Bridge): SBHS500W,SBHS700W	<U.S.A.> ASTM (A242, A588, A709) <JR standards> JRS-SPA-H <ISO> 4952
Seawater corrosion resistant steels	MARILOY® G400 (A, B, C)	———	———
Sulfuric acid resistant stees	S-TEN® (1, 2)	———	———
Corrosion-resistant steel plates for LNG-fired smock stack	WELACC®5	———	———
Steels for machine structural use	———	JIS G 4051 (Carbon Steel for Machine Structural Use): S10C～S58C JIS G 4053 (Chrome-Molybdenum Steels): SCM415～440	<U.S.A.> AISI (1008, 1015, 1020, 1021) SAE (Equivalent of AISI standards shown above)
Abrasion resistant steels	WEL-TEN® AR 235E～500E WEL-HARD®400, 500	———	———
Electrical steel plates	N-SMIP-1	———	———
Hot-dip galvanized steel plates	NAGP®	———	———

Remarks: 1) W is normally used with no treatment or with rust stabilization treatment; P is normally used painted.

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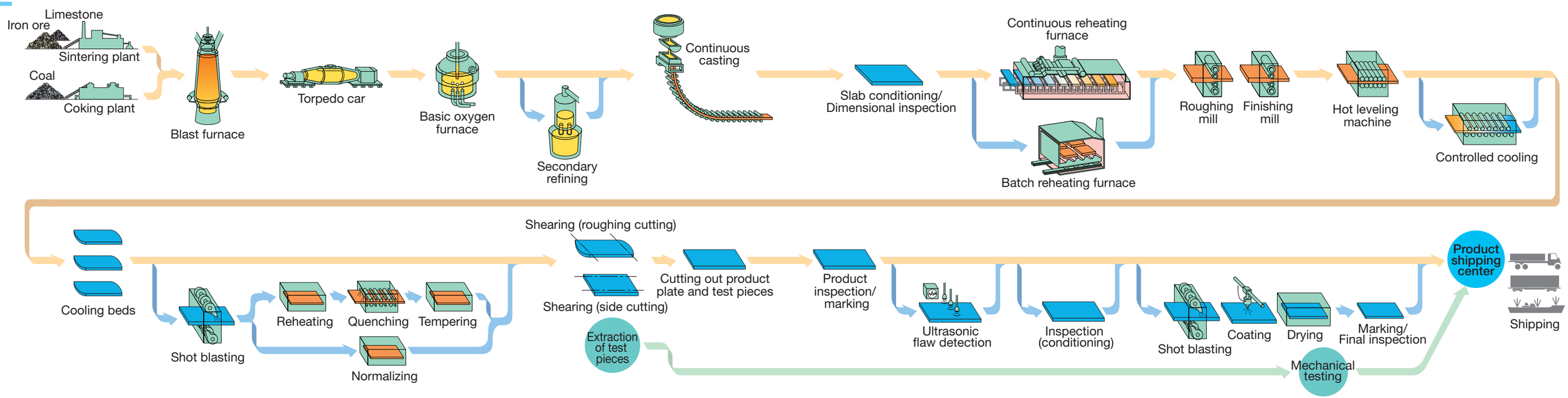
Standard Production Process



CLC® Steel Plate

Nippon Steel has developed an innovative plate manufacturing technology known as CLC (Continuous On Line Control Process). CLC technology is applied in the manufacture of high-strength steel plates with strength ratings of 490 N/mm² or more and such highly improved properties as low-temperature toughness and weld ability. These high-strength steel plates are used in a wide range of fields: shipbuilding, offshore structures, bridges, building construction, industrial machinery, line pipe and storage tanks.

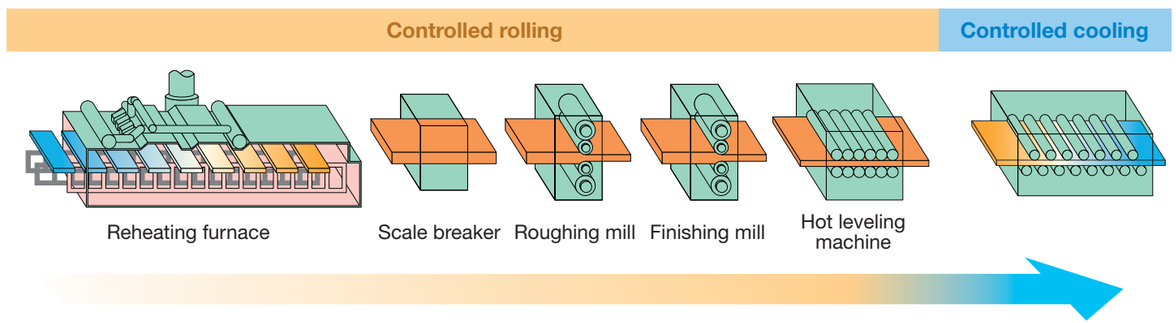
1. Outline of CLC

CLC is a new plate manufacturing process based on the combined use of controlled rolling and controlled cooling.

When producing 490 N/mm² high-strength steel plates by means of CLC, the carbon equivalent can greatly be reduced because the desired strength is secured through controlled cooling.

An outline of the equipment used in CLC is shown in Fig. 1.

Fig.1 CLC equipment layout



※TMCP (Thermo-Mechanical Control Process) is a generic term for the controlled rolling process for plate manufacture, or the process combining controlled rolling with controlled cooling. The CLC process falls under the latter category.

2. Features of CLC 490 N/mm² High-strength Steel Plates

(1) Extra-low Carbon Equivalent

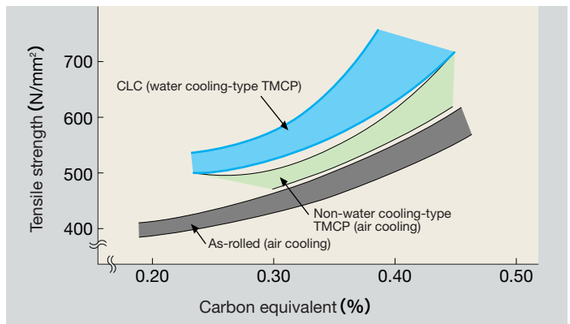
Toughness is improved by making the most of extra low carbon equivalent and CLC.

(2) Application Advantages of CLC 490 N/mm² High-strength Steel Plates

CLC 490 N/mm² high-strength steel plates offer an out standing improvement in weldability through a signify cant reduction of the carbon equivalent. This produces the fol-lowing application advantages and high user ratings.

- Lower preheating temperatures during welding than are acceptable for conventional high-strength steel plates, made possible by the reduction of carbon equivalent.
- Lower maximum hardness of welded joints than in con-ventional high-strength steel plates.
- Improved toughness of welded joints Extreme reduction in material quality changes caused by line heating.
- Extreme reduction in material quality changes caused by line heating.

Fig.2 Relation between carbon equivalent and strength of steel plates produced by conventional and CLC methods (plate thickness: 20~30 mm)



3. Example Applications of CLC 490 N/mm² High-strength Steel Plates

(1) Shipbuilding and offshore structures

CLC 490 N/mm² high-strength steel plates have obtained approvals from the following classification societies.

Standards of classification societies that approved CLC plates (examples)

Classification	YP315N/mm²			YP355N/mm²			YP390N/mm²		
	A-Grade	D-Grade	E-Grade	A-Grade	D-Grade	E-Grade	A-Grade	D-Grade	E-Grade
NK	●	●	●	●	●	●	●	●	●
ABS	●	●	●	●	●	●	●	●	●
DNV	●	●	●	●	●	●	●	●	●
LR	●	●	●	●	●	●	●	●	●
BV	●	●	●	●	●	●	●	●	●

●*Application examples*

Shipbuilding: Tankers, cargo vessels, container ships, refrigerator vessels, etc.

Offshore structures: Jack-up rigs, semi-submersible rigs, crane barge, etc.

(2) BT-HT325, 355 and 400 for building structures

(3) Industrial machinery, line pipe, storage tanks and other widely ranging general-purpose applications

4. High-toughness, High-strength Steel Plates for Low-temperature Applications

In response to user requests, CLC technology is increasingly applied in the manufacture of high-toughness, high-strength steel plates for low-temperature applications (offshore structures, jackets, offshore facilities, etc.).

5. Example Applications in Standards

(1) **Adoption in ASTM:** A841 (Steel Plates for Pressure Vessels), A844 (9% Ni Steel Plates)

(2) **Adoption in JIS:** G 3106 SM Grade, G 3114 SMA Grade, G 3136 SN Grade

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Weldable High-strength Steel Plates : WEL-TEN®590 and 690 Series

Brand name (applicable plate thickness)	Chemical composition (%)														Mechanical properties										
															Tensile test					Bending test[5] (test piece:JIS No.1)			Impact test (test piece:JIS No.4, 2mm V-notch, L direction)		
																	Elongation				Inside bending radius				
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	B	Ti	Ceq[1]	Pcm[1]	Yield point or proof stress (N/mm²)	Tensile strength (N/mm²)	Thickness (mm)	Min. elongation (%)	Test piece JIS	Bending angle	Thickness (mm)	Radius	Thickness (t) (mm)	Test temperature (°C)	Average absorbed energy of three test pieces (J)
WEL-TEN590RE (2.3～32mm)	≦0.12	≦0.55	≦2.00	≦0.030	≦0.025	–	–	–	–	–	–	–	≦0.15	≦0.45	–	t≦32 450≦[3]	590～710	t≦16	20	No.5		–	1.0t	12<t≦32	−5	47≦
																		16<t	28	No.5						
																		20<t	20	No.4						
WEL-TEN590 (6～200mm)	≦0.16	≦0.55	0.90～1.60	≦0.030	≦0.025	t≦100 ≦0.30 100<t ≦0.50	t≦100 ≦0.60 100<t ≦1.20	t≦100 ≦0.30 100<t ≦0.50	t≦100 ≦0.30 100<t ≦0.40	t≦100 ≦0.10 100<t ≦0.10	t≦100 ≦0.05 100<t ≦0.05	t≦100 ≦0.005 100<t ≦0.005	–	2)	–	t≦50 450≦[3]	t≦75 590～710	t≦16	20	No.5		t<32	1.5t	12<t≦32 32<t≦200	−5 −10	47≦
WEL-TEN590CF (6～75mm)	≦0.09	≦0.30	1.00～1.60	≦0.030	≦0.025	≦0.30	≦0.60	≦0.30	≦0.30	≦0.10	≦0.05	≦0.005	–	–	≦0.20	50<t 430≦	75<t 570～690	16<t	28	No.5		32≦t	2.0t	12<t≦32 32<t≦50	−5 −10	47≦
WEL-TEN590SCF (6～40mm)	≦0.07	≦0.40	≦1.60	≦0.030	≦0.025	≦0.30	≦0.60	≦0.30	≦0.30	≦0.10	≦0.05	–	–	–	≦0.18			20<t	20	No.4						
WEL-TEN610 (6～200mm)	≦0.16	≦0.55	0.90～1.60	≦0.030	≦0.025	t≦100 ≦0.30 100<t ≦0.50	t≦100 ≦0.60 100<t ≦1.20	t≦100 ≦0.30 100<t ≦0.50	t≦100 ≦0.30 100<t ≦0.40	t≦100 ≦0.10 100<t ≦0.10	t≦100 ≦0.05 100<t ≦0.05	t≦100 ≦0.005 100<t ≦0.005	–	2)	–	t≦50 490≦	t≦75 610～730	t≦16	19	No.5		t<32	1.5t	12<t≦32 32<t≦200	−10 −15	47≦
WEL-TEN610CF (6～75mm)	≦0.09	≦0.30	1.00～1.60	≦0.030	≦0.025	≦0.30	≦0.60	≦0.30	≦0.30	≦0.10	≦0.05	≦0.005	–	–	≦0.20	50<t 470≦	75<t 590～710	16<t	27	No.5	180°	32≦t	2.0t	12<t≦32 32<t≦50	−10 −15	47≦
WEL-TEN610SCF (6～40mm)	≦0.07	≦0.40	≦1.60	≦0.030	≦0.025	≦0.30	≦0.60	≦0.30	≦0.30	≦0.10	≦0.05	–	–	–	≦0.18			20<t	19	No.4						
WEL-TEN690RE-A (2.3～9mm)	≦0.14	≦0.55	≦2.00	≦0.030	≦0.025	–	–	–	–	–	–	–	≦0.25	≦0.50	–	590≦	690～830	t≦16	17	No.5		–	1.5t	–	–	–
WEL-TEN690RE-B (6～20mm)	≦0.14	≦0.55	≦2.00	≦0.030	≦0.025	≦0.40	≦0.40	–	–	–	–	–	≦0.25	≦0.50	–			16<t	25	No.5				12<t≦20	−15	47≦
WEL-TEN690 (6～75mm)	≦0.16	≦0.35	0.60～1.20	≦0.030	≦0.025	≦0.50	0.30～1.00	≦0.60	≦0.40	≦0.10	–	≦0.005	–	t≦50 ≦0.50 t≦75 ≦0.55	–	t≦50 620≦	t≦50 690～830[4]	t≦16	17	No.5		t<32	1.5t	12<t≦32	−15	47≦
																		16<t	25	No.5						
WEL-TEN690C (6～50mm)	≦0.16	≦0.35	0.60～1.20	≦0.030	≦0.025	≦0.50	–	≦0.80	≦0.40	Nb+V ≦0.15		≦0.005	–	≦0.50	–	50<t 600≦	50<t 670～810	20<t	17	No.4		32≦t	2.0t	32<t≦75	−25	47≦

1) Carbon equivalent, Ceq, and weld crack sensitivity, Pcm, are calculated for added elements using the following equation.

Ceq=C+Si/24+Mn/6+Ni/40+Cr/5+Mo/4+V/14%

Pcm=C+Si/30+Mn/20+Cu/20+Ni/60+Cr/20+Mo/15+V/10+5B%

2) Ceq is as follows.

Brand name	Plate thickness (mm)				
	t≦50	50<t≦75	75<t≦100	100<t≦150	t<150
WEL-TEN590	≦0.44	≦0.46	≦0.49	≦0.52	≦0.56
WEL-TEN610	≦0.45	≦0.47	≦0.50	≦0.53	≦0.57

3) When specially ordered, the yield point can be set at 490 N/mm² or more.

4) When specially ordered, the tensile strength of WEL-TEN 690 and 690C with thickness of 50 mm or under can be set at 710 N/mm² or more.

5) In the bending test, cracks shall not occur in the outside of test piece.
The bending test can be eliminated unless otherwise specified.

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Weldable High-strength Steel Plates : WEL-TEN®780 and 950 Series

Brand name (applicable plate thickness)	Chemical composition (%)													Ceq[1]	Mechanical properties											
															Tensile test					Bending test[3] (test piece:JIS No.1)			Impact test (test piece:JIS No.4, 2mm V-notch, L direction)			
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	B	Ti		Yield point or proof stress (N/mm²)	Tensile strength (N/mm²)	Elongation		Test piece JIS	Bending angle	Inside bending radius		Thickness (mm)	Test temperature (°C)	Absorbed energy (J)	
																	Thickness (mm)	Min. elongation (%)			Thickness (mm)	Radius			Average value	Each value
WEL-TEN780RE (2.3～9mm)	≦0.16	≦0.55	≦2.00	≦0.030	≦0.025	–	–	–	–	–	–	–	≦0.30	≦0.55	685≦	780～930	t≦9	15	No.5	180°	t≦9	1.5t	–	–	–	–
WEL-TEN780 (6～200mm)	≦0.16	t≦100 ≦0.35 100<t ≦0.55	t≦100 0.60～1.20 100<t 0.60～1.50	≦0.020	≦0.015	0.15～0.50	t≦150 0.40～1.50 150<t 0.40～2.00	0.40～0.80	0.15～0.60	≦0.10	–	≦0.005	–	2)	t≦50 685≦ 50<t 665≦	t≦50 780～930 50<t 760～910	t≦16	16	No.5		t<32	1.5t	12<t≦200	−20	47≦	27≦
WEL-TEN780C (6～150mm)	≦0.16	t≦50 ≦0.35 50<t ≦0.55	t≦50 0.60～1.20 50<t 0.60～1.50	≦0.025	≦0.015	≦0.50	t≦50 – 50<t ≦0.35	0.60～1.20	0.15～0.60	≦0.10	–	≦0.005	–	2)			16<t	24	No.5							
																	20<t	16	No.4		32≦t	2.0t	12<t≦150			
WEL-TEN780E (6～50mm)	≦0.22	≦0.55	≦1.60	≦0.025	≦0.015	t≦20 – 20<t ≦0.30	t≦20 – 20<t ≦0.30	t≦20 – 20<t ≦0.80	–	t≦20 – 20<t ≦0.05	t≦20 – 20<t ≦0.05	≦0.005	–	≦0.60	685≦	780～930	t≦16	16	No.5		t<32	1.5t	12<t≦50	−15	47≦	27≦
																	16<t	24	No.5		32≦t	2.0t				
																	20<t	16	No.4							
WEL-TEN950 (6～100mm)	≦0.16	≦0.35	0.60～1.60	≦0.012	≦0.008	0.15～0.50	0.50～3.50	0.40～0.80	0.30～0.60	≦0.10	≦0.02	≦0.005	–	≦0.76	885≦	950～1130	t≦16	13	No.5		–	2.0t	12<t≦100	−50	47≦	27≦
WEL-TEN950PE (6～25mm)	≦0.16	≦0.55	0.90～1.50	≦0.025	≦0.008	–	–	–	0.40～0.70	–	0.02～0.05	≦0.005	–	≦0.76			16<t	19	No.5							
																	20<t	13	No.4				12<t≦25	−20	47≦	27≦
WEL-TEN950RE (3～8mm)	≦0.16	≦0.55	≦2.00	≦0.025	≦0.020	–	≦0.50	–	–	–	–	≦0.005	≦0.30	≦0.50	885≦	950～1130	t≦6	8	No.5		–	1.5t	–	–	–	–
																	6<t	11	No.5							

Abrasion-resistant Steel Plates: WEL-TEN® AR and WEL-HARD® Series

Brand name (applicable plate thickness)	Mechanical properties											Hardness BHN[1] (10/3000)
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	B	
WEL-TEN AR235E (6～50mm)	≦0.22	0.15～0.55	≦1.60	≦0.025	≦0.015	–	–	≦0.50	–	–	≦0.005	235≦
WEL-TEN AR285E (6～50mm)												285≦
WEL-TEN AR320E (6～50mm)												321≦
WEL-TEN AR360E (6～50mm)												361≦
WEL-TEN AR400E (6～50mm)	≦0.25											401≦
WEL-TEN AR500E (6～50mm)	≦0.35			≦0.015	≦0.010	t≦20 – 20<t ≦0.30		≦1.00	t≦20 – 20<t ≦0.15		≦0.005	477≦
WEL-HARD 400 (6～50mm)	≦0.22	0.15～0.55	≦1.60	≦0.025	≦0.015	–	–	≦0.50	–	–	≦0.005	361～440
WEL-HARD 500 (6～50mm)	≦0.35	0.15～0.35		≦0.015	≦0.010	–	–	≦1.00	≦0.15	–		451～550

1) Carbon equivalent, Ceq, is calculated for added elements using the following equation.

Ceq=C+Si/24+Mn/6+Ni/40+Cr/5+Mo/4+V/14%

2) Ceq is as follows.

Brand name	Plate thickness (mm)				
	t≦50	50<t≦75	75<t≦100	100<t≦150	t<150
WEL-TEN780	≦0.60	≦0.60	≦0.60	≦0.63	≦0.67
WEL-TEN780C	≦0.60	≦0.63	≦0.63	≦0.70	–

3) In the bending test, cracks shall not occur in the outside of test piece.
The bending test can be eliminated unless otherwise specified.

1) Hardness test shall be carried out in accordance with JIS Z 2243 (Method of Brinell Hardness Test).

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Low-temperature Steel Plates: N-TUF, N-TUFCR®

This standard applies to storage and transport vessels for liquefied petroleum gas, chemical equipment, and pressure vessels, and provides for steel plates that must possess high notch toughness in low-temperature applications.

Remarks: Impact test values for N-TUFCR 196 are as shown in the table below.

Test piece size (2mm-V-notch) (mm)	*Average value of 3 test pieces* (J)	*Minimum value of single test pieces* (J)	*Test temperature* (°C)
10×10	34≦	27≦	−196
10×7.5	28≦	24≦	
10×5.0	24≦	19≦	

Brand name	*Applicable plate thickness* (mm)	*Heat treatment*	*Chemical composition* (%) C	Si	Mn	P	S	Ni	Other	*Mechanical properties* *Yield point or proof stress* (N/mm²)	*Tensile strength* (N/mm²)	*Elongation* *Test piece*	*Thickness* (mm)	*Min. elongation* (%)	*Bend-ing angle*	*Bending test* *Thickness* (mm)	*Inside bending radius / Thickness*	*Impact test*
N-TUF 295N	6≦t≦32	nomalized	≦0.14	0.15 ~0.35	1.00 ~1.60	≦0.030	≦0.030	–	–	t≦32 295≦	420~540	No.5	t<21	$10.8+5\sqrt{t}$	180°	–	1.0t	Steel plates are subjected to the impact test in accordance with the characteristic properties of plates, thickness classification, temperature classification and test temperatures according to application stress, prescribed in WES3003 (valuation criterion of rolled steels for low temperature application) of the Japan Welding Association Standards, and the average absorbed energy of a set of three test pieces thus obtained shall be 50% or more the maximum absorbed energy. However, the maximum absorbed energy shall denote the average absorbed energy in case when the impact test is conducted at room temperature on a set of three test pieces extracted from an optional plate of steel plates of identical molten steel and with identical heat-treatment conditions and thickness, and the percent shear is 100% for each test piece.
												No.4	21≦t	24				
N-TUF 325N	6≦t≦32		≦0.14	0.15 ~0.35	1.00 ~1.60			–	–	t≦32 325≦	440~560	No.5	t<21	$9.4+5\sqrt{t}$		–	1.5t	
												No.4	21≦t	22				
N-TUF 325	6≦t≦50	quenched and tempered	≦0.14	0.15 ~0.35	1.00 ~1.60			–	–	325≦	440~560	No.5	t<21	$9.4+5\sqrt{t}$		–	1.5t	
												No.4	21≦t	22				
N-TUF 365	6≦t≦50		≦0.14	0.15 ~0.35	1.00 ~1.60			≦0.70	–	365≦	490~610	No.5	t<21	$7.4+5\sqrt{t}$		–	1.5t	
												No.4	21≦t	20				
N-TUF 490	6≦t≦50		≦0.16	0.15 ~0.55	0.90 ~1.60			≦0.60	Cr ≦0.40 Mo ≦0.30 V ≦0.08	490≦	610~740	No.5	t<21	$3.6+5\sqrt{t}$		–	1.5t	
												No.4	21≦t	17				
N-TUF 570	6≦t≦26		≦0.14	0.15 ~0.35	≦0.70			2.00 ~2.75	Cr ≦0.50 Mo ≦0.55	t≦26 570≦	670~800	No.5	t<21	$2.2+5\sqrt{t}$		–	1.5t	
												No.4	21≦t	15				
N-TUFCR 130	6≦t≦26		≦0.14	0.15 ~0.30	≦0.70			3.25 ~3.75	–	t≦26 440≦	540~660	No.5	t<21	$4.8+5\sqrt{t}$		–	1.5t	
												No.4	21≦t	18				
N-TUFCR 196	6≦t≦40		≦0.13	0.15 ~0.30	0.90 ~1.50			5.00 ~6.00	Cr 0.10~1.00 Mo 0.10~0.30	590≦	690~820	No.5	t<21	$1.9+5\sqrt{t}$		t≦19	1.0t	Remark
												No.4	21≦t	22		19<t≦40	1.25t	

Sulfuric Acid-resisting Steel: S-TEN®

This standard provides for steel products with high sulfuric acid resistance that are used in boiler heat exchangers in which sulfuric acid dew-point corrosion caused by sulfuric acid gas is likely to occur. This standard also provides for steel plates used in air pollution-control equipment that treat various waste gases emanating from, for example, air preheaters, dust collectors, gas flues, smokestacks, garbage treatment facilities, etc.

Remarks:
(1) S-TEN1 plate manufactured at Nippon Steel's plate mills conforms to JIS G 3106 SM400A, and S-TEN2 to JIS G 3106 SM490A.
(2) In the bending test, cracks shall not occur in the outside of test piece. The bending test can be eliminated unless otherwise specified.

Brand name	*Applicable plate thickness* (mm)	*Chemical composition* (%) C	Si	Mn	P	S	Cu	Other	*Mechanical properties* *Yield point or proof stress* (N/mm²)	*Tensile strength* (N/mm²)	*Elongation* *Test piece*	*Thickness* (mm)	*Min. elongation* (%)	*Bending test* *Bending angle*	*Inside bending radius / Thickness*
S-TEN 1	1.6≦t≦20.2	≦0.14	≦0.55	≦1.60 1)	≦0.025	≦0.025	0.25 ~0.50	Sb ≦0.15	t≦16 245≦ t≦20.2 235≦	400 ~510	No.1A 2)	t≦16	18	180°	1.5t
												16<t	22		
											No.5	t≦20.2	23		
S-TEN 2	2.0≦t≦20.2	≦0.14	0.15 ~0.55	≦1.60	≦0.035	≦0.035	0.25 ~0.50	Cr 0.50~1.00 Ti ≦0.15	t≦16 325≦ t≦20.2 315≦	490 ~610	No.1A 2)	t≦16	17		1.5t
												16<t	21		
											No.5	t≦20.2	23		

1) 12.5× [C] ≦Mn 2) Applied in the case of manufacture as JIS G 3106.

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Corrosion-resisting Steel for Uncoated Welded Structure: NAW®-K, COR-TEN®

The standard provides for rolled steel products used in welded structures, especially with high weather resistance, and is based on the premise that these steel products are to be applied in an uncoated state (without any coating or after rust stabilization treatment) in bridges and other structures.

Remarks:
(1) As a rule, as-rolled plate is shipped. Heat treatment can be applied upon request. When the plate is subjected to normalizing in accordance with the customer's request, the designation is suffixed with an "N".
(2) The yield point of COR-TEN® 570 can be set at 490 N/mm² or more in accordance with the customer's request. However, in this case, the tensile strength shall be 570~740 N/mm².

Brand name		Applicable plate thickness (mm)	Chemical composition (%)							Mechanical properties							
													Elongation			Impact test V notch	
			C	Si	Mn	P	S	Cu	Other	Thickness (mm)	Yield point or proof stress (N/mm²)	Tensile strength (N/mm²)	Test piece	Thickness (mm)	Min. elongation (%)	Temperature (°C)	A prorked energy (J)
NAW-K 400	A	6≦t<50	≦0.16	0.15 ~0.65	≦1.25	≦0.035	≦0.035	0.30 ~0.50	Cr 0.45~0.75 Ni 0.05~0.30	t≦16	245≦	400~540	No.1A	t≦16	17	–	–
	B									16<t≦40	235≦		No.1A	16<t	21	0	27≦
	C									40<t	215≦		No.4	40<t	23	0	47≦
COR-TEN 490	A	6≦t<50	≦0.17	0.30 ~0.65	0.80 ~1.25	≦0.035	≦0.035	0.30 ~0.40	Cr 0.45~0.65 V 0.02~0.10 Ni 0.05~0.30	t≦16	360≦	490~610	No.1A	t≦16	15	–	–
	B									16<t≦40	355≦		No.1A	16<t	19	0	27≦
	C									40<t	335≦		No.4	40<t	21	0	47≦
COR-TEN 570		6≦t<50	≦0.17	0.40 ~0.65	0.80 ~1.25	≦0.035	≦0.035	0.30 ~0.40	Cr 0.45~0.65 V 0.02~0.10 Ni 0.05~0.30	t≦16	460≦	570~720	No.5	t≦16	19	–5	47≦
										16<t≦40	450≦		No.5	16<t	26		
										40<t	430≦		No.4	20<t	20		

Highly Corrosion-resisting Steel: COR-TEN® O

This standard provides for high-strength steel products, especially with high weather resistance, that are used in building structures, bridges, rolling stock, various industrial equipment and others.

Remarks:
(1) The test piece is extracted in the rolling direction.
(2) For the thickness surpassing 12.7mm, advance consultation is requested.
(3) In the bending test, cracks shall not occur in the outside of test piece. The bending test can be eliminated unless otherwise specified.

Brand name	Applicable plate thickness (mm)	Chemical composition (%)							Mechanical properties								
												Elongation			Bending test		
		C	Si	Mn	P	S	Cu	Other	Thickness (mm)	Yield point or proof stress (N/mm²)	Tensile strength (N/mm²)	Test piece	Thickness (mm)	Min. elongation (%)	Bending angle	Thickness (mm)	Inside bending radius / Thickness
COR-TEN O	1.6≦t≦76.0	≦0.12	0.25 ~0.75	0.20 ~0.50	0.07 ~0.15	≦0.035	0.25 ~0.55	Cr 0.30~1.25 Ni ≦0.65	t≦20	355≦	490≦	NO.5	t≦5	22	180°	t≦5	1.0t
									20<t≦38	325≦	460≦	NO.1A	5<t	18		5<t	1.5t
									38<t	295≦	430≦	NO.1A	t≦38	21			
												NO.4	38<t	23			

General-purpose, Corrosion-resisting Steel: NAW®

This standard provides for steel products with excellent weather resistance that are used in building structures, bridges, rolling stock, various industrial equipment and others.

Remarks:
(1) The test piece is extracted in the rolling direction.
(2) In the bending test, cracks shall not occur in the outside of test piece. The bending test can be eliminated as far as the customer does not specify.

Brand name	Applicable plate thickness (mm)	Chemical composition (%)							Mechanical properties								
											Elongation			Bending test		
		C	Si	Mn	P	S	Cu	Other	Yield point or proof stress (N/mm²)	Tensile strength (N/mm²)	Test piece	Thickness (mm)	Min. elongation (%)	Bending angle	Thickness (mm)	Inside bending radius / Thickness
NAW 400	3.2≦t≦12.7	–	–	–	≦0.150	≦0.050	0.20 ~0.40	Cr ≦0.40	t≦12.7	400~510	NO.5	t≦5	21	180°	t≦5	1.0t
									245≦		NO.1A	5<t	17		5<t	1.5t
NAW 490	t≦12.7	≦0.12	0.15 ~0.35	≦0.90	0.06 ~0.12	≦0.035	0.25 ~0.50	Ti ≦0.15	t≦12.7	490≦	NO.5	t≦6	22		t≦6	1.0t
									390≦		NO.5	6<t	23		6<t	1.5t

Seawater-resistant Steel for Welded Structures: MARILOY®

This standard provides for steel plates with the strength, toughness and workability appropriate for use as structural steel and for plates with sufficiently high corrosion resistance for use in offshore structures.

Remarks:
(1) When necessary, alloying elements other than those shown in the table may be added.
(2) Impact test shall be performed on plates 13mm or more in thickness.

Bending test	Impact test
In parallel with final rolling direction	

Brand name		Applicable plate thickness (mm)	Chemical composition (%)							Mechanical properties								
												Elongation			Bending test		Impact test V notch	
			C	Si	Mn	P	S	Cu	Other	Yield point or proof stress (N/mm²)	Tensile strength (N/mm²)	Test piece	Thickness (mm)	Min. elongation (%)	Bending angle	Inside bending radius / Thickness	Temperature (°C)	A prorked energy (J)
MARILOY S400	A	3.2≦t≦32	≦0.14	≦0.55	≦1.50	≦0.030	≦0.030	–	Cr 0.80~1.30	t≦16	400≦	NO.5	t≦5	23	180°	1.0t	–	–
	B									16<t≦32		NO.1A	5≦t≦16	19			0	27≦
	C									235≦			16<t	22			0	47≦

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Ni-Added Weathering Steel: NAW-TEN®

This standard provides for rolled steel products used in welded structures with higher salt resistance than JIS weathering steel and is based on the premise that these steel products are to be applied in an uncoated state (without any coating or after rust stabilization treatment) in bridges and other structures.

Brand name		Applicable plate thickness (mm)	Chemical composition (%)							Mechanical properties							
													Elongation			Impact test V notch	
			C	Si	Mn	P	S	Cu	Other	Thickness (mm)	Yield point or proof stress (N/mm²)	Tensile strength (N/mm²)	Test piece	Thickness (mm)	Min. elongation (%)	Temperature (°C)	A prorked energy (J)
NAW-TEN12-400	A	6≦t≦100	≦0.18	≦0.35	≦1.40	≦0.035	≦0.035	0.50 ～1.00	Cr ≦0.08 Ni 0.70～1.70	t≦16	245≦	400～540	No.1A	t≦16	17	–	–
	B									16＜t≦40	235≦		No.1A	16＜t	21	0	27≦
	C									40＜t≦100	215≦		No.4	40＜t	23	0	47≦
NAW-TEN12-490	A	6≦t≦100		≦0.55	≦1.60					t≦16	365≦	490～610	No.1A	t≦16	15	–	–
	B									16＜t≦40	355≦		No.1A	16＜t	19	0	27≦
	C									40＜t≦75	335≦		No.4	40＜t	21	0	47≦
										75＜t≦100	325≦						
NEW-TEN12-570		6≦t≦100		0.15 ～0.65	≦1.40					t≦16	460≦	570～720	No.5	t≦16	19	–5	47≦
										16＜t≦40	450≦		No.5	16＜t	26		
										40＜t≦75	430≦		No.4	40＜t	20		
										75＜t≦100	420≦						
NAW-TEN30-400	A	6≦t≦100	≦0.18	0.15 ～0.65	≦1.25	≦0.035	≦0.035	0.30 ～0.50	Cr ≦0.08 Ni 2.50～3.50	t≦16	245≦	400～540	No.1A	t≦16	17	–	–
	B									16＜t≦40	235≦		No.1A	16＜t	21	0	27≦
	C									40＜t≦100	215≦		No.4	40＜t	23	0	47≦
NAW-TEN30-490	A	6≦t≦100			≦1.40					t≦16	365≦	490～610	No.1A	t≦16	15	–	–
	B									16＜t≦40	355≦		No.1A	16＜t	19	0	27≦
	C									40＜t≦75	335≦		No.4	40＜t	21	0	47≦
										75＜t≦100	325≦						
NEW-TEN30-570		6≦t≦100								t≦16	460≦	570～720	No.5	t≦16	19	–5	47≦
										16＜t≦40	450≦		No.5	16＜t	26		
										40＜t≦75	430≦		No.4	40＜t	20		
										75＜t≦100	420≦						

Steel for Elasto-plastic Hysteretic-type Dampers for Building Structures: BT-LYP®100 and 225

These are low yield-point steel and extra-low yield-point steel used for elasto-plastic hysteretic-type vibration dampers that are used to absorb seismic energy.

Features:

- Yield point is low (100 N/mm² level for BT-LYP 100 and 225 N/mm² level for BT-LYP 225) and the range of yield point (yield strength) deviation is narrowly controlled.
- General elongation properties of 50% or more are guaranteed for BT-LYP 100 and 40% or more for BT-LYP 225, thereby offering the large deformation capacity required of vibration dampers.
- Small-lot orders are available. Advance consultation is requested regarding use.

Brand name	Chemical composition (%)							Mechanical properties						
													Impact test V notch	
	C	Si	Mn	P	S	N	Ceq	Yield point (N/mm²)	0.2% proof stress (N/mm²)	Tensile strength (N/mm²)	Yield ratio (%)	Elongation (%)	Temperature (°C)	A prorked energy (J)
BT-LYP100	≦0.01	≦0.03	≦0.20	≦0.025	≦0.015	≦0.006	≦0.36	–	80～120	200～300	≦60	50≦	0	27≦
BT-LYP225	≦0.10	≦0.05	≦0.50	≦0.025	≦0.015	≦0.006	≦0.36	205～245	–	300～400	≦80	40≦	0	27≦

Standard available sizes

(For the sizes surpassing the following, advance consultation is requested.)

Thickness 6～50mm
Length 3,000～8,000mm
Width 1,000～2,500mm

However, the width of BT-LYP100 is limited as in the following so as to prevent the deformation.

Thickness 6～8mm Thickness Width 2,000mm
Length 9～20mm Thickness Width 2,300mm
Width 21～50mm Thickness Width 2,500mm

Remarks:

(1) The tensile test piece shall be the JIS Z 2201 No. 5 test piece (gauge length: 50 mm).
(2) The procedure of mechanical test shall conform to the provision of JIS G 3136.
(3) Allowable thickness tolerance shall conform to the provision of JIS G 3136.

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TMCP Steel Plates for Building Structures: BT-HT Series

This standard provides for steel plates used in building structures that are produced by TMCP (Thermo-Mechanical Control Process). These plates feature excellent weldability and yield points similar or superior to those of steel plates with thicknesses of 40 mm or less, even for greater thickness.

Brand name	Applicable plate thickness (mm)	Chemical composition (%)												Mechanical properties										
														Tensile test						Tensile test			High-temperature characteristics	
																	Elongation						Thickness (mm)	
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Nb	V	Ceq※1	PCM※1	Yield point or proof stress (N/mm²)	Tensile strength (N/mm²)	Yield ratio (%)	Thickness (mm)	Test piece	Elongation (%)	Test temperature (°C)	Charpy absorbed energy (J)	Test piece	t≦40	40<t≦100
BT-HT325B	40<t≦50	≦0.18	≦0.55	≦1.60	≦0.030	≦0.015	–	–	–	–	–	–	≦0.38	≦0.24	325～445	490～610	≦80	t≦50	No.1A	21≦		27≦		–	–
	50<t≦100	≦0.20											≦0.40	≦0.26											
BT-HT325C	40<t≦50	≦0.18			≦0.020	≦0.008							≦0.38	≦0.24				40<t	No.4	23≦					
	50<t≦100	≦0.20											≦0.40	≦0.26											
BT-HT355B	40<t≦50	≦0.20	≦0.55	≦1.60	≦0.030	≦0.015	–	–	–	–	–	–	≦0.40	≦0.26	355～475	520～640	≦80	t≦50	No.1A	19≦					
	50<t≦100												≦0.42	≦0.27											
BT-HT355C	40<t≦50				≦0.020	≦0.008							≦0.40	≦0.26				40<t	No.4	21≦					
	50<t≦100												≦0.42	≦0.27											
BT-HT400C※1	16<t≦50	≦0.20	≦0.55	≦2.00	≦2.00	≦0.008	–	–	–	–	–	–	≦0.40	≦0.26	400～550	490～640	≦90	t≦50	No.1A	21≦		70≦			
	50<t≦100																	40<t	No.4	23≦					
BT-HT325B-FR	40<t≦50	≦0.18	≦0.55	≦1.60	≦0.030	≦0.015	–	–	≦0.70	0.30～0.90	–	–	–	≦0.24	325～445	490～610	≦80	t≦50	No.1A	21≦		27≦	V notch Rolling direction	–	217≦
	50<t≦100	≦0.20												≦0.26											
BT-HT325C-FR	40<t≦50	≦0.18			≦0.020	≦0.008								≦0.24				40<t	No.4	23≦					
	50<t≦100	≦0.20												≦0.26											
BT-HT355B-FR	40<t≦50	≦0.20	≦0.55	≦1.60	≦0.030	≦0.015	–	–	≦0.70	0.30～0.90	–	–	–	≦0.26	355～475	520～640		t≦50	No.1A	19≦	0			–	237≦
	50<t≦100													≦0.27											
BT-HT355C-FR	40<t≦50				≦0.020	≦0.008								≦0.26				40<t	No.4	21≦					
	50<t≦100													≦0.27											
BT-HT440B	19≦t≦40	≦0.18	≦0.55	≦1.60	≦0.030	≦0.008	–	–	–	–	–	–	≦0.44	≦0.28	440～540	590～740	≦80	19≦t	No.5	26≦		47≦			
	40<t≦100												≦0.47	≦0.30											
BT-HT440C	19≦t≦40				≦0.020								≦0.44	≦0.28				20<t	No.4	20≦					
	40<t≦100												≦0.47	≦0.30											
BT-HT440B-SP	19≦t≦40	≦0.12	≦0.55	≦1.60	≦0.030	≦0.008	–	–	–	–	–	–	≦0.44	≦0.22	440～540	590～740	≦80	19≦t	No.5	26≦		70≦		–	–
	40<t≦100												≦0.47												
BT-HT440C-SP	19≦t≦40				≦0.020								≦0.44					20<t	No.4	20≦					
	40<t≦100												≦0.47												
BT-HT500C	19≦t≦50	≦0.18	≦0.55	≦2.00	≦0.020	≦0.008	–	–	–	–	–	–	≦0.44	≦0.28	500～650	590～740	≦90	19≦t	No.5	26≦		70≦			
	50<t≦100												≦0.47	≦0.30				20<t	No.4	20≦					
BT-HT630B	9≦t≦100	≦0.16	≦0.35	0.60～1.60	≦0.030	≦0.015	≦1.50	≦2.00	≦0.80	≦0.60	≦0.05	≦0.60	≦0.60	≦0.35	630～750	780～930	≦85	9≦t≦16	No.5	16≦		47≦			
																		16<t≦20		24≦					
BT-HT630C																		20<t	No.4	16≦					

※1 fHAZ≦0.58% [**for vE0℃**(multi-pass welding)≧70J]
fHAZ(%)=C+Mn/8+6(P+S)+12N-4Ti
fHAZ(%):a chemical composition parameter for estimating the HAZ(Heat Affected Zone) toughness of building column—beam welding.
The content of Ti should be considered as 0 when it is equal to or less than 0.005 mass%.

Remarks:
(1) When necessary, alloying elements other than those shown in the tale may be added.
(2) Ceq(%)=C+Mn/6+Si24+Ni/40+Cr/5+Mo/4+V/14 %
PCM(%)=C+Si/30+Mn/20+Cu/20+Ni/60+Cr/20+Mo/15+V/10+5B %
(3) Yield ratio=Yield point or 0.2% proof stress/tensile strength×**100** %
(4) Test pieces for the tensile test shall be collected in the direction perpendicular to the final rolling direction.

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Fire-resistant Steel for Building Structures: NSFR® Series

This standard provides for fire-resistant steel, used in building structures, that has higher elevated-temperature yield strength than is available in conventional steel products for general building structures.

The application of fire-resistant steel allows for a greater reduction of fire protection, and even allows for the design of steel-frame building structures without the use of fire protection, depending on the fire and design conditions of the buildings.

Brand name		Equivalent JIS symbol	Applicable plate thickness (mm)	Remarks	Chemical composition (%)										Mechanical properties										
															Tensile test							Impact test			High-temperature strength
															yield point or proof stress		Tensile strength	Yield ratio	Elongation			Test temperature	Charpy absorbed energy	Test piece and direction	Thickness (mm)
															Thickness (mm)	(N/mm²)	(N/mm²)	(%)	Thickness (mm)	Test piece	Elongation (%)	(°C)	(J)		t≦40	40<t≦100
NSFR400	B	SN400B	6≦t≦100	As-rolled	≦0.15	≦0.35	0.60 ~1.40	≦0.030	≦0.015	–	–	≦0.70	0.30 ~0.70	≦0.26	6≦t<12 12≦t≦40 40<t≦100	235≦ 235~355 215~335	400~510 400~510 400~510	– ≦80 ≦80	6≦t≦16 16<t≦50 40<t≦100	No.1A No.1A No.4	18≦ 22≦ 24≦					
	BW	SN400B	6≦t≦100	As-rolled (with atmospheric corrosion resistance)	≦0.15	0.15 ~0.35	0.60 ~1.40	≦0.030	≦0.015	0.30 ~0.50	0.05 ~0.30	0.45 ~0.75	0.30 ~0.70	≦0.26	6≦t<12 12≦t≦40 40<t≦100	235≦ 235~355 215~335	400~510 400~510 400~510	– ≦80 ≦80	6≦t≦16 16<t≦50 40<t≦100	No.1A No.1A No.4	18≦ 22≦ 24≦					
	C	SN400C	16≦t≦100	As-rolled	≦0.15	≦0.35	0.60 ~1.40	≦0.020	≦0.008	–	–	≦0.70	0.30 ~0.70	≦0.26	16≦t≦40 40<t≦100	235~355 215~335	400~510 400~510	≦80 ≦80	16 16<t≦50 40<t≦100	No.1A No.1A No.4	18≦ 22≦ 24≦				157≦	143≦
	CW	SN400C	16≦t≦100	As-rolled (with atmospheric corrosion resistance)	≦0.15	0.15 ~0.35	0.60 ~1.40	≦0.020	≦0.008	0.30 ~0.50	0.05 ~0.30	0.45 ~0.75	0.30 ~0.70	≦0.26	16≦t≦40 40<t≦100	235~355 215~335	400~510 400~510	≦80 ≦80	16 16<t≦50 40<t≦100	No.1A No.1A No.4	18≦ 22≦ 24≦					
NSFR490	B	SN490B	6≦t≦100	As-rolled	≦0.15	≦0.55	≦1.60	≦0.030	≦0.015	–	–	≦0.70	0.30 ~0.90	≦0.26	6≦t<12 12≦t≦40 40<t≦100	325≦ 325~445 295~415	490~610 490~610 490~610	– ≦80 ≦80	6≦t≦16 16<t≦50 40<t≦100	No.1A No.1A No.4	17≦ 21≦ 23≦	0	27≦	V notch Rolling direction	217≦	197≦
	B-TMC	SN490B	40<t≦100	TMCP	≦0.15	≦0.55	≦1.60	≦0.030	≦0.015	–	–	≦0.70	0.30 ~0.90	≦0.23	40<t≦100	295~415	490~610	≦80	40<t≦50	No.1A	21≦				–	
	BW	SN490B	6≦t≦100	As-rolled (with atmospheric corrosion resistance)	≦0.15	0.15 ~0.55	≦1.60	≦0.030	≦0.015	0.30 ~0.50	0.05 ~0.30	0.45 ~0.75	0.30 ~0.90	≦0.27	6≦t<12 12≦t≦40 40<t≦100	325≦ 325~445 295~415	490~610 490~610 490~610	– ≦80 ≦80	6≦t≦16 16<t≦50 40<t≦100	No.1A No.1A No.4	17≦ 21≦ 23≦				217≦	
	C	SN490C	16≦t≦100	As-rolled	≦0.15	≦0.55	≦1.60	≦0.020	≦0.008	–	–	≦0.70	0.30 ~0.90	≦0.26	16≦t≦40 40<t≦100	325~445 295~415	490~610 490~610	≦80 ≦80	16 16<t≦50 40<t≦100	No.1A No.1A No.4	17≦ 21≦ 23≦					
	C-TMC	SN490C	40<t≦100	TMCP	≦0.15	≦0.55	≦1.60	≦0.020	≦0.008	–	–	≦0.70	0.30 ~0.90	≦0.23	40<t≦100	295~415	490~610	≦80	40<t≦100	No.4	23≦				–	
	CW	SN490C	16≦t≦100	As-rolled (with atmospheric corrosion resistance)	≦0.15	0.15 ~0.55	≦1.60	≦0.020	≦0.008	0.30 ~0.50	0.05 ~0.30	0.45 ~0.75	0.30 ~0.90	≦0.27	16≦t≦40 40<t≦100	325~445 295~415	490~610 490~610	≦80 ≦80	16 16<t≦50 40<t≦100	No.1A No.1A No.4	17≦ 21≦ 23≦				217≦	

※1 Pcm is calculated based on the following formula.
Pcm=C+Si/30+Mn/20+Cu/20+Ni/60+Cr/20+Mo/15+V/10+5B %

Remarks:
(1) NSFR Series is marketed as the JIS product because its properties at room temperature satisfy those of equivalent JIS product.
(2) Pcm is applied for NSFR Series because of its low C content, but Ceq is not applied.

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Applications

Tokyo Metropolitan Government office building complex

Bulbous gas holders (Saibu Gas Co., Ltd.)

Yokohama Landmark Tower

Steel frame construction in Yokohama Landmark Tower

Seto Ohashi Bridge

UO pipe

Akashi Kaikyo Ohashi Bridge

Information Required for Orders

About Specifications

(1) When plates are to be produced to a standard specification, grade designations and other symbols should be clearly indicated.
(2) When plates are to be produced to special specifications as to chemical composition, mechanical properties, thickness, tolerances, etc., Nippon Steel should be consulted in advance.
(3) Heat treatment, ultrasonic examination, sulphur print and other special requirements should be clearly indicated.

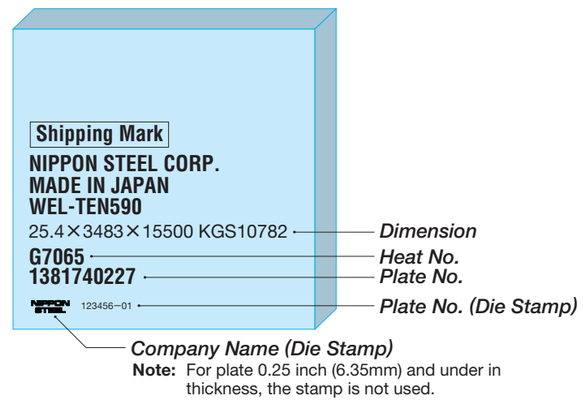
About Intended Application and Fabrication Method

(1) Information about the application for which the ordered plate is intended-e.g., tank heads, shell plates, bridge beam flanges-should be given in as much detail as possible.
(2) The fabrication method to be employed and fabrication conditions-e.g., cold forming, hot forming, bending radius and direction, drawing, welding and cutting-should be clearly described.

Inquiries about plates that have already been delivered should include information about the contract number, specification number, product dimensions and the plate number (heat number).

Marking

Plates are shipped without bundling and are loaded in bulk. Example of marking is shown below.



Note: For plate 0.25 inch (6.35mm) and under in thickness, the stamp is not used.

Note: For standard plate products used in building structures (as-rolled products) and manufactured to the standards, the symbol marking the standard is indicated on the surface of every plate.

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