HOT ROLLED STEEL

Product Manual

CSC

HOT ROLLED
STEEL

CSC

The quality policy of China Steel Corporation

China Steel Corporation, based-on customer orientation, will incessantly innovate, research & develop to provide excellent and eco-friendly products, and consequently fulfill our responsibility to society.

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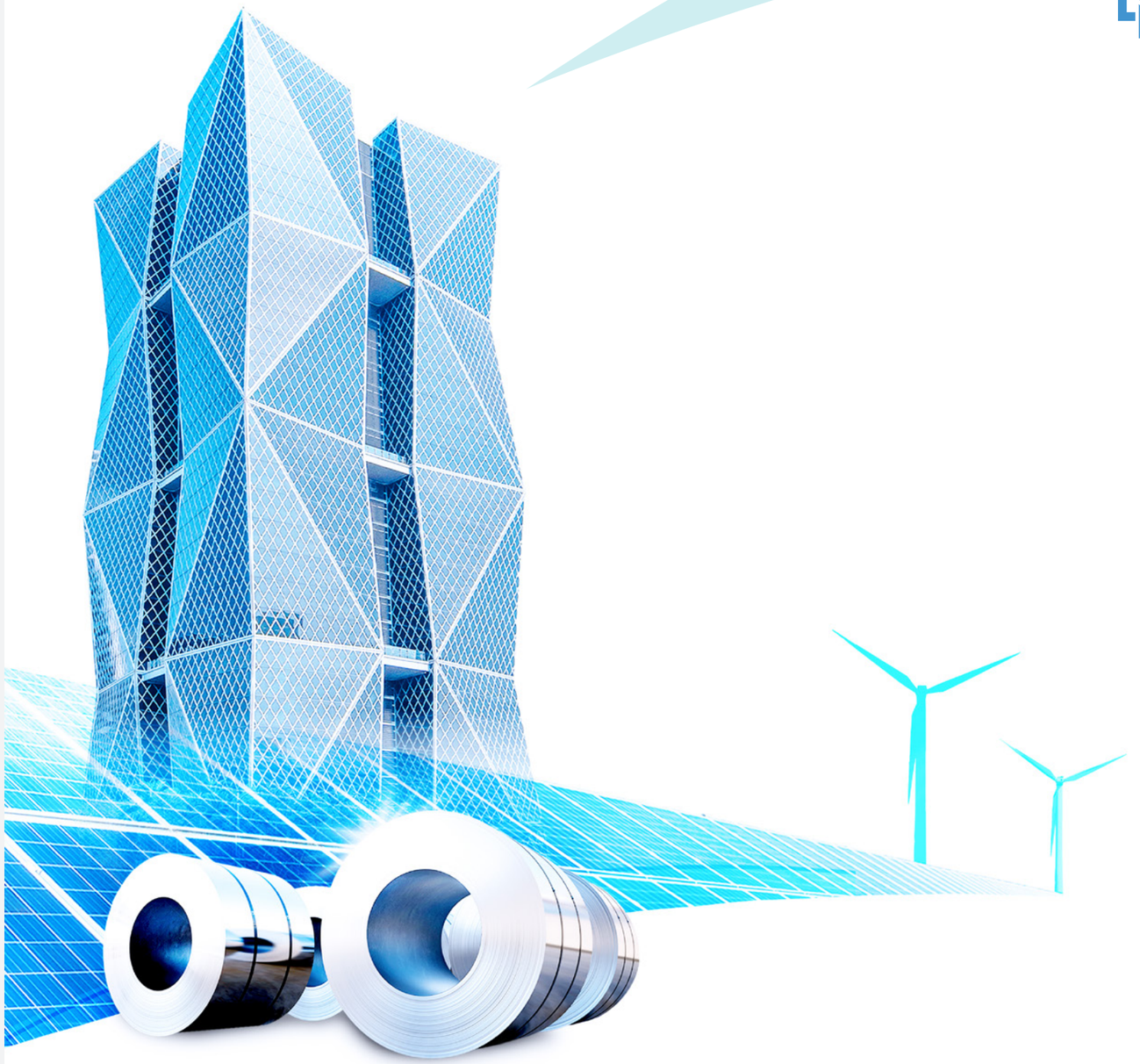


CSC

Vision

Smart Innovation / Green Energy / Value Co-creation

We aspire to be a sustainable growth enterprise.

A brief about China Steel Corporation (CSC),located at Kaohsiung,Taiwan was founded in December 1971.With annual capacity (in terms of crude steel) over 10 million tones,CSC produces a range of products that encompasses hot and cold rolled coils,coated coils,plate,bars and wire rods,The domestic market takes roughly 55.2% of CSC's production.Exports take the remaining 44.8%.CSC is the largest steel company in Taiwan,enjoying more than 50% of the domestic market.Principal export destinations are Europe,Japan and Southeast Asia.

CSC has the courage to innovate,as well as strong capability to put the innovations into practice.The company's vision is: "We aspire to be a trustworthy steel company of global distinction that pursues growth,environmental protection,energy saving and value-innovation" .CSC actively puts in practice its corporate values of teamwork, entrepreneurial approach.down-to-earthiness and pursuit of innovation.With the application of the latest technology and the most modem management concepts.it sinks deep roots for its core business in steel,and integrates the related downstream industries to foster healthy development of Taiwan's steel industry.CSC also moves toward diversification and toward developing into a globalized industrial group with the steel business at its core that extends to industrial materials,trade,transportation,engineering,finance,services,land development and state-of-the-art technology.

To become a steel mill that produces advanced premium products with high value

To develop the green energy industry

- Digital Transition
- Low-carbon Transition
- Supply Chain Transition

China Steel Corporation (CSC) is an integrated steel producer. After the completion of its phase II expansion construction on June 30, 1982, CSC launched its production of Hot Strip Mill. Products include hot rolled sheets, plates, coils, pickling and oiling coils, pickling and annealing coils, pickling and spheroidizing coils. These products not only have huge production but they also come in a variety with a wide range of selection.

Through developments and improvements over the years, CSC's comprehensive steel products have fulfilled industrial requirements demanded by industries including structural steel uses like middle-high strength, buildings, welding, automobiles, and other various steel uses like forming, machine structure, high pressure vessel, superior atmospheric corrosion resistance steels, steel pipes, oil-gas flow line pipes..., etc. Moreover, in order to meet market demands, CSC has continually developed a series of CSC specification products, such as CSC ACR-TEN (atmospheric corrosion resistance steels), CSC 50BV30 (Cr-B-V alloy steels), CSC HC1085 (high carbon tool steels with thermo-stable coating), and CSC HC 15B22 (high strength manganese boron steels), etc.

CSC's hot rolled products have been approved by many certifications such as ISO 9001, JIS Mark, ISO/TS16949, TAF (Taiwan Accreditation Foundation), IECQ QC08000 (Hazardous Substance Process Management) and ELV (End-of Life Vehicles). The approvals and qualifications are testament to CSC's commitment to reliable and superior products, thus providing its clients a peace of mind.

The vision of CSC's customer services is to gain customers' appreciation and trust and help them be successful, and the aim of that is to promote customers' technology and upgrade the steel industry. In order to enhance the customer services, CSC adopts multi-step and multi-level service pattern which is characterized by emphasizing on (1) the pre-sale services for helping customers to choose suitable materials and improve their production processes; (2) handling complains and claims from customers with proper and rapid manner, and conducting customers the corresponding improvements to the root-causes; (3) providing customers with the developed high-grade materials to meet the upgrade policy for domestic industries.

The stable and reliable quality of CSC's steel products have gained the acceptance of domestic industries widely, and CSC has also been selected as the first priority provider to purchase their needed steel materials owing to CSC's quick and efficient technical services. CSC will continue to improve customer services and the technical technologies both for customers and CSC itself to promote steel-use industries' international competitiveness.

CSC HT325Y

This grade offers low yield strength, excellent workability, and a supply thickness of up to 16 mm. It's used for square steel pipes like STKR490 and other BCR components and has been applied in the main structure of the Kaohsiung Music Center.

CSC HM440T FB

High-strength automotive steel with a high hole-expansion ratio, available in grades from 45 kgf to 80 kgf (CSC HM440T FB ~ HM780T FB), is widely used for hole expansion, flanging, and edge stretching, meeting lightweight and complex processing needs.

JIS G4401 SK95/SAE 1074

High carbon tool steel possesses good hardenability and is suitable for various heat treatment requirements, making it widely used in gardening tools, hand tools, and other applications.

CSC HC 15B22/15B36

High strength boron-manganese hot-rolled steel combine ease of welding and forming. After quenching, tempering, and heat treatment, it achieve ultra-high strength properties of over 1470 to 1800 MPa, making it suitable for applications like automotive impact beams.

API 5L X52M/X65M/X70M PSL2

This grade of steel is suitable for producing API 5L X52M/X65M/X70M PSL2 welded oil line pipes. If X52M is applied in polar or highly corrosive environments, additional options such as ultra-low temperature toughness or resistance to hydrogen-induced cracking (HIC) can be selected.

API 5CT J55U

This grade with low phosphorus and sulfur, enhances ductility and weldability. It suits API 5CT J55 oil well casings and can be upgraded to API 5CT N80Q high-strength spec via heat treatment, improving material management flexibility.

EN10025-2 S355J0

This grade of hot-rolled steel with low carbon equivalent and strength of 50 kgf possessing has excellent low temperature toughness and weldability that are best used in steel pipe pile for bridge, underwater tunnel, coastal wall, breakwaters. The maximum order thickness is 25mm.

CSC HC 1085

This grade is a high-carbon tool steel referenced to JIS G4401 SK85, enhanced for high-temperature coating properties, and is used in gardening tools, hand tools, and similar applications.

PAS Steels (Pickling and Spheroidizing coils)

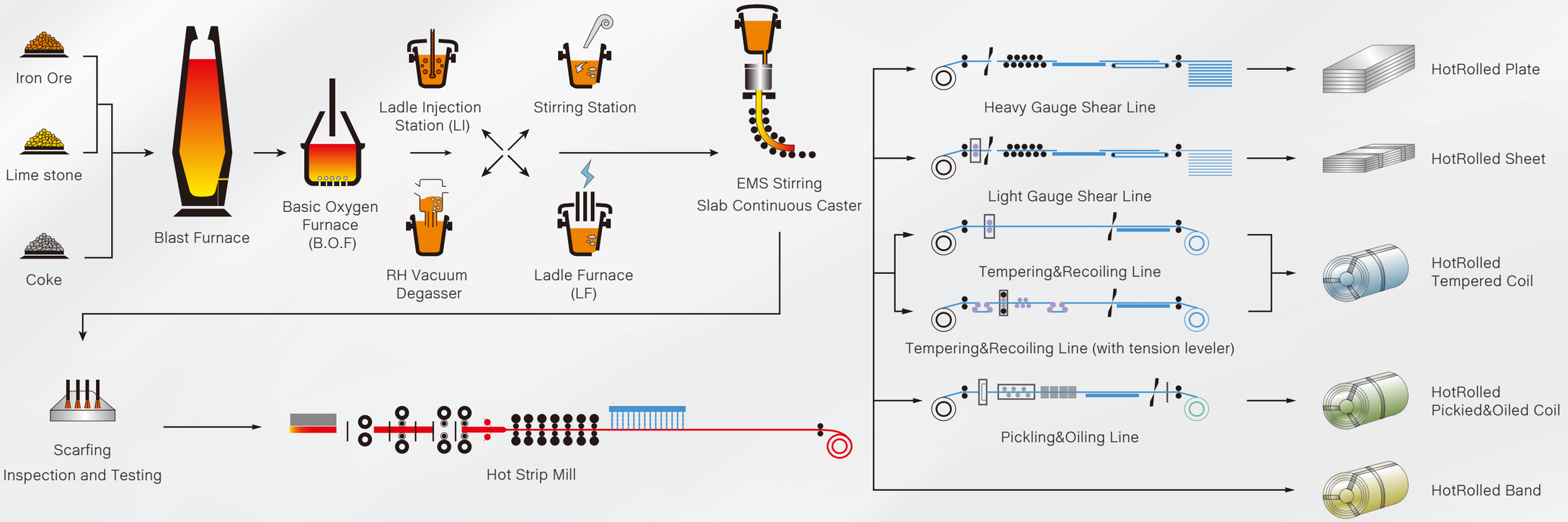
Besides having the characteristics of PA, PAS also features a spheroidized carbide structure, enabling medium-high carbon, low alloy, and tool steels to be used in demanding processes like fine blanking, shaving, cold forging, hole expansion, and stamping. Typical applications include sprockets, gear plates, sliders, starter gears, bearing rings, and sewing machine needle plates.

ASTM A572 GR.50 TYPE1

This grade of high strength low-alloy hot-rolled steel is applicable to structural use that is best used in sections and stiffening plates.

PA Steels (Pickling and Annealing coils)

PA material focuses on reducing hardness and improving the uniformity of mechanical properties in hot-rolled medium-high carbon steel, low alloy steel, and tool steel. This reduces deformation resistance and increases processing capacity, minimizes mold wear and extends life. It is suitable for simple processes like tube manufacturing, blanking, and bending, and is used in cold-drawn bicycle tubes, hydraulic tubes, washers, knives, and cold re-rolling applications.



Manufacturing Facilities

Reheating Furnace

Reheating furnaces are used to heat slabs to pre-defined temperature for hot rolling according to different heating curves based on steel grades.

Roughing Mill

Roughing mill is the main equipment to roling both slab thickness and width to pre-calculated value for finishinh rolling.

Finishing Mill

Tandem finishing mill further reduce strip thickness to customer ordered specification.

The finishing temperature, strip profile, flatness and surface quality are also controlled to meet customer's requirements.

Laminar Flow

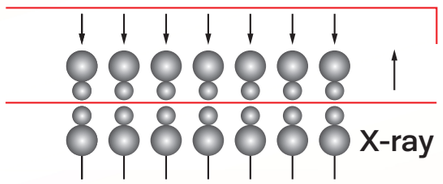
After finishing mill, the strip is cooled to proper temperature by laminar flow for achieving required mechanical and metallurgical properties.

Down Coiler

Hot strip is coiled by down coiler, then being packed, marked and delivered for customer or down stream plants.

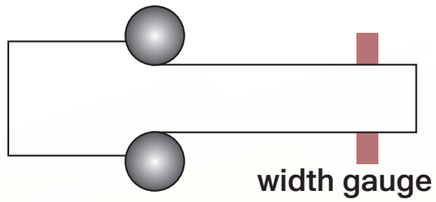
Production Facilities

Equipment Item	No. 1 HSM	No.2 HSM	No.3 HSM (Dragon Steel)
Reheating Furnace	4 Walking Beam Type Capacity: 250 Ton/Hr x 4	2 Walking Beam Type Capacity: 375 Ton/Hr x 2	2 Walking Beam Type Capacity: 300 Ton/Hr x 3
Slab Sizing Press	Flying Type	–	–
Vertical Edger	Caliber Type x4	Groove Type x1, Caliber Type x 1	Groove Type x1, Caliber Type x 1
Rougher R1	Two High	Two High	Two High
Rougher R2	Four High Reversing	Four High Reversing	Four High Reversing
Rougher R3	Four High	–	–
Rougher R4	Four High	–	–
Edge Heater	Elec-Magnet Induction	Elec-Magnet Induction	Elec-Magnet Induction
Finishing Mill	Four High Tandem (F1~F7) HAGC: F4~F7 WRS: F4~F7 (±150mm) WRB: F1~F7 (200MT/Chock)	Four High Tandem (F1~F7) HAGC: F1~F7 WRS: F1~F7 (±200mm) WRB: F1~F7(200MT/Chock)	Four High Tandem (F1~F7) HAGC: F1~F7, Pair Cross: F1~F4 WRS: F5~F7 (±200mm) WRB: F1~F4(120MT/Chock) F5~F7(200MT/Chock)
Down Coiler	Hydraulic Type x 3 Automatic Jumping Control	Hydraulic Type x 2 Automatic Jumping Control	Hydraulic Type x 2 Automatic Jumping Control



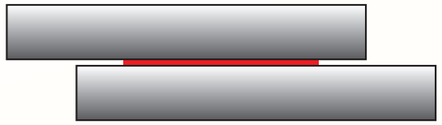
HAGC : Hydraulic Automatic Gauge Control

HAGC system is attached to finishing mill to control roll gap with hydraulic cylinders to achieve ordered thickness value.



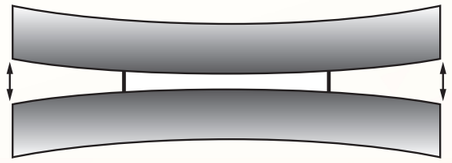
RAWC : Roughing mill Automatic Width Control

RAWC system is attached to roughing mill vertical edgers to control strip width to ordered value.



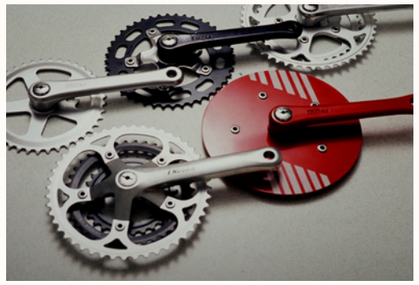
WRS : Work Roll Shifting System

WRS system is to shift work roll horizontally to control the even wearing of roll surface and thus to control strip thickness distribution in width direction.



WRB : Work Roll Bending System

WRB system is to bend work roll with hydraulic cylinders to control strip crown to target value.



Bicycle gear

Steel pipe

Container

Structural square tube

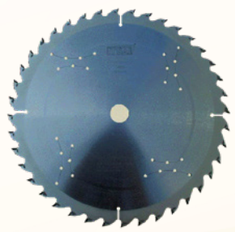
Automotive bracket

Automatic Transmission

Automotive disk

Truck body base

Automotive parts



Circular saw

Airbag case

6.1 Chemical Composition and Mechanical Requirements.

6.1.1 CSC ACR-TEN Superior Atmospheric Corrosion Resistance Steel

Grade	Applicable thickness range (mm)	Chemical Composition %					Tensile Test				Bendability		
		C	Si	Mn	P	S	Yield Strength N/mm²	Tensile Strength N/mm²	Elongation		Angle of bending	Inside Diameter	Test Piece
									Test Piece	%			
ACR-TEN A	1.6 — 12.7	0.12 max.	0.25 — 0.55	0.20 — 0.50	0.070 — 0.150	0.025 max.	345 min.	480 min.	No.5 in Rolling direction	25 min.	180°	thickness × 1.0	No.1 in Rolling direction
ACR-TEN AF	1.5 — 12.7	0.08 max.	0.15 — 0.45	0.15 — 0.45			285 min.	410 — 510					

Remark：1. The values specified shall not apply to the irregular portions at both ends of steel strip.
2. To improve the atmospheric corrosion resistant steel material properties, adding appropriate amount of Cu, Cr, Ni and other alloying elements.

6.1.2 CSC Cr-B-V Alloy steel

Grade	Applicable thickness range (mm)	Chemical Composition %						
		C	Mn	P	S	Cr	B	V
CSC 50BV30	2.2 ~ 5.0	0.27 — 0.33	0.70 — 1.00	0.025 max.	0.015 max.	0.30 max.	0.0005 max.	0.10 max.

6.1.3 CSC HM-690T (high strength steel)

Grade	Applicable thickness range (mm)	Chemical Composition %				
		C	Mn	P	S	Si
CSC HM-690T	2.0~10.0	0.18 max.	1.60 max.	0.03 max.	0.015 max.	0.55 max.

Grade	Tensile Test					Bendability			
	Yield Strength N/mm²	Tensile Strength N/mm²	Elongation %(transverse to rolling direction)			Angle of bending	Inside Diameter		Test Piece
			No.5 Test Piece				Thickness(t)mm		
			Thickness(t)mm						
			2.0 ≦ t < 2.3	2.3 ≦ t < 6.3	6.3 ≦ t ≦ 10		t ≦ 6.0	6.0 < t	
CSC HM-690T	550 max.	690 max.	15 min.	16 min.	18 min.	180°	3.0t	4.0t	No.3 Transverse to rolling direction

6.1.4 CSC high-strength and hole expansion steel for automotive use

Grade	Tensile Test			Hole Expansion Test
	Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation % No.5 Test Piece	Hole Expansion %
CSC HM440T FB	305 min.	440 min.	28 min.	80 min.
CSC HM590T FB	440 min.	590 min.	17 min.	55 min.
CSC HM620T FB	550 min.	620 min.	14 min.	50 min.
CSC HM750T FB	700 min.	750 min.	12 min.	45 min.

Remark : 1. CSC hole expansion steel, abbreviated as FB, is named based on its characteristic microstructure (Ferritic Bainitic). If customers have specific requirements, it can also be named HE (Hole Expansion) or other customized names.

2. CSC can supply hole expansion steel that meets certain automotive manufacturers' and other international specifications. Customers with specific needs can contact sales and technical service personnel for inquiries.

6.1.5 CSC HC 1085 (hot-rolled high carbon tool steel with thermostable coating)

Grade	Applicable thickness range (mm)	Chemical Composition %				
		C	Mn	P	S	Si
CSC HC 1085	3.2-5.0	0.80 — 0.90	0.10 — 0.50	0.02 max.	0.03 max.	0.08 max.

Remark：Supply hot-rolled pickled and annealing (spheroidizing) coil, only guaranteed chemical composition.

6.1.6 JIS G4401-23 Corbon Tool Steels

Grade	Chemical Composition %					
	C	Si	Mn	P	S	Cr
SK85	0.80 — 0.90	0.10 — 0.35	0.10 — 0.50	0.030 max.	0.030 max.	0.30 max.
SK95	0.90 — 1.00					

Remark：Supply hot-rolled pickled and annealing (spheroidizing) coil.

6.1.7 CSC HC 15B22 (hot-rolled high-strength B-Mn steel)

Grade	Applicable thickness range (mm)	Chemical Composition %						
		C	Mn	P	S	Si	Al	B
CSC HC15B22	1.8-2.8	0.19 — 0.25	1.05 — 1.35	0.020 max.	0.010 max.	0.15 — 0.25	0.075 max.	0.0005 — 0.0030
CSC HC15B36	2.0-2.8	0.33 — 0.39	1.10 — 1.40	0.020 max.	0.010 max.	0.20 — 0.30	0.075 max.	0.0010 — 0.0035

Remark：Only guaranteed chemical composition.

6.1.8 JIS G3101-24 Rolled Steel for General Structure

Grade	Applicable thickness range (mm)	Chemical Composition %				Tensile Test				Bendability		
		C	Mn	P	S	Yield Point or Yield Strength N/mm²	Tensile Strength N/mm²	Elongation %		Angle of bending	Inside radius	Test Piece
								No.5 Test Piece	No.1A Test Piece		Thickness (t)mm	
								Thickness(t)mm				
								t ≦ 5	5 < t ≦ 16			
SS330	16 max.	—	—	0.050 max.	0.050 max.	205 min.	330 - 430	26 min.	21 min.	180°	0.5 t	No.1
SS400	16 max.					245 min.	400 - 510	21 min.	17 min.		0.5 t	
SS490	16 max.					285 min.	490 - 610	19 min.	15 min.		0.5 t	
SS540	16 max.	0.30 max.	1.60 max.	0.040 max.	0.040 max.	400 min.	540 min.	16 min.	13 min.		0.5 t	

Remark：1. Alloy elements other than those shown in the above table may be added necessary.
2.The bend test may be omitted*.However, when the purchaser designates, the test shall be performed.
* It means that the test may be omitted by the manufacturer’s decision, but it means that the bendability shall satisfy the specification.

6.1.9 JIS G3106-24 Rolled Steel for Welded Structure

Grade	Applicable thickness range (mm)	Chemical Composition %				
		C	Si	Mn	P	S
SM400A	16 max.	0.23 max.	—	2.5 × C min.	0.035 max.	0.035 max.
SM400B	16 max.	0.20 max.	0.35 max.	0.60 — 1.50	0.035 max.	0.035 max.
SM490A	16 max.	0.20 max.	0.55 max.	1.65 max.	0.035 max.	0.035 max.
SM490B	16 max.	0.18 max.	0.55 max.	1.65 max.	0.035 max.	0.035 max.
SM490C	16 max.	0.18 max.	0.55 max.	1.65 max.	0.035 max.	0.035 max.
SM490YA	16 max.	0.20 max.	0.55 max.	1.65 max.	0.035 max.	0.035 max.
SM520C	16 max.	0.20 max.	0.55 max.	1.65 max.	0.035 max.	0.035 max.
SM570	16 max.	0.18 max.	0.55 max.	1.70 max.	0.035 max.	0.035 max.

Remark：Alloy elements other than those shown in the above table may be added necessary.

Grade	Tensile Test					Impact Test		
	Yield Point or Proof Strength N/mm²	Tensile Strength N/mm²	Elongation %			Test Temperature ℃	Charpy Absorbed Energy J	Test Piece
			No.5 Test Piece		No.1A Test Piece			
			Thickness(t)mm					
			t ≦ 5	t ≦ 16	5 < t ≦ 16			
SM400A	245 min.	400- 510	23 min.	—	18 min.	—	—	No.4 in rolling direction
SM400B	245 min.	400- 510	23 min.	—	18 min.	0	27 min.	
SM490A	325 min.	490- 610	22 min.	—	17 min.	—	—	
SM490B	325 min.	490- 610	22 min.	—	17 min.	0	27 min.	
SM490C	325 min.	490- 610	22 min.	—	17 min.	0	47 min.	
SM490YA	365 min.	490- 610	19 min.	—	15 min.	—	—	
SM520C	365 min.	520- 640	19 min.	—	15 min.	0	47 min.	
SM570	460 min.	570- 720	—	19 min.	—	-5	47 min.	

Remark：Impact test is applicable to thickness over 12.0mm of steel.

6.1.10 JIS G3113-18 Hot-Rolled Steel Plates, Sheets and Strip for Automobile Structural Uses

Grade	Applicable thickness range (mm)	Chemical Composition %		Tensile Test			
		P	S	Tensile Strength N/mm^2	Yield Point N/mm^2 Thickness(t)mm		
					t < 6.0	6.0 ≦ t < 8.0	8.0 ≦ t ≦ 14
SAPH310	1.6-14	0.040 max.	0.040 max.	310 min	(185) min.	(185) min.	(175) min.
SAPH370	1.6-14			370 min	225 min.	225 min.	215 min.
SAPH400	1.6-14			400 min	255 min.	235 min.	235 min.
SAPH440	1.6-14			440 min	305 min.	295 min.	275 min.

Grade	Tensile Test						Bendability			
	Elongation % (rolling direction) No.5 Test Piece thickness(t)mm						Angle of bending	Inside radius Thickness(t)mm		Test piece
	1.6 ≦ t < 2.0	2.0 ≦ t < 2.5	2.5 ≦ t < 3.15	3.15 ≦ t < 4.0	4.0 ≦ t < 6.3	6.3 ≦ t ≦ 14		t < 2.0	2.0 ≦ t	
SAPH310	33 min.	34 min.	36 min.	38 min.	40 min.	41 min.	180°	Flat on itself	1.0 t	No.3 transverse to rolling direction
SAPH370	32 min.	33 min.	35 min.	36 min.	37 min.	38 min.		0.5 t	1.0 t	
SAPH400	31 min.	32 min.	34 min.	35 min.	36 min.	37 min.		1.0 t	1.0 t	
SAPH440	29 min.	30 min.	32 min.	33 min.	34 min.	35 min.		1.0 t	1.0 t	

Remark：1. Values in parentheses mean reference values.
2.The values specified shall not apply to the irregular portions at both ends of steel strip.

6.1.11 JIS G3116-20 Steel Sheets, Plate and Strip for Gas Cylinders

Grade	Applicable thickness range (mm)	Chemical Composition %					Tensile Test				Bendability		
		C	Si	Mn	P	S	Yield Point or Proof Stress N/mm^2	Tensile Strength N/mm^2	Elongation %	Test Piece	Angle of bending	Inside radius Thickness (t) mm	Test Piece
SG255	1.6-6.0	0.20 max.	—	0.30 max.	0.020 max.	0.020 max.	255 min.	400 min.	28 min.	No.5 in rolling direction	180°	1.0 t	No.3 in rolling direction
SG295	1.6-6.0	0.20 max.	0.35 max.	1.00 max.	0.020 max.	0.020 max.	295 min.	440 min.	26 min.			1.5 t	
SG325	1.6-6.0	0.20 max.	0.55 max.	1.50 max.	0.020 max.	0.020 max.	325 min.	490 min.	22 min.			1.5 t	
SG365	1.6-6.0	0.20 max.	0.55 max.	1.50 max.	0.020 max.	0.020 max.	365 min.	540 min.	20 min.			1.5 t	

Remark：The values specified shall not apply to the irregular portions at both ends of steel strip.

6.1.12 JIS G3125-21 Superior Atmospheric Corrosion Resisting Rolled Steels

Grade	Thickness (t) mm	Chemical Composition %							
		C	Si	Mn	P	S	Cu	Cr	Ni
SPA-H	t ≦ 6.0	0.12 max.	0.20 I 0.75	0.60 max.	0.070 I 0.150	0.035 max.	0.25 I 0.55	0.30 I 1.25	0.65 max.
	6.0 < t ≦ 16								

Remark：Alloy elements other than those shown in the above table may be added necessary.

Grade	Tensile Test				Bendability		
	Yield Point or Proof Stress N/mm^2	Tensile Strength N/mm^2	Elongation		Angle of bending	Inside radius Thickness (t) mm	Test Piece
			Test Piece	%			
SPA-H	355 min.	490 min.	No.5	22 min.	180°	0.5 t	No.1 in rolling direction
			No.1A	15 min.		1.5 t	

6.1.13 JIS G3131-24 Hot-Rolled Mild Steel Plate, Sheets and Strip

Grade	Applicable thickness range (mm)	Chemical Composition %			
		C	Mn	P	S
SPHC	1.2-14	0.12 max.	0.60 max.	0.045 max.	0.035 max.
SPHD	1.2-14	0.10 max.	0.45 max.	0.035 max.	0.035 max.
SPHE	1.2-8	0.08 max.	0.40 max.	0.030 max.	0.030 max.
SPHF	1.4-8	0.08 max.	0.35 max.	0.025 max.	0.025 max.

Grade	Tensile Test								Bendability			
	Tensile Strength N/mm^2	Elongation % (Rolling direction) Thickness (t) mm						Test Piece	Angle of bending	Inside radius Thickness (t) mm		Test Piece
		1.2 ≦ t < 1.6	1.6 ≦ t < 2.0	2.0 ≦ t < 2.5	2.5 ≦ t < 3.2	3.2 ≦ t < 4.0	4.0 ≦ t			t < 3.2	3.2 ≦ t	
SPHC	270 min.	27 min.	29 min.	29 min.	29 min.	31 min.	31 min.	No.5 in rolling direction	180°	Flat on itself	0.5 t	No.3 in rolling direction
SPHD		30 min.	32 min.	33 min.	35 min.	37 min.	39 min.		—	—	—	
SPHE		31 min.	33 min.	35 min.	37 min.	39 min.	41 min.		—	—	—	
SPHF		37 min.	38 min.	39 min.	39 min.	40 min.	42 min.		—	—	—	

Remark：1. Grade SPHF is manufactured by a special process, such as made of killed steel to improve drawability.
2. The values specified shall not apply to the irregular portions at both ends of steel strip.
3. The bend test may be omitted*.However, when the purchaser designates, the test shall be performed.
* It means that the test may be omitted by the manufacturer’ s decision, but it means that the bendability shall satisfy the specification.

6.1.14 JIS G3132-18 Hot-Rolled Carbon Steel Strip for Pipes and Tubes

Grade	Applicable thickness range (mm)	Chemical Composition %				
		C	Si	Mn	P	S
SPHT1	1.2-13	0.10 max.	0.35 max.	0.50 max.	0.040 max.	0.040 max.
SPHT2	1.2-13	0.18 max.		0.60 max.		
SPHT3	1.6-13	0.25 max.	0.35 max.	0.30—0.90		
SPHT4	1.6-13	0.30 max.		0.30—1.00		

Grade	Tensile Test						Bendability			
	Tensile Strength N/mm^2	Elongation % Thickness (t) mm				Test Piece	Angle of bending	Inside radius Thickness (t) mm		Test Piece
		1.2 ≦ t < 1.6	1.6 ≦ t < 3.0	3.0 ≦ t < 6.0	6.0 ≦ t ≦ 13.0			t ≦ 3.0	3.0 < t ≦ 13.0	
SPHT1	270 min.	30 min.	32 min.	35 min.	37 min.	No.5 in rolling direction	180°	Flat on itself	0.5 t	No.3 in rolling direction
SPHT2	340 min.	25 min.	27 min.	30 min.	32 min.			1.0 t	1.5 t	
SPHT3	410 min.	(20 min.)	22 min.	25 min.	27 min.			1.5 t	2.0 t	
SPHT4	490 min.	(15 min.)	18 min.	20 min.	22 min.			1.5 t	2.0 t	

Remark：1. The Si content of SPHT1 can be modified to 0.04% max. upon agreement.
2. Values in parentheses mean reference values.
3. The values specified shall not apply to the irregular portions at both ends of steel strip.
4. The bend test may be omitted*.However, when the purchaser designates, the test shall be performed.
* It means that the test may be omitted by the manufacturer’ s decision, but it means that the bendability shall satisfy the specification.

6.1.15 JIS G3134-18 Hot-Rolled High Strength Steel Sheets with Improved Formability for Automobile Structural Uses

Grade	Applicable thickness range (mm)	Tensile Strength N/mm^2	Yield Point or Proof Stress N/mm^2	Elongation % Thickness (t) mm				Test Piece	Bendability Angle of bending	Inside radius Thickness (t) mm		Test Piece
				1.6 ≦ t < 2.0	2.0 ≦ t < 2.5	2.5 ≦ t < 3.25	3.25 ≦ t ≦ 6.0			1.6 ≦ t < 3.25	3.25 ≦ t < 6.00	
SPFH 490	1.6-6.0	490 min.	325 min.	22 min.	23 min.	24 min.	25 min.	No.5 transverse to rolling direction	180°	0.5 t	1.0 t	No.3 transverse to rolling direction
SPFH 540	1.6-6.0	540 min.	355 min.	21 min.	22 min.	23 min.	24 min.			1.0 t	1.5 t	
SPFH 590	1.6-6.0	590 min.	420 min.	19 min.	20 min.	21 min.	22 min.			1.5 t	1.5 t	
SPFH 540Y	2.0-4.0	540 min.	295 min.	—	24 min.	25 min.	26 min.			1.0 t	1.5 t	
SPFH 590Y	2.0-4.0	590 min.	325 min.	—	22 min.	23 min.	24 min.			1.5 t	1.5 t	

Remark：1. The chemical composition shall be agreed upon by the purchaser and supplier, if necessary.
2. The bend test may be omitted*.However, when the purchaser designates, the test shall be performed.
* It means that the test may be omitted by the manufacturer’ s decision, but it means that the bendability shall satisfy the specification.

6.1.16 JIS G3136-22 Rolled Steels for Building Structure

Grade	Applicable thickness range (mm)	Chemical Composition %				
		C	Si	Mn	P	S
SN400A	6-20	0.24 max.	—	—	0.050 max.	0.050 max.
SN400B	6-20	0.20 max.	0.35 max.	0.60 — 1.50	0.030 max.	0.015 max.
SN490B	6-20	0.18 max.	0.55 max.	1.65 max.		

Grade	Carbon Equivalent %	Yield Point or Proof Stress N/mm^2		Tensile Strength N/mm^2	Yield Ratio %		Elongation %	
	Thickness(t)mm				Thickness(t)mm		Test Piece No.1A Thickness(t)mm	
	t ≦ 20	6 ≦ t < 12	12 ≦ t ≦ 20		6 ≦ t < 12	12 ≦ t ≦ 16	6 ≦ t ≦ 16	16< t ≦ 20
SN400A	—	235 min.	235 min.	400~510	—	—	17 min.	21 min.
SN400B	0.36 min.	235 min.	235~355		—	80 max.	18 min.	22 min.
SN490B	0.44 min.	325 min.	325~445	490~610	—	80 max.	17 min.	21 min.

Remark：1. Impact test for SN400B and SN490B is applicable to thickness over 12.0mm of steel. Test temperature at 0℃ , charpy absorption energy is 27J min. , test piece is No.4 in rolling direction.

2. Carbon Equivalent=C + $\frac{Mn}{6} + \frac{Si}{24} + \frac{Ni}{40} + \frac{Cr}{5} + \frac{Mo}{4} + \frac{V}{14}$

6.1.17 SAE J403-24 Carbon Steel

Greade	Chemical Composition %				
	C	Si	Mn	P	S
1005(1)	0.06 max.	-	0.35 max.	0.030 max.	0.035 max.
1006(1) (2)	0.08 max.		0.25 — 0.40		
1008(1) (2)	0.10 max.		0.30 — 0.50		
1010	0.08 — 0.13		0.30 — 0.60		
1012	0.10 — 0.15		0.30 — 0.60		
1015	0.13 — 0.18		0.30 — 0.60		
1016	0.13 — 0.18		0.60 — 0.90		
1017	0.15 — 0.20		0.30 — 0.60		
1018	0.15 — 0.20		0.60 — 0.90		
1019	0.15 — 0.20		0.70 — 1.00		
1020	0.18 — 0.23		0.30 — 0.60		
1021	0.18 — 0.23		0.60 — 0.90		
1022	0.18 — 0.23		0.70 — 1.00		
1023	0.20 — 0.25		0.30 — 0.60		
1026	0.22 — 0.28		0.60 — 0.90		
1030	0.28 — 0.34		0.60 — 0.90		
1033	0.30 — 0.36		0.70 — 1.00		

Greade	Chemical Composition %				
	C	Si	Mn	P	S
1035	0.32 — 0.38	-	0.60 — 0.90	0.030 max.	0.035 max.
1038	0.35 — 0.42		0.60 — 0.90		
1040	0.37 — 0.44		0.60 — 0.90		
1045	0.43 — 0.50		0.60 — 0.90		
1049	0.46 — 0.53		0.60 — 0.90		
1050	0.48 — 0.55		0.60 — 0.90		
1055	0.50 — 0.60		0.60 — 0.90		
1060	0.55 — 0.65		0.60 — 0.90		
1065	0.60 — 0.70		0.60 — 0.90		
1070	0.65 — 0.75		0.60 — 0.90		
1074	0.70 — 0.80		0.50 — 0.80		
1086	0.80 — 0.93		0.30 — 0.50		
1524	0.19 — 0.25		1.35 — 1.65		
1536	0.30 — 0.37		1.20 — 1.50		
1541	0.36 — 0.44		1.35 — 1.65		
1552	0.47 — 0.55		1.20 — 1.50		

Remark：1. Ultra low carbon, interstitial free stabilized and nonstablized steel may be supplied for these grades.
2. MANGANESE—For grades G10060 and G10080 applicable to Structural Shapes, Plates, Strip, Sheets and Welded Tubing, the manganese limit is 0.45% maximum and 0.50% maximum, respectively, with no minimum.

6.1.18 SAE J404-09 Alloy Steel

Grade	Chemical Composition %							
	C	Si	Mn	P	S	Ni	Cr	Mo
4130	0.28 — 0.33	0.15 — 0.35	0.40 — 0.60	0.030 max.	0.040 max.	-	0.80-1.10	0.15-0.25

Remark：The Si content can be modified upon agreement.

6.1.19 JIS G4051-23 Carbon Steels for Machine Structural Use

Grade	Chemical Composition %				
	C	Si	Mn	P	S
S10C	0.08 — 0.13	0.15 — 0.35	0.30 — 0.60	0.030 max.	0.035 max.
S17C	0.15 — 0.20		0.30 — 0.60		
S35C	0.32 — 0.38		0.60 — 0.90		
S40C	0.37 — 0.43		0.60 — 0.90		
S45C	0.42 — 0.48		0.60 — 0.90		
S50C	0.47 — 0.53		0.60 — 0.90		
S53C	0.50 — 0.56		0.60 — 0.90		
S55C	0.52 — 0.58		0.60 — 0.90		

6.1.20 JIS G4053-23 Cr-Mo Steel

Grade	Chemical Composition %								
	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
SCM415	0.13~0.18	0.15 — 0.35	0.60 — 0.90	0.030 max.	0.030 max.	0.25 max.	0.90 — 1.20	0.15 — 0.25	0.30 max.
SCM420	0.18~0.23								
SCM435	0.33~0.38							0.15 — 0.30	
SCM440	0.38~0.43								

6.1.21 SAE J1392-08 High Strength Steel

Grade	Chemical Composition %		Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %	Test Piece	Bendability			
	C	Mn					Angle of bending	Inside Radius Thickness(t) mm		Test Piece
								t ≦ 4.55	4.55 < t	
050XLF	0.13 max.	0.90 max.	340 min.	410 min.	22 min.	In rolling direction	90°	1.0t	2.0t	Transverse to rolling direction
060XLF			410 min.	480 min.	20 min.					
080XLF	0.13 max.	1.65 max.	550 min.	620 min.	14 min.					

6.1.22 ASTM A36-19, A283-24 Carbon Steel for Structural Use

ASTM No (Description)	Applicable thickness range in.(mm)	Chemical Composition %					Tensile Test			
		C	Si	Mn	P	S	Yield Point ksi(N/mm²)	Tensile Strength ksi(N/mm²)	Elongation Gage Length in. (mm)	Elongation % min
A36 (Structural Quality)	t ≦ 3/4 in.(19.05mm)	0.25 max.	0.40 max.	—	0.04 max.	0.05 max.	36(250) min.	58~80 (400~550)	8(200)	20
									2 (50)	23
	3/4in. (19.05mm)< t ≦ 3/2in. (38.1mm)	0.25 max.	0.40 max.	0.8 - 1.2	0.04 max.	0.05 max.	36(250) min.	58~80 (400~550)	8(200)	20
									2 (50)	23
A283 Grade C (Low and Intermediate Tensile Strength)	-	0.24 max.	0.40 max.	0.90 max.	0.035 max.	0.04 max.	30(205) min.	55~75 (380~515)	8(200)	22
									2 (50)	25

Remark：1. Cu is 0.20% min. when specified.
2. “t” is the thickness of material.
3. For plates wider than 24 in.[600 mm], the elongation requirement is reduced two percentage points.

6.1.23 ASTM A1011-23 Carbon, structural, High-Strength Low-Alloy Steel and High-Strength Low-Alloy with Improved Formability.

〈 thickness less than 0.23 in. (6mm) 〉

Grade	Chemical Composition %											
	C	Mn	P	S	Al	Cu	Ni	Cr	Mo	V	Nb	Ti
CS Type B	0.02-0.15	0.60 max.	0.030 max.	0.035 max.	—	0.20 max.	0.20 max.	0.15 max.*1	0.06 max.	0.008 max.	0.008 max.	0.025 max.*1
DS Type B	0.02-0.08	0.50 max.	0.020 max.	0.030 max.	0.01 min.							
SS Gr. 36 Type 2	0.25 max.	1.35 max.	0.035 max.	0.04 max.	-							
HSLAS Gr.45 C1ass 1	0.22 max.	1.35 max.	0.04 max.						0.06 max.	0.005 min.	0.005 min.	0.005 min.
HSLAS-F Gr.50	0.15 max.	1.65 max.	0.020 max.	0.025 max.					0.16 max.			
HSLAS-F Gr.60												
HSLAS-F Gr.70									0.16 max.			
HSLAS-F Gr.80												

Remark : 1. Cr is 0.25% maximum when C ≦0.05%. Ti is permitted for SS designations to the lesser of (3.4N+1.5S) or 0.025% maximum., when C ≧0.02%,.

2. Nb, Ti and V is 0.005% min. when specified.

Grade	Tensile Strength MPa	Yield Strength Mpa	Elongation % G.L.=2 inch				Test Piece	Bend Test (Inside Radius)	Test Piece
		Thickness (t) mm						Thickness (t) mm	
		t < 6.0	t < 1.6	1.6 ≦ t < 2.5	t = 2.5	2.5 < t < 6.0		t < 6.0	
CS Type B	—	205-340	25 min.	25 min.	25 min.	25 min.	In rolling direction	—	Transverse to rolling irection
DS Type B	—	205-310	28 min.	28 min.	28 min.	28 min.		—	
SS Gr. 36 Type 2	400-550	250 min.	16 min.	20 min.	21 min.	21 min.		2.0t	
HSLAS Gr.45 C1ass 1	410 min.	310 min.	23 min.	23 min.	23 min.	25 min.		1.5t	
HSLAS-F Gr.50	410 min.	340 min.	22 min.	22 min.	22 min.	24 min.		1.0t	
HSLAS-F Gr.60	480 min.	410 min.	20 min.	20 min.	20 min.	22 min.		1.5t	
HSLAS-F Gr.70	550 min.	480 min.	18 min.	18 min.	18 min.	20 min.		2.0t	
HSLAS-F Gr.80	620 min.	550 min.	16 min.	16 min.	16 min.	18 min.		2.0t	

6.1.24 ASTM A1018-23 Heavy-thickness for Carbon, Commercial, drawing, structural steel、High-Strength Low-Alloy, and High-Strength Low-Alloy Steel with Improved Formability

〈 thickness from 0.230 in (6.0mm) through 1.000 in (25 mm) 〉

Grade	Chemical Composition %										
	C	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Ti	N
HSLAS-F Gr.80	0.15 max.	1.65 max.	0.025 max.	0.035 max.	0.20 max.	0.20 max.	0.15 max.	0.16 max.	0.005 min.	0.005 min.	0.005 min.	–

Remark : 1. Cu + Ni + Cr + Mo ≦0.50

2. Nb, Ti and V is 0.005% min. when specified.

Grade	Tensile Strength MPa	Yield Strength MPa	Elongation %			Bend Test (Inside Radius)	
		Thickness (t) mm					
		t ≦ 25	G.L.= 2 inch t ≦ 25	G.L.= 8 inch t ≦ 25	Test Piece	t ≦ 25	Test Piece
HSLAS-F Gr.80	620 min.	550 min.	12 min.	10 min.	Transverse to rolling direction	2.0t	Transverse to rolling direction

6.1.25 ASTM A572-21 GR.50 TYPE1 High-Strength Low-Alloy Steel

Grade	Chemical Composition %						Tensile Test		
	C	Mn	P	S	Si	Nb	Yield Strength N/mm^2	Tensile Strength N/mm^2	Elongation %
ASTM A572 GR.50 TYPE1	0.23 max.	1.35 max.	0.04 max.	0.05 max.	0.40 max.	0.005 | 0.050	345 min.	450 min.	18 min.

6.1.26 EN10111-08 Continuously Hot Rolled Low Carbon Steel Sheet and Strip for Cold Forming.

Grade	Steel No.	Applicable thickness range (mm)	Chemical Composition %				Tensile Test (transverse to rolling direction)						
			C	Mn	P	S	Yield Strength N/mm^2		Tensile Strength N/mm^2	Elongation %			
										G.L.=80mm			G.L.=5.65$\sqrt{S_0}$
							Thickness (t) mm			Thickness (t)mm			
							1.0 ≦ t < 2.0	2.0 ≦ t ≦ 11		1.0 ≦ t < 1.5	1.5 ≦ t < 2	2 ≦ t < 3	3 ≦ t ≦ 11
DD11	1.0332	1.0-11	0.12 max.	0.60 max.	0.045 max.	0.045 max.	170-360	170-340	440 max.	22 min.	23 min.	24 min.	28 min.
DD12	1.0398	1.0-11	0.10 max.	0.45 max.	0.035 max.	0.035 max.	170-340	170-320	420 max.	24 min.	25 min.	26 min.	30 min.
DD13	1.0335	1.0-11	0.08 max.	0.40 max.	0.030 max.	0.030 max.	170-330	170-310	400 max.	27 min.	28 min.	29 min.	33 min.
DD14	1.0389	1.0-11	0.08 max.	0.35 max.	0.025 max.	0.025 max.	170-310	170-290	380 max.	30 min.	31 min.	32 min.	36 min.

Remark：1. "S_0"Test piece section area.

6.1.27 EN 10149-2-13 Hot-Rolled Flat Products Made of High Yield Strength Steels for Cold Forming

Grade	Steel No.	Chemical Composition %										
		C	Mn	Si	P	S [2]	Al total	Nb[1]	V[1]	Ti[1]	Mo	B
S315MC	1.0972	0.12 max.	1.30 max.	0.50 max.	0.025 max.	0.020 max.	0.015 min.	0.09 max.	0.20 max.	0.15 max.	–	–
S355MC	1.0976		1.50 max.	0.50 max.								
S420MC	1.0980		1.60 max.	0.50 max.		0.015 max.						
S460MC	1.0982		1.60 max.	0.50 max.								
S500MC	1.0984		1.70 max.	0.50 max.								
S550MC	1.0986		1.80 max.	0.50 max.								
S600MC	1.8969		1.90 max.	0.50 max.						0.22 max.	0.50 max.	0.005 max.
S650MC	1.8976		2.00 max.	0.60 max.								
S700MC	1.8974		2.10 max.									

Remark : 1. Nb + V + Ti ≦ 0.22

2. The S content can be modified to 0.010% max. upon agreement between the purchaser and the manufacturer.

Grade	Steel No.	Tensile Strength N/mm^2	Yield Strength N/mm^2	Elongation% (in rolling direction)		Bend Test (Inside Diameter)
				Thickness(t) mm		
				t < 3 G.L.=80mm	3 ≦ t G.L.=5.65 $\sqrt{S_0}$	180° (Transverse to rolling direction
S315MC	1.0972	315 min.	390-510	20 min.	24 min.	Flat on itself
S355MC	1.0976	355 min.	430-550	19 min.	23 min.	0.5t
S420MC	1.0980	420 min.	480-620	16 min.	19 min.	0.5t
S460MC	1.0982	460 min.	520-670	14 min.	17 min.	1.0t
S500MC	1.0984	500 min.	550-700	12 min.	14 min.	1.0t
S550MC	1.0986	550 min.	600-760	12 min.	14 min.	1.5t
S600MC	1.8969	600 min.	650-820	11 min.	13 min.	1.5t
S650MC	1.8976	650 min.	700-880	10 min.	12 min.	2.0t
S700MC	1.8974	700 min.	750-950	10 min.	12 min.	2.0t

Remark : 1. "S_0" Test piece section area.

2. t > 8mm, yield strength of S650MC and S700MC can be lower by 20 N/mm^2.

6.1.28 EN 10025-2-19 Structural Steel

Geade	Steel No.	Chemical Composition %							
		C	Mn	Si	P	S	N	Cu	CEV
S235JR	1.0038	0.17 max.	1.40 max.	-	0.035 max.	0.035 max.	0.012 max.	0.55 max.	0.35 max.
S235J0	1.0114	0.17 max.	1.40 max.	-	0.030 max.	0.030 max.	0.012 max.	0.55 max.	0.35 max.
S235J2	1.0117	0.17 max.	1.40 max.	-	0.025 max.	0.025 max.	-	0.55 max.	0.35 max.
S275JR	1.0044	0.21 max.	1.50 max.	-	0.035 max.	0.035 max.	0.012 max.	0.55 max.	0.40 max.
S275J0	1.0143	0.18 max.	1.50 max.	-	0.030 max.	0.030 max.	0.012 max.	0.55 max.	0.40 max.
S275J2	1.0145	0.18 max.	1.50 max.	-	0.025 max.	0.025 max.	-	0.55 max.	0.40 max.
S355JR	1.0045	0.24 max.	1.60 max.	0.55 max.	0.035 max.	0.035 max.	0.012 max.	0.55 max.	0.45 max.
S355J0	1.0553	0.20 max.	1.60 max.	0.55 max.	0.030 max.	0.030 max.	0.012 max.	0.55 max.	0.45 max.
S355J2	1.0577	0.20 max.	1.60 max.	0.55 max.	0.025 max.	0.025 max.	-	0.55 max.	0.45 max.

Remark：$CEV=C+\frac{Mn}{6}+\frac{Cr+Mo+V}{5}+\frac{Ni+Cu}{15}$

Geade	Steel No.	Tensile Test (Transverse to rolling direction)									Impact Test		
		Tensile Strength N/mm^2		Yield Strength N/mm^2		Elongation %				G.L.=5.65 $\sqrt{S_0}$	Test Temperature ℃	Charpy Absorbed Energy J	Test Piece
		Thickness(t) mm				G.L.=80mm							
		t ≦ 16	16 < t ≦ 25	t < 3	3 ≦ t ≦ 25	1 < t ≦ 1.5	1.5 < t ≦ 2	2 < t ≦ 2.5	2.5 < t < 3	3 ≦ t ≦ 25			
S235JR	1.0038	235 min.	225 min.	360-510	360-510	16 min.	17 min.	18 min.	19 min.	24 min.	20	27 min.	In rolling direction
S235J0	1.0114										0		
S235J2	1.0117										-20		
S275JR	1.0044	275 min.	265 min.	430-580	410-560	14 min.	15 min.	16 min.	17 以上	21 min.	20		
S275J0	1.0143										0		
S275J2	1.0145										-20		
S355JR	1.0045	355 min.	345 min.	510-680	470-630	13 min.	14 min.	15 min.	16 min.	20 min.	20		
S355J0	1.0553										0		
S355J2	1.0577										-20		

Remark：1. “S_0” Test piece section area.

2. Impact tests shall not be required for nominal thickness < 6 mm.

6.1.29 API 5L-23 (Line Pipe)

Type of pipe	Level	Grade	Chemical Composition %					Tensile Test	
			C max.	Mn max.	Si max.	P max.	S max.	Yield Strength psi (MPa)	Tensile Strength psi (MPa)
Welded	PSL 1	B	0.26	1.20	-	0.030	0.030	35500 (245) min.	60200 (415) min.
		X42		1.30				42100 (290) min.	60200 (415) min.
		X46		1.40				46400 (320) min.	63100 (435) min.
		X52						52200 (360) min.	66700 (460) min.
		X56						56600 (390) min.	71100 (490) min.
		X60						60200 (415) min.	75400 (520) min.
		X65		1.45				65300 (450) min.	77600 (535) min.
		X70		1.65				70300 (485) min.	82700 (570) min.
	PSL2	BM	0.22	1.20	0.45	0.025	0.015	35500~65300 (245~450)	60200~95000 (415~655)
		X42M		1.30				42100~71800 (290~495)	60200~95000 (415~655)
		X46M						46400~76100 (320~525)	63100~95000 (435~655)
		X52M		1.40				52200~76900 (360~530)	66700~110200 (460~760)
		X56M						56600~79000 (390~545)	71100~110200 (490~760)
		X60M	0.12	1.60				60200~81900 (415~565)	75400~110200 (520~760)
		X65M						65300~87000 (450~600)	77600~110200 (535~760)
		X70M		1.70				70300~92100 (485~635)	82700~110200 (570~760)

Remark : 1. For each reduction of 0.01 % below the specified maximum for carbon, an increase of 0.05 % above the specified maximum for manganese is permissible, up to a maximum of 1.65 % for grades ≥ L245 or B, but ≤ L360 or X52; up to a maximum of 1.75 % for grades >L360 or X52, but < L485 or X70.

2. For Grade B –X65 and Grade X52M –X65M, the sum of the Nb, V, Ti contents shall not exceed 0.15%.

3. For Grade BM –X46M, Nb/ V/ Ti contents shall not exceed 0.05%/0.05%/0.04% seperately.

4. The purchase order shall include type of pipe.

6.1.30 API 5CT-23 (Casing and Tubing)

Geade	Chemical Composition %				Tensile Test	
	C	Mn	P max.	S max.	Yield Strength MPa	Tensile Strength MPa
J55	—	—	0.030	0.030	379-552	517 min.

Remark：The purchase order shall include type of pipe.

6.2 Dimensional Tolerance

6.2.1 JIS G3113 Thickness Tolerances of Hot-Rolled Plates, Sheets and Coils

Unit：mm

Thickness(t) \ Width(w)	w < 1200	1200 ≦ w < 1500	1500 ≦ w < 1800	1800 ≦ w ≦ 1880
1.60 ≦ t < 2.00	± 0.16	± 0.17	± 0.18	—
2.00 ≦ t < 2.50	± 0.17	± 0.19	± 0.21	—
2.50 ≦ t < 3.15	± 0.19	± 0.21	± 0.24	—
3.15 ≦ t < 4.00	± 0.21	± 0.23	± 0.26	—
4.00 ≦ t < 5.00	± 0.24	± 0.26	± 0.28	± 0.29
5.00 ≦ t < 6.00	± 0.26	± 0.28	± 0.29	± 0.31
6.00 ≦ t < 8.00	± 0.29	± 0.30	± 0.31	± 0.35
8.00 ≦ t < 10.0	± 0.32	± 0.33	± 0.34	± 0.40
10.0 ≦ t < 12.5	± 0.35	± 0.36	± 0.37	± 0.45
12.5 ≦ t ≦ 14.0	± 0.38	± 0.39	± 0.40	± 0.50

Remark：1. The positions where the thickness is to be measured shall be as follows:
(A) For mill-edged products, any point 25mm and over inward from the edge.
(B) For cut-edged products, any point 15mm and over inward from the edge.
2. The values specified shall not apply to the irregular portions at both ends of steel coils.

6.2.2 JIS G3116 Thickness Tolerances of Hot-Rolled Steel Plates, Sheets and Coils

Unit：mm

Thickness(t) \ Width(w)	600 ≦ w < 1200	1200 ≦ w < 1500	1500 ≦ w < 1800	1800 ≦ w ≦ 1880
1.60 ≦ t < 2.00	± 0.16	± 0.17	± 0.18	± 0.21
2.00 ≦ t < 2.50	± 0.17	± 0.19	± 0.21	± 0.25
2.50 ≦ t < 3.15	± 0.19	± 0.21	± 0.24	± 0.26
3.15 ≦ t < 4.00	± 0.21	± 0.23	± 0.26	± 0.27
4.00 ≦ t < 5.00	± 0.24	± 0.26	± 0.28	± 0.29
5.00 ≦ t < 6.00	± 0.26	± 0.28	± 0.29	± 0.31
t = 6.00	± 0.29	± 0.30	± 0.31	± 0.35

Remark：1. The above table applies to SG255 and SG295.
2. Thickness shall be measured at any point of 20mm and over inside the edges.
3. The values specified shall not apply to the irregular portions at both ends of steel coils.

6.2.3 JIS G3131 Thickness Tolerances of Hot-Rolled Steel Plates,Sheets and Coils

Unit：mm

Width(w) / Thickness(t)	w < 1200	1200 ≦ w < 1500	1500 ≦ w < 1800	1800 ≦ w ≦ 1880
t < 1.60	±0.14	±0.15	±0.16*1	—
1.60 ≦ t < 2.00	±0.16	±0.17	±0.18	±0.21
2.00 ≦ t < 2.50	±0.17	±0.19	±0.21	±0.25
2.50 ≦ t < 3.15	±0.19	±0.21	±0.24	±0.26
3.15 ≦ t < 4.00	±0.21	±0.23	±0.26	±0.27
4.00 ≦ t < 5.00	±0.24	±0.26	±0.28	±0.29
5.00 ≦ t < 6.00	±0.26	±0.28	±0.29	±0.31
6.00 ≦ t < 8.00	±0.29	±0.30	±0.31	±0.35
8.00 ≦ t < 10.0	±0.32	±0.33	±0.34	±0.40
10.0 ≦ t < 12.5	±0.35	±0.36	±0.37	±0.45
12.5 ≦ t ≦ 14.0	±0.38	±0.39	±0.40	±0.50

Remark：1. The above table applies to SPHC, SPHD, SPHE and SPHF grades.
2. Thickness shall be measured at any point of 20mm and over inside the edges.
3. The values specified shall not apply to the irregular portions at both ends of steel coils.

Note：*1. The value shall be applied to the steel strip under 1600mm in width.

6.2.4 JIS G3132 Thickness Tolerances of Hot-Rolled Steel Coils (SPHT1~SPHT3)

Unit：mm

Width(w) / Thickness(t)	w < 1200	1200 ≦ w < 1500	1500 ≦ w < 1800	1800 ≦ w ≦ 1880
t < 1.60	(±0.14)*2	±0.15	±0.16*1	—
1.60 ≦ t < 2.00	±0.16	±0.17	±0.18	±0.21
2.00 ≦ t < 2.50	±0.17	±0.19	±0.21	±0.25
2.50 ≦ t < 3.15	±0.19	±0.21	±0.24	±0.26
3.15 ≦ t < 4.00	±0.21	±0.23	±0.26	±0.27
4.00 ≦ t < 5.00	±0.24	±0.26	±0.28	±0.29
5.00 ≦ t < 6.00	±0.26	±0.28	±0.29	±0.31
6.00 ≦ t < 8.00	±0.29	±0.30	±0.31	±0.35
8.00 ≦ t < 10.0	±0.32	±0.33	±0.34	±0.40
10.0 ≦ t < 12.5	±0.35	±0.36	±0.37	±0.45
12.5 ≦ t ≦ 13.0	±0.38	±0.39	±0.40	±0.50

Remark：1. The above table applies to SPHT1~3 and CSC ACR-TEN grades.
2. Thickness shall be measured at any point 20mm and over inside the edges.
3. The values specified shall not apply to the irregular portions at both ends of steel coils.

Note：*1. The value shall be applied to the steel strip under 1600mm in width.
*2. Values in parentheses mean reference values.

6.2.5 JIS G3132 Thickness Tolerances of Hot-Rolled Steel Coils (SPHT4)

Unit：mm

Thickness (t) \ Width(w)	w < 1200	1200 ≦ w < 1500	1500 ≦ w < 1800	1800 ≦ w ≦ 1880
t < 1.60	(±0.14) *2	±0.15	±0.16*1	—
1.60 ≦ t < 2.00	±0.16	±0.19	±0.20	—
2.00 ≦ t < 2.50	±0.18	±0.22	±0.23	±0.25
2.50 ≦ t < 3.15	±0.20	±0.24	±0.26	±0.29
3.15 ≦ t < 4.00	±0.23	±0.26	±0.28	±0.30
4.00 ≦ t < 5.00	±0.26	±0.29	±0.31	±0.32
5.00 ≦ t < 6.00	±0.29	±0.31	±0.32	±0.34
6.00 ≦ t < 8.00	±0.32	±0.33	±0.34	±0.38
8.00 ≦ t < 10.0	±0.35	±0.36	±0.37	±0.44
10.0 ≦ t < 12.5	±0.38	±0.40	±0.41	±0.49
12.5 ≦ t ≦ 13.0	±0.41	±0.44	±0.45	±0.54

Remark：1. The above table applies to SPHT4 and CSC ACR-TEN grades.
2. Thickness shall be measured at any point 20mm and over inside the edges.
3. The values specified shall not apply to the irregular portions at both ends of steel coils.

Note：*1. The value shall be applied to the steel strip under 1600mm in width.
*2. Values in parentheses mean reference values.

6.2.6 JIS G3134 Thickness Tolerances of Hot-Rolled High Strength Steel Sheets with Improved for Formability for Automobile Structural Uses

Unit：mm

Thickness (t) \ Width(w)	w < 1200	1200 ≦ w < 1500	1500 ≦ w < 1800	1800 ≦ w ≦ 1880
1.60 ≦ t < 2.00	±0.16	±0.19	±0.20*1	—
2.00 ≦ t < 2.50	±0.18	±0.22	±0.23*1	—
2.50 ≦ t < 3.15	±0.20	±0.24	±0.26*1	—
3.15 ≦ t < 4.00	±0.23	±0.26	±0.28	±0.30
4.00 ≦ t < 5.00	±0.26	±0.29	±0.31	±0.32
5.00 ≦ t < 6.00	±0.29	±0.31	±0.32	±0.34
t = 6.00	±0.32	±0.33	±0.34	±0.38

Remark：1. The positions where the thickness is to be measured shall be as follows:
(A) For mill-edged products, any point 25mm and over inward from the edges.
(B) For cut-edged products, any point 15mm and over inward from the edges.
2. The values specified shall not apply to the irregular portions at both ends of steel coils.

Note：*1. The values are applicable to the steel sheets and coils under 1600 mm in width.

6.2.7 JIS G3136 Thickness Tolerances of Rolled Steel for Building Structure

Unit：mm

Thickness (t) \ Width(w)	w < 1600	1600 ≦ w ≦ 1880
6.00 ≦ t < 6.30	+0.70 -0.30	+0.90 -0.30
6.30 ≦ t < 10.0	+0.80 -0.30	+1.00 -0.30
10.0 ≦ t < 16.0	+0.80 -0.30	+1.00 -0.30

Remark：1. The above table applies to SN400A,SN400B,and SN490B grades.
2. The positions where the thickness is to be measured shall be as follows:
(A) For mill-edged products, any point 25mm and over inward from the edges.
(B) For cut-edged products, any point 15mm and over inward from the edges.

6.2.8 JIS G3193 Thickness Tolerances of Hot-Rolled Steel Plates, Sheets and Coils

Unit：mm

Thickness (t) \ Width(w)	w < 1600	1600 ≦ w ≦ 1880
t < 1.25	± 0.16	—
1.25 ≦ t < 1.60	± 0.18	—
1.60 ≦ t < 2.00	± 0.19	± 0.23
2.00 ≦ t < 2.50	± 0.20	± 0.25
2.50 ≦ t < 3.15	± 0.22	± 0.29
3.15 ≦ t < 4.00	± 0.24	± 0.34
4.00 ≦ t < 5.00	± 0.45	± 0.55
5.00 ≦ t < 6.30	± 0.50	± 0.60
6.30 ≦ t < 10.0	± 0.55	± 0.65
10.0 ≦ t < 16.0	± 0.55	± 0.65
16.0 ≦ t ≦ 20.0	± 0.65	± 0.75

Remark：1. The above table applies to SS,SM,SCM,SPA-H, and SXXC grades.
2. The positions where the thickness is to be measured shall be as follows：
(A) For mill-edged products, any point 25mm and over inward from the edges.
(B) For cut-edged products, any point 15mm and over inward from the edges.
3. Tolerance given in the table may be limited to either plus side or minus side upon the agreement between the purchaser and the supplier. The total tolerance range in this case shall be equal to that given in this table.

6.2.9 JIS G3193 Width Tolerances of Hot-Rolled Steel Plates, Sheets and Coils

Unit：mm

Width (w)	Thickness (t)	Tolerance			
		Mill edge		Cut edge（by ordinary cutting）	
		max.	min.	max.	min.
630 ≦ w < 1000	1.20 ≦ t < 20.0	25	0	10	0
1000 ≦ w < 1250	t < 6.00	30	0	10	0
	6.00 ≦ t < 20.0			15	
1250 ≦ w < 1600	t < 6.00	35	0	10	0
	6.00 ≦ t < 20.0			15	
1600 ≦ w ≦ 1880	t < 6.00	40	0	10	0
	6.00 ≦ t < 20.0			20	

6.2.10 JIS G3193 Length Tolerances of Hot-Rolled Steel Plates and Sheets

Unit：mm

Length（L）	Tolerances	
	by ordinary cutting	
	max.	min.
L < 4000	20	0
4000 ≦ L < 6000	30	0
6000 ≦ L < 8000	40	0

6.2.11 JIS G3193 Camber Tolerances of Hot-Rolled Steel Strip, Plate and Sheet

Unit：mm

Width (w)	Maximum value
250 ≦ w	5 in any 2000 length

The maximum value of camber of the steel plate and sheet shall be 0.2% or under of the length of the steel plate and sheet.

6.2.12 JIS G3193 Maximum Flatness of Hot-Rolled Steel Plates and Sheets

Unit：mm

Thickness (t) \ Width (w)	w < 1250	1250 ≦ w < 1600	1600 ≦ w ≦ 1880
t < 1.60	18 max.	20 max.	—
1.60 ≦ t < 3.15	16 max.	18 max.	20 max.
3.15 ≦ t < 4.00	16 max.		
4.00 ≦ t < 5.00	14 max.		
5.00 ≦ t < 8.00	13 max.		
8.00 ≦ t < 15.00	12 max.		

Remark：1. The table is not applicable by the plate and sheet leveling done after leveling machine.
2. Values in this table shall be applied to any 2000 mm length. For the steel plate and sheet under 2000 mm in length, the values shall be applied to the full length. For the steel plate and sheet over 2000 mm in wave pitch, the values in this table shall be applied to any pitch of the wave. For those over 4000 mm in wave pitch, however, the above values shall be applied to any 4000 mm lebgth.
3. Unless otherwise specified, 1.5 times the maximum deviation from flatness specified in this table shall be applied to the steel plate and sheet of which the lower limit of yield point or proof strength in tensile test is at least 460N/mm2, or chemical position on hardness is equivalent thereto, or quenched and tempered.
4. Measurement of flatness, as a rule, shall be made on a flat surface plate.
5. The table does not apply to rolled edge (mill edge) steel plate.
6. This table also applies to CSC ACR-TEN .

6.2.13 The Applicable Size Ranges of ASTM A6,A568 and A635

Unit：mm

Thickness (t) \ Width (w)	720 ≦ w < 1220	1220 ≦ w ≦ 1650
1.2 ≦ t < 4.58	coil：A568 sheet：A568	
4.58 ≦ t < 5.85		coil：A635 plate：A6
5.85 ≦ t ≦ 12.7		

Remark：1. A568 applies to A1011 specifications.
2. A635 applies to the heavy thickness coils of A1011, A1018 specifications.
3. A6 applies to A36 and A1011,A1018 specifications.

6.2.14 ASTM A568 Thickness Tolerances of Hot-Rolled Steel Sheets and Coils (Carbon Steel)

Unit：mm

Thickness (t) \ Width (w)	508 ≦ w < 1016	1016 ≦ w < 1220	1220 ≦ w < 1524	1524 ≦ w < 1829	1829 ≦ w
1.2 ≦ t < 1.30	±0.10	±0.10	—	—	—
1.30 ≦ t < 1.45	±0.10	±0.11	±0.11	±0.12	—
1.45 ≦ t < 1.81	±0.11	±0.11	±0.12	±0.12	—
1.81 ≦ t < 2.49	±0.12	±0.12	±0.12	±0.15	±0.15
2.49 ≦ t < 4.58	±0.12	±0.15	±0.15	±0.15	±0.15
4.58 ≦ t ≦ 5.84	±0.15	±0.17	±0.19	±0.20	±0.22

Remark：1. The above table applies to ASTM A1011 specifications.
2. The values in the above table are converted from inch-pound units.
3. Thickness shall be measured at any point across the width not less than 9.5mm from a cut edge and not less than 19mm from a mill edge.
4. The above table does not apply to the uncropped ends of mill-edged coils.

6.2.15 ASTM A568 Thickness Tolerances of Hot-Rolled Steel Sheets and Coils (High-Strength Low-Alloy Steel)

Unit：mm

Thickness(t) \ Width(w)	509 ≦ w < 813	813 ≦ w < 1017	1017 ≦ w < 1220	1220 ≦ w < 1525	1525 ≦ w < 1830	1830 ≦ w ≦ 2032
1.20 ≦ t < 1.30	±0.11	±0.11	±0.11	—	—	—
1.30 ≦ t < 1.50	±0.11	±0.11	±0.12	±0.12	—	—
1.50 ≦ t < 1.78	±0.12	±0.12	±0.12	±0.12	±0.15	—
1.78 ≦ t < 2.09	±0.12	±0.12	±0.12	±0.12	±0.15	±0.15
2.09 ≦ t < 2.49	±0.12	±0.15	±0.15	±0.15	±0.17	±0.17
2.49 ≦ t < 4.58	±0.15	±0.15	±0.19	±0.19	±0.20	±0.22
4.58 ≦ t ≦ 5.84	±0.17	±0.17	±0.19	±0.19	±0.20	±0.22

Remark：1. The above table applies to ASTM A1011 specifications.
2. The values in the above table are converted from inch-pound units.
3. Thickness shall be measured at any point across the width not less than 9.5mm from a cut edge and not less than 19mm from a mill edge.
4. The above table does not apply to the uncropped ends of mill-edged coils.

6.2.16 ASTM A568 Width Tolerances of Hot-Rolled Steel Sheets and Coils

Unit：mm

Width(w)	Tolerance		
	Mill edge		Cut Edge
	Carbon Steel	High-Strength Low-Alloy Steel	
720 ≦ w < 763	+ 23 − 0	+ 28 − 0	+ 3.1 − 0
763 ≦ w < 890	+ 28 − 0	+ 28 − 0	+ 4.7 − 0
890 ≦ w < 1220	+ 28 − 0	+ 31 − 0	+ 4.7 − 0
1220 ≦ w < 1270	+ 28 − 0	+ 31 − 0	+ 6.3 − 0
1270 ≦ w < 1525	+ 38 − 0	+ 38 − 0	+ 6.3 − 0
1525 ≦ w < 1651	+ 38 − 0	+ 41 − 0	+ 7.9 − 0
1651 ≦ w < 1778	+ 38 − 0	+ 44 − 0	+ 7.9 − 0
1778 ≦ w ≦ 1981	+ 38 − 0	+ 47 − 0	+ 7.9 − 0

Remark：1. The above table applies to ASTM A1011 specifications.
2. The values in the above table are converted from inch-pound units.
3. The above table does not apply to the uncropped ends of mill-edged coils.

6.2.17 ASTM A568 Length Tolerances of Hot-Rolled Steel Sheets

Unit : mm

Length(L)	763 ≦ L < 1525	1525 ≦ L < 3049	3049 ≦ L < 3963	3963 ≦ L < 4877	4877 ≦ L < 6096	6096 ≦ L
Tolerance	+ 12.7 − 0	+ 19.0 − 0	+ 25.4 − 0	+ 31.7 − 0	+ 38.1 − 0	+ 44.4 − 0

Remark : 1. The above table applies to A1011 specifications.
2. The values in the above table are converted from inch-pound units.

6.2.18 ASTM A635 Thickness Tolerances of Hot-Rolled Steel Sheets

Unit : mm

Thickness(t) \ Width(w)	509 ≦ w < 1017	1017 ≦ w < 1220	1220 ≦ w < 1525	1525 ≦ w < 1830	1830 ≦ w
5.84 ≦ t < 7.96	± 0.20	± 0.22	± 0.22	± 0.25	± 0.27
7.96 ≦ t < 9.53	± 0.22	± 0.25	± 0.26	± 0.27	± 0.30
9.53 ≦ t ≦ 12.7	± 0.26	± 0.26	± 0.27	± 0.30	± 0.34

Remark : 1. The above table applies to ASTM A1011 and A1018 specifications.
2. The values in the above table are converted from inch-pound units.
3. Thickness shall be measured at any point across the width not less than 15.875 mm from a cut-edge and not less than 25.4 mm from a mill-edge.
4. The above table does not apply to the uncropped ends of mill-edged coils.

6.2.19 ASTM A635 Width Tolerances of Hot-Rolled Heavy-Thickness Carbon Steel Coils

Unit : mm

Width(w)	Tolerance	
	Mill Edge	Cut Edge
720 ≦ w < 763	+ 28 − 0	+ 3.1 − 0
763 ≦ w < 890		+ 4.7 − 0
890 ≦ w < 1220	+ 31 − 0	
1220 ≦ w < 1271		+ 6.3 − 0
1271 ≦ w < 1525	+38 − 0	
1525 ≦ w < 1652	+ 41 − 0	+ 7.9 − 0
1652 ≦ w < 1779	+ 44 − 0	
1779 ≦ w ≦ 2032	+ 47 − 0	

Remark : 1. The above table applies to A1011 and A1018 specifications.
2. The values in the above table are converted from inch-pound units.
3. The above table does not apply to the uncropped ends of mill-edged coils.

6.2.20 ASTM A36 Thickness Tolerances of Hot-Rolled Steel Plates

Unit：mm

Thickness(t) \ Width(w)	720 ≦ w ≦ 2132
t ≦ 25.4	+ 0.76 − 0.25

Remark：1. The above table applies to ASTM A36 and A1011 specifications.
2. The values in the above table are converted from inch-pound units-
3. Thickness shall be measured at any point across the width 9.5 to 20 mm from the longitudinal edge .
4. For thickness measured at any location other than that specified in remark 3,the permissible maximum over tolerance shall be increased by 75%.

6.2.21 ASTM A6 Width and Length Tolerances of Hot-Rolled Steel Plates

Unit：mm

Length (L)	Width(w)	Width Tolerance			Length Tolerance	
		Mill Edge	Cut Edge			
			t < 9.53	9.53 ≦ t ≦ 15.87	t < 9.53	9.53 ≦ t ≦ 15.87
762 ≦ L < 3048	720 ≦ w < 889	+ 28 0	+ 9 − 6	+ 11 − 6	+ 12 − 6	+ 15 − 6
	889 ≦ w < 1270	+ 31 0				
	1270 ≦ w < 1524	+ 38 0				
	1524 ≦ w < 1651	+ 41 0	+ 11 − 6	+ 12 − 6	+ 15 − 6	+ 17 − 6
	1651 ≦ w < 1778	+ 44 0				
	1778 ≦ w ≦ 2031	+ 47 0				
3048 ≦ L < 6096	720 ≦ w < 889	+ 28 0	+ 9 − 6	+ 12 − 6	+ 19 − 6	+ 22 − 6
	889 ≦ w < 1270	+ 31 0				
	1270 ≦ w < 1524	+ 38 0				
	1524 ≦ w < 1651	+ 41 0	+ 12 − 6	+ 15 − 6		
	1651 ≦ w < 1778	+ 44 0				
	1778 ≦ w ≦ 2031	+ 47 0				
6096 ≦ L ≦ 7620	720 ≦ w < 889	+ 28 0	+ 9 − 6	+ 12 − 6	+ 25 − 6	+ 28 − 6
	889 ≦ w < 1270	+ 31 0				
	1270 ≦ w < 1524	+ 38 0				
	1524 ≦ w < 1651	+ 41 0	+ 12 − 6	+ 15 − 6		
	1651 ≦ w < 1778	+ 44 0				
	1778 ≦ w ≦ 2031	+ 47 0				

Remark：1. The above table applies to ASTM A36 specification.
2. The values in the above table are converted from inch-pound units.
3. " t" is the thickness of material.

7.1 Product Types and Mass Range

Item	Product Type	Mass Range
Plate and Sheet	HR Plate and Sheet, Mill Edge	2 ~5 t ／ Pack
	HR Plate and Sheet, Cut Edge[1]	
Coil	HR Coil, Mill edge	6~33 t ／ Coil
	HR Coil, Pickled and Oiled, Mill Edge	5.3~30 t ／ Coil
	HR Coi, Pickled and Oiled, Cut Edge[1]	5.3~30 t ／ Coil
	HR Coil, Pickled and Annealed-Spheroidized, Cut Edge	5.3~30 t ／ Coil
	HR Coil, Pickled and Annealed, Cut Edge	5.3~30 t ／ Coil
	HR Band	6~33 t ／ Coil

Note：These product types will be produced when a customer has no special requirements.

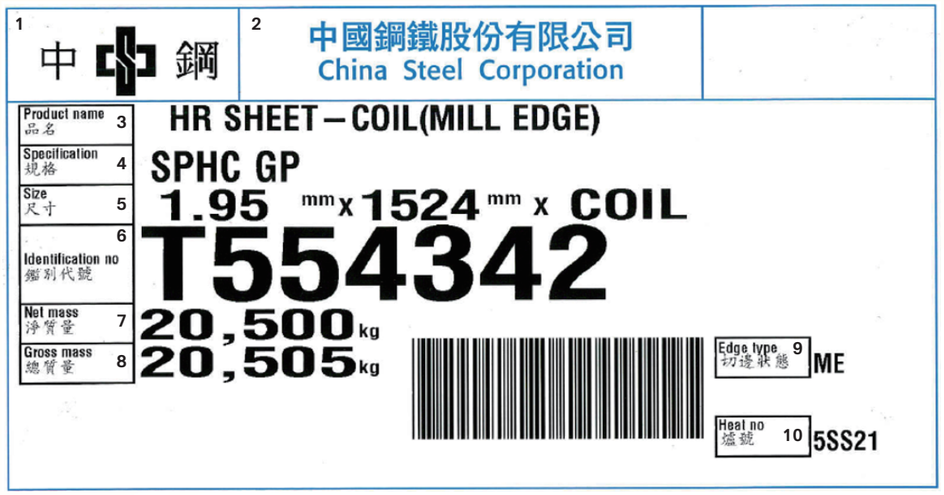
7.2 Available Sizes

Unit : mm

HR Product	Thickness Range	Mill Edge	Cut Edge	Length Range/ Inside Diameter
Sheet	1.20~5.99	—	860~1545	760~6096
Plate	6.00~12.7		860~1524	1500~7620
Coil	1.20~6.50	720~1855	—	Inside Diameter 762
	6.51~7.99	850~1560		
	8.00~9.50	850~1250		
Pickled and Oiled Coil	1.30~6.50	760~1575	785~1575	Inside Diameter 610
Band	2.00~10.0	740~1855	—	Inside Diameter 762
	10.01~20.0	740~1560		
Pickled and Annealed	2.0~6.5	—	785~1550	Inside Diameter 610
Pickled and Annealed-Spheroidized	2.0~6.5	—	785~1550	Inside Diameter 610

Note：The table as a reference only, Actual available size table of Steel grades and products will published by the China Steel.

8.1 Marking for Hot Rolled steel

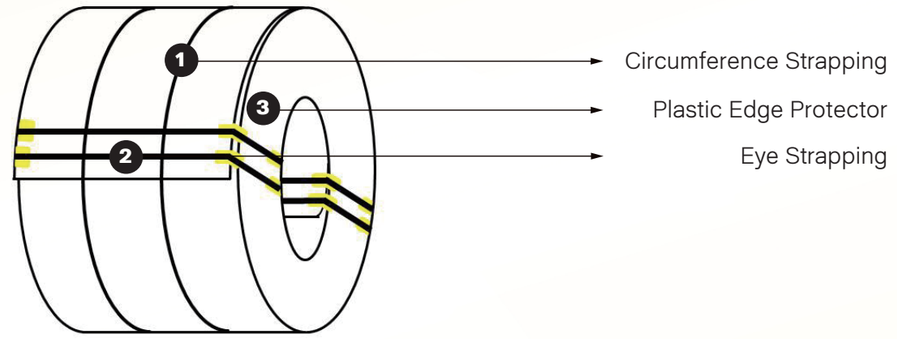


Label for hot rolled coil/ PO coil

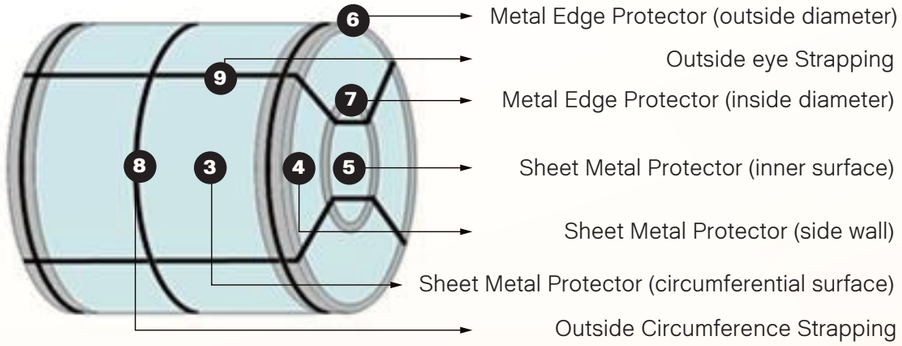
Making Item	
1	CSC logo
2	CSC name
3	Product name
4	Specification
5	Size
6	Identification no
7	Net mass
8	Gross mass
9	Edge type
10	Heat no

8.2 Packing for Hot Rolled steel

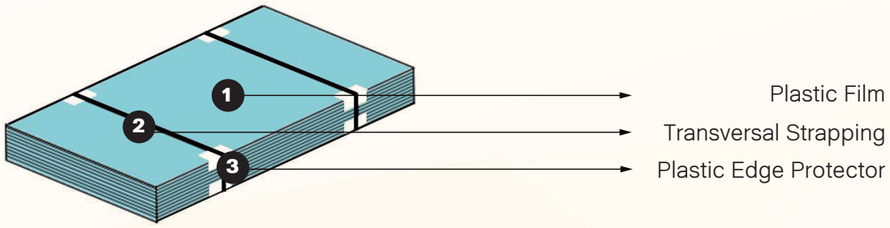
Hot rolled coil



Hot rolled PO coil



Hot rolled sheet



9.1 Surface Quality Control

The surface quality controls for hot rolled products when producing are based on the requirements of downstream uses. Such controls are roughly classified as Un-Exposed (UE), General Propose (GP), and General Exposed (GE), as shown in Table 1.

Table 1. Hot rolling surface, quality and suitable applications recommended

Class	Application
GE (General Exposed)	Bicycle parts,Elevator panel, Brake backing plate, ERW pipe for electro-coating, Ceiling fan parts, Jack(electrostatic coated), Automobile backing parts, Oil drum mouth,Motorcycle,Sprocket(Cr-Coating), Wheel Dick And Wheel Rim (Electrical Galvanized Or Electrostatic Coated), bumpers.
GP (General Purposes)	Bicycle Gear Hanger,Jack, Square Pipe,Compressor Case, Motorcycle Tube, Drawing Tube, Tubes For Automobile Cushion, Automobile Parts, Automobile Rear Axle, Drive Shaft, Boiler Parts,Water Stop Of Slurry Wall For Lng Tank,Oil Drum, Oil Tank, Gardening Tool,Gas Cylinder,Hand Tool －Sxxc, Cold Re-Rolling, Warehouse, Non-Expanded Welded Line Pipe, Speaker Washer,Free Wheel For Motorcycle, Bicycle Tube ,Container Trailer Chassis、Container ,Locking Rod , Wheel Dick Or Wheel Rim (For Painting)
UE (Unexposed)	Container,Angle Plate,Tubes For Structural Use,Chain Plate,Black Or Hot-Dipped Erw Pipe,Chain,Retaining Wall,Spiral Pipe,Fence Parts －Sc,Guardrail Of Highway,Dust Tube For Thermal Power Plant,Chain Plate(Re-Rolling).

9.2 Hardness profile along steel strip

After rolling and coiling, hot rolling strip will be gradually cooling down under room temperature. Due to the cooling rate of coil outer side is faster than inner side, the hardness of head and tail will be a fraction harder. Along the width direction, side part will be a fraction harder than central part.

9.3 Formability

Formability is based on hardness, metallographic structure, cleanness of the steel. Furthermore, most steel are prone to orientation, such as bending work, cracking will happen more when bending axis is parallel with coil rolling direction (longitude direction). On the other hand, bending work will be more successful when bending axis is vertical with longitude direction. Common physical characteristics of mechanical property and influence on formability of steel are listed in Table.2.

Table 2. Common physical characteristics of mechanical property and influence on formability of steel

Item	Physical characteristics	Influence
Yield Strength	Difficulty to do plastic deformation	YS ↘ Formability ↗
Tensile Strength	Difficulty for cracking happen	–
Elongation	The elongation from deformation to cracking	EL ↗ Formability ↗
Yield Ratio	Difficulty to do working and rebounding	YS/TS ↘ Formability ↗
Hardness	Hardness of steel strip	HR ↘ Formability ↗ (not absolutely)
Hole Expansion Ratio	The degree of expansion or flanging	HE ↗ Edge Formability ↗

9.4 Classification and Purpose of quality

Table 3. List of classification, spec, property and purpose of hot-rolled product.

Classification	Common Spec	Property and purpose
Commercial Quality (CQ)	JIS G3131 SPHC SAE 1008 ～ 1023 CQ	Appropriate for normal forming, bending, welding, such as water pipe, electric wire pipe, parts with non strength demand, cover…etc. ◦
Drawing Quality (DQ)	JIS G3131 SPHD JSH 270D 270E SAE 1006 ～ 1008 DQ	Appropriate for drawing work or forming, such as bicycle bead, handle grip, 5-way pipe…etc.
Structure Quality (SQ)	SS400、SS490、SM400、SM490、ASTM A36	Appropriate for simple bending work, welding and rivet joint with strength demand, such as ship hull, bridge, scaffold…etc.
Automobile Structure Quality (ASQ)	JIS G3113 SAPH310、SAPH370、SAPH400、SAPH440、SPFH590、CSC HM-690T，JSH780R CSC HM440T FB、HM590T FB、HM620T FB、HM750T FB	Appropriate for automobile parts, with strict inner quality and forming demand, normally used for automobile wheel rim, suspension system, chassis beam, brake back panel…etc.
Corrosion Resistance Steel Quality (CRSQ)	JIS G3125 SPAH， CSC ACR-TEN A、ACR-TEN AF	Adding elements like Cu, Cr, P, makes steel forming protective oxidizing firm, to avoid corrosion. Commonly used for container, rail car, bridge…etc.
Pressure Vessel Quality (PVQ)	JIS G3116 SG255、SG295 ASTM A516 GR60、70	Emphasizes strength, welding, formability, and strict inner quality. Some demand low toughness. Commonly used for steel gas cylinder and other pressure vessel.
Line Pipe Steel (LPSQ)	API 5L GR.B、X42、X52、X60	Strength, low temperature toughness, welding, formability, inner quality are all strictly demanded. Mainly used for gasoline, gas vapor, liquid transportation.
Mechanical Structure Quality (MSQ)	JIS S35C、S45C、S50C、SCM415 ～ SCM435，SAE 4130、1552 CSC 50BV30、CSC HC 15B36、SAE 1074、CSC HC1085、SK95	When such steel is manufactured as parts, it needs to do some heat treatment such as annealing, quenching, tempering by property, to raise and stabilize strength and hardness of the parts. Commonly used for gardening tool, chain plate, hand pull device…etc.
Re-Rolling Quality (RRQ)	SAE1006 RRQ ～ SAE1022 RRQ	Such steel is designed according to customer quality demand and process ability. It can be produced to cold rolling steel, galvanizing steel, color steel.

9.5 Common steel grade classify by strength

Table 4. Common HR steel grade classify by strength

T.S.(kg/mm^2)	30	35	40	45	50/55	60
Commercial Quality (CQ)	SPHC SAE1006 CQ SAE1008 CQ SAE1010 CQ ASTM A569	SAE1012	SAE1015 ～ SAE1019	SAE1020 ～ SAE1023	SAE1025	
Drawing Quality (DQ)	SPHD、SPHE JSH270D SAE1006 DQ SAE1008 DQ ASTM A621					
Structure Quality (SQ)	SAE1010 CQ SPHT1	SPHT2 SS330 A470 GR.30 A570 GR.33 A570 GR.36	SPHT3 SS400 SM400 ASTM A36 A570 GR.40 A570 GR.45	A570 GR.50 A570 GR.55	SPHT4 SS490 SS540 SM490A SM490YA	
Automobile Structure Quality (ASQ)	SAPH310	SAPH370	SAPH400	SAPH440	SPFH540	SPFH590
Corrosion Resistance Steel Quality (CRSQ)			ACR-TEN AF		ACR-TEN A SPA-H	
Pressure Vessel Quality (PVQ)			SG255	SG295	SG325、365	
Line Pipe Steel (LPS)		API 5L GR.A	API 5L GR.B API 5L X42	API 5L X46	API 5L X52 API 5L X56	API 5L X60 API 5L X65
Re-Rolling Quality (RRQ)	SAE1006 、 SAE1010 RRQ	SAE1012 RRQ	SAE1017 RRQ		S35C RRQ S40C RRQ	S45C RRQ S50C RRQ
Mechanical Structure Quality (MSQ)					S35C S40C S45C	SAE1045 ～ 1060 S45C、S50C SAE4130

9.6 Quality Notification

1. HR red rust (Tiger Mark)-When HR product have Si above 0.08%, there will be red rust (Tiger Mark) on the surface. Consider some grounding treatment before using.
2. Chemical property guarantee: The chemical property guarantee value stipulated by CSC and international standards is based on liquid steel analysis. There is a tolerance compared with the analysis of finished products. Please refer to the tolerance range according to international standards, such as JIS G0321, SAE J409 and ASTM A6.
3. Selection of thickness tolerance-Attention should be given to cut edge or mill edge. Though it match ordering spec tolerance, thinner side parts will still influence usage.
4. Damp caused by huge temperature difference (rust caused by fog)-Non-packing steel should watch out its storage environment and temperature variation, to avoid moisture.

9.7 Potential Safety Hazards

1. If the sides of HR products have rough or saw edge, they will have the potential dangers of scratching hands.
2. If hot-rolled products have poor roll shape or insufficient steel banding, there will be a potential risk of falling or rebounding to injure people during lifting or storage.
3. If HR products have defects such as sliver, lamination or hole, they will have the potential dangers of strip break to collide with machine or hurt people when slitting to make pipes or re-rolling.
4. HR product has potential dangers of break.
5. If oiled HR plates are not packed with steel straps, they will have the potential dangers of falling down when lifting or storing.
6. It will have the potential dangers of springing open to hurt people when their steel straps are being cut.

10. Conversion Tables

Length			
ft	in.	mm	m
1	12	3.048×10^{2}	3.048×10^{-1}
8.333×10^{-2}	1	2.54×10^{1}	2.54×10^{-2}
3.281×10^{-3}	3.937×10^{-2}	1	1×10^{3}

Weight	Force
1kg=2.20462 lb	1kgf=9.80665 N

Stress			
ksi（=1000psi）	psi	kgf/mm^2	N/mm^2(MPa)
1	1×10^{3}	7.0307×10^{-1}	6.89476
1×10^{-3}	1	7.0307×10^{-4}	6.89476×10^{-3}
1.42233	1.42233×10^{3}	1	9.80665
1.45038×10^{-1}	1.45038×10^{2}	1.01972×10^{-1}	1

Absorbed Energy		
ft-lbf	kgf-m	N-m（J）
1	1.38255×10^{-1}	1.35582
7.23301	1	9.80665
7.37562×10^{-1}	1.01972×10^{-1}	1

Steel Type		JIS	JFS	EN	ASTM	SAE
Commercial and drawing steel	CQ	G3131 SPHC	A1001 JSH270C	10111 DD11	A1011 CS	J2329 HR1
	DQ	G3131 SPHD	A1001 JSH270D	10111 DD12	A1011 DS	J2329 HR2
	DDQ	G3131 SPHE	A1001 JSH270E	10111 DD13	-	J2329 HR3
	EDDQ	G3131 SPHF	-	10111 DD14	-	-
Atmospheric Corrosion Resisting Steel		G3125 SPA-H	–	10025-5 S355J0WP	A242	
Steel for Gas Cylinders		G3116 SG295	–	10120 P265NB	A414 GR. B	
Steel for General Structure		G3101 SS400	–	10025-2 S235JR	A36	
High Strength Steel for Automobile Structural Uses		G3134 SPFH490~590	A1001 JSH490~590R/W	10149 S420MC-S550MC	-	J2340 420~550XF
Carbon Steel		G4051 S22C~S55C	-	10083-1 C22E~C55E	-	J403 1022~1050
Cr-Mo Steel		G4053 SCM425~SCM440	-	10083-1 25CrMo4~42CrMo4	-	J404 4130~4140

Note：Not equal between different steel grades, the above table is a comparison table for reference only.

Required Ordering Data				Example
1	Product Name	HR Plate	HR Pickled and Annealed/ Annealed-Spheroidized Coil	HR Coil
		HR Sheet	HR Pickled and Oiled Coil	
		HR Coil	HR Band	
2	Specification and Designation of Grade			JIS G3131 SPHC
3	Cut Edge or Mill Edge			Mill Edge
4	Size (Thickness × width ×Length or Coil)			1.60^{mm} × 1219^{mm} × Coil
5	Inside and Outside Diameter			ID 762^{mm}，OD 1700^{mm}max.
6	Mass	Maximum Mass		10t
		Order Mass		150t
7	Application and Fabricating Methods			Bicycle parts
8	Special Requirements(if Required)			—
9	Certificate Requirements(if Required)			RC12

1. The contents of this catalog are for reference only. Customers are urged to consult the specifications published by the corresponding Associations.
2. Information on the available steel grades, size, marking and packing as shown herein may be updated without notice to comply with actual production situations.
3. we invite you to contact our Head Office should you have any questions concerning steel specifications or ordering requirements.

Phone numbers are listed below for your convenience-Numbers of our international Offices are shown on the back cover.

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Fax	86-21-62896678
E-mail	c00392@csgtsha.com

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Fax	002-81-6-69100851
E-mail	gdwu@csgtjpn.co.jp

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	BARS & WIRE RODS	886-7-8051092	ELECTRICAL STEEL	886-7-8051270
Fax	886-7-8039553			

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