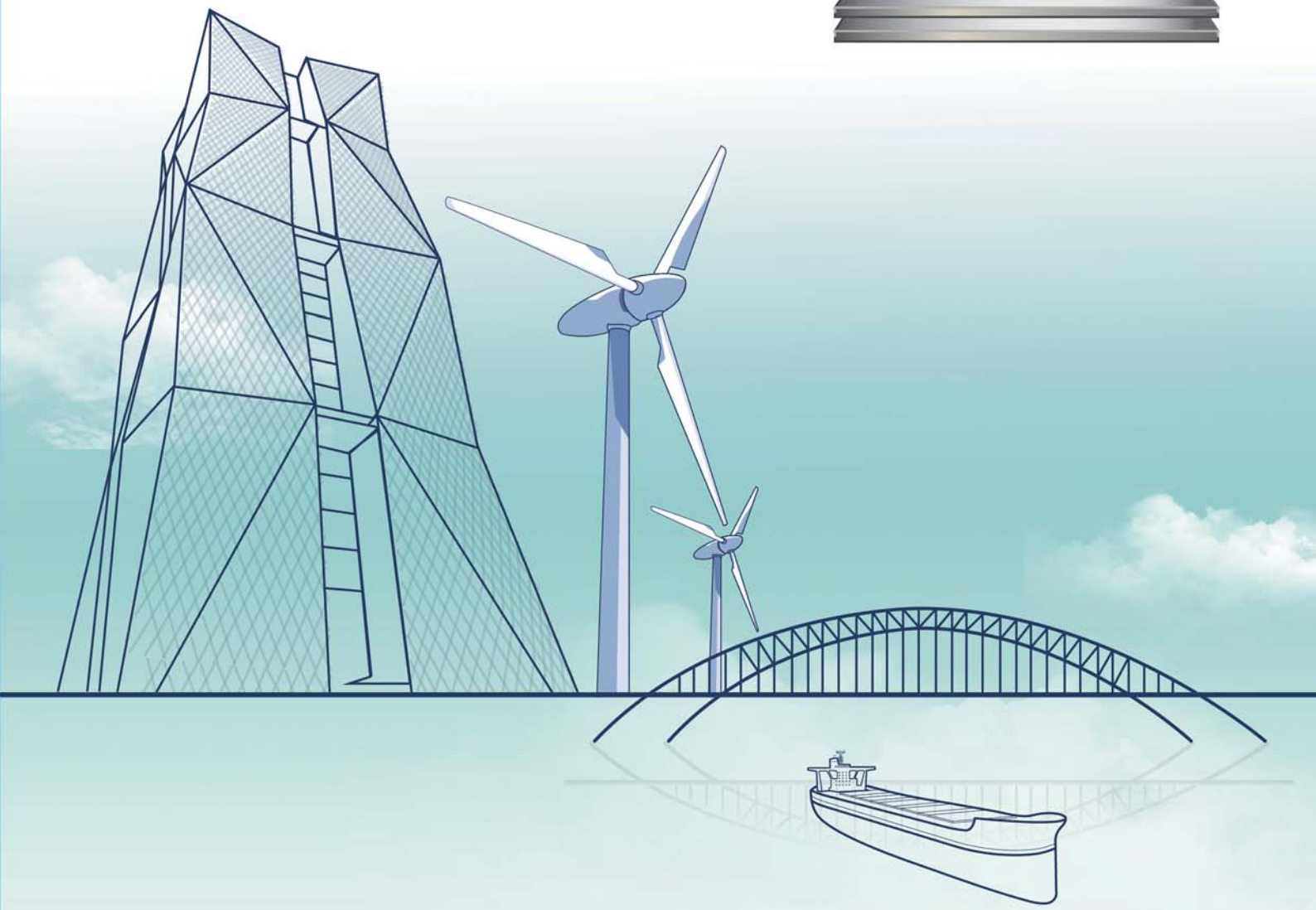
Steel Plate



PRODUCT MANUAL

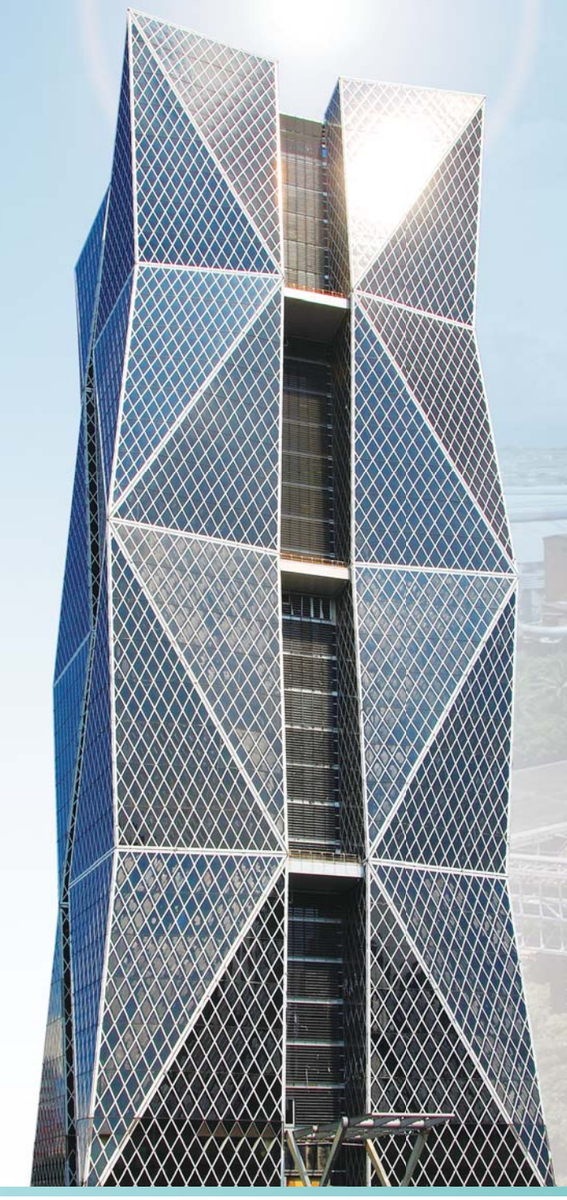
鋼板

CHINA STEEL

CSC GROUP

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.



China Steel Building (Group Headquarters)

CHINASTEEL

CHINASTEEL

China Steel Accelerated Cooling System

A NAME FOR QUALITY,
TECHNOLOGY AND SERVICE

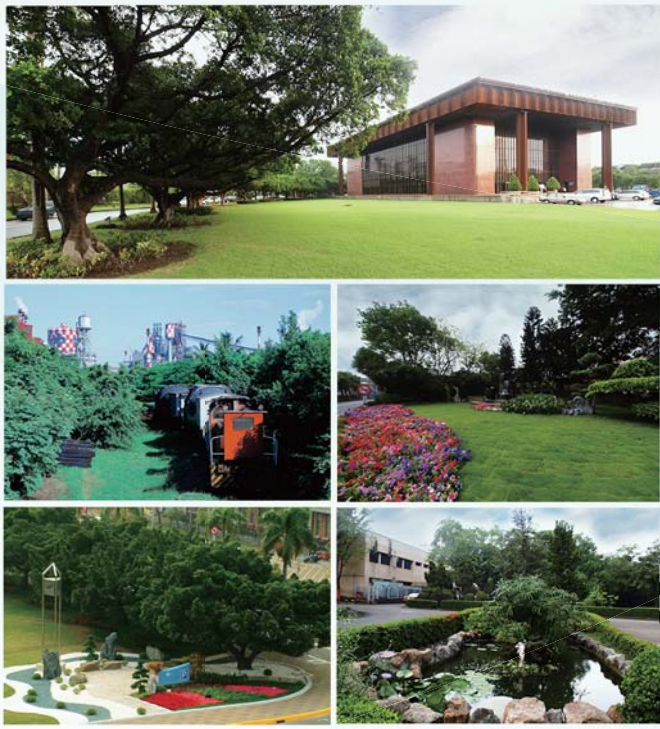
PRODUCT MANUAL

1

BRIEF INTRODUCTION

China Steel Corporation (CSC), located at Kaohsiung, Taiwan was founded in December 1971. With annual capacity (in terms of crude steel) around 10 million tonnes, CSC produces a range of products that includes plates, bars, wire rods, hot and cold rolled coils, electrogalvanized coils, electrical steel coils, hot-dip galvanized coils, and Ti/Ni-base alloy. The domestic market takes roughly 65% of CSC's production and the exports take the remaining 35%. CSC is the largest steel company in Taiwan, enjoying more than 50% of the domestic market. Major export destinations are Mainland China, Japan and Southeast Asia.

CSC is very active in innovation, and has 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 into practice its corporate values of "teamwork, entrepreneurial approach, down-to-earthiness and pursuit of innovation", as well as its operations beliefs of "promotion of social well-being, result orientation, implementation of teamwork, and emphasis on employees' self-realization." CSC keeps deepening the roots for its core business in steel, and devoted to integrate the related downstream industries to foster healthy development and international competitiveness of Taiwan's steel related industry.



Plant Greening

2 PRODUCT AND SERVICE FEATURES

China Steel Corporation (CSC) is an integrated steel producer that has produced steel plates since the commencement of its plate mill. Through developments and improvements over the years, CSC's comprehensive steel plate grades have fulfilled industrial requirements demanded by general structure and building applications such as earthquake resistance, weather resistance, corrosion resistance, fire resistance, bridge and welding, as well as other uses like construction of ships, pressure vessels, line pipes, HIC resistance, laser-cutting, etc.

Much emphasis has placed on product safety standards. As surrounding conditions change, the quality and reliability of the steel become increasingly important. If quality fails, accidents and severe consequences may result. Therefore, besides selecting the proper type of steel plate, it is also crucial for a steel producer to adopt proper design, process equipment, production conditions and quality control demanded by customer's requirements and specifications in order to ensure quality and stability.

CSC's steel plates have been approved by certifications such as ABS, BV, CR, CCS, DNV, GL, KR, LR, NK, ISO 9001, ISO/TS 16949, JIS MARK. They also conform to the regulations of QC080000, RoHS and REACH. 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.

ASTM A841 Gr.B Class2

This grade is a new specification of thermal-mechanical control process (TMCP) steel plates for pressure vessels possessing high yield strength, high charpy V-notch impact absorption energy at low temperature and low carbon content to obtain excellent weldability that are the best used in pressure vessel at low temperature environment (note: heat-treatment temperature during or after fabrications shall not exceed 650℃)

JIS G3101 SS400 -Steel Plates for Laser Cutting

This grade of steel plate has special surface quality to prevent problems from laser cutting such as nozzle blocking or miss-focusing, and providing good cutting quality

CSC LYS100

This grade of steel plate has excellent seismic resistance due to properties of extremely low yield strength and yield ratio that are the best used in steel structural parts of buildings for absorbing elastic potential energy released by earthquake and protect main structure

CSC PZ30H

This grade of chromium and molybdenum steel plate has excellent formability to attain high dimensional & shape accuracy after forming, also possesses excellent wear-resistance, toughness, heat- resistance to prevent abrasion or fracture that are best used in mold

CNS 13812 SN490YB/YC

The yield/tensile strength ratio of this grade of steel plate has been designed below 80% (YS: 325~445 MPa) to absorb maximum elastic potential energy released by earthquake that enables uniform plastic deformation within thickness range of 40.01~ 80.00mm and prevents buildings & constructions from collapsing.

CSC PZ590T

This grade of high strength structural steel plate belongs to the specification of HI-TEN590C group, and possesses very low C, S, P etc elements to obtain excellent weldability and toughness that are the best used in heavy machinery such as forks of power lift truck and dipper buckets of hydraulic shovel.

CSC PH490TB

This grade of structural steel plate possesses characteristics of fire-resistance through effects of alloying elements, and provides feature of yield strength at 600°C (873K) being 2/3 or more of the specified minimum yield strength at room temperature that are the best used in fire-resistant structure of high-rise buildings, factories and laboratories.

CSC SM570M (Building Structure with)

This grade of structural steel plate has higher strength than the general structures of building. Its strengths can be classified into 4 classes (A, B, C and C HW). In addition to excellent weldability, toughness and ultra-high strength, the class of C HW is applicable to high heat input welding that are the best used in structure of high-rise buildings such as Taipei 101 and Taipei Gemini towers.

ASTM A516 HIC (The pressure vessel of Hydrogen Induced Crack resistant)

This grade of steel plate has ultra-low C. P. S. elements, the design of proper alloy and the addition of special process, as well as provides resistance to hydrogen induced cracking (HIC) and controlling crack length ratio (CLR) below 15% that are the best used in those environments with high H_2S.

ABS EH47(Hull plate)

This grade of high-strength steel plate for shipbuilding has low sulfur and low phosphorus composition design and control of rolling mill reductions and accelerated cooling process, high cleanliness, high strength, high toughness, good welding characteristics that are applicable to the hatch coaming hull structure. In 2012, five certificates for these products were approved by the Classification Societies and then CSC provided CSBC with these products for building the large container ships.

4 CERTIFICATION

bsi.

Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO 9001:2008

This is to certify that: China Steel Corporation
1, Chung Kang Road
Hsiao Kang District
Kaohsiung City
81233
Taiwan

中國鋼鐵股份有限公司
臺灣
高雄市
小港區
中鋼路1號
81233

Holds Certificate No: **FM 93912**

and operates a Quality Management System which complies with the requirements of ISO 9001:2008 for the following scope:

The design, development, manufacture and servicing of steel products, including hot-dip galvanized and galvannealed steel coil, steel billet, steel plate, steel bar, steel wire rod, hot rolled steel plate/ coil/ sheet, cold rolled steel coil/ sheet, magnetic steel coil, electrolytic zinc-coated coil and color steel coil; and special alloy products including plate, sheet, bar, wire rod and coil.

For and on behalf of BSI Taiwan:

Gary Fenton, Global Assurance Director

Originally registered: 06/04/2005 Latest Issue: 02/04/2014 Expiry Date: 04/03/2015

Page: 1 of 2

...making excellence a habit."

ISO 9001 Certificate

IEC QUALITY ASSESSMENT SYSTEM (IECQ)
covering Electronic Components, Assemblies, Related Materials and Processes

IECQ Certificate of Conformity
Hazardous Substance Process Management

IECQ Certificate No.: IECQ-H BSI 09.0003 Issue No.: 3 Status: Current
Supersedes: IECQ-H BSI 09.0003 Issue 2 Issue Date: 2014/03/28 Org Issue: 2009/07/26
CB Certificate No.: HS40466 IECQ Issue 3 Expiration: 2015/07/25

Applicable to:
European Directive 2011/65/EU ("RoHS") requirements

China Steel Corporation
1, Chung Kang Road
Hsiao Kang District
Kaohsiung City, 81233
Taiwan

The organization has developed and implemented Hazardous Substance Process Management procedures and related processes which have been assessed and found to comply with the applicable requirements for IECQ HSPM organization approval which is in accordance with the Basic Rules IECQ 01 and Rules of Procedure IECQ 03-5 "IECQ Hazardous Substances Process Management" of the IEC Quality Assessment System for Electronic Components (IECQ), and with respect to the IECQ Specification:

- IECQ QC 080000:2012 - Hazardous Substance Process Management System Requirements

This Certificate is applicable to all electronic components, assemblies, related materials and processes for the following scope of activities:

Design, development, manufacture and servicing of steel products, including Hot-dip galvanized and galvannealed steel coil, steel billet, steel plate, steel bar, steel wire rod, hot rolled steel plate / coil / sheet, cold rolled steel coil / sheet, magnetic steel coil, electrolytic zinc-coated coil, color steel coil and special alloy products including plate, sheet, bar, wire rod and coil

Issued by the Certification Body BSI

Kitemark Court, Davy Avenue
Knowlhill, Milton Keynes MK5 8PP
United Kingdom

Authorized person:
Paul Turner

Sponsoring Member Body

IECQ Certificate

bsi.

Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO/TS 16949:2009

This is to certify that: China Steel Corporation
1, Chung Kang Road
Hsiao Kang District
Kaohsiung City
81233
Taiwan

中國鋼鐵股份有限公司
臺灣
高雄市
小港區
中鋼路1號
81233

Holds Certificate No: **TS 503691**

and operates a Quality Management System which complies with the requirements of ISO/TS 16949:2009 for the following scope:

The design and manufacture of steel products, including hot-dip galvanized and galvannealed steel coil, steel billet, steel plate, steel bar, steel wire rod, hot rolled steel plate/ coil/ sheet, cold rolled steel coil/ sheet, magnetic steel coil, electrolytic zinc-coated coil and color steel coil.

For and on behalf of BSI:

Managing Director BSI Taiwan, Peter Pu

Originally registered: 05/13/2012 Latest Issue: 02/04/2014 Expiry Date: 04/03/2015

IATF Number: 0135732

Page: 1 of 2

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ISO/TS 16949 Certificate

JQA

JIS

JISマーク表示制度
認証書

認証番号　：JQTW07007

認証取得者　：CHINA STEEL CORPORATION
1 CHUNG KANG ROAD, SIAOGANG DISTRICT, KAOHSIUNG, TAIWAN

当機構は、上記認証取得者に係る以下の鉱工業品が日本工業規格及び主務者令で定める基準に適合したことを認証いたします。

鉱工業品の名称	：	鉄鋼製品
認証の区分	：	構造用圧延鋼材
日本工業規格の番号及び名称	：	(1) JIS G 3101 一般構造用圧延鋼材 (2) JIS G 3103 ボイラ及び圧力容器用炭素鋼及びモリブデン鋼鋼板 (3) JIS G 3106 溶接構造用圧延鋼材 (4) JIS G 3136 建築構造用圧延鋼材
規格の種類又は等級（認証の範囲）	：	本認証書の附属書による
製造工場の名称及び所在地	：	CHINA STEEL CORPORATION 1 CHUNG KANG ROAD, SIAOGANG DISTRICT, KAOHSIUNG, TAIWAN
認証に係る法の根拠条項	：	工業標準化法　第２３条第１項
認証契約締結日	：	２００８年３月２７日
有効期限	：	２０１７年３月２６日
上記有効期限を更新するための定期認証維持審査申込期限	：	２０１６年３月３１日

東京都千代田区神田須田町１－２５
一般財団法人　日本品質保証機構
理事長　森本　修

JIS MARK Certificate

NIPPON KAIJI KYOKAI

Approval No. ST38RO
Certificate No. TA13689E

APPROVAL OF MANUFACTURING PROCESS

This is to certify that

China Steel Corporation, Kaohsiung Works
Kaohsiung, Taiwan

has been approved for the manufacturing process of undermentioned materials by the NIPPON KAIJI KYOKAI in accordance with the requirements of 1.2, Part K of the Society's "Rules for the Survey and Construction of Steel Ships" and Chapter 1, Part 1 of the Society's "Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use".

MATERIALS : Rolled Steels for Hull

The details of approval conditions are given in the PARTICULARS OF APPROVAL listed in the reverse of this certificate.

On this effect, the products for the ships classed with the Society are to be manufactured, tested and inspected in compliance with the Rules.

This certificate is valid until 1 June 2018.
Issued at Tokyo on 14 June 2013.

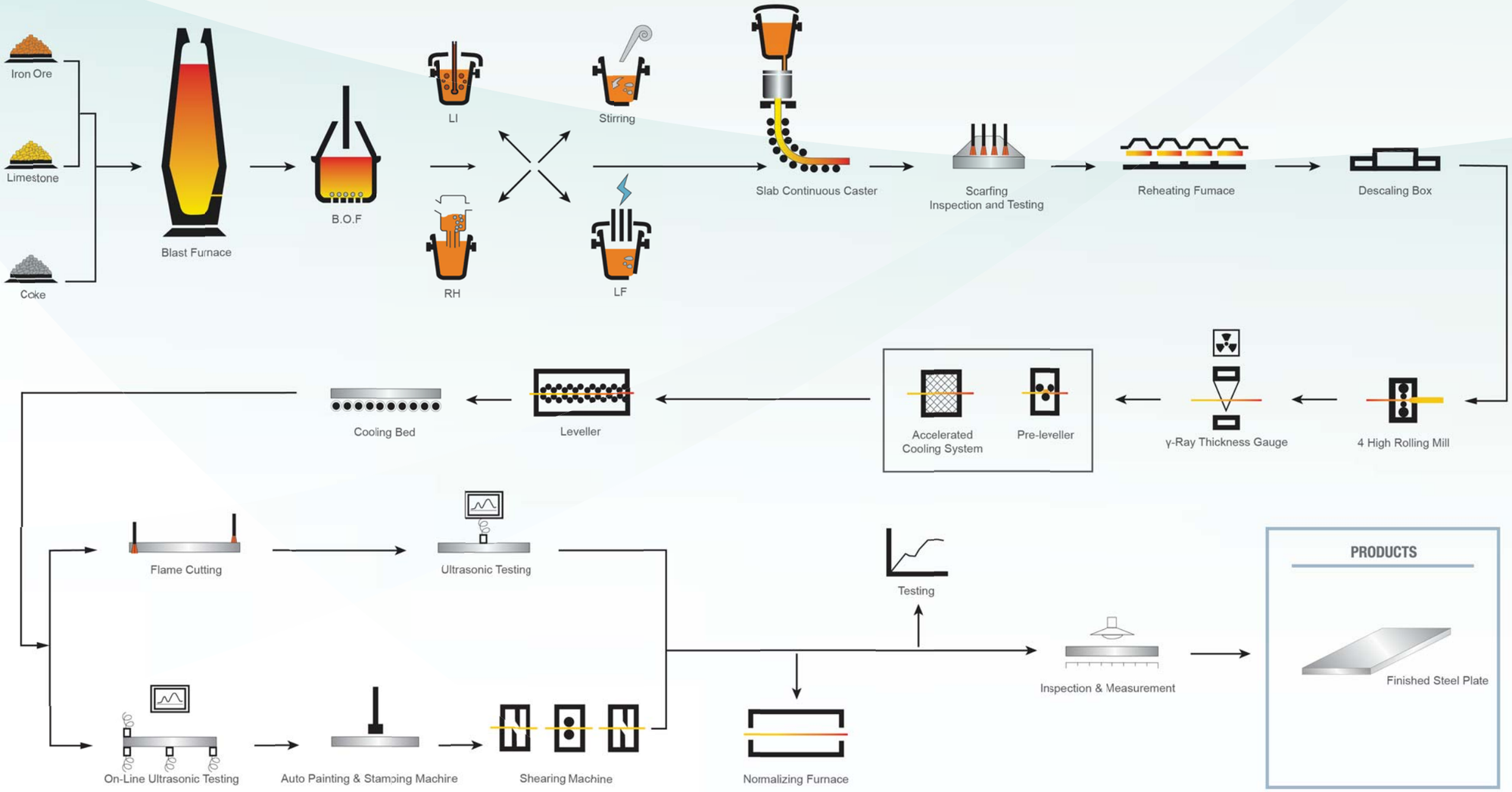
Renewal Date : 2 June 2013

T. Imamura
General Manager
Material and Equipment Department

ClassNK

HULL Certificate

5 MANUFACTURING PROCESS AND MAJOR EQUIPMENTS



Reheating Furnace

Slabs are heated a temperature in a typical range from 1150 to 1270 ℃. Reheating reduces the deformation strength of slabs sufficiently to allow it to be rolled, and ensure that all alloy elements are in solid solution.

4 High Rolling Mill

The rolling process for a plate thus has to achieve the correct dimensions. The device(HAGC,WRB,AWC) is used to obtain excellent dimensional accuracy and uniformity.

Vertical Edger

The addition of an edger and its integrated width control automation package gives more accurate control of the product width and significantly reduces width variations.

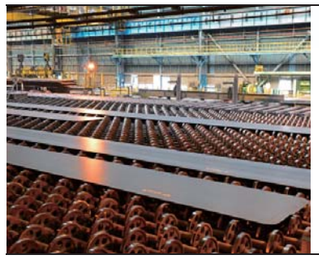
Accelerated Cooling

ACC equipments can be used to realize TMCP process and improve the properties of steel plates. Thermo-mechanical control process(TMCP) is a micro-structural control technique combining controlled rolling and cooling.

Hot Leveller

Leveller is a stress relief process carried out through low and controlled elongation in a multi-roller machine, the plate surface undergoing a series of reverse bends.

Cooling Bed



Plates are finally air cooled as they are transferred across a cooling bed. In special cases, stacking of plates to reduce the cooling rate is employed.

Ultrasonic Testing

Ultrasonic Testing is a form of quality assurance used for ensuring the strength and quality of rolled steel plate.

Hot Painting

Paint printing can be done on the surface of steel plate according to the requirements of customers and standards.

Shearing device

As well as cutting discrete plates to their ordered sizes. The shear-line also extracts test samples which are used to certify the plate properties.

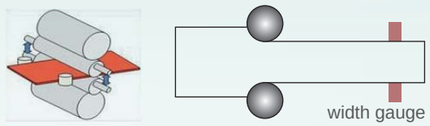
Normalizing furnace

The plates be treated by roller normalizing furnace, which can normalize, temper, anneal and stress-relief.

HAGC (Hydraulic Automatic Gauge Control):

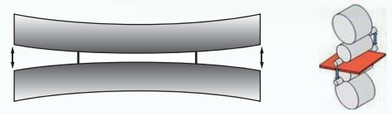
Automatic gauge control(AGC)is a closed loop control function designed to regulate thickness at the exit of the rolling mill stand to increase the thickness accuracy. To make sure that the flat products rolled in the mill are of required uniform thickness within the required tolerance.

AWC (Automatic Width Control):



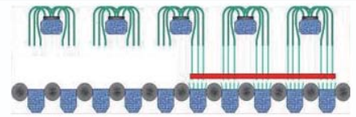
Automatic width control (AWC) can be applied at each edger to provide in-bar width control to increase the width accuracy by adjusting the roll gap. The addition of an edger and its integrated width control automation package gives more accurate control of the product width and significantly reduces width variations.

WRB (Work Roll Bending System):



The crowned roller will only compensate for one set of condition, specifically the material, temperature, and amount of deformation. Work roll bending involves using hydraulic cylinders at the ends of the rolls to counteract roll deflection. To make sure the flatness coming into the mill will be preserved at the exit of the mill.

CSAC (China Steel Accelerated Cooling):



Thermo-mechanical control process (TMCP) is a micro-structural control technique combining controlled rolling and cooling. TMCP is used to obtain excellent properties for steel plants, such as high strength, excellent toughness, and excellent weld-ability.

6 APPLICATION EXAMPLES

6.1 Building Structure

Taipei 101 Building was constructed by using steel SM570M for welded structures.

China Steel Building was constructed by building structure steel SN490B and SN490C.

6.2 Welded Structure

National Stadium of Kaoshiung is constructed by CSC's building structure steel SN490A and high strength structural steel A572 Gr.50.

CSC auditorium was constructed by atmospheric corrosion resistant structural steel A588.

6.3 Hull Construction

Hatch coaming top of the 8000 TEU cargo ship of Evergreen Marine Corporation (Taiwan) was constructed by CSC's EH47 hull plates.

6.4 Bridge Structure

Xinfa bridge, which was donated and constructed by CSC Group, was built by atmospheric corrosion structural steel for bridge A709 Gr.50W.

6.5 Pressure Vessel

Tank truck was made of pressure vessel steel.

6.6 Specialty Usage

One of CSC plant site chimneys was made from corrosion resistant steel SCR-TEN.

7.1 Chemical Compositions and Mechanical Properties

7.1.1 Steel Plates for General Structural Usage

7.1.1.1 JIS G3101-10 Rolled Steels for General Structure

Grade	Thick-ness (t) mm	Chemical Compositions %				Tension Test							
						Yield Point or Yield Strength N/mm²				Tensile Strength N/mm²	Elongation		
						Thickness (t) mm							
		C	Mn	P	S	t ≦ 16	16 < t ≦ 40	40 < t ≦ 100	t > 100		Thickness (t) mm	Test Piece	%
SS330	6 ≦ t ≦ 50	—	—	0.050 max.	0.050 max.	205 min.	195 min.	175 min.	165 min.	330 ~430	6 ≦ t ≦ 16	No.1A	21 min.
											16 < t ≦ 50	No.1A	26 min.
											40 < t	No.4	28 min.
SS400	6 ≦ t ≦ 150					245 min.	235 min.	215 min.	205 min.	400 ~510	6 ≦ t ≦ 16	No.1A	17 min.
											16 < t ≦ 50	No.1A	21 min.
											40 < t	No.4	23 min.
SS490	6 ≦ t ≦ 50					285 min.	275 min.	255 min.	245 min.	490 ~610	6 ≦ t ≦ 16	No.1A	15 min.
											16 < t ≦ 50	No.1A	19 min.
											40 < t	No.4	21 min.
SS540	6 ≦ t ≦ 40	0.30 max.	1.60 max.	0.040 max.	0.040 max.	400 min.	390 min.	—	—	540 min.	6 ≦ t ≦ 16	No.1A	13 min.
											16 < t ≦ 40	No.1A	17 min.

Remark：1. Alloy elements other than those shown in the above table may be added necessary.

2. For the elongation of No.4 test piece for steel plates over 90mm in thickness, it shall be subtracted 1% from the values of elongation per each increase of 25.0mm or its fraction in thickness. However, the limit to be subtracted shall be 3%.

7.1.1.2 JIS G3106-08 Rolled Steels for Welded Structure

Grade	Thick-ness (t) mm	Chemical Compositions %					Tension Test									Impact Test		Test piece
							Yield Point or Yield Strength N/mm²					Tensile Strength N/mm²	Elongation			Test Temp ℃	Charpy Absorbed Energy Average J	
							Thickness (t) mm						Thickness (t) mm	Test Piece	% min			
		C	Si	Mn	P	S	t ≦ 16	16 < t ≦ 40	40 < t ≦ 75	75 < t ≦ 100	100 < t ≦ 160							
SM 400A	t ≦ 50	0.23 max.	—	2.5 ×C min.	0.035 max.	0.035 max.	245 min.	235 min.	215 min.	215 min.	205 min.	400~ 510	6 ≦ t ≦ 16	No.1A	18	—	—	Parallel to rolling direction
	50 < t ≦ 90	0.25 max.																
SM 400B	t ≦ 50	0.20 max.	0.35 max.	0.60~ 1.40									16 < t ≦ 50	No.1A	22	0	27 min.	
	50 < t ≦ 90	0.22 max.											40 < t	No.4	24			
SM 400C	t ≦ 90	0.18 max.	0.35 max.	1.40 max.							—					0	47 min.	
SM 490A	t ≦ 50	0.20 max.	0.55 max.	1.65 max.	0.035 max.	0.035 max.	325 min.	315 min.	295 min.	295 min.	285 min.	490~ 610	6 ≦ t ≦ 16	No.1A	17	—	—	
	50 < t ≦ 90	0.22 max.																
SM 490B	t ≦ 50	0.18 max.	0.55 max.	1.65 max.									16 < t ≦ 50	No.1A	21	0	27 min.	
	50 < t ≦ 90	0.20 max.											40 < t	No.4	23			
SM 490C	t ≦ 100	0.18 max.	0.55 max.	1.65 max.							—					0	47 min.	
SM 490YA	t ≦ 90	0.20 max.	0.55 max.	1.65 max.	0.035 max.	0.035 max.	365 min.	355 min.	335 min.	325 min.	—	490~ 610	6 ≦ t ≦ 16	No.1A	15	—	—	
SM 490YB													16 < t ≦ 50	No.1A	19	0	27 min.	
													40 < t	No.4	21			
SM 520B	t ≦ 90	0.20 max.	0.55 max.	1.65 max.	0.035 max.	0.035 min.	365 min.	355 min.	335 min.	325 min.	—	520~ 640	6 ≦ t ≦ 16	No.1A	15	0	27 min.	
SM 520C													16 < t ≦ 50	No.1A	19	0	47 min.	
													40 < t	No.4	21			
SM 570	t ≦ 90	0.18 max.	0.55 max.	1.70 max.	0.035 max.	0.035 max.	460 min.	450 min.	430 min.	420 min.	—	570~ 720	6 ≦ t ≦ 16	No.5	19	-5	47 min.	
													16 < t	No.5	26			
													20 < t	No.4	20			

Remarks : 1. Alloy elements other than those shown in the above table may be added necessary.

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

7.1.1.3 ASTM A36-12 Carbon Structural Steel

Thickness (t) mm	Chemical Compositions %					Tension Test			
	C	Si	Mn	P	S	Yield Point ksi (N/mm²)	Tensile Strength ksi (N/mm²)	Elongation	
								Test Piece in.(mm)	%
t ≦ 19.05	0.25 max.	0.40 max.	—	0.040 max.	0.050 max.	36 (250) min.	58~80 (400~550)	GL=8(200) GL=2(50)	20min. 23min.
19.05 < t ≦ 38.10	0.25 max.		0.80~1.20						
38.10 < t ≦ 63.50	0.26 max.	0.15~0.40							
63.50 < t ≦ 101.60	0.27 max.		0.85~1.20						
101.60 < t	0.29 max.								

Remarks：1. When copper steel is specified, minimum Cu shall be 0.20%.

2. For each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum will be permitted up to the maximum of 1.35%.

3. For plates wider than 24 in.(600mm), the elongation requirement is reduced two percentage points.

4. For nominal thickness under 5/16 in.(8mm), the deduction from the specified percentage of elongation in 8 in.(200mm) shall be made for decreases of the nominal thickness below 5/16 in.(8mm). See elongation requirement adjustments under the Tension Tests Section of Specification A6 for deduction values.

7.1.1.4 ASTM A283-13 Low and Intermediate Tensile Strength Carbon Steel Plates

Grade	Chemical Compositions %						Tension Test			
	C	Thickness (t) mm		Mn	P	S	Yield Point ksi (N/mm²)	Tensile Strength ksi (N/mm²)	Elongation	
		t ≦ 38.10	t > 38.10						Test Piece in.(mm)	%
Grade C	0.24 max.	0.40 max.	0.15~0.40	0.90 max.	0.030 max.	0.030 max.	30(205) min.	55~75 (380~515)	GL=8(200) GL=2(50)	22min. 25min.
Grade D	0.27 max.						33(230) min.	60~80 (415~550)	GL=8(200) GL=2(50)	20min. 23min.

Remarks：1. When copper steel is specified, minimum Cu shall be 0.20%.

2. For plates wider than 24 in.(600mm), the elongation requirement is reduced two percentage points.

3. For nominal thickness under 5/16 in.(8mm), the deduction from the specified percentage of elongation in 8 in.(200mm) shall be made for decreases of the nominal thickness below 5/16 in.(8mm). See elongation requirement adjustments under the Tension Tests section of Specification A6 for deduction values.

4. Applicable thickness range of this specification is from 6.00 to 50.80mm.

7.1.1.5 ASTM A572-13 High-Strength Low-Alloy Columbium-Vanadium Structural Steel

Grade	Thickness (t) mm	Chemical Compositions %										Tension Test			
		C	Si	Mn	P	S	Type1	Type2	Type 3			Yield Point ksi (N/mm²)	Tensile Strength ksi (N/mm²)	Elongation	
							Nb	V	Nb	V	Nb +V			Test piece in.(mm)	%
Grade 42	t ≦ 38.10	0.21 max.	0.40 max.	1.35 max.	0.040 max.	0.050 max.	0.005~ 0.050	0.01~ 0.15	0.005~ 0.050	0.01~ 0.15	0.02~ 0.15	42 (290) min.	60 (415) min.	GL= 8(200) GL= 2(50)	20 min. 24 min.
	38.10 < t ≦ 101.60		0.15~ 0.40												
Grade 50	t ≦ 38.10	0.23 max.	0.40 max.									50 (345) min.	65 (450) min.	GL= 8(200) GL= 2(50)	18 min. 21 min.
	38.10 < t ≦ 101.60		0.15~ 0.40												
Grade 55	t ≦ 38.10	0.25 max.	0.40 max.									55 (380) min.	70 (485) min.	GL= 8(200) GL= 2(50)	17 min. 20 min.
	t > 38.10		0.15~ 0.40												
Grade 60	t ≦ 31.75	0.26 max.	0.40 max.									60 (415) min.	75 (520) min.	GL= 8(200) GL= 2(50)	16 min. 18 min.
Grade 65	t ≦ 12.70	0.26 max.	0.40 max.	1.35 max.								65 (450) min.	80 (550) min.	GL= 8(200) GL= 2(50)	15 min. 17 min.
	12.70 < t ≦ 31.75	0.23 max.		1.65 max.											

Remarks：1. When copper steel is specified, minimum Cu shall be 0.20%.

2. Manganese, minimum by heat analysis of 0.80% shall be required for all plates over 3/8 in.(9.53mm) in thickness, a minimum of 0.50% shall be required for plates 3/8 in.(9.53mm) and less in thickness, and for all other products. The manganese to carbon ratio shall not be less than 2 to1.
3. Gr.42,50,55,60 for each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum is permitted, up to a maximum of 1.60%.
4. Gr.65 if the thickness is 12.70mm or under, an alternative chemical requirement with a maximum carbon of 0.21% and a maximum manganese of 1.65% is permitted.
5. For plates wider than 24 in.(600mm), the elongation requirement is reduced two percentage points for Grades 42,50 and 55, and three percentage points for Grades 60 and 65. See elongation requirement adjustments in the Tension Tests section of Specification A6/A6M.

7.1.1.6 ASTM A573-13 Structural Carbon Steel Plates of Improved Toughness

Grade	Thickness (t) mm	Chemical Compositions %					Tension Test			
		C	Si	Mn	P	S	Yield Point ksi (N/mm²)	Tensile Strength ksi (N/mm²)	Elongation	
									Test piece in.(mm)	%
Grade 58	t ≦ 38.10	0.23 max.	0.10~ 0.35	0.60~ 0.90	0.030 max.	0.030 max.	32(220) min.	58~71 (400~490)	GL=8(200) GL=2(50)	21min. 24min.
Grade 65	t ≦ 12.70	0.24 max.	0.15~ 0.40	0.85~ 1.20			35(240) min.	65~77 (450~530)	GL=8(200) GL=2(50)	20min. 23min.
	12.70 < t ≦ 38.10	0.26 max.								
Grade 70	t ≦ 12.70	0.27 max.					42(290) min.	70~90 (485~620)	GL=8(200) GL=2(50)	18min. 21min.
	12.70 < t ≦ 38.10	0.28 max.								

Remarks：1. For plates wider than 24 in.(600mm), the elongation requirement is reduced two percentage points. See elongation requirement adjustments in the Tension Tests Section of Specification A6/A6M.

2. The upper limit of manganese for Gr.58 may be exceeded, provided that the carbon content plus 1/6 manganese content does not exceed 0.40% based on heat analysis.
3. Gr.58,65 for each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum is permitted, up to a maximum of 1.50% and 1.60% for Grades 70.

7.1.1.7 ASTM A709-13 Structural Steel for Bridges

Grade	Thick-ness (t) mm	Chemical Compositions %										Tension Test			
		C	Si	Mn	P	S	Type 1	Type 2	Type 3			Yield Point or Yield Strength ksi (N/mm²)	Tensile Strength ksi (N/mm²)	Elongation	
							Nb	V	Nb	V	Nb+V			Test piece in.(mm)	% min
Grade 36	t ≦ 19.05	0.25 max.	0.40 max.	—	0.040 max.	0.050 max.	—	—	—	—	—	36 (250) min.	58~80 (400~550)	GL= 8(200)	20
	19.05 < t ≦ 38.10			0.80~ 1.20											
	38.10 < t ≦ 63.50	0.26 max.	0.15~ 0.40											GL= 2(50)	23
	63.50 < t ≦ 101.60	0.27 max.		0.85~ 1.20											
Grade 50	t ≦ 38.10	0.23 max.	0.40 max.	1.35 max.			0.005 ~ 0.050	0.01 ~ 0.15	0.005 ~ 0.050	0.01 ~ 0.15	0.02 ~ 0.15	50 (345) min.	65(450) min.	GL= 8(200)	18
	38.10 < t ≦ 101.60		0.15~ 0.40											GL= 2(50)	21
Grade 50W Type A	t ≦ 101.60	0.19 max.	0.30~ 0.65	0.80~ 1.25			Ni	Cr	Cu	V	—	50 (345) min.	70(485) min.	GL= 8(200)	18
							0.40 max.	0.40 ~0.65	0.25 ~0.40	0.02 ~0.10	—			GL= 2(50)	21

Remarks：1. When copper is specified, minimum Cu shall be 0.20%.

2. For each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese.

3. Manganese of Gr.50, minimum by heat analysis of 0.80% shall be required for all plates over 3/8 in.(9.53mm) in thickness, a minimum of 0.50% shall be required for plates 3/8 in.(9.53mm) and less in thickness, and for all other products. The manganese to carbon ratio shall not be less than 2 to1.For eachreduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum is permitted, up to a maximum of 1.60%.

4. For Gr.50W Type A, the silicon content in excess of 0.40% by heat analysis must be negotiated.

5. For each reduction of 0.01% below the specified maximum for carbon, an increase of 0.06% above the specified maximum for manganese is permitted, up to a maximum of 1.50%.

6. For plates wider than 24 in.(600mm), the elongation requirement is reduced two percentage points. See elongation requirement adjustments in the Tension Tests section of Specification A6/A6M.

7.1.1.8 JIS G3140-08 SBHS500 Higher Yield Strength Steel Plates for Bridges

Grade	Thick-ness (t) mm	Composition %							Mechanical Properties								
		C	Si	Mn	P	S	N	Pcm	YS N/mm²	TS N/mm²	Elongation			Impact Test		
											No. 5	No. 5	No. 4	Temp ℃	AVG Joule	Test piece
											Thickness (t) mm					
											13 ≦ t ≦ 16	16 < t ≦ 20	20 < t ≦ 80			
SBHS 500	15 ≦ t ≦ 80	0.11 max.	0.55 max.	2.00 max.	0.020 max.	0.006 max.	0.006 max.	0.20 max.	500 min.	570 ~ 720	19 min.	26 min.	20 min.	-5	100 min.	Trans. to rolling direction

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

7.1.1.9 JIS G3136-12 Rolled Steels for Building Structure

Grade	Thick-ness (t) mm	Composition %						Mechanical Properties																
								Tension Test														Impact Test		
								Yield point or Proof Stress N/mm²				Tensile Strength N/mm²	Yield Ratio %				Elongation (%)			Through-thickness characteristics		Test Temp ℃	Charpy Absorbed Energy Average J	Test piece
								Thickness (t) mm					Thickness (t) mm				No. 1A	No. 1A	No. 4	Average %	Individual %			
		C	Si	Mn	P	S	Ceq	t < 12	12 ≦ t < 16	16 ≦ t ≦ 40	40 < t ≦ 100		t < 12	12 ≦ t < 16	16 ≦ t ≦ 40	40 < t ≦ 100	t ≦ 16	16 < t ≦ 50	40 < t ≦ 100					
SN400A	6.00 ≦ t ≦ 100	0.24 max.	—	—	0.050 max.	0.050 max.	—	235 min.	235 min.	235 min.	215 min.	400~510	—	—	—	—	17 min.	21 min.	23 min.	—	—	—	—	—
SN400B	6.00 ≦ t ≦ 50.00	0.20 max.	0.35 max.	0.60~1.50	0.030 max.	0.015 max.	0.36 max.	235 min.	235~355	235~355	215~335			80 max.	80 max.	80 max.	18 min.	22 min.	24 min.	—	—	0	27 min.	No. 4 in rolling direction
	50.01 ≦ t ≦ 100	0.22 max.																						
SN400C	16.00 ≦ t ≦ 50.00	0.20 max.			0.020 max.	0.008 max.		—	—					—						25 min.	15 min.			
	50.01 ≦ t ≦ 100	0.22 max.																						
SN490B	6.00 ≦ t ≦ 40.00	0.18 max.	0.55 max.	1.65 max.	0.030 max.	0.015 max.	0.44 max.	325 min.	325~445	325~445	295~415	490~610	—	80 max.	80 max.	80 max.	17 min.	21 min.	23 min.	—	—			
	40.01 ≦ t ≦ 50.00						0.46 max.																	
	50.01 ≦ t ≦ 100	0.20 max.																						
SN490C	16.00 ≦ t ≦ 40.00	0.18 max.			0.020 max.	0.008 max.	0.44 max.	—	—					—						25 min.	15 min.			
	40.00 < t ≦ 50.00						0.46 max.																	
	50.01 ≦ t ≦ 100	0.20 max.																						

Remarks：1.Alloy elements other than those shown in the above table may be added necessary.
2.Impact test is applicable to thickness over 12.0mm of steel.
3.Ceq ＝ C+Mn/6+Si/24+Ni/40+Cr/5+Mo/4+V/14。
4.Ultrasonic Test:
(1)SN400B and SN490B is over 13.00mm in thickness, which may be tested in accordance with JIS G0901 CL.Y If agreement between the purchaser and the manufacturer.
(2)SN400C and SN490C is 16.00mm or over, which shall be tested in accordance with JIS G0901 CL.Y

7.1.2 Shipbuilding Steel Plates

7.1.2.1 ABS（2014）Ordinary-Strength Hull Structural Steel

<table>
<tr><th rowspan="3">Grade</th><th colspan="6">Chemical Composition %</th><th colspan="3">Tension Test</th><th colspan="3">Impact Test</th></tr>
<tr><th rowspan="2">C</th><th rowspan="2">Si</th><th rowspan="2">Mn</th><th rowspan="2">P</th><th rowspan="2">S</th><th rowspan="2">C+Mn/6</th><th rowspan="2">Yield Point N/mm²</th><th rowspan="2">Tensile Strength N/mm²</th><th colspan="2">Elongation</th><th rowspan="2">Test Temp ℃</th><th colspan="2">Energy Average J</th></tr>
<tr><th>Test piece mm</th><th>%</th><th>Parallel to rolling direction</th><th>Transverse to rolling direction</th></tr>
<tr><td>Grade A</td><td rowspan="4">0.21 max.</td><td>0.50 max.</td><td>2.5×C min.</td><td rowspan="4">0.035 max.</td><td rowspan="4">0.035 max.</td><td rowspan="4">0.40 max.</td><td rowspan="4">235 min.</td><td rowspan="4">400~520</td><td rowspan="4">GL = 5.65 √A</td><td rowspan="4">22 min.</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>Grade B</td><td>0.35 max.</td><td>0.80 min.</td><td>0</td><td rowspan="3">27 min.</td><td rowspan="3">20 min.</td></tr>
<tr><td>Grade D</td><td rowspan="2">0.10~0.35</td><td>0.60 min.</td><td>-20</td></tr>
<tr><td>Grade E</td><td>0.18 max.</td><td>0.70 min.</td><td>-40</td></tr>
</table>

Remarks：1. When the content of soluble aluminum is not less than 0.015%, the minimum required silicon content does not apply.

2. For Grade A, rimmed steel sections may be accepted up to and including 12.5 mm (0.5 in.).

3. A maximum carbon content of 0.23% is acceptable for Grade A sections.

4. For Gr.B steel of cold flanging quality or when fully killed, the lower limit of manganese may be reduced to 0.60%.

5. Gr.D hull steel which is normalized, thermo-mechanical control processed or control rolled is to be marked AB/DN.

6. The contents of nickel, chromium, molybdenum and copper are to be determined and reported. When the amount does not exceed 0.02%, these elements may be reported as ≦ 0.02%.

7. For Grade A sections, the upper limit of tensile strength may be 550 N/mm^2 (56 kgf/ mm^2，80 ksi).

8. Applicable thickness range of this specification is from 6.00 to 50.80mm.

7.1.2.2 ABS(2014)Higher-Strength Hull Structural Steel

Grade	Chemical Composition %													Mechanical Properties						
														Tension Test				Impact Test		
	C	Si	Mn	P	S	Cu	Cr	Ni	Mo	Nb	V	Ti	Al	Yield Point N/mm²	Tensile Strength N/mm²	Elongation		Test Temp ℃	Energy Average J	
																Test piece mm	%		Thickness(t) mm	
																			Parallel to rolling direction	Transverse to rolling direction
AH 32	0.18 max.	0.10 ≀ 0.50	0.90 ≀ 1.60	0.035 max.	0.035 max.	0.35 max.	0.20 max.	0.40 max.	0.08 max.	0.02 ≀ 0.05	0.05 ≀ 0.10	0.020 max.	0.020 min.	315 min.	440 ≀ 590	GL = 5.65 √A	22 min.	0	t ≦ 50.0 31min.	t ≦ 50.0 22min.
DH 32																		-20		
EH 32																		-40	50.0 < t ≦ 70.0 38min. 70.0 < t ≦ 75.0 46min.	50.0 < t ≦ 70.0 26min. 70.0 < t ≦ 75.0 31min.
AH 36														355 min.	490 ≀ 620	GL = 5.65 √A	21 min.	0	t ≦ 50.0 34min.	t ≦ 50.0 24min.
DH 36																		-20	50.0 < t ≦ 70.0 41min.	50.0 < t ≦ 70.0 27min.
EH 36																		-40	70.0 < t ≦ 75.0 50min.	70.0 < t ≦ 75.0 34min.
EH 40														390 min.	510 ≀ 650		20 min.	-40	t ≦ 50.0 39min. 50.0 < t ≦ 70.0 46min. 70.0 < t ≦ 75.0 55min.	t ≦ 50.0 26min. 50.0 < t ≦ 70.0 31min. 70.0 < t ≦ 75.0 37min.
EH 47	0.10 max.	0.10 ≀ 0.55	1.60 max.	0.030 max.	0.030 max.	0.35 max.	0.20 max.	1.50 max.	0.08 max.	0.05 max.	0.10 max.	0.007 ≀ 0.020	0.020 min.	460 min.	570 ≀ 720		17 min.	-40	50.0 ≦ t ≦ 65.0 64min.	50.0 ≦ t ≦ 65.0 43min.

Remarks：1. AH steel 12.5mm(0.50 in.) and under in thickness may have a minimum manganese content of 0.70%.

2. When the content of soluble aluminum is not less than 0.015%, the minimum required silicon content does not apply.

3. Applicable thickness range of this specification is from 6.00 to 50.80mm for AH32~EH36, for higher strength grade EH40 is 40.00~75.00mm,and for extra strength grade EH47 is 50.00~65.00mm.

7.1.3 Steel Plates for boilers and Pressure Vessels

7.1.3.1 JIS G3103-12 Carbon Steel and Molybdenum Alloy Steel Plate for Boilers and Other Pressure Vessels

Grade	Thick-ness (t) mm	Chemical Composition %						Mechanical Properties							
								Tension Test				Bend Test			
		C	Si	Mn	P	S	Mo	Yield point N/mm²	Tensile Strength N/mm²	Elongation %, min	Test Piece	Bend Angle	Thickness (t) mm	Inside Radius	Test Piece
SB 410	t ≦ 25.0	0.24 max.	0.15~ 0.40	0.90 max.	0.020 max.	0.020 max.	—	225 min.	410~ 550	21	No. 1A	180°	t ≦ 25 25 < t ≦ 50 50 < t ≦ 100	0.50t 0.75t 1.00t	Transverse to rolling direction
	25.0 < t ≦ 50.0	0.27 max.								25	No. 10				
	50.0 < t ≦ 100	0.29 max.													
SB 450	t ≦ 25.0	0.28 max.						245 min.	450~ 590	19	No. 1A		t ≦ 25 25 < t ≦ 100	0.75t 1.00t	
	25.0 < t ≦ 50.0	0.31 max.								23	No. 10				
	50.0 < t ≦ 100	0.33 max.													
SB 480	t ≦ 25.0	0.31 max.		1.20 max.				265 min.	480~ 620	17	No. 1A		t ≦ 25 25 < t ≦ 50 50 < t ≦ 100	1.00t 1.00t 1.25t	
	25.0 < t ≦ 50.0	0.33 max.								21	No. 10				
	50.0 < t ≦ 100	0.35 max.													
SB 450M	t ≦ 25.0	0.18 max.		0.90 max.			0.45~ 0.60	255 min.	450~ 590	19	No. 1A		t ≦ 25 25 < t ≦ 100	0.50t 0.75t	
	25.0 < t ≦ 50.0	0.21 max.								23	No. 10				
SB 480M	t ≦ 25.0	0.20 max.						275 min.	480~ 620	17	No. 1A		t ≦ 25 25 < t ≦ 100	0.75t 1.00t	
	25.0 < t ≦ 50.0	0.23 max.								21	No. 10				

Remarks：1. For SB450 of over 25mm in thickness, the content of C may be designated to be within 0.30%, and that of Mn may be within 1.00%.

2. For tension test pieces, No.1A test piece shall be used for the steel plates of 50mm or under in thickness and No.10 test piece for that over 50mm. However, for the steel plates over 40mm in thickness, No.10 test piece may be used.

3. The elongation of No.1A test piece cut off from the steel plate under 8mm in thickness shall be the values in the above table reduced by 1% for every decrease of 1mm of thickness or its fraction.

4. The elongation of No.10 test piece cut off from the steel plate over 90mm in thickness shall be the values in the above table reduced by 0.5% for every increase of 12.5mm of thickness or its fraction. However, the reduction shall be limited to 3%.

5. When the elongation of No.1A test piece cut off from SB450M and SB480M steel plates of over 6 mm to and excluding 20 mm in thickness is more than the value specified in the above table subtracted by 3, the test piece shall be accepted despite the above specification provided that the value of elongation in the gage length of 50 mm including the broken part is 25% or over.

7.1.3.2 ASTM A285-12 Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength

Grade	Chemical Composition %				Mechanical Properties			
					Tension Test			
							Elongation	
	C	Mn	P	S	Yield Strength ksi(N/mm²)	Tensile Strength ksi(N/mm²)	Test piece in.(mm)	%
Grade A	0.17 max.	0.90 max.	0.025 max.	0.025 max.	24(165)min.	45~65(310~450)	GL=8(200) GL=2(50)	27min. 30min.
Grade B	0.22 max.				27(185)min.	50~70(345~485)	GL=8(200) GL=2(50)	25min. 28min.
Grade C	0.28 max.				30(205)min.	55~75(380~515)	GL=8(200) GL=2(50)	23min. 27min.

Remark：1.When the thickness less than 5/16 in.(8mm), See Specification A20/A20M for elongation adjustment.
2. Applicable thickness range of this specification is from 6.00 to 50.80mm.

7.1.3.3 JIS G3115-10 Steel Plates for Pressure Vessels for Intermediate Temperature Service

Grade	Chemical Composition %							Mechanical Properties													
								Tension Test						Bend Test				Impact Test			
								Yield point or proof stress N/mm²		Tensile Strength N/mm²	Elongation							Test Temp. ℃	Charpy Absorbed Energy J		Test piece
								Thick-ness (t) mm			Thick-ness (t) mm	Test piece	% min	Bend Angle	Thick-ness (t) mm	Inside Radius	Test piece		AVG	IDV	
	C		Si	Mn	P	S	Ceq	t ≦ 50	50 < t ≦ 100												
SPV 235	t ≦ 100	0.18 max.	0.35 max.	1.40 max.	0.030 max.	0.030 max.	—	235 min.	215 min.	400~510	t ≦ 16 t > 16 t > 40	No.1A No.1A No.4	17 21 24	180°	t ≦ 50 t > 50	1.0t 1.5t	No.1 transverse to rolling direction	0	47 min.	27 min.	V-notch, parallel to rolling direction
	t > 100	0.20 max.																			
SPV 315	0.18 max.		0.55 max.	1.60 max.				315 min.	295 min.	490~610	t ≦ 16 t > 16 t > 40	No.1A No.1A No.4	16 20 23		—	1.5t					
SPV 355	0.20 max.							355 min.	335 min.	520~640	t ≦ 16 t > 16 t > 40	No.1A No.1A No.4	14 18 21								
SPV 410	0.18 max.		0.75 max.					410 min.	390 min.	550~670	t ≦ 16 t > 16 t > 40	No.1A No.1A No.4	12 16 18					-10			

Remarks：1. Alloy elements other than those shown in the above table may be added if necessary.
2. Ceq(%) = C+Mn/6+Si/24+Ni/40+Cr/5+Mo/4+V/14.
3. Impact test is applicable to thickness over 12.0mm of steel.
4.Applicable thickness range of this specification is from 6.00 to 50.80mm

7.1.3.4 ASTM A515-10 Pressure Vessel Plates, Carbon Steel, for Intermediate - and High-Temperature Service

Grade	Thickness (t) mm	Chemical Composition %					Tension Test			
		C	Si	Mn	P	S	Yield strength ksi (N/mm²)	Tensile strength ksi (N/mm²)	Elongation	
									Test piece in.(mm)	%
Grade 60	t ≦ 25.40	0.24 max.	0.15~0.40	0.90 max.	0.025 max.	0.025 max.	32(220) min.	60~80 (415~550)	GL=8(200) GL=2(50)	21min. 25min.
	25.40 < t ≦ 50.80	0.27 max.								
	50.80 < t ≦ 101.60	0.29 max.								
Grade 65	t ≦ 25.40	0.28 max.					35(240) min.	65~85 (450~585)	GL=8(200) GL=2(50)	19min. 23min.
	25.40 < t ≦ 50.80	0.31 max.								
	50.80 < t ≦ 101.60	0.33 max.								
Grade 70	t ≦ 25.40	0.31 max.		1.20 max.			38(260) min.	70~90 (485~620)	GL=8(200) GL=2(50)	17min. 21min.
	25.40 < t ≦ 50.80	0.33 max.								
	50.80 < t ≦ 101.60	0.35 max.								

Remark：1. When the thickness less than 5/16 in(8mm), See Specification A20/A20M for elongation adjustment.

2. For each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum is permitted, up to a maximum of 1.50%.

7.1.3.5 ASTM A516-10 Pressure Vessel Plates, Carbon Steel, for Moderate-and Lower-Temperature Service

Grade	Thickness (t) mm	Chemical Composition %					Tension Test			
		C	Si	Mn	P	S	Yield strength ksi (N/mm²)	Tensile strength ksi (N/mm²)	Elongation	
									Test piece in.(mm)	%
Grade 55	t ≦ 12.70	0.18 max.	0.15~0.40	0.60~0.90	0.025 max.	0.025 max.	30 (205) min.	55~75 (380~515)	GL=8(200) GL=2(50)	23min. 27min.
	12.70 < t ≦ 50.80	0.20 max.		0.60~1.20						
	50.80 < t ≦ 101.60	0.22 max.								
Grade 60	t ≦ 12.70	0.21 max.		0.60~0.90			32 (220) min.	60~80 (415~550)	GL=8(200) GL=2(50)	21min. 25min.
	12.70 < t ≦ 50.80	0.23 max.		0.85~1.20						
	50.80 < t ≦ 101.60	0.25 max.								
Grade 65	t ≦ 12.70	0.24 max.		0.85~1.20			35 (240) min.	65~85 (450~585)	GL=8(200) GL=2(50)	19min. 23min.
	12.70 < t ≦ 50.80	0.26 max.								
	50.80 < t ≦ 101.60	0.28 max.								
Grade 70	t ≦ 12.70	0.27 max.					38 (260) min.	70~90 (485~620)	GL=8(200) GL=2(50)	17min. 21min.
	12.70 < t ≦ 50.80	0.28 max.								
	50.80 < t ≦ 101.60	0.30 max.								

Remarks：1. For each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum is permitted, up to a maximum of 1.50%.
2. Grade 60 plates 1/2 in.(12.7mm) and under in thickness may have 0.85~1.20% manganese on heat analysis, and 0.79~1.30% manganese on product analysis.
3. When the thickness less than 5/16 in(8mm), see specification A20/A20M for elongation adjustment.
4. When the thickness is over 1½ in.(38.1mm) and shall be normalized.

7.1.3.6 ASTM A537-13 Pressure Vessel Plates, Heat-treated, Carbon-Manganese-Silicon Steel

Grade	Thick-ness (t) mm	Chemical Composition %									Tension Test			
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Yield strength ksi (N/mm²)	Tensile strength ksi (N/mm²)	Elongation	
													Test piece in.(mm)	% min
Class 1	6.00 ≦ t ≦ 38.10	0.24 max.	0.15~0.50	0.70~1.35	0.025 max.	0.025 max.	0.35 max.	0.25 max.	0.25 max.	0.08 max.	50 (345) min.	70~90 (485~620)	GL=8(200) GL=2(50)	18 22
	38.11 ≦ t ≦ 50.80			1.00~1.60										

Remarks：1. When the thickness 1½ in.(38.1mm) and under, manganese may exceed 1.35%, up to a maximum of 1.60%, and nickel may exceed 0.25%, up to a maximum of 0.50%, provided the heat analysis carbon equivalent does not exceed 0.57% when based upon the following equation:
CE=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15
2. When the thickness less than 5/16 in.(8mm), see specification A20/A20M for elongation adjustment.
3. Class 1(All thickness) plates shall be normalized.

7.1.4 Steel Plates for Machine Structural Usage (ex: Abrasion Resisting)

7.1.4.1 JIS G4051 – 09 Steel Plates for Machine Strctural Usage

Chemical Composition %[1]						
Grade	Thickness (mm)	C	Si	Mn	P	S
S10C	t ≧ 7.90	0.08~0.13		0.30~0.60		
S12C	t ≧ 7.90	0.10~0.15		0.30~0.60		
S15C	t ≧ 7.90	0.13~0.18		0.30~0.60		
S17C	t ≧ 7.90	0.15~0.20		0.30~0.60		
S20C	t ≧ 7.90	0.18~0.23		0.30~0.60		
S22C	t ≧ 7.90	0.20~0.25		0.30~0.60		
S25C	t ≧ 7.90	0.22~0.28		0.30~0.60		
S28C	t ≧ 7.90	0.25~0.31		0.60~0.90		
			0.15~0.35		0.030max.	0.035max.
S30C	t ≧ 7.90	0.27~0.33		0.60~0.90		
S33C	t ≧ 7.90	0.30~0.36		0.60~0.90		
S35C	t ≧ 7.90	0.32~0.38		0.60~0.90		
S38C	t ≧ 7.90	0.35~0.41		0.60~0.90		
S40C	t ≧ 7.90	0.37~0.43		0.60~0.90		
S43C	t ≧ 7.90	0.40~0.46		0.60~0.90		
S45C	t ≧ 7.90	0.42~0.48		0.60~0.90		
S48C	t ≧ 7.90	0.45~0.51		0.60~0.90		
S50C	t ≧ 7.90	0.47~0.53		0.60~0.90		
S53C	t ≧ 7.90	0.50~0.56		0.60~0.90		
S55C	t ≧ 7.90	0.52~0.58		0.60~0.90		
S58C*	t ≧ 7.90	0.55~0.61		0.60~0.90		

7.1.4.2 CSC PC Machine Structural Usage (over-thickness)

Chemical Composition %						
Grade	Thickness (mm)	C	Si	Mn	P	S
PC1050[4]	t > 125	0.47~0.53	0.15~0.35	0.60~0.90	0.030max.	0.035max.

7.1.4.3 SAE (2009) General Carbon Machine Strctural Usage

Chemical Composition %						
Grade	Thickness (mm)	C	Si	Mn	P	S
1005	t ≧ 7.90	0.06max.		0.35max.		
1006	t ≧ 7.90	0.08max.		0.25~0.40(2)		
1008	t ≧ 7.90	0.10max.		0.30~0.50(2)		
1009	t ≧ 7.90	0.15max.		0.60max.		
1010	t ≧ 7.90	0.08~0.13		0.30-0.60		
1012	t ≧ 7.90	0.10~0.15				
1013	t ≧ 7.90	0.11~0.16				
1015	t ≧ 7.90	0.13~0.18				
1016	t ≧ 7.90			0.60~0.90		
1017	t ≧ 7.90	0.15~0.20		0.30~0.60		
1018	t ≧ 7.90			0.60~0.90		
1019	t ≧ 7.90			0.70~1.00		
1020	t ≧ 7.90	0.18~0.23		0.30~0.60		
1021	t ≧ 7.90			0.60~0.90		
1022	t ≧ 7.90			0.70~1.00		
1023	t ≧ 7.90	0.20~0.25		0.30~0.60		
1025	t ≧ 7.90	0.22~0.28		0.30~0.60		
1026	t ≧ 7.90			0.60~0.90		
1029	t ≧ 7.90	0.25~0.31	—	0.60~0.90	0.030max.	0.050max.
1030	t ≧ 7.90	0.28~0.34		0.60~0.90		
1033	t ≧ 7.90	0.30~0.36		0.70~1.00		
1035	t ≧ 7.90	0.32~0.38		0.60~0.90		
1037	t ≧ 7.90			0.70~1.00		
1038	t ≧ 7.90	0.35~0.42		0.60~0.90		
1039	t ≧ 7.90	0.37~0.44		0.70~1.00		
1040	t ≧ 7.90			0.60~0.90		
1042	t ≧ 7.90	0.40~0.47		0.60~0.90		
1043	t ≧ 7.90			0.70~1.00		
1044	t ≧ 7.90	0.43~0.50		0.30~0.60		
1045	t ≧ 7.90			0.60~0.90		
1046	t ≧ 7.90			0.70~1.00		
1049	t ≧ 7.90	0.46~0.53		0.60~0.90		
1050	t ≧ 7.90	0.48~0.55		0.60~0.90		
1053	t ≧ 7.90			0.70~1.00		
1055	t ≧ 7.90	0.50~0.60		0.60~0.90		
1060*	t ≧ 7.90	0.55~0.65		0.60~0.90		

Remarks：1. Cr shall not be over 0.20%. However, it may be specified as values under 0.30% upon the agreement between the manufacturer and the purchaser .
2. For grades 1006 and 1008 applicable to structural shapes, plates, strip or sheet, the manganese limit is 0.45% and 0.50% maximum, respectively, with no minimum.
3. With regards to upper limit of above table and the symbol * shall be inquiry before placing the order.
4. PC1050 needs to be agreement between the purchaser and the manufacturer before placing the order.

7.1.4.4 Alloy Machine Strctural Usage (Abrasion Resisting)

Chemical Composition %						
Grade	Thickness(mm)	C	Si	Mn	P	S
1330	t ≧ 7.90	0.28 ~ 0.33	0.15~0.35	1.60 ~ 1.80	0.030max.	0.040max.
1335	t ≧ 7.90	0.33 ~ 0.38		1.60 ~ 1.90		
1340	t ≧ 7.90	0.38 ~ 0.43				
1345	t ≧ 6.00	0.43 ~ 0.48				

7.1.5 Atmospheric Corrosion Resistant Steel Plates

7.1.5.1 CSC-specification plate for Sulfur Dew-Point Corrosion-Resistance

Grade	Thick-ness (t) mm	Chemical Composition %									Mechanical Properties						
											Tension Test				Bend Test		
		C	Si	Mn	P	S	Cu	Ni	Cr	Ti	Yield Point N/mm²	Tensile Strength N/mm²	Elongation %	Test piece	Bend Angle	Inside Radius	Test piece
SCR TEN2	6.00 ≦ t ≦ 20.00	0.14 max.	0.15 ≀ 0.55	0.90 max.	0.025 max.	0.035 max.	0.20 ≀ 0.50	0.50 max.	0.50 ≀ 1.00	0.15 max.	325 min.	440 min.	18 min.	No.1A	180°	1.5t	No.1
SCR TEN3					0.035 max.	0.035 max.	0.25 ≀ 0.50	—	0.80 ≀ 1.30	Sb 0.15 max.			22 min.	No.5			

7.1.5.2 CSC-specification plate for Galvanizing Pot

Grade	Thickness(t) mm	Chemical Composition %				
		C	Si	Mn	P	S
GP1	6.00 ≦ t ≦ 50.80	0.07 max.	0.02 max.	0.35 max.	0.020 max.	0.020 max.
GP2		0.15 ≀ 0.25	0.03 max.	0.90 max.	0.012 max.	

7.1.5.3 JIS G3114-08 Hot-Rolled Atmospheric Corrosion Resisting Steels for Welded Structure

Grade		Chemical Composition %								Mechanical Properties									
										Tension Test						Impact Test			
										Yield Point or Proof Stress N/mm² Thickness (t) mm			Tensile Strength N/mm²	Elongation			Symbol	Test temp ℃	Charpy Absorbed Energy Average J	Test piece
		C	Si	Mn	P	S	Cu	Cr	Ni	t ≦ 16	16 < t ≦ 40	40 < t ≦ 75		Thick-ness (t) mm	Test piece	% min.				
SMA 400 A.B.C.	W	0.18 max.	0.15 ~ 0.65	1.25 max.	0.035 max.	0.035 max.	0.30 ~ 0.50	0.45 ~ 0.75	0.05 ~ 0.30	245 min.	235 min.	215 min.	400 ~ 540	t ≦ 16 t > 16 t > 40	No.1A No.1A No.4	17 21 23	A	—	—	V-Notch in rolling direction
																	B	0	27 min.	
	P		0.55 max.				0.20 ~ 0.35	0.30 ~ 0.55	—								C	0	47 min.	
SMA 490 A.B.C.	W		0.15 ~ 0.65	1.40 max.			0.30 ~ 0.50	0.45 ~ 0.75	0.05 ~ 0.30	365 min.	355 min.	335 min.	490 ~ 610	t ≦ 16 t > 16 t > 40	No.1A No.1A No.4	15 19 21	A	—	—	
																	B	0	27 min.	
	P		0.55 max.				0.20 ~ 0.35	0.30 ~ 0.55	—								C	0	47 min.	
* SMA 570	W		0.15 ~ 0.65				0.30 ~ 0.50	0.45 ~ 0.75	0.05 ~ 0.30	460 min.	450 min.	430 min.	570 ~ 720	t ≦ 16 t > 16 t > 20	No.5 No.5 No.4	19 26 20	—	-5	47 min.	
	P		0.55 max.				0.20 ~ 0.35	0.30 ~ 0.55	—											

Remarks : 1. The letter symbol 'W' denotes that the plates are usually used in the delivered condition or chemically treated against rusting, while 'P' denotes that they are usually used after coated.

2 .The elements effective for the atmospheric corrosion resistance, such as Mo, Nb, Ti, V and Zr may be added to any grade of plates, provided that the total content of these elements does not exceed 0.15%.

3. Pertaining to the charpy absorbed energy, the value higher than those shown in the above table may be agreed upon by the parties concerned.

4. Impact test is applied only to the plates exceeding 12.00mm in thickness.

5. The symbol * means that shall be inquiry before placing the order.

6.Applicable thickness range of this specification is from 6.00 to 50.00mm

7.1.5.4 ASTM A242-13 High-Strength Low-alloy Structural Steel

Grade	Chemical Composition %					Tension Test				
	C	Mn	P	S	Cu	Thickness (t) mm	Yield point ksi (N/mm²)	Tensile strength ksi (N/mm²)	Elongation	
									Test piece in. (mm)	% min.
Type 1	0.15 max.	1.00 max.	0.150 max.	0.050 max.	0.20 min.	t ≦ 19.05	50 (345) min.	70 (480) min.	GL=8 (200)	18
						19.05 < t ≦ 38.10	46 (315) min.	67 (460) min.	GL=2 (50)	21
						38.10 < t ≦ 101.6	42 (290) min.	63 (435) min.		

Remarks：1. For plates wider than 24 in.(600mm), the elongation requirement is reduced two percentage points.
2. For nominal thickness under 5/16 in.(8mm), the deduction from the specified percentage of elongation in 8 in.(200mm) shall be made for decreases of the nominal thickness below 5/16 in.(8mm). See elongation requirement adjustments under the Tension Tests Section of Specification A6 for deduction values.

7.1.5.5 ASTM A588-10 HSLA Structural Steel up to 50 ksi min Yield Point, Atmospheric Corrosion Resistance

Grade	Chemical Composition %											Tension Test			
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Yield point ksi (N/mm²)	Tensile strength ksi (N/mm²)	Elongation	
														Test piece in. (mm)	% min
Grade A	0.19 max.	0.30 ~ 0.65	0.80 ~ 1.25	0.040 max.	0.050 max.	0.25 ~ 0.40	0.40 max.	0.40 ~ 0.65	—	0.02 ~ 0.10	—	50 (345) min.	70 (485) min.	GL=8 (200)	18
Grade B	0.20 max.	0.15 ~ 0.50	0.75 ~ 1.35			0.20 ~ 0.40	0.50 max.	0.40 ~ 0.70		0.01 ~ 0.10				GL=2 (50)	21
Grade K	0.17 max.	0.25 ~ 0.50	0.50 ~ 1.20			0.30 ~ 0.50	0.40 max.	0.40 ~ 0.70	0.10 max.	—	0.005 ~ 0.050				

Remarks：1. For each reduction of 0.01% below the specified maximum for carbon, an increase of 0.06% above the specified maximum for manganese is permitted, up to a maximum of 1.50%.
2. Gr.K for plates under 1/2 in.(12.70mm) in thickness, the minimum columbium is waived.
3. For plates wider than 24 in.(600mm), the elongation requirement is reduced two percentage points.
4. When the thickness less than 5/16 in(8mm), See Specification A6/A6M for elongation adjustment.
5.Applicable thickness range of this specification is from 6.00 to 50.80mm

7.1.6 Steel Plates for API 5L-2007 (ISO 3183) Line Pipe Usage

Level	Grade	Thickness t(mm)	Chemical Composition %											Tension Test	
			C	Mn	P	S	Si	Nb	V	Ti	Ni+V+Ti	(7) CEiiw	(8) CEpcm	Yield Strength ksi (N/mm²)	Tensile Strength ksi (N/mm²)
PSL1	A	6.00 ≦ t ≦ 50.80	0.22 max.	0.90 max.	0.030 max.	0.030 max.	—	—	—	—	—	—	—	30.5(210) min.	48.6(335) min.
	B(5)	6.00 ≦ t ≦ 50.80	0.26 max.	1.20 max.							0.15 max.			35.5(245) min.	60.2(415) min.
	X42	6.00 ≦ t ≦ 27.00		1.30 max.										42.1(290) min.	60.2(415) min.
	X46	—		1.40 max.										46.4(320) min.	63.1(435) min.
	X52	7.93 ≦ t ≦ 27.00												52.2(360) min.	66.7(460) min.
	X56	—												56.6(390) min.	71.1(490) min.
	X60	9.00 ≦ t ≦ 19.50									(6)			60.2(415) min.	75.4(520) min.
	X65	10.00 ≦ t ≦ 26.00		1.45 max.										65.3(450) min.	77.6(535) min.
	X70	15.00 ≦ t ≦ 30.00		1.65 max.										70.3(485) min.	82.7(570) min.
PSL2	BM	15.00 ≦ t ≦ 50.80	0.22 max.	1.20 max.	0.025 max.	0.015 max.	0.45 max.	0.050 max.	0.050 max.	0.040 max.	—	0.43 max.	0.25 max.	35.5~65.3 (245~450)	60.2~110.2 (415~760)
	X42M	15.00 ≦ t ≦ 27.00		1.30 max.										42.1~71.8 (290~495)	60.2~110.2 (415~760)
	X46M	—												46.4~76.1 (320~525)	63.1~110.2 (435~760)
	X52M	15.00 ≦ t ≦ 27.00		1.40 max.				—	—	—	0.15 max.			52.2~76.9 (360~530)	66.7~110.2 (460~760)
	X56M	—												56.6~79.0 (390~545)	71.1~110.2 (490~760)
	X60M	15.00 ≦ t ≦ 19.50	0.12 max.	1.60 max.							(6)			60.2~81.9 (415~565)	75.4~110.2 (520~760)
	X65M	15.00 ≦ t ≦ 26.00												65.3~87.0 (450~600)	77.6~110.2 (535~760)
	X70M	15.00 ≦ t ≦ 30.00		1.70 max.										70.3~92.1 (485~635)	82.7~110.2 (570~760)

Remarks：1. Gr.A through Gr.X70 for each reduction of 0.01% below the specified maximum carbon content, an increase of 0.05% above the specified maximum manganese content is permissible, but:

- X42~X52：Maximum manganese content is applicable to 1.50%.
- X56~X65：Maximum manganese content is applicable to 1.65%.
- X70：Maximum manganese content is applicable to 2.00%.

2. Niobium, vanadium, or combinations thereof may be used at the discretion of the manufacturer.
3. The sum of the niobium, vanadium, and titanium contents shall not exceed 0.15%.
4 .Gr.60 through Gr.X70 are permissible to add other chemical compositions by agreement between purchaser and manufacturer.
5. Elongation values are according to Specification of API 5L-2007 (ISO 3183).
6. The sum of niobium and vanadium contents shall not exceed 0.06% except for agreement between purchaser and manufacturer.
7. Carbon Equivalent CEiiw(%) = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15.
8. Carbon Equivalent CEpcm(%) = C + Si/30 + Mn/20 + Cu/20 + Ni/60 + Cr/20 + Mn/15 + V/10 + 5B.

7.1.7 Chemical Composition and Mechanical Property for New Products

7.1.7.1 ASTM A841-13 Gr. B Class 2 (For Welded Pressure Vessels use)

Thickness (t) mm	Chemical Composition %						Tension Test				Impact Test	
	C	Si	Mn	P	S	Tot-Al	Yield Strength ksi (N/mm²)	Tensile Strength ksi (N/mm²)	Elongation		Test Temp℃ / Test direction	Charpy Absorbed Energy Average J
									Test piece in.(mm)	%		
15.00 ≦ t ≦ 38.10	0.15 max.	0.15 ~ 0.50	0.70 ~ 1.35	0.030 max.	0.025 max.	0.020 min.	60 (415) min.	80~100 (550~690)	GL=2 (50)	22 min.	− 40 / in rolling direction	20 min.
38.10 < t ≦ 63.50			1.00 ~ 1.60									

Remarks : 1. When the thickness 1½ in.(38.1mm) and under, Manganese may exceed 1.35% on heat analysis, up to a maximum of 1.60%, provided that the carbon equivalent on heat analysis does not exceed 0.47%, or the value specified in Supplementary Requirement S77 When that requirement is invoked, when based on the following formula: CE=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15

2. By agreement, the steel may be produced with titanium, in which case the minimum aluminum content shall not apply. When this option is exercised, the titanium content, by heat analysis,shall be 0.006% to 0.02%.

3. For each reduction of 0.01 percentage point below the specified maximum for carbon, an increase of 0.06 percentage points above the specified maximum for manganese is permitted, up to a maximum of 1.85%.

7.1.7.2 JIS G3101 SS400 (Plates for Laser cutting ues)

Thickness (t) mm	Chemical Composition %					Tension Test					
						Yield Point or Yield Strength N/mm²		Tensile Strength N/mm²	Elongation		
						Thickness (t) mm			Thickness (t) mm	Test Piece	% min.
	C	Mn	P	S	Si	12.0 ≦ t ≦ 16.0	16.0 < t ≦ 25.0				
12.00 ≦ t ≦ 25.00	0.25 max.	1.35 max.	0.030 max.	0.030 max.	0.50 max.	245 min.	235 min.	400~ 510	12 ≦ t ≦ 16	No.1A	17
									16 < t ≦ 25		21

7.1.7.3 CSC LYS100 (Low Yield Strength Steel plate for Building Construction use)

Thickness (t) mm	Tension Test			
	Yield Strength N/mm²	Tensile Strength N/mm²	Elongation	
			Test Piece	%
6.00 ≦ t < 20.00	70~120	200~300	JIS No.5	50min.
20.00 ≦ t ≦ 50.80			JIS No.4	

7.1.7.4 CSC PZ30H Plates for Die of pressing

Thickness (t) mm	Chemical Composition %							
	C	Si	Mn	P	S	Ni	Cr	Mo
15 ≦ t ≦ 85	0.35max.	—	0.80min.	—	—	—	1.70max.	0.45max.

Remarks : 1. There is no mechanical properties requirements for die for pressing of plates.

2. This is applicable afterwards quenching and tempering process.

7.1.7.5 JIS G4053 SCM440 Nickel Chromium Steels for Machine Structural Use

Thickness (t) mm	Chemical Composition %								
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo
12 ≦ t ≦ 125	0.38~ 0.43	0.15~ 0.35	0.60~ 0.90	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.90~ 1.20	0.15~ 0.30

Remarks : 1. There is no mechanical properties requirements for die for pressing of plates.

2. This is applicable afterwards quenching and tempering process.

7.1.7.6.1 CNS 13812-12 SN490YB (Rolled steels for building structure)

Thickness (t) mm	Chemical Composition %						Mechanical Propertites						
	C	Si	Mn	P	S	Ceq	Yield Strength N/mm²	Tensile Strength N/mm²	Yield Ratio %	Elongation		Impact Test	
										Test piece	%	Temp/Test Direction	AVG Joule
6 ≦ t ≦ 16	0.18 max.	0.55 max.	1.60 max.	0.030 max.	0.015 max.	0.44 max.	325~445	490~610	80 max.	No.1A	17min.	0℃ / Parallel to rolling direction	27 min.
16 < t ≦ 40											21min.		
40 < t ≦ 50						0.46 max.				No.4	23min.		
50 < t ≦ 80													

7.1.7.6.2 CNS 13812-12 SN490YC (Rolled steels for building structure)

Thickness (t) mm	Chemical Composition %						Mechanical Propertites							
	C	Si	Mn	P	S	Ceq	Yield Strength N/mm²	Tensile Strength N/mm²	Yield Ratio %	Elongation		ZRa%	Impact Test	
										Test piece	%	AVG/ IDV min	Temp/ Test Direction	AVG Joule
t= 16	0.18 max.	0.55 max.	1.60 max.	0.020 max.	0.008 max.	0.44 max.	325~445	490~610	80 max.	No.1A	17 min.	25/15	0℃ / Parallel to rolling direction	27 min.
16 < t ≦ 40											21 min.			
40 < t ≦ 50						0.46 max.				No.4	23 min.			
50 < t ≦ 80														

Remarks：Carbon Equivalent Ceq(%) = C+Mn/6+Si/24+Ni/40+Cr/5+Mo/4+V/14. (This is applicable for non-TMCP supply of condition only)

7.1.7.7 CSC PZ590T (The most excellent strength plate for structural use)

Thickness (t) mm	Chemical Composition %						Mechanical Propertites								
	C	Si	Mn	P	S	Ceq	YS N/mm²	TS N/mm²	Elongation %		ZRa%		Impact Test		
									No.5	No.4	thickness (t) mm		Temp ℃	AVG Joule	Test piece
									thickness (t) mm		20 < t ≦ 80				
									15 ≦ t ≦ 20	20 < t ≦ 80	AVG	IDV			
15 ≦ t ≦ 40	0.09 max.	0.55 max.	1.80 max.	0.020 max.	0.008 max.	0.44 max.	440 min.	590 ~ 740	20 min.	20 min.	25 min.	15 min.	-5	47 min.	Parallel to rolling direction
40 < t ≦ 80						0.47 max.									

Remarks：1. Carbon Equivalent Ceq(%) = C+Mn/6+Si/24+Ni/40+Cr/5+Mo/4+V/14.
2. Impact test is applied only to the plates exceeding 12 mm in thickness.
3. It needs not to be performed in ZRa% test if below 20mm in thickness except for agreement between purchaser and manufacturer.

7.1.7.8 CSC PH490TB (Fire resistant steel plates)

Thickness (t) mm	Chemical Composition %						Mechanical Propertites							
	C	Si	Mn	P	S	Ceq	YS N/mm²	TS N/mm²	Yield Ratio %	Elongation % (No.1A)		Impact Test		
										thickness (t) mm		Temp ℃	AVG Joule	Test piece
										12 < t ≦ 16	16 < t ≦ 30			
12 < t ≦ 30	0.18 max.	0.55 max.	1.60 max.	0.030 max.	0.015 max.	0.44 max.	325~445	490~610	80 max.	17 min.	21 min.	0	27 min.	Parallel to rolling direction

Remarks：The product properties could be maintained by 2/3 yield strength of room temperature in 600℃ .

7.1.7.9 CSC SM570M (Building Structure with excellent strength and weldability)

Grade (Level)	thick-ness (t) mm	Chemical Composition %						Mechanical Propertites								
		C	Si	Mn	P	S	Ceq	YS N/mm²	TS N/mm²	Yield Ratio %	EL %	ZRa% AVG	ZRa% IDV	-5℃ Impact test Position	-5℃ Impact test AVG Joule	-5℃ Impact test Test piece
A	13 ≦ t < 50	0.18 max.	0.55 max.	1.60 max.	0.030 max.	0.008 max.	0.44 max.	420 ~ 540	570 ~ 720	85 max.	(1)	—		t/4	47min.	V-notch test piece in rolling direction
B	13 ≦ t ≦ 40									85 max.	(1)	—		t/4	47min.	
	40 < t < 50									80 max.	(1) 20	—		t/4	47min.	
	50 ≦ t ≦ 60						0.46 max.					25 min.	15 min.	t/4 t/2	47min. 27min.	
C	16 ≦ t < 50	0.18 max.	0.55 max.	1.60 max.	0.020 max.	0.008 max.	0.44 max.			85 max.	(1) 20	25 min.	15 min.	t/4	47min.	
	50 ≦ t ≦ 80						0.46 max.							t/4 t/2	47min. 27min.	
C HW (2)	16 ≦ t < 50						0.44 max.			85 max.	(1) 20	25 min.	15 min.	t/4	47min.	
	50 ≦ t ≦ 80						0.46 max.							t/4 t/2	47min. 27min.	

Remarks : 1. The individual value (IDV) of percent elongation shall be 19 min(t ≦ 16mm) and 26 min(16 < t ≦ 20mm) separatedly if below 20mm in thickness. The E.L% is 20 mininum if over 20mm in thickness.

2. The grade C HW is fit to high heat input welding. The heat affected zone (HAZ) is permitted by 880 KJ/cm in input welding. The temp. − 5℃ of impact test in fusion line shall be achieved above 15 Joules in guarantee.

3. Carbon Equivalent Ceq(%) = C+Mn/6+Si/24+Ni/40+Cr/5+Mo/4+V/14.

7.1.7.10 ASTM A516 HIC (The pressure vessel of Hydrogen Induced Crack resistant)

Grade	Thickness (t) mm	Chemical Composition %						Mechanical Propertites			
		C	Si	Mn	P	S	Ceq	YS N/mm²	TS N/mm²	Elongation Test piece	Elongation %
GR.60	6.00 ≦ t ≦ 50.80	0.20 max.	0.15~ 0.40	0.60~ 1.20	0.010 max.	0.003 max.	0.42 max.	220 min.	415~550	No.1A	21 min.
	50.80 < t ≦ 58.00									No.4	25 min.
GR.70	6.00 ≦ t ≦ 50.80	0.20 max.	0.15~ 0.40	0.85~ 1.20	0.010 max.	0.002 max.	0.42 max.	260 min.	485~620	No.1A	17 min.

Remarks : 1. The guarantee of crack length ratio (CLR) shall be 15% in maximum except for agreement between purchaser and manufacturer.

2. Carbon Equivalent Ceq(%) = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15.

3.This product specification shall be normalized and simulated post weld heat treatment.

7.2 Tolerances

7.2.1 JIS G3193 Thickness Tolerances of Steel Plates

unit：mm

Width (w) / Thickness (t)	800 ≦ w < 1600	1600 ≦ w < 2000	2000 ≦ w < 2500	2500 ≦ w < 3150	3150 ≦ w < 4000
6.00 ≦ t < 6.30	±0.50	±0.60	±0.60	±0.75	±0.75
6.30 ≦ t < 10.0	±0.55	±0.65	±0.65	±0.80	±0.80
10.0 ≦ t < 16.0	±0.55	±0.65	±0.65	±0.80	±0.80
16.0 ≦ t < 25.0	±0.65	±0.75	±0.75	±0.95	±0.95
25.0 ≦ t < 40.0	±0.70	±0.80	±0.80	±1.00	±1.00
40.0 ≦ t < 63.0	±0.80	±0.95	±0.95	±1.10	±1.10
63.0 ≦ t < 100	±0.90	±1.10	±1.10	±1.30	±1.30
100 ≦ t ≦ 125	±1.30	±1.50	±1.50	±1.70	±1.70

Remarks：1. When required, the tolerance in the above table may be one-sided either minus or plus side, provided that the total range of the tolerance in this case shall be equal to the total range of the tolerance given in the above table.

2. The positions where the thickness is to be measured shall be as follows:
   - For as-rolled steel plates with edge untrimmed, any point inward from the line of width predetermined to be cut.
   - For cut-edged steel plates, any point 15mm and over inward from the edge.

3. The above table does not apply to the pressure vessel plates.

7.2.2 JIS G3136(SN) Thickness Tolerances of Steel Plates

unit：mm

Width (w) / Thickness (t)	800 ≦ w < 1600	1600 ≦ w < 2000	2000 ≦ w < 2500	2500 ≦ w < 3150	3150 ≦ w < 4000
6.00 ≦ t < 6.30	+ 0.70	+ 0.90	+ 0.90	+ 1.20	+ 1.20
6.30 ≦ t < 10.0	+ 0.80	+ 1.00	+ 1.00	+ 1.30	+ 1.30
10.0 ≦ t < 16.0	+ 0.80	+ 1.00	+ 1.00	+ 1.30	+ 1.30
16.0 ≦ t < 25.0	+ 1.00	+ 1.20	+ 1.20	+ 1.60	+ 1.60
25.0 ≦ t < 40.0	+ 1.10	+ 1.30	+ 1.30	+ 1.70	+ 1.70
40.0 ≦ t < 63.0	+ 1.30	+ 1.60	+ 1.60	+ 1.90	+ 1.90
63.0 ≦ t < 100	+ 1.50	+ 1.90	+ 1.90	+ 2.30	+ 2.30
100	+ 2.30	+ 2.70	+ 2.70	+ 3.10	+ 3.10

Remarks：1. The minus side of thickness tolerance shall be -0.30mm.

2. The positions where the thickness is to be measured shall be as follows:
   - For as-rolled steel plates with edge untrimmed, any point inward from the line of width predetermined to be cut.
   - For cut-edged steel plates, any point 15mm and over inward from the edge.

7.2.3 JIS G3103(SB)，JIS G3115(SPV) Thickness Tolerances of Steel Plates

unit：mm

Width (w) / Thickness (t)	800 ≦ w < 1600	1600 ≦ w < 2000	2000 ≦ w < 2500	2500 ≦ w < 3150	3150 ≦ w < 4000
6.00 ≦ t < 6.30	+ 0.75	+ 0.95	+ 0.95	+ 1.25	+ 1.25
6.30 ≦ t < 10.0	+ 0.85	+ 1.05	+ 1.05	+ 1.35	+ 1.35
10.0 ≦ t < 16.0	+ 0.85	+ 1.05	+ 1.05	+ 1.35	+ 1.35
16.0 ≦ t < 25.0	+ 1.05	+ 1.25	+ 1.25	+ 1.65	+ 1.65
25.0 ≦ t < 40.0	+ 1.15	+ 1.35	+ 1.35	+ 1.75	+ 1.75
40.0 ≦ t < 63.0	+ 1.35	+ 1.65	+ 1.65	+ 1.95	+ 1.95
63.0 ≦ t < 100	+ 1.55	+ 1.95	+ 1.95	+ 2.35	+ 2.35

Remark：The minus side tolerance on thickness shall be -0.25mm.

7.2.4 ASTM A6，ASME SA6 Thickness Tolerances of Steel Plates

unit：mm

Thickness (t) \ Width (w)	800 ≦ w < 1219	1219 ≦ w < 1524	1524 ≦ w < 1829	1829 ≦ w < 2134	2134 ≦ w < 2438	2438 ≦ w < 2743	2743 ≦ w < 3048	3048 ≦ w < 3353	3353 ≦ w < 3658	3658 ≦ w < 4267
6.00 ≦ t < 6.35	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	1.02	—
6.35 ≦ t < 7.94	0.76	0.76	0.76	0.76	0.76	0.76	0.76	1.02	1.02	—
7.94 ≦ t < 9.53	0.76	0.76	0.76	0.76	0.76	0.76	0.76	1.02	1.02	1.27
9.53 ≦ t < 11.11	0.76	0.76	0.76	0.76	0.76	0.76	1.02	1.02	1.27	1.52
11.11 ≦ t < 12.70	0.76	0.76	0.76	0.76	0.76	0.76	1.02	1.02	1.27	1.52
12.70 ≦ t < 15.88	0.76	0.76	0.76	0.76	0.76	0.76	1.02	1.02	1.27	1.52
15.88 ≦ t < 19.05	0.76	0.76	0.76	0.76	0.76	1.02	1.02	1.02	1.27	1.52
19.05 ≦ t < 25.40	0.76	0.76	0.76	0.76	1.02	1.02	1.27	1.27	1.52	1.78
25.40 ≦ t < 50.80	1.52	1.52	1.52	1.52	1.52	1.78	2.03	2.54	2.54	2.79
50.80 ≦ t < 76.20	2.29	2.29	2.29	2.54	2.54	2.79	3.05	3.30	3.56	3.81
76.20 ≦ t < 101.60	2.79	2.79	2.79	2.79	2.79	3.30	3.56	3.56	3.56	3.81
101.60 ≦ t < 125.0	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	5.08

Remarks：1. The minus side tolerance on thickness shall be -0.25mm.

2. Thickness shall be measured at 9.53 to 19.05mm from the longitudinal edge.

3. For thickness measured at any location other than that specified in note 2, the permissible maximum over tolerance shall be increased by 75%.

7.2.5 ABS Thickness Tolerances of Steel Plates

unit：mm

Norminal Thickness(t)	Thickness Tolerance
6.00 ≦ t ≦ 75.00	According to ISO 7452 Class C rules

7.2.6 JIS G3193 Width Tolerances of Steel Plates

unit：mm

Width(w)	Thickness(t)	Tolerance			
		Mill Edge		Cut Edge (By Ordinary Cutting)	
		Lower	Upper	Lower	Upper
800 ≦ w < 1000	6.00 ≦ t < 20.0	0	Not specified	0	10
	20.0 ≦ t				15
1000 ≦ w < 1250	6.00 ≦ t < 20.0				15
	20.0 ≦ t				
1250 ≦ w < 1600	6.00 ≦ t < 20.0				
	20.0 ≦ t				
1600 ≦ w	6.00 ≦ t < 20.0				1.2%
	20.0 ≦ t				

7.2.7 JIS G3193 Length Tolerances of Steel Plates

unit：mm

Length(L)	Tolerance	
	Cut Edge(By Ordinary Cutting)	
	Lower	Upper
3048 ≦ L < 4000	0	20
4000 ≦ L < 6000	0	30
6000 ≦ L < 8000	0	40
8000 ≦ L < 10000	0	50
10000 ≦ L < 15000	0	75
15000 ≦ L ≦ 18000	0	100

7.2.8 ASTM Length & Width Tolerances of Sheared Plates

unit : mm

Specified Dimensions		Upper Limit of Tolerance on Length & Width for Thickness (t)							
Length(L)	Width(w)	t ≦ 9.53		9.53 < t ≦ 15.87		15.88 ≦ t ≦ 25.39		25.40 ≦ t ≦ 50.80	
		Width	Length	Width	Length	Width	Length	Width	Length
L < 3048	w < 1524	9	13	11	16	13	19	16	25
	1524 ≦ w < 2133	11	16	13	17	16	22	19	25
	2133 ≦ w < 2743	13	19	16	22	19	25	25	28
	2743 ≦ w	16	22	19	25	22	28	28	32
3048 ≦ L < 6096	w < 1524	9	19	13	22	16	25	19	28
	1524 ≦ w<2133	13	19	16	22	19	25	22	32
	2133 ≦ w<2743	14	22	17	24	20	28	25	35
	2743 ≦ w	16	25	19	28	22	32	28	35
6096 ≦ L < 9144	w < 1524	9	25	13	28	16	32	19	38
	1524 ≦ w < 2133	13	25	16	28	19	32	22	38
	2133 ≦ w < 2743	14	25	17	28	22	35	25	38
	2743 ≦ w	17	28	22	32	25	35	32	44
9144 ≦ L < 12192	w < 1524	11	28	13	32	16	35	19	41
	1524 ≦ w < 2133	13	32	16	35	19	38	22	41
	2133 ≦ w < 2743	14	32	19	35	22	38	25	47
	2743 ≦ w	19	35	22	38	25	41	32	47
12192 ≦ L < 15240	w < 1524	11	32	13	38	16	41	19	47
	1524 ≦ w < 2133	13	35	16	38	19	41	22	47
	2133 ≦ w < 2743	16	35	19	38	22	41	25	47
	2743 ≦ w	19	38	22	41	25	44	32	47
15240 ≦ L < 18288	w < 1524	13	44	16	47	19	47	22	57
	1524 ≦ w < 2133	16	44	19	47	22	47	25	57
	2133 ≦ w < 2743	16	44	19	47	22	47	28	57
	2743 ≦ w	22	44	25	51	28	57	32	63
18288 ≦ L	w < 1524	14	51	19	54	22	57	25	70
	1524 ≦ w < 2133	19	51	22	54	25	57	28	70
	2133 ≦ w < 2743	19	51	22	54	25	57	32	70
	2743 ≦ w	25	51	28	60	32	63	35	76

Remark : The lower limit tolerance on specified length and width is -6mm.

7.2.9 ASTM Width & Length Tolerances of Steel Plates(When Gas Cutting is Specified or Required)

unit : mm

Specified Thickness (t)	Tolerance on Width and length (Applies to Carbon Steel)	Tolerance on Width and length (Applies to Alloy Steel)
t < 50.8	+ 13 0	+ 19 0
50.8 ≦ t < 101.6	+ 16 0	+ 25 0
101.6 ≦ t ≦ 125	+ 19 0	+ 28 0

7.2.10 JIS G3193 Maximum Flatness Tolerances of Steel Plates

unit：mm

Measured Length	2000				4000		
Width(w) / Thickness (t)	800 ≦ w < 1250	1250 ≦ w < 1600	1600 ≦ w < 2000	2000 ≦ w	800 ≦ w < 2000	2000 ≦ w < 3000	3000 ≦ w
6.00 ≦ t < 8.00	13	13	13	21	22	28	—
8.00 ≦ t < 15.00	12	12	12	16	12	16	24
15.00 ≦ t < 25.00	12	12	12	16	12	16	22
25.00 ≦ t < 40.00	9	9	9	13	9	13	19
40.00 ≦ t < 80.00	8	8	8	11	8	11	16
80.00 ≦ t < 150	8	8	8	10	8	10	15
150 ≦ t < 250	10	10	10	15	10	15	20
250 ≦ t ≦ 350	20	20	20	20	20	20	20

Remarks：1.The above table applies to 4m in length at any place of steel plate, and for steel plate less than 4m in length,to the full length.

2. For the steel plate whose minimum tensile strength is specified to be 570N/mm^2 and over, or whose minimum yield strength 430N/mm^2 and over, the maximum value of flatness specified in the above table shall be altered to one and half times the given values, unless otherwise specified.
3. This table shall not be applied to the as-rolled steel plate with untrimmed edge.
4. Measurement of flatness, as a rule, shall be made on a flat surface plate.

7.2.11 ASTM Maximum Flatness Tolerances of Steel Plates(Applies to Carbon Steel Only)

unit：mm

Specified Thickness (t)	Permitted Variations From a Flat Surface for Specified Width (w)										
	w < 914	914 ≦ w < 1219	1219 ≦ w < 1524	1524 ≦ w < 1829	1829 ≦ w < 2134	2134 ≦ w < 2438	2438 ≦ w < 2743	2743 ≦ w < 3048	3048 ≦ w < 3658	3658 ≦ w < 4267	4267 ≦ w
t < 6.35	14	19	24	32	35	38	41	44	47	—	—
6.35 ≦ t < 9.53	13	16	19	24	28	32	35	38	41	—	—
9.53 ≦ t < 12.70	13	14	16	16	19	22	25	28	32	47	54
12.70 ≦ t < 19.05	11	13	14	16	16	19	25	25	28	38	50
19.05 ≦ t < 25.40	11	13	14	16	16	16	19	22	25	35	44
25.40 ≦ t < 50.80	9	13	13	14	14	16	16	16	17	28	38
50.80 ≦ t < 101.60	8	9	11	13	13	13	13	14	16	22	28
101.60 ≦ t < 125.00	9	11	13	13	14	14	16	19	22	22	25

Remarks：1. The above table applies to flatness variations for length and width.

2. The flatness variations across the width shall not exceed the tabular amount for the specified width.
3. The permissible variations in flatness along the length shall not exceed the tabular amount for the specified width in plates up to 3.6m in length, or in any 3.6m of longer plates.
4. When the longer dimension is under 914mm the permissible variation shall not exceed 6mm. When the longer dimension ranges from 914mm to 1829mm incl. the permissible variation shall not exceed 75% of the tabular amount for the specified width, but in no case less than 6mm.
5. These variations apply to plates which have a specified min. tensile strength not more than 60ksi(414N/mm^2). The limits in the table are increased 50% for plates specified to a higher min. tensile strength.

7.2.12 ASTM Maximum Flatness Tolerances of High-Strength Low-Alloy and Alloy Steel Plates

unit：mm

Specified Thickness(t)	Flatness Tolerances for Specified Widths(w)										
	w < 914	914 ≦ w < 1219	1219 ≦ w < 1524	1524 ≦ w < 1829	1829 ≦ w < 2134	2134 ≦ w < 2438	2438 ≦ w < 2743	2743 ≦ w < 3048	3048 ≦ w < 3658	3658 ≦ w < 4267	4267 ≦ w
t < 6.35	20	28	35	47	51	57	60	66	70	—	—
6.35 ≦ t < 9.53	19	24	28	35	44	47	51	57	60	—	—
9.53 ≦ t < 12.70	19	22	24	24	28	33	38	41	47	70	79
12.70 ≦ t < 19.05	16	19	20	22	25	28	32	35	41	57	76
19.05 ≦ t < 25.40	16	19	22	22	24	25	28	33	38	51	66
25.40 ≦ t < 50.80	14	16	19	20	22	24	25	25	25	41	57
50.80 ≦ t < 101.60	13	14	17	19	19	19	19	22	25	32	41
101.60 ≦ t ≦ 125.00	14	17	19	19	22	22	24	28	32	32	38

Remarks：1. The above table applies to flatness variations for length and width.

2. The flatness variations across the width shall not exceed the tabular amount for the specified width.
3. The permissible variations in flatness along the length shall not exceed the tabular amount for the specified width in plates up to 3.6m in length, or in any 3.6m of longer plates.
4. When the longer dimension is under 914mm the variation shall not exceed 9.5mm. When the longer dimension ranges from 914mm to 1829mm incl. the variation shall not exceed 75% of the tabular amount for the specified width.

7.2.13 JIS，ASTM Lateral Warpage Tolerance of Steel Plates

unit：mm

Length(L) / Width(w)	JIS				ASTM
	2500 ≦ L < 4000	4000 ≦ L < 6300	6300 ≦ L < 10000	10000 ≦ L	Not Specified
630 ≦ w < 1000	6max.	10max.	16max.	16 max. for 10000 of length at any place	
W ≧ 1000	5max.	8max.	12max.	12 max. for 10000 of length at any place	
Not Specified					2×Length(m) max.

Remark：The above table applies to shear-cut and flame-cut plates.

7.2.14 ASTM Permissible Variation in Waviness Tolerances for Plates

unit：mm

Tolerances from 7.2.11 or 7.2.12	Waviness Tolerances (Number of Waves/per 3600mm)						
	1	2	3	4	5	6	7
8	8	6	5	3	3	2	2
9	9	8	5	5	3	2	2
11	11	8	6	5	3	3	2
13	13	9	8	5	5	3	2
14	14	11	8	6	5	3	2
16	16	13	9	6	5	3	2
17	17	13	9	8	5	5	2
19	19	14	11	8	6	5	2
21	21	16	11	8	6	5	2
22	22	17	13	9	6	5	2
24	24	17	13	9	8	6	5
25	25	19	14	11	8	6	5
29	29	22	16	13	9	8	6
32	32	24	17	13	9	8	6
35	35	27	19	14	11	8	6
38	38	29	22	16	13	9	6
41	41	32	24	17	13	9	8
44	44	33	25	19	14	11	8
48	48	37	27	21	14	11	8
51	51	38	29	22	16	13	9
54	54	41	30	22	17	13	9
57	57	43	32	24	17	14	9
60	60	46	33	25	19	14	11
63	63	48	37	27	21	14	11
67	67	51	38	29	21	16	11
70	70	52	40	29	22	16	13
73	73	56	41	30	24	17	13
76	76	57	43	32	24	17	14
79	79	60	44	33	25	19	14

Remark: The waviness tolerance is a function of the flatness tolerance as obtained from 7.2.11 or 7.2.12.

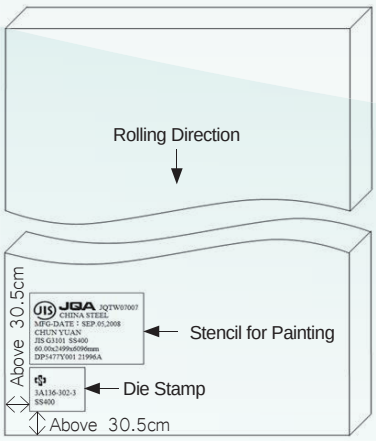
8 AVAILABLE SIZE

(Unit：Thickness/Width:mm, Length:m)

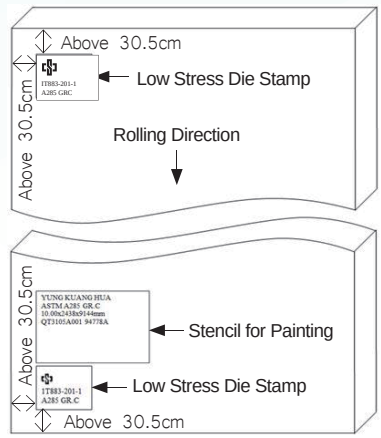
Length / Width	1524 ≤ 1599	1600 ≤ 1700	1701 ≤ 1800	1801 ≤ 1900	1901 ≤ 2050	2051 ≤ 2200	2201 ≤ 2400	2401 ≤ 2600	2601 ≤ 2800	2801 ≤ 3000	3001 ≤ 3200	3201 ≤ 3400	3401 ≤ 3600	3601 ≤ 3800	Width / Length
6.00~6.99													Negotiation		6.00~6.99
7.00~7.99															7.00~7.99
8.00~8.99															8.00~8.99
9.00~9.99															9.00~9.99
10.00~11.99															10.00~11.99
12.00~13.99															12.00~13.99
14.00~15.99															14.00~15.99
16.00~17.99															16.00~17.99
18.00~19.99															18.00~19.99
20.00~21.99															20.00~21.99
22.00~23.99														17.7	22.00~23.99
24.00~25.99												18.2	17.2	16.3	24.00~25.99
26.00~27.99											18.1	16.9	16.0	15.1	26.00~27.99
28.00~29.99										18.0	16.9	15.8	14.9	14.1	28.00~29.99
30.00~31.99									18.1	16.9	15.8	14.8	14.0	13.2	30.00~31.99
32.00~33.99								18.4	17.0	15.9	14.9	13.9	13.1	12.4	32.00~33.99
34.00~35.99								17.3	16.1	15.0	14.0	13.1	12.4	11.7	34.00~35.99
36.00~37.99							17.9	16.4	15.2	14.2	13.3	12.4	11.7	11.1	36.00~37.99
38.00~39.99							16.8	15.6	14.4	13.5	12.6	11.8	11.1	10.5	38.00~39.99
40.00~41.99				18.3		17.7	16.0	14.8	13.7	12.8	12.0	11.2	10.6	10.0	40.00~41.99
42.00~43.99		18.1	18.4	17.4	18.1	16.9	15.2	14.1	13.1	12.2	11.4	10.7	10.1	9.5	42.00~43.99
44.00~45.99	18.4	17.3	17.6	17.6	17.3	16.1	14.6	13.5	12.5	11.7	10.9	10.2	9.6	9.1	44.00~45.99
46.00~47.99	17.7	16.6	16.9	16.9	16.6	15.4	13.9	13.0	12.0	11.2	10.5	9.8	9.2	8.7	46.00~47.99
48.00~50.80	16.9	15.9	16.2	16.2	15.9	14.8	13.4	12.4	11.5	10.7	10.0	9.4	8.8	8.4	48.00~50.80
50.81~51.99	16.3	15.3	15.6	15.6	15.3	14.2	12.9	11.9	11.0	10.3	9.6	9.0	8.5	8.0	50.81~51.99
52.00~53.99	15.7	14.7	15.0	15.0	14.7	13.7	12.4	11.5	10.6	9.9	9.3	8.7	8.2	7.7	52.00~53.99
54.00~55.99	15.1	14.2	14.4	13.4	14.2	13.2	11.9	11.1	10.3	9.6	8.9	8.3	7.9	7.4	54.00~55.99
56.00~57.99	14.6	13.7	13.9	12.9	13.7	12.7	11.5	10.7	9.9	9.2	8.6	8.1	7.6	7.2	56.00~57.99
58.00~59.99	14.1	13.2	13.5	12.5	13.2	12.3	11.1	10.3	9.6	8.9	8.3	7.8	7.3	6.9	58.00~59.99
60.00~61.99	13.6	12.8	13.0	12.1	12.8	11.9	10.7	10.0	9.2	8.6	8.1	7.5	7.1	6.7	60.00~61.99
62.00~63.99	13.2	12.4	12.6	11.7	12.4	11.5	10.4	9.7	8.9	8.3	7.8	7.3	6.9	6.5	62.00~63.99
64.00~65.99	12.7	12.0	12.2	11.3	12.0	11.2	10.1	9.4	8.7	8.1	7.6	7.1	6.6	6.3	64.00~65.99
66.00~67.99	12.3	11.6	11.8	11.0	11.6	10.8	9.8	9.1	8.4	7.8	7.3	6.8	6.4	6.1	66.00~67.99
68.00~69.99	12.0	11.3	11.5	10.7	11.3	10.5	9.5	8.8	8.2	7.6	7.1	6.6	6.3	5.9	68.00~69.99
70.00~71.99	11.6	10.9	11.2	10.4	10.9	10.2	9.2	8.6	7.9	7.4	6.9	6.4	6.1	5.7	70.00~71.99
72.00~73.99	11.3	10.6	10.9	10.1	10.6	9.9	9.0	8.3	7.7	7.2	6.7	6.3	5.9	5.6	72.00~73.99
74.00~75.99	11.0	10.4	10.6	9.8	10.4	9.7	8.7	8.1	7.5	7.0	6.5	6.1	5.7	5.4	74.00~75.99
76.00~77.99	10.7	10.1	10.3	9.6	10.1	9.4	8.5	7.9	7.3	6.8	6.4	5.9	5.6	5.3	76.00~77.99
78.00~79.99	10.4	9.8	10.0	9.3	9.8	9.2	8.3	7.7	7.1	6.6	6.2	5.8	5.4	5.1	78.00~79.99
80.00~81.99	10.2	9.6	9.8	9.1	9.6	8.9	8.1	7.5	6.9	6.5	6.0	5.6	5.3	5.0	80.00~81.99
82.00~83.99	9.9	9.3	9.5	8.9	9.4	8.7	7.9	7.3	6.8	6.3	5.9	5.5	5.2	4.9	82.00~83.99
84.00~85.00	9.8	9.2	9.4	8.8	9.2	8.6	7.8	7.2	6.7	6.2	5.8	5.4	5.1	4.8	84.00~85.00
85.01~90.00	9.3	8.7	8.9	8.3	8.7	8.1	7.3	6.8	6.3	5.9	5.5	5.1	4.8	4.6	85.01~90.00
90.01~95.00	8.8	8.2	8.4	7.8	8.2	7.7	6.9	6.4	6.0	5.5	5.2	4.8	4.6		90.01~95.00
95.01~100.00	8.3	7.8	8.0	7.4	7.8	7.3	6.6	6.1	5.6	5.3	4.9	4.6			95.01~100.00
100.01~105.00	7.9	7.4	7.6	7.0	7.4	6.9	6.3	5.8	5.4	5.0	4.7				100.01~105.00
105.01~110.00	7.5	7.1	7.2	6.7	7.1	6.6	6.0	5.5	5.1	4.8					105.01~110.00
110.01~115.00	7.2	6.8	6.9	6.4	6.8	6.3	5.7	5.3	4.9						110.01~115.00
115.01~120.00	6.9	6.5	6.6	6.1	6.5	6.0	5.5	5.1	4.7						115.01~120.00
120.01~125.00	6.6	6.2	6.3	5.9	6.2	5.8	5.2	4.8	4.5						120.01~125.00
Thickness / Length / Width	1524 ≤ 1599	1600 ≤ 1700	1701 ≤ 1800	1801 ≤ 1900	1901 ≤ 2050	2051 ≤ 2200	2201 ≤ 2400	2401 ≤ 2600	2601 ≤ 2800	2801 ≤ 3000	3001 ≤ 3200	3201 ≤ 3400	3401 ≤ 3600	3601 ≤ 3800	Thickness / Length / Width

Maximum length for this area: 18.5m

(1) Plate for general use

	Instruction			Position
Stencil for painting	JIS JGA JQTW07007 CHINA STEEL MFG-DATE : SEP.05,2008 CHUN YUAN JIS G3101 SS400 60.00x2499x6096mm DP5477Y001 21996A	1	Pattern and Mark	
		2	CSC Name	
		3	Date	
		4	Customer Name	
		5	Spec./Grade	
		6	Dimensions	
		7	Order No/Plate No.	
Die Stamp	3A136-302-3 SS400	8	Trade Mark	
		9	Heat No./Slab ID	
		10	Grade	

(2) Plate for pressure vessel

	Instruction			Position
Stencil for painting (Two Sites)	YUNG KUANG HUA ASTM A285 GR.C 10.00x2438x9144mm QT3105A001 94778A	1	Customer Name	
		2	Spec./Grade	
		3	Dimensions	
		4	Heat No./Slab ID	
Low Stress Die Stamp	IT883-201-1 A285 GRC	5	Trade Mark	
		6	Heat No./Slab ID	
		7	Grade	

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PRECAUTIONS FOR USE

10.1 Orientation Feature

Plate products are produced from slabs through rolling process. In general, the properties of plate on rolling direction (longitudinal) are better than those on transverse direction. In addition, the applications, which stress is applied on thickness direction and the effect of middle thickness position of plate due to the center segregation of slabs, shall be considered. The properties on thickness direction shall be also asked to announce and verify if necessary.

10.2 Post-Processes and Quality Requirements

The ways of processing for plate products are mostly often seen in cutting, bending and welding, among which welding is specially the most major way of processing since almost all applications of steel plates need to have the post-process for welding. The use of steel plates, in addition to the requirements for specification tolerance and surface quality, the inner quality for satisfying various uses needs to have the corresponding quality properties, such as strength, toughness, corrosion resistance, weldability etc. Therefore, it should plan carefully in the early stage of material design according to the end-uses and consider the subsequent corresponding processes to avoid unexpected failures.

10.3 The Influences of Cutting

Since shear-cutting produces some unfavorable features such as micro cracks, burrs and hardened layer on the cutting surface, it is easy to result in the end-surface cracks that are detrimental to following processes. The effective methods to prevent the occurring of end-surface cracks are removing of burrs, making of rounded corners or heat annealing.

Flame-cutting will harden the cutting surface by the quenching effect which is positively correlative to the carbon equivalent. Mild heating to the cutting region before and after flame-cutting is helpful to the subsequent processes.

10.4 Weldability

Welding area includes fusion zone (i.e. the weld metal) and heat affected zone (HAZ). The fusion zone forms casting texture while the HAZ turns to a hardened area after welding. Due to quenching effect, HAZ is characterized by its low elongation and could be a crack source during welding or using. Hence, the material properties and welding conditions have to be confirmed so that the highest hardness in heat affected zone can be possibly reduced. Since the highest hardness is generally a direct proportion with the carbon content, the hardened area alloy additions (as carbon equivalent) can be considered and adjusted from the early stage of material design in order to improve the weldability and reduce the detrimental effects of HAZ.

The carbon equivalent can be estimated by following equation:

Ceq(%) = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15

Steel grades that contains Ni, Cr, Mo, Cu, V and Nb in the composition need to be treated carefully during welding because the material is easy to form a HAZ with very hard textures and result in such problems as low elongation and low-temperature cracks.

Low-temperature crack happens after a period of time from the welding, including underbead crack, root crack and toe crack, etc. The causes of low-temperature crack include the elongation of HAZ, the diffusion of hydrogen in weld metal, and the restraint and hardenability of material.

PCM, the low-temperature crack sensitivity, is a quantitative index to monitor the correlation between chemical composition and low-temperature crack occurrence, which can be calculated as below:

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

The lower PCM value, the lower risk of crack of materials is. It may reduce preheating temperature when doing the welding. PCM is a very important property to the steel maker developing high strength steels, and it have to be properly handled for the production of steels with excellent weldability and crack resistance.

10.5 Bendability

The bending radius applied on a steel plate shall not be smaller than the minimum value given by specification. The degree of minimum bending radius depends on the thickness and materials of steel plates. The smaller minimum bending radius, the better bendability of steel plates is. As for the influences of thickness of steel plates, the thicker, the more difficult processing is, and the larger minimum bending radius becomes, too.

Because the effect of rolling steel plates with longitudinal direction for bending work is better than that with the transverse direction, when the bending direction is toward parallel direction of rolling, the materials can bear more strains. In reverse, it is easy to crack if the bending direction is vertical direction of rolling. These factors should be regarded at sampling and planning stage for preventing bending work from cracks. Furthermore, burrs of cutting surface are supposed to be in the inner radius of bending since they are crack inducers under tension stress.

10.6 Ultrasonic Test

(1) Since CSC uses continuous casting slabs to roll steel plates, the maximum thickness of slabs is 270 mm. The maximum thickness of plate would be extended as possible to meet requirments of customers. And for the rolling ratio and safty considerations, customers should consider doing the UT examination.

(2) Adoptable ultrasonic test standards are listed as follows:

(a) ASTM A435 and A578: The ultrasonic tests that focus on inner layer type defect detection. Test and acceptance criteria of A578 are divided into 3 levels of A, B and C. Level A is the same with A435 that single defective spot shall not be larger than 3 inch or the circle area of the diameter of 1/2 thickness. Level B is altered from level A that nearby small defects will be involved into the calculation of defect size. Level C is the strictest that the acceptable single maximum defect size shall not be larger than 1 inch.

(b) JIS G0801 and G0901: G0801 is designed for pressure vessels and is divided into 3 types of SG、AC、AL and class X、Y. G0901 is designed for building structures and is divided into 2 types of X and Y. Both standards focus on the detection of inner layers and defect spots that the criteria of G0801 are stricter than that of G0901.

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CONVERSION TABLES

Length	ft	inch	mm	m
	1	12	304.8	0.3048
	0.08333	1	25.4	0.0254
	0.003281	0.03937	1	0.001

Mass	1kg = 2.20462 lb

Force	1kgf = 9.80665 N

Stress	ksi(=1000psi)	psi	kgf/mm^2	N/mm^2(=MPa)
	1	1000	0.70307	6.89476
	0.001	1	7.0307×10^{-4}	6.89476×10^{-3}
	1.42233	1422.33	1	9.80665
	0.145038	145.038	0.101972	1

Absorbed Energy	ft-lbf	kgf-m	N-m(= joule)
	1	0.138255	1.35582
	7.23301	1	9.80665
	0.737562	0.101972	1

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ORDERING INFORMATION

Required Ordering Data		Example
1	Specification	ASTM/ASME/JIS
2	Designation Grade and Year of Issue	A36/SA36/SS400
3	Order Size(Thickness × Width × Length)	6.00~125mm×1524mm×3048mm
4	Order Piece	7 pieces
5	Chemical Composition	Specification/Cust. Spec./Mill Range
6	Application	General Purpose
7	Edge Status	Mill Edge or Cut Edge
8	Delivery Condition	As-Rolled/Normalized/Control Rolled
9	Special Requirements(If required)	Ultrasonic Test (A435/A578/G0801/G0901)
		Impact Test (Temp./Direction/Absorption Energy)
		Simulated Post Welding Heat Treatment (Hold Temp./Time/Heating or Cooling Rate)

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

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CAT.NO.3-PL-01-2014-E1