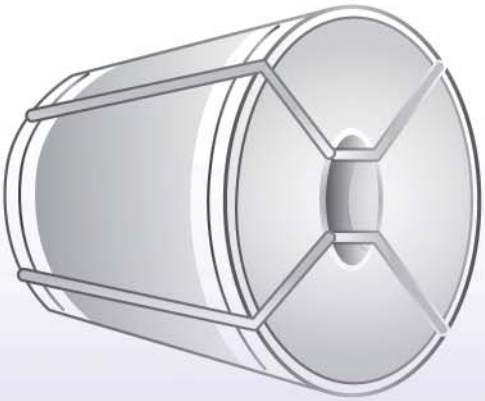
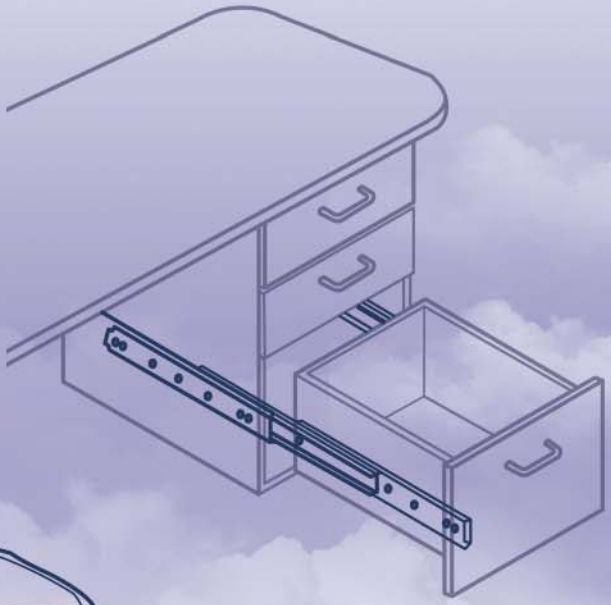
Cold Rolled Steel





PRODUCT MANUAL

冷軋

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

Reversing Cold Mill

A NAME FOR QUALITY,
TECHNOLOGY AND SERVICE

PRODUCT MANUAL

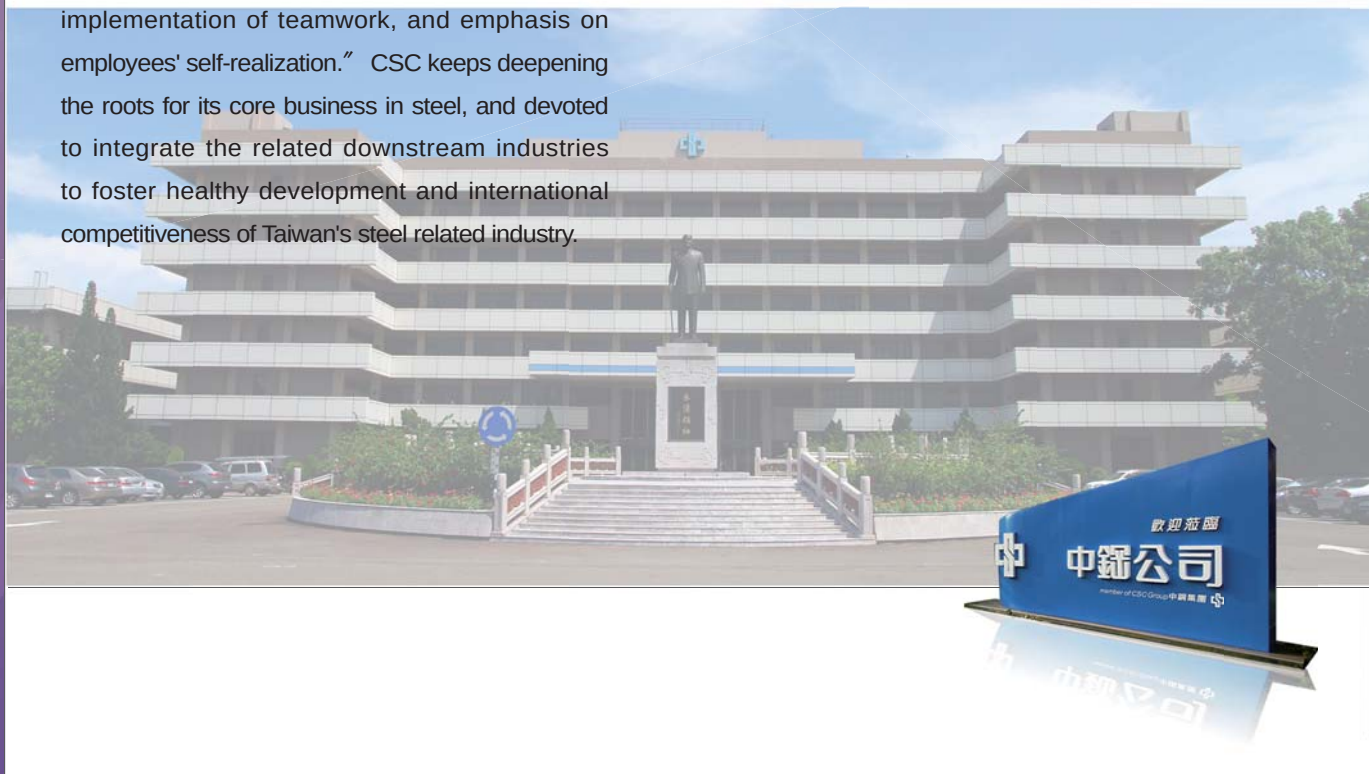
1

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. After its phase II expansion construction was completed on June 30, 1982, CSC launched its production of Cold Rolling Mill. Subsequently, CSC went through to complete its phases III and IV expansion constructions. Products include cold-rolled coils, magnetic steel coils, electro-galvanized coils, hot-dip galvanized coils and color coils. This manual introduces cold rolled coils only.

CSC's Cold Rolling Mill has numerous and complete production lines. Through unceasing developments and improvements over the years, cold rolled coils are diversified from narrow to wide, thin to thick, soft to hard and dull to bright. The available thickness of cold-rolled coils can be provided is 0.20 ～ 3.20mm, and available width is 780 ～ 1830mm. They are available for various processing uses and have been sufficient to meet the requirements of industries, such as forming soft steels, high strength steel sheets with improved formability for automobile structures, automobile structure steels with high strength dual-phase, steel sheets for fine blanking, steel sheets for slide rails, decarburized steel sheets and strips for porcelain enameling, as well as cold-rolled medium carbon steels, high carbon steels, alloy steels and special steel strips, etc.

Through the integrated quality management of iron making, steelmaking and steel rolling to the release and shipping of finished products, CSC's cold-rolled steel products are excellent in their internal and external quality, dimensional accuracy and processing properties, as well as have been approved for various related certifications such as ISO 9001, ISO/TS16949, JIS MARK, and IECQ QC080000 (Hazardous Substance Process Management). They meet the regulations of RoHS (Restriction of Hazardous Substances Directive) and REACH（Registration, Evaluation, Authorization and Restriction of Chemical substances）, and are verified through Certification of high-strength grades by the well-known carmakers. The quality is good enough to meet customers' needs.

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.

JFS JSC980Y Ultra-high strength structural steel for automobile

The tensile strength of this grade could reach 980 MPa above by formation of dual phase structure which combines the ductile ferrite and high strength martensite. By characteristics with high strength and superior ductility, this is an important material for light-weighted energy saving automobile design including application for safety structural parts, bumper, seat skid parts,etc.

EN HC420LA High strength low alloy (HSLA) structural steel

The yield strength of this grade could reach 420 MPa above in adoption of HSLA type steel structure which shows the high yield ratio, fine work formation and weldability. This is also an important material for light-weighted energy saving automobile design.

JFS JSC340H High strength baked-hardening (BH) steel

The tensile strength of this grade could reach 340 MPa above which processes the character of fine stamping formation and baked hardening. The material could be served as light-weighted energy saving automobile part such as outer panel or body construction which is strengthened after coating baked treatment.

SAE 1552

SAE1552 belongs to high manganese carbon steel with excellent cleanness and high strength after suitable heat treatment. The characteristics of this product fit in with requirements of manufacturing timing chain of automobile engine.

JIS G3311 SKS51M

SKS51M belongs to alloy tool steel with high hardness, high strength, great flatness and suitable for application of saw blade.

CSC CC8660

CSC CC8860 belongs to nickle chrome molybdenum steel with excellent anti-abrasion, anti-impact, anti-deformation and can be applied to chain saw for lumbering.

JIS G3125 SPA-C

JIS G3125 SPA-C is superior atmospheric corrosion resisting cold rolled steel and can be used in environment containing sulfuric waste gas.

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 hotdip 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.

鋼品與特殊合金產品之設計、開發、製造與服務，包括以下產品：
熱浸鍍鋅鋼捲、小鋼胚、鋼板、條鋼、線材、熱軋鋼板/ 鋼捲/ 鋼片、冷軋鋼捲/ 鋼片、電磁鋼捲、電鍍鋅鋼捲、彩色鋼捲以及特殊合金板材、長材、線材與扁鋼材。

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."

This certificate was issued electronically and remains the property of BSI and is bound by the conditions of contract.
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Printed copies can be validated at www.bsi-global.com/ClientDirectory or telephone +886 (02)2656-0333.

Information and Contact: BSI, Kitemark Court, Davy Avenue, Knowlhill, Milton Keynes MK5 8PP. Tel: + 44 845 080 9000
BSI Assurance UK Limited, registered in England under number 7805321 at 389 Chiswick High Road, London W4 4AL, UK.
A Member of the BSI Group of Companies.

ISO 9001 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 colo steel coil.
鋼品之設計與製造，包括以下產品：
熱浸鍍鋅鋼捲、小鋼胚、鋼板、條鋼、線材、熱軋鋼板/ 鋼捲/ 鋼片、冷軋鋼捲/ 鋼片、
電磁鋼捲、電鍍鋅鋼捲、彩色鋼捲

For and on behalf of BSI:

Managing Director BSI Taiwa, Peter Pu

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

IATF Number: 0135732

Page: 1 of 2

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Further clarifications regarding the scope of this certificate and the applicability of ISO/TS16949 rquirements may be obtained b consulting the organization.

IATF Contracted Office: BSI Group America Inc., 12110 Sunset Hills Road, Suite 330, Reston, VA20190, USA

Taiwan Headquarters: 5th Floor, No.39, Jr-Hu Rd., Nei-Hu Dist., Taipei 114, Taiwan, R.O.C.
A Member of the BSI Group of Companies.

ISO/TS 16949 Certificate

IECQ Certificate

IEC QUALITY ASSESSMENT SYSTEM (IECQ)
covering Electronic Components,
Assemblies, Related Materials and Processes
For rules and details of the IECQ visit www.iecq.org

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:	2009/07/28
CB Certificate No.:	H540466 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

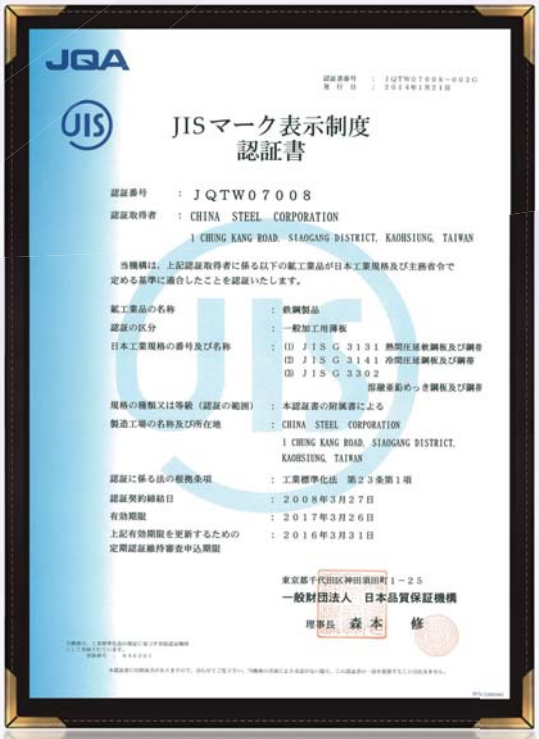
Issued by the Certification Body: BSI

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

Authorized person:
Paul Turner

bsi.

Sponsoring Member Body
BEC



JIS MARK 07008 Certificate

JQA

認証書番号 ： JQTW07008-002G
発行日 ： 2014年3月21日

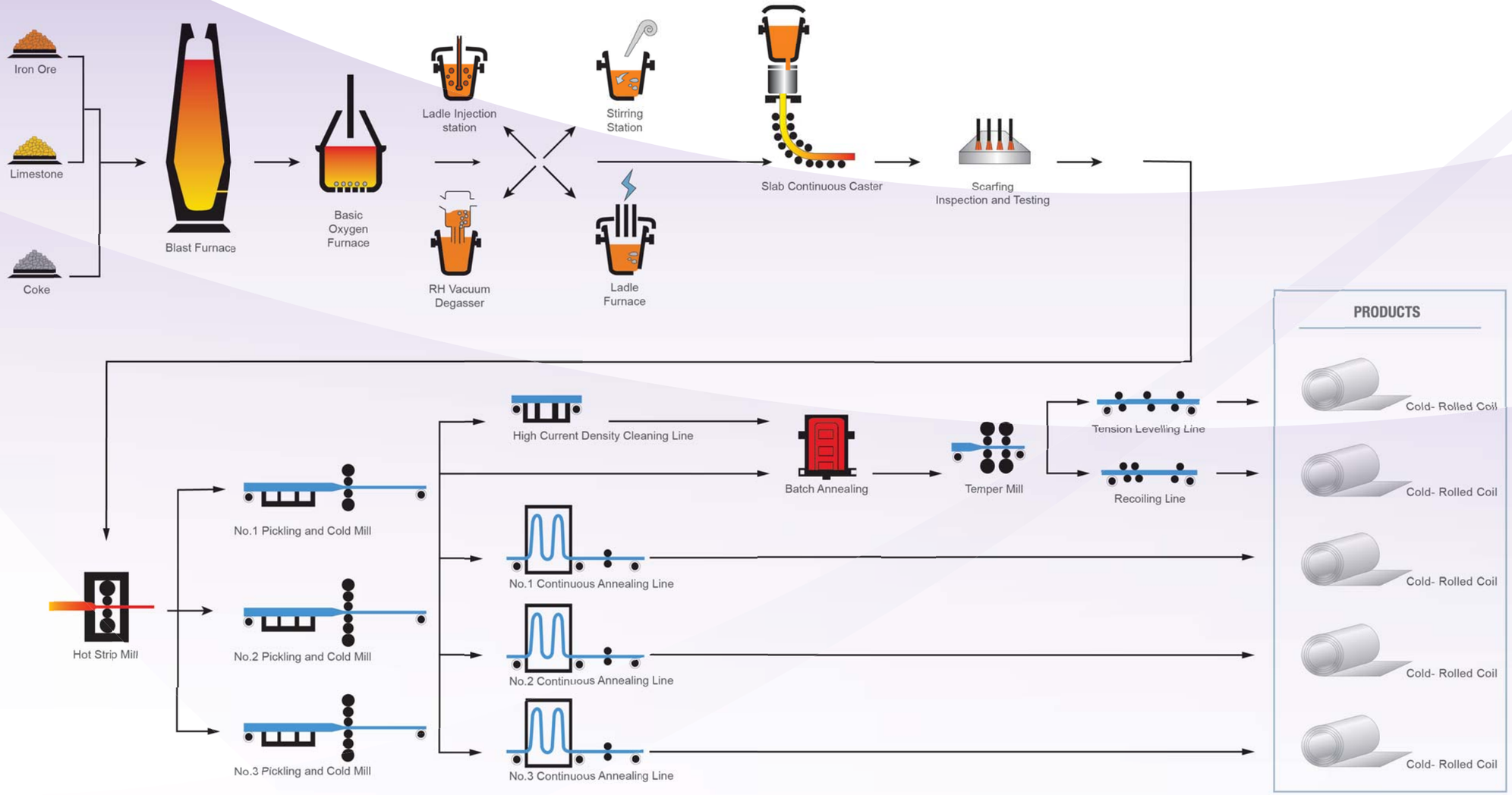
JISマーク表示制度
認証書

認証番号 ： JQTW07008
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	： 一般加工用薄板
日本工業規格の番号及び名称	： (1) ＪＩＳ Ｇ ３１３１ 熱間圧延軟鋼板及び鋼帯 (2) ＪＩＳ Ｇ ３１４１ 冷間圧延鋼板及び鋼帯 (3) ＪＩＳ Ｇ ３３０２ 溶融亜鉛めっき鋼板及び鋼帯
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



Pickling

The main purpose of this stage is to remove the scale of hot rolled coil by heated solution of hydrochloric acid for its smooth surface finish.

Cold rolling

The pickled coils are rolled into specified thickness by cold rolled mills with controlled rolling force and strip tension. Based on strip center and edge part measurements of the thickness at the entry and delivery sides of the mills, either the strip center or edge thickness deviation is minimized by the computer-controlled system.

Annealing

The steel strip is significantly hard and brittle after cold rolling which the grains are elongated along with lots strain energy. To obtain the desired mechanical properties of strip, the coils shall be piled and covered by the box which called batch annealing or the strip is continuous treated in furnace which called continuous annealing. Both annealing technology are possessed in CSC according to different product requirements.

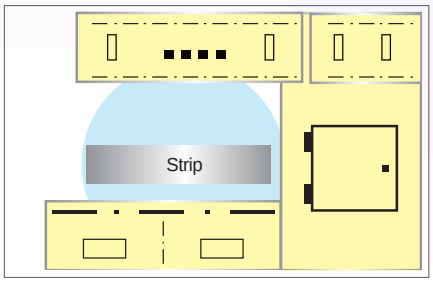
Temper Rolling

After the annealing, the strip is slightly rolled by the skin-pass mill to avoid the common defect called stretcher strain and adjusting mechanical properties. The strip surface roughness is also determined by this stage.

Finishing and Inspection

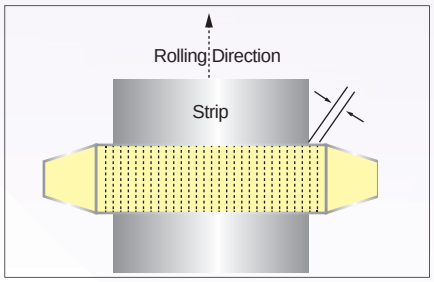
The entire coil strip thickness, width and surface quality are checked by automatic inspection system and well-trained inspectors in this stage. After the oil applied over strip surface, the product coil is cut into specified mass.

Edge Drop Measurement(EDM) System



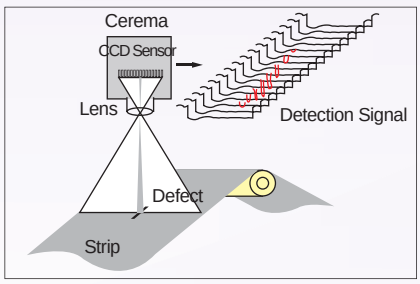
The thickness deviation with the whole coil is automatically inspected by the X-ray generated system to assure the thickness accuracy.

Shape-meter Roll



The rolling controlled could be dynamically adjusted depending on the simultaneous measurement result of strip flatness by shape-meter roll.

Automatic Surface Inspection System



Both sides of strip surface with entire coil length are automatically inspected by the high resolution camera system to assure the strip surface quality.

6 APPLICATION EXAMPLES

Automobile

Seats of Automobile

Slide

Metal Ceiling

Compartment Assembling

Containers

7.1 Chemical Compositions and Mechanical Properties

7.1.1 Carbon Steel Sheet for of Forming Fabrication

(1) JIS G3141-2011 SPCC/SPCD/SPCE/SPCF/SPCG (-SD, Standard temper)

Specification			JIS G3141					
Symbol of Grade			SPCC	SPCCT(NOTE 2)	SPCD	SPCE	SPCF	SPCG
Chemical Composition %	C max.		0.15		0.10	0.08	0.06	0.02
	Mn max.		0.60		0.50	0.45	0.45	0.25
	P max.		0.100		0.040	0.030	0.030	0.020
	S max.		0.035		0.035	0.030	0.030	0.020
	Si max.		—		—	—	—	—
Tension Test No.5 test piece rolling direction Thickness(t) mm	Tensile Strength N/mm² min.	0.25 ≦ t	—	270	270	270	270	270
	Yield Point N/mm² max.	0.25 ≦ t	—	—	(240)	(220)	(210)	(190)
	Elongation % min.	0.25 ≦ t < 0.30	—	28	30	32	—	—
		0.30 ≦ t < 0.40	—	31	33	35	—	—
		0.40 ≦ t < 0.60	—	34	36	38	40	42
		0.60 ≦ t < 1.00	—	36	38	40	42	44
		1.00 ≦ t < 1.60	—	37	39	41	43	45
		1.60 ≦ t < 2.50	—	38	40	42	44	46
		2.50 ≦ t	—	39	41	43	45	—
The average ratio of plastic strain $\bar{r}$		0.50 ≦ t ≦ 1.00	—	—	—	—	—	1.5min.
		1.00 < t ≦ 1.60	—	—	—	—	—	1.4min.
Bend Test No.3 test piece rolling direction	Bend Angle		(180°)					
	Inside Clearance		Flat on Itself					

Notes : 1. Alloying elements other than those in the above table can be added as necessary.
2. For SPCC that guarantees tensile strength and elongation.

Remarks : 1. For those less than 0.60 mm in thickness, as a rule, the tension test shall be omitted.
2. SPCF and SPCG shall be guarantees for non-ageing property for six months after shipment from the manufacturer's factory.
3. The upper limit of yield point or proof stress in parenthesis is informative and can be applied when agreed upon between the purchaser and the supplier.

(2) JIS G3141-2011 SPCC - 1D/2D/4D/8D

Specification		JIS G3141			
Classification		SPCC-1D	SPCC-2D	SPCC-4D	SPCC-8D
Hardness	HRB	85 min.	74~89	65~80	50~71
	HV	170 min.	135~185	115~150	95~130
Bend Test	Bend Angle	—	180°		
	Inside Clearance	—	Thickness×2.0	Thickness×1.0	Flat on Itself

Notes：As to hardness, either HRB or HV shall be applied.

(3) JIS G3141 SPCG-SD MR (Improve $\bar{r}$)

Symbol of Grade	Thickness (t) mm	Tensile Strength N/mm^2	Yield Point N/mm^2	Elongation %	$\bar{r}$
SPCG-SD	0.60 ≦ t < 0.80	270 min.	175max.	46min.	1.8min.
	0.80 ≦ t < 1.00		165max.	47min.	
	t = 1.00		155max.	48min.	

(4) ASTM A1008-2012

Symbol of Grade		CS Type			DS Type		DDS[F,G]	EDDS[J]
		A[D,E,F,G]	B[D]	C[D,E,F,G]	A[E,I]	B		
Chemical Composition %	C	0.10max.	0.02~0.15	0.08max.	0.08max.	0.02~0.08	0.06max.	0.02max.
	Mn max.	0.60			0.50		0.50	0.40
	P max.	0.030		0.100	0.020		0.020	0.020
	S max.	0.035			0.030		0.025	0.020
	Al min.	…[A]			0.01	0.02	0.01	0.01
	Si	…[A]						
	Cu max.	0.20[H]			0.20		0.20	0.10
	Ni max.	0.20			0.20		0.20	0.10
	Cr max.[B]	0.15			0.15		0.15	0.15
	Mo max.	0.06			0.06		0.06	0.03
	V max.	0.008			0.008		0.008	0.10
	Nb max.	0.008			0.008		0.008	0.10
	Ti max.[C]	0.025			0.025		0.025	0.15
	N	…[A]						
	B	…[A]						
Bend Test	Bend Angle	180°						
	Radius of Inside Surface	Flat on Itself						

Remarks：A. Where an ellipsis(…) appears in the table, there is no requirement, but the analysis result shall be reported.

B. Chromium is permitted, at the purchaser's option, to 0.25 % maximum when the carbon content is less than or equal to 0.05 %.

C. For steels containing 0.02 % or more carbon, titanium is permitted at the producer's option, to the lesser of 3.4N+1.5S or 0.025 %.

D. When an aluminum deoxidized steel is required for the application, it is permissible to order commercial steel (CS) to a minimum of 0.01 % total aluminum.

E. Specify Type B to avoid carbon level below 0.02 %.

F. It is permissible to furnish as a vacuum degassed or chemically stabilized steel, or both, at the purchaser's option.

G. For carbon contents less than or equal to 0.02 %, it is permissible to use vanadium, columbium or titanium, or a combination thereof, as stabilizing elements at the purchaser's option. In such cases, the applicable limit for vanadium or columbium shall be 0.10 % max. and limit for titanium shall be 0.15 % max.

H. When copper steel is specified, the copper limit is a minimum requirement. When copper steel is not specified, the copper limit is a maximum requirement.

I. If produced utilizing a continuous anneal process, stabilized steel is permissible at the producer's option, and Footnotes F and G apply.

J. Shall be furnished as vacuum degassed and stabilized steel.

(5) EN 10130- 2006

Symbol of Grade		DC01	DC03	DC04	DC05	DC06
Chemical Composition %	C max.	0.12	0.10	0.08	0.06	0.02
	Mn max.	0.60	0.45	0.40	0.35	0.25
	P max.	0.045	0.035	0.030	0.025	0.020
	S max.	0.045	0.035	0.030	0.025	0.020
	Ti max.	—	—	—	—	0.3(2)
Tension Test Type 2 test piece Perpendicular to rolling direction	Tensile Strength MPa	270~410	270~370	270~350	270~330	270~330
	Proof Stress MPa max.	280	240	210	180	170
	Elongation % min.	28	34	38	40	41
	ratio of plastic strain r_{90} min.	—	1.3	1.6	1.9	2.1
	tensile strain hardening exponent n_{90} min.	—	—	0.180	0.200	0.220

Notes：1. 1MPa=1 N/mm^2

2. Titanium may be replaced by niobium. Carbon and nitrogen shall be completely bound.
3. When the thickness is less than or equal to 0.7 mm and greater then 0.5 mm, the minimum value for elongation is reduced by 2 units. For a thickness less then or equal to 0.5 mm, the minimum value is reduced by 4 units.
4. The values of r_{90} and n_{90} only apply to products with a thickness equal to or greater than 0.5 mm.
5. When the thickness is over 2 mm, the value for r_{90} is reduced by 0.2.
6. For design purposes the lower limit of Yield Proof Stress for grades DC01, DC03, DC04 and DC05 may be assumed to be 140 MPa.

7.1.2 High Strength Steel Sheets with Improved Formability for Automobile Structural Uses

(1) JIS G3135-2006

Symbol of Grade	Tension Test					Bend Test		
	Tensile Strength N/mm^2	Proof Stress N/mm^2	Elongation % Thickness (t) mm 0.6 ≦ t < 1.0	Elongation % Thickness (t) mm 1.0 ≦ t ≦ 2.3	Test Piece	Bend Angle	Radius of Inside surface	Test Piece
SPFC340	340min.	175min.	34min.	35min.	JIS No.5 Perpendicular to rolling direction	180°	Flat on itself	JIS No.3 Perpendicular to rolling direction
SPFC370	370min.	205min.	32min.	33min.			Flat on itself	
SPFC390	390min.	235min.	30min.	31min.			Flat on itself	
SPFC440	440min.	265min.	26min.	27min.			Flat on itself	
SPFC490	490min.	295min.	23min.	24min.			Flat on itself	
SPFC540	540min.	325min.	20min.	21min.			Thickness × 0.5	
SPFC590	590min.	355min.	17min.	18min.			Thickness × 1.0	
SPFC490Y	490min.	225min.	24min.	25min.			Flat on itself	
SPFC540Y	540min.	245min.	21min.	22min.			Thickness × 0.5	
SPFC590Y	590min.	265min.	18min.	19min.			Thickness × 1.0	
SPFC780Y	780min.	365min.	13min.	14min.			Thickness × 3.0	
SPFC980Y	980min.	490min.	6min.	7min.			Thickness × 4.0	

Remarks：Concerning the applicable thickness of the elongation of SPFC780Y and SPFC980Y, 0.6 mm or over to and excl. 1.0 mm and 1.0 mm or over up to and incl. 2.3 mm shall be respectively shifted to 0.8 mm or over to and excl. 1.0 mm and 1.0 mm or over up to and incl. 2.0 mm.

(2) Automobile Structure Steel with High Strength Dual-phase (780/ 980 N/mm^2 class)

Symbol of Grade	Tension Test				
	Thickness (t) mm	Width (w) mm	Tensile Strength N/mm^2	Elongation %	Test Piece
SPFC780Y	0.90~2.00	850~1219	780min.	13min.	JIS No.5 Perpendicular to rolling direction
SPFC980Y	0.80~1.80	850~1000	980min.	9min.	

(3) EN 10268-2006 Cold Rolled Steel Flat Products with High Yield Strength for Cold Forming

Symbol of Grade	chemical composition %								Tension Test[1,2,3,4]					
	C max.	Si max.	Mn max.	P max.	S max.	Al min.	Ti max.	Nb max.	0.2% Proof Stress MPa	Tensile Strength MPa	Elongation Test Piece	Elongation % min.	Plastic strain ratio min. r_{90}	Strain hardening exponent min. n
HC220P	0.07	0.50	0.70	0.080	0.025	0.015	—	—	220~270	320~400	EN TYPE 2 Perpendicular to rolling direction	32	1.3	0.16
HC220Y	0.01	0.30	0.90	0.080	0.025	0.010	0.12	—	220~270	350~400		34	1.6	0.18
HC260Y	0.01	0.30	1.60	0.100	0.025	0.010	0.12	—	260~320	380~440		32	1.4	0.17
HC260LA	0.10	0.50	0.60	0.025	0.025	0.015	0.15	—	260~330	350~430		26	—	—
HC300LA	0.10	0.50	1.00	0.025	0.025	0.015	0.15	0.09	300~380	380~480		23	—	—
HC340LA	0.10	0.50	1.10	0.025	0.025	0.015	0.15	0.09	340~420	410~510		21	—	—
HC380LA	0.10	0.50	1.60	0.025	0.025	0.015	0.15	0.09	380~480	440~560		19	—	—
HC420LA	0.10	0.50	1.60	0.025	0.025	0.015	0.15	0.09	420~520	470~590		17	—	—

Remarkss :

1. 1MPa=1 N/mm^2
2. The minimum values for r_{90} and n_{90} only apply to products of thickness equal to or greater than 0.5 mm.
3. When the thickness is less than or equal to 0.7 mm and greater than 0.5 mm, the minimum value for elongation is reduced by 2 units.
4. For products with thickness over 2 mm the minimum r_{90} value is reduced by 0.2.

(4) SAE J2340 High Strength Automotive Sheet Steel

Symbol of Grade	Chemical Composition[1] %			Tension Test[2]			
	C max.	P max.	S max.	Proof Stress MPa	Tensile Strength MPa	Elongation %	Test Piece
340X	0.13	0.060	0.015	340~440	410min.	22min.	rolling direction
420X	0.13	0.060	0.015	420~520	490min.	18min.	rolling direction

Remarks :

1. The specified minimum for niobium, titanium, or vanadium is 0.005 %.
2. For thickness less than 2.5 mm, minimum percent elongation is permitted to be 2 % less than the value shown.

（5）CSC Specification

Symbol of Grade	Tension Test						Bend test		
	Tensile Strength N/mm²	Proof Stress N/mm²	Elongation % Thickness (t) mm 0.55 ≦ t < 1.0	Elongation % Thickness (t) mm 1.0 ≦ t ≦ 2.0	Elongation % Thickness (t) mm 2.0 < t ≦ 2.6	Test Piece	Bend Angle	Radius of Inside surface	Test Piece
CSC CF370R	370min.	205min.	33min.	34min.	—	No.5 Perpendicular to rolling direction	180°	Flat on itself	No.3 Perpendicular to rolling direction
CSC CF390R	390min.	235min.	31min.	32min.	—				
CSC CF440R	440min.	255min.	—	—	30min.				

Remark：The bend test shall be carried out on request of the purchaser.

（6）CSC Specification

Symbol of Grade	Tension Test				Bend test		
	Tensile Strength N/mm²	Proof Stress N/mm²	Elongation % Thickness (t) mm 0.9 ≦ t ≦ 2.0	Test Piece	Bend Angle	Radius of Inside surface	Test Piece
CSC CR500LA	570~710	500~620	14min.	EN Type 2 Perpendicular to rolling direction	180°	Thickness × 1.0	No.3 Perpendicular to rolling direction

7.1.3 CSC High Strength Steel Sheets for Strap

Symbol of Grade	Chemical Composition %					Tension Test			Bend test		
	C	Si	Mn	P	S	Tensile Strength N/mm²	Elongation %	Test Piece	Bend Angle	Radius of Inside surface	Test Piece
CSC HS840	0.20 max.	0.50 max.	0.70~ 1.50	0.030 max.	0.030 max.	840 min.	6.0 min.	JIS No.9A Parallel to rolling direction	90°	Thickness × 1.0	JIS No.3 Parallel to rolling direction

7.1.4 CSC Steel Sheets for Special Blanking Use

Symbol of Grade	Tension Test		Hardness HRB
	Proof Stress N/mm²	Test Piece	
CSC CW205YE	205~245	No.5 parallel to rolling direction	50~56

Remarks：

1. Thickness tolerance as per 1/4 JIS G3141 Class A.
2. Width tolerance as per JIS G3141 Class A.
3. Flatness tolerance as per 1/2 JIS G3141 Class A.

7.1.5 CSC Steel Sheets for Fine Blanking Use

Symbol of Grade	Tension Test				
	Tensile Strength N/mm^2	Proof Stress N/mm^2	Elongation %		Test Piece
			Thickness (t) mm	%	
CSC CB270TE	270min.	200max.	1.0 ≦ t < 1.6	43min.	No.5 Parallel to rolling direction
			1.6 ≦ t < 2.5	44min.	
			2.5 ≦ t ≦ 3.2	45min.	

Remarkss：

1. Thickness tolerance as per 1/4 JIS G3141 Class A.
2. Width tolerance as per JIS G3141 Class A.
3. Flatness tolerance as per 1/2 JIS G3141 Class A.

7.1.6 Cold Rolled Medium Carbon Steel, High Carbon Steel, Alloy Steel and Special Steel Strip

(1) JIS G3311-2010 Special Steel Strip

Symbol of Grade	Chemical Composition%									
	C	Si	Mn	P max.	S max.	Cu max.	Ni max.	Cr	Ni+Cr max.	Mo
S35CM	0.32~0.38	0.15~0.35	0.60~0.90	0.030	0.035	0.30	0.20	0.20max.	0.35	—
S45CM	0.42~0.48	0.15~0.35	0.60~0.90	0.030	0.035	0.30	0.20	0.20max.	0.35	—
S50CM	0.47~0.53	0.15~0.35	0.60~0.90	0.030	0.035	0.30	0.20	0.20max.	0.35	—
SK85M	0.80~0.90	0.10~0.35	0.10~0.50	0.030	0.030	0.25	0.25	0.30max.	—	—
SK95M	0.90~1.00	0.10~0.35	0.10~0.50	0.030	0.030	0.25	0.25	0.30max.	—	—
SKS51M	0.75~0.85	0.35 max.	0.50 max.	0.030	0.030	0.25	1.30~2.00	0.20~0.50	—	—
SCM415M	0.13~0.18	0.15~0.35	0.60~0.90	0.030	0.030	0.30	0.25	0.90~1.20	—	0.15~0.25
SCM435M	0.33~0.38	0.15~0.35	0.60~0.90	0.030	0.030	0.30	0.25	0.90~1.20	—	0.15~0.30

Remarks： For steel strips and cut-lengths of thicknesses over 4.00 mm or widths 600 mm or over, the thickness tolerance shall be as agreed between the purchaser and the manufacturer.

(2) SAE J403 / J404 (Medium Carbon Steel, High Carbon Steel and Alloy Steel)

Symbol of Grade	Chemical Composition %						
	C	Si	Mn	P	S	Cr	Mo
1050	0.48~0.55	—	0.60~0.90	0.030max.	0.050max.	—	—
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				
1552	0.47~0.55	—	1.20~1.50	0.030max.	0.050max.	—	—
4130	0.28~0.33	0.15~0.35	0.40~0.60	0.030max.	0.040max.	0.80~1.10	0.15~0.25
4135	0.33~0.38	0.15~0.35	0.70~0.90	0.030max.	0.040max.	0.80~1.10	0.15~0.25

(3) ASTM A684-2008 (High Cabon Steel)

Symbol of Grade	Chemical Composition %				
	C	Si	Mn	P	S
1050	0.48~0.55	0.15~0.30	0.60~0.90	0.030max.	0.035max.
1065	0.60~0.70	0.15~0.30	0.60~0.90	0.030max.	0.035max.
1070	0.65~0.75	0.15~0.30	0.60~0.90	0.030max.	0.035max.

7.1.7 CSC Steel Sheets for Slide Rail Use

Symbol of Grade	Tension Test		Bend test			Hardness HRB
	Proof Stress N/mm^2	Test Piece	Bend Angle	Radius of Inside surface	Test Piece	
CSC SL250Y	250~330	No.5 Perpendicular to rolling direction	180°	Thickness × 1.0	No.3 Perpendicular to rolling direction	65~80
CSC SL330Y	330~410					72~82
CSC SL420Y	420min.					—

Remarks :

1. Thickness tolerance as per 1/2 JIS G3141 Class A.
2. Width tolerance as per JIS G3141 Class A.
3. Flatness tolerance as per 1/2 JIS G3141 Class A.
4. For SL420Y, thickness tolerance as per 1/2 JIS G3135.

7.1.8 Decarburized Steel Sheets and Strip for Porcelain Enameling

Symbol of Grade	Chemical Composition(1) %				Tension Test (2)		
	C	Mn	P	S	Elongation %		Test Piece
					Thickness(t) mm	%	
SPP	0.008 max.	0.50 max.	0.04 max.	0.04 max.	0.40 ≦ t < 0.60	36min.	No.5 Parallel to rolling direction
					0.60 ≦ t < 1.00	38min.	
					1.00 ≦ t < 1.60	39min.	
					1.60 ≦ t < 2.00	40min.	

Remarks :

1. Such elements as Ti, Nb, Zr, V and B may be added. In this case, the content of the elements added shall be reported.
2. For steel sheets and strip under 0.60mm in thickness, the tension test shall normally be omitted when not requested by the purchaser.

7.1.9 CSC Low-carbon High Manganese Wear-resisting Steel

Symbol of Grade	Thickness (t)mm	Width (w)mm	Hardness HRB
CSC CC1513	1.61 ≦ t ≦ 1.97	850 ≦ w ≦ 1250	65~75

Remarks :

1. Thickness tolerance as per ASTM A568.
2. Flatness tolerance as per ASTM A568.

7.1.10 CSC High Strength Manganese-boron Steel

Symbol of Grade	Chemical Composition %							Tension Test	
	C	Si	Mn	P	S	Al	B	Elongation %	Test piece
CSC CC15B22	0.19~ 0.25	0.15~ 0.25	1.05~ 1.35	0.020 max.	0.010 max.	0.075 max.	0.0005~ 0.0045	26 min.	JIS No.5 Parallel to rolling direction

Remark : Thickness tolerance as per 1/2 JIS G3141 Class A.

7.1.11 CSC Steel Sheets for Relay Use

Symbol of Grade	Thickness (t) mm	Width (w) mm	Hardness HRB	Tension Test	
				Elongation %	Test piece
CSC CM-1	0.40 ≦ t ≦ 3.20	850 ≦ w ≦ 1250	35min.	37min.	JIS No.5 Parallel to rolling direction

Remarks :

1. Thickness tolerance as per 1/2 JIS G3141 Class A.
2. Thickness of 2.01 mm or more of the steel sheet are subject to the coil breaks.

7.1.12 CSC Low-carbon Bearing Retainer Steel

Symbol of Grade	Chemical Composition %				Tension Test			Hardness HRB
	C	Mn	P	S	Thickness (t) mm	Proof Stress N/mm^2	Test Piece	
CSC CF170YF	0.15 max.	0.60 max.	0.100 max.	0.050 max.	0.50 ≦ t ≦ 0.80	170~230	No.5 Parallel to rolling direction	45~55

Remark : Thickness tolerance as per 1/4 JIS G3141 Class A.

7.2 Tolerances

7.2.1 Thickness Tolerances

7.2.1.1 JIS G3141 Thickness Tolerances

unit：mm

Tolerance / Width (w) / Thickness (t)	w < 630	630 ≦ w<1000	1000 ≦ w<1250	1250 ≦ w<1630	w ≧ 1630
t < 0.25	±0.03	±0.03	±0.03	—	—
0.25 ≦ t < 0.40	±0.04	±0.04	±0.04	—	—
0.40 ≦ t < 0.60	±0.05	±0.05	±0.05	±0.06	—
0.60 ≦ t < 0.80	±0.06	±0.06	±0.06	±0.06	±0.07
0.80 ≦ t < 1.00	±0.06	±0.06	±0.07	±0.08	±0.09
1.00 ≦ t < 1.25	±0.07	±0.07	±0.08	±0.09	±0.11
1.25 ≦ t < 1.60	±0.08	±0.09	±0.10	±0.11	±0.13
1.60 ≦ t < 2.00	±0.10	±0.11	±0.12	±0.13	±0.15
2.00 ≦ t < 2.50	±0.12	±0.13	±0.14	±0.15	±0.17
2.50 ≦ t < 3.15	±0.14	±0.15	±0.16	±0.17	±0.20
3.15 ≦ t	±0.16	±0.17	±0.19	±0.20	—

Remark：Thickness shall be measured at any point 15 mm or more apart from both edges.

7.2.1.2 JIS G3135 Thickness Tolerances

unit：mm

Applicable division according to tensile strength	Width (w) / Thickness (t)	w < 630	630 ≦ w <1000	1000 ≦ w <1250	1250 ≦ w <1600	1600 ≦ w
Steel sheets of under 780 N/mm^2 in specification lower limit of tensile strength	0.60 ≦ t < 0.80	±0.06	±0.06	±0.06	±0.07	±0.08
	0.80 ≦ t < 1.00	±0.07	±0.07	±0.08	±0.09	±0.10
	1.00 ≦ t < 1.25	±0.08	±0.08	±0.09	±0.10	±0.12
	1.25 ≦ t < 1.60	±0.09	±0.10	±0.11	±0.12	±0.14
	1.60 ≦ t < 2.00	±0.10	±0.11	±0.12	±0.14	±0.16
	2.00 ≦ t ≦ 2.30	±0.12	±0.13	±0.14	±0.16	±0.18
Steel sheets of 780 N/mm^2 min. in specification lower limit of tensile strength	0.80 ≦ t < 1.00	±0.09			±0.10	—
	1.00 ≦ t < 1.25	±0.10			±0.12	—
	1.25 ≦ t < 1.60	±0.12			±0.15	—
	1.60 ≦ t ≦ 2.00	±0.14			±0.16	—

Remarks：1. The measuring position of thickness shall be an arbitrary point 25 mm min. apart from the edge for a mill edge and an arbitrary point 15 mm min. apart from the edge for a cut edge.

2. This table shall not be applied to the abnormal parts at both ends of steel strip in coil.

7.2.1.3 CSC CF370R/390R/440R Thickness Tolerances

unit：mm

Thickness（t） \ Width（w）	850 ≦ w < 1000	1000 ≦ w < 1250	1250 ≦ w
0.55 ≦ t < 0.60	±0.02	±0.02	±0.03
0.60 ≦ t < 0.80	±0.03	±0.03	±0.03
0.80 ≦ t < 1.00	±0.03	±0.04	±0.04
1.00 ≦ t < 1.25	±0.04	±0.04	±0.05
1.25 ≦ t < 1.60	±0.05	±0.05	±0.06
1.60 ≦ t ≦ 2.00	±0.05	±0.06	±0.07

Remark：Thickness shall be measured at any point 15 mm or more apart from both edges.

7.2.1.4 ASTM A568 Thickness Tolerances（All Designations）(Specified Nominal Thickness Tolerances)

unit：in.(mm)

Thickness（t） \ Width（w）	15（381）< w ≦ 72（1829）
0.014（0.36）≦ t ≦ 0.019（0.48）	± 0.0010（0.025）
0.019（0.48）< t ≦ 0.039（0.99）	± 0.0015（0.038）
0.039（0.99）< t ≦ 0.057（1.45）	± 0.0020（0.050）
0.057（1.45）< t ≦ 0.071（1.80）	± 0.0025（0.063）
0.071（1.80）< t ≦ 0.098（2.49）	± 0.0025（0.063）
0.098（2.49）< t ≦ 0.142（3.60）	± 0.0030（0.076）

Remark：Thickness shall be measured at any point 1 inch (25.4 mm) or more apart from both edges.

7.2.1.5 ASTM A568M Thickness Tolerances（All Designations）(Specified Nominal Thickness Tolerances)

unit：mm

Thickness（t） \ Width（w）	780 ≦ w ≦ 1829
0.20 ≦ t ≦ 0.40	± 0.025
0.40 < t ≦ 1.00	± 0.040
1.00 < t ≦ 1.20	± 0.050
1.20 < t ≦ 2.50	± 0.060
2.50 < t ≦ 3.00	± 0.075

Remark：Thickness shall be measured at any point 25 mm or more apart from both edges.

7.2.1.6 EN 10131 EN 10131 Thickness Tolerances(Minimum Yield Strength Re < 260 MPa)

unit : mm

Tolerance / Width (w) / Thickness (t)	w ≦ 1200	1200 < w ≦ 1500	1500 < w
0.35 ≦ t ≦ 0.40	± 0.03	± 0.04	± 0.05
0.40 < t ≦ 0.60	± 0.03	± 0.04	± 0.05
0.60 < t ≦ 0.80	± 0.04	± 0.05	± 0.06
0.80 < t ≦ 1.00	± 0.05	± 0.06	± 0.07
1.00 < t ≦ 1.20	± 0.06	± 0.07	± 0.08
1.20 < t ≦ 1.60	± 0.08	± 0.09	± 0.10
1.60 < t ≦ 2.00	± 0.10	± 0.11	± 0.12
2.00 < t ≦ 2.50	± 0.12	± 0.13	± 0.14
2.50 < t ≦ 3.00	± 0.15	± 0.15	± 0.16

7.2.1.7 EN 10131 Thickness Tolerances (Minimum Yield Strength 260 ≦ Re < 340 MPa)

unit : mm

Tolerance / Width (w) / Thickness (t)	w ≦ 1200	1200 < w ≦ 1500	1500 < w
0.35 ≦ t ≦ 0.40	± 0.04	± 0.05	± 0.06
0.40 < t ≦ 0.60	± 0.04	± 0.05	± 0.06
0.60 < t ≦ 0.80	± 0.05	± 0.06	± 0.07
0.80 < t ≦ 1.00	± 0.06	± 0.07	± 0.08
1.00 < t ≦ 1.20	± 0.07	± 0.08	± 0.10
1.20 < t ≦ 1.60	± 0.09	± 0.11	± 0.12
1.60 < t ≦ 2.00	± 0.12	± 0.13	± 0.14
2.00 < t ≦ 2.50	± 0.14	± 0.15	± 0.16
2.50 < t ≦ 3.00	± 0.17	± 0.18	± 0.18

7.2.1.8 EN 10131 Thickness Tolerances (Minimum Yield Strength 340 ≦ Re ≦ 420 MPa)

unit : mm

Tolerance / Width (w) / Thickness (t)	w ≦ 1200	1200 < w ≦ 1500	1500 < w
0.35 ≦ t ≦ 0.40	± 0.04	± 0.05	± 0.06
0.40 < t ≦ 0.60	± 0.04	± 0.05	± 0.06
0.60 < t ≦ 0.80	± 0.05	± 0.06	± 0.07
0.80 < t ≦ 1.00	± 0.06	± 0.07	± 0.08
1.00 < t ≦ 1.20	± 0.07	± 0.08	± 0.10
1.20 < t ≦ 1.60	± 0.09	± 0.11	± 0.12
1.60 < t ≦ 2.00	± 0.12	± 0.13	± 0.14
2.00 < t ≦ 2.50	± 0.14	± 0.15	± 0.16
2.50 < t ≦ 3.00	± 0.17	± 0.18	± 0.18

7.2.2 Width Tolerances

7.2.2.1 JIS G3141 Width Tolerances

unit：mm

Width（w）	Class A		Class B	
	Upper	Lower	Upper	Lower
w < 1250	7	0	3	0
w ≧ 1250	10	0	4	0

Remark：Class B generally applies to the re-cutting or precise cutting practice. Unless specified by the customer, class A is to be applied.

7.2.2.2 Width Tolerances of JIS G3135 and CSC CF370R/390R/440R

unit：mm

Width （w）	Tolerances	
	Upper	Lower
w < 1250	7	0
w ≧ 1250	10	0

7.2.2.3 ASTM A568 Width Tolerances（All Designations）(Specified Nominal Thickness Tolerances)

unit：in.(mm)

Width （w）	Tolerances	
	Upper	Lower
30 (762) < w ≦ 48 (1219)	3/16 (4.7)	0
48 (1219) < w ≦ 60 (1524)	1/4 (6.3)	0
60 (1524) < w ≦ 80 (2032)	5/16 (7.9)	0

7.2.2.4 ASTM A568M Width Tolerances(All Designations)(Specified Nominal Thickness Tolerances)

unit：mm

Width （w）	Tolerances	
	Upper	Lower
850 < w ≦ 1200	5	0
1200 < w ≦ 1500	6	0
1500 < w ≦ 1800	8	0
1800 < w	10	0

7.2.2.5 EN 10131 Width Tolerances

unit：mm

Width （w）	Tolerances	
	Upper	Lower
w ≦ 1200	4	0
1200 < w ≦ 1500	5	0
1500 < w	6	0

7.2.3 Flatness Tolerances

7.2.3.1 JIS G3141 Flatness Tolerances

unit：mm

Classification / Flatness (max.) / Width (w)	Class A			Class B		
	Bow Wave	Edge Wave	Center Buckle	Bow Wave	Edge Wave	Center Buckle
w < 1000	12	8	6	2	2	2
1000 ≦ w < 1250	15	9	8	3	2	2
1250 ≦ w < 1600	15	11	8	4	3	2
1600 ≦ w	20	13	9	5	4	2

Remarks：1. Class B generally applies to the steel sheets of stretcher-leveled steel sheet.
2. Class A applies to the normally refined steel sheets.

7.2.3.2 JIS G3135 Flatness Tolerances

unit：mm

Classification / Flatness (max.) / Width (w)	Bow Wave			Edge Wave			Center Buckle		
	1	2	3	1	2	3	1	2	3
w < 1000	12	16	18	8	11	12	6	8	9
1000 ≦ w < 1250	15	19	21	10	12	13	8	10	11
1250 ≦ w < 1600	15	19	21	12	14	15	9	11	12
1600 ≦ w	20	-	-	14	-	-	10	-	-

Remarks：1. Grade 1 to 3 shall respectively be applied to the steel sheet of which the lower limit specification value of tensile strength is under 780 N/ mm^2, 780 N/mm^2 and 980 N/mm^2.
2. The value of flatness shall, as a rule, be measured by placing the steel sheet on a surface plate. It shall be obtained by subtracting nominal thickness of steel sheet from the maximum value of strain and be applied to the upper side surface of steel sheet.

7.2.3.3 Flatness Tolerances for CSC CF370R/390R/440R

The flatness tolerances for 0.79mm and under in thickness shall conform to table A of JIS G3141, and for 0.80mm and over in thickness shall conform to 1/2 of table A of JIS G3141.

7.2.3.4 ASTM A568 Flatness Tolerances(All Designations)(Specified Nominal Thickness Tolerances) unit：in.（mm）

Thickness(t) \ Specified Yield Point / Width (w)		Under 45ksi (Under 310 MPa)	45 to 50 ksi (310 to 345 MPa)
t ≦ 0.044(1.12)	w ≦ 36 (914)	3/8 (9.5)max.	3/4 (19.1)max.
	36 (914) < w ≦ 60 (1524)	5/8 (15.9)max.	1 1/8 (28.6)max.
	60 (1524) < w	7/8 (22.2)max.	1 1/2 (38.1)max.
0.044(1.12) < t	w ≦ 36 (914)	1/4 (6.4)max.	3/4 (19.1)max.
	36 (914) < w ≦ 60 (1524)	3/8 (9.5)max.	3/4 (19.1)max.
	60 (1524) < w ≦ 72 (1829)	5/8 (15.9)max.	1 1/8 (28.6)max.

Remarks：Tolerances for high-strength, low-alloy steel with specified minimum yield point in excess of 50 ksi are subject to negotiation.

7.2.3.5 ASTM A568M Flatness Tolerances(All Designations)(Specified Nominal Thickness Tolerances) unit：mm

Thickness(t) \ Specified Yield Point / Width (w)		Under 310 MPa	310 to 345 MPa
t ≦ 1.0	w ≦ 900	10max.	20max.
	900 < w ≦ 1500	15max.	30max.
	1500 < w	20max.	40max.
1.0 < t	w ≦ 900	8max.	20max.
	900 < w ≦ 1500	10max.	20max.
	1500 < w ≦ 1800	15max.	30max.

Remarks：Tolerances for high-strength, low-alloy steel with specified minimum yield point in excess of 340 MPa are subject to negotiation.

7.2.4 Camber Tolerances

7.2.4.1 JIS G3141 Camber Tolerances

unit：mm

Width （w）	Tolerance （max.）
630 ≦ w	2 （Any portion of 2000 in length）

7.2.4.2 Camber Tolerances of JIS G3135 and CSC CF370R/390R/440R

unit：mm

Lower limit specification value of tensile strength	Width （w）	Tolerances（max.）
Under 780 N/mm^2	w ≧ 630	2 per an arbitrary length of 2000
780 N/mm^2 or over	w ≧ 630	3 per an arbitrary length of 2000

7.2.4.3 ASTM A568 Camber Tolerances

Production	Tolerance（max.）
Coils	1/4 inch（6.35mm） in any 8 ft （ 2438 mm）

7.2.4.4 ASTM A568M (Metric) Camber Tolerances

unit：mm

Production	Tolerance（max.）
Coils	5.0 in any 2000

7.3 Classification of Quality

Classification	Quality	Common Specification	Typical Applications
For Forming Fabrication	Commercial Quality (CQ)	JIS G3141 SPCC JFS A2001 JSC270C ASTM A1008 CS EN10130 DC01 CSC CB270TE	Furniture Refrigerator Case, Piping, Steel Drum, Tool Box, Computer Case, Cabinet Lock, Electronic Parts, Wheel Rim & Cap etc.
	Drawing Quality (DQ)	JIS G3141 SPCD JFS A2001 JSC270D ASTM A1008 DS EN 10130 DC03	Motor Housing Fender, Chassis, Lamp Shell, Door Inner, & Outer for Automobile, Roaster Oven, etc.
	Deep Drawing Quality (DDQ)	JIS G3141 SPCE/SPCF JFS A2001 JSC270E ASTM A1008 DDS EN 10130 DC04	Fuel Tank, Oil Can, Fender, Bumper, Trunk Lid Inner, Door Inner for Automobile, Front Lamp Set, Lighting Fixture, etc.
	Extra Deep Drawing Quality (EDDQ)	JIS G3141 SPCG JFS A2001 JSC270F ASTM A1008 EDDS EN 10130 DC05	Oil Can, Fuel Tank for Automobile, Lid inner & Door inner for Automobile, etc.
For Structural Use	Structural Quality (SS)	ASTM A1008 SS Grade XX	Frame, Automobile Body, Roofing Deck, etc
	High Strength Sheet With Improved Formability for Automobile Quality	JIS G3135 SPFCXXX JFS A2001 JSCXXX EN 10268 HCXXX CSC CF370R/390R/440R	Fender Bumper, Luggage Carrier, Automobile Frame, Bonnet and Trunk, etc.
	Bicycle parts	CSC CC1513	Chain Wheel for Bicycle
For Hardware, Tool Use	Special Steel Strip	JIS G3311 ASTM A684 SAE J404	Chain Plate, Hand Tool, Saw Plate, Golf Club

8.1 Unit mass

Product Type	Minimum Unit mass
CR Coil (Carbon Steel)	3 t / Coil
CR Coil (High Strength Low Alloy Steel)	3 t / Coil

8.2 Available Sizes

unit：mm

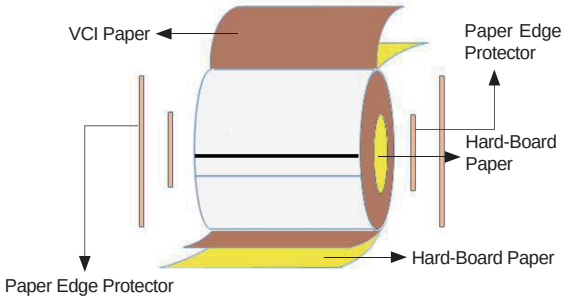
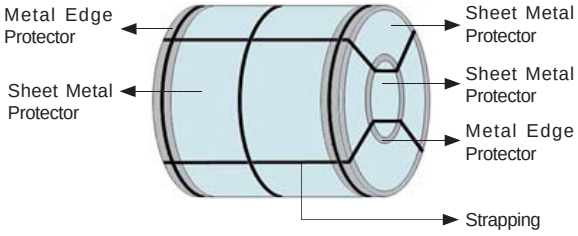
Product Type	Thickness	Width	Coil Inside Diameter
CR Coil (Carbon Steel)	0.20~0.29	850~1000	508 or 610
	0.30~0.34	850~1100	
	0.35~0.40	850~1219	
	0.41~0.49	780~1250	
	0.50~0.59	780~1410	
	0.60~0.69	780~1630	
	0.70~0.79	780~1776	
	0.80~1.60	780~1830	
	1.61~2.00	780~1676	
	2.01~3.20	780~1250	
CR Coil (High Strength Low Alloy Steel)	0.40~2.00	850~1520	
CR Coil (Special Steel Strip)	0.40~2.50	850~1000	

Remark： Above as a reference only.

9.1 Marking for cold rolled steel

Making Item	1	2	3	4	5	6	7	8	9	10	11
	CSC logo	CSC name	Product name	Specification	Size	Identification	Net mass	Gross mass	Quality type	Rough code	Heat no

9.2 Packing for cold rolled steel

Inside packing	Outside packing
	

Material / Product	Paper Pipe	VCI Paper	Hard-Board Paper			Paper Edge Protector		Sheet Metal Protector			Metal Edge Protector	
			circumferential surface	side wall	inner surface	outside diameter	inside diameter	circumferential surface	side wall	inner surface	outside diameter	inside diameter
Cold Rolled Coil		V	V			V	V	V	V	V	V	V
Non-Oiled Cold Rolled Coil		V	V		V	V	V	V	V	V	V	V
Thin Cold Rolled Coil	V	V	V			V	V	V	V	V	V	V
Non-Oiled Thin Cold rolled Coil	V	V	V		V	V	V	V	V	V	V	V

10

PRECAUTIONS FOR USE

10.1 Rust Prevention

If antirust treatment is not properly performed for the cold-rolled steel coils and sheets, it will be easy to rust the steel surface. Therefore, the coils have to be spread with proper rust preventive oil, and the coils are packed completely to protect them before shipping. However, the steel sheets and coils are easy to rust owing to the environmental factors during their storage and use. Especially the condensation problems are easy to occur when the coil storage is in an environment of high humidity and high/low temperature with rapid changes. Therefore, it should particularly pay attention to the prevention of condensation and drain water in advance. Besides, since the dust or acidic substance in the atmosphere are also easy to rust the surface of steel coils or sheets, such problems in the storage or processing must be eliminated for keeping good surface quality.

10.2 Stretcher strain and Aging

There are solid solution Carbon and Nitrogen in the low carbon steels. If they are not treated properly, the stretcher strain marks will be occurred in the process. Therefore, the temper rolling process will be carried out appropriately on these products to eliminate the extension of yield point. However, the extension of yield point may appear again with the longer period of storage as we called the aging problem. Aging is mainly related to solid solution Carbon、storing temperature and time. The "first in, first out (FIFO)" management to use these grades of steel is recommended as soon as possible in order to avoid the aging problems

10.3 Painting

The painting is one of the common ways to apply for further protecting the cold-rolled products, or enhancing their beauty and function. Not only the paint itself but also the painting pre-treatment is important factor to influence the coating performance. The main factors resulting in poor painting are:

(a) Insufficient clean: The residual oil and contaminant are often seen on the steel surfaces. These foreign matters may cause the paint to be unable to bond to the substrate surfaces, and may result in declining to fail the adhesion of film. It is better to understand the rust preventive oil, lubricants and other characteristics, proper choosing the way of cleaning and cleaning agents, paying more attention to storage conditions and painting operation environment for helping to improve the insufficient clean.

(b) Unsuitable chemical treatment: If the passivation film of chemical treatment is not sufficient or uneven, once outside corrosion factors are contacted with metal, the reactive metal is very easy to oxidize. Then oxide will thoroughly destroy the adhesion of primer paint to the steel surface. Moreover, if there are loose passivation films and coarse crystals or the residue contamination on the chemical treatment liquid, it will also cause the deficiency of the film adhesion. It is better to understand the reaction properties of the chemical treatment liquid, paying more attention on the differences between different cold-rolled steel sheet surfaces, properly adjusting the treatment

liquid concentration, temperature and time, as well as emphasizing on the clean of the treated surface.

(c) Improper paint：The environment and the end-use of products should be considered in the selection of paint, and the appropriate painting procedure should be adopted to ensure that the treated substrate surfaces are sufficiently wetted, are compatible with the paint, and have the ability to resist the environmental corrosion factors.

10.4 Electroplating

Electroplating is covering the cold-rolled steel sheets with a layer of metal or alloy by the principle of electrolysis, and the finishing products will have decorative metallic color and property. After electroplated, the appearance of the electroplated object is related to the current density. In the operational current density range, when the current density is smaller, the electroplated object will be more beautiful. Oppositely, there will be some uneven shapes. Generally, the electroplating bath is acidic that can dissolve the coating layer of Cathode. When the current density is too small, as a result of the dissolution of the acidic bath, the metal of coating layer will show the appearance of loose and matt. The contaminated water generated by electroplating process is an important source of water pollution, which is needed to concentrate on sewage treatment. The common electroplating is zinc-coated、copper-coated、nickel-coated、chrome-coated. The main factors resulting in poor electroplating are:

(a) Uneven coated layer: To obtain a uniform coated method is the well composition of coating bath. The reasonable operation makes the surface activity to be uniform. The reasonable hanging of the coated pieces makes the best current to be distributed uniformly. The current distribution can be improved by the distance and height between the anode and cathode, and by adding to auxiliary electrode、transmission device、insulation barrier etc.

(b) Coated layer with slag: Since it is due to impurity contamination, and impurity accumulation of long operation, it must always purify the coating bath. The main methods are：To use the filter material to remove solid impurities, to use activated carbon to remove organic matter, and to remove the metallic impurities by the electrolysis. Furthermore, the impurities can be removed by using the chemical methods of replacement、precipitation、pH adjustment and others.

(c) Coated layer with poor adhesion: It is due to the poor surface pre-treatment and oil contamination that the coated layer is unable to combine with the substrate. Therefore, it must execute the proper degreasing clean sufficiently.

10.5 Welding

(a) To compare with galvanized steel sheets, there are higher resistance values on cold-rolled steel sheets that only need a small welding current or shorter welding time to obtain sufficient resistance welding heat.

(b) Because the cold-rolled steel does not have the galvanized layer, there will be no phenomenon of the foreign

matter contaminated with electrodes in the welding process. The electrode durability of the cold-rolled steel sheets is higher than that of the galvanized steel sheets. Therefore, the electrode must be replaced or polished during welding if necessary.

(c) Although the cold-rolled steel sheets do not have the interference of the galvanized layer, it still needs to consider the correct welding parameters (welding time and welding current) that can obtain the correct welding strength and life of electrode tip.

(d) The resistance welding process as an example, if you want to weld the cold-rolled steel sheets, please refer to the following table of suggested welding parameters to ensure stable welding quality.

Suggested welding parameter table

Thickness of Steel (mm)	Electrode force (kgf)	Electrode Face Diameter (mm)	Holding time before welding (cyc)	Welding time (cyc)	Welding Current (kA)	Holding time after welding (cyc)
0.30~0.49	170	5	> 30	7	Expulsion of welding current-0.4	2
0.50~0.69	180	5	> 30	8	Expulsion of welding current-0.4	2
0.70~0.89	210	6	> 30	9	Expulsion of welding current-0.4	2
0.90~1.09	230	6	> 30	10	Expulsion of welding current-0.4	3
1.10~1.29	250	6	> 30	12	Expulsion of welding current-0.4	3
1.30~1.49	270	6	> 30	14	Expulsion of welding current-0.4	3
1.50~1.69	300	6	> 30	16	Expulsion of welding current-0.4	4
1.70~1.89	340	6	> 30	18	Expulsion of welding current-0.4	4
1.90~2.09	380	6 or 8	> 30	20	Expulsion of welding current-0.4	4
2.10~2.29	420	6 or 8	> 30	24	Expulsion of welding current-0.4	6
2.30~2.49	450	8	> 30	26	Expulsion of welding current-0.4	6

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CONVERSION TABLES

	ft	inch	mm	m
Length	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

	ksi(=1000psi)	psi	kgf/mm^2	N/mm^2(=MPa)
Stress	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

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

Conversion Table from HR30T to HRB

HR30T	Converted HRB	HR30T	Converted HRB	HR30T	Converted HRB	HR30T	Converted HRB
35.0	28.1	47.0	46.0	59.0	63.9	71.0	81.9
36.0	29.6	48.0	47.5	60.0	65.4	72.0	83.4
37.0	31.1	49.0	49.0	61.0	66.9	73.0	84.9
38.0	32.5	50.0	50.5	62.0	68.4	74.0	86.4
39.0	34.0	51.0	52.0	63.0	69.9	75.0	87.9
40.0	35.5	52.0	53.5	64.0	71.4	76.0	89.4
41.0	37.0	53.0	55.0	65.0	72.9	77.0	90.8
42.0	38.5	54.0	56.5	66.0	74.4	78.0	92.3
43.0	40.0	55.0	58.0	67.0	75.9	79.0	93.8
44.0	41.5	56.0	59.5	68.0	77.4	80.0	95.3
45.0	43.0	57.0	60.9	69.0	78.9	81.0	96.8
46.0	44.5	58.0	62.4	70.0	80.4	82.0	98.3

Note：This conversion table shall be in accordance with ASTM E140. Hardness not in the table of ASTM is obtained by interpolation.

Conversion Table from HR15T to HRB

HR15T	Converted HRB	HR15T	Converted HRB	HR15T	Converted HRB	HR15T	Converted HRB
70.0	28.8	76.0	47.3	82.0	65.8	88.0	84.3
70.5	30.3	76.5	48.8	82.5	67.3	88.5	85.8
71.0	31.9	77.0	50.4	83.0	68.8	89.0	87.3
71.5	33.4	77.5	51.9	83.5	70.4	89.5	88.9
72.0	35.0	78.0	53.4	84.0	71.9	90.0	90.4
72.5	36.5	78.5	55.4	84.5	73.5	90.5	92.0
73.0	38.0	79.0	56.5	85.0	75.0	91.0	93.5
73.5	39.6	79.5	58.1	85.5	76.6	91.5	95.0
74.0	41.1	80.0	59.6	86.0	78.1	92.0	96.6
74.5	42.7	80.5	61.1	86.5	79.6	92.5	98.1
75.0	44.2	81.0	62.7	87.0	81.2	93.0	99.7
75.5	45.7	81.5	64.2	87.5	82.7		

Note：This conversion table shall be in accordance with ASTM E140. Hardness not in the table of ASTM is obtained by interpolation.

Conversion Table from HV to HRB

HV	Converted HRB	HV	Converted HRB	HV	Converted HRB	HV	Converted HRB
85	41.0	145	76.6	210	93.4	330	—
90	48.0	150	78.7	220	95.0	340	(108.0)
95	52.0	155	79.9	230	96.7	350	—
100	56.2	160	81.7	240	98.1	360	(109.0)
105	59.4	165	83.1	250	99.5	370	—
110	62.3	170	85.0	260	(101.0)	380	(110.0)
115	65.0	175	86.1	270	(102.0)		
120	66.7	180	87.1	280	(103.5)		
125	69.5	185	88.8	290	(104.5)		
130	71.2	190	89.5	300	(105.5)		
135	73.2	195	90.7	310	—		
140	75.0	200	91.5	320	(107.0)		

Note：1. This conversion table shall be in accordance with ASTM E140. Hardness not in the table of ASTM is obtained by interpolation.

2. The value in parentheses is out of the scope of HRB and for reference. It may be reported as the round number.

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COMPARISON OF SPECIFICATION

Mild Steel

Classification	JIS G3141	JFS A2001	ASTM A1008	SAE J2329	EN 10130
CQ	SPCC	JSC270C	CS	Gr.1	DC01
DQ	SPCD	JSC270D	DS	Gr.2	DC03
DDQ	SPCE	JSC270E	DDS	Gr.3	DC04
EDDQ	SPCF	JSC270F	EDDS	Gr.4	DC05
SEDDQ	SPCG	JSC270G	—	Gr.5	DC06

Structural Steel-Commercial Type/Deep-drawing Type/Bake-hardening Type

Classification	JIS G3135	JFS A2001	ASTM A1008(SS)	SAE J1392	SAE J2340	EN 10268
Commercial Type	—	—	Gr.25	—	—	—
	—	JSC340W	Gr.30	—	—	—
	SPFC370	JSC370W	Gr.33	035CL	—	HC220P
	SPFC390	JSC390W	Gr.40	040CL	300S	—
	SPFC440	JSC440W	—	045CL		HC260P
Deep-drawing Type	—	JSC340P	—	—	180A	—
	—	JSC370P	—	—	210A	HC220Y
	—	JSC390P	—	—	250A	—
	—	JSC440P	—	—	280A	HC260Y
Bake-hardening Type	—	JSC270H	—	—	—	—
	—	JSC340H	—	—	180B	HC180B
	—		—	—	210B	HC220B
	—	—	—	—	250B	HC260B
	—	—	—	—	280B	HC300B

Structural Steel –High Yeild Ratio Type/ Low Yeild Ratio Type

Classification	JIS G3135	JFS A2001	ASTM A1008 (HSLAS)	SAE J1392	SAE J2340	EN 10268
High Yeild Ratio Type	—	—	Gr.45	045XL	300X	HC300LA
	—	JSC440R	Gr.50	050XL	340X	HC340LA
	—	—	Gr.55	—	380X	HC380LA
	—	—	Gr.60	060XL	420X	HC420LA
	—	JSC590R	Gr.65	—	—	—
	—	—	Gr.70	070XL	490X/R	—
	—	—	Gr.80	080XL	550X/R	—
	—	—	—	—	700R	—
	—	—	—	—	830R	—
	—	—	—	—	600DH	—
	—	—	—	—	700DH	—
Low Yeild Ratio Type	—	—	—	—	500DL	—
	—	—	—	—	600DL1	—
	SPFC590Y	JSC590Y	—	—	600DL2	—
	SPFC780Y	JSC780Y	—	—	800DL	—
	SPFC980Y	JSC980Y	—	—	950DL	—
	—	—	—	—	1000DL	—
	—	JSC1180Y	—	—	—	—

Note : The grades of these specificaitons are simlilar, not the same in the table above

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ORDERING INFORMATION

Required Ordering Data			Example
1	Specification (Name, Number, Grade)		JIS G3141 SPCC-SD CQ2 GP R35
	Temper	A,S,8,4,2,1	
	Surface Finish	Bright Finish (B)	
		Matte (Dull) Finish (D)	
	Surface Quality	General Purposes (GP)	
		Unexposed (UE)	
2	Oiled or Non-oiled		Oiled
3	Dimensions (Thickness×Width×Length(or coil))		1.0mm×1219mm×Coil
4	Coil Size (Inside Diameter, Outside Diameter)		ID 762mm, OD 1700mm max.
5	Mass	Max. Mass	10t max.
		Order Mass	450t
6	Applications and Fabricating Methods		Welded Pipe
7	Special Requirements (if Required)		Hardness : 55 HRB max.

Remarks : 1. The contents of this catalog are for reference only-customers are urged to consult the specifications published by the corresponding associations.

2. Information of the available steel grades, sizes, 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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