

# BAR & WIRE RODS

Product Manual





## **The quality policy of China Steel Corporation**

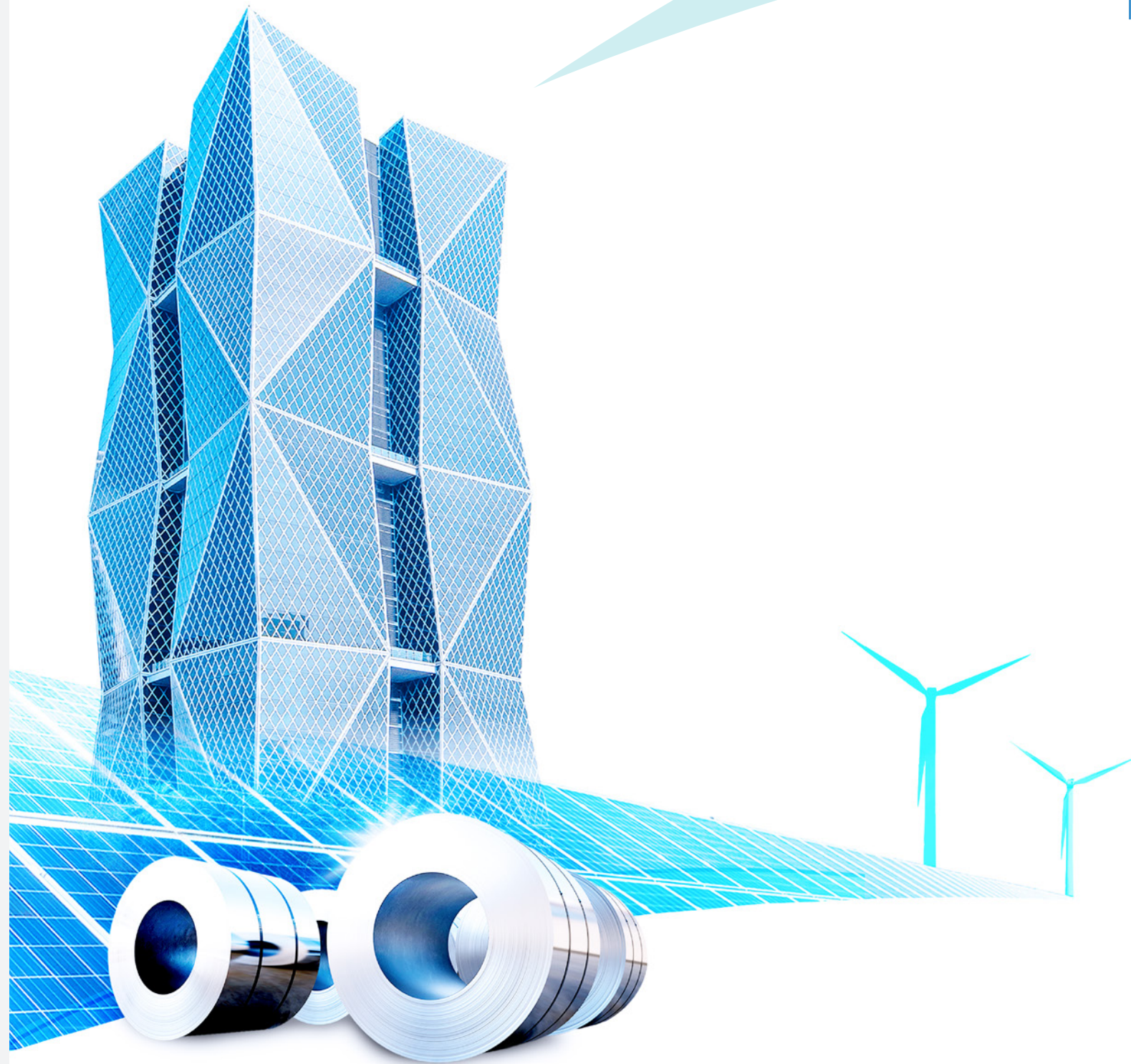
China Steel Corporation, based-on customer orientation, will incessantly innovate, research & develop to provide excellent and eco-friendly products, and consequently fulfill our responsibility to society.



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## Vision

**Smart Innovation** / **Green Energy** / **Value Co-creation**

**We aspire to be a sustainable growth enterprise.**

China Steel Corporation (CSC), located in Kaohsiung, Taiwan, was established in December 1971. Its annual output of crude steel is about 10 million metric tons. The main products are steel plates, bars, wire rods, hot-rolled and cold-rolled coils, electrogalvanized coils, electrical steel coils, and hot-dip galvanized steel coils. It is currently the largest domestic steel manufacturer with a domestic market share of more than 50%. About 55.2% of its products are domestically consumed and 44.8% exported mostly to Southeast Asia, Europe and Japan.

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 sustainable growth enterprise that distinguishes itself through a firm commitment to smart innovation, green energy, carbon reduction, and value co-creation." CSC actively puts in practice its corporate values of "teamwork, entrepreneurial approach, down-to-earthness and pursuit of innovation", as well as its operational concepts of "promotion of social well-being, result orientation, implementation of teamwork, and emphasis on employees' self-realization." Apart from continuing to cultivate in the steel industry, CSC is also committed to assisting the related downstream industries to upgrade and enhance the overall international competitiveness of the steel industry.



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

To develop the green energy industry

➤ Digital Transition

➤ Low-carbon Transition

➤ Supply Chain Transition





China Steel Corporation (CSC) is an integrated steel producer that has produced steel bars and wire rods since the commencement of its bar and rod mills. Through developments and improvements over the years, CSC's comprehensive steel products have fulfilled most of industrial requirements. The bars and wire rods have excellent quality and processing properties that enable CSC to provide customers with products like  $\Phi 14\sim 50\text{mm}$  bar in coils,  $\Phi 14\sim 125\text{mm}$  straight bars (among which  $\Phi 14\sim 17\text{mm}$  straightened bar in coils are provided),  $\Phi 5.5\sim 13\text{mm}$  wire rods and  $\Phi 5.5\sim 50\text{mm}$  spheroidized coils. For a long time, the aforementioned CSC's products have been used to make products like hand tools, screws, nuts, steel wires, wire ropes, welding rods, automobile parts, office OA and 3C product components, etc. The quality of these products has been recognized and highly regarded by domestic and foreign customers worldwide.

CSC has obtained ISO 9001, IATF 16949, and IECQ QC 080000 certifications. To meet the specific usage requirements of CSC's customers, certain steel plate products have obtained various country certifications, including those from Classification Societies (ABS, BV, CR, DNV, LR, and NK), Japan's JIS Mark, the European Union & UK (Construction Products Regulation, or CPR), Thailand's TISI, and Taiwan's CNS Mark. Additionally, CSC regularly outsources the testing of the chemical composition of steel products to ensure compliance with relevant international regulations on restricted hazardous substances. As a result, CSC's products are of excellent quality and can be trusted, providing customers with the assurance to use them confidently.

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.



### High Torsion Hand Tool Steel

CSC BT9865V has the guarantee of high cleanliness, low decarburization layer, and provides the screw driver with not only high torsion value(230-250 kgf-cm) and hardness(  $\geq$  HRC60), but tough enough to get long operation life time.

### High Strength Steel Wire Rope

CSC provides JIS G3502 SWRS92A for making ultra high strength (2,060N/mm<sup>2</sup>) steel wire rope. In addition, CSC further develops CSC BC1097 for making ultra high strength (2,160N/mm<sup>2</sup>) steel wire rope, which decreases the steel weight consumption, saves energy, and reduces the load of environment.

### Bolt and Nut Steel for Wind Power

CSC provides SAE 4140M for making grade 10.9 bolts and nuts with high strength, high impact value based on both high temperature and low temperature. It can be used in fasteners of wind power base, which promotes the development of eco-friendly industry.

### No Quenching and Tempering Hot Forging Steel

DIN EN 10267 30MnVS6, 38MnVS6 is a no quenching and tempering hot forging steel. It gets the strength approximated to quenching and tempering steel by adding precipitation hardening element, vanadium and applying proper cooling control after hot forging. It will be the key product for automobiles and motorcycles since it could omit heat treatment processes to save energy and production costs.

### High fatigue life bearing steel

JIS G4805 SUJ2 is a professional bearing steel. It controls precise vacuum while RH treatment, slag control while ladle refining, minimizes segregation and eutectic carbides while casting. It could get the fatigue life up to L10  $\geq 3.0 \times 10^7$ , so is suitable for inner and outer bearing ring of automobile and motorcycle.

### Air Screwdriver Bit Steel

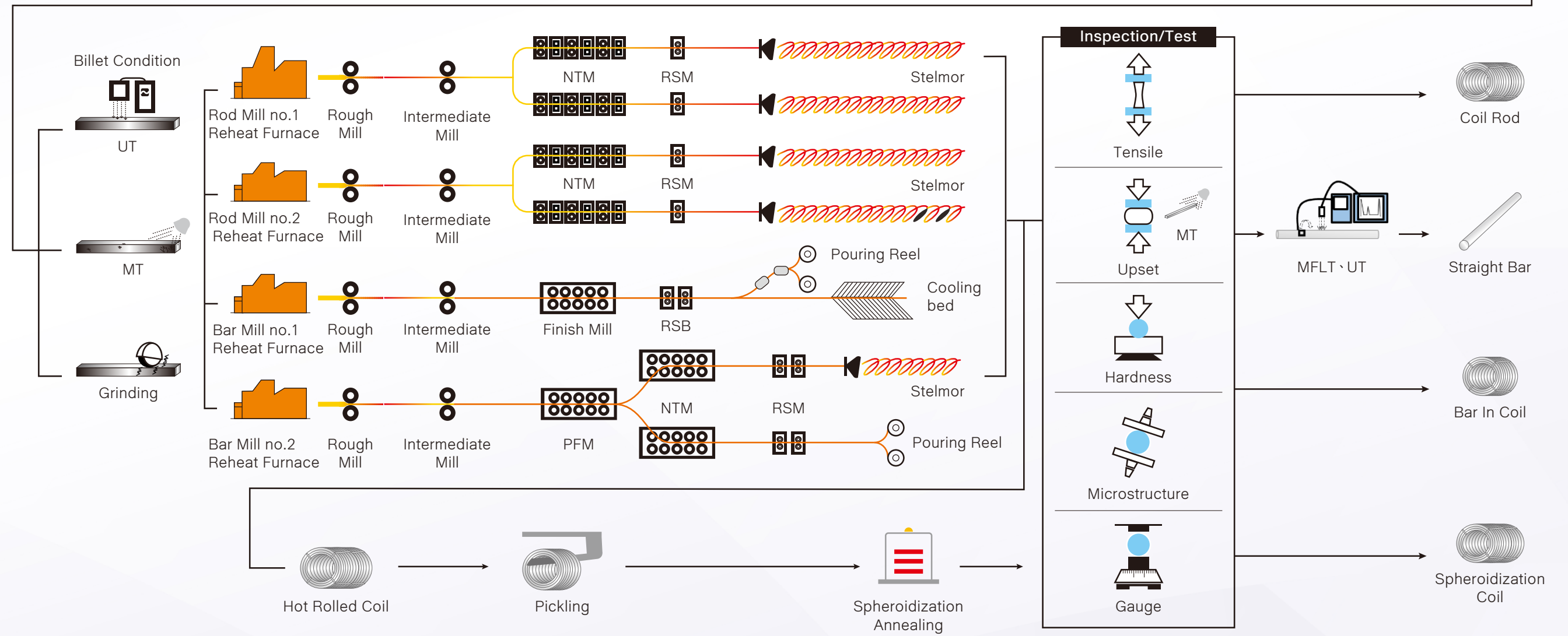
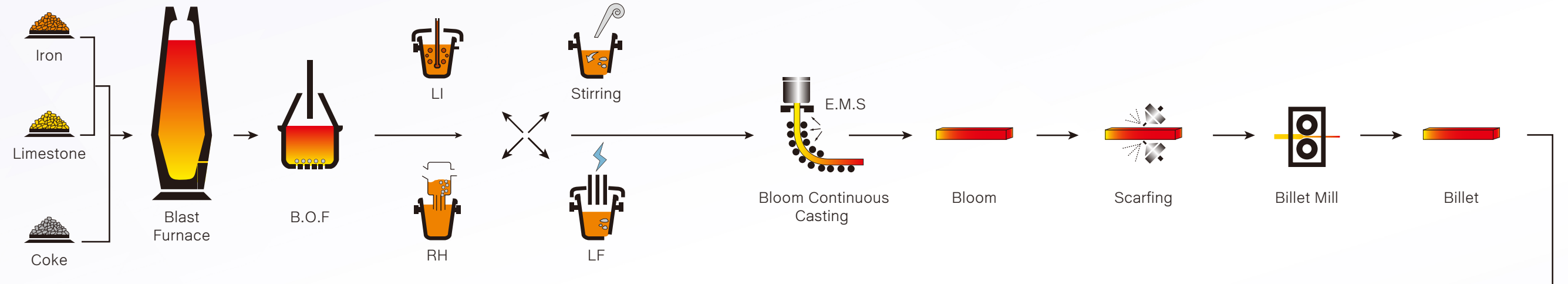
CSC SPEC BT4177(X8) bits, in comparison to manual screwdrivers, need to meet not only the basic requirements of high hardness for wear resistance but also to possess good impact and fatigue resistance to withstand the high-frequency instantaneous torque applied by pneumatic tools. Through the design with high carbon and alloy content, coupled with cleanliness control of billets, and appropriate heat treatment processes, the produced bits exhibit high hardness and fatigue performance.

### Tire Cord Steel

Since SAE 1080S tire cord steel needs to have the properties of high cleanliness, best drawability, and high tensile strength, CSC therefore applies inclusion improvement, segregation restraint, and controlled rolling technology to produce this kind grade of steel for meeting the tire cord steel's quality requirements.

### Steel for High Strength Submerged Arc Welding Electrode

AWS A5.17 EH12K is commonly used as a submerged arc welding electrode and is widely applied in industries such as shipbuilding, automotive, and wind power. Its high manganese content enhances the strength and toughness of the weld metal. Through the application of continuous casting segregation inhibition technology, combined with thermomechanical controlled rolling, high-elongation wire rod products are developed. This advancement promotes the welding industry towards higher value-added development.





## Major Equipments



**Converter**

In this process, impurities in hot metal, such as C, Si, Mn, P are removed by chemical reaction with oxygen. Liquid steel tapped from converter is provided to subsequent secondary refining process for composition adjustment in compliance with the demand of steel grade.



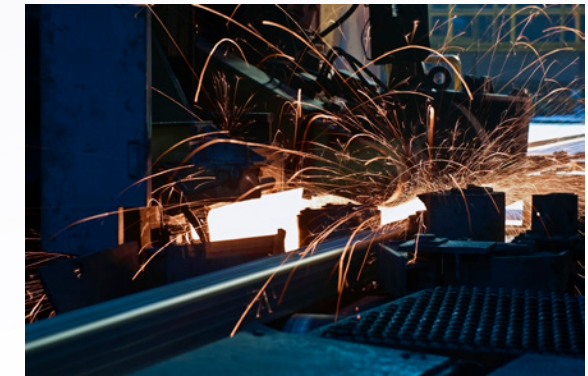
**RH Vacuum Degasser**

In the vacuum vessel, argon gas is used to promote circulation of liquid steel for deoxidization, decarburization and dehydrogenation reaction that hydrogen and inclusions can be eliminated to avoid hydrogen embrittlement and improve cleanliness. Facility equipped with feeding system can add alloy precisely and stabilize control of chemical composition.



**Bloom reheating furnace**

In the furnace, the blooms are heated uniformly with walking beam system. And if necessary, the scarf process is applied after discharging to remove the surface defects and decarburization.



**Billet conditioning**

In order to maintain the surface quality, the defects on the billet detected by MT can be removed by grinding.



**Cooling Box**

By controlling the temperature of the rolling stock, the automatically water cooling systems result in producing wire rod with required mechanical property and microstructure.



**Reducing & Sizing Mill**

The reducing & sizing mill not only provides precise diameter to save customer's mold operation life, but also make low temperature rolling and control cooling feasible.



**Magnetic Test Machine**

Applying stimulating current on the samples, defects such as seams, laps, and other surface cracks can be visible under black light surrounding.



**Straight Bar Inspection Line**

In order to maintain the surface and internal quality, straight bar detected by magnetic flux leakage testing and ultrasonic testing.

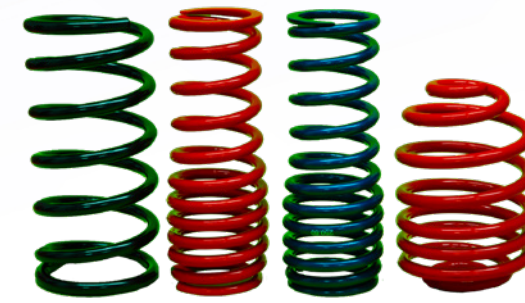




Linear Guides



Galvanized steel wire Strand



Springs



Automobile control arm



Automobile transmission parts



Automobile transmission gears



Screw and nut of wind turbine



Bits



Fasteners(Screws · Nuts)



Hand tools



## 6.1 Chemical Compositions and Mechanical Properties

### Chemical Compositions

The guaranteed chemical compositions are in accordance with international standards and are based on molten steel analysis. It shall be noted that there may be permissible deviations between molten steel analysis and product analysis. The permissible deviation range is determined by the relevant international standards, such as JIS G0321, SAE J409, and ASTM A6.

### 6.1.1 CSC Specifications-Extra Low Carbon and Medium Carbon Alloy Steels for Cold Heading and Cold Forging

Symbol	Chemical Composition %							
	C	Si	Mn	P	S	Cr	Al	Ti
C-CH1T	0.010 max.	–	0.40 max.	0.030 max.	0.020 max.	–	–	0.050 min.
C-CH1	0.015 max.	–	0.35 max.	0.030 max.	0.030 max.	–	–	–
C-CH35ACR	0.35~0.39	0.10 max.	0.60~0.90	0.025 max.	0.025 max.	0.30~0.50	0.010 min.	–
C-CH40ACR	0.40~0.44							

### 6.1.2 CSC Specifications – Boron Steels and Cr-V-B Steels

Symbol	Chemical Composition %							
	C	Si	Mn	P	S	Cr	V	B
10B20	0.18~ 0.23	0.10 max.	0.30~ 0.60	0.025 max.	0.025 max.	—	—	0.0005 min.
10B21								
10B22								
10B29	0.26~ 0.30	0.15~ 0.35	0.70~ 1.00					
10B33	0.32~ 0.36							
10B38	0.35~ 0.42							
50BV30	0.27~ 0.33	0.10 max.	0.70~ 1.00	0.030 max.	0.030 max.	0.30~ 0.50	0.10~ 0.15	0.0005 min.



### 6.1.3 CSC Specifications – Non-Lead Patenting Steel Wire Rod

Symbol	Chemical Composition %				
	C	Si	Mn	P	S
NLP33K	0.29~0.36	0.10~0.35	0.60~0.90	0.030 max.	0.035 max.
NLP77B	0.74~0.81	0.15~0.35		0.025 max.	0.025 max.
NLP82B	0.79~0.85				

### 6.1.4 CSC Specifications – High Hardness Bits Steel Wire Rod

Symbol	Chemical Composition %										
	C	Si	Mn	P	S	Al	Ni	Cr	Mo	V	Nb
BT4172SI	0.70~0.75	1.85~2.10	0.35~0.50	0.025 max.	0.01 max.	–	0.30~0.45	0.90~1.10	0.08~0.16	Addition	Addition
BT4177(X8)	0.75~0.79	1.95~2.20	0.45~0.55	0.025 max.	0.01 max.	–	–	0.95~1.15	0.10~0.17	Addition	Addition
BT9865V	0.63~0.68	1.70~1.90	0.40~0.60	0.025 max.	0.01 max.	–	0.25~0.45	0.60~0.80	0.25~0.35	Addition	Addition

### 6.1.5 JIS G3503-20 Wire Rods for Core Wire of Covered Electrode

Symbol	Chemical Composition %					
	C	Si	Mn	P	S	Cu
SWRY 11	0.09 max.	0.03 max.	0.35~0.65	0.020 max.	0.023 max.	0.20 max.
SWRY 21	0.10~0.15					

### 6.1.6 JIS G3505-24 Low Carbon Steel Wire Rods

Symbol	Chemical Composition %			
	C	Mn	P	S
SWRM 6	0.08 max.	0.60 max.	0.040 max.	0.040 max.
SWRM 8	0.10 max.			
SWRM 10	0.08~0.13	0.30~0.60		
SWRM 12	0.10~0.15			
SWRM 15	0.13~0.18			
SWRM 17	0.15~0.20			
SWRM 20	0.18~0.23			
SWRM 22	0.20~0.25			



### 6.1.7 JIS G3506-24 High Carbon Steel Wire Rods

Symbol	Chemical Composition %				
	C	Si	Mn	P	S
SWRH 27	0.24~0.31	0.15~0.35	0.30~0.60	0.030 max.	0.030 max.
SWRH 32	0.29~0.36				
SWRH 37	0.34~0.41				
SWRH 42A	0.39~0.46		0.30~0.60		
SWRH 42B			0.60~0.90		
SWRH 47A	0.44~0.51		0.30~0.60		
SWRH 47B			0.60~0.90		
SWRH 52A	0.49~0.56		0.30~0.60		
SWRH 52B			0.60~0.90		
SWRH 57A	0.54~0.61		0.30~0.60		
SWRH 57B			0.60~0.90		
SWRH 62A	0.59~0.66		0.30~0.60		
SWRH 62B			0.60~0.90		
SWRH 67A	0.64~0.71		0.30~0.60		
SWRH 67B			0.60~0.90		
SWRH 72A	0.69~0.76		0.30~0.60		
SWRH 72B			0.60~0.90		
SWRH 77A	0.74~0.81		0.30~0.60		
SWRH 77B			0.60~0.90		
SWRH 82A	0.79~0.86		0.30~0.60		
SWRH 82B			0.60~0.90		

Remark : When agreed upon between the purchaser and the manufacturer, the upper and the lower limits of the carbon content given in the above table each can be narrowed by 0.01%.



## 6.1.8 JIS G3507-1-21 Carbon Steel Wire Rods for Cold Heading — Wire Rods

Symbol	Chemical Composition %					
	C	Si	Mn	P	S	Al
SWRCH6A	0.08 max.	0.10 max.	0.60 max.	0.030 max.	0.035 max.	0.02 min.
SWRCH8A	0.05~0.10		0.30~0.60			
SWRCH10A	0.08~0.13					
SWRCH12A	0.10~0.15		0.60~0.90			
SWRCH15A	0.13~0.18					
SWRCH16A	0.15~0.20		0.70~1.00			
SWRCH18A			0.30~0.60			
SWRCH19A	0.70~1.00					
SWRCH20A			0.30~0.60			
SWRCH22A	0.30~0.60					
SWRCH25A	0.22~0.28					
SWRCH10K	0.08~0.13	0.10~0.35	0.30~0.60	0.030 max.	0.035 max.	—
SWRCH12K	0.10~0.15		0.60~0.90			
SWRCH15K	0.13~0.18					
SWRCH16K			0.60~0.90			
SWRCH17K	0.15~0.20		0.30~0.60			
SWRCH18K			0.60~0.90			
SWRCH20K	0.18~0.23		0.30~0.60			
SWRCH22K			0.70~1.00			
SWRCH24K	0.19~0.25		1.35~1.65			
SWRCH25K	0.22~0.28		0.30~0.60			
SWRCH27K	0.22~0.29		1.20~1.50			
SWRCH30K	0.27~0.33		0.60~0.90			
SWRCH33K	0.30~0.36					
SWRCH35K	0.32~0.38					
SWRCH38K	0.35~0.41					
SWRCH40K	0.37~0.43		1.35~1.65			
SWRCH41K	0.36~0.44					
SWRCH43K	0.40~0.46		0.60~0.90			
SWRCH45K	0.42~0.48					
SWRCH48K	0.45~0.51					
SWRCH50K	0.47~0.53					

Remark : In all the steel grades in this table, the content limits for Cu, Ni and Cr shall be 0.30%, 0.20% and 0.20% respectively.



### 6.1.9 JIS G3509-1-21 Low-Alloyed Steels for Cold Heading — Wire Rods

Symbol	Chemical Composition %								
	C	Si <sup>(1)</sup>	Mn	P	S	Ni	Cr	Mo	
SMn420RCH	0.17~0.23	0.15~0.35	1.20~1.50	0.030 max.	0.030 max.	0.25 max.	0.35 max.	—	
SMn420HRCH	0.16~0.23		1.15~1.55						
SMn433RCH	0.30~0.36		1.20~1.50						
SMn433HRCH	0.29~0.36		1.15~1.55						
SMn438RCH	0.35~0.41		1.35~1.65						
SMn438HRCH	0.34~0.41		1.30~1.70						
SMn443RCH	0.40~0.46		1.35~1.65						
SMn443HRCH	0.39~0.46		1.30~1.70						
SMnC420RCH	0.17~0.23		1.20~1.50				0.35~0.70		
SMnC443RCH	0.40~0.46		1.35~1.65						
SCr415RCH	0.13~0.18		0.60~0.90				0.90~1.20		
SCr415HRCH	0.12~0.18		0.55~0.95				0.85~1.25		
SCr420RCH	0.18~0.23		0.60~0.90				0.90~1.20		
SCr420HRCH	0.17~0.23		0.55~0.95				0.85~1.25		
SCr430RCH	0.28~0.33		0.60~0.90				0.90~1.20		
SCr430HRCH	0.27~0.34		0.55~0.95				0.85~1.25		
SCr435RCH	0.33~0.38		0.60~0.90				0.90~1.20		
SCr435HRCH	0.32~0.39		0.55~0.95				0.85~1.25		
SCr440RCH	0.38~0.43		0.60~0.90				0.90~1.20		
SCr440HRCH	0.37~0.44		0.55~0.95				0.85~1.25		
SCM415RCH	0.13~0.18		0.60~0.90				0.90~1.20		0.15~0.25
SCM415HRCH	0.12~0.18		0.55~0.95				0.85~1.25		0.15~0.30
SCM418RCH	0.16~0.21		0.60~0.90				0.90~1.20		0.15~0.25
SCM418HRCH	0.15~0.21		0.55~0.95				0.85~1.25		0.15~0.30
SCM420RCH	0.18~0.23		0.60~0.90				0.90~1.20		0.15~0.25
SCM420HRCH	0.17~0.23		0.55~0.95				0.85~1.25		0.15~0.30
SCM425RCH	0.23~0.28	0.60~0.90	0.90~1.20						
SCM425HRCH		0.55~0.95	0.85~1.25						
SCM430RCH	0.28~0.33	0.60~0.90				0.90~1.20			
SCM435RCH	0.33~0.38								



Symbol	Chemical Composition %								
	C	Si <sup>(1)</sup>	Mn	P	S	Ni	Cr	Mo	
SCM435HRCH	0.32~0.39	0.15~0.35	0.55~0.95	0.030 max.	0.030 max.	0.25 max.	0.85~1.25	0.15~0.35	
SCM440RCH	0.38~0.43		0.60~0.90				0.90~1.20	0.15~0.30	
SCM440HRCH	0.37~0.44		0.55~0.95				0.85~1.25	0.15~0.35	
SCM445RCH	0.43~0.48		0.60~0.90				0.90~1.20	0.15~0.30	
SCM445HRCH	0.42~0.49		0.55~0.95				0.85~1.25	0.15~0.35	
SCM822RCH	0.20~0.25		0.60~0.90				0.90~1.20	0.35~0.45	
SCM822HRCH	0.19~0.25		0.55~0.95				0.85~1.25		
SNC415RCH	0.12~0.18		0.35~0.65			2.00~2.50	0.20~0.50	-	
SNC415HRCH	0.11~0.18		0.30~0.70			1.95~2.50	0.20~0.55		
SNC631RCH	0.27~0.35		0.35~0.65			2.50~3.00	0.60~1.00		
SNC631HRCH	0.26~0.35		0.30~0.70			2.45~3.00	0.55~1.05		
SNC815RCH	0.12~0.18		0.35~0.65			3.00~3.50	0.60~1.00		
SNC815HRCH	0.11~0.18		0.30~0.70			2.95~3.50	0.55~1.05		
SNCM220RCH	0.17~0.23		0.60~0.90			0.40~0.70	0.40~0.60	0.15~0.25	
SNCM220HRCH			0.60~0.95			0.35~0.75	0.35~0.65	0.15~0.30	
SNCM240RCH	0.38~0.43		0.70~1.00			0.40~0.70	0.40~0.60		
SNCM420RCH	0.17~0.23		0.40~0.70			1.60~2.00			
SNCM420HRCH						1.55~2.00	0.35~0.65		
SNCM439RCH	0.36~0.43		0.60~0.90			1.60~2.00	0.60~1.00		
SNCM447RCH	0.44~0.50								
SNCM616RCH	0.13~0.20		0.80~1.20				2.80~3.20	1.40~1.80	0.40~0.60

Note : <sup>(1)</sup> The lower limit of Si may be below 0.15%, upon agreement between the purchaser and the manufacture.

Remark : 1. In all the steel grades in this table, the content limit for Cu, as impurity, shall be 0.30%.

2. Al may be added for the purpose of grain refining as agreed upon between the purchaser and the manufacture.



### 6.1.10 JIS G4051-23 Carbon Steels for Machine Structural Use

Symbol	Chemical Composition %				
	C	Si	Mn	P	S
S10C	0.08~0.13	0.15~0.35	0.30~0.60	0.030 max.	0.035 max.
S12C	0.10~0.15				
S15C	0.13~0.18				
S17C	0.15~0.20				
S20C	0.18~0.23				
S22C	0.20~0.25				
S25C	0.22~0.28				
S28C	0.25~0.31		0.60~0.90		
S30C	0.27~0.33				
S33C	0.30~0.36				
S35C	0.32~0.38				
S38C	0.35~0.41				
S40C	0.37~0.43				
S43C	0.40~0.46				
S45C	0.42~0.48				
S48C	0.45~0.51				
S50C	0.47~0.53				
S53C	0.50~0.56				
S55C	0.52~0.58				
S58C	0.55~0.61				
S09CK	0.07~0.12	0.10~0.35	0.30~0.60	0.025 max.	0.025 max.
S15CK	0.13~0.18	0.15~0.35			
S20CK	0.18~0.23				

Remark : 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. As impurities, Cu, Ni, Cr and Ni+Cr for grades S09CK, S15CK, S20CK shall not exceed respectively 0.25%, 0.20%, 0.20%, 0.30%, and Cu, Ni, Cr and Ni+Cr for all other grades shall not exceed respectively 0.30%, 0.20%, 0.20% and 0.35%. However, the upper limit of Ni+Cr can be specified under 0.40% for S09CK, S15CK and S20CK, and may be specified under for other grades upon the agreement between the manufacturer and the purchaser.

## 6.1.11 JIS G4052-23 Structural Steels with Specified Hardenability Bands

Symbol		Chemical Composition %											
		C	Si	Mn	P	S	Ni	Cr	Mo				
Mn	SMn420H	0.16~0.23	0.15~0.35	1.15~1.55	0.030 max.	0.030 max.	0.25 max.	0.35 max..	-				
	SMn433H	0.29~0.36											
	SMn438H	0.34~0.41		1.30~1.70									
	SMn443H	0.39~0.46											
Mn-Cr	SMnC420H	0.16~0.23		1.15~1.55				0.35~0.70					
	SMnC443H	0.39~0.46		1.30~1.70									
Cr	SCr415H	0.12~0.18		0.55~0.95				0.030 max.		0.030 max.	0.25 max.	0.85~1.25	0.15~0.30
	SCr420H	0.17~0.23											
	SCr430H	0.27~0.34											
	SCr435H	0.32~0.39											
	SCr440H	0.37~0.44											
Cr-Mo	SCM415H	0.12~0.18	0.85~1.25		0.15~0.35								
	SCM418H	0.15~0.21											
	SCM420H	0.17~0.23											
	SCM425H	0.23~0.28											
	SCM435H	0.32~0.39											
	SCM440H	0.37~0.44											
	SCM445H	0.42~0.49											
	SCM822H	0.19~0.25											
	SNC631H	0.26~0.35				0.35~0.75	0.35~0.65		0.15~0.30				
	SNC815H	0.11~0.18											
Ni-Cr	SNC415H	0.11~0.18	0.30~0.70	1.95~2.50	0.20~0.55	-							
	SNC631H			2.45~3.00	0.55~1.05								
	SNC815H			2.95~3.50									
Ni-Cr-Mo	SNCM220H	0.17~0.23	0.60~0.95	0.35~0.75	0.35~0.65	0.15~0.30							
	SNCM420H		0.40~0.70	1.55~2.00									

Remark : As impurities, Cu shall not exceed 0.30% in any steel of this table.



## 6.1.12 JIS G4053-23 Low-Alloyed Steels For Machine Strcutural Use

Symbol	Chemical Composition %									
	C	Si	Mn	P	S	Ni	Cr	Mo		
SMn 420	0.17~0.23	0.15~0.35	1.20~1.50	0.030 max.	0.030 max.	0.25 max.	0.35 max.	—		
SMn 433	0.30~0.36		1.35~1.65							
SMn 438	0.35~0.41									
SMn 443	0.40~0.46						1.20~1.50		0.35~0.70	
SMnC 420	0.17~0.23									
SMnC 433	0.40~0.46		1.35~1.65							
SCr 415	0.13~0.18						0.60~0.90		0.90~1.20	0.15~0.25
SCr 420	0.18~0.23									
SCr 430	0.28~0.33									
SCr 435	0.33~0.38									
SCr 440	0.38~0.43									
SCr 445	0.43~0.48									
SCM 415	0.13~0.18		0.70~1.00					0.15~0.30		
SCM 418	0.16~0.21									
SCM 420	0.18~0.23									
SCM 421	0.17~0.23		0.60~0.90					0.15~0.30		
SCM 425	0.23~0.28									
SCM 430	0.28~0.33									
SCM 432	0.27~0.37		0.30~0.60				0.15~0.30			
SCM 435	0.33~0.38									
SCM 440	0.38~0.43									
SCM 445	0.43~0.48		0.60~0.90				0.35~0.45			
SCM 822	0.20~0.25									
SNC 236	0.32~0.40					0.50~0.80		—		
SNC 415	0.12~0.18		0.35~0.65				0.50~0.90			
SNC 631	0.27~0.35								0.60~1.00	
SNC 815	0.12~0.18									
SNC 836	0.32~0.40									
SNCM 220	0.17~0.23		0.60~0.90				0.15~0.25			
SNCM 240	0.38~0.43		0.70~1.00			0.15~0.30				
SNCM 415	0.12~0.18		0.40~0.70							
SNCM 420	0.17~0.23		1.60~2.00				0.40~0.60			
SNCM 431	0.27~0.35									
SNCM 439	0.36~0.43									
SNCM 447	0.44~0.50									
SNCM 616	0.13~0.20	0.60~0.90	0.60~1.00							
SNCM 625	0.20~0.30	0.80~1.20	2.80~3.20	1.40~1.80	0.40~0.60					
SNCM 630	0.25~0.35		3.00~3.50	1.00~1.50	0.15~0.30					
SNCM 815	0.12~0.18		2.50~3.50	2.50~3.50	0.30~0.70					
SACM645	0.40~0.50		4.00~4.50	0.70~1.00	0.15~0.30					
			0.30~0.60							
			0.60 max.							

Remark : 1. As impurities, Cu Shall not exceed 0.30% in any steel of this table.

2. When the product analysis on steels is requested by the agreement between the manufacturer and the purchaser, this table shall be in accordance with table 4 of JIS G0321.

3. Al of SACM645 shall be 0.70% to 1.20%.

### 6.1.13 JIS G4801-21 Spring Steels

Symbol	Chemical Composition%						
	C	Si	Mn	P <sup>(1)</sup>	S <sup>(1)</sup>	Cr	others
SUP 6	0.56~0.64	1.50~1.80	0.70~1.00	0.030 max.	0.030 max.	-	
SUP 7		1.80~2.20					
SUP 9	0.52~0.60	0.15~0.35	0.65~0.95			0.65~0.95	-
SUP 9 A	0.56~0.64		0.70~1.00			0.70~1.00	
SUP 10	0.47~0.55		0.65~0.95			0.80~1.10	V: 0.15~0.25
SUP 11 A	0.56~0.64		0.70~1.00			0.70~1.00	B : 0.0005min.
SUP 12	0.51~0.59	1.20~1.60	0.60~0.90			0.60~0.90	-
SUP 13	0.56~0.64	0.15~0.35	0.70~1.00			0.70~0.90	Mo: 0.25~0.35

Note : <sup>(1)</sup> The value of P and S may be specified to be no more than 0.035% under the agreement between the manufacturer and the purchaser.

Remark : 1. As impurities, Cu content for each grade shall not exceed 0.30%.

2. In the case where the product analysis for the steel is carried out on request by the purchaser ; the allowable tolerance for this table shall be specified in attached table 4 in JIS G0321.

### 6.1.14 JIS G4805-19 High Carbon Chromium Bearing Steels

Symbol	Chemical Composition%						
	C	Si	Mn	P	S	Cr	Mo
SUJ 2	0.95~1.10	0.15~0.35	0.50 max.	0.025 max.	0.025 max.	1.30~1.60	0.08 max.

Remark : 1. As impurities, Ni and Cu shall not exceed 0.25% respectively Cu in wire rod shall be 0.20% or under.

2. When agreed between the manufacturer and the purchaser, elements not in this table of 0.25% or under may be added.

### 6.1.15 JIS Z3312-09 Solid wires for MAG and MIG Welding of mild steel, high strength steel and low temperature service steel

Symbol	Chemical Composition%										
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Al	Ti + Zr
YGW11	0.02~ 0.15	0.55~ 1.10	1.40~ 1.90	0.030 max.	0.030 max.	0.50 max.	-	-	-	-	0.02~ 0.03
YGW12		0.50~ 1.00	1.25~ 1.90							-	-
YGW13		0.55~ 1.10	1.35~ 1.90							0.10~ 0.50	0.02~ 0.03
YGW14		1.00~ 1.35	1.30~ 1.60							-	-
YGW15		0.40~ 1.00	1.00~ 1.60							-	0.02~ 0.15
YGW16			0.90~ 1.60							-	-
YGW17		0.20~ 0.55	1.20~ 2.10							-	-
YGW18	0.15 max.	0.55~ 1.10	1.40~ 2.60						0.40 max.	-	0.30 max.
YGW19		0.40~ 1.00	1.40~ 2.00							-	



## 6.1.16 SAE J403-24 Nonresulfurized Carbon Steels

UNS No.	SAE No.	Chemical Composition%			
		C	Mn	P	S
G10050	1005	0.06 max.	0.35 max.	0.030 max.	0.050 max.
G10060	1006	0.08 max.	0.25~0.40		
G10080	1008	0.10 max.	0.30~0.50		
G10100	1010	0.08~0.13	0.30~0.60		
G10120	1012	0.10~0.15			
G10150	1015	0.13~0.18	0.30~0.60		
G10160	1016		0.60~0.90		
G10170	1017	0.15~0.20	0.30~0.60		
G10180	1018		0.60~0.90		
G10200	1020	0.18~0.23	0.30~0.60		
G10210	1021		0.60~0.90		
G10220	1022		0.70~1.00		
G10230	1023	0.20~0.25	0.30~0.60		
G10250	1025	0.22~0.28			
G10260	1026		0.60~0.90		
G10290	1029	0.25~0.31			
G10300	1030	0.28~0.34			
G10350	1035	0.32~0.38			
G10370	1037		0.70~1.00		
G10380	1038	0.35~0.42	0.60~0.90		
G10390	1039	0.37~0.44	0.70~1.00		
G10400	1040		0.60~0.90		
G10420	1042	0.40~0.47			
G10430	1043		0.70~1.00		
G10440	1044	0.43~0.50	0.30~0.60		
G10450	1045		0.60~0.90		
G10460	1046		0.70~1.00		
G10490	1049	0.46~0.53	0.60~0.90		
G10500	1050	0.48~0.55			
G10530	1053		0.70~1.00		
G10550	1055	0.50~0.60	0.60~0.90		
G10600	1060	0.55~0.65			
G10650	1065	0.60~0.70			
G10700	1070	0.65~0.75			
G10780	1078	0.72~0.85	0.30~0.60		
G10800	1080	0.75~0.88	0.60~0.90	0.030 max.	0.050 max.
G10860	1086	0.80~0.93	0.30~0.50		
G10900	1090	0.85~0.98	0.60~0.90		
G10950	1095	0.90~1.03	0.30~0.50		

Remark : 1. Lead : Standard carbon steels can be produced with a lead range of 0.15-0.35% to improve machinability. Such steels are identified by inserting the letter "L" between the second and third numerals of the grade number, for example, "10L45" .

2. Boron : Standard killed carbon steels, which are fine grain, may be produced with a boron addition to improve hardenability. Such steels are produced to a range of 0.0005-0.003% boron. These steels are identified by inserting the letter "B" between the second and third numerals of the grade number, for example, "10B46" .

3. Copper : When copper is required, 0.20% minimum is generally specified.

4. Silicon : Bars and Semifinished-When silicon ranges or limits are required, the following ranges are commonly used: 0.10%max, 0.10 to 0.20%, 0.15 to 0.35%, 0.20 to 0.40%; or 0.30 to 0.60%.

Rods: When silicon is required, the following ranges and limits are commonly used for nonresulfurized steels: 0.10% max; 0.07 to 0.15%, 0.10 to 0.20%; 0.15 to 0.35%; 0.20 to 0.40%, 0.30 to 0.60%.

5. Certain qualities and commodities are customarily produced to lower the higher limits of phosphorus and sulfur.

## 6.1.17 SAE J404-09 Alloy Steels

UNS No.	SAE No.	Chemical Composition%																
		C	Mn	P	S	Si	Ni	Cr	Mo	others								
G13350	1335	0.33~0.38	1.60~1.90	0.030 max.	0.040 max.	0.15~0.35	-	-	-	-								
G13400	1340	0.38~0.43							0.20~0.30									
G40230	4023	0.20~0.25	0.70~0.90															
G40270	4027	0.25~0.30																
G40370	4037	0.35~0.40																
G40470	4047	0.45~0.50																
G41200	4118	0.18~0.23	0.70~0.90					0.40~0.60	0.08~0.15									
G41200	4120		0.90~1.20						0.13~0.20									
G41300	4130	0.28~0.33	0.40~0.60					0.80~1.10	0.15~0.25									
G41350	4135	0.33~0.38	0.70~0.90					0.80~1.10	0.15~0.25									
G41370	4137	0.35~0.40	0.70~0.90															
G41400	4140	0.38~0.43	0.75~1.00															
G41420	4142	0.40~0.45																
G41450	4145	0.43~0.48																
G41500	4150	0.48~0.53																
G43200	4320	0.17~0.22	0.45~0.65				1.65~2.00	0.40~0.60	0.20~0.30									
G43400	4340	0.38~0.43	0.60~0.80					0.70~0.90										
G46200	4620	0.17~0.22	0.45~0.65				3.25~3.75	-	-	B : 0.0005-0.003								
G48200	4820	0.18~0.23	0.50~0.70															
G50461	50B46	0.44~0.49	0.75~1.00				0.20~0.35	-	-	-								
G51150	5115	0.13~0.18	0.70~0.90				-											
G51200	5120	0.17~0.22	0.70~0.90					0.70~0.90										
G51300	5130	0.28~0.33						0.80~1.10										
G51320	5132	0.30~0.35	0.60~0.80				0.75~1.00											
G51400	5140	0.38~0.43	0.70~0.90					0.70~0.90										
G51500	5150	0.48~0.53						0.70~0.90	-	-								
G51600	5160	0.56~0.64	0.75~1.00															
G51601	51B60		0.70~0.90				0.40~0.70			0.40~0.60		-						
G61500	6150	0.48~0.53	0.70~0.90															
G86150	8615	0.16~0.18	0.70~0.90				0.40~0.60		-									
G86170	8617	0.15~0.20								0.40~0.60		0.15~0.25	-					



UNS No.	SAE No.	Chemical Composition%														
		C	Mn	P	S	Si	Ni	Cr	Mo	others						
G86200	8620	0.18~0.23	0.70~0.90	0.030 max.	0.040 max.	0.15~0.35	0.40~0.70	0.40~0.60	0.15~0.25	-						
G86220	8622	0.20~0.25														
G86225	8625	0.23~0.28														
G86300	8630	0.28~0.33														
G86400	8640	0.38~0.43	0.75~1.00	0.035 max.												
G86450	8645	0.43~0.48														
G86600	8660	0.56~0.64														
G87200	8720	0.18~0.23	0.70~0.90	0.030 max.		0.70~1.10	-	0.45~0.65	0.20~0.30							
G88220	8822	0.20~0.25	0.75~1.00						0.30~0.40							
G92590	9259	0.56~0.64	0.75~1.00			1.80~2.20		-								
G92600	9260															

Remark : As impurities, Cu, Ni , Cr and Mo shall not exceed 0.35%, 0.25%,0.20% and 0.06%, respectively, throughout all classes.

### 6.1.18 SAE J403-24 High Manganese Carbon Steels and Free Cutting Carbon Steels

UNS No.	SAE No.	Chemical Composition%			
		C	Mn	P	S
G11170	1117	0.14~0.20	1.00~1.30	0.030 max.	0.08~0.13
G11370	1137	0.32~0.39	1.35~1.65		
G11410	1141	0.37~0.45			
G11440	1144	0.40~0.48			0.24~0.33
G12150	1215	0.09 max.	0.75~1.05	0.04~0.09	0.26~0.35
G15240	1524	0.19~0.25	1.35~1.65	0.030 max.	0.050 max.
G15360	1536	0.30~0.37	1.20~1.50		
G15410	1541	0.36~0.44	1.35~1.65		
G15520	1552	0.47~0.55	1.20~1.50		

### 6.1.19 SAE J1268-10 Carbon and Carbon Boron Hardenability-Steels(H steels)

UNS No.	SAE No.	Chemical Composition%					
		C	Mn	P	S	Si	others
H10380	1038H	0.34~0.43	0.50~1.00	0.030 max.	0.050 max.	0.15~0.35	-
H10450	1045H	0.42~0.51					
H15220	1522H	0.17~0.25	1.00~1.50				
H15240	1524H	0.18~0.26	1.21~1.75				
H15260	1526H	0.21~0.30	1.00~1.50				
H15410	1541H	0.35~0.45	1.25~1.75	0.030 max.	0.050 max.	0.15~0.35	B : 0.0005~0.003
H15211	15B21H	0.17~0.24	0.70~1.20				
H15281	15B28H	0.25~0.34	1.00~1.50				
H15301	15B30H	0.27~0.35	0.70~1.20				
H15351	15B35H	0.31~0.39					
H15371	15B37H	0.30~0.39	1.00~1.50				
H15411	15B41H	0.35~0.45	1.25~1.75				
H15481	15B48H	0.43~0.53	1.00~1.50				
H15621	15B62H	0.54~0.67				0.40~0.60	

### 6.1.20 SAE J1268-10 Alloy Hardenability-Steels(H steels)

UNS No.	SAE No.	Chemical Composition%												
		C	Mn	P	S	Si	Ni	Cr	Mo	others				
H13300	1330H	0.27~0.33	1.45~2.05	0.030 max.	0.040 max.	0.15~0.35	-		-	-				
H13350	1335H	0.38~0.32												
H13400	1340H	0.37~0.44												
H13450	1345H	0.42~0.49												
H40270	4027H	0.24~0.30	0.60~1.00		0.035~0.050			-	-		-	-	-	
H40280	4028H													
H40320	4032H	0.29~0.35												
H40370	4037H	0.34~0.41												
H40420	4042H	0.39~0.46												
H40470	4047H	0.44~0.51												
H41180	4118H	0.17~0.23												
H41200	4120H	0.18~0.23			0.90~1.20									
H41300	4130H	0.27~0.33			0.30~0.70									
H41350	4135H	0.32~0.38			0.60~1.00									
H41370	4137H	0.34~0.41												
H41400	4140H	0.37~0.44												
H41420	4142H	0.39~0.46	0.65~1.10											
H41450	4145H	0.42~0.49												
H41470	4147H	0.44~0.51												
H41500	4150H	0.47~0.54												
H41610	4161H	0.55~0.65												



UNS No.	SAE No.	Chemical Composition%												
		C	Mn	P	S	Si	Ni	Cr	Mo	others				
H43200	4320H	0.17~0.23	0.40~0.70	0.030 max.	0.040 max.	0.15~0.35	1.55~2.00	0.35~0.65	0.20~0.30	-				
H43400	4340H	0.37~0.44	0.55~0.90					0.65~0.95						
H46200	4620H	0.17~0.23	0.35~0.75					-			0.20~0.30			
H47180	4718H	0.15~0.21	0.60~0.95				0.85~1.25	0.30~0.60	0.30~0.40					
H47200	4720H	0.17~0.23	0.45~0.75						0.15~0.25					
H48150	4815H	0.12~0.18	0.30~0.70				3.20~3.80	-	0.20~0.30					
H48170	4817H	0.14~0.20												
H48200	4820H	0.17~0.23	0.40~0.80											
H50401	50B40H	0.37~0.44	0.65~1.10				-	-	-	B : 0.0005~ 0.003				
H50441	50B44H	0.42~0.49												
H50460	5046H	0.43~0.50												
H50461	50B46H													
H50501	50B50H	0.47~0.54									0.30~0.70	-		
H50601	50B60H	0.55~0.65												
H51200	5120H	0.17~0.23	0.60~1.00							0.60~1.00	-			
H51300	5130H	0.27~0.33								0.75~1.20				
H51320	5132H	0.29~0.35	0.50~0.90							0.65~1.10				
H51320	5132H	0.29~0.35	0.50~0.90				-	0.65~1.10	-	-				
H51350	5135H	0.32~0.38	0.50~0.90					0.70~1.15						
H51400	5140H	0.37~0.44	0.60~1.00					0.60~1.00						
H51470	5147H	0.45~0.52	0.60~1.05					0.80~1.25						
H51500	5150H	0.47~0.54	0.60~1.00				-	0.60~1.00	-	-				
H51550	5155H	0.50~0.60												
H51600	5160H	0.55~0.65	0.65~1.10											
H51601	51B60H													
H61180	6118H	0.15~0.21	0.40~0.80								0.40~0.80	V : 0.10~ 0.15		
H61500	6150H	0.47~0.54	0.60~1.00								0.75~1.20	V : 0.15 min.		
H81451	81B45H	0.42~0.49	0.70~1.05								0.15~0.45	0.30~0.60	0.08~0.15	B : 0.0005~ 0.003
H86170	8617H	0.14~0.20	0.60~0.95								0.35~0.75	0.35~0.65	0.15~0.25	-
H86200	8620H	0.17~0.23												
H86220	8622H	0.19~0.25												
H86250	8625H	0.22~0.28												
H86270	8627H	0.24~0.30												
H86300	8630H	0.27~0.33												
H86301	86B30H	0.34~0.41					B : 0.0005~ 0.003							
H86370	8637H							0.70~1.05	-					

UNS No.	SAE No.	Chemical Composition%								
		C	Mn	P	S	Si	Ni	Cr	Mo	others
H86400	8640H	0.37~0.44	0.70~1.05	0.030 max.	0.040 max.	0.15~0.35	0.35~0.75	0.35~0.65	0.15~0.25	-
H86420	8642H	0.39~0.46								
H86450	8645H	0.42~0.49								
H86451	86B45H									B : 0.0005~0.003
H86500	8650H									
H86550	8655H	0.50~0.60								
H86600	8660H	0.55~0.65								
H87200	8720H	0.17~0.23	0.60~0.95						0.20~0.30	
H87400	8740H	0.37~0.44	0.70~1.05							
H88220	8822H	0.19~0.25								0.30~0.40
H92590	9259H	0.56~0.64	0.65~1.10			0.70~1.20	-	0.45~0.65	-	
H92600	9260H	0.55~0.65				1.70~2.20		-		
H94151	94B15H	0.12~0.18	0.70~1.05			0.15~0.35	0.25~0.65	0.25~0.55	0.08~0.15	B : 0.0005~0.003
H94171	94B17H	0.14~0.20								
H94301	94B30H	0.27~0.33								

Remark : As impurities, Cu, Ni, Cr and Mo shall not exceed 0.35%, 0.25%, 0.20% and 0.06%, respectively, throughout all grades.

### 6.1.21 ANSI/AWS A5.17-07 Carbon Steel Electrodes and Fluxes for Submerged Arc Welding

Symbol	Chemical Composition%					
	C	Mn	Si	P	S	Cu
EL8	0.10 max.	0.25~0.60	0.07 max.	0.030 max.	0.030 max.	0.35 max.
EL8K			0.10~0.25			
EL12			0.10 max.			
EM12	0.06~0.15	0.80~1.25	0.10 max.			
EM12K	0.05~0.15		0.10~0.35			
EM13K	0.06~0.16	0.90~1.40	0.35~0.75			
EM15K	0.10~0.20	0.80~1.25	0.10~0.35			
EH14		1.70~2.20	0.10 max.			

Remark : 1. The electrode shall be analyzed for the specific elements for which values are shown in this table. If the presence of other elements is indicated in the course of this work, the amount of those elements shall be determined to ensure that their total (excluding iron) does not exceed 0.50%.

2. The copper limit includes any copper coating that may be applied to the electrode.

### 6.1.22 ANSI/AWS A5.18-05 Carbon Steel Filler Metals for Gas Shielded Arc Welding

Symbol	Chemical Composition%									
	C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu
ER70S-3	0.06~0.15	0.90~1.40	0.45~0.75	0.025 max.	0.035 max.	0.15 max.	0.15 max.	0.15 max.	0.03 max.	0.50 max.
ER70S-4	0.06~0.15	1.00~1.50	0.65~0.85							
ER70S-6	0.06~0.15	1.40~1.85	0.80~1.15							

Remark : Copper due to any coating on the electrode or rod plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max..



### 6.1.23 ANSI/AWS A5.23-07 Low Alloy Steel Electrodes and Fluxes for Submerged Arc Welding

Symbol	Chemical Composition%						
	C	Mn	Si	P	S	Mo	Cu
EA2	0.05~0.17	0.95~1.35	0.20 max.	0.025 max.	0.025 max.	0.45~0.65	0.35 max.
EA3	0.05~0.17	1.65~2.20					

Remark : 1. The electrode shall be analyzed for the specific elements for which values are shown in this table. If the presence of other elements is indicated in the course of this work, the amount of those elements shall be determined to ensure that their total (excluding iron) does not exceed 0.50%.

2. The copper limit includes any copper coating that may be applied to the electrode.

### 6.1.24 EN 10267-98 No Quenching and Tempering Hot Forging Steel

Symbol	Chemical Composition%								
	C	Si	Mn	P	S	Cr	Mo	V	N
30MnVS6	0.26~0.33	0.15~0.80	1.20~1.60	0.025 max.	0.02~0.06	0.30 max.	0.08 max.	0.08~0.20	0.010~.020
38MnVS6	0.34~0.41	0.15~0.80	1.20~1.60	0.025 max.	0.02~0.06	0.30 max.	0.08 max.	0.08~0.20	0.010~0.020

### 6.1.25 JIS G3101-24 Rolled Steels for General Structure

Symbol	Chemical Composition%				Tension Test					
	C	Mn	P	S	Yield Point or Yield Strength		Tensile Strength	Elongation		
					Diameter(d) mm	N/mm <sup>2</sup>		Diameter(d) mm	Test Piece	%
SS330	-	-	0.050 max	0.050 max	d ≤ 16	205 min.	330~430	d ≤ 25	No.2	25 min.
					16 < d ≤ 40	195 min.		25 < d	No.14A	28 min.
					40 < d	175 min.				
SS400	-	-	0.050 max	0.050 max	d ≤ 16	245 min.	400~510	d ≤ 25	No.2	20 min.
					16 < d ≤ 40	235 min.		25 < d	No.14A	22 min.
					40 < d	215 min.				
SS490	-	-	0.050 max	0.050 max	d ≤ 16	285 min.	490~610	d ≤ 25	No.2	18 min.
					16 < d ≤ 40	275 min.		25 < d	No.14A	20 min.
					40 < d	255 min.				
SS540	0.30 max	1.60 max	0.040 max	0.040 max	d ≤ 16	400 min.	540 min.	d ≤ 25	No.2	13 min.
					16 < d ≤ 40	390 min.		25 < d	No.14A	16 min.
					40 < d	—				

### 6.1.26 ASTM A36-19 Structural Steel

Chemical Composition%						Tension Test			
Diameter(d) mm	C	Mn	P	S	Si	Tensile Strength ksi(N/mm <sup>2</sup> )	Yield Point ksi(N/mm <sup>2</sup> )	Elongation	
								Test Specimen in.(mm)	%
$d \leq 20$	0.26 max.	0.60~0.90	0.04 max.	0.05 max.	0.40 max.	58~80 (400~550)	36(250) min.	GL = 8(200) GL = 2(50)	20 min. 23 min.
$20 < d \leq 40$	0.27 max.								
$40 < d \leq 100$	0.28 max.								
$d > 100$	0.29 max.								

Remark : When copper is specified, minimum Cu shall be 0.20% and over.

### 6.1.27 SAE 1080S-14 For Tire Cord

Symbol	Chemical Composition %											
	C	Si	Mn	P	S	Ni	Cr	Cu	Mo	Al	N	Ceq
SAE 1080S	0.81~ 0.84	0.10~ 0.30	0.45~ 0.55	0.020 max.	0.020 max.	0.05 max.	0.05 max.	0.05 max.	0.01 max.	0.01 max.	0.007 max.	0.89~ 0.93

Remark : Ceq=C+Mn/6

### 6.1.28 SAE 9254-09 Spring Steels

Symbol	Chemical Composition %								
	C	Si	Mn	P	S	Ni	Cr	Cu	Mo
SAE 9254	0.53~0.58	1.30~1.60	0.60~0.80	0.030 max.	0.030 max.	0.20 max.	0.60~0.80	0.20 max.	0.06 max.



## 6.2 Tolerances

**Table 1 JIS G3503(SWRY) – Diameter Tolerances of Wire Rods**

unit : mm

Diameter Tolerances	Out-of-round
$\pm 0.50$	0.65 max.

**Table 2 JIS G3505(SWRM) – Diameter Tolerances of Wire Rods**

unit : mm

Diameter (d)	Diameter Tolerances	Out-of-round
$d \leq 15$	$\pm 0.40$	0.64 max.
$15 < d \leq 25$	$\pm 0.50$	0.80 max.
$d > 25$	$\pm 0.60$	0.96 max.

**Table 3 JIS G3506(SWRH) – Diameter Tolerances of Wire Rods**

unit : mm

Diameter Tolerances	Out-of-round
$\pm 0.40$	0.64 max.

**Table 4 JIS G3507-1(SWRCH) 、JIS G3507-1 、JISG4051(SXXC) and CSC<sup>(1)</sup> – Diameter Tolerances of Wire Rods**

unit : mm

Diameter (d)	Diameter Tolerances	Ovality
$d \leq 15$	$\pm 0.3$	0.4 max.
$15 < d \leq 25$	$\pm 0.4$	0.5 max.
$25 < d \leq 32$	$\pm 0.5$	0.6 max.
$32 < d \leq 50$	$\pm 0.6$	0.7 max.

Remark : <sup>(1)</sup> CSC 5.5<d ≤25mm Tolerances ± 0.40mm. , Ovality 0.5mm max..

**Table 5 JIS G4051 、JIS G4052 、G4052(H)and G4053 – Diameter Tolerances of Wire Rods**

unit : mm

Diameter (d)	Diameter Tolerances	Ovality
$d \leq 15$	$\pm 0.3$	0.4 max.
$15 < d \leq 25$	$\pm 0.4$	0.5 max.
$25 < d \leq 32$	$\pm 0.5$	0.6 max.
$32 < d \leq 50$	$\pm 0.6$	0.7 max.

**Table 6 ASTM A510 and SAE – Diameter Tolerances of Wire Rods**

unit : mm

Diameter (d)	Diameter Tolerances	Out-of-round
$d \leq 13$	$\pm 0.40$	0.60 max.

**Table 7 JIS G3191 – Diameter Tolerances of Hot Rolled Bars**

unit : mm

Diameter (d)	Diameter Tolerances	Out-of-round
$d < 16$	$\pm 0.4$	Not more than 70% of total tolerance range of diameter
$16 \leq d < 28$	$\pm 0.5$	
$28 \leq d < 120$	$\pm 1.8\%$	

Remark : the above table applies to the straight bar and bar-in-coil.

**Table 8 CSC Spec. – Diameter Tolerances of Hot Rolled Bars**

unit : mm

Diameter (d)	Diameter Tolerances	Out-of-round
$14 \leq d < 26.67$	$\pm 0.40$	Not more than 70% of total tolerance range of diameter
$26.67 \leq d < 120$	$\pm 1.5\%$	

Remark : The above table applies to the straight bar and bar-in-coil of JIS G4051, G4052, and G4053 Specifications.

**Table 9 JIS G4801(SUP) – Diameter Tolerances of Hot Rolled Bars**

unit : mm

Diameter (d)	Diameter Tolerances	Out-of-round
$d < 10$	$\pm 0.20$	0.20 max.
$10 \leq d < 16$	$\pm 0.25$	0.25 max.
$16 \leq d < 21$	$\pm 0.30$	0.30 max.
$21 \leq d < 34$	$\pm 0.40$	0.40 max.
$34 \leq d < 46$	$\pm 0.50$	0.50 max.
$46 \leq d < 75$	$\pm 0.70$	0.70 max.
$75 \leq d < 80$	$\pm 1.00$	1.00 max.



**Table 10 ASTM A29 and SAE – Diameter Tolerances of Hot Rolled Bars**

unit : mm

Diameter (d)	Diameter Tolerances	Out-of-round
$14 \leq d \leq 15.88$	$\pm 0.18$	0.25 max.
$15.88 < d \leq 22.23$	$\pm 0.20$	0.30 max.
$22.23 < d \leq 25.40$	$\pm 0.23$	0.33 max.
$25.40 < d \leq 28.58$	$\pm 0.25$	0.38 max.
$28.58 < d \leq 31.75$	$\pm 0.28$	0.41 max.
$31.75 < d \leq 34.93$	$\pm 0.30$	0.46 max.
$34.93 < d \leq 38.10$	$\pm 0.36$	0.53 max.
$38.10 < d \leq 50.80$	$\pm 0.40$	0.58 max.
$50.80 < d \leq 63.50$	$+ 0.79$ 0	0.58 max.
$63.50 < d \leq 88.90$	$+ 1.19$ 0	0.89 max.
$88.90 < d \leq 114.30$	$+ 1.59$ 0	1.17 max.
$114.30 < d \leq 127$	$+ 1.98$ 0	1.47 max.
$127 < d \leq 150$	$+ 3.18$ 0	1.78 max.

**Table 11 JIS G3191, JIS G4051 and CSC Spec. Length Tolerances of Hot-Rolled Steel Bars**

Length (L)	Tolerances
$L \leq 7\text{m}$	$+ 40\text{mm}$ 0mm
$7\text{m} < L$	Add 5 mm to plus side tolerance for every increase of 1m length or its fraction, tolerance for minus side shall be 0 mm.

**Table 12 ASTM A29 and SAE – Length Tolerances of Hot-Rolled Steel Bars**

unit : mm

Specified Length(L) Diameter (d)	Permissible Variations Over specified Length(L)			
	3048 ≤ L < 6096	6096 ≤ L < 9144	9144 ≤ L < 12192	12192 ≤ L < 18288
14.0 ≤ d ≤ 25.4	19.05	31.75	44.45	57.15
25.4 < d ≤ 50.8	25.40	38.10	50.80	63.50
50.8 < d ≤ 127	38.10	44.45	57.15	69.85
127 < d ≤ 150	63.50	69.85	76.20	82.55

Remark : The above table applies to the straight bar and SAE Specification only.

**Table 13 JIS G4051 – Straightness Tolerances of Hot-Rolled Steel Bars**

Not exceeding 3mm for every 1m and not exceeding 3mm*	$\frac{\text{length(m)}}{1\text{m for total length}}$
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Remark : The above table applies to the straight bar of JIS G4051, G4052 Specifications.

**Table 14 ASTM A29 and SAE Standard Straightness Tolerances of Hot Rolled Steel Bars**

6.35 mm in any 1524mm, Straightness Tolerances for lengths not exceeding=6.35mm*	$\frac{\text{length(m)}}{1.524\text{(m)}}$
--	--

**Table15 ASTM A29 and SAE Special Straightness Tolerances of Hot-Rolled Steel Bars**

3.18mm in any 1524mm, Straightness Tolerances for lengths not exceeding=3.18mm*	$\frac{\text{length(m)}}{1.524\text{(m)}}$
---	--

## 6.3 Spheroidized Products

The available spheroidized finishing products are shown in table 1 for purchaser's option.

Please specify the process code when ordering.

**Table 1 Product Name, Available Gage, Process Code and Production Process.**

Product Name	Available Gage,mm	Process Code		Production Process
Wire Rod/Bar	5.5~55.0	SA	1	As-Rolled → Pickling → Spheroidize Annealing

## 7.1 Product sizes and Coil Specification

Product	Size (mm)			Coil Spec.	
	Diameter(mm)	I.D About	O.D. About	Weight About(kg)	Coil Direction
Wire Rod	5.5~13.0	800~900	1200~1300	1400~2250	Counter-Clockwise
Bar in Coil	14.0~55.0	800~1100	1200~1450	1400~2250	Counter-Clockwise
Straight Round Bar	14.0~125.0	-	-	-	-

## 7.2 Available Sizes

Product	Wire Rod	Bar in coil		Straight Round Bar		
Diameter (mm)	5.5	14	36	14	34	80
	6.5	15	38	15	36	85
	7	16	40	16	38	90
	8	17	42	17	40	95
	8.5	18	45	18	42	97
	9	19	50	18.5	44	100
	10	19.5		19	45	103
	11	20		19.5	46	105
	12	20.5		20	48	110
	13	21		20.5	50	120
		22		21	53	125
		22.5		22	55	
		23		22.5	57	
		24		23	60	
		25		24	63	
		26		25	65	
		27		26	67	
		28		27	70	
		30		28	73	
		32		30	75	
		34		32	78	

Remark : 1. Sizes other than the above table are subjected to negotiation.  
2. Size 8.5mm is subjected to negotiation.



The products of CSC's steel bars and wire rods have superb surface and internal quality. Precision of dimensions, levels of cleanliness, minimized partial decarburization, homogeneous grain size and microstructure all contribute to exceptionally fine quality. Processing in cold heading, hot forging, wire drawing, free cutting and heat treatment all demonstrate excellent results. The quality of CSC products has gained customers' recognition and has long been highly regarded. The product characteristics and uses are briefly described as follows:

Bearing assemblies, ball screws and linear guideways are typical precision mechanical components. They are engineered to provide high tolerance for fatigue and stress to provide smooth and precise movement in continuous moving machine. These components are made with CSC's medium carbon steel, alloyed steel bars and wire rods with uniform and clean internal quality and defect-free surface. Therefore, CSC's medium carbon steel and alloy steel bars and wire rods are suitable for strict cold-working and heat treatments.

CSC's high carbon steel wire rods, which have good surface and inner quality, are most excellent in drawing. Hence, they are suitable for making wire ropes. In the future, the wire rope industry will develop new products aimed at high strength, long life, large size and rich softness. In order to meet users' needs for high grade and diversification, CSC will continue to develop appropriate wire rods for the wire rope industry in Taiwan and increase their competitiveness. In addition, CSC has also successfully produced super cleanliness steels which are used in automobile tire cords.

CO<sub>2</sub> welding electrodes containing Titanium have been successfully developed by CSC in recent years. They have good welding-electrode characteristics: splash resistance, larger range of electrical current operation, excellent mechanic welding properties, especially impact toughness. The impact value of CO<sub>2</sub> welding electrode at room temperature is more than twice that of traditional one. It can fully meet the demand of high efficiency welding operations.

In addition to CSC's high quality spheroidized steels, the overall improvement of production technology and peripheral product industries, Taiwan has become a hand tool export kingdom. Its products include various grades of hand tools from manual to pneumatic sockets. The hand tools have good toughness after heat treatment, and their hardness and torque conform to international standards. As a steel supplier, CSC has played a very important role in the hand tool industry.

In the spring steels department, related industry uses SAE 9254/60SiCrV steels to make coil springs by hot rolling them into irregular cross section. The coil springs, which are used in automobiles and motorcycles suspension springs, increase traveling distance through structural design, not only does it have the benefit of increasing fatigue tolerance, but it also reduces the weight of cars and motorcycles.

CSC is a cornerstone in the nuts and bolts industry worldwide. It has long produced good and useful steel wire rods. In the future CSC will continue to develop steel bars and wire rods with high performance to price ratio and increase nuts-and-bolts industry's international competitiveness.

## 9.1 Marking for bars and wire rods

CSC name and logo

Rolling no and Coil no

Specification

Dimension

Heat no

carbon & manganese

mass

Specification abbreviation

Certification Marking



Description

1. Tag back-ground color :

(1) Blue : Cold heading quality

(2) Green : Alloy steel and others

(3) Yellow : C content < 0.25 %

(4) Red : C content  $\geq$  0.25 %

2. When the specification is without certification approval, the bottom area of the Tag keeps blank.

## 9.2 Packing for bars and wire rods



### (1) Chemical Compositions

The guaranteed chemical compositions are in accordance with international standards and are based on molten steel analysis. It shall be noted that there may be permissible deviations between molten steel analysis and product analysis. The permissible deviation range is determined by the relevant international standards, such as JIS G0321, SAE J409, and ASTM A6.

### (2) Packing and appearance of Steel bars and wire rods

When the coiled bars and wire rods arrive, please confirm whether the dray is covered with the tarpaulin. In addition to checking the order, quantity, loading details and the bill of lading, it is also crucial for customers to examine the packing for completeness and whether there are any unacceptable abrasions, scratches, loose straps or damages to the products. Should these problems arise, please take pictures and record the loading details before discharging and contact China Steel Global Trading Corporation or CSC's Technical Service Section immediately.

### (3) Damp phenomenon(condensation rust)

Environmental temperature difference is tending to have damp phenomenon. The steel without packing should be aware of the temperature changes in the storage environment to avoid condensation rust.

### (4) Establish traceable information systems for raw materials

It is best to establish information system which allows customer to trace the identity of raw materials. Before production, customers should establish traceable information and check tag data of bars, wire rods or straight bars including steel grades, rolling sequence, coil numbers, heat numbers, size etc. Such preventive measure avoids misuse, mix up and helps with problem tracing and quality improvement.

### (5) Potential safety hazards of bars and wire rods

1. There is danger of tilt collapse if the steel straps of coils loosed or broken.
2. There is danger of workers injured by the bounce of steel straps while cutting the straps of coils.
3. There is danger of tilt collapse when coils stacked if the shape of coils appearance is not good.
4. There is danger of machines damage or workers injured if the wire of coils broke while drawing.
5. There is danger of bars slide if the surface saponification of coils straightens bars generated.
6. There is danger of bars falling off when straight bars are lifted by crane if the straps are not tied down or the lifting position is not proper.

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

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

Stress			
ksi(=1000psi)	psi	kgf/mm <sup>2</sup>	N/mm <sup>2</sup> (=MPa)
1	1000	0.703070	6.89476
0.001	1	0.703070 × 10 <sup>-4</sup>	6.89476 × 10 <sup>-3</sup>
1.42233	1422.33	1	9.80665
0.145038	145.038	1.101972	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

Specification Applications	CNS	JIS	SAE	ASTM
Low Carbon Steel Wire	8693 SWRM6-22	G3505 SWRM6-22	1005-1022	A510
Cold Heading & Cold Forging (Carbon Steel)	8694 SWRCH6A-22A SWRCH10K-50K	G3507-1 SWRCH6A-25A SWRCH10K-50K	1005-1050	A510
Electrode Core	2067 SWRY11-21	G3503 SWRY11-21	-	-
Hard Wire	3696 SWRH27-82B	G3506 SWRH27-82B	1026-1095	-
Piano Wire Rods	3379 SWRS62A-82B	G3502 SWRS62A-82B	1060-1080	-
General Structure	2473 SS330-540	G3101 SS330-540	-	A36
Polished Bar	3892 SGD A-B SGD 1-4	G3108 SGD A-B SGD 1-4	-	-
Machine Structure (Carbon Steel)	3828 S10C-S58C S09CK-S20CK	G4051 S10C-S58C S09CK-S20CK	1010-1060	-
Spring	2905 SUP.3,6,7,9(A),10, 11A, 12, 13	G4801 SUP3,6,7, 9(A),10,11A, 12, 13	-	A689
Machine Structure (Alloy Steel)	3230 SNC236-836 3271 SNCM220-815 3231 SCr415-445 3229 SCM415-822 4445 SMn420-443 SMnC420-443	G4053 SNC236-836 SNCM220-815 SCr415-445 SCM415-822 SMn420-443 SMnC420-443	- 43XX, 86XX 51XX 41XX 15XX -	A322
Machine Structure (Specified Hardenability Bands)	11999 SMn420-443H SMnC420-443H SCM415-822H SNCM220-420H SCr415-440H SNC 415-815H	G4052 SMn420-443H SMnC420-443H SCM415-822H SNCM220-420H SCr415-440H SNC415-815H	15XXH - 41XXH 43XXH,86XXH 51XXH	A304

Note : Not equal between different steel grades, and for reference only.



Required Ordering Data			Example
1	Specification(Name, Number, Grade)		SAE 1008
2	Dimension		8.0mm
3	Mass	Each Bundle	2.25 t
		Order Mass	150 t
4	Application and Fabricating Methods		Cold Headed Hexagon Nut
5	Delivery Condition		As Rolled
6	Special Requirements (if required)		Seam Depth:0.10mm max.

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.

### 1. Sales services

CHINA STEEL GLOBAL TRADING CORPORATION	
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E-mail	c00681@mail.csc.com.tw

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### 2. Metallurgical Department

Tel	886-800-741135 / 886-7-8051083			
	STEEL PLATE & HOT-ROLLED	886-7-8051525	COLD-ROLLED & ZINC COATED	886-7-8051578
	BARS & WIRE RODS	886-7-8051092	ELECTRICAL STEEL	886-7-8051270
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