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Steel Bars/Wire Rods B001en\_03\_202311f © 2019, 2023 NIPPON STEEL CORPORATION

NIPPON STEEL CORPORATION

## World-leading steel bar and wire products to meet a wide variety of needs

Our steel bar and wire rod products are trusted by many customers in Japan and overseas, and are used in a wide variety of fields such as for automobiles, construction, heavy industry, electrical appliances and OA devices.

NIPPON STEEL will continue to develop new products and improve manufacturing processes, by advancing technologies and skills, and respond to customer needs, such as the lightening of important parts with high-strength products, the promotion of process saving and energy saving with excellently formable products, and the realization of a recycling society with the supply of eco-friendly products.

# **SteeLinC**<sup>™</sup> is a brand of the Bar & Wire Rod Unit of NIPPON STEEL Group.



<Customer>

## <NIPPON STEEL> Steel ----- Link ----- Customer

#### **Brand Statement**

The Bar & Wire Rod Unit of NIPPON STEEL has accumulated experience in manufacturing including processing and the technologies used in processing. Based on this, we are committed to increase the value and productivity of customers' products through the provision of the world's most advanced steel bar and wire rod products and the creation of values resulting from the combination of our steel and customers' manufacturing method.

#### Innovation of next-generation values through the multiplication of "steel materials × processing method"



We consider the synergy effect with our customers the most valuable goal of our Bar & Wire Rod Unit, and thereby provide a comprehensive solution by combining our steel materials and the customer's processing method based on our strength in technologies, quality, supply system and skilled workers.



through our pursuit of the "full potential of steel"



In pursuit of a high-end product range that realizes the ultimate potential of steel, we have released innovative new products that contribute to high strength, high durability, omission of processes and environmental response of final products. In the future, we will commit to the highest efficiency and performance of the special steel.



Flat Products Plate Bar & Wire Rod Construction Pipe & Tube Railway, Automotive & Products Machinery Parts Stainless Steel Steel Bars Wire rods Manufacturing mills: North Nippon (Muroran, Kamaishi) Manufacturing mills: North Nippon (Muroran East Nippon (Kimitsu), Kyushu (Yawata), Kansai (Wakayama) Kyushu (Yawata)

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ntroduction of	Example of binding,20 packing and representation

We are the Best Steelmaker with World-Leading Capabilities

NIPPON STEEL realizes the full potential of steel products as industrial materials, and thus contributes not only to the developing needs of customers but also to the creation of an affluent society.

Titanium &

Specialty

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Strength in advanced technologies and on-site competence (i.e., strength in basic quality)



We have been putting our energy into improving the skill levels of the individual workers who actually produce our products, in order to allow the workers to manufacture steel materials that are designed with advanced technologies in an accurate and stable way.

High-end products created

## Application examples [Automobile]

Automobiles made in Japan are well-known as being No.1 in the world in terms of quality and performance. Our products have shared in the support of this successful technology. We have always been the leader in the technical development field with regard to keeping vehicles weight down or the development of steel bars in which the manufacturing process can be omitted, or environmentally friendly steel bars such as lead-free bars, etc. We are capable of providing our customers with appropriate suggestions, selecting from our diversified product menu, suitable for the shape of the parts, function, manufacturing method, etc. of your intended purpose.





#### Application [Construction, civil engineering, energy] [Electricity, etc.] examples

Our steel materials are used everywhere from urban development to living-ware.

Our wire rods for bridge cables in long-span bridge projects, our high-function products that provide high-safety construction and civil engineering and our products that contribute to reducing impact on the environment, and electric power lines in the energy field are employed in Japan and overseas. In a place closer to life, the office equipment and supplies and bed springs are highly evaluated.



□ High-strength bolts High-strength, high-quality bolts developed through proprietary chemical composition designs.







The wire rods we manufacture for saw wires reduce the inclusion to the utmost limit at which snapping may be caused when wire drawing or during the cutting process.



#### □ Staples

The development of high-quality staples is achieved by a mild steel wire material that achieves optimum strength and dimensional stability by original component design.

## **Representative eco-products**

NIPPON STEEL offers eco products that reduce the burden on the environment to the maximum extent, within the flow of: "mining raw materials > transportation > manufacturing of steel materials > forming and assembly of parts and members > use of the product by the customer > recycling," by means of its technical development strength - one of the best in the world - and based on the philosophy of LCA (Life Cycle Assessment). We are introducing our representative products.



In order to respond to customers'

needs for long bridge projects, which

are expanding all over the world, we

have developed products with the

world's highest strength up to a

2.0GPa grade using our original pro-

cess (DLP).



Power transmission / distribution lines The Plated steel wires with high corrosion resistance and steel stranded wires using hard steel wire rod have

reduced the life-cycle cost, and also contributed to the LCA of end products.



#### □ Miniature bearing

Bearings with an outer diameter of 30 mm or less, made of steel balls with extremely roundness in nanometers. It has long life and lighter weight, and uses it in a wide range of fields.



□ Bed springs

Developed steel for bed spring with high carbon steel wire material. It is excellent in elasticity, durability, shape conservation, contributing to the comfort of living.







Connecting rod

The steel for cracking connecting rods with both high fatigue strength and cutting formability. Contributing to reducing CO<sub>2</sub> emissions by realizing lighter and better fuel economy for automobiles.



Example of using OA shaft (light-blue part)



#### □ OA shafts

Developed low-carbon and lead-free free-cutting steel with low environmental impact. Excellent cutting formability improves productivity and realizes the OA shafts of smooth machined surfaces.







### Area Application Product name and characteristics

S	ne	Hot forged parts	High-strength non-refining steel for hot forging	•Component design according to the purpose, form and size of forged products on the customer side
obile	Engi	Cold forged parts	Steel bar for cold forging	•A wide range of strength and excellent workability •Component design according to the purpose and processing type of customers
ntom		Connecting rod	Steel for high-strength connecting rod	<ul> <li>High fatigue and high buckling non-refining steel</li> <li>Steel for cracking that provides compatibility of high fatigue strength and machinability</li> </ul>
Ā		Valve spring	Wire rods for high-strength valve springs	•High cleanliness and long life •Satisfies both high strength and good workability
	mission	Gear	Streel for high-strength gears (XG5, CM201, etc.)	<ul> <li>Optimal component design according to customers' needs</li> <li>XG5:excellent tooth strength and tooth bending strength</li> <li>CM201:excellent cycle bending strength, reduces carburized abnormal layers and provides thick carburized hardening-layers</li> </ul>
	ans	Parts for soft nitriding	Low-distortion and high-durability steel for soft nitriding	Pitching resistance resulting from hardening of deep layers, high fatigue strength
	μ	Carburized parts	Coarse grain prevention steel (NSACE™)	Coarse grain prevention during high-temperature carburizing
			Mild alloy	•Same components as standardized steel •Reduces hardness with the same rolling method
			Super mild alloy	•Addition of trace elements •Hardness equivalent to spheroidizing annealing (SA) with the same rolling method
	nsion	High-frequency quenched parts	Steel for high-strength, high-frequency quenching	<ul> <li>Excellent bearing fatigue strength and bending fatigue strength</li> <li>Optimal component design according to customers' needs</li> </ul>
Cold headed parts Super Forge (SF) Shafts Steel for direct normalizing treatment		Super Forge (SF)	Controlled rolling – the combination of controlled cooling and spheroidizing annealing improves the level of spheroidizing of carbides	
	0)	Shafts	Steel for direct normalizing treatment (FG, DN) High-strength, high-toughness steel without the quench-and-temper process	<ul> <li>Refining of structures using the controlled rolling method</li> <li>Our unique rolling method achieves high strength and high toughness equivalent to quenched and tempered steel</li> </ul>
		Suspension springs	Steel for high-strength suspension springs	•Excellent hydrogen embrittlement resistance and toughness
		Tires	Wire rod for steel tire codes	<ul> <li>Reduces hard inclusions and segregation</li> <li>Stable code property (strength, etc.) with small component fluctuations</li> <li>Our original high strength component design</li> <li>Thin wire rod (can supply wire rod with diameters of 3.8φ, 4.0φ and 4.5φ)</li> </ul>
	er	Bolts and nuts	Steel for high-strength bolts (MB series, ADS series)	•Controls hydrogen embrittlement (delayed fracture) and contributes to high strength
	Fastene		Boron steel for cold forging (SBR, NHB™)	•Maintains adequate bolt strength without a spheroidizing annealing process by reducing the carbon amount and adding boron
			Non-refining steel for cold forging (NHF™, SUC80D)	•Our original high-strength and non-refining component design
			Non-annealing type low-carbon aluminum killed steel (SNH*: A/B)	Prevents strain aging
			New soft wire rod (DS, DL)	•In-line softening treatment realizes a hardness level equivalent to that of the normal annealing with the same rolling process
			Simplified annealing wire rod (ED, EC, ES)	In-line softening treatment realizes uniform refining of annealing structures     Reduces hardness level after annealing
and nery	ll and inery	Cutting parts	Non-refining steel for direct cutting	•A wide range of strength •Component design according to customers' purposes
strial nachii	dustria I mach	macn	Free-cutting steel for machine structure	<ul> <li>Mechanical characteristics equivalent to carbon steel for mechanical structure and alloy steel for mechanical structure</li> <li>Excellent machinability</li> </ul>
al n	rica		SUMI-CUT™ (low-carbon free-cutting steel)	•Excellent machinability (containing sulfur, sulfur + lead)
ln ctrica	electi		Lead-free free-cutting steel (EZ, SMIGREEN™S, T, CS)	•Excellent machinability (no lead added)
ele		Solar power (saw wires)	Wire rod for saw wire (SPURKS™)	<ul> <li>High cleanliness and surface uniformity</li> <li>Thin wire rod (can supply wire rod with diameters of 3.8Φ, 4.0Φ, 4.5)</li> </ul>
hd ks	ure	High power bolts	SHTB <sup>™</sup> , steel for high-tension bolt	Controls hydrogen embrittlement and contributes to high strength
) a	on a ucti		Steel for fire resistant bolts	•Excellent fire resistance
o o	ctic		Steel for weather resistant bolts	•Excellent weather resistance
truct	onstru s infra	Bridge cables	Wire rod for high-strength bridge cables	•Thick and high strength materials •Received the "Main Award" of the 47th (FY 2014) Ichimura Prize in Industry
us,	öź	Chains	Steel for high-strength chains	•Our original component design contributes to high strength
ပိ	public w	Wire mesh for bank protection, fences, power transmission / distribution lines, etc.	TOUGH GUARD™ series	<ul> <li>Holds about 5 times more corrosion resistance than the conventional zinc aluminum alloy</li> <li>*Based on the corrosive loss evaluation by plate type in 5,000 hours of salt water spraying</li> </ul>
mon area	n area	Steel codes, piano wires, hard steel wires, wire rods for welding, etc.	Thin wire rod         (5.0Φ, 4.5Φ, 4.0Φ, 3.8Φ, 3.6Φ)	•Wire diameter (thin) •Excellent wire drawing capability
Com	Commo	Bridge cable, cold forged parts, etc.	DLP™ wire rod (DLP™: Direct in-Line Patenting)	•Our original in-line heat treatment wire rod •Excellent balance of strength and extension •Can be used for a wide range of purposes

Advantages for customers	High strength weight reduction	Omission of process Easy workability	Environmental response Others
•Enables omission of quenching and tempering processes			
•Enables cold forging for a wide range of purposes and processing types		•	•
Contributes to weight reduction and fuel improvement     Enables omission of manufacturing processes			
Reduces string weight and engine size			
Contributes to weight reduction and fuel improvement     Enables cold forging in combination with spheroidizing heat treatment     XG5:enables cold forging     CM201:realizes longer fatigue life	•	•	•
•Enables omission of the tooth repair cutting process by quenching to reduce distortion			
Enables omission of high-temperature carburizing and intermediate heat treatment processes			
<ul> <li>Enables omission of the annealing treatment process before cold processing</li> <li>Same hardness distribution as conventional materials after carburizing and quenching</li> </ul>			
<ul> <li>Enables omission of the annealing treatment process before cold processing</li> <li>Enables further softening and extension of life of metal molds when SA is adapted</li> </ul>			
Enables omission of the carburizing heat treatment process     Contributes to high-torque types and reducing part size			
Contributes to increasing the limit of processing when forging			
•Enables omission of the normalizing treatment process			
•The steel is available to reduce the quench-and-temper process			
•Contributes to the improvement of suspension design flexibility and weight reduction			
<ul> <li>Enables a stable wire drawing processing that prevents disconnection</li> <li>High-strength special component menu enables weight reduction of tires</li> <li>Thin wire rod menu enables omission of processes</li> </ul>	•	•	
•Contributes to the weight reduction by decreasing bolt size and the number of construction bolts			
Enables simplification of heat treatment process     Reduces costs for alloy steel			
<ul> <li>Enables omission of quenching and tempering processes after cold forging (requires bluing treatment)</li> <li>Enables cold forging while maintaining high strength</li> </ul>			
Enables repeated processes without annealing     Small processing hardening during cold forging			
<ul> <li>Extends the life span of metal molds</li> <li>Enables omission of the annealing process after wire drawing</li> </ul>			
<ul> <li>Extends the life span of metal molds</li> <li>Enables simplification (omission of grinding) in the wire drawing process</li> </ul>			
•Enables omission of quenching and tempering processes			
•Extends the life span of tools •Increases productivity			
•Extends the life span of tools •Increases productivity			
•Expands the life span of tools •Increases productivity •Reduces environmental load substances	•		•
<ul> <li>Reduces wire disconnection during wire drawing and cutting processes</li> <li>Reduces the cutting loss of silicon wafer, etc. due to thin wires</li> </ul>			
•Enables reduction of the size of joint works and construction costs			
•Applied to connecting bolts of fire resistant (FR) steel for construction structures			
•Applied to connecting bolts of steel structures such as bridges			
•Enables the reduction of design flexibility of bridges and decrease of construction costs			
Enables weight reduction of chains for mooring of marine structures, etc			
•Extends the life span and reduces costs •Excellent environmental performance			
<ul><li>Enables omission of the patenting process</li><li>Enables omission of the wire drawing process</li></ul>			
<ul> <li>Enables omission of the heat treatment process (LP = lead patenting) by the customer</li> <li>Contributes to environmental load reduction by saving energy</li> <li>Ontributes to the reduction of environmental load substances</li> </ul>			



### Manufacturing process





#### On-site capability that supports advanced technologies

#### Cultivation of human resources at manufacturing sites

We are committed to improving the skills of each worker who manufactures products in order to build steel materials, which are designed using advanced technologies, with elaborate work in a precise and stable manner. We train workers to become an "artisan" with a high level of skill through the integrated program, who fulfill the demands of customers.

#### Producing prominent craftsmen

Our site workers strive to acquire the world's top level skills in order to manufacture high-quality products. Many of our skilled workers have received honorable recognition from the government such as the Contemporary Master Craftsman\*1 or Medal with Yellow Ribbon<sup>\*2</sup>.



Excellent in quality control and analysis skills of wire rods (sensing fine inclusion of approx. 50µm with fingers) \*1 : Contemporary Master Craftsman: recognition given to those who contributed to the development of industry with excellent skills.

\*2 : Medal with a Yellow Ribbon: recognition given to those who have persevered in a task on the front lines and have acquired skills or made achievements that can be a role model for others.

Establishment of technology for using fire-retarding ore (enhancement of productivity), commitment to guidance and fostering of younger operators

### Integrated traceability system

Steel materials are manufactured under strict quality control. The manufacturing history can be traced back to the rolling and steelmaking process by one product unit\*, which ensures the reliability and safety of products.

\* Wire rod : 1 coil unit, steel bar : shifted from 1 lot unit to an integrated management system



Up to approximately 200 bars are manufactured from a single billet. In the past, accurate tracking after the cutting process was difficult. Our system can conduct a trace back to the casting section for even a single bar, based on our own in-house technologies.





## Multiple steelworks provide strong supply capabilities.

NIPPON STEEL boosts the steelmaking technologies of 100-year results, working alongside the Japanese manufacturing industry. Centering on the 13 nationwide manufacturing sites having know-how accumulated over many years and state-of-the-art technologies, we stably supply high-quality Japan-made products in cooperation with each research laboratory.



We utilize automated high-rise warehouses to store rolled coils, in order to avoid accidental flaws or rust.

For transportation, we have introduced small roll-on/roll-off ships for steel bars and wire rods. Products are directly loaded onto and unloaded from such ships using pallets, which reduces the handling time. We have also introduced all-weather berths for stable delivery, which allow us to stably transport products without being influenced by weather.

### Manufacturing technologies, material design

Our technologies and design meet customers' demands for high strength, high quality, cost reduction, environmental response, etc.

#### A wide range of steel types

We design the most suitable carbon amount and alloy ingredients in order to realize an adequate range of strength for customers' use.

#### Inclusion control

We are able to reduce the level of non-metal inclusions to the limit. We also suggest the active use of non-metal materials by controlling the form.

Technologies and skills for manufacturing

We are committed to the accurate and stable manufacturing of steel that is elaborately designed, using state-of-the-art manufacturing facilities, advanced production technologies, and skills of experienced engineers.

#### Designing the carbon amount and inclusions based on purposes and parts



#### Comparison of strengths of various materials



With 5 blast furnace bases and 5 rolling mill bases (3 steel bar steelworks and 4 wire rod steelworks), our Bar & Wire Rod Unit can respond to environmental changes and contingencies in a prompt and flexible manner. Also, a system to source steel from other varieties has been developed so that we can address a long-term disaster during a customer's BCP (business continuity plan). We received good reviews from customers for our stable quality and delivery during the Great East Japan Earthquake.

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### 院 SteeLinC™

### Processing and heat treatment technologies

We are committed to various research areas including technologies for usage and solution, which provide support to the manufacturing process of customers. This can offer customers with proposals for the omission of processes, cost reduction and functional improvement of parts.

#### Cutting technology

We are working on simulations to evaluate the machinability of steel materials using various cutting techniques (such as turning and drilling). We are proposing to customers not only new materials with improved machinability but also cutting conditions for those materials.



Cutting test (lathe turning)

#### Forging technology

By making full use of our state-of-the-art forging testing machines and simulation technology, we are engaged in research and development on the optimum design of forging processes and the prediction of critical cracking stress during foraina.

#### Secondary and tertiary processing techniques

We are also working on technical developments in the fields of secondary and tertiary processing, including wire drawing. In addition, we are proposing steel products that will demonstrate their true value when processed and heat treated by customers, such as steel wire rods for high-strength steel cord.

#### Heat treatment technology

By making full use of our state-of-the-art heat treatment testing facility and simulation-based predictions of heat treatment distortion, we provide customers with recommended heat treatment conditions. By utilizing a huge amount of material property data, which is one of the strengths of a steelmaker, heat treatment distortion can be predicted for any type of steel material.

#### Fracture-splitting technologies

We assist customers in developing processing methods, all through our abundant technologies for steel materials. For example, we have developed fracture-splitting/cracking steel for high strength connecting rods that are formed in one piece, then cracked, and then assembled again, which reduces both engine weight and manufac turing costs.





(testing facility



Cracking connecting r (cracked surface shown in the image at upper le



### Major manufacturing facilities

Process		North Nip	pon (Muroran)		North Nippon (Kamaishi)	
lron- making	Blast fur x Numbe	nace capacity er of furnaces	2902m <sup>3</sup> × 1 furnace			
	Prelim proce	ninary ssing	Molten iron pret	reatment (TPC type)		
Steel	Basic or capacity of conve	xygen furnace y x number erter furnaces	270T / CH × 2 ft	urnaces		
making	Contir castin	nuous Ig	350 × 560mm (4	4 strands), 220 × 220m	m (6 strands)	
	Refini equip	ng ment	Vacuum degasser (RH), outside-furnace		e refining equipment (LF)	
Blooming	Bloom	ning roller	Hot scarf + VH ( (hot scarf + dua	continuous system al reversing system + VH	H continuous system)	
Billet puri	ificatior	١	Shot blasting, si device	upersonic detector, mag	gnetic particle detector, defect removal	Shot blast, ultrasonic test equipment, magnaflux tester, defect removing machine
			Steel bar f	actory	Wire rod factory	Wire rod factory
	Forms	s of rollers	Continuous type high-rigidity 3-re	e VH mill + bll finishing mill	Continuous type VH mill + NT block mill + high precision finishing mill	Continuous type HH mill + NT block mill + mini block mill (MBM)
	Numb stranc	er of Is	1		1	2
Rolling	Contro coolin	olled	BIC: Air blast co	ooling, slow cooling	Warm water/cold water EDC, dry, retarded	Air blast cooling, SCS
	Coolir	ng bed	Fullrehen metho (with slow coolir	d ng cover)	_	-
	Cutter	r	Cold cutter		_	-
	Online machi	inspection ne	Hot eddy currer	it tester, Profile meter	Hot eddy current tester, Profile meter	Hot eddy current tester, Profile meter
Product Offline inspection finishing machine		inspection ne	Supersonic dete detector,Magne (MLFT)	ector, Magnetic particle tic leakage flux tester	_	-
Seconda	ry proc	essing	Continuous ann cleaning bonder	ealing furnace, batch ar izing equipment, full-lei	nnealing furnace, continuous acid ngth defect detection equipment	-
			BAR	BIC	WR	WR
	Dimer range	nsional	ф19 <b>~</b> 120	ф19~60	φ5.5~22.0	ф3.6~16.0*
	Produ	ict weight	Approx. 2t /binding	2.5t maximum, 2.0t standard	2.5t maximum, 2.0t standard	Standard 2.0t
	Coil outer diameter*		_	1300mm	1300mm	1320mm
	Coil inner diameter*		_	1000mm	980mm	880mm
Product	Coil h	eight*	-	1600mm full, 1000mm half	1700mm full, 1000mm half	1500mm full, 750mm half
specifi- cations	Coil w	vinding	_	Counterclockwise	Counterclockwise $\phi$ 9 or less : Clockwise [counterclockwise]	Clockwise winding
	airect	ion			φ9 or more : Counterclockwise [clockwise]	[counterclockwise winding]
		Score	3 bindings or 4 bindings	4 bindings	4 bindings	4 bindings
	Uni- fying	Material	Annealed wire or hoop	Ноор	Ноор	Ноор
		Large unification		Half 2-coil	Half 2-coil	Half 2-coil
	Rema	rks			Inside [] indicates a possibility with equipment.	Inside [] indicates a possibility with equipment. * The coil small-diameter size (φ3.6-4.0) may have a restriction in product type or application. Please consult us.

East Nippon (Kimitsu) Kyushu (Yawata) 4500 m<sup>3</sup>, 5555 m<sup>3</sup>, 2 furnaces 5000m<sup>3</sup> x 1 furnace Molten iron pretreatment (TPC type), KR Molten iron pretreatment, KR 255T / CH x 2 furnaces 350T/CH × 2 furnaces 305 x 502mm (4 strands) 339 × 456mm (6-strand) Vacuum degasser (REDA), Vacuum degasser (REDA), outside-furnace refining equipment (KIP) outside-furnace refining equipment (LF) Dual reversing system + hot scarf + VH continuous system Dual reversing system + hot scarf + VH continuous system Shot blast, ultrasonic test equipment, Shot blast, ultrasonic test equipment, magnaflux tester, defect removing machine magnaflux tester, defect removing machine Wire rod factory Steel bar fact Continuous type HH mill + high-rigidity 3-roll intermediate mill + NT block mill Continuous type VH high-rigidity 3-roll fi NT block mill 4 Air blast cooling, DLP BIC : Air blast coolin Fullrehen method \_ Cold shearing mach \_ Hot eddy current flaw detector, Hot eddy current fla profile meter profile meter Supersonic detecto \_ flux tester(MLFT), Ed Continuous heat-treatment furnace (coil), STC furnace (bar), \_ intermediate processing line, micro mill (cold rolling) WR BAR φ19~120 □50~350 φ5.0~16.0 Approx. 2t / 2.0t standard unification 1220mm 830mm 1550mm full, 850mm half Clockwise winding 3 to 6 bindings 4 bindings Ноор Annealing wire Half 2-coil

\* Approximate value



toryWire rod factoryI mill + nishing mill(RSB) +Full continuous VH mill + high-rigidity 3-roll intermediate mill + NT block millng, wind cooling1ng, wind coolingAir blast coolingI-hine-aw detector, brofile meterHot eddy current flaw detector, profile meteror, Magnetic leakage ciddy current tester (ET)-		
H mill +       Full continuous VH mill + high-rigidity 3-roll intermediate mill + NT block mill         1       1         ng, wind cooling       Air blast cooling         hine       -         aw detector,       Hot eddy current flaw detector, profile meter         br, Magnetic leakage       -	tory	Wire rod factory
1         ng, wind cooling       Air blast cooling         —       —         hine       —         aw detector,       Hot eddy current flaw detector, profile meter         br, Magnetic leakage       —         cddy current tester (ET)       —	H mill + inishing mill(RSB) +	Full continuous VH mill + high-rigidity 3-roll intermediate mill + NT block mill
ng, wind cooling Air blast cooling — — hine — aw detector, Hot eddy current flaw detector, profile meter or, Magnetic leakage iddy current tester (ET)		1
hine          aw detector,       Hot eddy current flaw detector,       profile meter       or, Magnetic leakage       iddy current tester (ET)	ing, wind cooling	Air blast cooling
hine		_
aw detector,     Hot eddy current flaw detector, profile meter       br, Magnetic leakage iddy current tester (ET)	hine	_
or, Magnetic leakage iddy current tester (ET)	aw detector,	Hot eddy current flaw detector, profile meter
	or, Magnetic leakage Eddy current tester (ET)	

BIC	WR
ф18.0~52.0	φ5.5~21.0
Maximum 3.0t, standard 2.0t	2.0t standard
1400mm	1350mm
950mm	900mm
1100mm full, 550mm half	1650mm full, 900mm half
Counterclockwise winding	Counterclockwise winding
4 bindings	4 bindings
Ноор	Ноор
Half 2-coil	Half 2-coil

 $^{\star}$  Those only related to rolled steel bars/wire rods in the factory are described.

### 1. Manufacturing sizes (mm)

Coil (φ)			F
3.6 *	13.0	29.5	
3.8 *	13.3	30.0	
4.0 *	13.5	31.0	
4.5	14.0	31.2	
5.0	14.3	31.75	
5.5	14.5	32.0	
5.7	14.7	32.5	
5.9	15.0	33.0	
6.0	15.3	34.0	
6.15	15.5	34.5	
6.35	15.7	35.0	
6.4	16.0	36.0	
6.5	16.3	36.45	
6.75	16.5	37.0	
7.0	16.7	37.45	
7.1	17.0	38.0	
7.3	17.5	39.0	
7.4	18.0	39.69	
7.5	18.3	40.0	
7.65	18.5	41.0	
8.0	18.7	42.0	
8.3	19.0	42.86	_
8.33	19.4	43.0	_
8.5	19.5	43.5	_
8.7	19.6	44.0	_
8.73	20.0	44.5	_
9.0	20.6	45.0	_
9.2	21.0	46.0	_
9.5	21.5	47.0	_
9.7	22.0	48.0 *	_
9.75	22.3	48.5 *	_
10.0	22.6	49.0 *	_
10.3	23.0	50.0 *	_
10.5	23.5	50.8 *	_
10.7	24.0	51.0 *	
11.0	24.5	52.0 *	
11.1	25.0	53.0 *	
11.3	25.4	54.0 *	
11.5	26.0	55.0 *	_
11.8	26.4	56.0 *	
11.9	27.0	57.0 *	
12.0	27.5	58.0 *	
12.3	28.0	59.0 *	_
12.5	28.6	60.0 *	
12.7	29.0		_

Round bar (ф)			S	Square stee	l (□)
19.0	54.0	100.0	_	50	*
20.0	55.0	102.0		55	*
21.0	57.0	103.0		57.15	*
22.0	57.15	105.0		58.7	*
22.22	58.0	106.0		60	*
23.0	60.0	107.0	_	63.5	*
24.0	62.0	108.0		65	*
25.0	63.0	110.0		70	*
25.4	63.50	115.0		75	*
26.0	65.0	117.0		80	*
27.0	66.68	119.0		83	*
28.0	67.0	120.0		85	*
28.58	68.0	123.0		90.0	*
29.0	69.85	125.0		93.0	*
30.0	70.0	130.0		95.0	*
31.0	71.0	135.0 *		100.0	
31.75	72.0	140.0 *		110.0	
32.0	73.0	145.0 *		115.0	
33.0	73.02	150.0 *		120.0	
34.0	74.0	155.0 *		125.0	*
34.92	75.0	160.0 *		130.0	*
35.0	76.0	170.0 *		140.0	*
36.0	76.20	180.0 *		150.0	*
37.0	77.0	190.0 *		160.0	*
38.0	78.0	200.0 *		162.0	*
38.10	79.0	210.0 *		180.0	*
39.0	80.0	220.0 *		190.0	*
40.0	81.0	230.0 *		235.0	*
41.0	82.0	240.0 *		250.0	*
41.28	82.55	250.0 *		280.0	*
42.0	83.0	260.0 *		300.0	*
43.0	84.0	270.0 *		340.0	*
44.0	85.0	280.0 *		350.0	*
44.45	86.0	290.0		400.0	*
45.0	87.0	300.0		450.0	*
46.0	88.0	310.0		500.0	*
47.0	90.0	320.0		550.0	*
47.62	91.0	330.0			
48.0	92.0	340.0			
48.5	92.08	350.0			
49.0	93.0	360.0			
50.0	94.0	370.0			
50.80	95.0	380.0			
51.0	95.25	390.0			
52.0	96.0	400.0			
53.0	97.0				
53.98	98.0				

### 2. Dimensional tolerance

We use the JIS tolerance as the standard: When manufacturing with precise dimensions, consult us.

### 3. Manufacturable length

The length of 4.5-6.0m is regarded as standard, please consults us for lengths outside this standard.

\* The coil small-diameter size (\$4.6-4.0) may have a restriction in product type or application. Please consult us.





When considering ordering the sizes marked  $\,\star\,$  , consult us.



### Types of steel for manufacturing

### JIS (Japanese Industrial Standards)

(1) Carbon steel material for mechanical structures JIS G 4051				
S10C	S20C	S30C	S40C	S50C
S12C	S22C	S33C	S43C	S53C
S15C	S25C	S35C	S45C	S55C
S17C	S28C	S38C	S48C	S58C
S09CK	S15CK	S20CK		

### (2) Steel material for steel alloys for mechanical structures JIS G 4053 SMn420 SMn438 SMnC420 SMn433 SMn443 SMnC443 SCr415 SCr430 SCr440 SCr420 SCr435 SCr445 SCM415 SCM421 SCM432 SCM445 SCM418 SCM425 SCM435 SCM822 SCM420 SCM430 SCM440 SNCM220 SNCM420 SNCM447 SNCM630 SNCM240 SNCM431 SNCM616 SNCM815

(3) Steel material (H steel) for structures					
that as		JIS	S G 4052		
SMn420H	SMn438H	SMnC420H			
SMn433H	SMn443H	SMnC443H			
SCr415H	SCr430H	SCr440H			
SCr420H	SCr435H				
SCM415H	SCM420H	SCM435H	SCM445H		
SCM418H	SCM425H	SCM440H	SCM822H		
SNC415H	SNC631H	SNC815H			
SNCM220H	SNCM420H				

SNCM415 SNCM439 SNCM625

### (4) Steel material for spring steel

			JIS	5 G 480
	SUP6	SUP9	SUP10	SUP12
	SUP7	SUP9A	SUP11A	SUP13
_				

#### (5) Bearing steel

		JIS G 4805		
	SUJ2			
(6) Free-cutti	ng steel materi	al of sulfur		
and sulfur	compositions	JIS G 4804		
SUM21	SUM25	SUM41		
SUM22	SUM31	SUM42		
SUM23	SUM32	SUM43		
(7) General steel material for cold				
finished steel bars JIS G 3108				
SGDA SGDB SGD1 SGD2 SGD3 SGD4				

00200, ( 00200	00 30	040 00	000	0 30490			
(9) Rolled st	eel for	genera	al s	tructure			
			JI	S G 310 <sup>.</sup>			
SS330 S	S400	SS49	0	SS540			
1							
(10) Low-ca	rbon s	teel wi	re	rods			
			JIS	S G 350			
SWRM2 SV	VRM8	SWRM	15	SWRM2			
SWRM4 SW	/RM10	SWRM	17				
SWRM6 SW	/RM12	SWRM	20				
(11) \\{\\	-l- (			- 6			
(11) Wire roo	l electi	core w rode	ire				
	4	0		S G 3503			
SWRI		5	VVF	1121			
(12) Hard st	eel wir	re					
()		-		C 3504			
SWBH27 SV	VBH32	S/W/RH	37	5 G 5500			
	RH52R	SWRHE	7/	SWDH22			
SWRH4/A SW	/RH5/B	SWRH/	SWRH82				
SWRH4/B SW	(RH62A	SWRH/					
SWRH52A SW	/RH62B	SWRH/	<i>(</i> A				
(12) Diana y	vira ra	do					
(13) FIAITO V	vire roo	us	ш	C 2500			
SWBS624 SW	RS72R	SWRS8		SWBS87			
SWIDSEDE SW	/R\$754	SW/RS8		SM/B202			
			00	SWD200			
200020 00	100774	200420	211H292				
200H20/B 200	/KS/ (A		SWRS82B				
014/00-04	00770	SWRS8					
SWRS72A SW	/RS77B	SWRS8 SWRS8	87A				
SWRS72A SW	/RS77B	SWRS8 SWRS8	37A	heading			
SWRS72A SW (14) Carbon st and cold	/RS77B	SWRS8 SWRS8 rods for		theading			
SWRS72A SW (14) Carbon st and cold	RS77B teel wire forging	SWRS8 SWRS8 rods for JI	525 57A colo	d heading G 3507-1			
SWRS72A SW (14) Carbon st and cold SWRCH6R	RS77B ceel wire forging SWRC	SWRS8 SWRS8 rods for JI CH10R	SV	d heading G 3507- <sup>-</sup> VRCH15F			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH8R	RS77B forging SWRC SWRC	SWRS8 SWRS8 rods for JI CH10R CH10R CH12R	SV	d heading G 3507- <sup>-</sup> VRCH15F VRCH17F			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH8R SWRCH6A	RS77B reel wire forging SWRC SWRC SWRC	SWRS8 SWRS8 rods for JI CH10R CH12R CH12A	SV SV SV	d heading G 3507 VRCH15F VRCH17F VRCH20/			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH8R SWRCH6A SWRCH8A	RS77B forging SWRC SWRC SWRC SWRC	SWRS8 SWRS8 rods for JI CH10R CH12R CH12R CH15A CH16A	SV SV SV SV	d heading G 3507-1 VRCH15F VRCH17F VRCH20/ VRCH22/			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH8R SWRCH6A SWRCH8A SWRCH10A	ARS77B forging SWRC SWRC SWRC SWRC SWRC	SWRS8 SWRS8 rods for JI CH10R CH12R CH15A CH15A CH16A CH18A	SV SV SV SV SV SV SV SV	d heading G 3507-1 VRCH15F VRCH17F VRCH20/ VRCH22/ VRCH22/ VRCH25/			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH8R SWRCH6A SWRCH8A SWRCH10A SWRCH12A	ARS77B teel wire forging SWRC SWRC SWRC SWRC SWRC	SWRSE SWRSE rods for JI CH10R CH12R CH15A CH15A CH15A CH16A CH19A	SV SV SV SV	d heading G 3507- VRCH15F VRCH17F VRCH20A VRCH22A VRCH25A			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH6A SWRCH6A SWRCH6A SWRCH10A SWRCH12A SWRCH12A	ARS77B reel wire forging SWRC SWRC SWRC SWRC SWRC SWRC	SWRSE SWRSE rods for JI CH10R CH10R CH12R CH15A CH16A CH16A CH18A CH19A CH22K	SV SV SV SV SV SV	d heading G 3507- VRCH15F VRCH17F VRCH20/ VRCH22/ VRCH25/ VRCH25/			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH8A SWRCH6A SWRCH10A SWRCH10A SWRCH10K SWRCH10K	ARS77B forging SWRC SWRC SWRC SWRC SWRC SWRC SWRC SWRC	SWRSE SWRSE rods for JI CH10R CH12R CH15A CH15A CH15A CH16A CH18A CH19A CH22K CH22K CH24K	SV SV SV SV SV SV SV SV	d heading G 3507-1 VRCH15F VRCH20/ VRCH22/ VRCH22/ VRCH25/ VRCH38F VRCH38F			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH6A SWRCH6A SWRCH10A SWRCH10A SWRCH10K SWRCH12K SWRCH12K	ARS77B reel wire forging SWRC SWRC SWRC SWRC SWRC SWRC SWRC SWRC	SWRSE SWRSE rods for JI CH10R CH12R CH15A CH15A CH15A CH16A CH19A CH19A CH22K CH22K CH22K CH25K	SV SV SV SV SV SV SV SV SV SV SV SV	d heading G 3507- VRCH15F VRCH17F VRCH20A VRCH20A VRCH25A VRCH25A VRCH38F VRCH38F VRCH40F VRCH41F			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH6A SWRCH6A SWRCH10A SWRCH10A SWRCH12A SWRCH12K SWRCH15K SWRCH16K	ARS77B ARS77B Forging SWRC SWRC SWRC SWRC SWRC SWRC SWRC SWRC	SWRSE SWRSE rods for JI CH10R CH12R CH12A CH15A CH15A CH16A CH18A CH19A CH22K CH22K CH25K CH25K CH27K	SV SV SV SV SV SV SV SV SV SV SV SV SV S	d heading G 3507- VRCH15F VRCH17F VRCH20A VRCH20A VRCH25A VRCH25A VRCH38F VRCH38F VRCH41F VRCH41F			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH6A SWRCH6A SWRCH10A SWRCH10A SWRCH10K SWRCH12K SWRCH15K SWRCH16K SWRCH17K	ARS77B ARS77B Forging SWRC SWRC SWRC SWRC SWRC SWRC SWRC SWRC	SWRSE SWRSE rods for JI CH10R CH12R CH15A CH15A CH15A CH16A CH16A CH18A CH19A CH22K CH22K CH22K CH27K CH27K CH27K	SV SV SV SV SV SV SV SV SV SV SV SV SV S	d heading G 3507- VRCH15F VRCH17F VRCH20/ VRCH22/ VRCH25/ VRCH25/ VRCH38F VRCH38F VRCH43F VRCH43F VRCH45F			
SWRS72A SW (14) Carbon si and cold SWRCH6R SWRCH8R SWRCH6A SWRCH10A SWRCH10A SWRCH10K SWRCH10K SWRCH15K SWRCH15K SWRCH16K SWRCH17K	ARS77B ARS77B Forging SWRC SWRC SWRC SWRC SWRC SWRC SWRC SWRC	SWRS8 SWRS8 rods for JI CH10R CH12R CH12A CH12A CH12A CH12A CH18A CH18A CH19A CH22K CH22K CH22K CH27K CH27K CH23K	SV SV SV SV SV SV SV SV SV SV SV SV SV S	d heading G 3507-1 VRCH15F VRCH20/ VRCH22/ VRCH22/ VRCH25/ VRCH38k VRCH38k VRCH38k VRCH43k VRCH43k VRCH48k			
SWRS72A SW (14) Carbon st and cold SWRCH6R SWRCH6A SWRCH6A SWRCH10A SWRCH10A SWRCH12A SWRCH12K SWRCH15K SWRCH15K SWRCH17K SWRCH17K	ARS77B ARS77B Forging SWRC SWRC SWRC SWRC SWRC SWRC SWRC SWRC	SWRS8 SWRS8 rods for JI CH10R CH12R CH12A CH15A CH15A CH15A CH19A CH19A CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K CH25K	SV SV SV SV SV SV SV SV SV SV SV SV SV S	d heading G 3507- VRCH15I VRCH20 VRCH20 VRCH22 VRCH25 VRCH38 VRCH41 VRCH41 VRCH43 VRCH45 VRCH48			

(8) Steel bars for concrete

JIS G 3112

reinforcement

SR235 SR295

### Japanese automobile standard organization JASO M 106

### (1) Carbon steel and boron steel

S10C	S	22C	S35	С	S48C					
S12C	S	25C	S38	С	S50C					
S15C	S	28C	S40	С	S53C					
S17C	S	30C	S430	С	S55C					
S20C	S	33C	S450	С	S58C					
ASBo20	AS	Bo33	ASBo	43	ASBo53					
ASBo25	AS	Bo35	ASBo	45						
ASBo28	AS	Bo38	ASBo	048						
ASBo30	AS	Bo40	ASBo	50						
(2) H-steel										
ASMn420	ЭH	ASMn	435H	ASMn448H						
ASMn425	ōН	SMn4	438H	ASMn453H						
ASMn430	ЭH	ASMn	440H							
SMn433	Н	ASMn	443H							
ASMnB22	OН	ASMn	B422H	AS	MnB433H					
ASMnB23	ЗH	ASMnl	B425H	AS	MnB443H					
ASMnC42	0H	ASMn(	C520H							
SMnC443	3H	ASMn(	C543H							
ASMnCB44	OH									
SCr415	Н	ASCr	423H	S	Cr435H					
ASCr418	ΒH	ASCr	425H	S	Cr440H					
SCr420	H	SCr4	30H	AS	SCr445H					
ASCB435	ōН	ASCB	440H							
ASCM115	ōН	ASCN	1320H	S	CM435H					
ASCM118	3H	ASCN	1325H	SCM440H						
ASCM120	ЭН	SCM	415H	SCM445H						
ASCM128	5H	SCM	418H	SCM822H						
ASCM31	5H	SCM	420H							
ASCM318	ЗH	ASCM	1430H							
SNCM220	ЭН	SNCM	1420H							
(3) Free- (Addition compo	cut on o nen	ting st r change ts of free	eel e concer e-cutting	rning g ste	g the eel)					
·····L1	*		·S0		·····S2					
L2	*		·S1							
Remarks : * lease conta	With act u	regard t s in adva	to lead-a ance.	adde	d steel,					

### SAE (Society of Automotive Engineers)

### (1) Carbon steel

	SAE J403
Steel type mark	UNS No.
(i) Standard carbon s	steel
1005	G10050
1006	G10060
1008	G10080
1010	G10100
1012	G10120
1013	G10130
1015	G10150
1016	G10160
1017	G10170
1018	G10180
1019	G10190
1020	G10200
1021	G10210
1022	G10220
1023	G10230
1025	G10250
1026	G10260
1029	G10290
1030	G10300
1035	G10350
1037	G10370
1038	G10380
1039	G10390
1040	G10400
1042	G10420
1043	G10430
1044	G10440
1045	G10450
1046	G10460
1049	G10490
1050	G10500
1053	G10530
1055	G10550
1060	G10600
1065	G10650
1070	G10700
1074	G10740
1075	G10750
1078	G10780
1080	G10800
1084	G10840
-	

(1) Carbon steel		(3) Alloy steel (continued)							
(continued)		(continuou)							
	SAE J403		SAE J404						
Steel type mark	UNS No.	Steel type mark	UNS No.						
(ii) Manganese carbo	on steel	(iii) Cr-Mo steel							
1522	G15220	4118	G41180						
1524	G15240	4130	G41300						
1526	G15260	4135	G41350						
1527	1527 G15270		G41370						
1536	G15360	4140	G41400						
1541	G15410	4142	G41420						
1548	G15480	4145	G41450						
1552	G15520	4150	G41500						
1566	G15660	(iv) Ni-Cr-Mo steel							
		4320	G43200						
		4340	G43400						
		(v) Mo-Ni steel							
(2) Sulfur free outt	ing staal	4615	G46150						
(2) Sullur free cutt	ing steel	4617	G46170						
		4620	G46200						
	SAE J403	4817	G48170						
Steel type mark	UNS No.	4820	G48200						
(i) Sulfur free cutting	steel	(vi) Cristeel	040200						
1117	G11170	50B46	C50461						
1118	G11180	5115	G50401						
1137	G11370	5120	G51200						
1140 G11400		5120	G51200						
1141 G11410		5130	G51300						
1144 G11440		5132	G51320						
1146 G11460		5140	G51400						
1151 G11510		5160	G51500						
(ii) Phosphorus sulf	Ir Cillolo	51860	G51601						
1010	C10100	52100	G51001						
1212	G12120	52100	G32900						
1213	G12150		001500						
1210	012100		G01500						
		(VIII) NI-Cr-Mo steel	000150						
		8615	G86150						
		8617	G86170						
(3) Alloy steel		8620	G86200						
		8622	G86220						
	SAE J404	0020	G00200						
Steel type mark	UNS No.	8027	G86270						
(i) Mn steel		8030	G86300						
1220	012200	9640	G00370						
1000	1330 G13300		G00400						
1340	G13300	0040	G00400						
1040	G13400	0000	G00000						
(ii) Ma start	G13400	0120	G01200						
	0.400000	Q140 QQ00	G22220						
4023	G40230	(iv) Si Ma staal	00220						
4027	G40270		000540						
4037	G40370	9254	G92540						
4047	G40470	9260	G92600						

(1) Carbon steel (continued)		(3) Alloy steel (continued)						
, , , , , , , , , , , , , , , , , , ,	SAE 1402	, , , , , , , , , , , , , , , , , , ,	SVE 140					
Steel type mark	UNS No.	Steel type mark	UNS No.					
(ii) Manganese carbon	steel	(iii) Cr-Mo steel						
1522	G15220	4118	G41180					
1524	G15240	4130	G41300					
1526	G15260	4135	G41350					
1527	G15270	4137	G41370					
1536	G15360	4140	G41400					
1541	G15410	4142	G41420					
1548	G15480	4145	G41450					
1552	G15520	4150	G41500					
1566	G15660							
1000	010000		0.40000					
		4320	G43200					
		4340	G43400					
		(v) Mo-Ni steel	0.40450					
(2) Sulfur free cuttin	g steel	4615	G46150					
		4617	G46170					
	SAF .1403	4620	G46200					
Stool typo mark		4817	G48170					
	UNS NU.	4820	G48200					
(i) Sulfur free cutting s	teel	(vi) Cr steel						
1117	G111/0	50B46	G50461					
1118	G11180	5115	G51150					
1137	G11370	5120	G51200					
1140	G11400	5130	G51300					
1141	G11410	5132	G51320					
1144	G11440	5140	G51400					
1146	G11460	5150	G51500					
1151	G11510	5160	G51600					
(ii) Phosphorus, sulfur		51B60	G51601					
1212	G12120	52100	G52986					
1213	G12130	(vii) Cr-V steel						
1215	G12150	6150	G61500					
		(viii) Ni-Cr-Mo steel						
		8615	G86150					
		8617	G86170					
(3) Allov steel		8620	G86200					
(-)		8622	G86220					
		8625	G86250					
	SAE J404	8627	G86270					
Steel type mark	UNS No.	8630	G86300					
(i) Mn steel		8637	G86370					
1330	G13300	8640	G86400					
1335	G13350	8645	G86450					
1340	G13400	8655	G86550					
1345	G13450	8720	G87200					
(ii) Mo steel		8740	G87420					
4023	G40230	8822	G88220					
4020	G10270	(ix) Si-Mn steel						
4021	G40270	025/	602540					
4007	GA0470	9204	G92040					
4047	G40470	9200	992000					

Steel type mark	
(i) Mn steel	
1330	
1335	
1340	
1345	
(ii) Mo steel	
4023	-
4027	
4037	
1017	

\*In case representation of the JIS mark is required, please confirm separately.

# Example of binding, packing and representation





## memo 1cm grid


