

KOBELCO

Kobe Steel's **Special Steel Sheets**

KOBE STEEL, LTD.

Kobe Steel's special steel sheets support the pursuit of better performance in numerous industrial products

◆ Introduction

At Kakogawa Works, we manufacture high-quality special steel sheets utilizing the latest equipment and technologies accumulated over many years.

We tirelessly endeavor to satisfy customers. Your continued support and patronage is appreciated.

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◆ Note and disclaimer

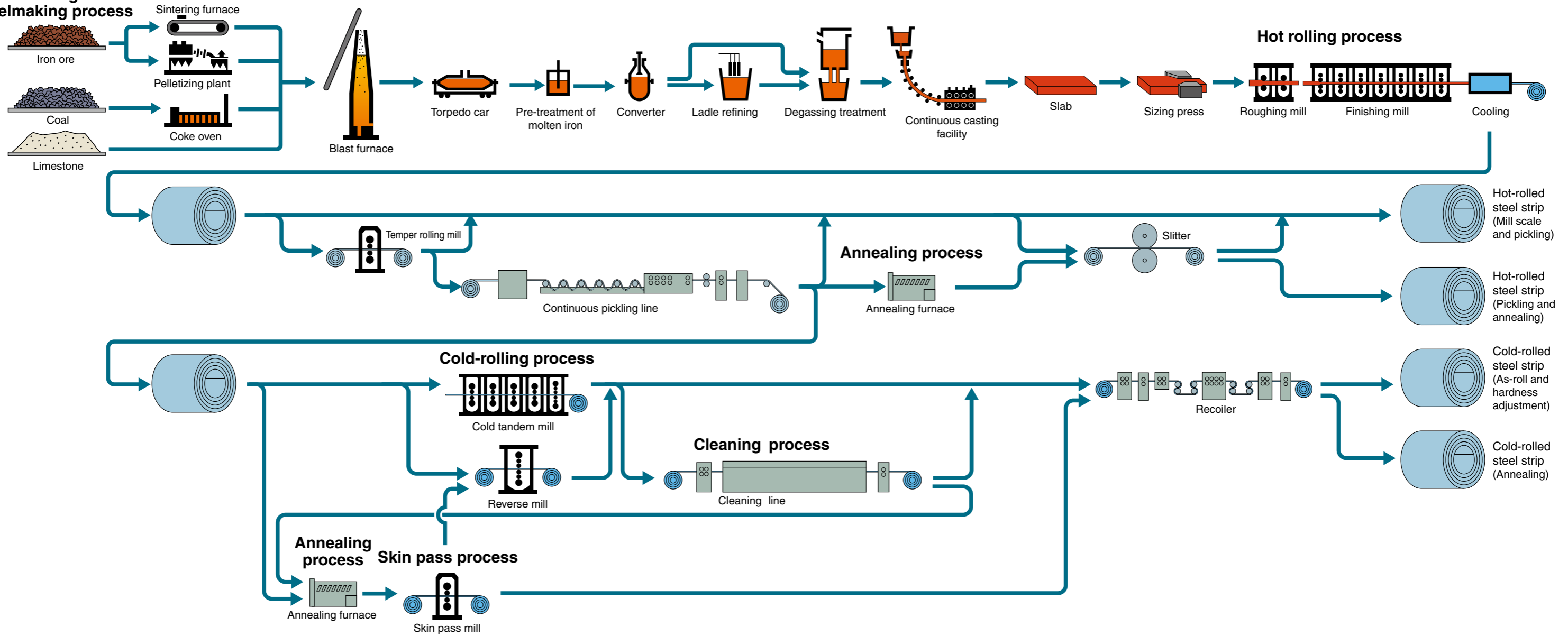
The technical information written in this document is intended to explain the general properties and performance of our products and is not intended to guarantee performance whatsoever.

The technical information in this document may not apply depending on the objectives, environment, conditions or other factors.

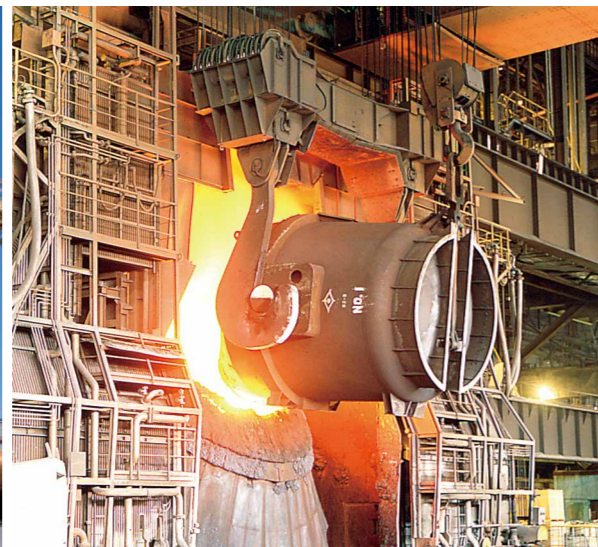
The descriptions in this document may be changed without prior notice. For the latest information, contact the relevant department of Kobe Steel, Ltd.

Manufacturing process

Ironmaking and steelmaking process



Blast furnace



Converter



Hot strip mill



Reverse mill



UAD batch annealing furnace

Standards and chemical components

Other standards than those described below may also be available upon request.

◆ Carbon steel for mechanical structures

JIS Standards	SAE Standards	Chemical components (%)							
		C	Si	Mn	P	S	Cu	Ni	Cr
S35C		0.32-0.38	0.15-0.35	0.60-0.90	0.030 or less	0.035 or less	0.30 or less	0.20 or less	0.20 or less
	SAE1035	0.32-0.38	—	0.60-0.90	0.030 or less	0.050 or less	—	—	—
S40C		0.37-0.43	0.15-0.35	0.60-0.90	0.030 or less	0.035 or less	0.30 or less	0.20 or less	0.20 or less
	SAE1040	0.37-0.44	—	0.60-0.90	0.030 or less	0.050 or less	—	—	—
S45C		0.42-0.48	0.15-0.35	0.60-0.90	0.030 or less	0.035 or less	0.30 or less	0.20 or less	0.20 or less
	SAE1045	0.43-0.50	—	0.60-0.90	0.030 or less	0.050 or less	—	—	—
S50C		0.47-0.53	0.15-0.35	0.60-0.90	0.030 or less	0.035 or less	0.30 or less	0.20 or less	0.20 or less
	SAE1050	0.48-0.55	—	0.60-0.90	0.030 or less	0.050 or less	—	—	—
S55C		0.52-0.58	0.15-0.35	0.60-0.90	0.030 or less	0.035 or less	0.30 or less	0.20 or less	0.20 or less
	SAE1055	0.50-0.60	—	0.60-0.90	0.030 or less	0.050 or less	—	—	—
	SAE1060	0.55-0.65	—	0.60-0.90	0.030 or less	0.050 or less	—	—	—
	SAE1065	0.60-0.70	—	0.60-0.90	0.030 or less	0.050 or less	—	—	—
	SAE1070	0.65-0.75	—	0.60-0.90	0.030 or less	0.050 or less	—	—	—
	SAE1075	0.70-0.80	—	0.40-0.70	0.030 or less	0.050 or less	—	—	—

The above chemical components are cited from JIS G 4051 (2016) and SAE J403 (DEC2009).

◆ Carbon tool steel

JIS Standards	SAE Standards	Chemical components (%)							
		C	Si	Mn	P	S	Cu	Ni	Cr
SK85 (SK5)		0.80-0.90	0.10-0.35	0.10-0.50	0.030 or less	0.030 or less	0.25 or less	0.25 or less	0.30 or less

The name from the previous version of JIS is enclosed in parentheses.
The above chemical components are cited from JIS G 4401 (2009).

◆ Chrome steel

JIS Standards	SAE Standards	Chemical components (%)							
		C	Si	Mn	P	S	Cu	Ni	Cr
	SAE5046	0.43-0.48	0.15-0.35	0.75-1.00	0.035 or less	0.040 or less	—	—	0.20-0.35

The above chemical components are cited from SAE J1249 (DEC2008).

Classification

Consult with us for a specific request about the roughness of a product.

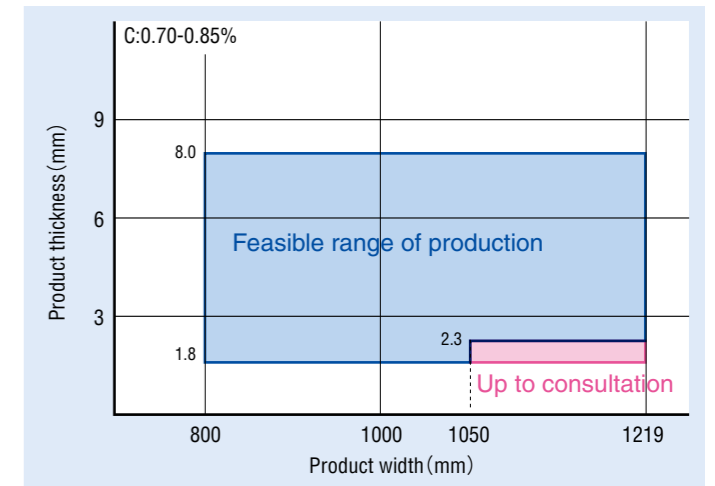
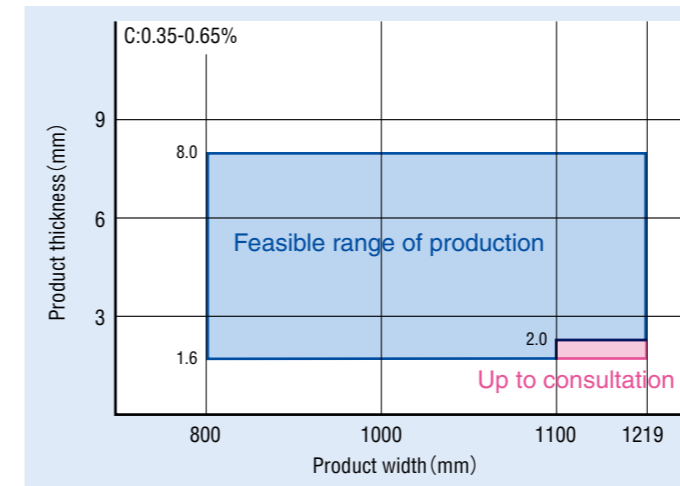
	Category	Code	Description
Hot-rolled steel strip	Mill scale	—	Left unprocessed after hot-rolling
	Pickling	P	After hot-rolling, the product is pickled to descale its surface.
Cold-rolled steel strip	Dull finish	D	A matte roll with a physically or chemically rough surface
	Bright finish	B	A smoothly-finished roll

Classification of thermal refining

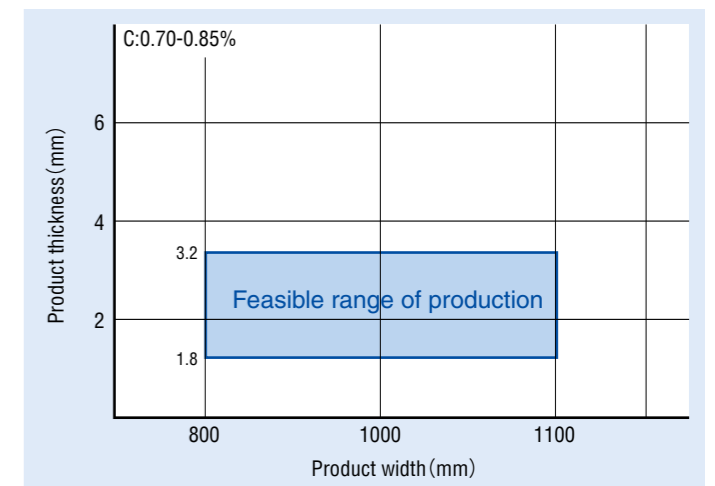
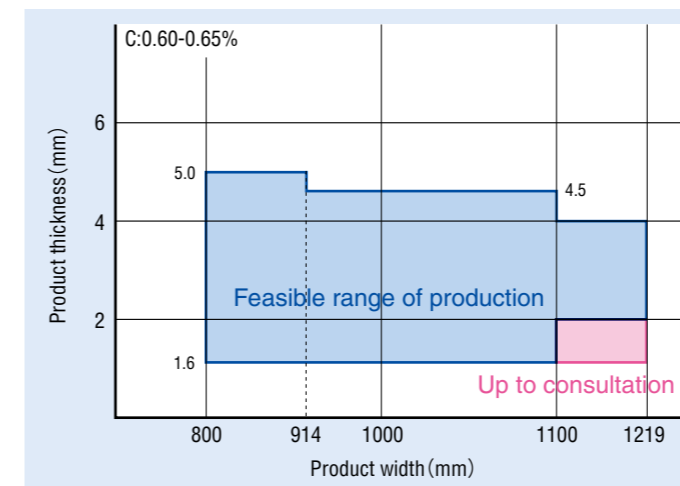
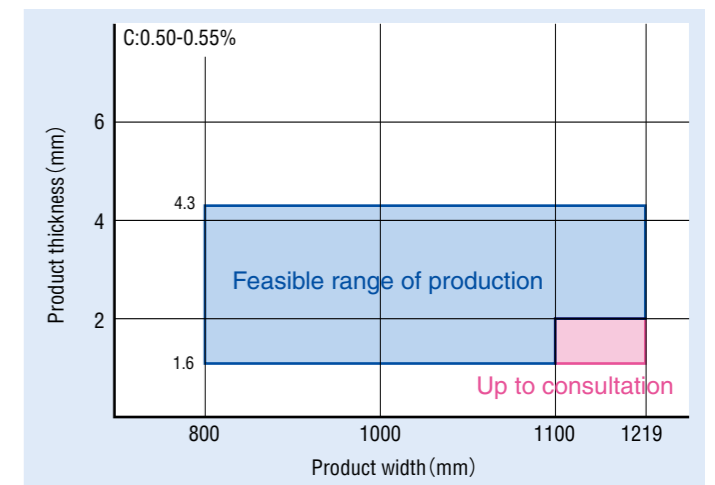
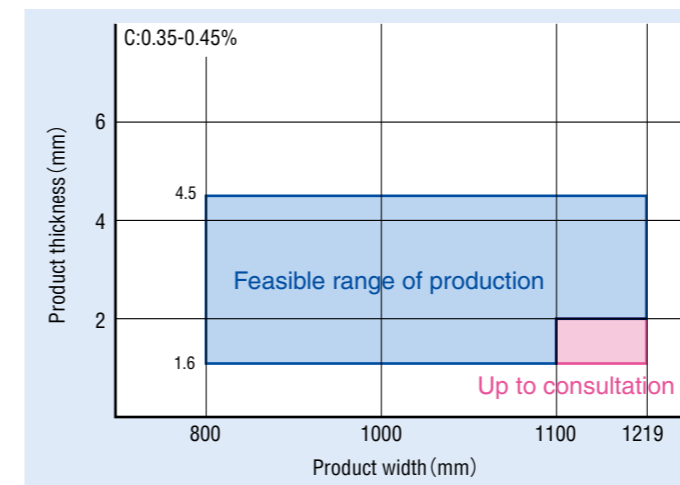
	Category	Code	Description
Hot-rolled steel strip (pickled)	Standard annealing	PA	Pickled material annealed in a standard manner
Cold-rolled steel strip	As-roll	H	Left unprocessed after cold-rolling
	Hardness adjustment	R	Cold-rolled material after hardness adjustment
	Standard annealing	S	Cold-rolled material annealed in a standard manner
	Spheroidizing	SP	Cold-rolled material after spheroidizing

Feasible range of production

◆ Hot-rolled steel strip (mill scale)

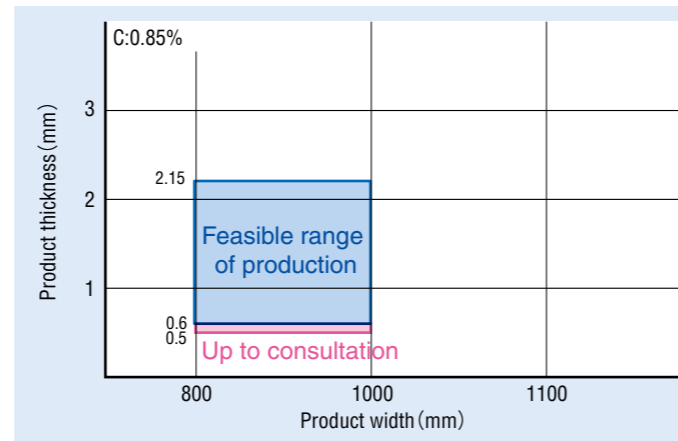
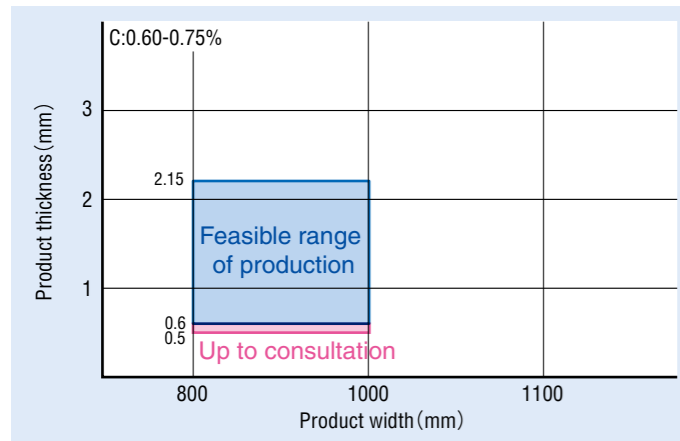
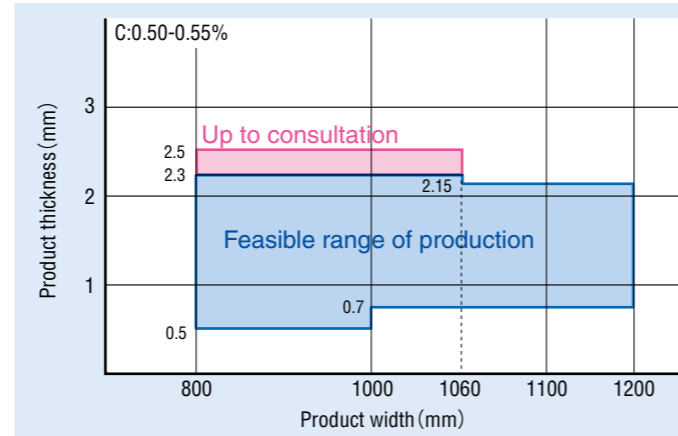
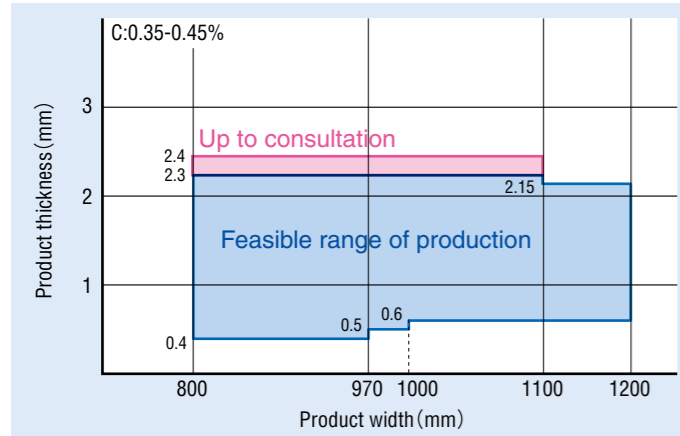


◆ Hot-rolled steel strip (pickling and pickling/annealing)

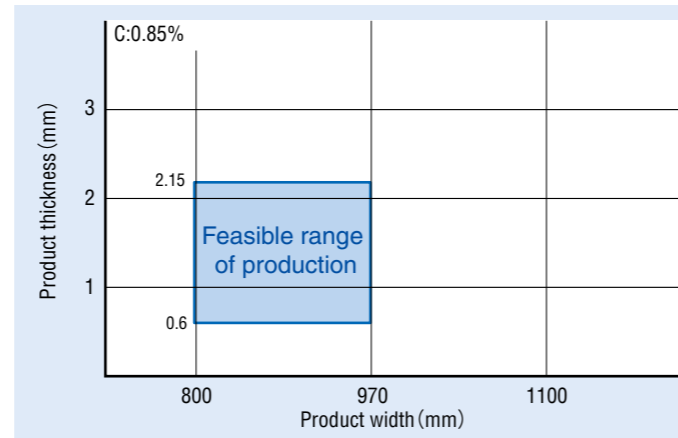
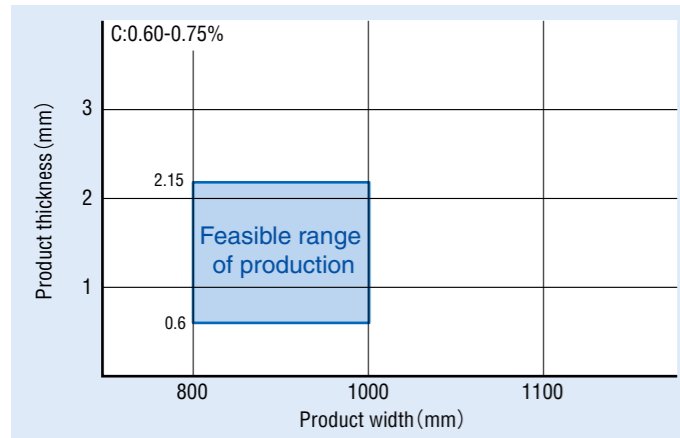
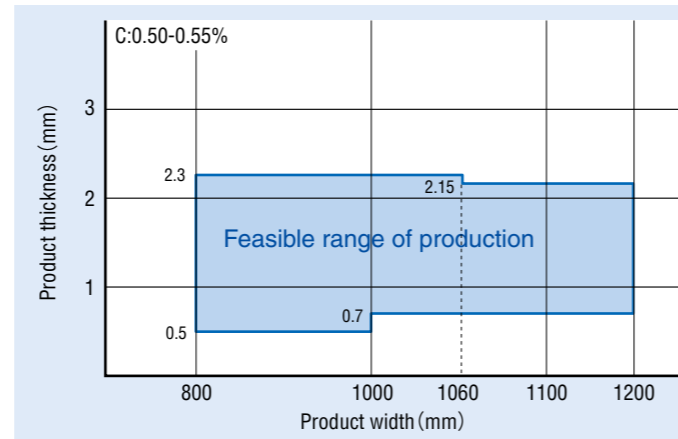
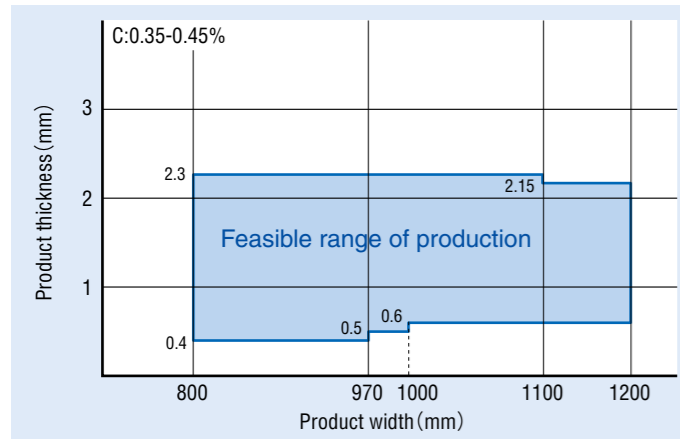


Feasible range of production

◆ Cold-rolled steel strip (hardness adjusted)



◆ Cold-rolled steel strip (standard annealing and spheroidizing)



Dimension tolerance

Dimension tolerance of a hot-rolled steel strip and a cold-rolled steel strip is as per Item 5 (shape and dimension tolerance) of JIS G 3193, unless otherwise specified.

However, the thickness tolerance of a cold-rolled steel strip is as per Table 16 (thickness tolerance A) of JIS G 3141.

Consult with us for any request for specific dimensions.

◆ Thickness tolerance of a hot-rolled steel strip

Unit: mm

Thickness	1.60 or more, but less than 2.00	2.00 or more, but less than 2.50	2.50 or more, but less than 3.15	3.15 or more, but less than 4.00	4.00 or more, but less than 5.00	5.00 or more, but less than 6.30	6.30 or more, but no more than 10.00
Thickness tolerance	±0.19	±0.20	±0.22	±0.24	±0.45	±0.50	±0.55

The above tolerance is cited from JIS G 3193 (2019).

Thickness is determined at an arbitrary point located 25 mm or more inward from the edge (for a mill edge type), or at an arbitrary point located 15 mm or more inward from the edge (for a cut edge type).

◆ Thickness tolerance of a cold-rolled steel strip

Unit: mm

Thickness	Width	
	800 or more, but less than 1000	1000 or more, but no more than 1200
0.40 or more, but less than 0.60	±0.05	±0.05
0.60 or more, but less than 0.80	±0.06	±0.06
0.80 or more, but less than 1.00	±0.06	±0.07
1.00 or more, but less than 1.25	±0.07	±0.08
1.25 or more, but less than 1.60	±0.09	±0.10
1.60 or more, but less than 2.00	±0.11	±0.12
2.00 or more, but no more than 2.40	±0.13	±0.14

The above tolerance is cited from JIS G 3141 (2021).

Thickness is determined at an arbitrary point located 25 mm or more inward from the edge (for a mill edge type), or at an arbitrary point located 15 mm or more inward from the edge (for a cut edge type).

◆ Width tolerance of a hot-rolled steel strip and a cold-rolled steel strip

Unit: mm

Width	Thickness	Mill edge	Cut edge Pursuant to normal sawing methods	
			+	-
800 or more, but less than 1000	Less than 3.15	+ 25 0	10	0
	3.15 or more, but less than 6.00		10	0
	6.00 or more, but no more than 10.00		10	0
1000 or more, but no more than 1219	Less than 3.15	+ 30 0	10	0
	3.15 or more, but less than 6.00		10	0
	6.00 or more, but no more than 10.00		15	0

The above tolerance is cited from JIS G 3193 (2019).

Mechanical properties

The following are the standard values of surface hardness for the products. Consult with us for any request for a specific hardness value.

Hot-rolled steel strip

Product	JIS Standards	SAE Standards	Mill scale and pickling	Pickling and annealing		
Hot-rolled steel strip	Carbon steel for mechanical structures	S35C	HRB 98 or less	HRB 90 or less		
		S40C	SAE1035	HRB 98 or less	HRB 90 or less	
			SAE1040	HRB 100 or less	HRB 91 or less	
		S45C	SAE1045	HRB 101 or less	HRB 91 or less	
			SAE1045	HRB 101 or less	HRB 91 or less	
		S50C	SAE1050	HRB 104 or less	HRB 92 or less	
			SAE1050	HRB 104 or less	HRB 92 or less	
		S55C	SAE1055	HRB 107 or less	HRB 93 or less	
			SAE1060	HRC 34 or less	HRB 94 or less	
		Carbon tool steel	SK85[SK5]	SAE1065	HRC 35 or less	HRB 95 or less
				SAE1070	HRC 37 or less	HRB 96 or less
				SAE1075	HRC 38 or less	HRB 96 or less

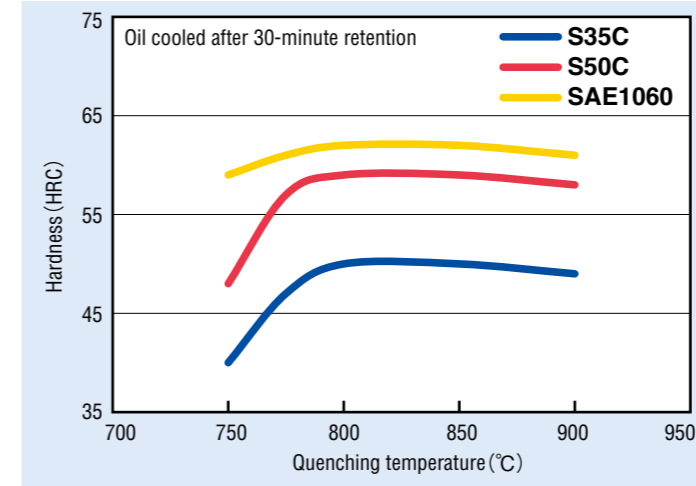
Cold-rolled steel strip

Product	JIS Standards	SAE Standards	Standard annealing	As-roll		
Cold-rolled steel strip	Carbon steel for mechanical structures	S35C	Hv 170 or less	Hv 170-250		
		S40C	SAE1035	Hv 170 or less	Hv 170-250	
			SAE1040	Hv 170 or less	Hv 170-260	
		S45C	SAE1045	Hv 170 or less	Hv 170-260	
			SAE1045	Hv 170 or less	Hv 170-260	
		S50C	SAE1050	Hv 180 or less	Hv 180-270	
			SAE1050	Hv 180 or less	Hv 180-270	
		S55C	SAE1055	Hv 180 or less	Hv 180-270	
			SAE1060	Hv 190 or less	Hv 190-280	
		Carbon tool steel	SK85[SK5]	SAE1065	Hv 190 or less	Hv 190-280
				SAE1070	Hv 190 or less	Hv 190-280
				SAE1075	Hv 200 or less	Hv 200-290

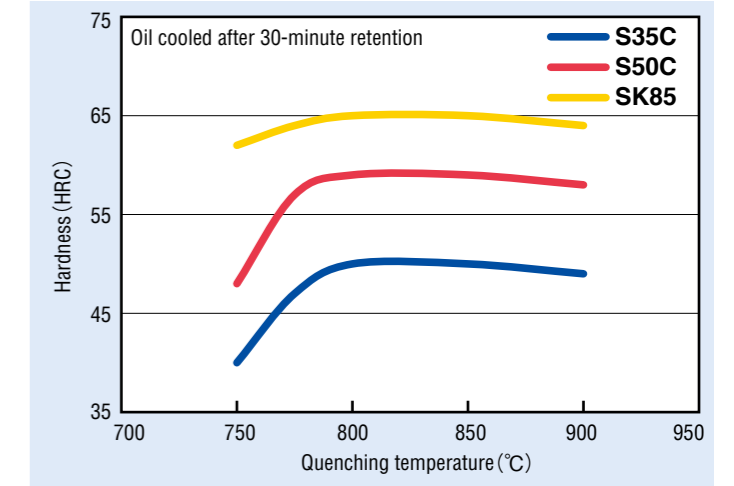
Heat treatability

Relationship between quenching temperature and hardness (example)

Hot-rolled steel strip (pickled)

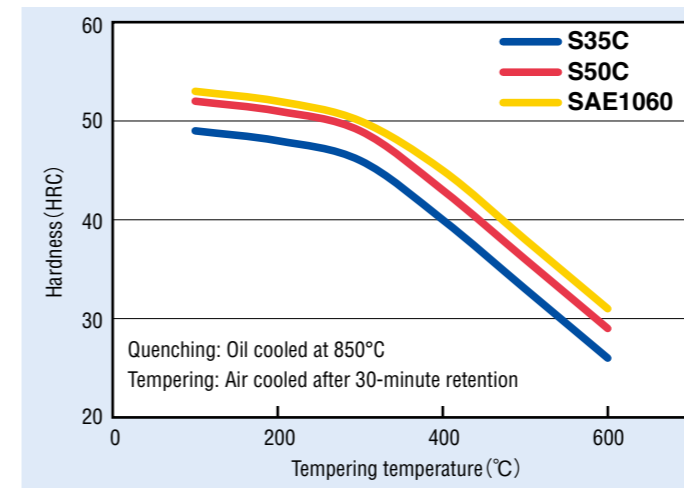


Cold-rolled steel strip (standard annealing)

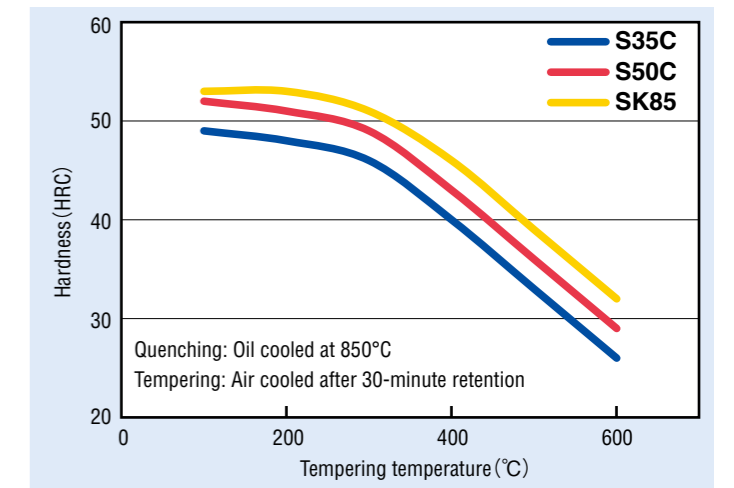


Relationship between tempering temperature and hardness (example)

Hot-rolled steel strip (pickled)



Cold-rolled steel strip (standard annealing)



Appended tables

◆ Effects of elements on steel

C	Enhances hardenability and increases strength and abrasion resistance. C and Fe form unstable Fe ₃ C (cementite). Steel may be referred to as hypoeutectoid steel, eutectoid steel or hypereutectoid steel depending on its carbon content, namely less than 0.8%, 0.8% and 0.8 - 2.0%, in that order.
Mn	Lowers the transformation point and enhances hardenability. Mn couples with S as MnS and prevents red shortness.
Si	Enhances strength by serving as a solid solution strengthening element. Si increases temper-softening resistance at 300°C or below.
P	Generally, S is an impurity element. P segregates into the crystal grain boundary and lowers the impact value. It also enhances strength and cutting performance.
S	Generally, S is an impurity element. With Fe, it forms FeS, generates red shortness and decreases hot workability. S also enhances cutting performance.
Cr	Cr enhances hardenability, temper-softening resistance and improves corrosion resistance.
Cu	Enhances hardenability and improves corrosion resistance. Cu forms deposits at a high temperature and enhances strength.
Ni	Lowers the transformation point and enhances hardenability. With the combined addition of Cr and Mo, Ni enhances low temperature toughness. Ni also improves corrosion resistance.
Al	Used as a deoxidizing agent for refining. With N, Al forms AlN, refines steel crystal grains and enhances toughness.
N	N forms nitrides with elements such as Al, Ti and V. It refines steel crystal grains and enhances toughness.

◆ Hardness conversion table(SAE J 417)

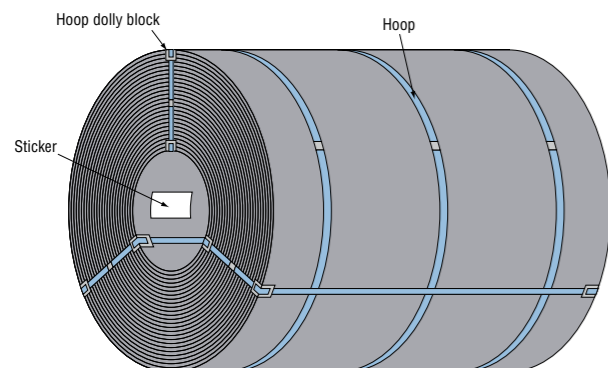
Vickers hardness (HV)	Brinell hardness (HB) standard ball	Rockwell hardness		Shore hardness (HS)	Tensile strength (MPa)
		Scale B (HRB)	Scale C (HRC)		
940	—	—	68	97	—
920	—	—	67.5	96	—
900	—	—	67	95	—
880	—	—	66.4	93	—
860	—	—	65.9	92	—
840	—	—	65.3	91	—
820	—	—	64.7	90	—
800	—	—	64	88	—
780	—	—	63.3	87	—
760	—	—	62.5	86	—
740	—	—	61.8	84	—
720	—	—	61	83	—
700	—	—	60.1	81	—
690	—	—	59.7	—	—
680	—	—	59.2	80	—
670	—	—	58.8	—	—
660	—	—	58.3	79	—
650	—	—	57.8	—	—
640	—	—	57.3	77	—
630	—	—	56.8	—	—
620	—	—	56.3	75	—
610	—	—	55.7	—	—
600	—	—	55.2	74	—
590	—	—	54.7	—	2055
580	—	—	54.1	72	2020
570	—	—	53.6	—	1985
560	—	—	53	71	1950
550	(505)	—	52.3	—	1905
540	(496)	—	51.7	69	1860
530	(488)	—	51.1	—	1825
520	(480)	—	50.5	67	1795
510	(473)	—	49.8	—	1750
500	(465)	—	49.1	66	1705
490	(456)	—	48.4	—	1660
480	448	—	47.7	64	1620
470	441	—	46.9	—	1570
460	433	—	46.1	62	1530
450	425	—	45.3	—	1495
440	415	—	44.5	59	1460
430	405	—	43.6	—	1410
420	397	—	42.7	57	1370

Vickers hardness (HV)	Brinell hardness (HB) standard ball	Rockwell hardness		Shore hardness (HS)	Tensile strength (MPa)
		Scale B (HRB)	Scale C (HRC)		
410	388	—	41.8	—	1330
400	379	—	40.8	55	1290
390	369	—	39.8	—	1240
380	360	(110.0)	38.8	52	1205
370	350	—	37.7	—	1170
360	341	(109.0)	36.6	50	1130
350	331	—	35.5	—	1095
340	322	(108.0)	34.4	47	1070
330	313	—	33.3	—	1035
320	303	(107.0)	32.2	45	1005
310	294	—	31	—	980
300	284	(105.5)	29.8	42	950
295	280	—	29.2	—	935
290	275	(104.5)	28.5	41	915
285	270	—	27.8	—	905
280	265	(103.5)	27.1	40	890
275	261	—	26.4	—	875
270	256	(102.0)	25.6	38	855
265	252	—	24.8	—	840
260	247	(101.0)	24	37	825
255	243	—	23.1	—	805
250	238	99.5	22.2	36	795
245	233	—	21.3	—	780
240	228	98.1	20.3	34	765
230	219	96.7	(18.0)	33	730
220	209	95.0	(15.7)	32	695
210	200	93.4	(13.4)	30	670
200	190	91.5	(11.0)	29	635
190	181	89.5	(8.5)	28	605
180	171	87.1	(6.0)	26	580
170	162	85.0	(3.0)	25	545
160	152	81.7	(0.0)	24	515
150	143	78.7	—	22	490
140	133	75.0	—	21	455
130	124	71.2	—	20	425
120	114	66.7	—	—	390
110	105	62.3	—	—	—
100	95	56.2	—	—	—
95	90	52.0	—	—	—
90	86	48.0	—	—	—
85	81	41.0	—	—	—

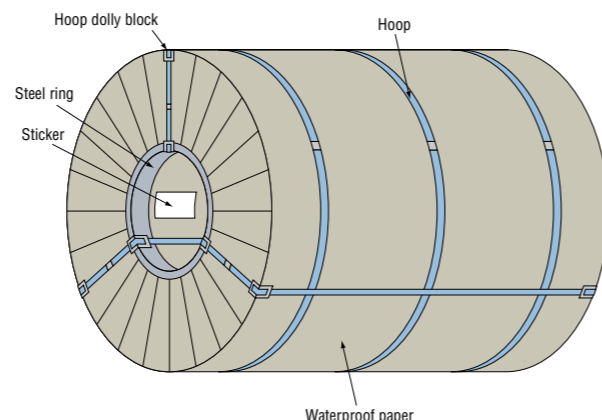
Packing and sticker indication

◆ Examples of packing

• Example of packing of a hot-rolled mill scale coil



• Example of packing of a hot-rolled pickled coil or a cold-rolled coil



◆ Example of sticker indication

KOBELCO COLD-ROLLED STEEL SHEET IN COIL				To:	
Standard S35C-R		Grade 1			
Dimensions 1.520 X 983 X COIL		Item number 082825		Supplier's code (1V) 	
Mass (net) 5120 KG				Item number (S) 	
Date of manufacture 20130128	Control number K19182			Mass/Quantity (O) 	
KOBE STEEL, LTD. Kakogawa Works				JISI A-1 KOBE STEEL, LTD.	

• For detailed information about the indication of a JIS mark, consult with us when you place an order.

Precautions

- ◆ The edge of a cold-rolled steel strip is very sharp. When handling it, be sure to follow safety measures such as wearing protective equipment.
- ◆ Hot-rolled pickled steel strips and cold-rolled steel strips may rust from becoming wet with water, condensation or other causes, even if rust preventive oil has been applied.

Order guide

See the following guide before contacting us to place an order.

[1] Standard

Choose an appropriate standard in accordance with the purpose of use of the product, degree of processing, method of processing and other factors. If you have any questions, please feel free to contact us.

[2] Dimensions

In principle, an order may be accepted for 0.1 mm in thickness and 1 mm in width and length.

[3] Inside and outside diameters of a coil

The following is the standard inside and outside diameter of a coil. Choose either.

Hot-rolled steel strip: 762 mm (30") or 610 mm (24")

Cold-rolled steel strip: 610 mm (24") or 508 mm (20")

If you have a limitation on the outside diameter of a coil, specify the maximum outside diameter.

[4] Classification of thermal refining

Choose from the following types of thermal refining. If you have any questions, please feel free to contact us.

Hot-rolled steel strip: No annealing and standard annealing

Cold-rolled steel strip: No annealing, hardness adjustment, standard annealing and spheroidizing

[5] Oil application

Rust preventive oil is usually applied to hot-rolled pickled steel strips and cold-rolled steel strips.

[6] Appearance quality

The products usually have a quality guarantee in the appearance of their outer surface.

[7] Ear finish

Specify either mill edge or slit edge.

[8] Other

Please inform us of the purpose of use for the product, your request for a specific processing method and any other requests. If you require stringent control on any of the items concerning our products, consult with us before placing an order.

If a defect has occurred, collect the defective coil and inform us of the relevant coil number.

Contact

Steel Sheet Sales Department

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Nagoya Branch Office
Chugoku Sales Office
Kyushu Sales Office

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