

ELECTRICAL STEEL

Product Manual



ELECTRICAL
STEEL



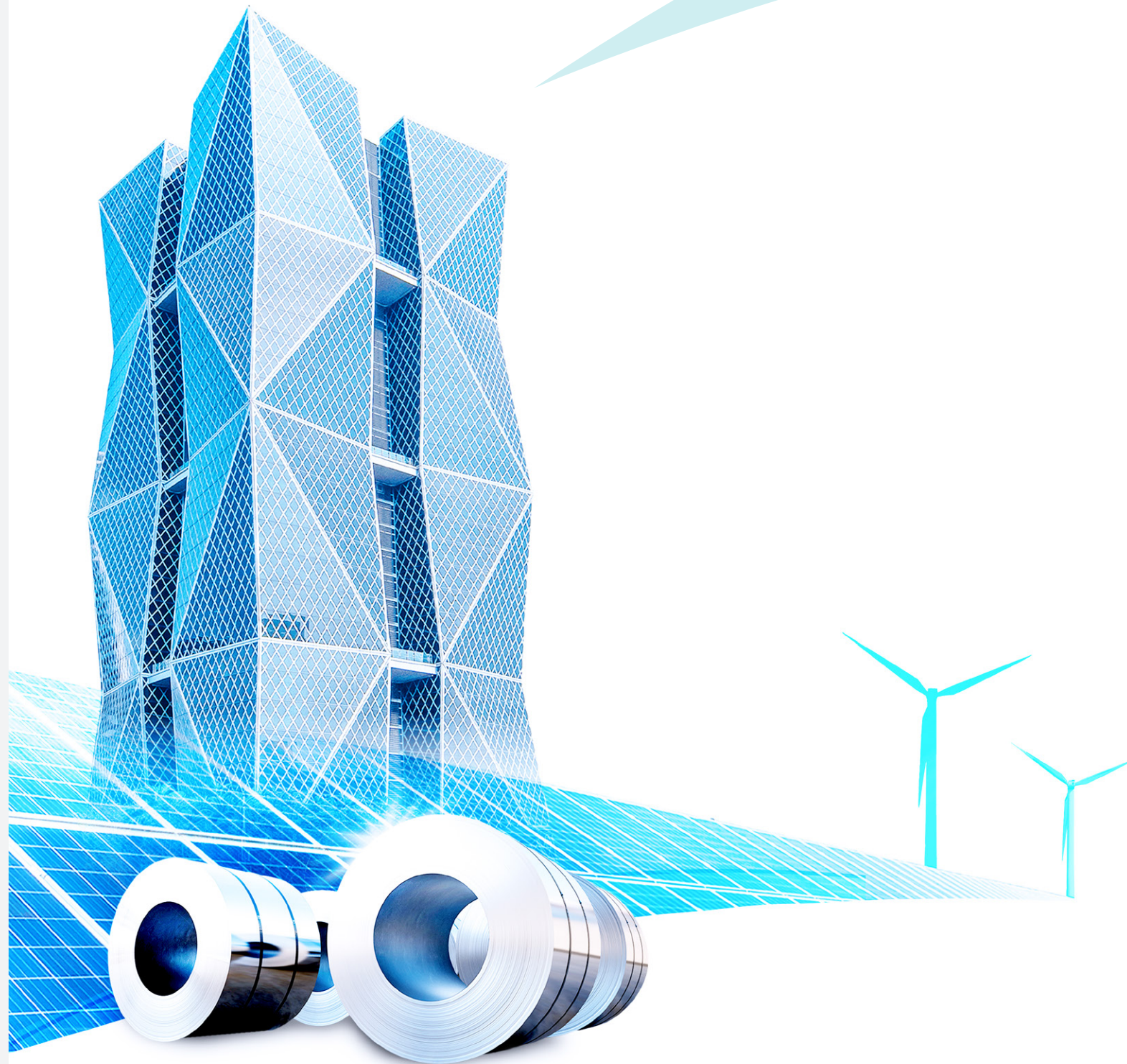
The quality policy of China Steel Corporation

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.

A brief about China Steel Corporation (CSC), located at Kaohsiung, Taiwan was founded in December 1971. With annual capacity (in terms of crude steel) over 10 million tones, CSC produces a range of products that encompasses hot and cold rolled coils, coated coils, plate, bars and wire rods. The domestic market takes roughly 55.2% of CSC's production. Exports take the remaining 44.8%. CSC is the largest steel company in Taiwan, enjoying more than 50% of the domestic market. Principal export destinations are Europe, Japan and Southeast Asia.

CSC has the courage to innovate, as well as strong capability to put the innovations into practice. The company's vision is: "We aspire to be a trustworthy steel company of global distinction that pursues growth, environmental protection, energy saving and value-innovation". CSC actively puts in practice its corporate values of teamwork, entrepreneurial approach, down-to-earthiness and pursuit of innovation. With the application of the latest technology and the most modern management concepts, it sinks deep roots for its core business in steel, and integrates the related downstream industries to foster healthy development of Taiwan's steel industry. CSC also moves toward diversification and toward developing into a globalized industrial group with the steel business at its core that extends to industrial materials, trade, transportation, engineering, finance, services, land development and state-of-the-art technology.



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



Electrical steel is a special type of steel applied to electrical machinery, transformers, and other electromagnetic devices. Because the silicon was added, it is commonly known as “silicon steel.” Its quality requirement is to ensure excellent electromagnetic properties, hence also was called “electrical steel.” Electrical steel is classified as grain-oriented (GO) or non-oriented (NO) by their texture, it can be classified as grain-oriented (GO) or non-oriented (NO). Currently only non-oriented steel sheets are available from China Steel Corporation (CSC).

Since the electrical steel coils had been produced in 1993, CSC has spent more than three decades continually refining its technology and expanding production. The company has made significant progress in the field of non-oriented electrical steel, not only increasing the capacity but also developing the high-grade products with low core loss, high magnetic flux density, high strength, and reduced thickness. These materials serve as excellent choices for manufacturing energy-efficient, low-carbon electrical equipment.

This catalog details general information such as the applications, specifications, and relevant product properties of the electrical steel manufactured by CSC. It serves to help downstream users to understand our materials properties.

China Steel Corporation (CSC) produces non-oriented electrical steel with the features of uniform magnetic properties, and this makes it especially suitable for a wide range of rotating machines and small transformers.

CSC's electrical steel products are manufactured under strict quality control through an integrated process—from steelmaking, rolling, annealing, and coating to final delivery to ensures that magnetic performance, dimensional accuracy, flatness, and coating quality all meet high standards, and all coating options are fully compliant with EU REACH and RoHS environmental regulations.

At the same time, in addition to continuously improving the magnetic properties, CSC is also investing in R&D to develop thinner top grades with lower core loss as well as new coating film. For example, the C3S self-bonding coating has taken the global lead by successfully achieving mass production for electric vehicle drive motors, providing customers with more diversified options in motor design.

Currently, all CSC's electrical steel grades have been widely applied in various electrical machines and equipment, and have been highly recognized by both domestic and international customers. The main applications of each grade are summarized in Table 1.

Table1: Applications of electrical steel

Grade		Thin gauge and top grade	Top grade	High grade	Medium grade	General grade
		15CS1200HF 20CS1150FY~1500HF(P) 25CS1200FY~1500HF 27CS1350FY~27CS1450FY 30CS1450FY~1800HF	35CS210~250 50CS230~290	35CS300~440 50CS350~470 65CS400~470	35CS550 50CS600~800 65CS600~1300	50CS1000~1300
Rotating Machines	Huge Motor		●	●		
	General medium Motor		●	●	●	●
	Compressor motors		●	●	●	●
	Small precision motors	●	●	●	●	
	Automotive drive motors	●	●			
	Other high-speed motors	●	●			
Static Machine	Medium power transformers		●	●	●	●
	Audio transformers		●	●	●	●
	Welding transformers	●			●	●
	Ballast		●	●	●	●
	Magnetics switch cores		●	●		



Electrical steel is a key material for manufacturing motor cores. In recent years, with the global rise in environmental awareness and the booming new energy vehicle market, the demand for steel used in drive motors has surged significantly. Moreover, the application fields of high-speed motors are gradually expanding with rapid technological advancements. Therefore, the development trend for electrical steel products is moving towards thinner gauge, low iron loss, high magnetic flux, and high strength.

China Steel Corporation expected these market changes as early as 2009 and planned to invest thin gauge and top grade electrical steel production line for high-speed, high-efficiency, and high-safety electric motor applications. The production line was launched in 2014, so that we can get a head start. After more than a decade of refinement, CSC's thin gauge and top grade electrical steels have matured significantly, able to meet various motor design and specification requirements, and has assisted countless customers in successfully developing new products and improving motor efficiency, thus establishing a world-leading brand reputation.

Thin Gauge and Top Grade Electrical Steel for Electric Vehicle Drive Motors (HF Series)

This product offers excellent low iron loss at a high-frequency, suitable for high-speed, low iron loss electric vehicle motors.

High Magnetic Flux, High Permeability Electromagnetic Steel for Drone Motors (P Series)

This product offers excellent low iron loss and high magnetic permeability, suitable for high-speed drones, cooling fans, and similar applications.

The Self-Bonding film(C3S) for Next Generation Electric Vehicle Drive Motor Application

The self-bonding film can assemble motor core through the adhesive strength of the film itself, eliminating the efficiency loss issues caused by traditional riveting or welding processes. It improves motor performance and efficiency, making it suitable for electric vehicle and drone motor usage. (Please refer to 8.4 Insulation Coating Characteristics)

High-Strength Thin Gauge Electromagnetic Steel for Electric Vehicle Drive Motors (FY Series)

This product offers outstanding low iron loss at a high-frequency and high strength, suitable for high-speed, low iron loss, and high-safety electric vehicle motors.

Annealed Thin Gauge and Top Grade Electrical Steel for Electric Vehicle Drive Motors (AFY Series)

This product offers excellent high strength, and it achieves low iron loss at a high frequencies after annealing process, suitable for rotors requiring high strength and stators demanding low iron loss in high-safety electric vehicle motors.

Classification	Grade of CSC Spec.	Density (kg/dm ³)	Iron Loss			Magnetic Flux Density, min		Mechanical Properties			Hardness
			W10/400 (W/Kg)		W15/50 (W/Kg)	B50 (Tesla)		YS (MPa)	TS (MPa)	EL (%)	HV1
			Guarantee (Max.)	Typical	Typical	Guarantee (Min.)	Typical	Typical			Typical
General thin gauge and Top Grade	15CS1200HF	7.60	12.0	10.5	2.3	1.60	1.63	373	492	15	183
	20CS1200HF	7.60	12.0	11.5	2.1	1.62	1.65	381	509	15	199
	20CS1500HF	7.65	15.0	12.3	2.3	1.63	1.66	328	460	20	176
	25CS1250HF	7.60	12.5	12.1	2.0	1.62	1.66	418	535	17	216
	25CS1500HF	7.65	15.0	13.7	2.2	1.65	1.68	328	461	21	180
	27CS1450HF	7.60	14.5	12.6	1.9	1.62	1.66	408	527	16	217
	30CS1450HF	7.60	14.5	13.8	2.0	1.62	1.66	414	528	18	216
	30CS1600HF	7.65	16.0	15.5	2.1	1.65	1.69	357	489	16	196
	30CS1800HF	7.65	18.0	15.9	2.2	1.65	1.68	334	455	25	183
	35CS1750HF	7.60	17.5	16.1	2.1	1.64	1.67	416	535	18	212
High Strength	35CS1850HF	7.60	18.5	17.2	2.2	1.65	1.68	377	509	22	201
	15CS1000FY	7.60	10.0	9.8	2.1	1.60	1.62	473	567	9	232
	20CS1150FY	7.60	11.5	10.6	1.9	1.60	1.65	452	560	13	231
	20CS1200FY	7.60	12.0	10.8	2.1	1.60	1.65	427	551	16	217
	25CS1200FY	7.60	12.0	11.8	1.9	1.62	1.66	450	565	13	225
	25CS1250FY	7.60	12.5	12.0	2.0	1.62	1.66	425	544	16	218
	27CS1350FY	7.60	13.5	12.3	1.9	1.60	1.66	456	559	10	225
	27CS1450FY	7.60	14.5	12.7	2.0	1.62	1.66	428	555	18	217
	30CS1400FY	7.60	14.0	13.7	1.9	1.62	1.66	459	568	10	227
	30CS1450FY	7.60	14.5	13.5	2.0	1.62	1.66	440	549	11	229
High Flux magnetic	30CS1500FY	7.60	15.0	13.9	2.1	1.62	1.66	433	557	17	218
	35CS1600FY	7.60	16.0	14.7	1.9	1.65	1.67	462	563	10	228
	20CS1500P	7.65	15.0	11.5	2.0	1.67	1.68	318	441	17	173
	25CS2000P	7.70	20.0	16.3	2.9	1.73	1.74	256	388	28	136
	27CS2000P	7.70	20.0	16.8	2.5	1.73	1.74	261	388	28	145
Annealing Type	30CS2000P	7.70	20.0	19.2	2.8	1.73	1.75	258	404	35	143
	20CS1100AFY*	7.60	11.0	9.9	-	1.60	1.61	560	656	24	228
	25CS1100AFY*	7.60	11.0	10.8	-	1.63	1.64	539	637	19	239

Note: (1) The result was tested in accordance with JIS Z 2241 method. The test direction of tensile test is Longitudinal.
(2) W15/50, W10/400 indicates the iron loss when the frequency is 50Hz, 400 Hz and the maximum magnetic flux density is 1.5T(1.5Wb/m²) and 1.0T.
(3) B50 indicates the magnetic flux density under the magnetic force 5000 A/m.
(4) AFY series products require stress relief annealing (SRA) at 850°C for 1 hour to achieve proper magnetic properties. The iron loss and magnetic flux density listed in the table are typical values after SRA. The mechanical properties and hardness are typical values before SRA. Please contact us if you would like to place an order for this specification.
(5) The data on above table is one example of sampling and for reference only.

The steel mill first sends the molten pig iron produced in the blast furnace to the pre-treatment station for desulfurization and dephosphorization. After blowing in the converter, the molten steel undergoes various treatments according to the characteristics and quality requirements of the ordered steel grades to adjust its composition. It is then cast into semi-finished steel slabs, which are inspected, ground, or surface defects are scarfed/burned off, or they are sent directly downstream to be rolled into hot-rolled steel coils.

The hot rolling process involves heating the flat steel slab, which is then rolled into a steel strip by the roughing mill and finishing mill. The strip is sprayed with water via a laminar cooling system to cool it to an appropriate temperature, and finally coiled into a crude steel coil by a coiler.

The cold rolling line utilizes a tension leveler and pickling to remove the scale from the hot-rolled steel coil. The steel strip is cleaned and dried to remove residual acid from the surface. A side trimmer then cuts the steel strip to the width required by the downstream production line. The strip is then rolled to the thickness required by the customer by a five-stand six-high rolling mill, and an automatic flatness controller is used to improve the flatness of the steel strip.

The annealing and coating line includes processes such as cleaning, annealing, coating, and edge trimming. After the steel strips are welded together by a welding machine, they enter the annealing furnace for annealing. The annealing furnace imparts different annealing temperatures according to different steel grades to achieve the required iron loss value.



6.1 Product Grade Symbols

Our electrical steel is designated using CSC (China Steel Corporation) specifications. The performance of all grades under the CSC specification fully meets the performance requirements of equivalent grades in standards such as JIS C2552 and CNS 7215, and they exhibit a superior iron loss value. The explanations of CSC product grade symbols and a summary of the specification contents are as follows.



e.g. The CSC symbol 50CS1300 denotes an electrical steel grade with a thickness of 0.5mm, which is equivalent to the 50A1300 grade specified in the JIS C2552 standard.

6.2 Standard Specifications and High Magnetic Flux Density Specifications

CSC Specs.	Thickness (mm)	Density (kg/dm ³)	Maximum Core Loss (W/kg)	Minimum Magnetic Flux Density (T)
			W15/50	B50
35CS210	0.35	7.60	2.1	1.62
35CS230		7.60	2.3	1.62
35CS250		7.60	2.5	1.62
35CS270		7.65	2.7	1.62
35CS300		7.65	3.0	1.62
35CS440		7.70	4.4	1.64
35CS550		7.65	5.5	1.68
50CS230	0.50	7.60	2.3	1.62
50CS250		7.60	2.5	1.62
50CS270		7.60	2.7	1.62
50CS290		7.60	2.9	1.62
50CS350		7.65	3.5	1.62
50CS400		7.65	4.0	1.64
50CS470	0.65	7.70	4.7	1.64
50CS600		7.75	6.0	1.68
50CS700		7.75	7.0	1.68
50CS800		7.75	8.0	1.68
50CS1000		7.85	10.0	1.70
50CS1300		7.85	13.0	1.70
65CS400	0.65	7.65	4.0	1.62
65CS470		7.65	4.7	1.62
65CS600		7.75	6.0	1.65
65CS700		7.75	7.0	1.65
65CS800		7.75	8.0	1.65
65CS1300		7.75	13.0	1.70
35CS250H	0.35	7.65	2.5	1.65
35CS300H		7.65	3.0	1.65
50CS470H	0.50	7.70	4.7	1.67
50CS600H		7.75	6.0	1.69

Notes: (1) The density is a reference value used in the calculation of the test piece cross-sectional area, and the actual density may vary slightly due to the steel grade composition.
(2) The core loss W15/50 denotes the core loss (iron loss) at a frequency of 50 Hz and a maximum magnetic flux density of 1.5 T (1T = 1 Wb/m²).
(3) The magnetic flux density B50 denotes the magnetic flux density at a magnetizing force of 5000 A/m.

Thickness (mm)							
0.15	0.20	0.25	0.27	0.30	0.35	0.50	0.65
Width Range(mm)							
1000~1260							

Notes: Please contact the company for any other size requirements.

8.1 Typical Mechanical Properties and Stacking Factor

The typical mechanical properties and stacking factor of CSC electrical steel are shown in the table below.

Typical Mechanical Properties and Stacking Factor of CSC Electrical Steel

Category	Spec	YS (N/mm ²)		TS (N/mm ²)		Elongation (%)		Hardness		Stacking Factor (%)
		L	C	L	C	L	C	HR30T	HV1	
Standard Specifications	35CS210	425	436	535	544	15	15	72	234	99
	35CS230	415	425	521	517	16	16	71	230	
	35CS250	379	390	515	526	22	22	69	202	
	35CS270	355	365	490	500	24	24	68	196	
	35CS300	332	345	478	490	26	26	66	191	
	35CS440	308	310	430	445	30	31	62	161	
	35CS550	292	302	403	414	34	35	59	142	
	50CS230	441	450	561	566	21	20	74	226	
	50CS250	411	421	532	542	19	21	72	223	
	50CS270	420	446	542	570	23	26	73	218	
	50CS290	376	394	513	537	25	26	71	205	
	50CS350	348	359	481	496	28	29	68	179	
	50CS400	318	329	453	473	29	31	66	176	
	50CS470	294	297	442	452	36	36	63	159	
	50CS600	275	267	413	418	38	39	60	139	
	50CS700	298	318	424	443	36	35	60	142	
	50CS800	332	342	407	414	35	32	61	141	
	50CS1000	313	323	402	410	37	38	58	136	
	50CS1300	312	330	388	394	37	38	59	135	
	65CS400	329	340	475	487	31	32	68	187	
	65CS470	336	353	484	501	31	33	68	181	
	65CS600	276	278	411	415	37	38	59	144	
	65CS700	290	300	421	434	36	38	60	142	
	65CS800	300	314	433	427	37	38	61	144	
	65CS1300	316	324	402	408	37	38	62	149	
High Magnetic Flux Density Specifications	35CS250H	331	342	472	490	25	26	66	187	99
	35CS300H	310	326	434	450	22	22	64	183	
	50CS470H	285	294	442	456	35	36	63	161	
	50CS600H	255	260	395	407	37	38	60	139	

Notes: (1) Testing is conducted according to JIS C 2550 (2000). L indicates that the test piece is parallel to the rolling direction, and C indicates that the test piece is perpendicular to the rolling direction.

(2) The values listed in the table above are examples only and are not guaranteed values.

8.2 Typical Electromagnetic Properties

Electromagnetic properties are the most important characteristics of electrical steel. China Steel Corporation (CSC) has continuously improved the electromagnetic characteristics through ongoing modifications to the metallurgical process conditions. In addition to complying with the JIS C2552 standard, CSC's electrical steel exhibits superior electromagnetic properties. The typical properties are shown in the table below.

Typical Electromagnetic Properties of CSC Electrical Steel

Category	Spec	Resistivity ($\mu\Omega\cdot\text{cm}$)	Maximum Core Loss (W/kg)					Minimum Magnetic Flux Density (T)				
			W _{10/50}	W _{15/50}	W _{10/60}	W _{15/60}	W _{10/400}	B3	B10	B25	B50	B100
Standard Specifications	35CS210	62	0.81	2.04	1.02	2.46	15.57	1.36	1.48	1.57	1.67	1.79
	35CS230	62	0.90	2.18	1.11	2.75	17.31	1.32	1.45	1.55	1.65	1.78
	35CS250	54	0.91	2.34	1.15	2.72	17.40	1.37	1.49	1.59	1.68	1.80
	35CS270	51	0.93	2.40	1.18	2.78	17.90	1.36	1.49	1.59	1.69	1.81
	35CS300	48	0.98	2.45	1.23	2.85	18.10	1.37	1.51	1.60	1.70	1.81
	35CS440	39	1.34	2.92	1.66	3.63	21.59	1.41	1.55	1.64	1.72	1.83
	35CS550	30	1.92	4.08	2.36	5.07	28.31	1.42	1.57	1.66	1.71	1.85
	50CS230	62	0.98	2.30	1.26	2.97	22.97	1.31	1.45	1.56	1.66	1.78
	50CS250	62	1.04	2.42	1.34	3.12	24.43	1.32	1.46	1.57	1.67	1.79
	50CS270	62	1.12	2.52	1.43	3.22	25.42	1.30	1.47	1.57	1.67	1.79
	50CS290	54	1.08	2.61	1.39	3.21	25.94	1.35	1.49	1.59	1.69	1.81
	50CS350	49	1.16	2.73	1.49	3.42	27.42	1.37	1.52	1.62	1.70	1.82
	50CS400	44	1.34	2.98	1.70	3.81	28.69	1.40	1.54	1.63	1.72	1.82
	50CS470	43	1.51	3.29	1.91	4.20	31.64	1.42	1.57	1.66	1.73	1.85
	50CS600	34	1.76	4.06	2.23	4.94	36.80	1.41	1.56	1.65	1.72	1.84
	50CS700	29	2.09	4.47	2.62	4.73	40.31	1.40	1.57	1.67	1.72	1.86
	50CS800	32	2.46	4.98	3.07	6.43	43.72	1.36	1.55	1.66	1.72	1.85
	50CS1000	26	2.51	5.42	3.15	6.89	48.39	1.41	1.58	1.67	1.75	1.87
	50CS1300	23	2.87	5.88	3.60	7.42	50.78	1.21	1.57	1.67	1.75	1.87
	65CS400	45	1.40	3.20	1.83	4.20	39.06	1.35	1.50	1.61	1.70	1.81
	65CS470	44	1.71	3.64	2.21	4.72	41.87	1.37	1.55	1.64	1.73	1.83
High Magnetic Flux Density Specifications	65CS600	29	2.10	4.69	2.70	6.19	53.10	1.38	1.54	1.65	1.71	1.84
	65CS700	30	2.33	5.18	2.99	6.71	56.44	1.37	1.57	1.66	1.72	1.85
	65CS800	29	2.11	5.36	2.73	6.27	54.90	1.37	1.54	1.65	1.71	1.84
	65CS1300	27	3.18	5.92	4.05	8.33	66.51	1.12	1.55	1.67	1.72	1.86
	35CS250H	49	0.94	2.26	1.19	2.73	18.27	1.39	1.52	1.61	1.70	1.82
	35CS300H	44	1.01	2.45	1.28	2.92	19.25	1.41	1.53	1.63	1.72	1.84
	50CS470H	43	1.45	3.30	1.84	4.05	30.90	1.41	1.56	1.66	1.74	1.85
	50CS600H	29	1.79	3.78	2.25	5.08	38.50	1.40	1.57	1.67	1.76	1.86

Notes: (1) Testing is conducted according to JIS C 2550 (2000). L indicates that the test piece is parallel to the rolling direction, and C indicates that the test piece is perpendicular to the rolling direction.
(2) The values listed in the table above are examples only and are not guaranteed values.

8.3 Transverse Thickness Variation

The typical transverse thickness variation of CSC electrical steel coils is listed in the table below.

Typical Transverse Thickness Variation of CSC Electrical Steel Coils

	Thickness Variation between Center and Edge of Width			
	5 mm from the edge	15 mm from the edge	25 mm from the edge	50 mm from the edge
Average	0.010 mm	0.006 mm	0.004 mm	0.003 mm
Maximum	0.020 mm	0.012 mm	0.008 mm	0.006 mm

8.4 Insulation Coating Characteristics

The insulation coatings available for CSC electrical steel surfaces include four types: C628, C6N8, G1MN, and C3S.

Among these, C628, C6N8, and G1MN are organic-inorganic hybrid coatings, classified as Type C5 coatings according to the ASTM standard. C628 is a chrome-containing coating, while C6N8 and G1MN are chrome-free coatings.

CSC has also independently developed a fast-curing self-bonding (or self-adhesive) coating, C3S, to address the issues of edge warping often caused when punching thin electrical steel sheets, and the degradation of motor efficiency due to residual stress during core riveting. This finished product coil is non-tacky (or non-sticky) at room temperature. After slitting and punching by the customer, a pressing and heating process is applied, which causes the coating to undergo a cross-linking reaction. This results in a self-bonded core with stable adhesion, high dimensional accuracy, high rigidity and bonding strength, and excellent electromagnetic properties. C3S is an organic, chrome-free, self-bonding coating, classified as a Type C3 coating according to the ASTM standard.

Please refer to the table below for the basic characteristics of the coatings.

Properties of Electrical Steel Coil Coatings

Coating Code	C628		C6N8		G1MN (EB5350S)	C3S	
Feature	Chromate		Chromate-free		Chromate-free	Self-bonding	
Composition	Chromate + Resin		Phosphate + Resin		Rembrandtin EB5350S	Resin	
Coating Thickness	Regular	0.4~0.8μm	Regular	0.4~0.8μm	0.8~1.2μm	Regular	1.0~2.0μm
	Heavy	0.8~1.2μm	Heavy	0.8~1.2μm		Customized coating thickness is negotiable	
Resistance (JIS C2550)	Regular	≥ 2.5Ω-cm ² /sheet	Regular	≥ 2.5Ω-cm ² /sheet	≥ 15Ω-cm ² /sheet	Regular	≥ 2.5Ω-cm ² /sheet
	Heavy	≥ 5.0Ω-cm ² /sheet	Heavy	≥ 5.0Ω-cm ² /sheet		Customized coating thickness is negotiable	
Stacking Factor	Regular	≥ 97.5%	Regular	≥ 97.5%	≥ 97.0%	Regular	≥ 96.5%
	Heavy	≥ 97.0%	Heavy	≥ 97.0%		Customized coating thickness is negotiable	
Anti-corrosion Bending Test	After subjecting the sample to a 5% salt spray (mist) test at a temperature of 35°C for 5 hours, the observed red rust area was less than 40%						
Bending Test	Using a 10mm bending mandrel diameter (Φ10mm radius), there was no film detachment (no coating delamination) observed on the outer bend. The coating adhesion is rated as good.						
Solvent Test	No film detachment (or coating removal) after 50 cycles of rubbing with alcohol.						
Punchability	No film detachment (or coating delamination) was observed after slitting, shearing, and punching. The coating adhesion remains good.						
Annealing Capability	The coating remained smooth and intact (or complete) after heat treatment at 750°C for 1 hour under N ₂ (Nitrogen) protection (or atmosphere).					No	
Bonding Strength (ASTM D1002)	N/A					Regular	>2 MPa
						Customized coating thickness is negotiable	

9.1 Avoiding rust and aging:

- (1) Due to slitting and punching that cause broken coating film, the ruptured surface will easily rusted, particularly in summer season when the relative humidity is high, So, it needs careful package and anti-rust treatment.
- (2) For having better magnetic property, electrical steel generally was produced without temper rolling process. Electrical steel is prone to strain aging; therefore, to avoid coil break during the slitting process, coils should not be stored for long periods.
- (3) For C3S self-bonding coating and thin-gauge products with a thickness of 0.25 mm or less, it is recommended not to stack them or to place them only on the upper layer during storage to prevent coil deformation or collapse caused by compression. If storage space is limited, please try to stack coils with similar weight from the same batch as much as possible to avoid the situation where larger coils press on smaller ones.

9.2 Stress-relief annealing

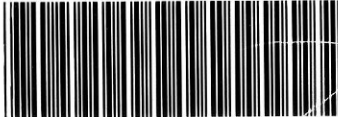
Magnetic properties of electrical steel coils will be deteriorated by mechanical strains when it was sheared and punched into laminations or cores. In order to relieve these stresses and restore the original magnetic properties, general stress-relief annealing is necessary. The following points are observed when laminations or cores are processed to stress-relief annealing.

- (1) The C6N8, C628, and G1MN coating films on our electrical steel coils are hybrid organic-inorganic types, which has certain level of annealing resistance. In principle, stress-relief annealing can be carried out at 750 °C for 1 hour in a non-oxidizing atmosphere. For any other temperature or atmosphere requirements, please feel free to contact CSC for feasibility evaluation.
- (2) The magnetic property almost was not affected by ordinary industrial cooling rate scale, but excessive heating and cooling will make distortion in cores. However, cooling should be taken until it reaches 350°C so that no strain will occur in material.
- (3) Since carburization and excessive oxidation will deteriorate magnetic properties of steel, the atmospheric gas must be carefully controlled and the dew point must be kept low. On the other hand, the oil and grease remained during fabrication also must be removed completely, and the low carbon materials are recommended to be used in the base and cover of annealing furnace.

10.1 Coil Packaging



10.2 Coil Marking and Labeling

		中國鋼鐵股份有限公司 China Steel Corporation	
Product name 品名	MAGNETIC COIL(NON – ORIENTED)		
Specification 規格	CSC 50CS1000		
Size 尺寸	0.500^{mm} x 1200^{mm} x COIL		
Identification no 鑑別代號	W199090		
Net mass 淨質量	5,265	kg	
Gross mass 總質量	5,305	kg	
Film code 塗膜代號	C6N8/C6N8		
			Heat no 爐號 5VS99

Nominal Thicknessmm	Core Loss W/kg max. W _{15/50}	中鋼	日本	國際電工	歐盟	中國	美國
		CSC	JIS C2552 (2014)	IEC 60404-8-4 (2022)	EN 10106 (2015)	GB/T 2521.1 (2016)	ASTM A677-16 (2023)
0.35	1.90	35CS190	—	—	—	—	—
	2.10	35CS210	35A210	M210-35A5	M210-35A	35W210	—
	2.30	35CS230	35A230	M230-35A5	—	35W230	—
	2.50	35CS250	35A250	M250-35A5	M250-35A	35W250	36F145 (2.52)
	3.00	35CS300	35A300	M300-35A5	M300-35A	35W300	36F175 (3.05)
	4.40	35CS440	35A440	—	—	35W440	—
	5.50	35CS550	—	—	—	—	—
0.50	2.30	50CS230	50A230	M230-50A5	M230-50A	50W230	—
	2.50	50CS250	50A250	M250-50A5	M250-50A	50W250	—
	2.70	50CS270	50A270	M270-50A5	M270-50A	50W270	—
	2.90	50CS290	50A290	M290-50A5	M290-50A	50W290	47F165 (2.88)
	3.50	50CS350	50A350	M350-50A5	M350-50A	50W350	47F200 (3.48)
	4.00	50CS400	50A400	M400-50A5	M400-50A	50W400	47F240 (4.18)
	4.70	50CS470	50A470	M470-50A5	M470-50A	50W470	47F280 (4.87)
	6.00	50CS600	50A600	M600-50A5	M600-50A	50W600	—
	7.00	50CS700	50A700	M700-50A5	M700-50A	—	47F400 (6.97)
	8.00	50CS800	50A800	M800-50A5	M800-50A	50W800	47F450 (7.84)
	10.00	50CS1000	50A1000	M1000-50A5	—	50W1000	—
	13.00	50CS1300	50A1300	—	—	—	—
0.56	8.00	56CS800	—	—	—	—	—
0.65	4.00	65CS400	65A400	M400-65A5	M400-65A	65W400	64F225 (3.92)
	4.70	65CS470	65A470	M470-65A5	M470-65A	65W470	64F275 (4.79)
	6.00	65CS600	65A600	M600-65A5	M600-65A	65W600	—
	7.00	65CS700	65A700	M700-65A5	M700-65A	—	—
	8.00	65CS800	65A800	M800-65A5	M800-65A	65W800	64F500 (8.70)
	13.00	65CS1300	65A1300	—	—	—	—

Notes: (1) W15/50 represents the core loss measured at a frequency of 50 Hz and a maximum magnetic flux density of 1.5 T (1 T = 1 Wb/m²).

Symbols and Units

Property	Unit	Symbol
Electric Current	ampere	A
Voltage	volt	V
Resistance	ohm	Ω
Inductance	Henry	H
Magnetic Flux	Weber	Wb
Magnetic Field Intensity/Strength	oersted	Oe
Magnetic Flux Density	tesla	T
Core Loss(Iron Loss)	watt/kg	W/kg
Frequency	hertz	Hz
Power	Watt	W

Unit Conversion Tables

Magnetic Field Intensity(Strength)

	Oe	A/m	A/in
1 Oe	1	7.96 X 10 ¹	2.02
1 A/m	1.26 X 10 ⁻²	1	2.54 X 10 ⁻²
1 A/in	4.95 X 10 ⁻¹	3.94 X 10 ¹	1

Magnetic Flux Density

	Gauss (G)	T	Wb/m ²	Line/in ²
1 Gauss (G)	1	1.00 X 10 ⁻⁴	1.00 X 10 ⁻⁴	6.45
1 T	1.00 X 10 ⁴	1	1	6.45 X 10 ⁴
1 Wb/m ²	1.00 X 10 ⁴	1	1	6.45 X 10 ⁴
1 Line/in ²	1.55 X 10 ⁻¹	1.55 X 10 ⁻⁵	1.55 X 10 ⁻⁵	1

Core Loss(Iron Loss)

	W/kg	W/lb
1 W/kg	1	4.54 X10 ⁻¹
1 W/lb	2.20	1

1. The contents of this catalog are for reference only-customers are urged to consult the specifications published by the corresponding Associations.
2. Information of the available steel grades, sizes, marking and packing as shown herein may be updated without notice to comply with actual production situations.
3. We invite you to contact our Head Office should you have any questions concerning steel specifications or ordering requirements.

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