

Baosteel Non-oriented Silicon Steel

Application Technology



Complete Material Database Support

Magnetic simulation for motor design

- DC & AC magnetization curves
- AC magnetization curves under special waveforms

Safety design

- Changes in mechanical property with temperature
- Changes in magnetic performance with temperature
- Fatigue performance



Stress analysis in rotor

Yield strength, tensile strength, stress - strain curve, elastic modulus

Cooling system design

Heat coefficient, expansion coefficient

An updating and complete database of non-oriented silicon steel provides our customers a strong support with data of mechanical properties, magnetic properties under normal and special working conditions. Data could be in format of performance index or original test curves points according to customers' requirement.

Non-oriented silicon steel database for NEV

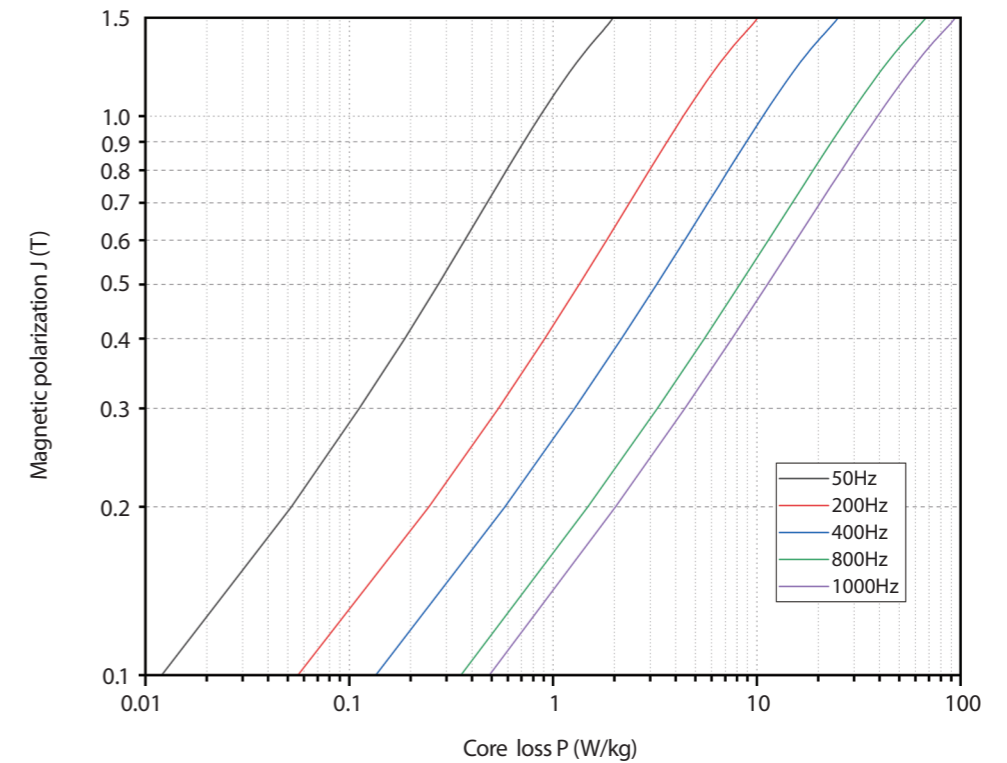
Typical magnetic properties	Mechanical properties at various temperatures (-40°C~250°C)	Other physical properties
20Hz~10kHz AC Core loss Curves	Yield strength	Heat coefficient
D.C. Magnetization Curves	Tensile strength	Coefficient of thermal expansion
20Hz~10kHz Magnetization Curves at various temperatures (-40°C~150°C)	Elongation	Elastic modulus
AC loss curve under special waveform	Fatigue strength(ambient temperature)	Number of bends

Magnetic Properties Test Platform

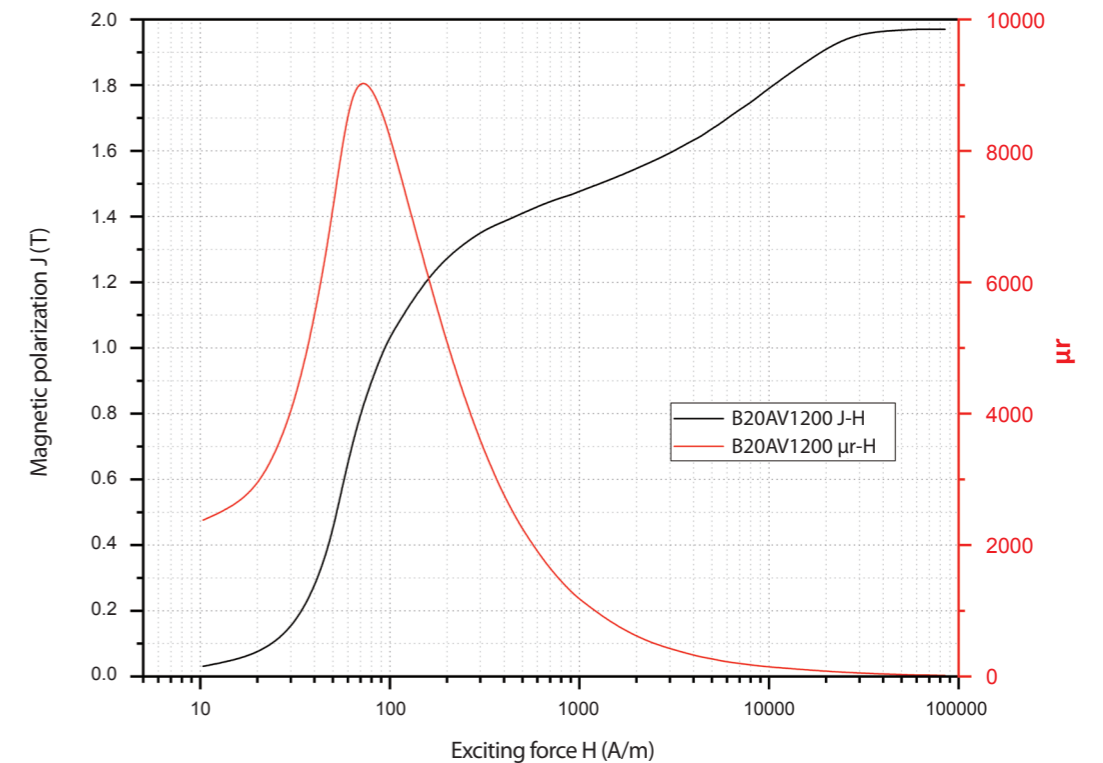
With complete material properties test platform, Baosteel could provide customers with magnetic properties data at any frequency between 20Hz and 10kHz and magnetic flux density up to 100kA/m, the measurement of J-P, J-H and H-μ and other forms of magnetic properties curves, to fully make use of the material properties to the greatest extent.

Taking B20AV1200 as an example

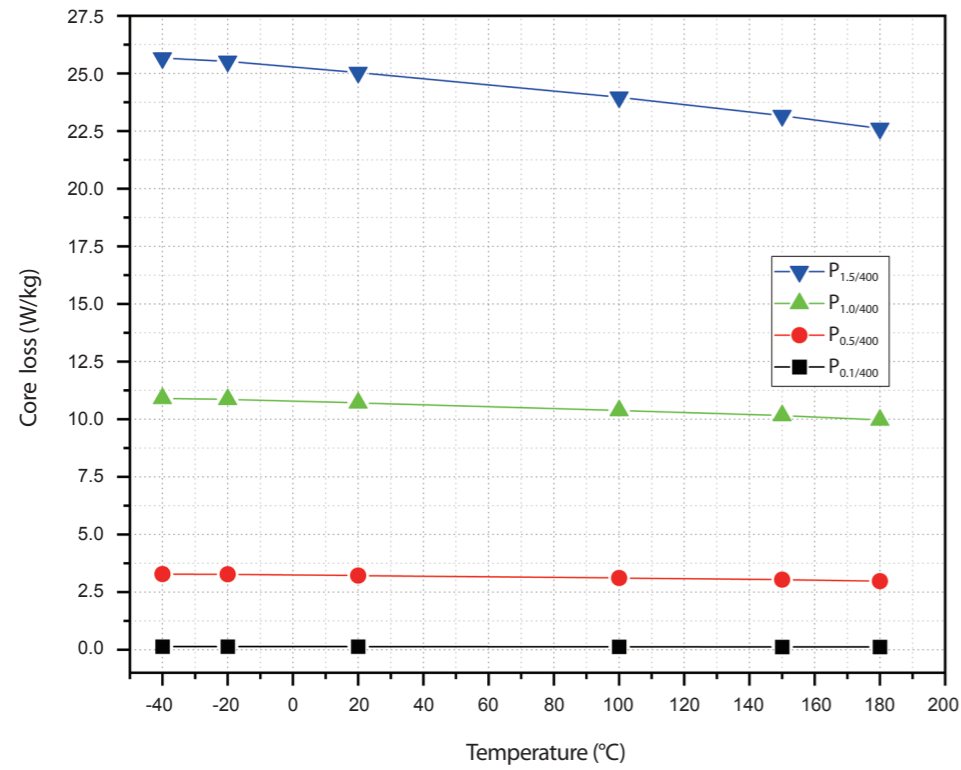
■ Iron loss curve



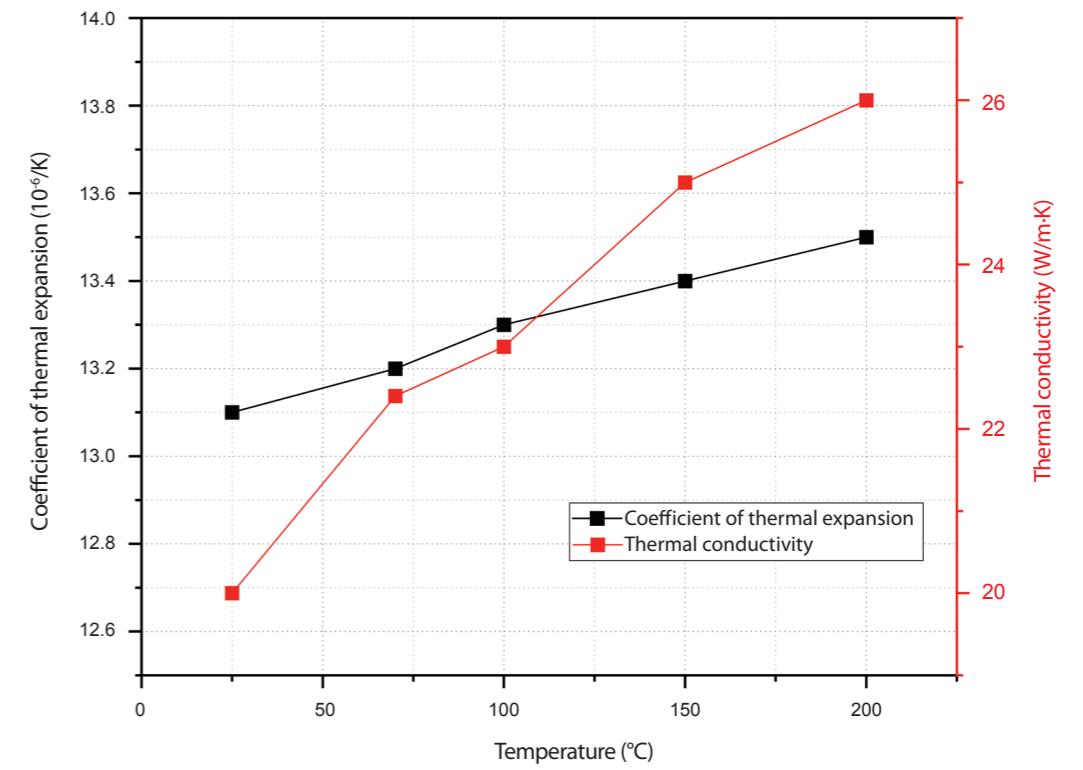
■ DC magnetization curve



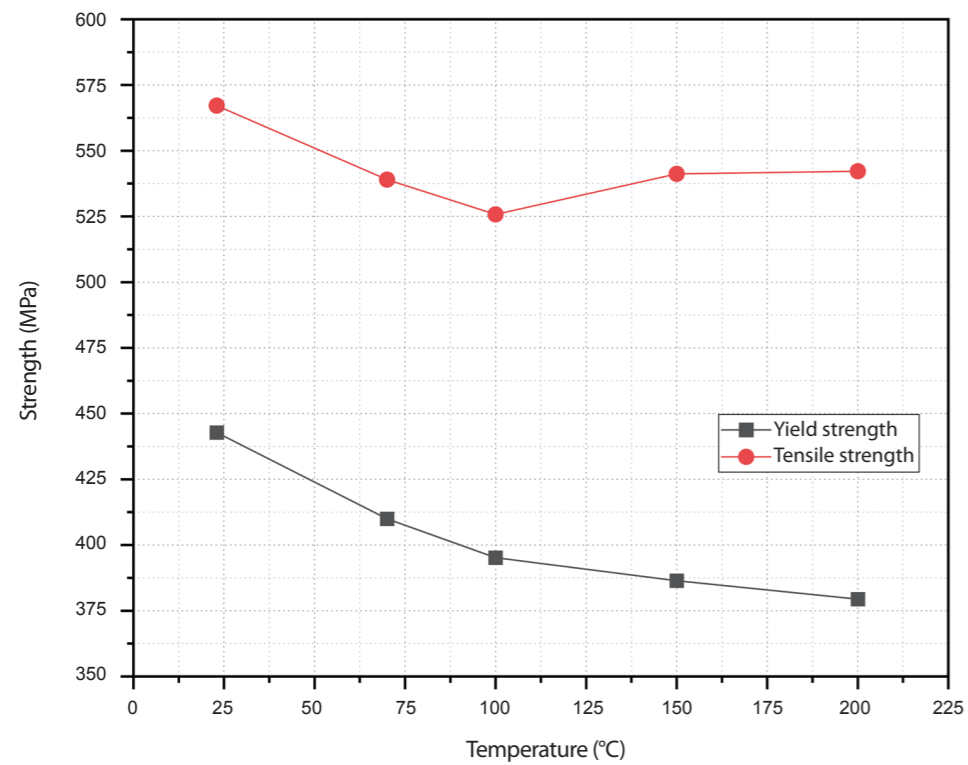
Iron loss - temperature curve



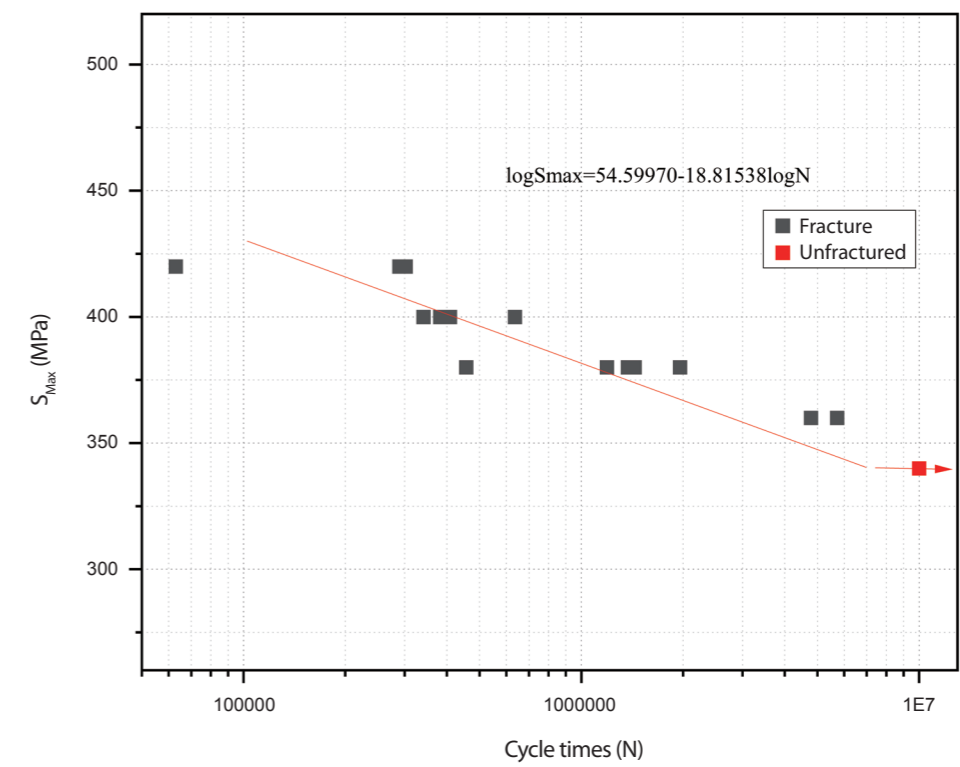
Thermal conductivity/coefficient of thermal expansion - temperature curve



Yield/tensile strength - temperature curve



Fatigue curve



4.3 Properties of Non-oriented Silicon Steel

4.3.1 Magnetic and Mechanical Properties

■ Electrical vehicle drive motor series

Type	Grade	Density (g/cm ³)	Core loss P _{1.0/400} (W/kg)		Core loss P _{1.0/800} (W/kg)	Magnetic polarization J ₅₀₀₀ (T)		Yield strength (MPa)
			Guarantee value	Typical value		Typical value	Guarantee value	
Low loss AV series	B15AV1000	7.60	≤10.0	9.5	23.8	≥1.60	1.62	425
	B20AV1200	7.60	≤12.0	10.6	28.7	≥1.61	1.63	445
	B20AV1300	7.65	≤13.0	12.0	31.5	≥1.63	1.64	395
	B25AV1300	7.60	≤13.0	12.0	33.2	≥1.62	1.63	440
	B27AV1400	7.60	≤14.0	13.2	37.5	≥1.62	1.64	440
	B30AV1500	7.60	≤15.0	14.2	41.0	≥1.63	1.64	445
	B35AV1700	7.60	≤17.0	16.2	47.5	≥1.64	1.66	438
	B35AV1800	7.60	≤18.0	17.2	50.5	≥1.64	1.66	413
	B35AV1900	7.65	≤19.0	17.5	52.5	≥1.65	1.67	400
	B35AV2000	7.65	≤20.0	18.5	54.8	≥1.65	1.68	380
	B35AV2100	7.65	≤21.0	19.5	57.1	≥1.66	1.68	355
Low loss high strength AVS series	B20AV1100S	7.60	≤11.0	10.6	27.2	≥1.62	1.64	490
	B20AV1200S	7.60	≤12.0	11.0	28.2	≥1.62	1.64	492
High efficiency AHV series	B20AHV1200	7.65	≤12.0	10.8	29.4	≥1.64	1.65	395
	B20AHV1300	7.65	≤13.0	12.2	32.5	≥1.65	1.67	360
	B27AHV1400	7.65	≤14.0	13.3	38.4	≥1.65	1.66	390
	B30AHV1500	7.65	≤15.0	14.2	40.8	≥1.66	1.67	395
	B35AHV1700	7.65	≤17.0	16.0	47.0	≥1.66	1.68	397
High induction APV series	B20APV1200	7.65	≤12.0	10.6	28.9	≥1.68	1.69	395
	B25APV1300	7.65	≤13.0	12.2	33.8	≥1.68	1.69	383
	B27APV1400	7.65	≤14.0	13.1	37.0	≥1.68	1.69	385
	B30APV1500	7.65	≤15.0	13.8	40.8	≥1.68	1.69	390
	B35APV1700	7.65	≤17.0	15.8	45.9	≥1.68	1.69	395

Type	Grade	Density (g/cm ³)	Core loss P _{1.0/400} (W/kg)		Magnetic polarization J ₅₀₀₀ (T)		Yield strength (MPa)	
			Guarantee value	Typical value	Guarantee value	Typical value	Guarantee value	Typical value
High efficiency-Higher strength AHV-M series	B15AHV950M	7.60	≤9.5	9.0	≥1.64	1.66	≥470	490
	B25AHV1300M	7.60	≤13.0	12.0	≥1.65	1.66	≥420	442
	B27AHV1300M	7.60	≤13.0	12.5	≥1.65	1.66	≥420	445
	B27AHV1400M	7.60	≤14.0	13.1	≥1.65	1.66	≥420	441
	B30AHV1400M	7.60	≤14.0	13.7	≥1.65	1.67	≥420	440
	B30AHV1500M	7.60	≤15.0	13.7	≥1.65	1.67	≥420	440
High strength series	B35AHS500	7.60	≤25.0	23.0	≥1.64	1.66	≥500	532
	B35AHS550	7.60	≤32.0	30.0	≥1.63	1.66	≥550	575
	B35AHS600	7.60	≤35.0	33.0	≥1.60	1.65	≥600	636
	25WY650	7.60	≤50.0	40.0	≥1.54	1.56	≥650	737
	25WY900	7.60	≤65.0	55.5	≥1.51	1.53	≥900	950
	35WY700	7.60	≤50.0	44.0	≥1.53	1.55	≥700	770
	35WY900	7.60	≤65.0	58.6	≥1.51	1.53	≥900	950
Stress relief annealing AHVR series	B20AVR1050*	7.60	≤10.5	9.9	≥1.61	1.63	≥470	485
	B25AHVR1150*	7.60	≤11.5	11.2	≥1.62	1.64	≥470	495

* Magnetic properties are measured after annealing at 800°C, 2h.

Type	Grade	Density (g/cm ³)	Core loss P _{1.5/50} (W/kg)		Core loss P _{1.5/100} (W/kg)	Magnetic polarization J ₅₀₀₀ (T)	Yield strength (MPa)
			Guarantee value	Typical value			
High efficiency industrial motor AM series	B35AM250	7.65	≤2.5	2.20	5.39	1.70	376
	B35AM270	7.65	≤2.7	2.35	5.68	1.70	383
	B35AM300	7.65	≤3.0	2.50	5.93	1.70	399
	B35AM360	7.75	≤3.6	2.65	6.44	1.72	278
	B35AM440	7.75	≤4.4	2.75	7.01	1.72	284
	B50AM250	7.65	≤2.5	2.30	6.30	1.69	400
	B50AM270	7.65	≤2.7	2.40	6.64	1.69	369
	B50AM310	7.65	≤3.1	2.55	6.93	1.70	376
	B50AM350	7.65	≤3.5	2.70	7.13	1.70	381
	B50AM400	7.75	≤4.0	2.90	8.10	1.73	272
	B50AM470	7.75	≤4.7	3.15	8.58	1.71	279

Type	Grade	Density (g/cm ³)	Core loss P _{1.5/50} (W/kg)		Magnetic polarization J ₅₀₀₀ (T)		Yield strength (MPa)	
			Guarantee value	Typical value	Guarantee value	Typical value	Guarantee value	Typical value
High strength WY series for large motors	50WY650	7.60	≤10.0	8.50	≥1.55	1.58	≥650	670
	50WY750	7.60	≤15.0	10.50	≥1.50	1.54	≥750	820
	65WY600	7.60	≤12.0	8.90	≥1.55	1.58	≥600	660

Type	Grade	Density (g/cm ³)	Core loss P _{1.5/50} (W/kg)		Magnetic polarization J ₅₀₀₀ (T)		Yield strength (MPa)
			Guarantee value	Typical value	Guarantee value	Typical value	Typical value
Low loss A/WW series	B35A230	7.60	≤2.28	2.10	≥1.64	1.66	405
	B35A250	7.60	≤2.45	2.25	≥1.64	1.66	409
	B35A270	7.65	≤2.65	2.40	≥1.64	1.67	395
	B35A300	7.65	≤2.90	2.55	≥1.64	1.68	385
	B50A250	7.60	≤2.48	2.37	≥1.64	1.66	428
	B50A270	7.60	≤2.65	2.50	≥1.64	1.67	411
	B50A290	7.60	≤2.85	2.60	≥1.64	1.67	400
	B50A310	7.65	≤3.00	2.70	≥1.65	1.68	395
	B50A350	7.65	≤3.20	2.85	≥1.65	1.68	385
	B50A400	7.70	≤3.30	3.00	≥1.66	1.69	333
	35WW250	7.60	≤2.28	2.20	≥1.64	1.67	415
	35WW270	7.60	≤2.45	2.33	≥1.64	1.67	415
	35WW300	7.65	≤2.65	2.45	≥1.64	1.68	395
	35WW360	7.65	≤3.20	2.69	≥1.65	1.69	380
	50WW270	7.60	≤2.48	2.45	≥1.64	1.67	420
	50WW290	7.60	≤2.65	2.49	≥1.64	1.67	420
	50WW310	7.60	≤2.85	2.68	≥1.64	1.69	390
	50WW350	7.65	≤3.00	2.70	≥1.65	1.69	390
50WW400	7.65	≤3.20	2.83	≥1.65	1.69	380	
50WW470	7.70	≤3.30	3.15	≥1.70	1.72	265	
High efficiency AH/WH series	B50AH350	7.70	≤3.00	2.85	≥1.71	1.73	302
	B50AH470	7.75	≤3.50	3.20	≥1.72	1.74	244
	50WH470	7.70	≤3.00	2.86	≥1.71	1.73	300
	50WH600	7.75	≤3.50	3.21	≥1.72	1.73	265

Type	Thickness (mm)	Grade	Core loss P _{1.0/400} (W/kg)		Magnetic polarization J ₅₀₀₀ (T)		Yield strength (MPa)	Tensile strength (MPa)
			Guarantee value	Typical value	Guarantee value	Typical value	Typical value	Typical value
AHR series	0.10	B10AHR-1	≤10.0	9.5	≥1.63	1.65	400	515
		B10AHR-2	≤10.0	9.2	≥1.66	1.68	430	535
	0.15	B15AHR-1	≤11.0	9.8	≥1.64	1.66	395	510
		B15AHR-2	≤11.0	9.5	≥1.67	1.69	400	500
	0.20	B20AHR-1	≤12.0	10.8	≥1.65	1.68	390	500
		B20AHR-2	≤12.0	10.5	≥1.68	1.70	390	500
		B20AHR-3	≤14.0	12.5	≥1.73	1.75	275	400
		B20AHR-4	≤20.0	19.2	≥1.79	1.81	206	340
	0.27	B27AHR-1	≤14.0	13.0	≥1.67	1.69	415	530
	0.30	B30AHR-1	≤20.0	18.5	≥1.74	1.75	275	400
		B30AHR-2	≤15.0	14.5	≥1.68	1.70	410	528
	0.50	B50AHR-1	≤8.0(P _{1.5/50})	5.2(P _{1.5/50})	≥1.78	1.80	246	372

4.3.2 Coating Properties

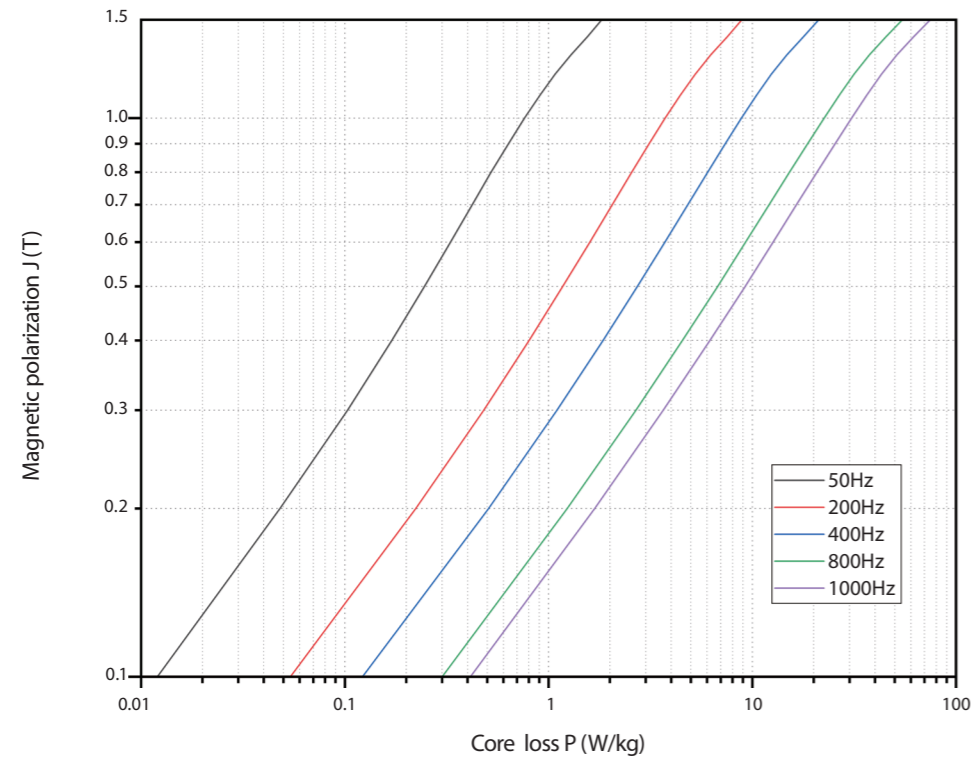
Coating code	A/T4	H/T4H	K/D	M/E	J/C5	Z/C3	L	
	Normal (Cr containing)		Environmental friendly (Cr free)					
ASTM Class	C-5	C-5	C-5	C-5	C-5	C-3	C-6	
Coating type	Semi-organic	Semi-organic	Semi-organic	Semi-organic	Semi-organic	Organic	Semi-organic	
Coating thickness (um/surface)	0.2-0.5μm	0.5-1.0μm	0.3-0.7μm	0.7-1.2μm	1.5-4μm	1.5-6.5μm	3-7μm	
Insulation resistance ^① (Ωcm ² /piece)	≥1	≥3	≥1	≥3	≥20	≥20	≥50	
Adhesiveness	1	3	1	3	1	1	1	
Punching ability ^② (x1000) punching times until 50um burr	1000	1500	1000	—	—	—	—	
Humidity proof ability ^③ Appearance	No change	No change	No change	No change	No change	No change	No change	
Oil-proof ability ^④	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
Weld ability ^⑤ (cm/min); maximum weld speed bubble<7	80~100	20~60	80~100	20~60	10~60	Not suitable	Not suitable	
Heat proof ability ^⑥	long time/air	180°C	180°C	180°C	180°C	270°C	155°C	180°C
	Short time/air	210°C×2500hr/ 600°C×30min	210°C×2500hr/ 600°C×30min	210°C×2500hr/ 600°C×30min	210°C×2500hr/ 600°C×30min	300°C×2500hr/ 600°C×30min	180°C×1000hr/ 160°C×2500hr	250°C×168hr/ 500°C×30min

Above are test data under certain condition in laboratory representing typical properties of coating but not guarantee values

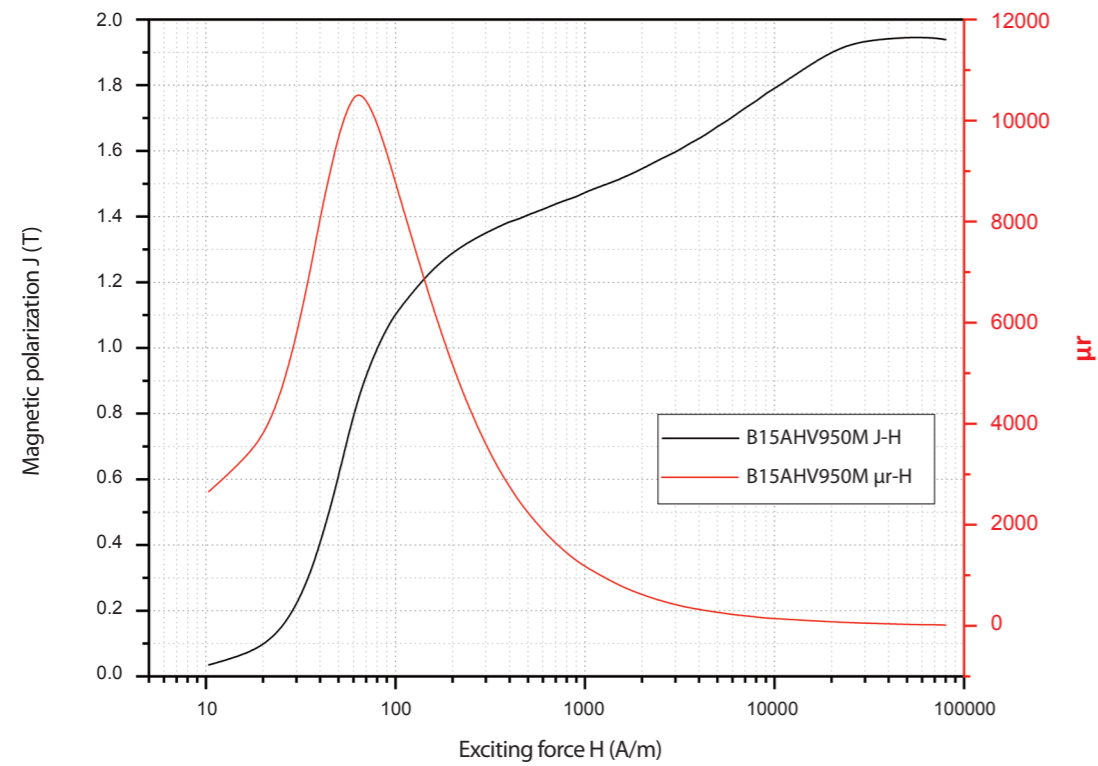
- Note: ① inter-lamination resistance (10 head, total area 6.45cm²)
 ② STD11, F15mm round sample, clearance 5% of thickness, with stamping oil
 ③ 50°C, 95% humidity, 14 days
 ④ In mixed liquid (99.5wt% METALUB ATF DEXRON (VI)+0.5wt% water) at 180°C for 504hr: no bubble, nowinkle, nopeeling off, and quality difference<5%
 ⑤ Protective Ar gas; welding current 120A; F 2.4mm Th-W electrode; welding torch interval 1.5mm; pressure 100kg/cm²
 ⑥ DIN IEC 60404-12

4.3.3 Magnetic Property Curves of Typical Grades

B15AHV950M iron loss curves

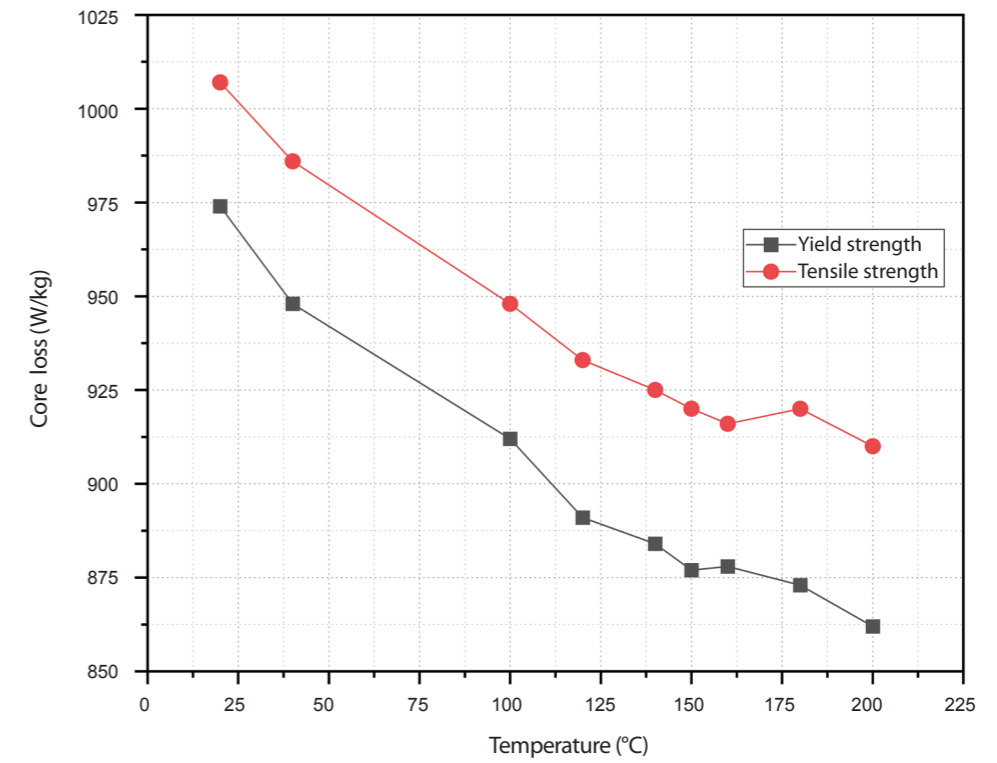


B15AHV950M DC magnetization curves

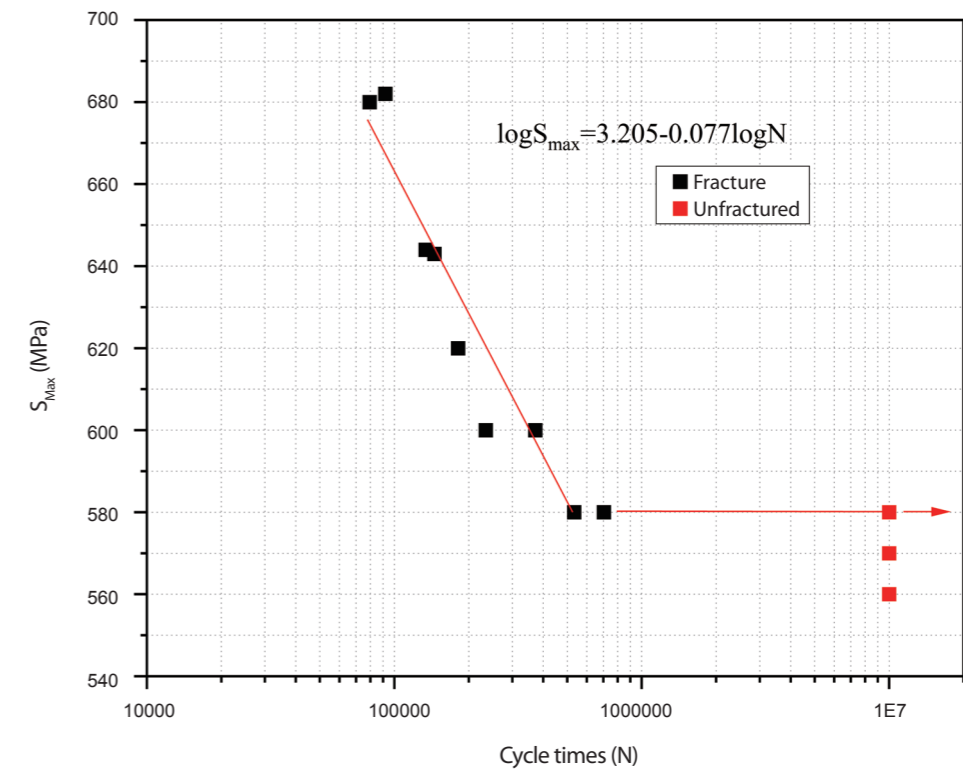


4.3.4 Magnetic Property Curves of Typical Grades

B30AV1500 Yield/tensile strength - temperature curve

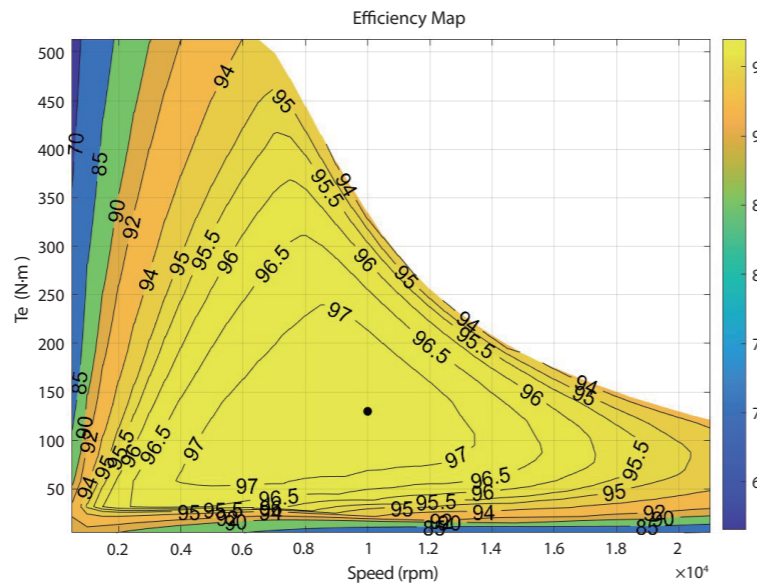
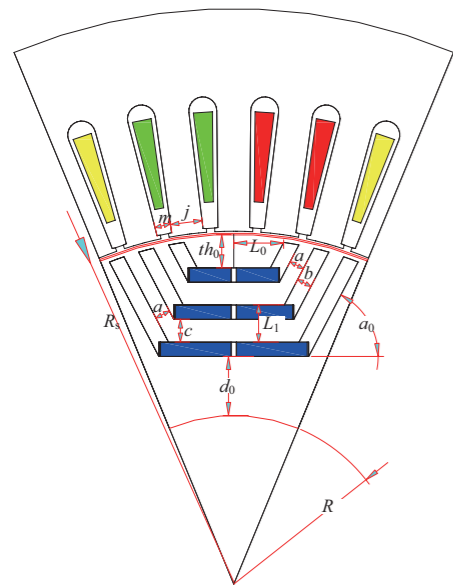


35WY900 Fatigue curve

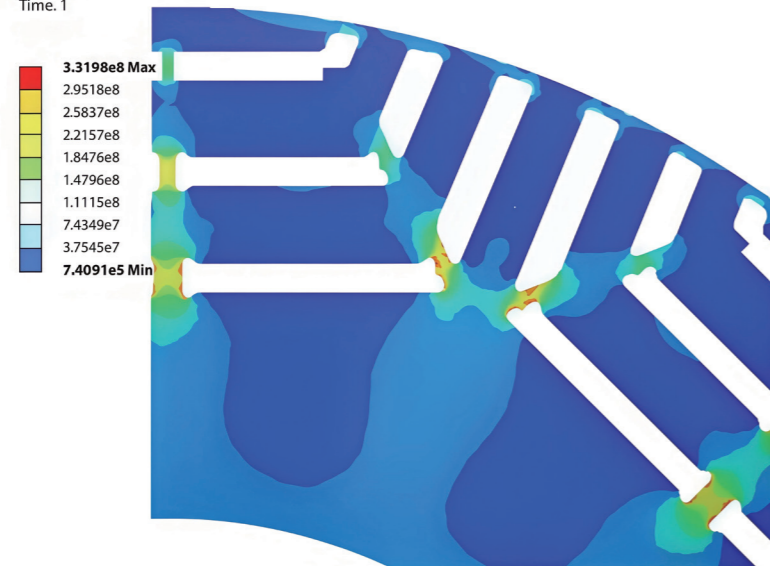


4.4 Simulation Analysis Capability

- Magnetic path analysis for material selection
- Motor efficiency cloud map analysis for material selection;
- Stress distribution analysis for safety



B: V10
Equivalent Stress
Type, Equivalent(von-Mises) Stress-Top/Bottom- Layer 0
Unit, Pa
Time, 1



4.5 Lamination Process Support

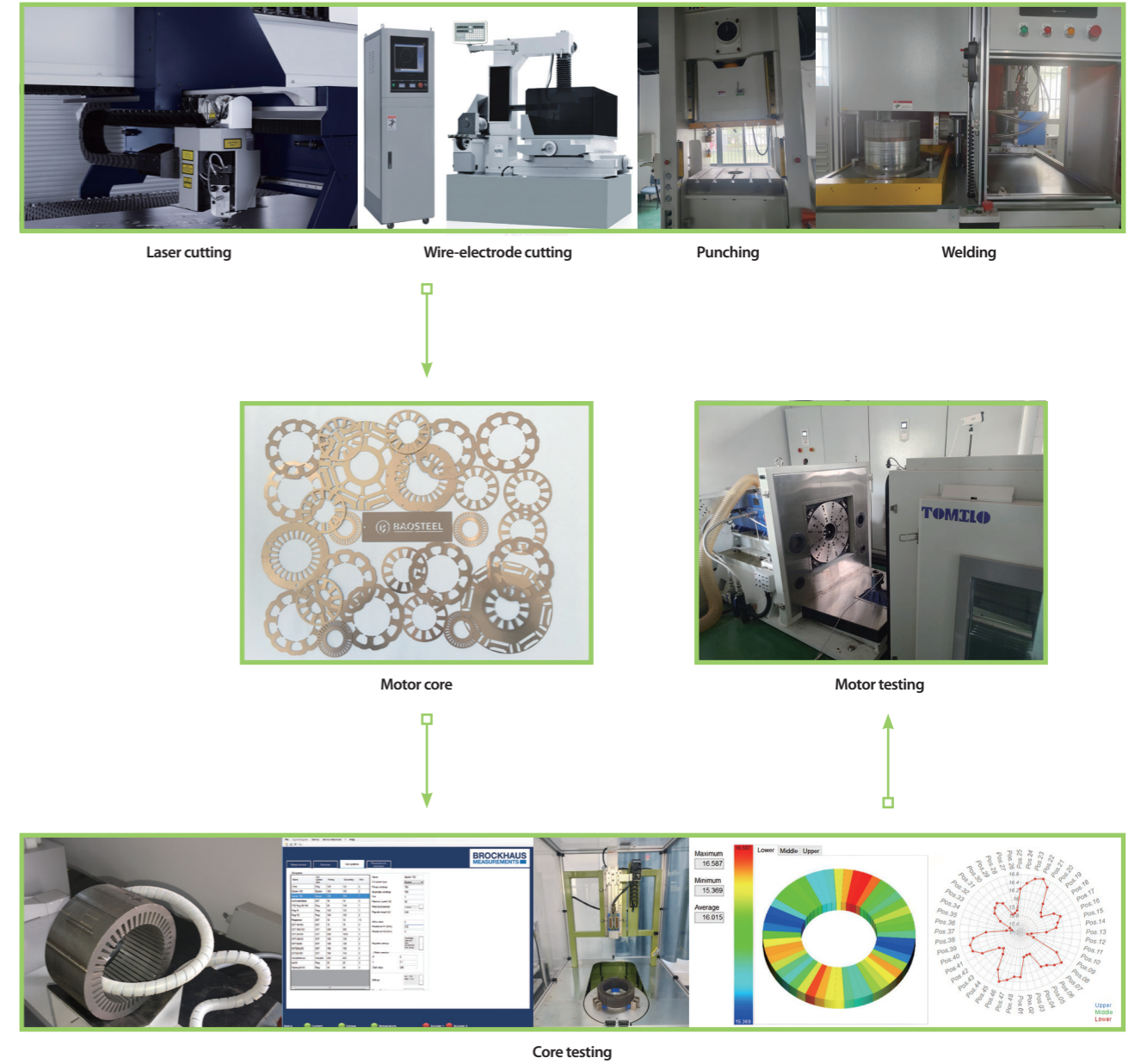


4.6 Experimental Research Ability



4.7 Prototype Iron Core Build & Test Platform

Technical service platform for silicon steel application technology: prototype iron core cutting and testing.



- Prototype iron core cutting service: To provide customs with silicon steel material, iron core cutting service to avoid prototype punching die building investment in early stage of new product development to shorten the R & D cycle.
- Properties testing: Iron core testing, motor testing.

5 Application Cases

To support customers for silicon steel selection for design of traction motor of clean-energy vehicle considering cost and performance, comparison would be done according to core design, manufacturing process design by simulation and experiments to realize an optimized performance price ratio.

Case 1: Thickness selection of silicon steel

(1) Motor Speed And Frequency

The motor speed of new energy vehicles is precisely matched with the power supply frequency, leveraging the high magnetic induction and low-loss characteristics of silicon steel materials. This ensures high-efficiency and stable operation across a wide speed range, meeting power output demands under diverse operating conditions.

Motor speed (rpm-4p)	Working frequency(Hz)
12000	800
18000	1200
21000	1400
30000	2000

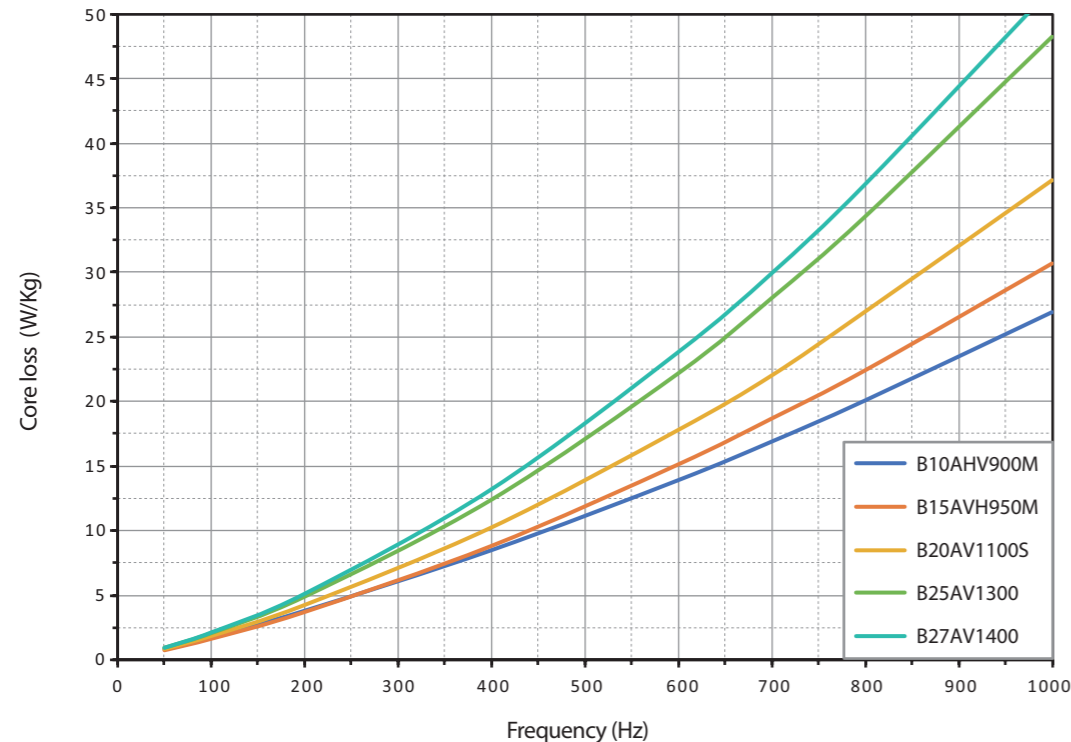
(2) Frequency-loss Relationship of Silicon Steel

Loss of silicon steel is closely related to frequency(f), where hysteresis loss P_h is proportional to frequency f, while eddy current loss P_e is proportional to frequency f square (shown as following equation):

$$P_h = k Vol f (B_{max})^n [W]$$

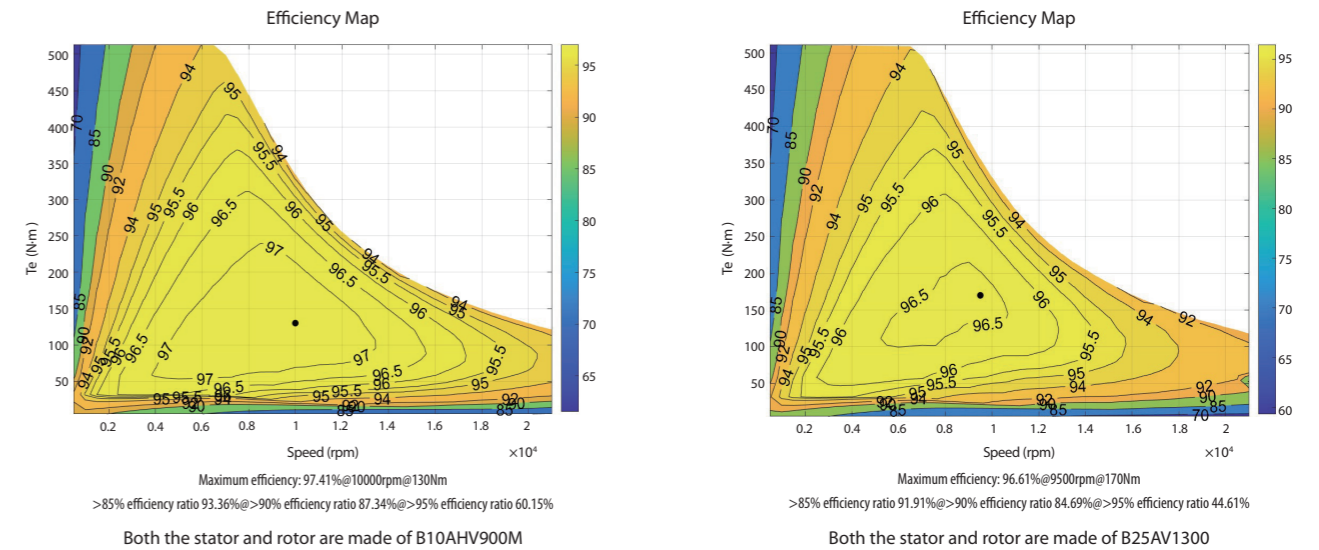
$$P_e = \frac{Vol \pi^2 f^2 t^2 (B_{max})^2}{6\rho} [W]$$

In order to increase motor efficiency, it's necessary to decrease iron loss of silicon steel greatly. The effective way is to reduce the thickness of silicon steel sheet. The iron losses of various thicknesses at magnetic induction density 1.0T under various frequencies are shown in following figure:



(3) Changes of Efficiency Map with Various Thickness of Silicon Steels

Simulation has been done with various thickness grades, the efficiency maps indicated that high efficiency area of 0.10mm material is much better than 0.25mm material's.



(4) Conclusions

The thickness and grade of silicon steel should be determined by maximum speed (frequency), rated speed(frequency), high efficiency region, and other factor regarding motor performance and cost. Thin gauge non-oriented silicon steels are good in reducing load loss in high speed region therefore improving motor efficiency.

Case 2: Selection of strength of silicon steel

(1) Strength of Silicon Steel

Modern electric motors are evolving towards higher power density and rotational speeds. The magnetic bridge, being the most stress-concentrated area in the motor (rotor), serves as the structural weak point of the entire system. Optimizing the magnetic bridge width can reduce magnetic leakage, enhance output power, and thereby lower the core height, which significantly contributes to cost reduction in motor manufacturing. Consequently, selecting silicon steel materials with appropriate strength is critically important.

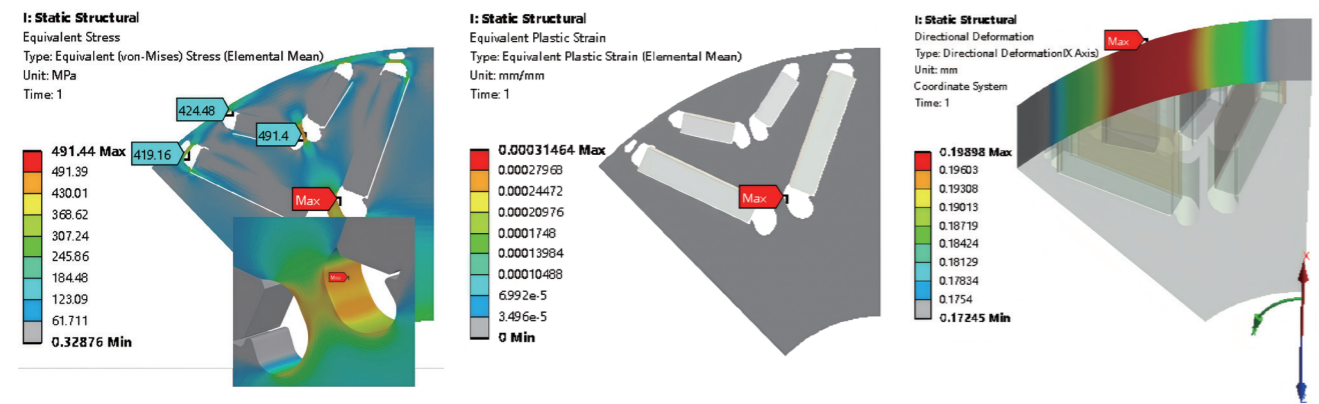
(2) Stress Analysis in Magnetic Bridge Area of Rotor

Basic data for stress analysis in rotor is shown in the following table: (yield strength of silicon steel is taken as 491MPa)

Motor design			Equivalent stress	Safety coefficient
Tmax(Nm)	Magnetic bridge	Width(mm)		
524.8	Two place	0.69/2.48	299.4	1.64

Safety coefficient 1.64 is the safety factor considering all uncertain factors, which includes but not be limited to: actual size change of magnetic bridge, variation of material strength, effect of temperature, manufacture resulted stress, speed excess, assembly tolerance, one side magnetic pulling force, etc.

The strain and deformation distributions are shown as following figures

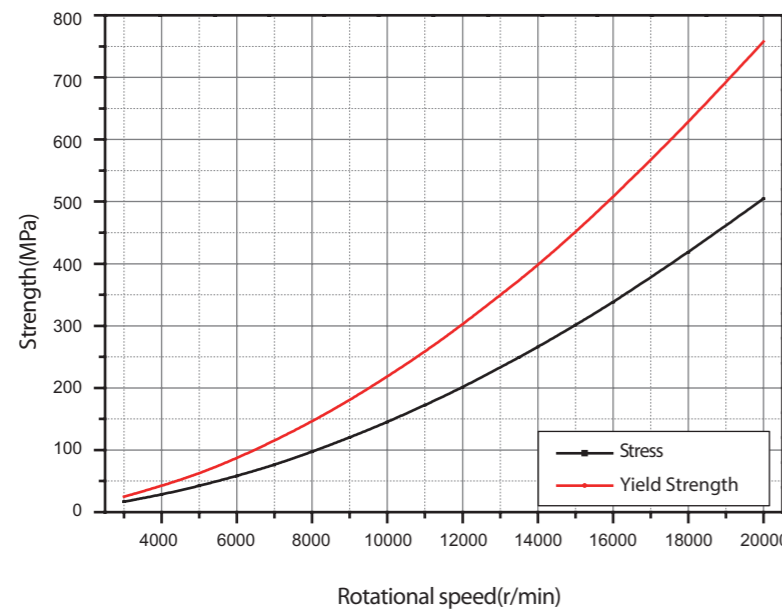


(3) Stress Dependence of Speed in Rotor

Stress in rotor mainly composes of following parts:

- Centrifugal force of outer circle (i.e., surrounding bridges) and steel magnet, being proportional to speed square.
- Magnetic force between rotor and stator when motor is running, passing on to iron core mainly at bridge, being roughly in inverse proportion to speed above rated speed range.
- One side pulling force due to uneven magnetic field, assembly gap, etc, being a fixed value basically and irrelevant to speed.

Stress in magnetic bridge composes mainly of above three parts, being generally proportional to speed by power between 1 to 2, where taking power 1.8.

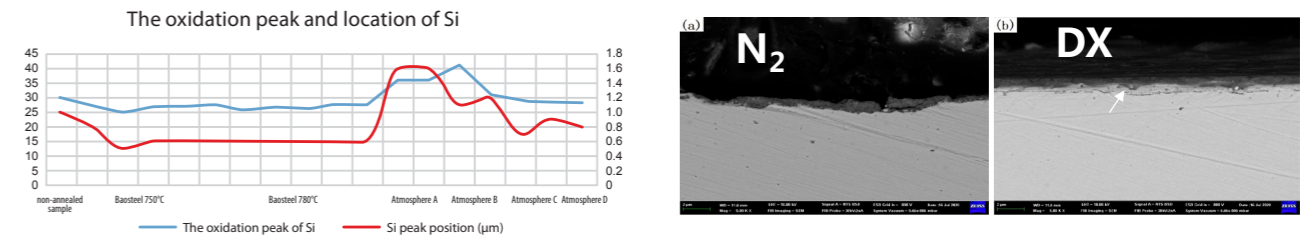


(4) Solution to Speed Rise

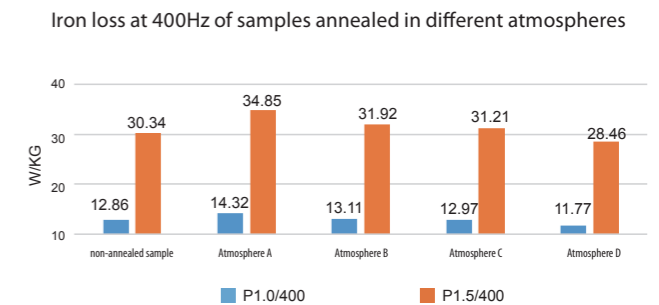
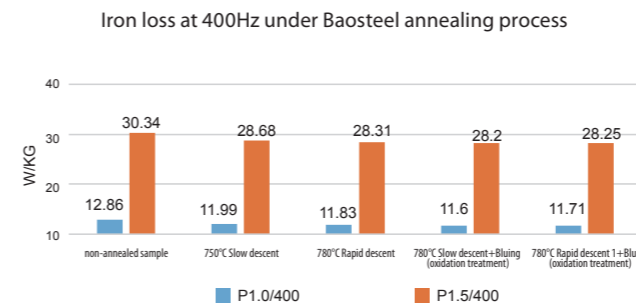
When the motor speed is below 18,000 rpm, conventional silicon steel materials with a minimum yield strength of 400-430 MPa can meet basic strength requirements. However, when motor speeds exceed 18,000 rpm, the yield strength must reach ≥ 450 MPa, requiring collaborative innovation between materials and structural design. As new energy vehicle motors enter the high-speed era exceeding 20,000 rpm, traditional 400-450 MPa grade materials can no longer address the dual challenges of rotor centrifugal force control and high-frequency iron loss reduction. Baosteel has revolutionized the industry by developing ultra-thin silicon steel with exceptionally low iron loss, achieving breakthrough ultra-high yield strength that significantly enhances deformation resistance compared to conventional products. Through its ultra-thin specification design, this material dramatically reduces iron loss. This innovation has successfully enabled an electric motor manufacturer to design a 50,000 rpm motor, providing a comprehensive solution for ultra-high-speed motors that integrates material strength optimization, process compatibility, and system reliability assurance.

Case 3: The effect of annealing atmosphere on performance of high grade silicon steel core and application suggestions

Due to the high silicon content of high-grade silicon steel and the high temperature in the manufacturing process of the steel plant, after the iron core is made, it is greatly affected by the processing stress and the performance deteriorates obviously. The atmosphere control of the iron core annealing process has a great correlation with the performance recovery of the iron core.



As shown in the figure, the SiO₂ depth of annealing in N₂ atmosphere is relatively ideal, the SiO₂ depth of annealing in DX atmosphere A, B and C is 1.6 μ m, and the SiO₂ depth of annealing in D atmosphere is 0.7 μ m, which indicates the thickness of the oxide film annealed in DX atmosphere A, B and C, and the oxidation depth is consistent with the oxidation strength of the atmosphere.



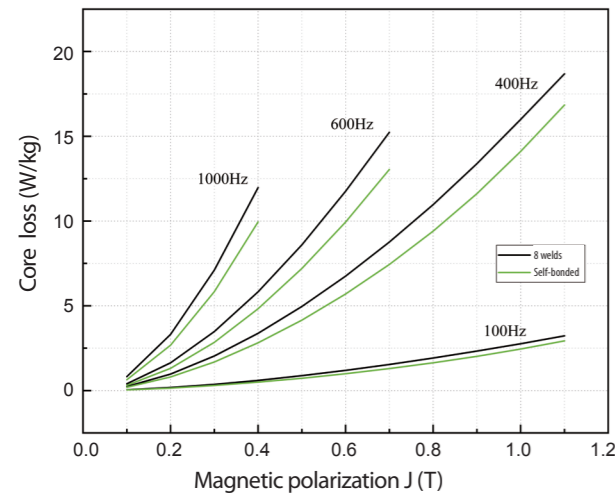
The properties of iron cores prepared from high grade materials were tested and compared in different atmospheres after annealing. The properties of samples annealed in N₂ atmosphere are consistent with the variation of process parameters. It shows that the iron loss of non-annealed sample is the highest, and the iron loss decreases with the increase of temperature. and the performance is the best when the temperature is kept at 780°C The results of DX atmosphere annealing process show that the performance of iron core after annealing is inconsistent with the rule of temperature and time, and The iron loss of A/B/C atmosphere samples after annealing is higher than that of the non-annealed sample.

Therefore, the recommendation for core annealing of high grade silicon steel is as follows:

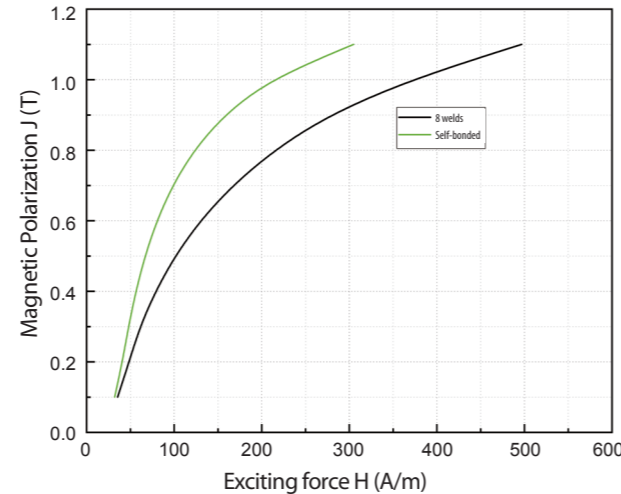
- Control annealing atmosphere to avoid forming inner oxide layer.
- If it is difficult for the user to change the atmosphere of the annealing, it is suggested that the motor core should not be annealed according to the actual use situation, which can stabilize the performance and save the annealing cost.

■ Case 4: The effect of machining method on the properties of high grade silicon steel

After the iron cores are made through different processing methods, the degrees of deterioration of the magnetic properties of the silicon steel are different. A comparison of iron losses has been carried out between the welded iron cores and the self-bonded iron cores with the same design.



Iron losses of iron cores with different processing methods



JH curve of iron cores with different processing methods (50Hz)

As the number of welding passes of the iron core increases, the magnetic induction decreases. Compared with the welded iron core, the iron loss of the self-bonded iron core decreases significantly and the magnetic induction increases. At the same time, the bonding force of the self-bonded iron core is better than that of the welded one. When designing a motor, using self-bonded materials can better improve the overall performance of the motor.

■ Case 5: The effect of material selection on efficiency improvement of IE4 motor

A certain motor manufacturing enterprise, in order to reduce production costs, selected Baosteel's No. 470 non-oriented silicon steel for the manufacturing of high-efficiency industrial motor iron core products. However, when manufacturing the iron cores of some model motors, it was found that the dimensional differences in all directions of the inner diameter of the stator iron core exceeded the standard range, which seriously affected the assembly and use of the products. The enterprise reported this problem to Baosteel, hoping that both sides could jointly analyze the causes and propose improvement plans.

Comparison of processing dimensions between the original silicon steel and Baosteel's silicon steel of grade 470

Item	Standard	Original silicon steel	Baosteel's grade 470 silicon steel
The dimensional differences in all directions of the inner diameter of the stator iron core	≤0.2mm	≤0.2mm	0.3~0.5mm

After receiving the feedback, Baosteel conducted performance tests on the strip samples with abnormal processing as reported by the user. The test results showed that both the electromagnetic properties and mechanical properties of the material were within the typical value range of this grade, and there was no quality abnormality in the material itself. Thus, the focus of the problem was locked on the compatibility between Baosteel's Grade 470 product and the user's mold.

Through further comparative analysis of the mechanical properties between Baosteel's Grade 470 product and original silicon steel, significant differences were found. Original silicon steel had higher strength, hardness, and yield ratio. For products with large differences in mechanical properties, stamping them in the same set of molds would inevitably lead to deviations in the machining dimensional accuracy.

Mechanical properties of two kinds of silicon steel

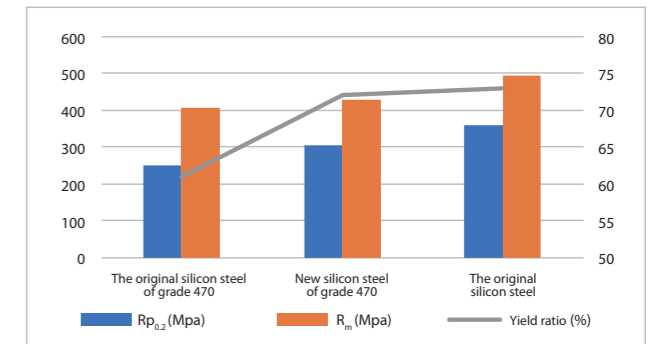
Material	Yield strength (MPa)	Tensile strength (MPa)	Elongation (%)	Hardness HV5	Yield ratio (%)
The original silicon steel	362	498	26.5	187	72.7
Baosteel's silicon steel of grade 470	246	400	36.5	130	61.5

Regarding the core of the problem, Baosteel's technicians proposed taking the yield ratio as the standard and launching "standard +α" products and solutions that are suitable for the actual production of users. Compared with the original grade 470 product, the new grade 470 silicon steel has comparable magnetic properties, but higher strength, hardness and yield ratio, and the processing performance can better match with the user's existing mold.

The user conducted a small-batch trial of the new material. The results showed that the processing process was normal, and the dimensional accuracy of the iron core met the standard requirements. At present, the enterprise has completed the batch switching of products, which has shown good performance in aspects such as stamping processability, weldability, and dimensional stability. It has successfully solved the production problems caused by the poor matching between the material and the mold, not only meeting the enterprise's demand for cost reduction but also ensuring the product quality.

Recommended solutions:

- 1) When designing the mold, appropriate springback and roundness compensation should be made for the mold dimensions according to the different mechanical properties of the stamping material.
- 2) When stamping materials, the compatibility between the mold and the mechanical properties of the material should be fully considered. It is not advisable to process materials with significantly different mechanical properties in the same set of molds at the same time.



The Mechanical Properties of the three Grades of Silicon Steel

■ Case6: Baosteel silicon steel assists large motors to increase the domestic production rate

The AP1000 nuclear power steam turbine generator has a capacity of 1250MW, which places very high demands on silicon steel sheets. This product requires 0.35mm-thick high-grade non-oriented silicon steel under power frequency. In terms of magnetic properties, it demands extremely low iron loss and high magnetic induction. Especially, the value of B₅₀ should be above 1.64T. Meanwhile, high requirements are also put forward for its mechanical properties, making the production extremely difficult.



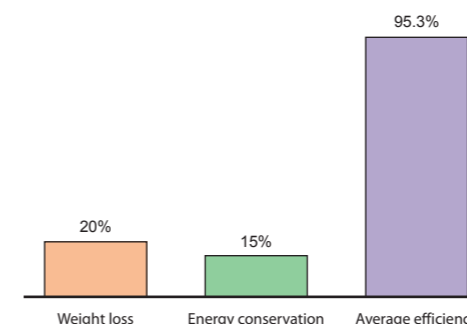
Hainan Changjiang Nuclear Power Plant

The R&D personnel of Baosteel reasonably control the processes during hot rolling, normalizing and annealing, and regulate favorable textures to improve the magnetic induction and reduce the loss. They achieve a high material utilization rate by optimizing the parameters of the rolling process. Eventually, the goals of low loss, high magnetic induction, high strength and high material utilization rate are realized. The products replace imported ones and are applied to AP1000 nuclear power steam turbine generator sets, such as the nuclear power generators in the projects of Changjiang in Hainan (Units 3# and 4#), Sanmen Unit 4# in Zhejiang, Lufeng Unit 5# in Guangdong and so on.

■ Case7: Baosteel is a model driver for the use of first-class energy-efficient motors

The higher the energy efficiency grade of the motor is, the higher the motor efficiency will be, and the more power the motor will save. For China, every 1% improvement in the energy efficiency of motors is equivalent to saving 26 billion kWh of electricity per year, which is the annual power generation of three Three Gorges power stations. Compared with the YE5 first-level energy efficiency motor, the YE6 super first-level energy efficiency has higher requirements. The improvement of the motor efficiency means that there are higher requirements for the electromagnetic properties of the silicon steel sheets.

Based on this, Baosteel established the world's first new continuous annealing unit, and developed the corresponding planar texture control technology and comprehensive mechanical property regulation technology. On the basis of the YE5 motor steel plate, Baosteel developed the B50AM250 grade silicon steel product specially for YE6 motors, which features high magnetic induction, low iron loss and resistance to shearing degradation, and is suitable for high-efficiency motors. The super first-level energy efficiency YE6 motor has remarkable characteristics such as material saving and high efficiency. While being miniaturized and lightweight, its manufacturing cost is significantly reduced, and its energy-saving advantage is more obvious. Taking the newly released YE6 model as an example, a single motor has the remarkable advantages of a 20% weight reduction and a 15% energy saving, and its average efficiency reaches 95.3%.



Silicon Steel Sales Department

Add: No. 151 Mohe Rd, Baoshan District,
Shanghai, 201999, China
TEL: 021-26642629

Baosteel Service Hot-line

400-820-8590

iBaosteel<http://www.ibaosteel.com>**Domestic Sales Channels**

**SHANGHAI BAOSTEEL
STEEL PRODUCTS TRADING CO., LTD.**
TEL: 021-26640916

**GUANGZHOU BAOSTEEL
SOUTHERN TRADING CO., LTD.**
TEL: 020-32219999

**BEIJING BAOSTEEL
NORTHERN TRADING CO., LTD.**
TEL: 010-56512000

**CHENGDU BAOSTEEL
WESTERN TRADING CO., LTD.**
TEL: 028-85335388

**WUHAN BAOSTEEL
CENTRAL CHINA TRADING CO., LTD.**
TEL: 027-84298800

**SHENYANG BAOSTEEL
NORTH-EASTERN TRADING CO., LTD.**
TEL: 024-31391180

Northeast Asia and Oceania Region

HOWA TRADING CO., LTD.
TEL: 0081-3-32379121
FAX: 0081-3-32379123

SEOUL OFFICE
TEL: 0082-2-5080893
FAX: 0082-2-5080891

BGM CO., LTD
TEL: 0082-70-44225903
FAX: 0082-31-3514558

KAOSIUNG OFFICE
TEL: 00886-7-3356606
FAX: 00886-7-3356609

BAO AUSTRALIA PTY LTD.
TEL: 0061-8-94810535
FAX: 0061-8-94810536

South East Asia and South Asia Region

BAOSTEEL SINGAPORE PTE LTD.
TEL: 0065-63336818
FAX: 0065-63336819

VIETNAM OFFICE
TEL: 0084-8-9100126
FAX: 0084-8-9100124

THAILAND OFFICE
TEL: 0066-2-6368485
FAX: 0066-2-2348989

HANOI OFFICE
TEL: 0084-24-62694200
FAX: 0084-24-62691392

**PT. BAOSTEEL INDONESIA STEEL SERVICE CENTER
(INDONESIA OFFICE)**
TEL: 0062-21-3040 8575
FAX: 0062-21-3040 8583

**BAOSTEEL INDIA COMPANY PRIVATE LTD.
(SANAND STEEL SERVICE CENTER)**
TEL: 0091-22-30071700
FAX: 0091-22-30071777

MALAYSIA OFFICE
TEL: 0060-32-2016986

Europe, Africa & Middle East Region

BAOSTEEL EUROPE GMBH
TEL: 0049-89-32709090
FAX: 0049-89-3270909130

BAOSTEEL ITALIA DISTRIBUTION CENTER SPA
TEL: 0039-010-530881
FAX: 0039-010-5308895

BAOSTEEL ESPAÑA, S.L.
TEL: 0034-93-4119325
FAX: 0034-93-4119330

BAOSTEEL MIDDLE EAST FZE
TEL: 00971-4-8840458
FAX: 00971-4-8840485

RUSSIA OFFICE
TEL: 7-499-2585602
FAX: 7-499-2585602

KENYA OFFICE
TEL: 00254-708678798

TÜRKIYE OFFICE
TEL: 0090-212-3440067
FAX: 0090-212-3440068

SAUDI ARABIA OFFICE
TEL: 00966-502894656

TUNISIA OFFICE
TEL: 00216-36013995

America Region

BAOSTEEL AMERICA INC.
TEL: 001-201-3073355
FAX: 001-201-3073358

BAOSTEEL DO BRAZIL LTDA.
TEL: 0055-11-26678869

CANADA OFFICE
TEL: 001-905-7315888/7315885
FAX: 001-905-7315883

SAN DIEGO OFFICE
TEL: 001-949-7526789
FAX: 001-949-7521234

MEXICO OFFICE
TEL: 0052-55-55319506
FAX: 0052-55-55319506-201

PANAMA OFFICE
TEL: 507-382-5225

MONTERREY OFFICE
TEL: 0052-81-12537111

