



Baoshan Iron and Steel Co., LTD. Enterprise standard

Q / BQB 381 - 2023

instead of Q/BQB 381-2019

Hot Rolled Steel Plate and Steel Strip for Magnetic Yoke and Pole of Hydroelectric Generator

Continuously hot-rolled steel sheet and strip for magnetic yoke and pole of water-wheel electric generator

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Preface

This document is drafted in accordance with the provisions of GB/T 1.1-2020 "Guidelines for Standardization Work Part 1: Structure and Drafting Rules for Standardization Documents".

This document is based on IEC60404-8-5:2020 and relevant industry standards, and combined with the actual production situation of Baosteel.

This document replaces Q/BQB 381-2019 "Hot rolled Steel Plate and Steel Strip for Magnetic yoke of hydroelectric generator". Compared with Q/BQB 381-2019, the main technical changes are as follows:

- The name of the document is changed to "Hot rolled steel plate and steel strip for magnetic yoke and pole of hydroelectric generator";
- Add the year number of GB/T 228.1 in the normative reference documents;
- Added Chapter 3 "Terms and Definitions";
- Added the name of the card with the letter "W" at the beginning;
- The use of magnetic poles is added to Table 1;
- 11 grades including B300TG180, B400TG179, WDER235 ~WDER750 and corresponding requirements have been added.

Appendix A to the present document is an informative appendix.

This document was proposed by the Manufacturing Management Department of Baoshan Iron and Steel Co., LTD.

This document is under the control of manufacturing management department of Baoshan Iron and Steel Co., LTD.

This document was drafted by manufacturing management department of Baoshan Iron and Steel Co., LTD.

Main drafter of this document: Huang Jinhua.

The release of this document and its replaced documents is as follows: Q/BQB 381-2018, Q/BQB 381-2019.

Hot Rolled Steel Plate and Steel Strip for Magnetic Yoke and Pole of Hydroelectric Generator

1 Scope

This document specifies the classification and code, size, shape, technical requirements, inspection and test, packaging, marking and inspection documents of hot rolled steel plates and steel strips used for magnetic yoke and magnetic pole of hydroelectric generators.

This document is applicable to the hot rolled steel plate and steel strip used for magnetic yoke and magnetic pole of hydroelectric generator produced by Baoshan Iron & Steel Co., LTD. (hereinafter referred to as steel plate and steel strip).

2 Normative References

The contents of the following documents are incorporated by reference as an integral part of this document. For dated references, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies to this document.

GB T 222 Permissible deviation of chemical composition of finished steel

GB T 223 Chemical analysis methods for steel and alloys (applied parts)

GB/T 228.1-2021 Metal Materials-Tensile Testing Part 1: Room temperature test methods

GB T 229 Metal materials Summer swing impact test method

GB T 232 Method of bending test for metal materials

GB/T 2975 Sampling position and sample preparation for mechanical properties test of steel and steel products

GB/T 3655 Method for measuring magnetic properties of electrical steel sheets (with) by Epstein square ring

GB/T 4336 Determination of multi-element content in carbon steel and medium-low alloy steel Spark discharge atomic emission spectrometry (conventional method) GB/T 8170 Rules for the rounding of numerical values and the expression and determination of limit values

GB/T 17505 General technical requirements for delivery of steel and steel products

GB/T 20066 Sampling and sample preparation methods for chemical composition determination of steel and iron

GB/T 20123 Determination of total carbon and sulfur content in steel infrared absorption method (conventional method) after combustion of high frequency induction furnace

GB 20125 Determination of multiple elements in low alloy steel Inductively coupled plasma emission spectrometry

Q/BQB 300 General provisions for packaging, marking and inspection documents of hot rolled steel plates and strips

Q/BQB 301 Dimensions, appearance, weight and permissible deviations of hot-rolled steel plates and strips

3 Terms and Definitions

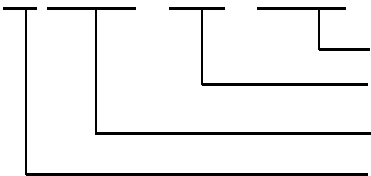
No terms and definitions requiring definition are included in this document.

4 Classification and Designations

4.1 The naming method of steel grade

4.1.1 The naming method for cards beginning with "B" is as follows.

B 0000 0000 0000



The magnetic field strength is 100 times of the specified minimum magnetic polarization strength value when the magnetic field strength is 15000A/m. TG: hot rolled products.

The specified minimum yield strength value, unit of MPa.

Baosteel is the first letter of the English name Baosteel.

Example 1: B350TG179 indicates that the minimum yield strength is 350MPa, and the specified minimum magnetic polarization strength value is 1.79T when the magnetic field strength of hot rolled products is 15000A/m.

4.1.2 When the name of a plate with the letter "W" is given, the plate consists of the first letters of the pinyin of "Wu", "Electric", "yoke", and "hot" in the hot rolling of Baowu hydroelectric generator magnetic yoke and magnetic pole, namely "WDER", and the specified minimum yield strength value (unit: MPa).

4.2 The grade, nominal thickness, use and product category of steel plate and steel strip are shown in Table 1.

Table 1

Plate num- bers ^a	normal thickness mm	use	category of the pr- oduct
B250TG180 (WDER235) B300TG180 B350TG179 (WDER345) B400TG179 B450TG179 (WDER450) B500TG179 (WDER490) B550TG178 (WDER550) B600TG178 (WDER600) B650TG178 (WDER650) B700TG178 (WDER700) B750TG178 (WDER750)	2.0~6.0	Used for manufacturing magnetic yoke and magnetic pole parts of large hydroele- ctric generator set rotor	hot rolled sheet Hot rolled steel strip hot rolled longitudinal cutting steel strip Hot rolled flat steel strip hot rolled heat tr- eated steel plate

^a according to the requirements of the buyer, the order can be placed according to the brand number in the bracket.

5 Information required for order

5.1 Users Must Provide the Following Information When Ordering:

- a) Document number;
- b) category of the product ;
- c) the name of a shop ;
- d) Specifications and dimensions (width) accuracy;
- e) boundary situation ;
- f) use ;
- g) Check the file type;
- h) Other requirements.

5.2 Omissions in the Order Contract

For uncut steel plates and steel strips, when the width accuracy is not specified, they shall be delivered with ordinary accuracy; when the edge condition is not specified, the steel strip shall be delivered without cutting, and the steel plate shall be delivered with cutting; for steel plates, when the flatness accuracy is not specified, they shall be delivered with ordinary accuracy.

6 Size, shape, weight and permissible deviations

6.1 The same plate difference is the difference between the maximum and minimum thickness measured on the same sheet of steel.

6.2 The allowable deviation of the thickness of steel plate and steel strip is $\pm 5\%$ of the nominal thickness; the difference of the same plate of steel plate is not more than 5% of its nominal thickness.

6.3 The allowable value of unevenness of steel plate shall comply with the provisions of Table 2.

Table 2

normal thickness mm	gage length mm	Allowable flatness value mm		
		Ordinary precision PF.A	Higher accuracy PF.B	High precision PF. C
2.0~6.0	1000	≤ 6	≤ 3	≤ 1

6.4 The sick bend of the cutting edge steel plate should not be greater than 3mm.

6.5 Other dimensions, shapes, weights and allowable deviations of steel plates and steel strips shall comply with the provisions of Q/BQB301.

6.6 As required by the buyer, stricter requirements may be put forward for the same plate difference, unevenness and sickle bend allowable deviation of the steel plate upon mutual agreement between the supply and demand parties and specified in the contract.

7 Technical Requirement

7.1 Name and Chemical Composition

The grade and chemical composition of the steel (smelting analysis) shall comply with the provisions of Table 3. The allowable deviation of the chemical composition of the finished steel plate and steel strip shall comply with the provisions of GB/T 222.

Table 3

the name of a shop	Chemical composition ^ (mass fraction)%						
	C	Si	Mn	P	S	Als	Nb+V+Ti
B250TG180 (WDER235) B300TG180 B350TG179 (WDER345) B4000TG179 B450TG179 (WDER450) B500TG179 (WDER490)	≤0. 15	≤0. 25	≤1. 80	≤0. 025	≤0. 015	≥0. 010	≤0. 40
B550TG178 (WDER550) B600TG178 (WDER600)			≤2. 00				
B650TG178 (WDER650) B700TG178 (WDER700) B750TG178 (WDER750)			≤2. 10				
^ variety of alloying elements may be added as required to improve the properties of steel.							

7.2 Smelting Process

The steel used in the steel plate and steel strip is the calming steel smelted in the oxygen converter.

7.3 Condition of Delivery

Steel plates and steel strips are delivered in the state of hot rolling, controlled rolling or heat treatment.

7.4 Mechanical and Process Properties

The mechanical and technological properties of steel plates and steel strips shall comply with the provisions in Table 4. After bending test, no visible cracks shall be found on the outer surface of the specimen. If the supplier can guarantee the passing of bending test, the test may not be carried out.

Table 4

the name of a strip	$\overset{a}{L}_0 = 5.65 \sqrt{S_0}$			180 ° Bending test D- bending center pressure head diameter a-sample thickness
	$R_{p0.2}$ MPa	Tensile strength R_{mPa}	Breakback elongation $A\%$	
B250TG180 (WDER235)	≥250	≥350	≥26	D=2a
B300TG180	≥300	≥400	≥24	D=2a
B350TG179 (WDER345)	≥350	≥450	≥22	D=2a
B400TG179	≥400	≥500	≥19	D=2a
B450TG179 (WDER450)	≥450	≥550	≥17	D=2a
B500TG179 (WDER490)	≥500	≥600	≥14	D=2a
B550TG178 (WDER550)	≥550	≥650	≥14	D=2a
B600TG178 (WDER600)	≥600	≥700	≥14	D=2a
B650TG178 (WDER650)	≥650	≥750	≥14	D=2a
B700TG178 (WDER700)	≥700	≥750	≥13	D=2a
B750TG178 (WDER750)	≥750	≥800	≥12	D=2a
^a tensile test was taken on the transverse specimen. Bending test takes transverse specimen. The width of bending specimen is b≥20mm, and b=20mm in arbitration test.				

7.5 Magnetic Performance

7.5.1 The magnetic properties of steel plates and steel strips shall comply with the provisions of Table 5.

Note: For many years, the magnetic induction intensity B has been used as a convention. In practice, the Epstein square measures the magnetic polarization intensity J. Magnetic induction intensity B and magnetic polarization intensity

The relationship between J: $B = J + \mu_0 H$ (where μ_0 is the permeability in vacuum, taken as $4\pi \times 10^{-7}$ H m; H is the magnetic field strength, in units of A/m)

7.5.2 If required by the buyer, the magnetic polarization strength under other magnetic fields or other requirements for magnetic properties may be specified upon mutual agreement between the supply and demand parties and stated in the contract.

7.6 Surface Quality

7.6.1 The surface of the steel plate and steel strip shall not have cracks, scabbing, folding, bubbles and inclusions and other defects harmful to the use, and the steel plate and steel strip shall not have delamination.

7.6.2 The surface of the steel plate and steel strip is allowed to have slight and local defects such as pockmarks, concave and convex surfaces, scratches and so on whose depth (or height) does not exceed half of the thickness tolerance of the steel plate, but the minimum allowable thickness of the steel plate and steel strip shall be guaranteed.

7.6.3 For steel strips, delivery with defects is permitted as there is no opportunity to remove the defective part, provided that the defective part does not exceed 5% of the total length of each coil.

7.7 Through negotiation between supply and demand parties, the following special requirements for steel plates and steel strips can be specified in the contract:

7.7.1 Impact test requirements.

7.7.2 Other requirements for magnetic properties.

7.7.3 Oil treatment requirements for steel plate surface.

Table 5

the name of a shop	Theoretical density kg/dm ³	Magnetic polarization intensity ^a , T	
		J_{5000}	J_{15000}
B250TG180 (WDER235)	7.85	1.60	1.80
B300TG180		1.60	1.80
B350TG179 (WDER345)		1.55	1.79
B400TG179		1.55	1.79
B450TG179 (WDER450)		1.54	1.79
B500TG179 (WDER490)		1.53	1.79
B550TG178 (WDER550)		1.52	1.78
B600TG178 (WDER600)		1.50	1.78
B650TG178 (WDER650)		1.50	1.78
B700TG178 (WDER700)		1.50	1.78
B750TG178 (WDER750)		1.50	1.78
^a J_{5000} represents the magnetic polarization intensity corresponding to the magnetic field strength H of 5000A/m, which can also be expressed as magnetic induction intensity B_{50} . J_{15000} represents the magnetic polarization intensity corresponding to the magnetic field strength H of 15000A/m, which can also be expressed as magnetic induction intensity B_{150} . If the ^a supplier can guarantee J_{15000} qualified, no test is required.			

8 Inspection and Testing

8.1 The appearance of steel plates and steel strips is visually inspected.

8.2 The size and shape of steel plates and steel strips should be checked with appropriate measuring tools.

8.3 Type of inspection documents When the prescribed inspection and test are selected, they shall comply with the provisions of 8.4 ~ 8.6.

8.4 The inspection items, sample quantity, sampling method and test method required for each batch of steel plate and steel strip shall comply with the provisions in Table 6.

8.5 sampling rate

8.5.1 Sampling frequency for chemical composition analysis

The chemical composition was analyzed by furnace melting.

8.5.2 Sampling frequency of mechanical properties, process properties and magnetic properties

Steel plates and steel strips shall be accepted by batch, each batch shall consist of steel plates or steel strips of the same furnace number, the same brand number, the same thickness and the same delivery state with a weight not greater than 70t.

Note: The weight of the inspection batch may be determined separately through negotiation between the supplier and the buyer.

Table 6

order number	inspecting item	Number of sam- ples	Sampling direction	sampling method	experimental method
1	Chemical analysis ^a	1 per furnace	-	GB/T 20066	GB/T 223, GB/T4336, GB/T 20123, GB/T 20125 or general method
2	Magnetic polarization intensity ^a	1 Group/batch	Half horizontal, half vertical	Width of steel plate or steel strip at 1/4	GB/T 3655 Sample size: length: 280mm ~ 320 mm width: 30mm
3	tension test	1 Per batch	broadwise	GB/T 2975	GB/T 228.1-2021 Method B ^c
4	bend test	1 Per batch	broadwise		GB/T 232
5	Impact test (protocol)	1 Groups (3) / batches	protocol		GB/T 229

^a When arbitration tests are carried out on chemical composition, according to GB/T 223.

The ^b magnetic polarization intensity is measured by the DC method. The sample preparation requirements are according to the grain non-oriented electrical steel sheet in GB/T 3655.

In order to improve the reproducibility of measurement results, it is recommended to use the beam displacement rate control method. The beam displacement rate for measuring yield strength is $0.00083\times L_c$ (mm/s) or $0.05\times L_c$ (mm/min). After yield strength is measured, the beam displacement rate is $0.0067\times L_c$ (mm/s) or $0.4\times L_c$ (mm/min).

8.6 Review

8.6.1 If the Impact Test Results Do Not Meet the Specified Requirements, Three Additional Samples Can Be Taken from the Same Sampling Product for Retest. In This Case, the Front and Rear

The average of the six samples shall not be less than the specified value, and there shall be no more than two samples below the specified value, only one of which is allowed to be less than 70% of the specified value.

8.6.2 The reinspection of other inspection items shall comply with the provisions of GB/T 17505.

9 Packaging, Marking and Inspection Documents

The packaging, marking and inspection documents of steel plates and steel strips shall comply with the provisions of Q/BQB 300, in which the packaging of steel plates shall comply with the provisions of Table 2 Figure 7 of Q/BQB 300.

10 Rules for Numerical Rounding

The numerical judgment adopts the rounding value comparison method, and the numerical rounding should comply with the provisions of GB/T 8170.

11 Appendix

The comparison table between this document and relevant standard grades is shown in Appendix A (information).

appendix A
(Informational)

This Document Is Similar to the Comparison Table of Brand Numbers With Relevant Standards

A.1 The comparison table between this document and relevant standards is shown in Table A.1.

Table A.1

Q/BQB 381 —2023	Q/BQB 381 —2019	Q/WG (RZ) 32 —2014	YB/T 4321 —2012	IEC 60404-8-5 :2020	EN10265-1996	Harbin Electric Agreement	Dongpil agreement
B250TG180 (WDER235)	B250TG180	WDER235	250TG180	TG250-...-180	250-...-TG180	HD235C	DCR235
B300TG180	—	—	250TG180	TG300-...-180	300-...-TG180	HD300C	—
B350TG179 (WDER345)	B350TG179	WDER345	350TG179	TG350-...-179	350-...-TG179	HD345C	DCR345
B400TG179	—	—	400TG179	TG400-...-179	400-...-TG179	HD400C	—
B450TG179 (WDER450)	B450TG179	WDER450	450TG179	TG450-...-179	450-...-TG179	HD450C	DCR450
B500TG179 (WDER490)	B500TG179	WDER490	500TG179	TG500-...-179	500-...-TG179	HD500C	DCR500
B550TG178 (WDER550)	B550TG178	WDER550	550TG178	TG550-...-178	550-...-TG178	HD550C	DCR550
B600TG178 (WDER600)	B600TG178	WDER600	600TG178	TG600-...-178	600-...-TG178	HD600C	DCR600
B650TG178 (WDER650)	B650TG178	WDER650	650TG178	TG650-...-178	650-...-TG178	HD650C	DCR650
B700TG178 (WDER700)	B700TG178	WDER700	700TG178	TG700-...-178	700-...-TG178	HD700C	DCR700
B750TG178 (WDER750)	B750TG178	WDER750	750TG178	—	—	HD750C	DCR750