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Replacing GB/T 28905-2012

Low yield strength steel plate for construction

建筑用低屈服强度钢板

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Foreword

This document is drafted in accordance with GB/T 1.1-2020 "Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents".

This document replaces GB/T 28905-2012 "Low yield strength steel plates for construction". Compared with GB/T 28905-2012, in addition to structural adjustment and editorial changes, the main technical changes are as follows:

a) Change the maximum thickness of steel plate to 120 mm; add the coiled steel plate with a thickness not greater than 25.4 mm (see Clause 1; Clause 1 of the 2012 edition);

b) Add LY300 designation and its corresponding technical requirements (see Table 1 and Table 2);

c) Change the chemical composition regulations of C and P; add the regulation that intentionally-added alloy elements shall be indicated in the certification (see Table 1; Table 1 of the 2012 edition);

d) In the delivery state, add the provision that delivery in other states can also be made after negotiation between the supplier and the purchaser (see 7.3; 6.3 of the 2012 edition);

e) Change the yield strength ratio regulations of designations LY160 and LY225 (see Table 2; Table 2 of the 2012 edition);

f) Add the regulations that surface defects of steel plates are allowed to be removed by methods such as grinding AND welding repairs are not allowed (see 7.5.3 and 7.5.4);

g) Change the regulation on the minimum thickness of through-thickness characteristics (see 7.6.3; 6.6.2 of the 2012 edition);

h) Add special requirements such as bend test, grain size, and nonmetallic inclusions (see 7.6.2 and 7.6.5);

i) Change inspection lot regulations (see 9.2; 7.2 of the 2012 edition);

j) Add provisions on type of inspection document (see Clause 10).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The issuing authority of this document shall not be held responsible for identifying any or all such patent rights.

This document was proposed by China Iron and Steel Association.

This document shall be under the jurisdiction of National Technical Committee 183 on Steel of Standardization Administration of China (SAC/TC 183).

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This document was first issued in 2012. This is the first revision.

Low yield strength steel plate for construction

1 Scope

This document specifies the designation representation method, order content, dimension, shape, weight, technical requirements, test methods, inspection rules, package, mark and certification of low yield strength steel plate for construction.

This document is applicable to single-rolled steel plates with a thickness not greater than 120 mm and coiled steel plates with a thickness not greater than 25.4 mm for the manufacture of building anti-seismic, shock-absorbing and other energy-dissipating structural components (such as energy-dissipating damping components, etc.).

2 Normative references

The contents of the following documents, through normative references in this text, constitute indispensable provisions of this document. Among them, for dated references, only the edition corresponding to that date applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 222 Permissible Tolerances for Chemical Composition of Steel Products

GB/T 223.5 Steel and Iron - Determination of Acid-Soluble Silicon and Total Silicon Content - Reduced Molybdosilicate Spectrophotometric Method

GB/T 223.12 Methods for chemical analysis of iron, steel and alloy - The sodium carbonate separation-diphenyl carbazide photometric method for the determination of chromium content

GB/T 223.23 Iron, steel and alloy - Determination of nickel content - The dimethylglyoxime spectrophotometric method

GB/T 223.26 Iron, steel and alloy - Determination of molybdenum content - The thiocyanate spectrophotometric method

GB/T 223.37 Iron, steel and alloy - Determination of nitrogen content - Indophenol blue spectrophotometric method after distillation separation

GB/T 223.40 Iron, steel and alloy - Determination of niobium content by the sulphochlorophenol S spectrophotometric method

GB/T 223.53 Methods for chemical analysis of iron, steel and alloy - The flame atomic absorption spectrophotometric method for the determination of copper

content

GB/T 223.54 Methods for chemical analysis of iron, steel and alloy - The flame atomic absorption spectrophotometric method for the determination of nickel content

GB/T 223.59 Iron, Steel and Alloy - Determination of Phosphorus Content - Bismuth Phosphomolybdate Blue Spectrophotometric Method and Antimony Phosphomolybdate Blue Spectrophotometric Method

GB/T 223.60 Methods for chemical analysis of iron, steel and alloy - The perchloric acid dehydration gravimetric method for the determination of silicon content

GB/T 223.63 Methods for chemical analysis of iron, steel and alloy - The sodium (potassium) periodate photometric method for the determination of manganese content

GB/T 223.64 Iron, steel and alloy - Determination of manganese content - Flame atomic absorption spectrometric method

GB/T 223.76 Methods for chemical analysis iron, steel and alloy - The flame atomic absorption spectrometric method for the determination of vanadium content

GB/T 223.78 Methods for chemical analysis of iron, steel and alloy - Curcumin spectrophotometric method for the determination of boron content

GB/T 223.84 Steel and iron - Determination of titanium content - Diantipyrylmethane spectrophotometric method

GB/T 223.85 Steel and iron - Determination of sulfur content - Infrared absorption method after combustion in an induction furnace

GB/T 223.86 Steel and iron - Determination of total carbon content - Infrared absorption method after combustion in an induction furnace

GB/T 228.1 Metallic materials - Tensile testing - Part 1: Method of test at room temperature

GB/T 229 Metallic materials - Charpy pendulum impact test method

GB/T 232 Metallic materials - Bend test

GB/T 247 General rule of package, mark and certification for steel plates (sheets) and strips

GB/T 709 Dimension, shape, weight and tolerance for hot-rolled steel strip, plate and sheet

GB/T 2970 Method for ultrasonic testing of thicker steel plates

GB/T 2975 Steel and Steel Products - Location and Preparation of Test Pieces for Mechanical Testing

GB/T 4336 Carbon and Low-Alloy Steel - Determination of Multi-Element Contents - Spark Discharge Atomic Emission Spectrometric Method (Routine Method)

GB/T 5313 Steel plate with through-thickness characteristics

GB/T 6394 Metal - Methods for Estimating the Average Grain Size

GB/T 8170 Rules of Rounding off for Numerical Values and Expression and Judgement of Limiting Values

GB/T 10561 Steel - Determination of Content of Nonmetallic Inclusions - Micrographic Method Using Standards Diagrams

GB/T 14977 General requirement for surface condition of hot-rolled steel plates

GB/T 17505 Steel and Steel Products - General Technical Delivery Requirements

GB/T 18253-2018 Steel and steel products - Types of inspection documents

GB/T 20066 Steel and iron - Sampling and preparation of samples for the determination of chemical composition

GB/T 20123 Steel and iron - Determination of total carbon and sulfur content - Infrared absorption method after combustion in an induction furnace (routine method)

GB/T 20124 Steel and iron - Determination of nitrogen content - Thermal conductimetric method after fusion in a current of inert gas

GB/T 20125 Low-alloy steel - Determination of multi-element contents - Inductively coupled plasma atomic emission spectrometric method

GB/T 20126 Unalloyed Steel - Determination of low carbon content - Part 2: Infrared absorption method after combustion in an in an induction furnace (With preheating)

3 Terms and definitions

This document does not have terms and definitions that need to be defined.

4 Designation representation method

The designation of steel consists of two parts: The first initials "LY" of "Low Yield" and the target value of the specified yield strength.

Example: LY160

LY - The first initials of "Low Yield";

160 - The target value of the specified yield strength, in megapascals (MPa).

5 Order content

The contract or order for ordering according to this document shall include the following content:

a) Product name;

b) The number of this document;

c) Designation;

d) Specification and dimension, roughness accuracy;

e) Delivery state;

f) Weight;

g) Other requirements.

6 Dimension, shape, weight

The dimension, shape, weight and tolerance of the steel plate shall comply with the provisions of GB/T 709.

7 Technical requirements

7.1 Designation and chemical composition

7.1.1 The designation and chemical composition (melting analysis) of steel shall comply with the requirements in Table 1.

Table 1 -- Designation and chemical composition of steel

Designation	Chemical composition (mass fraction)[a]/%					
	C	Si	Mn	P	S	N
LY100	≤0.01	≤0.10	≤0.40	≤0.020	≤0.015	≤0.006
LY160	≤0.03	≤0.10	≤0.50	≤0.020	≤0.015	≤0.006
LY225	≤0.05	≤0.10	≤0.60	≤0.020	≤0.015	≤0.006
LY300	≤0.16	≤0.30	≤1.50	≤0.020	≤0.015	≤0.006

[a] Selected by the supplier, other alloy elements such as Nb, V, Ti, B can be added as required. Their contents shall be indicated in the certification.

7.1.2 The content of residual elements copper, chromium and nickel in the steel shall not exceed 0.30%, respectively. The supplier may not make analysis if it can guarantee it.

7.1.3 The permissible tolerances for chemical composition of steel plate products shall comply with the provisions of GB/T 222.

7.2 Smelting method

Steel is produced from killed steel smelted in oxygen converters or electric arc furnaces. Unless the purchaser has special requirements and is specified in the contract, the smelting method shall be chosen by the supplier.

7.3 Delivery state

Steel plates are usually delivered in hot-rolled, controlled-rolled, or heat-treated state. If required by the purchaser, after negotiation between the supplier and the purchaser, and indicated in the contract, delivery in other states can also be made.

7.4 Mechanical properties

7.4.1 The mechanical properties of the steel plate shall meet the requirements in Table 2.

7.4.2 The steel plate with a nominal thickness not less than 6 mm shall be subjected to impact test. The size of the impact specimen shall be a standard specimen of 10 mm×10 mm×55 mm. When the thickness of steel plate is not enough to make standard specimen, it shall use small-size specimens of 7.5 mm×10 mm×55 mm and 5 mm×10 mm×55 mm. The impact absorption energy shall not be less than 75% or 50% of the value specified in Table 2, respectively. The larger-size specimen is preferred.

7.4.3 The impact absorption energy of steel plate is calculated according to the arithmetic mean of a group of 3 specimens. It is allowed that the single value of 1 specimen is lower than the specified value in Table 2; but not lower than 70% of the specified value. Otherwise, 3 specimens shall be taken from the same steel plate or the same billet for testing. The arithmetic mean of the impact absorption energy of the 6

specimens in the two groups shall not be lower than the specified value. It is allowed that 2 specimens have a single value lower than the specified value; but only one of them is allowed to have a single value lower than 70% of the specified value.

Table 2 -- Mechanical properties

Designation	Tensile test[a, b]				Charpy (V-notch) impact test[e, f]	
	Lower yield strength[c, d] R_{eL}/MPa	Tensile strength[d] R_m/MPa	Percentage elongation after fracture $A_{50\ mm}$/%	Yield strength ratio ≤	Test temperature ℃	Impact absorption energy KV_2/J
LY100	80～120	200～300	≥50	0.60	0	≥27
LY160	140～180	220～320	≥45	0.76	0	≥27
LY225	205～245	300～400	≥40	0.78	0	≥27
LY300	280～320	380～500	≥40	0.80	0	≥34

Table 2 -- Mechanical properties (continued)

Designation	Tensile test[a, b]				Charpy (V-notch) impact test[e, f]	
	Lower yield strength[c, d] R_{eL}/MPa	Tensile strength[d] R_m/MPa	Percentage elongation after fracture $A_{50\ mm}$/%	Yield strength ratio ≤	Test temperature ℃	Impact absorption energy KV_2/J

[a] Tensile test specimen is transverse.

[b] Tensile specimen size: For thickness not greater than 50 mm, use L_0=50 mm, b=25 mm; for thickness greater than 50 mm, use L_0=50 mm, d=14 mm. For thickness >25 mm~50 mm, L_0=50 mm and d=14 mm can also be used; but in the case of arbitration, L_0=50 mm, b=25 mm.

[c] When the yield phenomenon is not obvious, the specified plastic elongation strength $R_{p0.2}$ shall be used instead of the lower yield strength.

[d] If required by the purchaser, after negotiation between the supplier and the purchaser, and indicated in the contract, the range of yield strength and tensile strength can be adjusted appropriately.

[e] Impact test specimen is longitudinal.

[f] If required by the purchaser, after negotiation between the supplier and the purchaser, and indicated in the contract, other values of impact test temperature and impact absorption energy may be specified.

7.5 Surface condition

7.5.1 There shall be no harmful defects such as air bubbles, scars, cracks, folds, inclusions and pressed iron oxide scales on the surface of steel plate that will affect the use. Steel plates shall not have visible delamination.

7.5.2 The surface of steel plate is allowed to have a thin layer of iron oxide scale and rust without hindering the inspection of surface defects; and inconspicuous roughness, reticulation, pitting, scratches, and other local defects caused by pressing the iron oxide scale and rolls. However, its depth shall not be greater than half of the tolerance of the thickness of steel plate; the minimum allowable thickness of steel plate shall be

guaranteed.

7.5.3 Surface defects of steel plates are allowed to be removed by methods such as grinding. The cleaned place shall be smooth without edges and corners. The cleaning depth shall not be greater than half of the tolerance of the steel plate thickness. The minimum allowable thickness of steel plate shall be guaranteed.

7.5.4 Welding repairs are not allowed for steel plates.

7.5.5 After negotiation between the supplier and the purchaser, and indicated in the contract, the surface condition of steel plate can also comply with the provisions of GB/T 14977.

7.6 Special requirements

7.6.1 According to the requirements of the purchaser, after negotiation between the supplier and the purchaser, and indicated in the contract, the requirements of 7.6.2~7.6.5 can be supplemented.

7.6.2 The bend test requires that the diameter of the bend indenter, D=a, where a is the thickness of the specimen.

7.6.3 For the steel plate with a thickness not less than 15 mm, it shall carry out the through-thickness characteristics test. The steel plates with different through-thickness characteristics levels shall comply with the provisions of GB/T 5313.

7.6.4 Steel plates shall be subjected to ultrasonic testing one by one. The ultrasonic testing method shall be in accordance with GB/T 2970 or other methods. The testing standards and conformity levels shall be specified in the contract.

7.6.5 Inspection requirements for grain size and nonmetallic inclusions.

8 Test methods

8.1 The test methods for steel plate inspection items shall comply with the provisions in Table 3.

8.2 The chemical composition test of steel is generally carried out according to GB/T 4336, GB/T 20123, GB/T 20124, GB/T 20125, GB/T 20126, or other general methods. During arbitration, it shall be in accordance with the provisions of GB/T 223.5, GB/T 223.12, GB/T 223.23, GB/T 223.26, GB/T 223.37, GB/T 223.40, GB/T 223.53, GB/T 223.54, GB/T 223.59, GB/T 223.60, GB/T 223.63, GB/T 223.64, GB/T 223.76, GB/T 223.78, GB/T 223.84, GB/T 223.85, and GB/T 223.86.

Table 3 -- Inspection items, number of specimens, sampling methods, and test methods

No.	Inspection items	Number of specimens/pieces	Sampling methods	Test methods
1	Chemical analysis	1/furnace	GB/T 20066	8.2
2	Tensile test	1/lot	GB/T 2975, transverse	GB/T 228.1
3	Impact test	3/lot	GB/T 2975, longitudinal	GB/T 229
4	Bend test[a]	1/lot	GB/T 2975, transverse	GB/T 232
5	Through-thickness tensile characteristics test[a]	3/lot	GB/T 5313	GB/T 228.1
6	Ultrasonic inspection[a]	One by one	-	GB/T 2970 or other inspection methods
7	Grain size[a]	Negotiated	Negotiated	GB/T 6394
8	Nonmetallic inclusions[a]	Negotiated	Negotiated	GB/T 10561
9	Dimension and shape	One by one	-	Suitable measuring tool
10	Surface condition	One by one	-	Visually
[a] Additional inspection items that are negotiated by both the supplier and the purchaser and indicated in the contract according to the requirements of the purchaser.				

9 Inspection rules

9.1 The inspection and acceptance of steel plates shall be carried out by the quality inspection department of the supplier.

9.2 Steel plates shall be accepted in lots. Each lot shall be composed of successively rolled steel plates of the same designation, same heat number, same thickness, and same delivery state.

9.3 The number of specimens and sampling method of steel plate shall comply with the provisions in Table 3.

9.4 The re-inspection and determination of steel plates shall comply with the provisions of GB/T 17505.

9.5 The test results of chemical composition and mechanical properties are rounded according to the rounding value comparison method. The rules of rounding off shall be in accordance with the provisions of GB/T 8170.

10 Package, mark and certification

10.1 The package, mark and certification of the steel plate shall comply with the provisions of GB/T 247.

10.2 The type of certification of the steel plate shall comply with the provisions in GB/T 18253-2018. When the certification type is not specified, it shall be in accordance with GB/T 18253-2018, type 3.1.

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