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Replacing GB/T 13793-1992

Steel pipes with a Longitudinal Electric (Resistance) Weld

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Foreword

This Standard is revised by reference to ASTM A53/A53M-05 "Standard Specification for pipe, steel, Black and Hot-Dipped, zinc-Coated, Welded and Seamless" and JIS G 3444:2004 "Carbon steel tubes for general structural purposes".

This Standard replaces GB/T 13792-1992 "Welded steel pipe for supporting roller of belt conveyer" and GB/T 13793-1992 "steel pipes with a longitudinal electric (resistance) weld". Compared with GB/T 13792-1992 and GB/T 13793-1992, the main changes are as follows:

- Directly introduce general standard of welded steel pipe for dimensions;
- revise permissible deviations of dimension;
- revise the scope of length along full length;
- add the classification of steel pipe's curvature;
- add the requirements in steel pipe end surface;
- add the requirements in height of inner weld burr;
- delete steel designations 08F, 10F and 15F; add steel designation Q235C and low alloy steel;
- add post-welding hot-working manufacturing method;
- revise the spacing of slabs in flattening test;
- revise the requirements in steel pipe hydraulic test;
- add the requirements in steel pipe coating; propose the technical requirements in galvanized pipe;
- revise inspection and group-batching rules of steel pipe.

Annex A and Annex B of this Standard are normative.

This Standard was proposed by China Iron and steel Association.

This Standard shall be under the jurisdiction of National Iron and steel Standardization Committee.

Drafting originations of this Standard: Lingyuan iron and steel Group Co., Ltd., Panyu Chu Kong steel pipe Co., Ltd. AND Hengsui Jinghua steel pipe Co., Ltd.

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Steel pipes with a Longitudinal Electric (Resistance) Weld

1 Scope

This Standard specifies classification, code name, dimension, shape, weight, technical requirement, test method, inspection rules, packaging, marking and quality certificate of steel pipe with a longitudinal electric (resistance) weld.

This Standard is applicable to steel pipe with a longitudinal electric (high frequency resistance) weld for common purpose of which the outer-diameter is not larger than 630 mm.

2 Normative References

The following standards contain the provisions which, through reference in this text, constitute the provisions of this Standard. For dated reference, the subsequent amendments or revisions of these publications do not apply. However, the parties who enter into an agreement based on the cited standards are encouraged to study whether the latest versions of the cited documents are applicable. For undated references, the latest edition of the normative document referred to applies.

GB/T 222 Permissible Deviations for Chemical Composition of steel Products

GB/T 223.3 Methods for chemical analysis of iron, steel and alloy - The diantipyrylmethane phosphomolybdate gravimetric method for the determination of phosphorus content

GB/T 223.5 steel and iron - Determination of acid-soluble silicon and total silicon content - Reduced molybdosilicate spectrophotometric method

GB/T 223.10 Methods for chemical analysis of iron, steel and alloy - The cupferron separation-chrome azurol S photometric method for the determination of aluminium content

GB/T 223.11 Methods for chemical analysis of iron, steel and alloy - The ammonium persulfate oxidation volumetric method for the determination of chromium content

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 223.14 Methods for chemical analysis of iron, steel and alloy - The N-benzoyl-N-phenylhydroxylamine extraction photometric method for the determination of

vanadium content

GB/T 223.16 Methods for chemical analysis of iron, steel and alloy - The chromotropic acid photometric method for the determination of titanium content

GB/T 223.18 Methods for chemical analysis of iron, steel and alloy - The sodium thiosulfate separation iodimetric method for the determination of copper content

GB/T 223.19 Methods for chemical analysis of iron steel and alloy - The neocuproine-chloroform extraction photometric method for the determination of copper content

GB/T 223.23 Methods for chemical analysis of iron, steel and alloy - The dimethylglyoxime spectrophotometric method for the determination of nickel content

GB/T 223.24 Methods for chemical analysis of iron, steel and alloy - The extraction separation - The dimethylglyoxime spectrophotometric method for the determination of nickel content

GB/T 223.32 Methods for chemical analysis of iron, steel and alloy - The hypophosphite reduction-iodimetric method for the determination of arsenic content

GB/T 223.37 Methods for chemical analysis of iron steel and alloy - The indophenol blue photometric methods for the determination of nitrogen content after distillation separation

GB/T 223.40 Methods for chemical analysis of iron, steel and alloy - The anion-exchange separation-sulphochlorophenol S photometric method for the determination of niobium content

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 223.58 Methods for chemical analysis of iron, steel and alloy - The sodium arsenite-sodium nitrite titrimetric method for the determination of manganese content

GB/T 223.59 Methods for chemical analysis of iron, steel and alloy - The reduced molybdoantimonyl phosphoric acid photometric method for the determination of phosphorus content

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 223.61 Methods for chemical analysis of iron, steel and alloy - The ammonium phosphomolybdate volumetric method for the determination of phosphorus content

GB/T 223.62 Methods for chemical analysis of iron, steel and alloy - The butyl acetate extraction photometric method for the determination of phosphorus 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 Methods for chemical analysis of iron, steel and alloy - The flame atomic absorption spectrometric method for the determination of manganese content

GB/T 223.67 Methods for chemical analysis of iron, steel and alloy - The reducing distillation-methylene blue photometric method for the determination of sulfur content

GB/T 223.68 Methods for chemical analysis of iron, steel and alloy - The potassium iodate titration method after combustion in the pipe furnace for the determination of sulfur content

GB/T 223.69 Methods for chemical analysis of iron, steel and alloy - The gas-volumetric method after combustion in the pipe furnace for the determination of carbon content

GB/T 223.71 Methods for chemical analysis of iron, steel and alloy - The gravimetric method after combustion in the pipe furnace for the determination of carbon content

GB/T 223.72 Methods for chemical analysis of iron, steel and alloy - The alumina chromatographic separation-barium sulfate gravimetric method for the determination of sulphur content

GB/T 223.74 Methods for chemical analysis of iron, steel and alloy - The combustion gravimetric/gas-volumetric method for the determination of combined carbon content

GB/T 228 Metallic materials - Tensile testing at ambient temperature (GB/T 228-2002, ISO 6892:1998, EQV)

GB/T 241 Metal tubes - Hydrostatic pressure testing

GB/T 242 Metallic materials – Tube - Drift expanding test (GB/T 242-2007, ISO 8493:1998, IDT)

GB/T 244 Metallic materials - Tube - Bend test (GB/T 244-2008, ISO 8491:1998, IDT)

GB/T 246 Metal materials - Tube - Flattening test (GB/T 246-2007, ISO 8492:1998, IDT)

GB/T 699 Carbon constructional quality steel

GB/T 700 Carbon structural steels (GB/T 700-2006, ISO 630:1995, NEQ)

GB/T 1591 High strength low alloy structural steels

GB/T 2102 Acceptance packing marking and quality certification of steel pipe

GB/T 2975 steel and steel products - Location and preparation of test pieces for mechanical testing

GB/T 4336 Standard test method for spark discharge atomic emission spectrometric analysis of carbon and low-alloy steel (routine method)

GB/T 7735 steel tubes - The inspection method on eddy current test (GB/T 7735-2004, ISO 9304:1989, MOD)

GB/T 12606 steel tubes - The testing method of magnetic flux leakage (GB/T 12606-1999, eqv ISO 9402:1989, ISO 9598:1989)

GB/T 18256 Welded steel tubes (except submerged arc-welded-Ultrasonic testing for verification of hydraulic leak-tightness

GB/T 20066 steel and Iron Sampling and preparation of samples for the determination of chemical composition (GB/T 20066-2006, ISO 14284:1996, IDT)

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/T20123-2006, ISO 15350:2000, IDT)

GB/T 21835 Dimensions and masses per unit length of welded steel pipes (GB/T 21835-2008, ISO 1127:1992, ISO 4200:1991, NEQ)

3 Classification and Code Name

Based on manufacturing precision, the classification and code name of steel pipe are as follows:

- a) steel pipe with general precision outer-diameter, PD. A;
- b) steel pipe with higher precision outer-diameter, PD. B;
- c) steel pipe with super-precision outer-diameter, PD. C;
- d) steel pipe with general precision wall thickness, PT. A;

- e) steel pipe with higher precision wall thickness, PT. B;
- f) steel pipe with super-precision wall thickness, PT. C;
- g) steel pipe with general precision curvature, PS. A;
- h) steel pipe with higher precision curvature, PS. B;
- i) steel pipe with super-precision curvature, PS. C.

4 Contents of Ordering

4.1 The steel pipe purchase contract or order formulated according to this Standard shall include the following contents:

- a) Standard number;
- b) Product name;
- c) Designation of steel;
- d) Quantity (total weight or total length);
- e) Manufacturing method;
- f) Dimensions;
- g) Condition of delivery.

4.2 If the following requirements are chosen by demand-party, they shall be negotiated by both parties, and specified in steel pipe purchase contract or order:

- a) Purpose;
- b) Type of hydraulic test;
- c) Manufacturing precision;
- d) pipe end state;
- e) Inner burr clearing;
- f) Thickness of galvanizing coat;
- g) Other requirements.

5 Dimension, Shape, Weight and Permissible Deviation

outer-diameter, the length of the flattening test specimen is not less than 63.5mm. In the test, an angle of 90° shall be formed between weld-seam and exerting-force direction. When the outer-diameter of the steel pipe is flattened to 2/3D (3/4D for Q345), there shall be no crack on any position of the steel pipe.

6.5.1.2 According to the requirement of demand-party, negotiated by both parties and specified in the contract, flattening test may continue to conduct the following STEP 2 ductility test and STEP 3 soundness test:

- a) Ductility test (Step 2): when the distance between two parallel press-plates is less than 1/3 of the nominal outer-diameter of the steel pipe, but not less than 5 times of the steel pipe wall thickness, except the weld-seams of inner and outer surfaces of the steel pipe, there must be no fissure or crack on other positions. If the ratio of outer-diameter and wall-thickness is less than 10, the fissures or cracks on weld-seams and welding positions on the inner and outer surfaces (at 6-O'clock position and 12-O'clock position) of test specimen can be exempted from judgment basis.
- b) Soundness test (Step 3): flattening test is continued until test specimen is cracked or opposite pipe walls are contacted. In the entire flattening process, there must be no layering, defective material or weld-seam unsoundness.

6.5.2 Bending test

As for the steel pipe of which the outer-diameter is not larger than 60mm, bending test may replace flattening test. In bending test, there shall be no filler in test specimen; the bending radius is 6 times of the steel pipe's outer-diameter; the bend angle is 90°; the weld-seam is located on the outer lateral surface of bending direction.

6.5.3 Expanding test

According to the requirement of demand-party, negotiated by both parties and specified in the contract, expanding test may be done for steel pipe. The top-center taper in expanding test is one of 30°, 45° and 60°; the expanding rate of test specimen's outer-diameter shall be 6%; the test specimen shall not have fissure or crack.

6.6 Hydraulic test

6.6.1 hydraulic test shall be done for steel pipe for band conveyor roller. In the hydraulic test, test pressure for the steel pipe of which the outer-diameter is not larger than 108mm is 7MPa; the test pressure for steel pipe of which the outer-diameter is larger than 5mm is 5MPa. Under the test pressure, the regulated-pressure time shall not be less than 5s; steel pipe shall not have leakage.

6.6.2 According to the requirement of demand-party, negotiated by both parties and specified in the contract, hydraulic test may be done for steel pipe for other purpose.

In the hydraulic test, test pressure for the steel pipe of which the outer-diameter is not larger than 219.1mm is 5MPa; the test pressure for steel pipe (the outer-diameter is larger than 219.1mm) is 3MPa. Under the test pressure, the regulated-pressure time shall not be less than 5s; steel pipe shall not have leakage.

6.6.3 The supplier may replace hydraulic test with ultrasonic testing, eddy current test or flux leakage test. In ultrasonic testing, the artificial defect of contrast sample pipe shall meet the provisions of GB/T 18256; in eddy current test, the artificial defect of contrast sample pipe shall meet the provisions of acceptance Level-A in GB/T 7735; in flux leakage test, the artificial defect of contrast sample pipe shall meet the provisions of acceptance level Level-4 in GB/T 12606. If both parties have dispute, the result of hydraulic test shall prevail.

6.7 Surface quality

6.7.1 There shall be no crack, scar, fold, layering, lap-welding or over-burning defect on inner and outer surfaces of the steel pipe. The defects such as notch, scratch, weld-seam mis-position, burnt, thin iron scale and outer burr buff marks, which are smaller than the minus deviation of the wall thickness, are allowable.

6.7.2 Defect repair may be done for the steel pipe of which the outer-diameter is larger than 114.3mm. Before repairing, defects shall be removed completely to meet the requirement of repairing welding. the defect repairing positions per steel pipe shall not be more than 3; the repairing welding length per position is 50 mm ~ 150mm; the total repairing welding length shall not be larger than 300mm. Repairing weld-seam shall be flattened; the seams after flattening shall be smooth to surface profile of the steel pipe. Within 200mm from the pipe end, repairing welding is not allowed.

If the hydraulic test is specified, the steel pipe after repairing shall be tested by hydraulic test in accordance with the provisions of 6.6.

6.8 Coating

6.8.1 galvanizing

6.8.1.1 According to the requirement of demand-party, negotiated by both parties and specified in the contract, steel pipe may be galvanized on inner and outer surfaces with hot-dip process before delivering.

6.8.1.2 Inner and outer surfaces of galvanized steel pipe shall have complete galvanizing coat; there shall be no un-galvanized black spotting or bubble. However, partial rough surface and zinc lump may be allowable.

6.8.1.3 The galvanizing coat uniformity test shall be done for galvanized steel pipe (see Annex A). test specimen shall not show red (copper-plating color) after continual copper sulphate dipping for 5 times;

6.8.1.4 The thickness test of galvanizing coat shall be done for galvanized steel pipe

(see Annex B); the thickness of the galvanizing coat is selected by demand-party according to Table 9.

Table 9 Thickness of hot dip galvanized coating

Option	Requirement	Thickness of galvanizing coat (e)
A	Inner and outer surfaces (except weld-seam)	$\geq 75\mu\text{m}$
B	Inner and outer surfaces (except weld-seam)	$\geq 55\mu\text{m}$
C	Inner and outer surfaces (except weld-seam)	$\geq 45\mu\text{m}$

6.8.1.5 Bending test shall be done for the steel pipe (after galvanizing) of which the outer-diameter is not larger than 60.3mm. In bending test, there shall have no filler in test specimen; the bending radius is 8 times of the steel pipe's outer-diameter; the bending angle is 90° ; the weld-seam is located on the outer lateral surface of bending direction. After the test, test specimen shall have no fissure or zinc coating scaling.

According to the requirement of demand-party, negotiated by both parties and specified in the contract, flattening test may be done to replace bending test for steel pipe (after galvanizing) of which the outer-diameter is larger than 60.3mm. The length of the flattening test specimen is not less than 63.5mm. An angle of 90° shall be formed between the weld-seam and exerting-force direction in the test. When outer-diameter of the steel pipe is flattened to $3/4D$, test specimen shall not have zinc coating scaling.

6.8.1.6 Dimension, shape, mechanical property and processing property tests shall be done for steel pipe before galvanizing.

6.8.2 Other coatings

According to the requirement of demand-party, negotiated by both parties and specified in the contract, temporary coating and special coating may be selected; the determination can be made to coating material, positions and technical requirements.

7 test Method

7.1 The dimension and shape of steel pipe shall be tested, piece by piece, by measuring tools that comply with precision requirements. The outer-diameter of the steel pipe shall be tested at least 50mm away from the pipe end.

7.2 The inner and outer surfaces of steel pipe shall be tested, piece by piece, by visual inspection under good lighting condition.

7.3 The sampling method and test method for testing items of each-batch steel pipes shall meet the provisions of Table 10.

Annex A

(Normative)

Galvanizing coat uniformity test (cupric sulfate dipping method)

A.1 Preparation of test specimen

From the tested galvanized steel pipe of each batch, 2 pieces of pipe section of which the length is not less than 150mm are selected as test specimens. Oil on the test specimens shall be removed; the test specimens shall be cleaned with soft cloth.

A.2 Preparation of test solution

The test solution is composed of 33g of cupric sulfate crystals ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) or about 36g of industrial cupric sulfate that is dissolved in 100mL of distilled water. Add excessive amount of $[\text{Cu}(\text{OH})_2]$ or $[\text{CuCO}_3\text{Cu}(\text{OH})_2]$; stir up; neutralize with free acid; stay for 24h; then filter for clear. The density of test solution is $11.170\text{g}/\text{cm}^3$ under the temperature of 5°C . 10g of cupric hydroxide is added for per 10L of test solution; the excess condition of the cupric hydroxide is judged by the deposit on the container bottom.

12g of verdigris (chemically pure) is added for per 10L of the solution. If cupric hydroxide is replaced by cupric oxide (CuO), 8g of cupric oxide is added for per 10L of the solution; stay for 48h; and filter the solution.

A.3 Containers for test

A.3.1 The material for the test container shall be non-reactive to cupric sulfate.

A.3.2 The inner dimension of the container shall ensure that the test specimen has the 25 mm distance from any wall of the container after dipping.

A.4 test operation

A.4.1 The cut end of the test specimen is faced downwards; dip continually in the cupric sulfate solution for 5 times. The length of the test specimen dipped in the solution shall not be less than 100mm. In the test process, the temperature of the test specimen and the solution shall stay at $15^\circ\text{C} \sim 21^\circ\text{C}$. The test specimen and solution shall not be stirred. The test specimen shall be dipped in solution for 1 min for each-time; rinse immediately after taking out. All black precipitate shall be removed by soft brush; the test specimen is mopped up with soft cloth.

A.4.2 Except the last dipping, the test specimen shall be re-dipped into the solution.

A.4.3 Same test solution after 20 dippings shall be discarded.

A.5 Result judgment

The test specimen shall not show red (copper-plating color) after 5 continual dippings, rinsing and mopping up. But it is excluded that there is red metallic copper deposit on the position where is 25mm within the end of the test specimen and 10mm away from the liquid level of the solution.

If above test specimen shows red metallic copper deposit, and the adhesiveness can be judged by the following method: it is immersed in spirit of salt (volume ratio is 1:10) for 15s, and swabbed in flowing clean water; if the bottom surface hereof shows zinc coating, THEN the test specimen is deemed as qualified.

If there is dispute about whether there is red metallic copper deposited on the bottom surface, then the red metallic copper deposit can be scaled; a drop or more dilute hydrochloric acid is added on the scaled position; if there is zinc coating, reactive hydrogen gas will be generated. Furthermore, it may also be judged by zinc qualitative test, that is, acid liquor dripped down is collected by filter paper (small piece) or pipette, and neutralized by ammonium hydroxide to make it acid; hydrogen sulfide is access into the solution, it can be judged by whether the white deposit (zinc sulfide) is generated.

Annex B

(Normative)

Galvanizing coat thickness test (antimonic chloride method)

B.1 Preparation of test specimen

Any steel pipe (a piece) is selected from each batch of tested galvanized steel pipes; pipe sections (100mm in length) are respectively cut out from both ends of the steel pipe. There shall be no rough surface and zinc lump on the surface of the test specimen. The surface of the test specimen is cleaned with pure solvents like benzene, petrobenzene, trichloroethylene, or carbon tetrachloride; then rinse with ethanol and clean water; varnish lacquer (carbolic acid) is coated on the end surfaces of the test specimen; dry it sufficiently.

B.2 Preparation of test solution

32g of antimony trichloride (SbCl_3) or 20g of antimony trioxide (Sb_2O_3) is dissolved in 1000mL of hydrochloric acid, of which the density is more than 1.18 g/cm^3 , for preparing stock solution. The test solution is made of the stock solution and the hydrochloric acid (the density is more than 1.18 g/cm^3) at the volume ratio 1:20.

B.3 test operation

B.3.1 weighing the weight of the test specimen, free from oil, accurate to 0.01g.

B.3.2 Weighed test specimen is immersed in the test solution; dip a test specimen for each-time. The liquid level shall be higher than the test specimen. In the testing process, the temperature of the solution shall not be higher than 38°C .

B.3.3 When the hydrogen generation in solution is less and the galvanizing coat disappears, take the test specimen out; rinse with clean water; dry up with lint or clean cloth; weigh with balance after drying, accurate to 0.01g.

B.3.4 The outer-diameter and inner diameter of the test specimen shall be tested at one end of the test specimen at two mutually perpendicular directions after the zinc coating is scaled off. The mean value of two test results is adopted as the actual outer-diameter and inner diameter of the steel pipe, accurate to 0.01mm.

B.3.5 If the zinc coating is easy to remove, the test solution may be reused.

B.4 Calculation of test results

The surface area of the test specimen shall be calculated according to Formula (B.1):

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