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Welded steel pipes for offshore engineering pile

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Welded steel pipes for offshore engineering pile

1 Scope

This Standard specifies the dimensions, shape, weight, technical requirements, test methods, inspection rules, packaging, marks and quality certificates of welded steel pipes for offshore engineering pile.

This Standard is applicable to the welded steel pipes for offshore engineering and wharf pile foundation, as well as the welded steel pipes for pile foundation of railway, highway, bridge, construction pile foundation and wind power tower (hereinafter referred to as “steel pipes”).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 222, *Method of sampling steel for determination of chemical composition and permissible variations for product analysis*

GB/T 223.3, *Methods for chemical analysis of iron，steel and alloy - The diantipyryl methane 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 223.9, *Methods for chemical analysis of iron, steel and alloy - The chrome azurol S photometric method for the determination of aluminium 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-Benzoy-N-Phenylhydroxylamine Extraction Photometric Method for the Determination of Vanadium Content*

GB/T 223.17, *Methods for chemical analysis of iron，steel and alloy - The*

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, *Iron, steel and alloyed - Determination of manganese content - Flame atomic absorption spectrometric method*

GB/T 223.67, *Iron, steel and alloy - Determination of sulfur content - Methylene blue spectrophotometric method*

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, *Iron, steel and alloy - Determination of carbon contents - Gas-volumetric method after combustion in the pipe furnace*

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, *Iron, steel and alloy - Determination of sulfur content - Gravimetric 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 246, *Metallic materials - Tube - Flattening test*

GB/T 700, *Carbon structural steels*

GB/T 1591, *High strength low alloy structural steels*

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

GB/T 2651, *Tensile test method on welded joints*

GB/T 2653, *Bend test methods on welded joints*

>2540~4064	±20	+8.0 -0.8	
[a] Pipe end refers to a steel pipe within a length of 100mm at each end of the steel pipe.			

5.2 Length

5.2.1 The length of the steel pipe is determined by both the supplier and the purchaser according to the engineering needs.

5.2.2 Required by the purchaser, after agreed by the supplier and the purchaser and indicated in the contract, steel pipes can be delivered according to the cut length. The allowable deviation of steel pipe's cut length is $^{+200}_{0}$ mm.

5.3 Curvature

5.3.1 The curvature of the entire length of the steel pipe shall not be greater than 0.1% of the length of the steel pipe.

5.3.2 Required by the purchaser, after agreed by the supplier and the purchaser and indicated in the contract, other curvature indicators can be specified.

5.4 Out-of-roundness

The out-of-roundness of the pipe end (the difference between the maximum outer diameter and the minimum outer diameter of the same section) shall not exceed 1% of the nominal outer diameter.

5.5 Pipe end

5.5.1 Both ends of the steel pipe shall be cut perpendicular to the axis of the steel pipe and there shall be no incision burrs. When the outer diameter of the steel pipe is not greater than 1219mm, the cutting slope shall not be greater than 3mm. When the outer diameter of the steel pipe is greater than 1219mm, the cutting slope shall not be greater than 5mm.

5.5.2 Required by the purchaser, after agreed by the supplier and the purchaser and indicated in the contract, the steel pipe end face can process bevel. The shape and angle of the bevel are determined by the supplier and the purchaser.

5.6 Weight

5.6.1 The steel pipe is delivered according to the theoretical weight, and it can also be delivered according to the actual weight.

5.6.2 The theoretical weight of steel pipe is calculated according to formula (1) (the density of steel is 7.85kg/dm^3).

6.5 Process performance

6.5.1 Flattening

HFW steel pipes shall be subjected to the squash test. The specimen length of the flattening test shall not be less than 64mm. The welds of the two specimens shall be located at 90° or 0° to the direction of the force. During the test, when the distance between the two flat plates is 2/3 of the outer diameter of the steel pipe, no cracks or nicks shall appear at the weld. When the distance between the two flat plates is 1/3 of the outer diameter of the steel pipe, there shall be no cracks or nicks in other parts except the weld.

6.5.2 Guided bending

Submerged arc welded steel pipes shall be subjected to frontal guide bending test. Guided bending test specimens shall be extracted from the vertical weld on the steel pipes. The weld is in the middle of the specimen. There shall be no repair welds on the test specimen. The welding seam reinforcement shall be removed. The specimen is bent about 180° in the bending die. The core diameter is 8 times the wall thickness of the steel pipe. The guided bending test can also be taken on the same batch of welding test plates. The welding test plate shall be of the same designation, the same furnace number, the same welding process and the same heat treatment system as the steel pipe. After the test, it shall comply with the following provisions:

a) The specimen shall not break completely;

b) There shall be no cracks or ruptures of which the length exceeds 3.2mm in the weld metal on the specimen. The depth shall not be considered;

c) On the base material, heat-affected zone or fusion line, there shall be no cracks of which the length is greater than 3.2mm or cracks or ruptures of which the depth is greater than 10% of wall thickness;

d) Cracks appearing at the edges of the specimen and less than 6.4mm in length shall not be used as a basis for rejection.

6.6 Nondestructive testing

6.6.1 Ultrasonic testing

All welds of steel pipes shall be ultrasonically inspected. Ultrasonic testing shall meet the requirements of acceptance level 3 in GB/T 11345-2013.

6.6.2 Radiographic inspection

Required by the purchaser, after agreed by the supplier and the purchaser and indicated in the contract, steel pipes can be subjected to full-length or local

The treated surface shall have a smooth transition from the original surface. It shall reinspect after welding repair.

6.8 Steel strip butt weld

The distance from the connection point of HSAW steel strip butt weld and spiral seam to pipe end shall be greater than 150mm.

6.9 Pipe fittings

Required by the purchaser, after agreed by the supplier and the purchaser and indicated in the contract, steel pipes can be delivered with pipe fittings. Pipe fittings usually include pile boots, reinforcement rings, shear rings, locks, pile caps, bushings, studs and ribs. Pipe fittings can be manufactured according to the purchaser's engineering drawing.

6.10 Coating

Required by the purchaser, after agreed by the supplier and the purchaser and indicated in the contract, steel pipe surface can be coated for delivery. The surface coating of steel pipes usually uses epoxy zinc-rich anticorrosive coatings. The coating shall meet the design requirements of purchaser.

7 Test methods

7.1 The chemical composition analysis and sampling of steel pipes are carried out according to the rules of GB/T 20066. The chemical composition analysis is usually carried out according to GB/T 4336, GB/T 20123, GB/T 20124, GB/T 20125 or other common methods. The arbitration shall be in accordance with GB/T 223.3, GB/T 223.5, GB/T 223.9, GB/T 223.12, GB/T 223.14, GB/T 223.17, GB/T 223.18, GB/T 223.19, GB/T 223.23, GB/T 223.36, GB/T 223.37, GB/T 223.40, GB/T 223.53, GB/T 223.54, GB/T 223.58, GB/T 223.59, GB/T 223.60, GB/T 223.61, GB/T 223.62, GB/T 223.63, GB/T 223.64, GB/T 223.67, GB/T 223.68, GB/T 223.69, GB/T 223.71, GB/T 223.72, GB/T 223.85, GB/T 223.86, GB/T 20125.

7.2 It shall use the measuring tools or instruments that meet accuracy requirements to measure the dimensions, shape of steel pipes, burr height of HFW steel pipes and weld reinforcement of submerged arc welded steel pipes. The outer diameter of the steel pipe can be measured by the perimeter method. It shall be converted to outer diameter after measuring circumference. It can also use a suitable measuring tool to determine.

7.3 The surface quality of steel pipes shall be visually inspected one by one under sufficient lighting conditions.

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