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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 18984-2016

Replacing GB/T 18984-2003

Seamless steel tubes for low-temperature service piping

低温管道用无缝钢管

Issued on: December 30, 2016 **Implemented on: September 1, 2017**

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Standardization Administration of the PRC

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Foreword

This Standard is drafted in accordance with the rules given in GB/T 1.1-2009. This Standard replaces GB/T 18984-2003 "Seamless steel tubes for low-temperature- service piping", compared with GB/T 18984-2003, the main technical changes are as follows: - MODIFY the normative references; - MODIFY the scope of steel tubes' ordering specifications; - MODIFY the allowable deviation of steel tubes' dimension; - MODIFY the allowable deviation of cut to length; - MODIFY the curvature specifications; - ADD the steel grade of 06Ni9DG; - MODIFY the requirements for phosphorus and sulfur content of steel; - MODIFY the smelting method of steel; - MODIFY the delivery state of steel tubes; - MODIFY the scope of applicable specifications and determination requirements of flattening test; - MODIFY the requirements for low magnification inspection; - MODIFY the requirements for nonmetallic inclusion testing; - MODIFY the requirements for nondestructive testing; - MODIFY the batching rules. This Standard is proposed by the China Iron and Steel Association. This Standard is under the jurisdiction of National Technical Committee on Steel of Standardization Administration of China (SAC/TC 183). Drafting organizations of this Standard. Chengdu Steel Vanadium Co., Ltd. of Panzhihua Iron and Steel Group, Hengyang Valin Steel Tube Co., Ltd., China Metallurgical Information and Standardization Institute. Main drafters of this Standard. Cheng Haitao, Wu Hong, Huang Pingjia, Zhao Bin, Seamless steel tubes for low-temperature-service piping

1 Scope

China's national standard for the seamless steel tube used in piping that operates far below zero. It specifies the category and code, the order content, the dimensions, shape and

mass, the technical requirements, the test methods, the inspection rules, and the packaging, marking and quality certificate, and it applies to seamless tubes for low-temperature pressure vessel piping and low-temperature heat exchanger piping from the -45 C grade down to the -196 C grade. The lower end of that range is liquid nitrogen, and the whole document exists because of one property: steel that is perfectly ductile at room temperature can be brittle at cryogenic temperature. Ordinary carbon steel has a ductile-to-brittle transition, and below it a defect that would have been harmless propagates as a fast fracture through the whole component without warning and without deformation. In an LNG plant, an air separation unit or an ethylene cold box that is a catastrophic failure mode, so the material has to be qualified at temperature rather than assumed. The grades in the standard are therefore graded by service temperature, using nickel-alloyed steels at the colder end - the classic 3.5 per cent and 9 per cent nickel steels among them - and the governing requirement for every grade is the low-temperature impact test: specimens taken and oriented in a defined way, broken at the grade temperature, with a minimum absorbed energy that must be met by each specimen and not merely on average. Around that sit the chemical composition, the heat treatment condition, the room-temperature mechanical properties, the non-destructive testing and the dimensional tolerances, with a normative annex on tensile test sampling. Issued on 30 December 2016 and in force since 1 September 2017, it replaced GB/T 18984-2003 and has since been superseded by GB/T 18984-2026.

This Standard specifies the category, code, order content, dimension, shape, mass, technical requirements, test methods, inspection rules, packaging, marking and quality certificates of seamless steel tubes for low-temperature-service piping. This Standard applies to seamless steel tubes for -45 °C grade to -196 °C grade low- temperature pressure vessel piping and low-temperature heat exchanger piping.

2 Normative references

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

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 223.9 Iron steel and alloy - Determination of aluminium content - Chrom azurol S photometric method

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

GB/T 223.25 Methods for chemical analysis of iron, steel and alloy - The dimethylglyoxime gravimetric method for the determination of nickel content

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

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

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

GB/T 223.68 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 226 Test method for macrostructure and defect of steel by etching

5.2.2 Cut to length and multiple length

5.2.2.1 According to the requirements of the demand party, through the negotiation between supply and demand parties, and specified in the contract, steel tubes can be delivered in cut to length or multiple length. The total length of steel tubes' cut to length or multiple length shall be within the normal length.

5.2.2.2 Allowable deviation of cut to length of steel tubes shall comply with the following specifications.

a) length <= 6000 mm, 0 mm ~ 10 mm;

b) length > 6000 mm, 0 mm ~ 15 mm.

5.2.2.3 Each multiple length shall be given an incision margin as follows:

a) when D <= 159 mm, the incision margin is 5 mm ~ 10 mm;

b) when D > 159 mm, the incision margin is 10 mm ~ 15 mm.

5.3 Curvature The curvature of steel tubes shall be not more than the following.

a) when S <= 15 mm, the curvature is not more than

b) when S > 15 mm ~ 30mm, the curvature is not more than

c) when S > 30 mm or D >= 351 mm, the curvature is not more than

5.4 End shape The end surface of two ends of steel tubes shall be perpendicular to the axis of steel tubes, and the burrs on the incision shall be removed.

5.5 Out-of-roundness and unevenness of wall thickness According to the requirements of the demand party, through the negotiation between supply and demand parties, and specified in the contract, the out-of-roundness and unevenness of wall thickness of steel tubes shall not exceed 80 % of the outer diameter tolerance and wall thickness tolerance respectively. replace hydrostatic pressure test. When the magnetic flux leakage testing is used, the longitudinal groove of the outer surface of the sample tube for comparison shall comply with the specifications of acceptance grade F4 in

GB/T 12606-2016. When the eddy current testing is used, the artificial defect of the sample tube for comparison shall comply with the specifications of acceptance grade E4H or E4 in GB/T 7735-2016.

6.6 Process performance

6.6.1 Flattening Steel tubes with a diameter greater than 22 mm shall be subjected to the flattening test. The distance between the plates after flattening the sample is calculated according to formula (2). When the sample is pressed to such that the distance between two plates is H, the fractures or cracks are not allowed on the sample. //... (2) where. H - the distance between plates, in millimeters (mm); S - the nominal wall thickness of steel tubes, in millimeters (mm); D - the nominal diameter of steel tubes, in millimeters (mm); Alpha - the deformation coefficient of unit length, 0.08.

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