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Forged branch outlet fittings

锻制支管座

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Forged branch outlet fittings

1 Scope

This document specifies the types and codes, pressure class, pipe connection sizes, special branch outlet fittings, ordering content, shape, size and tolerance, material, design and manufacturing, heat treatment, inspection and testing, marking, surface protection and packaging, product quality certification requirements of forged branch outlet fittings; provides installation guidelines.

This document applies to branch outlet fittings forged with steel materials in pipeline systems.

Note: The branch outlet fittings in this document refer to branch outlet fittings with different diameters, that is, branch outlet fittings with trunk pipes larger than branch pipes.

2 Normative references

The contents of the following documents constitute essential clauses of this document through normative references in the text. Among them, for referenced documents with dates, only the versions corresponding to the dates apply to this document; for referenced documents without dates, the latest versions (including all amendments) apply to this document.

GB/T 9124 (all parts) Steel pipe flanges

GB/T 12459 Steel butt welding pipe fittings - Types and parameter

GB/T 12716 Pipe threads with the thread angle of 60 degrees where pressure-tight joints are made on threads

GB/T 14383 Forged fittings, socket-welding and threaded

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

GB/T 20801.3 Pressure piping code - Industrial piping - Part 3: Design and calculation

GB/T 28708 Specification for size selection of seamless and welded steel pipe used in piping engineering

NB/T 47013.3 Nondestructive testing of pressure equipment - Part 3: Ultrasonic testing

fittings and elbow branch outlet fittings and other branch outlet fittings that exceed the nominal size and wall thickness range of the trunk pipe listed in Table 2. When using relevant calculations, analysis or verification tests, the manufacturer shall keep these documents and provide them to the purchaser for inspection when necessary.

The socket welding, threaded and butt welding 90° branch outlet fittings (including extended branch outlet fittings, flange branch outlet fittings, thin-walled branch outlet fittings) with the outer diameter size of the body listed in Tables 4 ~ 14 and Tables 18 ~ 20 have passed the limit reinforcement calculation of opening reinforcement, according to the corresponding maximum wall thickness of the trunk pipe.

11.3 The allowable pressure rating of the branch outlet fitting manufactured according to this document can be calculated, based on the seamless straight pipe (trunk pipe welded to the branch outlet fitting) of the same specification, material and wall thickness.

11.4 When the wall thickness class of the branch pipe connected by the branch outlet fitting is different from the wall thickness class of the branch pipe listed in Table 2, the following provisions shall apply:

- When the wall thickness of the branch pipe is thicker, the corresponding branch outlet fitting size shall be selected according to the wall thickness of the trunk pipe; the flow aperture (d) shall be determined according to the inner diameter of the branch pipe; in this case, the other dimensions of the butt-welded branch outlet fitting may not be changed; the end outer diameter (D_2) of the socket-welded and threaded branch outlet fitting shall not be less than the sum of the outer diameter of the branch pipe and twice the wall thickness of the branch pipe plus 2 mm. If the end outer diameter (D_2) is larger than the outer diameter of the body (D_1), the end outer diameter (D_2) plus 2 mm shall be used as the size of the outer diameter (D_1) of the body;
- When the wall thickness of the branch pipe is thinner, the corresponding branch outlet fitting size shall be selected according to the wall thickness of the trunk pipe; the flow aperture (d) shall be determined according to the inner diameter of the branch pipe. In this case, other parameters may change, so one of the methods specified in 11.2 shall be used to determine whether the branch outlet fitting design meets the reinforcement requirements.

11.5 The branch outlet fitting can be made by cutting from forgings or bars. When forging is used, the material shall be forged as close to the specified shape and size as possible.

11.6 When forging with steel ingots, the head and tail of the ingot shall be fully cut off, to ensure that defects such as shrinkage, looseness, cracks, excessive segregation are eliminated.

11.7 When forging with steel ingots, billets or continuous casting billets, the forging ratio of the main cross-section of the forging shall be greater than or equal to 3; when forging with bars, the forging ratio of the main cross-section of the forging shall be greater than or equal to 1.6.

11.8 For the installation guide of the branch outlet fitting, see Appendix B.

12 Heat treatment

12.1 Except as specified in 12.2, the heat treatment of the branch outlet fitting shall comply with the provisions of the corresponding parts of GB/T 14383.

12.2 When the manufacturing conditions meet the following requirements, heat treatment is not required.

- a) Branch outlet fittings with a material category of carbon steel (excluding carbon steel branch outlet fittings in low-temperature steel) less than or equal to DN100 and a final forging temperature of not less than 700 °C.
- b) Branch outlet fittings made directly from bar cutting, meanwhile the raw materials have been heat treated or the carbon steel materials are in hot-rolled state when leaving the factory.
- c) For forgings with material classes of SF304, SF304L, SF316, SF316L less than or equal to DN100, when the final forging temperature is not less than 1040 °C, they can be quickly cooled in water after final forging to replace solution treatment.

13 Inspection and testing

13.1 Except for the provisions of 13.2 ~ 13.5, the inspection and testing of branch outlet fittings shall comply with the provisions of the corresponding parts of GB/T 14383.

13.2 After negotiation between the supplier and the buyer, branch outlet fittings formed by die forging with material category of carbon steel and less than or equal to DN100 can be accepted, only on the basis of hardness test; in this case, the hardness value shall be 110 HBW ~ 160 HBW.

13.3 For branch outlet fittings formed by free forging process, ultrasonic testing shall be carried out piece by piece according to NB/T 47013.3 after heat treatment; level I is qualified.

13.4 For branch outlet fittings formed by free forging process with material category of carbon steel, low temperature steel and alloy steel, magnetic particle testing shall be carried out piece by piece according to NB/T 47013.4; level I is qualified.

pipe × thread size code of branch pipe is DN600×NPT1½, is marked as:

Manufacturer name or trademark AF11 Product number or raw material melting furnace number XS×3000 DN600×NPT1½ THD-ELB-OL

Example 3: The flat-end extended branch outlet fitting, which has a material class LF485K2, impact test temperature of -50 °C, wall thickness class of trunk pipe × branch pipe of Sch160 × Sch160, nominal size of trunk pipe × branch pipe of DN40 × DN25, is marked as:

Manufacturer name or trademark LF485K2 S050 Product number or raw material smelting furnace number Sch160×Sch160 DN40×DN25 PE-NIP-OL

Example 4: The flange branch outlet fitting, which has a material class SF2507, trunk pipe wall thickness class × flange pressure class of STD×CLASS300, trunk pipe nominal size × flange nominal size of DN80×DN50, flange sealing surface code RF, flange standard number GB/T 9124.2, is marked as:

Manufacturer name or trademark SF2507 Product number or raw material smelting furnace number STD×CLASS300 DN80×DN50 RF-GB/T9124.2 FLG-OL

Example 5: The butt-welded thin-walled branch outlet fitting, which has a material class SF304/304L, wall thickness class of trunk pipe × branch pipe Sch10S×Sch10S, nominal size of trunk pipe × branch pipe DN50×DN15, is marked as:

Manufacturer name or trademark SF304/304L Product number or raw material smelting furnace number Sch10S×Sch10S DN50×DN15 BW-PIP-OL

15 Surface protection and packaging

15.1 The surface of the branch outlet fitting shall be clean, free of rust, burrs and attachments. The branch outlet fitting with forged surface should be sandblasted or shot blasted. The non-cutting surface of the stainless steel branch outlet fitting shall be pickled and passivated; the branch outlet fittings of other materials can be protected by surface blackening, anti-rust paint or weldable paint.

15.2 The branch outlet fitting can be galvanized according to the purchaser's requirements. For branch outlet fittings that require hot-dip galvanizing, the socket or threaded part of the branch outlet fitting shall be processed after hot-dip galvanizing.

15.3 Branch outlet fittings shall be packaged separately according to different material classes; pay attention to moisture-proof. A packing list shall be attached to the package box.

Appendix A

(Normative)

Design verification test

A.1 General

When the manufacturer uses verification test to evaluate the design of the branch outlet fitting, it shall be in accordance with the provisions of this Appendix.

The verification test shall be based on the calculated test pressure of the sample and its connected pipe section. The test adopts the burst test method.

A.2 Test assembly

A.2.1 Sample

The sample shall be taken from the finished branch outlet fitting with similar structure, same manufacturing method, same material property classification [see A.8d)]; the material class and size shall be checked. All requirements shall comply with the provisions of this document.

Note 1: Different varieties of 90° branch outlet fittings are of similar structure; the test of one 90° branch outlet fitting can represent other 90° branch outlet fittings with different branch connection methods, including extended branch outlet fittings and flange branch outlet fittings. Different types of 45° branch outlet fittings and elbow branch outlet fittings are of similar structure; the test of one 45° branch outlet fitting can represent other 45° branch outlet fittings with different branch connection methods, including elbow branch outlet fittings.

Note 2: Branch outlet fittings made by machining from forgings and branch outlet fittings made by direct machining from bars belong to different manufacturing methods.

A.2.2 Pipe sections

The pipe sections of the trunk pipe and branch pipes connected to the sample by welding shall be equivalent to the material of the sample and shall meet the requirements of the corresponding steel pipe standards. The calculated burst pressure of the pipe section shall not be lower than the test pressure specified in A.6. The wall thickness of the pipe section of the trunk pipe and branch pipe shall be consistent with the corresponding wall thickness class listed in Table 2; it shall also meet all requirements of the steel pipe specification.

The branch opening size of the trunk pipe shall be equal to the flow aperture (d). The length of the trunk pipe on both sides of the weld shall be at least twice the outer diameter of the trunk pipe, or a suitable length that can ensure that the verification test results will not be affected after welding. The extension length of the branch pipe is at

A.7.1 Applying test pressure

The test assembly shall be pressurized uniformly at an appropriate rate using a pump with appropriate pressurization capacity. First, the trapped air in the assembly shall be removed; then uniform pressure shall be applied until the yield point of the material (at this time, any unnecessary measuring instruments on the assembly can be removed); the pressure shall be increased uniformly again, until rupture or the required test pressure is reached/exceeded and maintained for at least 3 minutes. The pressure of the test assembly may be increased to compensate for the reduction in test pressure caused by the yielding of the test assembly.

A.7.2 Recording pressure-time readings

The test pressure and time readings shall be recorded regularly. Calibrated electronic devices should be used to complete the recording.

A.7.3 Test results

If any part of the test assembly (e.g., sample, trunk pipe, branch pipe, or weld, etc.) fails during the test, the test shall be terminated. If there is any leakage in the test assembly before or during the calculated test pressure, the test is unsuccessful. The test is qualified only when the test assembly reaches at least the calculated verification test pressure and maintains it for at least 3 minutes continuously without showing sealing failure or cracks, or when the test assembly ruptures after exceeding the calculated verification test pressure.

A.8 Applicability of test results

It is not necessary to test all branch outlet fittings of different varieties, specifications, pressure class, material class one by one. A qualified verification test of a representative sample that meets the requirements of A.2.1 can cover the following range of branch outlet fittings:

- a) Other branch outlet fittings with the same nominal size of the branch pipe and a larger nominal size of the trunk pipe than the nominal size of the test sample trunk pipe;
- b) Other branch outlet fittings with a nominal size ratio of the trunk pipe to the branch pipe equal to or greater than the nominal size ratio of the trunk pipe to the branch pipe of the test sample, and a nominal size of the branch pipe of 0.5 ~ 2 times the nominal size of the branch pipe of the test sample;
- c) Other branch outlet fittings with a nominal wall thickness to outer diameter ratio (t/D) of the branch pipe of 0.5 ~ 3 times the nominal wall thickness to outer diameter ratio (t/D) of the branch pipe of the test sample;
- d) The pressure bearing capacity of products with similar material properties is

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Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

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