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Restrained joint systems for ductile iron pipelines — Design rules and type testing

Assemblages verrouillés pour canalisations en fonte ductile — Règles de conception et essais de type

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 2, *Cast iron pipes, fittings and their joints*.

This second edition cancels and replaces the first edition (ISO 10804-1:2010), which has been technically revised. The main changes compared to the previous edition are as follows:

— the positive internal pressure type test in the configuration of minimum design radial gap has been introduced for joints restrained by gasket with hard anchor teeth;

— the references and presentation have been reviewed and improved.

Restrained joint systems for ductile iron pipelines — Design rules and type testing

1 Scope

This document specifies the design rules and type testing for restrained joint systems to be used on ductile iron pipelines complying with ISO 2531 and ISO 7186, in order to determine their mechanical properties and leaktightness.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 6708, *Pipework components — Definition and selection of DN (nominal size)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6708 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
restrained joint
joint in which a means is provided to prevent separation of the assembled joint

3.2
allowable operating pressure
PFA
maximum internal pressure, excluding surge, which a component can safely withstand in permanent service

3.3
allowable maximum operating pressure
PMA
maximum internal pressure, including surge, which a component can safely withstand in service

3.4
type test
proof-of-design test which is performed once and repeated only after change of design

3.5
allowable angular deflection
angular deflection that a joint between two components can safely withstand in service under the *allowable operating pressure (PFA)* (3.2)

4 Design rules

4.1 All restrained joints for ductile iron pipes, fittings and other components shall be designed in accordance with this clause. If the design of a restrained joint has been tested and successfully used for a minimum of 10 years, a type test as described in Clause 5 is only required for a significant change in the design which could adversely affect the performance of the restrained joint.

4.2 The minimum thickness of the spigot for restrained joints shall allow any necessary welding or loading from attachments (e.g. gasket teeth). This may result in a pipe thicker than the corresponding pressure class thickness of the pipe. The manufacturer shall declare the pipe thickness for their restrained joints.

4.3 The design safety factors with respect to failure against axial forces due to internal pressure shall be such that the joints shall withstand a type test of 1,5 times the allowable operating pressure (PFA) plus 5 bar (5×10^5 Pa).[1)]

4.4 The joints shall be type tested to a negative pressure of 0,9 bar (9×10^4 Pa) below atmospheric pressure [approximately 0,1 bar (10^4 Pa) absolute pressure]. When the restraining mechanism and sealing component of a restrained joint are independent, such a joint does not need to be subjected to a negative internal pressure test if the unrestrained version of the joint has passed this test (see ISO 2531).

4.5 The joints shall be type tested to a cyclic internal hydraulic pressure as follows:

a) 24 000 cycles;

b) test pressure of between PMA and (PMA - 5) bar.

4.6 Ductile iron pipelines and the restrained joints defined in this document are well suited for use in seismic zones. However, certain locations such as fault crossings, liquefaction zones and connections to structures require specialized designs. The pipe manufacturer or a competent earthquake engineer should be consulted.

4.7 For joint restraint components, the protection against aggressive soils shall be at least as good as that of the pipes and/or fittings. It may be achieved by means of works-applied coatings and/or site-applied protection systems.

5 Type testing

5.1 General

Each restrained joint design shall be tested in order to demonstrate its mechanical strength and its leaktightness under the most unfavourable condition of casting tolerances and joint movements.

The type tests shall be carried out in the configuration of maximum design radial gap between the components to be jointed (smallest spigot together with largest socket). In addition, the spigot thickness shall be the minimum casting thickness, $^{+10}_{0}$ %. The length of the minimum thickness of the spigot for the type test shall be such as to include any welding and/or attachments for that joint. It is permissible to machine the spigot end of the test pipe in the bore to achieve the required thickness.

In the type tests, the maximum gap shall not be less than the corresponding maximum design radial gap by more than 5 % or 0,5 mm (whichever is the smaller). The internal socket diameter may be machined to achieve this.

1) 1 bar = 10^5 Pa = 0,1 MPa = 0,1 N/mm^2 = 10^5 N/m^2.