INTERNATIONAL STANDARD

ISO 10804-1

First edition
1996-12-15

Restrained joint systems for ductile iron pipelines —

Part 1:
Design rules and type testing

Assemblages verrouillés pour canalisations en fonte ductile —
Partie 1: Règles de conception et essai de type

Reference number
ISO 10804-1:1996(E)

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 organisations, 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10804-1 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 2, *Cast iron pipes, fittings and their joints*.

ISO 10804 consists of the following parts, under the general title

Restrained joint systems for ductile iron pipelines :

- Part 1 : Design rules and type testing

- Part 2 : Calculation rules

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@isocs.iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

Restrained joint systems for ductile iron pipelines —

Part 1:
Design rules and type testing

1 Scope

This part of ISO 10804 specifies 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 standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10804. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10804 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2531 : 1991, *Ductile iron pipes, fittings, and accessories for pressure pipelines.*

ISO 6708 : 1995, *Pipework components - Definition and selection of DN (nominal size).*

ISO 7186 : 1996, *Ductile iron products for sewerage applications.*

3 Definitions

For the purposes of this part of ISO 10804 the definitions given in ISO 6708 and the following definitions apply :

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

3.2 allowable operating pressure : Internal pressure, excluding surge, that a component can safely withstand in permanent service.

3.3 maximum allowable operating pressure : Maximum internal pressure, including surge, that a component can safely withstand in service.

3.4 allowable test pressure : Maximum internal hydrostatic pressure which can be applied on site to a component in a newly installed pipeline.

NOTE — This test pressure is different from the system test pressure, which is related to the design pressure of the pipeline and is intended to ensure its integrity and leaktightness.

3.5 allowable bending moment : Bending moment that a joint between two components can safely withstand in service under the allowable operating pressure.

3.6 type test : Proof of design test which is done once, and is repeated only after change of design.

3.7 allowable angular deflection : Angular deflection that a joint between two components can safely withstand in service under the allowable operating pressure.

4 Design rules

4.1 All restrained joints for ductile iron pipes, fittings and other components shall be designed with the requirements of this clause. If the design of a restrained joint has been tested and successfully used for a minimum of ten 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 design safety factors with respect to failure against axial forces due to internal pressure shall be such that the joints can withstand a type test pressure of 1,5 times allowable operating pressure plus 5 bar [1)].

4.3 Alternatively, for those restrained joints which are rigid enough to be subjected to a bending moment the design safety factor with respect to failure against the combined effects of axial forces and a bending moment shall be at least 2 at the allowable operating pressure and allowable bending moment.

4.4 Ductile iron pipelines and the restrained joints as defined in this part of ISO 10804 are well suited for use in seismic zones. However, certain locations, such as fault crossings, liquefaction zones, connections to structures, etc., require specialized designs. The pipe manufacturer or a competent earthquake engineer should be consulted.

4.5 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.

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1) 1 bar = 10^5 N/m² = 10^5 Pa = 0,1 MPa

5 Type testing

5.1 General

Each restrained joint design shall be tested in order to demonstrate its mechanical strength and its watertightness under the most unfavourable conditions of castings 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 $^{+10}_{0}$ % .

NOTE — When the failure mode justifies it, the type tests are also carried out in the configuration of minimum design radial gap.

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.

5.2 Test conditions

There shall be a type test for at least one DN for each of the groupings given in table 1, normally using the preferred DN. One DN is representative of a grouping when the performances are based on the same design parameters throughout the size range.

Table 1

DN groupings	40 to 250	300 to 600	700 to 1000	1100 to 2000	> 2000
Preferred DN in each grouping	200	400	800	1600	2400

If a grouping covers products of different designs and/or products manufactured by different processes, the grouping shall be subdivided. If, for a certain manufacturer, a grouping contains only one DN, this DN may be considered as part of the adjacent grouping provided that it is of identical design and manufactured by the same process.

Each diameter tested shall be subjected to the following conditions :

a) joint assembled in the aligned position, then deflected to the allowable angular deflection indicated in the manufacturer's instructions, and tested while maintained in the deflected position ;

b) joint assembled in the aligned position, then subjected to a load giving a resultant shear force across the joint not less than 50 x DN (expressed in newtons), and tested under shear.

All joint assemblies shall exhibit no visible leakage and no mechanical instability after 2 h under a hydrostatic pressure as given in 4.2 or 4.3. In addition, any axial movement that may occur at the joint shall reach a constant value within the 2 h.

5.3 Test method

The testing apparatus shall be capable of providing suitable end closure whether the joint is in the aligned position, or deflected, or subjected to a shear load. It shall be equipped with a pressure gauge with an accuracy of ± 3 %.

The test shall be carried out on an assembled joint comprising two pipe sections, each at least 1 m long.

For the test according to 5.2 b), the shear load shall be applied to the spigot end by means of a V-shaped block with an angle of 120°, located at approximately 0,5 x DN, in millimetres, or 200 mm from the socket face (whichever is the larger) ; the socket shall bear on a flat support.

The testing assembly shall be filled with water and suitably vented. The test pressure shall be raised by steps : for example, 10 bar steps, at a rate not exceeding 1 bar/s ; the axial movement shall be measured after 5 min at each test pressure.

The test pressure shall be kept constant to ± 1 bar for at least 2 h during which the joint is thoroughly inspected and its axial movement measured every 15 min.

At the manufacturers option the test may be continued at higher pressures.

5.4 Test report

The test report shall contain the following :

a) type of joint ;

b) size range covered by the test ;

c) DN tested ;

d) class of pipe tested ;

e) allowable operating pressure ;

f) maximum allowable operating pressure ;

g) allowable test pressure ;

h) allowable angular deflection ;

i) allowable bending moment (if applicable) ;

j) result of test ;

k) date of test.

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ICS 23.040.01

Descriptors: pipelines, cast iron products, spheroidal-graphite cast-iron, pipes (tubes), pipe joints, design, tests, type testing (tests).

Price based on 4 pages