UDC 621.643

Ref. No.: ISO/R 13 - 1955 (E)

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 13

CAST IRON PIPES, SPECIAL CASTINGS AND CAST IRON PARTS FOR PRESSURE MAIN LINES

1st EDITION

November 1955

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 13 on Cast Iron Pipes, Special Castings and Cast Iron Parts for Pressure Main Lines was prepared by Technical Committee ISO/TC 5, *Pipes and fittings*, the Secretariat of which is held by the Association suisse de Normalisation.

At its meeting in Zurich in May 1951, the Technical Committee decided to assign the investigation into standardization of cast iron pipes to the Sub-Committee ISO/TC 5/SC 2, *Cast iron pipes, fittings and their joints*, the Secretariat of which was allocated to France.

The French Member Body drafted a first proposal, which was adopted at the Sub-Committee's meeting in Zurich in October 1951. The basic document, and a few alterations proposed at the January 1952 Paris meeting, were considered at the April 1952 plenary meeting in Milan and, allowing for reservations stated in the Milan Resolution No. 9, adopted by the Technical Committee as a Draft ISO Recommendation.

The Draft was distributed to all the ISO Member Bodies in March 1953, and approved by a majority. In view of observations submitted by various Member Bodies, the Secretariat made some amendments in the text of the Draft.

The revised text, which is that of the present ISO Recommendation, was approved by the following 20 Member Bodies (out of a total of 34):

Austria	Israel	Portugal
Chile	Italy	Spain
Denmark	Japan	Sweden
France	Mexico	Switzerland
Germany	Netherlands	United Kingdom
Hungary	New Zealand	Yugoslavia
Ireland	Pakistan	

The revised text of the Draft ISO Recommendation was submitted by correspondence to the Members of the ISO Council which decided, in March 1955, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 13 March 1955

CAST IRON PIPES, SPECIAL CASTINGS AND CAST IRON PARTS FOR PRESSURE MAIN LINES

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CAST IRON PIPES, SPECIAL CASTINGS AND CAST IRON PARTS FOR PRESSURE MAIN LINES

FOREWORD

The ISO Recommendation R 13 includes four sections:

I. TECHNICAL SPECIFICATION
II. JOINTS
III. PIPES
IV. SPECIAL CASTINGS

Comments on Section I — Technical specification

This specification applies generally to pipes, special castings and cast iron parts of all kinds for pressure mains, and chiefly to pipes and specials with sockets for lead joints (1).

It also applies to pipes and specials with other types of joints, particularly rubber joints. However, the characteristics of these joints, many of which are patented, are not detailed: they remain the subject of private agreement between manufacturers and users.

Castings with such joints may keep the overall measurements of castings with lead joints, which will facilitate the use by the manufacturer of interchangeable patterns allowing accurate and speedy manufacture.

With regard to socket joints (see clause 2), two different types have been included, in which the centreing bead is part of the interior of the socket or formed on the outside of the pipe spigot.

Centrifugal casting in a metallic mould does not allow a bead to be cast on the spigot of the pipe. The two types of joint, however, have been included because the alternative method is still used; the respective dimensions of the two types of joint are such that interchangeability is always possible.

The flanges normally have a machined facing strip and drilled holes; this does not exclude the possibility, in certain cases, of having rough-cast flanges where particularly accurate moulding processes are used.

In general, the specials (see clause 3) have a sufficiently great resistance to internal pressure for all the current uses. Different methods of reinforcement have been allowed, however, particularly in cases where high working

(1) Although spun pipes at present comprise the greater part of world production, sand cast pipes have been included, as they are still made by some manufacturers or in certain diameters.

pressures must be applied to specials with large branches in which the stresses in the metal are important.

The requirements of the draft specification drawn up in 1938 by the ISA/5a Technical Committee concerning the quality of the cast iron (see clause 5) have all been kept. They are sufficiently precise and leave to the manufacturer the choice between the different permissible manufacturing processes.

The limit of superficial hardness has been brought to the Brinell number 230 (see clause 6) to correspond to the value adopted in several national standards. This value takes into account the increase in resistance offered by the spun pipes.

The socket tolerances (see clause 7) have been fixed in relation to the normal caulking space.

It is logical to provide for equality between the plus and minus tolerances. Similarly, the socket tolerances are smaller than the barrel tolerances: in fact, the socket of the castings has a greater thickness than the barrel and, therefore, greater rigidity.

The value adopted for the density of the cast iron (see clause 11) is 7.15: it lies between the values fixed formerly in different countries, which vary between 7 and 7.25. The value of 7.15 ensures good practical agreement between the calculated and real weights.

The results to be attained for the mechanical tests (see clause 13) do not show any change when compared with those adopted in 1938 by the ISA/5 a Technical Committee. Only one new value for tensile resistance has been introduced for spun pipes of a nominal diameter greater than No. 600, which were not manufactured at that time.

The cast iron pipes, specials and castings for mains of different diameters are generally made in thicknesses suitable to the highest working pressures generally used (1).

In some cases, it may happen that these castings are intended to be submitted to working pressures giving an insufficient margin of safety as compared with the works test pressures (see clause 15). In such cases it will be for the users to state this and for the manufacturers to provide for a suitable increase in thickness and in test pressure.

Comments on Section II — Joints

Cast iron pipes, specials and castings for mains may be manufactured in the range of nominal diameters from No. 20 to No. 2 000 approximately (2).

However, the bodies of pipes smaller than nominal diameter No. 80 are generally manufactured in reduced lengths and with special joints. On the other hand, pipes of a nominal diameter greater than No. 1 000 are only just commencing to be manufactured centrifugally.

It has, therefore, appeared advantageous to limit the recommended range so as to lie between nominal diameters No. 80 and No. 1000, as the extension of

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(1) The water distribution pipelines follow the relief of the ground and the working pressure varies from one point to another along their route. In practice it would be very difficult to vary the thickness and consequently the resistance of the castings according to their position in the pipeline and the pressure they have to withstand. The resulting increase in the number of patterns would complicate both stocking and distribution, besides increasing the risk of errors on the construction site.

(2) In the tables, nominal diameter (*DN*) is only a number designating and classifying the dimensions of pipes, specials and line parts.

the recommendation to other nominal diameters at a later date does not present any difficulty.

The external shapes and measurements of the sockets of the pipes and specials vary slightly between the different countries. However, this does not cause difficulties, as the majority of these measurements are not bound up with the interchangeability of the castings. For reasons of safety, it has, however, been considered necessary to prescribe the minimum thicknesses of these sockets at the front and back (letters *g* and *h*, tables J 1 and J 2). The external shape of specials will allow, according to the pattern adopted, a slight projection at the joining of the socket and the barrel.

The problem is obviously the same for flanges the measurements of which, in the various countries, showed differences of several millimetres. Without wishing to bring in mathematical considerations, which are always difficult to justify, it has been decided to adopt a range of average thicknesses which follow a linear law in relation to the diameter. The measurements resulting from this formula are intermediate between those existing in the different countries. Interchangeability is thus ensured between the varying old flanges and the new unified flanges.

As a rule, the latter are particularly strong, and they may be used on socket mains at pressures up to 15 kg/cm² approximately.

It is to be noted that the diameter of the holes is greater by 1 mm than that provided for surface mains. This increase facilitates the installation of the castings, which is always difficult in the case of underground mains, and permits the use of bolts of increased diameter whenever this is thought necessary in order to resist corrosion.

Comments on Section III — Pipes

Until 1939, pipes were manufactured in several thicknesses which corresponded respectively to different international series B, A, LA. In each series the thicknesses were fixed arbitrarily according to local custom and without logical consideration. Most class B pipes of large diameter were not quite thick enough. On the other hand, for medium diameters, the differences in the thicknesses between the class A pipes and those of class LA were very slight — in certain cases 1/2 mm only — which was clearly insufficient to justify the coexistence of two different types.

One of the main purposes of this Recommendation is precisely to bring about agreement between the thicknesses of the different pipe classes.

Class LA has been taken as a basis and its thicknesses have been determined in a quite mathematical manner showing a linear relation to the nominal diameter. These thicknesses are generally equivalent to those which were applied in 1939.

Class A allows a 10 per cent increase in thickness over class LA for all nominal diameters.

Class B allows a 20 per cent increase in thickness over class LA for all nominal diameters. The thicknesses of class B for the nominal diameters No. 100 to No. 350 inclusive are absolutely equal to those used before 1939. Beyond the latter nominal diameter, the new series includes logically graded thicknesses, slightly greater than those used previously.

For special uses, classes C, D, E, etc. may be considered, allowing respective increases of thicknesses of 30 per cent, 40 per cent, 50 per cent, etc. over class LA.

The weights have been calculated for each of the lengths generally used, by taking into account in each case a socket weight, fixed arbitrarily as a proportion of the weight of the pipe barrel.

For flanged pipes, only class B pipes with moulded flanges or screwed flanges have been covered. In the latter case the method of screwing and the exact form of the thread are left to the discretion of the manufacturer, in view of the fact that the flanges are never removed after screwing on the barrels of the pipes.

Comments on Section IV — Special castings

As a rule, the specials have been designed with the minimum possible dimensions. Their ends are flanged or socketed (1).

As specials with spigot ends have less strength and precision, the standard provides only for flange and spigot pieces and plugs.

The flange and socket and the flange and spigot specials (see tables T 10 and T 11) are as short as possible so as to reduce the space required in underground chambers, in which they are often placed.

The 1/4 bends (see tables T 13, T 30 and T 31) have been designed with the radius of curvature adopted by the majority of countries.

The 1/8, 1/16 and 1/32 bends (see tables T 14, T 15, T 16 and T 32) have been designed with the same radius for the central part, allowing the machining in series of the corresponding curved part of the different patterns.

Only the 1/8 flanged bends, up to a nominal diameter No. 300 (see table T 32), have a different radius; this is dependent on the length prescribed for the tangents and is in conformity with the practice in many countries.

The tees (see tables T 17, T 18 and T 33) of a nominal diameter smaller than No. 350 have been provided with a full range of branches, as they are used chiefly in distribution mains for which branches down to a minimum nominal diameter No. 80 may be taken off the main piping.

Mains of a nominal diameter greater than No. 300, however, are usually trunk mains, either conducting or delivering, and are not generally used for taking off branches for distribution pipes of small diameter. That is why, beyond No. 300, only tees with branches of a nominal diameter equal to, or greater than, half the nominal diameter of the body, have been provided for.

Tees with very small branches of reduced lengths may be adopted subsequently, after study of their statistics of use.

It is important to note that two different types have been retained for each tee measurement, namely:

double socket tees with flanged branch (see table T 17),

double socket tees with socket branch (see table T 18).

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(1) This preference for specials with sockets is justified by many advantages.

In a main, the position of the specials: bends, tees, etc., is nearly always governed by the lay-out of the route and rarely coincides with the end of a pipe.

It is, therefore, necessary to interpose between the last whole pipe and the special, a section of reduced length obtained by cutting a whole pipe into two lengths. The first portion is used before the special and the second immediately afterwards, one of these portions being without a socket. The all-socket specials provide the missing socket, and, therefore, the construction of the pipe-line proceeds without any need of leaving out lengths on the site.

Specials with two sockets, as compared with the other specials, have the following advantages:

mechanical resistance increased by the presence at each of their ends of a very strong socket,

excellent stability on anchorages, which can extend over the whole length of the specials,

complete accessibility of joints which are clear of anchorages,

simplification of orders and of the supply of spares by the elimination of superfluous specials, many of which have the same use,

facility of moulding on symmetrical plate patterns, in conditions favouring precision and production.

The coexistence of these two types constitutes a regrettable situation, as the number of tee patterns is much greater than that of the other specials, on account of the variations in the diameter of the branches.

The necessity for the two types is imposed by the methods of fitting valves practised in different countries:

— in certain countries flanged valves, and consequently tees with flanged branches, are used;

— in other countries, and particularly in American countries, socket valves, and consequently tees with socket branches, are preferred.

It is, therefore, desirable, in order to achieve a reduction in the number of types, that an international unification should take place by degrees for the types of valves as well as of the tees.

Crosses (see tables T 19 and T 34) are provided for up to a nominal diameter No. 300, with equal branches on the body: the adoption of castings allowing reduced branches would be very disadvantageous, on account of the many possible combinations of branches and of the very small number of crosses used.

The double socket and double flanged tapers (see tables T 20 and T 35) are as short as possible, so as to allow the use of several successive tapers, if necessary.

The caps, plugs and blank flanges (see tables T 21, T 22 and T 36) have been shown unreinforced; they can also be quite suitably manufactured with domed ends, and they can have facing strips necessary for mounting the standpipes and gauges.

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As a rule, all the measurements have been fixed, not arbitrarily, but in a linear relation to the diameter.

This arrangement allows the grading of the measurements, as well as the outlines of the castings, to be harmonized.

SECTION I

TECHNICAL SPECIFICATION

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TECHNICAL SPECIFICATION

Clause 1 — Scope

This Recommendation is applicable to:

1. cast iron pipes manufactured by any one of the three following processes:
   (*a*) centrifugal casting in metal moulds,
   (*b*) centrifugal casting in sand moulds,
   (*c*) vertical casting in sand moulds;
2. cast iron special castings.

The Recommendation is applicable to pipes and all special castings with sockets, spigots or flanges defined by this Recommendation and to pipes and special castings with other types of joints, the general dimensions of which, except those relating to the joints, conform to the requirements of this Recommendation. It is not applicable to the down pipes and their specials used in the building industry.

Clause 2 — Types of joints

Socket pipes and special castings for lead joints may be provided with a centreing ring in the socket, and in this case, are supplied with a plain spigot end. Alternatively, the sockets may be without centreing ring, in which case the spigot ends could be plain or have a bead integrally cast or formed by means of a permanent hoop shrunk on hot.

Unless otherwise specified, flanges are machined on boss and their dimensions are in accordance with the relevant tables in this Recommendation. Bolt holes may be drilled or cored.

When pipes and special castings are ordered with a joint of a type other than those mentioned in this Recommendation, the dimensions and other characteristics of the joint are those applicable to that joint.

Clause 3 — Special castings

The special castings are of the thickness shown in the relevant tables, except when the working conditions necessitate some strengthening. Such strengthening may be in the form of additional thickness, ribs, bolts, or other means proposed by the manufacturer and finally approved by the purchaser.

If necessary, the reinforcement of the thickness may be obtained by reducing the internal diameter.

Clause 4 — Marking

Each pipe and special casting has cast or painted on it the mark of the manufacturer, the nominal diameter and, if necessary, its principal characteristics.

The marks are placed:

(*a*) on the socket faces of pipes centrifugally cast in metal moulds;

(*b*) on the outsides of the sockets or on the barrels of pipes centrifugally cast in sand moulds;

(*c*) on the outsides of the sockets or towards the ends of the barrels of pipes vertically cast in sand moulds;

(*d*) on the barrels of special castings.

The class or any other marks required by the purchaser may be painted on.

Clause 5 — Quality of metal used

The metal used for the manufacture of pipes and special castings should be of good quality. It is prepared at the discretion of the manufacturer in a cupola, an active mixer, or other suitable furnace, and is made from pig iron, or molten iron, or good iron and steel scrap with additions of good quality materials suited to the production method, excluding any raw material of inferior quality. Upon fracture, the iron should show a grey, close and uniform grain.

Clause 6 — Quality of pipes and special castings

Pipes and special castings are stripped with all precautions necessary to avoid warping or shrinking defects detrimental to their good quality.

The pipes and special castings should be sound and free from surface or other defects.

Repairing of defects by soldering or by the application of putty may not be done without previously securing the consent of the purchaser or his representative. This stipulation also applies to the plugging of leaks by caulking.

Pipes and special castings showing small imperfections inseparable from the method of manufacture and not affecting their use, are not rejected.

The pipes and special castings should be such that they can be cut, drilled or machined; in case of dispute, the castings are considered as acceptable, provided the hardness, measured at the centre of the thickness, does not exceed the Brinell number 215. The superficial hardness of pipes centrifugally cast in metal moulds does not exceed the Brinell number 230 (for hardness test, see clause 14).