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Cast Iron Pressure Pipes and Special Castings

Technical Conditions of Delivery

DIN 28 500

Gusseiserne Druckrohre und Formstücke; Technische Lieferbedingungen

The contents of this Standard are to a large extent in agreement with ISO Recommendation R 13 "Cast Iron Pipes and Special Castings for Pressure Main Lines" (November 1955) (ISO = International Organization for Standardization).

The current Standard has been converted from the October 1961 edition to the units specified in the "Law on Units in Metrology" dated 2nd July 1969, without any alteration of the basic contents.

1 Scope

This Standard applies to

1.1 Cast iron pressure pipes, viz:

a) Pipes cast in sand moulds
b) Pipes centrifugally cast in sand moulds
c) Pipes cast in metal moulds
d) Pipes centrifugally cast in metal moulds

1.2 Cast iron special castings cast in sand moulds.

1.3 All pipes and special castings with socket ends, flanges or plain ends which are manufactured in accordance with the Standards applicable to cast iron pressure pipes and special castings, and also to pipes and special castings with any other type of pipe joints, the principal dimensions of which conform with these Standards, with the exception of the joints themselves.

2 Types of pipe joints

2.1 Socket joints

Screwed sockets are used for nominal sizes 40 to 600, and gland sockets are used for nominal sizes 500 to 1200.

Pipes and special castings of nominal sizes 40 to 1200 can also be manufactured with lead joints sockets, but only as replacements.

2.2 Flanged joints

The diameter and number of bolt holes and the bolt pitch circle diameter and the hole position are all in agreement with ISO Recommendation R 13 in the case of PN 10 flanges in accordance with DIN 2501 Part 1.

The flanges are provided with machined packing strips unless anything to the contrary has been specifically agreed.

3 Wall thicknesses of pipes and special castings

3.1 Pipes

Categories LA, A and B are provided for in the Standards, which differ in respect of wall thickness. The wall thickness of category A is 10 % greater than that of category LA for all nominal sizes, and the wall thickness of category B is 20 % greater than that of category LA for all nominal sizes.

For higher nominal pressures than those specified in the Standards, pipes with an increased wall thickness may be manufactured, at the expense of the bore.

3.2 Special castings

Special castings for higher nominal pressures than those specified in the Standards can be strengthened by mutual agreement, by increasing the wall thickness or by other suitable means. In so far as necessary, the wall thickness may be increased at the expense of the bore.

4 Marking

The manufacturer's trade mark and the nominal size in mm must be cast or painted on every pipe and special casting, and, in the case of pipe bends, in addition the central angle in degrees of angle, and if necessary any other principal characteristics.

These markings shall be placed:

on the end face of the socket, or
on the outside of the socket, or
on the free surface area.

5 Condition of pipes and special castings

The pipes must be straight and truly circular both outside and inside. Pipes and special castings shall have smooth outer and inner surfaces and the castings shall be flawless. The pipes and special castings shall be capable of being cut, drilled or otherwise machined.

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Pipes and special castings which exhibit small imperfections inseparable from the method of manufacture and not affecting their use may not be rejected.
Castings with flaws which impair the strength or leak-tightness shall be excluded from the supply.

6 Permissible deviations on the outside diameter of the pipes and on the socket and flanged joints

These dimensional deviations are specified in the relevant dimensional Standards.

7 Permissible deviations on the wall thickness

For pipes: $-(1 + 0.05\,s)$ in mm [1]
For special castings [2]: $-(2 + 0.05\,s)$ in mm [1]
where s is the wall thickness of the shaft.
The wall thickness of special castings may exceptionally be reduced to not less than the minimum wall thickness of a category B pipe of the same nominal size, provided that said values do not already allow an even greater deviation. Such a wall thickness deviation shall not extend over an area larger than 1/10th of the cross-sectional area of the pipe bore.

8 Permissible deviations on the lengths

The following deviations on the manufactured lengths of pipes and special castings are permissible:

Type of casting	Nominal size	Permissible deviations in mm
Socket pipes and plain-ended pipes	all nominal sizes	−30 [1]
Socket special castings, socket and flange special castings	up to 450 mm	± 20
Flange and plain-ended special castings	over 450 mm	+20 −30
Flanged pipes and flanged special castings	all nominal sizes	± 10

If smaller length deviations are required, e.g. on flanged fitting pieces, such special deviations must be mutually agreed. The smallest permissible deviation in such cases is ± 1 mm.
Of the total length of socket pipes and plain-ended pipes of each nominal size to be supplied, up to 10% may be supplied in lengths shorter than the manufacturing lengths ordered, viz.:

Manufacturing lengths	Permissible reduced lengths
up to 4 m	0.5 m 1 m
over 4 m	0.5 m 1 m 1.5 m 2 m

9 Permissible deviations from a straight line

The permissible deviation from a straight line shall not exceed 1.25 mm per m length, with the pipe resting on two trestles spaced at approx. two thirds of the length of the pipe from one another.

10 Permissible deviations on the weight

The weights specified in the Standards shall be the governing weights; they are calculated on the basis of an average specific gravity of 7.15 kg/dm³. The weights of reinforced and non-standardized pipes and special castings are also calculated on the basis of a specific gravity of 7.15 kg/dm³ for cast iron.
The following deviations from these weights are permissible:

Type	Permissible deviations [3]
Pipes	± 5%
Special castings [4] with the exception of those listed below	± 8%
Bends, special castings with more than one branch, and non-standardized special castings	± 12%

Castings of a heavier weight than the maximum weight specified shall not be rejected, on condition that they comply in every other respect with the requirements of the Standards.

11 Material

Pipes and special castings shall be manufactured from cast iron (grey cast iron) in accordance with DIN 1691. The quality of the material shall be demonstrated by means of the strength test and of the hardness test. The strength and hardness requirements shall be deemed to have been fulfilled if at least two out of three test specimens attain the values stipulated in Section 11.1.

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1) No value is specified for the upper allowance (see Section 10, last paragraph).
2) This also includes pipes cast horizontally in sand moulds (flanged pipes with integrally cast flanges and overall lengths not exceeding 2000 mm).
3) The upper allowance should be regarded as a guide-line value.
4) This also includes pipes cast horizontally in sand moulds (flanged pipes with one or two integrally cast flanges and overall lengths not exceeding 2000 mm).

11.1 The material for the pipes and special castings must meet the following strength requirements:

Type	Nominal size	Type of specimen	Type of testing	Strength N/mm² minimum
Pipes and special castings cast in sand moulds	all nominal sizes	Machined tensile specimens from separately cast test bars	Tensile test	180
Pipes centrifugally cast in sand moulds	all nominal sizes	Machined tensile specimens taken from the pipe wall	Tensile test	200
Pipes cast and pipes centrifugally cast in metal moulds	up to DN 300	Ring specimens of 25 mm width cut from the pipe	Ring bending test	400 *)
	over DN 300	Machined tensile specimens taken from the pipe wall	Tensile test	200

*) The empirical value of the ring bending strength is approximately twice as great as the tensile strength.

The tensile test on the machined test bar may be replaced by a test on the ring, by mutual agreement between manufacturer and purchaser.

All pipes from which tensile specimens or ring specimens have been cut shall be accepted by the purchaser as complete lengths.

11.2 The Brinell hardness HB 30/5 at the centre of the cross-section of the wall shall not exceed 2150 N/mm². The surface hardness of pipes centrifugally cast in metal moulds and of pipes cast in metal moulds shall not exceed 2300 N/mm².

12 Strength testing

12.1 Sampling

Specimens for the strength test and the hardness test shall be taken during manufacture and twice at most in any one day of casting. The test results shall be considered valid for all pipes or special castings of all nominal sizes manufactured on the day of casting.

3 ring specimens or 3 tensile specimens shall be taken from the same pipe or from the same run of metal. See table in Section 11.1 for the type of test piece.

The separately cast test bars are cast in special moulds in accordance with DIN 50108 from the same casting ladle-fill as used for the casting itself. The nominal diameters of these separately cast test bars shall be in accordance with DIN 1691.

The tensile specimens are cut from the pipe wall and the ring specimens of 25 mm width shall be cut from the plain ends of the pipes.

12.2 Tensile test

The tensile specimens obtained from separately cast test bars or cut from the pipe wall in accordance with Section 11.1 shall comply with DIN 50109. The tensile specimens cut from the pipe wall shall have as great a nominal diameter as possible in relation to the thickness of the pipe wall (see DIN 50108, January 1967 edition, section 6). The tensile test shall be carried out in accordance with DIN 50109.

12.3 Ring bending test

The cut surfaces of the ring specimens in accordance with Section 11.1 must be machined on the lathe parallel to each other and perfectly plane. The rings are then gripped in a material testing machine in accordance with DIN 51220, class 1, on the inside on two knife edges diametrically opposed, with a 5 mm rounding-off radius, and pulled apart by these knife edges until fracture occurs.

The ring bending strength K_r is calculated from the maximum force (breaking load) in accordance with the formula below:

$$K_r = \frac{3\,P\,(d - s)}{\pi\,b\,s^2}$$

wherein:

K_r = Ring bending strength in N/mm²

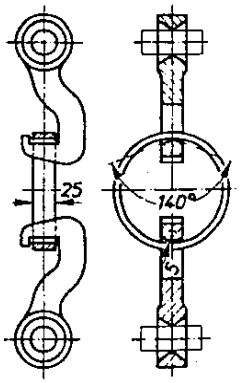
P = Maximum force (breaking load) in N

d = Outside diameter of the ring in mm

s = Wall thickness of the ring in mm

b = Width of the ring in mm

Dimensions in mm



13 Hardness testing

The hardness test is carried out on the remaining pieces of the specimens used for the strength test in accordance with DIN 50351.

14 Internal pressure testing

The test in accordance with DIN 50104 shall be carried out on every pipe and every special casting.

The factory test pressures to be applied (using water) are specified in the Standards for pipes and special castings. The test duration shall amount to 15 seconds at least. It is recommended to tap the pipes during the test with moderate blows of a hammer weighing 0.8 kg.

No leakage must occur during the test. If the manufacturing sequence at the supplier's works permits it, the hydraulic test should be carried out before the protective coating is applied.

15 Protective coating

Except when otherwise specified, all pipes and special castings shall be provided with a well adhering protective coating both inside and outside.

The inside protective coating must not incorporate any constituents soluble in water. In particular in the case of potable water lines, the inside coating must be free of constituents injurious to health, and must not impart any taste, smell or colour whatsoever to the water after suitable flushing out of the pipeline.

16 Acceptance

If the purchaser wishes to inspect the pipes and special castings for acceptance purposes, such an inspection shall take place at the manufacturer's works. The facilities and labour necessary for this purpose shall be provided by the manufacturer.

The purchaser or his appointed representative, who must be duly accredited to the manufacturer, must be notified in good time of the date on which the acceptance inspection is to take place.

The purchaser's representative may witness the casting process, the sampling, the preparation and testing of the specimens, the checking of dimensions and weights, and the internal pressure test.

The acceptance inspection of the pipes and special castings may take place after the protective coating has been applied.

Should the purchaser or his representative fail to turn up at the manufacturer's works at the agreed time for the acceptance inspection, then the manufacturer shall be entitled to proceed with the casting of the items concerned and with the carrying out of the acceptance tests and inspections in the absence of the purchaser or of his representative.

Explanations

This Standard supersedes DIN 2420. Its contents have been modelled on those if ISO Recommendation R 13 of 1955, and they take account of recent technical developments in the field of cast iron pressure pipes and special castings. It was however considered necessary to lay down specifications which go beyond the ISO Recommendation.

This Standard applies to all cast iron pressure pipes and special castings and to their joints. It also applies to cast iron special castings incorporated in pressure pipelines made of other materials.

The class designation of the pipes is only a designation of the various pipe wall thickness series. The wall thicknesses have been laid down in linear dependence of the nominal size. The corresponding pressure ratings, which are not featured in the ISO Recommendation, have been allotted to the pipes of various wall thicknesses.

The minimum tensile strength of pipes and special castings cast in sand moulds has been raised from 140 to 180 N/mm^2, in line with recent technical developments in the field of castings. This has made it possible also to raise the pressure ratings accordingly.

In Section 14 "Internal pressure test", the wishes of the Chemical Industry have been taken into account. By reference to DIN 50 104, testing with air (gases or vapours) is also provided for. If an internal pressure test is carried out with air, appropriate safety precautions must be taken.

In Section 15 "Protective coating", the recommendation "before application of the protective coating, the pipes must be warmed up to an adequate temperature", which was contained in DIN 2420 has been dropped, in order not to impede the further development of protective coatings. In the case of coal tar base protective coatings, the manufacturer guarantees (as he did previously) that the pipes and special castings will be adequately heated up before application of the coating.