
International Standard



4488

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Asbestos-cement pipes and joints for thrust-boring and pipe jacking

Tuyaux et joints en amiante-ciment pour fonçage

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4488 was developed by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*, and was circulated to the member bodies in September 1977.

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Asbestos-cement pipes and joints for thrust-boring and pipe jacking

1 Scope and field of application

This International Standard gives specifications relating to asbestos-cement pipes and joints for thrust-boring and pipe jacking¹⁾ for applications such as

- a) ducts to protect other pipes or cables;
- b) sewerage and drainage at atmospheric pressure.²⁾

It defines certain conditions of manufacture, classification, characteristics and acceptance tests for these products.

NOTE — Asbestos-cement pressure pipes are covered by ISO 160³⁾. Building and sanitary pipes in asbestos-cement are covered by ISO 391³⁾.

Asbestos-cement pipe fittings for building and sanitary purposes are covered by ISO 392³⁾.

Asbestos-cement pipes, joints and fittings for sewerage and drainage are covered by ISO 881³⁾.

2 References

ISO 390, *Asbestos-cement products — Sampling and inspection*.

ISO 2785, *Guide to the selection of asbestos-cement pipes subject to external load with or without internal pressure*.

3 Pipes

3.1 Composition

The pipes shall be made from a close and homogeneous mixture essentially consisting of a suitable inorganic hydraulic

binder,⁴⁾ asbestos fibre and water, excluding any materials liable to cause ultimate deterioration in the quality of the pipes.⁵⁾

3.2 Classification

3.2.1 Classes

The pipes are classified in two classes, as indicated in table 1, according to their permissible thrusting load.⁶⁾

Table 1 — Classification

Nominal diameter mm	Thrusting load	
	Class 1 kN	Class 2 kN
150	300	
200	400	
250	500	
300	600	
350	700	
400	800	
450	900	
500	1 000	
600	1 200	2 150
700	1 400	2 500
800	1 550	2 800
900	1 700	3 150
1 000	1 900	3 500
1 100	2 400	3 850
1 200	3 000	4 200
1 300	3 700	4 900
1 400	4 400	5 700
1 500	5 200	6 600
1 600	6 200	7 700
1 700	7 300	8 900
1 800	8 500	10 300
1 900	9 800	11 800
2 000	11 500	13 500

1) Throughout this document, the terms "thrusting" and "jacking" are to be taken as synonymous.

2) Accidental overpressures are admitted provided that a sufficient safety factor be maintained in relation to the hydraulic test pressure provided for in 3.5.3.

3) In preparation. (Revisions of ISO/R 160, ISO/R 391, ISO/R 392 and ISO/R 881.)

4) National standards may specify the binder to be used.

5) This International Standard applies both to water cured pipes and to autoclaved pipes in which the binder is partially replaced by ground silica.

6) See annex B.

This International Standard deals also with pipes having nominal diameters or permissible thrusting loads other than those shown in table 1. The permissible thrusting load of pipes with nominal diameters above 2 000 mm should be agreed between the manufacturer and the purchaser.

3.2.2 Choice of the class

The ratio of the load required to reach the longitudinal crushing strength (see 3.4.3.1) to the permissible thrusting load (see table 1) shall not be less than 1,7.

The purchaser’s engineer, who is qualified to judge the conditions of installation and operation of the pipes, shall decide the class of pipe to be used. Where the required thrusting load as calculated is intended to be used in conjunction with the minimum factor of safety of 1,7, the calculations shall take fully into account all special aspects of the individual application, such as

- effect of lubrication;
- vertical and longitudinal forces on the pipes;
- possibility of deviation of the pipeline during installation;
- experience of the installer and his operatives.

3.3 General appearance and finish

The internal surface shall be regular and smooth. If necessary (see 5.4), the pipes may be coated internally and/or externally with a suitable coating.

The part of the pipe where the rubber jointing rings are located shall satisfy the tolerances on the external diameter, as defined in 3.4.1.5 a), for a length appropriate to the type of joint adopted, and shall be free from irregularities which could affect the efficiency of the seal.

The shape of the finished ends shall be fixed by the manufacturer to suit the type of joint used. The end planes of the pipes shall be parallel to each other and perpendicular to the axis.

3.4 Characteristics

3.4.1 Geometrical characteristics

3.4.1.1 Nominal diameter

The nominal diameter of the pipes correspond to the internal diameter expressed in millimetres, tolerances excluded.

The series of nominal diameters is given in table 2. Nominal diameters not shown within parentheses are preferable.

3.4.1.2 Thickness of pipe wall

There are two design thicknesses (see figure 1) : e at the pipe end where the thrust is transmitted, and e' at the barrel of the pipe. The nominal thickness of the pipe is the thickness e of the portion where the thrust is transmitted.

Table 2 — Nominal diameters

150	(1 300)
200	1 400
250	1 500
300	1 600
350	(1 700)
400	1 800
450	(1 900)
500	2 000
600	(2 100)
700	2 200
800	(2 300)
900	2 400
1 000	2 500
(1 100)	
1 200	

NOTE — National standards may continue to provide for nominal diameters from the following range of approximately corresponding metric/inch sizes :

100/ 4 in,	125/ 5 in,	150/ 6 in,	175/ 7 in,
200/ 8 in,	225/ 9 in,	250/10 in,	300/12 in,
350/14 in,	375/15 in,	400/16 in,	450/18 in,
500/20 in,	525/21 in,	600/24 in,	675/27 in,
700/28 in,	750/30 in,	800/32 in,	825/33 in,
900/36 in,	975/39 in,	1 000/40 in,	1 050/42 in.

The design thicknesses shall be specified by the manufacturer, taking into consideration all the requirements provided for in this International Standard.

3.4.1.3 External diameter

The external diameter D_e refers to the external diameter on the barrel of the pipe (see figure 1). The external diameter shall conform to those in the manufacturer’s catalogues.

3.4.1.4 Length

The nominal length l of the pipes refers to the length measured between the extremities for pipes with plain ends and to the useful length for socketed pipes (see figure 1). It should normally be not less than 2 m.

3.4.1.5 Tolerances

a) External diameter of finished ends

The tolerances on the external diameter of the finished ends where jointing rings are located (plain ends), as well as a suitable method of measuring, shall be established by the manufacturer according to the type of joint used and taking into account the tolerances acceptable in respect of jointing rings. Tolerances shall be notified to the purchaser if required.

b) Regularity of the internal diameter (Roundness — Optional test)

If required, the regularity of the internal diameter of pipes < 500 mm shall be checked by means of a sphere or a disc, of a material unaffected by water, passing freely in the pipe.

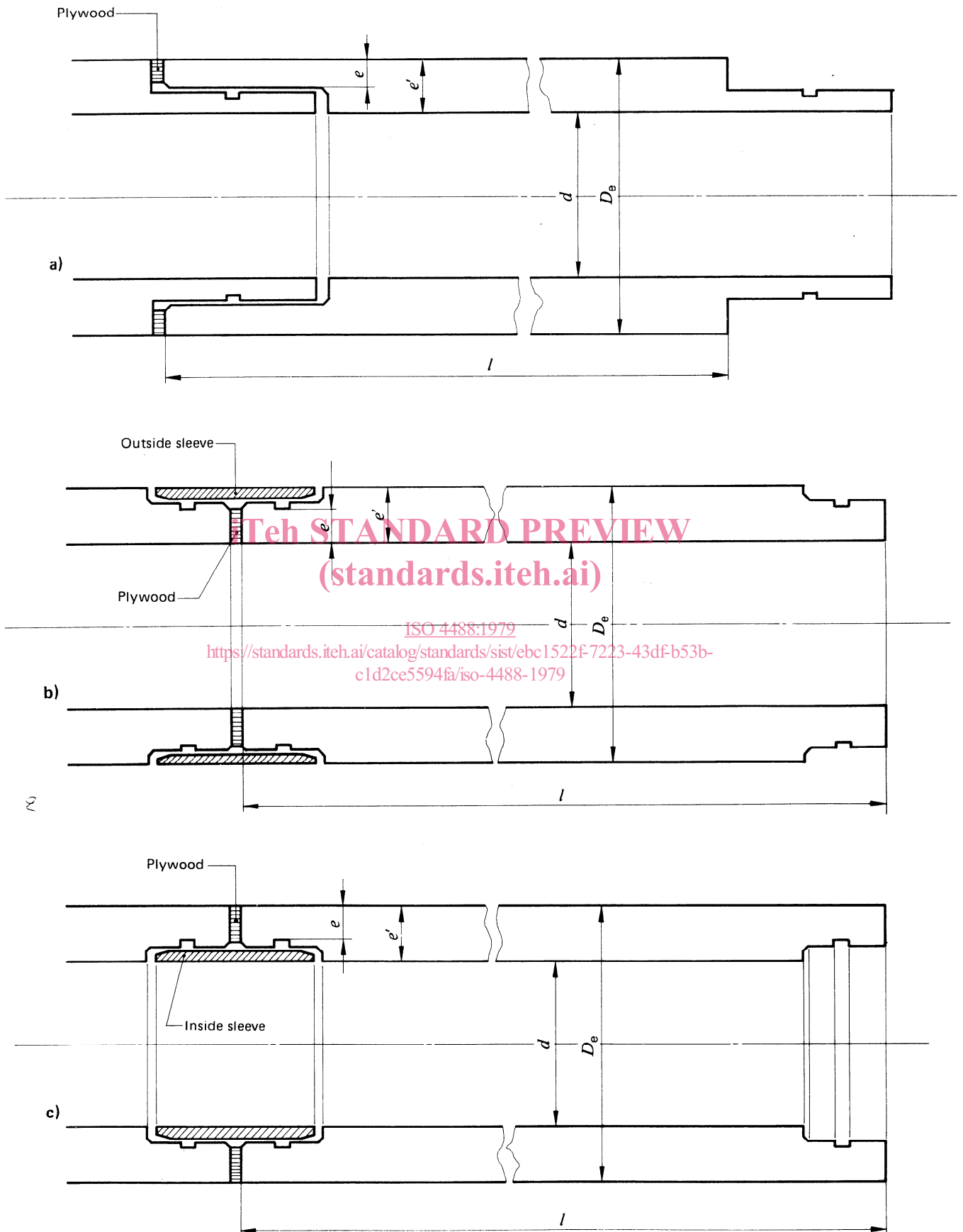


Figure 1 – Types of pipe

The disc shall be kept perpendicular to the axis of the pipe. The diameter of the sphere or the disc shall be less than the nominal diameter of the pipe by the following value, expressed in millimetres (rounded to the nearest millimetre) :

$$2,5 + 0,01 d$$

d being the nominal diameter, expressed in millimetres.

If required, the regularity of the internal diameter of pipes > 500 mm shall be checked by measuring three diameters at an angle of about 60° between them, at two different cross-sections of the pipe, with an accuracy of ± 1 mm. None of the six measurements shall be smaller than that allowed by application of the above formula.

c) Wall thickness (see figure 1)

Lower deviations for thicknesses e and e' :

- up to 10 mm : - 1,5 mm
- over 10 mm up to 20 mm : - 2,0 mm
- over 20 mm up to 30 mm : - 2,5 mm
- over 30 mm up to 60 mm : - 3,0 mm
- over 60 mm up to 90 mm : - 3,5 mm
- over 90 mm : - 4,0 mm

NOTE — Upper deviations are free.

d) External diameter of the barrel of the pipe

The tolerances on the external diameter on the barrel of the

pipe shall not be greater than the following value, expressed in millimetres (rounded to the nearest millimetre) :

$$\begin{aligned} &+ (6 + 0,011 d) \\ &- 0 \end{aligned}$$

d being the nominal diameter, expressed in millimetres.

e) Nominal length

$$\begin{aligned} &+ 5 \\ &- 20 \text{ mm} \end{aligned}$$

f) Straightness (Optional test)

The straightness may be checked by either of the following two methods, to be chosen by the manufacturer :

- by rolling the pipe on two parallel runners placed at a distance apart equal to two-thirds of the nominal length l of the pipe [see figure 2 a)], or
- by rolling the pipe on an even, flat floor [see figure 2 b)].

The maximum deviations, f according to the method in figure 2 a) and measured on the external surface at mid-span, or j according to the method in figure 2 b) and measured from the floor to the outer surface at the ends of the pipe, shall not exceed the following values, expressed in millimetres :

For all diameters :	f	j
	3,0 l	4,0 l

l being the length of the pipe, in metres.

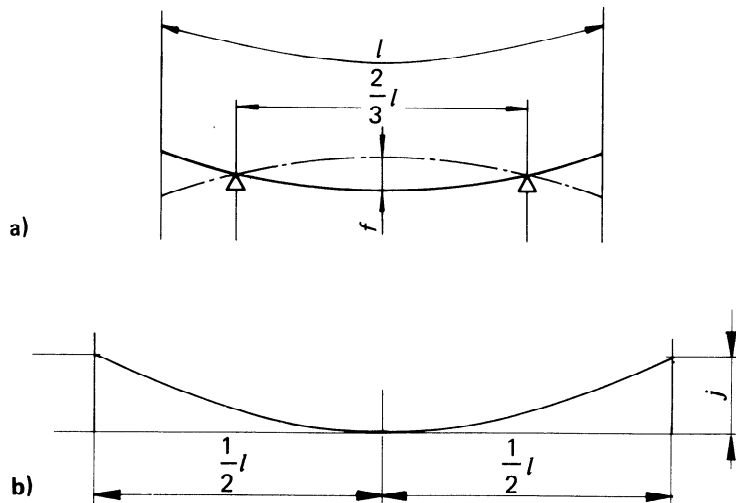


Figure 2 — Measurement of straightness

3.4.2 Physical characteristics

Tested as prescribed in 3.5.3 (optional test), the pipes shall show no fissure, leakage or sweating.

3.4.3 Mechanical characteristics

3.4.3.1 Longitudinal crushing test

Tested as prescribed in 3.5.1 (compulsory test), the pipes shall have a minimum unit longitudinal crushing strength of 50 N/mm².

3.4.3.2 Transverse crushing test

Tested as prescribed in 3.5.2 (compulsory test), the pipes shall have a minimum unit transverse crushing strength of 33 N/mm².

NOTES

1 Mechanical characteristics may be expressed in ultimate loads; however, the unit strengths determined by the tests prescribed in 3.5.1 and 3.5.2 shall not be less than those indicated in 3.4.3.1 and 3.4.3.2 respectively.

2 Tests on non-immersed specimens may be specified, in which case the following values shall apply :

- minimum unit longitudinal crushing strength : 60 N/mm²;
- minimum unit transverse crushing strength : 36 N/mm².

3.4.4 Chemical characteristics

Tested as prescribed in 3.5.4 (optional test), the pipes shall not show a neutralization of acetic acid exceeding 0,100 g per square centimetre.

3.5 Tests

The acceptance tests shall be carried out at the manufacturer's works on pipes, coated or otherwise, sufficiently matured.

a) Compulsory tests

- 1) Longitudinal crushing test (method as specified in 3.5.1).

- 2) Transverse crushing test (method as specified in 3.5.2).

b) Optional tests at purchaser's request, only when the pipes are being used as sewerage pipes

- 1) Hydraulic pressure test (method as specified in 3.5.3).
- 2) Chemical resistance test (method as specified in 3.5.4).

3.5.1 Longitudinal crushing test

The test shall be carried out on three samples, cut from one pipe, with dimensions $2e \times 2e \times e$,

e being the wall thickness, in millimetres, according to 3.4.1.2 (see figures 1 and 3), after immersion for 48 h in water at a temperature of 20 °C.

When tests are specified on non-immersed samples, the test samples shall be conditioned for 7 days in a room at a temperature of 20 ± 2 °C and a relative humidity of $(65 \pm 5)\%$.

The samples shall be sawn at three equidistant points of the pipe ends. If there is a groove in the finished ends, the sample shall be sawn in such a way that the groove is in the sample. The end planes shall be ground parallel to each other and perpendicular to the axis. This should be done with a stationary diamond grinding machine with a top grinding disc and a turning arm to bring the sample into the machine. Other equivalent methods may be used.

The extent to which the press plates of the test apparatus and the ground planes of the samples deviate from a flat plane, shall be kept to the absolute practical minimum.

The test samples shall be placed directly between the press plates, no felt or wood being used between the test piece and the press plates. The test piece shall be placed in the test apparatus with its centre of gravity in the line of the applied force (i.e. no eccentricity). Because of the round form of the test pieces, the exact location of the centre of gravity should be determined in advance, after which centring of the test pieces

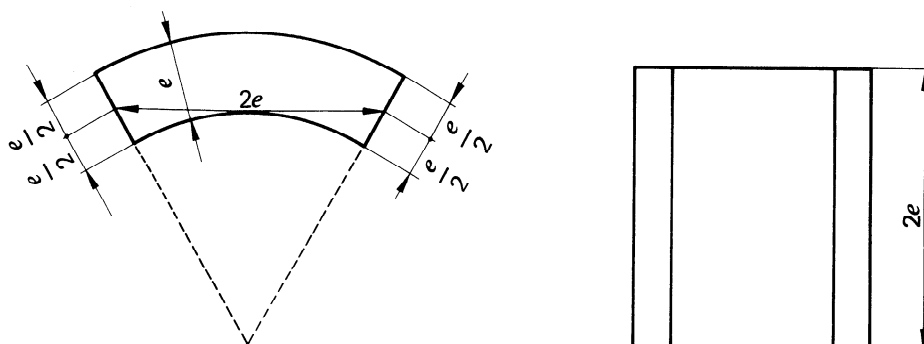


Figure 3 – Longitudinal crushing test sample