

**Plastics piping
systems —
Unplasticized
poly(vinyl chloride)
(PVC-U)
end-load-bearing
double-socket
joints —
Test method for
leaktightness and
strength while
subjected to bending
and internal pressure**

The European Standard EN ISO 13783:1997 has the status of a British Standard

ICS 23.040.60

Confirmed
March 2008

This British Standard, having been prepared under the direction of the Sector Board for Materials and Chemicals, was published under the authority of the Standards Board and comes into effect on 15 February 1998

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Amendments issued since publication

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National foreword

This British Standard is the English language version of EN ISO 13783:1997. It is identical with ISO 13783:1997.

This international standard is incorporated into BS 2782 *Methods of testing plastics: Part 11: Thermoplastics pipes, fittings and valves*, as Method 1123C, for association with related test methods for plastics materials and plastics piping components.

The UK participation in its preparation was entrusted to Technical Committee PRI/61, Plastics piping systems and components, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

To assist the use of this standard, the UK Technical Committee draws attention to the fact that generally in standards for plastics pipes for pressure applications, the value for the nominal pressure (PN) is expressed in bars, e.g. as given in Table 1, and the pressures for test conditions are also expressed in bars, as in 4.2 and in Figure 3. In 6.1 only, however, for the calculation of F_e the value to be used for p_i is the value in megapascals (MPa) of the internal pressure corresponding to the nominal pressure, and hence 0.1 times PN (as stated in 6.1).

NOTE 1 bar = 10^5 N/m² = 0.1 MPa

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

WARNING NOTE. This British Standard, which is identical with ISO 13783:1997, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the method should only be operated by trained personnel.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN ISO title page, pages 2 to 6 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

ICS 23.040.60

Descriptors: See ISO document

English version

Plastics piping systems — Unplasticized poly(vinyl chloride) (PVC-U) end-load-bearing double-socket joints — Test method for leaktightness and strength while subjected to bending and internal pressure

(ISO 13783:1997)

Systèmes de canalisations en plastiques — Double manchon en poly(chlorure de vinyle) non plastifié (PVC-U) résistant à la traction axiale — Méthode d'essai d'étanchéité et de la résistance en traction, avec sollicitation en flexion et pression interne
(ISO 13783:1997)

Kunststoff-Rohrleitungssysteme — Zugfeste Doppelmuffenverbindungen aus weichmacherfreiem Poly(vinylchlorid) (PVC-U) — Prüfverfahren für die Dichtigkeit und mechanische Festigkeit unter Biegung und Innendruck
(ISO 13783:1997)

This European Standard was approved by CEN on 1997-06-28. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

The text of EN ISO 13783:1997 has been prepared by Technical Committee CEN/TC 155 “*Plastics piping systems and ducting systems*”, the secretariat of which is held by NNI, in collaboration with Technical Committee ISO/TC 138 “*Plastics pipes, fittings and valves for the transport of fluids*”.

The material-dependent parameters and/or performance requirements are incorporated in the System Standard(s) concerned.

This standard is one of a series of standards on test methods which support System Standards for plastics piping systems and ducting systems.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 1998, and conflicting national standards shall be withdrawn at the latest by March 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This standard specifies a method for testing, while subjected to bending, the leaktightness and strength of assembled end-load-bearing double-socket joints of unplasticized poly(vinyl chloride) (PVC-U) which allow a maximum deflection of 3° .

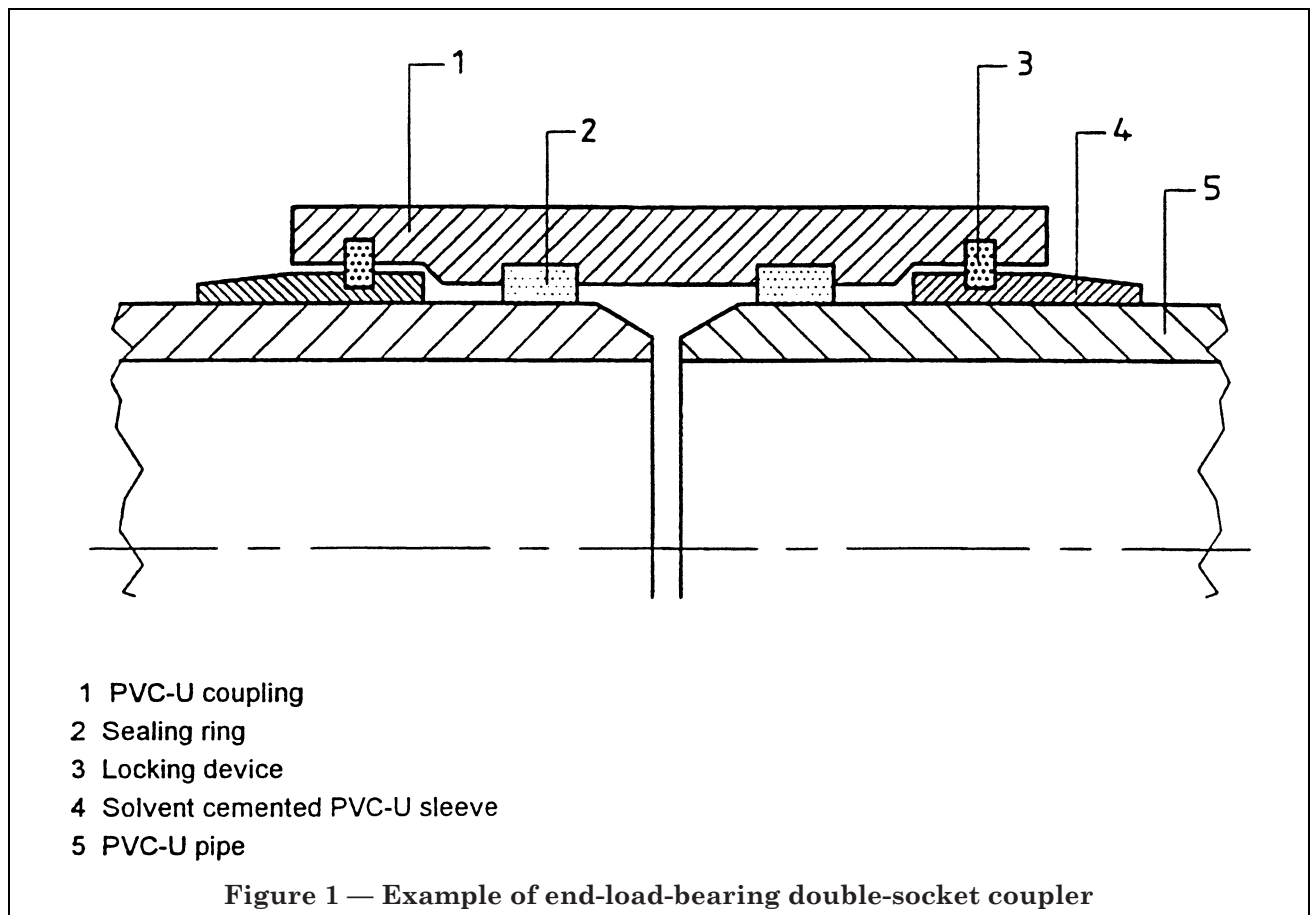
It is applicable to double-socket couplers provided with elastomeric sealing rings and locking rings and intended for use with PVC-U pressure pipes (see Figure 1).

The method specifies the internal pressure, the method of calculation for the additional bending force and the procedure for the bending test.

2 Normative reference

This Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 4065:1996, *Thermoplastics pipes — Universal wall thickness table*.



3 Principle

A test piece, consisting of PVC-U pipes mounted into a PVC-U double-socket coupler, is exposed to a specific cycle of internal hydrostatic pressures for specific test periods and at a specific temperature while the assembly is simultaneously subjected to a lateral bending force.

4 Apparatus

4.1 A *pressure control device*, connected to the test piece and capable of applying a variable internal hydrostatic pressure of at least 2,5 times the nominal pressure (PN) of the PVC-U pipe and joint assembly.

4.2 A *vacuum pump*, capable of applying a negative internal pressure of at least $-0,8$ bar ($-0,08$ MPa).

4.3 A *loading jig*, capable of applying a horizontal bending force to an assembled test piece while it is subjected to an internal hydrostatic pressure. The jig includes vertical supports equally spaced at $5d_n$ on either side of the axis of the horizontal force to restrain the test piece so that the horizontal force will induce bending, and horizontal supports beneath the test piece, to enable horizontal axial alignment of the test piece components. The supports have a low friction surface, to minimise inhibition of axial bending.

An example of a test arrangement is shown in Figure 2.

The length of the pipe sections and the total length of the test pieces shall conform to the values given in Figure 2.

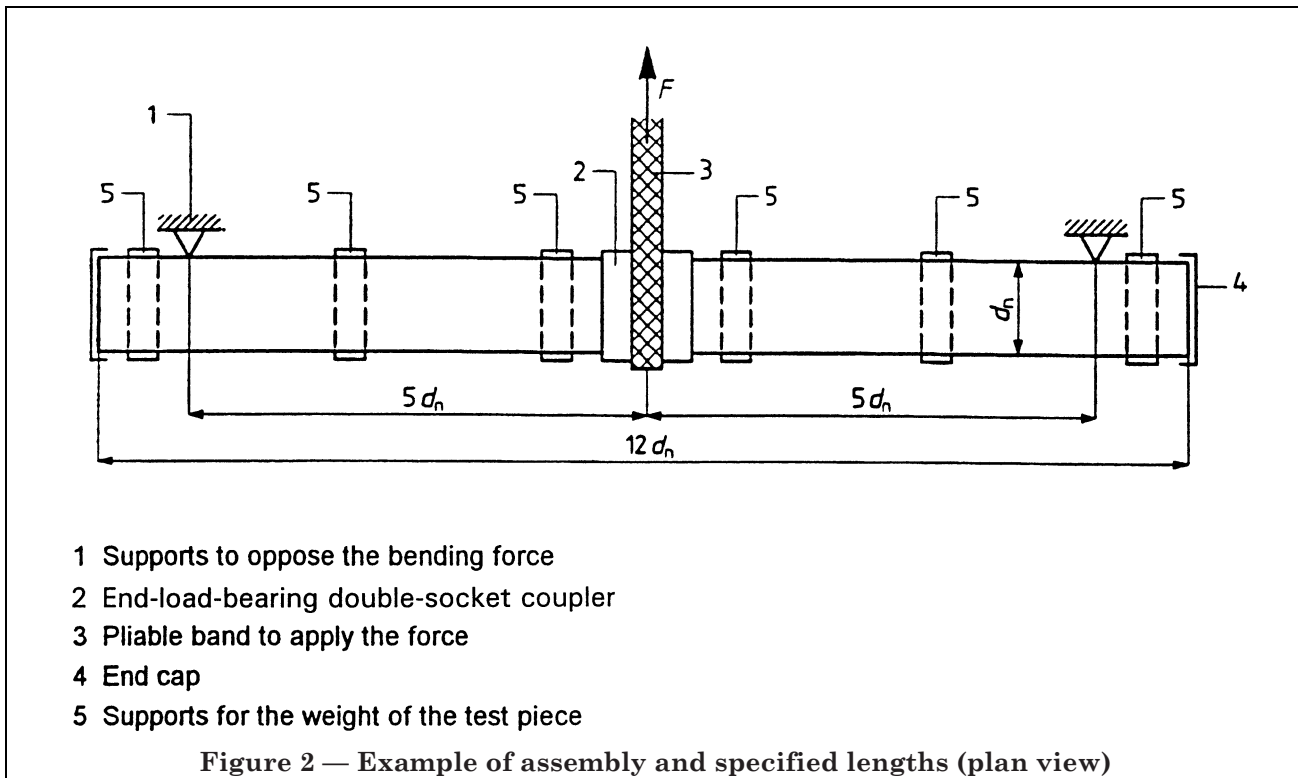
4.4 *Gauges*, for measuring the internal hydrostatic pressure and the applied bending force, each having an accuracy of $\pm 1\%$ at the measured values.

5 Test piece

The test piece shall consist of two PVC-U pipe sections mounted into the PVC-U end-load-bearing double-socket coupler to be tested. The assembly shall be carried out in accordance with the instructions of the manufacturer of the double-socket coupler.

The pipes and the double-socket coupler shall be of the same nominal pressure.

NOTE The mean outside diameter of the pipes should preferably conform to the minimum specified value, and the socket dimensions (mean inside diameter and the diameter of the groove for housing the sealing ring) should preferably conform to the maximum allowable values stated by the manufacturer in order to have dimensions as close as possible to the extreme limits of their relevant tolerances.



6 Procedure

6.1 Calculate the bending force F using the following equation:

$$F = 0,1 \left(\frac{d_n - e_n}{d_n} \right)^2 \times (\pi \sigma e_n d_{n,m} - F_e)$$

where:

d_n is the nominal outside diameter of the PVC-U pipes, in millimetres;

e_n is the nominal wall thickness of the PVC-U pipes, in millimetres;

σ is the resulting stress, due to the simultaneous effect of bending and internal pressure. It shall be 20 MPa (N/mm²);

$$d_{n,m} = d_n - e_n;$$

F_e is the force, in newtons, acting axially on the end caps and given by the following equation:

$$F_e = p_i \left(\frac{\pi d_i^2}{4} \right)$$

where:

p_i is the internal water pressure in MPa, which shall be 0,1 times the value of PN;

d_i is the calculated inside diameter of the PVC-U pipe, i.e. $(d_n - 2e_n)$.

NOTE Some values calculated for F , based on PVC-U pipes, are given in Table 1.

6.2 Lay the assembled test piece on the supports, ensuring that the pipes and the coupler are in axial alignment (see Figure 2).

6.3 Fill the test piece with water at (20 ± 5) °C and release all air. Allow the assembly to condition for 60 min to ensure equalization of temperature.

6.4 Carry out the procedure given in **6.5** at any ambient temperature between 15 °C and 25 °C while maintaining this ambient temperature within ± 2 °C and examining the joints for leakage during the whole test cycle.

6.5 Carry out the following test procedure in accordance with the schematic arrangement shown in Figure 3, which is not intended to require strictly linear rates of change in pressure or force, and by maintaining each static pressure and bending force within $^{+5}_0$ %.

At A: increase the water pressure over a period of 5 min to 1 times [PN], and maintain this pressure for 5 min.

At B: increase the water pressure over a period of 5 min to 2,5 times [PN], and maintain this pressure for 5 min.

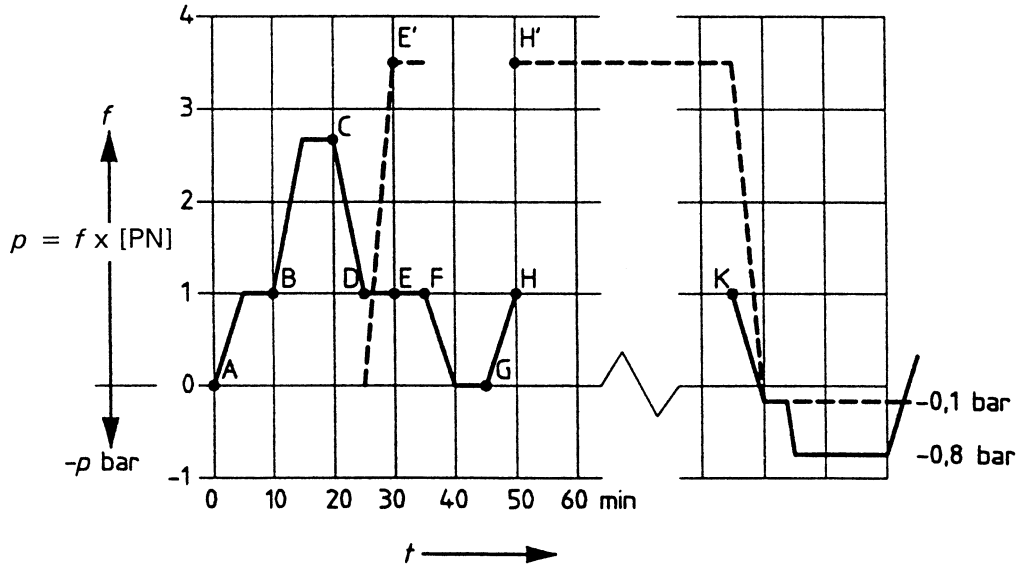
At C: reduce the water pressure over a period of 5 min to 1 times [PN].

At D: apply the calculated value of the bending force, F , in the horizontal plane over a period of 5 min whilst maintaining the internal pressure of 1 times [PN].

Table 1 — Calculated values for the bending force, F

PN	Bending force F on the double-socket coupler (in newtons)					
	6,0	6,3	8	10	12,5	16
d_n	S 20,8	S 20 ^a	S 16	S 12,5	S 10	S 8
110	1 179	1 217	1 510	1 833	2 280	2 748
125	1 555	1 594	1 975	2 385	2 930	3 489
160	2 511	2 640	3 155	3 955	4 816	5 738
200	3 867	4 013	5 012	6 127	7 500	8 989
250	6 078	6 376	7 763	9 540	11 592	13 956
315	9 588	9 923	12 321	14 817	18 413	22 235
355	12 300	12 647	15 587	18 797	23 377	28 284
400	15 468	16 050	19 830	23 654	29 797	35 765
500	24 311	25 220	30 778	37 893	46 622	56 064
630	38 353	39 690	48 939	59 602	73 651	

^a S is the pipe series conforming to ISO 4065:1996.



NOTE The solid line represents the time limits for pressure changes (inclusive of constant values) and the dotted line represents the bending force, F , (exclusive of values). The lines do not infer that the rates of change of pressure or force are strictly linear.

Figure 3 — Schematic hydrostatic pressure test regime with bending

At E: maintain the water pressure at 1 times [PN] for a further period of 5 min whilst maintaining the bending force F .

At F: reduce the water pressure to atmospheric pressure within 5 min and ensure that the deflection of the pipe is maintained constant for a further period of 5 min.

At G: increase the water pressure within a period of 5 min to 1 times [PN].

At H: adjust the bending force, F , to its original value. (The angle of deflection will normally be a little greater than at E.)

Repeat the cycle from E to H a further nine times.

At K: at the end of the 10th cycle, release the bending force and drain the water from the assembled test piece. Apply a negative pressure to the test piece until a constant pressure of $(-0,1 \pm 0,02)$ bar is achieved. Isolate the vacuum pump from the test piece, and observe the pressure for 15 min. Apply a further negative pressure to the test piece until a constant pressure of $(-0,8 \pm 0,02)$ bar is achieved, then isolate the vacuum pump from the test piece, and observe any increase in pressure for a further 15 min.

6.6 On completion of the test disassemble the joints and examine all parts for details of any cracks and deformations and record the results.

7 Test report

The test report shall include the following information:

- a reference to this standard, and to the referring standard;
- the nominal pressure, PN, of the double-socket coupler and the nominal pressure, PN, or pipe series S of the PVC-U pipe;
- the bending force, F , applied;
- the ambient temperature during the test;
- all information on the leaktightness of the joint;
- the result of the visual inspection of the test piece;
- the test results, i.e. whether or not the test piece conformed to the requirements of a referring standard;
- any factors which may have affected the results, such as any incidents or any operating details not specified in this standard.
- the date of the test, the testing laboratory and the name of the tester.

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