British Standard

BRITISH STANDARD

BS 5114:1975

Incorporating Amendment Nos. 1 and 2

Specification for

Performance requirements for joints and compression fittings for use with polyethylene pipes

UDC 621.643.4:621.643.2:678.742.2

Co-operating organizations

The Plastics Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

British Plastics Federation*
British Resin Manufacturers' Association
Chemical Industries Association Ltd.*
Department of the Environment, Building Research Establishment
Department of Industry
Department of Industry — N.P.L.
Electrical and Electronic Insulation Association
Electrical Installation Equipment Manufacturers' Association
Electrical Research Association
Engineering Equipment Users' Association*
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Plastics Institute
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Rubber and Plastics Research Association of Great Britain
Society of Motor Manufacturers and Traders Ltd.

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National Farmers' Union
National Water Council
Oil Companies Materials Association
Water Companies Association
Water Research Association

This British Standard, having been approved by the Plastics Industry Standards Committee, was published under the authority of the Executive Board on 30 May 1975

The following BSI references relate to the work on this standard:
Committee references PLM/9 and PLM/9/2
Draft for comment 72/51271DC

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Amendments issued since publication

Amd. No.	Date of issue	Comments
2016	June 1976	
5336	July 1987	Indicated by a sideline in the margin

Contents

Foreword

This British Standard has been prepared under the authority of the Plastics Industry Standards Committee and is based on a draft submitted by the British Plastics Federation.

This standard deals with the performance requirements for joints in polyethylene pipe using fittings made from either metal or plastics; it specifies no dimensional requirements.

Reference is made in this standard to BS 3796 "*Polythene pipe (Type 50) for general purposes including chemical and food industry uses*", which has been withdrawn and superseded by BS 6437 "*Polyethylene pipes (Type 50) in metric diameters for general purposes*". It should be noted that BS 6437 is not an alternative to BS 3796 for this edition of this British Standard because the system dimensions, nominal size designations and pressure classifications are incompatible.

The requirements specified in clause **4** and the corresponding test methods are being studied by Technical Committee 138 — Plastics pipes and fittings for the transport of fluids, of the International Organization for Standardization (ISO).

Attention is drawn to BS 864 "*Capillary and compression tube fittings of copper and copper alloy*", Part 3 "*Compression fittings for polyethylene pipes*" which specifies external dimensions for this type of fitting and performance requirements aligned with those of this standard.

The classification of plastics pipe according to pressure rating is specified in BS 3867 "*Outside diameters and pressure ratings of pipe of plastics materials*".

The requirements for the effects of non-metallic materials upon water quality have been updated to enable joints and fittings complying with this British Standard to be acceptable to UK water undertakings.

NOTE The name "polyethylene" is now preferred to "polythene" and is used in this British Standard except where the latter is included in the title of a published British Standard which has not yet been revised to take account of this preference.

Certification. Attention is drawn to the certification facilities described on the inside back cover of this standard.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover 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.

1 Scope

This British Standard specifies requirements for the performance of joints and compression fittings for use with polyethylene pipe not larger than nominal size 2 complying with the requirements of BS 1972, BS 1973, BS 3284 and BS 3796. The requirements are based on service with normal liquids under pressure; for aggressive liquids it will be necessary to establish the resistance to the fluid of the fitting, in particular the suitability of the elastomeric sealing ring, if fitted.

2 References

The titles of the British Standards referred to in this standard are listed on the page 8.

3 Material

3.1 The material from which the fittings are made shall be either plastics or metal; the fittings may include elastomeric sealing rings.

3.2 Where plastics materials are used they shall comply with the requirements for effect on water; if tin stabilizers are used, these shall be only dialkyl tins C_4 and higher homologues.

4 Performance requirements

4.1 Hydrostatic (hydraulic) requirement. When tested by the method described in Appendix A the jointed assembly shall withstand for 1 h without leakage a test pressure related to the maximum sustained working pressure specified for the class of pipe used in the assembly by the factor given in Table 1.

NOTE To test fittings it is advisable to use pipe complying with the requirements of BS 3284 or BS 3796.

4.2 Hydrostatic (hydraulic) requirement when subjected to bending stresses. When tested by the method described in Appendix B the jointed assembly shall withstand for 1 h without leakage the appropriate test pressure given in **4.1**.

4.3 External pressure requirement. When tested by the method described in Appendix C, a jointed assembly shall withstand an external pressure of 0.10 bar[1)] above atmospheric pressure for 1 h followed by a pressure of 0.80 bar above atmospheric pressure for a further 1 h without leakage.

4.4 Requirement for resistance to pull-out of assembled joint. When subjected to the longitudinal tensile force described in Appendix D, any axial movement of the pipe relative to the joint shall not exceed 1.0 mm.

5 Special requirements for plastics fittings

5.1 Effect of non-metallic materials on water quality. When used under the conditions for which they are designed, non-metallic materials in contact with or likely to come into contact with potable water shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste or odour, cloudiness or discoloration of the water.

Concentrations of substances, chemicals and biological agents leached from materials in contact with potable water, and measurements of the relevant organoleptic/physical parameters shall not exceed the maximum values recommended by the World Health Organization in its publication "Guidelines for drinking water quality, Vol. 1 Recommendations" (WHO, Geneva, 1984)[2)] or as required by the EEC Council Directive of 15 July 1980 relating to the quality of water intended for human consumption (Official Journal of the European Communities L229, pp 11 – 29)[2)], whichever in each case is the more stringent.

NOTE 1 Requirements for the testing of non-metallic materials in these respects are set out in the UK Water Fittings Byelaws Scheme Information and Guidance Note No. 5-01-02, ISSN 0267-0313, obtainable from the Water Research Centre, Water Byelaws Advisory Service, 660 Ajax Avenue, Slough, Berkshire SL1 4BG.

NOTE 2 Pending the determination of suitable means of characterizing the toxicity of leachates from materials in contact with potable water, materials approved by the Department of the Environment Committee on Chemicals and Materials of Construction for use in Public Water Supply and Swimming Pools are considered free from toxic hazard for the purposes of compliance with this subclause. A list of approved chemicals and materials is available from the Technical Secretary of that Committee at the Department of the Environment, Water Division, Romney House, 43 Marsham Street, London SW1P 3PY.

NOTE 3 Products manufactured for installation and use in the United Kingdom which are verified and listed under the UK Water Fittings Byelaws Scheme administered by the Water Research Centre (address as in note 1) are deemed to satisfy the requirements detailed in this subclause.

5.2 Opacity (applicable to fittings for use with potable water). When tested in accordance with BS 2782:Method 1104A, the wall of the fitting shall not transmit more than 0.2 % of the visible light falling on to it.

6 Appearance

The internal and external surfaces of all fittings shall be clean, smooth and reasonably free from grooving and other defects.

[1)] 1 bar = 10^5 N/m^2 = 100 kPa.
[2)] Available from HMSO.

Table 1 — Relationship of test pressure to maximum sustained working pressure

Test made on	Factor $\left\{\frac{\text{test pressure}}{\text{maximum sustained working pressure}}\right.$
fitting	3
pipe system made from pipe complying with the requirements of BS 3284 and BS 3796	3
pipe system made from pipe complying with the requirements of BS 1972 and BS 1973	2.5

7 Compliance

For compliance with this standard the requirement specified in **4.1** shall be subject to batch tests (see **8.2**) and the requirements specified in **4.2**, **4.3**, **4.4**, **5.1** and **5.2** shall be subject to type tests (see **8.1**).

8 Sampling and compliance

8.1 Sampling for type tests. Type tests are intended to prove the suitability and performance of a new composition, a new compounding or processing technique, or a new design or size of joint or fitting. Such tests therefore are applied when a change is made in polymer composition or method of manufacture, or when a new size or type of fitting is to be introduced, and in any case not less frequently than one every 12 months.

8.2 Sampling for batch tests

8.2.1 A batch test is a spot test carried out during manufacture to check the quality of a production run (batch).

8.2.2 From each production batch, the manufacturer shall take at random the number of fittings required by scheme 1, given in Appendix F, for testing in accordance with the requirement of **4.1**.

8.2.3 If all fittings pass the test, the production batch shall be deemed to comply with the requirements of this standard.

8.2.4 If any fitting fails the test, manufacturers shall have the option of either:

a) retesting the production batch as above, but on the number of fittings according to scheme 2, given in Appendix F; or

b) dividing the production batch into several lots of any convenient size, and testing from each lot the number of fittings according to scheme 2, given in Appendix F (i.e. applied to the size of each lot).

8.2.5 If the manufacturer chooses option **8.2.4** a), and if all the fittings pass the test, the production batch shall be deemed to comply with the requirements of this standard. If any fitting fails the test, the production batch shall be deemed not to comply with the requirements of this standard.

8.2.6 If the manufacturer chooses option **8.2.4** b), the provisions of **8.2.5** shall apply to each lot separately.

NOTE This sampling procedure is designed to be undertaken by the manufacturer at his works. Additional specimens may be tested and witnessed at the works by arrangement at additional cost to the customer.

8.3 Notwithstanding the requirements specified in **8.1** and **8.2** in respect of sampling for testing by the manufacturer, fittings tested by the purchaser or otherwise, subsequent to manufacture, shall comply with all the requirements specified in this standard.

9 Elastomeric sealing component

Elastomeric sealing components used in jointing shall comply with the requirements of BS 2494.

10 Marking

Fittings shall be indelibly marked to show:

a) the manufacturer's identification;

b) the number of this British Standard, i.e. BS 5114;

c) the nominal size of pipe for which the fitting is intended;

d) the appropriate class or pressure rating to which the fitting corresponds (see BS 3867).

Appendix A Hydrostatic (hydraulic) pressure test

A.1 Form of test specimen

The test specimen shall consist of one or more joints assembled between one fitting and one or more pieces of polyethylene pipe, each 300 mm in length. The open ends of the polyethylene pipe shall be sealed off in such a way that when the test pressure is applied longitudinal stresses are exerted within the pipe wall due to the water pressure acting on the end fittings.

The joint or joints shall be assembled in accordance with the fittings manufacturer's instructions.

A.2 Apparatus

The apparatus shall consist of a suitably designed pressure source capable of being connected to the test specimen and holding the specified test pressure to an accuracy of ± 2 %. A pressure gauge shall be fitted to the apparatus to enable the test pressure to be observed. A suitable apparatus is shown in Figure 1.

A.3 Procedure

Fill the test assembly with water at 18 °C to 22 °C and leave to condition for 1 h. Attach the test specimen to the pressure source and ensure that the outside of the test specimen is completely dry. Apply the specified test pressure and maintain it for 1 h.

Inspect the body of the fitting and the joint for any sign of leakage during the test.

Any leakage of the pipe remote from the joint does not constitute a test failure. If this happens a further test assembly shall be tested.

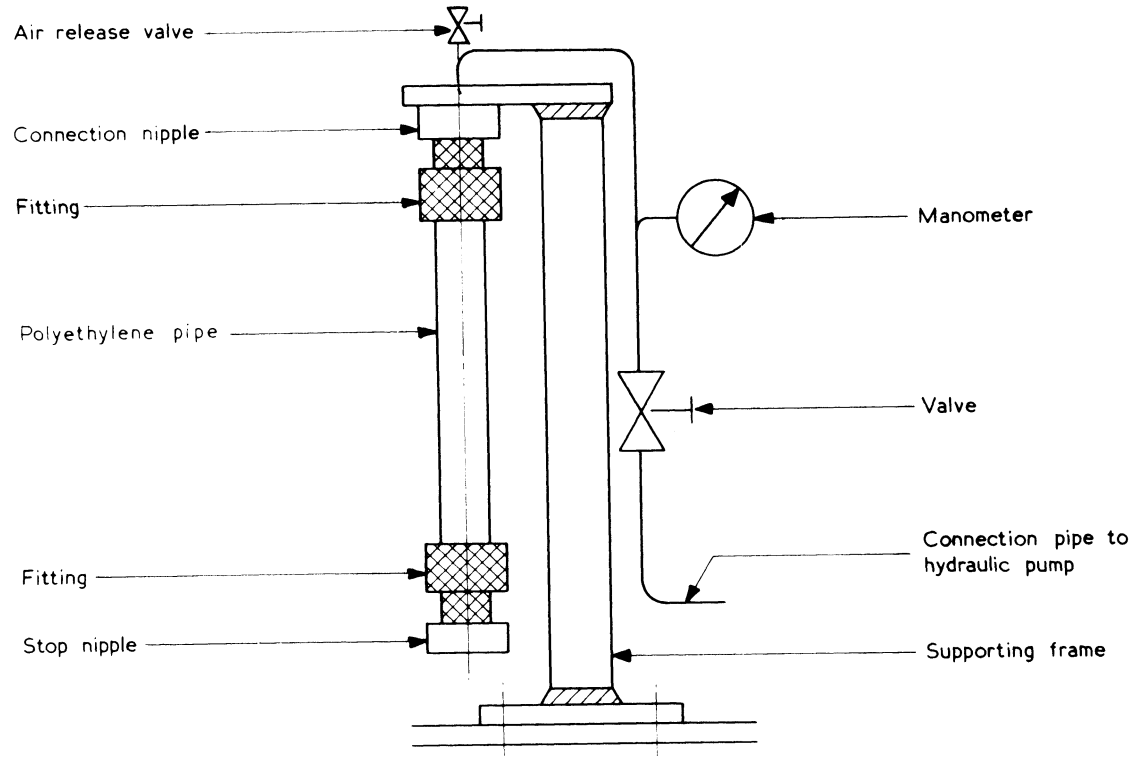


Figure 1 — Diagram of suitable apparatus for hydrostatic (hydraulic) pressure test

Appendix B Hydrostatic (hydraulic) pressure test when subjected to bending stresses

B.1 Form of test specimen

The test specimen shall consist of a polyethylene pipe of the same size and pressure rating as the fittings to be tested, and of length such that the free length after the fitting has been connected is 10 times the pipe diameter.

Two fittings of the type to be tested shall be mounted at the ends of the pipe according to the fittings manufacturer's specification, and in such a way as to be suitable for the pressure test described in Appendix A.

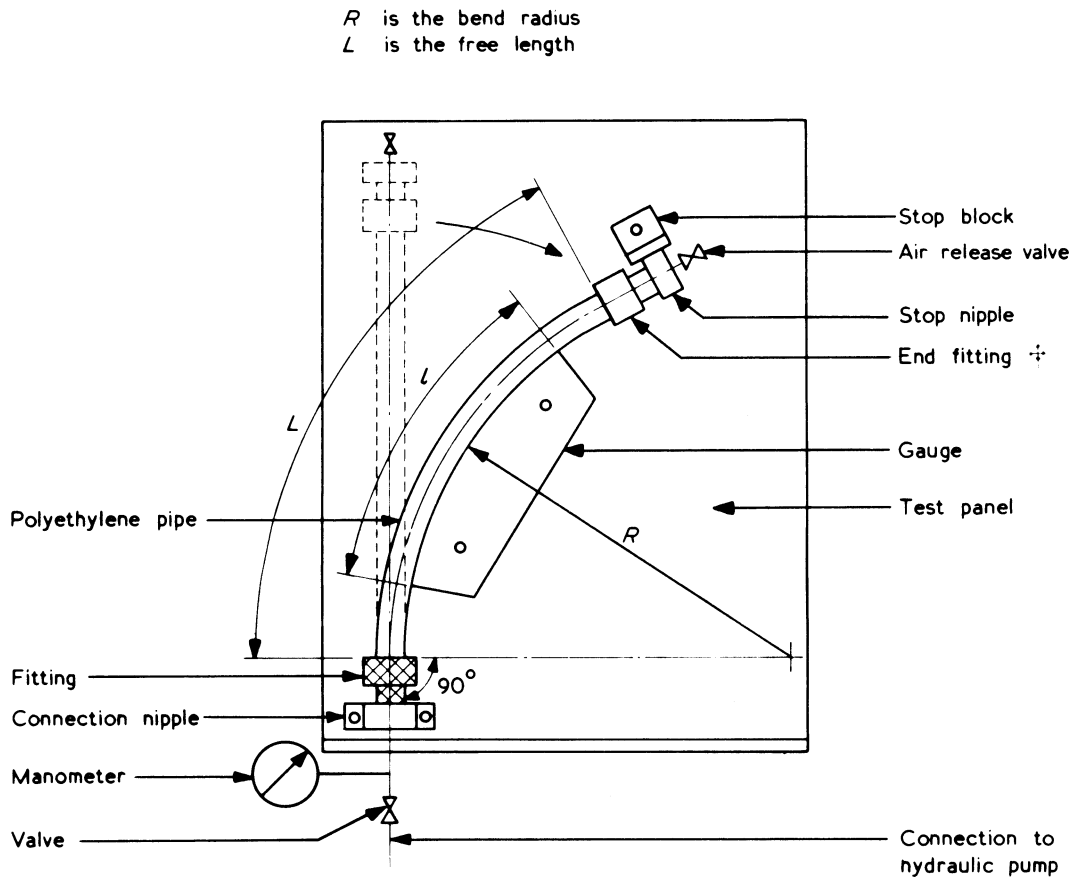
B.2 Apparatus

The apparatus shall consist of a bending gauge having a bearing length l equal to three quarters of the free length L between fittings. The bearing shall have a radius R equal to a value in millimetres of 15 times the nominal diameter of the pipe under test for class C[3)] pipe and a value in millimetres of 20 times the nominal diameter for class D[3)] pipe. A suitable apparatus is shown in Figure 2.

B.3 Procedure

Set up the test specimens on the bending gauge in such a way that bending stresses are supported by the fittings. Fit the pipe to the bending gauge over its entire length leaving equal free lengths of pipe at each end.

Apply the specified test pressure as described in Appendix A and inspect the specimens for any signs of leakage.



† The end fitting is only used for closing the test specimen and is not meant to be tested.

Figure 2 — Diagram of suitable apparatus for hydrostatic (hydraulic) pressure test when subjected to bending stresses

[3)] See BS 3867.

Appendix C External pressure test

C.1 Form of test specimen

The test specimen shall consist of the fitting to be tested, assembled with one or more pieces of polyethylene pipe of the size and quality for which the fitting is designed. Each piece of pipe shall be at least 300 mm in length. The joint or joints shall be assembled in accordance with the fittings manufacturer's instructions.

C.2 Apparatus

The apparatus shall consist of an enclosed tank capable of being used at the appropriate test pressures and of receiving the test specimen. The inside of the test specimen shall be open to atmosphere through the walls of the tank. The assembly shall be arranged so as to enable any leakage to be detected within the test specimen. The water tank shall be connected to a device capable of maintaining a water pressure of

a) $0.10\,^{+0.05}_{-0}$ bar[4] (gauge) and

b) $0.80\,^{+0.05}_{-0}$ bar (gauge).

A pressure gauge shall be fitted to the test tank to enable the test pressure to be observed. A suitable apparatus is shown in Figure 3.

C.3 Procedure

Secure the test specimen in the tank, fill the tank with water at a temperature of 20 ± 2 °C and wait for 20 min for the equilibration of temperature. Wipe any sign of condensation from inside the test specimen and wait a further 10 min. Ensure that the inside of the test specimen is completely dry. Apply the test pressure of 0.10 bar for 1 h, followed by an increase in test pressure to 0.80 bar for a further period of 1 h.

Inspect the test specimen for any sign of leakage at intervals during the test.

Appendix D Test for resistance to pull-out of assembled joint

D.1 Form of test specimen

The test specimen shall consist of the fitting or fittings to be tested, assembled with one or more pieces of polyethylene pipe of the size and quality for which the fitting is designed. Each piece of pipe shall be at least 300 mm in length. The joints shall be assembled in accordance with the fittings manufacturer's instructions.

D.2 Apparatus

The apparatus shall consist of a tensometer capable of holding the test specimen at a constant longitudinal force, or alternatively the force may be applied to the test specimen by means of weights, in which case the specimen shall be suspended in a frame with a suitable stirrup at the lower end to hold the weights. A suitable apparatus is shown in Figure 4.

Secure the test specimen in the apparatus and apply the appropriate force given in Table 2 gradually over a period of 30 s.

Hold the specimen in constant tension for a period of 1 h at a temperature of 20 ± 20 °C.

After the removal of the force, measure any movement of the pipe relative to the joint.

NOTE The applied tensile force is calculated on the basis of that developed when the jointed pipe is subjected to the maximum internal test pressure to which the pipe may be subjected, i.e. 3 times its maximum sustained working pressure. Under these conditions the following formula, which has been used to calculate the values in Table 2, applies:

$$F = 1.5 \times \delta T \times \frac{\pi}{4}(D^2 - d^2)$$

where

F is the applied force (N);

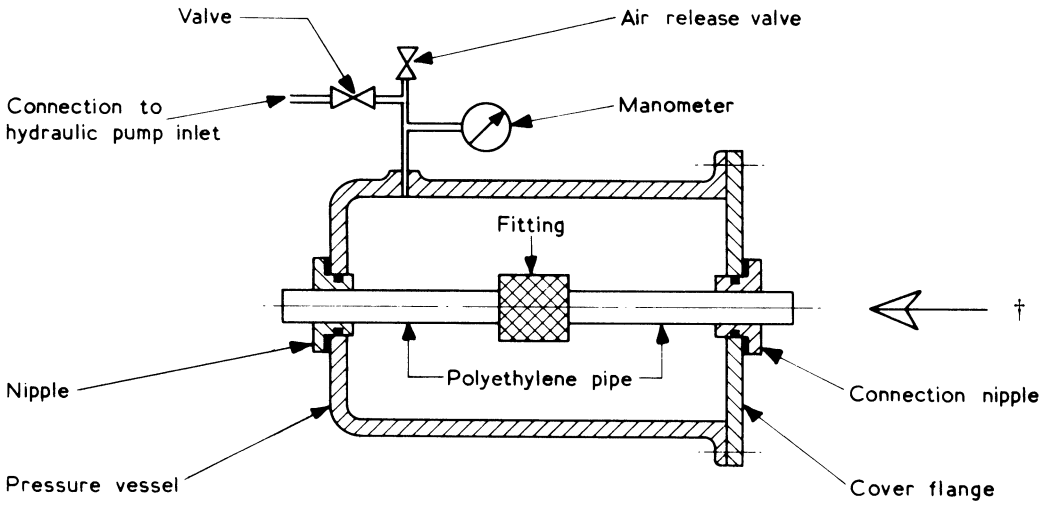
δT is the permissible tangential stress for polyethylene pipe (MPa);

D is the outside diameter of pipe (mm);

d is the internal diameter of pipe (mm).

The permissible tangential stress is 3.2 MPa for type 32 polyethylene pipe and 5.0 MPa for type 50 polyethylene pipe.

[4] 1 bar = 10^5 N/m^2 = 100 kPa.



† It is an essential feature of the apparatus that it should permit a clear view through the test specimen.

Figure 3 — Diagram of suitable apparatus for external pressure test

Table 2 — Force required for tensile test

Nominal size	Tensile force					
	Type 32 pipe (BS 1972 and BS 1973)			Type 50 pipe (BS 3284 and BS 3796)		
	Class B	Class C	Class D	Class B	Class C	Class D
	N	N	N	N	N	N
⅜	—	470	580	—	—	690
½	—	725	870	—	850	1 070
¾	810	1 140	1 380	—	1 370	1 660
1	1 320	1 760	2 180	1 600	2 080	2 650
1¼	2 060	2 800	3 470	2 400	3 360	4 200
1½	2 710	3 700	4 530	3 080	4 350	5 660
2	4 370	5 780	—	4 830	6 760	8 520

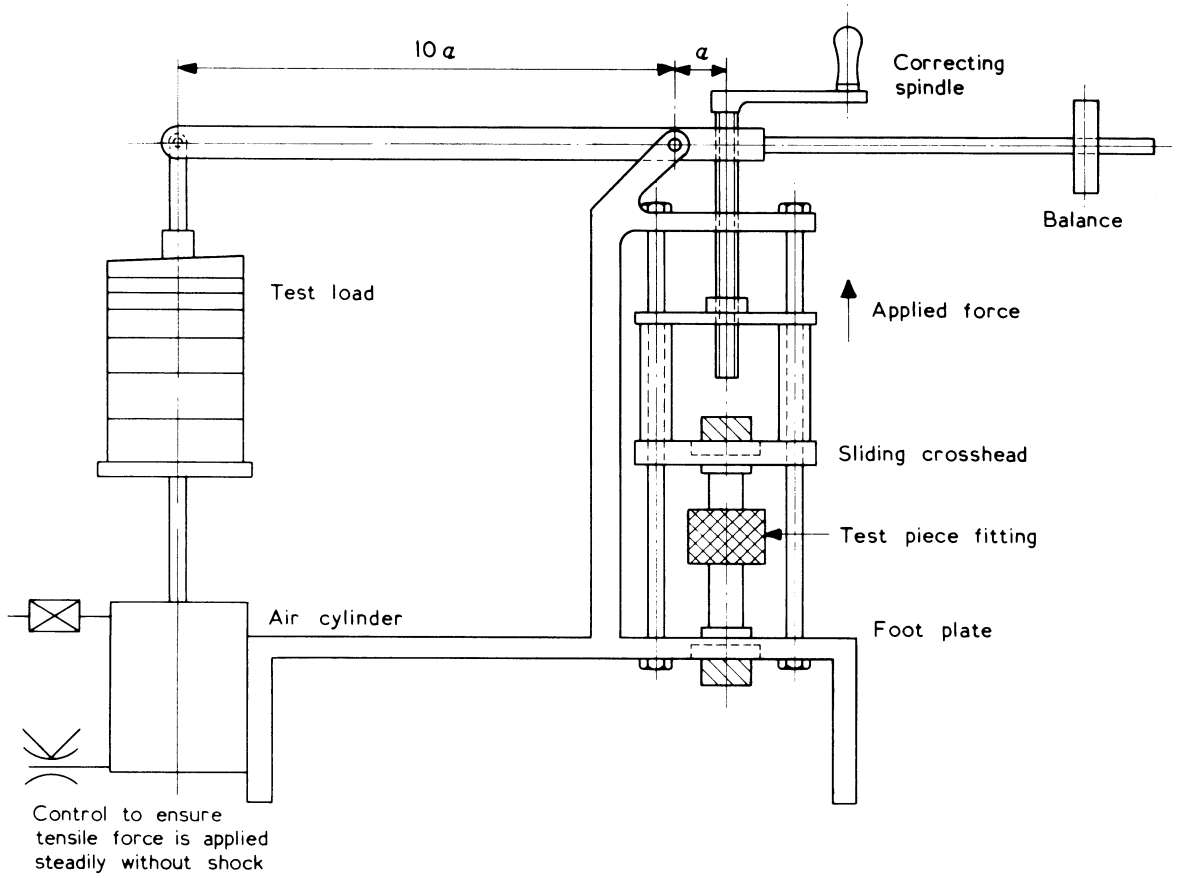


Figure 4 — Diagram of suitable apparatus for test for resistance to pull-out of assembled joint

Appendix E Test for opacity

Text deleted.

Appendix F Sampling quantities

Scheme 1

Number of fittings in batch	Number of specimens for each test
91 to 500	3
501 to 3 500	5
3 501 to 150 000	8

No failures are permitted for batch acceptance.

Scheme 2

Number of fittings in batch	Number of specimens for each test
91 to 150	3
151 to 1 200	5
1 201 to 35 000	8
35 001 to 150 000	13

No failures are permitted for batch acceptance.

NOTE These sampling schemes are based on the information given in BS 6001.

Publications referred to

This standard makes reference to the following British Standards:

BS 1972, *Polythene pipe (Type 32) for above ground use for cold water services.*

BS 1973, *Polythene pipe (Type 32) for general purposes including chemical and food industry uses.*

BS 2494, *Elastomeric joint rings for pipework and pipelines.*

BS 2782, *Methods of testing plastics.*

BS 2782:Method 1104A, *Measurement of opacity of thermoplastics pipes and fittings.*

BS 3284, *Polythene pipe (Type 50) for cold water services (Obsolescent).*

BS 3796, *Polythene pipe (Type 50) for general purposes including chemical and food industry uses.*

BS 3867, *Outside diameters and pressure ratings of pipe of plastics materials.*

BS 4346, *Joints and fittings for use with unplasticized PVC pressure pipes.*

BS 4346-1, *Injection moulded unplasticized PVC fittings for solvent welding.*

BS 4991, *Propylene copolymer pressure pipe.*

BS 6001, *Sampling procedures and tables for inspection by attributes.*

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