

## Information and Guidance Note

Information and Guidance Notes are also issued by:

United Kingdom Water Fittings Bylaws

Scheme ISSN 0267 0313

# SPECIFICATION FOR COMPRESSION FITTINGS OF COPPER AND COPPER ALLOY FOR POLYETHYLENE PIPES WITH OUTSIDE DIAMETERS TO BS 5556 (metric).

## FOREWORD

This specification is the result of consultations between WRc, the Copper Tube Fittings Manufacturers Association (CTFMA), the Water Industry and other interested parties. It is issued as an interim measure until BS 864: Part 4 is published and provides a specification against which copper and copper alloy fittings (for use with polyethylene pipe with outside diameters to BS 5556 metric series) may be manufactured and purchased.

Throughout this specification, fittings are designated by a size related to the metric nominal outside diameter of the pipe with which the fitting is to be used.

This specification does not attempt the complete dimensional standardisation of any of these types of fittings, since the variety in the design and methods of production already established by the various manufacturers makes any such attempts impracticable, and to do so would also restrict further development. It does however specify such dimensions and requirements as are essential to ensure satisfactory installation and performance.

This specification refers to the test methods specified in BS 5114 which is applicable to joints using fittings made from any metal or plastics material, but the test pressures and loads to be used for any particular size of fitting and the criteria of acceptance or failure are specified in this specification.

**Compliance with this specification does not of itself confer immunity from legal obligations.**

This specification does not purport to include all the necessary provisions of a contract. Users of this specification are responsible for its correct application.

This specification calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

It has been assumed in the drafting of this specification that the execution of its provisions is entrusted to appropriately qualified and experienced people, for whose guidance it has been prepared.

Attention is drawn to the WRc Water Fittings and Materials Directory, in which those products complying with the Water Byelaws are listed.

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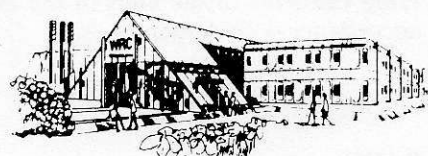
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## 1. SCOPE

**1.1** This specification specifies the materials, dimensions and construction details together with the testing requirements for compression fittings for use with blue polyethylene pipes in metric series complying with the requirements of BS 6572 and black polyethylene pipe in metric series complying with the requirements of BS XXXX for cold water services. It applies to the most commonly used type of fittings for connecting pipes of nominal outside diameters ranging from 20 to 63.

**NOTE:** BS 6437: Polyethylene pipes (type 50) in metric diameters for general purposes specifies outside diameters which are the same as those specified in BS 6572 and BS XXXX for polyethylene pipes for water services. The fittings specified in this specification will therefore be dimensionally compatible with pipe to BS 6437.

**1.2** Lightweight fittings for waste pipe systems are not covered by this specification. However, this does not preclude the use of fittings complying with the requirements of this specification for waste pipe purposes where considered desirable.

**1.3** The fittings when assembled with pipe complying with the requirements of specification 4-32-02, BS 6572 or BS XXXX and in accordance with the manufacturer's instructions shall be suitable for a maximum working service pressure of 12 bar at 20°C.

## 2. DEFINITIONS

For the purposes of this specification the following definitions apply:

**2.1 Fitting:** Any device used in a pipe system for the purpose of connecting the pipes either to each other or to a component part of a system.

**2.2 Compression fitting:** A fitting of the type in which the joint is made by the compression of a loose ring or sleeve on to the outside surface of the pipe, with a suitable internal support.

**2.3 Slip fitting:** A fitting without an internal shoulder or pipe stop.

## 3. DESIGNATION OF SIZES OF FITTINGS

The size of the fitting shall be designated by the nominal metric outside diameter of the pipe with which the fitting is to be used. The method of specifying the sizes of the ends of the fittings shall be in accordance with Appendix A.

**NOTE:** It is necessary when ordering fittings to state the specification or British Standard number for the pipe and the nominal metric size of the pipe e.g. BS 6572 size 20.

## 4. SCREWED ENDS OF FITTINGS

External and internal threads, other than for compression ends, shall be screwed with one of the appropriate forms of threads in accordance with clause 4 of BS 864: Part 2: 1983.

## 5. MATERIALS

Metals and alloys for the manufacture of fittings shall comply with Table 7 of BS 864: Part 2: 1983.

Any elastomeric joint rings shall be made from a biodeterioration resistant elastomer meeting the type W requirements of BS 2494: 1985.

**NOTE:** Where fittings are to be buried underground it is essential that the method of jointing and the material used for the joint are suitable for use underground. Copper alloy fittings installed underground are required by Water Undertakings Byelaws to be dezincification immune or resistant.

## 6. EFFECT OF NON-METALLIC MATERIALS ON WATER QUALITY

Non-metallic materials shall comply with the requirements for the testing of non-metallic materials set out in the UK Water Fittings Byelaws Scheme Information and Guidance Note No. 5-01-02, ISSN 0267-0313 obtainable from the WRc Water Byelaws Advisory Service, 660 Ajax Avenue, Slough, Berkshire SL1 4BG.

**NOTE:** Pending the determination of suitable means of characterising 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 clause. 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.

## 7. COMPONENTS MADE FROM CASTINGS, HOT PRESSINGS, ROD OR DRAWN TUBE

Components made from castings, hot pressings, rod or drawn tube shall be in accordance with clause 6 of BS 864: Part 2: 1983.

## 8. DIMENSIONS

**8.1** The dimensions of the fittings shall be as specified in Tables 1 and 2 except where modified by cross reference to BS 864: Part 2 (see also Figures 1 and 2).

**8.2** Threads, where appropriate, except those specified in Table 6 of BS 864: Part 2: 1983, shall when hand tightened have a minimum length of engagement in accordance with Table 3 (see also Figure 3).

### 8.3 Plain tails for lead

The minimum dimensions of plain tails for lead shall be as specified in Table 9 of BS 864: Part 2: 1983.

### 8.4 Tail pipe ends for swivel fittings

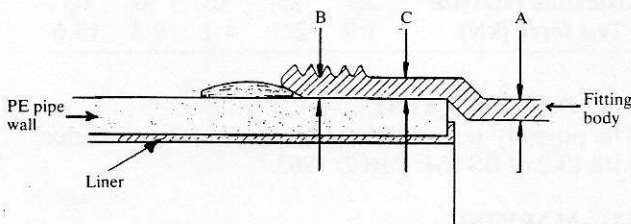
The dimensions of tail pipe ends for swivel fittings shall be specified in Table 10 of BS 864: Part 2: 1983.

**Table 1 – Dimensions of compression fittings and union ends**

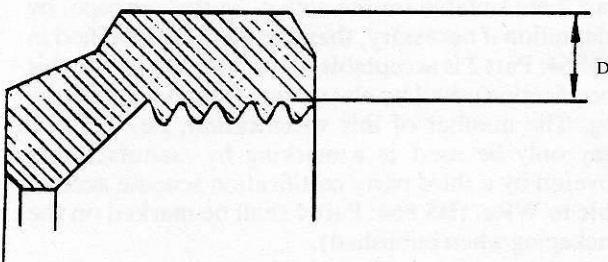
Nominal size of fittings	Minimum wall thickness at any point of body or nut A, B, C or D (see Figures 1 and 2)	
	Hot pressings and components made from rod	Castings
	mm	mm
20	1.4	1.5
25	1.5	1.8
32	1.6	1.8
50	1.9	2.3
63	2.0	2.4

**Table 2 – Minimum bore diameter**

Nominal size of fittings	Minimum bore diameter mm
20	13.0
25	17.3
32	22.1
50	34.7
63	43.8



**Figure 1 – Compression fittings**

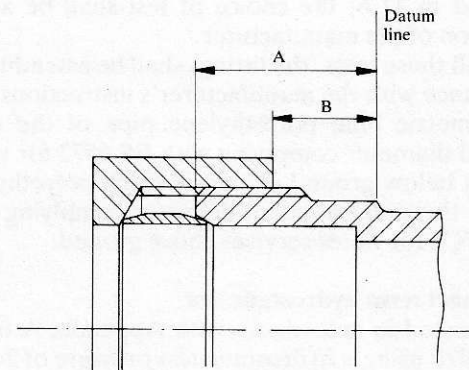
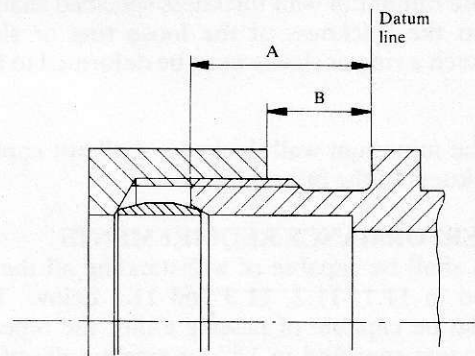


**Figure 2 – Nuts**

**NOTE:** Figures 1 and 2 are diagrammatic only; they do not purport to indicate standard forms or shapes and are solely for the purpose of indicating where the dimensions are to be measured.

**Table 3 – Minimum length of thread engagement for compression joints when assembled hand tight**

Nominal size of pipe	Minimum length of thread engagement (A – B) for compression joints (see Figure 3)
	mm
20	4.5
25	
32	5.5
50	
63	6.5



**Figure 3 – Diagram for determination of thread engagement in hand tight condition**

**NOTE:** Dimension A is measured from the datum line to the commencement of the thread on the body of the fitting.

## 9. BORE OF FITTING

**9.1** Except where otherwise specified in this specification, the area of the bore through each fitting assembly including liner shall be not less than the area of a circle of diameter equal to the minimum bore diameter as given in Table 2.

**9.2** This minimum waterway does not apply to fittings incorporating a tail pipe complying with the requirements of Table 10 of BS 864: Part 2: 1983.

## 10. DESIGN AND CONSTRUCTION

**10.1** Compression fittings shall comply with the conditions specified in 10.2 to 10.6.

**10.2** The wall thickness of compression fittings shall be as specified in Table 1.

**10.3** The fittings shall be free from internal fins or other irregularities which might restrict the free flow of fluid, and shall be so designed that the resistance to the flow of fluid through the fittings is minimised.

**10.4** Union nuts shall be either hexagonal or octagonal or shall have ribs for tightening.

**10.5** Provision for tightening shall be made on all straight fittings with screwed ends.

**10.6** Compression fittings shall be supplied either with an internal shoulder or stop against which an inserted pipe, cut square with its axis, shall abut for not less than 20% of that periphery, or, if specifically ordered, without an internal shoulder. In the latter case these shall be designated slip fittings.

**10.7** The minimum wall thickness specified shall not apply to the thickness of the loose ring or sleeve where such a ring or sleeve must be deformed to form a seal.

**10.8** The minimum wall thickness shall not apply to the thickness of the internal support.

## 11. PERFORMANCE REQUIREMENTS

Fittings shall be capable of withstanding all the test specified in 11.1, 11.2, 11.3 and 11.4 below. They shall also be capable of passing either the repeated pull-out test specified in 11.5 or single pull-out test specified in 11.6; the choice of test shall be at the discretion of the manufacturer.

For all these tests, the fittings shall be assembled in accordance with the manufacturer's instructions with either metric blue polyethylene pipe of the same nominal diameter complying with BS 6572 for water services below ground or metric black polyethylene pipe of the same nominal diameter complying with BS XXXX for water services above ground.

### 11.1 Short term hydrostatic test

When tested in accordance with Appendix A of BS 5114: 1975 using a hydrostatic test pressure of 24 bar for 1 hour, neither the fitting nor the joint shall on visual inspection show any sign of leakage during the test.

**NOTE:** A transparent safety screen should be placed between the observer and the test assembly prior to applying pressure.

### 11.2 Long term hydrostatic test

When tested in accordance with Appendix A of BS 5114: 1975 using a hydrostatic test pressure of 20 bar for 1,000 hours, neither the fitting nor the joint shall show on visual inspection any sign of leakage during the test.

### 11.3 Hydrostatic test when subjected to bending stresses

When tested in accordance with Appendix B of BS 5114: 1975 at a pressure of 24 bar for 1 hour, neither the fitting nor the joint shall show any sign of leakage.

### 11.4 External pressure test

When tested in accordance with Appendix C of BS 5114: 1975 a jointed test assembly shall withstand an external pressure of 0.10 bar above atmospheric pressure for 1 hour followed by a pressure of 0.80 bar above atmospheric pressure for a further 1 hour without leakage at either pressure.

### 11.5 Repeated test for resistance to pull-out of assembled joint

When tested in accordance with Appendix B, the maximum permanent axial movement of the pipe relative to the fitting body shall not exceed the appropriate value indicated in Table 4. If any movement of the pipe with relation to the fitting takes place during this test, it shall occur mainly during the first pull. The forces to be applied also depend on the size of the pipe and they are also given in Table 4.

**NOTE:** It is desirable that the total additional movement due to the last three pulls and relaxations should not exceed 1mm.

### 11.6 Single test for resistance to pull-out of assembled joint

When tested in accordance with Appendix C, the pipe shall not fracture within the fitting or separate from the fitting during the period of the test.

**Table 4 – Test forces and maximum slip for repeated pull-out tests**

Nominal pipe size	20	25	32	50	63
Test force (kN)	1.2	1.6	2.6	6.2	9.8
Maximum slip (mm)	2.0	2.5	3.0	3.5	4.0

**Table 5 – Test forces for single pull-out tests**

Nominal pipe size	20	25	32	50	63
Test force (kN)	1.9	2.5	4.1	9.8	15.6

## 12. POROSITY TEST

The porosity test shall be carried out in accordance with 13.2 of BS 864: Part 2: 1983.

## 13. MARKING

**13.1** Each fitting shall be legibly marked with the marker's name or trade mark and if specifically designed for polyethylene shall be marked 864.5.

**13.2** When fittings made in accordance with BS 864: Part 2 are suitable for use with polyethylene pipe, by adaptation if necessary, then the marking specified in BS 864: Part 2 is acceptable. The nominal size (to this specification) shall be clearly marked on the packaging. The number of this specification, i.e. 4-22-01, may only be used as a marking by manufacturers covered by a third party certification scheme acceptable to WRc. (BS 864: Part 4 shall be marked on the packaging when published).

**13.3** Internal supports, when in the form of a loose component, shall be suitably identified by either or both the following methods:

(a) by marking the specification size in legible characters or by some other unambiguous marking identification; or

(b) by colour coding black.

**14. ASSEMBLY INSTRUCTIONS**

Manufacturers shall ensure that full jointing instructions are available at the point of sale of the fittings.

**15. REFERENCES**

This specification makes reference to the latest edition of the following publications (except otherwise stated) including all addenda and revisions, which should also be consulted.

**BS 864** Capillary and compression tube fittings of copper and copper alloy.  
 Part 2 Specification for capillary and compression fittings for copper tubes.  
 Part 4 Specification for capillary and compression fittings for polyethylene pipes with outside diameters to BS 5556. (In course of preparation).

**BS 2494** Materials and elastomeric joint rings for pipework and pipelines.

**BS 5114** Performance requirements for joints and compression fittings for use with polyethylene pipes.

**BS 5556** Specification for general requirements for dimensions and pressure ratings for pipe of thermoplastics materials (metric series).

**BS 6437** Specification for polyethylene pipes (type 50) in metric diameters for general purposes.

**BS 6572** Specification for blue polyethylene pipes up to nominal size 63 below ground use for potable water.

**BS XXXX** Specification for black polyethylene pipes up to nominal size 63 for above ground use for cold potable water. (In course of preparation).

**WAA Sewers and Water Mains Committee Information and Guidance Note No. 4-32-02.** Specification for polyethylene pressure pipe for cold potable water (underground use).

**UK Water Fittings Byelaws Scheme Information and Guidance Note No. 5-01-02.** Requirements for the testing of non-metallic materials for use in contact with potable water.

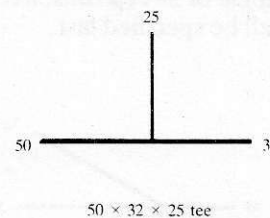
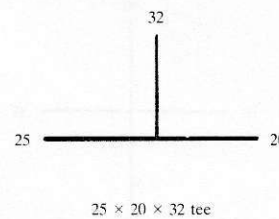
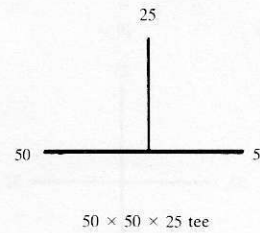
**APPENDIX A – METHODS OF SPECIFYING FITTINGS (see clause 3)**

The methods of specifying fittings shall be as follows: (All sizes in mm unless otherwise indicated)

(a) **Straight fittings.** For fittings with two unequal ends, the larger end shall be given first.

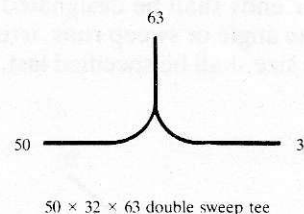
(b) **Right angle tees.** Right angle fittings having three ends shall be designated first by the ends of the "run", i.e. two ends (the larger of the two ends being specified first) in the same straight line, and then by the remaining end.

**Examples**



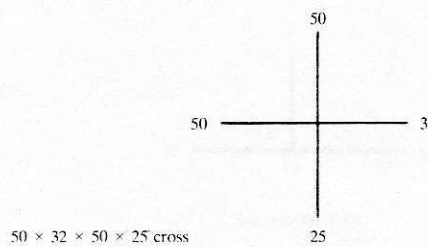
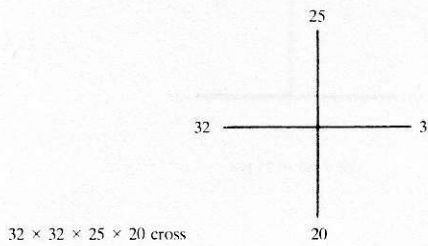
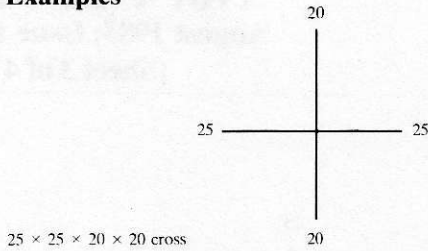
(c) **Double sweep tees.** Double sweep tees shall be designated in a manner similar to that for right angle tees.

**Example**



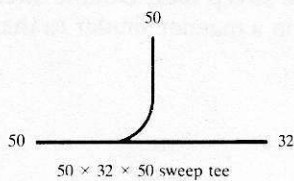
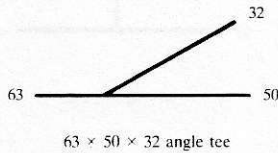
(d) **Right angle crosses.** Right angle fittings with four ends shall be designated first by the larger end on the "run" and then by the second end on the "run" followed by the remaining ends (the larger of the two remaining ends being specified first).

**Examples**



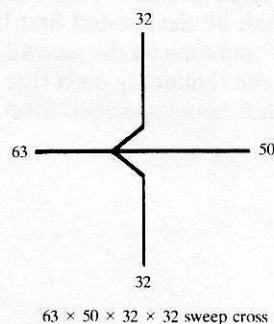
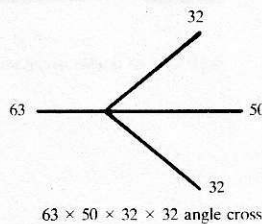
(e) **Angle or sweep tees.** Angle or sweep fittings having three ends shall be designated first by the end to which the angle or sweep runs, irrespective of size; the branch shall be specified last.

**Examples**



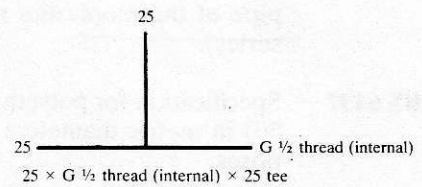
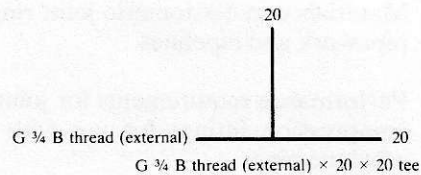
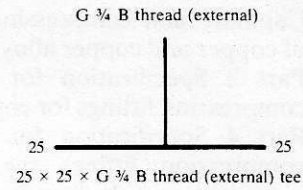
(f) **Angle or sweep crosses.** Angle or sweep fittings having four ends shall be designated first by the end to which the angle or sweep runs, irrespective of size; the branch size shall be specified last.

**Examples**



(g) **Screwed ends.** Designations given without qualifications shall be understood to relate to ends for joining polyethylene tubes. When it is desired to designate a screwed end the type of thread, and whether it is external or internal, shall be stated after the size designation of that end. The words “external” and “internal” relate to the thread of the fitting.

**Examples**



**APPENDIX B – TEST FOR RESISTANCE TO PULL-OUT OF ASSEMBLED JOINT (MULTIPLE PULL)**

**B1 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 300mm in length. The pipes and fittings shall be conditioned for at least 1 hour at 23 ± 2°C prior to assembly in accordance with the manufacturer’s instructions.

**B2 Apparatus**

The apparatus shall consist of a tensile testing machine capable of applying a constant force to the test specimen. Alternatively, the force may be applied by means of weights, in which case the specimen shall be suspended in a frame with a suitable fixture to hold the weights. A suitable apparatus of the latter type is shown in Figure 4.

**B3 Procedure**

Mark the outer surface of the pipe at the point of entry of the fitting (including the cap nut if appropriate) with a suitable reference mark around the circumference, e.g. indelible marker or adhesive tape.

Mount the test piece securely in the apparatus and apply the appropriate force given in Table 4 gradually over a period of 15 to 30 seconds.

Hold the specimen in constant tension for a period of 1 hour at a temperature of  $23 \pm 2^\circ\text{C}$ . After removal of the force, measure and record the maximum movement of the pipe relative to the joint to the nearest 0.2mm. Subject the test specimen to a further 3 force and relaxation cycles. After the final relaxation measure and record the movement of the pipe relative to the joint.

#### B4 Report

The report shall include the following:

- The full identification of the test specimens.
- Description of fitting assembly instructions.
- The force applied.
- The average permanent pull-out (after 4 cycles).
- The differences between the pull-out following the first and final cycles.
- The date of the test.

### APPENDIX C – TEST FOR RESISTANCE TO PULL-OUT OF ASSEMBLED JOINT (SINGLE PULL)

#### C1 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 300mm in length. The pipes and fittings shall be condition for at least 1 hour at  $23 \pm 2^\circ\text{C}$  prior to assembly in accordance with the fittings manufacturer's instructions.

#### C2 Apparatus

The apparatus shall consist of a tensile testing machine capable of applying a constant force to the test specimen. Alternatively, the force may be applied by means of weights, in which case the specimen shall be suspended in a frame with a suitable fixture to hold the weights. A suitable apparatus of the latter type is shown in Figure 4.

#### C3 Procedure

Mount the test piece securely in the apparatus and apply the appropriate force given in Table 5 gradually over a period of 15 to 30s. Hold the specimen in constant tension for a period of 5 minutes (+ 30 s - 0 s) at a temperature of  $23 \pm 2^\circ\text{C}$ . After removal examine the specimen for pull-out from the compression ring and/or fracture/tearing of the pipe. If appropriate, the cap nut shall be removed to permit examination.

#### C4 Report

The report shall include the following:

- The full identification of the specimens.
- Description of assembly instructions.
- The force applied.
- Comments on ring position on the pipe and pipe condition after test.
- The date of the test.

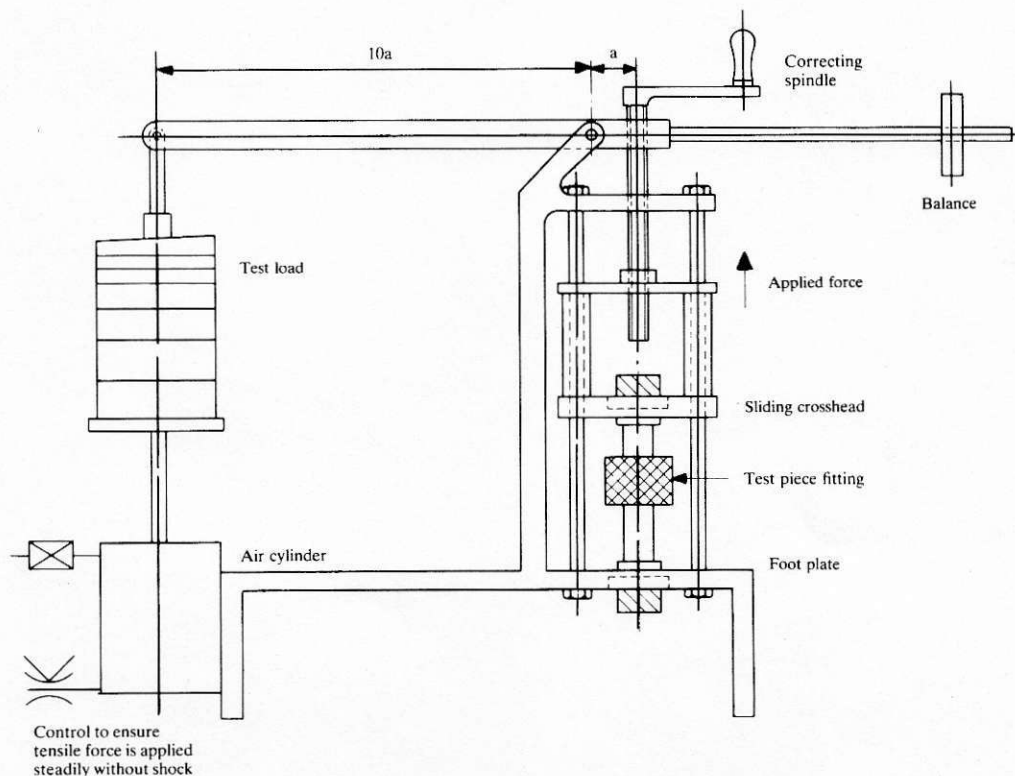


Figure 4 – Diagram of suitable apparatus for test for resistance to pull-out of assembled joint

