British Standard

BRITISH STANDARD

BS 1247-2:
1990

Manhole steps —

Part 2: Specification for plastics encapsulated manhole steps

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Health Care Standards Policy Committee (RDB/-) to Technical Committee RDB/35, upon which the following bodies were represented:

Association of London Borough Engineers and Surveyors
British Foundry Association
British Precast Concrete Federation Ltd.
Clay Pipe Development Association Ltd.
Consumer Policy Committee of BSI
County Surveyors' Society
Department of the Environment (Property Services Agency)
Department of Transport (Engineering Policy and Programme Division)
Ductile Iron Pipe Committee
Electricity Supply Industry in England and Wales
Industry of British Foundrymen
Institute of Building Control
Institute of Mechanical Engineers
Institution of Water and Environment Management (IWEM)
Institution of Works and Highways Management
Water Authorities Association

This British Standard, having been prepared under the direction of the Roads Engineering Standards Committee, was published under the authority of the Board of BSI and comes into effect on
30 September 1990

The following BSI references relate to the work on this standard:
Committee reference RDB/35
Draft for comment 89/17298 DC

ISBN 0 580 18868 X

Amendments issued since publication

Amd. No.	Date	Comments

Contents

Foreword

This Part of BS 1247 has been prepared under the direction of the Road Engineering Standards Policy Committee. It supplements BS 1247-1 which deals with galvanized ferrous and stainless steel manhole steps.

Previous editions of BS 1247 specified rigid dimensions for steps but this Part specifies performance criteria based on test requirements and only key dimensions have been included.

As in BS 1247-1, double steps (also known as rung irons) have been included and this Part deals with plastics encapsulated steel and aluminium steps. It is intended to prepare a further part covering aluminium steps with plastics fixings.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, 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 Part of BS 1247 specifies the essential dimensions and general requirements for plastics totally encapsulated manhole steps.

These types of plastics encapsulated manhole steps are for use in structures such as concrete manholes and inspection chambers in foul and surface water sewers or where the environment may include concentrated levels of acid and alkalis.

NOTE 1 This Part of BS 1247 not intended to cover steps which are subject to prolonged exposure to ultraviolet light.
NOTE 2 A sumary of items to be agreed between the manufacturer and the purchaser is given in Appendix A.
NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Materials

2.1 Plastics

The plastics used in steps shall be a polyolefin to BS 3412 or BS 5139.

2.2 Metal

2.2.1 ***Steel*** Steel used in steps shall be one of the following:

a) steel complying with BS 970-1, BS 3100, BS 4360 or BS 4449; or

b) stainless steel complying with BS 970-1.

2.2.2 ***Aluminium***

Aluminium used in steps shall comply with grade 6060, 6063 or 6082 of BS 1474.

3 Design features

3.1 Design and dimensions

3.1.1 Steps shall comply with the appropriate dimensions given in Figure 1 and Figure 2.

3.1.2 The minimum thickness of plastics shall be 3 mm when measured in accordance with Appendix B. The plastics cover shall be permanently moulded around the metal core.

3.2 Treads

3.2.1 Slip resistance of the treads shall be achieved by ribbing or chequering at least 2 mm in height.

3.2.2 Single steps shall have an upstand of at least 5 mm high and 25 mm long on each end of the tread.

3.2.3 Double steps shall have an upstand of at least 20 mm high and 25 mm long on each end of the tread to act as a boot stop.

NOTE The steps shown in Figure 1 and Figure 2 are examples only of typical configurations and are not intended to fix design.

3.3 Design projection

The design projection shall be defined by a change of section (see Figure 1 and Figure 2 for examples).

4 Finish

Steps shall be protected from corrosion by being totally encapsulated in plastics and shall be free from projections or sharp edges likely to cause injury.

5 Design tests

Steps shall be designed to satisfy the test requirements specified in **3.1** and clause **7**.

6 Quality control tests

Sample steps shall be tested for compliance with the requirements given in **7.1**, **7.2**, **7.4** and **7.5**. Sampling procedures shall be in accordance with BS 6001-1 or BS 6002 with a minimum AQL of 1.

7 Test requirements

7.1 Twist

When supported on three props of equal height on a level surface, as shown in Figure 3, the height (*H*) of the front edge of the tread from that surface shall not vary along its length by more than 3 mm for a single step or more than 5 mm for a double step.

7.2 Bending

When tested in accordance with Appendix C the step shall support a load of 2.5 kN without visible cracking and the deflection shall not exceed 5 mm. After removal of the load, the residual deflection shall not exceed 1 mm.

NOTE The residual deflection is intended to allow for a bedding in factor and not for yield in the material. The graphical plots of load against deflection should exhibit a straight line relationship, i.e. loading within the elastic range of the materials.

7.3 Pull out test

When tested in accordance with Appendix D steps shall resist a force of 7.5 kN.

7.4 Integrity of plastics test

When tested in accordance with Appendix E steps shall show an electrical resistance of at least 1 MΩ.

NOTE For acceptance of the steps there should be no cracking, fracturing or openings through the plastics encasement. An unacceptable casing will be indicated by a resistance of less than 1 MΩ after 30 min in the salt/detergent solution. An acceptable casing will be indicated by a resistance of not less than 1 MΩ after 30 min in the salt/detergent solution.

7.5 Impact test

When tested in accordance with Appendix F steps shall absorb an impact from a striker of mass 20 kg dropped from a height of 1 m without fracture. After testing, steps shall comply with **7.4**.

7.6 Chemical resistance test

Pairs of steps of the same type shall be immersed for a period of 168 h at a temperature of 20 ± 5 °C in one of each of the following solutions:

a) sulphuric acid, 0.01N (pH = 2.0 approximately);

b) nitric acid, 0.01N (pH = 2.0 approximately);

c) sodium hydroxide, 0.01N (pH = 12.0 approximately);

d) sodium hypochlorite, 0.01N (pH = 12.0 approximately).

When removed from solution and rinsed in water, the steps shall comply with **7.2** and **7.3**.

8 Marking

Each step shall be clearly and permanently marked with the following identification in a manner which is visible after installation:

a) the number and date of this British Standard, i.e. BS 1247-2:1990[1)];

b) the manufacturer's identification;

c) the year and month of manufacture;

d) length in millimetres.

[1)] Marking BS 1247-2:1990 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Appendix A Information to be given by the purchaser in his enquiry and order

The following information should be given by the purchaser in his enquiry and order:

a) type of step;

b) length and type of tail where applicable;

c) if a manufacturer's test certificate is required;

d) materials.

Appendix B Thickness of plastics test

B.1 Apparatus

B.1.1 *Vernier calliper* complying with BS 887.

B.2 Procedure

B.2.1 Cut the step vertically at the five points shown in Figure 4.

B.2.2 Measure the thickness of the plastics using the vernier calliper to an accuracy of ± 0.05 mm.

B.2.3 Record minimum thickness at any point to an accuracy of ± 0.1 mm.

Appendix C Bending tests

C.1 Apparatus

C.1.1 *A test block,* 75 mm in diameter, faced with hard rubber or other resilient material.

C.1.2 *A device capable of applying a load* of at least 25 % greater than the appropriate load specified in **7.2**. Testing devices should comply with the accuracy requirements for grade 1 or grade 2 testing machines given in BS 1610.

If applicable the calibration of the testing device should be checked in accordance with BS 5781-1.

C.1.3 *A clamping device* for holding the reinforcement of the step (a typical apparatus is shown in Figure 5).

NOTE Clamping blocks should be shaped to the profile of the tail of the step.

C.1.4 *A device suitable for measuring deflection.*

C.2 Procedure

Clamp the test sample firmly so as to leave the design projection acting as a cantilever.

Apply the load centrally and normal to the tread as shown in Figure 5 at a rate of 2.5 kN/min.

Apply the initial load up to 2.5 kN and hold for 1 min. Remove the load and take a reading at the centre of the tread to establish a datum from which to measure deflection.

Repeat the test for 2 cycles and for each cycle note the deflection at each 0.5 kN increment up to the maximum of 2.5 kN. Maintain the load for 1 min.

Remove load and record the residual deflection.

Appendix D Pull out test

D.1 Apparatus

D.1.1 *Hydraulic or mechanical equipment* capable of exerting a force in excess of 20 kN and with a means of measuring the load.

D.1.2 *Concrete mould* capable of producing mortar blocks either 100 mm × 100 m × 250 mm long or 100 mm × 100 mm × 500 mm long.

D.2 Procedure

D.2.1 Cast step into a mortar block (see **D.2.2**) and allow to cure for at least 10 days before testing.

The block for a single step should be 100 mm × 100 mm × 250 mm long.

The block for a double step should be 100 mm × 100 mm × 500 mm long.

NOTE Tails longer than 100 mm are permitted to protrude from the bottom of the mortar block or may be cut off.

D.2.2 Use a mortar mix having a 3 : 1 ratio by weight of Leighton Buzzard sand, Fraction A, (see BS 4550-5:1978) to OPC Standard blend cement. The free water/cement ratio shall be 0.40.

D.2.3 Apply the force between the test block (**C.1.1**) at the centre of the front tread of step and mortar block. Apply the force gradually and without shock and sustain the load for 1 min.

NOTE If failure occurs by a fracture or by a shear cone failure of the block this does not necessarily constitute failure of the step and a re-test is required.

Appendix E Integrity of plastics coating test

E.1 Apparatus

E.1.1 *An ohmmeter*

E.2 Procedure

E.2.1 Drill the step at one point to expose the reinforcement.

E.2.2 Prepare a water solution containing sodium chloride at a concentration of 3 % (*m*/*m*) and a wetting agent, e.g. liquid detergent, 0.25 % (*V*/*V*).

E.2.3 Place a wire from an anode in the salt/detergent solution to an ohmmeter. Test the step for integrity of the plastics coating by connecting the exposed metal to the ohmmeter and immersing the remainder of the sample in the salt/detergent solution to within 10 mm of the exposed metal for at least 30 min. Record the resistance indicated by the ohmmeter.

Appendix F Impact test

F.1 Apparatus

F.1.1 *A vertical tube* with a bore of 102 mm to 104 mm, at least 1.2 m long and with a means of indicating a minimum release height of 1 m above the step.

F.1.2 *A steel striker* 99 mm to 101 mm diameter with a hemisherical nose 30 mm radius. The length of the striker shall be such as to ensure a minimum mass of 20.0 kg.

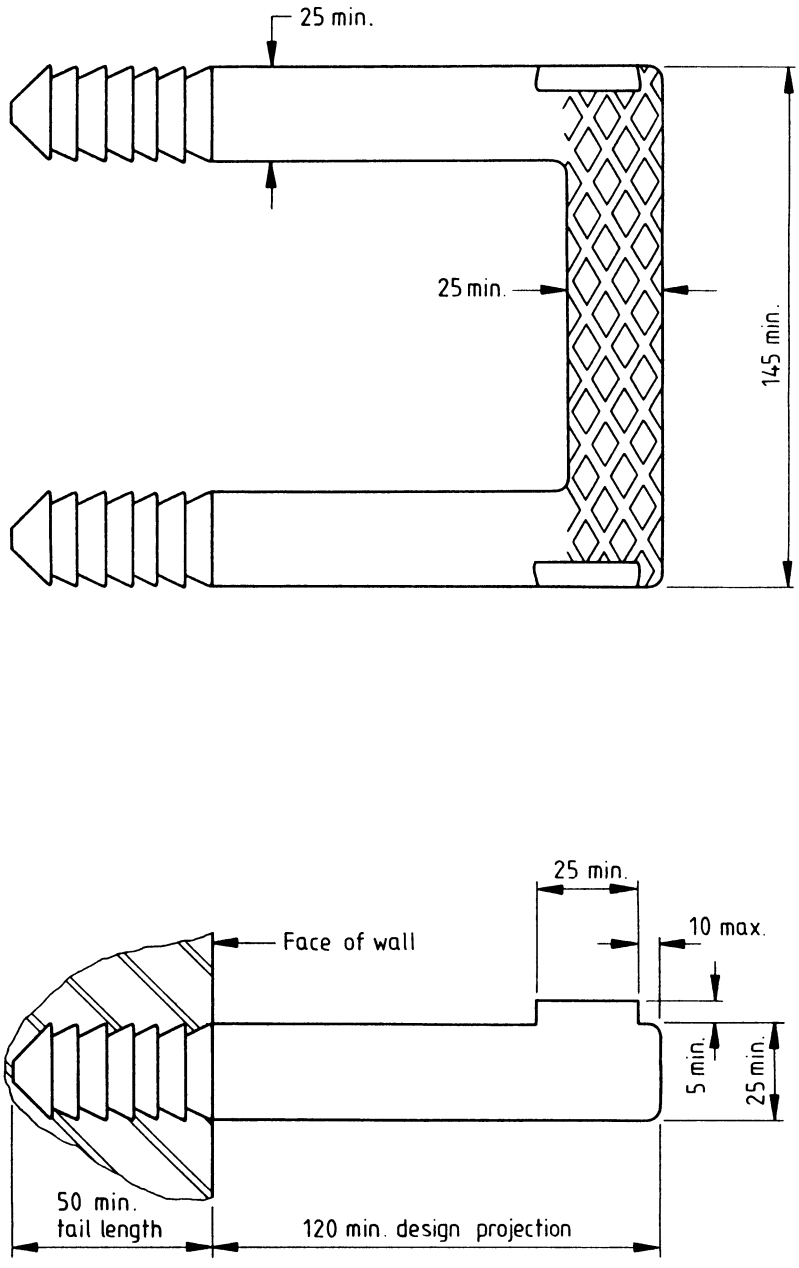
F.1.3 *Impact rig.* A typical rig is shown in Figure 6.

F.2 Procedure

F.2.1 Cast step in a concrete block as described in Appendix D, or fit to a block in accordance with the manufacturer's recommendations.

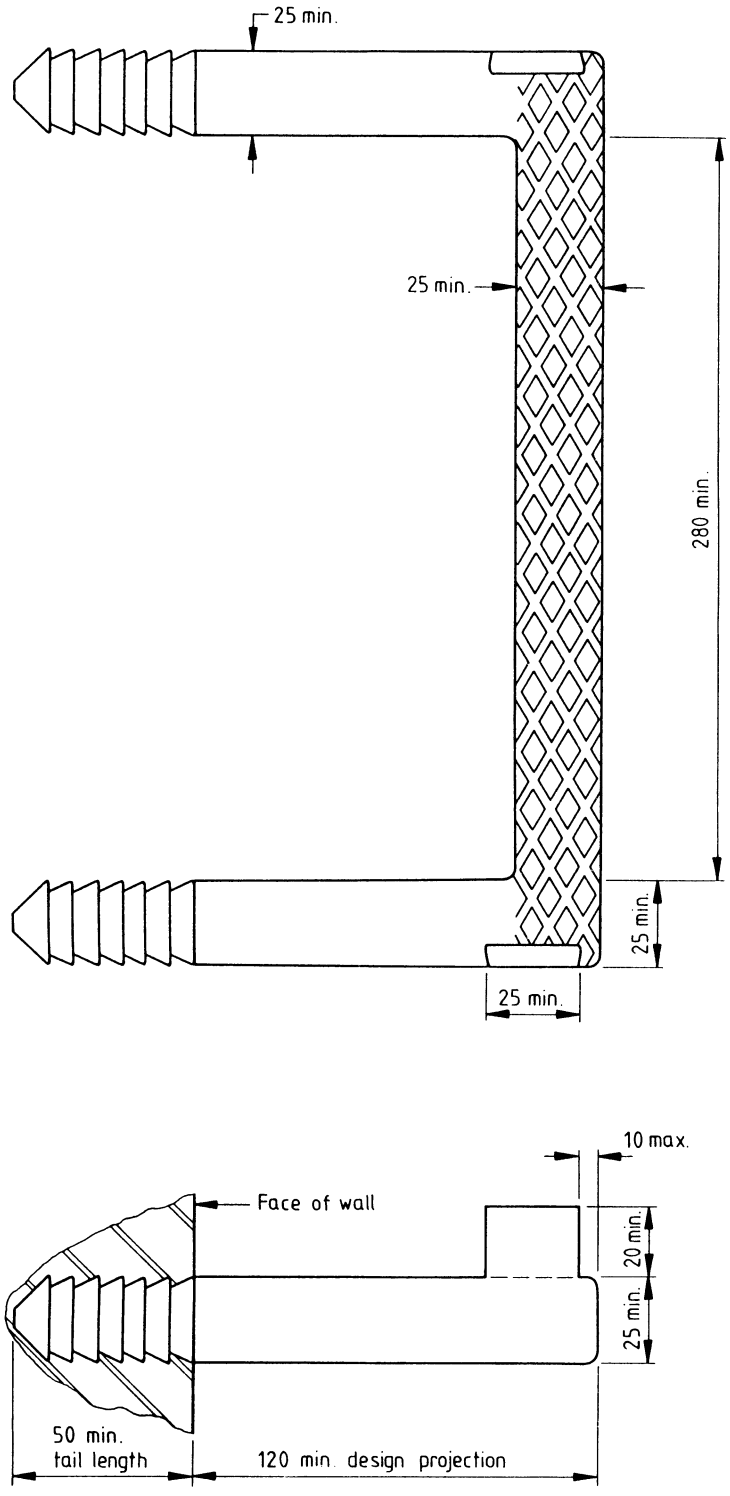
F.2.2 Locate the block so that the step faces vertically upwards.

F.2.3 Drop a striker of mass 20 kg from a height of 1 m on the centre of the step.



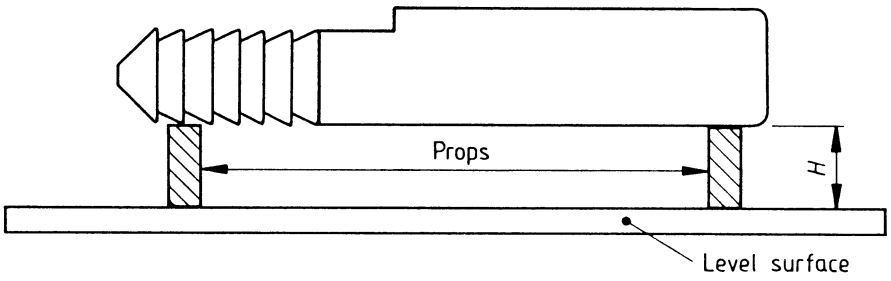
All dimensions are in millimetres.

Figure 1 — Typical single step



All dimensions are in millimetres.

Figure 2 — Typical double step



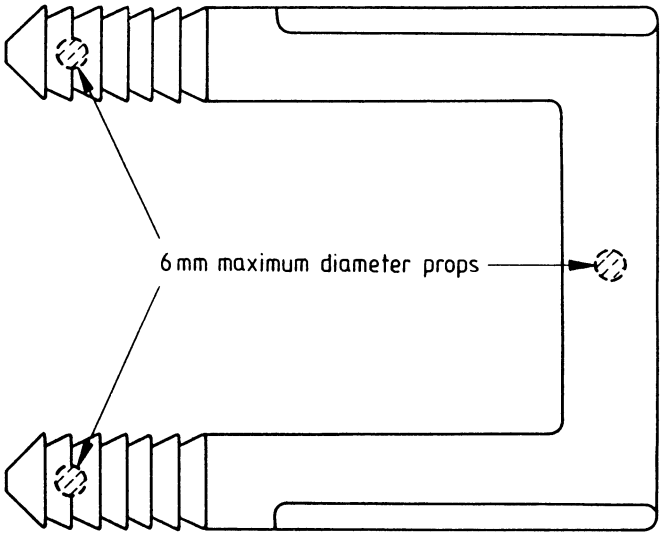
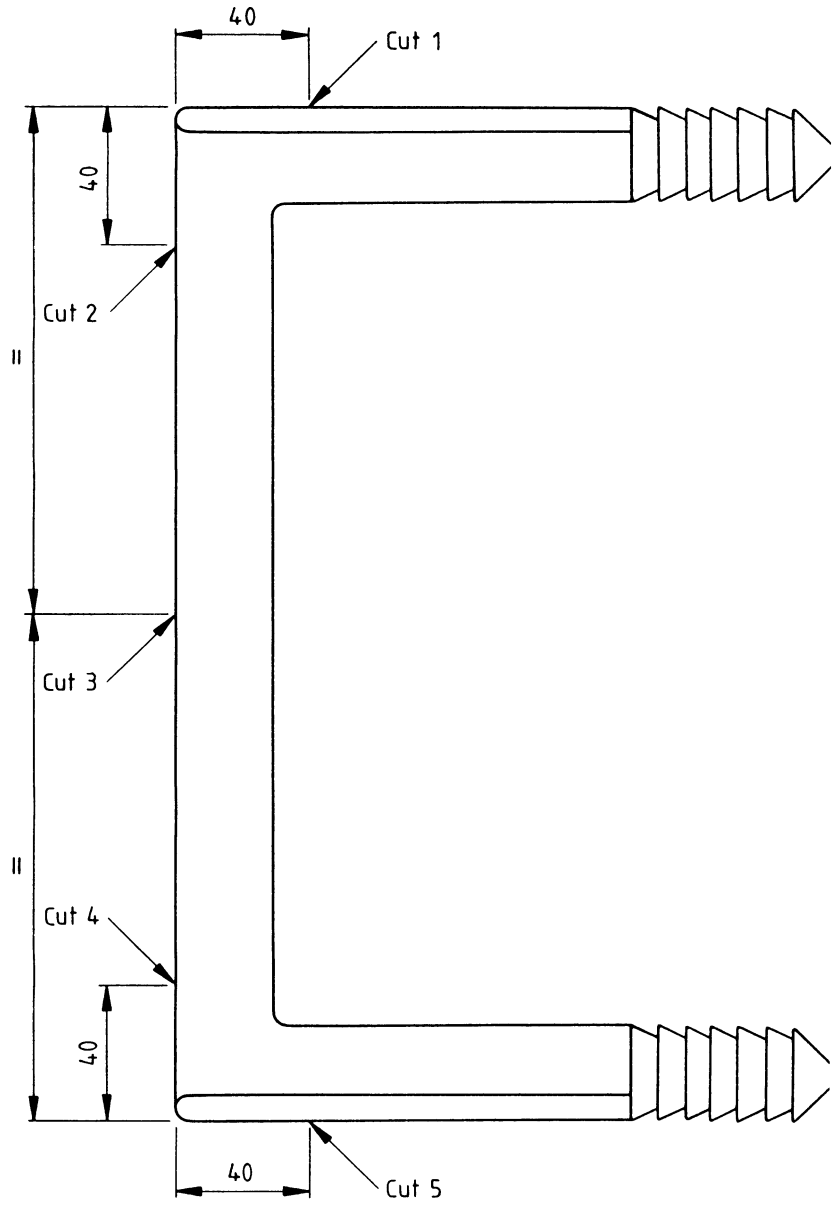


Figure 3 — Test for twist



All dimensions are in millmetres.

Figure 4 — Determination of thickness of plastics cover

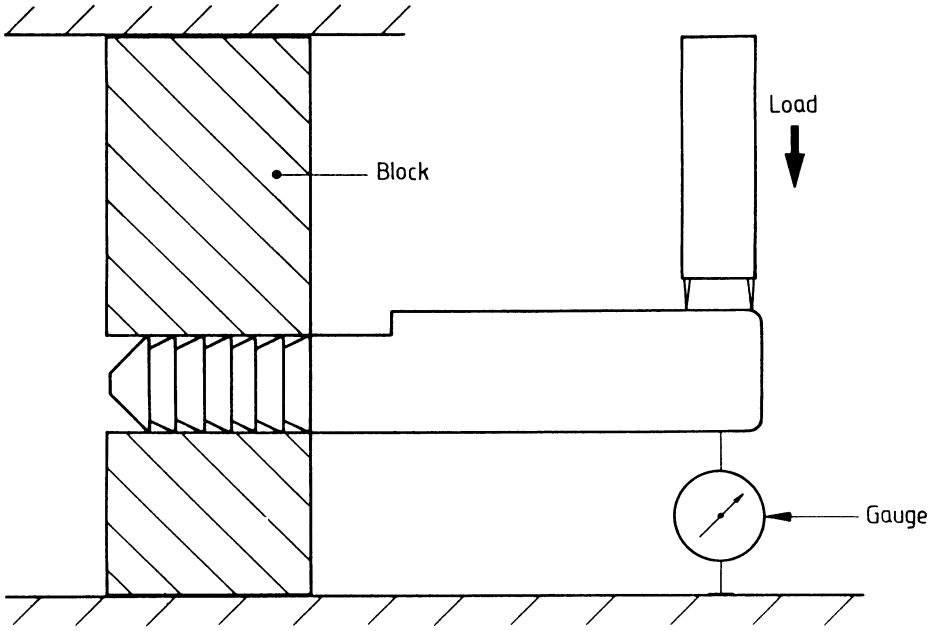
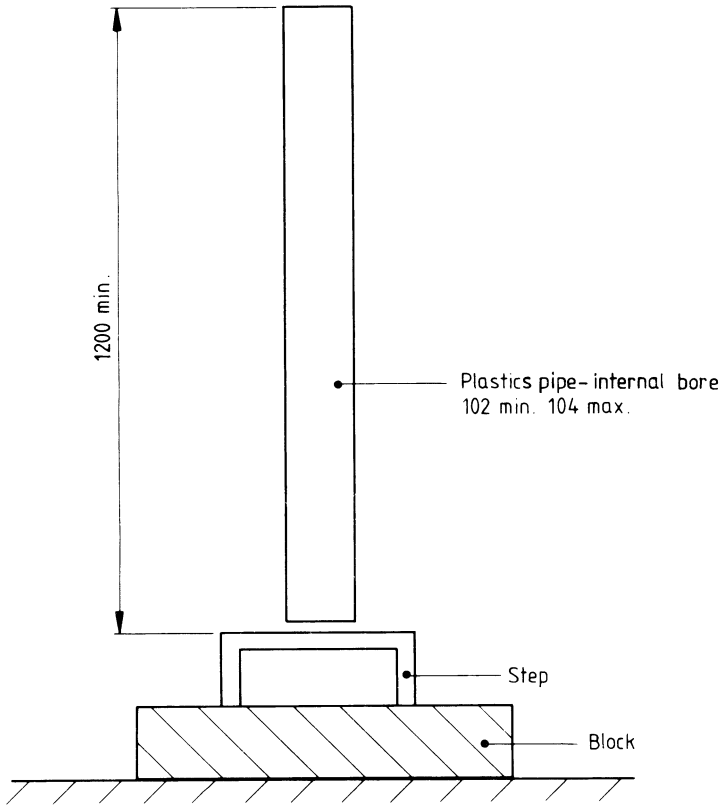
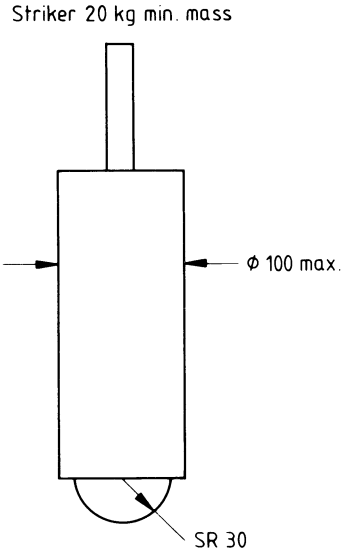


Figure 5 — Test for bending





All dimensions are in millimetres.

Figure 6 — Typical impact rig and striker

Publication(s) referred to

BS 887, *Specification for precision vernier callipers.*

BS 970, *Specification for wrought steels for mechanical and allied engineering purposes.*

BS 970-1, *General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels.*

BS 1247, *Manhole steps.*

BS 1247-1, *Specification for galvanized ferrous or stainless steel manhole steps*[2)].

BS 1474, *Specification for wrought aluminium and aluminium alloys for general engineering purposes: bars, extruded round tubes and sections.*

BS 1610, *Materials testing machines and force verification equipment.*

BS 3100, *Specification for steel castings for general engineering purposes.*

BS 3412, *Specification. Polyethylene materials for moulding and extrusion.*

BS 4360, *Specification for weldable structural steels.*

BS 4449 , *Specification for carbon steel bars for the reinforcement of concrete.*

BS 4550, *Methods of testing cement.*

BS 4550-5, *Standard sand for concrete cubes.*

BS 5139, *Classification for polypropylene plastics materials for moulding and extrusion.*

BS 5781, *Measurement and calibration systems.*

BS 5781-1, *Specification for system requirements.*

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

BS 6001-1, *Specification for sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

BS 6002, *Specification for sampling procedures and charts for inspection by variables for percent defective.*

[2)] Referred to in the foreword only.

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