PUBLICLY AVAILABLE SPECIFICATION

PAS 70:2003

HD clay bricks — Guide to appearance and site measured dimensions and tolerance

ICS 91.100.25

BSI British Standards

Amendments issued since publication

Amd. No.	Date	Comments

This Publicly Available Specification comes into effect on 28 October 2003

ISBN 0 580 42783 8

Contents

Foreword

This Publicly Available Specification, PAS 70, was developed through the British Standards Institution (BSI).

Acknowledgement is given to the following groups and organizations that were consulted in the development of this Publicly Available Specification:

Brick Development Association Ltd.

Ceram Building Technology

Kingston University

National Building Specification Ltd.

National House Building Council

Office of the Deputy Prime Minister

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Introduction

Where disputes over the appearance of clay brickwork arise they have traditionally been resolved with the assistance of Appendix F to BS 3921 which includes some general guidance and a means of comparing the appearance of sample panels built from a consignment of bricks with that of an agreed reference panel at the start of the contract.

When BS 3921 is withdrawn, Appendix F will no longer be available. This Publicly Available Specification is intended to supersede Appendix F by continuing to provide authoritative guidance, whilst removing reference to contractual arrangements and retaining a sample and reference panel approach to acceptability.

Similarly, where disputes over the size or tolerance of clay bricks arise they have traditionally been resolved using the procedure in BS 3921 which will be superseded by BS EN 771-1 in due course.

The BS 3921 procedure was to place 24 bricks in a row and to measure the overall length, width or height of the row using a tape. This overall dimension was required to be within certain upper and lower limits. Although the bricks-in-a-row test was very practical and helpful and had been in use for some 50 years, the practice in the majority of European countries has been to control the dimensional tolerances of individual masonry units and it is this procedure that has been adopted as the reference in BS EN 771-1. The BS EN 771-1 measurement procedure is complex and the measuring equipment not readily amenable to site use.

Consequently this Publicly Available Specification has been produced to give a simple site test that is intended to resolve most disputes without recourse to off site measurements and the use of long jaw callipers. In cases of dispute that cannot be resolved by these simple site procedures, it is recommended that the clay bricks are sampled in accordance with BS EN 771-1 and tested in accordance with BS EN 772-16, using the reference measuring procedure identified in BS EN 771-1.

1 Scope

This Publicly Available Specification gives guidance on assessing the appearance of facing bricks, and the determination of on-site measurements of work size dimensions, for all high density (HD) type clay bricks as defined by BS EN 771-1.

It includes a procedure for comparing sample panels with reference panels in order to assess the appearance acceptability of consignments of clay facing bricks. It is not intended to apply to common and engineering HD type clay bricks.

It also provides a method of determining the overall dimensions of all clay bricks. The limits for the tolerance categories for the mean and range are those that apply to HD type clay bricks where the manufacturer's declared work sizes are those traditionally known as British Standard dimensions (UK standard format clay bricks). If clay bricks are supplied with other work sizes, the limits for these categories will need to be calculated in accordance with BS EN 771-1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 4035:1966*, Specification for linear measuring instruments for use on building and civil engineering constructional works — Steel measuring tapes, steel bands and retractable steel pocket rules.*

BS EN 771-1:2003*, Specification for masonry units — Part 1: Clay masonry units.*

3 Terms and definitions

For the purpose of this Publicly Available Specification, the following terms and definitions apply.

3.1
brickwork
masonry of bricks bonded and solidly put together with mortar
[BS 6100-5.1:1992]

3.2
HD (high density) clay brick
clay masonry unit with a high gross dry density for use in unprotected masonry as well as in protected masonry
[BS EN 771-1:2003 with National Annex]
NOTE These relate most closely to facing units in BS 6100-5.3 although, as the BS EN is performance related, the requirements are written in terms of durability rather than appearance.

3.3
brick
masonry unit that does not exceed 338 mm in length, 225 mm in width or 113 mm in height
[BS 6100-5.3:1984]

3.4
facing unit
masonry unit specially made or selected to give an attractive appearance
[BS 6100-5.3:1984]

3.5
common unit
masonry unit suitable for general construction work, with no special claim to give an attractive appearance
[BS 6100-5.3:1984]

3.6
engineering brick
brick sized fired-clay unit that has a dense and strong semi-vitreous body, that conforms to defined limits for water absorption and compressive strength
[BS 6100-5.3:1984]

3.7
recessed joint
mortar joint with its face finished back from the arrises and face of the adjacent masonry units

3.8
flush joint
mortar joint with its face finished level with the face of adjacent masonry units
[BS 6100-5.1:1992]

3.9
reference panel
trial panel built as brickwork and usually constructed at the start of a project for the purpose of establishing the visual characteristics of the brick, which is to be representative of the appearance of the brick to be used in the executed work

3.10
sample panel
panel of brickwork or mortarless laid bricks erected adjoining the reference panel during the ongoing project works for the purpose of assessing the visual characteristics of bricks taken from subsequent project deliveries, to ensure a consistency of appearance in the executed work

4 Appearance

4.1 General

The definitions in Clause **3** are taken from, or based on, the relevant parts of BS 6100. In practice, the term in common usage and of the greatest relevance to the appearance of clay brickwork is facing brickwork, which is brickwork as defined in **3.1** made from facing units as defined in **3.4**.

In practice it is not possible to write a universally applicable definition of acceptable appearance of facing brickwork, as this will vary significantly with the type of clay brick chosen. The appearance of brickwork is additionally dependent on the choice of brick, mortar, joint profile and workmanship.

The characteristics of the surface of the clay brick are relevant only in so far as they prohibit the achievement of the specified required appearance. Consequently cracks or chips in the exposed face or arrises of a smooth faced regular shaped brick used with a recessed mortar joint may be unacceptable, but a similar number of such features may be quite acceptable on a handmade product used with a flush joint.

To illustrate the variety that can be achieved, some examples of different appearances produced by different bricks and mortars are:

a) smooth faced wire-cut brick with recessed joint and a flush joint;

b) stock brick with recessed joint and a flush joint;

c) effect of mortar variation;

d) effect of not blending bricks;

e) textured surfaces/multi-coloured facing bricks.

4.2 Principle

The acceptability of minor defects such as cracks, chips or surface blemishes of clay facing bricks when delivered to site is assessed. Sample panels from the brick deliveries are compared with a previously constructed reference panel, which is representative of what may reasonably be expected to be delivered, and is large enough to encompass known and acceptable variations in bricks. This method can be used to assess consistency of supply in respect of colour and texture. The panels are viewed from a distance of 3 m, which is sufficient to reliably compare their aesthetic characteristics.

4.3 Construction of the reference panel

Erect the reference panel on a level, firm foundation in a dry location, having good natural daylight. It should be sited so that it can be retained for further inspection and reference and should, therefore, be protected from damage and adverse weather conditions. If necessary, provision should be made for ensuring lateral stability of the panel.

The reference panel should be of a size agreed by all parties but not less than 1 m^2 and the clay bricks should be:

a) supplied by the manufacturer or supplier so that they are reasonably representative of the average quality of the whole order to be delivered; or

b) randomly sampled in accordance with BS EN 771-1.

Build the reference panel to the specification and contract requirements of the finished work and so that it exposes for assessment those faces that will be visible in the finished work. Lay bricks to the bond selected for the finished work to the horizontal and vertical gauge proposed and using mortar of the same class and colour, and finished with the same joint profile.

4.4 Construction of the sample panels

Either:

a) construct sample panels representing individual batches in the same way and of the same size as the reference panel (see **4.3**). Allow the mortar sufficient time to cure so that the appearance can be fairly judged, in a protected environment;

NOTE Seven days is usually sufficient curing time.

or

b) construct a dry bonded sample panel using no mortar between the bricks. Comparison of this dry stacked sample panel to the reference panel (see **4.3**) should take no account of the mortar profile, colour and texture. In the event of dispute, a mortared sample panel should be used for comparison purposes.

The clay bricks used for each panel should be randomly sampled from the batch delivered to the site in accordance with BS EN 771-1 prior to subsequent handling on site.

4.5 Assessment

Inspection of the sample panel should be carried out at any time prior to subsequent handling on site. When the sample panel is viewed at the same distance as the reference panel, which is usually 3 m and without close scrutiny of individual bricks, the two panels should not differ significantly.

It is important that the reference panel is agreed by all parties as having the appearance required of subsequent sample panels. In particular, if the clay bricks are being supplied through a third party, the manufacturer should agree to supply bricks equivalent in appearance to those of the reference panel.

5 Dimensions and tolerances

5.1 Principle

This guide includes two procedures for assessment of dimensions and tolerance, A and B.

Procedure A is a rapid method for determining the tolerance category for the mean length, width and height dimension. The overall dimension for ten clay bricks laid together in a row is measured and the average value determined. The difference between this average value and the declared work size is compared with tabulated values for the two tolerance categories for mean dimensions, T1 and T2 in BS EN 771-1.

Procedure B is used to determine the range class. Ten clay bricks are individually measured and the difference between the largest and the smallest for each dimension is compared to tabulated values for the two tolerance categories for the range, R1 and R2 in BS EN 771-1.

NOTE Although both procedures in this PAS are only calibrated for use with UK standard format clay bricks, other clay unit work dimensional formats can be dealt with in a similar way if tolerance recalibration is undertaken.

5.2 Apparatus

5.2.1 *Retractable steel pocket rule*, meeting the requirements of BS 4035.

5.3 Preparation of specimens

5.3.1 *Sampling*

Sample ten clay bricks in accordance with BS EN 771-1, unless otherwise agreed.

5.3.2 *Surface treatment*

Remove any superfluous material adhering to the clay bricks as a result of the manufacturing process before taking measurements.

5.4 Procedure A — Tolerances for mean dimensions (T1, T2 or Tm)

5.4.1 *Determination of mean dimensions*

Place the clay bricks in contact with each other in a straight line along a level surface, using the appropriate arrangement for each dimension as shown in Figure 1.

Measure the overall dimension (length, width and height) to the nearest millimetre, using a retractable rule (**5.2.1**), and record the result.

Divide each respective overall measurement by 10 to obtain a mean value to the nearest millimetre.

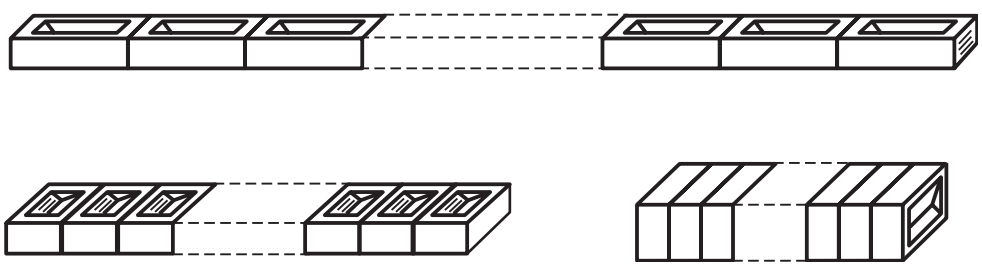

Figure 1 — Arrangement of bricks for measurement of dimension

5.4.2 *Tolerance category*

Determine the absolute values of the differences between the measured mean length, width and height of the sample and the values declared by the manufacturer, rounded to the nearest millimetre.

If the absolute value of the difference for each dimension is not greater than the respective criteria value given in Table 1 for tolerance category T2, then it may be assumed that the consignment conforms to the requirements for tolerance category T2 in BS EN 771-1.

If the absolute value for the difference of any dimension exceeds the respective criteria value in Table 1 for tolerance category T2 and, additionally, no absolute value for any of the individual dimension differences exceeds the relevant Table 1 tolerance category criteria value for T1, it may be assumed that the consignment conforms to the requirements for tolerance category T1 in BS EN 771-1.

NOTE 1 In the case of the width dimension for 102.5 mm wide bricks, the absolute value of the difference between measured and manufacturer's declared dimension will always be to half a millimetre and should be rounded to the next lowest whole number of millimetres.

Table 1 — Tolerance category criteria

Tolerance category	Length mm	Width mm	Height mm
T1	5	3	2
T2	3	2	1

NOTE 2 The values in Table 1 are lower than the criteria given in BS EN 771-1 in order that in practical situations there is sufficient confidence that the categories indicated by the site test would be confirmed using the more detailed measurement procedure in BS EN 771-1.

If the manufacturer has declared that the clay bricks conform to tolerance category Tm, compare the absolute value of the difference for each respective dimension with the manufacturer's declared deviation, less 1 mm. If the absolute value of the difference for each dimension is not greater than the declared deviation minus 1 mm, then it may be assumed that the consignment conforms to the requirements for tolerance category Tm as declared to BS EN 771-1.

5.5 Procedure B — Tolerance category for dimensional range (R1, R2 and Rm)

5.5.1 *Determination of length, width and height*

Determine the length, width and height, in millimetres, of each clay brick as the mean of two measurements taken at the mid point of the two bed faces, front and rear face and two ends respectively, as shown in Figure 2, using a retractable rule (**5.2.1**).

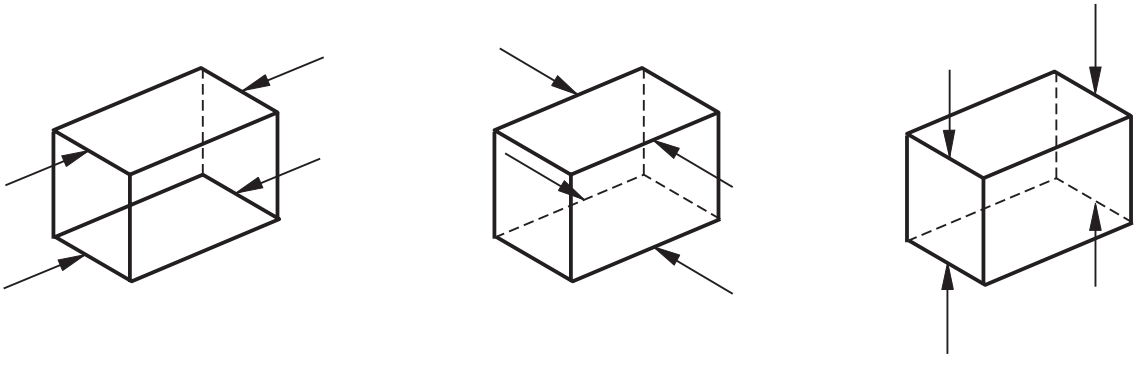

Figure 2 — Brick measurement positions

Record each individual measurement to the nearest millimetre. Record the mean length, width and height of each clay brick to the nearest millimetre.

5.5.2 *Range*

Calculate the difference between the largest and the smallest individual measured mean length, width and height in the sample of ten bricks rounded to the nearest millimetre.

If the value for the difference for each dimension is not greater than the relevant criteria value given in Table 2 for range category R2, then it may be assumed that the consignment conforms to the requirements for range category R2 in BS EN 771-1.

If the value for the difference of any dimension exceeds the respective criteria value in Table 2 for range category R2 and, additionally, none of the values of dimension difference are greater than the respective criteria values for range category R1, then it may be assumed that the consignment complies with the requirements for range category R1 in BS EN 771-1.

Prepare a test report in accordance with **5.7**.

Table 2 — Range category criteria

Tolerance category	Length mm	Width mm	Height mm
R1	8	5	4
R2	3	2	1

NOTE The values in Table 2 are lower than the criteria given in BS EN 771-1 in order that in practical situations there is sufficient confidence that the categories indicated by the site test would be confirmed using the more detailed measurement procedure in BS EN 771-1.

If the manufacturer has declared that the clay bricks conform to range category Rm, compare the value for the difference for each respective dimension with the manufacturer's declared deviation, less 1 mm. If the value for the difference for each respective dimension is not greater than the manufacturer's declared deviation minus 1 mm, then it may be assumed that the consignment conforms to the requirements for range category Rm as declared to BS EN 771-1.

5.6 Practical considerations of Procedures A and B

The procedure and consideration of the results in relation to BS EN 771-1 involves the length, width and height of the sample. In practice it may only be required to demonstrate that the deviations for one or two dimensions are within the limits in Table 1 and Table 2 for the tolerance being considered.

5.7 Test report

The test report should contain the following information:

a) name of construction site;

b) date of test;

c) name of manufacturer of unit;

d) name of product (catalogue name);

e) indicated tolerance class (where relevant);

f) indicated range class (where relevant);

g) names and affiliations of those present at the test;

h) signature of person responsible for test.

A suitable report format is shown in Annex A.

Annex A (informative)
Example report format for Procedure B

Name of construction site	Date
	Product name
Name of manufacturer	Batch reference no.
Manufacturers declared work size dimensions (length × width × height) mm	215 mm × 102.5 mm × 65 mm

Measured data														
Length mm	1st													
	2nd													
	Mean													
Width mm	1st													
	2nd													
	Mean													
Height mm	1st													
	2nd													
	Mean													
NOTE All numbers should be in whole mm.														

Deviation = (largest – smallest) individual mean dimensions in sample				
		Length mm	**Width** mm	**Height** mm
Circle the criteria satisfied	R_2	≤ 3	≤ 2	≤ 1
	R_1	>3 and ≤ 8	>2 and ≤ 5	>1 and ≤ 4
	R_m			
Indicated range category			R	

Name and affiliation of persons witnessing test	
Name	Affiliation
Identification number of retractable rule	
Signature of person responsible for test	

blank

Bibliography

BS 3921:1985, *Specification for clay bricks.*

BS EN 772-16:2000, *Methods of test for masonry units — Part 16: Determination of dimensions.*

BS 6100-5.1:1992, *Glossary of building and civil engineering terms — Part 5: Masonry — Section 1: Terms common to masonry.*

BS 6100-5.3:1984, *Glossary of building and civil engineering terms — Part 5: Masonry — Section 3: Bricks and blocks.*

Further reading

BS 4729:2004, *Recommendations for dimensions of bricks (including those of special shape)*[1)].

[1)] To be published in 2004.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL