

Natural stone cladding —

(Non-loadbearing)

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Foreword

This Code of Practice makes reference to the following British Standards:

BS 743, *Materials for damp proof courses.*

BS 849, *Plain sheet zinc roofing.*

BS 970, *Wrought steels in the form of blooms, billets, bars and forgings. Part 4: Stainless, heat resisting and valve steels.*

BS 1400, *Copper alloy ingots and copper and copper alloy castings.*

BS 1449, *Steel plate, sheet and strip. Part 4: Stainless and heat resisting plate, sheet and strip.*

BS 1453, *Filler rods and wires for gas welding.*

BS 1470, *Wrought aluminium and aluminium alloys. Plate sheet and strip.*

BS 1881, *Methods of testing concrete.*

BS 2787, *Glossary of terms for concrete and reinforced concrete.*

BS 2870, *Rolled copper and copper alloys. Sheet, strip and foil.*

BS 2872, *Copper and copper alloys. Forging stock and forgings.*

BS 2873, *Copper and copper alloys. Wire.*

BS 2874, *Copper and copper alloys. Rods and sections (other than forging stock).*

BS 2875, *Copper and copper alloys. Plate.*

BS 2901, *Filler rods and wires for gas-shielded arc welding.*

BS 2926, *Chromium-nickel austenitic and chromium steel electrodes for manual metal-arc welding.*

BS 3019, *General recommendations for manual inert-gas tungsten-arc welding. Part 2: Austenitic stainless and heat-resisting steels.*

BS 3798, *Coping units (of clayware, unreinforced cast concrete, unreinforced cast stone, natural stone and slate).*

CP 3, *Code of basic data for the design of buildings. Chap. V. Loading. Part 2: Wind loads.*

CP 116, *The structural use of precast concrete. Part 2: Metric units.*

CP 121.101, *Brickwork.*

CP 121.201, *Masonry walls ashlarred with natural stone or with cast stone.*

CP 153, *Windows and rooflights. Part 1: Cleaning and safety.*

CP 297, *Precast concrete cladding (non-loadbearing).*

PD 6440, *Accuracy in building. Part 2: Metric units.*

PD 6445, *Recommendations for the co-ordination of dimensions in building: Tolerances and joints. The derivation of building component manufacturing sizes from co-ordinating sizes.*

DD . . . , *Recommendations for the co-ordination of dimensions in building. Tolerances and fits for building. The calculation of work sizes. Joint clearances for building components. (In course of preparation.).*

Stone and other materials in the form of thin slabs of modest dimensions have been used for centuries as a decorative facing to backgrounds of stone and brickwork. With the advent of the framed structure where the loads are carried by the frame and not by the external walling, the materials or combination of materials used to cover the structural framework are now generally referred to as the cladding.

The construction of buildings of increasing size and height coupled with increasing speeds of erection has produced a number of design and structural problems related to cladding which did not previously exist.

Cladding, in the forms described in 1.1, requires care to ensure permanent fixing and to prevent or control the ingress of water. Adequate precautions have also to be taken to provide for permanent and temporary movements of the structure due to shrinkage and elastic deformation under load. Movements due to temperature and other factors have also to be taken into account.

The purpose of this Code is to describe the provisions necessary for the cladding to perform its function satisfactorily for the reasonable life of the building.

As part of BSI's programme of metrication, this Code is expressed in metric terms.

For further information on the values given in SI units, reference should be made to BS 3763, *"The International System of units (SI)"*.

NOTE 1 $\text{N/mm}^2 = 1 \text{ MN/m}^2$.

This Code of Practice represents a standard of good practice and therefore takes the form of recommendations. Compliance with it does not confer immunity from relevant statutory and legal requirements.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 23 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 General

1.1 Scope

This Code of Practice deals with the design and use of stone cladding in the form of:

- 1) an applied facing held to a solid background by mechanical means such as metal fixings,
- 2) units supported by the structural frame of the building, and
- 3) permanent formwork held mechanically to a background of in-situ concrete.

Stone faced concrete cladding, i.e. using composite units, is not included in this Code, apart from information on the choice of stone and treatment of finish, but is in CP 297, as, although the finished appearance will be that of natural stone, it is the properties of the concrete base which determines the design aspects, particularly those relating to the method of fixing.

Loadbearing cladding or cladding held only by adhesion is not included, nor is any type of cladding supported or held in position around the perimeter of stones or series of stones by metal framing, or stone cladding involving large stones individually supported and fixed independently of any adjacent stones, without mortar joints and without transmission of load from one stone to another.

The provisions contained in this Code relate to the best known conventional practices at the date of publication and are based on current cladding techniques.

NOTE The titles of the British Standards referred to in this Code of Practice are listed on page ii.

1.2 Definitions

For the purposes of this Code the definitions in BS 2787 and BS 2874 apply, with the following modifications and additions:

cladding

the external non-loadbearing covering to the frame of a building or structure

composite unit

a cladding unit having a facing of natural stone

Fixings

loadbearing fixing

any fixing designed to support the dead weight of one or more cladding units and to transfer this load directly to the structure

face fixing

a fixing which combines the functions of both loadbearing and tying back fixings

tying back fixing

any fixing designed to tie cladding units to their backing or to one another

galvanic corrosion

corrosion caused by contact between two dissimilar metals in the presence of an electrolyte

gasket

an elastic, flexible, preformed extrusion or moulding used to provide a seal between part of the structure and the cladding or between adjacent units. Its primary purpose is to act as a barrier to wind and rain and to function properly it is essential that it remains under some compression at all times

Joints

compression joint

a joint designed specifically to accommodate partial closure resulting from shortening of the structure to which the cladding is attached

dry butt joint

a completed joint in which units abut each other without any jointing material

filled joint

a completed joint in which the space between adjacent units or between a unit and another part of the building is filled with jointing material

movement joint

a vertical or horizontal joint designed specifically to accommodate recurring cyclical movement of the structure or of the cladding, or both, without detriment to the cladding or affecting its performance

sealant

an adhesive material of a consistency suitable for application by means of a trowel, knife or gun, or available as a preformed strip or tape, used for providing a seal between two units or between a unit and the structure. It is essential that the material be capable of accepting deviations and subsequent changes in the width of the gap it is intended to fill, but it should not be expected to be loadbearing

2 Materials**2.1 Cladding**

2.1.1 General. Stone used for cladding includes limestone, sandstone, marble, granite, slate and quartzite.

2.1.2 Finish. The following are the more general finishes given to various materials:

- 1) Limestones and sandstones: fine rubbed, sawn or tooled.
- 2) Marble: polished, eggshell or sand rubbed.
- 3) Granite: polished, eggshell or honed, fine rubbed, fine axed, or flame textured.
- 4) Slates: riven (a natural split surface), sawn or fine rubbed.
- 5) Quartzite: as for slate.

2.1.3 Stone faced concrete cladding. Any of the stones listed in **2.1.1** can be used as facings for composite units, provided they have sufficient strength in the relatively thin sections in which they may be used not to be damaged in the process of manufacturing the units. Once the concrete has hardened the strength of the stone is of less significance. Any of the finishes listed in **2.1.2** are suitable.

2.2 Fixing materials

The various types of fixing materials are given in **2.2.1** to **2.2.3**.

2.2.1 Non-ferrous metals. It is recommended that the following materials should be used:

Tying back fixings: copper, phosphor bronze and silicon aluminium bronze¹⁾.

Loadbearing fixings: aluminium bronze, phosphor bronze, gunmetal (for cast in sockets only) and silicon aluminium bronze¹⁾.

The materials copper, phosphor bronze, aluminium bronze and gunmetal should conform to the requirements of the appropriate British Standards: BS 2870, BS 2872, BS 2873, BS 2874, BS 2875 and BS 1400.

A wrought or continuously cast product should be used in preference to a sand casting. Freedom from porosity cannot be guaranteed in the latter.

¹⁾ Silicon aluminium bronze is not, at present, covered by a British Standard and should comply with the following material composition and mechanical properties:

Aluminium	6.0 % to 7.0 %
Silicon	1.5 % to 2.4 %
Manganese	0.5 % maximum
Iron	1.0 % maximum
Nickel	0.25 % maximum
Tin	0.05 % maximum
Lead	0.05 % maximum
Zinc	0.2 % maximum
Copper	Remainder
0.2 % Proof stress	232 N/mm ²
Tensile strength	525 N/mm ²
Elongation (5.65 √ S ₀)	25 %

Welding should only be permitted where the necessary facilities, expert knowledge and skill are available. Filler alloys for welding should, where appropriate, conform to the requirements of BS 1453, Group C, for gas welding and BS 2901 for gas shielded arc welding.

2.2.2 Stainless steel. The types of stainless steel recommended for tying back and loadbearing fixings are as follows:

Fixings made from sheet and strip (BS 1449, Part 4)

302S17, 304S16, 316S16, 321S12, 347S17

Fixings made from plate (BS 1449, Part 4)

304S15, 316S16, 321S12, 347S17

or the high proof stress versions of these steels

Fixings made from bar (BS 970, Part 4)

302S25, 303S21, 304S15, 316S16, 321S12, 347S17

or the high proof stress version of 316S16.

For fixings involving welding, steels 302S17, 302S25 and 303S21 should not be used. Welding should be by metal arc, selecting filler materials in accordance with the requirements of BS 2926, or tungsten inert gas in accordance with BS 3019, Part 2, selecting filler materials in accordance with BS 2901, Part 2.

Welding should only be permitted where the necessary facilities, expert knowledge and skill are available.

For fixings made by hot working involving prolonged heating, only steels 321S12 and 347S17 should be used, unless correct final heat treatment is applied to the fixings.

For fixings that are visible and must retain their original surface appearance, steel 316S16 should be chosen.

2.2.3 Ferrous or other materials. The use of ferrous metals and other materials is permitted where it can be shown that the performance characteristics of the fixings made from them are adequate in all respects for the conditions in which they are to be used.

2.3 Jointing and pointing materials

2.3.1 Mortars. Materials for mortar and their storage should be in accordance with the requirements of CP 121.201.

2.3.2 Sealants. These are available in various forms and are described in Table 2 and 3.5.2.

2.3.3 Gaskets. Polychloroprene is the base for most of the extruded gaskets and foamed butyl, polyethylene and polyurethane for cellular gaskets.

Gaskets may be of various sections, but tubular, fir cone and cellular are the most satisfactory. Gaskets require to be durable and to take up movements and tolerances.

2.4 Damp proof courses, flashings and membranes

2.4.1 Sheet material. Materials for damp proof courses are specified in BS 743 and where used should comply with the requirements of that standard. The same materials can often be used as flashings, as can aluminium complying with the requirements of BS 1470, Grade SIA, temper 0, zinc complying with BS 849 and stainless steel complying with BS 1449, Part 4. Other materials may be suitable; the manufacturer should be asked to give written evidence of their performance.

2.4.2 Brush-applied materials. Solutions or emulsions based essentially on bitumen or coal tar pitches can be used for providing a damp-resistant surface to a back-up wall, repelling small amounts of water which may penetrate the cladding. The material should be used to the manufacturer's instructions.

2.5 Water repellents

Silicone-based water repellents should comply with the requirements of BS 3826.

Stearate waterproofers are available as admixtures for mortars and the manufacturer's instructions for use should be followed.