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British Standard

# Fences

Part 6. Specification for wooden palisade fences

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## Foreword

This British Standard has been prepared under the direction of the Road Engineering Standards Committee. It is a revision of BS 1722 : Part 6 : 1972, which is withdrawn.

BS 1722 is published in separate Parts as follows:

- Part 1 Specification for chain link fences
- Part 2 Specification for rectangular wire mesh and hexagonal wire netting fences
- Part 3 Specification for strained wire fences
- Part 4 Specification for cleft chestnut pale fences
- Part 5 Specification for close boarded fences
- Part 6 Specification for wooden palisade fences
- Part 7 Specification for wooden post and rail fences
- Part 8 Specification for mild steel (low carbon steel) continuous bar fences
- Part 9 Specification for mild steel (low carbon steel) fences with round or square verticals and flat posts and horizontals
- Part 10 Specification for anti-intruder fences in chain link and welded mesh
- Part 11 Specification for woven wood and lap boarded panel fences
- Part 12 Specification for steel palisade fences
- Part 13 Specification for wire mesh fences for tennis court surrounds

The various Parts specify requirements for the types of fence that are considered suitable for standardization. It should be noted that no attempt has been made to standardize fences or gates of a purely decorative nature, or to suit special requirements, or to specify requirements for 'patent' proprietary fencing systems. It is recommended that the structure of such fences should comply with those parts of this Part of BS 1722 that are applicable.

It has been assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

The purpose of this standard is to establish minimum requirements for materials and workmanship for the more common types of fences in order to ensure satisfactory service for the purchaser, and to assist manufacturers and erecting contractors by eliminating unnecessary minor variations in the demands of purchasers. It specifies requirements for the components that make up a fence and the way in which the fence needs to be constructed. Throughout this standard there are requirements for sizes of components, together with the permissible tolerances on size. These are minimum requirements and it will normally be acceptable to use larger sizes, except where it would otherwise adversely affect the fit of components or where replacement parts need to match up with those already present.

This Part of BS 1722 describes fences incorporating main rails and palisades of triangular or rectangular cross section.

The choice of a fence is affected by factors such as the intended purpose of the fence, the desired service life, aesthetic considerations and the availability of components. The specifier of the fence will know its intended purpose and by reference to table 1 a suitable choice can be made.

This then gives those erecting the fence the basic characteristics that need to be provided. This standard includes requirements for protective treatments. However, an important aspect of providing an extended service life is the maintenance of the fence after its erection; this is outside the scope of this standard. Premature failure can be avoided by taking care not to damage protective treatments during installation. Occasionally aesthetics are important, and where this is so the specifier needs to provide suitable guidance to those providing the fence.

Ground condition may indicate that a variation in the length of a post, or of the depth to which it should be set, is desirable. The posts and setting depths specified in this standard are intended for use in normal ground but if special conditions exist that warrant a change in the specification, e.g. ground that is softer or firmer than usual, such a change needs to be agreed with the specifier, as for other variations.

To assist those specifying and/or providing a fence appendix D gives guidance on the more important details, which often take the form of selected options, which need to be specified at the time of ordering a fence. Appendix C contains a suggested sampling procedure. These are new features of the standard.

This revision has retained the method of allocating a reference code to each type of fence indicating its height, the type of infill used, and the size of and material used for the posts. These type references are given in full in table 1. The first two letters indicate the infill, the third letter indicates the material of the post and the numbers give an indication of the height of the fence. For the sake of uniformity the quoted heights are those of the main infill material and exclude any ground clearance at the base.

Designations of bolt size are in accordance with BS 4190.

The proof test for concrete posts has been deleted as experience had shown that there were technical problems associated with the application and interpretation of the tests. Cube tests of concrete strength are now required and the frequency testing is specified to ensure regular quality checks are made.

Since the publication of the previous edition of this standard BS 5589 has been published, and the timber appendix in this standard has been revised to include the recommendations of BS 5589.

In appendix B details have been included of methods for measuring defects in timber, and in particular the measurement of knots. In the case of the structural members of a fence, including posts and main rails, the principle of knot area ratio (K.A.R.) has been introduced as a means of determining, by visual assessment of the proportion of the cross section occupied by knots, the maximum permissible knots for fencing grade timber. Although the application of the method of knot measurement is new in so far as timber fencing components are concerned, it has been applied to the grading of structural timber for more than a decade. K.A.R. is a firmly established and widely

accepted method of knot assessment which in itself is a critical part of all timber grading. The adoption of K.A.R. as part of grading timber for fencing is a logical move in unifying timber grading rules where the question of strength is involved. Where a fence comprises timber components

that are not structural members, knot assessment can be by a simple measurement system, surface measurement, and this is also described in appendix B.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

## Section one. General

### 1.1 Scope

This Part of BS 1722 specifies requirements for the dimensions, materials, and erection of wooden palisade fences with main rails and palisades of rectangular or triangular cross section.

This Part of BS 1722 is divided into sections that specify separate requirements for the material components for fences (see section two) and the erection of fences (see section three).

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

### 1.2 Definitions

For the purposes of this Part of BS 1722, the timber definitions given in BS 6100 : Section 4.1 apply.

NOTE. For convenience, the relevant definitions have been repeated in B.2.

### 1.3 Dimensions and general characteristics

The dimensions of wooden palisade fences shall be as given in table 1.

Fence type		Height of fence	Suitable uses	No. of rails	Concrete posts*		Timber posts	
With concrete posts	With timber posts				Length	Cross section	Length	Cross section
WPC 105	WPW 105	m 1.05	Housing, parks, (inner fences)	2	m 1.60	mm  All 140 × 115 at base tapering to 100 × 115	m 1.65	mm 100 × 100
WPC 120	WPW 120	1.20	General purposes	2	1.75		1.80	100 × 125
WPC 150	WPW 150	1.50	General purposes	3	2.20		2.25	
WPC 165	WPW 165	1.65	Housing	3	2.35		2.40	
WPC 180A	WPW 180A	1.80	Housing	3	2.50		2.55	
WPC 180B†	WPW 180B†‡	1.80	Parks, railways, commercial and public buildings	3	2.50		2.55 §	100 × 150

\*See figures 1 and 2 for further details.  
†Separate extension arms and barbed wire may be attached.  
‡A single line of barbed wire may be directly attached to extended timber posts (see 3.3.3.1).  
§ If a single line of barbed wire is specified for direct attachment to the post (see 3.3.3.1) the post length shall be at least 2.70 m.

## Section two. Materials

### 2.1 Wire

#### 2.1.1 General

All wire shall comply with BS 4102.

#### 2.1.2 Tying wire

Tying wire shall be zinc coated low carbon steel (mild steel) wire and shall have a nominal wire diameter of 2.0 mm.

#### 2.1.3 Barbed wire

Barbed wire shall be zinc coated and shall be made from either low carbon steel (mild steel) wire or high tensile steel wire.

### 2.2 Concrete components

#### 2.2.1 General

**2.2.1.1 Material.** Concrete components shall be of steel reinforced concrete complying with appendix A.

**2.2.1.2 Tolerances on size.** The following permissible deviations shall apply to the specified size of concrete components when determining the actual sizes.

(a) A demoulding draw allowance of up to 4 mm on each of two opposing sides.

(b) An allowance on the base dimensions of tapered posts resulting from the use of a mould having the base dimensions given in table 1 that has been shortened by means of a stopping-off plate located not more than 300 mm from the base of the mould.

(c) Additional allowances on size of:

(1) length of posts  $\begin{matrix} +50 \\ -25 \end{matrix}$  mm;

(2) cross section of posts  $\begin{matrix} +6 \\ -4 \end{matrix}$  mm.

NOTE. The cross section is measured about the centre lines.

**2.2.1.3 General constructional details.** The long arrises formed in the mould shall either be rounded or shall have all sharp edges removed. The heads of posts shall be back weathered.

Holes for bolts shall allow the bolt to be freely inserted. All holes shall be free from obstruction and accurately positioned.

Posts for use with barbed wire extension arms shall be holed twice for M8 bolts for the attachment of extension arms (see also 2.4.2).

#### 2.2.2 Posts

The dimensions of concrete posts shall be as shown in figures 1 and 2. Posts shall be reinforced with four 8 mm diameter steel reinforcing bars, except that if steel having a characteristic strength greater than 250 N/mm<sup>2</sup> is used it shall be permissible for the cross section of the bars to be proportionately reduced.

### 2.3 Timber components

#### 2.3.1 General

**2.3.1.1 Material.** Timber components shall be of sawn timber complying with appendix B.

NOTE. Appendix C gives a suggested method of sampling for fence timber, for use when specified.

**2.3.1.2 Tolerances on size.** The following permissible deviations shall apply to the specified size of timber components when determining the actual size.

(a) The sizes specified in this standard all relate to timber with a moisture content of 28 %, determined in accordance with BS 5589. When timber has a lower moisture content than this an additional allowance (reduction) on size of 1 % for every 5 % of moisture content below 28 % shall be permitted.

(b) Additional deviations on size of:

(1) length of posts:  $\pm 50$  mm;

(2) length of palisades:  $\begin{matrix} +2 \\ -5 \end{matrix}$  mm;

(3) other dimensions,

specified size, under 75 mm:  $\pm 3$  mm.

specified size, 75 mm and over:  $\pm 6$  mm.

#### 2.3.2 Posts

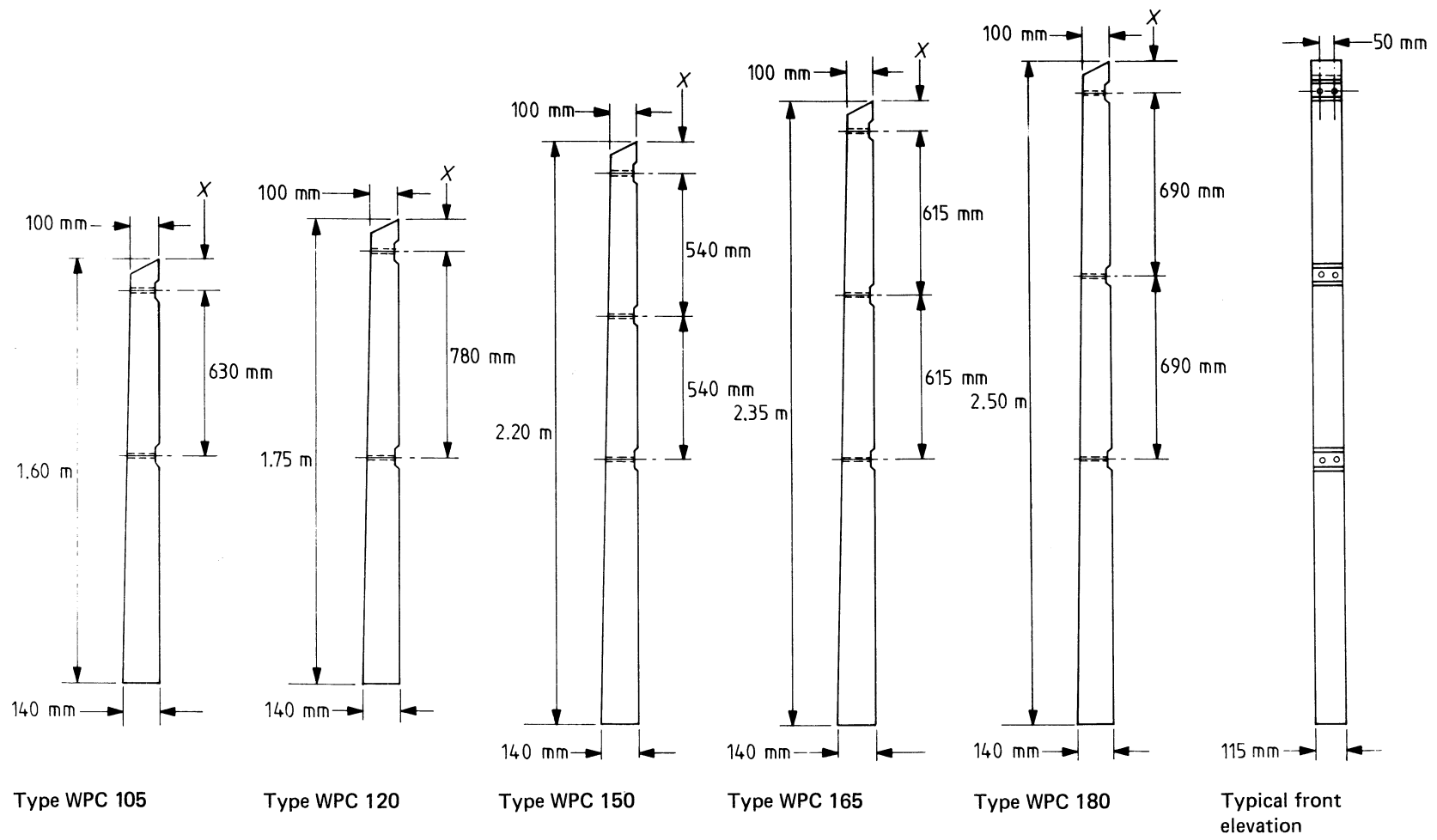
The dimensions of timber fence posts shall be as given in table 1. Fence posts shall have the same cross section throughout their length and shall be cut square across at their base. The tops of the posts shall be weathered to prevent the lodgement of water.

Timber posts shall have 65 mm  $\times$  25 mm mortices with their front edges either 25 mm from the face of the post (when rectangular section palisades are used) or 40 mm from the face of the post (when triangular section palisades are used), and positioned so that, when fixed, the centre of the bottom arris rail is approximately 225 mm from the bottom of the palisades, the centre of the top rail is approximately 225 mm from the top of the longest palisades, and the middle rail, if any, is central between the top and bottom rails.

Posts for use with barbed wire extension arms shall be holed twice for the attachment of the arms, the tops of posts for use with a single line of barbed wire shall be extended for direct attachment of wire as specified in 3.3.3.1.

#### 2.3.3 Rails

**2.3.3.1 Arris rails.** Timber triangular arris rails shall be cut from timber of 75 mm  $\times$  75 mm cross section, except that for fences of types having a suffix B in the designation, arris rails shall be cut from timber of 87 mm  $\times$  87 mm cross section.



NOTE. Dimension X to be 115 mm or 150 mm.

Figure 1. Elevations of recessed concrete posts



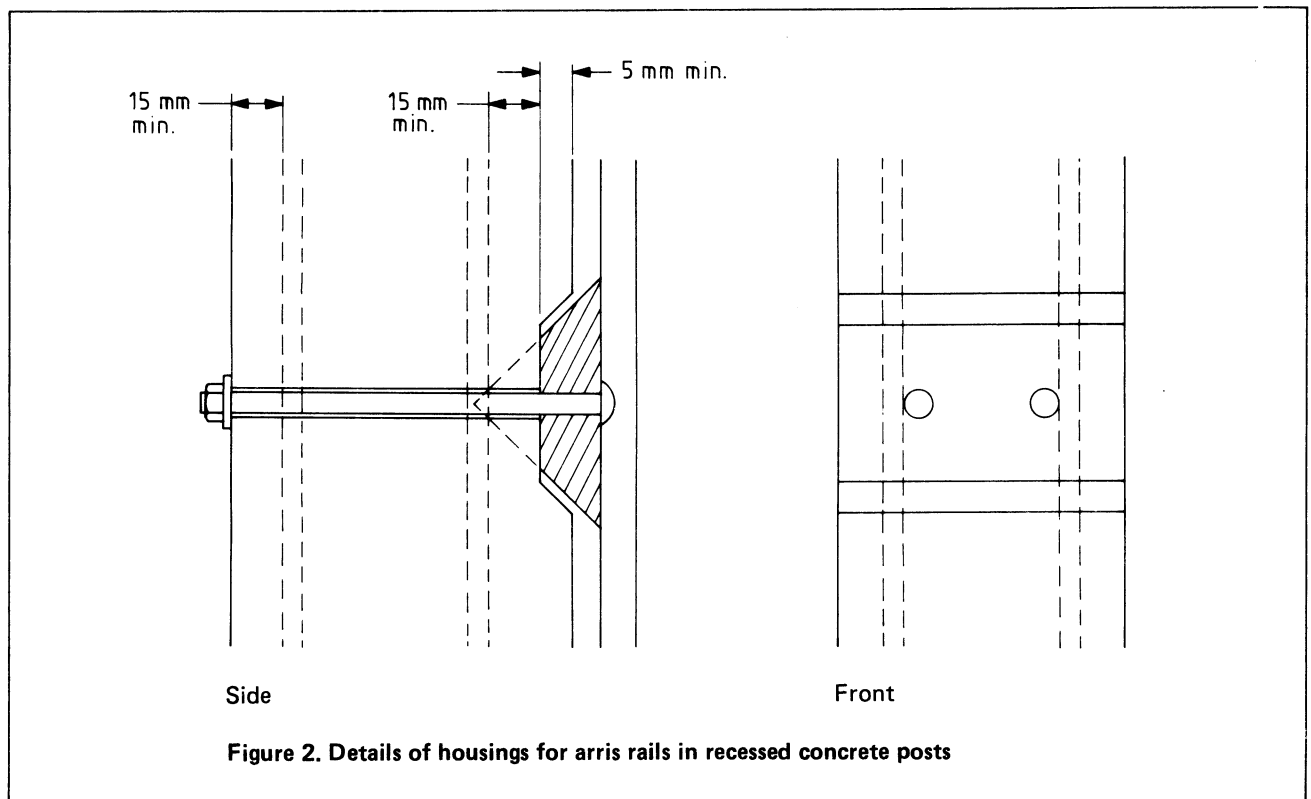


Figure 2. Details of housings for arris rails in recessed concrete posts

**2.3.3.2 Rectangular rails.** Timber rectangular rails shall be of 75 mm × 38 mm cross section, except that for fencing of types having a suffix B in the designation, the rails shall be of 100 mm × 50 mm cross section.

**2.3.3.3 Fixing.** When morticed timber posts are used, the ends of the rails shall be shaped to fit into the mortices for a depth of half the width of the post, so that when fixed, the face of the rails is in line with the front edges of the mortices.

When recessed posts are used, the ends of the rails shall be shaped to fit the housings in the posts, the ends of the rails being 25 mm thick for a length of approximately 65 mm so as to project in front of the face of the post when fixed, and each end of the rails shall be bored for one M8 bolt approximately 25 mm from the end.

#### 2.3.4 Palisades

Palisades shall be of rectangular cross section 75 mm × 20 mm or 65 mm × 20 mm, or alternatively, for fences having a height of 1.5 m or greater, palisades of triangular cross section may be used, two palisades being cut from timber of 50 mm × 50 mm cross section.

Unless the tops of the palisades are to be cut when fixed, the tops of rectangular palisades shall be pointed or cut square, and the tops of triangular palisades shall be weathered.

#### 2.3.5 Centre stumps

Centre stumps shall be 600 mm × 50 mm × 50 mm and shall be cut at the top to fit the bottom rail.

## 2.4 Fittings

### 2.4.1 Fixing and straining devices

**2.4.1.1 Eye bolt strainers.** Eye bolt strainers shall consist of bolts of 250 mm overall length and not less than 9.5 mm diameter with an eye at one end. They shall be threaded and fitted with nuts and washers. Two-way eye bolt strainers shall be fitted with ring nuts.

Eye bolt strainers shall be hot dip galvanized in accordance with BS 729.

**2.4.1.2 Staples.** Staples for fixing barbed wire to timber posts shall be 40 mm × 4 mm round or sectional wire staples, having a zinc coating complying with BS 443.

**2.4.1.3 Bolts, nuts, washers and nails.** Bolts shall comply with either BS 4190 or BS 4933 and shall be strength grade 4.6. Nails shall be round plain head nails complying with BS 1202 : Part 1. Washers shall comply with BS 4320. Bolts, nuts, washers and nails shall be hot dip galvanized in accordance with BS 729.

**2.4.1.4 Coach screws.** Coach screws for use with extension arms shall be 8 mm nominal diameter, 65 mm long and hot dip galvanized in accordance with BS 729.

### 2.4.2 Extension arms (for attachment of barbed wire)

**2.4.2.1 General.** Extension arms for barbed wire shall be either straight, or bent at an angle of 40° to 45° from the vertical. They shall be holed or slotted to allow the attachment of at least three lines of barbed wire. These holes or

slots shall be positioned such that the distance between lines of barbed wire is not greater than 150 mm, and the height of the lowest line of barbed wire is not more than 150 mm above the tops of the longest palisades. Extension arms and their fixing bolts shall be hot dip galvanized in accordance with BS 729.

**2.4.2.2** *Extension arms for use with straining fittings.*

Extension arms for use with straining fittings shall consist of low carbon steel (mild steel) angle 50 mm × 50 mm × 6 mm in cross section. They shall be holed to allow the attachment of eye bolt strainers and to allow attachment to a post.

**2.4.2.3** *Intermediate extension arms.* Intermediate extension arms shall consist of low carbon steel (mild steel) flat 30 mm × 6 mm in cross section and shall be holed twice to allow attachment to a post.

## **2.5 Concrete surrounding bases of posts**

Concrete for surrounding the bases of posts shall be not leaner by mass than one part of cement to ten parts of graded aggregate of 40 mm nominal maximum size mixed with the minimum requisite quantity of clean water. The concrete shall be placed in position before the commencement of the initial set.

## Section three. Erection

### 3.1 Level

The top of the fence shall follow approximately the level of the ground along the line of the fence.

NOTE. Unless specified (see appendix D) the erection of the fence will not include cutting or filling of the ground to vary the levels.

### 3.2 Posts

Posts shall be provided at intervals, measured centre-to-centre of the posts, of not more than 3 m.

Posts shall be set in the ground to a depth of 0.6 m for fences less than 1.5 m high, and 0.75 m for other fence heights. The holes for posts set in concrete shall be not less than 0.3 m × 0.3 m in plan or if round, as may be produced by an auger, not less than 0.3 m in diameter.

The holes for posts set only in rammed backfill shall be as small as practicable to allow for refilling with backfill and ramming. All holes shall have vertical sides.

NOTE. It is realized that the ground at the top of a hole is damaged during digging and this is acceptable provided it is limited to the top of the hole and does not extend down such that the hole itself is tapered out towards the top.

When erecting any concrete posts, after insertion of the post the hole shall be filled for not less than half its depth with concrete which shall be well rammed as the filling proceeds. The remainder of the hole shall be filled with backfill which shall be well rammed before the commencement of the initial set of the concrete.

If timber posts are used they shall either be set in concrete, as for concrete posts, or directly in the ground and surrounded by rammed backfill. The backfill shall be well rammed as the filling proceeds.

### 3.3 Infill

#### 3.3.1 Rails

Where recessed posts are used rails shall be fixed to the posts by means of one M8 bolt at each end.

Where morticed timber posts are used the rails shall be fitted into the mortices. The top rail shall be pinned at each end with a single 12 mm diameter wooden peg.

Centre stumps shall be fitted under the bottom rail at the centre of each bay, and nailed to the rail with one 65 mm × 3 mm nail. The opposite end shall be set in the ground.

#### 3.3.2 Palisades

Rectangular palisades shall be spaced as follows:

Size	Distance apart
75 mm × 20 mm	75 mm
65 mm × 20 mm	65 mm

Rectangular palisades shall be nailed to each rail with 50 mm × 2.65 mm nails, using two nails for each rail.

Triangular palisades shall be spaced 50 mm apart and shall be nailed to each rail with 65 mm × 3.35 mm nails, using two nails to each rail.

The tops of palisades shall be aligned. There shall be a clearance between the bottom of the palisades and the general ground level.

#### 3.3.3 Barbed wire

**3.3.3.1 Single lines of barbed wire.** Where a single line of barbed wire is specified for direct attachment to extended timber posts for fence types WPC 180B and WPW 180B (see table 1), it shall be stapled to the face of the post nearest to the property being served not more than 150 mm above the top of the longest pales.

**3.3.3.2 Extension arms.** Separately provided extension arms shall be attached with two hot dip galvanized M8 bolts, or alternatively with coach screws when timber posts are used (see 2.4.1.4).

NOTE. Cranked extensions for barbed wire should normally be directed inwards towards the property being served.

**3.3.3.3 Attachment of barbed wire.** Each line of barbed wire shall be strained to the extension arms on each post by means of eye bolt strainers at ends, corners and changes of direction, and at intervals not exceeding 150 m for straight lengths of barbed wire. It shall be secured to the extension arm on all other posts by means of a tie wire passed through a hole in the extension arm or, where the extension arm has slots, by straining the barbed wire and then placing it in the slots.

### 3.4 Renovation of damaged areas of hot dip galvanized coating

Small areas of hot dip galvanized coating damaged by welding, cutting or by excessively rough treatment during transit and erection shall be renovated either by the use of low melting point zinc alloy repair rods or powders made specifically for this purpose, or by the use of at least two coats of good quality zinc-rich paint (see BS 4652). Sufficient material shall be applied to provide a zinc coating at least equal in thickness to the original layer.

NOTE. The maximum size of the areas for which such repairs are acceptable will depend, to some extent, on the article and the application but for general guidance an area of 40 mm<sup>2</sup> is suggested as being suitable.

## Appendices

### Appendix A. Concrete components

#### A.1 Materials

##### A.1.1 Cement

The cement shall be Portland cement (ordinary or rapid hardening) complying with BS 12, Portland blastfurnace cement complying with BS 146, or sulphate-resisting Portland cement complying with BS 4027.

##### A.1.2 Aggregate

The aggregate shall comply with BS 882. The aggregate shall not exceed 10 mm nominal maximum size.

##### A.1.3 Admixtures

Admixtures shall comply with the following:

- (a) pigments, BS 1014;
- (b) concrete admixtures, BS 5075;
- (c) pulverized-fuel ash, BS 3892;
- (d) other admixtures, used in accordance with the manufacturer's instructions.

When admixtures are used they shall be such as to have no harmful effect on the reinforcement and the setting, hardening and durability of the concrete.

##### A.1.4 Reinforcement

The reinforcement shall comply with the requirements for size and tensile strength of BS 4449, BS 4461, BS 4482 or BS 4483.

#### A.2 Moulds

Moulds shall be so constructed that they remain rigid during the placing and compaction of the concrete and prevent the loss of water, grout or mortar. They shall be such that the finished components are accurate within the specified limits. Timber moulds shall be of closely jointed planed timber.

#### A.3 Manufacture

##### A.3.1 Concrete strength

The strength of the concrete in use at the manufacturer's works shall be demonstrated by regular testing to be not less than the following when tested in accordance with A.5.1:

- (a) 17 N/mm<sup>2</sup> when tested after 7 days; or
- (b) 25 N/mm<sup>2</sup> when tested after 28 days.

The cement content shall be not less than 350 kg per cubic metre of concrete.

NOTE. The above strengths may be expected from a mix composed of one part by mass of cement and not more than five parts by mass of graded aggregate. It is desirable that the water/cement ratio should not exceed 0.55 by mass.

##### A.3.2 Mixing

The concrete shall be mixed in a mechanical mixer until there is a uniform distribution of the materials and the mass is uniform in colour and consistency.

##### A.3.3 Placing and compacting

The concrete shall be used as soon as possible after being mixed, and shall be thoroughly compacted by vibration, tamping or other effective methods such that the surface achieved on demoulding is free from honey-combing or other large blemishes.

NOTE. Small surface voids caused by entrapped air or water are permissible.

##### A.3.4 Location of reinforcement

The reinforcement shall be prefabricated and located during the placing and compacting of the concrete in such a manner that the actual cover of concrete measured from main external faces and from the top of a post or strut is not less than 15 mm. The length of the assembled reinforcement shall be not less than the minimum length of the component, less an allowance not exceeding 100 mm to allow for the minimum cover and an allowance not exceeding 75 mm in total for cutting, prefabrication and location.

The reinforcement shall extend beyond the centre line of the uppermost line wire hole or beyond the top edge of the uppermost rail fixing point in a post, as appropriate.

NOTE. Where the ends of components are splayed, each bar may be of equal length.

##### A.3.5 Protection from freezing

No material that has been exposed to a temperature below freezing point shall be used until it has been completely thawed, nor shall components be moulded when the temperature of the moulds is below freezing point.

The components shall not be subjected to the effects of frost until either

- (a) the concrete has attained a strength of 5 N/mm<sup>2</sup> as shown by testing in accordance with A.5.2; or
- (b) the components are stored in such a way that they are not subjected to freezing until at least 48 h after casting.

##### A.3.6 Maturing

No components shall be supplied until one of the following conditions has been met:

- (a) the concrete has attained a strength of 25 N/mm<sup>2</sup> as shown by testing in accordance with A.5.2; or
- (b) the components have been allowed to mature under suitable conditions for not less than 28 days at normal temperatures.

#### A.4 Finish

The finish shall be that obtained by thoroughly compacting the concrete in the moulds (see A.3.3).

NOTE. Some manufacturing methods may produce a slightly textured finish or the imprint of the slight grain of planed timber and its joints.

## A.5 Tests

### A.5.1 Cube tests for concrete proportioning

Cubes shall be made and tested in accordance with BS 1881 : Part 116. The frequency of testing shall be not less than weekly. Each test result shall be not less than the strength specified in A.3.1. The record of results shall be available for inspection. Where the concrete mix is not in regular use, at least three satisfactory test results shall be required to establish compliance.

### A.5.2 Cube tests for concrete strength development

Cubes shall be made and tested in accordance with BS 1881 : Part 116, except that they shall be stored under similar conditions to products after casting. The frequency of testing shall be not less than weekly. Each test result shall be not less than the strength specified in A.3.5 or the mean of three consecutive results shall be not less than the strength specified in A.3.6, as applicable. The record of results shall be available for inspection. Where the concrete mix is not in regular use, at least three satisfactory test results shall be required to establish compliance.

### A.5.3 Examination of location of reinforcement

If the purchaser wishes to verify the location of reinforcement he shall select at random one product from the batch at the manufacturer's works, subject to a maximum of one in every 100 components, which shall be tested to ascertain if the location of the reinforcement complies with A.3.4. If the reinforcement is found to be incorrectly located it shall be permissible for a second product to be selected from the same batch, and if this also fails, the batch shall be deemed not to comply with this standard.

NOTE. If additional tests on hardened concrete are required, reference may be made to BS 1881 or BS 4408.

## Appendix B. Timber components

### B.1 General

The quality of fencing timber and the preservative treatment shall be as specified in B.4 and B.5.

NOTE 1. Provided a timber fencing component is suitably designed, for instance to avoid the collection of water at joints, and suitably protected against premature failure due to natural decay, by the use of suitable preservative treatment (see B.4), there is a large choice of species of timber available for use in fencing. This appendix is largely concerned with ensuring the durability of timber components, but in some cases there will be additional constraints on the choice of species, such as economic or aesthetic factors. The specifier needs to make known any additional limits on the type of timber to be used.

The timber shall be selected from the following:

- (a) oak (European and English) (see BS 881, 589), sweet chestnut or both;
- (b) other homegrown hardwoods (specified as mixed hardwoods);
- (c) imported hardwoods;

(d) softwoods;

(e) a mixture of hardwoods and softwoods.

NOTE 2. Although (e) is technically acceptable it may present difficulties to suppliers. Differences of shrinkage may be apparent if different species of wood are used together.

## B.2 Definitions

In this appendix the definitions given in BS 6100 : Section 4.1 apply; these include the following.

**B.2.1 knot.** Portion of a branch embedded in the wood.

**B.2.2 dead knot.** Knot having fibres intergrown with those of the surrounding wood to the extent of approximately 25 % or less of the cross-sectional perimeter.

**B.2.3 intergrown knot (*live knot* non-preferred).** Knot having fibres intergrown with those of the surrounding wood to the extent of approximately 75 % or more of the cross-sectional perimeter.

NOTE. A knot formed from the base of a live actively growing branch is normally completely intergrown.

**B.2.4 live knot.** See intergrown knot.

**B.2.5 knot cluster.** Group of knots around which the fibres are deflected.

**B.2.6 knot hole.** Hole caused by the removal of a knot.

**B.2.7 check.** Separation of fibres along the grain forming a crack or fissure that does not extend through timber or veneer from one surface to the other.

**B.2.8 end check.** Check at the end of a log or piece.

**B.2.9 split.** Separation of fibres along the grain forming a crack or fissure that extends through timber or veneer from one surface to the other.

**B.2.10 end split.** Split at the end of a log or piece.

## B.3 Nomenclature

Where structural components are referred to in this appendix they are posts and rails. Where non-structural components are referred to in this appendix they are palisades and stumps.

## B.4 Timber quality

### B.4.1 Limiting characteristics

When measured in accordance with B.4.2, either at any time within 14 days of delivery to the preservation treatment works or at any time within 14 days of delivery to site, the timber shall comply with table 2.

NOTE. Compliance of the timber with table 2 should be determined by a mutually agreed procedure. A suggested sampling procedure is given in appendix C.

Defects affected by changing climatic conditions shall not be considered a valid reason for subsequent rejection after the initial inspection within 14 days of delivery either to the preservation treatment works or to the site.

Table 2. Characteristics and defects of softwoods and hardwoods				
Characteristics		Posts	Rails	Non-structural components
All knots and knot holes		Total K.A.R. not greater than ½ *		Size of knot shall not exceed one half of the width of the face
Wane		Not more than 15 mm on any corner. At least two adjacent corners shall be free of wane	Not more than 10 mm on any corner. At least two adjacent corners shall be free of wane. Not more than 7 mm in width of palisades	
Slope of grain		Not more than 1 in 6 to the longitudinal axis of the piece		
Rate of growth		Unlimited		
Checks†		The depth of each check shall not exceed one half of the thickness of the piece.		
End splits†		Not longer than 150 mm except that for palisades they shall not exceed 25 mm		
Resin pockets		Unlimited	Not longer than the width of the piece	
Bark pockets		Unlimited	Not longer than the width of the piece and not wider than 5 mm	
Rot		Not permitted		
Active insect attack		Not permitted		
Lyctus damage		Not permitted		
Pin holes		Not more than 20 in any 0.3 m length	Not more than 10 in any 0.6 m length	
Blackheart		Unlimited‡		
Blue stain		Unlimited‡		
Straightness†	Bow	Not more than 25 mm within the length of the piece		
	Spring	Not more than 25 mm within the length of the piece		
	Twist	Not more than 20 mm within the length of the piece		
	Cup	Not more than one twenty-fifth of the width of the piece		
Boxedheart		Unlimited		
<p>*Within a parcel not less than 90 % of the number of pieces shall have a K.A.R. of ½ or less. A K.A.R. not exceeding 3/5 shall be permitted in up to 10 % of the number of pieces in the parcel.</p> <p>†Defects affected by changing climatic conditions (see B.4.1).</p> <p>‡Not considered a defect.</p>				

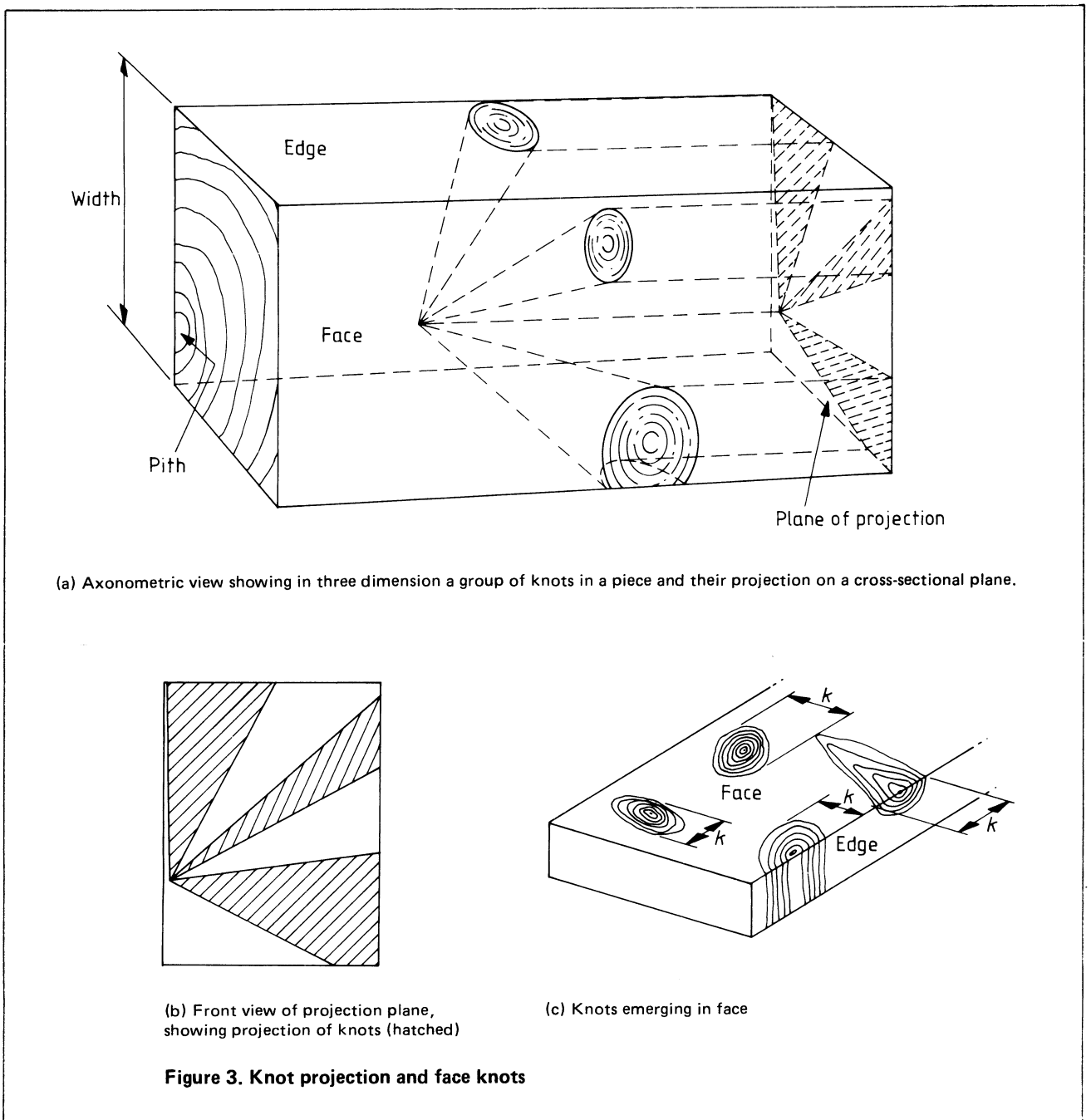
**B.4.2 Methods of measurement**

**B.4.2.1 Knots in structural components** (see figure 3(a) and (b)). Knots or groups of knots in the same cross section shall be limited by their knot area ratio (K.A.R.) which shall be taken as the ratio of the sum of the projected cross-sectional areas to the cross-sectional area of the piece. Knots shall be considered as part of the same cross section if any part of the knot, or the grain disturbances for which they are responsible, overlap along the length of piece. Knots or knot holes of less than 5 mm shall be ignored.

No distinction shall be made between knot holes, dead knots or live knots.

NOTE. B.4.3 describes a method for measuring K.A.R. for use in verifying the grading of a piece of timber, for instance in the case of a dispute.

**B.4.2.2 Knots in non-structural components** (see figure 3(c)). Only knots emerging on the face of non-structural components shall be considered. Take the size of the individual knots and knot clusters as being the minimum dimension ( $k$ ) that can be enclosed by a pair of parallel lines. Measure the dimension on each face, the maximum shall not exceed one third of the width of a face.



**B.4.2.3 Wane** (see figure 4). Place a straightedge against a face or edge of the piece and measure the wane.

**B.4.2.4 Slope of grain.** Measure the slope of grain either:

- (a) by taking a line parallel to the surface fissures; or
- (b) by the use of a grain detector as described in BS 4978.

The slope of grain shall be determined on adjacent faces

and edges over a distance sufficiently great to determine the general slope, disregarding local deviations. Measure the inclination of grain as shown in figure 5 in which AB is a line indicating grain direction, AC is a line drawn parallel to the edge of the member, BC is of length one unit (any convenient unit may be used) and is at right angles to AC. Express the slope of grain as 1 in  $x$  where  $x$  is the length of AC measured in terms of BC.

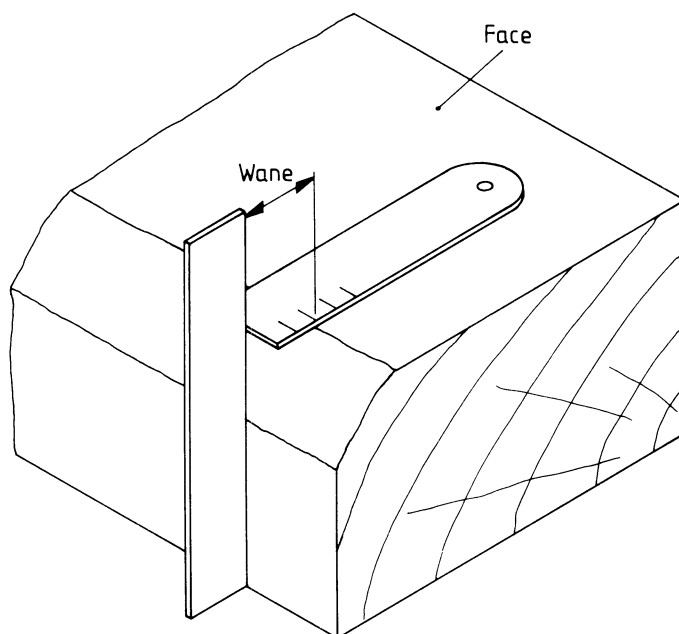


Figure 4. Measurement of wane



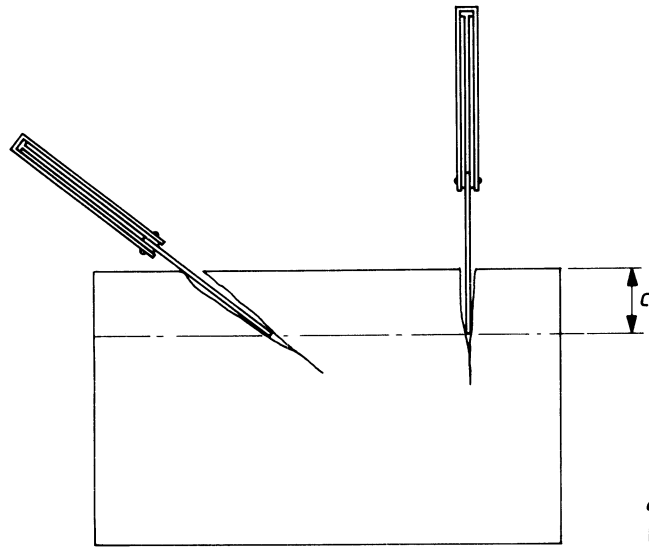
Slope of grain = 1 in  $\frac{AC}{BC}$

Figure 5. Measurement of slope of grain



**B.4.2.5 Checks** (see figure 6(a)). Measure the maximum depth to which a 0.2 mm feeler gauge complying with BS 957 : Part 2 can be inserted without using excessive force.

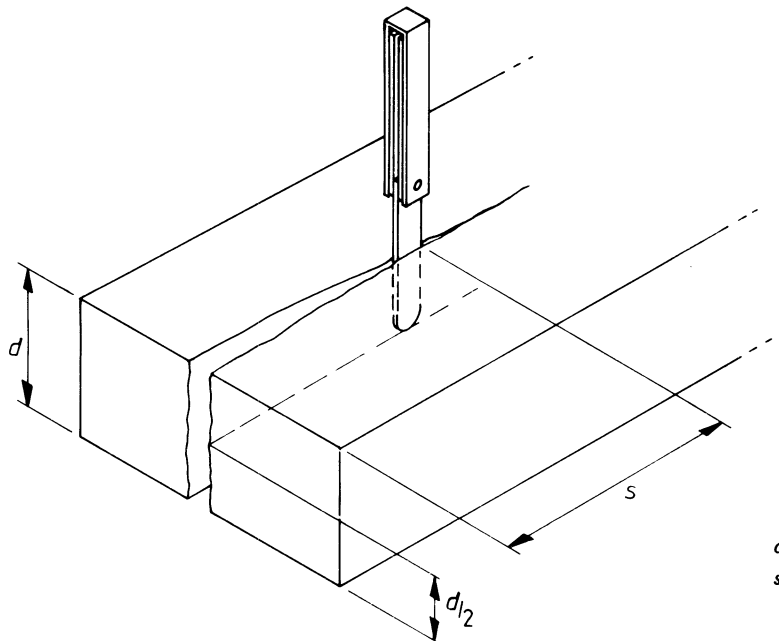
**B.4.2.6 End splits** (see figure 6(b)). Measure the maximum distance from the split end of the piece to a point at which a 0.2 mm feeler gauge complying with BS 957 : Part 2 can be inserted to a depth of half the piece without using excessive force.



*c* is the depth of check

NOTE. Both these checks measure the same.

(a) Depth of check



*d* is the depth of the piece  
*s* is the length of end split

(b) Length of end split

**Figure 6. Measurement of checks and end splits**

**B.4.2.7 Bow, spring, twist and cup.** Measure bow, spring, twist and cup as shown in figure 7 taking the actual length or width (as relevant) of the piece as the reference.

**B.4.3 Method for determining the knot area ratio (K.A.R.) for structural components**

**B.4.3.1 General.** B.4.3 describes a method for assessing the K.A.R. of a cross section by plotting a projection of the knots as a drawing. It is supplementary to visual grading and will usually only be applied when verification of the grading of a piece is required, for instance in the case of a dispute.

**B.4.3.2 Procedure.** Select a section in the piece that intersects a knot or group of knots.

Consider all knots and knot holes with diameters greater than 5 mm intersected by the chosen section in calculating the knot area ratio of the whole piece.

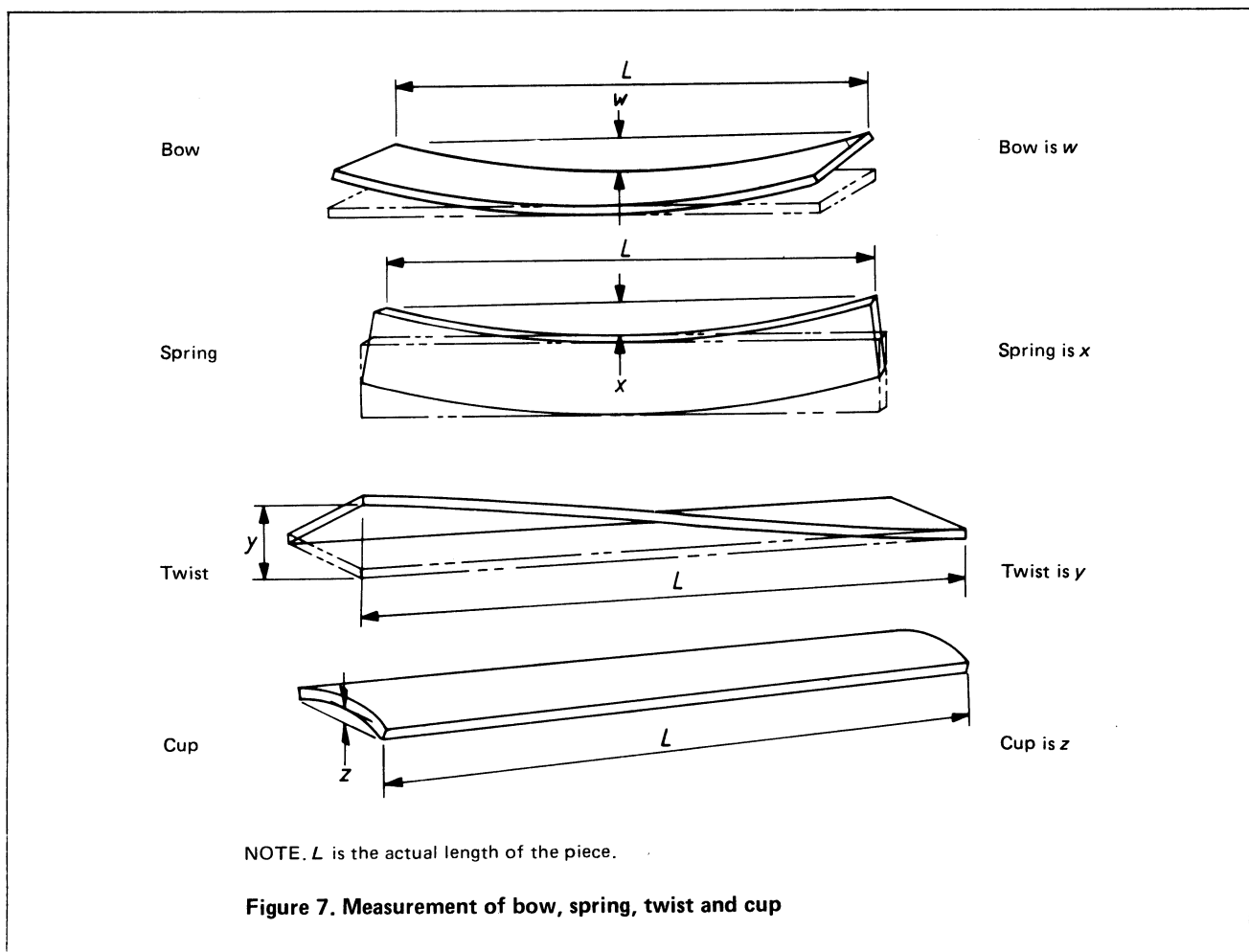
Make full scale drawings of the chosen section. Mark points on the appropriate side of the rectangle representing any knot on that surface. The points marked shall represent the widest projection of the knot on that face or edge.

Calculate the knot area ratio as described in either (a) or (b), according to whether or not the pith occurs within the cross section. For the purpose of estimating the position of the pith, within or without the cross section, examine the nearest end of the piece and assume that all annual rings are concentric with the pith.

(a) If the pith is within the cross section (see figure 3), join the points representing the limits of the knots on the drawing by straight lines to a point representing the estimated position of the pith. Measure the area within these lines which corresponds to knots for the whole cross section.

(b) Where the pith is outside the cross section, mark its estimated position at an appropriate position on the drawing. Join up the points on the perimeter of the drawing in a manner appropriate to the assumption that each knot is approximately a cone with its apex at the pith. Measure the area thus enclosed, corresponding to the estimated position of the knots, for the whole cross section.

In both cases (a) and (b) express the total area of knots within the cross-sectional area of the piece as a proportion of the cross-sectional area of the piece for the purpose of determining the knot area ratio.



## B.5 Preservative treatment

Timber shall be preserved in accordance with the recommendations for fencing timber in BS 5589.

NOTE 1. BS 5589 includes recommendations for preservative treatment for two categories of service life, these being category A (40 years) and category B (20 years). In most cases category B will provide sufficient protection, but if a longer service life is required category A should be specified.

NOTE 2. Certain species of timber do not require treatment depending upon the intended use and provided there is not excessive sapwood, i.e. in excess of one-third of the cross-sectional area of the piece, and details of these are given in BS 5589.

## Appendix C. Suggested sampling method for limiting characteristics of timber

### C.1 Purpose

The purpose of the sampling plan is to determine initially if the parcel complies with the requirements of table 2. It does not preclude the subsequent rejection of individual pieces for non-compliance with table 2, except for defects due to changing climatic conditions (see table 2).

### C.2 Procedure

Sample in accordance with table 3.

Table 3. Single sampling plan		
Number of pieces in parcel*	Number of pieces in sample	Rejection number
91 to 150	20	4
151 to 280	32	6
281 to 500	50	8
501 to 1 200	80	11
1 201 to 3 200	125	15
3 201 to 10 000	200	22

\*For parcels comprising 90 pieces or less, 100 % inspection is recommended.

Take the pieces comprising the sample at random. Inspect by defective pieces, not by defects (i.e. a piece containing one or more defects is to be counted as one defective piece).

Reject a parcel if the number of defective pieces is equal to, or exceeds, the rejection number.

\*See codes adopted in table 1.

## Appendix D. Specifying a wooden palisade fence

### D.1 General

This standard specifies requirements for materials and how they are combined and erected to provide a serviceable fence. Because a fence is made up of a number of separate components whose particular features may vary there will be a number of permissible combinations available to the user. When preparing a specification for a fence it is therefore important to give precise details of the requirements of the fence and of the erection site. This appendix lists those items which typically need to be specified. However, as conditions will vary from site to site it should not be assumed to be exhaustive in its listings.

### D.2 Site conditions

The following items will typically need to be specified.

- (a) Line and length of fence.
- (b) Profile of fence and ground clearance (see 3.1).
- (c) Site preparation (see 3.1):
  - (1) site clearance;
  - (2) cutting or filling of ground level.
- (d) Any specific requirements for non standard post lengths due to ground conditions (see the foreword).
 

NOTE. The requirements for the lengths of posts in this standard (table 1 and figures 1 and 2) have been related to 'normal' ground conditions. This standard does not cover situations where the ground is particularly firm or soft, when it may be necessary to modify the specified lengths or foundation sizes. The method used to set timber posts in the ground is also determined by the local ground conditions.
- (e) Number and position of any gates and type required.

### D.3 Construction of fence

The following items will typically need to be specified.

- (a) Fence reference type (see table 1\*).
- (b) Type of infill (see table 1\*):
  - (1) section of palisades (see 2.3.4);
  - (2) shape of top of palisades (see 2.3.4).
- (c) Additional security: barbed wire (see footnotes to table 1).
  - (1) separate extension arms and barbed wire:
    - (i) form of extension arm (see 2.4.2.1), i.e. vertical or cranked: specify orientation relative to protected site (see 3.3.3.2);

(ii) number of lines of barbed wire (see **2.4.2.1** and **3.3.3.1**);

(iii) particular requirements for attachment of barbed wires and extension arms (see **3.3.3.3**).

(2) single line of barbed wire directly attached to extended timber posts (see **3.3.3.1**).

(d) Posts:

(1) method of setting timber posts in ground (see **3.2**);

(2) any specific requirements for spacing of posts.

NOTE. **3.2** provides for posts at 3 m maximum centres. If shorter bays are required they need to be specified.

(e) Rails (see the foreword):

(1) arris;

(2) rectangular.

## D.4 Timber

The following items will typically need to be specified:

(a) any limits on species to use (see appendix B);

(b) hardwood (see **B.1**);

(c) softwood (see **B.1**);

(d) preservative treatment: category A or B? (see **B.5**);

(e) sampling: is sampling in accordance with appendix C required? (see **B.4.1**).

### Publications referred to

- BS 12      Specification for ordinary and rapid-hardening Portland cement  
BS 146      Portland-blastfurnace cement  
            Part 2 Metric units  
BS 443      Specification for testing zinc coatings on steel wire for quality requirements  
BS 729      Hot dip galvanized coatings on iron and steel articles  
BS 881, 589 Nomenclature of commercial timbers including sources of supply  
BS 882      Specification for aggregates from natural sources for concrete  
BS 957      Feeler gauges  
            Part 2 Metric units  
BS 1014     Pigments for Portland cement and Portland cement products  
BS 1202     Nails  
            Part 1 Steel nails  
BS 1881     Methods of testing concrete  
            Part 116 Method for the determination of compressive strength of concrete cubes  
BS 3892     Pulverized-fuel ash  
BS 4027     Specification for sulphate-resisting Portland cement  
            Part 2 Metric units  
BS 4102     Steel wire for fences  
BS 4190     ISO metric black hexagon bolts, screws and nuts  
BS 4320     Metal washers for general engineering purposes  
BS 4408     Recommendations for non-destructive methods of test for concrete  
BS 4449     Specification for hot rolled steel bars for the reinforcement of concrete  
BS 4461     Specification for cold worked steel bars for the reinforcement of concrete  
BS 4482     Hard drawn mild steel wire for the reinforcement of concrete  
BS 4483     Steel fabric for the reinforcement of concrete  
BS 4652     Metallic zinc-rich priming paint (organic media)  
BS 4933     ISO metric black cup and countersunk head bolts and screws with hexagon nuts  
BS 4978     Timber grades for structural use  
BS 5075     Concrete admixtures  
BS 5589     Code of practice for preservation of timber  
BS 6100     Glossary of building and civil engineering terms  
            Part 4: Section 4.1 Characteristics and properties of timber and wood based panel products

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The following BSI references relate to the work on this standard: Committee reference RDB/34 Draft for comment 83/13263 DC

## Committees responsible for this British Standard

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 British Timber Merchants' Association  
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 Fencing Contractors' Association  
 Forestry Commission  
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