

BS 1722-12:2016



BSI Standards Publication

Fences –

Part 12: Steel palisade fences –
Manufacturing and installation –
Specification

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Published by BSI Standards Limited 2016

ISBN 978 0 580 90498 1

ICS 91.090

The following BSI references relate to the work on this document:

Committee reference B/201

Draft for comment 16/30325063 DC

Publication history

First published June 1979

Second edition July 1990

Third edition April 1999

Fourth edition November 2006

Fifth (present) edition September 2016

Amendments issued since publication

Date	Text affected
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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 36, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 September 2016. It was prepared by Technical Committee B/201, *Fences and gates*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 1722-12:2006, which is withdrawn.

Relationship with other publications

BS 1722, *Steel palisade fences*, is published in the following parts:

- *Part 1: Specification for chain link fences;*
- *Part 2: Specification for strained wire and wire mesh netting fences;*
- *Part 4: Specification for cleft chestnut pale fences;*
- *Part 5: Specification for close-boarded and wooden palisade fences;*
- *Part 7: Specification for wooden post and rail fences;*
- *Part 8: Specification for mild steel (low carbon steel) continuous bar fences and hurdles;*
- *Part 9: Specification for mild steel (low carbon steel) fences with round or square verticals and flat horizontals;*
- *Part 10: Specification for anti-intruder fences in chain link and welded mesh;*
- *Part 11: Specification for prefabricated wood panel fences;*
- *Part 12: Steel palisade fences – Manufacturing and installation – Specification;*
- *Part 14: Specification for open mesh steel panel fences;*
- *Part 16: Specification for powder coatings used as a plastics finish to components and mesh;*
- *Part 17: Specification for electric security fences – Design, installation and maintenance;*
- *Part 18: Specification for free-standing temporary steel mesh perimeter fencing panels.*

Information about this document

This is a full revision and introduces additional factors in gate safety and component performance requirements.

The British Standard has also been arranged to make clear the principal responsibility for meeting the requirements of each section between manufacturer and installer.

It is generally assumed in the preparation of this British Standard that the fence is installed in level, normal ground conditions.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people. At the time of publication two appropriate qualification schemes are available: the Fencing Industry Skills Scheme (FISS) and the Construction Skills Certification Scheme (CSCS). ¹⁾ FISS/CSCS maintain a national register for fence installers and operatives. Other schemes might be available.

Presentational conventions

The provisions of this British Standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this British Standard are drafted in accordance with *Rules for the structure and drafting of UK standards*, subclause J.1.1, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this British Standard.

Contractual and legal considerations

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

Compliance with a British Standard cannot confer immunity from legal obligations.

¹⁾ FISS and CSCS are a trademarks owned by Lantra, Lantra House, Stoneleigh Park, Nr Coventry, Warwickshire, CV8 2LG and are examples of suitable schemes available commercially. This information is given for the convenience of users of this standard and does not constitute an endorsement by BSI of these schemes

1 Scope

This part of BS 1722 specifies requirements for steel palisade fences and gates for general purpose (GP) fences for heights up to 2.4 m, and for security purpose (SP) fences for heights of 3 m and 3.6 m, all with posts at 2.75 m centres. This British Standard also covers fences between 2.4 m and 3 m in height with components constructed to the SP specification.

NOTE 1 Where greater resistance against penetration is required for fences below 2.4 m in height, the SP components should be obtained from the purchaser.

NOTE 2 Requirements in this British Standard for the minimum sizes of fence components are based on a design wind loading, q , at right angles to the plane of the fence of 900 N/m² employing a shape factor of 1.9 on the net area presented to the wind.

NOTE 3 In situations of extreme exposure or abnormal loading, a special appraisal should be undertaken and the design criteria should be obtained from the purchaser.

NOTE 4 The responsibility for ensuring the final installation meets this British Standard belongs to the installer. This responsibility can be mitigated by obtaining certificates for materials used from the suppliers (see Clause 10).

2 Normative references

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

BS 4-1:2005, *Structural steel sections – Part 1: Specification for hot-rolled sections*

BS 907, *Specification for dial gauges for linear measurement*²⁾

BS 3692:2014, *ISO metric precision hexagon bolts, screws and nuts – Specification*

BS 3693, *Recommendations for design of scales and indexes on analogue indicating instruments*

BS 4320, *Specification for metal washers for general engineering purposes – Metric series*

BS 4484-1, *Specification for measuring instruments for constructional works – Part 1: Metric graduation and figuring of instruments for linear measurement*

BS 4652, *Specification for zinc-rich priming paint (organic media)*

BS 7371-3, *Coatings on metal fasteners – Part 3: Specification for electroplated zinc coatings*

BS 7371-6, *Coatings on metal fasteners – Part 6: Specification for hot dipped galvanized coatings*

BS 7805-1, *Swaged collar grooved rivets – Part 1: Specification for sizes up to and including 10 mm diameter*

BS 8500-1:2015+A1:2016, *Concrete – Complementary British Standard to BS EN 206 – Part 1: Method of specifying and guidance for the specifier*

BS 8500-2:2015+A1:2016, *Concrete – Complementary British Standard to BS EN 206 – Part 2: Specification for constituent materials and concrete*

BS EN 1011-1, *Welding – Recommendations for welding of metallic materials – Part 1: General guidance for arc welding*

²⁾ BS 907 has been partially superseded by BS EN ISO 463.

- BS EN 1011-2, *Welding – Recommendations for welding of metallic materials – Part 2: Arc welding of ferritic steels*
- BS EN 10025-2:2004, *Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels*
- BS EN 10056-1:1999, *Structural steel equal and unequal leg angles – Part 1: Dimensions*
- BS EN 10058:2003, *Hot rolled flat steel bars for general purposes – Dimensions and tolerances on shape and dimensions*
- BS EN 10210-1:2006, *Hot finished structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery requirements*
- BS EN 10210-2:2006, *Hot finished structural hollow sections of non-alloy and fine grain steels – Part 2: Tolerances, dimensions and sectional properties*
- BS EN 10219-1:2006, *Cold formed welded structural sections of non-alloy and fine grain steels – Part 1: Technical delivery requirements*
- BS EN 10219-2:2006, *Cold formed welded structural hollow sections of non-alloy and fine grain steels – Part 2: Tolerances, dimensions and sectional properties*
- BS EN 10263-1, *Steel rod, bars and wire for cold heading and cold extrusion – Part 1: General technical delivery conditions*
- BS EN 10263-2, *Steel rod, bars and wire for cold heading and cold extrusion – Part 2: Technical delivery conditions for steels not intended for heat treatment after cold working*
- BS EN 10263-3, *Steel rod, bars and wire for cold heading and cold extrusion – Part 3: Technical delivery conditions for case hardening steels*
- BS EN 10263-4, *Steel rod, bars and wire for cold heading and cold extrusion – Part 4: Technical delivery conditions for steels for quenching and tempering*
- BS EN 10296-1:2003, *Welded circular steel tubes for mechanical and general engineering purposes – Technical delivery conditions – Part 1: Non-alloy and alloy steel tubes*
- BS EN 12620, *Aggregates for concrete*³⁾
- BS EN ISO 376, *Metallic materials – Calibration of force-proving instruments used for the verification of uniaxial testing machines*
- BS EN ISO 463, *Geometrical Product Specifications (GPS) — Dimensional measuring equipment — Design and metrological characteristics of mechanical dial gauges*
- BS EN ISO 1461:2009, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods*
- BS EN ISO 7500-1:2015, *Metallic materials – Calibration and verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Calibration and verification of the force-measuring system*

³⁾ The 2013 version was withdrawn and the 2009 version reinstated as current.

Section 1: Manufacturers

3 Dimensions and general characteristics

3.1 Dimensions and tolerances

For other heights of GP fences, unless stated, the specification for the nearest fence height given in Table 1 shall be used.

NOTE Dimensions for components are shown in Table 1, Table 2 and Table 4.

For other heights of SP fences, unless stated, the specification for the nearest fence height given in Table 2 shall be used.

Table 1 Dimensions for general purpose (GP) fences with posts at 2.75 m centres

British Standard type reference	Fence height above ground m	Dimensions				
		Posts	Rails (horizontal)		Pales (maximum gap between pales, face-to-view, 89 mm)	
		Embedded length ^{A)} mm	Length m	Typical connector bolt diameter mm	Oversail	
					Top mm	Bottom ^{B)} mm
GP 15	1.50	525	2.72	10	225	150
GP 18	1.80	525	2.72	10	225	150
GP 21	2.10	625	2.72	10	275	200
GP 24 ^{C)}	2.40	725	2.72	12	300	210

^{A)} The embedded length shall be derived from the formula:

$$L = \frac{FH}{3} - 75$$

where:

L is length;

FH is fence height.

Minimum depth 525.

(all dimensions in mm)

^{B)} Maximum ground clearance 50 mm.

^{C)} If fences are required above this height, fixings as specified for SP fences shall be used.

Table 2 Dimensions for security purpose (SP) fences with posts at 2.75 m centres

British Standard type reference	Fence height above ground	Dimensions				
		Posts	Rails (horizontal)		Pales (maximum gap between pales, face-to-view, 86 mm)	
		Embedded length ^{A)}	Length	Connector bolt diameter	Oversail	
	m	mm	m	mm	Top mm	Bottom ^{B)} mm
SP 30	3	925	2.72	12	475	380
SP 36	3.60	1 125	2.72	12	650	550

^{A)} The embedded length shall be derived from the formula:

$$L = \frac{FH}{3} - 75$$

where:

L is embedded length;

FH is fence height.

(all dimensions in mm)

^{B)} Maximum ground clearance 50 mm.

3.2 Characteristics of pales

When tested in accordance with Annex A, pales shall conform to the load/deflection as follows:

- for SP fencing, the maximum deflection at the middle of the span under a test load of 3.5 kN shall not exceed 10 mm; and
- for GP fencing, the maximum deflection at the middle of the span under a test load of 2.5 kN shall not exceed 8 mm.

Pales shall also be capable of withstanding the loading for the pale to fence rail assembly in 5.2.

NOTE Pale strength is dependent on the profile section and the fabrication methods used.

3.3 Characteristics of posts

When tested in accordance with Annex B, posts shall conform to the load deflection as follows:

- for GP fencing posts, the maximum deflection at the middle of the 2 500 mm span under a test load of 10 kN shall not exceed 16 mm; and
- for SP fencing posts, the maximum deflection at the middle of the 2 500 mm span under a test load of 20 kN shall not exceed 9 mm.

The test load shall be applied to the post at right angles to the plane of the fence.

Posts shall be provided at a maximum of 2.75 m centres.

Posts shall be hot or cold roll-formed steel.

3.4 Characteristics of rails

When tested in accordance with Annex C, rails shall conform to the load deflection as follows:

- for GP 15-18 fencing rails, the maximum deflection at the middle of the 1 000 mm span under a test load of 5 kN shall not exceed 12 mm;

- b) for GP 21-24 fencing rails, the maximum deflection at the middle of the 1 000 mm span under a test load of 5 kN shall not exceed 9 mm;
- c) for SP 30 fencing rails, the maximum deflection at the middle of the 1 000 mm span under a test load of 5 kN shall not exceed 7 mm; and
- d) for SP 36 fencing rails, the maximum deflection at the middle of the 1 000 mm span under a test load of 5 kN shall not exceed 5 mm.

The test load shall be applied to the rail at right angles to the plane of the fence.

Rails shall also be capable of withstanding the loading for the pale to fence rail assembly in 5.2.

Rails shall be hot or cold roll-formed steel.

4 Materials

4.1 Steel

Steel components shall conform to their specified sizes within the typical allowance on cross sections as specified in the applicable material standard listed in Table 3.

The steel grade(s) employed shall be specified on the basis of the mechanical properties, formability and weldability required.

Table 3 – Steel grades

Material	Dimensional standard	Material standard	Material grade
Rolled steel angle	BS EN 10056-1:1999	BS EN 10025-2:2004	S235JR
Flat bar/plate	BS EN 10058:2003	BS EN 10025-2:2004	S235JR
Pales	BS 1722-12:2016	BS EN 10025-2:2004	S235JR
Circular, square or rectangular hollow sections	BS EN 10210-2:2006 BS EN 10219-2:2006	BS EN 10210-1:2006 BS EN 10219-1:2006	S235JRH S235JRH
Circular tubes	BS EN 10296-1:2003	BS EN 10296-1:2003	E 235
I/H sections – rolled steel joists, universal beams and universal columns	BS 4-1:2005	BS EN 10025-2:2004	S235JR

NOTE Where applicable, the use of higher strength or more enhanced grades than those shown is permissible, provided they meet the necessary requirements for formability, weldability or galvanizing as in the standards listed in this table.

Steel grades shall have a minimum yield strength in excess of 235 N/mm², unless the design permits lower strength materials to be employed.

NOTE Materials can be hot or cold formed.

4.2 Bolts, nuts and washers

All bolts and nuts shall conform to BS 3692.

Bolts shall be strength grade 4.6 for GP fences and strength grade 8.8 for SP fences. Panel fixing bolts shall be cup square headed. Bolts for pales shall have special formed heads to suit pale profiles and shall be tamper resistant, i.e. not easily removed using typical tools.

Nuts shall conform to BS 3692:2014, strength grade 4 and shall be tamper resistant.

Washers, if specified, shall conform to BS 4320.

The corrosion protection to be applied to the bolts, nuts and washers shall be selected from the following options:

- a) galvanizing in accordance with BS EN ISO 1461 or BS 7371-6;
- b) zinc electroplating in accordance with BS 7371-3; and
- c) other proprietary treatments with corrosion resistance properties equal to or greater than b).

4.3 Cold swaged pin and collar fixings

Cold swaged collar grooved or grooved fasteners shall conform to BS 7805-1, and shall be formed from carbon boron steel conforming to BS EN 10263-1, BS EN 10263-2, BS EN 10263-3 and BS EN 10263-4, or equivalent, having a minimum tensile strength of 850 N/mm². They shall have a suitably formed head and shall be provided with a ductile flanged collar.

NOTE Head types differ between manufacturers.

The tensile strength of cold swaged pin and collar fixings shall be determined in accordance with Annex D.

The corrosion protection to be applied to the cold swaged pin and collar fixings shall be selected from the following options:

- a) galvanizing in accordance with BS EN ISO 1461 or BS 7371-6;
- b) zinc electroplating in accordance with BS 7371-3; and/or
- c) other proprietary treatments with corrosion resistance properties equal to or greater than b).

5 Construction of the fence

5.1 Pales

Pales shall be fixed to the horizontal rails such that the maximum gap between, face-to-view, is:

- a) 89 mm for GP fences; and
- b) 86 mm for SP fences.

The clear distance between pales and adjacent posts shall not exceed the spacing between pales on adjacent fencing.

Pales shall be secured to the rails at every intersection by one of the following methods:

- 1) welding;
- 2) bolting; or
- 3) cold swaged pin and collar fixings.

Welding shall comprise 3 mm fillet welds of minimum length 30 mm on each side of the pale.

All welding operations shall be carried out by suitably qualified personnel in accordance with BS EN 1011-1 and BS EN 1011-2.

NOTE 1 Attention is drawn to BS EN 287-1 regarding personnel.

The heads of all fastenings shall have the minimum possible projection beyond the face of the pale to minimize tampering and footholds. For SP fences, the pale to fence rail fixing design shall allow for the protection of the fastener head from direct impact attack. The tolerance on the length of the pale shall be ± 5 mm.

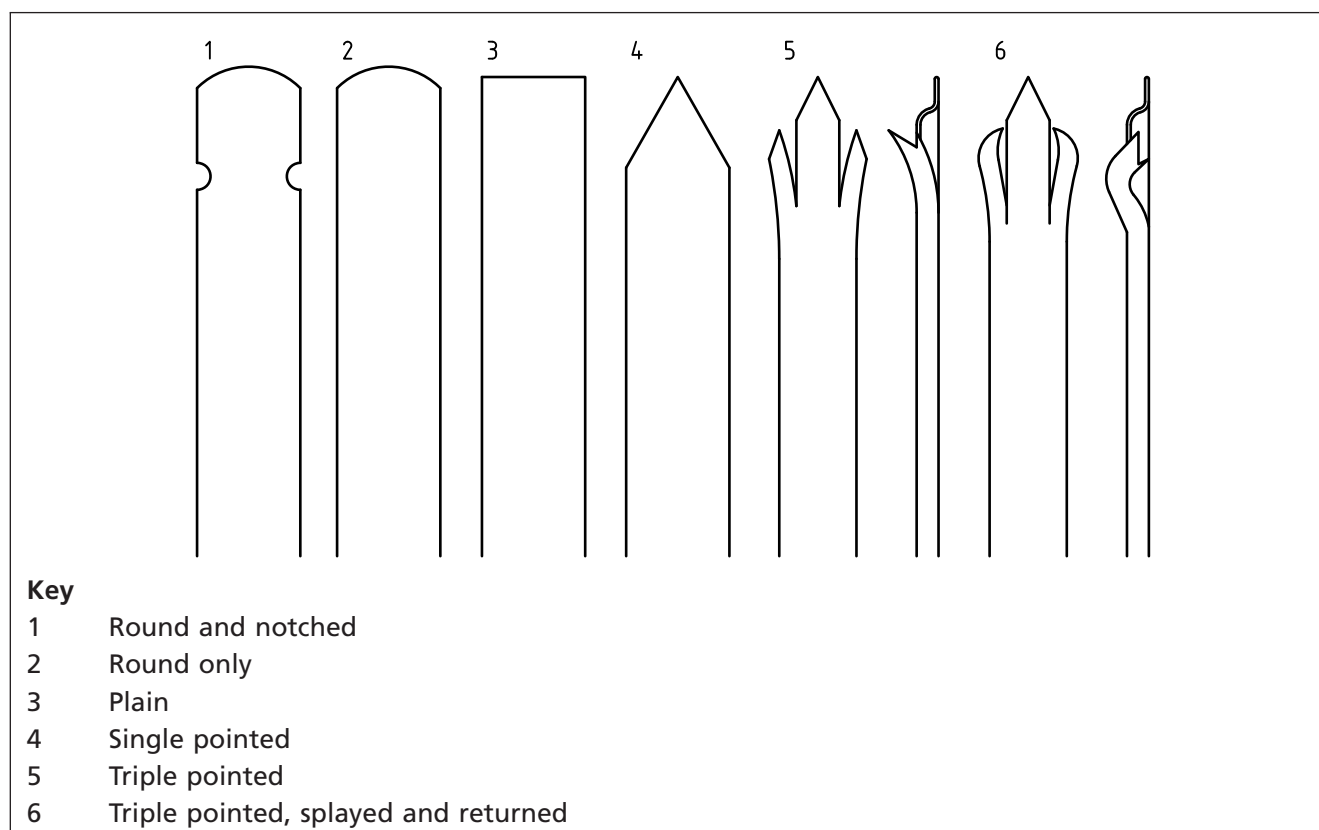
NOTE 2 Special fabrication procedures for pales might be required for fences to be installed on a gradient.

NOTE 3 The shape of the tops of the pales should be obtained from the purchaser. The shape of the tops of the pales should be selected from the basic shapes as shown in Figure 1 or from the manufacturer's literature. Pointed head pales are not recommended for use on fences less than 2.1 m high adjacent to public thoroughfares.

For SP fences, pale top shapes 1, 2 and 3 shall not be used (see Figure 1) unless some form of topping is also specified (see 6.4).

NOTE 4 Figure 1 illustrates typical angle pale top shapes.

Figure 1 Typical pale top shapes



5.2 Pale to rail fixing

All samples tested for the pale to rail fixing assembly shall withstand the following loadings when tested in accordance with Annex E:

- a) for GP fences: 10 kN; and
- b) for SP fences: 18 kN.

5.3 Posts

Posts shall be provided at a maximum of 2.75 m centres.

When a fence is fabricated with pointed top pales, posts shall also be pointed. Where posts are required at different centres, the centres shall be specified and all components shall be purpose designed.

Posts shall be embedded in concrete foundations to the minimum depths given in Table 1 and Table 2. Where removable lengths of palisade fence are required, the construction details or design criteria for the removable posts and their foundations shall be specified.

5.4 Stays

If stays are necessary to withstand abnormal loading or site conditions, the design criteria or constructional details of the stays shall be specified.

NOTE The fences specified by this British Standard are designed to be used without stays.

5.5 Rails

Fences shall have a minimum of two horizontal rails.

NOTE For SP fences, additional rails can be added by agreement between purchaser and supplier (see Clause 6).

5.6 Post to rail connections

Each rail shall be secured to posts with connector plates or fish plates bolted to the vertical leg of the rail. For SP fences, a fish plate or a connector plate shall be fitted to the web of the post. The diameter of the bolts shall be as given in Table 1 and Table 2. Provision shall be made for thermal expansion by providing slotted holes at the rail to plate connection. Plates shall be a minimum of 6 mm thick, and of sufficient sizing to give a minimum distance of 9 mm to the edge of the hole.

Connector plates or fish plates shall be connected to the post by one of the following methods:

- a) bolting;
- b) welding; or
- c) slotting.

5.7 Intermediate supports

Where appropriate, intermediate supports shall be provided to the lower structural rail in order to prevent the rail deflecting in excess of 10 mm (at any point) under the weight of the fence.

5.8 Protective treatment

After fabrication of gates and fencing components, including the punching or drilling of any holes and all welding, the fencing and gates shall be hot dip galvanized in accordance with BS EN ISO 1461, unless otherwise specified by the purchaser.

6 Security purpose (SP) fences

6.1 General

Additional security measures shall be taken for all SP fences.

NOTE These measures are optional for GP fences.

6.2 Burrowing

If burrowing is possible, one of the following measures shall be specified:

- a) a concrete sill shall be provided in accordance with 9.1.3;