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Fences –

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

bsi.

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Contents

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This British Standard supersedes BS 1722-12:2006, which is withdrawn.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/m^2 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	Dimensions				
		Posts	Rails (horizontal)		Pales (maximum gap between pales, face-to-view, 89 mm)	
		Embedded length[A]	Length	Typical connector bolt diameter	Oversail	
					Top	Bottom[B]
	m	mm	m	mm	mm	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	
					Top	Bottom[B)]
	m	mm	m	mm	mm	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:

a) 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

b) 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:

a) 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

b) 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:

a) 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/mm^2, 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/mm^2. 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.

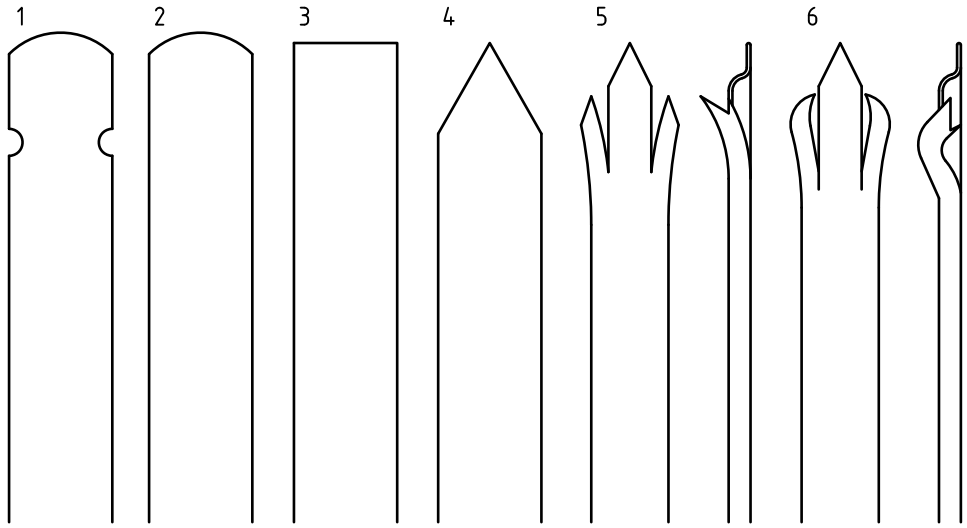
NOTE 2 Special fabrication procedures for pales might be required for fences to be installed on a gradient.

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**



Key

1 Round and notched
2 Round only
3 Plain
4 Single pointed
5 Triple pointed
6 Triple pointed, splayed and returned

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**;

b) pales shall be extended by 150 mm and embedded in the concrete sill as in a); or

c) pales shall be extended by 350 mm and buried in the ground.

6.3 Increased resistance to penetration

To increase resistance to pale removal, and if the pales are not buried or set in concrete in accordance with **6.2**, an additional rail shall be attached to the lower part of each pale. This additional rail shall be fixed to the pales 100 mm from the bottom of the pale.

NOTE To increase resistance to penetration additional rails can be added, for example, at waist height, by agreement between purchaser and supplier.

6.4 Topping

If required, further security against climbing shall be provided by fixing a spiked topping, barbed wire entanglement or barbed tape concertina to the pales. Such toppings shall be fitted as close to the top of the pales as possible or, in the case of barbed coils, the wire shall sit within the oversail.

NOTE The use of such toppings on SP fences is highly recommended. However, the use of barbed tape concertina is not recommended for fences below 3 m in height as the bottom of the coil should not be less than 2.5 m above ground level.

7 Renovation and repair of hot dipped galvanized coatings

The fence shall be inspected after installation and any damaged areas found in the hot dipped galvanized coating shall be repaired in accordance with one of the procedures given in BS EN ISO 1461:2009, **6.3**.

*NOTE 1 The procedures given in BS EN ISO 1461:2009, **6.3**, include thermal spraying with zinc or use of a suitable zinc rich paint.*

If zinc rich paint is used, such paint shall be in accordance with BS 4652, i.e. at least 80% in the dry film.

The coating thickness in the repaired area shall exceed that of the local galvanized coating layer. [4)]

NOTE 2 Minimum thickness 100 µm , see BS EN ISO 1461.

8 Construction of gates

8.1 General

Gates supplied shall provide a comparable degree of security to the adjacent fencing. The overall height of the gates when fixed shall not be less than the adjacent fencing height. The top and bottom rails of the gates shall be at the same level as the fence rails.

The distance from the bottom edge of the gate pales to the surface of the road shall not exceed 70 mm when the gate is in the closed position.

[4)] Suitable proprietary coating repair products are given by the Galvanizers' Association (www.hdg.org.uk). This information is given for the convenience of users of this standard and does not constitute an endorsement by BSI of these products.

The spacing of pales on the gates shall not be greater than that used on the fencing. The clear distance between any vertical framing of the gates and adjacent posts or pales shall not be greater than the clear distance between pales on the adjacent fencing.

All gate frame joints shall be continuously welded.

NOTE 1 The recommended minimum section sizes for gate frames are given in Table 4; alternative section sizes can be used if agreed between purchaser and supplier.

To provide rigidity and to limit deflection and sag in service:

a) all pales used shall be fully welded with 3 mm fillet welds at their contact points with the frame so that they form an integral part of the structure of the gate; or

b) vertical members shall be fully welded and located behind the pales at intervals not greater than 2 m and not more than 1 m from the hinge end of the frame.

Where pales are not welded they shall be attached by the same method as fence pales. This method shall afford the same resistance to penetration as the fence. There shall be no footholds between the top and bottom horizontal rails of the gate. Cross-bracing shall not be used. All welding operations shall be carried out in accordance with BS EN 1011-1 and BS EN 1011-2.

NOTE 2 Attention is drawn to BS EN 287-1 regarding personnel.

Table 4 **Typical frame sizes for individual gate leaf widths (pairs or singles)**

Fence height	Typical frame sizes for individual gate leaf widths							
m	≤1.5 m m	>1.5 m ≤1.75 m m	>1.75 m ≤2.5 m m	>2.5 m ≤3.5 m m	>3.5 m ≤3.75 m m	>3.75 m ≤4.75 m m	>4.75 m ≤5.5 m m	>5.5 m ≤6.5 m m
1.5	60 × 40 × 3	60 × 40 × 4	80 × 40 × 4	90 × 50 × 3.5	90 × 50 × 3.5	90 × 50 × 3.5	90 × 50 × 3.5	100 × 60 × 5
1.8	60 × 40 × 3	60 × 40 × 4	80 × 40 × 4	90 × 50 × 3.5	90 × 50 × 3.5	90 × 50 × 3.5	90 × 50 × 3.5	100 × 60 × 5
2.1	60 × 40 × 3	60 × 40 × 4	80 × 40 × 4	90 × 50 × 3.5	90 × 50 × 3.5	90 × 50 × 3.5	100 × 60 × 5	100 × 60 × 5
2.4	60 × 40 × 3	60 × 40 × 4	80 × 40 × 4	90 × 50 × 3.5	90 × 50 × 3.5	100 × 60 × 5	100 × 60 × 5	100 × 60 × 5
3 [A)]	90 × 50 × 3	60 × 40 × 3.5	100 × 40 × 5	100 × 60 × 5	100 × 60 × 5	100 × 60 × 5	120 × 60 × 5	120 × 60 × 6
3.6 [A)]	90 × 50 × 3	60 × 40 × 3.5	100 × 40 × 5	100 × 60 × 5	100 × 60 × 5	100 × 60 × 5	120 × 60 × 5	120 × 60 × 6

[A)] See Clause **8** for construction details.

NOTE 1 Where the clear opening of a gateway is critical this should be specified.
NOTE 2 The dimensions of the hollow sections specified are minimum dimensions.

8.2 Hinges

8.2.1 Hinge safety

Gates used shall be designed such that failure of a single hinge does not allow the gate to fall.

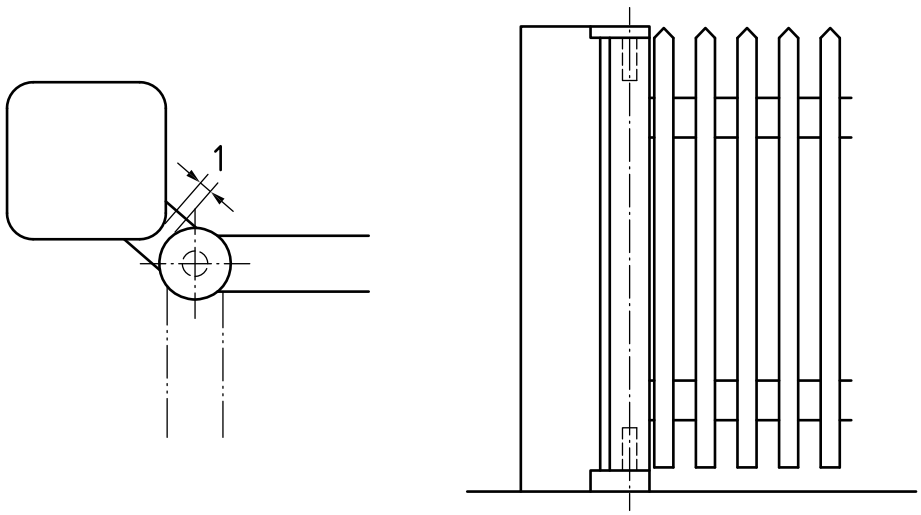
Hinges and gate posts used shall be designed to take the full load of the gate plus an allowance for superimposed vertical loads equal to 100 kg applied at the nose of the gate without deflection in any position detrimental to its operation.

Each hinge mechanism used shall be so designed to bear a load equal to 3.5 times the weight of the finished gate leaf.

NOTE 1 Typical dimensions of hinge components are given in Table 5 and Table 6. An example of a constant hinge gap is given in Figure 2.

NOTE 2 To prevent trapping injuries hinge gaps should be no greater than 89 mm, with moving gaps not closing to less than 12 mm unless the gap never exceeds 8 mm during any point of its operation (see BS EN 1176-1). Hinge guards where used should not cause any shearing or trapping points.

Figure 2 **Example of a constant gap hinge design**



Key

1 Constant gap ≤89 mm (see BS EN 1176-1)

Table 5 – Typical minimum requirements for fittings for gates

Height of fence	Fitting schedule category			
	For single gate	For pair of gates		
m	1.5 m wide or less	3.5 m wide or less	Over 3.5 m up to 5 m wide	Over 5 m up to 7 m wide
2.4	A	B	B	C
3	B	B	D	D
3.6	B	B	D	D

NOTE See Table 6, Figure 2, Figure 3, Figure 4, Figure 5 and Figure 6 for additional information on typical requirements for fittings for gates.

Table 6 **Typical minimum dimensions for gate fittings**

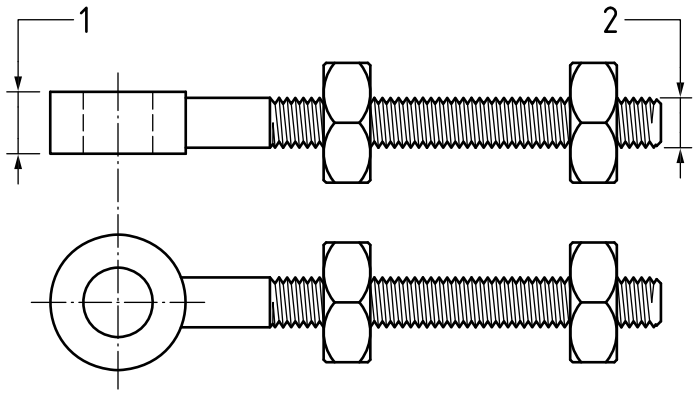
Description	Dimensions			
	Schedule A	Schedule B	Schedule C	Schedule D
	mm	mm	mm	mm
Hinge pins diameter	20	20	30	–
Pivot bolt diameter	20	20	30	30
Gate eye bolt:				
Eye thickness	20	20	30	30
Bolt diameter	20	20	30	30
Lugs:				
Single	20	20	30	–
Double	15	20	20	20
Backing plate thickness	10	12	12	12
Bolt diameter for connecting backing plate to gate frame or posts	2 × 16	2 × 20	2 × 20	2 × 20
Heel pin diameter	–	–	30	40
Heel cup block	–	–	75 × 75 on plan × 50 deep	75 × 75 on plan × 50 deep
Locking bar	50 × 10	50 × 10	75 × 10	75 × 10
Drop bolt diameter	20	22	22	22
Slam plate	6	8	8	8

8.2.2 Hinges and security

Hinges used shall be designed so that it is impossible to remove the gates by lifting at the hinges when they are in the shut and locked position. The hinges shall be provided with a simple and easily applied system of adjustment for the correction of sag, settlement or misalignment during installation and service.

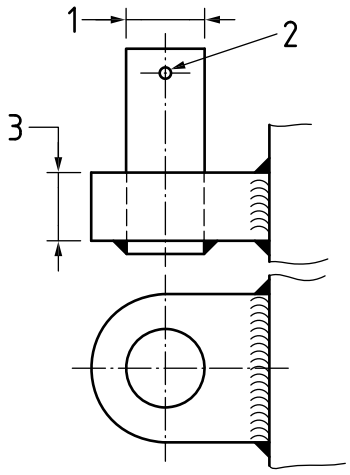
NOTE See Figure 3 for an example of a hinge eyebolt and Figure 4 for an example of a hinge pin.

Figure 3 – Example of a hinge eyebolt



Key
1 Eye thickness
2 Bolt diameter

Figure 4 – Example of a hinge pin



Key

1 Hinge pin diameter
2 Hole for fastener to prevent removal of gate (top hinge only)
3 Lug thickness

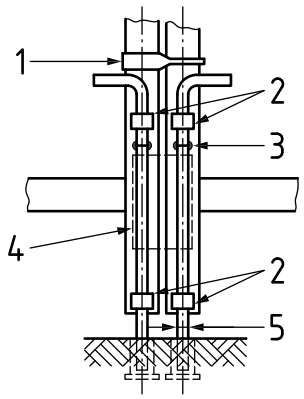
8.3 Drop bolts and slam plates

NOTE 1 Typical dimensions for drop bolt and slam plate are shown in Table 5 and Table 6.

Mild steel (low carbon steel) drop bolts shall be fitted to all gate frames (and therefore to each leaf of a double gate) so that they cannot be removed. Corresponding sleeves to receive the bolts shall be set securely in the ground and concreted in to enable the gate to be secured in both the closed and opened position. The last closing leaf of double gates shall incorporate a stop that prevents one drop bolt being lifted when the gates are closed. Double gates shall be provided with slam plates top and bottom on the first closing leaf.

NOTE 2 See Figure 5 for an example of a drop bolt arrangement.

Figure 5 **Example of a drop bolt arrangement**



Key

1 Stop (prevents bolt being lifted when a second gate is closed)
2 Guides
3 Fastener (prevents removal of bolt)
4 Slam plate
5 Bolt diameter

8.4 Locking devices

NOTE 1 Typical sizes for locking device are shown in Table 5 and Table 6.

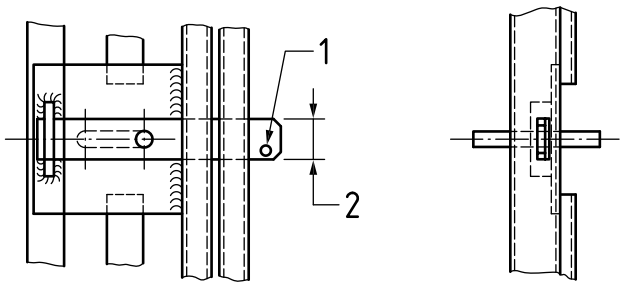
Double gates shall be fitted with a sliding horizontal locking bar, secured to a locking plate welded to the gate frame at approximately mid-height (but not exceeding 1.5 m) to ensure that the locking bar passes through both of the meeting stiles so that the two gate leaves are firmly held in the shut position.

Locking bars shall be holed to receive a padlock or the locking plate shall be prepared for alternative locking devices where specified by the purchaser.

Locking devices on SP gates shall not form a foothold or climbing aid on the face of the gate.

NOTE 2 See Figure 6 for an example of a locking bar arrangement.

Figure 6 – Example of a locking bar arrangement



Key

1 Hole to suit padlock size and type

2 Locking bar size

8.5 Gate posts

Hinges and gate posts used shall be designed to take the full load of the gate plus an allowance for superimposed vertical loads equal to 100 kg applied at the nose of the gate without deflection in any position detrimental to its operation.

NOTE 1 Typical dimensions for gate posts are shown in Table 7 and Table 8.

NOTE 2 In calculating the dimensions, it has been assumed that the major axis of the post is perpendicular to the line of the fence.

NOTE 3 Alternative section sizes can be used if agreed between purchaser and supplier.

Table 7 – Typical dimensions of steel posts (RSJ, UB or UC) for individual gate leaf widths (pairs or singles)

Fence height	Embedded length (see **8.3**)	Typical size of steel posts for individual gate leaf widths							
		≤1.5 m	>1.5 m ≤1.75 m	>1.75 m ≤2.5 m	>2.5 m ≤3.5 m	>3.5 m ≤3.75 m	>3.75 m ≤4.75 m	>4.75 m ≤5.5 m	>5.5 m ≤6.5 m
m	mm	mm	mm	mm	mm	mm	mm	mm	mm
1.5	525	178 × 102 × 19	178 × 102 × 19	152 × 152 × 37	152 × 152 × 37	203 × 203 × 60	203 × 203 × 60	203 × 203 × 60	203 × 203 × 86
1.8	525	178 × 102 × 19	178 × 102 × 19	152 × 152 × 37	152 × 152 × 37	203 × 203 × 60	203 × 203 × 60	203 × 203 × 60	203 × 203 × 86
2.1	625	178 × 102 × 19	178 × 102 × 19	152 × 152 × 37	203 × 203 × 60	203 × 203 × 60	203 × 203 × 86	203 × 203 × 86	254 × 254 × 107
2.4	725	178 × 102 × 19	152 × 152 × 37	152 × 152 × 37	203 × 203 × 60	203 × 203 × 60	203 × 203 × 86	254 × 254 × 89	254 × 254 × 107
3	925	152 × 152 × 37	152 × 152 × 37	203 × 203 × 60	203 × 203 × 60	203 × 203 × 86	254 × 254 × 89	254 × 254 × 89	305 × 305 × 97
3.6	1 125	152 × 152 × 37	152 × 152 × 37	203 × 203 × 60	203 × 203 × 60	203 × 203 × 86	254 × 254 × 89	254 × 254 × 89	305 × 305 × 97

NOTE The dimensions of the sections specified are minimum dimensions.

Table 8 – Typical steel posts sizes (RHS) for individual gate leaf widths (pairs or singles)

Fence height	Embedded length	Recommended size of steel posts for individual gate leaf widths							
	(see **8.3**)	≤1.5 m	>1.5 m ≤1.75 m	>1.75 m ≤2.5 m	>2.5 m ≤3.5 m	>3.5 m ≤3.75 m	>3.75 m ≤4.75 m	>4.75 m ≤5.5 m	>5.5 m ≤6.5 m
m	mm	mm	mm	mm	mm	mm	mm	mm	mm
1.5	525	80 × 80 × 5	100 × 100 × 5	100 × 100 × 6	120 × 120 × 6	200 × 200 × 6	200 × 200 × 6	200 × 200 × 6	200 × 200 × 6
1.8	525	80 × 80 × 5	100 × 100 × 5	100 × 100 × 6	120 × 120 × 6	150 × 150 × 6	200 × 200 × 6	200 × 200 × 6	200 × 200 × 6
2.1	625	80 × 80 × 5	100 × 100 × 6	120 × 120 × 6	120 × 120 × 6	150 × 150 × 6	200 × 200 × 6	200 × 200 × 6	200 × 200 × 8
2.4	725	80 × 80 × 5	100 × 100 × 6	120 × 120 × 6	120 × 120 × 6	150 × 150 × 6	200 × 200 × 6	200 × 200 × 6	200 × 200 × 8
3	925	100 × 100 × 5	100 × 100 × 6	120 × 120 × 6	150 × 150 × 6	200 × 200 × 6	200 × 200 × 6	200 × 200 × 6	250 × 250 × 8
3.6	1 125	100 × 100 × 5	100 × 100 × 6	120 × 120 × 6	150 × 150 × 6	200 × 200 × 6	200 × 200 × 6	200 × 200 × 6	250 × 250 × 8

NOTE The dimensions of the steel sections specified are minimum dimensions.

Section 2: Installers

9 Installation

9.1 Foundations and sills

*COMMENTARY ON **9.1***

During gate installation, where ground conditions necessitate, a hard threshold should be used to prevent burrowing.

9.1.1 General

Foundations for SP fences and gates used shall be designed to take account of conditions of service if these give rise to loads in excess of the defined wind loads.

Posts for all steel palisade fences shall be set in concrete where appropriate. The presence of any electricity, gas, water or other underground services shall be established prior to commencement of excavation, drilling or installation in the working area.

9.1.2 Holes for fence post foundations

Unless specifically designed foundations are specified by the purchaser, the dimensions in plan of the holes excavated to receive the posts shall conform to Table 9. The hole shall be formed, with vertical sides, to a depth below ground level equal to one third of the height of the fence above ground level.

Table 9 – Holes for fence post foundations

Fence height above ground level	Minimum plan dimensions	
	Square hole	Round hole
m	mm	mm
Less than 2.4	350 × 350	450 diameter
2.4	350 × 350	450 diameter
3	450 × 450	600 diameter
3.6	450 × 450	600 diameter

NOTE These foundation sizes are based on the assumption of average ground conditions and wind loading. In abnormal conditions, conditions of extreme exposure or severe conditions of service, special measures might be required.

9.1.3 Concrete sills

Where a concrete sill is specified by the purchaser, it shall be formed of in-situ concrete and shall be continuous between posts under the line of the pales. The sill shall be not less than 125 mm wide × 150 mm deep and cast with the top at, or within, 50 mm of ground level so that the distance between the underside of the pales and the top of the sill does not exceed 50 mm. If shuttering of the side or weathering of the top of the sill is required, this shall be specified.

9.1.4 Concrete for post foundations and sills

Concrete for post foundations and sills shall be at least one part cement to ten parts 20 mm all-in ballast conforming to BS EN 12620 mixed with the minimum requisite quantity of clean water, or grade C8/10 or ST2 concrete conforming to BS 8500-1:2015+A1:2016 and BS 8500-2:2015+A1:2016. The concrete shall be placed in position before commencement of the initial set.

9.2 Line

The fence shall follow lines specified by the purchaser. The bottom of the pales shall be not more than 50 mm above mean ground level or concrete sill level.

The presence of any electricity, gas, water or other underground services shall be established prior to commencement of excavation, drilling or installation in the working area.

NOTE Unless otherwise agreed between the purchaser and supplier (see Annex F) the installation of the fence does not include work required to cut or fill the ground to vary levels, nor does it cover special work to secure culverts, ditches, etc.

9.3 Posts

Posts shall be fixed in a concrete base to the appropriate depth.

NOTE 1 The minimum quantity of water necessary depends on the moisture content of the ballast prior to mixing.

Posts shall be vertical. The holes for the posts shall be filled to ground level, top of ground beam or road level with concrete which shall be rammed as the filling proceeds. The top of the concrete shall be weathered.

NOTE 2 See Table 9 for foundation sizes.

9.4 Posts for gates

Posts shall be fixed in a concrete base to the appropriate depth in accordance with the manufacturer's recommendations.

NOTE As a minimum, foundations should conform to those in Table 9.

Posts shall be vertical. The hole for the posts shall be filled to ground level, top of ground beam or road level with concrete which shall be rammed as the filling proceeds. The top of the concrete shall be weathered.

9.5 Intermediate supports

Intermediate supports, where required, shall be embedded in concrete to a depth of 100 mm. The concrete shall be either a concrete sill as specified in **9.1** or a concrete base (150 × 150 × 150) mm deep with the top at ground level.

9.6 Fastenings

On completion, fastenings shall be secure and tamper resistant, i.e. not removed using easily obtainable tools.

10 Statement of conformity

10.1 Fence installer

On completion, the fence installer shall provide the end user with a certificate, conforming to **10.2**, confirming that the installation and materials used are in accordance with this British Standard.

*NOTE 1 This certificate can be in the form of an invoice provided this conforms to **10.2**.*

The installer shall take responsibility for the materials used.

NOTE 2 On delivery, the installer can obtain a certificate/documentation from the manufacturer/supplier, stating materials supplied are in accordance with this British Standard.

10.2 Certificate/documentation

In addition to the requirements of **10.1**, the certificate/documentation shall also include the following information:

a) the supplier's name and address;

b) the contract or order number;

c) the date of delivery or installation;

d) the purchaser's name and address.

Test reports shall be provided as part of the certificate in accordance with **A.5**, **B.4** and **C.4**.

10.3 Statement

The installer shall make a written statement which details that it is their policy to conform to a previously agreed specification with the client and to offer goods and/or services accordingly. The installer shall obtain the same written statement from suppliers used.

NOTE This might be done by inclusion in any trade advertising and/or any terms of trading statements supplied with quotations.

Annex A (normative) Method for the determination of characteristic flexural strength of pales

A.1 Principle

The aim of this test is to determine a method of characteristic flexural strength of pales.

A.2 Apparatus

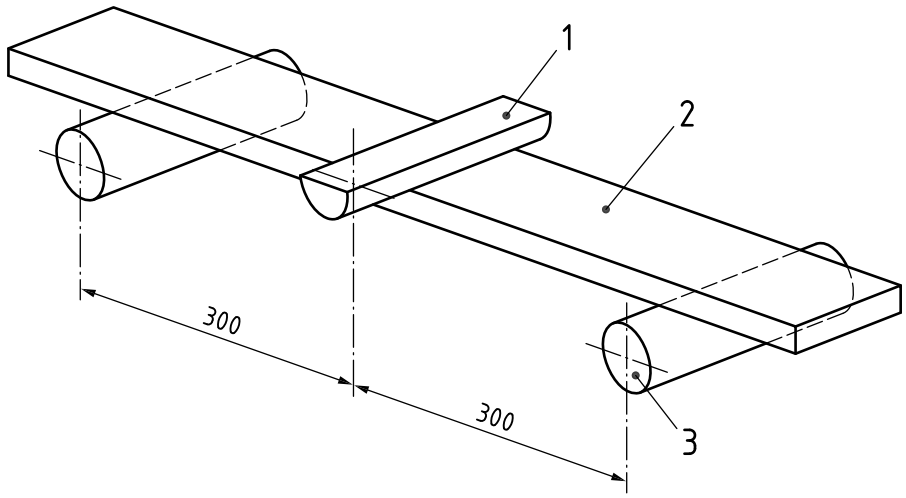
A.2.1 General

The test shall be carried out using any reliable machine of sufficient capacity with the capability to apply the load continuously and vertically.

The device for applying the load shall consist of two radiused supports and a load-applying roller or radiused pad (see Figure A.1).

Figure A.1 **Arrangement of loading test specimen**

Dimensions in mm



Key

1 Ø 40 loading pad
2 Test specimen
3 Ø 40 supporting rollers capable of rotation

All rollers, radiused loading pads and blocks shall be manufactured from steel and shall have a circular cross section with a diameter of (40 ±2) mm. They shall be at least 10 mm longer than the width of the test specimen.

The distance between the outer supports (i.e. the span) shall be equal to 600 mm. The load shall be applied at the centre of the span as shown in Figure A.1. All rollers shall be adjusted in their correct position with all distances having an accuracy of ±1 mm.

A.2.2 Load control

The machine shall be capable of applying the load uniformly without shock using manual or automatic control.

A.2.3 Load scale indicators or digital displays

A.2.3.1 The machine shall be provided with either:

a) easily read dials or scales which conform to BS 3693; or

b) electrical load indicators, which shall include a visual display.

If electrical load indicators are supplemented by recording devices, e.g. punched tape or printout recorders, these shall conform to the calibration requirements of BS EN ISO 376.

A.2.3.2 The machine shall conform to grade 2 of BS EN ISO 7500-1:2015. The machine scale range shall be chosen so that the specimens can be tested in the part of the range which is certified accurate to ±2% of the indicated load.

A.2.3.3 The grading of the machine in accordance with BS EN ISO 7500-1 shall not be affected by variations in mains supply voltage or frequency of ±10% from the typical value to the machine.

NOTE Where electrical or other interference exists, this can affect the accuracy of load indication and provisions to overcome this interference might be necessary.

A.2.4 Load verification

The machine dials, scales or displays shall be verified in accordance with BS EN ISO 7500-1.

A.2.4.1 *2 m metric metal tape measure*, conforming to BS 4484-1.

A.2.4.2 *0 mm to 25 mm dial test indicator*, conforming to BS 907.

A.3 Test specimens

A.3.1 Dimensions

Test specimens supplied by the mill or pale producer before any other form of processing, machining or surface treatment shall consist of pale cut to (1 000 ±20) mm in length.

A.3.2 Sample size

Six test specimens shall be tested.

A.4 Test procedure

A.4.1 The bearing surfaces of the supporting and loading members shall be wiped clean and any loose surface deposits shall be removed from the specimen.

A.4.2 The specimen shall be placed in the machine, correctly centred and with the longitudinal axis of the specimen at right angles to the supporting and loading rollers.

NOTE Packing between the specimen and the rollers should not be used.

A.4.3 The test load shall be applied when all loading and support members are in even contact with the specimen.

A.4.4 Any specimen which, due to twist, has a clearance of more than 1 mm from any contact position under zero load shall be discarded without testing.

A.4.5 A datum for deflection shall be established.

A.4.6 The test load shall be applied steadily and without shock over a period of not less than 30 s.

A.4.7 When equilibrium has been achieved, the deflection at the centre of the span shall be measured and recorded.

A.4.8 Using a new test specimen each time, the test shall be completed three times with the face of the pale uppermost and three times with the back of the pale uppermost.

A.5 Test report

A.5.1 The test report shall affirm that the tests were carried out in accordance with this annex, shall include the information in **A.5.2** and **A.5.3** and shall include the results of the tests.

A.5.2 The test report shall also state whether or not certificates of sampling and specimen preparation are available. If available, a copy of each certificate shall be provided.

A.5.3 Information to be provided to the test laboratory

The following information shall be provided to the test laboratory for inclusion in the test report:

a) the date, time and place of sampling and the sample identity number; and

b) the name of the supplier.

A.5.4 Information to be provided by the test laboratory

The following information on each specimen shall be provided by the test laboratory for inclusion in the test report:

a) identification (including pale profile);

b) condition when received;

c) date of receipt;

d) measured length, thickness, width and depth;

e) any surface preparation;

f) deflection at the specified loading;

g) date of test; and

h) any other remarks, as necessary.

Annex B (normative) Method for the determination of characteristic flexural strength of posts

B.1 Apparatus

B.1.1 General

The test shall be carried out using any reliable machine of sufficient capacity with the capability to apply the load continuously and vertically.

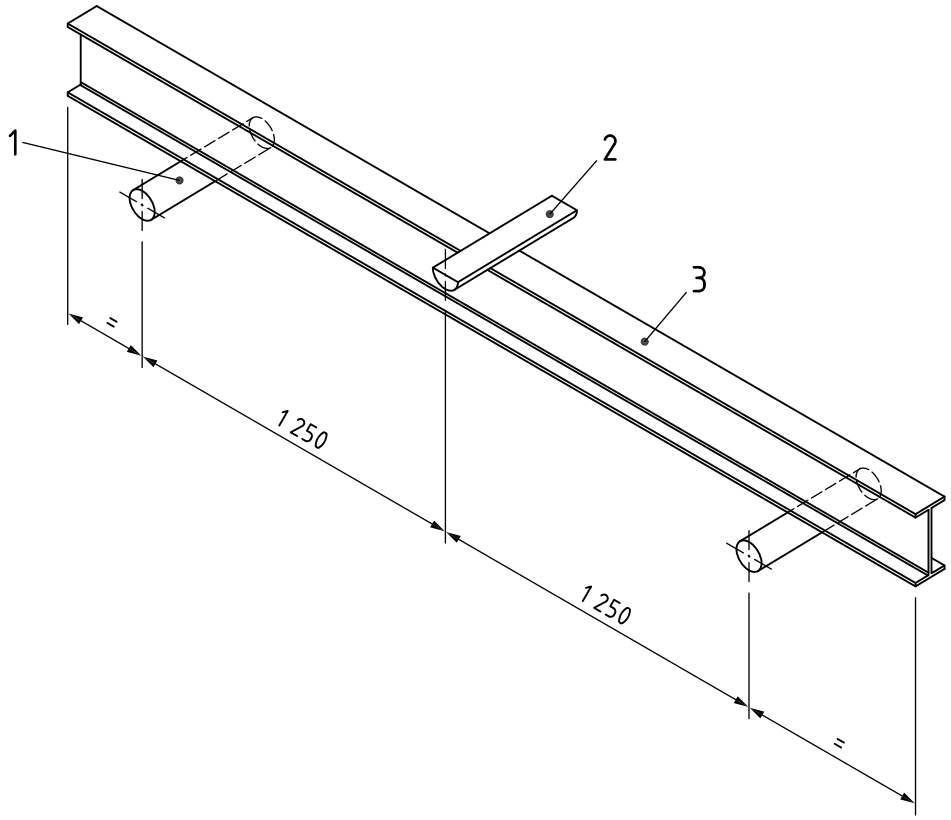
The device for applying the load shall consist of two radiused supports and a load-applying roller or radiused pad (see Figure B.1).

All rollers, radiused loading pads or blocks shall be manufactured from steel and shall have a circular cross section with a diameter of (40 ±2) mm. They shall be at least 10 mm longer than the width of the test specimen.

The distance between the outer supports (i.e. the span), shall be equal to 2 500 mm. The load shall be applied at the centre of the span as shown in Figure B.1. All rollers shall be adjusted in their correct position with all distances having an accuracy of ±1 mm.

Figure B.1 **Arrangement of loading test specimen**

Dimensions in mm



Key

1 Ø 40 supporting rollers capable of rotation
2 Ø 40 loading pad
3 Test specimen (angle section)

B.1.2 Load control

The machine shall be capable of applying the load uniformly without shock using manual or automatic control.

B.1.3 Load scale indicators or digital displays

B.1.3.1 The machine shall be provided with either:

a) easily read dials or scales which conform to BS 3693; or

b) electrical load indicators, which shall include a visual display.

If electrical load indicators are supplemented by recording devices, e.g. punched tape or printout recorders, these shall conform to the calibration requirements of BS EN ISO 376.

B.1.3.2 The machine shall conform to grade 2 of BS EN ISO 7500-1:2015. The machine scale range shall be chosen so that the specimens can be tested in the part of the range which is certified accurate to ±2% of the indicated load.

B.1.3.3 The grading of the machine in accordance with BS EN ISO 7500-1 shall not be affected by variations in mains supply voltage or frequency of ±10% from the typical value to the machine.

NOTE Where electrical or other interference exists, this can affect the accuracy of load indication and special provisions to overcome this interference might be necessary.

B.1.4 Load verification

The machine dials, scales or displays shall be verified in accordance with BS EN ISO 7500-1.

B.1.4.1 *4 m metric metal tape measure*, conforming to BS 4484-1.

B.1.4.2 *0 mm to 25 mm dial test indicator*, conforming to BS EN ISO 463.

B.2 Test specimens

B.2.1 Dimensions

Test specimens supplied by the mill or post producer before any other form of processing, machining or surface treatment shall consist of post cut to (3 000 ±20) mm in length.

B.2.2 Sample size

Three or six test specimens shall be tested (see **B.3.9**).

B.3 Test procedure

B.3.1 The bearing surfaces of the supporting and loading members shall be wiped clean and any loose surface deposits shall be removed from the specimen.

B.3.2 The specimen shall be placed in the machine, correctly centred and with the longitudinal axis of the specimen at right angles to the supporting and loading rollers.

NOTE If the profile of the post section being tested means it is unsuitable for testing without the inclusion of additional supports (the profile renders it unstable without lateral restraint), such restraint can be included at both supporting ends providing that it does not prohibit the free movement of the post about the end support rollers or provide additional resistance to the test load being applied. Packing between the specimen and the rollers should not be used.

B.3.3 The test load shall be applied when all loading and support members are in even contact with the specimen.

B.3.4 Any specimen which, due to twist, has a clearance of more than 1 mm from any contact position under zero load shall be discarded without testing.

B.3.5 A datum for deflection shall be established.

B.3.6 The test load shall be applied steadily and without shock over a period of not less than 60 s.

B.3.7 When equilibrium has been achieved the deflection at the centre of the span shall be measured and recorded.

B.3.8 The test shall be completed three times using a new test specimen each time.

B.3.9 If the section profile being tested is not symmetrical about both axis, the post shall be tested three times with the face of the post uppermost and three times with the back of the post uppermost.

B.4 Test report

B.4.1 General

The test report shall affirm that the tests were carried out in accordance with this annex, shall include the information in **B.4.2** and **B.4.3** and shall include the results of the tests. The test report shall also state whether or not certificates of sampling and specimen preparation are available. If available a copy of each certificate shall be provided.

B.4.2 Information to be provided to the test laboratory

The following information shall be provided to the test laboratory for inclusion in the test report:

a) the date, time and place of sampling and the sample identity number; and

b) the name of the supplier.

B.4.3 Information to be provided by the test laboratory

The following information on each specimen shall be provided by the test laboratory for inclusion in the test report:

a) identification (including post profile);

b) condition when received;

c) date of receipt;

d) measured length, thickness, width and depth;

e) any surface preparation;

f) deflection at the specified loading;

g) date of test; and

h) any other remarks, as necessary.

Annex C (normative) Method for the determination of characteristic flexural strength of rails

C.1 Apparatus

C.1.1 General

The test shall be carried out using any reliable machine of sufficient capacity with the capability to apply the load continuously and vertically.

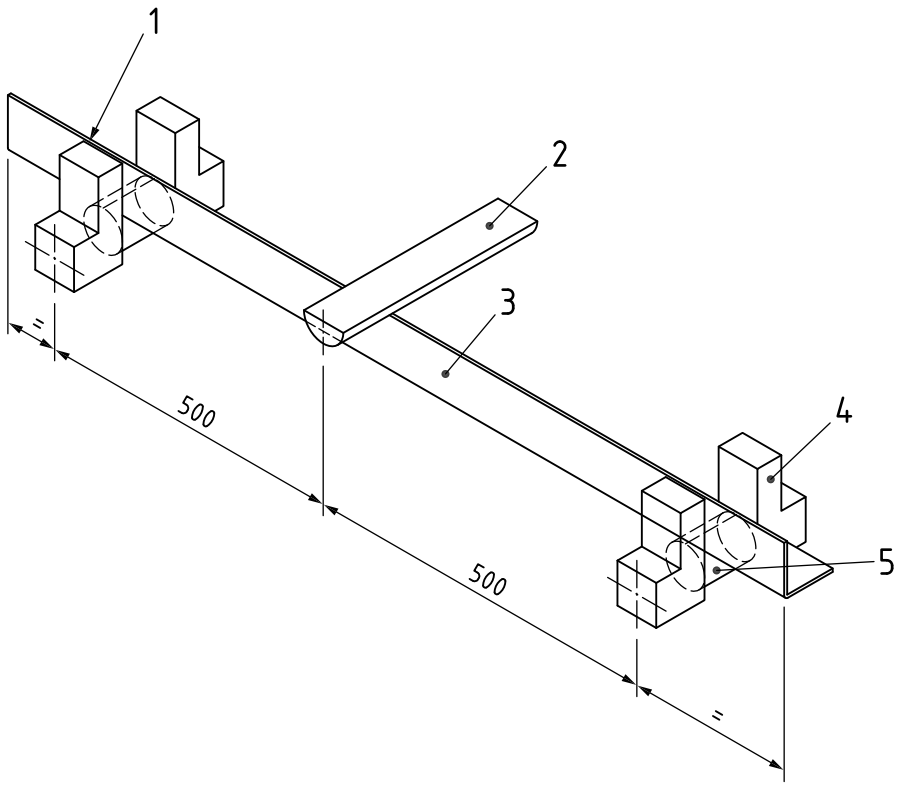
The device for applying the load shall consist of two radiused supports and a load-applying roller or radiused pad (see Figure C.1).

All rollers, radiused loading pads or blocks shall be manufactured from steel and shall have a circular cross section with a diameter of (40 ±2) mm. They shall be at least 10 mm longer than the width of the test specimen.

The distance between the outer supports (i.e. the span) shall be equal to 1 000 mm. The load shall be applied at the centre of the span as shown in Figure C.1. All rollers shall be adjusted in their correct position with all distances having an accuracy of ±1 mm.

Figure C.1 **Arrangement of loading test specimen**

Dimensions in mm



Key

1 Teflon [5)] packing between upright and test sample (to prevent frictional resistance)
2 Ø 40 loading pad
3 Test specimen (angle section)
4 Blocks at supports preventing angled section from overturning
5 Ø 40 supporting rollers capable of rotation

C.1.2 Load control

The machine shall be capable of applying the load uniformly without shock using manual or automatic control.

C.1.3 Load scale indicators or digital displays

C.1.3.1 The machine shall be provided with either:

a) easily read dials or scales which conform to BS 3693; or

b) electrical load indicators, which shall include a visual display.

If electrical load indicators are supplemented by recording devices, e.g. punched tape or printout recorders, these shall conform to the calibration requirements of BS EN ISO 376.

[5)] Teflon is a trade mark owned by Chemours Wilmington, Delaware, States. This information is given for the convenience of users of this standard and does not constitute an endorsement by BSI of the product named. Equivalent products may be used if they can be shown to lead to the same results.

C.1.3.2 The machine shall conform to grade 2 of BS EN ISO 7500-1:2015. The machine scale range shall be chosen so that the specimens can be tested in the part of the range which is certified accurate to ±2% of the indicated load.

C.1.3.3 The grading of the machine in accordance with BS EN ISO 7500-1 shall not be affected by variations in mains supply voltage or frequency of ±10% from the typical value to the machine.

NOTE Where electrical or other interference exists, this can affect the accuracy of load indication and provisions to overcome this interference might be necessary.

C.1.4 Load verification

The machine dials, scales or displays shall be verified in accordance with BS EN ISO 7500-1.

C.1.4.1 *2 m metric metal tape measure*, conforming to BS 4484-1.

C.1.4.2 *0 mm to 25 mm dial test indicator*, conforming to BS EN ISO 463.

C.2 Test specimens

C.2.1 Dimensions

Test specimens supplied by the mill or rail producer before any other form of processing, machining or surface treatment shall consist of rail cut to (1 400 ±20) mm in length.

C.2.2 Sample size

Six test specimens shall be tested.

C.3 Test procedure

C.3.1 The bearing surfaces of the supporting and loading members shall be wiped clean any loose surface deposits shall be removed from the specimen.

C.3.2 The specimen shall be placed in the machine, correctly centred and with the longitudinal axis of the specimen at right angles to the supporting and loading rollers.

NOTE If the profile of the rail section being tested means it is unsuitable for testing without the inclusion of additional supports (the profile renders it unstable without lateral restraint), such restraint can be included at both supporting ends providing that it does not prohibit the free movement of the rail about the end support rollers or provide additional resistance to the test load being applied. Packing between the specimen and the rollers should not be used.

C.3.3 The test load shall be applied when all loading and support members are in even contact with the specimen.

C.3.4 Any specimen which, due to twist, has a clearance of more than 1 mm from any contact position under zero load shall be discarded without testing.

C.3.5 A datum for deflection shall be established.

C.3.6 The test load shall be applied steadily and without shock over a period of not less than 30 s.

C.3.7 When equilibrium has been achieved the deflection at the centre of the span shall be measured and recorded.

C.3.8 Using a new test specimen each time, the test shall be completed six times. Test the rail three times with the face of the rail uppermost and three times with the back of the rail uppermost.

C.4 Test report

C.4.1 The test report shall affirm that the tests were carried out in accordance with this annex, shall include the information in **C.4.2** and **C.4.3** and shall include the results of the tests.

C.4.2 The test report shall also state whether or not certificates of sampling and specimen preparation are available. If available a copy of each certificate shall be provided.

C.4.3 The following information shall be provided to the test laboratory for inclusion in the test report:

a) the date, time and place of sampling and the sample identity number; and

b) the name of the supplier.

C.4.4 The following information on each specimen shall be provided by the test laboratory for inclusion in the test report:

a) identification (including post profile);

b) condition when received;

c) date of receipt;

d) measured length, thickness, width and depth;

e) any surface preparation;

f) deflection at the specified loading;

g) date of test; and

h) any other remarks, as necessary.

Annex D (normative) Method of determination of tensile strength of cold swaged pin and collar fixings

D.1 Principle

This annex describes a procedure for testing assembled fixings against pull-out and push-out loads.

This test is intended for design verification to be used:

a) during product development;

b) when there is a change in the design, cross section or material specification; and

c) whenever a definitive means of checking compliance is required.

D.2 Apparatus

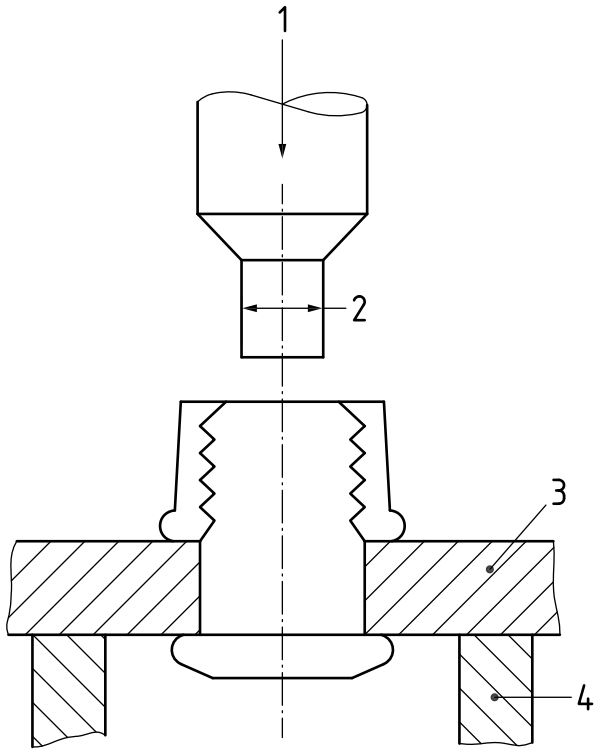
D.2.1 *Test plates of hardened steel*, as shown in Figure D.1 and Figure D.2, of a thickness suitable for the fastener to be tested.

D.2.2 *Hydraulic ram*, or other means of applying a force to the test plates and to test the plunger.

D.2.3 *Proving ring*, or other means of determining the force, applied to an accuracy of 0.5 kN.

Figure D.1 **Push-out test arrangement**

Dimensions in mm

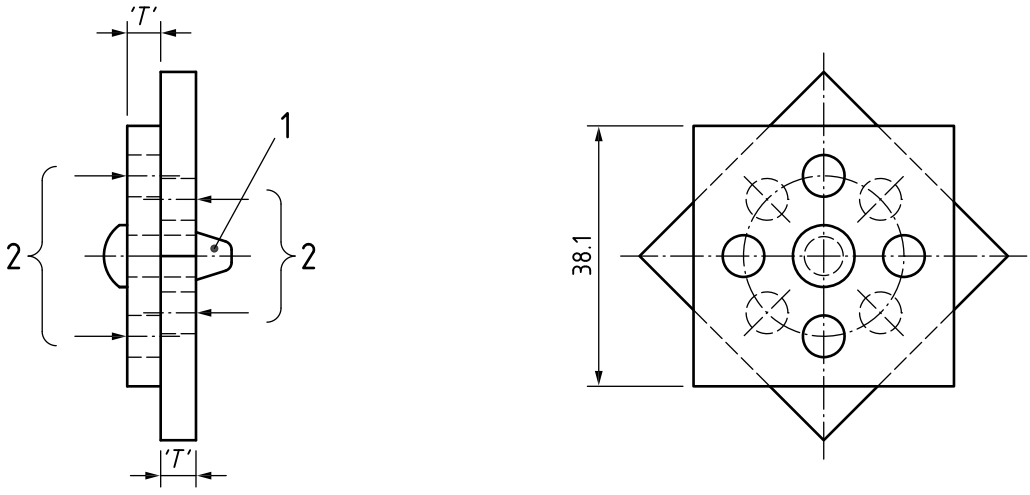


Key

1 Direction of applied load
2 Ø 0.25 = smaller than core diameter of pin
3 Steel block
4 Steel support block

Figure D.2 **Pull-out test arrangement**

Dimensions in mm



Key

1 Placed fastener
2 Load

D.3 Specimen

The specimen for the pull-out test shall consist of two test plates fastened together by the fixing under test, in accordance with the manufacturer's instructions. The specimens for the push-out test shall consist of the test fixing fastened to a steel block, in accordance with the manufacturer's instructions.

NOTE The hole diameter in the test pieces should be (8.2 ±0.05) mm for a nominal 8 mm fastener.

The thickness, *T*, shall be half the grip length of the fastener to be tested.

D.4 Sample size

A minimum of four fixings shall be tested.

D.5 Procedure for pull-out test

D.5.1 Two test plates of a total thickness equal to the maximum grip for the fastener shall be fastened together in accordance with the manufacturer's instructions.

D.5.2 An increasing load shall be applied to the plates in line with the axis of the fastener until the fastener fractures.

D.5.3 This shall be repeated with plates equal to the minimum grip for the fastener.

D.6 Procedure for push-out test

D.6.1 The fastener shall be fixed to a steel plate equal in thickness to the maximum grip for the fastener, in accordance with the manufacturer's instructions.

D.6.2 An increasing load shall be applied to the fastener via the plunger in line with the axis of the fastener until the fastener is pushed out.

D.6.3 This shall be repeated with a steel plate equal in thickness to the minimum grip for the fastener.

D.7 Test report

D.7.1 The four maximum loads for which the fastener was able to resist and identify them with each of the tests shall be recorded.

D.7.2 The tension test of the fastener which is the lowest of the four loads shall be reported.

Annex E (normative) Method of determination of the strength of the pale to fence rail fastening assembly

E.1 General

This annex describes the procedure for testing the assembled strength of the pale to fence rail fastening system. The test is intended for design verification when selecting components during:

a) product development;

b) whenever there is a change in design, product or material specification; and

c) to check compliance.

E.2 Apparatus

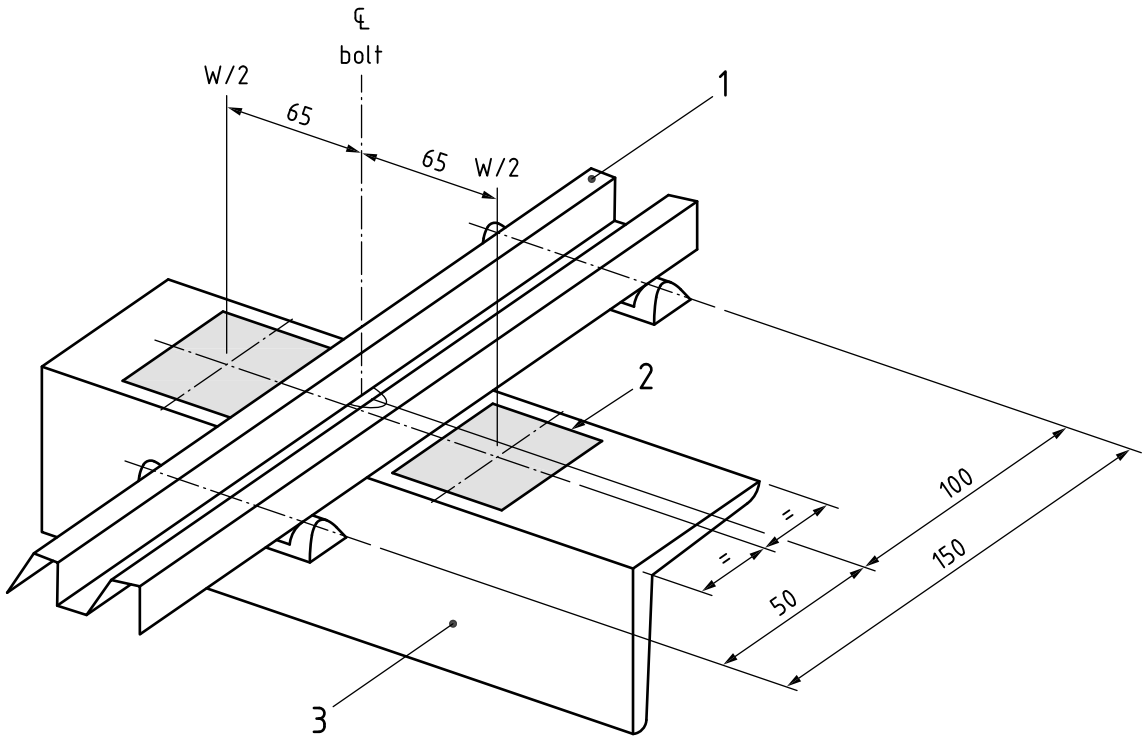
The test shall be carried out using any reliable machine of sufficient capacity with the capability to apply the load continuously and vertically, without shock, and at a strain rate not greater than 25 mm per minute.

The device for applying the load shall consist of two radiused supports and a heavy steel bridging piece with 50 mm square loading pads (see Figure E.1).

The span between supporting rollers shall be 150 mm and the centres of the loading pads shall be 130 mm.

Figure E.1 **Pale fixing test arrangement**

Dimensions in mm



Key

1 300 mm long piece of fence pale with fixing hole at mid-point of length
2 50 mm square loading area
3 200 mm long piece of fence rail

E.3 Test specimens

E.3.1 Sample size

Three test assemblies shall be tested.

E.3.2 Source

The test specimens shall be made from material and components of identical type and quality as those intended for use in the finished fencing system. The components and the machining of holes, etc., shall be the same as that intended to be used in the finished fence system.

The pale and rail material shall be self-coloured steel. Fasteners shall be in the condition as typically supplied by the fastener manufacturer.

The test assembly shall be set up in exactly the same manner and configuration as that proposed for the installed fencing system.

E.4 Test procedure

E.4.1 The bearing surfaces of the loading machine and the sample shall be wiped clean.

E.4.2 A stop shall be installed on the machine so that all sample pieces can be placed on exactly the same position with respect to the centre of the loading ram.

E.4.3 The specimen shall be placed in the machine so that it is in contact with the stop and place the loading bridge across the pale so that the loading pads are central about the pale centre line. The bridging piece shall not touch the sides or top of the pale profile or the pale bolting system.

E.4.4 The sample piece shall be assembled square and shall be sitting on the support rollers at right angles to the loading bridge.

E.4.5 Any sample that, due to twist or distortion, has a gap of more than 1 mm from any support or loading pad whilst under zero load shall be discarded.

E.4.6 The test load shall be applied steadily and without shock over a period of not less than 30 s.

E.4.7 The loading shall continue whilst the sample distorts and deflects until such time as it is apparent that the sample cannot accept further load, and remains intact.

NOTE Loading should not continue until destruction because this can obscure the mode of failure and make it difficult to determine which component precipitated failure.

E.4.8 The test shall be completed three times using a new sample each time.

E.5 Test report

E.5.1 Contents

The test report shall affirm that the tests were carried out in accordance with this annex, shall contain the information detailed in **E.5.2** and **E.5.3** and shall include the results of the test.

E.5.2 Information to be provided to the test laboratory

The following information shall be provided to the test laboratory for inclusion in the test report:

a) the date, time and place of sample manufacture and sample identity number;

b) the names of those to be present during testing (if any); and

c) the name of supplier of sample and fixing bolts and nuts.

E.5.3 Information to be provided by the test laboratory

The following information on each specimen shall be provided by the test laboratory for inclusion in the test report:

a) identification of the sample, pale type and fastener;

b) the condition when received;

c) the date of receipt;

d) the name of the test operator and those present during the test;

e) the date of the test;

f) the maximum load recorded on the sample;

g) any erratic behaviour by the sample during testing and application of the load;

h) identification and description of which component suffered the maximum distortion or deflection and, from observation, probably contributed most to the failure;

i) description of the condition of the pale, angle rail and bolt assembly after the test has been completed and the sample has been removed from the machine and has been examined in detail; and

j) any other remarks or observations (e.g. photographs), that would assist in determining how the effectiveness of the fastening assembly could be improved.

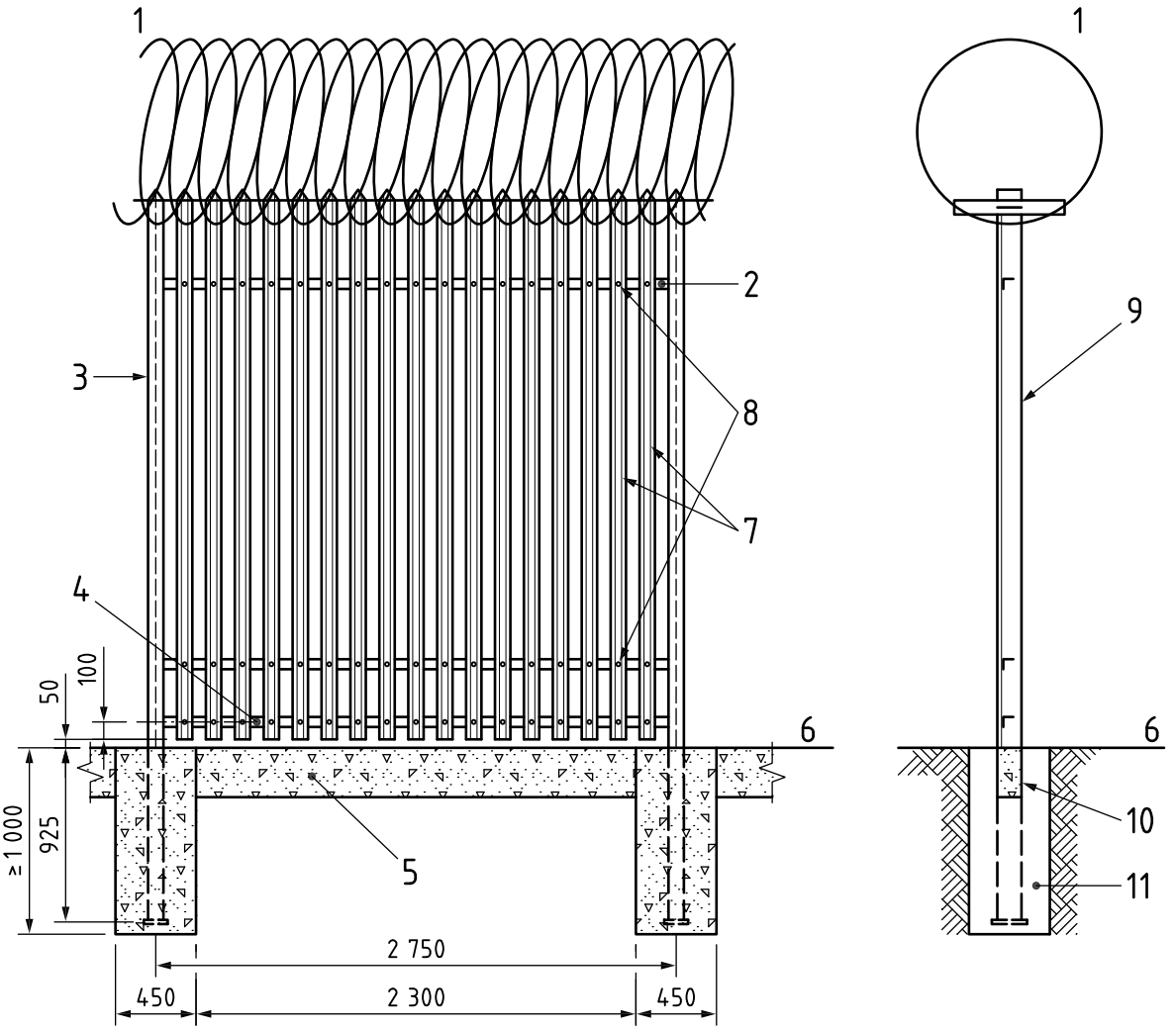
Annex F (informative) Specifying a steel palisade fence

F.1 General

When preparing a specification for a fence, precise details of the requirements of the fence and the installation site should be provided. This annex lists those items that should be specified at the time of ordering the fence. As conditions vary from site to site, this annex should not be assumed to be exhaustive.

A typical arrangement for a SP fence is shown in Figure F.1.

Figure F.1 **Typical arrangement for a security purpose (SP) fence**



Key

1 Barbed tape concertina topping (if required)
2 Rail fixed to post via connector plate which is fixed to post by bolting or slotting
3 (127 × 76) mm universal beam (UB) posts at 2 750 centres
4 Additional rail attached to pales
5 125 mm wide × 150 mm deep mm concrete sill between posts (if specified)
6 Ground level
7 Corrugated pales at 155 centres
8 Poles fixed to 2 rolled steel angle (RSA) rails with bolts, rivets or welding
9 (127 × 76) mm UB posts
10 (125 × 150) mm concrete sill
11 (450 × 450) mm concrete surround

F.2 Site conditions

The following items should be agreed between the supplier and purchaser at the time of enquiry and/or order:

a) the line and length of fence;

b) the height and type of fence, i.e. GP or SP (see Table 1 and Table 2);

c) site preparation (see Clause **6**):

1) site clearance;

2) cutting or filling of ground level;

d) any specific requirements for non-standard post lengths due to ground conditions;

NOTE The requirements for the lengths of posts and stays in this British Standard and foundation sizes are for average ground conditions. This British Standard does not cover conditions of particularly firm or soft ground, where other lengths or foundation sizes might be required. Unless otherwise agreed between the purchaser and supplier, the installation of the fence does not include the work required to cut or fill the ground to vary the levels.

e) any special measures required due to site gradients; and

f) the number and position of any gates (see Clause **8**).

F.3 Construction of fence

The following items should be agreed between the supplier and purchaser at the time of enquiry and/or order:

a) pales:

1) whether GP or SP;

2) the type of pale (for which a statement of conformity should be provided);

3) the shape of tops of pales (see **5.1**);

4) the method of fixing pales (see **5.1**);

b) posts:

1) the type of section (see Table 1 and Table 2);

2) the particular requirements for spacing posts (see **5.3**);

3) the design and foundation requirements for removable posts (see **5.3**).

Subclause **5.3** specifies 2.75 m centres for posts; if shorter bays are required, they should be specified.

c) the type of protective treatment (see **5.8**);

NOTE The same treatment can be applied to all components unless otherwise specified.

d) gates (see also **F.2**):

1) if any clear openings are required (see note 1 to Table 4);

2) the type of post (see Table 3 and Table 6);

3) locking devices (see **8.4**);

4) road profile (see **8.1**); and

e) additional security:

1) burrowing (see **6.2**);

2) pale removal (see **6.3**); and

3) topping (see **6.4**).

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 287-1, *Qualification test of welders – Fusion welding – Part 1: Steels* [6)]

BS EN 1176-1, *Playground equipment and surfacing – Part 1: General safety requirements and test methods*

[6)] BS EN 287-1 is still current, but has been replaced by BS EN ISO 9606-1:2013.

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