Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

BRITISH STANDARD

BS 585-1:1989

Incorporating Amendment No. 1

Wood stairs —

Part 1: Specification for stairs with closed risers for domestic use, including straight and winder flights and quarter or half landings

UDC 692.622.2:692.625.2:692.635.2:692.64:691.11:674.11:001.4

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Timber Standards Committee (TIB/-) to Technical Committee TIB/25, upon which the following bodies were represented:

British Woodworking Federation

Department of the Environment (Building Research Establishment)

Department of the Environment (Building Research Establishment, Princes Risborough Laboratory)

Department of the Environment (Housing and Construction Industries)

Fibre Building Board Organization (FIDOR)

Institute of Carpenters

Joinery Managers' Association Ltd.

London Housing Consortium

Royal Institute of British Architects

Scottish Development Department

Spiral Stair Manufacturers' Association

Timber Research and Development Association

Timber Trade Federation

This British Standard, having been prepared under the direction of the Timber Standards Committee, was published under the authority of the Board of BSI and comes into effect on 30 June 1989

© BSI 02-1999

First published, as BS 585, December 1944
First revision January 1956
Second revision March 1972
Third revision, as BS 585-1, September 1984
Fourth revision June 1989

The following BSI references relate to the work on this standard:
Committee reference TIB/25
Draft for comment 86/14036 DC

ISBN 0 580 16566 3

Amendments issued since publication

Amd. No.	Date of issue	Comments
6510	April 1990	Indicated by a sideline in the margin

Contents

		Page
Committees responsible		Inside front cover
Foreword		ii
1	Scope	1
2	Definitions	1
3	Sizes and tolerances	1
4	Materials and workmanship	2
5	Treads and risers	2
6	Strings	4
7	Newels	5
8	Construction	5
9	Handrails and balustrades	7
Appendix A Recommendations for site fixing of stairs		8
Appendix B Recommendations for the design of stairs with winder flights		12
Figure 1 — Glue blocks		3
Figure 2 — Typical details of stairs with winder flights		4
Figure 3 — Typical built-up newel		6
Figure 4 — Assembly details of straight flight with balustrade		9
Figure 5 — Assembly of balustrades for landings		10
Figure 6 — Assembly of bullnose step		11
Figure 7 — Clear width and going on winder flights		13
Figure 8 — Overall dimensions of winding stairs		16
Figure 9 — Calculation of centre going on winder flight		18
Figure 10 — Calculation of minimum going on winder flight		20
Figure 11 — Measurement of clear headroom on winder flight		21
Table 1 — Minimum finished sizes of members		2
Table 2 — Minimum overall sizes of stairs with three or six winder treads		15
Table 3 — Minimum overall sizes of stairs with four or eight winder treads		15
Publications referred to		Inside back cover

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Foreword

This Part of BS 585, which has been prepared under the direction of the Timber Standards Committee, is a revision of BS 585-1:1984, which is withdrawn. It is a prescriptive specification for the construction of timber stairs which may include plywood risers and treads and/or edge-to-edge jointed timber and/or glue-laminated wood components.

The principal changes made in this edition are the addition of stairs with winder flights, the inclusion of plywood treads and the increase in minimum size of strings and newels for stairs with more than nine goings unsupported.

The proper functioning and durability of a stair complying with this standard depend on care in handling during transportation to, and on site, as well as careful site storage, correct installation (see Appendix A), temporary protection, finishes and maintenance. Some general advice is given in BS 5395-1.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 22, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

1 Scope

This Part of BS 585 specifies materials and construction requirements for stairs constructed of timber, which may include plywood risers and treads and/or edge-to-edge jointed timber and/or glue-laminated wood components. It applies to stairs intended primarily for use inside one-family dwellings, including one or more of the following:

a) straight flights;

b) winder flights;

c) quarter landings;

d) half landings.

This Part of BS 585 does not apply to stairs with open risers, stairs having an overall width greater than 1 220 mm, or stairs having a total going in one flight exceeding 3 800 mm.

Appendix A gives recommendations for site fixing of stairs.

Appendix B gives recommendations for the design of stairs with winder flights.

NOTE 1 For stairs constructed of wood-based materials, see BS 585-2.
NOTE 2 For guidance on the design of straight stairs, see BS 5395-1.
NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purpose of this Part of BS 585, the definitions given in BS 5395-1, BS 5578-1 and BS 6100-1.0, BS 6100-1.3.4[1)] and BS 6100-1.5.1 and BS 6100-4 apply, together with the following.

2.1
glue-laminated wood

wood consisting of laminations glued together, no constituent lamination being more than 50 mm or less than 8 mm thick, with the exception of facing laminations

2.2
edge-to-edge jointed

jointing of timber of the same thickness to increase the width of the component

2.3
easement

piece of timber that is added to a straight string to increase its depth so as to accommodate winder tread and riser ends

2.4
winder flight[2)]

a small group of winders encompassing not more than a half turn

2.5
going on straight flight

horizontal distance between the nosings of two consecutive treads or between the nosing of the tread and the nosing of the landing immediately above it

2.6
going on winder flight

chord length on plan between two points on consecutive tread nosings at the same radius from the geometric centre of the winder flight

NOTE See **B.3**.

2.7
pitch line on straight flight

notional line connecting the nosings of the treads of a stair and nosing of top of flight and extending down to the landing at the bottom of the flight

2.8
pitch line on winder flight

notional line consisting of an arc drawn about the geometric centre connecting the nosings of the treads of a stair

2.9
clear width

unobstructed width between handrail and face of newel

NOTE See **B.1**.

3 Sizes and tolerances

3.1 Straight flights

NOTE All sizes specified in this standard are minimum finished sizes.

The overall width of a flight including strings shall be not greater than 1 220 mm and the total going of any one flight shall not exceed 3 800 mm. The maximum permissible deviations from the work size width shall be + 0 mm, – 3 mm. All other sizes shall be in accordance with BS 5395-1.

3.2 Winder flights

The overall width of a flight including strings shall be not greater than 1 220 mm and the clear width shall be not less than 770 mm. The flight shall not encompass more than 180° in a continuous turn. The maximum permissible deviations from the work size width shall be + 0 mm, – 6 mm. All other sizes shall be in accordance with Appendix B.

[1)] In preparation.
[2)] BS 6100 definition repeated for information.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

4 Materials and workmanship

4.1 Materials

NOTE If stairs are required with non-opaque finishes, reference should be made to the manufacturer with regard to the quality of the timber and its finish.

4.1.1 *Timber*. Timber for stairs for painting shall comply with the requirements for class 3 of BS 1186-1, except that handrails shall comply with the requirements for class 1 of BS 1186-1.

4.1.2 *Plywood for risers and treads.* Plywood shall be used only for risers and treads. It shall have an exposed surface suitable for painting and shall comply with BS 6566.

NOTE If plywood is used for treads, the laminations may show on the nosing of the tread.

4.1.3 *Glue-laminated components.* Glue-laminated components shall comply with clause **8** of BS 1186-2:1988.

4.1.4 *Adhesives.* Adhesives used for assembly of stairs shall be:

a) synthetic resin gap-filling adhesives (phenolic and aminoplastic) complying with the requirements for type BR or type MR of BS 1204-1; or

b) one part polyvinyl acetate emulsion adhesives complying with BS 4071; or

c) two part polyvinyl acetate emulsion adhesives complying with the relevant requirements of EN 204[3)].

4.2 Workmanship

The quality of workmanship shall comply with BS 1186-2.

5 Treads and risers

5.1 Finished sizes

The finished thickness of a tread or a riser shall be not less than the appropriate value given in Table 1. Timber members of more than one piece shall be jointed as specified in BS 1186-2. No piece of timber shall be less than 50 mm wide on the finished face of a member except that, in a jointed tread, the front piece on which the nosing is formed shall be not less than 90 mm wide.

5.2 Housing

Risers shall be tongued or housed not more than one-quarter of the actual tread thickness, but not less than one-quarter of the minimum tread thickness given in Table 1, into the underside of treads. The lower edge of risers shall be fixed to treads at centres not exceeding 230 mm with no. 10 gauge screws to give a penetration of at least 23 mm or 1.5 times the thickness of the riser, whichever is the greater.

5.3 Glue blocking

5.3.1 *Straight flights*. For straight flights, risers and treads shall be glue-blocked as shown in Figure 1(a), using angle blocks not less than 75 mm long and 38 mm wide on the shortest edges [see Figure 1(b)].

5.3.2 *Winder flights.* For winder flights, risers and treads shall be glue-blocked as shown in Figure 1(c), using angle blocks not less than 75 mm long and 38 mm wide on the shortest edges [see Figure 1(b)].

Table 1 — Minimum finished sizes of members (see note)

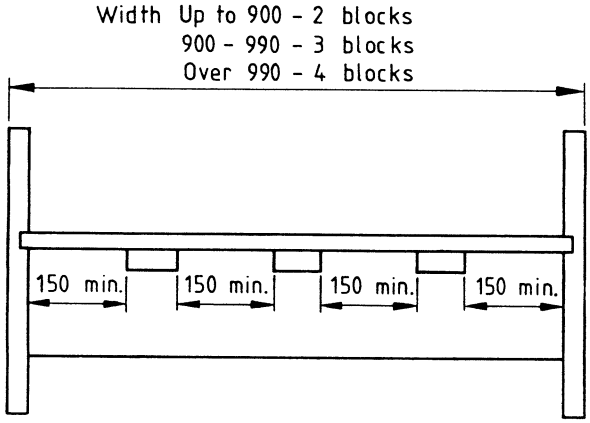
Support condition	Width of stair (overall including strings)	String thickness	Tread thickness	Riser thickness	Outer newel size
Supported by a side wall, or, up to 9 goings unsupported	mm Up to and including 990	mm 26	mm 20 (18 for plywood)	mm 14 (9 for plywood)	69 mm square or cross section of equivalent strength and stiffness
	Exceeding 990 but not exceeding 1 220	26	26 (24 for plywood)	14 (9 for plywood)	
More than 9 goings unsupported	Up to and including 990	32	20 (18 for plywood)	14 (9 for plywood)	90 mm square or cross section of equivalent strength and stiffness
	Exceeding 990 but not exceeding 1 220	32	26 (24 for plywood)	14 (9 for plywood)	

NOTE It is assumed that members are measured at a 20 % moisture content in accordance with BS 4471-1.

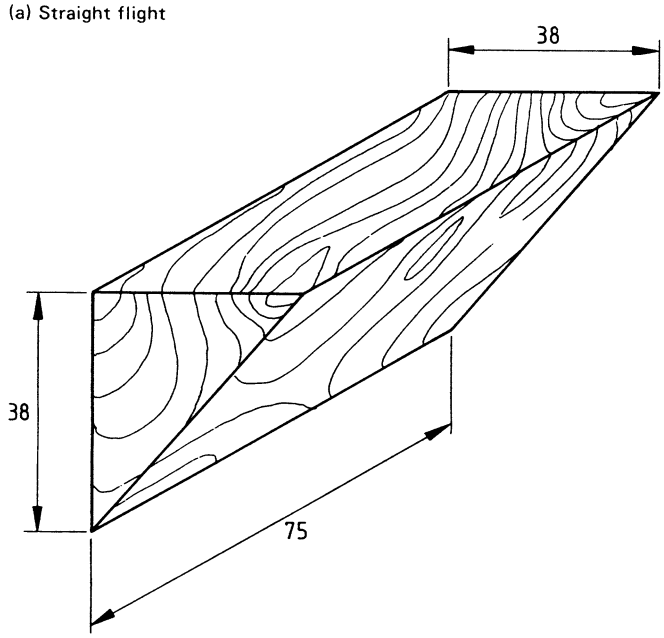
[3)] In preparation.

© BSI 02-1999

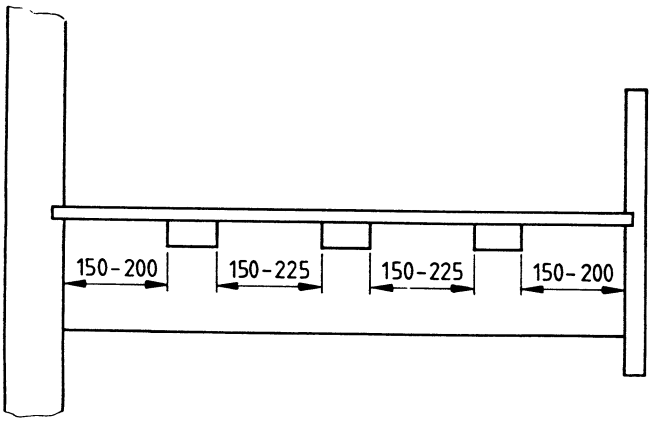
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013



(a) Straight flight



(b) Minimum sizes of blocks



(c) Winder flight

All sizes are in millimetres.

Figure 1 — Glue blocks

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

6 Strings

6.1 General

Strings shall have a finished thickness not less than the value given in Table 1.

NOTE Strings may be of one-piece timber or of glue-laminated section.

Edge-to-edge jointing of solid section timber shall be permitted provided that only two pieces, each greater than 50 mm deep, are used. The finished depth shall be not less than 215 mm.

Strings shall have tapered housings not less than 12 mm deep or 0.4 times the string thickness, whichever is the greater, to receive the tread and risers, which shall be secured by glue wedging.

The ends of strings to fit into newels shall be tenoned and prepared for fixing, except where the newels are face fixed. Tenons shall be not less than 12 mm thick and not less than 45 mm long.

6.2 Winder flights

For winder flights the upper and lower wall strings from the adjacent straight flights (see Figure 2) shall be enlarged by adding easements to give the depth necessary to contain the housings of the treads and risers. The middle wall string shall be built up to the depth necessary to accommodate the housings.

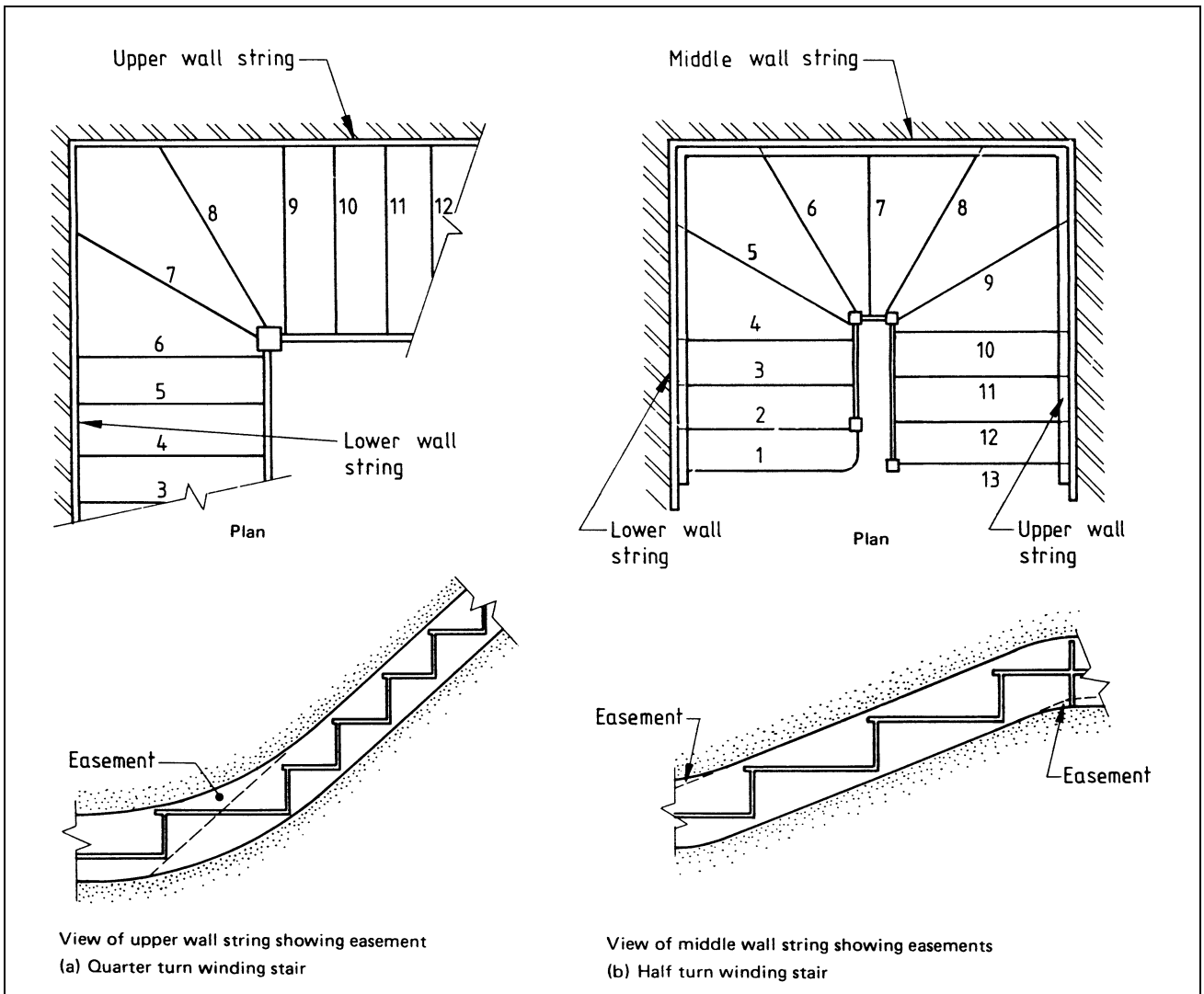
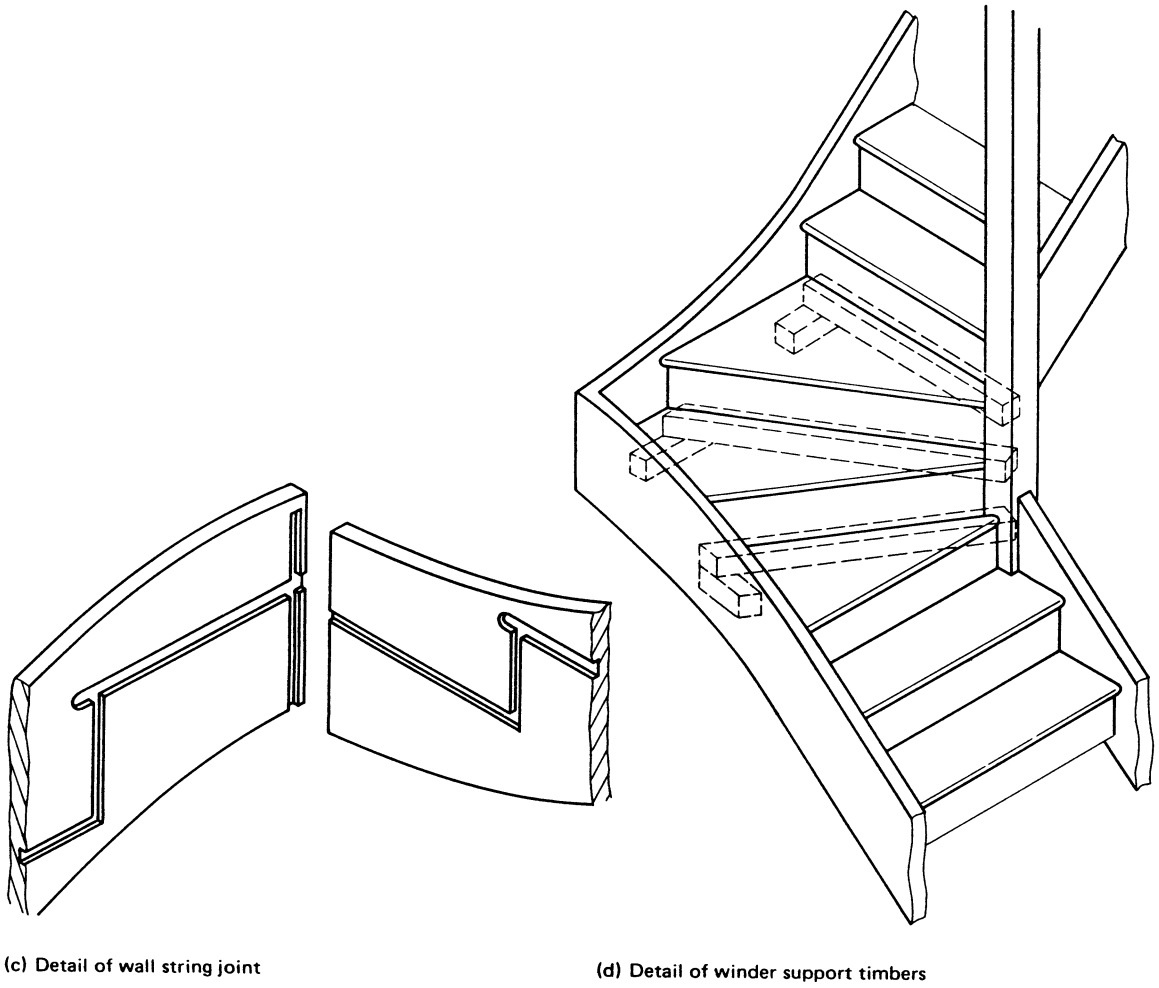


Figure 2 — Typical details of stairs with winder flights

© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013



(c) Detail of wall string joint

(d) Detail of winder support timbers

NOTE The tongue and groove arrangement shown assumes top fixing. For ease of erection in a confined space, it may be necessary to reverse the method of erection (see **A.2.1**) and hence the tongue and groove jointing of the strings. Reference should be made to the manufacturer.

Figure 2 — Typical details of stairs with winder flights *(concluded)*

7 Newels

7.1 Position

In the case of a free-standing stair or a stair in which neither string is supported by a wall, a newel shall be placed at every change of direction of the stair, at the top of the stair and no higher than two steps from the bottom of the stair.

7.2 Size

7.2.1 Solid outer newels shall have a minimum cross section of size as given in Table 1. Wall newels shall have a cross section of not less than 32 mm × 69 mm or shall have a cross section of equivalent strength and stiffness.

7.2.2 For winder flights, where larger newels are necessary, newels shall be either solid or built up from sections of finished thickness not less than 32 mm (see Figure 3).

7.3 Housing

Newels shall be housed not less than 12 mm deep to receive the ends of treads and risers shall be morticed for strings and handrails as required. Haunchings or notchings shall be not greater than one-third of the thickness of the newel.

8 Construction

8.1 Assembly

If stairs are supplied in kit form for assembly on site, instructions shall be provided.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

8.2 Construction of shaped ends for risers (straight flights)

NOTE Suitable methods of fixing include tonguing and grooving, rebating, blocking, gluing, nailing and screwing.

8.2.1 If a bullnose or similarly shaped end for a riser is constructed with a shaped block against which the end or ends of one or two straight parts of the riser abut, the following requirements shall apply.

a) The grain of the block shall be horizontal. The faces of block and straight riser where they meet shall be flush with one another.

b) The meeting edges of block and straight riser on the face of the work shall form a closely fitted vertical joint.

c) The ends of block and straight riser shall be fitted and secured together.

8.2.2 If a bullnose, half round or similarly shaped end is formed by cutting away material from the back of a solid riser to leave a veneer, which can be bent to the required shape, the following requirements shall apply.

a) The veneer shall be supported with a solid backing block. The back of the veneer and the face of the block shall be prepared and fitted and glued together so as to adhere over the whole area of the veneer.

b) The block shall be secured to the straight (unreduced) parts of the riser.

8.2.3 If the riser with a bullnose, half round or similarly shaped end is formed with thin plywood bent to shape during manufacture of the stairs, the following requirements shall apply.

a) The face of the complete riser shall consist of one piece of plywood or a solid straight timber portion with a plywood curved portion close jointed to the edge of the straight portion and secured to the solid timber.

b) The straight parts of the riser shall have solid backings not less than 20 mm thick. The curved part of the riser shall be backed with either a solid block or three shaped horizontal backing pieces each not less than 20 mm thick. The various parts shall be prepared, fitted and secured together by gluing and screwing.

8.2.4 If a shaped end is formed by the use of mitred joints in a riser, such mitres shall enable closely fitted vertical joints to be formed on the face of the work.

8.2.5 If a preformed riser with a shaped end is used, the plywood shall be at least 9 mm thick and shall be glue-blocked as specified in **5.3.1**.

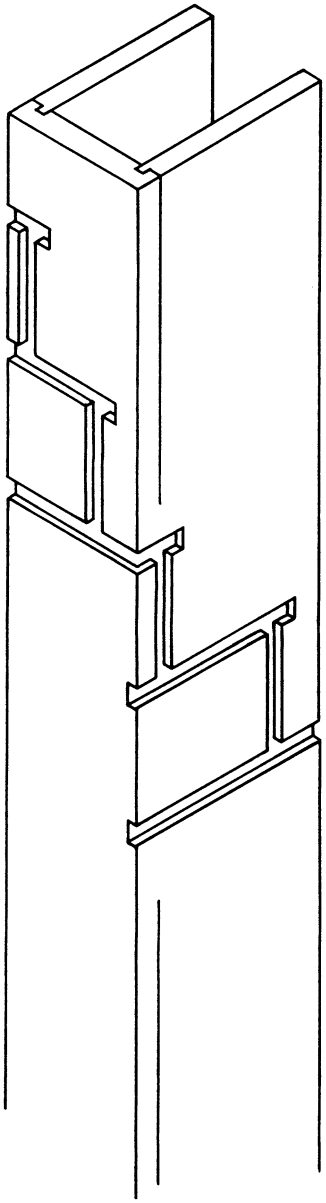


Figure 3 — Typical built-up newel

8.3 Assembly of risers, treads and newels

The top edge of every riser shall be housed or tongued into the underside of the tread along the whole of the straight part of its face as specified in **5.2**, unless the bullnosed or curtailed step is constructed as specified in **8.2.2**.

If the bottom riser is shaped, the cross section profile of any curtailed step shall match the treads, nosings and risers in the rest of the flight.

Shaped ends of steps shall be fixed to newels by housing in and fixing from the back or, where there are no newels, shall be secured by housing and fixed to the strings.

© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

9 Handrails and balustrades

Handrails and balustrades shall be designed in accordance with the recommendations in BS 5395-1. There shall be no opening in a balustrade that will permit the passage of a 100 mm sphere.

On winder flights, a handrail shall be provided on the side of the stair that includes the wider part of the treads, and where the clear width is 1 m or more handrails shall be provided on both sides of the stair.

NOTE 1 Details of typical balustrades are shown in Figure 4 and Figure 5. See BS 6180 for further guidance on design.
NOTE 2 Balustrades should be designed to minimize the risk of children climbing over them.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Appendix A Recommendations for site fixing of stairs

A.1 Straight flights

A.1.1 *General*

Site fixing of stairs with straight flights should begin at the top of the stairs and should be carried out in accordance with **A.1.2** to **A.1.4**, as appropriate. Suitable methods of fixing include tonguing and grooving, rebating, blocking, gluing, nailing and screwing.

A.1.2 *Straight flight with balustrade (no bullnose steps)*

A.1.2.1 Cut wall string to fit over trimmer and to suit landing skirting height [see Figure 4(a)]. Cut bottom of wall string along floor line to suit rise and vertically to suit skirting height [see Figure 4(b)]. Stand flight on wall string, offer up newels and mark string for draw boring. Remove newels and draw bore string. Cut and recess top newel to fit over trimmer [see Figure 4(c)].

A.1.2.2 Fit top newel, using glue and dowels. Fit top nosing into wall string and newel and fix riser. Offer up flight.

A.1.2.3 For balustrade with knee rails, proceed as follows.

a) Ensure rails are the correct way up.

b) Fit balustrade and bottom newel using glue and dowels [see Figure 4(d)]. Ensure that tenons are tight up to the top of the mortices.

A.1.2.4 For balustrade with balusters, proceed as follows.

a) Fit handrail and bottom newel using glue and dowels.

b) Cut balusters to the correct length and pitch.

c) Cut infill fillets to the correct length and pitch.

d) Fix balusters and infill fillets [see Figure 4(e)].

A.1.2.5 Fix wall string to wall, packing out as necessary, and fix top newel to trimmer.

A.1.3 *Straight flight with balustrade and bullnose step*

Proceed as described in **A.1.2.1**. Fit bottom newel, using glue and dowels. Fix bullnose step, using glue and wedges (see Figure 6). Proceed as described in **A.1.2.3** or **A.1.2.4**, as appropriate, but fix the top newel last. Fix wall string to wall, packing out as necessary.

A.1.4 *Landing balustrade*

A.1.4.1 *Balustrade between newels.* Shorten shoulder length and tenons to the correct dimensions.

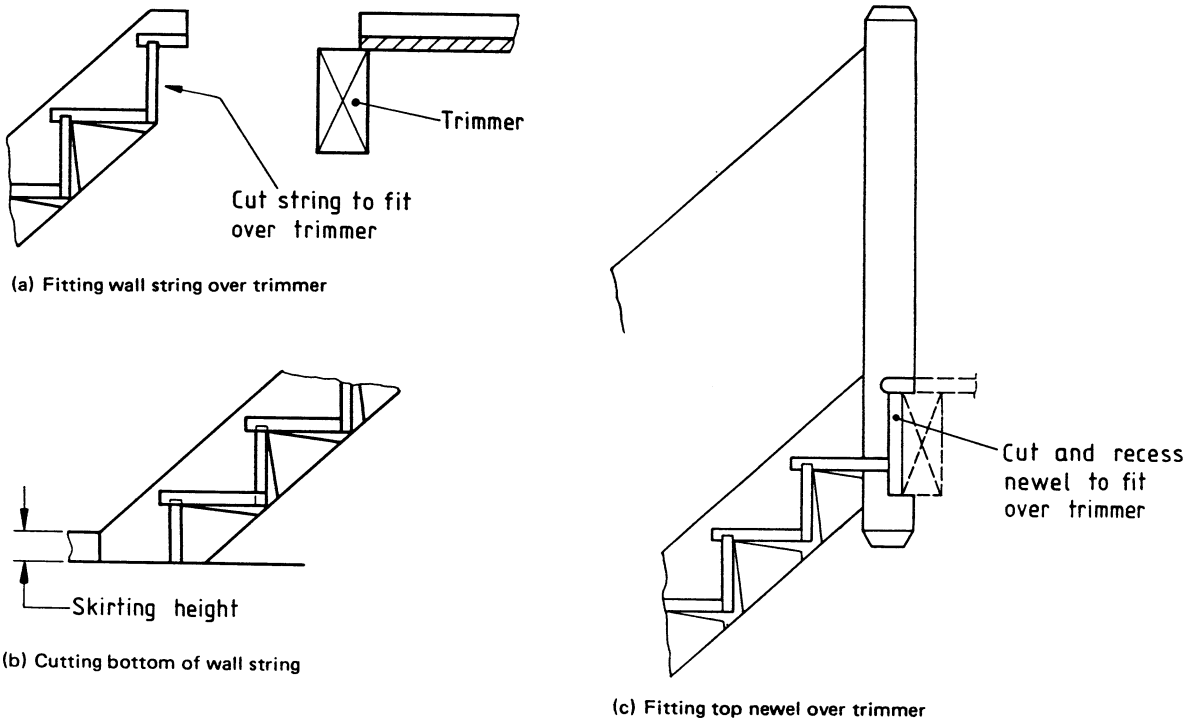


Figure 4 — Assembly details for straight flight with balustrade

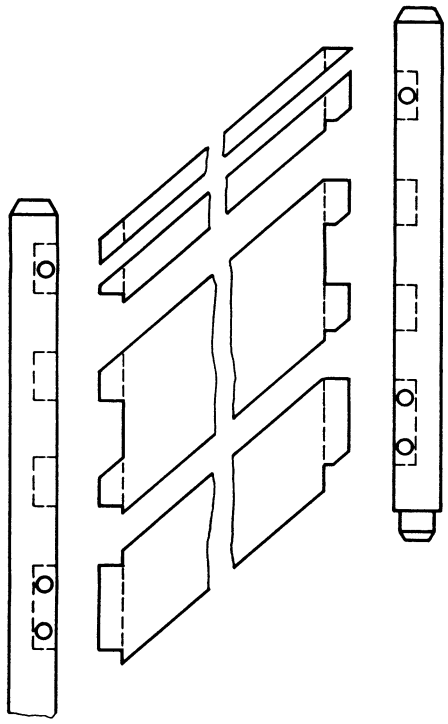
© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

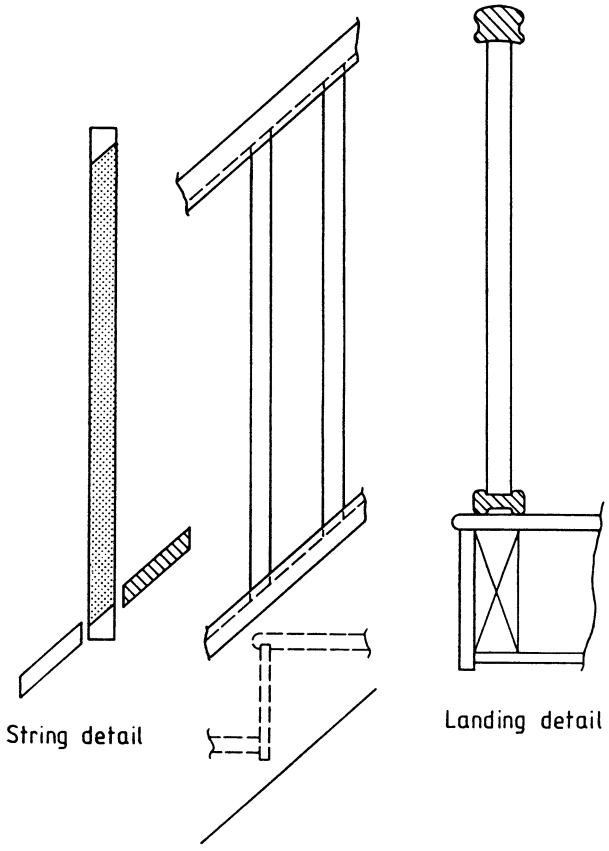
NOTE Handrails and balustrade rails are tenoned both ends but are cut to a length sufficient to allow for adjustments on site.

Draw bore and pin as necessary [see Figure 5(a)].

A.1.4.2 *Balustrade with return filler piece.* Rip return filler piece to suit size of stair well and mitre handrail over. Cut bare faced tenons on rails. Assemble as shown in Figure 5(b).



(d) Fitting balustrade with knee rails



(e) Fitting balustrade with balusters

All sizes are in millimetres.

(f) Typical balustrade components

Figure 4 — Assembly details for straight flight with balustrade *(concluded)*

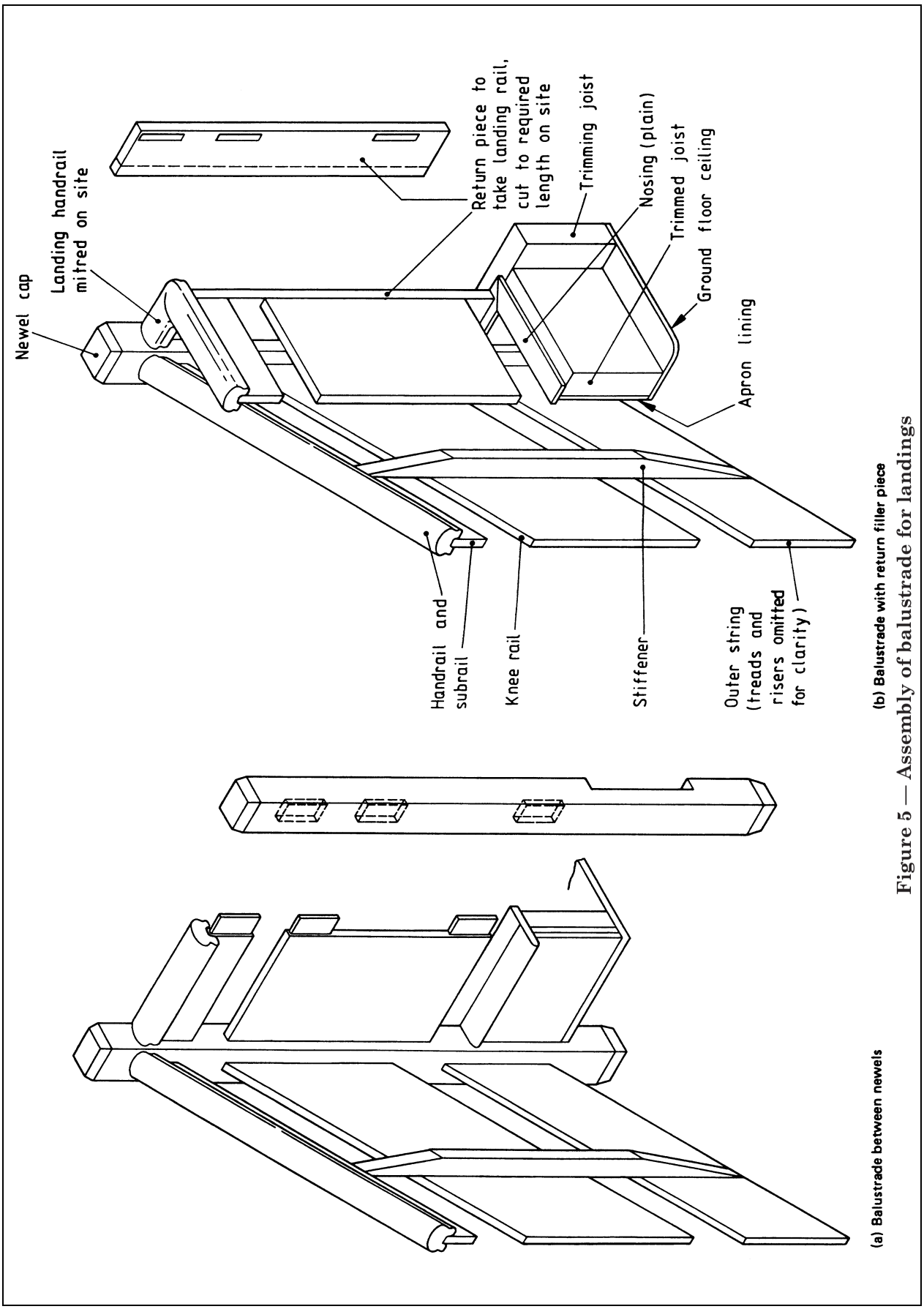


Figure 5 — Assembly of balustrade for landings

© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

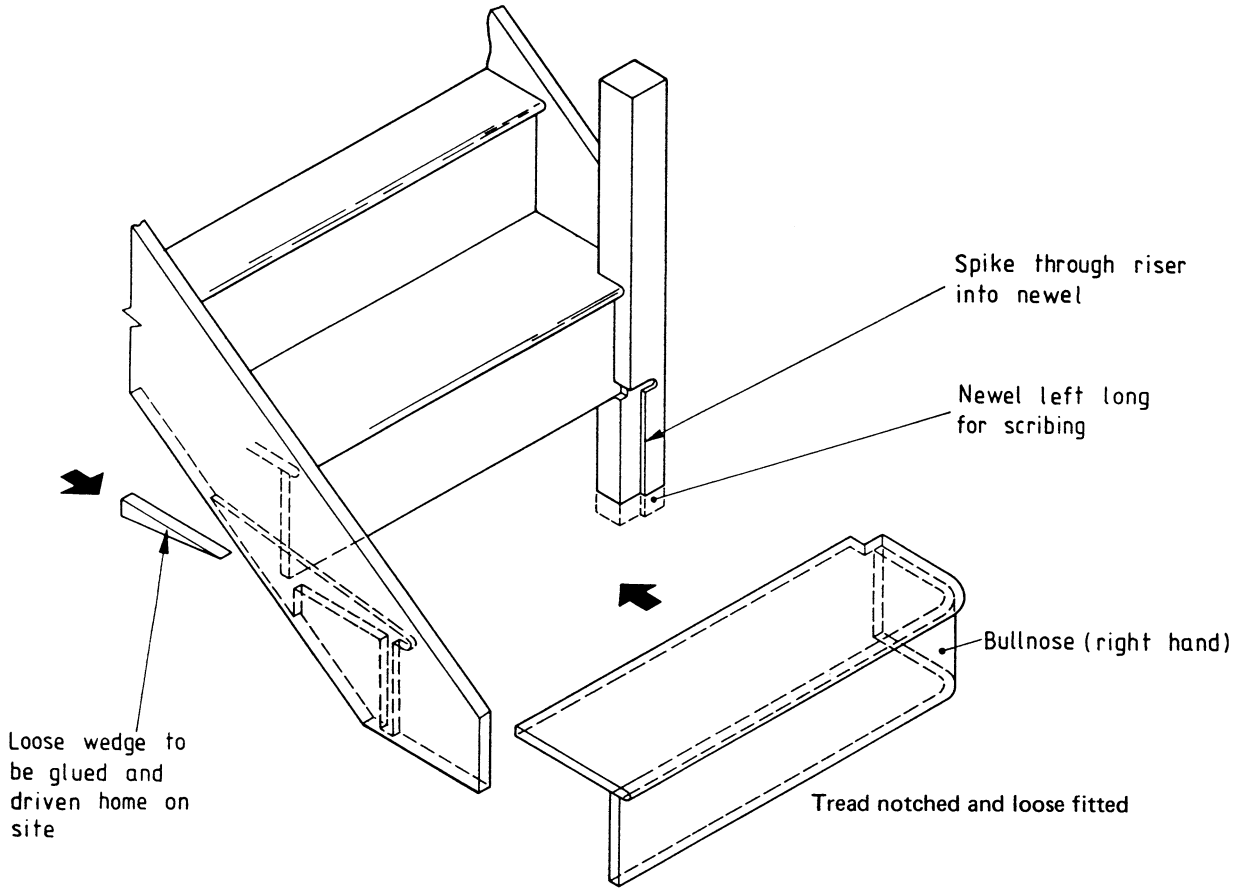


Figure 6 — Assembly of bullnose step

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

A.2 Winder flights

A.2.1 *General*

Site fixing of stairs with winder flights should be carried out in accordance with **A.2.2**. When installing stairs with winder flights, the top flight should normally be offered up first. However, for ease of fixing in a confined space it may be necessary to reverse the order of erection.

A.2.2 *Quarter and half turn winder flights (winder flights between two straight flights)*

Plumb cut upper wall strings to wall trimmer, making allowance for landing skirting height [see Figure 4(a)]. If top newel is framed to string, fit and notch over trimmer [see Figure 4(c)]. Fix top nosing and riser. Offer up flight, level in both directions and temporarily but securely prop and/or wedge in position. Offer up the newel that accepts the winding treads, trim to length to suit rise, enter string tenons into newel mortices and prop in position. For half turn flights offer up middle wall string [see Figure 1(b)], entering mortice/tenons to upper flight, and temporarily support in position to achieve a good fit. Check that the top line of the winder tread housings is horizontal.

Cut bottom of lower wall strings to finished floor line to suit rise and vertically to suit skirting height [see Figure 4(b)].

NOTE 1 If the finished screed is not laid, cut blocks to pack up to this level.

Cut to length and fit bottom newel if framed to string. Offer up lower flight, entering string tenons to the mortices and string tongues to the grooves, level and prop/wedge in position. Insert winder treads to string and newel housings and risers similarly and to groove in underside of tread. Check top and bottom flights for level in both directions and for squareness. Check newels for plumb. Adjust winder treads and risers as necessary to obtain a good fit.

Permanently fix flights and middle wall string. Thoroughly glue full length wedges and drive into position to secure winder treads and risers. Screw bottom edge of winder risers to back face of treads. Support underside of winder treads at junction with risers above, using timber of adequate strength and stiffness fixed between the strings [see Figure 2(d)]. Glue and screw blocks to strings to carry winder supports.

NOTE 2 Blocks and supports are not generally supplied with the stair.

NOTE 3 Winder treads of width greater than 900 mm will require extra blocking or other support.

Appendix B Recommendations for the design of stairs with winder flights

B.1 Design criteria

B.1.1 For straight flights, the recommendations in BS 5395-1 should be followed. For winder flights, the lines of all the risers should meet at one point, i.e. the geometric centre (see Figure 7 and Figure 8 and **B.3**), and the recommendations in **B.1.2** to **B.1.7** should be followed.

B.1.2 In a flight of steps from landing to landing, the rise should be uniform.

B.1.3 The centre going, which should be taken to be the going at the central point of the clear width (see Figure 7), should be uniform and should be not less than the going of the associated straight flight.

The minimum going, measured as shown in Figure 7, should be not less than 75 mm.

B.1.4 The relation between rise and centre going should be in accordance with the recommendations for straight flights in Table 1 of BS 5395-1:1977.

B.1.5 The angle of taper of the treads should be uniform.

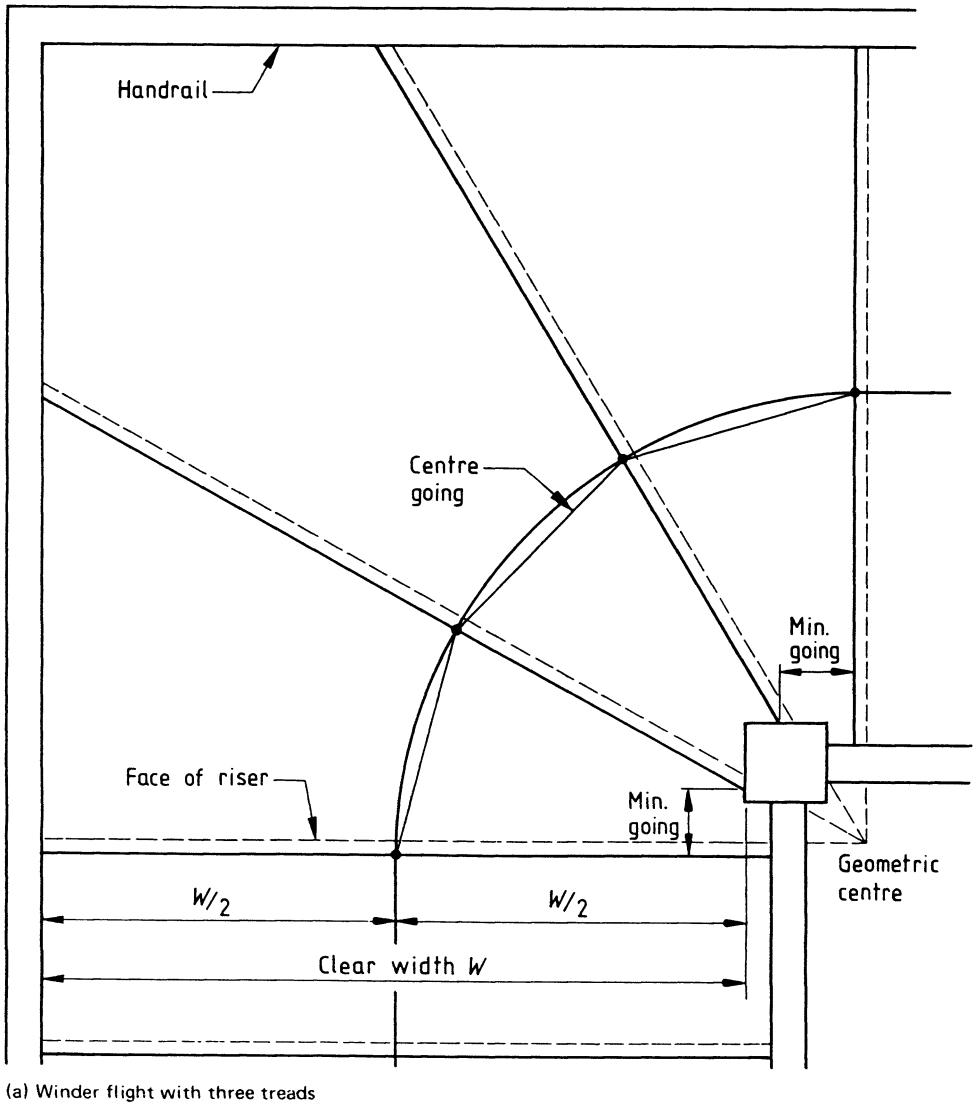
B.1.6 The clear width, measured as shown in Figure 7, should be not less than 770 mm.

B.1.7 The minimum headroom should be not less than 2 000 mm when measured vertically above the pitch line and there should be a minimum clearance of 1 500 mm when measured at right angles to the pitch line. Clearance may also be required on short flights of three or four steps and should be a minimum of 1 500 mm when measured at right angles to the flight.

NOTE Further information is given in clause **11** of BS 5395-1:1977.

© BSI 02-1999

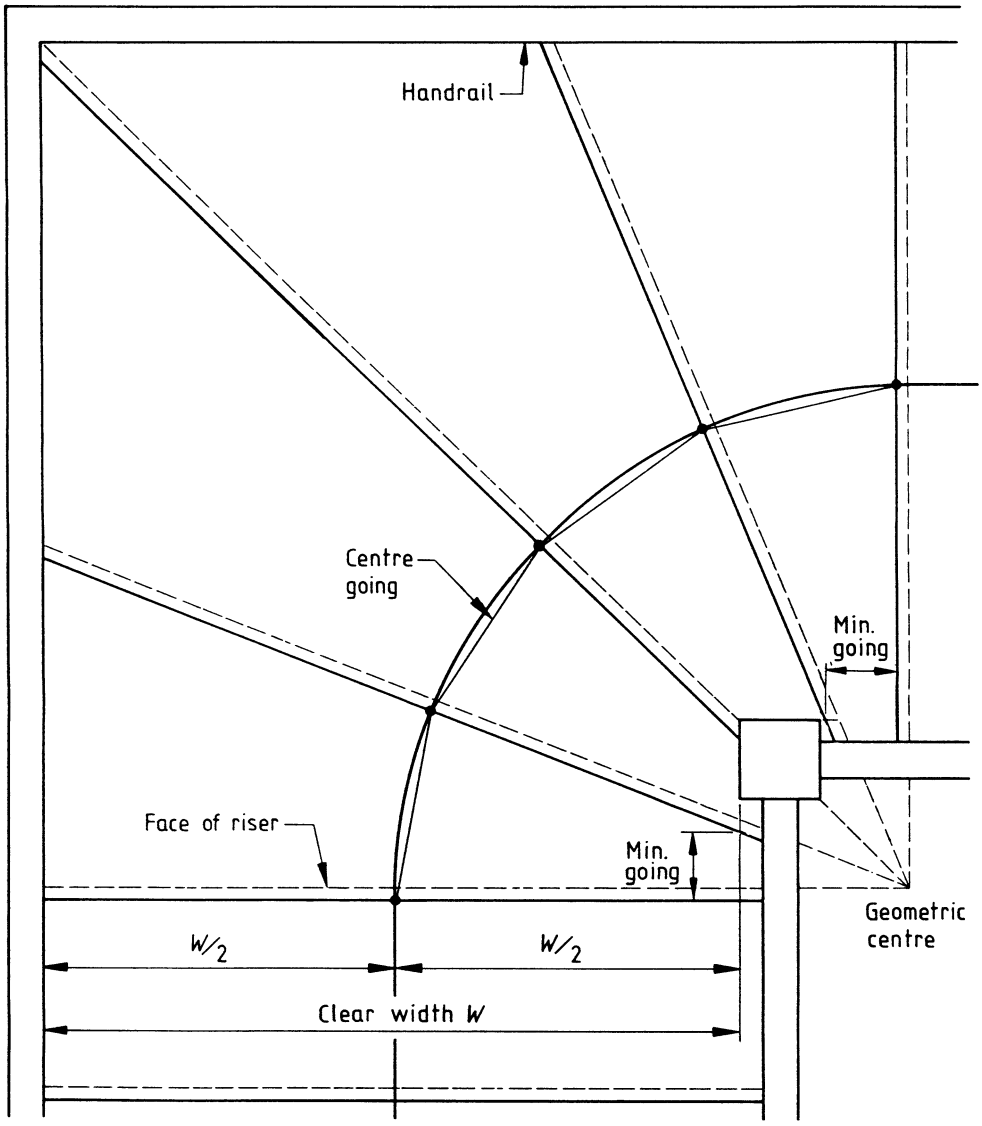
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013



(a) Winder flight with three treads

Figure 7 — Clear width and going on winder flights

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013



(b) Winder flight with four treads

Figure 7 — Clear width and going on winder flights *(concluded)*

© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

B.2 Overall sizes of stairs with winder flights

Stairs incorporating winder flights should have minimum overall sizes as given in Table 2 or Table 3, as appropriate.

NOTE 1 The values given in Table 2 and Table 3 are for stairs with a rise of 200 mm and a centre going on straight flights of 225 mm.

NOTE 2 All stairs shown in Figure 8 have 13 risers.

NOTE 3 The method for calculating the sizes given in Table 2 and Table 3 is given in **B.3** and can be used to calculate sizes for stairs with other combinations of rise and centre going on the straight flight.

Table 2 — Minimum overall sizes of stairs with three or six winder treads

Stair classification[a]	**Stair sizes** [see Figure 8 and Figure 9(a)]			
	A	*B*	B_1	B_2
	mm	mm	mm	mm
0/W/9	3 020	995		
1/W/8	2 795	1 220		
2/W/7	2 570	1 445		
3/W/6	2 345	1 670		
4/W/5	2 120	1 895		
5/W/4	1 895	2 120		
6/W/3	1 670	2 345		
7/W/2	1 445	2 570		
8/W/1	1 220	2 795		
9/W/0	995	3 020		
0/W/6/W/0[b]	3 340	995		
0/W/W/6	1 990		995	2 345
1/W/W/5	1 990		1 220	2 120
2/W/W/4	1 990		1 445	1 895
3/W/W/3	1 990		1 670	1 670
4/W/W/2	1 990		1 895	1 445
5/W/W/1	1 990		2 120	1 220
6/W/W/0	1 990		2 345	995

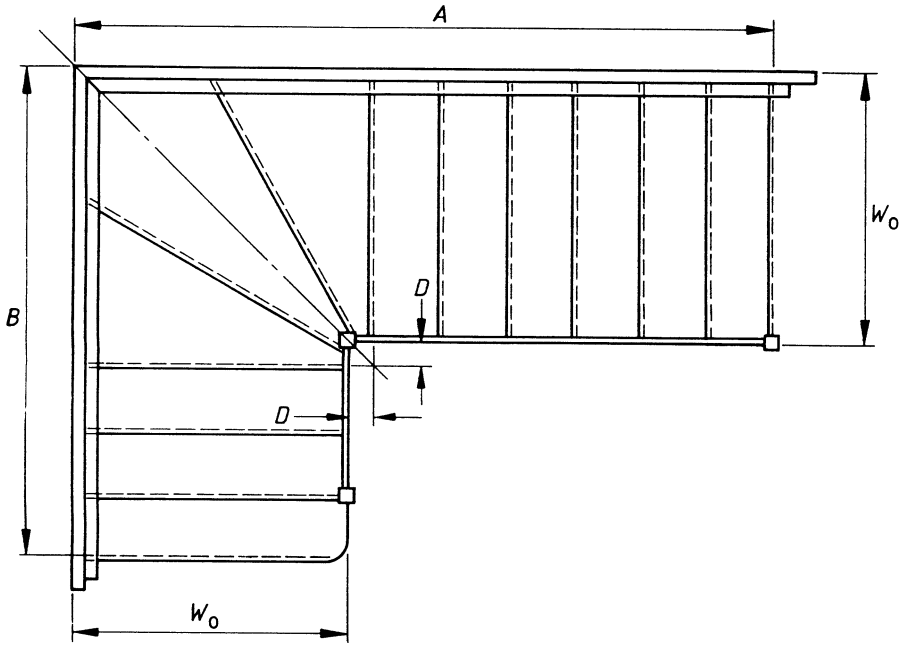
[a] The first figure gives the number of treads on the lower straight flight. The letter W indicates a winder flight of three treads. The last figure gives the number of treads on the upper straight flight.
[b] The middle figure gives the number of treads on the middle straight flight.

Table 3 — Minimum overall sizes of stairs with four or eight winder treads

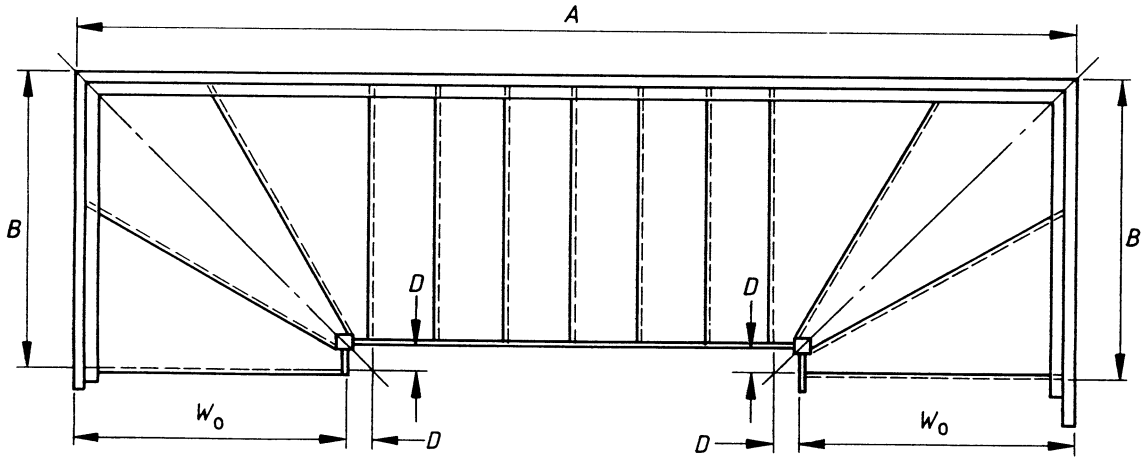
Stair classification[a]	**Stair sizes** [see Figure 8 and Figure 9(b)]			
	A	*B*	B_1	B_2
	mm	mm	mm	mm
0/W/8	2 852	1 052		
1/W/7	2 627	1 277		
2/W/6	2 402	1 502		
3/W/5	2 177	1 727		
4/W/4	1 952	1 952		
5/W/3	1 727	2 177		
6/W/2	1 502	2 402		
7/W/1	1 277	2 627		
8/W/0	1 052	2 852		
0/W/4/W/0[b]	3 004	1 052		
0/W/W/4	2 104		1 052	1 952
1/W/W/3	2 104		1 277	1 727
2/W/W/2	2 104		1 502	1 502
3/W/W/1	2 104		1 727	1 277
4/W/W/0	2 104		1 952	1 052

[a] The first figure gives the number of treads on the lower straight flight. The letter W indicates a winder flight of four treads. The last figure gives the number of treads on the upper straight flight.
[b] The middle figure gives the number of treads on the middle straight flight.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013



(a) Quarter turn winding stair



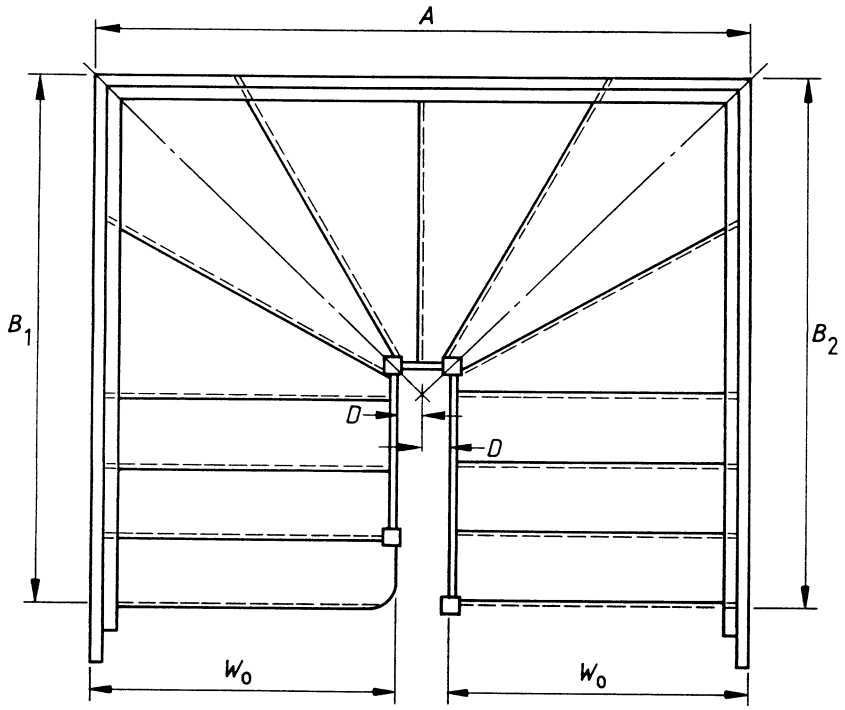
(b) Half turn winding stair with straight flight

NOTE Winding flights may have either three or four treads.

Figure 8 — Overall dimensions of winding stairs

© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013



(c) 180 ° half turn winding stair

Figure 8 — Overall dimensions of winding stairs *(concluded)*

B.3 Method for calculating the sizes of stairs with winder flights

B.3.1 *General*

The method given for calculating the sizes of stairs with winder flights is based on constructing the lines of all the risers to meet at one point.

B.3.2 *Centre going*

Draw an arc about the geometric centre of the stair from a point on the nosing representing the centre of the clear width at the end of an adjacent straight flight to a similar point on the nosing at the end of the other straight flight. Take the centre going, G_c (in mm), to be the chord length on plan between two points on consecutive tread nosings cut by this arc (see Figure 9), obtained from the equation

$$G_c = 2\ R_c \sin \frac{\alpha}{2} \quad (1)$$

where

α is the angle subtended by each tread (in degrees);

R_c is the radius of the arc (in mm) given by the equation

$$R_c = \sqrt{\left\{\left(\frac{W}{2} + E\right)^2 + V^2\right\}} \quad (2)$$

where

W is the clear width (in mm);

E is the distance from the meeting point of the lines of risers to the nearest edge of the clear width (in mm);

V is the overhang of the nosing beyond the face of the riser (in mm).

Normally, the angle of the corner, θ, is 90°.

If N_w is the number of winders at the corner then

$$\alpha = \frac{90}{N_w} \quad (3)$$

If θ is not 90° then

$$\alpha = \frac{180 - \theta}{N_w} \quad (4)$$

It is recommended that

$G_c \geq G$ (see **B.1.3**); and (5)

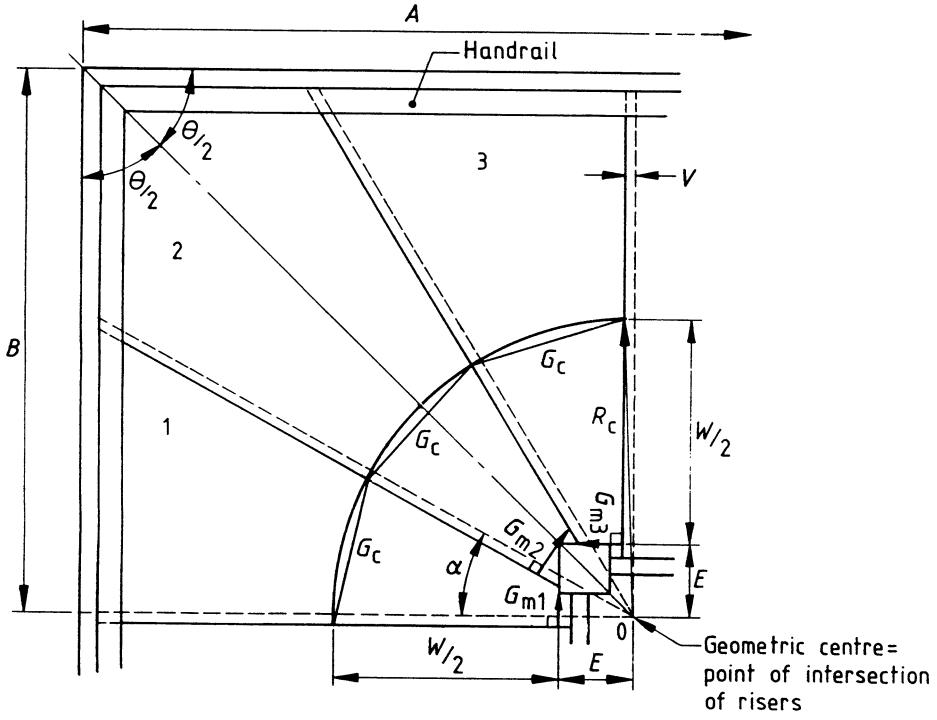
$G_c \leq 700 - 2r$ (6)

where

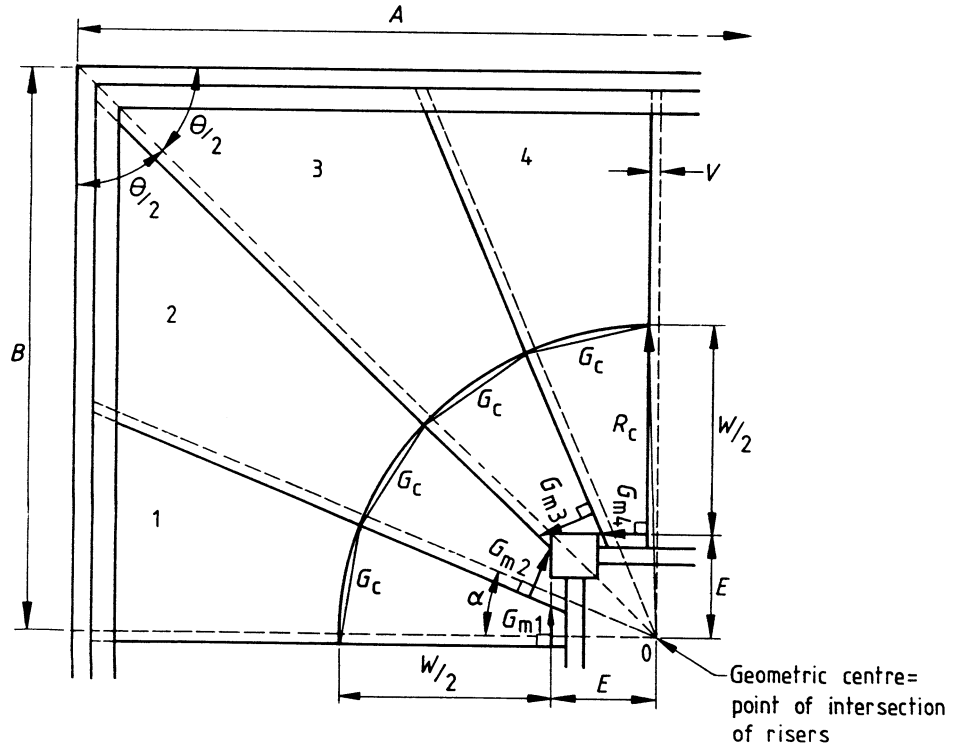
G is the going of the adjacent straight flight (in mm);

r is the rise (in mm).

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013



(a) Winder flight with three treads



(b) Winder flight with four treads

Figure 9 — Calculation of centre going on winder flight

© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

B.3.3 ***Minimum going***

At the narrow side of the winder tread, draw a perpendicular from one nosing to the next nosing in one direction. Draw a similar perpendicular between the same two nosings from the opposite direction. Take the minimum going, G_m, to be the smaller of these two distances (see Figure 10) given by the equation

$$G_m = E \tan\alpha \pm V \left(\frac{1-\cos\alpha}{\cos\alpha}\right) \quad (7)$$

where

E is the perpendicular distance from the geometric centre to the line of the going (in mm).

The sign + or – depends upon the position of the tapered tread. If D for the worst case is calculated, i.e. using the equation

$$G_m = E \tan\alpha - V \left(\frac{1-\cos\alpha}{\cos\alpha}\right) \quad (8)$$

the minimum G_m for all the winder treads will be satisfied.

B.3.4 ***Overall size of stair***

B.3.4.1 *Quarter turn winding stair* [see Figure 8(a)]. If the angle of the corner θ is 90° then the distance from the corner to the front face of the riser on the upper flight A (in mm) is given by the equation

$$A = W_o + D + N_2\, G \quad (9)$$

and the distance from the corner to the front face of the riser on the lower flight B (in mm) is given by the equation

$$B = W_o + D + N_1\, G \quad (10)$$

where

N_1 is the number of straight treads in lower straight flight;

N_2 is the number of straight treads in upper straight flight;

G is the going on both straight flights;

D is the distance from the geometric centre to nearest string (in mm);

W_o is the overall width between outside edges of strings (in mm).

If the angle of the corner θ is not 90° then

$$A = (W_o + D)\tan\left(90 - \frac{\theta}{2}\right) + N_2\, G \quad (11)$$

$$B = (W_o + D)\tan\left(90 - \frac{\theta}{2}\right) + N_1\, G \quad (12)$$

B.3.4.2 *Half turn winding stair* [see Figure 8(b) and Figure 8(c)]. For two sets of winder flights with an equal number of winder treads, N_w, and straight treads, N_3, of going G:

$$A = 2W_o + 2D + N_3\, G \quad (13)$$

$$B = W_o + D \quad (14)$$

For a complete 180° turn:

$$A = 2\, W_o + 2\, D \quad (15)$$

$$B_1 = W_o + D + N_1\, G \quad (16)$$

$$B_2 = W_o + D + N_2\, G \quad (17)$$

B.3.5 ***Clear headroom***

The height above the floor at point X_1, i.e. Y_1 (in mm), is given by the equation

$$Y_1 = \left(1 + \frac{S_1}{G}\right) r \quad (18)$$

where

S_1 is the horizontal distance from the edge of the bottom nosing (in mm);

G is the going on straight flight (in mm);

r is the rise (in mm) given by the equation

$$r = \frac{H}{(N_1 + N_2 + N_w + 1)}$$

where

H is the floor to floor height (in mm);

N_1 is the number of straight treads in lower straight flight;

N_2 is the number of straight treads in upper straight flight;

N_w is the number of winder treads at the corner.

The height above the floor at point X_2, i.e. Y_2 (in mm), is given by the equation

$$Y_2 = \left(N_1 + 1 + \frac{\phi_s}{\alpha}\right) r \quad (19)$$

where

ϕ_s is the angle of rotation from the straight nosing to point X_2 measured at the geometric centre.

The height above the floor at point X_3, i.e. Y_3 (in mm), is given by the equation

$$Y_3 = \left(N_1 + N_w + 1 + \frac{S_3}{G}\right) r \quad (20)$$

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

where

S_3 is the horizontal distance from the edge of the bottom nosing of the upper straight flight (in mm).

To be in accordance with the clear headroom recommendation of at least 2 000 mm (see **B.1.7**), the height of any obstruction above the floor should be at least equal to the total rise to the point directly beneath it on the stair, i.e. Y, plus 2 000 mm.

B.3.6 ***Examples***

B.3.6.1 *For a quarter turn winding stair with three winder treads, calculate the centre going and overall width for the minimum recommended sizes.*

From equations (1) and (2)

$$G_c = 2\sqrt{\left\{\left(\frac{W}{2} + E\right)^2 + V^2\right\}} \sin \alpha/2$$

Taking equation (8)

$$G_m = E \tan \alpha - V\left(\frac{1 - \cos \alpha}{\cos \alpha}\right)$$

Now $G_m \geq 75$ mm and $W \geq 770$ mm and $\alpha = 30°$

Therefore assuming that $V = 16$ mm

$E \geq 135$ mm and $G_c \geq 269$ mm

On the inner side of the stair, the projection of the newel ≤ 30 mm and the string width ≥ 32 mm.

On the outer side of the stair, if the handrail is 45 mm wide and there is a 45 mm clearance between the handrail and the wall, the distance from the outer edge of the clear width to the wall is 90 mm.

Therefore $W_o \geq 770 + 30 + 32 + 90$ mm

Therefore $W_o \geq 922$ mm.

B.3.6.2 *For a quarter turn winding stair with four winder treads, calculate the centre going and overall width for the minimum recommended sizes*

$G_m \geq 75$ mm, $W \geq 770$ mm, $\alpha = 22.5°$

Following the procedure in **B.3.1** gives $E \geq 185$ mm, $G_c \geq 222$ mm and $W_o \geq 922$ mm.

But G_c should be at least 225 mm to match straight flights.

Hence $E \geq 192$ mm and $G_c \geq 225$ mm.

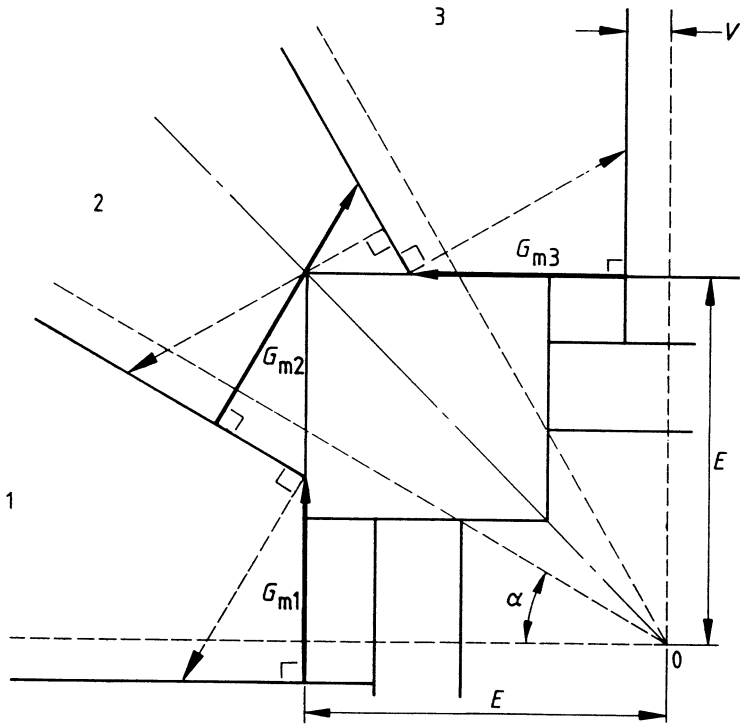


Figure 10 — Calculation of minimum going on winder flight

© BSI 02-1999

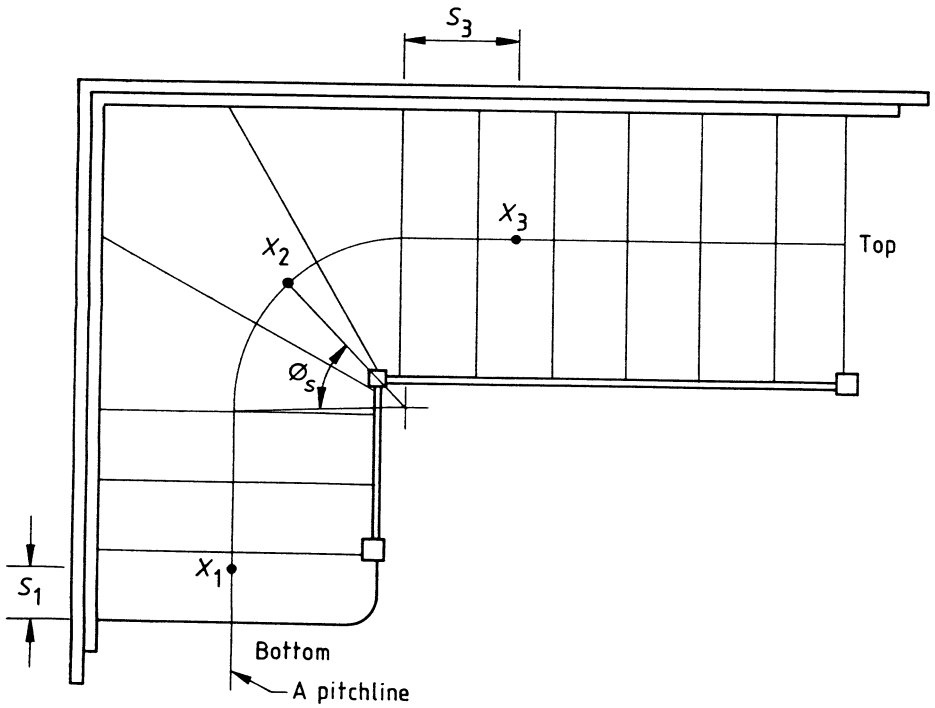


Figure 11 — Measurement of clear headroom on winder flight

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

blank

Publications referred to

BS 585, *Wood stairs.*

BS 585-2, *Specification for performance requirements for domestic stairs constructed of wood-based materials.*

BS 1186, *Timber for and workmanship in joinery.*

BS 1186-1, *Specification for timber.*

BS 1186-2, *Specification for workmanship.*

BS 1204, *Synthetic resin adhesives (phenolic and aminoplastic) for wood.*

BS 1204-1, *Specification for gap-filling adhesives.*

BS 4071, *Specification for polyvinyl acetate (PVA) emulsion adhesives for wood.*

BS 4471, *Specification for sizes of sawn and processed softwood.*

BS 5395, *Stairs, ladders and walkways.*

BS 5395-1, *Code of practice for the design of straight stairs.*

BS 5578, *Building construction — Stairs.*

BS 5578-1, *Vocabulary.*

BS 6100, *Glossary of building and civil engineering terms.*

BS 6100-1.0, *General.*

BS 6100-1.3.4, *Stairs and circulation elements*[4)].

BS 6100-1.5.1, *Coordination of dimensions; tolerances and accuracy.*

BS 6100-4, *Forest products.*

BS 6180, *Code of practice for protective barriers in and about buildings.*

BS 6566, *Plywood.*

EN 204, *Evaluation of non-structural adhesives for joining of wood and timber derived products.*

[4)] In preparation.

© BSI 02-1999

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

BSI — British Standards Institution

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

Revisions

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

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

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

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

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

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager. Tel: 020 8996 7070.

BSI
389 Chiswick High Road
London
W4 4AL