

BS 4592-1:2006

*Incorporating
Corrigendum No. 1*

BRITISH STANDARD

Industrial type flooring and stair treads –

Part 1: Metal open bar gratings – Specification

ICS 91.060.30

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British Standards

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 9 and a back cover.

Foreword

Publishing information

This part of BS 4592 was published by BSI and came into effect on 29 December 2006. It was prepared by Subcommittee B/208/1, *Stairs and walkways – Industrial*, under the authority of Technical Committee B/208, *Stairs and walkways*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 4592, together with Part 0, supersedes BS 4592-1:1995, which is withdrawn.

Information about this document

The start and finish of text introduced by Corrigendum No.1 is indicated in the text by tags C1 C1.

This part of BS 4592 incorporates some of the requirements of BS 5395-3 that will be removed from BS 5395-3 in due course.

BS 4592 is published in seven parts, as follows:

- *Part 0: Common design requirements and recommendations for installation;*
- *Part 1: Metal open bar gratings – Specification;*
- *Part 2: Expanded metal sections – Specification;*
- *Part 3: Cold formed metal planks – Specification;*
- *Part 4: Glass reinforced plastics (GRP) open bar gratings – Specification;*
- *Part 5: Solid plates in metal and glass reinforced plastics (GRP) – Specification;*
- *Part 6: Glass reinforced plastics (GRP) moulded open mesh gratings – Specification¹⁾.*

The requirements in this part cover areas that are not addressed by BS EN ISO 14122, *Safety of machinery – Permanent means of access to machinery*, which is published in the following parts:

- *Part 1: Choice of fixed means of access between two levels;*
- *Part 2: Working platforms and walkways;*
- *Part 3: Stairways, stepladders and guard-rails;*
- *Part 4: Fixed ladders.*

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, for whose use it has been produced.

¹⁾ In preparation.

Presentational conventions

The provisions of this 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 standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, 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 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 Scope

This part of BS 4592 specifies requirements for the design, manufacture, supply and installation of metal open bar gratings intended for use in industrial flooring and stair treads.

It is not applicable where access to machinery is required, in which case the requirements of BS EN ISO 14122 apply.

NOTE For the common requirements for industrial flooring and stair treads, see BS 4592-0.

In addition to the definitive requirements, this standard also requires the items detailed in BS 4592-0:2006, Clause 4 to be documented. For compliance with this standard, both the definitive requirements and the documented items have to be satisfied.

2 Normative references

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

BS 4592-0:2006, *Industrial type flooring and stair treads – Part 0: Common design requirements and recommendations for installation*

BS 8118-2, *Structural use of aluminium – Part 2: Specification for materials, workmanship and protection*

BS EN 10025, *Hot rolled products of non-alloy structural steels – Technical delivery conditions*

BS EN 1011, *Welding – Recommendations for welding of metallic materials*

BS EN 10258, *Cold-rolled stainless steel narrow strip and cut lengths – Tolerances on dimensions and shape*

BS EN 12020-1, *Aluminium and aluminium alloys – Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 – Part 1: Technical conditions for inspection and delivery*

BS EN 12020-2, *Aluminium and aluminium alloys – Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 – Part 2: Tolerances on dimensions and form*

BS EN ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods*

3 Terms and definitions

For the purposes of this part of BS 4592, the terms and definitions given in BS 4592-0 and the following apply.

NOTE Definitions of some common terms are illustrated in Figure 1.

3.1 end plate

plate fixed to stair tread for attachment to a string

- 3.2 curb angle**
support fixed to concrete or steelwork (vertical leg up) around perimeter of flooring to provide a toe plate
- 3.3 Types of bar**
 - 3.3.1 bearing bar**
member that carries the load between supports
 - 3.3.2 transverse bar**
member fixed at right angles to bearing bars to provide lateral restraint
 - 3.3.3 pressed bar**
member fixed diagonally between adjacent bearing bars to provide lateral restraint
 - 3.3.4 binding bar**
member or section fixed to the edge of a grating, flush with the top of the bearing bar
- 3.4 nosing**
member attached to the front edge of a stair tread or to a grating at the head of a stair
- 3.5 Dimensions of gratings**
 - 3.5.1 grating length**
overall measurement in a direction parallel to the bearing bars
 - 3.5.2 grating width**
overall measurement in a direction at right angles to the bearing bars
 - 3.5.3 grating depth**
overall depth of grating, which is usually the depth of the bearing bar
 - 3.5.4 grating starting edge**
distance from centre of first transverse bar to end of grating
- 3.6 Pitch**
 - 3.6.1 bearing bar pitch**
distance centre-to-centre of bearing bars
 - 3.6.2 transverse bar pitch**
distance centre-to-centre of transverse bars
 - 3.6.3 pressed bar pitch**
distance in a longitudinal direction between points of lateral restraint to adjacent bearing bars
 - 3.6.4 serration pitch**
distance centre-to-centre of the repeat pattern
- 3.7 solid top grating**
open mesh grating to which a steel plate is welded to the top surface during manufacture
- 3.8 resistance welding**
method whereby heat is generated at the metal intersection points by an electric current and, as the forging temperature is reached, pressure is applied and the materials are forge-welded together

Figure 1 Grating terms

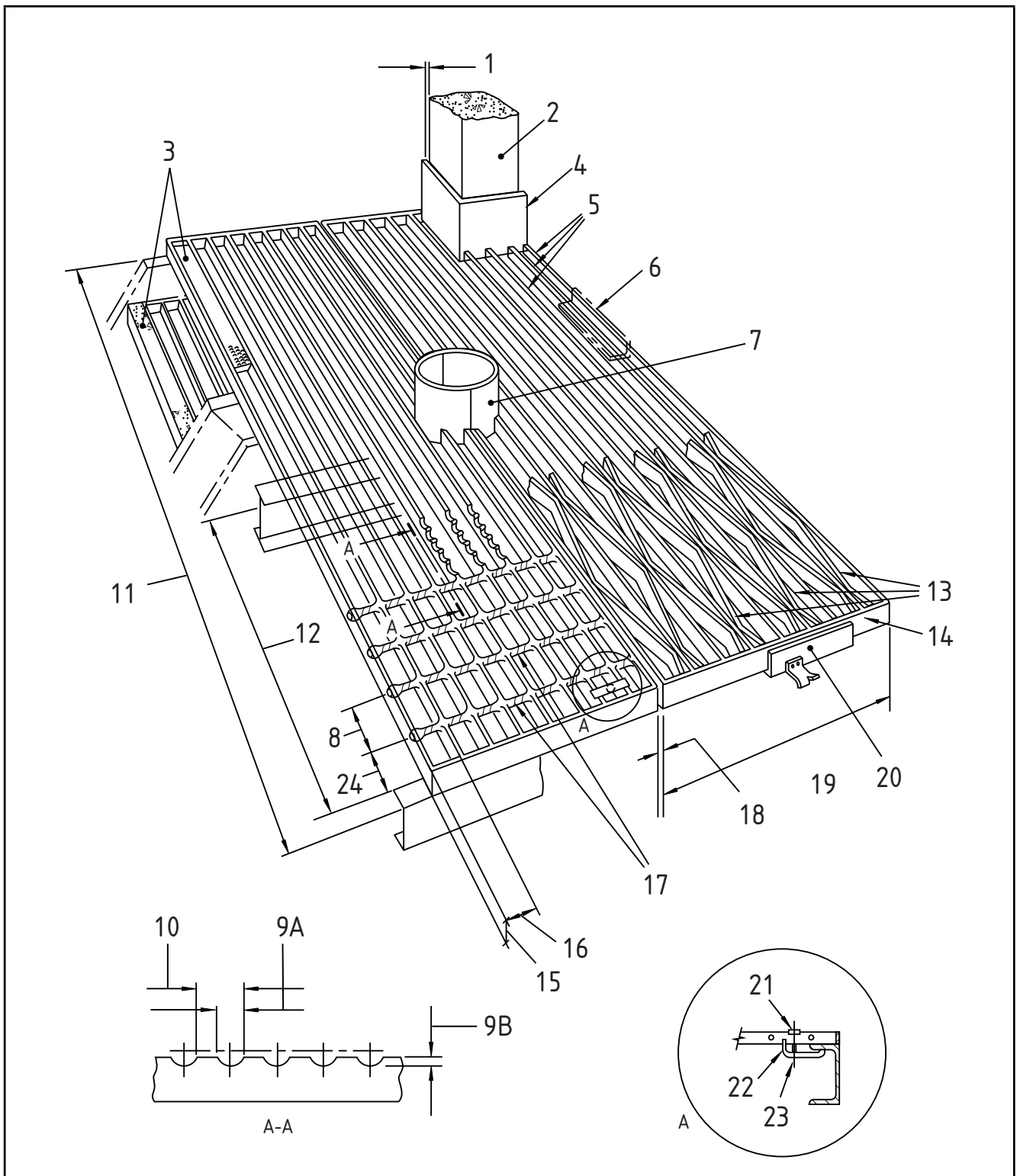


Figure 1 Grating terms (continued)

Key			
1	Erection clearance (from inside of toe plate to face of column)	12	Span
2	Wall or column	13	Pressed bar
3	Slip resistant strip (nosing) at top of stair or step-off point and tread	14	Binding bar
4	Cut-out with straight shaping and toe plate	15	Grating depth
5	Bearing bars	16	Bearing bar pitch
6	Curb angle used on edge of concrete rebate	17	Transverse bars
7	Cut-out with curved shaping and toe plate	18	Erection clearance
8	Transverse bar pitch	19	Width
9A	Length of serration (see 6.3)	20	Curb angle (with grouting tangs)
9B	Depth of serration (see 6.3)	21	Top clip
10	Serration pitch	22	Bottom clip
11	Grating length	23	Bolt
		24	Grating starting edge

4 Information to be supplied

The following items to be agreed between the contracting parties are specified in the clauses referred to and shall be fully documented. For compliance with the standard both the definitive requirements specified throughout this part of BS 4592 and those specified in BS 4592-0:2006, Clause 4 and the following documented item shall be satisfied.

- a) Requirements for protection against corrosion (see 5.3).

5 Material requirements

5.1 Steel

Low carbon steel for metal open bar gratings shall, as a minimum, conform to BS EN 10025.

Stainless steel shall, as a minimum, conform to the requirements of austenitic steel specified in BS EN 10258.

5.2 Aluminium

Aluminium for metal open bar gratings shall, as a minimum, conform to BS EN 12020-1 and BS EN 12020-2.

5.3 Protection against corrosion

Metal open bar gratings shall be free draining.

NOTE 1 The requirements vary, depending on the end-use and the exposure environment. However, hot dip galvanizing is recommended for external protection of low carbon steel.

Requirements for protection against corrosion shall be agreed between the manufacturer and the purchaser.

When hot dip galvanizing is applied, it shall conform to BS EN ISO 1461.

NOTE 2 Guidance on the required level of protection should be sought by referring to BS EN ISO 14713.

6 Size requirements

NOTE Gratings can be provided with a solid steel plate welded to the top surface during manufacture, in order to cover any opening in the top surface that would permit the passage of smaller objects. This would also increase the strength of the floor and provide a more suitable surface for the passage of small solid wheeled trolleys when required.

6.1 The thickness of bearing bars, binding bars and either flat, square or round transverse bars, or pressed bars subject to the tolerances permitted in the appropriate material standard, shall be such that it can be demonstrated by calculation or test, that they meet the appropriate design criteria specified in BS 4592-0 and are fit for the relevant design load, as specified in BS 4592-0:2006, Table 1.

6.2 The transverse bar pitch and pressed bar pitch shall be determined by calculation or test, such that they meet the appropriate design criteria and are fit for the purpose for which they are intended, as specified in BS 4592-0.

6.3 For serrations (see Figure 1), the serration length shall be not less than 55% of their pitch (see Figure 1, 9A) and serration depth shall be not less than 2.5 mm (see Figure 1, 9B). There shall be at least five serrations per 100 mm length of grating. \square Mill rolled and machine cut serrations shall be provided to increase grip and interlock between the top of the floor and the appropriate industrial type footwear to provide an enhanced slip resistant floor. \square

7 Tolerance requirements

7.1 The maximum permissible tolerances from finished sizes of gratings shall be as shown in Table 1.

7.2 The maximum permissible manufacturing tolerances shall be as given in Table 2.

Table 1 **Permissible tolerances**

Location	Tolerance mm
Length of grating panel or individual bearing bar	+0 -5
Width of grating	+0 -5
Depth of bearing bar:	
up to and including 25	+1 -0.5
over 25 up to 50	+1.5 -0.75
over 50 up to 100	+2.0 -1.0
over 100 up to 150	+2.0 -1.5
Thickness of bearing bar:	
up to 10	±0.4
over 10 up to 15	±0.5
Binding:	
top of binding bar above bearing bar	+4.0 -0
underside of binding bar above bottom of bearing bar	+0

Table 2 **Manufacturing tolerances**

Location	Tolerance mm
Difference between the length of diagonals	5 (out of squareness of grating panel)
Transverse bars in either direction from perpendicular alignment with bearing bars	1:100
Transverse bar spacing	±5 per 1 500 length of bearing bars
Bearing bar lean	1:10
Transverse bow of panel before fastening to supports	1:100
Longitudinal bow of panel before fastening to supports	1:200

8 Construction requirements

NOTE For imposed loads on treads, see BS 4592-0.

8.1 Bearing bars shall be provided with lateral restraint by means of transverse bars or pressed bars, fixed at each point of intersection or contact with the bearing bars by means of welding (see **8.2**), riveting or pressure locking.

8.2 Welding of steel shall either be arc welding, in accordance with BS EN 1011, or resistance welding.

Welding of aluminium shall be in accordance with BS 8118-2.

NOTE Binding bars can be reduced in depth to aid free draining (see 5.3) provided that it can be demonstrated if required, by calculation or test, that they are fit for the purpose for which they were intended.

NOTE 1 Alternatively, binding bars can be connected by an electroforge process in a manner that can be demonstrated if required, by calculation or test, that they meet the appropriate design criteria and are fit for the purpose for which they are intended.

NOTE 2 Where end plates transfer the load from stair treads through a ledge support, the amount of welding can be reduced, if this can be demonstrated by calculation or test.

8.3 Where binding bars are loadbearing, they shall be of equivalent strength to the bearing bars but not project below them.

8.4 Where the function of binding bars excludes load transfer, they shall be attached to the bearing bar by such means as that they can be demonstrated if required, by calculation or test, to be fit for the purpose for which they are intended.

However, where the binding bars are subject to load transfer from bearing bars, including end plates for stair treads, the connection between them shall be provided, if welded, by a fillet weld. The fillet weld shall have a leg length that is at least equivalent to the thickness of a bearing bar, throughout the depth of the connection on one side of every bearing bar.

8.5 When binding bars are applied along the length of a grating, they shall be secured at every transverse bar, or at every point where they are in contact with a pressed bar.

8.6 Where a cut-out is required in a grating and the gap is less than 30 mm, the opening shall be trimmed with a binding bar. Where a cut-out is required in a grating end and the gap is greater than 30 mm, the opening shall be trimmed with a toe plate.

8.7 Nosings shall be used consistently throughout the stair.

NOTE Nosings should be securely attached to end plates and gratings.

9 Performance requirements

9.1 Gratings

Metal open bar gratings shall withstand the appropriate loads given in BS 4592-0:2006, Clause 5.

Metal open bar gratings required to take vehicle loads travelling at 90° to the direction of bearing bars, i.e. across the bearing bars, shall either have pressed bars, or transverse bars that pass through the bearing bars below the top of the grating.

NOTE 1 This is in order to reduce the tendency for bearing bars to flip over, under accelerating or braking conditions, across the grating widths.

NOTE 2 For vehicular traffic, unfactored wheel loads can have the permissible stress increased by 10%, provided there is a 25% increase made to the unfactored load to allow for impact.

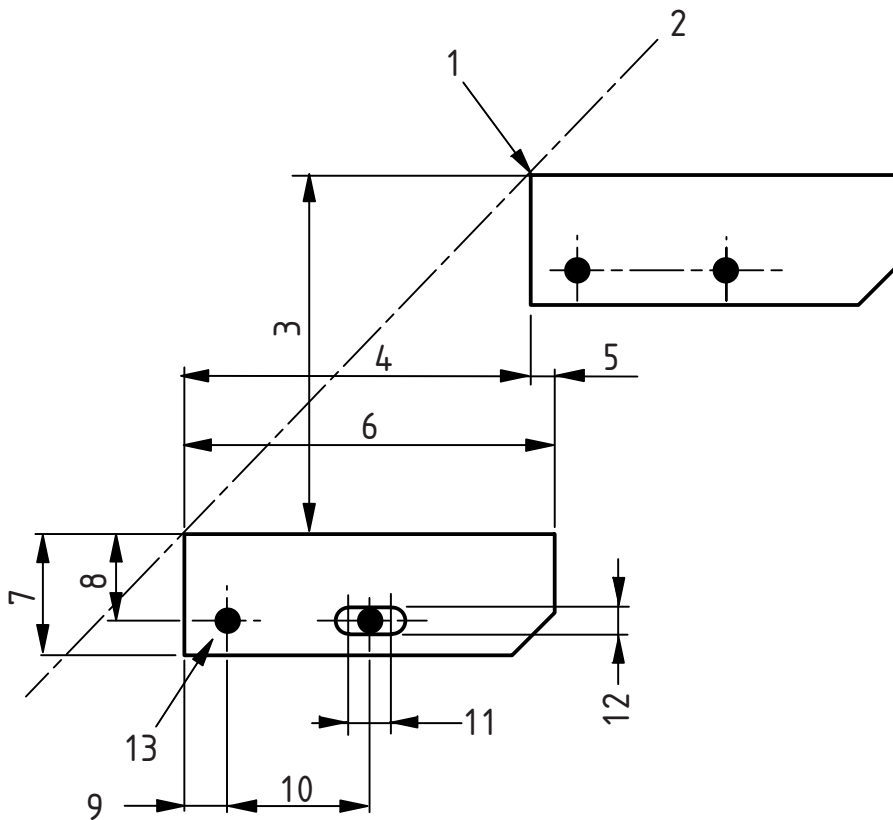
9.2 Stair treads

NOTE 1 Where end plates for stair treads are welded to the treads this should be for the full width of the tread along one side of each loadbearing bar, unless the load is transferred through a ledge support secured to, or forming part of, the end plate.

Stair treads shall withstand the appropriate loads given in BS 4592-0:2006, Clause 6.

NOTE 2 Fixing dimensions for bolted tread end plates are shown in Figure 2.

Figure 2 Fixing dimensions for tread end plates



Key

- | | | | |
|---|--|----|--|
| 1 | Leading edge of stair tread fitted with anti-slip nosing | 9 | Dimension from leading edge of tread to centre of first bolt (30 mm) |
| 2 | Pitch line | 10 | Bolt centre dimension (see Notes 1 and 2) |
| 3 | Riser | 11 | Hole centre for dimension from slotted hole (30 mm) |
| 4 | Going | 12 | Dimension for slot width (14 mm for stair treads, 12 mm for ladder treads) |
| 5 | Overlap (= >16 mm) | 13 | Hole diameter for first bolt (14 mm for stair treads, 12 mm for ladder treads) |
| 6 | Tread width | | |
| 7 | Overall depth of endplate (70 mm) | | |
| 8 | Dimension from top of endplate to centre bolts (50 mm) | | |

NOTE 1 For tread widths (6) of 250 mm to 290 mm dimension 10 is 125 mm.

NOTE 2 For tread widths (6) of 291 or more dimension 10 is 175 mm.

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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 5395-3, *Stairs, ladders and walkways – Part 3: Code of practice for the design of industrial type stairs, permanent ladders and walkways*

BS EN ISO 14122 (all parts), *Safety of machinery*

BS EN ISO 14713, *Protection against corrosion of iron and steel in structures – Zinc and aluminium coatings – Guidelines*

Further reading

BS 1449-1:1991, *Steel plate, sheet and strip – Carbon and carbon-manganese plate, sheet and strip – Part 1: General specification*

BS 5395 (all parts), *Stairs, ladders and walkways*

BS 5502, *Buildings and structures for agriculture*

BS 5950-1, *Structural use of steelwork in building – Code of practice for design – Part 1: Rolled and welded sections*

BS 6100-1.0, *Glossary of building and civil engineering terms – Part 1: General and miscellaneous – Section 1.0: General*

BS 8118 (all parts), *Structural use of aluminium*

BS EN 573-3:1995, *Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition*

BS EN 573-4:1995, *Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 4: Forms of product*

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