

BS 9101:2017



BSI Standards Publication

Steel and aluminium rainwater systems – Specification



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Published by BSI Standards Limited 2017

ISBN 978 0 580 80460 1

ICS 23.040.01; 91.060.20; 91.140.80

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

Committee reference B/542/6

Draft for comment 16/30270371 DC

Publication history

First published January 2017

Amendments issued since publication

Date	Text affected
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This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 40, 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 31 January 2017. It was prepared by Subcommittee B/542/6, *Corrugated sheeting materials*, under the authority of Technical Committee B/542, *Roofing and cladding products for discontinuous laying*. A list of organizations represented on these committees can be obtained on request to their secretary.

Relationship with other publications

Harmonization of European Standards resulted in the withdrawal of the British Standards for aluminium rainwater goods, BS 2997:1958, and steel rainwater goods, BS 1091:1963, leaving the UK with no standards for its generic types of steel and aluminium gutter and rainwater pipe systems.

This British Standard covers UK metal gutter and rainwater pipe systems excluded from the scopes of BS EN 612 and BS 8530.

Use of this document

Two methods of testing gutter strength are permitted by this British Standard: finite element analysis (Annex A) and physical testing (Annex B), to avoid limiting user's testing options. These are equivalent methods of testing.

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.

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 British Standard specifies requirements for the design and manufacture of metal gutters and pipes intended to drain rainwater from buildings. It specifies the materials, tolerances, mechanical properties and surface conditions, coatings, laminated surfaces, jointing methods and fixings for rainwater systems, including fittings and accessories for assembly or support.

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.

Standards publications

BS 1474, *Specification for wrought aluminium and aluminium alloys for general engineering purposes: bars, extruded round tubes and sections*¹⁾

BS 8530, *Traditional-style half round, beaded half round, Victorian ogee and moulded ogee aluminium rainwater systems – Specification*

BS EN 485-2:2016, *Aluminium and aluminium alloys – Sheet, strip and plate – Part 2: Mechanical properties*

BS EN 681-1, *Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanized rubber*

BS EN 755-2, *Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 2: Mechanical properties*

BS EN 755-3, *Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 3: Round bars, tolerances on dimensions and form*

BS EN 755-4, *Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 4: Square bars, tolerances on dimensions and form*

BS EN 755-5, *Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 5: Rectangular bars, tolerances on dimensions and form*

BS EN 755-7, *Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 7: Seamless tubes, tolerances on dimensions and form*

BS EN 755-9, *Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 9: Profiles, tolerances on dimensions and form*

BS EN 10025 (all parts), *Hot rolled products of structural steels*

BS EN 10088-1, *Stainless steels – Part 1: List of stainless steels*

BS EN 10111, *Continuously hot rolled low carbon steel sheet and strip for cold forming – Technical delivery conditions*

BS EN 10152:2009, *Electrolytically zinc coated cold rolled steel flat products for cold forming – Technical delivery and conditions*

BS EN 10346, *Continuously hot-dip coated steel flat products for cold forming – Technical delivery conditions*

BS EN 12056 (all parts), *Gravity drainage systems inside buildings*

BS EN 12056-3, *Gravity drainage systems inside buildings – Part 3: Roof drainage, layout and calculation*²⁾

¹⁾ Withdrawn.

²⁾ This standard gives informative references to BS EN 10256-3:2000.

BS EN 13523 (all parts), *Coil coated metals – Test methods*

BS EN ISO 544, *Welding consumables – Technical delivery conditions for filler materials and fluxes – Type of product, dimensions, tolerances and markings*

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

BS EN ISO 11600:2003+A1:2011, *Building construction – Jointing products – Classification and requirements for sealants*

Other publications

[N1] NATIONAL FEDERATION OF ROOFING CONTRACTORS LIMITED (NFRC).
Technical Bulletin 36: *Performance Standards for Butyl Strip Sealants in Metal Clad Buildings*. London: NFRC, June 2003.

3 Terms and definitions

For the purpose of this British Standard, the following terms and definitions apply.

3.1 accessories

rivets, bolts, nuts, washers and screws for fixing gutters and pipes to a building

3.2 angle

corner component which changes the direction of the gutter

3.3 boundary (or parapet) wall gutter

gutter positioned against the vertical internal face of a perimeter parapet wall

3.4 cast aluminium

type of aluminium made by pouring molten aluminium into a mould form

3.5 extruded aluminium

linear shaped aluminium profile formed by forcing a preheated softened aluminium mass under extreme pressure through a die, the opening of which corresponds to the required cross-sectional profile

3.6 fitting <gutter>

angle, outlet, stop end or double socket/spigot joint union for use with gutters

3.7 fitting <pipe>

shoe, offset (double bend), bend, branch, loose socket, pipe clip or hopper head for use with pipes

3.8 fittings and accessories for assembly or support

gutter joint unions, corner pieces, rainwater outlets, end caps and support brackets to create a complete gutter installation

3.9 Gutters

3.9.1 gutter

open channel which collects and evacuates rainwater from a roof area

3.9.2 eaves gutter

gutter fitted to the edge of a roof to the external face of a building

3.9.3 inboard gutter

gutter that is internal to the building fabric

NOTE These include valley, boundary wall, inplane roof and enclosed eaves gutters.

3.9.4 outboard gutter

gutter that is external to the building fabric

NOTE These gutters are exterior of the building envelope and supported on one side.

3.9.5 valley gutter

gutter positioned at the base of two sloping roofs

3.10 Gutter brackets**3.10.1 fascia bracket**

gutter bracket suitable for fixing to a surface which runs parallel to the building

3.10.2 gutter bracket

item for retaining/supporting a gutter to a building

3.10.3 purlin valley bracket

gutter bracket hooked over two parallel roof support members forming a cradle to carry a valley gutter

3.10.4 rise and fall bracket

gutter bracket assembly for fixing into masonry below the gutter, which provides height adjustment via a vertical bar connected to the gutter support cradle

3.10.5 side/top rafter bracket

gutter bracket suitable for fixing to the side or top of a roof rafter

3.11 gutter sole

horizontal base section of gutter

NOTE Also taken to refer to the width across the horizontal base section measured perpendicular to the gutter run.

3.12 Joints**3.12.1 joint**

connection between the ends of gutters, fittings or pipes

3.12.2 joggle joint

gutter jointing method whereby a jointing sleeve with holes along one edge to facilitate mechanical fixing is factory welded or fabricated to the end of a gutter section, allowing a bolted joint to be made to another gutter section

3.12.3 socket joint

end of an external profile of gutter or pipe enlarged to allow another section of pipe or gutter to be placed inside the enlarged area forming a joint between sections

3.12.4 spigot joint

end of an external profile of gutter or pipe proportionately reduced in size to allow the reduced end to be placed into a gutter or pipe to form a joint

3.13 nominal size DN

alphanumeric designation of size for components of a pipework system, which is used for reference purposes

NOTE The nominal size comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections.

- 3.14 patch outlet/roof outlet**
preformed flanged rainwater outlet which is mechanically fixed and sealed to the inside or outside of a flat or non-flat base gutter to drain rainwater from the gutter
- 3.15 pipe**
tube of uniform bore, straight in axis, having either a spigot or socket connector facility, or plain ended for connection with a separate connector
- 3.16 PPC**
electrostatically applied polyester powder coating painting method
- 3.17 press-formed sheet steel/aluminium gutter system**
gutter made from flat sheet metal/aluminium machine formed to a given longitudinal shape
- 3.18 protective coating**
coating or system applied to a corrosive metal substrate to prevent or reduce corrosion
- EXAMPLE**
- Galvanizing to BS EN ISO 1461 or electroplated zinc coating to BS EN ISO 2081
- 3.19 rainwater system**
above ground system for the conveyance of rainwater from a building
- 3.20 sheet steel or aluminium**
flat piece of steel or aluminium manufactured from molten steel or aluminium, formed when metal is passed through pinch rollers to reduce the material to required thickness
- 3.21 weir overflow**
opening or outlet pipe positioned below the overflow level of the gutter to act as a gutter outlet blockage warning indicator

4 Gutters

COMMENTARY ON CLAUSE 4

Many press-formed sheet steel gutter systems are manufactured to bespoke dimensions and profiles. It is therefore not possible to tabulate the required material thickness for all developed widths of gutters as the structural integrity is affected by various factors, such as profile, support method, bonded insulation materials. Also, valley and boundary wall gutters need to allow, where appropriate, for the additional load of pedestrian traffic for roof maintenance purposes.

Therefore, unless the required gutter design conforms to performance criteria when tested in accordance with Annex A (FEA) or Annex B (physical testing), the design needs to be supported by calculations as set out in Annex A or by independently certified test results to prove fitness for purpose.

4.1 The gutter dimensions and profiles necessary to achieve the required hydraulic performance shall be designed in accordance with BS EN 12056-3.

4.2 When a gutter system comprising the combination(s) of components in Table 1 to Table 6 appropriate for the anticipated application (e.g. type of building, such as industrial) and service design life (see BS 7543) is:

- a) subjected to the maximum applied service loads in accordance with Annex A (FEA test method):
 - 1) the reported stress shall be less than the yield strength of the material (see Table A.4);
 - 2) for inboard gutters, the reported deflection shall not exceed gutter sole width divided by 50 (L/50) (see Table A.4); and
 - 3) for outboard gutters, the reported deflection shall not exceed gutter sole width divided by 20 (L/20) (see Table A.4); or
- b) subjected to the maximum applied safety loads + 1.5 (factor of safety) in accordance with Annex B (physical test method), the reported stress shall be less than the maximum tensile strength of the material (see Table B.1).

4.3 The gutters to be tested to the requirements of 4.2 shall be selected based on the following parameters.

- a) For each gutter shape range, the largest gutter in the range shall be tested. If thinner material is used for smaller gutters in a range, then in addition to the largest gutter in the range, the largest gutter for any material thickness shall be tested.
- b) Any bespoke gutters falling outside the normal manufacturer's range shall be tested.

4.4 Where FEA methods are to be used, the two standard benchmark test cases in A.1 shall first be run using the FEA set-up and the results confirmed to be within $\pm 5\%$ of benchmark figures. The same procedures and set-up shall then be used for testing all the products to be tested by FEA.

Table 1 Gutter material and protective/decorative coatings

Material	Weather protection coating	Decorative coating
Mild steel sheet, coil or strip conforming to BS EN ISO 1461, BS EN 10025 or BS EN 10111 for galvanizing after manufacture	Black bitumen PVC/TPO/PPC coating	PPC Wet paint
Pre-galvanized sheet, coil or strip conforming to BS EN 10346	Black bitumen or PVC/TPO/ pre- or post-laminated membrane Self-finish	PPC Wet paint
Stainless steel sheet, coil or strip conforming to BS EN 10088-1	Self-finish	None
Plastisol-coated steel conforming to BS EN 13523	Double-sided self-finish or bitumen	Self-finish
Electro-zinc coated steel sheet conforming to BS EN 10152:2009, DC01+ZE 25/25	Black bitumen or PVC/TPO/PPC coating	PPC wet paint
Aluminium sheet of alloy 1050A H14, BS EN 485-2:2016	Self-finish	PPC Wet finish
Extruded aluminium to BS EN 755-2, BS EN 755-3, BS EN 755-4, BS EN 755-5, BS EN 755-7, BS EN ISO 544, BS 1474 ³⁾	Self-finish	PPC Wet finish anodized
Cast aluminium to BS 8530	Self-finish	PPC Wet finish

³⁾ Withdrawn.

Table 2 Example gutter types

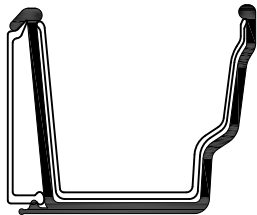
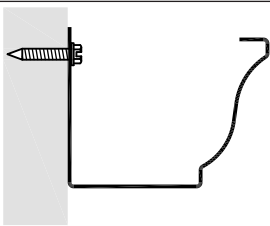
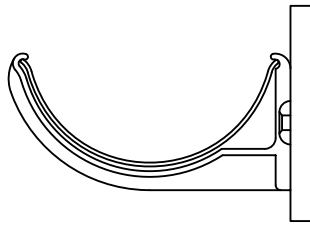
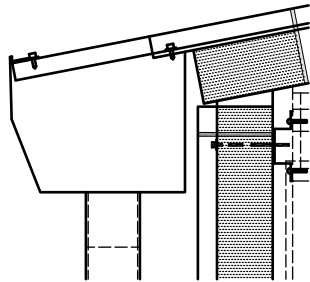
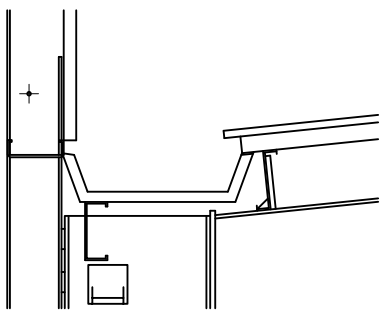
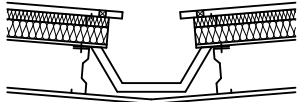
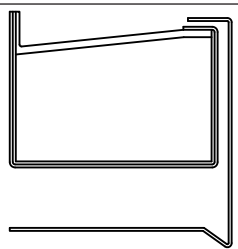
Type	Drawing
Outboard gutters Concealed fixed eaves gutter	
Direct fixed eaves gutter	
Eaves gutter with fascia bracket	
Trimline eaves gutter (top hung)	
Inboard gutters Boundary wall/parapet gutter	
Valley gutter	
Enclosed eaves gutter	

Table 3 Joints: Connection, sealants, fixings and expansion (1 of 2)

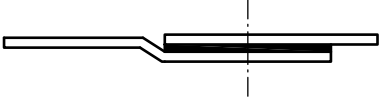
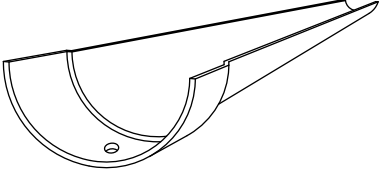
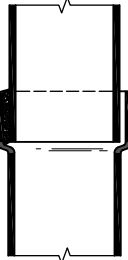
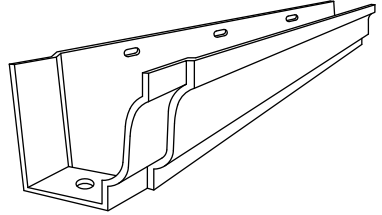
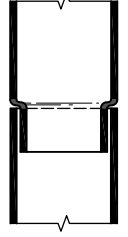
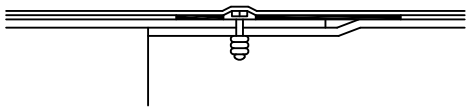
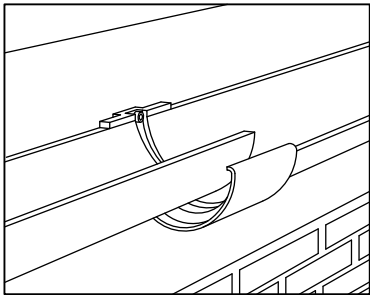
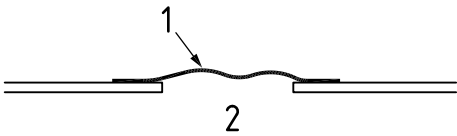
Connection type	Fixing type	Sealant
Loose butt strap joint: 	Captive nuts/rivets/studs Stainless self-drilling screws compatible with the gutter material substrate	Gun-applied, high-performance, low modulus silicone conforming to BS EN ISO 11600:2003+A1:2011; Butyl strip sealant of Class A classification as published in the NFRC Technical Bulletin 36 (June 2003) [N1]; or Compressed EPDM rubber seal strips conforming to BS EN 681-1
Joggle joint: 	Captive nuts/rivets/studs Stainless self-drilling screws compatible with the gutter material substrate	
Welded butt strap joint: 	Captive nuts/rivets/studs Stainless self-drilling screws compatible with the gutter material substrate	
Socket (gutter): 	Nuts and bolts/rivets compatible with the gutter material substrate	
Socket (pipe): 	No joint fixing required	
Spigot (gutter): 	Nuts and bolts/rivets compatible with the gutter material substrate	
Spigot (pipe): 	No joint fixing required	

Table 3 Joints: Connection, sealants, fixings and expansion (2 of 2)

Connection type	Fixing type	Sealant
Membrane joint: 	PVC/TPO membrane, incorporating mechanical fixing and aluminium foil tape	
Compression or snap fit gutter joint: 	No mechanical fixing	
Expansion joint:  Key 1 Flexible material bonded to gutter, both sides of joint 2 Gap in solid gutter to allow movement	Proprietary fixed per manufacturer's instructions	

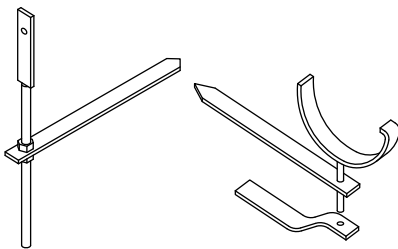
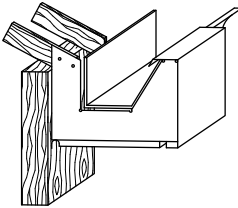
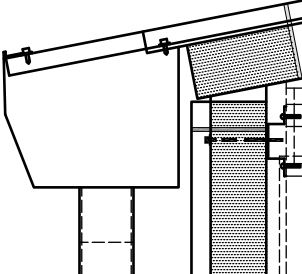
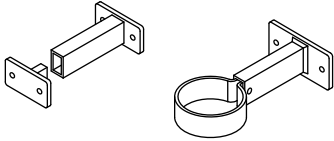
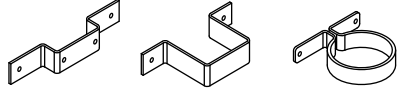
NOTE 1 Consideration to be given to bimetallic corrosion from dissimilar materials. Guidance on corrosion at bimetallic contacts is given in PD 6484.

NOTE 2 For internal gutters, insulation can be used. Note that the gutter does not have a U value; it has a ψ value to provide a thermal transmittance to permit ice in the gutter to melt before that on the remainder of the roof area.

Table 4 Gutter support: Connectivity to the frame, brackets, fascia fix (1 of 2)

Support type	Illustration
Fascia bracket	
Internal cross-brace	
Direct-fix 1: Eaves	
Direct-fix 2: Purlin	
Side/top rafter bracket	

Table 4 Gutter support: Connectivity to the frame, brackets, fascia fix (2 of 2)

Support type	Illustration
Rise and fall bracket	
Web bracket Cradle bracket	
Top hung from roof sheet (trimline gutter)	
Extension pipe brackets, pipe clips, concealed pipe clips	
Clips	
Concealed fixings	