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EAST AFRICAN STANDARD

Wrought copper and wrought zinc rainwater goods — Specification

EAST AFRICAN COMMUNITY

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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Introduction

In the preparation of this East African Standard, the following source was consulted extensively:

BS 1431:1960, *Specification for wrought copper and wrought zinc rainwater goods*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

Draft for comments only — Not to be cited as East African Standard

B.S. 1431 : 1960

SPECIFICATION FOR
WROUGHT COPPER AND
WROUGHT ZINC
RAINWATER GOODS

B.S. 1431 : 1960

THIS BRITISH STANDARD, having been approved by the Hardware and Ironmongery Industry Standards Committee and endorsed by the Chairman of the Building Divisional Council, was published under the authority of the General Council on 21st September, 1960.

First published November, 1948.
First revision September, 1960.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 3000, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook, price 15s.

This standard makes reference to the following British Standards:

- B.S. 219 Soft solders.
- B.S. 729 Copper sulphate test and visual examination of hot dip galvanized and sherardized coatings.
- B.S. 849 Plain sheet zinc roofing.
- B.S. 899 Rolled copper sheet and strip for general purposes.
- B.S. 1172 Phosphorus deoxidized non-arsenical copper for general purposes.
- B.S. 1174 Phosphorus deoxidized arsenical copper.
- B.S. 2997 Aluminium rainwater goods.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this standard:
Committee reference HIB/20 Draft for comment CZ(HIB) 9380

CO-OPERATING ORGANIZATIONS

The Hardware and Ironmongery Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- British Ironfounders' Association
- British Lock and Latch Manufacturers' Association
- British Plastics Federation
- *Building Industry Distributors
 - Cast Butt Hinge Manufacturers' Association
- *D.S.I.R.—Building Research Station
- *Institution of Municipal Engineers
- *London County Council
 - Metal Window Association
- *Ministry of Housing and Local Government
- *Ministry of Works
 - National Brassfoundry Association
 - National Federation of Building Trades Employers
 - National Federation of Ironmongers
- *Royal Institute of British Architects
- *Royal Institution of Chartered Surveyors

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this standard:

- Aluminium Development Association
- Aluminium Industry Council
- Associated Master Plumbers and Domestic Engineers
- British Federation of Plumbers' Merchants
- Copper Development Association
- Gutter Bracket Manufacturers' Association
- Light Metal Founders' Association
- Royal Society for the Promotion of Health
- Zinc Development Association

BRITISH STANDARD SPECIFICATION FOR
WROUGHT COPPER AND WROUGHT ZINC
RAINWATER GOODS

FOREWORD

This British Standard was prepared in order to co-ordinate the general features of rainwater goods made from wrought copper and wrought zinc. It has been revised so that as far as possible it is similar in form to B.S. 2997, 'Aluminium rainwater goods'.

In view of the importance of correctly fixing and jointing the types of rainwater goods described, recommendations covering these matters have been given, for reference, in Appendix A.

Factors to assist in conversions to metric units may be found in Appendix B.

SPECIFICATION

PART 1. GENERAL REQUIREMENTS

SCOPE

1. This British Standard covers the materials, workmanship, design, construction, dimensions and tolerances on dimensions of rainwater goods, comprising eaves gutter, gutter fittings, rainwater pipe and pipe fittings, made from copper and zinc.

Accessories such as gutter brackets are not dealt with in the specification but recommendations concerning their selection, design and use are given in Appendix A.

DEFINITION

2. For the purpose of this British Standard, the following definition applies:

Obtuse angle. An angle of $135 \pm 2^\circ$ unless otherwise specified by the purchaser.

MATERIALS

3. *a. Copper goods.* (i) *Gutter.* The gutter shall be made from material complying with the requirements of B.S. 899*, in the half-hard condition.

(ii) *Gutter fittings.* Gutter fittings shall be made from material complying with the requirements of B.S. 899*, in the half-hard condition.

* B.S. 899, 'Rolled copper sheet and strip for general purposes'.

(iii) *Rainwater pipe*. A. Rainwater pipe made from sheet or strip shall be made from material complying with the requirements of B.S. 899*, in the annealed condition.

B. Rainwater pipe which is solid-drawn shall be made from material which complies with the requirements of either B.S. 1172† or B.S. 1174‡ at the option of the manufacturer.

(iv) *Rainwater pipe fittings*. Rainwater pipe fittings shall be made from material complying with the requirements of B.S. 899*, in the annealed condition.

b. **Zinc goods**. All zinc rainwater goods shall be made from zinc sheet complying with the requirements of Part 1 of B.S. 849§.

c. **Solder**. Solder, if used, shall conform to Grade F of B.S. 219||.

WORKMANSHIP

4. a. **General**. The rainwater goods shall be free from deleterious defects such as holes, twist, burrs, laminations, surface cracks and drawing fractures.

b. **Joints**. Joints shall be soundly and solidly made and all surplus flux and superfluous jointing material shall be carefully removed.

c. **Finish**. There shall be no pronounced tool or drawing marks on the rainwater goods, which shall be finished 'as rolled' or 'as drawn'.

CONSTRUCTION

5. The rainwater goods shall be soundly constructed in accordance with the specific requirements of the appropriate clauses in this British Standard.

DIMENSIONS AND TOLERANCES

6. a. **Dimensions**. The dimensions of the rainwater goods shall conform to those given in the appropriate clauses, tables and drawings in Part 2 of this British Standard.

b. **Tolerances**. Unless otherwise specified in this British Standard, the dimensions (except decimal dimensions) given in Part 2 below shall be subject to a tolerance of $\pm \frac{1}{16}$ in, except that the extreme range of variation, from the specified dimensions, between articles supplied to any one order shall not exceed $\frac{1}{16}$ in.

* B.S. 899, 'Rolled copper sheet and strip for general purposes'.

† B.S. 1172, 'Phosphorus deoxidized non-arsenical copper for general purposes'.

‡ B.S. 1174, 'Phosphorus deoxidized arsenical copper'.

§ B.S. 849, 'Plain sheet zinc roofing'.

|| B.S. 219, 'Soft solder'.

MANUFACTURER'S CERTIFICATE AND MARKING

7. Articles shall be either marked indelibly with the manufacturer's name or identification mark and the number of this British Standard, or the manufacturer shall certify that the goods comply with this British Standard.

FACILITIES FOR INSPECTION

8. The purchaser or his representative shall, if he so requires, be given facilities at the works of the manufacturer at all reasonable times for the purpose of carrying out inspection during manufacture of the goods being supplied to his order.

The manufacturer shall, at his own cost, supply labour and any apparatus for such inspection as may be carried out on his premises.

PART 2. SPECIFIC REQUIREMENTS

SECTION ONE: RAINWATER GUTTERS AND GUTTER FITTINGS

TYPES OF GUTTERS

9. Gutters shall be of one of the cross sections shown in the following drawings:

Fig. 1, half-round, with a double bead.

Fig. 2, rectangular, with a bead on the exposed face.

Fig. 3, ogee, with a bead on the moulded face.

CONSTRUCTION OF GUTTERS

10. *a. General.* Gutters shall be cold formed from sheet or strip material.

b. Stays. The purchaser shall state with his order if he does not require the gutter to be strengthened by the affixing of stiffening stays, otherwise the manufacturer shall supply gutter having distance pieces, formed of tubes, soldered in the positions shown in Figs. 1-3, at centres not exceeding 15 in.

For copper gutters, fixed stays shall be of copper or a suitable copper alloy.

For zinc gutters, fixed stays shall be of zinc.

NOTE. For recommendations concerning stays which form part of the supporting brackets, see the Appendix.

c. Beaded edges. Gutters shall be provided with beaded edges of the types shown in Figs. 1, 2, 3 and 4*a* below, except that, if specially ordered by the purchaser, the bead shall have one of the alternative profiles shown in Figs. 4*b* or 4*c*.

DIMENSIONS OF GUTTERS

11. a. General. Gutters shall conform to the dimensions given in Sub-clauses *b*, *c*, *d* and *e* below.

b. Nominal sizes. The range of nominal sizes, which shall be measured internally as indicated by the letter A on Figs. 1, 2 and 3 below, shall be 3 in, 4 in, 4½ in and 5 in.

c. Lengths. Gutters shall be provided in overall* lengths of 6 ft 0 in, 7 ft 0 in and 8 ft 0 in or shorter lengths when specially ordered.

d. Thicknesses. The thickness of gutters and fittings shall be not less than the following:

(i) *Copper gutters:*

Nominal sizes less than 5 in	24 S.W.G. (0.022 in)
5 in nominal size	22 S.W.G. (0.028 in)

(ii) *Zinc gutters:*

Nominal sizes less than 5 in	23 S.W.G. (0.024 in) (i.e. 12 zinc gauge)
5 in nominal size	21 S.W.G. (0.032 in) (i.e. 14 zinc gauge)

e. Profiles. The profiles of gutters shall conform to Figs. 1, 2 and 3 and Table 1.

* It is impracticable to give 'effective lengths', as in other British Standards for gutters and pipes, because the types covered by this standard are not provided with sockets and it is customary, therefore, to refer only to overall lengths.

TABLE 1. DIMENSIONS OF GUTTER PROFILES

Type	Dimension	Nominal size (A)				
		3 in	4 in	4½ in	5 in	
		in	in	in	in	
Half-round	Depth at B	1⅞	2½	2¾	3	
	Depth at C	1½	2	2¼	2⅝	
	Diameter of bead E	⅜	½	½	⅝	
	Alternative width of flange E ₁	½	¾	¾	1	
Rectangular	Depth at B	2⅝	3⅝	3⅞	4¼	
	Depth at C	2	3	3¼	3½	
	Diameter of bead E	⅝	⅞	⅞	¾	
	Alternative width of flange E ₁	½	¾	¾	1	
Ogee	Depth at B	2¾	3⅝	3⅞	4¼	
	Depth at C	2⅝	3	3¼	3½	
	Depth at D	¾	1	1	1⅞	
	Diameter of bead E	⅝	⅞	⅞	¾	
	Radius F	1⅞	1⅞	1½	1⅝	
	Bed of gutter G	1⅞	2⅞	2⅞	2⅞	
	Alternative width of flange E ₁	½	¾	¾	1	
	Location of centre for external radius	X	½	¾	¾	¾
		Y	1¾	2⅞	2⅞	2⅞

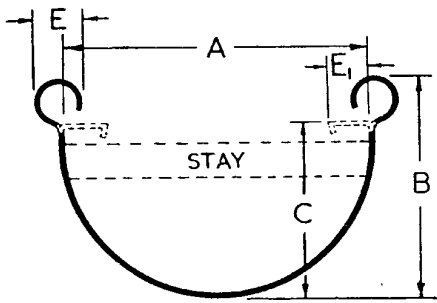


Fig. 1. Sectional view of half-round gutter

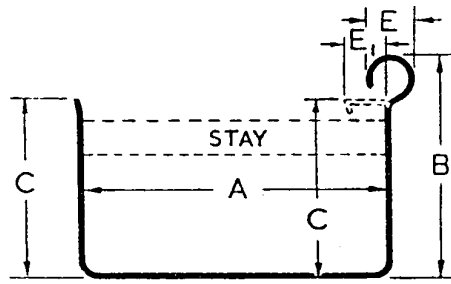


Fig. 2. Sectional view of rectangular gutter

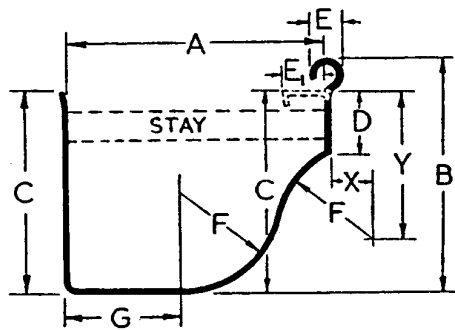


Fig. 3. Sectional view of ogee gutter



a. Inward rolled bead



b. Outward rolled bead



c. Square front

Fig. 4. Arrangements of bead for gutters illustrated in Figs. 1-3

TYPES OF GUTTER FITTINGS

12. Fittings for the gutters illustrated in Figs. 1, 2 and 3 above shall comprise the following:

Outlets (as shown in Figs. 5-7).

Stopends.

Stopend outlets (as shown in Figs. 8-10).

Angles, square and obtuse, internal and external (as shown in Figs. 11-13).

CONSTRUCTION OF GUTTER FITTINGS

13. *a. General.* Fittings for gutters shall conform to Figs. 5-13 below and shall be secured after forming and assembling by soldering or welding. They shall fit the gutters with which they are to be used.

b. Mitres. Mitres shall be reinforced by soldering, inside the gutter fitting, a stiffening strip cut to the contour of the gutter.

c. Stopends. Stopends shall comprise a flat section of metal of the appropriate shape for fixing in position in the gutter and shall have the top edge folded back on itself.

d. Nozzles of outlets and stopend outlets. Nozzles shall have a round section.

DIMENSIONS OF GUTTER FITTINGS

14. *a. General.* Fittings for gutters shall conform to the dimensions given in Clause 10 above in respect of nominal sizes, thicknesses and profiles and to Sub-clauses *b*, *c* and *d* below.

Other dimensions not specified in Sub-clauses *b*, *c* and *d* below shall conform to those shown in Figs. 5-13 below.

b. Lengths. The lengths of gutter fittings shall conform to those shown in Figs. 5-13 below.

c. Nozzles of outlets and stopend outlets. The internal diameter of nozzles shall be as follows:

Nominal size of gutter fittings	3 in	4 in	4½ in	5 in
Diameter of nozzle, H in half-round, rectangular and ogee gutter fittings illustrated in Figs. 5, 6, 7, 8, 9 and 10	1¾ in	2¾ in	2¾ in	3¾ in

d. Stiffening strips. The combined width of stiffeners used with each mitre shall be 1 in.

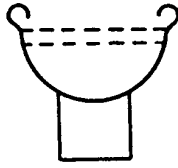
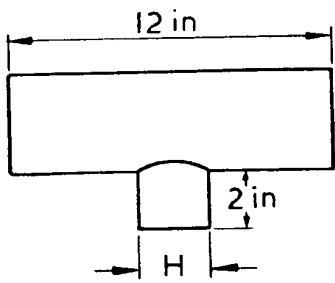


Fig. 5. Outlet for half-round gutter

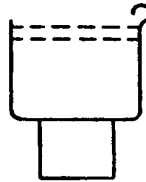
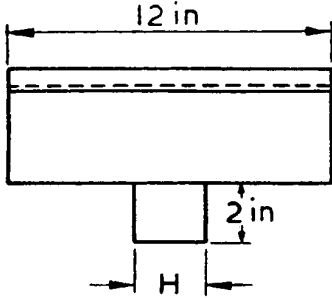


Fig. 6. Outlet for rectangular and ogee gutter

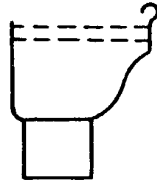
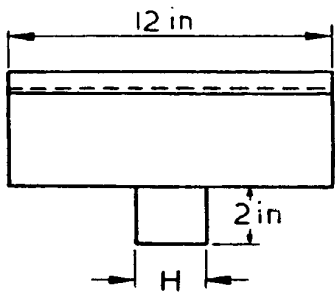
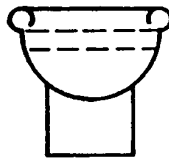
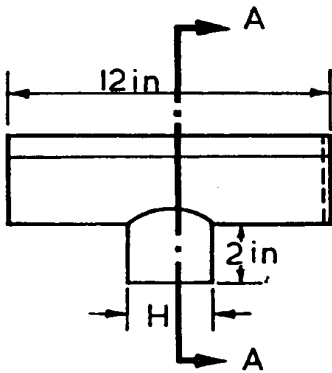
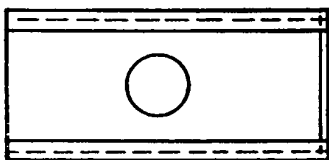


Fig. 7. Outlet for ogee gutter



Section A-A Fig. 8. Stopend outlet for half-round gutters



Plan

B.S. 1431 : 1960

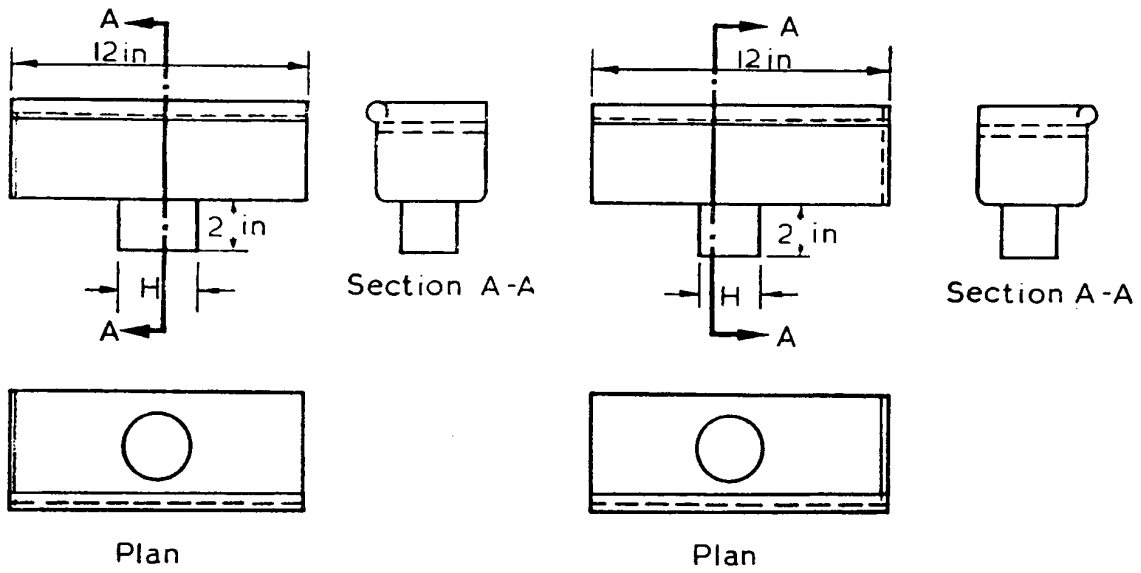


Fig. 9. Stopend outlet for rectangular gutters

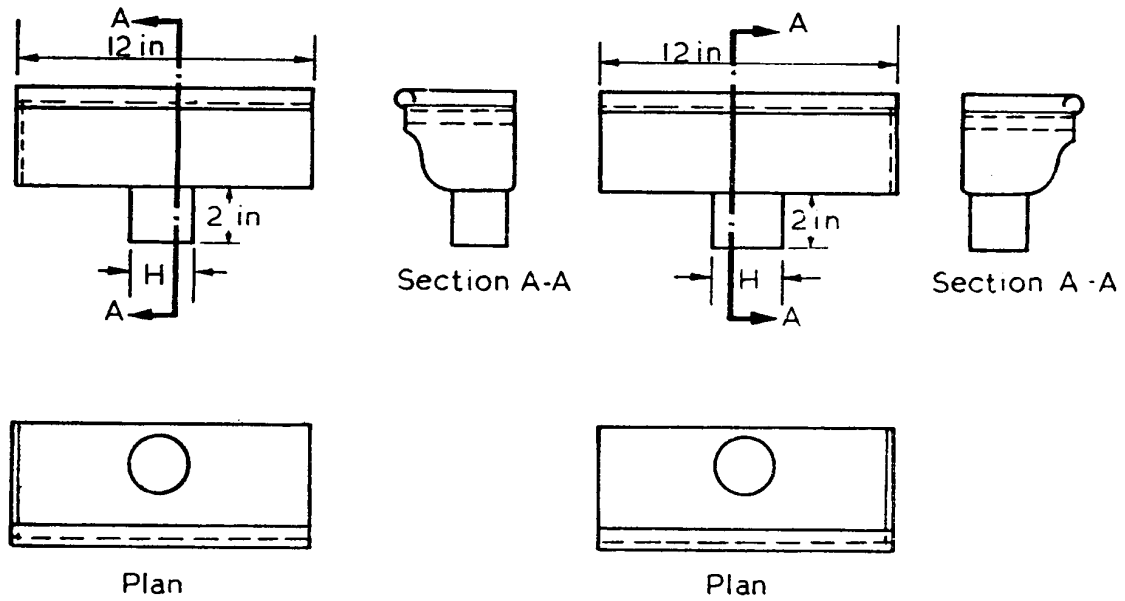


Fig. 10. Stopend outlet for ogee gutters

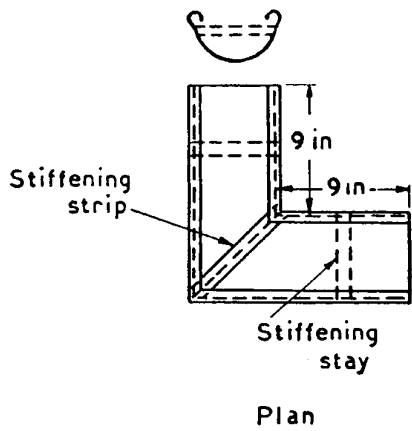


Fig. 11 a. Half-round, square angle (internal or external)

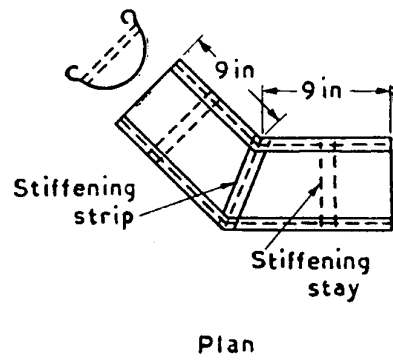


Fig. 11 b. Half-round, obtuse angle (internal or external)

Fig. 12. Angles for rectangular gutters

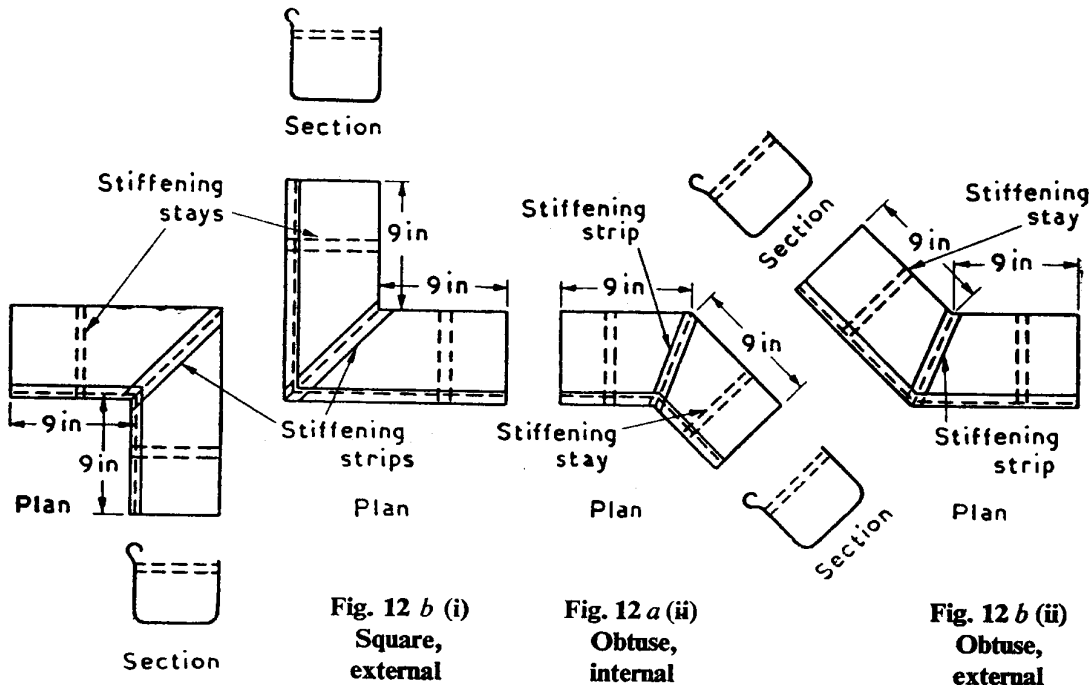


Fig. 12 a (i) Square, internal

Fig. 12 b (i) Square, external

Fig. 12 a (ii) Obtuse, internal

Fig. 12 b (ii) Obtuse, external

Fig. 13. Angles for ogee gutters

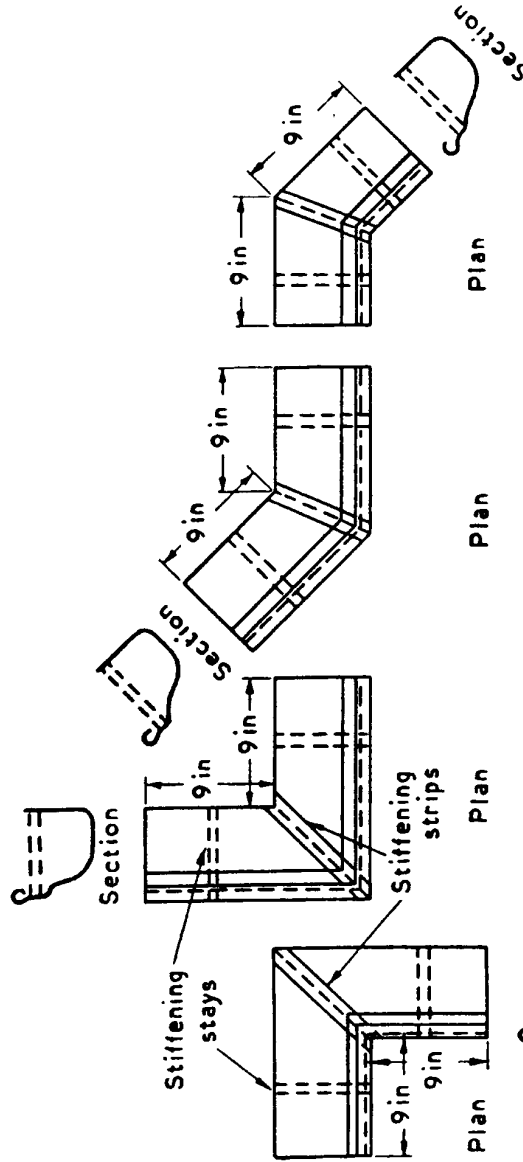


Fig. 13 a. (i)
Square, external

Fig. 13 b. (i)
Obtuse, external

Fig. 13 b. (ii)
Obtuse, internal

Fig. 13 a. (ii)
Square, internal

SECTION TWO: RAINWATER PIPES AND RAINWATER PIPE FITTINGS

TYPES OF RAINWATER PIPE

15. Pipes shall be either round type, as shown in Fig. 14, or rectangular type, as shown in Fig. 15.

The purchaser shall state which type is to be supplied.

CONSTRUCTION OF RAINWATER PIPES

16. a. General. Pipes shall be either seamed or solid drawn, as ordered. Solid drawn copper pipes shall be only of the round type.

b. Seams. Each seam shall be at the back of the pipe unless otherwise agreed by purchaser and vendor.

Seams in copper pipes shall be locked.

Seams in zinc pipes shall be either locked or lapped and soldered.

c. Joints. Pipes shall be so constructed that the larger or 'socket' end shall be of sufficient size to accommodate the smaller or 'spigot' end of the adjacent pipe to provide a slip or 'spigot and socket' joint at least 2 inches in length.

d. Ears. Each pipe shall be provided at its larger end with an ear of the appropriate pattern as shown in Figs. 14 or 15. The ear shall be formed either of a strap wrapped round the pipe for round pipes, or of a back strap for rectangular pipes.

A strap wrapped round the pipe shall be adequately secured to the pipe by one or more of the following methods:

- (i) riveting for copper pipes. The rivet shall not obstruct entry of the spigot into the socket;
- (ii) soldering;
- (iii) welding;
- (iv) swaging.

A back strap shall be adequately secured in position by either riveting, as in (i) above (for copper) or soldering to the pipe for the full width of the pipe.

Ears shall be made from material corresponding in quality to that of the pipes with which they are used.

When an ear is formed of a strap wrapped round the pipe, two beads or astragals may be formed in the strap. When an ear is formed of a back strap, two beads or astragals may be separately formed and securely attached to the larger end of the pipe.

DIMENSIONS OF RAINWATER PIPES

17. a. General. Rainwater pipes shall conform to the dimensions given in Sub-clauses *b*, *c*, *d* and *e* below.

b. Nominal sizes. The range of nominal sizes shall be as follows:

(i) **Round.** The nominal sizes of round rainwater pipes, which shall be measured internally as indicated by the letter D on Fig. 14 below, shall be 2 in, 2½ in, 3 in and 4 in.

(ii) **Rectangular.** The nominal sizes of rectangular rainwater pipes, which shall be measured internally, shall be:

- 2½ in wide × 2 in deep,
- 3½ in wide × 3 in deep.

In Fig. 15 below, the letter D indicates the width and d indicates the depth.

c. Lengths. Rainwater pipes shall be provided in overall* lengths of 6 ft 0 in, 7 ft 0 in and 8 ft 0 in, as may be ordered.

d. Thicknesses. The thicknesses of rainwater pipes shall be as follows:

- (i) **Copper pipes.** A. *Seamed construction.* 24 S.W.G. (0.022 in).
- B. *Solid drawn.*

Nominal size of pipe in	Thickness		Permissible tolerances on thickness	
	S.W.G.	in	Plus	Minus
2	19	0.040	0.004	0.002
2½	19	0.040	0.004	0.002
3	18	0.048	0.004	0.004
4	17	0.056	0.004	0.004

(ii) **Zinc pipes.** 23 S.W.G. (0.024 in) (i.e. 12 zinc gauge).

e. Diameters of round pipes. Round pipes shall have the following diameters, except as noted in Clause 16 c. above:

- (i) **Copper pipes.** A. *Seamed construction.* Internal diameter: not less than the nominal diameter.
- B. *Solid drawn.* Internal diameter: not less than the nominal diameter.

* It is impracticable to give 'effective lengths', as in other British Standards for gutters and pipes, because the types covered by this standard are not provided with the normal type of pipe socket and it is customary, therefore, to refer only to overall lengths.

Outside diameter:

Nominal size of pipe	Standard outside diameter	Permissible tolerances on outside diameter	
		Plus	Minus
in	in	in	in
2	2.128	0	0.003
2½	2.628	0	0.006
3	3.144	0	0.006
4	4.184	0	0.006

(ii) *Zinc pipes.* Internal diameter: not less than the nominal diameter.

f. *Ears.* (i) *Thickness of ears.* The thickness of ears shall be not less than that of the pipe to which they are attached.

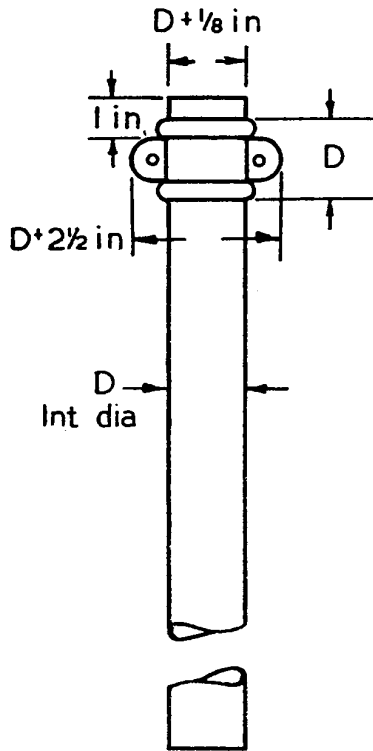


Fig. 14. Round rainwater pipe

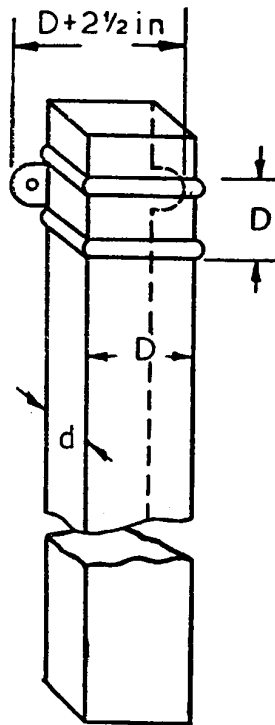


Fig. 15. Rectangular rainwater pipe

(ii) **Width of ears.** The width of the ears shall be not less than $D + 2\frac{1}{2}$ in, where D equals the nominal size of a cylindrical pipe or the width of a rectangular pipe (see Figs. 14–15).

(iii) **Depth of ears.** The depth (i.e., height) of the ears, including beads or astragals, shall be not less than D, where D equals the nominal size of a cylindrical pipe or the width of a rectangular pipe (see Figs. 14 and 15).

TYPES OF RAINWATER PIPE FITTINGS

18. Fittings for the rainwater pipes illustrated in Figs. 14 and 15 above shall comprise the following:

Offsets (as shown in Fig. 16).

Elbows, square and obtuse (as shown in Fig. 17).

Shoes (as shown in Fig. 18).

Rainwater heads, box type (as shown in Fig. 19).

NOTE. Other types of rainwater head may be obtained by agreement.

CONSTRUCTION OF RAINWATER PIPE FITTINGS^F

19. *a. General.* Fittings for rainwater pipes shall conform to Figs. 16–19 and shall fit the rainwater pipes with which they are to be used.

b. Seams. All fittings for rainwater pipes shall have seams constructed in accordance with Clause 16 *b*.

c. Joints. Fittings for rainwater pipes shall have joints constructed in accordance with Clause 16 *c*.

d. Ears. Fittings for rainwater pipes, other than shoes and heads, shall not have ears unless so ordered. Shoes and heads shall have ears constructed in accordance with Clause 16 *d*.

Offsets and elbows may have beads or astragals which shall be either swaged or constructed as specified in the final paragraph of Clause 16 *d*.

e. Nozzles of rainwater heads. Nozzles of rainwater heads shall be round type.

DIMENSIONS OF RAINWATER PIPE FITTINGS

20. *a. General.* Fittings for rainwater pipes shall conform to the dimensions given in Clause 17 above in respect of nominal sizes, thicknesses and diameters and to Table 2 and Sub-clause *b*.

Other dimensions not specified in Table 2 or in Sub-clause *b*. below shall conform to those shown in Figs. 16–19.

b. Nozzles of rainwater heads. The internal diameter of nozzles shall be as follows:

Nominal size of pipe (dia.)	2 in	2½ in	3 in	4 in
Internal dia. of nozzle	1¾	2¼	2¾	3¾

For rectangular pipes there shall be ⅛ in clearance

TABLE 2. DIMENSIONS OF RAINWATER PIPE FITTINGS

Fitting	Dimension	Sizes (D) Round type				Sizes (D × d) Rectangular type	
		in 2	in 2½	in 3	in 4	in 2½ × 2	in 3½ × 3
Offsets (P = 3 in, 6 in, 9 in, or 12 in as ordered)	B	5	5	5	5	5	5
90° elbows	B	3	4	4	6	4	6
135° elbows	B	5	5	5	5	5	5
Shoes	B	7½	8	8½	9½	8	9½
	C	4½	5	5½	7½	5	7½

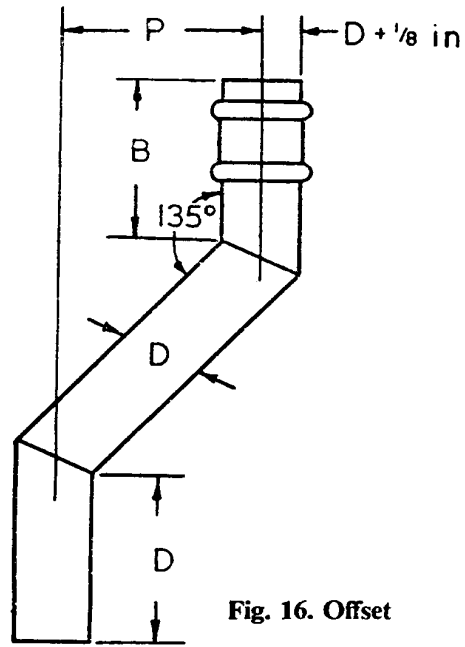


Fig. 16. Offset

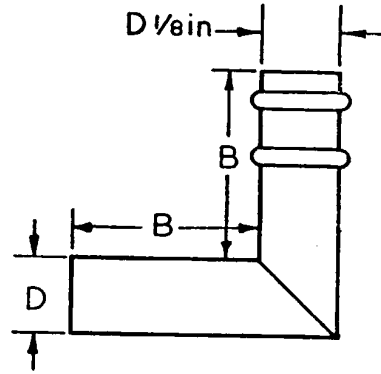


Fig. 17 a. Elbow, square

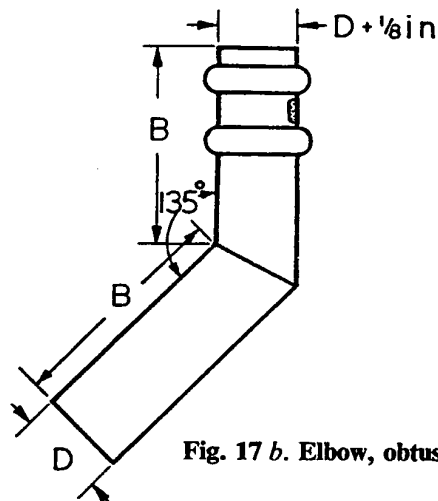


Fig. 17 b. Elbow, obtuse

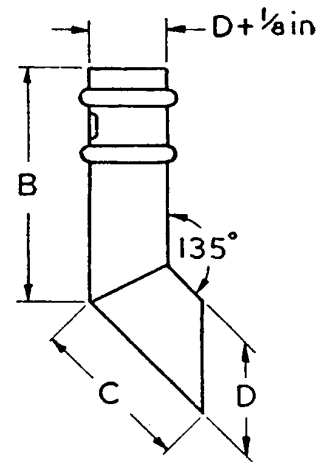


Fig. 18. Shoe

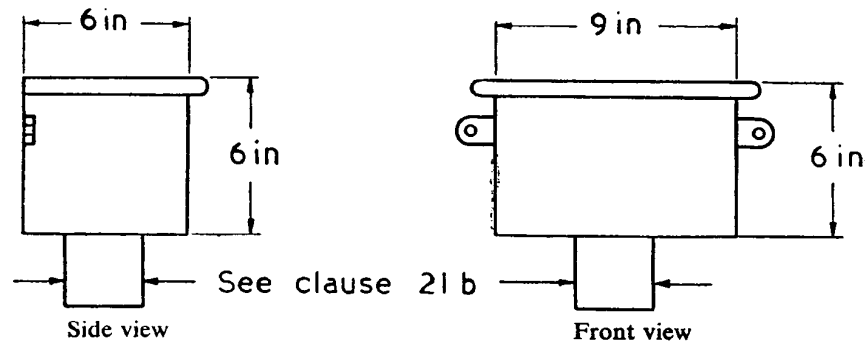


Fig. 19. Rainwater head, box-type

APPENDIX A

RECOMMENDED METHODS OF FIXING AND JOINTING

NOTE. The following recommendations are included with the specification pending the preparation of a Code of Practice.

A1. These recommendations are put forward with the object of securing the most satisfactory installation of, and service from, the types of rainwater goods covered by the specification.

It is considered that, as the use of these types has not, in the past, been so extensive as that of goods in alternative materials, scope should be left for development in their design and installation. The specification does not, therefore, include standard methods of staying or supporting gutters; similarly the requirements in regard to the jointing and fixing details of rainwater pipes, although providing a sufficient degree of control for all practical purposes, do not necessitate a standard design.

It is felt, however, that the requirements of the specification together with a close observance of the following recommendations should provide an entirely satisfactory installation.

GUTTERS

A2. a. Staying. All gutters should be stayed at centres not exceeding, in any circumstances, 15 in. The stays should consist of tubes, or other equivalent distance pieces or may be an integral part of the supporting bracket, provided that the gutter is adequately reinforced to withstand all normal conditions of use. The following sizes are recommended as minima and alternative designs should be of equivalent strength:

- | | |
|-------------------------------|---|
| Nominal sizes less than 5 in: | $\frac{1}{2}$ in diameter tube of a thickness not less than that of the gutter. |
| 5 in nominal size: | $\frac{5}{8}$ in diameter tube of thickness not less than that of the gutter. |

Stays of the tubular pattern should be soldered in position in the gutter. Stays forming part of the supporting bracket should be of such design that the assembly of bracket and stay is securely fixed in position. In all cases, the position of the stay should be such as to interfere as little as practicable with the effective capacity of the gutter.

Stays for copper gutters should be of copper or a suitable copper alloy; stays for zinc gutters should be of zinc except for those forming part of a supporting bracket, in which case they should be of galvanized mild steel.

b. Jointing. All joints should be lapped and soldered for at least $1\frac{1}{2}$ in in the direction of flow. The jointing faces of copper gutters should be pre-tinned

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with solder to ensure running of the molten jointing metal. The jointing faces of zinc gutters should be pre-fluxed and the molten solder drawn into the lap with the soldering tool. Every effort should be made to ensure that the resulting joint is soldered throughout the full girth of the gutter for the full extent of the lap.

A suitable solder for making the joints is Grade F to B.S. 219*. For copper gutters welding is sometimes preferable to soldering.

c. **Fixing.** All gutters should be supported at centres not exceeding 30 in and the supporting brackets or screws should normally coincide with alternate stays.

Brackets for copper gutters should be of hard copper or a suitable copper alloy and brackets for zinc gutters should be of galvanized mild steel. All brackets should be provided with clips or other equivalent means of securing the gutter in position at the back.

Gutters of the ogee and rectangular patterns in the 3 in and 4 in sizes may be fixed by screws inserted through alternate stays. The 4½ in and 5 in sizes should be fixed by screws inserted through every stay. Fixing of gutters by this method is not recommended when the fascia board is less than 1 in nominal thickness. The screws for copper gutters should be of hard copper or copper alloy and for zinc gutters should be of galvanized mild steel. They should be not less than size No. 14 and not less in length than the nominal size of the gutter plus 1 in. The heads of the screws should be such as to allow of screwing into position and screws should not be hammered into place.

The following are the recommended minimum sizes for the section of material to be used for making gutter brackets:

Fascia brackets	$\frac{3}{4}$ in \times $\frac{1}{8}$ in.
Rafter brackets	$\frac{3}{4}$ in \times $\frac{3}{16}$ in for the arm. $\frac{3}{4}$ in \times $\frac{1}{8}$ in for the clamp.

RAINWATER PIPES

A3. **Fixing.** Pipes should be fixed to the building by means of woodscrews inserted into suitable wall plugs. For copper pipes, the woodscrews should be of hard copper or copper alloy and for zinc pipes they should be of galvanized mild steel.

Where it is required to fix the pipes clear of the wall a hardwood block should be used and should be secured in place by screws inserted into suitable wall plugs. Oak blocks should not be used with zinc rainwater pipes. The overall size of the block should be the same as that of the ears so as to afford full support for their entire surface.

* B.S. 219, 'Soft solders'.

GENERAL

A4. a. Finish. The normal 'as made' finish of the material affords sufficient protection without the necessity for painting or other surface treatment. If painting is required for decorative purposes it should preferably be carried out after the gutters or pipes have weathered.

b. Galvanizing. Where galvanizing is referred to in this appendix, it should be effected by the hot dipping process and the resultant coating should be capable of passing the storage test described in B.S. 729*.

APPENDIX B

METRIC EQUIVALENTS

in	mm	ft	m	S.W.G.	mm
$\frac{1}{16}$	1.6	1	0.3	17	1.42
$\frac{1}{8}$	3.2	2	0.6	18	1.22
$\frac{1}{4}$	6.4	3	0.9	19	1.02
$\frac{1}{2}$	12.7	6	1.8	21	0.81
1	25.4			22	0.71
2	50.8			23	0.61
6	152.4			24	0.56

These equivalents have been rounded to the first decimal place in the case of two tables and the second in the case of the third. More accurate conversions may be based on the tables in B.S. 350, 'Conversion factors and tables'.

* B.S. 729, 'Copper sulphate test and visual examination of hot dip galvanized and sherardized coatings'.

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