BRITISH STANDARD

BS 416-1:1990

Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron —

Part 1: Specification for spigot and socket systems

Confirmed
February 2011

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Building Services Standards Policy Committee (SEB/-) to Technical Committee SEB/39, upon which the following bodies were represented:

Aluminium Federation
BCIRA
British Foundry Association
Builders Merchants' Federation
Copper Development Association
Department of the Environment (Property Services Agency)
Ductile Iron Producers' Association
Institute of British Foundrymen
Institute of Plumbing
Light Metal Founders' Association
National Association of Plumbing, Heating and Mechanical Services Contractors
National Metal Trades Federation

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Amendments issued since publication

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Contents

Foreword

This Part of BS 416 has been prepared under the direction of the Building Services Standards Policy Committee. It is the first Part of a two-part revision of BS 416:1973, which is withdrawn. Part 2 specifies socketless systems.

The main changes incorporated in the revision are as follows.

a) The products are specified as being of either grey or ductile cast-iron.

b) The range of pipe and fitting diameters has been rationalized to correspond to those commonly used, the DN 125 range of pipes and fittings having been deleted.

c) The dimensions given in the tables are such that the pipes covered by this Part of BS 416, manufactured by either process, are interchangeable and can be used with the fittings specified. Double socket lengths have been included and these comply with the requirements for corresponding spigot/socket pipes.

d) It has been made clear that the systems are for use above ground (see **2.1**), and internal diameters have been modified to obtain unobstructed flow when such systems are connected to below-ground systems complying with BS 437.

e) The significance of the Type A and Type B sockets has been clarified by early reference to the figure in Table 1.

f) Leak testing by both hydraulic and pneumatic methods is included.

g) In accordance with the convention of defining bend angles by the angle through which the direction of flow is thereby changed, these are now described as acute angles, supplementary to the obtuse angles used in BS 416:1973. Bends in stock which were made to comply with BS 416:1973 will be marked with obtuse angles; those made to comply with BS 416:1990 will be marked with their acute angles.

h) Some dimensional requirements have been added for access doors, ears, roof outlets, union sockets, holderbats, and bosses.

i) As regards coating materials, in order not to prohibit materials which are suitable, but which are not yet covered by a British Standard, a reference to such materials, certified by their manufacturer as suitable, has been added in item d) of clause **3**.

j) This revision deletes reference to laying lengths of fittings.

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 to iv, pages 1 to 18, 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.

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1 Scope

This Part of BS 416 specifies cast grey or ductile iron spigot and socket pipes manufactured by either the sand-cast or the spun process, with either Type A or Type B sockets (see Table 1). This Part of BS 416 also specifies sand-cast fittings.

These pipes and fittings are for use above ground (see **2.1**) in discharge or ventilating pipe systems in buildings.

This Part of BS 416 specifies quality of material, critical dimensions and tolerances, coating and marking. A leakage test is included.

For the convenience of specifiers and purchasers, a list of options available to them within the standard is given in Appendix A.

NOTE 1 Plan views of pipes and fittings are given in Figure 1 to Figure 4. Typical designs for pipes and fittings are illustrated in Figure 5 to Figure 31 in Appendix B. Dimensions are illustrated on the figures (where appropriate) and are given in the tables accompanying those figures (see Table 1 to Table 27).

Specifications for coatings are included by reference (in item d) of clause **3)** to existing British Standards and, for materials not covered by those standards, by a requirement for a manufacturer's certificate of suitability.

NOTE 2 The pipes specified may be used as rain-water pipes when a heavier grade of pipe than that specified in BS 460 is required.

NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the definitions given in BS 4118 apply, together with the following.

2.1
above ground

pipework within or external to a building, including any basements, but excluding any pipework which has entered the ground

2.2
right hand fitting

a bend or branch so constructed that when viewed with the spigot downwards and with the boss or access door facing the observer, the socket of the bend or the arm of the branch projects to the right

NOTE A right hand fitting is illustrated in Figure 1.

2.3
left hand fitting

a bend or branch so constructed that when viewed with the spigot downwards and with the boss or access door facing the observer, the socket of the bend or the arm of the branch projects to the left

NOTE A left hand fitting is illustrated in Figure 2.

2.4
type A socket

a socket with two beads

NOTE An example of a Type A socket is illustrated in Figure 5.

2.5
type B socket

a socket of any type other than Type A

NOTE An example of a Type B socket is illustrated in Figure 5.

2.6
DN (nominal size)

a numerical designation of the size of a unit which is a convenient round number approximately equal to a manufacturing dimension

2.7
manufacturer's declared length/angle

the length/angle which a manufacturer aims to produce

2.8
effective length

the length of a pipe or fitting less the depth of any socket

NOTE The effective length of a pipe is illustrated in Figure 3.

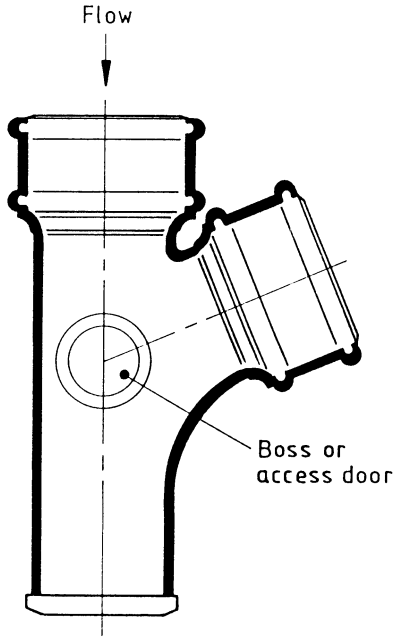


Figure 1 — Right hand fitting

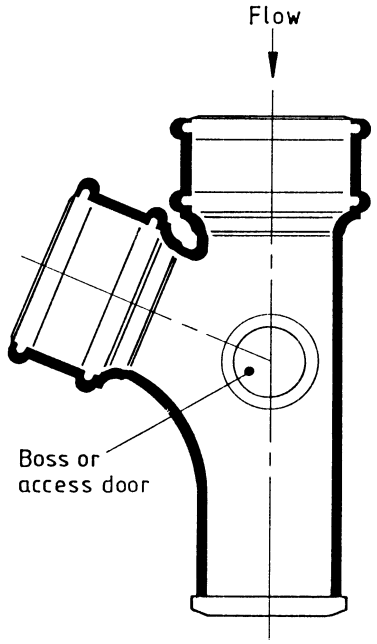


Figure 2 — Left hand fitting

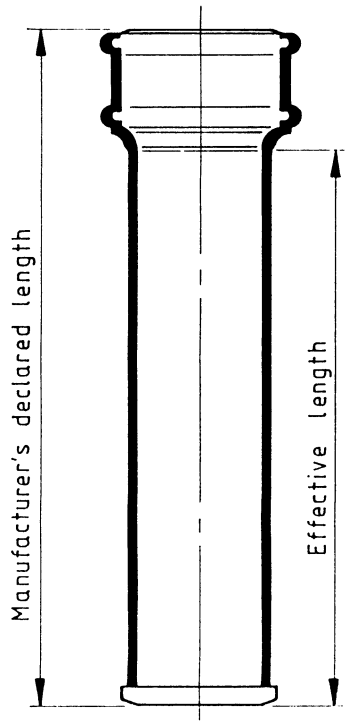


Figure 3 — Effective length

3 Materials

The materials used for the manufacture of products complying with this British Standard shall be as follows.

a) *For pipes and fittings:*

1) grey iron of tensile strength not less than grade 150 of BS 1452; or

2) ductile iron of tensile strength not less than that specified in BS 4772.

b) *For screws, bolts and washers for access fittings:* hot pressed brass, cadmium plated steel, stainless steel or sherardized steel.

c) *For access door gaskets:* a material not less than 3 mm thick complying with BS 2494, Type D, e.g. rubber IRHD 46 to 55.

d) *For coatings:* material complying with BS 3416, BS 4147, or BS 4164, or other material certified by the manufacturer as suitable for the purpose.

4 Dimensions and tolerances

4.1 Pipes

4.1.1 *Nominal bore size.* Ranges of nominal bores are quoted in the tables in Appendix B and shall be subject to the following minimum values:

a) for DN 50 pipe: 48 mm;

b) for DN 65 pipe: 63 mm;

c) for DN 75 pipe: 74 mm;

d) for DN 90 pipe: 88 mm;

e) for DN 100 pipe: 99 mm;

f) for DN 150 pipe: 150 mm.

4.1.2 *Pipe lengths.* Lengths are not specified in this British Standard, but the manufacturer shall provide information on available lengths, and the lengths supplied shall be within ± 20 mm of the measurement quoted.

4.1.3 *Pipe walls.* Pipe walls shall comply with the dimensions given in Table 1, subject to a tolerance of $^{+0}_{-1.5}$ mm.

4.2 Fittings

4.2.1 *Nominal bore size.* Ranges of nominal bores are quoted in the tables in Appendix B and shall be subject to the minimum values given in **4.1.1**.

4.2.2 *Fitting lengths.* Lengths are not specified in this British Standard, but the manufacturer shall provide information on available lengths and the lengths supplied shall be within ± 5 mm of the measurement quoted.

4.2.3 *Fitting walls.* Thickness of walls of fittings shall be no less than that of pipes with which they are used, subject to a tolerance of $^{+0}_{-1.5}$ min.

4.2.4 *Angles of fittings.* Angles of fittings shall be as indicated in the tables in Appendix B, subject to a tolerance of ± 1.5°.

4.3 Ears

Where ears are supplied, they shall be

a) with sand-cast pipes: cast during the pipe manufacture;

b) with spun pipes, either:

1) as loose bands;

2) rigidly attached to the socket of the pipe;

3) cast integrally with the pipe during spinning.

Where ears are supplied, they shall comply with the dimensions given in Table 1.

For pipes up to and including 75 mm nominal bore, the distance *p* from the back of the ear to the back of the pipe (see Figure 4) shall be 32 ± 2 mm.

For pipes greater than 75 mm nominal bore, the distance *p* from the back of the ear to the back of the pipe (see Figure 4) shall be 38 ± 2 mm.

4.4 Access doors

The minimum values of the shortest and longest dimensions of the access door shall be as indicated in the tables in Appendix B.

NOTE It is permissible for fittings to be provided with circular, oval or rectangular access doors. These may be of various designs and sizes (subject to the minimum values specified).

4.5 Depth of trap seal

The minimum depth of seal in all fittings incorporating a water seal shall be 50 mm unless otherwise shown in the relevant figure.

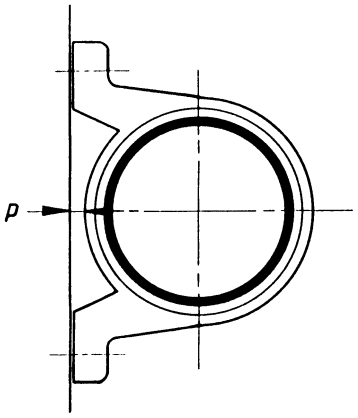


Figure 4 — Ears

5 Leakage test

When tested by the method described in Appendix B of BS 4772:1988, pipes and fittings shall be capable of withstanding for at least 15 s an internal hydrostatic pressure of at least 0.5 bar[1)] without leakage.

NOTE Pressure testing may also be carried out pneumatically. In air testing, safety valves should be fitted to prevent any pressure developing in excess of 0.6 bar and the test should be carried out under water.

6 Coatings

Pipes and fittings shall be coated with materials complying with item d) of clause **3**.

7 Marking

Every pipe or fitting shall be legibly and indelibly marked with the following:

a) the number of this British Standard[2)], i.e. either BS 416-1, BS 416-1 or BS 416/1;

b) the nominal bore, e.g. 100;

c) a mark identifying the manufacturer and the factory if there is more than one;

d) "DUCTILE" or "SG" for products made from ductile cast iron.

NOTE Products made from grey cast iron would not be so marked.

e) in the cast of fittings, with the angle (acute) where appropriate. (See item g) of the foreword.)

[1)] 1 bar = 10^5 N/m^2 = 100 kPa.

[2)] Marking BS 416-1 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Appendix A Information to be exchanged at the time of enquiry and/or order

The following options are available, and the selection should be clearly stated in any specification, enquiry or order:

a) grey iron or ductile iron;

b) Type A or Type B socket, with or without spigot bead;

c) single or double socket;

d) right hand or left hand fitting;

e) length and bore;

f) angle of fitting;

g) ears or no ears;

h) type of roof outlet and bellmouth gully inlet grating (see Figure 19 to Figure 22);

i) whether boss(es) to be provided (see Figure 31).

Appendix B Typical designs for pipes and fittings

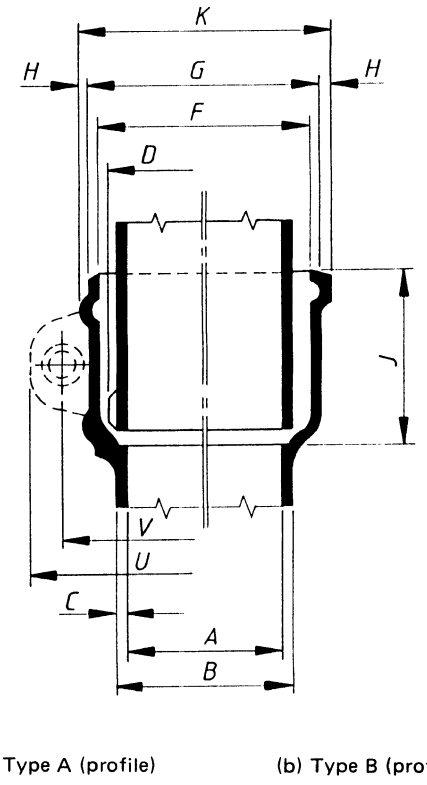


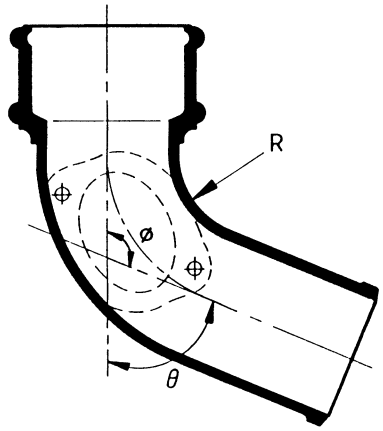
Figure 5 — Straight pipe, sockets (Types A and B) and spigots (see Table 1)

Table 1 — Straight pipe, sockets (Types A and B) and spigots (see Figure 5)

Dimensions		Nominal size (DN)					
		50	65	75	90	100	150
Pipe:		mm	mm	mm	mm	mm	mm
internal diameter, min.	*A*	48	63	74	88	99	150
outside diameter, max.	*B*	63	76	89	101	114	165
thickness, nominal	*C*	5	5	5	5	5	5
diameter of spigot bead[a], max.	*D*	70	84	97	109	122	175
Socket:							
internal diameter, min.	*F*	73	87	100	114	127	181
outside diameter, max.	*G*	89	103	116	130	143	197
thickness, nominal	*H*	6.5	6.5	6.5	6.5	6.5	6.5
internal depth, nominal	*J*	64	70	70	76	76	89
outside diameter over beads, min.	*K*	100	114	129	145	157	213
Ears[a]:							
length of flange, nominal	*U*	146	162	178	194	213	273
centre to centre of holes	*V*	114	130	146	162	181	235

NOTE Double socket pipes complying with the above dimensions can be supplied on demand.

[a] Optional.



NOTE Bends may be supplied with doors RH, LH, or on the heel. The centre of an access door, when fitted, should be approximately symmetrical with the central line of the fitting. (See Table 3.)

Figure 6 — Short radius bends with or without access door (see Table 2)

Table 2 — Short radius bends with or without access door (see Figure 6)

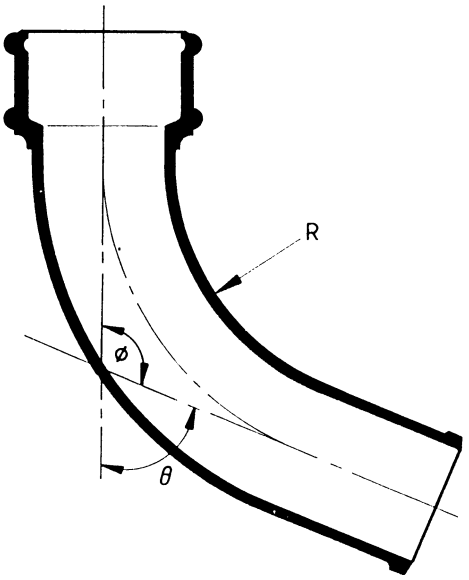
Angle of bend		Nominal size (DN)					
		50	65	75	90	100	120
θ	ϕ	Radius (R)					
degrees	degrees	mm	mm	mm	mm	mm	mm
87½	92½	38	38	38	38	38	38
76	104	38	38	38	38	38	38
67½	112½	38	38	38	70	70	70
45	135	70	70	70	121	121	121
22½	157½	227	248	262	275	286	319

NOTE For tolerances, see clause **4**.

Table 3 — Minimum access door dimensions

DN	Shortest opening dimension	Longest opening dimension
	mm	mm
50	35	60
75	55	90
100	75	100
150	95	120

NOTE For tolerances, see clause **4**.



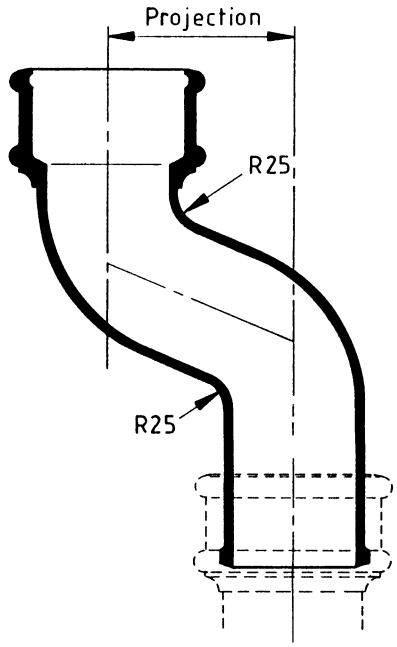
NOTE Bends with access doors are available in a limited range.

Figure 7 — Long radius bends (see Table 4)

Table 4 — Large radius bends (see Figure 7)

Angle of bend		Nominal size (DN)			
		75	90	100	150
θ	ϕ	Radius (R)			
degrees	degrees	mm	mm	mm	mm
87½	92½	152	152	152	152
67½	112½	200	200	200	200
45	135	286	279	273	248

NOTE For tolerances, see clause **4**.



All dimensions are in millimetres.

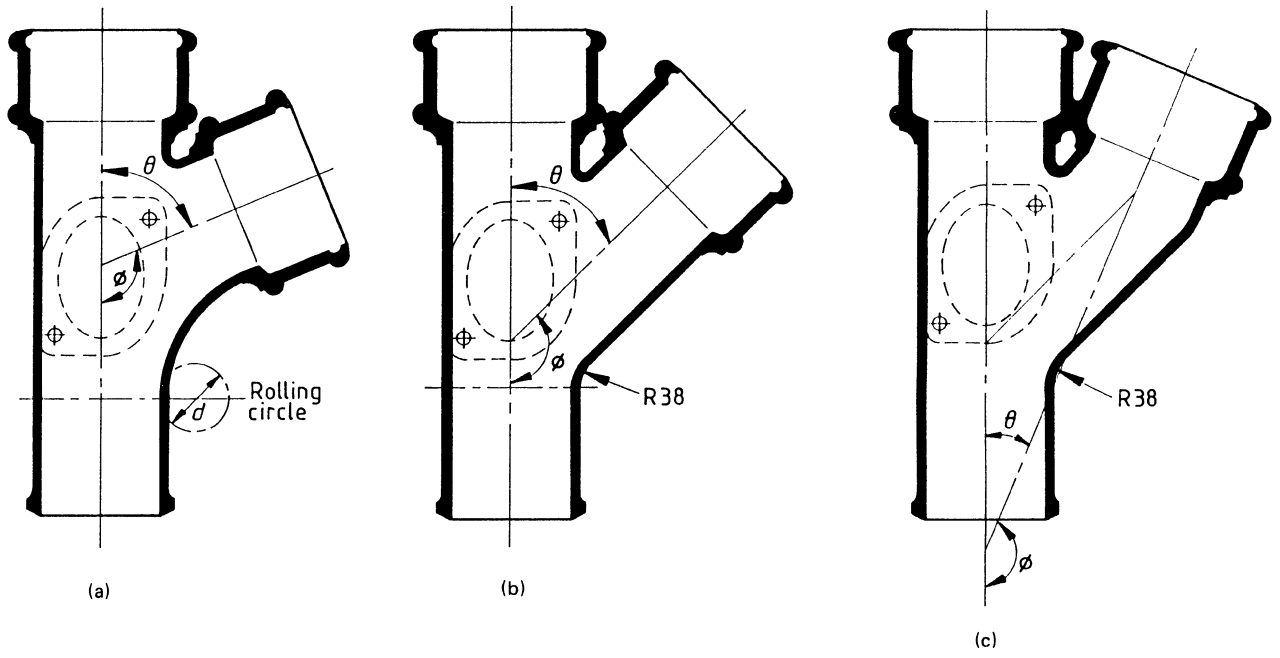
Figure 8 — Offsets (see Table 5 and Table 6)

Table 5 — Range of nominal bore size for offsets (see Table 6 and Figure 8)

Range of DN	50	65	75	90	100	150
NOTE For tolerances, see clause 4.						

Table 6 — Range of nominal projection for offsets (see Table 5 and Figure 8)

Range of projection	Tolerance
mm	mm
75	± 5
115	± 5
150	± 5
225	± 5
300	± 5



Linear dimensions are in millimetres.

NOTE 1 For details of double equal branches see Figure 12 and Table 10 and Table 11.

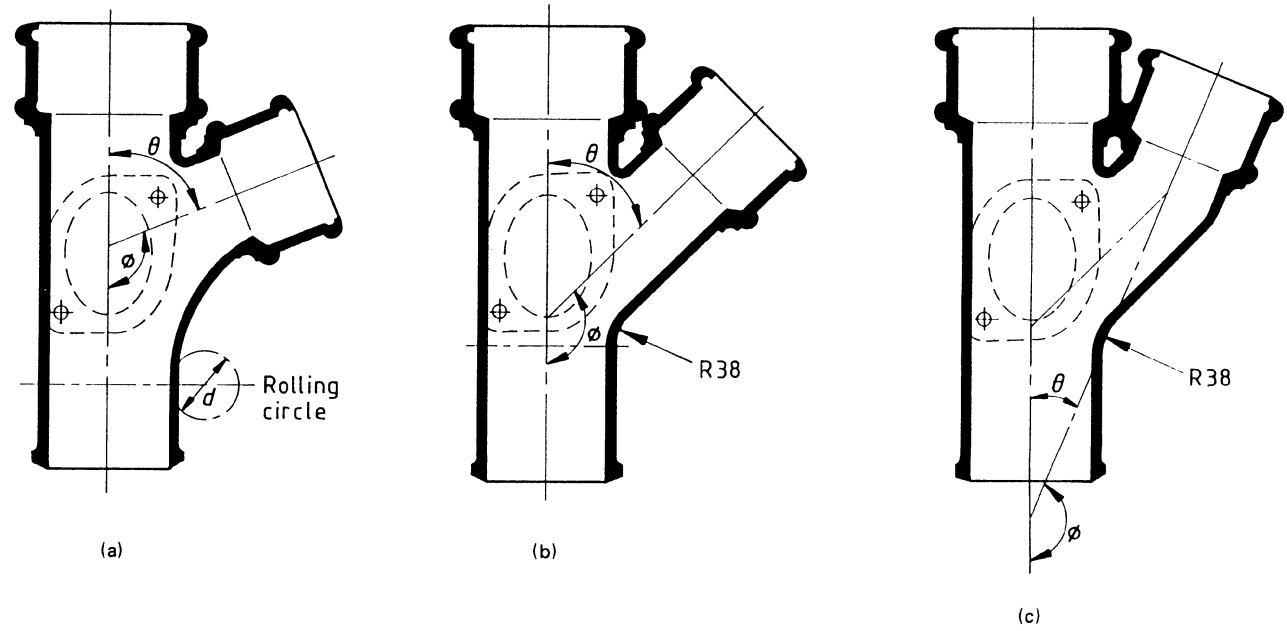
NOTE 2 Access doors may be supplied RH, LH or opposite the branch. For dimensions of access doors, see Table 3.

Figure 9 — Equal branches with or without access door (see Table 7)

Table 7 — Equal branches with or without access door (see Figure 9)

Angle of bend		Nominal size (DN)					
		50	65	75	90	100	150
θ	ϕ	Rolling circle (d)					
degrees	degrees	mm	mm	mm	mm	mm	mm
87½	92½	38	43	48	52	57	76
76	104	—	—	—	52	57	—
67½	112½	38	43	48	52	57	76
45	135	—	—	—	—	—	—
—	—	—	—	—	—	—	—

NOTE For tolerances, see clause **4**.



Linear dimensions are in millimetres.

NOTE 1 For details of double unequal branches, see Figure 13 and Table 12.

NOTE 2 Access doors may be supplied RH, LH, or opposite the branch. For dimensions of access doors, see Table 3.

NOTE 3 For values of dimension d and angles θ and ϕ, see Table 7.

Figure 10 — Unequal branches with or without access door (see Table 8)

Table 8 — Range of nominal bore size combinations for unequal branches with or without access door (see Figure 10)

Range (DN × DN)	65 × 50	75 × 50	75 × 65	90 × 50	90 × 65	90 × 75	100 × 50	100 × 65	100 × 75	100 × 90	150 × 100

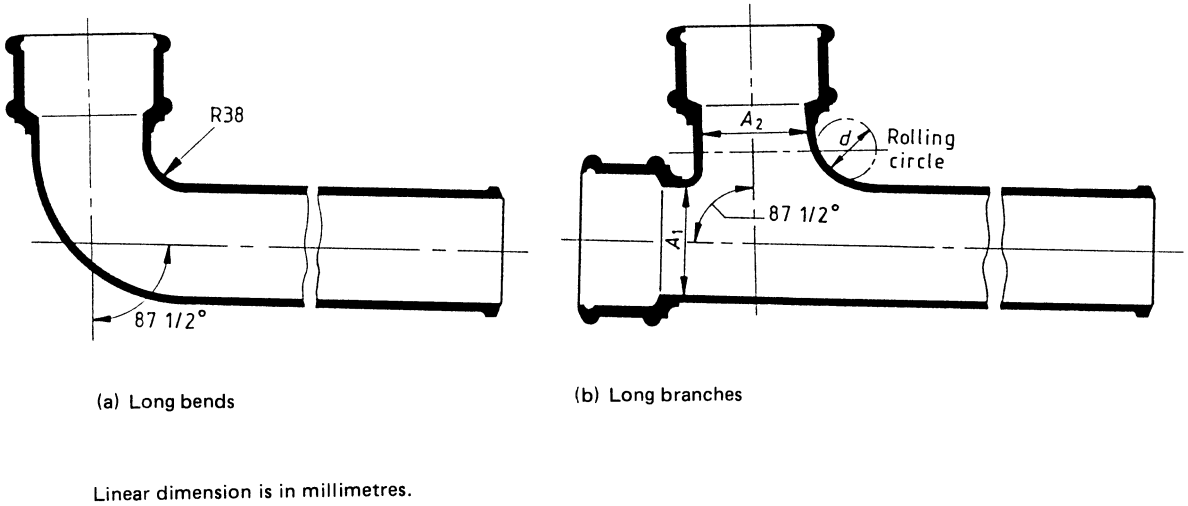
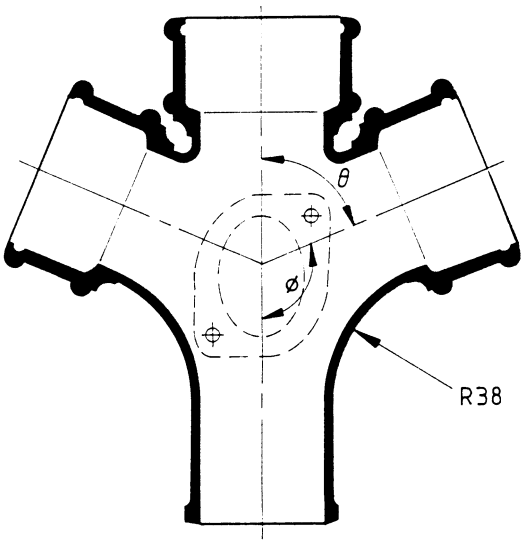


Figure 11 — Long bends and long branches (see Table 9)

Table 9 — Long branches (see Figure 11)

Nominal size (DN)		Rolling circle (d)
A_1	A_2	
		mm
90	90	52
100	100	57
100	90	52

NOTE For tolerances, see clause **4**.



NOTE For dimensions of access doors, see Table 3.

Figure 12 — Double equal branches with or without oval access door (see Table 10 and Table 11)

Table 10 — Range of nominal bore size combinations for double equal branches with or without oval access door (see Table 11 and Figure 12)

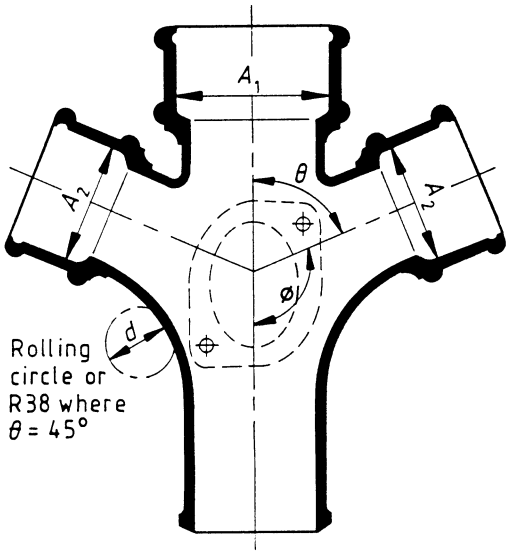
Range (DN × DN)	50 × 50	65 × 65	75 × 75	90 × 90	100 × 100	150 × 150

NOTE For tolerances, see clause **4**.

Table 11 — Range of nominal angle for double equal branches with or without oval access door (see Table 10 and Figure 12)

Angle of bend	Range			
	degrees	degrees	degrees	degrees
θ	87½	76	67½	45
ϕ	92½	104	112½	135

NOTE For tolerances, see clause **4**.



Linear dimension is in millimetres.

NOTE 1 The overall dimensions for double unequal branches are determined on the following principle: the projection of both arms from the outside of the body of the branch should be the same as that on double equal branches having the same nominal bore of arm.

NOTE 2 For dimensions of access doors, see Table 3.

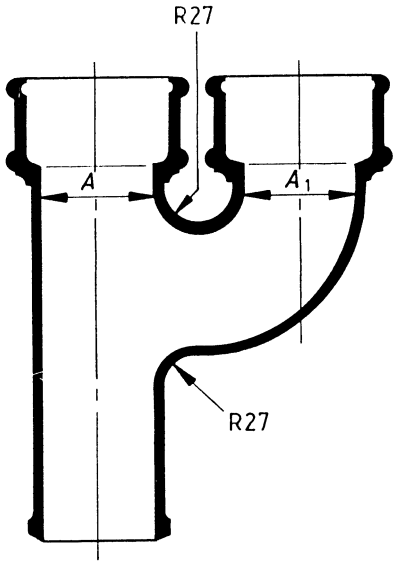
NOTE 3 On 45° branches, the position of dimension R is as shown in (b) of Figure 9.

Figure 13 — Double unequal branches with or without access door (see Table 12)

Table 12 — Double unequal branches with or without access door (see Figure 13)

Nominal size (DN)		Bend angles			
		θ = 87½° (ϕ = 92½°)	θ = 76° (ϕ = 104°)	θ = 67½° (ϕ = 112½°)	θ = 45° (ϕ = 135°)
A_1	A_2	Rolling circle (d)			Radius (R)
		mm	mm	mm	mm
75	50	38	—	38	38
90	50	38	—	38	38
90	75	48	—	48	38
100	50	38	—	38	38
100	75	48	—	48	38
100	90	52	48	52	38
150	100	57	—	57	38

NOTE For tolerances, see clause **4**.



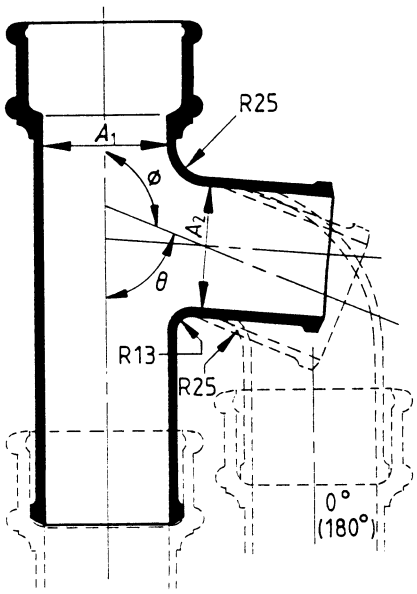
All dimensions are in millimetres.

Figure 14 — Parallel branches, single, equal and unequal (see Table 13)

Table 13 — Range of nominal bore size for parallel branches, single, equal and unequal (see Figure 14)

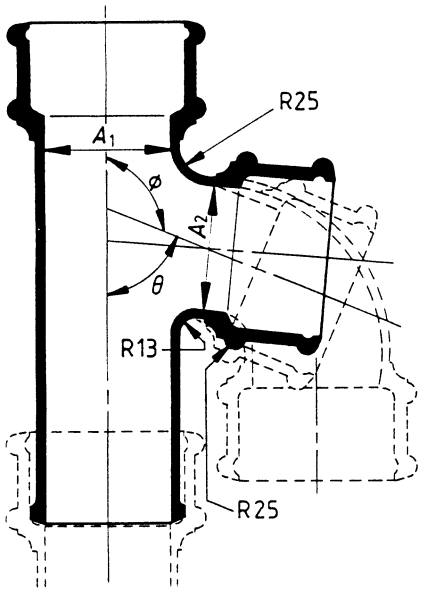
Range of DN	
A	A_1
90	50
90	90
100	50
100	75
100	100

NOTE For tolerances, see clause **4**.



Linear dimensions are in millimetres.

Figure 15 — Inverted branches (spigot type)
(see Table 14 and Table 15)



Linear dimensions are in millimetres.

Figure 16 — Inverted branches (socket type)
(see Table 16 and Table 17)

Table 14 — Range of nominal bore size for inverted branches (spigot type)
(see Table 15 and Figure 15)

Range of DN	
A_1	A_2
50	50
90	90
90	50
100	100
100	50

NOTE For tolerances, see clause **4**.

Table 15 — Range of nominal angle for inverted branches (spigot type)
(see Table 14 and Figure 15)

Angle	Range		
	degrees	degrees	degrees
θ	87½	67½	0
ϕ	92½	112½	180

NOTE For tolerances, see clause **4**.

Table 16 — Range of nominal bore size for inverted branches (socket type)
(see Table 17 and Figure 16)

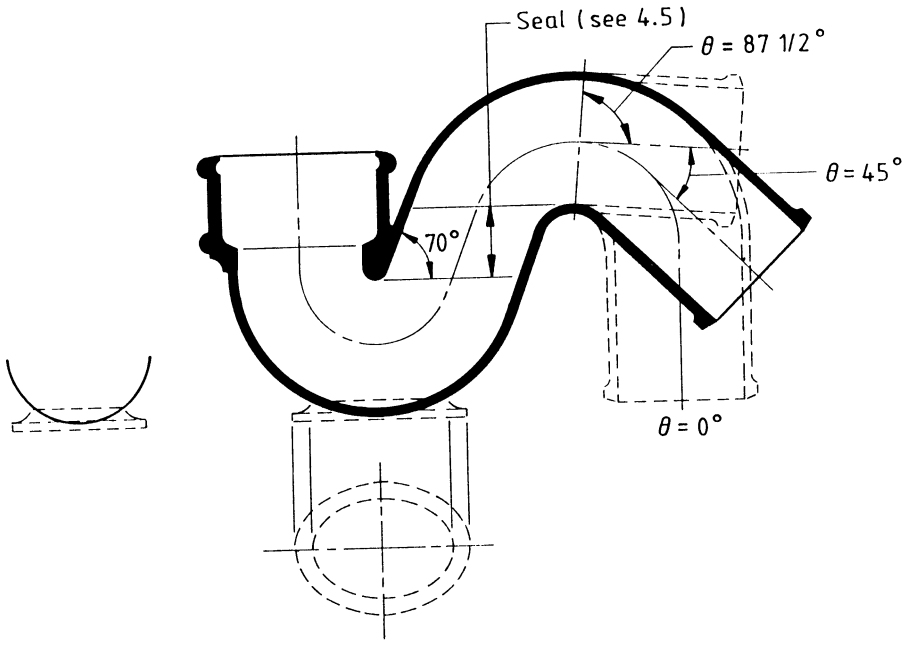
Range of DN	
A_1	A_2
50	50
90	90
90	50
100	100
100	50

NOTE For tolerances, see clause **4**.

Table 17 — Range of nominal angle for inverted branches (socket type)
(see Table 16 and Figure 16)

Angle of bend	Range		
	degrees	degrees	degrees
θ	87½	67½	0
ϕ	92½	112½	180

NOTE For tolerances, see clause **4**.

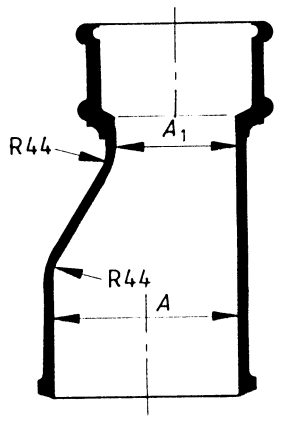


NOTE 1 For minimum depth of seal see **4.5**.
NOTE 2 Access doors may be supplied on heel or crown.
For dimensions of access doors, see Table 3.

Figure 17 — Traps with or without access door (see Table 18)

Table 18 — Range of nominal bore size for traps with or without access door
(see Figure 17)

Range of DN	50	65	75	90	100
NOTE For tolerances, see clause **4**.					

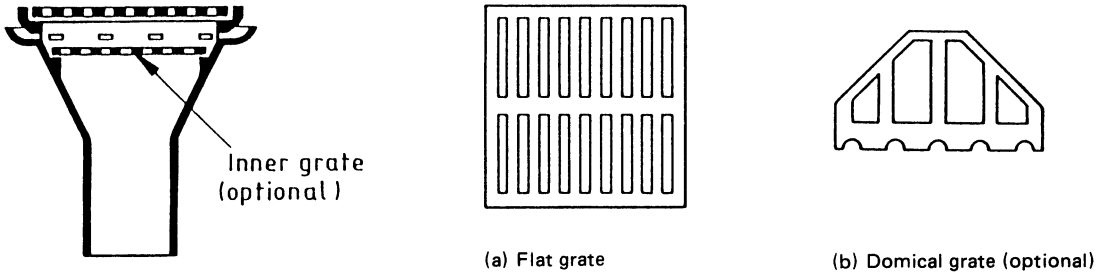


All dimensions are in millimetres.

Figure 18 — Tapers (see Table 19)

Table 19 — Range of nominal bore size for tapers (see Figure 18)

Range of DN	
A	***A*$_1$**
65	50
75	50
75	65
90	50
90	65
90	75
100	50
100	65
100	75
100	90
150	90
150	100
NOTE For tolerances, see clause **4**.	

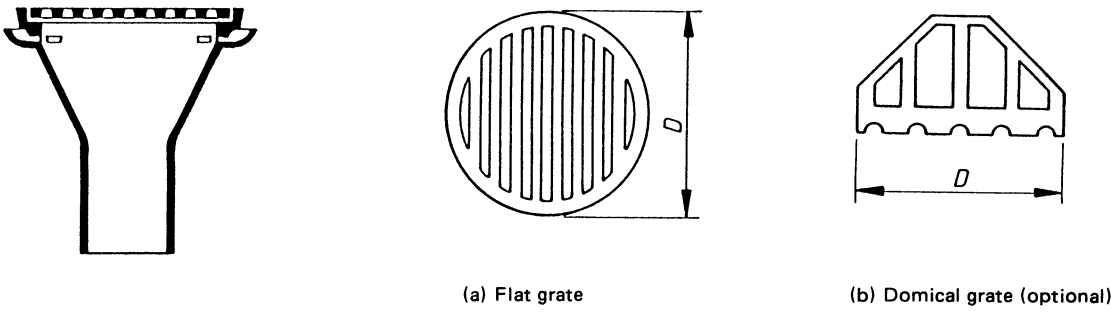


NOTE Flat gratings can be supplied with securing screws.

Figure 19 — Roof outlet (square grating) (see Table 20)

Table 20 — Range of nominal bore size for square grating roof outlets (see Figure 19)

Range of DN	50	65	75	90	100
NOTE For tolerances, see clause **4**.					

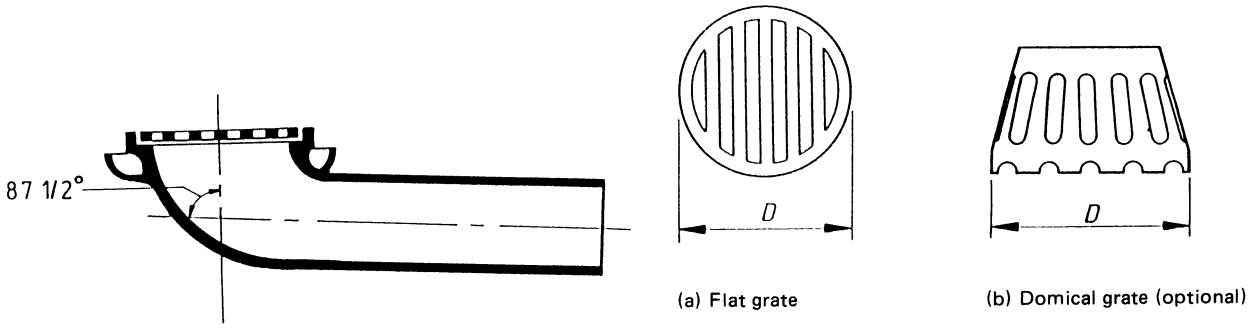


NOTE 1 Flat gratings can be supplied with securing screws.
NOTE 2 For values of dimension *D*, see Table 1.

Figure 20 — Roof outlet (circular grating) (see Table 21)

Table 21 — Range of nominal bore size for circular grating roof outlets (see Figure 20)

Range of DN	50	65	75	90	100
NOTE For tolerances, see clause **4**.					



NOTE 1 A dominical grate cannot be supplied with a notched plate.
NOTE 2 Flat gratings can be supplied with two securing screws.
NOTE 3 For values of dimension *D* see Table 1.

Figure 21 — 87½° bent roof outlet (see Table 22)

Table 22 — Range of nominal bore size for 87½° bent roof outlets (see Figure 21)

Range of DN	50	75	100
NOTE For tolerances, see clause **4**.			

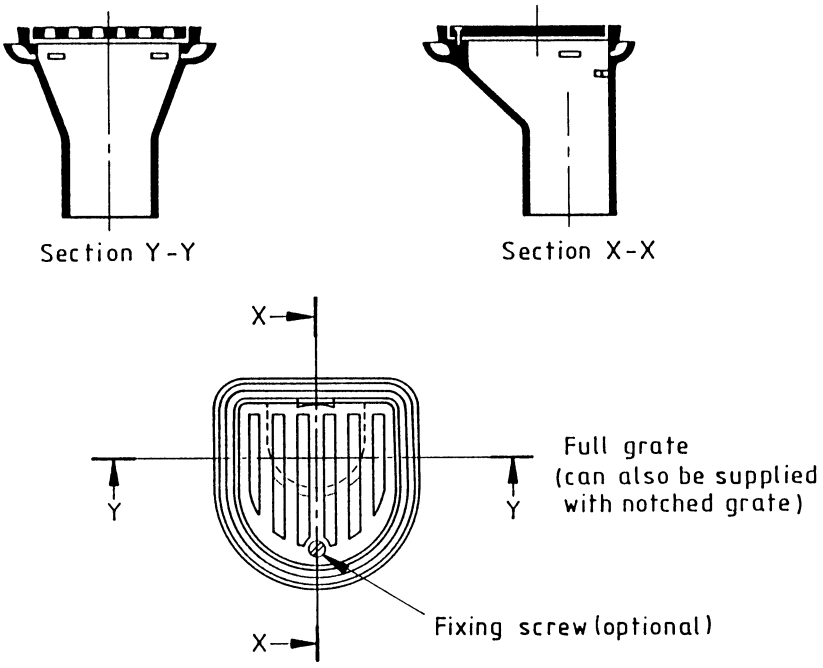
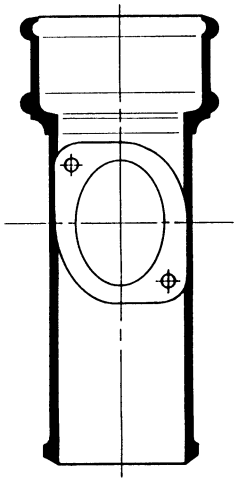


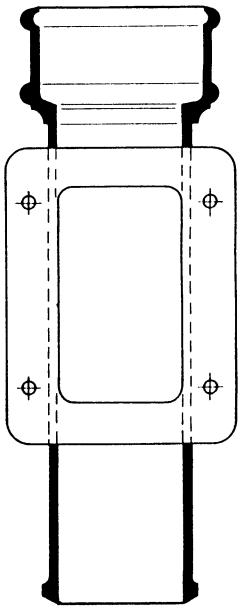
Figure 22 — Roof outlet (balcony grating) (see Table 23)

Table 23 — Range of nominal bore size for balcony grating roof outlets (see Figure 22)

Range of DN	50	75	100
NOTE For tolerances, see clause **4**.			



(a) Oval access door



(b) Rectangular access door

NOTE For dimensions of access doors, see Table 3.

Figure 23 — Straight inspection pieces with access door (see Table 24)

Table 24 — Range of nominal bore size for straight inspection pieces with access door
(see Figure 23)

Shape of access door	Range of DN					
Rectangular	—	—	—	90	100	150
Oval	50	65	75	90	100	150

NOTE For tolerances, see clause 4.

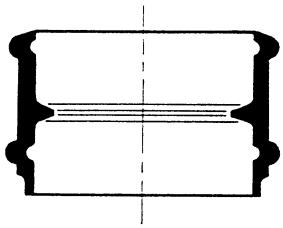


Figure 24 — Union sockets (see Table 25)

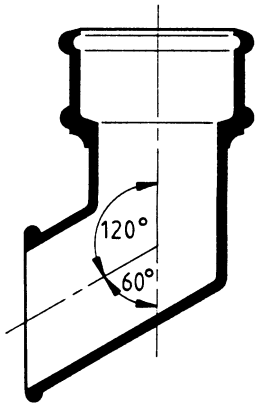


Figure 25 — Shoes (see Table 25)

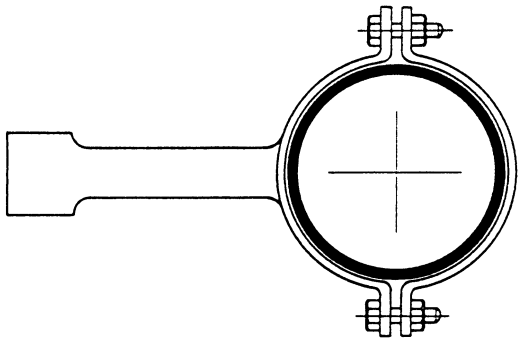
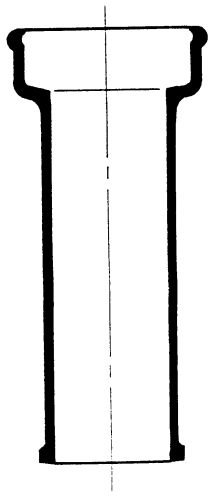


Figure 26 — Cast iron holderbats
(see Table 25)

Table 25 — Range of nominal bore size suitable for union sockets, shoes, and cast iron holderbats

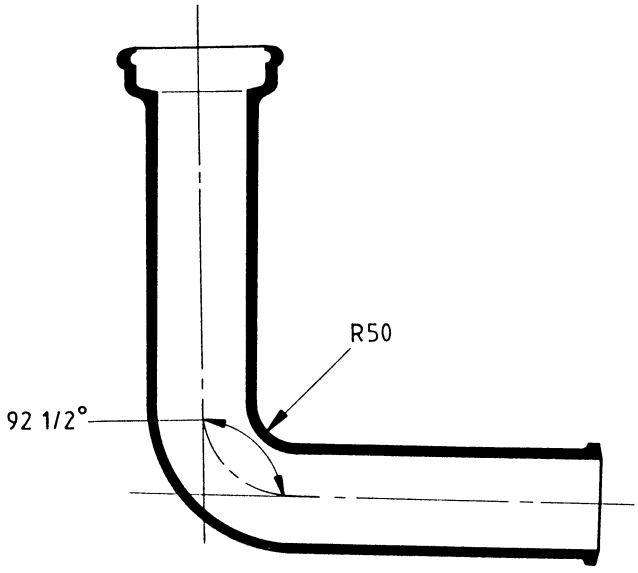
Fitting	Range of DN					
Union sockets (see Figure 24)	50	65	75	90	100	150
Shoes (see Figure 25)	50	65	75	90	100	150
Cast iron holderbats (see Figure 26)	50	65	75	90	100	150

NOTE For tolerances, see clause **4**.



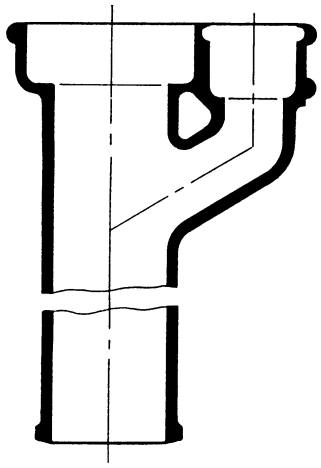
NOTE 1 This pipe is for connection to a DN 140 socket for w.c. outlets.
NOTE 2 Sockets for w.c. outlets are shallower than normal pipe sockets.

Figure 27 — Short connecting pipe: sanitary connection DN 90 and DN 100



Linear dimension is in millimetres.
NOTE 1 This pipe is for connection to a DN 140 socket for w.c. outlets.
NOTE 2 Sockets for w.c. outlets are shallower than normal pipe sockets.

Figure 28 — Sanitary bends: sanitary connection DN 90 and DN 100



NOTE Sockets for w.c. outlets are shallower than normal pipe sockets.

Figure 29 — DN 90 and DN 100 w.c connectors with anti-syphon socket (DN 50 branch)

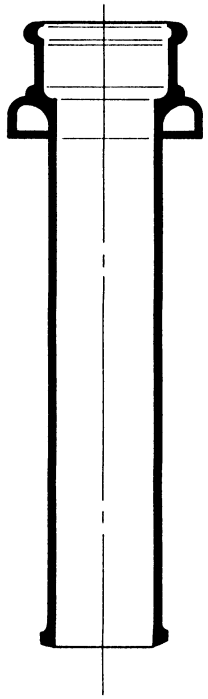
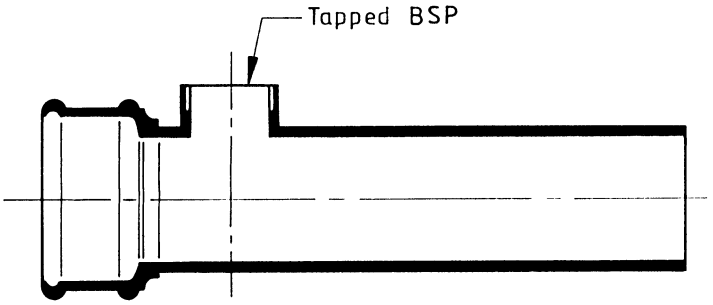


Figure 30 — Roof vent connector for asphalt (see Table 26)

Table 26 — Range of nominal bore size for vent pipe roof connectors (see Figure 30)

Range of DN	50	65	75	90	100	150
NOTE For tolerances, see clause 4.						



NOTE 1 Bosses are supplied in the following standard sizes: 2 in BSP; 1½ in BSP; 1¼ in BSP.
NOTE 2 The standard boss angle is 87½°.
NOTE 3 For dimensions of access doors, see Table 3.

Figure 31 — Bossed pipes (see Table 27)

Table 27 — Range of nominal bore size for bossed pipes (see Figure 31)

Range of DN	50	65	75	90	100	150
NOTE For tolerances, see clause **4**.						

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Publications referred to

BS 416, *Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron*[3)].

BS 416-2, *Specification for socketless systems.*

BS 437, *Specification for cast iron spigot and socket drain pipes and fittings*[3)].

BS 460, *Specification for cast iron rainwater goods.*

BS 1452, *Specification for grey iron castings.*

BS 2494, *Specification for elastomeric joint rings for pipework and pipelines.*

BS 3416, *Specification for bitumen-based coatings for cold application, suitable for use in contact with potable water.*

BS 4118, *Glossary of sanitation terms.*

BS 4147, *Specification for bitumen-based hot-applied coating materials for protecting iron and steel, including suitable primers where required.*

BS 4164, *Specification for coal-tar-based hot-applied coating materials for protecting iron and steel, including a suitable primer.*

BS 4772, *Specification for ductile iron pipes and fittings.*

[3)] Referred to in the foreword only.

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