BRITISH STANDARD

BS 7903 : 1997

Guide to

Selection and use of gully tops and manhole covers for installation within the highway

Confirmed
October 2008

ICS 93.080.30

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee B/505, Wastewater Engineering, to Subcommittee B/505/4, Manhole covers and other road fittings, upon which the following bodies were represented:

British Foundry Association
British Plastics Federation
British Precast Concrete Federation
Chartered Institute of Water and Environmental Management
Clay Pipe Development Association
Concrete Pipe Association
County Surveyors Society
Ductile Iron Pipe Committee
Fabricated Access Covers Association
Galvanisers Association
Highways Agency
Institute of British Foundrymen
Institute of Building Control
Institute of Civil Engineers (Works and Highways Committee)
London Technical Advisors Group
METCOM
Society of British Water Industries
Water Companies Association
Water Services Association of England and Wales

This British Standard, having been prepared under the direction of the Sector Board for Building and Civil Engineering, was published under the authority of the Standards Board and comes into effect on 15 November 1997

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference B/505/4
Draft for comment 96/107298 DC

ISBN 0 580 27696 1

Contents

Foreword

This British Standard has been prepared by Subcommittee B/505/4. It is to be used in conjunction with BS EN 124 : 1994 *Gully tops and manhole tops for vehicular and pedestrian areas — Design requirements, type testing, marking, quality control*, which superseded BS 497 : Part 1, withdrawn in June 1995.

This standard is not a substitute for BS EN 124.

Although BS EN 124 purports to be a performance standard, it is not yet comprehensive enough in its requirements for product performance. It also incorporates certain minimal dimensional requirements which, being minimal, may not necessarily ensure that the product is fit for its purpose in all traffic conditions.

The publication of BS EN 124 has resulted in a wider selection of products being available, and this standard has been prepared as an aid to those who select or use these products. When quoting BS EN 124 in contract, additional information will be required to obtain the appropriate product, and a table of purchaser's options is shown in annex A.

BS EN 124 : 1994 requires mandatory third party assessment and certification, and unless a product carries a third party certification mark it will be deemed not to conform. The published UK view is that whilst third party certification may be recommended in a standard, it should not be a mandatory aspect of a product specification. This view is now supported by CEN policy, which requires that a CEN Technical Board dispensation be granted before mandatory third party certification is included in a standard. The European committee responsible for revising EN 124 will seek such a dispensation if is decided to retain this requirement.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

Guide

1 Scope

This British Standard gives guidance on the selection of gully tops and manhole tops with a clear opening measuring up to 1000 mm as specified in BS EN 124 : 1994 for installation within the highway.

2 References

2.1 Normative references

This British Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this British Standard, the definitions given in BS EN 124 apply, together with the following.

3.1 area of waterway

The area of a gully grating through which water can pass.

3.2 ductile iron

Spheroidal or nodular graphite cast iron.

3.3 highway

Area that includes some or all of the following features: carriageway, cycleway, footway, verge, hard shoulder, hard strip and central reservation.

3.4 specifier

Person who has responsibility for the design and/or maintenance of works, or is responsible for ordering the product.

3.5 fine cast

A fettled casting without any coating.

3.6 grey iron

Flake graphite cast iron.

3.7 keyway

A hole in the top of the manhole cover suitable for the insertion of an appropriate lifting key.

3.8 clear area

The maximum unobstructed area through the frame (including the area between seats).

4 Classification

Manhole covers and gully gratings previously made in accordance with BS 497 : Part 1 (withdrawn) were graded in relation to the test load. However, in that standard the sizes of the test blocks used for manhole covers were different to the sizes of the blocks used for gully gratings. BS EN 124 uses a common classification system for all products, but the test block sizes are different to those used in BS 497 : Part 1. A direct comparison between BS 497 : Part 1 grades and BS EN 124 classes is therefore not possible due to the different testing regimes.

A broad comparison is set out in table 1.

Table 1. Comparison of classification

BS EN 124		BS 497 (withdrawn)	
Class	Test load (all materials) kN	Grade	Test load kN
		C	10
A 15	15		
B 125	125		
		B	150
C 250	250		
		A	350
D 400	400	D	400
E 600	600		
F 900	900		

5 Place of installation

(See clause **5** of BS EN 124 : 1994.)

The selection of the appropriate class of product to suit the site conditions is the responsibility of the specifier. Guidance on recommended usage in the United Kingdom is given in table 2.

NOTE. Where there is any doubt, a stronger class should be selected.

Table 2. Recommended minimum use within the highway

BS EN 124 classification			Recommended usage in United Kingdom
Group	Class	Place of installation	
1	Min. A 15	Areas which can only be used by pedestrians and pedal cyclists.	As BS EN 124
2	Min. B 125	Footways, pedestrian areas and comparable areas, car parks or car parking decks.	As BS EN 124, with slow moving cars and vehicles up to 3.5 tonnes gross vehicle weight.
3	Min. C 250	For gully tops installed in the kerbside channels of roads (see figure 9a of BS EN 124 : 1994), which, when measured from the kerb edge, extend a maximum of 0.5 m into the carriageway and a maximum of 0.2 m into the footway.	a) Slow moving normal commercial vehicles e.g. residential roads where speed is limited. b) Kerb type gullies
4	Min. D 400	Carriageways of roads (including pedestrian streets), hard shoulders (see figure 9b of BS EN 124 : 1994) and parking areas for all types of road vehicles.	As BS EN 124

6 Materials

6.1 General

BS 497 : Part 1 limited materials to either grey and ductile cast iron or cast steel. BS EN 124 permits a greater choice of materials for use in the highway. When considering the choice of materials offered by manufacturers, the specifier is advised to consider the long-term performance and maintenance implications of products made from other materials.

6.2 Other materials

(See **6.1.3** of BS EN 124 : 1994.)

It should be noted that BS EN 124 does not fully specify the requirements for the 'other' materials that it allows. In permitting 'other' materials, it requires conformity to the specification and any other relevant requirements and testing methods to be established by an approved independent body, without defining the qualifications or standing of such a body.

NOTE. BSI is in the process of establishing a Product Assessment Specification (PAS) to allow approval and marking of products manufactured from plastics materials that in all other respects conform to BS EN 124.

6.3 Coatings

With the exception of the galvanizing (see ISO 1461) of units made from rolled steel, there is no specification in BS EN 124 for protective coatings, and cast iron units may be supplied as fine cast.

Any coatings required for decorative or other purposes may be specified but it should be noted that short term coatings offer no lasting product enhancement and that any surface oxidization of the cast iron has no detrimental effect upon its use.

7 Design requirements

7.1 Size and shape

(See **7.15** of BS EN 124 : 1994.)

The shape of the supporting structure immediately below the frame in most engineering situations is rectangular or circular, and the specifier should therefore select a manhole top or gully top with a bedding area shape that is appropriate.

Irrespective of the exposed shape of the cover/grating, the effective bedding area should be determined so that the specifier can be assured that there is sufficient frame bearing area for the proposed application.

For any area of unsupported frame (see figure 1), the specifier should establish that there is sufficient strength to carry the expected loads. BS EN 124 does not require this part of the frame to be subjected to any direct test loads. In the single triangular design, for example, (shown in figure 1) the carriageway above the unsupported part of the frame has been recognized for many years in the United Kingdom as being the area which shows early road surfacing failure. This may in turn lead to a failure of the frame bedding.

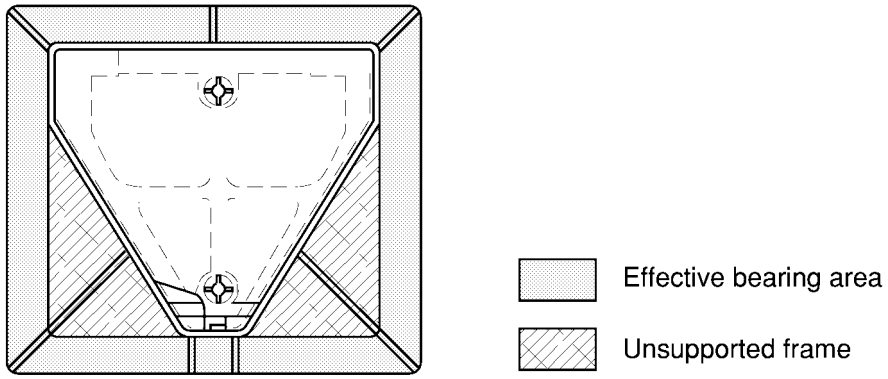


Figure 1. Single triangular cover over rectangular structure

7.2 Vents in covers for manhole tops

(See **7.2** of BS EN 124 : 1994.)

A maximum vent area is not specified. The specifier should refer to the corresponding clause in BS EN 124 : 1994 and the note at the end.

7.3 Clear opening of manhole top for man entry

(See **7.3** of BS EN 124 : 1994.)

BS EN 124 requires the opening of manhole tops designed for man entry to conform to safety requirements in force at the place of installation, and points out that these generally require a diameter measuring at least 600 mm. In the United Kingdom the following dimensions are recommended, in accordance with the safety guidelines published by the National Joint Health and Safety Committee for the Water Service [5]:

a) the minimum clear opening for a frame with a rectangular opening should be 600 mm with a diagonal measurement of not less than 700 mm;

b) the minimum clear opening for a frame with a circular opening should be a diametric measurement of not less than 700 mm;

c) the minimum clear opening for a frame with a triangular opening should be a diametric measurement of not less than 700 mm.

7.4 Depth of insertion

The depth of insertion is linked with securing the cover and is dealt with in **7.7**.

7.5 Seatings

(See **7.6** of BS EN 124 : 1994.)

BS EN 124 requires that units of class D 400 to F 900 be manufactured so as to 'ensure their stability and quietness in use'. It is recommended that the specifier extend this requirement to include class C 250 manhole covers where these are specified for use in the carriageway.

One of the methods suggested to achieve 'quietness in use' is the inclusion of cushioning inserts. However, BS EN 124 does not specify the materials to be used or the performance characteristics required of these inserts.

NOTE. There is no widespread public authority experience of cushioning inserts in the United Kingdom.

The specifier should satisfy himself about maintenance implications when deciding the methods to be used to achieve 'quietness in use'.

7.6 Coupling of sections

Where the 'quietness in use' feature is achieved by the use of three point suspension, and two triangular units are used to produce a rectangular cover or grating, then the specifier should be assured that their security within the frame is maintained. This may be ensured either by the units being loosely and permanently coupled together or by some other design feature.

The specifier should be assured that any loose couplings are of steel or ductile iron which cannot be over-tightened or detached without the use of a tool. Any nut and bolt supplied as a loose coupling should not be less than size M16. Any alternative steel coupling should have a minimum cross-sectional area of 140 mm^2.

A performance requirement of any loose coupling is that it should not be able to vibrate freely during its service life.

7.7 Securing the cover/grating within the frame

(See **7.8** of BS EN 124 : 1994.)

In the United Kingdom, designers have used several features to ensure the stability of the cover within the frame. These include the mass of the unit, the tightness of fit and the depth of the insertion of the cover into the frame.

When using class D units, and where the design relies upon the depth of insertion for the security of the cover/grating within the frame, then the depth of the cover/grating immediately adjacent to the frame should be not less than 80 mm.

BS EN 124 suggests locking devices may be used to ensure security but does not give any specification.

7.8 Slot dimensions

(See **7.9** of BS EN 124 : 1994.)

The minimum waterway area specified in BS EN 124 is 30 % of the clear area. This is lower than the values which have been used to provide hydraulic capacity in the United Kingdom. It is the total waterway area which is important, and the United Kingdom requirements have previously been stated in terms of minimum waterway area and the distribution of that area across the grating. It is equally important that adequate total waterway is provided and that there is a sufficiency concentrated in the area immediately adjacent to the kerb face. United Kingdom practice has encompassed both requirements.

Current United Kingdom design practice is based upon TRRL Contractor Report 2 [4]. The design method was derived using typical British Standard gullies which were of the sizes shown in table 3. Until such time as TRRL Contractor Report 2 is revised, or when replacing gully gratings manufactured to conform to BS 497 : Part 1 (withdrawn), the specifier is recommended to ensure that minimum nominal widths and waterway areas conform to table 3 and figure 2.

Table 3. Minimum nominal widths and waterway areas

Minimum nominal width of grating	Minimum area of waterway
325 mm	650 cm^2
450 mm	900 cm^2

7.9 Lifting holes

The Manual Handling Operations Regulations [2] place a duty on the employer to provide safe lifting and handling conditions.

Where the mass of a frame exceeds 15 kg, it is recommended that suitable lifting holes or hooking points in the frames are provided. These should be located to give a balanced lift. Any lifting holes within the bedding area of the frame should be taken into account when determining the minimum bearing area of the frame.

7.10 Keyways

BS EN 124 does not deal with keyways. To minimize maintenance costs, the UK practice has been to use standardized keyways that conform with the following recommendations:

a) the specifier should ensure suitable keyways(s) are provided in each complete cover, as detailed in figure 3;

b) where a cover is divided into two or more coupled sections, each section should be provided with at least one keyway.

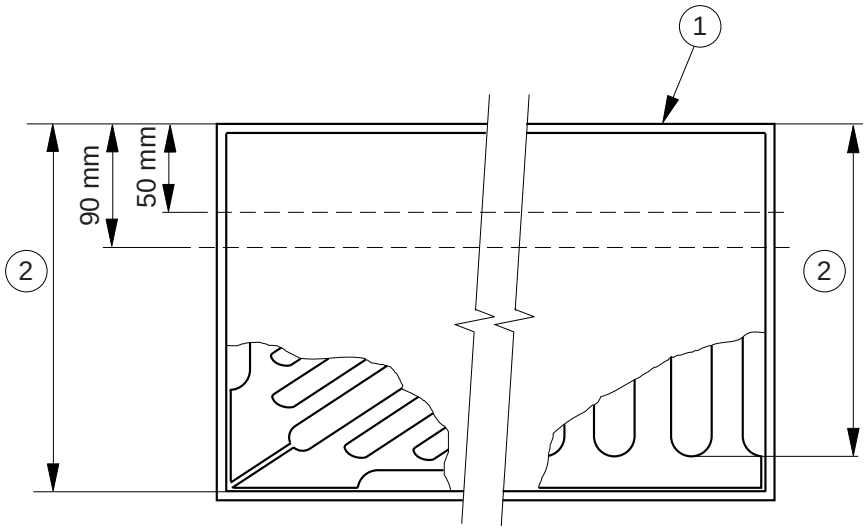
7.11 Sealed manhole tops

(See **7.14** of BS EN 124 : 1994.)

The design of the sealing feature for manhole tops is not included in BS EN 124. The depth of penetration of the cover sealing flange into the sealing material is typically 10 mm and the seal should be continuous to be fit for its purpose.

The specifier should state if a sealed cover is required. Figure 4 shows one method for the sealing of manhole tops.

To seal against the normal egress of sewer gases, the manhole frame may provide a continuous channel for retaining the sealing material which may be of either single or double seal pattern.



1. Kerb face of frame
2. Nominal width from kerb face of frame to extremity of waterway

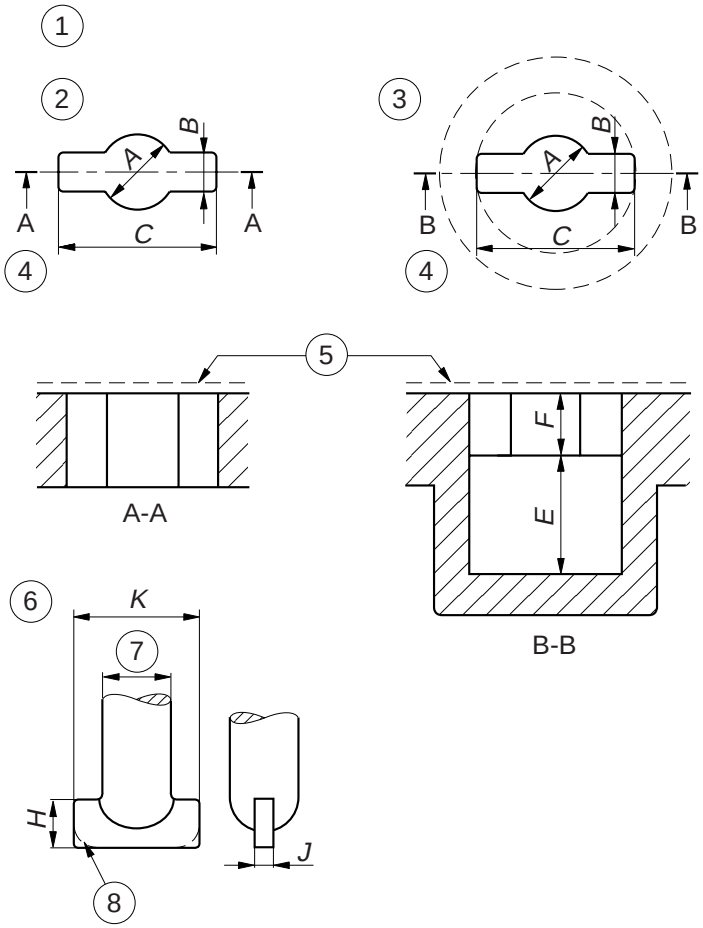
NOTE 1. There should be a minimum waterway area of 45 cm^2 between the kerb face of the frame and a parallel line 50 mm distant.
NOTE 2. There should be a minimum waterway area of 65 cm^2 between the kerb face of the frame and a parallel line 90 mm distant.

Figure 2. Distribution of waterway area

Type	Keyway					Key			
	A	*B*	*C*	*E*	*F*	*G*	*H*	*J*	*K*
	min./max.	min./max.	min.	min.	min.				
Small	14-16	9-11	29	17	6	12	12	6	25
Large	22-25	9-13	44	35	10	20	15	6	40

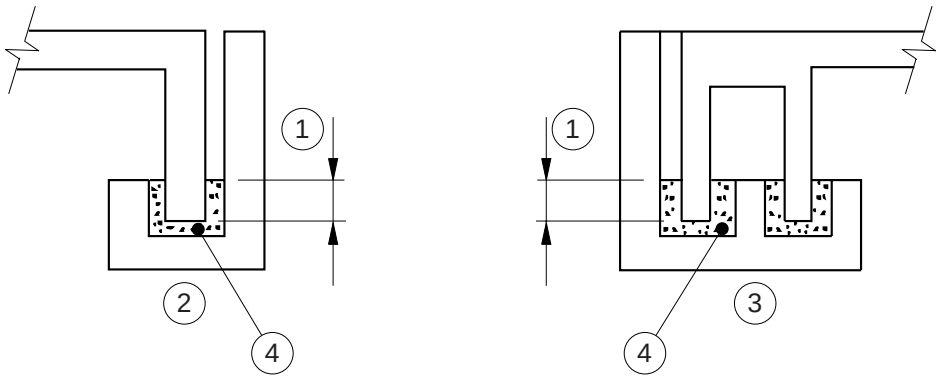
NOTE. Small key for class A and B kerb-type gully covers; large key for class C and above

All dimensions in millimetres



1. Keyways
2. Open
3. Closed
4. Plan
5. Line of raised pattern
6. Keys
7. *G* (dia)
8. Alternative shape

Figure 3. Keyways and keys



1. 10 mm typical
2. Single seal
3. Double seal
4. Sealing material

Figure 4. Typical sealing of manhole tops

7.12 Frame bearing area

(See **7.15** of BS EN 124 : 1994.)

BS EN 124 specifies a minimum frame bearing area based upon a maximum bearing pressure of 7.5 N/mm^2 under test load conditions. Taken in isolation, this could lead to a bedding width which may increase maintenance costs when adopting methods of installation currently used (see SCHM Preferred Method 7 [3]).

BS EN 124 also requires that the frame, including any external corners, provides an adequate contribution to the stability of the unit in working conditions. It is suggested that for class D 400 units with 150 mm deep frames, a minimum frame bedding width of 75 mm solid material should be specified (see figure 5). This should include external corners.

Where class D 400 units incorporate slots/holes in the frame bedding area, the width of the bedding area should be increased as appropriate in order to maintain sufficient bedding area. The specifier should also be satisfied that the corner quadrants remain solid when, as in triangular units, the cover support is concentrated at the frame corners.

7.13 Frame depth

(See **7.16** of BS EN 124 : 1994.)

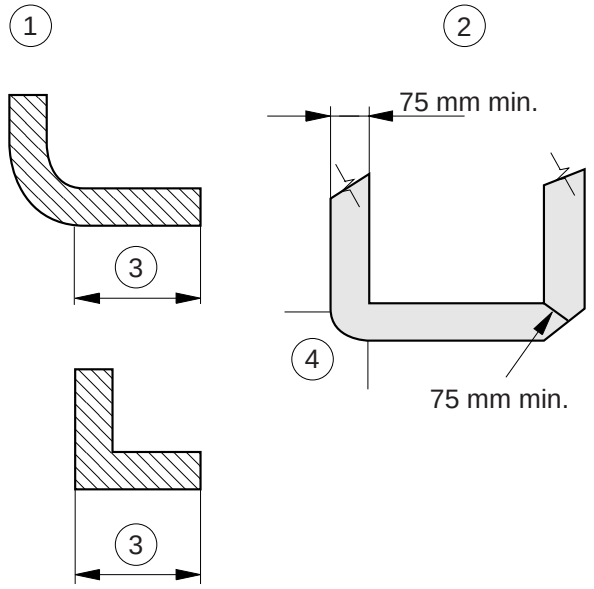
For units of class D 400 and above, BS EN 124 specifies minimum frame depths but allows the depth to be specified as considered appropriate to the traffic flow characteristics and the method of installation. It does not specify a minimum frame depth for class C 250.

The specifier may require frames with a depth in excess of 100 mm and should use the option permitted in the note.

The specifier is recommended to ensure that the products used have the minimum frame depths as given in table 4.

Table 4. Recommended frame depths

Class	Minimum frame depths within the carriageway	
	Motorway, trunk and similar primary roads carrying fast moving traffic	Other roads
C 250	Not recommended	75 mm
D 400	100 mm – Gully tops 150 mm – Manhole tops	100 mm



1. Frame section
2. Plan
3. Bedding width
4. Solid metal in corner quadrant

Figure 5. Examples of bedding width

7.14 Frame web/gusset

Where webs/gussets are provided to stiffen the frame and these are extended to the top of the frame, the compaction of the road surfacing material may be impaired. Experience in the United Kingdom indicates that this will lead to early failure of the installation and thus higher maintenance costs.

The specifier should be assured that, where vertical frame webs/gussets are provided, the tops of the webs/gussets should be at a minimum of 15 mm below the top of the frame for triangular webs/gussets and at a minimum of 25 mm for quadrilateral shaped webs/gussets.

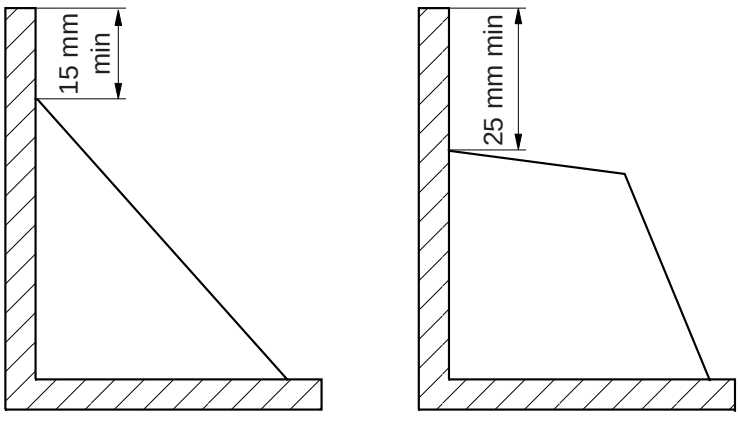


Figure 6. Webs/gussets

7.15 Kerb type gully covers and frames

7.15.1 *General*

The loading requirements for this type of unit are specified in BS EN 124; however, design features are not included. The specifier is recommended to consider including the following design features.

7.15.2 *Design*

Kerb type units should provide a kerb-side water intake and an access cover, and, if hinged, should open away from the carriageway or be hinged on the approach side. Weir depth (distance from top of cover to top of fixed weir, if any) should be either 115 mm or 165 mm at the specifier's discretion.

7.15.3 *Profile*

Kerb type gully covers and frames should be provided with a half batter profile in accordance with BS 7263 : Part 1, unless otherwise required by the specifier.

7.15.4 *Principal dimensions*

The recommended principal dimensions of kerb type gully covers and frames hitherto employed in the United Kingdom are given in table 5.

Table 5. Kerb type gully covers and frames

Weir depth	Minimum net weir length	Minimum rectangular clearway	Minimum rectangular clear opening
mm	mm	mm^2	mm
115	425	250	400 × 250
165	425	250	400 × 250

NOTE 1. Interruptions to weir length and cleaning area caused by debris trap features should not reduce the specified minima.
NOTE 2. Unless otherwise specified by the engineer, a road retaining bar of minimum cross section 35 mm × 25 mm should be provided. It should be supplied loose so as to allow adjustment to suit the required road level. Alternatively, a deflector plate may be provided if agreed by the specifier.

7.15.5 *Access cover*

The cover should be provided with either an open keyway(s) or a locking mechanism. Where the cover can be readily raised without the use of the key or other tool, a locking mechanism should be provided. Where a hinge is provided, this should be at the rear edge of the cover, as viewed from the road or on the approach side. The top should be self-draining and shall have a raised pattern conforming with BS EN 124.

7.15.6 *Debris trap*

A grid with a horizontal bar(s) of minimum diameter 12 mm and galvanized in accordance with ISO 1461 should be provided, or a minimum of two integrally cast vertical fins should be provided to act as a debris trap across the open mouth of the unit.

7.15.7 *Cleansing access*

The opened unit should provide a minimum rectangular clear opening of 400 mm × 250 mm.

8 Quality control

(See clause **10** of BS EN 124 : 1994.)

BS EN 124 requires independent third party control of the manufacturing process, with the mark of the third party being affixed to the product. This requirement is less onerous than, and should not be confused with, the procedures normally implemented by marked product certification schemes, since the qualifications of the third party are not defined. Marked certification schemes in the United Kingdom, e.g. the British Standard Kitemark or equivalent, are normally accredited by UKAS, regular audit of the quality assurance system to BS EN ISO 9002 and independent product audit testing.

BS EN 124 does not make any requirements in respect of the competence, qualifications and accreditation of such third party bodies. It should be noted that this lack of definition creates the potential for a wide variation in the quality of manhole covers and gratings marked as conforming to BS EN 124.

Specifiers and manufacturers are recommended to pay particular attention to the qualifications, competence and accreditation of third party bodies and to the content of certification schemes offered by them.

9 Installation

The specifier is referred to the Department of Transport Standing Committee on Highway Maintenance Preferred Method 7 for the Adjustment of Street Ironwork [3] for the installation of gully tops and manhole tops.

Annex

Annex A (informative)

Characteristics of gully tops and manhole tops for which requirements are given in BS EN 124 and/or additional guidelines are given in BS 7903

Table A.1 Characteristics of gully tops and manhole tops for which requirements are given in BS EN 124 and/or additional guidelines are given in BS 7903

Clause of BS EN 124	Corresponding clause of BS 7903	Characteristic
4 – 5	**4 – 5**	Class of unit
6.1.1/6.1.2	**—**	Material
6.1.4	**—**	Cover filling (if appropriate)
—	**6.3**	Coating (state if required or if fine cast is acceptable)
—	**7.1**	Size and shape
7.2	**—**	Vents
7.3	**7.3**	Size of clear opening
7.4	**7.4**	Minimum depth of insertion
7.6	**7.5**	Type of seatings
—	**7.6**	Coupling of sections (if appropriate)
7.8	**7.7**	Securing of the cover/grating in the frame
7.9	**7.8**	Slot dimensions (waterway area)
7.9.1	**—**	Slot widths
7.10	**—**	Dirt pans and dirt buckets
—	**7.9**	Lifting holes/hooks
—	**7.10**	Size of keyways and whether opened or closed
—	**7.11**	Sealing of manhole top
—	**7.12**	Minimum frame widths and/or bearing area
—	**7.13**	Minimum frame depth
7.17	**—**	Hinged units and position of hinge
—	**7.14**	Frame web/gusset limitations
		Kerb type gully cover and frames
—	**7.15.2**	Weir depth
—	**7.15.3**	Profile
—	**7.15.4**	Principal dimensions and road retaining bar
—	**7.15.5**	Style of access cover and location of hinge
—	**7.15.6**	Debris trap
—	**7.15.7**	Cleaning access
		For all units
10	**—**	Product certification

List of references (see clause 2)

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 7263 : Part 1 : 1994	*Precast concrete flags, kerbs, channels, edgings and quadrants. Part 1. Specification*
BS EN 124 : 1994	*Gully tops and manhole tops for vehicular and pedestrian areas. Design requirements, type testing, marking, quality control*

ISO publications

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO), Geneva.
(All publications are available from Customer Services, BSI.)

ISO 1461 : 1973	*Metallic coatings — Hot dip galvanized coatings on fabricated ferrous products — Requirements*

Informative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS EN ISO 9002 : 1994	*Quality systems — Model for quality assurance in production, installation and servicing*

Other publications

[1] Environmental Protection Act 1990 : Part 1

[2] Health and Safety Executive
The Manual Handling Operations Regulations 1992

[3] Department of Transport Standing Committee on Highway Maintenance (SCHM)
Preferred Method 7 — Adjustment of Street Ironwork

[4] Transport and Road Research Laboratory (TRRL) The drainage capacity of BS road gullies and a procedure for estimating their spacing — Contractors Report 2

[5] National Joint Health and Safety Committee for the Water Service
Safe working in sewers and at sewage works — Health and Safety Guideline No. 2 1979

BSI — British Standards Institution

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

Revisions

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

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

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

Buying standards

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

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

Information on standards

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

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

Copyright

BSI
389 Chiswick High Road
London
W4 4AL