

30 March 2020

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Yours Sincerely,

Deborah Stead

Head of Committee Services and International Secretariat

BS 7903:2020



BSI Standards Publication

**Selection and installation of manhole
tops and gully tops within the
highway — Guide**

bsi.

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Published by BSI Standards Limited 2020

ISBN 978 0 539 01771 7

ICS 93.080.30

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

Committee reference B/505

Draft for comment 19/30380857 DC

Amendments/corrigenda issued since publication

Date	Text affected
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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 March 2020. It was prepared by Technical Committee B/505, *Wastewater engineering*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 7903:1997, which is withdrawn.

Relationship with other publications

This British Standard gives guidance on the installation of products conforming to BS EN 124-1:2015, BS EN 124-2:2015, BS EN 124-3:2015, BS EN 124-4:2015, BS EN 124-5:2015 and BS EN 124-6:2015.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- the scope has been modified to clarify that the guidance is for the selection and installation of products conforming to the BS EN 124 series as part of an in-service system; and
- to avoid conflict with the BS EN 124 series, the “specifications” for products that appeared in the previous edition have been removed, but where appropriate have been re-drafted as current industry practice to preserve useful information.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Product certification. Users of this British Standard are advised to consider the desirability of obtaining third-party certification of conformity with BS EN 124-1:2015 to BS EN 124-6:2015 for products they intend to install.

NOTE Specifiers might require this as part of the contract.

Use of this document

As a guide, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification or a code of practice and claims of compliance cannot be made to it.

Presentational conventions

The guidance in this standard is presented in roman (i.e. upright) type. Any recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard gives guidance for the selection and installation of manhole tops and gully tops conforming to BS EN 124-1:2015 to BS EN 124-6:2015 for covering gullies, manholes and inspection chambers to be used in conjunction with other components and materials to form a safe, durable, maintainable and usable installed system for highway applications.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 124-1:2015, *Gully tops and manhole tops for vehicular and pedestrian areas – Part 1: Definitions, classification, general principles of design, performance requirements and test methods*

BS EN 124-2:2015, *Gully tops and manhole tops for vehicular and pedestrian areas – Part 2: Gully tops and manhole tops made of cast iron*

BS EN 124-3:2015, *Gully tops and manhole tops for vehicular and pedestrian areas – Part 3: Gully tops and manhole tops made of steel or aluminium alloys*

BS EN 124-4:2015, *Gully tops and manhole tops for vehicular and pedestrian areas – Part 4: Gully tops and manhole tops made of steel reinforced concrete*

BS EN 124-5:2015, *Gully tops and manhole tops for vehicular and pedestrian areas – Part 5: Gully tops and manhole tops made of composite materials*

BS EN 124-6:2015, *Gully tops and manhole tops for vehicular and pedestrian areas – Part 6: Gully tops and manhole tops made of polypropylene (PP), polyethylene (PE) or unplasticized poly(vinyl chloride) (PVC-U)*

BS EN 1339, *Concrete paving flags – Requirements and test methods*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS EN 124-1:2015 to BS EN 124-6:2015 and the following apply.

NOTE Attention is drawn to definition 3.1.5 in BS EN 124-1:2015, which states that the term “manhole top” refers to a cover for either a manhole or an inspection chamber.

3.1 highway

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

4 Classification

4.1 General (see BS EN 124-1:2015, Clause 4 and Annex F)

BS EN 124-1:2015, Annex F, gives recommendations for installation, including bedding and packing, and emphasizes the critical relationship between these for highway applications.

During its lifetime, a manhole top or gully top will be exposed to loads during the construction period (“pre-service”) and in normal use (“service”). BS EN 124:2015-1:2015 to BS EN 124:2015-6:2015

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

assume exposure to the “service” environment, but pre-service conditions should be considered to ensure that the installed product starts its service life in an optimal condition. Adequate protection may be provided either by interim protection measures or by selecting a different class of product.

When selecting products and/or interim protection measures, the specifier should take account of the following:

- a) loading during the construction period and final surfacing (for example, point loads and higher loads from site traffic than expected in normal use);
- b) site conditions prior to surfacing of the road (for example, use of a temporary roadway for construction traffic); and
- c) conditions during normal use, including any local provisions from adopting road authority and/or network provider, e.g. maintenance.

NOTE Further information on reinstatement is given in “Specification of the Reinstatement of Openings in Highways” (SROH) [1] and the RSTA/ADEPT “Code of Practice for Ironwork Systems Installation and Refurbishment” [2].

4.2 Place of installation

A view of a highway environment is given in BS EN 124-1:2015, Figure 5, but this does not cover all potential highway applications, e.g. shared spaces, pedestrianized areas and smart motorways. BS EN 124-1:2015 specifies minimum recommended classes for use in each group and states that, where there is any doubt, a higher class is selected. However, the following should also be taken into account when selecting the correct product for a given installation:

- a) the maximum load that might be incurred in any application;
- b) maintenance equipment loads;
- c) current and future traffic intensity (volume);
- d) predominant traffic type;
- e) anticipated abnormal loads: frequency and type;
- f) quietness and stability in use;
- g) other critical requirements, e.g. water ingress/egress and odour egress;
- h) frequency, method of, and provision for, access; and
- i) compatibility with surrounding materials, e.g. oxidization from ferrous products which could stain pavements, slip/skid differentials.

When a product is to be replaced, the items in a) to g) should again be used again to select the correct product for the installation rather than assume ‘like-for-like’ replacement is the appropriate solution.

5 Materials

5.1 General (see BS EN 124-1:2015, 5.1)

The materials for manhole and gully tops are set out in BS EN 124-2:2015 to BS EN 124-6:2015.

Where manhole tops and gully tops are to be installed in conditions more severe than those set out in BS EN 124-1:2015, 5.1, specifiers should seek advice from the manufacturer.

Materials for installation are not described in the BS EN 124:2015 series. Additional UK best practice is given in 5.2 to 5.5 to help the specifier.

5.2 Cover fillings (see BS EN 124-1:2015, 5.2)

Clarification is provided to BS EN 124-1:2015, 5.2, as follows.

- a) Where products are supplied factory-filled by the manufacturer (or their agent), care should be taken not to damage or replace the factory-installed fill during installation. The specific fill can contribute to the structural performance of the cover.
- b) Covers placed on the market in an unfilled condition can be supplied in two structural variants:
 - 1) where filling materials are not specified, the fill does not contribute significantly to structural performance of the cover; and
 - 2) where the filling materials are specified, the fill contributes to structural performance of the cover, so only the specified fill should be used.

NOTE The use of a different filling material can, for example, increase mass of product and impair lifting for access. For hinged products, care is needed to ensure retention of the filling material during service.

5.3 Frames in combination with concrete (see BS EN 124-1:2015, 5.3)

This document gives no guidance on the requirements of BS EN 124-1:2015, 5.3, for frames in combination with concrete.

5.4 Coating materials

The lifetime of coating should be taken into account when selecting covers and frames.

In addition to the coatings specified in the various parts of BS EN 124:2015, other coatings can be specified such as:

- a) colour coding (powder coating and paint);
- b) anti-slip/anti-skid;
- c) epoxy coating; and
- d) electroplating.

Coatings provided for decorative purposes can be specified but offer no lasting product enhancement or protection. Advice should be sought from the manufacturer of the manhole top/gully top about post-production application of coating materials.

5.5 Installation materials (see BS EN 124-1:2015, Annex F)

BS EN 124-1:2015, Annex F, gives recommendations for installation, including bedding and packing. No guidance is given on materials.

Where the installation materials are not specified, the guidance in RSTA/ADEPT *Code of Practice for Ironwork Systems Installation and Refurbishment* [2], *Sewers for Adoption* [3], *Design and construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code")* [4] or *Sewers for Scotland* [5] should be followed, as appropriate.

Bedding and packing materials should be compatible to ensure optimal performance, which includes but is not limited to:

- a) workability;
- b) mechanical characteristics (e.g. compressive/tensile/flexural strength and fracture toughness);
- c) water absorption;
- d) thermal expansion and contraction;

- e) profile/shape sensitivity; and
- f) chemical characteristics.

Bedding materials should be used strictly in accordance with the bedding material's manufacturer's instructions, including preparation, quantity and application.

5.6 Compatibility of components

Only components supplied with, or recommended for use with, the manhole top or gully top should be used in the installation.

6 Design attributes

6.1 Vents in covers (see BS EN 124-1:2015, 6.1)

BS EN 124-1:2015, 6.1, specifies a minimum ventilation area.

This minimum ventilation area might not be adequate. The specifier should determine the rate of airflow required and therefore the ventilation area. Onsite modifications to change the ventilation area can compromise performance and mean that the product no longer conforms to BS EN 124-1:2015.

6.2 Clear opening of manhole tops for man entry (see BS EN 124-1:2015, 6.2)

The clear opening size is a minimum dimension determined by the need for both safe access and egress.

NOTE Further guidance for UK applications is given in the National Annex to BS EN 752:2017, NA6.4.3.

6.3 Depth of insertion (see BS EN 124-1:2015, 6.3)

For classes D400 and above, BS EN 124-1:2015 specifies a minimum of 50 mm for products secured by either mass per unit area or other methods, but UK practice is, for traffic security purposes, to select only those with more than 80 mm if the design relies upon depth of insertion for security.

6.4 Clearance

6.4.1 Total clearance (see BS EN 124-1:2015, 6.4.1)

This document gives no guidance on the requirements of BS EN 124-1:2015, 6.4.1, for total clearance.

6.4.2 Clearance around hinges (see BS EN 124-1:2015, 6.4.2)

This document gives no guidance on the requirements of BS EN 124-1:2015, 6.4.2, for clearance around hinges.

6.5 Compatibility of seatings (see BS EN 124-1:2015, 6.5)

BS EN 124-1 only specifies that seatings for classes D400 to F900 are designed to ensure stability and quietness in use. Products are tested and supplied as a single unit to ensure this, so parts should not be interchanged.

For classes below D400, the specifier needs to determine whether these characteristics are required.

Where parts of an existing product, e.g. cover section or grating, have worn or otherwise require replacement, the complete unit should be replaced, unless components are designed to be replaced in service, e.g. gaskets, replaceable seatings and seals.

6.6 Securing of the cover/grating within the frame (see BS EN 124-1:2015, 6.6)

Retention of the cover or grating within the frame is addressed by BS EN 124-1:2015 and examples are given. Retention, however, can be compromised if the installation fails, e.g. deterioration or failure of substructure/surface surround leading to movement of the frame and potential lifting of the cover under traffic conditions.

Bedding should be installed in accordance with [5.5](#) and [6.15](#).

In high-risk applications, additional measures (e.g. cover locking) should be considered where an issue with retention of the cover/grating within the frame could be hazardous.

6.7 Handling of covers and gratings (see BS EN 124-1:2015, 6.7)

The BS EN 124:2015 series does not cover design and performance of additional features or devices. When selecting products, it is necessary to ensure that suitable product provisions exist for effective and safe loosening and removal of cover elements for chamber access or inspection and to establish whether special or standard tooling is required.

6.8 Slot dimensions of gratings

6.8.1 Waterway area (see BS EN 124-1:2015, 6.8.1)

This document gives no guidance on the requirements of BS EN 124-1:2015, [6.8.1](#), for waterway area.

6.8.2 Slot dimensions (see BS EN 124-1:2015, 6.8.2)

Slot dimensions given in BS EN 124-1:2015, [6.8.2](#), are sized and aligned to suit the typical traffic types anticipated and to provide sufficient waterway area for water evacuation from the highway surround.

Where located in pedestrian areas, BS EN 124-1:2015, Figure 8, permits such slots to be reduced in size to provide a more visibly solid pavement surface for pedestrian confidence and comfort. In doing so, there is usually a reduction in hydraulic performance which should be considered against the minimum waterway area needed for water evacuation.

CD 526: *Spacing of road gullies* [\[6\]](#) sets out calculations for determining classification and spacing of gully gratings.

6.9 Dirt pans and dirt buckets (see BS EN 124-1:2015, 6.9)

This document gives no guidance on the requirements of BS EN 124-1:2015, [6.9](#), for dirt pans and dirt buckets.

6.10 Positioning of covers and gratings (see BS EN 124-1:2015, 6.10)

BS EN 124-1:2015, [6.10](#), relates to the position of the cover in relation to the frame.

When selecting hinged products, additional consideration should be given to the orientation of the opening relative to the traffic direction so that if inadvertently left open, a traffic strike closes the cover or grating.

6.11 Flatness of manhole covers and gratings (see BS EN 124-1:2015, 6.11)

This document gives no guidance on the requirements of BS EN 124-1:2015, [6.11](#), for flatness of manhole covers and gratings.

6.12 Concaveness of gratings (see BS EN 124-1:2015, 6.12)

This document gives no guidance on the requirements of BS EN 124-1:2015, [6.12](#), for concaveness of gratings.

6.13 Surface conditions (see BS EN 124-1:2015, 6.13)

This document gives no guidance on the requirements of BS EN 124-1:2015, 6.13, for surface conditions.

6.14 Manhole tops with sealing features (see BS EN 124-1:2015, 6.14)

Where sealing features are needed to prevent or limit the escape of odours or the ingress and egress of surface water (see BS EN 124-1:2015, 6.14), these need to be identified at the design and specification stage. It is not normally possible to retrofit suitable measures after product installation.

Care should also be taken to avoid excessive water retention which might impact on the performance of cover or installation materials.

6.15 Frame bearing area (see BS EN 124-1:2015, 6.15)

BS EN 124-1:2015 gives a method of calculation for frame bearing area to ensure that the bearing pressure on the supporting structure is controlled. Taken in isolation this could lead to a bedding width which can increase maintenance costs when adopting methods of installation typically used in the UK.

Any apertures within the bedding area of the frame should be taken into account when calculating the minimum bearing area of the frame.

Traffic load is transferred through the cover and frame to the supporting structure. This is concentrated near contact points between the cover and frame. Research work by Nottingham University [7] has shown that bearing pressure can therefore vary around a frame perimeter, leading to localized excessive stresses on the supporting structure which can initiate bedding failure and deterioration of the road surface.

The frame needs to be completely supported to effectively transfer loads (see [Figure 1](#)).

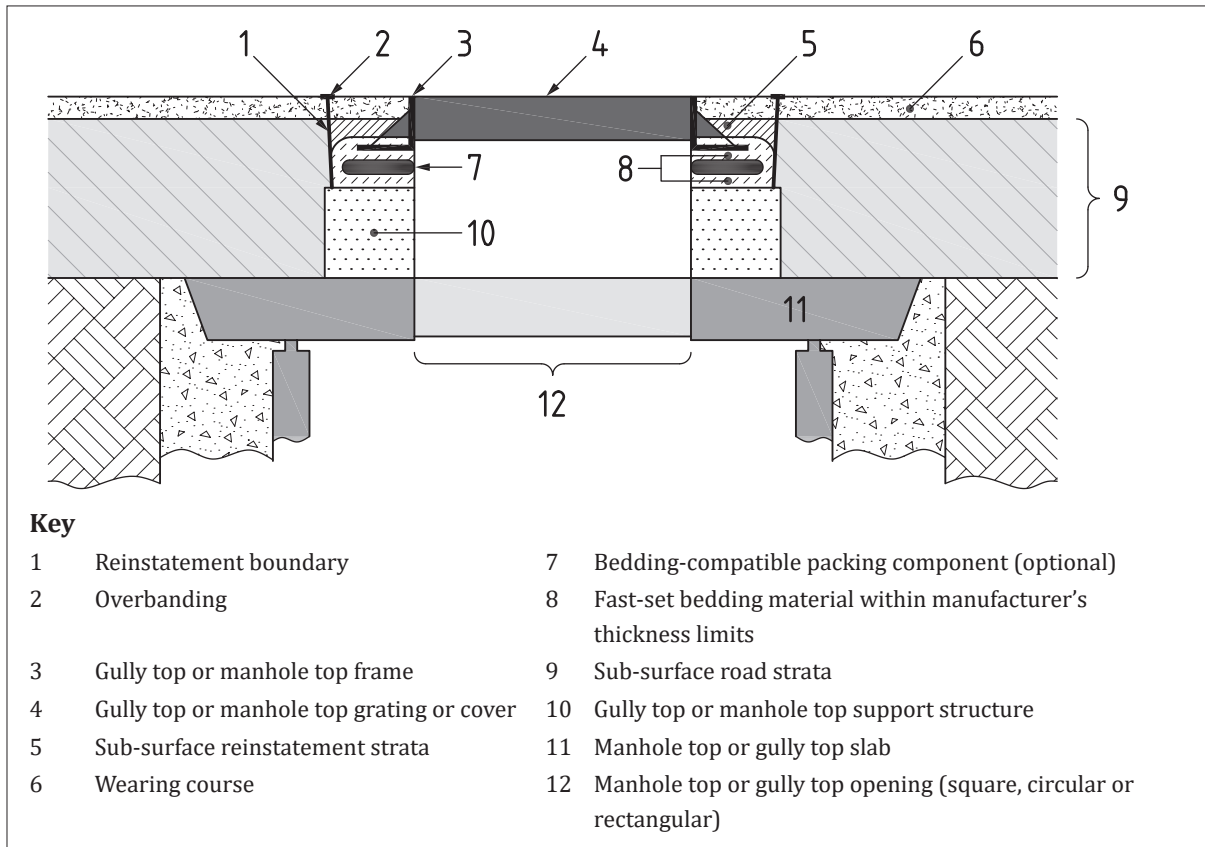
Due to the flexible nature of most covers and frames, bearing pressure is only one of the stress components involved in the dissipation of traffic loads. Therefore, other stresses (e.g. tensile, bending) and the way in which these are transferred through the installed system, should be taken into account when selecting the combination of cover, frame and bedding material.

The following should be taken into account when specifying the size and shape of the frame bearing area for a given installation:

- a) selecting a manhole top or gully top with a frame bearing area matched or sympathetic to the shape of the supporting structure immediately below the frame, typically rectangular or circular; and
- b) adequate support is provided by the bedding to the frame at all contact points.

NOTE Further information is given in "The Performance of Road Ironwork Installations" [7]. MCHW Series 500 [8] provides guidance on the properties of mortar bedding material which presumes a maximum nominal bearing pressure of 2.1 N/mm²; see also RSTA/ADEPT "Code of Practice for Ironwork Systems Installation and Refurbishment" [2].

Figure 1 — Installation materials and components



6.16 Frame depth (see BS EN 124-1:2015, 6.16)

Frame depths greater than the minimum specified in BS EN 124-1:2015, 6.16, can offer benefits in terms of greater rigidity and the ability to transfer traffic loads to the surround. This should be accounted for in conjunction with the design of the chosen seating arrangement and the depth of final reinstatement. Increased rigidity and load transfer can also be achieved by using alternative materials for the covers, frames and installation products.

NOTE Specific guidance for trunk roads and motorways is given in CD 534 [9]. For further information on final reinstatement, see SROH [1].

6.17 Opening angle of hinged covers/gratings (see BS EN 124-1:2015, 6.17)

Further guidance on the opening angle of hinged covers is given in BS 9124.

6.18 Covers with fillings (see BS EN 124-1:2015, 6.18)

This document gives no guidance on the requirements of BS EN 124-1:2015, 6.18, for covers with fillings.

6.19 Lifting provisions

The Manual Handling Operations Regulations 1992 [10] place a duty on the employer to provide safe lifting and handling conditions.

Where the mass of a frame exceeds 15 kg, suitable lifting holes or hooking points should be provided in the frame. These should be located to give a balanced lift.

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6.20 Keyways

The BS EN 124:2015 series does not deal with keyways. To minimize maintenance costs, the UK practice has been to use standardized keyways as follows:

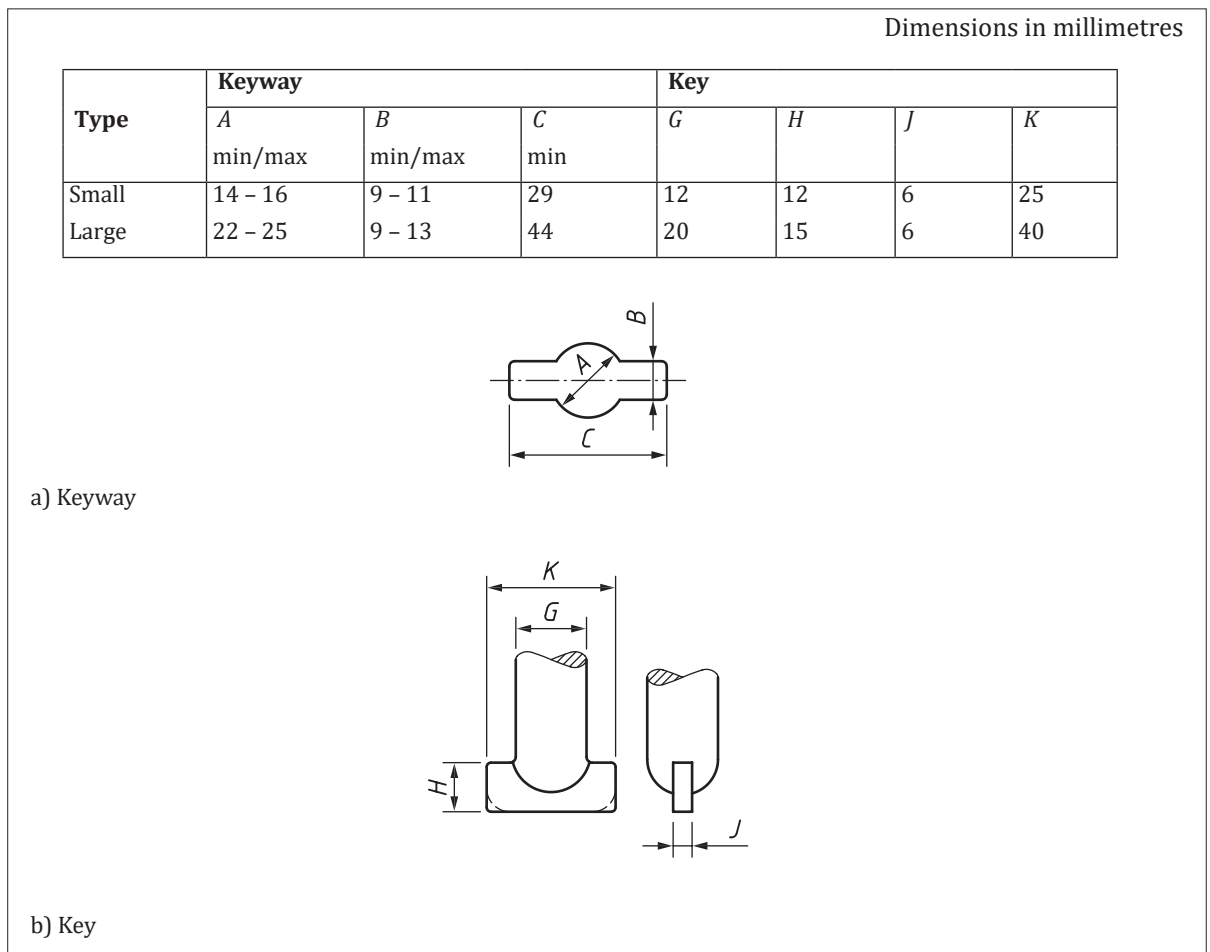
- suitable keyways are provided in each complete cover, as detailed in [Figure 2](#); and
- where a cover is divided into two or more coupled sections, each section is provided with at least one keyway.

Measures to be taken to avoid key detachment during cover lifting operations should be described.

Keyways can be of open or closed design. A preference should be specified.

NOTE A closed keyway is closed to the chamber.

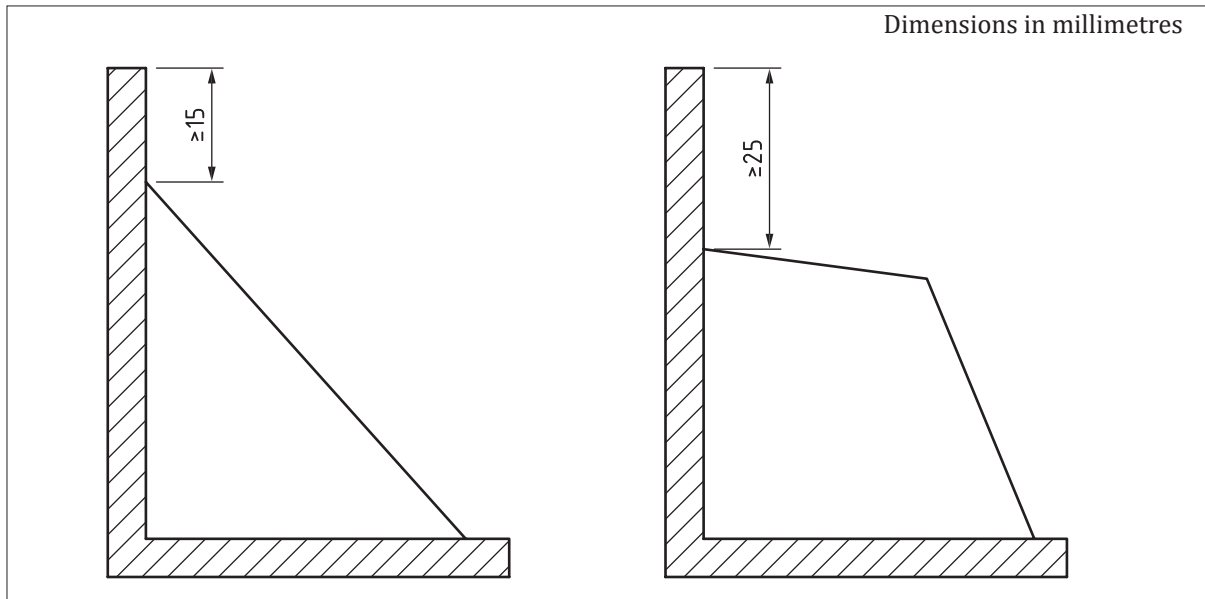
Figure 2 — Keyways and keys



6.21 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 can be impaired. Experience in the UK indicates that this leads to early failure of the installation and thus higher maintenance costs.

Practice in the UK for where vertical frame webs/gussets are provided is to locate the tops of the webs/gussets 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 (see [Figure 3](#)).

Figure 3 — *Frame web/gusset*

6.22 Kerb-type gully covers and frames

6.22.1 General

BS EN 124-1:2015 says little about kerb-type gully covers and frames, so this subclause gives specific guidance on these in addition to the preceding clauses. The loading requirements for this type of unit are specified in BS EN 124-1:2015; however, design features are not included. The specifier should take account of the design features in [7.1](#) to [7.5](#). For materials, the guidance in [Clause 5](#) should be followed.

6.22.2 Design

Kerb-type units should incorporate 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.

When selecting a product with a reversible-cover option, the guidance in [6.10](#) should be followed.

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.

6.22.3 Profile

Kerb-type gully covers and frames should be provided with a half batter profile in accordance with BS EN 1339, unless otherwise required by the specifier.

6.22.4 Principal dimensions

Practice in the UK is to use the dimensions in [Table 1](#).

A metal road retaining bar should be provided with the cover and frame but supplied loose to allow adjustment to suit the final road level. Alternatively, a deflector plate may be selected by the specifier.

Table 1 — Suggested minimum dimensions for kerb-type gully covers and frames

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

6.22.5 Debris trap

A grid to act as a debris trap is useful and UK practice shows that the following are satisfactory:

- a steel horizontal bar(s) of minimum diameter 12 mm; or
- a minimum of two integrally cast vertical fins provided across the open mouth of the unit; and
- other debris trap features.

6.22.6 Cleansing access

The minimum clear opening size required for cleaning equipment should be taken into account.

7 Performance

7.1 Appearance (see BS EN 124-1:2015, 7.1)

This document gives no guidance on the requirements of BS EN 124-1:2015, 7.1, for appearance.

7.2 Loadbearing capacity (see BS EN 124-1:2015, 7.2)

BS EN 124-1:2015 includes a test to assess the minimum loadbearing capacity based on the application of a defined test load to the centre of the manhole top. The test is the same for all products covered by the BS EN 124:2015 series, but the pass/fail criteria vary according to material properties. This is a static test for product evaluation and should not be taken as the working load of the cover but calculated to take account of dynamic forces generated by the respective, anticipated (BS EN 124:2015 series) group traffic types.

In practice, excessively high loads or repeat (dynamic) loads (from, for example, sharp braking or turning) can cause permanent set (see 7.3) or flexing of a cover, leading to wear of seatings, requiring frequent maintenance or replacement of parts. BS EN 124-1:2015 does not include a maximum value for deflection under load during this test, so specifiers might wish to seek advice from the cover manufacturer.

In high-risk applications, advice should be sought from the cover manufacturer on the suitability of the cover and frame for the expected loading conditions. This might be important where the traffic load might not be applied centrally to the cover and the capability of the cover at all points across its surface needs to be confirmed.

7.3 Permanent set (see BS EN 124-1:2015, 7.3)

This document gives no guidance on the requirements of BS EN 124-1:2015, 7.3, for permanent set.

7.4 Skid resistance

7.4.1 General (see BS EN 124-1:2015, 7.4.1)

BS EN 124-1:2015 requires manhole tops and gully tops to be skid resistant. This can be demonstrated either by using a concrete cover, or by conformity to specified design features (e.g. raised surface pattern, textured surface), or through pendulum friction testing.

The National Foreword to BS EN 124-1:2015 highlights the lack of available research to validate the equivalence of these alternatives.

In high-risk applications, specifiers might wish to seek advice from the cover manufacturer on the suitability of the skid resistance measure to the anticipated conditions. Highways England has addressed this for motorways and trunk roads in CD 534 [9].

7.4.2 Skid resistance of covers (see BS EN 124-1:2015, 7.4.2)

This document gives no guidance on the requirements of BS EN 124-1:2015, 7.4.2, for skid resistance of covers.

7.4.3 Skid resistance of gratings (see BS EN 124-1:2015, 7.4.3)

This document gives no guidance on the requirements of BS EN 124-1:2015, 7.4.3, for skid resistance of gratings.

7.4.4 Skid resistance of frames (see BS EN 124-1:2015, 7.4.4)

This document gives no guidance on the requirements of BS EN 124-1:2015, 7.4.4, for skid resistance of frames.

7.5 Child safety (see BS EN 124-1:2015, 7.5)

Unauthorized access of any persons, not just children, should be discouraged. Appropriate measures should be provided.

NOTE Further guidance is given in the National Annex to BS EN 752:2017.

8 Testing (see BS EN 124-1:2015, Clause 8)

This document gives no guidance on the requirements of BS EN 124-1:2015, Clause 8, for testing.

9 Assessment and verification of constancy of performance (AVCP) (see BS EN 124-1:2015, Clause 9)

This document gives no guidance on the requirements of BS EN 124-1:2015, Clause 9, for AVCP.

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