RWANDA STANDARD

DRS 607-1

First edition

2025-mm-dd

Gully tops and manhole tops for vehicular and pedestrian areas — Specification —

Part 1: Classification, general design and performance requirements

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Reference number

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

RS 607-1 was prepared by Technical Committee RSB/TC 47, Steel, aluminium and related products.

In the preparation of this standard, reference was made to the following standard:

1) 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*

The assistance derived from the above source is hereby acknowledged with thanks.

DRS 607 consists of the following parts, under the general title *Gully tops and manhole tops for vehicular and pedestrian areas — Specification*:

— *Part 1: Classification, general design and performance requirements;*

— *Part 2: Gully tops and manhole tops made of cast iron;*

— *Part 3: Gully tops and manhole tops made of steel or aluminium alloys;*

— *Part 4: Gully tops and manhole tops made of steel reinforced concrete;*

— *Part 5: Gully tops and manhole tops made of composite materials;*

— *Part 6: Gully tops and manhole tops made of polypropylene (PP), polyethylene (PE) or unplasticized poly (vinyl chloride) (PVC-U).*

Committee membership

The following organizations were represented on the Technical Committee on *Steel, aluminium and related products* (RSB/TC 47) in the preparation of this standard.

All City Rwanda Ltd

Asante Steel ® Ltd

CFAO Mobility Rwanda Limited

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OBOR TECHNOLOGY(RWANDA) LTD

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Gully tops and manhole tops for vehicular and pedestrian areas — Specification — Part 1: Classification, general design and performance requirements

1 Scope

This Draft Rwanda Standard specifies classification, general design, performance requirements and test methods for gully tops and manhole tops.

It applies for manhole tops and gully tops with a clear opening up to and including 1 000 mm for installation within areas subjected to pedestrian and/or vehicular traffic.

This standard is not applicable to gratings as part of prefabricated drainage channels, floor and roof gullies in buildings and surface boxes.

NOTE This Part 1 of DRS 607 is not applicable in isolation, but only in combination with DRS 607-2, DRS 607-3, DRS 607-4, DRS 607-5 and DRS 607-6.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS ISO 868, Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)

RS ISO 7500-1, Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines— Verification and calibration of the force-measuring system

RS ISO 22965-1, Concrete — Part 1: Methods of specifying and guidance for the specifier

RS ISO 22965-2, Concrete — Part 2: Specification of constituent materials, production of concrete and compliance of concrete

RS 542, Determination of slip resistance of pedestrian surfaces — Methods of evaluation

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply:

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3.1

gully

assembly to receive surface water for discharge into a …

3.2

manhole

chamber or access shaft to underground systems

3.3

gully top

upper part of a gully consisting of a frame and grating with or without cover

3.4

manhole

top upper part of a manhole consisting of a frame and cover and/or grating

3.5

frame

part of a gully top or manhole top which receives and supports a grating and/or a cover

3.6

frame depth

distance between the top surface and the bottom surface of the frame

3.7

grating

movable part(s) or opening within a manhole top or a gully top which permit(s) the passage of water through itself into the gully or manhole

3.8

cover

movable part(s) of a manhole top or a gully top which covers the manhole or gully opening

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3.9

element

frame or cover or grating

Note 1 to entry: Hinges, locking accessories and other accessories are not elements.

3.10

vent

opening in the cover of a manhole top to provide ventilation

3.11

dirt bucket

removable component of a gully top which collects debris

3.12

dirt pan

removable component of manhole top which collects debris

3.13

seating

surface on which the grating or the cover rests in the frame

3.14

depth of insertion

A distance between the top of the frame and the bottom of the cover or grating as shown in Figure 1

Note 1 to entry: Examples are given in Figure 1a) and b). The depth of insertion is expressed in millimetres (mm).

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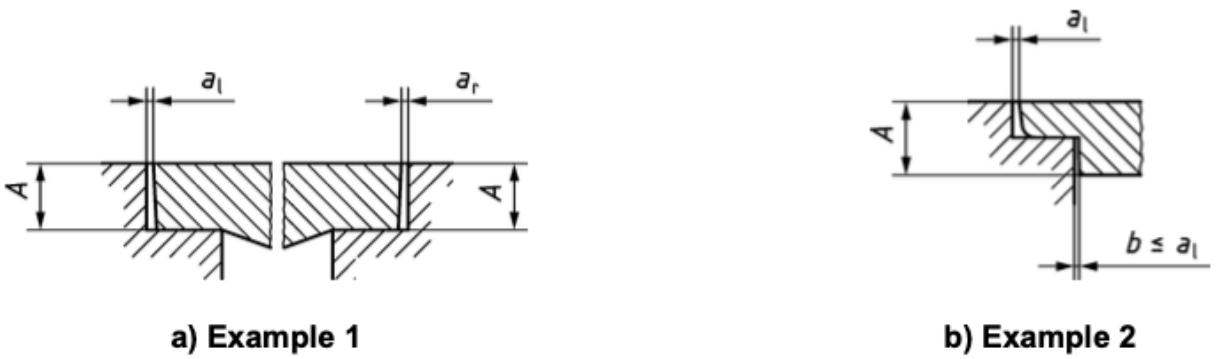


a) Example 1 **b) Example 2**

Figure 1— Examples for depth of insertion

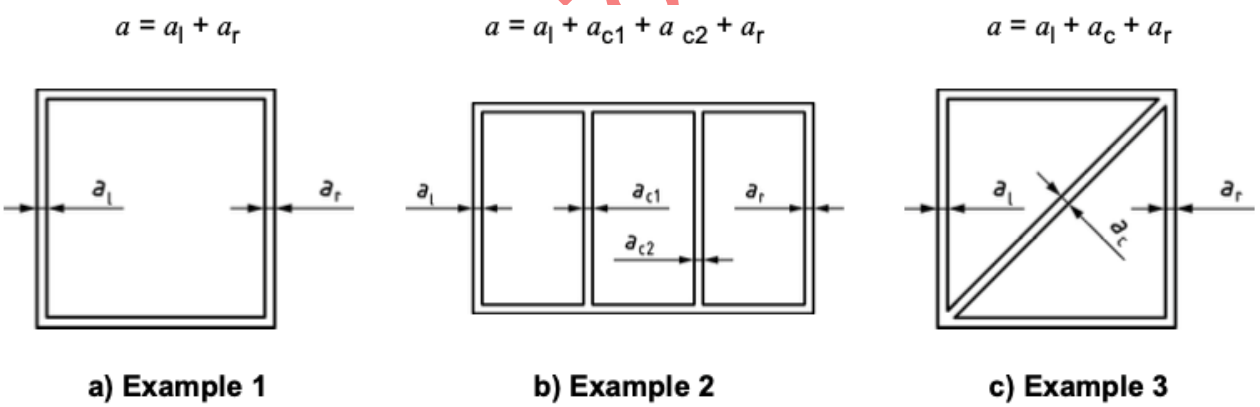
3.15

total clearance

a sum of the maximum individual clearances between adjacent elements of the frame and grating/cover

Note 1 to entry: Examples are shown in Figures 2 a), 2 b) and 2 c).

Note 2 to entry: The total clearance is expressed in millimetres (mm).



a) Example 1 **b) Example 2** **c) Example 3**

Key

a_l clearance left, a_c clearance centre, a_r clearance right

Figure 2 — Examples of total clearance

3.16

frame bearing, A_b

area A_b surface of the underside of a frame which rests upon the supporting structure Note 1 to entry: The bearing area is expressed in square millimetres (mm^2).

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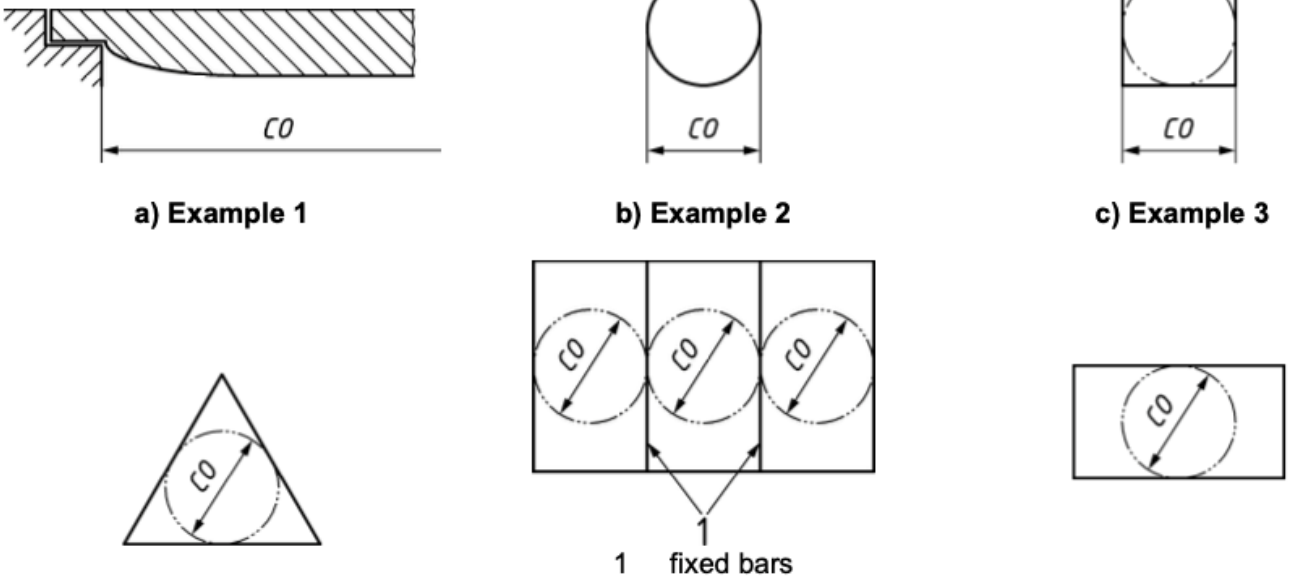
3.17

clear opening, *CO*

diameter of the largest circle that can be inscribed in the clear area (3.18) of the frame

Note 1 to entry: Examples are shown in Figures 3 a) to 3 f).

Note 2 to entry: The clear opening is expressed in millimetres (mm).



a) Example 1 **b) Example 2** **c) Example 3**

d) Example 4 **e) Example 5** **f) Example 6**

Figure 3— Examples of clear opening

3.18

clear area

unobstructed area between the seatings

Note 1 to entry: Examples for unobstructed areas are shown as the shaded area in Figures 4 a) to 4 c).

Note 2 to entry: The clear area is expressed in square millimetres (mm^2).

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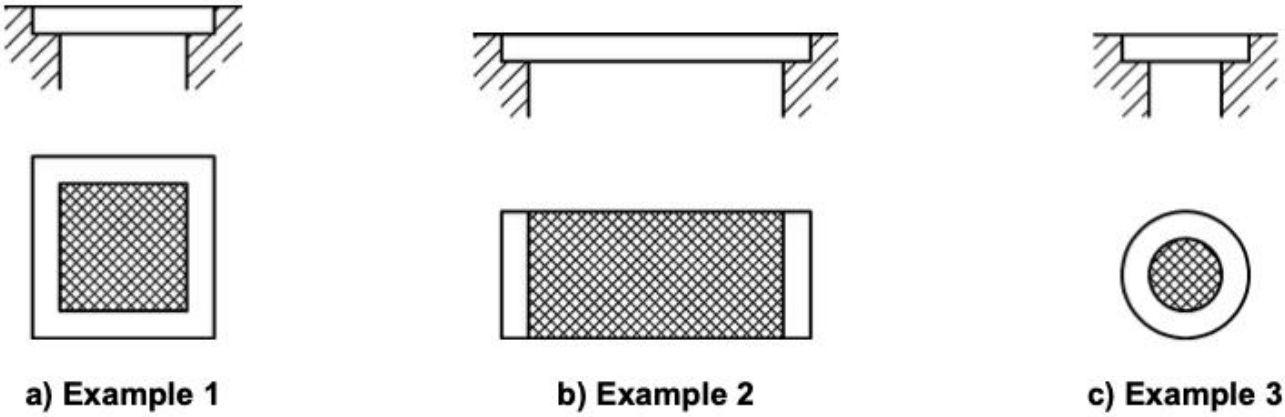

Figure 4 — Examples of clear area

3.19

waterway area

overall effective drainage inlet area in gully tops and in kerb units

Note 1 to entry: The waterway area is expressed in square millimetres (mm2).

3.20

securing feature

feature which is integral with frame or cover(s)/gratings(s)installed as part of the manufacturing process at the factory of production, to safely retain cover(s)/gratings(s) under traffic conditions in the place of installation and to prevent inappropriate movement of the cover(s)/gratings(s) as non-intended lifting/opening or ejection

EXAMPLE Screws, bolts, spring bars etc.

3.21

mass per unit area

total mass of the cover or the grating in kilograms divided by the clear area in square meters

Note 1 to entry: The mass per unit area is expressed in kg/m.

3.22

alternative design

designs not corresponding to a securing feature or mass per unit area but securing of cover(s)/grating(s) in the frame is achieved by specific design features

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3.23

cushioning insert

accessory provided within a frame, grating or cover to achieve stability and quietness in use

3.24

test load, F_T

load applied to gully tops or manhole tops for determination of the load bearing capacity

Note 1 to entry: The test load is expressed in Kilonewtons (kN).

3.25

permanent set load, F_P

load applied to gully tops or manhole tops for determination of the permanent set (F_P = 2/3 F_T)

3.26

deflection load F_D

load applied to gully tops or manhole tops for determination of the deflection under load (F_D = 1/3 F_T)

3.27

pedestrian areas/footway

area reserved for pedestrians and only occasionally open to vehicular traffic for delivery, cleaning purposes or in an emergency

3.28

pedestrian streets

area where vehicular traffic is prohibited during certain periods (e.g. pedestrian areas during business hours and vehicular traffic outside these hours)

3.29

fettle

removal of all sharp edges, sharp points and extraneous material e.g. weld splatter from a product, by grinding or other means

3.30

locking accessory

added component to prevent unauthorised lifting, opening or removal of cover/grating

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4 Classification

Based on the test loads according to Table 4, gully tops or manhole tops shall be classified into one of the following classes:

A 15, B 125, C 250, D 400, E 600 or F 900.

5 Places of installation

This clause gives guidance on the place of installation. For different classes of manhole tops or gully tops national regulations on the place of installation shall be taken into account.

The appropriate class of manhole top or gully top to be used depends upon the place of installation. The various places of installation have been divided into groups numbered 1 to 6, as listed below. Figures 5 and 6 show the location of some of these groups in a highway environment. The minimum class recommended for use in each group is shown in brackets. The selection of the appropriate class and the material is the responsibility of the designer. Where there is any doubt, the stronger class shall be selected.

— Group 1 (at least class A 15): Areas which can only be used by pedestrians and pedal cyclists.

— Group 2 (at least class B 125): Footways, pedestrian areas and comparable areas, car parks or car parking decks.

— Group 3 (at least class C 250): For gully tops, installed in the area of kerbside channels of roads (Figure 15) which, when measured from the kerb edge, extends a maximum of 0,5 m into the carriageway and a maximum of 0,2 m into the footway.

— Group 4 (at least class D 400): Carriageways of roads (including pedestrian streets), hard shoulders (Figure 16) and parking areas, for all types of road vehicles.

— Group 5 (at least class E 600): Areas imposing high wheel loads, e.g., docks, aircraft pavements.

— Group 6 (class F 900): Areas imposing particularly high wheel loads, e.g., aircraft pavements.

NOTE 1 Compliance of the product with the respective part of DRS 607 does not replace the responsibility of the user to ensure that the gully top or the manhole top is correctly installed and its component products (frame, grating and cover) have the necessary performance values.

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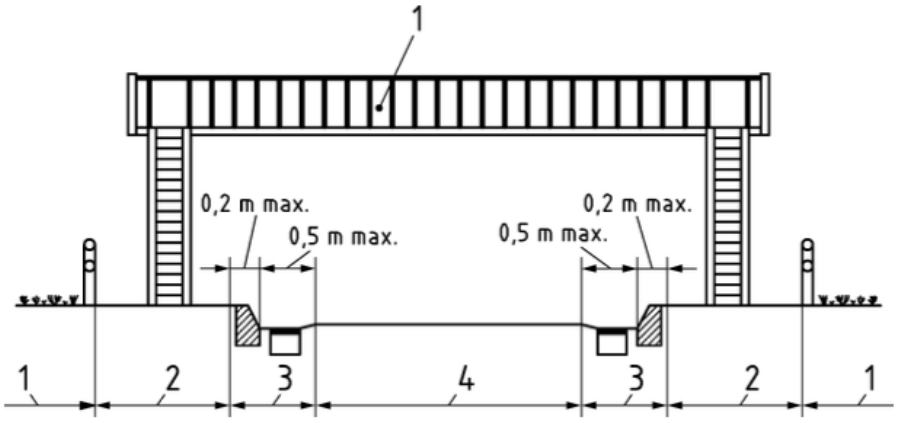


Key

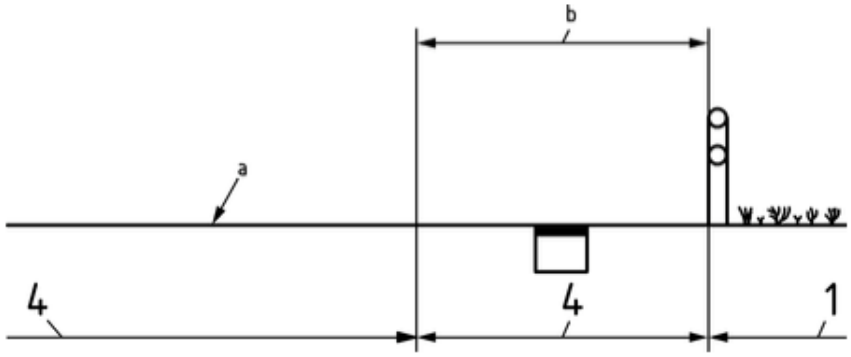
1 Group 1

2 Group 2

3 Group 3

4 Group 4

Figure 5 — Typical highway cross-section showing the location of the groups



Key

1 Group 1

4 Group 4

a carriage way

b hard shoulder

Figure 6 — Typical highway cross-section showing the location of the groups

NOTE 2 Recommendations for installation are given in Annex E.

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6 Materials

6.1 General

Materials used for manhole tops, gully tops and gratings shall meet the requirements specified in

— DRS 607-2, for gully tops and manhole tops made of cast iron,

— DRS 607-3, for gully tops and manhole tops made of steel or aluminium alloy,

— DRS 607-4, for gully tops and manhole tops made of steel reinforced concrete,

— DRS 607-5, for gully tops and manhole tops made of composite materials,

— DRS 607-6, for gully tops and manhole tops made of Polypropylene (PP), Polypropylene with mineral modifiers (PP-MD), Polyethylene (PE) or Polyvinyl-chloride (PVC-U).

All materials used shall be compatible, e.g., detrimental electro chemical or galvanic corrosion shall be avoided.

Manhole tops and gully tops resulting of a combination of elements made from different materials as specified in DRS 607-2 to DRS 607-6 shall comply with DRS 607-1 and elements shall comply with relevant requirements of the related part of DRS 607 in such cases, for the classification of the manhole top or gully top the lower class according to the material specific part of DRS 607 applies.

Manhole tops and gully tops according to this Standard shall be at least suitable for use in "wet, rarely dry" conditions and a slightly aggressive chemical environment, i.e., normal conditions for domestic sewage and treated industrial effluent, and for most natural soils and ground 172471-waters. If more severe conditions are expected, additional requirements for corrosion protection can be necessary.

NOTE A "wet, rarely dry" condition for concrete surfaces subject to long-term water contact and a "slightly aggressive chemical environment" are defined in RS ISO 22965-1 as classes XC2 and XA1, respectively. More severe environments are also defined in RS ISO 22965-1.

6.2 Cover fillings

Where cover fillings are factory made, they shall consist of concrete or other filling materials appropriate to the place of installation. Concrete used for filling the cover, shall have a minimum strength B 35 according to RS ISO 22965-1.

NOTE If covers are supplied from the factory unfilled and the filling is applied subsequently, the filling materials should have a minimum performance comparable to concrete or the surrounding pavement materials and shall fulfil the requirements of the appropriate Standards.

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7 Design requirements

7.1 Vents in covers

Covers can be designed with or without vents. For covers with vents the minimum vent area shall conform to Table 1 and their dimensions shall conform to Table 2.

Table 1 — Minimum vent area

Clear opening *CO*	**Minimum vent area** cm^2
≤ 600 mm	5 % of the area of a circle having a diameter equal to the clear opening
> 600 mm	140

Table 2 — Dimensions of vents in covers

Class	**Dimensions of slots** mm		**Diameters of holes** mm
	Length	Width	
A 15 and B 125	≤ 170	18 to 25	18 to 38
C 250 to F 900	≤ 170	18 to 32	30 to 38

7.2 Clear opening of manhole tops for man entry

The clear opening of manhole tops shall be declared in the product documentation.

NOTE In the vast majority of Member states the clear opening is considered to be at least 600 mm for man entry. In some other Member states larger openings are required.

7.3 Depth of insertion

Gully tops and manhole tops of classes D 400, E 600 and F 900 with the exception of those secured according to 7.6 a), shall have a depth of insertion A of minimum 50 mm. For the dimension *A*, the clearance values a_l and *b* shall be such that $b \leq 5$ mm (see 3.14).

7.4 Clearance

7.4.1 Total clearance

The clearance between the different parts of gully tops and manhole tops is defined in 3.15. This clearance can lead to horizontal displacement of the cover or grating in its frame. In order to limit this displacement, the total clearance a, shall conform to the following requirements:

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a) For covers or gratings in one or two parts:

— clear opening *CO* ≤ 400 mm: a ≤ 7 mm,

— clear opening *CO* > 400 mm: a ≤ 9 mm;

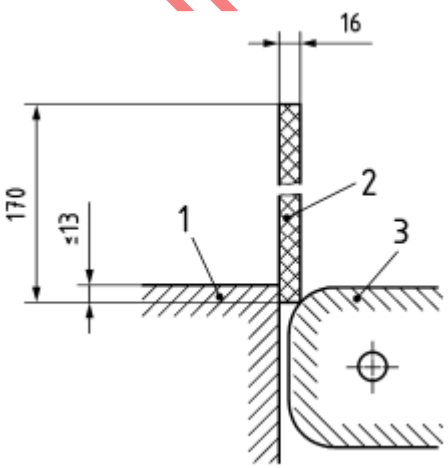
b) For covers or gratings with three or more parts secured in the frame each individual clearance (al, ac, ar) shall be limited to a maximum of 5 mm;

c) For covers or gratings with three or more parts not secured in the frame, the total clearance a resulting from the displacement of all parts shall not exceed 15 mm.

7.4.2 Clearance around hinges

Where hinged covers or gratings have a radial profiled edge on the hinged side, it shall be profiled so that the gauge of 170 mm × 60 mm × 16 mm, detailed in Figure 7, is prevented from entering the gap between the adjacent frame and the curved edge of the cover or grating by more than 13 mm of its 60 mm edge. For this the gauge shall be held vertical with its 60 mm edge parallel to the profiled edge. Between the hinges of gratings there can be a slot according to Table 3.

Where hinged covers or gratings, with two hinges on the same side, have a radial profiled edge on the hinged side, this edge shall be profiled so that the gauge of 170 mm × 60 mm × 16 mm is prevented from entering the gap between the adjacent frame and the profiled edge of the cover or grating at the hinges and in the area between the hinges by more than 13 mm of its 170 mm edge.



Key

1 frame

2 gauge

3 cover or grating

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Figure 7 — Gauge

7.5 Compatibility of seatings

Gully tops and manhole tops of all classes shall be such as to ensure the compatibility of their respective seatings. This shall be assessed by assembly.

In addition, for classes D 400 to F 900 these seatings shall be designed/manufactured in such a way as to ensure silent and stable behaviour. When tested according to 9.4.5, the cover/grating shall not have an increased change in height above the upper edge of the frame by more than 0,5 × depth of insertion with a maximum value of 25 mm at any point on the perimeter.

NOTE This can be achieved by machining of the contact surfaces, or the use of cushioning inserts, or three-point suspension design or any other appropriate methods.

7.6 Securing of the cover/grating within the frame

The cover/grating shall be secured within its frame to meet the required traffic conditions relevant to the intended place of installation defined in Clause 5.

This shall be achieved by at least one of the following methods:

a) securing feature;

b) sufficient mass per unit area;

c) alternative design

These methods shall also be designed so as to allow opening of the covers or gratings by means of usual tools. For securing features according a) and c), the corrosion resistance shall be equivalent to those used for the frame or the cover.

The securing method and design details shall be declared either in the technical drawings or commercial documentation.

NOTE 1 Due to the variety of constructional types the harmonisation of methods a) to c) could not be achieved. Those used in the different countries remain valid. Where required by specific provisions in the place of intended use, the methods for securing of cover(s)/grating(s) shall comply with these provisions.

NOTE 2 For purposes such as prevention of unauthorised removal or lifting of cover/gratings, vandalism additional locking accessories may be required by the specifier. The selection of the appropriate locking accessory is in the responsibility of the specifier.

The securing of covers/gratings within the frames according to 7.6 shall be tested in accordance with 9.4.6.

NOTE 3 For 7.6 b), weighing of mass is sufficient.

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7.7 Handling of covers and gratings

Provision shall be made for the effective loosening and for the opening of the covers and gratings by means of usual tools. Where required by health and safety provisions in the place of intended use, additional lifting features and/or devices can be incorporated in the design of manhole tops and/or gully tops.

7.8 Slot dimensions of gratings

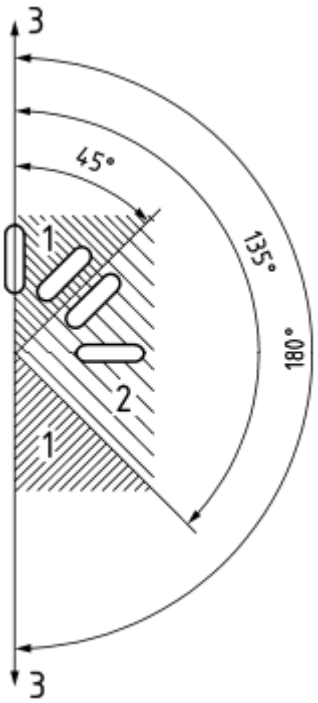
7.8.1 Waterway area

For all classes A 15 to F 900 the dimensions of slots in gratings shall be selected having regard to the hydraulic capacity and the slots shall be evenly distributed over clear area. The waterway area shall not be less than 30 % of the clear area and shall be declared in the product documentation.

7.8.2 Slot dimensions

The slots in gratings shall have the dimensions stated in Table 3. The dimensions of slots for classes C 250 to F 900 shall be dependent on the orientation of the longitudinal axis of the slots in relation to the direction of traffic, in accordance with Table 3 and Figure 8.

NOTE The dimensions of the waterway area and the openings of side entry or kerb gullies are not specified in this document.



Key

1 Orientation Pos. 1

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2 Orientation Pos. 2

3 Direction of traffic

Figure 8 — Orientation of slots in gratings

7.9 Dirt pans and dirt buckets

Where dirt pans or dirt buckets are used it shall be ensured by appropriate design of the top that drainage and ventilation can continue with the dirt pan or bucket filled.

7.10 Positioning of covers and gratings

Where the cover or grating has to be in a predetermined position relative to the frame, this shall be ensured by an appropriate design.

Table 3 — Slot dimensions

Openings			Class	Width (mm)	Length (mm)
Straight slots	Orientation according to Figure 8	Pos. 1 and Pos. 2	A 15 [a] and B 125 [a]	8 to 18	No limitation
				> 18 to 25	≤ 170
		Pos. 1	C 250 to F 900	16 to 32	≤ 170
		Pos. 2	C 250	16 to 42	No limitation
			D 400 to F 900	20 to 42	No limitation
Curved slots	Curved slots shall not exceed a width of 25 mm for classes A 15 and B 125 and a width of 42 mm for classes C 250 to F 900. They shall be designed in such a way as to prevent the 170 mm length of the 170 mm × 60 mm × 16 mm gauge from entering the slot. The gauge shall be held vertically with its 170 mm edge parallel to the surface of the grating.				

[a] In pedestrian areas/streets, the slot dimension may be reduced to 5 mm at the specifier's discretion.

NOTE The minimum width values of this table do not apply for the slots immediately adjacent to the hinged side of the grating associated with the opening of the grating (see 7.4.2).

7.11 Flatness of manhole covers and gratings

The upper surface, of gratings and covers of classes D 400 to F 900, which is the surface in contact with traffic, shall be flat within a tolerance of 1 % of the clear opening with a maximum of 6 mm.

7.12 Concaveness of gratings

Gratings designed with a dished surface exceeding 6 mm are described as concave. The places of installation shall be limited to the following places of intended uses (see Clause 5):

— Groups 1, 2 and 3;

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— Group 4, for parking areas only.

7.13 Surface conditions

The surface conditions shall be in accordance with 8.4.

7.14 Sealed manhole tops

Manhole tops can be designed to resist against accidental upward water pressure (surcharge). In such a case the frame shall be designed to be securely anchored. Manhole tops can also be designed to prevent or limit:

— The escape of odours through the manhole top (non-pressure); or
— Non-pressure surface water ingress (rain water).

NOTE The design and performance of such manhole tops with respect to this clause is not included in this standard.

7.15 Frame bearing area

The frame bearing area shall be designed in such a way that the bearing pressure P_b in relation to the test load F_T shall not exceed 7,5 N/mm² to provide an contribution to stability under working conditions. The bearing pressure P_b shall be calculated as follows:

$$P_b = {}^{F_T}/_{A_b}$$

NOTE P_b is expressed as N/mm^2

7.16 Frame depth

The depth of the complete frame of manhole tops or gully tops of class D 400, E 600 and F 900 shall be at least 100 mm. Where the frame is made of a combination of cast iron and concrete, the concrete shall have a compressive strength of at least C 35/45.

For class D 400 the frame depth may be reduced to 75 mm provided that the frame is made of cast iron and provides anchoring facilities.

7.17 Opening angle of hinged covers/gratings

The opening angle of hinged covers or gratings shall be at least 100° to the horizontal unless additional stays are provided.

NOTE Additional provisions may be required to prevent the cover or grating from accidental closing, e.g., site or service conditions.

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8 Performance requirements

8.1 Appearance

Gully tops and manhole tops shall be free from visible defects.

8.2 Load bearing capacity

When tested according to 9.3 gully tops and manhole tops with a clear opening (*CO*) equal to or greater than 250 mm shall withstand the test load according to Table 4 for each class independent of the material. Where the clear opening (*CO*) is less than 250 mm, the test load shall be as shown in Table 4, multiplied by *CO*/250 but not less than 0,6 times of the test load according to Table 4.

Covers, frames or gratings made of materials according to DRS 607-2, DRS 607-3, DRS 607 -5 and DRS 607-6 shall not show cracks or delamination, in the course of the test when viewed without magnification. For steel reinforced concrete the requirements of DRS 607 -4, 5.2.2 shall be met.

The load bearing capacity shall be declared as corresponding class according to Table 4.

Table 4 — Test loads

Class	A 15	B 125	C 250	D 400	E 600	F 900
F_T in kN	15	125	250	400	600	900

8.3 Permanent set

When tested according to 9.2, the permanent set of the cover or grating after the application of F_P (2/3 of the test load F_T) shall not exceed the values given in Table 5.

Frames, covers and gratings made of materials according to DRS 607-2, and DRS 607-3, DRS 607 -5 and DRS 607 -6, shall not show cracks or delaminations, in the course of the test when viewed without magnification. For steel reinforced concrete the requirements of DRS 607 -4, 5.2.2 shall be met.

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Table 5 — Permissible permanent set

Class	Permissible permanent set mm	
A 15 and B 125	$\frac{CO}{100}$ a	
C 250 up to F 900	$\frac{CO}{300}$ b When secured according to 7.6 a) or 7.6 c)	$\frac{CO}{500}$ c When secured according to 7.6 b)

a $CO/50$ for CO < 450 mm with a maximum value of 6,5 mm.
b 1,0 mm max. when CO < 300 mm.
c 1,0 mm max. when CO < 500 mm.

8.4 Skid resistance

8.4.1 General

All manhole tops and gully tops shall be skid resistant in their field of application. This can be achieved by:

a) Meeting the requirements on design (deemed to satisfy) according to 8.4.2 a) or b) for covers and/or 8.4.3 for gratings and 8.4.4 for frames, or
b) Testing according to 8.4.2 c) for covers and 8.4.4 for frames.

8.4.2 Skid resistance of covers

The term "Pass" shall be declared, where the cover is made of:

a) Concrete having satisfactory skid resistance provided that their upper surface of the cover has been neither ground nor polished.

NOTE 1 Additional provisions can be required to prevent the concrete cover or concrete filled cover from potential skid, e.g. where concrete mix contains fine limestone aggregates.

b) Materials with a defined raised pattern, which is the textured area between A_{T1}- and A_{T2}-level or coarse textured surface. The raised pattern or coarse textured surface of the cover shall have a height of 2 mm to 6 mm for classes A 15, B 125, C 250 and a height of 3 mm to 8 mm for classes D 400, E 600 and F 900. The raised pattern shall be distributed as far as possible evenly over the total plan surface area of the cover or frame. The total surface area of raised pattern $(\sum A_n)$ An shall not be less than 10 % and not more than 70 % of the total plan surface area $(A_{T2}-)$. The A_n shall be determined as shown in Figure 9. The raised pattern of covers shall be such as to permit the free drainage/dispersion of water. Parts of logo within the height requirements are considered as part of the raised pattern. In that case free drainage/dispersion of water should be permitted.

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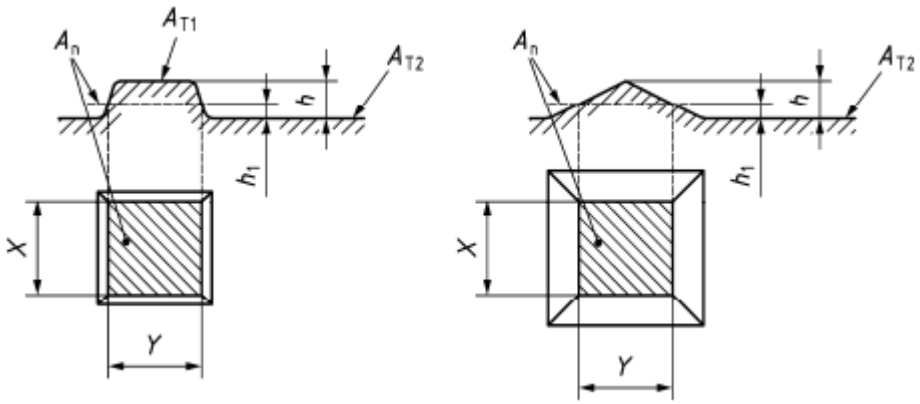

Key

$\boldsymbol{A_n}$ surface area of single raised pattern

$\boldsymbol{A_{T1}}$ total upper surface of raised pattern

$\boldsymbol{A_{T2}}$ total plan surface area

$\boldsymbol{h}$ height of raised pattern

h_1 minimum height of raised pattern for the considered class

Y length of raised pattern

X width of raised pattern

Figure 9 — Example for determination of raised pattern

NOTE 2 Coarse textured surface (more than 2 mm difference between peaks and depressions, for example raised pattern, dolly pointed, tooled, shot blasted) and concrete are assumed to give satisfactory skid resistance.

c) Where the cover does not fulfil the requirements of a) and/or b) or where required by provisions in the place of use, the USRV shall have a minimum value of 35 when tested in accordance with Annex C of RS 542,.

8.4.3 Skid resistance of gratings

Gratings in accordance with the requirements of 7.8.2 shall be deemed to satisfy the skid resistance. Gratings can have a raised pattern. Where this is provided it shall have a height of 2 mm to 6 mm for classes A 15, B 125, C 250 and a height of 3 mm to 8 mm for classes D 400, E 600 and F 900.

8.4.4 Skid resistance of frames

If frames or parts thereof have a horizontal visible width exceeding 80 mm, the requirements for covers according to 8.4.2 shall also apply.

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8.5 Child safety

Where required by specific provisions in the place of intended use child safety features and/or devices shall be incorporated in the design of manhole tops and/or gully tops.

The resistance of covers or gratings to removal by children shall be met by one of the following means:

a) Mass of the individual covers or gratings; or
b) Locking accessory or securing feature.

Where a locking accessory or securing feature is used, it shall be designed so that the cover or grating cannot be easily opened with objects readily accessible by children.

9 Testing

9.1 General

Gully tops and manhole tops shall be tested as complete units in their intended service position of use where cover/grating is suitably positioned within the frame, except for recessed covers delivered unfilled, which shall be load tested without filling. All tested products shall be visually inspected without magnification.

Manhole tops and gully tops resulting of a combination of elements made from different materials (from DRS 607-2 to DRS 607-6) shall be tested as complete units with respect to clause 6.1, 3rd Paragraph.

9.2 Permanent set (see 8.3)

The permanent set of the cover or grating shall be determined according to Annex A after the application of F_P = 2/3 F_T according to Table 4, without pre-loading. The permanent set shall be measured to an accuracy of 0,1 mm.

9.3 Load bearing capacity (see 8.2)

Immediately after the test according to 9.2 all gully tops and manhole tops shall be submitted to the load bearing capacity test according to Annex B under the test loads F_T according to 8.2, Table 4.

9.4 Verification of design requirements

9.4.1 Vents (see 7.1)

Vent slots and holes shall be measured to an accuracy of 1 mm. The vent area shall be calculated to the nearest 100 mm^2.

9.4.2 Clear opening (see 7.2)

The dimensions of the clear opening (*CO*) shall be measured to the nearest 1 mm.

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9.4.3 Depth of insertion (see 7.3)

The depth of insertion (*A*) and the clearance values al and b shall be measured to the nearest 0,5 mm.

9.4.4 Clearance (see 7.4)

The clearances between covers or gratings and frames shall be measured to an accuracy of 0,5 mm and the total clearance (Σa) shall be calculated. The clearance around a hinge shall be controlled by using a gauge of 170 mm × 60 mm × 16 mm.

9.4.5 Compatibility of seatings (see 7.5)

The compatibility of the seatings to ensure silent and stable behaviour of the cover or grating within its frame shall be inspected to the specification of the manufacturer and tested according to the tilt test in accordance with Annex C.

9.4.6 Securing of the cover and/or grating within its frame (see 7.6)

If securing is achieved by a sufficient mass per unit area (see 7.6 b)) the cover and/or grating shall be weighed to an accuracy of 1 % and the clear area calculated to an accuracy of 100 mm2.

If securing is achieved by a securing feature or an alternative design (see 7.6 a) or 7.6 c)) the securing of covers/gratings within the frames shall be tested in accordance with Annex D.

The declared securing method shall be visually inspected with respect to the function, use of materials and the measured values corresponding to the design details according to D.2.7.

9.4.7 Handling of covers and gratings (see 7.7)

The handling of covers and gratings shall be tested physically for loosening and opening according to manufacturer's instructions.

9.4.8 Slot dimensions (see 7.8)

The even distribution of the slots over the clear area shall be visually inspected. The waterway surface area shall be calculated to the nearest 100 mm^2. The dimensions of straight slots shall be measured to the nearest 1 mm. The dimensions of slots other than straight shall be controlled by a gauge of 170 mm × 60 mm × 16 mm with its 170 mm length parallel to the surface of the grating.

9.4.9 Dirt pans and dirt buckets (see 7.9)

The gully top or manhole top with a full dirt bucket/pan shall be visually inspected to ensure that both drainage and ventilation is still possible.

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9.4.10 Positioning of covers and gratings (see 7.10)

The positioning of covers and gratings shall be visually inspected according to 7.10, if appropriate. The appropriate design feature that ensures a particular orientation of the cover or grating in the frame shall be examined for fitness for purpose.

9.4.11 Flatness of covers and gratings (see 7.11)

The flatness shall be measured to an accuracy of 0,5 mm.

9.4.12 Concave gully tops (see 7.12)

The maximum depth shall be measured to an accuracy of 0,5 mm.

9.4.13 Skid resistance (see 8.4)

The skid resistance of the upper surface of the cover and the frame shall be determined as follows:

d) In case of concrete according to 8.4.2 a) the manufacturer shall declare that the cover has not been polished or ground and conforms with the provisions in accordance with DRS 607-4 for the relevant material;

NOTE Where aggregates contain fine limestone, additional provisions to prevent the concrete cover or concrete filled cover from potential skid can be necessary.

e) In case of a defined raised pattern as specified in 8.4.2 b) the height of the raised pattern shall be measured to an accuracy of 0,5 mm. The total surface area of raised pattern of the cover and frame shall be determined either by reference to the drawing and subsequently controlled by visual inspection, or by measuring the dimensions of the upper surface of the raised pattern to an accuracy of 100 mm^2. The percentage of the total surface area of raised pattern shall be calculated;

f) In case of products not conforming to 8.4.2 a) and 8.4.2 b), the surface condition shall be measured accordance with Annex C of RS 542.

9.4.14 Frame bearing area (see 7.15)

The bearing pressure shall be calculated.

9.4.15 Frame depth (see 7.16)

The depth of the complete frame shall be measured to the nearest 1 mm.

9.4.16 Opening angle (see 7.17)

The opening angle shall be measured to an accuracy of 5°.

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9.5 Child safety

— The resistance of covers or gratings to removal by children shall be tested according Annex D and declared as: sufficient mass, or
— Sufficient pull-out-force.

10 Evaluation of conformity

Evaluation of conformity shall be carried out in accordance with DRS 607-2 to DRS 607-6 as relevant for manhole tops and gully tops made of the materials specified in those standards.

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Annex A
(normative)

Permanent set test

A.1 Test Samples

Gully tops and manhole tops shall be tested as complete units in their end-use condition, except for covers delivered unfilled, which shall be tested without filling. Units tested shall be new units that have not been subjected to any other load tests, and shall be randomly selected.

A.2 Permanent set test load, (F_P)

A test load F_P = 2/3 F_T, the test load shown in Table 4, shall be applied for each class for all clear openings.

A.3 Apparatus

A.3.1 Testing machine

The testing machine, preferably a hydraulic test press, shall be capable of applying a load at least 25 % greater than the respective test load, F_T, for classes A 15 to D 400 and at least 10 % greater than the respective test load, F_T, for classes E 600 and F 900.

The test machine shall comply with ISO 7500-1, class 3.

Except for multiple units, the dimensions of the bed of the testing machine shall be greater than the bearing area of the unit to be tested.

A.3.2 Test blocks

The dimensions and shape of test blocks shall be as shown in Table A.1

A.3.3 Measurement device(s)

The measurement device(s) shall have a resolution of at least 0,01 mm and have a maximum overall accuracy of ± 5 %.

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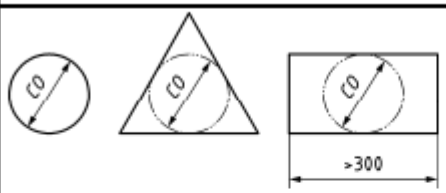
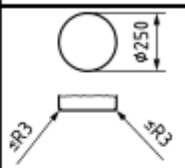
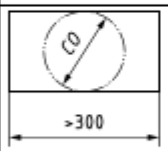
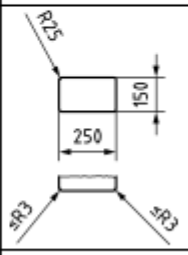
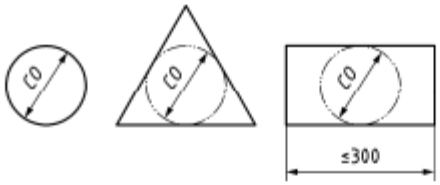
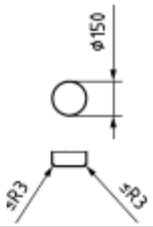
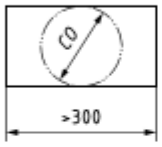
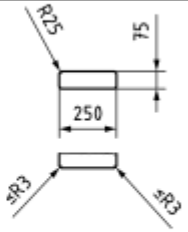
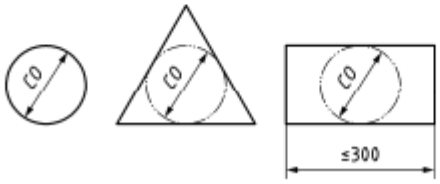
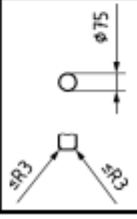
Table A.1 — Dimensions of test blocks (dimensions in mm)

Clear opening	Shape of gully top or manhole top	Dimensions of the test blocks
300 < *CO* ≤ 1 000		
200 ≤ *CO* ≤ 300		
200 ≤ *CO* ≤ 300		
CO < 200		
CO < 200		

A.4 Procedure

A.4.1 A.4.1 Procedure for single and double triangular manhole tops and gully tops

The test sample shall be placed on the test machine and shall be supported on the bed of the test machine in such a way as to ensure that when the cover or grating is deflected under the test load, it shall remain unsupported, and not in contact with the bed of the test machine. The cover or grating of the test sample shall rest normally in its frame.

The test block shall be placed on the test sample with its vertical axis perpendicular to the surface and coincidental in the locations of the cover or the grating (examples, see Figure A.1). In the case of double

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triangular covers or gratings, the test block shall be positioned in the geometric centre, as shown in Figures A.1, A.2 and A.3.

Figure A.1 — Example for testing of single manhole tops and gully tops

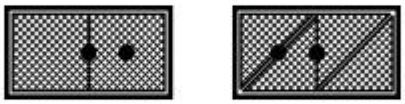

Figure A.2 — Example for testing of double manhole tops and gully tops

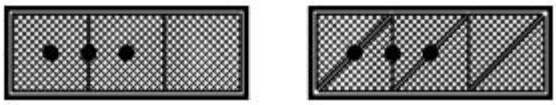

Figure A.3 — Example for testing of triple manhole tops and gully tops

The test load shall be uniformly distributed over the whole surface of the test block and any irregularities compensated for by means of an appropriate intermediate layer, e.g., softwood, fibre board, felt or similar material positioned between the cover or the grating and the test block. The dimensions of this intermediate layer shall not be larger than that of the test block. A similar intermediate layer, at the manufacturer's discretion, may also be positioned between the bed of the testing machine and the bearing area of the sample under test.

When testing gully tops or manhole tops with a non-flat surface, the contact face of the test block shall be shaped to match the grating or cover. Patterns as defined in 8.4 and small deviations from a flat surface do not require a shaped contact face of the test block.

Measurement of permanent set shall be made on the upper-side of the gully grating or manhole cover in the same place as the applied test load at the longest dimension which can be inscribed within the cover through the centre point of the load application. The measurement device(s) shall be positioned as close as possible to the centre point of the load application (see Figure A.1 to A.3) and the seating of the measuring device support as close as possible to the edge of the cover but not exceeding 10 mm from the edge. If the test block is positioned across two adjacent covers or gratings the permanent set shall be measured on both covers/gratings as close as possible to the centre point of the load application.

Before the first load, without preloading, is applied, an initial reading at the geometric centre of the cover or grating shall be taken.

The load shall be applied at a rate of 1 kN/s to 5 kN/s up to 2/3 of the test load (FP = 2/3 FT); the load on the test specimen is then released. This procedure shall be carried out five times. Then a final reading at the geometric centre shall be taken.

The permanent set shall then be determined according to Figure A.4 as the difference of the measured readings before the first and after the fifth loading.

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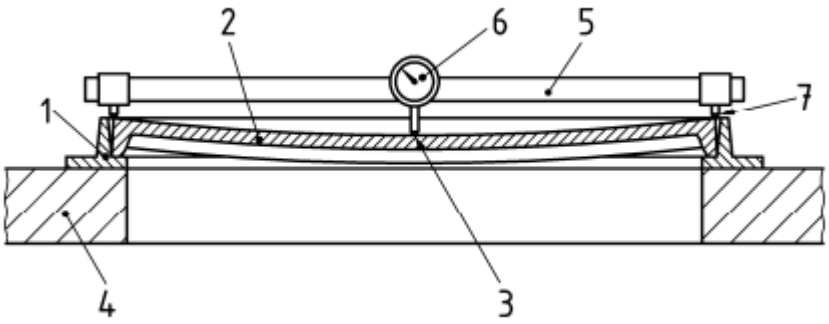

Key

1 frame

2 cover or grating

3 geometric centre

4 bed of testing machine

5 measuring device support

6 measuring device

7 seating of measuring device support

Figure A.4 — Measurement of permanent set

A.4.2 Procedure for multiple units

In the case of multiple units, each individual unit and each intermediate structural element shall be tested in accordance with Figure A.4. The location of the test blocks and the measurement device(s) shall be in accordance with Figures A.2 and A.3.

A.5 Observations and reporting

Records shall be made of all readings. The differences between the “reference readings” and the equivalent “readings after application of the fifth load” shall be determined. A comparison shall be made between these differences and the requirements of this standard, and a report prepared accordingly.

Test of load bearing capacity

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Annex B
(normative)

Test of load bearing capacity

B.1 Test samples

Gully tops and manhole tops shall be tested as complete units in their condition of service, except for covers delivered unfilled, which shall be tested without filling. This test shall be carried out on the sample immediately after the permanent set test.

B.2 Test load (FT)

The applied test load, F_T, shall be as shown in 8.2, Table 4, for each class for all clear openings and all materials.

B.3 Test procedure

Apparatus, test machine, test blocks, measurement devices and the application of the test load shall conform to Annex A. Immediately after the permanent set test according to 9.2 and Annex A, the test load shall be applied at the same rate as given in Annex A, until it is achieved. The test load shall be maintained for (30_0^{+2})s.

B.4 Test report

Record shall be made of the condition of the manhole top or gully top after removal of the test load and a report prepared accordingly.

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Annex C
(normative)

Tilt test

C.1 General

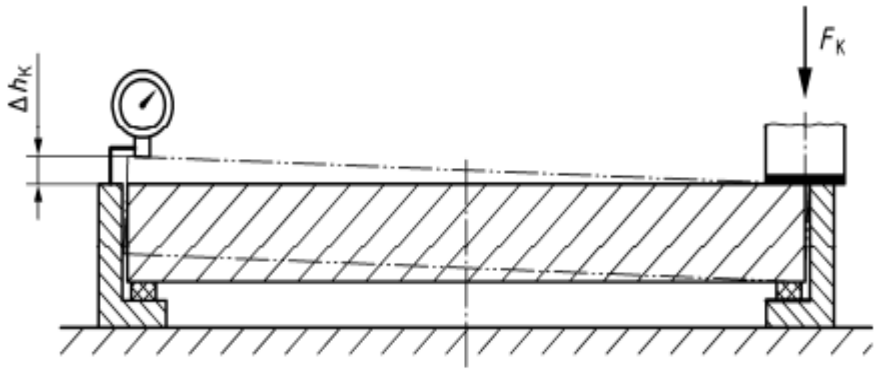
The stabile behaviour of covers and/or gratings according to 7.5 is to be tested by the tilt test.

C.2 Test procedure

At the edges of the cover and the frame a test block of 75 mm diameter (smallest test block according to Table A.1), equipped with a rubber sheet of 75 mm diameter with a thickness of 10 mm, hardness (60 ± 5)°, shore A according to ISO 868 at the bottom, shall be applied at the test points according to Figure C.2 to Figure C.6 (if applicable) in such a way that the axle centre of the test block is applied at the joint between cover/grating and frame.

A gradually increasing test load FK from 0 to 50 kN is to be applied 3 times with a rate of 1 kN/s to 5 kN/s.

Under effect of the test load the maximum increase in the vertical distance between the top of the frame and the top of the cover shall be measured according to Figure C.1. The test shall be carried out at a temperature of (25 ± 10) °C.



Key

F_K Tilt test load

Δh_K Maximum increase in the vertical distance

Figure C.1 — Test equipment for measuring the tilting height

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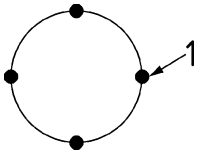
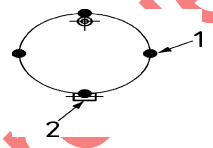
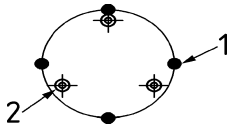
Table C.1 — Application of test load for different designs of manhole tops and gully tops

Design	Application of test load
round cover(s)/grating(s)	In four places evenly distributed over the circumference according to Figure C.2.  **Key** 1 test point **Figure C.2 — Circular covers/gratings**
cover(s)/grating(s) with hinges	In four places evenly distributed over the circumference, where one point of load shall be applied immediately adjacent to the hinge according to Figure C.3.  **Key** 1 test point 2 hinge **Figure C.3 — Hinges**
cover(s)/grating(s) with securing feature	In four places evenly distributed over the circumference, where one point of load shall be applied immediately adjacent to one securing feature according to Figure C.4.  **Key** 1 test point 2 road worthy anchorage **Figure C.4 — Securing feature**

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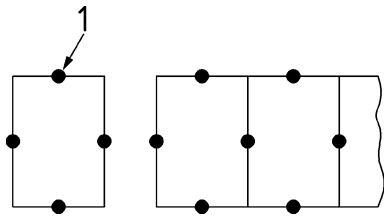
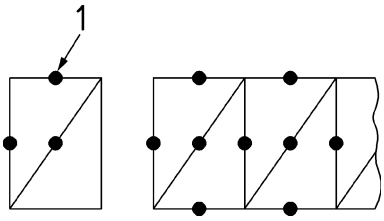
rectangular cover(s)/grating(s)	According to Figure C.5.  **Key** 1 test point **Figure C.5 — Rectangular covers/gratings**
triangular cover(s)/grating(s)	According to Figure C.6.  Key 1 test point **Figure C.6 — Triangular covers/gratings**
cover(s)/grating(s) with discontinuous depth of insertion	Where the depth of insertion varies due to cover/grating design, the test load shall be applied at each maximum depth of insertion and each minimum depth of insertion.

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Annex D
(normative)

Pout-out test

D.1 General

The aim of the pull-out test is to assess the securing of the covers(s)/grating(s) within the frame of a manhole top or gully top by applying one or more pull-out forces to theses covers/gratings and to measure their permissible vertical movement.

The pull-out force F_v and $F_{v,c}$, as applicable, and the vertical displacement h of the cover(s)/grating(s), measured in the test, shall be declared.

All securing methods, defined in 7.6 and shown in Table D.1 shall be tested with the vertical pull-out test.

NOTE For 7.6 b) weighing of mass is sufficient.

The pull-out test shall be carried out after the tilt test described in Annex C.

Table D.1 — Assignment of securing methods to the test(s)

Securing method according to clause		
6.6 a)	Securing feature	
	1	screws/bolts (on all multiple covers or on master one)
	2	spring bars or other clips (on all multiple covers or on master one)
	3	turn buckle device (on all multiple covers or on master one)
	4	other securing features
6.6 b)	Mass per unit area	
	1	surface mass value: 200 kg/m^2
	2	surface mass value: 250 kg/m^2
	3	surface mass value: 275 kg/m^2
	4	surface mass value: 300 kg/m^2
	5	other surface mass values
6.6 c)	Other methods	
	1	hinged covers
	2	multiple hinged covers
	3	double tri (or other shape) coupled covers
	4	ramp/slide-out covers (machined or not)
	5	other designs

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D.2 E.2 Vertical pull-out test procedure

D.2.1 Preparation of the test

The applied vertical pull-out forces shall be measured in N with a calibrated dynamometer or similar apparatus with a resolution of at least 10 N, capable of applying a force of at least 25 % greater than the maximum force.

The vertical direction of the vertical pull-out force Fv shall be measured with appropriate device.

NOTE For safety reasons, it is recommended to fix the frame of the test samples.

The measurement device(s) shall have a range of at least 30 mm with a resolution of at least 0,1 mm and have a maximum overall accuracy of ± 5 % to measure the vertical movement.

The vertical pull-out force Fv shall be applied vertically on each single cover/grating by means of a cable fixed at the geometric centre of the cover/grating. Examples are given in Figure D.1.

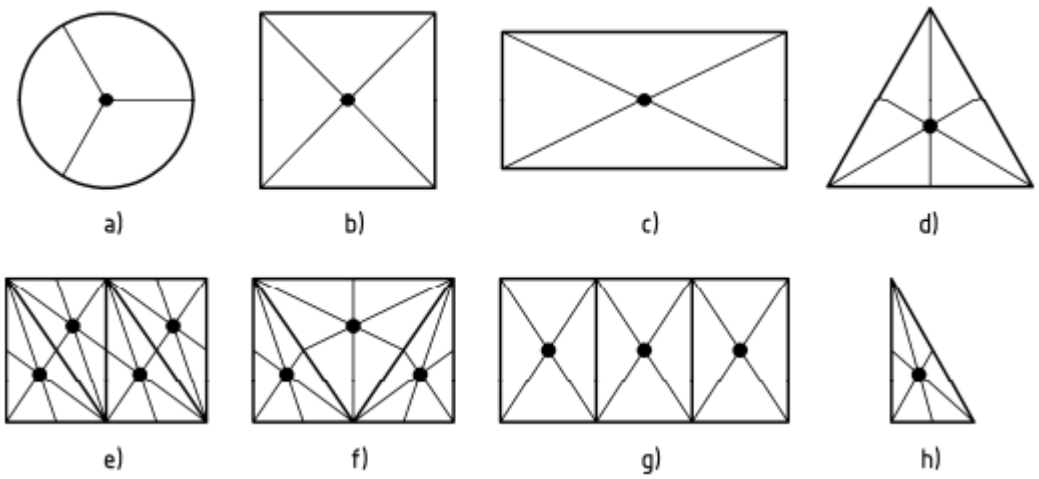

Figure D.1 — Examples for determination of the geometric centre of cover(s)/grating(s)

D.2.2 Testing arrangements

An appropriate anchoring device where the cable/chain/strap is secured shall be installed at the geometric centre of the cover/grating, by means of e.g., screwed or welded.

This anchoring device, as illustrated as shown in Figure D.2 shall be installed in such a way that:

- The distance between the top of the cover and the cable/chain/strap shall be (100 5 0 +) mm
- Its longitudinal axis is fixed perpendicular to the cover surface level.

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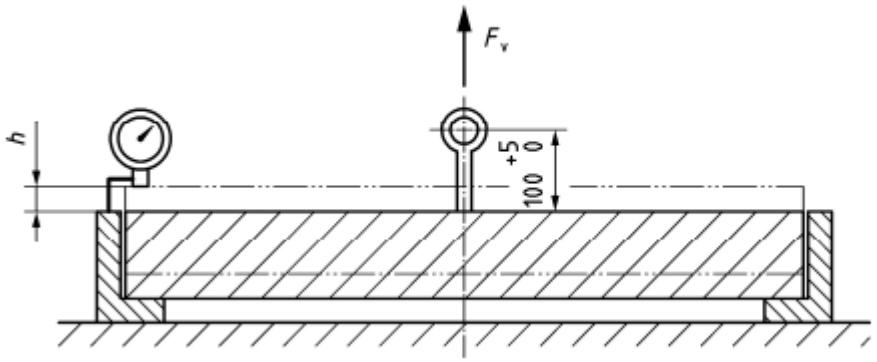
Dimensions in millimetres



Key

h vertical displacement

F_v vertical pull-out force

Figure 10.2 — Example of vertical pull-out test arrangement

If, in the case of, as example gratings or specific covers, the geometric centre is not fit for the securing of the anchoring device, washers/plates installed on top surface and underneath or other accessories can be used to rebuild the centre, and allow the installation of the anchoring device.

If the cover is not horizontal while moving vertically, it is necessary to determine the point corresponding to the highest vertical displacement where the measurement shall be made. To achieve this, a pre-test shall be carried out prior to the pull-out test.

D.2.3 Determination of the maximum permissible vertical displacement, h

The measurement of the zero point between the cover[s] and the frame shall be made once the cover is in service condition for the test as shown in Figure D.2.

The measurement of the depth of insertion A with the minimum value, where applicable, in accordance with 7.3, shall be made to determine the maximum vertical displacement h as 50 % of A with a maximum of 25 mm.

D.2.4 Determination of the maximum Pull-Out Force F_v

D.2.4.1 Single cover

The maximum vertical pull-out force shall be determined according to equation D.1. The clear area shall be determined as shown in Figure D.3.

$F_v = CAx0{,}4x10^{-2}$ (Equation *D.1*)

Where:

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F_v is the maximum vertical pull-out force in N;

CA is the clear area in mm².

NOTE The Clear Area, *CA*, is used instead of Clear Opening, *CO*, to achieve a consistent evaluation of the various dimensions and types of covers.

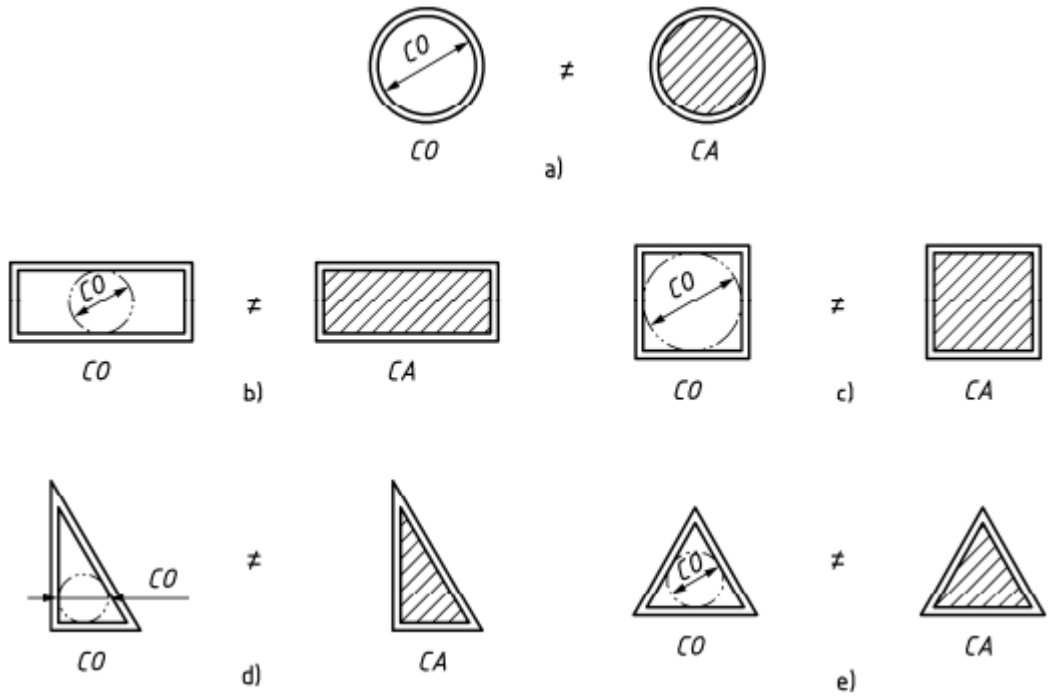

Figure D.3 — Examples of determination of Clear Areas of single covers/gratings

D.2.4.2 Multiple covers

The clear area of each individual cover shall be determined either on a drawing or at the sample in accordance with Figure D.4. The maximum vertical pull-out force shall be calculated in accordance with equation D.2 and applied at each individual cover.

$$F_{v,c} = CA_c x 0{,}4 x 10^{-2} \qquad \text{(Equation } D.2\text{)}$$

Where:

$F_{v,c}$ is the maximum vertical pull-out force of each individual cover in N;

CA_c is the clear area of each individual cover in mm².

NOTE The Clear Area, *CA*, is used instead of the Clear Opening, *CO*, to achieve a consistent evaluation of the various dimensions and types of covers.

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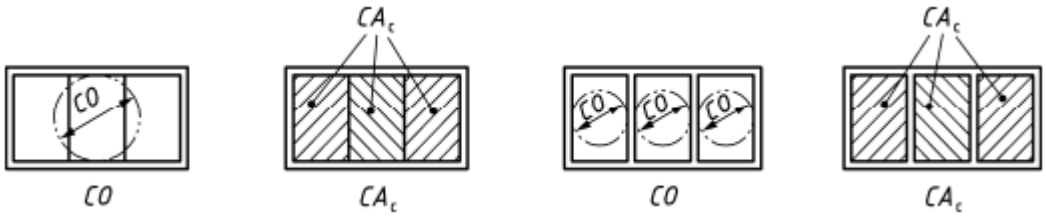

Figure E.4 — Examples of determination of Clear Areas of multiple covers/gratings

D.2.5 Application of the vertical pull-out force, F_v

The load shall be applied on each single cover at a rate of 0,01 kN/s up to 0,05 kN up to the lifting of the cover with a maximum of 25 mm or up to the maximum pull out force as calculated in D.2.4.2. The test shall be carried out 3 times consecutively and only the smallest vertical pull-out force, Fv, and its corresponding vertical displacement h shall be considered and declared.

In case of triangular covers with loose couplings, the loose couplings shall not be removed before the test.

D.2.6 Measurement of the vertical displacement h and of the pull-out force, Fv

The vertical displacement h shall be measured between the top of the frame and the highest point of the cover at the moment of lifting as shown in Figure D.2.

When the maximum permissible vertical displacement h is reached, the F_v or $F_{v,c}$ shall be measured and recorded.

D.2.7 Declaration of results

The smallest pull-out force F_v and its corresponding vertical displacement h measured for a single cover/grating in accordance with D.2.6 shall be declared.

In case of multiple covers the smallest pull out force $F_{v,c}$ of each individual cover and its corresponding vertical displacement *h* shall be declared.

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Annex E
(normative)

Recommendations for installation

E.1 General

The safe use of manhole tops and gully tops is dependent upon correct selection of the unit and good installation. This is particularly critical when they are installed in highway environments. The criteria, listed below should be taken into account. Sound installation in the highway may also make a significant contribution to savings in the whole life costs of manhole tops and gully tops. Conditions in the place of use may require more detailed instructions.

E.2 Location and opening size

A key responsibility for the safe location of a manhole top or gully top lies with the designer.

Where ever possible, the underground chamber upon which a manhole top or gully top is placed, should be located where traffic conditions are least arduous. However, wherever it is located, the designer has a responsibility to provide for future, as well as current traffic conditions. The designer should select an appropriate class of unit, for the chamber's location, in accordance with the recommendations of this standard and an appropriate clear opening size for safe entry.

E.3 Preparations before installation

Before installation the following should be checked:

- The manhole top or gully top is the correct size for the chamber;
- The manhole top or gully top is of an appropriate class for its location;
- If the manhole top or gully top should be fixed with a particular orientation, and is it properly aligned;
- The manhole top or gully top is appropriately marked, to show compliance with this standard, and with any third party's mark of conformity, if applicable;
- The manufacturer's installation guidance is available;
- The cover/grating and the frame form a matching set.

NOTE Manhole tops and gully tops are tested by manufacturers and certification bodies as a matching set. Generally they should be installed as such. The change of only one element may be undertaken on owners' request.

E.4 Operative skill, training and installation equipment

The installation of manhole tops and gully tops should be undertaken by appropriately skilled and trained operatives, using the proper equipment.

The user of the installation should ensure that any operatives or contractors (and their operatives) involved in the installation of manhole top or gully tops are appropriately competent to undertake the work.

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The installer should ensure that all equipment used during the installation of manhole tops or gully tops:

- Is properly maintained,
- Is appropriate for the safe installation of the manhole top or gully top, and
- Will cause no damage to the manhole top or gully top.

E.5 Bedding and packing materials

All bedding and packing materials should be used strictly in accordance with the manufacturers' recommendations. All such materials should be appropriate for use at the temperature prevalent at the time of installation.

E.6 Condition of supporting chamber

Before fixing the manhole top or gully top, operatives should ensure that the chamber upon which it to be installed is in a sound condition, and can safely carry the traffic or pedestrian load to be transferred to it by the manhole top or gully top. All appropriate repairs or renovation of the supporting structure of an existing chamber should be undertaken before the installation of a new manhole top or gully top.

E.7 Fixing of manhole tops or gully tops

The structure of the chamber and/or local conditions and practice may require that a particular type of frame and/or frame embedment is required. A wide variety of frame designs and methods of support for gratings and manhole covers are available. Therefore, when installing a manhole top or gully top, operatives should ensure that:

- The manhole top or gully top is fixed in accordance with the manufacturers recommendations;
- There is adequate bearing of the frame on the chamber or on the structure of the adjacent paved surface, (as required by local practice);
- The frame has appropriate anchoring and sound anchoring points (if specified);
- The upper surface of the manhole top or gully top is appropriately aligned to the adjacent paved surface; and
- The manhole top or gully top is soundly fixed in place and supported, such that it will not move when subject to traffic loading.

E.8 Post installation check and cleaning

After the installation of the manhole top or gully top has been completed, and before exposing it to traffic, the installer should thoroughly clean all elements of the manhole top or gully top, and its surroundings and carry out a check to ensure that all of its features function correctly. In particular the following aspects of the installation should be checked /inspected:

- Adequate curing time has elapsed for all bedding materials;
- The frame is secured in place;
- The cover or grating is stable within its frame and will not be disturbed by the action of traffic;
- There is no inappropriate interference between seatings or flanges of the cover or grating, and its frame;
- All additional features function correctly, e.g. hinges and locks;
- Any cushioning inserts are properly fixed in place and function correctly; and

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— Any feature which locks the grating or manhole cover in an open position is functioning correctly and in accordance with the manufacturer’s instructions.

Any abnormalities should be rectified before the manhole top or gully top is exposed to traffic.

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