
WATER INDUSTRY SPECIFICATION

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UK Water Industry

SPECIFICATION FOR LEAK TIGHTNESS OF COVERS FOR MANHOLES AND INSPECTION CHAMBERS

FOREWORD

Leakage (inflow) of surface water via manhole and inspection covers and frames (manhole covers) into foul sewers can represent a significant, and frequently unrecognised, contribution to total flow in foul sewers. Submergence of even a small number of manhole covers within a foul sewer network can be sufficient to overwhelm the capacity of pipelines, pumping stations or treatment works. At worst, foul flooding of property, and environmental contamination, can be the consequences. In less extreme circumstances, increased pumping and treatment costs can result.

This specification provides a means of product testing to determine the leak tightness of manhole covers. Products tested in accordance with this specification can be assigned a leak tightness classification between 0 - 3 based on measurement of a product's maximum leakage rate, expressed as litres/m² per 30 minute period of submergence. Use of this specification will permit designers, specifiers and procurement staff, working together, to select products that are appropriate to the type of sewerage system under consideration and the risk of such covers' submergence. The existence of this specification will assist product manufacturers and suppliers to measure and understand the performance of their existing product range and, where appropriate, amend their product offerings to meet performance criteria specified in accordance with this document.

Note 1: A water company experienced in the use of this approach, and upon whose experience this specification is based (see below), has determined that the costs of risk assessing individual manhole locations on foul sewerage systems outweighs the costs of blanket selection of manhole covers with a class 3 leak tightness classification. Whilst new foul systems are required to receive such covers they are also being retrofitted at renewal across the company's entire foul sewerage network.

Note 2: Inflows from manhole covers on combined sewerage systems are undesirable contributors to: flows to treatment; storm tank operation; and discharges from combined sewer overflows. However, such effects are secondary to road gullies' contribution to sewer inflow since these are more numerous and of even higher unit inflow volumes. Selection of leak tightness classifications for manhole covers use on combined sewerage systems is therefore more sensitive to cost benefit analysis.

This specification has been developed based on over 20-years' experience in a UK water company. In the early 2000's the water company experienced submergence of manholes on foul sewerage systems arising from groundwater flooding attributable to rising spring-lines in chalk aquifers. A single 600x600mm double triangular cover, within the manufacturing tolerances of EN124, was found capable of admitting 16 litres/second under 150mm depth of surface water. This is equivalent to the design peak foul flow from 350 houses. Adding in the prising slots and potential open keyways this reached 22 litres/second. This is equivalent to the design peak foul flow from 475 houses. At just 5mm immersion depth a 600x600mm double triangular cover within tolerances of EN124 was found still to admit more than 3 litres/second. Most of the water company's small "foul only" pumping stations have a pumping capacity of around 11 litres/second.

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The water company worked with successive manhole cover framework suppliers to develop a range of better covers and decided to require “low leakage” covers on all foul sewers at time of construction or renewal – this being cheaper than reviewing the risk in each case. By 2005 the water company had developed a test that could be used to compare covers from different suppliers. In 2011 the water company commissioned WRc to review the test in preparation for advocating its adoption as a Water Industry Specification (WIS). In 2023 WRc’s proposals formed the basis for a draft WIS presented to the Water UK Standards Board for further development prior to publication.

With the Board’s approval that development was undertaken by a Task and Finish Group chaired by a representative of the originating water company. The Group contained representatives from three other English water companies, Scottish Water, Irish Water, Water UK, WRc, the industry expert responsible for the internal standard’s development and eleven product manufacturers / suppliers. The draft WIS was open for three-months public comment on the WUK Standards Board website before finalisation and publication in its present form.

This specification does not purport to include all the necessary provisions of a contract and users are responsible for its correct application. Compliance with this specification does not itself confer immunity from legal obligations.

This specification calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to the technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Reference to a European Standard, British Standard, Water Industry Specification or any other specification applies equally to any equivalent specification.

Information contained in this specification is given in good faith. Neither Water UK nor the members of its Standards Board can accept any responsibility for actions taken as a result.

It has been assumed in the drafting of this specification that the execution of its provisions

is entrusted to appropriately qualified and experienced people, for whose guidance it has been prepared.

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APPENDIX A LEAK TIGHTNESS TEST PROCEDURE

1. SCOPE

This test specification is a supplementary requirement for manhole covers complying with BS EN 124 (parts 1-6) and intended for use on foul sewers. It specifies a test method and equipment for use as a reference test by which the leak tightness of a manhole cover and frame (with or without a seal plate) can demonstrate compliance with the functional requirements of BS EN 752. The test is applicable to covers with a clear opening dimension up to and including 1000mm.

2. TYPE TEST REQUIREMENT

2.1 When tested in accordance with the method described in this document, the manhole cover and frame (with any additional components) shall meet the appropriate maximum permissible inflow rate given in Table 1 for the appropriate class.

2.2 The product tested shall be as supplied (with any additional components to meet the leak tightness requirement). Where additional components are supplied, there shall be appropriate installation instructions available. Sealing systems shall be delivered complete with all required components.

Table 1 Maximum permissible inflow rates

Leak Tightness Class	Maximum permissible inflow rate (l/m ² per 30 min)
3	0.4
2	40
1	400
0	> 400

3. MARKING

Manhole covers, where no additional components such as seal plates are required, shall be marked with 'WIS 4-26-01 [Month] 2024 Issue 1. Leak Tightness Class 1, 2 or 3' in addition to the marking required by EN124.

Where the cover and frame require additional components such as seal plates to meet the specification, the mark shall be born on the additional component only but specifying the associated cover design to which it applies. Markings shall be clear and visible. Product performance may be declared through the provision of datasheets or certificates of conformity, providing the product type can be clearly identified. Where no leak tightness is claimed or the performance is Class 0, no marking is necessary.

4. REFERENCES

This specification makes reference to the latest edition of the following publications (except where otherwise indicated) including all addenda and revisions.

BS EN 124 *Gully tops and manhole tops for vehicular and pedestrian areas.* (All parts)

BS EN 752 *Drain and sewer systems outside buildings - Sewer system management*

APPENDIX A – LEAK TIGHTNESS TEST PROCEDURE

A.1 Apparatus

A.1.1 The apparatus shall consist of:

- a) A rigid, open topped box with dimensions in accordance with Figure 1 and having a hole cut centrally in its base of minimum dimensions 100mm diameter or 100 x 100mm square. The size of the box may be increased appropriately to accommodate covers of larger sizes;
- b) A blanking plate with an appropriately sized hole, equal to or greater than 100mm diameter or 100 x 100mm square, may be used for testing smaller size covers where the opening in the box is larger than the clear opening in the cover. Where a blanking plate is used it shall be sealed to the base of the test box;
- c) A support structure comprising, for example, at least four bricks, concrete or similar blocks or a structure capable of supporting the weight of the open box when filled with water plus the manhole cover and frame on test, and providing at least 75mm clearance below the base of the box;
- d) A stopwatch;
- e) A spirit-level with minimum length of 600mm;
- f) A method of adjusting the height of the corners of the support structure to ensure that it is level;
- g) Expanding polyurethane foam, or other sealant;
- h) A depth gauge accurate to ± 1 mm. Note: An example design is given in Clause A.1.4.

A.1.2 The box shall not visibly distort when filled with water to within 5mm of its top edge. It shall remain leak tight.

A.1.3 The apparatus shall be capable of supporting the weight of the manhole cover and frame on test, when filled with water, without any visible distortion.

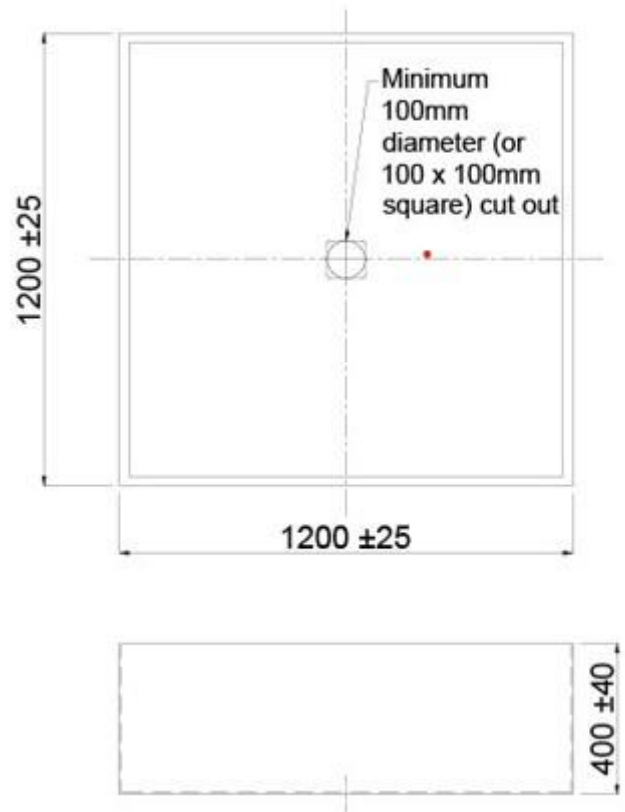


Figure 1 Test box

A.1.4 The depth gauge may be constructed in accordance with Figure 2 and comprise:

- a 100mm square plate of 6mm thick steel;
- a 200mm length of 8mm threaded steel rod (studding) welded perpendicularly to the centre of the plate;
- four nuts to fit onto the studding;
- two triangular pieces of steel or aluminium to form top and bottom markers;
- the top marker set at a distance of 150mm above the base of the plate;
- a distance (h) between the top and bottom marker in accordance with A.2.9

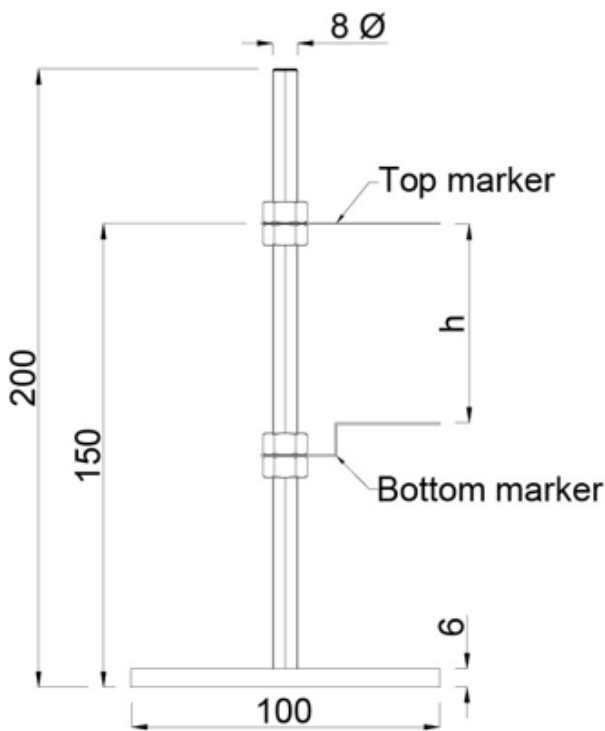


Figure 2 Example depth gauge construction

Note: Where the value of h is smaller than the sum of the thicknesses of the central nuts, a spacer may be used or the marker may be cranked.

A.2 Assembly

A.2.1 Place the apparatus, comprising box and support structure, on a hard well-drained surface and provided with an adequate water supply sufficient to fill the box.

A.2.2 Ensure that the structure supports the box a minimum of 75mm above the hard surface.

A.2.3 Check the base of the box is level using the spirit level. Make any necessary levelling corrections (e.g. using packers or adjusting screws if appropriate).

A.2.4 Install and seal a blanking plate with an appropriately sized hole over the standard sized hole in the base of the box, for testing covers of smaller dimensions if required.

A.2.5 Place the frame of the cover/frame assembly to be tested in the box. Apply sealant to the interfaces between the base flange of the frame and the box.

Note: Other methods of sealing the frame to the box are acceptable.

A.2.6 Demonstrate the leak tightness of the frame/box seal by filling the box with water to a level which does not exceed the height of the frame. Check for leaks and reseal if appropriate.

A.2.7 Place the cover and any seal plate carefully in the frame.

A.2.8 Record the internal plan dimensions of the box (in millimetres).

A.2.9 Calculate the distance (h) between the top and bottom marker on the depth gauge for the appropriate class from the maximum permissible inflow rate, the area of the cover and the area of the test rig using Equation 1.

$$h = Q_{max} \left(\frac{A_c}{A_b} \right) (t/30) \quad \text{Equation 1}$$

where:

Q_{max} is the maximum permissible inflow rate in l/m^2 in accordance with Table 1

A_c is the cross-sectional area of cover in m^2

A_b is the internal cross-sectional area of the box in m^2

t is the test time in minutes specified in table 2.

For some common sizes of covers values of h are given in Table 2.

A.2.10 Set the distance (h) between the top and bottom marker on the depth gauge by moving the bottom marker.

A.2.11 Place the depth gauge on the surface of the cover at a point where the cover is solid (i.e. do not allow it to block any gaps where inflow could occur).

A.3 Test Procedure

A.3.1 Assemble test box with frame and sealing apparatus as shown in figure 3.

A.3.2 Fill the box with water and allow the water surface to still.

A.3.3 Reduce the water level to the top marker of the depth gauge. At the tester's discretion a tap in the test box or a syphon may be used. Methods which minimise surface disturbance are preferred.

A.3.4 When the water level reaches the top marker, start the stopwatch.

A.3.5 If the water level reaches the bottom marker within 30 minutes, stop the watch and record the time (in seconds). Record the test as a fail.

Table 2 Maximum water level drop for commonly used manhole dimensions

Class	Cover dimensions (mm x mm)	Maximum water level drop in test period (h)*	Test period
3	600 Φ	3.8mm	24 hrs
	450 x 450	2.7mm	
	600 x 600	4.8mm	
	675 x 675	6.0mm	
2	600 Φ	7.9 mm	30 min
	450 x 450	5.6mm	
	600 x 600	10.0mm	
	675 x 675	12.5mm	
1	600 Φ	78.5mm	30 min
	450 x 450	56.3mm	
	600 x 600	100mm	
	675 x 675	125mm	
0	<i>Cover and frame not leak tight</i>		
<i>* Assumes test rig of 1200 x 1200mm cross-sectional area. h would need to be adjusted to accommodate variations in accordance with equation 1 (see A.2.9).</i>			

A.3.6 If the water level does not reach the bottom marker for the appropriate class within a period of 30 minutes, then for:

- Class 3: If there is no visible drop in water level during the test period, the test shall be continued for a further period of 23.5 hours after which period the total drop in water depth should not reach the bottom marker;
- Class 2: Record the test as a pass;
- Class 1: Record the test as a pass.

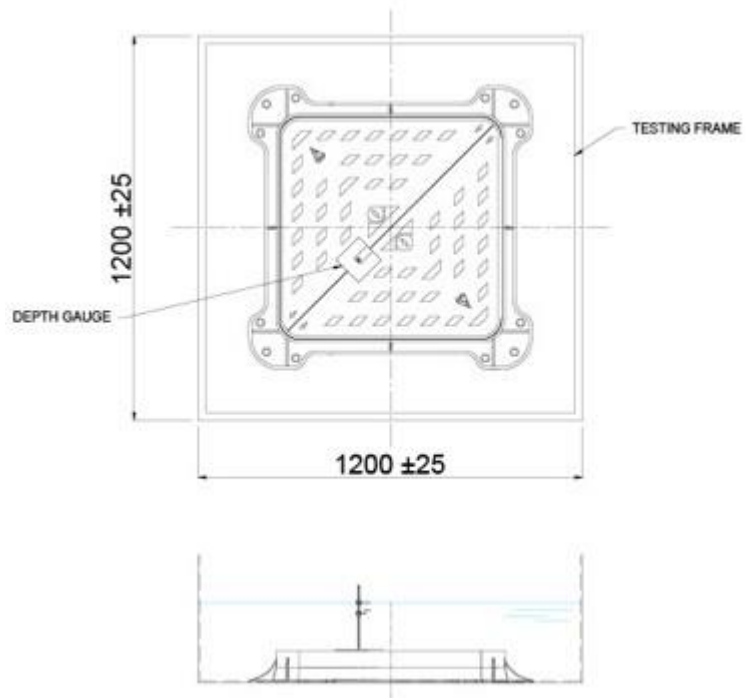


Figure 3 Test set up