

INDUSTRY STANDARD FOR
LIGHTWEIGHT MACRO-COMPOSITE
ACCESS COVERS AND COMPATIBLE FRAMES
FOR WATER SUPPLY AND SEWERAGE
WSA 133—2013



WSAA

**WATER SERVICES ASSOCIATION
OF AUSTRALIA**

PREFACE

This Standard, based on WSA 132, was prepared by the Water Services Association of Australia (WSAA) to focus on lightweight macro-composite access covers and compatible frames specifically intended for use in water supply and sewerage conveyance networks.

Lightweight composite covers and frames are currently being addressed by the development of EN 124-5 Gully tops and manhole tops for vehicular and pedestrian areas - Part 5: Gully tops and manhole tops made of composite materials. Thermoplastics covers and frames are currently being addressed by the development of EN 124-6 Gully tops and manhole tops for vehicular and pedestrian areas - Part 6: Gully tops and manhole tops made of Polypropylene (PP), Polypropylene with mineral modifiers (PP-MD), Polyethylene (PE) or Polyvinylchloride (PVC-U).

Access cover products conforming to WSA 133 are deemed functionally comparable to those conforming to WSA 132.

This Standard was driven by a desire for lower weight covers to improve worker health and safety outcomes during cover installation and removal. Lightweight macro-composite covers can currently only be economically manufactured for Class B applications and therefore this Standard is restricted to that Class.

Individual Water Agencies are responsible for determining the acceptability of cover products and the applicability of cover assembly specifications, in accordance with Agency asset requirements for particular cover applications. Agencies should assess the various loads imposed on access covers in particular applications, by reference to suitably qualified design engineering professionals, prior to cover selection.

Where a WSAA ruling to this Standard is of public significance and has been authorized for issue, it will be available from the WSAA website www.wsaa.asn.au. When the substance of a ruling has been included in an amended standard, the ruling will be withdrawn at the time of publication of the amendment. Enquiries should be directed to codes@wsaa.asn.au.

Comments and suggestions for improving the standard should be forwarded to:

Water Services Association of Australia
Level 8, Suite 802, 401 Docklands Drive, Docklands VIC 3008, Australia
or codes@wsaa.asn.au.

This Standard was issued on 24th April 2013 following a public review period that closed on 29th March 2013.

CONTENTS

PREFACE	2
1 SCOPE AND GENERAL	5
1.1 SCOPE	5
1.2 REFERENCED DOCUMENTS	5
1.3 DEFINITIONS	6
1.3.1 Access chamber, maintenance hole and manhole	6
1.3.2 Lightweight access cover	6
1.3.3 Macro-composite	6
2 MATERIAL REQUIREMENTS	6
2.1 GENERAL	6
2.2 POLYMERIC MATERIALS	7
2.3 DUCTILE IRON	7
2.4 DUCTILE IRON PROTECTIVE COATING	7
2.5 ELASTOMERIC MATERIALS	7
2.6 CORROSION-RESISTANT MATERIALS	7
3 LOAD CLASSIFICATION	7
3.1 CLASS	7
4 DESIGN AND PERFORMANCE REQUIREMENTS	8
4.1 COVER INSERTION DEPTH	8
4.2 CLEARANCE FIT OF MULTI – PART COVERS IN FRAMES	8
4.3 COVER SLIP RESISTANCE	8
4.4 SECURITY OF COVER FIXING	8
4.5 COVER LIFTING KEYHOLE	8
4.6 FREEDOM FROM DEFECTS	8
4.7 COVER DEFLECTION AND PERMANENT SET	9
4.8 IMPACT RESISTANCE	9
4.9 GAS-TIGHTNESS OF COVER/FRAME ASSEMBLY	9
4.10 WATERTIGHTNESS OF COVER/FRAME ASSEMBLY	9
5 MARKING	9
6 VERIFICATION OF CONFORMITY WITH THIS STANDARD	10
6.1 MANUFACTURING AND SUPPLY RESPONSIBILITIES	10
6.2 CONFORMITY TESTING	10
6.3 AS 3996:2006 REFERENCES	10
7 QUALITY ASSURANCE	10
APPENDIX A PURCHASING GUIDELINES	13
A1 INFORMATION TO BE SUPPLIED BY THE PURCHASER	13
A2 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER	13
APPENDIX B HIGH TEMPERATURE TEST	14
B1 GENERAL	14
B2 PROCEDURE	14
B3 TEST REPORT	14
APPENDIX C SUSTAINED LOADING TEST	15
C1 GENERAL	15
C2 PROCEDURE	15
C3 TEST REPORT	15

APPENDIX D IMPACT RESISTANCE OF COVER
D1 TEST EQUIPMENT
D2 TEST PROCEDURE
D3 TEST REPORT

16
16
16
16

1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the material, design and performance requirements for macro-composite (plastics and metallic materials) solid-top, lightweight access covers, compatible macro-composite or ductile cast iron frames and associated cover/frame assembly inserts, seals and fixings for Class B water industry applications. It applies to single and multiple part covers of square, rectangular and circular shapes.

NOTES:

1. This design of ventilated covers for specific ventilation and air flow requirements should be undertaken by a suitably qualified hydraulic design engineer.
2. Purchasing guidelines, based on Appendix B of AS 3996:2006 are provided in Appendix A. It includes information to be supplied at the time of calling for tenders or quotations.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

681.1	Elastomeric seals - Material requirements for pipe joint seals used in water and drainage applications - Vulcanized rubber
681.2	Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications – Thermoplastic elastomers
1110.1	ISO metric hexagon bolts and screws - Product grades A and B - Bolts
1112.1	ISO metric hexagon nuts - Style 1 - Product grades A and B
1646	Elastomeric seals for waterworks purposes
1831	Ductile cast iron
3996	Access covers and grates
5054	Ausferritic spheroidal graphite cast irons - Classification

AS/NZS

1462.3	Methods of test for plastics pipes and fittings - Method 3: Method for determining the impact characteristics of pipes
3750.4	Paints for steel structures – Bitumen paint
4131	Polyethylene compounds for pressure pipes and fittings
4586	Slip resistance classification of new pedestrian surface materials

ASTM

A240/240M	Heat-resisting chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels
A276	Stainless steel bars and shapes
A312	Seamless and welded austenitic stainless steel pipes

EN

124	Gully tops and manhole tops for vehicular and pedestrian areas – Design requirements, type testing, marking, quality control
prEN 124-5	Gully tops and manhole tops for vehicular and pedestrian areas –Part %: Gully tops and manhole tops made from composite materials
prEN 124-6	Gully tops and manhole tops for vehicular and pedestrian areas –Part %: Gully tops and manhole tops made from Polypropylene (PP), Polypropylene with mineral modifiers (PP-MD), Polyethylene (PE) or Polyvinyl-chloride (PVC-U)

ISO

1083	Spheroidal graphite cast irons - Classification
3506.1	Mechanical properties of corrosion-resistant stainless steel fasteners – Part 1: Bolts, screws and studs
4014	Hexagon head bolts - Product grades A and B
4032	Hexagon nuts, style 1 - Product grades A and B
4892-2	Plastics -- Methods of exposure to laboratory light sources -- Part 2: Xenon-arc lamps
17804	Ausferritic spheroidal graphite cast irons - Classification

ISO/IEC

Guide 28	Conformity assessment - Guidance on a third-party certification system for products
Guide 67	Conformity assessment - Fundamentals of product certification

WSA

02	Sewerage Code of Australia Part 0: Glossary of Terms, Abbreviations and References
----	--

1.3 DEFINITIONS

For the purpose of this Standard, the relevant definitions in AS 3996:2006 and EN 124:1994, except as amended or given below, apply:

1.3.1 Access chamber, maintenance hole and manhole

The terms “Access Chamber”, as defined in AS 3996:2006 Clause 1.4.1, maintenance hole, as defined in WSA 02 Part 0, and the term “Manhole”, as defined in EN 124:1994, shall have the same meaning.

1.3.2 Lightweight access cover

A removable cover for a maintenance structure and trade waste equipment and products with a mass of no more than 15 kg.

1.3.3 Macro-composite

A combination of polymeric and metallic materials. The polymeric material may also be a composite polymeric material.

2 MATERIAL REQUIREMENTS**2.1 GENERAL**

Covers may be manufactured from any macro-composite material, provided it meets all the requirements of this Standard.

Frames may be manufactured from any macro-composite material or ductile cast iron, provided they meet all the requirements of this Standard.

Sealing rings shall be manufactured from EPDM or NBR vulcanized rubber or thermoplastic elastomer and shall have no detrimental effects on the properties of the components. Sealing rings may be retained using components made from corrosion-resistant materials other than those of the actual cover and frame.

Locking devices shall be manufactured from corrosion-resistant materials.

2.2 POLYMERIC MATERIALS

All polymeric materials used shall be stabilised to ensure a 20 year minimum life when exposed to direct sunlight. For polyolefin materials, this can be demonstrated by the addition of an ultraviolet radiation (UV) stabiliser agent comprising at least 2.0% m/m carbon black complying with AS/NZS 4131. For PVC materials, this can be demonstrated by the addition of at least 2.0% m/m of rutile titanium dioxide.

Where other polymeric materials are used, appropriate evidence of the suitability of the material to resist ultraviolet radiation for a minimum 20 year life when exposed to direct sunlight shall be provided (typically via a service performance and / or accelerated testing).

NOTE: Compliance with the UV stability requirements of prEN 124-5 or prEN 124-6 or with the non-equatorial ageing and tensile impact requirements of Table 4 of ISO/FDIS 15398:2012 constitute “appropriate evidence”.

2.3 DUCTILE IRON

If applicable, frames shall be manufactured from ductile iron conforming to AS 1831/ISO 1083 grades JS/500-7/S, JS/550-5/S, JS/600-3/S or ISO 17804 grade 800/10.

2.4 DUCTILE IRON PROTECTIVE COATING

A protective bituminous coating in accordance with Clause 2.7.1 of AS 3996:2006 or with AS/NZS 3750.4 or EN 10300 shall be applied to all non-sealing and non-threaded surfaces of the frame. Sealing and threaded surfaces shall not be coated. After application and curing in accordance with the coating manufacturer’s application and curing specification, the coating shall be dry to touch.

2.5 ELASTOMERIC MATERIALS

Elastomeric seals shall comply with AS 1646 and AS 681.1 or AS 681.2.

2.6 CORROSION-RESISTANT MATERIALS

Corrosion-resistant materials shall be 316 or 316L stainless steel complying with ASTM 240/240M, ASTM 276, ASTM 312 or ISO 3506.1.

3 LOAD CLASSIFICATION

3.1 CLASS

Covers shall be classified as Class B as defined in AS 3996:2006. Class B covers are nominated for footways areas accessible to pedestrian but not general vehicular traffic loading, other than slow-moving light service vehicles, e.g. a park tractor, that can access footways and impose a nominal wheel load not exceeding 2,670 kg. Testing at a serviceability load of 53 kN (5,405 kg) and an ultimate load of 80 kN (8,158 kg) is specified.

NOTE: The static and dynamic load effects imposed on access covers in particular applications should be assessed by a suitably qualified design engineer, prior to specification of a required load class.

4 DESIGN AND PERFORMANCE REQUIREMENTS

4.1 COVER INSERTION DEPTH

Insertion depths shall not be less than 35 mm unless a cover fixing device complying with Clause 4.4 is provided, in which case the insertion depth shall not be less than 25 mm.

4.2 CLEARANCE FIT OF MULTI – PART COVERS IN FRAMES

For multi-part covers, with each part positioned in the frame in accordance with the cover manufacturer's assembly/installation instructions, there shall be no gap greater than 3 mm between adjacent parts (when measured with the cover at a constant temperature in the range 18–25°C).

4.3 COVER SLIP RESISTANCE

The upper surface(s) of covers shall have a slip-resistant raised pattern and comply with the test requirements specified Table 4.1.

TABLE 4.1
SLIP RESISTANCE TEST REQUIREMENTS

Test Method	Test Condition	Required Class
Appendix A (AS/NZS 4586:2004)	Wet pendulum	X, W or V

4.4 SECURITY OF COVER FIXING

Where a cover is required to be fixed in place, the cover, frame and associated fixing arrangements or fasteners shall be designed and supplied as an integrated assembly. Fixing arrangements and threaded fasteners shall be manufactured from 316 or 316L stainless steel in accordance with AS 1110.1 (ISO 4014) and ISO 3506.1, except as may otherwise be specified by the purchaser. The frame/cover design shall ensure that assembly fixing arrangements or fasteners mechanically secure the cover against the entire perimeter of the frame and provide the required tightness where water and gas tightness is required. The length of fastener thread engagement in solid frame structural material shall not be less than the nominal fastener diameter. The thread form of fastener tapings in frames shall be equivalent to AS 1112.1 (ISO 4032) preferred threads. Fasteners shall not protrude beyond the frame underside. At least two opposing fasteners shall be used to secure covers.

4.5 COVER LIFTING KEYHOLE

Covers shall be provided with a lifting keyhole of dimensions given in Figure 3.1 of AS 3996:2006, including a distance from the edge of a cover to the centre of a lifting keyhole of 35 +5, -0 mm. Covers with a perimeter ≤1 m may have alternative recesses or a lifting keyhole in accordance with Clause 3.2.2.6 of AS 3996:2006.

4.6 FREEDOM FROM DEFECTS

Small surface imperfections, inseparable from the method of manufacture, and not detrimental to the functional quality of covers, shall be permissible, provided that compliance with the other requirements of this Standard is maintained.

Minor surface defects may be rectified provided that compliance with the other requirements of this Standard is maintained.

Repair of cracks and tears in cover assembly structural materials shall not be permissible.

The seal contact surfaces of gas and water tight access cover/frame assemblies shall be clean and free from imperfections that result in the surfaces not sealing.

4.7 COVER DEFLECTION AND PERMANENT SET

Cover/frame assemblies shall meet the requirements specified in Table 4.2 when tested in accordance with Appendix C of AS 3996:2006 using the serviceability and ultimate limit state design loads nominated in Table 3.1 of AS 3996:2006, as well as the high temperature and sustained load tests specified in Appendices B and C of WSA 133.

TABLE 4.2
LOAD TESTS AND DEFLECTION LIMITS

Test	Test conditions	Maximum permanent set	Maximum deflection
Serviceability design	Appendix C (AS 3966:2006)	CO/250	CO/100
Ultimate limit state design load		-	-
High temperature	Appendix B (WSA 133)	CO/100	-
Sustained load	Appendix C (WSA 133)	CO/100	-

4.8 IMPACT RESISTANCE

When tested in accordance with Appendix D, covers shall show no visible cracking on either side of the cover and with no indentation exceeding 5 mm depth.

4.9 GAS-TIGHTNESS OF COVER/FRAME ASSEMBLY

Access cover/frame assemblies shall show no visible leakage when tested for gas-tightness in accordance with Clause 4.2.4 and Appendix F of AS 3996:2006.

4.10 WATERTIGHTNESS OF COVER/FRAME ASSEMBLY

Access cover/frame assemblies shall show no visible leakage when tested for watertightness in accordance with Appendix E of AS 3996:2006.

5 MARKING

In addition to the marking requirements specified in Clause 1.6 of AS 3996:2006, except for sub-clauses (c), (g) (h) & (i), covers shall be clearly and permanently marked to show:

- (a) Designations¹ for particular cover applications specified by the purchaser; and
- (b) The number of this Standard i.e. WSA 133.

NOTE:

1. Typical water industry cover designations include:

- (a) "WATER" for covers intended for use on drinking water supply infrastructure;
- (b) "NON-DRINKING" for covers for use on non-drinking water supply infrastructure;
- (c) "RECYCLED" for covers intended for use on recycled water supply infrastructure;
- (d) "SEWER" for covers intended for use on sewerage infrastructure.

6 VERIFICATION OF CONFORMITY WITH THIS STANDARD

6.1 MANUFACTURING AND SUPPLY RESPONSIBILITIES

A manufacturer shall be the entity that is accountable for:

- (a) controlling material selection/processing for and design of cover/frame assemblies;
- (b) managing cover/frame production processes and assembly of the finished end product;
- (c) managing quality assurance control processes associated with cover/frame manufacture;
- (d) undertaking product conformity assessment and acquiring a certificate of conformity in accordance with the requirements of this Standard.

A supplier shall be the entity that is accountable for:

- (i) directly sourcing cover/frame products from a manufacturer for on-sale to end-users;
- (ii) independently verifying product fitness for purpose and conformity with this Standard;
- (iii) taking appropriate preventive and corrective actions to stop the release of non-conforming product to market.

NOTE: A supplier may also be a manufacturer, producer, distributor, vendor, agent, tenderer or contractor for the supply of cover/frame assemblies.

6.2 CONFORMITY TESTING

Cover and frame assembly manufacturers shall demonstrate conformity of cover assembly design, load classification and production with this Standard by undertaking type tests, batch release tests and product quality inspections in accordance Table 7.1 of this Standard.

6.3 AS 3996:2006 REFERENCES

References herein to a “conformity assessment body” and in AS 3996:2006 to a “certification body” shall have the same meaning. References in Appendix A of AS 3996:2006 to “Paragraph A4” and “Table B1” shall mean “Paragraph A5” and “Table A1” respectively. The term “selected” in Clause 4.2.1.3 of AS 3996:2006 shall be synonymous with the term “sampled”.

7 QUALITY ASSURANCE

Product conformity with this Standard shall be assessed by means of third-party product certification, based on cover/frame manufacturing and assembly facility audits, in accordance with ISO/IEC Guide 67. The product certification scheme shall meet the criteria specified in AS 3996:2006 i.e. compliance with ISO/IEC Guide 28, except as may otherwise be specified by the purchaser.

Product sampling, inspecting and testing shall be planned /scheduled at time intervals that are no less frequent than those summarised in Table 7.1, except as may otherwise be agreed by the purchaser. Inspection and test results shall be recorded and test records shall be maintained to support characteristics nominated in product literature and provide verification of test outcomes for the purposes of product and, where required, production process conformity assessment.

Product certification shall be undertaken by a conformity assessment body (CAB) accredited by JAS-ANZ or by an accreditation agency that is a member of the International Accreditation Forum (www.iaf.nu/).

NOTE: A purchaser may nominate an alternative product conformity assessment scheme or system e.g. System 4 or System 3 in accordance with ISO/IEC Guide 67.

TABLE 7.1 PRODUCTION RECORD AND INSPECTION/TESTING SCHEDULE FOR ASSESSING CONFORMITY

Characteristics	Clause	Requirement	Test method	Test frequency	Audit Record Requirement	
					Manufacturer	CAB
TYPE TESTS						
Materials specifications	2.1, 2.2, 2.3, 2.4, 2.5 and 2.6 as applicable (WSA 133)	Material traceability from origin	As specified for the product	At any change of material grade, supply or source.	Retain traceable material records	Audit/verify records
Ultraviolet radiation resistance	2.2 (WSA 133)	Evidence of stabiliser addition or appropriate evidence of resistance to UV radiation	See Note in Clause 2.2 for acceptable test methods to demonstrate evidence of resistance to UV radiation	As specified for the product	Retain traceable material records or type test	As specified for the product
Cover insertion depth	4.1 (WSA 133)	≥35 mm or ≥25 mm with cover fixing device to Clause 4.4	Measuring tape/caliper	Once per batch	Type test	Verify measurement record compliance with requirement
Multi-part assembly clearance fit	4.2 (WSA 133)	Assembly gaps and clearances within given dimensional tolerances	Measuring tape, go/no-go (e.g. feeler) gauge and visual inspection	At any assembly design or manufacturing process change	Type test	Verify measurement record compliance with requirement
Cover slip resistance	4.3 (WSA 133)	Class X, W or V under wet pendulum test condition	Appendix A (AS/NZS 4586)	At any change in cover material, surface finish, and/or pattern	Retain traceable design records and Type test	Verify compliance of product with design
Security of cover fixing	4.4 (WSA 133)	Secure fixing and fastener design	Reference to assembly fixing or fastener specifications & drawings	At any change in cover fixing design	Retain traceable design records	Verify compliance of product with design
Cover lifting keyhole	4.5 (WSA 133)	Keyhole dimensions to Figure 3.1 of AS 3996:2006 including specified positioning from edge of cover	Reference to product design drawings and direct measurement	At any change in cover, design or dimensions	Retain traceable design records	Audit/verify record of design development

Characteristics	Clause	Requirement	Test method	Test frequency	Audit Record Requirement	
					Manufacturer	CAB
Serviceability design, ultimate limit state design load, high temperature and sustained load tests	4.7 (WSA 133) and Table 3.1 (AS 3996:2006)	Table 4.2 (WSA 133)	Appendix C (AS 3996:2006) Appendices B and C (WSA 133)	At any change in cover structural material or design	Type tests	Audit/verify records
Impact resistance	4.8 (WSA 133)	Meets 5 impacts without cracking and ≤5 mm indentation	Appendix D (WSA 133)	At any assembly design or manufacturing process change	Type test	Audit/verify test record compliance
Cover assembly gas-tightness	4.9 (WSA 133)	No visible leakage	Clause 4.2.4 (AS 3996:2006) and Appendix F (AS 3996:2006)	At any assembly design or manufacturing process change	Type test	Audit/verify test record compliance
Cover assembly watertightness	4.10 (WSA 133)	No visible leakage	Appendix E (AS 3996:2006)	At any assembly design or manufacturing process change	Type test	Audit/verify test record compliance

BATCH RELEASE TESTS (BRT)

Characteristics	Clause	Requirement	Test method	Test frequency	Audit Record Requirement	
					Manufacturer	CAB
Cover insertion depth	4.1 (WSA 133)	≥35 mm or ≥25 mm with cover fixing device to Clause 4.4	Measuring tape/caliper	Once per batch	Batch release test	Verify measurement record compliance with requirement
Security of cover fixing	4.4 (WSA 133)	Secure fixing and fastener arrangement	Reference to assembly fixing/fastener design specification/drawings	Once per batch	Batch release test	Verify product against design specification
Freedom from defects	4.6 (WSA 133)	No impaired performance	Visual inspection and touch	Once per batch	Batch release test	Verify inspection process & records
Cover markings	5 (WSA 133)	Compliant marking	Visual inspection	Once per batch	Batch release test	Audit/verify test record compliance

NOTE: Manufacturer design, production process and traceable test records should be retained as objective evidence of conformance for the purposes of product certification audits and later purchaser acceptability reviews.

APPENDIX A
PURCHASING GUIDELINES
(Informative)

A1 INFORMATION TO BE SUPPLIED BY THE PURCHASER

A purchaser should supply the following information at the time of calling for tenders or quotations for covers and frames:

- (a) Shape and dimensions of covers including whether single part or multi-part cover.
- (b) Requirement for security fixing (Y/N).
- (c) Marking to indicate cover application (Refer to Note 1 of Clause 5).
- (d) Lifting connection point requirements (also state if different from AS 3996:2006).

A2 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER

Where requested by the purchaser, the manufacturer should supply any or all of the following information in addition to that required by Clause 1.6 of AS 3996:2006:

- (a) Place of manufacture of the covers.
- (b) The standard and grade of all materials to be used in manufacture of the covers.
- (c) Installation instructions and drawings.
- (d) Provisions for lifting and handling of covers.

APPENDIX B

HIGH TEMPERATURE TEST

(Normative)

B1 GENERAL

This Appendix sets out method for type testing of covers at high temperature. The test involves subjecting the cover/frame assembly to the sustained application of the serviceability design load for 4 h at 50°C. The test shall be undertaken in accordance with this Appendix as well as the requirements specified in Appendix C of AS 3996:2006.

B2 PROCEDURE

The procedure shall be as follows:

- (a) Condition the specimen at 50±2°C for at least 4 h prior to commencement of the test.
- (b) Take an initial deflection reading at the geometric centre of the cover.
- (c) Apply the load at a rate of between 1 and 5 kN/s up to the serviceability design load specified in Table 3.1 (AS 3996:2006). Maintain the load (±2%) on the cover/frame assembly for at least 4 h at 50±2°C, and then release the load. Take a second reading after allowing the cover/frame assembly to recover for up to 1 hour at 50±2°C.
- (d) Determine the permanent set as the difference between the initial reading and the second reading.
- (e) Carry out visual inspection for signs of cracking, collapse, or structural failure.

B3 TEST REPORT

The following shall be reported:

- (a) Date of test.
- (b) Name of testing laboratory.
- (c) Full description of cover tested, circular opening in mm and frame material.
- (d) Applied load in kN.
- (e) Time load applied at 50°C, h.
- (f) Temperature range during the test, °C.
- (g) Test block size and shape.
- (h) Whether or not the cover passed or failed the requirement detailed in Table 4.2 without evidence of cracking, collapse, or structural failure.
- (i) Reference to Appendix B (WSA 133).

APPENDIX C
SUSTAINED LOADING TEST
(Normative)

C1 GENERAL

This Appendix sets out method for type testing of covers under sustained loading. The test involves subjecting the cover/frame assembly to the sustained application of the serviceability design load for 24 h at ambient temperature. The test shall be undertaken in accordance with this Appendix as well as the requirements specified in Appendix C of AS 3996:2006.

C2 PROCEDURE

The procedure shall be as follows:

- (a) Condition the specimen at 18–25°C for at least 1 h prior to commencement of the test.
- (b) Take an initial deflection reading at the geometric centre of the cover.
- (c) Apply the load at a rate of between 1 and 5 kN/s up to the serviceability design load specified in Table 3.1 (AS 3996:2006). Maintain the load ($\pm 2\%$) on the cover/frame assembly for at least 24 h at 18–25°C, and then release the load. Take a second reading after allowing the cover/frame assembly to recover for up to 1 hour at 18–25°C.
- (d) Determine the permanent set as the difference between the initial reading and the second reading.
- (e) Carry out visual inspection for signs of cracking, collapse, or structural failure.

C3 TEST REPORT

The following shall be reported:

- (a) Date of test.
- (b) Name of testing laboratory.
- (c) Full description of cover tested, circular opening in mm and frame material.
- (d) Applied load in kN.
- (e) Time load applied, h.
- (f) Temperature range during the test, °C.
- (g) Test block size and shape.
- (h) Whether or not the cover passed or failed the requirement detailed in Table 4.2 without evidence of cracking, collapse, or structural failure.
- (i) Reference to Appendix C (WSA 133).

APPENDIX D

IMPACT RESISTANCE OF COVER

(Normative)

D1 TEST EQUIPMENT

The test equipment shall be as given in AS/NZS 1462.3 or ISO 3127.

D2 TEST PROCEDURE

The procedure shall be as follows:

- (a) Place the cover on a vee block in such a way that at least a 30 mm gap between the cover and block is achieved at point of impact.

The vee block may be eliminated as long as the 30 mm gap remains between both the end of the guiding pipe and point of impact and between the ground and the cover at the point of impact.

- (b) Secure and condition the cover at 15–25°C for 2 +0.5, -0 h.
- (c) Use a straight pipe with an internal diameter of 100 mm to 106 mm and a length of 2.5 m. Place one end of this pipe at the position of greatest distance between ribs i.e. at the most vulnerable location on the cover, in a vertical position, perpendicular to the cover.
- (d) Drop a striker of radius = 50 mm with mass 3.75 kg, from 2.5 m.
- (e) Inspect both surfaces of the cover for cracking and measure the depth of indentation to the nearest 0.1 mm after allowing the cover to recover for up to 1 h at 15–25°C.
- (f) Repeat (c), (d) and (e) at four other locations on the cover.

D3 TEST REPORT

The following information shall be reported:

- (a) The complete identification of the cover under test.
- (b) The test temperature (°C).
- (c) The striker mass (kg).
- (d) The drop height (m).
- (e) The date of test.
- (f) Any evidence of cracks or other damage that might impair the function of the cover.
- (g) Depth of indentation (mm).
- (h) Reference to this test method.