WATER SERVICES
ASSOCIATION OF AUSTRALIA

DR WSA 137-2017

Industry standard for maintenance shafts and maintenance chambers for sewerage

PREFACE

This Standard was prepared by the Water Services Association of Australia (WSAA). It was published on the 18th March 2013[Date Field].

The objective of this Standard is to provide material and performance requirements for manufacturers and purchasers of plastics maintenance shafts and maintenance chambers for sewerage and sanitary drainage systems. Typically, a maintenance shaft or maintenance chamber assembly comprises:

(a) a base;

(b) a vertical riser;

(c) a cone, where required to reduce the opening at the top of a large diameter riser or placed immediately above the base to allow a smaller diameter riser to be used;

(d) a sealed riser cap below, but close to the finished ground surface level.

This edition includes requirements for moulded or fabricated inlet connectors that provide for single or multiple drain connections in the riser.

NOTE: Maintenance shafts and maintenance chambers complying with this Standard may also be suitable for other applications such as stormwater drainage.

In-service performance of a maintenance shaft or chamber is strongly dependent on a supportive embedment. It should be recognised that it is extremely difficult to anticipate soil types, soil loadings and future soil movement in all possible locations and conditions. Specific types of embedment and backfill materials and compaction standards for various depths and soil types should be adopted in order to minimise the risk of long-term failure. Thus, even with compliance with these performance requirements, installation conditions will have a significant influence on the long-term performance of maintenance shafts and maintenance chambers.

The design criteria of AS/NZS 2566.1, Buried flexible pipelines, Part 1: Structural design, provide guidance. Installation should be in accordance with design drawings and the Gravity Sewerage Code of Australia—WSA 02.

This Standard adopts the same means of determining structural integrity of maintenance shafts and maintenance chambers and durability of materials as ISO 13272. The elastomeric seal joint requirements are also in accordance withsimilar to ISO 13272 except that the base-to-pipe and base-to-riser joints are required to additionally comply with interface pressure and contact width as specified in, for example, AS/NZS 1260 and the infiltration / exfiltration test pressures are higher.

The plastics materials covered by this Standard include PVC-U, PE, PP and PP-MD. This document recognises that materials demonstrated to comply with the requirements of some AS/NZS and ISO Standards are suitable for the manufacture of maintenance shaft risers and/or bases, provided the structural integrity and durability requirements are satisfied. Other PVC-U, PE, PP or PP-MD materials need to satisfy additional durability requirements in order to demonstrate suitability. Maintenance shaft bases are typically manufactured by injection moulding, rotational moulding or fabrication.

Provided installation and operating conditions conform to the guidelines in this Standard, maintenance shaft and maintenance chamber life expectancy are expected to exceed 50 years. The reduction of riser stiffness from SN8 to SN4 is supported by structural analysis based on AS/NZS 2566.1 that considered buckling stability of the riser in different soil types with a water table to full installation depth.

While the Standard adopts an accessibility test using proving tools of two standard shapes, the ease of ingress and egress of maintenance and condition assessment equipment at various installation depths and with different base configurations can only be proven by installation trials as part of a product appraisal.

It is recognised that low surface energy acrylic structural adhesives are used to joint dissimilar plastics such as PE and PVC in some products. However, such adhesives have not been included pending the development of a recognised product standard for the jointing of dissimilar plastics in typical maintenance shaft and maintenance chamber applications i.e. buried structures handling sewage.

The Appendices are identified as ‘normative’ and, as such, form an integral part of this Standard.

CONTENTS

1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the material, performance and design requirements for plastics maintenance shafts and maintenance chambers comprising an injection moulded, rotationally moulded, fabricated or extruded base and riser made of unplasticised polyvinylchloride (PVC-U), polyethylene (PE), polypropylene (PP) or polypropylene with mineral modifiers (PP-MD).

A maintenance shaft or maintenance chamber may be a one-piece construction or an assembly of different components manufactured from compatible materials.

The jointing of individual components may be achieved using:

(a) elastomeric ring seal joints;

(b) solvent cement joints for PVC-U;

(c) welded joints for PVC-U, PP, PP-MD and PE;

(d) extrusion welding;

(e) mechanical jointing.

Maintenance shafts and maintenance chambers comprises a base and riser. They may also include:

(i) a cone between the base and riser, or between the riser and cap;

(ii) a telescopic part;

(iii) other near-surface components.

~~(iii)~~(iv) an inlet connector that is inserted into the riser or forms part of the riser to provide for single or multiple drain entries in the riser itself.

All maintenance shafts and maintenance chambers complying with this specification are:

(A) intended to operate at atmospheric pressure and a nominal temperature not greater than 25°C;

(B) intended to be suitable for installation at a depth, from the invert to just below ground surface, of ≤4 m. Alternatively, they may be tested to demonstrate suitability for installation at depths >4 m up to ≤6 m.

(C) not intended to be subject to direct traffic loads axially, but intended for installation in trafficable areas where the top part of the riser and/or cone may be subject to some transfer of wheel loads to the surrounding embedment.

1.2 COMPLIANCE REQUIREMENTS

Methods for demonstrating compliance with this Standard shall be in accordance with Appendix A.

1.3 LIMITATIONS

This Standard does not cover maintenance shafts and maintenance chambers intended for use at pressures other than atmospheric pressure. Special design considerations not covered in this Standard should be given to maintenance shafts and maintenance chambers subjected to superimposed mechanical forces, such as seismic forces and to average service temperatures in excess of 25°C.

1.4 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
1199	Sampling procedures for inspection by attributes
1199.1	Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
1646	Elastomeric seals for waterworks purposes
AS/NZS	
1260	PVC-U pipes and fittings for drain, waste and vent application
1462.1	Methods of test for plastics pipes and fittings Method 1: Method for determining the dimensions of pipes and fittings
1462.8	Methods of test for plastics pipes and fittings Method 8. Method for testing the leak tightness of assemblies
1462.11	Methods of test for plastics pipes and fittings Method 11. Method for high temperature stress relief testing of fittings
1462.13	Methods of test for plastics pipes and fittings Method 13. Method for the determination of elastomeric seal joint contact width and pressure
1462.22	Methods of test for plastics pipes and fittings Method 22. Method for the determination of pipe stiffness
1462.28	Methods of test for plastics pipes and fittings Method 28. Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds
1477	PVC pipes and fittings for pressure applications
2032	Installation of PVC pipe systems
2566.1	Buried flexible pipelines Part 1: Structural
2566.2	Buried flexible pipelines Part 2: Installation
3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
4131	Polyethylene (PE) compounds for pressure pipes and fittings
4441	Oriented PVC (PVC-O) pipes for pressure applications
4765	Modified PVC (PVC-M) pipes for pressure applications
5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
EN	
14758-1	Plastics piping systems for non-pressure underground drainage and sewerage – Polypropylene with mineral modifiers (PP – MD) – Part 1: Specifications for pipes, fittings and the system
ISO	
1133	Plastics – Determination of The Melt Mass-Flow Rate (MFR) and the Melt Volume-Flow Rate (MVR) of Thermoplastics
3127	Thermoplastics pipes – Determination of resistance to external blows – Round-the-clock method
3951.1	Sampling procedures for inspection by variables – Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL

3951.2	Sampling procedures for inspection by variables – Part 2: General specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection of independent quality characteristics
3951.3	Sampling procedures for inspection by variables – Part 3: Double sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
3951.5	Sampling procedures for inspection by variables – Part 5: Sequential sampling plans indexed by acceptance quality limit (AQL) for inspection by variables (known standard deviation)
4427	Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply
4435	Plastics piping systems for non-pressure underground drainage and sewerage – Unplasticised poly(vinyl chloride) (PVC-U)
8772	Plastics piping systems for non-pressure underground drainage and sewerage – Polyethylene (PE)
8773	Plastics piping systems for non-pressure underground drainage and sewerage – Polypropylene (PP)
13229	Thermoplastics piping systems for non-pressure applications – Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings – Determination of the viscosity number and K-value
13259	Thermoplastics piping systems for underground non-pressure applications – Test method for leaktightness of elastomeric sealing ring type joints
13267	Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics inspection chamber and manhole bases — Test methods for buckling resistance
13272	Plastics piping systems for non-pressure underground drainage and sewerage – Unplasticised poly(vinyl chloride) (PVC-U), polypropylene (PP), polypropylene with mineral modifiers (PP-MD) and polyethylene (PE) – Specifications for manholes and inspection chambers in traffic areas and underground installations
21138-1	Plastics piping systems for non-pressure underground drainage and sewerage – Structured-wall piping systems of unplasticised poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Part 1: Material specifications and performance criteria for pipes, fittings and system
21138-2	Plastics piping systems for non-pressure underground drainage and sewerage – Structured-wall piping systems of unplasticised poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Part 2: Pipes and fittings with smooth external surface, Type A
21138-3	Plastics piping systems for non-pressure underground drainage and sewerage – Structured-wall piping systems of unplasticised poly (vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Part 3: Pipes and fittings with non-smooth external surface, Type B
ISO/IEC	
Guide 28	Conformity assessment – Guidance on a third party certification system for products
WSAA	
02	Gravity Sewerage Code of Australia

1.5 DEFINITIONS

1.5.1 *Average service temperature*

The average temperature (T_{ms}) that a maintenance shaft or maintenance chamber will attain during service can be calculated from the following equation:

$$T_{ms} = \frac{2T_{sew} + T_{soil}}{3}$$

where

T_{sew} = average sewage temperature assessed over summer and winter months

= $0.5T_{sew-summer} + 0.5T_{sew-winter}$

T_{soil} = average soil temperature assessed over summer and winter months

= $0.5T_{soil-summer} + 0.5T_{soil-winter}$

The average temperature for the sewage and soil in contact with the maintenance shaft or maintenance chamber is the weighted average of the temperatures, as assessed in accordance with percentage of time spent at each temperature under operational conditions.

NOTE: For practical purposes, this should be taken to be the average temperature of sewage flowing through the maintenance shaft or chamber during the summer and winter months, which should be taken to be equal 6 monthly periods.

1.5.2 *Effective seal*

That part of the interface between an elastomeric seal and the spigot and socket where the contact pressure is greater than 0.4 MPa for vulcanised seals and 0.47 MPa for thermoplastic seals.

1.5.3 *Effective sealing length*

1.5.3.1 *Socket-mounted seals*

The distance between the cross-sectional centre of the elastomeric sealing ring installed in the socket and the root of the socket.

1.5.3.2 *Spigot-mounted seals*

The distance from the position of effective seal of the elastomeric sealing ring to the mouth of a socket or the point at which the mouth of a socket flares.

1.5.4 *Maintenance chamber*

Structure with a moulded and channelled base with up to three inlets ≤DN 225 (inlets at the base only), a riser ~~shaft~~ of nominal ~~shaft~~ size DN ~~450~~ 600 – DN ~~600~~ 800 and a removable cover constructed on a sewer that allows limited change of grade and/or direction and provides access to the sewer for inspection and most maintenance equipment, but which does not permit entry of a person. Base configurations include in-line, bend and junction. Maintenance chambers may be suitable for installation at depths up to 6 m subject to testing of products to meet design requirements associated with a water table to full installation depth.

1.5.5 *Maintenance shaft*

Structure with a moulded and channelled or spherical base with up to three inlets ≤DN 225 (inlets at the base only), a riser ~~shaft~~ of nominal ~~shaft~~ size DN 225 – DN ~~300~~ 425 and a removable cover constructed on a sewer that allows limited change of grade and/or direction, and provides access to the conduit for inspection and some maintenance equipment, but does not permit entry of a person. Base configurations include in-line, bend, junction and terminating. A maintenance shaft at the end of a reticulation sewer is known as a terminal maintenance shaft. Maintenance shafts may be suitable for installation at depths up to 6 m subject to testing of products to meet design requirements associated with a water table to full installation depth.

1.5.6 *Maintenance shaft base and maintenance chamber base*

A sewerage fitting used to connect, and/or to change the direction of, sewers. A base comprises a floor, walls and soffit. The floor of the base may shall contain a formed, graded channel for the passage of sewage.

1.5.7 *Riser*

A component, usually circular in cross-section, that provides service access to the base component from ground surface level. A riser may be an integral component of the maintenance shaft or maintenance chamber assembly or a separate pipe that can be jointed to the base.

NOTES:

1. Maintenance shafts and maintenance chambers finish near the surface. A suitably supported access cover and frame to WSA 02 requirements is usually provided above this point.
2. Risers for maintenance shafts have a diameter in the range DN 225 – DN 300425, and risers for maintenances chambers have a diameter in the range DN 450 600 – DN 8600.

1.5.8 *Cone*

A tapered adaptor placed at the top of a riser to reduce the diameter of a large diameter riser and prevent access of persons, or placed between a base and riser to allow a smaller diameter riser to be used.

1.5.9 *Cap*

A removable component attached to the top of the riser to prevent infiltration of ground or surface water and to provide access into the riser for routine operations and maintenance.

NOTES:

1. Caps can be either a locking type or a type that will permit flow relief.
2. Maintenance shafts and maintenance chambers finish near the surface. A suitably supported access cover and frame to WSA 02 requirements is usually provided above this point.

1.5.10 *Telescopic part*

Part of the assembly that allows accommodation of settlement that might occur after installation and allows adjustment of the height of the riser, cone and cap.

1.5.11 *Inlet connector*

A component that allows single or multiple sanitary drains to be connected to the riser shaft. The component may form part of the riser itself or be connected to the wall of the riser.

NOTE: Inlet connectors may be installed in the riser during construction or post construction.

1.6 ABBREVIATIONS

%	percentage
ºC	degree Celsius
AQL	acceptable quality level
AS	Australian Standard
AS/NZS	Australia and New Zealand Standard
DN	nominal size
g	gravitational constant
h	hour
HALS	hindered amine light stabiliser
IEC	International Electrotechnical Commission
ISO	International Standards Organisation
JAS-ANZ	Joint Accreditation System of Australia and New Zealand
kg	kilogram
kN	kilonewton
kPa	kilopascal
m	metre
MFR	melt mass-flow rate
mm	millimetre
min	minute
MPa	megapascal
N	Newton
N/m/m	Newtons per metre per metre
PE	polyethylene
PP	polypropylene
PP-MD	polypropylene with mineral modifiers
PVC	polyvinylchloride
PVC-U	polyvinylchloride unplasticised
PVT	process verification test
R	rating factor for the durability test
TT	type test
WSAA	Water Services Association of Australia

2 MATERIAL REQUIREMENTS

2.1 GENERAL

This section specifies the minimum general requirements applicable to PVC-U, PE, PP and PP-MD maintenance shafts and maintenance chambers, elastomeric seals and solvent cements. Requirements for freedom from defects, packaging, storage and transport are also defined.

NOTE: Different parts of maintenance shaft and maintenance chamber assemblies may be manufactured from a combination of two or more of the materials specified.

2.2 MATERIALS

2.2.1 *General*

Additives containing compounds based on lead (Pb), cadmium (Cd) or mercury (Hg) shall not be used in the manufacture of any components except that recycled PVC-U material containing these elements may be used in the core of sandwich construction pipe.

2.2.2 *Materials for bases*

2.2.2.1 *Standard materials*

When a material satisfying the material requirements of one of the Standards listed in Table 2.1 is used for manufacturing bases for maintenance shafts or maintenance chambers it shall, in addition, exhibit no cracks when tested for 1,000 h in accordance with Appendix B using the buckling resistance test specified in ISO 13267. The durability test shall be performed at a negative internal pressure of $-\frac{10H}{R}$ kPa and at the appropriate temperature given in Table B1 of Appendix B. *H* is equal to 4 unless the stated maximum burial depth of the maintenance shaft or maintenance chamber is greater than 4m, in which case *H* equals the stated maximum allowable burial depth.

Note: R is the rating factor listed in Table B1 for PVC-U, PE, PP and PP-MD.

2.2.2.2 *Non-standard materials*

When a material not complying with the material requirements of the Standards listed in Table 2.1 is used for manufacturing bases for maintenance shafts or maintenance chambers it shall exhibit no cracks when tested for 3,000 h in the buckling resistance test specified in ISO 13267. The durability test shall be performed at a negative internal pressure of $-\frac{10H}{R}$ kPa and at the appropriate temperature given in Table B1 of Appendix B. *H* is equal to 4 unless the stated maximum burial depth is greater than 4 m, in which case H equals the stated maximum allowable burial depth. Non-standard materials shall also be characterised in accordance with Clause B5 of Appendix B.

2.2.3 *Materials for risers and cones and inlet connectors*

2.2.3.1 *Standard materials*

A material complying with the Standards listed in Table 2.1 or complying with Clause 2.2.2.2 may be used for manufacturing risers, ~~or~~ cones or inlet connectors without additional material requirements. Pipes complying with the requirements of AS/NZS1477, AS/NZS 4441 or AS/NZS 4765 may also be used for manufacturing risers without additional testing.

2.2.3.2 *Non-standard materials*

When a material not complying with either Table 2.1 or Clause 2.2.2.2 is used to manufacture risers, the material shall comply with Clause B5 of Appendix B.

2.2.3.3 *Elastomeric Components*

Elastomeric components forming part of an inlet connector shall comply with AS 1646 and AS EN 681.1.

TABLE 2.1

STANDARD MATERIALS

Material	Standard
PVC-U	AS/NZS 1260, ISO 4435, ISO 21138.1, ISO 21138.2, ISO 21138.3,
PE	AS/NZS 4131, AS/NZS 5065, ISO 4427, ISO 8772, ISO 21138.1, ISO 21138.2, ISO 21138.3, A coloured or natural material that is: • fully pre-compounded • produced from a base resin used to produce a compound complying with AS/NZS 4131 • contains a minimum of 0.2% of a hindered amine light stabiliser (HALS) • has additives evenly dispersed, having a rating of appearance of not worse than Micrograph B in Annex B of AS/NZS 1462.28 and the arithmetic average of the maximum sizes of pigment agglomerations or foreign bodies shall not exceed 60 µm (corresponding to Grade 3 of AS/NZS 1462.28 • has an MFR, when measured in accordance with ISO 1133 Condition T, not greater than 2.0
PP	AS/NZS 5065, ISO 8773, ISO 21138.1, ISO 21138.2, ISO 21138.3,
PP-MD	EN 14758-1

2.2.4 *Rework*

Clean rework, which is generated from the manufacturer's own production of bases, risers or cones in accordance with this Standard, may be used if it is derived from the same material as used in the relevant production.

When rework material is added to a production run, the manufacturer shall treat this run as a new batch. For new batches of rotational moulding materials, the oxidation induction time and MFR shall be re-characterised in accordance with Clause B5 of Appendix B.

2.2.5 *Elastomeric seals*

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

2.2.6 *Solvent cements and priming fluids*

Solvent cements and priming fluids used for jointing PVC-U assemblies shall comply with AS/NZS 3879.

2.3 FREEDOM FROM DEFECTS

2.3.1 *General*

When viewed without magnification, the internal and external surfaces of bases, risers, cones and caps shall be smooth, clean and free from defects likely to prevent conformity with this Standard. Components shall not have any blisters, voids, burnt particles or heat marks. Where grooves, wrinkles, rippling, dents or projections are present, the components shall comply with the relevant dimensional requirements. Where defects are present and the product is submitted for acceptance, the manufacturer shall be able to demonstrate conformance to this Standard.

NOTE: Some products have grooves intentionally moulded into the surfaces of components for hydraulic reasons, which should not be cause for rejection.

2.3.2 *Pipe ends*

Pipe ends or spigots on maintenance shafts and maintenance chambers shall be cleanly cut square with the axis of the ends of the component and within any cutting zone if so recommended by the manufacturer.

2.3.3 *Cleanliness*

Maintenance shaft and maintenance chamber components shall be internally clean and free from swarf and other manufacturing debris.

NOTE: The defects described in Clauses 2.3.1, 2.3.2 and 2.3.3 cannot be completely quantified. Where the presence, size or frequency of any such defects are considered to be of concern, arrangements should be made between the purchaser/approving authority/certifying body (as appropriate), and the manufacturer. This may be achieved by the provision of acceptable type samples.

2.4 DIMENSIONS

2.4.1 *Sockets and spigots*

The dimensions of sockets or spigots on maintenance shafts and maintenance chambers shall enable compatibility to pipe work in accordance with the product Standard of the pipes they are intended to be connected to.

2.4.2 *Effective sealing length*

The effective sealing length of an elastomeric seal joint, when measured in accordance with AS/NZS 1462.1 shall be not less than the value specified in the relevant product Standard. Where the relevant product Standard specifies a length of engagement rather than the effective sealing length, the length of engagement, measured in accordance with AS/NZS 1462.1, shall be not less than the value specified.

2.5 PACKAGING, STORAGE, HANDLING AND TRANSPORTATION

Maintenance shafts, maintenance chambers and components shall be transported, handled and stored in accordance with the manufacturer's recommendations in a manner that prevents damage, deterioration or excessive distortion.

Maintenance shafts, maintenance chambers and components may be transported to site separately for assembly before or at installation.

All maintenance shafts, maintenance chambers and risers shall be stacked in a manner that minimises ovalisation and protects ends and projections from impacts and superimposed loading.

Maintenance shaft or maintenance chamber shaft assemblies and components shall not be stored near motors, generators or other heat-emitting equipment.

Maintenance shaft or maintenance chamber assemblies and components made of PVC-U and containing ≥1.5 parts of rutile titanium dioxide (TiO_2) pigment per 100 parts by mass of PVC content may be stored uncovered in direct sunlight. Maintenance chamber or maintenance shaft assemblies and components made of PE, PP or PP-MD containing 2.0 to 2.5% of carbon black in accordance with AS/NZS 4131 or AS/NZS 5065 may be stored in direct sunlight. Maintenance shaft or maintenance chamber assemblies and components made of PE or PP containing ≥ 0.2% HALS in accordance with AS/NZS 4131 or AS/NZS 5065 may be stored uncovered in direct sunlight for not more than 2 years.

All other maintenance shaft and maintenance chamber components shall not be stored in direct sunlight.

If extended storage beyond the periods stated above is anticipated, maintenance shaft and maintenance chamber assemblies and components shall be stored under cover in a manner providing ventilation and avoiding heat entrapment.

3 PERFORMANCE REQUIREMENTS

3.1 GENERAL

This section specifies the minimum performance requirements applicable to maintenance shafts and maintenance chambers.

3.2 STRUCTURAL INTEGRITY OF BASE

When tested for not less than 1,000 h at 20 to 25°C and negative internal pressure of -10*H* +0.5, −0 kPa in accordance with Appendix C and ISO 13267, the base shall not collapse nor show any signs of cracking. The predicted 50 year vertical H deformations shall be ≤5% of the main sewer pipe outside diameter. The predicted 50 year horizontal W deformation shall be ≤10% of the main sewer outside diameter.

3.3 IMPACT RESISTANCE OF BASE

When tested at 23±2°C in accordance with Appendix E using a striker of 1,000 +10 -0 g mass having a radius of 50 mm and a drop height of 2500 + 25 -0 mm the base shall not exhibit any cracks or other damage that impairs the function of the base.

3.4 RING STIFFNESS OF RISER

When tested in accordance with AS/NZS 1462.22 the ring stiffness of the riser shall be ≥4,000 N/m/m (SN4).

3.5 HIGH TEMPERATURE STRESS RELIEF OF PVC-U COMPONENTS

When tested at a temperature of 150±4°C for 30 +3, -0 min in accordance with AS/NZS 1462.11, PVC-U injection moulded components shall comply with the following requirements:

(a) There shall be no evidence of inclusions or voids of size greater than 20% of the wall thickness up to a maximum of 1 mm.

(b) Delamination or damage at the injection point shall not have reduced the wall thickness to less than 50% of the nominated minimum wall thickness.

(c) The weld line shall not open up to a depth of more than 50% of the wall thickness.

NOTE: The weld line is likely to become prominent and the fitting distorted, but this does not constitute failure.

(d) Not more than 5% of the total internal and external surface area of the chamber shall exhibit blisters and/or surface delamination.

3.6 ACCESSIBILITY TEST

A maintenance shaft or maintenance chamber shall be assembled with a 1 m length of riser pipe in a vertical position and with 1 m lengths of sewer pipe connected to each sewer pipe connection port. A proving tool of standard shape A, with dimensions as shown in Table 3.1 and Figure 3.1, shall be attached to cables and inserted through the riser pipe and pulled out through each of the sewer pipe connections in turn. This procedure shall also be repeated for a proving tool of standard cylindrical shape B, with dimensions as shown in Table 3.1.

The standard shapes A and B shall be capable of insertion with diameter D1 as the leading edge and shall pass, without restriction, through all of the connection ports of the maintenance shaft or maintenance chamber and into the connecting sewer pipes using a pulling force not exceeding 250 N.

The standard shapes shall be manufactured from steel or aluminium alloy with all sharp edges removed.

TABLE 3.1

DIMENSIONS OF STANDARD PROFILES

Inlet-outlet sewer nominal size[1] DN	Standard Shape A (see figure 3.1)			Standard shape B	
	Length, *L*	Diameter *D₁*	Diameter *D₂*	Length, *L*	Diameter *D₁*
100 / 110	300	90	65	400	75
150 / 160	400	135	90	400	125
175 /200	400	170	100	500	125
225 / 250	500	210	120	500	125
300 / 315	500	270	120	500	125
375 / 400	500	270	120	500	125

NOTE:

1. In accordance with the appropriate product Standard.

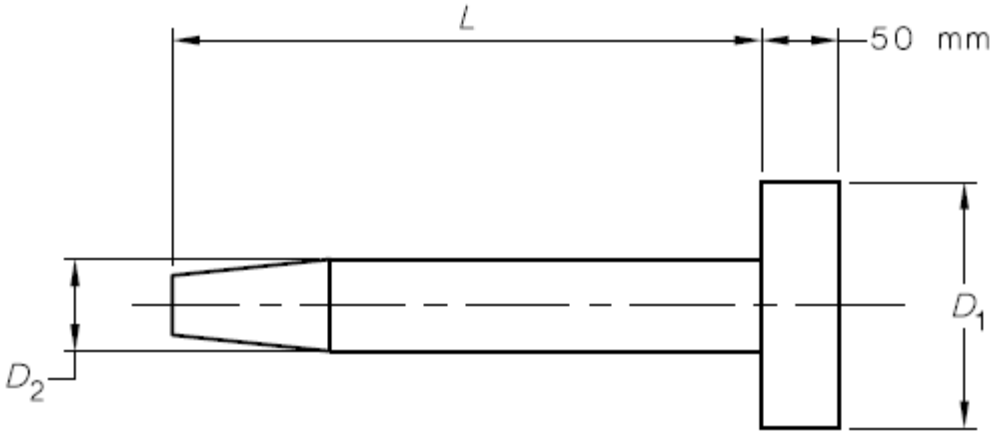

FIGURE 3.1 STANDARD SHAPE A

NOTE: Alternate profile shapes may be used by agreement between the manufacturer and asset owner.

3.7 ELASTOMERIC SEAL JOINTS

3.7.1 *General*

Elastomeric seal joints for joining maintenance shafts and maintenance chambers to pipes or to risers shall comply with the following requirements for hydrostatic pressure, liquid infiltration and contact width and pressure.

3.7.2 *Joints between a pipe and the base of a maintenance shaft or maintenance chamber*

When tested in accordance with ISO 13259, Condition D, under the following conditions, the joints shall not leak during the internal positive pressure tests and the pressure shall remain not less than 3 kPa above the negative test pressure during the test:

(a) Test temperature 23 ± 5°C

(b) Pipe diametric deflection ≥10%

(c) Socket deflection ≥5%

(d) Low test pressure 5+0.5, −0 kPa

(e) High test pressure 50 kPa for a maximum installation depth of 4 m, 60 kPa for a maximum installation depth of 5 m and 70 kPa for a maximum installation depth of 6 m.

NOTE: For intermediate installation depths interpolate the test pressure.

(f) Negative test pressure -50 kPa for a maximum installation depth of 4 m, -60 kPa for a maximum installation depth of 5 m and -70 kPa for a maximum installation depth of 6 m.

NOTE: For intermediate installation depths interpolate the test pressure.

(g) Angular deflection at the joint:

(i) 2 -0, +0.2° for DN ≤315

(ii) 1.5 -0, +0.2° for 315 <DN ≤630

(iii) 1 -0, +0.2° for DN >630.

3.7.3 *Watertightness of the base to riser connection*

When tested in accordance with ISO 13259, Condition A, under the following conditions, the joints shall not leak:

(a) Test temperature 23 ± 5°C

(b) Low test pressure 5+0.5, −0 kPa

(c) High test pressure 50 – 55 kPa for a maximum installation depth of 4 m, 60 – 65 kPa for a maximum installation depth of 5 m and 70 – 75 kPa for a maximum installation depth of 6 m

NOTE: For intermediate installation depths interpolate the test pressure.

(d) Negative test pressure -50 to -55 kPa for a maximum installation depth of 4 m, -60 to -65 kPa for a maximum installation depth of 5 m and -70 to -75 kPa for a maximum installation depth of 6 m.

NOTE: For intermediate installation depths interpolate the test pressure.

3.7.4 *Watertightness between riser and accompanying components*

When the assembled maintenance shaft or maintenance chamber is filled with water for 15 +5, −0 minutes to a depth of 5 +0.1, −0 m for a maximum installation depth of 4 m, 6+0.1, −0 m for a maximum installation depth of 5 m and 7+0.1, −0 m for a maximum installation depth of 6 m, there shall be no leakage.

NOTE: For intermediate installation depths interpolate the test pressure.

3.7.5 *Watertightness of telescopic section of riser*

When a maintenance shaft or maintenance chamber incorporating a telescopic section in the riser is filled with water for 15 +5, −0 minutes to a depth of 5 +0.1, −0 m for a maximum installation depth of 4 m, 6 +0.1, −0 m for a maximum installation depth of 5 m and 7 +0.1, −0 m for a maximum installation depth of 6 m, there shall be no leakage.

NOTE: For intermediate installation depths interpolate the test pressure.

3.7.6 *Watertightness of cone to riser connection*

When a maintenance shaft or chamber incorporating a cone section at the top of the riser is filled with water for 15 +5, −0 minutes to a depth of 5 +0.1, −0 m for a maximum installation depth of 4 m, 6 +0.1, −0 m for a maximum installation depth of 5 m and 7 +0.1, −0 m for a maximum installation depth of 6 m, there shall be no leakage.

NOTE:For intermediate installation depths interpolate the test pressure.

3.7.7 *Watertigtness of inlet connector in the riser*

When a maintenance shaft or chamber incorporating an inlet connector in the riser is filled with water for 15 + 5, -0 minutes to a depth of 5 +0.1, −0 m for a maximum installation depth of 4 m, 6 +0.1, −0 m for a maximum installation depth of 5 m and 7 +0.1, −0 m for a maximum installation depth of 6 m, there shall be no leakage.

NOTE::For intermediate installation depths interpolate the test pressure.

~~3.7.7~~3.7.8 *Effective seal*

This requirement applies to pipe to base and base to riser and inlet connector elastomeric seal joints.

When determined in accordance with AS/NZS 1462.13, elastomeric seals manufactured to:

(a) AS 1646 and AS 681.1 shall have a contact pressure exceeding 0.4 MPa over a continuous width of ≥4 mm.

(b) AS 1646 and AS 681.2 shall have a contact pressure exceeding 0.47 MPa over a continuous width of ≥4 mm.

3.8 INTEGRITY OF THE LID AND SEAL

3.8.1 *General*

The lid assembly used to close the top of the riser shall comply with the requirements for liquid infiltration. The lid assembly shall be prepared for testing in the same manner as intended for field installation.

3.8.2 *Liquid infiltration test*

When tested in accordance with AS/NZS 1462.8, but without angular deflection or diametric distortion, the lid assembly shall not leak, when subjected to an internal vacuum corresponding to a gauge pressure of −50 to −55 kPa for 60 +5, −0 min.

3.9 CHARACTERISATION OF ROTATIONALLY MOULDED PRODUCT SUBMITTED FOR PERFORMANCE TESTING

The initial product weight of rotationally moulded products, prior to any machining and/or installation of fittings, submitted for performance testing according to this Standard shall be determined before the testing is performed. The individual item weight of subsequent production shall be maintained to within the limits shown in Table 3.2.

TABLE 3.2

CHARACTERISATION OF ROTATIONALLY MOULDED PRODUCTS

Initial product weight kg	Subsequent production %
< 10	> 96
≥ 10 ≤ 50	> 97
> 50	> 98

3.10 RISER AND RISER JOINT LOAD RESISTANCE

3.10.1 *General*

The riser and riser joint(s) shall be designed to withstand the frictional down-drag forces generated either by settlement of the embedment and backfill after installation or as each layer of embedment and backfill is compacted during installation.

The design shall be considered adequate for this purpose by:

(a) adopting a telescopic riser system; or

(b) providing an elastomeric seal joint between the maintenance shaft or chamber and the riser section with an effective settlement allowance of at least 30 mm movement.

Alternatively, if the design does not incorporate the features in Items (a) or (b) above, the design shall be verified by type testing in accordance with Clause 3.10.2.

3.10.2 *Type testing*

When loaded in accordance with Appendix D, then subjected to an internal vacuum, an assembled maintenance shaft or chamber shall not buckle and the joints shall not leak.

Changes in external dimensions shall not exceed the following:

(a) 4% when measured through and at right angles to the centroid of the chamber and the riser.

(b) ±5 mm from a straight line or a flat plane along the invert of the chamber.

4 MANUFACTURE

4.1 DIMENSIONS OF THE BASE AND RISER

The wall thickness of the base shall be measured in accordance with AS/NZS 1462.1 and be not less than the design wall thickness or the wall thickness specified in the relevant product standard, as appropriate.

4.2 WELDING

4.2.1 *PVC*

Where hot-air (rod) welding is performed, all welds shall be partial penetration welds to at least 75% of the wall thickness of the sections being welded. All welding procedures shall be pre-qualified.

4.2.2 *PE and PP*

Where welding is required for fabrication of components butt welding, extrusion welding or electrofusion welding may be used. All welding procedures shall be pre-qualified.

4.2.3 *Training and certification*

Only trained welders shall perform welding of components. The welding of components shall be carried out and supervised by qualified and/or accredited personnel. Personnel who have successfully undertaken internationally recognised plastics welding courses or undertaken the following Units of PMB07 – Competence of Plastics, Rubber and/or Cablemaking training package appropriate to the welding processes used:

(a) PMBPROD287B—Weld plastics materials.

(b) PMBWELD301B—Butt weld polyethylene plastic pipelines.

(c) PMBWELD302B—Electrofusion weld polyethylene pipelines.

(d) PMBWELD309B—Weld plastics using extrusion techniques.

‘Successfully undertaken’ shall mean a ‘Statement of Attainment’ has been awarded for all of the relevant units of competence.

4.3 SOLVENT CEMENT JOINTING

Where solvent cement jointing is required, it shall be performed in accordance with the procedures outlined in AS/NZS 2032. The gap filling cement nominated by the fittings supplier shall be used when jointing fittings with parallel sockets.

5 MARKING REQUIREMENTS

5.1 GENERAL

Maintenance shafts, maintenance chambers and components shall be legibly and permanently marked with the following:

(a) Manufacturer's name or registered trademark.

(b) Date of manufacture identified by at least the month and year.

(c) Material identification in the form 'PVC-U' (or 'PVC'), 'PE', 'PP' or 'PP-MD' as appropriate.

(d) Nominal size in the form 'DN 100' or '100' for the connections and '300' for the riser.

(e) Configuration if the base includes a junction or change in direction.

(f) Identification of the place of manufacture if the manufacturer is producing the product in more than one location either nationally or internationally. The manufacturer's code is acceptable, e.g. 'P1'.

(g) Safe installation depth in the form '4 m' or '*H* m' where '*H*' is the maximum installation depth applied to the durability and structural integrity tests.

(h) The number of this Industry Standard.

Risers shall be marked in accordance with the appropriate product Standard listed in Table 2.1, or as for maintenance shafts and maintenance chambers above.

Marking shall not initiate cracks or other types of defects which might adversely affect the performance of the maintenance shaft or maintenance chamber.

Marking by indentation, whereby the wall thickness is reduced by not more than 0.25 mm, shall be deemed to conform to this clause without infringing the requirements for the wall thickness.

The size of the marking shall be such that it is legible without magnification.

NOTE: Manufacturers making a statement of compliance with this Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

5.2 ADDITIONAL INFORMATION

The manufacturer shall provide additional installation information that includes, but is not limited to, the following:

(a) Worst soil type and compaction allowed.

(b) Highest allowed traffic class.

(c) Specified cover solution.

(d) Sizes and specification of the pipes that the chamber is intended to be connected to.

(e) Drawing of assembled maintenance shaft or maintenance chamber including the near-surface components.

APPENDIX A

MEANS OF DEMONSTRATING COMPLIANCE WITH THIS STANDARD

(Normative)

A1 SCOPE

This Appendix sets out two means by which compliance with this Standard shall be demonstrated by a manufacturer, as follows:

(a) The use of a product certification scheme

(b) The use of a minimum sampling and testing frequency plan.

A2 RELEVANCE

The long-term performance of pipeline systems is critical to the operating efficiency of water agencies in terms of operating licences and customer contracts. The long-term performance of plumbing systems is similarly critical to the durability of building infrastructure, protection of public health and safety and protection of the environment.

A3 BATCH

A3.1 Acceptable quality level (AQL)

When a continuous series of lots or batches is considered, the quality level which for the purpose of sampling inspection is the limit of a satisfactory process average (see AS 1199.1 and ISO 3951 Parts 1, 2, 3 and 5).

NOTE: The designation of an AQL does not imply that a manufacturer has the right to knowingly supply any non-conforming unit of product.

A3.2 Batch

A3.2.1 Material or compound batch

A defined quantity of a homogeneous material or compound produced under uniform conditions. The batch is defined and identified by the material or compound producer.

A3.2.2 Pipes or fittings batch

Schedule of pipes or fittings, all the same nominal diameter, wall thickness and marking, manufactured from the same material or compound on the same machine. The batch is defined and identified by the pipe or fitting manufacturer.

A3.3 Batch release test

A test performed on a sample from the batch or lot to confirm conformance to the requirements of this Standard before the batch can be released.

A3.4 Inspection level

The relationship between the lot or batch size and the sample size (see AS 1199.1).

A3.5 Lot

A clearly identifiable subdivision of a batch for inspection purposes.

A3.6 New formulation

A change in material or compound formulation that exceeds the limits given in Clause A6.

A3.7 Process verification test (PVT)

A test performed on a sample at specific intervals to confirm conformance to the requirements of this Standard before further batches can be released.

A3.8 Sample

One or more units of product drawn from a batch or lot, selected at random without regard to quality.

NOTE: The number of units of product in the sample is the sample size.

A3.9 Sampling plan

A specific plan that gives the number of samples and the frequency of inspection or testing.

A3.10 Type test (TT)

A test performed on a sample to confirm conformance to the requirements of this Standard before any batches can be released.

A4 PRODUCT CERTIFICATION

A4.1 Products claiming conformity with this Standard shall be certified. The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with this Standard.

NOTE Product certification is an impartial third-party attestation that the products conform with this Standard.

A4.2 The certification scheme to undertake the production certification shall:

(a) be based on ISO/IEC TR 17026, Conformity assessment -- Example of a certification scheme for tangible products;

(b) include type testing from independently sampled production;

(c) require the manufacturer's production process to be covered by a quality management system that fulfils the requirements of AS/NZS ISO 9001, Quality management systems - Requirements; and

(d) include subsequent verification of conformance that the manufacturer maintains effective production control, at no greater than 12 monthly interval .

NOTE: The certification scheme serves to indicate that the products consistently conform to the requirements of this Standard.

The certification scheme shall meet the criteria described in HB 18.28 / SANZ HB 18.28 (ISO/IEC Guide 28) in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of this Standard.

Product certification shall be conducted by a certification body accredited by the Joint Accreditation System for Australia and New Zealand (JAS-ANZ) or by another certification body that is acceptable to JAS-ANZ.

The frequency of the sampling and testing plan, as detailed in Clause A5, shall be used by the certifying body for product compliance auditing. However, where the manufacturer can demonstrate adequate process control to the certifying body, the frequency of sampling and testing nominated in the manufacturer's quality and/or documented procedures shall take precedence for the purpose of product certification.

Product certification shall be conducted by a certification body that is accredited as fulfilling the requirements for AS/NZS ISO/IEC 17065, Conformity assessment - Requirements for bodies certifying products, processes and services, by a signatory member of the International Accreditation Forum (IAF) Multilateral Arrangement (MLA), with a relevant scope of accreditation to cover the products being certified.

NOTE In Australia, the signatory member of the IAF MLA is the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

A5 MINIMUM SAMPLING AND TESTING FREQUENCY PLAN

A5.1 General

Table A1 sets out the minimum sampling and testing frequency plan for a manufacturer to demonstrate compliance of product(s) to this Standard.

A5.2 Retesting

In the event of a test failure, the products manufactured since the previous test(s) conforming to the requirements outlined in Table A1 shall be quarantined as a batch. A further set of samples shall be selected randomly from the quarantined batch using a sampling plan to AS 1199.1 for an AQL of 2.5 and an inspection level of S3, unless otherwise specified. If the retest requirements are met, the batch may be released and compliance with this Standard for the quarantined batch may be claimed. Should a failure occur on retesting, then the quarantined batch shall be rejected and claims and/or marking indicating compliance to this Standard shall be suspended until the cause of the failure has been identified and corrected.

A5.3 Rejection after test

In the event of a quarantined batch being rejected after retesting in accordance with the procedures set out in Clause A5.2, it may be subjected to 100% testing for the failed requirement(s), and only those items found to comply may be claimed and/or marked as complying with this Standard.

TABLE A1

MINIMUM SAMPLING AND TESTING FREQUENCY PLAN

Type tests				
Characteristics	**Clause**	**Requirement**	**Test method**	**Frequency**
Material requirements				
Materials General	2.2.1	No lead, cadmium or mercury based additives	Process control records	At any change in material formulation, design or process
Materials for bases	2.2.2	Material compliance of standard materials Material compliance of non-standard materials Durability of standard and non-standard materials: no cracks after 1000 h or 3000 h as appropriate	Confirm third party certification for any materials or components for which compliance with Table 2.1 is claimed Compliance with Clause B5 of Appendix B ISO 13267 and Appendix B	

Type tests				
Characteristics	**Clause**	**Requirement**	**Test method**	**Frequency**
Materials for risers, cones and caps	2.2.3	Material compliance of standard materials Material compliance of non-standard materials	Confirm compliance with Clause 2.2 or third party certification for any risers for which compliance with AS/NZS 1477, AS/NZS 4441 or AS/NZS 4765 is claimed Compliance with Appendix B Clause B5	
Rework	2.2.4	Confirmation that only rework from manufacturer's own production is used.	Process control records	
Elastomeric seals	2.2.5	Compliance with AS 1646 and AS 681.1 or AS 681.2	Product certification to AS 1646 and AS 681.1 or AS 681.2	
Solvent cements	2.2.6	Compliance with AS/NZS 3879	Product certification to AS/NZS 3879	
Material requirements				
Freedom from defects	2.3	Structural and surface defects, condition of sockets and spigot ends, smoothness of internal joints, condition of elastomeric seals.	Visual examination	At any change in material formulation, design or process
Dimensions of sockets and spigots and effective sealing length	2.4	Compliance with appropriate product Standard, drawing or specification	AS/NZS 1462.1	At any change in material formulation, design or process
Packaging, storage, handling and transportation	2.5	Specific requirements for storage depending on material properties Stacking to maintain dimensions and protects ends and projections	Review of manufacturer's instructions and visual verification of storage conditions	
Performance requirements				
Structural integrity of base	3.2	50 year predicted vertical deflections ≤5% and horizontal deflections ≤10%	Appendix C and ISO 13267	At any change in material formulation, design or process

Type tests				
Characteristics	**Clause**	**Requirement**	**Test method**	**Frequency**
Impact resistance of base	3.3	No cracks or other damage that impairs the function of the base	Appendix E	
Ring stiffness of riser	3.4	Ring stiffness ≥4,000 N/m/m	AS/NZS 1462.22	
High temperature stress relief	3.5	No voids, contaminations or delaminations etc as described in Clause 3.5	AS/NZS 1462.11	
Accessibility test	3.6	Passes appropriate proving tool(s) through all connection ports	3.6	
Elastomeric seal joints between pipe and base	3.7.2	No leakage	ISO 13259 Condition D	
Elastomeric seal joints between the riser and base	3.7.3	No leakage	ISO 13259 Condition A	
Performance requirements				
Watertightness between the riser and accompanying components	3.7.4	No leakage	No leakage after 15 min when assembly filled with water to a depth of 4 m	At any change in material formulation, design or process
Watertightness of telescopic section of riser	3.7.5	No leakage	No leakage after 15 min when assembly filled with water	
Watertightness of cone section	3.7.6	No leakage	No leakage after 15 min when assembly filled with water	
Watertightness of Riser inlet connector	3.7.7	No Leakage	No leakage after 15 min when assembly filled with water	
Effective seal	3.7.8~~7~~	Contact pressure ≥0.4 MPa for vulcanised seals and 0.47 MPa for thermoplastic elastomeric seals over a contact width >4 mm	AS/NZS 1462.13	
Integrity of lid and seal – liquid infiltration test	3.8.2	No leakage	AS/NZS 1462.8	At any change in material formulation, design or process
Characterisation of rotationally moulded product.	3.9	Weight variation In accordance with Table 3.2	Weighing machine with a precision of at least 0.5% of the product weight	
Riser and riser joint load resistance	3.10	Withstand frictional down-drag forces of surrounding soil	By design or testing in accordance with Appendix D	
Manufacture				

Type tests				
Characteristics	**Clause**	**Requirement**	**Test method**	**Frequency**
Dimensions of base and riser	4.1	Not less than the design thickness or thickness of relevant Standard as appropriate	AS/NZS 1462.1	At any change in material formulation, design or process.
Welding	4.2	In accordance with Clause 4.2.3 and Clause 4.2.1 or 4.2.2 as appropriate	Visual verification and process control	
Solvent cement jointing	4.3	AS/NZS 2032	Visual verification and process control	

Batch release tests				
Characteristics	**Clause**	**Requirement**	**Test method**	**Frequency**
Freedom from defects	2.3	Structural and surface defects, condition of sockets and spigot ends, smoothness of internal joints, condition of elastomeric seals.	Visual verification	At start up and once per shift
Dimensions of sockets and spigots and effective sealing length	2.4	Compliance with appropriate product Standard, drawing or specification	AS/NZS 1462.1	Once per shift or once per batch, whichever is the more frequent
Packaging, storage, handling and transportation	2.5	Compliance with appropriate installation Standard, product drawing or specification	Visual examination	Once per shift
Ring stiffness of riser	3.4	Ring stiffness ≥ 4,000 N/m/m	AS/NZS 1462.22	At start up and once per week or once per batch, whichever is the more frequent
High temperature stress relief (PVC-U)	3.5	No voids, contaminations or delaminations etc as described in Clause 3.5	AS/NZS 1462.11	At start up and once per shift
Weight of rotationally moulded products	3.9	Table 3.2	Weighing machine with a precision of at least 0.5% of the product weight	
Dimensions of base and riser	4.1	Wall thickness not less than design wall thickness or relevant product Standard as appropriate	AS/NZS 1462.1	At start up and once per shift
Welding	4.2	Welding to be in accordance with nominated specification	Visual verification	
Solvent cement jointing	4.3	Evidence of application of primer	Visual verification	

Batch release tests				
Characteristics	**Clause**	**Requirement**	**Test method**	**Frequency**
		and absence of excess cement and joint made in accordance with AS/NZS 2032		
Marking	5	Complete, legible and permanent	Visual examination and comparison with production records	Each assembly Injection mouldings once per shift

Process verification tests				
Characteristics	**Clause**	**Requirement**	**Test method**	**Frequency**
Materials General	2.2.	Material compliance	Confirm third party certification for any materials or components for which compliance with Table 2.1 is claimed	Once per 2 years
Durability of standard and non-standard materials for bases	2.2.2.1 and 2.2.2.2	No cracks	Appendix B and ISO 13267	Once per year
Characterisation of non-standard materials for risers, cones and caps	2.2.3.2	Table B2	Appendix B Clause B5	
Rework	2.2.4	Confirmation only rework from manufacturer's own production is used	Process control records	
Elastomeric seals	2.2.5	Compliance with AS1646	Product certification to AS 1646	Once per 2 years
Solvent cements	2.2.6	Compliance with AS/NZS 3879	Product certification to AS/NZS 3879	
Impact resistance of maintenance base	3.3	No cracks or other damage that impairs the function of the base	Appendix E	
Elastomeric seal joints between pipe and base	3.7.2	No leakage	ISO 13259 Condition D	
Elastomeric seal joints between the riser and base	3.7.3	No leakage	ISO 13259 Condition A	Once per 2 years
Water tightness between the riser and accompanying components	3.7.4	No leakage	No leakage after 15 minutes when assembly filled with water to a depth of 4 m	
Water tightness of telescopic section of riser	3.7.5	No leakage	No leakage after 15 minutes when	

Process verification tests				
Characteristics	**Clause**	**Requirement**	**Test method**	**Frequency**
			assembly filled with water	
Water tightness of cone section	3.7.6	No leakage	No leakage after 15 minutes when assembly filled with water	
Watertightness of Riser inlet connector	3.7.7	No Leakage	No leakage after 15 min when assembly filled with water	
Integrity of lid and seal – liquid infiltration test	3.8	No leakage	AS/NZS 1462.8	
Riser and riser joint load resistance	3.10	Withstand frictional down-drag forces of surrounding soil	By design or testing in accordance with Appendix D	

A6 NEW FORMULATION

A change in the material / compound formulation occurs when the dosage level of ingredients exceeds the tolerances in Clauses A6.1, A6.2 or A6.3 as appropriate.

A6.1 Material specification of PVC-U

For the purposes of this Standard, the material specification consists of a formulation which defines the K value of the PVC, the nature of the additives and their dosage levels. The dosage level of ingredients of a PVC formulation shall not exceed the tolerance bands given in Table A2.

If any level exceeds the dosage band or if an ingredient type is changed, this variation in formulation constitutes a change in material.

The manufacturer's own rework material from their own production shall be allowed without limitation.

The values of the parts X added to 100 parts by mass of PVC shall be specified by the manufacturer in his quality plan.

TABLE A2

FORMULATION SPECIFICATION FOR PVC

Ingredients	Type	Band
PVC resin	Nominal K value: as specified	± 3 units
Type and content of stabiliser or master batch	1) Ça-Zn 2) Sn 3) Ca-Sn 4) others	X1: ± 25%
Lubricants	All	X2: ± 50% for X2 <0.2 X2: ± 0.1 parts for X2 >0.2
Fillers	1) $CaCO_3$ 2) others	X3: ± 3 parts X4: ± 25%
Impact modifiers	All	X5: ± I part
Flow agents/ processing aids	All	X6: ± 25% for X6 ≤2 X6: ± 0.5 parts for X6 >2
Pigments		No requirement
Others	To be specified by the manufacturer	X7: ± 25%

NOTE : X is the original determined value, specified by the manufacturer in his quality plan.

A6.2 Material specification for PP and PP-MD

For the purposes of this Standard, the PP or PP-MD material specification consists of a compound with specific trade name and additives with known dosage level.

The manufacturer's own rework material of the same compound shall be allowed without limitation.

A change in the commercial compound utilised in the manufacture of the maintenance shaft, chamber or component shall require requalification of the item affected.

A6.3 Material specification for PE

For the purposes of this Standard, the material specification consists of a compound comprising a PE compound with specific trade name and additives with known dosage level.

The manufacturer's own rework material from their own production shall be allowed without limitation.

APPENDIX B

DURABILITY AND MATERIAL TESTING

(Normative)

B1 SCOPE

This appendix sets out the requirements for determining the durability of standard and non-standard materials and the material characteristics of non-standard materials used in specific maintenance shaft and maintenance chamber designs.

B2 APPLICATION

This appendix is applicable to maintenance shafts and maintenance chamber bases manufactured from standard materials and bases, risers, cones and caps manufactured from non-standard materials (refer to Clauses 2.2.2 and 2.2.3).

B3 SAMPLES

Two maintenance shafts or maintenance chamber shall be selected for testing. The base of one shall be subjected to the durability test and the components of the other used for determining the material properties.

B4 TEST PROCEDURE

The durability of maintenance shaft or maintenance chamber bases shall be determined in accordance with ISO 13267 and the test parameters and rating factors given in Table B1. At the duration of the test the base shall be cooled to room temperature and inspected for any evidence of cracking.

TABLE B1

TEST PARAMETERS

Material	Test temperature °C	Rating Factor R (applicable to standard and non-standard materials)
PVC-U	60 ± 2	3.5
PE	80 ± 2	4.1
PE rotational moulded	80 ± 2	3.6
PP	80 ± 2	3.4
PP rotational moulded	80 ± 2	3.6

B5 NON-STANDARD MATERIAL CHARACTERISTICS

Material taken from the second maintenance shaft or maintenance chamber sample shall be tested for the appropriate characteristics in Table B2. Where a mixture of non-standard materials is used for bases, risers, cones and caps, each non-standard material shall be tested.

TABLE B2

MATERIAL CHARACTERISTICS

Characteristics	Test method	Requirement	Rotational moulded	Injection moulded

			PE	PP	PE	PP[2]	PVC-U
Density[1]	ISO 1183-1 or ISO 1183-2	Maximum deviation from agreed value (kg/m^3)	±25	±25	±25	±25	±25
Oxidation induction time (OIT) at 200°C	ISO 11357-6	(minutes)	≥10	≥8	≥10	≥8	NA
K value[3]	ISO 13229		NA	NA	NA	NA	±3
MFR[4]	ISO 1133[5]	Maximum upper deviation from agreed value	*X*[6] >1.5: +20% *X* ≤1.5 +0.3 g/min				NA

'NA' denotes 'Not applicable'.

NOTES

1 Not required for PE complying with AS/NZS 4131, PVC-U complying with AS/NZS 1260 or low pressure moulding materials.

2 For low pressure injection moulded PP components, (melt pressure less than 1400 kPa) the maximum upper deviation can be 100% for MFR <2.0.

3 Not required for PVC-U complying with AS/NZS 1260.

4 No lower limit is placed on the deviation of the MFR.

5 For moulded or fabricated PE use condition T, for rotational moulded PE use condition D and for PP use condition M.

6 *X* is the original determined value.

APPENDIX C

STRUCTURAL INTEGRITY OF BASE

(Normative)

C1 GENERAL

The structural integrity of bases shall be determined as the predicted 50 year deflection at ambient temperatures as described below.

C2 TEST PROCEDURE

The structural integrity of bases shall be determined in accordance with the test procedure given in ISO 13267.

C3 EVALUATION OF DATA

The 50-years deformation can be calculated as described in ISO 13267.

NOTE 1: For the predicted final deformation in the vertical, and the horizontal directions respectively, the final result according to this method of calculation is as follows:

$(\delta/d)v = Y50,v/d$ and $(\delta/d)h = Y50,h/d$.

where d is the nominal width of the flow profile.

If the predicted 50 years vertical deformation is higher than 2% or the horizontal deformation is higher than 4%, the correlation coefficient shall at least be 0.9. In all other cases, the correlation coefficient shall be ignored.

NOTE 2: When the deformation in the horizontal direction (width of flow profile) is less than 10%, normal inspection and cleaning equipment can be entered in the sewer system. When the deformation in the vertical direction is less than 5%, effects on flow performance can be neglected.

APPENDIX D

METHOD FOR LOAD TESTING

(Normative)

D1 SCOPE AND GENERAL

D1.1 Scope

This Appendix sets out a method for the load testing of a maintenance shaft or maintenance chamber to demonstrate the ability of the maintenance shaft or maintenance chamber to resist a load on the riser during and following installation. Following application of the load the maintenance shaft or maintenance chamber is tested for leakage or collapse with a negative internal pressure.

D1.2 Relevant of test

The riser of a maintenance shaft or maintenance chamber is required to withstand frictional down-drag forces generated, either, by settlement of the embedment and backfill after installation or, as each layer of embedment and backfill is compacted during installation.

D1.3 Preparation of test assemblies

A maintenance shaft or maintenance chamber assembled with a riser and pipe stubs, each of 300 mm minimum length, shall be used as the test assembly.

D2 TEST PROCEDURE - LOAD TESTING

D2.1 Principle

A test assembly is subjected to a load and then a partial internal vacuum.

D2.2 Apparatus

The following apparatus is required:

(a) Testing stand—A structurally rigid stand, to be used as a support for the test assemblies.

(b) Supports—At each end of the maintenance shaft or maintenance chamber, the centre-line of the collar shall be supported by a cradle of matching radius with an arc subtending an angle of 90°. Each cradle shall have a width of 50 mm and be mounted on a pinned roller support.

(c) Bearing block—A sufficiently rigid bearing block, to ensure that the load on the riser cap is evenly distributed.

(d) Testing device—A device or other means of load application, such as a hydraulic testing machine or pre-weighed elements, such as ingots, sand-filled bags or other suitable means, for applying the load. The device shall be capable of applying a load greater than the specified test load.

D2.3 Procedure

The procedure shall be as follows:

(a) Secure and condition the test assembly at 20–25°C for 2 +0.5, −0 h within the test stand, so that the load may be applied to the riser cap.

(b) Place the bearing block on the riser cap.

(c) Apply a test load of 15 +0.5, −0 kN, without shock, to the assembly through the bearing block.

(d) Sustain the load for a minimum of 5 min.

(e) Measure the change in external dimensions in accordance with AS/NZS 1462.1.

(f) Release and/or remove the test load.

(g) Inspect and record any evidence of damage including any bucking or collapse and for maintenance shafts and maintenance chambers with reinforcement, any separation between the maintenance shaft or maintenance chamber and its reinforcement, and any delamination, cracking or splitting of the reinforcement.

(h) Within 24 h, continue the vacuum testing in accordance with Clause D3.

D3 TEST PROCEDURE - VACUUM

D3.1 Principle

A test assembly is subjected to an internal vacuum. The assembly is then inspected for distortion.

D3.2 Apparatus

The following apparatus is required:

(a) End connections—Vacuum-tight connections shall be made to the test assembly within the socket, or on the external surface. Provision shall be made for connection to the vacuum system or venting of the pipe of specimen to atmosphere as required. Vacuum shall be applied through one of the end connections.

(b) Pressurising system—A system capable of producing and maintaining the test vacuum pressure.

D3.3 Procedure for vacuum test

The procedure shall be as follows:

(a) Secure and condition the test assembly at 20–25°C for 2 +0.5, −0 h.

(b) Gradually apply an internal vacuum corresponding to a gauge pressure of 80 kPa to 85 kPa for 15 +1, -0 minutes.

(c) At the completion of the test period measure the changes in external dimensions.

(d) At the completion of the test period recording any buckling or collapse and for maintenance shafts or maintenance chambers with reinforcement any separation between the maintenance shaft or maintenance chamber and its reinforcement, and any delamination, cracking or splitting of the reinforcement.

D4 TEST REPORT

The following information shall be reported:

(a) The complete identification of the maintenance shaft or maintenance chamber under test.

(b) The test temperature (°C).

(c) The test load applied to the assembly and the duration of the test.

(d) The change in external dimensions due to the applied load.

(e) The vacuum test pressure applied to the assembly and the duration of the vacuum test (kPa).

(f) Any leakage detected during the vacuum test.

(g) Any change in external dimensions due to the applied vacuum (mm).

(h) Any buckling or collapse and for maintenance shafts or maintenance chambers with reinforcement

(i) Any separation between the maintenance shaft or maintenance chamber and its reinforcement, and any delamination, cracking or splitting of the reinforcement.

(j) Reference to this test method.

APPENDIX E

IMPACT RESISTANCE OF BASE

(Normative)

E1 TEST EQUIPMENT

The test equipment shall be as given in ISO 3127.

E2 RELEVANCE OF TEST

The impact test is a laboratory test carried out under controlled and reproducible conditions to provide a measure of the resistance of the base to impact damage. The base is not tested in an ‘as installed’ configuration. Because the base is not fully supported underneath, the test is more severe than if it was fully embedded in soil.

E3 TEST PROCEDURE

The procedure shall be as follows:

(a) Place the complete maintenance shaft or maintenance chamber base on a vee block in such a way that at least a 30 mm gap between base and block is achieved at point of impact.

For larger bases, the apparatus can be modified to allow those bases to fit. 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 base at the point of impact.

(b) Secure and condition the base at 20–25°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 in the middle of the main flow profile of the base in a vertical position, perpendicular to the base.

(d) Drop a striker type d90 (see ISO 3127) with mass 1 kg, from 2.5 m.

(e) Inspect the impacted area for any evidence of cracking or other damage that might impair the function of the base.

E4 TEST REPORT

The following information shall be reported:

(a) The complete identification of the maintenance base 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 cracking or other damage that might impair the function of the base.

(g) Reference to this test method.