

EPS 500 - Engineering Product Specification for Standard Pipes and Fittings for Networks

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Revision details

Version No.	Clause	Description of revision
1	All	New revision

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Acronyms

Acronym	Definition
Al	Aluminium
CAC	Calcium aluminate cement mortar lined
CC-GRP	Centrifugally cast -- glass reinforced plastic
CIOD	Cast iron outside diameter
CML	Cement mortar lined
Cu	Copper
DI	Ductile iron
FW-GRP	Filament wound -- glass reinforced plastic
GB	General blended
GP	General purpose
GRP	Glass reinforced plastic
MC	Maintenance chambers
MH	Maintenance holes
MS	Maintenance shafts
OD	Outside diameter
PE	Polyethylene
PP	Polypropylene
PU	Polyurethane

Acronym	Definition
PVC-M	Polyvinylchloride modified
PVC-O	Polyvinylchloride oriented
PVC-U	Polyvinylchloride unplasticised
RC	Reinforced concrete
RRJ	Rubber ring jointing
SR	Sulphate resisting
VC	Vitrified clay
WSAA	Water services association of Australia
Zn	Zinc

1. Introduction

This Specification is for the design, supply and construction of network pipes and fittings for Sydney Water assets. It describes the minimum mandatory requirements that manufacturers and suppliers must comply with during manufacturing, fabricating, testing and certification of pipes and fittings that will be used in the construction of Sydney Water's pipe networks.

This specification must be read in conjunction with the associated Australian Standards, International Standards, Water Services Association of Australia (WSAA) Product Specifications, Water Industry Standards and relevant Sydney Water specifications.

It remains the responsibility of the pipe network designer to apply appropriate engineering judgement to the application and appropriate use of the product in the design. This product specification must be read in conjunction with any specific contract documentation for the relevant project.

This document replaces the List of Acceptable Product Specifications (BMIS no. CPDMS0018).

2. Scope

This specification applies to the manufacture, fabricating, testing and certification of standard pipes and fittings used in Sydney Water's drinking water, recycled water, sewerage and stormwater networks. For non-standard products, refer to EPS 501 - List of Approved Non-Standard Products for Networks.

This specification does not apply to pipes and fittings associated with treatment plants.

3. Quality assurance

Products must have third party product certification issued by a conformity assessment body accredited by JAS-ANZ, as evidence of conformity to the relevant specification.

Manufacturers of pipes and fittings covered by this specification must be capable of demonstrating certification of their quality management system to ISO 9001 and environmental management system to ISO 14001 by conformity assessment bodies that are certified by the national accreditation authority.

All items must be suitable for the purpose intended and must be standard commercial items proven in actual service conditions in similar applications. Only manufacturers who are fully experienced, reputable and qualified in the manufacture of such items must supply items specified herein.

4. Water quality

Pipes and fittings that are intended for conveyance of drinking water must comply with the requirements of AS/NZS 4020. Evidence of compliance to AS/NZS 4020 must be less than 5 years old. A scaling factor of 1 for pipe and 0.05 for fittings must be used.

Compliance must apply to pipe and fittings in the finished condition considering all coatings, linings, joint seals, flange gaskets, O-rings, and joint lubricants, which come into contact with the water in the pipeline.

Sydney Water is considering mandating all pipes of DN300 and less that are used for conveying drinking water be supplied, delivered and stored with end caps. For pipes that are produced in Australia, the caps must be fitted at the manufacturing facility. Overseas made pipes must be fitted with caps at the manufacturing facility or the first storage facility in Australia after customs.

Sydney Water is considering transitioning toward lead free products that are used as part of property service connections for drinking water. These products include tapping bands, main taps, fittings, water meters and valves for DN20 and DN25 property services. Lead free products have a maximum lead (Pb) content of 0.25%. Acceptable product testing standards to demonstrate compliance to lead free requirement include, but not limited to, NSF/ANSI 372.

5. Steel pipes and fittings

All steel pipes and fittings must comply with Sydney Water's *EPS 210: Engineering Product Specification for Welded Steel Pipes and Fittings*.

6. Ductile iron pipes and fittings

6.1 Reference standards

Standard No	Document title
WSA PS-200	Ductile Iron Pipes (CIOD) for Pressure Applications - Water Supply and Sewerage
WSA PS-201	Ductile Iron Fittings (CIOD) for Pressure and Non-Pressure Applications - Water Supply and Sewerage
WSA PS-246	Pre-Tapped Connectors for Pressure Applications - Water Supply
WSA PS-320	Sleeving, polyethylene (PE) for ductile iron pipes and fittings - water supply and sewerage

6.2 Requirements

- a) Ductile Iron (DI) pipes and fittings must comply with requirements of WSA Product Specification:
 - i. WSA PS-200
 - ii. WSA PS-201
- b) Pipes must be externally coated with either:
 - i. 50 µm bituminous coating
 - ii. 200 g/m² Zn coating
 - iii. 400 g/m² Zn-Al coating
 - iv. 800 µm PU coating
 - v. 1800 µm extruded PE coating.

Refer to Sydney Water's procedure of "Soil Assessment for Installation of Ductile Iron Pipes without Sleeving" for further details on appropriate selection of external coating.

- a) Fittings must be externally coated with thermal-bonded polymeric coating
- b) Pipes and fittings must be internally cement mortar lined (CML - types GP, GB or SR cement), calcium aluminate cement mortar lined (CAC), or thermal bonded polymeric lined as required
- c) Flanged pipes and fittings must be Flange Class pipe. Spigot and socket pipes and fittings must be PN35
- d) Seal coating is required for drinking water and recycled water DN300 and smaller pipes and fittings
- e) For fittings used in pressure applications, the minimum pressure class is PN35 for cement lined and PN16 for thermal bonded polymeric lined fittings
- f) Pre-Tapped Connectors must comply with requirements of WSA PS-246

- g) Polyethylene sleeving for DI pipes and fittings must comply with WSA PS-320.

7. Polyvinyl chloride (PVC) pipes and fittings

7.1 Reference standards

Standard no.	Document title
WSA PS-209	Polyvinylchloride, Modified (PVC-M) Pressure Pipes for Pressure Applications - Water Supply and Sewerage
WSA PS-210	Polyvinylchloride, Oriented (PVC-O) Pressure Pipes for Pressure Applications - Water Supply and Sewerage
WSA PS-211	Polyvinylchloride, Unplasticised (PVC-U) Pressure Pipes for Pressure Applications - Water Supply and Sewerage
WSA PS-212	Ductile Iron Fittings (CIOD) for Plastics Pressure Pipe for Pressure and Non-Pressure Applications - Water Supply and Sewerage
WSA PS-230	Polyvinylchloride, Unplasticised (PVC-U) Pipes and Fittings for Non-Pressure Applications - Sewerage and Drainage
AS/NZS 1254	PVC-U pipes and fittings for stormwater and surface water applications

7.2 Requirements

7.2.1 Pressure applications

- a) Modified (PVC-M), Oriented (PVC-O) and Unplasticised (PVC-U) Polyvinylchloride pipes and fittings for pressure applications must comply with requirements of WSAA Product Specification:
 - i. WSA PS-209
 - ii. WSA PS-210
 - iii. WSA PS-211, as applicable.
- a) Ductile iron fittings for use with PVC pipes must comply with requirements of WSA PS-212
- b) The minimum pressure class of PVC pipes must be PN16
- c) Pipe material classification for PVC-O pipes must not be less than 450
- d) All PVC pipe must be joined by elastomeric ring joints.

7.2.2 Non-pressure applications (sewerage and drainage, stormwater)

- a) Un-plasticised Polyvinyl Chloride (PVC-U) pipes and fittings for sewerage and drainage must comply with requirements of WSAA Product Specification WSA PS-230. Pipes must be Stiffness Class SN10 up to DN100 and SN8 for DN150 and above.
- b) Un-plasticised Polyvinyl Chloride (PVC-U) pipes and fittings for stormwater must comply with requirements of AS/NZS 1254. Pipes and fittings must be Stiffness Class SN8.
- c) Fittings must have a minimum stiffness class of SN8
- d) Method of jointing must be rubber ring (RRJ) or solvent cement

- e) Pipe colour sewerage and drainage must be grey to AS 2700 no darker than cloud grey N22 and no lighter than pearl grey N11
- f) Pipe colour for stormwater must be white.

8. Polyethylene pipes and fittings

8.1 Reference standards

Standard no	Document title
WSA PS-207	Polyethylene (PE) Pipes for Pressure Applications - Water Supply and Sewerage
WSA PS-208	Plastics Moulded Fittings for Pressure Applications with PE Pipe - Water Supply and Sewerage
WSA PS-216	Polyethylene (PE) Fabricated Fittings for Pressure Applications - Water Supply and Sewerage
WSA PS-218	Fabricated Polyethylene (PE) Fittings and Post Formed Bends for Non-Pressure Applications - Sewerage
WSA PS-242	Polyethylene (PE), Plain Wall, Pipes and Fittings for Non-Pressure Applications - Sewerage
WSA PS-245	Ductile Iron Fittings with Restrained Flexible Joints for Polyethylene Pipe of Nominal Sizes 90 to 1000 in Pressure Applications – Water Supply and Sewerage
WSA PS-281	Gate valves, resilient seated, with restrained flexible joints for polyethylene pipe in pressure applications – water supply and sewerage

8.2 Requirements

8.2.1 Pressure applications

- a) PE pipes and fittings must comply with requirements of WSAA Product Specifications:
 - i. WSA PS-207
 - ii. WSA PS-208
- b) Fabricated PE Fittings must comply with requirements of WSA PS-216
- c) Ductile iron fittings for use with PE pipes must comply with requirements of WSA PS-245
- d) PE pipes and fittings for pressure applications must be PE100 Series 1.
- e) Fabricated PE fittings for pressure applications must comply with WSA PS-216
- f) The minimum pressure class of PE pipes and fittings must be PN16
- g) Resilient seated gate valves with restrained flexible joints must comply with the requirements of WSA PS-281
- h) Unless specified otherwise, all flanges must be circular and conform in dimension and drilling to AS/NZS 4087 PN16
- i) The colour for pressure pipeline must be:
 - i. Drinking Water - Blue or black with blue stripes

- ii. Recycled Water - Purple or black with purple stripes
- iii. Pressure Sewer - Cream or black with cream stripes.

8.2.2 Non-pressure application

- a) PE plain wall pipes and fittings for non-pressure applications must comply with requirements of WSA PS-242
- b) Fabricated PE Fittings and Post Formed Bends must comply with requirements of WSA PS-218
- c) The minimum stiffness class must be SN8
- d) The pipe colour for non-pressure sewer pipe must be black with co-extruded white or light grey interior suitable for CCTV inspection

9. Polypropylene (PP)

9.1 Reference standards

Standard no.	Document title
WSA PS-240	Polypropylene (PP), Ribbed Construction, Pipe and Fittings for Non-Pressure Applications - Sewerage

9.2 Requirements

- a) The pipes and fittings must comply with requirements of WSAA Product Specifications WSA PS-240
- b) The minimum Pipe Stiffness Class must be SN10
- c) Pipe colour must be black.

10. Reinforced concrete (RC)

10.1 Reference standards

Standard no.	Document title
WSA PS-233	Reinforced Concrete (RC) Plastics-Lined Pipes for Non-Pressure Applications - Sewerage
WSA PS-249	Reinforced Concrete (RC) Unlined Rubber Ring Jointed Pipes for Non-Pressure Applications - Drainage in Open Trench Installations
CPDMS0023	Technical Specification - Civil

10.2 Requirements

- a) The pipes and fittings must comply with requirements of WSAA Product Specifications WSA PS-233. Unreinforced or fibre reinforced concrete pipes are not permitted.
- b) Reinforced concrete pipes in sewerage networks must be internally lined complying with the requirements of WSA 113
- c) The minimum pipe class must be Class 4

- d) Concrete and cover to reinforcement must comply with the requirements of CPDMS0023.

11. Vitrified clay (VC)

11.1 Reference standards

Standard no.	Document title
WSA PS-231	Vitrified Clay (VC) Pipes and Fittings for Non-Pressure Applications - Sewerage

11.2 Requirements

- a) The pipes and fittings must comply with requirements of WSAA Product Specifications WSA PS-231.

12. Glass reinforced plastic (GRP)

12.1 Reference standards

Standard no.	Document title
WSA PS-205	Filament Wound Glass Reinforced Plastics (FW-GRP) Pipes and Fittings for Pressure Applications - Water Supply
WSA PS-205J	WSA PS - 205J Centrifugally Cast Glass Reinforced Plastics (CC-GRP) Pipes for Pressure And Non-Pressure Applications - Water Supply And Sewerage - Installed Using Trenchless Installation
WSA PS-205S	Filament Wound Glass Reinforced Plastics (FW-GRP) Pipes and Fittings for Pressure and Non-Pressure Applications - Sewerage
WSA PS-206J	WSA PS - 206J Filament Wound Glass Reinforced Plastics (FW-GRP) Pipes for Pressure And Non-Pressure Applications - Water Supply And Sewerage - Installed Using Trenchless Installation

12.2 Requirements

- a) Glass reinforced plastic (GRP) pressure pipes and fittings in open trench installations in water and wastewater applications must comply with requirements of WSAA Product Specification:
- i. WSA PS-205
 - ii. WSA PS-205S, as applicable.
- b) Glass reinforced plastic (GRP) pressure pipes in trenchless installations in water and wastewater applications must comply with requirements of WSAA Product Specification:
- i. WSA PS-205J
 - ii. WSA PS-206J, as applicable.
- c) Centrifugally Cast Glass reinforced plastic (CC-GRP) non-pressure pipes and fittings in open trench installations for wastewater applications must comply with requirements of AS 3571.1.
- d) The minimum pressure rating must be PN16 for pressure applications
- e) The minimum stiffness class must be SN10000

- f) The outside diameter (OD) for pressure water applications must correspond to the Cast Iron Outside Diameter (CIOD) as specified in AS 2280.

13. Property services pipes

13.1 Reference standards

Standard no.	Document title
WSA PS-214	Copper (Cu) property service pipes for pressure applications - water supply
WSA PS-215	Polyethylene (PE) property service pipes for pressure applications - water supply
WSA PS-247	Metallic bodied mechanical compression joint fittings for pressure applications with polyethylene (PE) pipe of nominal sizes DN 20 to DN 90 - water supply and sewerage

13.2 Requirements

- a) Property services pipes and fittings must comply with requirements of WSAA Product Specification:
- i. WSA PS-214
 - ii. WSA PS-215
 - iii. WSA PS-247
- b) Copper tube dimension must be Type A or B
- c) Copper tube hardness must be “bendable” temper
- d) Polyethylene property service pipes must be:
- i. minimum pressure class PN16
 - ii. series 1 pipe dimension
 - iii. compound PE100
 - iv. blue or black with blue stripes for water
 - v. purple or black with purple stripes for recycled water.

14. Casing spacers

14.1 Reference standards

Standard no.	Document title
WSA PS-324	Casing spacers

14.2 Requirements

- a) Casing spacers must comply with requirements of WSAA Product Specification WSA PS-324

15. Clamps

15.1 Reference standards

Standard no.	Document title
WSA PS-313	Repair and off-take clamps for pressure applications - water supply

15.2 Requirements

- a) Repair and off-take clamps must comply with requirements of WSAA Product Specification WSA PS-313

16. Tapping bands

16.1 Reference standards

Standard no.	Document title
WSA PS-310	Tapping bands - mechanical for pressure applications - water supply
WSA PS-327	Tapping bands, mechanical, for use with polyethylene (PE) mains for pressure applications - water supply
WSA PS-329	Tapping saddles, electrofusion, for use with polyethylene (PE) mains for pressure applications - water supply and sewerage

16.2 Requirements

- a) Tapping bands must comply with requirements of WSAA Product Specification:
- i. WSA PS-310
 - ii. WSA PS-327
 - iii. WSA PS-329

17. Main taps and fittings

17.1 Reference standards

Standard no.	Document title
AS 3718	Water supply - Tap ware
AS 3688	Water supply and gas systems - Metallic fittings and end connectors

17.2 Requirements

- a) Main taps must comply with requirements of AS 3718
- b) Fittings must comply with requirements of AS 3688.

18. Flange gasket and O-rings

18.1 Reference standards

Standard no	Document title
WSA PS-312	Flange gaskets and O-rings

19. Hydrants

19.1 Reference standards

Standard no.	Document title
WSA PS-267	Hydrants (spring) for pressure applications - water supply

19.2 Requirements

- a) Hydrants must comply with requirements of WSAA Product Specification WSA PS-267

20. Hydrant and air valve isolator valves - water supply

20.1 Reference standards

Standard no.	Document title
WSA PS-282	Hydrant and air valve isolator valves - water supply

20.2 Requirements

- a) Hydrant and air valve isolator valves must comply with requirements of WSAA Product Specification WSA PS-282

21. Pipe couplings

21.1 Reference standards

Standard no.	Document title
WSA PS-235	Couplings, metal-banded flexible, for non-pressure applications - sewerage
WSA PS-270	Mechanical Couplings, Non-End Thrust Restraint for Pressure Applications - Water Supply and Sewerage
WSA PS-271	Mechanical Couplings and Flange Adapters, End Thrust Restraint, for Pressure Applications - Water Supply and Sewerage

21.2 Requirements

21.2.1 Pressure

- a) Mechanical couplings for pressure water and sewerage applications must comply with requirements of WSAA Product Specification:
- i. WSA PS-270

- ii. WSA PS-271, as applicable
- b) Flanges must comply with requirements of AS4087.

21.2.2 Non-pressure

- a) Metal-banded flexible couplings for gravity sewers must comply with requirements of WSA PS-235
- b) The metal band and fasteners must be stainless steel grade 316.

21.2.3 Thrust restraint

- a) Thrust restraint mechanical couplings and flange adapters must comply with WSA PS-271.

22. Gate valves

22.1 Reference standards

Standard no.	Document title
WSA PS-260	Gate valves, resilient seated for pressure applications - water supply and sewerage
WSA PS-261	Gate valves, metal seated for pressure applications - water supply and sewerage
WSA PS-278	Gate valves, resilient seated, with integral polyethylene (PE) end for pressure applications - water supply and sewerage
WSA PS-283	Gate valves, resilient seated, for underpressure linestopping – water supply
BMIS0209	Sydney Water Technical Specification - Mechanical

22.2 Requirements

- a) Gate valves must comply with requirements of:
 - i. WSA Product Specification WSA PS-260, WSA PS-261, WSA PS-278 and WSA PS-283
 - ii. BMIS0209.

23. Ball valves

23.1 Reference standards

Standard no.	Document title
WSA PS-274	Ball valves for pressure applications - water supply
BMIS0209	Sydney Water Technical Specification - Mechanical

23.2 Requirements

- a) Ball valves must comply with requirements of
 - i. WSA Product Specification WSA PS-274
 - ii. BMIS0209.
- b) Ball valves for property service connection with plastic female thread must be reinforced with a metallic band.

24. Air valves

24.1 Reference standards

Standard no	Document title
WSA PS-265	Air valves for pressure applications - water supply
WSA PS-275	Air valves for pressure applications - sewerage
BMIS0209	Sydney Water Technical Specification Mechanical

24.2 Requirements

- a) Air valves must comply with requirements of
 - i. WSAA Product Specification WSA PS-265 and WSA PS-275
 - ii. BMIS0209.

25. Access covers and frames

25.1 Reference standards

Standard no	Document title
WSA PS-290	Ductile Iron access covers and frames for water supply and sewerage to WSA 132
WSA PS-292	Macro-composite access covers and frames for water supply and sewerage to WSA 133
WSA PS-293	Thermoplastic access covers and frames for water supply and sewerage
WSA PS-294	Composite access covers and frames for water supply and sewerage

25.2 Requirements

- a) Access covers and frames for water supply and sewerage must comply with requirements of WSA PS-290.
- b) Thermoplastic access covers and frames must comply with requirements of:
 - i. WSA PS-292
 - ii. WSA PS-293
 - iii. WSA PS-294
- c) Covers and frames must be supplied with stainless steel holding down bolts
- d) Thermoplastic access covers must be class B.

26. Maintenance Hole Make-up Rings

26.1 Reference standards

Standard no	Document title
WSA PS-323	Maintenance Holes (MH) - Pre-Cast Concrete for Non-Pressure Applications - Gravity Sewerage
WSA PS-345	Polymeric Make-up Rings for Sewerage Access Chambers.

26.2 Requirements

- a) Concrete maintenance hole make-up rings must comply with requirements of:
 - i. WSA PS-323
- b) Thermoplastic maintenance hole make-up rings must comply with requirements of:
 - ii. WSA PS-345
- c) Make-up rings must be supplied with suitable flexible joint sealants and stainless steel holding down bolts

27. Maintenance holes (MH)

27.1 Reference standards

Standard no.	Document title
WSA PS-323	Maintenance Holes (MH) - Pre-Cast Concrete for Non-Pressure Applications - Gravity Sewerage
WSA PS-333	Pre-Cast Concrete Conical Bases for Concrete Maintenance Holes (MH) for Non-Pressure Applications - Gravity Sewerage
WSA 137	Uplasticized polyvinyl chloride (PVC-U), polypropylene (PP) and Polyethylene (PE) maintenance shafts, maintenance chambers and maintenance holes for sewerage
CPDMS0023	Sydney Water Technical Specification - Civil

27.2 Requirements

- a) Pre-cast concrete MH for non-pressure sewerage application must comply with WSA PS-323
- b) Pre-cast concrete conical bases for concrete MH for non-pressure sewerage application must comply with WSA PS-333
- c) Plastic MH for non-pressure sewerage application must be comply with WSA 137
- d) Pre-cast Concrete MH must comply with the requirements of CPDMS0023.

28. Maintenance chambers (MC)

28.1 Reference standards

Standard no	Document title
WSA PS-331	Maintenance Chambers (MC) - Pre-Cast Concrete for Non-Pressure Applications - Gravity Sewerage
WSA PS-337	Maintenance Chambers (MC) - Polypropylene (PP) for Non-Pressure Applications - Sewerage
WSA PS-338	Maintenance Chambers (MC) - Polyethylene (PE) for Non-Pressure Applications - Sewerage
CPDMS0023	Sydney Water Technical Specification - Civil

28.2 Requirements

- Pre-cast concrete MC for non-pressure sewerage application must comply with requirements of WSA PS-331
- Polypropylene MC for non-pressure sewerage application must comply with requirements of WSA PS-337
- Polyethylene MC for non-pressure sewerage application must comply with requirements of WSA PS-338.
- Pre-cast Concrete MH must comply with the requirements of CPDMS0023.

29. Maintenance shafts (MS)

29.1 Reference standards

Standard no.	Document title
WSA PS-321	Maintenance Shafts (MS) - Polyvinylchloride, Unplasticised (PVC-U) For Non-Pressure Applications - Sewerage
WSA PS-322	Maintenance Shafts (MS) - Polyethylene (PE) For Non-Pressure Applications - Sewerage
WSA PS-341	Maintenance Shafts (MS) - Polypropylene (PP) for Non-Pressure Applications - Sewerage

29.2 Requirements

- Polyvinylchloride MS for non-pressure sewerage application must comply with requirements of WSA PS-321
- Polyethylene MS for non-pressure sewerage application must comply with requirements of WSA PS-322
- Polypropylene MS for non-pressure sewerage application must comply with requirements of WSA PS-341

30. Surface fittings

30.1 Reference standards

Standard no.	Document title
AS 3996	Access covers and grates
EPS-352	Stop valve - surface cover and frame
EPS-354	Spring hydrant - surface cover and frame
EPS-359	Plastic surround for spring hydrant and stop valve covers
WAT-1305-V and WAT-1306-V	Typical surface fitting installation - hydrants

30.2 Requirements

- a) Access covers for MH, MC and MS and other structures must comply with the requirements of AS 3996
- b) Surface cover and frame for stop valves must comply with requirements of AS 3996 and EPS-352
- c) Surface cover and frame for spring hydrant must comply with requirements of AS 3996 and EPS-354
- d) Surface cover and frame for isolation valve with hydrant or air valve must comply with requirements of AS 3996 and WAT-1305-V and WAT-1306-V
- e) Plastic surround for spring hydrant and stop valve covers must comply with requirements of EPS-359.

31. Marking tape

31.1 Reference standards

Standard no.	Document title
WSA PS-318	Marking tape, detectable
WSA PS-319	Marking tape, non-detectable

31.2 Requirements

- a) Marking tape must comply with requirements of WSAA Product Specification:
 - i. WSA PS-318
 - ii. WSA PS-319.

32. Tracer wire

32.1 Reference standards

Standard no.	Document title
WSA PS-343	Tracer wire, detectable

32.2 Requirements

- a) Tracer wire must comply with requirements of WSAA Product Specification WSA PS-343

Document ownership and change history

Ownership

Role	Title
Group	Urban Design and Engineering (UD&E)
Owner	Manager, UD&E
Author	Jerry Sunarho, Senior Engineer

Change history

Version No.	Prepared by	Date	Approved by	Issue date
1	Jerry Sunarho, Gary de Leeuw, Robert Loncar	18/02/2020	Steve Keevil-Jones, Manager UD&E	18/02/2020

Appendices

Attachment	Title