Water Supply and Sewerage Approved Products Manual - February 2006

Gravity Sewerage Products - Maintenance Structures

Section SGO 01

PowerWater

MAINTENANCE STRUCTURES CONTENTS

SGO 01-S1 PRECAST CONCRETE MAINTENANCE HOLES - SHAFT SEGMENTS

STANDARD	AS 3735:2001	Concrete structures for retaining liquids
	AS 4058:1992	Precast concrete pipes (pressure and non-pressure)(pipe shaft segments)

DRAWING Power and Water: W2-2-02, W2-2-01D WSA 02: SEW-1300

DE

WITHDRAWN

exposure classification C to Table of AS 3735 supplement 1

Concrete cover to reinforcement for pipe shaft segments exceeds minimum requirements of AS 4058 (Table 3.3 10 mm) and is governed by the available manufacturer's pipe moulds. Reinforcing in shaft segments is to be circular, not elliptical. DN1050 & 1200 shaft segments to withstand ultimate loads 63 kN/m and 69 kN/m respectively.

MATERIALS	Concrete:	
	Shaft segments:	To AS 4058 section 2, concrete mix design sufficient to achieve Class 2 load classification
	Cement::	Type GP cement to AS 3972 for normal class concrete. Type SR cement for special class concrete
	Aggregate:	To AS 2758.1, no durability exposure classification specified, no maximum water absorption of coarse aggregate specified
	Reinforcement:	Welded wire fabric, wire and bars to AS/NZS 4671
	Reo supports:	Stainless steel grade to ASTM A 276 grade 304 or plastic
	Joint seal:	Approved epoxy
	Coatings:	Approved high build solventless epoxy (2 coats min.) where specified
INTERNAL SURFACE	Appearance:	To AS 4058 clause 3.3.3 and 3.3.4, free from defects that would impair strength or serviceability
	Smoothness:	To AS 4058 clause 3.3.3 equivalent to a steel trowel finish

SEGMENT JOINTS Flush jointed ends with epoxy mortar jointing

REO COVER Internally: 27 mm[1] (min spun or rolled pipe shaft segments) Externally: 27 mm[1] (min spun or rolled pipe shaft segments)
Note 1: Actual cover exceeds minimum cover

INTERNAL DIAM. Shaft Segments: 1050 mm and 1200 mm nominal minimum

MARKINGS
Manufacturer's name or registered trademark
Date and place of manufacture
Maximum mass of pipe in kilograms.
For pipes the nominal size and load class
Australian Standard number, i.e. AS 4058 (pipe shaft segments)(if product certification obtained)
Product certification mark (if product certification obtained), e.g. StandardsMark
Internal and external cover

MARKING METHOD Clearly and indelibly marked in an easily visible location.

SGO 01-S1A PRECAST CONCRETE MAINTENANCE HOLES (INTERIM)

STANDARD	AS 4198:1994	Precast concrete access chambers for sewerage applications
	AS 3735:2001	Concrete structures for retaining liquids

DESIGN

Concrete constituents and reinforcement cover have been chosen to provide improved performance. Maintenance holes within the Northern Territory are:

- mostly exposed internally to stale sewage due to high ambient temperatures and under alternate wet and dry (condensation, splashing or washing) conditions this equates to exposure classification D in Table 4.1 of AS 3735. This condition is exacerbated by high sulphate levels present in water supplies sourcing ground water.
- Exposed externally under worst case conditions to ground water in sandy soils, which may be saline with resistivity < 10Ω.m or having sulphates > 6000 ppm; this equates to exposure classification C to Table 4.1 of AS 3735 supplement 1

Concrete cover to reinforcement is derived from Table 4.3 of AS 3735. The cover decreases with increased concrete strength so the highest strength concrete is to be adopted to minimise cover. Reinforcing in shaft segments is to be circular, not elliptical.

All components to be designed to withstand an ultimate load test of 210 kN.

MATERIALS

Concrete:	Concrete to AS 1379/AS 3735 with compressive strength (f'c) of 50 MPa min at 28 days, nominal slump 80 mm, cement content of 400 kg/m^3 min. Water absorption of 6.5% maximum to AS 4198. Water/cement ratio not to exceed 0.5 and maximum drying shrinkage at 56 days of 700 x 10^{-6}.
Cement:	Generally Type GP cement to AS 3972 or where specified Type SR cement to AS 3972.
Aggregate:	Aggregate to AS 2758.1, durability for exposure classification C and maximum water absorption of 2.5%. Coarse aggregate with maximum particle size of 20 mm.
Reinforcement:	Welded wire fabric, wire and bars to AS/NZS 4671
Reo supports:	Stainless steel grade to ASTM A 276 grade 304, or plastic
Joint seal:	Approved epoxy
Coatings:	Approved high build solventless epoxy (2 coats min.) where specified

INTERNAL SURFACE

Appearance:	To class 2X finish shown in photograph in Appendix B of AS 3610 with blowhole depth not to exceed 5 mm.
Smoothness:	Hand finish as necessary to remove abrasive roughness. Do not bag.

SEGMENT JOINTS Flush jointed with epoxy mortar jointing

REO COVER Internally: 45 mm (min) Externally: 45 mm (min)

INTERNAL DIAM. Shaft Segments: 1100 mm nominal minimum

MARKINGS

Manufacturer's name or registered trademark, or both
For unreinforced components, 'U'. For reinforced components, 'R'.
Date and place of manufacture, or the manufacturer's traceability code incorporating date
Maximum mass of component in kilograms.
The Australian Standard number, i.e. AS 4198 (if product certification obtained)
Product certification mark (if product certification obtained) e.g. StandardsMark
For components using Type SR cement, 'SR'

MARKING METHOD Clearly marked in an easily visible location. Marking of cover slab to be on the top surface. Major top components to have permanent and indelible marking on the inside surface. Other components need not have permanent marking.

SGO 01-S1B PRECAST CONCRETE MAINTENANCE HOLES

STANDARD	AS 4198:1994	Precast concrete access chambers for sewerage applications
	AS 3735:2001	Concrete structures for retaining liquids

DESIGN

Concrete constituents and reinforcement cover have been chosen to minimise the rate of concrete corrosion. Maintenance holes within the Northern Territory are:

- mostly exposed internally to stale sewage due to high ambient temperatures and under alternate wet and dry (condensation, splashing or washing) conditions this equates to

MATE

		100 kg/m³ min. Water absorption of 6.5% maximum to AS 4198. Water/cement ratio not to exceed 0.5 and maximum drying shrinkage at 56 days of 700 x 10^{-6}.
	Cement:	Type SR (sulphate resisting) blended cement to AS 3972
	Aggregate:	To AS 2758.1, durability for exposure classification C and maximum water absorption of 2.5%. Calcareous coarse aggregate with maximum particle size of coarse aggregate 20 mm.
	Reinforcement:	Welded wire fabric, wire and bars to AS/NZS 4671
	Reo supports:	Stainless steel grade to ASTM A 276 grade 304 or plastic
	Joint seal:	Approved epoxy
	Coatings:	Approved high build solventless epoxy (2 coats min.) where specified
INTERNAL SURFACE	Appearance:	To class 2X finish shown in photograph in Appendix B of AS 3610 with blowhole depth not to exceed 5 mm.
	Smoothness:	Hand finish as necessary to remove abrasive roughness. Do not bag.

SEGMENT JOINTS	Flush jointed with epoxy mortar jointing
REO COVER	Internally: 45 mm (min) Externally: 45 mm (min)
INTERNAL DIAM.	Shaft segments: 1100 mm nominal minimum
MARKINGS	Manufacturer's name or registered trademark, or both For unreinforced components, 'U'. For reinforced components, 'R'. Date and place of manufacture, or the manufacturer's traceability code incorporating date Maximum mass of component in kilograms. The Australian Standard number, i.e. AS 4198 (if product certification obtained) Product certification mark (if product certification obtained), e.g. Standardmark
MARKING METHOD	Clearly marked in an easily visible location. Marking of cover slab to be on the top surface. Major top components to have permanent and indelible marking on the inside surface. Other components need not have permanent marking.

SGO 01-S2 PLASTIC MAINTENANCE HOLES

STANDARD	DIN 19537-3:90	Prefabricated high density polyethylene manholes for use in sewerage systems; dimensions and technical delivery conditions
	DIN 19565-5:90	Prefabricated glass fibre reinforced plastic (UP-GF) manholes for use in sewerage systems; dimensions and technical delivery conditions
	ASTM D3753-81(86)	Glass-Fibre-Reinforced Polyester Manholes

DESIGN

Plastic maintenance holes are to be of circular cross section only and are to be of appropriate ring stiffness, shape and design to resist:

- External hydrostatic pressures up to 6m pressure head to invert without buckling
- Overburden loads from the cover slab and traffic or maintenance vehicles without distortion or crushing.
- External pressure on placement of any surrounding or encasing concrete
- Surrounding soil differential loading, if not concrete encased (uniform compaction of soil about a plastic maintenance hole can be difficult to achieve and can lead to localised distortion of the ring cross section)
- Flotation (Lightweight plastic maintenance holes may require to be anchored into the ground using concrete, depending on the level of the water table above invert. Soil over the maintenance hole's pipeline connection stubs will provide some flotation resistance.)

Segmental component structure of plastic MH's for component field assembly or incorporating elastomeric sealing segments is not permitted as joints;

- diminish the structure's ability to support overburden loads; and
- can be a source of leakage due to uneven soil pressures causing differential distortion of adjacent segments.

All plastic maintenance holes are to be subject to an external hydrostatic pressure test before acceptance (in a test tank with appropriate restraint to prevent flotation).

MATERIALS

GRP to AS 3571 and AS 2634
Polyethylene to AS/NZS 4131, Type 80B or 80C

INTERNAL DIAM.

1050 mm and 1200 mm

MARKINGS

Manufacturer's name or registered trademark, or both
Date and place of manufacture, or the manufacturer's traceability code incorporating date
Maximum mass of component in kilograms

MARKING METHOD

Clearly marked in an easily visible location on the inside wall. Lettering height 20 mm minimum

USE LIMITS

To be defined on application for approval
Use of polyethylene products north of Alice Springs not preferred due to risk of termite damage

SGO 01-S3 MAINTENANCE HOLE ACCESS COVERS AND FRAMES

STANDARD	AS 3996: 1992 Metal access covers, road grates and frames
DRAWING	Power and Water: W2-2-02 WSA 02: SEW-1308
DESIGN	Unit (cover and frame) to withstand loads applicable for the location of use as defined by the class. Mating surfaces of cover and frame to be machined to provide; ▪ even and secure seating of cover in frame; ▪ permanent elimination of movement or dislodgment by normal traffic; and ▪ a watertight or gastight seal as required when coated with 0.25 mm grease or equivalent. Cover to include lifting holes with preferred dimensions as given in AS 3996 figure 3.1 and clockwise key engagement. Lifting keyholes to be fitted with removable plastic plugs to prevent material ingress. Recessed or infill type covers to have cross webbed, cellular construction not less than 15 mm deep to allow for concrete infill extending to within 25 mm of the outside of the frame at surface level but excepting keyhole housings and manufacturer's name or identification mark. Clearance between cover and frame and between covers in multiple cover units not to exceed 3 mm as measured at the cover surface. Concrete not to be proud of the metal top of the unit by more than 1 mm. Clearance between a straight edge and the top of a unit not to exceed 3 mm at any position that the straight edge is laid. Covers to be interchangeable in any frame from that manufacturer.
MATERIALS	Cover & frame: Ductile cast iron grade AS 1831/500-7 or 600-3 Grey cast iron grade AS 1830/T220 Frame bolts: Stainless steel to ASTM A276 grade 316 Concrete infill: Concrete to AS 1379 with minimum compressive strength of 32 Mpa at 28 days and minimum cement content of 400 kg/m^3 Coating: Bitumen to BS 3416 type II where cold applied and to BS 4147 type I grade C where hot applied Tar to BS 4164
ALLOWED CLASSES AND FINISH	Class D: Road reserves including the verge, nature strip or footpath and walkways or malls. Surface of cover to be flush with surrounding finished surface level. Class B: Other areas than specified for class D. Surface of cover 150 mm minimum above the surrounding finished surface level. Class C: Non-urban areas where specified
ALLOWED SHAPES AND CLASS LIMITS	Rectangular (900 mm x 600 mm clear opening): Class B, C and D Circular (600 mm diameter clear opening): Class B and D
ALLOWED TYPES	Sewerage: Gastight sealed recessed or solid top Non-sewerage (valve pits etc): Watertight sealed recessed or solid top
MARKINGS	Manufacturer's name or registered trademark Year of manufacture Code indicating place of manufacture Register or marking to show orientation of cover in frame (if specific orientation is essential). Class and type of unit, e.g. Class D, Watertight sealed Approximate maximum mass of the unit (cover & frame) including concrete, visible from above The Australian Standard number, i.e. AS 3996 Product certification mark, e.g. StandardsMark
MARKING METHOD	Legible marking. Items 4) and 5) to be permanent.
USE LIMITS	Solid top covers are required to be bolted to the maintenance hole. Use of cover shapes is specified on Power and Water standard drawings.

SGO 01-S4 PLASTIC MAINTENANCE SHAFTS

STANDARD	AS/NZS 4999 (Int) :2003 PVC-U Maintenance Shafts WSA 102 : Polyethylene Maintenance Shafts	
DRAWING	Power and Water: W2-2-07, W2-2-08, W2-1-09 WSA 02: SEW-1313 to SEW-1317	
DESIGN	Plastic maintenance shafts are to comprise a base chamber and a pipe riser. The riser may include junction fittings for property connections. The riser is to be adjustable to within 0.5° of vertical using fine angle bends (1 to 5°) at the chamber/riser connection. Plastic maintenance shafts are to be of a design to permit unimpeded access of maintenance equipment (i.e. jetters, cutters, sealing plugs, cameras, etc.) into the pipeline and allow unhindered operation of equipment from the surface. Internal surfaces of joints are to be smooth. The base chamber is to be of appropriate stiffness, shape and design to resist: ▪ External hydrostatic pressures up to 6 m pressure head to invert without buckling ▪ Soil loads up to 6 m depth to invert without cracking or significant deformation (negative or inward side deflection and inward curvature at any point is not allowed) ▪ Flotation	
MATERIALS	Base chamber:	PVC pipe sections to AS/NZS 1260 with polyester resin impregnated glass fibre reinforcement of fabricated joints Polyethylene to AS/NZS 4131, Type 80B or 100 or other approved compound with fusion jointing of segments to approved procedure Polypropylene to AS/NZS 5065 or ISO 8773
	Riser components:	PVC pipes and fittings to AS/NZS 1260 with polyester resin impregnated glass fibre reinforcement of fabricated joints, pipe stiffness class SN8
	Sewer joint seal:	Approved elastomer to AS 1646
	Riser joint seals:	Solvent cement to AS/NZS 3879 (Junction fitting on the riser may alternatively use an elastomeric seal to AS 1646)
DIMENSIONS	Riser:	DN 225
	Chamber:	Structural design dependent
JOINTING	Chamber to sewer:	Spigot-socket rubber ring joint
	Riser to chamber:	PVC riser to PVC chamber: spigot-socket solvent cement joint PVC riser to PE chamber: mechanical, threaded or flanged
CONNECTIONS	VC pipeline systems to EN 295 and AS 1741 Plain wall and ribbed PVC pipeline systems to AS/NZS 1260	
COMPONENT MARKINGS	Manufacturer's name or registered trademark, or both Component description, e.g. 150 x 150 x 15 deg MSEL (chamber with 150∅ end connections and a 15 degree elbow) Material designation, e.g. 'PVC' or 'PE' Date of manufacture in the form 980721 (year, month, day) Identification of the place of manufacture Direction of flow (chamber marking only)	
MARKING METHOD	Durably marked	
USE LIMITS	DN 150 and DN225 maintenance shafts are approved Do not use maintenance shafts where depth to invert exceeds 3m, unless specific project approval has been granted by the Water Engineering section of Power and Water Only use maintenance shafts adjacent to maintenance holes. Do not connect branch sewers at maintenance shafts Do not use a maintenance shaft as the first access upstream of an in-line gas trap. Do not use maintenance shafts at discharge points of pumping mains. Do not connect property connections to the chamber Do not connect more than two property connections to the riser and connect only residences.	

SGO 01-S5 MAINTENANCE SHAFT ACCESS COVERS AND FRAMES

STANDARD	AS 3996: 1992 Metal access covers, road grates and frames (note: standard does not apply to covers less than 450 mm clear opening, but is used here for reference)
DRAWING	Power and Water: W2-2-07 WSA 02: SEW-1317
DESIGN	Unit (cover and frame) are to withstand loads applicable for the location of use as defined by the class. Mating surfaces of cover and frame are to be machined to provide; ▪ Even and secure seating of cover in frame; ▪ Permanent elimination of movement or dislodgment by normal traffic; and ▪ a watertight or gastight seal to 0.5 kPa when coated with 0.25 mm grease or equivalent. Clearance between cover and frame is not to exceed 3 mm as measured at the cover surface. Bearing surfaces in frame are to be at least 20 mm wide for class B covers and at least 30 mm wide for class D covers. Covers are to have two lifting key holes aligned diametrically. The long dimension of the keyhole to be aligned along the diametrical line. Keyholes are to be to AS 3996 figure 3.1 with clockwise key engagement or are to allow lifting with a standard lifting key (GATIC lifter). Keyholes are to allow easy removal of dirt. Cover surface finish is to be chequered. Clearance between a straight edge and the top of a unit is not to exceed 3 mm at any position that the straight edge is laid. Covers are to be interchangeable in any frame from the same manufacturer. Covers are to be resistant to removal without standard lifting key. All Class B covers are to be bolt down and Class D cover are to bolt down where less than 20 kg. Bolts are to be M10. Non-bolt down covers are not to have grooves, recesses or surfaces that may facilitate lifting. Frames are to be cast in a concrete slab to resist horizontal and vertical displacement from accidental loading.
MATERIALS	Cover: Ductile cast iron grade AS 1831/500-7 or 600-3 Frame: Grey cast iron grade AS 1830/T220 Concrete for frame slab: Concrete to AS 1379 with minimum compressive strength of 32 MPa at 28 days and minimum cement content of 400 kg/m^3 Cover bolts: Stainless steel to ASTM A276 grade 304 or 316 Coating: Bitumen to BS 3416 type II where cold applied and to BS 4147 type I grade C where hot applied
ALLOWED CLASSES AND FINISH	Class D: Trafficable areas. Road reserves including the verge, nature strip or footpath and walkways or malls. Surface of cover to be flush with surrounding finished surface level. Class B: Non-trafficable areas. Other areas than specified for Class D. Surface of cover 100 mm above the surrounding finished surface level.
ALLOWED SHAPES	Circular cover and circular frame with 410 mm minimum clear opening or 375 mm minimum opening (deep flange only – 300 or greater depth)
ALLOWED TYPES	Watertight or gastight sealed using only grease or equivalent sealing (without elastomer seal).
COVER WEIGHTS	35 kg maximum
MARKINGS	"SEWER" in capital letters of 30 mm minimum height Manufacturer's or supplier's name or registered trademark Product code (to include identification of place of manufacture) Class or Application, i.e. "CLASS D", "CLASS B" or "VEHICULAR", "NON VEHICULAR" Approximate maximum mass of the cover (frame weight excluded)
MARKING METHOD	Raised or recessed letters, cast into the top of the cover, no higher than the surface pattern height. Lettering to be legible to normal or corrected vision from a distance of at least 4m.

SGO 01-S6 LIGHT DUTY INSPECTION OPENING COVERS AND FRAMES

STANDARD	In part: AS 3610 Formwork for concrete (for precast concrete surround)	
DRAWING	Power and Water: W2-1-05	WSA 02: None
DESIGN	Covers are to be interchangeable in any frame from the same manufacturer. Frames are usually integrated into a concrete surround poured on site, however frames may be manufactured as an integral component of a precast concrete surround. Top surface of frame and top surface of surround to be level. Alternatively, the design of the surround may be such that a separate frame is not required. Precast products will require tapers to vertical sides to facilitate mould release.	
MATERIALS	Concrete:	N32, maximum nominal aggregate size 10 mm, 14 mm or 20 mm and slump 80 mm to AS 1379
	Cement:	To AS 3972
	Aggregate:	Aggregate to AS 2758.1, durability for exposure classification B1
	Reinforcement:	Bars, fabric and wire to AS/NZS 4671. Reinforcement in frames and covers to be galvanised.
	Cover and frame	Ductile cast iron grade AS 1831/700-2, 600-3, 500-7, 450-10, 400-18 or 350-22 Grey cast iron grade AS 1830/150, 200 or 250
DIMENSIONS	Clear opening:	225 mm – 350 mm square or circular opening
	Cover thickness:	50 mm – 60 mm
	Frame:	150 mm – 200 mm height, thickness of concrete at the widest cross section shall be not less than 80 mm and the width of concrete at the thinnest cross section shall not be less than 50mm.
	Cover lifting hole:	50mm – 60 mm x 25 mm – 30 mm, or diameter 40 mm – 45 mm, centrally placed
	Surround size:	1000 mm x 1000 mm to 1025 mm x 1025 mm (taper at vertical sides not to reduce overall size by more than 50 mm)
	Surround thickness:	200 mm
	Cover reo:	50 mm x 50 mm x 4 mm galvanised fabric or alternative having at least equal cross sectional area. Fabric to be centrally placed
	Frame reo:	100 mm x 100 mm x 5 mm fabric or alternative having at least equal cross sectional area.
	Surround reo:	100 mm x 100 mm x 5 mm fabric or alternative having at least equal cross sectional area. Fabric to be centrally placed.
MANUFACTURE	Physical quality (cast iron):	Free of casting defects. Sharp protrusions etc. Cover and frame mating surfaces are to provide even and secure seating of cover in frame. Clearance between a straight edge and the top of a cover is not to exceed plus 0 mm, minus 3 mm at any position that the straight edge is laid across frame. Clearance between cover and frame is not to exceed 10 mm as measured at the cover surface.
	Physical quality (concrete):	Formed surfaces: To AS 3610 (generally tolerance $\pm$ 3 mm) Unformed surfaces: Flatness of surfaces $\pm$ 3 mm (not applicable to bottom surface)
	Surface finish (concrete):	Unformed top surface: Wood float finish or finished to provide a non slip surface (e.g. brush, sponge) Formed top surface: To AS 3610, Appendix B, for Class 2X, with blowhole depth not to exceed 5 mm with approved non slip surface (e.g. brush, sponge) Unformed other surfaces: Wood float finish Formed other surfaces: To AS 3610, Appendix B, for Class 3 NOTE: not applicable to bottom surface
	Lifting Points:	Where provided, lifting lugs shall be fitted to the side of the surround

SGO 01-S6 LIGHT DUTY INSPECTION OPENING COVERS AND FRAMES

MARKINGS	Manufacturer's name or registered trademark, or both
MARKING METHOD	Cover or frame: Legibly marked by either engraving, indenting or painted stencil lettering. NOTE: Stencil lettering to be either on the underside of cover or the inside face of the frame (cover marking is optional when surround design eliminates separate frame). Surround: Legibly marked by either engraving or indenting into top surface of precast concrete surround.
USE LIMITS	Not to be used in roads reserves, footpaths, areas with pedestrian traffic etc.. Finish 100 mm above finished surface level.

SGO 01-S7 HEAVY DUTY INSPECTION OPENING COVERS AND FRAMES

STANDARD	In part: AS 3610 Formwork for concrete (for precast concrete surround)	
DRAWING	Power and Water: W2-1-05	WSA 02: None
DESIGN	Covers are to be interchangeable in any frame from the same manufacturer. Frames are usually integrated into a concrete surround poured on site, however frames may be manufactured as an integral component of a precast concrete surround. Precast surrounds will require tapers to vertical sides to facilitate mould release. Minimum ultimate limit state design load is to be 80 kN. Holding down facility is optional.	
MATERIALS	Concrete:	N32, maximum nominal aggregate size 10 mm, 14 mm or 20 mm and slump 80 mm to AS 1379
	Cement:	To AS 3972
	Aggregate:	Aggregate to AS 2758.1, durability for exposure classification B1
	Reinforcement:	Bars, fabric and wire to AS/NZS 4671
	Cover and frame:	Ductile cast iron grade AS 1831/700-2, 600-3, 500-7, 450-10, 400-18 or 350-22 Grey cast iron grade AS 1830/150, 200 or 250
	Cover fastener:	Stainless steel ASTM A276 grade 304, 316 or approved alternative
	Cover plug:	Thermoplastic
	Coating:	Bitumen
DIMENSIONS	Clear opening:	225 mm to 350 mm
	Cover lifting hole:	As per manufacturer's design
	Surround size:	1000 mm x 1000 mm to 1025 mm x 1025 mm (taper at vertical sides not to reduce overall size by more than 50 mm) 200mm thick
	Surround thickness:	200 mm
	Surround reo:	F62 fabric top and bottom and two W6.3 rings at 50 centres (refer to drawing W2-1-05 for placement).
MANUFACTURE	Physical quality (cast iron):	Free of casting defects, sharp protrusions etc. Cover and frame mating surfaces are to provide even and secure seating of cover in frame. Clearance between a straight edge and the top of a cover is not to exceed plus 0 mm, minus 3 mm at any position that the straight edge is laid across frame. Clearance between cover and frame is not to exceed 3 mm as measured at the cover surface.
	Physical quality (concrete):	Formed surfaces to AS 3610 (generally tolerance of $\pm$ 3 mm) Unformed surfaces: Flatness of surfaces $\pm$ 3 mm. NA to surround bottom
	Surface finish: Surround top	Unformed surface: Wood float or finished to provide non slip surface (e.g. brush, sponge) Formed surface: To AS 3610, Appendix B, for Class 2X, with blowhole depth not to exceed 5 mm with approved non slip surface pattern (e.g. floor plate)
	Surface finish: Surround bottom	Unformed surface: Finish of surround bottom is not important
	Surface finish:	Unformed surface: Wood float
	Other surfaces:	Formed surface: To AS 3610, Appendix B, Class 3 e.g. vertical sides of surround
	Lifting Points:	Where provided, lifting lugs shall be fitted to the side of the surround
MARKINGS	Manufacturer's name or registered trademark, or both	
MARKING METHOD	Cover or frame: Legibly cast into top surface of cover or frame. Surround: Legibly marked by either engraving or indenting into top surface of concrete surround.	
USE LIMITS	Use in footpath, verge, driveways or where specified (e.g. Remote communities where vehicular damage is more likely). Not suitable for use in public roads (i.e. pavements). In road reserves, surface to be flush with finished surface level.	

SGO 01-S8 STEEL LADDERS

STANDARD	AS 1657:1992 Fixed platforms, walkways, stairways and ladders	
DRAWING	Power and Water: W2-2-04	WSA 02: SEW-1307
DESIGN	Rungs to be of cross section, length, surface finish and spacing to ensure secure footing. Stiles to be of cross section and separation to permit secure and comfortable hand grasp. Rungs to be welded to stiles fully around the rung circumference. Fastening brackets to be fully welded to stiles.	
MATERIALS	Rungs, stiles and fastening brackets:	< DN 300: Structural steel grade AS 3679/250 min and hot dip galvanised after ladder fabrication to AS 1650, minimum coating mass of 600g/m^2 ≥ DN 300: Stainless steel to ASTM A 276, grade 316L, weldable grade
	Wall fastening bolts and nuts:	Stainless steel to ASTM A276 grade 316
	Wall fastening washers:	Stainless steel to ASTM A276 grade 316 for SS ladders Nylon or other approved non-conductive material on galvanised steel ladders for internal washer
DIMENSIONS	Stile cross section:	50 mm wide x 12 mm thick
	Rung cross section:	20 mm diameter
	Stile spacing:	375 mm between centres; straight to 10mm tolerance in a 3m length
	Rung spacing:	300 mm between centres and parallel to within ± 2 degrees
	Stiles ending:	50 mm past centre of last rung for both top and bottom of ladder
	Wall offset:	210 mm to stile centreline
FASTENING BRACKETS	All MH's:	50 mm wide x 12 mm thick
	Rectangular MH's:	Bracket to have a right angle with wall offset length 210 mm and wall attachment length 75 mm.
	Circular MH's:	Bracket to be bent so that wall attachment length (75 mm) is flush with the wall. Bracket to be of length to achieve 40 mm offset of stile centre from inside face of access of entry opening.
FASTENERS	Bolts:	M16, 110 mm long to AS/NZS 1111
	Nuts:	M16 to AS 1112
	Washers:	75 mm x 75 mm x 6 mm (external) and M16 (internal) to AS 1237
FASTENING POINTS	Top and bottom brackets 200 mm from stile ends. Other brackets at 1000 mm maximum spacing.	
MARKINGS	Manufacturer's name or registered trademark, or both Date and place of manufacture, or the manufacturer's traceability code incorporating date	
MARKING METHOD	Legibly and durably engraved on outer facing side of a stile. Lettering height 10mm minimum.	
USE LIMITS	Ladders not required in maintenance holes with depth to benching of less than 1.0 m	

SGO 01-S9 GRP LADDERS

STANDARD	WSA 108 Fibre Reinforced Plastic Ladders	
DRAWING	Power and Water: W2-2-04	WSA 02: SEW-1307
DESIGN	GRP ladder sections are to be manufactured by a continuous open-ended moulding process such as pultrusion where continuous strands of resin impregnated glass fibres are pulled through a heated die and then if necessary through a heating chamber for post-curing. Ladder sections are to comprise an outer corrosion barrier and an inner structural core. The corrosion barrier is to have a resin rich layer 0.25-0.5 mm thick. Rungs are to be fitted into holes drilled through one wall of the stile tube, with rung ends butting against the inside face of the stile tube. Rungs are to be secured to stiles using GRP dowels passing fully through centres on the stiles and the rungs. Dowels are to be secured using polyester or epoxy resin. Cut surfaces and drilled holes are to have a gel coat of equivalent thickness to the resin rich outer layer on stiles. Rungs are to have a slip resistant finish through profiling or sanding as approved. Stiles are to have a smooth outer surface to prevent hand injury with all corners rounded. Stile ends are to be sealed by end caps or other approved means. Stile cross section is to allow adequate hand grip.	
MATERIALS	GRP rungs, stiles & dowels:	Isophthalic polyester resin to BS 3532 (vinyl ester resin may be used in wet wells of sewerage pumping stations) Continuously drawn filaments of E-glass with a silane or equivalent coupling agent. Not less than 25% by mass of the structural core. Outer corrosion barrier: May include surface tissue of C-glass or woven/non-woven textiles based on polyester or acrylic fibres
	End caps:	Approved thermoplastic complying with applicable material standard
	Reflectors:	Polycarbonate or other approved material
	Fastening brackets:	Stainless steel to ASTM A276 grade 316 Polypropylene or GRP composite as approved
	Fastening bolts, nuts, washers:	Stainless steel to ASTM A276 grade 316 Polyamide as approved (only for fastening brackets to ladder) GRP as approved (only for fastening mounting brackets to ladder)
DIMENSIONS	Stile x-section:	Rectangular tube, 50-60 mm x 30-35 mm (rung fitted into narrower face) with 5 mm minimum wall thickness Square tube, 40-50 mm x 40-50 mm with 5 mm minimum wall thickness Circular tube, 45-55 mm diameter with 5 mm minimum wall thickness
	Rung x-section:	Circular tube, 30-40 mm diameter with 5 mm minimum wall thickness
	Stile spacing:	375 mm to inside face of stiles; straight to 10 mm tolerance in a 3 m length
	Rung spacing:	300 mm between centres and parallel to within $\pm$ 2 degrees
	Stiles ending:	50 mm past centre of last rung for both top and bottom of ladder
WALL MOUNTING BRACKETS	Appropriate length to achieve 210 mm wall offset to ladder centreline.	
	GRP brackets:	U-channel - 100 mm min web x 30 mm min flanges x 6 mm min thickness.
	PP brackets:	Design as approved
	SS brackets:	50 mm minimum height x 12 mm minimum thickness
FASTENING POINTS	Top and bottom brackets 200 mm from stile ends. Other brackets at 1000 mm max. spacing.	
MARKINGS	Manufacturer's name or registered trademark, or both Date and place of manufacture, or the manufacturer's traceability code incorporating date	
MARKING METHOD	Legibly and durably marked on label adhered to outside face of stile. Letter height 10 mm min.	

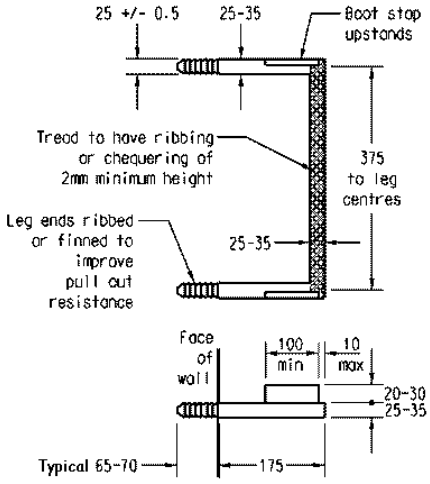
SGO 01-S10 PLASTIC ENCAPSULATED STEP IRONS

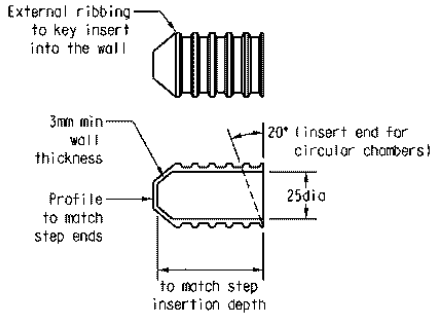
STANDARD/SPEC	BS 1247.2:1990	Manhole steps Part 2. Specification for plastic encapsulated manhole steps
	AS 1657:1992	Fixed platforms, walkways, stairways and ladders
	UK WIS 4-33-01 (Jan '90:Issue 1)	Specification for polypropylene encapsulated steps for use in manholes and access chambers

DRAWING Power and Water: W2-2-04 WSA 02: SEW-1307

DESIGN A steel step is to be fully encapsulated in plastic, which is to resist cracking or fracture to provide the steel long-term integrity of protection from a corrosive sewage environment. The plastic is to be chemically resistant to sewage and the sewage atmosphere. Steps are to be sufficiently resistant to twisting, bending and damage from impact. The plastic tread is to be ribbed or chequered to provide a slip resistant footing. Upstands are to be provided at each end of the tread to resist sideways loss of footing. The leg ends of steps to be inserted into the wall are to have circumferential ribs or fins to improve resistance to pullout. Steps are to be free of any sharp projections or edges likely to cause injury and are to provide a comfortable handhold. Plastic inserts for fitting into chamber walls to hold steps are to provide long-term retainment of the steps without step movement and are to provide sufficient frictional resistance to step pullout. Manufacturing injection ports are not to be on the top surface of the step.

MATERIALS	Inner steel core:	Mild steel to BS 4360 grade 43A or AS 1302 (bars) or equivalent Stainless steel grade 316 to BS 970: Part 1, ASTM A 276 or equivalent
	Plastic encapsulation and inserts:	Polypropylene to BS 5139 Type AC-M-A or equivalent Polyethylene to BS 3412 or AS 4131 or equivalent
DIMENSIONS	Inner steel core:	Sufficient to satisfy twisting and bending test requirements
	Outer coating:	3 mm minimum thickness





Wall insert to hold step iron

MARKINGS
Manufacturer's name or registered trademark, or both
Date and place of manufacture, or the manufacturer's traceability code incorporating date
The standards and/or specification to which the steps are manufactured
Model number
Tread width (to leg centres) and leg length not in wall (wall offset to front of step)

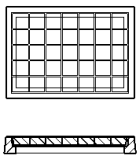
MARKING METHOD Legibly stamped in a position that is visible when installed. Lettering height 10 mm minimum.

USE LIMITS For use only where installed into precast concrete manhole segments on manufacture.
Only to be used as an alternative to ladders where approved.

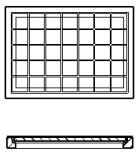
SGO 01-S11 EPOXY FOR JOINTING/REPAIR OF CONCRETE MH's

STANDARD	None
DESIGN	Epoxy jointing and repair materials are: ▪ To be viscous to provide gap filling properties. ▪ To be non sag. ▪ To achieve adhesion and curing under damp conditions. ▪ To have a setting time (pot time) to allow application completely to the joint and assembly before setting under the range of ambient temperatures and humidity experienced in tropical and central Australia arid zones. ▪ To have sufficient flexibility to retain a seal under external loads ▪ To retain seal and strength under wet or immersed conditions ▪ To have long storage (shelf) life under high ambient temperature tropical and arid conditions ▪ To have the two mixing parts in pre-measured packaging to ensure correct mixing ratios ▪ To be able to mix and blend the two parts easily ▪ To be termite resistant ▪ To be resistant to hydrogen sulphide gas and sulphuric acid in concentrations found in tropical sewage systems. ▪ To be resistant to aggressive ground waters found in sandy soils, which may be saline with resistivity < 10Ω.m or having sulphates > 6000 ppm
MATERIALS	Two-part epoxy paste comprising epoxy resin and carbonate free filler
CONTAINER MARKING	Manufacturer's name Net mass or volume Date of manufacture Recommended storage life Instructions for storage and use A statement on any toxic vapour or flammability hazards associated with the epoxy material The statement " No additives of any kind shall be mixed with this epoxy." (as applicable)
STORAGE	Store in a cool dry place

RECTANGULAR GASTIGHT RECESSED COVER 900 x 600



Class C or D



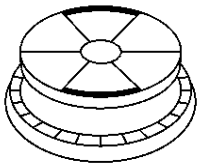
Class B

Class	ACO	Durham	Gatic-Milnes
B	✔ 2	✔ 1	✔ 4
C		✔ 1	
D	✔ 2	✔ 1	✔ 4
E		✔ 1	

NOTES

1. Access cover and frame comprises of a cover of ductile cast iron grade 500-7 to AS 1831 and frame of grey cast iron grade T220 to AS 1830.
2. Access cover and frame comprises of a cover of ductile cast iron grade 600-3 to AS 1831 and frame of grey cast iron grade T220 to AS 1830.
3. Grey cast iron grade T220
4. Ductile cast iron grade 500-7
5. Ductile cast iron grade 600-3

CIRCULAR GASTIGHT RECESSED COVER DN 600

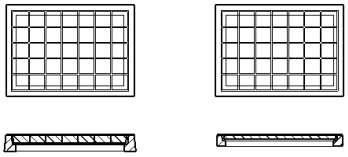


Class	Durham	Gatic-Milnes
B	✔ 1	✔ 2
C		
D	✔ 1	✔ 4

NOTES

1. Access cover and frame comprises of a cover of ductile cast iron grade 500-7 to AS 1831 and frame of grey cast iron grade T220 to AS 1830.
2. Access cover and frame comprises of a cover of grey cast iron grade T220 to AS 1830 and frame of ductile cast iron grade 500-7 to AS 1831.
3. Grey cast iron grade T220
4. Ductile cast iron grade 500-7

RECTANGULAR WATERTIGHT RECESSED COVER 900 x 600



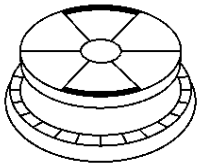
Class C or D Class B

Class	ACO	Durham	Gatic-Milnes
B	✔ 2	✔ 1	✔ 4
C		✔ 1	
D	✔ 2	✔ 1	✔ 4

NOTES

1. Access cover and frame comprises of a cover of ductile cast iron grade 500-7 to AS 1831 and frame of grey cast iron grade T220 to AS 1830.
2. Access cover and frame comprises of a cover of ductile cast iron grade 600-3 to AS 1831 and frame of grey cast iron grade T220 to AS 1830.
3. Grey cast iron grade T220
4. Ductile cast iron grade 500-7
5. Ductile cast iron grade 600-3

CIRCULAR WATERTIGHT RECESSED COVER DN 600

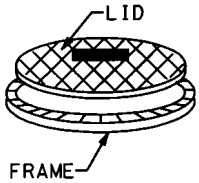


Class	Durham	Gatic-Milnes
B	✔ 1	✔ 2
D	✔ 1	✔ 4

NOTES

1. Access cover and frame comprises of a cover of ductile cast iron grade 500-7 to AS 1831 and frame of grey cast iron grade T220 to AS 1830.
2. Access cover and frame comprises of a cover of grey cast iron grade T220 to AS 1830 and frame of ductile cast iron grade 500-7 to AS 1831.
3. Grey cast iron grade T220
4. Ductile cast iron grade 500-7

CIRCULAR GASTIGHT SOLID TOP COVER DN 600

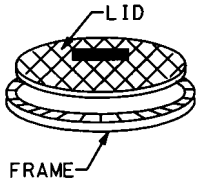


Class	Durham	Gatic-Milnes
B	✔ 1	✔ 2
D	✔ 1	✔ 2

NOTES

1. Access cover and frame comprises of a cover of ductile cast iron grade 500-7 to AS 1831 and frame of grey cast iron grade T220 to AS 1830.
2. Ductile cast iron grade 500-7

CIRCULAR WATERTIGHT SOLID TOP COVER DN 600

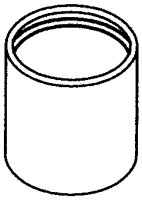


Class	Durham	Gatic-Milnes
B	✔ 1	✔ 2
D	✔ 1	✔ 2

NOTES

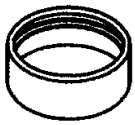
1. Access cover and frame comprises of a cover of ductile cast iron grade 500-7 to AS 1831 and frame of grey cast iron grade T220 to AS 1830.
2. Ductile cast iron grade 500-7

SHAFT SEGMENTS
(TO SPEC SGO 01-1A)



Nominal Size DN x height	Durham	DPP	Humes
1100 x 150	✔		
1100 x 260			✔
1100 x 300	✔		
1100 x 565			✔
1100 x 600	✔		
1100 x 885			✔
1100 x 900	✔		
1100 x 1200	✔		✔
1100 x 1510			✔
1100 x 1825			✔
1100 x 2135			✔
1200 x 1200		✔	

MAKE-UP RINGS

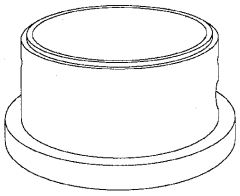


Nominal Size DN x height	DPP
1100 x 75	
1100 x 100	
1100 x 150	
1100 x 200	
1200 x 75	
1200 x 100	
1200 x 150	
1200 x 200	
1200 x <1200	✔

TAPERED MAKE-UP RINGS

Nominal Size DN x height
1100 x 75-125
1200 x 75-125

BASES



Nominal Size DN	Darwin PP	Durham
1100		✔
1200	✔	

COVER SLABS

Rectangular Cover/Frame

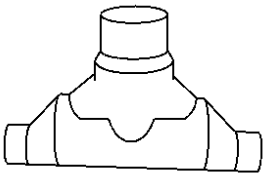
Circular Cover/Frame

Cover slab code[1]	Humes	DPP	Durham
1100 RB	✔		✔
1200 RC		✔	
1100 RC	✔		
1200 RC			
1100 RD	✔		✔
1200 RD		✔	
1100 CB	✔		
1200 CB			
1100 CC			
1200 CC			
1100 CD	✔		✔
1200 CD			

NOTES

1. The cover slab code represents the maintenance holes internal diameter it is compatible with and the metal access cover/frame, which the slab incorporates. The code is thus deciphered as:
   - 1100, 1150 or 1200 for the maintenance holes internal diameter in mm
   - R for a rectangular metal access cover/frame of 900 mm x 600 mm nominal clear opening and C for a circular metal access cover/frame of 600 mm nominal clear opening.
   - B, C or D for the class of the metal access cover/frame

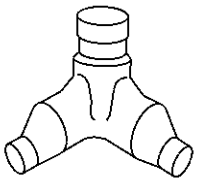
IN-LINE CHAMBERS
SO(RRJ) - SO(RRJ) – SO(SCJ)



Nominal Size DN	Aymroo	SMS	Wormall (Poo-Pit)
150 x 150	✔	✔	*
225 x 225	✔		*

* Interim approval for use only in Alice Springs, Kings Canyon and Yulara

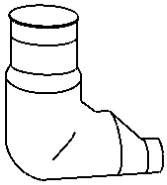
ELBOW CHAMBERS
SO(RRJ) - SO(RRJ) – SO(SCJ)



Nominal Size DN x bend angle	Aymroo	Wormall (Poo-Pit)
150 x 15° LEFT	✔	*
150 x 15° RIGHT	✔	*
225 x 15° LEFT	✔	*
225 x 15° RIGHT	✔	*
150 x 22.5° LEFT	✔	*
150 x 22.5° RIGHT	✔	*
225 x 22.5° LEFT	✔	*
225 x 22.5° RIGHT	✔	*
150 x 30° LEFT	✔	*
150 x 30° RIGHT	✔	*
225 x 30° LEFT	✔	*
225 x 30° RIGHT	✔	*
150 x 45° LEFT	✔	*
150 x 45° RIGHT	✔	*
225 x 45° LEFT	✔	*
225 x 45° RIGHT	✔	*
150 x 60° LEFT	✔	*
150 x 60° RIGHT	✔	*
225 x 60° LEFT	✔	*
225 x 60° RIGHT	✔	*
150 x 90°	✔	*
225 x 90°	✔	*

* Interim approval for use only in Alice Springs, Kings Canyon and Yulara

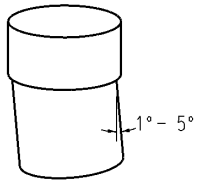
TERMINAL CHAMBERS
SO(RRJ) - SO(SCJ)



Nominal Size DN	Aymroo	Wormall (Poo-Pit)
150	✔	*
225	✔	*

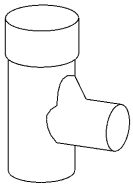
* Interim approval for use only in Alice Springs, Kings Canyon and Yulara

SHORT RADIUS RISER BENDS
SP-SO SCJ



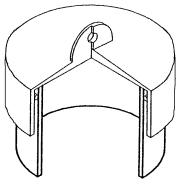
Nominal Size DN x bend angle	Aymroo
225 x 1°	✔
225 x 2°	✔
225 x 3°	✔
225 x 4°	✔
225 x 5°	✔

RISER JUNCTIONS



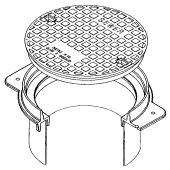
Nominal Size	Aymroo
225 x 150 SO-SO-SO RRJ	✔
225 X 150 SP-SO-SO RRJ	✔
225 x 150 SO-SO-SO SCJ	✔
225 x 150 SP-SO-SO SCJ	✔

RISER BAYONET CAP



Nominal Size	Aymroo	SMS (BT Bautechnik)	SMS (Iplex)
225	✔	✔	✔

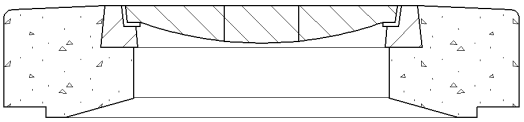
CIRCULAR WATERTIGHT SOLID TOP COVER DN 375



Class	Cooke	Durham
B		**I**
D	✔	**I**

I = Interim

COVER SLABS

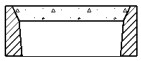


DPP	Durham
I	✔

I = Interim

LIGHT DUTY I.O.

(COVER AND FRAME)

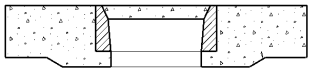


Concrete LD I.O.

Type	Humes
LD IO C	✔
LD IO R	

TERMINOLOGY:- C is for circular I.O., R is for rectangular I.O.

LIGHT DUTY I.O. WITHIN CONCRETE SURROUND



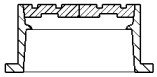
LD I.O. within concrete surround

Type	Humes	DPP	Durham
LD IO C & Surround	✔	✔	✔
LD IO R & Surround			

TERMINOLOGY:- C is for circular I.O., R is for rectangular I.O.

HEAVY DUTY I.O.

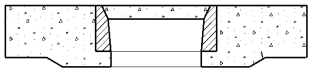
(COVER AND FRAME)



Cast Iron HD I.O.

	Gatic-Milnes	Cooke/Trigg	Durham
HD IO	✔	✔	✔

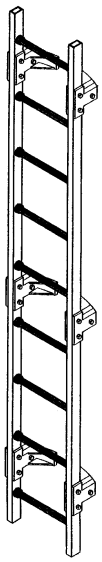
HEAVY DUTY I.O. WITHIN CONCRETE SURROUND



HD I.O. within concrete surround

Nominal Size	Humes	Cooke	DPP	Durham
HD IO & Surround	✔	✔	✔	✔

LADDERS

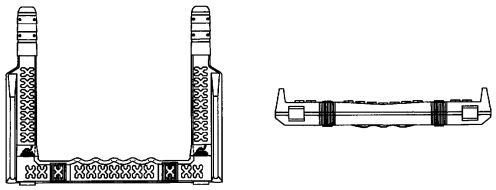


Material	Miyama[1]
GRP	✔
Polyethylene	
Stainless steel	
Galvanised steel	

NOTES

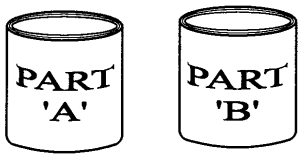
1. Miyama provide polypropylene/GRP ladder fastening brackets for rectangular maintenance holes and GRP ladder fastening brackets for circular maintenance holes. Nuts and bolts with the brackets, excluding the stainless steel wall fastenings, are made of polyamide resin nuts and bolts.

PLASTIC ENCAPSULATED STEP IRONS



Nominal Step Width (mm)	Miyama
400	✔

EPOXIES



Size (Kit)	Vivacity (Megapoxy P1)
4L	✔
20L	✔

NOTES

1. Shelf life limited to 2 years