Appendix A - Ductile Iron Pipe Classification

Item	Category	Manufacturer (Supplier)	Manufacturing Standards	Coating (outside)	Lining (inside)	Pressure Class Δ	Size	WSAA appraisal	Recommendation				Conditions of Use
									Buried		Not buried		
									Water (drinking & non-drinking)	Sewer (gravity & pressure)	Water (drinking & non-drinking)	Sewer (gravity & pressure)	
1	A	VonRoll (Reece) **Ecopur K12 Flanged** Ductile Iron Pipe for water supply	Δ EN 545:2010; EN 545:2006: and ISO 2531:2009	Polyurethane (Most Resilient)	Polyurethane (Most Resilient)	Class K12	DN 80 – 700 (ISO**)	PA 1430 dated 15/12/2015	✓	✘	✓	✘	• Urban Center or High Risk • Contaminated ground • Normal conditions
2		VonRoll (Reece) **Ecopur Socketed** Ductile Iron Pipe for water supply		Polyurethane (Most Resilient)	Polyurethane (Most Resilient)	• Class K9 - DN 80 to 700; • Pressure Class C100 (80 & 100), C64 (150 & 200); C50 (250 & 300); C40 (350 & 400) are available on request; • DN 500, 600 & 700 are available only in K9	DN 80 – 700 (ISO**)	PA 1430 dated 15/12/2015					
3	B	Saint Gobain PAM (Viadux) **Natural PUR** Ductile Iron Pipe for water supply	EN 545:2010 and ISO 2531:2009	Bio Zinalium (ZnAl/Cu) 400 g/m^2 + Aquacoat Acrylic pore sealer (More Resilient)	Polyurethane (Most Resilient)	• DN 80 to 300 (C40 – 40bar); DN 350 to 600 (C30 – 30bar); (DN 700 to 1000 (C25 – 25bar) • Higher Pressure Class pipes are available on request	DN 80 – 1000 (ISO**)	No WSAA assessment on PUR (NaturalPUR has WSAA appraisal for its external coating; Bio Zinalium and Zinalium)	✓ subject to soil & stray current assessment *	✘	✓	✘	• Urban Center or High Risk * • Contaminated ground • Normal conditions
4	C	Saint Gobain PAM (Viadux) **Hydroclass Zinalium** Ductile Iron pipe for water supply	AS/NZS 2280:2014	Zinalium (ZnAl Alloy) 400g/m^2 + Blue Synthetic Resin Pore Sealer (More Resilient)	CML with or without seal coat as per customer request (standard)	PN 35 and Flange Class^ Note: PN 20 Class is not approved	DN 100 – 750 (ISO**)	PA 1418 dated 28/11/2014	✓ subject to soil & stray current assessment *	✘	✓	✘	Normal conditions only
5		Saint Gobain PAM (Viadux) **Integral Zinalium** Ductile Iron pipe for sewerage	AS/NZS 2280:2014	Zinalium (ZnAl Alloy) 400g/m^2 + Red Synthetic Resin Pore Sealer (More Resilient)	Calcium Aluminate Cement (standard)	PN 35 and Flange Class^ Note: PN 20 Class is not approved	DN 100 – 750 (ISO**)	PA 1418 dated 28/11/2014	✘	✓ subject to soil & stray current assessment *	✘	✓	Normal conditions only
6	D	VonRoll (Reece) **Ducpur Socketed** Ductile Iron Pipe for water supply	EN 545:2010; EN 545:2006: and ISO 2531:2009	Zinc of at least 220 g/m^2 as per EN 545 and is covered with a layer of bitumen at least 70 µm thick (standard)	Polyurethane (Most Resilient)	• Class K9 – DN 80 to 700; • Pressure Class C100 (80 & 100), C64 (150 & 200); C50 (250 & 300); C40 (350 & 400) are available on request; • DN 500, 600 & 700 are available only in K9	DN 80 – 700 (ISO**)	PA 1430 dated 15/12/2015	✓ Only for lengths < 25m in low risk situations	✘	✓	✘	Normal conditions only
7	E	Viadux **Tytonxcel** Ductile Iron Pipe for water supply	AS/NZS 2280:2014	Zinc (Zn) 200g/m^2 + Black Synthetic Resin Pore Sealer (standard)	CML with or without seal coat as per customer request (standard)	PN 35 and Flange Class^ Note: PN 20 Class is not approved	DN 100 – 750	PA 1314 Part 1 Issue 2 dated 16/02/2016	✓ Only for lengths < 25m in low risk situations	✘	✓	✘	Normal conditions only
8		Viadux **Tytonxtreme** Ductile Iron Pipe for sewerage	AS/NZS 2280:2014	Zinc (Zn) 200g/m^2 + Red Synthetic Resin Pore Sealer (standard)	Calcium Aluminate Cement (standard)	PN 35 and Flange Class^ Note: PN 20 Class is not approved	DN 100 – 750	PA 1314 Part 1 Issue 2 dated 16/02/2016	✘	✓ Only for lengths < 25m in low risk situations	✘	✘	Normal conditions only
9		Crevet **Irontite** Ductile Iron Pipe for water supply	AS/NZS 2280:2014	Zinc (Zn) 200g/m^2 + two-part black epoxy resin finishing layer (standard)	CML with or without seal coat as per customer request (standard)	PN 35 and Flange Class^ Note: PN 20 Class is not approved	DN 100 – 750	PA 1611 dated 28/09/2016	✓ Only for lengths < 25m in low risk situations	✘	✓	✘	Normal conditions only
10		Crevet **Irontite** Ductile Iron Pipe for sewerage	AS/NZS 2280:2014	Zinc (Zn) 200g/m^2 + two-part red epoxy resin finishing layer (standard)	Calcium Aluminate Cement (standard)	PN 35 and Flange Class^ Note: PN 20 Class is not approved	DN 100 – 750	PA 1611 dated 28/09/2016	✘	✓ Only for lengths < 25m in low risk situations	✘	✘	Normal conditions only

* Approval of Zinalium/Bio Zinalium coated DI pipe is subjected to the following procedure: (Note: Zinalium/Bio Zinalium is a superior coating over the standard 200 g/m^2 Zinc coating)

Classification of coating and lining:

1. Standard — Coating or lining conforms to the relevant standard (i.e. AS/NZS 2280:2014, EN 545:2010, EN 545:2006 and ISO 2531:2009
2. More Resilient (Zinalium / Bio Zinalium) — better than the Standards mentioned in Item 1
3. Most Resilient (Polyurethane) — better than the Standards mentioned in Item 1

a) Soil resistivity of the proposed ground should be available. If the resistivity < 500 Ohms.cm additional protection to Zinalium / Bio Zinalium coating in the form of poly sleeves will be recommended *(Hydrocarbons and heavy metals presence in the soil are not going to affect corrosion of DI pipes. Chlorides may have an effect and soil test for resistivity will show the levels of chlorides and able to offer the best solution; soil resistivity is an indication of Chloride, primarily NaCl).*

b) **Stray Current effect:** When laid near tramline, sleeving must be applied. Zinalium and Bio Zinalium will not protect against stray current.

If we can prove there is stray current, consider PE100 PE or MSCL in lieu of DI, as in case of MSCL there is an obligation from the Victorian Electrolysis Committee to assist us in mitigating this problem.

Stray traction is present in all areas which have public transport (and in some areas where there is no public transport). The way we manage stray traction corrosion is by completing a circuit with the tram and train rails, thus returning the rail voltage to the associated substation. Due to rubber ring joints this is not possible with DI pipes therefore the entire protection is dependent on the Zinalium coating system. In an ideal world these coating would last 100 years and they may still, however if the coating is compromised there is a possibility that stray traction corrosion would occur, particularly in high activity areas.

PE sleeving of DI pipes may be more suitable in areas where there are known stray currents. Correctly applied sleeving will isolate the pipe form stray current and protect the pipe. If the sleeving is compromised the protection is reduced, however the reduction will depend on the situation (i.e. level of PE sleeve damage and stray current present). In high activity areas such as near HV power lines or when crossing a CP protected pipe, double sleeving may be required to reduce the risk from damaged sleeving. Other forms of protection for DI such as Polyurethane coating (VonRoll Ecopur) or PE Tape wrapping afford the same protection as PE sleeving and are equally vulnerable if the coating is compromised.

In the case of Melbourne tram lines, Saint Gobain PAM assessment of the code of practice employed in construction to return current results in a situation of low activity, hence single PE sleeving is sufficient.

Note: A special pipe classification, Flange Class, for manufacture of flanged pipe with screw-on flanges, is specified in Figure H1, Appendix H of AS/NZS 2280:2014. Flanged pipe, including pipes with bolt-on puddle flanges, shall be classified by PN number. The PN number of flanged pipe shall be classified by the PN number of the flange. The PN number of pipe shall be at least equivalent to the PN number of the flange. The thickness of 'Flange Class pipe' is similar to K12 of EN 545:2010 and thicker than PN35 rated pipe. Pipe threads are regarded as loss of wall thickness.

^ All flanges of the Flange Class DI pipe, including Ecopur, shall be wrapped with petrolatum tape system as per MRWA Drg No. MRWA-W-306A, Details A (Item D).

** Acceptable ISO sizes are; DN 80, 100, 150, 200, 250, 300, 350, 400, 500, 600 and 700.

Socketed DI fittings manufactured to AS/NZS 2280 could be joined with

a) vonRoll DI pipes manufactured to EN 545 / ISO 2531 at 16 Bar for sizes 100, 150, 200 & 250 and at 10 Bar for 300; and

b) Saint Gobain PAM DI pipes manufactured to EN 545 / ISO 2531 at 16 Bar for sizes 100, 150, 200, 250 and 300.

The joints between ISO sized DI pipe and AS/NZS 2280 socketed fittings are made using Gulf Rubber's special adaptor elastomeric seals.

Δ vonRoll manufactures two types of DI pipes; (a) Pressure Class C to EN 545:2010 and ISO 2531:2009 and (b) Thickness Class K to EN 545:2006. Refer to Appendix B for thickness of both types for the size range DN 80 to 700.

APPENDIX B - VONROLL DI PIPE 'C' CLASS AND 'K' CLASS

vonRoll Ductile Iron Pipe - Comparison of thickness class K vs pressure class C

DN	DE [mm]	Pressure Class 'C'						Thickness Class 'K'					
		25	30	40	50	64	100	7		9		12	
		e_{min} (mm)						e_{min} (mm)	PFA (bar)	e_{min} (mm)	PFA (bar)	e_{min} (mm)	PFA (bar)
80	98			3.0	3.5	4.0	4.7	4.7	141	4.7	141	5.6	170.0
100	118			3.0	3.5	4.0	4.7	4.7	116	4.7	116	5.8	145.0
125	144			3.0	3.5	4.0	5.0	4.7	94	4.7	94	6.1	124.0
150	170			3.0	3.5	4.0	5.9	4.7	80	4.7	80	6.4	110.0
200	222			3.1	3.9	5.0	7.7	4.7	61	4.8	62	6.9	90.0
250	274			3.9	4.8	6.1	9.5	4.7	49	5.2	54	7.5	79.0
300	326			4.6	5.7	7.3	11.2	4.7	41	5.6	49	8.0	70.0
350	378		4.7	5.3	6.6	8.5	13.0	4.7	35	6.0	45	8.6	65.0
400	429		4.8	6.0	7.5	9.6	14.8	4.7	31	6.4	42	9.1	61.0
500	532		5.6	7.5	9.3	11.9	18.3	5.2	28	7.2	38	10.2	55.0
600	635		6.7	8.9	11.1	14.2	21.9	5.8	26	8.0	36	11.3	51.0
700	738	6.8	7.8	10.4	13.0	16.5		6.4	24	8.8	34	12.4	48.0

Pressure Classes 'C' as per EN 545:2010

Thickness Classes 'K' as per EN 545:2006

Note: DN 80 to 500 vonRoll DI pipe with double chamber socket; DN 600 to 700 is pipe with single chamber socket.

DN 80 and 100	C100
DN 150 and 200	C64
DN 250 and 300	C50
DN 350 and 400	C40