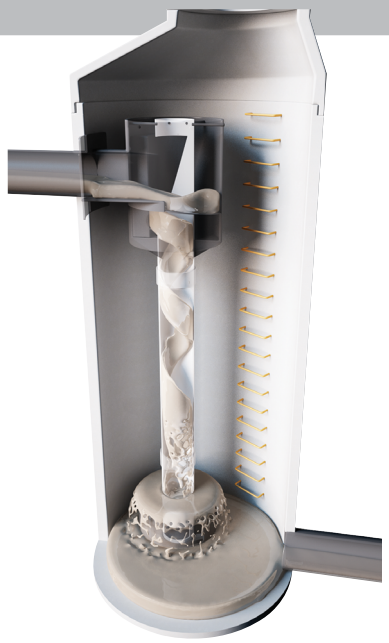
Vortex Flow™
ODOR & CORROSION CONTROL

Submittal Data Sheet



Project: .....

Engineer: .....

Contractor: .....

Submitted by: ..... Date

Approved by: ..... Date

Order No: ..... Date

Standard: .....

Installation Date: .....

STANDARDS

C900 & C905

B137.3

CAN/CGSB-41-22-93

C581-00

Standards

A. American Water Works Association (AWWA) Standards:

1. C900: Standard for Polyvinylchloride (PVC) Pressure Pipe and Fabricated Fittings, 4" to 12" nominal diameter.
2. C905: Standard for Polyvinylchloride (PVC) Pressure Pipe and Fabricated Fittings, 14" to 48" nominal diameter.

B. Canadian Standards Association (CSA) Standards:

1. B137.3: Fabricated Fittings

C. Canadian General Standards Borad (CGSB) Standards:

1. CAN/CGSB-41-22-93: Fiberglass

D. American Society for Testing and Materials (ASTM) Standards:

1. C581-00: Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service

Material Properties

Properties	PVC	Standards
Specific gravity	1.42	ASTM D792
Tensile strength, psi at 73°F	7,000	ASTM D638
Modulus of elasticity tensile, psi at 73°F	400,000	ASTM D638
Flexural strength, psi	14,500	ASTM D790
Izod impact, ft.lbs./in. at 73°F, notched	0.65	ASTM D256
Compressive strength, psi	9,000	ASTM D695
Poisson's ratio	0.38	
Working stress, psi at 73°F	2,000	
Coefficient of thermal expansion in./in./°F (x 10^{-5})	3	ASTM D696
Linear expansion, in./10°F per 100' of pipe	0.36	
Maximum operating temperature under pressure	140°F (60°C)	
Deflection temperature under load, °F at 66 psi	173	ASTM D648
Deflection temperature under load, °F at 264 psi	160	ASTM D648
Thermal conductivity, BTU. in./hr.ft^2.°F	1.2	ASTM C177
Burning rate	Self extinguish	ASTM D635
Burning class	V-0	UL-94
Flash ignition, °F	730	
Limited oxygen index (%)	43	ASTM D2863-70
Water absorption, %, (24 hrs. at 73°F)	0.05	ASTM D570

Standards Comparison

Quality Test	BS 3505/3506	ASTM – AWWA
Impact	1.75kg @ 20°C No splitting, cracking, shattering	300 Joules @ 0°C – ASTM D2444 & 3rd party certified by CSA B137, no splitting, cracking or shattering
Flattening	None	2" sample ring placed between parallel plates compressed until walls touch, no splitting, cracking or shattering
Solvent Immersion	Not part of batch release QC for production (approvals only)	20mins in a sealed container of Anhydrous (99.5% pure) Acetone – ASTMD2152
Sustained Pressure	Not part of batch release QC for production (approvals only)	Sustained pressure shall not fail, burst or weep as defined in ASTM D1598 at the applicable sustained pressure listed for 1,000hrs as specified in ASTM D2241. Also, each length hydrostatically tested to TWO times its pressure rating for 5 seconds to AWWA C900/C905
Instant Burst Pressure	(short term hydrostatic resistance @ 20°C) class c @ 32.4bar; class d @ 43.2 bar; class e @ 54 bar	Pieces of IPEX pipe are subjected to gradual increase in hydrostatic pressure over a specific short-term period (60-70 seconds), DR25 36 Bar, DR18 51.9 Bar, DR14 67.8 Bar. These tests conform to ASTM D1598 and third party certified by CSA B137.3
Longitudinal Reversion	150°C for 15mins @ wall thickness (WT) ≤ 8.6; 30mins @ wt > 8.6 but ≤ 14.1; 60mins @ WT > 14.1	180°C for 20mins as per ASTM F1057

Abrasion Resistance

PVC Pipe and GRP pipe both have excellent abrasion resistance and have undergone what is known as the Darmstadt Method of Abrasion Testing. This test consists of a specific sand, gravel and water mixture being put in a half section of pipe that is rocked back and forth to simulate sewer flow. GRP pipes exhibited approximately 200 µm of wear after 100,000 cycles, while PVC lost only 0.754 µm². With an IPEX Vortex Flow Insert, the waterway wall will be virgin PVC material, not FRP wrap, as the FRP wrap is not installed on the water-exposed surfaces of the structure. Since GRP typically has a relatively thin inside liner (sometimes made of PVC) to protect the inside structural layers, a PVC structure typically has a higher factor of safety for abrasion than GRP.

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FRP Properties

All Roving used in the fabrication of the Vortex Flow Insert is to be 24oz/sqyd minimum.

All Mat used in the fabrication of the Vortex Flow Insert is to be 1-1/2oz/sqft minimum.

All Derakane used in the fabrication of the Vortex Flow Insert will be of minimum grade 470-300.

M723A Mat used in the construction of the IPEX Vortex Flow Insert is manufactured in conformity of ISO 2559 and DIN 61853 and is listed by NSF for potable water applications.

M723A combines the excellent mechanical and electrical properties of E Glasses with the Acid Corrosion resistance of E-CR Glass and meets the requirement of both E and E-CR Glass per ISO 2078 and ASTM D578-00.

Property	Mat Weight (g/m^2)	Specification			Test Method[5]
		Min.	Nominal	Max.	
Weight Uniformity ($g/1{,}000\ cm^2$)[1,2]	225	18.2	22.5	26.8	W-01Fc-T[6]
	300	24.3	30.0	35.7	
	400	32.0	40.0	48.0	
	450	36.4	45.0	53.6	
	600	48.6	60.0	71.4	
	900	72.9	90.0	107.1	
Average Weight Uniformity (%)[3]	All	-10%	Nom.	+10%	W-01Fo-T[6]
Loss on Ignition (%)[4]	225	1.7	3.9	6.1	W-05Ec-T[6]
	300	1.6	3.4	5.2	
	450	1.1	2.4	3.9	
	600	1.6	2.75	4.0	
	900	1.8	2.85	4.0	
Width (cm)	All	-0.3	Nom.	+0.3	D-03Aa-T

Material Impact Testing

Debris such as wood, metal fasteners or rebar have often been left in the pipe system during construction, and could potentially impact the IPEX Vortex Insert when in service. IPEX conducted impact tests with sample specimens of PVC/FRP as made for a Vortex Flow Insert, to simulate the effects of impact of such debris.

The velocity calculation is as follows:

$$E_{g1} + E_{k1} = E_{g2} + E_{k2},$$

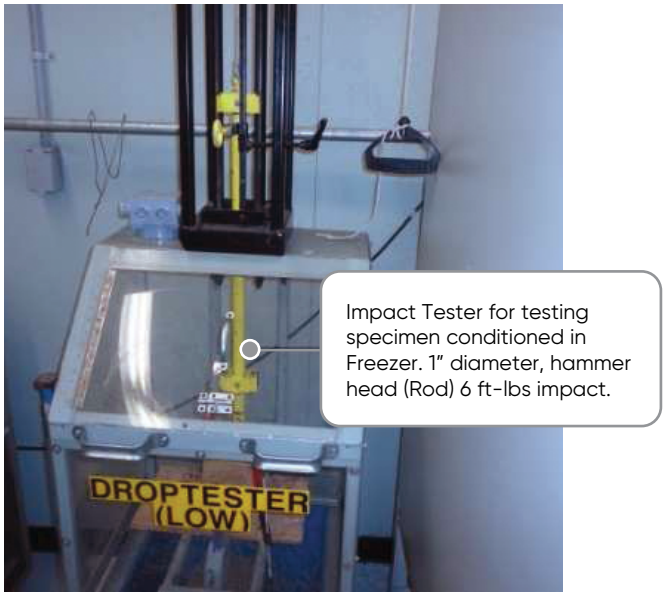
where E_g = Gravitational potential energy
E_k = Kinetic energy

1 is the positon when the tup is held stationary at its highest point and 2 is the tup at the point of impact.

E_g = mgh, $E_g = 1/2\ mv^2$
g = gravitational acceleration = 32.174ft / 2^2
h = height of the tup relative to the point of impact
v = velocity of the tup
m = mass of the tup

At point 1, the tup is not moving, so velocity is 0.
Therefore, Ek1 = 0

At point 2, the height of the tup relative to the test piece is 0.
Therefore, Eg2 = 0



Impact Tester for testing specimen conditioned in Freezer. 1" diameter, hammer head (Rod) 6 ft-lbs impact.

Thus, the formula becomes:

$$E_{g1} = E_{k2}$$
$$mgh^1 = 1/2\ mv^{2^2}$$
$$gh^1 = 1/2\ v^{2^2}$$

$$\frac{32.174\ ft}{S^2} \times 2.83\ ft = \frac{1}{2}$$

$$\frac{32.174\ ft}{S^2} \times 2.83\ ft\ ) = v^2$$

$$\sqrt{(\frac{32.174\ ft}{S^2} \times 2.83\ ft\ )} = v$$

$$V = 13.49\ ft/s$$

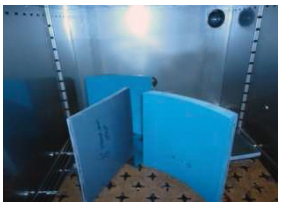
The specimens were conditioned as follows:

A. In an oven at 70 degrees Celsius for one hour, removed and let stand in ambient 23 degrees Celsius for one hour.
B. In an oven at 52 degrees Celsius for one hour, removed and tested immediately (less than one minute)
C. In a freezer at -35 degrees Celsius for four hours, removed and tested immediately (less than one minute)

Specimens were tested with and without support underneath the impact zone.

All specimens passed and had no visible cracks, flaking or damage to either the PVC side or the FRP side.

Test Oven



Samples in Test Oven

Specimen of PVC Pipe with FRP

Specimen of PVC Sheet with FRP

Part 1 – GENERAL

1.01 DESCRIPTION

A. Furnish and install Vortex Flow Insert and all associated mounting and connection materials in a drop structure as indicated and specified herein.

1.02 REFERENCES

A. American Water Works Association (AWWA) Standards:
   1. C900: Standard for Polyvinylchloride (PVC) Pressure Pipe and Fabricated Fittings, 4 to 12-inch nominal diameter.
   2. C905: Standard for Polyvinylchloride (PVC) Pressure Pipe and Fabricated Fittings, 14 to 48-inch nominal diameter.

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C. Canadian General Standards Board (CGSB) Standards:
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PART 2 – PRODUCT

2.01 DESIGN REQUIRMENTS

A. The Vortex Flow Insert consists of a Vortex Top Form, a Vortex Shaft and an Energy Dissipation Pool as specified by IPEX.

B. Vortex Flow Insert shall be designed to operate effectively with flows between 15% and 115% of their rated capacity, unless otherwise specified. Design flow to be supplied by engineer.

C. Contractor is responsible for securing, supporting and connecting the Vortex Flow Insert to existing influent pipe and manhole structure as specified and designed by the Engineer.

D. Vortex Flow Insert must display a label engraved "U.S. Patent No. 6,419,843".

2.02 MANUFACTURING

A. All Vortex Flow Inserts will be manufactured by IPEX USA L.L.C or IPEX Inc. (Canada).

B. All units to be manufactured to standard specifications produced and supplied under license by IPEX.

C. All pipe sections used in the fabrication of the Vortex Flow Insert must be manufactured to AWWA C900 and/or AWWA C905 standards.

D. All pipe sections used in the fabrication of the Vortex Flow Insert must be CSA Certified to CSA B137.3

E. All PVC sheet used in the fabrication of the Vortex Flow Insert is to be of 1/4" minimum thickness.

F. All Roving used in the fabrication of the Vortex Flow Insert is to be 24oz/sqyd minimum.

G. All Mat used in the fabrication of the Vortex Flow Insert is to be 1-1/2oz/sqft minimum.

H. All Derakane used in the fabrication of the Vortex Flow Insert will be of minimum grade 470-300.

I. All resin used in the fabrication of the Vortex Flow Insert will be determined by supplier to meet the specific requirements of the fluid and the temperature.

2.03 QUALITY ASSURANCE

A. Acceptance at site:
   1. The quality of all materials shall be subject to inspection and or approval by the Engineer. The Vortex Flow Insert shall be subject to rejection upon delivery on account of failure to meet specification requirements. If any material is damaged between the times of delivery and the completion of installation, it shall be repaired or replaced, if permitted by the Owner, at the expense of the Contractor.
   2. Materials will be inspected for compliance with specified standards and the specifications herein. In addition, all materials shall be inspected for general appearance, dimensions, and cracks.
   3. Minor imperfections may be repaired, if permitted by the Owner, at the expense of the Contractor. All repairs shall be inspected before final approval by the Engineer.

2.04 MOUNTING HARDWARE & SUPPORT STRUCTURE

A. Contractor shall provide all labor, materials, equipment, services and incidentals as shown or specified and required to furnish and install and place in satisfactory service the Vortex Flow Insert as designed and specified by the Engineer.

B. All bolts, fasteners, straps, supports and mounting hardware shall be SS, with the grade to be determined by the engineer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install Vortex Flow Insert in accordance with Engineers plans.

B. Align Vortex Flow Insert as designed and specified by the Engineer.

C. Anchor Vortex Flow Insert as designed and specified by the Engineer.

D. Provide spacers and supports for Vortex Flow Insert as designed and specified by the Engineer.

E. Provide a watertight connection between Vortex Flow Insert and influent pipe through the use of non-shrink sealant/grout or a similar method as approved by Engineer.

F. Protect Vortex Flow Insert from water and debris entering structure during construction.

G. Support all work until permanent support has been installed. Contractor is responsible for furnishing and installing temporary and permanent support systems.

About IPEX by Aliaxis

As leading suppliers of thermoplastic piping systems, IPEX by Aliaxis provides our customers with some of the world's largest and most comprehensive product lines. All IPEX by Aliaxis products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX by Aliaxis products are:

- Electrical systems
- Telecommunications and utility piping systems
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems
- PVC, CPVC, PP, PVCO, ABS, PEX, FR-PVDF, NFRPP, FRPP, HDPE, PVDF and PE pipe and fittings (1/2" – 48")