

### Description of liner type and properties

All our products are proudly manufactured on the Gold Coast. In 2007, our manufacturing operation received certification to AS/NZ 9001:2000 Quality Management Systems.

To rehabilitate drainage lines, including junctions, Nuflow utilises our Blueline® product.

The Blueline® liner is custom made from Texcel® geotextiles felt. This is a new generation of nonwoven staple fibre geotextiles. Manufactured from either Polyester and/or Polypropylene fibres, they have a unique staple fibre blend and an inbuilt flexibility to allow Engineers to specify mechanical and hydraulic criteria to suit tough Australian conditions.

Texcel® geotextiles, manufactured from Geofabrics' new manufacturing plant in Ormeau, South Queensland, are high quality, isotropic, nonwoven staple fibre geotextiles which are supported by 25 years of research, development and testing. They are abrasion and UV-resistant and provide superior filtration for coastal applications. Texcel® geotextiles also have high elongation properties minimising installation damage. The table below outlines the specifications.

	Test		Standard	Units	600R
	Mechanical Properties	Thickness		AS3706.1	mm
Wide Strip Tensile Strength		MD	AS3706.2	kN/m	17
		XMD			36
Trapezodial Tear Strength		MD	AS3706.3	N	475
		XMD			870
CBR Burst strength		AS3706.4	N	4500	

Our liner is impregnated with specially formulated two part epoxy resin that sets hard in a matter of hours allowing minimal disruption and inconvenience. These are manufactured at our factory on the Gold Coast from imported ingredients.

Nuflow have a wide range of resins that we use, allowing us to adapt to every circumstance. We have our Standard Nuflow Resin which is ideally suited for sewer and stormwater Lines allowing for good chemical resistance and flexibility.

We can provide a Potable Water Resin which meets AS/NZS 4020:2005 approval standards, ideal for spot repairs in water mains.

# Blueline<sup>®</sup>

## Part A Epoxy Resin Ingredients

### Final Product Name: Part A Epoxy Resin

#### Technical Name:

Epikote GY260  
Epikote GY191  
Cab-O-Sil  
TEPA  
Benzyl Alcohol  
NonylPhenol  
NevChem  
Arardur140  
Titanium Dioxide  
Vantigo DW0134  
Phthalo Blue Solvent  
Dispersbyk 110

#### Common Name:

Part A Standard  
Part A Runny

White Dye  
Green Dye  
Blue Dye

Part A Resin contains:

- Epikote KER828
- Titanium Dioxide (White Dye)

## Part B Epoxy Resin Ingredients

### Final Product Name: Slow Catalyst

#### Technical Name:

Epikote GY260  
Epikote GY191  
Cab-O-Sil  
TETA  
Benzyl Alcohol  
NonylPhenol  
NevChem  
Arardur140  
Titanium Dioxide  
Vantigo DW0134  
Phthalo Blue Solvent  
Dispersbyk 110

#### Common Name:

Part A Std  
Part A Runny

White Dye  
Green Dye  
Blue Dye

Slow catalyst contains the following chemicals:

- Cab-O-Sil T720
- Nev Chem
- Phthalo Blue Solvent (Blue Dye)
- Dispersbyk 110
- Triethylenetetramine

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### Description of liner installation method including equipment used, access requirements, handling and customer interruption

The Nuflow relining system is a CIPP (cure in place pipe) system that is installed by the pull in place method. We make our Liner out of a needle woven polyester fabric, which is customised at the Nuflow manufacturing facilities on the Gold Coast. We can produce any required length, thickness, or diameter ranging from 40mm to 1000mm.

Once the liner is tailor made and prepared, it is inserted in to your drain via any opening in the drain, Nuflow typically required two access points. It is positioned in place with a CCTV camera and inflated, forcing the liner to take the shape of the pipe filling and voids, cracks or lining over any damaged section. After a four to six hour curing period (subject to weather and conditions), the internal bladder of the liner will be retrieved, completing the process and making the drain ready for use immediately.

The seamless pipe reline prevents infiltration and exfiltration, restores structural integrity, eliminates weak joints that allow root intrusions, spans void sections and forms around multiple bends and junctions.

A benefit of utilising Nuflow is that because we utilise existing access points, disruption to customers will be kept to a minimum. In addition our cure times are kept to a minimum to ensure the lines are back up and running as soon as practical.

### Description of curing and typical time allowed for curing

The epoxy resins utilised in Nuflow's relining process are ambient cured. With the lengths of liners required for this job, we would be required to utilise slow curing resins. The time frames of the curing process are as follows:

- Summer months 4 to 5 hours (approximately)
- Winter months 7 hours (approximately)
- This can be sped up utilising hot water curing.

### Description of junction lining method

With Nuflow's product, we do not need to cut out junctions. Nuflow are the specialists in Lateral Connection Liners (LCL) for any type of junction. Our LCL liners completely rehabilitate the entire junction in one complete process. We can reline any type of pipe, diameter or length combination from 45 or 90 degrees. The Nuflow process of cure-in-place, is the most versatile repair system in the world.

The below diagram illustrates our LCL rehabilitation method.

# Blueline®

1. Blocked or root intruded pipes are cleaned with a high pressure jetter.



2. A Nuflow liner is pulled into place, inflated using a custom-made bladder and left to cure.



3. Once cured, the bladder is removed leaving behind a structural repair.



## Description of lateral lining method

Nuflow's pipe rehabilitation process of cured-in-place pipe relining, is one of the most versatile repair systems in the world. We can repair any type of pipes with minimal disruption, including PVC, earthenware or clay, asbestos, galvanised steel, cast iron, copper, concrete and HDPE.

We can repair diameters in from 40mm to 1000mm utilising our Blueline® technology. Stormwater, sewerage, trade waste or potable water pipes under tons of concrete, roads or factory floors, this presents no problem for Nuflow. Almost any shape pipe can be structurally rehabilitated utilising Blueline®, including Vertical or Horizontal, Square, Rectangular or Round pipes, 90 degree bends, P traps, S traps, Junctions and Elbows.

Our liners are custom made from Texcel® that is impregnated with specially formulated two part epoxy resin that sets hard, becoming a structural repair, in a matter of hours allowing minimal disruption and inconvenience.

Once the liner is tailor made and prepared, it is fed over a bladder. Once this process is completed it is then fed in to the line via any opening in the drain. The liner and bladder is then positioned in place with a camera and the bladder is inflated with air, forcing the liner to take the shape of the pipe filling voids or cracks and lining over any damaged section. After a curing period, the internal bladder of the liner is removed, completing the process and making the line ready for use immediately.

The below diagram illustrates our lateral lining method.

1. Blocked or root intruded pipes are cleaned with a high pressure jetter.



2. A Nuflow liner is pulled into place, inflated using a custom-made bladder and left to cure.



3. Once cured, the bladder is removed leaving behind a structural repair.



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### Description of testing method

Nuflow's product has been tested for the following:

#### Compression

Compression Tests have been carried out by Structural Testing Services using the AS 3572.10 – Method 10: Determination of the initial ring stiffness of glass filament reinforced plastic pipes, on the 22/08/2008. Specimen conditioning was set at 23°C with 50% RH constant for 88 hours.

Test Room conditions were 22°C with 42% RH. The aim of this test is to determine the amount of force required to deflect the pipe out of shape by 3%.

#### Flexure

All Flexure Tests were carried out by Structural Testing Services using the STS – Laminate Flexure (ISO 14125) msm method on the 12/08/2008. Tests were conducted with a 0 Degree Orientation of the Nuflow Test Panel, with a conditioning temperature of 23°C and humidity of 50% RH constant for 88 hours. Test room conditions were 20°C with a 21% RH.

#### Strength

The test was aimed at confirming the effectiveness of the Nuflow repair liner in a circumferentially cracked concrete pipe. The Nuflow liner is custom made from fabric which is impregnated with specially formulated two part epoxy resin that sets hard in a matter of hours. The Nuflow technology "no dig" system implements cured in place materials to mould to the host pipe. The seamless pipe reline prevents infiltration and exfiltration, restores structural integrity, eliminates weak joints that allow root intrusions, spans void sections and forms around multiple bends and junctions.

The 3 x 225 RRJ class 2 pipes were beam load tested to complete failure (complete wire snap) with a 2150mm span and the crack widths of each pipe were measured. The crack widths varied from 3mm to 17mm. The Nuflow liner was positioned and placed in the pipe, inflated with compressed air, forcing the liner to take the shape of the mould lining along the barrel of the pipe and the epoxy resin flowing into the full depth and width of the crack. The relined pipes were left for 3-4 hours for curing and then the internal bladder of the liner was retrieved completing the relining process. The pipes were further air cured for 48 hours and were beam tested to failure set up with the same span. Strength and crack widths at first visual and ultimate loads were measured and recorded.

#### Abrasion

Abrasion Tests were carried out by Structural Testing Services using the ASTM Designation: Standard Test. Method for measuring abrasion using the Dry Sand/Rubber Wheel Apparatus (Procedure B) on the 29/10/2008.

Three specimens were tested per sample material with nominal specimen dimensions being 56mm x 23mm x 13mm.