SPECIFICATIONS FOR NO-DIG CURED IN-PLACE LATERAL LINING

(As Provided by FORMADRAIN®)

NSF DWV/Sewer

FORMADRAIN®

1. INTENT

It is the intent of this specification to provide for the reconstruction of a sewer service lateral which connects to a collector pipe without any excavation.

2. GENERAL

The reconstruction will be accomplished using balanced bi-directional woven fibreglass of length according to measurements and a thermoset resin (completely odourless epoxy – VOC Free epoxy resin) with appropriate physical and chemical properties for the application. The woven fibreglass is impregnated with the thermoset resin (layer by layer, minimum of 2 layers). Once the wetting is completed the liner is rolled on the thermomandrel (size of mandrel will vary accordingly to length of repair and pipe diameter). A nylon rope is strung through the lateral up to the downstream manhole (or nearest). Then the mandrel is pulled through the main cleanout (''Y'' or ''T'' cleanouts) located either inside the building or outside. Once the thermomandrel (with the liner) is in position, we start inflate the thermomandrel with steam up to required pressure and for a determined duration (ex: 45 minutes for a 50 foot repair) – Reference: FORMADRAIN® ''INSTALLATION PROCEDURE MANUAL'' latest edition. Then the thermomandrel is cooled down for 10 minutes with air. Finally the thermomandrel is retrieved by the main cleanout to be reused. When the lateral is cooled down (use cold water) the CCTV inspection can be accomplished immediately. On site time should not exceed 4 hours. The final Liner should be smooth, conform to existing pipe shape, be tight fit into host pipe and have no wrinkles. Liner must conform to any pipe diameter increase; having no wrinkles at the 4 to 6 inches transition if any. Liner must be watertight.

3. MATERIAL

The liner consists of two or more layers of flexible bi-directional woven fiberglass impregnated with thermoset resin (odourless epoxy – VOC Free epoxy resin).

General physical properties of the fiberglass

Tensile load	3.4 x 10^3 Mpa	(493 000 psi)
Tensile modulus	72 x 10^3 Mpa	(10 442 000 psi)

General physical properties of the resin

Tensile load	ASTM D638	60 Mpa	(8 700 psi)
Tensile modulus	ASTM D638	3,3 x 10^3 Mpa	(478 600 psi)
Flexural load	ASTM D790	100 Mpa	(14 500 psi)
Flexural modulus	ASTM D790	2,1 x 10^3 Mpa	(304 500 psi)

Composite material [i]

Tensile load	ASTM D638 [ii]	160 Mpa	(23 200 psi)
Tensile modulus	ASTM D638	8.0 Gpa	(1 160 000 psi)
Flexural load	ASTM D790	160 Mpa	(23 200 psi)
Flexural modulus (E_S)	ASTM D790	9 Gpa	(1 305 000 psi)
Flexural modulus (E_L)	ASTM D2990	4.3 GPa	(623 500 psi)

The composite of the materials above will, upon installation inside the host pipe, will exceed the minimum test standards specified by American Society for Testing Methods.

Test Standard. for CIPP

FLEXURAL STRENGTH (ASTM D-790)	4,500 PSI
FLEXURAL MODULUS (ASTM D-790)	250,000 PSI

4. Wall thickness design

Engineering calculations are made accordingly to ASTM F1216 Appendix X1.

5. Chemical resistance

FORMADRAIN® Liner complies with ASTM F 1216 (latest edition) chemical requirements in Appendix X2. Also, FORMADRAIN® Liner is resistant to sewer gas like carbon monoxide, dioxide, hydrogen sulphide etc. The fiberglass tissue is not affected at all by a great majority of chemicals, bacteria's, fungus or insects (ref.: SPE Society of Plastics Engineers, Mr. George Lupin, chief scientist Grumman Aerospace Corporation).

5 Installation Procedure (summary)

5.1 Preparation of the conduit

The process requires a main cleanout either inside the building or outside. The roots must be reamed and removed on the whole length, solid residues must be removed with a flusher or otherwise, the conduit must be CCTV inspected and recorded, measurements must be taken precisely. A CCTV report (or cassette) is required before making any liner preparation.

5.2 Preparation of the liner

The surface to prepare the liner (floor or else) must be clean, smooth without burrs, bumps or holes. Thermomandrel is assembled accordingly to repair length, the thermomandrel must be tested before 1st use and visually inspected before every use. Fibreglass is cut according to length of repair. Proper weight of resin is mixed. Fibreglass is impregnated with the resin. Liner is then rolled on the thermomandrel and brought on site.

5.3 Insertion of liner

First, the lateral is strung with a nylon rope from main cleanout to downstream manhole (or nearest manhole). The thermomandrel is then pulled with a pulling cable with the winch located on the manhole. Radio's are required to communicate between the puller (winch on manhole) and the one who is inserting the thermomandrel (at the main cleanout). Once the thermomandrel is in position according to measurements previously taken we are ready to cure.

5.4 Curing of liner

The thermomandrel is inflated gradually with steam to required pressure and for the required time of curing according to Installation manual (10 feet repair = 45 minutes, 100 feet = 50 minutes).
Then the steam pressure is released and air is blown through the thermomandrel for 10 minutes to cool down the thermomandrel. Finally the thermomandrel is pulled out.

5.5 Final inspection

Before entering the camera in the lateral, we must cool down the lateral with cool water. The CCTV inspection is then completed to assure the integrity of the new seamless pipe. Owner will receive a VHS videotape recording of the final inspection.

5.6 Clean up

The site will always be left clean and the property returned to original condition.