

Assessment of the iPlus Composite™ full length lining system – schedule



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1. Scope

1.1 To assess the performance of the iPlus Composite™ system which is a fibre reinforced composite cured-in-place pipe (CIPP) full length lining system. The lining is used for the renovation of gravity pipes with internal diameters between 600mm (24inch) and 2400mm (96inch). Circular and non-circular cross-sections can be lined.

1.2 The iPlus Composite™ CIPP lining has a 'sandwich' construction comprising a 'conventional' CIPP material between two high-stiffness, fibre-reinforced layers which are reinforced with either glass (i.e. glass/glass) or carbon and glass fibres (i.e. carbon/glass).

1.3 The reinforcing fibre bundles are integrated into the pipe wall, laid out circumferentially adjacent to and parallel to each other on the inner and outer surfaces of the resin absorbent layer. During installation the overlapping fibre bundles can slide past each other when the tube is expanded and hence the lining can stretch to accommodate variations in host pipe diameter.

1.4 The iPlus Composite™ system installs a 'close-fit' CIPP lining which can be used as a partially or fully structural lining.

1.5 Approval exclusions:

i. The installation or reconnection of the laterals.

2. Assessment schedule

2.1 The assessment comprises the following:

- materials quality audit;
- review of the quality systems for the manufacture, supply, materials handling and storage;
- general and mechanical properties of the lining;
- quality control tests of the installed lining;
- structural design of the lining;
- review of all instructions for pre-installation procedures, environmental, planning, site preparation, receipt and storage of lining on-site and installation of the system;
- technical audit of the installation of the lining in accordance with the Medium Diameter AISC Insitutube Installation⁽¹⁾, and;
- witnessing of installation on site.

3. Materials quality audit

3.1 The iPlus Composite™ CIPP lining consists of a combination of materials, including:

- needlepunch polyester felt sleeve, approximately 175kg/m³;
- high molecular weight isophthalic unsaturated polyester resin;
- PAN based carbon fibre reinforcement;
- Advantex[®] fibreglass or equivalent ECR glass reinforcement, and;
- Polyolefin blow moulding grade internal membrane.

3.2 Quality management system certification for the materials supply



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and lining manufacture shall be audited.

4. Performance testing

4.1 Performance testing is listed below which is in accordance with ASTM F1216⁽²⁾ and ASTM D5813⁽³⁾.

General Characteristics

4.2 Appearance – the internal surface of the lining shall be smooth, clean and free from scoring, cavities, wrinkling and other surface defects that would prevent the iPlus Composite™ lining from meeting the general fitness for purpose requirement.

Mechanical Characteristics Testing

4.3 Mechanical testing requirements are listed below in Table 1 which are in accordance with ASTM F1216⁽²⁾.

Table 1 Mechanical characteristics

Parameter	Requirement
Short-term flexural modulus	Minimum 1,724MPa (250,000psi)
	Minimum iPlus value 5,172MPa (750,000psi)
Long-term flexural modulus (% retention of short-term value)	No requirement
	Glass/glass up to 75% Carbon/glass up to 75%
Short-term flexural strength (MPa)	Minimum 31MPa (4500psi)
	Glass/glass Pass Carbon/glass Pass
Chemical resistance	Glass/glass Pass

Quality Control Testing

4.4 One sample taken from each length of CIPP lining and tested in accordance with ASTM F1216⁽²⁾ as shown in Table 2.

Table 2 Quality control tests

Parameter	Requirement in ASTM F1216 ⁽²⁾
Short-term flexural (bending) properties	Clause 8.1.3.1
Leakage testing (if required)	Clause 8.2
Delamination test (if required)	Clause 8.4

5. Lining structural design

5.1 The lining is structurally designed in accordance with ASTM F1216⁽²⁾ and WRC Type II design⁽⁴⁾.

6. Review of installation instructions and site audits

6.1 Audit the installation instructions in the Insituform iPlus Composite™ system installation manual⁽¹⁾ and witness two on-site installations to check for compliance with instructions.

6.2 The installation at one site shall be medium diameter (e.g. 600 - 1200mm, (24 – 48inch)) and the second site over 1500mm (60inch).

7. Reference documents

1. WI-0178 Revision 2 – Medium Diameter AISC Insitutube Installation, 24 March 2009.
2. ASTM F1216-07b, Standard practice for rehabilitation of existing pipelines and conduits by the inversion and curing of a resin-impregnated tube.

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3. ASTM D5813 - 04(2008)
Standard Specification for
Cured-In-Place Thermosetting
Resin Sewer Piping Systems.
4. WRc Sewerage Rehabilitation
Manual, 4th Edition, 2001.