TEST REPORT

5001 East Philadelphia Street
Ontario, California – USA 91761-2816
Ph: 909.472.4100 | Fax: 909.472.4243
http://www.iapmortl.org

Report Number: 2643-18001-002 **Project No.:** 30407

Report Issued: December 18, 2018

Client: Pipe Lining Supply, Inc.
2970 E. La Palma Ave.
Anaheim, CA 92806 **Contact:** John Heisler

Source of Samples: The samples were sent by the manufacturer, and received in good condition by IAPMO R&T Lab on May 30, 2018, and December 07, 2018.

Date of Testing: June 12, 2018 to December 18, 2018.

Sample Description: Applied-in-Place Pipe Rehabilitation System (AIPPR)

Model: QCPUA-100 (used on PVC, ABS, Cast Iron, and Clay Pipes).

Scope of Testing: The purpose of the testing is to determine if the samples tested of the AIPPR meets the requirements of IAPMO IGC351-2018a, entitled "Applied-in-Place Rehabilitation Systems".

Conclusion: the tested samples of the AIPPR, model noted above, from Pipe Lining Supply, Inc., COMPLIES with all requirements of IAPMO IGC351-2018a.

Tested by,

Hanks Ninh, Project Engineer

Reviewed by,

Sean Vuu, P.E., Manager, Specialty Projects

Primary Standard: IAPMO IGC351-2018a, clauses tested / evaluated:

4 General Requirements
5 Testing Requirements
6 Markings and Accompanying Literature.

Test Results: all tests and evaluations were conducted per the written procedures specified in the standard.

IAPMO IGC351-2018a:

4 General Requirements

4.1 Materials - FOLLOWED

Applied in place pipe rehabilitation systems employ a general purpose two component polyurea derived through step-growth polymerization consisting of an isocyanate component and a synthetic resin blend that is compatible with the application process.

The AIPPR must be able to cure in dry pipe conditions and the initiation temperature for cure should be less than 180°F (82.2°C).

4.2 Thickness – FOLLOWED (see section 5.2)

The coating thickness shall be as specified by the manufacturer. In no case shall the minimum thickness be less than SDR=100 when calculated in accordance with Equation 1.

Note: Coating thicknesses specified by the manufacturer may vary depending on the pipe size, pipe material and other conditions.

$$\text{Equation 1: SDR} = \frac{do}{s}$$

d_O = coating outside diameter (3.94" for 4" pipes).
s = coating thickness.

Finding: minimum allowable thickness for SDR100 is: $\frac{3.94}{100} = 0.0394"$.

5 Testing Requirements

5.1 Test Specimen

5.1.1 Preparation – FOLLOWED

Test specimens may be harvested from the test assembly following the Minimum Thickness Coating test conducted in Section 5.2. When new or additional test samples to those harvested from the test assembly in Section 5.2 are needed, except where specified directly in the test procedures, test specimens shall be prepared as follows:
(a) Assemble a pipe and fitting connection using two 10 ft lengths of pipe and one 90-degree fitting.
(i) The pipe used for sample preparation shall be new and listed to the applicable standard; and

(ii) The fittings used for sample preparation shall be new and listed to the applicable standard;
(b) Install the AIPPR system into the pipes and fitting assembly and allowed to cure in the lab in accordance with the manufacturers installation instructions.
(c) Test specimens shall be prepared for each combination of the intended applications indicated by the manufacturers literature.

5.1.2 Test Cases – FOLLOWED

Specimens shall be prepared and tested in the combinations required to ensure the intended applications are addressed. At a minimum, test specimens shall be prepared for testing under the following test cases:

(a) Each type of pipe material that the AIPPR is specified for use in (PVC, ABS, Cast Iron and Clay); and,
(b) The minimum coating thickness specified (see section 5.2).

5.2 Minimum Coating Thickness Test

5.2.1 Assembly and Preparation – FOLLOWED

The test assembly shall be set up for each coating as follows:
(a) Using appropriate fittings to simulate an actual installation for the pipe material and application (e.g. CPVC processing/pressure pipe system or ABS DWV system).
(b) Connect five 3 m (10 ft) lengths of pipe.
(c) Install the AIPPR system in accordance with the manufacturer's instructions to the minimum allowable thickness
(d) The coated pipes and fittings shall be allowed to dry in accordance with the manufacturers installation instructions before use.

5.2.2 Test Procedure
The minimum coating thickness shall be measured in accordance with ASTM D7091, ASTM E376, ASTM E797 or as follows:
(a) Note the average wall thicknesses of the pipe and fittings before connection and assembly in accordance with Section 5.2.1(b)
(i) Measure at least 5 locations, around the pipe and fitting openings and as far inside each as practical.
(b) Calculate and record the average thicknesses of the pipe and the fittings before installation of the AIPPR system
(c) Remove and section the end fitting and at least one additional fitting from the assembly.
(d) Cut the fittings to obtain a section for measurement of the AIPPR layer (e.g. Bisect axially, longitudinally, or laterally to expose the original fitting thickness and the AIPPR layer to measurement.
(e) Cut and remove at least six pipe specimens from various locations in the test assembly.
(i) Measure the external diameter of the ends of each test specimen (D1)
(ii) Measure the internal diameter of the ends of each test specimen (D3);
(iii) Measure the thickness of the pipe without the AIPPR layer (T1).
Note: *If the thickness of the pipe without the AIPPR layer is not clear the average thickness of the pipe measured prior to specimen preparation may be used as (T1).*
(iv) Determine the thickness of the AIPPR layer (T3) in accordance with Figure 1 and Equation 2.

$$\text{Equation 2:} \quad T3 = \frac{D1-D3}{2} - T1$$

5.2.3 Performance Requirements – COMPLIED

The coating thickness shall be uniform throughout the sample with an allowable variation of no more than ± 25% from the manufacturers specification (0.11" – 0.22" for 4" pipes).

Note: *The minimum coating thickness test is intended to confirm that within a practical range a uniform coating can be applied based on manufacturer's instructions.*

Finding: the minimum thickness of is 0.116" (on 4" ABS pipe); 0.138" (on 4" Cast Iron pipe); 0.157" (on 4" Clay pipe); and 0.127" (on 4" PVC pipe).

5.3 Tear Strength Test

5.3.1 Test Procedure - FOLLOWED

The pull-off strength test shall be conducted in accordance with ASTM D4541, Test Method E.

5.3.2 Performance Requirements - COMPLIED

Finding: the surfaces adhesion strength was 1,128 psi.

5.4 Delamination Test

5.4.1 Test Procedure - FOLLOWED

The shear test shall be conducted in accordance with Section 7.4, Lap Shear Strength (Qualification Tests) of ASTM D2235 except test specimens shall be 25 by 25 mm (1 by 1 in) cut sections harvested from the test assembly following the Minimum Thickness Coating test conducted in Section 5.2.

5.4.2 Performance Requirements – COMPLIED

The minimum shear strength was found as specified in Table 1 (16 psi).

5.5 Hardness Test

5.5.1 Test Procedure – FOLLOWED

The hardness test shall be performed in accordance with ASTM D2240 using a Type M durometer.

5.5.2 Performance Requirement – COMPLIED (refer to MEi project number: C009751).

The minimum scratch hardness shall be as specified in Table 1 (62). The tested value was 95.

5.6 Flexural Strength, Flexural Modulus

5.6.1 Test Procedure – FOLLOWED

The flexural strength, flexural modulus and elongation tests shall be conducted in accordance with ASTM D790.

5.6.2 Performance Requirements – COMPLIED

The flexural strength and flexural modulus shall comply with the minimum requirement specified in Table 1 (3,200 psi for flexural strength and 100,000 psi for flexural modulus). The tested values were 4,669 psi for flexural strength, and 112,211 psi for flexural modulus.

5.7 Tensile Strength and Elongation Tests

5.7.1 Test Procedure – FOLLOWED

The tensile strength and elongation tests shall be conducted in accordance with ASTM D638.

5.7.2 Performance Requirements – COMPLIED

The tensile strength and elongation shall comply with the minimum requirement specified in Table 1 (<1,000% for elongation and >4,000 psi for tensile strength. The tested values were 10% for elongation and 4,228 psi for tensile strength.

5.8 Gravity Pipe Leakage Test

The gravity pipe leakage test shall be conducted on AIPPR systems intended for use in DWV or other gravity pipe applications.

5.8.1 Test Procedure – FOLLOWED

The gravity pipe leakage test of the AIPPR system shall be conducted as follows:
(a) Install the test specimen in accordance with the manufacturer's instructions.
(b) Conduct the test in accordance with Section 8.2, Gravity Pipe Leakage Testing of ASTM F1216.

5.8.2 Performance Requirements – COMPLIED

The allowable water exfiltration shall be as specified in Section 8.2, Gravity Pipe Leakage Testing of ASTM F1216.

Finding: no leakage was noted.

5.9 Pressure Pipe Leakage Test – NOT APPLICABLE

This AIPPR is not intended for pressure pipe applications (per manufacturer's recommendation).

6 Markings and Accompanying Literature – COMPLIED

6.1 The product packaging of applied in place pipe rehabilitation (AIPPR) systems complying with this Standard shall be marked with the:
(a) manufacturer's name or trademark "Pipe Lining Supply".
(b) pipe size, and pipe material for which it is intended (per label).
(c) model number, model name or description of polyurea as applicable "ALPUA-100 Side A & B".
6.2 Product package markings shall be permanent, legible, and visible.
6.3 AIPPR systems complying with this standard shall be accompanied by instructions for their installation, care and maintenance, and repair and. The Installation instructions shall at a minimum specify that following the installation of internally applied polyurea material used in rehabilitation of plastic and metallic non-potable piping (AIPPR) in a system, the system shall be marked to indicate the presence of the AIPPR liner.

IAPMO IGC 351-2018a

Applied in Place Pipe Rehabilitation (AIPPR) Systems

IAPMO STANDARDS®

IAPMO IGC 351-2018a
Applied in Place Pipe Rehabilitation (AIPPR) Systems

1 Scope

1.1 General

1.1.1 This Standard covers applied in place pipe rehabilitation (AIPPR) systems intended for use in 40 to 400 DN (1.5 to 16 NPS) gravity and pressure applications such as DWV, sanitary sewer, storm sewer, electrical conduit, ventilation, process piping, and non-potable supply piping systems and specifies requirements for materials, physical characteristics, performance testing, and markings.

1.1.2 Applied in place pipe rehabilitation systems (AIPPR) covered by this Standard

(a) employ a general purpose two component polyurea derived from the reaction product of an isocyanate component and a synthetic resin blend component through step-growth polymerization; and,

(b) are applied to the pipe and fitting system through using spray, brush or troweling to a finished thickness of not less than SDR 100.

1.2 Alternative Materials

The requirements of this Standard are not intended to prevent the use of alternative materials or methods of construction provided such alternatives meet the intent and requirements of this Standard.

1.3 Terminology

In this Standard,

(a) "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy to comply with the Standard;

(b) "should" is used to express a recommendation, but not a requirement;

(c) "may" is used to express an option or something permissible within the scope of the Standard; and

(d) "can" is used to express a possibility or a capability.

Notes accompanying sections of the Standard do not specify requirements or alternative requirements; their purpose is to separate explanatory or informative material from the text. Notes to tables and figures are considered part of the table or figure and can be written as requirements.

1.4 Units of Measurement

SI units are the primary units of record in global commerce. In this Standard, the inch/pound units are shown in parentheses. The values stated in each measurement system are equivalent in application, but each unit system is to be used independently. All references to gallons are to U.S. gallons.

1.5 Amendments

Proposals for amendments to this Standard will be processed in accordance with the standards-writing procedures of IAPMO.

2 Reference Publications

This Standard refers to the following publications and, where such reference is made, it shall be to the current edition of those publications, including all amendments published thereto.

ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D2235	Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D7091	Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non- Ferrous Metals
ASTM E376	Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy Current (Electromagnetic) Testing Methods
ASTM E797	Standard Practice for Measuring Thickness by Manual Ultra-Sonic Pulse-Echo Contact Method
ASTM F412	Standard Terminology Relating to Plastic Piping Systems
ASTM F1216	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

3 Definitions and Abbreviations

3.1 Definitions

In addition to the definitions specified in ASTM F412 the following definitions shall apply in this Standard:

Applied in Place Pipe Rehabilitation (AIPPR) —A coating of a thermoplastic resin is adhered to the inside surface of an existing pipe and cured through the natural reaction of the resin components to form a hardened shell integral to the existing pipe.
***Note**: An AIPPR system is adhered to the inside surface of an existing pipe by means of a spray, brush or spreader filling voids and areas of deteriorated pipe.*

Delaminated — Separation of the layers of the AIPPR.

Drip – The presence of overlapping resin to the pipe causing a drip or run of resin in the pipe.

Layers — The process of applying several coats of resin to form the finished new pipe. The number of layers is determined by the standard calculation of partially pipe design

3.2 Abbreviations

The following abbreviations apply in this Standard:

AIPPR — Applied in Place Pipe Rehabilitation

SDR — Standard Dimension Ratio

4 General Requirements

4.1 Materials

Applied in place pipe rehabilitation systems employ a general purpose two component polyurea derived through step-growth polymerization consisting of an isocyanate component and a synthetic resin blend that is compatible with the application process.

The AIPPR must be able to cure in dry pipe conditions and the initiation temperature for cure should be less than 82.2°C (180°F).

4.2 Thickness

The coating thickness shall be as specified by the manufacturer. In no case shall the minimum thickness be less than SDR=100 when calculated in accordance with Equation 1.
Note: Coating thicknesses specified by the manufacturer may vary depending on the pipe size, pipe material and other conditions.

$$\text{Equation 1: } SDR = {}^{d_0}/_{s}$$

d_0 = Coating outside diameter
s = Coating thickness

5 Testing Requirements

5.1 Test Specimen

5.1.1 Preparation

Test specimens may be harvested from the test assembly following the Minimum Thickness Coating test conducted in Section 5.2. When new or additional test samples to those harvested from the test assembly in Section 5.2 are needed, except where specified directly in the test procedures, test specimens shall be prepared as follows:

(a) Assemble a pipe and fitting connection using two 3m (10 ft) lengths of pipe and one 90-degree fitting.
   (i) The pipe used for sample preparation shall be new and listed to the applicable standard; and
   (ii) The fittings used for sample preparation shall be new and listed to the applicable standard;
(b) Install the AIPPR system into the pipes and fitting assembly and allowed to cure in the lab in accordance with the manufacturers installation instructions.
(c) Test specimens shall be prepared for each combination of the intended applications indicated by the manufacturer's literature.

5.1.2 Test Cases

Specimens shall be prepared and tested in the combinations required to ensure the intended applications are addressed. At a minimum, test specimens shall be prepared for testing under the following test cases:

(a) Each type of pipe material that the AIPPR is specified for use in; and,
(b) The minimum coating thickness specified;

5.2 Minimum Coating Thickness Test

5.2.1 Assembly and Preparation

The test assembly shall be set up for each coating as follows:

(a) Using appropriate fittings to simulate an actual installation for the pipe material and application (e.g. CPVC processing/pressure pipe system or ABS DWV system).
(b) Connect five 3 m (10 ft) lengths of pipe.
(c) Install the AIPPR system in accordance with the manufacturer's instructions to the minimum allowable thickness;
(d) The coated pipes and fittings shall be allowed to dry in accordance with the manufacturer's installation instructions before use.

5.2.2 Test Procedure

The minimum coating thickness shall be measured in accordance with ASTM D7091, ASTM E376, ASTM E797 or as follows:

(a) Note the average wall thicknesses of the pipe and fittings before connection and assembly in accordance with Section 5.2.1(b).
   (i) Measure at least 5 locations, around the pipe and fitting openings and as far inside each as practical.

(b) Calculate and record the average thicknesses of the pipe and the fittings before installation of the AIPPR system.

(c) Remove and section the end fitting and at least one additional fitting from the assembly.

(d) Cut the fittings to obtain a section for measurement of the AIPPR layer (e.g. Bisect axially, longitudinally, or laterally to expose the original fitting thickness and the AIPPR layer to measurement.

(e) Cut and remove at least six pipe specimens from various locations in the test assembly.
   (i) Measure the external diameter of the ends of each test specimen (D1)
   (ii) Measure the internal diameter of the ends of each test specimen (D3);
   (iii) Measure the thickness of the pipe without the AIPPR layer (T1).
      Note: *If the thickness of the pipe without the AIPPR layer is not clear the average thickness of the pipe measured prior to specimen preparation may be used as (T1).*
   (iv) Determine the thickness of the AIPPR layer (T3) in accordance with Figure 1 and Equation 2.

$$\text{Equation 2:} \qquad T3 = \frac{(D1-D3)}{2} - T1$$

5.2.3 Performance Requirements

The coating thickness shall be uniform throughout the sample with an allowable variation of no more than ± 25% from the manufacturers specification.

Note: *The minimum coating thickness test is intended to confirm that within a practical range a uniform coating can be applied based on manufacturer's instructions.*

5.3 Tear Strength Test

5.3.1 Test Procedure

The pull-off strength test shall be conducted in accordance with ASTM D4541, Test Method E.

5.3.2 Performance Requirements

The surfaces adhesion strength shall be at least 6.9 MPa (1000 psi)

5.4 Shear Test

5.4.1 Test Procedure

The shear test shall be conducted in accordance with Section 7.4, Lap Shear Strength (Qualification Tests) of ASTM D2235 except test specimens shall be 25 by 25 mm (1 by 1 in) cut sections harvested from the test assembly following the Minimum Thickness Coating test conducted in Section 5.2.

5.4.2 Performance Requirements

The minimum shear strength shall be as specified in Table 1.

5.5 Hardness Test

5.5.1 Test Procedure

The hardness test shall be performed in accordance with ASTM D2240 using a Type M durometer.

5.5.2 Performance Requirement

The minimum scratch hardness shall be as specified in Table 1.

5.6 Flexural Strength, Flexural Modulus

5.6.1 Test Procedure

The flexural strength, flexural modulus and elongation tests shall be conducted in accordance with ASTM D790.

5.6.2 Performance Requirements

The flexural strength and flexural modulus shall comply with the minimum requirement specified in Table 1.

5.7 Tensile Strength and Elongation Tests

5.7.1 Test Procedure

The tensile strength and elongation tests shall be conducted in accordance with ASTM D638.

5.7.2 Performance Requirements

The tensile strength and elongation shall comply with the minimum requirement specified in Table 1.

5.8 Gravity Pipe Leakage Test

The gravity pipe leakage test shall be conducted on AIPPR systems intended for use in DWV or other gravity pipe applications.

5.8.1 Test Procedure

The gravity pipe leakage test of the AIPPR system shall be conducted as follows:

(a) Install the test specimen in accordance with the manufacturer's instructions.

(b) Conduct the test in accordance with Section 8.2, Gravity Pipe Leakage Testing of ASTM F1216.

5.8.2 Performance Requirements

The allowable water exfiltration shall be as specified in Section 8.2, Gravity Pipe Leakage Testing of ASTM F1216.

5.9 Pressure Pipe Leakage Test

The pressure pipe leakage test shall be conducted on AIPPR systems intended for use in processing, supply or other pressure pipe applications.

5.9.1 Test Procedure

The pressure pipe leakage test of the AIPPR system shall be conducted as follows:

(a) Install the test specimen in accordance with the manufacturer's instructions.

(b) Conduct the test in accordance with Section 8.3, Pressure Pipe Testing of ASTM F1216.

5.9.2 Performance Requirements

The allowable water exfiltration shall be as specified in Section 8.3, Pressure Pipe Testing of ASTM F1216.

6 Markings and Accompanying Literature

6.1 The product packaging of applied in place pipe rehabilitation (AIPPR) systems complying with this Standard shall be marked with the:

(a) manufacturer's name or trademark;

(b) pipe size, pipe material and system types (e.g. DWV, sanitary sewer, storm sewer, electrical conduit) for which it is intended;

(c) model number, model name or description of polyurea as applicable.

6.2 Product package markings shall be permanent, legible, and visible.

6.3 AIPPR systems complying with this standard shall be accompanied by instructions for their installation, care and maintenance, and repair and. The Installation instructions shall at a minimum specify that following the installation of internally applied polyurea material used in rehabilitation of plastic and metallic non-potable piping (AIPPR) in a system, the system shall be marked to indicate the presence of the AIPPR liner.

Table 1
Minimum Performance Requirements
(See Sections 5.3, 5.4, 5.5, 5.6, 5.7)

Property	Test Method	Minimum Requirement	
		SI	Imperial
Tear Strength	ASTM D4541, Method E	6.9 MPa	1000 psi
Shear Test	ASTM D2235	0.11 MPa	16 psi
Hardness Test	ASTM D2240	62 N	
Flexural Strength Test Method	ASTM D790	22.0 MPa	3200 psi
Flexural Modulus Test Method	ASTM D790	689.5 MPa	100,000 psi
Elongation	ASTM D638	< 1000 %	
Tensile Strength Test Method	ASTM D638	27.6 MPa	4000 psi

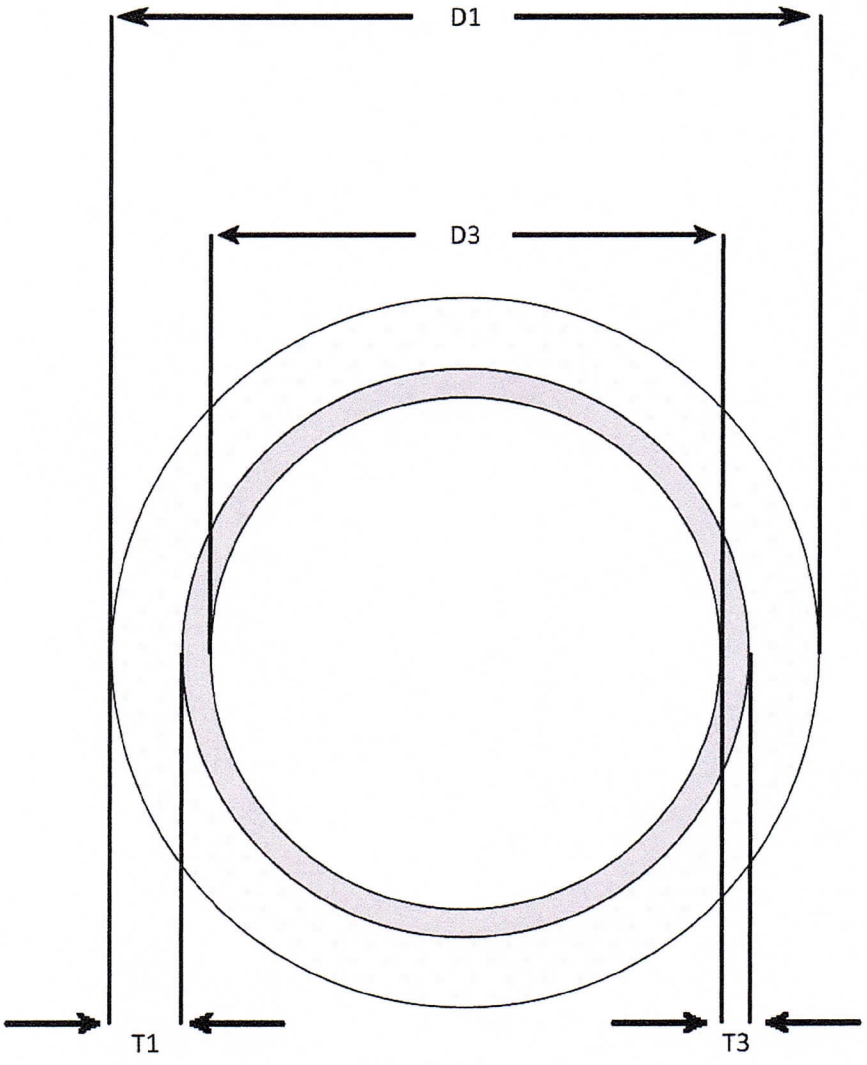

Figure 1
AIPPR Layer Thickness Dimensions
(See Section 5.2.2)

Appendix A (Informative)
Standard Practice for Installation for Procedure

A1 Design Considerations

A1.1 General Guidelines

A1.1.1 The design thickness should be calculated based on the formulas found in Appendix X1 of ASTM F1216. Less the calculations for surcharge loading regarding loads.

A1.1.2 The design thickness of the AIPPR shall be recommended by the coating manufacturer and should be greater than DR100 in accordance with the general requirements of this product standard. The minimum coating thickness should be designed such that the composite of the existing deteriorating pipe and fitting system and coating will restore the system to equal or greater than the original design load of the pipe and fitting system. This thickness shall resist buckling for drain, waste and vent piping inside structures.

A1.2 Specific Pipe Condition

The AIPPR process should not be used on compromised pipe or fittings unless the application of coating material pipe can be restored to a new useful life condition. Other methods should be employed for replacing compromised sections the pipe and fitting system before applying this process to the remainder of the pipe and fitting system if restoration of the compromised pipe or fittings with coating cannot be applied.

A2 Installation

A2.1 Cleaning and Inspection

A2.2 Cleaning of Drain Waste & Vent Piping

All internal debris should be removed from the original pipe. Gravity pipes should be cleaned with hydraulically powered equipment, high-velocity jet cleaners, or mechanically powered equipment (see NASSCO Recommended Specifications for Sewer Collection System Rehabilitation). Pressure pipelines should be cleaned with cable-attached devices or fluid-propelled devices as shown in AWWA Manual on Cleaning and Lining Water Mains, M 28. Tuberculation that narrows original pipe diameter shall be opened to 95% of original size pipe to be coated. The drain, waste and vent pipe shall be flushed with water of any remaining dust or debris and dried prior to coating.

A2.3 Inspection of Drain, Waste & Vent Piping

Inspection of pipes should be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed- circuit television. The interior of the piping should be carefully inspected to determine the location of any conditions that may prevent proper installation of the coating such as collapsed or crushed pipe, missing pipe sections, and reductions in the cross-sectional area of more than 40 %. These conditions should be noted so that they can be corrected.

A2.4 Line Obstructions

The original drain, waste and vent lines should be clear of obstructions such as solids, dropped joints, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 40% that will prevent the insertion of the equipment to coat the line. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then a point repair should be made to uncover and remove or repair the obstruction. This may involve opening a wall, ceiling or floor to fix the problem identified.

A2.5 Resin Calculation Requirements

Prior to application, calculations shall be made to determine the total amount of resin to be applied to the surface of the pipe. This calculation shall be noted and used to insure that the proper amount of coating has been applied to each line segment. This calculation shall be formulated using the total pipe surface segment multiplied by the design thickness to determine the quantity of resin required. Calculation of the amount of resin used can be made by weighing materials prior to installation and weighing the materials upon completion. If the resin applied is less than calculated, subsequent layers of material shall be installed to equate the amount of resin required by weight.

A2.6 Drying

A2.6.1 Once the pipe has been cleaned and flushed, the pipe shall be dried using air and/or heat to dry the surface prior to coating. A camera inspection will determine that the line is fully dried and ready for coating. If the line is not dry, continued drying operations and re-inspection will continue until the line is dry. Under no circumstances shall subsequent coating be applied to coating that isn't dry.

A2.6.2 Public advisory services will be required to notify all parties whose drain, waste and vent piping will be out of service until the repairs and re-notification has been given. Water servicing those areas affected by the repair shall be discontinued during the repair process and re-established upon completion.

A2.7 Coating

A2.7.1 Using Brushes or Spreaders

The brushes or spreaders shall be connected to a sheathed cable that adapts to the brushes or spreaders. There shall be two hoses, each delivering resin of part A and part B separately to a static mixer device and injected ahead of the brushes or spreaders. A camera shall be mounted behind the static mixer/brush to view the application of materials and spreading them over the surface of the pipe. The hoses shall be connected to a device at the pump end of the process to calculate and record flow rates and to allow the operator to start, increase, retard or stop flow rate to address pipe diameter changes as well as turns and bends in the lines.

An alternative method is to replace the brushes or spreaders with a spray nozzle to apply the two part resin system. This process shall apply layers of resin as noted above to spread an even thickness throughout the pipe.

A2.7.2 Application in Layers

To insure that the entire surface of the pipe is coated, the contractor shall apply the material in layers not to exceed more than 1 mm (0.039 in) per pass. This method insures that the pipe has been fully coated and that no untouched surface remains uncoated.

A2.7.3 Cleaning of Equipment

At the completion of each layer, the contractor shall remove excess resin before it sets from his brushes, spreaders or nozzles if intended for reuse for the next lift. This method involves immersing the nozzle ends into a cleaning solution intended for the type resin used, and spinning the brushes, spreaders or nozzles. After extraction of the head from this solution, the operator shall repeat the process by immersing the brush, spreader, or spray nozzle into Acetone to neutralize the cleaning solution.

A2.8 Curing

A2.8.1 Ambient Curing

After completion of each layer, the material shall be cured to a dry to the touch condition as directed by the resin supplier specifications before continuing on to the next layer. Failure to follow manufacturers recommendation may remove materials as the next coat layer is applied.

A2.8.2 Heat Curing

Dry air heat may be employed to speed up the curing process. Temperatures shall be at or below 82°C (180°F) and the resin supplier shall direct the time needed to effect cure. If heat is used that drive discharge temperatures above 82°C (180°F), the contractor shall insure that the cure temperatures inside the pipe not exceed 93°C (200°F) which may cause the resin to cure too quickly and stress crack.

A2.9 Re-inspection and Preparation for the Next Layer

After the resin reaches recommended cure level, a CCTV inspection may be conducted, however if the resin is obviously cured after the last few inches of pipe is inspected visually, the next layer may be initiated. If there are surfaces that are not smooth or areas where excess resin has built up and cured, those surfaces shall be smoothed using tools attached to the cable to smooth and prepare the surface for the next layer.

After smoothing of the surface, if required, any remaining debris should be removed by air or water to flush loose material. If water is used, drying shall commence again as outlined above.

A2.10 Application of Subsequent Layers

Steps from A2.6 to A2.9 shall be repeated until the coating requirements have been met to insure that the calculated amount of resin has been applied to the coated surface. Weighing the amount of resin that was applied is mandatory to ensure actual quantities of resin met or exceeded required design thickness. In addition, measure the actual thickness at 6 locations using the method described in ASTM E376 or ASTM E797.

A2.11 Finished Report

In addition to a video of the line segment coated, a report of the type resin, the resins structural characteristics, and the quantity of material applied to the segment shall be recorded and shared with the customer.

A2.12 Workmanship

The finished pipe should be continuous over the entire length of a run and be free of dry spots, lifts, and de-laminations. If any of these conditions are present additional processing shall be performed to address those areas.

Appendix B (Informative)
Terminology

B1 Terminology

B1.1 Deteriorated Pipe

The original pipe can support surcharge loads throughout the design life of the rehabilitated pipe. The pipe may have longitudinal cracks and up to 10.0% distortion of the diameter. If the distortion of the diameter is greater than 10.0%, alternative design methods are required (see Note 1).

B1.2 Compromised Pipe

The original pipe is not structurally sound and cannot support live loads or is expected to reach this condition over the design life of the rehabilitated pipe. This condition is evident when sections of the original pipe are missing, the pipe has lost its original shape, or the pipe has corroded because of the fluid, atmosphere, or applied loads.

Technical Data Sheet
QCPUA-100

Description

Quik-Coating System QCPUA-100 is a two-component, MDI based, 100% solvent free polyurea pipe lining material. It is a very moisture insensitive formula and can be easily pigmented before use.

Typical Physical Properties

Mix Ratio by Volume: 1A:1B

Mix Ratio by Weight: 53A:47B

Gel Time: 10 to 30 Seconds

Hardness, Shore A: 70 D

Percent Solids: 100

Viscosity: Side A: 800 cps
Side B: 1500 cps

Specific Gravity: Side A: 1.2 ± 0.03
Side B: 1.03 ± 0.03

Weight: Side A: 10.0 ± 0.20 lbs/gal
Side B: 8.61 ± 0.20 lbs/gal

Application Process

Agitation: Quik Coating QCPUA-100 may not be diluted under any circumstances. QCPUA-100 Side B (resin) is made up of many components. As a result, prior to using the resin, it must be agitated so that all the components mix thoroughly together. The rule of thumb for agitation is one minute per gallon.

Agitate one minute for every 1 US gallon of resin, or until mixed thoroughly.

DO NOT OVERAGITATE. If resin is agitated for excessive periods, catalyst levels may be reduced through exposure to air. Therefore, only agitate enough to thoroughly mix the resin. Components within the resin will begin to settle after approximately 6 hours. This means the resin will need to be agitated every day it is used.

QCPUA-100 Side A (iso) does not need to be agitated. QCPUA may “crust” over after 6 hours and if so, you can break a hole through the crust and insure that the crust is out of the flow line to the pump.

Surface Preparation: In general, coating performance and adhesion are directly proportional to surface preparation. Most failures in the performance of surface coatings can be attributed to poor surface preparation. Polyurea coatings rely on the structural strength of the substrate to which they are applied. All surfaces should be free of dust, dirt, oil, grease, rust, corrosion, and other contaminants using cleaning procedure found in the Step x Step Operation Guide. When coating pipe previously used, it is important to consider the possibility of substrate absorption, which may affect the adhesion of the coating system, regardless of the surface preparation. Pipe Lining Supply, Inc recognizes the potential for unique piping from one project to another. Refer to the technical bulletins in the Pipe Lining Supply, Inc. operations Manual concerning the preparation method for the substrate. For project-specific questions, please contact the Pipe Lining Supply, Inc Technical Department.

Coverage: QCPUA-100 may be applied at any rate to achieve desired thickness in layered applications

Application: QCPUA-100 is brush applied, using the Quik-Coating combination brush/static mixers. In straight pipe, use a brush/static mixer one inch larger than the pipe being coated. If 90-degree bends are being coated the brush/static mixer should be 2 diameters larger than the straight pipe being coating.

Both QCPUA-100 Side A and Side B materials should be preconditioned at 70-80°F (21-27°C) before application.

QCPUA-100 materials should be applied using Quik-Coating two-part component equipment and the recommended surface temperature must be at least 5°F above the dew point.

QCPUA-100 should be applied in smooth, unidirectional passes to improve uniform thickness and appearance. The application should use a CCTV camera to watch for and maintain a continuous bead ahead of the brush/static mixer.

Limitations: Due to its aromatic composition, Pipe Lining Supply, Corp. QCPUA-100 will tend to yellow or darken in color after exposure to UV light.

Packaging

QCPUA-100 comes in 1 gallon of Side A and 1 gallon of Side B.

Safety and Handling

Do not handle until the Safety Data Sheets (SDS) for each component have been read and understood. Regulations require that all employees be trained on Safety Data Sheets for all chemicals with which they come into contact.

THIS PRODUCT CONTAINS ISOCYANATE AND CURATIVE MATERIAL.

Quik-Coating QCPUA-100 has a shelf life of one year from date of manufacture, in factory-sealed containers.

Avoid exposure to freezing temperatures for an extended period of time. Store drums on wooden pallets to avoid direct contact with the ground. Both QCPUA-100 Side A and Side B are recommended to be stored above 60°F (16°C).

If stored for a long period of time, rotate containers (both Side A and Side B) regularly. Do not open containers until ready to use.

Quik-Coating System

Technical Data Sheet
QCPUA-100

Features

- Zero VOC
- Excellent Thermal Stability
- Low Temperature Flexibility
- Good Chemical Resistance
- Seamless
- Odorless
- Meets USDA/Agriculture Canada Criteria
- Coats Carbon or Mild Steel Metals Without Primer
- Installed with or Without Reinforcement in Transitional Areas

THIS PRODUCT IS FOR COMMERCIAL USE ONLY AND SHOULD ONLY BE APPLIED BY TRAINED PERSONNEL. NOT FOR SALE OR USE BY GENERAL PUBLIC.

Pipe Lining Supply, Corp. makes no representations or warranties as to the results of the use of the products and assume no obligation in connection therewith. Any written, oral, testing, or technical application advice is to the best of Pipe Lining Supply, Corp's knowledge and believed to be correct. It is to be considered only an indication without obligation. Customer is reminded that he must satisfy himself that the product supplied by Pipe Lining Supply, Inc is suitable for his purpose and conditions of use. Application, uses, and transformation of the products which are beyond our control are exclusive responsibility of the customer/applicator. Liability of Pipe Lining Supply, Corp. for all claims, whether arising out of breach of warranty, negligence, strict liability, or otherwise, is limited to the purchase price of the material only.

ICC-ES PMG Product Certificate

PMG-1485

Effective Date: January 2020

This listing is subject to re-examination in one year.

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CSI: DIVISION: 22 00 00—PLUMBING
Section: 22 13 16—Sanitary Drain, Waste and Vent Piping

Product certification system:

The ICC-ES product certification system includes testing samples taken from the market or supplier's stock, or a combination of both, to verify compliance with applicable codes and standards. The system also involves factory inspections, and assessment and surveillance of the supplier's quality system.

Products: Quik-Coating Applied in Place Pipe Rehabilitation (AIPPR) System

Listee: Pipe Lining Supply Corp.
2970 E. La Palma Ave
Anaheim, CA 92606
www.pipeliningsupply.com

Compliance with the following codes:

2018, 2015, 2012, 2009 *International Plumbing Code®* (IPC)
2018, 2015, 2012, 2009 *International Residential Code®* (IRC)
2018, 2015, 2012, 2009 *Uniform Plumbing Code®* (UPC)

Compliance with the following standards:

IAPMO IGC 351-2018a, Applied in Place Pipe Rehabilitation (AIPPR) Systems

Identification:

The product packaging shall be marked with the manufacturer's name or trademark, the pipe size, the pipe material and application types (e.g. DWV, sanitary sewer, storm sewer, electrical conduit) for which it is intended, the model number, model name or description of polyurea as applicable and the ICC-ES PMG listing mark. This marking shall be affixed to the containers of product (A & B components).

As this product is applied in liquid form, labels alerting future cleaning of the lines must be affixed at each cleanout affected by the polyurea coating process.

Installation:

Installation must comply with the manufacturer's published installation instructions and the applicable codes.

The Quik-Coating Applied in Place Pipe Rehabilitation (AIPPR) System must be applied by installers trained and certified by Pipe Lining Supply, Inc.

The Quik-Coating Applied in Place Pipe Rehabilitation (AIPPR) System may be used to repair vertical and horizontal pipelines and conduits.

Inspection and Cleaning: The pipe must be clean of all debris, roots and other obstructions that would block proper inversion of the AIPPR. The cleaning must be done with a high-pressure jet unit or with mechanically powered cleaning equipment such as an electric rod machine with cutting attachments.

Inspection of the pipe must be done using a closed circuit television (CCTV) camera and performed by experienced personnel trained in locating breaks, obstacles and service connections. The interior of the pipe must be carefully inspected to determine the location of any conditions that may prevent proper installation of the AIPPR liner into the pipe. Conditions such as protruding service taps, collapsed or crushed pipe, reductions in the cross-sectional area of more than 40 percent, or other obstructions must be corrected.

If inspection reveals a condition that cannot be removed by conventional sewer cleaning equipment, then a point repair excavation should be made to uncover and remove or repair the obstruction.

Preparation, Installation and Curing of the Liner: The mix ratio of Side A and Side B must be mixed in accordance with the manufacturer's recommendations.

Once the polyurea is mixed, the installer must evenly apply the coating using the equipment approved by the manufacturer to ensure thorough application. The polyurea must be cured in accordance with the manufacturer's recommendations.

Cured piping is then inspected in accordance with the manufacturer's published installation instructions using equipment approved by the manufacturer. A final CCTV inspection is performed and recorded in accordance with Item 5 of the Conditions of Listing section.

Models:

Quik-Coating Applied in Place Pipe Rehabilitation (AIPPR) System: The system consists of components tested and listed to IAPMO IGC 351.

The coating thicknesses shall be specified by the manufacturer and may vary depending on the pipe size, pipe material and other conditions. In no case shall the minimum thickness be less than SDR=100 when calculated in accordance with the following:

$$SDR = \frac{\text{Pipe outside diameter}}{\text{Pipe wall thickness}}$$

For standard installations, the manufacturers instructions for minimum and maximum thicknesses should be adhered to.

Conditions of Listing:

1. Installation must be performed by installers trained and certified by Pipe Lining Supply, Inc.
2. The Quik-Coating AIPPR System may be used to line pipe with a minimum diameter of 1.5 NPS (40 DN) up to a maximum diameter of 16 NPS (400 DN).
3. The pipe must be inspected and cleaned in accordance with the Inspection and Cleaning section of this listing and the manufacturer's published installation instructions.
4. Final video inspection must be performed and witnessed by the code official or his designated representative. The final inspection must verify that the liner is continuous over the entire length of the pipe and is free of dry spots, lifts, and delaminations.
5. The Quik-Coating AIPPR System is under a quality control program with an annual inspection by ICC-ES.