

# PROPOSED PMG LISTING CRITERIA FOR THE REHABILITATION OF EXISTING BUILDING DRAINS AND BUILDING SEWERS BY THE INVERSION OR PULLED-IN-PLACE METHOD AND CURING OF RESIN-IMPREGNATED TUBE

LC1011

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## PREFACE

Plumbing, mechanical and fuel gas (PMG) listings issued by ICC Evaluation Service, LLC (ICC-ES), are based upon performance features of the *International Plumbing Code*®, *International Mechanical Code*®, *International Residential Code*®, *Uniform Plumbing Code* and *Uniform Mechanical Code*. Section 105.2 of the *International Plumbing Code*® reads as follows:

**Alternative materials, methods and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material or method of construction shall be approved where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Similar provisions are contained in the Uniform Codes.

ICC-ES may consider alternate listing criteria, provided the listing applicant submits valid data demonstrating that the alternate listing criteria are at least equivalent to the listing criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria set forth in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise demonstrate compliance with the performance features of the codes, ICC-ES retains the right to refuse to issue or renew a listing, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

***Listing criteria are developed solely for use by ICC-ES for purposes of issuing ICC-ES PMG listings.***

## 1.0 INTRODUCTION

**1.1 Purpose:** The purpose of this listing criteria is to establish requirements for resin-impregnated tube used in the rehabilitation of existing pipelines to be recognized in an ICC Evaluation Service, LLC (ICC-ES), listing.

**1.2 Scope:** This listing criteria is for resin-impregnated tube installed pneumatically by the inversion or pulled-in-place (PIP) method of installation into existing drainage piping, of materials allowed in the applicable code, from 4 to 10 inches in diameter. The resin is cured by circulating hot water, steam or ambient air within the tube. When cured, the finished pipe will be a continuous pipe within a pipe. The product is used to rehabilitate rigid drainage piping (non-pressure applications) conforming to the IPC and IRC.

### 1.3 Codes and Referenced Standards:

Note: Any standard referenced herein shall be the current edition of that standard. In instances where the applicable code references a different edition of a given standard, the applicant shall also provide documentation of conformance with the code referenced standard edition.

**1.3.1** 2009 *International Plumbing Code*<sup>®</sup> (IPC), Chapter 1, Administration. International Code Council.

**1.3.2** 2009 *International Residential Code*<sup>®</sup> (IRC), Chapter 1, Administration. International Code Council.

**1.3.3** ASTM F 1216, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of Resin-Impregnated Tube, ASTM International.

**1.3.4** ASTM F 1743, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP), ASTM International.

**1.3.5** NSF 14, Plastic Piping System Components and Related Materials, National Sanitation Foundation.

## 2.0 BASIC INFORMATION

**2.1 Product Description:** The material specifications, the minimum resin coating wall thickness, and the pipe sizes and pipe materials that can be rehabilitated must be in accordance with the manufacturer's specifications.

**2.2 Installation Instructions:** Product shall be installed in accordance with the manufacturer's instructions, and the requirements of the applicable codes and reference standards in Section 1.3. The installation instructions shall also specify any certification requirements for the installing contractors.

**2.2.1** The installation instructions shall include the following requirements for the field preparation of the liner: The liner tube material shall be resin-impregnated by vacuum (wet - out). The volume of resin used shall be sufficient to fill all voids in the tube material at nominal thickness and diameter and shall be adjusted by adding 5 to 10 percent excess.

**2.2.2** The installation instructions shall include the following requirements for gravity pipe cleaning and inspection:

**2.2.2.1 Cleaning:** Internal debris shall be removed from the original pipeline. Gravity pipes shall be cleaned with hydraulically powered equipment, high-velocity jet cleaners or mechanically powered equipment.

**2.2.2.2 Inspection:** Inspection of the pipeline shall be performed by personnel trained and certified by the manufacturer in locating breaks, obstacles, and service connections by closed-circuit television or man entry. Prior to any entry into unventilated areas, the atmosphere therein shall be verified to be safe for humans. The interior of the pipe shall be carefully inspected to determine the location of any protruding service taps, collapsed or crushed pipe and reductions in cross-sectional area of 40 percent or more. All of these conditions shall be removed, by cleaning techniques or by replacement of the damaged pipe section, before the liner is inserted.

**2.2.3 Labeling:** The installation instructions shall include a requirement for labeling the system to indicate that a resin-impregnated tube liner has been installed within the piping. The labeling shall include a prohibition on the use of flame or heat to repair any part of the piping system.

**2.3 Product and Packaging Identifications:** The packaging shall be permanently and legibly marked with the manufacturer's name or trademark, a method for field identification of the resin and liner, and a description of the method of packaging. Identification provisions shall include the listing number and the PMG listing mark.

### 3.0 GENERAL REQUIREMENTS

**3.1 Plastic Piping System Components and Related Materials:** The resin-impregnated liner material shall be tested and listed to NSF 14.

### 4.0 TEST METHODS AND PERFORMANCE REQUIREMENTS

#### 4.1 Inversion Installation Method

**4.1.1 Property Verification Tests:** A test assembly shall be set up for coating, utilizing a 4-inch-diameter pipe that is a minimum of 50 feet in length. Fittings shall be used to simulate an actual installation. Provisions shall be included to obtain samples as noted in Sections 8.1.1, 8.1.2 and 8.1.3 of ASTM F 1216. The test assembly shall be lined and cured in accordance with the manufacturer's installation instructions. The following tests shall be performed:

**4.1.1.1** Short-term flexural strength and flexural modulus testing in accordance with ASTM D 790 shall be performed on samples obtained in accordance with Sections 8.1.1 and 8.1.2 of ASTM F 1216. Minimum flexural strength shall be 4,500 psi (31 MPa) and minimum flexural modulus shall be 250,000 psi (1724 MPa).

**4.1.1.2** Delamination testing in accordance with Section 8.4 of ASTM F 1216 shall be performed. The peel-of-stripping strength between any nonhomogeneous layers shall be a minimum of 10 lb/in (178 g/mm).

**4.1.1.3** The completed assembly shall be tested for leakage in accordance with Section 8.2 of ASTM F 1216. Maximum leakage with the maximum pressure at the lowest point (4.3 psi or 29.7 kPa) should be 50 gallons per inch of pipe diameter per mile per day with all air bled from the system.

**4.1.1.4** The completed assembly shall be visually inspected to verify that the liner is continuous over the entire length of the inversion and is free of dry spots, lifts, and delaminations.

**4.1.2 Installation Instructions:** The installation instructions shall be reviewed by the testing laboratory or a registered design professional and shown to be in compliance with ASTM F 1216. This review shall be in the form of a side-by-side comparison of instructions and requirements.

**4.1.3 Verification of Flow Capability:** Calculations sealed by a registered design professional shall

document that the maximum thickness of lining for each diameter of pipe does not reduce the flow capacity below that of unlined pipe at the minimum slope.

**4.1.4 Chemical Resistance:** Chemical resistance testing shall be performed in accordance with ASTM D 543 with samples subject to exposure for a minimum of one month at 73.4°F (23°C) to document resistance to the chemicals listed in Table X2.1 of ASTM F 1216. Condition of acceptance shall be that the samples lose not more than 20 percent of their flexural strength and flexural modulus when tested in accordance with Section 4.1.1 of this criteria.

## **4.2 Pulled-in-place Installation Method**

**4.2.1 Property Verification Tests:** A test assembly shall be set up for coating, utilizing a 4-inch-diameter pipe that is a minimum of 50 feet in length. Fittings shall be used to simulate an actual installation. Provisions shall be included to obtain samples as noted in Sections 8.1.1 through 8.1.3 of ASTM F 1743. The test assembly shall be lined and cured in accordance with the manufacturer's installation instructions. The following tests shall be performed:

**4.2.1.1** Short-term flexural strength and flexural modulus testing in accordance with ASTM D 790 shall be performed on samples obtained in accordance with Section 8.1.4 of ASTM F 1743. Minimum flexural strength shall be 4,500 psi (31 MPa) and minimum flexural modulus shall be 250,000 psi (1724 MPa).

**4.2.1.2** Delamination testing in accordance with Section 8.4 of ASTM F 1743 shall be performed. The peel-of-stripping strength between any nonhomogeneous layers shall be a minimum of 10 lb/in (178 g/mm).

**4.2.1.3** The completed assembly shall be tested for leakage in accordance with Section 8.2 of ASTM F 1743. Maximum leakage with the maximum pressure at the lowest point (4.3 psi or 29.7 kPa) should be 50 gallons per inch of pipe diameter per mile per day with all air bled from the system.

**4.2.1.4** The completed assembly shall be visually inspected to verify that the liner is continuous over the entire length of the inversion and is free of dry spots, lifts, and delaminations.

**4.2.2 Installation Instructions:** The installation instructions shall be reviewed by the testing laboratory or a registered design professional and shown to be in compliance with ASTM F 1743. This review shall

be in the form of a side-by-side comparison of instructions and requirements.

**4.2.3 Verification of Flow Capability:** Calculations sealed by a registered design professional shall document that the maximum thickness of lining for each diameter of pipe does not reduce the flow capacity below that of unlined pipe at the minimum slope.

**4.2.4 Chemical Resistance:** Chemical resistance testing shall be performed in accordance with ASTM D 543, with samples subject to exposure for a minimum of one month at 73.4°F (23°C) to document resistance to the chemicals listed in Table 2 of ASTM F 1743. The condition of acceptance shall be that the samples lose not more than 20 percent of their flexural strength and flexural modulus when tested in accordance with Section 4.1.1 of this criteria.

## 5.0 LISTING RECOGNITION

### 5.1 Inversion Installation Method

**5.1.1** The listing shall state the minimum and maximum diameters that can be lined with the manufacturer's system, and shall require that the minimum thickness of the liner be determined by a registered design professional in accordance with Section X1.2 of ASTM F 1216. Sealed calculations shall be submitted to the code official.

**5.1.2** The listing shall state that the installing contractor must be trained and certified by the lining manufacturer.

**5.1.3** The listing shall require that the pipe be inspected and cleaned in accordance with Section 2.2.2 of this criteria.

**5.1.4** The listing shall require that each installation be sampled as noted in Sections 8.1.1, 8.1.2 and 8.1.3 of ASTM F 1216, and tested as noted in Sections 5.4.1 and 5.4.2, below. The testing shall be conducted by an accredited laboratory acceptable to the code official.

**5.1.4.1** Under short-term flexural strength and flexural modulus testing in accordance with ASTM D 790, minimum flexural strength shall be 4,500 psi (31 MPa) and minimum flexural modulus shall be 250,000 psi (1724 MPa).

**5.1.4.2** Delamination testing shall be performed in accordance with Section 8.4 of ASTM F 1216.

**5.1.5** The listing shall require that the completed system be subject to the following inspection and

testing, which shall be witnessed by the code official or his designated representative:

**5.1.5.1** Subsequent to curing in accordance with the manufacturer's instructions, a final video inspection in accordance with Section 8.6 of ASTM F 1216. The final inspection shall verify that the liner is continuous over the entire length of the inversion and is free of dry spots, lifts, and delaminations.

**5.1.5.2** Leakage testing in accordance with Section 8.2 of ASTM F 1216.

## **5.2 Pulled-in-place Installation Method**

**5.2.1** The listing shall state the minimum and maximum diameters that can be lined with the manufacturer's system, and shall require that the minimum thickness of the liner be determined by a registered design professional in accordance with Section X1.2 of ASTM F 1216 as referenced in ASTM F 1743. Sealed calculations shall be submitted to the code official.

**5.2.2** The listing shall state that the installing contractor must be trained and certified by the lining manufacturer.

**5.2.3** The listing shall require that the pipe be inspected and cleaned in accordance with Section 2.2.2 of this criteria.

**5.2.4** The listing shall require that each installation be sampled as noted in Sections 8.1.1, 8.1.2 and 8.1.3 of ASTM F 1743, and tested as noted in Sections 5.2.4.1 and 5.2.4.2, below. The testing shall be conducted by an accredited laboratory acceptable to the code official.

**5.2.4.1** Under short-term flexural strength and flexural modulus testing in accordance with ASTM D 790, minimum flexural strength shall be 4,500 psi (31 MPa) and minimum flexural modulus shall be 250,000 psi (1724 MPa).

**5.2.4.2** Delamination testing shall be performed in accordance with Section 8.4 of ASTM F 1743.

**5.2.5** The listing shall require that the completed system be subject to the following inspection and testing, which shall be witnessed by the code official or his designated representative:

**5.2.5.1** Subsequent to curing in accordance with the manufacturer's instructions, a final video inspection in accordance with Section 8.6 of ASTM F 1743. The final inspection shall verify that the liner is continuous over the entire length of the inversion and is free of dry spots, lifts, and delaminations.

**5.2.5.2** Leakage testing in accordance with Section 8.2 of ASTM F 1743.