



Designation: F3240 – 17

Standard Practice for Installation of Seamless Molded Hydrophilic Gaskets (SMHG) for Long-Term Watertightness of Cured-in-Place Rehabilitation of Main and Lateral Pipelines^{1,2}

This standard is issued under the fixed designation F3240; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the requirements for the installation of seamless molded hydrophilic gaskets (SMHG) in cured-in-place pipe (CIPP) rehabilitation of main and lateral pipelines.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 There is no similar or equivalent ISO Standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:³

¹ This test method is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.67 on Trenchless Plastic Pipeline Technology.

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² Practice for Installation of Seamless Molded Hydrophilic Gaskets (SMHG) for Long-Term Watertightness of Cured-in-Place Rehabilitation of Main and Lateral Pipelines is covered by patents 6,994,118, 7,975,726, 8,240,340, 8,240,341, 8,567,451, 8,636,036, 8,651,145, 8,667,991, 8,678,037, 8,689,835, 9,169,957, 9,366,375, 9,562,339, 9,551,449, (LMK Technologies, Inc. 1779 Chessie Lane, Ottawa, IL 61350). Interested parties are invited to submit information regarding the identification of acceptable alternatives to this patented item to the Committee on Standards, ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment](#)

[D1600 Terminology for Abbreviated Terms Relating to Plastics](#)

[D2240 Test Method for Rubber Property—Durometer Hardness](#)

[F412 Terminology Relating to Plastic Piping Systems](#)

[F1216 Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube](#)

[F1743 Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe \(CIPP\)](#)

[F2019 Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic \(GRP\) Cured-in-Place Thermosetting Resin Pipe \(CIPP\)](#)

[F2599 Practice for The Sectional Repair of Damaged Pipe By Means of An Inverted Cured-In-Place Liner](#)

[F2561 Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner](#)

2.2 NASSCO Guidelines:⁴

[Recommended Specifications for Sewer Collection System Rehabilitation.](#)

[PACP NASSCO Pipeline Assessment & Certification Program](#)

2.3 ISO Standard⁵

[ISO 17025 General requirements for the competence of testing and calibration laboratories](#)

3. Terminology

3.1 *Definitions*—Unless otherwise indicated, definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600.

⁴ Available from NASSCO 2470 Longstone Lane, Suite M Marriottsville, MD 21104 <https://www.nassco.org/>

⁵ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *seamless molded hydrophilic gasket (SMHG)*—a single piece molded neoprene expansion gasket is positioned between the host pipe and the liner. The gasket absorbs water and expands to form a long-term watertight seal between the CIPP and host pipe, which prevents infiltration and exfiltration.

3.2.2 *SMHG End Seal Sleeve*—a molded neoprene expansion gasket in the shape of an elongated sleeve. The SMHG End Seal Sleeve is engineered to maximize the sealing surface area, to be self-supporting when placed at the ends of the host pipe within 6 in. from the manhole, and to form a robust seal. See Fig. 1.

3.2.3 *SMHG Connection Seal*—a molded neoprene expansion gasket consisting of a tubular portion and a brim portion. The SMHG Connection Seal when positioned at the connection of the lateral pipe and main pipe will form a robust seal between a main pipe or a main liner, and a lateral liner. See Fig. 2.

3.2.4 *SMHG O-Ring*—a molded neoprene expansion gasket in the shape of a circular ring. The O-Ring is designed to attach to a liner tube near the terminating end of a liner that is either inverted or pulled into place to form a robust seal. See Fig. 3.

3.2.5 *main pipe*—main collector pipe of a sewer collection system

3.2.6 *lateral pipe*—branch pipe that provides sewer service from a building to the main pipe.

3.2.7 *host pipe*—the pipe to be rehabilitated using CIPP or folded pipe liners.

3.2.8 *cured-in-place pipe*—a thermoset resin saturated into an absorbent textile tube pressed against an inner pipe wall and cured to form a new pipe within a pipe.

3.2.9 *liner*—A resin impregnated cured-in-place pipe fabric tube that takes the shape of a main pipe, lateral pipe, or a main to lateral connection when installed.

3.2.10 *main/lateral connection liner*—One-piece resin saturated liner assembly consisting of a main tube or a main sheet formed into tube (minimum of 16 in. in length) and a lateral tube forming a main/lateral connection liner.

3.2.11 *lateral liner*—Resin saturated liner tube used to renew a lateral pipe.

3.2.12 *main liner*—Liner (CIPP or Folded liner) used to renew a main pipe.

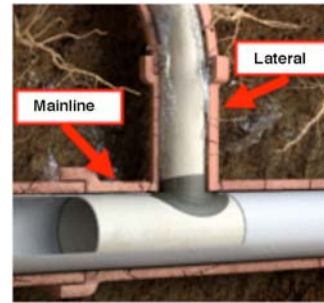


FIG. 2 SMHG Connection Seal



FIG. 3 SMHG O-Ring

3.2.13 *sectional liner*—CIPP installed in a portion of the main or lateral pipe for repairing a localized defect or a section of the pipe.

3.2.14 *inverting liner*—A liner that progresses through a pipe by turning inside out.

3.2.15 *leading edge*—the edge of the SMHG End Seal Sleeve that faces the direction of liner installation.

3.2.16 *watertight*—for the purposes of this standard, the SMHG shall not allow water to pass through or around the gaskets at head pressures up to 10 psi.

4. Summary of Practice

4.1 This is a practice for materials and the installation of a gasket with hydrophilic properties, positioned between the host pipe and the Liner, which has been molded without seams into various shapes such as an elongated sleeve, Connection Seal, or O-Ring to form a long-term watertight seal to prevent infiltration and exfiltration.

4.1.1 The SMHG End Seal Sleeve is positioned at the upstream and downstream ends of a main pipe section typically 6 in. from a manhole connection prior to the Main Liner installation. The SMHG End Seal Sleeve is held in place by a mechanical fastener. For large diameter pipe (diameter 18 in. and larger), the sleeve and its fastener are held in place by anchor screws. Once the liner is installed and cured the SMHG End Seal Sleeve shall remain positioned between the host pipe and the CIPP at both ends of the main pipe within 6 in. of the manhole. See Fig. 1.

4.1.2 The SMHG Connection Seal is attached to the Main/Lateral Connection Liner after resin impregnation by two stainless steel snaps located on opposite sides of the SMHG Connection Seal. The SMHG Connection Seal can be manufactured to fit a Tee or Wye connection. Once the liner is installed and cured the SMHG Connection Seal shall remain



FIG. 1 SMHG End Seal Sleeve

positioned between the host pipe and the CIPP at the main and lateral connection. See Fig. 2.

4.1.3 The SMHG O-Rings are used to seal CIPP ends with limited access, such as the upper end of a lateral liner inverted from the main pipe. Another use would be at the upstream and downstream ends of a sectional CIPP located in a main pipe or in a lateral pipe. The SMHG O-Rings are attached to an inverting liner near its terminating ends before resin impregnation. O-Rings are also placed around flat sheet liners that are formed into a tube by wrapping the sheet around an inflatable plug. Once the liner is installed and cured the SMHG O-Rings shall remain positioned between the host pipe and the CIPP liner. See Fig. 3.

4.1.4 Applicable ASTM standards or manufacturer’s recommendations, or both, shall govern the installation procedures for the various CIPP rehabilitation methods.

5. Significance and Use

5.1 This practice is for use by designers and specifiers, regulatory agencies, owners, and inspection organizations that are involved in the rehabilitation of main and lateral pipelines and manholes. As for any practice, modifications may be required for specific job conditions.

6. Materials

6.1 *Seamless Molded Hydrophilic Gasket (SMHG):*

6.1.1 The SMHGs shall be made with Neoprene rubber having hydrophilic properties. The gaskets will gradually expand when exposed to moisture such that it has a minimum 190% thickness increase and 800% weight increase after 10 000 hours.

6.1.2 The SMHGs shall be subjected to a 10 000-hour hydration/dehydration test performed by an ISO 17025 accredited testing facility. The test shall include submerging the gaskets in water for a period of 2, 7, 30, 90, 180 and 416 days then removed, measured, and weighed. The gaskets shall remain out of water for the same period of time as they were submerged except for the 416 day interval. This process is repeated until all samples within their respective cycles have been tested for 10 000 h. Results must show that the SMHGs continue to stay flexible by bending the sample in half and observing no cracking. Also the SMHGs shall have no loss of material, and never get smaller than their original dimensions. The SMHGs shall retain the ability to increase in thickness a minimum of 190% and a weight increase of 800%.

6.1.3 The SMHGs shall have a Shore A Hardness of at least 45 when tested in accordance with Test Method D2240.

6.1.4 The SMHGs shall meet the requirements of D1149, Test Method for Rubber Deterioration - Cracking in an Ozone Controlled Environment.

6.1.5 The SMHG End Seal Sleeve shall have the following dimensions for the respective host pipe inside diameter (ID). See Table 1.

6.1.6 The SMHG O-Ring shall have the following dimensions for the respective host pipe inside diameter (ID).

6.1.7 The SMHG Connection Seal shall have minimum values for the thickness, flange width, and length of tubular portion of 0.125 in., 2.5 in., and 1.6 in. respectively. The SMHG Connection Seal shall be molded in either a Wye or Tee

TABLE 1 SMHG End Seal Sleeve Dimensions

SMHG End Seal Sleeves End			
Host Pipe ID (in.)	Seal ID (in.)	Width (in.)	Thickness (in.)
6	5.6	3.5	0.06
8	7.5	3.5	0.08
10	9.5	3.5	0.12
12	11.5	3.5	0.12
15	14.25	3.5	0.12
18	17	3.5	0.12
21	20	3.5	0.12
24	22.75	3.5	0.12
27	25.75	3.5	0.18
30	28.5	3.5	0.18
36	34.25	3.5	0.18
42	40.25	3.5	0.24
48	46.25	3.5	0.24
54	52.25	3.5	0.24

configuration and in a manner in which it creates a circular or elliptical shape in the portion that extends into the lateral when the flange portion is forced to curve around the CIPP. The SMHG Connection Seal will conform to the curvature of main pipes from 6 in. diameter and larger.

6.2 *Mechanical Fastener for End Seal Sleeve:*

6.2.1 For host pipe diameters less than 18 in., mechanical fasteners shall be a flat bendable metal retaining clip with adhesive tape on one side that is inserted inside the SMHG End Seal Sleeve’s leading edge to force the sleeve outward near its full diameter. This shall result in a snug fit in the host pipe.

6.2.2 For host pipe diameters 18 in. or greater, the mechanical fastener shall be a ratcheting metal retaining ring or other spring type mechanism. The ratcheted retaining ring includes a strip of material having a total length generally greater than the pipe diameter. A ratcheting worm gear or other spring type mechanism is attached to the strip and the strip is formed into a ring shape of variable diameters that is used to hold the sleeve in the correct position within the host pipe.

6.3 *Anchor Screws for End Seal Sleeve:*

6.3.1 The Anchor Screw shall have the capability of mechanically anchoring the SMHG End Seal Sleeve into the host pipe.

6.3.2 The Anchor Screw shall be long enough to temporarily affix the retaining ring to the host pipe but not penetrate entirely through the pipe.

7. Procedure

7.1 *Cleaning and Inspection*—The cured-in-place pipe rehabilitation shall conform to the Access Safety, Cleaning of Pipeline, and Line Obstructions sections of Practice F1216, Practice F1743, Practice F2019, Practice F2561, and Practice F2599 whichever is most relevant.

7.2 *Seamless Molded Hydrophilic Gasket (SMHG):*

7.2.1 *SMHG End Seal Sleeve:*

7.2.1.1 *Measurement*—The pipe at the manhole shall be measured from 6:00 to 12:00 and from 3:00 to 9:00. The mean shall be the nominal inner diameter. The SMHG End Seal Sleeve shall be of the same or smaller inner diameter according to Table 1. For non-circular pipes the circumference shall be measured.

7.2.1.2 *Placement*—The SMHG End Seal Sleeve shall be unpackaged and installed no more than 24 h prior to CIPP installation. The SMHG End Seal Sleeves shall be installed while the mainline is temporarily plugged or bypassed flows for the installation of the CIPP. If the CIPP installation has not begun within 24 h of the SMHG End Seal Sleeve installation then they shall be removed. The first 6 in. of the inside of the main pipe shall be cleaned to remove all debris, deposits larger than 1/2 in. in diameter and visible grease deposits. The metal retaining clip shall then be placed at the leading edge inside the sleeve. An adhesive tape may be applied to the outer surface of the metal retaining clip. The adhesive tape shall be a thin flexible polyethylene (PE) film, coated on both sides with an aggressive synthetic rubber adhesive. It shall have excellent adhesion properties and good initial tack and shall create an immediate temporary bond to neoprene rubber and metal to prevent the metal retaining clip from slipping during CIPP installation. The SMHG End Seal Sleeve shall then be placed so that its leading edge is no more than 6 in. inside the end of the main pipe, measured from the manhole connection. If the pipe’s inner diameter is 18 in. or greater, anchor screws shall be used to hold the sleeve in place. In that case, a slot shall be placed in the metal circular retaining clip to allow anchor screws to be flush with the mechanical fastener. A minimum of four screws is recommended and shall be spread evenly along the circumference of the sleeve. Anchor screws shall be hand tightened to allow expansion of SMHG end seal.

7.2.1.3 *Pre-liner or Outer-bag*—If a pre-liner or outer-bag is used as part of the CIPP installation one SMHG End Seal Sleeve shall be placed into the host pipe prior to its installation and a second SMHG End Seal Sleeve shall be placed inside the pre-liner or outer-bag adjacent to the first SMHG End Seal Sleeve at the pipe ends within 6 in. of manhole. Therefore, the annular space between the pre-liner and the host pipe is sealed and the annular space between the CIPP and the pre-liner is sealed.

7.2.2 *SMHG Connection Seal:*

7.2.2.1 *Measurement*—The installation contractor shall determine the lateral diameter at the main pipe connection. There are a variety of commercially available techniques available to determine the lateral pipe diameter.

7.2.2.2 *Placement*—The SMHG Connection Seal shall be attached to the main/lateral liner after the resin saturation process by stainless steel snaps or other mechanical means that prevent it from being detached from the main/lateral liner. The lateral shall be plugged to eliminate any flows from interfering with the installation. Flow in the mainline shall either be bypassed or plugged until the inflation of the liner. The main/lateral one-piece liner shall be inserted into the main pipe and positioned at the main/lateral connection. The SMHG Connection Seal shall be positioned so that the brim portion is flush against the main pipe and the tubular portion extends into the lateral pipe.

7.2.3 *SMHG O-Ring:*

7.2.3.1 *Measurement*—The lateral or main pipe diameter at the anticipated location near the end of the respective liner shall be determined by the installation contractor. There are a variety of techniques available to determine the main pipe and lateral pipe diameters. The SMHG O-Ring shall be of the same or smaller inner diameter according to Table 2.

7.2.3.2 *Placement*—To prevent movement during installation, the SMHG O-Ring shall be attached to the lateral liner or sectional liner prior to resin saturation. Two (2) SMHG O-Rings shall be placed at each end of the lateral liner or sectional liner. The first SMHG O-Ring shall be adhered using a single drop of cyanoacrylate that is specifically designed to bond with neoprene rubber. A single drop of cyanoacrylate shall be placed at six equally distanced spots around the circumference of the liner. Install the first O-Ring at 4 in. from the edge of the liner and the second O-Ring 6 in. from the edge of the liner. The O-Rings may also be attached by sewing, welding or manufacturing as part of the liner.

7.2.4 *Liner Installation*—The installation of the cured-in-place pipe shall conform to Practice F1216, Practice F1743, Practice F2019, Practice F2561, or Practice F2599 whichever is most relevant. Flow shall be bypassed or plugged until the liner is inflated.

7.2.5 *Inspection and Acceptance*—The proper placement of the SMHG after installation shall be verified by visual inspection or by closed-circuit television (CCTV). The visual inspection of the finished rehabilitated CIPP shall reveal a visual impression of the correctly positioned SMHG. The gasket shall not be folded, torn, twisted or rolled. At the request of the owner a photo of the properly placed SMHG shall be submitted. See Fig. 4, Fig. 5, and Fig. 6. After the gaskets have expanded, no infiltration shall be observed at the installed SMHG. Inspection to verify watertightness shall take place during the period between 72 h after installation up until the end of the warranty period.

8. Keywords

8.1 anchor screws; CIPP; connection seal; cured-in-place liner; end seal sleeve; leading edge; mechanical fastener; O-Ring; seamless molded hydrophilic gasket (SMHG); sectional liner; watertight seal

TABLE 2 SMHG O-Dimensions

Pipe ID in.	SMHG O-Rings	
	O-Ring ID in.	Thickness in.
4	3.51	0.16
5	4.25	0.16
6	4.9	0.16
8	7.16	0.16
10	9.23	0.16
12	10.98	0.16
15	14.08	0.16
18	17.34	0.16
21	20.5	0.16
24	23.47	0.16
30	29.44	0.16
36	35.25	0.16



FIG. 4 SMHG End Seal after CIPP Installation



FIG. 5 SMHG Connection Seal after CIPP Installation



FIG. 6 SNHG O-ring after CIPPP Installation

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