

AWWA Class 1, 2, 3, and 4 Pipe Lining with SIPP

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Introduction

Spray-in-Place Pipe (SIPP) is a trenchless rehabilitation method where a polymer-based liner, such as polyurea or epoxy, is sprayed onto the interior of existing water mains to repair leaks, corrosion, or structural damage. The American Water Works Association (AWWA) Manual M28 classifies pipe liners into four classes (Class 1, 2, 3, and 4) based on their structural capabilities and interaction with the host pipe. This document explains the differences between these classes when using SIPP, with applications, standards, and limitations.

Overview of SIPP

SIPP involves spraying a fast-curing polymer liner inside pipes using an air-driven spray head for small-diameter pipes (1.25–72 inches) or manually for larger pipes. It addresses corrosion, leaks, and structural issues with minimal disruption. Key advantages include quick curing, corrosion resistance, and compliance with standards like AWWA C222 (polyurethane) and C210 (epoxy).

AWWA Class Definitions

Class 1: Non-Structural

- **Purpose:** Provides corrosion protection and improves hydraulic performance without structural support.
- **Characteristics:** Thin liner (0.5–2 mm), fully dependent on the host pipe for structural integrity.
- **SIPP Application:** Thin polyurea or epoxy coating to seal minor leaks or prevent corrosion (e.g., tuberculation in ductile iron pipes).
- **Use Case:** Pipes with good structural condition needing corrosion resistance.

- **Standards:** AWWA C222, C210; certified to NSF/ANSI 61 for potable water.
- **Limitations:** Ineffective for structurally compromised pipes.

Class 2: Semi-Structural, Interactive

- **Purpose:** Enhances pressure resistance while adhering to the host pipe.
- **Characteristics:** Medium liner (2–4 mm), supports internal pressure but relies on the host pipe for external loads.
- **SIPP Application:** Thicker polyurea/epoxy layer to bridge small cracks or pinholes.
- **Use Case:** Pipes with moderate deterioration (e.g., minor leaks).
- **Standards:** AWWA C222, C210, ensuring adhesion and flexibility.
- **Limitations:** Requires a structurally sound host pipe for external loads.

Class 3: Semi-Structural, Independent

- **Purpose:** Acts as an independent pressure vessel within the host pipe.
- **Characteristics:** Thicker liner (4–6 mm), handles internal pressure but relies on the host pipe for external loads.
- **SIPP Application:** Robust polyurea/epoxy liner for pipes with severe internal damage but stable external structure.
- **Use Case:** Water mains with significant corrosion but intact soil support.
- **Standards:** AWWA C222, C210, tested for pressure resistance.
- **Limitations:** Not suitable for fully deteriorated pipes.

Class 4: Fully Structural

- **Purpose:** Complete structural replacement, independent of the host pipe.
- **Characteristics:** Thickest liner (6 mm+), handles all internal and external loads (pressure, soil, traffic).
- **SIPP Application:** Heavy-duty polyurea or polyurethane liner (e.g., AquaPipe) for fully deteriorated pipes.
- **Use Case:** Collapsed or severely damaged water mains.
- **Standards:** AWWA C222, M28; high strength and flexibility.

- **Limitations:** Higher cost and complex application.

Comparison Table

Table 1: Comparison of AWWA Classes for SIPP Lining

Class	Structural Role	Liner Thickness	Host Pipe Dependency	
Class 1	Non-structural	0.5–2 mm	Fully dependent	Corrosion
Class 2	Semi-structural, interactive	2–4 mm	External loads	Minor
Class 3	Semi-structural, independent	4–6 mm	External loads	Severe
Class 4	Fully structural	6 mm+	Independent	Fully replaced

Key Considerations

- **Material Choice:** Polyurea (AWWA C222) preferred for flexibility and adhesion; epoxy risks cracking in thicker applications.
- **Application:** Requires thorough surface preparation (jetting, CCTV inspection) for effective adhesion.
- **Advantages:** Fast curing, corrosion/abrasion resistance, NSF/ANSI 61 compliance for potable water.
- **Limitations:** Effectiveness depends on skilled application to avoid pinholes or uneven coating.

Conclusion

SIPP offers versatile solutions for water main rehabilitation, with AWWA Classes 1–4 addressing varying levels of pipe deterioration. From non-structural corrosion protection (Class 1) to fully structural replacement (Class 4), SIPP enables cost-effective, trenchless repairs tailored to specific needs, ensuring durability and compliance with industry standards.

References

- AWWA Manual M28: Rehabilitation of Water Mains
- AWWA C222: Polyurethane Coatings for Pipelines
- AWWA C210: Liquid-Epoxy Coatings for Pipelines
- <https://www.awwa.org>