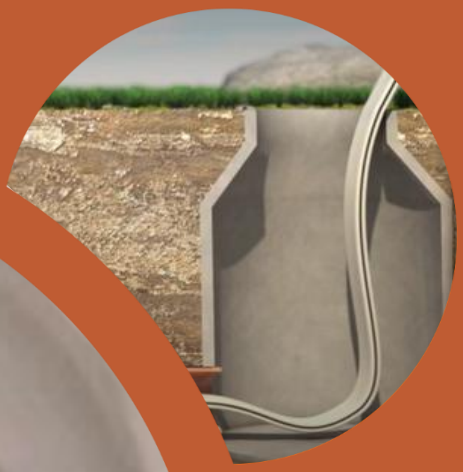

GRAVITY SEWER PIPE REHABILITAION

FOLD AND FORM LINING – PERFORMANCE SPECIFICATION GUIDELINE

Document No. ESF-600-STD-210

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Watercare

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More information

If you have further queries, please contact the Asset Lifecycle team at standards@water.co.nz

DOCUMENT CONTROL

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Definitions

ASTM	American Society for Testing Materials
ASTT	Australasian Society for Trenchless Technology
CCTV	Closed Circuit Television – which includes cameras and displays to record and inspect pipelines.
Contractor	Main contractor engaged by Watercare, responsible for delivering the works
Defect	Any discontinuity, imperfection or inclusion arising from substandard materials, improper pipe preparation, or faulty manufacture, installation or workmanship which affects the hydraulic or structural performance of the lining
Flow management plan (FMP)	Contractor plan(s) and methods to divert flows whilst preventing overflows or any adverse consequences whilst preparing the host pipe and installing the new liner.
IANZ	International Accreditation New Zealand
ISO	International Organisation for Standardisation
Lateral Junction repair (LJR)	Repair to a damaged lateral connection, either stand alone or in conjunction with a full or part liner
NDSRs	No-dig spot repairs
Project Specification	Project specific requirements specific by the design engineer which form part of the minimum requirements to be met during construction
PE	Polyethylene (HDPE)
PVC-U	Unplasticized polyvinyl chloride
Quality Control Plan	The Contractor's documentation that defines the procedures for delivering the level of construction quality required by the project.
Specialist Contractor	Contractor carrying out the physical installation of the liner in accordance with the project specifications and manufacturer's recommendations.
Watercare	Watercare's representative responsible for managing the project.

Table of Contents

1. Scope

This Performance Specification includes the minimum requirements for the rehabilitation of pipelines using fold and form liners. These liners are installed from manhole to manhole using continuous lengths of PVC-U or PE sections which are folded prior to installation.

Once installed, the liner will be reinstated to its original (manufactured) form to tightly fit within the host pipe. The liner shall be a seamless walled pipe, and jointing shall be avoided where possible. Should jointing be required, this will be carried out to achieve a fully ductile (integrated) joint.

This document shall be read in conjunction with *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*.

1.1 Overview

***Table 1**: Application of fold and form liners*

Reference	Description
Liner material	PE and PVC-U
Roughness coefficient	Refer to AS 2200: Design charts for water supply and sewerage
Liner Classification	Class A – Fully structural Class B – Semi-structural
Applications	Wastewater: Non-pressure
Pipe sizes	150mm to 1500mm diameter[(a)]
Installation	Manhole to manhole
Design life	50 years

(a) Dependent on installation method

2. Relevant Standards

***Table 2**: Standards applicable to spiral wound PVC-U liners*

Standard	Relevance	Applicable Fold and Form material
AS/NZS ISO 11295: Plastics piping systems used for the rehabilitation of pipelines - Classification and overview of strategic, tactical and operational activities	Planning and general	All – General
AS 2200: Design charts for water supply and sewerage	Design	All
AS/NZS ISO 11296.1: Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks, Part 1: General	General	All
AS/NZS ISO 11296.3: Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks - Part 3: Lining with close-fit pipes	Design, materials and testing	
ASTT – DS-D001 Specification: Design for Structural Renovation of Pipelines by Internal Lining, Part 1 – Circular Non-pressure Pipelines	Design	All
ISO/TS 23818-1: Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines – Part 1: Polyethylene (PE) material	Material	PE
ASTM F1504: Standard Practice for Folded Poly (Vinyl Chloride) (PVC) Pipe for Existing Sewer and Conduit Rehabilitation	Design and material	PVC-U
ASTM F1947: Standard Practice for Installation of Folded Poly (Vinyl Chloride) (PVC) Pipe into Existing Sewers and Conduits	Installation	PVC-U

Standard	Relevance	Applicable Fold and Form material
ISO/TS 23818-3: Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines - Part 3: Unplasticised poly(vinyl chloride) (PVC-U) material	Material and testing	PVC-U
ASTM D638: Standard Test Method for Tensile Properties of Plastics	Material and testing	All
ASTM D790: Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials	Material and testing	All
ASTM D543: Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.	Material	All

Note: The latest revisions of the standards listed above shall be referred to when carrying out any of the associated works.

3. Design

Design of the lining system shall meet all the relevant requirements of *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*.

The fold and form liner shall be designed using one of the following standards:

- PVC-U liners
  - **ASTT – DS-D001 Specification:** Design for Structural Renovation of Pipelines by Internal Lining, Part 1 – Circular Non-pressure Pipelines
  - **ASTM F1504**: Standard Practice for Folded Poly (Vinyl Chloride) (PVC) Pipe for Existing Sewer and Conduit Rehabilitation
- PE liners
  - **ASTT – DS-D001 Specification:** Design for Structural Renovation of Pipelines by Internal Lining, Part 1 – Circular Non-pressure Pipelines

The long term (50 year extrapolated) Creep Reduction Factor shall be set at 50% of the initial flexural modulus as determined by ASTM D790 test method. This value shall be used unless the Contractor submits long term test data (ASTM D2990) to substantiate a higher retention factor.

4. Material requirements

4.1 Material properties

The Contractor shall submit test data to substantiate that the values for material properties nominated in the design calculations can be achieved by the materials supplied for the pipeline installation.

Where material properties under load vary with time, material properties of the lining at the end of the 50-year design life shall be used in design calculations. The exception to this is design of the lining for loads applied only during installation, which may be based on short-term material properties.

The material properties of the lining material used in the rehabilitation of the pipeline shall be consistent with the design properties. These properties shall have the same values as those nominated by the Designer.

The fold and form liner shall meet the requirements set out in the following standards:

- PVC-U liners
  - **ASTM F1504**: Standard Practice for Folded Poly (Vinyl Chloride) (PVC) Pipe for Existing Sewer and Conduit Rehabilitation
  - **ASTM F1947**: Standard Practice for Installation of Folded Poly (Vinyl Chloride) (PVC) Pipe into Existing Sewers and Conduits (Sampling)
  - **ISO/TS 23818-3**: Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines - Part 3: Unplasticised poly(vinyl chloride) (PVC-U) material

- PE liners
  - **ISO/TS 23818-1:** Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines – Part 1: Polyethylene (PE) material

4.2 Chemical, temperature and abrasion resistance

The contactor shall provide evidence that the materials proposed, meet the applicable standards listed in this document. Refer to *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*, Section 4.3 for general requirements.

5. Construction

For all general construction requirements refer to *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*.

5.1 Installation

5.1.1 Liner installation

The liner installation shall be in accordance with the following standards and shall be installed as per the liner manufacturer's specification:

- PVC-U liners
  - **AS/NZS ISO 11296.3**: Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks - Part 3: Lining with close-fit pipes
  - **ASTM F1947**: Standard Practice for Installation of Folded Poly (Vinyl Chloride) (PVC) Pipe into Existing Sewers and Conduits
- PE liners
  - **AS/NZS ISO 11296.3**: Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks - Part 3: Lining with close-fit pipes

There shall be no defects or discontinuities that could adversely affect the hydraulic performance or long-term life of the lining.

5.1.1.1 Pre-heating

Prior to insertion of the liner into the host pipe, the Contractor shall pre-heat the liner in the manner prescribed by the manufacturer's installation instructions. The heated liner must be pliable enough to be pulled into the host pipe with as little resistance as possible, and within the allowable tension tolerance as specified.

5.1.1.2 Pipe liner insertion

The liner pipe shall be inserted into the sewer through existing manholes, without modification of the manholes. Insertion of the liner into the host pipe will be accomplished by pulling the liner into the host pipe by means of a cable strung through the host pipe from a winch located at the receiving manhole. The end of the liner shall be prepared for attachment to the cable in accordance with the manufacturer's instructions. The connection between the pulling cable and the prepared end of the liner shall include a swivel device to prevent twisting of the liner as it is pulled through the host pipe. The heated liner coil shall be placed in such a manner as to prevent damage to the liner as it is pulled through the manhole and into the host pipe.

5.1.1.3 Liner cutting at manholes

This section shall be read in conjunction with *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*. After installation the ends of the liner shall be cut off at manhole entry / exit points. The Lining Contractor shall make sufficient allowance for longitudinal shortening to occur before making final cuts to the liner ends to make them smooth and parallel with manhole walls. The finished liner shall not protrude into manholes or have contracted back into the pipeline.

5.1.2 Sealing manhole connections

This section shall be read in conjunction with *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*. A watertight seal at the manhole may be accomplished by placing a hydrophilic seal between the expanded liner and the host pipe prior to expansion of the liner.

5.1.3 Lateral connections

Refer to *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*.

Following installation of the liner, the Lining Contractor shall cut open the liner at the location of live lateral connections sufficient to allow the wastewater service from the laterals to be re-established whilst providing sufficient allowance for longitudinal shortening to occur before the lateral connection is fully opened and trimmed to be flush with the projected surface of the lateral and installation of the new lateral junction.

5.1.4 Defects

Liners shall be assessed for defects as per the relevant requirements of Section 5.2.10 of *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*.

The following are common examples of defects that are considered unacceptable and must be remediated:

- Liner installed over debris which interferes with the installation or adversely affects the hydraulic of structural performance of the liner.
- Liner installed over unacceptable protrusions or deformations in the host pipe.
- Poor quality cut outs or misalignment of cut out with lateral connections.
- Inadequate seals at manholes or lateral connections.
- Liner thickness installed is less than specified design value (incorrect procurement of liner).
- Liner not fully expanded, including plastic deformation from “folding”.

Note: The defects listed above are not intended to be an exhaustive list. Installed liners will be assessed to confirm they meet the functional requirements over the design life of the lining system.

6. Acceptance Control

Refer to *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*.

6.1 Testing

6.1.1 Leak testing

Refer to *ESF-600-STD-206: Gravity sewer pipe rehabilitation – General requirements for the installation of lining systems*.

6.2 Sampling

Retain a sample of the profile from each liner section between upstream and downstream manhole and record the batch number of the profile.

Material shall also be assessed and tested to demonstrate conformity with Section 4.

Appendix A: Example Inspection and Test Plan

Contractor Name	ABC Limited	**To be completed, submitted, and approved before works can commence**	**Complete Watercare's Health and Safety induction**	*Yes*	*Date*
Project Reference	(Project Name)		**Control of Work documentation submitted (AA, JSA, Work Permits etc.)**	*Yes*	*Date*
Contractor Representative			**Work Method Statement**	*Yes*	*Date*
			Flow management plan	*Yes*	*Date*
			Quality Control Plan	*Yes*	*Date*

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Upstream Structure (e.g. MH 01)	Downstream Structure (e.g. MH 02)	Pipe Cleaned (Yes / No)	Flow Management in place (Yes/No)	CCTV Inspection (Reference Report No.)	Confirm Pipe Size (mm)	Confirm Liner Size (mm)	Liner Material and Certificates	Confirm location of laterals	Pipeline preparation after cleaning (e.g. repairs)	Installed liner - no defects	Grouting around liner anulus (if required)	Liner termination and epoxy around manholes	Post-installation CCTV	Testing and sampling of pipeline	Remediate all defects	Contractor's Representative
MH01	*MH-02*	*Yes*	*Yes - in place (17/04/2024)*	*Yes: Report No. 1234 (18/04/2024)*	*300 mm*	*285 mm*	*PVC-U / Yes*	*Yes*	*Repairs completed (21/04/2024)*	*Yes*	*Not required, only at terminations*	*Yes (25/04/2024)*	*Yes: Report No. 9876 (26/04/2024)*	*Pass (30/04/2024)*	*Completed (02/05/2024)*	*Signed and Date*