creating a better tomorrow

Infiltration resistance testing of CIPP liners

No Dig Roadshow Sheffield - UKSTT

June 2025

The Big AMP 8 Challenge – Tackling Sewer Overflows

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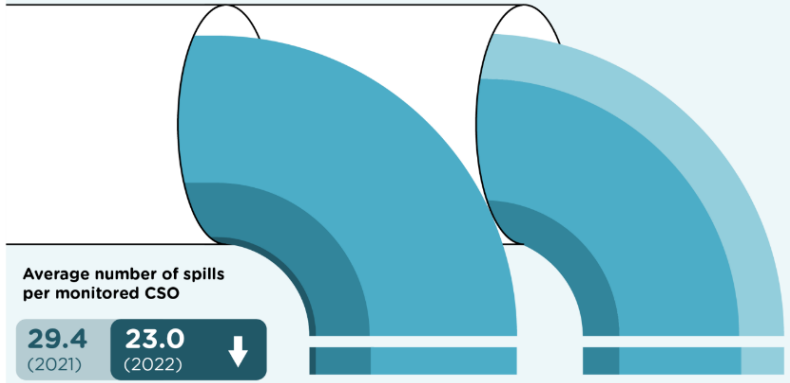
All water firms now investigated for sewage spills

Cause of Combined Sewer Overflow (CSO) spills in the UK



Average number of spills per monitored CSO

29.4 (2021) → 23.0 (2022)

The average number of spills per storm overflow has reduced to 23, compared to 29.4 in 2021. However, this is largely down to dryer weather, not water company action.

Cause of CSO spills (%, in 2021)

Exceptional rainfall	2%
Asset maintenance	29%
Hydraulic capacity	70%
Ongoing investigation	0%

Cause of CSO spills (%, in 2022)

Exceptional rainfall	0%
Asset maintenance	18%
Hydraulic capacity	60%
Ongoing investigation	21%

Source: Environmenmt Agency (2023)

Solving Infiltration problem

CIPP Testing

Infiltration

- UK Water Companies required to reduce storm overflow spills
- Infiltration reduction is key for many planned schemes to reduce the number of CSO spills
- Leak tightness is a functional requirement of drain and sewer systems (EN 752:2017 §5.1.9)
- Sewer linings are required to remain leak tight throughout their service life (WRc SRM Type 2 Structural Design).
- Currently no test method is specified in British or European standards for proving leaktightness of sewer repairs
- WRc previously developed a test method in 2007 (CP308) to investigate infiltration resistance of CIPP liners
- UK Water companies wanted a test method as a Water Industry Specification (WIS) and for future inclusion in a European standard

Project Objectives

Refine the test method in consultation with both water company and supplier participants into an agreed standard test method

Validate by testing CIPP liners of the supplier participants using test facilities built at WRc Swindon

Publish the test method as a draft Water Industry Specification for public comment

Work with the Water UK Standards Board to produce a final WIS

CP308 shortcomings – Why a revision was necessary

- CP308 established the effectiveness of some cured-in-place lining to resist infiltration
- The test method contained unnecessary tests used only for research and product development
- Questions over the maximum permissible leakage
- Developed for CIPP systems with a permanent close fit between liner and host pipe including those where resin may be exuded into any available space
- No test for post-lateral connection reopening
- Lacked detail for bond performance and end seal effectiveness
- Limited number of products tested and many no longer available
- Need to address current challenges and development in CIPP materials and technologies.

CP655

- Water companies identified despite large scale lining projects infiltration was still entering the network notably through reopened connections
- WRc requested to develop a new test method for assessing the liner leaktightness by the Water Companies
- WRc believed that developing a Water Industry Specification was the best route with its future potential for inclusion in European standards
- Thames Water, Southern Water, Wessex Water, Anglian Water, Severn Trent, Dŵr Cymru, and Government of Jersey formed the Project Steering Group and the Water UK Standards Task and Finish Group
- WRc invited CIP lining suppliers and manufacturers to join the project to provide technical insight and help refine the test method
- RSM / Saertex / Impreg / Lateral Repairs / Onsite / Inpipe / Vortex / Applied Felts all joined the project

Absolute Leaktightness vs. Acceptable Leakage ?

Ongoing discussion on what is an acceptable level of leakage or is an absolute leaktightness required.

Standards listed mandate no visual leakage as the passing criteria

CESWI 8

EN 476:2022 : New pipe products general requirements

BS EN 295: Clay pipes

BS EN 1916 & BS 5911-1: Concrete pipes

BS EN 1401-1: Thermoplastic pipes

BS EN ISO 23856: GRP pipes

IKT CIPP liner test standards

BS EN 1610 deviates by specifying an acceptable leakage levels under defined circumstances

CP655

Key Discussion Points

- Should the leakage criteria be revised to accommodate required lower levels of leakage?
- What elements of the testing method need modification to enhance accuracy and repeatability?
- Is a zero-leakage standard practical, or should allowances for minimal leakage be considered?
- Potential role in maintaining leak-tightness in the annulus between liner and host pipe
- Concerns regarding long-term effectiveness and durability of hydrophilic end seals.

Revisions in the draft

01

Incorporate updated testing methods considering advancements in materials and technologies.

02

Evaluate leakage criteria to align with industry standards and practical expectations.

03

Enhance guidelines for temperature/pressure considerations and their impact on testing.

04

Address concerns regarding the bond between CIPP liner and host pipe, and effectiveness of hydrophilic end seals.

Classes of products tested

TYPE A

Lining systems intended only to be used in host pipes without lateral connections

TYPE B

Lining system intended to be used in host pipes with lateral connections and not requiring a lateral connection collar

TYPE C

Lining systems intended to be used in host pipes with lateral connections using a lateral connection collar

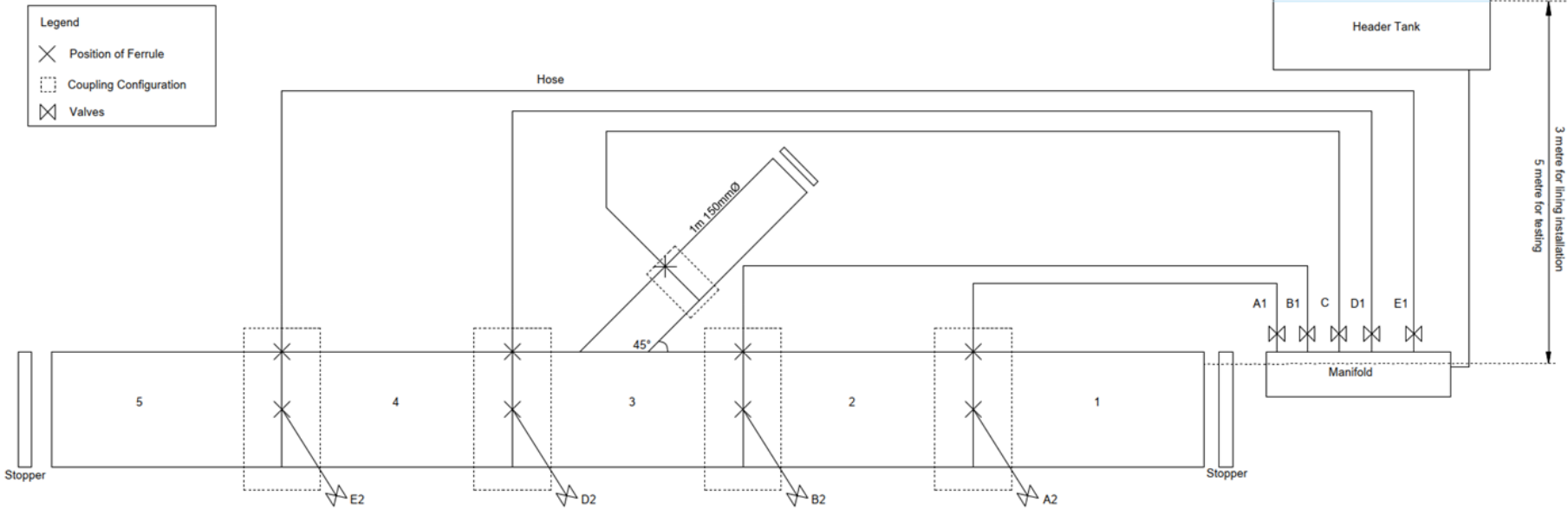
Type Test Requirements

- System tested includes **all components** installed in accordance with the supplier's installation manual in the conditions under an external hydrostatic pressure of 30 kPa.
- System then tested at an external hydrostatic pressure of 50 kPa and at each stage required for each class of lining system
- Measured infiltration shall not exceed the appropriate maximum permissible infiltration rate for the appropriate class.
- Each liner system should meet the leakage requirement for all the relevant tests for that type of liner
- Systems need to be tested with named components e.g. end seals / connection collars

Test stage	Type of lining system		
	A	B	C
Test 1 - Liner with closed lateral connection	✓	✓	✓
Test 2 - Liner with open lateral prior to the installation of any connection collar		✓	
Test 3 - Liner with open lateral after installation of a connection collar			✓
✓ = test required			

Infiltration Test rig

Infiltration Test rig



Testing outcomes

Method classifies liners by their recorded level of leakage

Class 1 = Zero leakage

Class 2 = Up to the permitted rate of leakage for new pipe

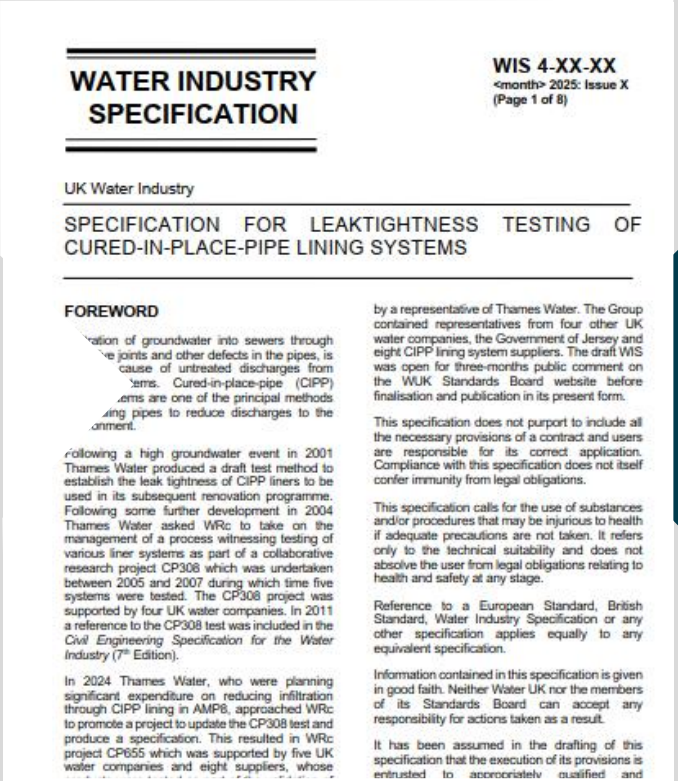
Class	Maximum permissible infiltration (I_{lim}) over 30 mins [ml]
1	$I_{lim} = 0$
2	$I_{lim} = 500 * D * L$ Where: D is the internal diameter of the host pipe [m] L the length of the pipeline [m] For Class 2 liners the measured infiltration rate over a period of 30 minutes in millilitre per metre length and per metre of diameter shall be stated (e.g. Class 2 [40])

Project Outputs

- Literature review
- Tested products and refined test method
- Water Industry Specification for leaktightness testing for CIPP liners
- Interim and Final Test Certificates issues for tested products
- Register of certified products on release of WIS

Public Comments needed

- Currently the draft WIS is out for public comment
- The Task and Finish Group would welcome public comments on the document
- Comments need to be received by 18th August 2025
- Task and finish group will address these comments and then document goes live



WATER INDUSTRY SPECIFICATION

WIS 4-XX-XX
<month> 2025: Issue X
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UK Water Industry

SPECIFICATION FOR LEAKTIGHTNESS TESTING OF CURED-IN-PLACE-PIPE LINING SYSTEMS

FOREWORD

ration of groundwater into sewers through e joints and other defects in the pipes, is cause of untreated discharges from ems. Cured-in-place-pipe (CIPP) ems are one of the principal methods ing pipes to reduce discharges to the onment.

Following a high groundwater event in 2001 Thames Water produced a draft test method to establish the leak tightness of CIPP liners to be used in its subsequent renovation programme. Following some further development in 2004 Thames Water asked WRc to take on the management of a process witnessing testing of various liner systems as part of a collaborative research project CP308 which was undertaken between 2005 and 2007 during which time five systems were tested. The CP308 project was supported by four UK water companies. In 2011 a reference to the CP308 test was included in the *Civil Engineering Specification for the Water Industry* (7th Edition).

In 2024 Thames Water, who were planning significant expenditure on reducing infiltration through CIPP lining in AMP8, approached WRc to promote a project to update the CP308 test and produce a specification. This resulted in WRc project CP655 which was supported by five UK water companies and eight suppliers, whose

by a representative of Thames Water. The Group contained representatives from four other UK water companies, the Government of Jersey and eight CIPP lining system suppliers. The draft WIS was open for three-months public comment on the WUK Standards Board website before finalisation and publication in its present form.

This specification does not purport to include all the necessary provisions of a contract and users are responsible for its correct application. Compliance with this specification does not itself confer immunity from legal obligations.

This specification calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to the technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Reference to a European Standard, British Standard, Water Industry Specification or any other specification applies equally to any equivalent specification.

Information contained in this specification is given in good faith. Neither Water UK nor the members of its Standards Board can accept any responsibility for actions taken as a result.

It has been assumed in the drafting of this specification that the execution of its provisions is entrusted to appropriately qualified and

https://standards-board.water.org.uk/document/specification-for-leaktightness-testing-of-cured-in-place-pipe-lining-systems/

Current Situation and Next Steps

- The Water Company's are seeking to for more CIP systems to be tested to provide greater flexibility and range of available products
- So WRc can now offer testing for lining products or different combinations of components not previously tested during the project
- CP655 Task and Finish Group considering the need to extend the test method for larger diameters and connection collars used individually

- **Contact Gareth Harris (Gareth.harris@wrcgroup.com) for more information on CP655 Testing**

CP655 Project Benefits

Confidence

Greater confidence in the deliverability infiltration reduction programmes using a range of tested CIPP liner products

Specification

UK standard to specify leak tightness requirements complementary to current standards BS EN ISO 11296-4 and BS EN ISO 11296-1 §8.2.

Compliance

Independent testing of a range of product(s) in accordance with the agreed test method listing all components used

Thank you

Whether you are a multi-national corporate, a regulated utility company, a government department, a contractor or an independent technology developer or supplier, our team will work with you to deliver exceptional service and create valued solutions for your needs.

If you would like more information about any of our products or services, or have a question, please do not hesitate to get in touch with Peter Henley (peter.henley@wrcgroup.com) and we will get back to you promptly.

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