Final draft BRL 5217-1
Comments before 2019-08-19

Evaluation Guideline

For the KOMO® process certificate for

Plastics piping systems for renovation of piping systems for rain and waste water discharge within the building structure using cured-in-place pipes with diameters up to and including 200 mm – part 1: Installation.

Determined by Board of Experts Plastics piping systems on jjjj-mm-dd.

Accepted by the Harmonisation Commission Bouw of the Stichting Bouwkwaliteit on jjjj-mm-dd.

Preface Kiwa

This evaluation guideline (BRL) has been prepared by the Board of Experts “Plastics Piping Systems” of Kiwa, in which interested parties in the area of “Plastics piping systems for renovation of piping systems for rain and waste water discharge within the building structure using cured-in-place pipes with diameters up to and including 200 mm – Installation” are represented. This board guides the implementation of certification and shall, if necessary adjust the evaluation guideline. Wherever the term “Board of Experts” is used in this evaluation guideline, the above mentioned Board of Experts is meant.

Kiwa will use this evaluation guideline in conjunction with the Kiwa Regulations for Product Certification. These regulations embody the examination procedure laid down by Kiwa for the issue of a product certificate as well the procedure for external inspection.

This evaluation guideline constitutes together with part 2 – “Products” a series of guidelines, wherein requirements are set for the installation and the intermediate products and the end product of cured-in-place pipes.

This second edition replaces the first edition of BRL 5217-1, which has been technically revised. The main modification is:

- The inspection of the liner according part 2 of BRL 5217-2 is performed by the installer at the site of installation

Binding Declaration
This evaluation guideline is declared binding by Kiwa by binding declaration date jjjj-mm-dd.

Kiwa Nederland B.V.
Sir Winston Churchilllaan 273
Postbus 70
2280 AB RIJSWIJK
The Netherlands

Tel. +31 70 414 44 00
Fax +31 70 414 44 20
info@kiwa.nl
www.kiwa.nl

Content

1 Introduction

1.1 General

The requirements embodied in this evaluation guideline (BRL) shall be used by certification bodies that are accredited by the Dutch Accreditation Council (RvA) which have a license with KOMO when dealing with applications for the issue or maintenance a KOMO® certificate for plastics piping systems for renovation of piping systems for rain and waste water discharge within the building structure using cured-in-place pipes with diameters up to and including 200 mm – part 1: Installation.

The requirements in this evaluation guideline are used by certification bodies which are accredited by the Accreditation Council, to treat an application for or maintain a process certificate for “Plastics piping systems for renovation of piping systems for rain and waste water discharge within the building structure using cured-in-place pipes with diameters up to and including 200 mm – part 1: Installation”.

The issued quality mark is called KOMO® process certificate.

Besides the requirements embodied in this evaluation guideline, certification bodies impose additional requirements in the sense of requirements with regard to general procedures for certification as laid down in the general certification regulations of the respective certification body.

This evaluation guideline supersedes BRL 5217-1 dated 2013-06-01.
Product certificates issued on the basis of that evaluation guideline lose their validity after 2019-mm-dd.

During the execution of certification activities, the certification bodies have to fulfil the requirements as laid down in the chapter ‘Requirements imposed on the certification body’.

1.2 Field of application

The field of application is a renovation technique for rain and waste water drainage systems which operate under gravity. It is applicable for drainage systems:

- inside buildings (marked with “B”)
- for both inside buildings and buried in ground within the building structure (marked with “BD”).

Note 1: The application area “inside buildings” according to this evaluation guideline, applies to the interior area of the building only. The application area” within the building structure” conforms to the requirements for “inside buildings” according to NEN 3215 (see figure 1).

Note 2: Repair systems are not part of this guideline.

The applied technique regards lining with cured-in-place pipes and for pipes with diameters up to and including 200 mm and if applicable renovation systems for the connections.

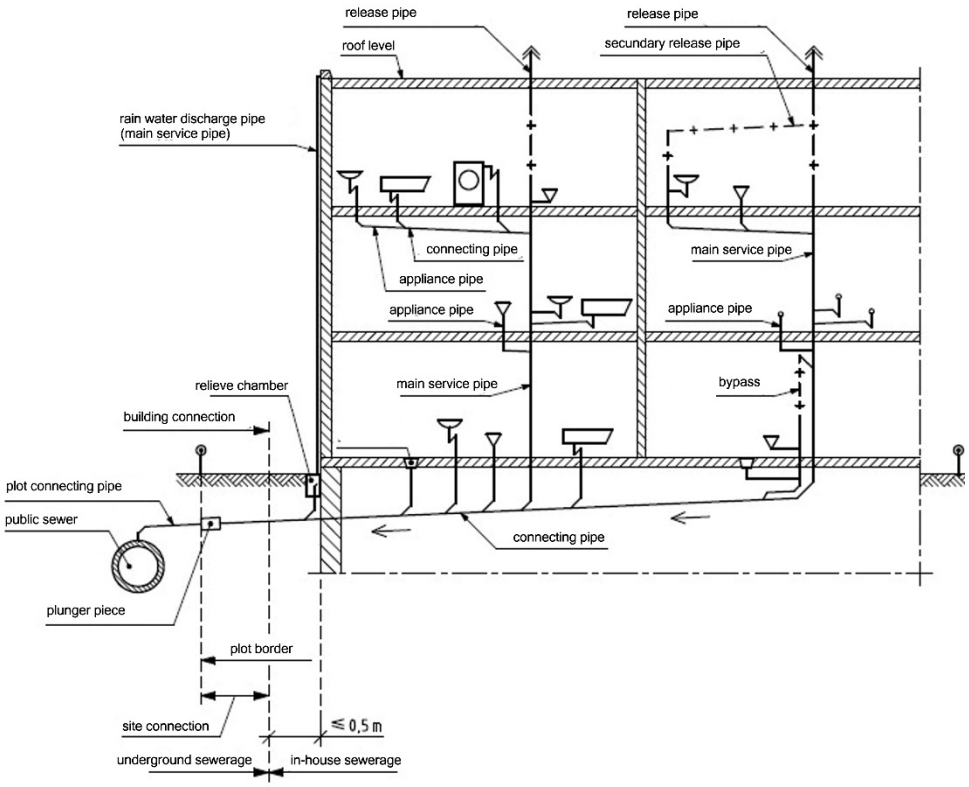

Figure 1: Field of application (source NEN 3215).

1.3 Object of certification

The object of certification is the installation process of a renovation system that includes cured-in-place pipe lining for a pipe section and watertight and durable connection between pipes in case connections are included in the liner system to be certified.

Examples of connections are:

- Connection with a renovated connecting pipe and renovated main service pipe;
- Connection with liner and existing pipe that will not be renovated;
- Connection of two liners (in main service pipe or connecting pipe).

Excluded are connections between a connecting pipe and a discharge device.

Renovation of laterals to the main sewer are covered in this evaluation guideline. The connections of these laterals to the main sewer are not covered.

1.4 Acceptance of test reports provided by the supplier

If the supplier submits reports from research bodies or laboratories to show that the requirements of the evaluation guideline are met, then these reports have to be prepared by a body meeting the prevailing accreditation standard, i.e.:

- NEN-EN-ISO/IEC 17025 for laboratories;
- NEN-EN-ISO/IEC 17020-1 for inspection bodies;
- NEN-EN-ISO/IEC 17065 for certification bodies certifying products;
- NEN-EN-ISO/IEC 17021-1 for certification bodies certifying management systems;
- NEN-EN-ISO/IEC 17024 for certification bodies certifying persons.

The body is deemed to meet these criteria if an accreditation certificate can be submitted which has been issued by the Dutch Accreditation Council or an accreditation body with which the Dutch Accreditation Council has concluded a mutual acceptance agreement.
This accreditation shall relate to the tests required for this evaluation guideline.
If no accreditation certificate can be submitted, the certification body itself shall verify whether the accreditation standard has been met or (let) carry out the tests concerned itself.
If it concerns a test laboratory then the certification body shall perform one or more audits at this laboratory to verify among others whether the execution of the tests in question is in accordance with the requirements of NEN-EN-ISO/IEC 17025.

1.5 Process certificate

Based on the KOMO system that applies to this evaluation guideline KOMO® process certificates are issued.

On the website of the KOMO foundation (www.komo.nl) the model certificate is listed, which is applicable for this evaluation guideline. The product certificate which will be issued is to be in accordance with this.

The certificate shall be registered by the certification body to be valid. A valid copy of the certificate is present on the work location of the installer.

2 Terminology

2.1 General definitions

In this evaluation guideline the meanings of the following terms are:

- Evaluation guideline (BRL): the agreements made within the Board of Experts on the subject of certification;
- Board of Experts: The Board of Experts “Plastics piping systems”;
- Supplier: the party that is responsible for ensuring that the products meet and continue to meet the requirements on which the certification is based;
- IQC scheme: a description of the quality inspections carried out by the supplier as part of his quality system.

2.2 Requirements and determination methods

In this evaluation guideline requirements and test methods are included, by which the following is meant:

2.2.1 Product requirements

Requirements made specific by means of measures or figures, focusing on (identifiable) characteristics of products and containing a limiting value to be achieved, which limiting value can be calculated or measured in an unequivocal manner.

2.2.2 Determination methods

Pre-certification investigation: investigation and or tests in order to ascertain that all the requirements recorded in the evaluation guideline are met.
Inspection tests: tests carried out after the certificate has been granted in order to ascertain whether the certified products continue to meet the requirements recorded in the evaluation guideline.

2.3 Terms and definitions

For the purpose of this document, the terms and definitions given in NEN-EN-ISO 11296 part 1 and part 4 and the following apply.

- **Product Design Specification (PDS);**

A statement of what a not yet designed product is intended to do.

- **Technical specification;**

describes the actual product when it is designed.

- **Repair**

The repair of local damage.

- **Connection**

Meeting point of two pipes or a discharge device with a connecting pipe.

- **Connecting pipe**

Drain pipe, but not a pipe for drainage of rain water, connected to only one discharge device.

- **Sanitary pipework of the building**

Arrangement of discharge pipework, with or without ventilating pipes, including all fittings, seals etc - when not a part of a discharge device – within the structure of the building or outside the building where it is attached to the building.

- **Lining with cured-in-place-pipes**

The technique of lining with a flexible tube impregnated with a thermosetting resin which produces a pipe after cure.

2.4 Abbreviations

Abbreviation	Description
BRL	Evaluation guideline
BoE	Board of experts
RvA	Dutch accreditation council
CIPP	Cured in place pipe
IQC	Internal quality control
PDS	Product design specification
VCA	Safety, health and milieu checklist for contractors
UV	ultra violet light source
LED	light emitting diode light source
DIBt	Deutsches Institut für Bautechnik
CB	Certification body

3 Procedure for obtaining a quality declaration

3.1 Assessment of approval

The assessment of approval, conducted by the certification body, will be performed on basis of the product requirements and the test methods in this evaluation guideline and contain:

- (Sample) research, to determine whether the products meet the process requirements;
- Assessment of the production of individual liner components;
- Assessment of the quality system and the IQC scheme;
- Examination for the presence and operation of other required procedures;
- Assessment of the regulations of the supplier.

A model of the IQC scheme to be issued on the basis of this evaluation guideline is included as an Annex I.

3.2 Evaluation of the quality system

For the purpose of obtaining the KOMO product certificate the certification body executes an investigation. To this entrance investigation program belong:

- assessment of the production process;
- assessment of the quality system and the IQC scheme;
- testing for the presence and functioning of the other required procedures.

It must be the extent to which the quality system complies with the requirements as laid down in the chapter 6 of this evaluation guideline.

3.3 Granting the quality declaration

After completion of the investigations (clauses 3.1 and 3.2), results are laid down to the decision maker. The decision maker evaluates the results and determines whether the certificate can be issued or whether additional information and / or tests are required in order to be able to issue the certificate.

4 Process requirements and determination methods

4.1 General

In this chapter the process requirements are laid down. These requirements shall be part of the technical specification of the certified installer which shall be referred to in the process certificate. During the pre-certification investigation the certification body shall check if the process is documented and is implemented in the quality system of the certified installer and fulfills the requirements.
This process certificate is only valid when the liner system is a KOMO® certified liner system according to BRL 5217 part 2, Products.

For each CIPP liner system product applies that the built -up of the product from individual components i.e. resin system, carrier, joint material etc. shall be specified to the certification body in terms of:

- product and type names;
- name of the manufacturer of the (intermediate) component;
- characteristics (materials, dimensions, mechanical, physical);

4.2 Process description

4.2.1 Relining of the host pipe

The process is a technique (pipe-in-pipe relining) for the rehabilitation of house services connections (connecting pipes and main service pipes according to figure 1.1). A flexible impregnated lining tube is installed through a shaft, inspection opening, access holes or roof runoffs. A new pipe is formed as the liner is cured within the host pipe.
There are various installation options:

- The inversion of the impregnated lining tube by means of compressed air;
- the inversion of the impregnated lining tube by means of hydrostatic water column.
- Winching into place of the impregnated lining tube and then inflating by means of pressurized air or water.

4.2.2 Impregnation

4.2.2.1 Impregation on the construction site

The impregnation of the liner on the construction site shall be performed with a mobile impregnation system. The requirements for this impregnation system shall be a part of the IQC scheme of the installer.
The storage and preparation of the used materials must be in accordance to manufacturer's instruction. That means, for example the required storage temperature of the resin, the hardener in temperature controlled tanks.
The mixture and impregnation process must be designed to be protected against weather influences.
The generation of a prepared resin mix must be reproducible and the manner of weighing, dosing and mixing shall be laid down in a separate procedure to which reference shall be made to the IQC-scheme of the installer. A proper impregnation of the liner materials can only be achieved using a vacuum and defined distances between the impregnation rollers (i.e. roller gap).

4.2.2.2 Impregnation on a factory location

Impregnation of the liner can also be carried out at the factory location. The requirements for the impregnation system shall be recorded in the installer's IQC scheme.
Storage and preparation of the materials shall comply to the instructions of the manufacturer(s) of these materials. This means, for example, that the resin shall be stored at the required temperature and the hardener shall be stored in temperature-controlled storage tanks.
The generation of a prepared resin mix must be reproducible and the manner of weighing, dosing and mixing shall be laid down in a separate procedure to which reference shall be made to the IQC-scheme of the installer. A proper impregnation of the liner materials can only be achieved using a vacuum and defined distances between the impregnation rollers (i.e. roller gap).
Storage and transport of the impregnated liner shall take place in accordance with the installer's written instructions. The measures taken here must prevent damage and deterioration of the quality of the impregnated liner.

4.2.3 Installation

The installation process must be gentle to avoid damages of the liner material. The pressure must be kept as constant as possible for the entire installation process.

4.2.4 Curing

The resin system is cured by e.g. circulation of hot water, steam in the installed liner or by means of light or it may also be possible to cure under ambient temperatures. Any additional requirements therefore need to be defined in the installation plan and IQC-scheme.

The liner should be cured in accordance with the instructions of the manufacturer. During the heating phase the temperature curve of the liner over the time must be recorded. Additionally the line pressure has to be checked at all times.

After installation of the cured-in-place pipe (CIPP), the connecting pipes are remotely opened (whenever applicable) and watertight seals or connections are remotely made.

4.2.5 Sealing of the joint between the host pipe and connecting pipe

4.2.5.1 Sealing of joint

The proper sealing between pipes depends on the applied CIPP lining method.
After the installation of the CIPP Liner, the connecting pipe is remotely cut open from the inside with a milling robot. If required, a seal of the interconnection of the area between the connecting pipe and the CIPP liner must be applied via filling or grouting with a remotely controlled robot or the implementation of a T-Hat profile.

For the sealing by filling or grouting materials such as polyaddition resins (Epoxy, Silicate) or plastic cement are applied. Remote controlled robots or grouting molds are used for this purpose. The distance of the sealant structure inside the connecting pipes depends on the applied method.

For the sealing with T-Hat profiles, carrier materials such as polyester needle felt, fiber glass or equivalent corrosion resistant materials are utilized. Cured-in-place-connecting pipe connection collars shall be classified, as indicated in table 4.1, according to the minimum distance extended into the connecting pipe.

Table 4.1 Classification of CIPP connection collars.

Class [1)]	Minimum extension into connecting pipes
A	1000 mm.
B	400 mm and at least 150 mm beyond first joint in existing connecting pipe.
C	100 mm.
1. Classification conform NEN-EN-ISO 11296-4: 2018, table 3	

The T-Hat profile must be bonded permanently to the lined main pipe and to an existing or renovated lateral pipe. The resulting liner system must withstand normal cleaning operations such as for example high pressure cleaning.

4.2.5.2 Sealing at open cut method

After the CIPP liner installation, the sealing of the connecting pipe connection can be realized by open cut method. The applied method must produce a long-term water tight seals in the liner system. Customary molded components must be connected and sealed to the CIPP Lining.

4.3 Construction of the liner system

The installation contains the components listed in table 4.2

Table 4.2 Components of the liner system.

Item	Description
1	Lining tube
2	Components to assure watertight and durable sealing of the pipes [1)].
[1)] Various techniques to make a watertight and durable sealing are allowed after proving the connection fulfills all requirements of the relevant type tests according BRL 5217, part 2	

From every installed liner the materials and components applied shall be documented by the installer.

4.4 Process structure

In figure 4.3 the various steps of the process are given. The CB checks whether the steps “general design” and “detailed design” are taken. No judgment is made whether the effects of these steps are correct for the intend application.

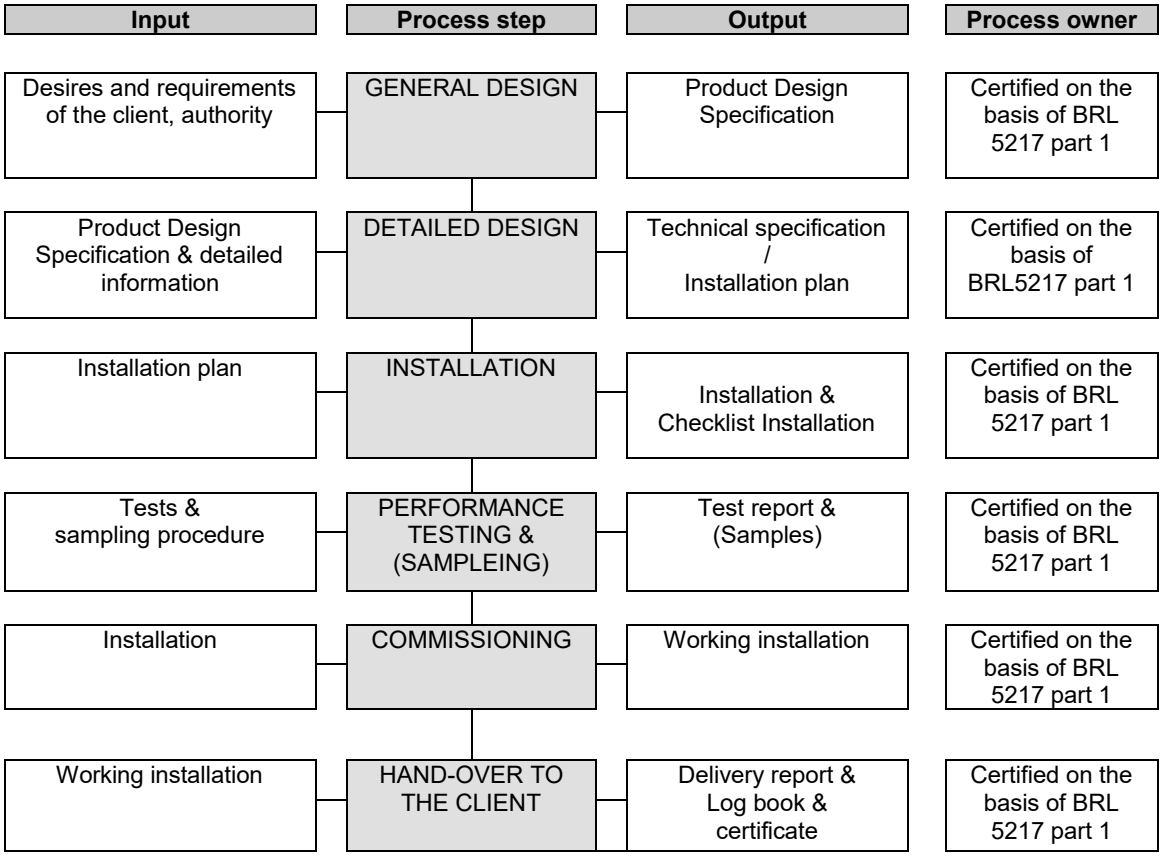

Figure 4.3 - Process structure.

4.4.1 General design

The desires and general requirements shall be recorded in the Product Design Specification (PDS) of the liner system. The PDS is a statement of what a not yet designed product is intended to do.

The PDS shall contain general functional requirements and general performance requirements of the installation and must consider the results of the feasibility study (see annex II).

The PDS must be accepted by the costumer or its representative.

When the consumer or its representative parties approved and accepted the PDS the process shall be proceeded into the next process step. The certificate holder validates the PDS of the liner system.

4.4.2 Detailed design

In this process step the details of the design shall be worked out.
The following issues shall be taken into account in this process step:

- Assessment of the need of excavation.
- Conditions of the workplace and accessibility.
- Work in confined spaces.
- Start and end time of the installation.
- Precautions, for instance preventing waste water entering the host pipe.
- Determination of critical places in the host pipes and measures to be taken.
- Requirements regarding diameter reduction of the host pipe after relining.
- Dimensions / drawings (diameter, length wall thickness, bend, reducers, ties).

- Choice of the liner system (resin type, carrier, reinforcement, cure with hot water or else, etc.)
- Fulfilling relevant legislation and (health and safety) regulations

The installer shall have a written procedure and suitable registration of this step in the installation process. This process step contains detailed:

- drawings of the liner system;
- order of installation when more then one lining tube has to be installed;
- control moments, decision points and a procedure clarifying how the responsibility is regulated;
- build-up of the liner (materials, thicknesses, membranes, types, names, etc.);
- connections (materials, types, names etc.).

The certified installer validates the detailed design by means of a technical specification and a installation plan. The technical specification describes the actual product when it is designed. The installation plan contains information to assure that the liner can be installed properly. During the design the checklist in annex III can be used.

4.4.3 Installation

4.4.3.1 Personnel

The installation of the lining tubes shall be carried out by qualified personnel in accordance with the installation plan and technical specifications.
During the installation the checklist in annex IV can be used.

4.4.3.2 Equipment

The installer shall have a procedure (manual) to demonstrate to the certification body all relevant registrations; e.g:

- Condition of the resin components prior to mixing.
- Procedure and means of (automatic) registration of the mixing process.
- Procedure and means of (automatic) registration of the amounts of components mixed.
- Procedure and means of (automatic) registration of vacuum during mixing and impregnation of the carrier material.
- Procedure and means of (automatic) registration of right amount of resin per tube lining length.
- Procedure and (Automatic) registration of the laminate temperature and when applicable the pressure applied on the lining tube during the whole time of curing by means of hot water or steam.
- Procedure and (Automatic) registration of the laminate temperature and when applicable the pressure applied on the lining tube during the whole time of curing by means of UV/LED light.

A documented mixing procedure shall demonstrate to the CB that during the mixing of the components entrapped air in the mixture is prevented.

Note 1:
Equipment for relining such as:

- A (mobile) dosage and mixing unit;
- controllable vacuum pump;
- calibration roller and calibration roller table;
- inversion device;
- heating unit;
- cutters.

is commercial available with registration and recording features.

Note 2:
The coldest place is usually the place on the lining tube where the heating medium flows out of the lining tube.

A continuous function check of the UV / LED lamps has to be assured.
The speed and the positioning of the lamps shall be controlled in accordance to the manual of the supplier of the liner system. The temperature of the liner must be checked on the inner surface of the liner to adjust the speed of the lamps. To assure a good cure over the liner thickness the temperature between liner and host pipe shall be controlled.
The pressure and temperature profile shall be documented over the whole cure phase and shall be in accordance with the manual of the system supplier.

Before every cure process the UV / LED lamps must visually checked and cleaned in accordance to the manual (for example removal of fingerprints, dust etc.). A blameless condition and surface clarity are crucial for the function of the lamp and for a proper cure of the liner.

As intensity check (irradiation power) of the UV lamps after the first 400 working hours a comparative measurement to a reference lamp must be made. Subsequently every further 150 working hours this intensity check has to be repeated. The inspection must be part of the internal quality control of the installer and must be done with a certified reference lamp and measuring sensor. At a decrease of intensity over 30% the lamp has to be replaced.
For every lamp the documentation has to include:

- serial number
- date of the first use of the lamp
- working hours (cure processes)
- date of intensity check
- measuring value and result of the intensity check
- identification of the reference lamp

The equipment to be used by the installer shall be recorded in the IQC scheme.

4.4.3.3 Validation of the installation

The installer validates the installation of the liner system according to the written procedure.

4.4.4 Tests and sampling

The tests and sampling shall be carried out by qualified personnel and can be initiated by various parties (see table 4.4).

Table 4.4 Sampling initiated by various parties.

Type of investigation	on behalf of:	sampling shall be carried out in the presence of qualified personnel.
Pre-certification	CB	CB
Inspections	CB	CB
	Installer	Installer
	Client	Client

The personnel responsible for the sampling shall identify the sample with a unique identification and registration.
The identification of the sample contains at least:

- Name and signature of the authorized sampler.
- Unique identification number.

In annex V a model datasheet sampling and testing is given.

It is permitted to take the sample from the liner outside the host pipe under the conditions that the liner outside the host pipe is supported in a comparable manner as in the host pipe. Further it shall be possible to determine the wall construction, density and demonstration of cure of the sample (see paragraph 5.4.2).

The test that have to be carried out on the sample shall be carried out by a NEN-EN-ISO 17025 accredited laboratory or by a laboratory that has been verified by the certification body.

The installer shall demonstrated that the installed liner complies with this evaluation guideline. The installer shall demonstrate compliance with this evaluation guideline by sampling every 25th installed liner per team of relining personnel.

A non-conformity of any test result shall:

- be registered by the installer according to ISO 9001.
- In the case of a dispute about the test results between the installer and costumer that can be solved within four weeks, the CB shall be notified by the installer.
- In case the costumer approaches the CB directly, the CB shall notify the installer.

Note: When the product continuously fulfil the requirements (for instance during four consecutive evaluations), the sample frequency of 1/25 could be lowered to, for instance 1/50 and in turn to 1/100. When one of the tests is not fulfilling the requirements once, sample frequency will be increased either from 1/100 to 1/50 or 1/50 to 1/25 installed liners per team.

the CB shall evaluate the workability of adjusting the frequency for a period of one year The result of this evaluation will be processed in the next revision of the guideline.

In addition to the sampling carried out by the installer during inspection visits on project the certification body shall sample with the frequency listed in chapter 6.

4.4.5 Commissioning

The commissioning shall be carried out by qualified personnel and contains the proceedings to make the system functional and operational according to the technical specification and the installation plan.
The installer shall have a written procedure of the commissioning process.
Results of evaluations and unforeseen measures needed to commission the liner system shall be registered.

The following shall be used during the commissioning:

- Camera inspection of the installed liner.
- Evaluation of the connections.
- Checking the functioning of the liner system.

An qualified person recognized by the certified installer validates the commissioning of the liner system.

4.4.6 Hand-over to the client

The installer has a written procedure for the hand-over of the installation to the client.
The installer shall deliver a report that contains:

- A statement in which the installer declares that the installed liner system functions according to the technical specification and validated design as listed in paragraphs 4.4.1 and 4.4.2.

- Technical specification.
- Installation plan.
- Checklist with all performed controls.
- Registration and video data according of a camera inspection, when this has been specified in the technical specification.
- Detailed description of all used certified components and auxiliary goods of the liner system.
- Reference to the certificate of the used products.
- (automatic) registration of the mixing, if applicable.
- (automatic) registration of the calibration of the equipment, if applicable.
- (automatic) registration of the curing e.g. temperature registration, speed of light train etc., if applicable.

This report also must demonstrate that all components and auxiliary goods fulfill the requirements in accordance with BRL 5217, parts 1 and 2.
The report shall be presented to the client within one month after hand-over of the installed liner. The installer (certification holder) shall keep a copy of the report for a period of 10 years for any warranty or liability.

4.5 Documentation and marking

4.5.1 Installation and user instructions

The installer shall provide proper written installation and user instructions in the language of the country where the piping system is to be installed. These instructions shall reference compliance with national regulations.

4.5.2 Certification mark

The KOMO® certification mark shall be included in the delivery report (see clause 4.4.6). The certified installer can use the KOMO® certification mark in conjunction with the certification number in for example: quotations, brochures, website etc.

KOMO® certification mark

5 Product requirements and determination methods

5.1 General

In this chapter the product requirements and determination methods on the installed liner system are laid down.
A distinction is made between “manufactured” stage (“M” stage) and “installed” stage (“I” stage). The “M” stage refers to a stage as manufactured i.e. before any subsequent site processing of components associated with the cured-in-place renovation technique. The “I” stage refers to a stage as installed, i.e. in the final configuration after any site processing of components associated with the CIPP renovation technique.
The evaluation guideline BRL 5217 part 2 “Products” specify the various properties of the components and materials in both stages.

In this evaluation guideline requirements of the materials and components in the “M” stage shall be part of the IQC schema of the installer. Properties and determination methods of the materials and components in the “M” stage shall be addressed under the section “incoming goods” in the IQC schema.

All product requirements listed in this evaluation guideline refer to the “I” stage.

5.2 Liner system

The installer shall demonstrate the suitability of the lining tube and components used. The components of the installed liner system shall be KOMO® certified according to BRL 5217 part 2.
To demonstrated the suitability of the lining tube and the components the following point are mandatory:

- Description of the material composition of all components;
- Description of the (design) wall construction;
- detailed drawings of the liner system;
- detailed drawings of the connection / seal and work instruction making the connection / seal.
- description of the manufacturing of the components to the end product, including a description of the installation technique used.
- based on the assessment of approval of the combined products of the liner according to BRL 5217, part 2.

5.3 Installed product

The end product shall confirm to the requirements mentioned in the PSD and technical specification.

5.4 Product requirements and determination methods

5.4.1 Liner system

The following product requirements shall be determined on the liner system.

5.4.1.1 Surface irregularities

With respect to surface irregularities in the liner (in addition to those of the host pipe) shall comply to the requirements listed in table 5.1

Table 5.1 Requirements surface irregularities

Component	Nominal diameters (DN)	maximum height irregularity
Straight pipe or bends with radius greater than 10 times the nominal diameter of the host pipe	All	6 mm
Bends with radius greater then 5 times the nominal diameter of the host pipe	All	8 mm
Bends with a radius smaller then 5 times the nominal diameter of the host pipe	DN ≤ 150 mm	10 mm
	150 mm < DN ≤ 200 mm	20 mm
For 90° bends without a radius surface requirements regarding irregularities shall be defined in the technical specification.		

Camera inspections and visual assessments shall be used to determine whether the installed liner meets the requirements with respect to surface irregularities . This procedure shall be recorded in a work instruction.

5.4.1.2 Leak tightness

The leak tightness of the installed liner shall be determined according to EN 1610 clause 13. The test shall be conducted either with water or with air. The test shall be carried out before opening of connections, when applicable, on every 25th installed liner per team of relining personnel.

5.4.2 Installed liner (test piece)

The following product requirements shall be determined on a test piece from the installed liner

5.4.2.1 Wall construction

The thickness and relative position of each component layer of the wall, including tolerances, shall be determined and compared to the declared wall construction (design). The wall structure shall be verified by visual examination of the edge of a cut section of pipe, with magnification, if necessary, and use of a scale or caliper capable of measuring to within 0.1 mm. Measurements shall be carried out at a temperature of (23 ± 2) °C.

Installed liners in the building structure shall have a minimum wall thickness of 2.0 mm. For buried in the ground installed liners the minimum wall thickness is 3.0 mm or the design wall thickness.

Dimensions shall be determined in accordance with NEN-EN-ISO 3126.

5.4.2.2 Density

The density of the test piece is determined according to ISO 1183-1, method A. The test requirement is satisfied if the arithmetic mean of the density is greater than 90 % of the declared value.

5.4.2.3 Demonstration of cure

Resin cure shall be demonstrated in accordance with the determination methods given in table 5.2. Samples shall be taken from actual or simulated installations. The glass transition temperature shall be specified to the certification body.

Table 5.2 Demonstration of resin cure

Characteristic	Requirement	Test parameters		Test method
		Parameter	value	
Epoxy	Not less than declared value	glass transition temperature mid point temperature (T_{mg}) heating rate	20 °C/min	ISO 11357-2
Polyester/ Vinylester	Not more than 2% relative to mass of the total sample taken	residual monomeer content		ISO 4901

The resin cure of innovative styrene free resin systems shall be demonstrated to the certification body before approval of the resin system.

Residual monomer content shall be determined for polyester based liners according to ISO 4901 using the full thickness of the test piece.
Cut the polymerized piece into 1 to 2 mm wide strips. Dry the strips and cut them into approximately 10 mm long pieces. During cutting and drying avoid any overheating which could modify the monomer content.
Depending on the monomer content expected, weight 0.5 g to 2 g of sample for the determination of monomer content.

6 Quality system requirements of the supplier

6.1 General

This chapter contains the requirements that have to be fulfilled by the supplier's quality system.

6.2 Qualification of personnel

The installer is responsible for the qualification of the personnel performing the relining. It must be demonstrated that the personnel has sufficient expertise to be able carry out the relining process according to the requirements of the guideline.

There shall be a written procedure available where this method is included. This includes at least:

- the required skills and knowledge of the workers how carry out the relining;
- the training of workers installing / replacing connections;
- assisting of workers who make connections in training by qualified personnel;
- the (re-)qualification method;
- required skills;
- the responsibilities for the nomination for qualification of the workers, the qualification itself, authorisation and registration;
- registration;
- archiving.

6.3 Manager of the quality system

Within the supplier's organisational structure an employee must be appointed who is in charge of managing the quality system.

6.4 Internal quality control/quality plan

As part of the quality system the supplier must implement an internal quality control schedule (IQC-scheme).

In this IQC-scheme the following must be demonstrably recorded:

- which aspects are inspected by the manufacturer;
- according to which methods these inspections are carried out;
- how often these inspections are carried out;
- how the inspection results are registered and stored.

This IQC-schedule shall be in the format as shown in the annex I. The schedule must be detailed in such a way that it provides sufficient confidence that requirements will be continuously fulfilled.

At the time of the assessment of approval this schedule must function for a minimum of three months.

6.5 Control of test and measuring equipment

The supplier shall verify the availability of necessary test and measuring equipment for demonstrating process conformity with the requirements in this evaluation guideline. When required the equipment shall be kept calibrated (e.g. recalibration at interval). The status of actual calibration of each equipment shall be demonstrated by traceability through an unique ID.
The supplier must keep records of the calibration results.

The supplier shall review the validity of measuring data when it is established at calibration that the equipment is not suitable anymore.

6.6 Procedures and work instructions

The manufacturer must be able to submit:

- procedures for:
  - the handling of non-conforming products;
  - corrective actions in case non-conformities are found;
  - the handling of complaints regarding the products and / or services supplied;
- the work instructions and inspection sheets in use;
- instructions for packaging and closing off of products during storage and transport.

6.7 VCA certificate

At least one employee of the certified company shall have followed the training VOL-VCA certificate successfully. The personnel installing liners shall have followed the training B VCA successfully.

Note: VCA stands for safety checklist for contractors. It is a voluntary certification scheme covering requirements for a safe and healthy working space.

7 Summary of tests and inspections

This chapter contains a summary of tests and inspections to be carried out during:

- **Pre-certification tests**: the investigation necessary in order to determine whether all requirements of the evaluation guideline are fulfilled,
- **Inspection visits**: the surveillance inspections carried out after issue of the certificate in order to determine whether the certified products continuously fulfil the requirements of this evaluation guideline. The inspections are carried out according to the frequency indicated.
- **Inspection of the quality system**: inspection with regard to the correct implementation of the IQC-schedule and procedures.

Note The test procedure performed on behalf of the installer which has to be satisfactorily completed before the liner can be released is listed in clause 4.4.4.

7.1 Investigation matrix

The Pre-certification tests and inspection visits of the certification body of the relining process, the installed liner and the quality system of the installer shall be carried out on the bases of visits to the installer's office and visits of a location were a liner is installed (see table 7.1).

Table 7.1. Investigation matrix – Description of the visits

	Chapter BRL	Pre-certification		Inspection visits	
		Office	Project	Office	Project
Process	4	x	x	x	x
Product	5	x	x	x	x
Quality system	6	x	x	x	x

The visits on location (projects) shall be randomly scheduled on the basis of the planning of the installer. To be able to randomly pick a project, two times a year the installer shall send his monthly planning regarding the installation of liners to the certification body.

In table 7.2 the frequency of the visits are listed.

Table 7.2 Investigation matrix – frequency of the visits.

CB visits	Office	Project
Pre-certification	Once	Once
Inspection	1 x per year	2 x per year per team *)

*) A team is defined via a foreman which shall always be present on the job side during the installation. Other personnel within the team(s) is exchangeable.

In table 7.3 (test matrix) all requirements are listed.

Table 7.3 Test matrix

Description of requirement	Article this BRL	Tests within the scope of		
		pre-certi-fication tests[2)]	Surveillance by Kiwa after issue of the certificate[2)]	
			Inspec-tion visits	Frequency (x/year)
Process requirements				
Relining	4.2.1	X	X	1x per year
Impregnation	4.2.2	X	X	1x per year
Installation	4.2.3	X	X	1x per year
Curing	4.2.4	X	X	1x per year
Connections	4.2.5	X	X	1x per year
Build-up of the liner system	4.3	X	X	1x per year
General design	4.4.1	X	X	1x per year
Detailed design	4.4.2	X	X	1x per year
Installation	4.4.3	X	X	1x per year
Personnel	4.4.3.1	X	X	1x per year
Equipment	4.4.3.2	X	X	1x per year
Performance testing and sampling	4.4.4	X	X	1x per year
Commissioning	4.4.5	X	X	1x per year
Hand-over to the client	4.4.6	X	X	1x per year
Certification mark	4.5	X	X	1x per year
Product requirements				
General	5.1	X	X	1x per year
Liner system	5.2	X	X	1x per year
Installed product	5.3	X	X	1x per year
Surface irregularities	5.4.1.1	X	X	1x per year
Leak tightness	5.4.1.2	X	X	1x per year
Installed liner (test piece)[1)]	5.4.2	X	X	1x per year
Wall construction [1)]	5.4.2.1	X	X	1x per year
Density [1)]	5.4.2.2	X	X	1x per year
Demonstration of cure [1)]	5.4.2.4	X	X	1x per year
Quality system requirements				
Qualification of the personnel	6.2	X	X	1x per year
Manager of the quality system	6.3	X	X	1x per year
Internal quality control	6.4	X	X	1x per year
Control of test and measuring equipment	6.5	X	X	1x per year
Procedures and work instructions	6.6	X	X	1x per year
VCA certificate	6.7	X	X	1x per year

1) During a project visit the certification body shall sample a piece of the installed liner to perform listed tests.
2) Inspection of the certification body shall be carried out on location (project) or at the office of the installer depending on where the information is at hand.

Additional tests shall be carried out whenever there is a change in design, in material and/or in the production method, other than routine in-process adjustments, and/or whenever there is an extension of the product range.

8 Requirements imposed on the certification body

8.1 General

The certification body shall be accredited for the subject of this BRL according to NEN-EN-ISO/IEC 17065 by the Dutch Accreditation Council and which have a license agreement with KOMO.

The certification body must have the disposal of a regulation, or an equivalent document, in which the general rules for certification are laid down. In particular these are:

- The general rules for carrying out the product investigation, to be distinguished in:
  - The way suppliers are informed about the handling of the application;
  - execution of the product investigation;
  - the decision with regard to the product investigation executed.
- The general rules with regard to the execution of inspections and the inspection aspects to be employed;
- The measures to be taken by the certification body in the event of nonconformities;
- The rules for termination of the certificate;

The possibility of lodging appeal against decisions or measures made by the certification body.

8.2 Staff involved in the conformity assessment

The staff involved in the certification is to be sub-divided into:

- Certification assessor / Reviewer: in charge of carrying out the design and document evaluations, applications and admission of applications and the review of conformity assessments;
- Site assessor: in charge of carrying out external inspections at the supplier's works;
- Decision-makers: in charge of taking decisions in connection with the precertification tests performed, continuing the certification in connection with the inspections performed and taking decisions on the need of corrective actions.

8.2.1 Competence requirements

The competence requirements are composed of:

- Basic and technical competence requirements that comply with the NEN-EN-ISO/IEC 17065 requirements;
- Technical competence requirements established additionally by the Board of Experts for the subject of this BRL.

Education and experience of the executive staff involved in certification shall be demonstrably be documented (see table 8.1).

Table 8.1 - Education and experience of certification personnel.

	Certification assessor / Reviewer	Site assessor	Decision maker
Basic competence			
Knowledge of company processes Can competently judge.	• Bachelor (HBO) thinking and working level • 1 year relevant work experience	• High school (MBO) thinking and working level • 1 year relevant work experience	• Bachelor (HBO) thinking and working level • 5 years of working experience from which at least 1 year with respect to certification
Audit skills	• Detailed knowledge of the BRL or similar BRL's	• Knowledge about witness testing • Knowledge of the parts of the BRL with respect to quality systems and testing	• Not applicable.
Technical competence			
Relevant knowledge of: • the technology of the manufacture of the products to be inspected, the implementation of processes and services are provided; • The way products are used, processes are performed and services are provided; • Any defect which may occur during the use of the product, any error in the execution of processes and any inadequacy in the provision of services.	• HBO thinking and working level. • Minimum of 1 year experience in manufacturing, testing, inspection and / or installation, • including: - two inspections under supervision Or Internal training including: - two inspections under supervision.	• MBO thinking and working level. • Minimum of 1 year experience in manufacturing, testing, inspection and/or installation. • including three inspections under supervision Or Internal training including: - three inspections under supervision	Not applicable.

The level of education and the experience of the certification staff involved should be demonstrably recorded.

8.2.2 Qualification

Certification staff must be demonstrably qualified by evaluation of education and experience with respect to the above-mentioned requirements. In case qualification takes place on the basis of other criteria, then this has to be recorded in writing. The authority for qualification rests with the management of the certification body.

8.3 Report Pre certification tests

The certification body records the results of the process and product investigation tests in a dossier. This dossier must fulfil the following requirements:

- completeness: the reports verdicts about all requirements included in the evaluation guideline;
- traceability: the findings on which the verdicts have been based shall be recorded traceable;
- basis for decision: the decision maker shall be able to base his decision on the findings included in the report.

8.4 Decision for granting the certificate

The decision for granting the certificate shall be made by a qualified decision maker which has not been involved in the pre certification tests. The decision shall be recorded traceable.

8.5 Nature and frequency of external inspection audits

The certification body shall carry out audits on site at the supplier at regular intervals to check whether the supplier complies with his obligations. The Board of Experts decides on the frequency of audits.

At the time this BRL entered into force, the frequency of audits amounts one office visit and a minimum of two project visits (see also clause 7.1).

The audit program at the office audit shall cover at least:

- The specification of the process specified in the certificate;
- The products and materials used in the process;
- the suppliers IQC scheme and the results obtained from inspections carried out by the supplier;
- compliance with required procedures;
- handling of complaints.

The results of each audit shall be recorded by the certification body in a traceable manner in a report.

8.6 Report to the Board of Experts

The certification body reports at least once a year about the certification activities performed. In this reporting, the following subjects must be addressed:

- Mutations in number of certificates (new/cancelled).
- Number of inspections carried out in relation to the fixed frequency.
- Results of the inspections.
- Measures imposed in case of non-conformities.
- Complaints received from third parties concerning certified products.

8.7 Interpretation of requirements

The Board of Experts may lay down the interpretation of this evaluation guideline in a separate interpretation document. The certification body is obliged to inform whether an interpretation document is available. If this is the case, then the interpretations as laid down in the interpretation document must be employed.

8.8 Non conformities

When the certification requirements are not met, measures are taken by the certification body in accordance with the sanctions policy what is published on the certification body service portal in the corresponding BRL.

8.9 Specific rules adopted by the board of experts

The Board of experts defined the following specific rules for the implementation of the certification that shall be followed by the certification body.
Agreements on the implementation of the certification study are:

- Before the company may deliver projects, the company must undergone an office audit without any deficiencies. The certification body will make a statement. Based on this statement, the company may inform clients about the status of the certification investigation.
- The company must have made two projects without shortcomings, before the company can be certified.

9 List of mentioned documents

9.1 Standards / normative documents:

Norm	Title
NEN 3215:2011/C1:2014	Gebouwriolering en buitenriolering binnen de perceelgrenzen - Bepalingsmethoden voor de afvoercapaciteit, water- en luchtdichtheid en afstand van dakuitmondingen Bouwbesluit 2012 norm
NEN-EN 1610:2015	Construction and testing of drains and sewers
NEN-EN-ISO 1183-1:2012	Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pyknometer method and titration method
NEN-EN-ISO 3126:2005	Plastics piping systems - Plastics components - Determination of dimensions
NEN-EN-ISO 9001:2015	Quality management systems - Requirements
NEN-EN-11357-2:2014	Plastics - Differential scanning calorimetry (DSC) - Part 2: Determination of glass transition temperature and glass transition step height
NEN-EN-ISO/IEC 17020:2012	Conformity assessment - Requirements for the operation of various types of bodies performing inspection
NEN-EN-ISO/IEC 17021-1:2015	Conformity assessment - Requirements for bodies providing audit and certification of management systems - Part 1: Requirements
NEN-EN-ISO/IEC 17024:2012	Conformity assessment - General requirements for bodies operating certification of persons
NEN-EN-ISO/IEC 17025:2018	General requirements for the competence of testing and calibration laboratories
NEN-EN-ISO/IEC 17065:2012	Conformity assessment - Requirements for bodies certifying products, processes and services
NEN-ISO 4901:2011	Reinforced plastics based on unsaturated-polyester resins - Determination of the residual styrene monomer content, as well as the content of other volatile aromatic hydrocarbons, by gas chromatography

I Model IQC scheme

Subjects	Aspects	Method	Frequency	Registration
Raw materials or materials supplied: • Recipe sheets • Incoming inspection raw materials				
Production process, production equipment, material: • procedures • work instructions • equipment • release of product				
Finished-products				
Measuring and testing equipment • measuring equipment • calibration				
Logistics • internal transport • storage • preservation • packaging • identification or marking of semi finished and finished products				

II Design: Feasibility study

A feasibility study shall be carried out to investigated whether it is possible to used CIPP technique to restore the functionality of the sewerage network. The usefulness of the technique shall depend on:

1. General information about the pipeline to renovate.
2. Conditions of the pipeline to renovate.
3. Environmental conditions the renovation has to take place.

ad 1) General information about the pipeline to renovate
The following could be relevant:

- Material of the host pipeline.
- Type and shape.
- Dimensions.
- Medium that flows through the pipeline.

ad 2) Conditions of the pipeline to renovate.
The condition of the sewerage network can be determined by means of camera inspections. The following could be relevant.
Geometric deviations:

- Reductions in the pipeline.
- Deformation of the pipeline.
- Radial displacements.
- Axial displacements.

Hydraulic deviations:

- Leaks,
- Obstructions

Structural deviations:

- Cracks.
- Partly collapsed pipeline.
- Abrasion.
- Corrosion.

ad 3) Environmental conditions
At least the following environmental conditions shall be taken into account:

- Accessibility of the piping network to be renovated.
- Freedom of movement / working space.

Structural conditions:

- Groundwater level.
- Conditions of the surrounding soil.
- (Traffic) loads.

Note: The installer shall take the necessary measures (re-design) when potential problems are expected. For instance in a situations with to great pipe reductions and bends.

III Design: Checklist

	Description			remark
	Diameter (DN-OD)			
	Discharge capacity			
	Bends:			
	Reducers:			
	acceptable surface irregularities (5.4.4.1)			
	Restore of connections: - Diameter - Position			
	Obstacles: - Inserted pipes - Debris - Ingrown tree roots - Corrosion - Infiltration of groundwater - Misalignment of the piping system			
	Material piping system to be renovated: - Plastic - Asbestos - Concrete - Cast iron - Other			
	Environmental conditions: - Freedom of movement imports of the pipeline - Height of the rook / piping system - Ground conditions - Permit - Weather conditions - Period of closure of the sewerage system. - Informing the surrounding			

IV Installation: Checklist points of interest

The work instructions shall contain the following:

- Instruction / prescription at which minimal temperature it is not allowed to carry on with the relining process.
- Instruction / prescription at which temperature relining is not recommended but can be carried out when special precautions are taken.
- Instructions special precautions at low temperatures.
- Instructions cleaning the sewerage network prior to relining.
- Instructions camera inspection.
- Checking the dimensions of the liner to be installed with the dimension of the drawings.
- Instruction of any preparations prior to installing the lining tube (placement of auxiliary parts, reliner).
- Instruction impregnation of the lining tube.
- Instruction for insertion of the lining tube (method and means).
- Instructions final work after curing of the lining tube.
- Instructions connecting connecting pipes / other pipes.
- Instructions connecting manholes
- Instruction to re-connect discharge devices.

Note: Before starting with the relining process, be sure that the sewerage system is out of order.

Check further if the liner- and resin system comply with the following:

- Declaration of the liner system.
- Charge number.
- Expiry date (of resin system / lining tube / other components).
- Processing temperature range of lining tube and components.
- Markings hazardous substances.
- (Visual) defects.

V Datasheet sampling and testing

□ First test	□ Second test		Test report nr:	
Sampling				
Name sampler:	Date:		Time:	Signature:
Test identification				
Initiator of the testing:			Date of installation	
Contractor:			Liner type	
Building project:			material ID	
Performer of the work:			Manufacture liner:	
Resin type	□ UP □ VE □ other:		Classification host pipe:	□ I □ II □ III
Carrier material	□ glass fibre □ felt □ other:		Position sample taken:	□ Pipe □ End point □ Manhole
Host pipe geometry	□ Circular, d …mm □ other:			□ Top □ Bottom □ other:
Use of preliner	□ Yes □ No	□ Inner □ Outer		
Required tests				
□ Thickness and relative position of each component layer according to handbook of manufacturer.				□ Pass □ Fail
□ Density				□ Pass □ Fail
□ Demonstration of cure		□ Epoxy resin □ styrene-containing resin		□ Pass □ Fail