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TECHNICAL PRESCRIPTIONS

PTV 845-1
(ex PTV 8450-1)

TECHNICAL PRESCRIPTIONS

FOR

PREFABRICATED SYNTHETIC LINERS FOR MANHOLES AND INSPECTION CHAMBERS

Product requirements

COPRO - A not-for-profit impartial product control body for the construction industry

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FOREWORD

This document contains the technical requirements for prefabricated synthetic liners for manholes and inspection chambers, including the synthetic connection sockets, if applicable. The requirements included in these PTV respond to needs established by the various interested parties according to local customs.

The prefabricated liners are normally used to improve some properties (hydraulic or chemical) of the manholes or inspection chambers, but they can be used as lost formwork too. It is possible that in combination with the synthetic liner, synthetic connection sockets are used. The requirements for these connection sockets are also included in this PTV.

But not only the requirements for the prefabricated synthetic liners are important. Also the contact of the prefabricated synthetic liner with the base material of the manhole or inspection chamber should comply for the intended use. Therefore, PTV 845-2 described the requirements and the test methods for the combination of the prefabricated synthetic liner with the base material.

This PTV doesn’t describe the requirements for the base material of the manhole or inspection chamber itself. These materials are described in other normative documents.

The customer and/or user can require conformity of prefabricated synthetic liners and the connection sockets to the requirements of this PTV to be demonstrated by way of an assessment of deliveries.

The conformity of prefabricated synthetic liners and the connection sockets can also be certified under the voluntary COPRO mark. With the COPRO mark, the supplier has to declare the performance of prefabricated synthetic liners and the connection sockets for all the characteristics relevant to guaranteeing the application and limit values imposed by this PTV.

COPRO certification is based on full product certification in accordance with NBN EN ISO/IEC 17067.

1 INTRODUCTION

1.1 TERMINOLOGY

1.1.1 Definitions

Impartial body	Body that is independent of the supplier or user and is entrusted with conducting the assessment of deliveries.
Inner layer	Part of the layer of a GRP liner or a GRP connection socket that is especially designed to provide a low resistance to flow. The layer exists of a thermosetting resin layer without aggregates or fillers and without reinforcement of glass filaments.
Outer layer	Structural layer of a GRP liner or a GRP connection socket that is designed to give the liner it's strength.
Prefabricated synthetic liner	A prefabricated liner is a formed thermoplastic sheet (PU, PP) or is made out of GRP (glass fibre reinforced polyester) with fitted on connection bells and eventually also with a shaft lining in variable height. The bell and liner diameter as well as the channel size and angles are made in order to meet the customers' requests. The back side of the liner is rough and can have bounding bridges in order to assure a solid connection to the base material.
Producer	The party responsible for producing the product.
Product	The result of an industrial activity or process. Meant by this in the context of these technical requirements are prefabricated synthetic liners and the connection sockets. It is the collective term for all product articles and product types to which this PTV applies.
Product article	Set of units of a product with the same characteristics and performance that are produced in a specific manner and comply with the technical file.
Production unit	Technical facility/facilities tied to a geographical location used by a producer and in which one or more products are made.
Test	Technical action comprising the determination of one or more properties of a raw material or product according to a specified process.
Reference document	Document specifying the technical characteristics with which the materials, equipment, raw materials, production process and/or the product must comply (a standard, specification or any other technical specification).
Supplier	The party having to ensure that the product complies with the technical requirements.

	This definition can apply to the producer, the dealer, the importer or the distributor.
Type test	A series of checks for initially establishing (initial type testing) or, possibly, periodically confirming (repeat type testing) the characteristics of a product article and its conformity.

1.1.2 Abbreviations

GRP	Glassfibre Reinforced Polyester resin
PP	PolyPropylene
PS	PolyStyrene
PTV	Technical Prescriptions
PU	PolyUrethane

1.1.3 References

DIN 16946-2	Cured casting resins: types
EN 14020-1	Reinforcements - Specification for textile glass rovings - Part 1: Designation
EN 14020-2	Reinforcements - Specification for textile glass rovings - Part 2: Methods of test and general requirements
EN 14020-3	Reinforcements - Specification for textile glass rovings - Part 3: Specific requirements
EN ISO 62	Plastics - Determination of water absorption
EN ISO 178	Plastics - Determination of flexural properties
EN ISO 179-1	Plastics - Determination of Charpy impact properties - Part 1: Non-instrumented impact test
EN ISO 179-2	Plastics - Determination of Charpy impact properties - Part 2: Instrumented impact test
EN ISO 527-1	Plastics - Determination of tensile properties - Part 1: General principles
EN ISO 527-2	Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics
EN ISO 527-4	Plastics – Determination of tensile properties – Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites
EN ISO 868	Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness)
EN ISO 1133-1	Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics- Part 1: Standard method

EN ISO 1172	Textile-glass-reinforced plastics – Prepregs, moulding compounds and laminates – Determination of the textile-glass and mineral-filler content – calcination methods
EN ISO 1183-1	Plastics - Methods for determining the density of noncellular plastics - Part 1: Immersion method, liquid : pyknometer method and titration method
EN ISO 2039-1	Plastics - Determination of hardness - Part 1: Ball indentation method
EN ISO 2505	Thermoplastics pipes - Longitudinal reversion - Test method and parameters
EN ISO 3126	Plastics piping systems - Plastics components - Determination of dimensions
EN ISO 3451-5	Plastics - Determination of ash - Part 5: Polyvinyl chloride
EN ISO/IEC 17067	Conformity assessment - Fundamentals of product certification and guidelines for product certification schemes
PTV 832-1	Technical Prescriptions for elastomeric seals : Part 1: Vulcanized rubber.
PTV 845-2	Technical Prescriptions for prefabricated synthetic liners for manholes and inspection chambers : system requirements.

This PTV contains dated and undated references. Only the cited version applies to dated references. The latest version always applies to undated references, including any errata, addenda and amendments.

Of all the EN standards referred to in these prescriptions, the corresponding Belgian publication NBN EN applies in each case. COPRO can allow the use of a publication other than the Belgian one provided its content is identical to that of the Belgian publication.

1.2 AVAILABILITY OF THIS PTV

The current version of this PTV is available free of charge on the COPRO website.

A paper version of this PTV can be ordered from COPRO. COPRO has the right to charge for this.

No changes may be made to the original PTV approved by the advisory board and/or confirmed by the Management Body of COPRO.

1.3 STATUS OF THIS PTV

1.3.1 Version of this PTV

This PTV concerns version 3.0, and replaces version 2.0.

1.3.2 Approval of this PTV

This PTV was approved by the Advisory Board on the 20th of November 2023.

1.3.3 Confirmation of this PTV

This PTV was confirmed by the Management Body of COPRO on the 12th of December 2023.

1.4 HIERARCHY OF RULES AND REFERENCE DOCUMENTS

1.4.1 Legislation

If certain rules contained in this PTV are inconsistent with applicable law, the rules arising from the legislation shall prevail. It is the responsibility of the supplier to monitor this and report any contradictions to COPRO in advance.

1.4.2 Directives concerning health and safety

If certain technical requirements are inconsistent with the directives concerning health and safety, such directives shall prevail. It is the responsibility of the supplier to monitor this and report any contradictions to COPRO in advance.

1.4.3 Tender documents

If certain rules from the applicable tender documents are inconsistent with these technical requirements, the supplier can report this to COPRO.

1.5 QUESTIONS AND COMMENTS

Questions or comments concerning these technical prescriptions are directed to COPRO.

2 POSITIONING OF TECHNICAL REQUIREMENTS

2.1 PTV REDACTION

2.1.1 Redaction of this PTV

These technical requirements for the prefabricated synthetic liners for manholes and inspection chambers, including the connection sockets, if applicable, are drawn up by the advisory board Synthetic liners for manholes and inspection chambers of COPRO.

2.2 OBJECTIVES

2.2.1 Purpose of this PTV

2.2.1.1 The aim of this PTV is to specify requirements for prefabricated synthetic liners and connection sockets used in combination with new manholes or inspection chambers (produced in a factory) and not for renovation of existing manholes or inspection chambers. They can be used on all parts of the manhole or inspection chamber (base unit, chamber unit, shaft unit, cover slab, reducing slab, adjusting unit, taper).

2.3 SCOPE

2.3.1 Subject of these technical requirements

2.3.1.1 This document contains the requirements to which a prefabricated synthetic liner for manholes and inspection chambers must comply, including the synthetic connection sockets, if applicable. The prefabricated synthetic liner can only be used in combination with new manholes or inspection chambers (produced in a factory) and not for renovation of existing manholes or inspection chambers. They can be used on all parts of the manhole or inspection chamber (base unit, chamber unit, shaft unit, cover slab, reducing slab, adjusting unit, taper).

The dimensions for the liner are depending on the intended use of the product, so they are not included in this PTV. These dimensions (and their tolerances) shall be determined by the producer, together with the producer that produces the manhole or inspection chamber with the prefabricated synthetic liner.

The dimensions (and their tolerances) of the connection sockets shall be determined by the producer, again in consultation with the producer of the manhole or inspection chamber. When determining these dimensions, the requirements for the connecting pipe material shall be taken in consideration. The connection sockets can only be used in combination with the prefabricated synthetic liner.

The synthetic liners and the connection sockets can be made of polyurethane (PU), polypropylene (PP), glass fibre reinforced polyester resin (GRP) or hard polystyrene (PS – only for connection sockets).

2.3.2 Circulars

COPRO can supplement this PTV with one or more circulars forming an integral part of this PTV.

2.4 REFERENCE DOCUMENTS

2.4.1 Product standards

There aren't any applicable product standards.

2.4.2 Tender documents

There aren't any applicable tender documents.

2.4.3 Test methods

The applicable test methods are mentioned in clause 3.

2.4.4 Other

Other applicable reference documents are mentioned in clause 1.1.3.

3 REQUIREMENTS

3.1 PRODUCTION UNIT AND EQUIPMENT

3.1.1 Production unit

The production unit (in its entirety and all its parts) is presumed to comply with all the applicable laws concerning the environments, operation, economic, et cetera.

There aren't any supplementary requirements for the production unit.

3.1.2 Production equipment

There aren't any requirements for the production equipment.

3.1.3 Stock management

There aren't any requirements for the stock management.

3.2 RAW MATERIALS AND ELASTOMERIC SEALS

3.2.1 Raw materials

The requirements for the raw materials are described in clauses 3.4 and 3.5.

The compound for liners from polypropylene (clause 3.4.3) shall be PP base material without any mineral filler.

The compound for the connection sockets shall be PP base material with mineral fillers, to which are added those additives that are needed to facilitate the production of connection sockets conforming to the requirements of this PTV.

Each raw material is presumed to comply with the applicable legislation.

3.2.2 Elastomeric seals

If elastomeric seals are used for connecting the connection socket with the connection sewer, they shall be according PTV 832-1 (clauses 3.4.14 to 3.4.18 are voluntary requirements). These elastomeric seals have to be delivered by the producer of the liner and connection socket. Nevertheless, the elastomeric seals shall also comply to the requirements for the seals as foreseen in the specifications for the connection sewer.

In case the prefabricated synthetic liners are used to improve the chemical properties of the sewer-element, then the elastomeric seals, if applicable, shall also comply PTV 8681-1, clause 3.4.16.

Each elastomeric seal is presumed to comply with the applicable legislation.

3.3 PRODUCTION PROCESS

There aren't any requirements for the production process.

3.4 PREFABRICATED SYNTHETIC LINERS

3.4.1 General

3.4.1.1 Prefabricated synthetic liners meet the requirements set out in clauses 3.4.2 to 3.4.4.

3.4.1.2 The supplier shall in each case declare the performance for the characteristics set out in clauses 3.4.2 to 3.4.4 for the prefabricated synthetic liners for manholes and inspection chambers.

3.4.1.3 In the tables in clauses 3.4.2 to 3.4.4, pH1 and pH12 is mentioned. These should be obtained as follows:

- pH1: mixture of de-ionized water with H2SO4 with approximately pH1;
- pH12: mixture of de-ionized water and NaOH with approximately pH12.

3.4.2 Liners from polyurethane (PU)

Property	Test methodh	Requirement
Dimensions	quality plan of the producer	declaration of the producer
Density	EN ISO 1183-1	≥ 1,18 g/cm³
Shore D hardness	EN ISO 868	≥ 70 Shore-D
Flexural properties:	EN ISO 178	
- flexural stress		≥ 35 MPa
- flexural strain		≥ 2,7 %
- flexural modulus		≥ 1300 MPa
Charpy impact properties	EN ISO 179-1 or EN ISO 179-2	≥ 10 kJ/m²
Wall thickness	EN ISO 3126	≥ 4,0 mm
Water absorption	EN ISO 62 method 4 50 % R.H., 23 ± 2 °C, 192 h drying 72 h	≤ 0,1 %
Change in density after immersion 28 days in pH1 and pH12	EN ISO 1183-1	≤ 2 %
Change in flexural stress after immersion 28 days in pH1 and pH12	EN ISO 178	≤ 20 %

3.4.3 Liners from polypropylene (PP)

Property	Test method	Requirement
Dimensions	quality plan of the producer	declaration of the producer
Ash content	EN ISO 3451-5	< 1 %
Density	EN ISO 1183-1	≥ 0,9 g/cm³
Hardness – Ball indentation method (ball = 5,0 mm ± 0,05 mm)	EN ISO 2039-1	≥ 40 N/mm²
MFR (230 °C – 2160 g)	EN ISO 1133-1	0,45 ± 0,05 g/10 min
Heat stability – change in dimensions	test method from EN ISO 11501 + test conditions from EN ISO 2505	≤ 2 %
Wall thickness:	EN ISO 3126	
- sole		≥ 4,0 mm
- channel wall		≥ 1,5 mm
- benching		≥ 1,5 mm
Water absorption	EN ISO 62 method 4 50 % R.H., 23 ± 2 °C, 192 h drying 72 h	≤ 0,1 %
Tensile strength	EN ISO 527-1/-2	declaration of the producer
Change in density after immersion 28 days in pH1 and pH12	EN ISO 1183-1	≤ 2 %
Change in tensile strength after immersion 28 days in pH1 and pH12	EN ISO 527-1/-2	≤ 20 %

3.4.4 Liners from glass reinforced polyester resin (GRP)

Property	Test method	Requirement
Dimensions	quality plan of the producer	declaration of the producer
Type of resin	declaration	DIN 16946-2, table 3, type 1130
Type of glass fiber	declaration	E – or E-CR glass fiber according EN 14020-1, EN 14020-2 and EN 14020-3
Inner layer:		
- thickness	measurement	0,7 ± 0,1 mm
- mineral filler content	EN ISO 1172	≤ 0,1 %
Outer layer:	EN ISO 1172	
- mineral filler content		≤ 17 %
- mass fiber glass mat		≥ 150 g / m² / mm
- glass fiber content		16 ± 4 % by mass
Total layer: thickness	EN ISO 3126	7,0 ± 3,0 mm
Water absorption	EN ISO 62 method 4 50 % R.V., 23 ± 2 °C, 192 h drying 72 h	≤ 0,1 %
Tensile strength	EN ISO 527-1/-4	declaration of the producer
Change in density after immersion 28 days in pH1 and pH12	EN ISO 1183-1	≤ 2 %
Change in tensile strength after immersion 28 days in pH1 and pH12	EN ISO 527-1/-4	≤ 20 %

3.5 CONNECTION SOCKETS

3.5.1 General

3.5.1.1 Connection sockets meet the applicable requirements set out in clauses 3.5.2 to 3.5.5.

3.5.1.2 The supplier shall in each case declare the performance for the applicable characteristics set out in clauses 3.5.2 to 3.5.5 for the connection sockets, to be used in combination with prefabricated synthetic liners for manholes and inspection chambers.

3.5.1.3 In the tables in clauses 3.5.2 to 3.5.5, pH1 and pH12 is mentioned. These should be obtained as follows:

- pH1: mixture of de-ionized water with H2SO4 with approximately pH1;
- pH12: mixture of de-ionized water and NaOH with approximately pH12.

3.5.2 Connection sockets from polyurethane (PU)

Property	Test method	Requirement
Dimensions	quality plan of the producer	declaration of the producer
Density	EN ISO 1183-1	≥ 1,18 g/cm³
Shore D hardness	EN ISO 868	≥ 70 Shore-D
Flexural properties:	EN ISO 178	
- flexural stress		≥ 35 MPa
- flexural strain		≥ 2,7 %
- flexural modulus		≥ 1300 MPa
Charpy impact properties	EN ISO 179-1 or EN ISO 179-2	≥ 10 kJ/m²
Wall thickness	EN ISO 3126	≥ 4,0 mm
Water absorption	EN ISO 62 method 4 50 % R.V., 23 ± 2 °C, 192 h drying 72 h	≤ 0,1 %
Change in density after immersion 28 days in pH1 and pH12	EN ISO 1183-1	≤ 2 %
Change in flexural stress after immersion 28 days in pH1 and pH12	EN ISO 178	≤ 20 %

3.5.3 Connection sockets from polypropylene (PP)

Property	Test method	Requirement
Dimensions	quality plan of the producer	declaration of the producer
Ash content (mineral filler content)	EN ISO 3451-5	5 – 35 %
Density	EN ISO 1183-1	≥ 0,92 g/cm³
Hardness – Ball indentation method (ball = 5,00 mm ± 0,05 mm)	EN ISO 2039-1	≥ 45 N/mm²
MFR (230 °C – 2,16 kg)	EN ISO 1133-1	9,2 + 3,0/-6,0 g/10 min
Heat stability – change in dimensions	test method from EN ISO 11501 + test conditions from EN ISO 2505	≤ 2 %
Water absorption	EN ISO 62 method 4 50 % R.V., 23 ± 2 °C, 192 h drying 72 h	≤ 0,1 %
Wall thickness	EN ISO 3126	5,0 mm ± 1,0 mm
Tensile strength	EN ISO 527-1/-2	declaration of the producer
Change in density after immersion 28 days in pH1 and pH12	EN ISO 1183-1	≤ 2 %
Change in tensile strength after immersion 28 days in pH1 and pH12	EN ISO 527-1/-2	≤ 20 %

3.5.4 Connection sockets from glass fiber reinforced polyester resin (GRP)

Property	Test method	Requirement
Dimensions	quality plan of the producer	declaration of the producer
Type of resin	declaration	DIN 16946-2, table 3, type 1130
Type of glass fiber	declaration	E – or E-CR glass fiber according EN 14020-1, EN 14020-2 and EN 14020-3
Inner layer:		
- thickness	measurement	0,7 ± 0,1 mm
- mineral filler content	EN ISO 1172	≤ 0,1 %
Outer layer:	EN ISO 1172	
- mineral filler content		≤ 17 %
- mass fiber glass mat		≥ 230 g / m² / mm
- glass fiber content		≥ 20 % by mass
Total layer: thickness	EN ISO 3126	6,0 ± 2,0 mm
Density	EN ISO 1183-1	declaration of the producer
Tensile strength	EN ISO 527-1/-4	declaration of the producer
Water absorption	EN ISO 62 method 4 50 % R.V., 23 ± 2 °C, 192 h drying 72 h	≤ 0,1 %
Change in density after immersion 28 days in pH1 and pH12	EN ISO 1183-1	≤ 2 %
Change in tensile strength after immersion 28 days in pH1 and pH12	EN ISO 527-1/-4	≤ 20 %

3.5.5 Connection sockets from hard polystyrene (PS)

Property	Test method	Requirement
Dimensions	quality plan of the producer	declaration of the producer
Density	EN ISO 1183-1	≥ 1,03 g/cm³
Hardness (358 N / 30 s)	EN ISO 2039-1	≥ 62 N/mm²
MFR (200 °C – 5 kg)	EN ISO 1133-1	5,0 + 2,0 g/10 min
Heat stability – change in dimensions	To be determined	To be determined
Water absorption	EN ISO 62 method 4 50 % R.V., 23 ± 2 °C, 192 h drying 72 h	≤ 0,1 %
Wall thickness	EN ISO 3126	5,0 mm ± 1,0 mm
Tensile strength	EN ISO 527-1/-2	declaration of the producer
Change in density after immersion 28 days in pH1 and pH12	EN ISO 1183-1	≤ 2 %
Change in tensile strength after immersion 28 days in pH1 and pH12	EN ISO 527-1/-2	≤ 20 %

3.6 TYPE TESTING

3.6.1 General

Type tests can be executed on a finished product or on laboratory samples. In case of laboratory samples, the producer has to assure that the relevant properties of the laboratory sample are identical as the finished products. The characteristics of the system according to PTV 845-2 are executed on the combination of a prefabricated synthetic liner and a new manhole or inspection chamber.

The conditions in which the type test is carried out shall be representative of the particular product article. This means that the conditions for the type test (production parameters, raw materials used, test parameters) has to be identical or representative for the final product.

The type test is conducted under the responsibility of the producer.

3.6.2 Scope

The type test is conducted on each product article of prefabricated synthetic liners and connection sockets for manholes and inspection chambers.

3.6.3 Requirements

All characteristics of clauses 3.4 and 3.5 of this PTV and clause 3.4 of PTV 845-2 are determined in the type test.

3.6.4 Type test report

The details and results of the type test are recorded in a type test report by the producer.

3.6.5 Validity

Only type test reports approved by the producer are valid.

A type test is valid until there are changes in raw materials or production method that modifies the characteristics of the final product.

3.6.6 Modifications

When there is a change in

- raw material (new supplier, new type of raw material, new specification of the raw material);
- equipment;
- production process

the producer has to examine the influence of this change with respect to the conformity of the final product. In case of a significant impact, the type testing is repeated.

4 TEST METHODS

4.1 SAMPLING

4.1.1 Sampling

Sampling can be either on the finished product or on the raw material before producing the finished product. When possible, sampling on the finished product is preferable.

5 PRODUCT IDENTIFICATION

5.1 PRODUCT NAME

5.1.1 Official name

"Prefabricated synthetic liners for manholes and inspection chambers".

"Connection sockets for manholes and inspection chambers".

5.1.2 Commercial name

The commercial is freely chosen by the supplier insofar as it does not lead to confusion or clash with the official name.

5.2 IDENTIFICATION

5.2.1 Delivery modes

5.2.1.1 The product can be delivered in a package.

5.2.1.2 If the product is delivered in a package, it is identified on each packaging unit and on every individual product.

5.2.2 Packages and individual products

The following information must be embedded in each individual product:

- name of the supplier and/or producer,
- type of raw material of the product (PP, PU, PS, GRP).

The following information must be given on each packaging unit:

- name of the supplier and/or producer,
- reference to this PTV,
- relevant dimensions for the intended use.

5.3 DELIVERY NOTE

5.3.1 Information

Each delivery of prefabricated synthetic liners or connection sockets is additionally accompanied of the delivery note.

The following information is given on each delivery note:

- name and address of the supplier and/or producer,
- name of the customer,
- name(s) of the product according to clause 5.1,
- date of delivery,
- quantity of individual products.

6 ASSESSMENT OF DELIVERIES

6.1 PRODUCT CHECK BY THE CUSTOMER ON DELIVERY

6.1.1 Check by the customer

On receipt of the prefabricated synthetic liners or connection sockets, the customer checks:

- compliance of the delivery note with clause 5.3;

- compliance of the identification of the product with clause 5.2.

If the prefabricated synthetic liners or connection sockets are delivered under the voluntary COPRO mark, the conformity of the product is demonstrated and clause 6.2 does not apply.

6.2 LOT CONTROL BEFORE DELIVERY

6.2.1 General

The aim of a lot control is to check whether there is sufficient confidence that the characteristics of the products of a lot offered, comply with this PTV.

6.2.2 Sampling

6.2.2.1 Sampling is carried out in principle by an impartial body on the supplier's premises.

6.2.2.2 Sampling is carried out randomly and is representative of the entire lot.

6.2.2.3 Sampling is carried out in compliance with clause 4.1.

6.2.3 Lot size and number of samples

6.2.3.1 One lot contains maximum 350 individual prefabricated synthetic liners or connection sockets. One lot contains either prefabricated synthetic liners, or connection sockets.

6.2.3.2 Of each lot, enough samples are taken to do all the testing and – if necessary - re-testing.

6.2.4 Checking

All applicable characteristics of clauses 3.4 and 3.5 are determined.

6.2.5 Applying of the product

The products of a lot may only be applied after all the results of the tests are known and satisfactory.