



TECHNICAL PRESCRIPTIONS

FOR

**VITRIFIED CLAY PIPE SYSTEMS FOR DRAINS
AND SEWERS**

Part 1 : Requirements for pipes, fittings and joints

Version 2.0 dated 2018-11-09

COPRO vzw Impartial institute for the monitoring of construction products

Z.1 Research Park
Kranenberg 190
1731 Zellik

tel. +32 (2) 468 00 95
fax +32 (2) 469 10 19
info@copro.eu

www.copro.eu
BTW BE 0424.377.275
KBC BE20 4264 0798
0156

CONTENTS

| | |
|--|----|
| FOREWORD..... | 3 |
| 1 INTRODUCTION..... | 4 |
| 1.1 TERMINOLOGY..... | 4 |
| 1.2 AVAILABILITY OF THIS PTV..... | 5 |
| 1.3 STATUS OF THIS PTV..... | 5 |
| 1.4 HIERARCHY OF RULES AND REFERENCE DOCUMENTS..... | 6 |
| 1.5 QUESTIONS AND COMMENTS..... | 6 |
| 2 POSITIONING OF TECHNICAL PRESCRIPTIONS..... | 7 |
| 2.1 PTV FORMAT..... | 7 |
| 2.2 OBJECTIVES..... | 7 |
| 2.3 SCOPE..... | 7 |
| 2.4 REFERENCE DOCUMENTS..... | 8 |
| 3 PRESCRIPTIONS..... | 9 |
| 3.1 PRODUCTION UNIT AND EQUIPMENT..... | 9 |
| 3.2 RAW MATERIALS, JOINT MATERIALS AND COUPLING MATERIALS..... | 9 |
| 3.3 PRODUCTION PROCESS..... | 11 |
| 3.4 PIPES AND FITTINGS..... | 11 |
| 3.5 JOINT ASSEMBLIES..... | 19 |
| 4 TEST METHODS..... | 22 |
| 4.1 SAMPLING..... | 22 |
| 4.2 SAMPLE PREPARATION..... | 22 |
| 4.3 HIGH CHEMICAL RESISTANCE OF SOFT CAST POLYURETHANE..... | 22 |
| 5 PRODUCT IDENTIFICATION..... | 25 |
| 5.1 PRODUCT NAME..... | 25 |
| 5.2 IDENTIFICATION..... | 25 |
| 6 APPLICATION OF THE PRODUCT (informative)..... | 27 |
| 6.1 APPLICATION OF THE PRODUCT..... | 27 |
| 6.2 INSTALLATION OF THE PRODUCT..... | 27 |

FOREWORD

This document contains the technical prescriptions for pipes, fittings and joints for vitrified clay pipe systems for drains and sewers. The requirements included in these PTV respond to needs established by the various interested parties according to local customs.

The conformity of pipes, fittings and joints can be certified under the voluntary BENOR mark. With the BENOR mark, the supplier has to declare the performance of pipes, fittings and joints for all the characteristics relevant to guaranteeing the application and limit values imposed by this PTV 895-1.

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

The CE mark applies to pipes, fittings and joints for vitrified clay pipe systems for drains and sewers, coming under the area of application of NBN EN 295-1. Pursuant to European Regulation (EU) no. 305/2011 (Construction Product Regulation – CPR) dated 2011-03-09, the CE mark relates to the essential characteristics of the product specified in NBN EN 295-1, Annex ZA, Table ZA.1.

The CE mark is the only mark to declare that the product complies with the declared performance of the essential characteristics covered by NBN EN 295-1.

1 INTRODUCTION

1.1 TERMINOLOGY

1.1.1 Definitions

| | |
|--------------------|---|
| 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. |
| Supplier | The party having to ensure that the product complies with the technical prescriptions. This definition can apply to the producer, the dealer, the importer or the distributor. |
| Impartial body | Body that is independent of the supplier or user and is entrusted with conducting the acceptance test on delivery. |
| Joints | Component used in an assembly of a vitrified clay product with another (vitrified clay) product |
| Junction | Piece specially designed to create a three-way connection |
| 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 prescriptions is the product. It is the collective term for all articles and product types to which this PTV applies. |
| Product unit | An individual produced item. Different product units can form a unit group. |
| 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). |

All definitions described in NBN EN 295-1; Clause 3 are also valid in this PTV.

1.1.2 Abbreviations

PTV Technical Prescriptions

All symbols and abbreviations described in NBN EN 295-1, Clause 4 are also valid in this PTV.

1.1.3 References

| | |
|----------------------|--|
| CPR | Construction Product Regulation |
| EN ISO 7500-1 | Metallic materials – Calibrations and verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Calibration and verification of the force-measuring system |
| NBN EN 295-1 | Vitrified clay pipe systems for drains and sewers – Part 1: Requirements for pipes, fittings and joints |
| NBN EN 295-3 | Vitrified clay pipe systems for drains and sewers – Part 3: Test methods |
| NBN EN ISO/IEC 17067 | Conformity assessment - Fundamentals of product certification and guidelines for product certification schemes |
| PTV 895-4 | Technical prescriptions for vitrified clay pipe systems for drains and sewers: Part 4: Requirements for adaptors, connectors and flexible couplings |
| PTV 8681-1 | Technical prescriptions for elastomeric seals: Part 1: Vulcanized Rubber |

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 sectoral commission and/or confirmed by the Board of Directors of COPRO.

1.3 STATUS OF THIS PTV

1.3.1 Version of this PTV

This PTV concerns version 2.0.

1.3.2 Approval of this PTV

This PTV was approved by the sectoral commission on 2018-11-29.

1.3.3 Confirmation of this PTV

This PTV was confirmed by the Board of Directors of COPRO on 2018-12-11.

1.3.4 Registration of this PTV

This PTV was submitted to the association BENOR on 2018-12-11.

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 prescriptions 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 Special specification

If certain rules from the applicable special specification are inconsistent with these technical prescriptions, 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 PRESCRIPTIONS

2.1 PTV FORMAT

2.1.1 Format of this PTV

These technical prescriptions for the pipes, fittings and joints for vitrified clay pipe systems for drains and sewers are drawn up by the Sectoral Commission for clay products 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 the pipes, fittings and joints used for vitrified clay pipe systems for drains and sewers.
- 2.2.1.2 According to the legislation in the Member State where pipes, fittings and joints for vitrified clay pipe systems for drains and sewers are brought onto the market, the performance for some essential characteristics has to be declared for the CE mark by the supplier on the basis of its Declaration of Performance in accordance with the harmonised standard NBN EN 295-1. Unless other statutory provisions apply, the supplier has the choice in the context of the CE mark to declare no performance for one or more essential characteristics. This PTV clarifies some requirements and adds supplementary provisions with regard to use and sustainable behaviour.

2.3 SCOPE

2.3.1 Subject of these technical prescriptions

- 2.3.1.1 The subject of these technical prescriptions is the same as the scope in NBN EN 295-1, Clause 1.
- 2.3.1.2 The area of application of this PTV is entirely or partially covered by the intended use included in the harmonised standard NBN EN 295-1. This PTV imposes additional application requirements.

The requirements included in this PTV for the pipes, fittings and joints for the buried drain and sewer systems for the conveyance of wastewater (including domestic wastewater, surface water and rainwater) under gravity and periodic hydraulic surcharge or under continuous low head of pressure, respond to needs determined by the various interested parties according to local construction technologies and customs.

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

The applicable product standard is NBN EN 295-1.

2.4.2 Tender documents

The applicable tender documents are SB 250, CCT Qualiroutes, TB 2015 and special tender documents.

2.4.3 Test methods

The applicable test methods are prescribed in NBN EN 295-3 and Clause 4 of this PTV.

2.4.4 Other

Other applicable reference documents are mentioned in Clause 1.1.3.

3 PRESCRIPTIONS

3.1 PRODUCTION UNIT AND EQUIPMENT

There aren't any requirements for the production unit and the equipment.

3.2 RAW MATERIALS, JOINT MATERIALS AND COUPLING MATERIALS

3.2.1 General

- 3.2.1.1 The materials shall be free of any substances which may have a deleterious effect on the fluid being conveyed, or on the life of the seal, or on the pipe or fitting.

3.2.2 Clay

- 3.2.2.1 Pipes and fittings shall be made from suitable natural clays to enable the body to be fired to vitrification, so that the final product is in accordance with EN 295-1.

3.2.3 Vulcanized rubber sealing elements

- 3.2.3.1 To be considered as a vulcanized rubber sealing element, suitable for the use in combination with pipes and fittings according this PTV, the rubber sealing element shall comply with PTV 8681-1, including Clause 3.4.18.

3.2.4 Hard cast polyurethane sealing elements

- 3.2.4.1 To be considered as a hard cast polyurethane sealing element, suitable for the use in the socket of pipes according this PTV, the polyurethane sealing element shall comply with NBN EN 295-1, Clause 6.1.4.

3.2.5 Soft cast polyurethane sealing elements

- 3.2.5.1 To be considered as a soft cast polyurethane sealing element, suitable for the use on the spigot of pipes according this PTV, the polyurethane sealing element shall meet the requirements set out in Clauses 3.2.5.2 to 3.2.5.9.
- 3.2.5.2 Dimensional tolerances
See NBN EN 681-4, Clause 4.2.1.
- 3.2.5.3 Imperfections and defects
See NBN EN 681-4, Clause 4.2.2.

3.2.5.4 Hardness

See NBN EN 681-4, Clause 4.2.3.

Shore A hardness measurements shall be used instead of IRHD.

3.2.5.5 Tensile strength and elongation at break

See NBN EN 681-4, Clause 4.2.4.

3.2.5.6 Compression set in air

See NBN EN 681-4, Clause 4.2.5.

3.2.5.7 Accelerated ageing in air

See NBN EN 681-4, Clause 4.2.6.

3.2.5.8 Stress relaxation in compression

See NBN EN 681-4, Clause 4.2.7.

3.2.5.9 High chemical resistance

High chemical resistance shall not be greater than the values given in table 1.

Table 1: High chemical resistance

| Property | Unit | Requirement |
|-------------------------------|---------|-------------|
| ΔV_7 | % | ≤ 5 |
| $\Delta \text{Shore A}_7$ | Shore A | ≤ 10 |
| $\Delta \text{Shore A}_{7/7}$ | Shore A | ≤ 5 |

In this context is:

- ΔV_7 : relative change in volume as % after depositing the test fluid for seven days at (23 ± 2) °C.
- $\Delta \text{Shore A}_7$: change in Shore A hardness after depositing in the test fluid for seven days at (23 ± 2) °C.
- $\Delta \text{Shore A}_{7/7}$: change in Shore A hardness after depositing in the test fluid for seven days at (23 ± 2) °C and then drying out for seven days at normal temperature.

High chemical resistance is tested in accordance to clause 4.3 of this PTV.

3.2.6 Polypropylene sleeve couplings

3.2.6.1 To be considered as a polypropylene sleeve coupling, suitable for connecting pipes according this PTV, the polypropylene sleeve coupling shall comply with NBN EN 295-1, Clause 6.1.3.

Vulcanized rubber sealing elements used in combination with polypropylene sleeve couplings according to this PTV shall comply with Clause 3.2.3 of this PTV.

3.3 PRODUCTION PROCESS

There aren't any requirements for the production process.

3.4 PIPES AND FITTINGS

3.4.1 General

- 3.4.1.1 The pipes and fittings meets the requirements set out in Clauses 3.4.2 to 3.4.22.
- 3.4.1.2 The supplier shall in each case declare the performance for the characteristics set out in Clauses 3.4.2 to 3.4.22 for the pipes and fittings for vitrified clay pipe systems for drains and sewers. If it concerns an essential characteristic, the supplier shall declare this on its Declaration of Performance.
- 3.4.1.3 Pipes and fittings shall be sound and shall be free from such defects as would impair their function when in service.

3.4.2 Water absorption

See NBN EN 295-1, Clause 5.1.3.

Water absorption is determined in accordance with Clause 28 of NBN EN 295-3.

3.4.3 Appearance

See NBN EN 295-1, Clause 5.1.4.

3.4.4 Internal diameter

See NBN EN 295-1, Clause 5.2.

To be considered as pipes and fittings for vitrified clay pipe systems for drains and sewers according to this PTV, the minimum internal diameter has to conform EN 295-1. The internal diameter shall not be greater than the values given in table 2.

Table 2: Internal diameter

| Nominal size DN | Maximum internal diameter mm | Nominal size DN | Maximum internal diameter mm | Nominal size DN | Maximum internal diameter mm |
|-----------------|------------------------------|-----------------|------------------------------|-----------------|------------------------------|
| 100 | 104 | 350 | 355 | 800 | 804 |
| 125 | 130 | 400 | 406 | 900 | 905 |
| 150 | 156 | 450 | 455 | 1000 | 1025 |
| 200 | 205 | 500 | 505 | 1200 | 1230 |
| 250 | 256 | 600 | 609 | 1400 | 1435 |
| 300 | 307 | 700 | 706 | | |

Other nominal sizes can be manufactured to comply with this PTV, providing that the minimum internal diameter shall not be less than 97,5 % of the nominal size and shall not be greater than 102,5 % of the nominal size, rounded by the nearest whole millimetre.

3.4.5 Length

See NBN EN 295-1, Clause 5.3.

3.4.6 Squareness of ends

See NBN EN 295-1, Clause 5.4.

Squareness of ends is determined in accordance with Clause 5.1 of NBN EN 295-3.

3.4.7 Deviation from straightness

See NBN EN 295-1, Clause 5.5.

Deviation from straightness is determined in accordance with Clause 6 of NBN EN 295-3.

3.4.8 Water seal of trapped fittings

See NBN EN 295-1, Clause 5.6.

3.4.9 Angle of curvature and radius of bends

3.4.9.1 Bends with a socket

See NBN EN 295-1, Clause 5.7.

To be considered as pipes and fittings for vitrified clay pipe systems for drains and sewers according to this PTV, the dimensions of the bend shall be as given in table 3.

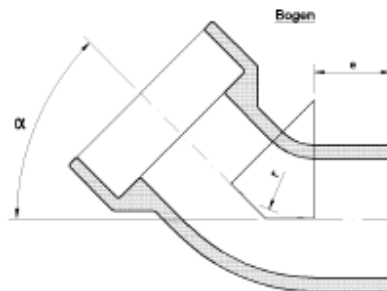


Table 3: Dimensions of bends

| DN | E min. in mm. | Bend length in mm | | | | | | | | | | | |
|-----|---------------------|-------------------|-------------|----------|-------------|------------|-------------|----------|-------------|----------|-------------|--------------|-------------|
| | | 11,25° ± 3° | | 15° ± 3° | | 22,5° ± 4° | | 30° ± 4° | | 45° ± 5° | | 60°/90° ± 5° | |
| | | | Max dev. | | Max dev. | | Max dev. | | Max dev. | | Max dev. | | Max dev. |
| 100 | 70 | 120 | ± 25 | 250 | ± 25 | 150 | ± 25 | 250 | ± 25 | 250 | ± 25 | * | ± 25 |
| 125 | 70 | | | 250 | ± 25 | | | 250 | ± 25 | 250 | ± 25 | * | ± 25 |
| 150 | 75 | 175 | ± 25 | 260 | ± 25 | 180 | ± 25 | 260 | ± 25 | 260 | ± 25 | * | ± 25 |
| 200 | 85 | 245 | ± 25 | 270 | ± 25 | 250 | ± 25 | 270 | ± 25 | 270 | ± 25 | * | ± 25 |
| 250 | 85 | 245 | ± 25 | 350 | ± 25 | 250 | ± 25 | 350 | ± 25 | 350 | ± 25 | | |
| 300 | 85 | 245 | ± 25 | 370 | ± 30 | 250 | ± 25 | 370 | ± 30 | 370 | ± 30 | | |

* The bend length shall be determined by the manufacturer

Bends > DN 300 can be manufactured as a segmented bend with 2 or 3 segments.

The bend length has to be measured, using a talmeter, at the inside of the bend.

The radius is determined according to a method proposed by the manufacturer.

3.4.9.2 Bends without a socket

See NBN EN 295-1, Clause 5.7.

To be considered as pipes and fittings for vitrified clay pipe systems for drains and sewers according to this PTV, the dimensions of the bend shall be as give in table 4.

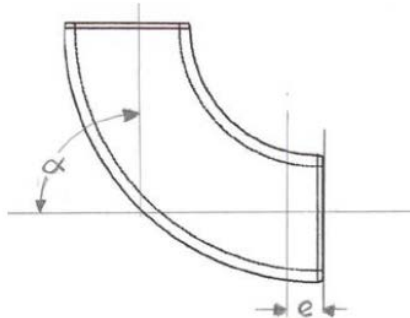


Table 4: Dimensions of bends

| DN | E min. in mm. | Bend length in mm | | | | | | | |
|-----|---------------------|-------------------|-------------|----------|-------------|----------|-------------|----------|-------------|
| | | 15° ± 3° | | 30° ± 4° | | 45° ± 5° | | 90° ± 5° | |
| | | | Max dev. | | Max dev. | | Max dev. | | Max dev. |
| 100 | 40 | 165 | ± 25 | 165 | ± 25 | 170 | ± 25 | * | ± 25 |
| 150 | 50 | 180 | ± 25 | 190 | ± 25 | 230 | ± 25 | * | ± 25 |
| 200 | 60 | 235 | ± 25 | 270 | ± 25 | 305 | ± 25 | * | ± 25 |
| 250 | 85 | 260 | ± 25 | 360 | ± 25 | | | | |
| 300 | 90 | 345 | ± 30 | 390 | ± 30 | | | | |

* The bend length shall be determined by the manufacturer

Bends > DN 300 can be manufactured as a segmented bend with 2 or 3 segments.

The bend length has to be measured, using a talmeter, at the inside of the bend.

The radius is determined according to a method proposed by the manufacturer.

3.4.10 Branch angle of junctions

3.4.10.1 Junctions with a socket

See NBN EN 295-1, Clause 5.8.

To be considered as pipes and fittings for vitrified clay pipe systems for drains and sewers according to this PTV, the dimensions of the branch angle of the junctions has to be according table 5.

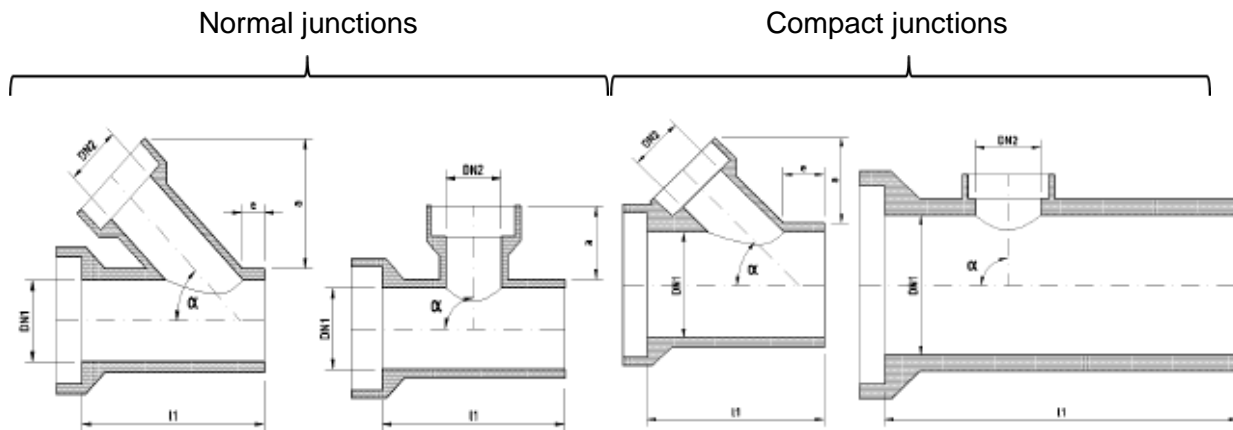


Table 5: Dimensions of junctions

| DN 1 | DN 2 | e min. in mm | a max. in mm for branch angle of junctions | | | | Regular length l1 in mm (1) | | | | | | | |
|------|------|--------------|--|-------------|------------|-------------|-----------------------------|-----|-----|-----|------|------|------|---|
| | | | Normal 45° | Compact 45° | Normal 90° | Compact 90° | (2) | 500 | 600 | 750 | 1000 | 2000 | 2500 | |
| 100 | 100 | 70 | 240 | | | | X | | | | | | | |
| 125 | 100 | 70 | 240 | | | | X | | | | | | | |
| | 125 | 70 | 260 | | 160 | | X | | | | | | | |
| 150 | 100 | 75 | 240 | | | | X | | | | | | | |
| | 125 | 75 | 260 | | | | X | | | | | | | |
| | 150 | 75 | 270 | 270 | 160 | | X | | | | | | | |
| 200 | 100 | 85 | 250 | | 170 | | | X | | | | | | |
| | 125 | 85 | 300 | | 170 | | | X | | | | | | |
| | 150 | 85 | 305 | 305 | 170 | | | X | | | | | | |
| | 200 | 85 | 350 | | 180 | | | | X | | | | | |
| 250 | 125 | 85 | 300 | | 170 | | | X | | | | | X | X |
| | 150 | 85 | 300 | 300 | 170 | | | X | | | | | X | X |
| | 200 | 85 | 350 | | 180 | | | | X | | | | X | X |
| 300 | 125 | 85 | 300 | | 170 | | | X | | | | | X | X |
| | 150 | 85 | 300 | 300 | 170 | | | X | | | | | X | X |
| | 200 | 85 | 350 | | 200 | | | | X | | | | X | X |

| DN 1 | DN 2 | e min. in mm | a max. in mm for branch angle of junctions | | | | Regular length l1 in mm (1) | | | | | | |
|--------------|------|-----------------|--|----------------|---------------|----------------|-----------------------------|-----|-----|-----|------|------|------|
| | | | Normal 45° | Compact 45° | Normal 90° | Compact 90° | (2) | 500 | 600 | 750 | 1000 | 2000 | 2500 |
| 350 & 450 | 125 | 85 | | | 170 | | | | X | X | X | X | |
| | 150 | 85 | | | 170 | | | | X | X | X | X | |
| | 200 | 85 | | | 200 | | | | X | X | X | X | |
| 400 | 125 | 85 | | | 170 | | | | X | X | X | X | |
| | 150 | 85 | | | 170 | 70 | | | X | X | X | X | |
| | 200 | 85 | | | 200 | 80 | | | X | X | X | X | |
| 500 - 800 | 125 | 95 | | | 170 | | | | X | X | X | X | |
| | 150 | 95 | | | 170 | 70 | | | X | X | X | X | |
| | 200 | 95 | | | 200 | 80 | | | X | X | X | X | |

(1) The tolerance on the length l1 shall be from -1 % to +4 % or ± 10 mm, whichever is the larger.

(2) Chosen by the manufacturer, but not less than 400 mm.

3.4.10.2 Junctions without a socket

See NBN EN 295-1, Clause 5.8.

To be considered as pipes and fittings for vitrified clay pipe systems for drains and sewers according to this PTV, the dimensions of the branch angle of the junctions has to be according table 6.

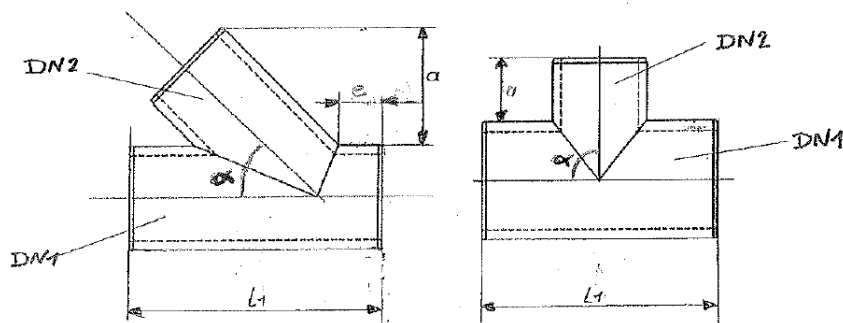


Table 6: Dimensions of junctions

| DN 1 | DN 2 | e min in mm | a max in mm | | Regular length l1 in mm | |
|------|------|----------------|-------------|-----|-------------------------|-----|
| | | | 45° | 90° | 45° | 90° |
| 100 | 100 | 40 | 160 | 115 | 350 | 350 |
| 150 | 100 | 50 | 165 | 95 | 450 | 450 |
| | 150 | 50 | 215 | 120 | 450 | 450 |
| 200 | 100 | 60 | 135 | 112 | 500 | 500 |
| | 150 | 60 | 180 | 112 | 500 | 500 |
| | 200 | 60 | 280 | 112 | 600 | 600 |
| 250 | 150 | 70 | 265 | 140 | 500 | 500 |
| | 200 | 70 | 290 | 140 | 700 | 700 |
| 300 | 150 | 90 | 240 | 110 | 600 | 500 |
| | 200 | 90 | 260 | 110 | 800 | 600 |

3.4.11 Crushing strength

See NBN EN 295-1, Clause 5.9.

Crushing strength shall be determined in accordance with Clause 7 of NBN EN 295-3.

If required the crushing strength can be calculated from the bending tensile strength, as described in NBN EN 295-1 Clause 5.10.

3.4.12 Bending tensile strength

See NBN EN 295-1, Clause 5.10.

The manufacturer can choose between the following two possibilities:

- Either the bending tensile strength is determined according to NBN EN 295-3 Clause 8.
- Either the bending tensile strength is calculated from the crushing strength according to the formula mentioned in NBN EN 295-3 Clause 11.3.

In any case the bending tensile strength σ_b has to be minimum 18 N/mm². This guarantees fatigue strength under cyclic load.

3.4.13 Bending moment resistance (BMR)

See NBN EN 295-1, Clause 5.11

Bending moment resistance is determined in accordance with Clause 9 of NBN EN 295-3.

The highest value of the bending moment resistance for which the product conforms shall be declared on the technical data sheet.

3.4.14 Bonding strength of adhesive used for fixing fired clay parts together

See NBN EN 295-1, Clause 5.12.

Bonding strength of adhesive used for fixing fired clay parts together is determined in accordance with Clause 10 of NBN EN 295-3.

3.4.15 Fatigue strength under cyclic load

See NBN EN 295-1, Clause 5.13.

If required, fatigue strength under cyclic load is determined in accordance with Clause 11 of NBN EN 295-3.

As there is a correlation between fatigue strength under cyclic load and bending tensile strength, the fatigue strength under cyclic load can be guaranteed without testing and instead determine the bending tensile strength.

3.4.16 Watertightness of pipes and junctions

See NBN EN 295-1, Clause 5.14.

Watertightness of pipes and junctions is determined in accordance with Clause 12 of NBN EN 295-3.

3.4.17 Chemical resistance

See NBN EN 295-1, Clause 5.15.

Chemical resistance is determined in accordance with Clause 13 of NBN EN 295-3.

3.4.18 Hydraulic roughness

See NBN EN 295-1, Clause 5.16.

Hydraulic roughness is determined in accordance with Clause 14 of NBN EN 295-3.

3.4.19 Abrasion resistance

See NBN EN 295-1, Clause 5.17. Maximum values for the abrasion resistance are given in table 7.

Abrasion resistance is determined in accordance with Clause 15 of NBN EN 295-3.

Table 7: Abrasion resistance

| Class AH | Class AN |
|----------|----------|
| 0,25 mm | 0,50 mm |

The class is part of the identification of the product (see Clause 5.1.1) and shall be declared on the technical data sheet.

3.4.20 Airtightness

See NBN EN 295-1, Clause 5.18.

Airtightness is determined in accordance with Clause 16 of NBN EN 295-3.

3.4.21 Tightness of fittings

See NBN EN 295-1, Clause 5.19.

Tightness is determined in accordance with Clause 12 or Clause 16 of NBN EN 295-3. Depending whether the test is carried out using a water test or an air test.

3.4.22 Resistance against high pressure water jetting

See NBN EN 295-1, Clause 5.20.

Resistance against high pressure water jetting is determined in accordance with Clause 17 of NBN EN 295-3.

3.5 JOINT ASSEMBLIES

3.5.1 General

- 3.5.1.1 Joint assemblies of pipes and fittings shall meet the requirements set out in Clauses 3.5.2 to 3.5.8 and voluntary the additional requirement set out in Clauses 3.5.9.
- 3.5.1.2 The supplier shall in each case declare the performance for the characteristics set out in Clauses 3.5.2 to 3.5.8 for the joint assemblies of pipes and fittings for vitrified clay pipe systems for drains and sewers. The supplier shall also declare the performance for the applicable additional characteristic set out in Clause 3.5.9 for the joint assemblies of pipes and fittings for vitrified clay pipe systems for drains and sewers. If it concerns an essential characteristic, the supplier shall declare this on its Declaration of Performance.

3.5.2 Watertightness under deflection and shear load

See NBN EN 295-1, Clause 6.2.

Watertightness of joint assemblies under angular deflection and shear load is determined in accordance with Clause 21 of NBN EN 295-3.

The highest value of deflection for which the product conforms shall be declared on the technical data sheet.

3.5.3 Increased watertightness of jointed pipes at 1 bar

The increased watertightness of jointed pipes at 1 bar shall be tested in accordance with NBN EN 295-3 Clause 21.1 without shear load or angular deflection at a pressure of 1 bar \pm 0,05 bar. During the testing time of 15 minutes no visual leakage may occur.

3.5.4 Continuity of invert in joint assemblies

See NBN EN 295-1, Clause 6.3.

Continuity of invert in joint assemblies is determined in accordance with Clause 22 of NBN EN 295-3.

This characteristic is only applicable for socketed pipes.

3.5.5 Joint interchangeability of pipes and fittings in joint assemblies

See NBN EN 295-1, Clause 6.4.

To be considered as pipes and fittings for vitrified clay pipe systems for drains and sewers according to this PTV, the joint systems of Clause 6.4 of NBN EN 295-1 are limited to joint systems C, E, F and G.

3.5.6 Chemical and physical resistance to effluent of joint assemblies

See NBN EN 295-1, Clause 6.5, taking into account that there will be a distinction between solutions for extreme conditions (class CH) and solutions for normal conditions (class CN), as described in table 8.

Table 8: Test solutions for normal and extreme conditions

| Class CH | Class CN |
|---|--|
| Sulphuric acid solution c (H ₂ SO ₄) = 0.5 mol/L (pH = 0 approximately) | Sulphuric acid solution c (H ₂ SO ₄) = 0.005 mol/L (pH = 2.0 approximately) |
| Nitric acid solution c (HN0 ₃) = 1 mol/L (pH = 0 approximately) | Nitric acid solution c (HN0 ₃) = 0.01 mol/L (pH = 2.0 approximately) |
| Sodium hydroxide solution c (NaOH) = 1 mol/L (pH = 14 approximately) | Sodium hydroxide solution c (NaOH) = 0.01 mol/L (pH = 12.0 approximately) |
| Sodium hypochlorite solution c (NaOCL) = 1 mol/L stabilised with sodium hydroxide (pH = 14 approximately) | Sodium hypochlorite solution c (NaOCL) = 0.01 mol/L stabilised with sodium hydroxide (pH = 12.0 approximately) |

The class is part of the identification of the product (see Clause 5.1.1) and shall be declared on the technical data sheet.

Chemical and physical resistance to effluent of joint assemblies is determined in accordance with Clause 23 of NBN EN 295-3.

3.5.7 Thermal cycling stability of joint assemblies

See NBN EN 295-1, Clause 6.6.

Thermal cycling stability of joint assemblies is determined in accordance with Clause 24.1 of NBN EN 295-3.

3.5.8 Long-term thermal stability of joint assemblies

See NBN EN 295-1, Clause 6.7.

Long-term thermal stability of joint assemblies is determined in accordance with Clause 24.2 of NBN EN 295-3.

3.5.9 Airtightness of jointed pipes (voluntary)

The airtightness of 2 jointed pipes shall be tested under positive pressure in accordance with EN 295-3, Clause 16. The two jointed pipes shall be tested under 200 mbar pressure (p_0) and the time, given in table 9. The measured change in pressure shall not exceed $\Delta p = 15$ mbar from the initial pressure p_0 .

Table 9: Testing time

| Nominal size DN | Test period in minutes | Nominal size DN | Test period in minutes |
|-----------------|------------------------|-----------------|------------------------|
| 100 | 5 | 500 | 17,5 |
| 125 | 6 | 600 | 20 |
| 150 | 7,5 | 700 | 22 |
| 200 | 9 | 800 | 25 |
| 250 | 10 | 900 | 30 |
| 300 | 11 | 1000 | 35 |
| 350 | 12.5 | 1200 | 19 |
| 400 | 14 | 1400 | 22 |
| 450 | 15 | | |

4 TEST METHODS

4.1 SAMPLING

4.1.1 Sampling of soft cast polyurethane

See NBN EN 681-4, Clause 7.1.

4.1.2 Sampling of the other products

Sampling of all the other products is executed in accordance with the relevant clauses of the applicable standards.

4.2 SAMPLE PREPARATION

4.2.1 Sample preparation of soft cast polyurethane

See NBN EN 681-4, Clause 5.1.

4.2.2 Sample preparation of the other products

Sample preparation of all the other products is executed in accordance with the relevant clauses of the applicable standards.

4.3 HIGH CHEMICAL RESISTANCE OF SOFT CAST POLYURETHANE

4.3.1 Aim and principle

The aim of this test is to determine the resistance of the seal to environments with pH0 and pH14.

The principle of this test is to condition the sample at pH0 and pH14 for 168 hours after which change in volume and in hardness is determined.

Change in hardness will also be measured after conditioning the sample at pH0 and pH14 for 168 hours and air-drying for seven days at specific conditions.

4.3.2 Instruments

See ISO 1817, Clause 3.1 and 3.3.

See ISO 48, Clause 5.

4.3.3 Sample preparation

Test samples for the determination of change in volume shall have 1 of the following dimensions in mm:

- Cylinder (diameter x height): $(13 \pm 0,5) \times (6,3 \pm 0,3)$, with parallel end faces,
- Cuboid $(11,5 \pm 0,5) \times (11,5 \pm 0,5) \times (6,3 \pm 0,3)$.

Test samples for determination of change in hardness shall be according ISO 48, Clause 6.

4.3.4 Test temperature for soft cast polyurethane

See NBN EN 681-4, Clause 5.2.

4.3.5 Method

4.3.5.1 Determination of change in volume ΔV_7

- Measure the dimensions of the test sample and calculate the volume (V_0). The volume shall be determined at $0,005 \text{ cm}^3$;
- Expose the test sample to sulphuric acid (pH level about 0) and caustic soda (pH level about 14) over 168 hours at test temperature;
- Remove the test samples out of the test fluid and measure the dimensions within 5 minutes after removal out of the test fluid. Determine the volume at $0,005 \text{ cm}^3$ (V_1).

4.3.5.2 Determination of change in hardness $\Delta \text{Shore } A_7$

- Measure the hardness Shore A of the test sample according to method M of ISO 48 (Shore A_0). Another method of ISO 48 can be accepted, but in case of doubt, method M shall be used as reference;
- Expose the test sample to sulphuric acid (pH level about 0) and caustic soda (pH level about 14) over 168 hours at test temperature;
- Remove the test sample out of the test fluid and measure the hardness Shore A according to ISO 48 within 5 minutes after removal out of the test fluid (Shore A_1). The same test method of ISO 48 used before exposure to the test fluid shall be used after exposure.

4.3.5.3 Determination of change in hardness $\Delta\text{Shore } A_{7/7}$:

- Measure the hardness Shore A of the test sample according to method M of ISO 48 (Shore A_2). Another method of ISO 48 can be accepted, but in case of doubt, method M shall be used as reference;
- Expose the test samples to sulphuric acid (pH level about 0) and caustic soda (pH level about 14) over 168 hours at test temperature;
- Remove the test samples out of the test fluid and dry them out for seven days at a standard atmosphere 23/50 class 2 according to NBN EN ISO 291;
- Measure the hardness Shore A according to ISO 48 within 5 minutes after removal out of the drying conditions (Shore A_3). The same test method of ISO 48 used before exposure to the test fluid shall be used after exposure drying;
- If possible, determination of hardness Shore A_1 and hardness Shore A_3 can be performed on the same test samples. In that case value of hardness Shore A_2 can be adopted from the value of hardness Shore A_0 .

4.3.6 Result

ΔV_7 is calculated as follows: $\Delta V_7 = \text{abs}((V_1 - V_0)/V_0) * 100 \%$;

$\Delta\text{Shore } A_7$ is calculated as follows: $\text{abs}(\text{Shore } A_1 - \text{Shore } A_0)$;

$\Delta\text{Shore } A_{7/7}$ is calculated as follows: $\text{abs}(\text{Shore } A_3 - \text{Shore } A_2)$.

4.3.7 Test report

The test report sets out at least:

- the details of the laboratory,
- the details and identification of the sample,
- a description of the packaging in which the sample was delivered (possible damage, et cetera),
- the start-date and the end-date of the test,
- V_0 , V_1 and ΔV_7 ,
- Shore A_0 , Shore A_1 , Shore A_2 , Shore A_3 , $\Delta\text{Shore } A_7$ and $\Delta\text{Shore } A_{7/7}$,
- a reference to PTV 895-1, clause 3.2.4.9.

Each test report is supplemented by an assessment of conformity to the requirements.

5 PRODUCT IDENTIFICATION

5.1 PRODUCT NAME

5.1.1 Official name

The official name has to be in accordance to article 8 of EN 295-1, supplemented with:

- the class for the abrasion resistance (see Clause 3.4.19);
- the class for the chemical and physical resistance to effluent (see Clause 3.5.6).

5.1.2 Commercial name

The commercial name is chosen by the supplier in so far 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 Pipes and fittings are delivered in bulk.

5.2.1.2 Joint materials supplied as separate components are delivered in bulk.

5.2.2 Identification of the products

5.2.2.1 Pipes and fittings

The following information must be given on each product unit:

- all relevant information as foreseen in NBN EN 295-1, Clause 9;
- reference to this PTV;
- reference to the unit group's technical data sheet code.

5.2.2.2 Joint materials

5.2.2.2.1 Vulcanized rubber sealing elements

Vulcanized rubber sealing elements which are supplied as separate components, shall be marked with reference to PTV 8681-1 and the classification for high chemical resistance.

5.2.2.2.2 Cast polyurethane sealing elements

Identification is not possible. These joint materials are always fixed at a pipe or fitting.

5.2.2.3 Coupling materials

5.2.2.3.1 Polypropylene sleeve couplings

As according to this PTV, polypropylene sleeve couplings shall meet the requirements of this PTV, they shall be marked with reference to PTV 895-1.

6 APPLICATION OF THE PRODUCT (informative)

6.1 APPLICATION OF THE PRODUCT

6.1.1 Application of a lubricant

The lubricant is delivered by the dealer of the pipes and fittings.

6.2 INSTALLATION OF THE PRODUCT

Longitudinal flexibility of buried clay pipe drainage systems is achieved by the provision of flexible joints. These allow for settlement and other movements in the ground. The connection of pipelines to manholes or inspection chambers and buildings is made using sufficient flexible joints so that any additional strains from differential settlement are avoided at the interface between pipe and structure.
