Technical manual for vitrified clay pipe systems of Sweillem Vitrified Clay Pipes Co. Cairo

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preface

The use of vitrified clay pipe and duct systems has a long tradition in many countries. Even today, after dozens of new sewer systems made of a wide variety of materials have increased and continue to increase the diversity in the market in recent decades, pipe systems made of vitrified clay have a stable share in the new construction of pipe and sewer systems for municipal and industrial wastewater in free-fall systems.

What makes Sweillem Vitrified Clay Pipes Co. products stand out is that they adhere to a traditionally proven manufacturing process.This means that all pipes and fittings were fired upright which allows all components to be glazed on the inside and outside.
The natural clay undergoes a volume loss of up to 14% during the firing process. This shrinkage and the upright standing of the tubes in the furnace mean that these tubes are not completely round and also not completely straight.
The interlocking tolerances defined in the "DIN EN 295" standard make it possible to build sewers made of vitrified clay that meet all the requirements of a sewer in free-fall, but they also require some experience during processing.
For the seals of the push-in sleeve "K" to connection system "C", the choice of material remains consistently polyurethane (PU).
This is a very durable material that hardly changes over time and is also known from manhole construction for sewage systems. Stoneware pipe and duct systems are made of clay, a natural material, and are characterized by a special property.
Sewer systems made of stoneware does not age and change over time.
Thus, the quality of the seals and the quality of the installation by the pipelayers have a decisive influence on the longevity of the sewer structures.

As an simplified reference work, this handbook is aimed first and foremost at the processing construction companies with tips from practical experience, but also at construction-monitoring engineers who accompany the construction sites on behalf of the investors as part of construction supervision.

Germany Brüggen-Bracht december 2021.

Table of contents:

1. Euro Sweillem GmbH in Brüggen, a wholly owned subsidiary of the Egyptian producer Sweillem Vitrified Clay Pipes Co. based in Cairo.

Following its establishment in Cologne in 2015, DIN-Plus certification and other country-specific certifications, Sweillem has become a force to be reckoned with in the European and, in particular, the German vitrified clay pipe market.
In order to ensure the availability of all materials at all times, a quantity of currently 6,000 to 8,000 tons in nominal sizes DN150 to DN800 is held at the central warehouse in Brüggen.
The products are externally monitored and certified in accordance with DIN EN 295 by the independent Office for Materials Testing (MPA) in Dortmund.

Service and benefits:

- Product and application consulting
- Calculations of structural engineering of sewers
- Consultations on construction sites
- Training for construction companies and specialized dealers

2. Manufacturing, Quality, Certifications

2.1 DIN EN 295

This is the European standard for vitrified clay pipe and duct systems.
It's regulated in its respective parts:

- Part 1: Requirements for pipes, fittings and joints.
- Part 2: Quality monitoring and sampling.
- Part 3: The test procedures.
- Part 4: Requirements for special fittings, transition parts and accessories.
- Part 5: Requirements for pipes and joints for pipe jacking

2.2 **DIN-Plus**, Mark of conformity to the certification program ZP WN 295.

The DIN-Plus certification is issued by DIN CERTCO "Gesellschaft für Konformitätsbewertung mbH" in Berlin. The basis for testing is DIN EN 295-1 2013-05 as well as the certification program ZP WN 295 for glazed pipes and fittings made of vitrified clay as well as their accessories for wastewater pipes and sewers.

2.3 Production pipes and fittings

The basis of Sweillem's vitrified clay pipe systems is clay extracted from various clay pits in the Aswan region of Egypt. With the addition of other components, a malleable mass is created as the basis of the pipes and fittings. These components are:

- Different clays about 50%
- Ground ceramic shards about 18% bis 28%
- Water about 5% to 17%
- Granite dust about 5% to 10%

The conditioning of this mass takes 24 to 48 hours.
Clay is a natural raw material and it is not possible to obtain a consistent quality from a clay pit. For this reason, the clays of different clay pits are mixed in varying proportions with the aim of achieving a relatively consistent quality of the resulting clay mixture as a basis for industrial shaping with approximately constant quality.

Mixing the clays

A pipe comes out of the pipe press

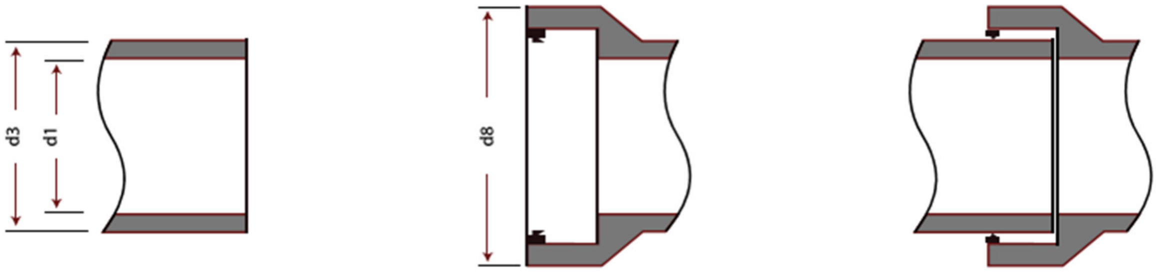
Glaze is applied during dipping

after the process of burning

2.4 Sealing systems according to DIN EN 295

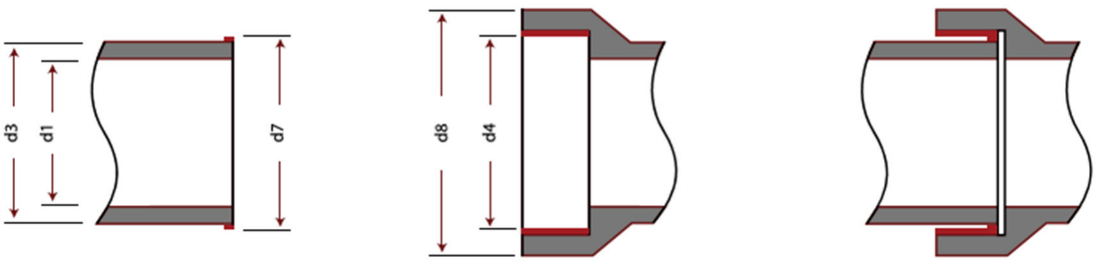
- Connect sleeve L according to connection system F

The connection system F (socket L) is according to DIN EN 295-1 table 14, a connection system determined by the spigot end. The sealing element is integrated in the socket.



- Connect sleeve K according to connection system C

The connection system C (socket K) is according to DIN EN 295-1 table 13, a connection system determined by the socket.   To compensate for ceramic tolerances, the spigot end (polyurethane soft) and the socket (polyurethane hard) are cast tightly.



The carousel for attaching the seals, socket K according to connection system C.

2.5 Quality control and certificates.

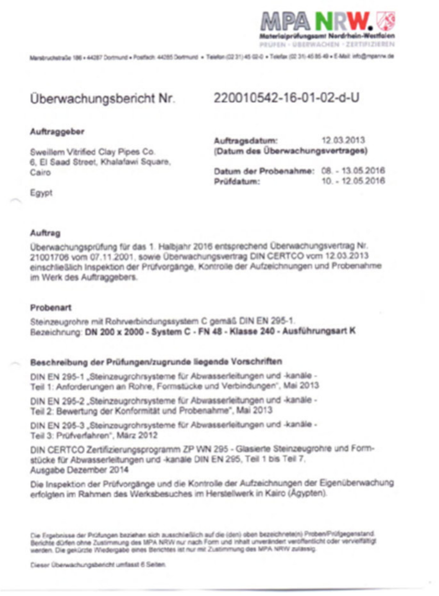
Quality control is carried out on the one hand in the form of self-monitoring by the company's own testing laboratory. Here, the quality and suitability of the supplied raw materials are monitored during the process of production.

Examples of self-monitoring:

The pipe connection is angled under an internal pressure of 0.5 bar.

Test bench for testing the load capacity of the pipe until rupture

Furthermore, all products are subject to external monitoring in accordance with DIN EN 295 by an external and independent testing institute, the "Materialprüfamt Nordrhein-Westfalen" in Dortmund (MPA), as well as DIN-Plus certification, issued by the DIN Certco company. See 2.1 and 2.2 above.



MPA NRW.
Materialprüfungsamt Nordrhein-Westfalen
PRÜFEN · ÜBERWACHEN · ZERTIFIZIEREN

Überwachungsbericht Nr. 220010542-16-01-02-d-U

Auftraggeber

Sweillem Vitrified Clay Pipes Co.
6, El Saad Street, Khalafawi Square,
Cairo

Egypt

Auftragsdatum: 12.03.2013
(Datum des Überwachungsvertrages)

Datum der Probenahme: 08. - 13.05.2016
Prüfdatum: 10. - 12.05.2016

Auftrag

Überwachungsprüfung für das 1. Halbjahr 2016 entsprechend Überwachungsvertrag Nr. 21001706 vom 07.11.2001, sowie Überwachungsvertrag DIN CERTCO vom 12.03.2013 einschließlich Inspektion der Prüfvorgänge, Kontrolle der Aufzeichnungen und Probenahme im Werk des Auftraggebers.

Probenart

Steinzeugrohre mit Rohrverbindungssystem C gemäß DIN EN 295-1.
Bezeichnung: **DN 200 x 2000 - System C - FN 48 - Klasse 240 - Ausführungsart K**

Beschreibung der Prüfungen/zugrunde liegende Vorschriften

DIN EN 295-1 „Steinzeugrohrsysteme für Abwasserleitungen und -kanäle - Teil 1: Anforderungen an Rohre, Formstücke und Verbindungen", Mai 2013

DIN EN 295-2 „Steinzeugrohrsysteme für Abwasserleitungen und -kanäle - Teil 2: Bewertung der Konformität und Probenahme", Mai 2013

DIN EN 295-3 „Steinzeugrohrsysteme für Abwasserleitungen und -kanäle - Teil 3: Prüfverfahren", März 2012

DIN CERTCO Zertifizierungsprogramm ZP WN 295 - Glasierte Steinzeugrohre und Formstücke für Abwasserleitungen und -kanäle DIN EN 295, Teil 1 bis Teil 7, Ausgabe Dezember 2014

Die Inspektion der Prüfvorgänge und die Kontrolle der Aufzeichnungen der Eigenüberwachung erfolgten im Rahmen des Werksbesuches im Herstellwerk in Kairo (Ägypten).

Die Ergebnisse der Prüfungen beziehen sich ausschließlich auf die (den) oben bezeichnete(n) Proben/Prüfgegenstand. Berichte dürfen ohne Zustimmung des MPA NRW nur nach Form und Inhalt unverändert veröffentlicht oder vervielfältigt werden. Die gekürzte Wiedergabe eines Berichtes ist nur mit Zustimmung des MPA NRW zulässig.

Dieser Überwachungsbericht umfasst 6 Seiten.

DIN CERTCO

ZERTIFIKAT

Zertifikatinhaber: Sweillem Vitrified Clay Pipes Co.
6, El Saad Street, Khalafawi Square
Cairo
ÄGYPTEN

Weitere Angaben siehe Anhang.

"DIN-Plus" - stickers are on some pipes and fittings.

3. These installation instructions for Euro Sweillem vitrified clay pipe systems are subordinate to the standards of the respective country and provide supplementary information.

3.1 Basics of sewer construction

3.1.1 DIN EN 295 Vitrified clay pipe systems for waste water pipelines European standard of manufacturing.

3.1.2 The respective state standards for the installation and testing of sewage pipes.

3.2 Delivery, unloading, testing and storage.

3.2.1 Transport, storage and testing

- Unloading and transport on the construction site should be carried out with suitable construction equipment. If possible, the pipe pallets should always be placed on level ground. If it is not possible to avoid placing the pipes on sloping ground, the pipes should be placed vertically to the slope.

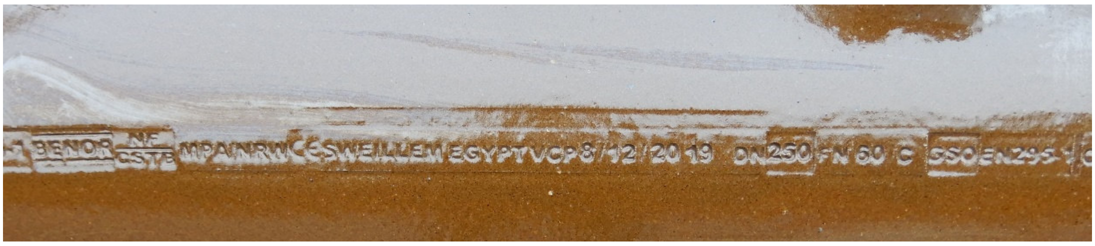
Practice note: After unloading, the sleeves and spigot ends of the pipes on the outside of the pallets must be checked for damage. These may have chafed together during shipment. Damaged seals at the pointed ends may render the pipes unusable.

Practice note: Use protection on forks when a forklift is necessary to mowe from the inside oft he pipes. This avoids scratching the interior glaze oft he pipes.

- Pipes and pipe joints should be inspected upon delivery to ensure that they match the ordered materials on the delivery invoice.

- Complaints must be noted immediately on the delivery invoice.

Practice note: Ceramic pipes and fittings are imprinted with the following information among others: independent supervising organisation, production standard, production date, nominal size and crest pressure force in KN/m.



3.2.2 Storage

The sealing elements of the connecting systems are resistant to exposure to sun damage. During outdoor storage, avoid the sinking of pallets into the ground and damaging the soft seals at the spigot end of the pipes.

- Individual ceramic components should always be stored vertically on the socket. The spigot ends of the pipes should lie on wood to avoid damage to the seal.

3.3 Laying the pipes

3.3.1 Testing and laying of pipes and fittings

The following integrity checks should be performed prior to installation:

- General visual inspection for damage and defects.
- Sound test for integrity of the ceramic. Be aware that the seal of the socket K reduces the sound.
- Sample with dust: by wiping out the shaft ends with talcum powder, any hairline cracks become visible.



- The seals should be checked for tight adhesion.

- Sockets and spigot ends must be undamaged and clean.
- Euro Sweillem GmbH recommends the type "Steinzeug Blau" as a lubricant.

Laying the pipes and fittings:

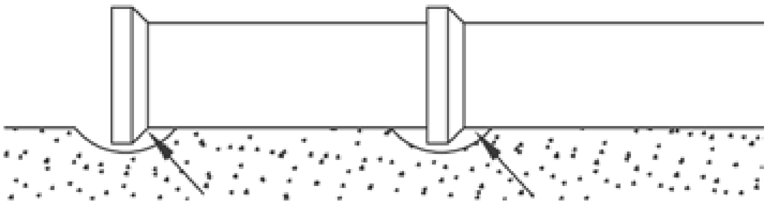
- During the laying period the bottom of the trench must be kept free of water and frost.
- The flow direction of vitrified clay pipes is always running into the sockets. Euro Sweillem pipes must be laid in such a way that the spigot end is pushed into the socket without tilting.

- In the case of vitrified clay pipes, a gap clearance of at least 5 mm must be maintained to allow an angular deflection in case of ground settlements without causing edge chipping in the ceramic. For the maximum butt joint, please see 7.3.2.

- For pipes with push-in socket K, the apex markings of the pipes must be observed to minimize the invert offset.

- The apex markings also mark the center of gravity of the tubes.

- So-called socket holes are to be formed in the pipe support in the area of the push-in sockets in order to ensure uniform support of the pipe shaft.



- Only devices that allow controlled centered joining of the pipes may be used.

- After the tubes have been aligned, they must be pressed together again.

- In the case of concrete supports, it must be ensured that the possibility of angling the pipe joints is maintained. This is made possible, for example, by completely separating the concrete support under the pipe joints with a foam layer. For this purpose, thin sheets of polystyrene, which can be easily cut to size, have proven successful.

- Joining the pipes with the excavator shovel is not allowed.

3.3.2 Socket gap

In the case of rigid pipe materials, a joint gap of at least 5 mm must be maintained between the pipes, depending on the jointing technique.
The maximum values of the joint gap listed here are the manufacturer's own requirements. This indicates the limit of dimension of the joint gap the connections need to be tight. The joint gaps obtained in practice should be as close as possible to the minimum dimension of 5mm.

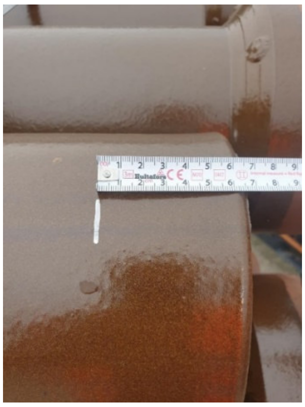
Manufacturer's specifications for maximum socket gap.				
Diameter DN	Plug-in sleeve	Maximum gap normal load tubes mm	Maximum gap high load tubes mm	Minimum socket gap always mm
150	L	11	---	5
200	L	11	---	5
200	K	11	11	5
250	K	11	11	5
300	K	11	11	5
400	K	13	13	5
500	K	15	15	5
600	K	17	17	5
700	K	---	19	5
800	K	---	21	5

3.3.3 Insertion depth

The insertion depth directly influences the expected joint gap. This must be at least 5mm, but can also be larger. (see also 3.3.2)
However, the socket gap in installed pipes cannot be checked directly due to the overall lengths of the pipes. We would like to show here how the joint gap in the pipe connections can be measured from the outside on a pipe that has not yet been laid.

➢ For the **push-in socket L**, you can mark the insertion depth for self-checking as follows and then check it:

- Measure the distance from the socket mirror to the front edge of the socket.
- This distance is transferred to the tip ends and marked with a marker.
- If the pipes are now pushed together, the distance of the marking to the socket edge corresponds to the socket gap in the pipe joint.



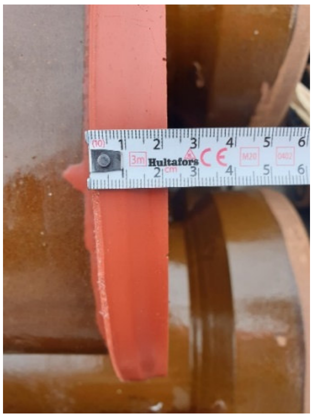
➢ Sweillem's **socket K** is designed in such a way that it is not possible to push the spigot end so far into the socket with physical force that ceramic meets ceramic. A joint gap of at least 5 to 8 mm is thus not to fall short. When using force-reinforcing aids, there is a risk that the tubes will be inserted up to the ceramic stop.
Since the sleeve is cast in a conical shape, the seal is overcompressed and this can cause the sleeve to burst.

In the case of the push-in socket K, with the pipes already laid in the open trench, the resulting socket gap can be determined as follows:

- First, the distance between the socket mirror and the front edge of the socket is measured in relation to the nominal size (socket depth SD).
- Now measure the width of the tip end grout (TEG) and subtract it from the socket depth.

  Example on the photos: 65mm SD – 21mm TEG = 44mm

- The depth to which the socket grout is inserted in the socket can now be measured on the laid pipes. If this value is = 44mm as in the example, then the socket gap in the pipe joint is 0. In practice, the inserted spigot end stops at least 5mm in front of the socket mirror, so the optimum value of the socket gap in the example would be 39mm.



Practical note: For larger nominal diameters, mechanical devices are also used to achieve the necessary insertion forces. These can be hydraulic, a winch or even a hoist.
In these cases, there is no feeling for the force required. As described, it is advisable to determine the optimum distance between the inserted spigot end seal and the socket edge beforehand.
When pushing the pipes together, a colleague should then stand next to the socket and use a ruler to track when the optimum insertion depth is reached.

3.3.4 Gradient

Vitrified clay pipes and sewers shall be self draining as gravity sewers.
The slope to be realized is specified by the planning and depends on the hydraulic requirements and the terrain profile. As a rule the slope is between 1% (1:100) and 2% (1:50).
If the tolerances of the pipe geometry are observed, vitrified clay pipes from Euro Sweillem GmbH naturally drain at a slope of 0.4%.

3.3.5 Statics

According to DIN EN 1610 Section 4.2 „Securing the assumed load“

Before starting construction, the load-bearing capacity of a pipeline must be verified in accordance with EN 752-3 and EN 1295-1.
Euro Sweillem GmbH offers the calculation of a verifiable structural analysis according to DWA-A 127 as a free service. If a certified structural analysis is required this can only be done by a certified test engineer for structural analysis.
You can download our structural analysis questionnaire here:

http://www.euro-sweillem.de/einbautechnik/

3.3.6 Wall bushings

In rare cases it is necessary to lead a vitrified clay pipe through a concrete wall or foundation. For these cases we recommend the use of "GE - pieces" and a sleeve seal as a wall lead-through. For thicker walls it may be necessary to use a pipe cut to fitting length instead of one of the two GE - pieces. In this case, the outer glaze should be partially ground off to allow the mortar to adhere to the pipe.
Photo 2 shows an annular space seal as a seal between the pipe and the wall of a borehole, for example through a building wall.

3.3.7 Pipe support, pipe bedding and backfilling of the pipe trench

- The loosened trench bottom must be compacted by a machine.

- The bedding, according to DIN EN 1610 section 7.2, must ensure a uniform pressure distribution under the pipe in the support area in order to avoid point loads.

- After making the pipe connection, the tamping of the pipe must be carefully tamped, for example, with hand tampers.
  The bedding type 1 DIN EN 1610 section 7.2.1 may be applied for each pipe zone that allows the pipes to be supported over their entire length. Unless otherwise specified, the thickness of the lower bedding layer is measured below the pipe shaft and should not be less than the following values.

    - 100mm in normal ground conditions
    - 150mm for rocks or solid bedded soils

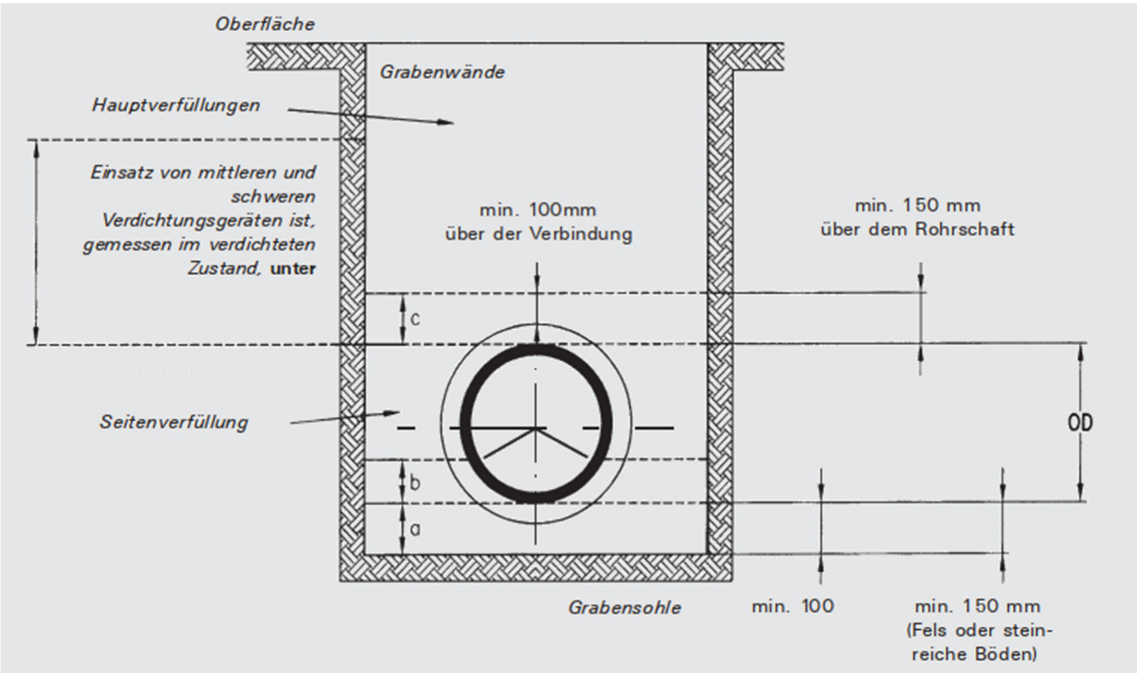
  The thickness of the upper bedding layer b must correspond to the static calculation. (please see below in the table of layer thicknesses).

Practice note:

The height of the upper bedding layer b corresponds to approximately ¼ of the pipe diameter for a gravel-sand bedding of 90°. With a gravel-sand support of 120°, the height of this layer b is approximately ⅓ of the pipe diameter.

- As a general rule, line zones a, b, and c, as well as the side fill, should have as uniform a degree of compaction as possible.
- A verifiable structural analysis must be available before the start of construction.
- The questionnaire for a free, verifiable structural analysis can be found on our website www.euro-sweillem.de under "Installation technology".

Euro Sweillem GmbH recommends bedding type 1 according to DIN EN 1610.



The construction material for the pipeline zone can be the existing soil, the usability of which has been tested (stone-free), or delivered material can also be used.
Euro Sweillem GmbH recommends stone-free gravel with the following grain sizes for the bedding material up to 30cm above the pipe crown.

:

- **Grit size 22mm ≤ DN200 Nominal pipe size**
- **Grit size 40mm > DN200 Nominal pipe size**

Layer thicknesses a and b for common gravel - sand supports (beddings)						
Pipes normal load DN	Pipes high load DN	Diameter tube shank D3 mm	Support 90° bottom bedding a (mm)	Support 90° upper bedding b (mm)	Support 120° bottom bedding a (mm)	Support 120° upper bedding b (mm)
150		186 ±2	100	30	100	50
200		242 ±3	100	40	100	65
	200	254 ±5	100	40	100	70
250		299 ±6	100	45	100	75
	250	318 ±6	100	50	100	85
300		355 ±7	100	55	100	90
	300	376 ±7	100	60	100	100
350		417 ±7	100	65	100	105
400		486 ±8	100	70	100	120
	400	492 ±8	100	75	100	130
	450	548 ±8	100	85	100	145
500		581 ±9	100	90	100	150
	500	609 ±9	100	90	100	155
600		687 ±12	100	105	150	175
	600	725 ±12	150	110	150	190
700		831 ±15	150	120	150	210
800		949 ±14	150	140	150	235

Layer thicknesses measured in compacted state.

3.3.8 clear trench width

The clear trench width according to DIN EN 1610 depends firstly on the pipe nominal width and secondly on the trench depth.
The larger value from the following two tables is binding:

Minimum trench width depending on nominal pipe size D3 = Tube outer diameter			
Tube outer diameter DN mm	Trench with shoring m	Trench without shoring > 60° m	Trench without shoring < 60° m
≤ 225	D3 +0,40	D3 + 0,40	D3 + 0,40
> 225 ≤ 350	D3 + 0,50	D3 + 0,50	D3 + 0,40
> 350 ≤700	D3 + 0,70	D3 + 0,70	D3 + 0,40
800	D3 + 0,85	D3 + 0,85	D3 + 0,40

Minimum trench width Depending on trench depth	
trench depth (m)	minimum trench width (m)
≤ 1,00	no specifications
> 1,00 ≤ 1,75	0,80
> 1,75 ≤ 4,00	0,90
> 4,00	1,00

3.3.9 Main filling

The use of the existing soil for backfilling the pipe trench above the pipeline zone has a positive effect on the statics of the entire system. The specifications of the planning must be observed.
The layer-by-layer pulling of the shoring and the resulting compaction against the native soil ensure the so-called static silo effect.
If the general conditions do not permit this type of compaction and if the shoring is only pulled after the compaction work, this must be taken into account in the structural calculations.
The proper handling of compaction equipment avoids damage to the pipe.
Please refer to the regulations of the respective country for the areas of application of compaction equipment, bulk heights of the backfilled layers and the number of passes with the compaction equipment.

4 Accessories

4.1 Shortening the tubes

Vitrified clay pipes in accordance with DIN EN 295 must be cut to length using suitable diamond cutting discs or cutting chains.
. If the pipes have a crown marking, this must be transferred to the shortened pipe. The cut edges must be deburred to avoid damaging lip seals in particular.

Diamond cutting disc

Cutting chain

4.2 Fitting rings (P-ring)

For pipes which have been shortened by cutting, the missing seal at the pointed end of the pipe can be replaced by a sealing ring (P-ring).

4.3 Couplings according to DIN EN 295-4 (sleeve seals)

Shortened pipes are connected with couplings type 2B according to DIN EN 295-4. (For details see also item 5.1)

Common areas of use are:

- Installation of repair branches.
- Subsequent installation of normal branches when using an additional fitting piece.
- Repair measures and pipe replacements.

Sleeve seals are able to connect 12mm difference in diameter. If the difference in pipe diameters is greater, the smaller spigot end must be enlarged with an appropriate compensating ring.
The flat rubber and superglue required for this purpose are available in stock from specialist civil engineering dealers.

Socketless repair branches as shown in this photo are available as standard in nominal sizes DN150 to DN300 in load classes standart and extra strength.
To insert socketless branches into an existing pipeline, a piece is cut out of the pipeline which is 1 cm longer than the repair branch to be inserted.

4.4 Transition rings DN150 (Ü - rings)

Ü-rings enable the connection of a vitrified clay pipe DN150 (socket) with a PVC- KG- or cast iron pipe (spigot end) with the same inside diameter.

4.5 Subsequent side connections

4.5.1 by drilling

Test series and empirical values indicate that the drilling of vitrified clay pipes from DN300 extra strength upwards appears to be technically possible without having to accept in terms of statics and tightness.
The hole should be placed 45° to the side of the pipe apex.



Euro Sweillem offers ceramic tapping sleeves in nominal diameters of DN150 and DN200.
The nominal size DN200 is in the socket with the connection systems F and C available.
Tapping sleeves are available in two shaft lengths (5cm and 7cm), because the shaft must not protrude into the sewer pipe.
The B - ring (sealing ring) is to be inserted correctly into the borehole, then the nozzle is pushed in using lubricant.
Adherence to the borehole tolerance is decisive for the permanent, correct seating of the nozzle.

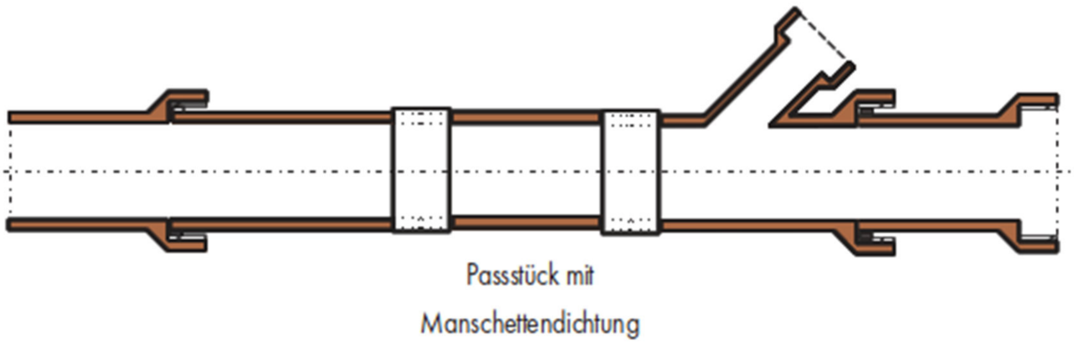
Drill hole diameter and tolerances			
Nominal size tapping spigot mm	Drill hole diameter mm	Minus tolerance mm	Plus tolerance mm
150	200	0	+ 1
200	257	0	+ 1

Practice note:

Municipal utilities and special-purpose wastewater associations have in some cases specified regarding technical solutions.
Therefore, it should be clarified with the client which tapping sleeves are approved.

4.5.2 Installation of a branch

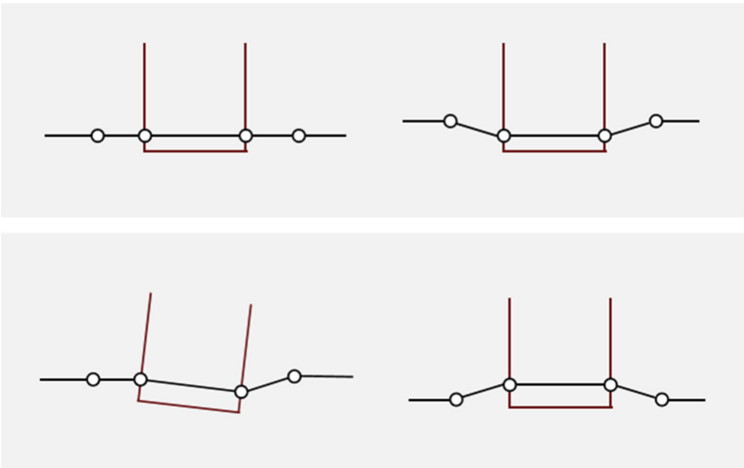
First, cut out the length of the branch plus about 30 to 40 cm for the necessary fitting piece. While observing the direction of flow the P-ring is now fitted and the sleeve of the branch is pushed on.



Now measure the distance between the remaining cut ends and make a fitting piece about 1 cm shorter. This is then installed using of two sleeve seals.

4.6 Shaft connection

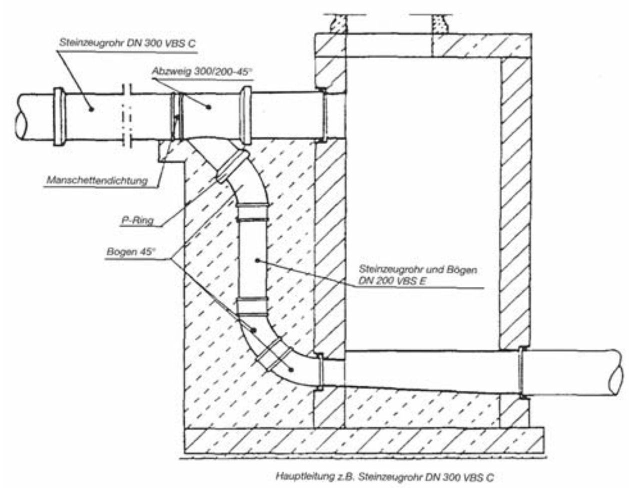
Where piping is installed through manholes or walls, articulated joints shall be installed in the wall and located as close as possible to the exterior wall of the structure.
Additional articulation may be provided by installing short pipes or joint pieces directly in front of the shaft wall.
These requirements are met with the use of joint pieces at the inlet and outlet.



Principle of double-jointed manhole connection.

deeper connection to a manhole:

It is necessary to ensure a common foundation base with the shaft.
The vertical inlet shall be set in cast-in-place concrete. So-called socket base rings should be inserted into the vertically installed pipe joints. These prevent ceramic from colliding with ceramic in the pipe joints and thus increase the longevity of the pipes.



5. Repair of existing vitrified clay channels in nominal widths which are only available to a limited extent or are no longer available.

5.1 Conditionally available nominal sizes (only available through Euro Sweillem)

Euro Sweillem also produces pipes of the following nominal sizes:

Pipes Connection system C Plug-in socket K										
Nominal width	**Connection system**	Capacity class **TKL**	Peak pressure **FN**	Inside ø **D1** ± Tolerance	Pipe shaft **D3** ± Tolerance	Wall thickness **S**	Inner dimension socket **D4**	Dimension tip end seal **D7**	Pipe weight	Construction length
(mm)	(--)	(--)	(KN/m)	(mm)	(mm)	(mm)	(mm)	(mm)	Kg/m	(m)
225	C	160	32	225 ±6	271 ±5	23	285,5 ±0,5	288,0 ±0,5	45	2,00
350	C	160	56	375 ±7	435 ±7	27	433,5 ±0,5	436,5 ±0,5	88	2,00
375	C	120	55	375 ±7	435 ±7	30	454,8 ±0,5	457,8 ±0,5	93	2,00
450	C	160	72	447 ±8	548 ±8	49	579 ±0,5	582,0 ±0,5	178	2,00

The sections to be replaced are connected with couplings.

Practice note: Please enquire in good time about the delivery times of these tubes, as they are only in stock in smaller quantities.

5.2 Nominal sizes no longer available.

The following nominal sizes were laid until the 1940s and are still in the network inventory in some large cities.
Here we will show how these channels could be repaired with new vitrified clay pipes.

The following table follows rule sheet 711 of the Berlin Utilities and is intended here as an example of how necessary rehabilitation of these nominal pipe sizes could be carried out.

Existing vitrified clay pipe		planned vitrified clay pipe according to DIN EN 295				Possible pipe offset		
Inner diameter mm	Outer diameter mm	Nominal pipe size mm	Inner diameter mm	Additional limit value internal dimension mm	Capacity class TKL	Maximum permissible pipe offset mm	Connect pipes with:	Sleeve seals type 2B
175	---	200	200 ±5		160	6	* F	
180	---	200	200 ±5		160	6	* F	
210	250	200	200 ±5	min. 198	160	6		X
240	280	250	250 ±6	max. 252	160	6		X
270	315	250	300 ±7		160	6	* E	
275	---	300	300 ±7		160	6	* F	
325	---	350	350 ±7		160	7	* F	
330	380	350	350 ±7		160	7	* E	
360	415	350	350 ±7	min. 346	160	7		X
390	450	400	398 ±8	max. 406	160	8		X
420	485	400	398 ±8	min. 404	160	8		X
425	---	450	447 ±8		160	9	* F	
480	550	500	496 ±9	max. 500	120	10	* E	

- *E Sleeve seals with compensating rings.
  The final assembly of these couplings is always based on the respective pipe outside diameter measured on site.

- *F The pipe ends shall be wrapped with a suitable sealing bandage, sealed and surrounded with a concrete seal.

. Please also visit our website

www.euro-sweillem.de

6. Pressure tests and optical tests

Please observe the installation regulations of the respective country. In general, note the following:

- The leak test of pipes and manholes shall be performed either with air or with water.
- Separate testing of pipes, fittings and manholes may also be carried out using different test methods.
- When testing with air, the number of corrective actions and repetitions is unlimited.
- In case of airtest inadequacy, it’s possible to tranfer to a watertest.
- The test procedure should be determined by the client.

6.1 Testing with air

As part of self-monitoring, it is recommended to perform a preliminary test of the pipeline in the open trench using a digital air pressure tester.
The final test for certification is performed on the backfilled trench.

- After the test pressure has been built up, a settling time of at least 5 minutes must be observed.
- At the beginning of the test, the test pressure must be 10% higher.
- If groundwater is present, the test pressure must be increased by 1 kPa for every 10 cm of groundwater above the top of the pipe.
- However, the maximum test pressure of 20 kPa must never be exceeded.
- Alternative test methods such as single socket testing and vacuum testing with air are permitted.

  Practice note:
  All pipes and fittings must be secured against displacement. Branches must be closed and sealed with suitable closing elements such as closing lids or quick-locking plates.

Test method air: test pressure, test time and allowable pressure drop.									
Pipe material	**Prüf-verfahren**	**Po³**	**Δp**	**testig time minutes**					
		mbar (kPa)		**DN100**	**DN200**	**DN300**	**DN400**	**DN600**	**DN800**
wet concrete pipes and all other materials	**air (A)**	10 (1)	2,5 (0,25)	5	5	7	10	14	19
	air (B)	50 (5)	10 (1)	4	5	6	7	11	15
	air ©	100 (10)	15 (1,5)	3	5	4	5	8	11
	air (D)	200 (20)	15 (1,5)	1,5	1,5	2	2,8	4	5

Practice note:
Extreme caution must be exercised when performing leak tests with air.
Since air, unlike water, is compressed under pressure, a pipe under air pressure is similar to a gun barrel.
Shut-off plates that are not precisely placed can come loose abruptly and be shoot off.
Therefore, people must never stand in front of the shut-off devices and should always stand to the side of them.

6.2 testing with water

- The settling time for the test with water should not be less than 1 hour.
- The test duration is always 30 minutes.
- The water column should be maintained for the entire test period.
- The necessary amount of water supplied over the test time should not exceed 0.15L/m² for pipelines.
  The necessary amount of water supplied over the test time must not exceed 0.20L/m² inner surface for pipelines including manholes.
- Each test must be recorded.

Practice note:
If the test with air is not passed, the test with water can be performed. If this is successful, the pressure test of the pipe is considered to have passed.

Required water volume and permissible water loss.			
Pipe diameter DN (mm)	Required water quantity in liters per meter of pipe	Permissible water loss in liters per meter of pipe	Allowable water loss (pipes & manholes) in liters per meter of pipe.
150	18	0,07	0,09
200	31	0,09	0,13
250	49	0,12	0,16
300	71	0,14	0,19
350	96	0,16	0,22
400	126	0,19	0,25
450	159	0,21	0,28
500	196	0,24	0,31
600	283	0,28	0,38
700	385	0,33	0,44
800	510	0,37	0,50

6.3 Visual inspection by camera

Inspections and assessments of wastewater pipes outside buildings are subject to their own country-specific standard.
In this national standard, a coding system specifies the description of observations made inside wastewater pipes and manholes during visual inspection, regardless of the pipe and manhole materials used.

Before the camera inspection, the sewer should be cleaned with high-pressure flushing. Coarse rock must be removed beforehand.
Only camera devices that provide exact visual defects measurements should be used for inspection. Self estimations are not allowed.

Practice note:
If the camera evaluation of installed pipes made of vitrified clay reveals any defects, it is recommended that the manufacturer of the pipes be consulted for further evaluation.
Pipe systems made of glazed vitrified clay can lead to misinterpretation due to discoloration in the glaze, scratches or deposits. There are also glaze defects which are tolerated by the European standard for vitrified clay pipe manufacturers.
If cracks are detected, the evaluation of the crack patterns allows conclusions to be drawn about their cause.
The producer can advise the best plan of action for repair.

7. Packaging concept

Pipes are delivered on pallets. These are dividible into two half pallets by loosening the outer straps.
Thus, it is possible to perform the unloading by smaller weights. It is also possible to distribute the pipes more optimally at the trench without transporting them unpacked.

Molded parts

- The pallets of the **articulated pieces** can be divided in a similar way to tube pallets.

- **Branches and bends** are originally packed in wooden packaging for safe transport. No deposit is charged on this packaging.

- On request, **pipe bends** can be unpacked in practical mesh boxes free of charge. This is gladly accepted by the stockholding specialized trade. Grid boxes are deposit articles.

8. Accessories

8.1 Couplings according to DIN EN 295-4 Type 2B (sleeve seals)

Couplings Normal load according to DIN EN 295-4 Type 2B

Diameter DN (mm)	**Clamping range** (mm)	Width b (mm)	Pressure level (bar)	Weight (Kg/piece)
125	140 - 165	120	2,5	1
150	175 - 200	150	2,5	2
200	225 - 250	150	2,5	2
250	285 - 310	190	2,5	5
300	340 - 360	190	2,5	5
400	465 - 490	190	2,5	7
500	570 - 600	190	2,5	9
600	686 - 785	190	1,5	11
700	786 - 880	190	1,5	12
800	881 - 980	190	1,5	14

Couplings High load according to DIN EN 295-4 Type 2B High load				
Diameter DN (mm)	**clamping range** (mm)	Width b (mm)	Pressure level (bar)	Weight (Kg/piece)
200	240 - 265	150	2,5	3
250	305 - 335	190	2,5	5
300	355 - 385	190	2,5	5
400	480 - 510	190	2,5	8
500	590 - 620	190	2,5	9
600	686 - 785	190	1,5	11

8.2 Fitting rings

Fitting rings normal load			
Diameter DN (mm)	**Outside pipe dimension** (mm)	Load capacity class TKL	Weight (Kg/piece)
200	237 - 247	160	1
250	293 - 305	160	1
300	348 - 362	160	1
400	478 - 494	120	1
500	572 - 590	120	2
600	675 - 699	95	3

Fitting rings high load			
Diameter DN (mm)	**Outside pipe dimension** (mm)	Load capacity class TKL	Weight (Kg/piece)
200	249 - 259	240	1
250	312 - 324	240	1
300	371- 381	240	1
400	484 - 500	200	1
500	600 - 618	200	2
600	713 - 737	160	3

8.3 Drilling rings

Drilling rings			
Diameter DN (mm)	**Description** (mm)	**Tolerance of the hole** (mm)	**Weight** (Kg/piece)
150	Sealing element for DN150 spigot	200 +1	1
200	Sealing element for DN200 spigot	257 +1	1

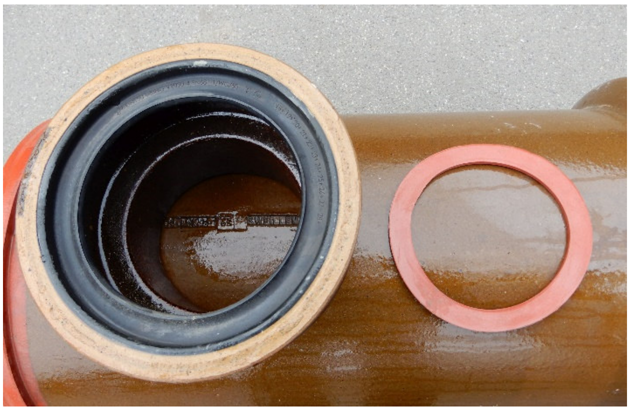
Practice note:
Drill holes should always be placed at least 50cm from the pipe ends. The minimum distance between two drill holes should not be less than 50cm.
A maximum of 2 holes can be drilled per pipe (2.0m).

Caution: Please coordinate with the operator which tapping sleeves are preferred. In some cases, products have been specified.

8.4 Transition rings

Transition rings		
Diameter DN (mm)	Description (mm)	Weight (Kg/piece)
150	Transition spigot end plastic pipes to socket vitrified clay pipe	1

8.5 Socket base ring in Diameter 150 und 200



In vertically installed pipe joints, for example in drop structures, ceramic meets ceramic in the socket joints. This results in point loads which can lead to fracture of the ceramic. The socket base ring inserted into the sockets ensures the required socket gap of at least 5mm and thus contributes to the longevity of the pipes and fittings.

When possible, a vertical connection of a house connection to the main sewer should not be made above the apex of the main sewer. Also the inlet should be at a 45° angle to the apex of the main sewer and routed to the vertical next to the main sewer. Here, a concrete seal should be placed under the inlet spigot to prevent later shear forces and thus breakage of the inlet spigot.

8.6 Glaze color from Euro Sweillem

Extract DIN EN 295 - 1 Section 5.1.4 Properties

Visual defects such as glaze flaws, unevenness, pinch pleats at the transition from the pipe to the socket and minor surface defects are permissible. However, the tightness, durability and hydraulic performance of the pipes and fittings must not be diminished.

Glaze defects, which technically do not devaluate the pipes and fittings, can however become noticable during the camera evaluation and lead to discussions.
Euro Sweillem GmbH offers a cold glaze for the optical repair of these defects. This cold glaze is largely adapted to the original glaze color and enables a permanent optical improvement of glaze defects.

8.7 Lubricant

Euro Sweillem GmbH recommends "stoneware blue" as a lubricant. This lubricant is characterized by a high proportion of graphite, which ensures very good sliding properties.

8.8 Stoneware split tiles

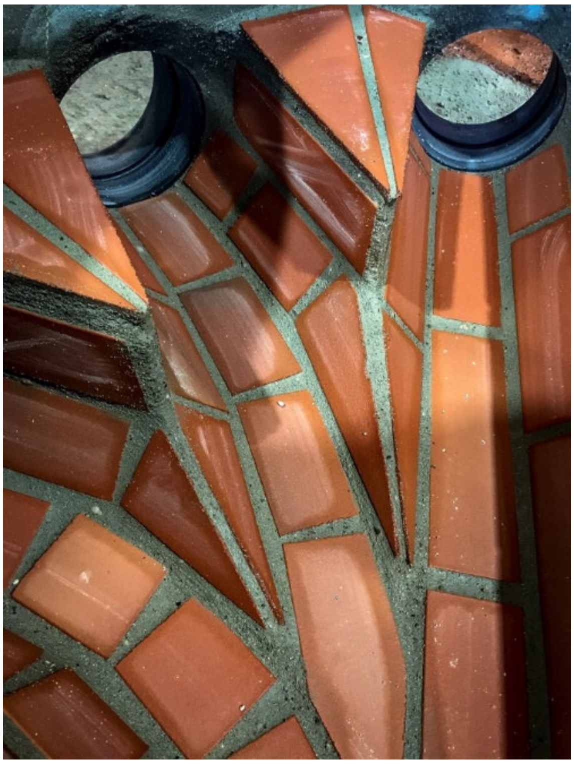
Stoneware split tiles unglazed					
Dimensions (mm)	**Material density** (g/cm³)	**Blast resistance** (N/mm²)	**Water absorption** (%)	**E - module** (N/mm²	**Mohs hardness** (Scale 1 bis 10)
240 x 115 x 15	2,3	25	3 bis 6	50.000	7

Description:

The split tiles are used for lining of structures in the field of sewage. Lining with these panels protects these structures against corrosion. The tiles are unglazed for greater slip resistance. The back of the panels has a special profile which ensures a tight fit in the mortar.
For processing, we recommend channel and manhole construction mortar.

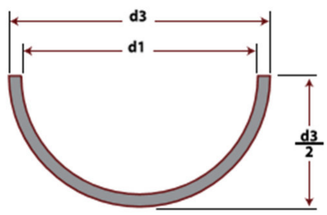
Examples of applications for split tiles:

Application in shaft construction as berm and channel:



8.9 Half shells

Half shells		
Diameter (mm)	Length & Tolerance (cm)	Weight (Kg/Piece)
150	100 - 1	10
200	100 - 1	14
250	100 - 1	19
300	100 - 1	23
400	100 - 1	48
500	100 - 1	80
600	100 - 1	98
700	100 - 1	145
800	100 - 1	176



Half shells are also available in 0.5m overall length on request.

Practical tip for half shells:

The outer diameter, as with the tubes, also has larger tolerances.
If half shells are to be laid as a channel one behind the other in a row, larger offsets may occur at the transitions between the half shells. For this reason, it is recommended to measure the D3 - dimensions of the ends and to sort and number the half shells.
The aim is to line up half shells with similar dimensions when possible.

9. Properties of ceramic materials according to DIN EN 295, the European standard for vitrified clay pipes.

9.1 Chemical resistance

Under normal conditions of use for domestic wastewater, vitrified clay pipes are resistant to chemical attack. (DIN EN 295-1 section 5.15)

9.2 Wall roughness

Vitrified clay pipes and fittings have a low wall roughness (typical values are between k=0.02 mm and k=0.05 mm). (DIN EN 295-1 Section 5.16)

9.3 Abrasion resistance

Under normal conditions of use, vitrified clay pipes are resistant to abrasion. Typical abrasion values are between 0.25 mm and 0.50 mm after 100,000 load cycles. (Test method according to DIN EN 295-3 section 15)

Vitrified clay pipes and fittings have a scratch resistance value according to

Mohs of 7. (DIN EN 295-1 section 5.17)

9.4 Water tightness

The water tightness test is carried out in accordance with DIN EN 295-3 section 12 at a water pressure of 0.5 bar over a test time of 15 minutes.

9.5 Resistance to flushing with high pressure

Resistance to high pressure water jets should be tested at 12 MPa (120 bar) using a movable nozzle and/or at 280 bar using a fixed nozzle. (DIN EN 295-4 section 17)

9.6 Deviation of the tubes from the straight line

The deviation from the straight line of a pipe shaft must not exceed the following values:

Diameter DN	ZP WN 295 mm/Meter pipelength
150	4,5
200 bis 250	4
300	4
350 bis 800	3

DIN EN 295-1 section 5.5

Practice note:
Especially in the nominal diameters DN150 to DN300, the deviation from the straight line is sometimes visually conspicuous.

The correct method of this measurement is described below:

- The measurement is always made on the outside of the pipe, since measurements on the inside of the pipe cannot provide useful results.
- The test length must be 150mm shorter than the full length of the pipe.
- Rotate the measuring bar around the pipe to finf the lacation with the largest gap.
- Example: For pipes DN200 to DN300 the deviation of the straight line may be 4mm/m pipe. A measuring distance of 1.85m results in a maximum permissible gap between the measuring bar and the tube shaft of 7.4mm. (4mm/m x 1.85m = 7.4mm)
- If this value is exceeded, the pipe is outside the allowed standard.
- When in doubt, contact the manufacturer via the trade partner.

9.7 Angleability of the pipe connections

Angleability of the pipe connections		
Diameter DN	**Max. angulation according to DIN EN 295** mm/m Pipe length	**Max. angulation according to ZP WN 295 (DIN Certco)** mm/m Pipe length
150 bis 200	80	100
250 bis 450	30	50
500 bis 800	20	30

DIN EN 295-1 section 6.2.2

Example:
A DN200 pipe with 2.0m construction length can be moved 20cm out of alignment according to ZP WN 295 without the pipe connection leaking.

9.8 Shear load resistance of the pipe connections

The shear load resistance requirements are defined according to DIN EN 295-1 Section 6.2.3 as 25N/mm nominal size.

Shear load resistance of the pipe connections		
Diameter DN	**Pipe joint normal load KN**	**Pipe joint high load KN**
150	3,75	
200	5,00	10,00
250	6,25	12,50
300	7,50	15,00
350	8,75	
400	10,00	20,00
450		22,50
500	12,50	25,00
600	15,00	30,00
700		17,50
800		20,00

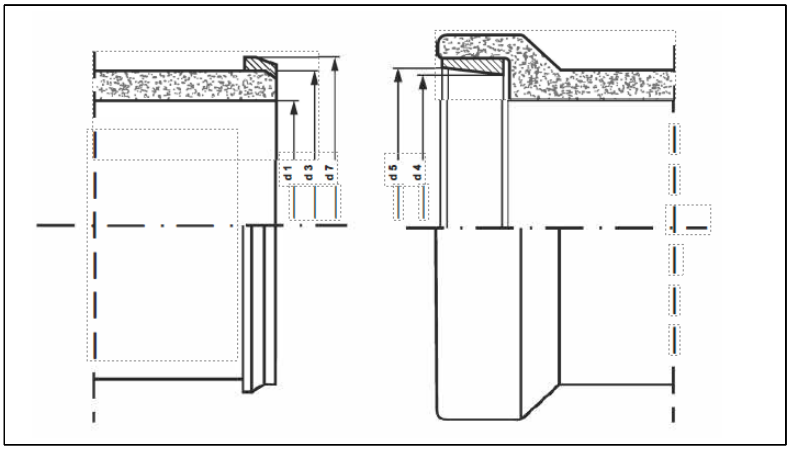
The pipe joints are considered to be root resistant if the tightness is given with simultaneous loading by the above mentioned shear forces.

9.9 Equality of the bottom of the pipe joints

Quote from DIN EN 295-1 section 6.3: When tested in accordance with DIN EN 295-3 (2012) Section 22, the shoulders in the flow bottom of adjacent pipes and fittings must not exceed the following values:

- 4mm for nominal diameters up to and including DN400
- 1% of the nominal size for nominal sizes larger than DN400

Permissible bottom jumps	
Diameter DN	**ZP WN 295 mm**
150	4
200	4
250	4
300	4
350	4
400	4
450	4,5
500	5
600	6
700	7
800	8



Where required for invert uniformity, pipes shall be marked with a crest mark.

9.10 Thermal shock resistance

DIN EN 295-1 section 6.6: Connections should withstand thermal cycling between (-10 ±2) °C and (70 ±2) °C without visible damage.

9.11 Fire behavior

DIN EN 295-1 section 7.1: Vitrified clay pipes, fittings and their joints are classified as class A1 and do not require testing for their fire behavior.

9.12 Durability

DIN EN 295-1 sectiont 7.2: Vitrified clay pipes, fittings and joints for sewers and drains have consistent proven durability.