UDC 621.643.2.06-036.742.23 : 628.2 : 620.1 DEUTSCHE NORM January 1988

High-density polyethylene (HDPE) pipes and fittings for drains and sewers
Technical delivery conditions

DIN 19 537 Part 2

Rohre und Formstücke aus Polyethylen hoher Dichte (PE-HD) für Abwasserkanäle und -leitungen; technische Lieferbedingungen

Supersedes October 1983 edition.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Dimensions in mm

Contents

1 Field of application

This standard applies to extruded high-density polyethylene (HDPE) pipes and fittings for drains and sewers as specified in DIN 19 537 Part 1, which are generally operated as buried free-flow conduits.

2 Material

Pipes and fittings shall be made from high-density polyethylene (HDPE) as specified in DIN 8075.

Only materials of known composition shall be used for the manufacture. Reclaimed material shall not be processed, the use of rework made from the same mix being, however, permitted.

3 Requirements

3.1 Design and surface condition

Pipes and fittings (i.e. fittings which are not hand finished) shall be seamless, the ends of the pipes shall be square with the pipe axis and be free from burr. Pipes shall be straight and shall have a circular cross section.[1] Fittings shall not exhibit any cavitation damage. Pipes and fittings shall be free of blisters, cavities and inhomogeneities.

[1] The specifications of *DVS-Merkblatt* (DVS Instruction sheet) 2207 Part 2 shall be observed in respect of the fabrication of welded joints.

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3.2 Strength

3.2.1 Creep rupture strength

When tested in accordance with subclause 4.2.1, pipes shall not fail as a result of fracture during the specified period.

3.2.2 Creep modulus[2] [3]

3.2.2.1 Method A

When testing in accordance with subclause 4.2.2.1, the creep modulus shall reach the following values:

1 minute creep modulus	$E_{bc(1\,min)} \geq 800\,N/mm^2$
24 hour creep modulus	$E_{bc(24\,h)} \geq 380\,N/mm^2$
2000 hour creep modulus	$E_{bc(2000\,h)} \geq 250\,N/mm^2$

3.2.2.2 Method B

When testing in accordance with subclause 4.2.2.2, the creep modulus shall reach the following values:

1 minute creep modulus	$E_{bc(1\,min)} \geq 800\,N/mm^2$
24 hour creep modulus	$E_{bc(24\,h)} \geq 380\,N/mm^2$
2000 hour creep modulus	$E_{bc(2000\,h)} \geq 250\,N/mm^2$

3.3 Heat reversion

3.3.1 Pipes

When tested in accordance with subclause 4.3.1, pipes shall not exhibit any change in length exceeding 3%.

3.3.2 Fittings

When tested in accordance with subclause 4.3.2, injection-moulded fittings shall not show any blisters or cracks, minor delaminations near the gate marks, with a depth not exceeding 20% of the wall thickness being permitted.

3.4 Watertightness of pipes, fittings and pipe joints

3.4.1 Tightness under internal hydrostatic pressure

3.4.1.1 Pipes and fittings

Pipes and fittings, when tested in accordance with subclause 4.4.1.1, shall be tight.

3.4.1.2 Deflected pipe joints

When tested in accordance with subclause 4.4.1.2, the pipe joint shall remain tight under an internal hydrostatic pressure of 0 to 0,5 bar, combined with a simultaneous angular deflection.

3.4.1.3 Distorted pipe joints

When tested in accordance with subclause 4.4.1.3, the pipe joint shall remain tight under an internal hydrostatic pressure of 0 to 0,5 bar, combined with a simultaneous distortion.

3.4.1.4 Deflected and distorted pipe joints

When tested in accordance with subclause 4.4.1.4, the pipe joint shall remain tight.

3.4.2 Tightness under external hydrostatic pressure

When tested in accordance with subclause 4.4.2, the pipe joint shall remain tight, i.e. no water shall enter the pipe.

3.5 Resistance to root penetration

Pipe joints for buried drains and sewers shall exhibit resistance to root penetration when tested in accordance with subclause 4.5.

3.6 Melt flow index (melt flow rate)

When testing in accordance with subclause 4.6, the melt flow index MFI 190/5 for the pipe or fitting shall be between 0,3 g/10 min and 0,8 g/10 min. It shall not differ from the melt flow index of the unprocessed granules by more than 0,2 g/10 min.

3.7 Surface finish

Pipes and fittings shall exhibit a smooth external and internal surface commensurate with the manufacturing process, when checked in accordance with subclause 4.7. Minor flat longitudinal grooves and fluctuations in wall thickness are permitted, provided that they do not exceed the tolerances specified in table 1 of DIN 19 537 Part 1, October 1983 edition. In no case are sharp-edged grooves and cavitation defects permitted.

3.8 Colour

Pipes and fittings shall be uniformly imbued throughout with black dye.

3.9 Dimensions

The pipe and fitting dimensions shall be as specified in DIN 19 537 Part 1.

3.10 Weldability

Pipes and fittings shall be weldable (see subclause 4.10 for testing).

4 Testing

Testing shall be carried out on pipes and fittings.

Unless otherwise specified, testing shall be carried out not earlier than 15 hours after completion of manufacture.

4.1 Design and surface condition

The design and surface condition as specified in subclause 3.1 shall be checked by visual examination.

4.2 Strength

4.2.1 Creep rupture strength

Testing shall be carried out on pipes in accordance with DIN 8075, under the following conditions:

a) test temperature: 80 C;

b) minimum duration of test: 170 hours;

c) proof stress: $4\,N/mm^2$.

4.2.2 Determination of creep modulus

4.2.2.1 Method A

Testing shall be carried out on pipe sections, the length of which shall be equal to twice the pipe internal diameter, but shall not exceed 1 m, i.e. $l = 2\,d, l_{max} = 1$ m. The test temperature shall be (23 ± 2) C. A linear force shall be applied

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[2] The creep modulus is a function of temperature and time. For the verification of creep, the pipe wall temperature relevant for the application concerned and the duration of stressing shall be taken into consideration, the pipe wall temperature being influenced, amongst other things, by the temperature of the sewage, c.f. subclause 5.1.4 of DIN 1986 Part 1, September 1978 edition, and table 1 of DIN 19 543, August 1982 edition.

[3] The creep modulus $E_{bc(50\,a)}$ (extrapolated value for a failure time of 50 years) may be obtained from *ATV-Arbeitsblatt* (ATV Instruction sheet) A 127.

normal and in line with the pipe axis over the entire length of the pipe section. The support to be used (two steel angles) is illustrated in figure 1; the length of the steel angles shall be equal to the length of the pipe section, their spacing, e, not exceeding $0{,}05\,d$.

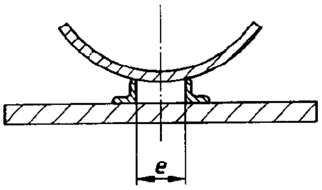

Figure 1.

Before application of the force, the internal diameter and the wall thickness of the pipe section shall be measured at a distance of $0{,}2\,d$, but not exceeding 50 mm, from each end of the pipe section, and in the middle of the pipe section (i.e. three measuring points in all). The measuring points shall be marked before the measurements are made. The mean values, $\bar{d}$ and $\bar{s}$, from three measurement each shall be reported.

Then, the pipe section shall be subjected within 10 seconds to a steadily increasing smooth load up to the test force, F, so as to produce an initial deformation, $\overline{\Delta d_v}/d$, of 3 %.

The change in diameter, Δd_v, for the 1 minute creep modulus, $E_{bc\,(1\,min)}$, shall be determined 60 seconds after the application of the test force, whilst the change in diameter, Δd_v, for the 2000 hour creep modulus, $E_{bc\,(2000\,h)}$, shall be determined 2000 hours after application of the test force. The mean change in diameter, $\overline{\Delta d_v}$, shall be determined as the mean value from three measurements. The creep modulus $E_{bc\,(t)}$ shall be calculated using the following formula:

$$E_{bc\,(t)} = \frac{12\,\xi \cdot F}{\overline{\Delta d_v} \cdot l} \cdot \left(\frac{\bar{d} + \bar{s}}{2\,\bar{s}}\right)^3 \qquad (1)$$

where

$E_{bc\,(t)}$ is the creep modulus, in N/mm²;

ξ is the coefficient of deformation (see table 1);

F is the test force, in N;

$\bar{d}$ is the mean internal diameter, in mm;

$\bar{s}$ is the mean wall thickness, in mm;

$\overline{\Delta d_v}$ is the mean change in diameter, in mm;

l is the length of pipe section, in mm.

Table 1. **Coefficient of deformation, ξ**

Deformation, $\overline{\Delta d_v}/d$, in %	ξ
0	0,1488
1	0,1508
2	0,1528
3	0,1548
4	0,1568
5	0,1588
6	0,1608
7	0,1628
8	0,1648
9	0,1668
10	0,1688
11	0,1708
12	0,1728
13	0,1748
14	0,1768
15	0,1788

Intermediate values may be obtained by linear interpolation.

4.2.2.2 Method B

Method B is only designed for pipe, the wall thickness of which permits test bars as shown in figure 2 to be taken.

Testing shall be carried out on test bars taken in the longitudinal direction of the pipe axis as close as possible to the outer surface of the pipe wall. The test bars (see figure 2), the opposite surfaces of which shall be machined plane parallel to each another, shall have the following dimensions:

length l = 120 mm;

width b = 10 mm;

height h = 10 mm.

The width, b, and height, h, of the test bar shall be measured at various points and the mean value determined to the nearest 0,01 mm. In the test, that part of the test bar corresponding to the pipe outer surface shall be loaded.

The creep modulus shall be determined by four-point loading as specified in DIN 54852 (see clause 4 and figure 2 of DIN 53457).

Within 10 seconds a flexural stress of 2 N/mm² shall be applied and after one minute, the deflection determined.

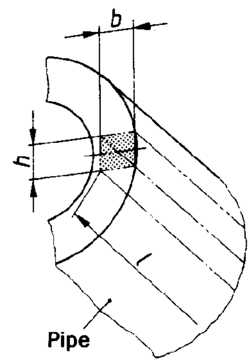

Figure 2.

$E_{bc\,(1\,min)}$ shall then be calculated using the following formula:

$$E_{bc\,(1\,min)} = \frac{1}{f_{(1\,min)}} \cdot \frac{M_b}{b}\,C \qquad (2)$$

where

$E_{bc\,(1\,min)}$ is the 1 minute creep modulus, in N/mm²;

$f_{(1\,min)}$ is the deflection of the test bar, in mm (to the nearest 0,01 mm);

M_b is the bending moment, in N mm;

b is the test bar width, in mm;

C is a factor dependent on the test bar height, h, in 1/mm (see equation 5).

The bending moment, M_b, shall be calculated as follows:

$$M_b = \sigma_b \cdot W \qquad (3)$$

$$\text{with } W = \frac{h^2 \cdot b}{6} \qquad (4)$$

where

M_b is the bending moment, in N mm;

σ_b is the flexural stress, in N/mm² (here, $\sigma_b = 2$ N/mm²);

W is the section modulus, in mm³;

h is the test bar height, in mm;

b is the test bar width, in mm (here, b = 10 mm).

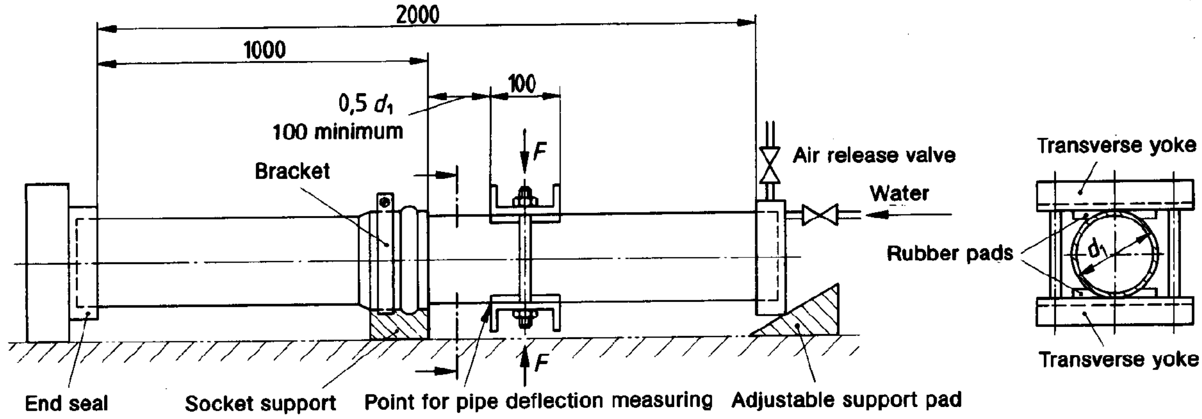

Figure 3.

Factor C is to be calculated from the following formula on the basis of the theory of elasticity and expressed in 1/mm:

$$C = \frac{3}{2 \cdot h} \cdot \left(\frac{l'^2}{h^2} \cdot \mu \right) \quad (5)$$

where

h is the test bar height, in mm;

l' is the gauge length of the deflection measuring device, in mm (here, $l' = 60$ mm);

μ is the transverse shrinkage coefficient ($\mu = 0{,}4$ for plastics).

After the measurement of $f_{(1\,\text{min})}$ and the calculation of $E_{\text{bc}(1\,\text{min})}$ at a constant flexural stress of 2 N/mm^2 the deflection $f_{(t)}$ for a period of 24 hours and of 2000 hours shall be determined.

The 24 hour and 2000 hour creep moduli shall be calculated using the following formula:

$$E_{\text{bc}(t)} = E_{\text{bc}(1\,\text{min})} \frac{f_{(1\,\text{min})}}{f_{(t)}} \quad (6)$$

$E_{\text{bc}(t)}$ in N/mm^2

4.3 Heat reversion

4.3.1 Pipes

Testing shall be carried out in accordance with DIN 8075.

4.3.2 Fittings

Fittings shall be placed horizontally on a support in an oven with forced air circulation complying with DIN 50011 Part 12 at (120 ± 3) °C, so as not to obstruct deformation.

The conditioning period shall be

a) 60 minutes for wall thicknesses not exceeding 8 mm;

b) 120 minutes for wall thicknesses between 8 and 16 mm;

c) 240 minutes for wall thicknesses exceeding 16 mm.

After cooling down to ambient temperature (18 to 28 °C), the fittings shall be checked for any blisters, cracks or delaminations.

4.4 Watertightness of pipes, fittings and joint assemblies

4.4.1 Internal hydrostatic pressure test

The watertightness tests described below shall be carried out on joint assemblies including joints with an elastomeric sealing ring or socket fusion joints. In the test, the joint assembly shall be deemed to be watertight if no water (not even in the form of single drops) escapes from the assembly, when tested in accordance with subclauses 4.4.1.1 to 4.4.1.4, or conversely, if no water enters the pipe when testing in accordance with subclause 4.4.3.

All tests shall be carried out at ambient temperature.

4.4.1.1 Testing of pipes and fittings

Watertightness shall be tested applying internal hydrostatic pressure at ambient temperature. For this purpose, a joint assembly of three pieces including two joints shall be prepared. A test pressure of 0,5 bar shall be applied for not less than 15 minutes.

If no water (not even in the form of single drops) escapes, the pipes, fittings and joint assembly shall be deemed to be watertight.

4.4.1.2 Deflected pipe joint assemblies

An assembly of two pipes including one pipe joint shall be arranged in accordance with figure 3, but without using the transverse yoke. The axial force resulting from the internal pressure shall be absorbed so (e.g. by a chain or a tie rod) as to ensure free movement of the inserted pipe. The total angular deflection is composed of the free angular deflection inherent to the design (figure 4, position 2) and of the forced deflection, β (figure 4, position 3), which shall be 2° for d_1 up to 160 mm and 1° for d_1 exceeding 160 mm.

The assembly shall be filled with water (unpressurized) and deflected as shown in figure 4, position 3. After six minutes an internal hydrostatic pressure of 0,5 bar shall be produced for a period of not less than one minute, this pressure being maintained for a further 15 minutes.

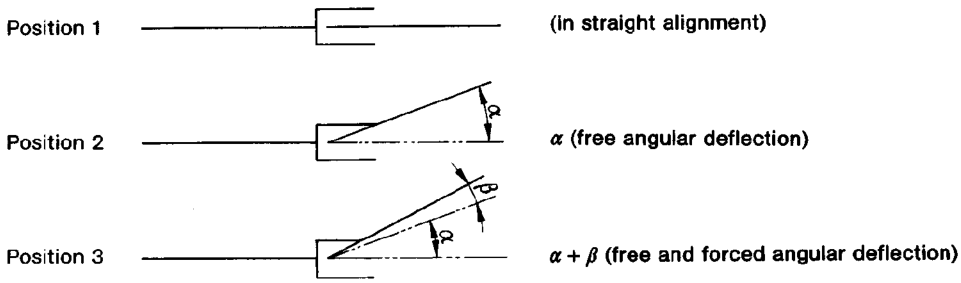

Figure 4.

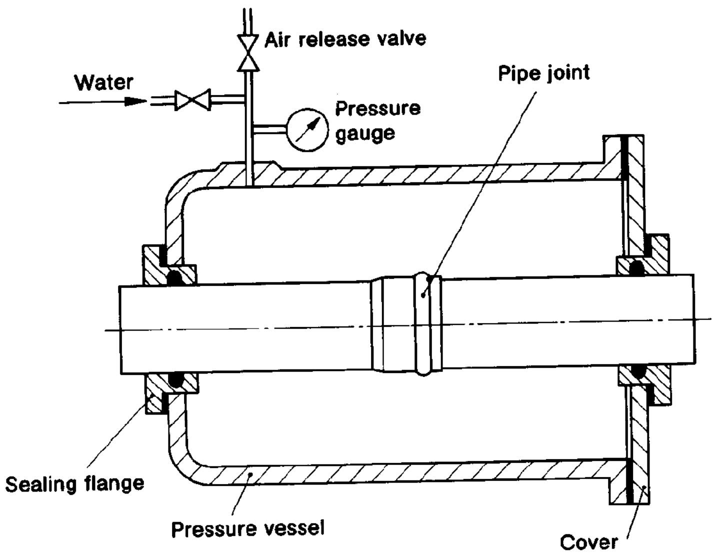

Figure 5.

It shall be checked whether any water (even in the form of single drops) escapes from the assembly in the region of the joint.

4.4.1.3 Distorted pipe joint assemblies

After pressure release, the assembly tested in accordance with subclause 4.4.1.2 shall be returned to the straight alignment position in accordance with figure 4, position 1. The distortion shall be effected by means of two transverse yokes as shown in figure 3, and in the case of spigot and socket joints, the distorting force shall be applied to the pipe inserted in the socket. By uniformly tightening both yokes, a distortion (reduction of pipe outside diameter) equal to 5 % of the original pipe diameter shall be produced at the measuring point illustrated in figure 3. Then, an internal hydrostatic pressure of 0,5 bar shall be produced for a period of not less than one minute, this pressure being maintained for a further 15 minutes.

It shall be checked whether any water (even in the form of single drops) escapes from the assembly in the region of the joint.

4.4.1.4 Deflected and distorted pipe joints

The assembly tested in accordance with subclause 4.4.1.3 shall, after pressure release, but with the distortion maintained be set to the position described in subclause 4.4.1.2. Then, an internal hydrostatic pressure of 0,5 bar shall be produced for a period of not less than one minute, this pressure being maintained for a further 15 minutes.

It shall be checked whether any water (even in the form of single drops) escapes from the assembly in the region of the joint.

4.4.2 External hydrostatic pressure test

This test shall only be carried out on joint assemblies of a type where, owing to the design of the sealing element, the behaviour under external pressure is likely to be different from that under internal pressure (e.g. where pipe joints with lip seal are used).

An assembly of two pipes including one joint shall be arranged in a pressure vessel in accordance with figure 5 so that the interior of the pipes can be monitored. The pressure vessel shall then be filled with water and a hydrostatic pressure of 0,5 bar produced for a period of not less than one minute, this pressure being maintained for a further 15 minutes.

It shall be checked whether any water has entered the assembly. If necessary, the test apparatus shall be tilted so as to enable any water which may have accumulated in the assembly to run out freely.

4.5 Resistance to root penetration

Proof of watertightness under stressing in accordance with subclause 4.4.1.3 shall be taken as proof of resistance to root penetration.

4.6 Melt flow index (melt flow rate)

Testing shall be carried out in accordance with DIN 53 735 at 190 °C using a test force of (50 ± 0,2) N.

4.7 Surface finish

The outer and inner surfaces of every pipe and fitting shall be examined visually with the aid of a suitable light source (backlighting).

4.8 Colour

Surfaces and end faces are to be checked to see whether the material has been thoroughly imbued with the dye.

4.9 Dimensions

The mean pipe external diameter shall be determined by circumferential measurement, whilst all the remaining dimensions shall be measured with the aid of appropriate measuring instruments with limits of error not exceeding ± 0,05 mm when measuring the wall thickness and ± 0,1 mm for all other measurements.

The following dimensions shall be checked:

a) external diameter, d_1 (only in the zone of the spigot end in the case of fittings);
b) wall thicknesses s_1, s_2 and s_3 (also in the zone of the socket and of the groove);
c) socket internal diameter, d_2, at $u/2$;
d) groove internal diameter, d_3, for type A;
e) length of socket behind the groove, u;
f) internal diameter and ring cord diameter of sealing ring, d_4 and d_5, for type A sockets (inspection in accordance with DIN 4060 Part 1, March 1979 edition)[4]);
g) lengths (overall lengths, etc. (except for z dimensions));
h) angle α.

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[4]) Testing shall be carried out on the basis of an inspection contract for sealing rings.

4.10 Weldability

The test weld to be made shall be a butt welded joint made with the aid of a heated tool as specified in *DVS-Merkblatt* 2207 Part 2. The weldability shall be tested using the bend test as described in *DVS-Merkblatt* 2203 Part 5.

5 Inspection

This clause is based on DIN 18 200.

5.1 General

Compliance with the requirements specified in clause 3 shall be checked by inspection consisting of internal control and third-party inspection.

5.2 Internal control

5.2.1 Scope and frequency

The manufacturer shall control the properties of pipes and fittings in each of his works in accordance with table 2 below.

5.2.2 Defects

If the requirements specified in table 2 are not met, the manufacturer shall immediately take the necessary measures to remedy the defects; the customers shall be informed where this is necessary to avoid possible consequent damage.

After the defects have been remedied, the tests concerned shall be repeated where necessary. Products not complying with the requirements shall be rejected.

5.2.3 Results of internal control

The results of internal control shall be recorded and statistically evaluated as far as possible. The records shall be kept on file for at least five years and, on request, submitted to the inspection agency (see subclause 5.3).

5.3 Third-party inspection

5.3.1 Scope and frequency

5.3.1.1 Third-party inspection shall be undertaken at least twice a year by a competent inspection agency (quality assurance association)[5] or by a testing agency[5] accredited for this purpose, on the basis of an inspection contract. See table 3 for the inspections and tests to be undertaken. Compliance with personnel and equipment requirements shall also be verified.

The inspections and tests shall be carried out on three pipes and on three samples each of two different types of fitting (e.g. three bends and three single junctions) of one nominal size selected at will, or on specimens taken therefrom, unless otherwise specified in clause 3.

5.3.1.2 Prior to starting on third-party inspection, the inspection agency shall undertake a comprehensive initial inspection in accordance with clause 3 in order to establish whether the pipes and fittings meet the requirements. The agency shall also satisfy itself that the personnel and equipment allow the manufacture to be carried out in due form at all times, including correct internal control.

DN 500 pipes shall be the subject of initial inspection in respect of inspection group 1 (see table 4), or pipes of the largest nominal size manufactured. As regards inspection group 2, initial inspection shall be undertaken for pipes of the largest nominal size manufactured.

Third-party inspection as described in subclause 5.3.1.1 shall commence after successful conclusion of the initial inspection.

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5) Lists of quality assurance associations and of testing agencies accredited by the building inspectorate are kept under the imprint of the inspection mark by the *Institut für Bautechnik* (Institute of Building Technology), and published in the institute's proceedings (obtainable from *Wilhelm Ernst & Sohn*, Hohenzollerndamm 170, D-1000 Berlin 31).

Table 2. **Scope and frequency of internal control**

Item No.	Object to be inspected	Property	Frequency of control	Requirement as specified in subclause	Testing as specified in subclause
1	Pipes and fittings	Melt flow index	At each change of nominal size and change of raw material	3.6	4.6
2		Design and surface condition	At regular intervals	3.1	4.1
3		Surface finish	At regular intervals	3.7	4.7
4		Colour	At regular intervals	3.8	4.8
5		Dimensions	At regular intervals	3.9	4.9
6		Weldability	When changing material-related or production-related parameters	3.10	4.10
7	Pipes	Creep moduli $E_{bc(1\ min)}$ and $E_{bc(24\ h)}$	Once a month, and when changing material-related or production-related parameters	3.2.2.1 or 3.2.2.2	4.2.2.1 4.2.2.2
8	Pipes	Heat reversion	Once a week from each extrusion and injection moulding plant, from each nominal size manufactured, also when changing material-related or production-related parameters	3.3.1	4.3.1
9	Fittings			3.3.2	4.3.2

Table 3. **Scope and frequency of third-party inspection**

Item No.	Object to be inspected	Property	Frequency of control	Requirement as specified in subclause	Testing as specified in subclause
1	Pipes and fittings	Dimensions	Twice yearly, one nominal size per inspection group	3.9	4.9
2		Design and surface condition		3.1	4.1
3	Pipes	Creep modulus		3.2.2.1 or 3.2.2.2	4.2.2.1 4.2.2.2
4	Pipes	Heat reversion		3.3.1	4.3.1
5	Fittings			3.3.2	4.3.2
6	Pipes and fittings	Surface finish		3.7	4.7
7		Colour		3.8	4.8
8		Verification of internal control		5.2	–

5.3.1.3 If third-party inspection reveals any short-comings in the test results, a repeat inspection shall be carried out without delay, in respect of which the same number of specimens shall be taken, and these shall satisfy all the requirements in accordance with table 3. Defects that have been noted in the course of internal control, and which have been remedied immediately shall not be cause for complaint.

Table 4. **Inspection groups**

Inspection group	Nominal size (DN)
1	100 to 500
2	from 600

5.3.2 Sampling

Samples shall be drawn by the inspector or by the person appointed by the inspection agency, from as large a stock as possible, or from the manufactured items released for despatch; they shall be representative of the products manufactured. Undamaged samples may also be taken from a dealer's stock or from a building site in special cases. Products designated as defective by the manufacturer shall only be excepted from sampling if they have been clearly marked as such and stored separately (see subclause 5.2.2). These samples shall immediately be marked in a manner which precludes any confusion.

The person taking the samples shall draw up a record of the samples taken, sign it and have it countersigned by the works manager or by his deputy. This record shall provide at least the following information:

a) manufacturer and works;
b) place of sampling, if applicable;
c) designation of product (e.g. standard designation);
d) marking of samples;
e) place and date of sampling;
f) signatures.

5.3.3 Inspection report

The results of third-party inspection shall be recorded in an inspection report which may also consist of a test certificate and of a report on the visit. The inspection report shall provide the following information, with reference to this standard:

a) manufacturer and works;
b) designation of product (e.g. standard designation);
c) scope, results and assessment of internal control;
d) details of sampling procedure, if applicable;
e) results of the tests carried out during third-party inspection, and comparison with the requirements;
f) overall assessment;
g) place and date of inspection;
h) signature and stamp (seal) of inspection agency.

The inspection report shall be kept on file for five years at least at the manufacturer's premises and also at the inspection agency's offices.

Proof of third-party inspection shall also be deemed to have been provided if the manufacturer holds the licence to use the quality mark issued by an accredited quality assurance association[5]).

5.4 Other tests

The performance of tests that go beyond the specifications given in this standard shall be agreed in writing between manufacturer and customer.

6 Marking

Pipes and fittings shall be clearly and permanently marked with the following:

a) DIN 19537;
b) pipe series;
c) nominal size;
d) outside diameter;
e) wall thickness;
f) manufacturer's trade mark;
g) year of manufacture.

This marking shall be applied to pipes at intervals not exceeding 1 m. Bends and branches shall additionally be marked with their angle.

In applying this marking, the manufacturer is making a binding declaration that the pipes and fittings comply with this standard.

7 Installation instructions

The manufacturer shall, on request, provide binding and detailed instructions for installation, in accordance with DIN 19550 and DIN 4033.

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5) See page 6.

Standards and other documents referred to

DIN 1986 Part 1	Site drainage systems; construction
DIN 4033	Drains and sewers; code of practice for construction
DIN 4060 Part 1	Elastomeric sealing rings for pipe joints in drains and sewers; circular and similar effective cross sections; design, requirements and testing
DIN 8075	High-density polyethylene (HDPE) pipes; general quality requirements and testing
DIN 18200	Inspection of construction materials, structural members and types of construction; general principles
DIN 19537 Part 1	High-density polyethylene (HDPE) pipes and fittings for drains and sewers; dimensions
DIN 19543	General requirements for joints in drains and sewers
DIN 19550	General requirements for pipes and fittings for buried drains and sewers
DIN 50011 Part 12	Technical climatology; controlled-atmosphere installations; climatic parameter: air temperature
DIN 53452	Testing of plastics; bend test
DIN 53457	Testing of plastics; determination of the elastic modulus by tensile, compression and bend testing
DIN 53735	Testing of plastics; determination of melt flow index of thermoplastics
DIN 54852	Testing of plastics; determination of flexural creep by three-point and four-point loading
DVS-Merkblatt 2203 Part 5	*Prüfen von Schweißverbindungen aus thermoplastischen Kunststoffen; Technologischer Biegeversuch* (Testing of welded joints on thermoplastics products; bend test)
DVS-Merkblatt 2207 Part 2	*Schweißen von thermoplastischen Kunststoffen, PE-HD (Polyethylen hoher Dichte); Heizelementstumpfschweißen; Rohre und Rohrleitungsteile für Abwasserkanäle und -leitungen* (Welding of thermoplastics; HDPE; hot-plate butt welding; pipes and fittings for drains and sewers)
ATV A 127	*Richtlinie für die statische Berechnung von Entwässerungskanälen und -leitungen* (Code of practice for static design of drains and sewers[6])

Other relevant standards and documents

DIN 1986 Part 2	Site drainage systems; determination of the internal diameters and nominal sizes of pipelines
DIN 1986 Part 3	Site drainage systems; operation and maintenance
DIN 1986 Part 4	Site drainage systems; fields of application of sewer pipes and fittings made from different materials
DIN 8074	High-density polyethylene (HDPE) pipes; dimensions
Supplement 1 to DIN 8075	High-density polyethylene (HDPE) pipes; resistance to chemicals of pipes and fittings
DIN 16928	Thermoplastics pipes; pipe joints, fittings; installation; general rules

Previous editions

DIN 19537 Part 2: 07.79; 10.83.

Amendments

The following amendments have been made to the October 1983 edition.

a) The dimensions of the test bar used when testing the creep modulus are now those specified in DIN 54852.

b) The flexural creep test has been specified instead of the tensile creep test.

Explanatory notes

The following assumptions may be made regarding flexural stress when designing drains and sewers.

Buried pipes are subject to flexural stress due to the soil load. The resulting strain tends to decrease gradually in the case of HDPE pipes because of the viscoelastic behaviour of thermoplastics. In the stress analysis the following should thus be verified:

a) short-term flexural stress; according to DIN 53452, an average value of 30 N/mm^2 may be used for HDPE specimens;

b) long-term flexural stress; to date no method of test is available by which long-term flexural stressing can be simulated.

In the case of buried plastics pipes, a stress analysis may normally be dispensed with, as the stresses due to normal loading lie well below the critical value. Where a stress analysis is, however, undertaken in order to estimate the permissible long-term stresses, use can be made of the values to be obtained from creep curves originating in internal hydrostatic pressure tests. A rough estimate of the long-term flexural stress may be obtained by multiplying the short-term flexural stress of 30 N by a time factor derived from the above values (8,2 : 17 = 0,48), which gives a value of 14,4 N/mm^2.

International Patent Classification

E 03 F 3/04	G 01 M 3/00
F 16 L 9/12	G 01 N 33/44

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[6]) Obtainable from *Abwassertechnische Vereinigung e.V.*, Markt 71, D-5202 St. Augustin 1.