# DIN EN 1401 â€“ 1 / Plastics Piping Systems for non-Pressure Underground Drainage and Sewerage â€“Unplasticized Poly(vinyl chloride) (PVC-U) â€“Part 1: Specifications for Pipes, Fittings and the System / Testing Equipment

## Description



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4.2 Pipe material
When tested in accordance with the test method as specified in Table 1, using the indicated parameters, the pipe material shall have characteristics conforming to the requirements given in Table 1.
The pipe material shall be tested in the form of a pipe.

**Table 1 — Material characteristics of pipes**

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| Resistance to internal pressure | No failure during the test period | End caps | Type A or B conforming to EN ISO 1167-1:2006 | EN ISO 1167-1:2006 |
| | | Test temperature | 60 °C | |
| | | Orientation | Free | |
| | | Number of test pieces | 3 | |
| | | Circumferential (hoop) stress | 10 MPa | |
| | | Conditioning period | 1 h | |
| | | Type of test | Water-in-water | |
| | | Test period | 1 000 h | |

4.3 Fitting material

When tested in accordance with the test method as specified in Table 2, using the indicated parameters, the fitting material shall have characteristics conforming to the requirements given in Table 2.

The fitting material shall be tested, in the actual formulation, in the form of an extruded or injection-moulded pipe. Fabricated fittings or parts of fabricated fittings shall be made from pipes conforming to this European Standard, except for the requirements for the wall thickness, and/or mouldings from

PVC-U which conform to material, mechanical and physical characteristics as required in this European Standard.

**Table 2 — Material characteristics of fittings**

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| Resistance to internal pressure | No failure during the test period | End caps | Type A or B conforming to EN ISO 1167-1:2006 | EN ISO 1167-1:2006 |
| | | Dimensions | 50 mm ≤ $d_n$ ≤ 110 mm<br>3 mm ≤ $e$ ≤ 5 mm | |
| | | Free length for injection-moulded pipe | ≥ 140 mm | |
| | | Test temperature | 60 °C | |
| | | Orientation | Free | |
| | | Number of test pieces | 3 | |
| | | Circumferential (hoop) stress | 6,3 MPa | |
| | | Conditioning period | 1 h | |
| | | Type of test | Water-in-water | |
| | | Test period | 1 000 h | |

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7 Mechanical characteristics

7.1 Mechanical characteristics of pipes

7.1.1 General requirements

When tested in accordance with the test method as specified in Table 9 using the indicated parameters, the pipe shall have general mechanical characteristics conforming to the requirements given in Table 9.

**Table 9 — General mechanical characteristics of pipes**

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| Impact resistance [a] (round-the-clock method) | TIR ≤ 10 % | Test/conditioning temperature | 0 °C | EN 744:1995 |
| | | Conditioning medium | Water or air | |
| | | Type of striker | $d$90 conforming to EN 744:1995 | |
| | | Mass of striker for: | | |
| | | $d_n$ = 110 mm | 1,0 kg | |
| | | $d_n$ = 125 mm | 1,25 kg | |
| | | $d_n$ = 160 mm | 1,6 kg | |
| | | $d_n$ = 200 mm | 2,0 kg | |
| | | $d_n$ = 250 mm | 2,5 kg | |
| | | $d_n$ ≥ 315 mm | 3,2 kg | |
| | | Fall height of striker for: | | |
| | | $d_n$ = 110 mm | 1 600 mm | |
| | | $d_n$ ≥ 125 mm | 2 000 mm | |

[a] If the manufacturer chooses to use indirect testing (see prCEN/TS 1401-2:2007 [1]), the preferred temperature is (23 ± 2) °C.

7.2 Mechanical characteristics of fittings

When tested in accordance with the test methods as specified in Table 11 using the indicated parameters, the fitting shall have mechanical characteristics conforming to the requirements given in Table 11.



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**Table 11 — Mechanical characteristics of fittings**

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| Mechanical strength or flexibility [a] | No sign of splitting, cracking, separation, and/or leakage | Test period<br>Minimum moment for<br>[DN] ≤ 250<br>[DN] > 250<br>or<br>Minimum displacement | 15 min<br><br>$0{,}15[DN]^3 \times 10^{-6}$ kNm<br>0,01[DN] kNm<br><br>170 mm | EN 12256 |
| Impact strength (drop test) | No damage | Test/conditioning temperature<br>Fall height for<br>$d_n$ = 110 mm<br>$d_n$ = 125 mm<br>$d_n$ = 160 mm<br>$d_n$ = 200 mm<br>Point of impact | 0 °C<br><br><br>1 000 mm<br>1 000 mm<br>500 mm<br>500 mm<br>Mouth of the socket | EN 12061 |
| [a] Only for fabricated fittings made from more than one piece. A sealing ring retaining means is not considered as a piece. | | | | |

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8 Physical characteristics

8.1 Physical characteristics of pipes

When tested in accordance with the test methods as specified in Table 12 using the indicated parameters, the pipe shall have physical characteristics conforming to the requirements given in Table 12.

**Table 12 — Physical characteristics of pipes**

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| Vicat softening temperature (VST) | ≥ 79 °C | Shall conform to EN 727 | | EN 727 |
| Longitudinal reversion | ≤ 5 %<br>The pipe shall exhibit no bubbles or cracks | Test temperature<br>Immersion time for:<br>$e \leq 8$ mm<br>$e > 8$ mm | 150 °C<br><br>15 min<br>30 min | EN ISO 2505: Liquid bath |
| | | **or** | | |
| | | Test temperature<br>Immersion time for:<br>$e \leq 4$ mm<br>4 mm < $e \leq 16$ mm<br>$e > 16$ mm | 150 °C<br><br>30 min<br>60 min<br>120 min | EN ISO 2505: Air oven |
| Resistance to dichloromethane at a specified temperature | No attack [a] | Test temperature<br>Immersion time | 15 °C<br>30 min | EN 580 |
| [a] Isolated spots less than 2 mm shall not be considered an attack. | | | | |
| NOTE if a more detailed investigation on the gelation level is wanted, ISO 18373-1 and ISO 18373-2 [4] can be used. | | | | |

8.2 Physical characteristics of fittings

When tested in accordance with the test methods as specified in Table 13 and Table 14 if applicable



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using the indicated parameters, the fitting shall have physical characteristics conforming to the requirements given in Table 13 and/or Table 14, as applicable.

**Table 13 — Physical characteristics of fittings**

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| Vicat softening temperature (VST) | ≥ 77 °C [a] | Shall conform to EN 727 | | EN 727 |
| Effects of heating | [b] and [c] | Test temperature<br>Heating time for:<br>$e \leq 10$ mm<br>$e > 10$ mm | 150 °C<br><br>30 min<br>60 min | EN ISO 580:<br>Air oven |

[a] VST ≥ 79 °C for application area code "D" and for $d_n$ less than or equal to 200 mm.

[b] 1) within a radius of 15 times the wall thickness around the injection point(s), the depth of cracks, delamination or blisters shall not exceed 50 % of the wall thickness at that point;
2) within a distance of 10 times the wall thickness from the diaphragm zone, the depth of cracks, delamination or blisters shall not exceed 50 % of the wall thickness at that point;
3) within a distance of 10 times the wall thickness from the ring gate, the length of cracks shall not exceed 50 % of the wall thickness at that point;
4) the weld line shall not have opened more than 50 % of the wall thickness at the line;
5) in all other parts of the surface the depth of cracks and delaminations shall not exceed 30 % of the wall thickness at that point. Blisters shall not exceed a length 10 times the wall thickness.

[c] After cutting through the fitting, the cut surfaces shall show no foreign particles, when viewed without magnification.

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**Table 14 — Physical characteristics of fabricated fittings**

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| Watertightness [a] | No leakage | Water pressure<br>Duration | 0,5 bar<br>1 min | EN 1053 |

[a] Only for fabricated fittings made from more than one piece. A sealing ring retaining means is not considered as a piece.

9 Performance requirements

When tested in accordance with the test methods as specified in Table 15 using the indicated parameters, the joints and the system shall have fitness for purpose characteristics conforming to the requirements given in Table 15.



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**Table 15 — Performance requirements**

| Characteristic | Requirements | Test parameters | | Test method |
|---|---|---|---|---|
| Tightness of elastomeric sealing ring joints | | Test temperature<br>Spigot deflection<br>Socket deflection | (23 ± 5) °C<br>10 %<br>5 % | EN 1277, Condition B |
| | No leakage | Water pressure | 0,05 bar | |
| | No leakage | Water pressure | 0,5 bar | |
| | ≤ –0,27 bar | Air pressure | –0,3 bar | |
| | | Test temperature<br>Angular deflection for:<br>$d_n \leq 315$ mm<br>315 mm < $d_n \leq 630$ mm<br>$d_n > 630$ mm | (23 ± 5) °C<br><br>2°<br>1,5°<br>1° | EN 1277, Condition C |
| | No leakage | Water pressure | 0,05 bar | |
| | No leakage | Water pressure | 0,5 bar | |
| | ≤ –0,27 bar | Air pressure | –0,3 bar | |
| Elevated temperature cycling [a] | No leakage | Shall conform to EN 1055 | | EN 1055 using test assembly b) (Figure 2) |

[a] Test required only for components intended to be used for application area code "D" and for $d_n$ less than or equal to 200 mm.

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## Summary of Testing Equipment

- Dimensional measurement equipment for pipes and fittings
- Mechanical Flexibility EN 12256
- Vicat Softening Point EN 727
- Resistance to Dichloromethane EN 580
- Falling Weight Impact Tester EN 744 / EN 12061
- Longitudinal Reversion (Hot Air Oven) EN ISO 2505
- Water Tightness Tester EN 1053
- Thermal Cycling tester EN 1055
- Hydrostatic Pressure Tester EN ISO 1167-1
- Hot Water Bath for Hydrostatic Pressure Tester EN 921
- SS304 End Caps
- Combinational Test for Seals EN 1277




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1. Equipment for Standards
2. Standards