ISO 16422 – Pipes and Joints Made of Oriented Unplasticized Poly(vinylchloride) (PVC-O) for the Conveyance of Water Under Pressure – Testing Equipment

Description

9 General requirements for pipes
9.1 Appearance
When viewed without magnification, the internal and external surfaces of the pipe shall be smooth, clean and free from scoring, cavities and other surface defects which would prevent conformity with this International Standard. The material shall not contain visible impurities. The ends of the pipe shall be cut cleanly and square to the axis of the pipe.
9.2 Opacity
If a pipe is required to be opaque for use in above ground applications, the wall of the pipe shall not transmit more than 0,2 % of visible light falling on it when tested in accordance with ISO 7686.

11 Mechanical characteristics of pipes
11.1 Resistance to hydrostatic pressure
11.1.1 Pipes
Resistance to hydrostatic pressure shall be verified using the induced stresses derived from the analysis of
the test data in accordance with ISO 9080. For a period of 10 h at 20 °C and at the time of 1 000 h at 20 °C, the 99,5 % LPL value shall be taken as the minimum stress level.
For a period of 1 000 h at 60 °C, the 99,5 % LPL value established from analysis of test data at 60 °C in accordance with ISO 9080 can be taken as the minimum stress level. In case of a lack of data, alternatively, a value of 0,625 times the MRS value shall be taken as the minimum stress level.
When tested using either end cap type A or type B in accordance with ISO 1167-1, and using the combinations of test temperatures and induced stresses so derived, the pipe shall not fail in less than the times stated above.
See Annex A for the procedure to establish 20 °C test stress values for testing under provisional qualification.

11.1.2 Pipes with integral socket
When tested in accordance with ISO 1167, using the test procedure as given in 11.1.1, integral sealing ring sockets formed on pipes shall not fail in less than the time according to 11.1.1. The length of the pipe section shall meet the requirements or specification given in 11.1.1. Failure shall not occur in either pipe or socket sections. Data obtained is valid for pipe specified in 11.1.1.
11.1.3 Pressure testing Pressure testing shall be conducted in accordance with ISO 1167-1 with the following provisions.
a) End fittings: testing may be conducted using either end cap type A or type B, including for reference purposes. However, the same type of end caps shall be used for both acceptance and quality tests.

b) Number of specimens: one specimen shall constitute a test. In the event of a test failure, three more specimens may be selected from the same batch and tested, and shall pass.

c) Conditioning times: testing may proceed directly following the conditioning times stated in ISO 1167-1.
d) Socket tests: when testing integral sockets or couplings in accordance with 11.1.2, the pipe spigot inserted into the socket may be of different material or heavier gauge than the specimen under test. The
sealing ring may be restrained from blow-out by adhesive or mechanical means, provided such means do
not materially reduce the stress on the pressurized portion of the socket.

11.2 Resistance to external blows at 0 °C

Pipes shall be tested at 0 °C in accordance with ISO 3127, and shall have a true impact rate (TIR) of not more than 10 % when using masses given in Table 3. The radius of the striker nose shall be R = 12,5 mm.

Table 3 — Classified striker mass and drop height conditions for the falling-weight impact test

Nominal size DN	Total mass kg
63	4
75	5
90	5
110	6,3
125	6,3
140	8
160	8
180	10
200	10
≥ 225	12,5

Drop height is 2 m.
NOTE 1 Masses are based on experience of pipe material classes 450 and 500. Masses for other pipe material classes are still under study.
NOTE 2 Impact characteristics can change over time. These values are applicable only at the time of manufacture.
11.3 Ring stiffness
The ring stiffness of pipes conforming to this International Standard may be determined in accordance with ISO 9969.
Pipes of stiffness less than 4 kN/m2 might not be suitable where high vacuum or external pressure could be developed, and could need special installation techniques where installed below ground.
National regulations and/or national practices on use of specific fittings may require minimum stiffness of
pipes.
NOTE Minimum stiffness of pipes could be required for installation with some type of fittings
The calculated nominal stiffness of the pipes is given in Annex D.

12 Physical characteristics

When tested in accordance with the test methods as specified in Table 4 using the indicated parameters, the pipe shall have physical characteristics conforming to the requirements given in Table 4.

Table 4 — Physical characteristics

Characteristic	Requirement	Test parameters	Test method
K value	>= 64	ISO 1628-2	ISO 1628-2
Vicat softening temperature	>= 80 °C	Shall conform to ISO 2507 Number of test pieces: 3	ISO 2507-1
Resistance to dichloro-methane at a specific temperature (degree of gelation) [a]	No attack at any part of the surface of the test piece	Temperature of bath : (15 +/- 1) °C Immersion time: 15 min. Min. wall thickness: 1,5 mm	ISO 9852
Alternative test method to resistance to dichloromethane Uniaxial tensile test	Minimum stress 48 MPa	In accordance with ISO 6259-2:	ISO 6259-2
Alternative test method to resistance to dichloromethane Differential Scanning Calorimetry (DSC)	B onset temperature ≥ 185 °C	Shall conform to ISO 18373-1 Number of test pieces: 4	ISO 18373-1

[a] To be carried out on feedstock pipe or on reverted pipe

13 Mechanical characteristics of assemblies, including joints

13.1 Assemblies with non-end-load-bearing joints

The following types of assemblies with non-end-load-bearing joints shall fulfil the fitness for purpose requirements given in 13.2 to 13.5 and Tables 5, 6 and 7, as applicable:

a) integrally socketed PVC-O pipe to pipe assemblies with elastomeric ring seal joints conforming to this
International Standard;
b) metal fitting and PVC-O pipe assemblies with elastomeric ring seal joints;
c) metal valve and PVC-O pipe assemblies with elastomeric ring seal joints;
d) mechanical joint assemblies with PVC-O pipes.

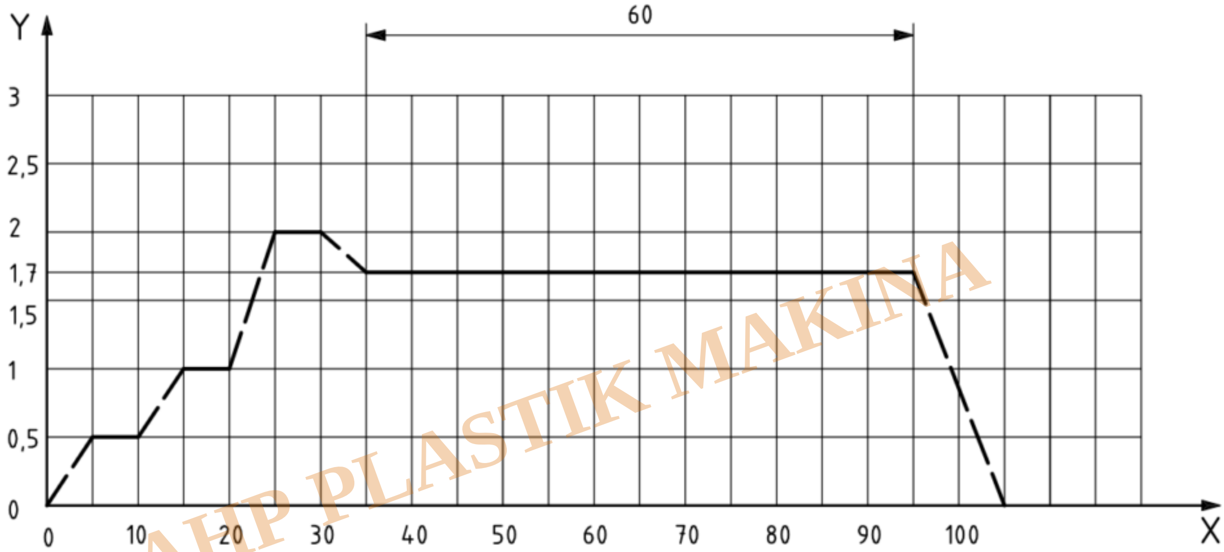
13.2 Short-term pressure test for leak tightness of assemblies

13.2.1 Test procedure

When an assembly with one or more elastomeric sealing ring type joints is tested using a hydrostatic pressure and angular deflection in accordance with ISO 13845, and the test conditions given in Table 5, the assembly shall conform to the requirement given in Table 5.

Table 5 — Test conditions and requirement for short-term assembly test

Test temperature °C	Test pressure bar	Test time	Test requirement
$T \pm 2$ where T is any temperature between 17 °C and 23 °C	Pressure calculated in accordance with Figure 2 and 13.2.2	One cycle in accordance with Figure 2	No leakage at any point of the jointing areas throughout the whole test cycle
NOTE The pressure changes from one pressure level to the next shall take place within the periods indicated, but need not take place at strictly linear rates.			



Key

X time, min

Y factor f

Figure 2 — Hydrostatic pressure test regime

13.2.2 Test pressure

The test pressures pT shall be calculated by multiplying the factor f indicated in Figure 2 by the nominal
pressure PN, i.e. by using the following equation:

$$p_T = f \times PN$$

where

PN is the nominal pressure

f is the multiplying factor

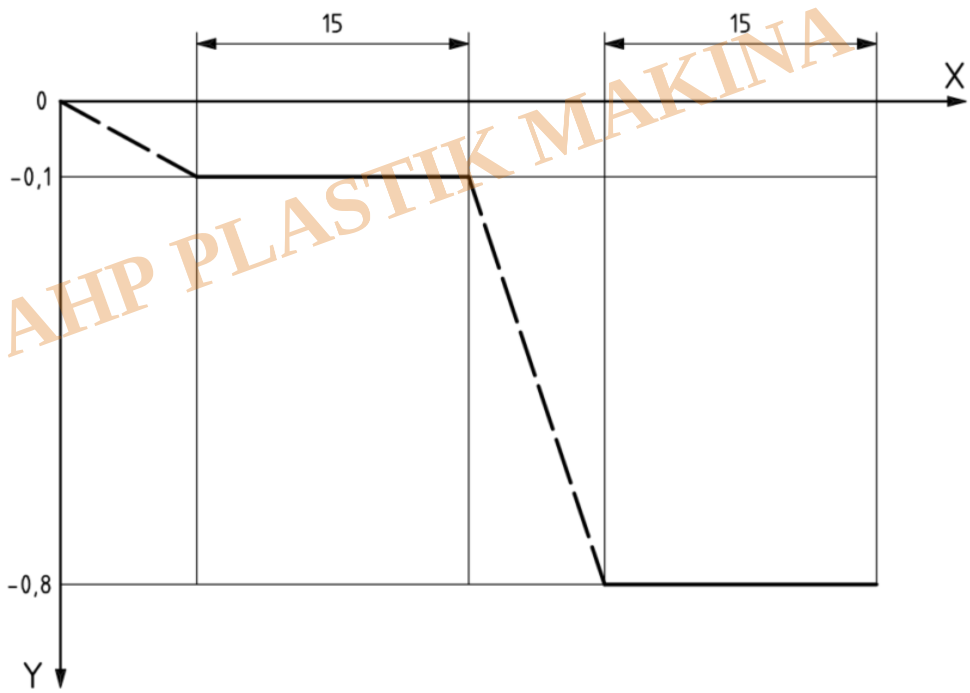
pT is the test pressure

13.3 Short-term negative pressure test for leak tightness of assemblies

When an assembly with one or more elastomeric sealing ring type joints is tested using a negative pressure with angular deflection and the deformation in accordance with ISO 13844 and the test conditions given in Table 6, the assembly shall conform to the requirement given in Table 6.

Table 6 — Test conditions and requirement for short-term negative-pressure assembly test

Test temperature °C	Test pressure bar	Test time	Test requirement
$T \pm 2$ where T is any temperature between 17 °C and 23 °C	Pressure calculated in accordance with Figure 3	One cycle in accordance with Figure 3	The change in negative pressure shall be not more than 0,005 MPa during each 15 min test period shown in Figure 3
Note 1 The pressure changes from one pressure level to the next need not take place at strictly linear rates.			
Note 2 For pipes with integral sockets there is no need for testing with angular deflection.			
Note 3 For pipes SN less than 4 kN/m^2 it is allowed to support the pipe to avoid collapsing during testing.			



Key

X time, min

Y pressure, bar

Figure 3 — Negative-pressure test regime

13.4 Long-term pressure test for leak tightness

When an assembly with one or more joints selected from elastomeric sealing ring type sockets and other
end-load-bearing and non-end-load-bearing joints for oriented PVC-U components for a piping system

is
tested in accordance with ISO 13846, using the test conditions given in Table 7 for the test temperatures of 20 °C and 40 °C, the assembly shall conform to the requirement given in Table 7.

Table 7 — Test requirement for the long-term pressure testing of assembled joints

Test temperature °C	Test pressure [a] bar	Test time (h)	Test requirement
20	1,4 PN	1 000	No leakage at any point of the jointing areas for at least the test time
40	1,1 PN	1 000	

[a] The PN rating used in this calculation is the PN rating of the fitting or, if pipe with an integral joint is being tested, the PN rating of the pipe. See Annex E for an explanation of the values.

13.5 End-load-bearing joints

Pressure and bending test for leak tightness and strength When end-load-bearing joints having one or more sockets (see note) and fitted with one or more elastomeric sealing rings together with one or more locking rings to withstand the longitudinal forces resulting from the application of internal hydraulic pressure are tested in accordance with ISO 13783 at a single ambient temperature of (T ± 2)°C (where T is any temperature between 17 °C and 23 °C), the joint shall remain leak tight throughout the whole of the test period.
NOTE Such joints are usually, but not necessarily, in the form of double sockets.

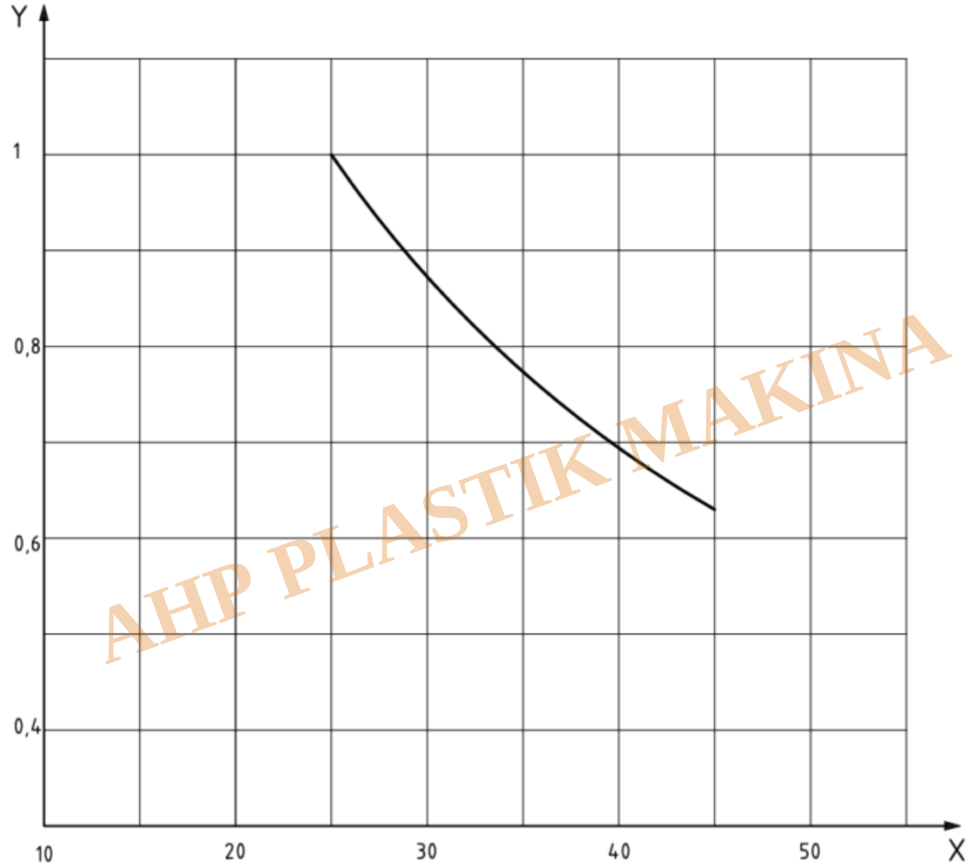
14 Elastomeric seals

Elastomeric seals used for joining components shall conform to both of the following requirements:
a) the rings shall conform to the material requirements specified in ISO 4633;
b) the rings shall be free from chemical agents (e.g. plasticizers) that could have a detrimental effect on the pipes or fittings, or on the quality of the water.

Annex C
(normative)

Temperature derating factor

Temperature derating information given in Figure C.1 may be used as a guide unless real figures from manufacturers are available.



Key

X temperature, °C

Y derating factor, f_T

Figure C.1 — Derating factor f_T as a function of operating temperature

Annex D
(informative)
Ring stiffness of pipes
D.1 Calculation of initial ring stiffness
For design purposes, the calculated initial ring stiffness of the pipes can be derived from Table D.1.

Table D.1 — Initial ring stiffness of pipes

Pipe material class	Theoretical minimum stiffness kN/m²				
	PN				
	10	12,5	16	20	25
315	4,6	8,9	18,7	36,5	71,2
355	3,9	7,6	16,0	31,3	61,1
400	2,7	5,2	10,9	21,3	41,7
450	1,9	3,7	7,8	15,2	29,7
500	1,3	2,5	5,2	10,2	19,9

This value has been calculated from the formula

$$S_{\text{calc}} = \frac{E \times I}{(d_{\text{n}} - e_{\text{n}})^3} = \frac{E}{96\ (\text{S})^3} \qquad (14)$$

where

S_{calc} is the calculated initial ring stiffness in kN/m²;

E is Young's modulus:

— for pipe class 315, $E = 3{,}5 \times 10^6$ kN/m²;

— for pipe class 355 and higher, $E = 4 \times 10^6$ kN/m²;

I is the moment of inertia = 1/12 e_{n}^3, in cubic millimetres per metre (mm³/m).

NOTE The stiffness values are calculated on the basis of minimum wall thickness at any point $e_{\text{y,min}} = e_{\text{n}}$ (see 3.2). Since the stiffness is a function of the mean wall thickness, it is statistically not possible for these values to be realized in practice, and the real stiffness will be significantly greater. For a tolerance of 15 % of wall (grade T), the mean could reasonably be expected to be around 5 % over minimum, and the stiffness correspondingly 16 % higher than the above results.

D.2 Negative pressure capability of pipes

Pipes may be subject to unstable buckling under negative pressure conditions due to vacuum and/or external or groundwater pressure, if unsupported by soil or other lateral stiffening devices.

Table D.2 — Negative pressure capabilities of pipes

Pipe material class	P_{cr} kPa				
	PN				
	10	12,5	16	20	25
315	137	268	562	1 097	2 143
355	118	230	482	942	1 840
400	80	157	329	642	1 254
450	57	112	234	457	893
500	38	75	157	306	598

These values have been calculated from the formula

$$P_{cr} = \frac{24\, S_{calc}}{(1-\upsilon^2)} \qquad (15)$$

where

P_{cr} is the unsupported critical buckling pressure, in kilopascals (kPa);

υ is Poisson's ratio, which can be assumed to have a value of 0,45.

NOTE The critical buckling pressure can likewise be expected to be around 16 % higher than these values in practice. No other design coefficient is incorporated.

When pipes are buried with cover exceeding two diameters, lateral soil support will increase buckling pressures significantly. Users should refer to appropriate engineering texts for advisory material.

Annex E
(informative)
Determination of the long-term test pressure by creep consideration
The calculation for the test pressures for the long-term leak tightness test of PVC-O assemblies is based on the method as specified in ISO 1452-5:2009, Annex B.
For details of the calculation of the factors, see ISO 1452-5:2009, Annex B, for ?s = 12,5 MPa.
It is considered that for PVC-O pipes these factors are the worst case. Where a manufacturer has made available stress/strain data, the actual factors may be derived from this information in accordance with the
method given in ISO 1452-5: 2009, Annex B.

Annex F
(informative)
Determination of axial and tangential orientation factor
F.1 Principle
A piece of pipe is measured under identical conditions before and after heating in the oven at a specified

temperature for a specified duration.
The reversion is calculated as the percentage variation in length, diameter and wall thickness in relation to the initial values. The test pieces are examined on any changes in appearance e.g. bubbles and cracks.

F.2 Method

The axial and tangential orientation factor shall be determined conforming to ISO 2505.

F.3 Test parameters

Specimen length : 300 mm
Distance between the marks : 200 mm
Test temperature : 150 ± 2°C
Medium : air
Immersion time : 60 or 120 minutes
Number of test pieces : 3

F.4 Test procedure

The test is carried out according to ISO 2505.
The coefficient of axial orientation ?a is calculated as:

$$\lambda_a = \frac{L_o}{L_i} \qquad (16)$$

where:

L_o is the measured length before conditioning

L_i is the measured length after conditioning

The coefficient of radial orientation λ_r is calculated as:

$$\lambda_r = \frac{(D_{em} - e_{em})}{(D_i - e_i)} \qquad (17)$$

where:

D_{em} is the measured outside diameter before conditioning

D_i is the measured outside diameter after conditioning

e_{em} is the mean wall thickness before conditioning

e_i is the mean wall thickness after conditioning

Haze Meter (Opacity Tester)

ISO 7686 – Plastics Pipes and Fittings – Determination of Opacity – Testing

Equipment

Hydrostatic Pressure Test Unit

Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part1: General method

Hot Water Bath for Chemical Resistance Testing

Falling Weight Impact Tester

ISO 3127 Thermoplastics Pipes – Determination of Resistance to External Blows – Round-the-Clock Method

Ring Stiffness Tester According to ISO 9969

ISO 9969 Thermoplastics Pipes — Determination of Ring Stiffness / Testing Equipment

Differential Scanning Calorimeter (DSC, OIT)

ISO 18373 -1 Rigid PVC pipes — Differential Scanning Calorimetry (DSC) Method —Part 1:Measurement of the Processing Temperature – Testing Equipment

HDT Vicat Tester / Computerized Model 3 Station

ISO 306 Vicat Test Method

End Caps (Clamp Set for Creep-Life Testing Of Polymer Pipes)

Hot Air Oven

ISO 9852 – Unplasticized Poly(vinyl chloride) (PVC-U) Pipes — Dichloromethane Resistance at Specified Temperature (DCMT) – Testing EquipmentDichloromethane ResistanceISO 9852 – Unplasticized Poly(vinyl chloride) (PVC-U) Pipes — Dichloromethane Resistance at Specified Temperature (DCMT) – Testing Equipment

ISO 13845 – Elastomeric-Sealing-Ring-Type Socket Joints for use with Unplasticized Poly(vinylchloride) (PVC-U) Pipes — Test Method for Leaktightness Under Internal Pressure and with Angular Deflection – Testing Equipment

ISO 13844 – Elastomeric-Sealing-Ring-Type Socket Joints of Unplasticized Poly(vinyl chloride)(PVC-U) for Use with PVC-U pipes —Test Method for Leaktightness Undernegative Pressure – Testing Equipment

ISO 13846 – Plastics Piping Systems — End-Loadbearing and non-End-Load-Bearing Assemblies and Joints for Thermoplastics Pressure Piping — Test Method for Long-Term Leaktightness Under Internal Water Pressure – Testing Equipment

DIN EN ISO 13783 – Test Method for Leaktightness and Strength While Subjected to Bending and Internal Pressure – Testing Equipment

---

Hot Air Oven

ISO 2505 – Thermoplastics Pipes — Longitudinal Reversion — Test Method and Parameters – Testing Equipment

---

Check our YouTube channel for videos of the products, ask any questions on WhatsApp:

- YouTube
- WhatsApp

Category

1. Equipment for Standards
2. Standards