TECHNICAL SPECIFICATION

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Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure —

Part 3: Fittings

Tubes et assemblages en poly(chlorure de vinyle) non plastifié orienté (PVC-O) pour le transport de l'eau sous pression —

Partie 3: Raccords

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids,* Subcommittee SC 2, *Plastics pipes and fittings for water supplies*.

A list of all parts in the ISO 16422 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Molecular orientation of thermoplastics results in the improvement of physical and mechanical properties. Orientation is carried out at temperatures well above the glass transition temperature.

Orientation of PVC-U pipe-material can be induced by different processes.

In general, the following production process is common. A thick-wall tube is extruded (feedstock) and conditioned at the desired temperature. The orientation process is activated in circumferential and axial directions under controlled conditions.

After the orientation process, the pipe is cooled down quickly to ambient temperature.

The orientation of the molecules creates a laminar structure in the material of the pipe wall. This structure gives the ability to withstand brittle failure emanating from minor flaws in the material matrix or from scratches at the surface of the pipe wall.

Improved hoop strength allows reduced wall thickness with material and energy savings. Improved resistance to impact and fatigue also result.

The classification depends on the material compound/formulation and stretch ratios used. Therefore, with the classification, these characteristics can be specified or determined.

The ISO 16422 series, of which this document is Part 3, specifies the requirements for a piping system made from oriented unplasticized poly(vinyl chloride) (PVC-O) and its components. The piping system is intended to be used for water supply, pressurized drainage and sewerage and irrigation systems to be used underground or above ground where protected to direct sunlight.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the products covered by this document, the following points are relevant:

— this document provides no information as to whether or not the products can be used without restriction;

— requirements and test methods for PVC-O material and components, other than fittings, are specified in ISO 16422-1 and ISO 16422-2. For other components (not manufactured from PVC-O) reference is made to the following documents: ISO 1452-3 (PVC-U) and EN 12842 (Cast Iron). Characteristics for fitness for purpose (mainly for joints) are specified in ISO 16422-5.

The future documents ISO 16422-1, ISO 16422-2 and ISO 16422-5 are intended to cancel and replace ISO 16422:2014.

This document is a completely new part of the ISO 16422 series since PCV-O fittings were not included in ISO 16422:2014.

This document is specifically focussed on fittings, as opposed to more general specifications, which are now covered in the various other parts of the ISO 16422 series.

Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure —

Part 3: Fittings

1 Scope

This document specifies the characteristics of solid-wall oriented unplasticized poly(vinyl chloride) (PVC-O) fittings for piping systems intended to be used underground or above ground where protected from direct sunlight, for water supply, buried drainage, sewerage, treated wastewater and irrigation under pressure. This document is applicable to double sockets, repair couplings, reducers and to non-end load bearing elbows only. This document is not applicable to tees, flange adaptors, etc.

NOTE For double sockets, repair couplings, and reducers, there are no special fittings designs for end-load bearing applications. However, restrained gaskets can be used for end-load bearing applications. In this case, the requirements of ISO 16422-5 are applicable.

This document also specifies the test parameters for the test methods referred to in this document.

In conjunction with ISO 16422-1 and ISO 16422-5, this document is applicable to oriented PVC-O pipes with or without an integral socket, intended to be used for the following:

a) water mains and services lines;

b) conveyance of water for both outside and inside buildings;

c) drainage, sewerage and treated wastewater under pressure;

d) irrigation under pressure.

This document is applicable to piping systems intended for the supply of water under pressure up to and including 25 °C (cold water), intended for human consumption and for general purposes as well as for wastewater under pressure.

This document is also applicable to components for the conveyance of water and wastewater up to and including 45 °C. For temperatures between 25 °C and 45 °C, see ISO 16422-2, Figure C.1.

The piping system according to this document is intended for the conveyance of cold water up to pressure of 25 bar[1)] and especially in those applications where special performance requirements are needed, such as impact loads and pressure fluctuations, up to pressure of 25 bar.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 16422-1:—[2)], *Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure — Part 1: General*

1) 1 bar =0,1 MPa=10^5 Pa; 1 MPa= 1 N/mm^2.

2) Under preparation. Stage at the time of publication: ISO/DIS 16422-1:2023.

ISO 16422-2:—[3], *Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure — Part 2: Pipes*

ISO 16422-5:—[4], *Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure — Part 5: Fitness for purpose of the system*

ISO 161-1, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series*

ISO 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 1167-3, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 3: Preparation of components*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

ISO 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*

ISO 2507-1, *Thermoplastics pipes and fittings — Vicat softening temperature — Part 1: General test method*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 4633, *Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials*

ISO 6259-1, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

ISO 6259-2, *Thermoplastics pipes — Determination of tensile properties — Part 2: Pipes made of unplasticized poly(vinyl chloride) (PVC-U), oriented unplasticized poly(vinyl chloride) (PVC-O), chlorinated poly(vinyl chloride) (PVC-C) and high-impact poly(vinyl chloride) (PVC-HI)*

ISO 7686, *Plastics pipes and fittings — Determination of opacity*

ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*

ISO 9852, *Unplasticized poly(vinyl chloride) (PVC-U) pipes — Dichloromethane resistance at specified temperature (DCMT) — Test method*

ISO 18373-1, *Rigid PVC pipes — Differential scanning calorimetry (DSC) method — Part 1: Measurement of the processing temperature*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16422-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3) Under preparation. Stage at the time of publication: ISO/DIS 16422-2:2023.

4) Under preparation. Stage at the time of publication: ISO/DIS 16422-5:2023.

3.1
PVC-O fitting
fitting of oriented unplasticized poly(vinyl chloride) (PVC-O) made from stretching PVC-U preforms under certain conditions which improve its mechanical behaviour

Note 1 to entry: This means that fittings made from different components are excluded from the scope of this document.

3.2
laying length socketed outlet
***Z*-length**
distance from the inserted tube or spigot end to the intersection point of the fitting/valve axis (fitting or valve centre)

[SOURCE: ISO 1452-3:2009, 3.1.1]

3.3
laying length spigot outlet
***Z*-length**
distance from the outlet end to the intersection point of the fitting/valve axis (fitting or valve centre)

[SOURCE: ISO 1452-3:2009, 3.1.2]

3.4
laying length socket with parallel outlets
***Z*-length**
distance between the ends of the inserted tubes or spigots

[SOURCE: ISO 1452-3:2009, 3.1.3]

3.5
laying length one socket and one spigot with parallel outlets
***Z*-length**
distance from the inserted tube or spigot end to the end of the spigot outlet

[SOURCE: ISO 1452-3:2009, 3.1.4]

3.6
design length of bends
***Z*-length**
length of an outlet, excluding any socket length or insert length of spigot

[SOURCE: ISO 1452-3:2009, 3.1.5]

3.7
lower confidence limit of the predicted hydrostatic pressure
p_{LPL}
quantity with the dimension of pressure, which represents the 97,5 % (one sided) lower confidence

4 Symbols

C	overall service design coefficient
$D_{e,meas,1}$	measured outside diameter before testing
$D_{e,meas.2}$	measured outside diameter after testing
d_e	outside diameter (at any point)
d_{em}	mean outside diameter

d_i	inside diameter (at any point)
d_{im}	mean inside diameter of socket
d_n	nominal (outside or inside) diameter
e	wall thickness (at any point)
e_m	mean wall thickness
$e_{m,1}$	mean wall thickness before testing
$e_{m,2}$	mean wall thickness after testing
e_n	nominal wall thickness
f_A	derating (or uprating) factor for application
f_T	derating factor for temperatures
K	*K*-value
l_s	length of socket
$l_{s,max}$	maximum length of socket
$l_{1,min}$	minimum length of spigot
m_{min}	minimum depth of engagement
MRP	minimum required pressure capability of the fitting is the value of the p_{LPL} at 20 °C for 50 years rounded to the nearest 0,01 bar
PFA	allowable operating pressure
PN	nominal pressure
p	internal hydrostatic pressure
p_T	test pressure
r	bend radius
r_{min}	minimum bend radius
S_{calc}	calculated preferred value of the nominal S series number of the pipe from according to ISO 4065:2019, Table 2
Z_c	design length connecting part double socket
$Z_{c,min}$	minimum design length connecting part double socket
Z_d	design laying length
$Z_{,d,min}$	minimum design laying length
Z_r	design length reducing part
$Z_{r,min}$	minimum design length reducing part
α	bend angle

β minimum angle chamfer

λ_a axial orientation factor

λ_c circumferential orientation factor

ρ density

σ hydrostatic stress

σ_{LPL} lower predicted confidence limit

σ_s design stress

NOTE The *MRP* is related to the *PN* by means of the overall safety coefficient, *C*:

$$PN = \frac{MRP}{C}$$

5 Material

5.1 General

The material from which the pipes are made shall conform to ISO 16422-1 and to the requirements given in 5.2 and 5.3.

5.2 Density

The density, ρ, at 23 °C of the pipe, when measured in accordance with ISO 1183-1, shall be within the following limits:

$1\,350 < \rho < 1\,460$

where ρ is measured in kg/m^3.

5.3 Orientation factor

The circumferential orientation factor shall be declared by the manufacturer with a minimum value of 1,5.

The orientation factor shall be measured in accordance with Annex B and specified by the manufacturer to be within −5 % and +15 % deviation from the declared values.

6 General characteristics

6.1 Appearance

When viewed without magnification, the internal and external surfaces of pipes shall be smooth, clean and free from scoring, cavities and other surface defects to an extent that would prevent conformity to this document. The material shall not contain any impurities visible without magnification. The ends of the fitting shall be cut cleanly and square to the axis of the fitting ends.

6.2 Colour

The colour of the fittings shall be uniform throughout the wall.

The preferred colour of fittings shall be as follows:

a) for water supply, cream, blue, white or white with blue striping;

b) for irrigation under pressure, blue, white or white with blue stripping;

c) for pressurized drainage and sewerage, grey, brown or white with brown stripes;

d) for treated wastewater, purple.

NOTE Attention is drawn to the fact that the colouring of pipes for the supply of water for human consumption can be covered by national regulations.

6.3 Opacity

If a fitting is required to be opaque for use in above-ground applications, the wall of the fitting shall transmit not more than 0,2 % of visible light falling on it when tested in accordance with ISO 7686.

6.4 Classification of fittings

Fittings shall be classified to their nominal pressure, PN, and declared by the manufacturer.

The PN classification shall be established according to Annex A by means of the long-term pressure strength determination.

7 Geometrical characteristics

7.1 Design lengths, bend radii and angles

The relevant dimensions are shown in Figure C.1 (elbows), Figure C.2 (reducers) and Figure C.3 (double sockets) and shall be specified by the manufacturer in accordance with the requirements given in 7.2 to 7.4. Annex C gives recommended values. For other dimensions, the geometries of ISO 1452-3:2010, 6.7 are recommended.

7.2 Measurement of dimensions

Dimensions shall be measured in accordance with ISO 3126.

7.3 Nominal outside diameters and wall thickness

The nominal outside diameter of fittings with spigot end shall be in accordance with ISO 161-1.

The nominal (minimum) wall-thickness shall be calculated to fulfil the pressure requirements as defined in Table 1 and shall not be lower than the nominal (minimum) wall-thickness for SDR 41 as defined in ISO 16422-2:—, Table 2.

NOTE The SDR 41 requirement is introduced to safeguard an appropriate ring stiffness performance of the fitting.

7.4 Fittings with integral sockets with elastomeric sealing ring type

Fittings with integral sockets shall be in accordance with ISO 16422-2:—, 7.4.

For spigots, $l_{1,\min}$ shall be declared. For the sockets, $l_{s,\max}$ and $m_{\min}$ shall be declared.

8 Pressure and operating temperature

8.1 Selection of nominal pressure for water up to and including 25 °C

The PN rating of PVC-O fittings shall be equal to or higher than the PN of the pipes to be used in the pipeline.

8.2 Determination of the allowable operating pressure for water up to 45 °C

The allowable operating pressure, *PFA*, for temperatures up to and including 25 °C shall be equal to the nominal pressure, *PN*.

To determine the allowable operating pressure, *PFA*, for temperatures between 25 °C and 45 °C, a supplementary derating factor, f_T, shall be applied to the nominal pressure, *PN*, as given in Formula (1):

$$PFA = f_T \times PN \quad (1)$$

This factor is given in ISO 16422-2:—, Figure C.1.

NOTE Another derating factor, f_A, can be used, taking account of the application. Normally, f_A equals 1. For other values, see related installation documents, e.g. ISO/TR 4191.

9 Mechanical characteristics — Resistance to hydrostatic pressure

The mechanical strength of the fitting as a single component of a piping system shall be verified by the application of internal pressure tests.

When tested in accordance with ISO 1167-3, using end cap type B and the test parameters given in Table 1, the fitting or parts of the fitting shall conform to the requirements given in Table 1 for the declared PN.

Table 1 — Resistance of fittings to internal pressure

Characteristic	Requirement	Test parameters							Test method
		Temp °C	Pressure of the test [b] bar [c]				Time h	Type of test	No. of test pieces	
			PN 12,5	PN 16	PN 20	PN 25				
Short- and long-term strength	No failure during the test	20	26,2	33,1	41,6	52,3	10	Water in water	1 [a]	ISO 1167-1, ISO 1167-2 and ISO 1167-3
		20	23,4	29,5	37,0	46,6	1 000			

[a] The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan.

[b] The basis for the calculated pressures are as shown in the specified hoop stress in ISO 16422-1:—, Table 1, using e_n for C = 1,6.

[c] 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

10 Physical characteristics

When tested in accordance with the test methods as specified in Table 1 using the indicated parameters, the pipe shall have physical characteristics conforming to the requirements given in Table 2.

Table 2 — Physical characteristics

Characteristic	Requirements	Test parameters		Test method
Vicat softening temperature (VST) [a]	≥ 80 °C	Shall conform to ISO 2507-1		ISO 2507-1
Resistance to dichloro-methane at a specific temperature [b]	No attack [c]	Temperature of bath Immersion time	(15 ± 1) °C 15 min	ISO 9852
Uniaxial tensile strength [b]	≥ 48 MPa	Speed Temperature	(5 ± 1) mm/min (23 ± 2) °C	ISO 6259-1 and ISO 6259-2
Differential scanning calorimetry (DSC) [a,b]	B-onset temperature ≥ 185 °C [d]	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.

[b] One test method shall be chosen by the producer for factory production control, taking into consideration national regulations or internal health and safety policies. In case of dispute, the DSC method shall be used.

[c] Isolated spots less than 2 mm shall not be considered as an attack.

[d] For CaZn and organic-based stabilized formulations, the B-onset temperature shall be ≥ 180 °C.

11 Sealing rings

The material of the elastomeric sealing ring used in joint assemblies for fittings shall be chosen from ISO 4633 and shall conform to the appropriate class.

The sealing ring shall have no detrimental effect on the properties of the fitting and shall not cause the test assembly to fail the functional requirements of ISO 16422-5.

12 Performance requirements

When fittings conforming to this document are jointed to components conforming to other parts of the ISO 16422 series or to components of the ISO 1452 series, the fittings and the joints shall conform to the performance requirements as given in ISO 16422-5.

13 Marking

13.1 General

The marking elements shall be printed or formed directly on each fitting in such a way that after storage, weathering, handling and installation, legibility is maintained during the use of the products.

NOTE The manufacturer is not responsible for marking being illegible due to actions caused by installation and use such as painting, scratching, covering of the pipes or by use of detergents on the fitting.

Marking shall not initiate cracks or other types of defects which would impair conformity to the requirements of this document.

If printing is used, the colouring of the printed information shall differ from the basic colouring of the fitting.

The size of the marking shall be such that the marking is legible without magnification.

13.2 Minimum required marking

The minimum required marking on fittings shall conform to Table 3.

Table 3 — Minimum required marking on fittings

Aspects	Mark or symbol
Number of this document	ISO/TS 16422-3
Manufacturer's name and/or trademark	Xyz
Material	PVC-O
Design coefficient, C	C=1,6
Nominal outside diameter, d_n	e.g. DN 110
Nominal pressure, PN	e.g. PN 16
Manufacturer's information	e.g. mm yyyy
Intended use	e.g. W/P

[a] To provide traceability, the following details shall be given:

— the production period, the year and month, in figures or in code;

— a name or code for the production site, if the manufacturer is producing in different sites, nationally and/or internationally;

— identification of the extrusion line, if there is more than one.

[b] Optionally, for information on abbreviated terms, see CEN/TR 15438[1] and/or national rules.

13.3 Additional marking

Fittings conforming to this document and also conforming to other standard(s) may be marked additionally the number(s) of the other standard(s), together with the minimum required marking in accordance with the other standard(s).

Annex A
(normative)

Determination of long-term hydrostatic strength

A.1 General

This method measures the minimum strength pressure capability (MRP) of PVC-O fittings by means of the methodology established in ISO 9080 to obtain σ_{LPL}. The procedure described in Clause A.2, according to ISO 1167-1, using test pieces prepared in accordance with ISO 1167-2 and ISO 1167-3 shall be followed.

A.2 Test procedure

A.2.1 General

PVC-O fittings shall be designated by the nominal pressure (PN). The PN value for the classification shall be derived from the MRP and p_{LPL} at 20 °C for 50 years, in accordance with A.2.4.

The p_{LPL} is determined by analysis in accordance with ISO 9080 by means of hydrostatic pressure tests carried out in accordance with ISO 1167-1, ISO 1167-2 and ISO 1167-3, using end caps type B, tested with water-in-water and using the same procedures to obtain σ_{LPL} but taking the pressure tests values for the calculation instead of the stress values.

The PN classification shall be done on the fitting with the lowest orientation factor.

A.2.2 Classified feedstock material

If the feedstock material is classified as MRS 250 in accordance with ISO 9080, the following shall be followed.

The classification involves the determination of at least 10 failure points at 20 °C. The observations shall have the following failure time distribution:

— time from 100 h up to and including 5 000 h: the times of which 3 samples shall be between 3 000 h and 5 000 h.

NOTE The regression can be improved by adding more failure points to the data set of 10. Due to the nature of PVC-O, the regression will improve when longer term points are added.

Determination of the MRP and p_{LPL} value at 50 years and 20 °C shall be obtained by analysis in accordance with ISO 9080 and A.2.4.

A.2.3 Not-classified feedstock material

If the feedstock material is not classified as MRS 250 material; the spread of failure data shall conform to ISO 9080.

Determination of MRP and p_{LPL} value at 50 years and 20 °C shall be obtained by analysis in accordance with ISO 9080 and following A.2.4.

A.2.4 Classification according to MRP

Determination of MRP shall be made according to ISO 9080 considering the pressure test values in the analysis at 20 °C and 50 years (p_{LPL}, 20 °C, 50 y). Final classification of the fitting shall be according to Table A.1, considering the design coefficient and the final MRP obtained from the analysis.

Table A.1 — PN classification based on *MRP* and *C*

Range of lower confidence limits $p_{LPL, (20\,°C, 50\,year)}$ bar [a]	PN classification [b] bar [a]
$12{,}50 \leq \frac{MRP}{C}$	12,5
$16{,}00 \leq \frac{MRP}{C}$	16
$20{,}00 \leq \frac{MRP}{C}$	20
$25{,}00 \leq \frac{MRP}{C}$	25

[a] 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

[b] For the PN classification, C = 1,6 shall be used.

A.3 Confirmation and control points

The confirmation points for the test results are specified in Table 1.

A.4 Test report

The report shall include the following information:

a) a reference to this document, including the year of publication, i.e. ISO/TS 16422-3:2023;

b) the test method used;

c) the complete identification of the fitting component, including manufacturer, material type, batch number, figure type, size;

d) the dimensions of the fitting used for the testing;

e) the number of test pieces;

f) a table of observations, including for each observation, the test temperature (in °C), pressure level (in bar), data of the test, and any other relevant observations;

g) a graph presenting observed failure points and linear regression lines;

h) the result(s);

i) any factors that can have affected the results, such as incidents or operation details not mentioned in this document, any deviations from the procedure or any unusual features observed;

j) the date of test.

Annex B
(normative)

Determination of circumferential orientation factor

B.1 Principle

A piece of fitting 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 diameter in relation to the initial values. The diameter measurements will be taken from the minimum outer diameter (OD) of the sample to check the minimum circumferential orientation factor. The test pieces are examined on any changes in appearance, e.g. bubbles and cracks.

B.2 Method

The circumferential orientation factor shall be determined according to ISO 2505, whereby the minimum outer diameter (OD) of the fitting is measured before heating in the shaded areas as indicated in Figure B.1. Subsequently, the minimum orientation factor shall be calculated.

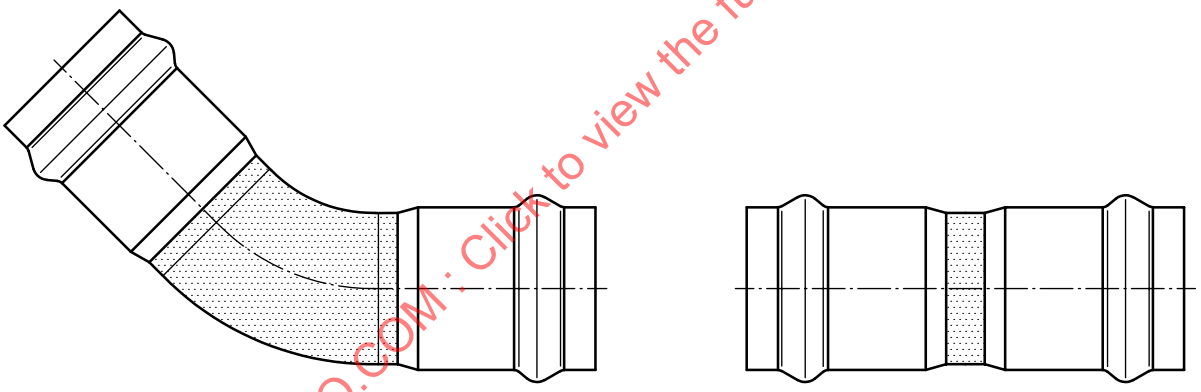

Figure B.1 — Measurement area outer diameter before heating

B.3 Test parameters

The test parameters are specified in Table B.1.

Table B.1 — Test parameters orientation factor

Test temperature:	(150 ± 2) °C
Medium:	Liquid or air
Heating time:	In accordance with ISO 2505. For e_n >16 mm in air oven 240 min and in liquid 60 min.
Number of test pieces:	3

B.4 Test procedure

The test shall be carried out according to ISO 2505.

The circumferential orientation factor, λ_c, is calculated according to Formula (B.1):

$$\lambda_c = \frac{(D_{e,meas,1} - e_{m,1})}{(D_{e,meas,2} - e_{m,2})} \quad \text{(B.1)}$$

where

$D_{e,meas,1}$ is the measured outside diameter before testing;

$D_{e,meas.2}$ is the measured outside diameter after testing;

$e_{m,1}$ is the mean wall thickness before testing;

$e_{m,2}$ is the mean wall thickness after testing.

B.5 Test report

The report shall include the following information:

a) a reference to this document, including the year of publication, i.e. ISO/TS 16422-3:2023;

b) the test method used;

c) the complete identification of the fitting component, including manufacturer, material type, batch number, figure type, size;

d) the dimensions of the fitting used for the testing;

e) the number of test pieces;

f) the measured outer diameter and mean wall thickness before and after testing;

g) a figure indicating the measured area;

h) the result(s);

g) any factors that can have affected the results, such as incidents or operation details not mentioned in this document, any deviations from the procedure or any unusual features observed;

h) the date of test.

Annex C
(informative)

Recommended dimensions of PVC-O fittings

C.1 General

This annex provides the preferred geometric dimensions for design lengths, bend radii and angles for PVC-O fittings. All of these dimensions are based on ISO 1452-3 and shall be included in the technical file of the manufacturer.

C.2 Elbows

Figure C.1 gives examples of elbows with relevant dimensions.

Minimum bend radius and minimum design length for PVC-O elbows are specified in the Table C.1.

The minimum spigot length, $l_{1,min}$, shall ensure the whole insertion of the spigot end into the pipe socket and shall be declared by the manufacturer.

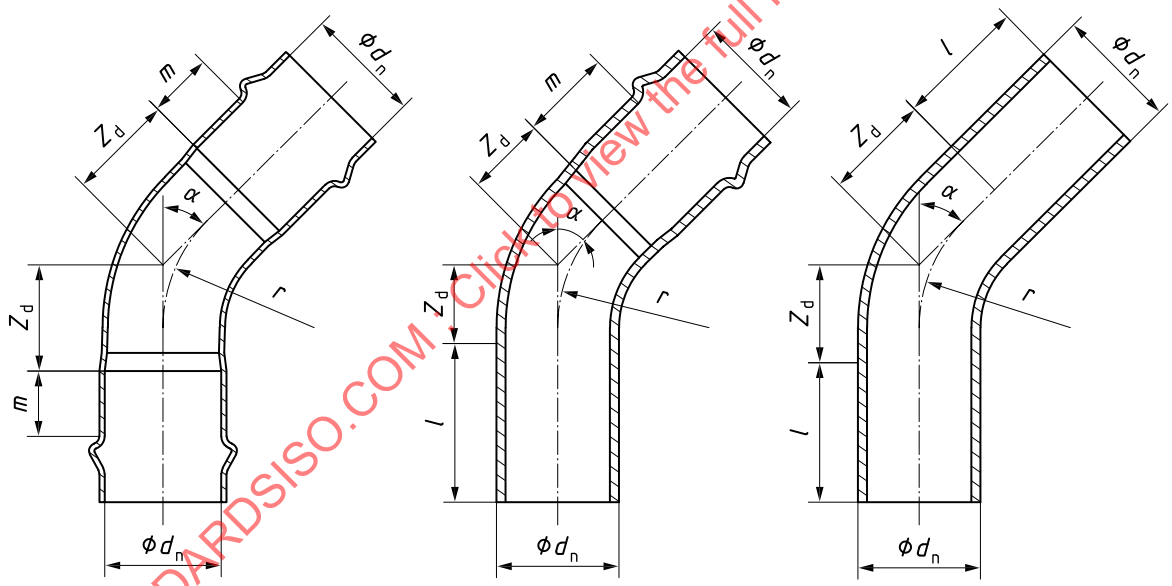

Figure C.1 — Typical elbows