TECHNICAL SPECIFICATION

ISO/TS 16422-3

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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).

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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.