



FINAL DRAFT International Standard

ISO/FDIS 21036

Plastics piping systems for industrial applications — Unplasticized polyamide (PA-U) — Metric series for specifications for components and system

*Systèmes de canalisations en matières plastiques pour les
applications industrielles — Polyamide non plastifié (PA-U) —
Séries métriques pour les spécifications pour les composants et le
système*

[ISO 21036](https://standards.iteh.ai/iso/21036)

<https://standards.iteh.ai/catalog/standards/iso/a3b4bad3-0320-4d76-bc63-19bc219cef0b/iso-21036>

ISO/TC 138/SC 3

Secretariat: **UNI**

Voting begins on:
2024-11-05

Voting terminates on:
2024-12-31

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO 21036

<https://standards.iteh.ai/catalog/standards/iso/a3b4bad3-0320-4d76-bc63-19bc219cef0b/iso-21036>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	3
3.1 Geometrical definitions.....	3
3.2 Material definitions.....	4
3.3 Definitions related to material characteristics.....	4
3.4 Definitions related to service conditions.....	5
4 Symbols and abbreviated terms	6
4.1 Symbols.....	6
4.2 Abbreviated terms.....	7
5 Material	7
5.1 General.....	7
5.2 Long-term hydrostatic strength properties.....	7
5.3 Material characteristics.....	7
5.4 Virgin, reworkable and recyclable material.....	8
5.5 Materials for components not made from PA-U.....	8
5.5.1 General.....	8
5.5.2 Metallic materials.....	8
5.5.3 Sealing materials.....	8
5.5.4 Other materials.....	8
6 General characteristics	8
6.1 Appearance.....	8
6.2 Colour.....	8
6.3 Influence of UV radiation.....	9
6.4 Conditioning or saturation of pipe-based test specimens.....	9
7 Geometrical characteristics	9
7.1 General.....	9
7.2 Mean outside diameters, out-of-roundness (ovality), and tolerances.....	9
7.3 Wall thicknesses and related tolerances.....	9
7.4 Angles.....	9
7.5 Laying lengths.....	10
7.6 Threads.....	10
7.7 Mechanical fittings.....	10
7.8 Joint dimensions of valves.....	10
8 Mechanical characteristics	10
8.1 Resistance to internal pressure of components.....	10
8.2 Calculation of the test pressure for components.....	10
8.2.1 Pipes.....	10
8.2.2 Fittings.....	10
8.2.3 Valves.....	11
8.2.4 Resistance to rapid crack propagation, RCP.....	11
9 Physical characteristics	11
10 Chemical characteristics	11
10.1 Effects on the component material(s).....	11
10.2 Effects on the fluids.....	11
11 Electrical characteristics	11
12 Performance requirements	12
12.1 General.....	12

ISO/FDIS 21036:2024(en)

12.2	Fusion compatibility.....	12
13	Components performance	12
14	Classification of components	12
15	Design and installation	12
16	Declaration of conformity	12
17	Marking	13
17.1	General.....	13
17.2	Minimum required marking of pipes	13
17.3	Minimum required marking of fittings	13
17.4	Minimum required marking of valves.....	14
Annex A (normative) Industrial piping systems made from unplasticized polyamide (PA-U)		15
Annex B (informative) Design and installation		33
Bibliography.....		34

iTeh Standards (<https://standards.iteh.ai>) Document Preview

[ISO 21036](https://standards.iteh.ai/catalog/standards/iso/a3b4bad3-0320-4d76-bc63-19bc219cef0b/iso-21036)

<https://standards.iteh.ai/catalog/standards/iso/a3b4bad3-0320-4d76-bc63-19bc219cef0b/iso-21036>

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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 3, *Plastics pipes and fittings for industrial applications*.

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.

ISO 21036

<https://standards.iteh.ai/catalog/standards/iso/a3b4bad3-0320-4d76-bc63-19bc219cef0b/iso-21036>

Introduction

This document specifies the characteristics and requirements for a piping system and its components made from unplasticized polyamide (PA-U), as applicable, intended to be used for industrial applications above ground or below ground by authorities, design engineers, certification bodies, inspection bodies, testing laboratories, manufacturers, and users.

At the date of publication of this document, standards for piping systems of other plastics used for industrial applications include the following:

ISO 10931, *Plastics piping systems for industrial applications — Poly(vinylidene fluoride) (PVDF) — Specifications for components and the system*

ISO 15493, *Plastics piping systems for industrial applications — Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) — Specifications for components and the system — Metric series*

ISO 15494, *Plastics piping systems for industrial applications — Polybutene (PB), polyethylene (PE), polyethylene of raised temperature resistance (PE-RT), crosslinked polyethylene (PE-X), polypropylene (PP) — Metric series for specifications for components and the system*

iTeh Standards (<https://standards.iteh.ai>) Document Preview

[ISO 21036](https://standards.iteh.ai/catalog/standards/iso/a3b4bad3-0320-4d76-bc63-19bc219cef0b/iso-21036)

<https://standards.iteh.ai/catalog/standards/iso/a3b4bad3-0320-4d76-bc63-19bc219cef0b/iso-21036>

Plastics piping systems for industrial applications — Unplasticized polyamide (PA-U) — Metric series for specifications for components and system

1 Scope

This document specifies the characteristics and requirements for a piping system and its components, made from unplasticized polyamide (PA-U) intended to be used for thermoplastics piping systems in industrial applications above and below ground.

NOTE 1 Requirements applying to industrial valves are given in this document and in other standards.

This document is applicable to PA-U pipes, fittings, valves and their joints, and to joints with components of other plastics and non-plastic materials, depending on their suitability, intended to be used for the conveyance of liquid and gaseous fluids as well as solid matter in fluids for industrial applications such as the following:

- transport of oil, gaseous fuels and multiphase mixtures (exploration and production; general purpose hydrocarbon-based fluids);
- transport of renewable gases (hydrogen, biomethane);
- transport of contaminated sewer (e.g. contaminated with hydrocarbons);
- transport of CO₂ [carbon capture and utilisation or storage (CCUS)].

NOTE 2 National regulations can apply.

NOTE 3 Other application areas are possible if the requirements of this document and/or applicable national requirements are fulfilled.

Characteristics and requirements which are applicable for PA-U are covered by the relevant clauses of this document. Those characteristics and requirements which are dependent on the material are given in the relevant normative [Annex A](#).

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 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 307, *Plastics — Polyamides — Determination of viscosity number*

ISO 472, *Plastics — Vocabulary*

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO/FDIS 21036:2024(en)

- ISO 1110, *Plastics — Polyamides — Accelerated conditioning of test specimens*
- ISO 1133-2, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 2: Method for materials sensitive to time-temperature history and/or moisture*
- 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 1167-4, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 4: Preparation of assemblies*
- ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*
- ISO 1183-2, *Plastics — Methods for determining the density of non-cellular plastics — Part 2: Density gradient column method*
- ISO 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*
- ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*
- ISO 6964, *Polyolefin pipes and fittings — Determination of carbon black content by calcination and pyrolysis — Test method*
- ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*
- ISO 11922-1, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*
- ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications — Classification, designation and design coefficient*
- ISO 13478, *Thermoplastics pipes for the conveyance of fluids — Determination of resistance to rapid crack propagation (RCP) — Full-scale test (FST)*
- ISO 13479, *Polyolefin pipes for the conveyance of fluids — Determination of resistance to crack propagation — Test method for slow crack growth on notched pipes*
- ISO 15512:2019, *Plastics — Determination of water content*
- ISO 15853, *Thermoplastics materials — Preparation of tubular test pieces for the determination of the hydrostatic strength of materials used for injection moulding*
- ISO 16135, *Industrial valves — Ball valves of thermoplastics materials*
- ISO 16486-4, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing — Part 4: Valves*
- ISO 18553, *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*
- IEC 60529, *Degrees of protection provided by enclosures (IP-code)*
- EN 12099, *Plastics piping systems — Polyethylene piping materials and components — Determination of volatile content*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472, ISO 1043-1, and the following apply.

3.1 Geometrical definitions

3.1.1

nominal outside diameter

d_n
specified outside diameter assigned to a nominal size, DN/OD

Note 1 to entry: The nominal inside diameter of a socket is equal to the nominal outside diameter of the corresponding pipe.

Note 2 to entry: It is expressed in millimetres.

3.1.2

outside diameter

d_e
value of the measurement of the outside diameter through its cross-section at any point of the pipe, rounded to the next greater 0,1 mm

Note 1 to entry: The symbol d_e corresponds to d_{ey} given in other International Standards such as ISO 11922-1.

3.1.3

mean outside diameter

d_{em}
value of the measurement of the outer circumference of the pipe or spigot end of a fitting in any cross-section divided by π ($= 3,142$), rounded to the next greater 0,1 mm

3.1.4

nominal size

DN/OD
numerical designation of the size of a component, other than a component designated by thread size, which is a convenient round number, approximately equal to the manufacturing dimension in millimetres (mm) and related to the outside diameter

3.1.5

nominal size of flange

DN
numerical designation of the size of a flange for reference purposes and related to the manufacturing dimension in millimetres

3.1.6

out-of-roundness

ovality

difference between the maximum and the minimum outside diameter in the same cross-section of a pipe or spigot

3.1.7

nominal wall thickness

e_n
numerical designation of the wall thickness of a component, which is a convenient round number, approximately equal to the manufacturing dimension in millimetres (mm)

Note 1 to entry: For thermoplastics components conforming to [Annexes A](#) and [B](#), the value of the nominal wall thickness, e_n , is identical to the specified minimum wall thickness at any point, e_{min} .

Note 2 to entry: The symbol e_n corresponds to e_{ey} given in other International Standards, such as ISO 11922-1.

**3.1.8
wall thickness at any point**

e
wall thickness at any point around the circumference of a component, rounded to the next greater 0,1 mm

**3.1.9
minimum wall thickness at any point**

e_{\min}
minimum value for the wall thickness at any point around the circumference of a component, as specified

**3.1.10
pipe series**

S
dimensionless number for pipe designation

Note 1 to entry: The pipe series, S , conforms to ISO 4065.

Note 2 to entry: The relationship between the pipe series, S , and the standard dimension ratio, SDR, is given by the following formula as specified in ISO 4065:

$$S = \frac{\text{SDR} - 1}{2}$$

Note 3 to entry: Flanges are designated on the basis of nominal pressure, PN.

**3.1.11
standard dimension ratio**

SDR
numerical designation of a pipe series, which is a convenient round number, approximately equal to the dimension ratio of the nominal outside diameter, d_n , and the nominal wall thickness, e_n

3.2 Material definitions

**3.2.1
virgin material**

material in a form such as granules or powder that has not been subjected to use or processing other than that required for its manufacture and to which no reprocessable or recyclable materials have been added

**3.2.2
reworked material**

plastics material from rejected unused products or trimmings capable of being reclaimed within the same process that generated it

Note 1 to entry: Previously referred to as “own reprocessed material”.

3.3 Definitions related to material characteristics

**3.3.1
lower confidence limit of the predicted hydrostatic strength**

σ_{LPL}
quantity with the dimensions of stress, which represents the 97,5 % lower confidence limit of the predicted hydrostatic strength at a temperature, T , and time, t

Note 1 to entry: It is expressed in megapascals.

3.3.2**minimum required strength**

MRS

value of σ_{LPL} (lower confidence limit of the predicted hydrostatic strength) at 20 °C and 50 years, rounded down to the next smaller value of the R10 series or the R20 series

Note 1 to entry: The R10 series conforms to ISO 3 and the R20 series conforms to ISO 497.

3.3.3**design stress** σ_s

allowable stress for a given application at 20 °C that is derived from the minimum required strength (MRS) by dividing it by the coefficient C

Note 1 to entry: Design stress can be calculated using the following formula:

$$\sigma_s = \frac{\text{MRS}}{C}$$

Note 2 to entry: It is expressed in megapascals.

3.3.4**design coefficient** C

coefficient with a value greater than one which takes into consideration service conditions as well as the properties of the components of a piping system other than those represented in the lower confidence limit

3.4 Definitions related to service conditions**3.4.1****nominal pressure**

PN

numerical designation used for reference purposes related to the mechanical characteristics of the components of a piping system

Note 1 to entry: A pressure, in bar, with the numerical value of PN is identical with the pressure, PS, as defined by Reference [19] if both pressures are taken at 20 °C.

Note 2 to entry: For plastics piping systems conveying water, PN corresponds to the maximum continuous operating pressure in bar, which can be sustained for water at 20 °C for 50 years, based on the following minimum design coefficient:

$$\text{PN} = \frac{10\sigma_s}{[S]} = \frac{20\sigma_s}{\text{SDR}-1}$$

where

σ_s is expressed in MPa;

PN is expressed in bar.

Note 3 to entry: 1 bar = 0,1 MPa = 10⁵ Pa; 1 MPa = 1 N/mm².

3.4.2**hydrostatic stress** σ

stress induced in the wall of a pipe when an internal hydrostatic pressure is applied

Note 1 to entry: The hydrostatic stress is related to the applied internal hydrostatic pressure (in bar), p , the wall thickness at any point, e , and the mean outside diameter, d_{em} , of a pipe. It is calculated using the following formula:

$$\sigma = p \frac{d_{em} - e_{min}}{20e_{min}}$$

Note 2 to entry: This formula is applicable for pipes only.

Note 3 to entry: The value is expressed in megapascals.

4 Symbols and abbreviated terms

4.1 Symbols

C design coefficient (design factor)

D_1 mean inside diameter in the fusion zone

D_2 minimum diameter of the flow channel through the body of the fitting

d_e outside diameter (at any point)

d_{em} mean outside diameter

d_n nominal outside diameter

D_{f1} outside diameter of chamfer on shoulder

D_{f2} outside diameter of flange adaptor

DN nominal size of flange

e wall thickness (at any point)

e_n nominal wall thickness

h height of the service pipe

H height of the saddle

L width of the tapping tee

L_1 depth of penetration of the pipe or male end of a spigot end fitting

L_2 nominal length of the fusion zone

L_3 nominal unheated entrance length of the fitting

L_{b2} outside tubular length

p internal hydrostatic pressure

p_c critical pressure

$p_{c,REF}$ critical reference pressure

p_s maximum allowable pressure

r_f radius of chamfer on shoulder

T temperature

t time