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Plastics piping systems — Plastics components — Determination of dimensions

Systèmes de canalisations en plastiques — Composants en plastiques — Détermination des dimensions

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 3126 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 5, *General properties of pipes, fittings and valves of plastic materials and their accessories — Test methods and basic specifications*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

This second edition cancels and replaces the first edition (ISO 3126:1974), which has been technically revised.

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Foreword

This document (EN ISO 3126:2005) has been prepared by Technical Committee CEN /TC 155, "Plastics piping systems and ducting systems", the secretariat of which is held by NEN in collaboration with Technical Committee ISO/TC 138 "Plastics pipes, fittings and valves for the transport of fluids".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2005, and conflicting national standards shall be withdrawn at the latest by September 2005.

This document is one of a series of standards on test methods, which support system standards for plastics piping systems and ducting systems.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This document specifies methods for measurement and/or determination of the dimensions of plastics pipes and fittings and the accuracy of the measurement.

It specifies procedures for measuring angles, diameters, lengths, squareness and wall thicknesses for the purposes of checking conformity to geometric limits.

NOTE This document is using metric units. However the procedures and tolerances are applicable to other units by using appropriate conversion factors.

2 Normative references

The following referenced documents are indispensable for the application 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/R 463, *Dial gauges reading in 0,01 mm, 0,001 in and 0,0001 in.*

ISO 3599, *Vernier callipers reading to 0,1 and 0,05 mm.*

ISO 3611, *Micrometer callipers for external measurement.*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method.*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
accuracy
closeness of agreement between a test result and the accepted reference value

NOTE The term "accuracy", when applied to a set of test results, involves a combination of random components and a common systematic error or bias component (ISO 3534-1).

3.1.2
calibration
set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realised by standards

3.1.3
reference standard
internationally accepted definition of a given unit of measurement

3.2 Symbols

b_1 : distance between the edge of a flange bolt hole and its bore

b_2 : distance between the edge of a flange bolt hole and its outside diameter

b_3 : distance between the centre of a flange bolt hole and its bore

b_4 : distance between the centre of a flange bolt hole and its outside diameter

c_1 : distance between the edges of two adjacent flange bolt holes

c_2 : distance between the centres of two adjacent flange bolt holes

d_e : outside diameter of a (part of a) component

$d_{i,m}$: mean inside diameter of the main of a branch

d_1 : outside diameter of a socket end

d_2 : outside diameter of a spigot end

d_3 : bore of a flange

d_4 : diameter of a flange bolt hole

D : outside diameter of a flange

e : wall thickness of a component

k : pitch circle diameter of a flange

$L_{e,b}$: effective length of a branch

$L_{e,m}$: effective length of the main of a branch

$L_{e,r}$: effective length of a reducer

$L_{e,so}$: effective length of the socket end of a fitting

$L_{e,sp}$: effective length of the spigot end of a fitting

L_{str} : length of the straight part of a socket or a spigot end of a fitting

L_t : length of the tapered part of a reducer

L_1 : maximum out-of-squareness distance from theoretical

L_2 : measured distance from the root of the angle between a straight ruler and a reference surface to the component along the surface

L_3 : measured distance from the root of the angle between a straight ruler and a reference surface to the component along the ruler

L_4 : vertical distance from a reference surface to the nearest point of the upper end

L_5 : socket insertion depth

L_6 : overall length of a branch main

L_7 : distance, measured in the centre-line plane of a branch, between the end of the branch spigot or socket to the bottom of the main

L_8 : overall length of a reducer

L_9 : distance between the edges of two selected bolt holes of a flange

L_{10} : overall length of a flange in axial direction

γ : calculated angle of out-of-squareness

θ : angle of bend or branch

4 Measuring devices

4.1 General requirements

4.1.1 Accuracy of measuring devices

The measuring device shall be selected so that together with the associated procedures used the required accuracy of the measured dimension is obtained.

4.1.2 Calibration

Device used for measuring shall be calibrated at regular intervals of time in accordance with the quality plan of the user of this document. The calibration shall be traceable to an accredited reference standard (see 3.1.3).

4.2 Instruments

4.2.1 Contact instruments

4.2.1.1 In use the instruments shall not apply a force to the surface of the test piece that will cause local deformation.

4.2.1.2 Measuring devices that require contact between the test piece and one or more surfaces, e.g. a tube micrometer, shall conform to the following:

a) the surface in contact with the internal surface of a component shall have a radius less than that of the test piece surface with which it is in contact;

b) the surface in contact with the external surface of a component shall be either flat or radiused;

c) the contact surfaces of the instrument shall have a hardness not less than 500 HV when tested in accordance with ISO 6507-1.

4.2.1.3 Micrometer callipers shall conform to ISO 3611 if applicable. Vernier callipers shall conform to ISO 3599 if applicable.

4.2.1.4 If the measuring instrument incorporates a dial gauge, it shall conform to ISO/R 463.

4.2.1.5 If the device comprises a circumference tape (π tape), it shall be graduated in diameters expressed in millimetres. When a force of 2,5 N is applied in the longitudinal direction to the extremities of the tape, the elongation of the tape shall not exceed 0,05 mm/m.

4.2.1.6 Measuring instruments may be used in conjunction with a setting standard of calibrated thickness or length, and then used as a comparator, i.e. to measure small differences between the setting piece and the measured dimension on the test piece.

NOTE This is particularly recommended when measuring large diameter or thick walled components.

4.2.1.7 Go/no-go gauges may be used for checking conformity to specific limits.

4.2.1.8 Contact instruments other than those mentioned in 4.2.1.3, 4.2.1.4, 4.2.1.5 and 4.2.1.7 may also be used. Ultrasonic measuring devices shall be regarded as non-contact instruments (see 4.2.2).

4.2.2 Non-contact instruments

If non-contact instruments or devices based on e.g. optical or ultrasonic scanning devices are used, the accuracy of measurement shall conform to accuracy levels specified in the relevant subclause of Clause 5 or their use shall be restricted to finding relevant positions for measurements to be made by other means, e.g. points comprising maximum or minimum dimensions.

5 Determination of dimensions

5.1 General

5.1.1 Ensure that measurement of dimensions is carried out by personnel trained in the applicable equipment and procedures.

5.1.2 Unless otherwise specified in the referring standard, ensure that either:

a) the temperature of the measuring device, the test piece and the ambient air temperature are at (23 ± 2) °C; or

b) results are correlated by calculation or experience to their value at 23 °C.

5.1.3 Examine the test piece surface for any features that could affect dimensional measurements, e.g. marking, parting lines, blisters or inclusions. If found, record their nature and effects on the measurement.

5.1.4 For selection of the cross-section(s) in which to make measurements, one or more of the following shall apply, as applicable:

a) select cross-section(s) as specified by the referring standard;

b) identify a cross-section not less than 25 mm from the end or in accordance with the component manufacturer's specification;

c) for measurements of a dimension associated with another dimension, e.g. to enable calculation of a further dimension, the cross-section shall be appropriate to the dimension to be calculated.

5.1.5 Results of measurements are rounded as specified in 5.2.3, 5.3.3 and 5.3.4. When determining mean values the rounding shall be done after the arithmetic mean value has been calculated.

5.2 Wall thicknesses

5.2.1 General

Select instrument(s) or device(s) and associated procedures for measuring wall thickness so that the accuracy of the result is within the limits given in Table 1, unless otherwise specified in the referring standard.

Table 1 — Measurement of wall thickness

Dimensions in millimetres

Wall thickness	Required accuracy of individual result	Round arithmetic mean value to the nearest: [a]
≤ 10	0,03	0,05
> 10 and ≤ 30	0,05	0,1
> 30	0,1	0,1
[a] Exactly intermediate values shall be rounded up.		

5.2.2 Maximum and minimum wall thicknesses

Move the measuring device until the positions of the maximum and/or minimum wall thicknesses as appropriate in the selected cross-sections are found and record the observed value(s).

5.2.3 Mean wall thickness

In each selected cross-section, take at least six measurements of the wall thickness at regular intervals around the circumference.

From the values obtained, calculate the arithmetic mean value, round in accordance with Table 1 and record the answer as the mean wall thickness, e_m.

5.3 Diameters

5.3.1 General

5.3.1.1 Select the instrument(s) or device(s) and associated procedures for measuring diameters (outside or inside) of the test piece at the selected cross-section(s), so that the accuracy of the result is in accordance with Table 2, unless otherwise specified in the referring standard.

Table 2 — Measurement of diameter

Dimensions in millimetres

Nominal diameter DN	Required accuracy of individual result	Round arithmetic mean value to the nearest: [a]
≤ 600 600 < DN ≤ 1600 > 1600	0,1 0,2 1	0,1 0,2 1
[a] Exactly intermediate values shall be rounded up.		

5.3.1.2 For measuring the diameter(s) of components, select the relevant cross-section(s) in accordance with 5.1.4.

5.3.2 Measurement of maximum and minimum diameter

Move the measuring device in each selected cross-section until the appropriate extreme value(s) of the diameter are found and record the observed value(s).

5.3.3 Mean outside diameter

The mean outside diameter, $d_{e,m}$, may be determined from either:

a) direct measurement using a π-tape; or

b) a calculated value derived from a series of individual measurements conforming to Table 3, taken at regular intervals around each of the selected cross-sections.

In case of item b), calculate the arithmetic mean of the individual measurements, round in accordance with Table 2 and record the answer as the mean outside diameter, $d_{e,m}$.

Table 3 — Number of individual diameter measurements for a given nominal size

Nominal size of pipe or fitting	Number of individual diameter measurements required in a given cross section
≤ 40 > 40 and ≤ 600 > 600 and ≤ 1600 > 1600	4 6 8 12

5.3.4 Mean inside diameter

Using a device conforming to 5.3.1.1, determine either:

a) a series of individual measurements conforming to Table 3 at regular intervals; or

b) direct measurement using an inside π-tape.

Calculate the arithmetic mean of the individual measurements obtained in a), round in accordance with Table 2 and record it as the applicable mean inside diameter, $d_{i,m}$.