INTERNATIONAL STANDARD

ISO 12628

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Thermal insulating products for building equipment and industrial installations — Determination of dimensions, squareness and linearity of preformed pipe insulation

Produits isolants thermiques pour les équipements des bâtiments et les installations industrielles — Détermination des dimensions, de l'équerrage et de la linéarité des coquilles isolantes préformées

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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.

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 12628 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*.

ISO 12628 includes the original EN 13467 prepared by Technical Committee CEN/TC 88 *Thermal insulating materials and products*. However,

— Subclause 5.3, “conditioning of test specimen”,

— Subclause 6.1, “test conditions”, and

— Clause 9, “test report”

have been modified to reflect conditions for tropical countries.

This International Standard is one of a series of standards which specify test methods for determining dimensions and properties of thermal insulating materials and products. The original EN 13467 supports a series of product standards for thermal insulating materials and products which derive from the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to constructive products (Directive 89/106/EEC) through the consideration of the essential requirements.

This International Standard is one of a series of existing European Standards on test methods for products used to insulate building equipment and industrial installations which is comprised of the following group of International Standards:

ISO standard	Title	Respective EN standard
ISO 12623	*Thermal insulating products for building equipment and industrial installations — Determination of short-term water absorption by partial immersion of preformed pipe insulation*	EN 13472
ISO 12624	*Thermal insulation products — Determination of trace quantities of water soluble chloride, fluoride, silicate, sodium ions and pH*	EN 13468
ISO 12628	*Thermal insulating products for building equipment and industrial installations — Determination of dimensions, squareness and linearity of preformed pipe insulation*	EN 13467
ISO 12629	*Thermal insulating products for building equipment and industrial installations — Determination of water vapour transmission properties of preformed pipe insulation*	EN 13469

A further series of existing European Standards on test methods was adopted by ISO. This “package” of standards comprises the following group of interrelated standards:

ISO standard	Title	Respective EN standard
ISO 29465	*Thermal insulating products for building applications — Determination of length and width*	EN 822
ISO 29466	*Thermal insulating products for building applications — Determination of thickness*	EN 823
ISO 29467	*Thermal insulating products for building applications — Determination of squareness*	EN 824
ISO 29468	*Thermal insulating products for building applications — Determination of flatness*	EN 825
ISO 29469	*Thermal insulating products for building applications — Determination of compression behaviour*	EN 826
ISO 29470	*Thermal insulating products for building applications — Determination of the apparent density*	EN 1602
ISO 29471	*Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23 degrees C/50 % relative humidity)*	EN 1603
ISO 29472	*Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions*	EN 1604
ISO 29764	*Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions*	EN 1605
ISO 29765	*Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*	EN 1607
ISO 29766	*Thermal insulating products for building applications — Determination of tensile strength parallel to faces*	EN 1608
ISO 29767	*Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion*	EN 1609

ISO standard	Title	Respective EN standard
ISO 29768	*Thermal insulating products for building applications — Determination of linear dimensions of test specimens*	EN 12085
ISO 29769	*Thermal insulating products for building applications — Determination of behaviour under point load*	EN 12430
ISO 29770	*Thermal insulating products for building applications — Determination of thickness for floating-floor insulating products*	EN 12431
ISO 29771	*Thermal insulating materials for building applications — Determination of organic content*	EN 13820
ISO 29803	*Thermal insulation products for building applications — Determination of the resistance to impact of external thermal insulation composite systems (ETICS)*	EN 13497
ISO 29804	*Thermal insulation products for building applications — Determination of the tensile bond strength of the adhesive and of the base coat to the thermal insulation material*	EN 13494
ISO 29805	*Thermal insulation products for building applications — Determination of the mechanical properties of glass fibre meshes*	EN 13496

The Application of Agreement on technical cooperation between ISO and CEN (Vienna Agreement), Modes 1, 2, 4 and 5, was not approved by CEN/TC 88 and the necessity not seen by its stakeholders.

Thermal insulating products for building equipment and industrial installations — Determination of dimensions, squareness and linearity of preformed pipe insulation

1 Scope

This International Standard specifies the equipment and procedures for determining the dimensions, squareness and linearity of preformed pipe insulation, supplied in one piece, half sections or segments. It is applicable to thermal insulating products.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply (see Figures 1 and 4).

2.1
circumference
C
circular length of the outer surface of the pipe insulation

2.2
outside diameter
D_o
linear distance between two opposite points on the outside surface of the pipe insulation measured across the centre

2.3
inside diameter
D_i
linear distance between two opposite points on the inside surface of the pipe insulation measured across the centre

2.4
length
l
linear dimension measured perpendicularly to the circumference of the pipe insulation

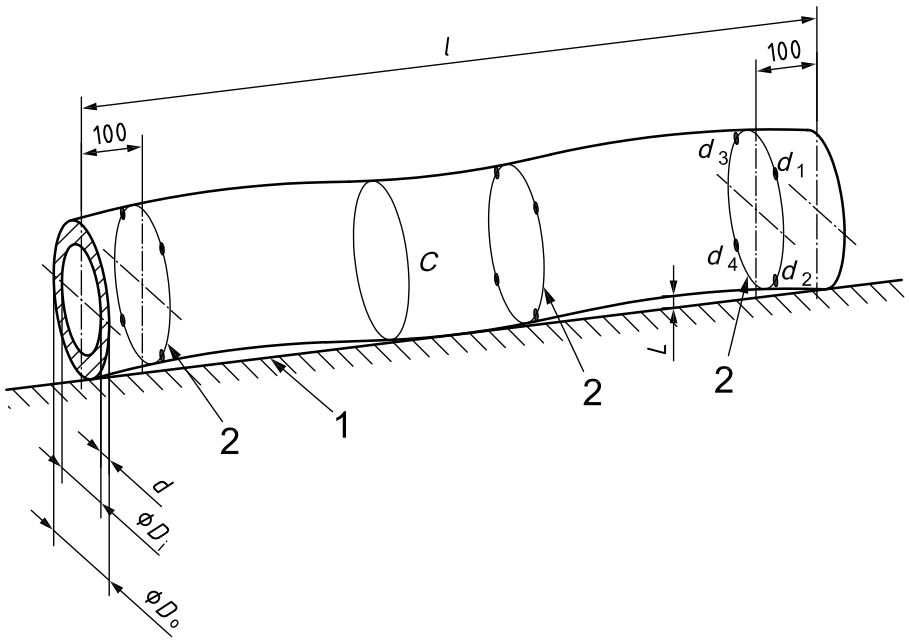
2.5
thickness
d
thickness of the insulation product measured perpendicularly between the outside and the inside surface of the pipe insulation

2.6
deviation from squareness
v
maximum distance between a product, at its end, from a line which just touches the product and which is perpendicular to its major axis

NOTE See Figure 4.

2.7
deviation from linearity
L
maximum distance between a plane reference surface on which the test specimen rests and the outside surface of the pipe insulation

Dimensions in millimetres



Key
1 flat surface
2 locations for measurements (see 6.2.2.3)

Figure 1 — Illustration of the definitions

3 Principle

Determination of the dimensions, squareness and linearity of a pipe insulation along or at a right angle to its major axis.

4 Apparatus

4.1 For circumference, outside and inside diameter and thickness

4.1.1 Metal tape, graduated in millimetres for measuring circumference and diameter.

Accuracy of reading:

diameter at least 1 mm,

circumference at least 3 mm.

4.1.2 Metal pipe, for supporting the insulation with an outside diameter which ensures no deformation of the product.

4.1.3 Rack, for supporting the metal pipe (see Figure 2).

4.1.4 Thickness gauge, capable of applying a load of minimum (0,5 ± 0,05) N to a load distributing plate, diameter 50 mm. The load shall be such that no deformation of the product occurs during measurement.

Accuracy of reading at least 0,5 mm.

4.1.5 Conical mandrel, graduated in 0,5 mm intervals (see Figure 3).

Accuracy of reading at least 0,5 mm.

4.1.6 Caliper

Accuracy of reading at least 0,1 mm.

4.2 For length

4.2.1 Metal tape, graduated in millimetres.

Accuracy of reading at least 1 mm.

4.3 For deviation from squareness

4.3.1 Metal square with limbs at least 500 mm long with a deviation from squareness of not more than ±0,1 mm when measured at 500 mm from the corners (see Figure 4).

4.3.2 Metal tape, graduated in millimetres.

Accuracy of reading at least 1 mm.

4.4 For deviation from linearity

4.4.1 Flat surface, on which the test specimen rests.

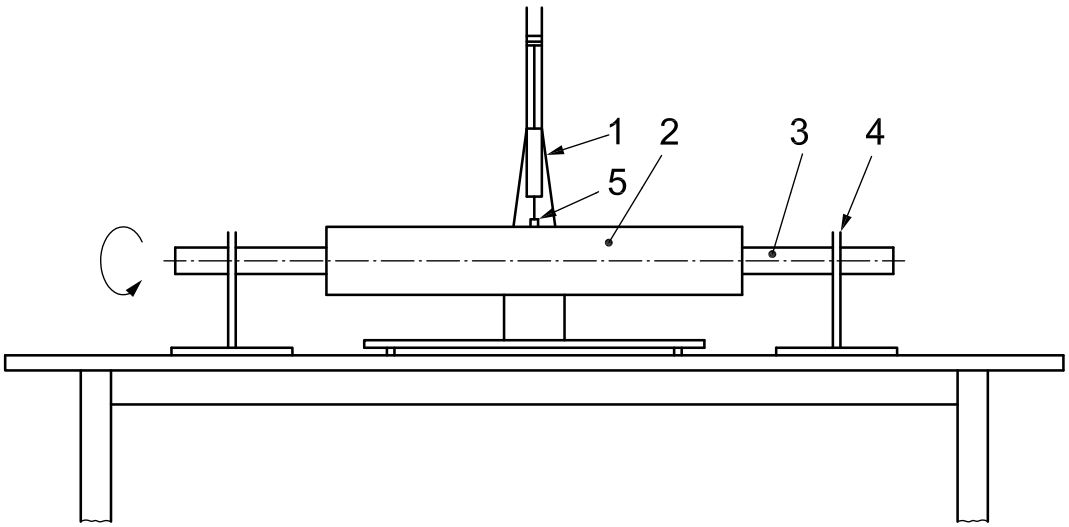
4.4.2 Metal tape, graduated in millimetres.

Accuracy of reading at least 1 mm.

4.4.3 Thickness gauge, (wedge shape), graduated in 0,5 mm (see Figure 5).

Accuracy of reading at least 0,5 mm.

NOTE For all measured dimensions test equipment which provides the same result with at least the same accuracy can be used.



Key

1 thickness gauge
2 test specimen
3 metal pipe
4 rack
5 load distribution plate

Figure 2 — Example of equipment for thickness measurement with thickness gauge

Dimensions in millimetres

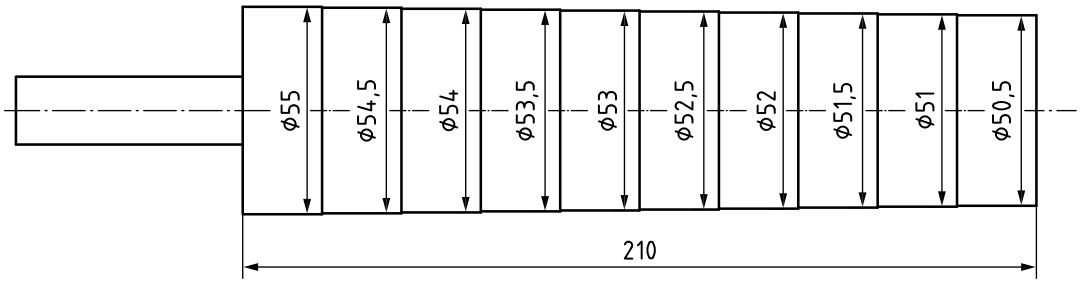
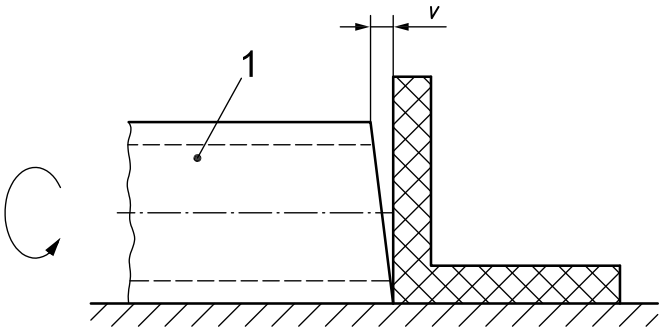


Figure 3 — Example of conical mandrel



Key

1 test specimen

Figure 4 — Principle of measurement of deviation from squareness

Dimensions in millimetres

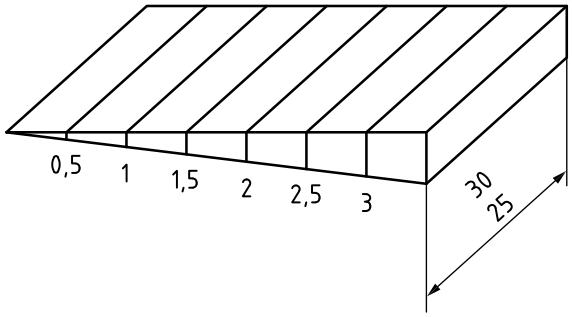


Figure 5 — Thickness gauge (wedge shape)

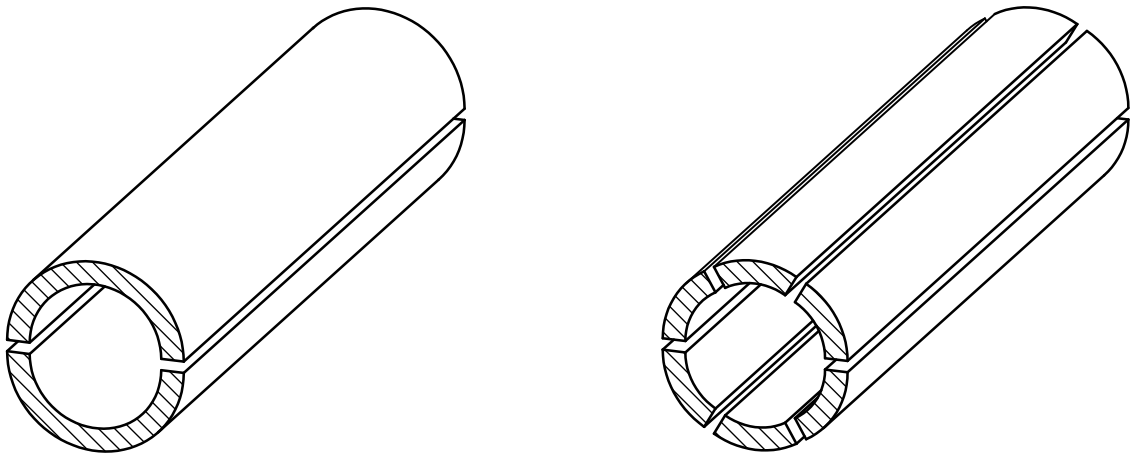
5 Test specimens

5.1 Dimensions of test specimens

The test specimens shall be, wherever possible, the full-size pipe insulation product. The dimensions of the test specimens shall be measured including any surface skins, facings, or coatings on both the inner and the outer surfaces.

NOTE For the measurement of circumference/outside diameter, inside diameter, and thickness, the test specimen can be divided transversely or longitudinally into several pieces; minimum dimension is 100 mm.

Pipe insulation pieces (half sections or segments), which together form a complete pipe insulation layer, without visual deformation, shall be held in place by adhesive tape to facilitate measurement (see Figure 6).



a) Two half sections **b) Segments**

Figure 6 — Examples of pipe insulation pieces

5.2 Number of test specimens

The number of test specimens shall be as specified in the relevant product standard. If the number is not specified, then at least three test specimens shall be used.

NOTE In the absence of a product standard or any other European technical specification, the number of test specimens can be agreed between parties.

5.3 Conditioning of test specimens

The test specimens shall be stored for at least 6 h at (23 ± 5) °C. In case of dispute, they shall be stored at (23 ± 2) °C and (50 ± 5) % RH (relative humidity) for the time stated in the relevant product standard.

In tropical countries, different conditioning and testing conditions can be relevant. In this case, the conditions shall be (27 ± 5) °C and (65 ± 5) % RH, and shall be stated clearly in the test report.

6 Procedure

6.1 Test conditions

The test shall be carried out at (23 ± 5) °C. In case of dispute, it shall be carried out at (23 ± 2) °C and (50 ± 5) % RH.

In tropical countries, different conditioning and testing conditions can be relevant. In this case, the conditions shall be (27 ± 2) °C and (65 ± 5) % RH.

6.2 Test procedure

6.2.1 General

Determine the thickness, d, of the test specimen and its inside and outside diameter, D_i and D_o, from one of the following pairs of measurements:

a) outside circumference and inside diameter;

b) inside diameter and outside diameter;

c) inside diameter and thickness;

d) outside diameter and thickness;

e) outside circumference and thickness.

Each set of measurements shall be performed at the same place on the pipe insulation.

NOTE 1 The listed options are not equivalent. Only when thickness itself is measured can an estimate of concentricity be obtained.

For pipe insulation with large inside diameter and small thickness, attention should be paid to the required accuracy. Method c) or d) or e) should be used.

Determine the length, l, deviation from squareness, v, and deviation from linearity, L, in accordance with 6.2.3, 6.2.4 and 6.2.5.

NOTE 2 Determination of deviation from squareness and deviation from linearity are not relevant for all materials or applications.

6.2.2 Circumference — Outside diameter, inside diameter, wall thickness

6.2.2.1 General

The appropriate apparatus, described in Clause 4, shall be used for the measurements below.

During the measurement, any longitudinal joints shall be kept close together.

The pipe insulation shall not be visibly deformed due to the measuring process.

Measure pipe insulation, with a length smaller than or equal to 600 mm, at two locations, either at the ends or 100 mm from each end.

Measure pipe insulation, with a length larger than 600 mm, as above with one extra measurement for each additional 400 mm in length evenly distributed along the length, with a maximum of five measurements.

NOTE The pipe insulation can be cut into smaller pieces at appropriate locations to facilitate measurement.

The reading accuracy of the measurements shall correspond to the accuracy of the apparatus.

6.2.2.2 Circumference — Outside diameter

Measure the circumference, C, of the test specimen using a metal tape.

Measure the outside diameter, D_o, using either a metal tape or a caliper. Each measurement shall consist of two readings at right angles to the longitudinal axis of the test specimen at the selected locations. The readings of the outside diameter shall also be made at right angles to each other.

6.2.2.3 Inside diameter

Measure the inside diameter, D_i, using either a metal tape or a caliper. Each measurement shall consist of two readings at right angles to the longitudinal axis of the test specimen at the selected locations. The readings of the inside diameter shall also be made at right angles to each other.

Alternatively, the inside diameter may be measured with a conical mandrel moved into position along the major axis of the pipe insulation.

NOTE For inside diameter greater than 55 mm, the use of a conical mandrel can be impractical.

6.2.2.4 Thickness

Measure the thickness, d, using either a metal tape, a caliper or a thickness gauge. Each measurement shall consist of four readings at right angles to each other at the selected locations.

When a thickness gauge is used on a metal pipe (see 4.1.2) the pipe insulation shall be supported (see Figure 2). Before making measurements on the pipe insulation, the thickness gauge shall be read with the measuring plate resting on the metal pipe. The pipe insulation shall then be suspended on the metal pipe and the thickness gauge read again. The difference between the two measurements is the thickness of the test specimen at that location. The load distributing plate of the thickness gauge shall be raised between each new reading.

6.2.2.5 Thickness uniformity

Determine the deviation from thickness uniformity, Δd, at each location by deducting the lower reading of thickness from the higher reading.

6.2.3 Length

Place the pipe insulation on a flat surface. Measure the length, l, twice, using a metal tape, at diametrically opposite sides on the surface of the pipe insulation (see Figure 1).

The length is measured with an accuracy of 1 mm for length $\leqslant$ 600 mm and an accuracy of 2 mm for length $>$ 600 mm.

6.2.4 Deviation from squareness

Place the pipe insulation on a flat surface. Place the metal square on the flat surface against the end of the pipe insulation (see Figure 4). Measure the deviation from squareness, v, as the maximum distance from the top edge of the pipe insulation to the metal square. It is measured with a metal tape by rotating the pipe insulation until the point is reached where the distance between the metal square and the pipe insulation is a maximum. The measurement is carried out at both ends of the pipe insulation.

The deviation from squareness is measured with an accuracy of 1 mm.

6.2.5 Deviation from linearity

Place the pipe insulation on a flat surface and rotate it until a gap is observed between the pipe insulation and the flat surface. Measure the deviation from linearity, L, when the gap is at maximum using either a metal tape or a thickness gauge (see Figure 5) with an accuracy of 1 mm.

7 Calculation and expression of results

Table 1 — Measurement and calculation of dimensions

Measured values	Calculated values	Equations
C, D_i	D_o, d	$D_o = \frac{C}{\pi}$ (1) $d = \frac{D_o - D_i}{2}$ (2)
D_i, D_o	d	$d = \frac{D_o - D_i}{2}$ (3)
D_i, d	D_o	$D_o = D_i + 2 \times d$ (4)
D_o, d	D_i	$D_i = D_o - 2 \times d$ (5)
C, d	D_o, D_i	$D_o = \frac{C}{\pi}$ (6) $D_i = D_o - 2 \times d$ (7)

where

C is the circumference, in millimetres;

D_o is the outside diameter, in millimetres;

D_i is the inside diameter, in millimetres;

d is the thickness, in millimetres.

7.1 Outside diameter and inside diameter

Calculate the average of the values in accordance with Table 1 and round to the nearest millimetre.

7.2 Thickness

Calculate the average of the values in accordance with Table 1 and round to the nearest millimetre.

7.3 Thickness uniformity

Record the deviation from thickness uniformity as the maximum value of Δd, in millimetres rounded to the nearest millimetre.

7.4 Length

Calculate the length, l, in millimetres as the average of two measurements, rounded to the nearest millimetre.

7.5 Deviation from squareness

Record the deviation from squareness, v, in millimetres as the largest angular deviation at each end of the pipe insulation, and round to the nearest millimetre. Report the nominal outside diameter of the pipe insulation.

7.6 Deviation from linearity

Record the deviation from linearity, L, rounded to the nearest millimetre.

8 Accuracy of measurement

NOTE It has not been possible to include a statement on the accuracy of the method in this edition of this International Standard, but it is intended to include such a statement when this International Standard is next revised.

9 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) product identification:

   1) product name, factory, manufacturer or supplier;

   2) production code number;

   3) type of product;

   4) packaging;

   5) the form in which the product arrived at the laboratory;

   6) presence of surface skins, facings or coatings and their nominal thickness;

   7) other information as appropriate, e.g. nominal dimensions, nominal density;

c) test procedure:

   1) pre-test history and sampling, e.g. who sampled and where;

   2) conditioning;

   3) number of test specimens;

   4) deviation from Clauses 5 and 6, if applicable;

5) conditioning and testing conditions in tropical countries, if applicable;

6) date of testing;

7) general information relating to the test including information on the chosen apparatus and methods a) to e);

8) events which may have affected the results.

Information about the apparatus and identity of the technician should be available in the laboratory, but it need not be recorded in the report.

d) results;

e) all individual values and the mean value for each dimension, deviation from squareness and deviation from linearity.

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