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Second edition
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Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics

Spécification géométrique des produits (GPS) — Équipement de mesurage dimensionnel: Micromètres d'extérieur — Caractéristiques de conception et caractéristiques métrologiques

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Contents

Page

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 3611 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

This second edition cancels and replaces the first edition (ISO 3611:1978), which has been technically revised.

Introduction

This International Standard is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences the chain link 5 of the chain of standards on size in the general GPS matrix.

For more detailed information on the relation between this International Standard, other standards and the GPS matrix model, see Annex F.

Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics

1 Scope

This International Standard specifies the most important design and metrological characteristics of micrometers for external measurements:

— with analogue indication;

— with digital indication: mechanical or electronic digital display.

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 14253-1, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specifications*

ISO 14253-2, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 2: Guidance for the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

ISO 14978:2006, *Geometrical product specifications (GPS) — General concepts and requirements for GPS measuring equipment*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14978, ISO/IEC Guide 99 and the following apply.

3.1
micrometer for external measurements
measuring instrument which gives the evaluation of a dimensional quantity of an external feature of a workpiece on the basis of movement of a spindle with a measuring face, moving relatively to a material measure and an anvil, with the movement generated by a screw thread

NOTE 1 The guiding elements of the spindle and of the anvil are connected by a frame.

NOTE 2 Usually, micrometers for external measurements have a thread as a material measure with the anvil, spindle and material measure arranged in a line.

3.2
measuring face contact
contact between the measuring face and a feature of a workpiece

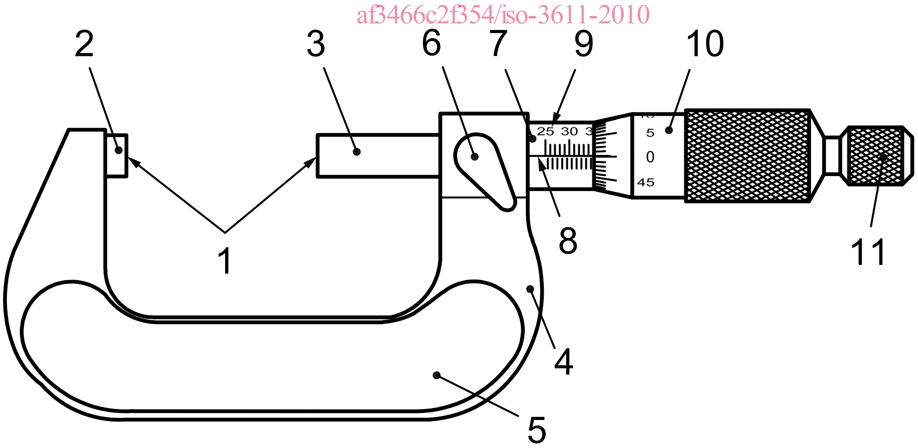
3.2.1
full measuring face contact
contact between the full area of the measuring face and a feature of a workpiece

3.2.2
partial measuring face contact
contact between a partial area of the measuring face and a feature of a workpiece

4 Design characteristics

4.1 General design and nomenclature

The general design and workmanship of the micrometer for external measurements shall be such that its metrological characteristics comply with the requirements of this International Standard under all operational orientations, unless otherwise specified by the manufacturer. See Figure 1 for the general design.



Key

1 measuring faces
2 anvil
3 measuring spindle
4 frame
5 thermally insulating plate
6 spindle clamp
7 sleeve
8 fiducial line
9 analogue indication
10 thimble
11 fast drive

Figure 1 — Nomenclature and general design of a micrometer for external measurements

4.2 Main dimensions

The micrometer for external measurements shall conform to the dimensions specified in Figure 2 and Table 1.

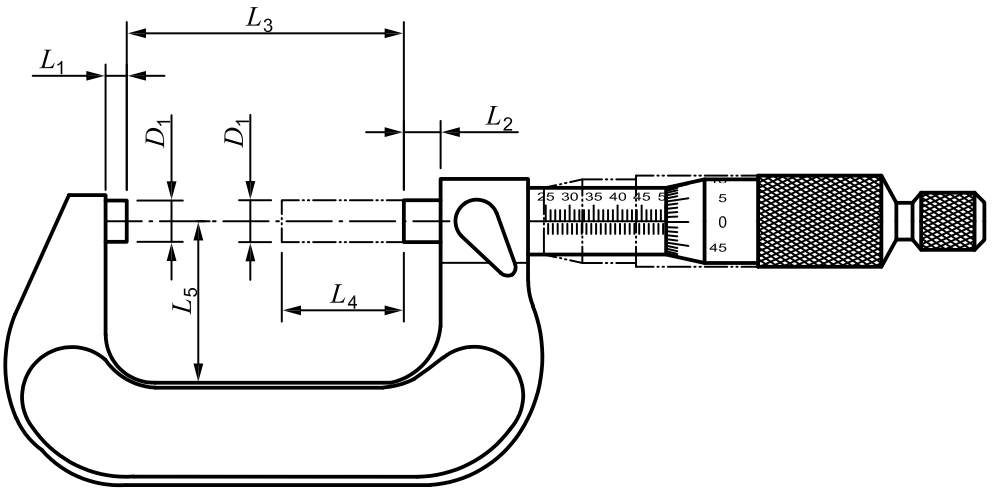


Figure 2 — Dimensions of a micrometer for external measurements

Table 1 — Dimensions of a micrometer for external measurements

Dimension	Nominal value
Anvil length, L_1	
Spindle length in end position, L_2	
Maximum dimension measurable, L_3	
Measuring span, L_4	25 mm[c]
Frame depth, L_5[b]	
Spindle and anvil diameter, D_1	6,35 mm, 6,5 mm, 7,5 mm, 8 mm[a]

NOTE The dimensions D_1, L_1 and L_2 are important for the interchangeability of accessories mounted on the measuring faces.

[a] At the manufacturer's discretion. Other diameters are possible.

[b] Usually, the frame is shaped to permit the measurement of a cylinder whose diameter is equal to the last value of the measuring range.

[c] Usually, the measuring span L_4 is 25 mm. Other measuring spans are possible.

4.3 Types of indicating devices

4.3.1 General

Several types of indicating devices are possible:

— analogue indicating devices;

— digital indicating devices with mechanical digital display;

— digital indicating devices with electronic digital display.

On micrometers with analogue indicating devices, the scale interval and its unit shall be labelled.

On micrometers with a digital indicating device, the unit of the indication shall be labelled.

NOTE Combinations of analogue and digital indicating devices are possible.

4.3.2 Analogue indicating devices

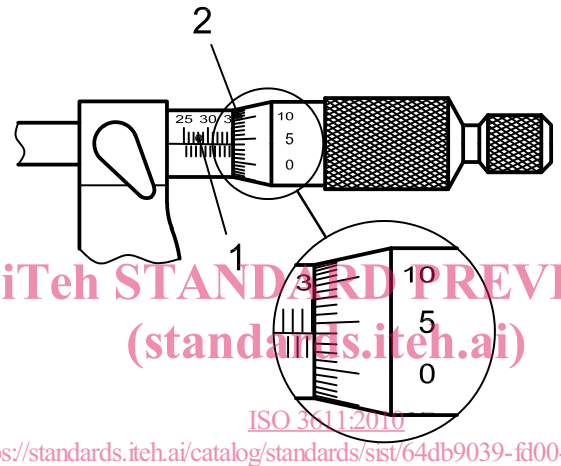
4.3.2.1 General

The measuring spindle should have a pitch of 0,5 mm or 1 mm. In the case of micrometers with spindles having a pitch of 0,5 mm, the 0,5 mm graduation lines on the main scale shall be clearly distinguishable from the 1 mm graduation lines by means of their arrangement above and below the fiducial line.

The secondary scale on the thimble should have a scale graduated with 50 (pitch 0,5 mm) or 100 (pitch 1 mm) graduation lines, each scale interval representing 0,01 mm. For graduations of 0,001 mm, a vernier scale can be added on the sleeve.

See Figures 3 to 5 for scales and arrangement of scales.

4.3.2.2 Main scale and secondary scale

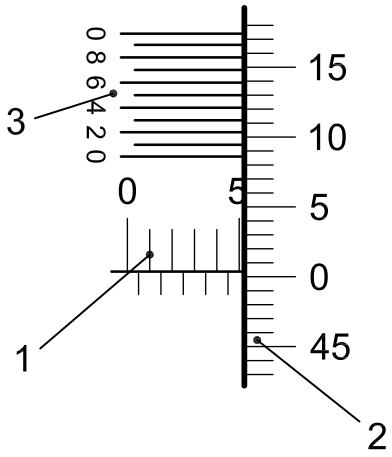


Key
1 main scale
2 secondary scale

NOTE The reading in Figure 3 is 35,04 mm.

Figure 3 — Analogue indicating device with spindle pitch of 0,5 mm

4.3.2.3 Vernier scale



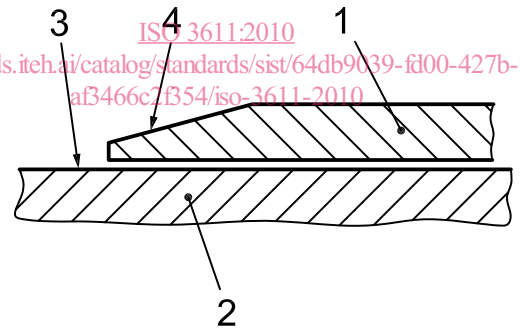
Key

1 main scale
2 secondary scale
3 vernier scale

NOTE The reading in Figure 4 is 5,005 mm.

Figure 4 — Analogue indicating device with spindle pitch of 0,5 mm and vernier scale interval of 0,001 mm

4.3.2.4 Arrangement of scales



Key

1 thimble
2 sleeve
3 main scale
4 secondary scale

Figure 5 — Arrangement of sleeve and thimble

The height difference between the edges of the secondary scale surface and the main scale surface should be as small as possible, for example 0,4 mm.

4.3.3 Digital indicating devices, with mechanical digital display

The mechanical digital display (see Figure 6) should have a digital step of 0,01 mm or 0,001 mm. The digits of the display should provide a good contrast with the background.