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**Geometrical product specifications  
(GPS) — Dimensional measuring  
equipment —**

**Part 1:  
Callipers; Design and metrological  
characteristics**

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*Spécification géométrique des produits (GPS) — Équipement de  
mesurage dimensionnel —*

*Partie 1: Pieds à coulisse; caractéristiques de conception et  
caractéristiques métrologiques*

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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 13385-1 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

This first edition of ISO 13385-1, together with ISO 13385-2, cancels and replaces ISO 3599:1976 and ISO 6906:1984, which have been technically revised.

ISO 13385 consists of the following parts, under the general title *Geometrical product specifications (GPS) — Dimensional measuring equipment*:

- *Part 1: Callipers; Design and metrological characteristics*
- *Part 2: Calliper depth gauges; Design and metrological characteristics*

## Introduction

This part of ISO 13385 is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences chain link 5 of the chains of standards on size and distance in the general GPS matrix.

The ISO/GPS Masterplan given in ISO/TR 14638 gives an overview of the ISO/GPS system of which this document is a part. The fundamental rules of ISO/GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document unless otherwise indicated.

For more detailed information on the relation of this part of ISO 13385 to other standards and the GPS matrix model, see Annex G.

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# Geometrical product specifications (GPS) — Dimensional measuring equipment —

## Part 1: Callipers; Design and metrological characteristics

### 1 Scope

This part of ISO 13385 provides the most important design and metrological characteristics of callipers

- with analogue indication: vernier scale or circular scale (dial), and
- with digital indication: 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 14253-2:2011, *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 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 calliper**  
measuring instrument which gives the evaluation of a dimensional quantity of an internal or external feature on the basis of the movement of a slider with a measuring jaw, moving relative to a measuring scale on a rigid beam and a fixed jaw

See Figures 1 and 2.

NOTE 1 Callipers with an additional measuring face at the end of the beam and a depth measuring rod are used for depth measurements (see Figure 1).

NOTE 2 The indication may be either analogue (vernier), circular scale or digital. Regarding digital data transfer, see 4.3.3.

NOTE 3 See Annex C for examples of different types of callipers.

NOTE 4 See Annex D for examples of several types of measurements.

**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

**3.2.3 measuring face line contact**  
contact between a line, perpendicular to the length of the jaws, on the measuring face and a feature of a workpiece

NOTE Form deviations in either the measuring face(s) or the feature are disregarded for the purposes of these definitions.

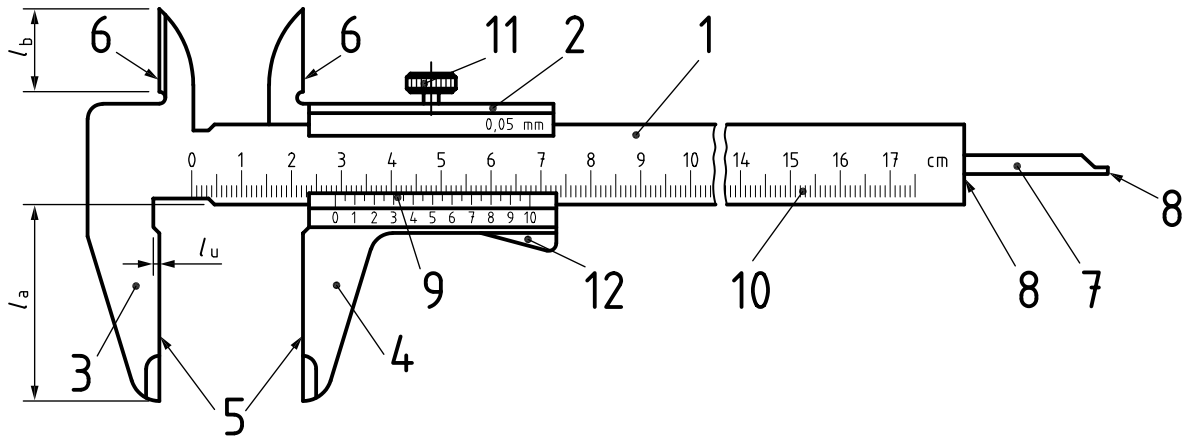
### 4 Design characteristics

#### 4.1 General design and nomenclature

The general design and workmanship of the calliper shall be such that its metrological characteristics comply with this part of ISO 13385 under all operational orientations unless otherwise specified by the manufacturer.

See Figures 1 and 2 for general design.

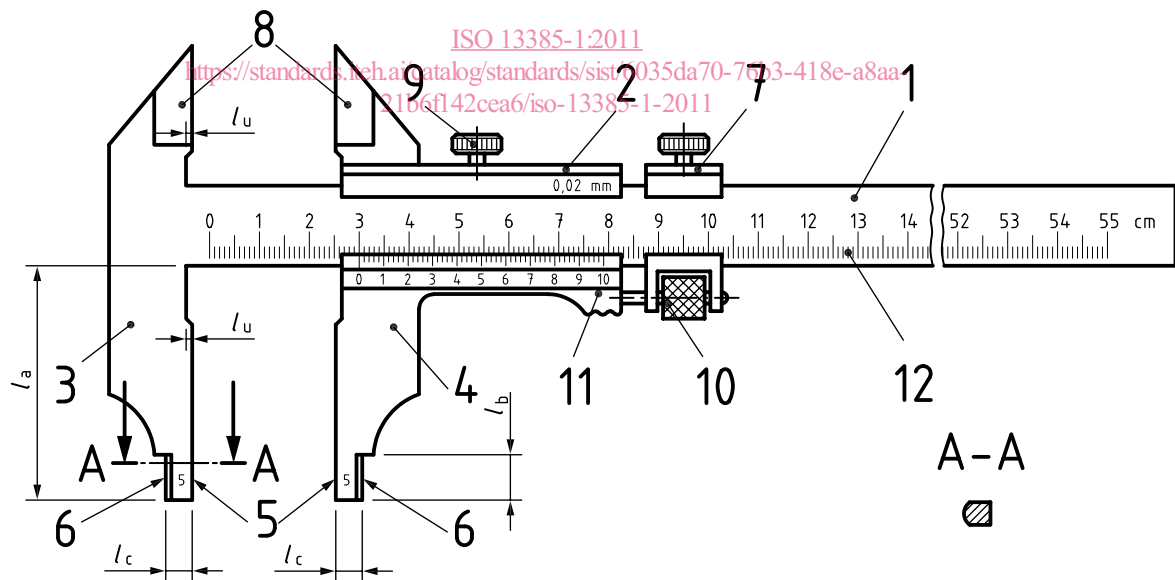




**Key**

- |  |   |
|--|---|
| 1 beam   | 7 depth measuring rod                   |
| 2 slider   | 8 measuring faces for depth measurement |
| 3 fixed (measuring) jaw  | 9 vernier scale                         |
| 4 sliding (measuring) jaw  | 10 main scale                           |
| 5 measuring faces for external measurements                            | 11 locking screw                        |
| 6 measuring faces for internal measurements (crossed knife-edge faces) | 12 clamping device                      |
- $l_a$  length of jaw  
 $l_b$  length of jaw for internal measurements  
 $l_u$  undercut depth

**Figure 1 — Example for a design of a calliper for external, internal and depth measurement (slider with locking screw or with clamping device)**



**Key**

- |   |   |
|---|---|
| 1 beam                                      | 7 fine adjustment clamp                 |
| 2 slider                                    | 8 knife edges for external measurements |
| 3 fixed (measuring) jaw                     | 9 locking screw                         |
| 4 sliding (measuring) jaw                   | 10 fine adjustment device               |
| 5 measuring faces for external measurements | 11 vernier scale                        |
| 6 measuring faces for internal measurements | 12 main scale                           |
- $l_a$  length of jaw  
 $l_b$  length of jaw for internal measurements  
 $l_c$  width of measuring faces  
 $l_u$  undercut depth

**Figure 2 — Example for a design of callipers for external and internal measurement with a fine adjustment device**

4.2 Dimensions

The dimensions of the elements which are given in Table 1 are typical dimensions.

Table 1 — Dimensions of callipers

Dimensions in millimetres

Measuring range up to	Lengths $l_a$ and $l_b$ of the jaws				Width $l_c$ of the faces for internal measurement
	Calliper according to Figure 1		Calliper according to Figure 2		
	$l_a$	$l_{b,min}$	$l_a$	$l_b$	
150	40	up to 8	—	—	5
200	40 to 50	up to 8	60 to 80	8 to 10	5
250	—	—	70 to 85	10	5
300	60 to 65	up to 10	70 to 100	10	5
400	—	—	100 to 125	20	5 or 10
500	—	—	100 to 150	18 to 20	5 or 10
750	—	—	100 to 150	18 to 20	5 or 10
1 000	—	—	125 to 150	20	10
1 500	—	—	150 to 200	20	10 to 20
2 000	—	—	150 to 200	20	10 to 20

NOTE The measuring range given for the callipers in Figures 1 and 2 refers to the measurement of external dimensions.

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The length of the undercut,  $l_u$ , is typically kept as small as practicable.

4.3 Types of indicating devices

4.3.1 General

Several types of indicating devices exist:

- analogue indicating devices with either a vernier scale or a circular scale (see Figures 3 and 8);
- digital indicating devices with a digital display (see Figure 9).

On callipers with an analogue indicating device, the scale interval and its unit shall be labelled.

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

4.3.2 Analogue indicating devices

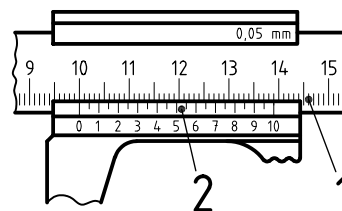
4.3.2.1 General

The scale interval of the main scale on the beam of a calliper with a vernier scale shall be 1 mm. The main scale shall be longer by at least one vernier scale length than the measuring range of the calliper. In the case of callipers with circular scales, the scale interval on the beam may be 1 mm or 2 mm (see Figure 8).

4.3.2.2 Main scale and vernier scale

Key

- 1 main scale
- 2 vernier scale



NOTE The actual reading in this figure is 100,00 mm.

Figure 3 — Example of analogue indicating device with vernier scale

4.3.2.3 Design of vernier scale

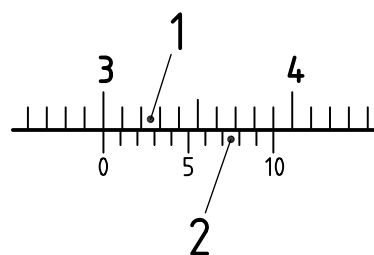
The graduating method of vernier scales is shown in Table 2.

Table 2 — Graduating methods of vernier scales

Dimensions in millimetres

Main scale interval	Graduating method of vernier scales	Nominal vernier scale interval	Explanatory figure
1	Divide 9 mm into 10 equal parts	0,1	Figure 4
1	Divide 19 mm into 10 equal parts	0,1	
1	Divide 19 mm into 20 equal parts	0,05	
1	Divide 39 mm into 20 equal parts	0,05	
1	Divide 49 mm into 50 equal parts	0,02	Figure 5

Examples of vernier scales with vernier intervals of 0,1 mm and 0,02 mm are shown in Figures 4 and 5.

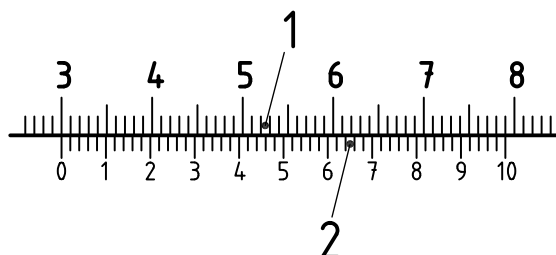


Key

- 1 main scale
- 2 vernier scale

NOTE The actual reading in this figure is 30,0 mm.

Figure 4 — 0,1 vernier scale of length 9 mm



Key

- 1 main scale
- 2 vernier scale

NOTE The actual reading in this figure is 30,00 mm.

Figure 5 — 0,02 vernier scale of length 49 mm