

# INTERNATIONAL STANDARD

**ISO**  
**9960-2**

First edition  
1994-09-01

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## Draughting instruments with or without graduation —

### Part 2: Protractors

**STANDARD PREVIEW**  
**(standards.itech.ai)**

*Instruments de dessin avec ou sans graduation —*  
*Partie 2: Rapporteurs*



Reference number  
ISO 9960-2:1994(E)

## 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.

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.

International Standard ISO 9960-2 was prepared by Technical Committee ISO/TC 10, *Technical drawings, product definition and related documentation*, Subcommittee SC 9, *Media and equipment for drawing and related documentation*.

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ISO 9960 consists of the following parts, under the general title *Draughting instruments with or without graduation*:

- Part 1: *Draughting scale rules*
- Part 2: *Protractors*
- Part 3: *Set squares*

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International Organization for Standardization

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# Draughting instruments with or without graduation —

## Part 2: Protractors

### 1 Scope

This part of ISO 9960 specifies requirements for protractors of the circular and semicircular types for drawing-office use, made from transparent plastics material. This part of ISO 9960 does not apply to protractors made from other materials.

### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9960. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9960 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications*.

ISO 3098-1:1974, *Technical drawings — Lettering — Part 1: Currently used characters*.

ISO 9960-1:1992, *Draughting instruments with or without graduation — Part 1: Draughting scale rules*.

### 3 Definitions

For the purposes of this part of ISO 9960, the definitions given in ISO 9960-1 and the following definition apply.

**3.1 protractor:** Circular or semicircular draughting instrument for angular measurement on which one or more graduations are applied.

### 4 Characteristics and dimensions

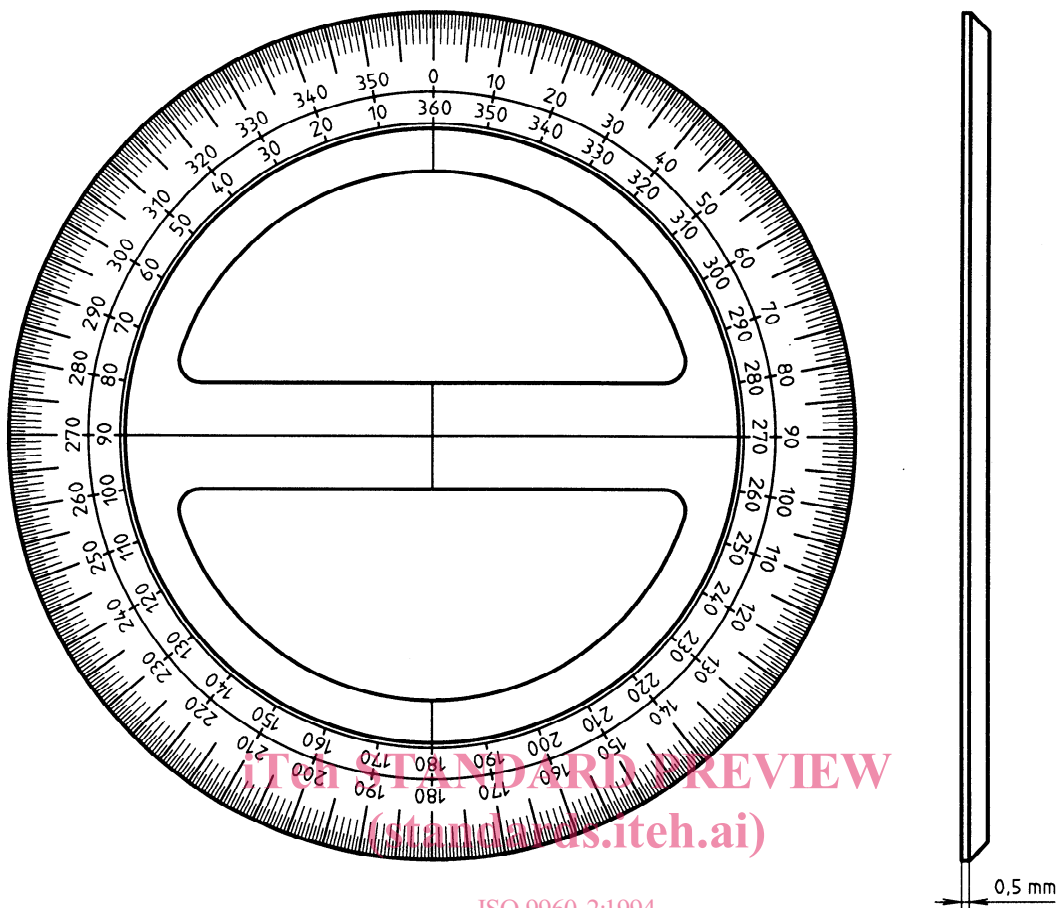
#### 4.1 Marking

The circumferential graduations shall be marked indelibly, preferably in black, on the underside readable from the upper side at maximum intervals of 1° by radial division lines, extending to the working edge. The division lines shall be figured at every 10° interval and shall read from 0 to 360° in both directions (see figure 1).

The centre of the protractor shall be indicated in the same plane as the graduation.

#### 4.2 Characters

Vertical characters of Type A in accordance with ISO 3098-1 shall be used.



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 Figure 1

### 4.3 Edge

The circumferential edge of the protractor may be bevelled on the upper side. The vertical edge thickness shall be not less than 0,5 mm (see figure 1).

### 4.4 Lengths of division lines

The lengths of the division lines shall be selected from the following:

1,8 mm; 2,5 mm; 3,5 mm; 5 mm; 7 mm; 10 mm.

The length of lines for each level of subdivision shall be constant over the protractor.

### 4.5 Limit deviations of lengths of division lines

The limit deviations of the length of the division lines are as follows:

— lengths of 1,8 mm and 2,5 mm:  $\pm 0,3$  mm

— lengths of 3,5 mm and 5 mm:  $\pm 0,5$  mm

— lengths of 7 mm and 10 mm:  $\pm 1$  mm

### 4.6 Widths of division lines

The mean width of division lines measured at the perimeter shall range from:

- a minimum of 0,08 mm to a maximum of 0,13 mm for adjacent division lines where the distance between division lines is not more than 0,5 mm;
- a minimum of 0,09 mm to a maximum of 0,18 mm for adjacent division lines where the distance between division lines is more than 0,5 mm.

The width of each division line shall not differ by more than 10 % from the mean width. In each protractor the same mean width of division lines shall be used, regardless of their length.

#### 4.7 Distance between division lines

The distance between division lines shall be measured between their centres at the perimeter of the protractor. The space between adjacent division lines shall be not less than:

- a) twice the width for division lines where the distance between division lines is not more than 0,5 mm;
- b) three times the width for division lines where the distance between division lines is more than 0,5 mm.

#### 4.8 Protractor dimensions

Protractor dimensions (nominal diameter and nominal thickness) shall comply with table 1. Protractors of tolerance grade 00 are intended for professional use and protractors of tolerance grade 0 are intended for other use.

Flatness tolerances shall be 0,5 mm/100 mm for grade 00 and 0,8 mm/100 mm for grade 0.

The limit deviations of any fixed angle (10° steps) shall be  $\pm 2'$  for grade 00 and  $\pm 4'$  for grade 0.

The change in any linear dimension shall not exceed 1 % for variations in ambient temperature from 10 °C to 30 °C and in relative humidity from 25 % to 100 %.

### 5 Material

The material shall possess toughness, hardness and flexibility sufficient to permit constant handling.

### 6 Designation and marking

The designation of protractors shall consist of the following elements in the order given:

- a) "Protractor";
- b) reference to this part of ISO 9960, i.e. ISO 9960-2;
- c) the shape, i.e. circular (C) or semicircular (S);
- d) the nominal diameter;
- e) the tolerance grade in accordance with table 1.

#### EXAMPLE

Designation for a circular protractor (C) of 150 mm nominal diameter, grade 00:

**Protractor ISO 9960-2 - C 150 - 00**

For protractor marking purposes, item a) of the designation (i.e. the block descriptor "Protractor") may be omitted.

### 7 Inspection

The tests to verify features established in clause 4 shall be carried out under standard test atmosphere 23/50 in accordance with ISO 554, using an optical measuring device with a resolution of not less than  $\pm 1 \mu\text{m}$ .

**Table 1 — Dimensions for protractors**

Dimensions in millimetres

Type	Diameter of protractor			Thickness of protractor	
	Nominal	Limit deviations		Nominal	Limit deviations, grade 00 and grade 0
		Grade 00	Grade 0		
Circular and semi-circular	150	$\pm 1,5$	$\pm 3,5$	1,5	$\pm 0,18$
	200	$\pm 2$	$\pm 5$	2	$\pm 0,24$
	250	$\pm 2,5$	$\pm 6$	2	$\pm 0,24$
	300	$\pm 3$	$\pm 7,5$	2	$\pm 0,24$

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### ICS 01.100.40

**Descriptors:** drawing equipment, protractors, specifications, dimensions, designation, marking.

Price based on 3 pages

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