
**Mechanical pencils for technical
drawings —**

**Part 3:
Black leads — Bending strengths of
HB leads**

Porte-mines pour le dessin technique —

Partie 3: Mines graphite — Résistance à la flexion des mines HB

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 10, *Technical product documentation*.

This second edition cancels and replaces the first edition (ISO 9177-3:1994), of which it constitutes a minor revision. The changes are as follows:

- The first element of the title has been revised for consistency with ISO 9177-1, with the addition of “for technical drawings”.
- Clause 2 has been updated.
- A Bibliography has been added.
- Minor editorial changes.

A list of all parts in the ISO 9177 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document was developed for mechanical pencils and their leads that are limited to technical drawing usage only.

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Mechanical pencils for technical drawings —

Part 3:

Black leads — Bending strengths of HB leads

1 Scope

This document specifies bending strengths and a test method for black leads of HB hardness degree used for mechanical pencils for technical drawings.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

bending strength

quality requirement of lead strength as determined by bending the lead to its breaking point, using a prescribed test method and formula.

4 Bending strength

4.1 General

Bending strength of HB leads used for mechanical pencils shall be tested in accordance with [Clause 5](#) and shall satisfy the requirements specified in [4.2](#).

4.2 Bending strength of HB leads for mechanical pencils

The bending strength (σ) shall be not less than the value specified in [Table 1](#) corresponding to the respective nominal diameter.

Table 1 — Bending strength of HB leads for mechanical pencils

Lead type	Nominal diameter	Minimum bending strength, σ
	mm	MPa
Polymer (P)	0,35 ^a	240
	0,5	190
	0,7	160
	1 ^a	95
Ceramic (C)	2	70

^a Current practice is to label or mark mechanical pencils and boxes 0,3 and 0,9 as applicable. The user should note that leads with new standardized designations apply perfectly well to mechanical pencils with the old designations and vice versa; i.e. 0,35 and 1 correspond respectively to 0,3 and 0,9.

5 Test method

On a lead sample taken at random, bending strength shall be tested as follows:

Arrange the lead test piece as shown in [Figures 1](#) and [2](#) and apply a load on the lead at a distance halfway between the two supporting anvils at the following rates ($\pm 10\%$):

0,5 N/s for 2 mm nominal diameter lead;

0,1 N/s for 0,35 mm, 0,5 mm, 0,7 mm and 1 mm nominal diameter leads.

These loading rates shall be verified beforehand using a rigid test piece instead of a lead.

Determine the load (F) at which the lead has broken and use this value to calculate the bending strength (σ) according to the following formula:

$$\sigma = \frac{8Fl}{\pi d^3}$$

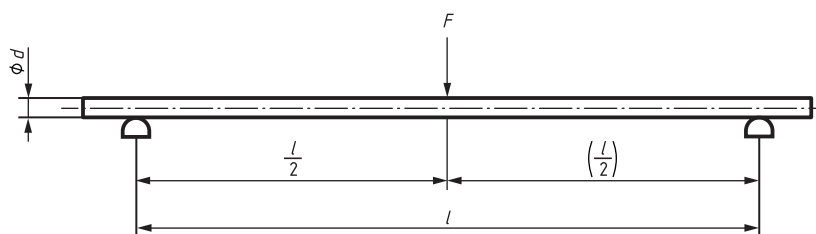
where

σ is the bending strength, in megapascals;

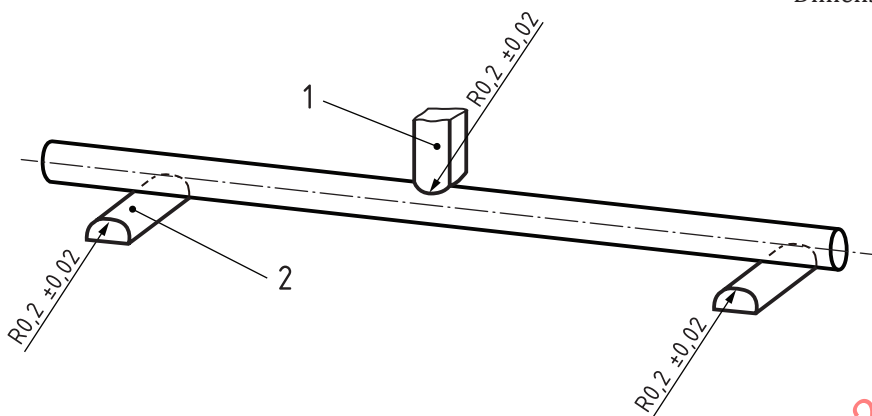
F is the load, in newtons;

l is the distance, in millimetres, between the two supporting anvils according to [Table 2](#);

d is the actual diameter of the lead, in millimetres.

**Figure 1 — Arrangement for bending strength test**

Dimensions in millimetres



Key

- 1 loading anvil
- 2 supporting anvil

Figure 2 — Anvils for bending strength test

Table 2 — Distance between the two supporting anvils

Dimensions in millimetres

Lead type	Nominal diameter	Distance
		<i>l</i>
P	0,35; 0,5; 0,7 and 1	20 to 40
C	2	40 to 60

6 Test report

The test report shall contain the following information:

- a) reference to this document;
- b) lead type (P or C);
- c) actual diameter (relating to the nominal diameter) of the lead under test;
- d) test values for *F* and *l*;
- e) bending strength as evaluated according to [Clause 5](#);
- f) name of test centre, date and signature of person carrying out the test.