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Mechanical pencils and leads for general use – Classification, dimensions, quality and test methods –
Part 2: Black leads (ISO 20318-2:2019, IDT)

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Den internationella standarden ISO 20318-2:2019 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 20318-2:2019.

The International Standard ISO 20318-2:2019 has the status of a Swedish Standard. This document contains the official English version of ISO 20318-2:2019.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Skriv- och ritmateriel, SIS/TK 507/AG 07.

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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*.

A list of all parts in the ISO 20318 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 in response to the recent increase in popularity of mechanical pencils and their leads among students who use them for general writing, and where varieties of both hardness degrees and thickness (designated as marking diameter) of leads have been expanding in response to different types of usage. It should be noted that the entire production volume of mechanical pencils has been increasing every year, whereas the production of mechanical pencils for technical drawings has been decreasing.

Despite those recent trends, ISO 9177-1 was revised in 2011 with a scope limited to technical drawing usage only.

Therefore, it is clear that this document is necessary for general use and that it should be independent of technical drawings. The ISO 20318 series consists of two parts: mechanical pencils and black leads.

A set of a mechanical pencil and lead of the same marking diameter should be completely complementary, and should be compatible even with pencils and lead from different manufacturers.

It should also be noted that there are two issues which have not been resolved since the first relevant standard was published. First, on marking of labelling the diameters on mechanical pencils and cases of leads, two designations coexist: 0,35 and 0,3 and 1 and 0,9. This document attempts to clarify this designation issue by defining diameters precisely. Second, a scientific definition of hardness degree of leads is not yet available. Even though this document tried to establish a solely quantitative evaluation method, qualitative evaluation turned out to be inevitable. The issue, therefore, remains unresolved.

The title of the 2016 third edition of ISO 9177-1 was revised to distinguish it clearly from this document with the addition of “for technical drawings”.

Mechanical pencils and leads for general use — Classification, dimensions, quality and test methods —

Part 2: Black leads

1 Scope

This document specifies classification, dimensions, quality and test methods for black leads used for mechanical pencils for general writing, as specified in ISO 20318-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 5-3:2009, *Photography and graphic technology — Density measurements — Part 3: Spectral conditions*

ISO 12757-1, *Ball point pens and refills — Part 1: General use*

ISO 14145-1, *Roller ball pens and refills — Part 1: General use*

ISO 20318-1, *Mechanical pencils for general use — Classification, dimensions, quality and testing methods — Part 1: Mechanical pencils*

JIS S 6005, *Leads for mechanical pencils*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20318-1 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
black lead
solid writing material for mechanical pencil, which consists of black colour materials (e.g. graphite) and a binding agent, generating lines which are erasable

3.2
hardness degree
combination of two alphanumeric or alphabetical symbols used to indicated the hardness and density (darkness) of the lead when used in writing

Note 1 to entry: See Table 1.

Note 2 to entry: Hardness increases from 6B to 9H, density of line increases from 9H to 6B.

Note 3 to entry: HB represents the median hardness degree.

Note 4 to entry: A scientific definition of hardness degree is not yet available

3.3
marking diameter
numerical symbol used to classify leads by thickness (diameter) of lead

Note 1 to entry: These are used to label or mark lead boxes to indicate a corresponding mechanical pencil specified in ISO 20318-1.

4 Classification

Black leads for mechanical pencils for general use shall be classified according to the hardness degree and the marking diameter as specified in Table 1.

Table 1 — Classification

Dimensions in millimetres

Marking diameter (see 3.3)	**Hardness degree** (see 3.2)	**Informative** **Nominal diameter** (see ISO 9177-2)
0,2	F, HB, B, 2B	—
0,3	4H, 3H, 2H, H, F, HB, B, 2B	0,35
0,4		—
0,5	4H, 3H, 2H, H, F, HB, B, 2B, 3B, 4B	0,5
0,7	4H, 3H, 2H, H, F, HB, B, 2B	0,7
0,9	4H, 3H, 2H, H, F, HB, B, 2B, 3B, 4B	1
1,3	2H, H, F, HB, B, 2B	—
1,4		—[a]
2	9H, 8H, 7H, 6H, 5H, 4H, 3H, 2H, H, F, HB, B, 2B, 3B, 4B, 5B, 6B	2

[a] 1,4 is the line width specified in ISO 128-20.

5 Quality

5.1 Bending strength

The bending strength of black leads shall conform to the specifications in Table 2, in which the minimum value is specified for each marking diameter when tested in accordance with 7.2.

Table 2 — Bending strength of black lead

Dimensions in MPa

Hardness degree	**Bending strength** **Marking diameter** (mm)								
	0,2	0,3	0,4	0,5	0,7	0,9	1,3	1,4	2
9H, 8H, 7H	—	—	—	—	—	—	—	—	80
6H, 5H	—	—	—	—	—	—	—	—	75
4H, 3H	—	265	230	200	180	105	—	—	
2H, H							95	90	
F, HB	300	240	215	190	160	95	85	80	70
B, 2B	230	220	185	150	140	90	80	70	40
3B, 4B	—	—	—	130	—	80	—	—	30
5B, 6B	—	—	—	—	—	—	—	—	20

5.2 Hardness degree

The hardness degree of black leads shall be evaluated quantitatively and qualitatively, because its scientific definition is not yet available (see 3.2).

It shall be specified quantitatively as the writing density by using a line-drawing device. The writing density of HB shall conform to the specification of A (recording type) or B (spiral type) in Table 3, and for the leads of the same brand, the order of writing density shall not reverse or alter in the order of the hardness degree, when tested in accordance with 7.3.2 a) to c).

Furthermore, it shall be confirmed qualitatively in the order of the density and the hardness by handwriting. The order of density and hardness of the same brand leads shall not reverse or alter in the order of the hardness degree, when tested in accordance with 7.3.3.

Table 3 — The writing density of HB

Marking diameter (mm)	Type of line-drawing device	
	A: Recording type	B: Spiral type
0,2	0,15 to 0,30	0,25 to 0,45
0,3		
0,4	0,25 to 0,45	
0,5		
0,7		0,30 to 0,50
0,9		
1,3		
1,4		
2		

6 Dimensions

The actual diameter of black lead shall conform to the specifications in Table 4 when measured in accordance with 7.4.

The length of leads for marking diameter 0,2 mm to 1,4 mm should be (60 ± 1) mm, and that of marking diameter 2 mm should be (130 ± 1) mm, respectively. However, the length may be any dimension as selected upon agreement between the purchaser and the supplier.

Table 4 — Dimensions of black lead

Dimensions in millimetres

Diameter of leads		Length	Informative
Marking diameter	Range of actual diameter of the lead for mechanical pencils	Recommended value	Nominal diameter (see ISO 9177-2)
0,2	0,27 to 0,29	60 ± 1	—
0,3	0,37 to 0,39		0,35
0,4	0,46 to 0,48		—
0,5	0,55 to 0,58		0,5
0,7	0,69 to 0,73		0,7
0,9	0,88 to 0,92		1
1,3	1,25 to 1,32		—
1,4	1,37 to 1,44		—[a]

Table 4 *(continued)*

Diameter of leads		Length	Informative
Marking diameter	**Range of actual diameter of the lead for mechanical pencils**	**Recommended value**	**Nominal diameter** (see ISO 9177-2)
2	1,95 to 2,05	130 ± 1	2
[a] 1,4 is the line width specified in ISO 128-20.			

7 Test methods

7.1 Test conditions

Unless otherwise specified, the test shall be carried out at the ordinary temperature (20 ± 15) °C and ordinary relative humidity (65 ± 20) %.

7.2 Bending strength

The sample for the bending strength test shall be 10 leads taken at random from the smallest container. If 10 leads or fewer are contained in the smallest container, all the leads shall be taken for the sample.

The test method is that shown in Figure 1. Apply a load on the lead at the constant rate of 10 mm/min and at a distance halfway between the two supporting anvils as specified in Table 5. Next, measure the load at the time when the lead is broken, and calculate the bending strength using Formula (1).

$$\sigma = \frac{8Fl}{\pi d^3} \tag{1}$$

where

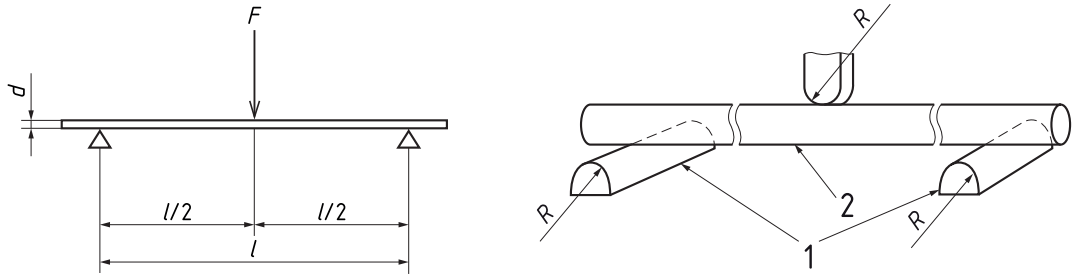
σ is bending strength (MPa);

F is load (N) average of 10 samples or all samples if fewer than 10;

l is distance between supporting anvils (mm) actual performance value based on Table 4;

d is diameter of lead (mm).

The shape of the tops (radius R) for applying load and of the two supporting anvils shall be such that R = (0,2 ± 0,02) mm.



Key

1 supporting anvil
2 lead
F load (N)
d diameter of lead (mm)
l distance between supporting anvils (mm) actual performance value based on Table 4
R radius (mm)

Figure 1 — Method for bending strength test

Table 5 — Distance between the supporting anvils

Dimensions in millimetres

Marking diameter	Distance
0,2; 0,3; 0,4; 0,5; 0,7; 0,9; 1,3; and 1,4	20 to 40
2	40 to 60

7.3 Hardness degree

7.3.1 General

The sample for the hardness degree test shall use five leads taken at random from the smallest container. If five leads or fewer are contained in the smallest container, all leads shall be taken as samples.

7.3.2 Writing density

The writing density test shall be as follows:

a) Using a line-drawing device either of recording type (A method) as shown in Figure 2 and Figure 3, or of spiral type (B method) as shown in Figure 4 and Figure 5, draw a line with the sample on line-drawing paper which has been conditioned in advance at the temperature and the relative humidity specified in Table 6 for 12 h or more.

b) Measure the density of the line at the middle of line-drawing width, either at four positions in the case of method A as shown in Figure 3 or at three positions in the case of method B as shown in Figure 5, using a densitometer.

The measuring conditions shall be as shown in Table 6.