INTERNATIONAL STANDARD

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Third edition
2017-11

Gel ink ball pens and refills —

Part 1: General use

Stylos à bille à encre gel et recharges —

Partie 1: Utilisation générale

Reference number
ISO 27668-1:2017(E)

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Foreword

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

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

This third edition cancels and replaces the second edition (ISO 27668-1:2016), of which it constitutes a minor revision, with changes in Clause 2 and 5.2.

A list of all parts in the ISO 27668 series can be found on the ISO website.

Introduction

This document is applicable to gel ink ball pens for general use.

ISO 27668-2 is applicable to gel ink ball pens for documentary use.

For documentary use, some requirements, in addition to those for general use, are necessary

a) to ensure the legibility of lettering, and

b) for the handling and storage of documents over long periods of time (these requirements are often discussed with the archivist).

An example of documentary use is the preparation of documents that are required as evidence.

Furthermore, pens which meet the requirements for documentary use produce lines which are more resistant to modification (e.g. attempts to falsify a document) than those for general use.

Gel ink ball pens and refills —

Part 1:
General use

1 Scope

This document establishes minimum quality requirements for gel ink ball pens (refillable and non-refillable) and refills for general use.

Additional requirements for gel ink ball pens for documentary use are given in ISO 27668-2.

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 105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 105-B02, *Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test*

ISO 534, *Paper and board — Determination of thickness, density and specific volume*

ISO 535, *Paper and board — Determination of water absorptiveness — Cobb method*

ISO 536, *Paper and board — Determination of grammage*

ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 2144, *Paper, board and pulps — Determination of residue (ash) on ignition at 900 degrees C*

ISO 5627, *Paper and board — Determination of smoothness (Bekk method)*

ISO 8791-4, *Paper and board — Determination of roughness/smoothness (air leak methods) — Part 4: Print-surf method*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
pen
writing instrument equipped with a feeding system which deposits a writing fluid on a surface

Note 1 to entry: It is available in refillable or non-refillable (disposable) form.

3.2
ball pen
pen with a writing fluid feeding system based on a rotatable ball writing tip integrated either within the pen itself or within a refill

3.3
gel ink ball pen
ball pen which deposits a writing fluid whose viscosity decreases markedly with rotation of the ball when writing and increases back to or near to the original viscosity in non-movement, i.e. when not writing

Note 1 to entry: See Annex A.

3.4
cartridge
disposable container for the writing fluid, which is detached when empty and replaced by a (new) full container

Note 1 to entry: Adapted from ISO 9175-1:1988, 3.4.

3.5
refill
identifiable assembly of components, usually removable from a complete pen, with which it is possible to write independently of the complete pen, but which lacks either characteristics or components which would make it suitable for use as a pen

3.6
write test machine
device for mechanically generating a line with a pen or refill on a writing surface and which can be adjusted for

— a writing angle between 60° and 90°,

— writing load from 0,1 N to 5 N,

— writing speed between 1 m/min and 10 m/min, and

— line pitch between 1 mm and 5 mm,

with a continuous spiral line (100 mm circumference) and a fixed or rotating motion along the longitudinal axis of the pen or refill; the writing surface is to be placed on a polished stainless steel plate

[SOURCE: ISO 12756:2016, 3.1.7]

3.7 Test parameters

3.7.1 Resistance to chemical influences including water

3.7.1.1
water resistance
ability of a line written on specified testing paper to remain visible after immersion in distilled or deionized water for a specified length of time

3.7.1.2
ethanol resistance
ability of a line written on specified testing paper to remain visible after immersion in a specified ethanol solution for a specified length of time

3.7.1.3
hydrochloric acid resistance
ability of a line written on specified testing paper to remain visible after immersion in a specified hydrochloric acid solution for a specified length of time

3.7.1.4
ammonium hydroxide resistance
ability of a line written on specified testing paper to remain visible after immersion in a specified ammonium hydroxide solution for a specified length of time

3.7.1.5
bleaching resistance
ability of a line written on specified testing paper to remain visible after treatment in a specified bleaching solution for a specified length of time

3.7.2 Resistance to physical influences

3.7.2.1
erasure resistance
ability of a line written on specified testing paper to resist erasure using specified procedures with a specified eraser without altering the surface of the testing paper

3.7.2.2
light resistance
ability of a line written on specified testing paper to remain visible after exposure to specified light for a specified length of time

3.7.3 Other parameters

3.7.3.1
strike through
condition in which a writing fluid has penetrated through specified testing paper so as to appear on the opposite side of the paper from the written line

3.7.3.2
drying time
length of time required for a line drawn on specified testing paper to become non-smearing

Note 1 to entry: The drying time test estimates the resistance to transference to skin and to superimposed paper, under specified conditions.

3.7.3.3
reproducibility
ability of an original written line to be reproduced by a specified photocopier, microfilm processor or telefacsimile machine

3.7.3.4
shelf life
minimum expected storage life, measured from the date of manufacture, during which the product maintains its specified performance when stored under specified conditions, and during which the pen or refill is unused

3.7.3.5
cap-off time
length of time during which unused roller ball pen and gel ink ball pen maintain their writing ability when stored horizontally without their cap after writing

3.7.3.6
writing speed
rate of line generation

3.7.3.7
point load
vertical component of force applied to a writing tip during line generation

3.7.3.8
writing angle
included angle measured from the plane of the writing surface to the longitudinal axis of a pen or refill when in writing position

4 Requirements

4.1 Tip classification

Tips shall be classified according to the ball diameter (see Table 1).

Table 1 — Tip classification

Dimensions in millimetres

Tip classification (line width)	**Tip code**	**Ball diameter**
Ultra fine	UF	Ø < 0,40
Extra fine	EF	0,40 ≤ Ø < 0,55
Fine	F	0,55 ≤ Ø < 0,75
Medium	M	0,75 ≤ Ø < 1,00
Broad	B	1,00 ≤ Ø

4.2 Shapes and dimensions of refills

Refills shall be classified into types J, K, L, G2 and N. The shapes and dimensions of types J, K and L are given in Figure 1 and Table 2. The shape and dimensions of type G2 are given in Figure 2 and Table 3. Refills with shapes and dimensions other than those specified in Figure 1 and Figure 2 are designated type N.

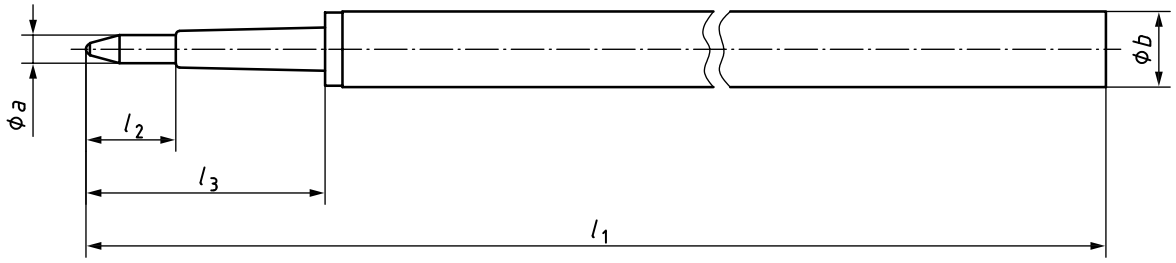

Figure 1 — Refill types J, K and L

Table 2 — Refill types J, K and L

Dimensions in millimetres

Type	l_1	l_2 min	l_3	a	b
J	111 ± 1,0	7,7	21 ± 1,5	2,3 ± 0,05	5,5 ± 0,15
K	111 ± 1,0	7,7	20 ± 1,5	2,3 ± 0,05	6,1 ± 0,15
L	111 ± 1,0	8,9	20 ± 1,5	2,5 ± 0,05	6,0 ± 0,15

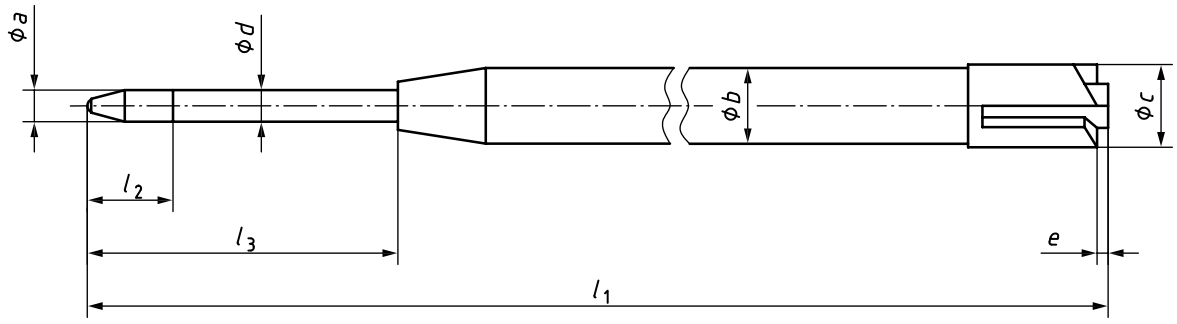

Figure 2 — Refill type G2

Table 3 — Refill type G2

Dimensions in millimetres

Type	l_1	l_2	l_3	a	b	c	d	e
G2	$98{,}1^{+0{,}40}_{-0{,}35}$	6,2 ± 0,2	23,2 ± 1	$2{,}54^{+0{,}03}_{-0{,}04}$	5,8 ± 0,1	$6^{+0{,}1}_{-0{,}2}$	2,4 ± 0,1	0,6 ± 0,2

4.3 Performance

4.3.1 Writing performance

Smooth writing shall start within 10 cm and the writing distances shall be at least those specified in Table 4, without obvious starving or fluctuation of line intensity, when tested as specified in 6.3.1.

Table 4 — Writing distance

Dimensions in metres

Tip classification (line width)	Tip code	Writing distance min
Ultra fine	UF	400
Extra fine	EF	400
Fine	F	300
Medium	M	150
Broad	B	100

4.3.2 Strike through

No strike through shall be evident to a trained eye when tested as specified in 6.3.2.

4.3.3 Drying time

The line shall be found non-smearing when tested as specified in 6.3.3.

4.3.4 Reproducibility

The reproduced line shall be visible when tested as specified in 6.3.4.

4.3.5 Water resistance

The line shall remain visible when tested as specified in 6.3.5.

NOTE This performance is optional and is only applicable to gel ink ball pens or refills marked "water resistant" (WR).

4.3.6 Light resistance

The line shall remain visible when tested as specified in 6.3.6.

4.3.7 Cap-off time

The gel ink ball pen shall start writing within 10 cm without starving when tested as specified in 6.3.7.

4.3.8 Shelf life

The gel ink ball pen or refill shall conform with 4.3.1 when tested as specified in 6.3.8.

5 Test equipment and accessories

5.1 Write test machine

The write test machine shall be set to each of the following conditions when performing the machine write test:

a) point load: 0,5 $^{0}_{-0,1}$ N for tip code UF, and 1 $^{0}_{-0,3}$ N for tip codes EF, F, M and B;

b) writing angle: test write a sample at 60° $^{+5°}_{0}$ and 70° $^{0}_{-5°}$ to determine at which angle the trace is most consistent and select this angle;

c) writing speed: 4,5 m/min ± 0,5 m/min; and

d) writing pattern: continuous spiral line (100 mm circumference) with a pitch between 2 mm and 5 mm.

5.2 Performance testing paper

The performance testing paper shall conform to the specifications given in either Table 5 or Table 6.

Table 5 — Testing paper A

Specification		Reference International Standard
Grammage	80 g/m² ± 5 g/m²	ISO 536
Smoothness	3 µm ± 0,25 µm	ISO 8791-4
Residue after incineration	(11 ± 1) % residue (ash) at 900 °C	ISO 2144
Cobb value	18 g/m² ± 2 g/m² (45") (≙$Cobb_{60}$ = 20 g/m² ± 3 g/m²)	ISO 535
Thickness	80 µm ± 5 µm	ISO 534
Colour	White	—
Composition	100 % wood cellulose fibre, bleached	—
NOTE This paper was previously designated for ball point pens.		

Table 6 — Testing paper B

Specifications		Reference International Standard
Grammage	70 g/m^2 ± 10 g/m^2	ISO 536
Smoothness	50 s ± 30 s	ISO 5627
Residue after incineration	$\begin{pmatrix} +2 \\ 7 \\ -3 \end{pmatrix}$ % residue (ash) at 900 °C	ISO 2144
Cobb value, $Cobb_{60}$	25 g/m^2 ± 10 g/m^2	ISO 535
Thickness	80 µm ± 10 µm	ISO 534
Colour	White	—
Composition	100 % wood cellulose fibre, bleached	—
NOTE This paper was previously designated for roller ball pens and gel ink ball pens.		

5.3 Eraser

Eraser, without abrasive and with a hardness of (45 ± 5) Shore A in accordance with ISO 868.

5.4 Reproducibility apparatus

Photocopier, microfilm processor or telefacsimile machine.

5.5 Light test apparatus

Fade-o-meter, xenotest or technical equivalent.

6 Testing

6.1 Sampling

Gel ink ball pen and refill samples shall be tested within six months of manufacture, except for the shelf life test (see 6.3.8).

6.2 Climatic conditions for testing

The test shall be carried out under a standard test atmosphere of either 23/50 (23 °C, 50 % relative humidity) or 27/65 (27 °C, 65 % relative humidity) and according to conditions at the place of testing. Ordinary tolerances (temperature ± 2 °C, relative humidity ± 5 %) are to be applied.

NOTE The resultant limits of relative humidity are therefore: (45 % to 55 %) and (60 % to 70 %).

6.3 Procedure

6.3.1 Writing performance test

Take a quantity of at least 10 gel ink ball pens and/or refills at random. Generate a continuous line as specified in Table 4 on the testing paper specified in 5.2 by the write test machine specified in 5.1 under the climatic conditions specified in 6.2.

At the start and finish of the writing distance, examine for conformity with 4.3.1.

Use this machine-written test sheet for the following tests, except for 6.3.3 (drying time test), 6.3.7 (cap-off test) and 6.3.8 (shelf life test).

6.3.2 Strike through test

Prepare a machine-written test piece approximately 5 cm long, without the beginning and end of a written line, from the test sheet provided in 6.3.1 and keep it under the climatic conditions specified in 6.2 for 24 h.

Examine the back of the testing paper for conformity with 4.3.2.

6.3.3 Drying time test

Draw a straight line in accordance with 5.1 a), b) and c) on the testing paper specified in 5.2. After 20 s, rub once perpendicularly across the written line with the eraser specified in 5.3.

Examine the line for conformity with 4.3.3.

6.3.4 Reproducibility test

Reproduce the written line from a machine-written test piece approximately 5 cm long from the test sheet provided in 6.3.1 using the apparatus specified in 5.4.

Examine the reproduced line for conformity with 4.3.4.

6.3.5 Water resistance test

Keep a machine-written test piece approximately 5 cm long from the sheet provided in 6.3.1 under the climatic conditions specified in 6.2 for 2 h, then immerse in distilled water or deionized water for 1 h. Remove and allow to air dry.

Examine the written line of the test piece for conformity with 4.3.5.

6.3.6 Light resistance test

Expose a machine-written test piece approximately 5 cm long from the test sheet provided in 6.3.1 to the light source of the apparatus specified in 5.5, together with the blue wool references specified in ISO 105-B02, until the contrast between the unexposed and the exposed blue wool reference 3 becomes equal to grey scale grade 4 specified in ISO 105-A02.

Examine the written line of the test piece for conformity with 4.3.6.

6.3.7 Cap-off time test

Remove the cap from the unused gel ink ball pen and expose the writing tip. After establishing flow, keep it horizontally under the climatic conditions specified in 6.2 for 24 h.

Hand-write a straight line and examine it for conformity with 4.3.7.

6.3.8 Shelf life test

Select a quantity of at least 10 recently manufactured and unused gel ink ball pens and/or refills complete with caps. Store horizontally at a temperature of (40 ± 2) °C and at a relative humidity of (55 ± 5) % for 90 days.

Test in accordance with 6.3.1 and examine for conformity with 4.3.8.

7 Designation and marking

7.1 Designation

The designation of a gel ink ball pen or refill shall comprise, in the given order, the following elements:

a) the description block (e.g. “gel ink ball pen” or “gel ink ball refill”);

b) the number of this document (i.e. ISO 27668-1);

c) the type classification code for refills (see 4.2);

d) the tip classification code (UF, EF, F, M or B; see Table 1); and

e) the classification code for water resistant (WR), if applicable.

EXAMPLES A disposable gel ink ball pen complying with the requirements of this document, with medium-sized tip (M), shall be designated as follows:

Gel ink ball pen ISO 27668-1 **M**

A gel ink ball refill complying with the requirements of this document, type K, with broad sized tip (B), water resistant (WR), shall be designated as follows:

Gel ink ball refill ISO 27668-1 **K B WR**

7.2 Marking

For identification, disposable gel ink ball pens or refills shall be marked as follows:

a) the name of the manufacturer, supplier or trademark;

b) the designation in accordance with 7.1 [except 7.1 a), which is optional]; and

c) the date of manufacture (year/month, in full or coded) or the batch number.

8 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 27668-1;

b) the date and place of the test;

c) precise identification of the samples (see 7.2);

d) identification of the following variable or optional requirements:

   1) test atmosphere (see 6.2),

   2) writing angle and writing pitch (see 5.1),

   3) testing paper (see 5.2),

   4) reproducibility apparatus (see 5.4), and

   5) light test apparatus (see 5.5);

e) the results in accordance with this document;

f) any deviations from the specified procedures (see Clauses 5 and 6); and

g) the identification and signature of the tester.

Annex A
(informative)

Explanatory note on gel ink

In order to assist in understanding the "degree of decrease and/or increase in viscosity of a writing fluid" in the definition of a gel ink ball pen (see 3.3), some provisions on gel ink from the Japanese Standard JIS S 6061:2005[4] are provided below.

5.1 Gel ink quality

When tested according to 8.3.1, the quality of gel ink shall have a viscosity ratio (η_1/η_2) of 2,0 or more, and an apparent viscosity (η_3) of 20 mPa·s or more.

7.1 Viscometer

Cone-plate rotational viscometer (E-type viscometer) specified in JIS Z 8803 or other testing apparatus equivalent in technological level.

NOTE The cone rotor should have an angle of 1° 34′ between cone and plate, and standard rotor with 24 mm radius is recommended.

8.3.1 Gel ink viscosity test

Measurements shall be made according to the method in JIS Z 8803, Clause 9, at temperature of (23 ± 2) °C with viscometer specified in 7.1.

a) Apparent viscosity (η_1) is measured at any shear-rate of 3 s^{-1} to 50 s^{-1}. Then, apparent viscosity (η_2) at 10 times the initial shear-rate is measured, and viscosity ratio (η_1/η_2) is calculated to check whether it meets the requirements in 5.1.

b) Apparent viscosity (η_3) is measured at any shear-rate of 383 s^{-1} or more to check whether it meets the requirements in 5.1.

NOTE Shear-rate is the ratio of change in fluidity of liquid to laminar flow velocity at right angle, also known as shear rate.

Bibliography

[1] ISO 9175-1, *Tubular tips for hand-held technical pens using India ink on tracing paper — Part 1: Definitions, dimensions, designation and marking*

[2] ISO 12756, *Drawing and writing instruments — Ball point pens and roller ball pens — Vocabulary*

[3] ISO 27668-2, *Gel ink ball pens and refills — Part 2: Documentary use (DOC)*

[4] JIS S 6061, *Gel ink ball pens and refills*

[5] JIS Z 8803, *Viscosity of liquid — Methods of measurement*

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