SOUTH AFRICAN STANDARD

Specification

Stationery — Marking pens for text highlighting
SABS 1872
Ed. 1
SOUTH AFRICAN BUREAU OF STANDARDS

SPECIFICATION

STATIONERY — MARKING PENS FOR TEXT HIGHLIGHTING

Obtainable from the

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Republic of South Africa
0001

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South African Bureau of Standards
Notice

This standard was approved in accordance with SABS procedures on 9 October 2002.

Manufacturers producing marking pens for text highlighting to this standard may, under a mark permit issued by the SABS, apply the certification mark as illustrated above to the commodity as evidence to the purchaser that the commodity is being made in accordance with the standard and that compliance with its requirements is ensured by tests and inspections carried out by the SABS.

NOTE 1 In terms of the Standards Act, 1993 (Act 29 of 1993), it is a punishable offence for any person other than a mark permit holder to apply a certification mark to a commodity or to refer to the SABS or any of its standards in a manner likely to create the impression that the commodity has been approved by the SABS. Furthermore, no person shall claim or declare that he or any other person complied with an SABS standard unless

a) such claim or declaration is true and accurate in all material respects, and

b) the identity of the person on whose authority such claim or declaration is made, is clear.

NOTE 2 It is recommended that authorities who wish to incorporate any part of this standard into any legislation in the manner intended by section 31 of the Act consult the SABS regarding the implications.

This standard will be revised when necessary in order to keep abreast of progress. Comment will be welcome and will be considered when the standard is revised.

Foreword

Annexes A and B form an integral part of this standard. Annex C is for information only.
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This South African standard was approved by SABS TC 5140.03, Stationery and office requisites.

The following organizations were represented on SABS TC 5140.03 when edition 1 was approved:

Afrikaanse Handelsinstituut
Apex Rolfe
Bic South Africa (Pty) Ltd
Eldon Stationery Co (Pty) Ltd
Gauteng Office of Consumer Affairs
Helix (SA) (Pty) Ltd
National Office Products & Stationery Association of Southern Africa
Penflex (Pty) Ltd
Pentel South Africa
Scola Quip (Pty) Ltd
Staedtler (SA) (Pty) Ltd
Testing and Conformity Services (Pty) Ltd
White Point (Pty) Ltd

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Committee administrator – DA Duval (SABS Standards)

First published October 2002
SPECIFICATION

Stationery — Marking pens for text highlighting

1 Scope

This standard specifies the constructional and performance requirements for marking pens used for text highlighting. The standard applies to marking pens where the ink is stored in a fibrous reservoir. It excludes any free ink products.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards can be obtained from the South African Bureau of Standards.


JIS S 6037, *Marking pens*.

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

SABS ISO 554, *Standard atmospheres for conditioning and/or testing – Specifications*.


SABS ISO 11540, *Caps for writing and marking instruments intended for use by children up to 14 years of age – Safety requirements*. 
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3 Definitions

For the purpose of this standard the following definitions apply:

3.1 acceptable
acceptable to the authority administering this standard or to the parties concluding the purchase contract, as relevant

3.2 chroma
figure used during colour measurement to indicate the saturation of the colour

3.3 drainage (drain-back)
diffusion of the ink within the reservoir as a result of storage of the marking pen in either the vertical or the horizontal position

3.4 drying time
time needed for the ink to dry after application to standard test paper

3.5 flash
overflow of plastics at the parting line of a mould, when subjected to full pressure

3.6 hiding power
ability of the ink to hide the underlying text

3.7 highlighter
marking pen for text highlighting

3.8 hue
quality of a colour as determined by its dominant wavelength

3.9 ink, dye based
ink, the colour of which is obtained by dissolved colour agents

3.10 ink, pigment based
ink, the colour of which is obtained by dispersed colour agents

3.11 lightness
figure used during colour measurement to indicate the lightness of the colour

3.12 reservoir
container for the ink inside the barrel, also referred to as pen filler or filter or fibre rod
3.13 solvent loss
loss of solvent from the ink as a result of storage of the marking pen at relatively high temperatures for specific time periods

3.14 starving
fading of the ink intensity, possible during writing performance

3.15 “store-frost” protected
treated so as to prevent the solids in the dye from precipitating out of solution when stored at relatively low temperatures

3.16 strike-through
penetration of the ink through standard paper to be visible on the reverse side

4 Requirements

4.1 General

The components of the marking pen shall be assembled to form a durable and airtight unit. The marking pen shall not corrode or develop defects in normal service or storage. The fully assembled marking pen shall, when viewed with the naked eye, be seen to be flash-free. Materials used shall contain no poisonous ingredients in a quantity toxic to humans.

4.2 Components

4.2.1 Barrel

4.2.1.1 Ventilation

The marking pen shall be adequately vented within the structure.

4.2.1.2 End plug (back plug)

If a plug is present, it shall fit firmly into the back end of the barrel, and shall comply with the relevant requirements of BS 7272-2.

4.2.2 Cap

4.2.2.1 Airtight fit

The cap shall fit firmly over the tip and, when tested in accordance with 5.3, shall seal up to a maximum pressure of 4 psi (no bubbles shall escape across the entire surface area of the marking pen with its cap).

4.2.2.2 Safety

The cap shall comply with the relevant requirements of SABS ISO 11540.
4.2.3 Writing tip

4.2.3.1 Tip line width

The tip shall be able to produce a line width that falls within either or both of the following ranges:

a) 1 mm to 3 mm; and

b) > 3 mm to 5 mm.

4.2.3.2 Increase in line width after application of a known force on the tip

When tested in accordance with the tip push-down test in 5.4, the tip shall produce a line width with a maximum increase of 15 % from its original width.

4.2.4 Ink

The ink shall be homogeneous with no objectionable odour, shall contain no poisonous ingredient in a quantity toxic to humans and shall comply with ASTM D 4236. The ink shall not dissolve or react with the components of the marking pen with which it has direct contact. The colour of the ink, as required (see annex A), may be obtained by either dissolved colour agents (see 3.9) or dispersed colour agents (see 3.10). The ink may contain a fluorescent agent, as required (see annex A) and shall be “store-frost” protected (see 3.15).

4.2.5 Reservoir

The reservoir system shall be of the capillary type where ink is absorbed through capillary forces.

4.3 Performance

4.3.1 Writing performance

When tested in accordance with 5.5.1 or 5.5.2, the lines drawn shall be vivid, smooth and without obvious starving or fluctuations of intensity.

4.3.2 Strike-through

When the test paper used in 5.5.1 is reversed and the beginning and end of the drawn lines ignored, there shall be no sign of strike-through.

4.3.3 Drainage

When tested in accordance with 5.6, the lines drawn with all the marking pens shall comply with the requirements of 4.3.1.

4.3.4 Drying time

When tested in accordance with 5.7, the writing shall be dry within 5 s and shall not smudge.

4.3.5 Solvent loss

When tested in accordance with 5.8, the marking pen shall not lose more than 0,5 % of its mass.
4.3.6 Hiding power

When visually inspected, lines drawn as described in 5.5.1 shall not hide the following types of underlying text: printed text, faxed text (on standard and thermal fax paper) and handwritten characters with ballpoint pen on standard test paper.

4.3.7 Fax resistance on thermal fax paper

When tested in accordance with 5.9, the highlighted areas on the fax paper may lose brilliancy, but shall not change colour, or darken, or hide the underlying text.

4.3.8 Light fastness (resistance to fading) of ink on paper

When determined in accordance with 5.10, colour change values shall comply with table 2.

Table 2 — Evaluation of colour change — Maximum numerical values for ∆L*, ∆C* and ∆H*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dye ink</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour</td>
<td>∆L* max.</td>
<td>∆C* max.</td>
<td>∆H* max.</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>2,0 (–)</td>
<td>6,0 (–)</td>
<td>2,5 (–)</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>2,5 (–)</td>
<td>10,5 (–)</td>
<td>6,5 (+)</td>
<td></td>
</tr>
<tr>
<td>Violet</td>
<td>8,5 (+)</td>
<td>18,0 (–)</td>
<td>27,5 (+)</td>
<td></td>
</tr>
<tr>
<td>Pink</td>
<td>7,0 (+)</td>
<td>24,5 (–)</td>
<td>12,5 (+)</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>2,0 (–)</td>
<td>16,0 (–)</td>
<td>7,5 (+)</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>5,0 (–)</td>
<td>8,5 (–)</td>
<td>4,5 (–)</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>13,5 (+)</td>
<td>33,5 (–)</td>
<td>36,5 (+)</td>
<td></td>
</tr>
<tr>
<td><strong>Pigment ink</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour</td>
<td>∆L* max.</td>
<td>∆C* max.</td>
<td>∆H* max.</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>8,5 (+)</td>
<td>10,5 (–)</td>
<td>2,0 (+)</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>5,5 (+)</td>
<td>9,0 (–)</td>
<td>2,5 (–)</td>
<td></td>
</tr>
<tr>
<td>Violet</td>
<td>11,5 (+)</td>
<td>8,0 (–)</td>
<td>25,5 (+)</td>
<td></td>
</tr>
<tr>
<td>Pink</td>
<td>7,0 (+)</td>
<td>9,5 (–)</td>
<td>9,0 (+)</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>8,5 (+)</td>
<td>15,0 (–)</td>
<td>1,5 (–)</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>2,5 (+)</td>
<td>18,5 (–)</td>
<td>6,5 (+)</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>4,5 (+)</td>
<td>9,5 (–)</td>
<td>5,5 (+)</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE 1** L* equals lightness value, on a scale of 0 (black) to 100 (white); C* equals chroma or saturation (0 to 120); and H* equals hue angle (0° to 360°), where 0° is red, 90° is yellow, 180° is green and 270° is blue. ∆ means the change in the relevant value.

**NOTE 2** The sign in brackets behind each value indicates the direction of change for each parameter.
5 Inspection and methods of test

5.1 Inspection

Visually examine the containers and marking pens for compliance with clause 6. Examine the marking pens taken in accordance with 5.2 for compliance with the relevant requirements of 4.1, 4.2 and 4.3.

5.2 Test samples

Randomly divide the sample taken in accordance with B.2 into test groups as shown in table 3. Keep these sample groups of marking pens in a horizontal position, away from direct light, in a standard atmosphere of 23 °C and a relative humidity of 50 %, until testing commences (see SABS ISO 554). These conditions shall be adhered to during or in between testing, when relevant.

<table>
<thead>
<tr>
<th>Number of marking pens per test</th>
<th>Test</th>
<th>Test method subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Airtight fit</td>
<td>5.3</td>
</tr>
<tr>
<td>3</td>
<td>Tip push-down test</td>
<td>5.4</td>
</tr>
<tr>
<td>3</td>
<td>Writing performance: Manual writing</td>
<td>5.5.1</td>
</tr>
<tr>
<td>3</td>
<td>Writing performance: Machine writing</td>
<td>5.5.2</td>
</tr>
<tr>
<td>3 (from manual writing test)</td>
<td>Strike-through</td>
<td>5.5.1</td>
</tr>
<tr>
<td>9</td>
<td>Drainage test</td>
<td>5.6</td>
</tr>
<tr>
<td>3 (from manual writing test)</td>
<td>Drying time</td>
<td>5.7</td>
</tr>
<tr>
<td>3</td>
<td>Solvent loss</td>
<td>5.8</td>
</tr>
<tr>
<td>7 (one of each colour)</td>
<td>Fax resistance on thermal fax paper</td>
<td>5.9</td>
</tr>
<tr>
<td>7 (one of each colour, from fax resistance test)</td>
<td>Light fastness</td>
<td>5.10</td>
</tr>
</tbody>
</table>

5.3 Airtight fit

Ensure that each of the three marking pens under test has its cap fitted firmly over the tip. Drill a hole of diameter slightly smaller than 8 mm into the back end of the marking pen. Insert one end of a flexible plastics hose, with an outside diameter of 8 mm, into the hole and seal the interface between the hose and marking pen to ensure a pressure tight seal. Connect the other end of the hose to an air pressure supply and increase the pressure to 4 psi above atmospheric pressure. Submerge the marking pen in water for a period of 3 min, while checking for escaping bubbles across the entire surface area of the marking pen with its cap. Check for compliance with 4.2.2.1.

5.4 Tip push-down test

5.4.1 Apparatus

5.4.1.1 Force-measuring device, that has a platform on to which a force may be applied, and a scale that indicates the applied force.
5.4.1.2 Loading devices with angle clamps. Movable devices, capable of securing the marking pens at the relevant angles so as to ensure a perpendicular force on the edge of the tip during testing.

5.4.1.3 Nikon V12 (or similar) profile projector, with a digital readout.

5.4.1.4 Standard test paper.

NOTE Details of the standard test paper are obtainable from the South African Bureau of Standards.

5.4.2 Procedure

5.4.2.1 Manually draw three lines with the marking pen as described in 5.5.1.

5.4.2.2 Secure the marking pen in the appropriate loading device. Position the loading device on the platform of the measuring device so that the force will be applied along the entire length of the edge of the marking pen's tip, and perpendicular to the edge. Apply and increase the force gradually and uniformly to the edge of the tip until the force indicated on the scale reads 2.4 N for the 1 mm to 3 mm range and 4 N for the > 3 mm to 5 mm range tip line widths.

5.4.2.3 Detach the marking pen from the loading device without delay and manually draw another three lines below the original three in the same manner.

5.4.2.4 Measure the line width of all six lines by using the profile projector. Calculate the average line width of the three manually produced lines before a known force was applied to the tip, and the average line width of the three lines manually produced after a known force was applied to the tip. Calculate the percentage line width increase by using the following formula:

\[ X = \frac{X_1 - X_2}{X_2} \times 100 \]

where

- \( X \) is the percentage line width increase;
- \( X_1 \) is the average line width of the three lines manually produced after a known force was applied to the tip, expressed in millimetres;
- \( X_2 \) is the average line width of the three manually produced lines before a known force was applied to the tip, expressed in millimetres.

Check for compliance with 4.2.3.2.

5.5 Writing performance

5.5.1 Manual writing

Hold the marking pen in the hand in such a way as to touch the standard test paper with the entire length of the tip's edge. Apply a moderate force and move the marking pen to the right across the full width of the test paper. Immediately draw five more lines in the same manner.

Inspect the writing quality for compliance with 4.3.1 and 4.3.2.

NOTE Details of the standard test paper are obtainable from the South African Bureau of Standards.
5.5.2 Machine writing

5.5.2.1 Apparatus

5.5.2.1.1 Standard testing machine

A mechanical writing machine that is so designed as to give continuous writing, on a moving sheet of paper, by the marking pen at a specified writing speed and subjected to a specified writing pressure (see JIS S 6037).

NOTE 1 Details of the standard testing machine are obtainable from the South African Bureau of Standards.

NOTE 2 Other machines may be used, provided that they produce the specified test conditions and give results comparable to those obtained on the standard testing machine held by the South African Bureau of Standards.

5.5.2.1.2 Performance test paper, as specified in ISO 14145-1.

5.5.2.2 Procedure

Produce lines with the marking pens under test by using the standard testing machine (see JIS S 6037) and performance test paper. Examine the first 300 m of the lines drawn by the machine and check for compliance with 4.3.1.

5.6 Drainage test

Store three marking pens vertically point up, three vertically point down and three horizontally for one week in a standard atmosphere of 23 °C and a relative humidity of 50 % (see SABS ISO 554). Draw lines as described in 5.5.1 with all the marking pens under test.

Examine the writing quality for compliance with 4.3.3.

5.7 Drying time

Perform the following test in a standard atmosphere of 23 °C and a relative humidity of 50 % (see SABS ISO 554):

On one corner of a sheet of standard test paper position a 100 g flat-bottomed cylindrical mass piece of diameter 25 mm. Repeat the test in 5.5.1 on another sheet of test paper and allow the writing to dry for 5 s.

Position the second sheet (ink side up) under the first sheet with the mass piece. Immediately draw the first sheet slowly over the writing on the second sheet.

Check for compliance with 4.3.4.

5.8 Solvent loss

Weigh a sample of three marking pens. Record the mass and store in a horizontal position for one week in an oven at 40 °C. Let it cool down to room temperature, weigh again and record the mass.
Calculate the percentage loss \(S\) by using the formula:

\[
S = \left( \frac{W_1 - W_2}{W_1} \right) \times 100
\]

where

- \(S\) is the solvent loss, as a percentage;
- \(W_1\) is the mass of three marking pens before treatment, expressed in grams;
- \(W_2\) is the mass of three marking pens after treatment, expressed in grams.

Check for compliance with 4.3.5.

5.9 Determination of fax resistance on thermal fax paper

5.9.1 Apparatus

5.9.1.1 Thermal fax paper.

5.9.1.2 Marking pens, one of each colour.

5.9.2 Procedure

5.9.2.1 By using one of each colour of the marking pens, highlight an acceptable area of text on a freshly faxed page of thermal fax paper.

5.9.2.2 Keep the highlighted page away from direct light, in standard atmosphere of 23 °C and a relative humidity of 50 % (see SABS ISO 554) for 24 h.

5.9.2.3 Visually inspect the highlighted areas and the underlying text and check for compliance with 4.3.7.

5.10 Light fastness (resistance to fading) of ink on paper

5.10.1 Materials

5.10.1.1 Performance test paper, as specified in ISO 14145-1.

5.10.1.2 Marking pens, one of each colour.

5.10.2 Procedure

5.10.2.1 Remove the cap of the sample under test. Remove the top part of the marking pen containing the tip from the barrel, with the necessary force, so as to expose the reservoir inside the barrel. Remove the reservoir from the barrel and insert a shallow cut along its whole length to expose the inside fibre. Apply the ink to the specified performance test paper by using the fibre from the opened reservoir as a brush.

5.10.2.2 Measure the colour by using the colour measurement scale CIE L*\(C^*\)H* in accordance with SABS ISO 7724-1 and SABS ISO 7724-2. Expose the samples for 20 h to a Xenon arc lamp, in accordance with SABS ISO 105-B02.
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5.10.2.3 Measure the colour of the exposed samples by using the colour measurement scale CIE \( L^*C^*H^* \) in accordance with SABS ISO 7724-1 and SABS ISO 7724-2. Calculate the colour change by using the following formulae:

\[
\Delta L^* = L_2 - L_1 \tag{1}
\]

where

- \( L_1 \) is the lightness value before exposure;
- \( L_2 \) is the lightness value after exposure.

\[
\Delta C^* = C_2 - C_1 \tag{2}
\]

where

- \( C_1 \) is the chroma value before exposure;
- \( C_2 \) is the chroma value after exposure.

\[
\Delta H^* = H_2 - H_1 \tag{3}
\]

where

- \( H_1 \) is the hue angle before exposure;
- \( H_2 \) is the hue angle after exposure.

Check for compliance with 4.3.8.

NOTE In order to prevent the samples from inadvertent exposure, any delay between steps should be avoided or, if this is not possible, it is recommended that samples should be stored away from direct light in a standard atmosphere in between measurement and exposure steps (see SABS ISO 554 and 5.2).

6 Packing and marking

6.1 Packing

Marking pens for text highlighting shall be packed in acceptable containers. Only marking pens of the same design, components, materials, tip size and ink colour shall be packed in the same bulk container.

6.2 Marking

6.2.1 Pens

Each marking pen shall bear the following information in prominent, legible and indelible markings:

a) date of manufacture or batch number or date code;

b) brand name;
c) an indication of the ink colour; and

d) words to indicate that the marking pen is suitable for use on fax paper.

NOTE Fax paper shall include thermal fax paper.

6.2.2 Containers

Each container shall bear the following information in prominent, legible and indelible markings:

a) as for pens (see 6.2.1(a) to (d)); and

b) the quantity of marking pens per container.
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Annex A
(normative)

Notes to purchasers

The following requirements shall be specified in tender invitations and in each order or contract:

a) the tip line width (see 4.2.3.1);

b) the colour of the ink (see 4.2.4); and

c) when relevant, that the ink be fluorescent (see 4.2.4).

Annex B
(normative)

Sampling and compliance with this standard

B.1 Sampling

B.1.1 General

The following sampling procedure shall be applied in determining whether a lot complies with the relevant requirements of this standard. The sample so drawn shall be deemed to represent the lot for the respective properties.

B.1.2 Definitions

B.1.2.1 defective
marking pen for text highlighting that fails to comply in one or more respects with the relevant requirements of this standard

B.1.2.2 lot
marking pens for text highlighting of the same design, components, materials, tip line width, and type of ink and packed in containers bearing the same date of packing or batch number, consisting of six of each colour, from one manufacturer, and submitted at any one time for inspection and testing

B.2 Sample for testing

Take at random 31 marking pens from the lot (at least one of each colour).
B.3 Compliance with the standard

The lot shall be deemed to comply with the requirements of this standard if, after inspection and testing of the samples taken in accordance with B.2:

a) no defective is found in respect of the requirements given in clause 6; and

b) in the sample taken in accordance with B.2, not more than one marking pen shall fail the relevant tests as described in 5.3 to 5.10, inclusive.

Annex C
(informative)

Quality verification of marking pens for text highlighting

When a purchaser requires ongoing verification of the quality of marking pens for text highlighting it is suggested that, instead of concentrating solely on evaluation of the final product, he also direct his attention to the manufacturer’s quality system. In this connection it should be noted that SABS ISO 9001 covers the provision of an integrated quality system.

Bibliography

SABS ISO 9001, Quality management systems – Requirements.