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Routine analytical cigarette-smoking machine — Additional test methods for machine verification

Machine à fumer analytique de routine pour cigarettes — Méthodes d'essais complémentaires pour la vérification de la machine

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

This document was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*, Subcommittee SC 1, *Physical and dimensional tests*.

This fourth edition cancels and replaces the third edition (ISO 7210:2013), which has been technically revised.

The main changes to the previous edition are as follows:

— the requirements given by the more intense smoking regime described in ISO 20778 have been included;

— a description for a soap film bubble flowmeter for the determination of the puff volume has been added.

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.

Routine analytical cigarette-smoking machine — Additional test methods for machine verification

1 Scope

This document specifies additional test methods for routine analytical cigarette-smoking machines intended to check the conformity of these machines with ISO 3308 and ISO 20778.

It only establishes additional test methods for smoking machines and does not deal with actual smoking, which is described in other International Standards.

It is composed of four sections relating to

— the determination of pressure drop (Clause 4);

— the determination of significant puff profile parameters (Clause 5);

— the verification of restricted smoking (Clause 6);

— the description of the soap film bubble flowmeter for the determination of the puff volume (Clause 7).

NOTE There are more possibilities for determining the aforementioned parameters. Systems giving the same results and accuracies can be used. The certificate of conformity with this standard can be obtained from the machine manufacturer.

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 3308, *Routine analytical cigarette-smoking machine — Definitions and standard conditions*

ISO 20778, *Cigarettes — Routine analytical cigarette smoking machine — Definitions and standard conditions with an intense smoking regime*

ISO 4387, *Cigarettes — Determination of total and nicotine-free dry particulate matter using a routine analytical smoking machine*

ISO 20779, *Cigarettes — Generation and collection of total particulate matter using a routine analytical smoking machine with an intense smoking regime*

ISO 3402, *Tobacco and tobacco products — Atmosphere for conditioning and testing*

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
pressure drop
static pressure difference between the two ends of a pneumatic circuit (of a smoking machine) when it is traversed by an air flow under steady conditions in which the measured volumetric flow, under standard conditions, at the output end is 17,5 ml/s

3.2
puff profile
flow rate measured directly behind the butt end of the cigarette, and depicted graphically as a function of time

3.3
restricted smoking
condition that exists when the butt end of a cigarette is closed to the atmosphere between successive puffs

3.4
puff duration
interval of time during which the port of a smoking machine is connected to the suction mechanism

3.5
puff volume
volume of smoke leaving the butt end of a cigarette and passing through the smoke trap of a smoking machine

3.6
smoulder stream smoke
smoke which leaves the butt end of the cigarette during the interval of time between successive puffs

3.7
port
aperture of the suction mechanism through which a puff is drawn and to which is attached a smoke trap

3.8
channel
element of a smoking machine consisting of one or more cigarette holders, one trap and a means of drawing a puff through the trap

3.9
bubble
liquid film (of surface-active agent/wetting agent/detergent solution) extending over the cross section of a pipe

4 Determination of pressure drop

4.1 Principle

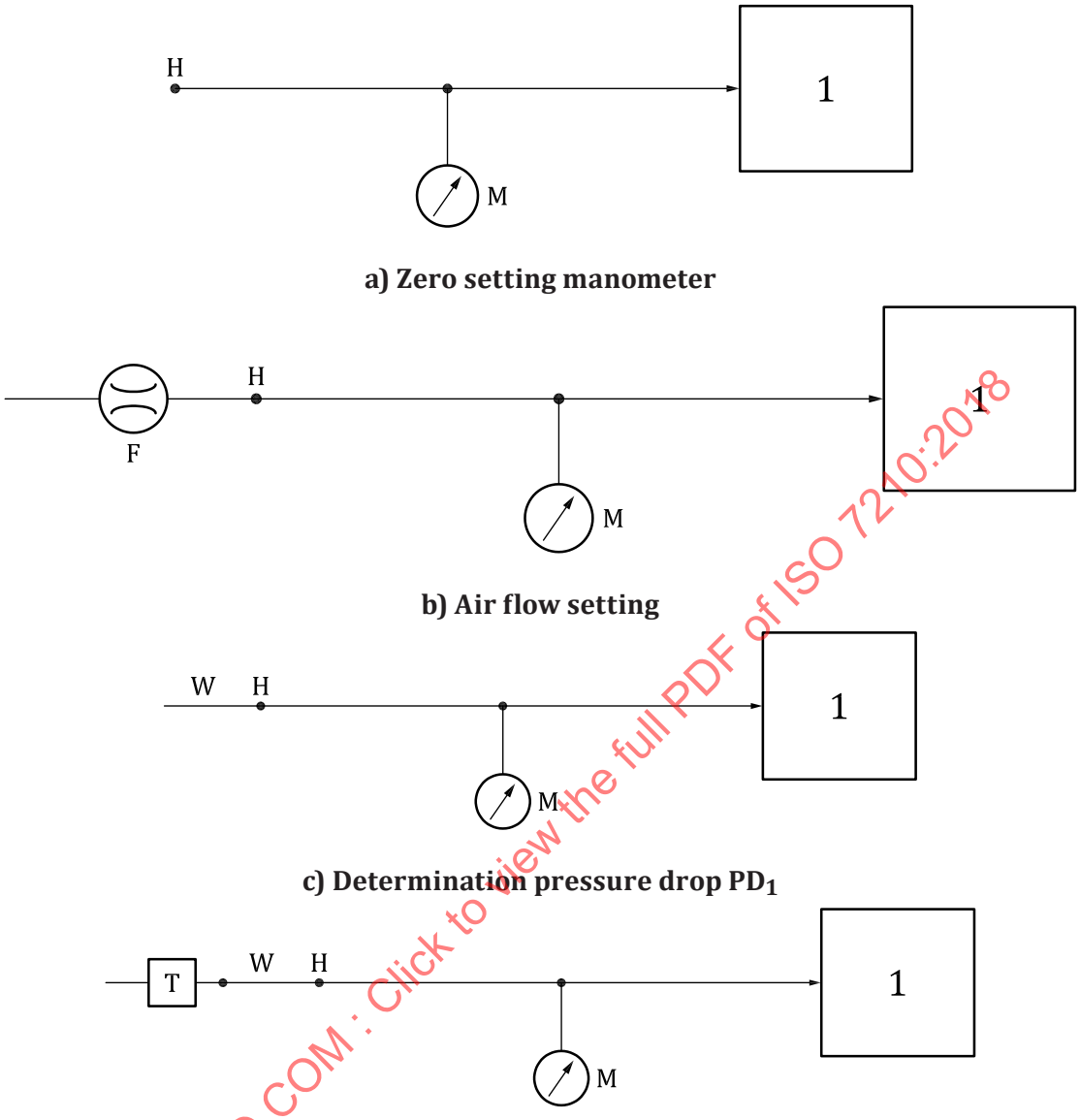
Measurement, under well-specified air flow conditions, of the pressure drop of a smoking machine by means of an appropriate manometer.

4.2 Apparatus

The test apparatus shall be capable of

— sucking a constant flow of air which is unaffected by the pressure drop of the system under test;

— measuring the pressure drop with sufficient accuracy.



Key

1 flow generator
H test head point
F flowmeter
W wide-bore tubing
T smoking machine under test
M manometer

NOTE Arrows indicate the direction of air flow.

Figure 1 — Pneumatic circuit of a typical apparatus

4.3 Test atmosphere

All measurements shall be carried out under standard ambient conditions of temperature and relative humidity as specified in ISO 3402.

4.4 Procedure

4.4.1 General

The flow of air through the smoking machine shall always be in the same direction as during the puffing cycle, i.e. from the cigarette to the suction source. The air used for measurement shall be from the test atmosphere.

4.4.2 Testing

4.4.2.1 Connect the manometer, M, as indicated in Figure 1 a) and set it to zero.

4.4.2.2 Connect the flowmeter, F, as indicated in Figure 1 b) and establish an air flow of 17,5 ml ± 0,5 ml/s.

4.4.2.3 Disconnect the flowmeter, F, and if needed in regard to 4.4.2.4 attach a suitable length of wide-bore tubing, W, to the test head point, H, as indicated in Figure 1 c). Read the pressure, if any, on the manometer, M. Record the value as PD_1.

4.4.2.4 Attach the free end of the wide-bore tubing, W, to the point in the smoking machine from which the puffing source was disconnected as indicated in Figure 1 d). Read the pressure on the manometer, M. Record the value as PD_2.

4.4.2.5 Calculate the pressure drop ($PD_2 - PD_1$).

4.4.2.6 Repeat the operation for each channel of the smoking machine.

4.5 Expression of results

The following values shall be recorded:

— the pressure drop for each channel, in pascals;

— the test atmosphere used.

5 Determination of significant puff profile parameters

5.1 Principle

Continuous measurement of the flow rate of air of a puff through a pressure drop device of 1 000 Pa ± 50 Pa (see ISO 3308 and ISO 20778).

5.2 Apparatus

5.2.1 General

The apparatus shall comprise the elements shown in the principle diagram (Figure 2), i.e. the diagram of elements required for the two alternative measuring systems, A and B, with two different levels of sophistication.

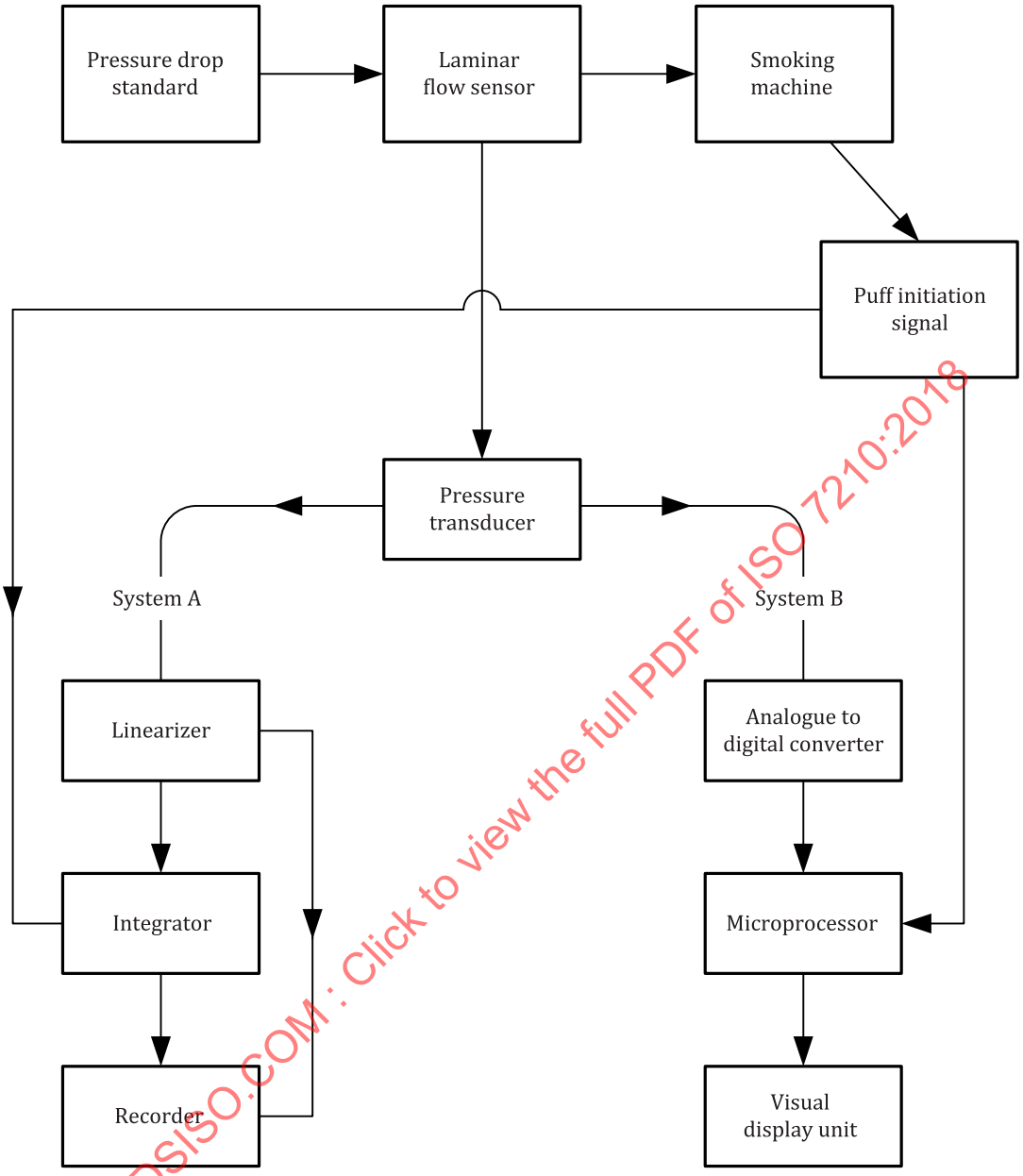


Figure 2 — Principle diagram

5.2.2 System A

The signal delivered by the pressure transducer is linearized by appropriate circuits and transmitted to an integrator and a recording apparatus.

The system can record a picture of the puff profile and measure its volume.

5.2.3 System B

This system uses digital conversion and a computer to produce the same information as it is given by system A.

5.2.4 Requirements for both systems

The device shall not increase the pressure drop of the system above the limit of 300 Pa and the overall gain and response of the system shall be sufficient to visualize the puff profile and determine its significant parameters.

A sufficient result will be achieved by the use of elements that fulfil the following conditions:

— laminar flow element with a nominal pressure drop of 100 Pa ± 10 Pa at a flow of 17,5 ml/s;

— pressure transducer with a suitable range, an accuracy of ± 5 Pa or better and a minimal response frequency of 1 kHz.

The above apparatus provides the means to obtain flow rate and time profiles for puffing as shown in ISO 3308 and ISO 20778.

NOTE Measurement of puff volume, by either system A or system B, can only be a secondary measurement following calibration by reference to a primary device such as a soap film burette as described in Clause 7.

5.2.5 Expression of results

The following results need to be reported:

— total drawn puff volume, in ml;

— maximum flow rate, in ml/s;

— time between starting and reaching the maximum flow rate, in s;

— volume drawn after the time the puffing source ceases to apply suction, in ml;

— total puff duration time, in s.

The target values for the above parameters shall be those specified in ISO 3308 and ISO 20778.

6 Verification of restricted smoking

6.1 Principle

Measurement of the volume of the smoulder stream smoke between two puffs for machines of discontinuous function or between two suction strokes for machines of continuous function.

For smoking machines with permanent connection of the port to the suction device, this test is not necessary.

6.2 Apparatus

Apparatus permitting an assembly as shown in Figure 3, so that:

— the length of a soap film bubble flowmeter does not exceed 12 cm;

— there is close contact between the smoke port or the cigarette holder, the soap film bubble flowmeter and the cigarette.

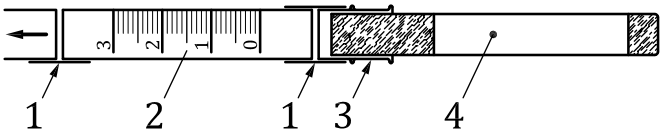
6.3 Procedure

Smoke the first half of a cigarette without using the test unit. Introduce and adjust a soap bubble in the soap film bubble flowmeter as described in the supplier's manual. Connect the test unit to the smoke port or cigarette holder and insert the cigarette into it. Carry out the test during smouldering of the

second half of the total length of the cigarette. On linear machines the test should be performed for at least one minute. On rotary machines it should be performed over a full rotation.

6.4 Expression of results

Note the flow rate of the smoulder stream smoke, in millilitres per minute, for each channel of the smoking machine. The result shall not exceed 1 ml/min.



Key

1 rubber connection
2 soap film bubble flowmeter
3 cigarette holder or glass tube
4 cigarette

Figure 3 — Diagram of test apparatus for restricted smoking

7 Soap film bubble flowmeter for the determination of the puff volume

7.1 General

This clause describes the apparatus of a soap film bubble flowmeter used for the determination of the puff volume as specified in ISO 4387 and ISO 20779.

7.2 Principle

The burette is moistened with wetting agent solution and connected to the smoking position of the smoking machine. A lamella (bubble) is generated and adjusted to the zero-mark of the burette. Upon release of a puff, the bubble is displaced by the puff volume of the smoking machine and thus indicates the actual puff volume amount. Figure 4 shows the principal design of a soap film bubble flowmeter.