

**INTERNATIONAL
STANDARD**

**ISO
7210**

Fourth edition
2018-10-01

**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*



Reference number
ISO 7210:2018(E)

© ISO 2018



COPYRIGHT PROTECTED DOCUMENT

© ISO 2018, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents		Page
Foreword		iv
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Determination of pressure drop	2
4.1	Principle	2
4.2	Apparatus	2
4.3	Test atmosphere	3
4.4	Procedure	4
4.4.1	General	4
4.4.2	Testing	4
4.5	Expression of results	4
5	Determination of significant puff profile parameters	4
5.1	Principle	4
5.2	Apparatus	4
5.2.1	General	4
5.2.2	System A	5
5.2.3	System B	5
5.2.4	Requirements for both systems	6
5.2.5	Expression of results	6
6	Verification of restricted smoking	6
6.1	Principle	6
6.2	Apparatus	6
6.3	Procedure	6
6.4	Expression of results	7
7	Soap film bubble flowmeter for the determination of the puff volume	7
7.1	General	7
7.2	Principle	7
7.3	Apparatus	8
7.3.1	Glass burette	8
7.3.2	Bubble generation	8
7.3.3	Bubble positioning	8
7.3.4	Wetting	9
7.3.5	Detergent solution	9
7.4	Procedure	9
7.4.1	Preparation	9
7.4.2	Performing a measurement	9

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://www.iso.org/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](http://www.iso.org/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

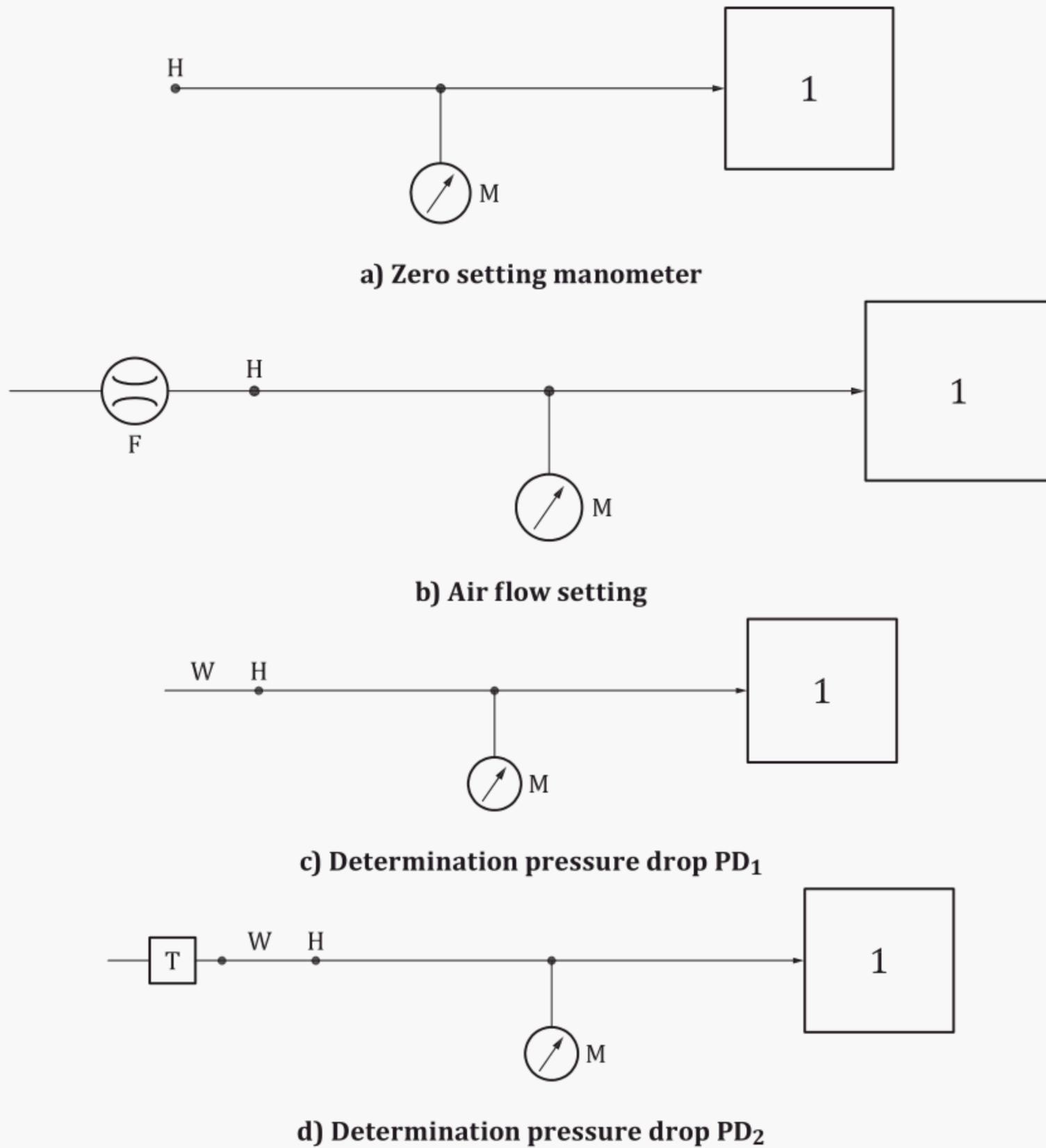
4.1 Principle

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 $17,5 \text{ ml} \pm 0,5 \text{ ml/s}$.

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 $1\,000 \text{ Pa} \pm 50 \text{ Pa}$ (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.

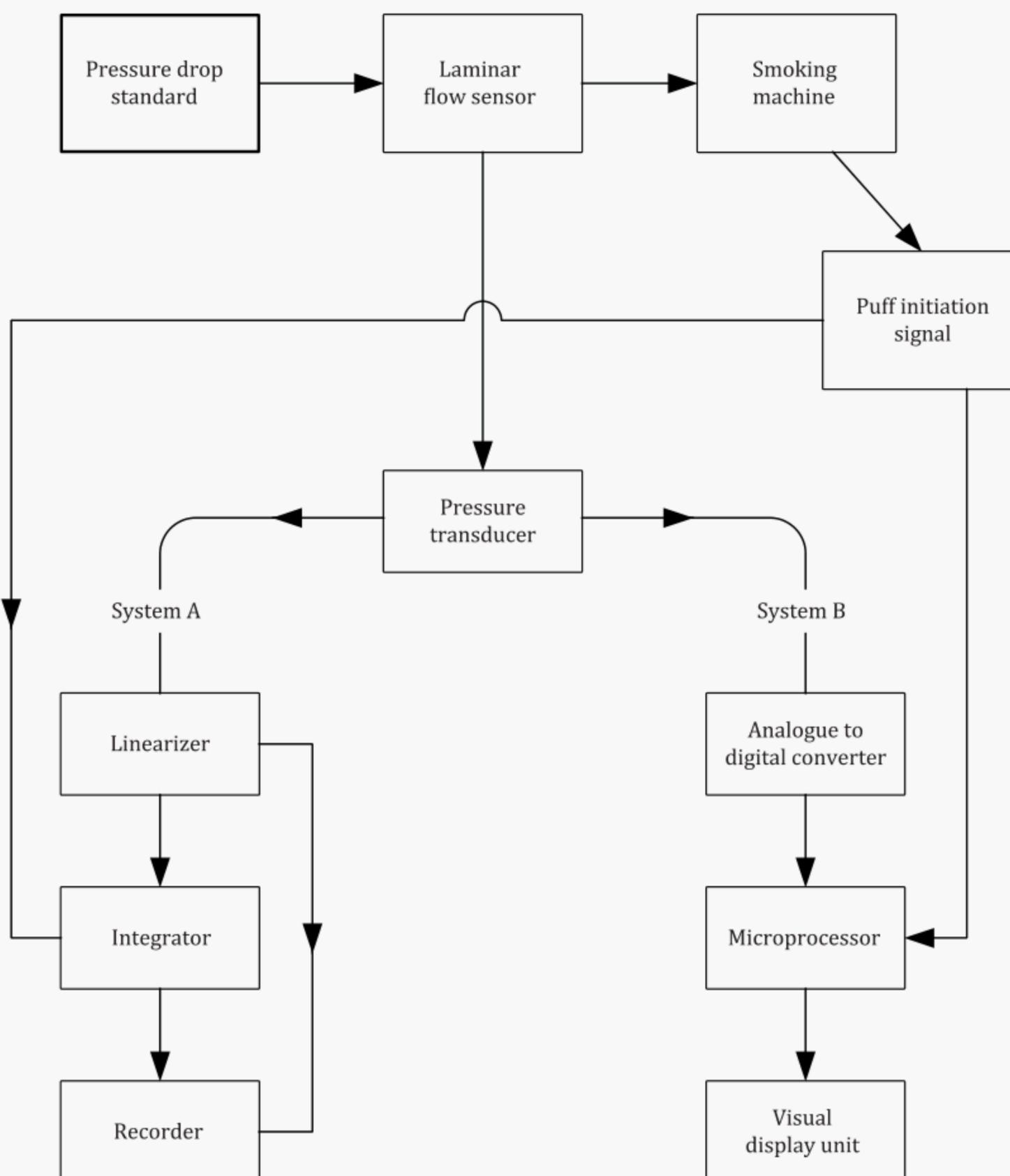


Figure 2 — Principle diagram

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 \pm 10 Pa at a flow of 17,5 ml/s;
- pressure transducer with a suitable range, an accuracy of \pm 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.

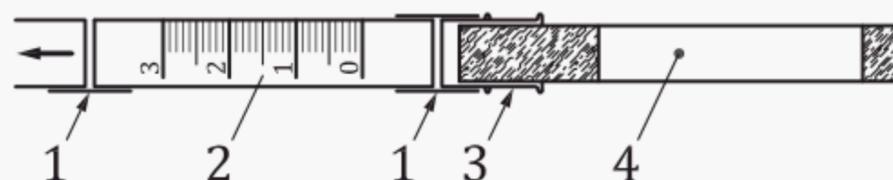
6.3 Procedure

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

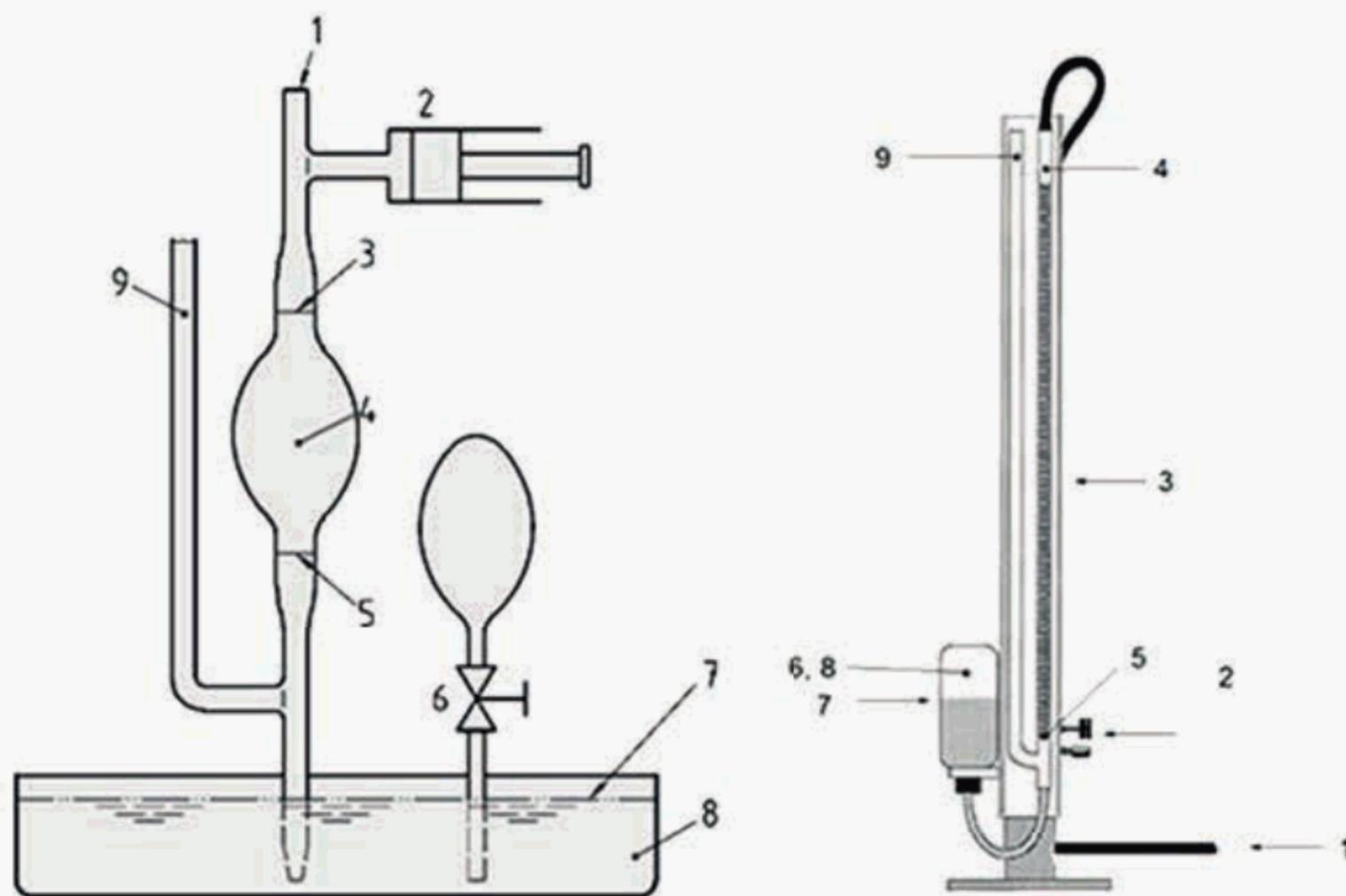
7 Soap film bubble flowmeter for the determination of the puff volume

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.



- Key**
- 1 suction port
 - 2 device for bubble positioning
 - 3 mark of nominal volume
 - 4 glass burette
 - 5 zero-point mark
 - 6 hand pump used for wetting and bubble generation
 - 7 level of wetting agent (detergent) solution
 - 8 sealed container with wetting agent solution
 - 9 bypass for bubble generation

Figure 4 — Soap film bubble flowmeter: principal design of two examples

7.3 Apparatus

7.3.1 Glass burette

The glass burette for 35 ml has a zero-point mark at the lower part and a scale from 34 ml to 36 ml at the upper part with an accuracy of $\pm 0,2$ ml and a 0,1 ml graduation. The glass burette for 55 ml has a zero-point mark at the lower part and a scale from 54 ml to 56 ml at the upper part with an accuracy of $\pm 0,5$ ml and a 0,2 ml graduation.

7.3.2 Bubble generation

The apparatus shall have a device for generating the bubble.

7.3.3 Bubble positioning

The apparatus shall have a device for positioning the bubble at the zero-point mark.

7.3.4 Wetting

The apparatus shall have a device for wetting the inner surface of the glass burette over the full measuring range with wetting agent solution.

7.3.5 Detergent solution

Detergent solution as specified by the supplier of the soap bubble flow meter in the corresponding manual should be used.

7.4 Procedure

7.4.1 Preparation

For wetting the inner surface of the burette, pump the wetting liquid slowly up over the full measuring range, then slowly lower the liquid level. Since the accuracy of the measurement is influenced by the thickness of the soap film, wait at least 30 seconds before starting a measurement. If some bubbles remain in the burette, repeat the wetting procedure to clear the burette completely, otherwise wrong measurement results can occur. It is recommended that the detergent solution as specified by the supplier of the soap bubble flow meter in the corresponding manual is used.

7.4.2 Performing a measurement

Determination of puff volume shall be performed according to [ISO 4387](#) and [ISO 20779](#).

- Warm up the smoking machine (if necessary).
- Prepare the corresponding adapter required for use with the respective smoking machine and connect it to the device.
- Pump up the solution a little above the connection of the bypass for bubble generation ([Figure 4](#), key reference 9). Upon flowing back of the solution, a bubble is generated in the burette.
- Adjust bubble to the zero-mark.
- Release from the smoking machine the puff to be measured.
- Read the measuring value in ml at the graduation of the burette.
- Generate a new bubble and repeat the measurement procedure three times in order to ensure a high accuracy of the measurement.

If the bubble bursts during a measurement procedure, rewetting of the burette is recommended. If this does not help, cleaning of the burette is required.

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.

The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.

A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

A British Standard purchased in hard copy format is for personal or internal company use only.

It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services

Tel: +44 345 086 9001

Email (orders): orders@bsigroup.com

Email (enquiries): cservices@bsigroup.com

Subscriptions

Tel: +44 345 086 9001

Email: subscriptions@bsigroup.com

Knowledge Centre

Tel: +44 20 8996 7004

Email: knowledgecentre@bsigroup.com

Copyright & Licensing

Tel: +44 20 8996 7070

Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK