126

International Standard ISO 7210

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Smoking machines for tobacco and tobacco products — Non-routine test methods

Machines à fumer pour tabac et produits du tabac — Méthodes d'essais non habituels

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 7210 was developed by Technical Committee ISO/TC 126, *Tobacco and tobacco products*, and was circulated to the member bodies in March 1982.

It has been approved by the member bodies of the following countries :

Austria	Greece	Sweden
Belgium	India	Switzerland
Brazil	Iraq	Tanzania
Cuba	Italy	Turkey
Czechoslovakia	Malaysia	United Kingdom
Egypt, Arab Rep. of	Mexico	USSR
France	Portugal	
Germany, F.R.	South Africa, Rep. of	

No member body expressed disapproval of the document.

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Smoking machines for tobacco and tobacco products — Non-routine test methods

0 Introduction

This International Standard is intended to establish non-routine test methods for smoking machines, i.e. not dealing with the actual smoking which is described in other International Standards.

It is composed of the following sections :

Section one : Pressure drop

Section two : Puff profile

Section three : Restricted smoking

Section four : Total dead volume

Other sections, including the following, are in preparation :

— Cigarette holders

— Ambient conditions

1 Scope and field of application

This International Standard specifies non-routine test methods intended to check the conformity of smoking machines with ISO 3308.

2 References

ISO 3308, *Tobacco and tobacco products — Routine analytical cigarette-smoking machine — Definitions, standard conditions and auxiliary equipment.*

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

Section one : Pressure drop

3 Definition

pressure drop of a smoking machine : The difference in static pressure between two points in a smoking machine between which a current of air passes at a constant flow rate of 17,5 ml/s.

4 Principle

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

5 Apparatus

5.1 Requirements

The whole flow path between the smoking port and the suction source shall offer the least possible draw resistance and the pressure drop shall not exceed 300 Pa (3 mbar).

The test apparatus shall be capable of

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

— measuring the pressure drop with sufficient accuracy.[1)]

5.2 Types

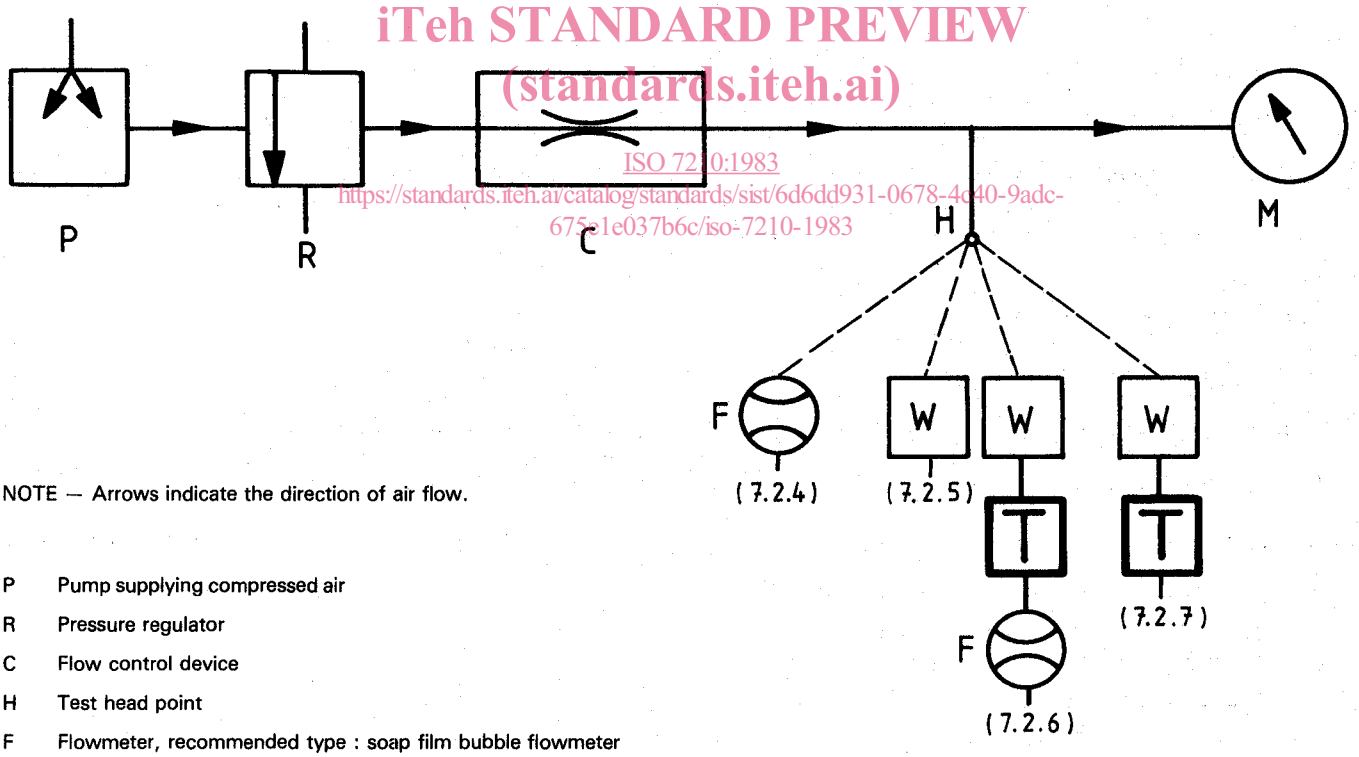
Two general types of apparatus fulfil these requirements, namely

5.2.1 Pressure-controlled apparatus (see figure 1).

5.2.2 Vacuum-controlled apparatus (see figure 2).

6 Test conditions

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

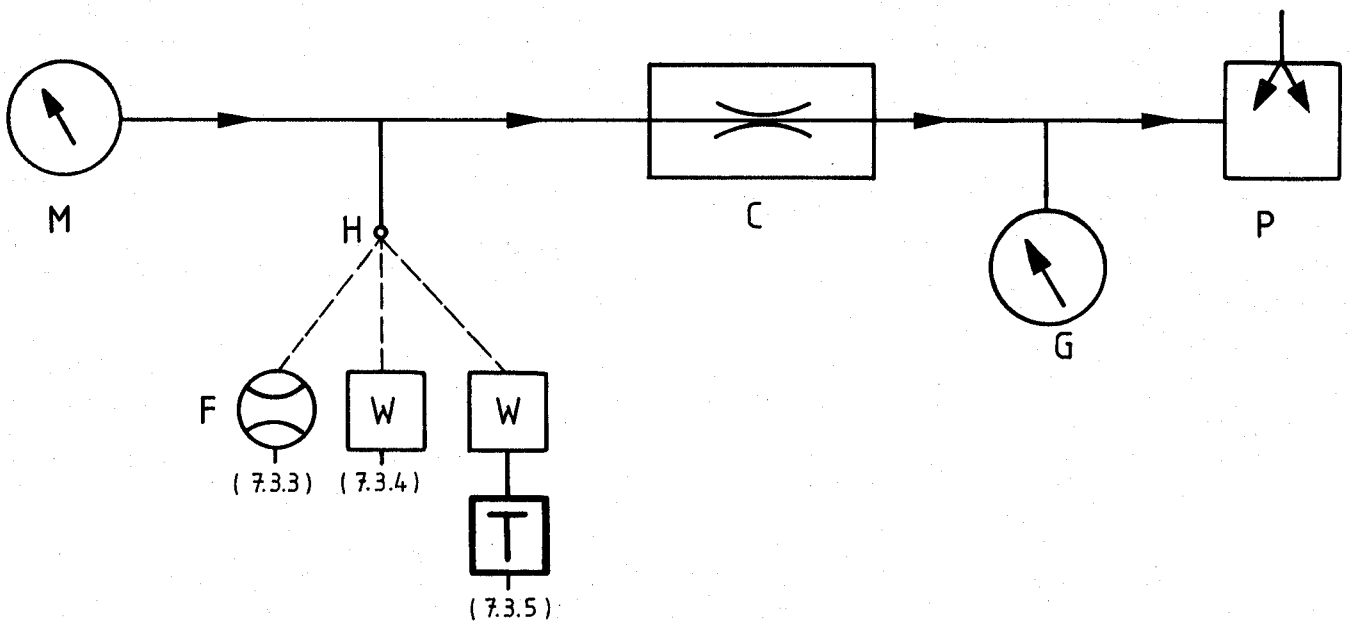


NOTE — Arrows indicate the direction of air flow.

P Pump supplying compressed air
R Pressure regulator
C Flow control device
H Test head point
F Flowmeter, recommended type : soap film bubble flowmeter
W Wide-bore tubing
T Apparatus under test
M Manometer
--- Test method connections.

Figure 1 — Pneumatic circuit of a typical pressure-controlled apparatus

1) In consideration of the pressure difference to be expected, the use of an inclined manometer may be preferable.



NOTE — Arrows indicate the direction of air flow.

P Vacuum pump

G Vacuum gauge, or mercury manometer

C Critical flow orifice

H Test head point

F Flowmeter, recommended type : soap film bubble flowmeter

W Wide-bore tubing

T Apparatus under test

M Manometer, simple tube or commercial device with overflow protection and liquid levelling devices

--- Test method connections.

Figure 2 — Pneumatic circuit of a typical vacuum-controlled apparatus

7 Procedure

7.1 General

The procedure depends on the type of apparatus (5.2.1 or 5.2.2). However, 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.

7.2 Pressure-controlled apparatus (see figure 1)

7.2.1 Disconnect the puffing source from the smoking machine. Make any necessary electrical or mechanical adjustment to valves, etc., so that there is a free passage of air only from the smoking port to the point from which the puffing source was disconnected.

7.2.2 Switch on the pump supplying compressed air P, and adjust R so that a regulated supply of air is furnished, under a pressure of approximately 55 kPa (550 mbar), to the flow control device C.

7.2.3 Ensure that the manometer M is correctly set up and that the liquid zero level is correct.

7.2.4 Connect the flowmeter F to the test head point H in the pneumatic circuit and adjust the flow of air through the smoking machine to 17,5 ml/s, using the flow control device C.

7.2.5 Disconnect the flowmeter F and attach a suitable length of wide-bore tubing W to the test head point H. Read the pressure drop, if any, on the manometer M. Record this value as PD_1.

NOTE — This pressure drop is usually measured and expressed as a manometric height.

7.2.6 Attach the free end of the wide-bore tubing W to the smoking port equipped with the cigarette holder and the filtering device of the machine T. Check the flow of air by switching the flowmeter F to the point from which the puffing source was disconnected. Adjust the flow, if necessary.

7.2.7 Remove the flowmeter F and read the pressure drop of the system on the manometer M. Record this value as PD_2.

NOTE - This pressure drop is usually measured and expressed as a manometric height.

7.2.8 Calculate the pressure drop ($PD_2 - PD_1$) by converting the difference between the two manometric heights into pascals or millibars.

Example : 1 mm water column corresponds in practice to 9,81 Pa or 0,098 1 mbar.

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

7.3 Vacuum-controlled apparatus (see figure 2)

7.3.1 Switch on the vacuum pump P and adjust the vacuum so that it is not less than 48 kPa (480 mbar).

7.3.2 Ensure that the manometer M is correctly set up and that the liquid zero level is correct.

7.3.3 Connect the flowmeter F to the test head point H in the pneumatic circuit and record the air flow. The flow through the system is uniquely determined by the parameters of the critical flow orifice C. If the flow is not 17,5 ml/s, then the critical flow orifice shall be recalibrated.

7.3.4 Disconnect the flowmeter F and attach a suitable length of wide-bore tubing W to the test head point H. Read the pressure drop, if any, on the manometer M. Record this value as PD_1.

NOTE — This pressure drop is usually measured and expressed as a manometric height.

7.3.5 Attach the free end of the wide-bore tubing W to the point in the smoking machine from which the puffing source was disconnected.

7.3.6 Read the pressure drop of the system on the manometer M. Record this value as PD_2.

NOTE — This pressure drop is usually measured and expressed as a manometric height.

7.3.7 Calculate the pressure drop ($PD_2 - PD_1$) by converting the difference between the two manometric heights into pascals or millibars.

Example : 1 mm water column corresponds in practice to 9,81 Pa or 0,098 1 mbar.

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

8 Expression of results

The following values shall be recorded :

— the pressure drop for each channel, in pascals (Pa) or in millibars (mbar);

— the test atmosphere used.

Section two : Determination of puff profile

9 Definition

puff profile : The flow measured directly behind the butt end of the cigarette, and depicted graphically as a function of time.

10 Principle

Continuous measurement of the flow rate of air of a puff through an unlit cigarette or standard test resistance.

11 Apparatus

The apparatus shall comprise the elements shown in the principle diagram (figure 3), i.e. the diagram of the elements required for the alternative measuring systems at two different levels of sophistication A and B, one of which is used.

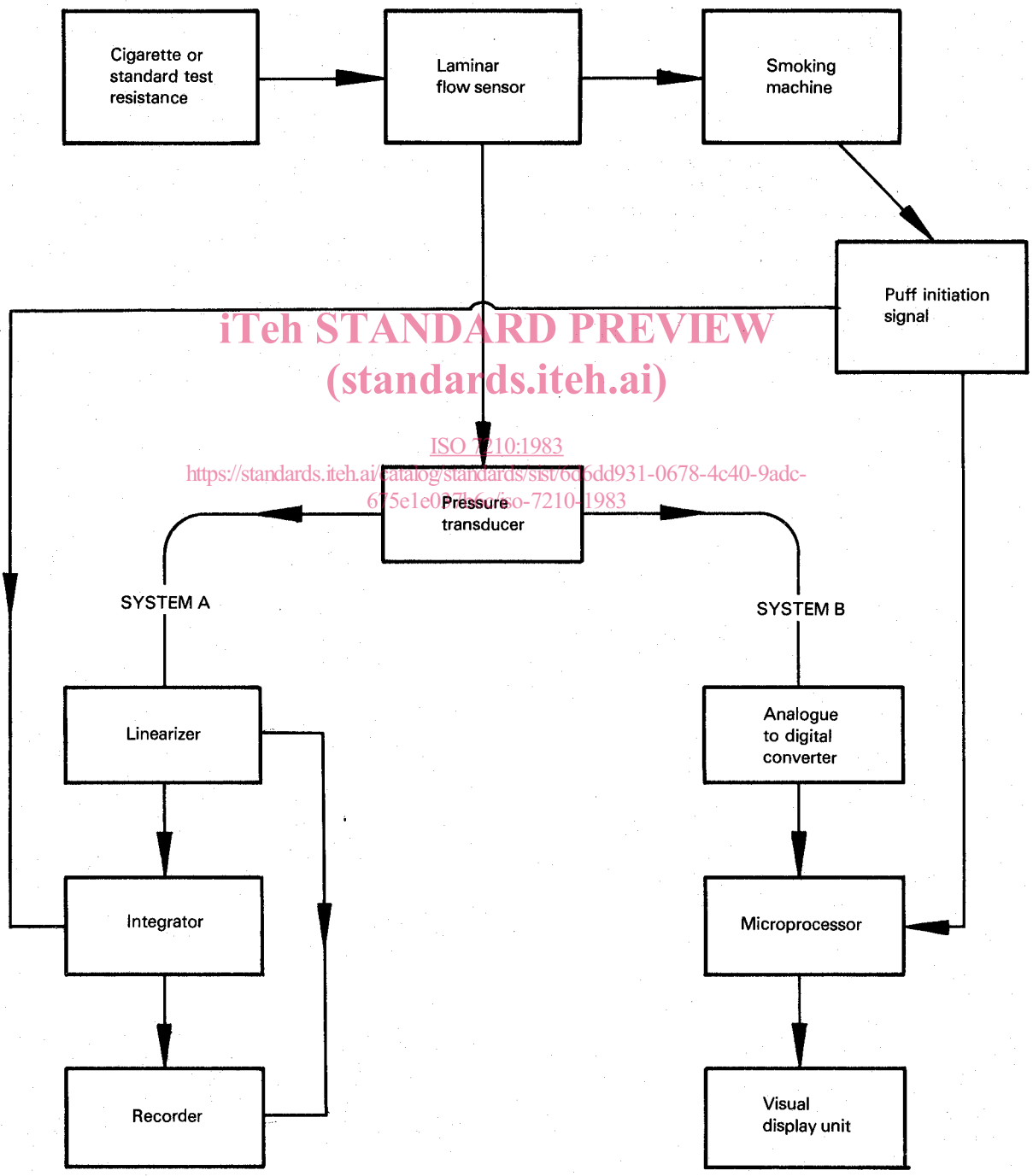


Figure 3 — Principle diagram

11.1 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.

11.2 System B

This system uses digital conversion and a microprocessor with a visual display unit.

11.3 Requirements for both systems

The elements used in the systems shall fulfil the following conditions :

— laminar flow sensor (for example bundles of capillaries, sintered glass discs, cellulose acetate filters) providing a pressure drop proportional to the flow passing through it; this pressure drop shall be in the order of 10 % of the pressure drop of the cigarette or standard test resistance.

— pressure transducer of 0 to 2 mbar, with high speed of response. As the response time may be affected by dead volumes within the transducer and its connections, the total dead volume shall not exceed 5 ml.

The above apparatus provides the means to obtain flow rate and time profiles for puffing as shown in figure 4.

NOTES

1 In system B, it is possible to program the microprocessor to calculate, compare and obtain the data. The flow rate is integrated for the periods t_p and $t_f - t_p$.

The value

$$\frac{V_1}{35} \times 100$$

shows, as a percentage, the degree of compliance of V_1 with the standard puff volume and shall be at least 95 % of this volume. The second integral V_2 shall be added to V_1 to check the overall accuracy of the measuring system, i.e.

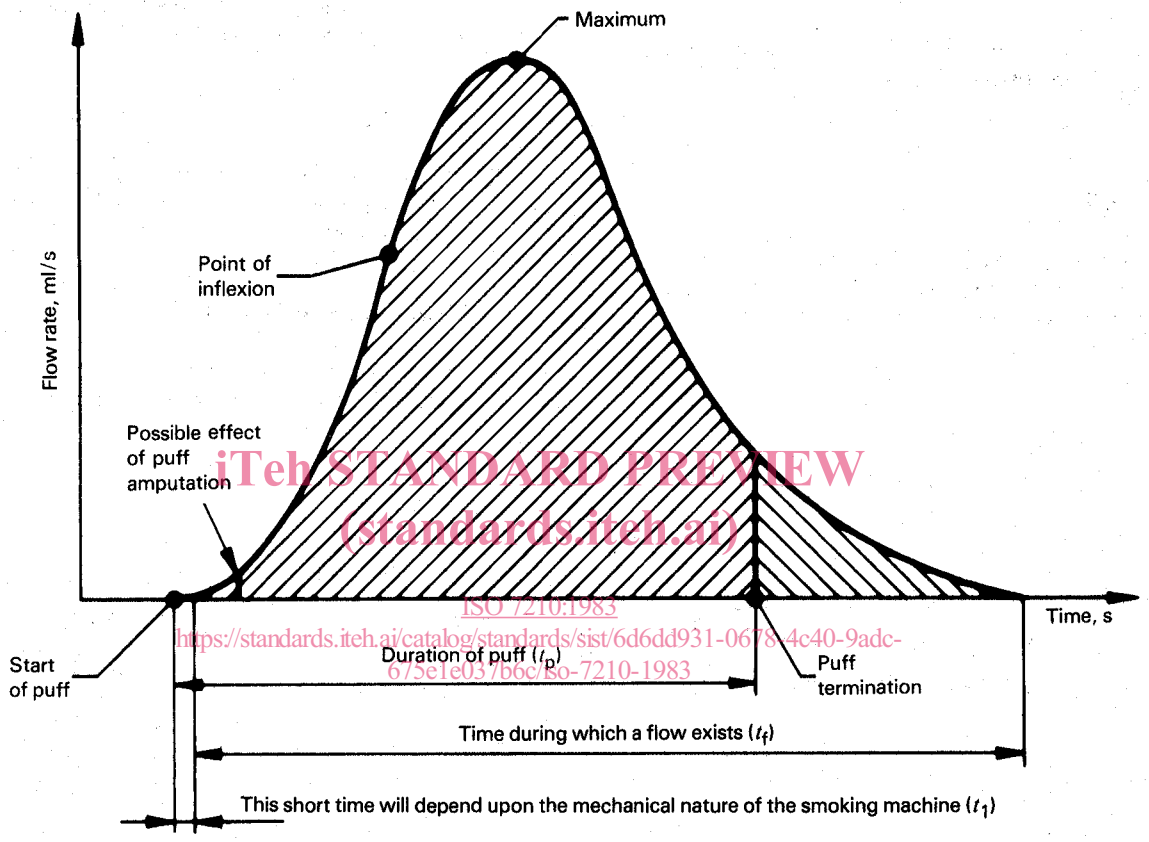
$V_1 + V_2 = 35{,}0$ ml shall be checked.

($V_1 + V_2$ is the standard puff volume according to ISO 3308.)

2 The values of t_1, t_p and t_f may be measured to check that t_1 is small and that $t_p = 2{,}0$ s to ensure that $t_f - t_p$ is small.

3 The microprocessor memory may be used to store data about the shape of the standard profile. The test shape data may then be compared and difference values taken at appropriate points on the profile to show compliance with ISO 3308.

4 In system A, the data mentioned in the above notes 1 to 3 may be subject to appropriate calculations and comparisons.



Volume V_1

That part of the puff volume not leaving the cigarette in the puff duration : V_2

Figure 4 — Puff profile as a function of flow rate and time