
**Vapour products — Determination of
e-liquid vaporised mass and aerosol
collected mass**

*Produits de vapotage — Détermination de la masse de e-liquide
vaporisé et de la masse d'aérosol collecté*

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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).

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This document was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*, Subcommittee SC 3, *Vape and vapour products*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 437, *Electronic cigarettes and related e-liquids*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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.

Introduction

Technical investigation of vapour products requires determining aerosol collected mass (ACM) and e-liquid vaporized mass (EVM) measurements in emissions. Therefore, there is a necessity to have an International Standard in place to get reliable/comparable data on ACM and EVM in electronic cigarette emissions.

The method in this document is based upon the CORESTA recommended method (CRM) 84,^[1] which was written on the basis of the results obtained from interlaboratory studies conducted in 2015^[2] and 2019^[3] involving 18 and 11 laboratories, respectively.

This document has been developed to describe the procedures used to measure the amount of ACM and EVM in the aerosol from vapour products utilizing a gravimetric method. The experimental design parameters^{[4][5]} used to collect the aerosolised vapour should be evaluated and documented for each analysis.

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Vapour products — Determination of e-liquid vaporised mass and aerosol collected mass

1 Scope

This document specifies a method of measurement of the masses of e-liquid vaporised and the aerosol collected from vapour product(s).

It does not specify the vapour product(s), the vapour product(s) operational settings or, e-liquid to be used.

NOTE Application of this document can be required as a preliminary step for subsequent analyses.

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 20768, *Vapour products — Routine analytical vaping machine — Definitions and standard conditions*

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 <https://www.electropedia.org/>

3.1

aerosol collected mass

ACM

mass of aerosol collected on a glass fibre filter pad resulting from the operation of a vapour product by a routine analytical vaping machine after a defined number of puffs

Note 1 to entry: Routine analytical vaping machine is covered by ISO 20768.

3.2

puff block

finite series of sequential puffs as defined by the test request

EXAMPLE Puff block 1: puffs 1 to 50, puff block 2: puffs 51 to 100, puff block 3: puffs 101 to 150

3.3

e-liquid vaporised mass

EVM

mass of e-liquid transferred from the vapour product to the aerosol

Note 1 to entry: The term “vapour product mass loss” or “mass loss” refers to the e-liquid vaporised mass.

3.4

glass fibre filter pad overload

physical capacity of the glass fibre filter pad exceeded, which leads to a situation where the (volume of) aerosol condensate is no longer retained by the glass fibre filter pad (trap) or can be introduced into the glass fibre filter pad (be trapped)

Note 1 to entry: The glass fibre filter pad overloading is further described in [Annex A](#).

4 Principle

Aerosol is generated from vapour products by using a routine analytical vaping machine according to ISO 20768. The vapour products generate an aerosol from the e-liquid, which allows the gravimetric measurement of e-liquid vaporised mass and the aerosol collected mass, respectively.

5 Apparatus

Usual laboratory apparatus and, in particular, the following.

- 5.1 **Vaping machine**, in accordance with ISO 20768.
- 5.2 **Analytical balance**, be precise at a minimum of 1 mg with a display precision of 0,1 mg.
- 5.3 **Soap bubble flow meter**, suitable to confirm the required puff volume.
- 5.4 **Glass fibre filter pad**, with specifications according to [Annex B](#).

6 Procedure

6.1 General

EVM is calculated from the vapour product mass loss due to aerosol generations, while ACM is calculated from the aerosol generated using a fixed number of puffs and puff blocks following standard operational settings and environmental conditions in accordance with ISO 20768.

Prior to vaping, each aerosol collection system used should be checked to ensure that there are no leaks and that the correct puff volume is obtained. Both leak and puff volume checks should be performed according to the vaping machine manufacturer's recommendations. The amount of aerosol generated depends on the nature of the vapour product, operational settings and the e-liquid. It is highly recommended to perform a trapping efficiency study to verify the glass fibre filter pad has not been overloaded. Trapping efficiency is described in more detail in [Annex A](#).

6.2 Preparation

6.2.1 Vapour products

All the vapour products to be tested should be stored at room temperature. Vapour products with rechargeable batteries shall be fully charged before the test and be operated in accordance with the manufacturer recommendations.

6.2.2 Filter pad handling

The handling of the filter pad shall be done according to the following laboratory practises.

- Wear proper gloves (powder free) for all operations to prevent contamination.

- Filter pads shall be stored in the target atmosphere of the test conditions for a minimum of 24 h prior to use.
- Prepared filter pad holders shall be weighed and mass recorded (see 6.4, m_i).
- If the filter pad holder is not used immediately, install a filter pad holder cap to prevent water loss or uptake.

6.2.3 Aerosol trapping

The number of puffs or puff blocks are dependent on the test device performance and/or test requirements and shall also take into consideration the avoidance of glass fibre filter pad overloading.

6.2.4 Puff volume check

Prior to vaping, each vaping channel shall be checked to ensure the correct puff volume is obtained. Volume checks shall be performed according to the vaping machine manufacturer's recommendations.

6.2.5 Handling of aerosol samples

If aerosol samples are not analysed immediately after vaping, install a filter pad holder cap to prevent water loss or uptake.

6.3 Determination of e-liquid vaporised mass (EVM)

Step 1: To perform the test, the vapour product shall be operated in accordance with the manufacturer's recommendations.

Step 2: The initial measurement shall be carried out on the whole vapour product filled or pre-filled with e-liquid (e.g. tank or pod with power source, but without mouth end protective cap). Measure and record the mass (m_i) of the vapour product, then attach it to the corresponding port of the vaping machine.

Step 3: Generate a sufficient number of puffs to provide enough mass loss to be measured gravimetrically with sufficient accuracy.

Step 4: Disconnect the vapour product from the vaping machine.

Step 5: The final measurement of the vapour product's mass (m_f) shall be carried out on the whole vapour product (e.g. tank or pod with power source, but without mouth end protective cap).

The e-liquid vaporised mass is calculated by [Formula \(1\)](#).

$$m_{\text{EVM}} = m_i - m_f \quad (1)$$

where

m_{EVM} is the e-liquid vaporised mass (EVM), in milligram;

m_i is the vapour product mass before aerosol generation, in milligram;

m_f is the vapour product mass after aerosol generation, in milligram.

6.4 Determination of aerosol collected mass (ACM)

Step 1: To perform the test, the vapour product shall be operated in accordance with the manufacturer recommendations.

Step 2: The initial measurement shall be carried out on the aerosol collection system. Connect the pre-measured and recorded (m_i) glass fibre filter pad holder including the glass fibre filter pad to the vaping machine by using trapping seal if necessary.

Step 3: Generate a sufficient number of puffs to provide enough mass to be measured gravimetrically with sufficient accuracy

Step 4: Disconnect the aerosol collection system from the vaping machine.

Step 5: Measure the final mass (m_f) of the glass fibre filter holder.

The aerosol collected mass is calculated by [Formula \(2\)](#).

$$m_{ACM} = m_f - m_i \quad (2)$$

where

m_{ACM} is the aerosol collected mass (ACM), in milligram;

m_i is the glass fibre filter holder mass before aerosol generation, in milligram;

m_f is the glass fibre filter holder mass after aerosol generation, in milligram.

6.5 Specific mass determination of puff blocks

The mass of vapour product or glass fibre filter holder before next aerosol collection shall be verified.

The e-liquid vaporised mass shall be measured on each puff block. The m_E is defined by the following [Formula \(3\)](#) and [Formula \(4\)](#).

$$m_{EVM,t} = \sum_{k=1}^n m_{EVM,k} \quad (3)$$

$$m_{EVM,n} = m_{i,n} - m_{f,n} \quad (4)$$

where

$m_{EVM,t}$ is the e-liquid vaporised mass (EVM) for all puff blocks, in milligram;

$m_{EVM,n}$ is the e-liquid vaporised mass for one puff block, in milligram;

k is the number of puff block;

n is the numbering of the puff block or puffs;

$m_{i,n}$ is the vapour product mass before aerosol generation of puff block n , in milligram;

$m_{f,n}$ is the vapour product mass after aerosol generation of puff block n , in milligram.

If reservoir is not refilled between puff blocks: $m_{f,n} = m_{i,n+1}$

If reservoir is refilled between puff blocks: $m_{f,n} \neq m_{i,n+1}$

The aerosol collected mass shall be measured on each puff block. The aerosol collected mass is defined by the following [Formula \(5\)](#) and [Formula \(6\)](#).

$$m_{ACM,t} = \sum_{k=1}^n m_{ACM,k} \quad (5)$$