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**Cigarettes — Determination of carbon  
monoxide in sidestream smoke —  
Method using a routine analytical linear  
smoking machine equipped with a fishtail  
chimney**

*Cigarettes — Détermination du monoxyde de carbone dans le courant  
secondaire de fumée — Méthode utilisant une machine à fumer  
analytique de routine linéaire équipée d'une cheminée individuelle en  
forme de queue de poisson*



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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 20774 was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*.

## Introduction

Cigarettes are manufactured to close tolerances using strict quality control procedures.

However, all the constituents involved in the manufacture are derived from natural products and this results in a final product which is intrinsically variable. Further complexity arises as the cigarette is combusted during smoking to yield the cigarette smoke.

The quantitative measurement of carbon monoxide is therefore dependent on the arbitrary definition of the means used to generate and collect the smoke. In particular, the ambient conditions (e.g. temperature, humidity, air movement within the laboratory) under which the test pieces are conditioned and smoke is collected, play a critical role in the accuracy of the measurement.

Sidestream smoke in this International Standard is understood to be the smoke that is evolved from the cigarette during the smoking run other than from the mouth end.

**NOTE** This is distinguished from environmental tobacco smoke (ETS), which is a mixture of aged and diluted exhaled mainstream smoke and aged and diluted sidestream smoke, and for the assessment of which the present method does not apply.

From the time that scientists have attempted to determine carbon monoxide yields in sidestream smoke, many different methods have been adopted. However, experience has shown some procedures to be more reliable and more amenable to handling of large numbers of samples. With these factors in mind, during the 1999–2002 period, collaborative studies by a task force composed of CORESTA members have shown that improvements in repeatability and reproducibility result when some restrictions are placed upon the wide variety of methods and practices described in existing methods.

This International Standard, produced after much collaborative experimentation by many laboratories in many countries, reflects the results of the optimization proposed and validated by the task force and provides one set of procedures that are the accepted reference procedures and for which repeatability and reproducibility of the determinations were assessed. Experience in the task force has shown how strict adherence to the detailed set up and conditions of the method, as well as the degree of proficiency of the operator, affect the precision of the results.

Further, it is preferable that the selected method be compatible with different modes of cigarette equilibration or puffing parameters for the smoking of the tested pieces. The standards defined by ISO for the determination of mainstream yields were, however, followed to the largest possible extent, although the machines used by the different laboratories were all of a linear type.

This method is a machine method and it allows cigarettes to be smoked using a strictly controlled set of parameters. Thus it enables the sidestream carbon monoxide yields from cigarettes, when smoked by this procedure, to be compared and ranked. In the course of its studies, the task force demonstrated the value of comparing the analytical processes and their stability by use of the CORESTA monitor test piece for determining sidestream CO yields.

Since the determination of sidestream CO yield is by nature more complex and delicate than its counterpart performed on mainstream smoke, it is highly recommended to include a control test piece in the smoking plans, as is done in mainstream determinations. It is possible to use the CORESTA monitor or any other internally designed control cigarette for this purpose. The use of an internationally recognized monitor test piece is recommended.

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# Cigarettes — Determination of carbon monoxide in sidestream smoke — Method using a routine analytical linear smoking machine equipped with a fishtail chimney

## 1 Scope

This International Standard is applicable to the determination of carbon monoxide present in the sidestream smoke from cigarettes. The described method is specified using the ISO 3308 smoking parameters (puff volume, duration and frequency) and butt length, but it is technically compatible with other smoking regimes.

NOTE The method may not be directly applicable to other sidestream smoke analytes.

## 2 Normative references

The following referenced documents are indispensable for the application 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 2971, *Cigarettes and filter rods — Determination of nominal diameter — Method using a laser beam measuring apparatus*

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

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

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

ISO 6488, *Tobacco and tobacco products — Determination of water content — Karl Fischer method*

ISO 6565, *Tobacco and tobacco products — Draw resistance of cigarettes and pressure drop of filter rods — Standard conditions and measurement*

ISO 8243, *Cigarettes — Sampling*

ISO 8454:1995, *Cigarettes — Determination of carbon monoxide in the vapour phase of cigarette smoke — NDIR method*