
**Information technology —
Determination of chemical emission
rates from electronic equipment —**

**Part 1:
Using consumables**

*Technologies de l'information — Détermination des taux d'émission
chimique d'un équipement électronique —*

Partie 1: Utilisation de consommables

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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 document should be noted (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC 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) or the IEC list of patent declarations received (see patents.iec.ch).

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 www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by ECMA International (as ECMA-328-1) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

This second edition cancels and replaces the first edition (ISO/IEC 28360-1:2018), which has been technically revised.

The main change compared to the previous edition is as follows:

- reorganization to incorporate RAL-UZ Options into the main text as one of the two methods for determining emission rates of VOC and carbonyl compounds.

A list of all parts in the ISO/IEC 28360 series can be found on the ISO and IEC websites.

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 and www.iec.ch/national-committees.

Introduction

Globally, governmental agencies, academic institutions, environmental organizations and manufacturers have started to develop methods to determine chemical emissions from electronic equipment. These attempts however, initially resulted in a range of tests from which the results were not necessarily comparable, either qualitatively or quantitatively.

Following the publications of the 1st edition of ECMA-328 in 2001 and the “Test method for the determination of emissions from Hard Copy Devices” (RAL-UZ 122), experts from BAM and Ecma have collaborated to harmonise methods to determine the chemical emission rates from ICT & CE equipment in the 2nd edition.

In addition to stricter test procedures, the 2nd edition used generalised emission formulae, and their derivations developed in Annex C, to calculate emission rates from concentrations of analytes that are measured in Emission Test Chambers.

The 3rd edition was fully aligned with the 1st edition of ISO/IEC 28360:2007 adopted under ISO/IEC JTC 1 fast track procedure and published in September 2007.

In addition, the 4th edition fixed a number of errata on ISO/IEC 28360:2007 that JTC 1/SC 28 identified.

Following the publications of the 4th edition of ECMA-328 and the “Test method for the determination of emissions from Hard Copy Devices” (RAL-UZ 122), experts from BAM, WKI, JBMIA and Ecma have collaborated to harmonise methods to determine the Fine Particle (FP) and Ultrafine Particle (UFP) emissions from hard copy devices in the 5th edition.

The 6th edition was aligned with the 2nd edition of ISO/IEC 28360:2012, and it added a new ozone calculation method. “Test method for the determination of emission from Hard Copy Devices” (RAL-UZ 122) has been replaced by “Test method for the determination of emission from Hard Copy Devices” (RAL-UZ 171) published in January 2013. Therefore, “RAL-UZ 122 option” is replaced with “RAL-UZ 171 option” in the 6th edition.

The 7th edition of ECMA-328 is fully aligned with ISO/IEC 28360:2015.

The 8th edition was divided into two parts, a part for electronic equipment using consumables and a part for electronic equipment not using consumables:

- Determination of Chemical Emission Rates from Electronic Equipment – Part 1 (using consumables)
- Determination of Chemical Emission Rates from Electronic Equipment – Part 2 (not using consumables)

The purpose of the split was to make the description of test procedures simpler (they included considerable differences between the two equipment categories) and to facilitate users' understanding.

This 8th edition is fully aligned with “Test method for the determination of emission from Hard Copy Devices” (RAL-UZ 205).

The 9th edition is fully aligned with the third edition of ISO/IEC 28360:2018.

The 10th edition has been re-organised to incorporate RAL-UZ Options into the main text as one of the two methods for determining emission rates of VOC and carbonyl compounds.

One method (QEM), which is in harmony with DE-UZ 205¹, Test Method for the Determination of Emissions from Hardcopy Devices (Appendix S-M), originates from the former RAL-UZ 205 Options. The other method (CEM) employs the generalised constant emission model in the former editions. The two methods may yield slightly different emission rates, so the user is encouraged to select the one that satisfies their technical application.

Different elements of the two methods are described alongside each other in the main text. The models used to calculate emission rates in each method are explained in the informative Annexes C and D. Some requirements in the former RAL-UZ Options which appear too detailed and stringent as an international standard are now listed in the informative Annex E so that users can fully meet the requirements of DE-UZ 205¹ (Appendix S-M).

In this edition, it is deduced in the CEM that emission rates of VOC and carbonyl compounds during the operating phase (SER_{ope}) originate from the pre-operating phase (SER_{pre}) and printing (SER_{prp}) operations as well as in the QEM and the former RAL-UZ Options.

This part of the Standard is Part 1.

This Ecma Standard was developed by Technical Committee 38 and was adopted by the General Assembly of December 2020.

¹ The German Blue Angel Environmental Label changed the naming convention of its award criteria from RAL-UZ 205 to DE-UZ 205 in 2019.

Information technology — Determination of chemical emission rates from electronic equipment —

Part 1: Using consumables

1 Scope

This Standard (all parts) specifies methods to determine chemical emission rates of analytes from ICT & CE equipment during intended operation in an Emission Test Chamber (ETC).

This Standard (all parts) includes specific methods for equipment using consumables, such as printers, and equipment not using consumables, such as monitors and PC's.

Part 1 specifies the methods to determine the emission rates of VOC and carbonyl compounds, ozone, particulate matter, fine particles (FP) and ultra-fine particles (UFP) from electronic equipment using consumables.

The methods comprise preparation, sampling (or monitoring) in a controlled ETC, storage and analysis, calculation and reporting of emission rates.

Part 1 has two different methods for the determination of emission rates of VOC and carbonyl compounds. The two methods use two different emission models, the quasi-equilibrium model (QEM) and the constant emission model (CEM) respectively, to determine the emission rates of VOC and carbonyl compounds during the pre-operating phase.

The quasi-equilibrium model method has been developed with hard copy devices for office or home use in mind whose energy-saving modes automatically activate during most intervals between operations. The calculation of emission rates during the pre-operating phase is based on the quasi-equilibrium assumption as shown in Annex C.

The emission rates determined with this method can be used to compare equipment in the same class since test procedures are specified more narrowly than the other method (CEM).

The constant emission model (CEM) has been developed for hard copy devices whose energy-saving modes have such a negligible effect on the determination of emission rates of VOC and carbonyl compounds that the generalised constant emission model shown in Annex D can be used for the determination of their emission rates during the pre-operating phase. This method presents more flexible test procedures than the QEM. Due to such features of this method, it may be used for hard copy devices whose idling mode usually lasts throughout intervals between operations, such as large hard copy devices used professionally. It may also be used for various equipment having different functions and structure for its intended use and the determination of carbonyl compounds requiring longer sampling duration due to a lack of sensitivity.

Annex A specifies monochrome and colour print patterns for use in the operating phase of EUT using consumables.

The operational readiness of AMS is confirmed according to Annex B.

Predictions of “real indoor” concentrations from the determined emission rates are outside the scope of this document.

2 Conformance

Determinations of emission rates and total number of emitted particles conform to this Standard (Part 1) when:

1. Executed using a Quality Assurance Project Plan, Quality Assurance and Quality Control as specified in ISO 16000-9;
2. Tested in a controlled ETC as specified in Clause 7;
3. Sampled/monitored and calculated as specified in Clause 8 and Annex B;
4. Reported as specified in Clause 9.

3 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 554:1976, *Standard atmospheres for conditioning and/or testing – Specifications*

ISO 16000-3:2011, *Indoor air – Part 3: Determination of formaldehyde and other carbonyl compounds – Active sampling method*

ISO 16000-6:2011, *Indoor air – Part 6: Determination of volatile organic compounds in indoor and chamber air by active sampling on TENAX TA sorbent, thermal desorption and gas chromatography using MS/FID*

ISO 16000-9:2006, *Indoor air – Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method*

ISO 16017-1:2000, *Indoor ambient and workplace air - Sampling and analysis of volatile organic compounds by sorbent tube / thermal desorption / capillary gas chromatography – Part 1: Pumped sampling*

CIE 15:2004, *Commission Internationale de l'Eclairage – Colorimetry, 3rd edition*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1

averaged concentration time series

simple moving average of total particle number concentration (C_p) over 31 ± 3 seconds

4.2

averaged ozone concentration time series

simple moving average of ozone concentration (Co_3) over 80 ± 5 seconds

4.3

aerosol

suspension of solid particles and/or liquid droplets in a gas

4.4

aerosol measuring system

AMS

device category for measuring the total particle number concentration of an aerosol within a size range at a certain frequency