

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS X 6936 : 2011

(JBMIA/JSA)

**Information technology—
Office equipment—Measurement of
ozone, volatile organic compounds
and dust emission rates from
copiers, printers and multi-function
devices**

ICS 13.040.99;19.040;35.260;37.100.10

Reference number : **JIS X 6936 : 2011 (E)**

Date of Establishment: 2005-03-20

Date of Revision: 2011-01-20

Date of Public Notice in Official Gazette: 2011-01-20

Investigated by: Japanese Industrial Standards Committee
Standards Board

Technical Committee on Information Technology

JIS X 6936:2011, First English edition published in 2012-07

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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Printed in Japan

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Business Machine and Information System Industries Association (JBMIA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS X 6936:2005** is replaced with this Standard.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public or utility model right. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public or utility model right.

Information technology— Office equipment—Measurement of ozone, volatile organic compounds and dust emission rates from copiers, printers and multi-function devices

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO/IEC 28360** published in 2007 with some modifications of the technical contents such that matters relating to the equipment which does not use consumables are deleted, because **JIS C 9913** has been also established for that equipment based on **ISO/IEC 28360**.

The portions given dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies methods to determine the chemical emission rates of analytes from hard copy devices which use consumables during intended operation in an emission test chamber (ETC).

This Standard consists of the preparation, sampling (or monitoring) of air in the ETC, storage and analysis, and calculation and reporting of emission rates.

In Annex A, monochrome and colour print patterns for use in the operating phase of the hard copy devices are specified. In Annex B, the approximation equation led from the generalised model is described.

The determination may be according to the additional requirements identified by “RAL-UZ-122 Option”.

The emission rates determined with this method may be used to compare equipment in the same class.

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

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO/IEC 28360:2007 *Information technology—Office equipment—Determination of chemical emission rates from electronic equipment* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are **IDT** (identical), **MOD** (modified), and **NEQ** (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Conformance

Conditions where the determination of emission rate conforms to this Standard shall be as follows.

- a) The Quality Assurance Project Plan, Quality Assurance and Quality Control specified in **ISO 16000-9** shall be used. For the measuring method and the accuracy of results, **JIS Z 8402-1**, **JIS Z 8402-2** and **JIS Z 8402-3** shall be conformed.
- b) Tests shall be executed in the controlled ETC specified in clause **7** and **8.1**.
- c) The air sampling and calculation method specified in clause **8** shall be conformed.
- d) Reporting shall be executed as specified in clause **9**.

Determinations according to additional requirements identified by “RAL-UZ 122 Option” herein shall conform to Appendix 2 of **RAL-UZ 122**.

3 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards with the year indication, only the editions of the indicated year shall be applied and the revisions (including amendments) made thereafter shall not be applied. For those without the indication of the year, the most recent editions (including amendments) shall be applied.

JIS Z 8402-1 *Accuracy (trueness and precision) of measurement methods and results—Part 1: General principles and definitions*

JIS Z 8402-2 *Accuracy (trueness and precision) of measurement methods and results—Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

JIS Z 8402-3 *Accuracy (trueness and precision) of measurement methods and results—Part 3: Intermediate measures of the precision of a standard measurement method*

ISO 554:1976 *Standard atmospheres for conditioning and/or testing—Specifications*

ISO 13655 *Graphic technology—Spectral measurement and colorimetric computation for graphic arts images*

ISO 16000-3:2001 *Indoor air—Part 3: Determination of formaldehyde and other carbonyl compounds—Active sampling method*

NOTE : Corresponding Japanese Industrial Standard: JIS A 1962:2005 *Indoor air—Determination of formaldehyde and other carbonyl compounds—Active sampling method* (MOD)

ISO 16000-6:2004 *Indoor air—Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA[®] sorbent, thermal desorption and gas chromatography using MS/FID*

NOTE : Corresponding Japanese Industrial Standard: JIS A 1965:2007 *Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA[®] sorbent, thermal desorption and gas chromatography using MS/FID* (MOD)

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*

NOTE : Corresponding Japanese Industrial Standard: JIS A 1901:2009 *Determination of the emission of volatile organic compounds and aldehydes for building products—Small chamber method* (MOD)

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*

NOTE : Corresponding Japanese Industrial Standard: JIS A 1966:2005 *Indoor air—Sampling and analysis of volatile organic compounds by sorbent tube / thermal desorption / capillary gas chromatography—Pumped sampling* (MOD)

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

RAL-UZ 122 *Test method for the determination of emissions from Hard Copy Devices*

4 Terms and definitions

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

4.1 air exchange rate, n

ratio of the volume of air brought into the ETC per hour (m^3/h) to the unloaded ETC volume (m^3)

(Unloaded means the state where the EUT is not installed in the ETC.)

4.2 air velocity

air speed (m/s) measured in the ETC in which the EUT is not installed

4.3 analyte

volatile organic compounds, carbonyl compounds, ozone and particulate matter

4.4 consumables

toner, ink, paper and ribbon

4.5 ETC (Emission Test Chamber)

enclosure with controlled operational parameters for testing analyte mass emitted from the EUT

4.6 EUT (Equipment Under Test)

hard copy devices to be tested including accessories, if applicable

4.7 loading factor

ratio of the volume of the EUT to the volume of the unloaded ETC

4.8 hard copy devices

equipment using consumables that includes printers, (photo)copiers and multi functional devices (MFD)

4.9 operating phase

phase in which the EUT is performing its intended functions

4.10 particulate matter

airborne particles

4.11 pre-operating phase

phase in which the EUT is connected to an electrical supply before it enters the operating phase, which may include the warming-up mode and the energy saving modes

4.12 post-operating phase

phase following the operating phase, which may include the energy saving modes

4.13 VOC (Volatile Organic Compounds)

organic compounds identified between *n*-hexane and *n*-hexadecane on the gas chromatographic analysis using non-polarized column

4.14 TVOC (Total Volatile Organic Compounds)

sum of the identified VOC where mass calculation of unidentified substances are obtained by converting to toluene

4.15 SER (unit Specific Emission Rate)

mass of a specific analyte emitted per hour and per EUT ($\mu\text{g/h}$)

4.16 concentration area

time integral value of concentration of VOC in the ETC emitted from the emission source

5 Symbols and abbreviations

5.1 Acronyms and abbreviations

DNPH	2,4-dinitrophenylhydrazine
ETC	Emission Test Chamber
EUT	Equipment Under Test
FID	Flame Ionisation Detector
GC/MS	Gas Chromatography/Mass Spectrometry
MFD	Multi Functional Device
PTFE	Polytetrafluoroethene
PVC	Polyvinylchloride
rH	relative Humidity

SER	unit Specific Emission Rate
TVOC	Total Volatile Organic Compounds
VOC	Volatile Organic Compounds

5.2 Symbols

C_s	Average concentration ($\mu\text{g}/\text{m}^3$)
C_{bg}	Background concentration ($\mu\text{g}/\text{m}^3$)
C_{max}	Maximum ozone concentration ($\mu\text{g}/\text{m}^3$)
C_0	Initial concentration ($\mu\text{g}/\text{m}^3$)
C_{pre}	Average concentration during pre-operating phase ($\mu\text{g}/\text{m}^3$)
C_{ope}	Average concentration during operating phase and optionally during post-operating phase ($\mu\text{g}/\text{m}^3$)
H'	Ozone half-life (min): period for ozone concentration to drop to half
k	Ozone decay constant without air exchange (min^{-1})
k'	Ozone decay constant with air exchange ($k' = k + n/60$) (min^{-1})
m_{after}	Sample filter mass after sampling (μg)
m_{before}	Sample filter mass before sampling (μg)
m_{bg}	Sampled VOC mass for ETC background (μg)
m_{pm}	Mass of particulate matter deposited on filter (μg)
$m_{ref-after}$	Reference filter mass after sampling (μg)
$m_{ref-before}$	Reference filter mass before sampling (μg)
m_s	Sampled VOC mass (μg)
m_{pre}	Sampled VOC mass during pre-operating phase (μg)
m_{ope}	Sampled VOC mass during operating phase and optionally post-operating phase (μg)
n	Air exchange rate (h^{-1})
P	Atmospheric pressure (Pa)
SER_{bg}	Background SER for VOC ($\mu\text{g}/\text{h}$)
SER_{ope}	SER for VOC during operating phase and optionally post-operating phase ($\mu\text{g}/\text{h}$)
SER_{O_3}	SER for ozone ($\mu\text{g}/\text{min}$)
SER_{pm}	SER for particulate matter ($\mu\text{g}/\text{h}$)
SER_{pre}	SER for VOC during pre-operating ($\mu\text{g}/\text{h}$)
T	Ambient temperature (K)
t_{ope}	Operating phase period (h)

t_G	Sampling period during operating phase and optionally post-operating phase (h)
t_{pre}	Pre-operating phase period (h)
V	Volume of ETC (m ³)
V_s	Sampled air volume in ETC for concentration determination (m ³)
V_{bg}	Sampled air volume for background concentration determination (m ³)
V_{pre}	Sampled air volume in ETC for concentration determination during pre-operating (m ³)
V_{ope}	Sampled air volume in ETC for concentration determination during operating phase and optional post-operating phase (m ³)

6 Test method overview

The test method shall be as the flowchart given in figure 1. The number of clause or subclause is shown in parentheses.

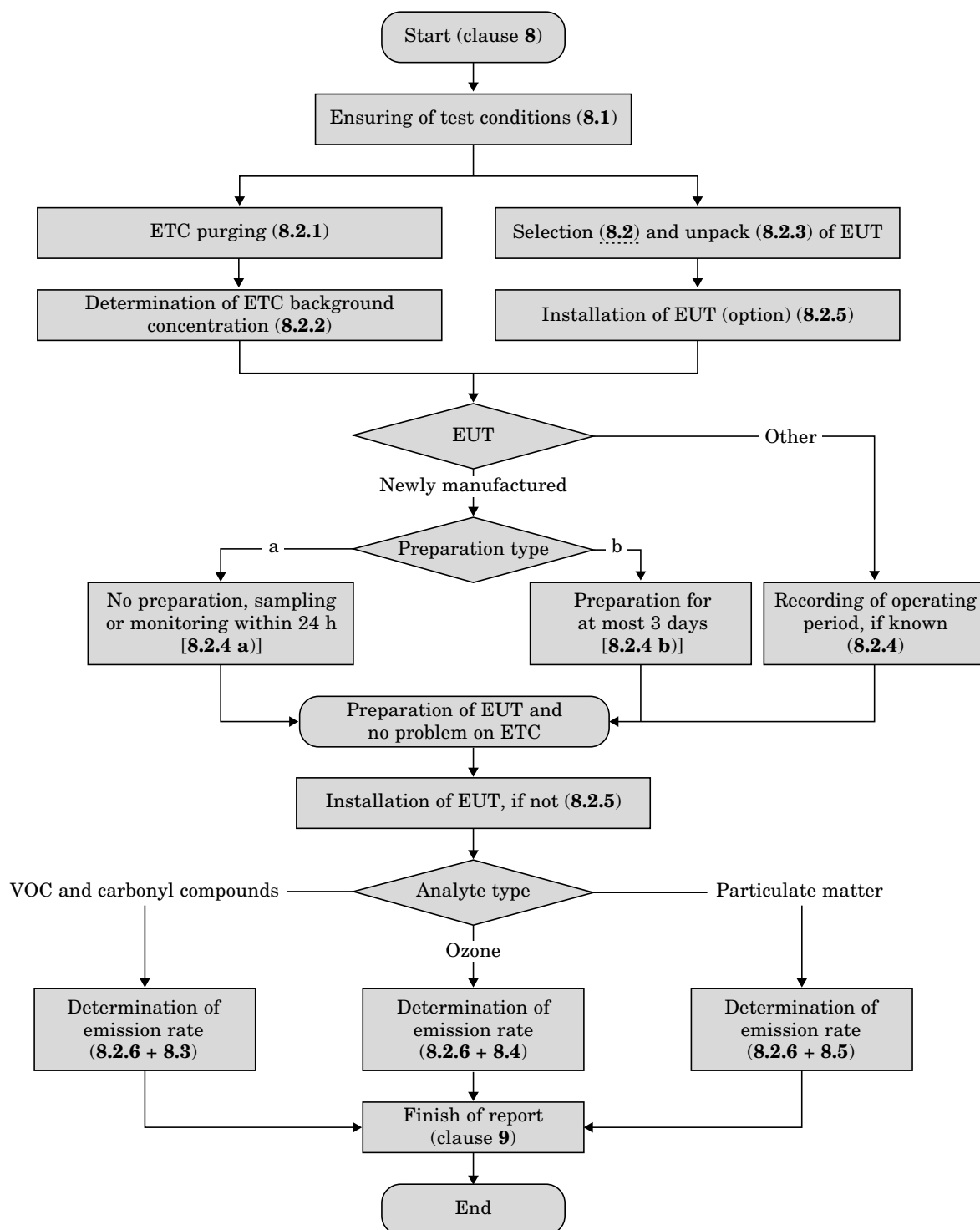


Figure 1 Test method overview

7 Requirements for ETC

7.1 Construction materials

The construction materials of ETC shall be as specified in **ISO 16000-9**.

7.2 Air tightness

The air tightness of ETC shall be as specified in **ISO 16000-9**.

7.3 Air mixing efficiency

The air mixing efficiency in ETC shall be as specified in **ISO 16000-9**.

8 Test method

For the RAL-UZ 122 Option, tests shall be executed within 10 working days after the delivery of EUT.

8.1 Test conditions

To meet the operational requirements specified herein, the parameters of ETC such as temperature, relative humidity and supply airflow shall be controlled and measured at regular intervals, recorded as specified in **ISO 16000-9**, and reported as specified in clause 9.

8.1.1 Operating temperature and relative Humidity (rH)

The test shall be executed at $23\text{ °C} \pm 2\text{ °C}$ and $50\text{ \%rH} \pm 5\text{ \%rH}$ as specified in **ISO 554**. For the EUT used in alternative climatic conditions, higher operating temperature and humidity conditions may be used as specified in **ISO 554**.

See **8.2.6** for special requirements on rH.

8.1.2 Air exchange rate (n)

For the unloaded ETC with a volume larger than 5 m^3 , n shall be in the range from 0.5 to 2.0. For the unloaded ETC with a volume of 5 m^3 or smaller, n shall be in the range from 0.5 to 5.0.

8.1.3 Air velocity

The air velocity shall be in the range from 0.1 m/s to 0.3 m/s.

8.1.4 Sampled airflow

The sum of sampled airflow shall be less than 80 % of the inlet airflow into the ETC.

8.2 Handling of EUT and ETC

The EUT shall be selected from normal manufactured batches or shall be a prototype that is representative for the EUT from such batches. For the determination using the RAL-UZ 122 Option, the EUT shall be stored in an air-conditioned room (e.g., 23 °C , $50\text{ \%rH}$) in its original packaging.

To ensure detection of a minimum emission rate within a practicable period, the ETC with capabilities as specified in **7.2** shall be selected such that the loading factor is in the range of 1:4 to 1:100.

8.2.1 ETC purging

The selected ETC shall be unloaded and its interior walls shall be cleaned as specified in **ISO 16000-9**.

k' shall be less than $0.069\text{ 3 (min}^{-1}\text{)}$, which corresponds to an ozone half-life of greater than 10 min when $n = 1$.

To determine k' , the ETC should be deactivated by exposure to an ozone concentration of 0.2 mg/m^3 to 0.4 mg/m^3 until a stable concentration is reached.

Thereafter, the ETC shall be purged with 4 ETC volumes of clean air.

8.2.2 Background concentration (C_{bg})

Following purging, C_{bg} of analyte shall be determined by sampling the air in the unloaded ETC, and recorded.

NOTE : C_{bg} may stem from e.g., emissions from the ETC itself and sampling tubes or filters.

The C_{bg} values at $n=1$ shall be less than the limits given in table 1.

Table 1 Background concentration

Analyte	Limit $\mu\text{g/m}^3$
VOC and carbonyl compound	2 for each analyte
TVOC	20
Ozone	4
Particulate matter	10

8.2.3 EUT unpacking

The EUT shall be unpacked from the shipping containers, and the EUT shall be separated from all protective shipping/packaging elements. Emissions from packaging may influence measurements considerably; packaging itself may emit substances that are not representative for the EUT in typical use.

NOTE : After unpacking, installation of EUT (8.2.5) may precede the preparation of EUT (8.2.4).

8.2.4 Preparation of EUT before testing

Using 60 g/m^2 to 80 g/m^2 A4 paper with water content from 3.8 % to 5.6 %, while printing the print patterns specified in A.1 and A.2, the maximum operating period shall be determined. Thereafter, lightness (L^*) and/or colour values (L^* , a^* , b^*) shall be determined from the printouts according to CIE 15 and ISO 13655.

For the RAL-UZ 122 Option, no further preparation shall be executed.

Newly manufactured equipment is known to emit higher levels in the first days of use, which is not representative for the normal emissions over the intended lifetime. For newly manufactured equipment, one of the following operations shall be executed.

- The EUT shall not be energized/operated before testing, and supplied to the test within 24 h after unpacking.
- The EUT shall have been in operation for a maximum of 3 days or equivalent, and supplied to the test.

For other equipment that may have been operated longer than 3 days, no preparation shall be executed; in this case, the number of days that the EUT has been in operation shall be recorded, if known, otherwise “not known” shall be reported.