IEC 60456

Edition 5.0 2010-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Clothes washing machines for household use – Methods for measuring the performance

Machines à laver le linge pour usage domestique — Méthodes de mesure de l'aptitude à la fonction

IEC 60456:2010-02(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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CLOTHES WASHING MACHINES FOR HOUSEHOLD USE – METHODS FOR MEASURING THE PERFORMANCE

FOREWORD

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International Standard IEC 60456 has been prepared by subcommittee 59D: Home laundry appliances, of IEC technical committee 59: Performance of household and similar electrical appliances.

This fifth edition cancels and replaces the fourth edition published in 2003 and constitutes a technical revision.

Experience with the use of the fourth edition of IEC 60456, together with some revised test conditions and the need for a more globally applicable standard, are the main reasons for this fifth edition.

This edition includes the following significant technical changes from the previous edition.

- Modified test load mass requirement for cases where rated capacity of test machine is not declared. Test load mass determination in case rated capacity is not declared was changed to remove the ambiguity in edition 4 and to encourage declaration.
- Introduction of soft water option.
- Expanded stain/soil set (for assessment of washing performance).

- Improved method of loading and folding test load items to better suit vertical axis, horizontal axis and twin tub systems.
- Revised and amended reference machine specification reflecting full qualification of new Electrolux Wascator CLS.
- New reference programmes for lower temperatures and vertical axis systems. New informative annex comparing reference programmes to typical household programmes.
- Refined rinsing efficiency method.
- Introduction of low power modes "Off" and "Left On" (for assessment of energy consumption).
- New annex about uncertainty of measurements.

This bilingual version (2018-11) corresponds to the monolingual English version, published in 2010-02.

The text of this standard is based on the following documents:

FDIS	Report on voting
59D/358/FDIS	59D/360/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

Words in **bold** in the text are defined in Clause 3.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of September 2011 have been included in this copy.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

CLOTHES WASHING MACHINES FOR HOUSEHOLD USE – METHODS FOR MEASURING THE PERFORMANCE

1 Scope

This International Standard specifies methods for measuring the performance of clothes **washing machines** for household use, with or without heating devices utilising cold and/or hot water supply. It also deals with appliances for water extraction by centrifugal force (**spin extractors**) and is applicable to appliances for both washing and drying textiles (**washer-dryers**) with respect to their washing related functions. This International Standard also covers **washing machines** which specify the use of no detergent for normal use.

NOTE 1 Tumble dryer performance is assessed to IEC 61121.

The object is to state and define the principal performance characteristics of electric household **washing machines** and **spin extractors** and to describe the test methods for measuring these characteristics.

NOTE 2 This international standard applies also to **washing machines** for communal use in blocks of flats or in launderettes. It does not apply to **washing machines** for commercial laundries. This International Standard is not intended to be used for the comparative evaluation of detergents.

NOTE 3 This International Standard does not specify acoustical noise requirements for **washing machines**. Acoustical noise measurements are specified in IEC 60704-1 and IEC 60704-2-4.

NOTE 4 This International Standard does not specify safety requirements for **washing machines**. Safety requirements are specified in IEC 60335-2-7.

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.

IEC 60335-2-7, *Household and similar electrical appliances – Safety – Part 2-7: Particular requirements for washing machines*

IEC 60734, *Household electrical appliances – Performance – Hard water for testing*

IEC 62053-21, *Electricity metering equipment (a.c.) – Particular requirements – Part 21: Static meters for active energy (classes 1 and 2)*

IEC 62301, *Household electrical appliances – Measurement of standby power*

IEC Guide 109, *Environmental aspects – Inclusion in electrotechnical product standards*

ISO 31-0:1992, *Quantities and units – Part 0: General principles*

ISO 2060, *Textiles – Yarn from packages – Determination of linear density (mass per unit length) by the skein method*

ISO 2061, *Textiles – Determination of twist in yarns – Direct counting method*

ISO 7211-2, *Textiles – Woven fabrics – Construction – Methods of analysis – Part 2: Determination of number of threads per unit length*

EN 12127, *Textiles – Fabrics – Determination of mass per unit area using small samples*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1
washing machine
appliance for cleaning and rinsing of textiles using water which may also have a means of extracting excess water from the textiles

3.1.2
test washing machine
washing machine that is subjected to part or all of the requirements in this document in order to determine its performance

NOTE T**est washing machine** may include washing machines according to 3.1.7, 3.1.8, 3.1.9 and/or 3.1.10.

3.1.3
reference machine
specially constructed **washing machine** of known performance which is used to increase repeatability and reproducibility of results

NOTE It may be used to provide a known performance level within a laboratory against which to compare selected performance parameters on test washing machines as defined in this document – refer 5.4.2.

3.1.4
washer-dryer
washing machine which includes both a **spin extraction** function and also a means for drying the textiles, usually by heating and tumbling

NOTE This document only covers the operations which relate to the **washing machine** function – see Scope.

3.1.5
spin extractor
separate water-extracting appliance in which water is removed from textiles by centrifugal action (**spin extraction**)

3.1.6
standard extractor
spin extractor used to remove water remaining in the base load at the completion of the programme where a rinse performance measurement is required

3.1.7
vertical axis washing machine
w**ashing machine** in which the load is placed in a drum which rotates around an axis which is vertical or close to vertical. For the purposes of this document, vertical axis is where the angle of the axis of rotation is more than 45 degrees to horizontal. Where the drum does not rotate, the washing machine shall be classified as a vertical axis washing machine.

NOTE The classification of vertical axis or horizontal axis in this document is only used to define the placement of the load into the drum.

3.1.8
horizontal axis washing machine
washing machine in which the load is placed in a drum which rotates around an axis which is horizontal or close to horizontal. For the purposes of this document, horizontal axis is where the angle of the axis is less than or equal to 45 degrees to horizontal.

NOTE The classification of vertical axis or horizontal axis in this document is only used to define the placement of the load into the drum.

3.1.9
manual washing machine
washing machine where the machine requires user intervention at one or more points during the programme to enable the machine to proceed to the next **operation**

NOTE Examples of user intervention could include manual fill (non automatic water level), transfer of the load between a washing drum and a **spin extractor** drum or manual draining. **Manual washing machines** have special requirements regarding the **programme** which is tested for this document; see Annex M.

3.1.10
automatic machine
washing machine where the load is fully treated by the machine without the need for user intervention at any point during the **programme** prior to its completion

3.1.11
test run
single performance assessment as specified in Clause 7 of this document

3.1.12
test series
group of **test runs** on a **test washing machine** which, collectively, are used to assess the performance of a **washing machine**

3.1.13
operation
each performance of a function that occurs during the **washing machine programme** such as pre-wash, washing, rinsing, draining or spinning

3.1.14
programme
series of **operations** which are pre-defined within the **washing machine** and which are declared by the manufacturer as suitable for washing certain textile types

3.1.15
cycle
complete washing process, as defined by the **programme** selected, consisting of a series of **operations** (wash, rinse, spin, etc.) and including any **operations** that occur after the completion of the **programme**

NOTE Examples of **operations** that may occur after the completion of the **programme** are pumping, monitoring and anti-creasing (where applicable).

3.1.16
spin extraction
water-extracting function by which water is removed from textiles by centrifugal action. This is included as a function (built in **operation**) of an **automatic washing machine** but may also be performed in a **spin extractor**

3.1.17
spin speed
rotational frequency of a drum during **spin extraction**

NOTE A method for determination of **spin speed** is not defined in this standard.

3.1.18
base load
textile load used for testing without stain test strips or wool shrinkage specimens

3.1.19
test load
base load used for testing plus stain test strips or wool shrinkage specimens

3.1.20
test load mass
actual mass of the base load plus stain test strips or wool specimen

3.1.21
nominal test load mass
mass of dry textiles of a particular type for which the performance of the test washing machine shall be tested (rated capacity or part load). Target value for the conditioned **test load mass**

3.1.22
rated capacity
maximum mass in kg of dry textiles of a particular type which the manufacturer declares can be treated in the **washing machine** on the **programme** selected

3.1.23
programme time
programme time is the time from the initiation of the **programme** (excluding any user programmed delay) until the completion of the **programme**. If the end of **programme** is not indicated, the **programme time** is equal to the **cycle time**.

3.1.24
end of programme
the **programme** is complete when the **washing machine** indicates the end of the **programme** and the load is accessible to the user. Where there is no end of **programme** indicator and the door is locked during operation, the **programme** is complete when the load is accessible to the user. Where there is no end of **programme** indicator and the door is not locked during operation, the **programme** is complete when the power consumption of the appliance drops to some steady state condition and is not performing any function.

NOTE An indication of the end of the **programme** may be in the form of a light (on or off), a sound, an indicator shown on a display or the release of a door or latch. In some **washing machines** there may be a short delay from an end of **programme** indicator until the load is accessible by the user.

3.1.25
cycle time
time from the initiation of the **programme** (excluding any user programmed delay) until all activity ceases. Activity is considered to have ceased when the power consumption reverts to a steady state condition that persists indefinitely without user intervention. If there is no activity after the end of the **programme**, the **cycle time** is equal to the **programme time**

NOTE **Cycle time** includes any activity that may occur after the **programme** is completed. This could include any electronic activity or any additional mechanical activity that occurs for a limited period after any end of **programme** indicator. Any cyclic event that occurs indefinitely is considered to be steady state.

3.1.26
main wash duration
time from the commencement of the initial water intake for the main wash until the commencement of the initial water intake for the first rinse

NOTE Variations in the laboratory water supply pressure may affect the **main wash duration**. This definition is only applicable to **test washing machines**. The **reference machine** wash time used for calibration of the **reference machine** is defined differently. Refer to Table E.1.

3.1.27
remaining moisture content
measure for the additional amount of moisture that is contained in the **base load** in relation to the equilibrium condition for **base load** items which have been conditioned in a controlled space (refer to 6.4.5.2)

NOTE This equilibrium condition is defined as 0 % **remaining moisture content** in this document. Hence it is possible for a **base load** or load items to have a negative **remaining moisture content** when treated with a tumble drier. Refer also to Annex G.

3.1.28
off mode
condition where the product is switched off using appliance controls or switches that are accessible and intended for operation by the user during normal use to attain the lowest power consumption that may persist for an indefinite time while connected to a mains power source and used in accordance with the manufacturer's instructions. Where there are no controls, the washing machine is left to revert to a steady state power consumption of its own accord.

3.1.29
left on mode
lowest power consumption mode that may persist for an indefinite time after the completion of the programme and unloading of the machine without any further intervention of the user

NOTE In some products this mode may be an equivalent power to **off mode**.

3.1.30
rated voltage
voltage assigned to the appliance by the manufacturer

3.2 Symbols

3.2.1 Symbols relating to Subclause 9.2 – washing performance

C_k	the sum of the average reflectance values (Y-values) for each **test run**
$\overline{C}$	the average sum of the reflectance values (Y-values) for each of the five types of soils, for all valid **test runs**
$C_{k_{\text{test}}}$	the sum of the reflectance values in each **test run** of the **test washing machine**
$\overline{C}_{\text{test}}$	the average sum of the reflectance values of the **test washing machine**
$\overline{C}_{\text{ref}}$	the average sum of the reflectance values in each **test run** of the **reference machine**
m	the number of soil types per stain test strip
n	the number of stain test strips in each **test run**
p	confidence interval for q
q	ratio between the **test washing machine**, $\overline{C}_{\text{test}}$, and the **reference machine**, $\overline{C}_{\text{ref}}$
s_q	standard deviation of the ratio q
s_C	the standard deviation of C_k
s_i	the standard deviation of the reflectance values for each soil type within a given **test run**
$t_{\text{w-1, 0,05}}$	the "Student T" factor for (w-1) degrees of freedom for a confidence of 95 % (i.e. 2,776 for five **test runs** equals four degrees of freedom, two sided test)
w	the number of **test runs** in the **test series**
$\overline{x}_i$	the average reflectance values for each soil type