

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Tumble dryers for household use – Methods for measuring the performance

Sèche-linge à tambour à usage domestique – Méthodes de mesure de l'aptitude à la fonction

IEC 61121:2012

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**TUMBLE DRYERS FOR HOUSEHOLD USE –
METHODS FOR MEASURING THE PERFORMANCE**

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International Standard IEC 61121 has been prepared by subcommittee 59D: Home laundry appliances, of IEC technical committee 59: Performance of household and similar electrical appliances.

This fourth edition cancels and replaces the third edition published in 2002 and Amendment 1 (2005). This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) General:

- more terms have been defined and some previous definitions have been streamlined, in addition to the correction of some symbols and equations;
- where possible, definitions and terms have been used in common with IEC 60456:2010;
- the content has been organised into a more logical and simple structure, and repetitive sections have been removed.

b) Conditions of measurement:

- the wording of various sections has been revised to reduce ambiguity;
- limits have been defined for water characteristics for automatic tumble dryers that are sensitive to conductivity as well as methods to adjust these characteristics where necessary.

c) Reproducibility and repeatability of test results:

- revision of the specification for the cotton **test load** to include suitable test materials which are currently available on the market;
- more careful definition of the process and conditions for **pre-treatment, conditioning and normalization**.

d) Test methods:

- accuracy of measurement has been defined for all instruments;
- limits and interpretations of the allowable **final moisture content** for each type of dryer are now defined;
- practical advice regarding the test procedure has been given with the aim of reducing ambiguity.

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

This bilingual version (2013-07) corresponds to the monolingual English version, published in 2012-02.

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

| FDIS | Report on voting |
|---|------------------|
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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.

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.

INTRODUCTION

This fourth edition has been developed in light of experience with use of the third edition of IEC 61121. The structure has been revised to ensure that this remains harmonised with the IEC 60456:2010 for clothes washers.

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TUMBLE DRYERS FOR HOUSEHOLD USE – METHODS FOR MEASURING THE PERFORMANCE

1 Scope

This International Standard is applicable to household electric **tumble dryers** of the **automatic** and **non-automatic** type, with or without a cold water supply and incorporating a heating device. This excludes **tumble dryers** which use gas or other fuels as a heating source.

The object is to state and define the principal performance characteristics of household electric **tumble dryers** of interest to users and to describe standard methods for measuring these characteristics.

NOTE This International Standard applies also to **tumble dryers** for communal use in blocks of flats or in launderettes. It does not apply to **tumble dryers** for commercial laundries.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60335-2-11:2008, *Household and similar electrical appliances – Safety – Part 2-11: Particular requirements for tumble dryers*

IEC 60456:2010, *Clothes washing machines for household use – Methods for measuring the performance*

IEC 60734:-1, *Household electrical appliances – Performance – Water for testing*

IEC 62053-21:2003, *Electricity metering equipment (a.c.) – Particular requirements – Part 21: Static meters for active energy (classes 1 and 2)*

IEC 62301:2011, *Household electrical appliances – Measurement of standby power*

ISO 5167-1:2003, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full – Part 1: General principles and requirements*

ISO 80000-1:2009, *Quantities and units – Part 1: General*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

¹ To be published.

3.1.1**tumble dryer**

appliance in which textiles are dried by tumbling in a rotating drum, through which air is passed

3.1.2**air vented tumble dryer**

tumble dryer that draws in fresh air which is passed over the textiles and where the resulting moist air is exhausted into the room or vented outside

3.1.3**condenser tumble dryer**

tumble dryer which includes a device for removing moisture from the air used for the drying process

3.1.4**automatic tumble dryer**

tumble dryer which switches off the drying process when a certain **moisture content** of the load is reached

Note 1 to entry: This may include systems that use conductivity or temperature sensing.

3.1.5**non-automatic tumble dryer**

tumble dryer which does not switch off the drying process when a certain **moisture content** of the load is reached, usually controlled by a timer, but may also be controlled manually

3.1.6**test load**

textile load used for testing

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3.1.7**pre-treatment**

processing of a new **test load** prior to its first use to avoid rapid changes of characteristics during the tests

3.1.8**conditioning**

bringing the **test load** into thermodynamic equilibrium with the defined ambient air conditions of temperature and humidity

Note 1 to entry: The process of **conditioning** is not the same as "wetting" which is described in 6.5.7.

3.1.9**test run**

single performance assessment

3.1.10**test series**

group of **test runs** on a **tumble dryer** which, collectively, are used to assess the performance of that **tumble dryer**

3.1.11**operation**

each performance of a function that occurs during the **tumble dryer** drying process such as heating up, drying, cooling, anti-creasing

3.1.12

programme

series of **operations** which are pre-defined within the **tumble dryer** and which are declared by the manufacturer as suitable for drying certain types of textiles

3.1.13

end of the programme

moment in time when the **tumble dryer** indicates the **programme** is complete and the load is accessible to the user

Note 1 to entry: Where there is no such indicator and the door is locked during **operation**, the **programme** is deemed to be complete when the load is accessible to the user. Where there is no indicator and the door is not locked during **operation**, the **programme** is deemed to be complete when the power consumption of the appliance drops to a steady state condition and it is not performing any function. For **non-automatic tumble dryers**, the **programme** is deemed to be complete when it is stopped by the operator.

Note 2 to entry: 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 **tumble dryers** there may be a short delay from an **end of the programme** indicator until the load is accessible by the user.

3.1.14

programme time

period of time from the initiation of the **programme** (excluding any user programmed delay) until the **end of the programme**

3.1.15

cycle

complete drying process, as defined by the selected **programme**, consisting of a series of **operations** including any **operations** that occur after the **end of the programme**

Note 1 to entry: Examples of **operations** that may occur after the completion of the **programme** are monitoring and anti-creasing **operations** (where applicable).

3.1.16

cycle time

period of 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 1 to entry: **Cycle time** includes any activity that may occur for a limited period after the **end of the programme**. Any cyclic event that occurs indefinitely is considered to be steady state.

3.1.17

normalization

processing of a **test load** after a pre-determined number of **cycles** to bring the **test load** to a normal state prior to testing

3.1.18

rated capacity

maximum mass in kg of dry textiles of a particular defined type, which the manufacturer declares can be treated in a specific **programme**

3.1.19

test load mass

actual mass of the **test load**

3.1.20**nominal test load mass**

mass of dry textiles of a particular type for which the performance of the **tumble dryer** will be tested (**rated capacity** or part load). Target value toward which the conditioned **test load mass** will be adjusted

3.1.21**moisture content**

ratio of the difference between **test load mass** and the conditioned **test load mass** to the conditioned **test load mass** expressed in percent

3.1.22**initial moisture content**

moisture content of a **test load** prior to a test run

3.1.23**final moisture content**

moisture content of a **test load** at the end of a test run

3.1.24**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.

Note 1 to entry: Where the **tumble dryer** has no controls or switches that can bring it to the **off mode** condition, it is left to revert to a steady state power consumption by its own accord.

3.1.25**left on mode**

the 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 1 to entry: In some products this mode may be an equivalent power to **off mode**.

3.1.26**rated voltage**

voltage assigned to the appliance by the manufacturer

3.2 List of symbols

The symbols are listed in Table 1.

Table 1 – List of symbols

| Symbol | Unit | Definition |
|------------------|---------------------|---|
| a | - | constant part of the regression line |
| \overline{A} | - | weighted average age of the test load expressed as the number of test runs |
| A_k | - | age of item after conditioning |
| b | - | slope part of the regression line |
| C | % | arithmetical average of the condensation efficiency of all valid test runs |
| C_j | % | condensation efficiency for test run j |
| d | kg/l | density of water |
| E | kWh | arithmetical average of the corrected energy consumption of all valid test runs |
| E_j | kWh | corrected electric energy consumption for test run j |
| E_{mj} | kWh | measured electric energy consumption for test run j |
| E_s | kWh/kg | specific energy consumption |
| F | m ³ /min | volumetric flow rate |
| j | - | test run number |
| k | - | test load item number |
| K | - | constant = $1,9 \cdot 10^{-3} \text{ Pa h}^2/\text{m}^6$ |
| L | l | arithmetical average of the corrected water consumption of all valid test runs |
| L_j | l | corrected water consumption for test run j |
| L_{mj} | l | measured water consumption for test run j |
| L_s | l/kg | specific water consumption |
| m_c | g | Conditioned mass of textile sample (Figure H.1) |
| n | - | number of test runs |
| N | - | number of items in the test load |
| p | Pa | static pressure |
| P_{off} | W | off mode power |
| P_{on} | W | left on mode power |
| S | - | standard deviation of measured results |
| S_b | - | standard deviation of the measured final moisture content for all valid test runs |
| S_w | - | arithmetical average of the evenness of drying of all valid test runs |
| s_{wj} | - | evenness of drying for a single test run |
| t | min | arithmetical average of the programme time of all valid test runs |
| t_s | min/kg | specific programme time |
| t_j | min | corrected programme time for test run j |
| t_{mj} | min | measured programme time for test run j |
| V_c | l | clothes container volume |
| V | m ³ | exhaust air volume |
| W | g | rated capacity for the type of load tested |
| W_0 | g | mass of the conditioned test load |
| W_{0k} | g | mass of conditioned test load item k |

| Symbol | Unit | Definition |
|--------------|------|---|
| W_f | g | mass of the test load after drying |
| W_{fj} | g | mass of test load after drying for test run j |
| W_{fk} | g | mass of test load item <i>k</i> after drying |
| W_i | g | mass of the test load after wetting |
| W_{wj} | g | mass of water collected in the condenser reservoir during test run j |
| x_i | - | <i>i</i> -th term of parameter <i>x</i> |
| \bar{x}_i | - | mean of all terms of parameter <i>x</i> |
| Y | - | performance parameter (energy consumption or programme time) |
| y_b | - | number of table tennis balls |
| μ_f | % | arithmetical average of the measured final moisture content of all valid test runs |
| μ_{fjav} | % | arithmetical average final moisture content of all the individual items in the test load |
| μ_{f0} | % | target final moisture content |
| μ_{fj} | % | measured final moisture content after test run j |
| μ_{fjk} | % | measured final moisture content of the test load item <i>k</i> for each valid test run j |
| μ_{ij} | % | measured initial moisture content for test run j |
| μ_{i0} | % | nominal initial moisture content |

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4 Requirements

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4.1 General

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This international standard does not specify minimum performance requirements for **tumble dryers**. This International Standard does however set methods for the measurement of following performance parameters:

- Electric energy consumption;
- Water consumption;
- **Programme time**;
- Condensation efficiency;
- Evenness of drying;
- Volumetric flow rate of exhaust air;
- **Off mode** power and **left on mode** power.

Any claims of performance referring to this International Standard for these parameters shall be measured in accordance with the requirements of this standard. Any claims of performance referring to this document at other than **rated capacity** shall be qualified with load type and capacity used for the test (refer to Clause 7 for details).

4.2 Rated capacity

The manufacturer or supplier shall declare the **rated capacity** at 0,5 kg intervals for each relevant textile type. Relevant textile types are cotton and synthetic/blends.

The **rated capacity** for any textile type shall not exceed the maximum mass of dry laundry, in kilograms, to be used in the appliance in accordance with 3.1.9 of IEC 60335-2-11:2008.