IEC PAS 63124

Edition 1.0 2017-06

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

colour inside

Tumble dryers for commercial use – Methods for measuring the performance

IEC PAS 63124:2017-06(en)

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

IEC PAS 63124

Edition 1.0 2017-06

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

colour inside

Tumble dryers for commercial use – Methods for measuring the performance

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 97.060

ISBN 978-2-8322-4519-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD 6
1 Scope 8
2 Normative references 8
3 Terms, definitions and symbols 8
3.1 Terms and definitions 8
3.2 List of symbols 11
4 Requirements 12
4.1 General 12
4.2 Rated capacity 13
4.3 Dimensions 13
5 Test conditions, materials, equipment and instrumentation 13
5.1 General 13
5.2 Ambient conditions 14
5.2.1 Electricity supply 14
5.2.2 Water supply 14
5.2.3 Ambient temperature and humidity 15
5.3 Test materials 15
5.3.1 General 15
5.3.2 Test load 15
5.3.3 Detergent 16
5.4 Equipment 16
5.4.1 Equipment for normalization 16
5.4.2 Equipment for conditioning the test load 16
5.4.3 Equipment for wetting the test load prior to a test 16
5.4.4 Equipment for measurement 16
5.5 Instrumentation and accuracy 17
6 Preparation for testing 17
6.1 General 17
6.2 Test specifications from manufacturers 18
6.3 Installation of the tumble dryer 18
6.4 Preparation of the tumble dryer for a test series 18
6.5 Preparation of the tumble dryer for a test run 18
6.6 Preparation of test loads 19
6.6.1 General 19
6.6.2 Pre-treatment of new test load items prior to use 19
6.6.3 Requirements regarding the age of test load items 19
6.6.4 Normalization of test load items 19
6.6.5 Conditioning of test load items 20
6.6.6 Test load composition 20
6.6.7 Wetting 22
7 Performance measurements – General requirements 23
8 Tests for performance 24
8.1 General 24
8.2 Test procedure for performance tests 24
8.2.1 Test conditions, materials and preparation for testing 24
8.2.2 Programme 24

8.2.3 Test load 25
8.2.4 Test procedure 25
8.2.5 Validity of a test run 25
8.2.6 Validity of a test series 25
8.3 Measurements to determine water and energy consumption and programme time 26
8.3.1 General 26
8.3.2 Procedure 26
8.4 Measurements to determine condensation efficiency 26
8.4.1 General 26
8.4.2 Procedure 27
8.5 Measurements to determine exhaust air volume 27
8.6 Performance measurement at maximum exhaust duct pressure 27
8.7 Measurement of the textile drying temperature 27
9 Assessment of performance 27
9.1 General 27
9.2 Final moisture content of the load 28
9.3 Total energy 28
9.4 Corrected energy 28
9.5 Corrected water consumption 29
9.6 Corrected programme time 29
9.7 Condensation efficiency 30
9.8 Evaporation capacity 31
9.9 Exhaust air volume 31
10 Data to be reported 31
Annex A (normative) Reference list 32
A.1 Reference detergent 32
A.2 Specification of test load 32
A.3 The bone dry method of conditioning 32
A.4 Uncertainty of measurement 32
A.5 Environmental aspects of tumble dryer use 32
A.6 Source of materials and supplies 32
A.7 Washing machine for normalization 32
Annex B (normative) Exhaust ducts for tumble dryer testing 33
B.1 General 33
B.2 Specification of the exhaust duct type 1 33
B.2.1 Duct material 33
B.2.2 The form of the duct 33
B.2.3 Instrumentation 34
B.3 Exhaust duct type 2 34
B.3.1 General 34
B.3.2 Specification of exhaust duct Type 2 34
B.3.3 Setting the correct exhaust duct pressure 34
Annex C (informative) Flow diagrams 38
Annex D (normative) Test report – Data to be reported 41
Annex E (normative) Procedure to determine test load size where rated capacity is not declared 45
E.1 General 45

E.2 Determination of the volume of the clothes container 45
E.3 Determination of the test load 45
Annex F (normative) Flexible initial moisture content method 46
F.1 General 46
F.2 Procedure 46
F.3 Evaluation 46
Annex G (normative) Performance testing of steam heated tumble dryers 48
G.1 General 48
G.2 Types of steam heating – Steam heated tumble dryers 48
G.3 Specification of steam properties 48
G.3.1 Type of steam 48
G.3.2 Steam generator 48
G.4 Equipment and instrumentation 48
G.4.1 Test equipment for measuring the characteristics of steam 48
G.4.2 Instruments 49
G.5 Installation 49
G.5.1 General 49
G.5.2 Installation of the measurement equipment for indirect steam heated tumbler dryers.(Alternative 1) 49
G.5.3 Installation of the measurement equipment for indirect steam heated tumble dryers. (Alternative 2) 51
G.6 Preparation for testing 52
G.6.1 General 52
G.6.2 Indirect heated tumble dryer installed according to Alternative 1 52
G.6.3 Indirect heated tumble dryer installed according to alternative 2 53
G.7 Tests for performance 53
G.7.1 General 53
G.7.2 Performance testing of indirect steam heated tumble dryer installed according to alternative 1 53
G.7.3 Performance testing of indirect heated tumble dryers installed according to Alternative 2 53
G.8 Assessment of performance 54
G.8.1 General 54
G.8.2 Evaluation of performance of indirect heated tumble dryer installed according to alternative 1 54
G.8.3 Evaluation of performance of indirect heated tumbler dryers installed according to alternative 2 55
G.8.4 Evaluation of total energy supplied to the tumbler dryer by steam 55
G.9 Data to be reported 56
Annex H (informative) Performance testing of gas heated tumble dryers 57
H.1 General 57
H.2 Installation, testing procedure and calculation of supplied gas energy 57
Annex I (informative) Measurement of exhaust air volume 58
I.1 Procedure 58
I.2 Exhaust air volume 58
Annex J (normative) Measurement of the textile drying temperature 59
J.1 General 59
J.2 Specification of the loggers 59
J.3 Preparation of the loggers before measurement 59
J.4 Number of loggers 59

J.5 Measuring the temperature 60
J.6 Presenting the result 60
Bibliography 61

Figure B.1 – Exhaust duct bend 33
Figure B.2 – Exhaust duct Type 2 35
Figure C.1 39
Figure C.2 40
Figure G.1 – Schematic installation of the measurement equipment for steam heated tumble dryers (Alternative 1) 50
Figure G.2 – Schematic installation of the measurement equipment for steam heated tumble dryers (Alternative 2) 52

Table 1 – List of symbols 11
Table 2 – Specification of instruments 17
Table 3 – Number of items in the test load for various test load masses 21
Table 4 – Specifications for initial moisture content in the test load 23
Table 5 – Specification for final moisture content of the test load after drying in a cotton dry programme 24
Table B.1 – Equivalent tube length of a 90° bend 33
Table B.2 – Pressure drop values for different diameters and flows for a 15 m long duct 36
Table D.1 – Identification data 41
Table D.2 – Test measurements 42
Table D.3 – Test conditions and materials 44
Table J.1 – Specification of temperature logger suitable for temperature measurement for both washing and drying 59
Table J.2 – Number of temperature loggers to be used during a textile drying temperature measurement 60

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

TUMBLE DRYERS FOR COMMERCIAL USE – METHODS FOR MEASURING THE PERFORMANCE

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

A PAS is an intermediate specification not fulfilling the requirements for a standard, but made available to the public.

IEC PAS 63124 has been processed by subcommittee 59D: Performance of household and similar electrical laundry appliances, of IEC technical committee 59: Performance of household and similar electrical appliances.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
59D/447/DPAS	59D/451/RVDPAS

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This document is based on CLC/TS 50594:2015.

This PAS shall remain valid for an initial maximum period of 2 years starting from the publication date. The validity may be extended for a single period up to a maximum of 2 years, at the end of which it shall be published as another type of normative document, or shall be withdrawn.

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.

TUMBLE DRYERS FOR COMMERCIAL USE – METHODS FOR MEASURING THE PERFORMANCE

1 Scope

This PAS is applicable to **tumble dryers** for commercial use of the **automatic** and **non-automatic** type, incorporating an electric or steam heating device. It also includes **tumble dryers** which use gas as a heating source with a reference to appropriate EN gas standards.

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

NOTE It does not apply to **transfer tumble dryers** or dryers with automatic loading and unloading.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 12953-10, *Shell boilers – Part 10: Requirements for feedwater and boiler water quality*

EN 50570:2013, *Household and similar electrical appliances – Safety – Particular requirements for commercial electric tumble dryers*

CLC/TS 50640:2015, *Clothes washing machines for commercial use – Methods for measuring the performance*

EN 60456:2011, *Clothes washing machines for household use – Methods for measuring the performance* (IEC 60456:2010, modified)

EN 60734, *Household electrical appliances – Performance – Water for testing* (IEC 60734)

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

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.

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
transfer tumble dryer
tumble dryer with automatic loading and unloading via conveyers or by other means

Note 1 to entry: The loading and unloading conveyers are often located on opposite sides of the drying basket.

3.1.7
test load
textile load used for testing

3.1.8
pre-treatment
processing of a new **test load** prior to its first use to avoid rapid changes of characteristics during the tests

3.1.9
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 6.6.7.

3.1.10
test run
single performance assessment

3.1.11
test series
group of **test runs** on a **tumble dryer** which, collectively, are used to assess the performance of that **tumble dryer**

3.1.12
operation
performance of a function that occurs during the **tumble dryer** drying process such as heating up, drying, cooling, anti-creasing

3.1.13
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

3.1.14
end of the programme
moment in time when the **tumble dryer** indicates the **programme** is complete and the load is accessible to the user

3.1.15
programme time
period of time from the initiation of the **programme** (excluding any user programmed delay) until the **end of the programme**

3.1.16
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).

3.1.17
cycle time
period of time from the initiation of the **programme** (excluding any user programmed delay) until all activity ceases

Note 1 to entry: 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 2 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.

3.1.18
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

3.1.19
rated capacity
maximum mass in kilograms of dry textiles of a particular defined type, which the manufacturer declares can be treated in a specific **programme**

3.1.20
test load mass
actual mass of the **test load**

3.1.21
conditioned test load mass
mass of the **test load** when conditioned to correct humidity and temperature defined in 5.2.3.2

3.1.22
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)

Note 1 to entry: Target value toward which the **conditioned test load mass** will be adjusted.

[SOURCE: EN 61121:2013, 3.1.20, modified – The second part of the definition has been turned into the present Note 1 to entry.]

3.1.23
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

3.1.24
initial moisture content
moisture content of a **test load** prior to a test run

3.1.25
final moisture content
moisture content of a **test load** at the end of a test run

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
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_C	kg/min	evaporation capacity
E_j	kWh	corrected **total energy** consumption for **test run** *j*
E_{mj}	kWh	measured **total energy** consumption for **test run** *j*
E_{ej}	kWh	measured **electric** energy consumption for **test run** *j*
E_{sj}	kWh	measured **steam** energy consumption for **test run** *j*
E_{gj}	kWh	measured **gas** energy consumption for **test run** *j*
E_s	kWh/kg	specific corrected energy consumption
F	m^3/min	volumetric flow rate
j	-	**test run** number
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
n	-	number of **test runs**
p	Pa	static pressure
S	-	standard deviation of measured results

Symbol	Unit	Definition
S_b	-	standard deviation of the measured **final moisture content** for all valid **test runs**
T	min	arithmetical average of the corrected **programme time** of all valid **test runs**
T_s	min/kg	specific corrected **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_f	g	mass of the **test load** after drying
W_{fj}	g	mass of the **test load** after drying for **test run** j
W_i	g	mass of the **test load** after wetting
W_w	g	mass of water collected
W_{wj}	g	mass of water collected during **test run** j
W_S	kg	mass of the small sheet in a **test load**
W_M	kg	mass of the medium sheet in a **test load**
W_L	kg	mass of the large sheet in a **test load**
W_T	kg	desired masst of the test load
x_i	-	i-th term of parameter x
$\overline{x_i}$	-	mean of all terms of parameter x
X_S		number of small sheets in a **test load**
X_M		number of medium sheets in a **test load**
X_L		number of large sheets in a **test load**
Y	-	performance parameter (energy consumption or **programme time**)
μ	%	average measured **final moisture content** for a **test load**
μ_{f0}	%	target **final moisture content**
μ_{fj}	%	measured **final moisture content** after **test run** j
μ_{ij}	%	measured **initial moisture content** for **test run** j
μ_{i0}	%	nominal **initial moisture content**

4 Requirements

4.1 General

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

- electric energy consumption;
- steam energy consumption;
- gas energy consumption;
- water consumption;
- **programme** time;
- condensation efficiency;

- drying temperature of the textiles;
- volumetric flow rate of exhaust air.

Any claims of performance referring to this PAS for these parameters shall be measured in accordance with the requirements of this PAS. 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 up to a **rated capacity** of 10 kg. For capacities larger than 10 kg the supplier may declare the **rated capacity** at 1 kg intervals. 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 EN 50570:2013, 3.1.9.

If the **rated capacity** is not declared by the manufacturer, the **rated capacity** shall be deduced from the clothes container volume (see 4.3) as described in Annex E.

Where the manufacturer gives a range of values for the **rated capacity** for a particular textile type, the maximum value shall be used.

For different textiles the **rated capacity** of an appliance may be different.

4.3 Dimensions

Where a manufacturer declares dimensions, these shall be in accordance with the following requirements, as applicable. The dimensions shall be given in mm and shall be rounded up to the nearest higher millimetre.

- Height = vertical dimension measured from the lower edge (on the floor) to the upper edge of the top, with the door/lid closed: if adjustable levelling feet are provided, they shall be moved to determine maximum possible height.
- Max height = maximum vertical dimension measured from the lower edge (on the floor) to a horizontal plane at the maximum height of the **tumble dryer** with the door/lid open: if adjustable levelling feet are provided, they shall be moved up and down to determine minimum and maximum possible heights.
- Width = horizontal dimension, between the sides, as measured between two parallel vertical planes against the sides of the **tumble dryer**, including all projections.
- Depth = horizontal dimension as measured from a vertical rear plane against the **tumble dryer** and the most prominent part of the front, knobs and handles not being taken into account, with the door/lid closed, including all projections.
- Max depth = horizontal **dimension** as measured from a vertical rear plane against the **tumble dryer** and the most prominent part of the front knobs and handles not being taken into account, with the door/lid open (generally when at right angles to the machine front), including all projections.
- Clothes container volume = the volume of the container in which textiles are placed, where required, shall be determined in accordance with Annex E.

5 Test conditions, materials, equipment and instrumentation

5.1 General

The tolerances specified for parameters within this PAS, using the symbol ‘ ± ’, indicate the allowable limits of variation from the specified parameter outside which the test or results