



BSI Standards Publication

Household and similar electric appliances – Methods for measuring the performance of tumble dryers intended for commercial use

National foreword

This British Standard is the UK implementation of EN 50594:2018. It supersedes PD CLC/TS 50594:2015, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CPL/59/1, Dishwashers and washing machines.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

**Household and similar electric appliances - Methods for
measuring the performance of tumble dryers intended for
commercial use**

Appareils électrodomestiques et analogues - Méthodes de
mesure de l'aptitude à la fonction pour les sèche-linge à
tambour à usage commercial

Elektrische Geräte für den Hausgebrauch und ähnliche
Zwecke - Verfahren zur Messung der
Gebrauchseigenschaften für Wäschetrockner für den
gewerblichen Gebrauch

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European foreword

This document (EN 50594:2018) has been prepared by CLC/TC 59X "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has (dop) 2019-04-23
to be implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2021-04-23
standards conflicting with this document
have to be withdrawn

This document supersedes CLC/TS 50594:2015.

This document is based on portions of EN 61121:2013.

The procedures described in this European Standard are modified substantially compared to the procedures described in EN 61121. Therefore, results of tests according to this European Standard cannot and are bound not to be compared to results of similar procedures of EN 61121.

Significant technical differences from EN 61121 are:

- a) test procedures for tumble dryers of any size on the market;
- b) test procedure for measuring power consumption also for steam heated and gas heated tumble dryers;
- c) the introduction of a new type of test load;
- d) the introduction of a new initial moisture content level.

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

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

1 Scope

This European Standard is applicable to **tumble dryers** intended to be used by trained users e.g. in hotels, hospitals, factories, in light industry and on farms. It covers **tumble dryers** declared for commercial use in public areas and operated by lay persons e.g. in launderettes, apartment houses and communal laundry rooms. This European Standard covers **tumble dryers** which use electricity, gas or steam as a heating source.

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 **tumble dryers** only possible to operate 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 437:2003+A1:2009, *Test gases — Test pressures — Appliance categories*

CEN/TR 1749:2014, *European scheme for the classification of gas appliances according to the method of evacuation of the combustion products (types)*

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*

EN 50640:2018, *Clothes washing machines for commercial use — Methods for measuring the performance*

EN 60456:2016, *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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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 conveyors 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 cycle**

when the load is accessible to the user and next programme can be started

3.1.15

cycle

complete drying process until the load is accessible to the user, as defined by the selected **programme**, consisting of a series of **operations**

3.1.16

cycle time

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

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 kilograms 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

conditioned test load mass

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

3.1.21

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.

3.1.22

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

3.1.23

initial moisture content

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

3.1.24

final moisture content

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

3.1.25

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
HS,n	kWh/m ³	heating value referred to standard conditions
V_m	M ³	measured gas volume
W	kWh	average corrected energy consumption
W_j	kWh	corrected consumption for test run j
W_{mj}	kWh	measured consumption for test run j
W_{ej}	kWh	corrected electric energy consumption for test run j
W_{sj}	kWh	corrected steam energy consumption for test run j
W_{gj}	kWh	corrected gas energy consumption for test run j
W_{mej}	kWh	measured electric energy for test run j
W_{msj}	kWh	measured steam energy for test run j
W_{mgj}	kWh	measured gas energy for test run j
W_{cs}	kWh	<i>energy of the recovered condensate</i>
W_{gt}	kWh	<i>total gas energy consumption</i>
W_s	kWh/kg	specific corrected energy consumption
F_v	m ³ /min	volumetric flow rate
F	-	Gas factor according to H.6.1
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
M_{dst}	kg	mass of supplied steam to the tumble dryer during a test run
n	-	number of test runs
p	Pa	static pressure
S	-	standard deviation of measured results
S_b	-	standard deviation of the measured final moisture content for all valid test runs
T	min	arithmetical average of the corrected cycle time of all valid test runs
T_s	min/kg	specific corrected cycle time
T_j	min	corrected cycle time for test run j

Symbol	Unit	Definition
T_{mj}	min	measured cycle time for test run j
T_c	°C	the condensate temperature
T_{cs}	°C	the temperature recorded by the steam temperature sensor
t_{max}	°C	maximum drying temperature
t_{amax}	°C	maximum ambient temperature during a test run
t_{amin}	°C	minimum ambient temperature during a test run
t_{amean}	°C	average ambient temperature during a test run
V_c	l	clothes container volume
V	m ³	exhaust air volume
M	g	rated capacity for the type of load tested
M_0	g	mass of the conditioned test load
M_f	g	mass of the test load after drying
M_{ff}	g	mass of the test load after drying for test run j
M_i	g	mass of the test load after wetting
M_{ij}	kg	mass of the test load used after wetting but before drying
M_w	g	mass of water collected
M_{wj}	g	mass of water collected during test run j
M_S	kg	mass of the small sheet in a test load
M_L	kg	mass of the large sheet in a test load
M_T	kg	desired mass of the test load
x_i	-	i -th term of parameter x
$\bar{x}_i$	-	mean of all terms of parameter x
X_S	-	number of small sheets in a test load
X_L	-	number of large sheets in a test load
Y	-	performance parameter (energy consumption or cycle time)
μ	%	average measured final moisture content for a test series
μ_0	%	target final moisture content
μ_{ff}	%	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 European Standard does not specify minimum performance requirements for **tumble dryers**. This European Standard does however set methods for the measurement of following performance parameters:

- electric energy consumption;

- steam energy consumption;
- gas energy consumption;
- water consumption;
- **cycle time**;
- condensation efficiency;
- drying temperature of the textiles;
- volumetric flow rate of exhaust air.

Any claims of performance referring to this European Standard for these parameters shall be measured in accordance with the requirements of this European 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

The **rated capacity** for any textile type shall not exceed the maximum mass of dry laundry, 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 mm.

- 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 European Standard, using the symbol '±', indicate the allowable limits of variation from the specified parameter outside which the test or results shall be invalid. The statement of tolerance does not permit the deliberate variation of these specified parameters.

5.2 Ambient conditions

5.2.1 Electricity supply

The supply voltage to the test **tumble dryer** shall be 230 V or 400 V as defined by the manufacturer's installation guide. If more than one option for installation is available and no clear indication for testing is given, the supply voltage shall be 400 V. The supply voltages shall be maintained throughout the test within ± 2 %. For **tumble dryers** with a drum volume equal or larger than 1000 l the voltage tolerance is allowed to be ± 3 %. The supply voltage measured during the tests shall be recorded.

The electric supply cable shall not exceed 4 m of length unless a longer supply cable is delivered together with the **tumble dryer** from the manufacturer. The plug (or the end of the cable furthest from the dryer) is the reference point at which the supply voltage shall be maintained.

The supply frequency to each **test tumble dryer** shall be maintained at 50 Hz ± 1 % throughout the test. Voltage stabilizers should be designed such that the normal **operation** of the **tumble dryer** does not cause undue distortion of the voltage waveform.

5.2.2 Water supply

5.2.2.1 General

This section describes the specifications for water to be used for preparing **test loads**, wetting **test loads** and for water used as cooling fluid.

In all cases the water supply shall meet the requirements given in 5.2.2.2. Water used for normalizing **test loads** and wetting **test loads** shall meet the requirements of 5.2.2.2 and 5.2.2.3.

Water used for wetting **test loads** for testing conductivity controlled **automatic tumble dryers** shall meet the requirements of 5.2.2.2, 5.2.2.3 and 5.2.2.4.

NOTE The performance of a **tumble dryer** may differ when water of different quality is used to wet the **test load**.

5.2.2.2 Water temperature and pressure

The temperature of the cold water supply shall be $(15 \pm 2) ^\circ\text{C}$.

The pressure of the water supply during water intake at the appliance water inlet shall be maintained at $(240 \pm 50) \text{ kPa}$.

The measured water temperature and pressure shall be reported.

5.2.2.3 Water hardness

Standard soft water with a total hardness of $(0,5 \pm 0,2) \text{ mmol/l}$ shall be used for all procedures within this European Standard. If available, naturally occurring water of the correct total hardness may be used. Alternatively, water of the correct total hardness shall be prepared according to EN 60734.

The total hardness of the water used shall be reported.

5.2.2.4 Water alkalinity, pH and conductivity

When testing conductivity controlled **automatic tumble dryers**, the characteristics of the water used for wetting the **test load** can have a large influence on the test results. The water characteristics are defined in terms of hardness, alkalinity, pH and conductivity.

For the purpose of testing **automatic tumble dryers** the water for wetting the **test load** shall have the characteristics of water prepared according to Method B of EN 60734 for soft water ($0,5 \pm 0,2$) mmol/l.

If water characteristics need to be adjusted, Method B or Method C3 of EN 60734 shall be followed.

If applicable the alkalinity, pH and conductivity of the water used shall be reported.

5.2.3 Ambient temperature and humidity

5.2.3.1 Ambient temperature and relative humidity for tumble dryer testing

The ambient temperature of the test room shall be (23 ± 2) °C at the start of the drying test. The ambient temperature shall not rise more than 4 K during the **test run**. The ambient temperature during tumble dryer testing shall be recorded. The maximum, minimum and average temperature during the **test run** shall be reported. The temperature measurement location shall be in the vicinity of the air intake and the temperature shall be rounded to the nearest 0,5 °C.

For dryers with a drum volume equal or larger than 1000 l the ambient temperature tolerance can be increased to $(23\text{ °C} + 6\text{ °C} / - 2\text{ °C})$ at the start of the drying test. If the starting ambient temperature is above the normal temperature range of (23 ± 2) °C a correction shall be made according to K.5.6.11.

The ambient relative humidity of the test room shall be maintained at (55 ± 10) % throughout the **tumble dryer** test. The ambient relative humidity shall be measured in the vicinity of the **tumble dryer** being tested. The maximum and minimum measured ambient relative humidity for **tumble dryer** testing shall be reported rounded to the nearest whole percentage.

Care should be taken to ensure that the ambient temperature and relative humidity are not influenced by the appliance itself or other appliances in the laboratory.

5.2.3.2 Ambient temperature and ambient relative humidity for conditioning of test load items

Where an ambient controlled room or chamber is used for **conditioning** the **test load**, the following conditions shall be maintained:

- ambient temperature: (20 ± 2) °C;
- ambient relative humidity: (65 ± 5) %.

The measured ambient temperature and relative humidity for **conditioning test load** items shall be reported. The ambient temperature shall be rounded to the nearest 0,5 °C, the ambient relative humidity shall be rounded to the nearest whole percentage.

NOTE Requirements for **conditioning** the **test load** are specified in 6.6.5.2.

5.3 Test materials

5.3.1 General

This section sets out the specifications for test materials required for **tumble dryer** testing to this European Standard, including **test loads** and detergent.

5.3.2 Test load

The **test load** shall consist of small and large sheets as specified in A.2.

5.3.3 Detergent

The specification for the IEC Standard Powder Detergent 2016 (IEC-P) base powder as defined in A.1. Detergent dosage is specified in 6.6.4.2.

5.4 Equipment

5.4.1 Equipment for normalization

The specification for a washing machine which is used for the **normalization** of **test loads** is defined in A.5.

5.4.2 Equipment for conditioning the test load

This European Standard requires **test load** items to be treated in a controlled manner prior to their use in performance tests in order to determine their mass under standardized ambient conditions. The alternative methods of **conditioning** the **test load** items are:

- Leaving the **test load** items in a room or chamber with a controlled ambient temperature and humidity (refer to 5.2.3.2) until their remaining **moisture content** is in equilibrium with the ambient conditions. Refer to 6.6.5.2 for details.
- Treating the **test load** items in a clothes dryer of specified performance to ensure that the **test load** items are in a “bone dry” state. Refer to 6.6.5.3 for details. A.3 sets out the method and the specifications for a **tumble dryer** which is used for this method.

5.4.3 Equipment for wetting the test load prior to a test

Any washing machine may be used to wet the **test load** prior to a test, provided it has the following features:

- a **rated capacity** which is equal to or greater than the **test load** being wetted;
- at least one rinse **operation** with a duration of at least five minutes;
- the rinse shall consist of a volume of water in litres at least three times the mass of the **test load** in kilograms;
- a spin drying **operation** capable of achieving the desired **initial moisture content**.

5.4.4 Equipment for measurement

This European Standard requires the measurement of a range of parameters during testing of a **tumble dryer**. These parameters include the following:

- mass;
- electrical parameters (voltage, energy, power and frequency);
- steam energy (steam pressure, steam temperature, steam flow);
- gas energy (gas flow);
- temperature of water and air;
- water pressure;
- textile temperature during drying;
- relative humidity;
- total water hardness;
- conductivity of water (conductivity sensing **tumble dryers** only);
- alkalinity of water (conductivity sensing **tumble dryers** only);
- time.

The specifications of instruments used to take the measurements for some of these parameters are explicitly defined in 5.5.

NOTE Several different instruments for the measurement of mass are likely to be required for tasks such as mass of **test load** items and the whole **test load** and mass of detergent.

5.5 Instrumentation and accuracy

Instruments used for this European Standard shall comply with the specifications set out in Table 2.

Devices using viscosity to measure water volume shall be calibrated at the actual nominal temperature ± 5 °C, and the nominal flow rate.

Table 2 — Specification of instruments

Parameter	Unit	Resolution	Accuracy	Additional requirements
Mass				
Masses above 50kg	g	50 g	±100 g	-
Masses in the range between 10 kg and 50 kg	g	10 g	±20 g	-
Masses in the range between 2 kg and 10 kg	g	1 g	±5 g	-
Masses in the range between 100 g and 2 000 g	g	0,5 g	±1 g	-
Masses in the range up to 100 g	g	0,05 g	±0,1 g	-
Temperature	°C	0,1 °C	±0,5 K	-
Ambient temperature	°C	-	-	See spec. in Annex J
Textile temperature	°C	0,1 °C	±0,5 K	-
Water temperature				
Ambient humidity	% (RH)	1 % (RH)	±3 % (RH)	The specifications shall be met over a temperature range of 15 °C to 30 °C
Water volume (water inlet)	l	0,1 l	±2 %	-
Water pressure	kPa	10 kPa	±5 %	
Time	s	5 s	±1 %	-
Energy	kWh	As specified in EN 62053–21, Class 1 instrument definition - -	±1 %	Due to distortion of the voltage and current wave forms caused by inductive devices such as motor controls, specific requirements for energy meters are necessary. See Annex G. See Annex H.
Electrical energy consumption	kWh		±2 %	
Steam energy consumption	kWh		±2 %	
Gas energy consumption				
Hardness of water	mmol/l	As specified in EN 60734		
Conductivity of water	µS/cm	As specified in EN 60734		
Alkalinity of water	-	As specified in EN 60734		

6 Preparation for testing

6.1 General

This section sets out the requirements for the preparation of a **tumble dryer**. It also specifies the requirements for the preparation of **test loads**.

6.2 Test specifications from manufacturers

Specifications that are given specifically for use by test laboratories shall be ignored.

6.3 Installation of the tumble dryer

The measurements shall generally be carried out on a new **tumble dryer** which is installed and used in accordance with the manufacturer's instructions, except as required by this European Standard. Where there is more than one option for installation, the option chosen for testing shall be documented in the test report.

Steam heated **tumble dryers** shall be installed according to instructions in Annex G. Gas heated **tumble dryers** shall be installed according to instructions in Annex H.

Where the **tumble dryer** is intended for use without a duct (i.e. the **tumble dryer** is intended to be vented into the room), the **tumble dryer** shall be tested as supplied without a duct.

Where the **tumble dryer** is intended for use with a duct the **tumble dryer** shall be tested with a duct as specified in Annex B.

Where a manufacturer gives the option to use the **tumble dryer** both with and without a duct, the **tumble dryer** shall be tested with a duct.

The test report shall clearly state which duct configuration as specified in Annex B, if any, is used in each test.

Where a water inlet is supplied, it shall be connected to an appropriate laboratory water supply system for testing (refer to 5.2.2).

If the manufacturer gives the option to use a **condenser tumble dryer** both with and without condensation box, the **tumble dryer** shall be tested in accordance with the manufacturer's instructions. If no instructions are provided, then the **tumble dryer** shall be tested with the condensation box.

6.4 Preparation of the tumble dryer for a test series

Before a **test series** is commenced the **tumble dryer** shall be checked to confirm that it has no operating defects that may affect the **operation** of the unit.

Before each **test series** the filters, heat exchangers and ducts intended to be serviced by the user shall be cleaned according to the manufacturer's instructions.

6.5 Preparation of the tumble dryer for a test run

6.5.1 General

The manufacturer's specification for the frequency of cleaning of the heat exchanger and related filters shall be followed. If no specification is given regarding frequency, then the heat exchanger and its related filters shall not be cleaned between **test runs** within a **test series**. In this context, the manufacturer's specification for cleaning the heat exchanger and its related filters means the specification that is directed towards the user.

6.5.2 Preparation requirements for all heating alternatives except for heat pump equipped tumble dryers

A commercial **tumble dryer** will mostly be running in a more or less continuous **operation** and therefore the preparation requirements for a **tumble dryer** will be as follows.

Prior to start of a **test run** one preparatory run shall be made in the **tumble dryer** with a load equal to the **nominal test load mass**. The load shall be wetted to the limits set in Table 5. The load shall be dried to a dry state. The time between the preparatory run and the **test run** shall be (15 ± 5) min. If next consecutive **test run** can be started within (15 ± 5) min from the end of the previous **test run** no preparatory run is needed.

6.5.3 Preparation requirements for heat pump equipped tumble dryers

Tumble dryers equipped with heat pumps will change their operating characteristics considerably depending of if the heat pump system is cold (the start condition) or warm (in continuous **operation**). A commercial **tumble dryer** will mostly be running in a more or less continuous **operation** and therefore the preparation requirements for a **tumble dryer** equipped with a heat pump will be as follows.

Prior to start of a **test run** two preparatory runs shall be made in the **tumble dryer** with a load equal to the **nominal test load mass**. The load shall be wetted to the limits set in Table 5. The load shall be dried to a dry state. The time between the two preparatory runs shall be (15 ± 5) min and the time between the second preparatory run and the **test run** shall also be (15 ± 5) min. If next consecutive **test run** can be started within (15 ± 5) min from the end of the previous **test run** no preparatory runs are needed.

6.6 Preparation of test loads

6.6.1 General

Test loads intended for **tumble dryer** tests following this European Standard shall not be used for any other purpose except for wash performance tests following the full procedures in EN 50640. **Test loads** that have been used for any other purpose are not suitable for **tumble dryer** tests following this European Standard.

This section sets out requirements for the preparation of the **test loads** used in the **tumble dryer** which is to be tested in accordance with this European Standard. Refer to Clause 7 regarding the selection of the required **test load mass** and requirements for tests at **rated capacity**. This section sets out:

- **pre-treatment** of new **test load** items prior to use in testing;
- age requirements for **test load** items used in a **test series**;
- **normalization** of the **test load** items;
- **conditioning** of **test load** items to determine the **test load mass** at a known remaining **moisture content**;
- **test load** composition;
- wetting of the **test load**.

6.6.2 Pre-treatment of new test load items prior to use

New **test load** items shall be treated before their first use by undergoing a **normalization** wash process five times, as defined in 6.6.4 but without intermediate drying. 14 g/kg **test load** of the IEC-P base powder is added to each of the first five washes. After the final **pre-treatment** wash, the **test load** shall be dried. **Test load** items that have undergone full **pre-treatment** following EN 50640:2018, 6.4.2 do not need to undergo a new **pre-treatment** when used for drying.

6.6.3 Requirements regarding the age of test load items

No individual **test load** items shall be used for more than 100 **test runs** defined as **test runs** for washing performance according to EN 50640 and/or **test runs** and any preparatory runs for **tumble dryer** testing according to this European Standard excluding **pre-treatment** runs prior to initial use and the **normalization** runs (refer to 6.6.4).

To meet the age requirements specified in this European Standard, a system for tracking the number of **test runs** for each **test load** item is advisable.

6.6.4 Normalization of test load items

6.6.4.1 General

After they have been used for a minimum of 10 **test runs** and a maximum of 12 **test runs**, all **test load** items shall undergo **normalization**. **Normalization** is the process of washing the **test load** in a washing machine using a specified **programme** in order to bring the **test load** back into a standardized state.

6.6.4.2 Normalization procedure of test load items

Normalization of the **test load** items is achieved by processing them once in a washing machine using 14 g per kg of **test load** items of the IEC-P base powder. Carry this out using a washing machine and

programme as described in A.5. On completion of the **programme**, the **test load** items shall then be dried in a **tumble dryer**.

6.6.5 Conditioning of test load items

6.6.5.1 General

Conditioning is the process of bringing the **test load** to a known **moisture content** after **normalization** and drying at the completion of a **test series** in order to check the standardized mass of each **test load** item prior to commencing the next **test series**.

Conditioning may be done in an ambient controlled room/chamber or using the bone dry method.

The **conditioning** method used shall be reported.

6.6.5.2 Conditioning of test load items in an ambient controlled room/chamber

In this method, the **test load** items are dried in a tumble dryer to a **remaining moisture content** of each single item of less than 0 % and are then stretched or flattened by hand before **conditioning**. They are then allowed to reach an equilibrium **moisture content** when placed in a room/chamber with an ambient temperature and humidity which is maintained in accordance with 5.2.3.2. Under this method, two options are available as follows:

- The test load items shall be hung singly and separately so that air can freely circulate between individual **test load** items. The **test load** is left for a period of not less than 15 h.
- The test load items shall be left until their mass has changed by less than 0,5 % for two successive measurements which are taken at intervals of 2 h or more.

NOTE The **final moisture content** is defined as less than 0 % in order to ensure that all items of the **test load** are conditioned coming from a more dry state.

The mass of the complete **test load** in its conditioned state shall be recorded.

6.6.5.3 Conditioning of test load items using the bone dry method

In this method, the **test load** textiles are dried continually in a **tumble dryer** of known performance until the remaining **moisture content** has been reduced to a level that is known as the “bone dry” condition, where very little free moisture is present. The conditioned mass of the **test load** is then determined by taking the bone dry mass and multiplying it by factor which is determined by the **tumble dryer** performance characteristics. The specification for the **tumble dryer** used and the method to prepare the **test load** to the bone dry condition prior to a **test series** and the calculation of conditioned mass is specified in A.3.

6.6.6 Test load composition

6.6.6.1 General

The **test load mass** is adjusted so that it corresponds to the required **test load mass** for the specified **programme** of the **tumble dryer** to be tested. The number of **test load** items is specified in Table 4. Final adjustment of the **test load mass**, is made by adding or removing small sheets so that the total mass is as close as possible ($\pm 0,08$ kg) to the required **nominal test load mass**.

6.6.6.2 Test load

The **test load** shall consist of 2 sizes of sheets as specified according to A.2. The nominal size and nominal mass of each of the **test load** items at conditioned state are given in Table 3:

Table 3 — Size and mass of the different test load items

Test load item	Size mm	Mass g
Small sheet With Lengh	720 ± 20 900 ± 20	155 ± 10
Large sheet With Lengh	1480 ± 20 2200 ± 20	750 ± 20

Table 4 — Number of items in the test load for various test load masses

Test load mass kg	Number of small sheets	Number of large sheets
2,0	13	0
2,5	16	0
3,0	15	1
3,5	18	1
4,0	16	2
4,5	19	2
5,0	18	3
5,5	21	3
6,0	24	3
6,5	23	4
7,0	26	4
7,5	29	4
8,0	27	5
8,5	31	5
9,0	29	6
9,5	32	6
10	31	7
15	34	13
20	32	20
25	31	27
30	34	33
40	31	47
50	32	60
60	34	73
70	31	87
80	32	100
90	34	113
100	31	127
150	34	193
200	32	260
250	31	327
300,0	34	393
For test load sizes not shown in Table 4 see 6.6.6.3.		