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**Specifikacije za industrijske pralnice strojev - Definicije in preskušanje
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Specifications for industrial laundry machines - Definitions and testing of capacity and consumption characteristics - Part 4: Washer-extractors

Anforderungen an industrielle Wäschereimaschinen - Definition und Prüfung von Kapazitäts- und Verbrauchsmerkmalen - Teil 4: Waschschleudermaschinen

Spécifications pour les machines de blanchisserie industrielles - Définitions et contrôle des caractéristiques de capacité et de consommation - Partie 4 : Laveuses-essoreuses

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Specifications for industrial laundry machines - Definitions and testing of capacity and consumption characteristics - Part 4: Washer-extractors

Spécifications pour les machines de blanchisserie
industrielles - Définitions et contrôle des
caractéristiques de capacité et de consommation -
Partie 4 : Laveuses-essoreuses

Festlegungen für Wäschereimaschinen - Definition und
Prüfung der Beladung und Verbrauchsmerkmale - Teil
4: Waschschleudermaschinen

This European Standard was approved by CEN on 17 September 2018.

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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EN 17116-4:2019 (E)**European foreword**

This document (EN 17116-4:2019) has been prepared by Technical Committee CEN/TC 214 "Textile machinery and accessories", the secretariat of which is held by SNV.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2020, and conflicting national standards shall be withdrawn at the latest by January 2020.

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

This document is based on ISO 9398-4 extended by the application of the state of the art methodology to measure performance and has been prepared by CEN/TC 214/WG 05.

The standard testing procedure for washer-extractors is based on ISO 9398-4. It includes among others the references EN ISO 10472-1 and EN ISO 10472-2.

EN 17116-4:2019 enhances the second edition of ISO 9398-4, i.e. ISO 9398-4:2003, to comply with European Standard requirements.

ISO 9398-4:2003 is extended by state of the art methodology to measure performance. Significant technical differences from ISO 9398-4:2003 are:

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- a) more detailed description of testing procedure;
 - b) changed test conditions under practical *in situ* laundry conditions;
 - c) introduction of a new type of test load;
 - d) implementation of energy consumption of various heat sources;
 - e) implementation of air compressor energy consumption;
 - f) implementation of detergent consumption;
 - g) implementation of washing performance, as stain removal, secondary wash performance and rinse performance;
 - h) comparison of wash performance with reference washing machine;
 - i) preparation for testing measuring hygienic requirements.

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

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document defines the characteristics of washer-extractors and gives the usual test methods for these characteristics with regard to machine capacity, power consumption and productivity. It is applicable for use as a reference in the drafting of purchasing orders for washer-extractors whose net usable cage volume is 400 dm³ (litres) respectively 40 kg and above. In addition, it is recommended for determination of energy consumption and productivity according to Directive 2009/125 EC. Furthermore, the document describes standard methods for measuring principal performance characteristics of washer-extractors. It does not cover safety requirements (see EN ISO 10472-2).

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 676, *Automatic forced draught burners for gaseous fuels*

EN 1049-2, *Textiles — Woven fabrics — Construction — Methods of analysis — Part 2: Determination of number of threads per unit length (ISO 7211-2:1984 modified)*

EN 1773, *Textiles — Fabrics — Determination of width and length*

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

EN ISO 139, *Textiles — Standard atmospheres for conditioning and testing (ISO 139)*

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

EN ISO 2061, *Textiles — Determination of twist in yarns — Direct counting method (ISO 2061)*

EN ISO 3759, *Textiles — Preparation, marking and measuring of fabric specimens and garments in tests for determination of dimensional change (ISO 3759)*

EN ISO 15797:2018, *Textiles — Industrial washing and finishing procedures for testing of workwear (ISO 15797:2017)*

ISO 2267, *Surface active agents — Evaluation of certain effects of laundering — Methods of preparation and use of unsoiled cotton control cloth*

ISO 4312, *Surface active agents — Evaluation of certain effects of laundering — Methods of analysis and test for unsoiled cotton control cloth*

ISO 9398-1, *Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics — Part 1: Flatwork ironing machines*

ISO 9398-3, *Specifications for industrial laundry machines — Definitions and testing of capacity and consumption characteristics — Part 3: Washing tunnels*

DIN 4754 (all parts), *Heat transfer installations working with organic heat transfer fluids*

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DIN 38409-23, *German standard methods for the examination of water, waste water and sludge — Parameters characterizing effects and substances (group H) — Part 23: Determination of bismut active substances (H 23)*

DIN 61101-1, *Weaves; general terms, basic weaves*

RAL-GZ 992/1, *RAL-Gütezeichen 992 für sachgemäße Wäschepflege „Objekt- und Haushaltswäsche“*

3 Terms, definitions and symbols**3.1 Terms and definitions**

For the purposes of this document, the terms and definitions given in ISO 9398-1 and the following 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**washer-extractor**

machine for cleaning and rinsing of textiles by means of water and having an extraction process for de-watering the textiles at the end of the programme or by intermediate

3.1.2**test washer-extractor**

washer-extractor that is subject to part or all of the requirements in this document in order to determine its performance <https://standards.iteh.ai/catalog/standards/sist/68005945-9b11-4311-a1f1-a84b3b393c89/sist-en-17116-4-2020>

3.1.3**reference washing machine**

specially constructed washing machine of known washing performance level with high repeatability and reproducibility of results which is used to compare the primary washing performance (stain/soil removal of supplied test fabrics)-on tested washer-extractor as defined in this standard

Note 1 to entry: Refer to 5.2.

3.1.4**top loaded machine**

washer-extractor where the load is placed into the cage from the top (vertical position)

3.1.5**front loaded machine**

washer-extractor where the load is placed into the cage in direction of the axis

3.1.6**side loaded machine**

washer-extractor where the load is placed into the cage perpendicular to the direction of the cage axis

3.1.7**barrier washer**

washer-extractor which can be built in a wall and where the load is placed from one side (unclean section) of the machine and taken out from another side (clean section), mostly combined with spatial separation of clean and unclean section for disinfection processes, etc

3.1.8**Pullman machine**

washer-extractor where the horizontal inner drum is divided in two compartments

3.1.9**Y-pocket machine**

washer-extractor where the inner cage is divided in three compartments

3.1.10**test run**

single performance assessment in a test series

3.1.11**test series**

number of test runs on a washer-extractor which, collectively, are used to assess the performance of that machine

3.1.12**operation**

performance of a function that occurs during the washer-extractor programme such as pre-wash, washing, rinsing, draining or spinning

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3.1.13**programme**

series of operations which are pre-defined within the washer-extractor that are declared by the manufacturer as suitable for washing certain textile types

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3.1.14**wash cycle**

complete washing process, as defined by the selected programme, which consists of a series of operations (including extraction, without loading/unloading), and which starts with the start signal (closed door) and ends with standstill of cage after the final spin (closed door)

3.1.15**spin extraction**

water-extracting function by which water is removed from the textiles by centrifugal action and which is included as a function (built in operation) of the washer-extractor

3.1.16**spin speed**

number of revolutions of the inner cage per min during spin extraction

Note 1 to entry: A method for determination of spin speed is not defined in this standard.

3.1.17**nominal load (of a washer-extractor)**

weight of normally soiled load in kg of cotton (100 %) textiles (including (9 ± 2) % residual moisture content, related to bone dry load that may be washed and extracted in the machine

EN 17116-4:2019 (E)**3.1.18****test load**

mass of the nominal load plus stain and soil monitors, wash process control sheets and rinse performance fabrics (test fabrics)

3.1.19**cage volume**

net usable volume, expressed in cubic decimetres (litres), equivalent to inside volume minus all inwardly projecting volumes

3.1.20**load ratio**

ratio of the nominal capacity of the washer-extractor, expressed in kilograms, to the cage volume, expressed in cubic decimetres (litres); the usual value of this ratio being 1:10 for flatwork cotton

3.1.21**wash cycle time**

time of one wash cycle

3.1.22**end of wash cycle**

wash cycle ends with standstill of cage after the final spin and possibility to open the door

3.1.23**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

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Note 1 to entry: Thermo-stop is included in main wash duration.
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Note 2 to entry: Variations in the water supply pressure and temperature as well as in the heating system may affect the main wash duration. This definition is only applicable to test washer-extractors.

3.1.24**thermo-stop**

start of wash duration after achievement of the pre-determined temperature and maintaining that temperature during the whole wash step

3.1.25**nominal hourly production output**

weight of hourly production based on nominal load at defined testing conditions

3.1.26**bone dry-conditioning**

bringing the test load into conditions without moisture content (bone dry) by multiple drying until a steady-state weight is achieved

3.1.27**residual moisture content (extraction efficiency)**

measure for the remaining amount of moisture that is contained in the nominal load in relation to the conditioned state (bone dry state)

3.1.28**rated voltage**

constant voltage with an acceptable range of $\pm 10\%$ (EN 60038) assigned to the washer-extractor by the manufacturer

3.1.29**rated steam pressure**

min./max. steam pressure assigned to the washer-extractor by the manufacturer

3.1.30**rated water pressure**

min./max. water pressure assigned to the washer-extractor by the manufacturer

3.1.31**rated compressed air pressure**

min./max. compressed air pressure assigned to the washer-extractor by the manufacturer

3.2 Symbols and abbreviations

The symbols are listed in Table 1.

Table 1 — List of symbols

Symbol	Unit	Definition
C_{Yu}	—	sum of average reflectance values of all stain fabrics before washing
C_{Yw}	—	sum of average reflectance values of all stain fabrics after washing
E_A	kWh	measured energy for air compression
$E_{A,i}$	kWh	measured energy for air compression per test run
E_E	kWh	measured electric energy consumption
$E_{E,i}$	kWh	measured electric energy consumption per test run
E_H	kWh	measured energy for heating
$E_{H,gas}$	kWh	gas heating energy
$E_{H,i}$	kWh	measured energy for heating per test run
E_{HF}	kWh	calculated energy embedded/lacking in hot/cold feed water
$E_{HF,i}$	kWh	calculated energy embedded/lacking in hot/cold feed water per test run
$E_{HF,dw}$	kWh/kg	calculated energy embedded/lacking in hot/cold feed water per kg dry load
$E_{tot,nt}$	kWh	sum of energy consumption for heating, electric energy for motors and air compression
$E_{tot,nt,i}$	kWh	sum of energy consumption for heating, electric energy for motors and air compression per test run

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Symbol	Unit	Definition
$E_{\text{tot,nt,dw}}$	kWh/kg	sum of energy consumption for heating, electric energy for motors and air compression per treated weight of test load
$E_{\text{tot,nt,dw,i}}$	kWh/kg	sum of energy consumption for heating, electric energy for motors and air compression per treated weight of test load and per test run
$\bar{E}_{\text{tot,nt,dw}}$	kWh/kg	mean value of sum of energy consumption for heating, electric energy for motors and air compression per treated weight of test load
E_{tot}	kWh	total energy consumption
$E_{\text{tot,i}}$	kWh	total energy consumption per test run
$E_{\text{tot,spec}}$	kWh/kg	total specific energy consumption
f	—	calculation factor for calculation of gas heating energy
FAZ	—	colour shift number
H_{gas}	kWh/m ³	heating value of the gas under laundry conditions
$H_{\text{gas,ss}}$	kWh/m ³	heating value of the gas related to standard state conditions (0 °C, 1 013 mbar)
I_A	A	amperage of air compressor
m	—	number of stain/soil types
mc_{sl}	%	moisture content of soiled nominal load under ambient conditions in the laundry
$mc_{\text{sl,i}}$	%	moisture content of selected soiled nominal load items under ambient conditions in the laundry
$m_{\text{load/hour}}$	kg/h	weight of washed nominal load during 1 h
$m_{\text{load/hour,i}}$	kg/h	weight of washed nominal load during 1 h in one test run
$\bar{m}_{\text{load/hour}}$	kg/h	arithmetic mean of weight of washed nominal load during 1 h
$M_{\text{HF,dw}}$	kg/kg	weight of the specific feed water per kg dry load
M_{li}	l	water consumption during the test run
$M_{\text{li,dw}}$	l/kg	specific water consumption per kg dry load (9 % residual moisture)
$M_{\text{li,dw,i}}$	l/kg	specific water consumption per kg dry load (9 % residual moisture) per test run
$\bar{M}_{\text{li,dw}}$	l/kg	mean value of specific water consumption per kg load of single test runs
n	—	number of readings of tristimulus value per stain
N	—	number of test runs
p_{baro}	mbar	atmospheric pressure
p_{gas}	mbar	gas pressure at metering system

Symbol	Unit	Definition
rmc_{ae}	%	residual moisture content of nominal load after extraction
$rmc_{ae,i}$	%	residual moisture content of nominal load after extraction per test run
\overline{rmc}_{ae}	%	mean value of residual moisture content of nominal load after extraction
s	—	damage factor, chemical damage
S_{ae}	%	standard deviation of residual moisture content of nominal load after extraction
S_i	—	standard deviation of reflectance values for each type of stain within a test run
$S_{tot,nt,dw}$	kWh/kg	standard deviation of sum of energy consumption for heating, electric energy for motors and air compression per treated weight of test load
$S_{li,dw}$	l/kg	standard deviation of water consumption per treated weight of test load
$S_{D,tot,dw}$	mg/kg ml/kg	standard deviation of total detergent consumption per treated mass of test load
$S_{load/hour}$	kg/h	standard deviation of weight of washed nominal load during 1 h
t_A	min	running time air compressor
t_{DP}	s	time to reach determined detergent volume
$t_{D,tot}$	s	total dosing time of detergent
t_{tr}	min	duration of the test run
θ_{gas}	°C	gas temperature
R_c	—	cleaning index, ratio between difference of Y-values increase (washed-unwashed) in tested machine and reference machine
U_A	V	voltage of air compressor
V_{DP}	ml	volume of detergent
$V_{DP/t}$	ml/s	flow rate of dosing pumps
V_{gas}	m ³	consumption of gas
W_{ae}	kg	weight of moist nominal load after extraction
W_{bd}	kg	weight of the bone dry nominal load
W_{bdi}	kg	weight of the selected soiled bone dry (conditioned) nominal load items
W_c	kg	weight of the nominal load, related to ambient conditions 20 °C, 65 % r.h.