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**oSIST prEN 17116-3:2017**  
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**Specifikacije za industrijske pralnice strojev - Definicije in preskušanje  
zmogljivosti in značilnosti porabe - 3. del: Kontinuirni pralni tuneli**

Specifications for industrial laundry machines - Definitions and testing of capacity and consumption characteristics - Part 3: Continuous tunnel washer

Anforderungen an industrielle Wäschereimaschinen - Definition und Prüfung von Kapazitäts- und Verbrauchsmerkmalen - Teil 3: Durchlaufwaschanlagen

Spécifications pour les machines de blanchisserie industrielles - Définitions et contrôle des caractéristiques de capacité et de consommation - Partie 3 : Tunnels de lavage

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**Specifications for industrial laundry machines - Definitions  
and testing of capacity and consumption characteristics -  
Part 3: Continuous tunnel washer**

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Verbrauchsmerkmalen - Teil 3:  
Durchlaufwaschanlagen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 214.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
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EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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**prEN 17116-3:2017 (E)****European foreword**

This document (prEN 17116-3:2017) has been prepared by Technical Committee CEN/TC 214 “Textile machinery and accessories”, the secretariat of which is held by SNV.

This document is currently submitted to the Enquiry.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This draft is based on ISO 9398-3 extended by the application of the state of the art methodology to measure performance and has been prepared by the EUP Lot 24 Working Group of VDMA — ETCT European Textile Care Technology and CEN/TC 214 in collaboration with wfk-Cleaning Technology Institute, Germany.

The standard testing procedure for continuous tunnel washer is based on ISO 9398-3. It includes among others the references EN ISO 10472-1 and EN ISO 10472-3.

prEN 17116-3 enhances the second edition of ISO 9398-3, i.e. ISO 9398-3:2003, to comply with European Standard requirements.

ISO 9398-3:2003 is extended by state of the art methodology to measure performance. Significant technical differences from ISO 9398-3:2003 are:

- 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/soil removal, secondary wash performance and rinse performance;
- h) comparison of wash performance with reference washing machine.

Contrary to washer extractors, dewatering of the load is carried out in separate machines, like presses or centrifuges. Therefore, these machines are not content of this standard.

A bilingual version of this publication may be issued at a later date.



## 1 Scope

This draft European standard defines the characteristics of continuous tunnel washer 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 continuous tunnel washer. In addition it is recommended for determination of energy consumption and productivity according to Directive 2009/125 EC. This standard excludes the energy consumption for dewatering of the load. Furthermore, the standard describes standard methods for measuring principal performance characteristics of continuous tunnel washer. It does not cover safety requirements (see EN ISO 10472-3).

## 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.

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)*

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 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method (ISO 13934-1)*

EN ISO 15797:2004, *Textiles — Industrial washing and finishing procedures for testing of workwear (ISO 15797:2002)*

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*

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

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.

**3.1.1****continuous tunnel washer**

automatic washing system that processes laundry in continuous operation or in batches

**3.1.2****compartment, cage**

single unit in a continuous tunnel washer which contains the laundry batch

**3.1.3****compartment, cage (basket) volume**

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

**3.1.4****zones of the continuous tunnel washer**

one or more compartments used for different washing phases

**3.1.5****pre-wash zone**

one or more compartments of continuous tunnel washer zones used for pre-washing

**3.1.6****main wash zone**

one or more compartments of continuous tunnel washer used for main wash

**3.1.7****rinsing zone**

one or more compartments of continuous tunnel washer used for rinsing

**3.1.8****conditioning/Neutralization zone**

one or more compartments of continuous tunnel washer used for conditioning which means neutralization and/or other final treatment like softening, starching

**3.1.9****counter flow**

continuous tunnel washer zone where the continuous water flow is opposite to the direction of laundry flow

**3.1.10****bath exchange**

part of the washing process in continuous tunnel washer where within one cycle water is drained out of a compartment and refilled with fresh or other recovered water

**3.1.11****standing bath**

compartment without water drainage and water inlet during cycle time and consequently no counter-current or concurrent water flow

**3.1.12****water recovery tank**

tank for collecting water from different zones of the continuous tunnel washer and/or from de-watering unit (e.g. press, extractor)

**3.1.13****drum agitation**

movement of drum during the cycle time, depending on kind of load transfer system in one direction or by oscillating

**3.1.14****bottom transfer machine**

continuous tunnel washer with load transfer into the next compartment via the bottom of drum, e.g. by the Archimedean transfer principle

**3.1.15****centre transfer machine**

continuous tunnel washer with load transfer into the next compartment through centre of drum by transport scoop which is integrated in the drum construction

**3.1.16****top transfer machine**

continuous tunnel washer with load transfer into the next compartment via the top part of the drum by transport scoop which is integrated in the drum construction

**3.1.17****inner drum**

moving drum which contains laundry/textiles and water

**3.1.18****outer drum**

fixed drum around inner drum, allows the supply of water, chemicals, energy and drainage as well as control applications

**3.1.19****single drum machine**

continuous tunnel washer with compartments consisting of only single moving drum

**prEN 17116-3:2017 (E)****3.1.20****double drum machine**

continuous tunnel washer with compartments each consisting of an inner and an outer drum

**3.1.21****combined single/double drum machine**

continuous tunnel washer with compartments consisting of both single drums and compartments with added double drums

**3.1.22****reference washing machine**

specially constructed washer extractor 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) of tested continuous tunnel washer as defined in this standard

Note 1 to entry: Refer to 5.2.

**3.1.23****nominal load**

weight of normally soiled load in kg of cotton (100 %) textiles (including  $(9 \pm 2)$  % residual moisture content, related to bone dry load) in the compartment of a continuous tunnel washer

Note 1 to entry: The value of nominal load is given on the manufacturer's rating plate of the machine.

**3.1.24****nominal hourly production output**

nominal load multiplied by the number of unloads per hour

**3.1.25****process time**

time, in minutes, for the batch of textiles to pass through the entire length of the tunnel without de-watering including loading and unloading

**3.1.26****cycle time**

time between start of drum agitation movement and end of load transfer into the next compartment of the continuous tunnel washer

**3.1.27****bone dry-conditioning**

bringing the test load (see 3.1.33) into a state without moisture content (bone dry) by multiple drying until a steady-state weight is achieved (identical weight for minimum three replicating drying cycles)

**3.1.28****test run**

single performance assessment

**3.1.29****test series**

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

**3.1.30****operation**

performance of a function that occurs during the continuous tunnel washer process such as pre-wash, main wash, rinsing and conditioning

**3.1.31****programme**

series of operations which are pre-defined within the continuous tunnel washer and which are declared by the manufacturer as suitable for washing certain types of textiles

**3.1.32****wash cycle**

complete washing process, as defined by the selected programme, consisting of a series of operations but excluding dewatering

**3.1.33****test load**

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

**3.1.34****rated voltage**

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

**3.1.35****rated steam pressure**

min./max. steam pressure assigned to the continuous tunnel washer by the manufacturer

**3.1.36****rated water pressure**

min./max. water pressure assigned to the continuous tunnel washer by the manufacturer

**3.1.37****rated compressed air pressure**

min./max. compressed air pressure assigned to the continuous tunnel washer by the manufacturer

**3.2 List of symbols**

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 and soil fabrics before washing in test machine
$C_{Yu,ref}$	—	sum of average reflectance values of all stain and soil fabrics before washing in reference machine
$C_{Yw}$	—	sum of average reflectance values of all stain and soil fabrics after washing in the test machine
$C_{Yw,ref}$	—	sum of average reflectance values of all stain and soil fabrics after washing in the reference machine
$E_A$	kWh	measured energy for air compression for the test run
$E_E$	kWh	measured electric energy consumption for the test run
$E_H$	kWh	measured energy for heating for the test run
$E_{HF}$	kWh	calculated energy embedded/lacking in hot/cold fresh water
$E_{HF,dw}$	kWh/kg	calculated energy embedded/lacking in hot/cold fresh water per dry load
$E_{wt,tot,nt}$	kWh	sum of energy consumption for heating, electric energy for motors and air compression
$E_{wt,tot,nt,dw,M}$	kWh/kg	mean value of energy consumption of continuous tunnel washer (specific energy consumption) without hot water feeding
$E_{wt,tot,nt,dw}$	kWh/kg	sum of energy consumption for heating, electric energy for motors and air compression per treated mass of test load
$E_{wt,tot,nt,dw,i}$	kWh/kg	sum of energy consumption for heating, electric energy for motors and air compression per treated mass of test load and per test run
$E_{wt,tot,nt,dw,M}$	kWh/kg	mean value of sum of energy consumption for heating, electric energy for motors and air compression per treated mass of test load
$E_{wt, tot.}$	kWh	total energy consumption of continuous tunnel washer
$E_{wt,tot nt,spec}$	kWh/kg	total specific energy consumption per kg dry load without hot/cold water feed
$E_{wt, tot, spec}$	kWh/kg	total specific energy consumption; including energy embedded/lacking in hot/cold fresh water
$FAZ$	—	colour shift number
$m$		number of stain/soil types
$mc_{sl}$	%	moisture content of soiled test load under ambient conditions in the laundry
$m_{load/hour}$	kg/h	mass of washed load of normally soiled hotel cotton textiles during the 1 h
$m_{load/hour,i}$	kg/h	mass of washed load of normally soiled hotel cotton textiles during 1 h in one test run

Symbol	Unit	Definition
$m_{\text{load/hour,M}}$	kg/h	arithmetic mean of mass of washed load of normally soiled hotel cotton textiles during 1 h
$M_{\text{HF,dw}}$	kg/kg	mass of the specific fresh water per kg dry load
$M_{\text{li}}$	l	water consumption during the test run
$M_{\text{li,dw}}$	l/kg	water consumption per kg bone load (9 % residual moisture)
$M_{\text{li,dw,i}}$	l/kg	water consumption per kg bone load (9 % residual moisture) per test run
$M_{\text{li,dw,M}}$	l/kg	mean value of water consumption per kg load (9 % residual moisture) of single test runs
$n$		number of readings of tristimulus value per stain/soil
$N$		number of test runs
$p$		number of treated nominal loads (batches) during the test run
$s$		damage factor, chemical damage
$S_{\text{tot,nt,dw}}$	kWh/kg	standard deviation of sum of energy consumption for heating, electric energy for motors and air compression per treated mass of test load
$S_{\text{Mli,dw}}$	l/kg	standard deviation of water consumption per treated mass of test load
$S_{\text{M,D,total,dw}}$	mg/kg ml/kg	standard deviation of total detergent consumption per treated mass of test load
$S_{\text{M,load/hour}}$	kg/h	standard deviation of mass of washed load of normally soiled hotel cotton textiles during 1 h
$t_{\text{DP}}$	s	time to reach determined detergent volume
$t_{\text{D,total}}$	s	total dosing time per test run
$t_{\text{tr}}$	min	duration of the test run
$R_{\text{c}}$	—	cleaning index, ratio between difference of Y-values increase (washed-unwashed) in tested machine and reference machine
$V_{\text{DP}}$	ml	volume of detergent
$V_{\text{DP/t}}$	ml/s	flow rate of dosing pumps
$W_{\text{bd}}$	kg	mass of the bone dry test load
$W_{\text{bdi}}$	kg	mass of the bone dry (conditioned) items
$W_{\text{c}}$	kg	mass of the test load, related to ambient conditions 20 °C, 65 % r.h.
$W_{\text{D,total}}$	ml mg	total consumption of completely designed detergents, single detergent components and/or boosters added into the compartments of the continuous tunnel washer during cycle time