



BSI Standards Publication

Clothes washing machines for household use — Methods of measuring the performance

National foreword

This British Standard is the UK implementation of EN 60456:2016+A12:2023. It is derived from IEC 60456:2010, incorporating corrigendum September 2011. It supersedes BS EN 60456:2016+A11:2020, which is withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags **[C]** **[C]**.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to text carry the number of the CENELEC amendment. For example, text altered by CENELEC amendment A11 is indicated by **[A11]** **[A11]**.

The UK participation in its preparation was entrusted to Technical Committee CPL/59, Performance of household electrical appliances.

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

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Amendments/corrigenda issued since publication

Date	Text affected
31 December 2020	Implementation of IEC corrigendum September 2011: replacement of contents of Subclause 6.3.2
31 January 2021	Implementation of CENELEC amendment A11:2020
29 February 2024	Implementation of CENELEC amendment A12:2023

English Version

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

Machines à laver le linge pour usage domestique -
Méthodes de mesure de l'aptitude à la fonction
(IEC 60456:2010 , modifiée)

Waschmaschinen für den Hausgebrauch - Verfahren zur
Messung der Gebrauchseigenschaften
(IEC 60456:2010 , modifiziert)

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Ref. No. EN 60456:2016/A11:2020 E

European foreword

This document (EN 60456:2016) consists of the text of IEC 60456:2010 prepared by SC 59D "Home laundry appliances" of IEC/TC 59 "Performance of household and similar electrical appliances", together with the common modifications prepared by CLC/TC 59X "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-12-14
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2018-12-14

This document supersedes EN 60456:2011.

Significant technical differences are:

- a) the test procedure to measure power and energy consumption in left-on-mode and the referenced standard has been corrected; (Z.A. 4.9);
- b) deletion of RMS and two sided confidence level formulas (Z.A. 5.2);
- c) corrections in evaluation of water extraction performance (formulas) are integrated (Z.A. 5.4);
- d) corrections in evaluation of spin speed (formulas) are integrated (Z.A. 5.5);
- e) corrections in evaluation of power and energy consumption measurements in left-on-mode (formulas and references) are integrated (Z.A. 5.9);
- f) Table ZA17: Correction of the reported precision;
- g) Annex ZB is re-phrased;
- h) the normative references in Annex ZC are updated;
- i) new Annexes ZZA and ZZB.

This European Standard also specifies, as far as necessary, the test methods which shall be applied in accordance with the COMMISSION DELEGATED REGULATION (EU) No 1061/2010 implementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of household washing machines and in accordance with the COMMISSION REGULATION (EU) No 1015/2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household washing machines.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60456:2010 are prefixed "Z".

Annex ZA sets out the procedure to be applied for testing according to Commission Regulations with regard to energy labelling and ecodesign and provides all necessary links to all relevant clauses of this European Standard.

Annex ZB has been re-phrased and provides control procedures for checking measured values in comparison to values declared by the manufacturer and taking into account any permitted tolerances.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports Commission Regulation (EU) No. 1015/2010 and Commission Delegated Regulation (EU) No. 1061/201.

For the relationship with Commission Regulation (EU) No. 1015/2010 and Commission Delegated Regulation (EU) No. 1061/201 see informative Annex ZZA and ZZB, which are integral parts of this document.

Endorsement notice

The text of the International Standard IEC 60456:2010 was approved by CENELEC as a European Standard with agreed common modifications.

Foreword to amendment A11

This document (EN 60456:2016/A11:2020) consists of the text IEC 60456:2010 prepared by SC 59D "Home laundry appliances", together with the common modifications prepared by CLC/TC 59X "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-07-21
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2023-10-21

Significant technical differences are:

a) the **programme** to be tested for the **combined test series** is the new introduced **eco 40-60 programme**. This **programme** needs to be tested with default settings with the given temperature;

b) the **test loads** that have to be used for testing are full, half and quarter of the **rated capacity** of the **washing machine**. Therefore, a new **quarter load** is introduced and defined to be approximately a quarter of the **rated capacity** (see table ZA15). The **quarter load** is treated as a separate load and not created by dividing **full load** or **half load**;

c) the number of **test runs** per **treatment** for the **combined test series** changed to 3 tests with **full load**, 4 tests with **half load** and 3 tests with **quarter load**;

d) the time between two subsequent **test runs** within one day changed from 2 h to one hour;

e) the normalization run is included in the calculation of the load age. The maximum number of usages for the cotton base load per item is changed to 96 and the weighted average age of the base load is changed to be between 35 and 60 normalisation runs and test runs.

f) rinsing effectiveness is integrated. It is referred to CLC/TS 50677 (see ZA 4.10);

g) temperature inside the load is integrated. It is referred to CLC/TS 50707:2020 (under preparation) (see ZA4.11);

h) the procedure to measure low power modes is modified (see ZA4.9);

i) specific weighting factors are introduced for the calculation of the weighted average value of the **combined test series** and

j) Annex ZB Tolerances and control procedures is deleted. Annex ZB is replaced by an new Annex ZB which defines the testing procedure for multi-drum **washing machines**.

This document also specifies, as far as necessary, the test method for household **washing machines** in accordance with the COMMISSION DELEGATED REGULATION (EU) 2019/2014 of 11 March 2019 supplementing Regulation 2017/1369 of the European Parliament and of the Council with regard to energy labelling of household **washing machines** and household **washer-dryers** and repealing Commission Regulation (EU) No 1061/2010 and Commission Directive 96/60/EC and in accordance with the COMMISSION REGULATION (EU) 2019/2023 of 1 October 2019 laying down ecodesign requirements for household **washing machines** and household **washer-dryers** pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Commission Regulation (EC) No 1275/2008 and repealing Commission regulation EU) No 1015/2010.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60456:2010 are prefixed “Z”.

Annex ZA sets out the procedure to be applied for testing according to Commission Regulations with regard to energy labelling and ecodesign and provides all necessary links to all relevant clauses of this European Standard.

This document has been prepared in view of upcoming Standardization Request which will be given to CENELEC by the European Commission and the European Free Trade Association, and supports Commission Delegated Regulation (EU) 2019/2014 and Commission Regulation (EU) 2019/2023.

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.

For the relationship with Commission Delegated Regulation (EU) 2019/2014 and Commission Regulation (EU) 2019/2023 informative Annex ZZA and Annex ZZB will be published following the adoption of the Standardization Request.

Endorsement notice

The text of the International Standard IEC 60456:2010 was approved by CENELEC as a European Standard with agreed common modifications

European foreword to Amendment A12

This document (EN 60456:2016/A12:2023) 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 to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-04-27
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2026-10-27

This document introduces the following technical modifications:

- a) The **programme** to be tested for the **combined test series** is the new introduced **eco 40-60 programme**. This **programme** needs to be tested with default settings with the given temperature.
- b) The **test loads** that have to be used for testing are full, half and quarter of the **rated capacity** of the **washing machine**. Therefore, a new **quarter load** is introduced and defined to be approximately a quarter of the **rated capacity** (see Table ZA.15). The **quarter load** is treated as a separate load and not created by dividing **full load** or **half load**.
- c) The number of **test runs** per **treatment** for the **combined test series** changed to 3 tests with **full load**, 4 tests with **half load** and 3 tests with **quarter load**.
- d) The time between two subsequent **test runs** within one day changed from 2 h to one hour.
- e) The normalization run is included in the calculation of the load age. The maximum number of usages for **base load** with a load mass greater or equal to 4.5 kg was changed to be between 35 and 60 normalization runs and test runs and the maximum number of usages for **base load** with a load mass less than 4.5 kg was changed to be between 30 and 67 normalization runs and test runs.
- f) Annex ZE is integrated, which defines the test procedure for temperature inside the load.
- g) Annex ZF is integrated, which defines the test procedure for rinsing effectiveness.
- h) The procedure to measure low power modes is modified (see Annex ZD).
- i) Specific weighting factors are introduced for the calculation of the weighted average value of the **combined test series**.
- j) Annex ZB Tolerances and control procedures is deleted. Annex ZB is replaced by a new Annex ZB which defines the testing procedure for multi-drum **washing machines**.
- k) A new standard powder detergent IEC-P is introduced (see Annex B), that substitutes the standard powder detergent IEC-A* by replacing the bleach component sodium perborate with sodium percarbonate due to Commission Regulation (EU) 2020/171 amending Annex XIV to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). According to REACH Regulation Article 56, the substances which are listed in the Annex XIV cannot be used or placed on the market after the "sunset date", unless the authorization is granted. Sodium perborate has a sunset date of 27th of May 2023 after having been classified as toxic to reproduction.

- l) The tolerances for the remaining moisture content in Table E.2 are adapted, due to change in the commercially available material.
- m) In normative clauses undated references were dated.

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 standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annexes ZZA and ZZB, which are an integral part of this document.

Annex ZA sets out the procedure to be applied for testing according to Commission Regulations with regard to energy labelling and ecodesign and provides all necessary links to all relevant clauses of this document.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Annex ZA (normative)

Test procedure for a combined test sequence of cotton 40 °C and cotton 60 °C with full load and partial load

ZA.1 General

The intent of the procedures as set out in this Annex is the determination of performance and related parameters for **full load**, **half load** and **quarter load** for an **eco 40-60 programme** for the **test washing machine**.

The test sequence to measure performance parameters is defined as a **combined test series** consisting of 3 **treatments** with 10 **test runs** in total as follows and detailed in Figure ZA.1:

- **treatment full**: 3 test runs;
- **treatment half**: 4 test runs;
- **treatment quarter**: 3 test runs;

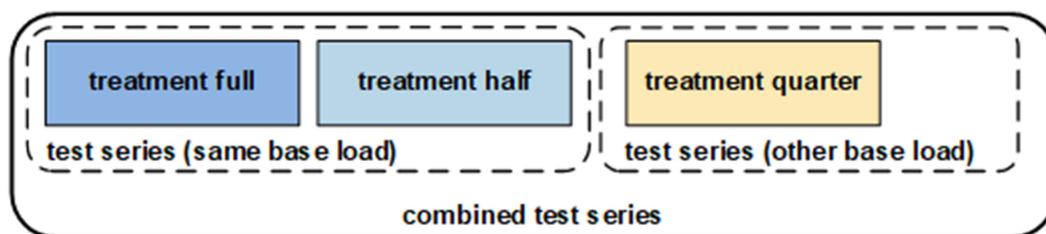


Figure ZA.1 — Relation between treatments, test series and combined test series

The **reference washing machine** is operated in parallel at the defined load size of 5,00 kg with a **test series** consisting of 5 **test runs** at cotton 60 °C.

NOTE Z1 Subclause ZA.4.4 describes the parallel **operation** of the reference **washing machine** and the **test washing machine**.

The airborne acoustical noise shall be measured according to EN 60704-2-4:2012⁴.

Rounding shall only be applied to reported values in ZA.6. If numbers have to be rounded, they shall be rounded to the nearest number according to EN ISO 80000-1:2013, B.3, Rule B. If the rounding takes place to the right of the comma, the omitted places shall not be filled with zeros.

ZA.2 Preparation for testing: Test loads

Subclause 6.4 sets out requirements for the preparation of the **test loads** used in the **test washing machine** and the **reference machine**. All requirements of 6.4 are applied to define the **full load** and the **quarter load** for a **test series**. For the **test runs** with **half load** the **full load** shall be split into two parts. This clause defines the splitting of the **full load** into two **half loads** named **part A** and **part B** as detailed in Table ZA.1.

Table ZA.1 — Half loads: number of items in part A and part B of the cotton test load

Target test load mass at rated capacity [kg]	Target test load mass at partial load [kg]	Number of sheets Part A	Number of pillow cases Part A	Number of towels Part A	Number of strips Part A	Towels adjustment ^a Part A	Number of sheets Part A	Number of pillow cases Part A	Number of towels Part A	Number of strips Part A	Towels adjustment ^a Part B
1	0,5	0	1	2	1	add	0	1	2	1	remove
1,5	0,75	0	2	3	1	remove	0	1	4	1	add
2	1	0	2	4	1	add	0	2	5	1	remove
2,5	1,25	0	3	5	1	remove	0	2	6	1	add
3	1,5	1	2	3	2	remove	1	2	2	2	add
3,5	1,75	1	2	5	2	remove	1	2	4	2	add
4	2	1	2	7	2	add	1	2	7	2	remove
4,5	2,25	1	3	7	2	add	1	3	7	2	remove
5	2,5	1	3	9	3	add	1	3	9	3	remove
5,5	2,75	1	4	9	3	add	1	4	9	3	remove
6	3	1	4	12	3	remove	1	4	11	3	add
6,5	3,25	1	5	12	3	remove	1	5	11	3	add
7	3,5	1	6	12	4	remove	1	6	11	4	add
7,5	3,75	2	5	10	4	remove	1	7	11	4	add
8	4	2	5	12	4	remove	1	7	13	4	add
8,5	4,25	2	6	12	4	remove	1	8	13	4	add
9	4,5	2	7	12	5	remove	2	7	11	5	add
9,5	4,75	2	7	14	5	add	2	7	14	5	remove
10	5	2	8	14	5	add	2	8	14	5	remove
10,5	5,25	3	6	14	5	remove	2	9	14	5	add
11	5,5	3	6	16	6	remove	2	9	16	6	add
11,5	5,75	3	7	17	6	remove	2	9	18	6	add
12	6	3	8	16	6	remove	3	9	14	6	add
12,5	6,25	3	8	18	6	add	3	9	17	6	remove
13	6,5	3	9	19	7	remove	3	9	18	7	add
13,5	6,75	3	10	19	7	remove	3	9	20	7	add
14	7	3	10	21	7	add	3	9	23	7	remove
14,5	7,25	4	8	20	7	add	3	12	19	7	remove
15	7,5	4	9	21	8	remove	3	12	21	8	add

^a **Part A** and **part B** shall be made entirely from the **full load** without adding or subtracting any towels. If the **full load** has a different number of towels than indicated in Table 2 in 6.4.6.1, then the number of towels in the **half loads A** and **B** will also differ from the number given in Table ZA.1. In this case, add or remove towels as indicated in the relevant "towels adjustment" column:
 Add = Add first and all odd numbers of towels in this part (add all even numbers in the other part)
 Remove = Remove first and all odd numbers of towels from this part (remove all even numbers from the other part)

For each **half load**, the **conditioned base load mass** shall be recorded.

The increased difference between the **base load mass** of **part A** and **part B** and **test load mass** of **part A** and **part B** due to the mass of any test strips that need to be added according to Table ZA.1 shall be ignored. The requirement for **test load mass** to be within ± 60 g of the **nominal test load mass** does not apply to **half loads**.

For **test load masses** for the whole or half kg ratings which are greater than those specified in Table 2 in 6.4.6.1 ($>15,00$ kg), the number of items for **part A** and **part B** is defined as follows:

Part A:

Number of stain test strips is equal to the numerical value of the nominal half **test load mass** rounded to the nearest kg

$$n_{STS,A} = \left[Mn_{part} \right]$$

where

Mn_{part} is the nominal half **test load mass** in kg.

Number of sheets is the half of the number of sheets at rated **test load mass** rounded to the next whole sheet (always round up)

$$n_{SH,A} = \left\lceil \frac{n_{SH}}{2} \right\rceil$$

where

n_{SH} is the number of sheets at rated **test load mass**.

Number of pillowcases is the number of pillowcases at rated **test load mass** divided by the number of sheets at rated **test load mass** multiplied by the difference of the number of sheets at rated **test load mass** and the number of sheets from **part A** rounded to the nearest whole pillowcase

$$n_{PC,A} = \left[\frac{n_{PC}}{n_{SH}} \cdot (n_{SH} - n_{SH,A}) \right]$$

where

n_{PC} is the number of pillowcases at rated **test load mass**;

n_{SH} is the number of sheets at rated **test load mass**;

$n_{SH,A}$ is the number of sheets in **part A**.

Number of towels is the numerical value of the nominal half **test load mass** in kg minus the number of pillowcases from **part A** multiplied by 0,240 minus the number of sheets from **part A** multiplied by 0,725 minus the number of stain test strips from **part A** multiplied by 0,022 and divided by 0,110 rounded to the nearest whole towel

$$n_{T,A} = \left\lceil \frac{Mn_{part} - (n_{PC,A} \times 0,240) - (n_{SH,A} \times 0,725) - (n_{STS,A} \times 0,022)}{0,110} \right\rceil$$

where

Mn_{part} is the nominal half **test load mass** in kg;

$n_{PC,A}$ is the number of pillowcases in **part A**;

$n_{SH,A}$ is the number of sheets in **part A**;

$n_{STS,A}$ is the number of stain test strips in **part A**.

Part B:

Number of stain test strips is equal to the numerical value of the nominal half **test load mass** rounded to the nearest kg

$$n_{STS,B} = \left[Mn_{part} \right]$$

where

Mn_{part} is the nominal half **test load mass** in kg.

Number of sheets is the number of sheets at rated **test load mass** minus the number of sheets from **part A**

$$n_{SH,B} = n_{SH} - n_{SH,A}$$

where

n_{SH} is the number of sheets at rated **test load mass**;

$n_{SH,A}$ is the number of sheets in **part A**.

Number of pillowcases is the number of pillowcases at rated **test load mass** minus the number of pillowcases from **part A**

$$n_{PC,B} = n_{PC} - n_{PC,A}$$

where

n_{PC} is the number of pillowcases at rated **test load mass**;

$n_{PC,A}$ is the number of pillowcases in **part A**.

Number of towels is the number of towels at rated **test load mass** minus the number of towels from **part A**

$$n_{T,B} = n_T - n_{T,A}$$

where

n_T is the number of towels at rated **test load mass**;

$n_{T,A}$ is the number of towels in **part A**.

ZA.3 Performance measurements – general requirements

Performance parameters shall be measured for the **test washing machine** using a **combined test series** consisting of 3 **treatments** with 10 runs in total as set out in ZA.4. The evaluation of these parameters for the **test washing machine** is specified in ZA.5.

Performance parameters shall be measured for the **reference washing machine** using a single **test series** consisting of a total of 5 **test runs** as set out in Clause 8. The evaluation of these parameters for the **reference washing machine** is specified in Clause 9.

ZA.4 Procedure for performance tests

ZA.4.1 General

This subclause sets out the additional requirements for the test procedure as defined in Clause 8 for the determination of the following parameters for a cotton load related to the **combined test series** for the **test washing machine**:

- washing performance (see ZA.4.5);
- water extraction performance (see ZA.4.6);
- **spin speed** (see ZA.4.7);
- water consumption (see ZA.4.8);
- energy consumption (see ZA.4.8);
- **programme time** (see ZA.4.8).
- rinsing effectiveness (see ZA.4.9)
- temperature inside the load (see ZA.4.10)
- power consumption of low power modes (see Annex ZD).

The **test load** for the **test washing machine** shall be subjected to the performance test procedure specified in ZA.4. The **test load** for the **reference machine** shall be subjected to the performance test procedure specified in 8.1.

For the assessment of washing performance the results from the **test washing machine** are compared to the result from the **reference machine** which is operated in parallel.

ZA.4.2 Test load and loading

Prior to a **test series**, separate conditioned **base loads** having the required **test load mass** shall be prepared for the **reference machine** and the **test washing machine**. For the **combined test series** according to Annex ZA two **base loads** shall be prepared. One **base load** is required for **full load** and **half load** testing and a separate **base load** is required for **quarter load** testing.

It is recommended to mark the **half load part A** and **part B** before a **test series** is started.

For tests with **half load**, the **test washing machine** shall be loaded in accordance with the general requirements of Annex H using the loading sequences for **part A** and **part B** defined in Tables ZA.2 to ZA.7 for **horizontal axis washing machines** and in Tables ZA.8 to ZA.14 for **vertical axis washing machines**. If it is necessary to adjust the number of towels for **half load** the loading sequence shall be adjusted as follows:

Additional towels shall be added to the steps marked for adjustment one by one as needed in the order from inner to outer layers.

Excess towels shall be removed from the steps marked for adjustment one by one as needed in the order from outer to inner layers.

For tests with **full load**, the **test washing machine** and the **reference machine** shall be loaded in accordance with the requirements of Annex H.

**Table ZA.2 — Horizontal axis washing machines,
loading sequence for part A and part B of the cotton test load (7,50 kg – 6,50 kg)**

	part load	A	B	A	B	A	B	A	B	A	B
step	partial test load mass kg	7,50		7,25		7,00		6,75		6,50	
1	pillowcase	1	1	1	1	1	1	1	1	1	1
2	towels adjust number here	3	3	3	2	3	3	2	3	2	2
3	towel + strip	1	1	1	1	1	1	1	1	1	1
4	pillowcase	1	1	1	1	1	1	1	1	1	1
5	sheet	1	1	1	1	1	1	1	1	1	1
6	towel + strip	1	1	1	1	1	1	1	1	1	1
7	pillowcase	2	2	1	2	2	2	2	2	2	2
8	towels adjust number here	2	2	2	2	3	3	3	2	2	2
9	towel + strip	1	1	1	1	1	1	1	1	1	1
10	sheet	1	1	1	1	1	1	1	1	1	1
11	towel + strip	1	1	1	1	1	1	1	1	1	1
12	pillowcase	1	2	1	2	1	1	1	1	1	1
13	towels adjust number here	2	2	3	3	3	3	3	3	3	3
14	pillowcase	1	2	1	2	1	1	1	1	1	1
15	towel + strip	1	1	1	1	1	1	1	1	1	1
16	sheet	1		1							
17	towel + strip	1	1								
18	towels adjust number here	3	3	2	2	2	4	2	2	2	2
19	pillowcase	1	2	1	2	2	1	2	1	1	1
20	towel + strip	1	1	1	1	1	1	1	1	1	1
21	sheet	1	1	1	1	1	1	1	1	1	1
22	pillowcase	1	1	1	1	1	1	1	1	1	1
23	towel + strip	1	1	1	1	1	1	1	1	1	1
24	towels adjust number here	3	3	3	3	3	3	2	3	3	2
25	pillowcase	1	1	1	1	1	1	1	1	1	1

**Table ZA.3 — Horizontal axis washing machines,
loading sequence for part A and part B of the cotton test load (6,25 kg – 5,25 kg)**

	part load	A	B	A	B	A	B	A	B	A	B
step	partial test load mass kg	6,25		6,00		5,75		5,50		5,25	
1	pillowcase	1	1	1	1	1	1	1	1	1	1
2	towels adjust number here	2	2	2	2	2	3	2	2	2	2
3	towel + strip	1	1	1	1	1	1	1	1	1	1
4	pillowcase	1	1	1	1	1	1	1	1	1	1
5	sheet	1	1	1	1	1	1	1	1	1	1
6	towel + strip	1	1	1	1	1	1	1	1	1	1
7	pillowcase	1	2	1	2	1	2		2	1	2
8	towels adjust number here	3	2	2	2	3	2	2	2	2	2
9	towel + strip	1	1	1	1	1	1	1	1	1	1
10	sheet	1	1	1	1	1		1		1	
11	towel + strip										
12	pillowcase	1	1	1	1	1					
13	towels adjust number here	2	2	2	1	2	2	2	2	3	3
14	pillowcase	1	1	1	1	1	1	2	1	1	1
15	towel + strip	1	1	1	1	1	1	1	1		
16	sheet										
17	towel + strip										
18	towels adjust number here	3	3	2	1	2	2	2	2		
19	pillowcase	1	1	1	1		2		2		2
20	towel + strip	1	1	1	1	1	1	1	1	1	1
21	sheet	1	1	1	1	1	1	1	1	1	1
22	pillowcase	1	1	1	1	1	1	1	1	1	1
23	towel + strip	1	1	1	1	1	1	1	1	1	1
24	towels adjust number here	2	2	2	2	2	3	2	2	2	2
25	pillowcase	1	1	1	1	1	1	1	1	1	1

**Table ZA.4 — Horizontal axis washing machines,
loading sequence for part A and part B of the cotton test load (5,00 kg – 4,00 kg)**

	part load	A	B	A	B	A	B	A	B	A	B
step	partial test load mass kg	5,00		4,75		4,50		4,25		4,00	
1	pillowcase	1	1	1	1	1	1	1	1	1	1
2	towels adjust number here	3	3	3	3	2	2	2	2	2	2
3	towel + strip	1	1	1	1	1	1	1	1	1	1
4	pillowcase	1	1	1	1	1	1	1	1	1	1
5	sheet	1	1	1	1	1	1	1		1	
6	towel + strip	1	1	1	1	1	1	1		1	
7	pillowcase	1	1	1	1	1	1		2		2
8	towels adjust number here	1	1	1	1	1		2	2	2	2
9	towel + strip	1	1	1	1	1	1		1		1
10	sheet								1		1
11	towel + strip								1		1
12	pillowcase										
13	towels adjust number here	2	2	2	2	2	2	2	3	2	3
14	pillowcase	2	2	1	1	1	1	2	2	1	1
15	towel + strip										
16	sheet										
17	towel + strip										
18	towels adjust number here										
19	pillowcase	1	1	1	1	1	1				
20	towel + strip	1	1	1	1	1	1	1		1	
21	sheet	1	1	1	1	1	1	1		1	
22	pillowcase	1	1	1	1	1	1	1	1	1	1
23	towel + strip	1	1	1	1	1	1	1	1	1	1
24	towels adjust number here	3	3	3	3	2	2	2	2	2	2
25	pillowcase	1	1	1	1	1	1	1	1	1	1

**Table ZA.5 — Horizontal axis washing machines,
loading sequence for part A and part B of the cotton test load (3,75 kg – 2,75 kg)**

	part load	A	B	A	B	A	B	A	B	A	B
step	partial test load mass kg	3,75		3,50		3,25		3,00		2,75	
1	pillowcase	1	1	1	1	1	1	1	1	1	1
2	towels adjust number here	2	2	2	2	2	2	2	2	1	1
3	towel + strip	1	1	1	1	1	1	1	1	1	1
4	pillowcase	1	1	1	1	1	1	1	1	1	1
5	sheet	1									
6	towel + strip	1									
7	pillowcase		2	1	1						
8	towels adjust number here	1	1	2	2	2	2	3	2	2	2
9	towel + strip		1	1	1						
10	sheet		1	1	1	1	1	1	1	1	1
11	towel + strip		1	1	1	1	1	1	1	1	1
12	pillowcase										
13	towels adjust number here	1	2	2	1	2	2	2	2	2	2
14	pillowcase	1	1	1	1	1	1				
15	towel + strip										
16	sheet										
17	towel + strip										
18	towels adjust number here										
19	pillowcase										
20	towel + strip	1									
21	sheet	1									
22	pillowcase	1	1	1	1	1	1	1	1	1	1
23	towel + strip	1	1	1	1	1	1	1	1	1	1
24	towels adjust number here	2	2	2	2	3	2	2	2	1	1
25	pillowcase	1	1	1	1	1	1	1	1	1	1

**Table ZA.6 — Horizontal axis washing machines,
loading sequence for part A and part B of the cotton test load (2,50 kg – 1,50 kg)**

	part load	A	B	A	B	A	B	A	B	A	B
step	partial test load mass kg	2,50		2,25		2,00		1,75		1,50	
1	pillowcase	1	1	1	1	1	1	1	1	1	1
2	towels adjust number here	1	1	1	1	1	1	2	1	0	0
3	towel + strip	1	1	1	1	1	1	1	1	1	1
4	pillowcase	1	1	1	1						
5	sheet										
6	towel + strip										
7	pillowcase										
8	towels adjust number here	2	2	2	2	2	2				
9	towel + strip										
10	sheet	1	1	1	1	1	1	1	1	1	1
11	towel + strip	1	1								
12	pillowcase										
13	towels adjust number here	2	2	1	1	1	1				
14	pillowcase										
15	towel + strip										
16	sheet										
17	towel + strip										
18	towels adjust number here										
19	pillowcase										
20	towel + strip										
21	sheet										
22	pillowcase										
23	towel + strip	1	1	1	1	1	1	1	1	1	1
24	towels adjust number here	1	1	1	1	1	1	1	1	1	0
25	pillowcase	1	1	1	1	1	1	1	1	1	1

**Table ZA.7 — Horizontal axis washing machines,
loading sequence for part A and part B of the cotton test load (1,25 kg – 0,50 kg)**

	part load	A	B	A	B	A	B	A	B
step	partial test load mass kg	1,25		1,00		0,75		0,50	
1	pillowcase	1	1	1	1	1	1	1	1
2	towels adjust number here	1	2	1	2	1	2	1	1
3	towel + strip	1	1	1	1	1	1	1	1
4	pillowcase	1							
5	sheet								
6	towel + strip								
7	pillowcase								
8	towels adjust number here								
9	towel + strip								
10	sheet								
11	towel + strip								
12	pillowcase								
13	towels adjust number here								
14	pillowcase								
15	towel + strip								
16	sheet								
17	towel + strip								
18	towels adjust number here								
19	pillowcase								
20	towel + strip								
21	sheet								
22	pillowcase								
23	towel + strip								
24	towels adjust number here	3	3	2	2	1	1	0	0
25	pillowcase	1	1	1	1	1	0	0	0

**Table ZA.8 — Vertical axis washing machines,
loading sequence for part A and part B of the cotton test load (7,50 kg – 6,75 kg)**

		part load	A	B	A	B	A	B	A	B	
step	group	partial test load mass kg	7,50		7,25		7,00		6,75		quadrant
1	1	Pillowcase	2	2	1	2	2	2	2	2	front
2		Towels	2	2	2	2	2	2	2	2	left
3		towel + strip	1	1	1	1	1	1	1	1	left
4		Pillowcase	1	1	1	1	1	1	1	1	back
5		towel + strip	1	1	1	1	1	1	1	1	back
6		Sheet	1	1	1	1	1	1	1	1	right
1	2	Pillowcase	1	2	1	2	1	1	1	1	left
2		Towels	2	2	2	2	2	2	2	2	back
3		towel + strip	1	1	1	1	1	1	1	1	back
4		Pillowcase	1	1	1	1	1	1	1	1	right
5		towel + strip	1	1	1	1	1	1	1	1	right
6		Sheet	1	1	1	1	1	1	1	1	front (front-left)
1	3	Pillowcase	1	2	1	2	2	1	2	1	back
2		Towels	2	2	2	2	2	2	2	2	right
3		towel + strip	1	1	1	1	1	1	1	1	right
4		Pillowcase	1	1	1	1	1	1	1	1	front
5		towel + strip	1	1	1	1	1	1	1	1	front
6		Sheet	1	1	1	1	1	1	1	1	left (left-back)
1	4	Pillowcase	1	1	1	1	1	1	1	1	right
2		Towels	2	2	2	2	2	2	2	2	front
3		towel + strip	1	1	1	1	1	1	1	1	front
4		Pillowcase	1	1	1	1	1	1	1	1	left
5		towel + strip	1	1							left
6		Sheet	1		1						back
1	5 add on	Pillowcase									left
2		Towels									front
3		towel + strip									front
4		Pillowcase									right
5		towel + strip									back
6		Toels adjust number here	5	5	5	1	6	8	4	5	spread on top

**Table ZA.9 — Vertical axis washing machines,
loading sequence for part A and part B of the cotton test load (6,50 kg – 5,75 kg)**

step	group	part load	A	B	A	B	A	B	A	B	quadrant
		partial test load mass kg	6,50		6,25		6,00		5,75		
1	1	Pillowcase	2	2	1	2	1	2	1	2	front
2		Towels	2	2	2	2	2	2	2	2	left
3		towel + strip	1	1	1	1	1	1	1	1	left
4		Pillowcase	1	1	1	1	1	1	1	1	back
5		towel + strip	1	1	1	1	1	1	1	1	back
6		Sheet	1	1	1	1	1	1	1	1	right
1	2	Pillowcase	1	1	1	1	1	1	1	1	left
2		Towels	2	2	1	1	1	1	1	1	back
3		towel + strip	1	1	1	1	1	1	1	1	back
4		Pillowcase	1	1	1	1	1	1	1	1	right
5		towel + strip	1	1							right
6		Sheet	1	1	1	1	1	1	1		front (front-left)
1	3	Pillowcase	1	1	1	1	1	1	1	1	back
2		Towels	2	2	2	2	2	2	2	2	right
3		towel + strip	1	1	1	1	1	1	1	1	right
4		Pillowcase	1	1	1	1	1	1	1	1	front
5		towel + strip	1	1	1	1	1	1	1	1	front
6		Sheet	1	1	1	1	1	1	1	1	left (left-back)
1	4	Pillowcase	1	1	1	1	1	1	1	1	right
2		Towels	2	2	1	1	1	1	1	1	front
3		towel + strip	1	1	1	1	1	1	1	1	front
4		Pillowcase	1	1	1	1	1	1		1	left
5		towel + strip									left
6		Sheet									back
1	5 add on	Pillowcase									left
2		Towels									front
3		towel + strip									front
4		Pillowcase									right
5		towel + strip									back
6		Toels adjust number here	4	3	6	5	4	2	5	6	spread on top

**Table ZA.10 — Vertical axis washing machines,
loading sequence for part A and part B of the cotton test load (5,50 kg – 4,75 kg)**

		part load	A	B	A	B	A	B	A	B	
step	group	partial test load mass kg	5,50		5,25		5,00		4,75		quadrant
1	1	Pillowcase	1	2	1	2	1	1	1	1	front
2		Towels	2	2	2	2	2	2	2	2	left
3		towel + strip	1	1	1	1	1	1	1	1	left
4		Pillowcase	1	1	1	1	1	1	1	1	back
5		towel + strip	1	1	1	1	1	1	1	1	back
6		Sheet	1	1	1	1	1	1	1	1	right
1	2	Pillowcase	1	1	1	1	1	1	1	1	left
2		Towels	1	1	1	1	1	1	1	1	back
3		towel + strip	1	1	1	1	1	1	1	1	back
4		Pillowcase		1		1	1	1	1	1	right
5		towel + strip									right
6		Sheet	1		1						front (front-left)
1	3	Pillowcase	1	1	1	1	1	1	1	1	back
2		Towels	2	2	2	2	2	2	2	2	right
3		towel + strip	1	1	1	1	1	1	1	1	right
4		Pillowcase	1	1	1	1	1	1	1	1	front
5		towel + strip	1	1							front
6		Sheet	1	1	1	1	1	1	1	1	left (left-back)
1	4	Pillowcase	1	1	1	1	1	1	1	1	right
2		Towels	1	1	1	1	1	1	1	1	front
3		towel + strip	1	1	1	1	1	1	1	1	front
4		Pillowcase		1		1	1	1			left
5		towel + strip									left
6		Sheet									back
1	5 add on	Pillowcase									left
2		Towels									front
3		towel + strip									front
4		Pillowcase									right
5		towel + strip									back
6		Toels adjust number here	4	3	6	5	4	2	5	6	spread on top

Table ZA.11 — Vertical axis washing machines, loading sequence for part A and part B of the cotton test load (4,50 kg – 3,75 kg)

step	group	part load	A	B	A	B	A	B	A	B	quadrant
		partial test load mass kg	4,50		4,25		4,00		3,75		
1	1	Pillowcase	1	1	1	1	1	1	1	1	front
2		Towels	2	1	1	1	1	1	1	1	left
3		towel + strip	1	1	1	1	1	1	1	1	left
4		Pillowcase	1	1	1	1	1	1	1	1	back
5		towel + strip	1	1							back
6		Sheet	1	1	1		1		1		right
1	2	Pillowcase	1	1	1	1	1	1	1	1	left
2		Towels	1	1	1	1	1	1	1	1	back
3		towel + strip	1	1	1	1	1	1	1	1	back
4		Pillowcase	1	1		1		1		1	right
5		towel + strip									right
6		Sheet									front (front-left)
1	3	Pillowcase	1	1	1	1	1	1	1	1	back
2		Towels	2	1	1	1	1	1	1	1	right
3		towel + strip	1	1	1	1	1	1	1	1	right
4		Pillowcase	1	1	1	1		1		1	front
5		towel + strip									front
6		Sheet	1	1	1		1		1		left (left-back)
1	4	Pillowcase	1	1	1	1	1	1	1	1	right
2		Towels	1	1	1	1	1	1	1	1	front
3		towel + strip	1	1	1	1	1	1	1	1	front
4		Pillowcase				1					left
5		towel + strip									left
6		Sheet				1		1		1	back
1	5 add on	Pillowcase									left
2		Towels									front
3		towel + strip									front
4		Pillowcase									right
5		towel + strip									back
6		Toels adjust number here	1	2	4	5	4	4	2	3	spread on top

Table ZA.12 — Vertical axis washing machines, loading sequence for part A and part B of the cotton test load (3,50 kg – 2,75 kg)

		part load	A	B	A	B	A	B	A	B	
step	group	partial test load mass kg	3,50		3,25		3,00		2,75		quadrant
1	1	Pillowcase	1	1	1	1	1	1	1	1	front
2		Towels	1	1	1	1	1	1	1	1	left
3		towel + strip	1	1	1	1	1	1	1	1	left
4		Pillowcase	1	1	1	1					back
5		towel + strip									back
6		Sheet					1		1		right
1	2	Pillowcase	1	1	1	1	1	1	1	1	left
2		Towels	1	1	1	1	1	1	1	1	back
3		towel + strip	1	1							back
4		Pillowcase									right
5		towel + strip									right
6		Sheet									front (front-left)
1	3	Pillowcase	1	1	1	1	1	1	1	1	back
2		Towels	1	1	1	1	1	1	1	1	right
3		towel + strip	1	1	1	1	1	1	1	1	right
4		Pillowcase	1	1							front
5		towel + strip									front
6		Sheet									left (left-back)
1	4	Pillowcase	1	1	1	1	1	1	1	1	right
2		Towels	1	1	1	1	1	1	1	1	front
3		towel + strip	1	1							front
4		Pillowcase									left
5		towel + strip									left
6		Sheet	1	1	1	1	1	1	1	1	into or around the middle
1	5 add on	Pillowcase									left
2		Towels									front
3		towel + strip									front
4		Pillowcase									right
5		towel + strip									back
6		Toels adjust number here	4	3	5	4	5	4	2	2	spread on top

Table ZA.13 — Vertical axis washing machines, loading sequence for part A and part B of the cotton test load (2,50 kg – 1,75 kg)

		part load	A	B	A	B	A	B	A	B	
step	group	partial test load mass kg	2,50		2,25		2,00		1,75		quadrant
1	1	Pillowcase	1	1							front
2		Towels	1	1							left
3		towel + strip	1	1							left
4		Pillowcase			1	1	1	1	1	1	back
5		towel + strip			1	1	1	1	1	1	back
6		Sheet									right
1	2	Pillowcase	1	1	1	1					left
2		Towels									back
3		towel + strip									back
4		Pillowcase									right
5		towel + strip									right
6		Sheet									front (front-left)
1	3	Pillowcase	1	1							back
2		Towels	1	1	2	2					right
3		towel + strip	1	1							right
4		Pillowcase			1	1	1	1	1	1	front
5		towel + strip			1	1	1	1	1	1	front
6		Sheet									left (left-back)
1	4	Pillowcase									right
2		Towels									front
3		towel + strip									front
4		Pillowcase									left
5		towel + strip									left
6		Sheet	1	1	1	1	1	1	1	1	into or around the middle
1	5 add on	Pillowcase									left
2		Towels									front
3		towel + strip									front
4		Pillowcase									right
5		towel + strip	1	1							back
6		Toels adjust number here	4	4	3	3	5	5	3	2	spread on top

Table ZA.14 — Vertical axis washing machines, loading sequence for part A and part B of the cotton test load (1,50 kg – 0,50 kg)

		part load	A	B	A	B	A	B	A	B	A	B	
step	group	partial test load mass kg	1,50		1,25		1,00		0,75		0,50		quadrant
1	1	Pillowcase			1	1	1	1	1				front
2		Towels											left
3		towel + strip											left
4		Pilowcase	1	1	1	1	1	1	1	1	1	1	back
5		towel + strip	1	1	1	1	1	1	1	1	1	1	back
6		Sheet											right
1	2	Pillowcase											left
2		Towels			1	1	1	1					back
3		towel + strip											back
4		Pilowcase											right
5		towel + strip											right
6		Sheet											front (front-left)
1	3	Pillowcase											back
2		Towels											right
3		towel + strip											right
4		Pilowcase	1	1	1								front
5		towel + strip	1	1									front
6		Sheet											left (left-back)
1	4	Pillowcase											right
2		Towels			1	1	1	1					front
3		towel + strip											front
4		Pilowcase											left
5		towel + strip											left
6		Sheet	1	1									into or around the middle
1	5 add on	Pillowcase											left
2		Towels											front
3		towel + strip											front
4		Pilowcase											right
5		towel + strip											back
6		Toels adjust number here	1	0	2	3	1	2	2	3	1	1	spread on top

For tests with **quarter load**, the **test washing machine** shall be loaded in accordance with the requirements of Annex H using a separate **base load** and the load composition shall be in accordance with Table 2. The **test load mass** for **quarter load** shall be rounded to the nearest 0,50 kg. For rated capacities below 5,00 kg the **test load mass** for **quarter load** shall be always 1,00 kg.

Table ZA.15 — Test load mass for quarter load

nominal load mass	quarter load mass	nominal load mass	quarter load mass
15,00 kg	4,00 kg	8,00 kg	2,00 kg
14,50 kg	3,50 kg	7,50 kg	2,00 kg
14,00 kg	3,50 kg	7,00 kg	2,00 kg
13,50 kg	3,50 kg	6,50 kg	1,50 kg
13,00 kg	3,50 kg	6,00 kg	1,50 kg
12,50 kg	3,00 kg	5,50 kg	1,50 kg
12,00 kg	3,00 kg	5,00 kg	1,50 kg

nominal load mass	quarter load mass	nominal load mass	quarter load mass
11,50 kg	3,00 kg	4,50 kg	1,00 kg
11,00 kg	3,00 kg	4,00 kg	1,00 kg
10,50 kg	2,50 kg	3,50 kg	1,00 kg
10,00 kg	2,50 kg	3,00 kg	1,00 kg
9,50 kg	2,50 kg	2,50 kg	1,00 kg
9,00 kg	2,50 kg	2,00 kg	1,00 kg
8,50 kg	2,00 kg		

ZA.4.3 Programme

Programme to be tested on the **test washing machine**:

The **eco 40-60 programme** shall be selected in accordance with the manufacturers' instruction. Exactly the same **programme** setting for the **eco 40-60 programme** shall be used for the tests with **full load**, **half load** and **quarter load**.

The **reference programme** to be used on the **reference machine** shall be cotton 60 °C as defined on the **programme** memory card labelled EN 60456:2011, IEC 60456:2010 ed.5 or higher supplied by the manufacturer of the **reference machine**.

ZA.4.4 Order of tests for the test washing machine and the reference machine

This procedure applies to the **test washing machine** and the **reference machine** which shall be run in parallel as explained below.

The following 10 **test runs** are required for the **test washing machine**:

- 3 **test runs** with **treatment full**;
- 4 **test runs** with **treatment half**;
- 3 **test runs** with **treatment quarter**.

For the **reference machine** 5 **test runs** cotton 60 °C (one test per day) with a 5,00 kg **test load** shall be carried out.

For the **test machine**, each part of **full load** and **half load**, shall be used for 5 runs as follows:

Part A and **part B** shall be used twice for the **eco 40-60 programme** with **half load** as shown in Figure ZA.2.

Part A and **part B** together shall be used for 3 **test runs** with **full load**.

For the **test machine**, the **quarter load**, shall be used for 3 runs:

The detailed order of tests is as follows.

Day 1:

- **Test run 1** : **test washing machine** with **treatment half** using **part A**
- **Test run 2** : **test washing machine** with **treatment half** using **part B**

Test run 1 of the **reference machine** shall be carried out in parallel to **test run 1** or **test run 2** of the **test washing machine**.

Day 2:

- **Test run 3** : **test washing machine** with **treatment half** using **part A**

- **Test run 4 : test washing machine with treatment half using part B**

Test run 2 of the **reference machine** shall be carried out in parallel to **test run 3** or **test run 4** of the **test washing machine**.

Day 3:

- **Test run 5 : test washing machine with treatment full**
- **Test run 6 : test washing machine with treatment quarter**

Test run 3 of the **reference machine** shall be carried out in parallel to **test run 5** or **test run 6** of the **test washing machine**.

Day 4:

- **Test run 7 : test washing machine with treatment full**
- **Test run 8 : test washing machine with treatment quarter**

Test run 4 of the **reference machine** shall be carried out in parallel to **test run 7** or **test run 8** of the **test washing machine**.

Day 5:

- **Test run 9 : test washing machine with treatment full**
- **Test run 10 : test washing machine with treatment quarter**

Test run 5 of the **reference machine** shall be carried out in parallel to **test run 9** or **test run 10** of the **test washing machine**.

A schematic representation of the **combined test series** is set out in Figure ZA.2.

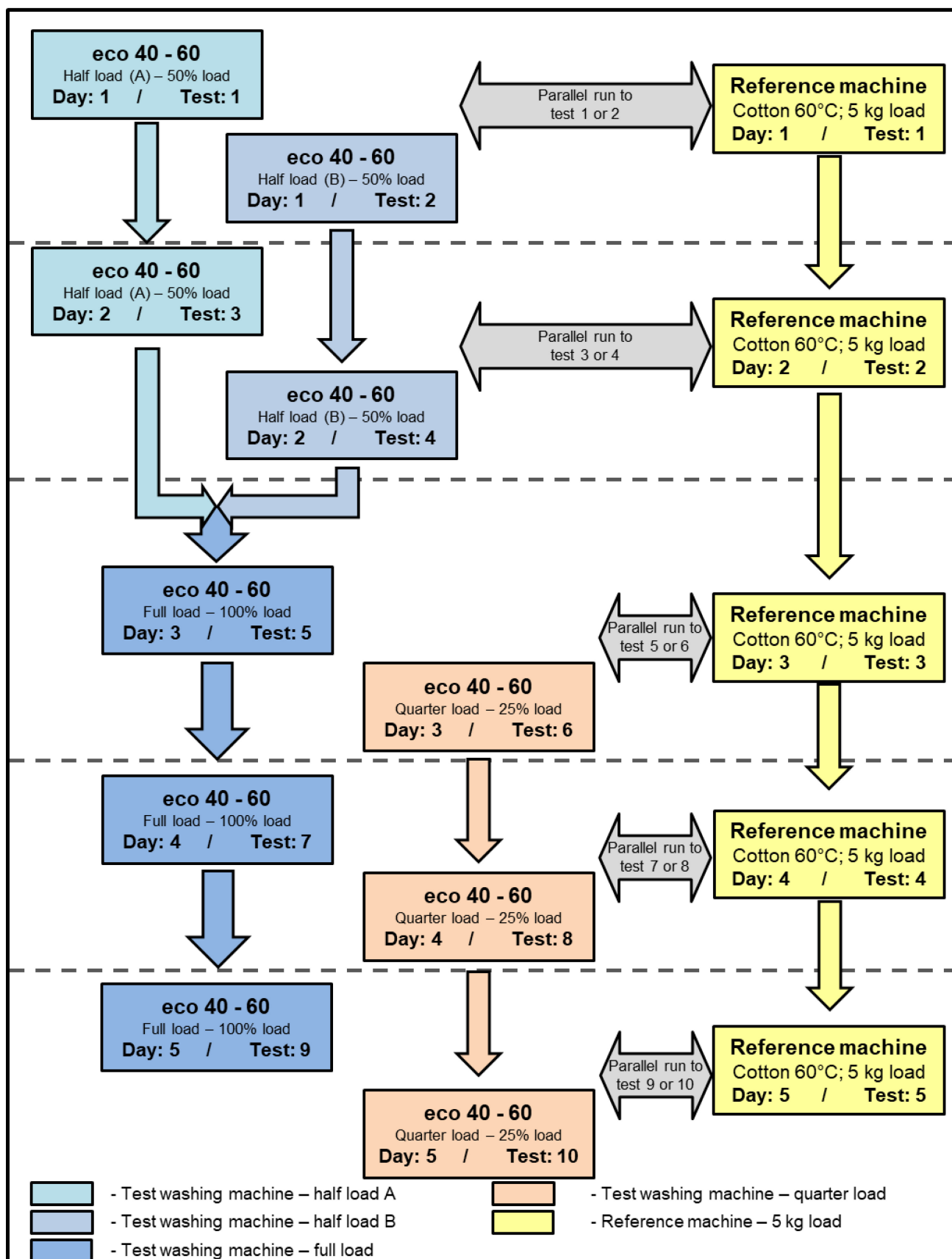


Figure ZA.2 — Test Series: load usage and order of tests

The time between the end of the first **test run** and the start of the second **test run** on the same day shall be at least 1 h but not more than 1 h and 20 min.

Care is required to ensure that **half load part A** and **part B** are not mixed up and no items are lost, gained or exchanged between **test runs** or between **base loads**.

A **test run** shall be considered to be invalid if one or more of the following occurs:

- laboratory conditions fail to remain within the tolerances specified in this European Standard during the **test run**;
- laboratory test equipment or recording systems fail during the **test run**;
- the **reference machine** operated in parallel fails to perform within the tolerances specified in this European Standard;
- a relevant test procedure specified in this European Standard has not been followed correctly.

If an invalid **test run** occurs within a **combined test series** then the following rules shall be followed:

- 1) If an invalid **test run** occurs on the **reference machine**, then that **reference machine** run and all **test washing machine** runs shall be repeated;
- 2) If one or both **half load test runs** carried out on the same day is invalid, then both **test runs** shall be repeated in parallel with an additional run on the **reference machine**. If the first of two **half load test runs** carried out on the same day is invalid, then the second **half load test run** of that day shall still be carried out;
- 3) If a **full load** or **quarter load test run** is invalid, then only that **test run** shall be repeated in parallel with an additional run on the **reference machine**.
- 4) If an invalid **test run** is repeated, the repeat **test run** shall be carried out in the given sequence.
- 5) If a **test run** is interrupted before the rinsing process is finished, then the **base load** has to be washed again in the selected **programme** without detergent;
- 6) The maximum number of repeat **test runs** carried out on the **reference machine** in a **test series** shall be one. If more than one repeat **test run** is required on the **reference machine** due to invalid runs then the **test series** for the test machines concerned shall be invalid. The maximum number of repeat **test runs** within a **combined test series** carried out on the **test washing machine** with

a) **treatment full** is one or **treatment half** is two

and/or

b) **treatment quarter** is one

NOTE The maximum number of repeat **test runs** carried out on the **reference machine** in a **test series** can thus only be one.

- 7) The reason for carrying out additional **test runs** shall be reported;
- 8) The results from any invalid **test runs** shall be eliminated completely from any subsequent evaluation. This includes in the case of **half loads** all tests of the relevant day regardless which **test run** was considered invalid on that day;
- 9) All **test runs** started shall be included when recording the age of the load.

A schematic representation of a **combined test series** is set out in Figure ZA.3.

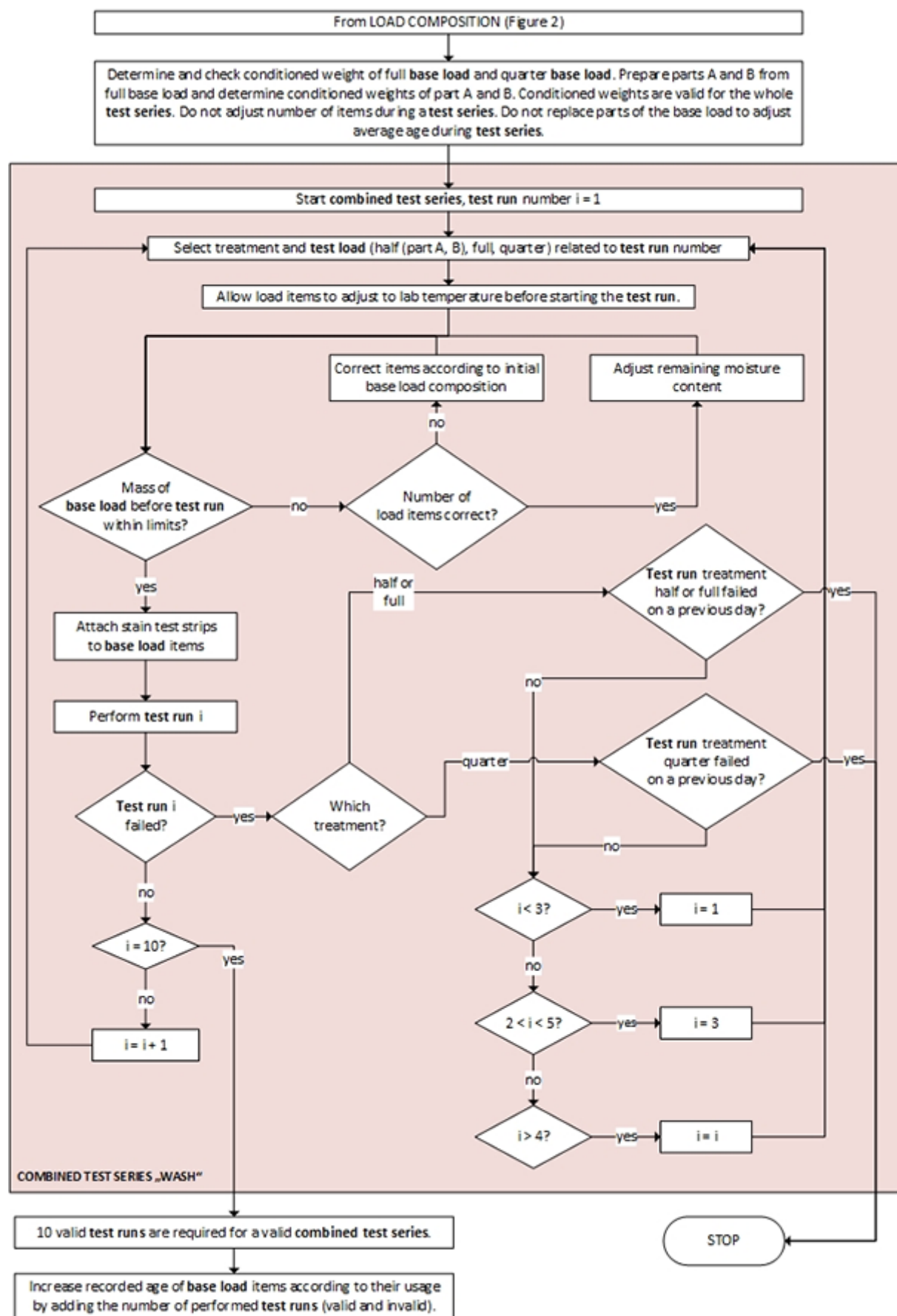


Figure ZA.3 — Combined test Series: process and decisions for load mass and age

ZA.4.5 Measurements to determine the washing performance

As specified in 8.3.3, to assess washing performance, tristimulus Y reflectance measurements are carried out on each of the individual soil types. Reflectance measurements are taken with not less than four layers of the same washed soil type as backing for the piece being measured.

NOTE Z1 This requirement also applies to measurements made on stain test strips from **half load** tests and **quarter load** tests where the number of strips may be less than four. In this case, stain test strips from other **test runs** having similar reflectance shall be used to make up the four layers of backing.

ZA.4.6 Measurements to determine water extraction performance

The stain test strips are removed at the completion of the test **programme** as set out in 8.2.4. The mass of the moist **base load** (of the complete load for **test runs** at **rated capacity**, of the **base load** at quarter of the **rated capacity** or of **part A** or **part B** for **test runs** at **half load**) at the completion of the **programme** shall be recorded.

ZA.4.7 Measurements to determine maximum spin speed

During the test, **spin speed** shall be recorded at intervals of 1 s or less. The maximum **spin speed** of each **cycle** shall be determined during a period of 60 s when the highest **spin speed** values are reached. The maximum **spin speed** shall be recorded as the lowest speed measured during this period.

If it is necessary to remove or modify any parts of the **test washing machine** in order to install a sensor for the measurement of **spin speed**, then all such parts and modifications shall be replaced as far as possible in their original position so that the installation does not significantly affect the performance of the **test washing machine** in any way pertinent to the tests being carried out. The type, installation and accuracy of the instrument used shall be reported.

ZA.4.8 Measurements to determine water consumption, energy consumption of the programme and programme time

During these tests instrumentation for the measurement of water volume, water temperature and electrical energy shall record the required parameters. Data for all parameters shall be recorded at least once per second throughout the test using a data logger or computer. Measurements for water and energy consumption of the **test washing machine** and the **reference machine** are commenced when the **programme** is initiated (without any user programmed delay). They are stopped at the completion of the **programme**.

ZA.4.9 Measurement to determine the rinsing effectiveness

Measurement to determine the rinsing effectiveness shall be in accordance with the requirements of Annex ZF.

ZA.4.10 Measurement to determine the temperature inside the load

Measurement to determine the temperature inside the load shall be in accordance with the requirements of Annex ZE.

ZA.5 Assessment of performance

ZA.5.1 General

This subclause sets out the additional requirements for the assessment of performance as defined in Clause 9 for the determination of the following parameters for a cotton load related to the combined test sequence for the **test washing machine**:

- evaluation of data (see ZA.5.2);
- washing performance (see ZA.5.4);
- water extraction performance (see ZA.5.5);
- **spin speed** (see ZA.5.6);

- water consumption (see ZA.5.7);
- **programme time** (see ZA.5.8);
- energy consumption of the **programme** (see ZA.5.9);
- calculation of the Energy Efficiency Index (*EEI*) (see ZA.5.10)

For the evaluation of washing performance the results from the **test washing machine** is compared to the result from the **reference machine** which is operated in parallel.

Under no circumstances shall any data from an invalid **test run** in either the **test washing machine** or the **reference machine** be used for evaluation. For detailed definition of invalid runs for the combined test sequence refer to ZA.4.4.

ZA.5.2 Weighting factors

Weighting factors are used to calculate the weighted average value for the **combined test series**. The values of the weighting factors depend on the **rated capacity** according to the following equations:

For **test washing machines** with a **rated capacity** lower than or equal to 3,00 kg:

$$A = 1$$

$$B = 0$$

$$C = 0$$

For **test washing machines** with a **rated capacity** greater than 3,00 kg:

$$A = -0,0391 \times c + 0,6918$$

$$B = -0,0109 \times c + 0,3582$$

$$C = 1 - (A + B)$$

where

- c* is the rated capacity;
- A* is the weighting factor for the full rated washing capacity and rounded to three decimal places;
- B* is the weighting factor for half of the rated washing capacity and rounded to three decimal places;
- C* is the weighting factor for a quarter of the rated washing capacity and rounded to three decimal places.

ZA.5.3 Evaluation of data

Test data from a **combined test series** consisting of 3 **treatments** with 10 **test runs** in total shall be evaluated. It is required that the results from **test runs** within one **treatment** are averaged to yield a single test result per **treatment**. Where it is required, the results from each of the three **treatments** are averaged to yield a single test result. This clause describes how the average value shall be calculated for each performance parameter.

In addition to the evaluations described in the following subclauses, a statistical analysis shall be carried out. This subclause describes the procedure for the statistical analysis.

a) The formulae in Clause 5 use the following abbreviations:

- 1/4 means treatment quarter;
- 1/2 means **treatment half**;

— *full* means **treatment full**.

b) The average value per **treatment** x_z shall be calculated as follows:

$$x_z = \frac{1}{n_z} \sum_{i=1}^{n_z} x_{z,i}$$

where

$x_{z,i}$ is the value for each **test run** i of **treatment** z ($z = \text{full}, 1/2, 1/4$);

n_z is the number of **test runs** for **treatment** z ($z = \text{full}, 1/2, 1/4$);

c) The standard deviation per **treatment** s_z shall be calculated as follows:

$$s_z = \sqrt{\sum_{i=1}^{n_z} \frac{(x_{z,i} - x_z)^2}{n_z - 1}}$$

where

x_z is the average value for **treatment** z ($z = \text{full}, 1/2, 1/4$);

$x_{z,i}$ is the value for each **test run** i of **treatment** z ($z = \text{full}, 1/2, 1/4$);

n_z is the number of **test runs** for **treatment** z ($z = \text{full}, 1/2, 1/4$);

z is the **treatment** ($z = \text{full}, 1/2, 1/4$).

d) The weighted average x per **treatment** shall be calculated as follows:

$$x = A \times x_{\text{full}} + B \times x_{1/2} + C \times x_{1/4}$$

ZA.5.4 Evaluation of washing performance

a) The average value for the sum of the reflectance values C_z per **treatment** shall be calculated as follows:

$$C_z = \frac{1}{n_z} \sum_{i=1}^{n_z} C_{z,i}$$

where

$C_{z,i}$ is the sum of the average reflectance values (Y-values) for each **test run**, as calculated in 9.2 b);

z is the **treatment** ($z = \text{full}, 1/2, 1/4$);

n_z is the number of **test runs** for **treatment** z ($z = \text{full}, 1/2, 1/4$);

i is the test run.

The Washing Efficiency Index $I_{W,z}$ per **treatment** shall be calculated as follows and rounded to three decimal places:

$$I_{W,z} = \frac{C_z}{C_{\text{ref}}}$$

where

C_z is the average value for the sum of the reflectance values for **treatment** z ($z = \text{full}, 1/2, 1/4$);

C_{ref} is the average sum of the reflectance values for the **reference machine** out of all 5 **test runs** (as calculated in 9.2 c));

z is the **treatment** ($z = \text{full}, 1/2, 1/4$).

- b) The Washing Efficiency Index I_W for the **combined test series** shall be calculated as follows and rounded to three decimal places:

$$I_W = \min(I_{W,\text{full}}, I_{W,1/2}, I_{W,1/4})$$

where

$I_{W,\text{full}}$ is the average Washing Efficiency Index for treatment full;

$I_{W,1/2}$ is the average Washing Efficiency Index for treatment half;

$I_{W,1/4}$ is the average Washing Efficiency Index for treatment quarter.

ZA.5.5 Evaluation of water extraction performance

- a) The **remaining moisture content** $D_{1/2, \text{part}, i}$ for each **test run** with **half load** (**part A** or **part B**) shall be expressed in percent and calculated as follows:

$$D_{1/2, \text{part}, i} = \frac{M_{r, 1/2, \text{part}, i} - M_{\text{part}}}{M_{\text{part}}}$$

where

M_{part} is the mass of the conditioned **half load** part ($\text{part} = \text{part A}, \text{part B}$) in g;

$M_{r, 1/2, \text{part}, i}$ is the mass of the **half load** part ($\text{part} = \text{part A}, \text{part B}$) at the end of the **test run** i ($i = 1, 2, 3, 4$) in g.

- b) The **remaining moisture content** $D_{z, i}$ for each **test run** with **full load** and **quarter load** shall be expressed in percent and calculated as follows and rounded to two decimal places:

$$D_{z, i} = \frac{M_{r, z, i} - M_z}{M_z}$$

where

M_z is the mass of the conditioned **full load** or the conditioned **quarter load** in g;

$M_{r, z, i}$ is the mass of the **full load** or **quarter load** at the end of the **test run** i ($i = 1, 2, 3$) in g;

z is the **treatment** ($z = \text{full}, 1/4$).

- c) The average value for the **remaining moisture content** $D_{1/2}$ for the **treatment half** shall be expressed in percent and calculated as follows and rounded to two decimal places:

$$D_{1/2} = \frac{1}{4} (D_{1/2, \text{part A}, 1} + D_{1/2, \text{part B}, 2} + D_{1/2, \text{part A}, 3} + D_{1/2, \text{part B}, 4})$$

where

$D_{1/2,part,i}$ is the **remaining moisture content** of **test run** i ($i = 1, 2, 3, 4$) with **half load** part ($part = part A, part B$) in %;

- d) The average value for the **remaining moisture content** D_z for **treatment full** and **treatment quarter** shall be expressed in percent and calculated as follows and rounded to two decimal place:

$$D_z = \frac{1}{n_z} \sum_{i=1}^{n_z} D_{z,i}$$

where

$D_{z,i}$ is the remaining moisture content of test run i with full load or quarter load in %;

n_z is the number of **test runs** for **treatment** z ($z = full, 1/2, 1/4$); ;

z is the **treatment** ($z = full, 1/4$).

- e) The weighted average value for the **remaining moisture content** D for the **combined test series** shall be expressed in percent, calculated as follows and rounded to one decimal place:

$$D = A \cdot D_{full} + B \cdot D_{1/2} + C \cdot D_{1/4}$$

where

$D_{1/4}$ is the average value for remaining moisture content for treatment quarter in %;

$D_{1/2}$ is the average value for remaining moisture content for treatment half in %;

D_{full} is the average value for **remaining moisture content** for **treatment full** in %.

A , B and C are the weighting factors as described in **ZA.5.3**.

ZA.5.6 Evaluation of maximum spin speed

- a) The average value for the maximum **spin speed** S_z per **treatment** shall be expressed in min^{-1} which is equivalent to rpm and calculated as follows and rounded to the nearest Integer:

$$S_z = \frac{1}{n_z} \sum_{i=1}^{n_z} S_{z,i}$$

where

$S_{z,i}$ is the maximum **spin speed** of **test run** i for **treatment** z ($z = full, 1/2, 1/4$) in min^{-1} ;

z is the **treatment** ($z = full, 1/2, 1/4$);

n_z is the number of **test runs** for **treatment** z ($z = full, 1/2, 1/4$);

i is the **test run**.

ZA.5.7 Evaluation of water consumption

- a) The average value for the total water consumption V_z per **treatment** shall be expressed in litres and calculated as follows and rounded to one decimal place:

$$V_z = \frac{1}{n_z} \sum_{i=1}^{n_z} V_{z,i}$$

where

- $V_{z,i}$ is the total water consumption for **test run** i for **treatment** z
($z = full, 1/2, 1/4$) in L;
 z is the **treatment** ($z = full, 1/2, 1/4$);
 n_z is the number of **test runs** for **treatment** z ($z = full, 1/2, 1/4$);
 i is the **test run**.

- b) The weighted average value for the total water consumption V for the **combined test series** shall be expressed in litres, calculated as follows and rounded to the nearest whole litre:

$$V = A \cdot V_{full} + B \cdot V_{1/2} + C \cdot V_{1/4}$$

where

- V_{full} is the average water consumption for treatment full in L;
 $V_{1/2}$ is the average water consumption for treatment half in L;
 $V_{1/4}$ is the average water consumption for treatment quarter in L.

ZA.5.8 Evaluation of programme time

- a) The average value for the **programme time** t_z per **treatment** shall be expressed in min and can be expressed in the format h:mm and calculated as follows:

$$t_z = \frac{1}{n} \sum_{i=1}^n t_{z,i}$$

where

- $t_{z,i}$ is the **programme time** for **test run** i for **treatment** z ($z = full, 1/2, 1/4$) in h:mm;
 z is the **treatment** ($z = full, 1/2, 1/4$);
 n_z is the number of **test runs** for **treatment** z ($z = full, 1/2, 1/4$);
 i is the **test run**.

ZA.5.9 Evaluation of energy consumption of the programme

- a) The total energy consumption of the **programme** for each **test run** is determined according to 9.5.4.
b) The average value for the total energy consumption W_z per **treatment** shall be expressed in kWh and calculated as follows and rounded to three decimal places:

$$W_z = \frac{1}{n_z} \sum_{i=1}^{n_z} W_{z,i}$$

where

W_{zi} is the total energy consumption for **test run** i for **treatment** z ($z = full, 1/2, 1/4$) in kWh;

z is the **treatment** ($z = full, 1/2, 1/4$);

n_z is the number of **test runs** for **treatment** z ($z = full, 1/2, 1/4$);

i is the **test run**.

- c) The weighted average value for the total energy consumption W for the **combined test series** shall be expressed in kWh, calculated as follows and rounded to three decimal places:

$$W = A \cdot W_{full} + B \cdot W_{1/2} + C \cdot W_{1/4}$$

where

$W_{1/4}$ is the average energy consumption for treatment quarter in kWh;

$W_{1/2}$ is the average energy consumption for treatment half in kWh;

W_{full} is the average energy consumption for treatment full in kWh.

ZA.5.10 Calculation of the Energy Efficiency Index (EEI)

For the calculation of the Energy Efficiency Index EEI , the average total energy consumption W is compared to its Standard Cycle Energy Consumption SCE_c .

- a) The Standard Cycle Energy Consumption SCE_c in kWh shall be calculated as follows and rounded to three decimal places:

$$SCE_c = -0,0025 \cdot c^2 + 0,0846 \cdot c + 0,3920$$

where

c is the **rated capacity** as declared by the manufacturer for the **eco 40–60 programme** at **full load**.

- b) The Energy Efficiency Index EEI shall be calculated as follows and rounded to one decimal place:

$$EEI = \frac{W}{SCE_c} \cdot 100$$

where

W is the weighted average energy consumption as calculated in ZA.5.9 b) in kWh;

SCE_c is the Standard Cycle Energy Consumption.

ZA.5.11 Calculation of the rinsing effectiveness

The maximum value for the **rinsing effectiveness** D_L for the **combined test series** shall be expressed in g/kg, calculated as follows and rounded to one decimal place:

$$R_{max} = \max(R_{full}, R_{1/2}, R_{1/4})$$

where

R_{full} is the average value for **rinsing effectiveness** for **treatment full** in g/kg;

$R_{1/2}$ is the average value for **rinsing effectiveness** for **treatment half** in g/kg;

$R_{1/4}$ is the average value for **rinsing effectiveness** for **treatment quarter** in g/kg.

ZA.6 Data to be reported

This subclause presents the data to be reported for the **test washing machine**. The data to be reported for the **reference machine** is the same as shown in Annex S.

The layout of the following tables is only a recommendation.

Title: “**Test Report to EN 60456**” (state edition and year used)

ZA.6.1 Data for test washing machine**Table ZA.15 — Data for test washing machine**

Brand:		Model:	
Country of manufacture (if indicated):			
Product number code:		Serial number:	
Source of machine:		Internal heater (yes/no):	
Appliance dimension declared:		Appliance dimension measured:	
Rated capacity	cotton:		
Drum volume declared:		Drum volume measured: (if required)	
Washer axis (see 3.1.7, 3.1.8 and H.3.1):		Washer loading (top/front):	
Water connections (hot, cold, hot and cold):		Rated input power:	
Rated voltage:		Test voltage:	
Rated frequency:		Test frequency:	
Additional information:			

ZA.6.2 Data, parameters and results for the test series

Table ZA.16, Table ZA.17 and Table ZA.18 shall be reported for a **test series** used to determine the performance of a **test washing machine** when applying the combined test procedure using a cotton **base load**. Table S.2a and Table S.2b shall be used for the **reference machine**. Following parameters of Table S.2a are not considered relevant for **reference machine**:

- Mass of titration sample of tap water
- Total amount of HCl 0,1N for tap water
- Mass of titration sample of extracted water
- Total amount of HCl 0,1N for extracted water

Following data of Table S.2b are not considered relevant for **reference machine**:

- **Off mode** power
- **Left on mode** power
- Rinsing Index

Laboratory	
Checked / approved by	
Machine identification	
Internal test identifier	
Reference machine test series identifier	
Programme selected	eco 40–60
Nominal required test load mass	
Reason for extra test run (if applicable)	
'End of programme' indication (refer to 3.1.24)	

[illegible]

[illegible]

Documents

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Table ZA.17 — Data, parameters and results for the low power mode measurements

Laboratory						
Checked / approved by						
Machine identification						
Internal test identifier						
Programme and options selected						
	Symbol (refer to 3.2)	Symbol as given in regulation	Unit	Noted (n) Measured (m) Calculated (calc)	Reported precision (note 1)	Result
General						
Date of test run	-	-	yyyy.mm.dd	n	-	
Is off mode available?	-	-	-	n	Yes/No	
Is standby mode available?	-	-	-	n	Yes/No	
If standby mode is available, does it include the display of information or status?	-	-	-	n	Yes/No	
Is delay start available?	-	-	-	n	Yes/No	
If delay start is available, is delay start possible for more than 24h?	-	-	-	n	Yes/No	
Is network connection(s) available?	-	-	-	n	Yes/No	
If network connection(s) is available, is activation and deactivation of the network connection(s) possible?	-	-	-	n	Yes/No	
If network connection(s) is available, is network connection(s) deactivated by default?	-	-	-	n	Yes/No	
Is the machine automatically switching to off mode or standby-mode within 15 min?	-	-	-	n	Yes/No	
Measurements						
Power consumption in ' off mode ' (if applicable)	P_{om}	P_o	W	m	0,01	
Power consumption in ' standby mode ' (if applicable)	P_{sm}	P_{sm}	W	m	0,01	
Description of appliance interaction(s) and optional programme run(s)						
- If delay start is available, power consumption in ' delay start '	P_{ds}	P_{ds}	W	m	0,01	
Power consumption in ' standby mode ' in condition of network standby (if applicable)	P_{ns}	P_{sm}	W	m	0,01	

Description of delay start setting and selected programme	
NOTE 1 The figures for reported precision specify the rounding and reporting of values. As an example, a reported precision of 0,001 means that the result shall be reported rounded to 3 decimal places.	

Table ZA.18 — Performance results of the test washing machine

Laboratory						
Checked / approved by						
Machine identification						
Internal test identifier						
Programme and options selected	eco 40–60					
'End of programme' indication (refer to 3.1.24)						
	Symbol (refer to 3.2)	Symbol as given in regulation	Unit	Reported precision (see note 1)	Average	Standard deviation
Rated capacity at 0,5 kg intervals	c	c	kg	0,1		
Weighting factor for treatment full	A	A	-	0,001		
Weighting factor for treatment half	B	B	-	0,001		
Weighting factor for treatment quarter	C	C	-	0,001		
Energy consumption of treatment full	W_{full}	$E_{W,full}$	kWh	0,001		
Energy consumption of treatment half	$W_{1/2}$	$E_{W,1/2}$	kWh	0,001		
Energy consumption of treatment quarter	$W_{1/4}$	$E_{W,1/4}$	kWh	0,001		
Weighted energy consumption	W	E_W	kWh	0,001		
Standard energy consumption	SCE_c	SCE_W	kWh	0,001		
Energy Efficiency Index	EEI	EEI_W	-	0,1		
Water consumption of treatment full	V_{full}	$W_{W,full}$	L	0,1		
Water consumption of treatment half	$V_{1/2}$	$W_{W,1/2}$	L	0,1		
Water consumption of treatment quarter	$V_{1/4}$	$W_{W,1/4}$	L	0,1		
Weighted water consumption	V	W_W	L	1		
Washing efficiency index of treatment full	$I_{W,full}$	I_W	-	0,001		
Washing efficiency index of treatment half	$I_{W,1/2}$	I_W	-	0,001		
Washing efficiency index of treatment quarter	$I_{W,1/4}$	I_W	-	0,001		
Washing efficiency index for the combined test series	I_W	-	-	0,001		
Rinsing effectiveness of treatment full	R_{full}	I_R	g/kg	0,1		
Rinsing effectiveness of treatment half	$R_{1/2}$	I_R	g/kg	0,1		
Rinsing effectiveness of treatment quarter	$R_{1/4}$	I_R	g/kg	0,1		
Rinsing effectiveness for the combined test series	R	-	g/kg	0,1		
Programme duration of treatment full	t_{full}	t_W	h:mm	X:XX		
Programme duration of treatment half	$t_{1/2}$	t_W	h:mm	X:XX		

Programme duration of treatment quarter	$t_{1/4}$	t_w	h:mm	X:XX		
Temperature reached for minimum 5 min inside the load of treatment full	ϑ_{full}	T	°C	1		
Temperature reached for minimum 5 min inside the load of treatment half	$\vartheta_{1/2}$	T	°C	1		
Temperature reached for minimum 5 min inside the load of treatment quarter	$\vartheta_{1/4}$	T	°C	1		
Spin speed in the spinning phase of treatment full	S_{full}	S	rpm	1		
Spin speed in the spinning phase of treatment half	$S_{1/2}$	S	rpm	1		
Spin speed in the spinning phase of treatment quarter	$S_{1/4}$	S	rpm	1		
Remaining moisture content of treatment full	D_{full}	D_{full}	%	0,01		
Remaining moisture content of treatment half	$D_{1/2}$	$D_{1/2}$	%	0,01		
Remaining moisture content of treatment quarter	$D_{1/4}$	$D_{1/4}$	%	0,01		
Weighted remaining moisture content	D	D	%	0,1		
Airborne acoustical noise emissions during the spinning phase	-	-	dB(A) re 1 pW	1		

NOTE 1 The figures for reported precision specify the rounding and reporting of values. As an example, a reported precision of 0,001 means that the result shall be reported rounded to 3 decimal places.

ZA.6.3 Additional information to be reported

The number of items included in **part A** and **part B** of the **base load** shall be reported.

The age distribution of the **base loads** shall be reported for both the **test washing machine** and the **reference machine** according to S.3.

Materials used for the **test series** shall be reported for both the **test washing machine** and the **reference machine** according to S.4.

Standard Equipment used for the **test series** shall be reported for both the **test washing machine** and the **reference machine** according to S.5.

Following data of Table S.5 are not considered relevant:

- pH-meter
- Titration equipment $\triangle A_{12}$

A12 Annex ZB (normative)

Multi-Drum Washing Machines

ZB.1 Rated capacity for multi-drum washing machines

Where neither the **combined rated capacity** nor the individual drums **rated capacity** information is available, the **test load** shall be determined according to Annex N for each individual drum.

Where information of the **combined rated capacity** is available, but no information of individual drums **rated capacity** is available, the **detergent dose** shall be calculated according the **combined rated capacity** and split based on the ratio of drum volumes determined according Annex N.

ZB.2 Tests for performance

ZB.2.1 General

A **multi-drum washing machine** may have drums, that can be operated separately in the **eco 40-60 programme** and/or drums that can be operated only in **multi-drum mode** in the **eco 40-60 programme**.

All drums, that can be operated separately in the **eco 40-60 programme** are tested and assessed separately.

All drums, that can only be operated in **multi-drum mode** in the **eco 40-60 programme** are tested together in the **multi-drum mode**. For these drums, all requirements of this annex shall be applied.

The assessment of washing performance, water extraction performance and rinsing performance of a **multi-drum washing machine** shall be done for each drum separately using the **simultaneous programme**.

The assessment of **combined programme time**, combined energy and combined water consumption shall be done from the initiation of the **simultaneous programme** for two or more drums until the end of the **simultaneous programme**.

ZB.2.2 Test procedure for performance tests

ZB.2.2.1 preparation of the test multi-drum washing machine after installation

For **multi-drum washing machines** each individual drum shall be prepared according to 6.2.1.2.

ZB.2.2.2 Test load and loading

The **base load** (refer to 5.3.2) and **nominal test load mass** shall be selected for each **test series** and for each drum individually.

A specific **base load** shall be dedicated to each individual drum for all **test runs** in a **test series**

Each drum of the **test washing machine** and the **reference machine** shall be loaded in accordance with the requirements of Annex H.

ZB.2.2.3 Test procedure

Within 10 min after the completion of the **programme** at an individual drum, remove the **test load**. Then remove the stain test strips. For the evaluation of washing performance, water extraction performance and rinse performance, each drum shall be tested according to the requirements of 8.3, 8.4 and 8.5, and the values for each drum should be recorded separately.

ZB.2.2.4 Test series

The complete **test run** shall be considered invalid if the run of at least one working drum is invalid. It is permitted to conduct a sixth **test run** according to specifications in 8.2.5.

ZB.3 Assessment of performance of a multi-drum washing machine

ZB.3.1 General

All assessment shall be done for each drum individually

The principle for performance evaluation is to measure the parameters for each drum (to ensure compliance with minimum performance requirements if any) and then combine the individual ratings to give an overall appliance performance rating. This will be detailed in each relevant part of this section.

ZB.3.2 Evaluation of washing performance

The wash performance is evaluated and reported for each drum.

ZB.3.3 Evaluation of water extraction performance

Water extraction performance is evaluated for each drum individually and then a load size weighted average shall be calculated for the complete appliance at the **combined rated capacity**.

ZB.3.4 Evaluation of rinsing effectiveness

Rinsing effectiveness is evaluated for each drum individually.

ZB.3.5 Evaluation of water and energy consumption and programme time

ZB.3.5.1 General

The combined water and energy consumption and **combined programme time** shall be evaluated using the measurements determined in 8.6.

ZB.3.5.2 Water volumes

Combined water consumption for the simultaneous program shall be expressed in litres, and rounded to the nearest 0,1 l. Separate volumes for hot and cold water shall be reported, where applicable. Total water consumption shall be reported rounded to the nearest whole litre.

ZB.3.5.3 Combined programme time

Combined programme time is determined by selecting the maximum **programme time** of all drums running simultaneously for each run within a **treatment** followed by calculating the average **combined programme time** of all runs within a **treatment**. **Combined programme time** is rounded to the nearest minute.

ZB.3.5.4 Combined Energy consumption

The combined energy consumed over a **simultaneous programme** is the sum of the electrical energy plus any cold water correction plus the energy embodied in any hot water. 