
**Textiles — Domestic washing and
drying procedures for textile testing**

*Textiles — Méthodes de lavage et de séchage domestiques en vue des
essais des textiles*





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Contents		Page
	Foreword	v
	Introduction	vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Principle	2
5	Apparatus and materials	3
5.1	Automatic washing machines.....	3
5.1.1	Reference washing machine Type A — horizontal axis, front-loading type.....	3
5.1.2	Reference washing machine Type B — Vertical axis, top-loading agitator type.....	3
5.1.3	Reference washing machine Type C — Vertical Axis, top-loading pulsator type.....	3
5.2	Tumble dryers.....	3
5.2.1	Type A1 tumble dryer — vented.....	3
5.2.2	Type A2 tumble dryer — Condenser.....	3
5.2.3	Type A3 tumble dryer — Large vented.....	3
5.3	Electrically (dry) heated flat-bed press.....	3
5.4	Line drying.....	3
5.5	Drying racks.....	3
5.6	Ballasts.....	3
5.6.1	Type I, 100 % cotton ballast.....	3
5.6.2	Type II, 50 % cotton/50 % polyester ballast.....	3
5.6.3	Type III, 100 % polyester ballast.....	3
5.6.4	Other ballast.....	4
6	Reagents	4
6.1	Reference detergents.....	4
6.1.1	Reference detergent 1.....	4
6.1.2	Reference detergent 2.....	4
6.1.3	Reference detergent 3.....	4
6.1.4	Reference detergent 4.....	4
6.1.5	Reference detergent 5.....	4
6.1.6	Reference detergent 6.....	5
6.1.7	Reference detergent 7.....	5
6.2	Water.....	5
6.2.1	Water hardness.....	5
6.2.2	Water pressure.....	5
6.2.3	Cold-water inlet temperature.....	5
7	Conditioning and testing atmosphere	5
8	Wash load	5
8.1	Total wash load.....	5
8.2	Number of specimens.....	5
8.3	Selection of ballast.....	6
8.4	Ratio of load to ballast.....	6
9	Washing procedure	6
10	Drying procedure	7
10.1	General.....	7
10.2	Open-air dry.....	7
10.2.1	General.....	7
10.2.2	Procedure A — line dry.....	7

10.2.3	Procedure B — Line drip dry	7
10.2.4	Procedure C — Flat dry	7
10.2.5	Procedure D — Flat drip dry	8
10.3	Procedure E — Flat press	8
10.4	Procedure F — Tumble dry	8
10.4.1	General	8
10.4.2	Endpoint moisture content by setting time	8
10.4.3	Endpoint overdry state by setting time	8
10.4.4	Endpoint moisture content by automatic tumble dryer sensing	9
11	Domestic washing and drying procedure report	9
Annex A	(normative) Specification for reference washing machine Type A — Horizontal axis, front-loading type	10
Annex B	(normative) Specification for wash procedures for reference washing machine Type A	13
Annex C	(normative) Specification for machines and procedures for reference washing machine Type B — Vertical axis, top-loading agitator type	18
Annex D	(normative) Specification for reference washing machine Type C — Vertical axis, top-loading pulsator type	19
Annex E	(normative) Specification for washing procedures for reference washing machine Type C	20
Annex F	(normative) Specification for tumble dryers	21
Annex G	(normative) Specifications for all ballast types used in washing	22
Annex H	(normative) Nominal percentage composition for non-phosphate powder reference detergent 1	24
Annex I	(normative) Nominal percentage composition for non-phosphate reference detergent 2	26
Annex J	(normative) Nominal percentage composition for non-phosphate reference detergent 3	27
Annex K	(normative) Nominal percentage composition for reference detergent 4	28
Annex L	(normative) Nominal percentage composition for reference detergent 6	29
Annex M	(normative) Nominal percentage composition for reference detergent 7	30
Annex N	(normative) Distribution and mixing of reference detergent 2, 3, or 6	31
Annex O	(normative) Determination of cycle drying time for tumble dryers with a time device	33
	Bibliography	36

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 2, *Cleansing, finishing and water resistance tests*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 248, *Textiles and textile products*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 6330:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

- a new terminology [wash load (3.11)] has been added for clarification;
- information on available detergents have been updated;
- information on ballasts have been clarified;
- acceptable devices have been updated;
- in [Annex L](#), the reference detergent has been corrected as SDC reference detergent Type 4 (it was incorrectly designated as IEC reference detergent A in ISO 6330:2000);
- annexes within the document have been harmonized.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is utilized by a broad range of textile quality and performance evaluations including but not exclusive to: smoothness appearance, dimensional change, stain release, water resistance, water repellence, colour fastness to domestic laundering, and care labelling that are prescribed in other international and regional test method standards.

This document is also used to evaluate not only the attributes of fabrics themselves but also the performance of apparel, home products and other textile end-products. The selection of washing and drying machines and their associated ballast types, detergents, and other drying options are determined according to the international region in which the textile will be used by consumers.

NOTE Suitable machines, detergents and ballast are available commercially. If you need this information, please contact the ISO TC 38/SC 2 Secretariat.

Textiles — Domestic washing and drying procedures for textile testing

1 Scope

1.1 This document specifies domestic washing and drying procedures for textile testing. The procedures are applicable to textile fabrics, garments or other textile articles which are subjected to appropriate combinations of domestic washing and drying procedures. This document also specifies the reference detergents and ballasts for the procedures.

1.2 Provision is made for

- a) 16 different washing procedures based on the use of the reference washing machine Type A: horizontal axis, front-loading type,
- b) 11 procedures based on the use of the reference washing machine Type B: vertical axis, top-loading agitator type, and
- c) 7 procedures based on the use of the reference washing machine Type C: vertical axis, top-loading pulsator type.

1.3 Each washing procedure represents a single domestic wash.

1.4 This document also specifies six drying procedures: line dry, line drip dry, flat dry, flat drip dry, flat press, and tumble dry.

1.5 A complete test consists of a washing and drying procedure.

NOTE Use of different parameters (washing machine type, detergent type and type of tumble dryer) can affect test results for any test using this document.

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.

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

ISO 6059, *Water quality — Determination of the sum of calcium and magnesium — EDTA titrimetric method*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

3.1

ambient condition

temperature and relative humidity in the test environment not differing from the typical indoor condition or the typical outdoor condition in the region where the test is performed

3.2

ballast

textile fabric to be added to the specimen(s) under test in order to fill the mass required by the washing procedure

3.3

tumbler moisture sensor

control unit in a tumble dryer capable of measuring the humidity of the load and ending the drying operation at a predetermined residual moisture level

3.4

overdrying

prolonged drying operation where the load is dried until all remaining moisture in the load has been removed

3.5

reference detergent

detergent with specified formulations to be used for testing purposes

3.6

reference washing machine

washing machine with defined engineering specifications to be used for testing purposes

3.7

washing procedure

cycle of the washing action including water supplying, washing, and repeated rinsing, *spinning* (3.8) and water supplying and ended by spinning as predetermined on the washing machine

3.8

spinning

water-extracting process in the washing machine by which water is removed from the textiles by centrifugal action as part of the *washing procedure* (3.7)

3.9

still air

air not influenced by any natural wind or mechanical device giving it a forced flow

3.10

total air-dry load mass

mass the specimen under test and the ballast in a conditioned state following ISO 139

3.11

wash load

material to be processed, comprised of the ballast and specimen mixed together

4 Principle

A specimen is washed in an automatic washing machine and dried according to specified procedures.

5 Apparatus and materials

5.1 Automatic washing machines

5.1.1 Reference washing machine Type A — Horizontal axis, front-loading type

The specification for reference washing machine Type A shall be in accordance with [Annex A](#).

5.1.2 Reference washing machine Type B — Vertical axis, top-loading agitator type

The specification for reference washing machine Type B shall be in accordance with [Annex C](#).

5.1.3 Reference washing machine Type C — Vertical Axis, top-loading pulsator type

The specification for reference washing machine Type C shall be in accordance with [Annex D](#).

5.2 Tumble dryers

5.2.1 Type A1 tumble dryer — Vented

The specification for Type A1 tumble dryer shall be in accordance with [Annex F](#).

5.2.2 Type A2 tumble dryer — Condenser

The specification for Type A2 tumble dryer shall be in accordance with [Annex F](#).

5.2.3 Type A3 tumble dryer — Large vented

The specification for Type A3 tumble dryer shall be in accordance with [Annex F](#).

5.3 Electrically (dry) heated flat-bed press

If this method of drying is used, the type of press shall be specified among the interested parties.

5.4 Line drying

For procedure for line drying, see [10.2.1](#); for line drip drying, see [10.2.2](#).

5.5 Drying racks

Use screen drying racks of approximately 16 mesh stainless steel or plastic for flat drying (see [10.2.3](#)) or flat drip drying (see [10.2.4](#)).

5.6 Ballasts

5.6.1 Type I, 100 % cotton ballast

The nominal composition of 100 % Cotton ballast shall be in accordance with [Annex G](#).

5.6.2 Type II, 50 % cotton/50 % polyester ballast

The nominal composition of 50 % cotton/50 % polyester ballast shall be in accordance with [Annex G](#).

5.6.3 Type III, 100 % polyester ballast

The nominal composition of 100 % polyester ballast shall be in accordance with [Annex G](#).

5.6.4 Other ballast

Ballast associated with another product performance specification may be used if agreed upon between interested parties. If used, include alternate ballasts in the test report.

6 Reagents

6.1 Reference detergents

NOTE [Annex H](#) uses the term “brightener”, [Annexes I and L](#) use the term “optical whitener”, and [Annex K](#) uses the term “optical brightener”, both of which represent “optical brightener”.

6.1.1 Reference detergent 1

Reference detergent 1 is a non-phosphate powder detergent without enzymes and is available both with and without optical brightener. [Other designations are 1993 AATCC standard reference detergent without optical brightener (WOB) and 1993 AATCC standard reference detergent with optical brightener.]

Reference detergent 1 may only be used in machine Type B.

The nominal composition of reference detergent 1 shall be in accordance with [Annex H](#).

6.1.2 Reference detergent 2

Reference detergent 2 is a non-phosphate powder detergent with optical brightener and with enzymes. (Another designation is IEC reference detergent A*.)

Reference detergent 2 may be used in both machine Type A and Type B.

The nominal composition of reference detergent 2 shall be in accordance with [Annex I](#).

Distribution and mixing shall be in accordance with [Annex N](#).

6.1.3 Reference detergent 3

Reference detergent 3 is a non-phosphate powder detergent without optical brightener and without enzymes. (Another designation is ECE reference detergent 98.)

Reference detergent 3 may be used in both machine Type A and Type B.

The nominal composition of reference detergent 3 shall be in accordance with [Annex J](#).

Distribution and mixing shall be in accordance with [Annex N](#).

6.1.4 Reference detergent 4

Reference detergent 4 is a non-phosphate powder detergent with optical brightener and with enzymes. [Another designation is [ISO 3571](#) (Category 1).] Reference detergent 4 can only be used in washing machine Type C.

The nominal composition of reference detergent 4 shall be in accordance with [Annex K](#).

6.1.5 Reference detergent 5

Reference detergent 5 was a non-phosphate liquid detergent available from AATCC. It is no longer commercially available. In order to maintain continuity through the rest of the document and eliminate confusion in the markets, subsequent references will maintain their original names (i.e. Reference Detergent 6 will continue to be known as Reference Detergent 6).

6.1.6 Reference detergent 6

Reference detergent 6 is a non-phosphate powder detergent with optical brightener and without enzymes.

Reference detergent 6 may be used in machine Type A.

The nominal composition of reference detergent 6 shall be in accordance with [Annex L](#).

Distribution and mixing shall be in accordance with [Annex N](#).

6.1.7 Reference detergent 7

Reference detergent 7 is a liquid detergent for wool/silk material for mild/delicate washing process. This detergent can be suitable for materials that are typically labelled as delicate or hand wash.

The nominal composition of reference detergent 7 shall be in accordance with [Annex M](#).

6.2 Water

6.2.1 Water hardness

Water hardness shall be a maximum of 5,0 mmol/l expressed as calcium carbonate, in accordance with ISO 6059.

Alternative water hardness can be applicable with a consent among the interested parties. In this case, water hardness shall be reported.

6.2.2 Water pressure

The laboratory water supply pressure at the inlet to the reference washing machine shall be higher than 150 kPa.

6.2.3 Cold-water inlet temperature

The water temperature at the inlet to the reference washing machines shall be no more than 25 °C.

When the measurement is carried out with a water temperature that differs from the limit, the supply temperature shall be reported.

7 Conditioning and testing atmosphere

The conditioning atmosphere used for textile specimens shall be in accordance with ISO 139.

8 Wash load

8.1 Total wash load

The total air-dry load mass (i.e. specimen plus appropriate balls, see [5.6](#) and [8.3](#)) shall be $(2,0 \pm 0,2)$ kg for all types of reference washing machines.

In the case of testing a whole garment, report the total load mass if it is more than 2,2 kg.

8.2 Number of specimens

The number of specimens to be subjected to the washing and drying procedure specified in this document shall be determined by the purpose for which the material is being tested.

8.3 Selection of ballast

For specimens with 51 % or more of cellulosic fibres, the cotton ballast, Type I shall be used (see 5.6.1), unless otherwise agreed upon by interested parties. For specimens with 51 % or more of synthetic fibres, the polyester ballast, Type III shall be used (see 5.6.3), unless otherwise agreed upon by interested parties. For specimens that are made of other fibres or blends, either the polyester/cotton ballast, Type II or the polyester ballast, Type II may be used (see 5.6.2 and 5.6.3), unless otherwise agreed upon by interested parties. In all cases the ballast type shall be reported.

A ballast associated with another product performance specification that references procedures in this document shall be used so long as it is agreed upon between interested parties and is reported.

8.4 Ratio of load to ballast

If dimensional stability is being determined, not more than half of the wash load shall consist of specimens being tested.

In the case of testing a whole garment, report the ratio of load to ballast if it is more than 1/1.

9 Washing procedure

9.1 Select the washing procedure to be used from those stated in Annex B for a type A reference washing machine, from Annex C for a type B reference washing machine, or from Annex D for a type C reference washing machine.

9.2 Weigh the (individual) specimens, made-up articles, or garments before washing. If required add ballast to meet the required load mass (see 8.1). The specimen and the ballast shall be evenly mixed before it is loaded into the reference machine.

9.3 Place the material to be washed in the washing machine (see 5.1.1 to 5.1.3).

- a) In reference washing machines Type A, add (20 ± 1) g of the reference detergent 2, 3 or 6 directly into the dispenser. For delicate items or wool, use (47 ± 1) g of reference detergent 7 in the dispenser.
- b) In reference washing machines Type B fill the machine with water at the selected temperature, then add (66 ± 1) g of reference detergent 1 or if reference detergent 2 or 3 is used, add the appropriate amount to provide good running suds having a height of not more than $(3,0 \pm 0,5)$ cm at the end of the washing cycle.
- c) In reference machines Type C, fill the machine with water at the selected temperature, then add 1,33 g/l of reference detergent 4 directly into the dispenser.
- d) See Table 1 for a summary of the reference detergent dosage.

Table 1 — Dosage of the reference detergents

Reference detergents	Reference washing machines		
	Type A	Type B	Type C
1	—	(66 ± 1) g	—
2	(20 ± 1) g	Appropriate	—
3	(20 ± 1) g	Appropriate	—
4	—	—	1,33 g/l
5	—	—	—
6	(20 ± 1) g	—	—
7	(47 ± 1) g	—	—

9.4 After the washing procedure has been completed, remove the specimen(s) carefully, ensuring that they are neither stretched nor distorted, and dry according to one of the drying procedures described in clause 10.

10 Drying procedure

10.1 General

At the end of the selected washing procedure, immediately remove the material and follow the selected drying procedures A to E.

10.2 Open-air dry

10.2.1 General

For drip drying, the washing procedure shall be finished without the final spinning, and material samples shall be removed.

10.2.2 Procedure A — Line dry

Remove the specimen from the washing machine and hang each hydro-extracted specimen unfolded to avoid distortion. Suspend the specimen being tested from a line, in still air under ambient conditions.

The warp or wale direction of the material specimen shall be vertical. Made-up articles shall be suspended in the direction of use.

For subsequent testing, the drying may be carried out in a conditioned atmosphere according to ISO 139.

10.2.3 Procedure B — Line drip dry

Follow the procedure in 10.2.2 using the programs 3HD or 4HD in order to perform drip dry (e.g. without extracting the water).

For subsequent testing, the drying may be carried out in a conditioned atmosphere according to ISO 139.

10.2.4 Procedure C — Flat dry

Remove the specimen from the machine and spread out each hydro-extracted specimen on a horizontal screen drying rack (see 5.5) or perforated surface, remove the wrinkles by hand without stretching or distorting. Allow the specimen to dry in still air in ambient conditions.

For subsequent testing, the drying may be carried out in a conditioned atmosphere according to ISO 139.

10.2.5 Procedure D — Flat drip dry

Follow the procedure in 10.2.4 using the programs 3HD or 4HD in order to perform drip dry (e.g. without extracting the water).

For subsequent testing, the drying may be carried out in a conditioned atmosphere according to ISO 139.

10.3 Procedure E — Flat press

Remove the specimen from the washing machine and place the specimen on the flat bed of the press (see 5.3). Smooth out heavy wrinkles by hand and lower the head of the press, which shall be set at a temperature suitable for the specimen to be pressed, for one or more short periods as required to dry the specimen. Record the temperature and pressure used.

10.4 Procedure F — Tumble dry

10.4.1 General

At the end of the selected washing procedure, immediately remove the load and place the specimens and the ballast in the tumble dryer (see 5.2). Tumble dry the load as specified in 10.4.2, 10.4.3, or 10.4.4.

For the machines specified in 5.2, ensure that the temperature of the exhaust from the drum is set at a minimum temperature of 40 °C and not exceeding 80 °C for normal temperature and 60 °C for low temperature.

10.4.2 Endpoint moisture content by setting time

To determine the optimum cycle time for drying, tumble dry the load at a suitable heat setting for the calculated test cycle time as determined by the method described in Annex 2.

At the end of the calculated test cycle time according to Annex 0, the final moisture shall be equivalent to the moisture content of the conditioned textile.

For both normal temperature and low temperature, cycle time needs to be determined for each ballast type.

Operate the dryer until the load is dry and continue tumbling for 5 min with the heat turned off. Remove the specimen immediately.

If measuring the specimen temperature during tumble drying is required, plastic ribbons (thermolabels) that indicate the temperature shall be affixed to the specimen. These thermolabels shall be capable of measuring in the temperature range 40 °C to 90 °C.

10.4.3 Endpoint overdry state by setting time

Overdrying is characterized by drying to a final moisture level below the conditioned state.

In relation to the textile composition, the following values of the final moisture shall be applied:

- -2 % for textile made of synthetic materials compared with the conditioned specimen mass;
- -5 % for textile made of cellulosic materials compared with the conditioned specimen mass;
- for textile made of other fibres and blends, refer to appropriate resources for final moisture.

In order to find out the influence of the overdrying on material properties, the specific property (e.g. dimensional change) of the textile material under testing should be determined before and after the overdrying stage.

Proceed to further dry the load until the determined final moisture is reached.

Continue tumbling for 5 min with the heat turned off and then remove the specimen immediately.

10.4.4 Endpoint moisture content by automatic tumble dryer sensing

Tumble dry the load at a suitable heat setting until the final moisture measured by the tumbler moisture sensor reaches the agreed moisture content, according to Table 2.

Continue tumbling for at least 5 min with the heat turned off and then remove the specimen immediately.

The tumble dryer cycle should be agreed between the interested parties; otherwise the tumble dryer cycle 1 should be applied.

Table 2 — Final moisture content

Tumble dryer cycle	Material	Final moisture content of load
		%
1	Dry cotton	0 ± 3
2	Synthetics and blends	2 ± 3
3	Iron dry cotton	12 ± 3

11 Domestic washing and drying procedure report

The applied domestic washing and drying procedure shall be reported in any test report referring to ISO 6330 and shall contain the following information:

- date of test
- a reference to this document, i.e. ISO 6330:2021;
- the atmosphere used for conditioning according to ISO 139;
- the type of reference washing machine and washing procedure used;
- the drying procedure used and the type of machine, if applicable; or if flat pressed according to Procedure E, the temperature and pressure used;
- the type of detergent used; if optical brightener, sodium perborate or percarbonate are used, this shall be reported;
- details of any deviation from the specified procedures;
- the type of ballast used and the product performance specification it is associated with if not a ballast specified within this document;
- unusual observations that occur during testing

Annex A
(normative)

**Specification for reference washing machine Type A —
Horizontal axis front-loading type**

Table A.1 provides the specification for reference washing machine Type A.

Table A.1 Specification for reference washing machine Type A

Position items	Items	Details	Type A1 Specification for the new replacement machine	Type A2 (manufactured pre 2002)	
Inner drum	Diameter	—	(520 ± 1) mm	(515 ± 5) mm	
	Depth	—	(315 ± 1) mm	(335 ± 5) mm	
	Net volume	—	61 l	65 l	
	Lifting vanes	Number	—	3	3
		Height (manufacturing specification) See Figure A.1	—	(53 ± 1) mm	(53 ± 5) mm
	Lifting vanes	Length	—	Extended the depth of the inner drum	Extended the depth of the inner drum
		Side length (for in laboratory calibration) See Figure A.2	—	(60 ± 1) mm	(60 ± 1) mm
Lifting vanes	Spacing	—	120°	120°	
	Outer drum	Diameter	—	(554 ± 1) mm	(575 ± 5) mm
Drum speed	Wash	With load and water	(52 ± 1) r/min	(52 ± 1) r/min	
	Hydroextraction	Low spin	(500 ± 20) r/min	(500 ± 20) r/min	
		High spin	(800 ± 20) r/min	(500 ± 20) r/min	
Heating system	Heating power	—	5,4 kW ± 2 %	5,4 kW ± 2 %	
	Thermostat	—	Controlled	Controlled	
		Accuracy at switch-off temperature	—	±1 °C	±1 °C
Rotating action	Normal ON	Tolerance refers to timer intervals	(12,0 ± 0,1) s	(12,0 ± 0,1) s	
			(3,0 ± 0,1) s	(3,0 ± 0,1) s	
	Mild ON	Tolerance refers to timer intervals	(8,0 ± 0,1) s	(8,0 ± 0,1) s	
			(7,0 ± 0,1) s	(7,0 ± 0,1) s	
	Gentle ON	Tolerance refers to timer intervals	(3,0 ± 0,1) s	(3,0 ± 0,1) s	
			(12,0 ± 0,1) s	(12,0 ± 0,1) s	

At least once a year, calibrate the reference washing machine according to calibration instructions, which can be obtained from the manufacturer.

Table A.1 (continued)

Position items	Items	Details	Type A1 Specification for the new replacement machine	Type A2 (manufactured pre 2002)
Water system	Cold-water supply	Flow rate	(20 ± 2) l/min	(16 ± 2) l/min
		Temperature	(20 ± 5) °C	(20 ± 5) °C
	Level sensing	Step size	≤ 3 mm	≤ 3 mm
		Repeatability	± 5 mm or ± 1 l	± 5 mm or ± 1 l
Drain system	Drain valve	>30 l/min	>30 l/min	

At least once a year, calibrate the reference washing machine according to calibration instructions, which can be obtained from the manufacturer.

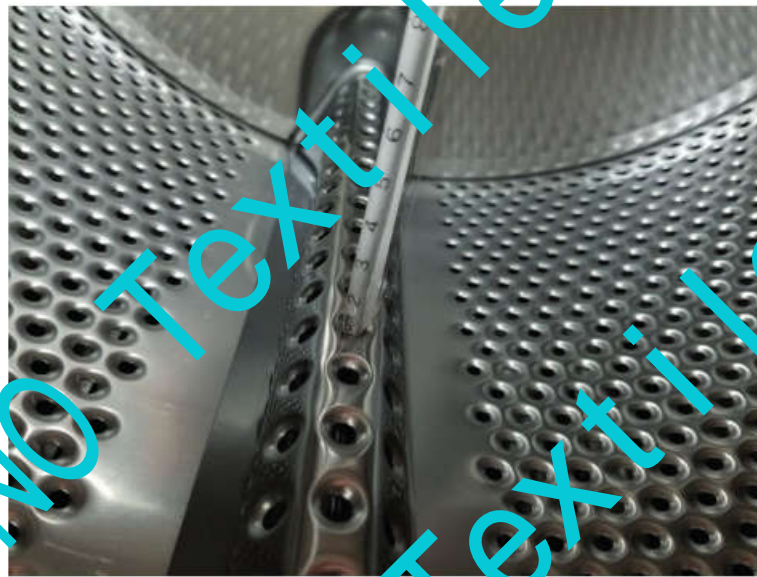


Figure A.1 — Measuring the height of the lifting vane

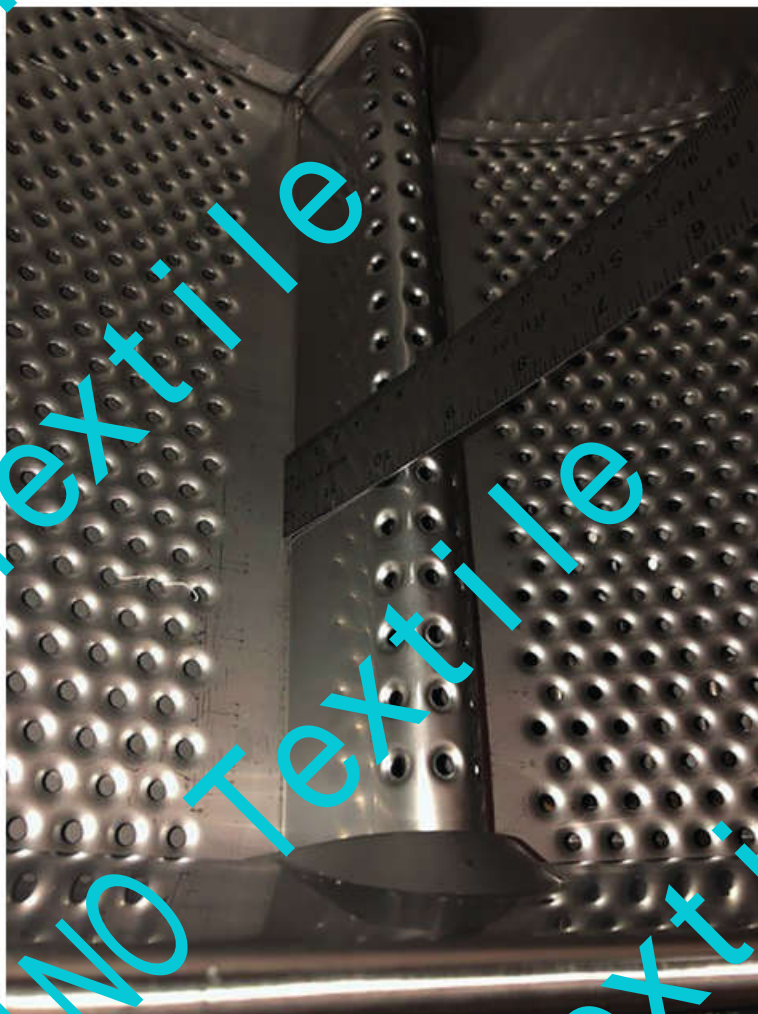


Figure A.2 — Measuring the side of the lifting vane

Annex B
(normative)

**Specification for wash procedures for reference washing machine
Type A**

[Table B.1](#) provides washing procedures for use in reference washing machine Type A.

Table B.1 – Washing procedures for reference washing machine Type A

Procedure No.	Agitation during heating, washing and rinsing		Washing		Rinse 1		Rinse 2		Rinse 3		Rinse 4		
	Temp.	Liquor level	Wash time	Cool down	Liquor level	Rinse time	Liquor level	Spin time	Liquor level	Rinse time	Spin time	Liquor level	Spin time
9N ^h	Normal	92 ± 3	100	Yes ⁱ	130	3	130	—	130	2	—	130	2
7N ^h	Normal	70 ± 3	100	Yes ⁱ	130	3	130	—	130	2	—	130	2
6N ^h	Normal	60 ± 3	100	No	130	3	130	—	130	2	—	130	2
6M ^h	Mild	60 ± 3	100	No	130	2	130	—	130	2	—	—	—
5N ^h	Normal	50 ± 3	100	No	130	3	130	—	130	2	—	130	2
5M ^h	Mild	50 ± 3	100	No	130	2	130	—	130	2	2 ^j	—	—
4N	Normal	40 ± 3	100	No	130	3	130	—	130	2	—	130	2

NOTE 1 For type A machines, ready-made memory cards (A1) or detailed programmed instructions (A2) can be obtained from the manufacturer. The memory cards are locked and the content cannot be exchanged or altered.

- N Normal agitation: 12 s drum movement and 3 s static. High spin
- I Intense agitation: 8 s drum movement and 7 s static. Low spin
- G Gentle agitation: 3 s drum movement and 12 s static. Low spin
- H Simulated hand wash: gentle agitation, 3 s drum movement and 12 s static. Low spin
- HD Draining of water from washer without a spin extraction.
- a Main wash temperature differs to the heating switch-off temperature.
- b Liquor level is measured from the bottom of the cage after the machine has been run for 1 min and allowed to stand for 30 s.
- c For Type A1 machines: use volume measurement for better accuracy. See [table B.2](#).
- d The stated times may have a tolerance of ±20 s.
- e No agitation during heating up to set temperature -5 °C. From the set temperature +5 °C to the set temperature, agitate with gentle action. The expression "very mild" in ISO 3758 corresponds to "gentle" in ISO 6330 for practical (mnemonic) reason to remind the washing cycle.
- f Cool down: top up with cold water to 130 mm level and agitate for a further 2 min.
- g Rinse time is measured when liquor level is reached.
- h Heat to 40 °C, hold for 15 min with agitation before heating to wash temperature.
- i For some laboratory practice only.
- j Drop spin
- k Drop dry

Table B.1 (continued)

Procedure No.	Agitation during heating and rinsing		Washing			Rinse 1			Rinse 2			Rinse 3			Rinse 4		
	Temp.	Liquor level	Wash time	Cool down	Liquor level	Rinse time	Liquor level	Spin time	Liquor level	Rinse time	Liquor level	Spin time	Liquor level	Rinse time	Liquor level	Spin time	Rinse time
	a	bc	d	f	bc	dg	bc	d	bc	dg	bc	d	bc	dg	bc	d	eg
	°C	mm	min		mm	min	mm	min	mm	min	mm	min	mm	min	mm	min	min
4M	40 ± 3	100	15	No	130	2	130	—	130	2	130	2	—	—	—	—	—
4G	40 ± 3	130	3	No	130	3	130	1	130	2	—	—	—	—	—	—	—
3N	30 ± 3	100	15	No	130	3	130	—	130	2	—	—	130	2	—	5	—
3M	30 ± 3	100	15	No	130	3	130	—	130	2	—	—	130	2	—	—	—
3G	30 ± 3	130	3	No	130	3	130	—	130	2	—	—	130	2	—	—	—
3H	30 ± 3	130	1	No	130	2	130	2	—	—	—	—	—	—	—	—	—
4H	40 ± 3	130	—	No	130	2	130	2	—	—	—	—	—	—	—	—	—

NOTE 1 For type A machines, ready-made memory cards (A1) or detailed programmed instructions (A2) cannot be exchanged or altered.

N Normal agitation: 12 s drum movement and 3 s static. High spin

M Mild agitation: 8 s drum movement and 7 s static. Low spin

G Gentle agitation: 3 s drum movement and 12 s static. Low spin

H Simulated hand wash: gentle agitation, 3 s drum movement and 12 s static. Low spin

HD Draining of water from washers without a spin extraction.

a Main wash temperature refers to the heating switch-off temperature.

b Liquor level is measured from the bottom of the cage after the machine has been run for 1 min and allowed to stand for 30 s.

c For Type A1 machines: use volume measurement for better accuracy. See Table B.2.

d The stated times may have a tolerance of ±20 s.

e No agitation during heating up to set temperature -5 °C. From the set temperature of -5 °C to the set temperature, agitate with gentle action. The expression "very mild" in ISO 3758 corresponds to "gentle" in ISO 6330 or practical (mnemonic) reason to remind the washing cycle.

f Cool down: top up with cold water to 130 mm level and agitate for a further 2 min.

g Rinsing time is measured when liquor level is reached.

h Heat to 40 °C, hold for 15 min with agitation before heating to wash temperature.

i For safe laboratory practice only.

j Short spin.

k Drip dry.

Table B.1 (continued)

Procedure No.	Agitation during heating, washing and rinsing		Washing		Rinse 1		Rinse 2		Rinse 3		Rinse 4	
	Temp.	Liquor level	Cool down	Liquor level	Rinse time	Liquor level	Rinse time	Liquor level	Rinse time	Liquor level	Rinse time	Liquor level
3HD	a °C 30 ± 3	bc mm 130	f min No	bc mm 130	dg min 2	bc mm 130	dg min 2	bc mm 130	dg min 2	bc mm 130	dg min 2	bc mm 130
4HD	a °C 40 ± 3	bc mm 130	f min No	bc mm 130	dg min 2	bc mm 130	dg min 2	bc mm 130	dg min 2	bc mm 130	dg min 2	bc mm 130

NOTE For type A machines, ready-made memory cards (A1) or detailed programmes and instructions (A2) can be obtained from the manufacturer. The memory cards are locked and the content cannot be exchanged or altered.

N Normal agitation: 12 s drum movement and 3 s static. High spin
M Mild agitation: 8 s drum movement and 7 s static. Low spin
G Gentle agitation: 3 s drum movement and 1 s static. Low spin
H Simulated hand wash: gentle agitation, 3 s drum movement and 12 s static. Low spin
H₀ Draining of water from washer without a spin extraction
a Main wash temperature refers to the heating switch or temperature.
b Liquor level is measured from the bottom of the cage. For one machine has been run for 1 min and allowed to stand for 30 s.
c For Type A1 machines: use volume measurement for better accuracy. See [Table B.2](#).
d The stated times may have a tolerance of ±20 s.
e No agitation during heating up to set temperature -5 °C. From the set temperature of -5 °C to the set temperature, agitate with gentle action. The expression "very mild" in ISO 3758 corresponds to "gentle" in ISO 6330 for practical (mnemonic) reason to remind the washing cycle.
f Cool down: top up with cold water to 130 mm level and agitate for a further 2 min.
g Rinse time is measured when liquor level is reached.
h Heat to 40 °C, hold for 15 min when agitation before heating to wash temperature.
i For safe laboratory practice only.
j Short spin.
k Drip dry.

Table B.1 provides the volume measurement for Type A1 machines.

Table B.2 — Volume measurement for Type A1 machines

Procedure	Water level	Volume
	mm	l
Main wash (water added to dry load)	100	16
	130	18
Rinses (water added to wet load)	130	14

Annex C (normative)

Specification for machines and procedures for reference washing machine Type B — Vertical axis, top-loading agitator type

The following parameters in [Table C.1](#) were developed by AATCC and are part of AATCC Laundering Procedure 1.

NOTE For model number(s) of washer(s) and tumble dryer(s) reported to meet the parameters in [Table C.1](#), visit <https://aatcc.org/testing/>. It is possible that cycle and temperature names on machines do not match those in the tables.

Table C.1 — Standard washing machine parameters

Cycle	Normal	Delicate	Permanent press
Water level, l (gal)	72 ± 4 (19 ± 1)	72 ± 4 (19 ± 1)	72 ± 4 (19 ± 1)
Agitation speed, strokes/min.	86 ± 2	27 ± 2	86 ± 2
Washing time, min.	16	8,5	12
Final spin speed, r/min	660 ± 15	500 ± 15	500 ± 15
Final spin time, min.	5	5	5
Wash Temp. °C (°F) ^a	Cold: 27 ± 3 (80 ± 5)	Cold: 27 ± 3 (80 ± 5)	Cold: 27 ± 3 (80 ± 5)
	Warm: 41 ± 3 (105 ± 5)	Warm: 41 ± 3 (105 ± 5)	Warm: 41 ± 3 (105 ± 5)
	Hot: 49 ± 3 (120 ± 5)	Hot: 49 ± 3 (120 ± 5)	Hot: 49 ± 3 (120 ± 5)
	Extra hot: 60 ± 3 (140 ± 5)	Extra hot: 60 ± 3 (140 ± 5)	Extra hot: 60 ± 3 (140 ± 5)

^a The temperatures in this table are similar to those specified by the US Federal Trade Commission for call label verification. Due to US Department of Energy requirements, many consumer washing machines use cooler water. An external control box may be used to override the machine set temperatures.

Annex D (normative)

Specification for reference washing machine Type C — Vertical axis, top-loading pulsator type

Table D.1 provides the specifications for reference washing machine Type C.

Table D.1 — Specification of reference washing machine Type C

Position/Items	Items	Details	Type C Top-loading vertical rotating pulsator type
Inner drum (Basket)	Depth	—	(440 ± 1) mm
	Diameter	—	(460 ± 1) mm
	Volume	—	50 l
	Pulsator	Number	One
Outer drum (Tub)	Depth	—	(510 ± 1) mm
	Diameter	—	(990 ± 1) mm
Drum speed	Hydroextraction (spin)	High spin	(780 ± 20) r/min to (830 ± 30) r/min
		Low spin	(500 ± 30) r/min
Rotating action	Pulsator speed	Normal	(120 ± 20) r/min
		Gentle	(90 ± 20) r/min
Water system	Water supply for rinsing	—	15 l/min (house tap)
	Level sensing [(water volume)/(inner drum water volume)]	57 l ^a	[(57 l ± 2 l)/(43 l ± 2 l)]
		40 l	[(40 l ± 2 l)/(27 l ± 2 l)]
	Drain system	Drain valve	27 l/min

Other machines of equivalent characteristics may be employed after correlation tests with the machine described above.

A water level of 54 l is designated at the washing load of 5 kg. The no-load water volume is 59 l and at a load of 2 kg, the water volume is 57 l.

Annex E
(normative)

Specification for washing procedures for reference washing machine Type C

Table E.1 provides the washing procedures for reference washing machine Type C.

Table E.1 — Washing procedure for reference washing machine Type C

Procedure No.	Agitation during washing and rinsing	Washing				Rinsing 1 ^b			Rinsing 2 ^b		
		Temperature	Liquor level	Time	Spin time	Liquor level	Time	Spin time	Liquor level	Time	Spin time
		°C	l	min	min	l	min	min	l	min	min
4N	Normal ^c	40 ± 3	40	15	3	40	2	3	40	2	7
4M	Normal ^c	40 ± 3	40	6	3	40	2	3	40	2	3
4G	Normal ^c	40 ± 3	40	3	3	40	2	3	40	2	≤ 1
3N	Normal ^c	30 ± 3	40	15	3	40	2	3	40	2	7
3M	Normal ^c	30 ± 3	40	6	3	40	2	3	40	2	3
3G	Normal ^c	30 ± 3	40	3	3	40	2	3	40	2	≤ 1
4H	Gentle ^d	40 ± 3	54	6	2	54	2	1	54	2	≤ 1

a The water for washing is preheated to the designated temperature and supplied to the machine.
 b The water used for rinsing is cold and is supplied from a house tap.
 c Normal agitation is the rotating action of "normal" pulsator speed with agitation for 0,8 s ON and 0,6 s OFF, then reverse agitation for 0,8 s ON and 0,6 s OFF, as a cycle.
 d 4H is the simulated hand-wash procedure with gentle agitation, which corresponds to the rotating action of gentle pulsator speed with agitation for 1,3 s ON and 5,8 s OFF, then reverse agitation of 1,3 s ON and 5,8 s OFF, as a cycle.
 e Spin for 4H corresponds to low spin of the drum speed of hydroextraction, and spin for the others is high spin.

Annex F (normative)

Specification for tumble dryers

Table F.1 provides the specification for tumble dryers.

Table F.1 — Specification for tumble dryers

Items	Details	Type A1	Type A2	Type A3
Drying system	—	Vented	Condenser	Vented
Humidity control	—	Timer	Timer	Timer
	—	Automatic	Automatic	Automatic
Drum	Volume	80 l to 150 l	80 l to 150 l	151 l to 200 l
	Diameter	500 mm to 625 mm	550 mm to 625 mm	626 mm to 700 mm
	Peripheral centrifugal acceleration	0,6 g to 0,95 g	0,6 g to 0,95 g	0,6 g to 0,95 g
Lifting vanes	Number	2 or 3	2 or 3	2 or 3
	Height	50 mm to 90 mm	50 mm to 90 mm	50 mm to 100 mm
	Spacing	Evenly distributed	Evenly distributed	Evenly distributed
Heating input	—	Max. 3,5 kW	Max. 2 kW	Max. 6 kW
Drying rate	100 % cotton	Min. 25 ml/min	Min. 25 ml/min	Min. 50 ml/min
	Cotton/polyester	Min. 20 ml/min	Min. 20 ml/min	Min. 40 ml/min
Controlled exhaust temperature	Normal temperature	Max. 80 °C	Max. 80 °C	Max. 80 °C
	Lower temperature	Max. 60 °C	Max. 60 °C	Max. 60 °C
Cool down period	—	Min. 5 min or lower 50 °C	Min. 5 min or lower 50 °C	Min. 5 min or lower 50 °C
Condensation efficiency	—	—	Min. 80 %	—
Rated capacity Load factor = load(kg)/drum volume(l)	Load factor 1:15	5,3 kg to 10,0 kg	5,3 kg to 10,0 kg	10,1 kg to 13,3 kg
	Load factor 1:25	3,2 kg to 6,0 kg	3,2 kg to 6,0 kg	6,1 kg to 8,0 kg
	(100 % cotton)			
	Load factor 1:30	2,7 kg to 5,0 kg	2,7 kg to 5,0 kg	5,1 kg to 6,7 kg
	Load factor 1:50 (Cotton/polyester)	1,6 kg to 3,0 kg	1,6 kg to 3,0 kg	3,1 kg to 4,0 kg

Annex G (normative)

Specifications for all ballast types used in washing

G.1 Composition of ballast

See [Table G.1](#) for greige information.

Table G.1 — Composition and specification of greige fabrics^a

Items	Type I	Type II	Type III
Composition	100 % cotton	50 % polyester / 50 % cotton	100 % polyester
Linear density of single yarn	(34,7 +/- 1,0) Tex	(40,0 +/- 1,2) Tex	— ^b
Fabric construction	Plain woven fabric	Plain woven fabric	Knitted interlock fabric made of texturized polyester yarn
Thread count, warp	(25,9 ± 2) threads/cm	(18,9 ± 2) threads/cm	
Thread count, weft	(22,7 ± 2) threads/cm	(18,9 ± 2) threads/cm	
Fabric mass per unit area	(188 ± 10) g/m ²	(155 ± 10) g/m ²	(310 ± 20) g/m ²
Finish	Desizing, boiling off, singeing, bleaching, no filling or stiffening finish, sanforizing	-	Washing, no filling or stiffening finish, (thermo fixation)
^a Greige fabric. These specifications apply to the production of ballast only.			
^b Linear density of yarn is not a critical parameter. Construction and fabric mass per unit area are the critical concerns.			

G.2 Composition and specification of ballast

See [Table G.2](#) for ballast information.

Table G.2 — Composition and specification of ballast

Items	Type I 100 % Cotton	Type II 50 % Polyester/ 50 % Cotton	Type III 100 % Polyester
Piece size	(92 ± 2) cm × (92 ± 2) cm	(92 ± 2) cm × (92 ± 2) cm	(20 ± 4) cm × (20 ± 4) cm
Piece mass	(±20 ± 10) g	(260 ± 10) g	(50 ± 5) g
Shrinkage (warp and weft) or (course and wale)	±5 %	±5 %	±5 %

G.3 Sewing of ballast

See [Table G.3](#) for sewing information

Table G.3 — Sewing of ballast

Items	Type I 100 % Cotton	Type II 50 % Polyester/ 50 % Cotton	Type III 100 % Polyester
Layer	2	2	4
Sewing	sewn on all four sides	sewn on all four sides	over-locked on all four sides, and bar-tacked at the corners

Annex H (normative)

Nominal percentage composition for non-phosphate powder reference detergent 1

H.1 1993 AATCC standard reference detergent 1 without optical brightener (WOB)

Reference detergent 1 without optical brightener formula is given in [Table H.1](#).

Table H.1 — Reference detergent 1 without optical brightener

Composition	Reference detergent 1, %
Linear sodium alkylbenzene sulfonate, sodium salt ^a	19,0 (±17)
Sodium aluminosilicate solids	28,3 (±20)
Sodium carbonate	16,5 (±10)
Sodium silicate solids ^b	0,6 (±10)
Sodium sulfate	22,6 (±10)
Polyethylene glycol	2,1 (±10)
Sodium polyacrylate	2,7 (±10)
Silicone, suds suppressor	0,2 (±10)
Moisture	5,0 (±1)
Miscellaneous (unreacted in surfactant stocks)	2,2 (±10)
Total	100,0
^a C10-16	
^b SiO ₂ /Na ₂ O = 1,6.	

H.2 1993 AATCC standard reference detergent 1 with optical brightener.

Reference detergent 1 with optical brightener formula is given in [Table H.2](#).

Table H.2 — Reference detergent 1 with optical brightener

Composition	Reference detergent 1, %
Linear sodium alkylbenzene sulfonate, sodium salt ^a	19,0 (±17)
Sodium aluminosilicate solids	28,3 (±20)
Sodium carbonate	16,5 (±10)
Sodium silicate solids ^b	0,6 (±10)
Sodium phosphate	22,4 (±10)
Polyethylene glycol	2,1 (±10)
Sodium polyacrylate	3,7 (±10)
Silicone, suds suppressor	0,2 (±10)
Moisture	5,0 (±10)
Miscellaneous (unreacted in surfactant stock)	2,2 (±10)
Brightener	0,2 (±10)
Total	100,0
^a C ₁₀₋₁₆	
^b SiO ₂ /Na ₂ O =1,6.	

Annex I (normative)

Nominal percentage composition for non-phosphate reference detergent 2

I.1 General warning

This annex calls for the use of substances/procedures that can be injurious to the health/environment. It refers only to technical suitability. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

I.2 IEC reference detergent A*

Reference detergent 2 formulas are given in [Table 1](#).

Table I.1 — Reference detergent 2 — IEC reference detergent A*

Composition	Reference Detergent 2	Reference Detergent 2
	with perborate	with percarbonate
	%	%
Linear sodium alkyl benzene sulfonate	8,8 (±0,3)	9,4 (±0,5)
Ethyoxylated fatty alcohol C ₁₂₋₁₄ (7EO)	4,7 (±0,3)	5,0 (±0,3)
Sodium soap (tallow soap)	3,4 (±0,2)	3,4 (±0,2)
Foam-inhibitor concentrate (12 % silicon on inorganic carrier)	3,9 (±0,3)	4,1 (±0,3)
Sodium aluminium silicate zeolite 4A (80 % active substance)	28,3 (±1,0)	30,1 (±1,1)
Sodium carbonate	11,6 (±1,0)	12,4 (±1,1)
Sodium salt of a copolymer from acrylic and maleic acid (granulate)	2,4 (±0,2)	2,6 (±0,2)
Sodium silicate (SiO ₂ :Na ₂ O = 3,3:1)	3,0 (±0,2)	3,2 (±0,2)
Carboxymethylcellulose	1,2 (±0,1)	1,2 (±0,1)
Phosphonate (DEQUEST 2066, 25 % active acid)	2,8 (±0,2)	3,0 (±0,2)
Optical whitener for cotton (stilbene type)	0,2 (±0,02)	0,2 (±0,02)
Sodium sulfate	6,5 (±0,5)	6,9 (±0,5)
Protease (Savinase 8,0)	0,4 (±0,04)	0,4 (±0,04)
Sodium perborate tetrahydrate (active oxygen 10,00 % - 10,40 %) (as a separate addition)	20,0 (±0,1)	—
Sodium percarbonate (as separate addition)	—	15,0 (±0,1)
Tetra-acetyethylpiperazine (active content 90,0 % - 94,0 %) (as a separate addition)	3,0 (±0,1)	3,0 (±0,1)
Total	100,0	100,0

Annex J (normative)

Nominal percentage composition for non-phosphate reference detergent 3

J.1 General warning

This annex calls for the use of substances/procedures that can be injurious to the health/environment. It refers only to technical suitability. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

J.2 ECE reference detergent 98 without optical brightener

Formulas with perborate and with percarbonate are given in [Table J.1](#).

Table J.1 — Reference detergent 3 — ECE reference detergent 98 without optical brightener

Composition	Reference detergent 3	Reference detergent 3
	with perborate	with percarbonate
	%	%
Linear sodium alkylbenzene sulfonate (mean length of alkane chain C ₁₁₋₁₇)	7,5 (±0,5)	8,0 (±0,5)
Ethoxylated fatty alcohol C ₁₂₋₁₈ (7EO)	5,0 (±0,3)	4,3 (±0,3)
Sodium soap (chain length C ₁₂₋₁₇ 46 %; C ₁₈₋₂₀ 54 %)	2,5 (±0,2)	3,0 (±0,2)
Foam inhibitor (DC-42485)	5,0 (±0,3)	5,3 (±0,3)
Sodium aluminum silicate zeolite 4A	25,0 (±1,0)	26,6 (±1,1)
Sodium carbonate	9,1 (±1,0)	9,7 (±1,1)
Sodium salt of a copolymer from acrylic and maleic acid	4,0 (±0,2)	4,3 (±0,2)
Sodium silicate (SiO ₂ :Na ₂ O = 3,3:1)	2,6 (±0,2)	2,7 (±0,2)
Carboxymethylcellulose (CMC)	1,0 (±0,1)	1,1 (±0,1)
Diethylene-triamine penta (methylene phosphoric acid)	0,6 (±0,1)	0,6 (±0,1)
Sodium sulfate	6,0 (±0,5)	6,4 (±0,5)
Water	9,4 (±0,1)	10,0 (±0,1)
Sodium perborate tetrahydrate (as separate addition)	20,0 (±0,1)	—
Sodium percarbonate (as separate addition)	—	15,0 (±0,1)
Tetra-acetyletylenediamine (TAED) (100 % active) (as separate addition)	3,0 (±0,1)	3,0 (±0,1)
Total	100,0	100,0

Annex K (normative)

Nominal percentage composition for reference detergent 4

K.1 General warning

This annex calls for the use of substances/procedures that can be injurious to the health/environment. It refers only to technical suitability. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

K.2 JIS K 3371 (Category 1) reference detergent 4 for top-loading type C washers.

Detergent 4 formula is given in [Table K.1](#).

Table K.1 — Reference detergent 4 — JIS K 3371 reference detergent

Composition	Reference detergent 4 %
Linear sodium alkylbenzene sulfonate	15,0 (±1,0)
Zeolite	7,0 (±1,0)
Sodium silicate	5,0 (±0,5)
Sodium carbonate	7,0 (±0,5)
Carboxymethylcellulose (CMC)	1,0 (±0,5)
Sodium sulfate	55,0 (±5,0)
Optical brightener	+
Enzyme	+
Total	100,0

NOTE 1 This is an example of a suitable detergent. Other detergents can be used if it has been established that they give equivalent or better washing performance.

NOTE 2 Dosage 1,33 g/l.

Annex L (normative)

Nominal percentage composition for reference detergent 6

L.1 General warning

This annex calls for the use of substances/procedures that can be injurious to the health/environment. It refers only to technical suitability. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

L.2 Non-phosphate reference detergent 6

Detergent 6 Formula is given in [Table L.1](#).

Table L.1 — Reference detergent 6 - Non-phosphate reference detergent

Composition	Reference detergent 6 with perborate	Reference detergent 6 with percarbonate
	%	%
Linear sodium alkyl benzene sulfonate	7,5 (±0,5)	8,0 (±0,5)
Ethyloxylated fatty alcohol C ₁₂₋₁₈ (7EO)	4,0 (±0,3)	4,3(±0,3)
Sodium soap	2,8 (±0,2)	3,0(±0,2)
Foam-inhibitor concentrate (8 % silicon on organic carrier)	5,0 (±0,3)	5,3(±0,3)
Sodium aluminum silicate	25,0 (±1,0)	26,6(±1,1)
Sodium carbonate	9,1 (±1,0)	9,7(±1,1)
Sodium salt of a copolymer from acrylic and maleic acid	4,0 (±0,2)	4,3(±0,2)
Sodium silicate (SiO ₂ : Na ₂ O = 3,3:1)	2,6 (±0,2)	2,7(±0,2)
Carboxymethylcellulose	1,0 (±0,1)	1,1(±0,2)
Diethylene-triaminepenta	0,6	0,6
Sodium sulfate	5,8 (±0,5)	6,2(±0,5)
Optical whitener for cotton (stilbene type)	0,20(±0,02)	0,2 (±0,02)
Water	9,4 (±0,1)	10,0 (±0,1)
Sodium perborate tetrahydrate (as separate addition)	20,0 (±0,1)	—
Sodium percarbonate (as separate addition)	—	15,0 (±0,1)
Tetra-acetylenyl ethylamine (as separate addition)	3,0 (±0,1)	3,0 (±0,1)
Total	100,0	100,0

Annex M (normative)

Nominal percentage composition for reference detergent 7

M.1 General warning

This annex calls for the use of substances/procedures that can be injurious to the health/environment. It refers only to technical suitability. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

M.2 Reference detergent 7. IEC-W Liquid wool wash detergent

This detergent was developed for use in IEC 60456. Formula is given in [Table M.1](#).

Table M.1 — Reference detergent 7

Nominal composition	Specification	Tolerance ±
Linear sodium alkyl benzene sulfonate	10 %	1,0 %
Ethoxylated fatty alcohol C ₁₂₋₁₄ (7 EO)	5,0 %	0,5 %
Fatty acid (as anti foam)	1,0 %	0,5 %
Phosphonate	0,50 %	0,05 %
Popanediol	5,0	0,52 %
1,2-Benzisothiazoline-3-on (BIT, e.g. "Proxel")	100 mg/kg	10 mg/kg
Sodium hydroxide	Use composition to adjust to pH 3,5	—
Demineralized water	Balance	—

Annex N (normative)

Distribution and mixing of reference detergent 2, 3, or 6

N.1 General information

The reference detergent 2, 3 or 6 is distributed in three separate parts:

- 1) detergent base powder;
- 2) sodium-perborate tetrahydrate;
- 3) bleach activator tetra-acetylene diamine.

They shall be mixed prior to use according to the following procedure.

For consistency, it is desirable to dry mix the three separate parts in the proportions of:

- 77 parts detergent base powder
- 20 parts sodium perborate, and
- 3 parts bleach activator.

For the use of sodium percarbonate in place of sodium perborate, it is desirable to dry mix the 3 separate parts in the proportions of:

- 82 parts detergent base powder,
- 15 parts sodium percarbonate, and
- 3 parts bleach activator.

Weigh the quantity of detergent components to make up the detergent dose required for the test. The components shall be mixed together thoroughly prior to use. Mixed detergent shall be stored in a sealed container if it is not used immediately. The maximum storage time prior to use of reference detergent 2, 3 or 6 after mixing of detergent components shall be fourteen days. All detergent components shall be within their expiry date at the time of use.

N.2 Effect of enzymes (applicable to detergents 2 and 3 only)

If it is desirable to evaluate the effects of enzymes, the optional addition of the following enzymes to detergents 2 and 3 can be made with a corresponding reduction in the detergent powder.

Recommended additions are given in [Table N.1](#)

Table N.1 — Optional addition quantity of enzymes

Enzyme	Product	Addition %
Protease	Savinase 12T	0,5
Lipase	Lipolase 100T	0,1
Amylase	Termamyl 60T	0,3
Cellulase	Celluzyme 0,7T	0,3

Annex O (normative)

Determination of cycle drying time for tumble dryers with a timer device

0.1 Method of estimating cycle time

0.1.1 Use a load composed entirely of ballast, specific ballast type may vary depending upon user requirements, (see 5.6) and condition it in the standard atmosphere (see Clause 7, determine the conditioned mass of the load, in kilograms, to the nearest 0,05 kg.

For both normal temperature and low temperature, cycle time needs to be determined for each ballast type.

Estimated cycle time may vary depending in the type of ballast used.

0.1.2 Wash the load as specified in Clause 9. After spinning, weigh the load (initial mass).

0.1.3 Set the tumble dryer (5.2) to a time in excess of 80 min and let it run. After 30 min (or 45 min if preferred) stop the machine, remove the load and weigh. Calculate the amount of moisture evaporated and from this, the "drying rate", a , which is the amount of evaporated moisture divided by the drying time.

0.1.4 Re-wet the load by filling the machine to the same level as was used in 9.1 and then advance the programme to the last hydroextraction. At the end of the hydroextraction, weigh the load. From this mass and the drying rate, a , calculate the preliminary cycle time which is the moisture content divided by the drying rate.

0.1.5 Re-load the dryer and set to a time slightly in excess of the preliminary cycle time and let it run.

0.1.6 Immediately after the preliminary cycle time, stop the dryer, remove the load and weigh. Calculate the amount of evaporated moisture. From this and the preliminary cycle time, calculate the "drying rate", b , which is the moisture evaporated divided by the cycle time. The cycle time estimated in this way shall be within $\pm 2\%$ of the true time as calculated with the load weight, weighed on an accurate scale. If the weight of the load indicates that the drying time is not within $\pm 2\%$ redo applicable parts of this annex.

0.1.7 Perform test cycles at a time setting determined from the final estimated test cycle time according to Formula (0.1):

$$t_f = \frac{m}{b} \times 60 + t_c \quad (0.1)$$

where

- t_f is the final estimated test cycle time, in min;
- m is the initial mass-conditioned mass, in kg;
- b is the drying rate, in kg/min;
- t_c is the cool-down time, in min.

The following example illustrates the method of calculating the final estimated test cycle time:

The conditioned mass of the load	= 2,0 kg
The initial mass of the load (0.1.2)	= 3,75 kg
Moisture retained	= 1,75 kg
If after 30 min, moisture evaporated	= 0,9 kg (measured)
or if after 45 min, moisture evaporated	= 1,35 kg (measured)
Then, drying rate (a)	= 1,8 kg/h
and, therefore, preliminary cycle time	= $\frac{1,75}{1,8} = 0,97$ h (i.e. 58 min)
If, after 58 min, moisture evaporated	= 1,71 kg (measured)
Then, drying rate (b)	= $\frac{1,71}{0,97} = 1,77$ kg/h
i.e. in this case	$\frac{1,75 \times 60}{1,77} + 5 = 64$ min

As can be seen from the example above, using drying rate a for the final estimated test cycle times would lead to an under-estimate of 5 %, hence the need for the second run to compensate for the falling rate period. It is suggested that, if ambient temperature and relative humidity conditions are reasonably consistent, drying rate b need only be determined once, but if they are variable, the drying rate should be determined for the new conditions.

The cycle time estimated in this way shall be within ± 2 % of the true time as calculated with the load mass using an accurate scale. This level of precision is adequate given the arbitrary nature of the over-dry factors when drying different fibre types in the same load. If the weight of the load indicates that the drying time is not within ± 2 % redo applicable parts of this annex.

0.2 Creasing

For some textiles, tumble drying can be beneficial in removing creases formed by the washing process.

0.3 Repeat testing

The machine shall be cooled to ambient temperature between tests. This can be done by repeating the cool-down stage.

0.4 End point

For all textiles, this should be between 0 and -3 % of the conditioned mass as shown in [Formula \(0.2\)](#):

$$t_e = \left(\frac{m_d}{m_c} - 1 \right) \times 100 \quad (0.2)$$

where

t_e is the end point, %;

m_d is the mass of load after dry cycle time, in kg;

m_c is the conditioned mass, in kg.

Bibliography

- [1] ISO 3758, *Textiles — Care labelling code using symbols*
- [2] ISO 3759, *Textiles — Preparation, marking and measuring of fabric specimens and garments in tests for determination of dimensional change*
- [3] IEC 60456, *Clothes washing machines for household use — Methods for measuring the performance*
- [4] JIS K 3371, *Standard Reference Laundry Detergent*
- [5] AATCC M1 *AATCC Standard Reference Detergent and Laundry Detergents in General*
- [6] AATCC LP1 *Laboratory Procedure for Home Laundering: Machine Washing*

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