SRI LANKA STANDARD 1302 : 2013
ISO 6330 : 2012

DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING

(First Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard
DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING
(First Revision)

SLS 1302 : 2013
ISO 6330 : 2012

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SRI LANKA STANDARDS INSTITUTION
17, Victoria Place
Elvitigala Mawatha
Colombo - 08
SRI LANKA.

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

Sri Lanka Standard
DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING
(First Revision)

NATIONAL FOREWORD

This standard was approved by the Sectoral Committee on Textiles, Clothing and Leather and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2013-10-02.

This Sri Lanka Standard was first published in 2006 which was an adoption of ISO 6330 : 2000. The ISO 6330 has been revised in 2012. This Sri Lanka Standard is identical with ISO 6330:2012 Textiles - Domestic washing and drying procedures for textile testing.

TERMINOLOGY AND CONVERSIONS

The text of the International Standard has been accepted as suitable for publication, without deviation as a Sri Lanka Standard. However certain terminology and conversions are not identical with those used in Sri Lanka Standards. Attention is therefore drawn to the following :

a) Wherever the words “International Standard” appear referring to this standard they should be interpreted as “Sri Lanka Standard”.

b) The comma has been used throughout as a decimal marker. In Sri Lanka Standards it is the current practice to use the full point at the base as the decimal marker.

c) Wherever page numbers are quoted, they are ISO page numbers.

CROSS REFERENCES

International Standard	Corresponding Sri Lanka Standard
ISO 6059 Water quality – Determination of the sum of calcium and magnesium –EDTA titrimetric method	No equivalent Sri Lanka Standard.
ISO 139 Textiles – Standard atmospheres for conditioning and testing	SLS 16 Standard atmospheres for conditioning and testing of Textiles

SLS 1302 :2013

INTERNATIONAL STANDARD

ISO 6330

Third edition
2012-04-15

Textiles — Domestic washing and drying procedures for textile testing

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

Reference number
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 6330 was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 2, *Cleansing, finishing and water resistance tests*.

This third edition cancels and replaces the second edition (ISO 6330:2000), which has been technically revised. It also incorporates ISO 6330:2000/Amd.1:2008.

Introduction

This International Standard 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 International Standard 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 to be made 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.

INTERNATIONAL STANDARD **ISO 6330:2012(E)**

Textiles — Domestic washing and drying procedures for textile testing

1 Scope

1.1 This International Standard 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 International Standard also specifies the reference detergents and ballasts for the procedures.

1.2 Provision is made for

a) 13 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 International Standard also specifies six drying procedures:

A — Line dry

B — Drip line dry

C — Flat dry

D — Drip flat dry

E — Flat press

F — 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 drier) may affect test results for any test using this International Standard. Therefore, parties using this standard are strongly encouraged to agree on the parameters to be used.

2 Normative references

The following referenced documents are indispensable for the application 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 6059, *Water quality — Determination of the sum of calcium and magnesium — EDTA titrimetric method*

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

3 Terms and definitions

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

3.1
ambient conditions
temperature and relative humidity in the test environment not differing from the normal indoor condition or the normal outdoor condition in the region where the test is performed

3.2
ballast
textile load (cotton, cotton/polyester or polyester) to be added to the specimen under test in order to achieve the specified weight in the reference washing machines

3.3
controlled humidity device
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 and water supplying and ended by spinning as predetermined on the washing machine

3.8
spinning process
water-extracting process in the washing machine by which water is removed from the textiles by centrifugal action as a part of the washing procedure

3.9
still air
air not influenced by any natural wind or mechanical device giving it a forced flow

3.10
total air-dry mass
total weight of the specimen under test and the ballast in a conditioned state according to ISO 139

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 is given in Annex A.

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

The specification for reference washing machine Type B is given in Annex C.

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

The specification for reference washing machine Type C is given in Annex E.

5.2 Tumble dryers

5.2.1 Type A1 tumble dryer – Vented

The specification for Type A1 tumble dryer is given in Annex G.

5.2.2 Type A2 tumble dryer – Condenser

The specification for Type A2 tumble dryer is given in Annex G.

5.2.3 Type A3 tumble dryer – Large vented

The specification for Type A3 tumble dryer is given in Annex G.

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 10.1.1; for drip line drying, see 10.1.2.

5.5 Drying racks

Use screen drying racks of approximately 16 mesh stainless steel or plastic for flat drying (see 10.1.3) or drip flat drying (see 10.1.4).

5.6 Ballasts

5.6.1 Type I, 100 % Cotton ballast

The nominal composition of 100 % Cotton ballast is given in Annex H.

5.6.2 Type II, 50 % Cotton/50 % Polyester ballast

The nominal composition of 50 % Cotton/50 % Polyester ballast is given in Annex H.

5.6.3 Type III, 100 % Polyester ballast

The nominal composition of 100 % Polyester ballast is given in Annex H.

6 Reagents

6.1 Reference detergents

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 can only be used in machine Type B.

The nominal composition of reference detergent 1 is given in Annex I.

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 can be used in both machine Type A and Type B.

The nominal composition of reference detergent 2 is given in Annex J.

For distribution and mixing, see Annex O.

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 can be used in both machine Type A and Type B.

The nominal composition of reference detergent 3 is given in Annex K.

For distribution and mixing, see Annex O.

6.1.4 Reference detergent 4

Reference detergent 4 is a non-phosphate powder detergent with optical brightener and with enzymes. [Another designation is JIS K 3371 (Category 1).]. Reference detergent 4 can only be used in washing machine Type C.

The nominal composition of reference detergent 4 is given in Annex L.

6.1.5 Reference detergent 5

Reference detergent 5 is a non-phosphate liquid detergent and is available both with and without optical brightener (WOB). (Other designations are 2003 AATCC standard reference liquid detergent with optical brightener and 2003 AATCC standard reference liquid detergent without optical brightener.)

Reference detergent 5 can only be used in washing machine Type B.

The nominal composition of reference detergent 5 is given in Annex M.

6.1.6 Reference detergent 6

Reference detergent 6 is a non-phosphate powder detergent with optical brightener and without enzymes. (Another designation is SDC Reference Detergent Type 4. This was incorrectly designated as IEC reference detergent A in ISO 6330:2000.)

Reference detergent 6 can be used in machine Type A. The nominal composition of reference detergent 6 is given in Annex N.

For distribution and mixing, see Annex O.

6.2 Water

6.2.1 Water hardness

Water hardness shall be lower than 0,7 mmol/l expressed as calcium carbonate, when determined in accordance with ISO 6059.

NOTE A water hardness of lower than 2,7 mmol/l can be applicable with a consent among the interested parties in accordance with IEC 60456.

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 (20 ± 5) °C

In tropical countries, the water temperature (20 ± 5) °C should be regarded as a minimum temperature. When the measurement is carried out with a water temperature that differs from these limits, the supply temperature should be stated in the test report.

7 Conditioning and testing atmosphere

The atmospheres used for conditioning 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., test specimen plus appropriate ballast, see 5.6 and 10.2) shall be (2,0 ± 0,1) kg for all types of reference washing machines.

NOTE In the case of testing a whole garment, report the total load if it is more than 2,1 kg.

8.2 Number of specimens

The number of specimens to be subjected to the washing and drying procedures specified in this International Standard will be determined by the purpose for which the material is being tested.

8.3 Selection of ballast

For cellulosic products, the Cotton ballast, Type I shall be used (see 5.6.1). For synthetic products and products that are made of blends, either the Polyester/Cotton ballast, Type II or the Polyester ballast, Type III shall be used (see 5.6.2 and 5.6.3).

8.4 Ratio of load to ballast

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

NOTE 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 given in Annex B for a type A reference washing machine, from Annex D for a type B reference washing machine, or from Annex F for a type C reference washing machine.

9.2 Weigh the (individual) specimens or made-up articles or garments before washing if measurement of weight loss is required or if they are to be tumble dried.

9.3 Place the material to be washed in the washing machine (see 5.1.1 to 5.1.3) and add sufficient ballast (see 5.6) to make a total air-dry material load of the mass shown in 8.1 using the washing procedure selected. The specimen and the ballast shall be evenly mixed before it is loaded into the reference machine.

a) In Reference washing machines Type A, add (20 ± 1) g of the reference detergent 2, 3 or 6 directly into 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 add (100 ± 1) g of reference detergent 5, 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 ± 0,5) 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	—	(100 ± 1) g	—
6	(20 ± 1) g	—	—

9.4 After the washing procedure has been completed, remove the test 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 Open-air dry

At the end of the selected washing procedure, immediately remove the material and follow the selected drying procedures A to F. In the case of drip drying, the washing procedure shall be finished without spinning; this means taking out the material before final spinning.

10.1.1 Procedure A — Line dry

Remove the specimen from the washing machine and hang each hydro-extracted specimen unfolded with the fabric length in the vertical direction to avoid distortion. Suspend the test specimen 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.

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

10.1.2 Procedure B — Drip line dry

Follow the procedure in 10.1.1 without extracting the water.

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

10.1.3 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.

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

10.1.4 Procedure D — Drip flat dry

Follow the procedure in 10.1.3 without extracting the water.

10.1.5 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.

10.2 Tumble dry

10.2.1 Procedure F — Tumble dry

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 either 10.2.2, 10.2.3 or 10.2.4.

10.2.2 Timer setting for tumble dryer

To determine the optimum heat setting, tumble dry the load at the normal (high) heat setting for the calculated test cycle time as determined by the method described in Annex P. At the end of the calculated test cycle time, the final moisture shall be equivalent to the moisture content of the conditioned textile relative humidity.

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

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 fabrics and 60 °C for delicate fabrics. Operate the dryer until the load is dry, and continue tumbling for 5 min with the heat turned off. Remove the fabrics immediately.

10.2.3 Overdrying

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-textile relative humidity;

— −5 % for textile made of cellulosic materials compared with the conditioned-textile relative humidity.

In order to find out the influence of the overdrying on the dimensional measures, the dimensions 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 material immediately.

10.2.4 Humidity rate for tumble dryer

Tumble dry the load at the normal or low heat setting until the final moisture measured by the humidity device reaches the agreed moisture rate, according to Table 2.

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

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

Table 2 — Humidity rate for tumble dryer

Tumble dryer cycle	Materials	Humidity rate setting up of the tumble dryer %
1	Dry cotton	0 (± 3)
2	Synthetics and blends	2 (± 3)
3	Iron dry cotton	12 (± 3)

11 Test report

The test report for any test using ISO 6330 shall contain the following information:

a) a reference to this International Standard, i.e. ISO 6330:2012;

b) the type of machine and washing procedure used;

c) the drying procedure used and the type of machine, if applicable, if flat pressed, the temperature and pressure used;

d) the type of detergent used;

e) total air-dry mass of the specimens and ballast;

f) details of any deviation from the specified procedures;

g) the type of ballast used.

Annex A
(normative)

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

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	(53 ± 1) mm	(53 ± 5) mm
		Length	Extended the depth of the inner drum	Extended the depth of the inner drum
		Spacing	120°	120°
Outer drum	Diameter		(554 ± 1) mm	(575 ± 5) mm
Drum speed	Wash	With load and water	(52 ± 1) rpm	(52 ± 1) rpm
	Hydroextraction	Low spin	(500 ± 20) rpm	(500 ± 20) rpm
		High spin	(800 ± 20) rpm	(800 ± 20) rpm
Heating system	Heating power		5,4 kW ± 2 %	5,4 kW ± 2 %
	Thermostat		Controlled	Controlled
		Accuracy at switch-off temperature	±1 °C	±1 °C
		Switch-on temperature	≤ 4 °C below switch-off temperature	≤ 4 °C below switch-off temperature
Rotating action	Normal ON Normal OFF	Tolerance refers to timer intervals	(12 ± 0,1) s (3 ± 0,1) s	(12 ± 0,1) s (3 ± 0,1) s
	Mild ON Mild OFF	Tolerance refers to timer intervals	(8 ± 0,1) s (7 ± 0,1) s	(8 ± 0,1) s (7 ± 0,1) s
	Gentle ON Gentle OFF	Tolerance refers to timer intervals	(3 ± 0,1) s (12 ± 0,1) s	(3 ± 0,1) s (12 ± 0,1) s
Water system	Cold-water supply	Flow rate Temperature	(20 ± 2) l/min (20 ± 5) °C	(16 ± 2) l/min (20 ± 5) °C
	Level sensing	Step size	≤3 mm	≤3 mm
		Repeatability	± 5 mm (± 1 l)	± 5 mm (± 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.				

Annex B
(normative)

Specification for wash procedures for 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	Rinse time	Spin time	Liquor level	Rinse time	Spin time	Liquor level	Rinse time	Spin time
		a	bc	d	f	bc	dg	bc	dg	d	bc	dg	d	bc	eg	d
		°C	mm	min		mm	min	mm	min	min	mm	min	min	mm	min	min
9N[h]	Normal	92 ± 3	100	15	Yes[i]	130	3	130	3	—	130	2	—	130	2	5
7N[h]	Normal	70 ± 3	100	15	Yes[i]	130	3	130	3	—	130	2	—	130	2	5
6N[h]	Normal	60 ± 3	100	15	No	130	3	130	3	—	130	2	—	130	2	5
6M[h]	Mild	60 ± 3	100	15	No	130	3	130	2	—	130	2	2[j]	—	—	—
5N[h]	Normal	50 ± 3	100	15	No	130	3	130	3	—	130	2	—	130	2	5
5M[h]	Mild	50 ± 3	100	15	No	130	3	130	2	—	130	2	2[j]	—	—	—
4N	Normal	40 ± 3	100	15	No	130	3	130	3	—	130	2	—	130	2	5
4M	Mild	40 ± 3	100	15	No	130	3	130	2	—	130	2	2[j]	—	—	—
4G	Gentle[e]	40 ± 3	130	3	No	130	3	130	3	1	130	2	6	—	—	—
3N	Normal	30 ± 3	100	15	No	130	3	130	3	—	130	2	—	130	2	5
3M	Mild	30 ± 3	100	15	No	130	3	130	2	—	130	2	2[j]	—	—	—

Table B.1 *(continued)*

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	Rinse time	Spin time	Liquor level	Rinse time	Spin time	Liquor level	Rinse time	Spin time
		a	bc	d	f	bc	dg	bc	dg	d	bc	dg	d	bc	eg	d
		°C	mm	min		mm	min	mm	min	min	mm	min	min	mm	min	min
3G	Gentle[e]	30 ± 3	130	3	No	130	3	130	3	—	130	2	2[j]	—	—	—
4H	Gentle[e]	40 ± 3	130	1	No	130	2	130	2	2	—	—	—	—	—	—

NOTE 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.

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

G Gentle: 3 s drum movement and 12 s static.

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

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.

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 safe laboratory practice only.

j Short spin or drip dry.

Table B.2 — Volume measurement for Type A1 machines

Procedure	Water level mm	Volume 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 reference washing machine Type B — Vertical axis, top-loading agitator type

Table C.1 — Specification for reference washing machine Type B

Position items	Items	Details	Type B Top-loading vertical rotating agitator machine
Inner drum (Basket)	Depth		(370 ± 1) mm
	Width		
	Volume		90,6 l
	Agitator	Number	1
Outer drum (Tub)	Diameter	Top	(565 ± 1) mm
	Diameter	Bottom	(551 ± 1) mm
Drum speed	Hydroextraction (spin)	Low spin	(399 to 420) rpm
	Hydroextraction (spin)	High spin	(613 to 640) rpm
Heating system	Heating power		None
Rotating action	Stroke rate	Normal	(173 to 180) strokes/min
		Gentle	(114 to 120) strokes/min
Water system	Water supply		House tap
	Level sensing	High	(356 ± 13) mm
		Medium	(297 ± 25) mm
		Low	(237 ± 25) mm
		Ex. low	(178 ± 25) mm
	Drain system	Drain valve	(43 to 64) l/min
Other machines of equivalent characteristics may be employed after correlation tests with the machine described above.			

Annex D
(normative)

Specification for washing procedures for reference washing machine Type B

Table D.1 — Washing procedures for reference washing machine Type B

Procedure No.	Washing				Rinse		Spin	
	Agitation during heating, washing and rinsing	Total load (air-dry mass) kg	Temp. °C	Liquor level mm	Wash time min	Liquor level mm	Rinse time min	Spin speed rpm	Spin time min
1B	Normal	2 ± 0,1	60 ± 3	297 ± 25	12	297 ± 25	3	613 to 640	6
2B	Normal	2 ± 0,1	49 ± 3	297 ± 25	12	297 ± 25	3	613 to 640	6
3B	Normal	2 ± 0,1	49 ± 3	297 ± 25	10	297 ± 25	3	399 to 420	4
4B	Normal	2 ± 0,1	41 ± 3	297 ± 25	12	297 ± 25	3	613 to 640	6
5B	Normal	2 ± 0,1	41 ± 3	297 ± 25	10	297 ± 25	3	399 to 420	4
6B	Normal	2 ± 0,1	27 ± 3	297 ± 25	12	297 ± 25	3	613 to 640	6
7B	Normal	2 ± 0,1	27 ± 3	297 ± 25	10	297 ± 25	3	399 to 420	4
8B	Gentle	2 ± 0,1	27 ± 3	297 ± 25	8	297 ± 25	3	399 to 420	4
9B	Normal	2 ± 0,1	16 ± 3	297 ± 25	12	297 ± 25	3	613 to 640	6
10B	Normal	2 ± 0,1	16 ± 3	297 ± 25	10	297 ± 25	3	399 to 420	4
11B	Gentle	2 ± 0,1	16 ± 3	398,5 ± 17,8	8	297 ± 25	3	399 to 420	4

Annex E
(normative)

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

Table E.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		(490 ± 1) mm
Drum speed	Hydroextraction (spin)	High spin	(780 ± 30) to (830 ± 30) rpm
		Low spin	(500 ± 30) rpm
Rotating action	Pulsator speed	Normal	(120 ± 20) rpm
		Gentle	(90 ± 20) rpm
Water system	Water supply for rinsing		15 l/min (house tap)
	Level sensing [(water volume)/(inner drum water volume)]	54 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

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

[a] 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 F
(normative)

Specification for washing procedures for reference washing machine Type C

Table F.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
		[a]			[e]			[e]			[e]
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	2	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 G
(normative)

Specification for tumble dryers

Table G.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 to130 l	80 l to130 l	160 l to 200 l
	Diameter	550 mm to 590 mm	550 mm to 590 mm	650 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	80 mm to100 mm
	Spacing	Evenly distributed	Evenly distributed	Evenly distributed
Heating input		Max. 3,5 kW	Max. 3 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 Load factor 1:25 (100 % cotton)	5,3 kg to 8,7 kg 3,2 kg to 5,2 kg	5,3 kg to 8,7 kg 3,2 kg to 5,2 kg	10,6 kg to 13,3 kg 6,4 kg to 8 kg
	Load factor 1:30 Load factor 1:50 (Cotton/polyester)	2,7 kg to 4,4 kg 1,6 kg to 2,6 kg	2,7 kg to 4,4 kg 1,6 kg to 2,6 kg	5,3 kg to 6,7 kg 3,2 kg to 4 kg

Annex H
(normative)

Specifications for all ballast types used in washing

H.1 Composition of ballast

Table H.1 — Composition and specification of ballast

Items	Type I 100 % Cotton	Type II 50 % Polyester/ 50 % Cotton	Type III 100 % Polyester
Yarn	Ne 17/1	40/1 Tex	
Fabric construction	Plain woven fabric	Plain woven fabric	Knitted polyester textile
Thread count, warp[a]	(25,9 ± 2) per cm	(18,9 ± 2) per cm	texturized
Thread count, weft[a]	(22,7 ± 2) per cm	(18,9 ± 2) per cm	
Fabric mass[a]	(188 ± 10) g/m^2	(155 ± 10) g/m^2	(310 ± 20) g/m^2
Piece size	[92 × 92 (± 2)] cm	[92 × 92 (± 2)] cm	[20 × (20 ± 4)] cm
Piece mass	(320 ± 10) g	(260 ± 10) g	(50 ± 5) g
Shrinkage (warp and weft)	± 5 %	± 5 %	± 5 %
Finish	Desizing, boiling off, singeing, bleaching, no filling or stiffening finish, sanforizing		Washing, no filling or stiffening finish, (thermo-fixation)

[a] Grey fabric.

H.2 Sewing of ballast

Table H.2 — Sewing of ballast

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

Annex I
(normative)

Nominal percentage composition for non-phosphate powder reference detergent 1

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

Table I.1 — Reference detergent 1 without optical brightener

Composition	Reference detergent 1 %
Linear sodium alkylbenzene sulfonate, sodium salt[a]	18,79 (± 1,0)
Sodium aluminosilicate solids	27,91 (± 1,5)
Sodium carbonate	16,56 (± 0,8)
Sodium silicate solids[b]	0,58 (± 0,03)
Sodium sulfate	22,51 (± 1,2)
Polyethylene glycol[c]	2,14 (± 0,1)
Sodium polyacrylate	3,70 (± 0,2)
Silicone, suds suppressor	0,38 (± 0,02)
Moisture	7,22 (± 0,4)
Miscellaneous (unreacted in surfactant stocks)	0,07
Total	100,0

[a] C11.8 LAS, introduced as Stepan's Calsoft L-50-12.

[b] $SiO_2/Na_2O = 1,6$.

[c] 2 % introduced via base granulates and 0,76 % introduced via suds-suppressor admixture.

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

Table I.2 — Reference detergent 1 with optical brightener

Composition	Reference detergent 1 %
Linear sodium alkylbenzene sulfonate, sodium salt[a]	18,79 (± 1,0)
Sodium aluminosilicate solids	27,91 (± 1,5)
Sodium carbonate	16,56 (± 0,8)
Sodium silicate solids[b]	0,58 (± 0,03)
Sodium sulphate	22,51 (± 1,2)
Polyethylene glycol[c]	2,14 (± 0,1)
Sodium polyacrylate	3,70 (± 0,2)
Silicone, suds suppressor	0,38 (± 0,02)

[a] C11.8 LAS, introduced as Stepan's Calsoft L-50-12.

[b] $SiO_2/Na_2O = 1,6$.

[c] 2 % introduced via base granulates and 0,76 % introduced via suds-suppressor admixture.

Table I.2 *(continued)*

Composition	**Reference detergent 1** %
Moisture	7,22 (± 0,4)
Brightener	0,21 (± 0,01)
Total	100,0
[a] C11.8 LAS, introduced as Stepan's Calsoft L-50-12.	
[b] SiO_2/Na_2O = 1,6.	
[c] 2 % introduced via base granulates and 0,76 % introduced via suds-suppressor admixture.	

Annex J
(normative)

Nominal percentage composition for non-phosphate reference detergent 2

J.1 General warning

This annex calls for the use of substances/procedures that may be injurious to the health/environment. It refers only to technical suitability and does not absolve the user from legal obligations or professional regional recommendations relating to health and safety/environment at any stage.

J.2 IEC reference detergent A*

Table J.1 — Reference detergent 2 – IEC reference detergent A*

Composition	**Reference detergent 2** %
Linear sodium alkyl benzene sulfonate	8,8 (± 0,5)
Ethyloxylated fatty alcohol $C_{12/14}$ (7EO)	4,7 (± 0,3)
Sodium soap (tallow soap)	3,2 (± 0,2)
Foam-inhibitor concentrate (12 % silicon on inorganic carrier)	3,9 (± 0,3)
Sodium aluminium silicate zeolite 4A (80 % active substance)	28,3 (± 1,0)
Sodium carbonate	11,6 (± 1,0)
Sodium salt of a copolymer from acrylic and maleic acid (granulate)	2,4 (± 0,2)
Sodium silicate (SiO_2:Na_2O = 3,3:1)	3,0 (± 0,2)
Carboxymethylcellulose	1,2 (± 0,1)
Phosphonate (DEQUEST 2066, 25 % active acid)	2,8 (± 0,2)
Optical whitener for cotton (stilbene type)	0,2 (± 0,02)
Sodium sulfate	6,5 (± 0,5)
Protease (Savinase 8,0)	0,4 (± 0,04)
Sodium perborate tetrahydrate (active oxygen 10,00 – 10,40 %) (as a separate addition)	20,0
Tetra-acetylethylenediamine (active content 90,0 – 94,0 %) (as a separate addition)	3,0
Total	100,0

Annex K
(normative)

Nominal percentage composition for non-phosphate reference detergent 3

K.1 General warning

This annex calls for the use of substances/procedures that may be injurious to the health/environment. It refers only to technical suitability and does not absolve the user from legal obligations or professional regional recommendations relating to health and safety/environment at any stage.

K.2 ECE reference detergent 98 without optical brightener

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

Composition	**Reference detergent 3** %
Linear sodium alkylbenzene sulfonate (mean length of alkane chain C11-5)	7,5 (± 0,5)
Ethyloxylated fatty alcohol C_{12-18} (7EO)	4,0 (± 0,3)
Sodium soap (chain length C_{12-17} 46 %; C_{18-20} 54 %)	2,8 (± 0,2)
Foam inhibitor (DC-42485)	5,0 (± 0,3)
Sodium aluminium silicate zeolite 4A	25,0 (± 1,0)
Sodium carbonate	9,1 (± 1,0)
Sodium salt of a copolymer from acrylic and maleic acid	4,0 (± 0,2)
Sodium silicate (SiO_2:Na_2O = 3,3:1)	2,6 (± 0,2)
Carboxymethylcellulose (CMC)	1,0 (± 0,1)
Diethylene-triamine penta (methylene phosphoric acid)	0,6
Sodium sulfate	6,0 (± 0,5)
Water	9,4
Sodium perborate tetrahydrate (as separate addition)	20,0
Tetra-acetylethylenediamine (TAED) (100 % active) (as separate addition)	3,0
Total	100,0

Annex L
(normative)

Nominal percentage composition for reference detergent 4

L.1 General warning

This annex calls for the use of substances/procedures that may be injurious to the health/environment. It refers only to technical suitability and does not absolve the user from legal obligations or professional regional recommendations relating to health and safety/environment at any stage.

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

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

Composition	**Reference detergent 4** %
Linear sodium alkylbenzene sulfonate	15,0 (± 1,0)
Zeolite	17,0 (± 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 M
(normative)

Nominal percentage composition for non-phosphate liquid reference detergent 5

M.1 General warning

This annex calls for the use of substances/procedures that may be injurious to the health/environment. It refers only to technical suitability and does not absolve the user from legal obligations or professional regional recommendations relating to health and safety/environment at any stage.

M.2 2003 AATCC standard reference liquid detergent without optical brightener (WOB)

Table M.1 — Reference detergent 5 – 2003 AATCC standard reference liquid detergent without optical brightener

Nominal composition	**Reference detergent 5** %
Linear sodium alkylbenzene sulfonate, sodium salt	12,0 (± 0,6)
Nonionic	8,0 (± 0,8)
Citric acid (as sodium citrate)	1,2 (± 0,12)
Fatty acid (C24 sodium salt)	4,0 (± 0,6)
Caustic (NaOH)	2,7
Chelant (DTPA)	0,3 (± 0,05)
Stabilizers (Propanediol)	8,0 (± 1,2)
Preservative (Borax)	1,0 (± 0,1)
Water/Miscellaneous	balance
Total	100,0

M.3 2003 AATCC standard reference liquid detergent with optical brightener

Table M.2 — Reference detergent 5 – 2003 AATCC standard reference liquid detergent with brightener

Nominal composition	**Reference detergent** %
Linear sodium alkylbenzene sulfonate, sodium salt	12,0 (± 0,6)
Nonionic	8,0 (± 0,8)
Citric acid (as sodium citrate)	1,2 (± 0,12)
Fatty acid (C24 sodium salt)	4,0 (± 0,6)
Caustic (NaOH)	2,65
Chelant (DTPA)	0,3 (± 0,05)
Stabilizers (Propanediol/Neutralant)	8,13 (± 1,2)
NOTE 2003 AATCC standard reference liquid detergent can only be used in type B reference washing machines.	

Table M.2 *(continued)*

Nominal composition	**Reference detergent** %
Preservative (Borax)	1,0 (± 0,1)
Fluorescent whitening agent	0,04 (± 0,01)
Water/Miscellaneous	balance
Total	100,0
NOTE 2003 AATCC standard reference liquid detergent can only be used in type B reference washing machines.	

Annex N
(normative)

Nominal percentage composition for reference detergent 6

N.1 General warning

This annex calls for the use of substances/procedures that may be injurious to the health/environment. It refers only to technical suitability and does not absolve the user from legal obligations or professional regional recommendations relating to health and safety/environment at any stage.

N.2 Non-phosphate reference detergent 6

(SDC Reference Detergent Type 4. Incorrectly designated as IEC reference detergent A in ISO 6330:2000)

Table N.1 — Reference detergent 6 – Non-phosphate reference detergent

Composition	**Reference detergent 6** %
Linear sodium alkyl benzene sulfonate	7,5 (± 0,5)
Ethoxylated fatty alcohol C12-18 (7EO)	4,0 (± 0,3)
Sodium soap	2,8 (± 0,2)
Foam-inhibitor concentrate (8 % silicon on organic carrier)	5,0 (± 0,3)
Sodium aluminium silicate	25,0 (± 1,0)
Sodium carbonate	9,1 (± 1,0)
Sodium salt of a copolymer from acrylic and maleic acid	4,0 (± 0,2)
Sodium silicate (SiO_2: Na_2O = 3,3:1)	2,6 (± 0,2)
Carboxymethylcellulose	1,0 (± 0,1)
Diethylene-triaminepenta	0,6
Sodium sulfate	5,8 (± 0,5)
Optical whitener for cotton (stilbene type)	0,2 (± 0,02)
Water	9,4
Sodium perborate tetrahydrate (as separate addition)	20,0
Tetra-acetylethylenediamine (as separate addition)	3,0
Total	100,0

Annex O
(normative)

Distribution and mixing of reference detergent 2, 3 or 6

O.1 General warning

This annex calls for the use of substances/procedures that may be injurious to the health/environment. It refers only technical suitability and does not absolve the user from legal obligations or professional regional recommendations relating to health and safety/environment at any stage.

O.2 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-acetylethylene 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

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.

O.3 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.

Table O.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 P
(normative)

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

P.1 Method of estimating cycle time

P.1.1 Use a load composed entirely of 100 % ballast (see 5.6) and condition it in the standard atmosphere (see Clause 6). Determine the conditioned mass of the load, in kilograms, to the nearest 0,05 kg.

P.1.2 Wash the load as specified in Clause 8. After spinning, weigh the load (initial mass).

P.1.3 Set the tumble dryer (5.2) to a time in excess of 80 min and let it run. After 30 min (or 60 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.

P.1.4 Re-wet the load by filling the machine to the same level as was used in 8.1 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.

P.1.5 Re-load the dryer and set to a time safely in excess of the preliminary cycle time and let it run.

P.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.

P.1.7 Perform test cycles at a time setting determined from the final estimated test cycle time given by the following equation:

$$\text{Final estimated test cycle time} = \frac{(\text{Initial mass-conditioned mass})}{\text{Drying rate } (b)} \times 60 + \text{cool-down time}$$

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 (P.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

Final estimated test cycle time = $\frac{\text{Moisture retained}}{\text{Drying rate } (b)} \times 60 + 5$ min cool-down

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 will be within ±2 % of the true time as measured 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.

P.2 Creasing

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

P.3 Repeat testing

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

P.4 End point

For all textiles, this should be between 0 and −3 % of the conditioned mass:

$$\text{End point} = \left[\frac{\text{Mass of load after dry cycle time}}{\text{Conditioned mass}} - 1 \right] \times 100\ \%$$

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