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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”  
Mazdoor Kisan Shakti Sangathan  
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”  
Jawaharlal Nehru  
“Step Out From the Old to the New”

IS 15370 (2005): Textiles - Domestic Washing and Drying 
Procedures for Textiles Testing [TXD 5: Chemical Methods of Test]

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”  
Bhartrhari—Nitisatakam  
“Knowledge is such a treasure which cannot be stolen”
Indian Standard

TEXTILES — DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING

ICS 59.080.01

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 2005
NATIONAL FOREWORD

This Indian Standard which is identical with ISO 6330 : 2000 'Textiles — Domestic washing and drying procedures for textile testing' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendations of the Chemical Methods of Test Sectional Committee (TX 05) and approval of the Textile Division Council.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their places are listed below along with their degree of equivalence for the editions indicated. However, that International Standard cross-referred in this adopted ISO Standard, which has subsequently been revised, position in respect of that latest ISO Standard has been given:

<table>
<thead>
<tr>
<th>International Standard</th>
<th>Corresponding Indian Standard</th>
<th>Degree of Equivalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 3758 : 1991 Textiles — Care labelling code using symbols</td>
<td>IS 14452 : 1997 Textiles — Care labelling code using symbols</td>
<td>Equivalent</td>
</tr>
</tbody>
</table>

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'.

Indian Standard

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.

1.2 Provision is made for:

a) ten different washing procedures based on the use of a horizontal drum, front-loading type of machine (type A washer) or

b) eleven procedures based on the use of a top-loading agitator type of machine (type B washer).

The results obtained with the two types of machine may not be comparable.

1.3 Each washing procedure represents a single domestic wash.

1.4 This International Standard also specifies five drying procedures:

A — Line dry
B — Drip dry
C — Flat dry
D — Flat press
E — Tumble dry

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

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.


3 Principle

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

4.1 Reference detergents

4.1.1 AATCC 1993 reference detergent WOB (without optical brightener).

NOTE 1 AATCC 1993 reference detergent WOB can only be used in top-loading type B washers.

NOTE 2 The nominal composition of AATCC 1993 reference detergent WOB is given in annex A.

4.1.2 Non phosphate ECE reference detergent A (without optical brightener)

NOTE 1 Non phosphate ECE reference detergent A can be used in all machines.

NOTE 2 The nominal composition of non phosphate ECE reference detergent A is given in annex B.

4.1.3 Non phosphate IEC reference detergent A (with optical brightener). This can be used except when colour fastness is being assessed.

NOTE 1 Non phosphate IEC reference detergent A can be used in all machines.

NOTE 2 The nominal composition of non phosphate IEC reference detergent A is given in annex B.

4.2 Water of hardness not exceeding 0.002 % (20 ppm), expressed as calcium carbonate, when determined in accordance with ISO 6059:1984.

5 Apparatus

5.1 Automatic washing machines, capable of being operated under the following conditions.

5.1.1 Type A washer — Front loading, horizontal drum type

NOTE 1 Suitable machines are available commercially. Names of such machines may be obtained from national standards bodies. Other machines can be used if it has been established that they give equivalent results.

a) Front loading horizontal rotating drum type.

b) Diameter of inner drum: (51.5 ± 0.5) cm.

c) Depth of inner drum: (33.5 ± 0.5) cm.

d) Distance between inner and outer drums: (2.8 ± 0.1) cm.

e) Lifting vanes: three, each (5 ± 0.5) cm high, extending the depth of the inner drum and spaced 120° apart.

f) Rotating action:
   1) (Normal): (12 ± 0.1) s clockwise, (3 ± 0.1) s stop, (12 ± 0.1) s anticlockwise, (3 ± 0.1) s stop.
   2) (Gentle): (3 ± 0.1) s clockwise, (12 ± 0.1) s stop, (3 ± 0.1) s anticlockwise, (12 ± 0.1) s stop.

g) Rotational frequency:
   — during washing: 52 min⁻¹
   — during hydroextraction (spin): (500 ± 20) min⁻¹.

h) Water supply normal: (25 ± 5) l/min, (20 ± 5) °C.
NOTE 2 In tropical countries this figure should be regarded as a minimum temperature. When the measurement is carried out with the water temperature different from these limits, the supply water temperature should be stated in the measurement report.

i) Filling time: less than 2 min when filled to 13 cm.

j) Draining time: less than 1 min when drained from 13 cm.

k) Heating: electric, thermostatically controlled.

l) Heater capacity: 5.4 kW, with a relative tolerance of ±2%.

5.1.2 Type B washer — Top-loading, agitator type

NOTE 1 Suitable machines are available commercially. Names of such machines may be obtained from national standards bodies. Other machines can be used if it has been established that they give equivalent results.

NOTE 2 Conditions represent machines manufactured from 1992 onwards. For machines manufactured prior to 1992, contact the Secretariat of ISO/TC 38/SC 2 for information on machine specifications.

a) Machines consist of a drum with an inner perforated basket (50 ± 5) cm in diameter and (30 ± 5) cm in depth.

b) Examples of alternative washing conditions:

<table>
<thead>
<tr>
<th>Machine cycle</th>
<th>Washing temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Normal/Cotton sturdy</td>
<td>II (27 ± 3) °C</td>
</tr>
<tr>
<td>2) Delicate</td>
<td>III (41 ± 3) °C</td>
</tr>
<tr>
<td>3) Durable press</td>
<td>IV (49 ± 3) °C</td>
</tr>
<tr>
<td></td>
<td>V (60 ± 3) °C</td>
</tr>
<tr>
<td></td>
<td>VI (70 ± 3) °C</td>
</tr>
</tbody>
</table>

Examples of machine settings without load:

<table>
<thead>
<tr>
<th>Cycle</th>
<th>Normal</th>
<th>Delicate</th>
<th>Durable press</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water level</td>
<td>Agitation speed (2,983 ± 0,033) s⁻¹ [(179 ± 2) rpm]</td>
<td>(1,983 ± 0,033) s⁻¹ [(119 ± 2) rpm]</td>
<td>(2,983 ± 0,033) s⁻¹ [(179 ± 2) rpm]</td>
</tr>
<tr>
<td>Wash time</td>
<td>(12 ± 1) min</td>
<td>(8 ± 1) min</td>
<td>(10 ± 1) min</td>
</tr>
<tr>
<td>Spin speed</td>
<td>(10,75 ± 0,25) s⁻¹ [(645 ± 15) rpm]</td>
<td>(7,167 ± 0,25) s⁻¹ [(430 ± 15) rpm]</td>
<td>(7,167 ± 0,25) s⁻¹ [(430 ± 15) rpm]</td>
</tr>
<tr>
<td>Final spin time</td>
<td>(6 ± 1) min</td>
<td>(6 ± 1) min</td>
<td>(4 ± 1) min</td>
</tr>
</tbody>
</table>

5.2 Dryer of the rotary tumble type, complying with the following requirements:

NOTE Suitable machines are available commercially. Details may be obtained from the Secretariat of ISO/TC 38 or from the ISO Central Secretariat. Other machines can be used if it has been established that they give equivalent results.
5.2.1 For use with type A washers:

a) Controlled exhaust temperature: Maximum 80 °C (see 8.5)
b) Peripheral centrifugal acceleration: 0.6 g to 0.9 g
c) Drum volume: 80 l to 120 l
d) Drum reversal: Yes
e) Drum diameter: Minimum 55 cm
f) Lifting vanes shall be at least three in number, regularly spaced within the drum either as an integral part of the construction or as fitments. Each lifting vane shall measure between 4 cm and 9 cm at its base, tapering through a vertical height of 4 cm to 8 cm to a width of 1 cm to 2 cm.
g) Heating input: Maximum 3.5 kW
h) Cool-down period: Minimum 5 min

5.2.2 For use with type B washers:

a) Machines consist of a drum with a cylindrical basket (75 ± 5) cm in diameter and at least (40 ± 5) cm in depth.
b) Alternative tumble drying conditions:

<table>
<thead>
<tr>
<th>Designation</th>
<th>Exhaust temperature</th>
<th>Cool-down</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Normal/Cotton sturdy</td>
<td>(66 ± 5) °C</td>
<td>5 min</td>
</tr>
<tr>
<td>Permanent press</td>
<td>(66 ± 5) °C</td>
<td>10 min</td>
</tr>
<tr>
<td>b) Delicate</td>
<td>&lt; 60 °C</td>
<td>5 min</td>
</tr>
</tbody>
</table>

5.3 Ballast

5.3.1 For use with type A machines:

Ballast of 100 % knitted polyester texturized filament fabric having a mass per unit area of (310 ± 20) g/m². Ballast test pieces shall consist of four thicknesses of fabric, overlapped together on all four sides, and basted at the corners. The pieces shall be square and measure (20 ± 4) cm x (20 ± 4) cm. Each test piece shall weigh (50 ± 5) g.

Alternatively, either hemmed pieces of 100 % bleached cotton fabric sheeting or 50 % polyester/50 % cotton plain woven fabric, both having a mass per unit area of (155 ± 5) g/m² and dimensions (92 ± 5) cm x (92 ± 5) cm may be used.

5.3.2 For use with type B machines:

<table>
<thead>
<tr>
<th>Ballast characteristics</th>
<th>Type I 100 % cotton</th>
<th>Type III 50/50 + 3 % polyester/cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yarns (ring spun)</td>
<td>16/1</td>
<td>30/2</td>
</tr>
<tr>
<td>Fabric construction</td>
<td>21 x (19 ± 2) cm</td>
<td>19 x (19 ± 2) cm</td>
</tr>
<tr>
<td>Fabric mass</td>
<td>(155 ± 5) g</td>
<td>(155 ± 5) g</td>
</tr>
<tr>
<td>Piece size</td>
<td>92 x (92 ± 2) cm</td>
<td>92 x (92 ± 2) cm</td>
</tr>
<tr>
<td>Piece mass</td>
<td>(130 ± 10) g</td>
<td>(130 ± 10) g</td>
</tr>
</tbody>
</table>
5.4 Electrically (dry heated) heated flat-bed press. If this method of drying is used, the type of press shall be specified between the interested parties.

5.5 Facilities for line drying (see 8.1) or drip drying (see 8.2).

5.6 Screen drying racks of approximately 16 mesh stainless steel or plastic (see 8.3).

6 Test 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.

7 Washing procedure

7.1 Select the washing procedure to be used from those given in Table 1 for a front-loading type of machine or from Table 2 for a top-loading type of machine.

7.2 Weigh the (individual) specimens or made-up articles (8.2) or garments (8.5) before washing if they are to be tumble dried.

7.3 Place the material to be washed in the washing machine (see 5.1.1 or 5.1.2) and add sufficient ballast (see 5.3) to make a total air-dry material load of the mass shown for the washing procedure selected. If dimensional stability is being determined, not more than half of the wash load shall consist of test specimens. Add sufficient detergent (4.1.1 to 4.1.3, as appropriate) to provide a good running suds having a height of not more than \((3 \pm 0.5)\) cm at the end of the washing cycle.

Before placing the test load to be washed in type B washers, fill the machine with water at the selected temperature, add \((66 \pm 1)\) g 1993 AATCC Standard Reference Detergent or the appropriate amount of IEC or ECE detergent, to provide good running suds having a height of not more than \((3 \pm 0.5)\) cm at the end of the washing cycle.

7.4 After the hydroextraction of the washing procedure has been completed, remove the material, taking care that it is neither stretched nor distorted, and dry it by one of the drying procedures described in clause 8.

7.5 If the material is to be drip dried, stop the machine just before the final hydroextraction and remove the material, taking care that it is neither stretched nor distorted.

8 Drying procedure

8.1 Procedure A — Line dry
Suspend the hydroextracted material from a line to dry according to the procedure specified in 8.2.

8.2 Procedure B — Drip dry
Remove the material from the machine and, without extracting the water, suspend it from a line in still air at room temperature and allow to dry.

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

8.3 Procedure C — Flat dry
Spread out the material on a horizontal screen drying rack (see 5.6), remove the wrinkles by hand without stretching or distorting, and allow it to dry.
8.4 Procedure D — Flat press

Place the material on the flat bed of the press (see 5.4). Smooth out heavy wrinkles by hand and lower the head of the press, which shall be set at a temperature suitable for the material to be pressed, for one or more short periods as required to dry the material. Record the temperature and pressure used.

8.5 Procedure E — Tumble dry

NOTE This procedure is not intended to be used for evaluating articles containing temperature sensitive fibres. Research is on-going to establish the appropriate criteria for these fabrics.

At the end of the selected washing and hydroextraction process, immediately place the material and the ballast in the tumble dryer (see 5.2). Tumble dry the load as follows.

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.

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 C. At the end of the calculated test cycle time the final moisture shall be equivalent to the moisture content of the conditioned textile (0 % at 20 °C and 65 °C relative humidity).

If a weighing device is used, place the tumble dryer on the platform of the weighing device and determine the mass of the dryer. Place the weighed specimens or garments including ballast in the dryer and switch on the dryer. Continue drying until the mass does not change and then switch off the heat and allow to run without heat for at least 5 min. After this time, measure the mass of the relaxed specimens or garments.

Determine the dimensions of the materials and then proceed to further dry the load until the final moisture shall be either – 2 % for synthetics or – 5 % for cellulosics.

Dry to constant mass.

For machines specified in 5.2.2, ensure that the temperature of the exhaust from the drum is set at a temperature not exceeding 70 °C for normal fabrics and 50 °C for permanent press or delicate fabrics. Operate the dryer until the load is dry, and continue tumbling for 5 min with the heat turned off. Remove the material immediately.

9 Test report

The test report shall contain the following information:

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

b) the type of machine and washing procedure used;

c) the drying procedure used and the type of machine if applicable;

d) the type of detergent used;

e) total dry mass of the specimens and ballast;

f) details of any deviation from the specified procedures.

g) the ballast used.

NOTE Precision and bias for methods associated with this procedure are being established and will be described in the appropriate International Standards.
Table 1 — Washing procedures for horizontal rotating drum machine — Type A

<table>
<thead>
<tr>
<th>Procedure No.</th>
<th>Agitation during heating and rinsing</th>
<th>Total load (dry mass) a</th>
<th>Washing</th>
<th>Rinse 1</th>
<th>Rinse 2</th>
<th>Rinse 3</th>
<th>Rinse 4</th>
<th>Spin time</th>
<th>Liquor level</th>
<th>Liquor level</th>
<th>Liquor level</th>
<th>Liquor level</th>
<th>Liquor level</th>
<th>Liquor level</th>
<th>Liquor level</th>
<th>Liquor level</th>
<th>Liquor level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A h</td>
<td>Normal</td>
<td>2 ± 0,1 kg</td>
<td>92 ± 3 °C</td>
<td>10</td>
<td>15</td>
<td>Yes i</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>2</td>
<td>—</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2A h</td>
<td>Normal</td>
<td>2 ± 0,1 kg</td>
<td>60 ± 3 °C</td>
<td>10</td>
<td>15</td>
<td>No</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>2</td>
<td>—</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3A h</td>
<td>Normal</td>
<td>2 ± 0,1 kg</td>
<td>60 ± 3 °C</td>
<td>10</td>
<td>15</td>
<td>No</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>2</td>
<td>—</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4A h</td>
<td>Normal</td>
<td>2 ± 0,1 kg</td>
<td>50 ± 3 °C</td>
<td>10</td>
<td>15</td>
<td>No</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>2</td>
<td>—</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5A h</td>
<td>Normal</td>
<td>2 ± 0,1 kg</td>
<td>40 ± 3 °C</td>
<td>10</td>
<td>15</td>
<td>No</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>3</td>
<td>—</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6A h</td>
<td>Normal</td>
<td>2 ± 0,1 kg</td>
<td>40 ± 3 °C</td>
<td>10</td>
<td>15</td>
<td>No</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>2</td>
<td>—</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7A h</td>
<td>Gentle k</td>
<td>2 ± 0,1 kg</td>
<td>40 ± 3 °C</td>
<td>13</td>
<td>3</td>
<td>No</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>3</td>
<td>1</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8A h</td>
<td>Gentle k</td>
<td>2 ± 0,1 kg</td>
<td>30 ± 3 °C</td>
<td>13</td>
<td>3</td>
<td>No</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>3</td>
<td>—</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9A h</td>
<td>Gentle k</td>
<td>2 ± 0,1 kg</td>
<td>92 ± 3 °C</td>
<td>10</td>
<td>12</td>
<td>Yes i</td>
<td>13</td>
<td>3</td>
<td>13</td>
<td>2</td>
<td>—</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulated Hand wash</td>
<td>Gentle k</td>
<td>2 ± 0,1 kg</td>
<td>40 ± 3 °C</td>
<td>13</td>
<td>1</td>
<td>No</td>
<td>13</td>
<td>2</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a  For procedures 1A, 2A and 5A an alternative load of 5 kg and for procedure 7A an alternative load of 1 kg is recommended where articles are being tested for washing efficiency, possible abrasion sensitivity or similar effects.

b  All filling temperatures for wash and rinse are (20 ± 5) °C.

c  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.

d  The volumes of liquor corresponding to the quoted levels are determined by a separate test using a graduated measuring vessel.

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

f  Cool down: top up with cold water to 13 cm 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 before heating to wash temperature.

i  For safe laboratory practice only.

j  Short spin or drip dry.

k  No agitation during heating.

l  This programme is retained because it is part of ISO 3758.
Table 2 — Washing procedures for agitator-type machines — Type B

<table>
<thead>
<tr>
<th>Procedure No.</th>
<th>Agitation during washing and rinsing</th>
<th>Total load (dry mass)</th>
<th>Temperature</th>
<th>Washing</th>
<th>Washing cycle time</th>
<th>Rinsing Liquor level</th>
<th>Hydroextraction time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>70 ± 3</td>
<td>Full water level</td>
<td>12</td>
<td>Full water level</td>
<td>Normal cycle</td>
</tr>
<tr>
<td>2B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>60 ± 3</td>
<td>Full water level</td>
<td>12</td>
<td>Full water level</td>
<td>Normal cycle</td>
</tr>
<tr>
<td>3B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>60 ± 3</td>
<td>Full water level</td>
<td>10</td>
<td>Full water level</td>
<td>Gentle cycle</td>
</tr>
<tr>
<td>4B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>50 ± 3</td>
<td>Full water level</td>
<td>12</td>
<td>Full water level</td>
<td>Normal cycle</td>
</tr>
<tr>
<td>5B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>50 ± 3</td>
<td>Full water level</td>
<td>10</td>
<td>Full water level</td>
<td>Gentle cycle</td>
</tr>
<tr>
<td>6B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>40 ± 3</td>
<td>Full water level</td>
<td>12</td>
<td>Full water level</td>
<td>Normal cycle</td>
</tr>
<tr>
<td>7B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>40 ± 3</td>
<td>Full water level</td>
<td>10</td>
<td>Full water level</td>
<td>Gentle cycle</td>
</tr>
<tr>
<td>8B</td>
<td>Gentle setting</td>
<td>2 ± 0,1</td>
<td>40 ± 3</td>
<td>Full water level</td>
<td>8</td>
<td>Full water level</td>
<td>Gentle cycle</td>
</tr>
<tr>
<td>9B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>30 ± 3</td>
<td>Full water level</td>
<td>12</td>
<td>Full water level</td>
<td>Normal cycle</td>
</tr>
<tr>
<td>10B</td>
<td>Normal setting</td>
<td>2 ± 0,1</td>
<td>30 ± 3</td>
<td>Full water level</td>
<td>10</td>
<td>Full water level</td>
<td>Gentle cycle</td>
</tr>
<tr>
<td>11B</td>
<td>Gentle setting</td>
<td>2 ± 0,1</td>
<td>30 ± 3</td>
<td>Full water level</td>
<td>8</td>
<td>Full water level</td>
<td>Gentle cycle</td>
</tr>
</tbody>
</table>

*a Use cold setting for rinse cycle.*
Annex A
(normative)

AATCC 1993 reference detergent WOB
(zero-phosphate formula without brightener)

<table>
<thead>
<tr>
<th>Nominal composition</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear alkylbenzenesulfonate, sodium salt (^a)</td>
<td>18,00</td>
</tr>
<tr>
<td>Sodium aluminosilicate solids</td>
<td>25,00</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>18,00</td>
</tr>
<tr>
<td>Sodium silicate solids (^b)</td>
<td>0,50</td>
</tr>
<tr>
<td>Sodium sulphate</td>
<td>22,13</td>
</tr>
<tr>
<td>Polyethylene glycol (^c)</td>
<td>2,76</td>
</tr>
<tr>
<td>Sodium polyacrylate</td>
<td>3,50</td>
</tr>
<tr>
<td>Silicone, suds suppressor</td>
<td>0,04</td>
</tr>
<tr>
<td>Moisture</td>
<td>10,00</td>
</tr>
<tr>
<td>Miscellaneous (unreacteds in surfactant stocks)</td>
<td>0,07</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100,00</strong></td>
</tr>
</tbody>
</table>

\(^a\) C11.8LAS, introduced as Stepan's Calsoft L-50-12.

\(^b\) SiO\(_2\) / Na\(_2\)O = 1.6.

\(^c\) 2 % introduced via base granules and 0.76 % introduced via suds suppressor admixture.
Annex B
(normative)

Non phosphate ECE and IEC reference detergents

B.1 Nominal percentage composition

<table>
<thead>
<tr>
<th>Composition</th>
<th>ECE detergent</th>
<th>IEC detergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear sodium alkylbenzene sulfonate (mean length of alkane chain C_{11-15})</td>
<td>7.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Ethoxylated fatty alcohol C_{12-18} (7 EO)</td>
<td>4.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Sodium soap (chain length C_{12-17}: 46%; C_{18-20}: 54%)</td>
<td>2.8%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Foam inhibitor concentrate 8% on inorganic carrier</td>
<td>5.0%</td>
<td>5.0%</td>
</tr>
<tr>
<td>Sodium aluminium silicate (zeolite 4 A)</td>
<td>25.0%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>9.1%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Sodium salt of a copolymer from acrylic and maleic acid</td>
<td>4.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Sodium silicate (SiO_{2} : Na_{2}O = 3:1)</td>
<td>2.6%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Carboxymethylcellulose</td>
<td>1.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Diethylene-triaminepentant (methylene phosphonic acid)</td>
<td>0.6%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Optical whitener for cotton (stibene type)</td>
<td>—</td>
<td>0.2%</td>
</tr>
<tr>
<td>Sodium sulfate (as accompanying substance or added)</td>
<td>6.0%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Water</td>
<td>9.4%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Sodium perborate tetrahydrate</td>
<td>20.0%</td>
<td>20.0%</td>
</tr>
<tr>
<td>Tetraacetylethlenediamine</td>
<td>3.0%</td>
<td>3.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

B.2 Distribution and mixing

These detergents are distributed in three separate parts:

1) detergent base powder;
2) sodium perborate tetrahydrate;
3) bleach activator tetraacetylethlenediamine.

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

For consistency reasons it is desirable to pre-dissolve the three separate parts in the proportions of 77 parts detergent base powder : 20 parts sodium perborate : 3 parts bleach activator. Dissolve the base powder and sodium perborate in tap water at approximately 40 °C. Cool this solution to 30 °C and add the bleach activator before adding the final solution to the machine (see 7.3).
If it is desirable to evaluate the effect of enzymes, the optional addition of the following enzymes can be made with a corresponding reduction in the detergent base powder.

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Name</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protease</td>
<td>Savinase 12T</td>
<td>0.5 %</td>
</tr>
<tr>
<td>Lipase</td>
<td>Lipolase 100T</td>
<td>0.1 %</td>
</tr>
<tr>
<td>Amylase</td>
<td>Termamyl 60T</td>
<td>0.3 %</td>
</tr>
<tr>
<td>Cellulase</td>
<td>Celluzyme 0.7T</td>
<td>0.3 %</td>
</tr>
</tbody>
</table>

All these enzymes are available from Novo Nordisk Bioindustrials¹).

¹) These enzymes are examples of suitable products available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of these products.
Annex C
(normative)

Tumble drying — Determination of drying capacity

C.1 Method of estimating cycle time

C.1.1 Use a load composed entirely of 100 % ballast (see 5.3) and determine the conditioned mass of the load.

C.1.2 Wash the load as specified in clause 7. After spinning, weigh the load (initial mass).

C.1.3 Set the 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.

C.1.4 Re-wet the load by filling the machine to the same level as was used in 7.1 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.

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

C.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.

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

\[
\text{Final estimated test cycle time} = \frac{(\text{initial mass} - \text{conditioned mass})}{\text{Drying rate (}a\text{)}} \times 60 + \text{cool-down time}
\]

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

The conditioned mass of the load = 4,0 kg
The initial mass of the load (C.1.2) = 7,5 kg
Moisture retained = 3,5 kg
If after 30 min, moisture evaporated = 1,3 kg (measured)
or if after 60 min, moisture evaporated = 2,6 kg (measured)
Then, drying rate \( a \) = 2,6 kg/h
and, therefore, preliminary cycle time = \( \frac{3,5}{2,6} = 1,35 \text{ h (i.e. 81 min)} \)
If, after 81 min, moisture evaporated = 3,34 kg (measured)
Then, drying rate \( b \) = \( \frac{3,34}{1,35} = 2,47 \text{ kg/h} \)
Final estimated test cycle time = \( \frac{\text{Moisture retained}}{\text{Drying rate (}b\text{)}} \times 60 + 5 \text{ min cool-down} \)

i.e., in this case
\[
\frac{(3,5 \times 60)}{2,47} + 5 = 90 \text{ min}
\]
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.

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.

C.2 Creasing

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

C.3 Repeat testing

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

C.4 End point

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

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