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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Textiles — Domestic washing and drying procedures for textile testing

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **ISO 6330** published in 2012 with some modifications of the technical contents to correspond to the actual situation of domestic washing in Japan.

The portions given dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JB. The matters contained in Annex JA are unique contents of **JIS** that are not given in the corresponding International Standard.

This Standard is utilized for quality and performance evaluations of a broad range of textile (textile fabrics, garments, etc) including but not exclusive to : appearance change, dimensional change, soil resistance, water repellency, colour fastness to domestic washing and drying (except for bleaching and ironing), and care labelling that are prescribed in other international and Japanese test method standards.

This Standard is also used to evaluate not only the attributes (performance, property) 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 country or international region in which the textile will be used by consumers.

NOTE : Suitable washing machines, detergents and ballast specified in this Standard are available commercially.

1 Scope

1.1 This 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 of this Standard

Provision is made for as follows.

a) 13 different washing procedures based on the use of the reference washing machine Type A.

b) 11 procedures based on the use of the reference washing machine Type B.

c) 7 procedures based on the use of the reference washing machine Type C.

1.3 Washing procedure

Each washing procedure represents a single domestic wash.

1.4 Drying procedure

This Standard 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 Provision of test

A complete test consists of a washing and drying procedure.

NOTES 1 Use of different parameters (washing machine type, detergent type and type of tumble drier) may affect test results for any test using this Standard. Therefore, parties using this Standard are strongly encouraged to agree on the parameters to be used.

2 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 6330 : 2012 *Textiles — Domestic washing and drying procedures for textile testing* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) listed below shall be applied.

JIS K 0101 *Testing methods for industrial water*

JIS K 3362 *Test method of household synthetic detergent*

JIS K 3371 *Synthetic detergents for home laundering*

JIS L 0105 *General principles of physical testing methods for textiles*

NOTE : Corresponding International Standard : ISO 139 *Textiles — Standard atmospheres for conditioning and testing* (MOD)

JIS L 0208 *Glossary of terms used in textile industry — Testing*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS L 0105**, JIS

L 0208 and following 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 over-drying

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 **JIS L 0105**

4 Principle

A specimen is washed and dried according to the procedures specified in clauses **9** and **10**.

5 Apparatus and materials

5.1 Automatic washing machines

5.1.1 Reference washing machine Type A — Horizontal axis, front-loading type (drum 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 type (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 type (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 (procedure A), see **10.1.1**; for drip line drying (procedure B), see **10.1.2**.

5.5 Drying racks

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

NOTE : For the mesh, it should be 16 mesh and 1.0 to 1.2 in aperture sizes as reference value.

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 Detergents and water

6.1 Reference detergents

NOTE : Terms used in Annex I to Annex N : "Brightener" for reference detergent 1, "Optical whitener" for reference detergents 2 and 6, "Optical brightener" for reference detergent 4, and "Fluorescent whitening agent" for reference detergent 5, mean fluorescent brightening agent.

6.1.1 Reference detergent 1

Reference detergent 1 shall be as follows.

a) 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.]

b) Reference detergent 1 can only be used in machine Type B.

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

6.1.2 Reference detergent 2

Reference detergent 2 shall be as follows.

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

b) Reference detergent 2 can be used in both machine Type A and Type B.

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

d) For distribution and mixing, see Annex O.

6.1.3 Reference detergent 3

Reference detergent 3 shall be as follows.

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

b) Reference detergent 3 can be used in both machine Type A and Type B.

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

d) For distribution and mixing, see Annex O.

6.1.4 Reference detergent 4

Reference detergent 4 shall be as follows.

a) Reference detergent 4 is a non-phosphate powder detergent with optical brightener and with enzymes. [Another designation is **JIS K 3371** (Category 1).].

b) Reference detergent 4 can only be used in washing machine Type C.

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

6.1.5 Reference detergent 5

Reference detergent 5 shall be as follows.

a) 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.)

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

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

6.1.6 Reference detergent 6

Reference detergent 6 shall be as follows.

a) Reference detergent 6 is a non-phosphate powder detergent with optical brightener and without enzymes. (Another designation is **SDC** Reference detergent Type 4.)

b) Reference detergent 6 can be used in machine Type A.

c) The nominal composition of reference detergent 6 is given in Annex N.

d) For distribution and mixing, see Annex O.

6.2 Water

6.2.1 Water hardness

Water hardness shall be not more than 300 mg/L [1)] expressed as calcium carbonate, when determined in accordance with **15.1.1** of **JIS K 0101**.

NOTES 1 A water hardness is specified to be lower than 0.7 mmol/L (70 mg/L) expressed as calcium carbonate, when determined in accordance with **ISO 6059**, in the corresponding International Standard (**ISO 6330**).

2 A water hardness of lower than 2.7 mmol/L (270 mg/L) can be applicable with a consent among the interested parties in accordance with **IEC 60456**, in the corresponding International Standard (**ISO 6330**).

3 Hardness means the total amount of calcium ion and magnesium ion in water converted to the amount of calcium carbonate ($CaCO_3$) (mg/L) contained per litre.

Note [1)] It is in accordance with the Ministerial Ordinance of the Drinking Water Quality Standards based on the Water Works Act of the Ministry of Health, Labor and Welfare.

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 cold-water inlet temperature is as follows.

a) The water temperature at the inlet to the reference washing machine type A shall be (20 ± 5) °C.

b) The water at the inlet to the reference washing machine Type C shall be preheated to the specified temperature in Annex F at the beginning of washing.

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 **JIS L 0105**. When textile specimens are simply conditioned, they are left in a room under the standard condition for 4 h or longer.

8 Wash load

8.1 Total wash load

The total air-dry load mass shall be (2 000 ± 100) g for all types of reference washing machines. 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 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.

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 reference washing machine Type A, from Annex D for a reference washing machine Type B, or from Annex F for a reference washing machine Type C.

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.

9.4 Dosage of the detergents shall be as follows.

a) In reference washing machines Type A, add 20 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 g	Type B g	Type C g/L
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	—	—

9.5 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 D. In the case of drip drying (procedures B and D), 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 unfold to avoid distortion. Suspend the test specimen from a line. For woven specimen, the warp direction shall be vertical. For knitted specimen, the wale direction shall be vertical. Made-up articles

shall be suspended in the direction of use. Allow the specimen to dry in still air at room temperature.

NOTE : For subsequent testing, the drying should be carried out in a standard atmosphere according to **JIS L 0105**.

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 should be carried out in a standard atmosphere according to **JIS L 0105**.

10.1.3 Procedure C — Flat dry

Spread out the specimen on a horizontal screen drying rack (see **5.5**) and remove the wrinkles by hand without stretching or distorting. Allow the specimen to dry in still air at room temperature.

NOTE : For subsequent testing, the drying should be carried out in a standard atmosphere according to **JIS L 0105**.

10.1.4 Procedure D — Drip flat dry

Follow the procedure in **10.1.3** without extracting the water.

10.2 Tumble dry

10.2.1 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.

10.2.2 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 any of **10.2.2.1**, **10.2.2.2** or **10.2.2.3**.

10.2.2.1 Timer setting for tumble dryer

To determine the optimum heat setting, tumble dry the load at the normal 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.

10.2.2.2 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.

10.2.2.3 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 shall contain the following information :

a) number and title of this Standard;

b) name of the testing laboratory and number of the test report;

c) date of the test;

d) test method;

e) test condition;

1) type of washing machine and dryers used;

2) type of detergent used;

3) type of ballast used;

4) drying procedure used (if flat pressed, the temperature and pressure used, if tumble drying, the temperature used and total air-dry mass);

5) any necessary issues (details of any deviation from the specified procedures);

f) test result.

Annex A (normative)

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

Specification for reference washing machine Type A shall be as given in Table A.1.

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	Tolerance refers to timer intervals	Normal agitation	ON (12 ± 0.1) s OFF (3 ± 0.1) s	ON (12 ± 0.1) s OFF (3 ± 0.1) s
		Mild agitation	ON (8 ± 0.1) s OFF (7 ± 0.1) s	ON (8 ± 0.1) s OFF (7 ± 0.1) s
		Gentle	ON (3 ± 0.1) s OFF (12 ± 0.1) s	ON (3 ± 0.1) s OFF (12 ± 0.1) s
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 (± 1 L)	± 5 mm (± 1 L)
	Drain system	Drain valve	>30 L/min	>30 L/min
NOTE : 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 (drum type)

B.1 Specification for wash procedures for reference washing machine Type A shall be as given in Table B.1.

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. [a]	Liquor level [b], [c]	Wash time [d]	Cool down [f]	Liquor level [b], [c]	Rinse time [d], [g]	Liquor level [b], [c]	Rinse time [d], [g]	Spin time [d]	Liquor level [b], [c]	Rinse time [d], [g]	Spin time [d]	Liquor level [b], [c]	Rinse time [e], [g]	Spin time [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]	—	—	—
3G	Gentle [e]	30 ± 3	130	3	No	130	3	130	3	—	130	2	2	—	—	—
4H	Gentle [e]	40 ± 3	130	1	No	130	2	130	2	2	—	—	—	—	—	—

Table B.1 (concluded)

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.

NOTE 2 : Meanings of procedure No. and condition of agitation are as follows.

- 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.

Notes [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.

B.2 Volume measurement for Type A1 machines shall be as given in Table B.2.

Table B.2 Volume measurement for Type A1 machines

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

Annex C (normative)

Specification for reference washing machine Type B — Vertical axis, top-loading type (agitator type)

Specification for reference washing machine Type B shall be as given in Table C.1.

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
NOTE : 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 (agitator type)

Specification for washing procedures for reference washing machine Type B shall be as given in Table D.1.

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 type (pulsator type)

Specification of reference washing machine Type C shall be as given in Table E.1.

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	1
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		—	approx. 15 L/min (house tap)
	Liquor level	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. Examples of test methods for correlation tests are given in Annex JA.				
Note [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 (pulsator type)

Washing procedure for reference washing machine Type C shall be as given in Table F.1.

Table F.1 Washing procedure for reference washing machine Type C

Procedure No.	Agitation during washing and rinsing	Washing				Rinsing 1 [c]			Rinsing 2 [c]		
		Temperature [a] °C	Liquor level [b] L	Time min	Spin time [f] min	Liquor level [b] L	Time min	Spin time [f] min	Liquor level [b] L	Time min	Spin time [f] min
C4N	Normal [d]	40 ± 3	40	15	3	40	2	3	40	2	7
C4M	Normal [d]	40 ± 3	40	6	3	40	2	3	40	2	3
C4G	Normal [d]	40 ± 3	40	3	3	40	2	3	40	2	≤ 1
C3N	Normal [d]	30 ± 3	40	15	3	40	2	3	40	2	7
C3M	Normal [d]	30 ± 3	40	6	3	40	2	3	40	2	3
C3G	Normal [d]	30 ± 3	40	3	3	40	2	3	40	2	≤ 1
C4H	Gentle [e]	40 ± 3	54	6	2	54	2	2	54	2	≤ 1

Notes
[a] The water for washing is preheated to the designated temperature and supplied to the machine.
[b] Liquor level of washing machine. For water volume by level sensing, see Table E.1. The water used for rinsing is supplied from a house tap.
[c] The water used for rinsing is cold and is supplied from a house tap.
[d] 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.
[e] Gentle agitation is 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.
[f] Spin for C4H corresponds to low spin of the drum speed of hydroextraction, and spin for the others is high spin.
NOTE : C4H indicates the simulated hand-wash procedure.

Annex G (normative)
Specification for tumble dryers

Specification of tumble dryers shall be as given in Table G.1.

Table G.1 Specification of 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 to 100 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

Composition and specification of ballast shall be as given in Table H.1.

Table H.1 Composition and specification of ballast

Items		Type I	Type II	Type III
Composition		100 % Cotton	50 % Polyester/ 50 % Cotton	100 % Polyester
Yarn		Ne 17/1	40/1 Tex	—
Fabric construction		Plain woven fabric	Plain woven fabric	Knitted polyester textile texturized
Thread count	Warp [a)] Weft [a)]	(25.9 ± 2) per cm (22.7 ± 2) per cm	(18.9 ± 2) per cm (18.9 ± 2) per cm	—
Fabric mass [a]		(188 ± 10) g/m²	(155 ± 10) g/m²	(310 ± 20) g/m²
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 %	Warp and weft ± 5 %	Wale and course ± 5 %
Finish		Desizing, boiling off, singeing, bleaching, no filling or stiffening finish, sanforizing	—	Washing, no filling or stiffening finish, (thermo-fixation)
Note [a)] Grey fabric				

H.2 Sewing of ballast

Sewing of ballast shall be as given in Table H.2.

Table H.2 Sewing of ballast

Items	Type I	Type II	Type III
Composition	100 % Cotton	50 % Polyester/ 50 % Cotton	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)
Composition of reference detergent 1

I.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.

I.2 Standard reference detergent 1 [Other designation : 1993 AATCC (WOB)]

Reference detergent 1 [Other designation : 1993 **AATCC (WOB)**] is a non-phosphate powder detergent without enzymes and without optical brightener, its composition shall be as given in Table I.1. This detergent can only be used in machine Type B.

Table I.1 Reference detergent 1 : Composition for non-phosphate powder detergent without enzymes and without optical brightener (WOB)

Composition	Reference detergent 1 %
Linear sodium alkylbenzene sulfonate	18.79 (± 1.0)
Sodium aluminosilicate solids	27.91 (± 1.5)
Sodium carbonate	16.56 (± 0.8)
Sodium silicate solids	0.58 (± 0.03)
Sodium sulfate	22.51 (± 1.2)
Polyethylene glycol	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

I.3 Standard reference detergent 1 (Other designation : 1993 AATCC)

Reference detergent 1 (Other designation : 1993 **AATCC**) is a non-phosphate powder detergent without enzymes and with optical brightener, its composition shall be as given in Table I.2. This detergent can only be used in machine Type B.

Table I.2 Reference detergent 1: Composition for non-phosphate powder detergent without enzymes and with optical brightener

Composition	Reference detergent 1 %
Linear sodium alkylbenzene sulfonate	18.79 (± 1.0)
Sodium aluminosilicate solids	27.91 (± 1.5)
Sodium carbonate	16.56 (± 0.8)
Sodium silicate solids	0.58 (± 0.03)
Sodium sulphate	22.51 (± 1.2)
Polyethylene glycol	2.14 (± 0.1)
Sodium polyacrylate	3.70 (± 0.2)
Silicone, suds suppressor	0.38 (± 0.02)
Moisture	7.22 (± 0.4)
Brightener	0.21 (± 0.01)
Total	100.0

Annex J (normative)
Composition of 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 Standard reference detergent 2 [Other designation : IEC reference detergent A*]

Reference detergent 2 [Other designation : **IEC** reference detergent A*] is a non-phosphate powder detergent with optical brightener and with enzymes, its composition shall be as given in Table J.1. This detergent can be used in both machine Type A and Type B.

Table J.1 Reference detergent 2 : Composition for non-phosphate powder detergent with optical brightener and with enzymes

Composition	Reference detergent 2 %
Linear sodium alkylbenzene 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)
Composition of 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 Standard reference detergent 3 (Other designation : ECE reference detergent 98)

Reference detergent 3 (Other designation : **ECE** reference detergent 98) is a non-phosphate powder detergent without optical brightener and without enzymes, its composition shall be as given in Table K.1. This detergent can be used in both machine Type A and Type B.

Table K.1 Reference detergent 3 : Composition for non-phosphate powder detergent without optical brightener and without enzymes

Composition	Reference detergent 3 %
Linear sodium alkylbenzene sulfonate (mean length of alkane chain C_{11-5})	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)
Composition of 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 Standard reference detergent 4 (Other designation : JIS K 3371·Category 1)

Reference detergent 4 (Other designation : **JIS K 3371**·Category 1) is a non-phosphate powder detergent with optical brightener and with enzymes, its composition shall be as given in Table L.1. This detergent can only be used in machine Type C.

Table L.1 Reference detergent 4 : Composition for non-phosphate powder detergent with optical brightener and with enzymes

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
NOTES 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. Dosage of the detergents is in accordance with the direction of the detergent. Regents and test materials are in accordance with **JIS K 3362**. 2 Dosage 1.33 g/L, for reference detergent 4.	

Annex M (normative)
Composition of 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 Standard reference detergent 5 [Other designation : 2003 AATCC (WOB)]

Reference detergent 5 [Other designation : **2003 AATCC (WOB)**] is a non-phosphate liquid detergent without optical brightener, its composition shall be as given in Table M.1. This detergent can only be used in machine Type B.

Table M.1 Reference detergent 5 : Composition for non-phosphate liquid detergent without optical brightener (WOB)

Nominal composition	Reference detergent 5 %
Linear sodium alkylbenzene sulfonate	12.0 (± 0.6)
Nonionic	8.0 (± 0.8)
Citric acid (as sodium citrate)	1.2 (± 0.12)
Fatty acid (C_{24} 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 Standard reference detergent 5 (Other designation : 2003 AATCC)

Reference detergent 5 (Other designation : **2003 AATCC**) is a non-phosphate liquid detergent with optical brightener, its composition shall be as given in Table M.2. This detergent can only be used in machine Type B.

Table M.2 Reference detergent 5 : Composition for non-phosphate liquid detergent with optical brightener

Nominal composition	Reference detergent %
Linear sodium alkylbenzene sulfonate	12.0 (± 0.6)
Nonionic	8.0 (± 0.8)
Citric acid (as sodium citrate)	1.2 (± 0.12)
Fatty acid (C_{24} sodium salt)	4.0 (± 0.6)
Caustic (NaOH)	2.65
Chelant (DTPA)	0.3 (± 0.05)
Stabilizers (Propanediol/Neutralant)	8.13 (± 1.2)
Preservative (Borax)	1.0 (± 0.1)
Fluorescent whitening agent	0.04 (± 0.01)
Water/Miscellaneous	balance
Total	100.0

Annex N (normative)
Composition of 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 Standard reference detergent 6 (Other designation : SDC reference detergent Type 4)

Reference detergent 6 (Other designation : **SDC** reference detergent Type 4) is a non-phosphate powder detergent with optical brightener and without enzymes, its composition shall be as given in Table N.1. This detergent can only be used in both machine Type A and Type B.

NOTE : Other designation is SDC reference detergent Type 4. This was incorrectly designated as **IEC** reference detergent A in Annex B of **ISO 6330** : 2000.)

Table N.1 Reference detergent 6 : Composition for non-phosphate powder detergent with optical brightener and without enzymes

Composition	Reference detergent 6 %
Linear sodium alkyl benzene sulfonate	7.5 (± 0.5)
Ethoxylated fatty alcohol $C_{12\text{-}18}$ (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 :

a) detergent base powder;

b) sodium perborate tetrahydrate;

c) 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 14 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 (see Table O.1).

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 Preparation

Use a load composed entirely of 100 % ballast (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.

P.1.2 Initial mass

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

P.1.3 Calculation of drying rate *a*

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 Calculation of preliminary cycle time

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.

P.1.5 Drying

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

P.1.6 Calculation of drying rate *b*

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 Calculation of final estimated test cycle time

Perform test cycles at a time setting determined from the final estimated test cycle time given by the following formula :

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

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

i.e. in this case $\frac{1.75 \times 60}{1.77} + 5 = 64 \text{ min}$

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.

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 shall be between 0 and –3 % of the conditioned mass:

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

Annex JA (informative)

Measuring method for washing mechanical force by reference washing machine Type C and results of measuring

JA. 1 General matter

The test method using pulsator type washing machine was prepared to be proposed at the time of revision of **ISO 6330** starting from 2005. Consequently, the test, to compare the mechanical action to textiles to be washed by the drum type washing machine described in Annex A, and the pulsator type washing machine described in Annex E, was carried out. And operating condition (hereafter referred to as "method C") in Annex F was proposed. In this Annex, that test method and the value obtained by the test are described.

This time, because any appropriate method by which the mechanical action (in this Annex, referred to as the "washing mechanical force") to textiles is directly measured does not exist, alternative methods to measure MA value, dot desorption rate and dimensional change rate are applied by using existing MA test cloth, EMPA 306 test cloth and dimensional change measurement cloth. These methods present the condition to make the washing mechanical force of reference washing machine and that of other washing machine equal.

JA. 2 Test cloth for measurement of washing mechanical force

Test cloth for measurement of washing mechanical force (hereafter referred to as "test cloth") is as follows.

a) **MA test cloth**, plain white cotton cloth with a certain level of flexural rigidity having five circular holes of 35 mm in diameter punched beforehand. Wash it with textiles to be washed, dry it, count the number of threads broken into the holes, take the total number of them on five holes as MA value (Mechanical Action Value) and evaluate the washing mechanical force by this value.

NOTE : The MA test cloth (hereafter referred to MA cloth) is the test cloth made by Danish Technological Institute (Denmark) and the abbreviation of Mechanical Action Test Cloth. There are mainly two sizes : 40 cm × 40 cm, and 24 cm × 24 cm and in this test the MA cloth of 24 cm × 24 cm in size was used.

b) **EMPA 306 test cloth**, white cotton cloth (34 cm × 34 cm) with one surface bonded with small resin dots beforehand. Wash it with textiles to be washed, dry it, count the number of dot desorbed, and evaluate the washing mechanical force by the desorption rate.

NOTES 1 EMPA 306 test cloth (hereafter referred to as "EMPA 306") is the test cloth made by EMPA Testmaterialien AG (Switzerland).

2 EMPA 306 is used basically to evaluate the washing mechanical force

by the change of Y value before and after washing obtained from the reflectance measurement at the prescribed four sits of test cloth (see Bibliography [1] **IEC/PAS 62473** : 2007).

However, in this test, the method to scan test cloth before and after washing, measure the number of dots by using a software for graphic analysis and calculate the desorption rate, is applied. When software for graphic analysis is not available, the reflectance measuring method or simplified measuring method (see Bibliography [4]) may be used.

c) **Dimensional change measurement cloth**, the wool fabric specified as wool No. 1-1 for the standard adjacent fabrics for staining of colour fastness test in **JIS L 0803**, (hereafter referred to as "dimensional change measurement cloth"). Wash and dry it with textiles to be washed, and evaluate the washing mechanical force by the dimensional change before and after washing. This method uses the easiness of milling of wool by washing.

NOTE : For any three kinds of test cloth, the test results may vary depending on the lot, therefore the test cloth from the same lot should be used at the time of test, and the test to observe correlation between the lots should be carried out.

JA.3 Ballast

The ballast used in this test is 20 cm × 20 cm in finished size (see Figure JA.1) and lock-stitched [1)] four layers together on all four sides and diagonally by using the knit fabric of 100 % polyester processed yarn specified as type III in Table H.2 (310 g/m^2 ± 20 g/m^2 in weight per unit area). The mass of the ballast is 50 g/sheet ± 5 g/sheet.

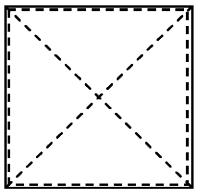


Figure JA.1 Sewing of ballast

Note [1)] Figure JA.1 shows the sewing of ballast used this time and the sewing of ballast specified in type III of Table H.2 is different from it.

JA.4 Detergent

The detergent is a weak-alkaline synthetic detergent.

NOTE : To create the data in Table JA.2, the synthetic detergent for clothing on the market (weak alkaline powder) was used.

JA.5 Test method

JA.5.1 Test condition

The test condition is as follows.

a) Mass of textiles to be washed : 2.0 kg ± 0.1 kg

b) Ballast : not less than two for each test

c) Bath ratio : 1 : 14

NOTE : When the washing tank consists of two drums such as an outer drum and an inner drum, the ratio of the textiles to be washed to the water volume of inner drum is taken as a bath ratio (28 L for a reference washing machine Type C).

d) Dosage of detergent: In accordance with the standard dosage specified for the detergent.

NOTE : When the washing tank consists of two drums such as an outer drum and an inner drum, it is a water volume (40 L for a reference washing machine Type C).

JA.5.2 Washing condition

Washing condition is as follows.

a) In accordance with C4N, C4M, C4G and C4H of the washing procedure for the reference washing machine Type C in Table F.1 of Annex F.

b) Number of test treatment

1) The number of test treatment of MA cloth and EPMA 306 is one.

2) The number of test treatment of dimensional change measurement cloth is three (repeat from washing to drying). However, for drying, smooth out the wrinkles lightly and carry out flat drying under the standard condition each time.

JA.6 Measuring method of MA cloth

JA.6.1 Preparation

Draw two narrow lines, in total 4 lines at the warp and weft respectively near the each hole of MA cloth (24 cm × 24 cm). [see Figure JA.4 a) ① and Figure JA.4 b)]. Then stich the ballast specified in **JA.3** at the four corners (see Figure JA.2).

NOTE : The purpose of drawing the narrow lines to the threads contacting to holes is to assist in counting the cut threads at the time of measurement.

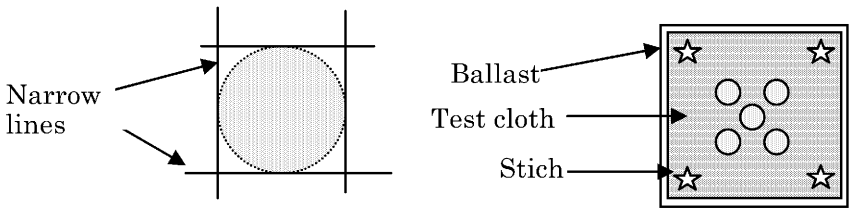


Figure JA.2 Examples of narrow lines of MA cloth and ballast stitched

JA.6.2 Test method

The test method of MA cloth is in accordance with the test method in **JA.5**.

JA.6.3 Measuring method of MA value

The measuring method of MA value is as follows.

a) X=the number of cut threads, Y = the number of loose threads in a state of being connected (see Figure JA.3).

b) After counting at four places of circumscribed square and calculating the total of X + Y of one hole, obtain the total of five holes and obtain the average of number of test sheet (N number) to the nearest integer.

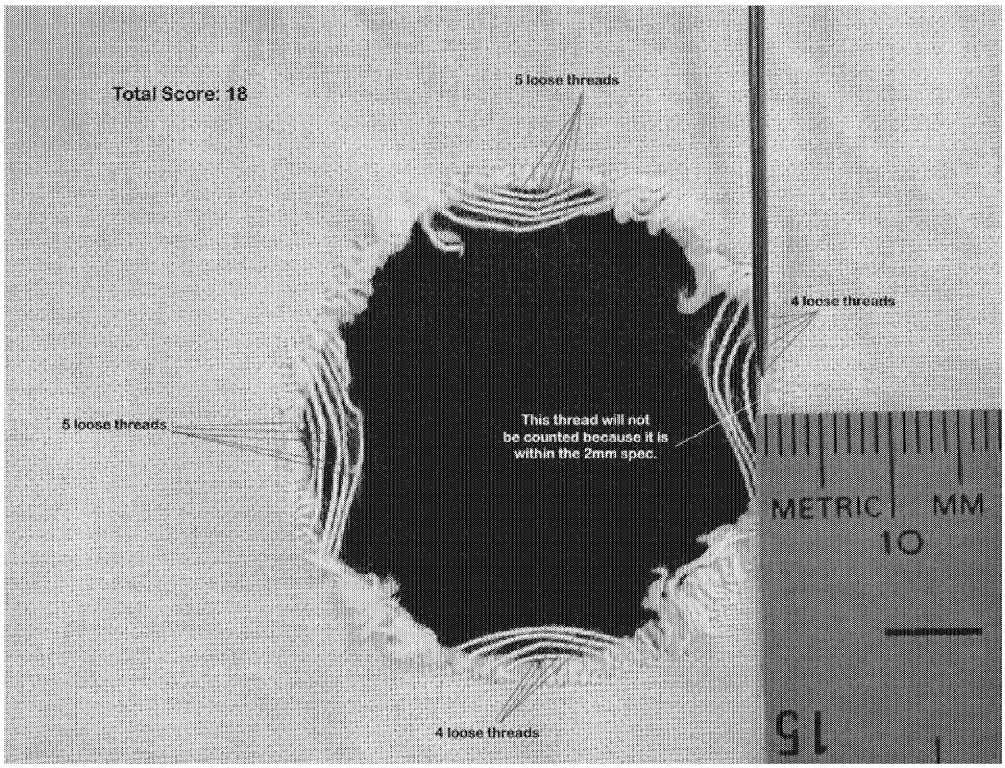
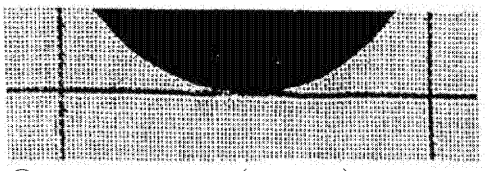
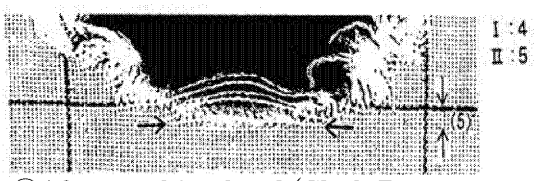


Figure JA.3 Examples of counting Y (see Bibliography [1])

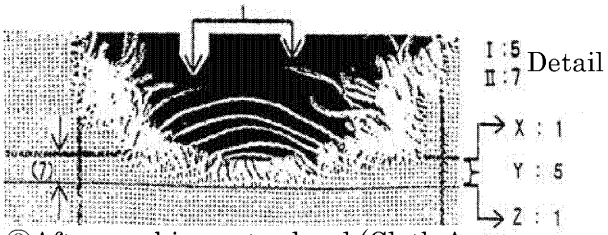


①Before washing (Cloth B)



②After washing hard (Cloth B 100 rpm 10 min)

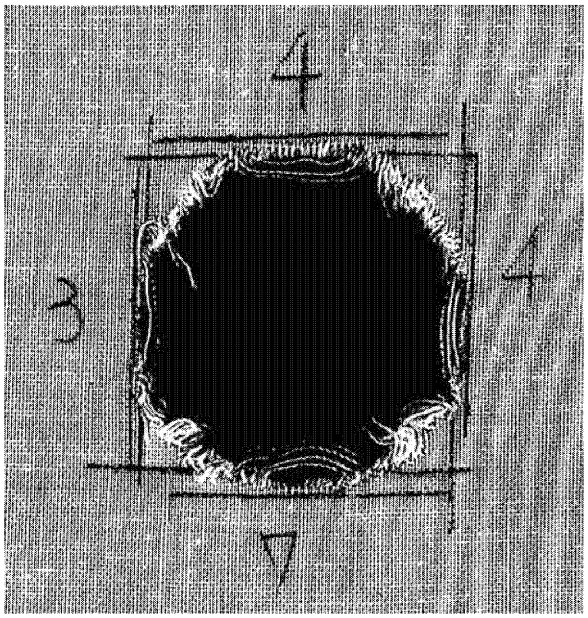
Ends of cut threads



③After washing extra hard (Cloth A 150 rpm 10min)

X : number of cut threads
Y : number of loose threads
Z : number of deformed threads

a)



b)

Figure JA.4 Examples of counting X+Y+Z

NOTE : Figure JA.4 a) (see Bibliography [2]) and Figure JA.4 b) (see Bibliography [3]) shows the method to measure X+Y+Z. In this Standard the value of X+Y is used, and value of Z is not used.

JA.7 Measuring method using EMPA 306

JA.7.1 Preparation

Cut EMPA 306 (34 cm × 34 cm) into one quarter (17 cm × 17 cm) and take them as test cloths. Then stitch the ballast specified in **JA.3** at the four corners (see Figure JA.5).

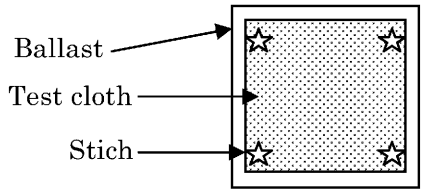


Figure JA.5 Examples of EMPA 306 stitched

JA.7.2 Test method of EMPA 306

The test method of EMPA 306 is in accordance with the test method in **JA.5**.

JA.7.3 Measuring method for the dot desorption rate

The measuring method for the dot desorption rate of EMPA 306 is as follows.

a) Mark a square of 13 cm × 13 cm approximately at the central part of a sample of 17 cm × 17 cm and count the number of dots in the square before test (see Table JA.1).

b) Count the number of dots in the square after test and obtain the desorption rate according to the following formula.

c) Obtain the average % of number of test sheet (N number) to the nearest integer.

$$a = \frac{b_0 - b_1}{b_0} \times 100$$

where, a : desorption rate (%)

b_0 : number of dots in 13 cm × 13 cm before test

b_1 : number of dots in 13 cm × 13 cm after test

NOTE 1 : The simplified measuring method is as follows (see Bibliography [4]).

① Cut off a sample of 5 cm square from inside except about 2 cm in outer circumference of 34 cm × 34 cm of EMPA 306 (see Figure JA.6).

② Draw a circle of about 2 cm in diameter at the centre of sample (see Figure JA.7). To use an outer circumference of one-yen coin is recommended.

③ Magnify it by using a photocopy machine and record the number (b_0) of dots inside the line (see Figure JA.8). except the dots on the line or the dot removed and paled out.

④ Stitch it to the ballast or sample.

⑤ After test, record the number (b_1) of dots by the same operation as ③.

⑥ Obtain the desorption rate (a) according to **JA.7.3 c**).

⑦ Samples of five sheets or over are preferable for one time of test.

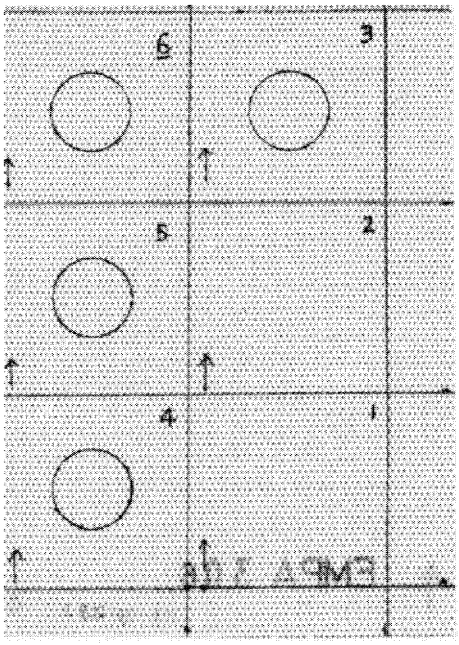


Figure JA.6 Outer circumference of 5 cm square

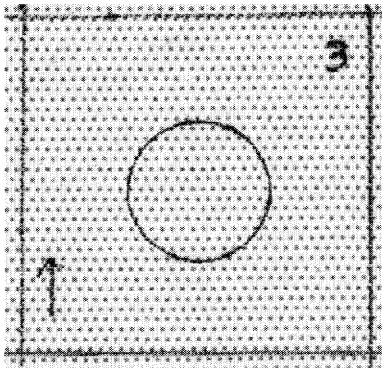


Figure JA.7 Circle by using outer circumference of one-yen coin

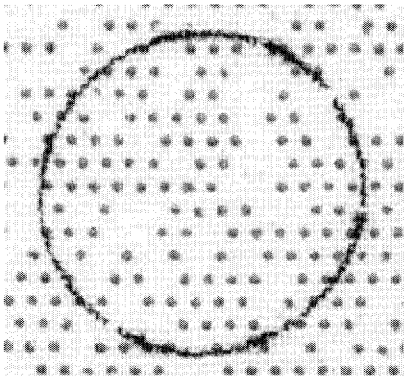


Figure JA.8 Magnified photocopy

Table JA.1 Measurement of dots (Example)

Number of line	Specimen (e.g. No.3)	
	Before treatment	After treatment
1	4	3
2	8	5
3	10	5
4	11	8
5	12	9
6	13	10
7	14	12
8	13	8
9	13	10
10	12	8
11	10	7
12	9	7
13	6	4
Total	135	96
Difference	—	39
Dot desorption rate %	—	29

JA.8 Measuring method of dimensional change measurement cloth

JA.8.1 Preparation

Prepare dimensional change measurement cloth of two layers of 35 cm × 35 cm in size of cloth, and sew them by over-edge chain lock stitch. After the wrinkles of dimensional change measurement cloth are smoothed out lightly, mark eight places in total at intervals of 25 cm to measure three places in the longitudinal direction and three places in the traverse direction (see Figure JA.9).

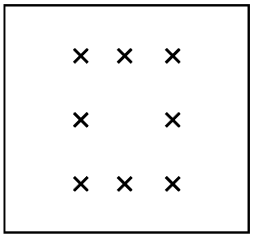


Figure JA.9 Example of marking to dimensional change measurement cloth

JA.8.2 Test method

The test method of dimensional change measurement cloth is in accordance with the test method in **JA.5**.

JA.8.3 Measuring method for dimensional change rate

Measuring method for dimensional change rate of dimensional change measurement cloth is as follows.

a) Measure the length between each mark before washing treatment.

b) Measure the length between each mark after washing treatment.

c) Obtain the average (to one decimal place) of the length of three longitudinal measurement sections before and after washing treatments and obtain the dimensional change rate (to two decimal places) according to the following formula. Similarly obtain the traverse dimensional change rate.

d) Totalize the longitudinal and traverse dimensional change rates.

e) Obtain the average of the number of specimen (N number) and round off to one decimal place.

$$\Delta L = \frac{L_2 - L_1}{L_1} \times 100$$

where, ΔL : dimensional change rate (%)

L_1 : length before washing treatment (mm)

L_2 : length after washing treatment (mm)

JA.9 Measuring test results of washing mechanical force by reference washing machine Type C

Measuring test results of washing mechanical force of three types of test cloth by the test method in Annex F are as follows.

Table JA.2 Measuring test results of washing mechanical force

Operational condition No.	MA Cloth	EMPA306	Dimensional change measurement cloth
	MA value(X + Y method) (Lot No. VIII)	Dot desorption rate %	Dimensional change rate % (Longitudinal and traverse after washing three times)
C4N	85 to 105	70 to 80	−7.0 to −10.0
C4M	70 to 85	40 to 60	−4.5 to −6.0
C4G	55 to 70	30 to 40	−2.5 to −4.0
C4H	to 35	—	to −2.5

NOTES 1 This table indicates the numerical values examined by comparing with Method A for introducing Method C at the time of the revision of **ISO 6330** and the reference range of each washing method.

2 There is the possibility that the values differ depending on the lot in any three types of test cloth, therefore when the test is carried out on the new lot of test cloth, it is recommended that the confirmation test should be carried out after the comparison table between the lots and the like are acquired.

3 For MA cloth, these are the date of lot No. VIII. It has been Lot No. x since 2014. The comparison table between the lots can be acquired from the dealer. However, the values should be tested for confirmation.

4 The EMPA 306 and the dimensional change measurement cloth were purchased in 2008, and the test results using them are indicated.

Bibliography

[1] IEC/PAS 62473 : 2007 *Clothes washing machines for household use—Methods for measuring the mechanical action in household washing machines*

[2] Original figures from : Michiko Katayama, Ryo Funabashi, Shoko Fujikawa and Reiko Ozawa, "*A Modified MA-Test Method for Evaluating Mechanical Action in Machine Washing*" Journal of home economics of Japan(2003)54, Fig.5 in p480 in 237-242

[3] Reference material provided : Prof. Michiko Katayama, Tokyo Kasei University

[4] Michiko Katayama & Reiko Sugihara, "*Which type of washing machine should you choose ?*" International Journal of Consumer Studies (2011) 35, p 238 from 237-242

[5] 1993 AATCC *Standard Reference Detergent and Laundry Detergents in General*

[6] 2003 AATCC *Standard Reference Liquid Laundry Detergent*

[7] ISO 3758 : 2012 *Textiles — Care labelling code using symbols*

[8] ISO 3759 : 2011 *Textiles — Preparation, marking and measuring of fabric specimens and garments in tests for determination of dimensional change*

[9] IEC 60456 *Clothes washing machines for household use — Methods for measuring the performance*

[10] JIS L 0803 *Standard adjacent fabrics for staining of colour fastness test*

Annex JB (informative)
Comparison table between JIS and corresponding International Standard

JIS L 1930 : 2014 *Textiles — Domestic washing and drying procedures for textile testing*			**ISO 6330** : 2012 *Textiles — Domestic washing and drying procedures for textile testing*				
(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
3 Terms and definition	Ten definitions such as **3.1** ambient conditions and others are specified.		3	Almost identical with **JIS**.	Addition	The terms given in **JIS L 0105**, **JIS L 0208** and this Standard apply	Terms are specified. There is no technical deviation.
6 Detergents and water	6.1 Fluorescent brightening agent in the composition of reference detergents 6.2 Water 6.2.3 Cold-water inlet temperature		6	Almost identical with **JIS**.	Alteration Addition	In **6.2** the water hardness is altered to the reference value of city water in Japan specified in the Ministerial Ordinance of the Ministry of Health, Labour and Welfare. The cold-water inlet temperature in **6.2.3** is specified to be the temperature at the beginning of washing, because pulsator type is not equipped with water heating device.	The exception from WTO/TBT agreement (geographic factor) Modification will be proposed at the time of review of **ISO** Standard.
9 Washing procedure	9.4 Dosage of the detergents		—	—	Addition	In **JIS**, **9.4** is added and divided into **a**) to **d**).	It is editorial matter. There is no technical deviation.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
11 Test report			11	Almost identical with **JIS**.	Addition	Date of test is added in **JIS**.	Date of test is necessary in test report. Modification will be proposed at the time of review of **ISO** Standard.
Annexes I to O (normative)			Annexes I to O (normative)	Almost identical with **JIS**.	Addition Deletion	A warning is specified in other Annexes, but not in Annex I. Therefore the warning at the time of using is added in **I.1**. Notes [a], [b] and [c] are deleted from Tables I.1 and I.2.	Modification will be proposed at the time of review of **ISO** standard. There is no technical deviation. Detergents are commercially available, therefore information on these detergents is not necessary and deleted.

Overall degree of correspondence between **JIS** and International Standard (**ISO 6330** : 2012): MOD

NOTE 1 Symbols in sub-columns of classification by clause in the above table indicate as follows:

— Deletion : Deletes the specification items(s) or content(s) of International Standard.

— Addition : Adds the specification item(s) or content(s) which are not included in International Standard.

— Alteration : Alters the specification content(s) which are included in International Standard.

NOTE 2 Symbol in column of overall degree of correspondence between **JIS** and International Standard in the above table indicates as follows:

— MOD : Modifies International Standard.

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