# इंटरनेट मानक

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Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 302-2-7 (2010): Safety of household and similar electrical appliances, Part 2: Particular requirements : Section 7 Domestic electric clothes washing machines [ETD 32: Electrical Appliances]

"ज्ञान से एक नये भारत का निर्माण"
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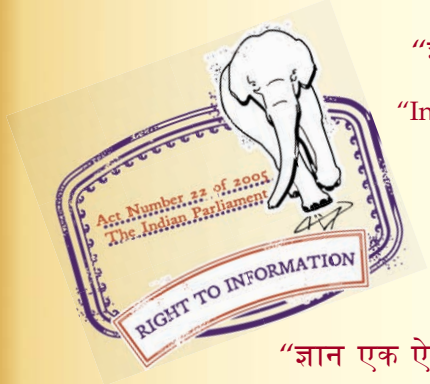



"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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*भारतीय मानक*

# घरेलू और समान विद्युत साधित्रों की सुरक्षा

**भाग 2 विशेष अपेक्षाएँ**

**अनुभाग 7 कपड़े धोने की मशीनें**

*( पहला पुनरीक्षण )*

*Indian Standard*

# SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

**PART 2 PARTICULAR REQUIREMENTS**

**Section 7 Domestic Electric Clothes Washing Machines**

*( First Revision )*

ICS 97.060; 13.120



**BUREAU OF INDIAN STANDARDS**
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*March* 2010 **Price Group 6**

Electrical Appliances Sectional Committee, ETD 32

FOREWORD

This Indian Standard (Part 2/Sec 7) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electrical Appliances Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was first published in 1994. This revision has been undertaken primarily to align the existing standard with latest version of corresponding International Standard and also to align with revised version of Part 1 of this standard.

This standard covers the safety requirements of electric washing machines for household and similar use, that are intended for washing clothes and textiles, their rated voltage being not more than 250 V for single-phase appliances and 480 V for other appliances.

This standard does not cover the performance requirements, which is covered under a separate standard (*see* IS 14155 : 1994 'Domestic electric clothes washing machines for domestic use').

It has been assumed in the formulating of this Indian Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IS 732 : 1989 'Code of practice for electrical wiring installations (*third revision*)' and SP 30 : 1985 'National electrical code' as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another Part 2 of IS 302-1, the relevant Part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

Application of this standard, as far as is reasonable, may be considered to appliances not mentioned in Part 2, and to appliances designed on new principles.

NOTE — Throughout this standard, when Part 2 is mentioned, it refers to the relevant Part of IS 302.

This standard is to be read in conjunction with IS 302-1 : 2008 'Safety of household and similar electrical

(*Continued on third cover*)

(*Continued from second cover*)

appliance: Part 1 General requirements (*sixth revision*)'. For the sake of convenience, the clauses of this standard corresponds to those of IS 302-1, instead of reproducing full text of each clause, clauses of IS 302-1 which is applicable (which means that relevant provisions of the clause apply) or not applicable and the sub-clauses or portion there of which are not applicable are indicated as under:

a) In case of a clause where it is applicable, the wording used is 'This clause of IS 302-1 is applicable/ not applicable'; and
b) In case of sub-clause or part thereof 'Not applicable'.

Wherever a sub-clause of IS 302-1 is to be replaced by a new text, it has been indicated as under:

Replacement or Modification — followed by the new text.

Any addition to the existing provision of a sub-clause of IS 302-1 has been indicated as under:

'Addition — followed by the text of the additional matter'.

Clauses/tables which are additional to those of IS 302-1 are numbered starting from **101** and additional sub-clauses are numbered with the main clause number followed by **101**, **102**, etc. for example, **7.101**,

Should however, any deviation exist between IS 302-1 and this standard, the provision of the latter shall apply.

This standard is based on IEC Pub 60335-2-7 (2002) + A1 (2004) + A2 (2006) 'Household and similar electrical appliance-safety — Part 2-7 : Particular requirements for washing machines' issued by the International Electrotechnical Commission except for the following modification:

a) The leakage current value is more stringent as compared to IEC Publication; and
b) Ambient test conditions are based on national conditions.

Following changes have been incorporated in this revision:

a) Sequence of test modified (*see* **5.2** and **5.3**);
b) Endurance test included;
c) Transient overvoltage test added;
d) Additional test for abnormal operation test added (*see* **19.102**);
e) New test added in **21** for mechanical strength test; and
f) Ageing test for elastomeric parts.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

# SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

## PART 2 PARTICULAR REQUIREMENTS

## Section 7 Domestic Electric Clothes Washing Machines

*( First Revision )*

### 1 SCOPE

This clause of Part 1 is replaced by the following.

This Indian Standard deals with the safety of electric washing machines for household and similar use, that are intended for washing clothes and textiles, their rated voltage being not more than 250 V for single-phase appliances and 480 V for other appliances.

NOTE **101** — Washing machines also supplied with other forms of energy are within the scope of this standard.

Appliances not intended for normal household use but which nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard.

NOTE **102** — Examples of such appliances are washing machines for communal use in blocks of flats or in launderettes.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account

a) the use of appliances by young children or infirm persons without supervision; and

b) playing with the appliance by young children.

NOTE **103** — Attention is drawn to the fact that:

a) for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;

b) in many countries additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities;

c) for appliances having a separate spin container for water extraction, IS 302-2-4 is also applicable; and

d) for appliance having a drying function, IS 302-2-11 is also applicable.

NOTE **104** — This standard does not apply to:

a) appliances intended exclusively for industrial purposes; and

b) appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

### 2 REFERENCES

This clause of Part 1 is applicable except as follows:

**Addition**

| *IS No.* | *Title* |
|---|---|
| 3400 (Part 6) : 1983 | Methods of test for vulcanized rubbers: Part 6 Resistance to liquids |
| 14155 : 1994 | Domestic electric clothes washing machines for domestic use |

### 3 TERMINOLOGY

This clause of Part 1 is applicable except as follows :

**3.1.9** *Replacement*

*Normal Operation*

Operation of the appliance under the following conditions:

The appliance is filled with textile material having a mass in the dry condition equal to the maximum mass stated in the instructions, and with the maximum quantity of water for which it is constructed. However, if the power input or current is higher when only 50 percent of the textile material is used, the appliance is operated with this load instead.

The temperature of the water is;

a) 65 ± 5°C for appliances without heating elements,

b) 15 ± 5°C for other appliances, and

c) 15 ± 5°C for appliances without heating elements and intended for connection to the cold water supply only.

If the appliance does not incorporate a programmer, the water is heated to 90° ± 5°C or as high as the construction will allow if lower, before starting the first washing period.

The textile material consists of pre-washed double-hemmed cotton sheets having dimensions approximately 70 cm × 70 cm and a specific mass between 140 g/m² and 175 g/m² in the dry condition.

NOTE **101** — For impeller type washing machines, if the textile material does not move properly during operation,

a) the quantity of textile material may be reduced until the maximum power input of the motor is attained, or

b) a textile material comprising pre-washed double-hemmed cotton sheets, having dimensions of approximately 90 cm × 90 cm and a mass between 90 g/m² and 110 g/m² in the dry condition, may be used.

In case of doubt, the test should be carried out using the reduced quantity of textile material.

## 4 GENERAL REQUIREMENT

This clause of Part 1 is applicable.

## 5 GENERAL CONDITIONS FOR THE TESTS

This clause of Part 1 is applicable except as follows:

### 5.2 Addition

The relevant tests of **21.101**, **21.102** and **22.104** shall be carried out on the same appliance as that used for the test of **18**.

### 5.3 Addition

The test of **15.101** is carried out before the test of **15.3**.

The relevant tests of **21.101** and **21.102** are carried out before the test of **18.** The test of **22.104** is carried out after the test of **18**.

### 5.7 Addition

NOTE **101** — Doubt is considered to exist if the temperature of the water is within 6 K of the boiling point and the difference between the temperature rise of the relevant part and the limit specified does not exceed 25 K minus the room temperature.

## 6 CLASSIFICATION

This clause of Part 1 is applicable except as follows:

### 6.1 Modification

Appliances shall be of Class I, Class II or Class III.

### 6.2 Addition

Appliances shall be at least IPX4.

## 7 MARKING AND INSTRUCTIONS

This clause of Part 1 is applicable except as follows:

### 7.1 Addition

Appliances without automatic water level control shall be marked with the maximum water level.

The safety release mechanism of power-driven wringers shall be marked to indicate its method of operation, unless its operating means has to be continuously actuated by the user.

NOTE **101** — This marking may be near the mechanism.

Appliances not intended for connection to the hot water supply and not provided with heating elements shall be marked with the substance of the following:

**CAUTION**: Do not connect to the hot water supply.

### 7.10 Addition

If the off position is only indicated by letters, the word ‘off’ shall be used.

### 7.12 Addition

The instructions shall specify the maximum mass of dry cloth, in kilogram, to be used in the appliance.

The instructions for washing machines incorporating a power-driven wringer shall draw attention to the potential hazards involved when operating the wringer and shall state that:

a) wringer must be disengaged or switched off when not in use; and

b) appliance must not be operated by children.

**7.12.1** *Addition*

For washing machines having ventilation openings in the base, the installation instructions shall state that the openings must not be obstructed by a carpet.

### 7.101 BIS Certification Marking

The appliances may also be marked with the Standard Mark.

**7.101.1** The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## 8 PROTECTION AGAINST ACCESS TO LIVE PARTS

This clause of Part 1 is applicable.

## 9 STARTING OF MOTOR-OPERATED APPLIANCES

This clause of Part 1 is not applicable.

## 10 POWER INPUT AND CURRENT

This clause of Part 1 is applicable except as follows:

### 10.1 Addition

NOTE **101** — The selected representative period is the period during which the power input is the highest.

### 10.2 Addition

NOTE **101** — The selected representative period is the period during which the current is the highest.

## 11 HEATING

This clause of Part 1 is applicable except as follows:

### 11.7 Replacement

Appliances incorporating a programmer are operated for three cycles with the programme that results in highest temperature rises, with a rest period of 4 min between cycles.

Other appliances are operated for three cycles, with a rest period of 4 min between cycles. Each cycle consists of the following operations:

| | |
|---|---|
| for appliances without means for water extraction, | washing; |
| for appliances having a single drum for washing and water extraction, | washing followed by water extraction; |
| for appliances having separate drums for washing and water extraction that cannot be used simultaneously, | washing and water extraction separated by an additional 4 min rest period; |
| for appliances having separate drums for washing and water extraction that can be used simultaneously, | washing together with water extraction so that the operations terminate simultaneously; |
| for appliances incorporating a power-driven wringer, | washing followed by wringing; |
| for appliances having a single drum for washing, water extraction and drying: | |
| a) that allow the same quantity of textile material to be washed and dried in the drum, | washing followed by water extraction, followed by drying; |
| b) that according to the instructions, only allow a portion of the washed textile material to be dried in the drum, | washing followed by water extraction followed by two drying periods, with an additional rest period of 4 min before each drying period. In this case only two cycles of operation are carried out. |

For appliances incorporating a timer, the washing period, the water extraction period and the drying period are equal to the maximum period allowed by the timer.

For appliances without a timer,

a) the washing period has a duration of:
   1) 6 min, for washing machines of the continuously rotating impeller type,
   2) 18 min, for washing machines of the agitator type, and
   3) 25 min for washing machines of the drum type, unless a longer period is stated in the instructions; and
b) the water extraction period has a duration of 5 min.

For power-driven wringers, the duration of each wringing period is 8 min. The wringer is loaded by passing a board through the rollers once a minute, the roller pressure being adjusted to the maximum value. The board is approximately 20 mm thick and 80 cm long, its width being at least equal to three-quarters of the effective length of the rollers. The board is uniformly tapered at each end down to a thickness of approximately 3 mm, over a distance of 20 cm.

The rest period, including any braking time, has a duration of 4 min.

After the specified sequence of operation, discharge pumps that are driven by a separate motor and switched on and off manually, are subjected to three operating periods separated by rest periods of 4 min. Each operating period is equal to 1.5 times the period necessary to empty the appliance when filled to the maximum normal water level. The outlet of the water discharge pipe is 90 cm above the floor.

NOTE **101** — Washing machines with a hand-operated wringer are tested as appliances without means for water extraction.

## 12 VOID

## 13 LEAKAGE CURRENT AND ELECTRIC STRENGTH AT OPERATING TEMPERATURE

This clause of Part 1 is applicable except as follows:

### 13.2 Modification

For stationary Class I appliances, the leakage current shall not exceed 3.5 mA, or 1 mA/kW of rated power input with a limit of 5 mA, whichever is greater.

## 14 TRANSIENT OVERVOLTAGES

This clause of Part 1 is applicable.

## 15 MOISTURE RESISTANCE

This clause of Part 1 is applicable except as follows:

### 15.2 Replacement

Appliances shall be constructed so that spillage of liquid in normal use does not affect their electrical insulation even if an inlet valve fails to close.

Compliance is checked by the following test:

Appliances with type X attachment, except those having a specially prepared cord, are fitted with the lightest permissible type of flexible cord of the smallest cross-sectional area specified in Table 13.

Appliances intended to be filled with water by the user are completely filled with water containing approximately 1 percent NaCl. A further quantity of this solution equal to 15 percent of the capacity of the appliance or 0.25 litre, whichever is greater, is poured in steadily over a period of 1 min.

Other appliances are operated until the maximum water level is reached, and 5 g of the detergent specified in Annex AA is added for each litre of water in the appliance. The inlet valve is held open and the filling continued for 15 min after first evidence of overflow or until the inflow is automatically stopped by other means.

For appliances that are loaded from the front, the door is then opened if this can be achieved manually and without damage to the door interlock system.

For appliances having a working surface, 0.5 l of water containing approximately 1 percent NaCl and 0.6 percent of rinsing agent, as specified in Annex AA, is poured over the top of the appliance, the controls being placed in the on position. The controls are then operated through their working range, this operation being repeated after a period of 5 min.

The appliance shall then withstand the electric strength test of **16.3** and inspection shall show that there is no trace of water on insulation that could result in a reduction of clearances and creepage distances below the values specified in **29**.

**15.101** Appliances shall be constructed so that foaming does not affect electrical insulation.

Compliance is checked by the following test that is carried out immediately after that of **15.2**.

The appliance is operated under the conditions specified in **11** but for one complete cycle with the programme that results in the longest period of operation. Twice the quantity of detergent necessary for normal washing is added, the composition of which is specified in Annex AA.

For appliances incorporating a detergent dispenser, the solution is added manually at the point in the cycle when it would normally be dispensed automatically. For other appliances the solution is added before starting the cycle.

The appliance shall then withstand the electric strength test of **16.3**.

The appliance is kept in a test room having a normal atmosphere for 24 h before being subjected to the test of **15.3.**

## 16 LEAKAGE CURRENT AND ELECTRIC STRENGTH

This clause of Part 1 is applicable.

## 17 OVERLOAD PROTECTION OF TRANSFORMERS AND ASSOCIATED CIRCUITS

This clause of Part 1 is applicable.

## 18 ENDURANCE

This clause of Part 1 is replaced by the following.

**18.101** Appliances shall be constructed so that the lid or door interlock withstands the stresses to which it may be exposed in normal use.

Compliance is checked by the following test.

The lid or door is opened as in normal use and the force applied to the handle, or actuating means of the release mechanism, is measured. The force required to close the lid or door is also measured.

The lid or door is then subjected to 10 000 cycles of opening and closing. For the first 6 000 cycles, the appliance is supplied at rated voltage and operated so that the interlock mechanism is energized and de-energized each cycle. For the last 4 000 cycles, the appliance is not connected to the supply mains. For appliances having a drying function, the total number of cycles is increased to 13 000, the first 9 000 cycles

being carried out with the interlock mechanism energized and de-energized each cycle.

NOTE — If the interlock operates more than once during normal operation, it is operated for this number of times during each cycle.

Lids are opened each time by approximately 45° and doors by 90°, the speed of opening being approximately 1.5 m/s. The force applied to open the lid or door is twice the measured opening force, with a minimum of 50 N and a maximum of 200 N.

Doors are closed at a speed of approximately 1.5 m/s, the force applied being five times the measured closing force, with a minimum of 50 N and a maximum of 200 N. Lids are allowed to close under their own weight but if they fail to latch, a force of five times the measured closing force is applied, with a minimum of 50 N and a maximum of 200 N.

After the tests, compliance with the relevant requirements of **20.103** to **20.105** shall not be impaired.

**18.102** The braking mechanism of appliances having a lid that can be opened during the water extraction period shall withstand the stresses to which they may be exposed in normal use.

Compliance is checked by the following test.

The appliance is supplied at 1.06 times rated voltage and operated under normal operation until the motor has reached its highest speed. The lid is then fully opened. The test is repeated after the drum has been at rest for a period long enough to ensure that the appliance does not attain an excessive temperature.

The test is carried out 1 000 times, the textile material being re-saturated with water at least every 250 times.

After the test, the appliance shall be fit for further use and compliance with this standard shall not be impaired.

NOTE — Forced cooling may be used to prevent excessive temperatures and to shorten the test.

## 19 ABNORMAL OPERATION

This clause of Part 1 is applicable except as follows:

### 19.1 Addition

For appliances incorporating a programmer or a timer, the tests of **19.2** and **19.3** are replaced by the test of **19.101**.

The test of **19.7** is not carried out on motors driving moving parts of an oscillating agitator.

Appliances not intended for connection to the hot water supply and not provided with heating elements are also subjected to the test of **19.102**.

### 19.2 Addition

Restricted heat dissipation is obtained without water in the appliance or with just sufficient water to cover the heating elements, whichever is the more unfavourable.

### 19.7 Addition

Appliances without a programmer or timer are operated for 5 min.

Moving parts of a wringer are locked even if a trip bar prevents rotation of the rollers.

**19.9** Not applicable.

### 19.13 Addition

The textile material shall not ignite and shall not show any charring or glowing.

NOTE **101** — Light brown colouring of the textile material or slight emission of smoke is ignored.

During the tests of **19.101** and **19.102**, the temperature of windings shall not exceed the values specified in Table 8.

The appliance shall comply with the appropriate requirements of **20.103** to **20.105** if it can still be operated.

**19.101** The appliance is supplied at rated voltage and operated under normal operation. Any fault condition or unexpected operation that may be applied in normal use is introduced.

NOTES

**1** Examples of fault conditions and unexpected operations are:

a) the programmer stopping in any position;

b) disconnection and reconnection of one or more phases of the supply during any part of the programme;

c) open-circuiting or short-circuiting of components;

d) failure of a magnetic valve;

e) failure or blocking the mechanical parts of a water-level switch. This fault condition is not applied if:

1) the cross-sectional area of the tube supplying the air chamber is greater than 5 $cm^2$ with a minimum dimension of 10 mm,

2) the outlet of the chamber is at least 20 mm above the highest water level, and

3) the tube connecting the air chamber to the water-level switch is fixed so that there is no likelihood of bending or pinching;

f) puncture of the capillary tube of a thermostat.

**2** Locking the main contacts of a contactor, used for energizing heating elements, in the 'on' position is considered to be a fault condition, unless at least two independent sets of contacts are provided. This may be achieved by two contactors operating independently of each other or by one contactor having two independent armatures operating two independent sets of contacts.

**3** In general, tests are limited to the fault conditions that may be expected to give the most unfavourable results.

The simulation of component faults is limited to those that could expose the user to a hazard.

**4** If operation without water in the appliance is a more unfavourable condition for starting any programme, the tests with that programme are carried out with the water valve closed. This valve is not closed after the programme has started to operate.

**5** If the appliance stops at any particular point in the programme, the test with that fault condition is considered to be ended.

**6** The fault condition with,

a) the automatic filling device held open is covered by **15.2**;

b) thermal controls short-circuited is covered by **19.4**; and

c) motor capacitors short-circuited or open-circuited is covered by **19.7**.

**19.102** Appliances not intended for connection to the hot water supply and not provided with heating elements are operated under the conditions of **11**, except that they are supplied at rated voltage and filled with water at a temperature of $65^{\circ} \pm 5^{\circ}$C.

## 20 STABILITY AND MECHANICAL HAZARDS

This clause of Part 1 is applicable except as follows.

### 20.1 Modification

The appliance is empty or filled as specified for normal operation, whichever is more unfavourable. Doors and lids are closed and any castors turned to the most unfavourable position.

**20.101** Washing machines of the drum type that are loaded from the top through an opening with a hinged lid shall incorporate an interlock that de-energizes the motor before the lid opening exceeds 50 mm.

If a removable or sliding lid is provided, the motor shall be de-energized as soon as the lid is removed or displaced and it shall not be possible to start the motor unless the lid is in the closed position.

The interlock shall be constructed so that unexpected operation of the appliance is unlikely unless the lid is in the closed position.

Compliance is checked by inspection, by measurement and by manual test.

NOTE — Interlocks that can be released by means of test probe B of IS 1401 are not considered to comply with this requirement.

**20.102** Appliances shall not be adversely affected by an unbalanced load.

Compliance is checked by the following test.

The appliance is placed on a horizontal support and a load having a mass of 0.2 kg or 10 percent of the maximum mass of the cloth specified in the instructions, whichever is greater, is fixed to the inside wall of the drum half-way along its length.

The appliance is supplied at rated voltage and operated during the water extraction period.

The test is carried out four times, the load being moved each time through an angle of $90^{o}$ around the wall of the drum.

The appliance shall not overturn and the drum shall not hit other parts except the enclosure. After the test, the appliance shall be fit for further use.

**20.103** For washing machines of the drum type that are loaded from the front or from the top, the door or lid shall be interlocked so that the appliance can only be operated when the door or lid is in the closed position.

Compliance is checked by inspection and by manual test.

NOTE — Interlocks that can be released by means of test probe B of IS 1401 do not meet this requirement.

**20.104** It shall not be possible to open the lid or door of the appliance while the drum speed exceeds 60 rev/min if the drum has a rotational kinetic energy exceeding 1 500 J, or a maximum peripheral speed exceeding;

a) 20 m/s, for drums that rotate about the horizontal axis, and

b) 40 m/s, for drums that rotate about the vertical axis.

Compliance is checked by the following test.

The appliance is supplied at rated voltage and operated empty. The force determined during the test of **22.104** with the lid interlocked is applied to the lid or door in an attempt to open it.

It shall not be possible to open the lid or door while the drum speed exceeds 60 rev/min. If the appliance is loaded from the front and the door can be opened, the motor shall be de-energized before the opening exceeds 50 mm.

NOTE — The rotational kinetic energy is calculated from the following formula:

$$E = mv^2/4$$

where

$E$ = rotational kinetic energy, in J;

$m$ = mass of cloth specified in the instructions, in kg; and

$v$ = maximum peripheral speed of the drum, in m/s.

**20.105** Appliances shall have an automatic means for switching off the motor, or for reducing the drum speed to 60 rev/min, when the lid or door is opened if

the drum has a rotational kinetic energy not exceeding 1 500 J and a peripheral speed not exceeding;

a) 20 m/s, for drums that rotate about the horizontal axis, and
b) 40 m/s, for drums that rotate about the vertical axis.

Compliance is checked by the following test.

The appliance is supplied at rated voltage and operated empty. A force not exceeding 50 N is applied to the lid or door in an attempt to open it, as in normal use. If the lid or door opens, the drum speed shall be no higher than 60 rev/min within 7 s of opening the lid or door by 50 mm. In addition, if the appliance is loaded from the front, the motor shall become de-energized.

NOTE — The rotational kinetic energy is measured in accordance with the formula given in **20.104**.

**20.106** Power-driven wringers shall be constructed so that the pressure between the rollers has to be maintained by the user, unless a readily accessible safety release or other means of protection is incorporated.

The release mechanism shall operate easily without violent ejection of any part and shall release pressure on the rollers immediately. The rollers shall separate either by at least 45 mm at both ends or by at least 25 mm at one end and 75 mm at the other.

The safety release shall be operable by a person standing in any normal working position relative to the wringer, even if the fingers of both hands are trapped between the rollers.

Power-driven wringers shall be constructed to prevent fingers being squeezed between a roller and the frame.

Power-driven wringers shall be controlled by an easily accessible switch.

NOTE — The switch controlling the washing machine may also control the wringer.

Compliance is checked by inspection, by measurement, by manual test and by the following test.

The pressure between the rollers is adjusted to its maximum value. The board described in **11.7** is passed between the rollers and the wringer is stopped when the board is approximately halfway through. A force is gradually applied to the operating means of the safety release. The release shall operate before the force exceeds 70 N.

## 21 MECHANICAL STRENGTH

This clause of Part 1 is applicable except as follows:

**21.101** Lids and doors shall have adequate mechanical strength.

Compliance is checked by the test of **21.101.1** for lids and **21.101.2** for doors.

**21.101.1** A rubber hemisphere having a diameter of 70 mm and hardness between 40 IHRD and 50 IHRD is fixed to a cylinder having a mass of 20 kg and dropped from a height of 100 mm onto the centre of the lid.

The test is carried out three times, after which the lid shall not be damaged to such an extent that moving parts become accessible.

**21.101.2** A vertically downwards force of 150 N is applied in the most unfavourable position to the door while it is open at an angle of 90 ± 5°. The force is maintained for 1 min.

After the test, the appliance shall not be damaged or deformed to such an extent that compliance with **20.103** to **20.105** is impaired.

**21.102** Lids shall have adequate resistance to distortion.

Compliance is checked by the following test.

A force of 50 N is applied to the open lid in the most unfavourable direction and position.

The test is carried out three times, after which the hinges shall not have worked loose and the appliance shall not be damaged or deformed to such an extent that compliance with **20.103** to **20.105** is impaired.

## 22 CONSTRUCTION

This clause of Part 1 is applicable except as follows:

### 22.6 Modification

Instead of coloured water, a solution composed of 5 g of the detergent specified in Annex AA per litre of distilled water is used.

**Addition**

NOTE **101** — Parts that withstand the ageing test specified in Annex BB are not considered to be parts where leakage could occur.

**22.101** Appliances shall be constructed so that when the water level is above the lower edge of the door opening, it shall not be possible to open the door by a simple action while the appliance is operating.

Compliance is checked by inspection and by manual test.

NOTE — Interlocked doors and doors that are opened by means of a key or by two separate actions, such as pushing and turning, meet this requirement.

**22.102** Appliances shall be constructed so that textile material cannot come into contact with heating elements.

Compliance is checked by inspection.

**22.103** Appliances shall be constructed so that during normal use filter compartments cannot be opened by a simple action if this results in an outflow of water having a temperature exceeding 50°C.

NOTES

**1** Interlocked covers, and covers that are opened by means of a key or by two separate actions such as pushing and turning, are considered to comply with this requirement.

**2** Rotation by more than 180º is not considered to be a simple action.

Compliance is checked by inspection and by manual test. If the filter compartment can be opened, any flow of water shall not exceed 0.5 l/min.

**22.104** Lid and door interlocks shall be constructed so that they are unlikely to be forced open in normal use.

Compliance is checked by the following test.

The lid or door is opened as in normal use and the force applied to the handle, or actuating means of the release mechanism, is measured.

The lid and door is closed. The appliance is supplied at rated voltage and operated for a sufficient period for the interlock to be energized. An attempt is then made to open the lid or door as in normal use. The force applied is gradually increased to five times the measured opening force, with a minimum of 50 N and a maximum of 200 N, over a period of 5 s.

The test is carried out 300 times at a rate of approximately six times per minute.

The force is then increased to 10 times the measured opening force, with a minimum of 50 N. It shall not be possible to open the lid or door.

NOTES

**1** The test is only carried out if the interlock is required for compliance with **20**.

**2** Damage to handles is ignored.

## 23 INTERNAL WIRING

This clause of Part 1 is applicable except as follows:

**23.101** The insulation and sheath of internal wiring for the supply of magnetic valves and similar components incorporated in external hoses for connection to the water mains shall be at least equivalent to light polyvinyl chloride sheathed flexible cord as per IS 694.

Compliance is checked by inspection.

NOTE — The mechanical characteristics specified in IS 694 are not checked.

## 24 COMPONENTS

This clause of Part 1 is applicable except as follows:

**24.1.4** *Addition*

The number of cycles of operation for programmers is 3 000.

For lid or door interlocks, the number of cycles of operation declared shall not be less than 6 000. For appliances that include a drying function, the minimum number of cycles of operation is increased to 9 000. If the interlock operates more than once during normal operation, the minimum number of cycles of operation is increased accordingly.

**24.101** Thermal cut-outs incorporated in washing machines for compliance with **19.4** shall not be self-resetting.

Compliance is checked by inspection.

## 25 SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CORDS

This clause of Part 1 is applicable.

## 26 TERMINALS FOR EXTERNAL CONDUCTORS

This clause of Part 1 is applicable.

## 27 PROVISION FOR EARTHING

This clause of Part 1 is applicable.

## 28 SCREWS AND CONNECTIONS

This clause of Part 1 is applicable.

## 29 CLEARANCES, CREEPAGE DISTANCES AND SOLID INSULATION

This clause of Part 1 is applicable except as follows:

**29.2 Addition**

The microenvironment is pollution degree 3, and the insulation shall have a CTI not less than 250, unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution during normal use of the appliance due to:

a) condensation produced by the appliance; and
b) chemicals, such as detergent or fabric conditioner.

## 30 RESISTANCE TO HEAT AND FIRE

This clause of Part 1 is applicable except as follows:

**30.2 Addition**

For appliances incorporating a programmer

**Table 101 Schedule of Type Tests**
(*Clause* 101.1)

| Sl No. | Tests | Clause Reference |
|---|---|---|
| (1) | (2) | (3) |
| i) | Protection against access to live parts | **8** |
| ii) | Power input and current | **10** |
| iii) | Heating | **11** |
| iv) | Leakage current and electric strength at operating temperature | **13** |
| v) | Transient overvoltages | **14** |
| vi) | Moisture resistance | **15** |
| vii) | Leakage current and electric strength | **16** |
| viii) | Overload protection of transformers and associated circuits | **17** |
| ix) | Abnormal operation | **19** |
| x) | Stability and mechanical hazards | **20** |
| xi) | Mechanical strength | **21** |
| xii) | Construction | **22** |
| xiii) | Internal wiring | **23** |
| xiv) | Components | **24** |
| xv) | Supply connection and external flexible cords | **25** |
| xvi) | Terminals for external conductors | **26** |
| xvii) | Provision for earthing | **27** |
| xviii) | Screw and connections | **28** |
| xix) | Clearances, creepage distances and solid insulation | **29** |
| xx) | Resistance to heat and fire | **30** |
| xxi) | Resistance to rusting | **31** |
| xxii) | Radiation, toxicity and similar hazards | **32** |
| xxiii) | Ageing test for elastomeric parts | Annex BB |

or a timer, **30.2.3** is applicable. For other appliances, **30.2.2** is applicable.

## 31 RESISTANCE TO RUSTING

This clause of Part 1 is applicable.

## 32 RADIATION, TOXICITY AND SIMILAR HAZARDS

This clause of Part 1 is applicable.

## 101 TESTS

### 101.1 Type Tests

The tests specified in Table 101 shall constitute the type tests and shall be carried out on a sample selected preferably at random from regular production lot (*see* **5.3**). Before commencement of the tests, the irons shall be visually examined and inspected of components, parts and their assembly, constructions, mechanical hazards, marking provision of suitable terminals for supply connections, earthing and the effectiveness screws and connection. The external surface finish shall be even and free from finishing defects.

**101.1.1** *Criteria of Acceptance*

Sample shall successfully pass all the type tests for proving conformity with the requirements of the standard. If the sample fails in any of the type tests, the testing authority at its discretion, may call for fresh samples not exceeding twice the original number and subject them again to all tests or to the test(s) in which failure(s) had occurred. No failure should be permitted in the repeat tests(s).

### 101.2 Acceptance Tests

The following shall constitute the acceptance tests:

| *Test* | *Clause Reference* |
|---|---|
| (1) | (2) |
| a) Protection against access to live parts | **8** |
| b) Power input and current | **10** |
| c) Heating | **11** |
| d) Leakage current and electric strength at operating temperature | **13** |
| e) Moisture resistance | **15** |
| f) Leakage current and electric strength | **16** |
| g) Provision for earthing | **27** |

NOTE — For the purpose of acceptance tests, the humidity treatment shall be done for 24 h while conducting the test for moisture resistance (**15**).

**101.2.1** A recommended sampling procedure for acceptance tests is given in Annex J of IS 302-1.

### 101.3 Routine Test

The schedule of routine tests are given in Part 1 of this standard.

# ANNEXES

The Annexes of Part 1 are applicable except as follows.

## ANNEX AA
(*Clauses* 15.2, 15.101 *and* 22.6)

### DETERGENT AND RINSING AGENT

### AA-1 DETERGENT

The composition of the detergent is as follows:

| *Sl No.* | *Substance* | *Parts by Mass* Percent |
|---|---|---|
| (1) | (2) | (3) |
| i) | Linear sodium alkyl benzene sulphonate (mean length of alkane chain $C_{11,5}$) | 6.4 |
| ii) | Ethoxylated tallow alcohol (14 EO) | 2.3 |
| iii) | Sodium soap (chain length $C_{12\ to\ 16}$: 13 percent to 26 percent and $C_{18\ to\ 22}$: 74 percent to 87 percent) | 2.8 |
| iv) | Sodium tripolyphosphate | 35.0 |
| v) | Sodium silicate ($SiO_2$: 76.75 percent and $Na_2O$: 23.25 percent) | 6.0 |
| vi) | Magnesium silicate | 1.5 |
| vii) | Carboxy methyl cellulose | 1.0 |
| viii) | Ethylenediamine tetra-acetic-sodium-salt | 0.2 |
| ix) | Optical whitener for cotton (dimorpholinostilbene type) | 0.2 |
| x) | Sodium sulphate (as accompanying substance or added) | 16.8 |
| | Water | 7.8 |
| xi) | Sodium perborate tetrahydrate (supplied separately) | 20.0 |

NOTES

**1** The detergent specified in the instructions may be used, but if there is any doubt with regards to the test results, this composition is to be used.

**2** The composition of the detergent is extracted from IS 14155.

### AA-2 RINSING AGENT

The composition of the rinsing agent is as follows:

| *Sl No.* | *Substance* | *Parts by Mass*, Percent |
|---|---|---|
| (1) | (2) | (3) |
| i) | Plurafac LF 221[1)] | 15.0 |
| ii) | Cumene sulfonate (40 percent solution) | 11.5 |
| iii) | Citric acid (anhydrous) | 3.0 |
| iv) | Deionized water | 70.5 |

The rinsing agent has the following properties:

a) viscosity, 17 mPas; and

b) *p*H, 2.2 (1 percent in water).

NOTES

**1** Any commercially available rinsing agent may be used, but if there is any doubt with regards to the test results, this composition is to be used.

**2** The composition of the rinsing agent is extracted from IS 14155.

**3** Plurafac LF 221 is the trade name of a product supplied by BASF. This information is given for the convenience of users of this Indian Standard and does not constitute an endorsement of this product.

# ANNEX BB

(*Foreword*; and *Clause* 22.6)

## AGEING TEST FOR ELASTOMERIC PARTS

The ageing test on elastomeric parts is carried out by measuring their hardness and mass before and after immersion in a solution of detergent at elevated temperature.

The test is carried out on at least three samples of each part. The samples and test procedure are as specified in IS 3400 (Part 6), with the following modifications.

### 4 TEST LIQUIDS

The liquid is obtained by dissolving 5 g of the detergent specified in Annex AA per litre of distilled water.

NOTE — Care is to be taken to ensure that the total mass of the test pieces immersed does not exceed 100 g for each litre of solution, that the test pieces are completely immersed and that their entire surface is freely exposed to the solution. During the tests, the test pieces are not to be exposed to direct light. Test pieces of different compounds are not to be immersed at the same time in the same solution.

### 5 TEST PIECES

#### 5.4 Conditioning of Test Pieces

The temperature is 27 ± 2°C and the relative humidity is 50 ± 5 percent.

### 6 IMMERSION IN THE TEST LIQUID

#### 6.1 Temperature

The solution is heated within 1 h with the test pieces immersed, to a temperature of $75^{+5}_{0}$°C and maintained at this value. The solution is renewed every 24 h and heated in the same way.

NOTE — To avoid undue evaporation of the solution, it is recommended to use a closed-circuit system or similar method for renewing the solution.

#### 6.2 Duration

The test pieces are immersed for a total period of $48^{+1}_{0}$h.

The test pieces are then immediately immersed in a fresh solution, which is maintained at ambient temperature. The pieces are immersed for 45 min ± 15 min.

After having been removed from the solution, the test pieces are rinsed in cold water at 15° ± 5°C and then dried with blotting paper.

### 7 PROCEDURE

#### 7.2 Change in Mass

The increase in mass of the test pieces shall not exceed 10 percent of the value determined before immersion.

#### 7.6 Change in Hardness

The micro-test for hardness applies.

The hardness of the test pieces shall not have changed by more than 8 IRHD. Their surface shall not have become sticky and shall show no crack visible to the naked eye or any other deterioration.

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