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IS 2486-4 (1981): Insulator Fittings for Overhead Power Lines with a Nominal Voltage Greater than 1 000 V, Part IV: Tests for Locking Devices [ETD 6: Electrical Insulators and Accessories]

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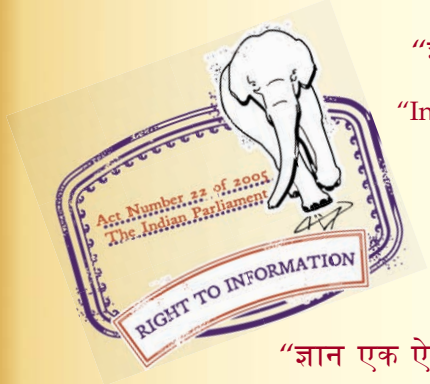

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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS : 2486 (Part IV) - 1981
(Reaffirmed 2001)

Indian Standard

SPECIFICATION FOR INSULATOR FITTINGS FOR OVERHEAD POWER LINES WITH A NOMINAL VOLTAGE GREATER THAN 1 000 V

PART IV TESTS FOR LOCKING DEVICES

UDC 621·315·624 : 621·882·5 : 620·1

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

Gr 5

September 1982

Indian Standard

SPECIFICATION FOR INSULATOR FITTINGS FOR OVERHEAD POWER LINES WITH A NOMINAL VOLTAGE GREATER THAN 1 000 V

PART IV TESTS FOR LOCKING DEVICES

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(*Continued on page* 16)

Indian Standard

SPECIFICATION FOR INSULATOR FITTINGS FOR OVERHEAD POWER LINES WITH A NOMINAL VOLTAGE GREATER THAN 1 000 V

PART IV TESTS FOR LOCKING DEVICES

0. FOREWORD

0.1 This Indian Standard (Part IV) was adopted by the Indian Standards Institution on 29 December 1981, after the draft finalized by the Electrical Insulators and Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The object of this standard (Part IV) is to define test methods for locking devices for ball and socket couplings of string insulator units specified in IS : 2486 (Part III)-1974*, and to present the criteria for acceptance.

0.3 General requirements for locking devices for ball and socket couplings of string insulator units and the corresponding metallic fittings are covered in Part III of this standard. This standard (Part IV) shall, therefore, be read in conjunction with IS : 2486 (Part III)-1974*.

0.4 Other parts of this standard are:

Part I General requirements and tests,

Part II Dimensional requirements, and

Part III Locking devices

0.5 In the preparation of this standard, assistance has been derived from IEC Pub 372-2 (1976) ' Locking devices for ball and socket couplings of string insulator units, Part 2 Tests ' issued by International Electrotechnical Commission.

*Specification for insulator fittings for overhead power lines with a nominal voltage greater than 1 000 V : Part III Locking devices.

0.6 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, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part IV) covers the test methods for locking devices for ball and socket couplings used with string insulator units and fittings.

1.1.1 The general requirements for locking devices are covered in IS : 2486 (Part III) -1974†.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions in addition to those given in 2 of IS : 2486 (Part I)-1971‡ shall apply.

2.1 Type Tests — Tests carried out to prove conformity with the specification. These are intended to prove the general qualities and design of a given type of locking device.

2.2 Acceptance Tests — Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

2.2.1 *Lot* — All the locking devices of the same type and design manufactured under similar conditions of production offered for acceptance; a lot may consist of the whole or part of the quantity offered.

2.3 Routine Tests — Tests carried out on each insulator fitting to check requirements which are likely to vary during production.

3. TESTS

3.0 Classification of Tests

3.0.1 *Type Tests* — The following shall constitute type tests:

a) Visual examination (*see* **3.1**),

b) Verification of dimensions (*see* **3.2**),

c) Verification of resistance to bending (*see* **3.3**),

*Rules for rounding off numerical values (*revised*).

Specification for insulator fittings for overhead power lines with a nominal voltage greater than 1 000 V:

†Part III Locking devices.

‡Part I General requirements and tests (*first revision*).

d) Hardness test (*see* **3.4**),

e) Operation test (*see* **3.5**), and

f) Test for resistance to internal corrosion (*see* **3.6**).

3.0.2 *Acceptance Tests* — The following shall constitute acceptance tests:

a) Visual examination (*see* **3.1**),

b) Verification of dimensions (*see* **3.2**),

c) Verification of resistance to bending (*see* **3.3**),

d) Hardness test (*see* **3.4**),

e) Operation test (*see* **3.5**), and

f) Test for resistance to internal corrosion (*see* **3.6**).

NOTE 1 — The test at (f) above shall be carried out on five locking devices. This test, as an acceptance test, is optional and it shall not be necessary to repeat it, if a test certificate on the profiled material used in the manufacture of the batch is available.

NOTE 2 — A recommended plan of sampling and criteria for acceptance is given in Appendix A.

3.0.3 *Routine Tests* — Visual examination (*see* **3.1**) shall be carried out as a routine test.

3.1 Visual Examination — The locking devices shall not have any defects prejudicial to satisfactory behaviour in service.

3.1.1 An acceptance quality level of 1·5 percent shall be allowed for surface cracking or incipient cracks and 6·5 percent shall be allowed for rough surface blisters.

3.2 Verification of Dimensions — The dimensions of the locking devices shall conform to the requirements specified in **3** of IS : 2486 (Part III)-1974*.

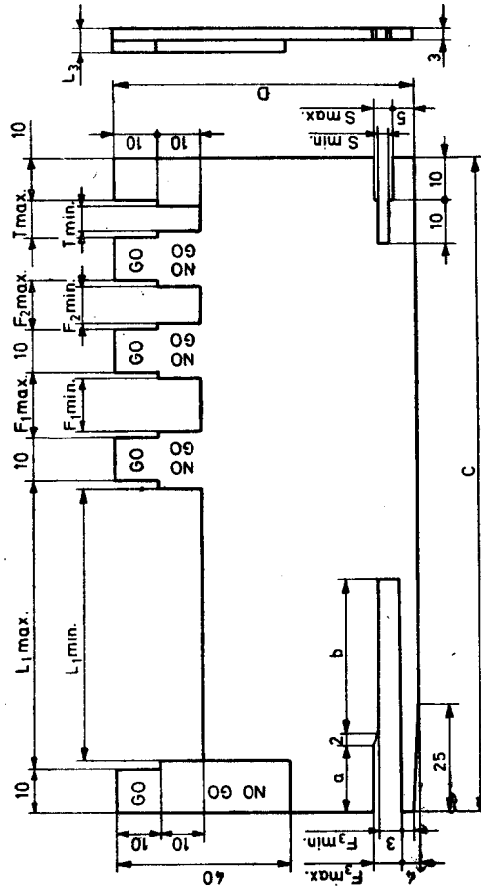
3.2.1 The dimensions for verification and the gauge for split-pins shall be as shown in Fig. 1.

NOTE — The gauge shown in Fig. 1 is only an example. Other configurations are also possible.

3.2.2 The dimensions for verification and the gauge for W-clips shall be as shown in Fig. 2.

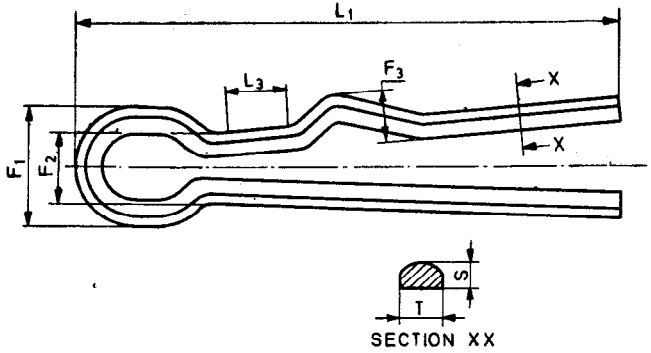
NOTE — It is important that, in forming the W-clips, extremity F_6 (*see* Fig. 2A) is approximately perpendicular to the axis when the clip is in locking position.

*Specification for insulator fittings for overhead power lines with a nominal voltage greater than 1 000 V: Part III Locking devices.



All dimensions in millimetres.

1A Gauge for Split-Pins



1B Dimensions of Split-Pins for Verification

All dimensions in millimetres.

STANDARD SIZE	L_1		L_3	F_1		F_2		F_3		T		S		a	b	DIMENSIONS $C \times D$
	Max	*Min*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*			
11	51·5	48·5	4·1	12·4	11·4	8·6	8·2	4·7	4·3	5	4·8	2·3	2·1	11	28	127·5×70
16A	66·5	63·5	4·7	15	14	10·7	10·3	5·7	5·3	5·7	5·5	3·3	3·1	13	37	147·9×70
16B	66·5	63·5	6	16·9	15·9	11·1	10·7	5·7	5·3	8·1	7·9	3·3	3·1	15	37	152·6×70
20	81·5	78·5	6	16·9	15·9	11·1	10·7	6·2	5·8	7·2	7	3·3	3·1	15	45	166·7×70
24	101·5	98·5	7·2	20·5	19·5	13·2	12·8	7·2	6·8	8·9	8·7	4·1	3·9	17	55	194·1×70

NOTE 1 — It is not considered necessary to show any tolerance appropriate to the manufacture or wear of the gauge.

NOTE 2 — Although the dimension L_3 *max* does not appear on the example of the gauge, it shall be checked.

FIG. 1 DIMENSIONS FOR VERIFICATION AND GAUGE FOR SPLIT PINS

3.3 Verification of Resistance to Bending

3.3.1 *Split-Pins* — The test shall be carried out on a sample taken from the straight part of a branch of the split-pin or on a sample selected from the profiled material from which the pins have been manufactured.

3.3.1.1 The test consists in bending through an angle of about 75° around a radius specified below on a straight part of a branch of the split-pin:

Standard couplings	11	16A	16B	20	24
Radius	2	3	4	4	5

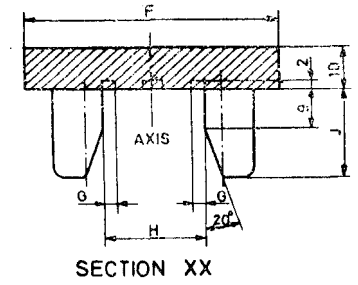
3.3.1.2 One end of the test piece shall be inserted into a vice, one of the jaws of which is covered with a lining piece made of steel with its surface at about 75° from the vertical position (*see* Fig. 3). By means of a wooden mallet, the test piece shall be bent against the inclined surface. The bend shall be made in the direction in which bending is carried out after fitting the split-pin in the socket. After bending, there shall be no sign of cracking.

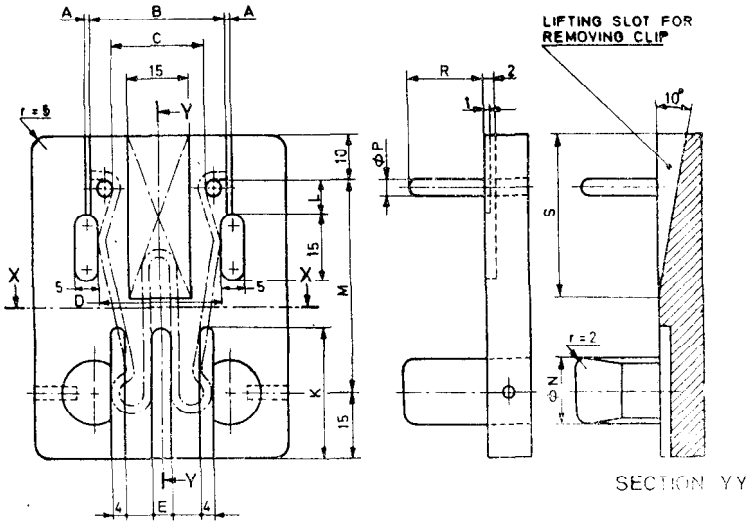
3.3.2 *W-Clips* — There shall be no bending test on W-clips, since the visual examination is considered sufficient to check that bending in manufacture has not caused any cracks or incipient cracks.

3.4 Hardness Test — The hardness test shall be carried out by any of the following methods on one of the flat surfaces of the locking device (the side opposite the rounding in the case of split-pins). A series of three measurements shall be carried out on each locking device. The average of the three measurements shall be as specified below:

Method of Measurement	*Hardness*	
	Split-pin	W-clip
Vickers (according to IS : 2866-1965*)	160 HV	150 HV
Brinell (according to IS : 3054-1965†)	152 HB	143 HB
Rockwell B Scale (according to IS : 1586-1968‡)	83·4 HRB	80·0 HRB

*Method for Vickers hardness test for copper and copper alloys.
†Method for Brinell hardness test for copper and copper alloys.
‡Methods for Rockwell hardness test (B and C scales) for steel (*first revision*).

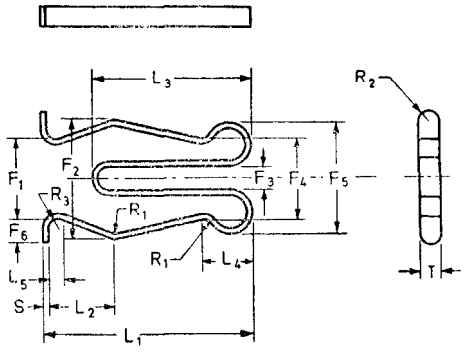




NOTE 1 — Dimensions *B*, *C*, *D*, *E* and *H* shall be symmetrical about the axis.

NOTE 2 — It is not considered necessary to show tolerances appropriate to the manufacture or wear of the gauge.

2A Gauge for W Clips



2B Dimensions of W-Clips for Verification

W-CLIP	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*	*K*	*L*	*M*	*N*	*P*	*R*	*S*
11	0·6	23	15	20	4	50	3	19	18	24	4·5	32	12	3	18	32
16A	1	32	22	28	5	60	2·5	24	20	30	8	44	15	4	18	32
16B	1	32	22	28	5	60	2·5	24	20	30	8	44	15	4	18	32
20	1	32	22	30	5	60	2·5	24	20	30	8	55	15	4	18	40
24	1	32	22	30	5	60	3	25	20	30	8	65	15	4	18	42

NOTE 1 — The clip shall be mounted in the gauge in the position shown, so that the nominal dimensions F_1 and F_5 are maintained by the pegs and stops respectively.

NOTE 2 — The grooves of width *A* correspond to the allowed tolerances of dimensions F_6. The ends of the "ears" of the clip must lie within the zone defined by these grooves.

NOTE 3 — Dimension *D* corresponds to the nominal overall width F_2 of the clip. The two recesses allow comparison between the clip and the nominal dimension.

NOTE 4 — Dimension *E* corresponds to the nominal width F_3 of the internal loop. The recess allows comparison between the clip and the nominal dimension.

NOTE 5 — The recesses of width *G* correspond to the difference between the nominal dimensions F_2 and F_4. The internal edges of these recesses allow comparison between the clip and the nominal dimension F_5.

NOTE 6 — Comparison of the clip with the nominal dimensions L_1, L_2, L_3 and L_4 shall be made by direct measurement.

NOTE 7 — Dimensions *S* and *T* on the clip shall be verified by direct measurement.

All dimensions in millimetres.

FIG. 2 DIMENSIONS FOR VERIFICATION AND GAUGE FOR W-CLIPS

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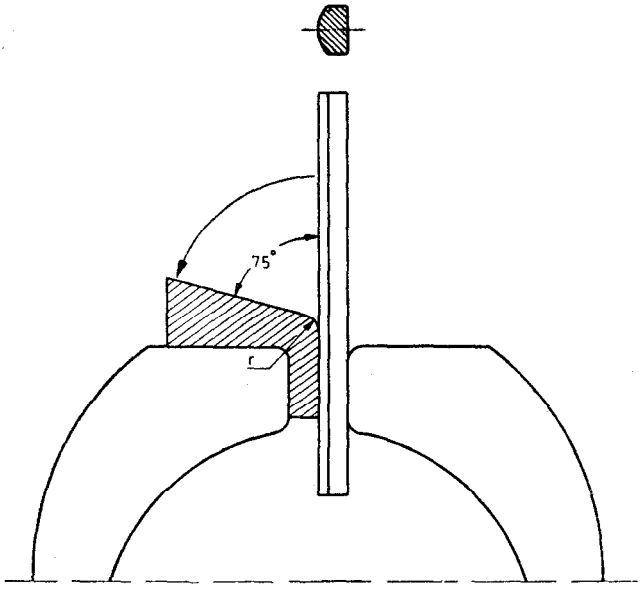


FIG. 3 BENDING TEST FOR SPLIT-PINS

3.5 Operation Test — The locking devices shall be kept in the locking position (*see* Fig. 4 for split-pins and Fig. 5 for W-clips) in a socket conforming to IS : 2486 (Part II)-1974* and to IS : 2486 (Part III)-1974†. When the socket is made of a ferrous metal, it shall be galvanized. There shall be no roughness, especially on the edges of the hole for locking device.

NOTE — In the case of locking devices presented for acceptance without sockets, the tests should be carried out in sockets conforming to IS : 2486 (Part II)-1974* and IS : 2486 (Part III)-1974† and, if possible, in sockets with which the locking devices are to be used.

3.5.1 *Split-Pins* — By means of an appropriate device, a load shall be applied to the eye of the split-pin along its axis. The load shall be increased gradually until the split-pin moves to the coupling position (*see* Fig. 4). The load F which causes the split-pin to move from the locking to the coupling position shall be between the values of F_{min} and F_{max} given below:

For standard coupling 11 $\begin{cases} F_{min} = 30 \text{ N} \\ F_{max} = 300 \text{ N} \end{cases}$

*Specification for insulator fittings for overhead power lines with a nominal voltage greater than 1 000 V: Part II Dimensional requirements (*first revision*).

†Specification for insulator fittings for overhead power lines with a nominal voltage greater than 1 000 V: Part III Locking devices.

For standard coupling 16A-16B-20-24

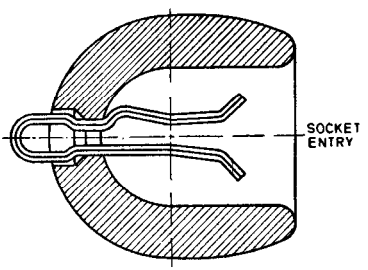
$$\begin{cases} F_{min} = 50 \text{ N} \\ F_{max} = 500 \text{ N} \end{cases}$$

The operation from the locking to the coupling position shall be carried out three times in succession. The values of the load F shall remain between F_{min} and F_{max} for the three operations. In addition, a load F_{max} shall be applied and this shall not cause complete removal of the split-pin from the socket.

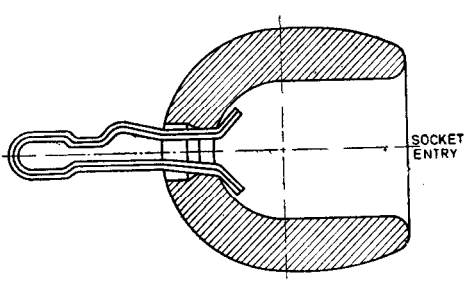
NOTE — In the case of split-pins made from very hard rust-resisting steels, loads of 300 N and 500 N may sometimes be insufficient to cause movement from the locking to the coupling position. Subject to agreement between the manufacturer and the purchaser, one of the following may be specified:

a) Higher values for F_{max} if live-line working methods permit higher loads, or

b) Lower values for dimension F_3 than those which are specified in IS : 2486 (Part III)-1974*.



4A Locking Position



4B Coupling Position

FIG. 4 LOCKING AND COUPLING POSITIONS OF SPLIT-PIN

*Specification for insulator fittings for overhead power lines with a nominal voltage greater than 1 000 V: Part III Locking devices.

3.5.2 *W-Clips* — By means of a steel bar of rectangular section whose length is F_5 and width T [*see* Fig. 5 of IS : 2486 (Part III)-1974*], a load F shall be applied to the two rounded extremities of the clip along its axis. This load shall be increased gradually until the W-clip moves to its coupling position (*see* Fig. 5). The load F which causes the W-clip to move from the locking to the coupling position shall be between the values of F_{min} and F_{max} given below:

For standard couplings 11-16A-16B-20-24 $\begin{cases} F_{min} = 25 \text{ N} \\ F_{max} = 250 \text{ N} \end{cases}$

The operation from the locking to the coupling position shall be carried out three times in succession. The values of the load F shall remain between F_{min} and F_{max} for three operations. In addition, a force F_{max} shall be applied and this shall not cause complete removal of the W-clip from the socket.

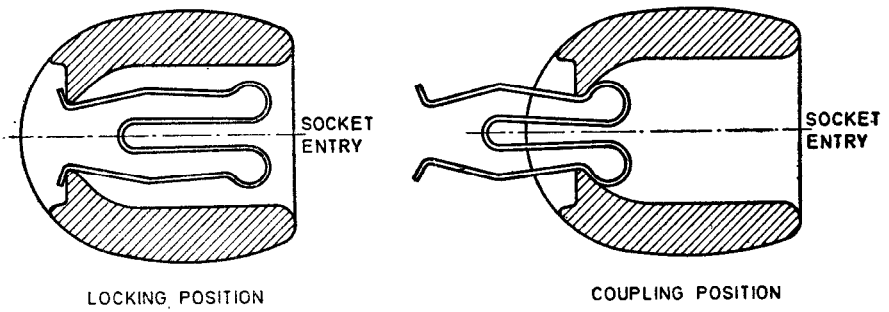


FIG. 5 LOCKING AND COUPLING POSITIONS OF W-CLIP

3.6 Test for Resistance to Internal Corrosion

3.6.1 This test shall be applicable to locking devices made of copper and copper alloys only.

3.6.2 This test is intended to verify that the locking devices have a good resistance to internal corrosion, sometimes called intercrystalline corrosion or stress corrosion.

3.6.3 This test is not concerned with corrosion due to corrosive atmospheric conditions or contact corrosion which occurs with different metals. This is not a problem with the copper alloys currently used in galvanized ferrous sockets.

*Specification for insulator fittings for overhead power lines with a nominal voltage greater than 1 000 V: Part III Locking devices.

3.6.4 The test shall be carried out in accordance with IS : 2305-1962*. At the end of the test, there shall be no sign of cracking.

NOTE — The test for resistance to internal corrosion depends on the material used for the manufacture of the locking devices. At present, it is not possible to specify tests for other materials and consideration is being given to devising suitable tests. The need to conduct tests with the locking device under tension is also left for future consideration.

APPENDIX A

(*Clause* 3.0.2)

SAMPLING PROCEDURE FOR LOCKING DEVICES

A-1. SCALE OF SAMPLING

A-1.1 Lot — In a consignment all the locking devices of the same size manufactured from the same material in the same factory under similar conditions of production shall be grouped together to constitute a lot.

A-1.2 The number of locking devices to be selected from each lot shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 1.

TABLE 1 SAMPLE SIZE AND ACCEPTANCE NUMBER

(*Clauses* A-1.2, A-2.1 *and* A-2.2)

LOT SIZE	FOR VISUAL EXAMINATION			FOR OTHER ACCEPTANCE TESTS
	Sample Size	Acceptance Number a_1	Acceptance Number a_2	Sample Size
(1)	(2)	(3)	(4)	(5)
Up to 500	32	1	5	2
501 to 1 000	50	2	7	3
1 001 to 3 000	80	3	10	5
3 001 to 10 000	125	5	14	7
10 001 and above	200	7	21	10

*Method for mercurous nitrate test for copper and copper alloys.

A-1.2.1 These locking devices shall be selected from the lot at random. In order to ensure randomness of selection, procedures given in IS : 4905-1968* may be followed.

A-2. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

A-2.1 The locking devices selected at random according to col 1 and 2 of Table 1 shall be examined visually for surface cracking, incipient cracks and rough surface blisters. A locking device failing to satisfy any of these requirements shall be termed as defective. The lot shall be considered as conforming to the requirements of visual examination if the number of defectives found in the sample for surface cracking or incipient cracks is less than or equal to the corresponding acceptance number given in col 3 of Table 1 and the number of defectives for rough surface blisters is less than or equal to the corresponding acceptance number given in col 4 of Table 1.

A-2.2 The lot which has been found as conforming to the above requirement shall then be subjected to other acceptance tests. For the purpose, the sample size shall be in accordance with col 1 and 5 of Table 1. The lot shall be considered as conforming to these requirements if no defective is found in the sample.

A-2.3 The lot shall be considered as conforming to the requirements of acceptance tests, if **A-2.1** and **A-2.2** are satisfied.

*Methods for random sampling.

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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