भारतीय मानक

Indian Standard

IS 4992 : 2024

मोर्टिस लॉक के लिए दरवाजे के हैंडल्स — विशिष्टि

(दूसरा पुनरीक्षण)

Door Handles for Mortice Locks — Specification

(Second Revision)

ICS 91.190

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

March 2024 **Price Group 7**

Builder's Hardware Sectional Committee, CED 15

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Builder's Hardware Sectional Committee had been approved by the Civil Engineering Division Council.

This standard covers requirements regarding materials, manufacture, dimensions, finish and performance of door handles of mortice locks used in doors, gates, etc for mortice locks covered in IS 16015 : 2022 ‘Mortice locks and latches (mechanically operated) — Specification (*first revision*)’.

This standard was first published in 1968 and was subsequently revised in 1975 in which the provision for use of extruded aluminium alloy section for the component door handle housing were incorporated.

In this revision, this standard has been brought out in light of the experience gained with the uses since its last version. Special attention has been given on performance tests. Major modifications made in this revision are as follows:

a) Various types of key hole profiles have been included;
b) Typical designs of handle cover plates and rosesets have been included;
c) Coding system have been introduced;
d) Performance test like axial strength test, durability test, salt spray test and fire resistance test have been introduced;
e) Reference clause to various Indian Standards has been updated; and
f) Marking clause has been updated.

In the formulation of this standard due weightage has been given to international coordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

The composition of the Committee responsible for formulation of this standard is given in Annex B.

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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. 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

DOOR HANDLES FOR MORTICE LOCKS — SPECIFICATION

(Second Revision)

1 SCOPE

This standard covers requirements of door handles that is lever door handle and door knobs for mortice locks used in doors, for operation of mortice locks (vertical type, sliding door locks and dead locks) covered in IS 16015.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publications, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 TERMINOLOGY

For the purpose of this document, following terms and definitions shall apply:

3.1 Centre Distance — Vertical distance measured from the center of handle axis to center of keyhole axis (*see* Fig. 1).

3.2 Coin Slot/Emergency Release — A slot provided on the rotating element on the external cover that enables the door to be opened in case of emergency with the help of any handy device like a screw driver or a coin (*see* Fig. 5).

3.3 Cover Plate/Back Plate — A elongated plate whose primary purpose is functional providing bearing for the rotation of door lever handle or knob and the means of attachment to the door and secondly, decorative, working as a trim plate to cover the holes provided in the door for passage of spindles, keys or cylinders (*see* Fig. 3B).

3.4 Door Knob — A fixed or rotatable operating element, of any ergonomic shape with a maximum offset of 75 mm from its axis of rotation. A rotating door knob engages with a spindle and is used to operate the latch mechanism (*see* Fig. 1B). Fixed door knobs (non-rotatable) are also referred to as ‘door pulls’.

3.5 External Cover Plate — A cover plate or roseset assembly that fit on the outer side of the door to the room (*see* Fig. 5).

3.6 Indicator — A device or an arrangement that is part of cover plate/roseset/escutcheon fixed on the door and which visually indicates whether the door is locked or unlocked (*see* Fig. 5).

3.7 Inner Cover Plate — Inside component of a two-piece cover plate which has provision of fixing on the door by means of fixing accessories which may guide or hold the mechanism (*see* Fig. 3B).

3.8 Internal Cover Plate/Internal Roseset — A cover plate or roseset assembly that fit on the inner side of the door to the room (*see* Fig. 5).

3.9 Key Hole Cover/Escutcheon — A part of hardware assembly that suitably surrounds the hole cut on the door panel which is primarily intended to protect door leaf from abrasion caused by keys or guide the key cylinder. It may house a cover or a mechanism to give protection against dust, sand, insects etc (*see* Fig. 4).

3.10 Lever Door Handle — A rotatable operating element designed as a lever with a length from its axis of rotation to its free end that exceeds 75 mm, and which engages a spindle passing through a door and is used to operate the latch mechanism (*see* Fig. 1A). Fixed lever handles (non-rotatable) are also referred to as ‘Door Pulls’

3.11 Outer Cover Plate/Trim Plate — Outside component of a two-piece cover plate which is fastened to the inner plate as decorative cover which may guide or hold the mechanism (*see* Fig. 3B).

3.12 Roseset — A handle assembly which is smaller in size which only accommodates spindle for operation of the latch bolt and is not extended to cover the holes made for key hole or cylinders (*see* Fig. 4).

3.13 Spindle — A shaft, usually square in cross section that engages with the suitable hole provided in the handle and transmits motion to the lock body follower.

3.14 Spring-Assisted Lever Handle — A lever handle assembly which incorporates a spring but it may not return the handle to “at-rest” position because of its heavy weight. It requires assistance of additional spring or engagement with latch mechanism to bring it to “at-rest” position.

NOTE — For exceptionally heavy lever handles, it is difficult to design springs that have sufficient torque to return the handles to their ‘at-rest’ position and also have an

adequate working life. springs, the operating angle of such lever handles is usually restricted to 40°, and they are used with latches whose bolts retract fully at this angle of operation. When in use, the combined action of the lever handle spring and the latch spring is sufficient to return the lever handle to its intended 'at-rest' position.

3.15 Sprung Lever Handle — A lever handle that incorporates a spring which fully returns the lever handle or knob to its intended 'at-rest' position after operating the latch.

NOTE — Sprung lever handles frequently includes an internal stop to prevent rotation beyond the intended 'at-rest' position, but this feature is not essential if the handle is used with a latch mechanism incorporating its own stop.

3.16 Thumb Turn — A small knob fitted on the internal plate/rose of a set of handle that operates a primary or secondary deadbolt to provide privacy rather than high security (*see* Fig. 5).

3.17 Un-Sprung Lever Handle — A lever handle which does not have a spring and which completely depends on latch mechanism to bring it to its 'at-rest' position.

4 DESIGN OF LEVER DOOR HANDLE, DOOR KNOB, HANDLE COVER PLATE AND ROSESET

4.1 Design of Lever Door Handle and Door Knob

Design of any lever door handle and door knob includes following major parameters that shall be declared by the manufacture along with the drawing.

a) Length of the cover plate with distance between the fixings screws and screw types;

b) Length of the lever and number of joints in lever. In case of knob, the offset dimensions; and

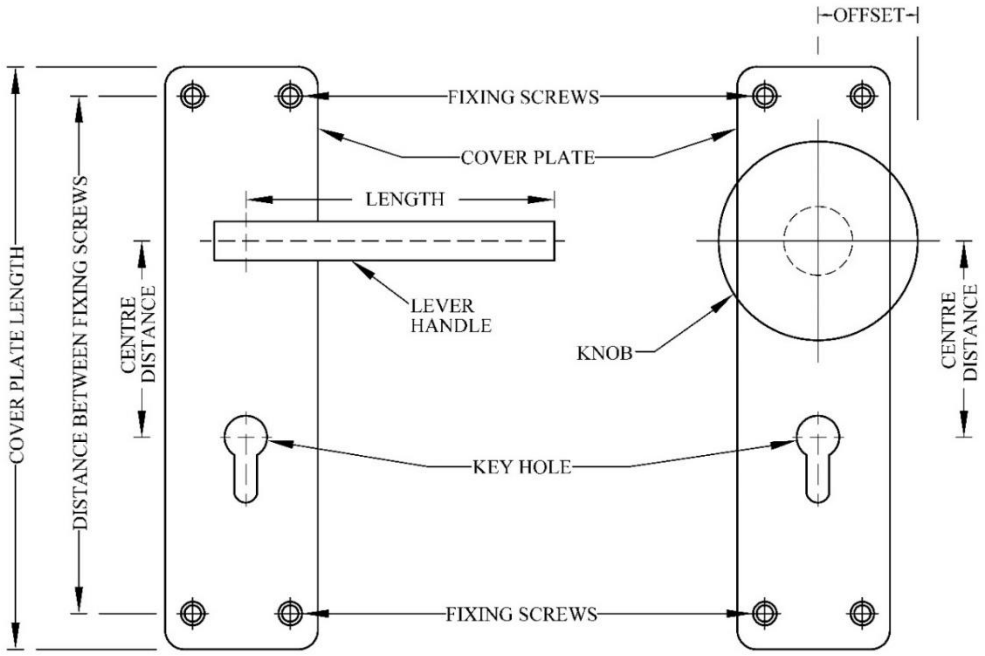
c) Weight of the lever door handle/door knob.

4.2 Key Hole Profiles

The typical shapes of key holes are given in Fig. 2. The manufacturers may use their own key hole profiles to match the shape of the key or profile of the cylinder proposed to be used with the lock.

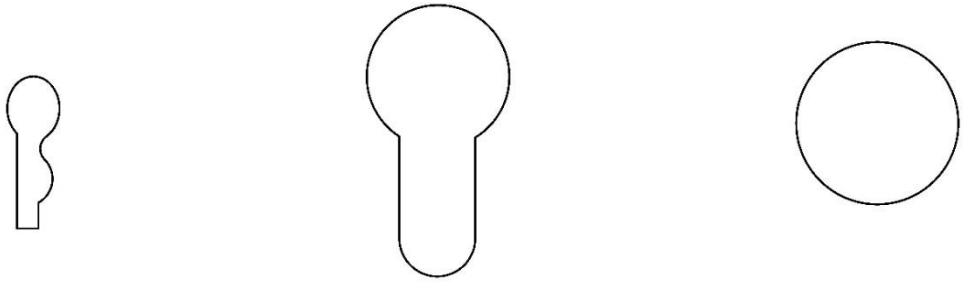
4.3 Design of Parts and Types of Handle Cover Plates and Rosesets

The typical examples of shapes of the handle cover plates and roseset handles given in Fig. 3A, 3B, 4, 5, 6, 7 and Fig. 8 are intended for illustration purpose only. Other shapes and designs may also be made as per manufacturer's design or as agreed to between the purchaser and the manufacturer. The manufacturers may use suitable material and finish for manufacturing of various components of the handle cover plates and rosesets. However, the assembly shall meet the requirements mentioned in 5 and 6.



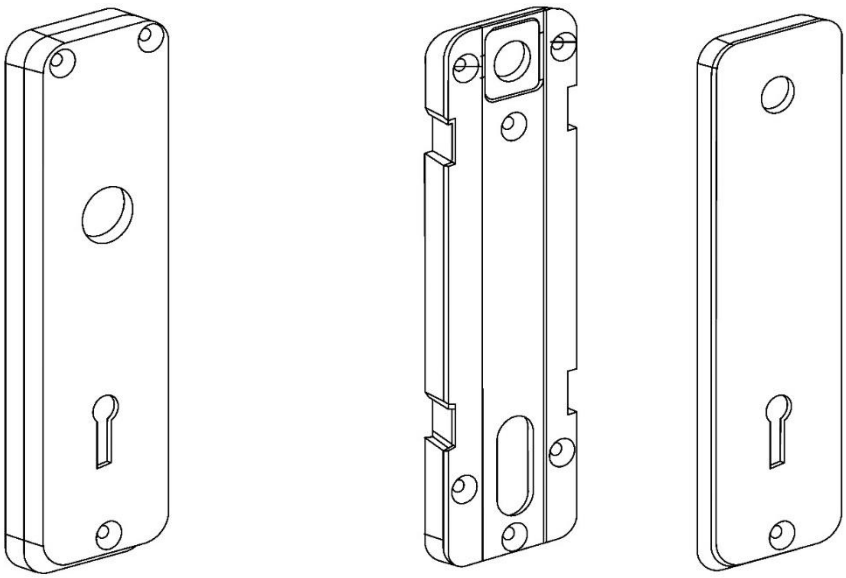
1A LEVER HANDLE TYPE 1B KNOB TYPE

FIG. 1 DOOR HANDLES FOR MORTICE LOCK



LEVER PROFILE EURO PROFILE SWISS PROFILE

FIG. 2 TYPICAL SHAPES OF KEY HOLE PROFILE



INNER COVER PLATE OUTER COVER PLATE

3A ONE PIECE COVER PLATE 3B TWO PIECE COVER PLATE

FIG. 3 TYPICAL SHAPE OF COVER PLATES

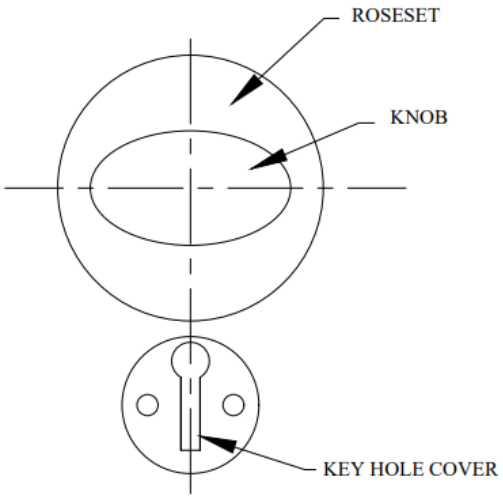


FIG. 4 EXAMPLE OF ROSESET

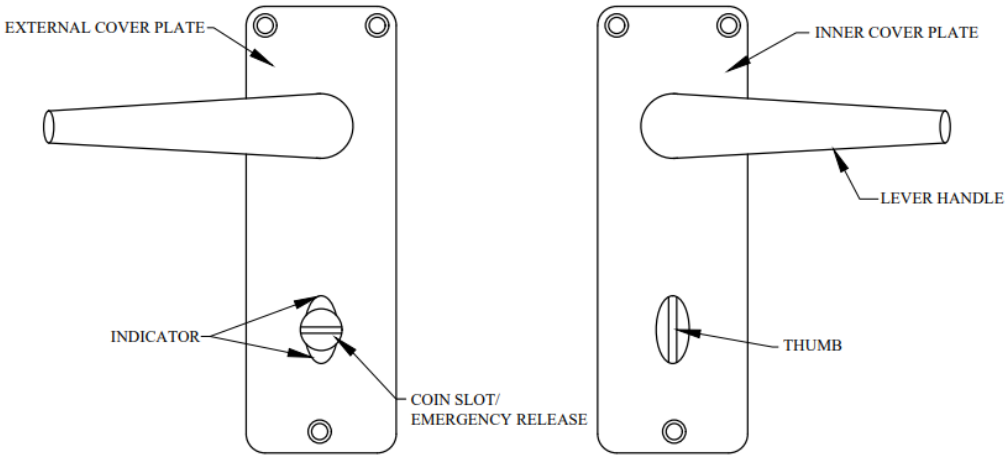


FIG. 5 TYPICAL BATHROOM HANDLE SET

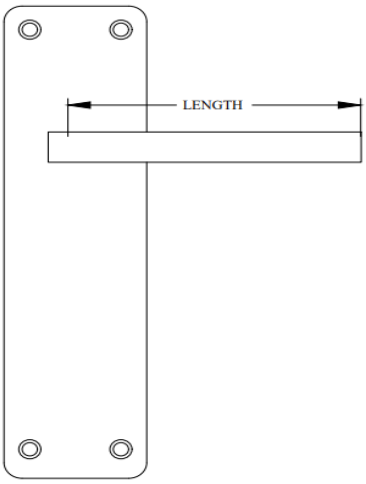


FIG. 6 TYPICAL DESIGN OF LATCH DOOR HANDLE COVER PLATE

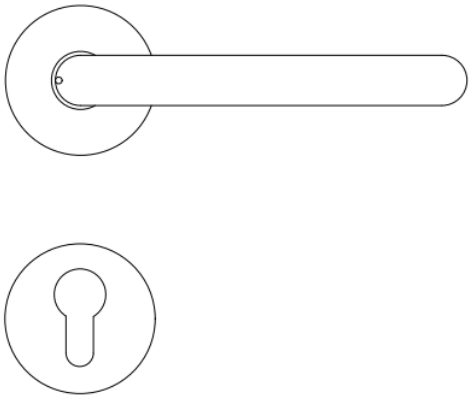
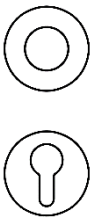
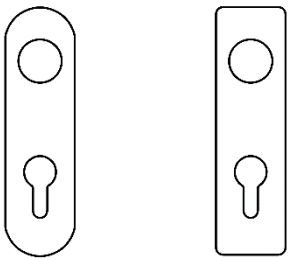


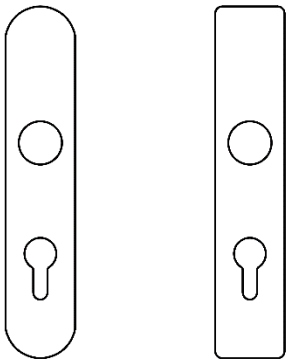
FIG. 7 TYPICAL DESIGN OF ROSESET HANDLE



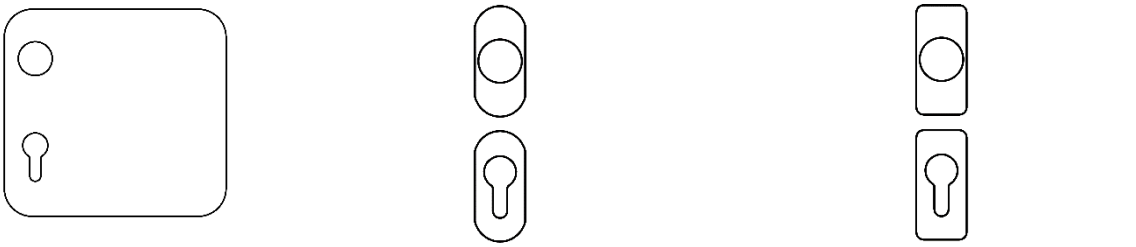
ROSESET AND ESCUTCHEON



SHORT BACK PLATE COVER ROUND AND RECTANGLE



LONG BACK PLATE COVER ROUND AND RECTANGLE



ROSESET AND ESCUTCHEON FOR SQUARE COVER | NARROW PROFILE ROSES AND ESCUTCHEON — OVAL SHAPE | NARROW PROFILE ROSES AND ESCUTCHEON — RECTANGLE SHAPE

FIG. 8 TYPICAL EXAMPLES OF LEVER HANDLE, ROSEST AND ESCUTCHEON

4.4 Dimensional Details

For reference purpose, centre distance of handle cover plate (*see* **3.1**) are given in Table 1.

Table 1 Reference Table for Centre Distance of Handle Cover Plate

(*Clause* 4.4)

Sl No.	Item	Centre Distance mm
(1)	(2)	(3)
i)	Main door cover plates	85 72
ii)	Interconnecting door cover plates	72 50

4.5 Fasteners

The manufacturer should supply suitable fasteners which are suitable for wooden doors/aluminum doors/metal doors along with the handles.

NOTE — As a practice, wood screws are used to fix the handles on wooden doors, machined screws are used to fix the handles on aluminum doors and through and through screws are used to fix the handles on the metal doors.

5 CLASSIFICATION

For the purpose of this standard, the door handles have been classified in accordance with the six-digit coding system mentioned in the subsequent clauses.

5.1 Digit 1 — Category of Use

Based on category of use, four grades have been identified.

a) *Grade* 1 (*Light Duty*) — Products under this category will be of light duty or low frequency and not recommended for any commercial application. There is a high incentive to exercise care of the product and small chances of misuse of the product in this kind of application. For example, residential apartments or internal doors.

b) *Grade* 2 (*Medium Duty*) — Products under this category will be of moderate duty and can be used for commercial application, where there is some incentive to exercise care. The products under this category are mostly used in offices as the user will exercise little care with some chance of misuse. For example, internal office doors or external doors of apartment.

c) *Grade* 3 (*Heavy Duty*) — High frequency of use by public with little incentive to exercise care, with a high chance of misuse. For example, Public buildings like multipurpose halls etc.

d) *Grade* 4 (*Very Heavy Duty*) — Subject to heavy traffic access to doors, tends to abrasive usage with no incentive to take care. For example, stadiums, barracks, malls, theatres etc.

5.2 Digit 2 — Durability

Based on the durability aspects, four grades are specified:

a) *Grade* 4 — 25 000 cycles of operation without failure;

b) *Grade* 5 — 50 000 cycles of operation without failure;

c) *Grade* 6 — 1 00 000 cycles of operation without failure; and

d) *Grade* 7 — 2 00 000 cycles of operation without failure.

5.3 Digit 3 — Test Door Mass

No classification. The test of 'door mass' is not applicable for this product. However, for classification code purpose the third digit of classification code shall be '-'.

5.4 Digit 4 — Fire Resistance

The fire resistance is categorized as below:

a) *Grade* 0 — Not suitable for use on fire/smoke check doors;

b) *Grade* 1 — Minimum fire resistance capacity 30 min;

c) *Grade* 2 — Minimum fire resistance capacity 60 min;

d) *Grade* 3 — Minimum fire resistance capacity 90 min;

e) *Grade* 4 — Minimum fire resistance capacity 120 min; and

f) *Grade* 5 — Minimum fire resistance capacity 180 min.

5.5 Digit 5 — Corrosion Resistance

Based on the resistance to corrosion, five grades have been identified as per IS 9844:

a) *Grade* 0 — No defined corrosion resistance;

b) *Grade* 1 — Mild resistance – up to 24 h (minimum requirement for internal use);

c) *Grade* 2 — Moderate resistance, up to 48 h (Interiors subject to condensation);

d) *Grade* 3 — High resistance – up to 96 h (minimum requirement for damp interior and external use);

e) *Grade* 4 — Very high resistance, up to 240 h (polluted exterior – industrial/ coastal); and

f) *Grade 5* — Extremely high resistance, up to 480 h (marine applications).

NOTE — Products intended to develop a natural patina (such as bare bronze or brass) are not required to comply with any corrosion requirements.

5.6 Digit 6 — Types of Operation

On the basis of operation, three digits have been identified towards operational aspects:

Grade A — Spring assisted handle;
Grade B — Spring loaded handle; and
Grade U — Un-sprung handle.

5.7 Example of Classification

For the door handle with heavy duty frequency of use, durability grade 6, fire resistance for 60 min, high corrosion resistance and spring loaded handle, the coding is as given below:

3	6	-	2	3	B

A handle or knob being tested for a particular grade of category of use shall fulfil test requirements mentioned for that particular grade in both Table 2 and Table 3.

6 TEST AND REQUIREMENTS

6.1 Fastening Elements and Spindle

The spindle and fastening elements shall be supplied or specified by the manufacturer with every set of handle. The manufacturer shall state clearly the door thickness or range of door thicknesses for which the handle is suitable. The fastening elements supplied along with the product or specified by the manufacturer shall be used to mount the handle on the testing fixtures during all the tests.

6.2 Axial Strength

The axial strength test shall be performed on samples that have not been subjected to any previous tests. When tested as per the procedure mentioned below, there shall be no failure of any component, and lever handles or knobs and shall still be operational after the test.

The sample set of lock or latch shall be mounted on the test block/door as per **6.1** and Fig. 9. The sample shall be subjected to a pre-load of 5 N ± 1 N, followed by a test force applied without shock in a direction away from the test block surface and perpendicular to it ± 2°. The forces shall be applied at a distance of 50 mm ± 1 mm from the axis of rotation.

Apply the pre-load, measure, and then record the distance from the face of the test block/door to the

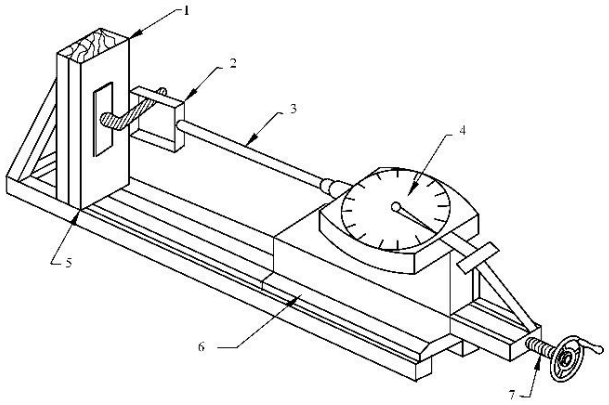
underside of the lever handle or knob bar, at a reference point 75 mm ± 2 mm from the axis of rotation.

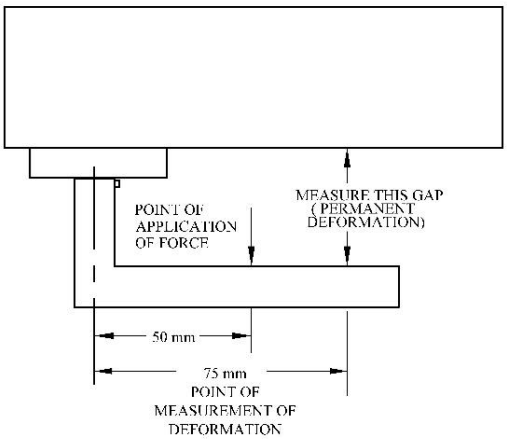
Apply the test force in accordance with Table 2. Maintain the test force for 60 s $^{+5}_{-0}$ s and then slowly reduce it back to the pre-load value of 5 N ± 1 N. Re-measure and record the distance from the face of the test block to the reference point on the lever handle or knob bar 75 mm ± 2 mm from the axis of rotation.

After testing, the permanent deformation for lever handles or knobs measured at the reference point 75 mm ± 2 mm from the axis of rotation shall not increase by more than 2 mm.

Repeat and record the measurements with the lever handle or knob rotated to a position 60° ± 5° from the 'at-rest' position as shown in Fig. 10 and Fig. 11, or at the maximum angle of rotation allowed by the design. The manufacturer has to declare the maximum angle of rotation allowed by the design before starting of the test.

The axial strength of fastening elements shall conform to requirements given in Table 2.

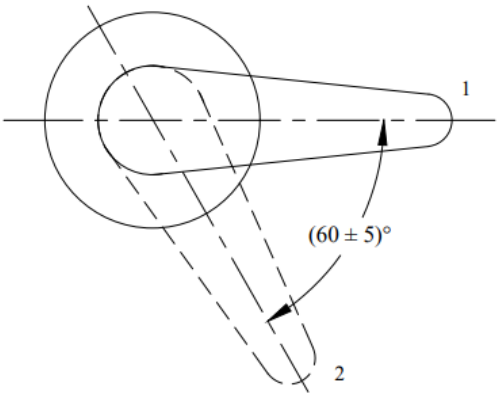




Key

1 Fixed mounting block
2 Handle attachment means
3 Cable
4 Dial gauge
5 Machine bed
6 Fixed saddle
7 Screw thread moveable side

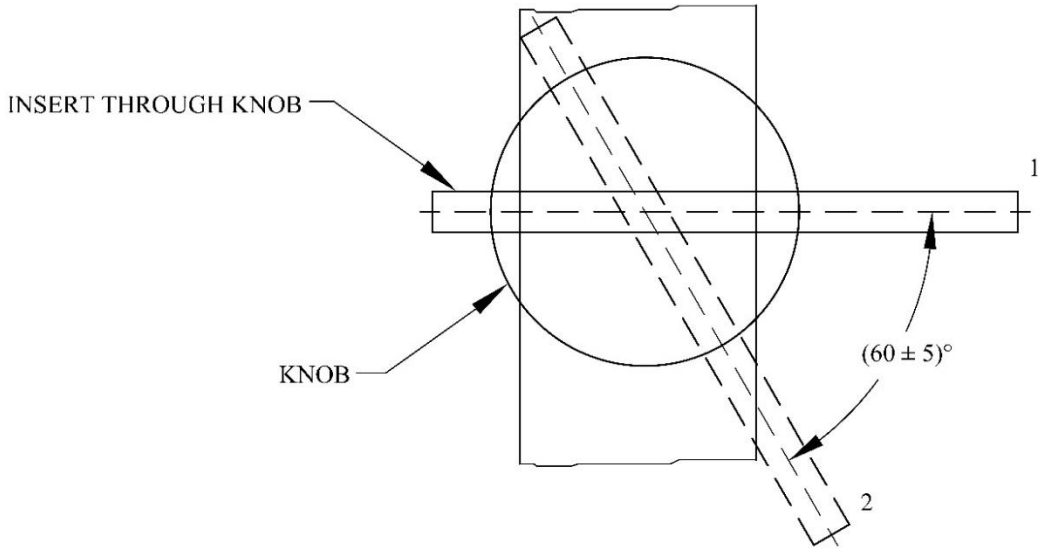
FIG. 9 TEST APPARATUS FOR AXIAL STRENGTH TEST



Key

1 At rest position
2 Position after rotation

FIG. 10 HANDLE ROTATION TERMINOLOGY



Key

1 At rest position

2 Position after rotation

FIG. 11 DOOR KNOB ROTATION TERMINOLOGY

6.3 Safety Requirements

When the lock or latch handle is fitted to the test block there shall be no sharp edges that can cause injury.

The design of handle or knob after fitting shall ensure that, it is not possible for the fingers of the user to be trapped between lever handle or knob and cover plate or rose over the full range of rotation of the lever handle or knob.

6.4 Durability of Mechanism

The durability test shall be performed on samples that have not been subjected to any previous tests.

The test apparatus should be capable of supporting the test block and attached handle or knob in a secured manner and capable of subjecting it to the required forces. A suitable test apparatus is illustrated in Fig. 12.

A force "P" as mentioned in Table 3, shall be applied to one of the lever handles or knobs by a cord carrying a suitable load that passes over a pulley whose axis is (500 ± 10) mm from the face of the test block. The position of the pulley shall be such that when the lever handle or knob is in its 'at-rest' position (*see* Fig. 10 and Fig. 11), the cord is perpendicular ± 2° to the plane of the test block (*see* Fig. 12).

For lever handles, the force shall be applied without shock and in a controlled manner, and at a point (50 ± 1) mm from the axis of rotation of the spindle. For knobs, the force shall be applied without shock and in a controlled manner, coaxially along the axis of rotation within ± 1 mm. Apply a force on the lever handle which is on the other side of the preloaded handle in value which is sufficient to rotate the lever handle or knob through the maximum angle permitted by the design of the handle. Release the handle back to its 'at rest' position (*see* Fig. 10 and Fig. 11), by removing this force. Repeat this application of force and then removal of the same for the durability number mentioned in Table 3.

The frequency of the application of this force should be between 20 to 30 cycles per minutes.

When tested as per the procedure mentioned above, while it is understood that the internal components may undergo wear, there shall be no failure of any component, and lever handles or knobs and shall still be operational after the test.

After every 5 000 cycles the test can be stopped for not more than 30 min to externally examine whether there is any failure of the components or the handle or knob by not removing the same from the testing apparatus. The cable can be removed by the inspector during this external test. The handle and cover plate can be cleaned suitably and lubricated externally during this examination.

The manufacturer can provide any suitable lockbody which is compatible with the handle or knob for the testing purpose. If the lockbody or its components undergoes any failure during the durability test of the handle or knob, the lockbody should be replaced with another lockbody of same specification and the durability test can be continued for remaining numbers of cycles to meet the requirement of number of cycles mentioned in Table 3.

Table 2 Requirement of Axial Strength Test

(*Clauses* 5.7 *and* 6.2)

Sl No.	Description	Category of Use Acceptance Criteria			
		Grade 1	Grade 2	Grade 3	Grade 4
(1)	(2)	(3)	(4)	(5)	(6)
i)	Axial strength:				
	a) Axial strength $^{+5}_{-0}$ percent at (50 ± 1) mm;	100 N	200 N	400 N	800 N
	b) Pre-load ± 1N at (50 ± 1) mm; and	5 N	5 N	5 N	5 N
	c) Permanent deformation at (75 ± 1) mm.	≤ 2 mm	≤ 2 mm	≤ 2 mm	≤ 2 mm

6.5 Corrosion Resistance

The corrosion resistance test shall be performed on samples that have not been subjected to any previous tests. All the surfaces of the lever handle or knob which are visible when fitted in service, when tested for neutral salt spray test as per IS 9844, shall conform to the classification mentioned in 5.5.

NOTE — Products intended to develop a natural patina (such as bare bronze or brass) are not required to comply with any corrosion requirements.

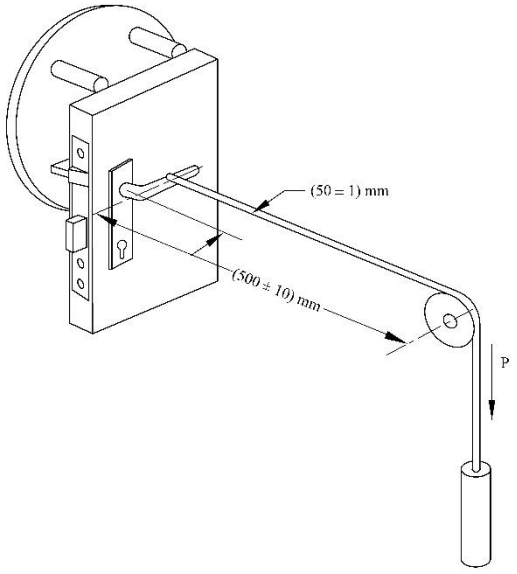


FIG. 12 TEST APPARATUS FOR DURABILITY TESTS

Table 3 Requirement of Durability Test

(*Clauses* 5.7 *and* 6.4)

Sl No.	Description	Category of Use Acceptance Criteria			
		Grade 1	Grade 2	Grade 3	Grade 4
(1)	(2)	(3)	(4)	(5)	(6)
i)	Durability:				
	a) Number of cycles $^{+1}_{-0}$ percent; and	25 000	50 000	1 00 000	2 00 000
	b) Force "P" $^{+5}_{-0}$ percent.	–	40 N	40 N	40 N

6.6 Fire Resistance Test

This requirement is based on the evaluation of product on test door assemblies as per IS 3614 or other individual test for use on fire rated door. The manufacturer shall indicate the method of fixing which may be used, together with the details of any additional material necessary to achieve the required performance under this test. The product shall conform to the classification mentioned in 5.4.

7 SAMPLING AND CRITERIA FOR CONFORMITY

7.1 Scale of Sampling

7.1.1 *Lot*

In any consignment, all the lever door handles or knobs for mortice lock of the same design (*see* 4.1), classification (*see* 5) and manufactured from the same materials under essentially similar conditions of production in one day shall be grouped together to constitute a lot.

NOTE — For grouping and testing purpose, lever door handles/ door knob with higher classification may be tested to cover all the lower classifications of same design (*see* 4.1).

7.1.2 The number of door handles, to be selected from a lot, shall depend upon the size of the lot and shall be in accordance with col (2) and col (3) of Table 4. These door handles shall be selected at random for at least 10 percent of the packages subject to a minimum of 3, equal number of door handles being selected from each such package. In order to ensure the randomness of selection, procedure given in IS 4905 may be followed.

7.2 Number of Tests and Criteria for Conformity

7.2.1 Each of the handle selected in accordance with col (2) and col (3) of Table 4 shall be tested as per 5 and 6. A handle failing in any one or more of the requirements for the characteristics shall be considered as defective handle.

7.2.2 A lot shall be considered as conforming to the requirement of this standard if the number of door handles for mortice lock among those tested does not exceed the corresponding number given in col (4) of Table 4, otherwise the lot shall be deemed as not meeting the requirements of this standard and shall be rejected.

8 MARKING

8.1 Each door handle/door knob for mortice lock shall be legibly and indelibly marked with the following information

a) Manufacturer's name or trade-mark; and
b) Classification as per 5.

8.2 BIS Certification Marking

The product conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder and the product may be marked with the Standard Mark.

9 PACKING

9.1 The door handles for mortice lock shall be suitably packed in cartons. Each carton shall be legibly and indelibly marked with the following:

a) Manufacturer's name and registered trade-mark, if any;
b) Address of the manufacturer;
c) Classification as per 5;
d) Quantity in the package; and
e) Date of manufacture and Lot/Batch No.

9.2 Each packing box shall contain an instruction leaflet regarding use of the door handle for mortice lock.

Table 4 Scale of Sampling and Permissible Number of Defective Handles

(*Clauses* 7.1.2, 7.2.1 *and* 7.2.2)

Sl No.	Lot Size	Sample Size	Permissible No. of Defective Handles
(1)	(2)	(3)	(4)
i)	Up to 100	5	0
ii)	101 to 150	8	0
iii)	151 to 300	13	0
iv)	301 to 500	20	1
v)	501 to 1 000	32	2
vi)	1 001 and above	50	3

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*	*IS No.*	*Title*
IS 3614 : 2021	Fire doors and doorsets — Specification (*first revision*)		and anodized aluminium coatings by neutral salt spray test
IS 4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)	IS 16015 : 2022	Mortise locks and latches (mechanically operated) — Specification (*first revision*)
IS 9844 : 1981	Methods of testing corrosion resistance of electroplated		

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Builder's Hardware Sectional Committee, CED 15

Organization	*Representative(s)*
In Personal Capacity (*1421 Sector A, Pocket B and C, Vasant Kunj, New Delhi - 110070*)	SHRI B. MAJUMDAR **(*Chairperson*)**
Allied Anodisers, Kolkata	SHRI SUSHIL TAWAR
Argent Industries, New Delhi	SHRI ANIL CHADHA SHRIMATI VANITA CHADHA (*Alternate*)
Builders Association of India, New Delhi	SHRI NEERAV PARMAR SHRI H. S. PSRICHA (*Alternate*)
Central Public Works Department, New Delhi	SHRI M. K. MALLICK SHRI DIVAKAR AGRAWAL (*Alternate*)
CSIR - Central Building Research Institute, Roorkee	SHRI S. K. NEGI SHRI CHANDAN SWAROOP (*Alternate*) SHRI V. CHAKRADHAR (*Alternate*)
D. P. Garg and Company Pvt Ltd, Noida	SHRI S. M. GARG SHRI R. C. MALHOTRA (*Alternate*)
Dormakaba India Pvt Ltd, New Delhi	SHRI HANISH ARORA SHRI TAPAN CHUGH (*Alternate*)
Godrej and Boyce Manufacturing Company Ltd, Mumbai	SHRI KSHITIJ R. GAIKAR SHRI VINAYAK G. NALGIRKAR (*Alternate*)
Hettich India Pvt Ltd, Mumbai	SHRI VIRENDRA KUMAR SHRI INDU KUMAR SHARMA (*Alternate*)
Hindalco Industries Ltd, Sonbhadra	SHRI JAYANTA RANASINGH DR SAIKAT ADHIKARI (*Alternate*)
Intertek India Pvt Ltd, Gurugram	SHRI POORNESH KUMAR CHATURVEDI SHRI GARISH MALHOTRA (*Alternate*)
Jindal Stainless Ltd, New Delhi	SHRI RAJEEV GUPTA SHRIMATI NISHA GOEL (*Alternate*)
Kich Architectural Products Pvt Ltd, Rajkot	SHRI BHAVDEEP K. NAKUM SHRI ANIL VANJANI (*Alternate*)
LGF Sysmac India Pvt Ltd, New Delhi	SHRI ASHIM CHUGH
M. C. Mowjee and Company Pvt Ltd, Kolkata	SHRI RUSHD MOWJEE SHRI SAJID MOWJEE (*Alternate*)
MECH (India) Industries, Delhi	SHRI SUDHIR BATRA SHRI SAMEER ARORA (*Alternate*)

Organization	*Representative(s)*
Metalurgical Services Pvt Ltd, Mumbai	SHRI NAGENDRA HEBBAR SHRI NEEL THAKAR (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi	SHRI SOMESH KUMAR COL N. CHAKRABORTY (*Alternate*)
Ministry of Micro, Small and Medium Enterprises, New Delhi	SHRI D. KIRAN KUMAR SHRI A. SURESH (*Alternate*)
Shakti Hormann Pvt Ltd	SHRI SYED MOHAMED SHRI MAHESH SINGH (*Alternate*)
South India Agencies, Bengaluru	SHRI MUKESH PURSHOTAM DAS SHRI GAUTAM DINESH (*Alternate*)
The Indian Institute of Architects, Mumbai	SHRI ABHIJIT RAY
BIS Directorate General	SHRI ARUN KUMAR S., SCIENTIST 'E'/DIRECTOR AND HEAD (CIVIL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI SINAM HUDSON SINGH
SCIENTIST 'D'/JOINT DIRECTOR
(CIVIL ENGINEERING), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: CED 15 (20020).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi