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SPECIFICATION FOR METAL ROLLING SHUTTERS AND ROLLING GRILLS

(First Revision)

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

Indian Standard

SPECIFICATION FOR METAL ROLLING SHUTTERS AND ROLLING GRILLS

(*First Revision*)

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(*Continued on page 2*)

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Indian Standard

SPECIFICATION FOR METAL ROLLING SHUTTERS AND ROLLING GRILLS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 29 May 1979, after the draft finalized by the Doors, Windows and Shutters Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Rolling shutters are being largely provided at the entrances of shops, garages, godowns and even in workshops, power houses, mills and factories for affording protection and safety. Rolling grills, which operate on the same principle as rolling shutters, are being provided for showrooms and display windows for exhibiting any goods while ensuring safety. These may also be used in conjunction with rolling shutters where it is desired to have certain amount of ventilation combined with safety.

0.2.1 This standard was first published in 1971. In this revision modifications have been made regarding the size of the guide channel and material specifications. Besides, provisions have also been made for a square bar for extra tying of bracket-plate to guide channel.

0.3 This standard contains Appendix A which requires the purchaser to supply certain technical information at the time of placing orders.

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

0.5 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*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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

1. SCOPE

1.1 This standard lays down the requirements regarding materials, fabrication and finish of metal rolling shutters and rolling grills for normal use.

NOTE — Since the term 'rolling shutters' is more commonly used, the reference in this standard is mainly to rolling shutters. However, since rolling shutters and rolling grills are similar in design, construction and operation, all references to rolling shutters in this standard shall apply to rolling grills also. A separate clause (see 9) dealing with the special features of rolling grills, as different from rolling shutters, has also been incorporated.

2. TERMINOLOGY

2.0 For the purpose of this standard, the main component parts of rolling shutters shall be defined as given in 2.1 to 2.12 (*see also* Fig. 1)

2.1 Bottom Lock Plate — The fabricated bar inserted at the bottom of rolling shutter curtain, so as to lie against the sill, including the slide bolts, pulling handles, etc.

2.2 Bracket Plates — The supporting plates at either end on the top, together with the U-shaped clamps supporting the entire moving mechanism of the rolling shutter.

2.3 Crank Handle — The winding handle used for raising and lowering mechanical gear-operated rolling shutters through a bevel gear box.

2.4 Curtain — The main apron of the rolling shutter consisting of the assembly of lath sections end-locking clips and the connecting pieces at the top.

2.5 Guide Channels — The channels on either side in which the shutter moves up and down.

2.6 Hood Cover — A sheet metal cover bent into a suitable shape for covering the roller.

2.7 Lath Sections — The individual rolled interlocking laths or slats with which the rolling shutter curtain is assembled.

2.8 Overall Height — The distance between the sill and the top of the bracket plate of the rolling shutter plus an allowance of not more than 150 mm.

NOTE — The allowance is meant for taking care of the extra curtain height required for partly covering the roller in the closed position.

2.9 Overall Width — The outer distance between the backs of the two guide channels of the rolling shutter.

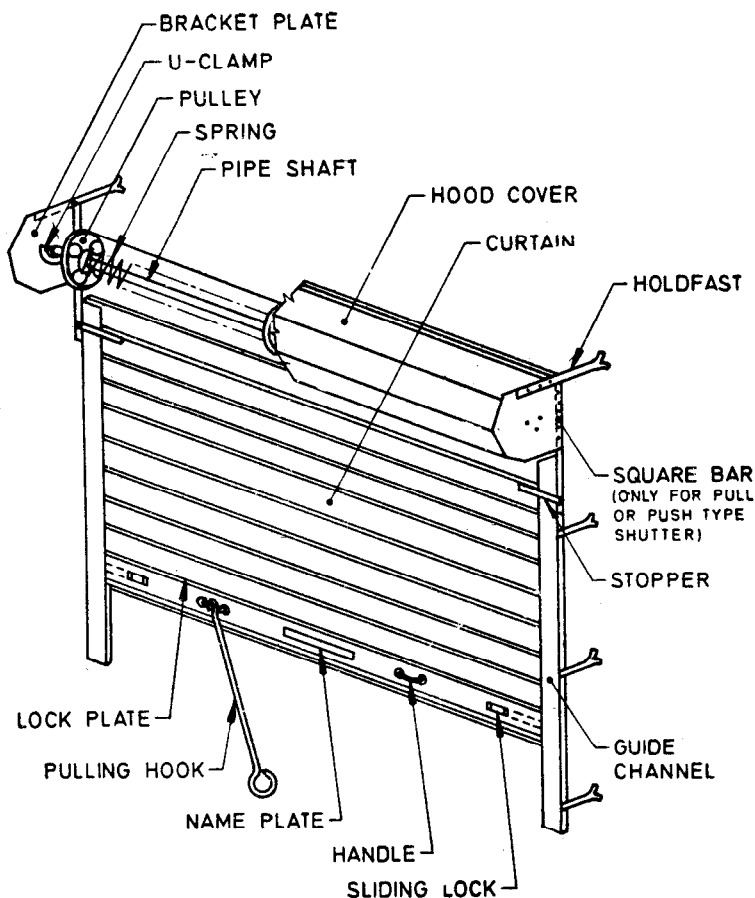


FIG. 1 COMPONENT PARTS OF SELF-COILING ROLLING SHUTTER

2.10 Pulling Hook — The steel rod shaped into a hook at one end and into a ring at the other, used for raising and lowering self-coiling type rolling shutters.

2.11 Roller — The entire rolling portion at the top of the shutter including the suspension shaft, the pulleys, the springs and ball bearing, if any.

2.12 Stopper Height — The stopper height of a rolling shutter shall be the height as measured from the sill to the bottom of the lock plate, when the rolling shutter is in the full open position.

3. SIZES

3.1 The size of a rolling shutter shall be denoted by specifying the clear width (W) and the clear height (H) of the opening for which the rolling shutter is required, in the following manner, care shall be taken to mention the width first always:

$$2\ 500\ (W) \times 3\ 500\ (H)\ \text{mm}$$

3.1.1 The clear size of rolling shutters shall be defined and identified as given in 3.1.1.1.

3.1.1.1 Clear size — The clear size of a rolling shutter, to suit any opening, shall be arrived at by measuring the opening as follows:

- a) *Clear width* — The clear distance between the two jambs of the opening.
- b) *Clear height* — The clear distance between the sill and the soffit (bottom of lintel) of the opening.

NOTE — It is recommended that all openings for taking rolling shutters be designed with width and length rounded off to 0.2 m.

3.2.2 Stopper Height — The maximum available stopper height shall be 10 cm less than the clear height of the rolling shutter, although special arrangements may be made for the stopper height to be equal to the clear height, in exceptional cases. The stopper height shall always be specified by the user, whenever there is a minimum height stipulation for the clearance of vehicles, goods; etc, through the rolling shutter in the open position.

4. TYPES BASED ON POSITION OF FIXING

4.1 The different types of rolling shutters based on standard positions of fixing and the standard designations applicable to them shall be as given in Table 1 (*see also* Fig. 2).

5. TYPES OF SHUTTERS AND APPLICABLE SIZES

5.1 Rolling shutters shall be supplied in the following alternative types based on different methods of operation (*see* 8). The size range applicable to each type shall be as follows:

- a) *Self-Coiling Type (Push-Pull Type or Manual Type)* — It shall be used up to a maximum of about 8 m² clear area without ball bearings and up to a clear area of about 12 m² with ball bearings.

- b) *Gear-Operated Type (Mechanical Type)* — It shall be fitted with ball bearings. It shall be used up to a maximum of about 25 m² clear area, if the rolling shutter is operated by a bevel gear-box and crank handle and up to a maximum of about 35 m² clear area, if the rolling shutter is operated by chain wheel and hand chain, mounted directly on the worm shaft.
- c) *Electrically Operated Type* — It shall be used up to a maximum of about 50 m² clear area.

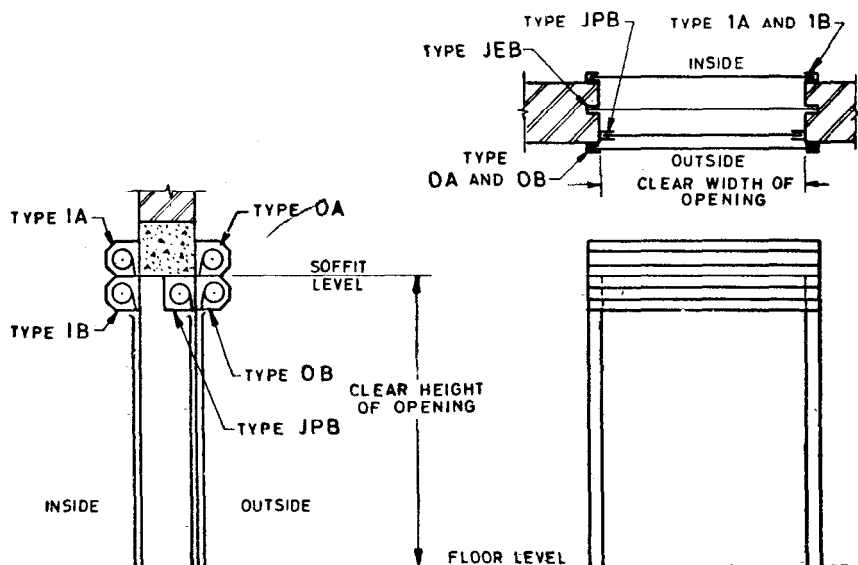


FIG. 2 METHOD OF FIXING ROLLING SHUTTERS

6. MATERIALS

6.1 Cold-Rolled Steel Strips — Cold-rolled steel strips used for rolling shutter lath sections shall conform to temper No. 5, Dead soft quality of IS : 4030-1973*.

6.2 Mild Steel Sections — Mild steel sheets and plates used for manufacturing the guide channels, brackets and lock plate shall be of hot-rolled steel of thickness not less than 3.15 mm and shall be free from surface defects and edges cleanly sheared (see IS : 5986-1970†).

*Specification for cold-rolled carbon steel strip for general engineering purposes (first revision).

†Specification for hot-rolled steel plates and flats for cold-forming and flanging operations.

**TABLE 1 TYPES OF SHUTTERS BASED ON STANDARD
POSITION OF FIXING**

(Clause 4.1)

DESIGNATION	REPRESENTING	DESCRIPTION
(1)	(2)	(3)
Type IA	Inside and above soffit	With guide channels overlapping the jambs on the inside face of the wall on either side and with the roll on the face of the lintel inside
Type IB	Inside and below soffit	With guide channels as in Type IA, but with the roll below soffit level inside
Type OA	Outside and above soffit	With guide channels overlapping the jambs on the outside face of the wall on either side and with the roll on the face of the lintel outside
Type OB	Outside and below soffit	With guide channels as in Type OA, but with the roll below soffit level outside (where sunshades, CHAJJAS, etc, project from the soffit level)
Type JPB	Jamb, projecting and below soffit	With guide channels projecting into the opening in front of the jambs and with the roll mounted in between the jambs just below soffit level (for example, when a large opening is surrounded by concrete columns on either side and a concrete beam on top)
Type JEB	Jamb, embedded and below soffit	With guide channels embedded inside the jambs in grooves and with the roll mounted in between the jambs (slightly recessed at the top) just below soffit level. The exact position where the guide channel is to be embedded in the thickness of the wall is left to the preference of the user, as it will not affect the fabrication

6.3 Steel Pipes — Mild steel pipes used for the suspension shaft of the roller shall be heavy duty pipe suitable for mechanical purposes and shall conform to IS : 1161-1968*.

6.4 Cast Iron Castings — Cast iron castings used for roller pulley wheels, U-clamps and bevel gears shall be free from blow holes, surface defects, such as cracks, burns, etc, and shall conform to Grade 15 of IS : 210-1970†.

6.5 Springs — The springs used in the roller for counterbalancing the rolling shutter shall be made either from high tensile spring steel wire or flat spring steel strip.

6.5.1 The spring steel wire used for helical spring shall conform to Grade 2 of IS : 4454 (Part I)-1975‡.

6.5.2 Flat spring steel strip used for spiral spring shall be from 0.8 to 1.0 percent carbon steel strip, specially hardened and tempered.

6.6 Malleable Cast Iron — Malleable cast iron used for clips shall conform to IS : 2108-1962§.

6.7 Aluminium Alloy Sheets — Aluminium alloy sheets to be used for curtain in case of rolling grills, shall conform to 52000 (NS 4), 53000 (NS 5) or 64430 (HS 30) of IS : 737-1974||.

6.8 Aluminium Alloy Extrusions — Aluminium alloy extrusion for the components of rolling shutters of aluminium shall conform to 53000 (NE 5) or 64430 (HE 30) of IS : 733-1975¶.

7. FABRICATION

7.1 Curtain — The curtain shall be built up of interlocking lath section formed from cold-rolled steel strips (see 6.1). The thickness of the sheets from which the lath sections have been rolled shall be not less than 0.900 mm for shutters up to 3.5 m width and not less than 1.20 mm for shutters above 3.5 m width. Curtain above 9 metres in width should be divided into 2 parts with provision of one middle fixed or movable guide channel or supported from the back side to resist wind pressure. The lath

*Specification for steel tubes for structural purposes (second revision).

†Specification for grey iron castings (second revision).

‡Specification for steel wires for cold-formed springs: Part I Patented and cold drawn steel wires — unalloyed (first revision).

§Specification for blackheart malleable iron castings.

||Specification for wrought aluminium and aluminium alloys, sheet and strip (for general engineering purposes) (second revision).

¶Specification for wrought aluminium and aluminium alloy, bars, rods and sections (for general engineering purposes) (second revision).

section shall be rolled so as to have interlocking curls at both edges and a deep corrugation at the centre with a bridge depth of not less than 12 mm to provide sufficient curtain stiffness for resisting manual pressure and normal wind pressure (see Fig. 3). Each lath section shall be continuous single piece without any welded joint. When interlocked, the lath sections shall have a distance of 75 mm between rolling centres, although lath sections with 50 mm and 25 mm rolling centres may be used for special purposes, like small show windows, bus windows, etc. Each alternate lath section shall be fitted with malleable cast iron or mild steel clips securely riveted at either end, thus locking the lath section at both ends and preventing lateral movement of the individual lath sections. The clips shall be so designed as to fit the contour of the lath sections.

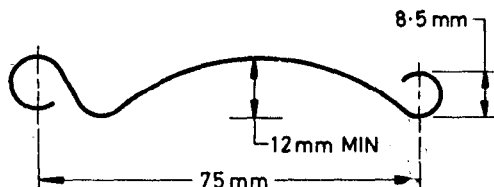


FIG. 3 TYPICAL LATH SECTION

7.2 Lock Plate — A fabricated lock plate of riveted construction made of mild steel sheet of not less than 3.15 mm thickness, reinforced with mild steel angle section of not less than $35 \times 35 \times 5$ mm size at the bottom, shall be interlocked with bottommost lath section of curtain so as to provide contact against the sill, when closed. Alternatively, the lock plate may also be fabricated out of unequal mild steel angles or 'Tee' section, of not less than 5 mm thickness. The lock plate shall be fitted with sliding bolts at either end to engage with suitable receiving pockets at the bottom of guide channels. The sliding bolts shall be capable of being locked by means of padlocks both from outside and inside. The lock plate shall also be provided with pulling handles, one handle for widths up to 2.5 m and two handles for widths of above 2.5 m. Pulling handles shall be fixed on both the interior side and exterior side of the lock plate.

7.3 Guide Channels

7.3.1 The guide channels shall be of mild steel deep channel section and of rolled, pressed or built up (fabricated) construction. The thickness of the sheet used shall not be less than 3.15 mm. The depth of the guide should be such that there is sufficient clearance between the curtain and the inner surface of the guide to avoid any rubbing or obstruction for free movement of the curtain. The curtain shall project into the guide at least 40 mm up to 3.5 m width and 60 mm for greater width and there

shall be a clearance of 10 mm minimum between the guide wall and the end clips of the curtain to permit free movement of the curtain under normal wind pressure. Where the shutter is installed in heavy windy zones special wind locking arrangements shall be provided to prevent the curtain coming out of the guide.

7.3.1.1 The gap, on either side, between the edge of curtain and the inside edge of the guide channel shall be about 5 mm to allow for the free movement of the curtain and at the same time to prevent rattling of the curtain due to wind.

7.3.1.2 *Size of the guide channel* — The depth and width of the guide channel shall be as under:

a) *Depth*

<i>Clear width of shutter</i>	<i>Depth of guide channel, Min</i>
Up to 3.5 m	65 mm
3.5 m up to 8 m	75 mm
8 m and above	100 mm

b) Width of guide channel shall be 25 mm for lath sections with bridge depth of about 12 mm and 32 mm for lath sections with bridge depth of about 16 mm.

7.3.2 Each guide channel shall be provided with a minimum of three fixing cleats or supports for attachment to the walls or column by means of bolts or screws. The spacing of cleats shall not exceed 0.75 m. Alternatively, the guide channels may also be provided with suitable dowels, hooks or pins for embedding in the walls.

7.3.3 The guide channels shall be attached to the jambs, plumb and true, either in the overlapping fashion, projecting fashion or embedded in grooves, depending on the method of fixing.

7.3.4 For OA and OB Type fixings, the guide channels shall have a box welded on at the bottom to conceal the end of the slide bolt.

7.4 Bracket Plate — The bracket plate shall be fabricated out of mild steel of 3.15 mm thickness (minimum), thicker plates may be used depending upon the height of shutter. The size of the bracket plate for

different heights of different rolling shutters shall be as follows:

Clear Height		Size of Bracket Plate, Min
m		mm × mm × mm
Up to 2·3		300 × 300 × 3·15
Above 2·3 and up to 2·6		325 × 325 × 3·15
„ 2·6 „ to 3·0		350 × 350 × 3·15
„ 3·0 „ to 3·5		375 × 375 × 3·15
„ 3·5 „ to 4·5		400 × 400 × 6
„ 4·5 „ to 5·5		450 × 450 × 6
„ 5·5 „ to 6·5		500 × 500 × 10
„ 6·5		To be designed

The bracket plate shall be of hexagonal, square or circular contour. The bracket plate shall have fitted at the centre a U-shaped cast iron or mild steel clamp riveted or welded to it. Since the bracket plate carries the full load of the shutter, it should have sufficient cross-sectional area to resist the shear force and it shall be held in position rigidly by means of suitable foundation bolts. In the case of push and pull shutter, extra tying of the bracket plate to the guide channel is provided by means of a square bar not less than 20 mm size (see Fig. 4).

7.4.1 This square bar shall be welded on to the back of the guide channel for a length of at least 20 cm. The bracket plate shall then be attached to the top of this square bar by means of 6 mm countersunk rivets at a spacing of not more than 100 mm. An angle 40 × 40 × 6 mm split at one end is firmly riveted or welded at the top line of the bracket so that this will act as a foundation holdfast. The angle shall extend at least 20 cm from the edge of the bracket plate. This angle is grouted firmly into the wall with the split end of the angle well buried in concrete.

7.4.2 When the bracket is to be fixed on concrete the angle is suitably bent and fixed to the concrete beam or lintel with anchor sleeves and bolts of at least 16 × 75 mm size.

7.4.3 A stopper made out of 40 × 6 mm flat is bolted on to the square bar so that the lock plate may be arrested from going beyond the limit.

7.5 Roller

7.5.1 The suspension shaft of the roller shall be made of steel pipe conforming to heavy duty of IS : 1161-1968* and of sufficient diameter so as to resist deflection due to the weight of the rolling shutter. The deflection shall not exceed 5 mm per metre width. The recommended sizes of pipes for various widths of rolling shutters/grills are given below;

*Specification for steel tubes for structural purposes (second revision).

the height of the shutter being limited to a maximum of 5 m. For sizes other than those given below, the size of shaft shall be designed taking into consideration the permissible deflection:

<i>Width</i>	<i>Size of Pipe</i>
Up to 2 m	32 mm nominal bore
Up to 3 m	40 mm nominal bore
Up to 6 m	50 mm nominal bore

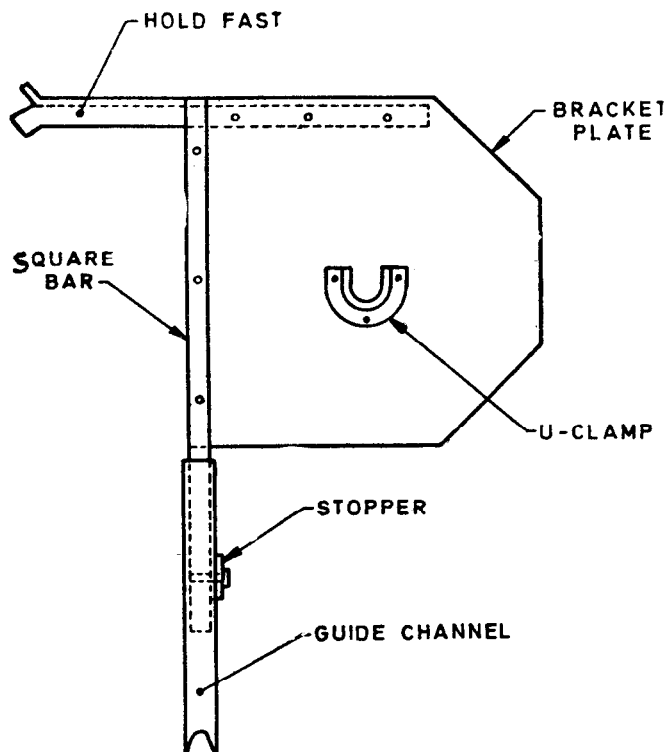


FIG. 4 DETAILS OF SQUARE BAR FIXTURE

7.5.1.1 The pipes of the suspension shaft which are clamped to the brackets shall be fitted with rotatable cast iron pulleys to which the curtain

is attached, The pulleys and the pipe shaft shall be connected by means of pretensioned helical springs to counterbalance the weight of the curtain and to keep the shutter in equilibrium in any partly opened position.

7.5.2 When the width of the opening is greater than 3.5 m, the pulleys shall be interconnected with a cage formed out of mild steel flats of at least 32×6 mm and mild steel dummy rings made of similar flats so that the torque is distributed uniformly. In such cases, self-aligning two row ball bearings shall be provided with special cast iron casings at the extreme pulleys at either ends. The caging rings shall have a minimum spacing of 15 mm and there shall be at least 4 number flats running throughout the length of the roller.

7.5.3 In the case of shutters for larger openings where the operation of the shutter is carried out using mechanical gear [see 5.1(b)] the roller shall be fitted with a pinion wheel at one end which is in contact with a worm fitted to the bracket plate. In this case also the pulleys shall be interconnected with caging as in 7.5.2, with two ball bearings.

7.6 Hood Covers — Hood covers shall be made of mild steel sheets not less than 0.900 mm thick. They shall be of hexagonal, square or circular contour depending on the contour of the bracket plate.

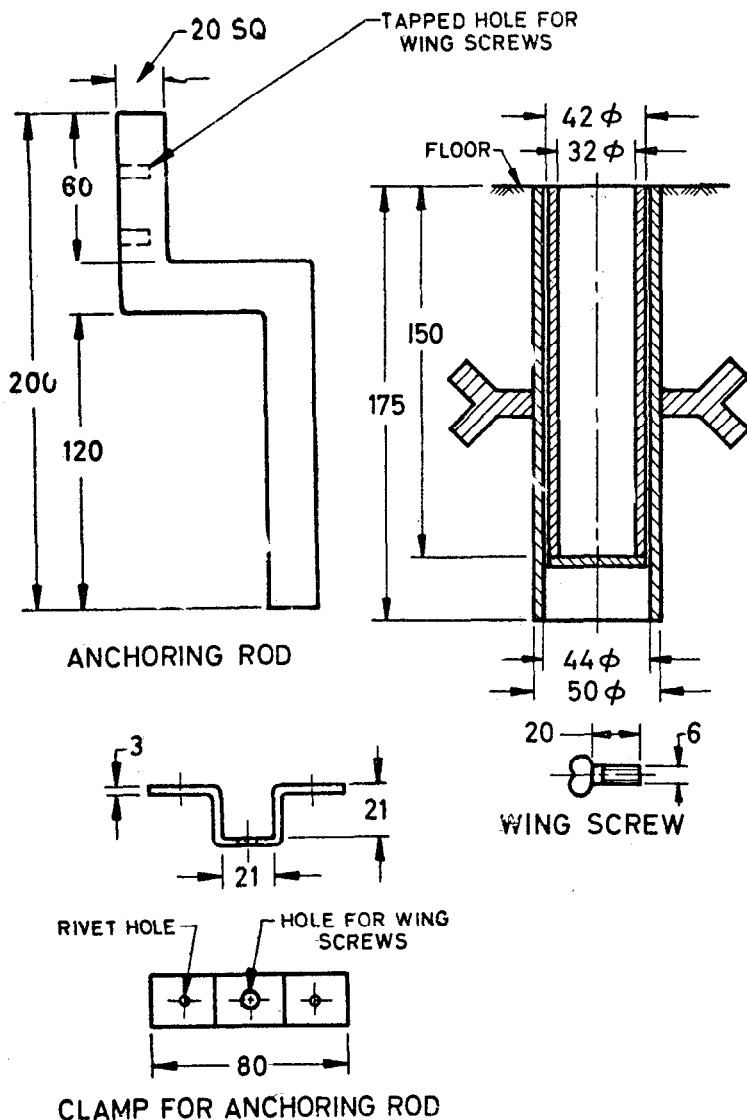
7.6.1 The hood cover shall be stiffened with angle or flat stiffeners at top and bottom edges to retain shape. The hood cover shall be fixed to the bracket plate by means of angle cleats and supported at the top at suitable intervals for preventing sagging.

7.7 Gears Worms, etc — All gears, worms, etc, used in the assembly of the rolling shutters shall be machine-cut. Worm gear wheels shall be of high grade cast iron or mild steel or phosphor bronze. The worms shall be of mild steel or gun-metal or phosphor bronze.

7.8 Fixing Bolts — All fixing bolts shall be of good quality and adequate strength and at sufficiently close pitch to ensure strength and rigidity of the rolling shutter after erection.

7.9 Safety Devices — For width up to 2.5 m, a properly fabricated and reinforced bottom lock plate shall be provided to give protection. For widths above 2.5 m, one or both of the safety devices mentioned in 7.9.1 and 7.9.2 may be provided.

7.9.1 Anchoring Rods — A crank shaped rod, fitted with clamps, behind bottom lock plate shall be provided by means of removable wing screws (see Fig. 5). There shall be a suitable pocket on the sill of the opening, lined with two close fitting pipes of approximately 150 mm length for receiving bottom end of the anchoring rod to a length of at least 100 mm.



All dimensions in millimetres.

FIG. 5 TYPICAL DETAIL OF ANCHORING ROD DEVICE

Of the two pipes, the outer pipe shall be grouted to the floor and the inner pipe shall be removable and have a closed bottom to enable any dust accumulation to be cleared periodically. The pipes shall be embedded in the sill so as not to project above the sill surface. Anchoring rods shall be provided at the rate of one per extra 2.5 m width or part thereof above a clear width of 2.5 m. Anchoring rods prevent the bottom lock plate from being pulled forward by tampering instruments, such as pullers used by burglars. The anchoring rod may be removed from the bottom lock plate, when opening the shutter, so as not to cause any obstruction in the door way and may then be replaced when closing the shutter.

7.9.2 Central Hasp and Staple — In case of shutters of large width an additional safety device is necessary in order to cut down the unsupported length of the bottom lock plate to prevent tampering. This shall be achieved by providing a central hasp and staple outside at the centre of the bottom lock plate. The hasp shall be grouted on the ground so as to be in level with the sill and thus not to cause any obstruction. The staple shall be fitted at the centre of the bottom lock plate outside at a correct position so that the hasp may properly engage with the staple when the shutter is in the closed position and bottom lock plate lies against the sill. Normally, one central hasp and staple outside will be sufficient for any width of door.

7.10 Optional Features

7.10.1 Intermediate Posts or Mullions — Intermediate posts or mullions may be of the fixed, removable or sliding type and are used for sectionalizing the rolling shutters for multiple door installations or unusually wide openings. These mullions form the guide channels between the various sections of the rolling shutters. The sliding mullions may also be of the winch operated type for large sizes. The intermediate posts or mullions shall be fitted so as to be plumb and true, when placed in position before closing the rolling shutters.

7.10.2 Wicket Doors — Where required by the purchasers for main entrances of mills, factories, etc, a subsidiary door known as the 'wicket door' may be provided. The wicket door is a hinged service door provided in the rolling shutter for affording pedestrian access without opening the rolling shutter when it is closed. The wicket door may be of 600 × 1 200 mm size, for ordinary use, and 900 × 1 800 mm size for large installations. Larger size wicket doors are not recommended as these cause difficulties in installation and operation. The wicket doors shall be of robust construction and shall be fitted with a good lever lock operated by key, lockable both from inside and outside. The wicket doors shall be erected

in such a way as not to foul with the main rolling shutter when opening or closing. The wicket doors shall be swung clear of the opening before the rolling shutter is raised or lowered.

7.10.3 Safety Lever Locks — In addition to the padlock arrangement, one pair of safety lever locks may be fitted on either end of the bottom lock plate so as to secure the slide bolts in the closed position for extra security.

7.10.4 Galvanizing — In order to deal with the problem of corrosion in the vicinity of the sea, in chemical factories, etc, the lath sections, the guides, the lock plate, the bracket plates, the suspension shaft and the hood cover may be hot-dip galvanized with a zinc coating containing not less than 97.5 percent pure zinc. The weight of the zinc coating shall be not less than 230 g/m² and the coating shall be free from flaking or peeling [see IS : 1477 (Part I)-1971*].

8. OPERATION

8.1 Self-Coiling Type Rolling Shutters — Self-coiling type rolling shutters shall be raised or lowered manually by means of a pulling hook applied to the pulling handles fixed on the bottom lock plate. The length of the pulling hook shall be adequate to push the bottom lock plate to the topmost position with ease (see Fig. 1).

8.2 Gear-Operated Type Rolling Shutters — Gear-operated type rolling shutters ordinarily employ a worm drive arrangement, the worm driving the worm wheel attached to one end of the roller. Worm drive is preferred in view of its irreversible nature, which provides a safeguard against any accidental downward descent of the curtain due to failure of the springs.

8.2.1 Gear-operated type rolling shutters shall be operated: (a) by means of bevel gear box and crank handle or, and (b) by a chain wheel and endless hand chain mounted directly on the worm shaft (see Fig. 6A and 6B) respectively. The bevel gear box shall be mounted on the wall adjacent to the shutter at a height of approximately 0.85 m from the floor. The gear box shall operate the worm by a straight shaft connecting the top of the gear box and the worm. The crank handle of the gear box shall be detachable. If so desired by the customer, the crank handle operation shall be provided on both sides of the wall by extending the horizontal shaft of the gear box backwards and providing an extra crank handle at the back of the wall. Chain wheel and hand chain operation may also be provided from both sides, if needed. The endless hand chain shall hang to a distance of approximately 0.85 m from the floor level.

*Code of practice for painting of ferrous metals in buildings: Part I Pretreatment (first revision).

The gear reduction shall be calculated to reduce the pressure exerted, on the crank handle or the pull exerted on the hand chain to not over 16 kg.

8.3 Electrically Operated Rolling Shutters — Electrically operated rolling shutters shall be operated by an electric motor operating on 400/440 V, 3 phase, 50 cycles ac supply. The electric motor shall drive the worm shaft by chain or Vee-belt drive or through a reduction gear box. The reduction gear box shall have a control lever within easy reach from the floor so that the motor may be disengaged and the auxiliary chain gear operating mechanism may be engaged instantly in the event of power failure. The motor unit shall be so mounted that the motor may be completely removed without interfering with the operation of the rolling shutter or the auxiliary drive. The electric drive shall be so designed as to limit the speed of movement of the curtain in either direction to not more than about 10 cm/s (*see* Fig. 6 C)

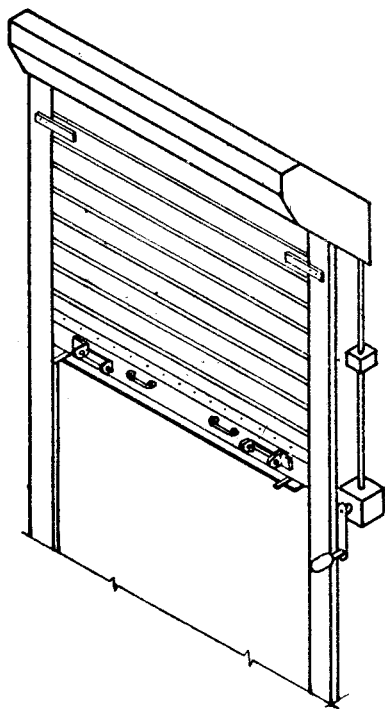
8.3.1 The controls provided for the electric motor shall include push button control through the medium of a 3-phase reversing starter with interlocking contractors and overload protection. The reversing starter shall be wall-mounted and fitted adjacent to the shutter in a convenient position. A minimum of 3 phase buttons marked 'Forward', 'Reverse', 'Stop' or 'Up', 'Down', 'Stop' shall be provided with a mechanical locking arrangement to prevent unauthorized or irregular operation of the push buttons. Limit switches shall be provided to cut off current to the motor when the rolling shutter reaches the limit of its travel in the 'Up' and 'Down' directions.

8.3.2 Arrangement shall also be provided for emergency mechanical operation of the rolling shutter in the event of failure of electricity or electrical equipment. The emergency mechanical operation shall be by an auxiliary chain wheel and hand chain drive on the worm shaft.

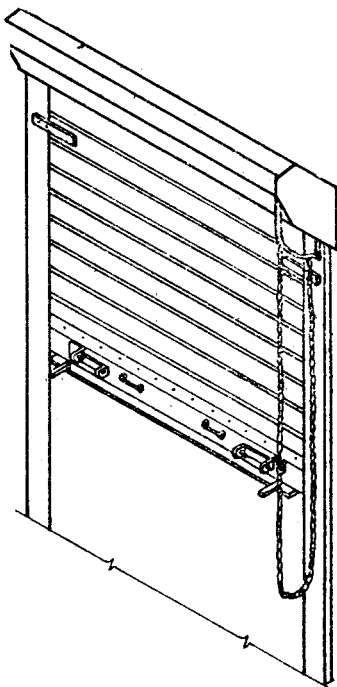
9. ROLLING GRILLS

9.1 Rolling grills are similar in design, construction and operation to rolling shutters and consequently all the provisions applicable to rolling shutter apply equally to rolling grills, except in respect of the curtains. Rolling grill curtains may be built of aluminium alloy (*see* 6.7 and 6.8) or cold-rolled steel sheet links of 0.90 mm thickness assembled on tubes or rods. Grills may also be manufactured out of 8 mm diameter mild steel or aluminium alloy round bars.

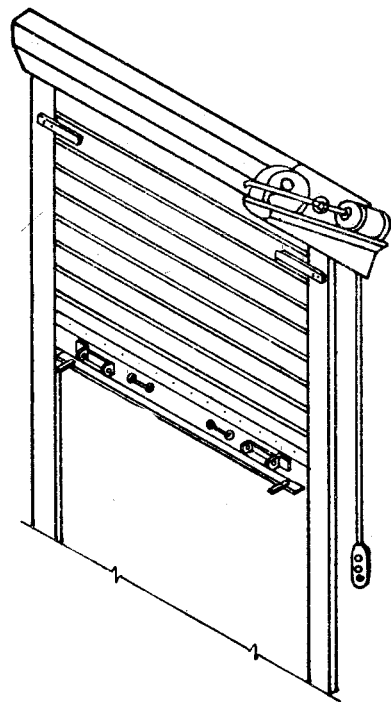
9.1.1 Rolling grill links may be manufactured in a number of designs to suit manufacturer's convenience and customer's preference as also the purpose, the degree of safety required, etc. The details of fabrication and



6A Gear-Operated Type with
Crane Handle



6B Gear-Operated Type with Chain
Wheel and Hand Chain



6C Electrically Operated Type

FIG. 6 OPERATION OF SHUTTER

assembly of the rolling grill curtain depend on the actual type of links chosen. The function of a rolling grill is to provide visibility and/or ventilation, where necessary. At the same time, it provides less protection and less safety as compared to a rolling shutter. This factor shall be borne in mind when specifying rolling grills.

9.2 Rolling Shutter-cum-Grill—In situations where a certain amount of ventilation combined with safety is called for, for example, in transformer rooms, sub-stations, etc, the rolling shutter may have a small rolling grill portion either at the top or at the bottom or at both places. The height of the grill portion shall be a maximum of 0.5 m.

10. PAINTING

10.1 All component parts of the rolling shutter (excepting springs and the inside of guide channels) shall be given one coat of a brushing quality ready mixed primer conforming to IS : 102-1962*before despatch. Where a rust inhibiting quality of paint is called for, a zinc chromate primer shall be used. The portions of a rolling shutter where there is contact between aluminium and steel shall be painted with a zinc chromate primer to avoid possibility of corrosion due to electrolytic action [see IS : 1477 (Part I)-1971† and IS : 1477 (Part II)-1971‡].

10.1.1 Phosphate treatment may be given prior to painting, if required, by mutual agreement between the purchaser and the supplier.

11. PACKING

11.1 The rolling shutter curtain and bottom lock plate shall be interlocked together and rolled in one piece and wire bound. The other parts like guide channels, bracket plates, rollers, etc, shall be despatched separately. Small parts like bolts and nuts, rivets, keys, fixing screws, etc, shall be separately packed in a bundle. If necessary, the component of the rolling shutter may be crated to prevent scratching of material and paint and for safe handling in transit, at the option of the purchaser.

12. MARKING

12.1 Each shutter shall be clearly and legibly marked with the following information:

- a) Manufacturer's name or trade-mark, if any;
- b) Size; and
- c) Year of manufacture.

*Specification for ready mixed paint, brushing, red lead, nonsetting, priming (revised).

†Code of practice for painting of ferrous metals in buildings: Part I Pretreatment (first revision).

‡Code of practice for painting of ferrous metals in buildings: Part II Painting (first revision).

12.1.1 The shutter may also be marked with the Standard Mark

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1936 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

APPENDIX A(*Clause 0.3*)**INFORMATION TO BE SUPPLIED BY THE PURCHASER
WHILE PLACING THE ORDER**

A-1. The purchaser shall furnish information to the manufacturer or the supplier in regard to the following points:

- a) Clear width and clear height of the opening, together with a drawing of the opening, if possible (*see 3.1.1*);
- b) Special stopper height to be stipulated, if any;
- c) Thickness of lath section required, that is, 0.900 mm or 1.25 mm;
- d) Position of fixing (*see 4*);
- e) Type of shutter required, that is, self-coiling type or gear-operated type or electrically-operated type (*see 5.1*);
- f) Details of construction or masonry around the opening, that is, whether brick masonry, stone masonry, concrete or structural steel;
- g) Details of any beams, sunshades, etc, that may be present near the opening, either parallel to it or perpendicular to it, together with the clearance, etc;
- h) Thickness of wall or column, where gear-operated shutters require crank handle or chain gear operation both from inside and outside; and
- j) Special or optional features required, if any (*see 7.10*).

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