IS 10439 (1983): Code of practice for patent glazing [CED 13: Building Construction Practices including Painting, Varnishing and Allied Finishing]

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(Reaffirmed 2000)

Indian Standard

CODE OF PRACTICE FOR PATENT GLAZING

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

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May 1983

Indian Standard

CODE OF PRACTICE FOR PATENT GLAZING

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Indian Standard

CODE OF PRACTICE FOR PATENT GLAZING

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 31 January 1983, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The 'Patent Glazing' is considered as a generic term applied to a system of glazing in which glazing compounds or putty is not usually incorporated. The term is usually applied to those forms of glazing that rely for their efficiency upon some means of collecting and removing water in channels or grooves incorporated in the glazing bar, as distinct from putty or other glazing compounds that provide a sealed joint. Unlike putty glazing where the glazing compound is applied to a metal or timber surround already fixed in position, patent glazing involves fixing (directly to purlins or columns that are an integral part of the main structure) of all the components necessary to cover open areas of a building. It is employed for all types of roof lights and for vertical wall glazing in buildings, where areas to be glazed are large and which are generally not easily accessible. The advantages of such a system are that it reduces maintenance and replacement, secures weather tightness, permits free expansion and contraction of glass, provides maximum amount of light, takes care of reasonable amount of shock and vibration and ensures adequate strength in construction.

0.2.1 This code is intended to provide guidance regarding materials design, and techniques to be followed for fixing patent glazing (sloping and vertical) in buildings.

0.3 The code represents the practice being followed in the country in this field and due weightage has also been given to the need of international coordination among standards prevailing in different countries of the world.

0.4 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.

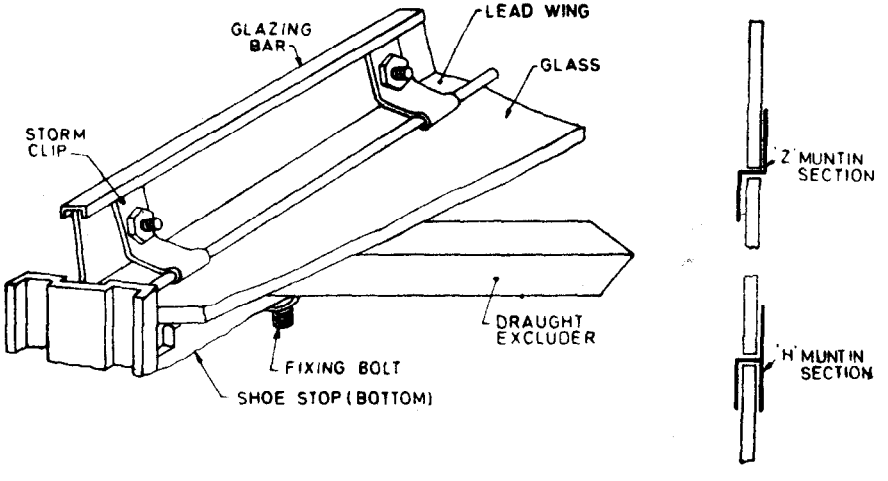
1. SCOPE

1.1 This code covers all systems of dry or puttyless glazing, sloping and vertical, both single and double, for roofs, external and internal walls, generally known as ' patent glazing '.

1.2 This code provides recommendation on glazing bars, type of glass, and ancillary components for various conditions and information on related matters such as fire resistance, thermal insulation, weather proofing and use of special glasses.

2. TERMINOLOGY

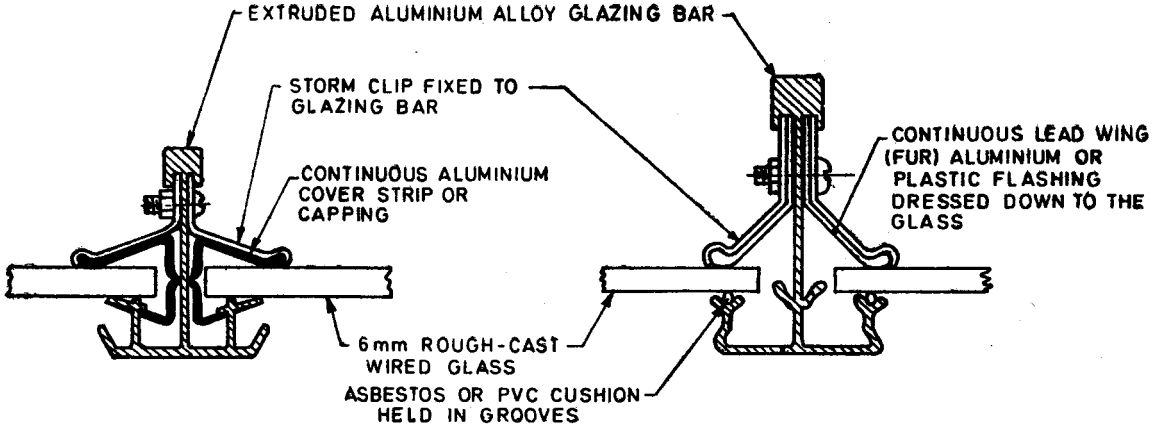
2.0 For the purpose of this code, the following definitions shall apply (*see* Fig. 1).



1A Component Parts of Patent Glazing

FIG. 1 TYPICAL PATENT GLAZING — *Contd*

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



1B Typical Alternative Details of Glazing Bars

FIG. 1 TYPICAL PATENT GLAZING

2.1 Glazing Bar — A member which supports, secures in position and makes it weather-tight, i.e. a load bearing element plus any associated capping or filling.

2.2 Capping or Cover Strip or Weathering — A performed metal or plastic strip fitted externally to a glazing bar to form a barrier to penetration of water and to restrain the glass from being lifted due to suction forces.

2.3 Storm Clip — A fitment fixed externally to a glazing bar to restrain the glass against suction pressure.

2.4 Depth of Glazing — The distance between the top and the bottom extremities of the glass measured in the plane of the glass.

2.5 Draught Excluder — A strip to fill the space between the under side of the glass and the structural member to prevent the penetration of driving rain or snow.

2.6 Flashing — A strip of flexible, impervious material usually metal or plastic used to exclude water from the junction between glazing and adjacent part.

2.7 Pitch — The angle of inclination of the glazing bar with the horizontal.

2.8 Shoe Stop — A fitting secured to the lower end of a glazing bar and acting as a stop to the glass.

2.9 Span — The distance between the points of supports of a glazing bar.

2.10 Pane (Square) — A piece of glass of shape, cut to size ready for glazing.

2.11 Muntin Section — A light bar of suitable material, such as thin preformed aluminium strip or plastic section in the shape of the letter 'h' or 'Z' to weather horizontal but joint between two panes of glass held vertically in the same plane by glazing bars.

2.12 Lead Wing — A projecting lead fur forming an integral part of a glazing bar, it is dressed down to the glass to form a barrier against penetration by water.

3. MATERIALS

3.1 Glass

3.1.1 *Transparent Sheet Glass* — Transparent sheet glass for glazing shall conform to IS : 2835-1977*.

*Specification for flat transparent sheet glass (*second revision*).

3.1.2 *Wired and Figured Glass* — These shall conform to IS : 5437-1969*.

3.1.3 *Laminated and Toughened Safety Glass* — These shall conform to IS : 2553-1971†.

3.2 Glazing Bar — All patent glazing bars and ancillary components shall be made from materials as given in **3.2.1** and shall be capable of protected resistance to corrosion and degradation in the conditions in which they are to be used.

3.2.1 *Materials for Load Bearing Element*

3.2.1.1 *Steel bar* — Steel used for the fabrication of bar or core shall conform to IS : 2062-1980‡. After fabrication the steel bar should be protected by hot dip galvanizing according to the practice as recommended in IS : 6159-1971§.

3.2.1.2 *Aluminium bar* — Aluminium bar shall be extruded to the requisite profile from aluminium alloy preferably of 63400 WP Grade conforming to IS : 733-1975||.

3.2.1.3 *Wooden bar* — Wooden bar used shall be manufactured from structural timber conforming to IS : 3629-1966¶. The timber shall be seasoned and preserved in accordance with IS : 1141-1973** and IS : 401-1967††.

3.2.2 *Sheaths* — Plastic sheaths shall be extruded from unplasticized polyvinyl chloride (*see* IS : 9766-1981‡‡) or any other suitable grade. External and internal surfaces of the sheath shall be clean, smooth and reasonably free from grooving and other defects.

3.2.3 *Cappings and Wings* — Cappings and wings shall be made from either aluminium or zinc or copper or plastics conforming to relevant Indian Standards.

3.2.4 *Fittings* — All fittings shall be of materials which does not allow severe, bimetallic corrosion in service, and their nature shape and thickness shall be adequate.

3.2.5 *Fastenings* — Nuts, bolts and screws shall be of either aluminium or steel or brass and shall conform to relevant Indian Standards.

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*Specification for wired and figured glass.
†Specification for safety glass (*second revision*).
‡Specification for structural steel (fusion welding quality) (*second revision*).
§Recommended practice for design and preparation of material prior to galvanizing.
||Specification for wrought aluminium and aluminium alloy bars, rods, and sections (for general engineering purposes) (*second revision*).
¶Specification for structural timber in building.
**Code of practice for seasoning of timber (*first revision*).
††Code of practice for preservation of timber (*second revision*).
‡‡Specification for flexible PVC compound.

4. NECESSARY INFORMATION

4.1 Arrangements shall be made for proper exchange of informations between those engaged in laying the glazing and all others whose work will affect or will be affected.

4.2 Information supplied should be sufficient to provide those responsible for the patent glazing with full knowledge of the atmospheric and other conditions. This information shall include the nature of adjacent coverings and positions of lights in relation there to, and shall indicate whether the building is new or existing and in latter case, if it will be unoccupied during the glazing operation and any special difficulty of access.

4.3 For the efficient design and construction of the work, detailed information with regard to the following is necessary:

a) The number and dimensions of the areas to be glazed;
b) The position of the openings, whether in roof or walls;
c) Details of construction, fixing details;
d) Span and spacing or roof principale or in the case of side glazing, the spacing and size of stanchions, piers, etc;
e) Pitch of roof when glazing occurs therein;
f) Height from ground at which the glazing is to be fixed;
g) Kind of glass;
h) Details of ventilation required and method of operation; and
j) Type and weight of flashing.

4.4 The detailed treatment of flashings and fixing shall be agreed upon at an early stage in the design. Those who will be responsible for drilling steel work, forming pockets in concrete or rebating timbers or for other preparatory work for securing the glazing and the gearing for any opening lights, shall be supplied with details of all such work and it is preferred that the same be done by the structural or general contractor. Figured dimensions should be given on the drawings and the dimensions shall be checked on the site. Where fixing is to the steel work, the steel work contractor shall be supplied with details of all drilling required well in advance, and the manufacturer should supply proper shop drawings if required.

5. DESIGN CONSIDERATIONS

5.1 Functions of a Patent Glazing Bar — The patent glazing bar shall support and retain the glass and provide a weather tight joint without the aid of glazing compounds. It shall be strong enough to preserve the glass under the prescribed design loading. The essential features of a glazing bar shall be:

a) A load bearing member which shall provide continuous edge supports;

b) Capping cover strip or weathering to retain the glass and impede weather penetration;

c) Channels to dispose off the water which may penetrate beyond the cappings or cover strips; and

d) Fittings for attachment of the glazing to the structure or for the retention of glass or both.

5.2 Loading — The patent glazing is supported by and attached to purlins or side rails. Loads to be taken into consideration for designing such members are:

a) Wind loads, expressed as a pressure;

b) Dead loads of bars and glass expressed as a pressure;

c) Maintenance loads, usually expressed as a load but for which an equivalent pressure is assumed in calculations;

d) Snow loads usually expressed as a pressure.

The design shall take into consideration the most severe combination of loads given above which is likely to occur in service.

5.2.1 *Wind Loads* — Wind loading is based on the highest gust speed likely to be encountered and shall be in accordance with the recommendations of IS : 875-1964*. The calculation shall include consideration of the site location, slope and height of the glazing above the prevailing ground level, its proximity to eaves, gables and other parts of the building, the shape of the building, its proximity to other buildings and its openings.

5.2.2 *Dead Loads* — The component of average weight per unit area of bars and glass perpendicular to the plane of the glazing shall be calculated. For the purpose of this calculation, the weight of single glazing may be taken as 240 N/m^2 and of double glazing 430 N/m^2.

5.2.3 *Maintenance* — In special cases where the glazing bars are subjected to the load of ladder, plank or scaffolding and persons, the load shall be assumed as 535 N applied centrally or distributed load of 1 070 N.

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*Code of practice for structural safety of buildings: Loading standards (*revised*).

5.2.4 *Snow* — The pressure perpendicular to the plane of the glazing can be derived with sufficient accuracy as follows:

$P_S = 800 - 10A$, where A is 30° or less, and

$P_S = 18 (60 - A)$ where A is more than 30° but less than 60°,

where

A = Angle of the slope of glazing (degrees) to the horizontal.

P_S = Component of the pressure due to snow, perpendicular to the plane of the glazing (N/m^2).

5.2.4.1 If the angle of the slope of glazing to the horizontal is more than 60°, the snow loading is insignificant and need not be considered.

5.2.5 *Permanent Imposed Loads* — Where any other permanent loads, such as walkways and ventilators are to be carried by the glazing bars, separate consideration shall be given to each and the bars and fastenings shall be designed to have the necessary additional strength and stiffness.

5.3 Bar Spacing — The exact spacing of the glazing bar varies slightly with different types and strength of glass. But normally the bars shall be spaced to suit glass of 610 mm width in case of 6·4 mm thick glass. Allowing for expansion of the glass and the width of the glazing bar, which varies according to the system used, a bar spacing of approximately 630 mm centre to centre may be taken. In general, the thinner the glass, the lesser the spacing and thicker the glass, wider spacing may be permitted to the extent to which the glass will safely resist transverse bending.

5.4 Bar Stiffness — The glazing bars shall be of sufficient stiffness to restrict:

a) Deflection which shall not be greater than one-ninetieth of the span, and

b) Longitudinal stresses in the glass to a safe value.

5.5 Bar Strength — Glazing bars shall be of sufficient strength to avoid permanent bending or yielding of their material. The section modules (Z) of the glazing bar shall be calculated as follows:

$$Z = \frac{p_2 \, d \, s^2}{8f \, 10^6}$$

where

Z = Section modulus of the glazing bars in mm^3,

p_2 = Working pressure for use in calculations involving the strength of the glazing bars N/m^2,

d = Actual unsupported span between glazing bars in mm,

s = Span of the glazing bars mm, and

f = 0·1 percent proof stress of aluminium alloy or the yield stress of steel (N/mm^2). A value of 154 N/mm^2 for aluminium alloy and 246 N/mm^2 for steel is recommended.

5.5.1 Table 1 gives the section modulus of glazing bars of aluminium alloy (Grade 63400 WP) for different working forces and spans.

5.6 Choice of Glass — While selecting the most suitable type of glass for patent glazing the following shall be considered:

a) Light Transmission,

b) Weather Resistance,

c) Durability,

d) Fire Resistance,

e) Strength, and

f) Thermal Transmittance.

5.6.1 The properties of the various types of glasses are given in Appendix A to assist in the choice of the glass. The minimum illumination levels to be achieved shall be in accordance with IS : 2440-1975*.

5.7 Retention of Glass — All glazing bars shall have shoes or stops to prevent sliding of the panes. A continuous and independent initial capping or cover strip shall be provided to secure the glass on the bars and to prevent the entry of water. The glass is thus held between the seating and the capping or wings without impeding thermal movement. The capping or cover strip shall be designed to check capillary attraction and shall make contact with glass throughout its length, in order to exclude weather. In the exposed situation where there is a danger of glass being lifted owing to internal pressure or where the glass is subjected to mechanical vibration, continuous capping or storm clips shall be bolted to bars.

5.8 Protection of Glass — Wherever the glazing is exposed to falling objects, guards preferably made of aluminium alloy or galvanized steel mesh may be provided to protect the wired glass which itself is unable to provide protection in such situation.

*Guide for daylighting of buildings (*second revision*).

TABLE 1 SECTION MODULUS OF GLAZING BARS

(*Clause* 5.5.1)

Sl No.	Total Working Force on Glazing Bar (KN)	Section Modulus (Z) for Aluminium Alloy Glazing Bars for Spans												
		1·0 m	1·2 m	1·4 m	1·6 m	1·8 m	2·0 m	2·2 m	2·4 m	2·6 m	2·8 m	3·0 m	3·2 m	3·4 m
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
i)	1·0	0·81	0·97	1·1	1·3	1·5	1·6	1·8	1·9	2·1	2·3	2·4	2·6	2·8
ii)	1·5	1·21	1·50	1·7	1·9	2·2	2·4	2·7	2·9	3·2	3·4	3·7	3·9	4·1
iii)	2·0	1·60	1·90	2·3	2·6	2·9	3·2	3·6	3·9	4·2	4·5	4·9	5·2	5·5
iv)	2·5	2·0	2·4	2·8	3·2	3·7	4·0	4·5	4·9	5·3	5·7	6·1	6·5	6·9
v)	3·0	2·4	2·9	3·4	3·9	4·4	4·9	5·4	5·8	6·3	6·8	7·3	7·8	8·3
vi)	3·5	2·8	3·4	4·0	4·5	5·1	5·7	6·3	6·8	7·4	8·0	8·5	9·1	9·7
vii)	4·0	3·2	3·9	4·5	5·2	5·8	6·5	7·1	7·8	8·4	9·1	9·7	10	11

NOTE 1 — The value of Z given in the table are to be multiplied by 10^3. For example, the value of Z corresponding to a force of 2·5 KN and a span of 2 m is $4 \times 10^3 = 4\,000$ m^3.

NOTE 2 — The section modulus for steel bars, shall be one-third of the above values.

5.9 Weather Resistance — To ensure adequate weather resistance, the following points shall receive attention:

a) *Water Channels* — Water channels or grooves shall be provided in the glazing bars in order to drain off to the outside of the roof any water which may get under the external wing or capping of the bar.

b) *Seating* — A continuous support for the edge of the glass shall be provided along full length of the bar preferably by means of oiled asbestos cord, PVC or similar cushions.

c) *Pitch* — It is recommended that the pitch shall not be less than 20°.

d) *Bottom Overhang* — A glass overhang of at least 20 mm should be provided beyond the lower edge of the member supporting the glazing bars at the bottom of the glazing.

e) *Lap* — In the lapped glazing, the upper tier of glazing should overlap the lower tier by at least 50 mm.

f) *Draught Excluder* — Draught excluder should be used between the glass and the lower support to prevent the penetration of driving rain or snow, wherever necessary.

g) *Flashings* — All flashings should extend at least 75 mm over the glass. To prevent passage of water by capillary action, flashings shall not be dressed into close contact with the extreme upper edge of squares.

h) *Rain Water* — Concentration of rain water from down pipes or other sources shall on no account be allowed to flow over patent glazing.

j) *Pollution* — Excessive dust, grit or dirt from sources such as the main stack of a solid fuel burning boiler house or stone or cement works is liable to silt up the water channels. In such cases consideration may be given to the sealing of the wings or cappings to the glass.

5.10 Durability — The durability of patent glazing depends mainly on the conditions of exposure and on the materials used in the patent glazing.

5.10.1 *Glazing Bars* — Under normal conditions of exposure, any type of glazing bars may be used. In determining the type of bar best suited to the conditions, consideration should be given to atmospheric pollution in and around the building. Aluminium should not be used when

alkaline pollution may be expected. For insect proof airtight glazing special double cushioned or similar type of bar may be used. No two metals shall be used in proximity which may set up marked bi-metallic corrosion. Copper or its alloys must not be situated so that rain falling or running upon them subsequently reaches aluminium or zinc-based alloys.

5.10.2 *Fastenings* — Fastening devices such as screw, cotters and clips must have a corrosion-resistant finish. Where glazing is subject to vibration from machinery within a building, nuts, screws or washers which resist slackening should be used. Bare sheraridized steel fastenings should not be used where their appearance is important are unsightly staining of aluminium could occur.

5.10.3 *Glass* — Glass that conforms to the requirements shall have high resistance to corrosion.

5.11 Fire-Resistance — The patent glazing is usually incombustible and does not directly increase fire risk, the bars may however under the influence of heat, distort and collapse and so tend to increase draughts. There may also be risk of fire entering the building through the glazing. The use of wired glass will help to prolong resistance to collapse of glass, thus preventing the passage of flame or smoke although the glass may crack by heat (*see* IS : 1642-1960*).

5.12 Heat Gain Through Glazing — The thermal conductivity of glass is substantially the same as that of brick work or concrete. But the thickness of the sheets used, gives relatively high transmittance values of 6w/m^{2}K hr °C for vertical glazing and 7w/m^{2}K hr °C for sloping glazing. The use of either double glazing with ordinary glasses or heat insulating glass is single glazing will have nearby half of these values.

5.13 Effect of Solar Heat — Large areas of roof glazing exposed to the sun will admit enough heat to give serious discomfort and it will be generally best used only in limited areas. Solar heating may be reduced by obscuration, or by the use of heat-absorbing or heat-insulating glass. Heat-absorbing glass also absorbs some light but it becomes so hot that special allowance for expansion shall have to be made. Shadows cast upon part of the glass may also cause cracking due to uneven expansion. Primarily, roof glazing (except northlight glazing) in ordinary workshop and factories is not recommended. The benefits from obscuration (white wash) is derived mainly due to the reflection of effective solar heat therefore, the wash shall be as white as possible. It is generally preferable to apply the wash outside and during early summer; by the time the summer is over and obscuration is no longer required the greater

*Code of practice for fire safety of buildings (general): Materials and details of construction.

part may have been removed by weather and the remainder may be cleansed off easily. White wash shall be applied in accordance with the details given in IS : 6278-1971*. Care shall be taken to keep the white wash clear of glazing bars, as this dried deposit is liable to impair the efficiency of the weathering and also, if the glazing bars are of aluminium or any of its alloys, there may be a risk of corrosion in the bars.

5.14 Condensation — Condensation will occur on any surface, the temperature of which is less than the 'Dew Point' of the atmosphere near the surface. Thus when the climatic conditions cause the temperature of the inner surface of patent glazing to fall low enough or the interior specific humidity is increased sufficiently, condensation will occur. Inside buildings, the humidity is commonly increased by the release of process moisture (including that from cooking) and by the moisture from inhabitants. It may reach high values where ventilation is inadequate. Provided that the pitch of the glazing exceeds 30° and condensation is not severe, the condensate will generally run down the glazing, though in some circumstances with dirty or patterned glass the condensate may drip at much steeper angles. Provision shall be made for water running down the glass to be released at the draught excluder. The less the depth of the glazing the less is the tendency for droplets of condensate to fall, and consequently, where the day lighting requirements indicate considerable depths of glazing it shall be provided in two or more tiers or in separate runs. Where the interior atmosphere is warm and humid and the glazing is at low pitch and the possibility of falling droplets cannot be allowed, double glazing shall be used. Under extreme conditions the parts of glazing bars in contact with the interior atmosphere may be covered with an insulating material. In such circumstances it may be advisable to separate aluminium glazing bars from the supporting steel structure by application of suitable non-metallic backing or coating.

5.15 Maximum Size of Glass — For safety and convenience in handling, the length of a square of glass should not exceed two metres. If greater depth is required it is recommended to use two glasses with an intermediate muntin section. This muntin section may be made out of the thin aluminium sheet preferably of 0·45 mm thickness so that the ends may be safely covered by capping, in case of vertical glazing. In case of inclined glazing, lapped glazing is preferable.

5.16 Ventilation — The following methods should be adopted to provide ventilation in patent glazing:

a) *Opening Lights* — Single pane or multiple pane. Top hung opening lights of patent glazing construction which are usually

*Code of practice for white washing and colour washing.

one or two panes wide but of which a larger number may be arranged as a continuous opening light. Considering of accessibility and weight, operation of any of these may be by hand (cord or pole) mechanical, electrical hydraulic.

b) *Louvers* — Fixed louvers may be provided where the risks of dust, driving rain or snow can be ignored and these may be suitably provided in vertical glazing only.

c) *Permanent aperture at top or bottom of glazing* — This arrangement is only suitable where risk of dust, driving rain or snow can be ignored.

5.17 Jalhousie Louvers — Pivoted and adjustable louvers commonly known as jalhousie should be provided and fixed. These may be provided with hand operating or mechanically operating arrangement depending on the size of the panel as well as accessibility for maintenance. It is recommended that the details for the ventilating arrangement should ensure weather resistance and condensation.

5.18 Gutters — Valley and parapet gutters adjoining patent glazing should be at least 250 mm wide and strong enough so as to allow sufficient space for a man to work without causing injury to him or damage to glazing or the adjacent roofing.

5.19 Walkways — Regular cleaning of daylighting should be facilitated by the provision of walkway where no other means of access is available. External walkways should have standards of durability similar to those of the glazing bars and fittings. Structural members shall be of galvanized steel and should be further protected by plating, specially in aggressive chemical atmosphere. Vertical glazing should be accessible from both inside and outside and if neccssary walkways on both sides should be provided. Roof walkways may be supported at intervals of 1·8 m by specially designed glazing bars having the following maximum requirements:

Second moment of area, I : 120×10^4 mm^4

Section modulus, Z : 27×10^3 mm^3

6. WORK AT SITE

6.1 It is advantageous to prepare all patent glazing components of the site according to the desired measurements. The glazing bars and glass shall be delivered ready for fixing.

6.2 Storage — All glass should be stacked in a dry, protected place and no glass should stand or lean against, materials that may damage its edges or surfaces. Condensation of moisture on the glass should be

avoided at this could collect between the sheets and cause alkaline attack on the glass. In removing glass from the crates, great care shall be taken to avoid damage. The glass shall be lifted and stored on its long edge and shall be put into stacks of not more than 25 pane, supported at two points by fillets of wood at 300 mm from each end. The first pane laid in each stack shall be so placed that its bottom edge is about 25 mm from the base of the wall or other support against which the stack rests. All glazing bars and its components shall be stored and handled in such a manner as to protect their coating or covering.

6.3 Preparation for Glazing — All roofing below and at end of glazing shall be completed and all gutters fixed before glazing is commenced. Joints shall be racked out and chases cut or other preparations made as required to take the flashing to the glass.

6.3.1 All structural members shall be painted before patent glazing is fixed. The structural members shall be prepared to receive the bolts which secure the patent glazing and also to receive the fixing brackets or other fittings. During patent glazing work, steel, concrete or timber members shall not be cut nor any other preparatory work done which might impair the strength of the structure be carried out without approval of the engineer-in-charge.

6.3.2 When the roofs are glazed on one slope only (for example north-light) the sheeting on the unglazed slope shall be fixed in advance to prevent glass from being disturbed by gales. On a sheeted and glazed roof slope, the glazier shall begin his work as soon as the sheets below the glass are fixed so that he may dress down his flashings on the sheets. The sheets above the glass should not be laid until the glazier has fixed the glazing and held the top flashings.

6.4 Fixing of Glazing Bars — Glazing bars should be fixed by screws or bolts or any corrosion-resisting materials in some cases. It is recommended that the advice of manufacturer should be obtained for any drilling or plugging required in the purlins for fixing the bar. One screw or bolt is usually sufficient to secure each bar at each purlin, but special fixing arrangements may be necessary in windy localities. Bearings of not less than 40 mm at the top and 50 mm at the bottom should always be provided so that the bars may be properly secured. The lower end of each bar should be raised on a washer or other suitably shaped fitting, clear of the purlins, to prevent the collection of condensation. Reinforced concrete glazing bars are normally employed with reinforced concrete purlins and the method of fixing the bars usually varies according to the design of the roof structure.

6.5 Fixed Flashings — It is recommended that the fixing of flashings to the glass be done by the glazier. Where it is not possible, the general contractor may fix the flashings, but these should be turned back to receive the glass and subsequently to be dressed down on to the glass by the glazier to complete the work.

6.6 Fixing of Glazing — All patent glazing, including the fixing of glazing bars, draught excluders and glass shall be carried out by the patent glazing contractor. It is undesirable to allow access to the areas beneath the glazing in course of erection. If, however, it is impossible to keep this area clear, protective measures shall be adopted. The correct spacing and and alignment of the glazing bars shall be carefully maintained to ensure adequate support for the glass and freedom of movement of the glass under changes in temperature. Where the two surface of glass differ, it shall be laid with the smoother surfaces outermost to minimize the collection of dirt on the glass surface. After the glass has been fixed, flashings shall be provided at the periphery of glazing, and shall be carefully dressed down on the glass.

7. INSPECTION AND TESTING

7.1 General — During the erection, the work shall be inspected to avoid unsatisfactory construction and the following points shall be checked particularly after the completion of the work:

a) Glazing bars shall be undistorted and the protective coating if any shall be undamaged;

b) Tightness of all nuts and screws shall be checked and so also the fixing of the glazing bars to the structure;

c) Lead or aluminium or plastic flashing shall be properly dressed down;

d) Storm clips shall be provided where specified;

e) Glass shall be free from cracks and scratches;

f) Capping or independent cover strips and cushions shall make close contact with the glass throughout; and

g) The glass shall be clean and the whole installation weather proof.

7.2 Testing — Gearing for opening lights shall be inspected and tested for effective and easy operation.

8. MAINTENANCE

8.1 General — Inspections shall be arranged periodically to prevent entry of moisture, to replace the faulty and damaged glazing materials and to replace the cracked and broken glass.

8.2 Cleaning — Periodical cleaning of the glass shall be carried out to avoid serious loss of light due to accumulation of dirt on glass surface. While cleaning the glass care should be taken not to disturb cappings or flashings. The use of strong acid or alkali for cleaning of glass shall be avoided even if the glass could not be cleaned by normal cleaning methods. In such cases the advice of the glazing contractor may be obtained.

APPENDIX A

(*Clause* 5.6.1)

GENERAL PROPERTIES OF VARIOUS TYPES OF GLASS

A-1. ROUGH CAST

A-1.1 It is low cast general purpose glass which gives a useful diffusion of direct sunlight with approximately 80 percent transmittance.

A-2. WIRED GLASS

A-2.1 Two patterns of wire mesh are generally incorporated which prevent displacement of cracked glass and thereby prevent falling. The presence of wire weakens the glass to some extent, especially in resistance to thermal stresses. In case of fire, however, use of wired glass will help to prolong the resistance to collapse of glass, thus preventing the passage of flame or smoke although the glass may crack due to heat. It will give a useful diffusion of sunlight with approximately 75 percent transmittance.

A-3. SHEET

A-3.1 It is a transparent glass in normal use in patent glazing but shows a slight distortion of vision and deflection. It can only be used where there is no danger from falling glass or for special use in horticultural glass houses, etc, where diffused light is not required.

A-4. CLEAR PLATE

A-4.1 Where transparency is required together with undistorted vision or undistorted reflection or both, clear plate is essential. It allows 85 percent transmittance of light.

A-5. HEAT ABSORBING GLASS

A-5.1 It usually has a greenish tint and shall not be used in situations where the colour distortion involved is objectionable. The heat transmission which is obtained by the use of heat absorbing glass is accompanied by some reduction in light transmission. Because of the heat absorbing properties of this type of glass, care shall be taken to minimize abrupt and persistent shadow demarcations on the glass which tend to set up local temperature differentials causing cracks. Special allowance should be made for expansion. Heat absorbing glass with damaged edges shall not be used.

A-6. FACTORY MADE DOUBLE GLAZING UNITS

A-6.1 There are types of double glazing units available in which the two panes are either fused together at the edges or joined with a composite seal. Where the latter are to be used for patent glazing the manufacturers shall be consulted. The use of double glazing with ordinary glass has approximately half the thermal conductivity of single glass. The insulation value of double glazing improves as the air space is increased up to 20 mm. No further movement is obtained by increasing the air space beyond this amount. Double glazing also reduces the sound transmission. Use of these units may entail variation of the design considerations.

(*Continued from page* 2)

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SHRI S. K. CHANDA	Public Works Department, Government of West Bengal, Calcutta
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SHRI SUBRATO RAY	Balmer Lawrie & Co Ltd, Calcutta

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
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