CHAPTER VIII

Skylights, Roof lights, Sloped & Horizontal Glazing

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- **National Fenestration Rating Council**
  Procedure Manuals

Note: This Selection Guide replaces the following AAAMSA Publication which is hereby withdrawn in its entirety:

- Selection Guide for Glazed Architectural Aluminium Products – Introducing Energy Efficiency in Fenestration – June 2008

Any information contained in Selection Guides of earlier dates, which contradicts with data contained in this manual, is information superseded by this publication

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8. GENERAL SPECIFICATION FOR SKYLIGHTS

Reader’s attention is drawn to the requirements in the National Building Regulations, regulation A2 (1)(g), that proof of compliance shall be provided at the time of application for approval of the erection of a building.

Skylights, Roof lights, sloped and horizontal glazing are not covered by SANS 10400:N, Glazing and require to be executed under the control of a Competent Person (Glazing) and Competent Person (Structures) appointed at the time of application for building approval (SANS 10400:A). Skylight are covered by SANS 10400:XA Energy Efficiency in Buildings where thermal insulation and solar heat gain coefficient are specified (see section 8.4 below).

Roof lights are also referred to in SANS 10400 Part L: Roofs which states roof lights shall:

a) Have a maximum opening area of $0.6m^2$ or, if in the form of a translucent roof sheet, an installed width of 700mm,
b) Resist ultraviolet radiation degradation for a period of at least 15 years,
c) Resist hail impact of 10J in accordance with the requirements of SANS 10400:B,
d) Be designed and installed in a manner that does not allow rainwater to penetrate the roof.

It should be noted that in terms of SANS 10400:T, Fire Protection, Shopping Centres and Atrium Buildings are not adequately covered by the deemed-to-satisfy provisions in Part T. Skylights, Roof lights, Sloped and Horizontal Glazing in Shopping Centres and Atrium buildings will require additional sign-off by Competent Person (Fire Engineering)

8.1 MATERIALS

8.1.1 ALUMINIUM EXTRUSIONS

Extruded aluminium sections shall be fabricated from alloy 6063 or 6061 in temper T5 or T6 all in accordance with the latest edition of BS EN 755 - "Aluminium and its alloys – extruded rod/bar, tube and profiles."

The extruded section shall be of such quality and strength that the section properties of the load bearing profiles meet the requirements as laid down in section 8.3.

8.1.2 ALUMINIUM SHEET

Ancillary members such as sills, flashings, infill panels and the like which may be formed from flat sheet material shall be fabricated from aluminium alloy 1200 or 3004 or 5251 of appropriate temper all in accordance with the latest edition of BS EN 573 - "Aluminium and Aluminium Alloys."

8.1.3 TIMBER

Structural timber members where used should be of suitable strength material and comply in all respects with SANS 10163.

8.1.4 STEEL

Structural steel members where used should be of suitable strength material and comply in all respects with SANS 10162.

8.1.5 FLASHINGS

A suitable corrosion resistance, malleable sheet material shall be used for the forming of flashings, saddles and drainage channels at abutments, junctions and valleys.

8.1.6 GLAZING MATERIALS & GLAZING

- **PLASTIC GLAZING MATERIALS & GLAZING**

Plastic glazing material shall be ……. ***(Architect to specify)***

Minimum depth of rebate shall be 20mm.

Glazing shall be executed strictly in conformance with glass manufacturer’s recommendations and all in accordance with the National Building Regulations Part N, SANS 10137, SANS 10400-N and SANS 1263:1.

- **GLASS & GLAZING**

Glass/specialized plastic glazing materials shall be ***........ (Architect to specify)***.

Glazing shall be executed strictly in conformance with glass manufacturer's recommendations and all in accordance with the National Building Regulations Part N, SANS 10137, SANS 10400 and, SANS 1263:1.

A warranty is to be provided that the manufacturer of the laminated safety glass and/or the hermetically sealed glazing units warrants the product against delamination and colour degradation for a period of not less than 15 (fifteen) years.

In case of structural glazing written proof is to be provided that all stages of fabrication and installation have been executed with disciplined quality assurance in accordance with the relevant part of SANS ISO 9000.

Structure using materials having in-situ applied finishes may not be used for structural glazing. Written confirmation of compatibility of structural sealant with extrusion surface, glazing tape and glass is to be supplied by the structural sealant manufacturer together with the regular relevant test reports regarding the adhesion of the sealant to the aluminium frame in accordance with ASTM/C 794-80 (Standard Test for Adhesion-in-Peel of Elastomeric Joint Sealants).

8.2. FINISHES

8.2.1 ALUMINIUM

- **ANODISING**

All anodising shall be executed in strict adherence to SANS 999. ***(Architect to specify colour and anodic film thickness) i.e. 15 or 25 microns.*** A Certificate of conformance is to be supplied with each delivery that the anodised materials meet with SANS 999 in all aspects.

- **POWDER COATING**

All powder coating shall be executed only by applicators approved by the specified powder manufacturers and shall be executed strictly in conformance with SANS 1769.

(Architect to specify type (Interpon D, Vedoc or other) and colour).

A guarantee of no less than 15 years is to be provided against peeling and discolouration.

8.2.2 TIMBER

The finish of the Timber structure shall be …….. ***(Architect to specify)***

8.2.3 STEEL

The finish of the Steel structure shall be ….. ***(Architect to specify)***

8.3. CONSTRUCTION (Irrespective of framing material used)

8.3.1 DESIGN (Loading – SANS 10160-Part 2 & 3)

- The Design wind pressure is ….. ***(Architect and/or Structural Engineer to provide)***
- Hail, snow and maintenance loads are ….. ***(Architect and/or Structural Engineer to provide) – default values are stated in SANS 10160:2.***
- The plastic, shrinkage and creep deflections of floor slabs are …. ***(Structural Engineer to provide)***
- Tenderers are to allow for thermal movement due to an atmospheric temperature range of -10°C to 35°C. ***(Architect to confirm)***
- The combined loadings as specified in 8.3.1.1 and 8.3.1.2 above shall be used in the selection of appropriate uniform loading.

TABLE 8.1: AAAMSA Test Performance Criteria (SANS 613)							
Test	**Class Designation**						**Requirement**
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	
Deflection (positive and negative) under uniform loading Pa (the design wind load)	1000Pa	1500Pa	2000Pa	2500Pa	3,000Pa	3500Pa	Maximum deflection 1/175 of span (2)
Structural proof loading 1.5 x Uniform loading	1500Pa	2250Pa	3000Pa	3750Pa	4500Pa	5250Pa	No failure allowed
Water resistance under a pressure of x Pa	x=200Pa	x=300Pa	x=400Pa	x=500Pa	x=600Pa	x=750Pa	No leakage when subjected to a flow of 0.05 *l*/s/m^2
Air leakage through opening sections of the specimen under a pressure difference of 75Pa	y = 2	y = 2	y = 2	y = 2	y = 2	y = 2	Not more than y = *l*/s/m^2 for all categories (1)
(1) For fixed glazing y = 0,3 l/s per m^2. For swing doors and revolving doors 5l/s/m^2 (SANS 204, SANS 613)							
(2) For spans greater than 4115mm, but less than 12,2m deflection shall be limited to 1/240th of span plus 6mm.							

8.4 DESIGN (Energy Efficiency – SANS 204)

Roof lights serving a habitable room, public area or an interconnecting space such as a corridor, halfway or stairway shall:

a) If the total area of roof lights is more than 1.5% but not more than 10% of the floor area or space they serve, the roof lights must comply with table 1.2; and

b) If the total area of roof lights is more than 10% of the floor area of the room or space they serve, roof light can only be used where

1. Compliance with the natural lighting requirement, in accordance with SANS 10400-O, can only be achieved by installing a roof light;

2. The transparent and translucent elements of the roof lights, including any imperforate ceiling diffuser achieves and SHGC of not more than 0.25 and a total U-value of not more than 2.0.

Note: The thermal performance of an imperforate ceiling diffuser may be included in the total U-value of a roof light.

Table 1.2 Roof lights – Thermal performance of transparent and translucent elements						
1	2	3	4	5	6	7
Roof light shaft index*	Total area of roof lights serving the room or space as percentage of the floor area of the room or space					
	1.5% to 3%		3% to 5%		5% to 10%	
	SHGC	Total U-value W/m^2/K	SHGC	Total U-value W/m^2/K	SHGC	Total U-value W/m^2/K
<0.5	≤0.75	≤5.0	≤0.50	≤5.0	≤0.25	≤2.5
1.5<1.0	-		≤0.70		≤0.35	
1.0<2.5	-		-		≤0.45	
>2.5	-		-		-	
Note 1 – The total area of roof lights is the combined area for all roof lights serving the room or space						
Note 2 – The area of a roof light is the area of the roof opening that allows light to enter the building						
*The roof light shaft index is determined by measuring the distance from the centre of the shaft at the roof to the centre of the shaft at the ceiling level and dividing it by the average internal dimension of the shaft opening at the ceiling level (or the diameter for a circular shaft) in the same units of measurement.						

8.5 DESIGN (SANS 10400:T – Fire Protection)

Roof lights in atrium buildings and shopping centres are to be approved by Competent Person (Fire Engineering).

8.6 MANUFACTURE

Conformance to SANS 613 – Mechanical performance of Fenestration will generally ensure that manufacture is fit for purpose.

8.6.1 Materials and workmanship shall be free from any characteristics of defects, which may render the finished product unsuitable for the intended purpose.

8.6.2 Skylights shall be fabricated to neat and weather tight construction and with secure and well fitted joints.

8.6.3 Hardware and fittings shall be removable without removing the frames from the structure and must be compatible with the adjoining materials.

8.6.4 Sliding members shall be constructed so that no metal to metal sliding contact occurs.

8.7 FITTINGS

8.7.1 Weather sealing shall be of materials that are compatible with aluminium and shall be such that any degradation, shrinking, warping or adherence to sliding or closing surfaces does not impair the performance of the installation.

8.7.2 Glazing beads, gaskets and glazing compounds shall be of materials that are compatible with the aluminium finishes, the glass and other glazing materials and suitable to ensure performance for 15-years under the revailing weather conditions.. Putty glazing is not permitted.

8.7.3 Hardware, bearing devices and fittings in general must be made of materials resistant to atmospheric corrosion and shall be of a design so as to be accessible for adjustment repair and replacement after the windows etc. have been installed.

8.7.4 Fastenings shall be of material which is compatible with aluminium and aluminium finishes.

8.8 INSTALLATION

8.8.1 The Skylights and Space enclosures shall be installed such that they are securely anchored, sealed and undamaged and meet in all respects with the performance criteria as set out in item 3.

8.8.2 The glazing material shall be installed strictly in accordance with the glazing material manufacturer's specifications.

8.8.3 The frames and glazing material are to be installed in accordance with the main contractor's building programme and the exposed aluminium is to be protected by means of low tack adhesive tape against mortar droppings and other non-mechanical damage.

8.9 INSPECTION

Inspection of installed frames and glass shall, amongst others, be carried out according to the following criteria:

8.9.1 SCRATCHES AND BLEMISHES

This inspection will be viewed at a distance of three metres under normal lighting conditions, i.e. reasonable lighting conditions under which the project is normally viewed.

8.9.2 FENESTRATION

Scratches on framing are defined as being a mark on the surface, which penetrates the powder coated, anodised or painted surface, thereby exposing the base material.

If visible when viewed from a distance of three metres under normal lighting conditions, the product may be rejected. Flaws/Stains, paint runs or other indication that mars the aesthetic appearance of aluminium, which is visible when viewed from a distance of three metres under normal lighting conditions, may cause the product to be rejected.

8.9.3 GLASS AND PLASTICS

In laminated glass interlayer bubbles larger than 1.5mm diameter will not be allowed. Larger clusters or close spacing of smaller bubbles will also be disallowed.

If visible when viewed from a distance of three metres under normal lighting conditions scratches in glass and plastics will not be acceptable.

8.10 QUALITY ASSURANCE

8.10.1 AT PLAN APPROVAL STAGE:

NOTE:
Government Gazette # 31084 dated 30 May 2008 declared regulations, as set out, to come into operation on 1 October 2008.

Government Gazette # 34463 dated 22 July 2011 declared regulation XA, as set out, to come into operation on 9 November 2011.

The above Gazettes not only introduced Energy Efficiency in Buildings but also compelled participants in the building industry to reliably demonstrate, or predict with certainty, to the satisfaction of the appropriate local authority, that an adopted building solution has an equivalent or superior performance to a solution that complies with the requirements of the relevant part of SANS 10400 (Regulation AZ4 (1)(b)(ii))

This is reinforced by regulation A2 (1)(g) which requires any person intending to erect any building to submit to the local authority a declaration in the relevant portion of Form 1 contained in SANS 10400-A as to how the applicable functional regulation (i.e. National Building Regulations) shall be satisfied.

8.10.1.1 Obtain copy of AAAMSA Performance Compliance Report from the Aluminium System Suppliers or

8.10.1.2 Obtain a copy of the appropriate AAAMSA Performance Test Certificate from the Manufacturer/Specialist Contractor supplying/installing the Glazed Architectural Products.

8.10.2 PRIOR COMMENCEMENT OF ANY SITE WORK:

8.10.2.1 Obtain a copy of the appropriate AAAMSA Performance Test Certificate from the Manufacturer/Specialist Contractor supplying/installing the Glazed Architectural Products.

8.10.2.2 Obtain a copy of the appropriate SAFIERA Energy Rating Certification.

8.10.2.3 Obtain a full set of detailed manufacturing drawings/manuals relevant to the installed products.

8.10.3 UPON COMPLETION OF ALL SITE WORK (AT HANDOVER)

8.10.3.1 Obtain the following certificates:

a) AAAMSA Performance Test Certificate
b) AAAMSA or SAGGA Glass & Glazing Certificate
c) AAAMSA Surface Finishing Certificate
d) AAAMSA or SASA Skylight System Certificate (when applicable)
e) AAAMSA Architectural Product Certificate (in the event drawings are not provided)
f) SAFIERA Energy Rating Certification

8.11 GENERAL

8.11.1 This General Specification for Glazed Architectural Products replaces all previous publications.

8.11.2 Attention is drawn to SANS 10160-3 Wind Action which has profoundly changed the method for the determination of wind action on buildings/fenestration. In terms of SANS 10400-N wind action on fenestration (glazing) must be determined by a Competent Person (Structures).

8.11.3 AAAMSA has withdrawn all its recommendations to determine wind load on glazing in view of paragraph 1.10.2 above.

8.11.4 The requirements for Energy Efficient Design for Fenestration have been based on SANS 10400-XA and SANS 204.

8.12 DESIGN GUIDELINE FOR ALUMINIUM FRAMED SKYLIGHTS AND SLOPED GLAZING

Sloped glazing includes the fenestration of skylights and space enclosures which are tilted more than 15º from the vertical. Sloped glazing systems should be inclined a minimum of 15º from the horizontal to insure proper condensation and water infiltration control and to minimize accumulation of dirt above horizontal or purlin framing supports. Systems inclined less than 15º from the horizontal may require special consideration.

All glazing materials are breakable. Failure may not be recognizable; breakage is usually sudden, sometimes unnoticed, and frequently for no readily apparent cause. Glass breakage from any cause is a probability function due to the minute individual characteristics of apparently identical panes. Sloped glazing installations may be situated above areas where people pass or work. This raises safety and liability considerations for the owner, designer, glazing and skylight manufacturer. Breakage can result from any of the following causes:

1. Excessive loading: wind, live, snow or concentrated
2. Impact loads from falling (i.e. hailstones) or wind borne (i.e. roof gravel) objects
3. Thermal effects generated within the glazing material itself (i.e. heat-absorbing tinted, reflective) due to inclined position
4. Inadequately designed glazing system which does not provide proper support, clearance and drainage
5. Edge or surface damage to glazing material during manufacturing, handling, installation or maintenance

6. Vandalism or destructive accidents
7. Effects of long-term weathering

Condensation, while generally not a factor affecting human safety, is an important consideration in the design of overhead glazing systems. Skylights and space enclosures should be mechanically designed (through the use of a guttered weep system) to control both condensation and water infiltration. Alternatives would be to increase the insulation value of both the glazing material and the framing elements exposed to internal atmosphere or to prevent the internal moist atmosphere from coming into contact with the cold parts of the glazing system by means of a vapour barrier. It must also be noted that should a roof light be installed using a light well on a pitched roof the walls of that light well may effectively bypass the ceiling insulation and therefore the wall of the lightwell may have to be insulated to prevent condensation formation.

The use of architectural systems designed for vertical application must be discouraged as these systems lack the ability to drain condensation.

Aluminium is the material of choice for skylight construction. Aluminium is lightweight and can be easily extruded into the complex shapes necessary for skylight design. However the properties of aluminium must be clearly understood by the architect and engineer, and not based on the “steel manual” way of thinking.

For example, the stiffness of aluminium is one-third that of steel; an aluminium section can deflect three times that of an identical steel section under the same conditions without permanent deformation. An engineer or architect may thus question the allowable deflections of some aluminium-framed structures, when no damage whatsoever will result from these deflections.

The coefficient of thermal expansion is twice that of steel. Steel/Aluminium interfaces must be carefully analysed or serious connection problems could result. The effect of thermal movement can also impact on various support conditions.

Aluminium is anodic in nature and the potential for galvanic corrosion with dissimilar materials exists. Even though an interior space is considered a dry space, at times of high relative humidity there can be condensation on connections adjacent to steel or concrete curbs. Using a proven barrier between dissimilar elements can minimize this problem.

Also the heat of welding will change the temper of the aluminium alloy and reduce the allowable stress within 25mm of the weld area.

Engineers and designers are advised to consult the Aluminium Federation of Southern Africa for detailed information on maximum permissible stresses for aluminium alloys.

The vast majority of building designers and engineers' expertise is with steel and concrete structures. The basic engineering approach taken in the design of aluminium skylights is no different to that of steel or concrete, but many of the rules of thumb, or typical critical engineering considerations, are very different. The following section addresses these important differences. As each of these complex and often unique engineering problems cannot be solved within the scope of this document, the goal is to highlight these considerations as an aid to the design community.

a) DEFLECTION

Aluminium and most glazing materials have high strength but relatively low stiffness so deflection criteria are the usual controlling parameters in the selection of appropriate structural components.

Three items must be considered when specifying deflection criteria:

1. Excessive deflection can cause air or water leaks. As members shift or rotate, sealant joints may fail, mechanical joints may open, insulated glass edge seals may be overstressed, or gutter systems may fail to drain properly.

2. Excessive movement may lead to glazing breakage. Differential deflection may warp glazed panels or cause metal to contact the glazing material and induce fracture.

3. Excessive deflection can detract aesthetically from a structure.

The limiting of deflection as it pertains to skylights/sloped glazing has three basic considerations (See figure 9).

i) In-plane deflection
This deflection in framing members shall not reduce the glass bite to less than 75% of the design dimension and shall not reduce the edge clearance to less than 25% of design dimension or 3mm which ever is the greater. The calculation referred to in 4.1.2 above will meet this requirement. Careful location of the setting blocks is essential in order to prevent glass to metal contact.

ii) Normal to surface deflection
This deflection shall be $1/175^{th}$ of the span of framing members up to 4115mm. For spans greater than 4115mm, but less than 12.2m deflections shall be limited to $1/240^{th}$ of the span plus 6mm.

Due to the flexibility and breakage resistance of most plastic and composite panel glazing materials relative deflections as high a 1/100 of the span can be considered for their supporting structure. Consult knowledgeable material suppliers and manufacturers.

iii) In plane racking
Racking requires careful investigation in order to assure that glazing does not come in contact with metal and that edge engagement is not compromised. Racking occurs when a force causes a rectangular skylight panel to shift out of square. Differential support settlement or deflection and lateral loads cause racking.

As many skylight geometries lack conventional diagonal bracing the structure may not have the stiffness to resist racking. There is little doubt that fixing glazing panels do help stiffen a structure and reduce the effects of racking. However, quantifying this benefit has proven extremely difficult.

Creep and compression set in gaskets, fabrication and installation tolerances, as well as thermal movement considerations, necessitate caution. When racking is a concern, consultation with knowledgeable manufacturers is recommended.

b) SIDEWAY

Sideway, or story drift, as it relates to aluminium skylights is not specifically addressed by any standards, although it occurs in most freestanding frames. The objectives of the proper limitation of excessive sideway are identical to that for deflection; to limit glazing breakage, leakage, and visual impact. Again careful consideration must be given to both in-plan and out-of-plane sideway, as well as differential sway caused by varying spacing or end conditions that may cause racking or warping of glazing.

Differential drift or sideway of aluminium framed skylights due to lateral load between any two points of a continuous glazed frame should be limited to the difference in height/160 for glass or height/100 for non-glass glazing materials. The designer should specify the absolute maximum differential drift. Figures 8.1 to 8.5 depict the deformed geometries of several typical skylight forms.

Glazed ends of freestanding frames can pose complex detail problems if sideway is large. End details must transfer transverse load into the system and still allow the primary frame to sway. When improperly designed, differential sideway will lead to warping and possibly breakage in the glazing material. Consultation with knowledgeable manufacturers may be appropriate for details of this nature.

c) CONNECTIONS

When analysing an aluminium skylights, connections account for the vast majority of engineering documentation. Assumptions made in the general frame analysis must be coordinated with the design of the connections. As custom shapes are the rule rather than the exception, most connections must be engineered from scratch.

Moment connections are commonplace in aluminium skylights, yet are often not scrutinized as closely as they should be. The elastic method for design of eccentrically loaded fastener groups is the most widely accepted in aluminium construction.

The development of high-strength steel bolts has led many designers to utilize the concept of friction connections in steel design. Aluminium would seem to be a natural for this technique the coefficient of friction is quite high. However, skylight components are typically pre-finished, therefore this justification becomes suspect.

Furthermore, aluminium and stainless steel bolts are not capable of the high torques required for friction connections. Friction connections should not be counted upon in the design of aluminium framed skylights.

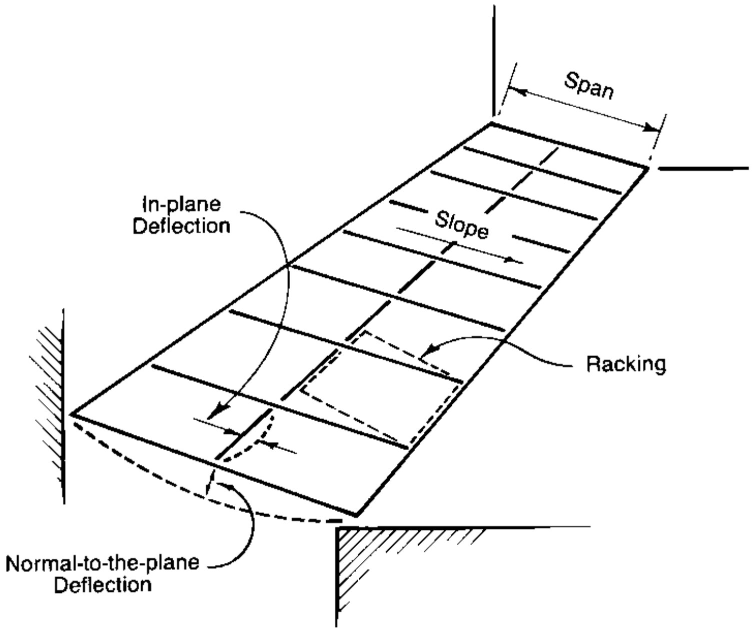

Figure 8.1: Deflection Considerations of a Single Slope Skylight

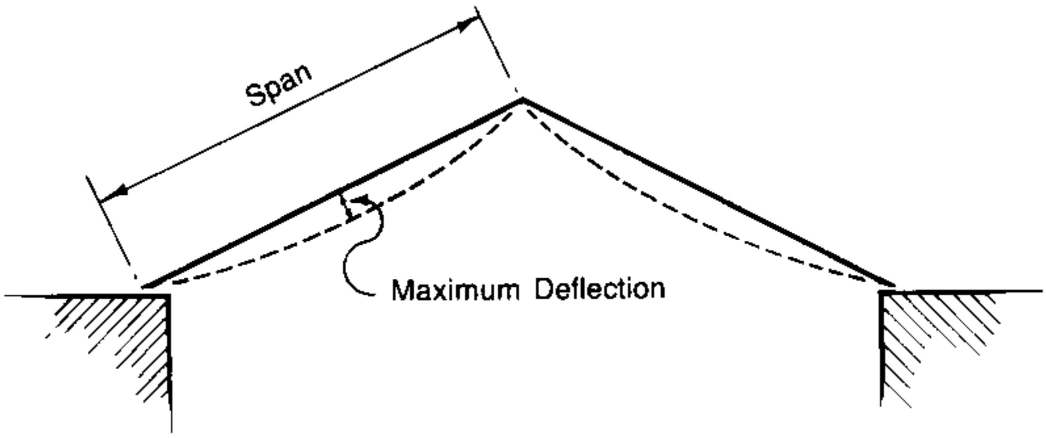

Figure 8.2: Ridge Skylight Deformation under Gravity Loads

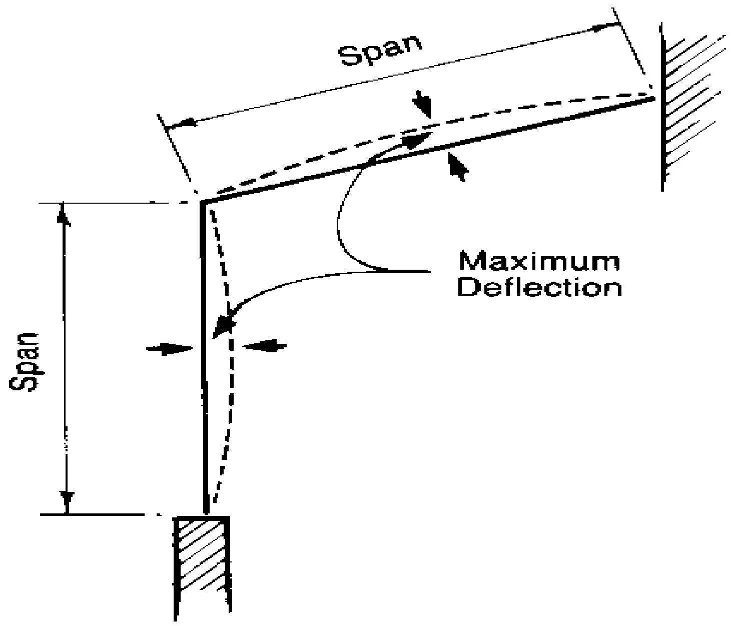

Figure 8.3: Lean-to Skylight Deformation under Wind Load

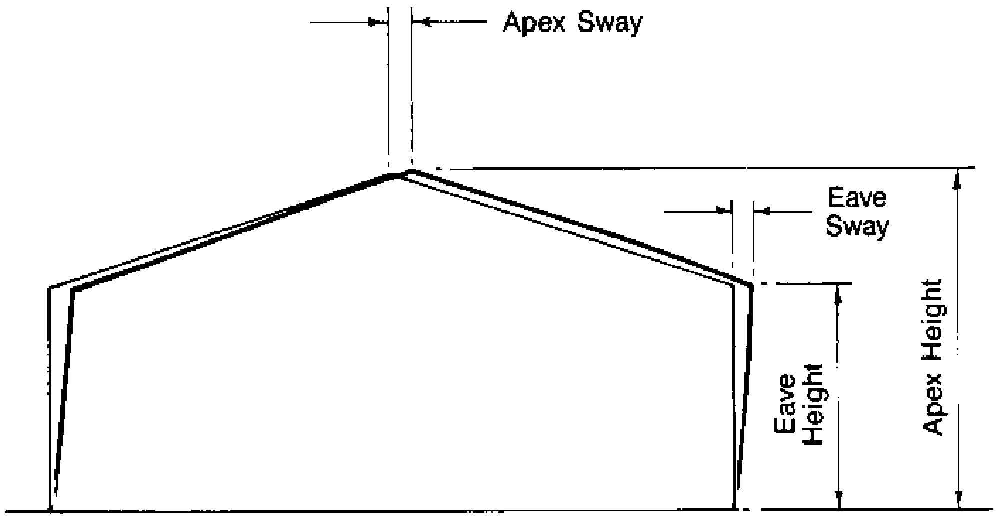

Figure 8.4a: Gable Frame Deformation under Wind Load

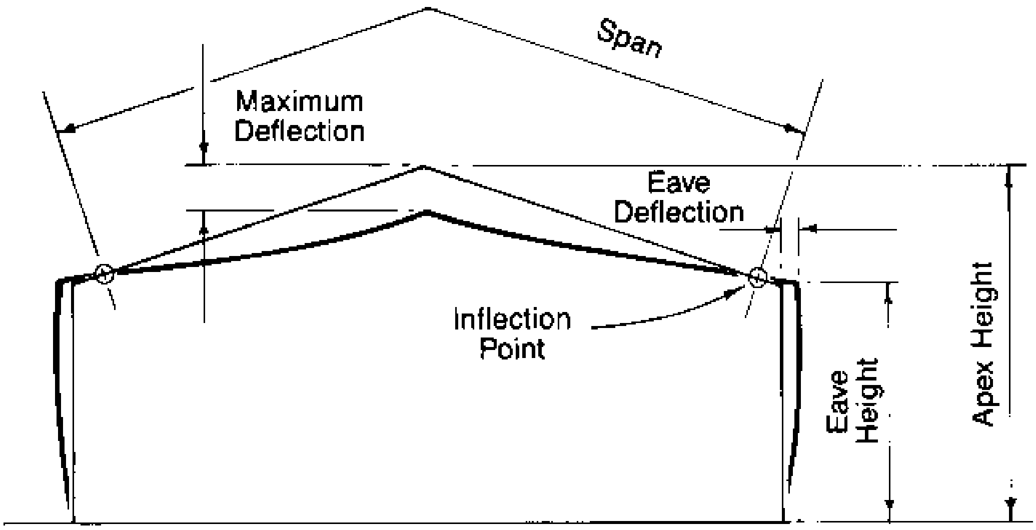

Figure 8.4b: Gable Frame Deformation under Gravity Loads

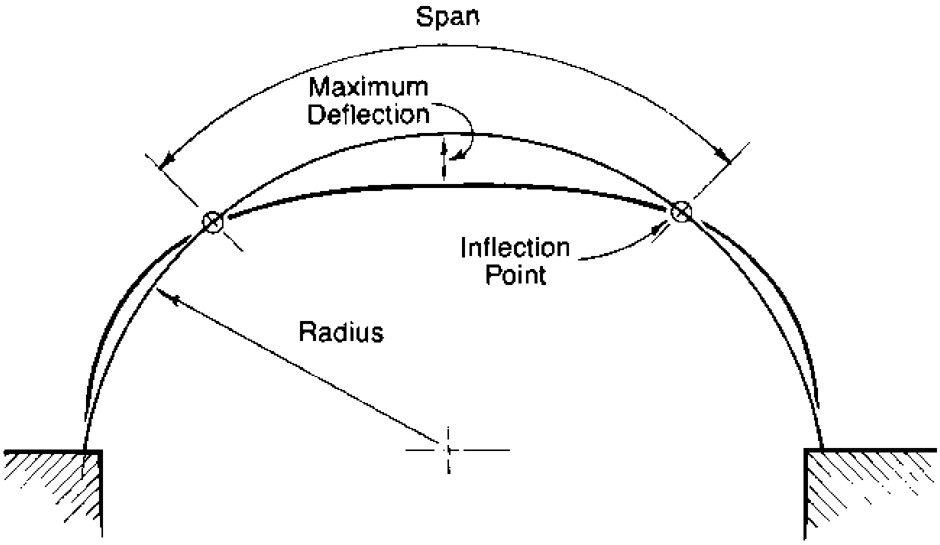

Figure 8.5a: Arched Frame Deformation under Gravity Loads

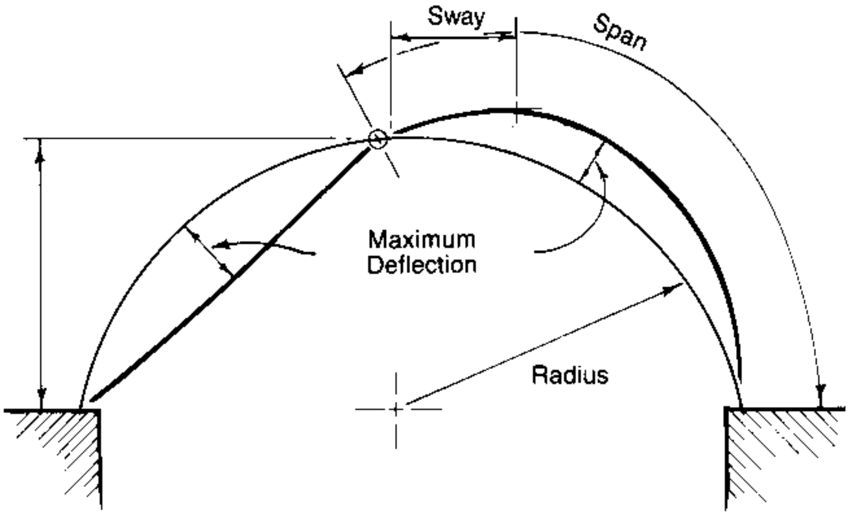

Figure 8.5b: Arched Frame Deformation under Wind Loads

d) SUPPORTS

Support conditions and other interfaces between aluminium and adjacent construction can also be complex. Not only should thermal movement, deflection, water infiltration and electrolytic corrosion effects be considered, but the transfer of loads from one structural element to another must be accomplished. Care must be exercised in coordinating the structural requirements and assumptions of the supporting structure with those of the skylight.

All skylights exert some degree of both vertical and horizontal forces on the supporting structure. Considerable horizontal forces on the supporting structure. Gravity loads alone can generate considerable horizontal thrust. Improperly designed supports can lead to excessive skylight deflection and other associated complications. As a general guideline horizontal deflection of skylight supporting curbs should be limited to 1/750 of the curb length or 12mm unless curb flexibility is considered in the analysis of the skylight frame.

The skylight manufacturer is responsible for the structure integrity of the skylight system and should fully describe all forces exerted on the supporting structure. Responsibility for the design of the structure supporting the skylight is that of the building's structural engineer. Improved communication between engineers, designers and manufacturers is the key to eliminating problems associate with supporting structure. Typically, the supporting structure is constructed of steel, concrete or wood. All three of these materials can be engineered to properly support a skylight; however, several practical concerns warrant review.

i) Steel

Erection tolerances for steel are commonly unacceptable for pre-fabricated skylights. Dimensions must be either guaranteed or adequate provisions made for adjustment within the skylight system. Pre-drilled holes and shop-welded support brackets must be detailed with caution as their in-place location is often suspect.

Access to supporting steel can also be complicated by prior coordination between trades. Careful planning with input from the skylight manufacturer is recommended.

i) Concrete

As with steel, tolerance and accessibility are critical concerns. Cast-in-place anchor bolts are often located improperly. Zinc or cadmium plated steel expansion anchors are usually preferred. Minimum spacing and edge distances for expansion anchors in concrete often dictate a curb width of at least 200mm.

ii) Wood

Wood is a popular choice for skylights substructure, but must be engineered with caution. Wood is very flexible. Its stiffness is one-tenth that of aluminium. Curb deflection must be closely scrutinized. Lag bolts in wood have limited holding power compared to steel or concrete. Anchor design is typically governed by the strength of the wood, not the fastener, and in many instances leads to an excessive number of anchors.

e) LATERAL BRACING OF BEAMS

Lateral bucking is a failure mode commonly overlooked in the design of aluminium skylights.

f) SLENDERNESS AND STABILITY RATIO

Contact the Aluminium Federation of Southern Africa for information regarding Standards and Stability ratios. This failure mode can be prevented by adequate lateral bracing of the compression flange. Of course, cross bars or purlins, provide this critical function under typical live and load conditions. However, under negative wind load cases, the compression flange may be partially braced or un-braced. For adequate crossbar bracing of the compression flange in this mode, the crossbar depth must be at least 50% of the main rafter bar’s depth.

8.13 PROPERTIES FOR SPECIALIZED PLASTIC GLAZING MATERIALS

Table 8.2: Shading Coefficients* for Specialised Plastic Glazing Materials

Cast Acrylic Sheet		
Clear	1,0	
Bronze	0,78	
Opal	0,47	
Polycarbonate Sheet		
Clear	0,97	
Bronze	0,75	
Opal	0,67	
Multiwalled Polycarbonate Sheet	**6mm**	**10mm**
Clear	0,99	0,98
Bronze	0,63	0,63
Grey	0,58	0,58
Blue	0,81	0,76
Green	0,59	0,59
Opal	0,87	0,82

** Due to the vast range of available product the specifier is advised to consult with manufacturers/suppliers to obtain/confirm relevant data.*

Table 8.3: Acoustical Insulation Solid Polycarbonate * Sheet DIN 52210

Thickness in mm	75 Rw (db)
4	27
5	28
6	29
8	31
9.5	32
12	34

Table 8.4Heat Loss Properties Solid Polycarbonate * Sheets

Thickness in mm	U-Value W/m^2K
4	5,33
5	5,21
6	5,09
8	4,84
9.5	4,69
12	4,35

** Due to the vast range of available product the specifier is advised to consult with manufacturers/suppliers to obtain/confirm relevant data.*

Table 35: Centre to Centre distance glazing profiles (shortest side)./Specialized Plastic Glazing Materials (solid Sheets)

Sheet thickness in mm	Ratio sheet width/sheet length																							
	1:1	1:2	1:>2	1:1	1:2	1:>2	1:1	1:2	1:>2	1:1	1:2	1:>2	1:1	1:2	1:>2	1:1	1:2	1:>2	1:1	1:2	1:>2	1:1	1:2	1:>2
3	775	600	400	700	550	375	650	500	-	600	450	-	575	400	-	550	-	-	525	-	-	500	-	-
4	1050	800	550	950	700	490	875	650	450	825	600	425	780	550	400	740	500	-	710	475	-	685	450	-
5	1300	975	675	1180	975	325	1100	800	575	1025	750	550	975	700	510	930	670	490	900	625	470	875	560	450
6	1475	1150	800	1375	1010	725	1300	960	680	1225	900	650	1175	850	600	1125	800	575	1075	710	550	1025	650	525
8	1850	1450	1150	1700	1350	1000	1600	1275	925	1525	1200	860	1475	1150	810	1425	1075	775	1375	1000	750	1325	950	725
9.5	2050	1600	1300	1950	1475	1150	1850	1400	1075	1750	1350	1025	1675	1300	975	1625	1250	925	1575	200	880	1525	1100	850
12	2050	1750	1500	2050	1700	1400	2050	1600	1325	2050	1525	1275	2000	1475	1225	1950	1450	1175	1875	1400	1125	1800	1350	1075
Loading in Pa		600			800			1000			1200			1400			1600			1800			2000	

Warning!!

Persons using these methods for selection of plastic materials **MUST** obtain confirmation for their findings, in writing, from Competent Person (Glazing) without exception!

Table 36: Typical Properties Polycarbonate * Solid sheet

	Standard	Unit	Polycarbonate Solid Sheet
Physical Properties Specific gravity	DIN 53479		1.20
Mechanical Properties Tensile strength at yield	DIN 53455	N/mm^2	>60
Tensile strength at break	DIN 53455	N/mm^2	>70
Elongation at yield	DIN 53455	%	6-8
Elongation at break	DIN 53455	%	>100
Flexural modulus	DIN 53457	N/mm^2	2500
Flexural yield strength	DIN 53452	N/mm^2	100
Impact strength (falling dart) *	GE Method	Nm	>200
ZOD notched (1/8")	ASTM	J/m	600-800
At room temperature	D256		
Thermal Properties Heat resistance temperature: Vicat VST/B	DIN 53460	°C	>145-150
DTUL 1.82N/mm^2	ASTM D648	°C	135-140
Coefficient of linear thermal expansion	VDE	m/m°C	6.7 x 10-5
Thermal Conductivity	DIN 52612	m/m°C	0.21

*Measured on injection moulded test specimens.

AAAMSA Fenestration

Table 37: Centre to centre distance curved support/glazing profiles in metres

Sheet thickness in mm	Radius in metres: 0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.6	5.8	Pa
3	2.05	1.83	1.26	1.0	0.8	0.7	0.55	0.48	0.40																			600
4			2.05	2.0	1.62	1.35	1.15	0.97	0.85	0.75	0.68	0.6	0.55															
5						2.05	1.98	1.68	1.45	1.3	1.115	1.03	0.95	0.88	0.8	0.74	0.68	0.63										
6									2.05	2.0	1.8	1.6	1.46	1.34	1.24	1.14	1.05	1.0	0.9	0.85	0.8	0.75						
8																	2.05	1.9	1.82	1.7	1.6	1.5	1.4	1.3	1.24	1.18	114	
3	2.05	1.34	0.98	0.76	0.5	0.44																						800
4		2.05	1.95	1.50	1.2	1.0	0.86	0.75	0.65	0.58	0.53																	
5					2.05	1.75	1.48	1.26	1.1	0.98	0.88	0.8	0.73	0.67	0.6	0.56												
6							2.05	1.95	1.72	1.52	1.36	1.22	1.12	1.02	0.95	0.87	0.8	0.75										
8													2.05	2.0	1.85	1.72	1.6	1.5	1.4	1.3	1.22	1.17	1.1	1.05	1.0			
3	1.60	1.1	0.8	0.6	0.5	0.4																						1000
4		2.05	1.58	1.25	0.98	0.82	0.7	0.6	0.53																			
5				2.05	1.65	1.38	1.18	1.02	0.9	0.8	0.72	0.65	0.6															
6						2.05	1.87	1.58	1.37	1.22	1.1	1.0	0.9	1.8	0.77	0.7												
8											2.05	1.95	1.8	1.63	1.5	1.4	1.3	1.2	1.13	1.06	1.0	0.94	0.9					
3	1.40	0.9	0.66	0.52	0.42																							1200
4	2.05	1.88	1.36	1.02	0.83	0.7	0.6	0.5																				
5			2.05	1.78	1.43	1.2	1.0	0.86	0.76	0.67	0.6																	
6					2.05	1.80	1.53	1.32	1.16	1.03	0.93	0.85	0.77	0.7														
8										2.05	1.85	1.66	1.50	1.38	1.28	1.17	1.1	1.02	0.96	0.9	0.86							
3	1.25	0.8	0.58	0.45																								1400
4	1.9	1.67	1.13	0.9	0.71	0.6	0.5	0.45																				
5			2.05	1.54	1.22	1.0	0.86	0.75	0.66	0.6																		
6				2.05	1.96	1.59	1.34	1.15	1.0	0.9	0.8	0.7																
8									2.05	1.78	1.58	2.43	.32	1.1	1.02	0.95	0.9	0.8										
3	1.02	0.7	0.51	0.4																								1600
4	1.65	1.36	1.0	0.8	0.65	0.53	0.45																					
5		2.05	1.7	1.32	1.07	0.9	0.8	0.66	0.6																			
6				2.05	1.66	1.38	1.17	1.0	0.9	0.8	0.7																	
8								2.05	1.75	1.57	1.42	1.27	1.15	1.06	1.0	0.9	0.85	0.8										
3	0.9	0.6	0.45																									1800
4	1.5	1.22	0.92	.07	0.57	0.47																						
5		2.05	1.52	1.2	1.0	0.8	0.7	0.6																				
6			2.05	1.82	1.47	1.23	1.04	0.9	0.8	0.7																		
8							2.05	1.85	1.6	1.4	1.25	1.15	1.05	0.95	0.9	0.8												
3	0.84	0.56	0.42																									2000
4	1.35	1.12	0.82	0.64	0.51	0.43																						
5	2.05	1.8	1.4	1.1	0.9	0.7	0.62																					
6			2.05	1.68	1.35	1.12	0.96	0.83	0.7																			
8						2.05	1.9	1.6	1.45	1.27	1.14	1.3	0.94	0.86	0.8													

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