5. SELECTION OF GLAZING METHODS

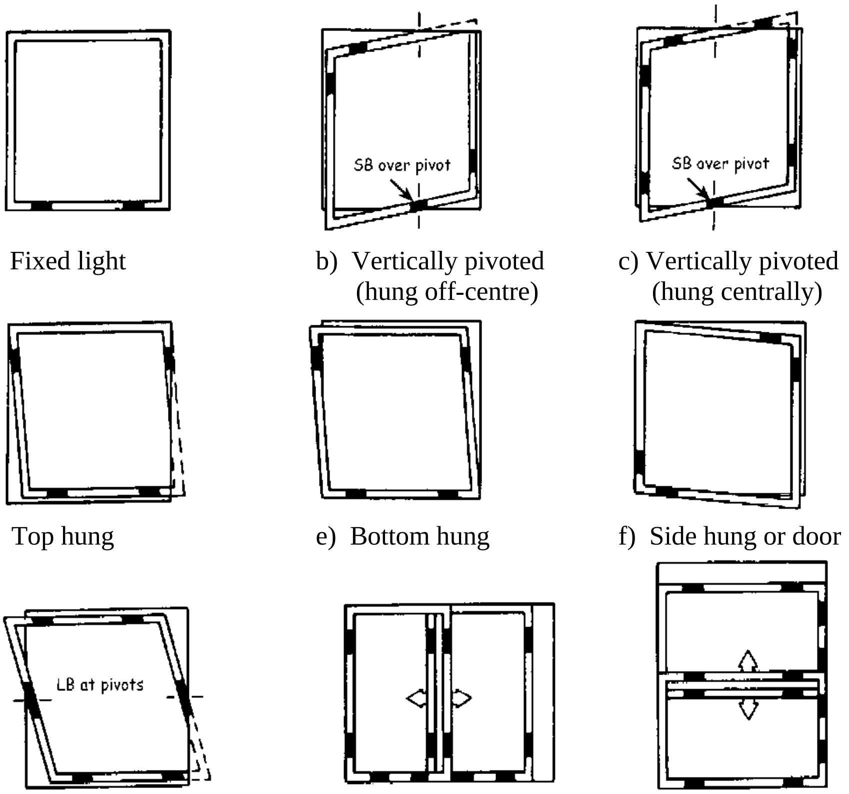
5.1 SETTING AND LOCATION BLOCKS

Glass-to-metal contact must be avoided at all times by using setting and location blocks having a hardness of 50º to 90º shore A durometer. Use only blocks made of Neoprene, EPDM, Silicone or other elastomeric material.

Setting blocks are to have a minimum thickness of 3mm and must be at least 27mm in length per square metre of glass area.

In the event of laminated glass and/or sealed insulated glass units drainage is to be provided to prevent the glass edge to be submerged. Two or more 7mm diameter holes or 5mm x 9mm slotted holes, or larger, are to be equally spaced in the sill section of sash or frame to allow for such ventilation/drainage.

The position of the setting and location blocks is illustrated in Figure below:



a) Fixed light
b) Vertically pivoted (hung off-centre)
c) Vertically pivoted (hung centrally)
d) Top hung
e) Bottom hung
f) Side hung or door
g) Horizontally pivoted and reversible
h) Horizontally sliding; 6 blocks to each pane
i) Vertically sliding

Figure 5.1: Position of setting and location blocks

5.2 PREFORMED COMPRESSION GASKETS

Also known as gasket glazing or channel glazing this method forms an integral part of the design of the individual architectural aluminium systems.

It is therefore essential that the manufacturer/sub contractor uses only those preformed compression gaskets supplied by the architectural aluminium systems suppliers as part of the system.

Gaskets used from other sources will compromise the air and water tightness of the installed glazing systems i.e. the installed end product.

Preformed compression gaskets are manufactured of PVC or synthetic rubber and product testing by our Association has concluded that PVC gaskets are only suitable for products having A1 performance requirements. PVC gaskets, washers and the like must not be used in conjunction with specialized plastic glazing materials as the plasticiser in the PVC reacts adversely with the specialized plastic glazing materials.

All tests conducted on products having A2, A3 and A4 performance requirements use synthetic rubber (i.e. Santroprene and the like) as material for the gaskets.

10. GUIDE FOR ACCURACY OF INSTALLED ARCHITECTURAL ALUMINIUM PRODUCTS

This AAAMSA Guide will assist Architects, Specifiers, Manufacturers, Suppliers and Installers of Architectural Aluminium and Glazing Products in determining the accuracy of manufacturing and installation dimensions of Architectural Aluminium and Glazing Products.

10.1 INHERENT DIMENSIONAL INACCURACIES

Dimensional accuracies of other building materials are covered in SANS 10155 – Accuracy in Buildings. These inherent dimensional inaccuracies are due to the nature of the materials involved and include the following:

10.1.1 MOVEMENT OF FOUNDATIONS

Due to the nature of the products used in Architectural Aluminium and Glass Products, expansion joints which allow parts of buildings to move independently from one and other can cause the components to deform permanently and/or break. It is recommended that expansion joints are located away from openings incorporating Architectural Aluminium and Glazing Products for this reason.

The onus rests with the Architect/Consulting Engineer/ Specifier to specify the expected movements in the expansion joints at time of tender.

10.1.2 DEFLECTION UNDER LOAD

The design of Architectural Aluminium Products such as Curtain Walling, Window Walling, Staircase Screens and Shopfronts are very susceptible to damage due to the deflections of the structure to which the Architectural Aluminium and Glazing Products are fixed. At no time is it permitted that loads imposed by the deflections of the structure are supported by the installed Architectural Aluminium and Glazing Products.

Settlement, creep, occupation load deflections and any other type of deflection movements are to be specified by Architect/Consulting Engineer/Specifier at time of tender.

10.1.3 CHANGES IN DIMENSIONS CAUSED BY VARIATIONS IN TEMPERATURE

In addition to requirements of paragraph 10.1.1, 10.1.2 and 10.2 the manufacturer of Architectural Aluminium Products must take cognisance during the design of the Products of the changes in dimensions caused by variations in temperature. The range of the expected changes of temperature is to be specified by the Architects/Consulting Engineer/Specifier at time of tender.

Table 10.1: Illustrates the changes in dimensions caused by a variation of 65°C (-10°C to + 55°C) for various building materials

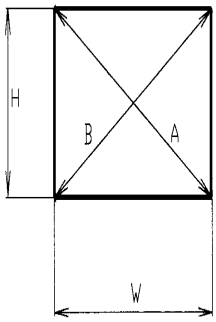
Building Material	Coefficient of Linear Expansion	Changes in dimensions (in mm) caused by variations in temperature over a range of 65° centigrade for a distance of					
	/°C	1m	2m	3m	4m	5m	6m
Concrete	15×10^{-6}	0.98	1.95	2.93	3.90	4.88	5.85
Steel	12×10^{-6}	0.78	1.56	2.34	3.12	3.90	4.68
Aluminium	23×10^{-6}	1.50	2.99	4.49	4.98	7.48	8.97
Glass	9×10^{-6}	0.59	1.19	1.76	2.34	2.93	3.51
PVC	50×10^{-6}	3.25	6.50	9.75	13.00	16.30	19.50

10.2 INDUSED DIMENSIONAL INACCURACIES

Induced Dimensional Inaccuracies are brought about by the actual work done during manufacture and installation of Architectural Aluminium Products and may arise in the determination of the following:-

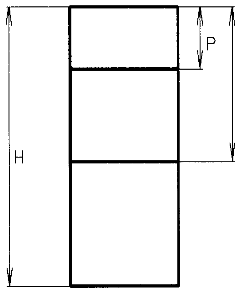
10.2.1 MANUFACTURED DIMENSIONS (ACCURACY OF FABRICATION)

OVERALL FRAME DIMENSIONS



Height or width	TOL	Difference between A & B	Straightness (Bow)
Up to/incl 2500	+0 -1.5mm	3.0mm	1.5mm
2501 Upwards	+0 -3.0mm	3.0mm	3.0mm

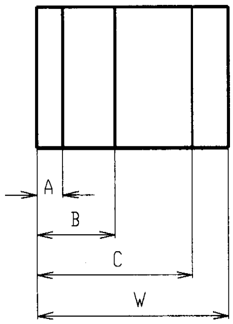
TRANSOM DIMENSIONS (Positioning within framing)



P ± 1.5mm

Q ± 1.5mm

MULLION DIMENSIONS (Positioning within framing)



A ± 1.5mm

B ± 1.5mm

C ± 1.5mm

10.2.2 INSTALLED DIMENSIONS

Table 10.2: INDIVIDUAL FRAMES AND VENTS	FRAME	DOOR/VENT
i. Fitting of moving components (Opening sections i.e. doors and vents into frames)	±1.5mm	± 1.5mm
ii. Level (subject to limit between adjacent units - see 3.3)	± 5mm per bay or per linear metre	
iii. Plumb	± 3mm per metre height and maximum of 10mm per storey height	
iv. Position of fare of frame relative to gridline or reference surface	± 10mm	

Table 10.3: CURTAIN WALL AND STRIP WINDOW COMPONENTS	FRAME	DOOR/VENT
i. Fitting of moving components (Opening sections i.e. doors and vents into frames)	± 1.5mm	± 1.5mm
ii. Level of horizontal member or edge (subject to limit between adjacent units - see 3.3)	± 3mm per linear metre or maximum 10mm per structural bay	
iii. Plumb of vertical member or edge or plain of glazing	± 3mm per metre height and maximum of 10mm per storey height	
iv. Position of centre line of any vertical member relative to gridline or reference surface	± 10mm	
v. Position of centre line of any horizontal member relative to benchmark or reference surface	± 10mm	

10.2.2.1 ACCURACY OF JUNCTIONS BETWEEN COMPONENTS

a) Within the length of any joint (including in-line continuations across transverse joints). The greatest width shall not exceed the least width by more than 15%

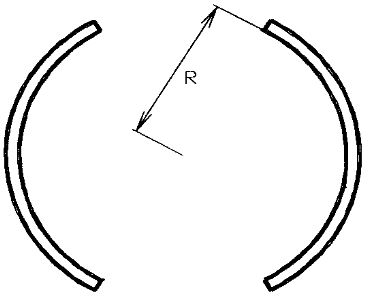
or 2.5mm which ever is greater. Any variation to be evenly distributed with no sudden changes.

b) The offset in elevation between nominally in-line edges across a vertical or horizontal transverse joint shall not be more than 15% or 2.5mm which ever is greater of the width of the transverse joint.

c) The offset in plan or section between flat surfaces of adjacent panels across any joint shall not be more than 15% or 2.5mm which ever is greater of the width of the joint.

10.2.2.2 REVOLVING DOORS

Inner surface of cheeks to be correct to ± 3mm measured from pivot centre of revolving door.



10.3 GENERAL

10.3.1 The selection of grade of accuracy for Architectural Aluminium Products as laid down in this guide has been based on "Grade II accuracy" as defined in Table 7 of the South African Code of Practice for Accuracy in Buildings SANS 10155 where applicable.

10.3.2 At the time of tender the Architect/Consulting Engineer/Specifier must supply the required information noted under point 2 and all parties must agree the permitted deviations for movement joints.

10.3.3 It is noted that the manufacturer of Architectural Aluminium Products assumes that the structure to which the products are fixed are constructed to Grade II accuracy as laid down in SANS 10155-2009 Edition 1.2.

10.3.4 Should the structure not be build to Grade II accuracy, this is to be indicated at tender stage as the manufacturer of Architectural Aluminium Products must compensate for the deviation as follows:

10.3.4.1 Structures built to Grade III accuracy require the Architectural Aluminium Products to absorb larger dimensional inaccuracies.

10.3.4.2 Structures built to Grade I accuracy require the Architectural Aluminium Products to absorb smaller dimensional inaccuracies and require increased amount of control during building, manufacture and installation.

10.4 QUALITY GUIDE FOR INSTALLED ARCHITECTURAL ALUMINIUM PRODUCTS

AAAMSA is very aware of the fact that the quality for manufactured aluminium products depends on the control exercised by the sub-contractor over all the activities concerned, from design through to fabrication and installation. Although the product may have some form of protection it is still very susceptible to damage on site by following trades. Unless a product is properly controlled during these various stages, it will not necessarily meet the requirements expected by the building owner and specifier.

With the above in mind, the purpose of this guide is to enable building owners, specifiers, building contractors and sub-contractors to be able to easily establish on-site that the installed products confirm to acceptable industry norms.

AAAMSA considers the following requirements should be addressed when carrying out on-site inspections of installed architectural aluminium products.

10.4.1 PRE-INSPECTION COMPLIANCE LIST

Specifiers are recommended prior to the installation of products to ensure that a thorough check is made for compliance with the specification. This will include inter alia:-

- The production of relevant AAAMSA test certificates.
- Proof that anodising complies with SABS specifications. SANS 999 in case of external application and SANS 1407 in case of internal application.
- Proof that powder coating finishes comply with a SABS specification. SANS 1247 in case of internal application and SANS 1796 in case of external application.

10.4.2 SURFACE FINISHES

i) **ANODISING**

There are likely to be variations in shade in both natural and colour anodising when viewed at different angles, this being due to the metallurgical structure and surface texture of the aluminium. This can be particularly noticeable between extrusions in opposite planes and also between extruded and sheet products.

It is recommended light and dark colour limits should agreed between the specifier, sub-contractor and finishing company, before commencement of any production. Where a thickness of anodising is specified, the bottom limit should not be more than 3 microns less than the thickness specified. It is an accepted norm that products are manufactured from pre-anodised or pre-painted materials.

ii) **ORGANIC** (Paint)

Whilst organic finishes are not as prone to initial colour variations as anodising, it is also recommended that the same pre-production procedures as for anodising be carried out and more importantly - that the correct paint specifications have been used. Severe chalking or colouration can occur if incorrect paint quality has been used.

iii) **STRUCTURAL SEALANT GLAZING**

In structural sealant glazing systems, adhesion of the sealant to the substrates is of prime importance. Since the sealant is the structural element which holds the glass place, it must be absolutely mandatory that the adhesion and compatibility characteristics of all the elements are thoroughly tested, analysed and verified by the sealant manufacturer.

10.4.3 FRAMING

All aluminium framing should be cleaned prior to inspection.

7. BASIC FASTENING POSITIONS OF SIMPLE FENESTRATION APPLICATION

7.1 GENERAL FUNDAMENTALS

BUILDING MATERIAL

The substrate and its quality are decisive for selection of the fixing: the building material and anchor base. A differentiation is made between concrete, masonry and panel building materials.

Concrete is building material containing cement, which can be divided into two sub-categories: Standard concrete and lightweight concrete. While standard concrete contains gravel, lightweight concrete comprises additives like pumice, expanded clay or stryopore, usually with lower compressive strength. Because if this, among other things unfavourable conditions occur for anchoring fixings.

The magnitude of the bearing force of a heavy-load fixing depends, among other things on the compressive strength of the concrete. This is indicated by the numbers in the short designations: e.g. the most frequently occurring concrete strength C 20/25 has a compressive strength of 25N/mm^2 when a sample 150mm cube is crushed in a test machine.

Masonry building materials. Masonry is a composite of blocks and mortar. The compressive strength of the blocks is usually higher than that of the mortar, especially in old buildings. Therefore, as much as possible, fixing should be anchored in the masonry block. Regarding fixing in masonry, often the bricks itself are the weakest part of the system. Therefore the exact load depends on the condition of the masonry.

Generally, four groups of masonry blocks are differentiated:

Solid blocks with dense structure are building materials that are very resistant to compressive loads without cavities or with only a low percentage of hole surfaces (up to max. 15%, e.g. as grip-hole). They are very well suited for anchoring fixings.

1. Solid sand-lime brick
2. Solid blocks, also known as brick or clinker brick

Perforated blocks with a compact structure (perforated and hollow checker bricks). These are mostly manufactured from the same compressive strength materials as solid blocks but are provided with cavities. If higher loads are introduced into these building materials, special fixings should be used, e.g. those which bridge or fill out the cavities.

1. Horizontal perforated blocks and vertical perforated blocks are often termed latticed or honeycomb blocks
2. Sand-lime perforated blocks, sand-lime hollow blocks

Solid blocks with porous structure usually have a very large number of pores and low compressive strength. Therefore, special fixings should be used for optimal fastening, e.g. fixing with long expansion zone and fixings that engage with the material.

1. Solid blocks of light concrete, solid blocks of expanding clay, e.g. “liapor”, “Gisoton”
2. Aerated concrete, e.g. “Ytong”, “Hebel”

Perforated blocks with porous structure (light perforated bricks) have many cavities and pores and thus usually low compressive strength. In this case, special care is needed in selection and installation of the correct fixing. Suitable fixings include those with a long expansion zone or injection anchors with a form locking anchorage - especially with light concrete hollow blocks, with cavities that can be filled with polystyrene.

Light concrete hollow blocks, e.g. of purnice or expanding clay

Panel building materials are thin-walled construction materials that frequently have only strength - e.g. plasterboard panels like “Rigips”, Knauf”, “LaGyp”, “Norgips”, gypsum fireboard like “Fermacell” or “Rigicell” or chipboard, hard particle board, plywood, etc. For optimum fastening, special fixings have to be selected: cavity fixing as they are called. These are fixings of plastic or metal and expand on the reverse side - fixing engaging with form locking that can anchor directly on the reverse side of the panel in the cavity.

Panel building materials

DRILLING

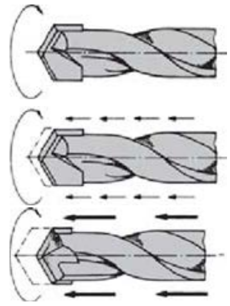
The building material is critical for drilling - four methods are available:

Rotary drilling: Drilling in rotation without impact for perforated blocks and construction materials with low strength so that the hole does not become too large and/or the webs in the perforated blocks don’t break.

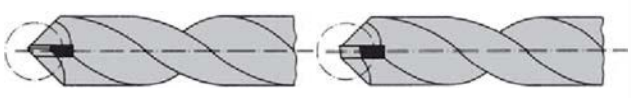
Impact drilling: Rotation and a high number of light impacts with the impact drilling machine, for solid building materials with dense structure

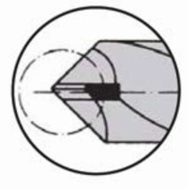
Hammer drilling: Rotation and a small number of impacts with high impact energy with the drilling hammer, also for solid building materials with dense structure

Diamond or core drilling process: Mainly used for large hole diameters or with greater reinforcement.

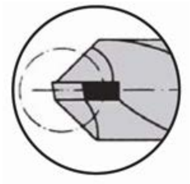


One more tip on drilling without impact: Carbide drill bits drill faster if they are ground sharp, similar to steel drill bits. There are also special masonry drill bits available.





Standard carbide drill



Sharply ground carbide drill

INSTALLATION

Generally, the following aspects have to be considered during installation:

The edge distance and axial spacing, as well as the component thickness and width, must be complied with properly if the fixing is to hold the required load. Otherwise splitting/spalling of the construction material or cracks may occur. Generally, for plastic fixings, a required edge distance 2 x h_{ef} (h_{ef} - effect, anchorage depth) and a required axial spacing 4 x h_{ef} are usual. If the expansion direction of the fixing runs parallel to the component, the edge distance can be reduced to 1 x h_{ef}.

The hole depth must - with only a few exceptions - for example be larger than the anchoring depth: that is because function safety is only ensured if the screw has enough room to project beyond the tip of the plastic fixing. The respective hole depths are indicated for all products in the product tables on the following pages.

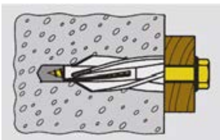
Hole cleaning after drilling, by blowing out or suction, is indispensable. A hole that is not cleaned reduces the holding forces. The drilling dust has a negative effect on proper functioning of the fixing in the hole.

THE INSTALLATION TYPES

Differentiate between three different methods:

Pre-positioned installation: in this case, the fixing is usually flush with the construction surface.
The installation sequence:
Transfer hole pattern of the object to be mounted to the anchor base. Drill, clean holes, set fixing and screw on item to be attached.

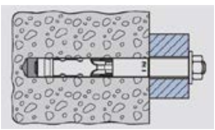
Aircrete fixing GB



Push-through installation is especially recommended to simplify installation in standard production installations or for items to be mounted with two or more fastening points:

The holes in the item to be mounted can be used as a drilling template, since their hole diameters are at least as large as the drill diameter in the construction material.
In addition to simplifying installation, a good fit of the fixing holes is achieved.

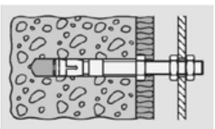
High performance anchor FH



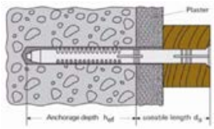
For frame fixings and use of a washer, the fixing is inserted through the washer to the rim of the fixing.

Stand-off installation is used to fasten items to be mounted at a specific distance from the anchor base with compressive and tensile strength. To do this, usually metal anchors with metric internal threads are used that can hold screw or threaded rods with lock nuts

Bolt FBN



Useful length and anchoring depth: in addition to the type of installation, the useful length and anchoring depth of the respective fixing have to be considered during installation:



The useful length d_a (clamping thickness) of the fixing and/or the screw should correspond to the thickness of the item to be mounted. On anchors with internal threads, this can be varied by selection of the screw length. However, in pass-through installation and with bolt anchors, the maximum useful length is specified by the fixing. Because of their two different approved anchoring depths, bolts anchors offer a larger variety of useful lengths.

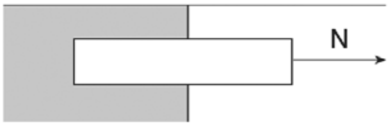
If the anchor base is covered with plaster or insulating material, screws or fixings must be selected with a useful length that corresponds at least to the plaster thickness, plus the thickness of the item to be mounted.

The anchorage depth h_{ef} corresponds, for plastic and steel fixings, to the distance between the upper edge of the load bearing component to the lower edge of the expansion part and for chemical anchors to the lower end of the treaded rod.

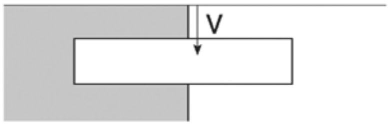
LOADING

Not only the construction material and the type of installation are important for selection of the fixing, but also the loading to which is exposed: how great is the force? In what direction does it act? And where is it applied? Accordingly, forces are determined according to: magnitude, direction and point of application. The forces are specified in kN (kilo newton - 1 kN = 100kg), the bending moments in Nm (Newton meters).

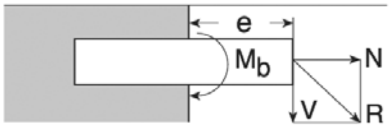
Tension



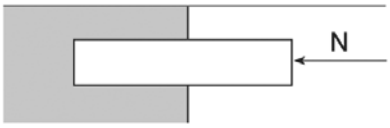
Shear load



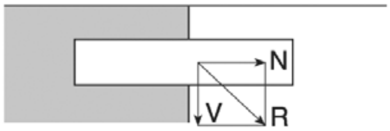
Combined tension and shear load at distance e



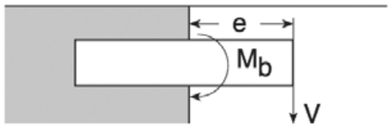
Compression



Combined tension and shear load



Shear load at distance e



N - Normal force, positive/negative, V = Shear force, Mb = Bending moment

The following loads are especially relevant for selection of the correct fixing:

Ultimate loads, i.e. those loads that lead either to a failure of the anchor base or a failure or pulling out of the fixing. Their average values result from at least 5 individual tests.

Characteristic loads designate those loads that are reached or exceeded in 95% of all tests.

Permissible loads are working loads that already include an appropriate material and installation safety factor - according to approvals by ETA e.g. these apply only if the approval conditions are complied with.

Recommended loads or maximum working loads include an adequate load safety factor.

The calculation of the maximum working load from the failure loads and/or the characteristics loads are carried out by dividing the respective failure loads by a safety factor:

$$\text{Max. working load} = \frac{\text{Failure load (F)}}{\text{Safety factor } (\gamma)}$$

Recommended safety factor
Compared to the average failure load:
- Steel and bonded anchors $\gamma \geq 4$
- Plastic fixing $\gamma \geq 7$

Compared to the characteristic failure loads:
- Steel and bonded anchors $\gamma \geq 3$
- Plastic fixing $\gamma \geq 5$

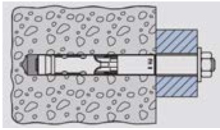
Example of a steel fixing with a failure load of 40kN: $F_{Gebr.}$ = 40kN/4 = 10kN

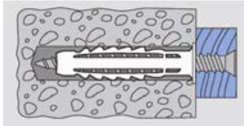
These safety factors are standard recommendations and are only to be used for fixings if northing different is indicated in the tables of this catalogue. With approved fixings, the safety factor can be decreased to γ = 2.52 by using many test series: this means that the utilization can be optimized with the use of approved fixings.

PRINCIPLES OF FUNCTION

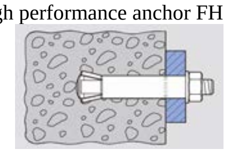
There are different bearing mechanisms that transfer the forces that act on the fixing into the base material.

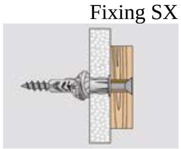
With friction connection the expansion part of the fixing is pressed against the hole wall: the outer tensile loads are held by friction.


High performance anchor FH

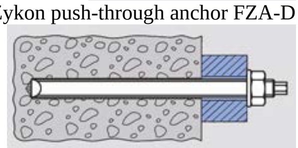

Fixing SX

With form locking, the fixing geometry matches the shape of the substrate and/or of the drill hole.


Zykon push-through anchor FZA-D


Universal fixing UX

With adhesive bond the mortar adheres the fixing with the anchor base

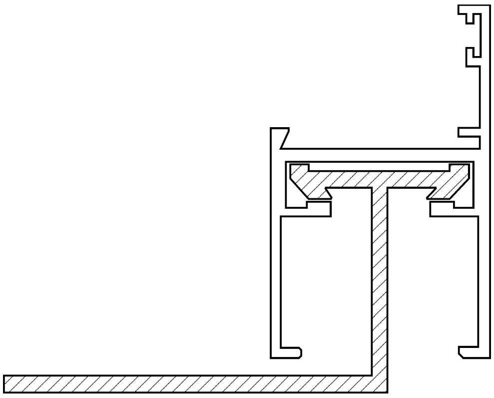

Reaction anchor R

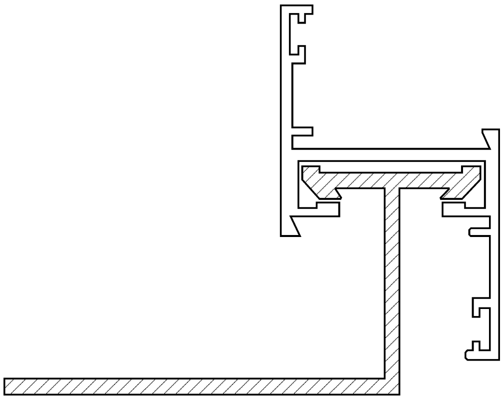
METHOD

A) WINDOWS

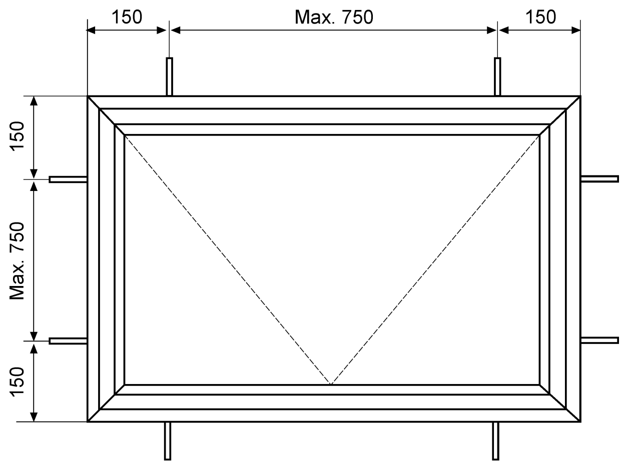
1) Using an extruded aluminium fixing lug:
This allows the window to be factory glazed and wrapped. Most commonly used when the inside reveal is to be plastered after fixing. Therefore concealing the lug. Use a minimum 6 x 35mm HPS anchor.

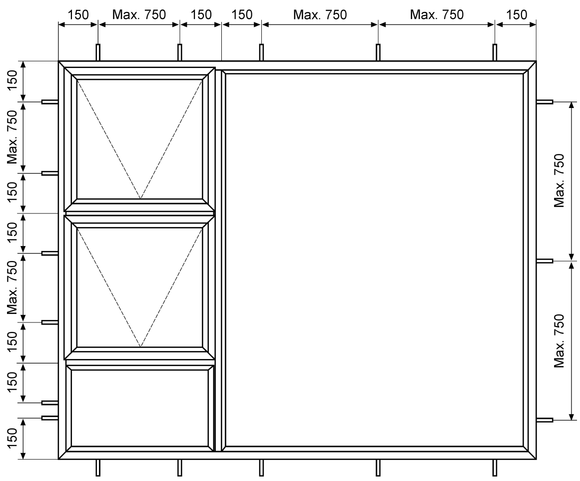
2) Using a plug and screw:
Counter sunk screw-fixing through the frame of unglazed windows. This method is used to fit a window to a face-brick reveal therefore glazing and plastic wrap is done in situ. Use a minimum 5 x 75mm stainless steel or plated woodscrew.





TYPICAL CASEMENT WINDOWS FASTENING POSITIONS



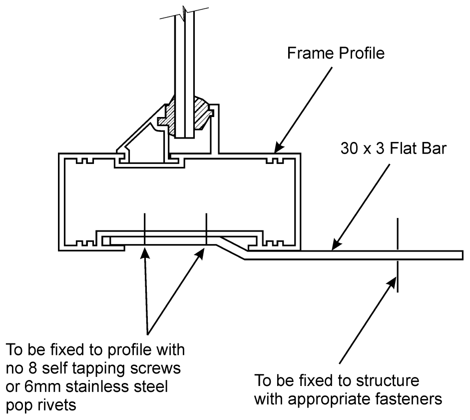


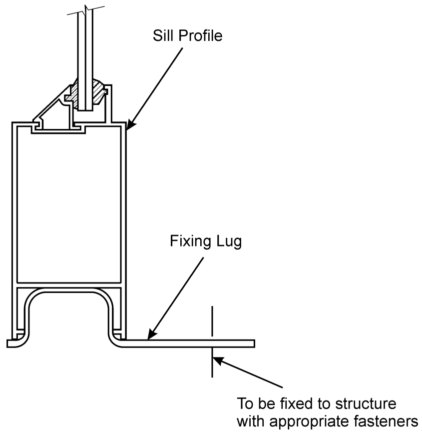
GENERAL

The window is fixed into position - the cill is then built at a later stage - the bottom lugs can be left in place but it is often found that most times the mason either bends them out of his way or breaks them off. This practically means that most windows are only secured on 3 sides.

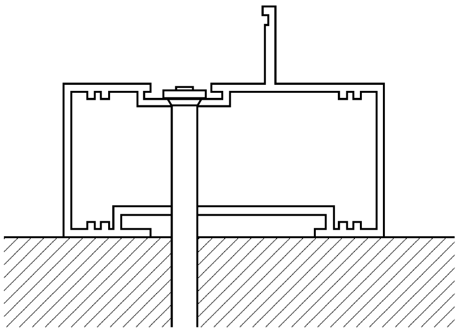
B) SHOPFRONTS:

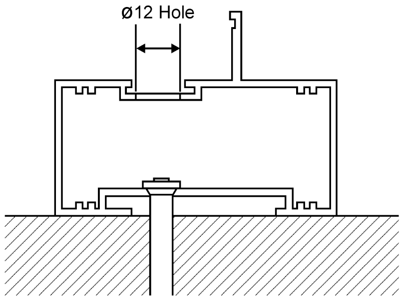
1) Using an aluminium strap:
Reveal to be plastered after installation - use a minimum 6 x 35mm HPS Anchor.





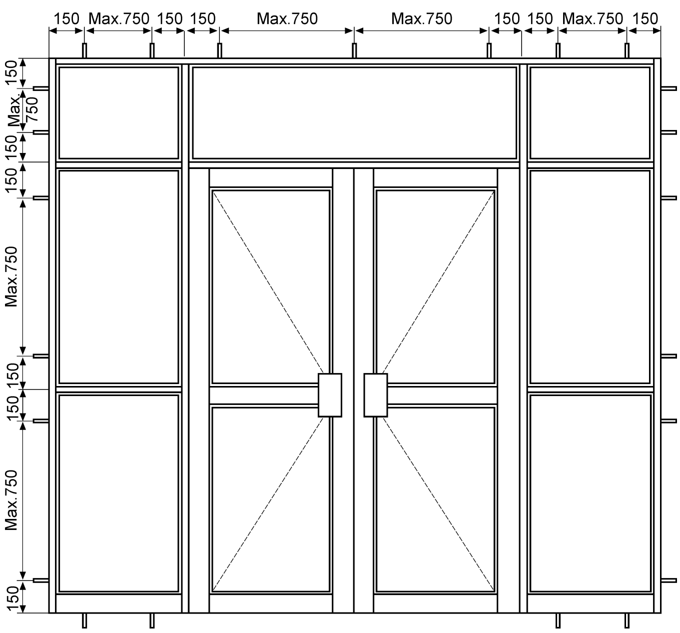
2) Using plug and screw:
Counter sunk screw-fixed through the frame (See methods A & B)

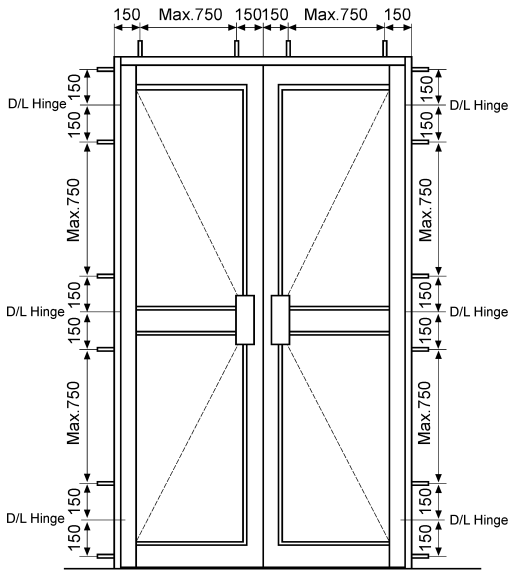


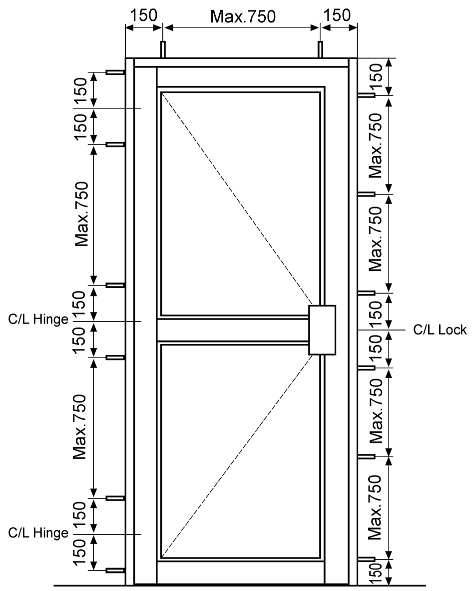


Recommend positions of fixing lugs - see attached drawings:

TYPICAL SHOPFRONT FASTENING POSITIONS

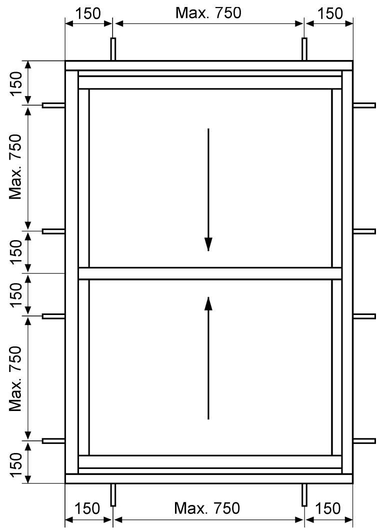


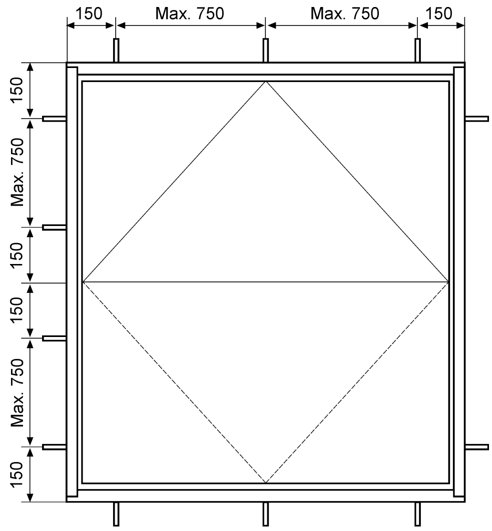




TYPICAL VERTICAL SLIDING WINDOW FASTENING SYSTEMS

TYPICAL PIVOT WINDOW FASTENING POSITIONS





TYPICAL HORIZONTAL SLIDING WINDOW & DOORS