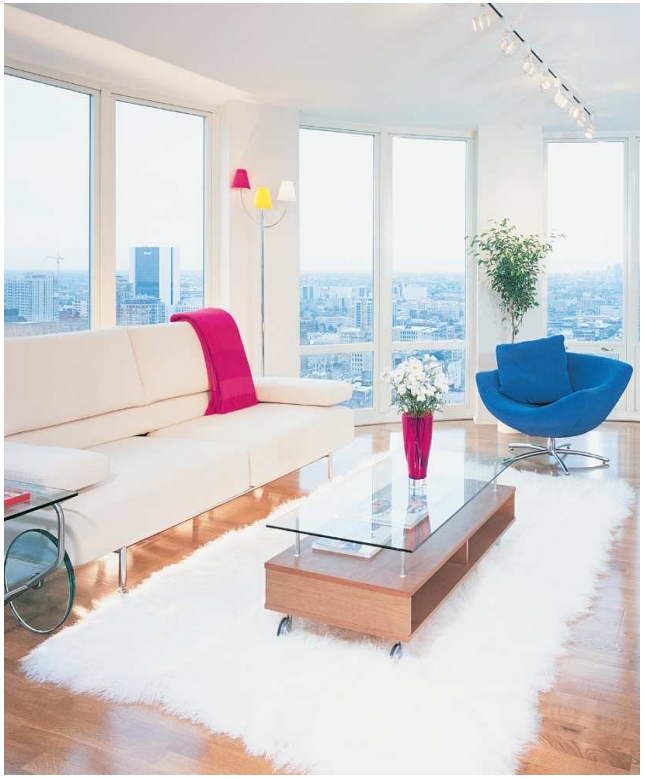
Engineering progress
Enhancing lives

uPVC Energy Efficient Windows and Doors CPD Seminar

REHAU

Contents

- uPVC profile extrusion
- Specifying window and door systems (uPVC)
- Specifying window and door hardware and ancillaries
- uPVC design parameters and wind loading
- RSA testing and compliance
- uPVC Window and door fabrication
- uPVC window and door installation
- Green and environmental
- Frequently asked qestions
- General discussion



REHAU in a nutshell

Network of internal laboratories, chemists, engineers and R&D

Leading developer in polymer-based solutions

> **20,000** employees
> **170** locations
> **50** countries
> **3.6 billion** Euro annual revenue

Internally split into 5 divisions:

- Automotive
- Building and Infrastructure
- Furniture
- Windows
- Industrial Solutions

What you might not know about REHAU

Interesting facts

We supply the construction, furniture and automotive industries with over **40,000 products**

With **100 patents per year**, REHAU is engineering progress

Every 3rd car in Europe has a REHAU component

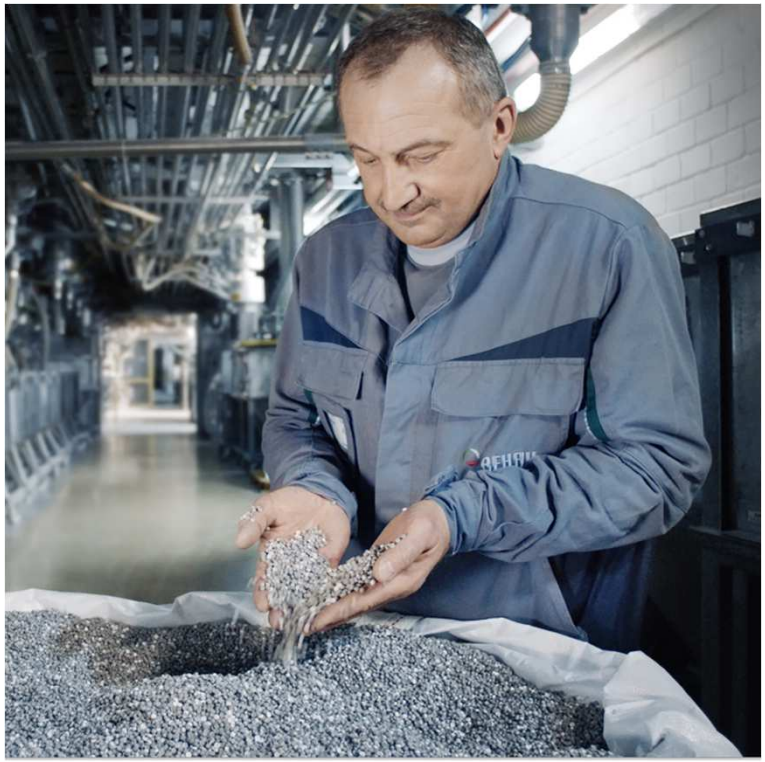
REHAU produces **10 million bumpers** per year making cars safer

Each year we develop around **1,000 new edgeband designs for the** furniture industry

CPD Seminar
What is uPVC?

As with any specialist product, it is necessary to understand the basics of its origin.

- uPVC
- U=Unplasticized= Rigid material
- P = Poly= Polymer based component
- V= Vinyl
- C=Chloride=manufactured from a mixture of petroleum by-products and salt



What is uPVC?

PVC in its natural form is very susceptible to heat and therefore requires additional substances to be added to supply the correct weather resistance, impact and durability.

- Stabilizers - heat and UV stabilizers are added
- Processing aids - these help bind all the additives together
- Impact modifiers - these improve the impact properties of the profile so that they can be handled during fabrication and installation
- Lubricants - they are added to help in the extrusion process and help achieve the smooth surface and gloss of the profile.
- Fillers - certain fillers are added to achieve a better bonding of all polymers
- Titanium Dioxide - This product provides the brilliant white finish as well as the all important UV stabilizer.

CPD Seminar

Arrival of raw material

PVC Storage

Mixing

Packaging

Storage

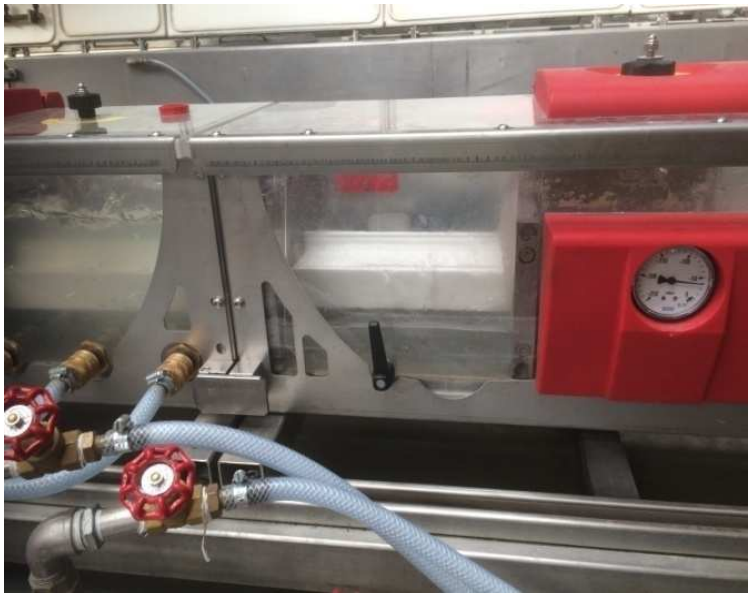
Picking

Dispatch

Recycling

EXTRUSION PROCESS

uPVC Profile Extrusion



Composition is heated and passed through profile dye tools

Constant calibration

Facts & Figures

- Plants: 9 extrusion plants for window profiles worldwide
- Tonnage: approx. 300 000 tonnes/a
- Systems: approx. 40 different systems
- No of articles: approx. 4 500 window profiles and accessories
- No of variants: approx. 21 5000 (colour and packaging variants)
- History (since 1957) more than 55 years of experience in uPVC window design

- Sales Structure: more than 140 REHAU sales offices worldwide
- Sales Volume: more than 20 million windows made out of REHAU profiles are installed every year around the world

uPVC Profile Extrusion

5.8m long (white) profile bars for the fabrication of uPVC window frames and sashes

CPD Seminar

Specifying window & door systems, designs

Decide on the most appropriate window designs in uPVC
Note: check with uPVC system supplier regarding availability of systems in South Africa

WINDOWS

- Open out casement windows, top hung, side hung or combination.
- Open in tilt and turn windows
- Vertical sliding sash windows
- Fire rated fixed windows

DOORS

- Single residential doors
- Double (French doors)
- Multifold doors
- Stable doors
- Sliding doors

Specifying window and door systems, designs

Common window styles with multiple design options

Top and/or side hung combinations

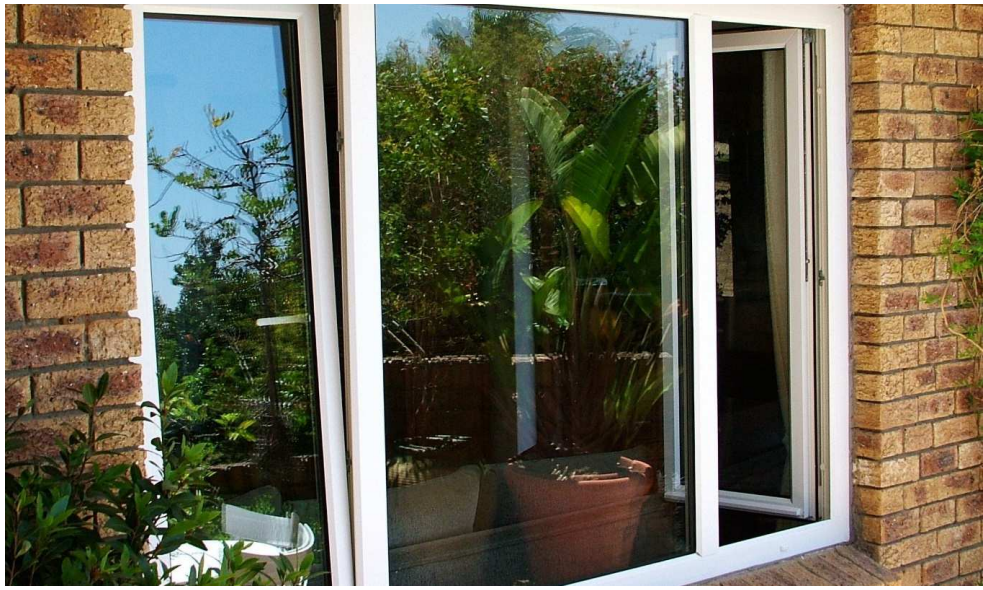
Residential, individual dwellings, large scale developments.

Schools, libraries, government buildings

Tilt and Turn Windows

Can be opened from side turn, bottom tilt
Large openings possible
Cleaning from inside
Concealed or face fixed hinges

Applications:
Upmarket residential
Offices and industrial
Education
Health



CPD Seminar

Specifying window and door systems, designs

Vertical Sliding Sash Windows

Applications: Upmarket residential Office and industrial Education, Health

Cape Dutch design

Double glazing up to 28mm

Internal cleaning facility

Specifying window and door systems, designs

Single and double doors

Available with side panels and top lights

Open in/out

Suitable for commercial applications

Can be fitted with automated entry hardware

Low or standard threshold

Stable door available

Specifying window and door systems, designs

Sliding windows and doors

Frame options: 2 or 3 track

2 panel up to 6 panel windows or door

Aluminium running rail

Heavy duty carriage depending on glass weight

Specifying window and door systems, designs

Multifold doors

Wide open area

Provides flexibility, but consider thresholds

Custom designed and manufactured to suit the application

CPD Seminar

Specifying window and door systems, designs

Securi Slide & Fold windows and doors

Aaa

bbbb

ccc

ddd

Window & Door Systems

Slim Tec System

50mm platform depth

High thermal performance at lower cost

Ideal for development work

Cut costs on expensive glass

Glazing 4 – 8.76

Std UPVC fabrication with welded corners and cleat fixing for fast installation.

CPD Seminar

Window & Door Systems

Specifying window and door systems, designs

Colour Systems for uPVC

Painting

Coating systems are available for uPVC windows and doors.

Large variety of colours available.

Must be approved by the profile system company

Versatile and hard wearing

Window & Door Systems

Specifying window and door systems, designs

Colour Systems for uPVC

Foiling

Foiling systems are available for uPVC windows and doors

Highly durable

UV resistant

Easy cleaning and maintenance

Note:

Ensure foil is approved by the uPVC system company. Always ask for samples.

CPD Seminar

Window & Door Systems

Specifying window and door systems, designs

Window locks

Espagnolet handles and high security locks

Cockspur handles standard type

Window and door systems

Specifying window and door systems, designs

Window hinges

Friction stays

Restricted

Fire egress

Austinetic 304 coastal

Tilt and turn

uPVC Ancilliaries

Trickle vents

Child restrictors

Acoustic vents

External window sills

Specification summary

Specification considerations

Security

Intruder restricing glazing = double glazing

Specify high security locks and security tape

Specification summary

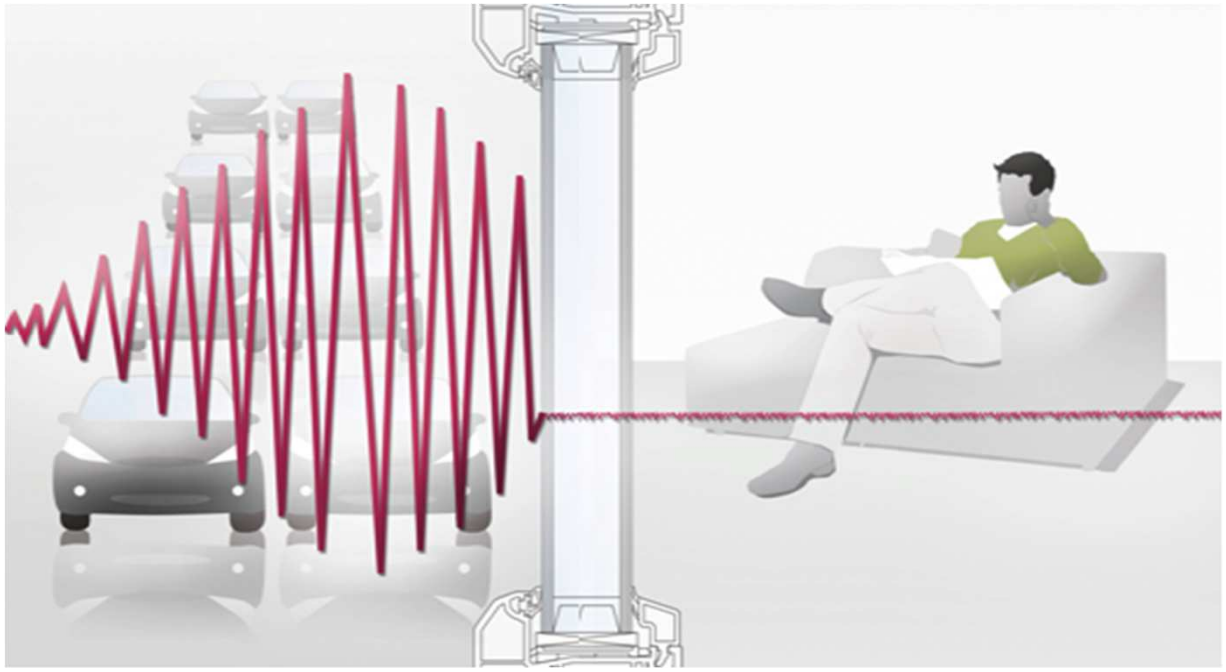
Specification considerations

Sound attenuation

Single glazed 8.76 soundstop

Double-glazed using laminated glass

Consider varying glass sizes 8/12/6



Specification summary

Specifying hardware and ancillaries

uPVC Door Hardware

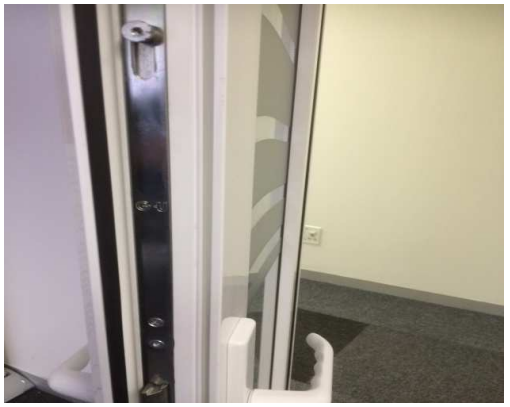
High security 5 point locking systems

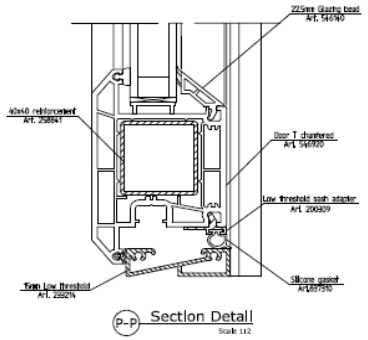
Heavy duty flag adjustable hinges

Low thresholds

Electronic door systems

Door closers

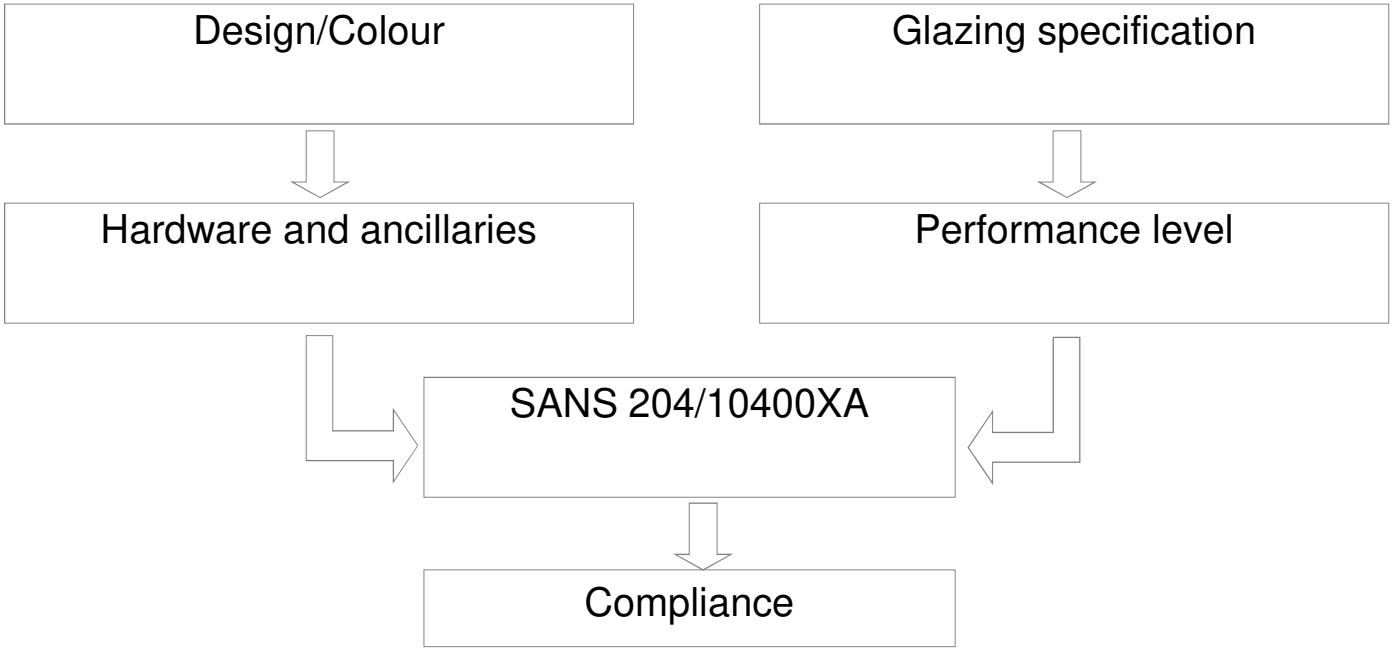




Open Out Door
on Aluminium Low Threshold

Specification summary

Specification Considerations



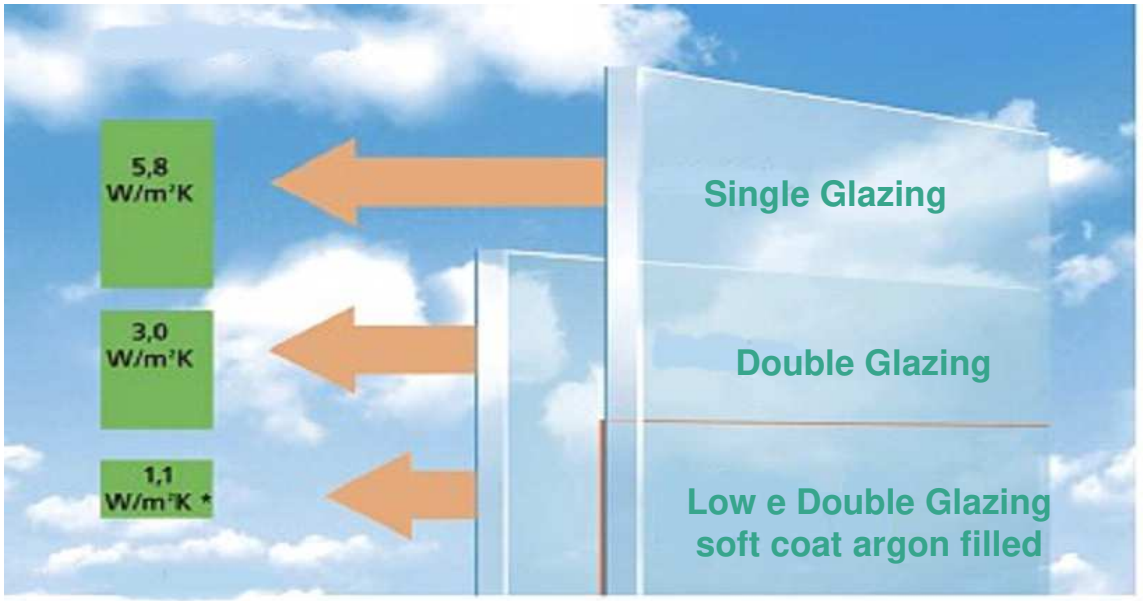
Specification summary

Specification Considerations

Thermal heat loss: glazing → thermal efficient glazing

*U_g Value according to EN 673

Energy loss through the glass (U_g Value)



Specification summary

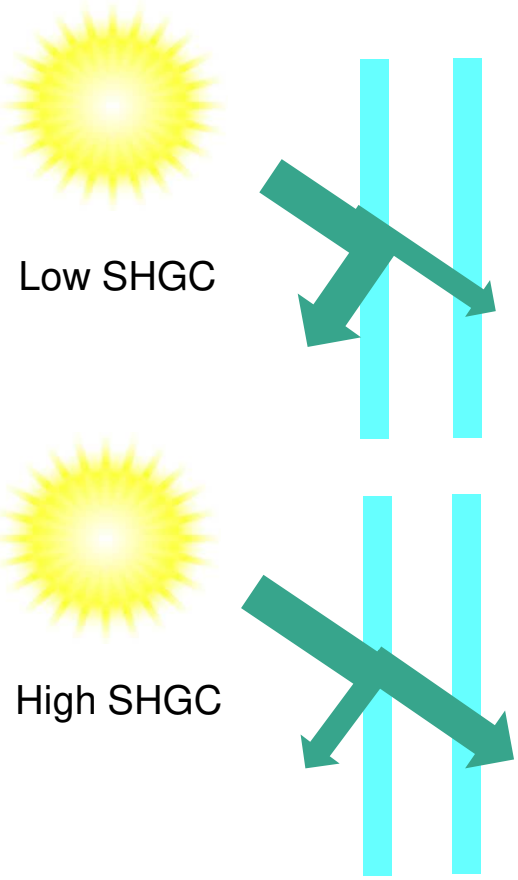
Specification Considerations

Thermal heat gain: glazing → thermal efficient glazing

The Solar Heat Gain Coefficient (SHGC) is a figure assigned to the glass that indicates how much heat that the glass lets pass into the building from the sun. SHGC numbers range from 0 to 1, and the lower the number, the less heat will enter your home.

For example 0,74 indicates a high SHGC and 0,38 a low SHGC.

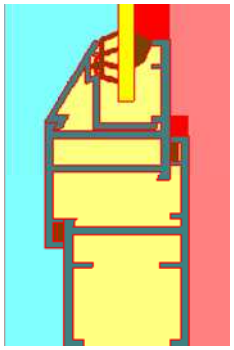
The framing material also has an impact, so a material with a high conductivity will allow more heat in than a frame material with a low conductivity.



Specification summary

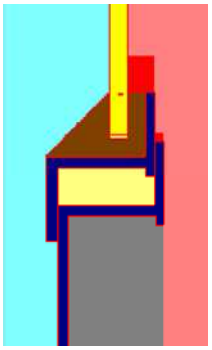
Specification Considerations

Thermal heat loss framing → Specify thermally efficient frames



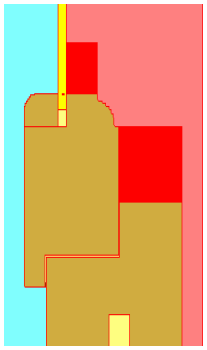
Aluminium

U_f = 7.5 W/m^{2}K



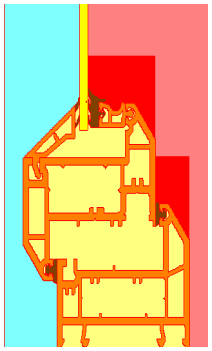
Steel

U_f = 5.2 W /m^{2}K



Timber

U_f = 2.3 W /m^{2}K



uPCC

U_f = 1.7 W /m^{2}K

U values for window profiles made from aluminium, steel, Timber and uPVC are above.

Specification summary

Thermal Efficiency

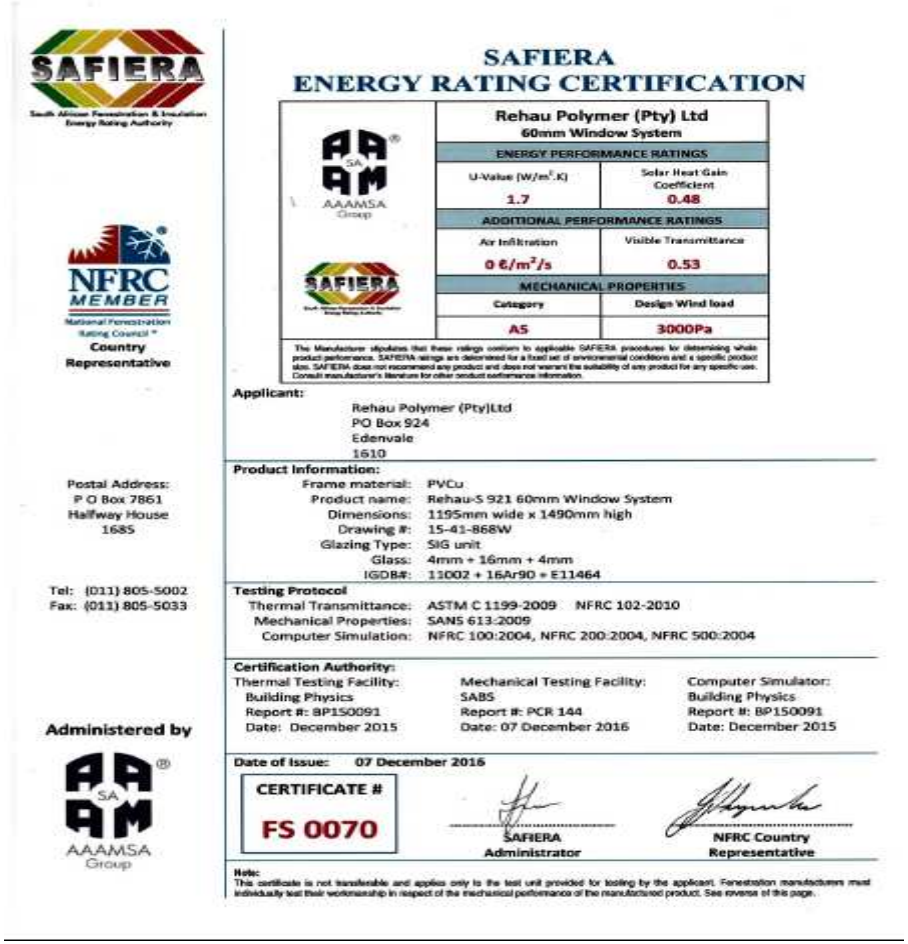
Table 6 — Worst-case whole glazing element performance values

1	2	3	4	5
Glass description	**Performance values**			
	Aluminium/Steel framing		**Timber/PVCu/Aluminium thermal break framing**	
	Total *U*-value $W/m^2 \cdot K$	***SHGC***	**Total *U*-value** $W/m^2 \cdot K$	***SHGC***
Single – Clear	7,9	0,81	5,6	0,77
Single – Tinted	7,9	0,69	5,6	0,65
Single – Low E^a	5,73	0,66	4,06	0,63
Clear double[b] (3/6/3)	4,23	0,72	3,0	0,68
Tinted double[b]	4,23	0,59	3,00	0,56
Clear double[b] low E^a	3,40	0,66	2,41	0,62
Tinted double[b] low E^b	3,40	0,54	2,41	0,51

Specification summary

Specifying Thermal Performance

Table 6 or tested value



SAFIERA
South African Fenestration & Insulation Energy Rating Authority

NFRC MEMBER
National Fenestration Rating Council
Country Representative

Postal Address:
P O Box 7861
Halfway House
1685

Tel: (011) 805-5002
Fax: (011) 805-5033

Administered by
AAAMSA Group

SAFIERA
ENERGY RATING CERTIFICATION

AAAMSA Group

Rehau Polymer (Pty) Ltd 60mm Window System	
ENERGY PERFORMANCE RATINGS	
U-Value ($W/m^2.K$)	Solar Heat Gain Coefficient
1.7	0.48
ADDITIONAL PERFORMANCE RATINGS	
Air Infiltration	Visible Transmittance
0 $\ell/m^2/s$	0.53
MECHANICAL PROPERTIES	
Category	Design Wind load
A5	3000Pa

The Manufacturer stipulates that these ratings conform to applicable SAFIERA procedures for determining whole product performance. SAFIERA ratings are determined for a fixed set of environmental conditions and a specific product size. SAFIERA does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.

Applicant:
Rehau Polymer (Pty)Ltd
PO Box 924
Edenvale
1610

Product Information:
Frame material: PVCu
Product name: Rehau-S 921 60mm Window System
Dimensions: 1195mm wide x 1490mm high
Drawing #: 15-41-868W
Glazing Type: SIG unit
Glass: 4mm + 16mm + 4mm
IGDB#: 11002 + 16Ar90 + E11464

Testing Protocol
Thermal Transmittance: ASTM C 1199-2009 NFRC 102-2010
Mechanical Properties: SANS 613:2009
Computer Simulation: NFRC 100:2004, NFRC 200:2004, NFRC 500:2004

Certification Authority:

Thermal Testing Facility:	Mechanical Testing Facility:	Computer Simulator:
Building Physics	SABS	Building Physics
Report #: BP150091	Report #: PCR 144	Report #: BP150091
Date: December 2015	Date: 07 December 2016	Date: December 2015

Date of Issue: 07 December 2016

CERTIFICATE # FS 0070

SAFIERA Administrator

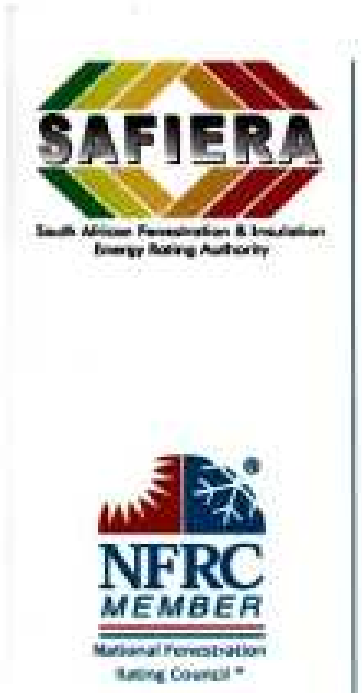
NFRC Country Representative

Note:
This certificate is not transferable and applies only to the test unit provided for testing by the applicant. Fenestration manufacturers must individually test their workmanship in respect of the mechanical performance of the manufactured product. See reverse of this page.

Specification summary

Specifying Thermal Performance

Table 6 or tested value



SAFIERA
ENERGY RATING CERTIFICATION

AAAMSA Group

SAFIERA

Rehau Polymer (Pty) Ltd 60mm Window System	
ENERGY PERFORMANCE RATINGS	
U-Value ($W/m^2.K$) 1.7	Solar Heat Gain Coefficient 0.48
ADDITIONAL PERFORMANCE RATINGS	
Air Infiltration 0 $\ell/m^2/s$	Visible Transmittance 0.53
MECHANICAL PROPERTIES	
Category	Design Wind load
A5	3000Pa

Specification summary

Size limitations and wind loading

NOTE : uPVC window and door systems have different guidelines, the following information is for general guidance, and confirmation should be sought from the technical department of the systems company.

There are four main considerations for determining maximum component sizes.

1. Local conditions and wind load requirements (SANS 10160)
2. Manufacturers maximum sizes for components and expansion
3. Hardware availability
4. Weight

Wind loading must be established by an engineer or competent person : Not the window supplier

Specification summary

Size limitations and wind loading

Performance requirements:

The requirements laid down in the table below are in accordance with SANS 613 Performance Requirements for test and classification of the products presented for testing:

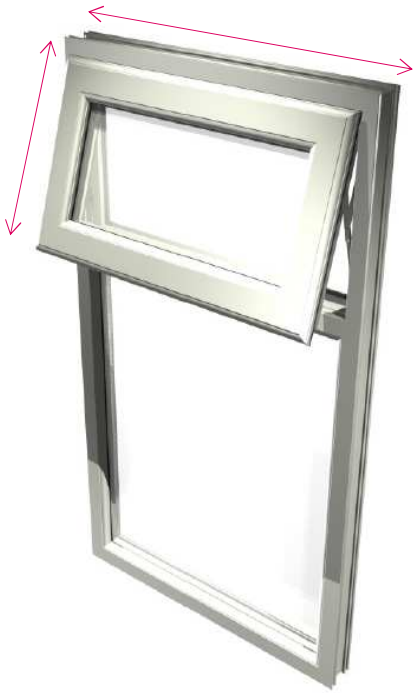
Test Performance Criteria						
Test Description	**Class designation**					
	A1	**A2**	**A3**	**A4**	**A5**	**A6**
	Test pressure - Pa					
Deflection (Maximum or minimum)	1 000	1 500	2 000	2 500	3 000	3 500
Structural strength	1 500	2 250	3 000	3 750	4 500	5 250
Water resistance	200	300	400	500	600	700

The above can be used to specify required performance

Specification summary

Size limitations and wind loading

Casement window sashes



Top hung sashes :
Maximum width 1200
Maximum height 1200
Maximum overall m² 1.0
Maximum weight 40kg

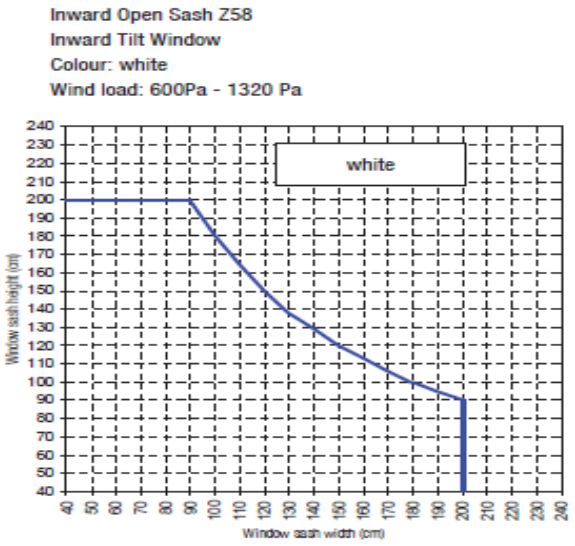
Side hung sashes :
Maximum width 900
Maximum height 1600
Maximum overall m² 1.2
Maximum weight 40kg

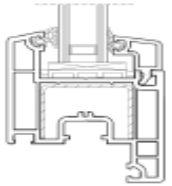
Specification summary

Size limitations and wind loading

Tilt and turn sashes

Tilt and turn sashes:
Maximum width 2000
Maximum height 2000
Width decreases with height





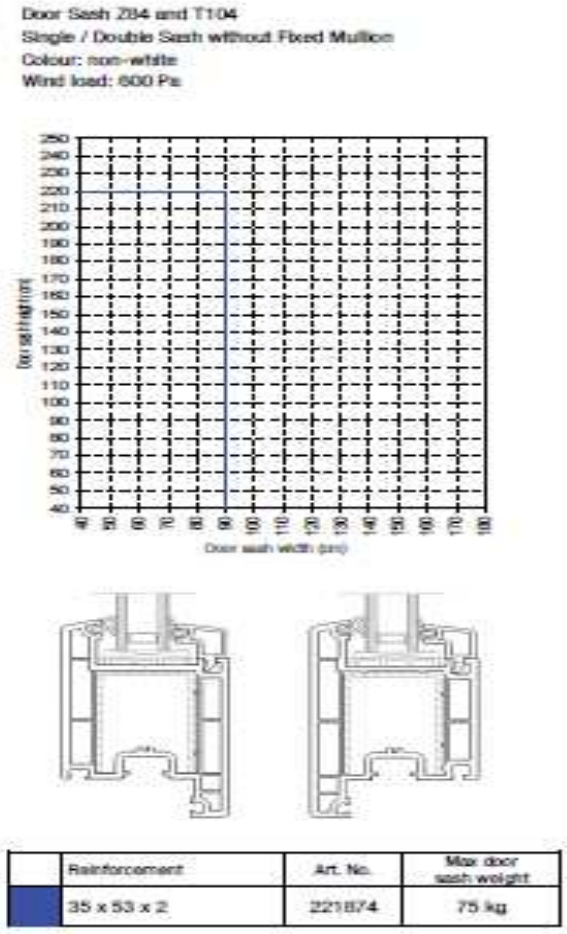
Specification summary

Size limitations and wind loading

Residential and multifold doors

Door sashes.
Maximum width 1000
Maximum height 2300
75kg per sash

Note: Note linear expansion limits frames to 5000 wide.



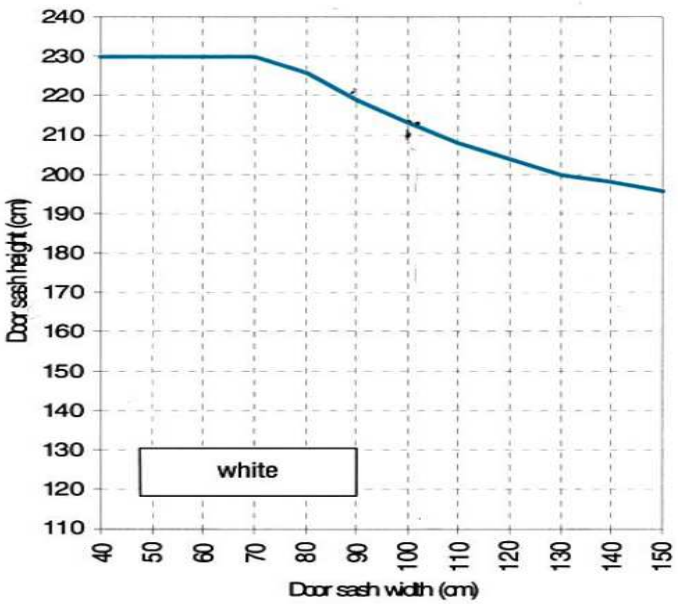
Specification summary

Size limitations and wind loading

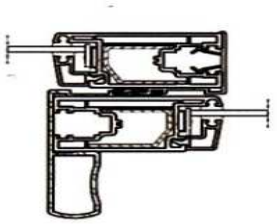
Sliding doors and windows std

Sliding door sashes.
Maximum width 1500
Maximum height 2300
Width decreases with height

Sliding window sashes.
Maximum width 1000
Maximum height 1500
Width decreases with height



Note: Note linear expansion limits frames to 5000 wide.



Specification summary

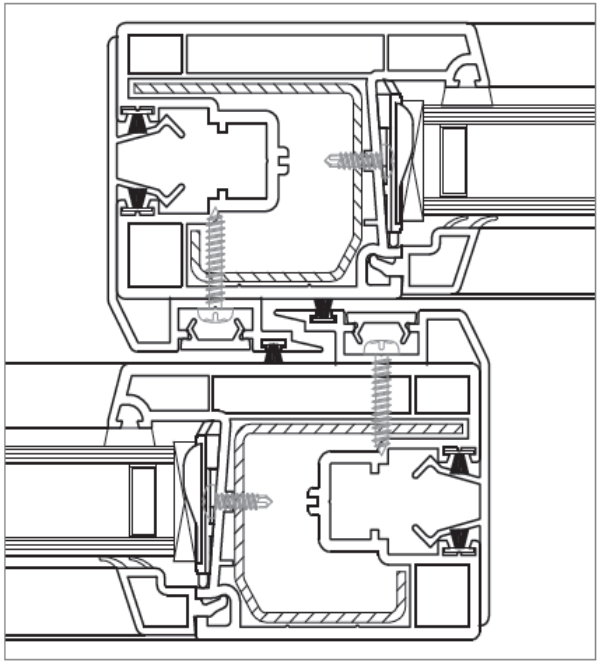
Size limitations and wind loading

Sliding doors heavy duty

Door sashes.
Maximum width 2000
Maximum height 2700
Width decreases with height

Note: Note linear expansion limits frames to 5000 wide.

Maximum Sash Sizes
Double Glazing, Door Sash SA (1500486 + 1320077), White

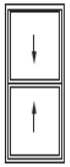


Specification summary

Size limitations and wind loading

Vertical sliding sash windows

Vertical Sliding Window



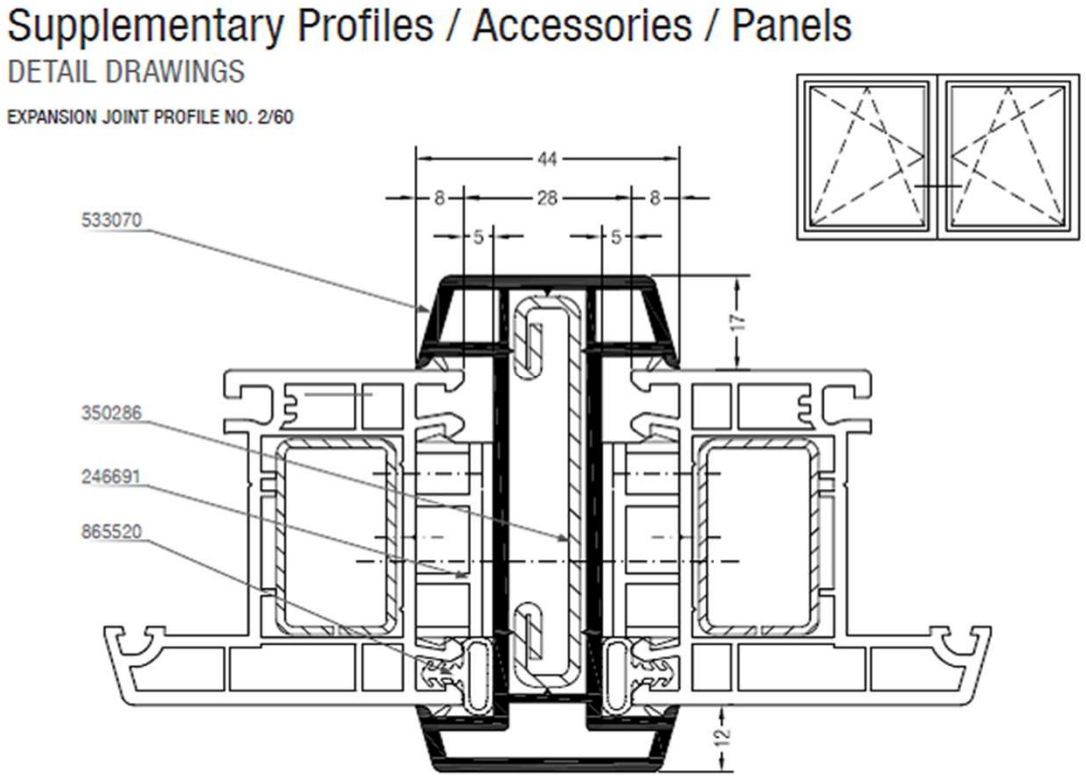
Maximum Frame Sizes		Maximum
Sash	Finish	WxH cm
Slim/Intermediate Sash	White	1500 X 3000*
Intermediate/Large Sash	White	1800 X 3500*
Slim/Intermediate Sash	Foiled	1500 X 2500*
Intermediate/Large Sash	Foiled	1650 X 2500*

Window sashes.
Maximum width 1800
Maximum height 2500
Weight 50kg per sash

Specification summary

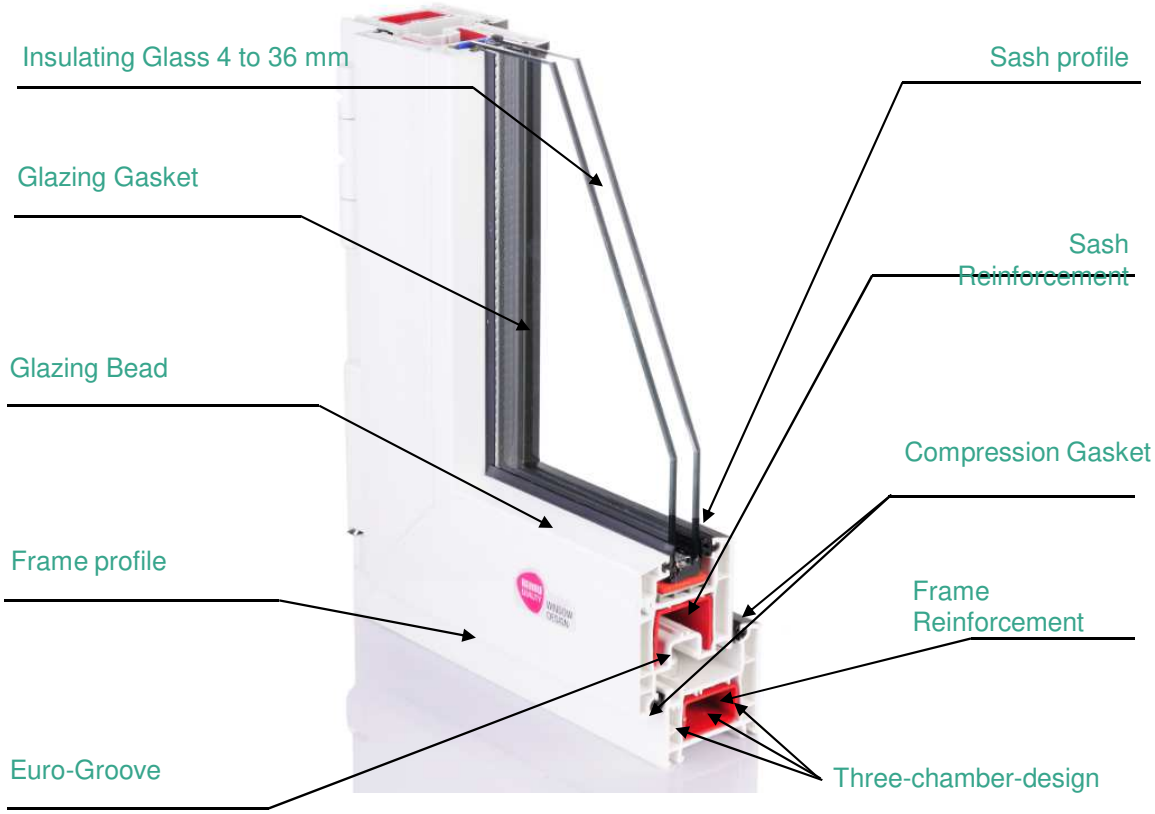
Size limitations and wind loading

Window coupling



Fabrication of uPVC Windows

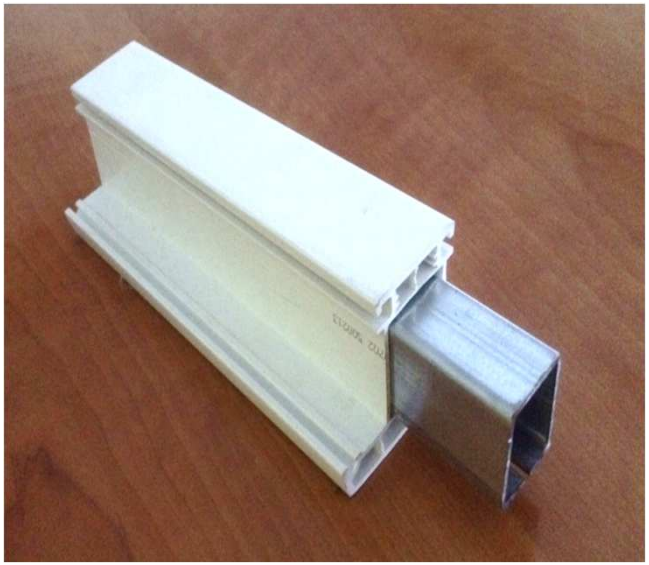
Components of a typical window



Fabrication of uPVC Windows

The fabrication of uPVC windows and doors differs from that of other window products in that:

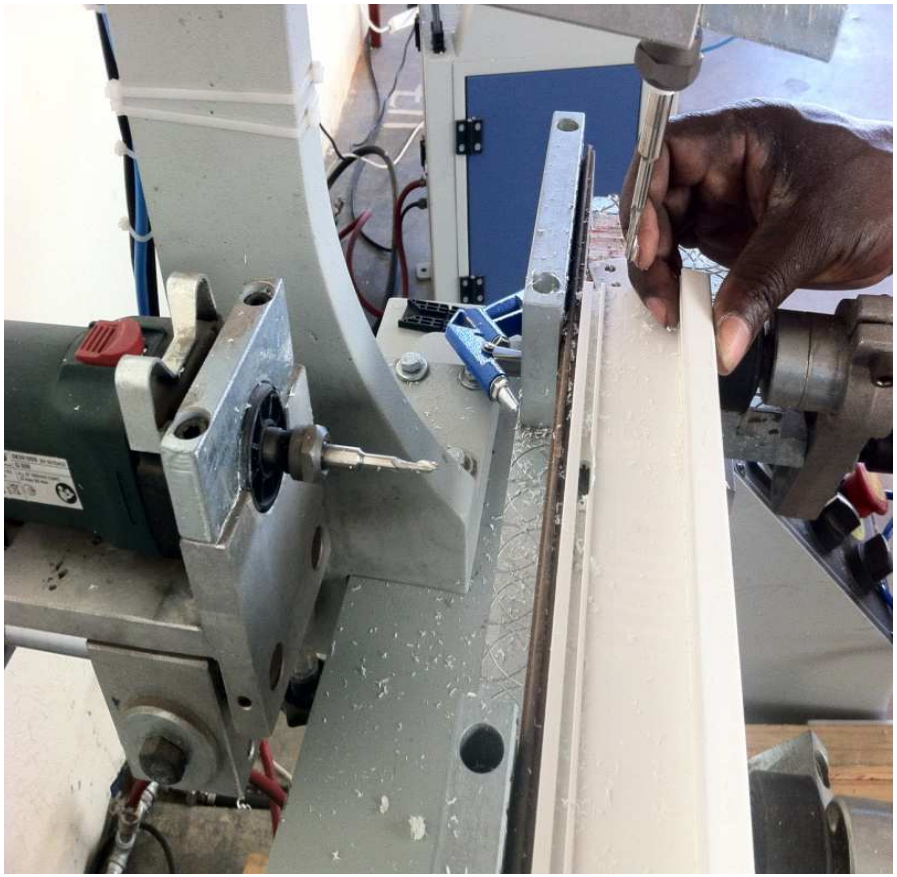
- After the profile is cut to size
- Galvanized steel reinforcing is inserted into the profile.



Fabrication of uPVC Windows

Glazing beads, incorporate co-ex gasket.

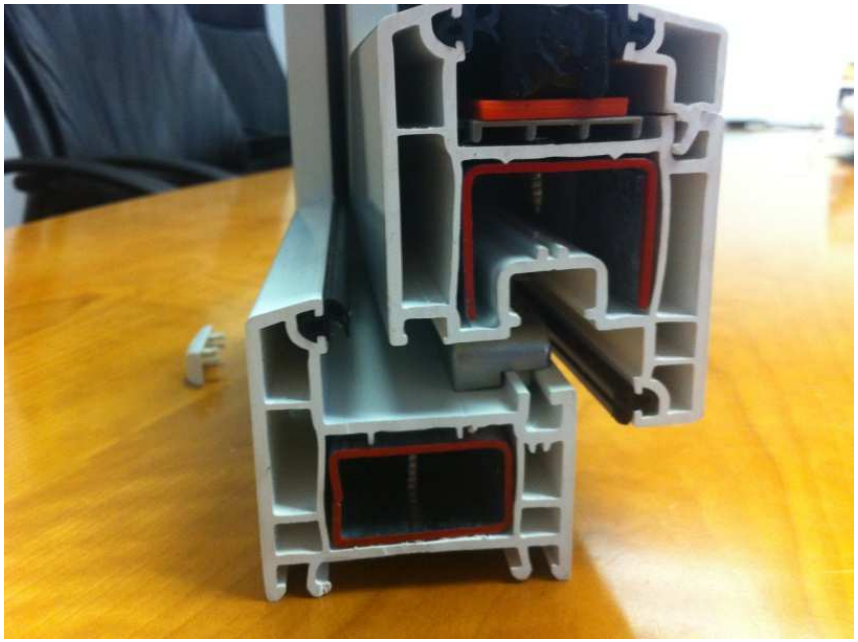
Water drainage slots in a profiles.



Fabrication of uPVC Windows

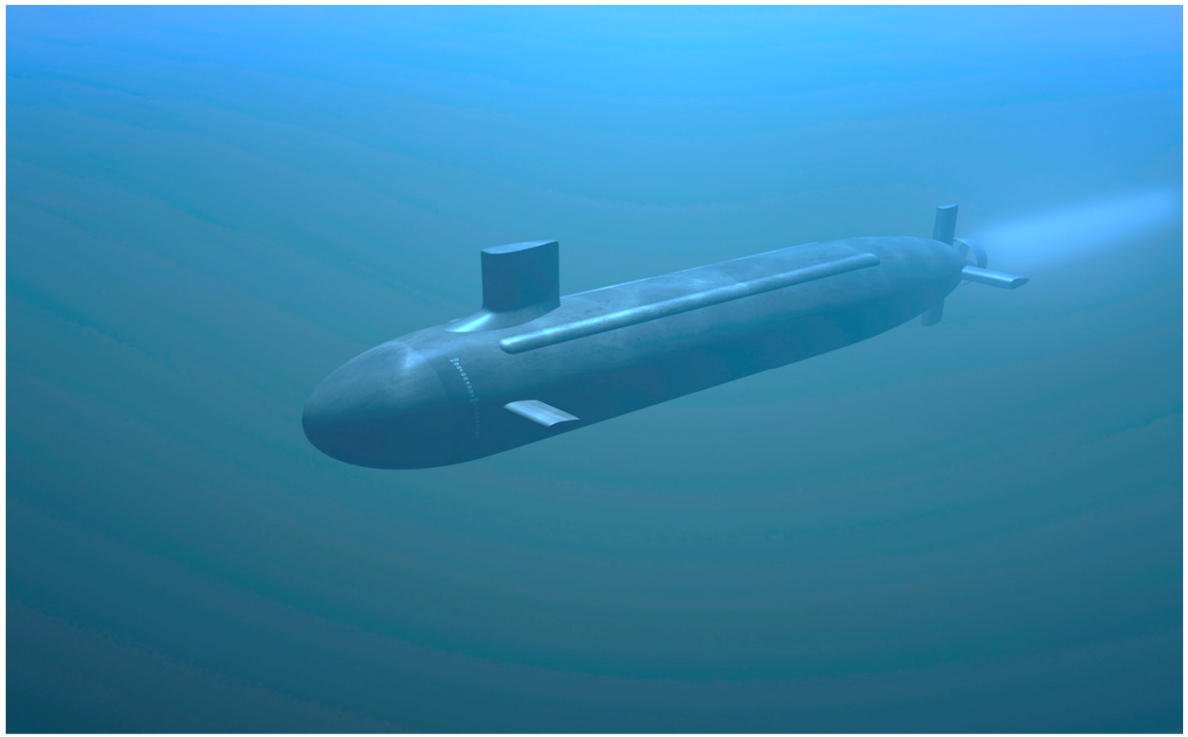
The importance of drainage and water dispersal.

How and why does water enter the window system?



Fabrication of uPVC Windows

DRAINAGE AND WATER DISPERSAL?? 32 Water pumps



Fabrication of uPVC Windows

The corners are fusion welded, no glue or screw joints.

The welded corners are cleaned of excess welding material.

Fabrication of uPVC Windows

High volume CNC production at 2,500 frames per week.

RSA Windows Testing

uPVC Profile Testing	**SANS 1553-1:2007** Edition 1.1
Hot Box testing and thermal simulations	**SANS 204 - 1:2008** Edition 1
Mechanical testing	**SANS 613**

RSA Windows Testing

uPVC Profile Testing

Who should test? -> System company

Why test?

- SA Compliance
- Specification safety
- UV protection

RSA Windows Testing

Hot Box testing and SAFIERA Certification

SANS 204/10400XA

Who tests? -> System companies

Why Test?

- Confirmation of simulation results
- Additional SHGC Figures included
- SAFIERA certificate
- Include visual transmittance figures
- No test or simulations revert to table 6

SAFIERA
South African Fenestration & Insulation Energy Rating Authority

NFRC MEMBER
National Fenestration Rating Council
Country Representative

Postal Address:
P O Box 7861
Halfway House
1685

Tel: (011) 805-5002
Fax: (011) 805-5033

Administered by
AAAMSA Group

SAFIERA
ENERGY RATING CERTIFICATION

AAAMSA Group

Rehau Polymer (Pty) Ltd 60mm Window System	
ENERGY PERFORMANCE RATINGS	
U-Value ($W/m^2.K$)	Solar Heat Gain Coefficient
1.7	0.48
ADDITIONAL PERFORMANCE RATINGS	
Air Infiltration	Visible Transmittance
0 $\ell/m^2/s$	0.53
MECHANICAL PROPERTIES	
Category	Design Wind load
A5	3000Pa

The Manufacturer stipulates that these ratings conform to applicable SAFIERA procedures for determining whole product performance. SAFIERA ratings are determined for a fixed set of environmental conditions and a specific product size. SAFIERA does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.

Applicant:
Rehau Polymer (Pty)Ltd
PO Box 924
Edenvale
1610

Product Information:

Frame material:	PVCu
Product name:	Rehau-S 921 60mm Window System
Dimensions:	1195mm wide x 1490mm high
Drawing #:	15-41-868W
Glazing Type:	SIG unit
Glass:	4mm + 16mm + 4mm
IGDB#:	11002 + 16Ar90 + E11464

Testing Protocol

Thermal Transmittance:	ASTM C 1199-2009 NFRC 102-2010
Mechanical Properties:	SANS 613:2009
Computer Simulation:	NFRC 100:2004, NFRC 200:2004, NFRC 500:2004

Certification Authority:

Thermal Testing Facility:	Mechanical Testing Facility:	Computer Simulator:
Building Physics	SABS	Building Physics
Report #: BP150091	Report #: PCR 144	Report #: BP150091
Date: December 2015	Date: 07 December 2016	Date: December 2015

Date of Issue: 07 December 2016

CERTIFICATE # FS 0070

SAFIERA Administrator

NFRC Country Representative

Note:
This certificate is not transferable and applies only to the test unit provided for testing by the applicant. Fenestration manufacturers must individually test their workmanship in respect of the mechanical performance of the manufactured product. See reverse of this page.

RSA Windows Testing

Hot Box testing and SAFIERA Certification

How does it work?

Test one window 1200 x 1500

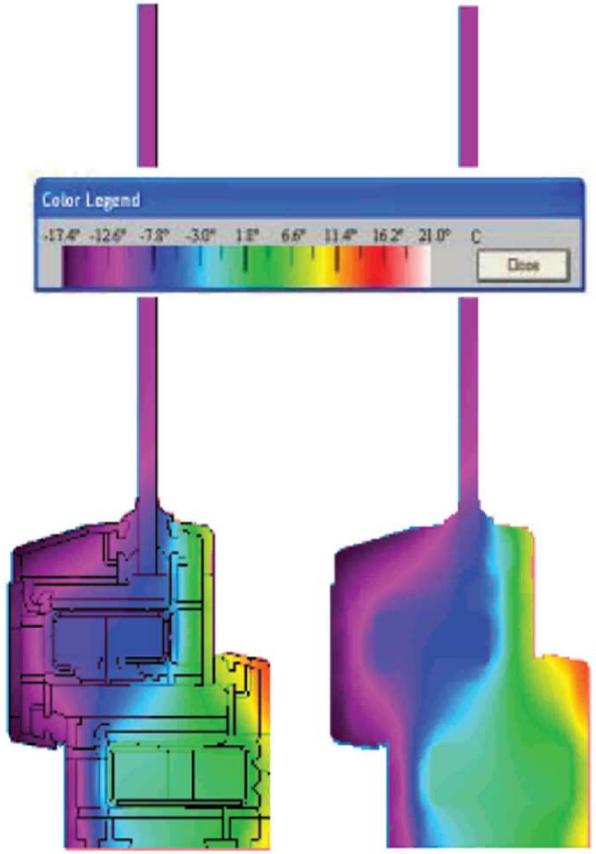
Results simulated for other designs.

- Simulations
- Cascaded down to fabricators
- If you do have proof of thermal test, then you have to use Table 6.

RSA Windows Testing

Hot Box testing and SAFIERA Certification

	uPVC Table 6	Typical tested uPVC
Single glazing	5.6	4.65
Single Low e	4.06	2.99
Std Double glazing	3.0	2.86
Double glazing low e	2.41	2.13



Infrared view of frame, with and without polygon outlines

RSA Windows Testing

SANS 613 Testing

Who tests? -> Fabricators

Why? Legal requirement to comply with building regulations NBR N & XA

Process:

1. Application form and payment

2. Supply drawing, design, specification

3. Product full specification, glass, hardware

4. Arrange a test with AAAMSA

RSA Windows Testing

SANS 613 Testing

TABLE 1.1: 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 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.

RSA Windows Testing

SANS 613 Testing

WINDOW TEST. WATER TEST 0.05l/sm²
15 minute intervals @ 200pa A1
Up to 750pa A6

DEFLECTION – l/175 @ 1000pa A1
3500pa A6

AIR LEAKAGE – not more than 2l/sec/m²

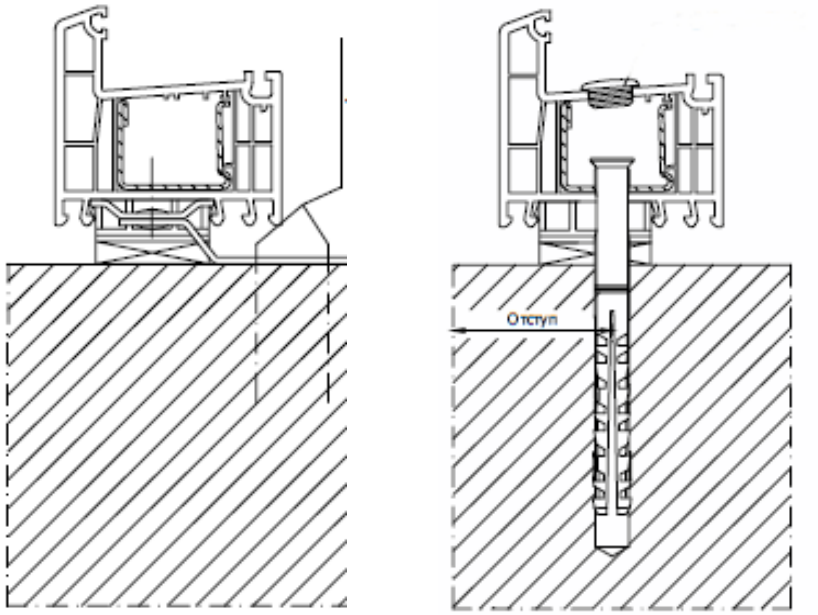
OPERATION – not more than 80 N

uPVC Window Installation

Frame installation

Establish cleat fix (new build) or direct (refurbishment)

- Install level and plumb with equal tolerance gap (10mm)
- If direct fix: fit through glazing rebate NOT bead area
- Fixings no nearer to a weld than150mm further than 250mm
- Fixings no further apart than 600mm
- Pack above fixing points
- Doors should not be fixed by cleats alone



Green and Environmental

Green Building South Africa

greenstar Rating System ★★★★★★ GREEN BUILDING COUNCIL

GREEN STAR RATING SOUTH AFRICA

Voluntary Scheme for private developments, 4 Star Rating mandatory for public developments.

What makes uPVC windows a green product?

- Keeps hot air outside and cold air inside in summer
- Less air conditioning required
- Protect the environment. Reduce CO_2 emissions!
- Uses less primary energery. Thus has a small carbon footprint

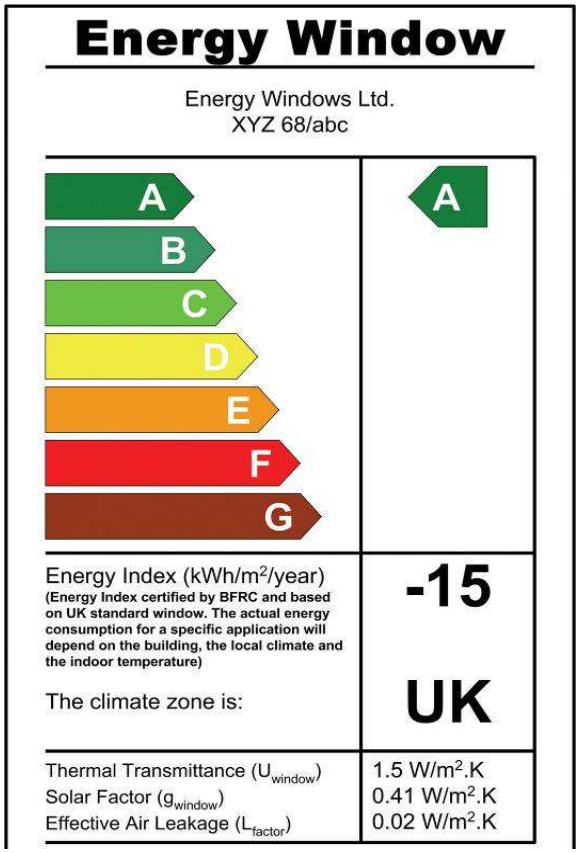
Green and Environmental

Use uPVC profile manufactured in accordance with BS EN ISO14001

uPVC profile now has a larger content of recycled material

uPVC window systems are supported by the BRE Green Guide with an A rating for residential and A+ rating for commercial application

Most uPVC window systems easily achieve an A rated window energy rating



Green and Environmental

uPVC system companies have defined world wide recycling programmes

Here in South Africa uPVC off cuts are collected and sent to a recycling company to be made into PVC products

Where volume allows, the uPVC off cuts are sent back to the factory and used again in the profile

FAQ’s

Do uPVC windows discolour?

Is the plastic weak?

Are uPVC windows very expensive?

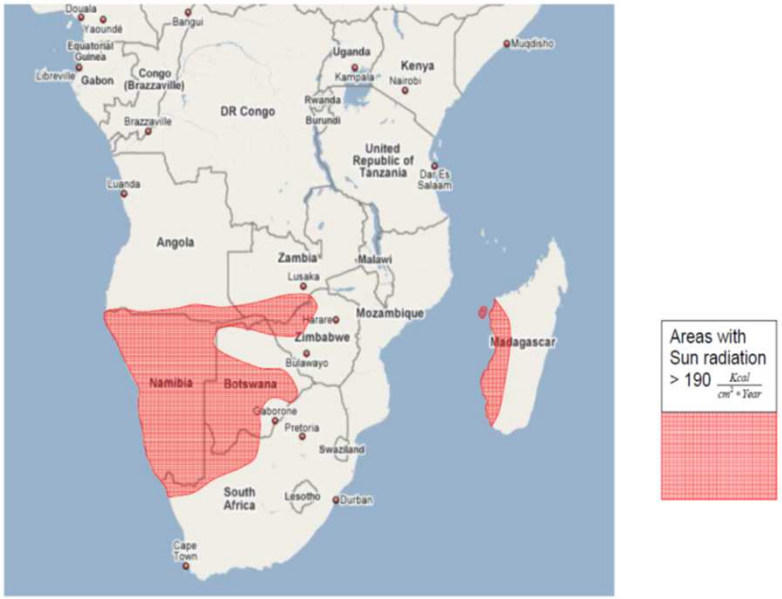
Are uPVC windows only available in white?

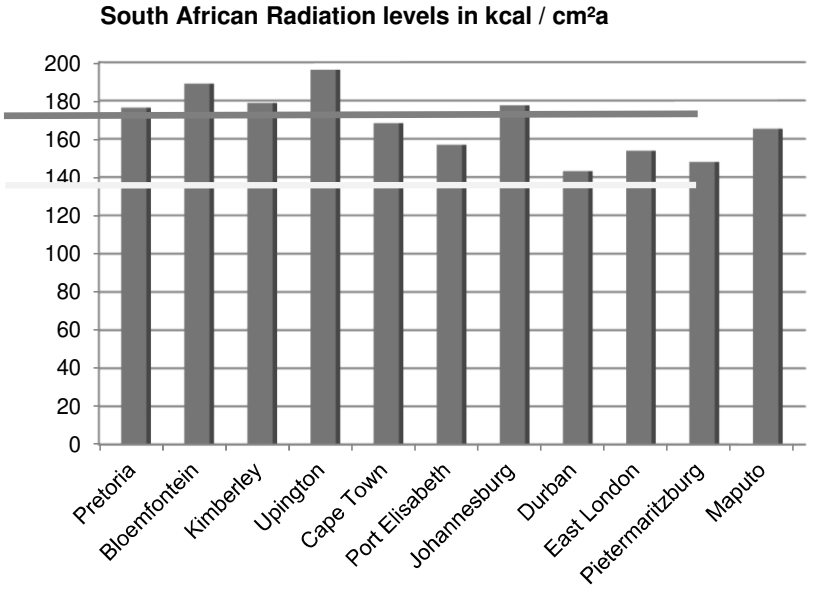
Is uPVC environmentally friendly?

FAQ's

Do uPVC windows discolour? → South African Radiation values

Note: use a uPVC system that can verify that the profile can cope with SA UV conditions.





kWh/m²/a	Kcal/ cm²/ a
1200	Ca. 100
1600	Ca. 140
1900	Ca. 160
2100	Ca. 180
2300	Ca. 200

FAQ's

Is uPVC weak?

Reinforcement creates strength for wind loading

Reinforcement reduces expansion

Reinforcement provides firm anchorage for hardware fixings

Reinforcement is specifically designed to suit each profile

FAQ's

Is uPVC expensive?

Using uPVC alleviates the need for low e glass in most cases.

	U value	uPVC std	aluminium low e
ptt606	U value	3.01	5.01
pt1506	U value	4.01	4.64
pt609	U value	3.46	3.5
pt1806	U value	3.5	4.85
sh609	U value	3.74	4.82
ptshh1809	U value	3.97	4.66
shsh1212	U value	3.77	4.66
shh1815	U value	4.75	4.85
shd0921	U value	4.08	5.07

FAQ’s

Is uPVC only available in white?

Bespoke colouring systems.

Two part acrylic process, weather and scratch resistant

FAQ’s

Is uPVC only available in white?

Grey out, white in profiles. Foiled on the outside, weather and scratch resistant.

FAQ's

Is uPVC environmentally friendly?

bre GREEN GUIDE 2008 RATINGS

Element	PVC-U window with steel reinforcement, double glazed
Element Number	831500001
Summary Rating	A+

Specification support services

We recognise the value in offering a complete Support Package.

- Comprehensive support at every stage of any project.

- Cad drawings

- Thermal calculations

- Project feasibility

- Design support

CPD Seminar

uPVC fenestration solutions

Residential

CPD Seminar

uPVC fenestration solutions

Residential

uPVC fenestration solutions

High density housing

Northgate Heights, Johannesburg

22 on North, Dunkeld

CPD Seminar

uPVC fenestration solutions

High density housing

Marikana Housing Project

uPVC fenestration solutions

Leisure

Holiday Inn, OR Tambo

Sunnyside Park Hotel, Johannesburg

uPVC fenestration solutions

Health

Lakeview Hospital, Benoni

CPD Seminar

uPVC fenestration solutions

Education

German School, Johannesburg (DSJ)

uPVC fenestration solutions

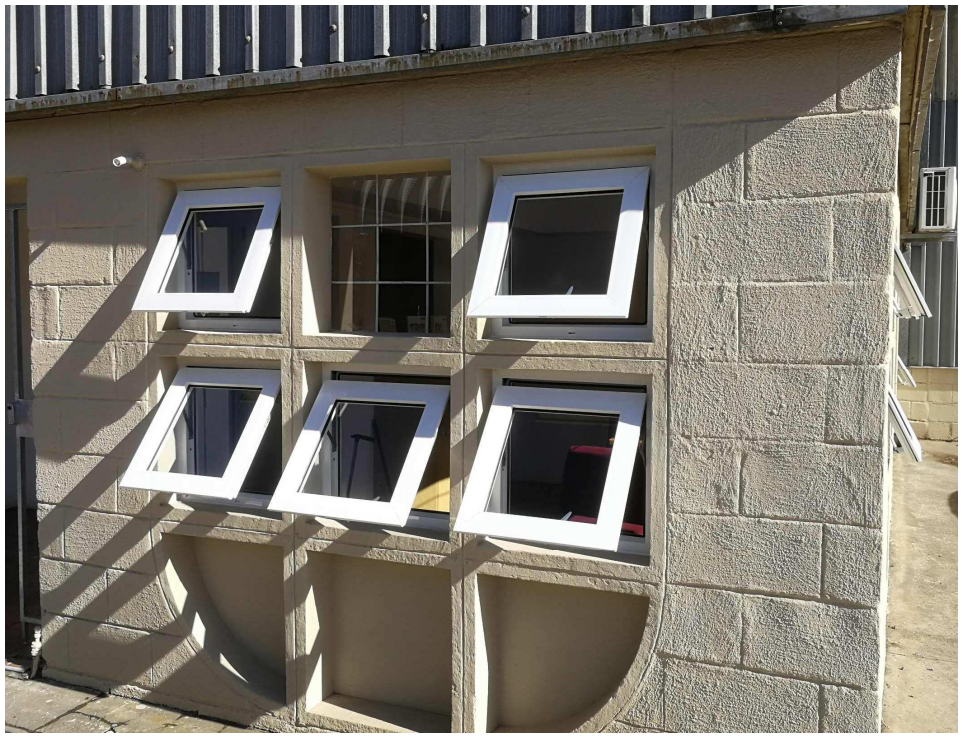
Education

Dundee FET College

uPVC fenestration solutions

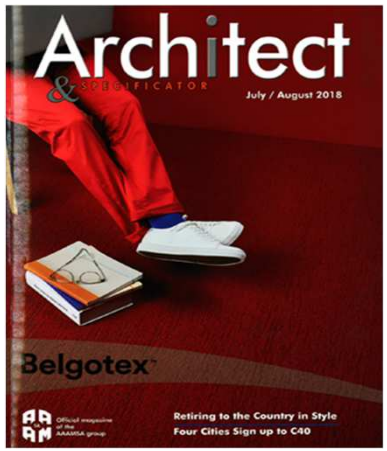
Offices and warehousing

Image Makers Offices, Cape Town



Warehousing, East London

Discussion



Thank you for your attention! Any questions?