SHIELD

Specification Guide

Effective from May 2004

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SCHEMATICS

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About Synseal

Synseal have been involved at all levels of the PVCu window and door industry since 1980. Starting as a non-fabricating, direct sell and fix operation, working our way through the fabrication sector, trade frame sales, profile extrusion, and more recently the conservatory industry, to what is today undeniably one of the largest and most successful PVCu window extrusion companies in the industry.

In the UK, Synseal are the chosen suppliers to more window and door fabricators than any other extruder operating in today's market. Hardly surprising when considering that independent verification proves that our customers are more satisfied than any of our competitor's customers.* In fact approximately 1 out of every 10 windows, doors and conservatories fitted in the UK are made from Synseal extrusion.

This guide has been compiled to highlight the technical attributes of the Shield PVCu window and door system. The system that was launched to the industry in 1999, the system that is the bedrock of Synseal's continued success.

*Source: Windowbase Database

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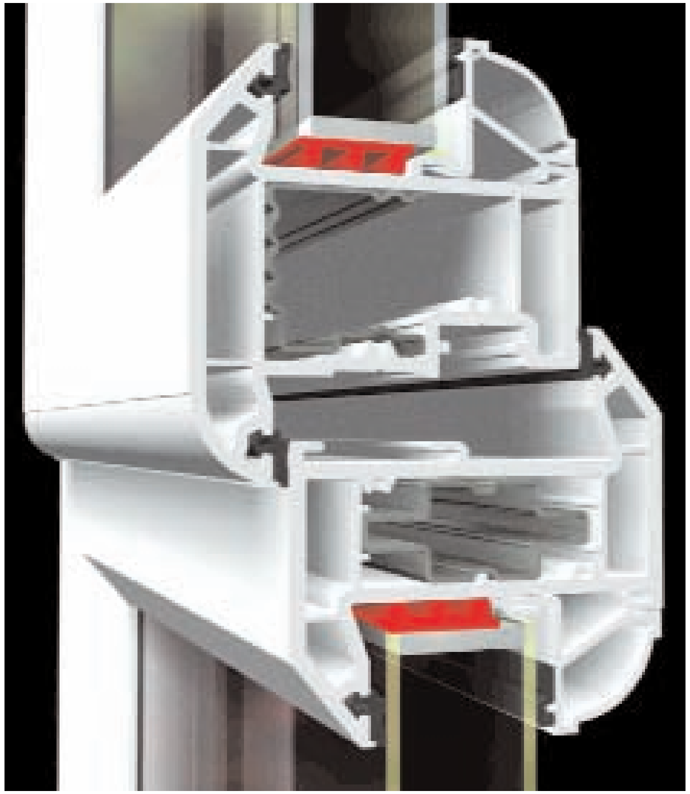
Accreditations

Synseal Extrusions Ltd. holds a number of accreditations (see right) from recognized authorities (British Standards Institution and the British Board of Agrément). To maintain registration, licenses and certificates, periodic on-site audits are carried out by the regulatory authority to inspect systems and where necessary take product samples for independent third party testing.



BSI

FM 31451

Registered to BS EN ISO 9001:2000, Certificate No. FM 31451 - Quality Management System Scope: - Manufacture and supply of a range of white and brown windows PVC-U profiles and beads for the fabrication of doors and windows. Manufacture of conservatory roofing systems to customer specified requirements.

BS7413
KM 30983

Kitemark License No KM 30983 - Conforms with BS7413 - specification for white PVC-U extruded hollow profiles with heat welded corner joints for plastic windows: materials type A.

BS7950/7413
KM 41324

Kitemark License No KM 41324 - Conforms with BS7950/7413 - specification for enhanced security performance of casement and tilt/turn windows for domestic applications in association with BS7413.

BBA - Assessment report no. 1672 - Assessment of Shield outward opening PVC-U window system.

FAQs

TECHNICAL

For woodgrain on white windows how do I know which face to order?
The profile wallcharts and price lists clearly identify which faces are foiled by using A and B codes. These wallcharts are available in PDF format from our website - www.synseal.com.

Do you offer the service of Patio Midrail End milling and how do I measure for Midrail length?
Yes, and we require the overall finished patio width including the number of panes.

What colour are Synseal's extruded products?
If matching door panels, the colour code nearest match for white profile is C121. If difficulty is experienced it is advisable to send a sample of profile to the door panel supplier.

What is the standard stack height for friction stays on Synseal casement windows?
13mm is the standard.

What woodgrain finish do you use?
We offer Light Oak, Mahogany and Cherrywood finishes.

What back-set espag or shootbolt will fit into Synseal casement?
A 22mm back-set espag or shootbolt will be fine.

Which backset door lock is recommended?
35mm is recommended.

What are the maximum sizes for your windows?
For Kitemarked windows, the following maximum sizes apply:

Top hung:	1200mm x 1200mm
Side hung:	650mm wide x 1200mm high
Fixed:	2500mm x 2500mm (maximum perimeter: 8200mm)
Multi-light:	1800mm x 1800mm (maximum perimeter: 6000mm and maximum transom/mullion length including frame: 1200mm)

QUALITY ASSURANCE

Can we use kitemark logo on our adverts?

No, use the phrase 'Our Windows are manufactured from profile supplied by Synseal Extrusions Ltd, which are Kitemarked to BS7413 (Licence no. KM30983) and BS7950/7413 (Licence no. KM41324)'.

Does the profile have a BBA certificate?

No, but Synseal Shield profiles have been assessed by the BBA, Assessment report no. 1672

Can I make a half hour fire rated door from Synseal Extrusions?

No, as with all PVCu profile, Synseal Extrusions achieve a class 1 surface spread of flame when tested to BS476 part 7.

Are PVCu windows & doors load bearing?

No, but load bearing data is available for bay poles, posts & RA76 frame coupling aluminium.

Is there any regrind material in Synseal's window and door profiles?

None, all of Synseal's PVCu window and door profiles are extruded from 100% virgin compound from our own chemical mixing plant.

WINDOW/DOOR/PATIO INSTALLATION

Is it necessary to install Safety Glass in patio doors?

Yes, the use of safety glass in buildings is specified in a British Standard - refer to BS6262-4:1994. For further information, reference should also be made to Building Regulations Approved Document N - Glazing.

When replacing windows do Tricklevents need to be installed?

Not always, but for replacement windows, the existing measures for background or natural ventilation should be maintained. Refer to Building Regulations Approved Document F - Ventilation.

Do I have to employ the services of a FENSA approved fitter when installing windows and doors?

No, but if non-FENSA approved fitters are used, then application to the local Building Control Office must be made to arrange appropriate inspection and approval. However, it is recommended that FENSA approved fitters are used.

Is it essential to have gas fires reserviced after fitting windows and doors?

No, but whilst it is not essential, this is always a good idea to ensure ventilation is still adequate.

When replacing timber windows and/or doors with PVCu ones, do I need to check/replace as necessary the lintel above the removed windows/doors to maintain structural integrity.

Yes, PVC-U windows are not designed to be load-bearing.

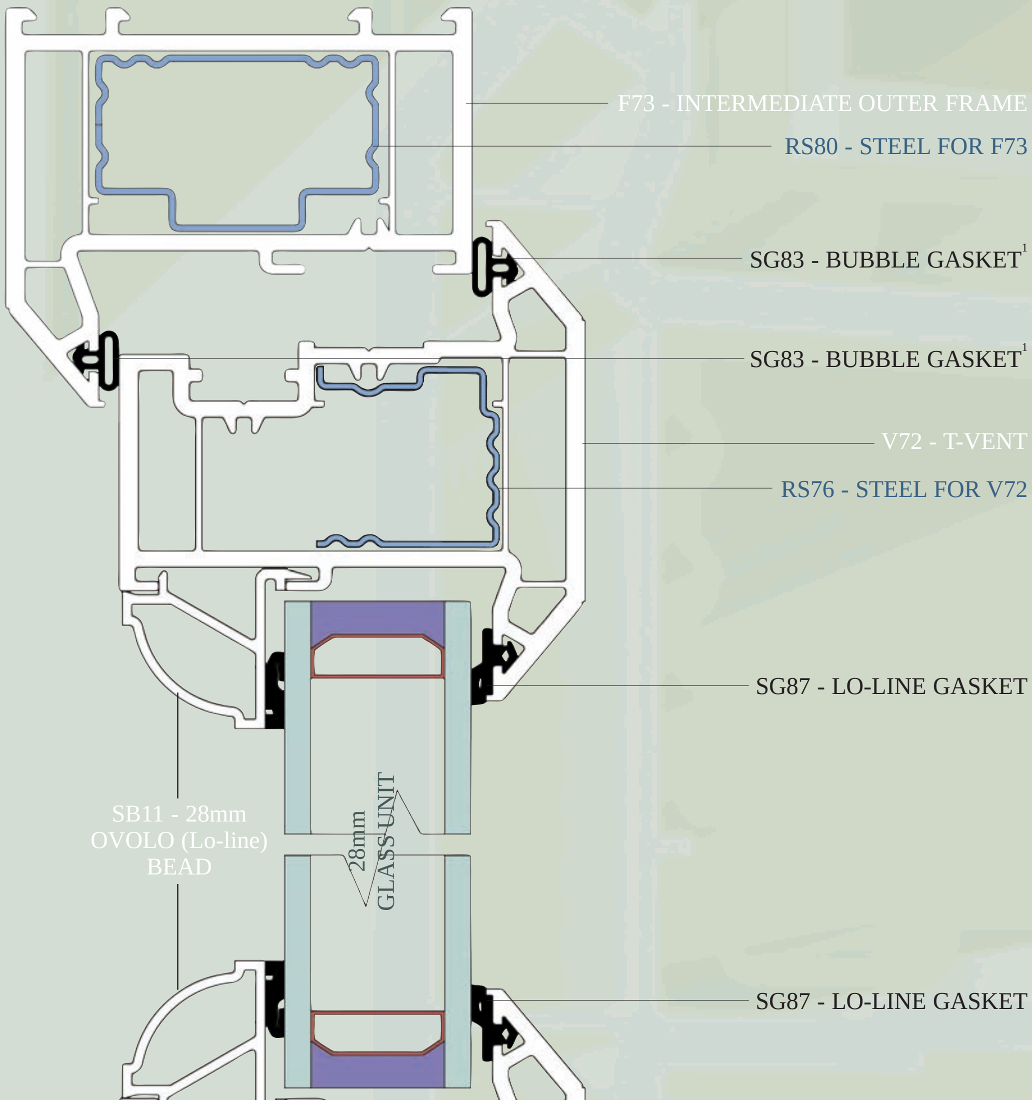
What is the minimum size for a fire escape window?
The minimum size is an unobstructed openable area that is at least 0.33m^2 and at least 450mm high and 450mm wide. The bottom of the openable area should not be more than 1100mm from the floor. See Building Regulations Approved Document B.

Schematics

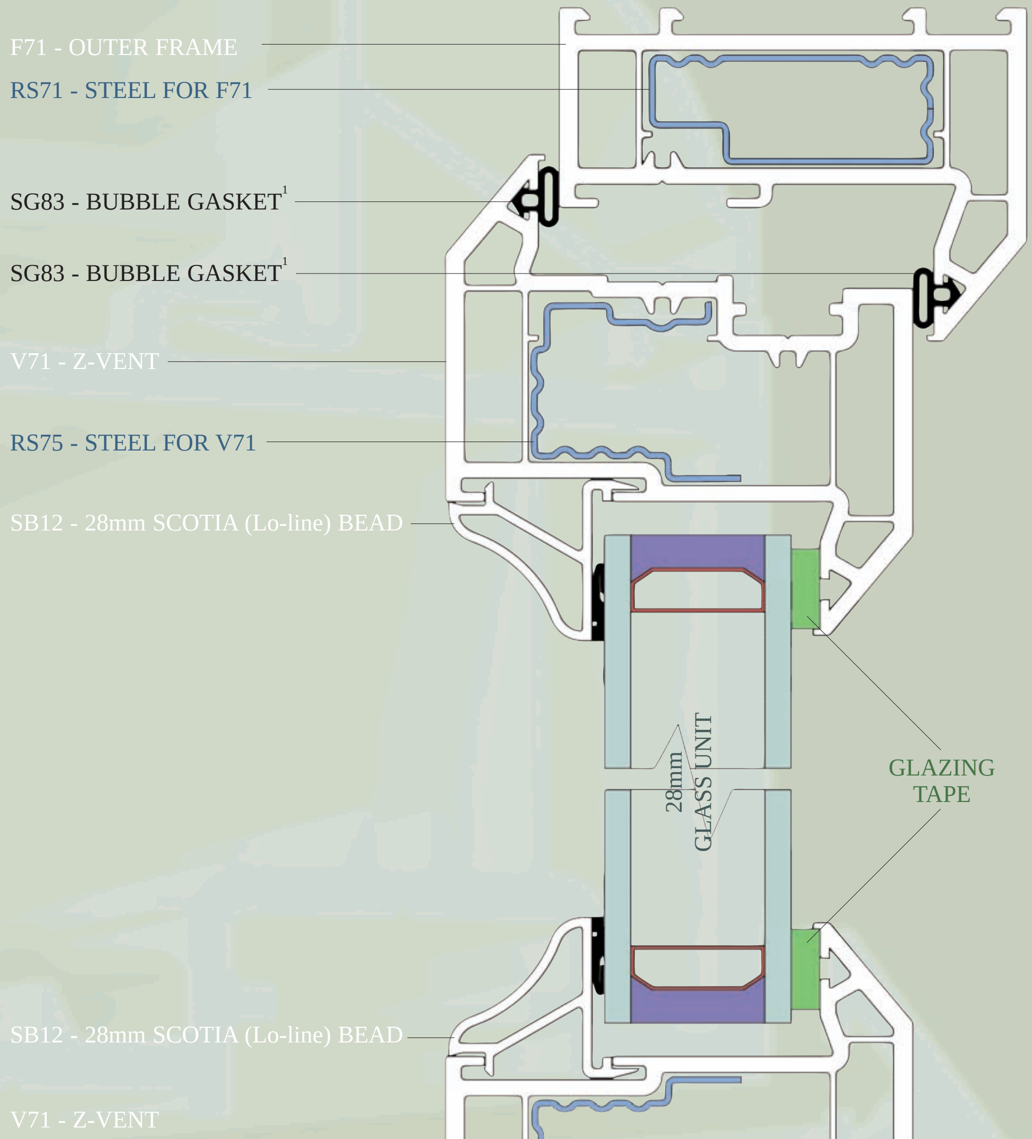
Key: = Plastic = Aluminium = Rubber = Steel = Foam = Glass = Sealant = Various/Other

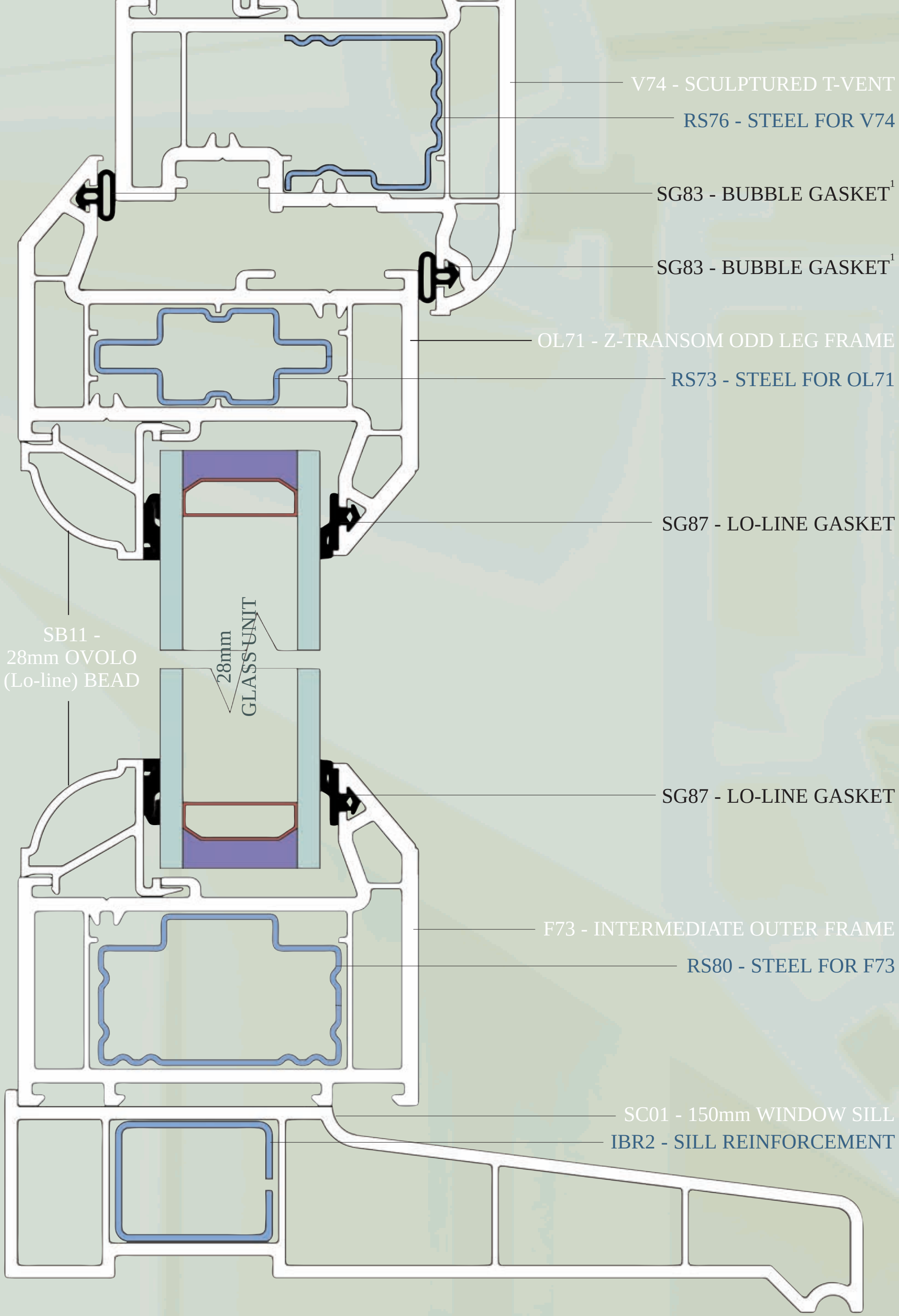
Please note: on both layouts different glazing options are available

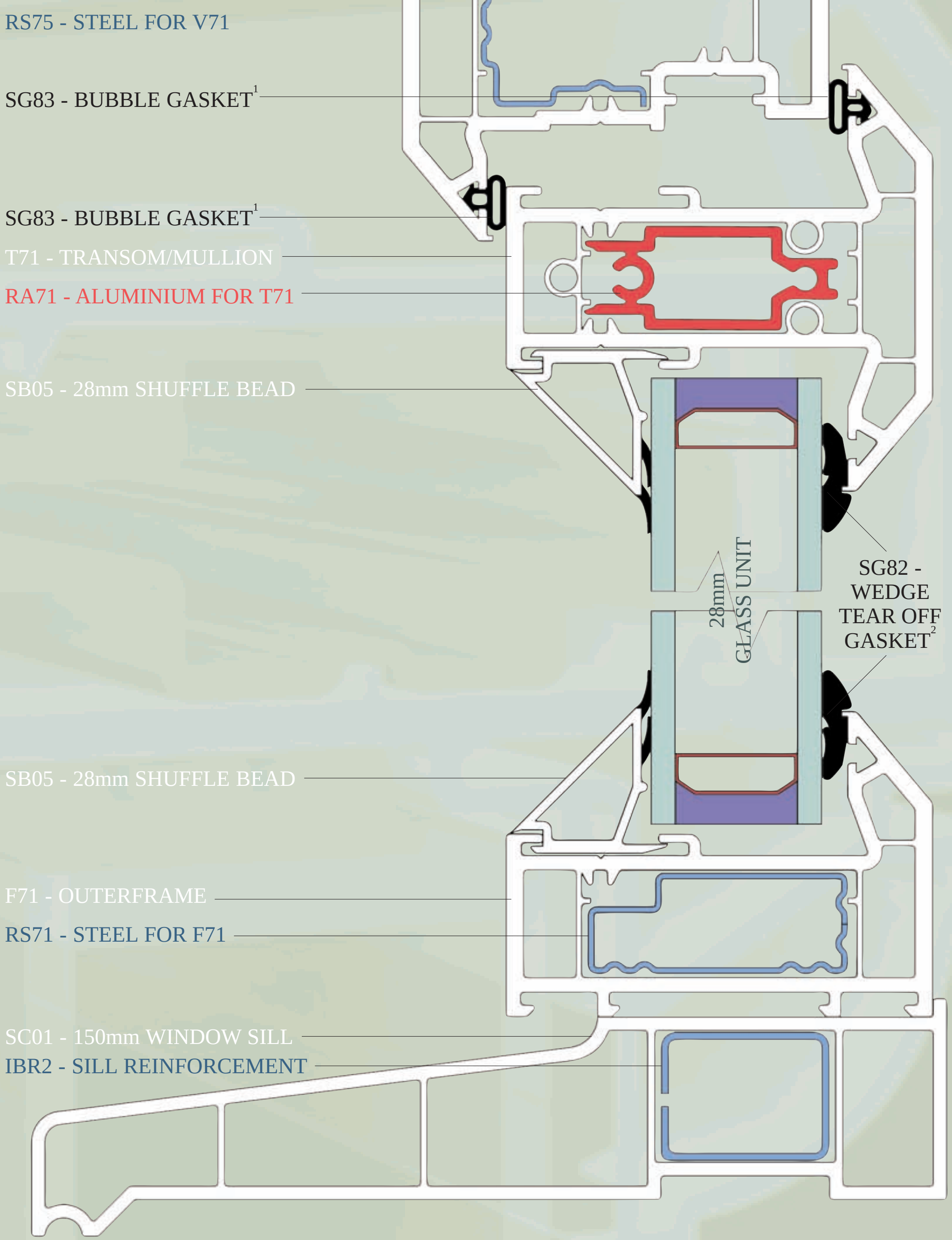
Internally Beaded Casement Window



Externally Beaded Casement Window







[1]Weatherseal Gasket Option:
SG84 - FLIPPER SEAL GASKET can be used instead of SG83 - BUBBLE GASKET

[2]Option: SG85 - WEDGE TEAR OFF GASKET
can be used instead of SG82 - WEDGE TEAR OFF GASKET

SCHEMATICS

KEY: = PLASTIC = ALUMINIUM = RUBBER = STEEL = FOAM = GLASS = SEALANT = VARIOUS/OTHER

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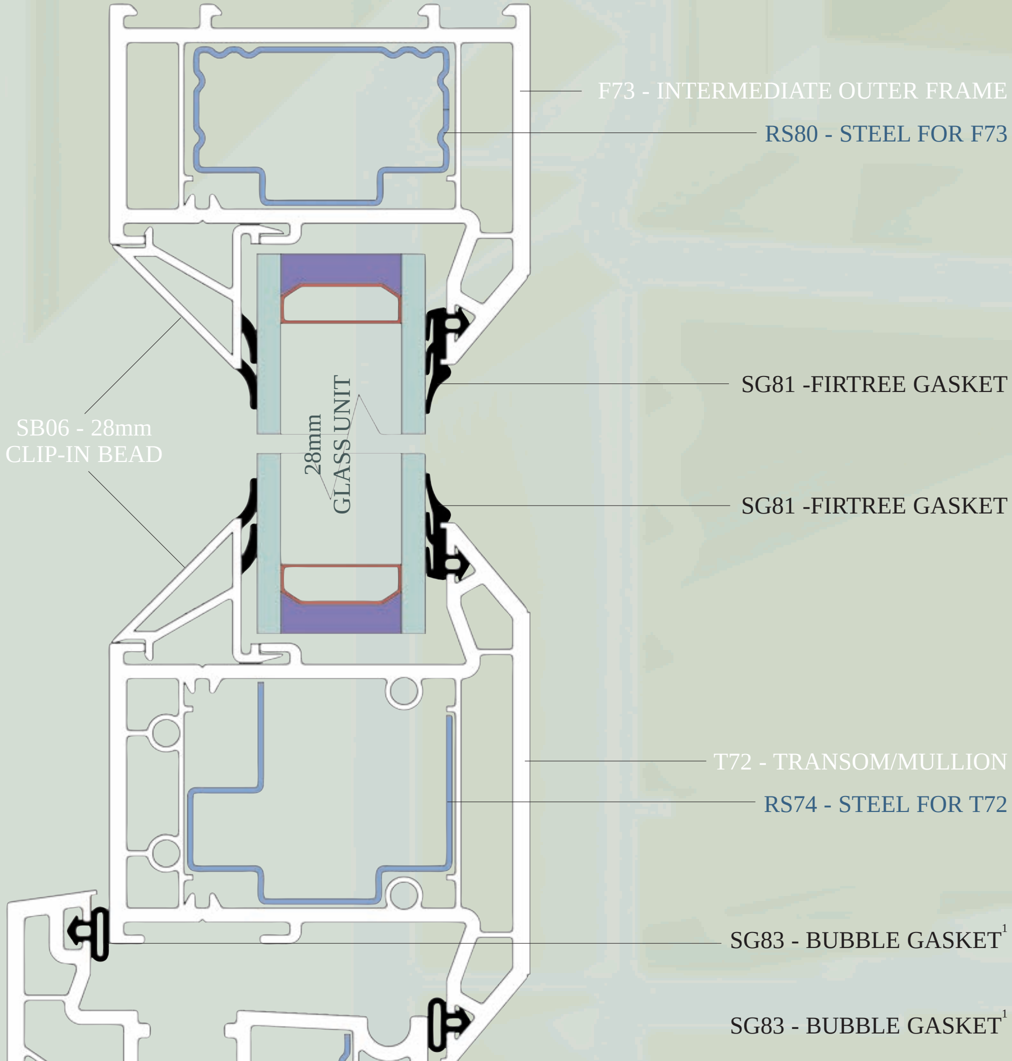
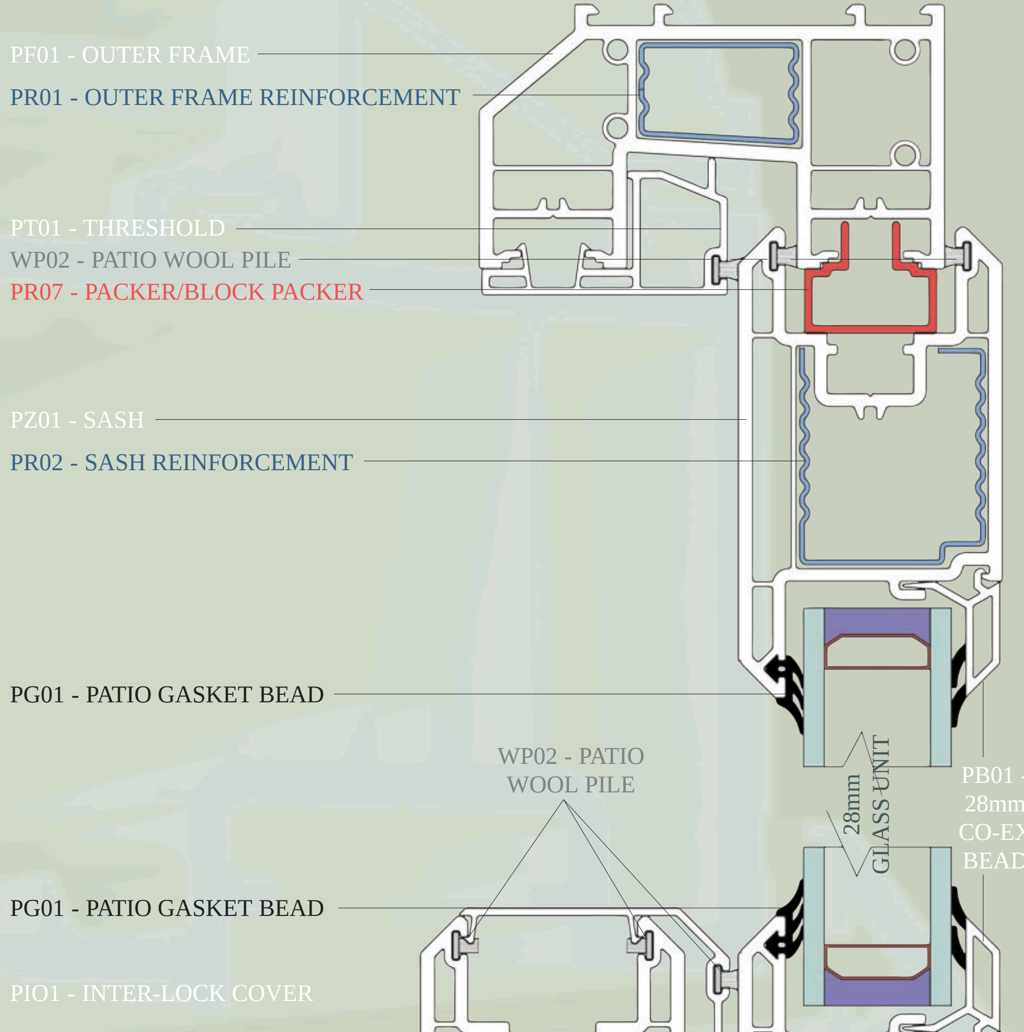
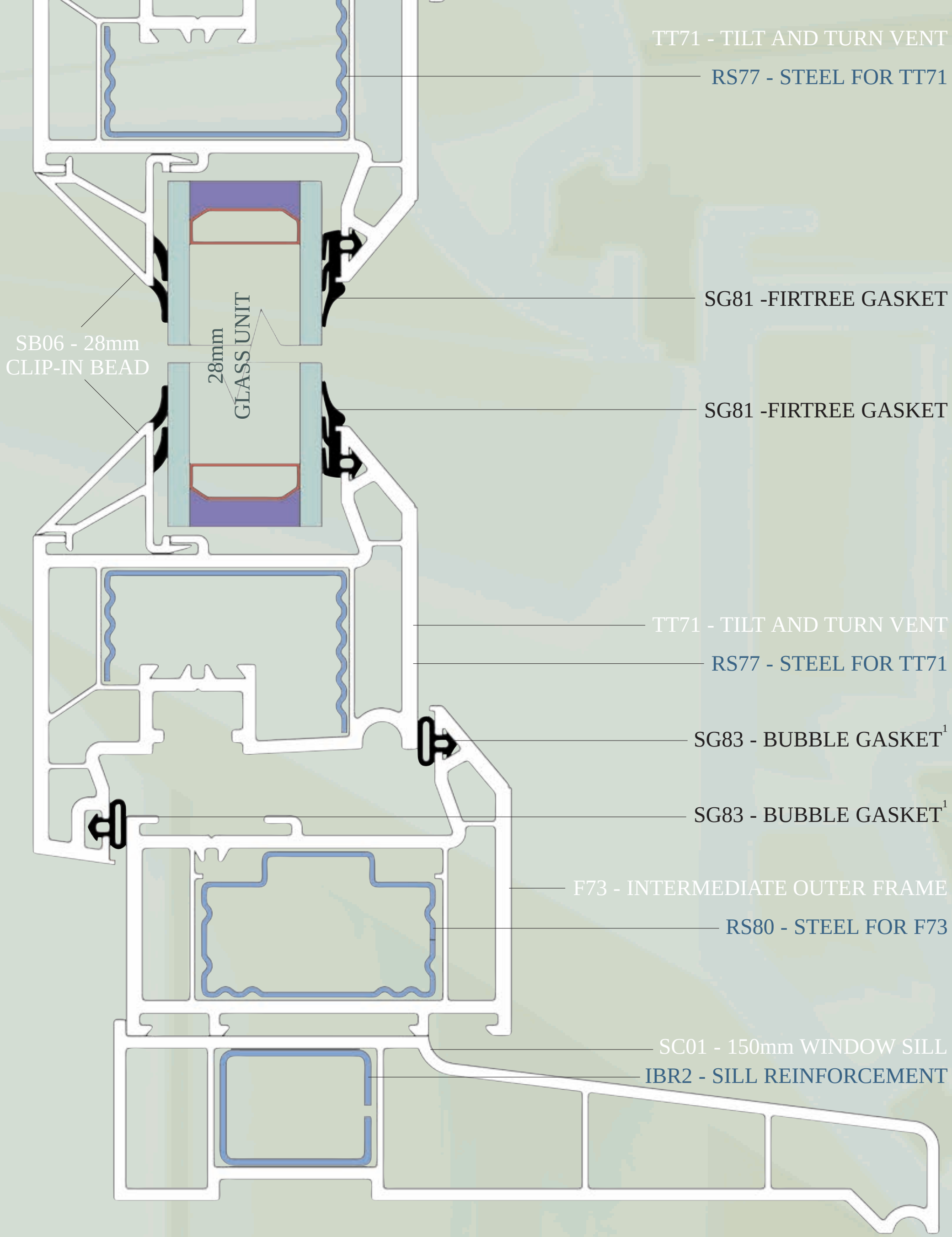
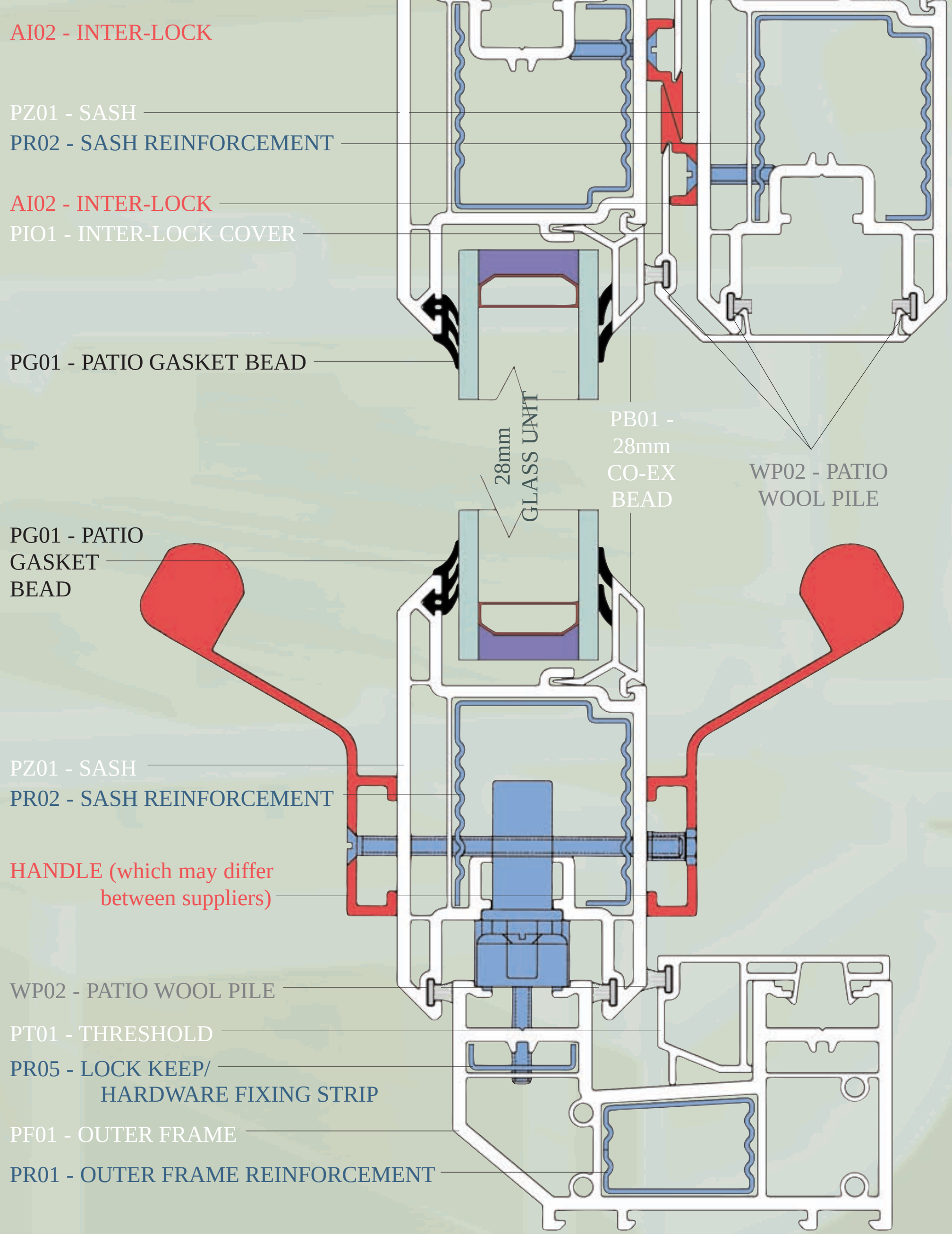
TILT & TURN WINDOW



PATIO HORIZONTAL CROSS SECTION







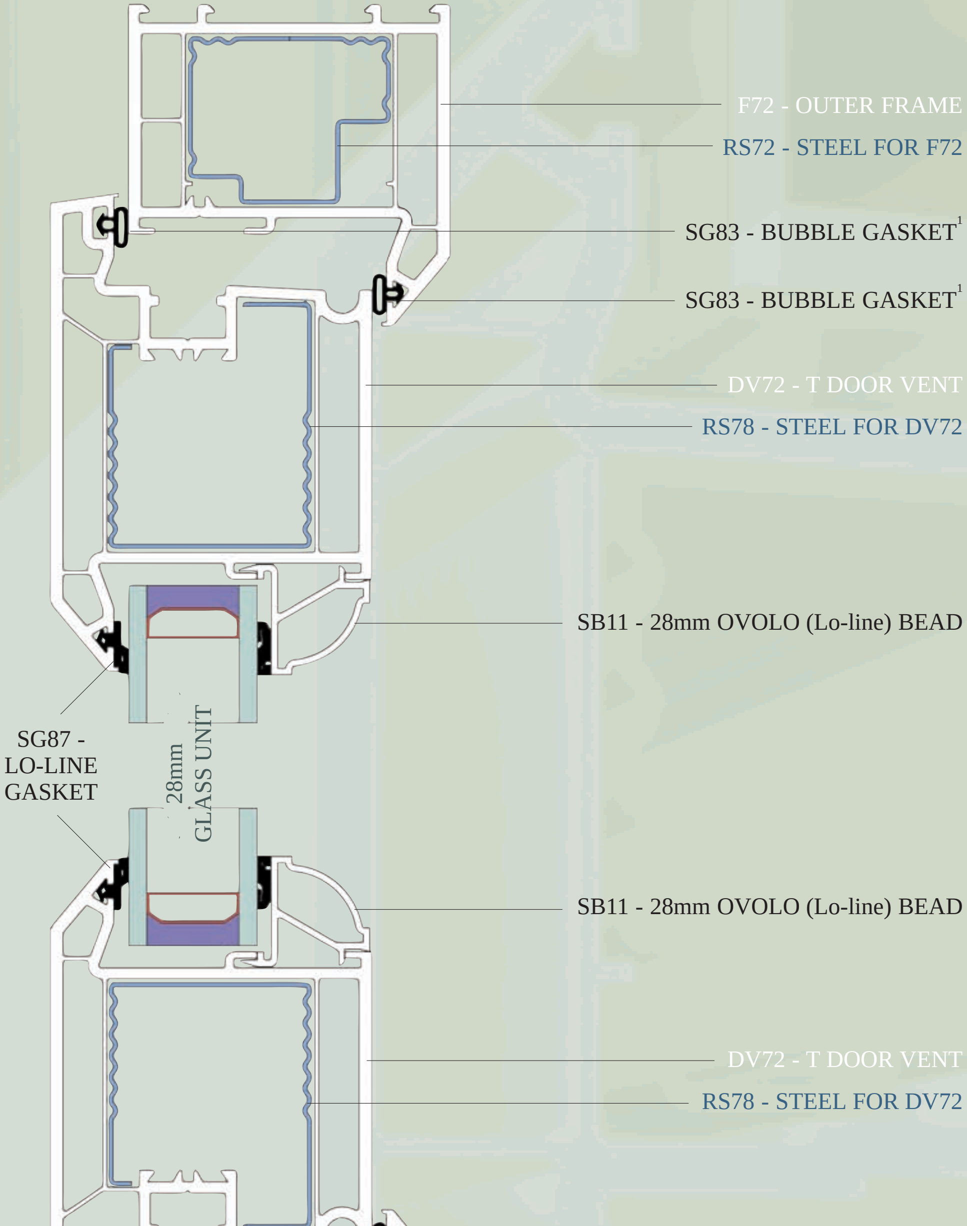
[1]Weatherseal Gasket Option:
SG84 - FLIPPER SEAL GASKET can be used instead of SG83 - BUBBLE GASKET

SCHEMATICS

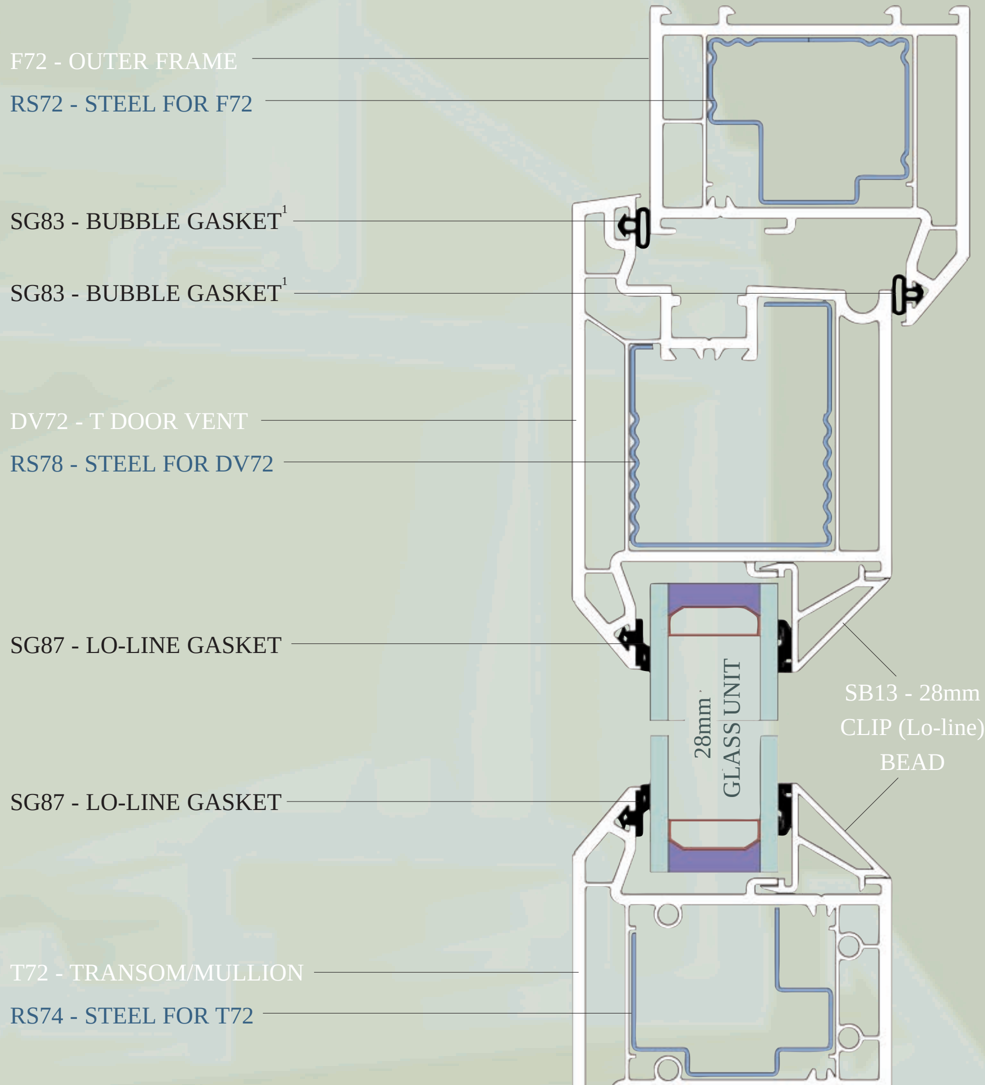
KEY: = PLASTIC = ALUMINIUM = RUBBER = STEEL = FOAM = GLASS = SEALANT = VARIOUS/OTHER

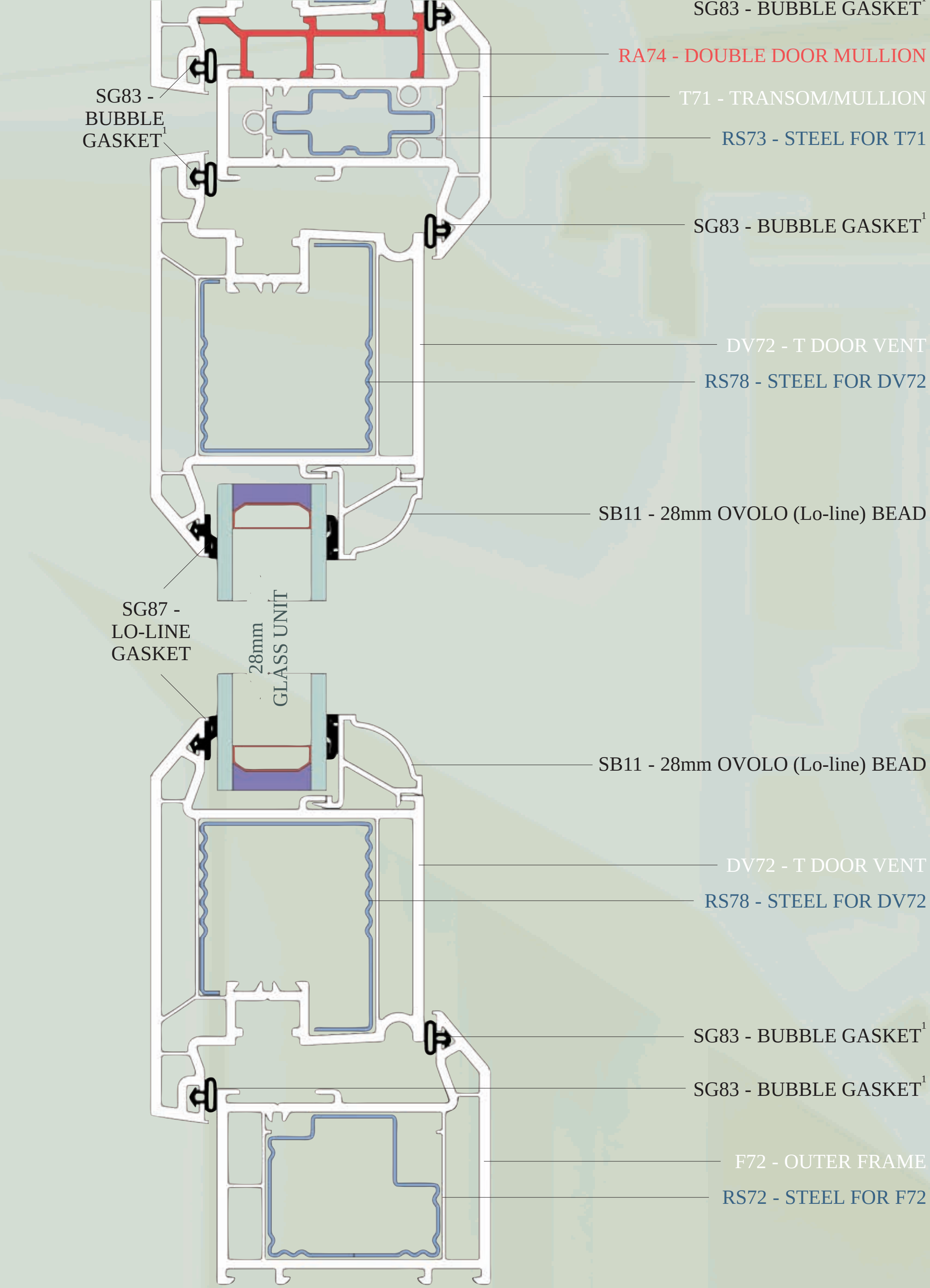
Please note: on both layouts different glazing options are available

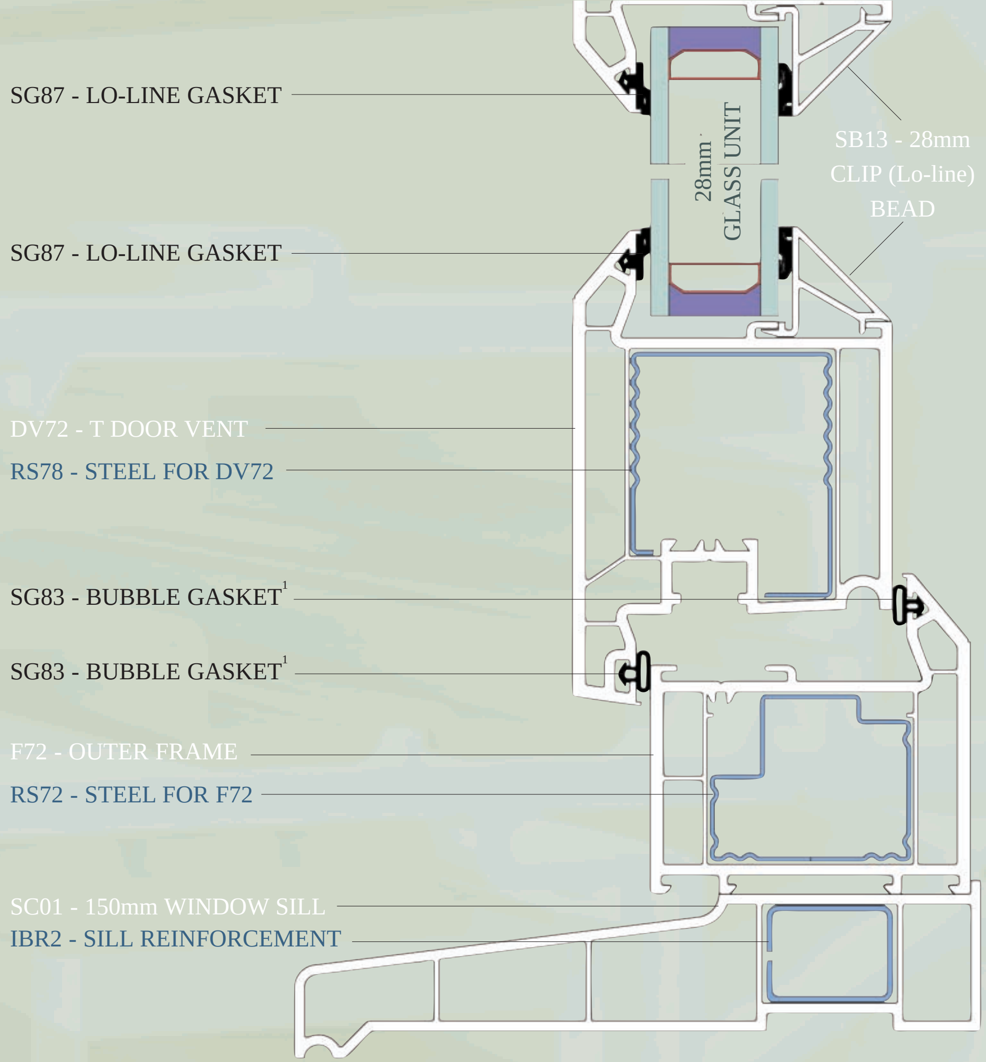
DOUBLE DOOR



RESIDENTIAL DOOR







[1] Weatherseal Gasket Option:
SG84 - FLIPPER SEAL GASKET can be used instead of SG83 - BUBBLE GASKET

Technical Data

Main Technical Details

Name: Shield; 3mm system for windows and doors.

Grade Reference: SYN10 White 01

Material: Acrylic modified high quality impact resistant, white unplastised Polyvinyl Chloride extrusion to produce a rigid multichamber extrusion.

Physical Properties: Comply with BS 7413:2002

Colours: White, Mahogany, Light Oak and Cherrywood.

Appearance: Smooth, white, non-porous gloss surface.

Surface Finish: Stabilised against UV light to prevent excessive colour shift. Meets requirements of BS 7413:2002 when used in the UK.

Corner Welding: Weld not to fracture below 20mpa (average 25mpa): BS 7413:2002 Clause 5.9.

Glass and Glazing: Subject to manufacture in accordance with the Synseal Technical Manual recommendations, the casement window system will conform to the requirements of the standard.

Physical Properties of PVC-U Type A Material
Grade Ref: SYN10 White 01

Thermal Conductivity At 20 deg C: Typical test value 0.16 W/M deg C. PVC-U has a low thermal conductivity, and is virtually constant over a wide temperature range.

Fire Classification/ Performance: PVC-U is a difficult material to burn which decreases the likelihood and development of fire. "When exposed to a flame, PVC-U carbonizes without burning or producing droplets, and it has been established that Synseal profiles can be used to achieve a Class 1 surface spread of flame rating to BS 476:Part 7."

Accelerated Weathering: Complies with requirements of BS 7413:2002

Heat Reversion: To BS 7413:2002 clause 5.5 (Test method: 1 Hr at 100 deg C). When tested, the mean maximum reversion value for individual samples shall not be greater than 2% for profiles and 3% for glazing beads. The variation between individual face sides of the same sample shall not be greater than 0.4% for profiles.

Heat Ageing: To BS 7413:2002 5.7 (Test method: 30 mins. At 5 deg C). When tested, the profile shall show no bubbles, cracks or de-lamination.

Resistance of Impact At Low Temperature: To BS 7413:2002 5.6 (Test method: 1kg from 1.5m at -10 deg C). When mainframe, subsill, casement and sash profiles are tested, no sample shall exhibit cracking through the entire wall thickness of the profiles on either face.

Heat Resistance / Softening Point: To BS 7413:2002. When tested to BS 2782 102B/ISO 306. Minimum vicat softening point: 75 deg C. Typical result 82 deg C. This is well above the requirements of the UK and German specifications.

Apparent Modules Of Elasticity: To BS 7413:2002. Minimum requirement 2200 mpa value, when tested to BS 2782 320A/ISO 178. Typical result 2350 mpa.

Co-Efficient of Thermal Expansion: Test method BS 4618. Allowances for changes in dimensions are required that occur when the temperature varies. The co-efficient of linear expansion for PVC-U is typically 7-10 to power 5. It is about half that of many other thermoplastics.

Retention of Impact Strength After Artificial Ageing: To BS 7413:2002. Minimum 70% of original value specified when tested to BS 2782 Part 3.

Colour Fastness: To BS 1006 1990 Part A03 Clause 4.7 of BS 7413. Specified 3 / 4 maximum on the grey scale. Typical result 4 / 5.

Windows: Windows manufactured from Synseal profiles perform to BS 6375: Parts 1 and 2, and when tested in accordance with BS 5368:Part 1 (Air Permeability) Part 2 (watertightness) and Part 3 (Wind Resistance). The Synseal window system complies with BS 7412.

Wind Resistance: Clause 11.4.1 BS 7412 (Tested in accordance with Clause 7 BS 6375:Part 1)

Operation and Strength: Clause 12 BS 7412 BS 6375:Part 2

Functionality: Clause 10 BS 7412

Doors: Residential doors manufactured from Synseal profiles perform to BS 6375:Parts 1 and 2, and when tested in accordance with BS 5368:Part 1 (Air permeability), Part 2 (Watertightness), and Part 3 (Wind resistance).

Maintenance: PVC-U maintenance free. Abrasive materials are not recommended. PVC-U cream cleaners/mild non-abrasive detergent solutions used regularly are recommended. Application of light oil will maximize life of exposed hardware and fittings.

PVC-U Windows in Fires

(information from Tangram Technology Ltd)

Introduction:

PVC-U exhibits excellent fire behaviour and does not burn once the source of heat or flame has been removed.

Building Regulations:

UK Building Regulations do not stipulate any fire performance standards for the material used in window frames. Whilst no degree of 'fire resistance' (as defined by BS 476 part 8) can be achieved by PVC-U window units, the large scale fire tests carried out show no difference between PVC-U and wood under the conditions of test.

PVC-U can, when correctly formulated, achieve high ratings (usually Class 1 surface spread of flame) when performance is assessed to BS 476: parts 6 and 7.

Ignition and burning response:

PVC-U is very difficult to ignite using commonly available ignition sources (match, blow-lamp, etc). Tests with a wide variety of sources varying in heat intensity and impingement area on PVC-U window frames show that the product only burns whilst the source is applied. When the source is removed there is no residual flame on the product. In terms of ignitability, the temperature required to ignite PCV-U is more than 120ºC higher than that of pinewood (385ºC for PVC-U and 260ºC for wood as defined for self ignition.) Once a material has been ignited the flammability can be defined in terms of the Limiting Oxygen Index (LIO) test.
This defines the amount of oxygen that needs to be present for a material to burn freely. A material with an LIO of 21 will burn freely in air (which contains 21% oxygen) and one with an LIO of more than 21 will not burn in air at room temperature.

PVC-U has an LIO of approximately 50, compared with wood at an LIO of 21. This shows that PVC-U will not sustain combustion in air at room temperature and is better than wood in this test.

The limited burning of PVC-U is confirmed in a variety of other standard tests which measure specific parameters, such as rate of heat release and flame spread under different conditions.

The conclusions are clear:

1) the rate of heat release and total heat released by PVC-U are significantly lower than most other building materials.

2) when flames do contact PVC-U, it forms a protective charred layer which insulates the material below and excludes the oxygen necessary for combustion. This restricts the burning zone. In addition, any HCl emitted acts as a combustion inhibitor.

3) PVC-U is very difficult to ignite using common ignition sources.

Smoke and fumes:

Smoke is the result of incomplete burning of a material and consists of solid or liquid particles in the combustion gases. Smoke densities are similar to wood under smouldering conditions, but greater under flaming conditions. The combustion gases (e.g. HCl) may lead to some corrosion of metallic materials but restoration is normally possible. The corrosion gases have no effects on the structural elements of the building. The toxic potency of the combustion gases of PVC-U is similar to, and certainly not significantly worse than, those of many natural materials. The build up of toxic fumes will be slow compared with rapidly burning materials of a similar toxic potency.
The rate of generation and quantity of smoke and fumes produced by a PVC-U window will depend on the severity of the source applied. The smoke and fumes emitted will be confined to the area of the product affected by the source and their transport away from the impingement zone will depend on local factors such as ventilation and survival of the glazing.

In a typical domestic fire the PVC-U window frames will not materially affect the progress of the fire or the possibility of personal injury. Most deaths in fires are caused by smoke or fume inhalation. In a typical domestic fire the occupants are likely to suffer from the inhalation effects from burning carpets, settees, curtains, etc. before the PVC-U in the window frames has even begun to emit smoke or fumes.

Fire resistance:

The fire resistance of a glazed window is mainly influenced by the fracture behaviour of the glazing at high temperature. The fire resistance of glazed PVC-U window frames is generally found to be similar to that of glazed wood window frames.

Large scale fire tests:

In a research programme carried out by the Fire Research Station, the performance of PVC-U window frames in fires was compared with that of traditional wood frames in a typical domestic room. All windows were double glazed and both a large fuel load / non-ventilated controlled fire and a medium fuel load / ventilation controlled fire were used.

The conclusions of the report were;

1) little damage was evident to both PVC-U and wood windows until the glass panes were displaced at approximately 250ºC to 400ºC. Glass panes failed by cracking and falling out in a random manner.

2) after failure of one glass pane, the increased ventilation changed the mode of the fire and accelerated the fire growth. In most tests the other panes fell out soon after.

3) wood frames burned after the displacement of the glass while the PVC-U window frames softened and the casement sometimes fell out. There was some evidence of combustion of the PVC-U, but PVC-U windows did not show any aspects of performance which would create new hazards in fire involving buildings.

4) carbon monoxide, produced mainly from the wooden fuel under low ventilation conditions, was the major toxic hazard in each test and was produced in volumes that would prove lethal in regions where ambient temperatures would allow survival.

5) the concentrations of carbon monoxide were noticeably lower in the fire involving only PVC-U frames; this was possibly caused by a lower rate of burning in this test.

Summary:

The base PVC-U material has good fire properties and PVC-U windows give a satisfactory performance in fires compared with other materials.

Technical Data

Thermal Expansion of PVC-U

(information from Tangram Technology Ltd)

The linear thermal expansion of a material is a measure of how much that material will expand for each 1 degree change in temperature.

Typical values:

PVC-U: 0.0000600/ºC

Mild Steel (0.06 carbon): 0.0000126/ºC

Aluminium (99 % pure) 0.0000240/ºC

The values of the coefficient of thermal expansion can be regarded as constant over the temperature range normally experienced in the U.K.

A temperature difference between the inside and outside surfaces can lead to differential thermal expansion, which may in some circumstances lead to buckling or distortion.

The bulk temperature of the material is usually used to calculate the expansion. This is not always the same as the surface temperature.

For white profile the temperatures are approximately the same, but for dark (wood-grain) profiles the bulk temperatures may be higher than the air temperature due to the higher solar heat gain of dark profiles. Expansion gaps should always be larger for wood-grain profiles than for white profiles to allow for this.

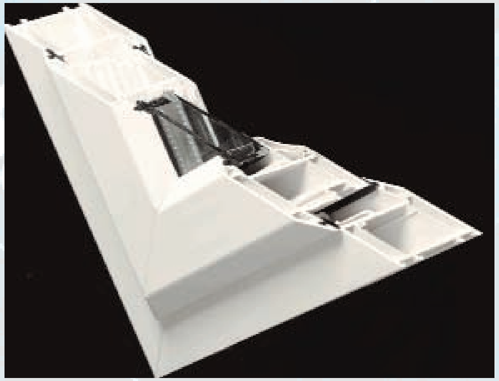
Calculation example:

If a 1000 mm. length of PVC-U profile is heated up from 20ºC to 40ºC, then the expansion is given by:

Original length X change in temperature X coefficient of thermal expansion, i.e.

1000 x 20 x 0.00006 = 1.2 mm.

Therefore the final length of the PVC-U profile is 1001.2 mm.



Exposure Categories

(taken from Table 1 of BS7412:2002 - Plastics windows made from PVC-U extruded hollow profiles - Specification.)

Exposure Category (design wind pressure) Pa	Air Permeability Pa	Watertightness Pa	Wind Resistance Pa
800	up to 200	200	800
1200	up to 200	200	1200
1600	up to 300	200	1600
2000	up to 300	200	2000
over 2000 (state design wind pressure)	up to 300	300	equal to design wind pressure

Conversion Table - Wind Pressure and Speed

Pressure		Speed		
Pa	lb f / ft²	m/s	km/h	m.p.h.
800	16.4	35.6	129	80
1200	24.55	43.6	157.5	98.3
1600	32.75	50.4	181	113
2000	40.9	56.3	202.5	126.5

Note: The above conversions are based on the aerodynamic relationship:
Pressure = (velocity)2 x (a constant)

For design wind pressures these values must be multiplied by a shape factor.

'U' - Values ($W/m^2/°K$)

(from computer simulations unless otherwise stated)

SHIELD GGF STANDARD WINDOW

UNIT: 4/20 air/4 Pilkington K	
spacer	u' - value
Aluminium	1.9
AZON	1.8
EdgeTech	1.8

UNIT: 4/20 air/4 Optitherm	
spacer	u' - value
Aluminium	1.7
AZON	1.6
EdgeTech	1.6

UNIT: 4/20 argon/4 Pilkington K	
spacer	u' - value
Aluminium	1.8
AZON	1.7
EdgeTech	1.6

UNIT: 4/20 argon/4 Optitherm	
spacer	u' - value
Aluminium	1.5
AZON	1.4
EdgeTech	1.4

Hot - Box test results: (BBA reports 2013 and 2014 - June 2003)

Shield window (4/20air/4Pilkington K, aluminium spacer)	**1.8 $W/m^2/°K$**
Silhouette window (4/20air/4 Pilkington K, Swiggle spacer):	**1.8 $W/m^2/°K$**

SHIELD PATIO

UNIT: 4/20 air/4 Pilkington K		
midrail	spacer	u' - value
none	Aluminium	1.9
	AZON	1.9
	EdgeTech	1.8
PM01	Aluminium	2.0
	AZON	1.9
	EdgeTech	1.9

UNIT: 4/20 air/4 Optitherm		
midrail	spacer	u' - value
none	Aluminium	1.7
	AZON	1.7
	EdgeTech	1.6
PM01	Aluminium	1.8
	AZON	1.7
	EdgeTech	1.7

UNIT: 4/20 argon/4 Pilkington K		
midrail	spacer	u' - value
none	Aluminium	1.8
	AZON	1.8
	EdgeTech	1.7
PM01	Aluminium	1.9
	AZON	1.8
	EdgeTech	1.8

UNIT: 4/20 argon/4 Optitherm		
midrail	spacer	u' - value
none	Aluminium	1.5
	AZON	1.5
	EdgeTech	1.4
PM01	Aluminium	1.6
	AZON	1.5
	EdgeTech	1.5

SHIELD FRENCH DOOR (24 MM UNITS)

UNIT: 4/16 air/4 Pilkington K		
midrail	spacer	u' - value
none	Aluminium	1.8
	AZON	1.8
	EdgeTech	1.8
T72	Aluminium	1.9
	AZON	1.9
	EdgeTech	1.8
T73	Aluminium	1.9
	AZON	1.9
	EdgeTech	1.8

UNIT: 4/16 air/4 Optitherm		
midrail	spacer	u' - value
none	Aluminium	1.7
	AZON	1.6
	EdgeTech	1.6
T72	Aluminium	1.8
	AZON	1.7
	EdgeTech	1.6
T73	Aluminium	1.8
	AZON	1.7
	EdgeTech	1.6

UNIT: 4/16 argon/4 Pilkington K		
midrail	spacer	u' - value
none	Aluminium	1.7
	AZON	1.7
	EdgeTech	1.7
T72	Aluminium	1.8
	AZON	1.7
	EdgeTech	1.7
T73	Aluminium	1.8
	AZON	1.8
	EdgeTech	1.7

UNIT: 4/16 argon/4 Optitherm		
midrail	spacer	u' - value
none	Aluminium	1.5
	AZON	1.5
	EdgeTech	1.4
T72	Aluminium	1.6
	AZON	1.5
	EdgeTech	1.5
T73	Aluminium	1.6
	AZON	1.5
	EdgeTech	1.5

SHIELD FRENCH DOOR (28 MM UNITS)

UNIT: 4/20 air/4 Pilkington K		
midrail	spacer	u' - value
none	Aluminium	1.9
	AZON	1.8
	EdgeTech	1.8
T72	Aluminium	1.9
	AZON	1.8
	EdgeTech	1.8
T73	Aluminium	1.9
	AZON	1.8
	EdgeTech	1.8

UNIT: 4/20 air/4 Optitherm		
midrail	spacer	u' - value
none	Aluminium	1.7
	AZON	1.6
	EdgeTech	1.6
T72	Aluminium	1.7
	AZON	1.7
	EdgeTech	1.6
T73	Aluminium	1.7
	AZON	1.7
	EdgeTech	1.6

UNIT: 4/20 argon/4 Pilkington K		
midrail	spacer	u' - value
none	Aluminium	1.7
	AZON	1.7
	EdgeTech	1.7
T72	Aluminium	1.8
	AZON	1.7
	EdgeTech	1.7
T73	Aluminium	1.8
	AZON	1.7
	EdgeTech	1.7

UNIT: 4/20 argon/4 Optitherm		
midrail	spacer	u' - value
none	Aluminium	1.5
	AZON	1.5
	EdgeTech	1.4
T72	Aluminium	1.6
	AZON	1.5
	EdgeTech	1.4
T73	Aluminium	1.6
	AZON	1.5
	EdgeTech	1.4

Technical Data

Safe Working Capacities of Bay-Poles & Posts

(Refer to BPF Publication - Code of Practice for the Survey of PVC-U Windows and Doorsets)

Key: = Aluminium

Bay-pole Load-bearing Capacity

The load-bearing capacity of a bay pole depends upon two factors:

1. the Least Radius of Gyration
2. the Effective Length of the pole.

The Least Radius of Gyration is given by:

r = square root (I/A)
where I is the moment of inertia (least axis) and A is the cross-sectional area of the pole.

The Effective Length of a pole is determined by the fixings at it's ends. If the pole is held in position at both ends, but not restrained in direction, then the Effective Length is the actual length of the pole (usually the case for most poles.)

If the pole is effectively held in position and restrained at both ends, then the Effective Length is only 70% of the actual length (this condition will only apply if the pole is fixed to the structure so that it will not move until the column starts to buckle.)

The Slenderness Ratio of the bay pole can then be calculated by dividing the Effective Length by the Least Radius of Gyration. The maximum permissible stress for that length of bay pole can then be obtained from the graph below. The actual load that can be applied is then given by multiplying the allowable stress by the cross-sectional area.

(We have done this for the most commonly used Synseal bay poles and posts, see tables and graphs on this page.)

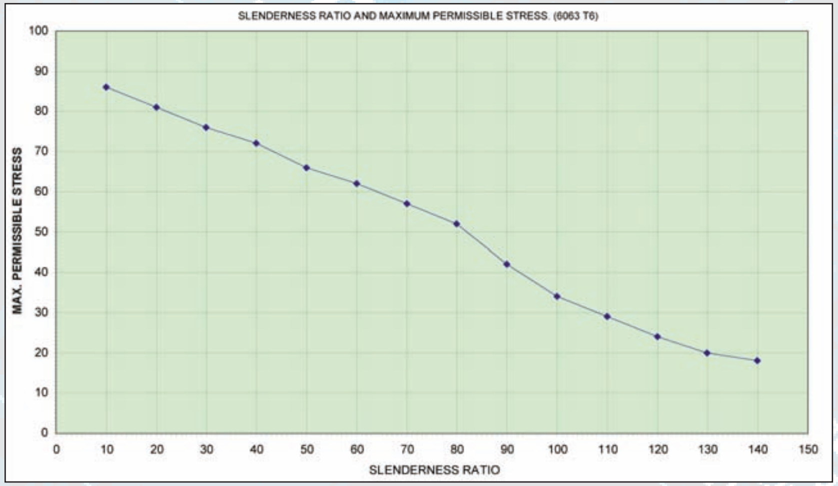
52.5mm. dia. BAY POLE - RA75

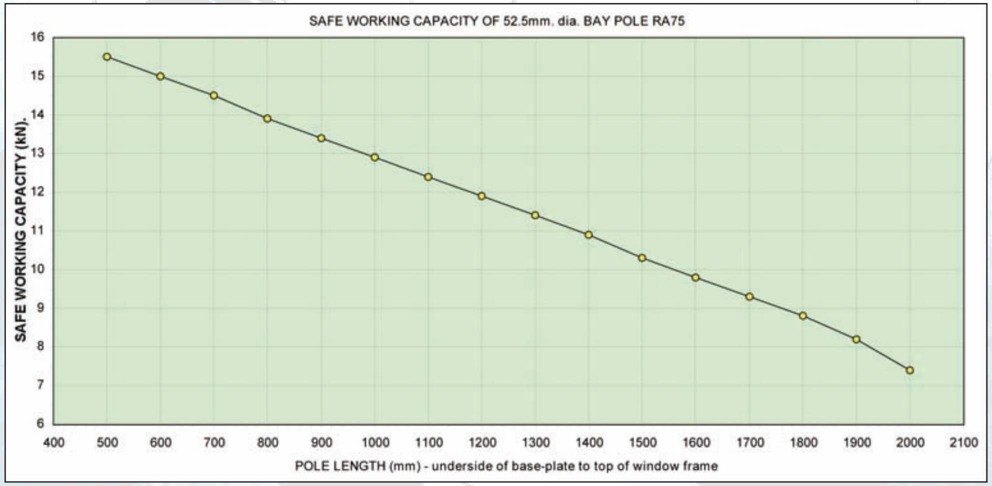
data supplied by Elliott & Brown - Consulting Civil & Structural Engineers - Nottingham

HEIGHT (mm)	SLENDERNESS RATIO	PERMISSIBLE STRESS (N/mm2)	CAPACITY (kN)
500	27.9	54.1	15.5
600	33.4	52.3	15.0
700	39.0	50.6	14.5
800	44.6	48.5	13.9
900	50.2	46.7	13.4
1000	55.7	45.0	12.9
1100	61.3	43.3	12.4
1200	66.9	41.5	11.9
1300	72.5	39.8	11.4
1400	78.0	38.0	10.9
1500	83.6	35.9	10.3
1600	89.2	34.2	9.8
1700	94.8	32.4	9.3
1800	100.3	30.7	8.8
1900	105.9	28.6	8.2
2000	111.5	25.8	7.4

SLENDERNESS RATIO AND MAXIMUM PERMISSIBLE STRESS (ALUMINIUM GRADE 6063 T6)

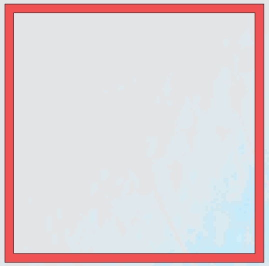
(from BPF Code of Practice for the Survey of PVC-U Windows and Doorsets)



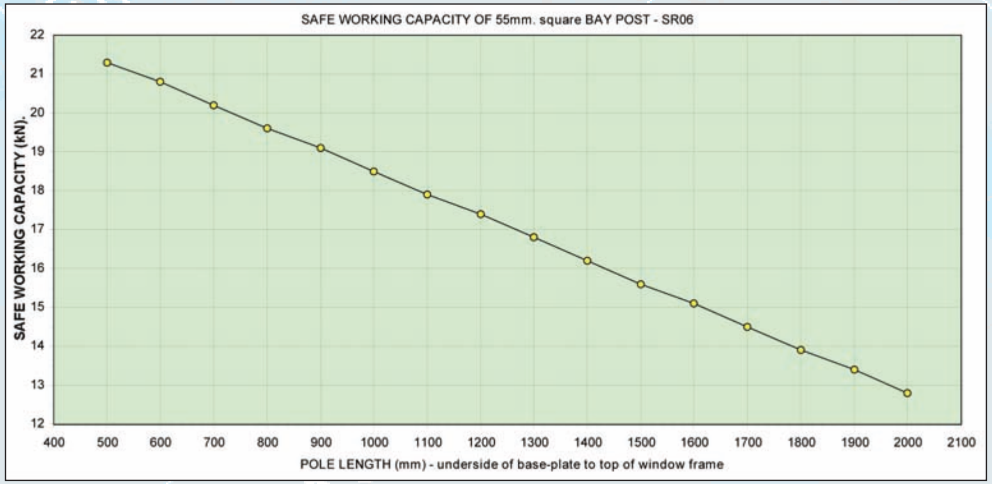


55mm. square BAY POST - SR06

data supplied by Elliott & Brown - Consulting Civil & Structural Engineers - Nottingham

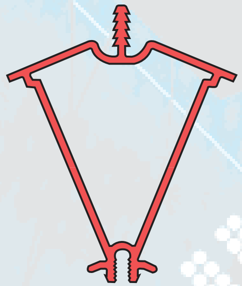


HEIGHT (mm)	SLENDERNESS RATIO	PERMISSIBLE STRESS (N/mm2)	CAPACITY (kN)
500	23.5	56.8	21.3
600	28.2	55.3	20.8
700	32.9	53.8	20.2
800	37.6	52.3	19.6
900	42.3	50.8	19.1
1000	46.9	49.3	18.5
1100	51.6	47.8	17.9
1200	56.3	46.3	17.4
1300	61.0	44.8	16.8
1400	65.7	43.2	16.2
1500	70.4	41.7	15.6
1600	75.1	40.2	15.1
1700	79.8	38.7	14.5
1800	84.5	37.2	13.9
1900	89.2	35.7	13.4
2000	93.9	34.2	12.8

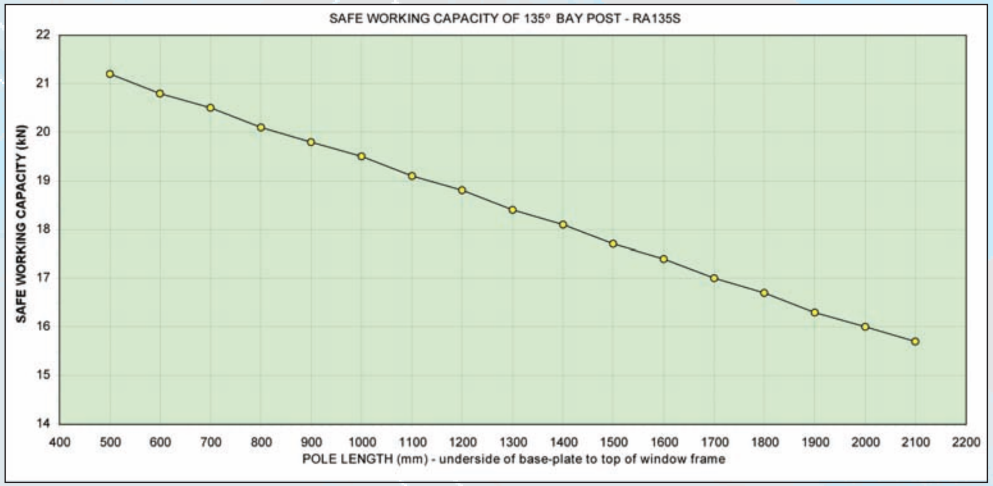


135º CORNER POST - RA135S

data supplied by Elliott & Brown - Consulting Civil & Structural Engineers - Nottingham



HEIGHT (mm)	SLENDERNESS RATIO	PERMISSIBLE STRESS (N/mm^2)	CAPACITY (kN)
500	24.7	55.7	21.2
600	29.6	54.8	20.8
700	34.5	53.8	20.5
800	39.5	52.9	20.1
900	44.4	52.0	19.8
1000	49.3	51.1	19.5
1100	54.3	50.2	19.1
1200	59.2	49.3	18.8
1300	64.1	48.3	18.4
1400	69.1	47.4	18.1
1500	74.0	46.5	17.7
1600	78.9	45.6	17.4
1700	83.9	44.7	17.0
1800	88.8	43.8	16.7
1900	93.8	42.8	16.3
2000	98.7	41.9	16.0
2100	103.6	41.0	15.7



SOUND TRANSMISSION THROUGH WINDOWS

(ref. Canadian Building Digest, article by J.D.Quirt)

Introduction:

In addition to their primary function as visual openings, windows also transmit sound. This is of concern not only for the exterior surfaces of a building, but also for interior applications ranging from office doors to control booths in recording studios. Sound transmitted through windows often limits the overall acoustical insulation.

Sound transmission through windows is governed by the same physical principles that affect walls, but practical noise control measures are influenced by the properties of glass and the characteristics of the window assemblies. Increasing the glass thickness, for example, gives greater noise reduction at most frequencies, but the stiffness of glass limits the improvement. Using multiple layers (double or triple glazing) increases noise reduction at most frequencies, but this is dependent on the separation of the layers.

As with other building assemblies, transmission of sound through cracks may drastically reduce the effective noise reduction. This is of particular concern for openable windows: even windows with good weather-stripping have reduced noise reduction because of air leakage. Most of the data presented in this report are for sealed windows.

The acoustic terms used in this report are as follows:

decibels (abbreviated to dB.)
Sound Transmission Loss (TL) which is a standardised measure of the noise reduction in decibels for specific frequency ranges.
Sound Transmission Class (STC) is a single figure rating of sound transmission,calculated by fitting a standard contour to the TL data. It is most commonly used in North America.

Sealed single glazing:

The TL for a large thin panel would theoretically increase by 6 dB for each doubling of the sound frequency or the mass if the effect of stiffness was ignored. Although single glazing does approach this 'mass law' behaviour at some frequencies, the stiffness of the glass and the limited size of typical windows cause significant deviations from this prediction **(see fig. 1 on page 19)**.

The sharp decrease in TL at specific frequencies is called the 'coincidence dip', and is caused by bending waves in the glass panel. Above the coincidence frequency, laminated glass can provide much higher TL than solid glass. This is apparently due to damping (dissipation of vibrational energy) by the plastic interlayer.

Sealed double glazing:

The TL of double glazing is strongly dependent on the features of the cavity between the two layers of glass. The STC rating increases as the air space increases **(see fig. 2 on page 19)**. For each doubling of the air space, the STC increases by approximately 3. The STC also increases with increasing glass thickness.

If the separation between the panes is small, the STC rating is only slightly higher than that for a single pane of the same glass. This occurs because the air in the space between the two panes acts like a spring, transferring vibrational energy from one pane to the other. This resonance falls within the range of 200 to 400 Hz for a unit with a small air gap **(see fig. 3 on page 19)** Most of the energy from aircraft or heavy traffic falls within this frequency range, but by increasing the air space and using heavier glass, the resonant frequency can be lowered to improve the insulation against such noise sources.

Sealed triple glazing:

Despite the widespread belief that adding another layer of glass must be beneficial, triple glazing provides essentially the same noise reduction as double glazing, unless the air gap is very large. **Figure 4 (on page 19)** compares TL data for a double glazed window with that for a triple glazed window of similar total thickness.

Designing for noise control:

In most cases where substantial noise control is required, double glazing is the most sensible choice. The airspace should be sufficiently large to provide the desired TL.

Using different thicknesses of glass for double glazing gives greater noise reduction. The highest STC values shown in figure 2 are for double 6 mm. glass; windows with 3mm. substituted for one of the 6 mm. panes would have equal or higher STC ratings.

The use of laminated glass has also been shown to reduce sound transmission.

Figure 1. Sound transmission loss (TL) for sealed single glazing

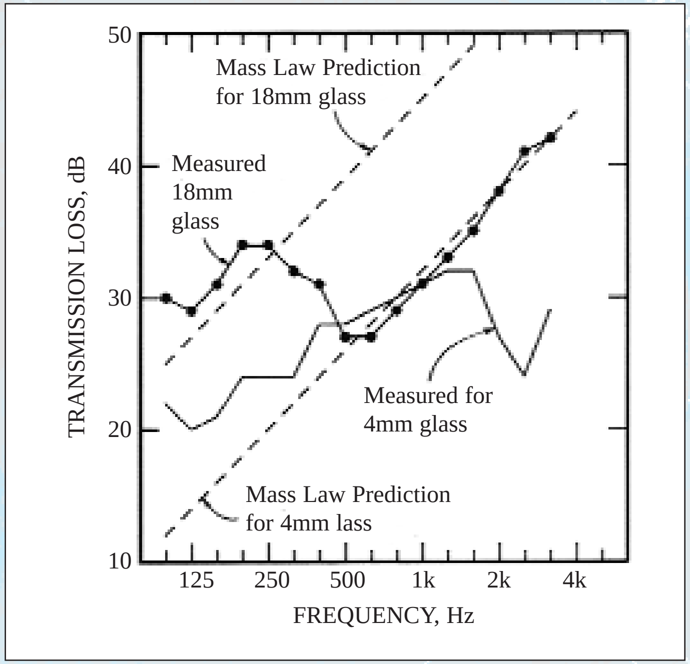


Figure 2. Sound transmission class (STC) versus interpane spacing for double glazing

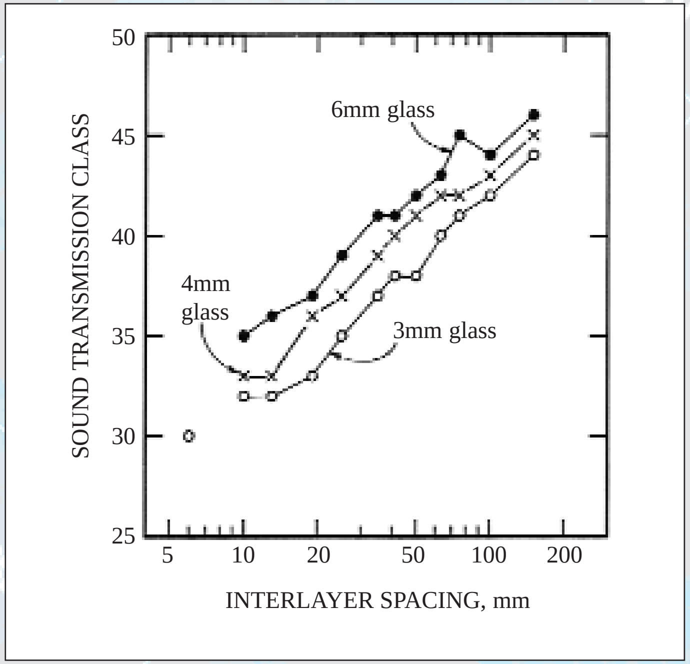


Figure 3. The effect of a small airspace on TL of double glazing

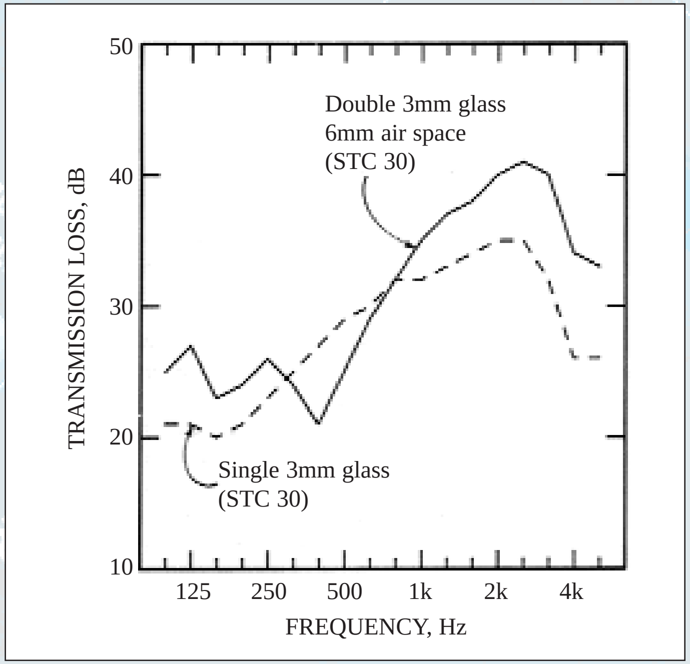
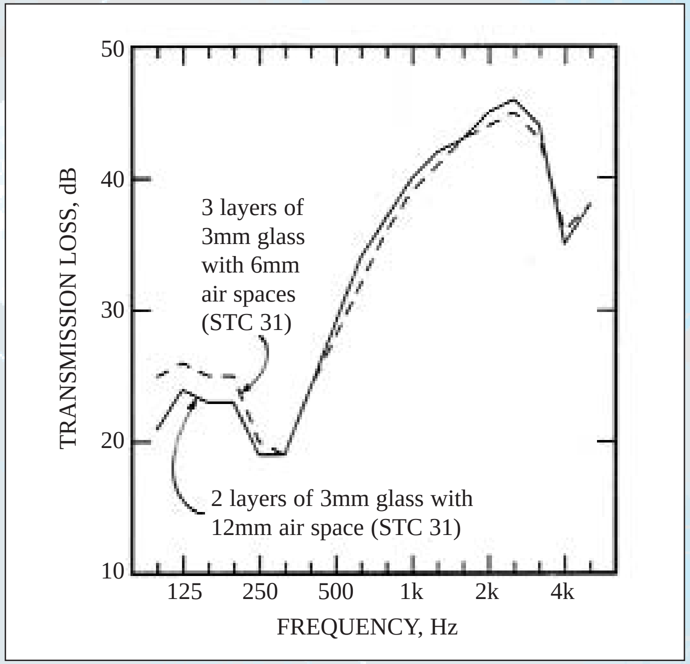


Figure 4. TL of double and triple glazed windows



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