How leaky windows and doors negatively impact a home's energy efficiency.

Presented by Paul Lohan

How is window & door Air Infiltration measured?

- Australian Standards tested in NATA-accredited laboratories
- Products that pass the Australian Standard also meet:
  - Building Code of Australia (BCA) and National Construction Code (NCC)
- Australian Standard AS2047 – *Window and External Glazed Doors in Buildings*
  - AS 4420.2 Deflection Test
  - AS 4420.3 Operating Force Test
  - AS 4420.4 Air Infiltration Test
  - AS 4420.5 Water Penetration Resistance Test
  - AS 4420.6 Ultimate Strength Test
- Measures Air Infiltration under positive and negative pressure at 75 Pa and 150 Pa
- The result is expressed at each pressure in litres per second per square metre

Rylock AS2047 Laboratory Testing

How is window & door Air Infiltration reported?

AS 4420.4 Air Infiltration Test

- Window Energy Rating Scheme (WERS) publishes Air Infiltration at 75 Pa pressure for a non-conditioned building (such as a house that has openable windows for ventilation)
- Represents a wind speed of ~ 11m/s or roughly 40km/hr.

Air Leakage < 5 L/s/m²

What factors determine a product's Air Infiltration?

- Product Type
  - Hinged windows with a compression seal typically perform better than sliding windows with a wipe seal
- Hardware
  - Primary operator
  - Additional hardware (e.g. secondary latching)
- Quantity of Seals
  - Single perimeter vs. dual perimeter
- Compression vs. Wipe Seal
  - Compression seals typically perform best. A tightly compressed wipe seal increases friction and reduces sliding action

Rylock Commercial Series – Awning Window Latches

What factors determine a product's Air Infiltration?

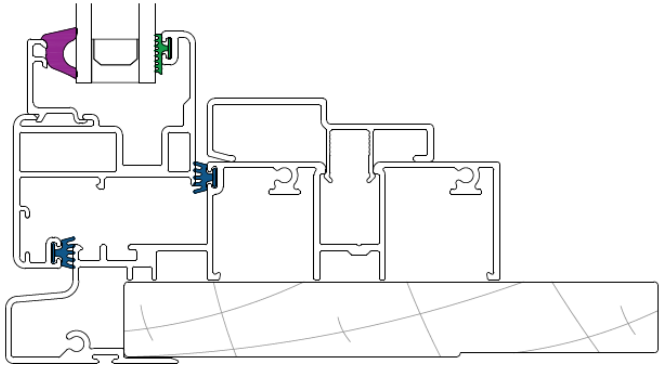
- Seal Material Type
  - The quality of the seal is heavily dependent on the material type
    - Durability and "memory" (ability to regain shape after distortion)
    - uPVC, EPDM (e.g. Santoprene), Polypropylene, Nylon and Silicone

- Seal Design
  - Width, thickness, hardness/suppleness, co-extruded and multiple contact points

- Product Size
  - Larger products will have an *actual* Air Infiltration result greater than the product tested at a nominal size for AS2047
  - Air Infiltration is measured in L/s/m^2 – so if a window or door sash is twice the size, it's reasonable to infer that the Air Infiltration result will be twice as much

Rylock Commercial Series – Hinged Door Panel Stile Fin Pile Seal

How are these seals integrated into product profiles?



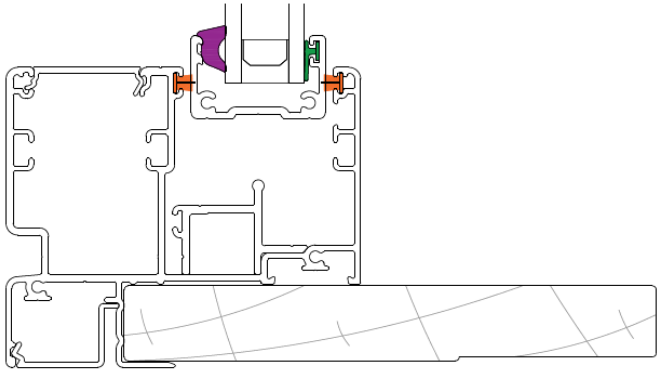
Rylock Commercial Series – Awning Window

Co-extruded EPDM polypropylene backing seal

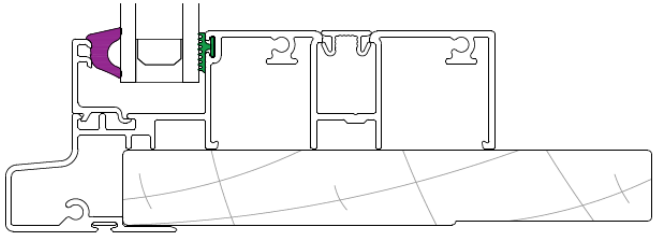
Co-extruded EPDM polypropylene sash seal

uPVC wedge

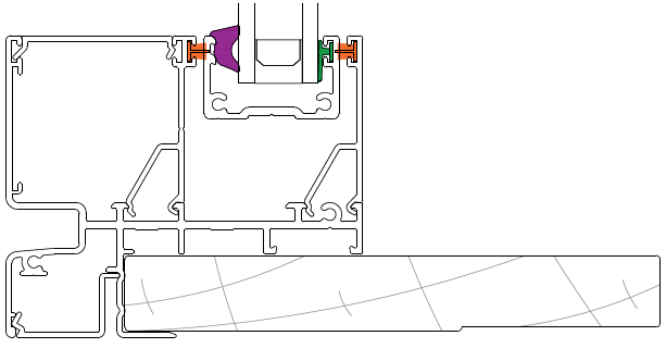
Polypropylene fin-pile seal



Rylock Architectural Aluminium Series – Horizontal Sliding Window

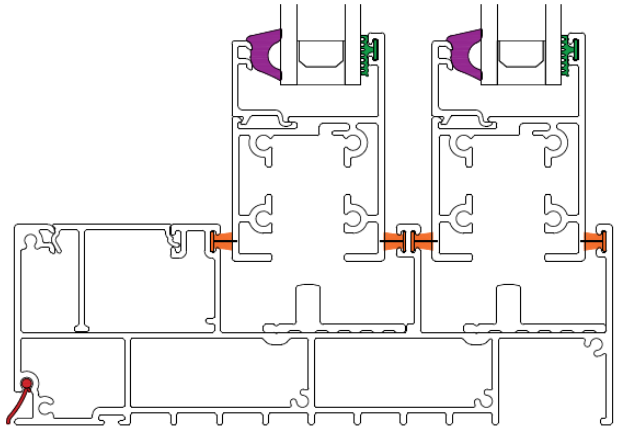


Rylock Commercial Series – Fixed Lite Window

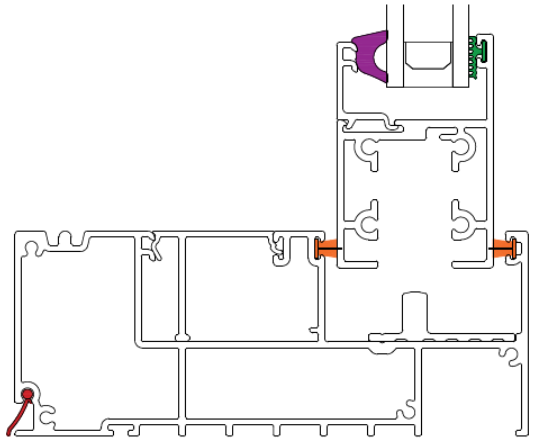


Rylock Architectural Aluminium Series – Double Hung Window

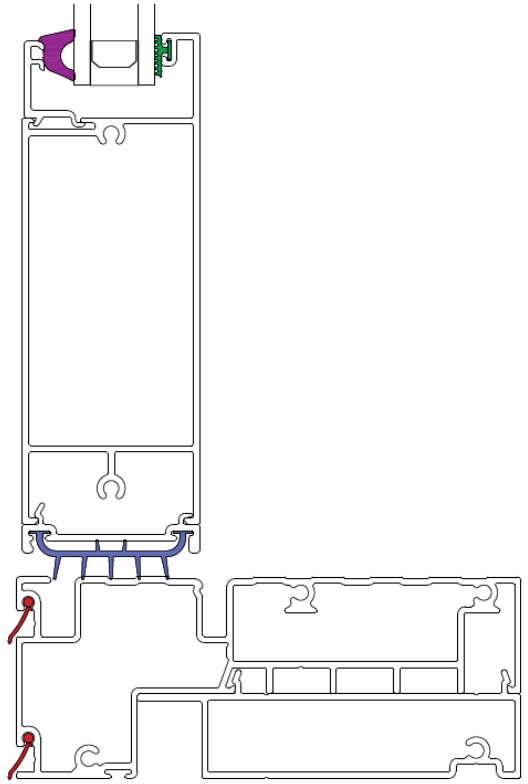
How are these seals integrated into product profiles?



Rylock Commercial Series – Stacker Door



Rylock Commercial Series – Sliding Door



Rylock Commercial Series – Hinged Door

Co-extruded EPDM polypropylene backing seal

Polypropylene fin-pile seal

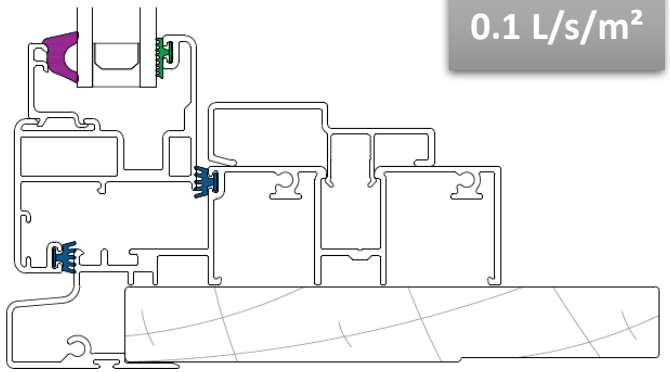
uPVC wedge

Silicone weather seal

uPVC drain slot flap

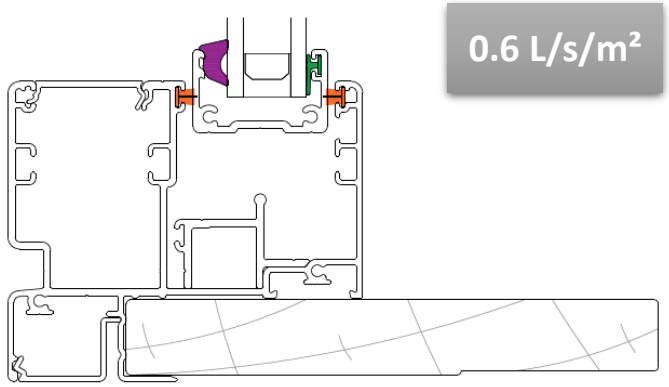
Seal effectiveness on various Rylock products (per AS2047 4420.4)

0.1 L/s/m²



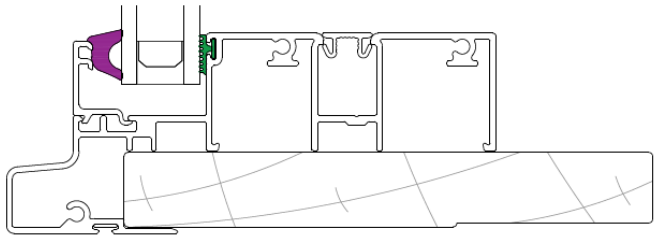
Rylock Commercial Series – Awning Window

0.6 L/s/m²



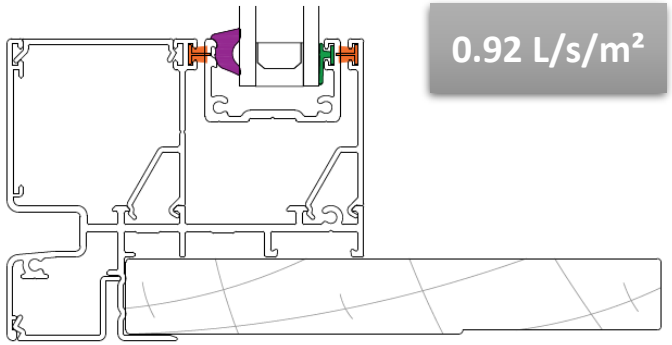
Rylock Architectural Aluminium Series – Horizontal Sliding Window

0.1 L/s/m²



Rylock Commercial Series – Fixed Lite Window

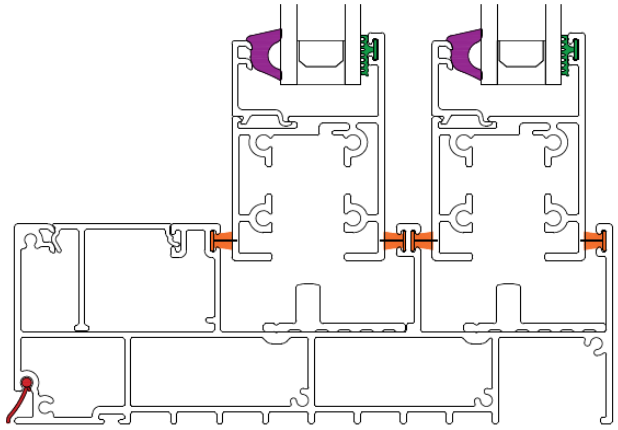
0.92 L/s/m²



Rylock Architectural Aluminium Series – Double Hung Window

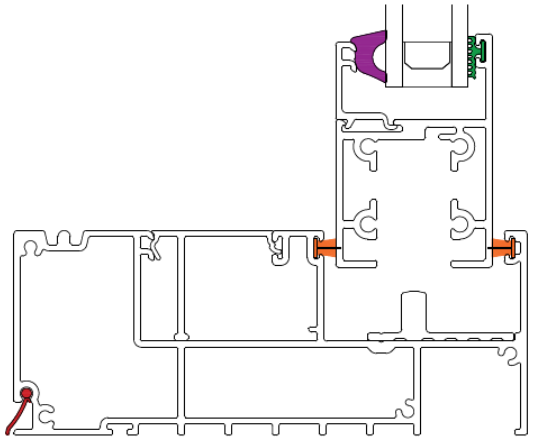
Seal effectiveness on various Rylock products (per AS2047 4420.4)

0.5 L/s/m²



Rylock Commercial Series – Stacker Door

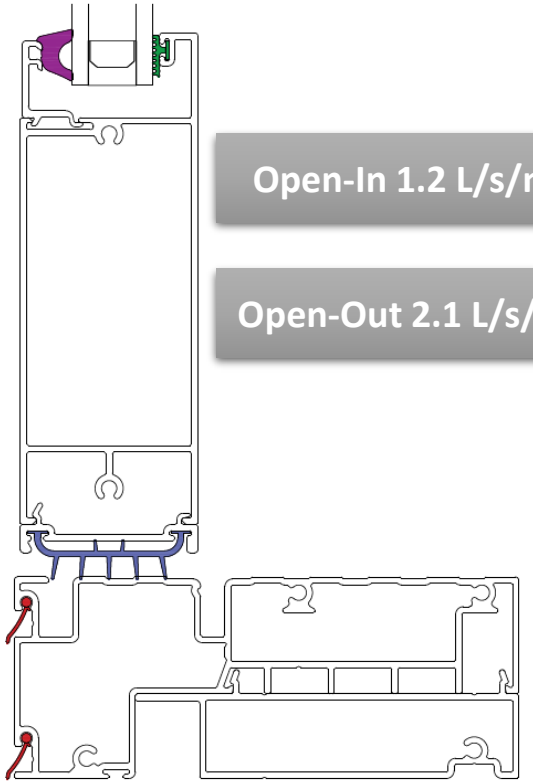
0.5 L/s/m²



Rylock Commercial Series – Sliding Door

Open-In 1.2 L/s/m²

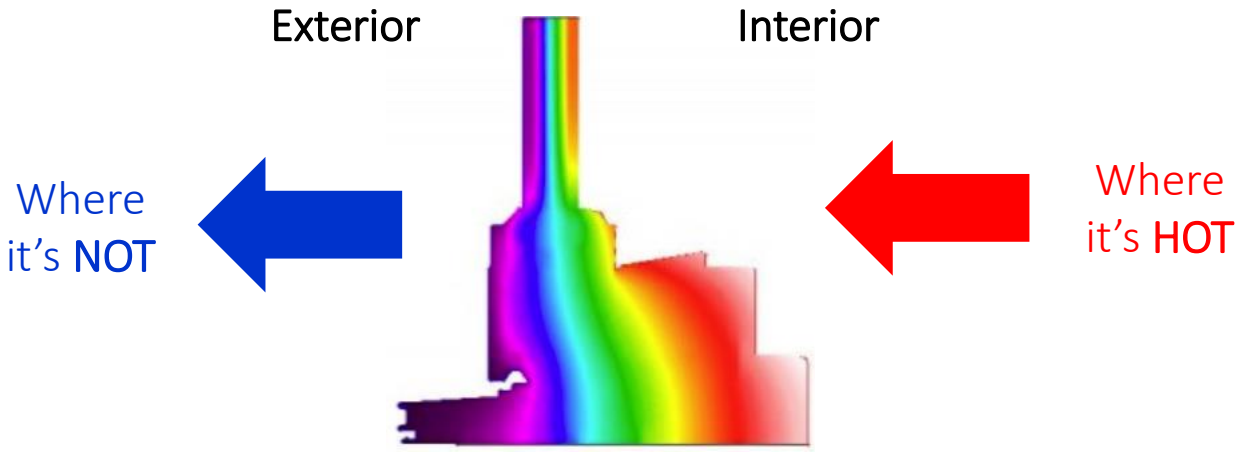
Open-Out 2.1 L/s/m²



Rylock Commercial Series – Hinged Door

How does the Air Infiltration affect the energy efficiency performance of a window or door?

- Two important parameters of window and door energy efficiency are:
  - SHGC: heat gained in a building from direct solar radiation
  - **U-value:** the measure of heat transfer used to calculate the heat loss of a house.
  - When there's a difference in temperature between two side of a building element (eg: a window or door), heat exchange takes place



Measured in W / m² / C°

Remember: 1 W = 1 J / s

Air Infiltration to U-Value Calculation/Comparison

Competitor Sliding Door Product

$Q = W/m^2$	Note: For Ti - Te = 1 then Q = 'U'
$q = m^3/s/m^2$	Air Leakage (Note: quoted @ 75 Pa)
$p = kg/m^3$	Density of Air (Science Data Book, Oliver & Boyd, 1971)
$C_p = J/kg/K$	Specific Heat Capacity of Air @ STP (Science Data Book, Oliver & Boyd, 1971)
Ti = K	Internal Temperature
Te = K	External Temperature

Wind Speed (m/s)	5.5
Window Height (m)	1.0
Window Width (m)	1.0
Air Leakage @ 75 Pa ($L/s/m^2$)	4.3

Q = ('U' for (Ti-Te) of 1)	q	p	C_p	(Ti - Te)	Pressure Factor	Window Area (m^2)
1.336	0.0043	1.293	993	1	0.242	1

WERS 'U' Value	3
Air Infiltration 'U' Value	1.3
Net Total 'U' Value	4.3

WERS 'U' Value	3
Air Infiltration 'U' Value	1.3
Net Total 'U' Value	4.3

Rylock Commercial Series Sliding Door

$Q = W/m^2$	Note: For Ti - Te = 1 then Q = 'U'
$q = m^3/s/m^2$	Air Leakage (Note: quoted @ 75 Pa)
$p = kg/m^3$	Density of Air (Science Data Book, Oliver & Boyd, 1971)
$C_p = J/kg/K$	Specific Heat Capacity of Air @ STP (Science Data Book, Oliver & Boyd, 1971)
Ti = K	Internal Temperature
Te = K	External Temperature

Wind Speed (m/s)	5.5
Window Height (m)	1.0
Window Width (m)	1.0
Air Leakage @ 75 Pa ($L/s/m^2$)	0.5

Q = ('U' for (Ti-Te) of 1)	q	p	C_p	(Ti - Te)	Pressure Factor	Window Area (m^2)
0.155	0.0005	1.293	993	1	0.242	1

WERS 'U' Value	3
Air Infiltration 'U' Value	0.2
Net Total 'U' Value	3.2

WERS 'U' Value	3
Air Infiltration 'U' Value	0.2
Net Total 'U' Value	3.2

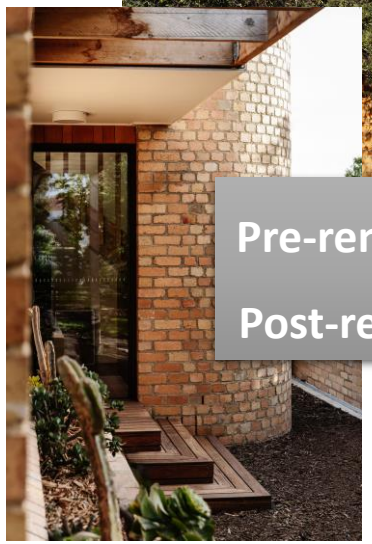
Key Takeaways

- Rylock products are tested to exceed AS2047 – *Window and External Glazed Doors in Buildings* and the NCC / BCA
- Window and door Air Infiltration performance is dependent on various factors: Product type, Hardware, Quantity of Seals, Seal Material, Seal Design, Product Size

Key Takeaways

- Good seals resulting in low air leakage are crucial to a product's overall energy efficiency
- Air Infiltration is highly indicative of how well a product performs for water leakage and noise attenuation

Case Study Examples



Pre-renovation blower door test = 27.7 ACH

Post-renovation blower door test = 7.7 ACH

Designer and Builder: Sustainable Homes Melbourne
Photographer: Marnie Hawson

Post-construction blower door test = 1.1 ACH

Builder: Riccon
Development + Construction