



# Airtightness of window-wall interfaces in masonry brick walls and wood-frame construction

Nathan Van Den Bossche



## Overview

- Introduction
- Experimental setup
- Masonry construction
- Wood-frame construction
- Conclusions

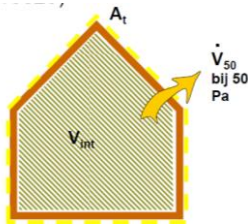


## Introduction

An 'average' dwelling:  
 Exterior volume  $V_e$ : 617 m<sup>3</sup>  
 Interior volume  $V_i$ : 453 m<sup>3</sup>  
 Area building shell  $A_b$ : 426 m<sup>2</sup>  
 Area windows  $A_w$ : 43.4 m<sup>2</sup>

$$n_{50} = \dot{V}_{50} / V_n \quad [h^{-1}]$$

$$v_{50} = \dot{V}_{50} / A_t \quad [m^3 / h / m^2]$$



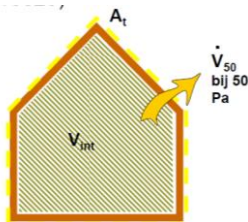
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## Introduction

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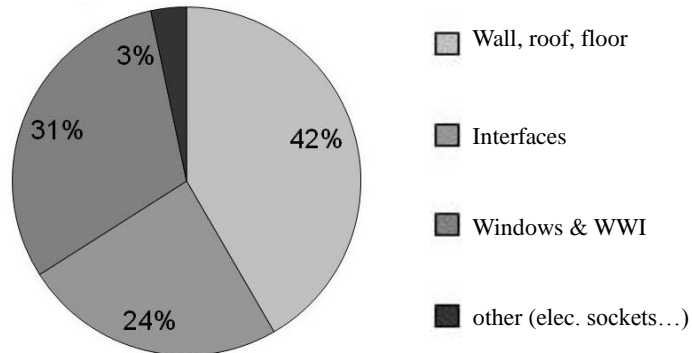


	$V_{50}$ [m <sup>3</sup> /h]	$n_{50}$ [h <sup>-1</sup> ]	$v_{50}$ [m <sup>3</sup> /h/m <sup>2</sup> ]
Standard (EPBD)	5112.0	11.28	<b>12.00</b>
low energy	906.0	<b>2.00</b>	2.13
passive house	271.8	<b>0.60</b>	0.64

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## Introduction

Typical distribution of air leakage paths



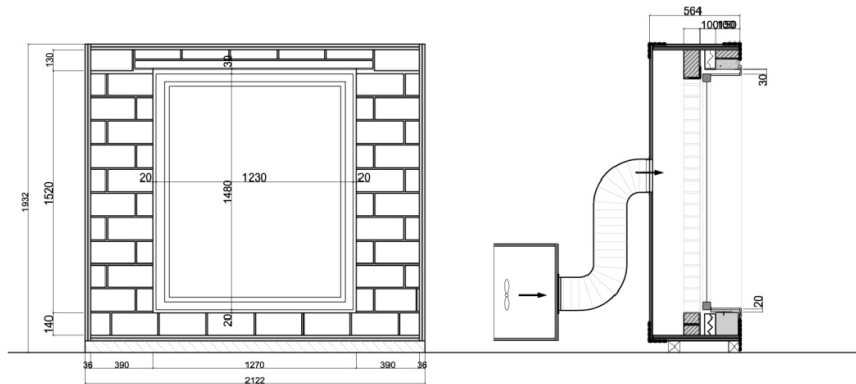
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## Experimental setup



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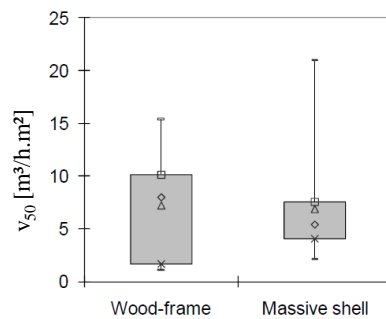
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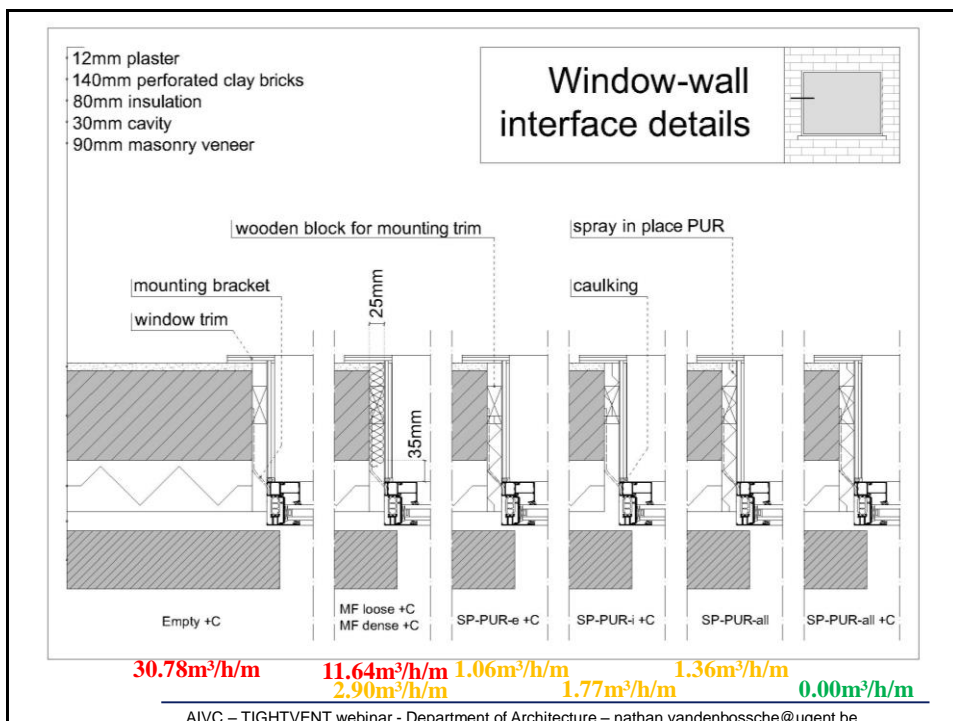
## Masonry construction

- Air leakage per meter @ 50Pa (including corners)
- 14 details tested for standard configuration
- 1 detail tested in a passive house wall
- collaboration with manufacturers and contractors
- results: 0.00 to 33.07m<sup>3</sup>/h/m

3 Classes:

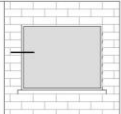
- **Poor:**  $v_{50} > 3.3 \text{ m}^3/\text{h/m}$
- **Average:**  $0.33 \text{ m}^3/\text{h/m} < v_{50} < 3.3 \text{ m}^3/\text{h/m}$
- **Good:**  $v_{50} < 0.33 \text{ m}^3/\text{h/m}$

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- 12mm plaster
- 140mm perforated clay bricks
- 80mm insulation
- 30mm cavity
- 90mm masonry veneer

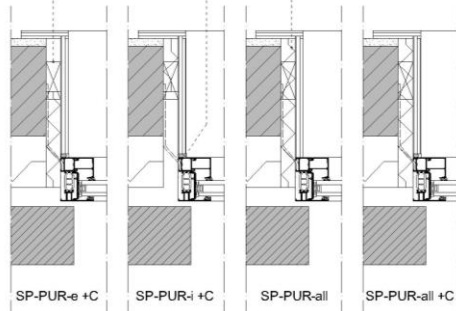
## Window-wall interface details




wooden block for mounting trim

spray in place PUR

caulking



1.06m<sup>3</sup>/h/m

1.77m<sup>3</sup>/h/m

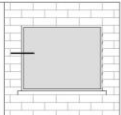
1.36m<sup>3</sup>/h/m

0.00m<sup>3</sup>/h/m

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- 12mm plaster
- 140mm perforated clay bricks
- 80mm insulation
- 30mm cavity
- 90mm masonry veneer

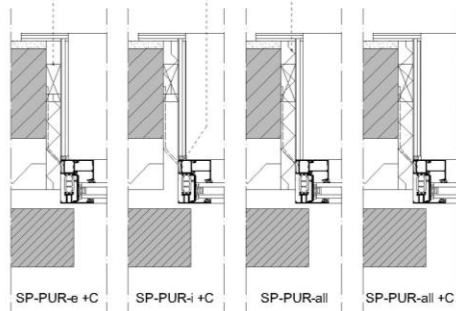
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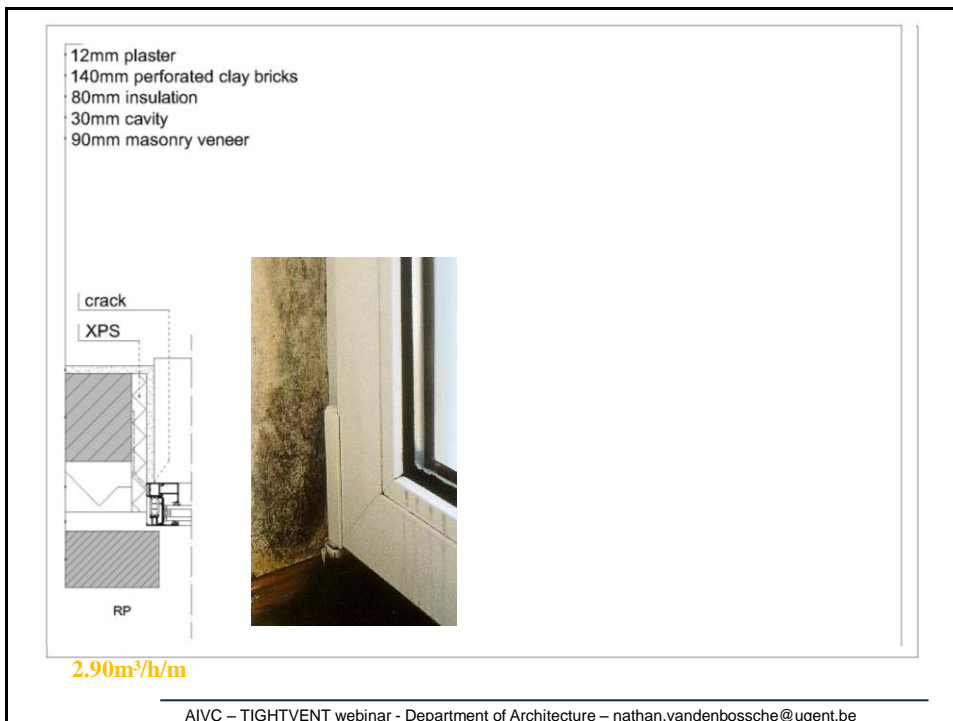
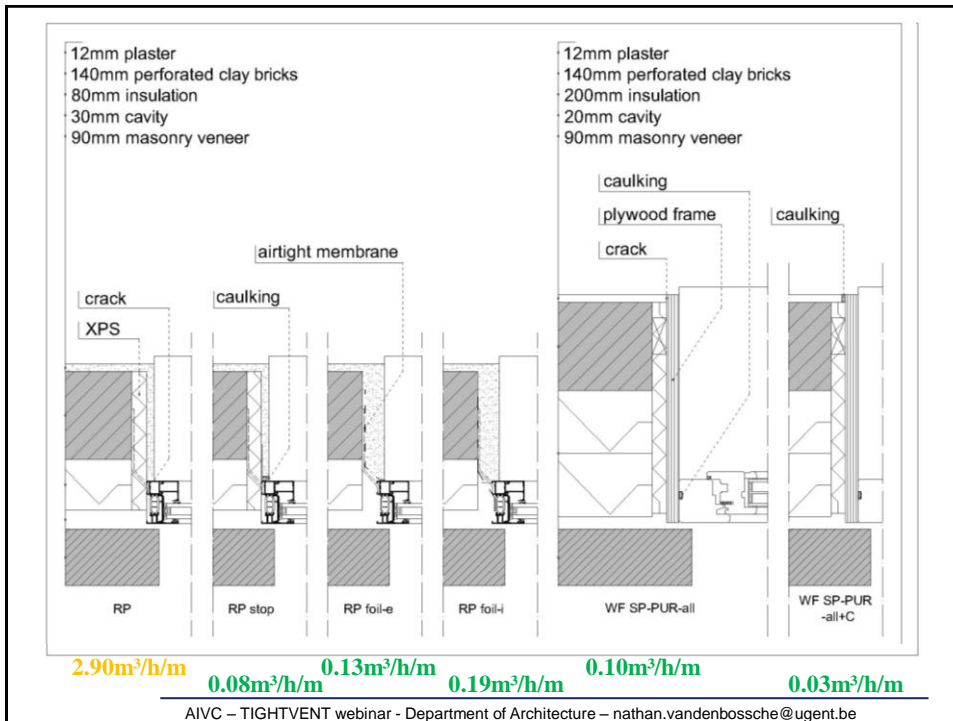
1.77m<sup>3</sup>/h/m

1.36m<sup>3</sup>/h/m

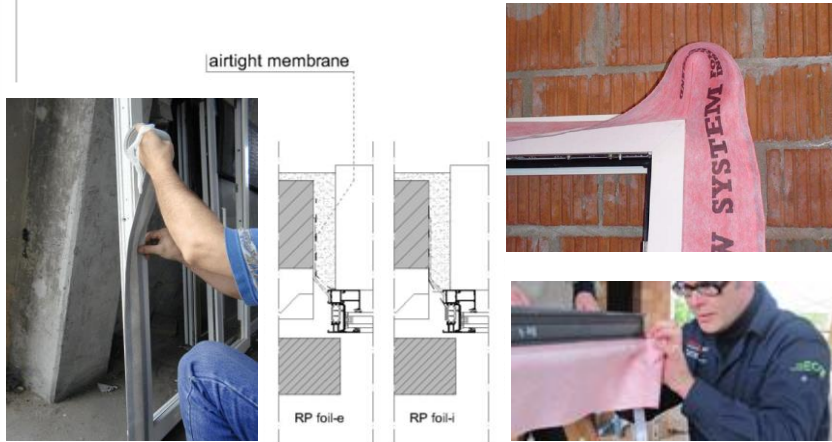
0.00m<sup>3</sup>/h/m

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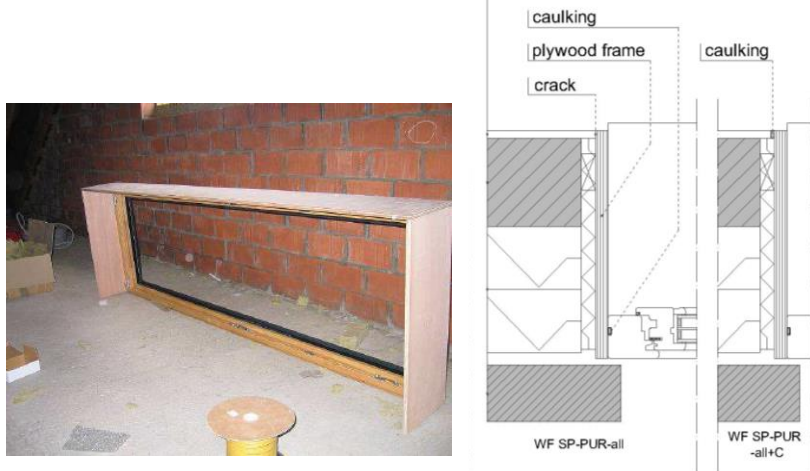
- 12mm plaster
- 140mm perforated clay bricks
- 80mm insulation
- 30mm cavity
- 90mm masonry veneer



0.13m<sup>3</sup>/h/m      0.19m<sup>3</sup>/h/m

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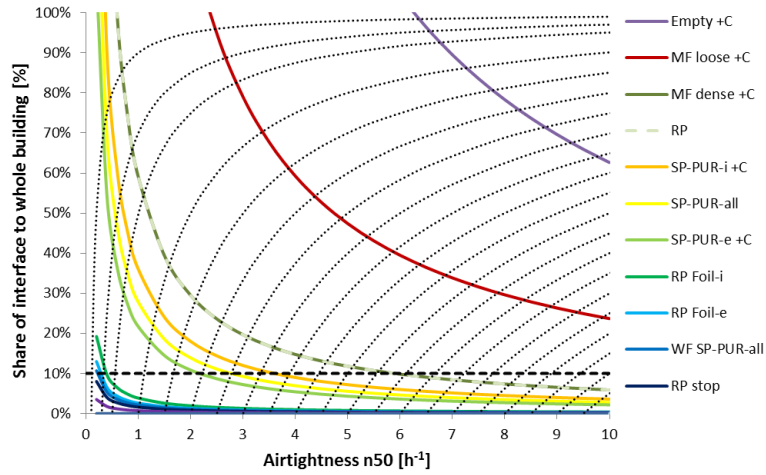
- 12mm plaster
- 140mm perforated clay bricks
- 200mm insulation
- 20mm cavity
- 90mm masonry veneer



0.10m<sup>3</sup>/h/m      0.03m<sup>3</sup>/h/m

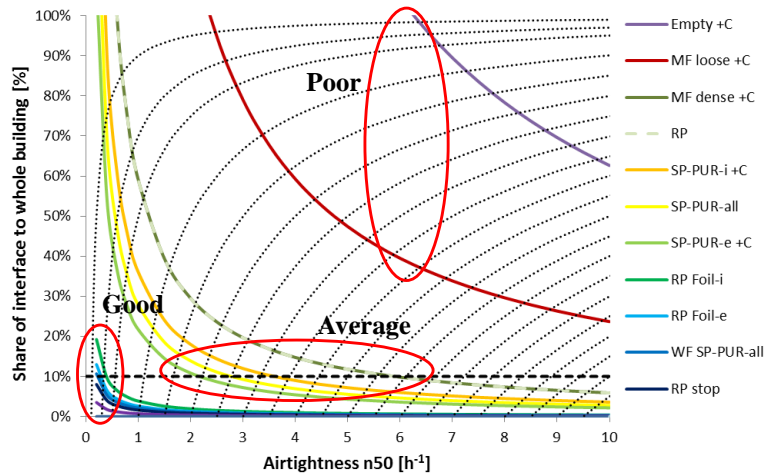
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## Results



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## Foil continuous – exterior corner



**Basic setup:**

**0.3 m<sup>3</sup>/h/m**

**Silicone at corners:**

**0.09 m<sup>3</sup>/h/m**

**BRACKETS**



## Foil continuous – exterior corner

**Impact 10 screws Ø 4mm:  
0.09 m<sup>3</sup>/h/m extra**



**Screws removed:  
0.16 m<sup>3</sup>/h/m extra**

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## Foil discontinuous – exterior corner



**Basic setup:  
0.23 m<sup>3</sup>/h/m**

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## Foil continuous – interior corner



**Basic setup:**

**1.68 m<sup>3</sup>/h/m**



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## Foil continuous – interior corner



**Basic setup:**

**1.68 m<sup>3</sup>/h/m**

**Silicone at corners:**

**1.19 m<sup>3</sup>/h/m**



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## Foil discontinuous – interior corner



**Basic setup:**

**1.13 m<sup>3</sup>/h/m**



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## Spray-in-place polyurethane foam (SPF)



**SPF without moistening:**

**0.09 m<sup>3</sup>/h/m**

**SPF with moistening:**

**0.03 m<sup>3</sup>/h/m**

**BRACKETS**

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## Foil – window in plywood frame



Basic setup:

0.25 m<sup>3</sup>/h/m



PLYWOOD

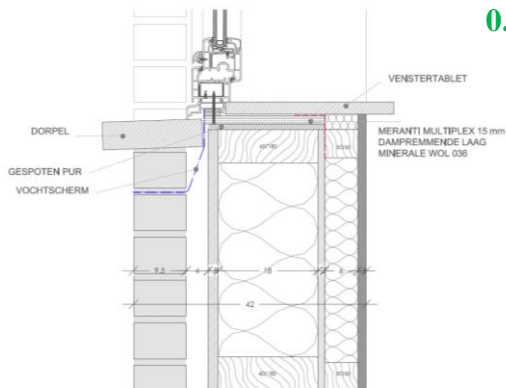
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## Foil – window in plywood frame

Basic setup:

0.25 m<sup>3</sup>/h/m



PLYWOOD

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## SPF – window in plywood frame



**SPF with moistening:**  
**0.00 m<sup>3</sup>/h/m**



## SPF – window in plywood frame



**SPF with moistening:**  
**0.00 m<sup>3</sup>/h/m**

**Other type of plywood:**  
**air currents at plywood edge**  
**additional 0.11 m<sup>3</sup>/h/m**



## Conclusions:

- Windows class 4: not sufficient for very airtight buildings
- Average performance joint: air loss  $< 3.3 \text{ m}^3/\text{h.m}$  @ 50Pa
- Good performance joint: air loss  $< 0.33 \text{ m}^3/\text{h.m}$  @ 50Pa
- Foil: apply continuous, mind the corners
- SPF: mind the mounting brackets, moistening

*Airtightness in practice: materials, training, coordination*

## Questions?

# BUILDING AIRTIGHTNESS SOLUTIONS: SEALANTS AND PU-FOAMS



Filip Van Mieghem – Senior Product Manager

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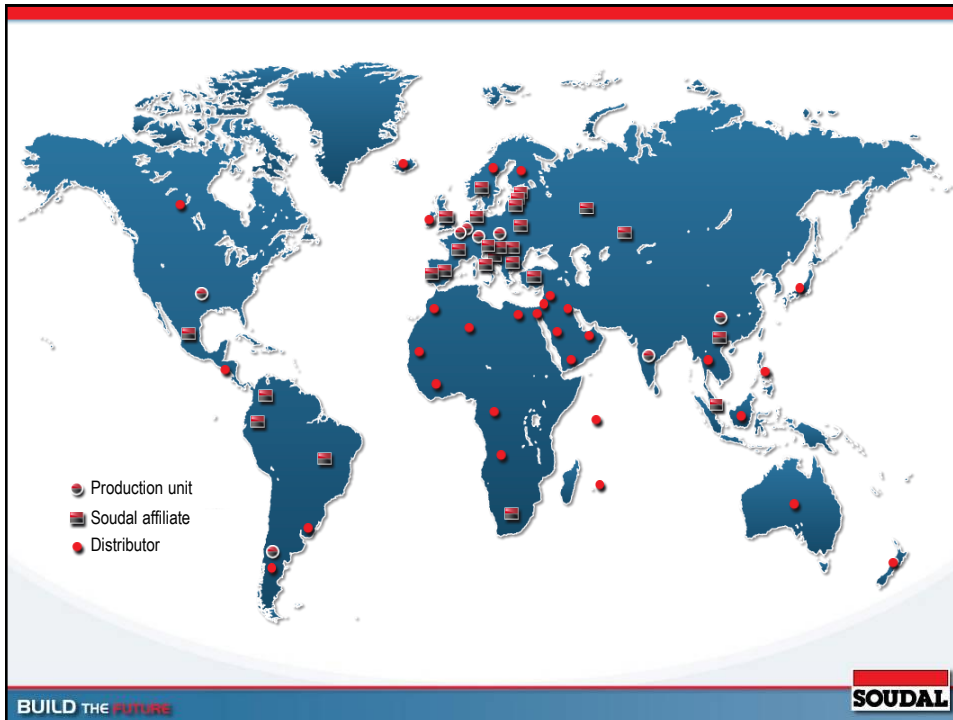
## Soudal



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## Sealants





- ▶ Silicone (AC / Alcoxy / Oxime)
- ▶ Acrylics
- ▶ Hybrid polymers
- ▶ Polyurethane
- ▶ Polyisobutylene
- ▶ Bitumen
- ▶ Fire rated sealants
- ▶ Fast curing
- ▶ Primers & tools

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## PU Foams



- ▶ Handheld / gun / click & fix
- ▶ Construction foam
- ▶ Insulation foam
- ▶ Sound proofing foam
- ▶ All weather foam
- ▶ 2K-foam
- ▶ Isocyanate free foam
- ▶ PU mining foam
- ▶ Multi position foam
- ▶ Fire rated foam

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## Adhesives



- ▶ Contact neoprene & SBR
- ▶ 1K & 2K PU
- ▶ PVA wood
- ▶ Construction
- ▶ Floor / tile / glass fibre
- ▶ PVC
- ▶ Cyano
- ▶ Epoxy
- ▶ Chemical anchors

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## Hybrid polymers



- ▶ Industrial adhesives
- ▶ Parquet applications
- ▶ Sealing & bonding
- ▶ 2K
- ▶ High tack
- ▶ Crystal clear
- ▶ Ultra

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## Building chemicals in Europe



- ▶ Legislation on (level of) raw materials / chemicals (Reach, Biocides,...)
- ▶ Construction Products Directive is basis for:
  - ▶ Harmonised norms (CE marking)
  - ▶ Energy Performance of Buildings (EPB)
  - ▶ Sustainability
- ▶ CPD becomes CPR as of 1/7/2013, and...
- ▶ EN ISO 11600 for sealants becomes basis for harmonised norm / CE marking: hEN15651-1 to -5
  - ▶ Function: glazing, facade (interior/exterior), sanitary, pedestrian walkways
  - ▶ Movement capacity: only applies to elastic sealants: movement capacity from 7,5% to 25%

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## Construction joints



- ▶ Important unimportance
- ▶ Function
  - ▶ Weather sealing / water tightness
  - ▶ Cosmetical
  - ▶ Thermal insulation (thermal bridges)
  - ▶ Fire proofing
  - ▶ Acoustics
  - ▶ Burglar resistance
  - ▶ Airtightness
- ▶ And mostly a combination thereof...

## Sealants



## PU-foams / adhesives

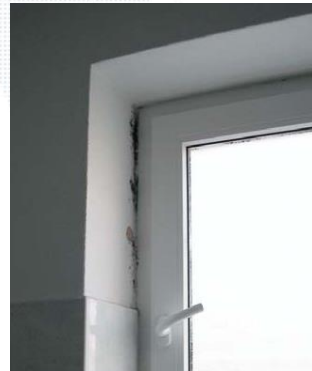


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## Condensation risc

- ▶ Cold surfaces inside: mould
- ▶ Often result from poorly executed building knots:
  - ▶ Airleaks
  - ▶ Thermal bridges
  - ▶ Or a combination of both

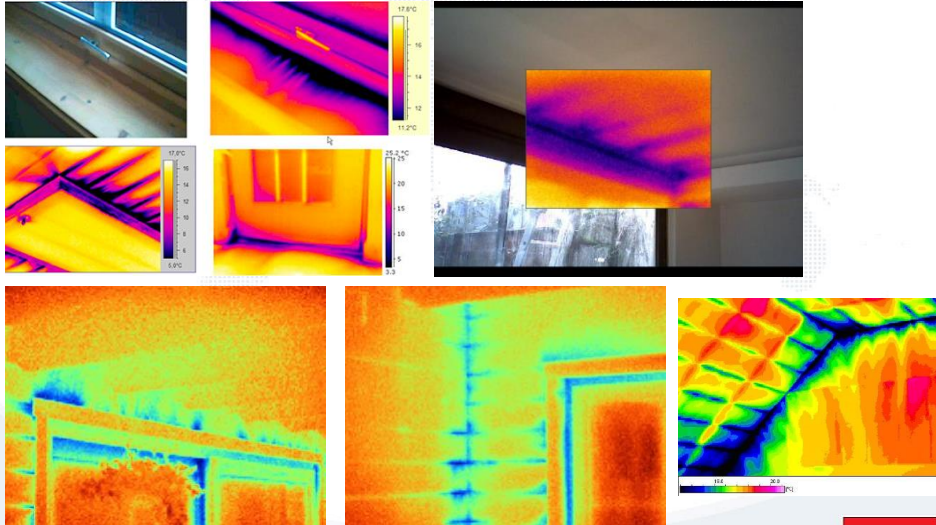


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## Airtightness



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## Airtightness of construction materials

- ▶ (Inter)national norms relating to airtightness of sealants and foams
  - ▶ NONEXISTENT
  - ▶ No specific norm on airtightness of sealants
  - ▶ Even no product norm on PU-Foams
- ▶ EN 12114: Air permeability of building components and building elements
  - ▶ General test method (in case there are no product specifications)
  - ▶ Only for laboratory testing (as opposed to 'in situ' testing)
  - ▶ Max. pressures can be chosen: 50, 100, 200, 500, 1.000Pa
  - ▶ 3 pulsations and then gradual steps both positive and negative pressure

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## Sealants and airtightness: cohesion/adhesion

- ▶ Cohesion: sealants are airtight from their nature:
  - ▶ can generally contribute a lot to airtightness
- ▶ Adhesion: you also need a bond to the substrate(s)/supports
- ▶ Sealants can easily take the form of all kinds of shapes when applied in a joint (or as adhesives if used in a thin layer)
- ▶ Check for CE marking (transition period: 1/7/2013 – 1/7/2014)
  - ▶ hEN15651-1: facade interior and exterior
  - ▶ hEN15651-2: glazing
- ▶ Check for quality labels
- ▶ Use the right product for the job and apply it the right way

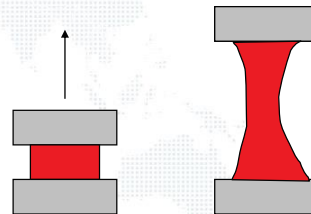
SUBSTRATE 1

Sealant

SUBSTRATE 2

## Sealants and airtightness: movement capacity

- ▶ ISO EN 11600, now hEN15651: max % of total joint width a sealant can permanently take without shearing
- ▶ Lowest category
  - ▶ 7,5% and 12,5%
  - ▶ Plastic or elastic (P or E)
  - ▶ Acrylics
- ▶ All other sealants: silicones, PU's, hybrids
  - ▶ 20% or 25%
  - ▶ All elastic
  - ▶ Softer sealants, or harder sealants (LM or HM)
  - ▶ Application: F or G (Façade or Glass)





## Sealants and airtightness: adhesion

- ▶ Make sure supports are clean, free of dust and grease
- ▶ Check substrates:
  - ▶ Most sealants work better on some substrates
  - ▶ There are also sealants that work on almost all substrates: hybrid sealants for example, even on wet surfaces (see video at the end)
  - ▶ Typically problematic: PE, PP, PTFE
- ▶ Watch application temperature (acrylics can even freeze during storage)
- ▶ Check curing time of product
  - ▶ RH can also have major impact on curing (time)

## Sealants & Adhesives



- ▶ Hybrid sealants: permanently elastic
  - ▶ Excellent adhesion on almost any substrate
  - ▶ Diverse, low modulus and high modulus
  - ▶ High movement capacity (20-25LM or HM – EN-ISO 11600)
  - ▶ No cracks under UV-radiation
  - ▶ Paintable
  - ▶ Adhesion on damp surfaces
- ▶ Silicone sealants: permanently elastic
  - ▶ Excellent adhesion on glass, metals.
  - ▶ Ideal for airtight glass sealing
  - ▶ High movement capacity (20LM – 25LM)
  - ▶ Very resistant to UV

# Sealants & Adhesives



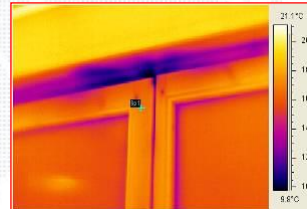
- ▶ Specialties
  - ▶ Self adhesive acrylic to glue vapourbarriers

# SWS : system approach



## Window connection joints

Inside



Outside



# Research at University of Ghent



▶ Testing according to EN12114



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# Airtightness



Standard cavity wall construction

Passive cavity wall construction



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# Airtightness Results

Façade element	Beschrijving opstelling	Flow at 50 Pa [m³/h/m]						
		underpres sure	abs. dev.	overpres sure	abs. dev.	average	Class	abs. dev
Standard	casing, empty	30,90	0,97	35,23	1,11	33,07	C	1,04
	casing, mineral wchool	2,61	0,13	3,31	0,15	2,96	C	0,14
	casing, Flexifoam	0,95	0,09	1,59	0,12	1,27	B	0,10
	casing, Flexifoam, Acryrub	0,01	0,06	0,00	0,08	0,00	A	0,07
	plaster, profile, Acryrub	0,08	0,03	0,06	0,03	0,07	A	0,03
	Plaster, SWS-foil, inside	0,08	0,03	0,27	0,03	0,18	A	0,03
	Plaster, SWS-foil, side	0,08	0,03	0,24	0,03	0,16	A	0,03
Passive	pleister, flexifoam, droog.	0,03	0,03	0,00	0,04	0,02	A	0,04

# Airtightness

## Timber frame



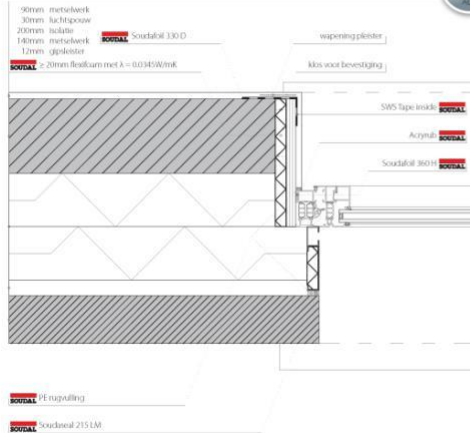


# Flexifoam

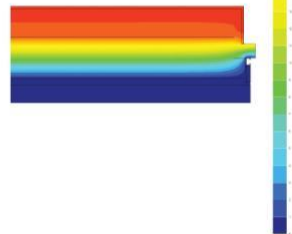


1  
AU

4. PASSIEF-PLEISTER + ZONWERING  
4.1. HORIZONTAL



f	≥	0,77
θ	≤	15,4 °C
ψ	≤	0,094 W/mK
ψ	max vlgg. epb.	0,10 W/mK



lictheemen 0°C - 20°C

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# PU-foams: airtight?



## PU-foam can be airtight !

- ▶ If used in the correct joint dimensions
- ▶ If used between 2 airtight building elements
- ▶ If self-expanding
- ▶ If flexible

... Thus combining insulation and airtightness

## ➔ Flexifoam®

- ➔ Elasticity: 9000 cycles at 12,5% movement (ift report 105 35276)
- ➔ Airtight:  $A < 0,1 \text{ m}^3/[\text{h.m (daPa)}^{2/3}]$  (ift report 105 33428 – EN12114)
- ➔ Thermal insulation:  $\lambda = 0,0345 \text{ W/m.K}$  (MPA report 070598.1)



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## To moisten or not to moisten



**Crucial for cell structure  
(insulation), adhesion and  
airtightness !!!**

Without

With

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## Emission



- ▶ Indoor air quality is getting more of a concern with airtightness
- ▶ Sustainability: Leed, Breeam, ...
- ▶ France: mandatory emissions class labelling
  - ▶ All construction products used indoors
  - ▶ Highest class is A+
  - ▶ Measured after 28 days
- ▶ Germany
  - ▶ GEV: adhesives for floor coverings
  - ▶ EC1(R), EC1 Plus are the highest classes
  - ▶ Harder to achieve



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# Websites



- ▶ General
  - ▶ [www.soudal.com](http://www.soudal.com)
- ▶ Airtight window installation
  - ▶ [www.soudalwindowssystem.be](http://www.soudalwindowssystem.be)
- ▶ Hybrids: sealing and bonding
  - ▶ [www.fixall.eu](http://www.fixall.eu)



## IMPREGNATED TAPES: APPLICABLE STANDARDS AND PROPERTIES

TightVent Webinar 4<sup>th</sup> June

An **RPM** Company

Impregnated tapes: Applicable standards and properties

### Content

- Tremco illbruck
- Technology Impregnated tapes
- DIN 18542:2009-07
- VOC Standards

## Impregnated tapes: Applicable standards and properties

### Content

- Tremco illbruck
- Technology Impregnated tapes
- DIN 18542:2009-07
- VOC Standards

## Tremco illbruck – At a Glance



Business Area:  
Sealing and Bonding for Construction  
and Industry

Strategic Segments:  
Windows, Façades, Waterproofing,  
Fire Protection, Distribution, Industry

International Presence:  
1,000 Employees  
25 sites in Europe, Africa & Middle East

Turnover:  
290 million €

Structure:  
Part of RPM International Inc., USA

## Centres of Excellence

*Where do our products come from?*

Dijon, FR (IG)



Arkel, NL (Foams/Sealants)



Wigan, UK (Coatings/Fire Protection)



Bodenwöhr, DE (Tapes/Membranes)



Traunreut, DE (Adhesives)



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## Impregnated tapes: Applicable standards and properties

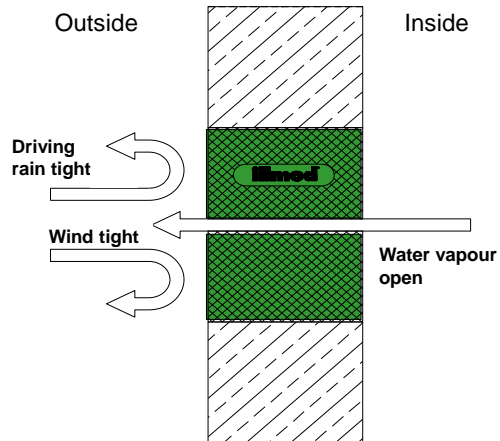
### Content

- Tremco illbruck
- Technology Impregnated tapes
- DIN 18542:2009-07
- VOC Standards

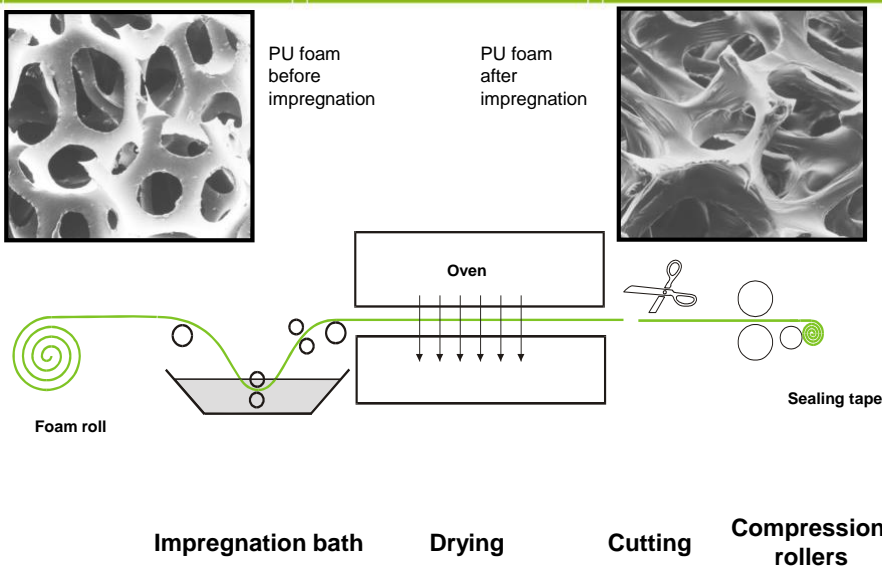
### The main principle of impregnated tapes

**Main components:**

- Water based Acrylic dispersion
- PU Foam



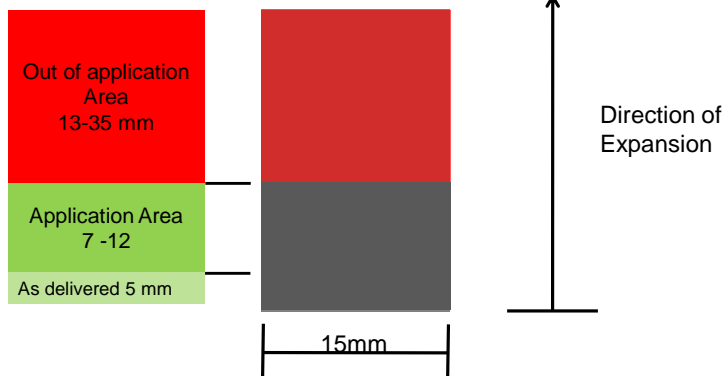
### Impregnation process





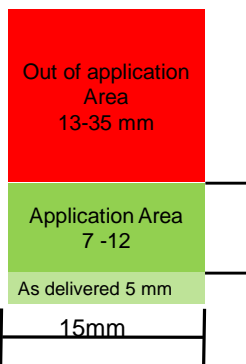
**Once again how it works!**

TP600 illmod 600  
15 / 7-12 mm



**Once again how it works!**

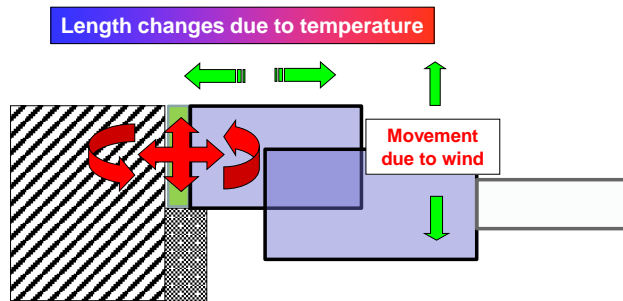
Illmod tape  
15 / 7-12 mm



Dimensions illbruck illmod 600

Bestell-Nr.		Joint depth in mm	Application area in mm	m/box
anthrazit 450-3-	grau 451-2-			
8308	8308	8	2	462,50
8309	8309	10		375,00
8310	8319	15		250,00
8311	8311	20		187,00
8398	8398	8	3	370,00
8320	8326	10		300,00
8321	8321	15		200,00
8322	8322	20		150,00
8329	8329	12	3 - 7	200,00
8332	8332	15		160,00
8333	8333	20		120,00
8354	8354	15	5 - 10	112,00
8355	8355	20		84,00
8364	8364	15	7 - 12	86,00
8365	8365	20		64,50
8376	8376	20	8 - 15	49,50
8378	8378	30		33,00
8391	8391	20	10 - 18	97,50
8392	8392	25		78,00
8393	8393	30		65,00
9508	9508	30	13 - 24	52,00
9509	9509	40		36,40
9528	9528	35	17 - 32	32,00
9525	9525	40		28,00
9540	9540	40		18,90
9541	9541	50	28 - 40	16,20

### Handling all Potential Stresses



### Joint width recommendation

#### Impregnated Sealing Tapes

Anschlagart				
	Mindestfugenbreite für stumpfe Leibung $b_{SR}$ in mm			
	Elementbreite			
Rahmenwerkstoff	bis 1,5	bis 2,5	bis 3,5	bis 4,5
PVC hart (weiß)	8	8	10	10
PVC hart und PMMA (dunkel) (farbig extrudiert)	8	10	10	12

#### Wet Sealants

Anschlagart				
	$b_{S2a}$ für Dichtstoffe mit einer zulässigen Gesamtverformung von 25 % $b_{S2b}$ für Dichtstoffe mit einer zulässigen Gesamtverformung von >15 % Mindestfugenbreite bei stumpfer Leibung $b_{SR}$ in mm			
	Elementbreite			
Rahmenwerkstoff	bis 1,5	bis 2,5	bis 3,5	bis 4,5
PVC hart (weiß)	10	15	20	25
PVC hart und PMMA (dunkel, farbig extrudiert)	15	20	25	30

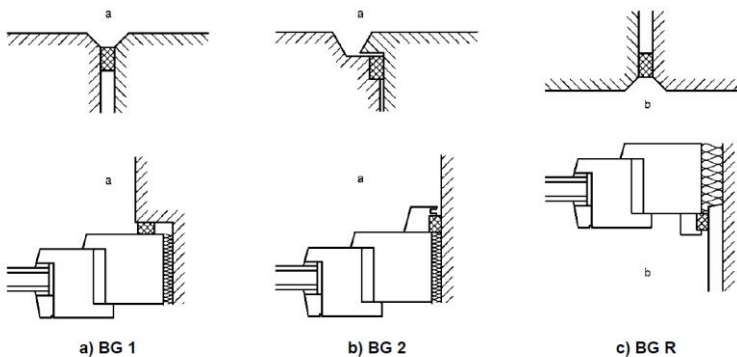
## Impregnated tapes: Applicable standards and properties

### Content

- Tremco illbruck
- Technology Impregnated tapes
- DIN 18542:2009-07
- VOC Standards

## German Standard DIN 18542: 2009-07

DIN 18542 Sealing of outside wall joints with impregnated sealing tapes made of cellular plastics - Impregnated sealing tapes - Requirements and testing



### Legende

- a Exterior
- b Interior

## Impregnated Tapes – Stress Group Classification DIN 18542:2009-07

Table 2: Requirements

No.	Property	BG 1	BG 2	BG R
1	Joint leakage coefficient, $a$ , at 10 a, in $m^3/(h \cdot m \cdot (daPa)^{2/3})$	$\leq 1,0$	$\leq 1,0$	$\leq 0,1$
2	Tightness to driving rain at $\Delta p$ , in Pa	Not less than 600 Pa	Not less than 300 Pa	–
3	Imperviousness of joint intersections to driving rain at $\Delta p$ , in Pa	Not less than 600 Pa	–	–
4	Resistance to temperature fluctuations	Between $-20\text{ °C}$ and $+80\text{ °C}$	Between $-20\text{ °C}$ and $+60\text{ °C}$	Between $-20$ and $+60\text{ °C}$
5	Resistance to the effects of light and moisture	To be ensured.	–	–
6	Compatibility with adjacent materials	Up to $80\text{ °C}$	Up to $60\text{ °C}$	Up to $60\text{ °C}$
7	Fire behaviour (building material class as in DIN 4102-1)	B1	B2	B2
8	$s_p$ -Value, in m	$\leq 0,5$	$\leq 0,5$	Value to be measured

## Impregnated Tapes – Stress Group Classification DIN 18542:2009-07

Table 2: Requirements

No.	Property	BG 1	BG 2	BG R
1	Joint leakage coefficient, $a$ , at 10 a, in $m^3/(h \cdot m \cdot (daPa)^{2/3})$	$\leq 1,0$	$\leq 1,0$	$\leq 0,1$
2	Tightness to driving rain at $\Delta p$ , in Pa	Not less than 600 Pa	Not less than 300 Pa	–
3	Imperviousness of joint intersections to driving rain at $\Delta p$ , in Pa	Not less than 600 Pa	–	–
4	Resistance to temperature fluctuations	Between $-20\text{ °C}$ and $+80\text{ °C}$	Between $-20\text{ °C}$ and $+60\text{ °C}$	Between $-20$ and $+60\text{ °C}$
5	Resistance to the effects of light and moisture	To be ensured.	–	–
6	Compatibility with adjacent materials	Up to $80\text{ °C}$	Up to $60\text{ °C}$	Up to $60\text{ °C}$
7	Fire behaviour (building material class as in DIN 4102-1)	B1	B2	B2
8	$s_p$ -Value, in m	$\leq 0,5$	$\leq 0,5$	Value to be measured

**illbruck TP600 illmod 600**



Material: Open-cell flexible polyurethane foam, impregnated with an acrylic polymer (flame-retardant)

UV-resistant

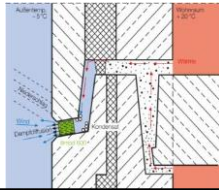
Colours: Anthracite / grey

Availability:

On pre-compressed rolls, self adhesive on one side

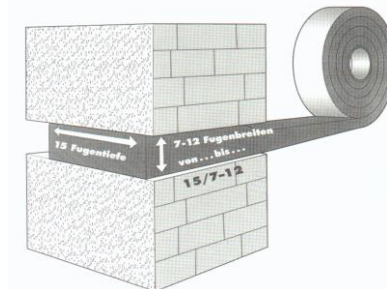
Storage: 2 years shelf life

Application area: For the outside driving rain resistant sealing in facade and windows connections



**illbruck illmod 600 – Product advantages**

- Independently monitored driving rain resistance over 600 Pa
- Open to water vapour diffusion
- Up to **40 mm** joint width
- No preparation with primer
- Easy installation, possible in any weather
- **Permanently elastic during movements**
- Test from outdoor tapes since 1995
- 10- year performance warranty\*
- BG 1 tested





**illbruck TP680 illmod 600 green**



Material: An open cell polyurethane soft foam impregnated with an acrylic based resin. The tape contains a proven percentage of bio-based material.

- Contains bio-based material (certified by DIN CERTCO)
- BG1 following DIN 18542
- Low emission certified by EMICODE® EC1Plus



illbruck TP680 illmod 600 green is an impregnated tape for use in a wide variety of movement joints for window installation and façade sealing.

**Impregnated Tapes – Stress Group Classification DIN 18542:2009-07**

Table 2: Requirements

No.	Property	BG 1	BG 2	BG R
1	Joint leakage coefficient, $a$ , at 10 a, in $m^2/(h \cdot m \cdot (daPa)^{2/3})$	$\leq 1,0$	$\leq 1,0$	$\leq 0,1$
2	Tightness to driving rain at $\Delta p$ , in Pa	Not less than 600 Pa	Not less than 300 Pa	–
3	Imperviousness of joint intersections to driving rain at $\Delta p$ , in Pa	Not less than 600 Pa	–	–
4	Resistance to temperature fluctuations	Between $-20^\circ\text{C}$ and $+80^\circ\text{C}$	Between $-20^\circ\text{C}$ and $+60^\circ\text{C}$	Between $-20$ and $+60^\circ\text{C}$
5	Resistance to the effects of light and moisture	To be ensured.	–	–
6	Compatibility with adjacent materials	Up to $80^\circ\text{C}$	Up to $60^\circ\text{C}$	Up to $60^\circ\text{C}$
7	Fire behaviour (building material class as in DIN 4102-1)	B1	B2	B2
8	$s_p$ -Value, in m	$\leq 0,5$	$\leq 0,5$	Value to be measured

### illbruck TP300 illac



Material: Open- cell flexible polyurethane foam, impregnated with an acrylic polymer

**Not UV-resistant / 300 Pa**

Colours: Anthracite / grey

Availability:  
On pre-compressed rolls, self- adhesive on one side

Application area: For sealing against sound, driving Rain, dust, draught and heat loss

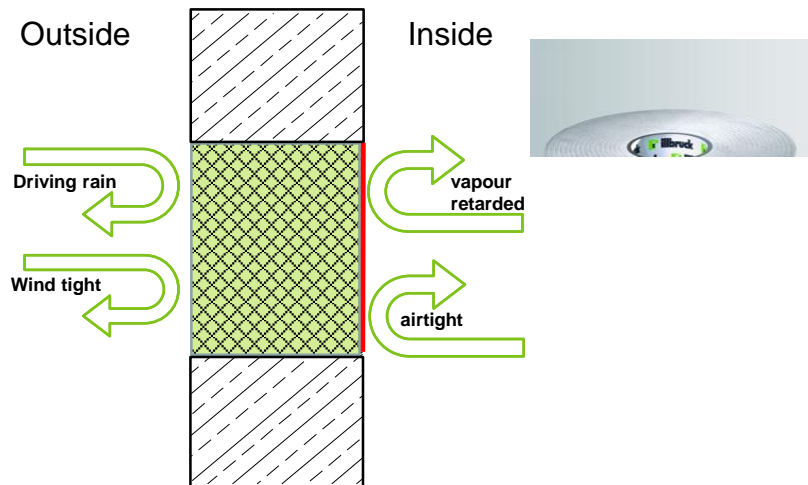
In covered joint constructions around windows and window couplings

### Impregnated Tapes – Stress Group Classification DIN 18542:2009-07

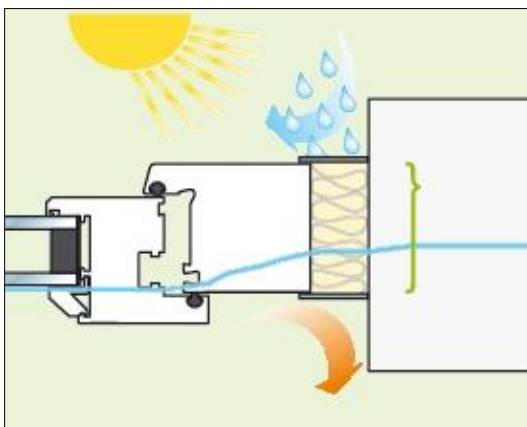
Table 2: Requirements

No.	Property	BG 1	BG 2	BG R
1	Joint leakage coefficient, $a$ , at 10 a, in $m^2/(h \cdot m \cdot (daPa)^{2/3})$	$\leq 1,0$	$\leq 1,0$	$\leq 0,1$
2	Tightness to driving rain at $\Delta p$ , in Pa	Not less than 600 Pa	Not less than 300 Pa	–
3	Imperviousness of joint intersections to driving rain at $\Delta p$ , in Pa	Not less than 600 Pa	–	–
4	Resistance to temperature fluctuations	Between $-20^\circ\text{C}$ and $+80^\circ\text{C}$	Between $-20^\circ\text{C}$ and $+60^\circ\text{C}$	Between $-20$ and $+60^\circ\text{C}$
5	Resistance to the effects of light and moisture	To be ensured.	–	–
6	Compatibility with adjacent materials	Up to $80^\circ\text{C}$	Up to $60^\circ\text{C}$	Up to $60^\circ\text{C}$
7	Fire behaviour (building material class as in DIN 4102-1)	B1	B2	B2
8	$s_p$ -Value, in m	$\leq 0,5$	$\leq 0,5$	Value to be measured

### Illmod Trio – The one that provides all 3 principles in one



### Basic for the Connection Joint – Inside-Insulation-Outside



**Outside:**

- Driving rain tight
- No damage by weathering
- No cold wind pass through
- Water vapour open

**Insulation:**

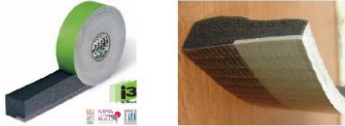
- Sound protection
- Thermal insulation
- No condensation

**Inside:**

- No warm/humid air pass through
- „inside more water vapour tight than outside

## illbruck TP652 illmod trioplex+

Bild



### Characteristics

- Fast and easy application 1min/m
- Application area from passive house, new buildings, renovation to insulation only

### Description

Multi-functional Tape with side impregnation and additional compression tape for high requirements

ausen:  
RAL-Zertifiziert

### Application

3 Layer in one tape

### DIN 18542

BG1/BGR

### Degree of Compression [%]

14%-26%

### Application time

1 min/m

### Corner Solution

Butt-joint

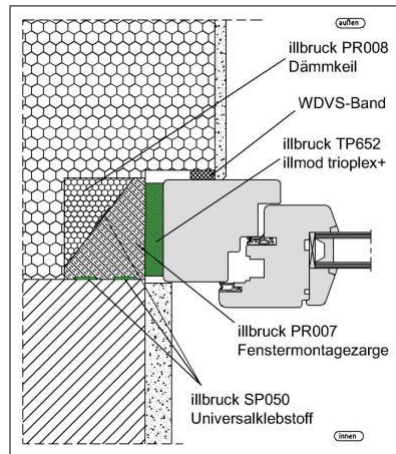
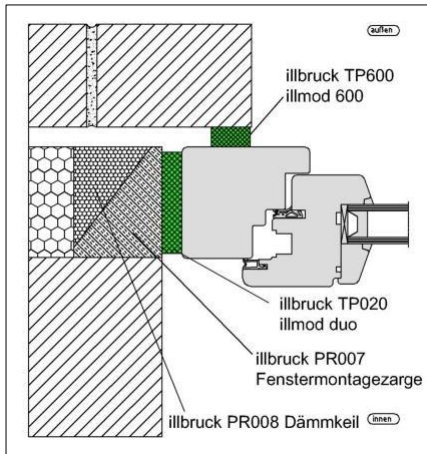


10

## Illmod Trio – The one that provides all 3 principles in one



## Application with Illbruck Projecting window system



21

### Advantages for Tapes!

**Driving rain:**  
Tight up to 600 Pa

**Experience:**  
More than 30 years of experience  
in production and application

**UV-Resistant and Durable:**  
Weather test for aging running now  
since 1995, tested by an  
independent testing authority

**Breathable:**  
Airtight but vapour open

**U-Value:**  
Defined U-Value for the joint,  
depending on the depth of the tape  
e.g. Trio 56mm = 0,71 W/m<sup>2</sup>K; Trio  
88 = 0,49 W/m<sup>2</sup>K

**Application:**  
Independent from weather  
conditions  
No treatment of the substrates  
necessary (no primer, etc.)  
Fast and easy



## Impregnated tapes: Applicable standards and properties

### ➤ Content

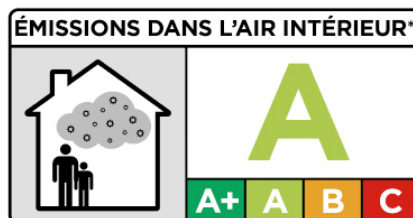
- Tremco illbruck
- Technology Impregnated tapes
- DIN 18542
- VOC Standards



## VOC France

### Obligation to label emissions in France

- The voluntary labeling of the conduct of emissions is compulsory since January 2012 for new building products
- Emission rating A+, A, B and C
- Transition period for existing products until September 2013
- Subject to certification are TVOCs, formaldehyde and further 9 single VOCs



## VOC France

**French VOC regulation / Arrêté du 19 avril 2011 (decree as of 19th April 2011)**

### Limit values

Additionally to the total of emissions of volatile organic compounds (TVOC) the list of the limit values focuses on the 10 following substances (in µg/m<sup>3</sup>):.

Substances/Emissions' class	A+	A	B	C
Formaldehyde	<10	<60	<120	>120
Acetaldehyde	<200	<300	<400	>400
Toluol	<300	<450	<600	>600
Tetrachlorethene	<250	<350	<500	>500
Xylene	<200	<300	<400	>400
1,2,4-Trimethylbenzene	<1000	<1500	<2000	>2000
1,4-Dichlorbenzene	<60	<90	<120	>120
Ethylbenzene	<750	<1000	<1500	>1500
2-Butoxyethanol	<1000	<1500	<2000	>2000
Styrene	<250	<350	<500	>500
TVOC	<1000	<1500	<2000	>2000



## VOC France

**French VOC regulation / Arrêté du 19 avril 2011 (decree as of 19th April 2011)**

The following products are subject to marking:

- **Floor coverings, walls and ceilings:** carpets, parquets, laminate, linoleum, wallpapers, tapestries, wall claddings, paints, varnishes, oils, mordants, gypsum, crown moulding, etc.
- **Partition walls and intermediate ceilings:** wall panel, PVC, wood, gypsum, flexible partition walls, drop ceilings, skirting and wooden boards, etc.
- **Insulation materials:** every kind of insulation, interior insulation, thermic and acoustic insulation materials, etc.
- **Windows and doors:** interior doors, windows, doors, etc.
- **Products for installation or preparation:** adhesives, sealings, sealing compounds, etc.

Not subject to marking are:

- Furniture
- Furnishings such as rods, curtains, lamps, roller blinds
- Sanitary fittings and armatures
- Electrical appliances, cables, switches
- Detergents for floor coverings
- Metal goods (e.g. fitting) and glass
- Products for outdoor use



## VOC France

**French VOC regulation / Arrêté du 19 avril 2011 (decree as of 19th April 2011)**

Products with certificate:

TP600  
TP650  
ME500  
SP050  
SP150  
FA101  
LD705  
FM330  
FM610  
...  
...



## VOC in Germany

GEV – the Association for the Control of Emissions in Products for Flooring Installation, Adhesives and Building Materials – was founded in 1997. Through the EMICODE® it offers consumers, planners, architects and professional craftsmen guidance for the selection of flooring installation products, adhesives and building materials. It provides independent and impartial assessments designed to assure the highest level of consumer and environmental protection.



## VOC in Germany

### GEV classification criteria

The emissions must lie below stringent limits.  
Emitted VOCs are individually identified and their concentrations are summated. The resulting emission concentrations give the TVOC value (total volatile organic compounds) and TSVOC (total semi-volatile organic compounds) and are definitive for the EMICODE classification.

$\mu\text{g}/\text{m}^3$	TVOC after 3 days	TVOC / TSVOC after 28 days
EMICODE EC 1 <sup>PLUS</sup> - very low emission	$\leq 750$	$\leq 60 / 40$
EMICODE EC 1 - very low emission	$\leq 1000$	$\leq 100 / 50$
EMICODE EC 2 - low emission	$\leq 3000$	$\leq 300 / 100$



Tests performed to other specifications, e.g. during approval procedures for construction products by the German DIBt approval body, may also be submitted as supporting evidence, provided they demonstrate compliance with the GEV requirements.

## VOC in Germany

GEV product matrix	EMICODE		
	EC 1 <sup>PLUS</sup>	EC 1	EC 2
	TVOC/TSVOC <sub>28d</sub> in $\mu\text{g}/\text{m}^3$		
<b>1. Liquid products</b>			
1.1 Primers			
1.2 Ready to use liquid fixations and adhesives (e.g. rolled fixations, spray adhesives)			
1.3 Damp proof primers			
1.4 Liquid sealants			
<b>2. Powder based products</b>			
2.1 Levelling compound based on cement or gypsum			
2.2 Tile mortars and joint fillers			
2.3 Waterproofing slurries based on cement	After 3 days	After 3 days	After 3 days
<b>3. Pasty products with high content of organic binder</b>	$\leq 750$ TVOC;	$\leq 1000$ TVOC;	$\leq 3000$ TVOC;
3.1 Adhesives for floor coverings, wood floorings and ceramic tiles	after 28 days	after 28 days	after 28 days
3.2 Fixations for floor coverings			
3.3 Levelling compounds (water based or reactive)	$\leq 60$ TVOC /	$< 100$ TVOC /	$\leq 300$ TVOC /
3.4 Powder based adhesives with high content of organic binder			
<b>4. Ready to use products which do not require chemical curing or physical drying</b>	$\leq 40$ TSVOC	$\leq 50$ TSVOC	$\leq 100$ TSVOC
4.1 Underlays for flooring installation			
4.2 Sound adsorbing underlays			
4.3 Self adhesive tapes and membranes			
4.4 Installation-/ decoupling boards			
<b>5. Joint sealants, joint insulations, joint sealing tapes</b>			
5.1 Joint sealants (water based or reactive)			
5.2 Joint insulations			
5.3 Pre-compressed joint sealing tapes			
5.4 Sealing membranes (for window or facade)			



## VOC Germany

Products tested so far EC1+:

illbruck FM812 Pistolenschaum Öko  
illbruck JF100 Fugenfüller  
illbruck ME500 TwinAktiv  
illbruck ME501 TwinAktiv HI  
illbruck ME503 TwinAktiv VZ  
illbruck ME904 Butyl- & Bitumenprimer Öko  
illbruck SP150 Universalklebstoff Plus  
**illbruck TP600 illmod 600**  
**illbruck TP610 illmod eco**  
**illbruck TP650 illmod trioplex**

**illbruck TP652 illmod trioplex+**  
**illbruck TP680 illmod 600 green**  
Tremco FA870 Natursteinsilikon  
illbruck FM230 Fensterschaum+  
illbruck PU700 Steinkleber  
illbruck SP025 Fenster-Folienkleber Öko  
illbruck SP525 Hochbau- und  
Anschlussfugen Dichtstoff

Perennator FA101 Fenster- und  
Anschlussfugen-Silikon



## Summary

### Impregnated Tapes



### Sealants



### Foams



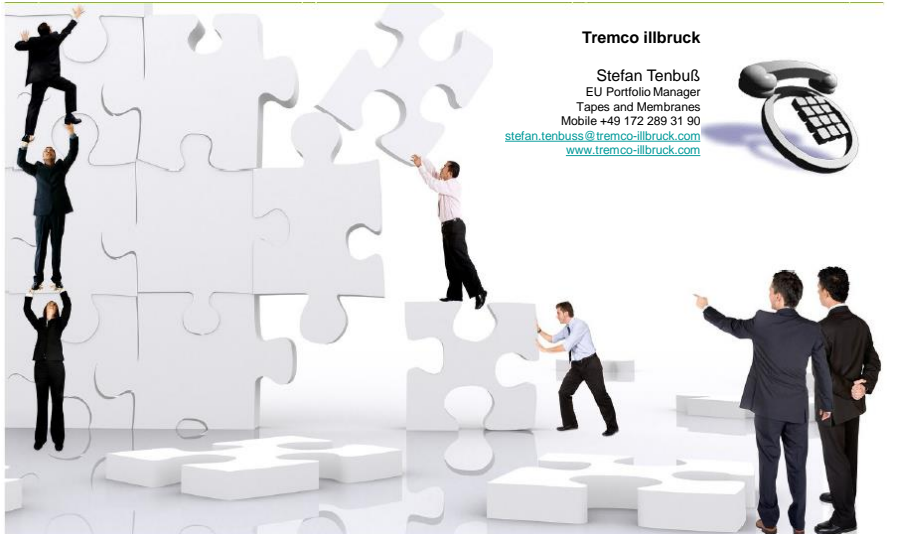
### Membranes



### Hybrids







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