Success with competence and quality

Practical criteria and samples for proper installation

NEW – RAL/ift guideline in Romanian available

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Director PR & Communication, ift Rosenheim

Congress EUROFEREASTRA 15th of July

ift Rosenheim – all services from a single source!

Testing Body

- Research & Development
- Testing of construction products
- Technical analysis and evaluation

Services

- Standardization & guidelines
- Technical hot line
- Publication and literature
- Test rigs, test centers, calibration

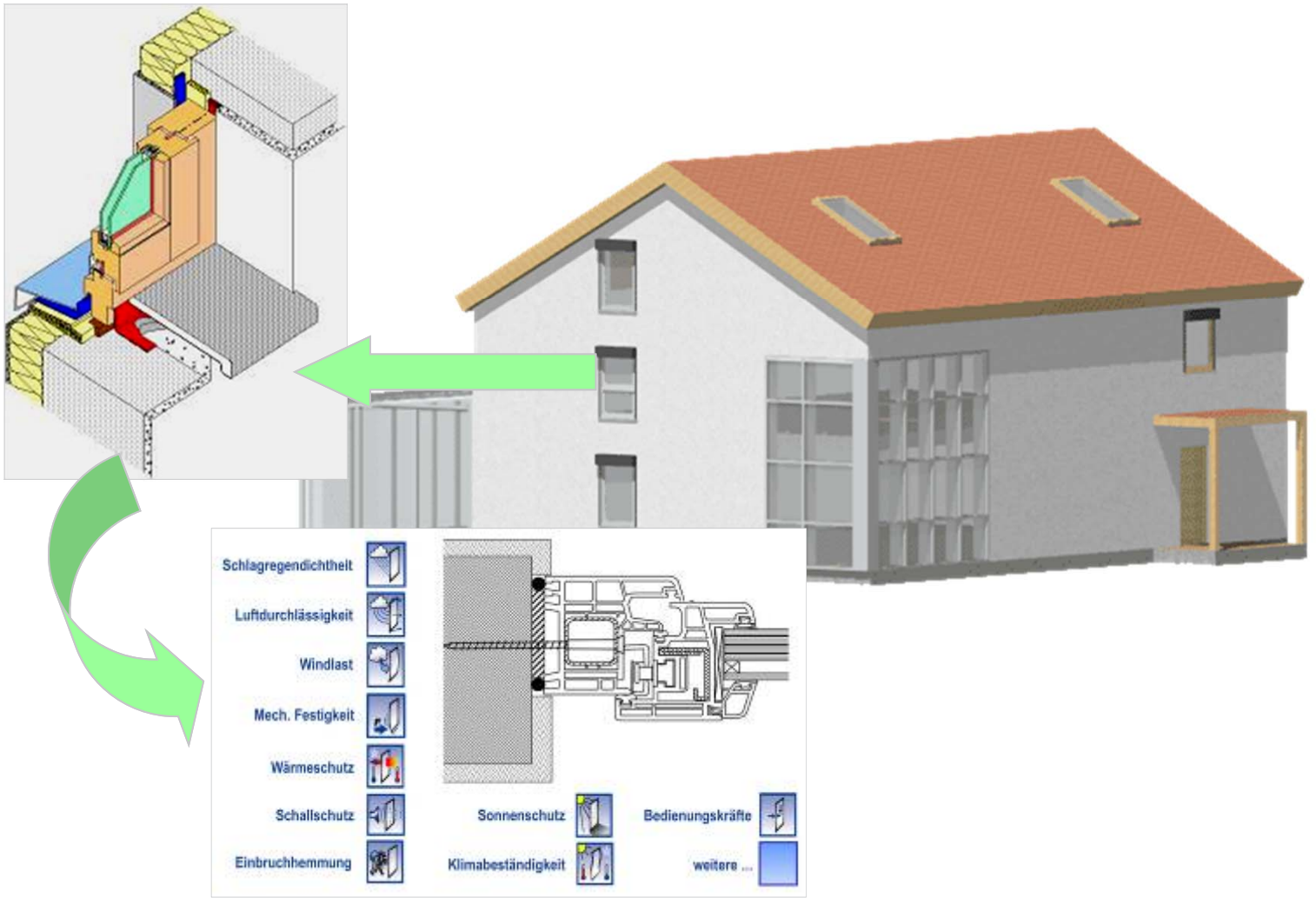
Certification

- Management systems
- product certification
- Surveillance

Training

- Seminars, Workshops, In-house trainings
- Congresses

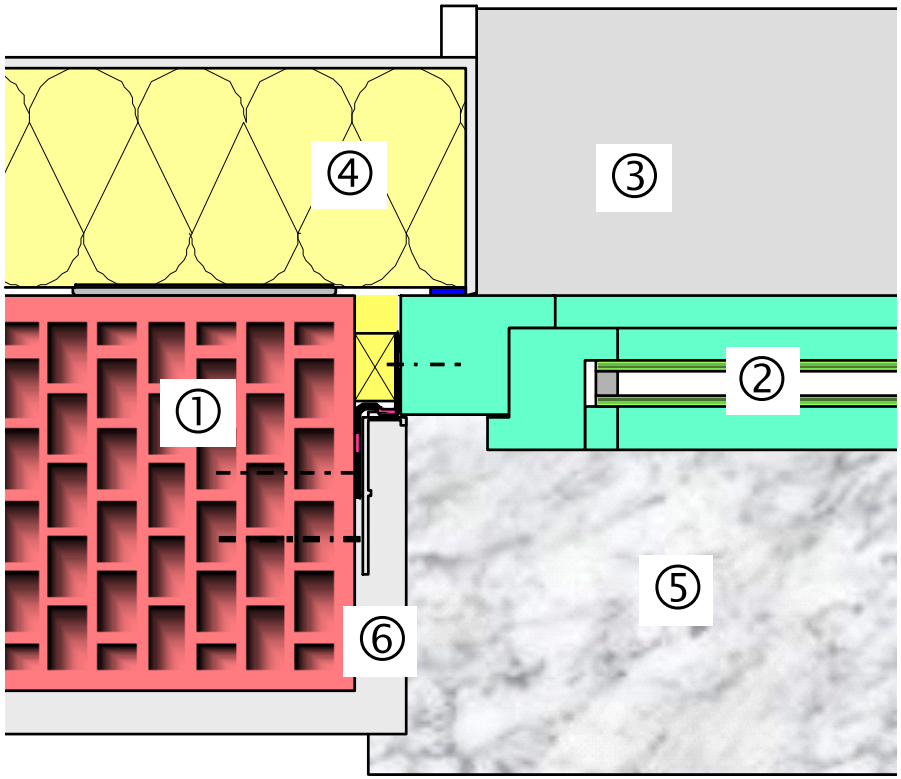
Complexity of windows integrated in buildings

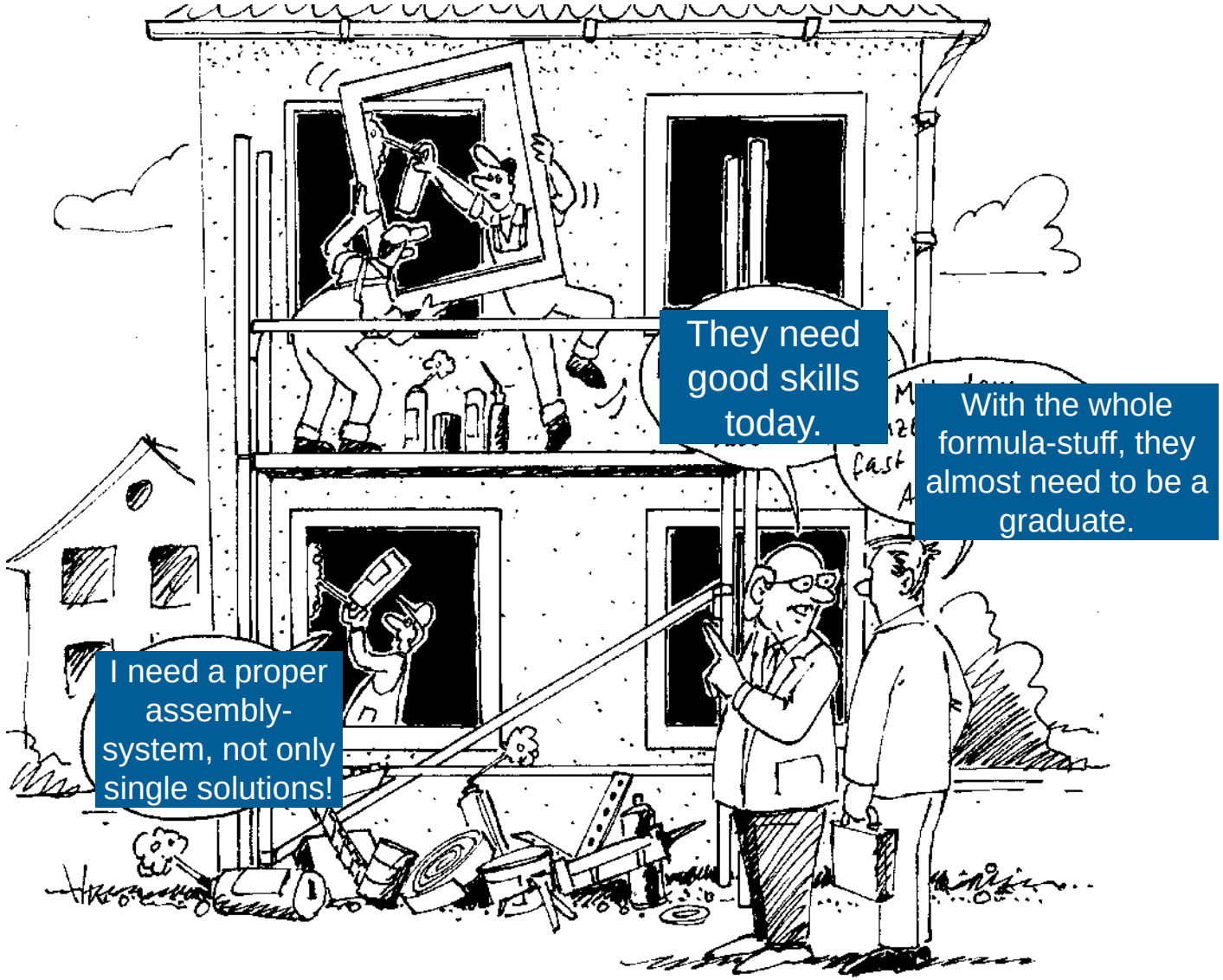


Assembly asks for trade-overlapping planning

1. carcass
2. window assembly mit fixings, insulation and sealing
3. external window sill
4. facade work with external sealing
5. roomsided window sill
6. interior fittings

→ **In this example up to 6 trades!**



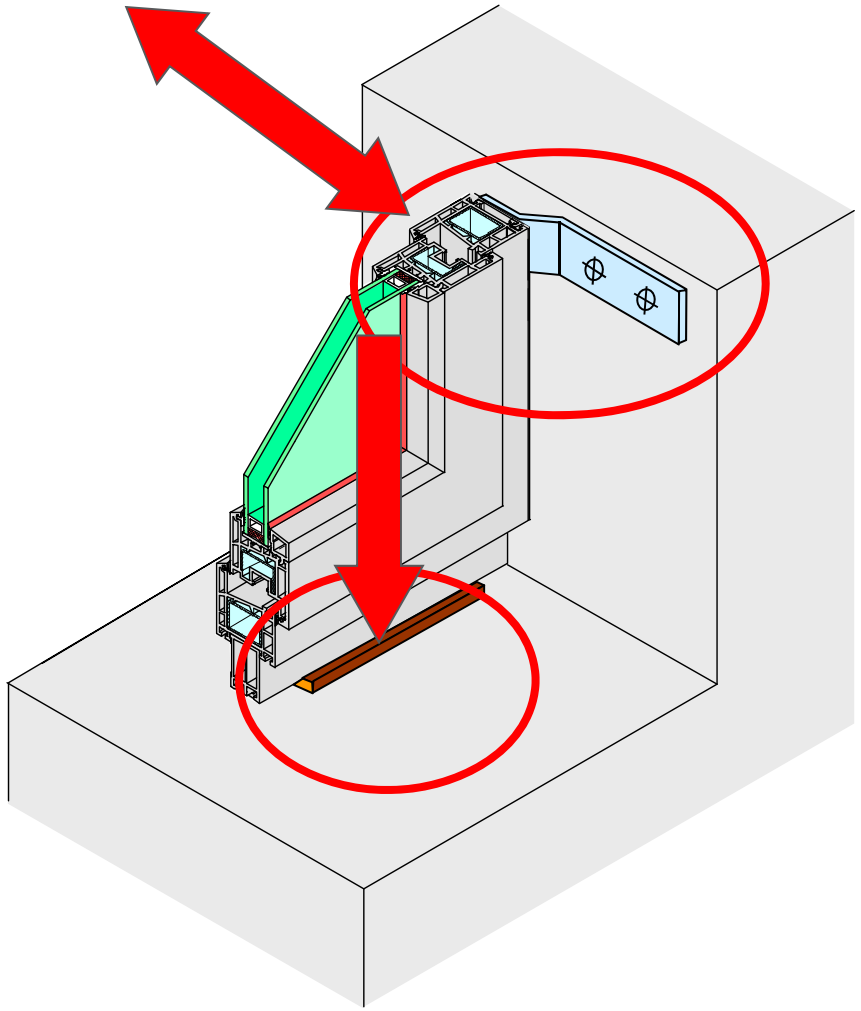


Aims of installation

1. **Load transmission/Fixing**
   (wind, dead load, function)
2. **Insulation**
   (thermal, sound, fire etc.)
3. **Tightness**
   (air, water,)
4. **Special function**
   (burglar resistance, fire, smoke etc.)

Requirements – fixing

- Load transmission vertical to window level by adapted fixing material.
- Consideration of necessary corner-, lug- and edge distance.
- Load transmission in window level with adapted, corrosion-proof support pads.



Fixing ...„That will work“ isn't enough!

don't do like this!!!

Nails are not a suitable fixing and here the nail is deformed and not deep enough in the wall

Additional loads

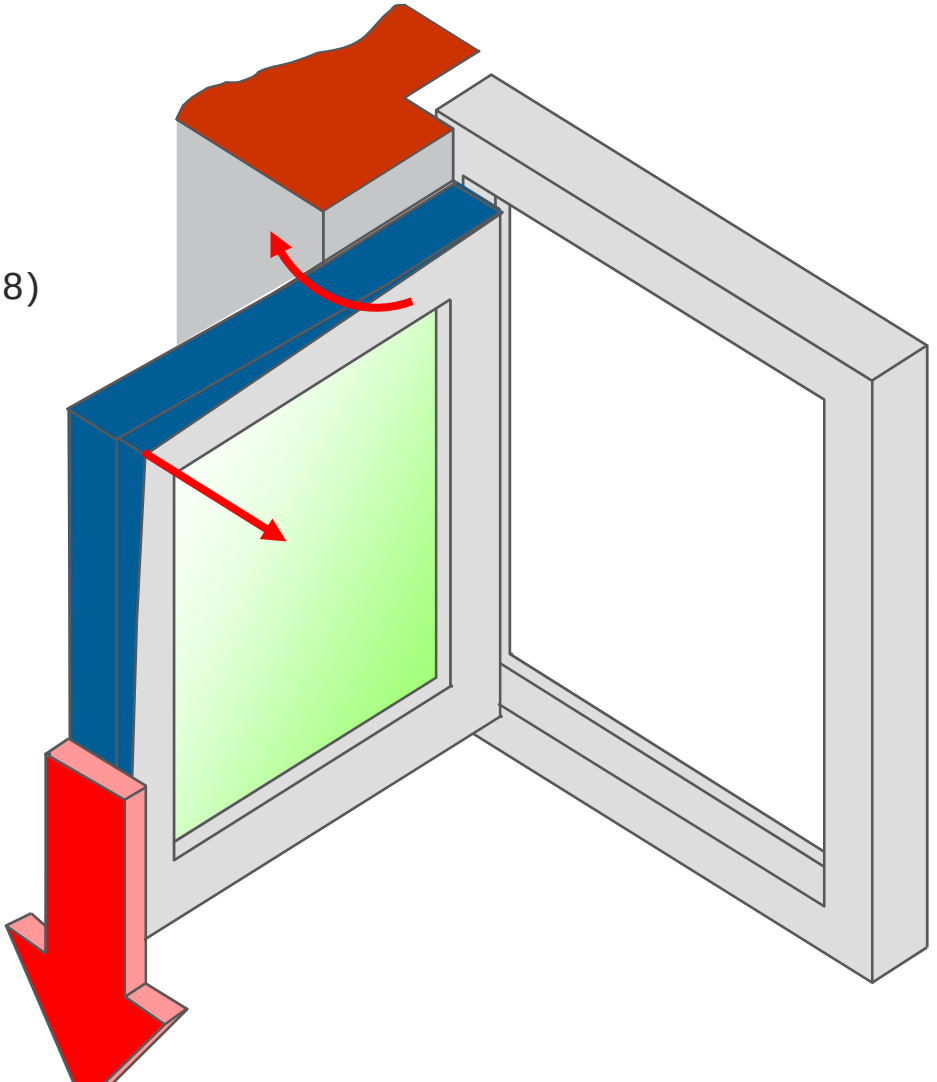
Vertical loads

20kg... 80 kg
(depending on class EN 14608)

static torsion

20kg...35 kg

(depending on class EN 14608)



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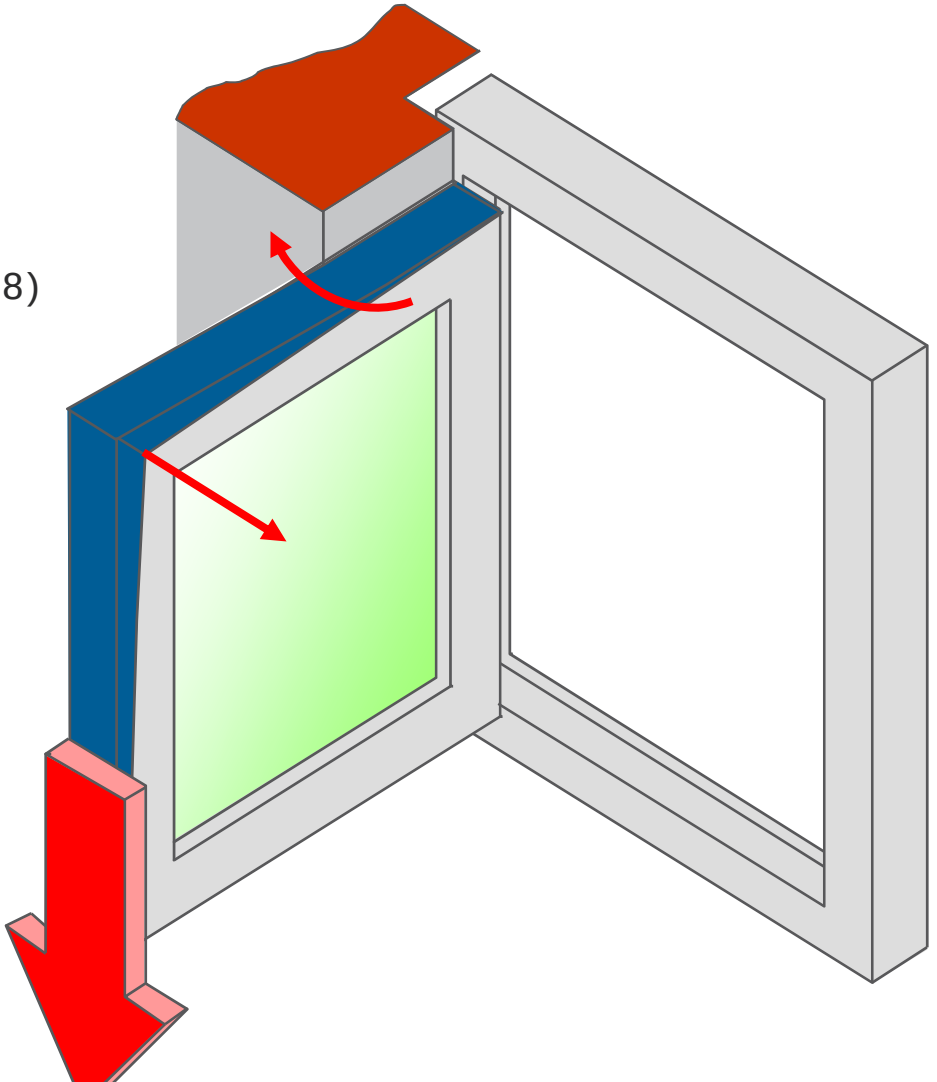


ift code of practice for installation (ift/RAL guideline)

The ift/RAL guideline offers an all-embracing **support** for

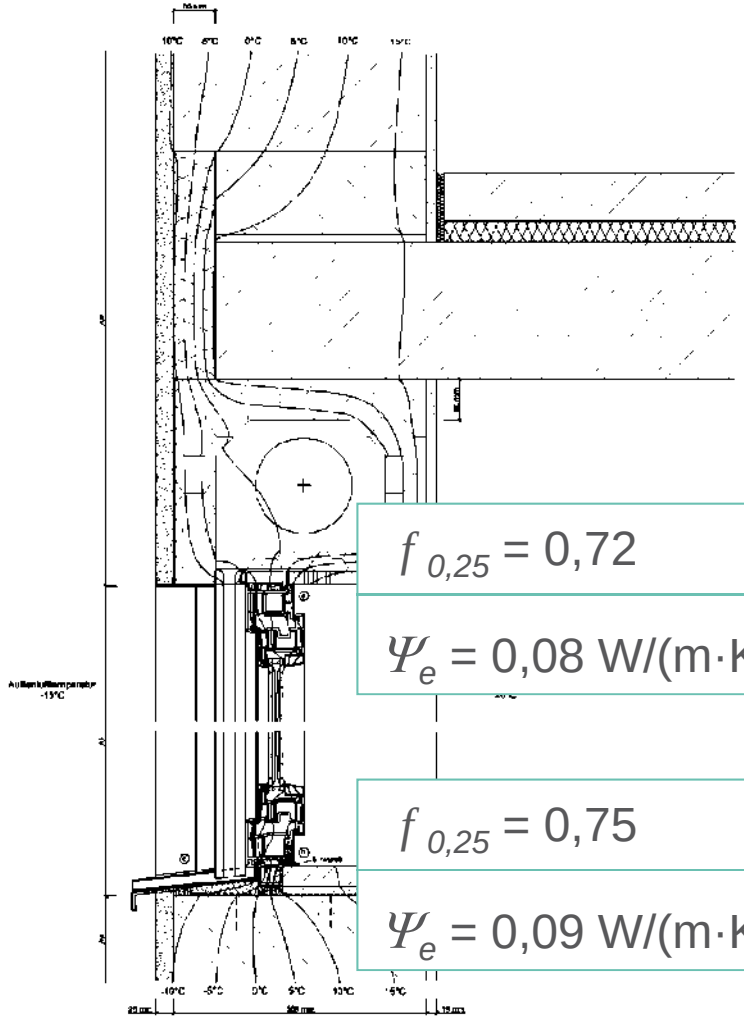
- Information for **planning** – construction (building physics, fixing, static)
- **specification** for **material** and practical construction
- **Checklists** for planers and executors
- **examples** of application

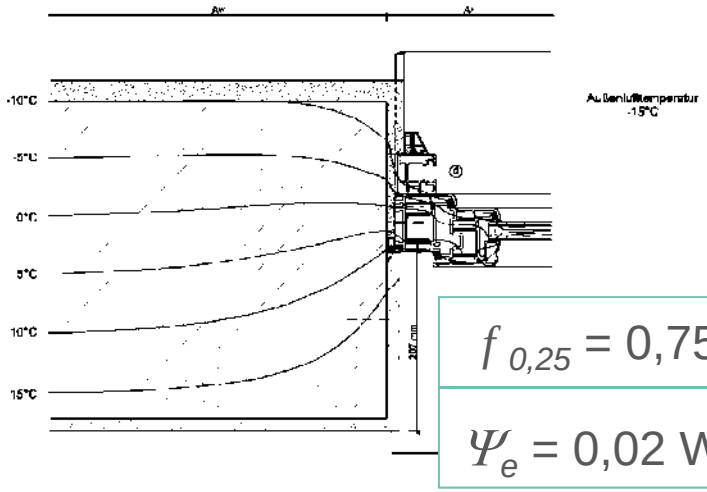
Orders in D/EU and Sample pages at
https://www.ift-rosenheim.de/shop/detail/index/sArticle/446

Order in Romania at ???

50,47 Euro
ca. 3.500 INR
(plus VAT)

Example of application



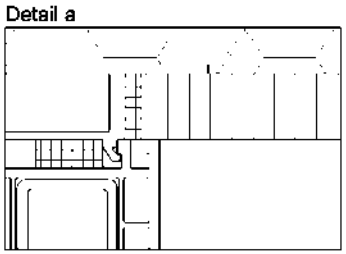


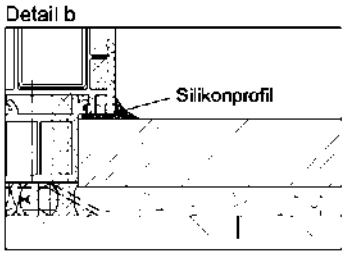
$f_{0,25} = 0,75$

$\Psi_e = 0,02$ W/(m·K)

$f_{0,25} = 0,72$

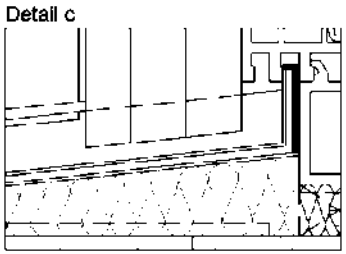
$\Psi_e = 0,08$ W/(m·K)

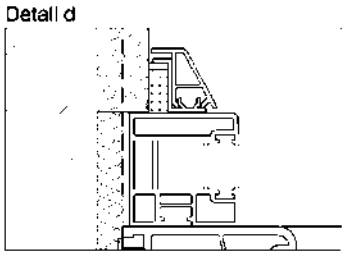




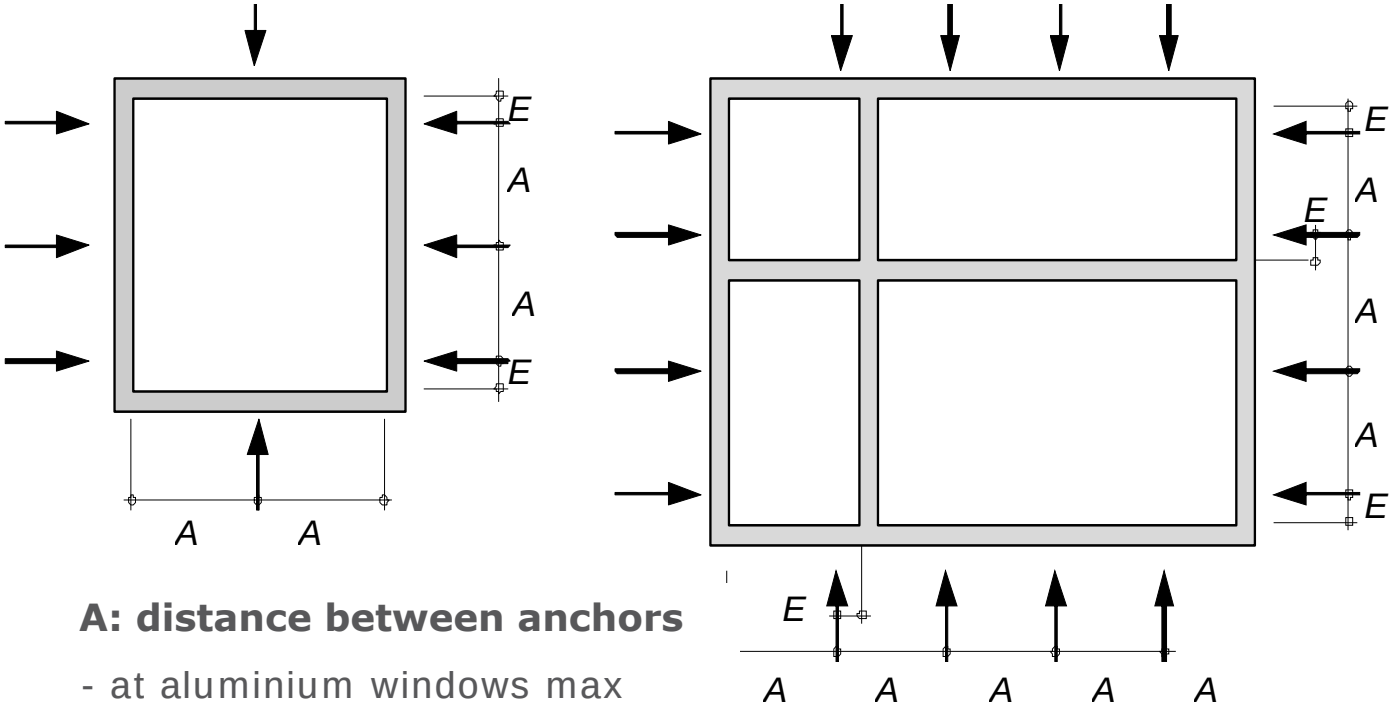
$f_{0,25} = 0,75$

$\Psi_e = 0,09$ W/(m·K)





Recomended Fixing point



A verification is necessary, if this is sufficient for the individual case!

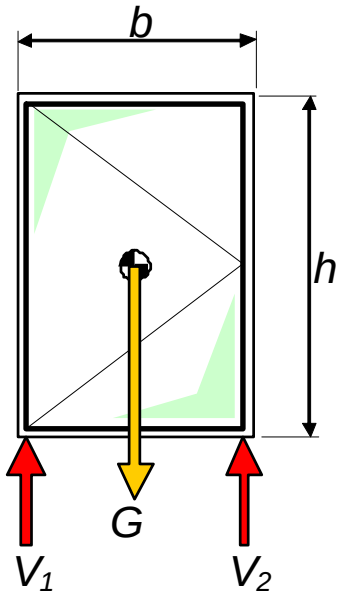
A: distance between anchors

- at aluminium windows max 800mm
- at wood windows max 800mm
- at PVC windows max 700mm

E: distance from inner corner

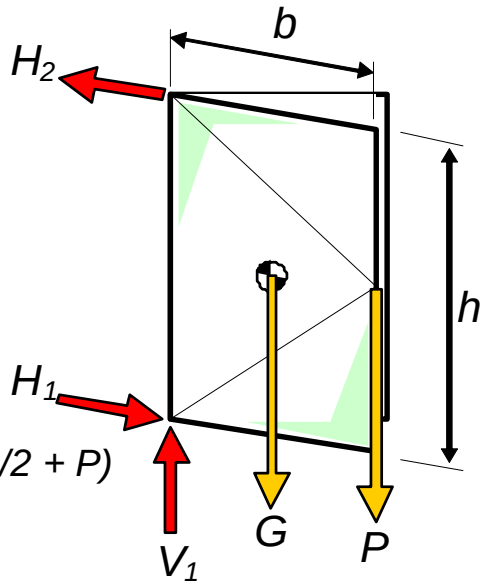
Distance from the frame inner corner and for transom/mullions from the inner side of the profile 100 to 150mm

Calculation of loads within the window layer (in ift guideline)



Slash closed
Support reaction

$V_1 = V_2 = G/2$



Slash minimal open
Support reaction

$V_1 = G + P$

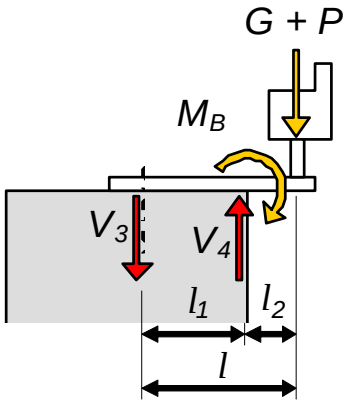
$H_1 = H_2 = b/h \cdot (G/2 + P)$

Relationship of forces of pprojecting installation:

$M_B = (G + P) \cdot l_2$

$V_3 = (G + P) \cdot l_2 / l_1$

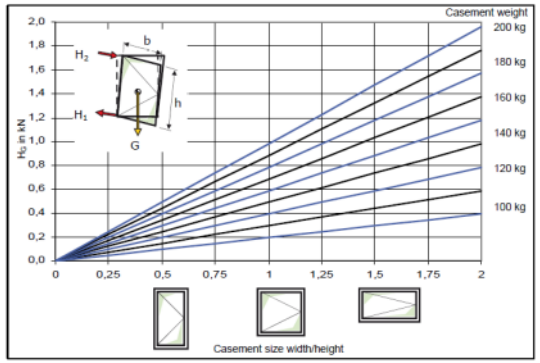
$V_4 = (G + P) + V_3$



Legend:

b, h	Width, heigth of element and slash
G	Load of weight of slash in N
P	Vertical using load (200/400/600/800 N, under requirement of mechanical strength of the window construction according EN 13115)
V_n	Support reaction in N vertical in the window level
H_n	Support reaction in N horizontal, rate of H_1 and H_2 independant of the opening width and effective line in the level of the slash level

Easy calculation by tables (in ift guideline)



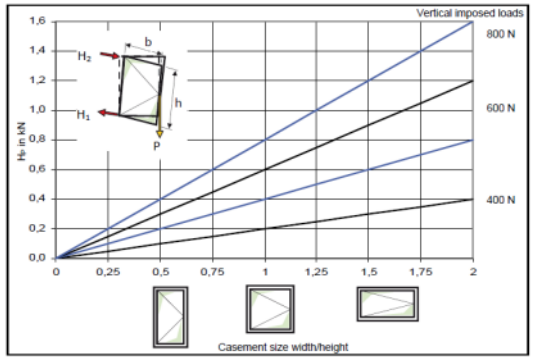


Figure 5.11 Determining the horizontal supporting forces H_G resulting from the casement weight (graphical display above and H_P as a result of a vertical imposed load (graphical display below). The resulting supporting force H_1 and/or H_2 is obtained from the sum of the two individual values ($H_1 = H_2 = H_G + H_P$).

You can also determine the supporting forces resulting from the wind with fixing on all four sides and 2-sides fixing from the following tables. The values are determined for the resistance class B3 (= design wind load 1.2 kN/m²). For other wind loads, the value must be multiplied with the factor $f_{wind} = w_{nom} / 1.2$.

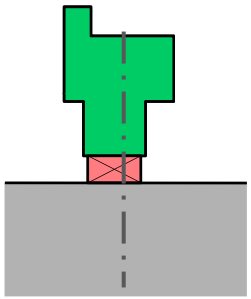
Table 5.5 Determining the supporting force F_{FP} per fixing point resulting from a wind load of 1.2 kN/m² (wind resistance class B3) **with fixing on all four sides** at distances of ≤ 700 mm.

Supporting forces per fixing point F_{FP} in kN for element width B and element height H in mm and the number of fixing points n_{FP} per edge												
	B	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000
H	N_{FP}	1	1	1	2	2	2	3	3	3	3	4
1000	2	0.20	0.24	0.28	0.24	0.27	0.30	0.26	0.29	0.31	0.34	0.30
1200	3	0.18	0.22	0.25	0.23	0.26	0.29	0.26	0.29	0.31	0.34	0.31
1400	3	0.21	0.25	0.29	0.27	0.30	0.34	0.31	0.34	0.36	0.39	0.36
1600	3	0.24	0.29	0.34	0.31	0.35	0.38	0.35	0.38	0.42	0.45	0.41
1800	4	0.22	0.26	0.30	0.29	0.32	0.36	0.34	0.37	0.40	0.43	0.41
2000	4	0.24	0.29	0.34	0.32	0.36	0.40	0.38	0.41	0.45	0.48	0.45
2200	4	0.26	0.32	0.37	0.35	0.40	0.44	0.41	0.45	0.49	0.53	0.50
2400	4	0.29	0.35	0.40	0.38	0.43	0.48	0.45	0.49	0.53	0.58	0.54
2600	5	0.26	0.31	0.36	0.36	0.40	0.45	0.43	0.47	0.51	0.55	0.52
2800	5	0.28	0.34	0.39	0.38	0.43	0.48	0.46	0.50	0.55	0.59	0.56
3000	5	0.30	0.36	0.42	0.41	0.46	0.51	0.50	0.54	0.59	0.63	0.60

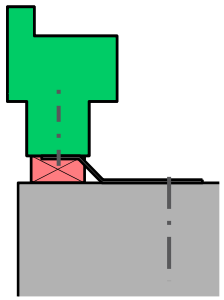
Table 5.6 Determining the supporting force F_{FP} per fixing point resulting from a wind load of 1.2 kN/m² (wind resistance class B3) with **with fixing on 2 sides** at distances of ≤ 700 mm.

Supporting forces per fixing point F_{FP} in kN for element width B and element height H in mm and the number of fixing points n_{FP} per edge												
	B/H	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000
H/B	N_{FP}	–	–	–	–	–	–	–	–	–	–	–
1000	2	0.30	0.36	0.42	0.48	0.54	0.60	0.66	0.72	0.78	0.84	0.90
1200	3	0.27	0.32	0.38	0.43	0.49	0.54	0.59	0.65	0.70	0.76	0.81
1400	3	0.33	0.40	0.46	0.53	0.59	0.66	0.73	0.79	0.86	0.92	0.99
1600	3	0.39	0.47	0.55	0.62	0.70	0.78	0.86	0.94	1.01	1.09	1.17
1800	4	0.30	0.36	0.42	0.48	0.54	0.60	0.66	0.72	0.78	0.84	0.90
2000	4	0.34	0.41	0.48	0.54	0.61	0.68	0.75	0.82	0.88	0.95	1.02
2200	4	0.38	0.46	0.53	0.61	0.68	0.76	0.84	0.91	0.99	1.06	1.14
2400	4	0.42	0.50	0.59	0.67	0.76	0.84	0.92	1.01	1.09	1.18	1.26
2600	5	0.35	0.41	0.48	0.55	0.62	0.69	0.76	0.83	0.90	0.97	1.04
2800	5	0.38	0.45	0.53	0.60	0.68	0.75	0.83	0.90	0.98	1.05	1.13
3000	5	0.41	0.49	0.57	0.65	0.73	0.81	0.89	0.97	1.05	1.13	1.22

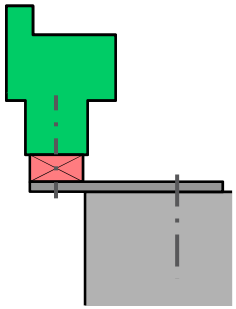
Mechanical mounting – types of mounting



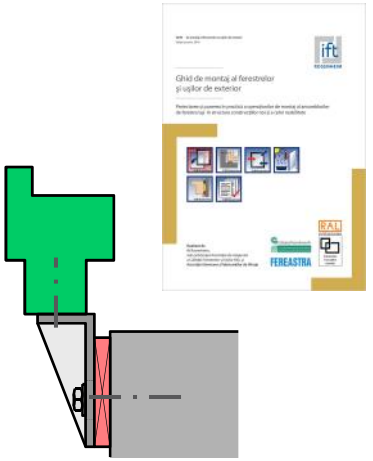
frame screw



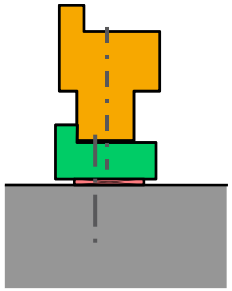
anchor



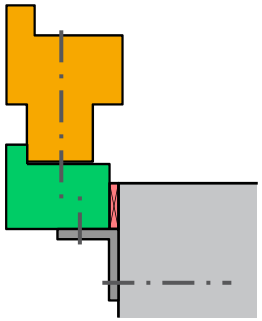
load transferring steel mounting plate



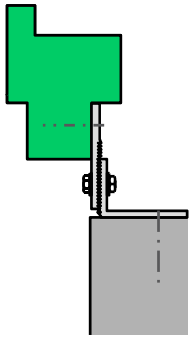
cantilever



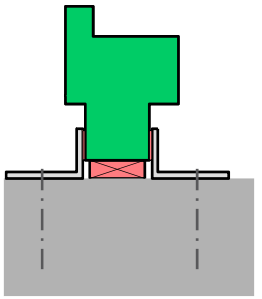
Fitting frame



load transferring frame

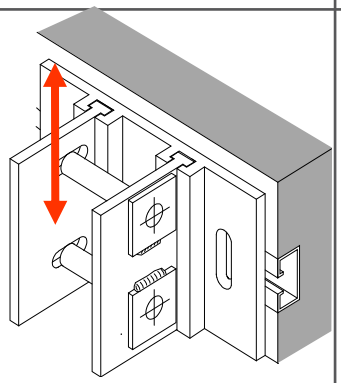
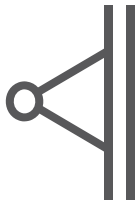
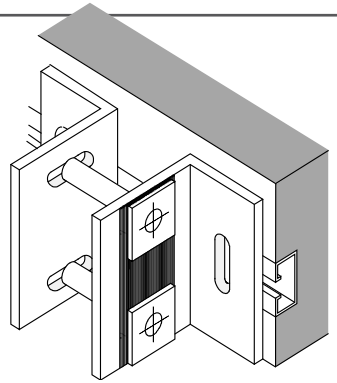
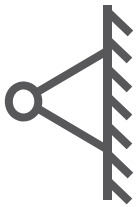


adjustable fastener

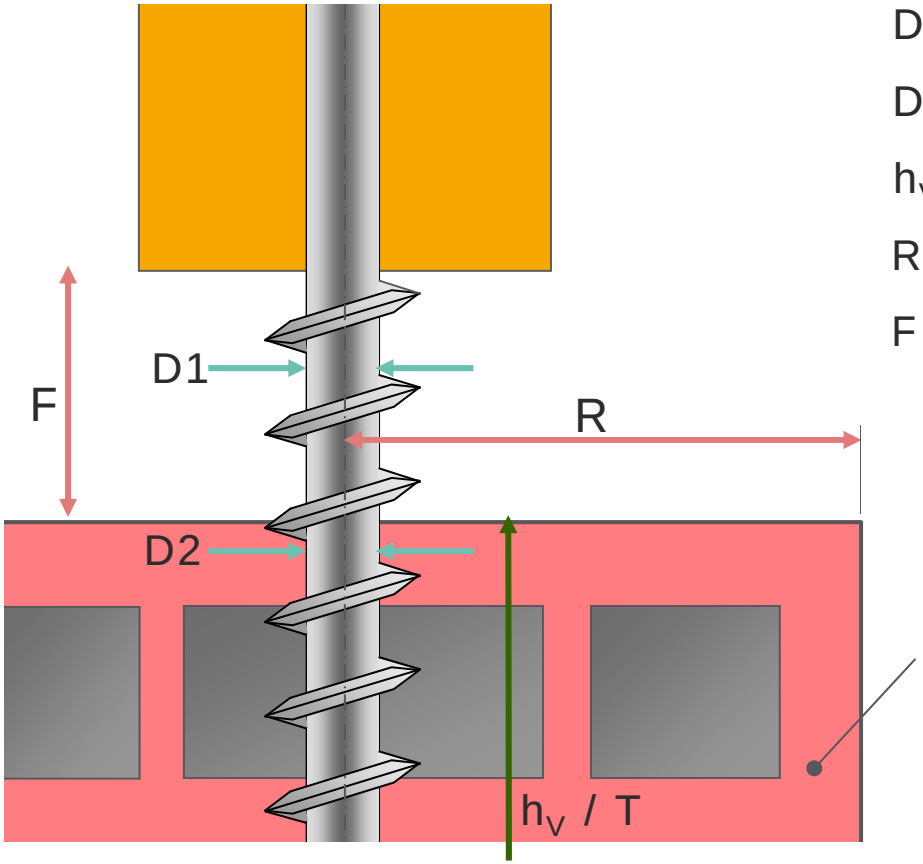


mechanical feed

Samples of floating/fixed bearing in facades

Name		Symbol	loads	Degrees of freedom
Floating bearing			Wind load impact load	2 Degrees of freedom rotation displacement
Fixed bearing			Wind load impact load Self weight	1 Degree of freedom rotation

Dimensions and specifications of fixing material



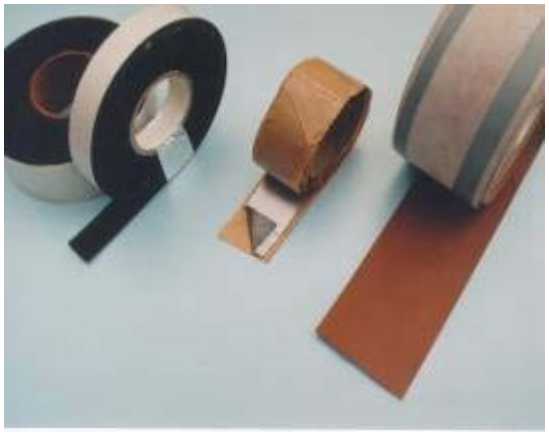
D1	screw diameter
D2	drill hole diameter
h_V / T	impression-/ drilling depth
R	edge distance
F	free dowel length

Type of anchorage

Sealing

- Sealing systems
- Application

Adapted materials in the installation gap



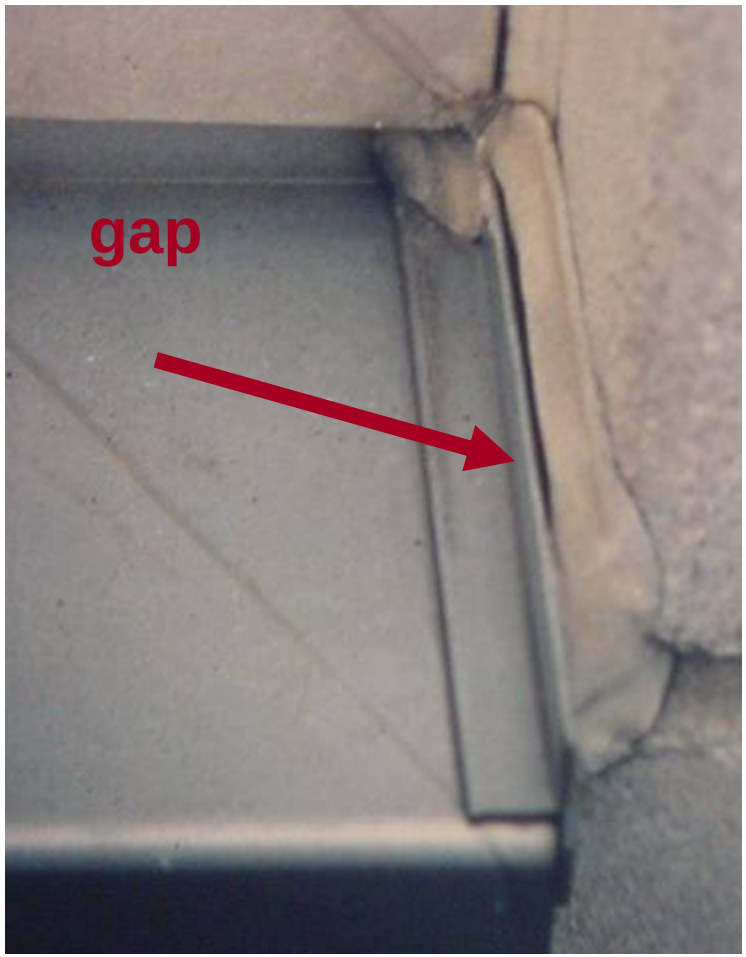
Sealing strips and –films

insulating material

sealing material

fixing material

Application of sealing – not that way!!

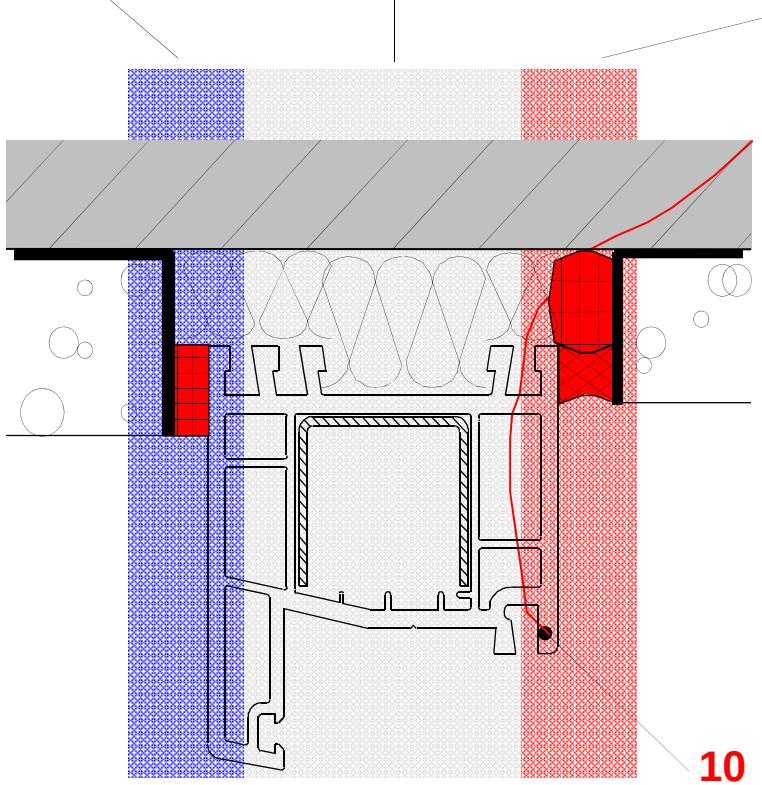


Sealing of mounting joint – layer concept

layer (3) weather protection

layer (2) function

layer (1) Separation of internal and external climate

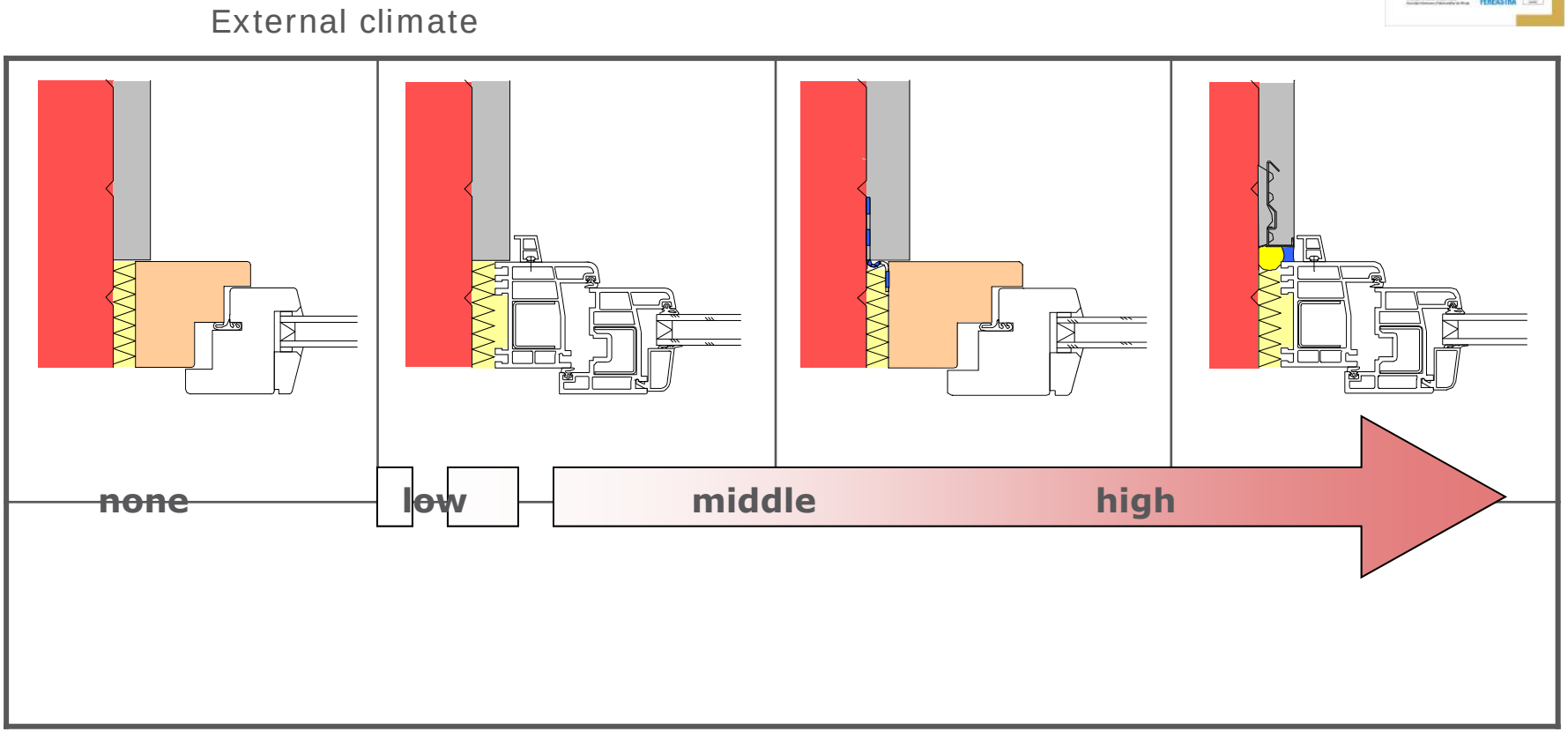


10 ° GIsotherme

layer (1) closed and sealing system of layer (3) with higher water vapo ut diffusion

⇒ no humidty increase in layer (2)

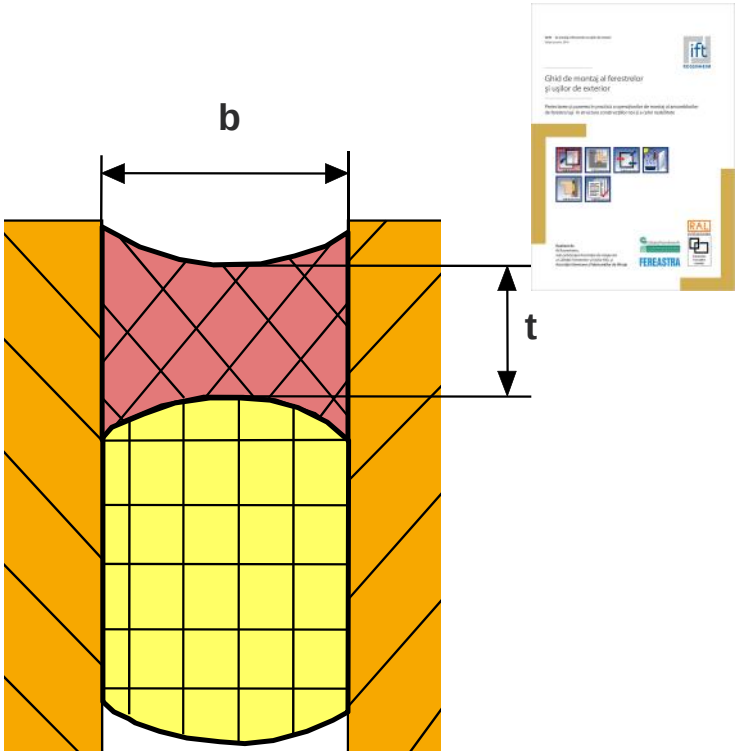
Design of joint according to external condition



Design of joint and sealing is neccessary
Rules for professional sealing

Pay attention to

- Expected movements and exposures
- Constitution of the surfaces
- Tolerances
- Dimensions of the joints
- Maximum deformation of the sealing material
- Application guideline of supplier

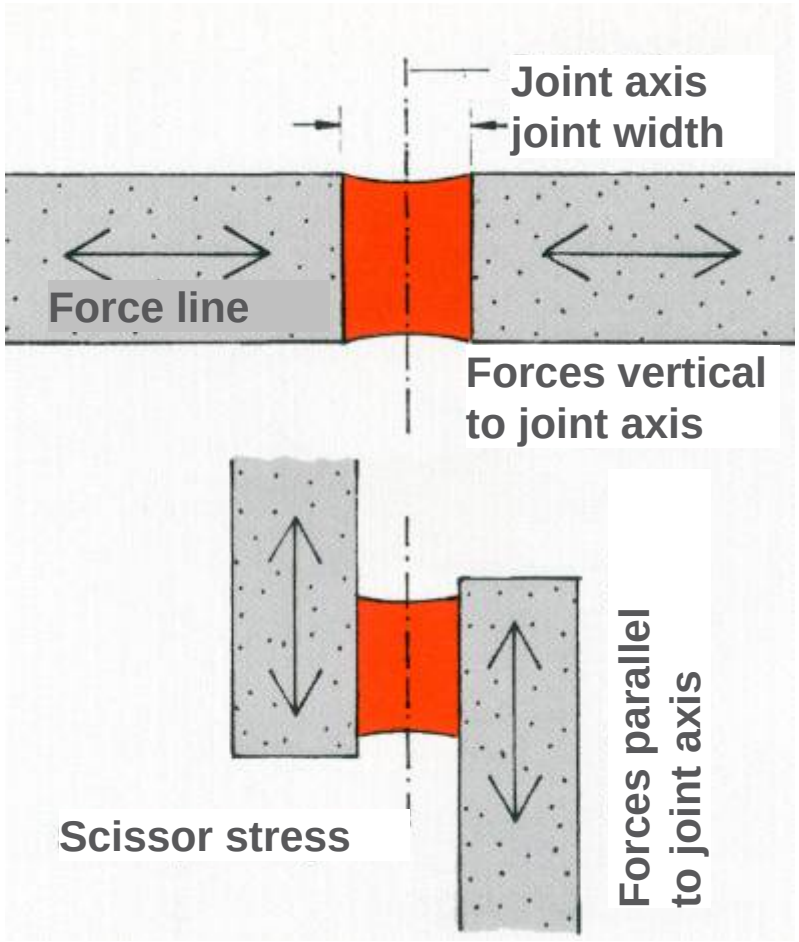


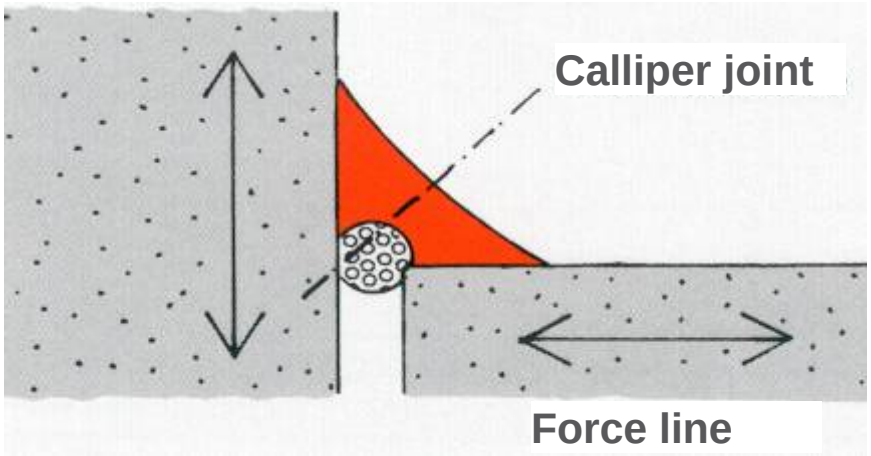
Ratio of width (b) to depth (t) of joint

t ~ 0,5 x b

but minimum ≥ 6 mm

Geometry of sealing joints





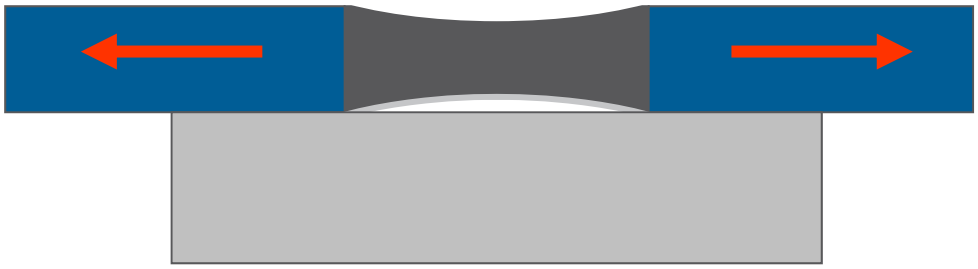
Triangular connection

Positioning of separator material and back filling in joint corner is needed for a proper sealing

Damage – three-shoulder-adhesion

Joint, in which the sealant has adhesion on three surfaces.

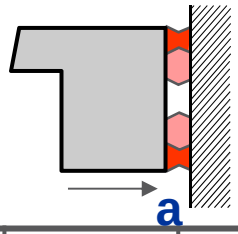
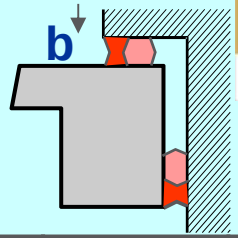
The implications are material-cracks on elongation, as the possibility of moving of the sealant is not given.



The back side of the joint was covered with a film.

The sealant is now able to back down to the elongations.

Minimum joint width for sealants

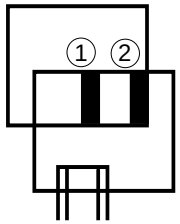
Minimal width for joints in mm (Recommendet)							
Length of frame in m	max. **1,5**	max. **2,5**	max. **3,5**	max. **4,5**	max. **2,5**	max. **3,5**	max. **4,5**
PVC (white)	10	15	20	25	10	10	15
PVC (dark), PMMA (couloured)	15	20	25	30	10	15	20
PUR-Integral Foam	10	10	15	20	10	10	15
Metal-plastic composite profiles (light)	10	10	15	20	10	10	15
Metal-plastic composite profiles (dark)	10	15	20	25	10	10	15
Wood profile	10	10	10	10	10	10	10

Max. total deformation of the sealing interior 15 %, exterior 25 %

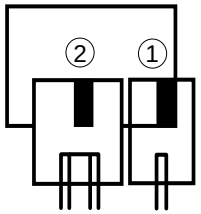
Requirements–building physics

Sound insulation, acoustics

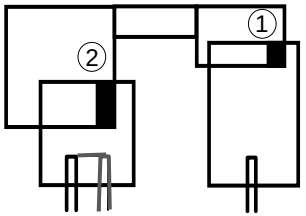
Sound insulation of windows



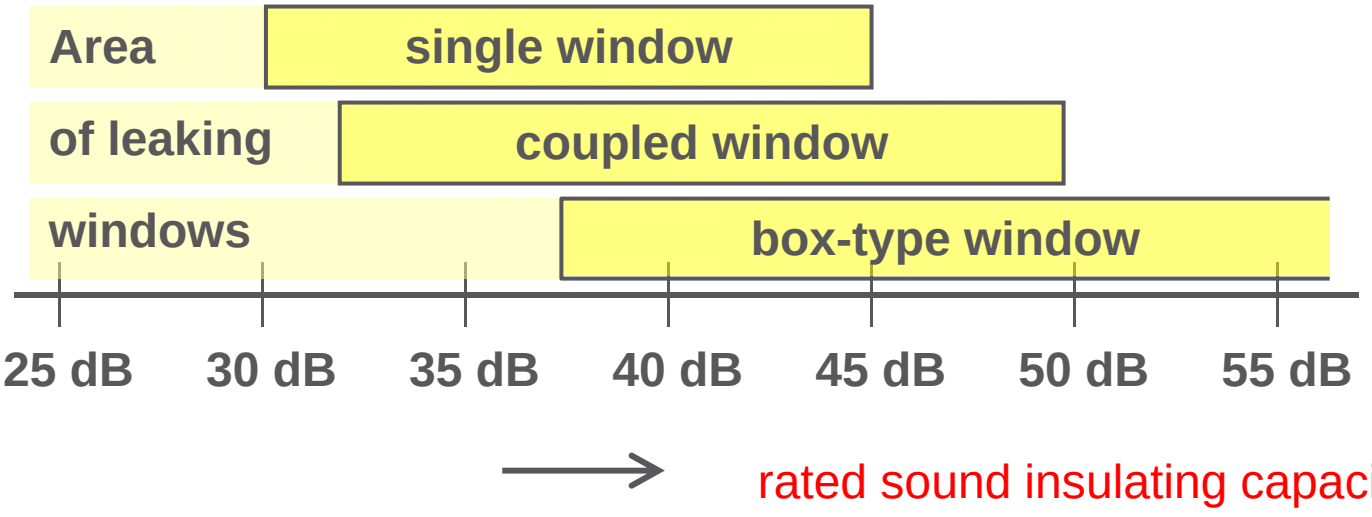
single window



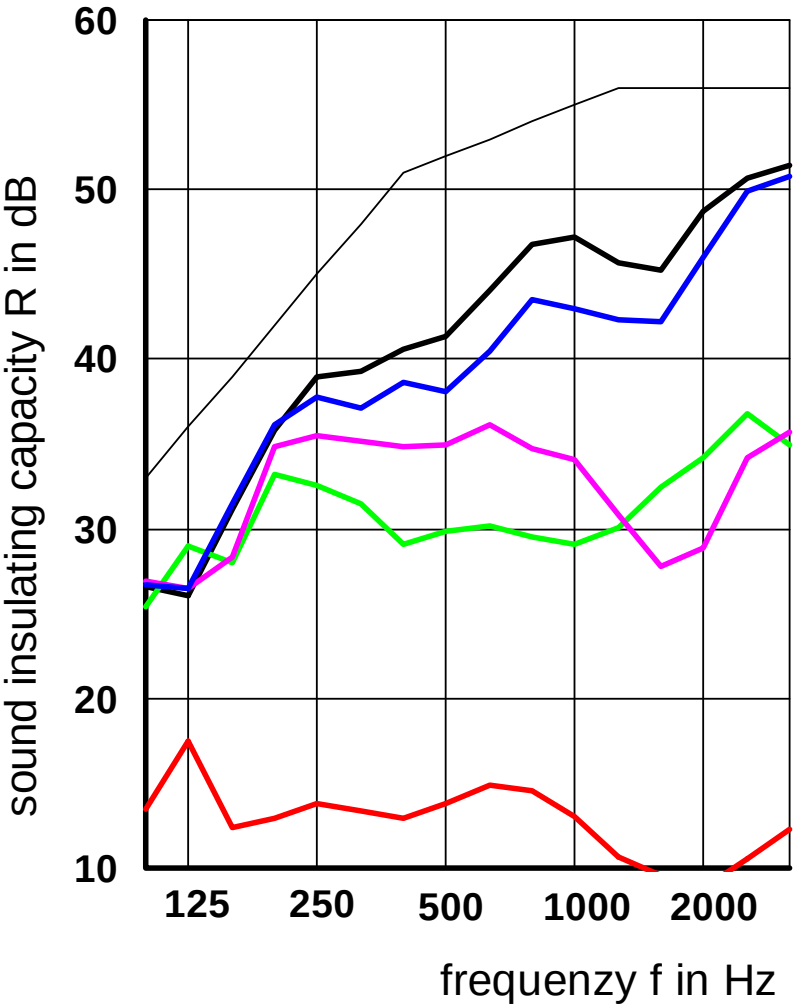
coupled window



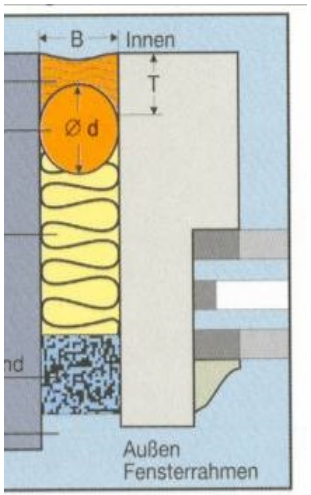
box-type window



Sound installation – Reduction by installation joints



- Window, join **tight**
  $R_w(C;C_{tr})$ **= 45 (-1;-5) dB**
- Window with **empty** join
  $R_w(C;C_{tr})$ **= 12 (-1; 0) dB**
- Window **foamed**, hair join
  $R_w(C;C_{tr})$ **= 32 (-1;-2) dB**
- Window **foamed**, 1 cotter slot
  $R_w(C;C_{tr})$ **= 33 (-1;-1) dB**
- Join fully **foamed**
  $R_w(C;C_{tr})$ = **43 (-1;-4) dB**
- Reference curve according to DIN EN ISO 717-1



Tabulated values

Variation	Sound reduction index $R_{S,w}$ in dB		
	width of joints 10 mm	20 mm	30 mm
Empty join*	15	10	5
Mineral fibre stuffed (according to stuff level)*	35..45	30..40	25..35
In-situ foam*	≥ 50	≥ 47	≥ 45
Sealing strip, 50% compressed	20 - 30	-	-
Sealing strip, 80% compressed	≥ 40	-	-
2 sealing strips, 80% compressed	≥ 50	-	-
Multi-functional strip, 65% compressed	≥ 40	≥ 35	-
Sealed on two sides *	≥ 55	≥ 54	≥ 53
Xoated on one sideC	≥ 40	≥ 35	≥ 30
Coated on two sides*	≥ 50	≥ 45	≥ 40

Analyzing of the air tightness on site

Smoke testing
at lift-sliding doors

Thank you – ift Rosenheim

Research, Verification, Certification, Training