NTNU

ROBUST

Rain tightness of wind barrier and sealing of window joints

Experimental laboratory testing

Inside the test chamber

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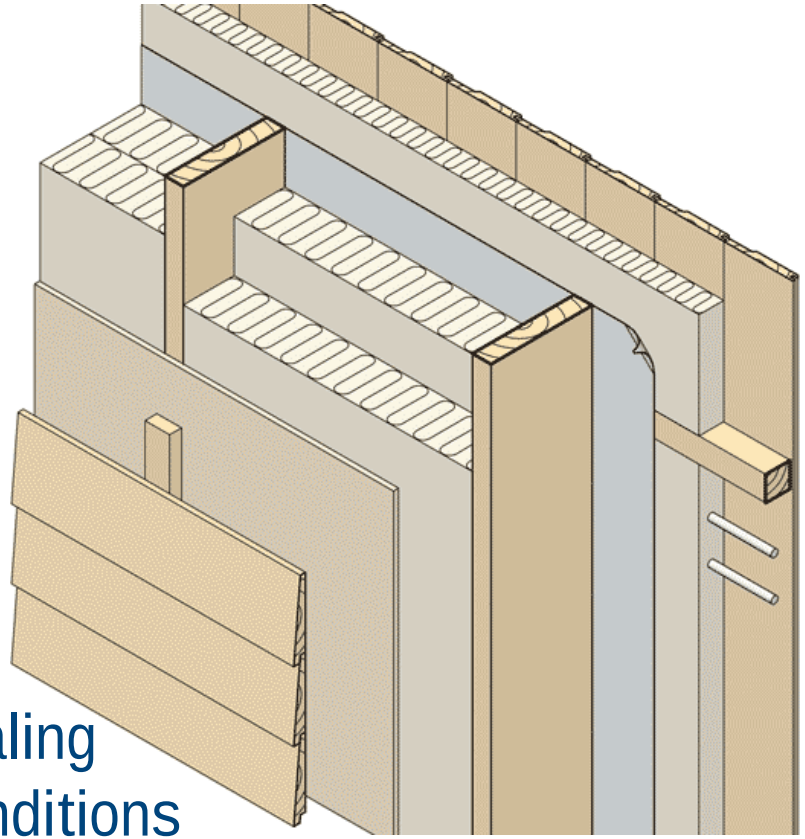
Quantify the rain tightness to

- Wind barriers
- Sealing of window joints

Background

- More extreme weather conditions
- Avoid moisture damages from rain during the building period
- Possibility to choose materials and sealing methods depending on the weather conditions where the building is situated
- More open claddings → wind barrier exposed

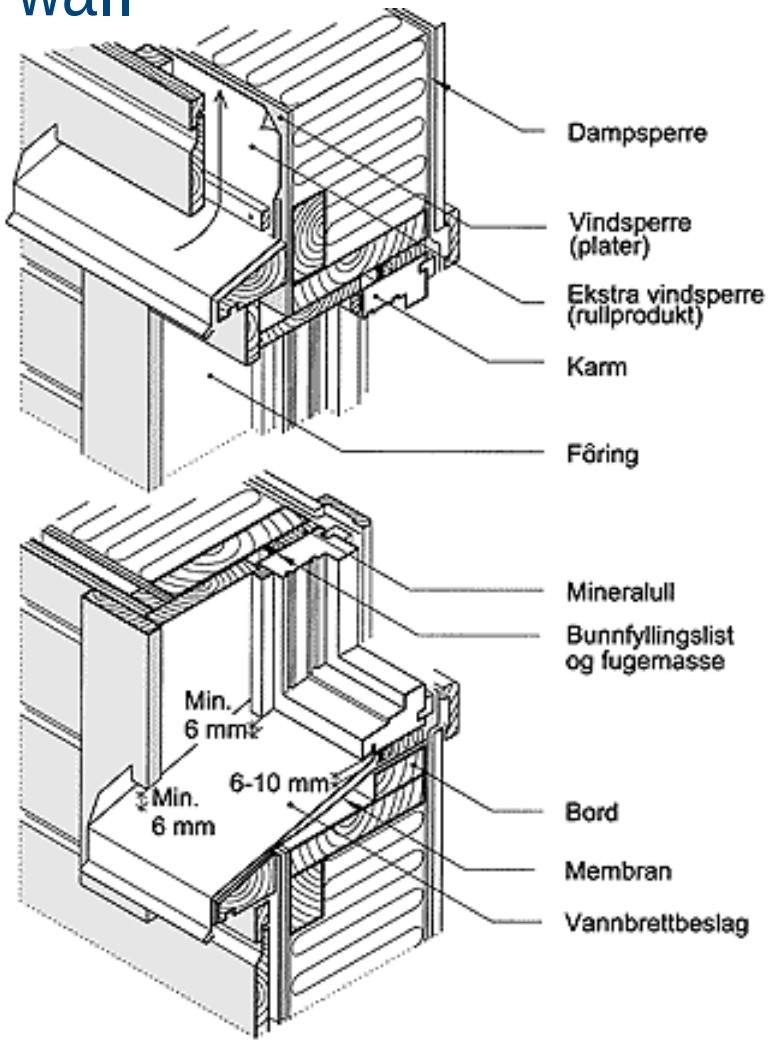


Timber frame wall

Wind barrier layer and windows mounted in timber frame wall

Two step rain and air tightening

- Rain shield
- Ventilated air space
- Wind barrier / window sealing
- Timber frame with insulation
- Water vapor barrier
- Indoor cladding



Wind barrier = air barrier

- Moving the air tight layer to the outside of the building means fewer joints, less risk for penetration and may reduce the labor costs (Langmans 2011)
- An air tight wind barrier is essential to achieve a rain tight wind barrier layer
- The buildings air change rate can be measured early in the construction period when the wind barrier is visible from both sides

  → easier and less costs to improve the wind barriers air tightness

Testing of water tightness,

EN1027, method 1A – static pressure 5 nozzles each 2 L/min

10 minutes on every pressure difference, 0-600 Pa

Test chamber

visual observation of water leakages

Inside the test chamber, nozzles

spraying water on the test section

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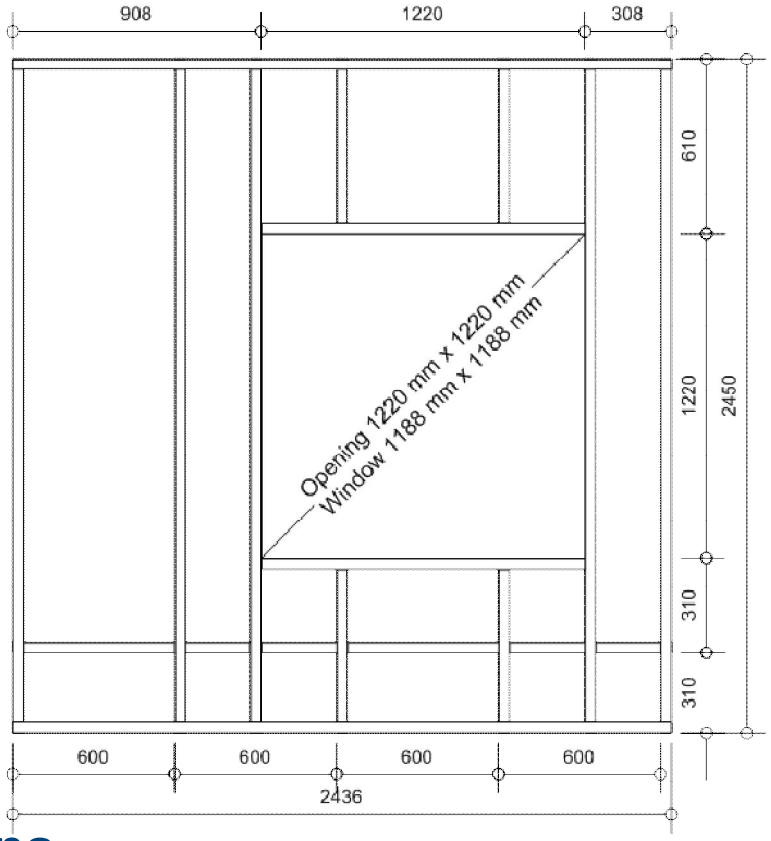
Wind barriers and sealing methods tested

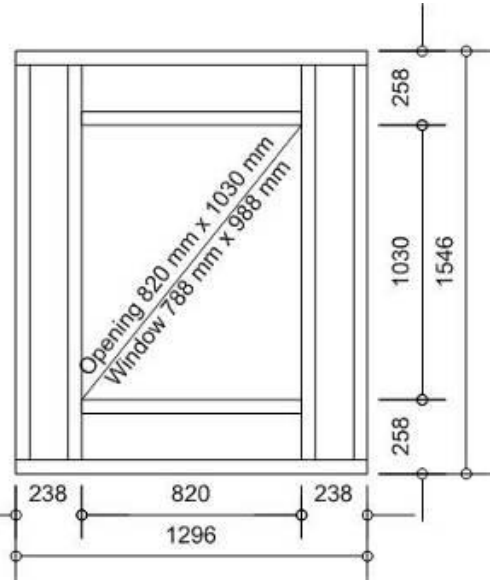
Wind barrier materials

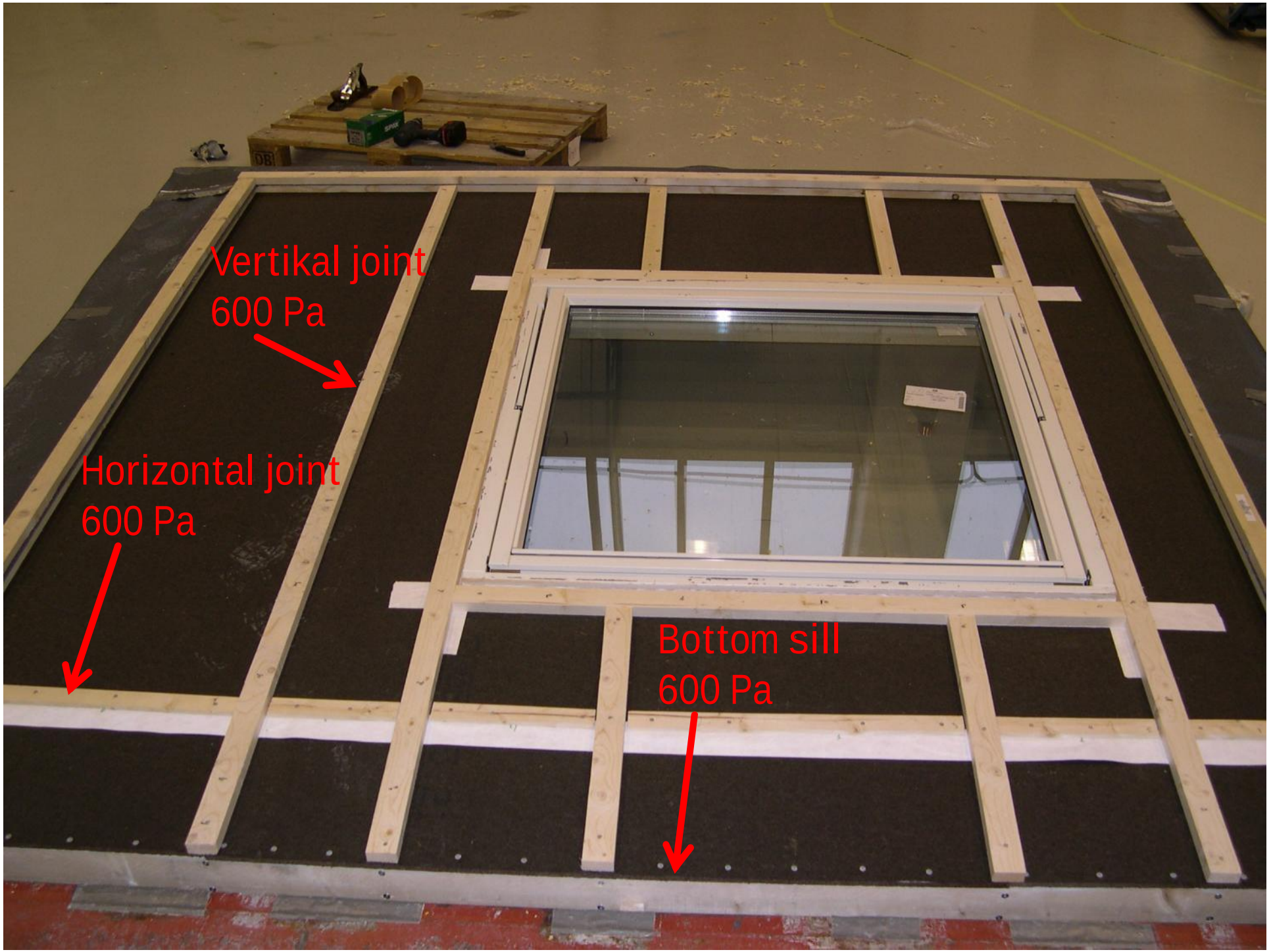
- Asphalt impregnated fiber board
- Gypsum board
- Nonwoven spun bond plastics

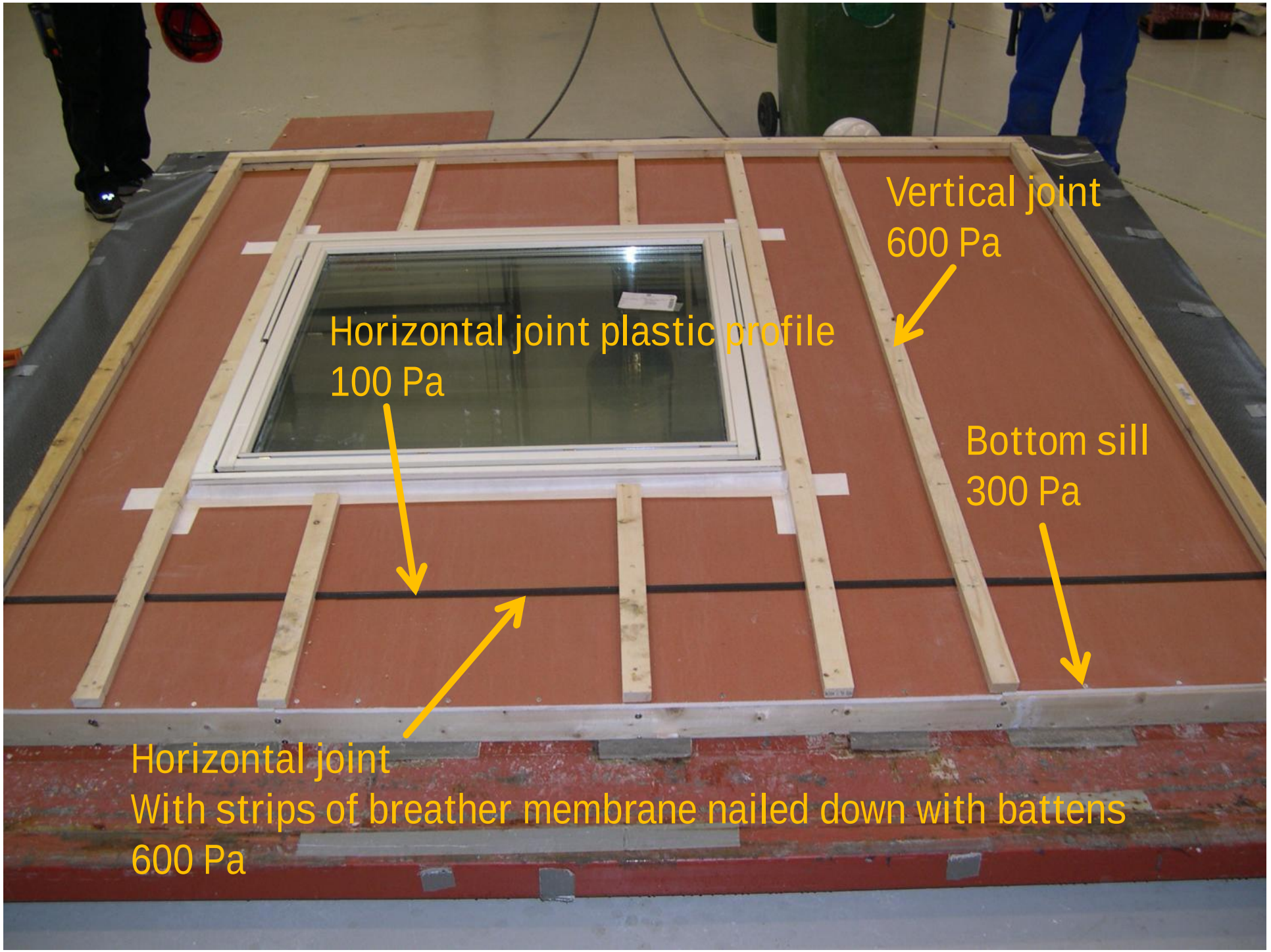
Sealing methods

- Strips of nonwoven nailed down with battens
- Sealing compound of acrylic paste
- Expanding sealing tape
- Adhesive tape / adhesive nonwoven
- Adhesive bitumen membrane



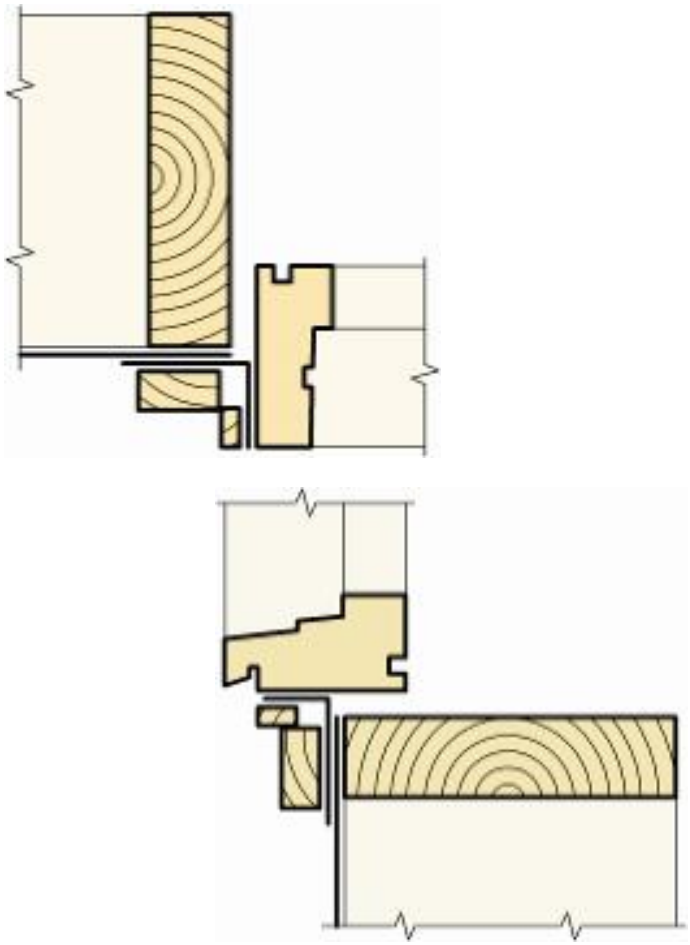



Vertikal joint
600 Pa
Horizontal joint
600 Pa
Bottom sill
600 Pa

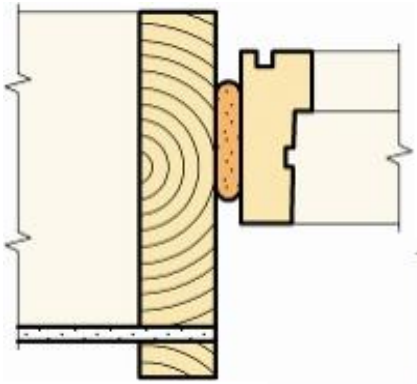

Vertical joint
600 Pa
Horizontal joint plastic profile
100 Pa
Bottom sill
300 Pa
Horizontal joint
With strips of breather membrane nailed down with battens
600 Pa

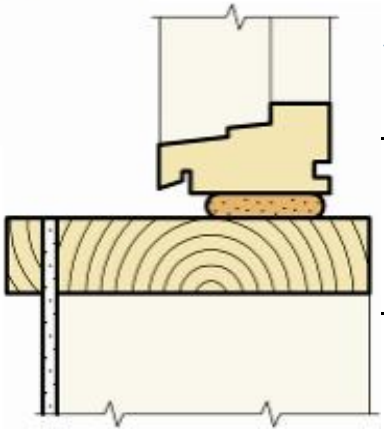

Vertical joint
600 Pa
Horizontal joint
600 Pa
Bottom sill
450 Pa

Strips of nonwoven nailed down with battens



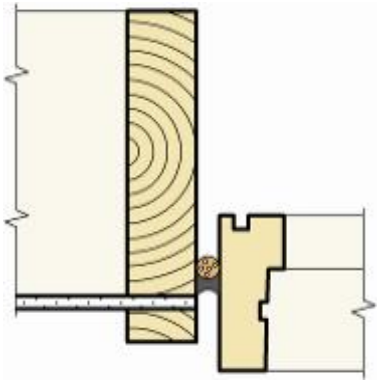
Wind barrier	Rain tighness in Pa			
	corner	under	above	side
Fibre board	0	0	0	600
Fibre board	50	0	100	250
Gypsum board	150	150	0	150
Nonwoven	0	0	0	600

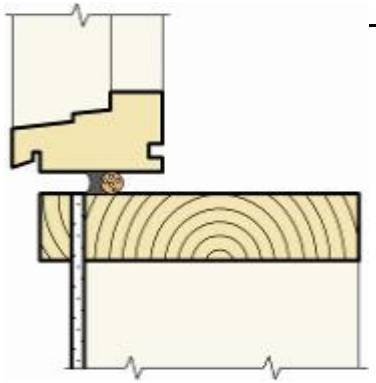




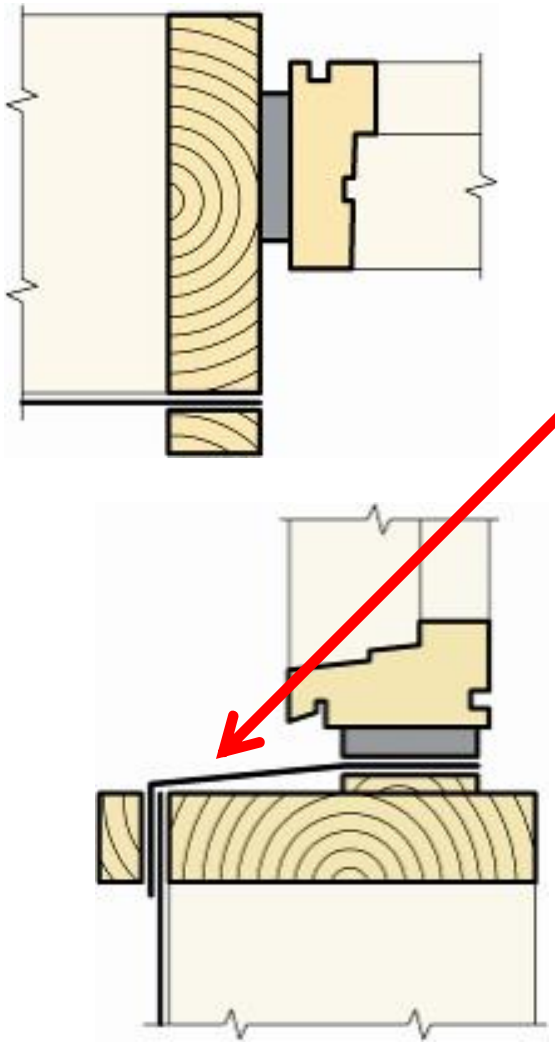
Polyurethane foam
Sealing compound of acrylic paste

	Rain tighness in Pa			
	corner	under	above	side
Polyurethane foam	200	50	600	200
Sealing compound	400	400	100	400



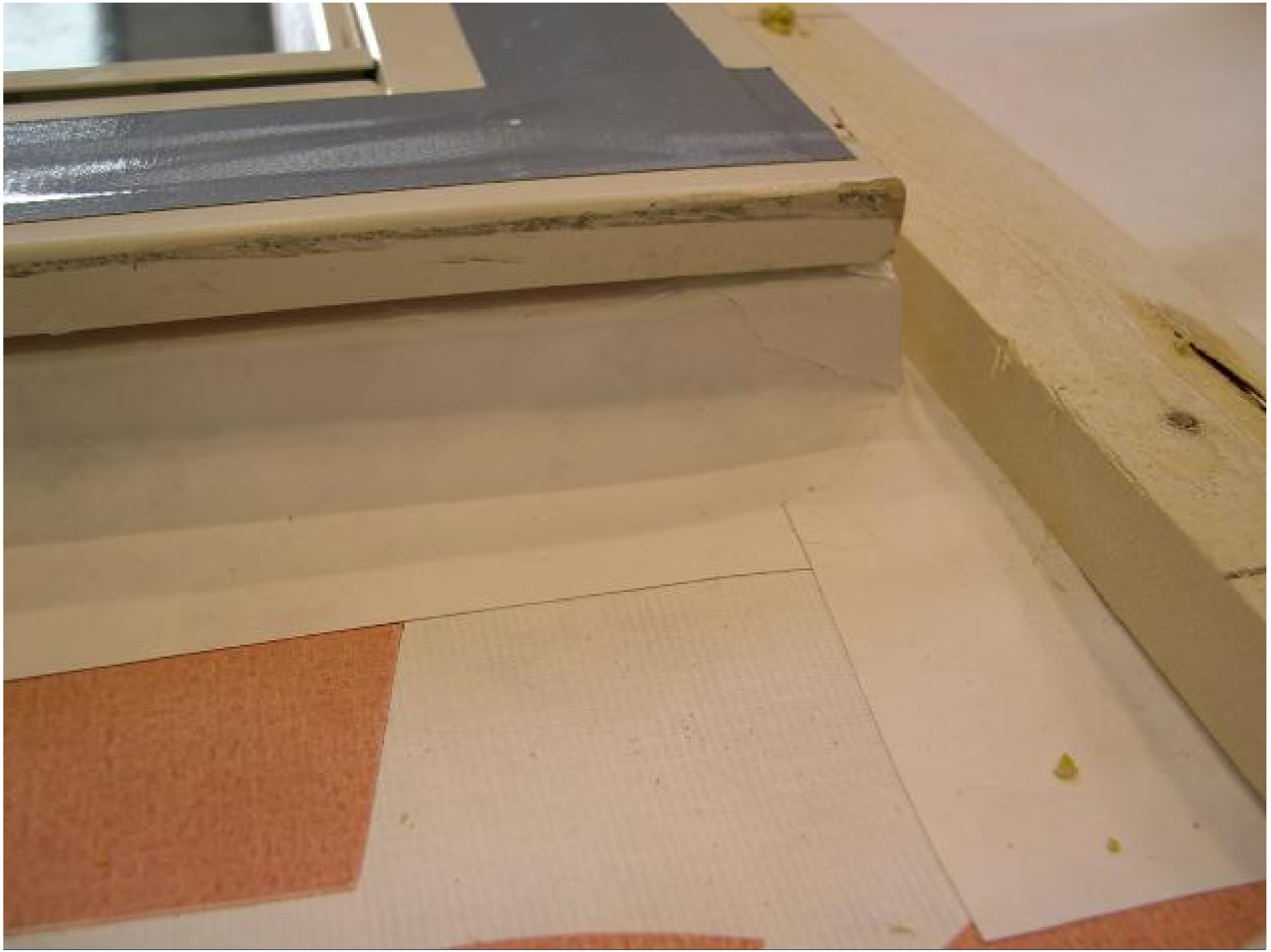


Expanded sealing tape

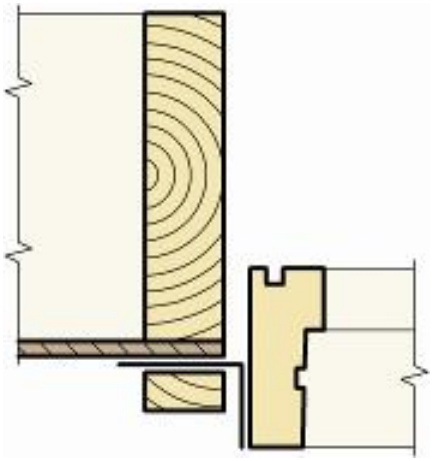


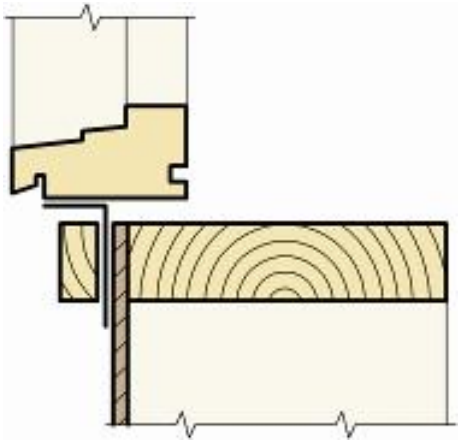
	Rain tighness in Pa			
	corner	under	above	side
Expanded sealing tape	100	50	600	600
With mambrane		(600)[1)]		
With rain shield	600	600	600	600
Expanded sealing tape	600	150	600	600
Without membrane				
With rain shield	600	600	600	600

[1)] Under the membrane



Adhesive tape



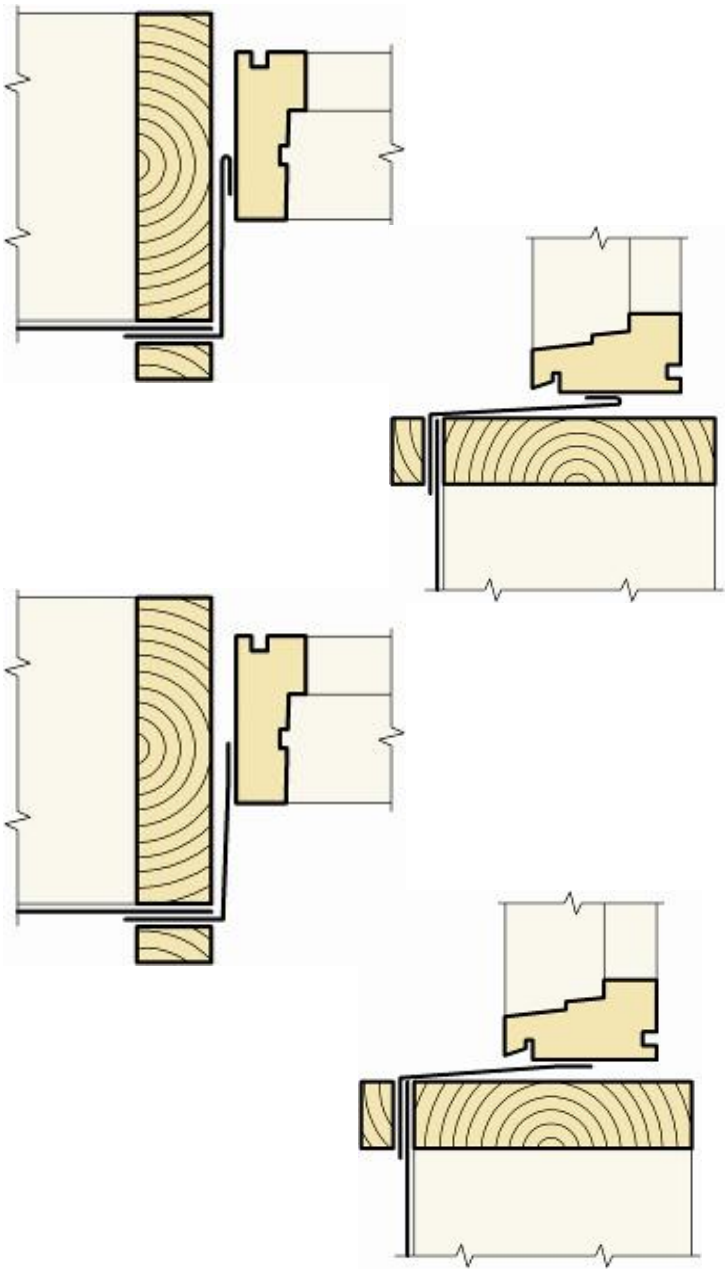


Wind barrier	Rain tighness in Pa			
	corner	under	above	side
Fibre board	150	600	600	600
Gypsum board	150	250	200	600
Nonwoven	150	600	600	600


Hex
Isola
0839


DuPont™
FlexWrap

3M
Flashing Tape 8067
All Weather
3M
Flashing Tape 8067
3M
All Weather
3M
Flashing Tape 8067



Adhesive bitumen membrane

Strips of nonwoven

Wind barrier	Rain tighness in Pa			
	corner	under	above	side
Nonwoven	600	600	600	600
Nonwoven	600	600	600	600
Nonwoven	600	600	600	600

Wind barrier, conclusion

Vertical joints

- Battens nailed down over the joints give good tightening
- Unevenness under battens give leakages were vertical joints end over the window or end in horizontal joints
- Bad placing of nails may give early but relatively small leakages

Horizontal joints

- Battens nailed down over the joints give good tightening
- Plastic profiles in joints give relatively good tightening
- Bad placing of nails may give early but relatively small leakages

Recommendation

- Rain tightness of wind barrier layer minimum 300 Pa.
  This corresponds with details described in SINTEF design sheets

Sealing of window joints, conclusion

Strips of nonwoven nailed down with battens

- Have been used for decades
- Poor tightening and not suitable when window assembled deep in wall

Expanding sealing tape, polyurethane foam, sealing compound

- Rain tight at minimum 50 Pa
- Timber frame and board edges exposed for rain
- Timber frame underneath window has to be protected with membrane

Adhesive Tape and strips of adhesive nonwoven or bitumen

- Rain tight at minimum 150 Pa
- Several test sections rain tight at minimum 600 Pa
- Suitable when window assembled deep in wall

Adhesive tape and durability

- Adhesive tape has earlier not been recommended due to insufficient documentation of durability
- Several products are now tested and can document lasting adhering
- Adhesive tape has to document good long term adhering to the current materials used