Canada

Research & Development Highlights

Technical Series
91-202

Airtightness Testing of Air Barrier Connection Techniques

Introduction

The creation of an effective air barrier requires the creation of an airtight seal between individual elements of the air barrier (for example, individual sheets of gypsum board). This seal must remain intact under temperature and pressure conditions which can vary depending on where the air barrier is located. lf the air barrier is located on the room side of the insulating material, the temperature will remain fairly constant at around 20°C. If the air barrier is located on the exterior side, however (water-resistant drywall or Tyvek, for example), the temperature may vary from *-20°C* in winter to *65°C* in summer.

Since temperature has a direct effect on strength, adherence and connection creep, it is essential to take this factor into consideration in selecting air barrier materials. Canada Mortgage and Housing Corporation (CMJbIC) therefore commissioned a study of the behaviour of several air barrier connection techniques when submitted to a pressure differential and extremes of temperature over a prolonged period.

Test Program

In all, 23 assemblies were tested. Each was exposed to **a** pressure differential of 150 Pa for five months. Testing took place at -200C, 200C or *650C*, depending on the nature of the elements of the system and the position of the air barrier in the wall.

Results

The amount of deterioration for each of the assemblies tested is indicated by the increase in air leakage from the beginning of the test to the end. Detailed results appear in the following table. Air leakage, expressed in cubic metres of air per metre length of joint per hour (m'/h-m), was measured under a pressure differential of 75 Pa.

None of the samples tested at -20'C suffered damage or lost airtightness. At 200C, the test samples with open cell gaskets, sheet type air barriers or mineral wool improved their airtightness due **to** an accumulation of dust on or within the joints. Test samples with closed cell backer joints and EPDM gap gaskets lost part of their tightness due **to** greater losses at the joint ends due to shrinkage. At *650C*, the spun bounded olefin paper was completely torn offits staples, causing it to completely lose its airtightness.

The acrylic sealing joint samples were extensively damaged. All the joints cracked and one of the 12.7 mm (1/2") joints popped out completely over several centimetres. It was not possible **to** take a final airtightness measurement on this sample.

Materials or Assemblies Tested

No	Material Description	Air leakage before testing mu/h~m* at 75 Pa	Air leakage after testing m3lh~m* at 75 Pa	Change in air leakage
1	Closed ceii backer rod (initial compression = 30%)	0.0756 (200C)	0.0777	+3%
2	Closed cell backerrod (initial compression = 50%)	0.0437 (2000)	0.0749	+71%
3	Open cell backer rod (initial compression = 50%) Open celi gasket (compression = 20%)	23.90 (2000)	21.86	-8.5%

'cubic metres ofair per metre length of joint per hour

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MaterIals or Assemblies Tested

No	Material Description	Air leakage before testing ms/h~m* at 75 Pa	Air leakage after testing m/h~m* at 75 Pa	Change in air leakage
		‘cubic metres of air per metre length of joint per hour		
4	Open cell gasket (compression = 40%)	12.75 (20 0C)	11.78	-8%
5	Mineral wool (width = 12.7mm [1/21) (low compaction density)	14.11 (200C)	14.11	0%
6	Mineral wool (width = 12.7 mm [1/21) (average compaction density)	5.232 (200C)	5.05	-3.5%
7	Mineral wool (width = 12.7 mm [1/21) (high compaction density)	1.706 (200C)	1.743	+2%
8	Polyethylene + mineral wool (12.7 mm [1/21)	0.5888 (200C)	0.5647	-4%
9	EPDM gap gasket (12.7 mm [1/21)	0.0638 (200C)	0.0787	+23%
10	Wood - urethane (12.7 mm [1/21)- aluminium	0.0602 (200C)	0.0599	-0.5%
11	Adhesive tape on water resistant drywall joints (Spacing = 12.7 mm [1/21)	(11-1) 0 (-200C) (11-2) 0 (650C)	(11-1) 0 (11-2) 0	
12	Adhesive tape on water resistant drywall joints (Spacing = 6.35 mm [1/41)	(12-1) 0 (-200C) (12-2) 0 (650C)	(12-1) 0 (12-1) 0	
14	Adhesive tape on spun bonded olefin paper joints	(14-1) 0.0276j200C) (14-2) 0.0315 (-200C) (14-3) 0.02586 (650C)	0.0252 0.0307 Nil Tightness	-9% -2% _
15	Adhesive tape on perforated polyethylene air barrier joints	(15-1) 0.7740 (200C) (15-2) 1.5452 (-200C) (15-3) 3.1669 (650C)	0.5276 0.5257 2.2351	-32% -66% -23%
16	Interior sealant joints (Acrylic) - width = 6.35 mm (1/4”) - wood-sealant-aluminium -backer rod	0 (200C)	0	
17	interior sealant joints (Acrylic) - width = 12.7 mm (1/2”) - wood-sealant-aluminium - backer rod	0 (200C)	0	
18	Interior sealant joints (Silicone) - width = 6.35 mm (1/4”) - wood-sealant-aluminium - backer rod	0 (200C)	0	
19	interior sealant joints (Silb,ne) - width = 12.7 nTn (1/Z’) - wood-sealant-aluminium - backer rod	0 (200C)	0	

Materials or Assemblies Tested

No	Material Description	Air leakage before testing nWh-m' at 75 Pa	Air leakage after testing mllh~m* at 75 Pa	Change in air leakage
		'cubic metres of eir per metre length ofjoint per hour		
20	Exterior sealant joints (Acrylic) - width =6.35 mm (1/4'~ - wood-sealant-aluminium - backer rod	(20-1) 0 (~200C)	0	
		(20-2) 0 (6500)	0.9998	
21	Exterior sealant joints (Acrylic) - width = 12.7 mm (1/2") - wood-sealant-aluminium - backer rod	(21-1) 0 (-20CC)	0	
		(21-2) 0 (650C)	Nil Tightness	–
22	Exterior sealant joints (Silicone) - width = 6.35 mm (1/4") - wood-sealant-aluminium -backer rod	(22-1) 0 (-20CC)	0	
		(22-2) 0 (6500)	Q	
23	Exterior sealant joints (Acrylic) - width = 0 - waferboard -sealant on surface of waferboard	(23-1) 0 (-20CC)	0	
		(23-2) 0 (65CC)	0	
24	Exterior sealant joints (Acrylic) - width = 3.18 mm (1/8") - waferboard-sealant—waferboard	(24-1) 0 (-20CC)	0	
		(24-2) 0 (6500)	0	

Conclusions

Silicone base sealant and the adhesive tape showed perfect adherence qualities whatever the conditions.

The spun bonded olefin paper and acrylic base sealant should not be used at connections where the temperature may be high. Spun bonded olefin paper should not be attached with staples if it is expected to act as an air barrier.

Given their high permeability, open cell gaskets, mineral

Project Manager: Jacques Rousseau

Research Report: Air Tightness Tests on Components Used to Join Different or Similar Materials of the Building Envelope

Research Consultant: Air-Ins Inc.

Afull report on this research project is available from the Canadian Housing Irjformation Centre at the address below.

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