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Data needs to be ... #5848

AIR LEAKAGE RESISTANCE OF NEW ZEALAND BUILDING MATERIALS

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SUMMARY

This report presents the results of a series of measurements of air leakage resistance of 60 New Zealand building materials.

A discussion of the air leakage resistance of materials is given. This primarily makes a comparison between the air leakage resistance of the varieties of common building materials available in the New Zealand market.

A dicussion of the effects of paint coatings and other details on the air leakage resistance of building materials based on the values reported is described.

This data is not expected to be immediately useful to building designers. However, as future investigation yields more information about air leakage control, it is expected that the data will become increasingly useful.

INTRODUCTION

This report summarises the results of a series of measurements on the air leakage resistance of common New Zealand building materials. It must be emphasised that there are no "good" or "acceptable" values - requirements depend on the application. Trade names are used to aid identification and do not signify either approval or criticism of the products.

Air leakage resistances have been reported in MNs/m^3.

Values of air leakage resistance were calculated using Equation 1. These values were reported to the nearest significant figure.

Measurements were made under "air-dry" conditions. The trade name and surface conditions of samples are given together with the air leakage resistance. In some cases, leakage of moistened samples was also made, and this increased the resistance, but not markedly so (except probably for concretes or ceramics).

The magnitude of the numbers gives a measure of the air leakage resistance. Figure 1 showed the air leakage resistance spectrum.

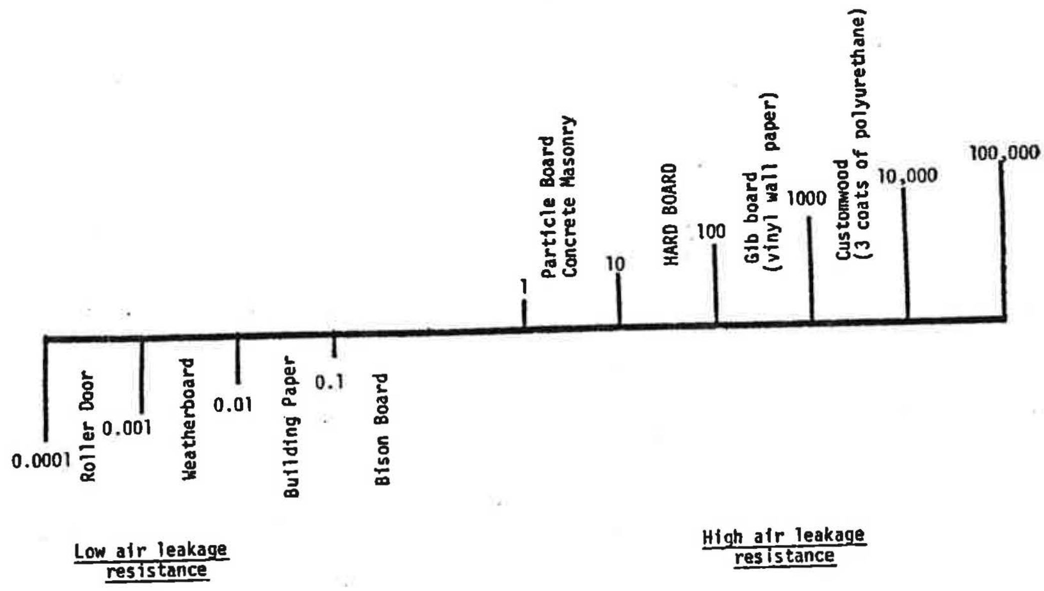


FIG. 1 . Illustrating the scale of air leakage resistance values (MNs/m^3), with typical examples

Air leakage resistance

The air leakage flow through a material is defined by Equation 1.

$$Q = \frac{A.\ \ P}{R} \quad 10^6 \qquad \frac{m^3}{s} \qquad (1)$$

where

R represents the air leakage resistance in MNs/m^3

A represents the area of material in m^2

P represents the pressure difference across material in N/m^2

Q represents the volume flow rate of air through the material of area A.

Example:

A lining material has an air leakage resistance of 180 MNs/m^3. If the wind speed is 40 km/h, the pressure difference across the material thickness would be, say, 85 N/m^2.

For a surface area of 1.0 m^2, the air leakage rate would be:-

$$\frac{1.0 \times 85}{180 \times 10^6} \qquad m^2 \quad \frac{N}{m^2} \qquad \frac{m^3}{Ns}$$

$= 4.6 \times 10^{-7}\ m^3/s$ or 4.6×10^{-4} l/s or $1.3.10^{-1}$ l/hour

or about a cupfull per hour.

Discussion

The main purpose of this survey was to establish a data base to enable a comparison between the air leakage resistance of the various buildings and materials, and the relative importance of face leakage and crack leakage.

Regarding paint coatings, the following points should be noted.

1. A first coat often increases air leakage resistance only moderately. Further coats often have sharply increased effect.

2. Two or more coats of polyurethane varnish will increase the air leakage resistance by a substantial amount (2 or 3 orders of magnitude).

3. Oil-based (or water based) paint usually increases in air

leakage resistance by less than 1 order of magnitude.

4. PVA-copolymer based paints increase the air leakage resistance of building materials by approximately 1 order of magnitude.

It can be concluded that for very porous lining materials, it is immaterial whether the joints are "tight" and sealed. This fact is confirmed for Rocboard ceiling tiles and Pinex ceiling tiles.

The following conclusions are indicated by the results obtained for weather boards.

(1) The air leakage resistance of rusticated weatherboards can be increased by 2 orders of magnitude by good fixing procedures and paint coatings.

(2) Bevel back weather lap has a higher air leakage resistance than rusticated weather lap.

The air leakage resistance of roller door (normally used in workshops and garages) is very low.

<u>Paint systems used</u>

1. Polyurethane varnish

2. Hi-gloss house paint (Dulux)

3. Ultra-flat plastic paint (Berger)

4. Dulux "Spring" (PVA copolymer based)

5. Dulux "Vinyl Satin Plastic" (PVA copolymer based)

6. Dulux "Firebrake" (PVA copolymer based)

7. Dulux (Superseal) (Oil varnish based)

8. Dulux "Spruce" (acrylic copolymer)

TABLE 1

AIR LEAKAGE RESISTANCE OF BUILDING MATERIALS

	Ra MNs/m^3
MEMBRANES	
1. Building paper (dry)	0.003-0.8
2. Building paper (damp)	0.1
3. Roofing felt	4.0
BOARDS	
Particle board	
Low density - 10mm	
(a) Uncoated	0.10
Medium density - 12mm	
(a) Uncoated	2.0
(b) 2 coats of polyurethane varnish	7 500
Flooring grade - 19mm	
(a) Uncoated	5.0
(b) 1 coat of polyurethane varnish	6.0
(c) 3 coats of polyurethane varnish	100 000
Bison board - 5mm	
(a) Uncoated	0.1
(b) 2 coats of polyurethane	1400
Custom wood	
(a) Not coated	0.4
(b) 2 coats of polyurethane varnish on one side only	2200
(c) 4 coats of polyurethane varnish	6500
Hard board 4.5mm	
(a) Uncoated	20
(b) 2 coats of glossy paint	20
(c) Oil-tempered hard board	130

Plywood

Interior grade 4.5mm

(a)	Uncoated	30	
(b)	1 coat of polyurethane	180	

Exterior grade 5.5mm

(a)	Uncoated	700	(?)
(b)	1 coat of acrylic paint	700	

Construction ply 7.5mm

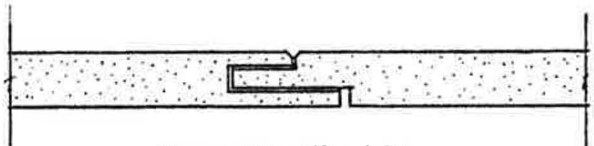
(a)	Uncoated	90
(b)	2 coats of glossy paint	1200

Hardiflex Asbestos Cement Board

(a)	Uncoated	20
(b)	3 coats water based epoxy paint on one side only	180
(c)	Dulux "Spring" paint - 2 coats on one side only	1200
(d)	2 coats Vinyl Satin Plastic	850
(e)	Dulux "Spruce" paint - 2 coats on one side only	2700
(f)	2 coats acrylic paint	410

Pinus Soft Board

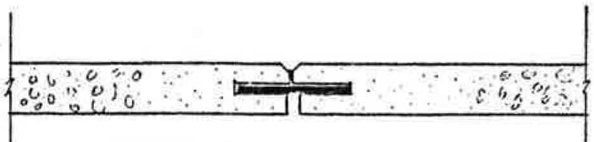
(a)	Whole board	2.0
(b)	Jointed ceiling tiles	0.03



Pinex ceiling tiles joint

Rocboard

(a)	Prepainted, jointed	0.03
(b)	As (a) joint sealed with vaseline	0.03



Rocboard ceiling tiles joint

Gibraltar board

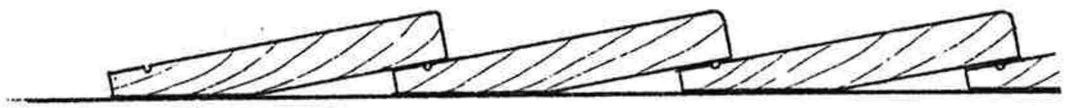
(a)	Uncoated	7.0
(b)	Single-sided foil gib board	75
(c)	Single-sided foil plus 1 coat acrylic paint on the other	70
(d)	Vinyl wall paper on one side	420
(e)	Muralflex painted one side only	3700
(f)	1 coat Dulux Superseal 1 coat Firebrake 1 coat Vinyl Satin Plastic	1100
(h)	Artex (trowelled) finish	7.0
(i)	1 coat acrylic paint on one side only	9.0
(j)	3 coats acrylic paint	11.0

Glass fibre reinforced Plaster Board

(a)	1 coat Dulux Superseal 1 coat Dulux "Spruce"	60
(b)	Vinyl Satin Plastic on one side only	600

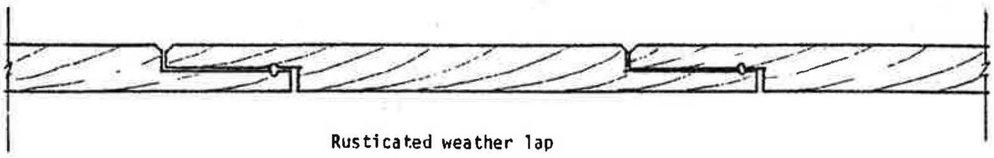
Lapped weatherboards

(a)	Pine, primer, 2 coats oil-based exterior paint	0.16



Bevel back weather lap

(b)	Pine, primer, 2 coats of exterior oil-based paint. Rusticated weather lap	0.005
(c)	Cedar, unpainted. Rusticated weather lap.	0.006
(d)	Pine, unpainted, clamped. Rusticated weather lap.	1.0



Rusticated weather lap

EXPANDED POLYSTYRENE 11.5mm	0.02
BUTYNOL	
(a) 1mm	4500
(b) 1.5mm	1600
CONCRETE MASONRY (This applies to slabs made from same mix as concrete blocks and not to concrete blocks proper)	
(a) "Low quality" - 40mm	3.2
(b) "High quality" - 40mm	7.0
ROLLER DOOR	0.0001-0.0003
STEEL PLATE	100 000