Air Leakage Test Utilising The General Principles of BS 476: Part 31, Section 31.1: 1983, on Two Similar Letterplates Incorporated Within a Sample Section of Door Leaf

Test Sponsor

Firestop Intumescent Services

THE PROFESSIONALS IN FIRE SAFETY •

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Holmesfield Road, Warrington, UK WA1 2DS • Tel: 01925 655116 • Telex 628743 WARRES G • Fax: 01925 655419

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Air Leakage Test Utilising The General Principles of BS 476: Part 31, Section 31.1: 1983, on Two Similar Letter Plates Incorporated Within a Sample Section of Door Leaf

Test Sponsor

Report	Name	Signature*
Responsible Officer	S. Hankey	S. Hankey
Approved	C. W. Miles	

* For and on behalf of Warrington Fire Research Centre

Report Issued : 4th November 1997

Air Leakage Test Utilising The General Principles of BS 476: Part 31, Section 31.1: 1983, on Two Similar Letterplates Incorporated Within a Sample Section of Door Leaf

Summary

Two similar specimens of letterplates incorporated within a sample section of door leaf have been subjected to a test utilising the principles of BS 476: Part 31, Section 31.1: 1983.

The sample section of door leaf had overall nominal dimensions of 1000 mm high by 1000 mm wide and incorporated two apertures, each fitted a similar letterplate system. The letterplates differed in that Specimen 'A' incorporated a brass letter flap and Specimen 'B' incorporated an Aluminium letter flap.

The specimen was face fixed to a plywood faced, timber studded partition to form the test construction.

The results obtained were as follows:

Pressure (Pa)	Specimen A Air Leakage (m^3/h)	Specimen B Air Leakage (m^3/h)
-100	0.17	0.24
-70	0.07	0.09
-50	0.12	0.19
-30	0.05	0.12
-25	0.05	0.10
-20	0.07	0.26
-10	0.07	0.07
-5	0.12	0.05
0	0.00	0.00
5	0.16	0.06
10	0.22	0.15
20	0.19	0.24
25	0.10	0.12
30	0.19	0.14
50	0.19	0.24
70	0.19	0.33
100	0.21	0.26

Date of Test : 24th September 1997

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CONTENTS

1 Purpose of the Test

1.1 To determine the air leakage through two similar letterplate assemblies fitted within a sample section of doorleaf utilising the general principles of BS 476: Part 31, 'Methods for measuring smoke penetration through doorsets and shutter assemblies', Section 31.1: 1983, 'Method of measurement under ambient temperature conditions'.

2 Introduction

2.1 Guidance with respect to the performance of fire doors required to resist the passage of smoke at ambient temperature conditions is given in Amendment 6160, October 1993 to BS 5588: Parts 2, 3, 6 and 10: 1983.

2.2 Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group has identified a number of such areas and has agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Group. Where such Resolutions are applicable to this test they have been followed.

2.3 The test was conducted on the 24th September 1997, at the request of Firestop Intumescent Services, the sponsor of the test.

3 Test Specimen Construction

3.1 A comprehensive description of the test construction is given in Annex A. The description is based on a detailed survey of the specimen and information supplied by the sponsor of the test.

3.2 The specimen was supplied by the test sponsor on the 22nd September 1997. Warrington Fire Research Centre was not involved in any selection or sampling procedures of the specimen or any of the components.

3.3 The partition was supplied by Warrington Fire Research Centre on the 22nd September 1997. The specimen was installed within the partition on the 22nd September 1997 by representatives of Warrington Fire Research Centre.

4 Instrumentation and Measuring Equipment

4.1 The test was conducted utilising the general procedures specified in BS 476: Part 31: Section 31.1: 1983.

4.2 Each letterplate was completely sealed and the differential pressures were applied and the leakage measured, this being the designated rig leakage. The letterplate was then unsealed and the leakage measured at the same differential pressures. The above procedure was then repeated with the air flow in the opposite direction.

4.3 The readings were corrected for each leakage measurement to a reference temperature of 20°C and standard atmospheric pressure (1 atmosphere equals 101325 Pa) utilising the following formula:

$$Q = Qa \times \frac{(Pa + p)}{101325} \times \frac{293.15}{(Ta + 273.15)} \times 1 - 0.3795 \times \frac{Mw}{100} \times \frac{Es}{Pa + p}$$

Where Q = Adjusted rate of air flow (m^3/h)

Qa = Measured rate of airflow (m^3/h)

p = Pressure increase (Pa)

Pa = Barometric Pressure (Pa)

Ta = Air temperature (°C)

Mw = Relative Humidity (%)

Es = Saturated water vapour pressure (Pa)

5 Test Procedure

5.1 The following data, which was recorded during the test, is given in Annex B:

5.1.1 Table of the net leakages through the specimen at specified pressure differentials.

5.1.2 Graph of the net leakages through the specimen at specified pressure differentials.

5.2 The ambient air temperature in the vicinity of the test construction was 20°C at the start of the test with no variation during the test.

5.3 The relative humidity in the vicinity of the test construction was 46% at the start of the test with no variation during the test.

6 Test Data and Information

6.1 Guidance with respect to the performance of fire doors required to resist the passage of smoke at ambient temperature conditions is given in Amendment 6160, October 1993 to BS 5588: Parts 2, 3, 6 and 10: 1983. This states:

'A fire door required to resist the passage of smoke at ambient temperature conditions should, when tested in accordance with BS 476: Section 31.1 with the threshold taped and subjected to a pressure of 25 Pa, have a leakage not exceeding 3 $m^3/m/h$.'

Since it is unfeasible to calculate the leakage of the tested specimen in terms of $m^3/m/h$ due to there being no obvious perimeter door gap length. In the absence of other criteria, the net air leakage has been calculated in terms of m^3/h for a range of differential pressures and are detailed in the table below.

7 Conclusions

7.1 Two similar specimens of letterplates incorporated within a sample section of doorleaf have been subjected to a test utilising the general principles of BS 476: Part 31, Section 31.1: 1983.

7.2 The results obtained were as follows:

Pressure (Pa)	Specimen A Air Leakage (m^3/h)	Specimen B Air Leakage (m^3/h)
-100	0.17	0.24
-70	0.07	0.09
-50	0.12	0.19
-30	0.05	0.12
-25	0.05	0.10
-20	0.07	0.26
-10	0.07	0.07
-5	0.12	0.05
0	0.00	0.00
5	0.16	0.06
10	0.22	0.15
20	0.19	0.24
25	0.10	0.12
30	0.19	0.14
50	0.19	0.24
70	0.19	0.33
100	0.21	0.26

8 Limitations

8.1 The results relate only to the behaviour of the specimens under the particular conditions of test.

8.2 The test results relate only to the specimen tested. Application of the results to specimens of different dimensions or incorporating different components should be the subject of a design appraisal.

9 Review

9.1 The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

4th November 1997

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ANNEX A

SCHEDULE OF COMPONENTS
(Refer to Figure 1)
(All values are nominal unless stated otherwise)
(All other details are as stated by the sponsor)

SPONSORS REFERENCE :- MAP Hardware Limited Letterplate system incorporating an Intumescent lining manufactured by Firestop Intumescent Services, and fitted within a section of door leaf supplied by 'STP' (Bristol).

Item	Description

Letterbox, as supplied by MAP Hardware Limited and comprising of items 1 to 5 :-

1. **Letter box moulding (Specimen A and B)**

Material	:	Acrylonitrile Butadiene Styrene (ABS).
Thickness (of each sleeve)	:	2.5 mm approximately.
Length of sleeves (see Figure 1)		
i) inner sleeve	:	38 mm.
ii) outer sleeve	:	28 mm.
Overall sizes	:	See Figure 1.
Fixing method		
i) mouldings together	:	Manufactured as two telescopic sleeve sections with the inner sleeve being a sliding fit in the outer sleeve to suit the door leaf thickness.
ii) mouldings to door leaf	:	Steel screws (item 5).

2. **Letter box flaps**

Material		
i) for specimen A	:	Brass.
ii) for specimen B	:	Aluminium.
Thickness		
i) brass	:	1 mm.
ii) aluminium	:	1.8 mm.
Overall size (typical)	:	247 mm long x 65 mm deep.

3. **Flap pins (Specimen A and B)**

Material	:	Acetal.
Diameter	:	3.9 mm diameter across retaining peg.
Length	:	100 mm (each pin).
Quantity	:	2 No. pins per flap.

4. **Weatherstrip seal (Specimen A and B)**

Reference	:	SL-05.
Material	:	T.P.R.
Fixing method	:	Glued.

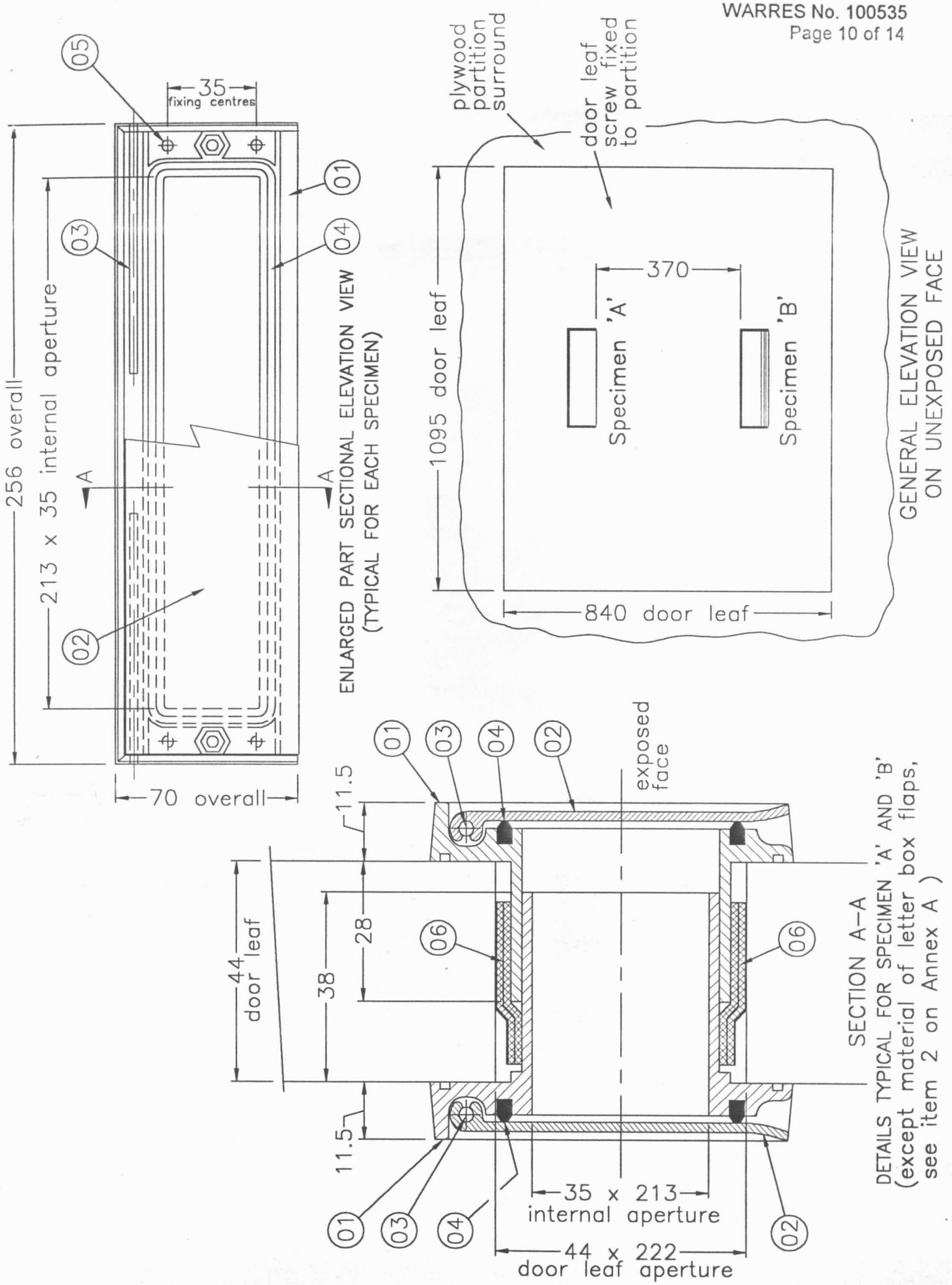
Annex A (Continued)

5. **Letter box fixings to door leaf (Specimen A and B)**

Type	:	Round head woodscrews.
Material	:	Mild steel.
Size	:	20 mm long.
Quantity	:	4 No. screws at each face of door leaf at positions shown on Figure 1.

6. **Intumescent Lining (Specimen A and B)**

Manufacturer	:	Firestop Intumescent Services.
Reference	:	Firestop Intumescent Lining.
Material		
i) intumescent layers	:	Graphite compound.
ii) outer foil	:	Aluminium.
Thickness		
i) intumescent layers	:	1.8 mm (each layer)
ii) outer foil	:	40 microns.
Width of lining	:	33 mm.



All dimensions are in mm.
See Annex A for schedule.
Do not scale

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FIGURE 1

ANNEX B

DATA RECORDED DURING THE TEST

TABLE 1

RECORDED NET AIR LEAKAGES 'SPECIMEN A'

Pressure (Pa)	Net Air Leakage (m^3/h)
-100	0.17
-70	0.07
-50	0.12
-30	0.05
-25	0.05
-20	0.07
-10	0.07
-5	0.12
0	0.00
5	0.16
10	0.22
20	0.19
25	0.10
30	0.19
50	0.19
70	0.19
100	0.21

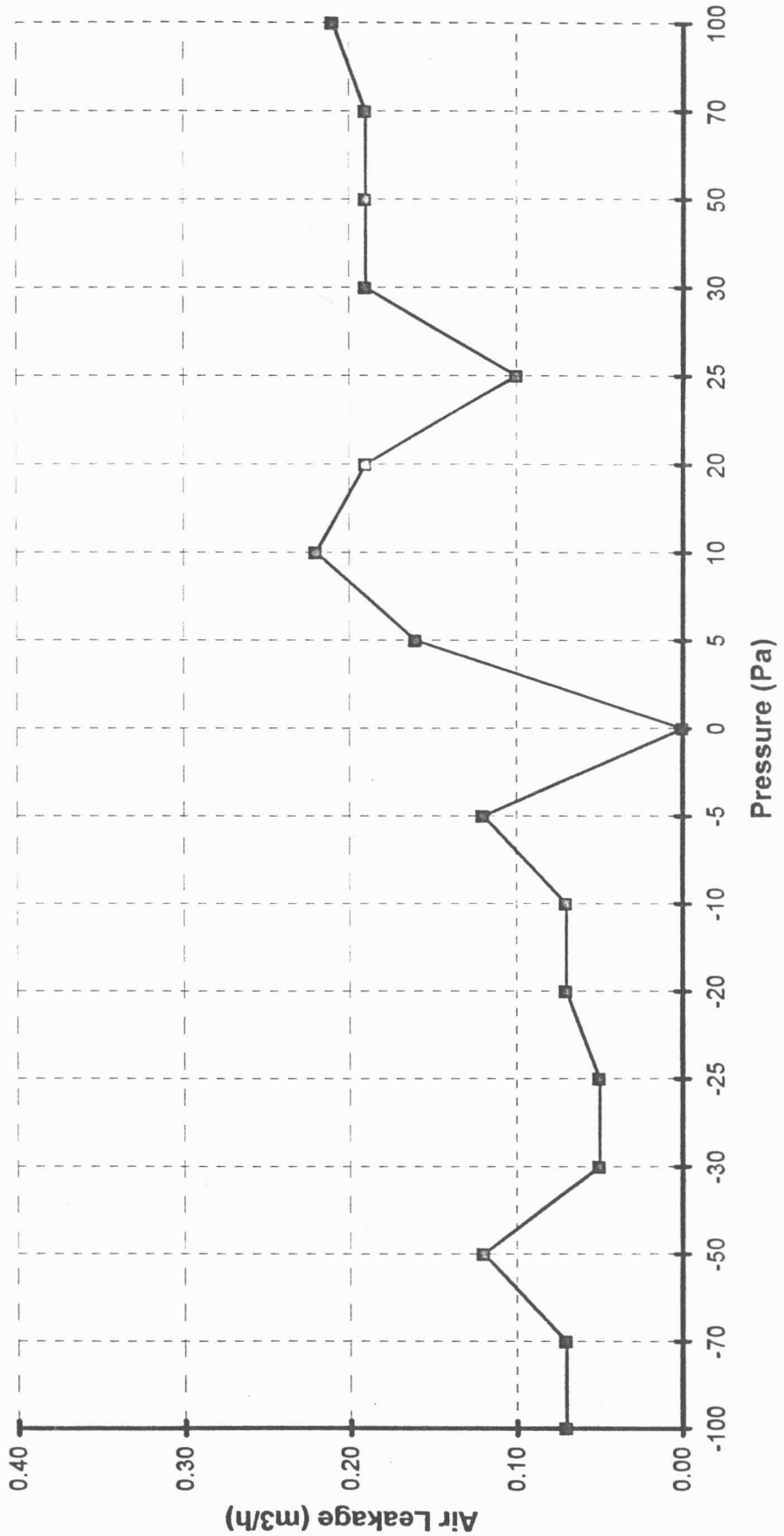

Figure 2. Net Air Leakage of Specimen 'A'

Annex B (Continued)

TABLE 2

RECORDED NET AIR LEAKAGES 'SPECIMEN B'

Pressure (Pa)	Net Air Leakage (m^3/h)
-100	0.24
-70	0.09
-50	0.19
-30	0.12
-25	0.10
-20	0.26
-10	0.07
-5	0.05
0	0.00
5	0.06
10	0.15
20	0.24
25	0.12
30	0.14
50	0.24
70	0.33
100	0.26

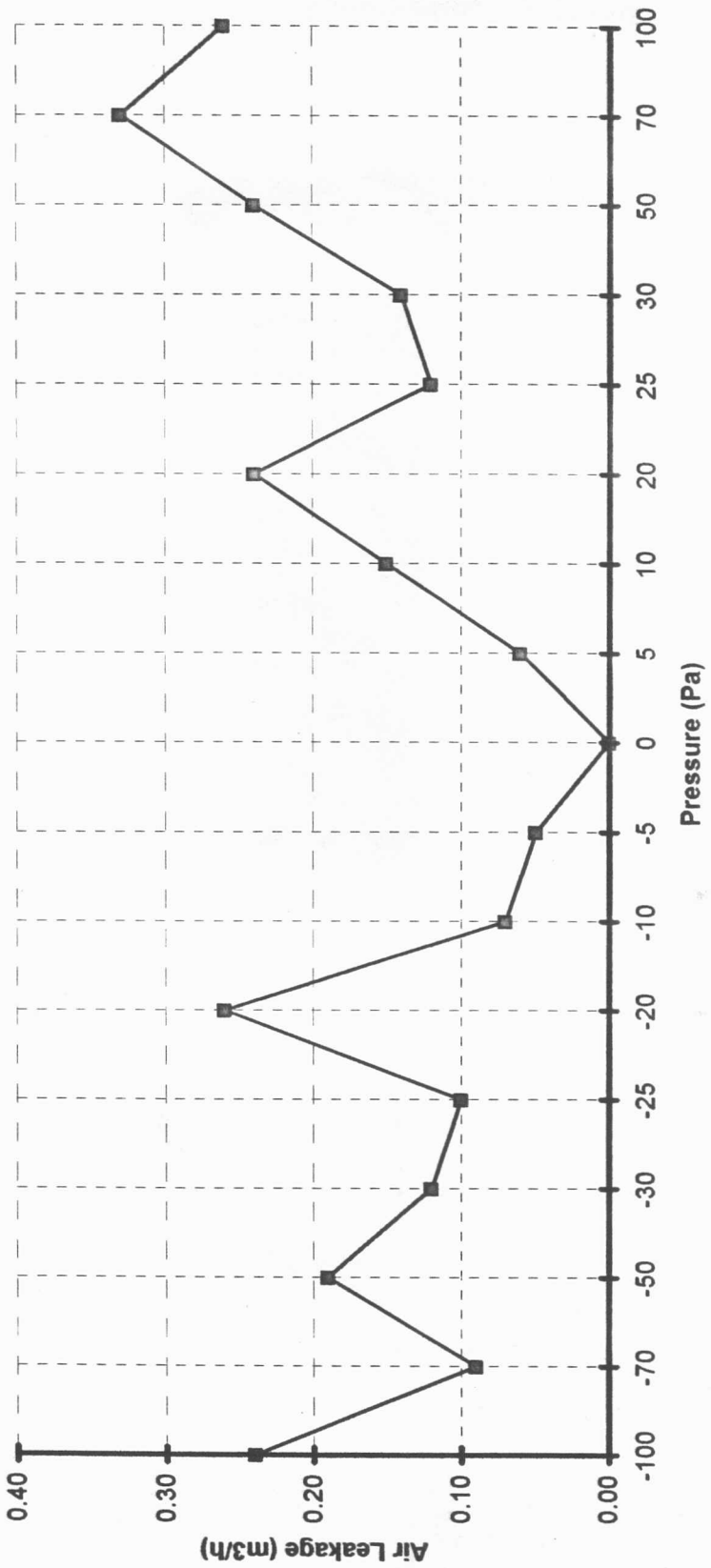

Figure 3. Net Air Leakage of Specimen 'B'