



Universitat de Girona

Departament d'Enginyeria
Industrial

This report is developed after carrying out the corresponding trials established in the scientific collaboration agreement of mechanic-fluid behavior of rectangular airflow ducts.

TECHNICAL REPORT

REQUESTER

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TRIAL OBJECTIVE

Determining the rigidity of a sheet sample for the manufacturing of airflow ducts commercially named "PIR-ALU 35 panel".

SAMPLE CHARACTERISTICS

PIR-ALU 35 panel is made up with a 35 grs/dm³ density polyisocianurate nucleus layered with embossed aluminum plates in both sides of 165 grs/m² of density and 60 μ m of thickness. The panel thickness is of 20mm.

TRIAL METHOD

Mechanical rigidity trial is done in two different types of airflow duct sheets according to the Norma project "Ductwork standard. Ductwork made of insulation ductboards" CEN/TC156/WG3N207 section 6.1 (*see annex*).

RESULTS

PIR-ALU 35: In this case a calibrated weight was applied for 406.53 grs. value trial which implies a strength of 3.988 N in order to deform the sheet.

Two different cut directions were tested for the same type of sheet:

- A: In a longitudinal sense to manufacturing.
- L: In a perpendicular sense to manufacturing.

The results are obtained from types of material and kind of cuts when setting up the sample.

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PIR-ALU 35 Panel (A)		
Sample	Deformation (mm)	EI (Nmm ²)
1	15.15	150482
2	15.15	150482
3	14.6	156151
4	13.3	171414
5	13.55	168251
6	13.3	171414
Mean EI		161366
EI Standard Deviation		10134

PIR-ALU 35 Panel (L)		
Sample	Deformation (mm)	EI (Nmm ²)
1	12.15	187638
2	11.95	190779
3	11.2	203554
4	11	207255
5	11	207255
6	11.4	199983
Mean EI		199411
EI Standard Deviation		8410

In order to calculate the result of the Young Module per inertia (EI) referred to 1 mm of width is done by using the formula provided in the Norma specifications used in the flexion trial of one plate with a single support.

The recommended deformation interval was kept in order not to have permanent deformations.

On the other hand, all original sample were weighted to establish if there was a important variation of density for each type product. The mean density results are detailed in the following table:

PIR-ALU 35 (A)		PIR-ALU 35 (L)	
Mean Density	35,6 grs/dm³	Mean Density	36,1 grs/dm³

Weight variation is almost unnoticeable (less than 3%)

Samples show a very similar density to the described commercial values.



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Trial date: Girona. July 24, 1998.

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This document has two sealed pages.

ANEXO

(1 página)

Proyecto de Norma Europea "Ductwork standard. Ductwork made of insulation ductboards"
CEN/TC156/WG3N207. 4ª revisión. Apartado 6.1.

One end of the sample is placed on a horizontal surface as shows the figure below, leaving the other end free in a length of 750 mm. In a point at 700 mm of the end of the support surface, a weight (W) is applied slowly and retired several times, until the distances to a reference plane, with and without the weigh, d_1 and d_2 , are constant. Then \underline{d} is calculated as the difference between d_1 and d_2 .

The weigh \underline{W} is chosen to have a deformation , d , in the range of 10 to 20 mm. As a guide, on function of the expected El_U , can be taken:

Expected El_U	$W(Nw)$
55.000	1.3
90.000	2.6
160.000	3.9

Sample size: 1200 x 200 x thickness.

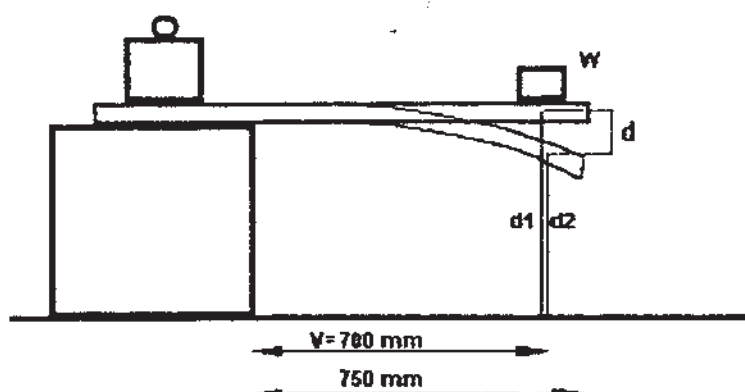


Fig. 1.1. Deflection of a beam under a point load.

El_U is calculated using the following expression:

$$El_u = \frac{W / AV^3}{3d}$$

El_U (Nmm ²)	: Flexural rigidity for 1mm wide
W (Newton)	: Weight applied
A (mm)	: Sample widthness = 200 mm
d (mm)	: Deformation under load
V (mm)	: Distance between the support surface and the point where the load is applied=700 mm