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For the attention of Mr Pedro URIZ

Villeurbanne, 10th December, 2009

Person in charge: **Anne TISSOT**
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Test Report N° 2914197/2
Version: 00

Tests on glasswool air conditioning duct according to EN 13403 Pressure losses tests

EQUIPMENT ID: P8858 Panel
MANUFACTURER: URSA IBERICA AISLANTES SA
REFERENCE DOCUMENT(S): EN 13403
TESTS PERFORMED BY: Dominique Pugnet
DATE OF TESTS: December 2009

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Version	Date	Nature of change	Modified pages
00	10/12/2009	First edition	

CONTENTS

1. INTRODUCTION

The objective of the tests was to characterise the linear pressure losses of an air conditioning duct made in insulation ductboards, reference **P8858**. The report 2914197/1 of the 24th of November deals with the results of previous tests made on same product (erosion and emission of particles, resistance against pressure, air leakage factor and airtightness class).

Figure 1: tested product

Summary of the results is in part 2.

The description of the tests is in APPENDIX 1 -.
The detailed are in APPENDIX 2 -.

The tests were made by Mr Dominique PUGNET.

2. SUMMARY OF THE RESULTS

The Figure 2 presents the values of the linear pressure losses according to air velocity, for the standard conditions (20°C, 101325 Pa), and for a section of 300 mm × 300 mm. The linear pressure losses are due to the roughness of the inner surface of the ductboards and the turbulence possibly created by the links between each board.

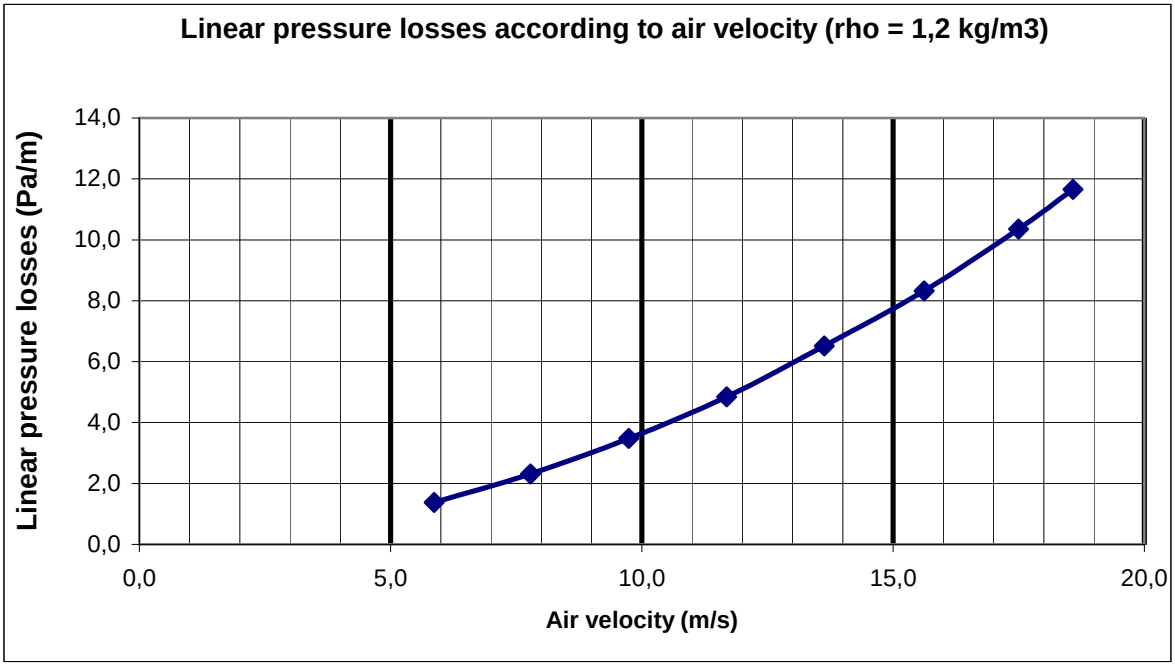

Figure 2 : Linear pressure losses according to air velocity, for P8858 reference, 300 mm × 300 mm

APPENDIX 1 - DESCRIPTION OF THE TESTS

The aim of the tests is to determine the linear pressure losses of the duct, due to the roughness of the inner surface of the ductboards and the turbulence possibly created by the links between each board.

The pressure losses tests were made using the samples built for the previous tests :

- 2 m + 2 m L-shaped assembly, section of 300 mm × 300 mm,
- straight duct of 7 modules of 1,16 m of length and section of 300 mm × 300 mm,
- Straight duct of 2 modules of 1.16 m of length and section of 300 mm × 300 mm.

The hydraulic diameter of the duct is then 300 mm.
Upstream of the L – shaped assembly are the fan and the airflow rate measurement device.
The static pressure difference is measured between two points placed on the straight part of the assembly. The distance between these two points is 7.0 m, and includes 6 links between the boards.

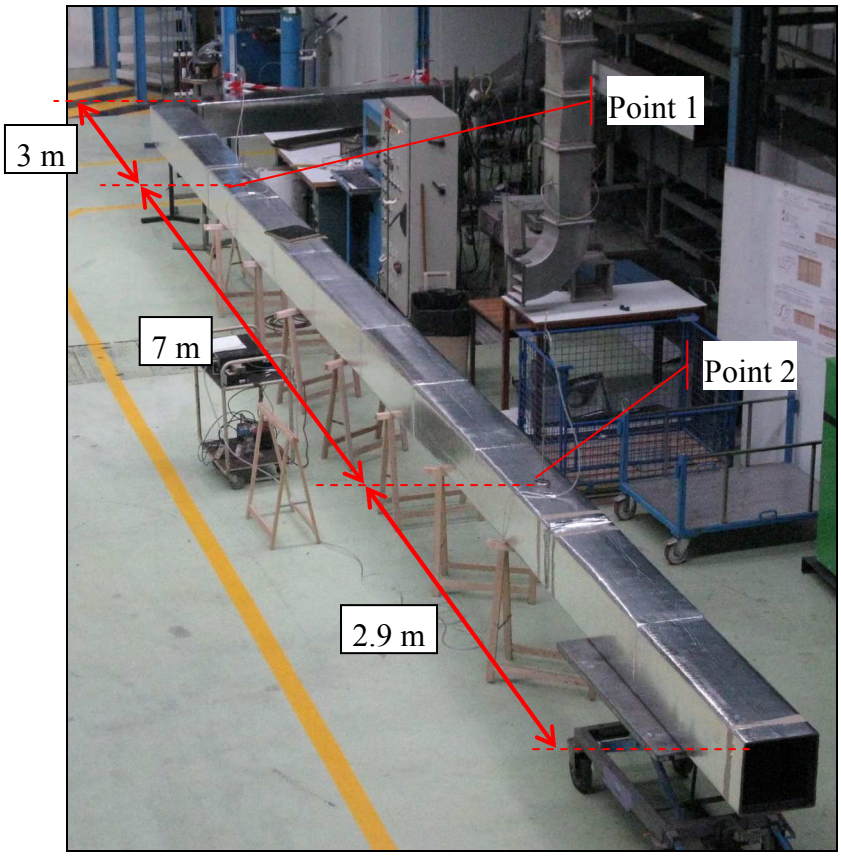

Figure 3 : View of the tests assembly

The first static pressure tap is 3 m behind the 90° - bend, that is to say 10 hydraulic diameters. The static pressure is measured with a Pitot probe in the centre of the duct. Before the measurements, the homogeneity of the static pressure was checked for the air velocity of 12 m/s, at 9 different points in the same section.

Figure 4 : Position of the Pitot Probe, point 1

The static pressure difference between the point 1 and the point 2 is measured for different airflow rates in the duct. For each point of the curve, the following parameters are measured :

- Atmospheric pressure,
- Air temperature,
- Airflow rate,
- Relative humidity,
- Static pressure difference.

As the average air velocity is the same at point 1 and at point 2, the static pressure difference corresponds to the pressure losses (the dynamic pressure is the same at point 1 and at point 2).

The results are then used to determine :

- The Reynolds number Re,
- The friction coefficient λ,
- The pressure losses according to the airflow rate in standard conditions (air temperature = 20°C, Pressure = 101325 Pa).

With :

$$Re = \frac{\rho V D_h}{\mu} \text{ And } \Delta P = \frac{\lambda}{D_h} \times L \times \frac{1}{2} \times \rho \times V^2$$

Re: Reynolds number, adimensional
ρ : absolute density, in kg/m^3
V: Average air velocity in the duct, in m/s
D_h: hydraulic diameter of the duct, in m
μ : dynamic air viscosity, in Pa.s
λ : friction coefficient, adimensional
L: length of the duct, in m

APPENDIX 2 - DETAILED RESULTS

Measurements

	Airflow rate	Temperature	Atmospheric pressure	Dew point temperature	Pressure losses
	Qv	T	Patm	Td	ΔP
	m^3/h	℃	Pa	℃	Pa
1	1948	20,4	99232	10,4	9,6
2	2583	20,3	99240	10,4	16,2
3	3234	20,4	99250	10,5	24,3
4	3886	20,6	99272	10,5	33,9
5	4545	21,1	99285	10,5	45,6
6	5212	21,3	99300	10,6	58,3
7	5859	21,9	99316	10,6	72,4
8	6232	22,2	99326	10,6	81,6

Calculations for the test conditions

	Air velocity	Pressure losses	Absolute density	Dynamic viscosity	Reynolds number	friction coefficient	Linear pressure losses
	V	ΔP	ρ	μ	Re	λ	ΔP/L
	m/s	Pa	kg/m^3	Pa.s	-	-	Pa/m
1	6,01	9,6	1,172	1,81E-05	1,2E+05	0,0195	1,4
2	7,97	16,2	1,172	1,81E-05	1,5E+05	0,0186	2,3
3	9,98	24,3	1,172	1,81E-05	1,9E+05	0,0178	3,5
4	11,99	33,9	1,172	1,82E-05	2,3E+05	0,0173	4,8
5	14,03	45,6	1,170	1,82E-05	2,7E+05	0,0170	6,5
6	16,09	58,3	1,169	1,82E-05	3,1E+05	0,0165	8,3
7	18,08	72,4	1,167	1,82E-05	3,5E+05	0,0163	10,3
8	19,24	81,6	1,166	1,82E-05	3,7E+05	0,0162	11,7

Calculations for the standard conditions (20°C, 101325 Pa)

	friction coefficient	Absolute density	Dynamic viscosity	Air velocity	Pressure losses
	λ	ρ	μ	V	ΔP
	-	kg/m^3	Pa/s	m/s	Pa
1	0,0195	1,2	1,81E-05	5,87	9,4
2	0,0186	1,2	1,81E-05	7,78	15,8
3	0,0178	1,2	1,81E-05	9,74	23,7
4	0,0173	1,2	1,81E-05	11,69	33,0
5	0,0170	1,2	1,81E-05	13,63	44,2
6	0,0165	1,2	1,81E-05	15,62	56,4
7	0,0163	1,2	1,81E-05	17,49	69,7
8	0,0162	1,2	1,81E-05	18,58	78,3

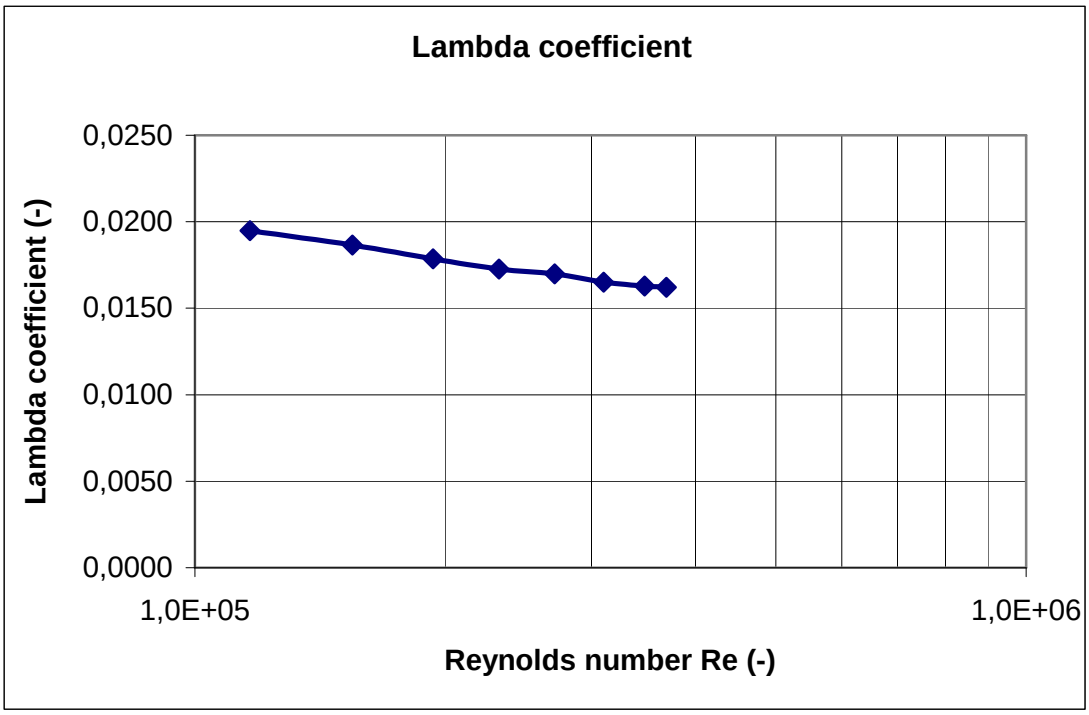

Figure 5 : Friction coefficient according to Reynolds number

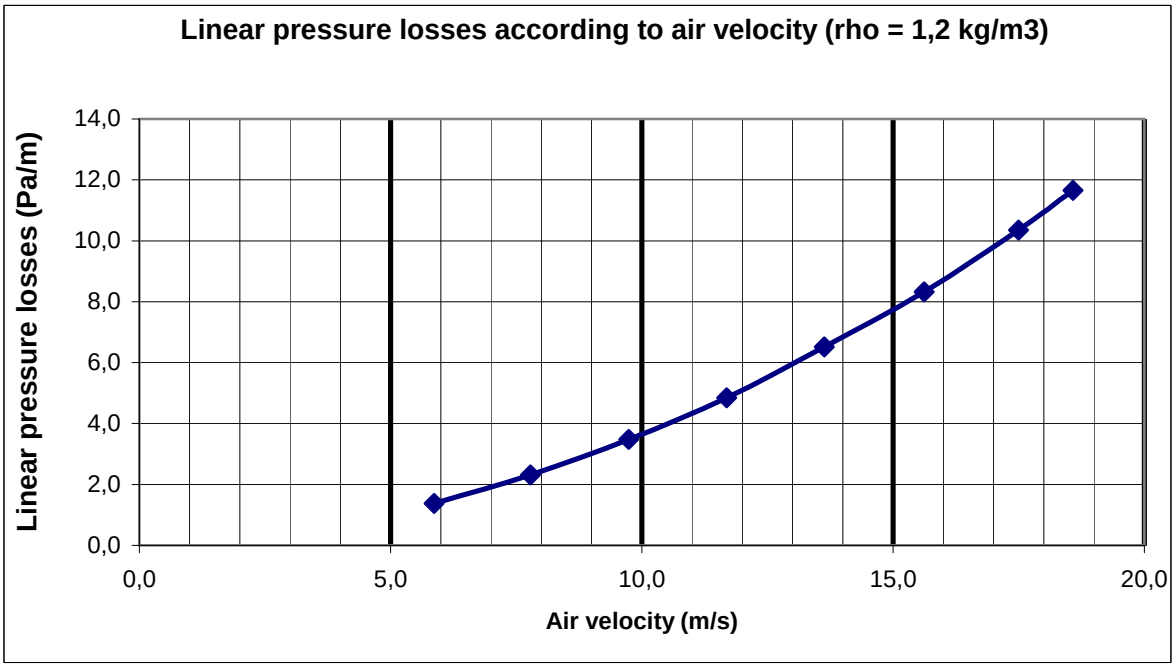

Figure 6 : Linear pressure losses according to air velocity