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For the attention of Mr Pedro URIZ

Villeurbanne, 27th October, 2014

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Test Report N° 2914197/1

Version: 02

**Tests on glasswool air conditioning duct
according to EN 13403**

EQUIPMENT ID : P8858 URSA AIR ZERO

MANUFACTURER : URSA IBERICA AISLANTES SA

REFERENCE DOCUMENT(S) : EN 13403, EN 1507

TESTS PERFORMED BY: Dominique PUGNET

DATE OF TESTS: November 2009

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Version	Date	Nature of change	Modified pages
00	24/11/2009	First edition	
01	18/11/2013	correction of the reference of the product	1 – 4 – 5
02	27/10/2014	Update of airtightness class based on updated version of EN 1507 standard	5 – 12 -13

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1. INTRODUCTION

The objective of the tests was to characterise a glasswool ducts according to EN 13403 July 2003 "Ventilation for buildings – Non-metallic ducts – Ductwork made from insulation ductboards". Tests were :

- Erosion and Emission of particles (§7.2 of EN 13403) ;
- Resistance against pressure (§7.3 of EN 13403) ;
- Air leakage factor and airtightness class (§4.3 of EN 13403 with airtightness classes defined in §3.10 of EN 1507) ;

The reference of tested sample is **P8858 URSA AIR ZERO**.



Figure 1: tested product

Summary of the results is in part 2.

Detailed results of erosion and emission of particle tests are in APPENDIX 2 -.

Detailed results of resistance against pressure tests are in APPENDIX 3 -.

Detailed results of air leakage factor and airtightness class tests are in APPENDIX 4 -.

2. SUMMARY OF THE RESULTS

EROSION AND EMISSION OF PARTICLES TEST		
Air velocity = 18,6 m/s		
	Requirements	P8858 URSA AIR ZERO
Particles > 0,5 µm	< 60 µg/m ³	0.007 µg/m ³
Particles > 5,0 µm	< 4,0 µg/m ³	0.004 µg/m ³

RESISTANCE AGAINST PRESSURE TEST
Pressure = 2000 Pa
P8858 URSA AIR ZERO
The fixation staples did not move during the test. The adhesive tape did not move during the test. There is no evidence of damage, which would cause the sample to become unusable.

AIRTIGHTNESS TEST		
	Test pressure limits	P8858 URSA AIR ZERO
Leakage factor (l/s/m ²)	-756 Pa	0,050
Airtightness class		D
Leakage factor (l/s/m ²)	1012 Pa	0,049
Airtightness class		D

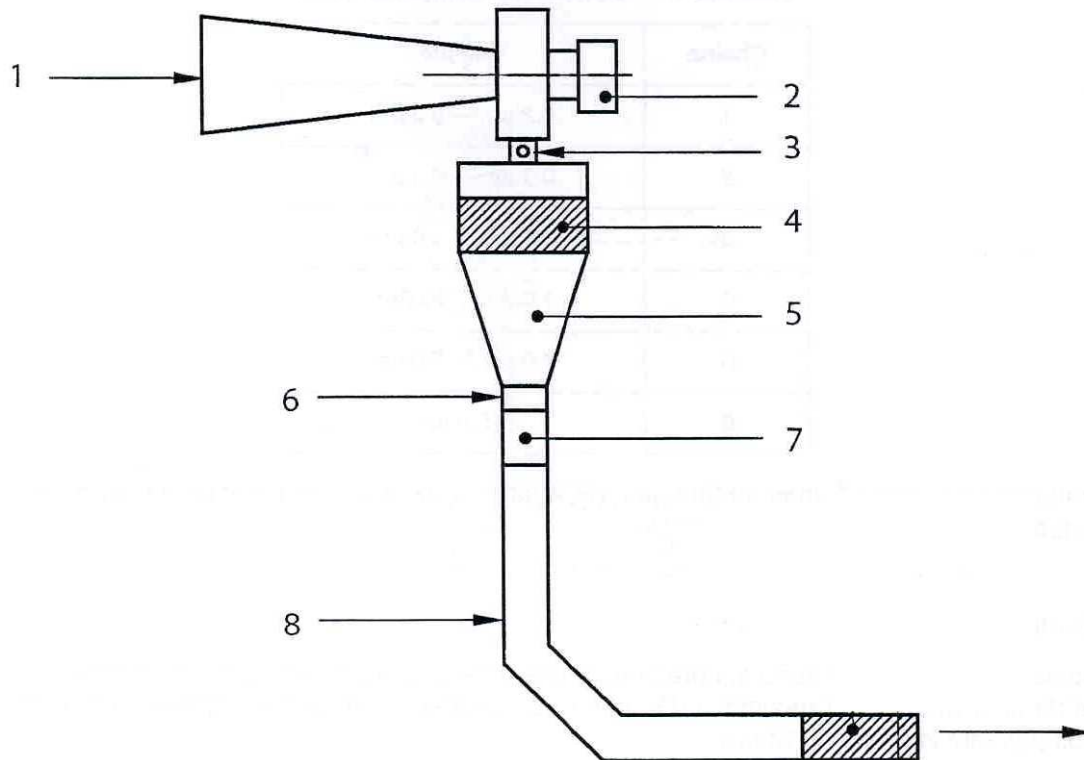
APPENDIX 1 - REFERENCES

EN 13403 (2003): Ventilation for buildings – Non-metallic ducts – Ductwork made from insulation duct boards.

EN 1507 (July 2006): Ventilation for buildings – Sheet metal air ducts with rectangular section – Requirements for strength and leakage.

APPENDIX 2 - EROSION AND EMISSION OF PARTICLES

The samples are arranged in an L-shaped assembly. The entire assembly has similar cross-section (300 mm × 300 mm).



- | | |
|----------------------|-----------------------|
| 1 : Sucking box | 5 : Blowing plenum |
| 2 : Sucking fan | 7 : Connexion duct |
| 3 : Control valve | 8 : Duct to be tested |
| 4 : Absolute filters | |

Figure 2 : Construction for particle emission

Tests consisted in :

- Purge during 1 h, air velocity = 12 m/s,
- Stop during 15 min,
- Erosion test during 5 h, air velocity = 18,6 m/s.

The particle accounting is made with an optical laser counter with different channels given in Table 1. The counting is not done during the purge.

Channel	Range
1	0,2 – 0,3 µm
2	0,3 – 0,5 µm
3	0,5 – 0,7 µm
4	0,7 – 1,0 µm
5	1,0 – 2,0 µm
6	2,0 – 3,0 µm
7	3,0 – 5,0 µm
8	> 5 µm

Table 1 : Laser counter range

The extracted flow rate is of 28,3 l/min.

The average particle concentration is calculated from the extracted air volume and the measurement of the particle's mass using the following formula :

$$C = \frac{M}{Q_v t}$$

Where :

C is the particle concentration in µg/m³,

M is the particles' mass in µg,

Q_v is the extraction flow rate in m³/s.

The mass of particles is determined from the number of counted particles and the relative density of the glass (2500 kg/m³).



Figure 3 : View of the inside of the tested duct

Detailed results

Duration of extraction for the optical laser counter : 305 minutes

Extracted flow rate for the optical laser counter : 28,3 l/min = 0,0283 m³/min

Extracted flow : 305 × 0,0283 = 8,63 m³

$$\text{Volume of a particle (diameter } d) = \frac{4}{3} \times \pi \times \left(\frac{d}{2}\right)^3$$

Air velocity in the duct : 18,6 m/s

Air temperature : 21.3°C < T < 22.8°C

Range of particles diameter (µm)	Nb of counted particles	Nb of particles/m ³	Particles mass in µg/m ³
0,2 - 0,3	3673	426	8.70E
0,3 - 0,5	2948	342	2.86E
0,5 - 0,7	986	114	3.23E
0,7 - 1,0	894	104	8.33E
1,0 - 2,0	893	103	4.57E
2,0 - 3,0	360	42	8.53E
3,0 - 5,0	183	21	1.78E
> 5,0	191	22	3.62E

Table 2 : Detailed results of the erosion test

	Requirements	Test results
Particles > 0,5 µm	< 60 µg/m ³	0.007 µg/m ³
Particles > 5,0 µm	< 4,0 µg/m ³	0.004 µg/m ³

Table 3 : Comparison with the requirements

The material from the inside surface of the ductwork does not break away, flake off and does not show evidence of delamination or erosion.

The requirements concerning the maximum particle concentration are fulfilled.

APPENDIX 3 - RESISTANCE AGAINST PRESSURE TEST

The pressure test determines the fitness for purpose of the ductboard assembly. A test sample is prepared like it can be seen in.

A typical rectangular section ducts were constructed by the URSA IBERICA AISLANTES SA company and assembled with a peripheral joint. The used internal section is 300 mm × 300 mm.

A pressure tap is sealed on the test sample and connected to a manometer. The manometer is checked for zero reading at the beginning and end of each test.

An air supply tape is sealed on the test sample to supply specified air pressure. Figure 4 shows a sample in test.

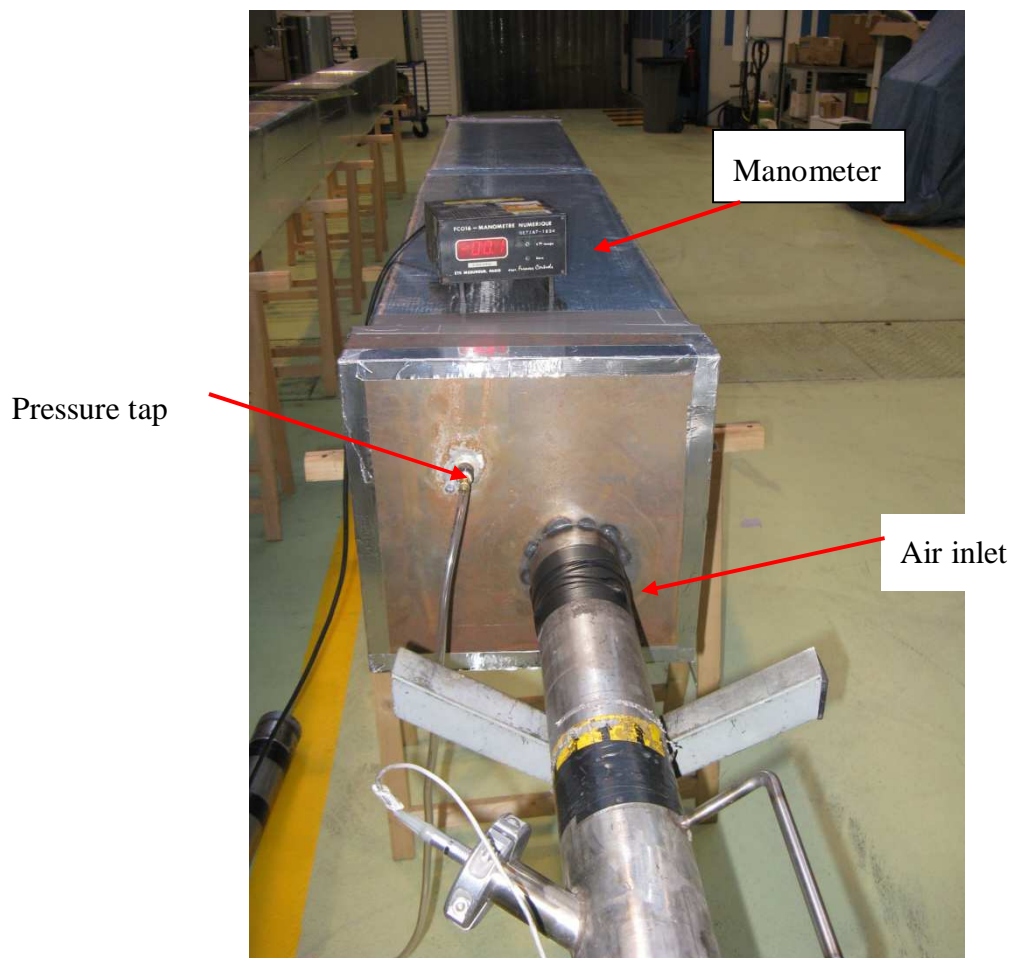


Figure 4 : View of the test facility

The manufacturer's rated pressure is 800 Pa.

This pressure is gradually reached in a time between 45 and 60 s, and is maintained during 1 min. It is then increased to 2000 Pa (2,5 times 800 Pa), and maintained during 1 h.

Detailed results

Fixation staples of the peripheral joint did not move during the pressure test.

APPENDIX 4 - AIRTIGHTNESS TEST

Test is made following EN 1507 standard.

The test sample built by URSA IBERICA AISLANTES consists of 7 modules of 1,16 m of length and section of 300 mm × 300 mm.

Ductwork surface area (A) = $8,15 \times 4 \times 0,3 = 9,78 \text{ m}^2$

Total joint length (L) = $6 \times 4 \times 0,3 + 8,15 = 15,35 \text{ m}$.

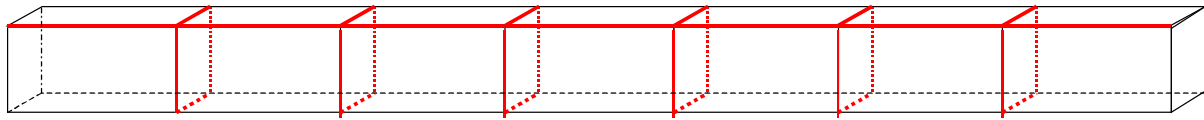


Figure 5: Diagram of the samples

CETIAT closed the ends of the sample with metal sheets.

Table 2 shows the airtightness classification defined in the EN 1507 standard.

Air tightness class	Air leakage limit $\text{l.s}^{-1}.\text{m}^{-2}$	Static gauge pressure limits (Pa)	
		Negative	Positive
A	$0,027.p_{\text{test}}^{0,65}$	-200	400 (class 1)
B	$0,009.p_{\text{test}}^{0,65}$	-500	1000 (class 2)
C	$0,003.p_{\text{test}}^{0,65}$	-750	1000 (class 2)
D	$0,001.p_{\text{test}}^{0,65}$	-750	1000 (class 2)

Table 1: Definition of the airtightness classes – EN 1507

The limit for the pressure tests is defined by the manufacturer, following the design operating pressure of the ducts.

Detailed results

Atmospheric pressure : 99600 Pa

Air temperature : 21.5°C

Negative pressure

Pressure	Measured air leakage	Airflow rate leakage at 20°C and 101325 Pa	Airflow rate leakage at 20°C and 101325 Pa	Airflow rate leakage at 20°C and 101325 Pa
Pa	Nm ³ /h	m ³ /h	l/s	l/s/m ²
-52	0.33	0.35	0.10	0.010
-100	0.51	0.55	0.15	0.016
-204	0.85	0.92	0.25	0.026
-352	1.01	1.08	0.30	0.031
-509	1.31	1.41	0.39	0.040
-756	1.64	1.77	0.49	0.050

Positive pressure

Pressure	Measured air leakage	Airflow rate leakage at 20°C and 101325 Pa	Airflow rate leakage at 20°C and 101325 Pa	Airflow rate leakage at 20°C and 101325 Pa
Pa	Nm ³ /h	m ³ /h	l/s	l/s/m ²
98	0.41	0.44	0.12	0.012
203	0.68	0.73	0.20	0.021
403	1.11	1.20	0.33	0.034
608	1.16	1.25	0.35	0.035
808	1.36	1.46	0.41	0.041
1012	1.61	1.73	0.48	0.049

	Air leakage rate (l/s/m ²)	Air leakage limit class D (l/s/m ²)	Class
-756 Pa	0.050	0.074	D
1012 Pa	0.049	0.090	D

The sample is in the class D within the limits of positive and negative test pressure.

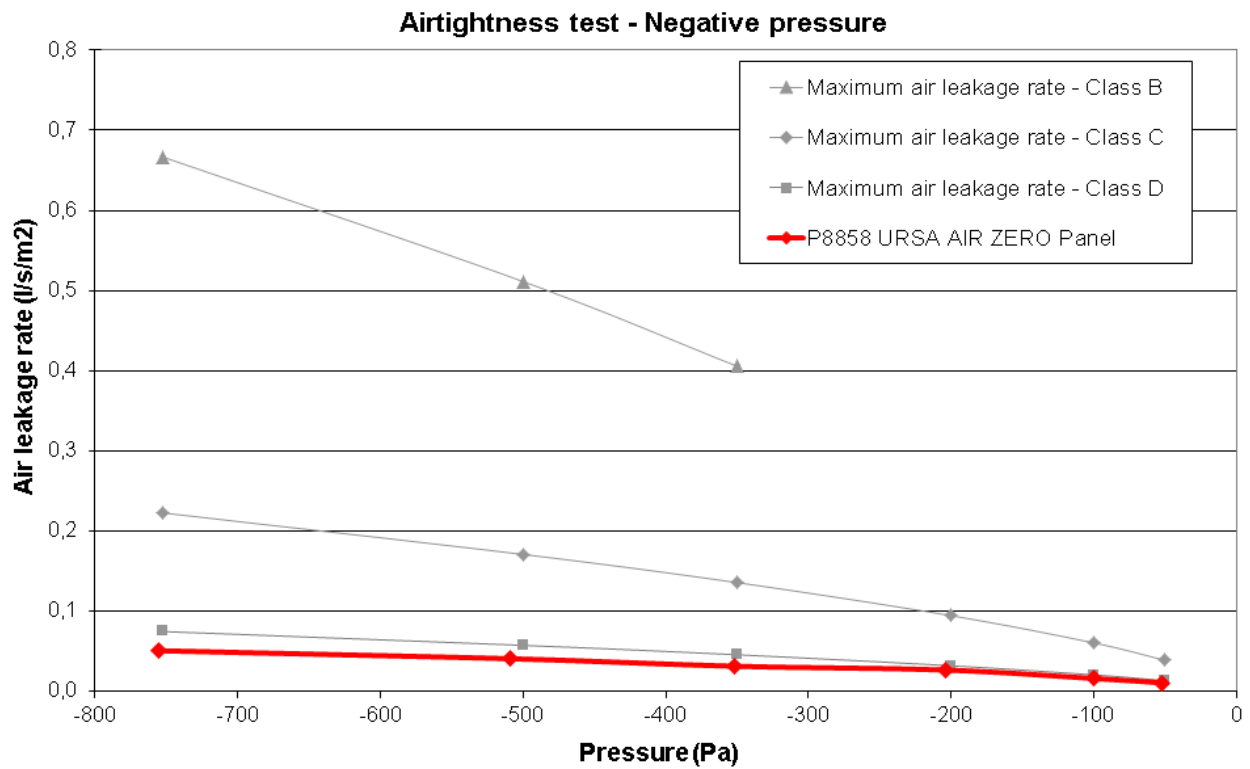


Figure 6 : Air leakage rate according to negative pressure

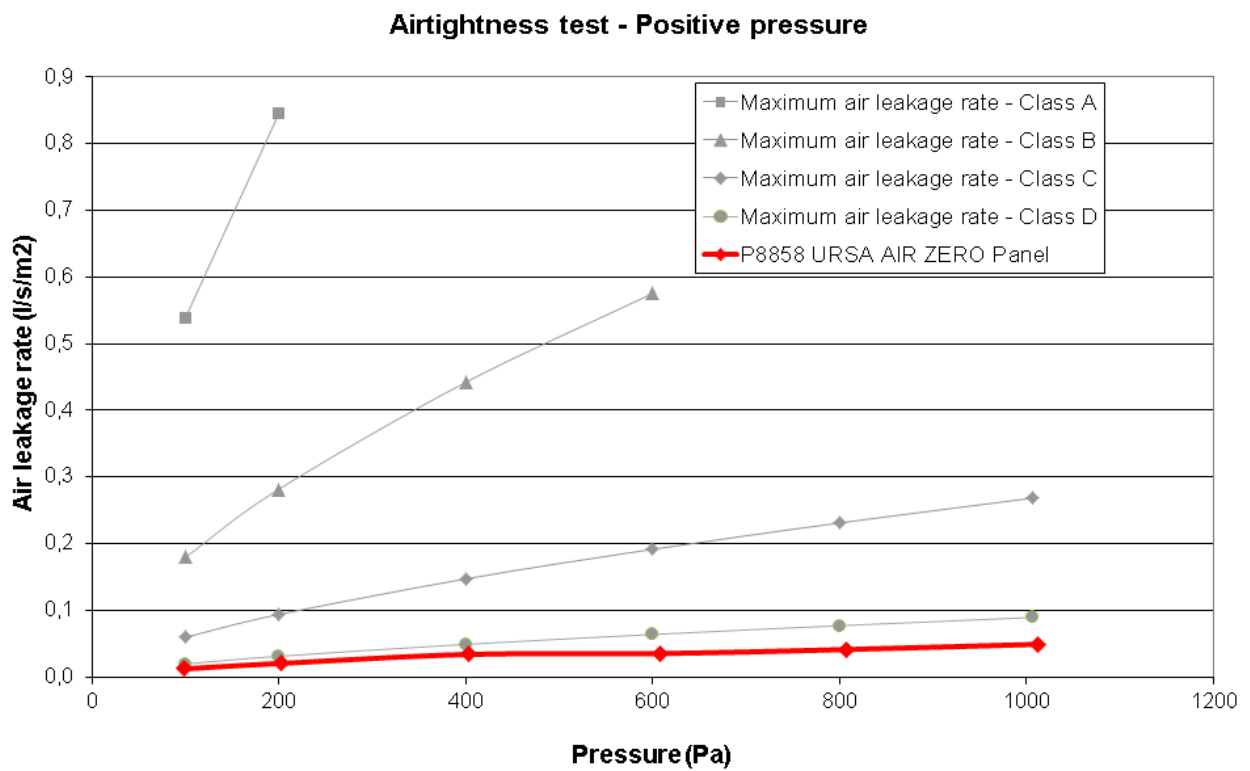


Figure 7 : Air leakage rate according to positive pressure



Figure 8 : View of the airtightness test plant