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TEST REPORT No. 326288

This test report cancels and replaces test report No. 321829 dated 26/01/2015 issued by Istituto Giordano

Place and date of issue: Bellaria-Igea Marina - Italia, 17/07/2015

Customer: ASAWA INSULATION PRIVATE Ltd - Plot No - 52 & 53 - Arkose Industrial Estate - Adhoshi Road Dekhu 410203 SAJGAON, KHALAPUR, KHOPOLI, MAHARASHTRA - India

Date testing requested: 28/11/2014

Order number and date: 64993, 28/11/2014

Date sample received: 22/12/2014

Date of testing: from 07/01/2015 to 22/01/2015

Purpose of testing: Test on ductwork according to standard EN 13403:2003 of a non-metallic duct

Place of testing: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italia

Origin of sample: sampled and supplied by the Customer

Identification of sample received: No. 2014/2617

Sample name*

The sample under test is named “SAMPLE FOR TESTING”.

Description of sample*

The sample for testing consists of a duct system, and in detail:

– duct, section 104 × 104 mm, length 2,5 m and test surface 10,4 m^2;

– 2 ducts, internal dimension 300 × 300 mm and length 1000 mm each, connected together;

(*)According to that stated by the Customer

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- 3 panels, dimensions 1200 × 200 mm;
- 3 ducts, internal sections 252 × 252 mm, length 4 m each, interconnected with a total length of 12 m;
- duct, section 340 × 340 mm and length 1000 mm.

Normative references

The test was carried out in accordance with standard EN 13403:2003 dated April 2003 "Ventilation for buildings - Non-metallic ducts - Ductworks made from insulation ductboards".

Test equipment

The test was carried out using a computerised semiautomatic control and measurement system capable of performing all tests with the parameters requested by the normative references and fitted with the following equipment:

- for the measurement of air flow: pressure differential devices (orifice plates, nozzles and Venturi tubes) compliant with standards ASME MFC-14M:2003 "Measurement of fluid flow using small bore precision orifice meters", UNI EN ISO 5167-1:2004 dated 01/10/2004 "Misurazione della portata dei fluidi mediante dispositivi a pressione differenziale inseriti in condotti a sezione circolare piena - Parte 1: Principi e requisiti generali" *("Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements")* and UNI EN ISO 5167-2:2004 dated 01/10/2004 "Misurazione della portata dei fluidi mediante dispositivi a pressione differenziale inseriti in condotti a sezione circolare piena - Parte 2: Diaframmi" *("Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice plates")*;
- for measurement of pressure inside the test chamber: differential pressure transducers with calibration certificate;
- for measuring deflection: 6 electronic displacement transducers complete with calibration report issued by Istituto Giordano S.p.A.;
- oven with air circulation.

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Conditioning of sample prior to test

The sample was conditioned for seven days immediately prior to testing under the ambient conditions specified in the following table.

Temperature	(22 ± 1) °C
Relative humidity	(50 ± 5) %

Test method

The elements comprising the sample were fitted to the test apparatus and subjected to, test, in detail:

- determination of air leakage factor and air tightness class according to clause 4.3 of standard EN 13403:2003 on the duct with surface >10 m^2;
- determination of resistance against pressure according to clause 4.2 of standard EN 13403:2003 on 2 typical rectangular section ducts, internal section 300 × 300 mm, assembled with a peripheral joint;
- determination of the board stiffness according to clause 4.7.3 of standard EN 13403:2003; the flexural rigidity "El_u" was established using the formula

$$El_u = \frac{\rho \cdot v^4}{8 \cdot d}$$

where: ρ = material load per unit length, in N/mm;
v = unsupported length equal to 1000 mm;
d = deflection in mm;

"El_u" is calculated using the following equation:

$$El_u = \frac{\frac{W}{A \cdot V^3}}{3 \cdot d}$$

where: El_u = flexural rigidity for 1 mm wide, in N/mm^2;
W = weight applied in N;
A = sample width (200 mm);
d = deflection under load in mm;
V = distance between the support surface and the point where the load is applied (700 mm);

- determination of the air pressure drop due to friction into a 12 m duct composed of 3 pieces assembled, according internal test method;

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inside the duct with length of 12 m was insufflated an air flow rate corresponding to the rate of 1 m/s, 2 m/s, 4 m/s, 6 m/s and 8 m/s, through blower with variable speed; using the differential manometer connected was measured the difference in static pressure at 1 m from the beginning and at 1 m from the end of the conduit so as to determine the pressure difference "ΔP" due to 10 m element concerned; finally, it was calculated the coefficient of flow resistance "ζ" of the duct using the formula:

$$\zeta = \frac{\Delta P}{\frac{1}{2}\rho \cdot v^2}$$

– determination the resistance to the high temperature of air into the duct 304×304 mm with internal method: 110°C per 48 h.

Test results

Determination of air leakage factor and air tightness class

Static pressure differential		Air flow*				
nominal	test	total	related to the area and relative uncertainty**	Maximum air leakage		
				Class A	Class B	Class C
[Pa]	[Pa]	[l/s]	[l/s·m^2]	[l/s·m^2]	[l/s·m^2]	[l/s·m^2]
400	401,2	0,21	0,020 ± 0,001	1,32	0,44	0,14
800	799,9	0,44	0,042 ± 0,002	//	0,69	0,23
1000	1000,0	0,51	0,049 ± 0,002	//	0,80	0,27
1200	1201,1	0,63	0,060 ± 0,003	//	0,90	0,30
1500	1499,7	0,76	0,073 ± 0,004	//	1,10	0,36

(*) All figures refer to pressure of 101,3 kPa and temperature of 293 K.

(**) uncertainty considers contributions caused by measurement of the following quantities: air flow, test chamber pressure and size of sample; expanded uncertainty has been calculated using a coverage factor “k” of 2, corresponding to a confidence level of 95 %.

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Determination of resistance against pressure

Pressure		Duct wall deflection				observation
nominal [Pa]	test [Pa]	up [mm]	left [mm]	right [mm]	bottom [mm]	
0	0	0,002	0,006	-0,001	-0,003	no rupture
200	199	0,033	0,043	0,014	0,028	no rupture
400	401	0,063	0,085	0,063	0,051	no rupture
600	598	0,091	0,133	0,127	0,082	no rupture
800	802	0,106	0,165	0,153	0,117	no rupture
1000	1003	0,137	0,227	0,209	0,169	no rupture
1200	1201	0,186	0,258	0,239	0,209	no rupture
1400	1399	0,222	0,296	0,281	0,255	no rupture
1600	1612	0,239	0,326	0,326	0,271	no rupture
0	0	-0,004	-0,009	-0,012	-0,008	no rupture
-200	-201	-0,019	-0,039	-0,057	-0,035	no rupture
-400	-402	-0,078	-0,082	-0,099	-0,080	no rupture
-600	-600	-0,103	-0,116	-0,164	-0,119	no rupture
-800	-798	-0,136	-0,172	-0,194	-0,140	no rupture
-1000	-998	-0,164	-0,202	-0,229	-0,196	no rupture
-1200	-1199	-0,203	-0,260	-0,289	-0,242	no rupture
-1400	-1396	-0,246	-0,276	-0,340	-0,266	no rupture
-1600	-1604	-0,287	-0,324	-0,375	-0,306	no rupture

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Determination of the board stiffness

Load [N]	El_u Board 1 [N/mm^2]	El_u Board 2 [N/mm^2]	El_u Board 3 [N/mm^2]	El_u (mean) [N/mm^2]
1,1	648951	575826	609693	611490
1,8	625152	631519	619930	625534
3,2	690054	639987	519857	616632
4,0	686069	563551	628146	625922
6,0	728392	529500	625560	627818
overall average				**621479**

Determination of the air pressure drop due to friction into the duct

Flow rate "v" [m/s]	Pressure difference "ΔP" [Pa]	Coefficient of flow resistance "ζ"	Coefficient of flow resistance per unit "ζ/m"
1,0	0,3	0,49	0,049
3,3	0,7	0,10	0,010
5,0	1,4	0,09	0,009
15,6	5,9	0,04	0,004
16,1	12,0	0,08	0,008

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Determination the resistance to the high temperature of air into the duct

Nominal static pressure differential	Air flow*			
	Before test		After exposition to 110°C air flux for 48h	
	total	related to the area and relative uncertainty**	total	related to the area and relative uncertainty**
[Pa]	[l/s]	[l/s·m^2]	[l/s]	[l/s·m^2]
400	0,027	0,020 ± 0,001	0,028	0,020 ± 0,001
800	0,057	0,042 ± 0,002	0,056	0,042 ± 0,002
1000	0,066	0,049 ± 0,002	0,067	0,049 ± 0,002
1200	0,082	0,060 ± 0,003	0,083	0,061 ± 0,003
1500	0,763	0,073 ± 0,004	0,765	0,073 ± 0,004

(*) All figures refer to pressure of 101,3 kPa and temperature of 293 K.

(**) uncertainty considers contributions caused by measurement of the following quantities: air flow, test chamber pressure and size of sample; expanded uncertainty has been calculated using a coverage factor "k" of 2, corresponding to a confidence level of 95 %.

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.

This test report alone shall not be considered a certificate of conformity.

Test Technician
(Geom. Roberto Porta)

Head of
Security and Safety Laboratory
(Dott. Andrea Bruschi)

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

Firmato digitalmente da GIORDANO SARA LORENZA