

TESTING PROTOCOL

Date: 2022-01-03

Protocol number: 21063

Test unit: AVS heating coil (see test sample list)

Order number: 21063



Number of sample: See test sample list


Customer: SALDA UAB, Ragainės str.100, Šiauliai LT-78109, Lithuania

Date of sample arrival: 2021-12-06

Date of test: 2021-12-06 till 2022-01-03

Test method: LST EN 15727: 2010
CR 14378: 2002

Measurements are performed by: Tadas Aleksėjus 
Sandra Navickytė 

Technical manager: Donatas Tarkauskas 

Note: Laboratory does not select samples, samples delivered by customer are tested.

The results apply to the sample as received.

Results of testing are related only to tested object.

When information is provided by the customer and can affect the validity of results, the laboratory disclaims liability for it.

Protocol or separate parts of the protocol can not be copied without written consent of laboratory.

Information about testing methods

LST EN 15727:2010 Ventilation for buildings - Ducts and ductwork components, leakage classification and testing

CR 14378: 2002 Ventilation for buildings - Experimental determination of mechanical energy loss coefficient of air handling components

Test sample list

Test sample name/model	Test sample number
ACC007149-AVS 100	B21063-1
ACC007025-AVS 125	B21063-2
ACC002028-AVS 160	B21063-3
ACC002029-AVS 200	B21063-4
ACC002030-AVS 250	B21063-5
ACC002031-AVS 315	B21063-6
ACC002032-AVS 400	B21063-7
ACC002033-AVS 500	B21063-8

Data of measurements

B21063-1 (ACC007149 AVS 100)

Description of the sample

Duct connection	0,100	m
Length	0,230	m
Width / depth	0,208	m
Height	0,300	m
Area of the sample surface (A_p)	0,343	m^2
Required air tightness class	Not declared	
Operating pressure	Not declared	
The total joint length (L)	0,628	m
The virtual product surface area (A_c)	0,314	m^2

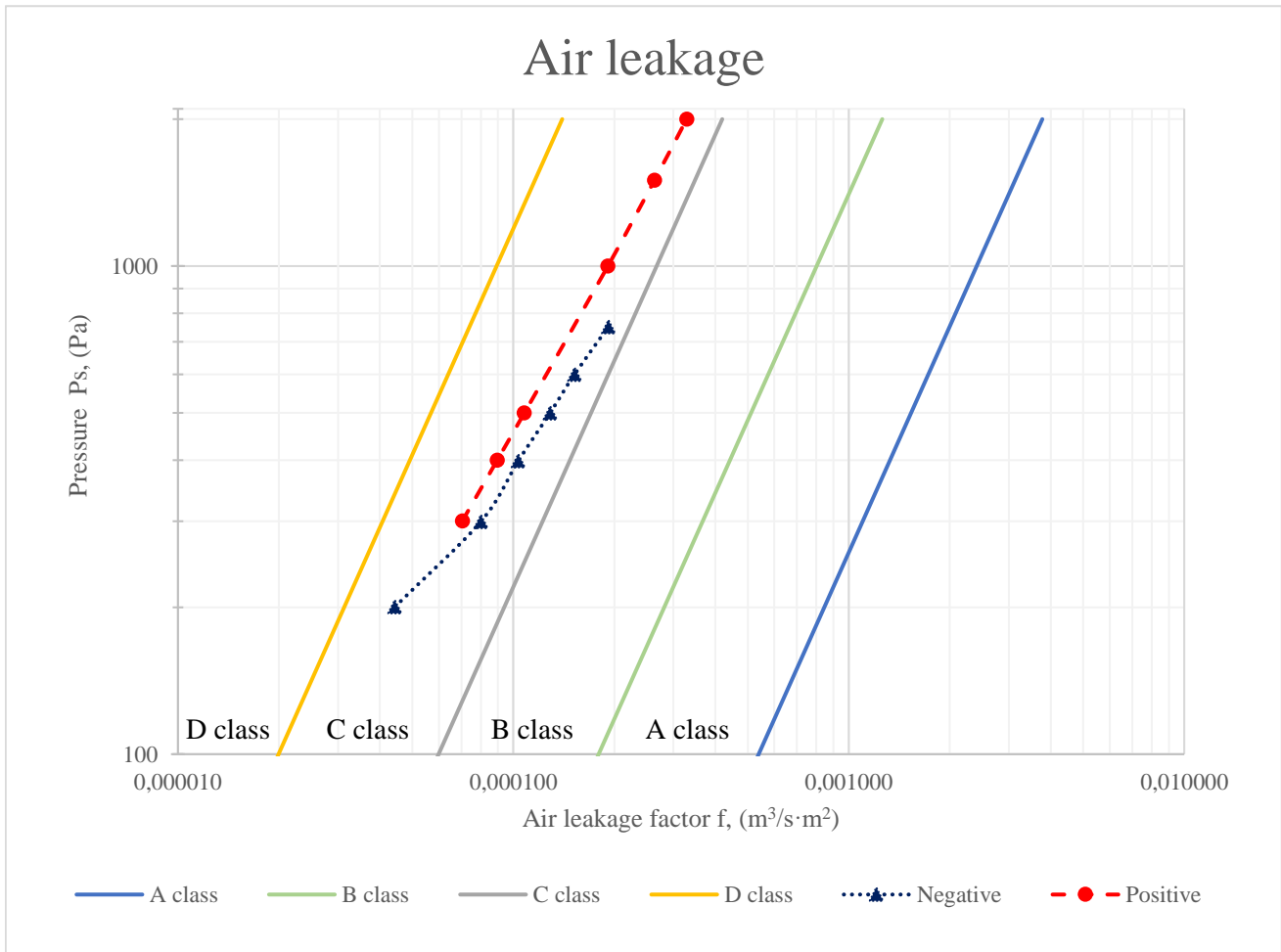
Environment condition during the measurements

Average air temperature	17,2	°C
Average humidity	17,4	%
Average atmospheric pressure	745,6	mmHg / 99,40 kPa

	Air leakage				
	Test pressure	Air leakage	Corrected air leakage*	Air leakage factor	Clasification
	Pa	m^3/h	m^3/h	$(m^3/s \cdot m^2)$	
Negative	200	0,055	0,055	0,000044	C
	300	0,100	0,099	0,000080	C
	399	0,129	0,128	0,000103	C
	500	0,160	0,159	0,000129	C
	600	0,190	0,188	0,000152	C
	751	0,239	0,237	0,000192	C
Positive	300	0,088	0,087	0,000070	C
	401	0,112	0,111	0,000090	C
	500	0,134	0,133	0,000108	C
	1000	0,238	0,236	0,000191	C
	1500	0,328	0,325	0,000263	C
	2001	0,410	0,406	0,000329	C

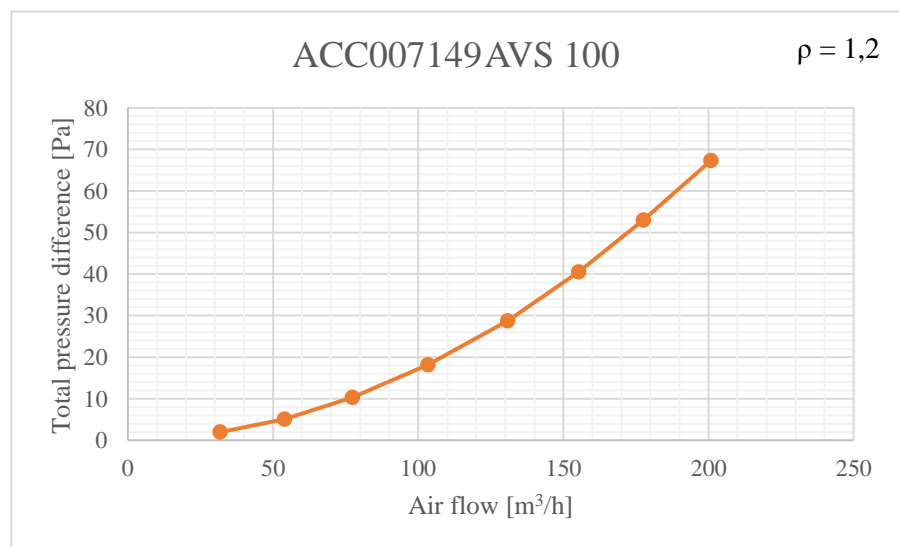
* - adjusted to standard conditions (+20 °C temp. and 101325 Pa).

Air leakage diagram



Pressure drop test data

ACC007149 AVS 100	
q_v	$\Delta p_{1,2}$
m^3/h	Pa
200,8	67,3
177,6	53,0
155,3	40,5
130,8	28,7
103,4	18,2
77,3	10,3
53,9	5,1
31,7	2,0



Data of measurements

B21063-2 (ACC007025 AVS 125)

Description of the sample

Duct connection	0,125	m
Length	0,230	m
Width / depth	0,208	m
Height	0,300	m
Area of the sample surface (A_p)	0,334	m ²
Required air tightness class	Not declared	
Operating pressure	Not declared	
The total joint length (L)	0,785	m
The virtual product surface area (A_c)	0,393	m ²

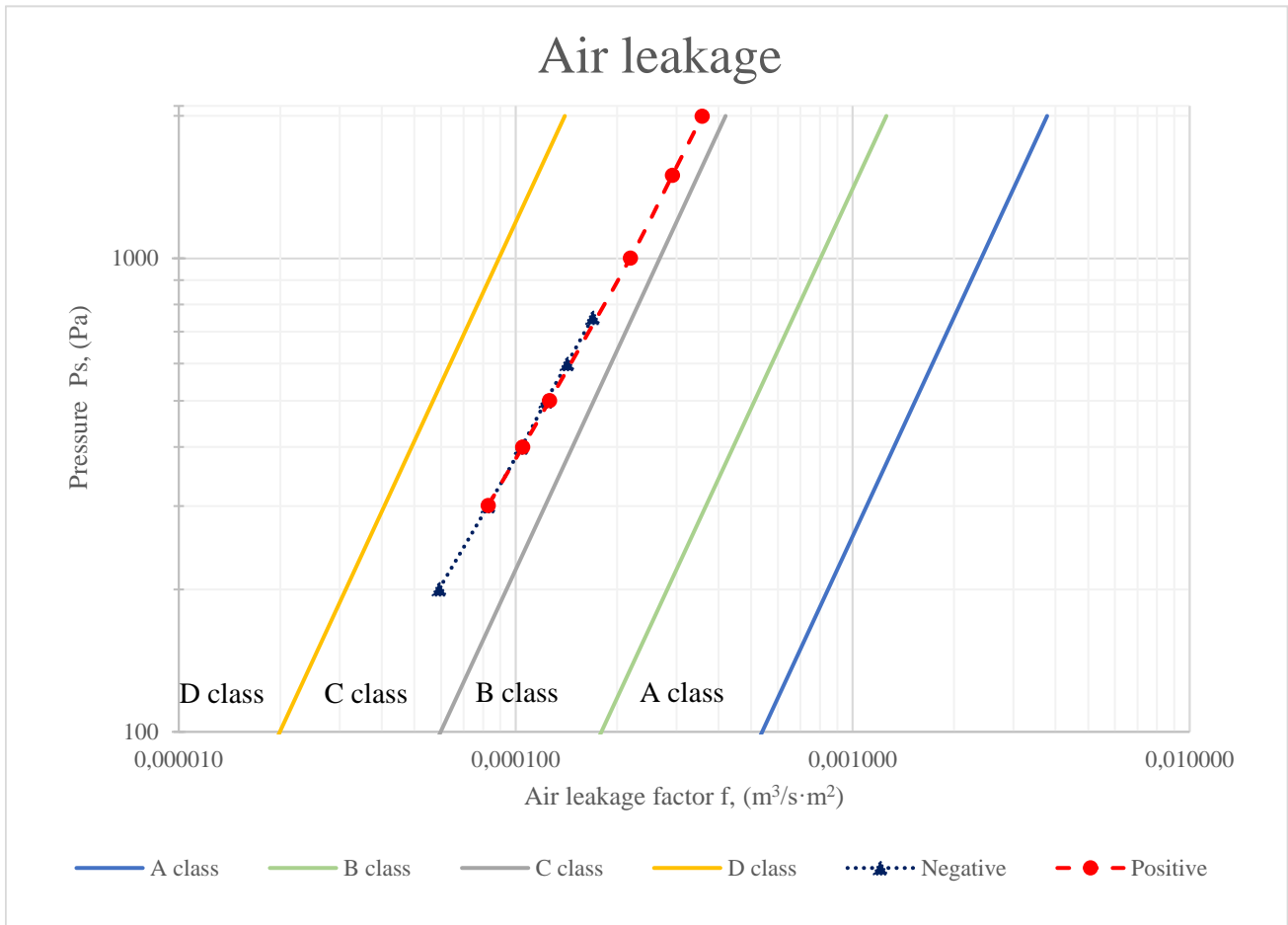
Environment condition during the measurements

Average air temperature	17,2	°C
Average humidity	17,4	%
Average atmospheric pressure	745,6	mmHg / 99,40 kPa

	Air leakage				
	Test pressure	Air leakage	Corrected air leakage*	Air leakage factor	Classification
	Pa	m ³ /h	m ³ /h	(m ³ /s·m ²)	
Negative	200	0,085	0,084	0,000059	C
	300	0,118	0,117	0,000083	C
	400	0,148	0,147	0,000104	C
	500	0,176	0,174	0,000123	C
	600	0,203	0,201	0,000142	C
	751	0,242	0,239	0,000169	C
Positive	301	0,118	0,117	0,000083	C
	400	0,150	0,148	0,000105	C
	501	0,180	0,178	0,000126	C
	1002	0,312	0,309	0,000219	C
	1500	0,416	0,412	0,000292	C
	1999	0,510	0,505	0,000358	C

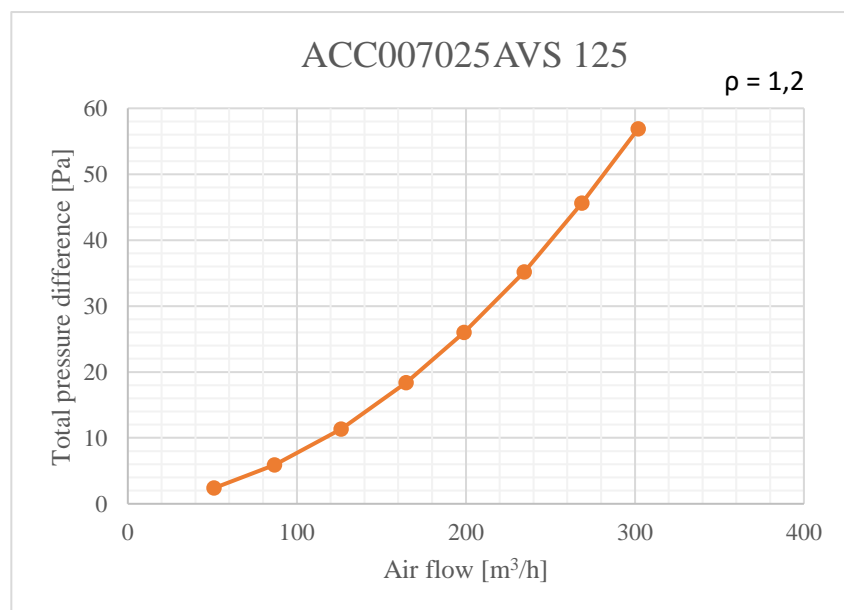
* - adjusted to standard conditions (+20 °C temp. and 101325 Pa).

Air leakage diagram



Pressure drop test data

ACC007025 AVS 125	
q_v	$\Delta p_{1,2}$
m^3/h	Pa
302,0	56,9
268,6	45,6
234,5	35,2
199,0	26,0
164,7	18,4
126,1	11,4
86,7	5,9
51,0	2,4



Data of measurements

B21063-3 (ACC002028 AVS 160)

Description of the sample

Duct connection	0,160	m
Length	0,230	m
Width / depth	0,275	m
Height	0,300	m
Area of the sample surface (A_p)	0,389	m ²
Required air tightness class	Not declared	
Operating pressure	Not declared	
The total joint length (L)	1,005	m
The virtual product surface area (A_c)	0,502	m ²

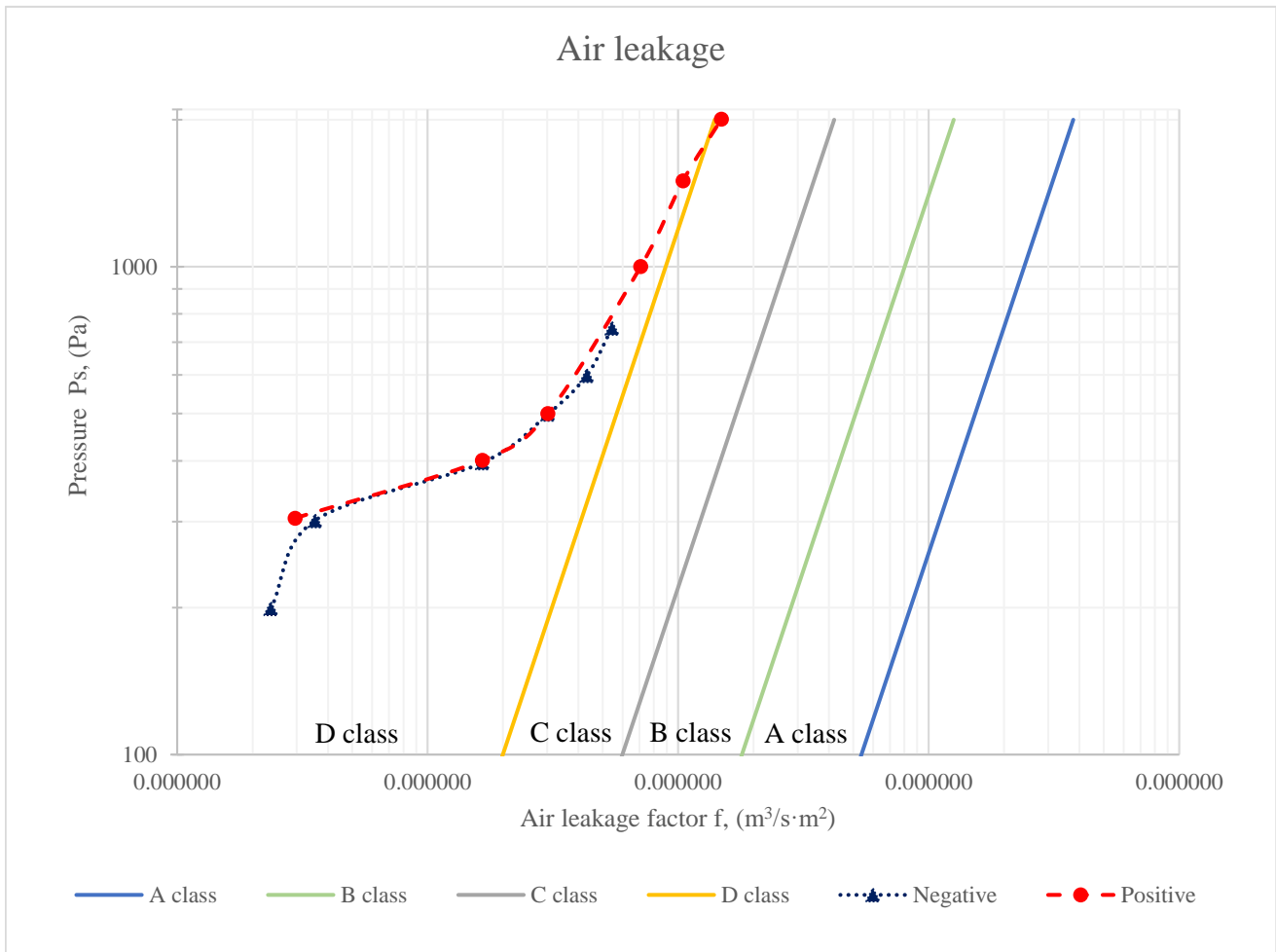
Environment condition during the measurements

Average air temperature	19,2	°C
Average humidity	15,6	%
Average atmospheric pressure	753,7	mmHg / 100,48 kPa

	Air leakage				
	Test pressure	Air leakage	Corrected air leakage*	Air leakage factor	Classification
	Pa	m ³ /h	m ³ /h	(m ³ /s·m ²)	
Negative	199	0,004	0,004	0,000002	D
	302	0,006	0,006	0,000004	D
	397	0,030	0,030	0,000017	D
	498	0,055	0,055	0,000030	D
	598	0,078	0,078	0,000043	D
	748	0,099	0,098	0,000054	D
Positive	305	0,005	0,005	0,000003	D
	401	0,030	0,030	0,000017	D
	500	0,055	0,055	0,000030	D
	1001	0,129	0,128	0,000071	D
	1500	0,190	0,189	0,000105	D
	2007	0,271	0,269	0,000149	C

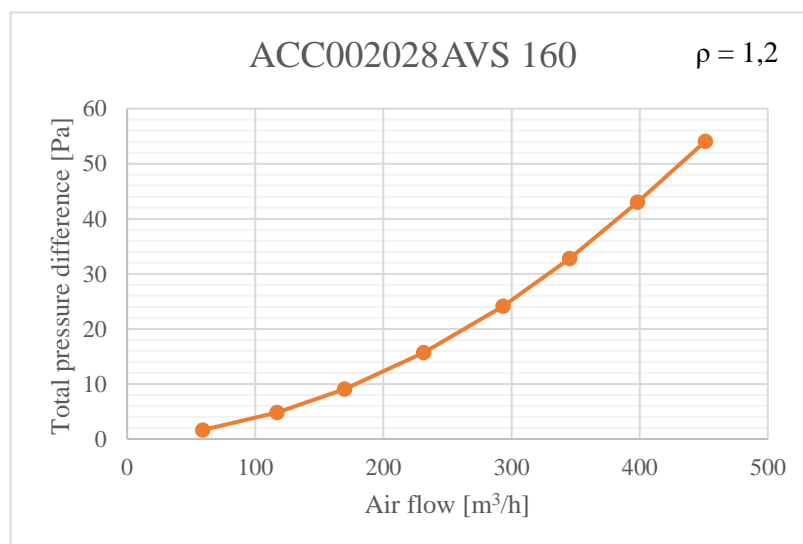
* - adjusted to standard conditions (+20 °C temp. and 101325 Pa).

Air leakage diagram



Pressure drop test data

ACC002028 AVS 160	
q_v	$\Delta p_{1,2}$
m^3/h	Pa
451,2	54,1
398,2	43,0
345,4	32,8
293,3	24,1
231,5	15,7
169,8	9,0
117,0	4,8
58,9	1,6



Data of measurements

B21063-4 (ACC002029 AVS 200)

Description of the sample

Duct connection	0,200	m
Length	0,230	m
Width / depth	0,275	m
Height	0,300	m
Area of the sample surface (A_p)	0,367	m ²
Required air tightness class	Not declared	
Operating pressure	Not declared	
The total joint length (L)	1,256	m
The virtual product surface area (A_c)	0,628	m ²

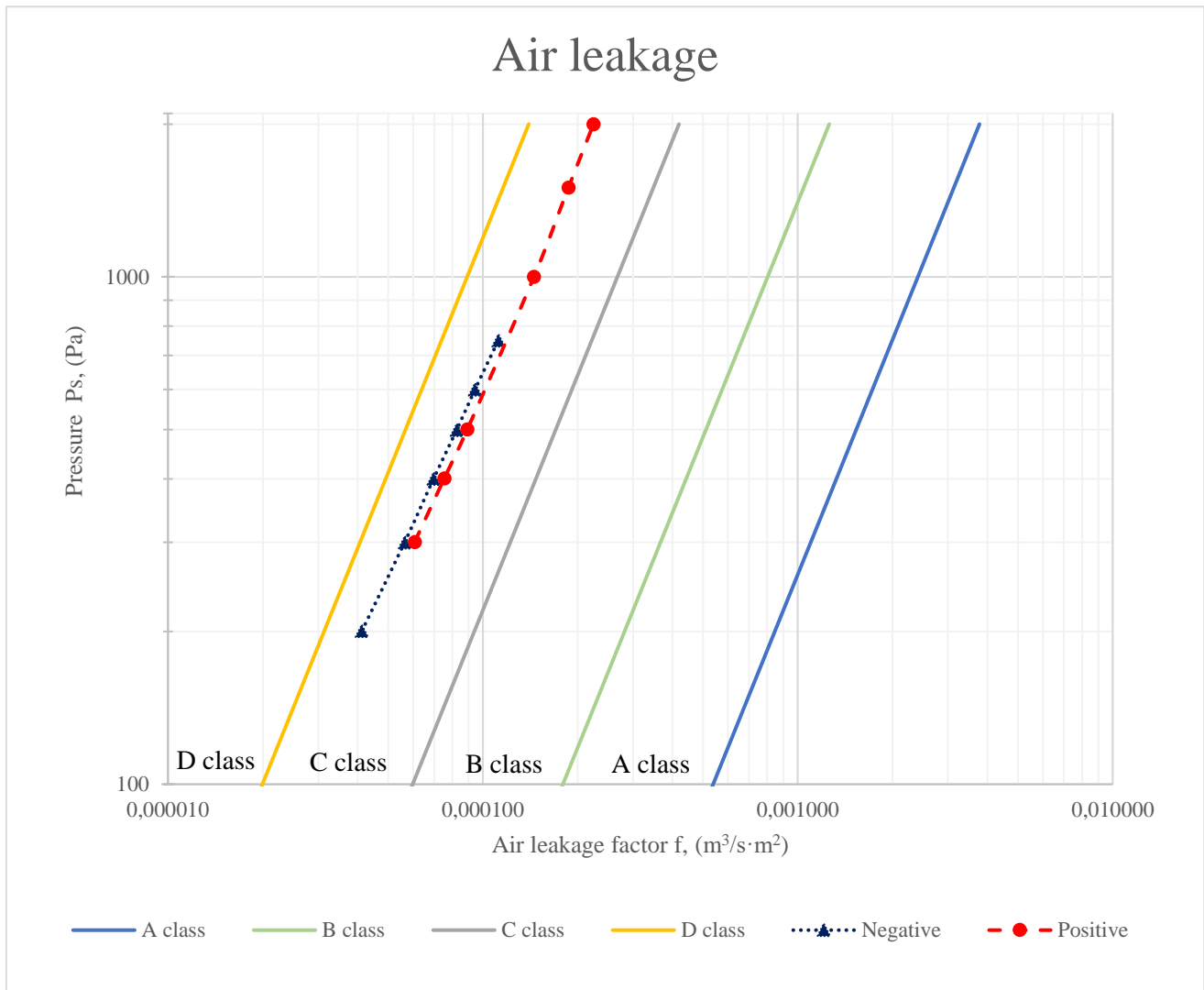
Environment condition during the measurements

Average air temperature	17,2	°C
Average humidity	17,4	%
Average atmospheric pressure	745,6	mmHg / 99,40 kPa

	Air leakage				
	Test pressure	Air leakage	Corrected air leakage*	Air leakage factor	Clasification
	Pa	m ³ /h	m ³ /h	(m ³ /s·m ²)	
Negative	201	0,094	0,093	0,000041	C
	300	0,129	0,128	0,000056	C
	400	0,159	0,158	0,000070	C
	499	0,189	0,187	0,000083	C
	600	0,216	0,214	0,000094	C
	750	0,256	0,253	0,000112	C
Positive	300	0,139	0,137	0,000061	C
	401	0,172	0,171	0,000075	C
	500	0,204	0,202	0,000089	C
	1000	0,332	0,328	0,000145	C
	1500	0,427	0,423	0,000187	C
	2000	0,512	0,508	0,000225	C

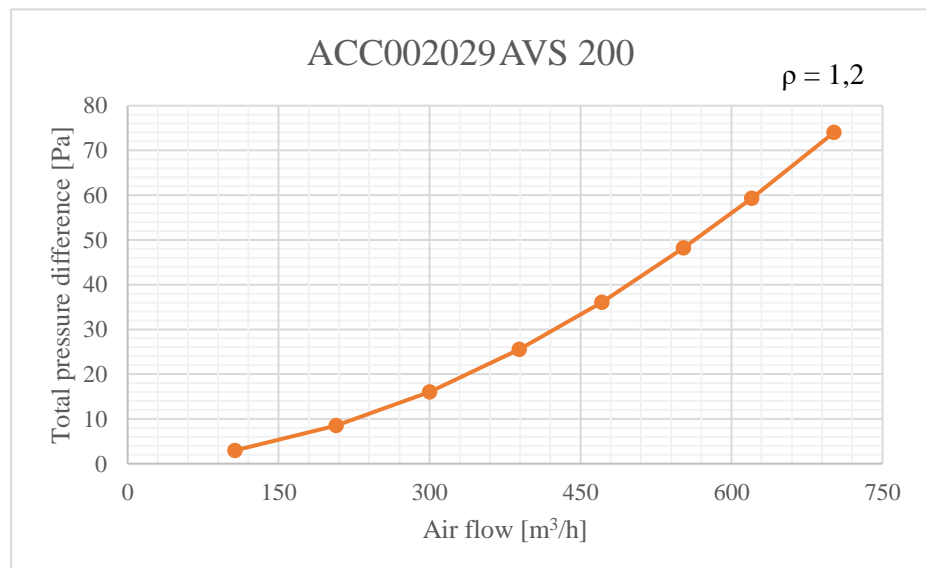
* - adjusted to standard conditions (+20 °C temp. and 101325 Pa).

Air leakage diagram



Pressure drop test data

ACC002029 AVS 200	
q_v	$\Delta p_{1,2}$
m^3/h	Pa
701,7	74,0
620,1	59,3
552,1	48,2
471,2	36,1
389,1	25,5
300,0	16,0
207,2	8,5
106,5	2,9



Data of measurements

B21063-5 (ACC002030 AVS 250)

Description of the sample

Duct connection	0,250	m
Length	0,230	m
Width / depth	0,342	m
Height	0,350	m
Area of the sample surface (A_p)	0,460	m ²
Required air tightness class	Not declared	
Operating pressure	Not declared	
The total joint length (L)	1,570	m
The virtual product surface area (A_c)	0,785	m ²

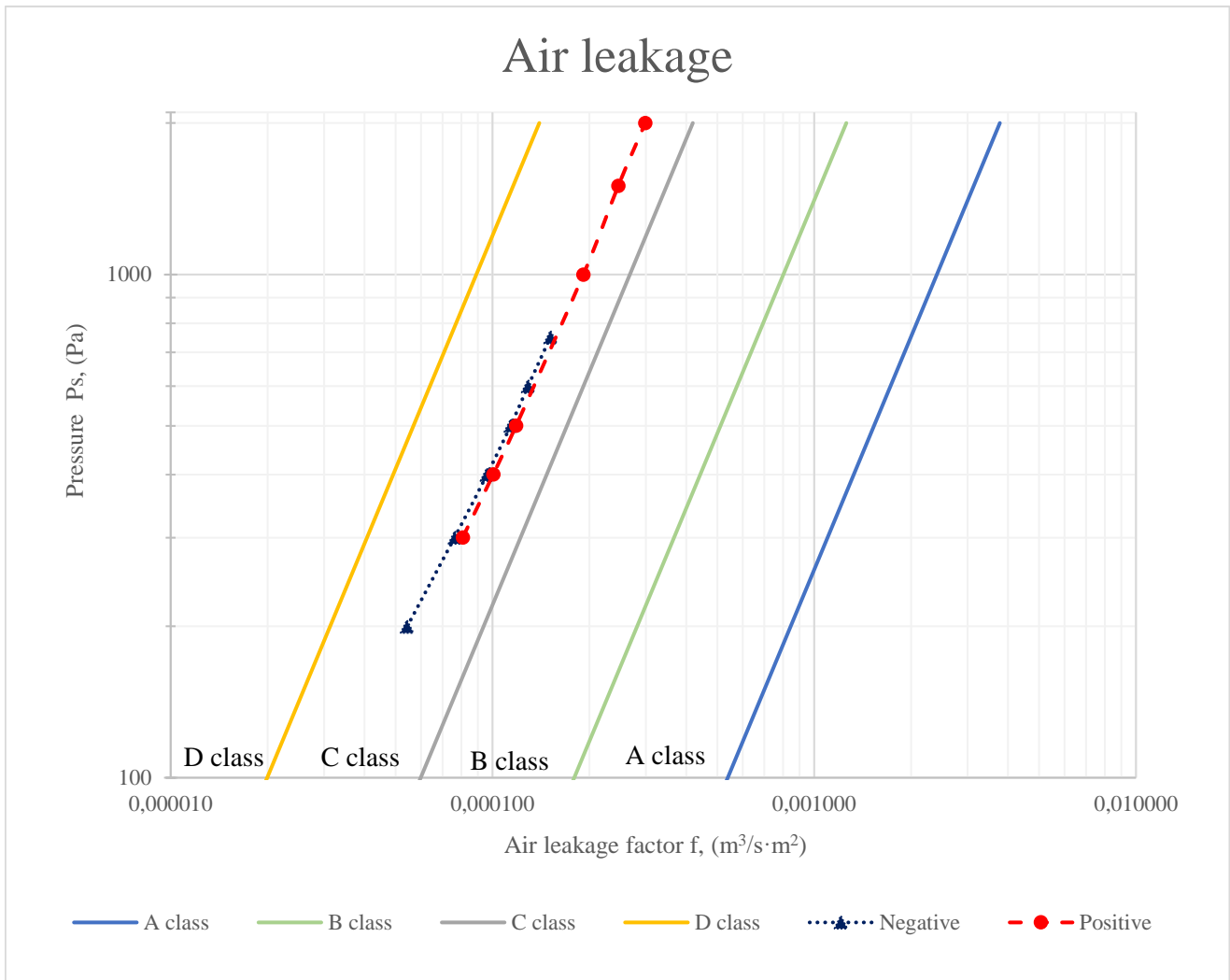
Environment condition during the measurements

Average air temperature	17,2	°C
Average humidity	17,4	%
Average atmospheric pressure	745,6	mmHg / 99,40 kPa

	Air leakage				
	Test pressure	Air leakage	Corrected air leakage*	Air leakage factor	Clasification
	Pa	m ³ /h	m ³ /h	(m ³ /s·m ²)	
Negative	200	0,155	0,153	0,000054	C
	300	0,218	0,216	0,000076	C
	400	0,274	0,271	0,000096	C
	501	0,325	0,322	0,000114	C
	600	0,368	0,365	0,000129	C
	751	0,432	0,428	0,000152	C
Positive	300	0,231	0,229	0,000081	C
	401	0,287	0,284	0,000101	C
	501	0,338	0,335	0,000118	C
	1000	0,547	0,542	0,000192	C
	1500	0,702	0,695	0,000246	C
	1999	0,852	0,843	0,000298	C

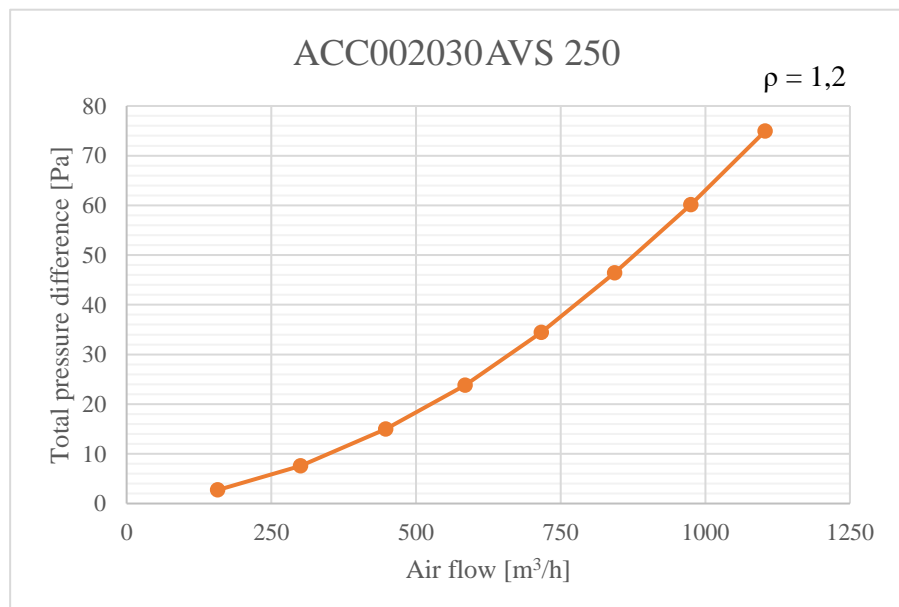
* - adjusted to standard conditions (+20 °C temp. and 101325 Pa).

Air leakage diagram



Pressure drop test data

ACC002030 AVS 250	
q_v	$\Delta p_{1,2}$
m^3/h	Pa
1103,4	74,9
974,8	60,1
843,3	46,4
716,6	34,4
584,6	23,8
447,3	15,0
300,4	7,5
157,2	2,7



Data of measurements

B21063-6 (ACC002031 AVS 315)

Description of the sample

Duct connection	0,315	m
Length	0,230	m
Width / depth	0,375	m
Height	0,440	m
Area of the sample surface (A_p)	0,549	m ²
Required air tightness class	Not declared	
Operating pressure	Not declared	
The total joint length (L)	1,978	m
The virtual product surface area (A_c)	0,989	m ²

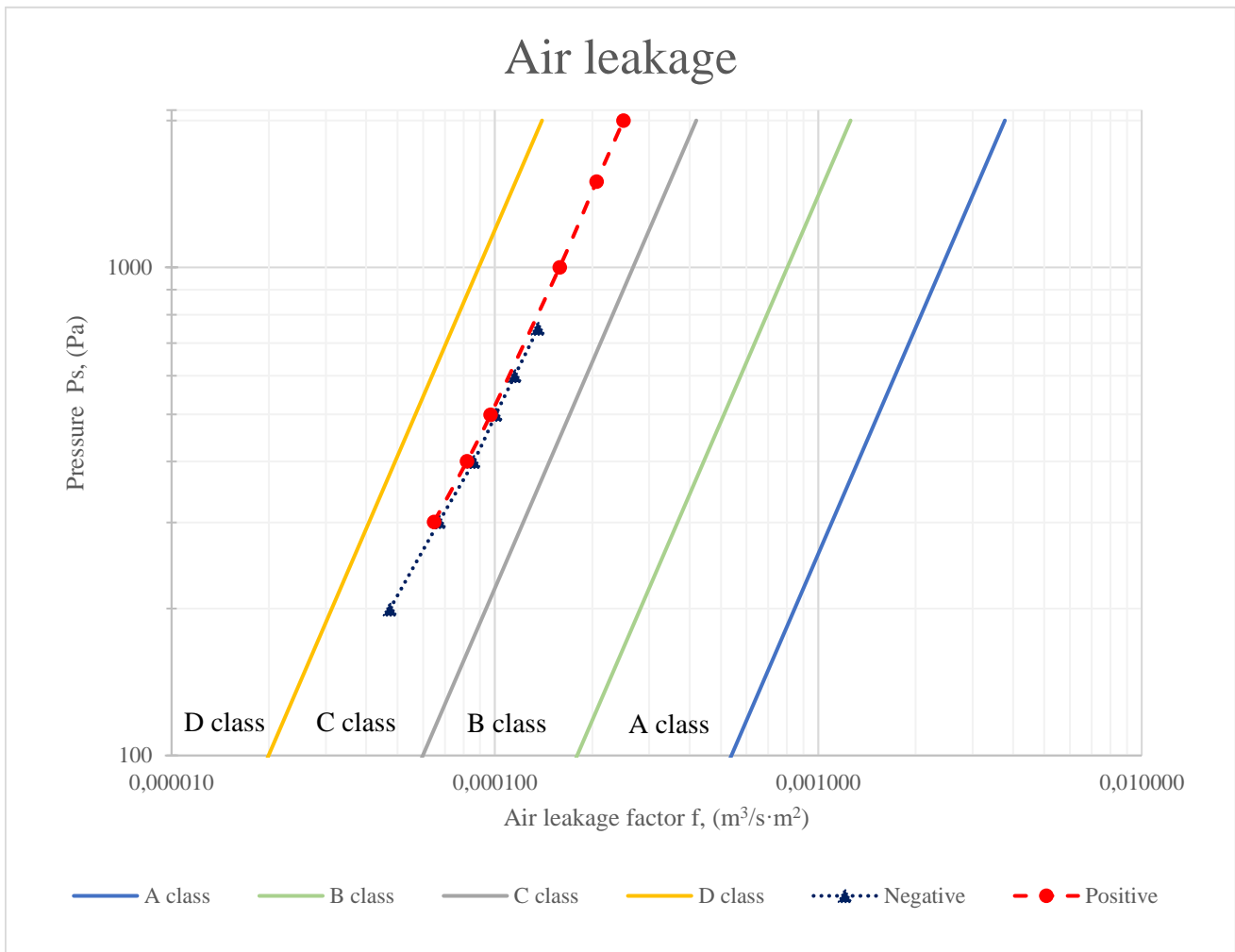
Environment condition during the measurements

Average air temperature	17,2	°C
Average humidity	17,4	%
Average atmospheric pressure	745,6	mmHg / 99,40 kPa

	Air leakage				
	Test pressure	Air leakage	Corrected air leakage*	Air leakage factor	Classification
	Pa	m ³ /h	m ³ /h	(m ³ /s·m ²)	
Negative	199	0,170	0,168	0,000047	C
	301	0,242	0,239	0,000067	C
	400	0,309	0,306	0,000086	C
	500	0,362	0,358	0,000101	C
	600	0,414	0,410	0,000115	C
	750	0,489	0,484	0,000136	C
Positive	301	0,233	0,231	0,000065	C
	401	0,295	0,292	0,000082	C
	499	0,349	0,346	0,000097	C
	1001	0,570	0,564	0,000159	C
	1499	0,741	0,734	0,000206	C
	1999	0,898	0,890	0,000250	C

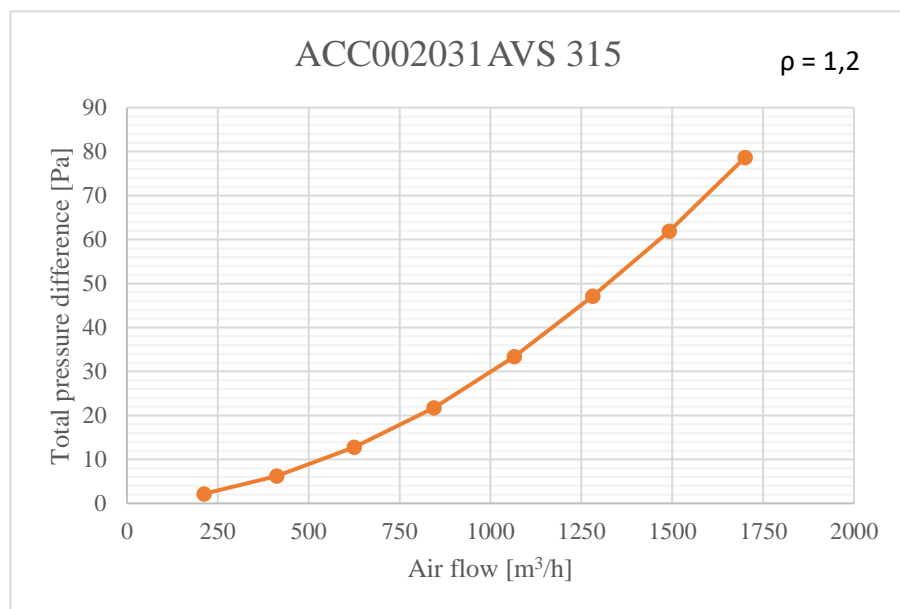
* - adjusted to standard conditions (+20 °C temp. and 101325 Pa).

Air leakage diagram



Pressure drop test data

ACC002031 AVS 315	
q_v	$\Delta p_{1,2}$
m^3/h	Pa
1700,6	78,7
1492,0	61,9
1281,2	47,2
1065,2	33,4
845,0	21,8
625,3	12,8
412,4	6,2
212,0	2,2



Data of measurements

B21063-7 (ACC002032 AVS 400)

Description of the sample

Duct connection	0,400	m
Length	0,230	m
Width / depth	0,442	m
Height	0,530	m
Area of the sample surface (A_p)	0,664	m ²
Required air tightness class	Not declared	
Operating pressure	Not declared	
The total joint length (L)	2,512	m
The virtual product surface area (A_c)	1,256	m ²

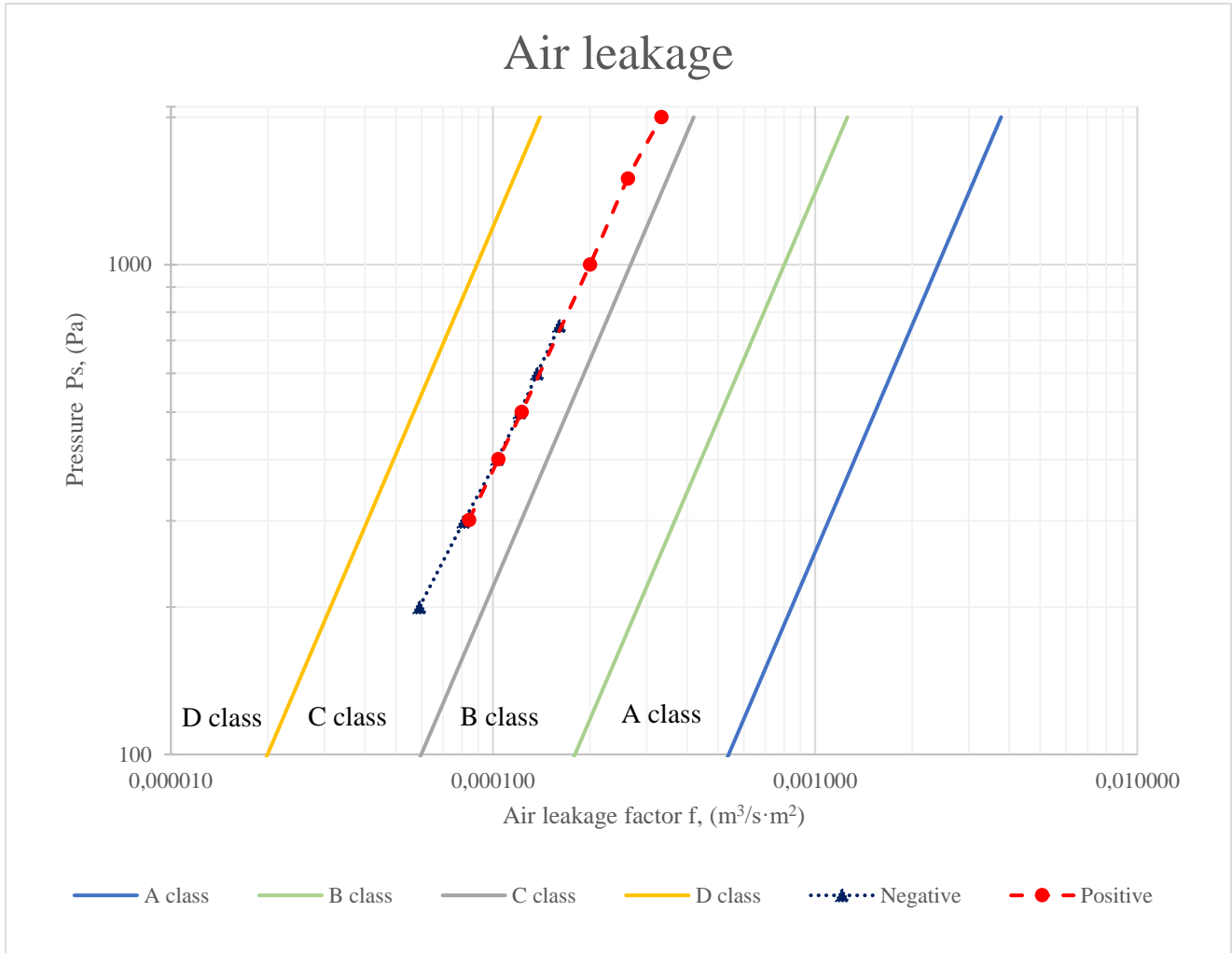
Environment condition during the measurements

Average air temperature	17,2	°C
Average humidity	17,4	%
Average atmospheric pressure	745,6	mmHg / 99,40 kPa

	Air leakage				
	Test pressure	Air leakage	Corrected air leakage*	Air leakage factor	Classification
	Pa	m ³ /h	m ³ /h	(m ³ /s·m ²)	
Negative	200	0,270	0,267	0,000059	C
	299	0,371	0,367	0,000081	C
	401	0,471	0,467	0,000103	C
	500	0,553	0,547	0,000121	C
	600	0,626	0,620	0,000137	C
	750	0,733	0,726	0,000161	C
Positive	301	0,385	0,381	0,000084	C
	401	0,475	0,470	0,000104	C
	501	0,560	0,555	0,000123	C
	1001	0,913	0,905	0,000200	C
	1500	1,197	1,186	0,000262	C
	2000	1,522	1,508	0,000333	C

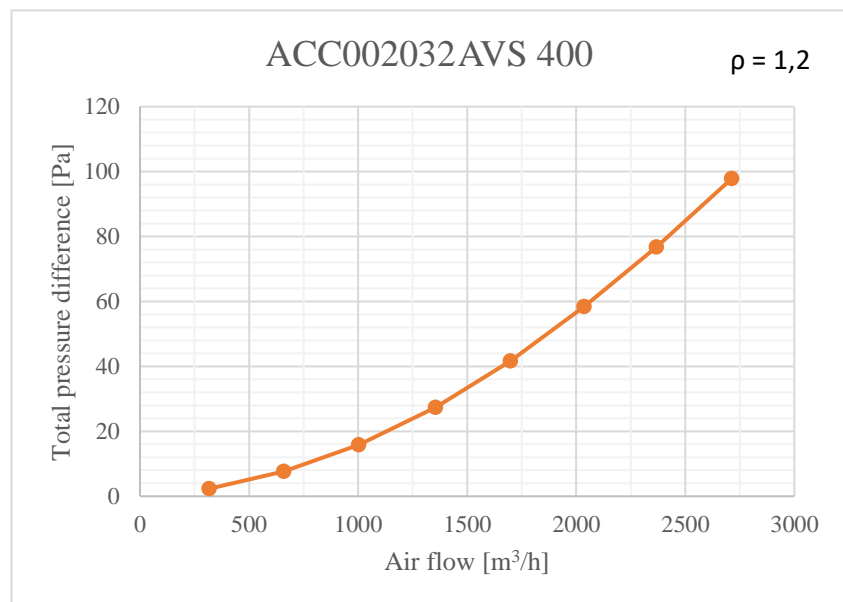
* - adjusted to standard conditions (+20 °C temp. and 101325 Pa).

Air leakage diagram



Pressure drop test data

ACC002032 AVS 400	
q_v	$\Delta p_{1,2}$
m^3/h	Pa
2712,5	97,8
2368,6	76,8
2036,1	58,5
1698,4	41,7
1354,7	27,4
1002,6	15,8
658,8	7,6
317,6	2,3



Data of measurements

B21063-8 (ACC002033 AVS 500)

Description of the sample

Duct connection	0,500	m
Length	0,230	m
Width / depth	0,542	m
Height	0,734	m
Area of the sample surface (A_p)	0,990	m ²
Required air tightness class	Not declared	
Operating pressure	Not declared	
The total joint length (L)	3,140	m
The virtual product surface area (A_c)	1,570	m ²

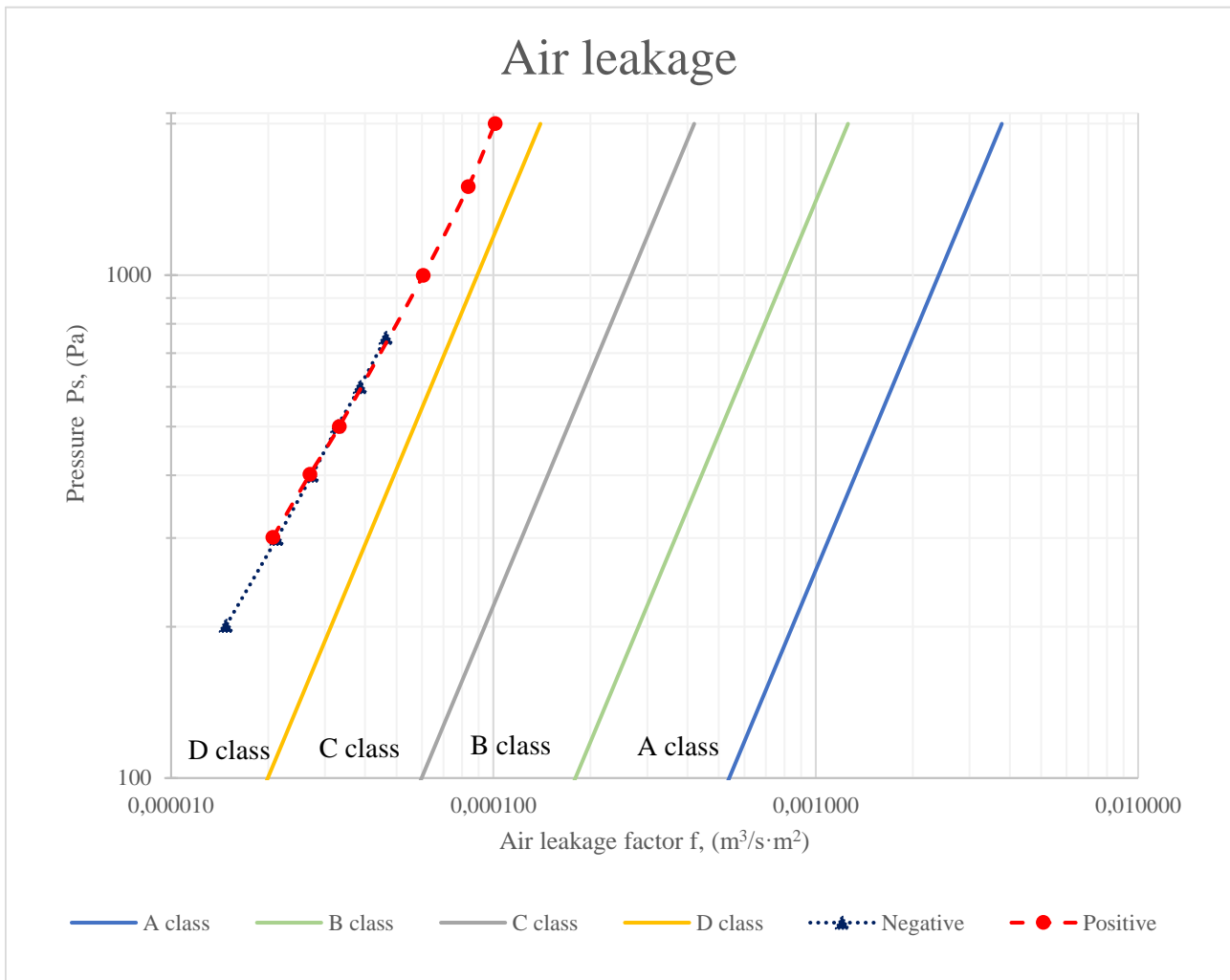
Environment condition during the measurements

Average air temperature	17,2	°C
Average humidity	17,4	%
Average atmospheric pressure	745,6	mmHg / 99,40 kPa

	Air leakage				
	Test pressure	Air leakage	Corrected air leakage*	Air leakage factor	Classification
	Pa	m ³ /h	m ³ /h	(m ³ /s·m ²)	
Negative	201	0,085	0,084	0,000015	D
	299	0,121	0,120	0,000021	D
	400	0,156	0,155	0,000027	D
	501	0,187	0,186	0,000033	D
	600	0,220	0,218	0,000039	D
	752	0,264	0,262	0,000046	D
Positive	301	0,118	0,117	0,000021	D
	402	0,154	0,152	0,000027	D
	500	0,190	0,188	0,000033	D
	999	0,346	0,342	0,000061	D
	1500	0,477	0,472	0,000084	D
	2003	0,577	0,572	0,000101	D

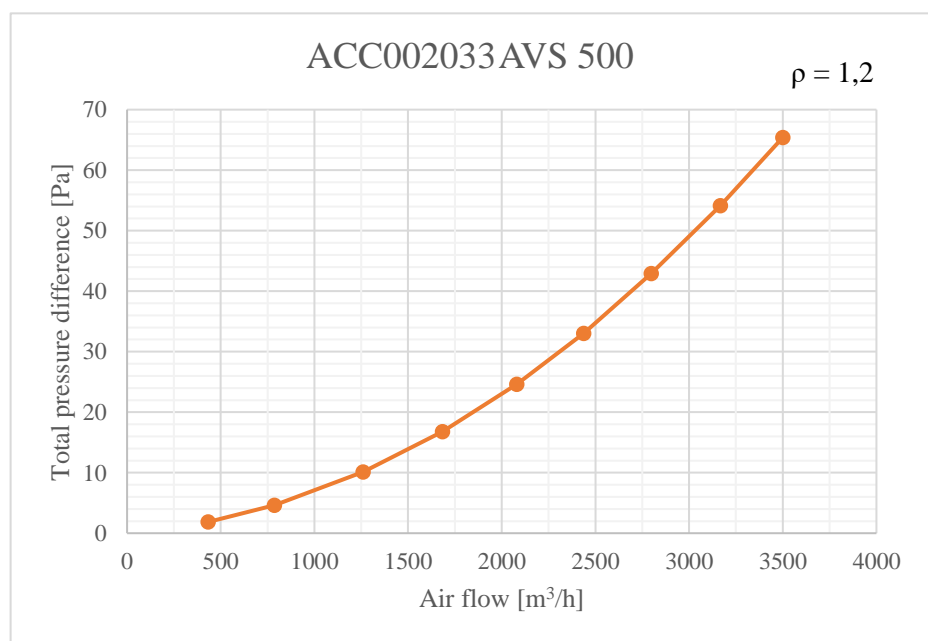
* - adjusted to standard conditions (+20 °C temp. and 101325 Pa).

Air leakage diagram

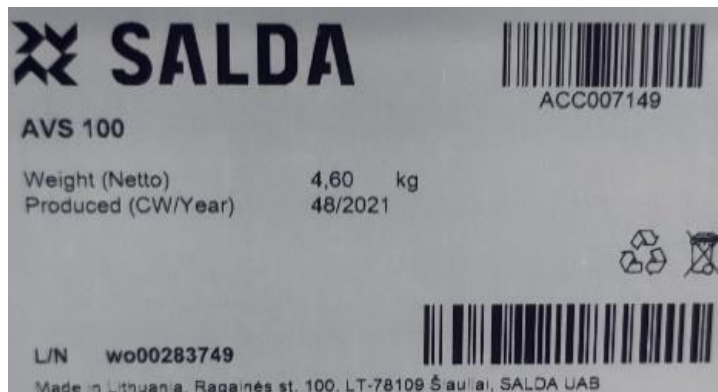


Pressure drop test data

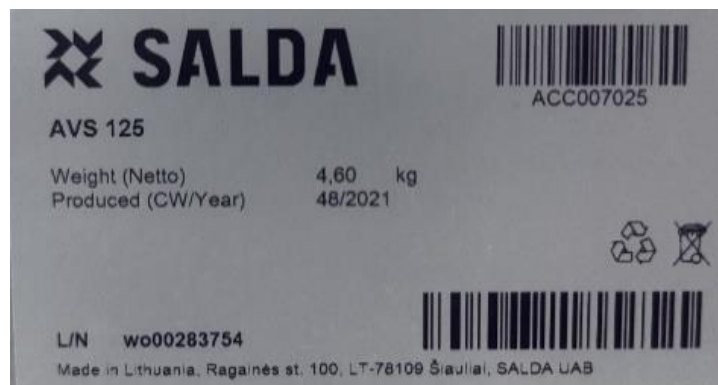
ACC002033 AVS 500	
q_v	$\Delta p_{1,2}$
m^3/h	Pa
3500,4	65,4
3166,7	54,2
2798,0	42,9
2437,3	33,0
2080,0	24,6
1684,3	16,8
1259,6	10,1
785,9	4,6
432,7	1,9



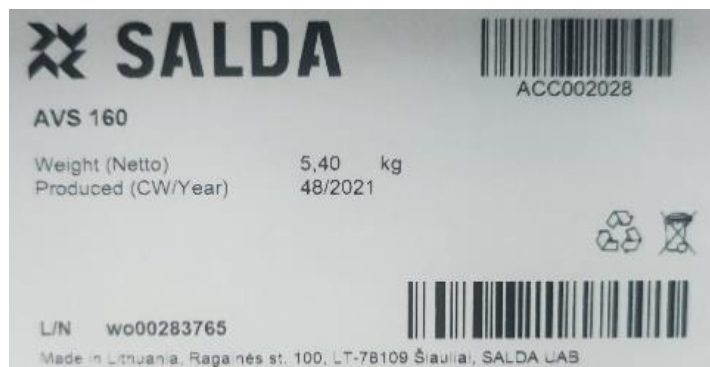
Annex 1. Pictures of the sample



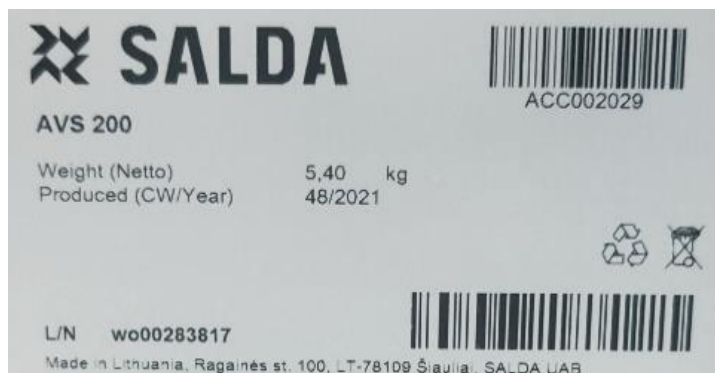
B21063-1



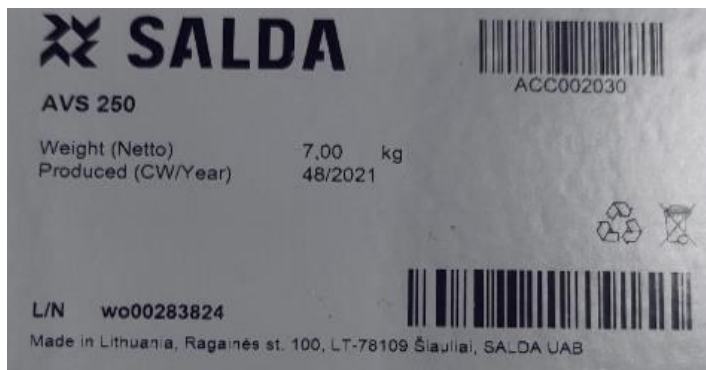
B21063-2



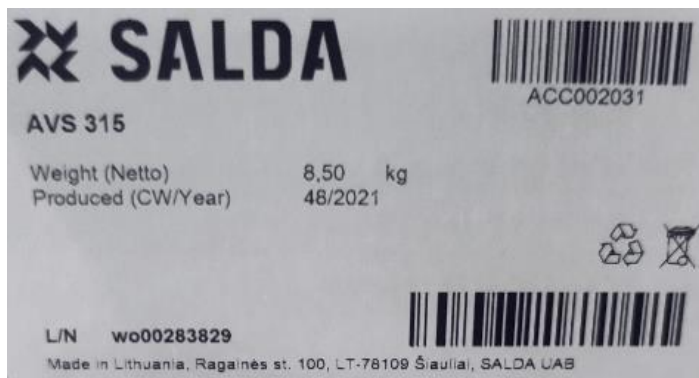
B21063-3



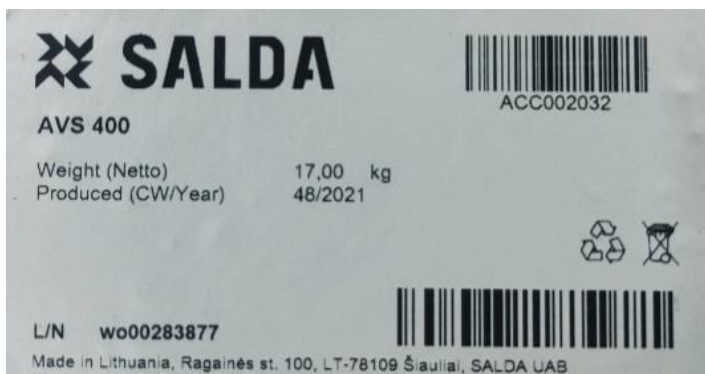
B21063-4



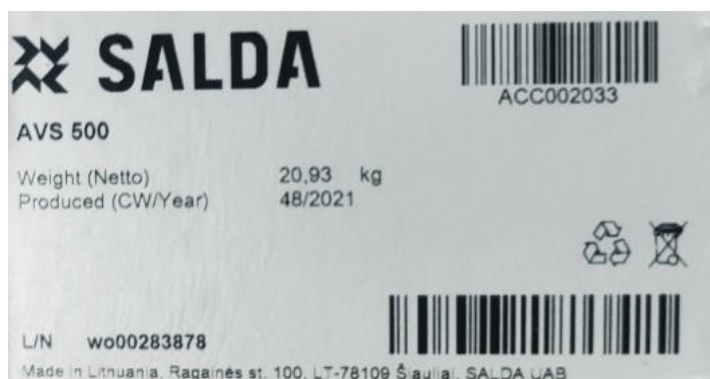
B21063-5



B21063-6



B21063-7



B21063-8

Annex 2. Equipment for measurements

Equipement for air leakage measurement

Type of equipment	Manufacturer / Model	Number	Range	Calibration data
Pressure sensor	TESTO/6351	PT-02885991	(-5000÷5000) Pa	2021-04
Pressure sensor	TESTO/6351	PT-02963093	(-100÷100) Pa	2021-04
Flow meter	COMMON/CGR-01 G40	861912	(0,65÷65) m ³ /h	2021-04
Flow meter	SIERRA/822S-M-4-OV1-PV2-V4	188960	(0,04÷2) m ³ /h	2021-04
Environment conditions	COMET SYSTEM / T7511	13960841	(0÷100) %; (-30÷105) °C; (450÷825,1) mmHg	2021-03

Equipement for airflow measurement

Type of equipment	Manufacturer / Model	Number	Range	Calibration data
Environment condition	COMET SYSTEM T7511	13960841	(0÷100) %; (-30÷105) °C; (450÷825,1) mmHg	2021-03
Pressure transducer	KIMO / CP303	PT-09121789	-1000 to +1000 Pa	2021-03
Pressure transducer	KIMO / CP303	PT-09121789	-1000 to +1000 Pa	2021-03
Pressure transducer	KIMO / CP212	PT-2F141005198	-1000 to +1000 Pa	2021-03
Pressure transducer	KIMO / CP212	PT-2F141005199	-1000 to +1000 Pa	2021-03
Temperature sensor Pt100	Ahlborn / FPA50K01	T3-SFM1	-40 to +200 °C	2021-03
Temperature humidity sensor	Ahlborn / FHAD462	TRH7-SFM1	-20 to +60 °C 5 to 98 % RH	2021-03
Multinozzle inlet chamber	Siventa	S-FM-1	NA	2021-09

Annex 3. Air leakage test calculation info

Calculation of the total joint length (L)

The total joint length, in metres, for a product of circular cross-section is the sum of the joint perimeter of each connection (1 to n).

$$L = \pi \times (d_1 + d_2 + \dots + d_n)$$

The total joint length, in metres, for a product of rectangular cross-section is the sum of each joint perimeter.

$$L = 2 \times (a_1 + b_1 + a_2 + b_2 \dots + a_n + b_n)$$

Calculation of the virtual product surface area (A_c)

The virtual product surface area A_c, in square metres, is:

$$A_c = L \times 0,5$$

or

$$A_c = A_p \text{ (the product surface area).}$$

whichever is the larger.

Air tightness classification for technical ductwork products with circular cross section connections (LST EN 15727)

Air tightness class	Static pressure limit (p_s)		Air leakage limit (f_{max}) $m^3 \cdot s^{-1} \cdot m^{-2}$
	Pa		
	Positive	Negative	
A	500	500	$0,027 \times p_{test}^{0,65} \times 10^{-3}$
B	1000	750	$0,009 \times p_{test}^{0,65} \times 10^{-3}$
C	2000	750	$0,003 \times p_{test}^{0,65} \times 10^{-3}$
D	2000	750	$0,001 \times p_{test}^{0,65} \times 10^{-3}$