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2019-05-03
M104146/46 RFD/STEG

Fabric Rhythm 60000, Manufacturer Gabriel A/S

Determination of airflow resistance according to ISO 9053-1

Test Report No. M104146/46

Client:	Gabriel A/S Hjulmagervej 55 9000 Aalborg DENMARK
Consultant:	Dipl.-Ing. (FH) Dominik Reif
Date of report:	2019-05-03
Delivery date of test object:	2019-02-20
Date of test:	2019-03-07
Total number of pages:	In total 10 pages, thereof 5 pages text, 3 pages Appendix A and 2 pages Appendix B.

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1 Task

On behalf of Gabriel A/S, 9000 Aalborg, Denmark, the airflow resistance of three samples of the fabric Rhythm 60000 was to be determined according to ISO 9053-1 [1].

2 Basis

This test report is based on the following document:

[1] DIN EN ISO 9053-1: Acoustics –Determination of airflow resistance – Part 1: Static airflow method (ISO 9053-1:2018);
German version EN ISO 9053-1:2018. March 2019

3 Test objects

The tested fabrics are described in Table 1. The indicated characteristic values were determined by the testing laboratory on the basis of the three samples delivered by the manufacturer.

Table 1. Test objects.

Test object (manufacturer's information)	**Area specific mass m'' [g/m²]**	**Thickness t [mm]**
Fabric Rhythm 60000, manufacturer Gabriel A/S, sample 13334-1	342	2.97
Fabric Rhythm 60000, manufacturer Gabriel A/S, sample 13334-2	341	2.99
Fabric Rhythm 60000, manufacturer Gabriel A/S, sample 13334-3	340	2.97

4 Execution of measurements

The airflow resistance was determined according to ISO 9053-1 [1].

The test method, the test facility and the test equipment used are described in Appendix B.

5 Measurement results

The measurement results are shown in diagrams and tables in the test certificates in Appendix A of this report.

The measurement results are also shown in the following Table 2.

Table 2. Test results.

Test object (manufacturer's information)	**Airflow resistance R_S / (Pa s / m)**	**Appendix A, page**
Fabric Rhythm 60000, manufacturer Gabriel A/S, sample 13334-1	38	1
Fabric Rhythm 60000, manufacturer Gabriel A/S, sample 13334-2	34	2
Fabric Rhythm 60000, manufacturer Gabriel A/S, sample 13334-3	31	3
Mean value	34	

For the three tested samples an average specific airflow resistance of

$$R_s = 34 \text{ Pa} \cdot \text{s/m}$$

was determined.

The measurement results are shown in diagrams and tables in the test certificate in Appendix A of this report.

6 Remarks

The test results exclusively relate to the investigated subjects and conditions described.

Dipl.-Ing. (FH) Dominik Reif
(Project Manager)

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Deutsche
Akkreditierungsstelle
D-PL-14119-07-00

Durch die DAkkS Deutsche Akkreditierungsstelle GmbH
nach DIN EN ISO/IEC 17025 akkreditiertes Prüflaboratorium.
Die Akkreditierung gilt für die in der Urkunde aufgeführten Prüfverfahren.

ISO 9053-1
Determination of airflow resistance

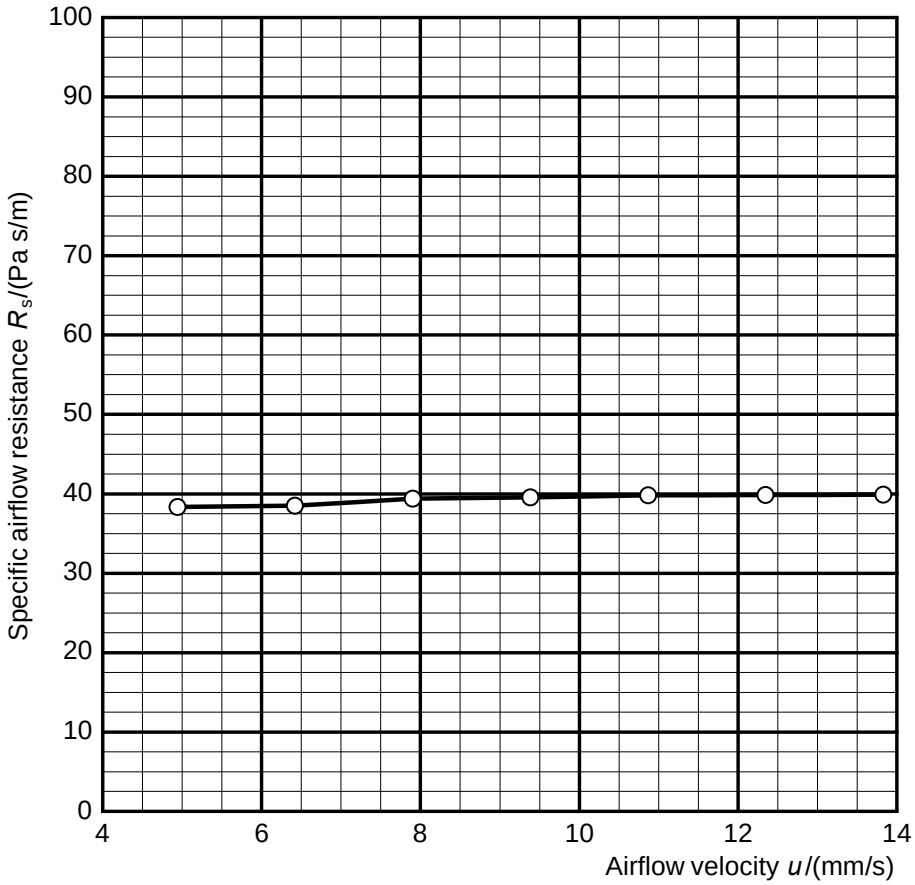
Client:: Gabriel A/S
Hjulmagervej 55
9000 Aalborg
DENMARK

Project Number:: M104146
Sample Number:: 13334-1
Test object: - Rhythm 60000, sample 1

Diameter: 100 mm
Thickness: 2.97 mm
Area-specific mass: 342 g/m^2

Barometric pressure:
B = 94,0 kPa
Temperature:
θ = 21,5 °C
Relative humidity:
r. h. = 14,0 %

u/ (mm/s)	R_s/ (Pa s/m)
4.94	38
6.42	39
7.90	39
9.38	40
10.86	40
12.35	40
13.83	40



Specific airflow resistance R_s = 38 Pa s/m

Laboratory: Planegg
Responsible: Moll
Date: 2019-03-07

ISO 9053-1
Determination of airflow resistance

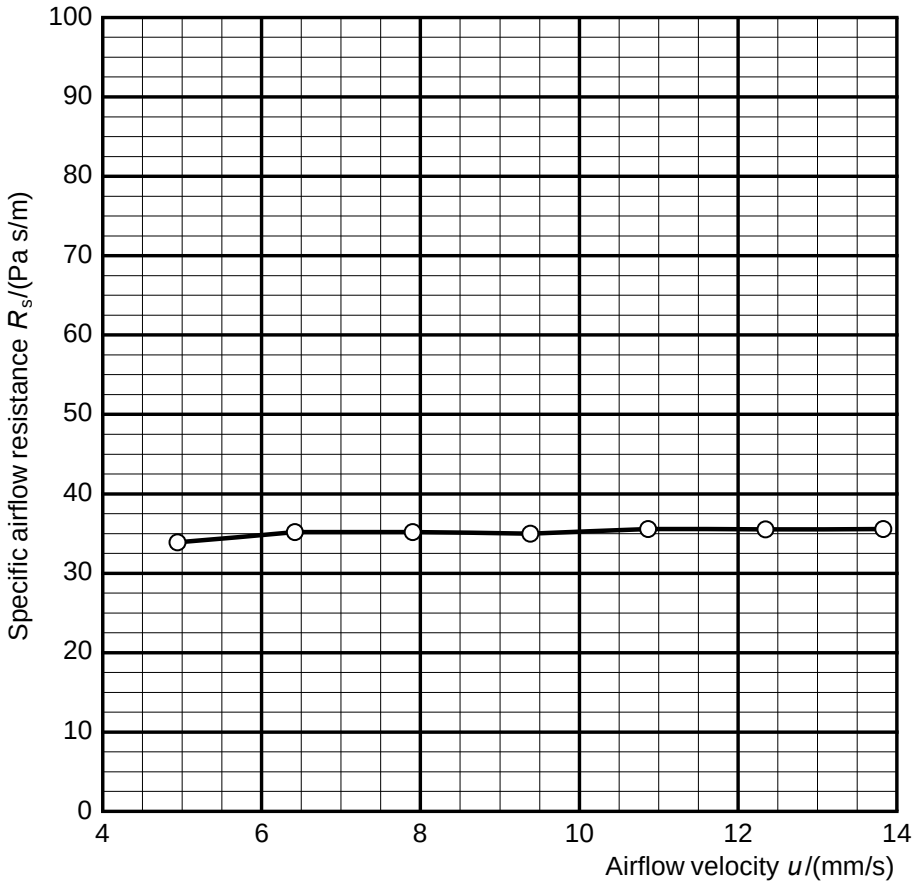
Client:: Gabriel A/S
Hjulmagervej 55
9000 Aalborg
DENMARK

Project Number:: M104146
Sample Number:: 13334-2
Test object: - Rhythm 60000, sample 2

Diameter: 100 mm
Thickness: 2.99 mm
Area-specific mass: 341 g/m^2

Barometric pressure:
B = 94,0 kPa
Temperature:
θ = 21,5 °C
Relative humidity:
r. h. = 14,0 %

u/ (mm/s)	R_s/ (Pa s/m)
4.94	34
6.42	35
7.90	35
9.38	35
10.86	36
12.35	36
13.83	36



Specific airflow resistance R_s = 34 Pa s/m

Laboratory: Planegg
Responsible: Moll
Date: 2019-03-07

ISO 9053-1
Determination of airflow resistance

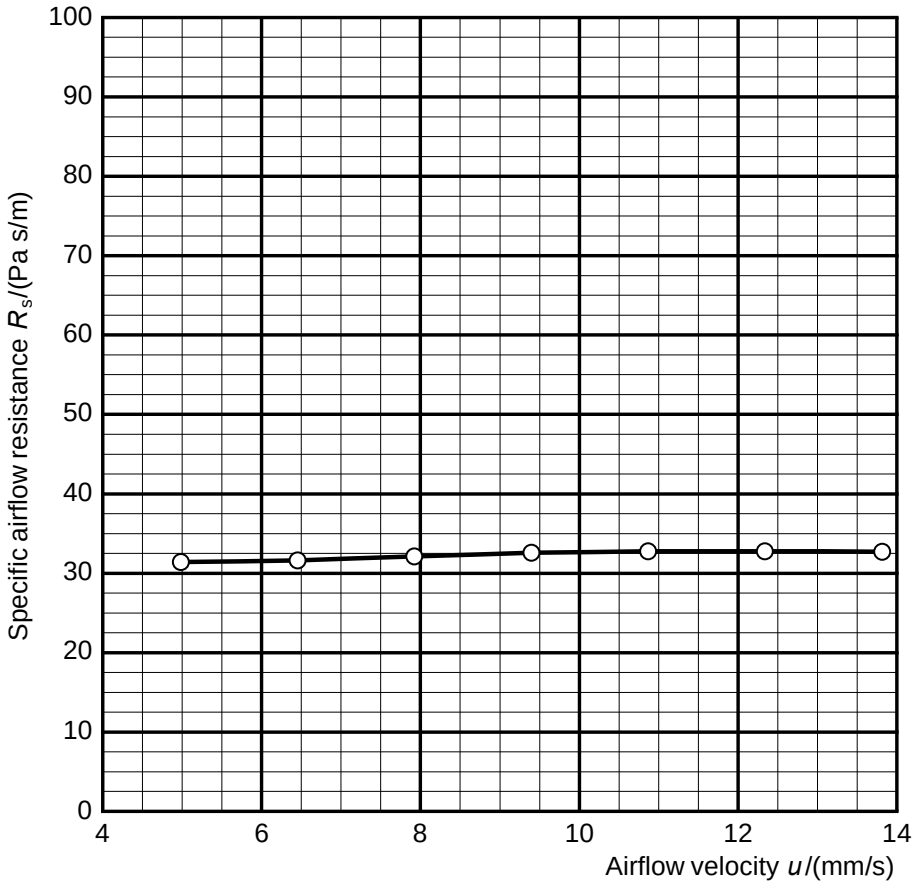
Client:: Gabriel A/S
Hjulmagervej 55
9000 Aalborg
DENMARK

Project Number:: M104146
Sample Number:: 13334-3
Test object: - Rhythm 60000, sample 3

Diameter: 100 mm
Thickness: 2.97 mm
Area-specific mass: 340 g/m^2

Barometric pressure:
B = 94,1 kPa
Temperature:
θ = 21,5 °C
Relative humidity:
r. h. = 14,0 %

u/ (mm/s)	R_s/ (Pa s/m)
4.98	31
6.45	32
7.92	32
9.40	33
10.87	33
12.34	33
13.82	33



Specific airflow resistance R_s = 31 Pa s/m

Laboratory: Planegg
Responsible: Moll
Date: 2019-03-07

Description of the test procedure for the determination of the airflow resistance

1 Measurand

The specific airflow resistance R_S of the test object was determined. For this purpose, the air pressure difference in front of as well as behind the test object was measured at different volumetric airflow rates. The specific airflow resistance $R_{S,I}$ for each volumetric airflow rate q_i determined was calculated using the following equation:

$$R_{S,i} = \frac{\Delta p_i \cdot A}{q_{v,i}}$$

With:

$R_{S,i}$ specific airflow resistance in Pa s/m

Δp_i air pressure difference across the test object with respect to the atmosphere in Pa

A cross-sectional area of the test object perpendicular to the direction of flow in m^2

$q_{v,i}$ volumetric airflow rate passing through the test object in m^3/s

u_i linear airflow velocity in m/s

In addition, the linear airflow velocity u_i was determined:

$$u_i = \frac{q_{v,i}}{A}$$

The indicated measurement result is the specific airflow resistance R_S which is calculated for an airflow velocity of u = 0.0005 m/s by extrapolation with the help of the linear regression.

2 Test procedure

The direct airflow method (method A according to ISO 9053-1) was applied. A steady unidirectional airflow with different airflow rates is pressed through the test object in the specimen holder. The resulting pressure drop between the two free faces of the test object is measured.

The specimen holder had a diameter of D = 100 mm.

3 Precision

According to ISO 9053-1 [1], for the test procedure based on round-robin tests for open-pored foam, a repeatability precision of approximately 15 % was determined.

4 List of test equipment

The test equipment used is listed in Table B.1.

Table B.1. Test equipment

Name	Manufacturer	Type	Serial-No.	Calibration valid until
Measurement system airflow resistance	Müller-BBM	M89319-00	315003	2020-03
Software for measurement and evaluation	Müller-BBM Acoustic Solutions	m|ars	1.9.6697.32125	
Digital measuring slide	Mitutoyo	CD-15PPR	07019377	2021-03
Electronic balance	Kern	KB1200-2N	W1402353	2021-03