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M104146/62 Version 1 RFD/LBN

Fabric
"Design Focus Royal"
Manufacturer Gabriel A/S

Determination of the airflow resistance according to DIN EN ISO 9053-1

Test Report No. M104146/62

Client:	Gabriel A/S Hjulmagervej 55 9000 Aalborg DENMARK
Consultant:	Dipl.-Ing. (FH) Dominik Reif
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Appendix A: Test certificates

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1 Task

On behalf of Gabriel A/S, 9000 Aalborg, Denmark, the airflow resistance of the fabric type “Design Focus Royal” was to be determined according to DIN EN ISO 9053-1 [1].

2 Basis

This test report is based on the following documents:

[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

[2] DIN EN ISO 5084: Textiles – Determination of thickness of textiles and textile products (ISO 5084:1996); German version EN ISO 5084:1996. October 1996

3 Test objects

3.1 General

The tested fabric is described in the following Table 1. The indicated characteristic values were determined by the testing laboratory on the basis of a sample delivered by the manufacturer. For each fabric, three samples were tested. Each measured sample had the dimensions of 210 mm x 297 mm.

The thickness of the test objects was determined by the testing laboratory according to DIN EN ISO 5084 [2]. Testing was performed at three positions of the samples at a pressure of 1.00 kPa and with a presser-foot of 2,000 mm².

3.2 Design Focus Royal

Table 1. Test object “Design Focus Royal” – without lamination.

Test object (manufacturer’s information)	**Sample 15068/**	**Area specific mass m'' [g/m²]**	**Thickness t [mm]**
Fabric: “Design Focus Royal” Colour number: 60040 Composition: 100 % New Zealand Wool	01	467	1.64
	02	461	1.60
	03	464	1.60
Mean		464	1.61

4 Execution of measurements

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

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

5 Measurement results

5.1 General

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

5.2 Design Focus Royal

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

Table 2. Specific airflow resistance.

Test object / Fabric type "Design Focus Royal"	**Specific airflow resistance R_S / (Pa s / m)**	**Appendix A, page**
Sample 1/3 (no. 15068/1)	157	1
Sample 2/3 (no. 15068/2)	170	2
Sample 3/3 (no. 15068/3)	171	3

For the three tested samples, a mean specific airflow resistance of

$$R_s = 166 \text{ Pa} \cdot \text{s/m}$$

was determined.

6 Remarks

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

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

Deutsche Akkreditierungsstelle D-PL-14119-07-00

Testing laboratory accredited by DAkkS according to DIN EN ISO/IEC 17025:2018.
The accreditation is valid only for the scope listed in the annex of the accreditation certificate.

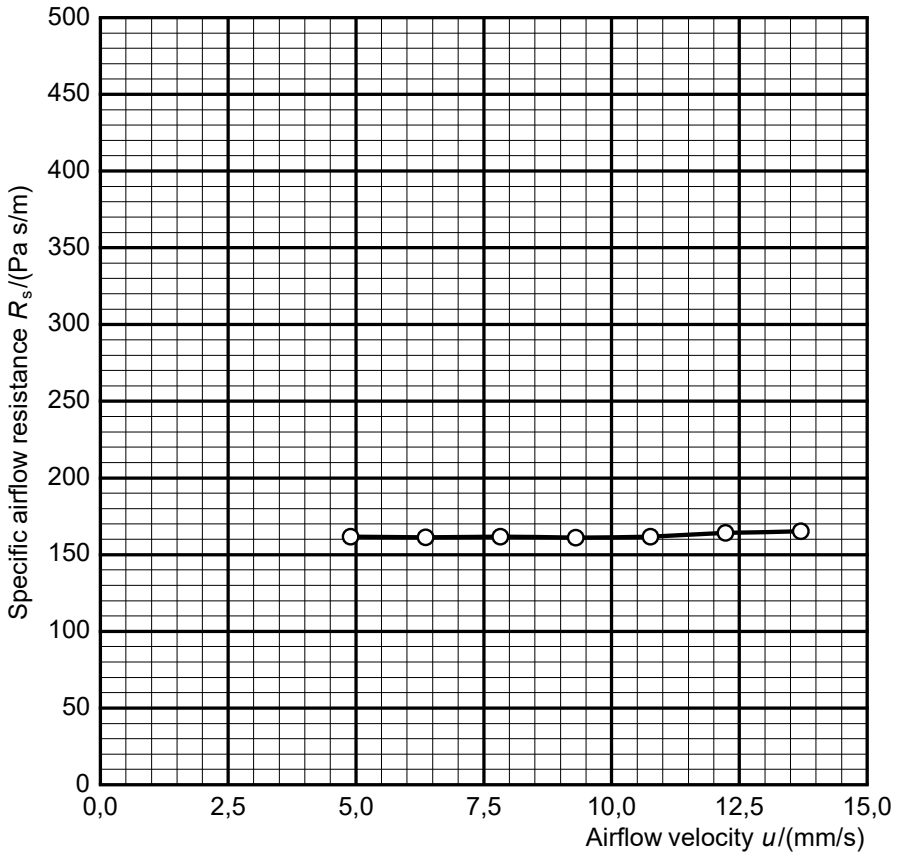
EN ISO 9053-1
Determination of airflow resistance

Client: Gabriel A/S
Hjulmagervej 55
DK-9000 Aalborg
Denmark
Project number: M104146
Sample number: 15068/01
Test object: Design Focus Royal
Colour No.: 60040
Material: 100 % New Zealand Wool

Diameter: 100 mm
Thickness: 1.64 mm
Area-specific mass: 467 g/m^2

Barometric pressure:
B = 95,4 kPa
Temperature:
θ = 27,9 °C
Relative humidity:
r. h. = 19,4 %

u/ (mm/s)	R_s/ (Pa s/m)
4.90	162
6.36	161
7.83	162
9.30	161
10.76	162
12.23	164
13.70	165



Specific airflow resistance R_s(0.5 mm/s) = 157 Pa s/m

Laboratory: Planegg
Responsible: Reif
Date: 2022-07-20

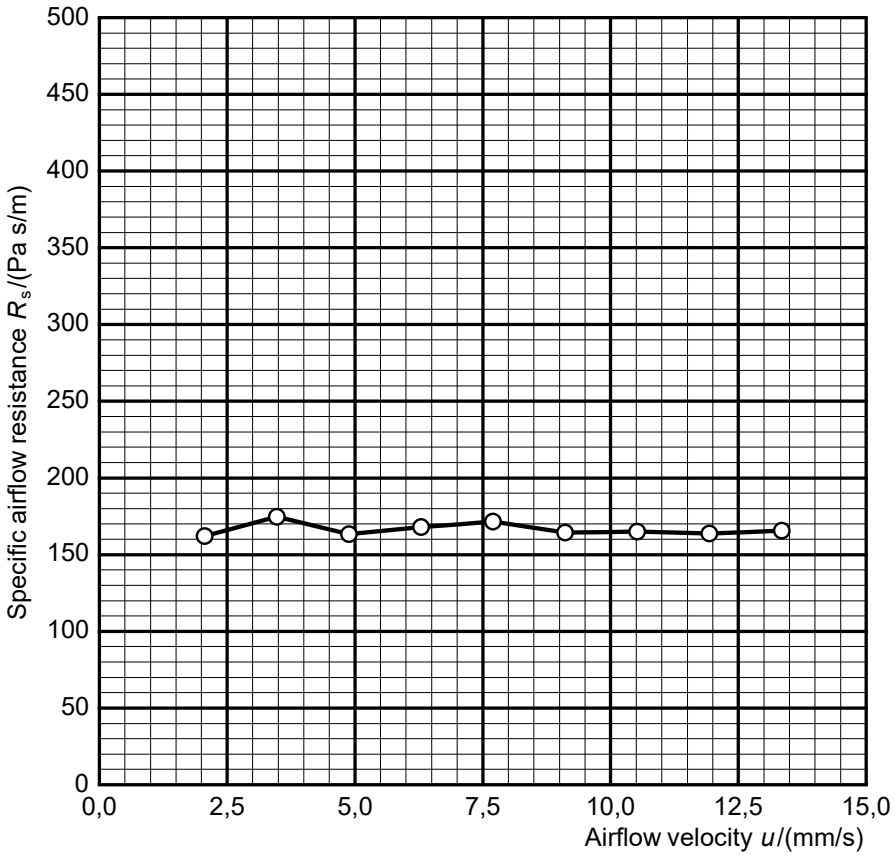
EN ISO 9053-1
Determination of airflow resistance

Client: Gabriel A/S
Hjulmagervej 55
DK-9000 Aalborg
Denmark
Project number: M104146
Sample number: 15068/02
Test object: Design Focus Royal
Colour No.: 60040
Material: 100 % New Zealand Wool

Diameter: 100 mm
Thickness: 1.6 mm
Area-specific mass: 461 g/m^2

Barometric pressure:
B = 95,4 kPa
Temperature:
θ = 28,0 °C
Relative humidity:
r. h. = 11,4 %

u/ (mm/s)	R_s/ (Pa s/m)
2.06	162
3.47	175
4.88	163
6.29	168
7.70	172
9.11	164
10.52	165
11.93	164
13.35	166



Specific airflow resistance R_s(0.5 mm/s) = 170 Pa s/m

Laboratory: Planegg
Responsible: Reif
Date: 2022-07-20

EN ISO 9053-1
Determination of airflow resistance

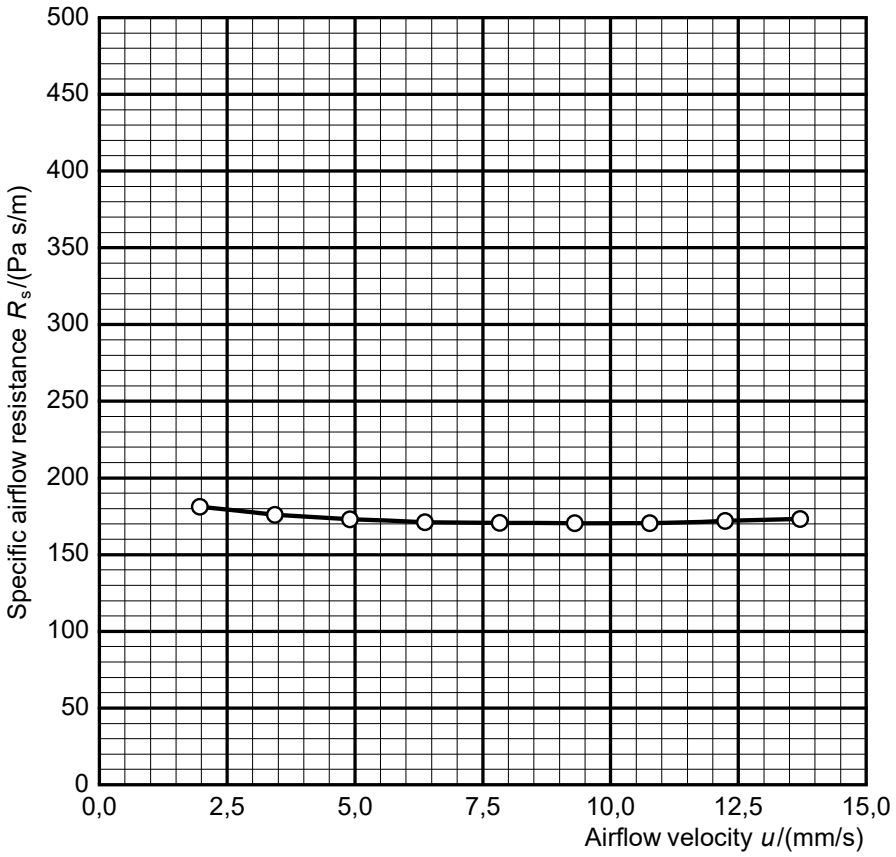
Client: Gabriel A/S
Hjulmagervej 55
DK-9000 Aalborg
Denmark

Project number: M104146
Sample number: 15068/03
Test object: Design Focus Royal
Colour No.: 60040
Material: 100 % New Zealand Wool

Diameter: 100 mm
Thickness: 1.6 mm
Area-specific mass: 464 g/m^2

Barometric pressure:
B = 95,4 kPa
Temperature:
θ = 28,1 °C
Relative humidity:
r. h. = 9,8 %

u/ (mm/s)	R_s/ (Pa s/m)
1.97	181
3.43	176
4.90	173
6.37	171
7.83	171
9.30	170
10.77	170
12.24	172
13.71	173



Specific airflow resistance R_s(0.5 mm/s) = 171 Pa s/m

Laboratory: Planegg
Responsible: Reif
Date: 2022-07-20

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 help of the linear regression.

2 Test procedure

The direct airflow method (static airflow method according to DIN EN ISO 9053-1 [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

For the test method DIN EN ISO 9053-1 [1] states a reproducibility of approx. 15 % for open porous foam materials. This information was determined on the basis of round robin tests.

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.
Measurement system airflow resistance	Müller-BBM	M89319-00	315003
Software for measurement and evaluation	Müller-BBM Acoustic Solution	m|ars	Version 1.14.7256. 28813
Thickness gauge	Hans Schmidt & Co. GmbH	D-2000-C0913	2985
Digital measuring slide	Mitutoyo	CD-15PPR	07019377
Electronic balance	Kern	KB1200-2N	W1402353