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2023-05-16
B104146/64 Version 1 RFD/STY

Fabric
Design: Hush Flair
Manufacturer Gabriel A/S

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

Test Report No. B104146/64

Client:	Gabriel A/S Hjulmagervej 55 9000 Aalborg DENMARK
Consultant:	Dipl.-Ing. (FH) Dominik Reif
Report date:	2023-05-16
Delivery date of test object:	2023-04-28
Date of test	2023-05-12
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1 Task

On behalf of Gabriel A/S, 9000 Aalborg, Denmark, the airflow resistance of the fabric type “Design: Hush Flair” 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 object

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

The thickness of the fabric was determined acc. to DIN EN ISO 5084 [2] (per sample mean value of three positions, pressure 1.00 kPa, pressure-foot 2,000 mm²).

Table 1. Test object.

Test object (manufacturer's information)	Sample 15266/	Area specific mass m' [g/m ²]	Thickness t [mm]
Fabric: “Design: Hush Flair” Colour number: 61225 Material: 80 % Polyester / 20 % Viscose	01	182	1.28
	02	183	1.29
	03	185	1.30
Mean		183	1.29

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

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

For the tested fabric, the following specific airflow resistance was determined:

Table 2. Specific airflow resistance.

Test object / Fabric type "Design: Hush Flair"	Specific airflow resistance R_s / (Pa s / m)	Appendix A, page
Sample 1/3 (no. 15266/01)	129	1
Sample 2/3 (no. 15266/02)	137	2
Sample 3/3 (no. 15266/03)	153	3
Mean	140	--

6 Remarks

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

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

EN ISO 9053-1
Determination of airflow resistance

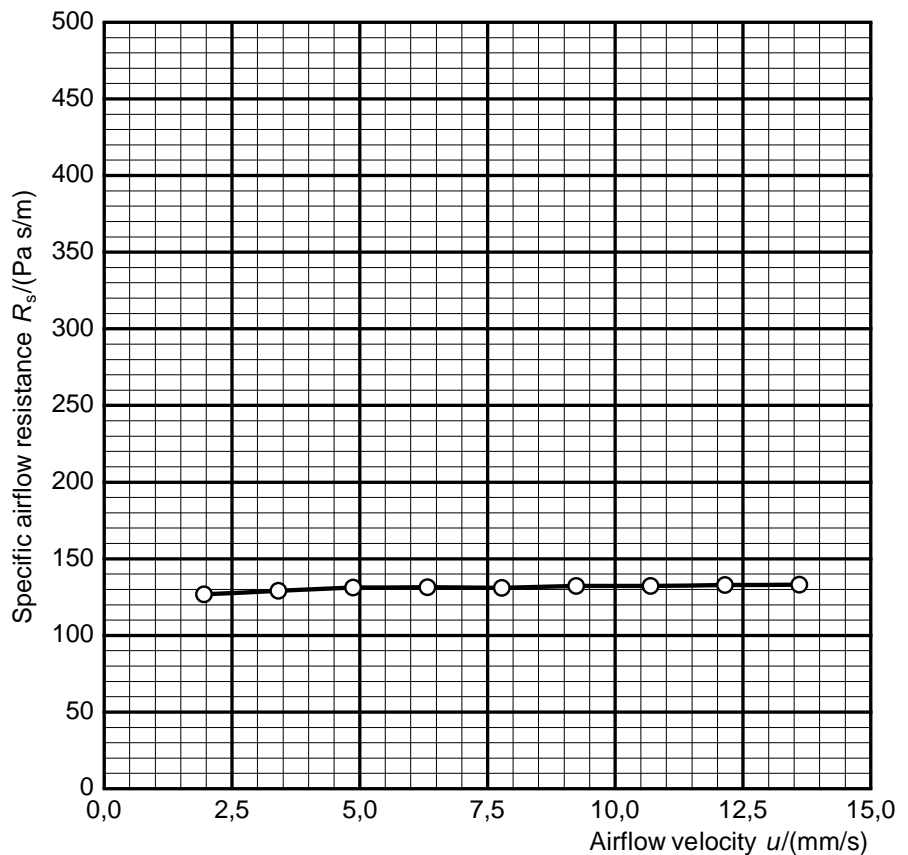
Client: Gabriel A/S
Hjulmagervej 55
DK-9000 Aalborg
Denmark

Project number: B104146
Sample number: 15266/01
Test object: Design: Hush Flair - Sample 1
Colour No.: 61225
Material: 80 % Polyester / 20 % Viscose

Diameter: 100 mm
Thickness: 1.28 mm
Area-specific mass: 182 g/m²

Barometric pressure:
 $B = 94,9$ kPa
Temperature:
 $\theta = 23,2$ °C
Relative humidity:
 $r. h. = 22,8$ %

$u/$ (mm/s)	$R_s/$ (Pa s/m)
1.95	127
3.41	129
4.87	131
6.32	131
7.78	131
9.24	132
10.69	132
12.15	133
13.60	133



Specific airflow resistance $R_s(0.5$ mm/s) = 129 Pa s/m

Laboratory: Planegg
Responsible: Reif
Date: 2023-05-12

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EN ISO 9053-1
Determination of airflow resistance

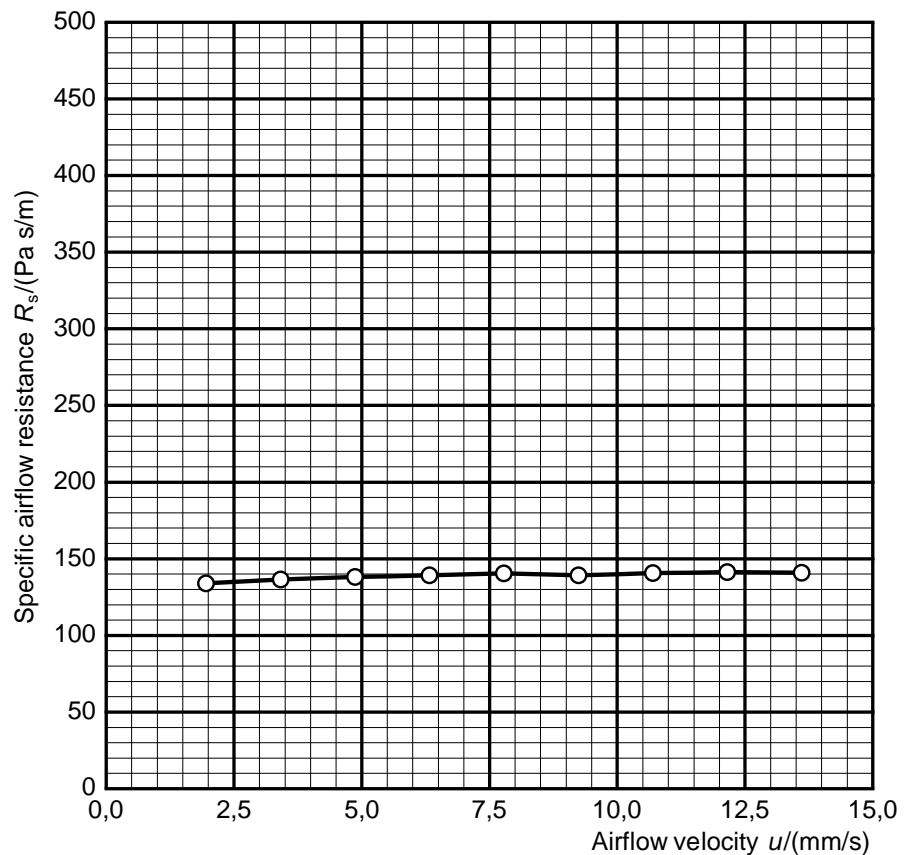
Client: Gabriel A/S
Hjulmagervej 55
DK-9000 Aalborg
Denmark

Project number: B104146
Sample number: 15266/02
Test object: Design: Hush Flair - Sample 2
Colour No.: 61225
Material: 80 % Polyester / 20 % Viscose

Diameter: 100 mm
Thickness: 1.29 mm
Area-specific mass: 183 g/m²

Barometric pressure:
 $B = 94,9 \text{ kPa}$
Temperature:
 $\theta = 23,3 \text{ °C}$
Relative humidity:
 $r. h. = 16,8 \text{ %}$

$u/$ (mm/s)	$R_s/$ (Pa s/m)
1.96	134
3.41	136
4.87	138
6.33	139
7.78	140
9.24	139
10.70	141
12.15	141
13.61	141



Specific airflow resistance $R_s(0.5 \text{ mm/s}) = 137 \text{ Pa s/m}$

Laboratory: Planegg
Responsible: Reif
Date: 2023-05-12

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m:\ars 1.25.8343.22825 - \S-muc-fs01\allefirmen\B\Proj\104\B104146\Messungen\MaarsData\2023-05-12\HUSH FLAIR - Sample 2.mrs (12.05.2023)

EN ISO 9053-1
Determination of airflow resistance

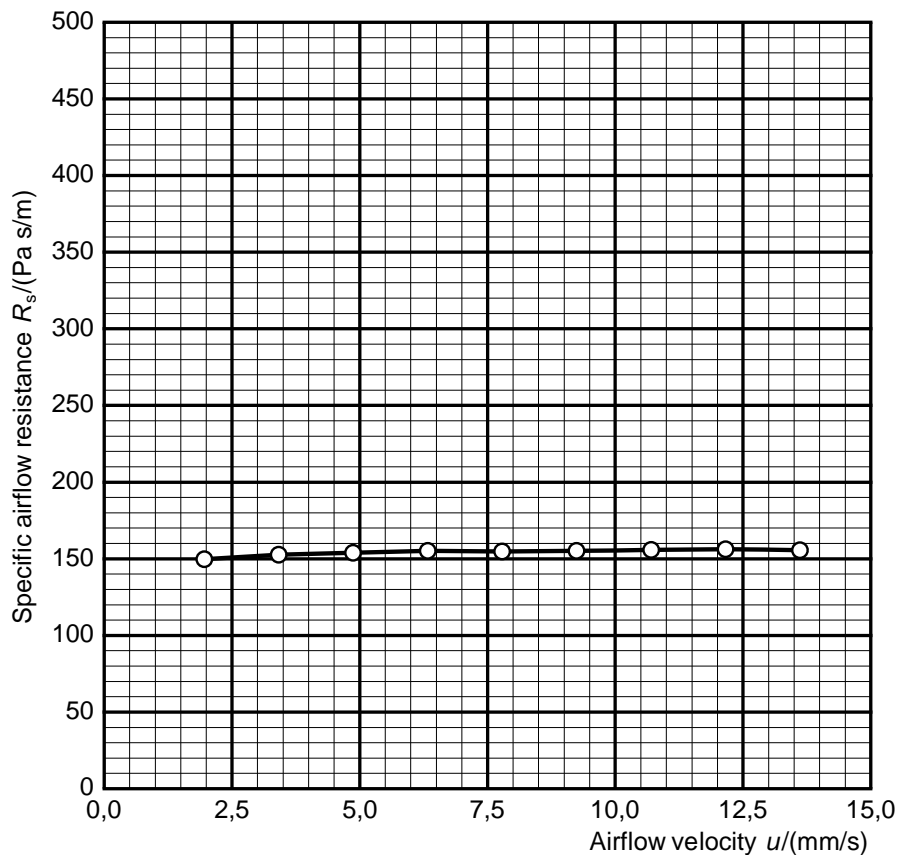
Client: Gabriel A/S
Hjulmagervej 55
DK-9000 Aalborg
Denmark

Project number: B104146
Sample number: 15266/03
Test object: Design: Hush Flair - Sample 3
Colour No.: 61225
Material: 80 % Polyester / 20 % Viscose

Diameter: 100 mm
Thickness: 1.3 mm
Area-specific mass: 185 g/m²

Barometric pressure:
 $B = 94,9$ kPa
Temperature:
 $\theta = 23,5$ °C
Relative humidity:
 $r. h. = 13,3$ %

$u/$ (mm/s)	$R_s/$ (Pa s/m)
1.96	150
3.41	153
4.87	154
6.33	155
7.79	155
9.24	155
10.70	156
12.16	156
13.61	156



Specific airflow resistance $R_s(0.5$ mm/s) = 153 Pa s/m

Laboratory: Planegg
Responsible: Reif
Date: 2023-05-12

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 m²

$q_{v,i}$ volumetric airflow rate passing through the test object in m³/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 1.23.8256. 29682
Thickness gauge	Hans Schmidt & Co. GmbH	D-2000-C0913	2985
Electronic balance	Kern	KB1200-2N	W1402353