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2021-08-13
M104146/58 Version 1 RFD/STY

Fabric “Focus/Focus Melange” Manufacturer Gabriel A/S

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

Test Report No. M104146/58

Client:	Gabriel A/S Hjulmagervej 55 9000 Aalborg DENMARK
Consultant:	Dipl.-Ing. (FH) Dominik Reif
Report date:	2021-08-13
Delivery date of test object:	2021-06-21
Date of test:	2021-07-07
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Appendix A: Measurement results and evaluation

Appendix B: Description of the test procedure and list of test equipment

1 Task

On behalf of Gabriel A/S, 9000 Aalborg, Denmark, the airflow resistance of the fabric type "Focus/Focus Melange" 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

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

Table 1. Test object.

Test object (manufacturer's information)	Sample	Area specific mass m'' [g/m ²]	Thickness t [mm]
Fabric "Focus/Focus Melange" Color number: 60209 Composition: 100 % wool	1	444	1.23
Fabric "Focus/Focus Melange" Color number: 60209 Composition: 100 % wool	2	444	1.17
Fabric "Focus/Focus Melange" Color number: 60209 Composition: 100 % wool	3	442	1.20
Mean		444	1.20

The thickness as stated above was determined by the testing laboratory according to DIN EN ISO 5084 [2]. Testing was done at three positions of the sample at pressure of 1.00 kPa and with a presser-foot of 2000 mm².

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.

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

Table 2. Specific airflow resistance.

Test object Fabric type "Focus/Focus Melange"	Airflow resistance R_s / (Pa s / m)	Appendix A, page
Sample 1/3 (no. 14299-1)	475	1
Sample 2/3 (no. 14299-2)	518	2
Sample 3/3 (no. 14299-3)	501	3
Mean	498	---

For the three tested samples a mean specific airflow resistance of

$$R_s = 498 \text{ Pa} \cdot \text{s/m}$$

was determined.

6 Remarks

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



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

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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, Postboks 59
DK-90000 Aalborg
Danmark

Project number: M104146

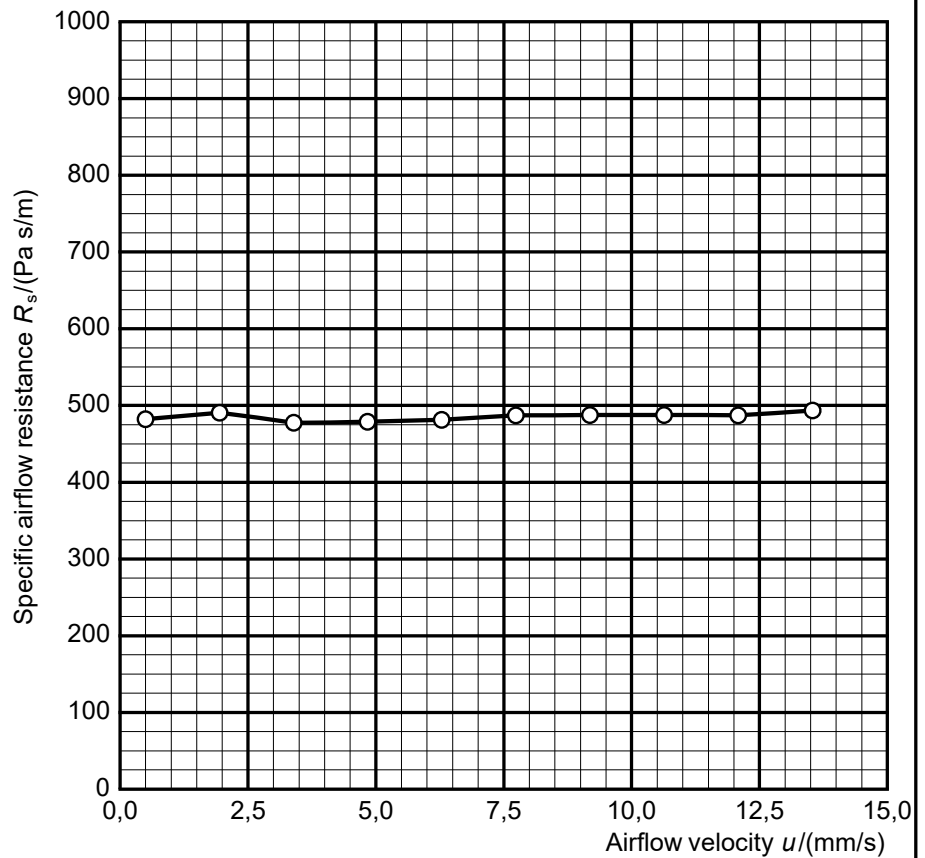
Sample number: 14299-1

Test object: Gabriel A/S
Design No.: 253660209
Design Descrip.: Focus/Focus Melange, col. 60209
Ordner No.: 0011543226
Roll-ID: 34234930321
Sample 1/3

Diameter: 100 mm
Thickness: 1.23 mm
Area-specific mass: 444 g/m²

Barometric pressure:
 $B = 95,4$ kPa
Temperature:
 $\theta = 25,3$ °C
Relative humidity:
 $r. h. = 12,8$ %

$u/$ (mm/s)	$R_s/$ (Pa s/m)
0.50	482
1.94	490
3.39	478
4.84	479
6.29	481
7.74	487
9.18	487
10.64	488
12.08	487
13.54	493



Specific airflow resistance $R_s(0.5 \text{ mm/s}) = 475 \text{ Pa s/m}$

Laboratory: Planegg
Responsible: sgm/prhcs
Date: 2021-07-07

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EN ISO 9053-1
Determination of airflow resistance

Client: Gabriel A/S
Hjulmagervej 55, Postboks 59
DK-90000 Aalborg
Danmark

Project number: M104146

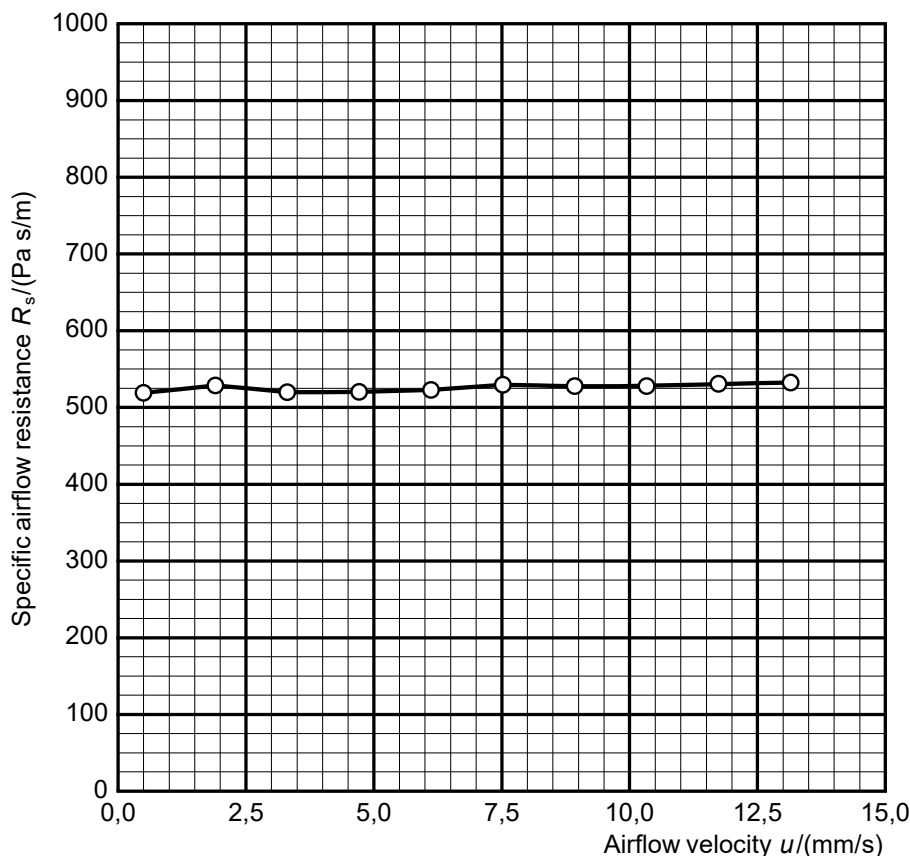
Sample number: 14299-2

Test object: Gabriel A/S
Design No.: 253660209
Design Descrip.: Focus/Focus Melange, col. 60209
Ordner No.: 0011543226
Roll-ID: 34234930321
Sample 2/3

Diameter: 100 mm
Thickness: 1.17 mm
Area-specific mass: 444 g/m²

Barometric pressure:
 $B = 95,5$ kPa
Temperature:
 $\theta = 26,3$ °C
Relative humidity:
 $r. h. = 26,1$ %

$u/$ (mm/s)	$R_s/$ (Pa s/m)
0.50	519
1.90	529
3.31	520
4.71	520
6.12	523
7.52	530
8.92	528
10.33	528
11.74	531
13.15	532



Specific airflow resistance $R_s(0.5 \text{ mm/s}) = 518 \text{ Pa s/m}$

Laboratory: Planegg
Responsible: sgm/prhcs
Date: 2021-07-07

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EN ISO 9053-1
Determination of airflow resistance

Client: Gabriel A/S
Hjulmagervej 55, Postboks 59
DK-90000 Aalborg
Danmark

Project number: M104146

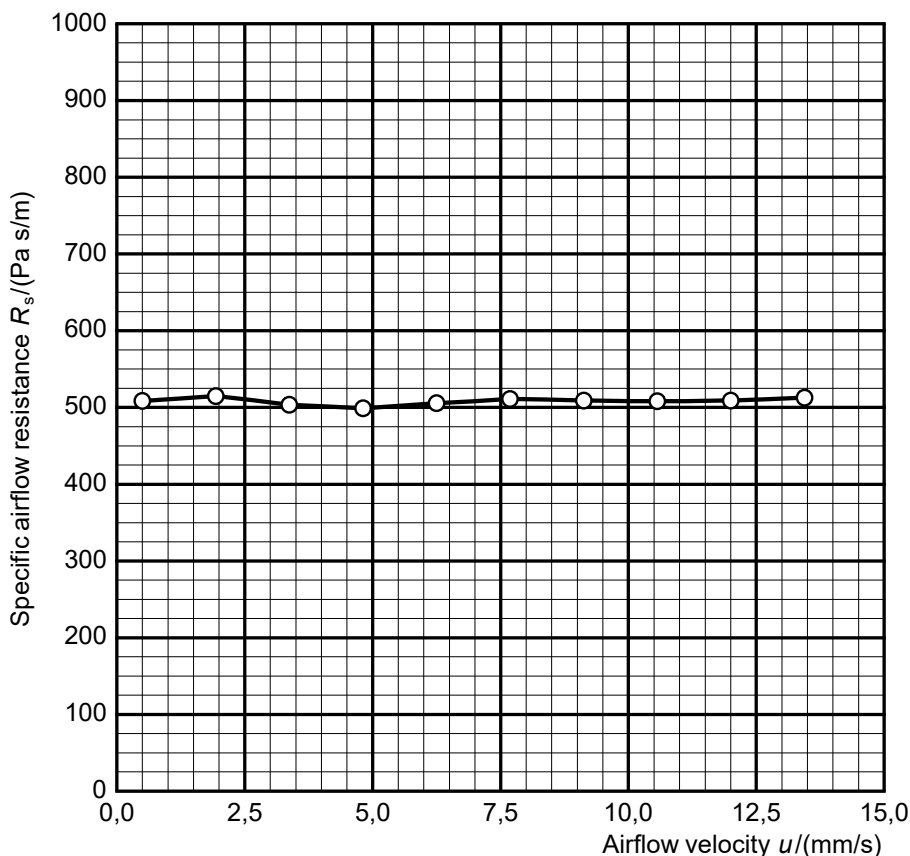
Sample number: 14299-3

Test object: Gabriel A/S
Design No.: 253660209
Design Descrip.: Focus/Focus Melange, col. 60209
Ordner No.: 0011543226
Roll-ID: 34234930321
Sample 3/3

Diameter: 100 mm
Thickness: 1.2 mm
Area-specific mass: 442 g/m²

Barometric pressure:
 $B = 95,5 \text{ kPa}$
Temperature:
 $\theta = 26,3 \text{ }^\circ\text{C}$
Relative humidity:
 $r. h. = 17,7 \%$

$u/$ (mm/s)	$R_s/$ (Pa s/m)
0.50	508
1.93	515
3.37	503
4.81	499
6.25	505
7.69	511
9.13	509
10.56	508
12.00	509
13.44	513



Specific airflow resistance $R_s(0.5 \text{ mm/s}) = 501 \text{ Pa s/m}$

Laboratory: Planegg
Responsible: sgm/prhcs
Date: 2021-07-07

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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 1.14.7256. 28813
Thickness gauge	Hans Schmidt & Co. GmbH	D-2000-C0913	2985
Digital measuring slide	Mitutoyo	CD-15PPR	07019377
Electronic balance	Kern	KB1200-2N	W1402353
Electronic balance	Kern	440-49N	WC0633572