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2020-04-06
M104146/52 Version 1 RFD/STY

Fabric “Crisp”
Manufacturer Gabriel A/S

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

Test Report No. M104146/52

Client:	Gabriel A/S Hjulmagervej 55 9000 Aalborg DENMARK
Consultant:	Dipl.-Ing. (FH) Dominik Reif
Report date:	2020-04-06
Delivery date of test object:	2020-03-12
Date of test:	2020-03-12
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1 Task

On behalf of Gabriel A/S, 9000 Aalborg, Denmark, the airflow resistance of three samples of the fabric “Crisp 04731” 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; German version EN ISO 5084. October 1996

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 “Crisp 04731” Blue Brown, manufacturer Gabriel A/S, sample 13821 design no. 242404731	327	0.81
Fabric “Crisp 04731” Blue Brown, manufacturer Gabriel A/S, sample 13822 design no. 242404731	331	0.81
Fabric “Crisp 04731” Blue Brown, manufacturer Gabriel A/S, sample 13823 design no. 242404731	324	0.81

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 airflow 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. Test results.

Test object (manufacturer's information)	**Airflow resistance R_S / (Pa s / m)**	**Appendix A, page**
Fabric "Crisp 04731" Blue Brown, manufacturer Gabriel A/S, sample 13821 design no. 242404731	696	1
Fabric "Crisp 04731" Blue Brown, manufacturer Gabriel A/S, sample 13822 design no. 242404731	723	2
Fabric "Crisp 04731" Blue Brown, manufacturer Gabriel A/S, sample 13823 design no. 242404731	740	3
Mean value	720	

For the three tested samples an average specific airflow resistance of

$$R_s = 720 \text{ Pa} \cdot \text{s/m}$$

was determined.

The measurement results are shown in diagrams and tables in the test certificates 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)

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.

ISO 9053-1
Determination of airflow resistance

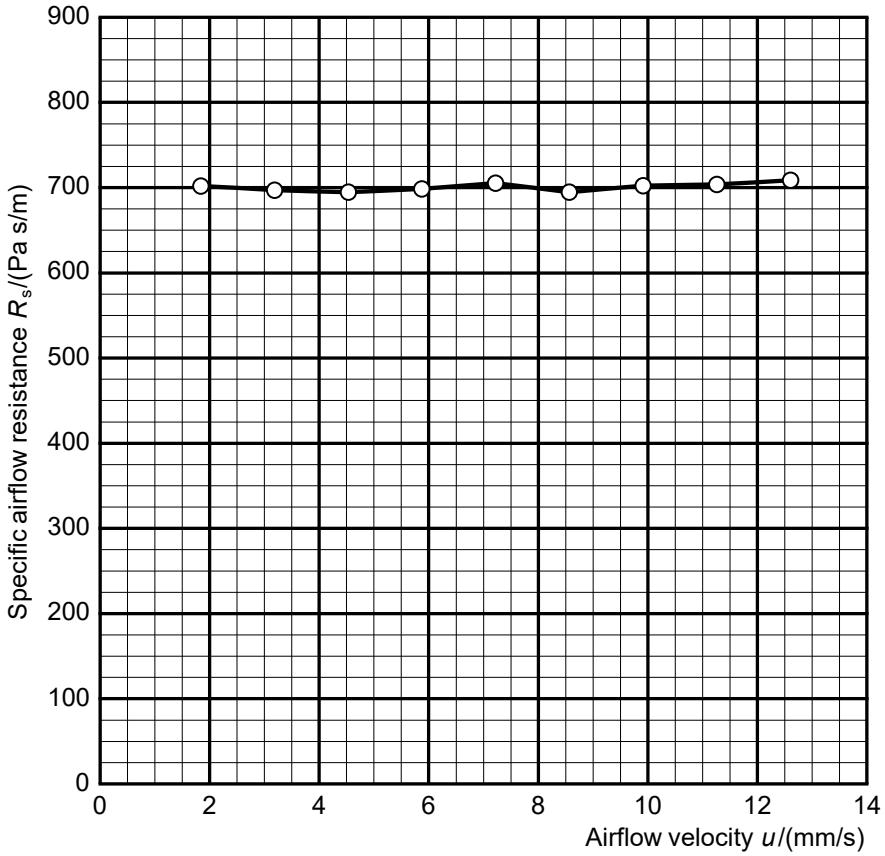
Client:: Gabriel A/S
Hjulmagervej 55
9000 Aalborg
DENMARK

Project Number:: M104146
Sample Number:: 13821
Test object: Gabriel fabric "Crisp 04731 Blue Brown - Sample 1
Designno.: 242404731

Diameter: 100 mm
Thickness: 0.81 mm
Area-specific mass: 327 g/m^2

Barometric pressure:
B = 94,9 kPa
Temperature:
θ = 24,2 °C
Relative humidity:
r. h. = 18,1 %

u/ (mm/s)	R_s/ (Pa s/m)
1.84	702
3.19	697
4.53	695
5.88	698
7.22	705
8.57	694
9.91	702
11.26	703
12.61	709



Specific airflow resistance R_s = 696 Pa s/m

Laboratory: Planegg
Responsible: rfd
Date: 2020-04-01

ISO 9053-1
Determination of airflow resistance

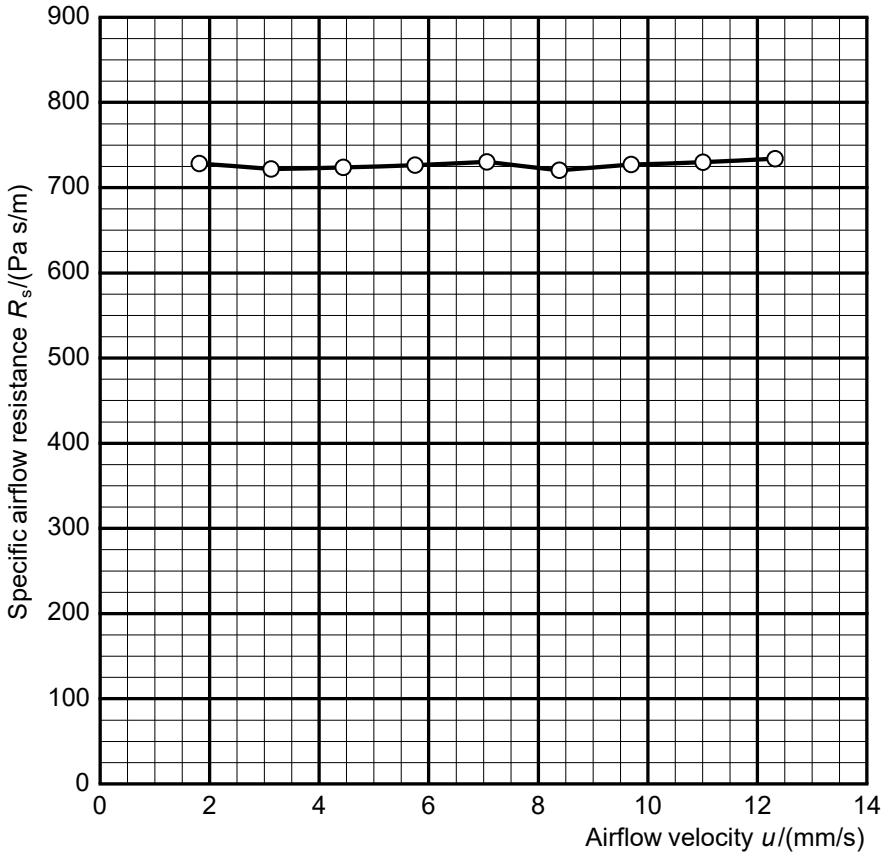
Client:: Gabriel A/S
Hjulmagervej 55
9000 Aalborg
DENMARK

Project Number:: M104146
Sample Number:: 13822
Test object: Gabriel fabric "Crisp 04731 Blue Brown - Sample 2
Designno.: 242404731

Diameter: 100 mm
Thickness: 0.81 mm
Area-specific mass: 331 g/m^2

Barometric pressure:
B = 94,9 kPa
Temperature:
θ = 24,2 °C
Relative humidity:
r. h. = 11,4 %

u/ (mm/s)	R_s/ (Pa s/m)
1.81	728
3.12	722
4.44	724
5.75	726
7.06	730
8.38	720
9.69	727
11.01	730
12.32	734



Specific airflow resistance R_s = 723 Pa s/m

Laboratory: Planegg
Responsible: rfd
Date: 2020-04-01

ISO 9053-1
Determination of airflow resistance

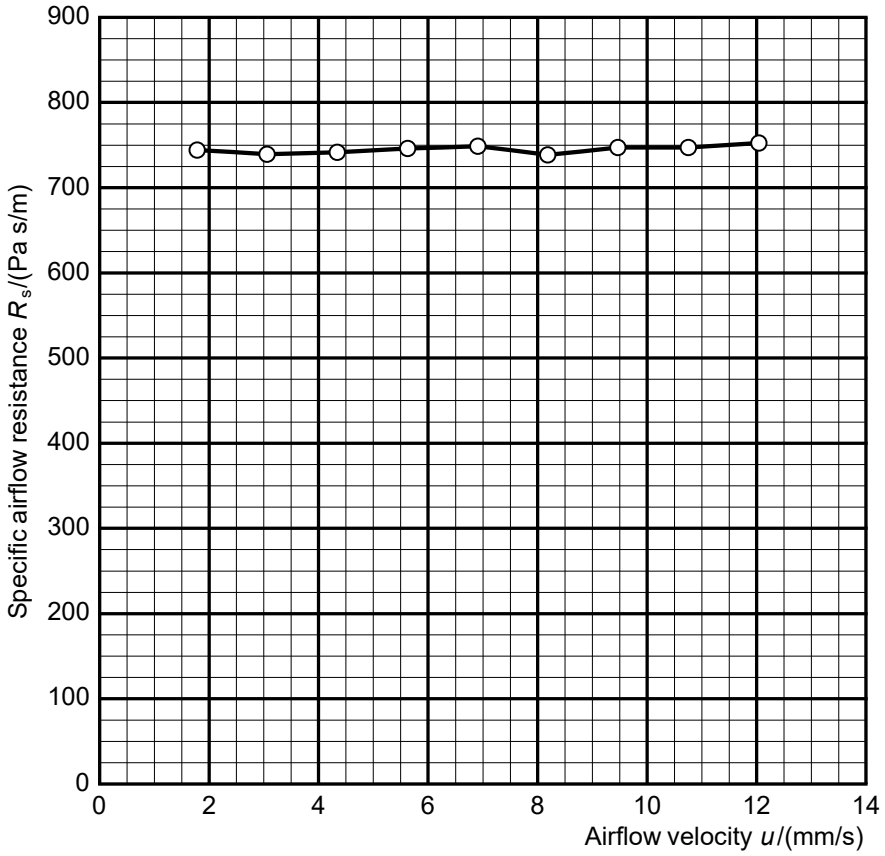
Client:: Gabriel A/S
Hjulmagervej 55
9000 Aalborg
DENMARK

Project Number:: M104146
Sample Number:: 13823
Test object: Gabriel fabric "Crisp 04731 Blue Brown - Sample 3
Designno.: 242404731

Diameter:	100	mm
Thickness:	0.81	mm
Area-specific mass:	324	g/m^2

Barometric pressure:
B = 94,9 kPa
Temperature:
θ = 24,2 °C
Relative humidity:
r. h. = 9,9 %

u/ (mm/s)	R_s/ (Pa s/m)
1.78	744
3.06	739
4.34	741
5.62	746
6.91	749
8.19	739
9.47	747
10.75	747
12.04	753



Specific airflow resistance R_s = 740 Pa s/m

Laboratory: Planegg
Responsible: rfd
Date: 2020-04-01

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.

The determination of the airflow resistivity σ was effected according the following equation:

$$\sigma = \frac{R_S}{d}$$

With:

σ airflow resistivity in $kPa\ s/m^2$

d thickness of the test object in the direction of flow in m

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.	Calibration valid until
Measurement system airflow resistance	Müller-BBM	M89319-00	315003	2020-03
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	2021-06
Digital measuring slide	Mitutoyo	CD-15PPR	07019377	2021-03
Electronic balance	Kern	KB1200-2N	W1402353	2021-03