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Client Ullfrotté AB Chaufförsvägen 29 831 48 Östersund	Client's ref. nr.		
	Contact person Sofia Åberg	Our ref. nr. 5080244	

Object: Determination of various properties of three fabrics.

Test material: Fabrics and garment according to list below:

1. Woolpower Crewneck 200, one piece of fabric and one sweater.
2. Woolpower Full Zip Jacket 400, one piece of fabric and one jacket.
3. Woolpower FR Full Zip Jacket 400, one piece of fabric and one jacket.

The test material was received from the client 2008-03-12.

The commission was performed 2008-03-12—04-21 and 2008-11-25—12-03.

Procedure and results:

Conditioning- and testing climate, where nothing else is stated:
(20 ±2) °C and (65±3) % RH.

Dimensional change after washing and drying

Preparation, marking and calculation was performed according to
SS-EN ISO 3759:1995 and SS-EN 25 077:1994

Number of specimens: 1 per material

Specimen size: appr. (50 x 50) cm

The back part of the garment was tested.

Washing and drying was performed according to SS-EN ISO 6330:2001

Washing machine: Type A, Electrolux Wascator FOM 71 MP-Lab

Water supply: 17 l/min

Washing procedure 2A, 60 °C

Detergent: IEC A "Star" /Sodium Perborate tetrahydrate/TAED

Dosage: 1 g/l

Number of washes: 1

Total load (loading fabric and test specimens): 2 kg

Loading fabric: 100 % knitted Polyester, (310±20) g/m²

Drying:

Procedure E, tumble dry

Temperature: max 70 °C

Deviations from the standard:

Tumble dryer: Nyborg, model 210 T,

Drum volume: approx. 220 l, no reversal drum,

Only one vane, high 12 cm, depth 20 cm

Rotational frequency: 40 min⁻¹, 5 kW heating input

Determination of drying capacity was not performed.

Sample	Measuring distance	Dimensional change, %	
		Length	Width
1.	1	-4,8	-7,1
	2	-5,2	-6,7
	3	-4,5	-4,8
Mean value		-4,8	-6,2
Uncertainty of measurement	2,5 %		
2.	1	-2,1	-4,4
	2	-0,9	-5,8
	3	+0,5	-4,0
Mean value		-0,8	-4,8
Uncertainty of measurement	2,5 %		
3.	1	-3,6	-3,6
	2	-2,6	-4,0
	3	-2,3	-2,0
Mean value		-2,8	-3,2
Uncertainty of measurement	2,5 %		

The uncertainty of measurement is stated as expanded uncertainty of measurement with the coverage factor k= 2, corresponding to a coverage probability of approx. 95 % for normal distribution of homogeneous materials

Standard uncertainty of measurement is determined according to GUM.

Determination of abrasion resistance of fabrics by the Martindale method

was performed according to SS-EN ISO 12947-2:1999/SS-EN ISO 12947-2/AC:2006.

Testing- and conditioning atmosphere: (20±2)°C and (65±3)% RH.

The specimens were preparatory treated according to annex A.1.

Pressure used: 9 kPa.

Test series for all samples: 2 000 rubs.

Specimen breakdown definition: One thread broken.

The test was performed on all three materials.

Abrasion resistance, number of rubs at which breakdown has not yet been observed

	Sample		
	1	2	3
Specimen 1	14 000	20 000	16 000
Specimen 2	14 000	16 000	20 000
Specimen 3	14 000	16 000	20 000
Mean value	14 000	17 300	18 700
Uncertainty of measurement	±15 %	±22 %	±21 %

The uncertainty of measurement is stated as expanded uncertainty of measurement with the coverage factor k= 2, corresponding to a coverage probability of approx. 95 % for normal distribution.

Standard uncertainty of measurement is determined according to GUM.

Resistance to pilling and surface fuzzing was determined according to SS-EN ISO 12945-1:2001, pilling box method (Not an accredited method).

Number of specimens: 4 (2 in each direction)

Number of revolutions: 15 000.

Number of observers: 2

Viewing conditions: Light Cabinet Ortospectra 60, D65, worst angle.

Resistance to pilling and surface fuzzing, rating

Sample	<u>1</u>		<u>2</u>		<u>3</u>	
Direction	Length	Width	Length	Width	Length	Width
Assessment	3	4	3-4	3-4	4	4

Scale 1-5, where 5 is best.

Pills and surface fuzzing appeared on the test specimens.

Water-vapour resistance, R_{et} was determined (with the Skin model) according to SS-EN 31 092:1993 / ISO 11 092:1993.

Conditioning climate: $(35 \pm 2) ^\circ\text{C}$ and $(40 \pm 3) \% \text{RH}$.

Testing climate: $(35 \pm 0,1) ^\circ\text{C}$ and $(40 \pm 3) \% \text{RH}$.

Number of specimens: 3 per material

Specimen size: appr. (25 x 25) cm

Water-vapour resistance is determined with an electronically heated and sweating measuring unit inside a climate chamber. The measuring unit is filled with water and covered with a cellophane membrane which allows water-vapour, but not water-fluid, to pass through. The measuring unit has a temperature of 35°C .

The inner side of the material was facing the measuring unit. After steady-state conditions were reached the values were recorded during 10 minutes.

Ullfrotté original 200 g/m ²	60 % Wool 25 % PET 15 % PA
	Water-vapour resistance, R_{et} m ² Pa/W
	Calculated water-vapour flow ¹⁾ kg/m ² , 24 h
Sample 1	8,57
Sample 2	8,51
Sample 3	8,95
Mean value	8,68
	9,8

Ullfrotté original 400 g/m ²	70 % Wool 18 % PA 12 % aramid
	Water-vapour resistance, R_{et} m ² Pa/W
	Calculated water-vapour flow ¹⁾ kg/m ² , 24 h
Sample 1	10,33
Sample 2	10,36
Sample 3	10,61
Mean value	10,43
	8,2

Ullfrotté original 400 g/m ²	70 % Wool 30 % PA	
	Water-vapour resistance, R _{et} m ² Pa/W	Calculated water-vapour flow ¹⁾ kg/m ² , 24 h
Sample 1	8,94	
Sample 2	8,58	
Sample 3	9,08	
Mean value	8,87	9,6

1) Calculated for condition 50 % RH at 20°C

The repeatability of measurements of materials with values up to 10 m² Pa /W is according to standard SS-EN 31 092:1993 0,3 m² Pa /W. For values higher than 10 m² Pa /W, it is 7 %.

Thermal resistance, R_{ct} was determined (with the Skin model) according to SS-EN 31 092:1993 / ISO 11 092:1993.

Conditioning climate: (20 ± 2)°C at (65 ± 3) % RH.

Testing climate: (20 ± 0,1)°C at (65 ± 3) % RH.

Number of specimens: 3 per material

Specimen size: appr. (25 x 25) cm

Thermal resistance is determined with an electronically heated measuring unit inside a climate chamber. The measuring unit has a temperature of 35°C.

The inner side of the material was facing the measuring unit. After steady-state conditions were reached the values were recorded during 10 minutes.

Ullfrotté original 200 g/m ²	60 % Wool 25 % PET 15 % PA	
	Thermal resistance, R _{ct} m ² K /W	
Sample 1	0,0872	
Sample 2	0,0699	
Sample 3	0,0696	
Mean value	0,0756	

Ullfrotté original 400 g/m ²	70 % Wool 18 % PA 12 % aramid	
	Thermal resistance, R _{ct} m ² K /W	
Sample 1	0,1008	
Sample 2	0,0934	
Sample 3	0,0921	
Mean value	0,0954	

Ullfrotté original 400 g/m ²	70 % Wool 30 % PA
	Thermal resistance, R _{ct} m ² K /W
Sample 1	0,0909
Sample 2	0,0886
Sample 3	0,0941
Mean value	0,0912

The repeatability of measurements of materials with values up to $50 \cdot 10^{-3} \text{ m}^2 \text{ K/W}$ is according to SS-EN 31 092:1993 $3 \cdot 10^{-3} \text{ m}^2 \text{ K/W}$. For values higher than $50 \cdot 10^{-3} \text{ m}^2 \text{ K/W}$, it is 7 %.

All results relate only to the material tested.

Möln dal, 2009-03-03
Swerea IVF

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