



## **Mechanical Action / Gentleness of Action (GoA)**

**Felix Frey**

**EMPA Testmaterialien AG**

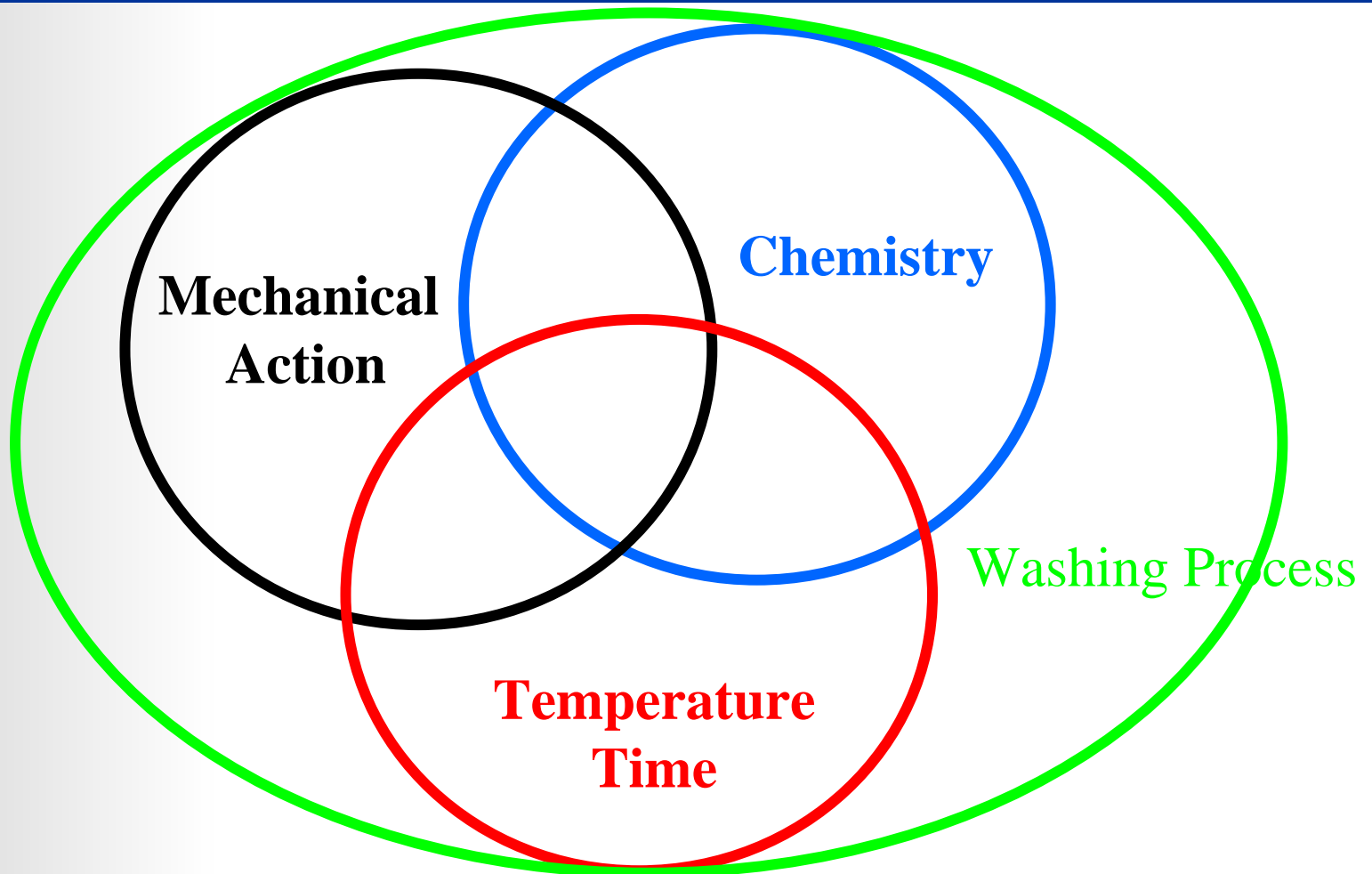
**for**

**IEC 60456 Workshop**

**Sao Paulo, 26th August 2008**



## Mechanical Action / Gentleness of Action



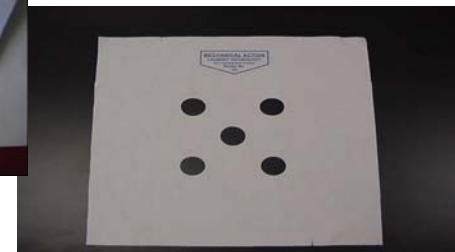
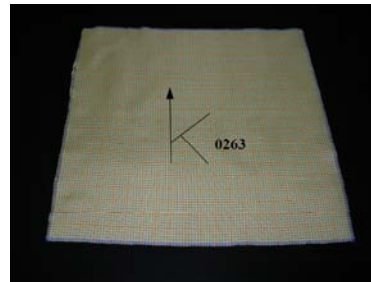
Felix Frey



## GoA

## 3 possible Methods to measure „Mechanical Action“ for IEC

- EMPA 304 Fraying Cloth
- EMPA 306 „Poka Dots“
- Danish 5 Hole



- Active as IEC/PAS 62473 Ed. 1.0 (**P**ublic **A**vailable **S**pecification)
- Target to integrate the finaly chosen method(s) into IEC 60456 (Ed.6)



## GoA – Different Methods

## Washing Process

EMPA Article 320 - Cotton Shrinkage

EMPA Article 306 – “Poka Dots”

EMPA - Article 304

Danish 5 hole

Wool

Horizontal Axis

Wascator

Wool

Vertical Axis

GoA

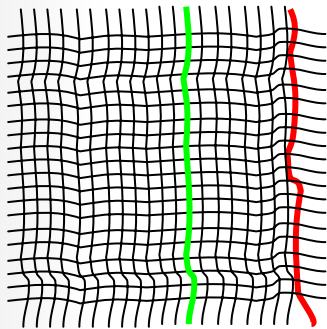
## GoA – The EMPA Fraying Method with Article 304



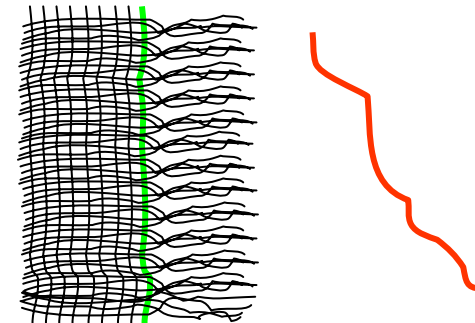
## GoA – The EMPA Fraying Method with Article 304



Standard fabric to determine  
GoA in Washing and Tumble Dry  
Processes



before washing



after washing



## GoA - Article 304 - Specifications

## EMPA Article 304:

Construction: plain woven  
Yarn: PA  
Weight: ca. 85 g/m<sup>2</sup>

**End Marking Threads:**

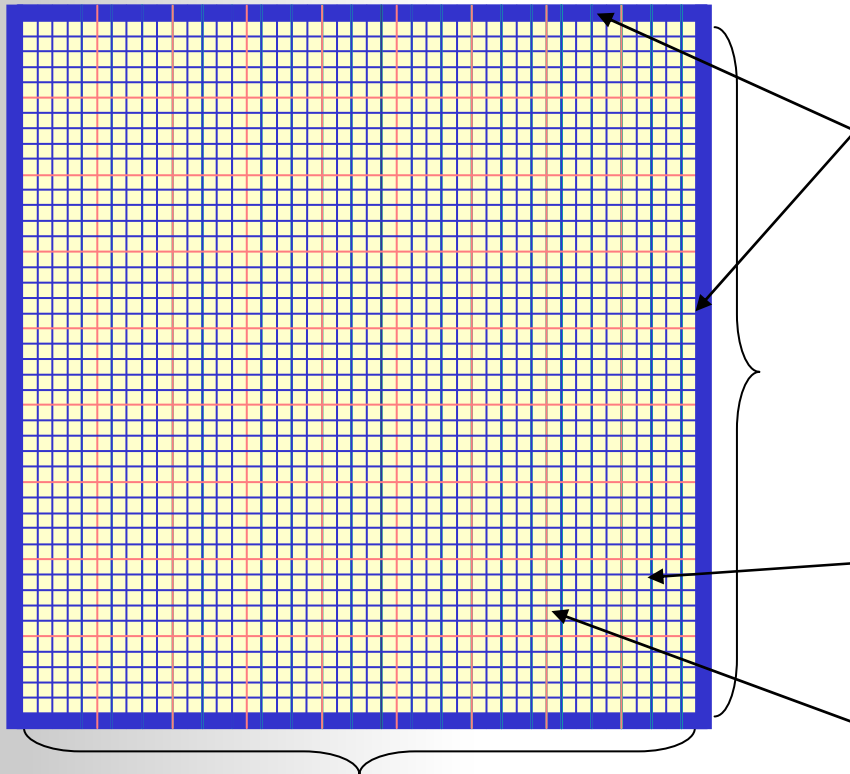
**Warp and Filling: each 5 blue threads**

*(All end marking threads have to be removed for testing)*

**Split up Threads (for easy counting):**

**Every 5th thread in warp and filling direction is blue**

**Every 25th thread in warp and filling direction is red**



Each direction 499 Threads = ~ 29.5 cm Felix Frey

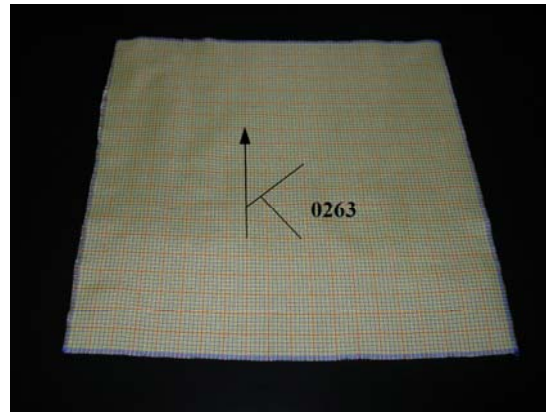


## GoA - Article 304 - Preparation

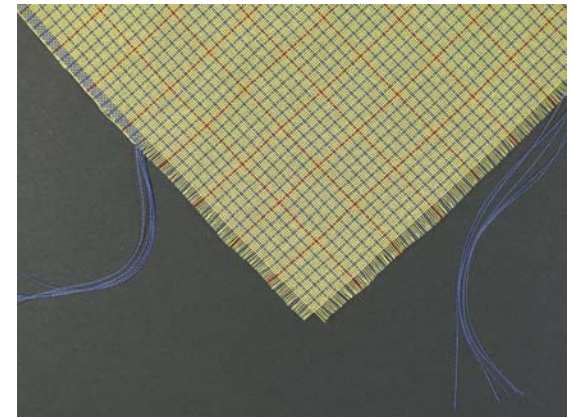
### The preparation for the test



**Cut sample between  
the blue  
end marking threads**



**Mark warp direction  
In the center**



**Remove blue  
end marking threads**



# GoA - Article 304 - Loading

## IEC 59D WG 13.2. "Gentleness of Action RR 2006 / 2007 Loading Table HA Machines for GoA Tests

| kg          | 10.00 | 9.50 | 9.00 | 8.50 | 8.00 | 7.50 | 7.00 | 6.50 | 6.00 | 5.50 | 5.00 | 4.50 | 4.00 | 3.50 | 3.00 | 2.50 | 2.00 | 1.50 | 1.00 |
|-------------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Strips      | 10    | 10   | 9    | 9    | 8    | 8    | 7    | 7    | 6    | 6    | 5    | 5    | 4    | 4    | 3    | 3    | 2    | 2    | 2    |
| Sheets      | 4     | 4    | 4    | 3    | 3    | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 0    | 0    | 0    | 0    | 0    |
| Pillowcases | 16    | 14   | 14   | 14   | 12   | 12   | 12   | 10   | 8    | 8    | 6    | 6    | 4    | 4    | 4    | 5    | 4    | 3    | 2    |
| Towels      | 28    | 28   | 23   | 25   | 25   | 21   | 23   | 23   | 23   | 18   | 18   | 14   | 14   | 11   | 5    | 11   | 9    | 7    | 5    |

| four sheets | three sheets | two sheets | no sheet |
|-------------|--------------|------------|----------|
|-------------|--------------|------------|----------|

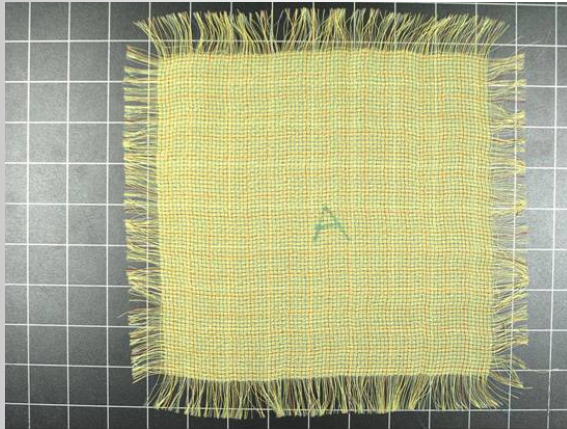
| step | horizontal axis                                      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1    | pillow   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2    | GoA swatch 304                                       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3    | towel folded as with strip                           | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4    | GoA swatch Poka Dot                                  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5    | towels (adjust number here*)                         | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 1 | 1 | 1 | 0 |
| 4    | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5    | pillow   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 6    | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7    | sheet  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8    | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9    | pillow   | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10   | GoA swatch 304                                       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11   | towels (adjust number here*)                         | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 12   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 13   | sheet  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 14   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 15   | pillow   | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 16   | GoA swatch Poka Dot                                  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 17   | towels (adjust number here*)<br>folded as with strip | 4 | 4 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| 18   | GoA swatch 304                                       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 19   | pillow   | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 20   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 21   | sheet  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 22   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 23   | towels adjust number here                            | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| 24   | GoA swatch Poka Dot                                  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 25   | pillow   | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 27   | sheet  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 28   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 29   | pillow   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 30   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 31   | towels (adjust number here*)                         | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 1 | 1 | 0 |
| 32   | GoA swatch 304                                       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 33   | towel folded as with strip                           | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 34   | GoA swatch Poka Dot                                  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 35   | pillow   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

\*at least one towel should be placed here, violate tolerances for climatized weight if necessary

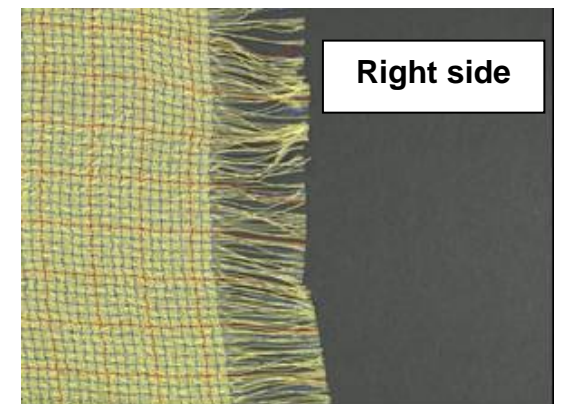
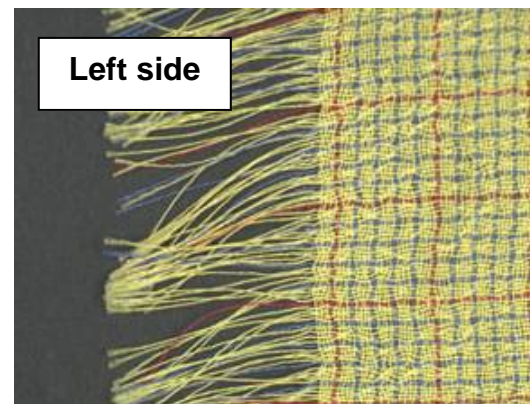
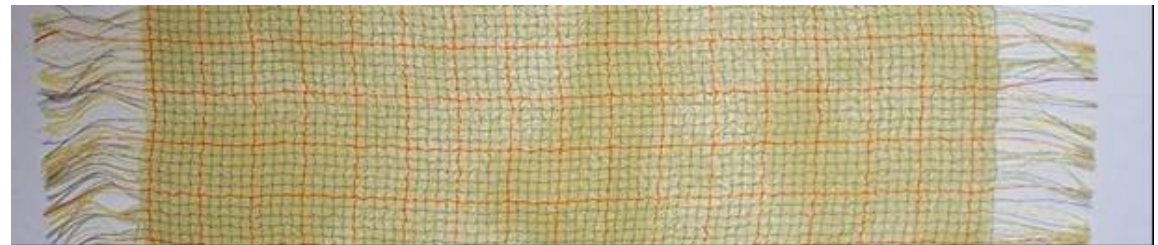


## GoA - Article 304 - Evaluation

### The evaluation of the test



**Lay sample flat  
on a table.  
Remove all  
“not remaining”  
threads before  
counting.**



**Count remaining threads**

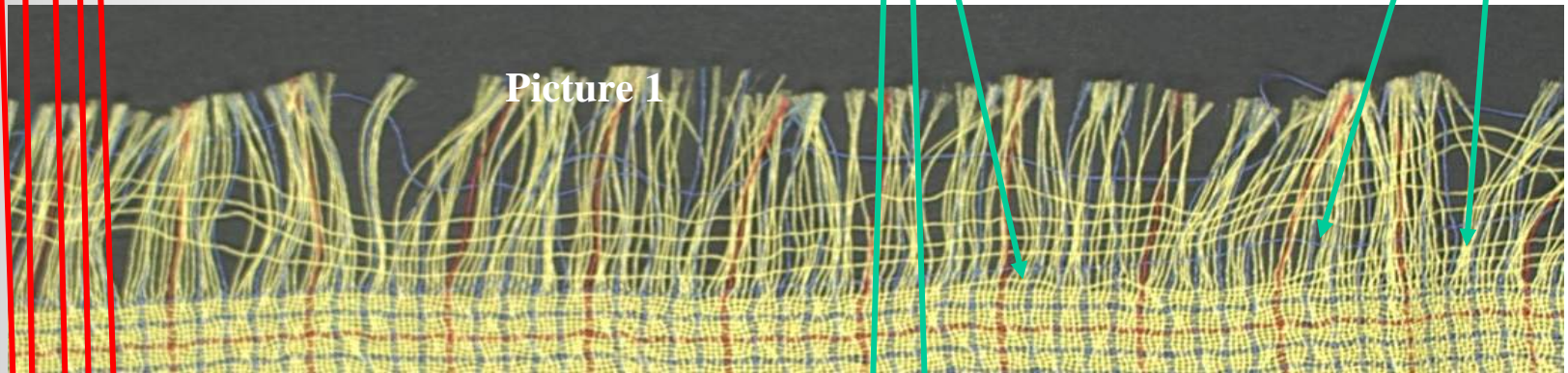


## GoA - Article 304 - Evaluation

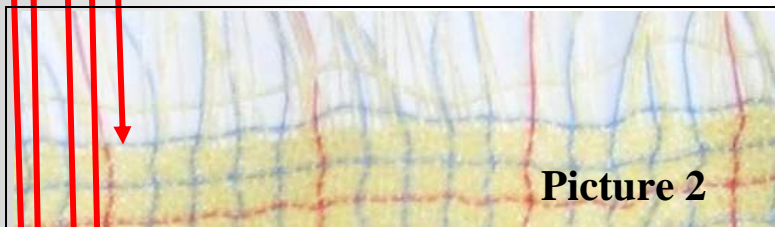
“Not remaining” thread to be removed from sample:

“Remaining” thread do not remove thread from sample:

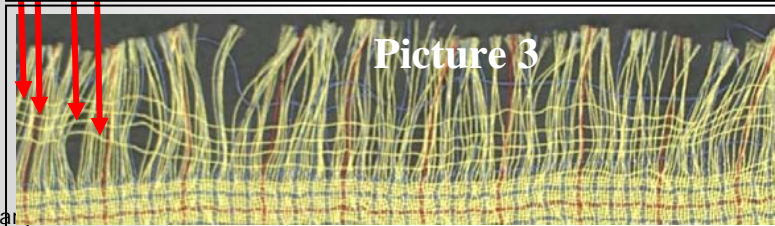
Picture 1



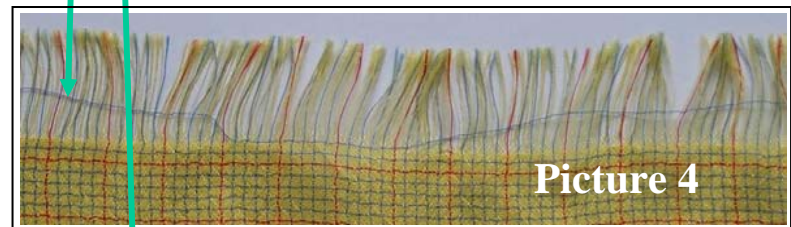
Picture 2



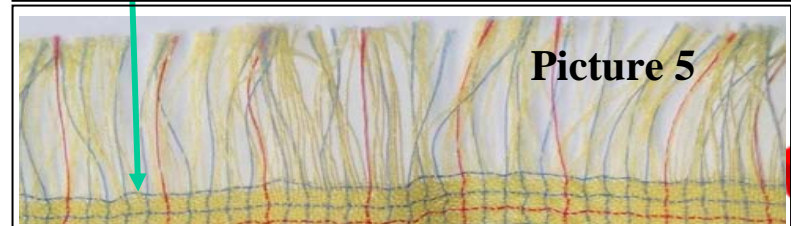
Picture 3



Picture 4



Picture 5



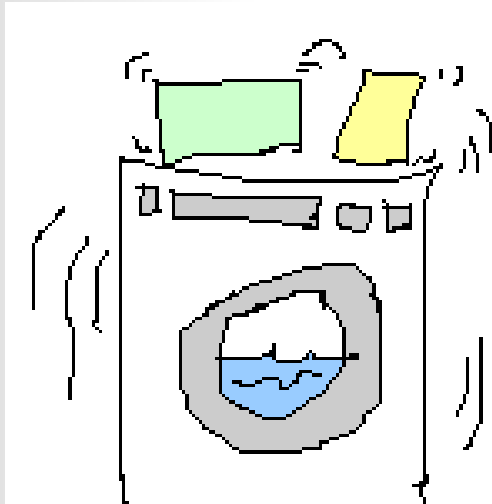
## GoA - Article 304 - Evaluation

| Evaluation Mechanical Action with "EMPA-MA(S)" article 304 |         |                            |         |   |                     |                       |
|--|---------|----------------------------|---------|---|---------------------|-----------------------|
| Name:  |         | EMPA Testmaterialien       |         | Date:   |                     | 27.10.2006            |
| Package:   |         | C                          |         |   |                     |                       |
| Trial:   | Sample: | removed threads after wash |         | Total removed threads warp and filling after wash |                     |                       |
|  |         | Warp                       | Filling | single sample                                     | average all samples | deviation all samples |
| 1 <sup>st</sup> run  |         |                            |         |   |                     |                       |
| 1  | A       | 14                         | 12      | 26  |                     |                       |
|  | B       | 15                         | 13      | 28  |                     |                       |
|  | C       | 14                         | 14      | 28  |                     |                       |
|  | D       | 15                         | 15      | 30  | <u>28</u>           | 1.6                   |
| 2 <sup>nd</sup> run  |         |                            |         |   |                     |                       |
| 1  | E       | 12                         | 14      | 26  |                     |                       |
|  | F       | 14                         | 14      | 28  |                     |                       |
|  | G       | 13                         | 13      | 26  |                     |                       |
|  | H       | 14                         | 14      | 28  | <u>27</u>           | 1.2                   |
| 3 <sup>rd</sup> run  |         |                            |         |   |                     |                       |
| 1  | J       | 13                         | 12      | 25  |                     |                       |
|  | K       | 13                         | 14      | 27  |                     |                       |
|  | L       | 14                         | 15      | 29  |                     |                       |
|  | M       | 15                         | 13      | 28  | <u>27</u>           | 1.7                   |
| Average and deviation of all runs                          |         |                            |         |   | <u>27</u>           | 0.5                   |

**Result is the removed threads (Difference between original amount of threads and remaining threads) because of the Mechanical action during the wash process. It is expressed in lost (or „not remaining) threads“.**



## GoA - Article 304 - Test



**Washing machine**

**(IEC-PAS 62473 Ed. 1.0)**

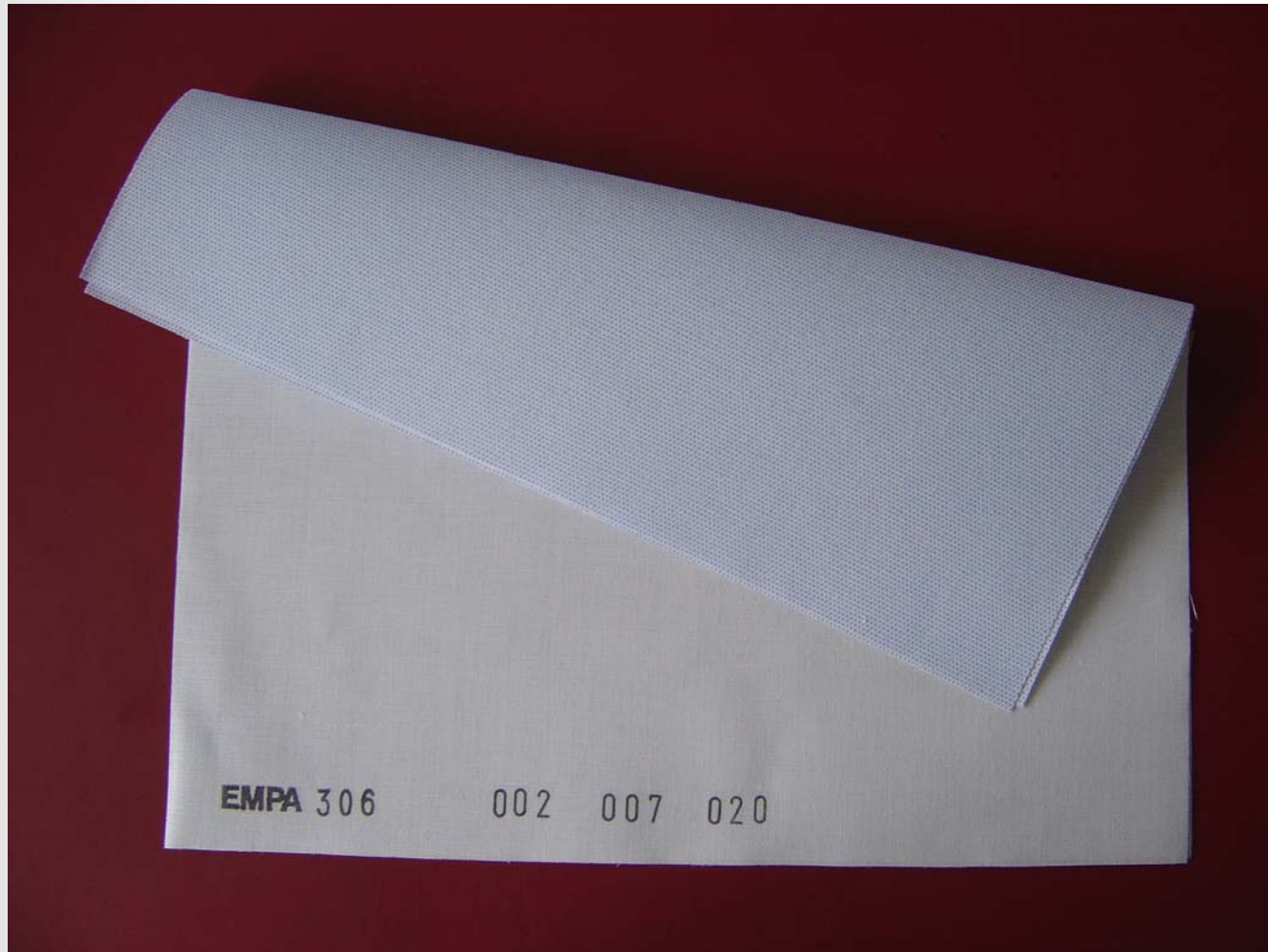


**Tumble dryer**

**(under consideration)**



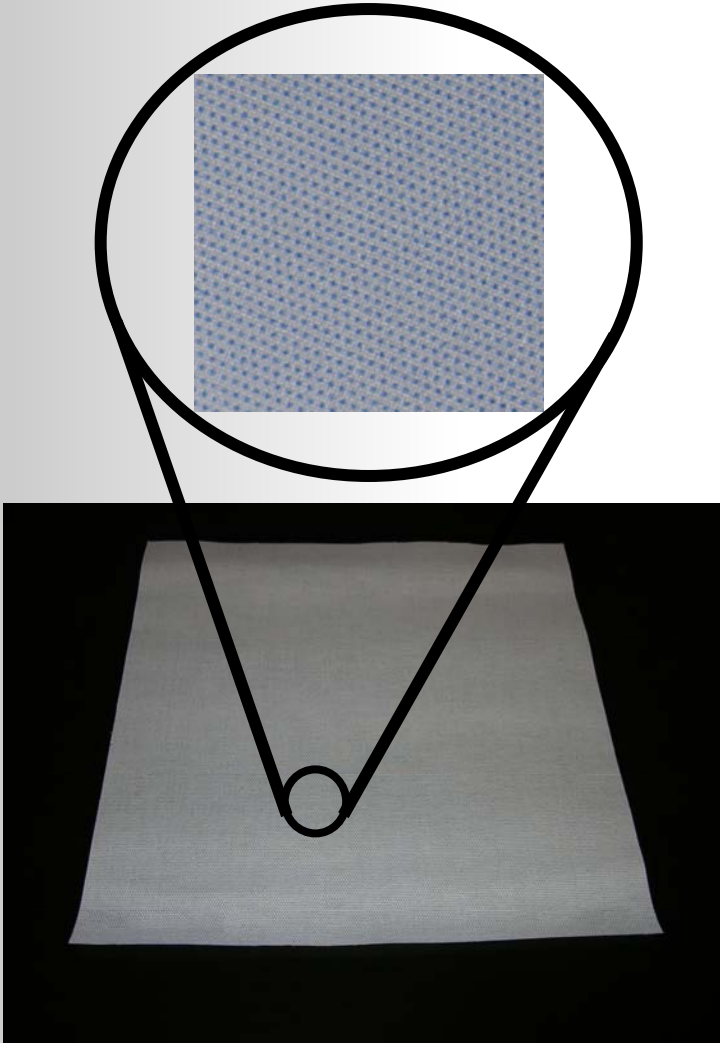
## GoA – The EMPA “Poka Dots” Method with Article 306



## GoA – The EMPA “Poka Dots” Method with Article 306

### Article 306 “Poka Dots”

|                    |   |
|--------------------|---|
| Size:              | 34x34 cm  |
| Basic fabric:      | 100% Cotton<br>plain woven, white<br>125 g/m <sup>2</sup> |
| Yarn:              | Nm 34/34  |
| Yarn count per cm: | Warp / Filling 19.5 / 19.5                                |
| Dots:              | 100% PA, coloured   |
| Density of dots:   | about 45.5/ cm <sup>2</sup>                               |
| Weight             | ca. 140 g/m <sup>2</sup>                                  |



# GoA - Article 306 - Loading

## IEC 59D WG 13.2. "Gentleness of Action RR 2006 / 2007 Loading Table HA Machines for GoA Tests

| kg          | 10.00 | 9.50 | 9.00 | 8.50 | 8.00 | 7.50 | 7.00 | 6.50 | 6.00 | 5.50 | 5.00 | 4.50 | 4.00 | 3.50 | 3.00 | 2.50 | 2.00 | 1.50 | 1.00 |
|-------------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Strips      | 10    | 10   | 9    | 9    | 8    | 8    | 7    | 7    | 6    | 6    | 5    | 5    | 4    | 4    | 3    | 3    | 2    | 2    | 2    |
| Sheets      | 4     | 4    | 4    | 3    | 3    | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 0    | 0    | 0    | 0    | 0    |
| Pillowcases | 16    | 14   | 14   | 14   | 12   | 12   | 12   | 10   | 8    | 8    | 6    | 6    | 4    | 4    | 4    | 5    | 4    | 3    | 2    |
| Towels      | 28    | 28   | 23   | 25   | 25   | 21   | 23   | 23   | 23   | 18   | 18   | 14   | 14   | 11   | 5    | 11   | 9    | 7    | 5    |

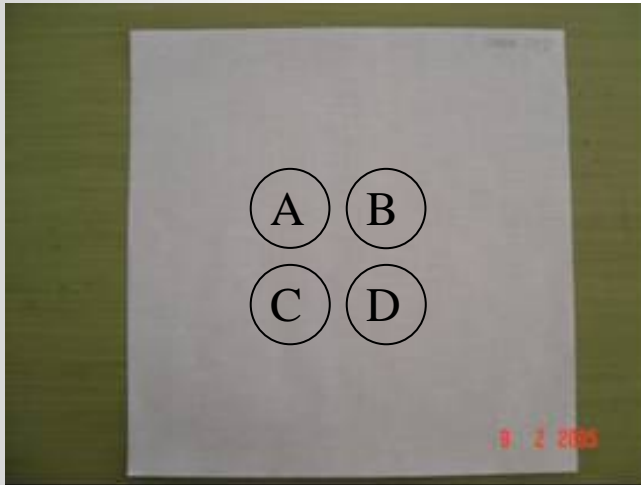
| four sheets | three sheets | two sheets | no sheet |
|-------------|--------------|------------|----------|
|-------------|--------------|------------|----------|

| step | horizontal axis                                      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1    | pillow   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2    | GoA swatch 304                                       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3    | towel folded as with strip                           | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4    | GoA swatch Poka Dot                                  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5    | towels (adjust number here*)                         | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 1 | 1 | 1 | 0 |
| 4    | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5    | pillow   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 6    | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7    | sheet  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8    | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9    | pillow   | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10   | GoA swatch 304                                       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11   | towels (adjust number here*)                         | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 12   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 13   | sheet  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 14   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 15   | pillow   | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 16   | GoA swatch Poka Dot                                  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 17   | towels (adjust number here*)<br>folded as with strip | 4 | 4 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| 18   | GoA swatch 304                                       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 19   | pillow   | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 20   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 21   | sheet  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 22   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 23   | towels adjust number here                            | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| 24   | GoA swatch Poka Dot                                  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 25   | pillow   | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 27   | sheet  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 28   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 29   | pillow   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 30   | towel + strip  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 31   | towels (adjust number here*)                         | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 1 | 1 | 1 | 0 |
| 32   | GoA swatch 304                                       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 33   | towel folded as with strip                           | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 34   | GoA swatch Poka Dot                                  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 35   | pillow   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

\*at least one towel should be placed here, violate tolerances for climatized weight if necessary



## GoA - Article 306 - Evaluation



**The test specimen has to be measured on 4 different spots within 15 – 18 cm in the centre (as shown on the picture on the left side). The average of all 4 spots A – D will give the Y-value needed for further evaluation.**



## GoA - Article 306 - Evaluation

| Evaluation Mechanical Action with "EMPA-MA(P)" article 306 |         |                      |               |              |                     |                       |
|--|---------|----------------------|---------------|--------------|---------------------|-----------------------|
| Name:  |         | EMPA Testmaterialien |               | Date:        |                     | 27.10.2006            |
| Package:   |         | C                    |               |              |                     |                       |
| Trial  | Sample: | Y - values           |               |              |                     |                       |
|  |         | Original             | after washing | Difference   | average all samples | deviation all samples |
| 1 <sup>st</sup> run  |         |                      |               |              |                     |                       |
| 1  | A       | 74.52                | 77.42         | -2.90        |                     |                       |
|  | B       | 73.66                | 76.88         | -3.22        |                     |                       |
|  | C       | 72.31                | 75.44         | -3.13        |                     |                       |
|  | D       | 71.12                | 74.42         | -3.30        | <u>-3.14</u>        | 0.17                  |
| 2 <sup>nd</sup> run  |         |                      |               |              |                     |                       |
| 1  | E       | 75.26                | 78.32         | -3.06        |                     |                       |
|  | F       | 74.12                | 76.88         | -2.76        |                     |                       |
|  | G       | 73.89                | 76.99         | -3.10        |                     |                       |
|  | H       | 71.66                | 75.33         | -3.67        | <u>-3.15</u>        | 0.38                  |
| 3 <sup>rd</sup> run  |         |                      |               |              |                     |                       |
| 1  | J       | 74.18                | 77.34         | -3.16        |                     |                       |
|  | K       | 82.56                | 84.17         | -1.61        |                     |                       |
|  | L       | 73.60                | 76.92         | -3.32        |                     |                       |
|  | M       | 75.20                | 78.44         | -3.24        | <u>-2.83</u>        | 0.82                  |
| Average and deviation of all runs                          |         |                      |               | <u>-3.04</u> | 0.18                |                       |

**Result is the average difference of the Y value.**

**Original value  
minus  
value after treatment  
of all 4 test specimen.**

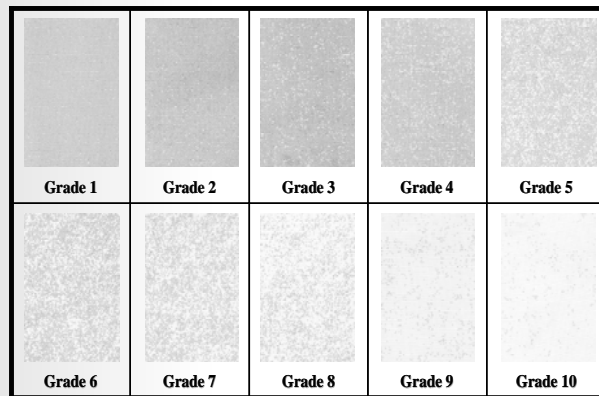


## GoA - Article 306 – Evaluation with “Comparison to a Standard”

**A second possibility to evaluate:**

**Rating with a standard to detect the “Mechanical Action”:**

***“EMPA – MA(P) evaluation manual and standard  
for  
measuring sample v/s standard”***

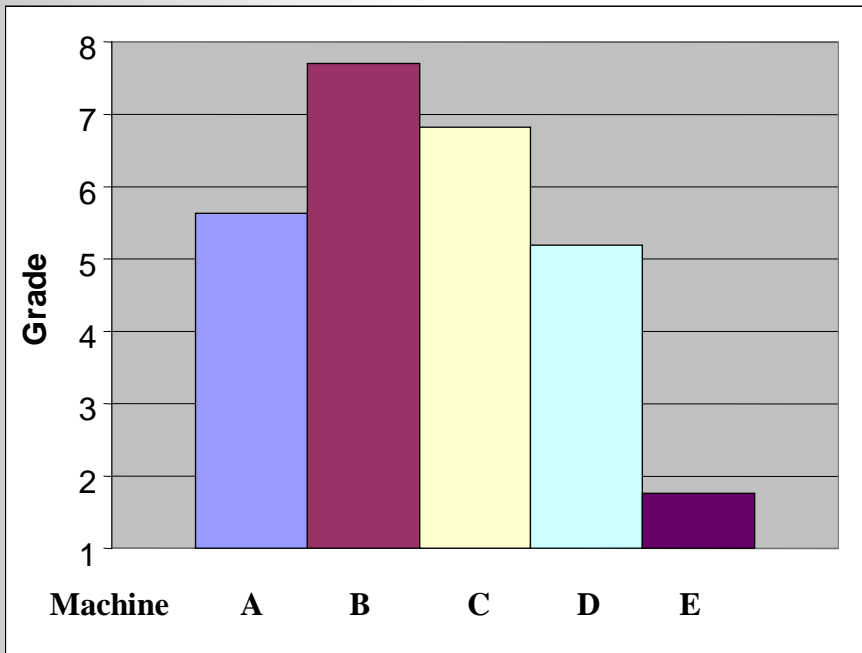


***This copy of the standard is according to the today's EMPA rating standard, but does not show the actual size of standard grades (19 x 25 cm) and might have color, copy or other interferences.***

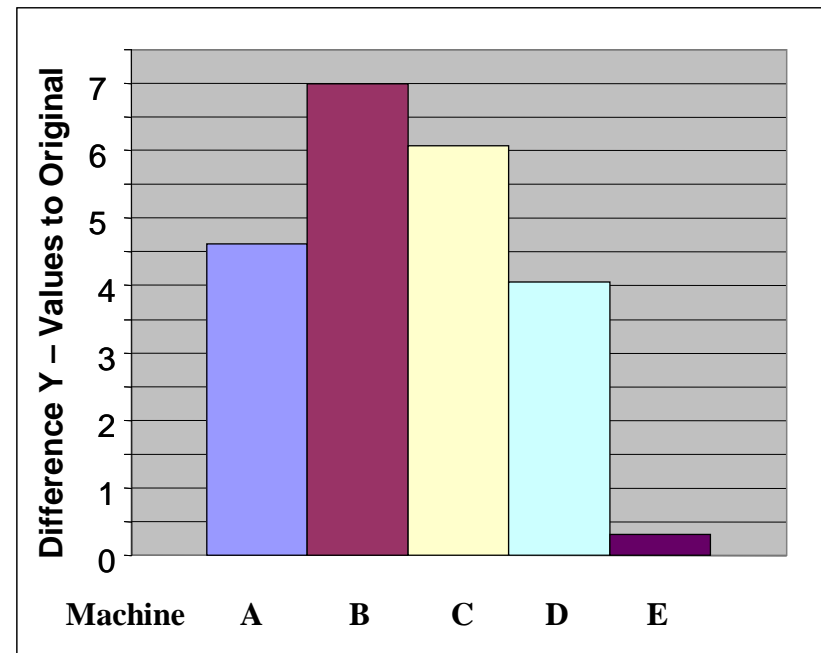


## GoA - Some Results

Visual Rating with a Standard



Rating with Color Matching



**BRAND NEW !!****GoA – Digital Imaging System****BRAND NEW !!**

## Automatical Measurement of EMPA Article 306 „Poka Dots“:



- Automatical measurement
- Easy to handle
- Scanner and computer can be bought in any computer shop
- Real count of dots left on the fabric!
- Results exported in excel-files

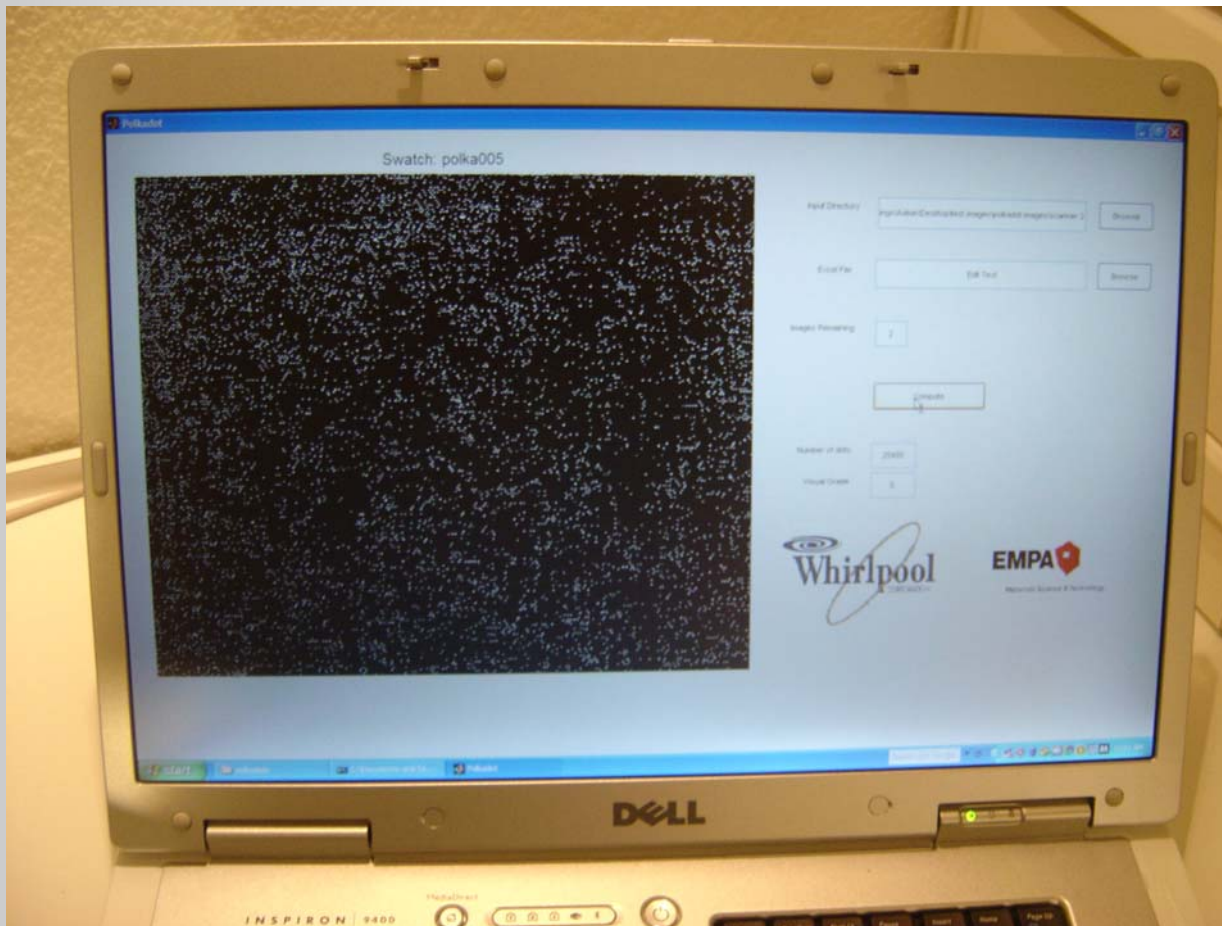
empa<sup>+</sup>testmaterials

in collaboration with:



## GoA – Digital Imaging System

Automatical Measurement of EMPA Article 306 „Poka Dots“:



empa<sup>+</sup>testmaterials

in collaboration with:



## GoA - Article 306 - Test



**Washing machine**

**(IEC-PAS 62473 Ed. 1.0)**



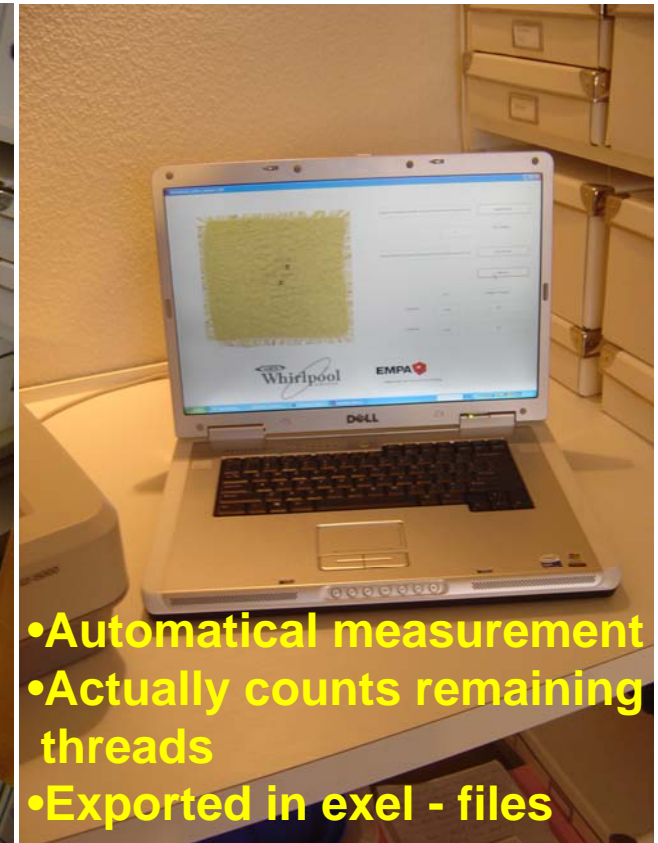
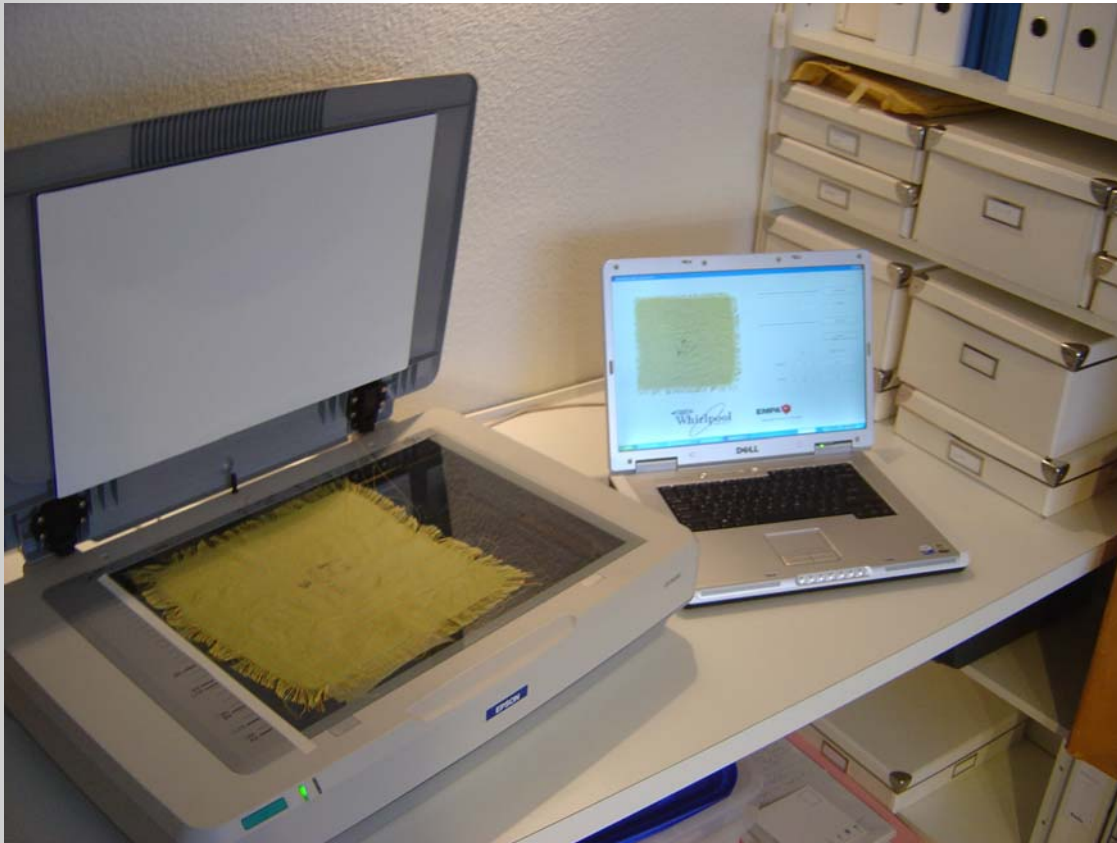
**Tumble dryer**

**(under consideration)**



## GoA – Digital Imaging System

### Automatical Measurement of Article 304:

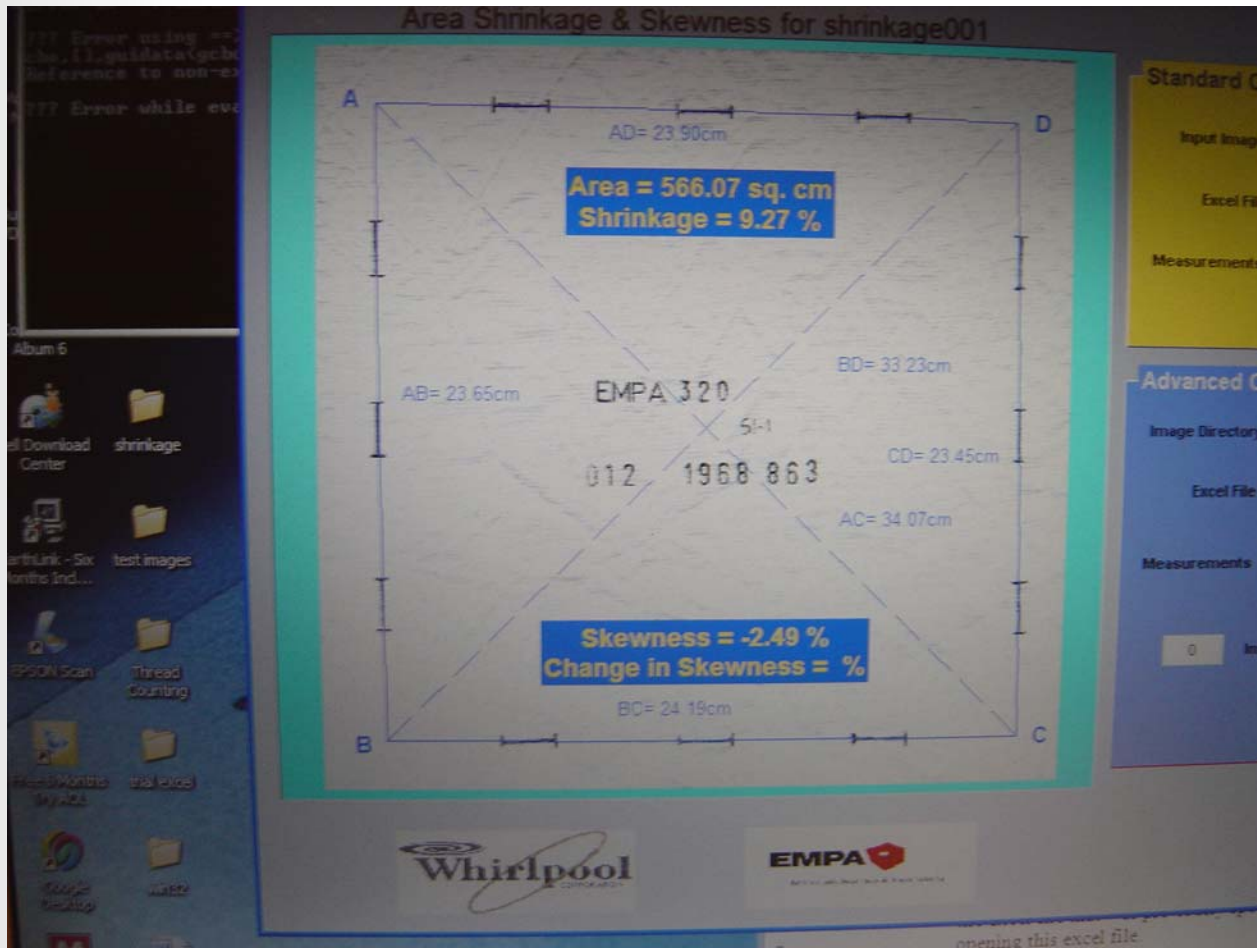


- Automatical measurement
- Actually counts remaining threads
- Exported in excel - files



# GoA – Digital Imaging System

## Automatical Measurement of Cotton Shrinkage - EMPA article 320:



# GoA – Ongoing Work at IEC

| IEC 59 D WG 13.2 "GoA"<br>2nd Comparison GoA |                                   |         |              | Packages for Participants  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |
|--|-----------------------------------|---------|--------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|---|
| Package                                      | Machine                           | Program | Trial number | EMPA   | BSH  | WFK  | Whirlpool  | Miele  | Elektro-lux  | Indesit  | Arcelik  | Henkel   | F & P  | Woolmark   | Swedish Energy Agency  | MABE   | Whirlpool China  | Samsung  |   |
|  |                                   |         |              | <a href="mailto:felix.frey@empa-testmaterials.ch">felix.frey@empa-testmaterials.ch</a> | <a href="mailto:gundula.czyzowski@bshg.com">gundula.czyzowski@bshg.com</a><br><a href="mailto:meike.hempel@bshg.com">meike.hempel@bshg.com</a> | <a href="mailto:t.hilgers@testgewebe.de">t.hilgers@testgewebe.de</a> | <a href="mailto:raveendran.vaidhyanathan@whirlpool.com">raveendran.vaidhyanathan@whirlpool.com</a><br><a href="mailto:Ami.L.Huff@whirlpool.com">Ami.L.Huff@whirlpool.com</a> | <a href="mailto:christoph.wendker@miele.de">christoph.wendker@miele.de</a><br><a href="mailto:e.markus.kamp@miele.de">e.markus.kamp@miele.de</a><br><a href="mailto:egine.hockeler@miele.de">egine.hockeler@miele.de</a> | <a href="mailto:sten.h.almstrom@electrolux.se">sten.h.almstrom@electrolux.se</a> | <a href="mailto:Elisabetta.Ainardi@indesitcompany.com">Elisabetta.Ainardi@indesitcompany.com</a><br><a href="mailto:dino.bongini@indesitcompany.com">dino.bongini@indesitcompany.com</a> | <a href="mailto:zehra.ulger@arcelik.com">zehra.ulger@arcelik.com</a> | <a href="mailto:willi.buchmeier@henkel.com">willi.buchmeier@henkel.com</a><br><a href="mailto:Marianne.Roehl@henkel.com">Marianne.Roehl@henkel.com</a> | <a href="mailto:anna.duncan@fp.co.nl">anna.duncan@fp.co.nl</a> | <a href="mailto:Linda.Riley@wool.com">Linda.Riley@wool.com</a> | <a href="mailto:karin.bulow@stem.se">karin.bulow@stem.se</a> | <a href="mailto:martha.hecht@mabe.com">martha.hecht@mabe.com</a> | <a href="mailto:Sabrina.Zhang@whirlpool.com">Sabrina.Zhang@whirlpool.com</a> | <a href="mailto:Michael.laue@samsung.de">Michael.laue@samsung.de</a> |   |
| S  | Siemens IQ 1632                   | high MA | S 1          | X  | X  | -  | -  | X  | -  | X  | X  | X  | -  | -  | X  | -  | -  | -  |   |
|  |                                   |         | S 2          | X  | X  | -  | -  | X  | -  | X  | X  | X  | -  | -  | X  | -  | -  | -  |   |
|  |                                   |         | S 3          | X  | X  | -  | -  | X  | -  | X  | X  | X  | X  | -  | -  | X  | -  | -  | - |
|  |                                   | low MA  | S 4          | X  | X  | -  | -  | X  | -  | X  | X  | X  | X  | -  | -  | X  | -  | -  | - |
|  |                                   |         | S 5          | X  | X  | -  | -  | X  | -  | X  | X  | X  | X  | -  | -  | X  | -  | -  | - |
|  |                                   |         | S 6          | X  | X  | -  | -  | X  | -  | X  | X  | X  | X  | -  | -  | X  | -  | -  | - |
| K  | Kenmore AHAM HLW 1 RR             | high MA | K 1          | X  | -  | X  | X  | -  | -  | -  | -  | X  | X  | -  | -  | -  | -  | -  |   |
|  |                                   |         | K 2          | X  | -  | X  | X  | -  | -  | -  | -  | -  | X  | X  | -  | -  | -  | -  |   |
|  |                                   |         | K 3          | X  | -  | X  | X  | -  | -  | -  | -  | -  | X  | X  | -  | -  | -  | -  |   |
|  |                                   | low MA  | K 4          | X  | -  | X  | X  | -  | -  | -  | -  | -  | X  | X  | -  | -  | -  | -  | - |
|  |                                   |         | K 5          | X  | -  | X  | X  | -  | -  | -  | -  | -  | X  | X  | -  | -  | -  | -  | - |
|  |                                   |         | K 6          | X  | -  | X  | X  | -  | -  | -  | -  | -  | X  | X  | -  | -  | -  | -  | - |
| C  | Wascator CLS                      | high MA | C 1          | X  | X  | X  | X  | -  | X  | ?  | X  | -  | ?  | X  | X  | X  | -  | ?  |   |
|  |                                   |         | C 2          | X  | X  | X  | X  | -  | X  | ?  | X  | -  | ?  | X  | X  | X  | -  | ?  |   |
|  |                                   |         | C 3          | X  | X  | X  | X  | -  | X  | ?  | X  | -  | ?  | X  | X  | X  | -  | ?  |   |
|  |                                   | low MA  | C 4          | X  | X  | X  | X  | -  | X  | ?  | X  | -  | ?  | X  | X  | X  | -  | ?  |   |
|  |                                   |         | C 5          | X  | X  | X  | X  | -  | X  | ?  | X  | -  | ?  | X  | X  | X  | -  | ?  |   |
|  |                                   |         | C 6          | X  | X  | X  | X  | -  | X  | ?  | X  | -  | ?  | X  | X  | X  | -  | ?  |   |
| M  | Wascator MP Lab                   | high MA | M 1          | X  | -  | -  | -  | X  | X  | ?  | -  | -  | ?  | -  | -  | -  | X  | ?  |   |
|  |                                   |         | M 2          | X  | -  | -  | -  | X  | X  | ?  | -  | -  | ?  | -  | -  | -  | X  | ?  |   |
|  |                                   |         | M 3          | X  | -  | -  | -  | X  | X  | ?  | -  | -  | ?  | -  | -  | -  | X  | ?  |   |
|  |                                   | low MA  | M 4          | X  | -  | -  | -  | X  | X  | ?  | -  | -  | ?  | -  | -  | -  | X  | ?  |   |
|  |                                   |         | M 5          | X  | -  | -  | -  | X  | X  | ?  | -  | -  | ?  | -  | -  | -  | X  | ?  |   |
|  |                                   |         | M 6          | X  | -  | -  | -  | X  | X  | ?  | -  | -  | ?  | -  | -  | -  | X  | ?  |   |
| W  | Machine chosen by the participant | high MA | W 1          | -  | -  | -  | -  | X  | -  | -  | -  | -  | ?  | -  | -  | X  | X  | X  |   |
|  |                                   |         | W 2          | -  | -  | -  | -  | X  | -  | -  | -  | -  | ?  | -  | -  | X  | X  | X  |   |
|  |                                   |         | W 3          | -  | -  | -  | -  | X  | -  | -  | -  | -  | ?  | -  | -  | X  | X  | X  |   |
|  |                                   | low MA  | W 4          | -  | -  | -  | -  | X  | -  | -  | -  | -  | -  | ?  | -  | -  | X  | X  | X |
|  |                                   |         | W 5          | -  | -  | -  | -  | X  | -  | -  | -  | -  | -  | ?  | -  | -  | X  | X  | X |
|  |                                   |         | W 6          | -  | -  | -  | -  | X  | -  | -  | -  | -  | -  | ?  | -  | -  | X  | X  | X |



# GoA – Ongoing Work at IEC

| IEC 59 D WG 13.2 "GoA"<br>2nd Comparison GoA |                                      |             |         | Test Matrix  |  |           |                  |            |                             |                        |                    |         |  |
|--|--------------------------------------|-------------|---------|--------------|--|-----------|------------------|------------|-----------------------------|------------------------|--------------------|---------|--|
| Package Number                               | Machine                              | Temp.       | Cycle   | Trial number | Machine Settings *   | Load Size | Test Swatches ** | IEC strips | Main wash water volume **** | Detergent Amount ***** | Water hardness *** | Re-runs | Remarks:   |
| S  | Siemens IQ 1632                      | 40°C        | high MA | S 1          | "Easy Care 30" with "stains" button                            | 2 kg      | 4 + 4            | 2          | 9                           | 86                     | 150 ppm            | 3       | Please take note, that "Easy Care" is a program specifically made for the RR. The temperature is automatically fixed on 40°C, regardless of temperature settings 30, 40, 50°C. Use only the program (box) sent to you by Gundula Czyzewski!! Read carefully the instruction in the main manual!! |
|  |                                      |             |         | S 2          | "Easy Care 40" with "stains" button                            | 3.5 kg    | 4 + 4            | 4          | 11.5                        | 110                    | 150 ppm            | 3       |  |
|  |                                      |             |         | S 3          | "Easy Care 50" with "stains" button                            | 5 kg      | 4 + 4            | 5          | 14                          | 134                    | 150 ppm            | 3       |  |
|  |                                      |             | low MA  | S 4          | "Easy Care 30" without "stains" button                         | 2 kg      | 4 + 4            | 2          | 9                           | 86                     | 150 ppm            | 3       |  |
|  |                                      |             |         | S 5          | "Easy Care 40" without "stains" button                         | 3.5 kg    | 4 + 4            | 4          | 11.5                        | 110                    | 150 ppm            | 3       |  |
|  |                                      |             |         | S 6          | "Easy Care 50" without "stains" button                         | 5 kg      | 4 + 4            | 5          | 14                          | 134                    | 150 ppm            | 3       |  |
| K  | Kenmore AHAM HLW-1-RR                | 40°C (warm) | high MA | K 1          | perm. Press 10 + heavy action + water level small (1)          | 2 kg      | 4 + 4            | 2          | 12 - 13 gallons             | 70                     | 150 ppm            | 3       |  |
|  |                                      |             |         | K 2          | perm. Press 10 + heavy action + water level medium-large (3)   | 3.5 kg    | 4 + 4            | 4          | 17 - 18 gallons             | 82                     | 150 ppm            | 3       |  |
|  |                                      |             |         | K 3          | perm. Press 10 + heavy action + water level large (4)          | 5 kg      | 4 + 4            | 5          | 21 - 22 gallons             | 94                     | 150 ppm            | 3       |  |
|  |                                      |             | low MA  | K 4          | perm. Press 4 + handwash action + water level small (1)        | 2 kg      | 4 + 4            | 2          | 12 - 13 gallons             | 70                     | 150 ppm            | 3       |  |
|  |                                      |             |         | K 5          | perm. Press 4 + handwash action + water level medium-large (3) | 3.5 kg    | 4 + 4            | 4          | 17 - 18 gallons             | 82                     | 150 ppm            | 3       |  |
|  |                                      |             |         | K 6          | perm. Press 4 + handwash action + water level large (4)        | 5 kg      | 4 + 4            | 5          | 21 - 22 gallons             | 94                     | 150 ppm            | 3       |  |
| C  | Wascator CLS                         | 40°C        | high MA | C 1          | Cotton 40°C (40* - 3 Min)                                      | 2 kg      | 4 + 4            | 2          | 26                          | 180                    | 150 ppm            | 3       | Please use only the program card delivered with the main manual for the Round Robin!   |
|  |                                      |             |         | C 2          | Cotton 40°C (40* - 3 Min)                                      | 3.5 kg    | 4 + 4            | 4          | 26                          | 180                    | 150 ppm            | 3       |  |
|  |                                      |             |         | C 3          | Cotton 40°C (40* - 3 Min)                                      | 5 kg      | 4 + 4            | 5          | 26                          | 180                    | 150 ppm            | 3       |  |
|  |                                      |             | low MA  | C 4          | Wool 40 Nev+30sec  | 2 kg      | 4 + 4            | 2          | 26                          | 180                    | 150 ppm            | 3       | Please use only the program card delivered with the main manual for the Round Robin!   |
|  |                                      |             |         | C 5          | Wool 40 Nev+30sec  | 3.5 kg    | 4 + 4            | 4          | 26                          | 180                    | 150 ppm            | 3       |  |
|  |                                      |             |         | C 6          | Wool 40 Nev+30sec  | 5 kg      | 4 + 4            | 5          | 26                          | 180                    | 150 ppm            | 3       |  |
| M  | Wascator MP Lab                      | 40°C        | high MA | M 1          | Cotton 40°C  | 2 kg      | 4 + 4            | 2          | 26                          | 180                    | 150 ppm            | 3       |  |
|  |                                      |             |         | M 2          | Cotton 40°C  | 3.5 kg    | 4 + 4            | 4          | 26                          | 180                    | 150 ppm            | 3       |  |
|  |                                      |             |         | M 3          | Cotton 40°C  | 5 kg      | 4 + 4            | 5          | 26                          | 180                    | 150 ppm            | 3       |  |
|  |                                      |             | low MA  | M 4          | Wool 40  | 2 kg      | 4 + 4            | 2          | 26                          | 180                    | 150 ppm            | 3       |  |
|  |                                      |             |         | M 5          | Wool 40  | 3.5 kg    | 4 + 4            | 4          | 26                          | 180                    | 150 ppm            | 3       |  |
|  |                                      |             |         | M 6          | Wool 40  | 5 kg      | 4 + 4            | 5          | 26                          | 180                    | 150 ppm            | 3       |  |
| W  | Machine as chosen by the participant | 40°C        | high MA | W 1          | as chosen  | 2 kg      | 4 + 4            | 2          | acc. to machine             | acc. to IEC            | 150 ppm            | 3       | If possible, the range of GoA for this program should be near to the 40° C Cotton program of the Wascator.   |
|  |                                      |             |         | W 2          | as chosen  | 3.5 kg    | 4 + 4            | 4          | acc. to machine             | acc. to IEC            | 150 ppm            | 3       |  |
|  |                                      |             |         | W 3          | as chosen  | 5 kg      | 4 + 4            | 5          | acc. to machine             | acc. to IEC            | 150 ppm            | 3       |  |
|  |                                      |             | low MA  | W 4          | as chosen  | 2 kg      | 4 + 4            | 2          | acc. to machine             | acc. to IEC            | 150 ppm            | 3       | If possible, the range of GoA for this program should be near to the Wool program of the Wascator.   |
|  |                                      |             |         | W 5          | as chosen  | 3.5 kg    | 4 + 4            | 4          | acc. to machine             | acc. to IEC            | 150 ppm            | 3       |  |
|  |                                      |             |         | W 6          | as chosen  | 5 kg      | 4 + 4            | 5          | acc. to machine             | acc. to IEC            | 150 ppm            | 3       |  |

18.10.2006

EMPA Testmaterials/ Felix Frey

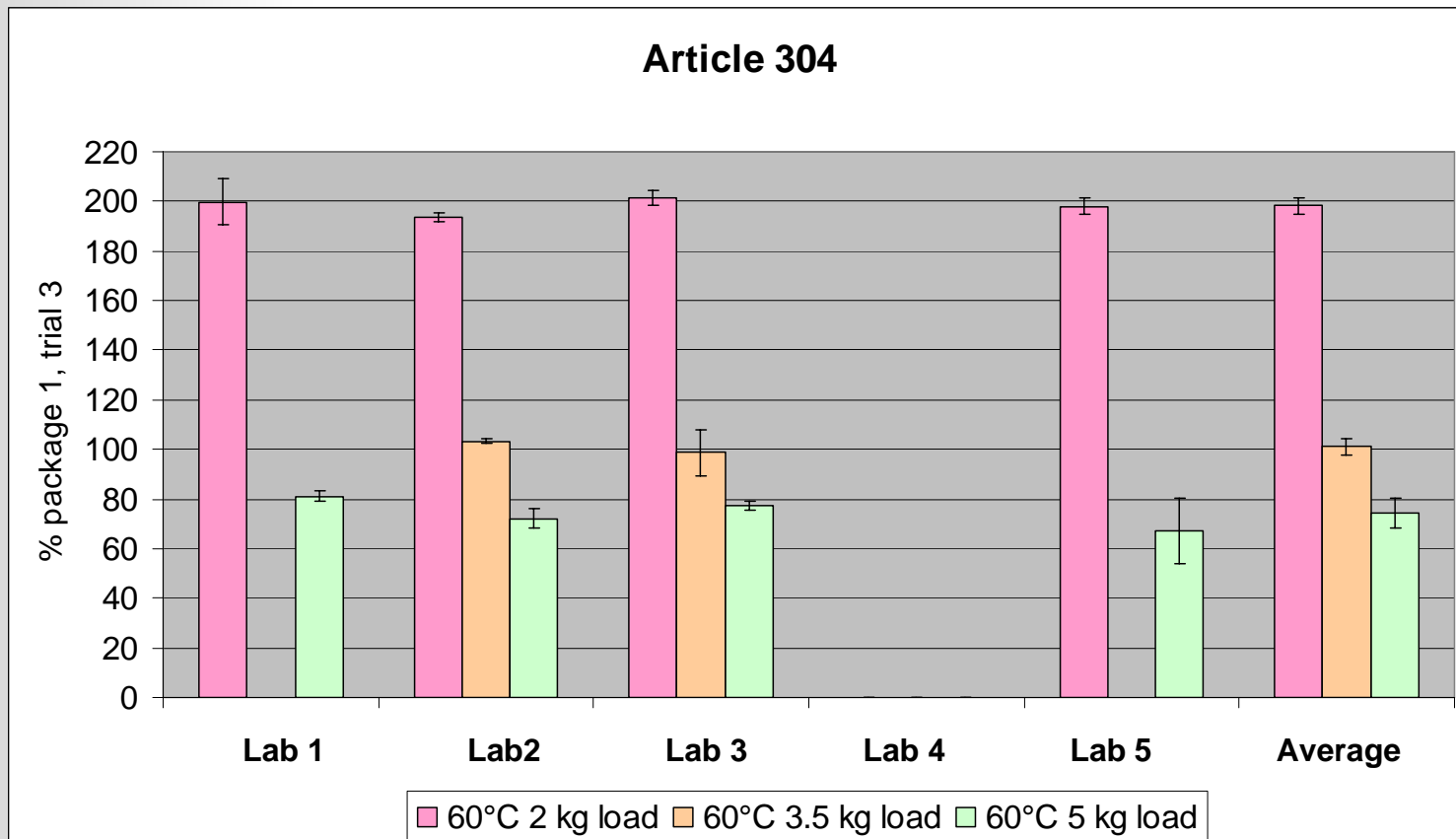
\* further details for settings, water level, etc. will be given in the RR manual.  
 \*\* 4 samples poka dot (article 306) + 4 samples article 304, placed as described in "loading scheme"  
 \*\*\* If the hardness of water can not be fulfilled by the laboratory, the hardness should be stated separately.

\*\*\*\* please adapt for lb., if necessary  
 \*\*\*\*\* please check the main wash water volume is correct (as listed)



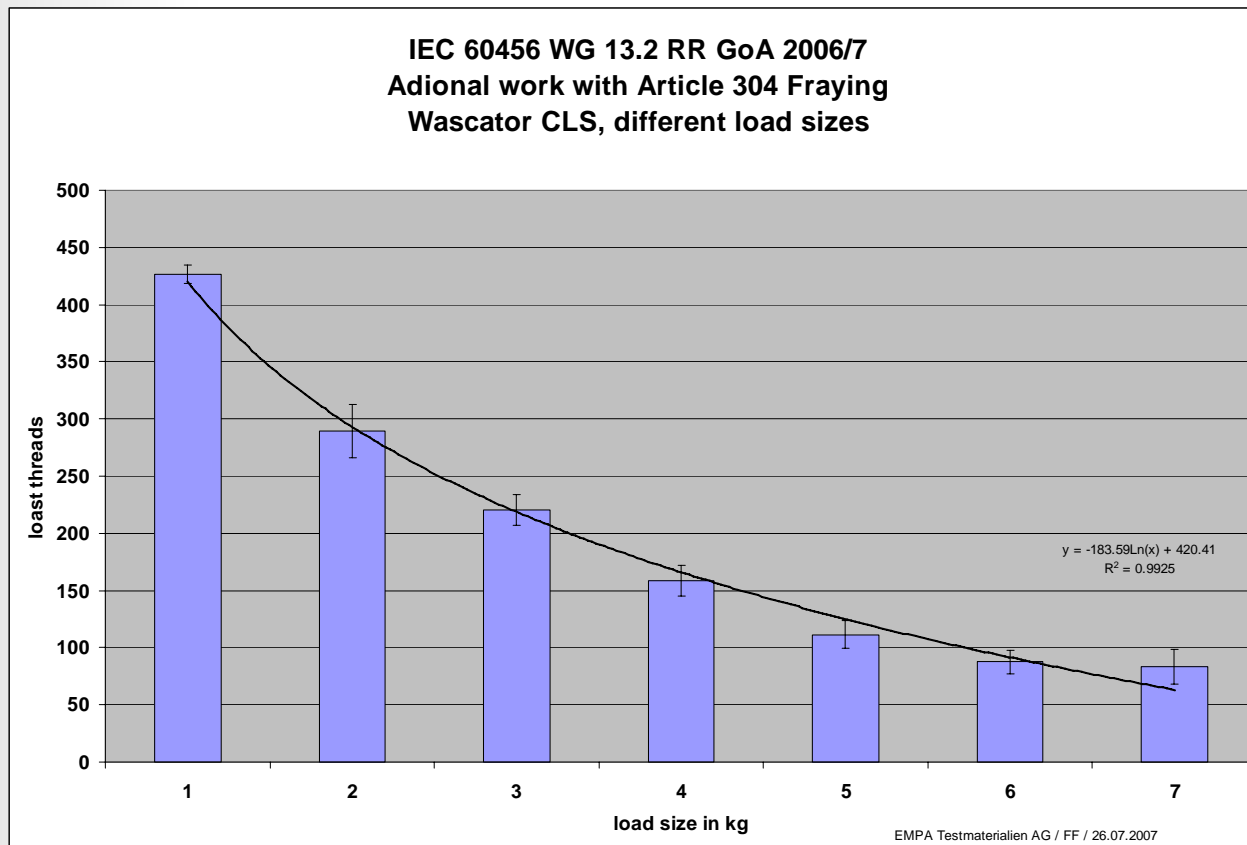
## GoA - Some Results

Does the load size in a HA Machine have an influence on the mechanical action cloth?



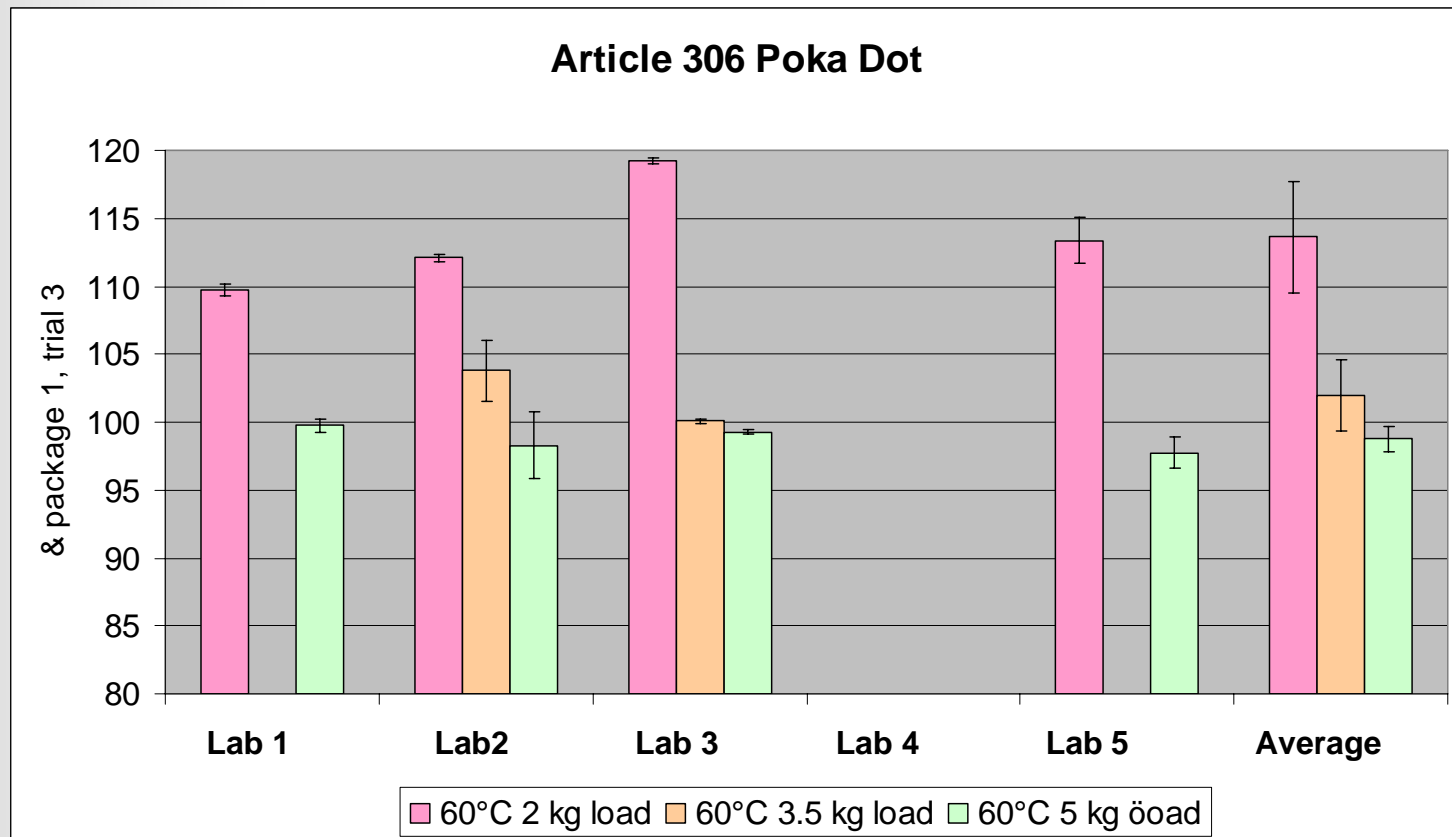
## GoA - Some Results

Does the load size in a HA Machine have an influence on the mechanical action cloth?



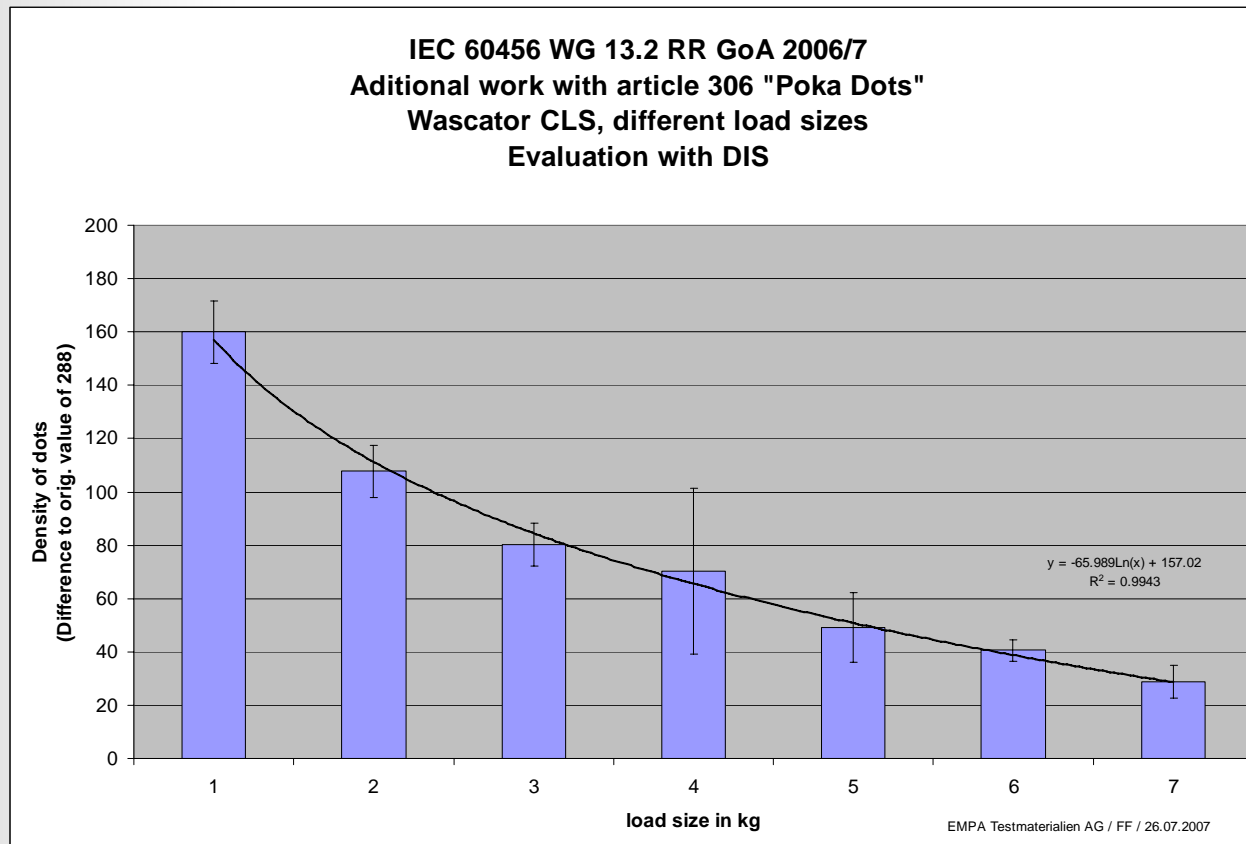
## GoA - Some Results

Does the load size in a HA Machine have an influence on the mechanical action cloth?



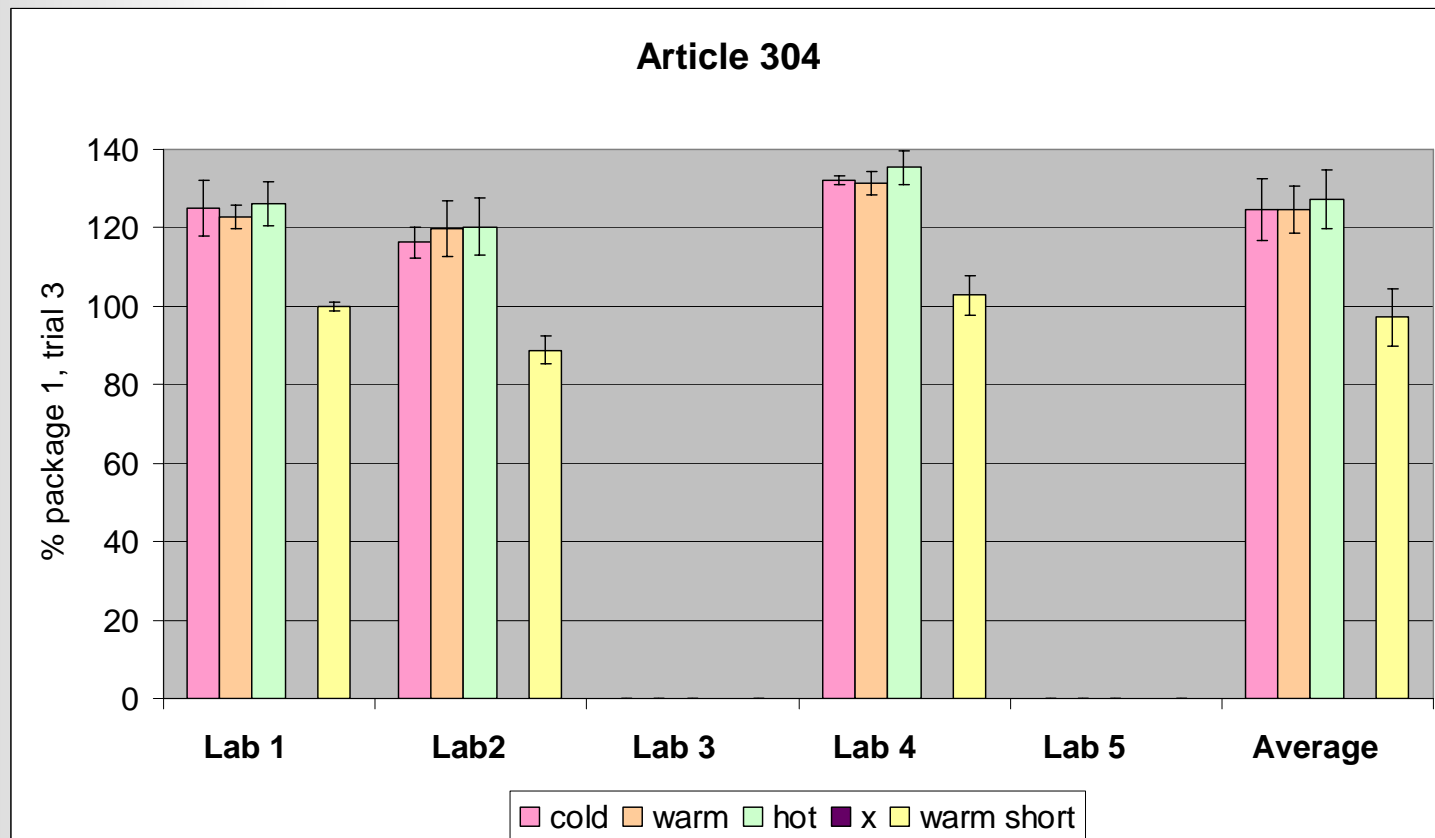
## GoA - Some Results

Does the load size in a HA Machine have an influence on the mechanical action cloth?



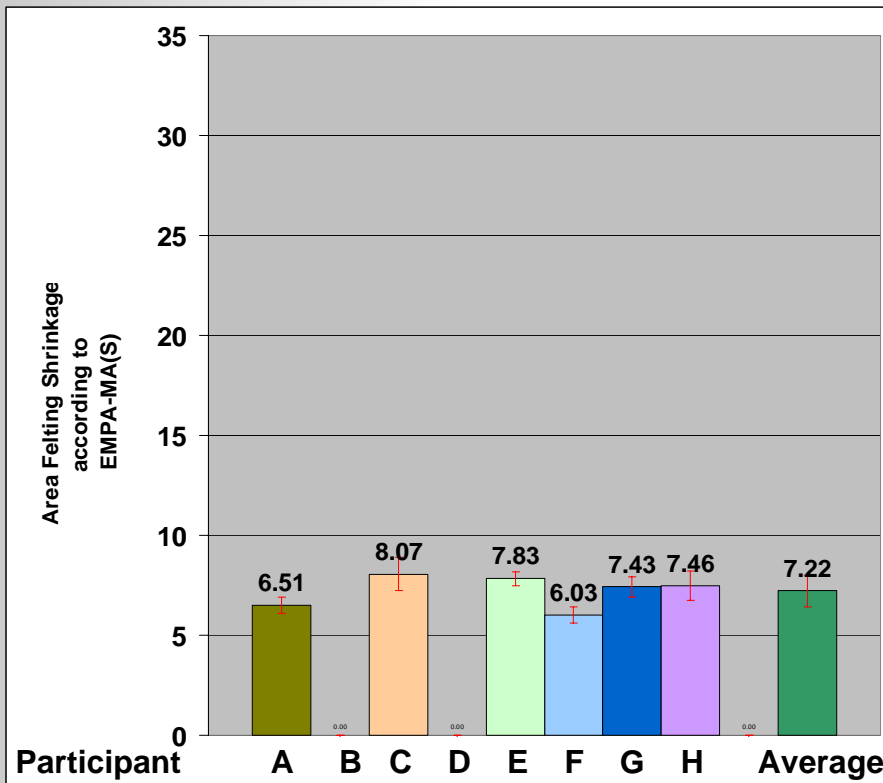
## GoA - Some Results

**Can the mechanical action cloth find a difference of a long and a short cycle in a VA washing machine?**

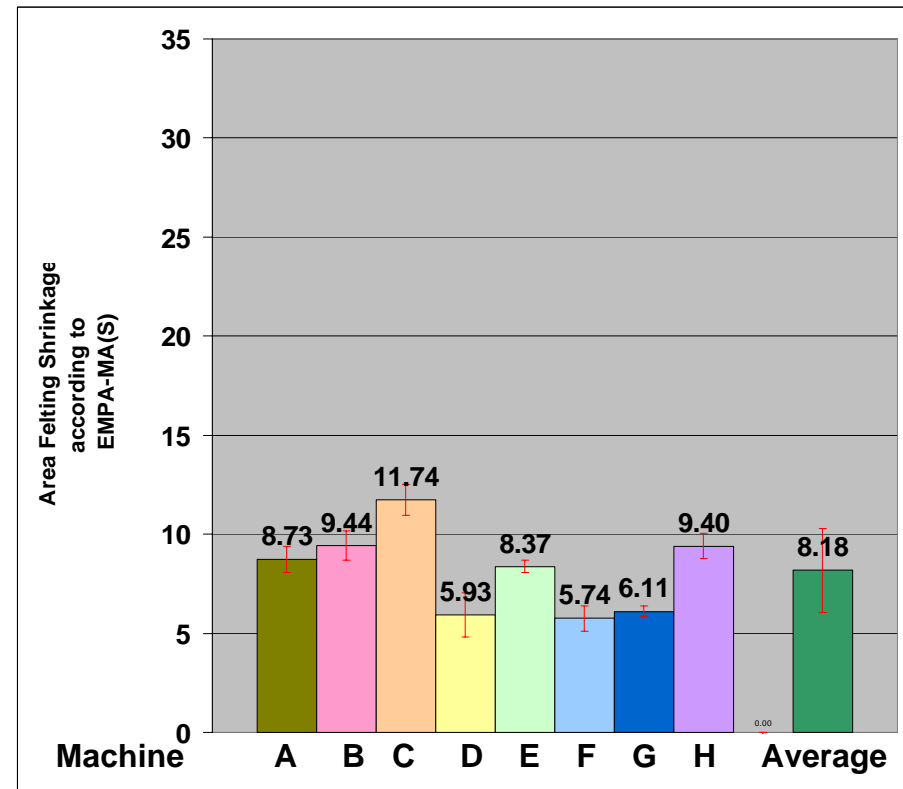


## GoA - Results on Wool Program

### Same Machinetype different Laboratories

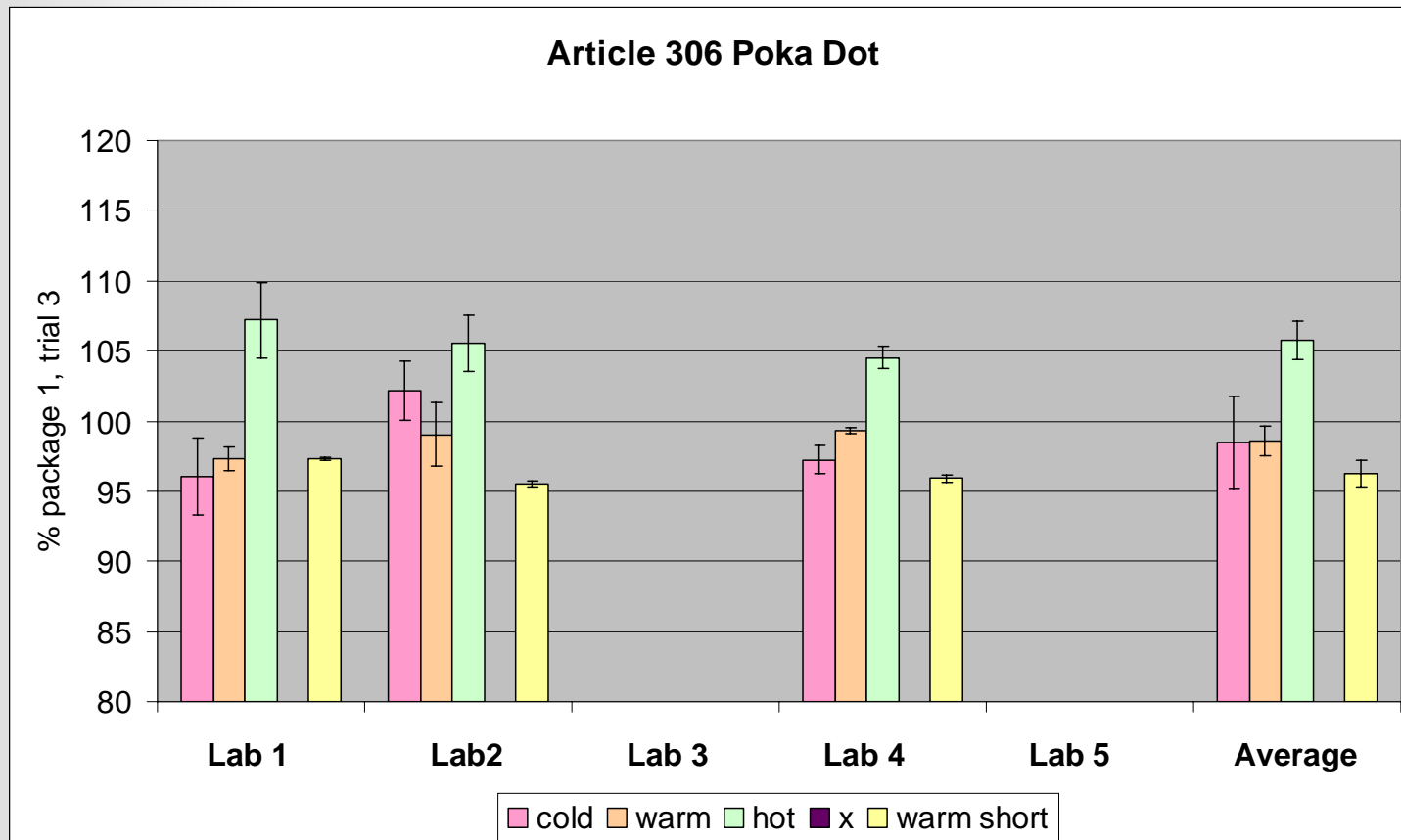


### Different Machinetypes different Laboratories



## GoA - Some Results

**Can the mechanical action cloth find a difference of a long and a short cycle in a VA washing machine?**



**THANK YOU VERY MUCH  
FOR YOUR ATTENTION !!**

Felix Frey

