FEMTECH STANDARDS PUBLICATION

Reusable Absorbent Undergarment Testing Protocol

FemTech at MAS

HOHENSTEIN

BRINGING NORMALCY TO WOMEN'S LIVES, EVERYDAY.

CONTENTS

1. SCOPE

This Standard specifies the maximum absorption capacity before leakage, rewet and wicking speed for reusable absorbent undergarment designed to be used for any type of body fluids including but not limited to menstruation and urinary incontinence applications.

FemTech at MAS has designed this testing standard together with Hohenstein Laboratories GmbH & Co. KG, considering real life 3D wear scenario. The method of testing is simplified to ensure valid and repeatable test data provided the fit and size of the undergarment is accurate to the wearer.

The chosen test parameters (weight, fluid amount, wait time) are based on average data and represent a scenario close to worst case in terms of wear and flow rate of the body fluid activity.

2. NORMATIVE REFERENCES

The following reference document are required for the application of this standard. Latest edition of the document with amendments should be used.

- ISO 139, Textiles — Standard atmospheres for conditioning and testing
- AATCC 150-2018 — Dimensional Changes of Garments after Home Laundering (As a wash method to test after wash performance)
- ISO 6330:2012 -Textiles — Domestic washing and drying procedures for textile testing (As a wash method to test after wash performance.) [Note: washing method shall be selected based on the care label instructions of the Undergarment]
- Synthethic Blood Simulant Recipe

1. Test method No. 12/2015 MDS-Hi (German Healthcare Medical Service) (https://www.gkv-spitzenverband.de/media/dokumente/krankenversicherung_1/hilfsmittel/fortschreibungen_aktuell/20160311/032016_Pruefmethode_Nr_12-2015_MDS-Hi.pdf)
2. Reference blood simulant (5.1.1): European patent specification EP 1 355 607 B1 (https://data.epo.org/publication-server/document?iDocId=3303810&iFormat=0)

3. TERMS & DEFINITIONS

For the purposes of this document, the following terms and definitions apply.

3.1 Gusset Composite

Gusset composite is a combination of multiple functional layers attached together to provide specific functional requirements including, but not limited to, wicking, absorbency, leak resistance etc. in a reusable absorbent undergarment.

3.2 Test Specimen/ Sample

Sample used in testing purpose to determine the required parameters.

3.3 Functional Properties

The nature of having a certain function and/or performance features in products.

3.4 Menstruation

Menstruation is the regular vaginal bleeding that occurs as part of a woman's monthly cycle.

3.5 Urinary Incontinence

Urinary incontinence refers to involuntary urine leakage.

3.6 Reusable Absorbent Undergarment

Reusable absorbent underwear is a pair of undergarments that can be worn during menstruation, urinary incontinence, or for any other body fluids. The reusable absorbent undergarment absorbs the body fluids utilizing a multi-layer textile material assembly built into the gusset region of the undergarment which is identified as the gusset composite. This undergarment can be washed after use to be re-used multiple times.

3.7 Waiting Time

Keep time to settle absorbed liquid in between fluid additions.

4. PRINCIPLE

4.1 Maximum Absorbent Capacity Before Leakage

The maximum absorbent capacity before leakage measures how much of liquid can be held in the gusset composite of the reusable absorbent undergarment before leaking. Amount of liquid is measured by continuously adding liquid to the gusset composite of the reusable absorbent undergarment over a defined period with a defined amount until leakage is detected.

4.2 Rewet

Rewet is the fluid retention performance of the gusset composite in a reusable absorbent undergarment. The testing principle is based on determination of the rewet based on the fluid amount that is taken up by a stack of blotting paper under defined pressure. For the real user case, it's typically how much absorbed liquid gets resurfaced to the body touching side from the top wicking material of the gusset. This measures user comfortability in terms of wet or dry feeling throughout product usage.

4.3 Wicking speed

A defined amount of fluid is applied to a small area of the gusset composite and the elapsed time until the fluid is completely absorbed is recorded.

5. MATERIALS

5.1 Fluids

5.1.1 Synthetic Blood Simulant

Dissolve 8 g CMC (Carboxy Methyl Cellulose, 0.60-0.95 degree of substitution, CAS 9004-32-4, Sigma-Aldrich resp. Merck) and 9 g NaCl per litre of distilled water under stirring and heating up to 35 °C. Liquid is used after cooling to room temperature.

[Reference: European patent specification EP 1 355 607 B1]

5.1.2 Saline for Urine Simulant

0.9 % saline solution (9 g of NaCl per litre of distilled water)

6. APPARATUS

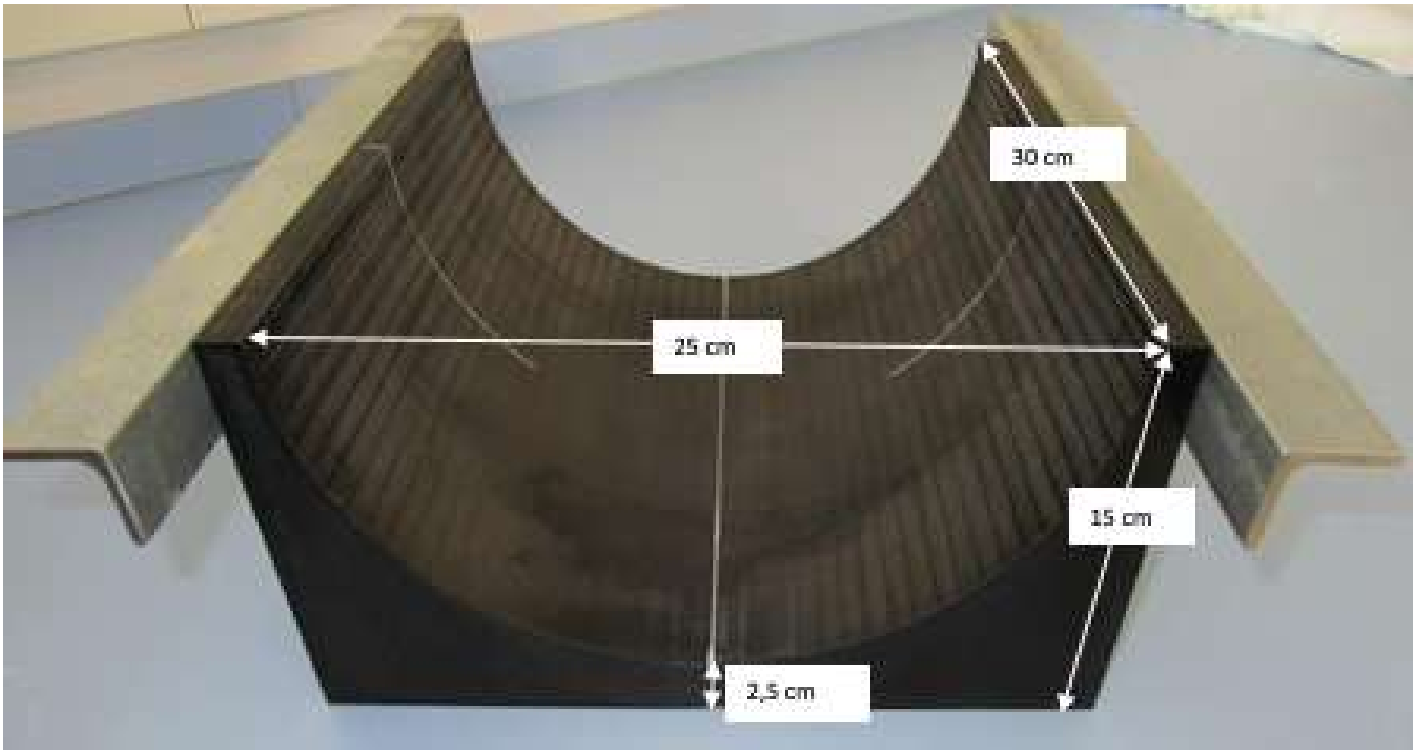
6.1 Blotting Paper approx. 300 x 400 mm size (or alternatively filter paper)

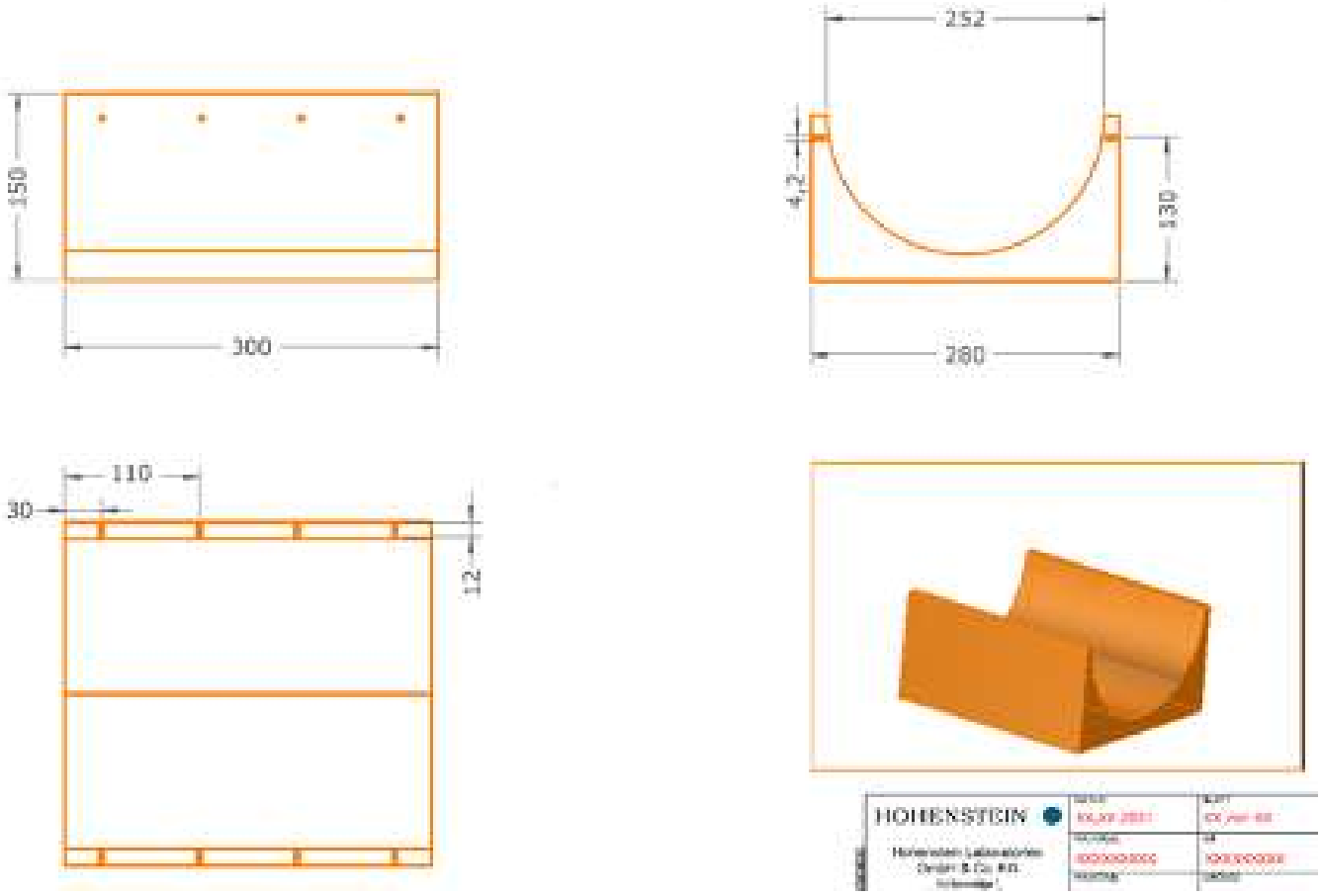
6.2 Graduated pipet (Volume: 5ml; precision 0.05ml)

6.3 Stopwatch (precision between 0.05 -0.1 s)

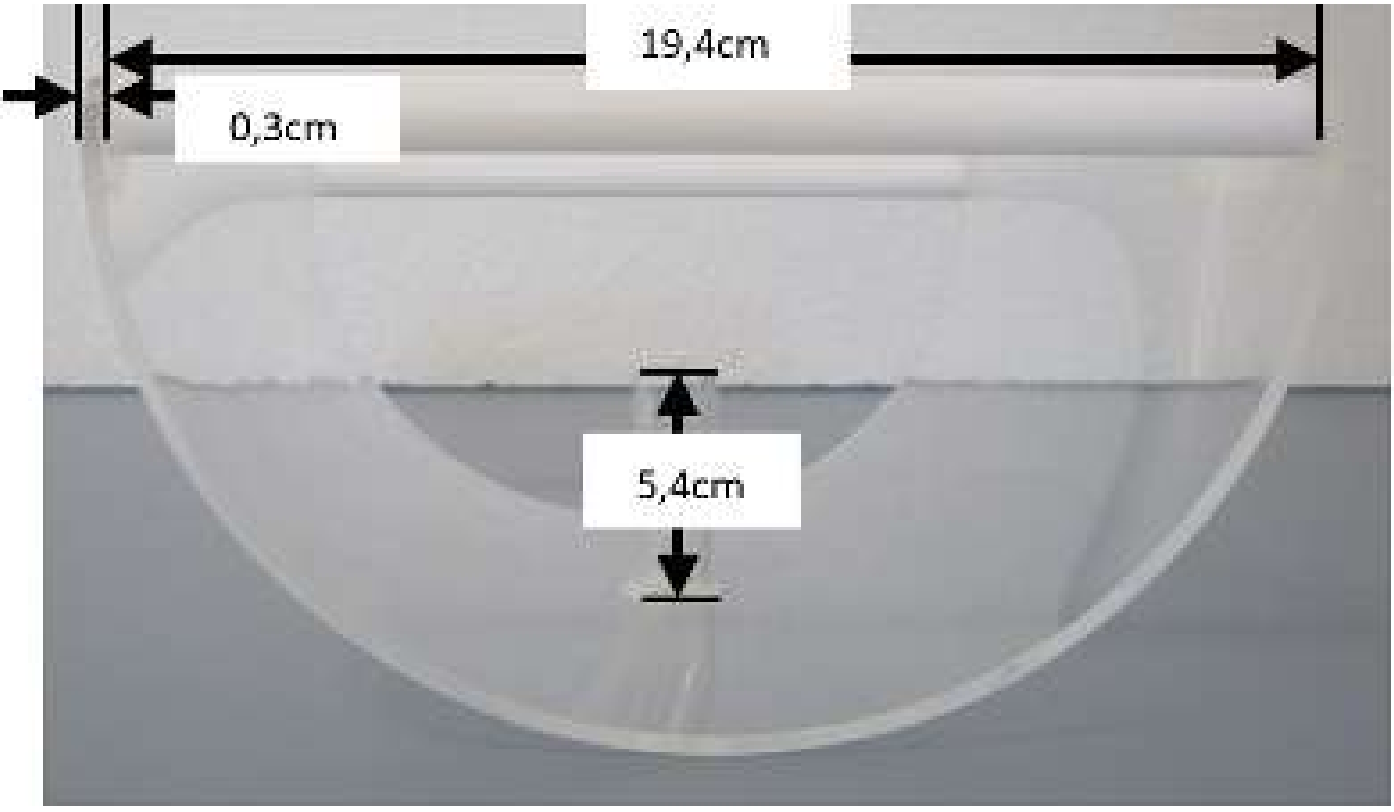
6.4 Weighing scale (accuracy 0.001 g)

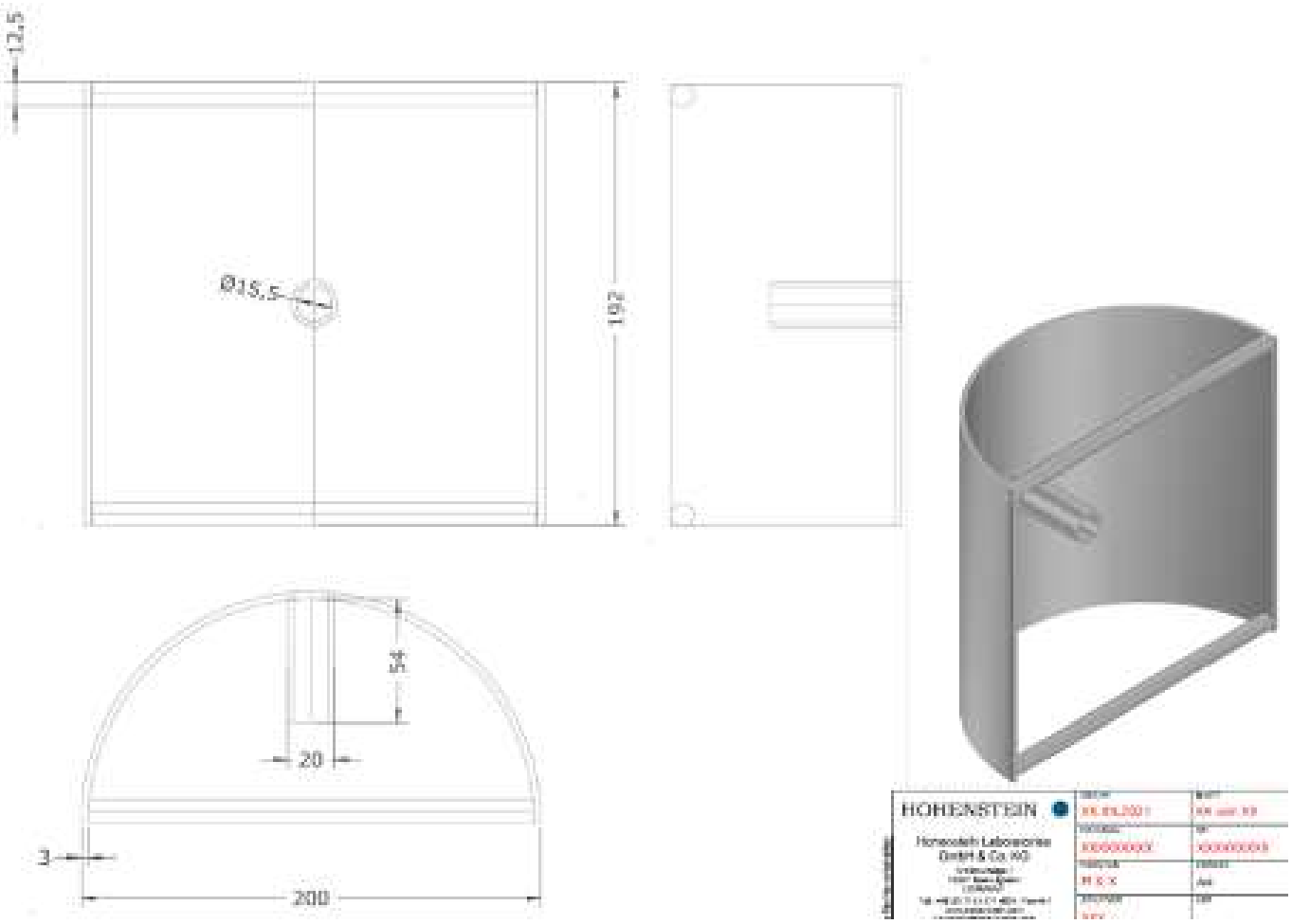
6.5 Specimen holder "halfpipe", radius 125 mm, preferably 3D-printed





6.6 Transparent stamp with a small tube, made from acrylic tubes 200/194 mm and 20/16 mm outer/inner diameter, weight: 313 g for maximum absorbency before leakage testing

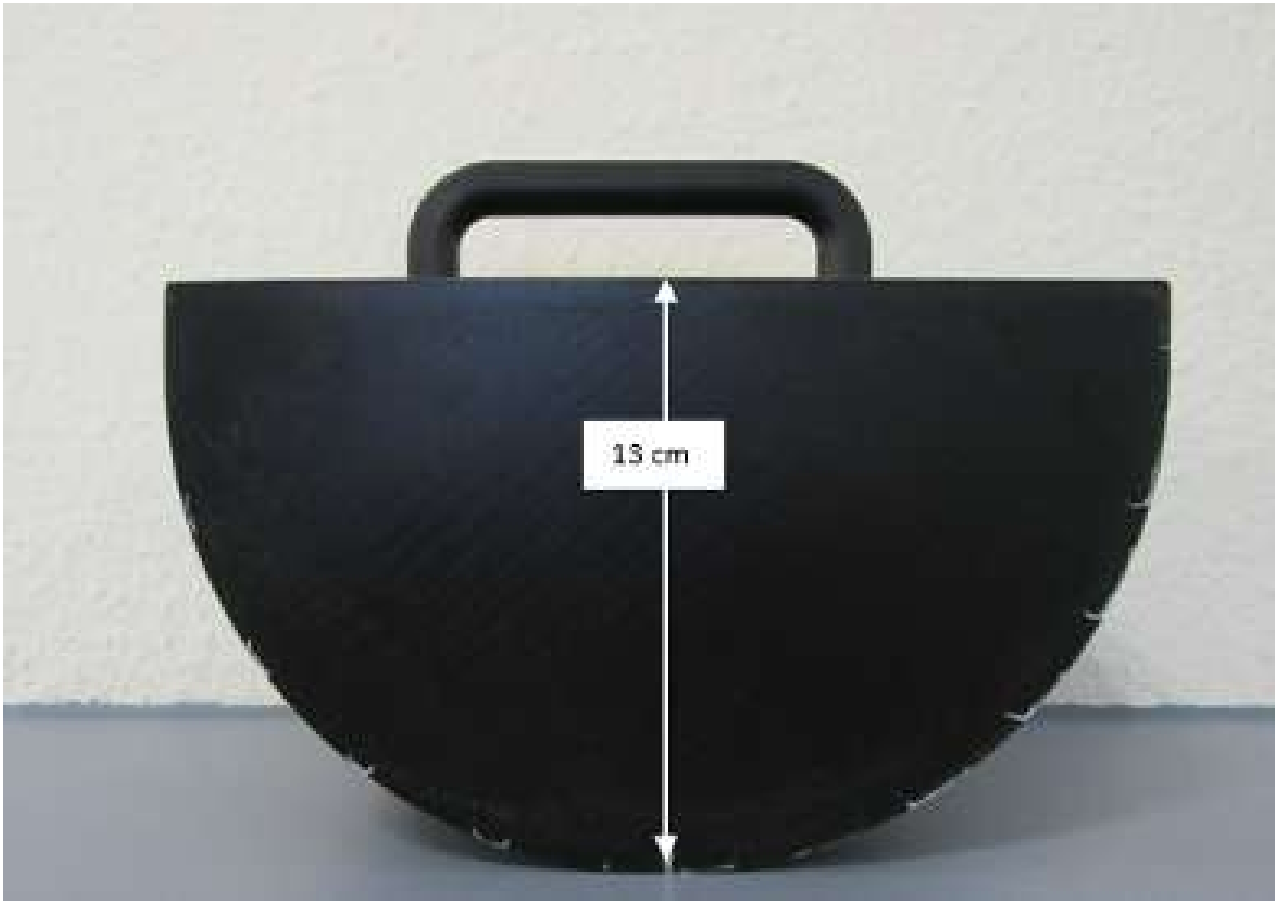


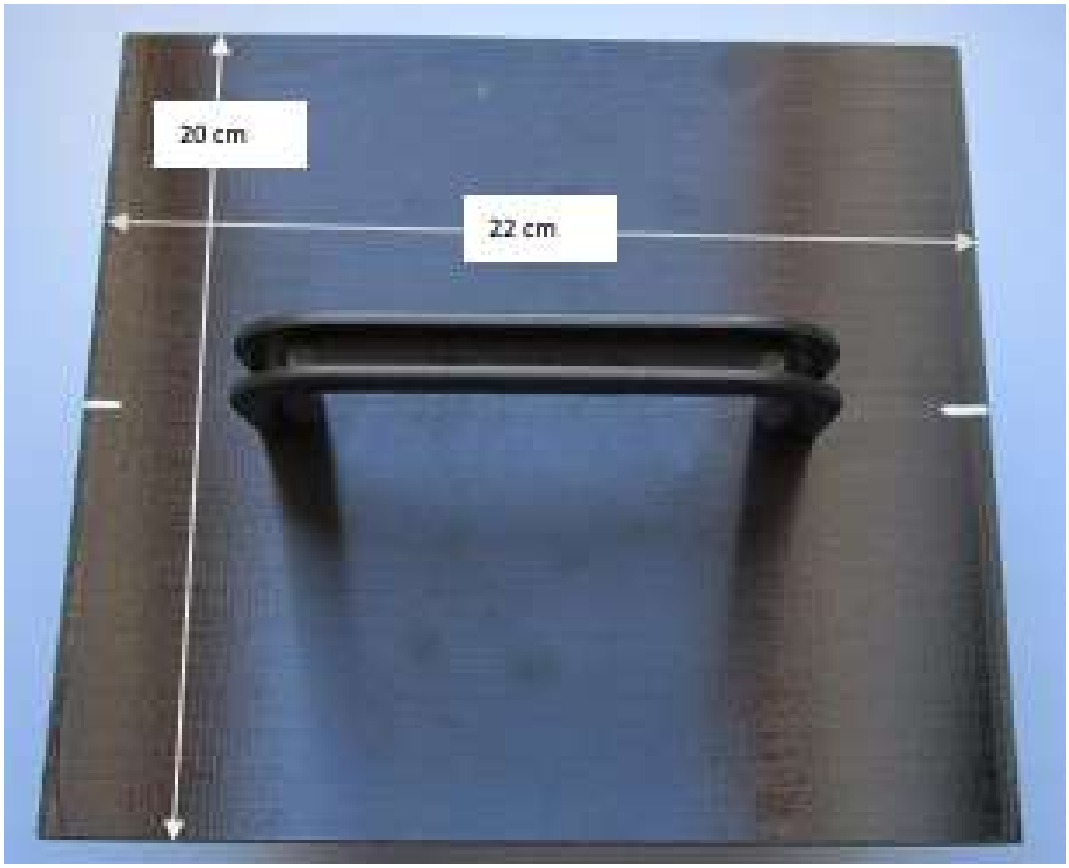


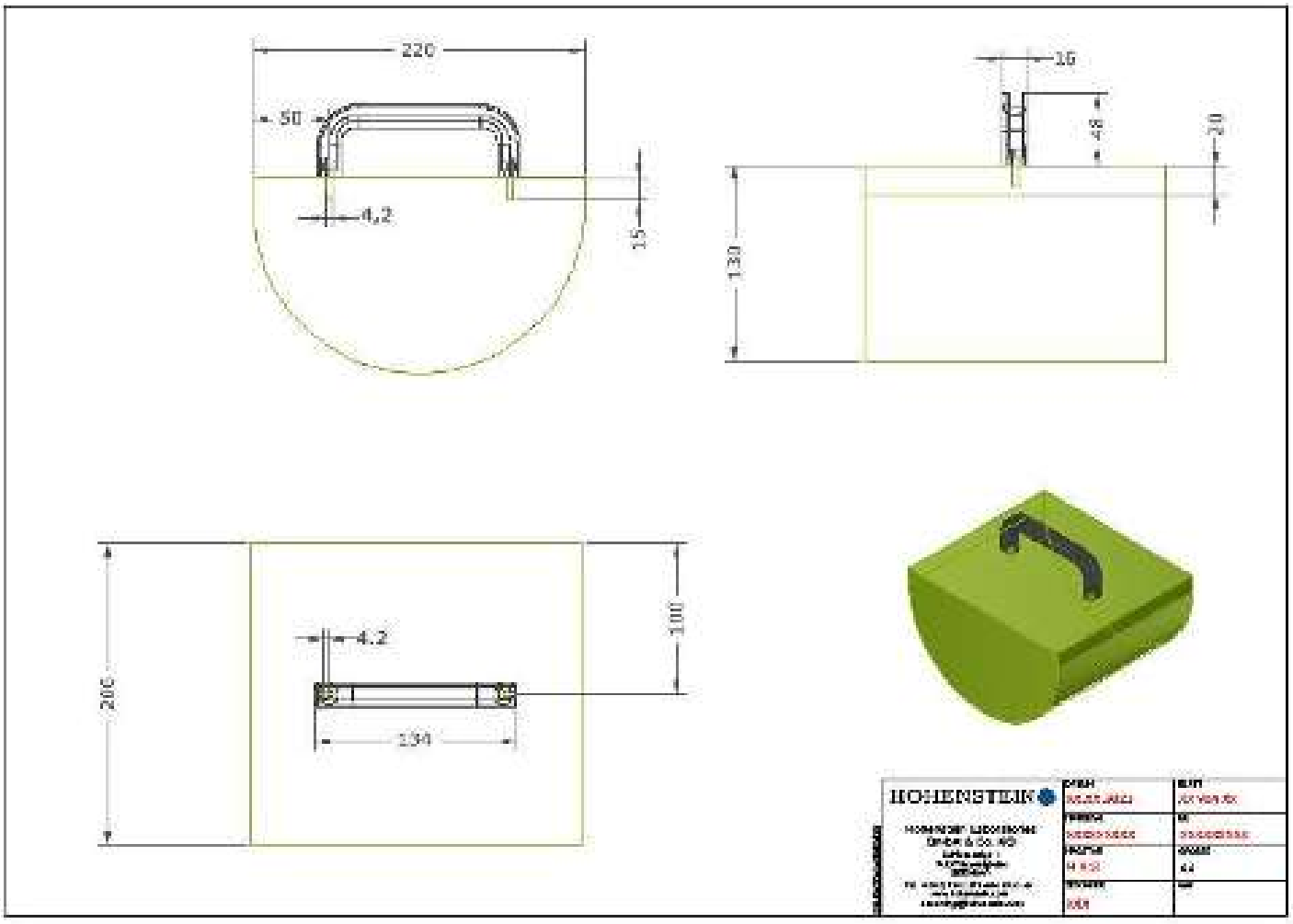
6.7 Additional weight, Metal beads in weight-adjustable bag

Metal beads in weight-adjustable bags were chosen to allow the total weight of the stamp to be flexibly adjusted. Furthermore, it allows easy placement even on curved surfaced – i.e. on the transparent stamp the weight-adjustable bags are placed directly next to the small tube. On the intransparent stamp one weight-adjustable bag is placed under the handle.

6.8 Intransparent stamp without hole, weight 757g, preferably 3D-printed for rewet testing







7. TEST PROCEDURE

The following test procedures can be conducted with both synthetic blood simulant (5.1.1) as well as saline solution (5.1.2).

7.1 Sample preparation

(a) Prior to testing all samples, they must at least be washed one time/cycle according to ISO 6330 / AATCC 150 (30 °C gentle, line-drying) procedure 3M A or acc. to the labeled care instructions and conditioned at least 24 h acc. to ISO 139.

(b) Cut open the garment on two side waists (left-side seam and right-side seam) so that the garment can lay properly on the curved bottom surface. The cut-open reusable absorbent undergarment with the gusset composite in the middle is the test specimen for all following test procedures.

7.2 Maximum Absorbent Capacity Before Leakage

(a) Take 1 layer of blotting paper (6.1) and note down its weight (+/- 0.01 g).
(b) Place the blotting paper in specimen holder (6.5).
(c) Place (new/dry) test specimen on top of the blotting paper and make sure that on both sides of the gusset is placed on top of the blotting paper to detect leakage.
(d) Place transparent stamp (6.6) on top of the test specimen and add additional weight (6.7) so that the total mass of the transparent stamp is 1 kg. (place small dosing tube of the transparent stamp on the average mid-point of the gusset and narrowest part of the test specimen)
(e) Add 3 ml of test fluid within ten seconds with a pipette into the small tube of the transparent stamp
(f) Allow the fluid to settle by waiting for 5 min.
(g) Lift the transparent stamp for 5 seconds, completely off the test specimen, and then place it back again.
(h) Repeat e) f) g) until the blotting paper shows wet, around the gusset composite area, especially next to at least one of the side edges of the gusset.
(i) Note down the amount of fluid added prior to observing leakage around the gusset.
(j) Continue with the rewet testing (7.3) right after detecting leakage and leave the test specimen as it is in the specimen holder.
(k) Repeat the testing with 2 more specimen to obtain triple replicate readings.

7.3 Rewet

Rewet Testing should be performed right after recording the maximum absorption capacity before leakage (7.2) using the already wet test specimen. This measures the rewet of the garment at the point of leakage, this can typically be considered as the worst-case scenario for the user.

However, the same test can be conducted to test the rewet at different intervals. For example, once you identify the maximum absorption capacity in ml, the same test can be conducted using only 25%, 50%, 75% of that maximum absorption capacity amount in ml to test the rewet at different intervals before leakage.

Rewet test method at the point of leakage:

(a) Take 4 layers of blotting paper and note down its weight (+/- 0.01 g).
(b) Place the 4 layers of blotting paper onto the wet test specimen from procedure 7.2.
(c) Place intransparent stamp (6.8) on top of the wet test specimen and add additional weight (6.7) so that the total mass of the intransparent stamp is 1 kg.
(d) Wait for 5 minutes
(e) Weigh 4-layered blotting paper stack after placing it on top of the wet test specimen(Δ1)
(f) Weigh blotting paper underneath the test specimen(Δ2) (from procedure 7.2)
(g) Repeat the testing with 2 more specimen to obtain triple replicate readings.

Rewet test method at different intervals before the final leakage point (25%, 50%, 75% etc.)

25%:

- Maximum absorbent capacity before leakage (ml) /4) =Y
- Repeat 7.2 until garment absorb Y ml fluid.
- Repeat 7.3 rewet test.
- Repeat the testing with 2 more specimen to obtain triple replicate readings.

50% and 75% should be conducted same as 25% considering

- 50% as (Maximum absorbent capacity before leakage (ml) /2) =Y
- 75% as (Maximum absorbent capacity before leakage (ml) / (3/4)) =Y

7.4 Wicking Speed

- Place (new/dry) test specimen into the specimen holder (6.5).
- Place transparent stamp (6.6) on top of the test specimen without any additional weight.
- Add 3 ml of test fluid within one second on to the gusset composite, and start the stopwatch immediately.
- Record the time elapsed until the test fluid is completely absorbed and soaked up by the test specimen.
- Repeat the testing with 2 more specimen to obtain triple replicate readings.

8. CALCULATION & EXPRESSION OF RESULTS

8.1 Maximum Absorption Capacity Before Leakage

The final result is the average of the three replicates of the test fluid amount until leakage.

8.2 Rewet

The final result is the sum of test fluid rewet weight of the 2 blotting papers (Δ1, Δ2).

$$m = \Delta 1 + \Delta 2$$

The fluid rewet is determined as follows:

$$\Delta 1 = m_{wet1} - m_{dry1}$$

$$\Delta 2 = m_{wet2} - m_{dry2}$$

with Δ1 being the 1 layer of blotting paper under the test specimen and Δ2 being the average value of the 4-layered blotting paper stack on top of the test specimen (7.3)

The rewet in % (percent) is determined as follows:

$$\%\, rewet = \frac{m}{total\ amount\ of\ added\ fluid} \times 100$$

8.3 Wicking Speed

The final result is the wicking speed v [ml/s] calculated as follows:

$$v = \frac{3\ \mathrm{ml}}{t}$$

with 't' being the average value of the elapsed time in seconds

9. BIBLIOGRAPHY

- ISO 139, Textiles — Standard atmospheres for conditioning and testing
- AATCC 150-2018 — Dimensional Changes of Garments after Home Laundering
- ISO 6330:2012 -Textiles — Domestic washing and drying procedures for textile testing.
- Test method No. 12/2015 MDS-Hi (German Healthcare Medical Service)

ANNEX A: INFORMATIVE

Test Protocol Part 2 - Additional Garment Form Testing

This part of the standard specifies the functional properties other than described in part 1. This Includes:

- Water Vapor Resistance Ret (Breathability) of the undergarment
- Microbiological Testing
- Odor testing-GC and Sensory evaluation
- Dimensional stability after repeated home laundering
- Appearance after repeated home laundering
- Biological evaluation of garments -Cytotoxicity, Skin irritation, and Skin Sensitization
- Drying rate and time of undergarments
- Sensations of skin touch material of the reusable absorbent undergarment.
- pH-value of the undergarment crotch.

FemTech at MAS

ABOUT US

FemTech at MAS is a pioneer in innovative apparel solutions addressing female health. Our purpose is to bring normalcy to women's lives from menarche to menopause, and everything in between, supporting them through the ups & downs of womanhood. The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our processes.

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