ASSOCIATION OF HOME APPLIANCE MANUFACTURERS

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AHAM.ORG

May 31, 2024

Via E-Mail

Ms. Ashley Armstrong
U.S. Department of Energy
Building Technologies Office
Mailstop EE-5B
1000 Independence Avenue, SW
Washington, DC 20585-0121

Dear Ms. Armstrong:

On behalf of the Association of Home Appliance Manufacturers (AHAM), I am writing to respectfully and urgently request that the Department of Energy (DOE) allow the use of the American Association of Textile Chemists and Colorists (AATCC) Dummy III cloth material to be used in addition to the existing momie cloth material for the applicable energy tests for commercial and residential clothes washers and residential clothes dryers per 10 CFR Subpart B, Appendices D1, D2, J, J2 and J3. AHAM and its fellow collaborators in the Energy Test Cloth Task Force (Task Force) have reviewed AHAM member and Guidehouse test data for clothes washers and clothes dryers comparing test results using the traditional momie test cloth and AATCC cloth material used in energy testing. Based on those results, we believe that the AATCC test cloth will produce similar results with similarly low variation. Allowing this extra option for test cloth will alleviate significant supply issues limiting manufacturer (and perhaps DOE) energy testing capability for clothes washers and clothes dryers. This relief is needed quickly and, thus, if DOE deems it appropriate, we request a short-term solution while DOE conducts any necessary rulemaking to make this change more permanent. AHAM is pleased to present the Department with this recommendation and request.

Background

As you may recall, AHAM informed DOE on March 3, 2022 that there were significant issues with the quality and availability of the required test cloth material for the applicable energy tests for commercial and residential clothes washers and consumer clothes dryers.[1] Appendices D1, D2 and J3 specify the test cloth material, preconditioning and evaluation testing requirements. The availability and uniformity of the test cloth material is critical in ensuring consistent and reliable test results for clothes washers and clothes dryers. AHAM's initial investigations revealed serious issues with variation in Lot 24, the current lot of test cloth material at that time, that had an impact on certification, verification, and regulatory testing efforts. We discovered

[1] *See* AHAM letter to Ms. Ashley Armstrong, March 3, 2022.

that Lot 24 had unknown "sublots" due to the textile finishing process. These sublots were creating variation that was not being measured and accounted for in the Appendix J3 correction factor process. The Task Force began investigating within- and between- sublot variation and asked WFK, the primary finished goods supplier of the momie cloth, to help map its textile supplier's process so that the Task Force could more accurately create correction factors for the sublots. Although we did not receive a detailed process map, the Task Force was successful in creating the correction factors and enabling the use of the remainder of the Lot 24 cloth as sublots 24A, 24B and 24D. In addition to concerns regarding variation in Lot 24, we are very concerned manufacturers will not have sufficient test cloth in the relatively near-term. AHAM members have reported that supply of test cloth is limited and, because many have little or no test cloth with allowable runs left, many members have had to pause or reduce their testing. Our understanding is that this supply shortage could also eventually impact DOE's ability to do assessment, enforcement, or other testing. AHAM shared these concerns with DOE, requested that DOE use its enforcement discretion to allow longer use of test cloth, and notified the Department of our intent to address both the short-term and long-term implications via a dedicated Task Force.

The Department responded quickly to mitigate the immediate impact of these challenges by issuing the following enforcement discretion on September 28, 2023:

> In an exercise of enforcement discretion, the U.S. Department of Energy (DOE) will not impose civil penalties on a clothes washer or commercial clothes washer manufacturer for certifying compliance with DOE's energy conservation standards based on testing that exceeds the maximum test cloth run provision set forth in the DOE test procedure washers and commercial clothes washers...Likewise, DOE will not impose civil penalties on a clothes dryer manufacturer for certifying compliance with DOE's energy conservation standards based on testing that exceeds the maximum test cloth run provision set forth in the DOE test procedure...Instead, clothes washer and commercial clothes washer manufacturers may use a single test cloth for up to 120 test runs, and clothes dryer manufacturers may use a single test cloth for up to 50 test runs. DOE also may use test cloths in the same manner for assessment and enforcement tests.[2]

The Department and Guidehouse have also been active collaborators in AHAM's efforts to begin the development and approval of the next lots of test cloth, Lot 25A and 25B. DOE and Guidehouse were integral to resolving the test cloth issues we reported in a timely manner for the short-term, and we appreciate DOE's swift action.

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[2] DOE, Enforcement Policy Statement Test Cloths for Clothes Washers and Clothes Dryers, Sept. 28, 2023, *available at* https://www.energy.gov/sites/default/files/202309/Test%20Cloth%20Policy%20for%20Clothes%20Washers%20and%20Clothes%20Dryers%20Enforcement%20Policy.pdf

Next Steps

Recognizing that a long-term solution is needed as well, AHAM's Task Force kept working. Upon receiving the first samples of Lot 25A, it was evident that the cloth was made of a different weave, which required additional evaluation and testing. Concurrently, AHAM and its members were evaluating an alternative test cloth material (AATCC Dummy III) that has been used by the AATCC for over eighty years. The key difference in this dummy fabric material, is that it is an "open weave" instead of the "granite weave." On August 7, 2023, AHAM informed the Department of its intent to evaluate AATCC Cloth material as a potential optional alternative energy test cloth to the existing momie cloth.[3]

AHAM members and Guidehouse labs spent months conducting comparison washer and dryer energy testing on the AATCC cloth material which we had cut and hemmed in the momie cloth dimensions. The results of that testing show that the variation observed is similar to the lot-to-lot variation that has been historically seen with the traditional momie cloth. The lot-to-lot 3 RMC percentage point allowance found in 429.134(c)(1)(ii)(F) was added to account for variation for which the cloth lot correction factor could not account. Combined data from AHAM members and Guidehouse is included in Appendix A and summarized below:

	Clothes Washers			Clothes Dryers		
	IMEF	IWF	RMC %	FMC %	CEF	Cycle Time
AATCC	2.48	3.42	35%	1%	4.36	68
Momie	2.54	3.40	34%	1%	4.39	68
Standard Deviation	0.036	0.012	0.278%	0.068%	0.0181	0.3174

Lot 25A is already depleted, and AHAM is very close to completing J3 testing of Lot 25B. AHAM and its members expect high demand for Lot 25B as well. Momie cloth Lot 26 from WFK should be produced in the next month and we should expect at least six to nine months lead time to allow for manufacturing and approval testing. Thus, test cloth supply with the momie cloth alone continues to be a significant concern, especially as manufacturers begin activities to develop products to comply with amended energy conservation standards for laundry products.

AATCC cloth Lot 3345 material from Testfabrics, Inc is currently in storage, ready to be cut and sewn into DOE energy cloth should DOE approve this request. Not only is this material readily available, but it is also a viable option based on our testing. A proposed correction factor testing per J3, A=0.7367 and B=0.0589, has been completed for this lot and together with this request regarding approving AATCC test cloth as an alternative, we are submitting to the DOE, as

[3] *See* AHAM letter to Ms. Ashley Armstrong, August 7, 2023.

Appendix B, the necessary data to approve this proposed correction factor and include it on the Clothes Washer Test Cloth Correction Factor Information website and CCMS submittal form. Test results using Lot 3345 show that it produces repeatable, reproducible test results when used for testing per Appendices D1, D2, J, J2 and J3. Lot 3345 was made with a different AATCC cloth material than what has been traditionally called "momie cloth." Lot 3345 also has a P value of 0.072 and is less than the limit of 0.1 in section 8.8 of J3. The reduced P value appears to occur due to a difference in performance of this cloth at the lowest spin speed of 100 g-force. Allowing for this deviation in P value is a conservative approach as Lot 3345 retains more moisture at lower spin speeds than Lot 3 that the correction factors are based on. (See the Interaction Plot tab on the J3 test report). We, therefore, request that DOE accept Lot 3345 with a P value less than 0.1. We suspect this will consistently be the case when comparing the new AATCC cloth material back to the momie cloth Lot 3.

A summary of the material properties tests conducted per Appendix J3 Sections 3 and 7 is also attached as Appendix C. These are material properties that are defined and required by Appendices D1, D2, and J3 that must be satisfied, to allow for accurate energy performance measurement testing when conducting water extraction measurement testing.

Request

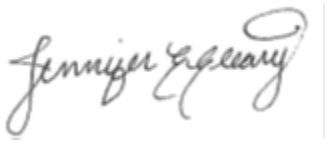
Based on the results of this data, AHAM is confident that AATCC cloth material is an adequate alternative to existing momie cloth material for both clothes washer and clothes dryer energy testing. Therefore, we request that DOE:

1. Expressly permit the use of AATCC Laundering Ballast Type 3 (aka AATCC Dummy Type 3) material cut and hemmed to momie cloth dimensions for clothes washer and clothes dryer energy testing in addition to the existing momie cloth. In other words, either test cloth material should be permissible in the testing of clothes washers and clothes dryers under the applicable test procedures. Importantly, our request is limited to the 16/1 greige/grey fabric yarn version of the AATCC Laundering Ballast Type 3 material, which is a single-string yarn; it does not include the 30/2, which is a two-string version of yarn and is half the diameter of the single-string version.
2. Permit the preconditioning procedure to be the same for clothes washers and clothes dryers.
3. Clarify that Fabric Weight and Thread Count are measured on "finished goods cloth prior to preconditioning".
4. Define cut orientation of the larger test cloth in relation to the fabric roll.
5. Align the spelling of "preconditioning" versus "pre-conditioning" between the clothes washer and clothes dryer appendices.
6. Continue to allow WFK supplied momie cloth lots to be used to twice the number of cycles per the enforcement discretion from September 28, 2023 mentioned above while supply issues persist but do not allow twice the number of cycles on the AATCC cloth material as we do not have any test data to support this extended number of cycles at this time.

We have included in Appendix D a sample redline of specific adjustments as an example to aid the Department in this effort. Together, we hope that these measures will alleviate the immediate need for an alternative option and avoid future test cloth supply challenges.

Thank you for your ongoing collaboration to overcome the shortage in essential inputs to preserve the consistency and rigor of this important energy-saving program. We understand that notice and comment rulemaking may be needed to make many of our requested changes to the applicable test procedures, but relief is needed more urgently so we urge DOE to permit the AATCC tests cloth as an option for testing immediately to allow short-term relief. As this is of critical importance, AHAM would be glad to discuss these matters in more detail should you so request.

Thank you,



Jennifer Cleary
Vice President, Regulatory Affairs
Association of Home Appliance Manufacturers

cc: Lucas Adin, DOE
Troy Watson, DOE
Delphine Kaiser, Guidehouse
Timothy Sutherland, Guidehouse

About AHAM: AHAM represents more than 150 member companies that manufacture 90% of the major, portable and floor care appliances shipped for sale in the U.S. Home appliances are the heart of the home, and AHAM members provide safe, innovative, sustainable and efficient products that enhance consumers' lives. The home appliance industry is a significant segment of the economy, measured by the contributions of home appliance manufacturers, wholesalers, and retailers to the U.S. economy. In all, the industry drives nearly $200 billion in economic output throughout the U.S. and manufactures products with a factory shipment value of more than $50 billion.

Appendix A

IMEF

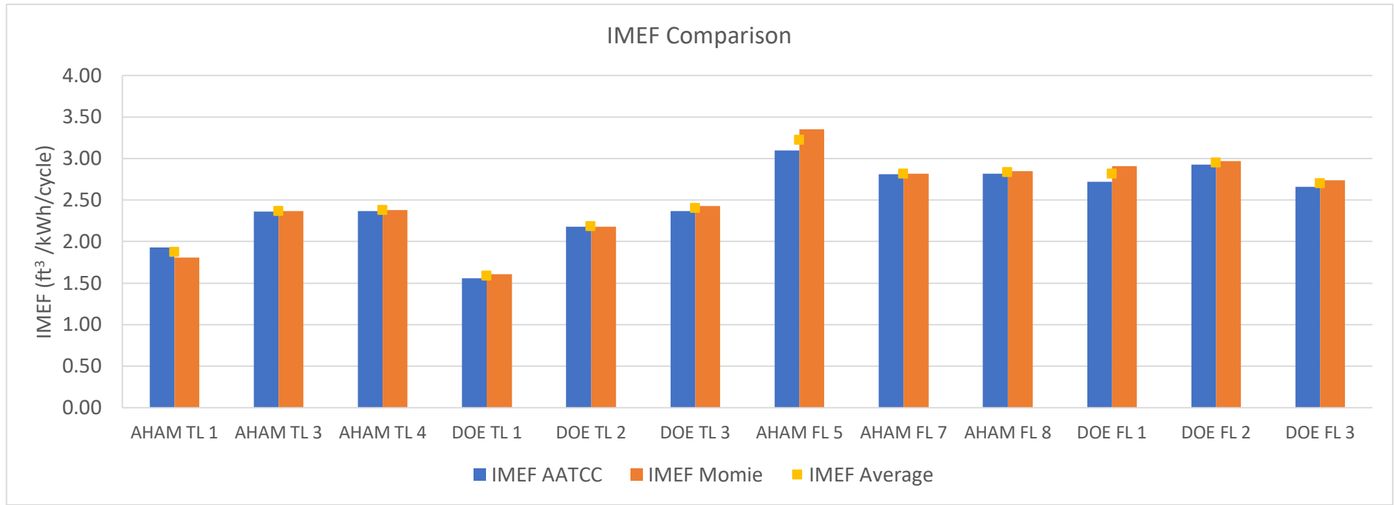
Model	AATCC	Momie	Average	Standard Dev
AHAM TL 1	1.93	1.81	1.87	0.085
AHAM TL 3	2.36	2.37	2.37	0.007
AHAM TL 4	2.37	2.38	2.38	0.007
DOE TL 1	1.56	1.61	1.59	0.035
DOE TL 2	2.18	2.18	2.18	0.000
DOE TL 3	2.37	2.43	2.40	0.042
AHAM FL 5	3.10	3.35	3.23	0.177
AHAM FL 7	2.81	2.82	2.82	0.007
AHAM FL 8	2.82	2.85	2.84	0.021
DOE FL 1	2.72	2.91	2.82	0.134
DOE FL 2	2.93	2.97	2.95	0.028
DOE FL 3	2.66	2.74	2.70	0.057
	2.484	2.535		0.036

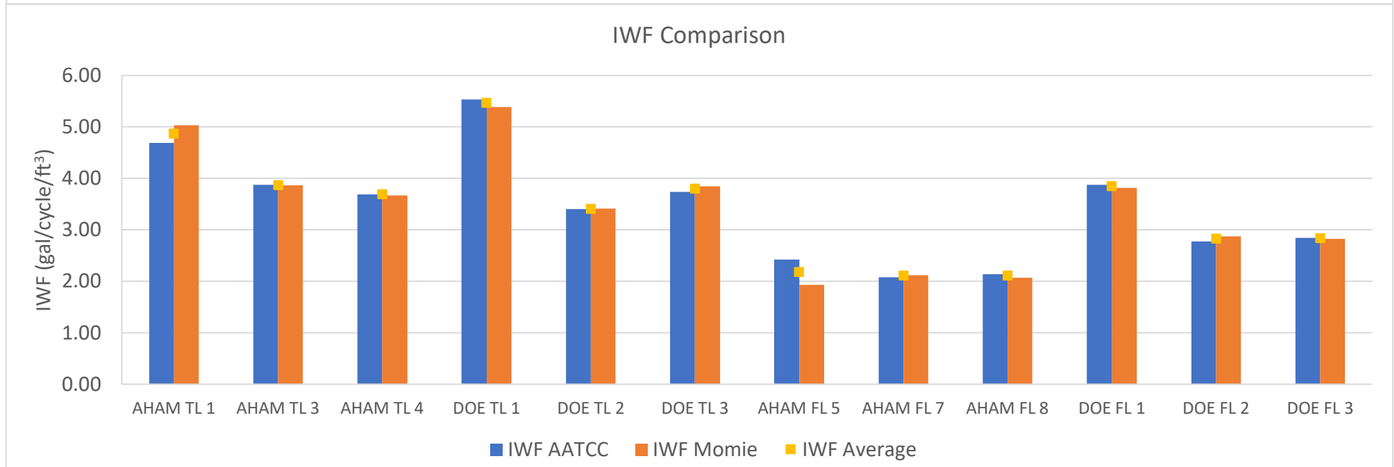
IWF

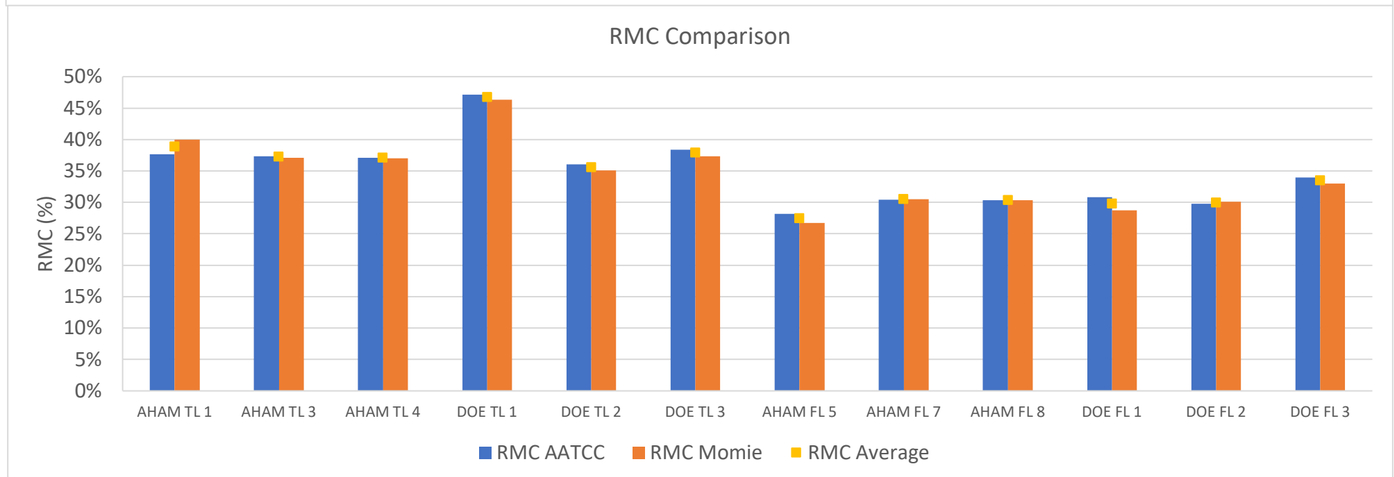
Model	AATCC	Momie	Average	Standard Dev
AHAM TL 1	4.69	5.03	4.86	0.240
AHAM TL 3	3.87	3.86	3.87	0.007
AHAM TL 4	3.69	3.67	3.68	0.014
DOE TL 1	5.53	5.39	5.46	0.099
DOE TL 2	3.40	3.41	3.41	0.007
DOE TL 3	3.74	3.85	3.80	0.078
AHAM FL 5	2.42	1.93	2.18	0.346
AHAM FL 7	2.08	2.12	2.10	0.028
AHAM FL 8	2.14	2.07	2.11	0.049
DOE FL 1	3.87	3.82	3.85	0.035
DOE FL 2	2.78	2.87	2.83	0.064
DOE FL 3	2.84	2.82	2.83	0.014
	3.421	3.403		0.012

RMC

Model	AATCC	Momie	Average	Standard Dev
AHAM TL 1	37.6%	40.0%	38.8%	1.655%
AHAM TL 3	37.3%	37.1%	37.2%	0.141%
AHAM TL 4	37.1%	37.0%	37.1%	0.071%
DOE TL 1	47.1%	46.4%	46.8%	0.537%
DOE TL 2	36.0%	35.1%	35.6%	0.665%
DOE TL 3	38.4%	37.4%	37.9%	0.707%
AHAM FL 5	28.1%	26.7%	27.4%	1.004%
AHAM FL 7	30.4%	30.5%	30.5%	0.071%
AHAM FL 8	30.3%	30.3%	30.3%	0.000%
DOE FL 1	30.8%	28.7%	29.8%	1.499%
DOE FL 2	29.8%	30.1%	30.0%	0.212%
DOE FL 3	34.0%	33.0%	33.5%	0.651%
	34.7%	34.4%		0.278%







FMC

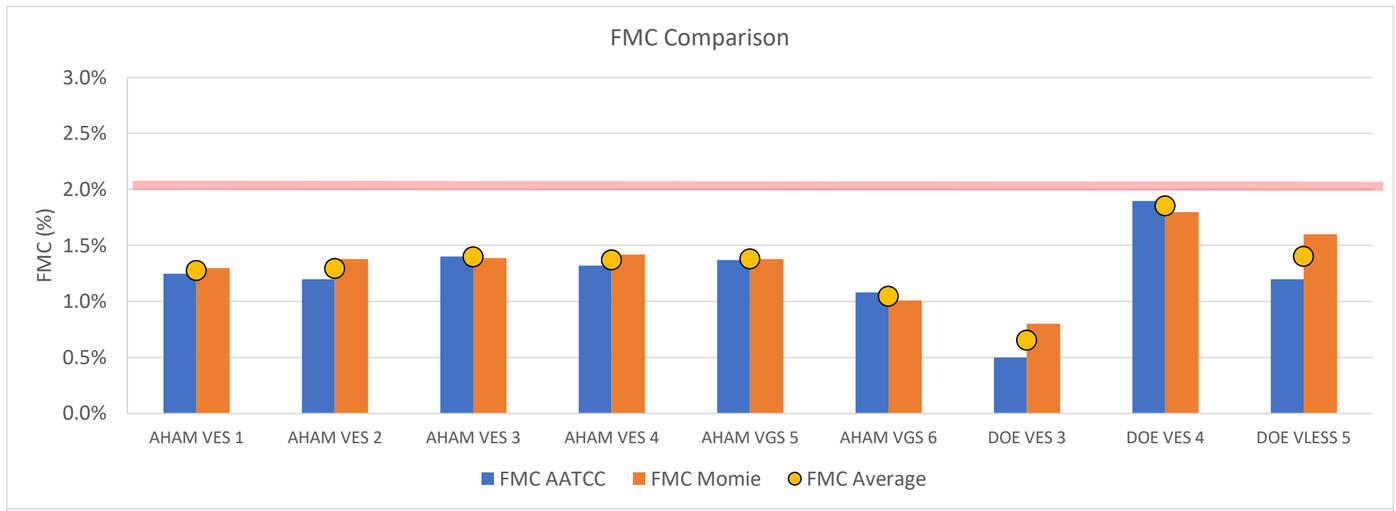
Model	AATCC	Momie	Average	Standard Dev
AHAM VES 1	1.3%	1.3%	1.3%	0.035%
AHAM VES 2	1.2%	1.4%	1.3%	0.127%
AHAM VES 3	1.4%	1.4%	1.4%	0.007%
AHAM VES 4	1.3%	1.4%	1.4%	0.071%
AHAM VGS 5	1.4%	1.4%	1.4%	0.007%
AHAM VGS 6	1.1%	1.0%	1.0%	0.049%
DOE VES 3	0.5%	0.8%	0.7%	0.212%
DOE VES 4	1.9%	1.8%	1.9%	0.071%
DOE VLESS 5	1.2%	1.6%	1.4%	0.283%
	1.2%	1.3%		0.068%

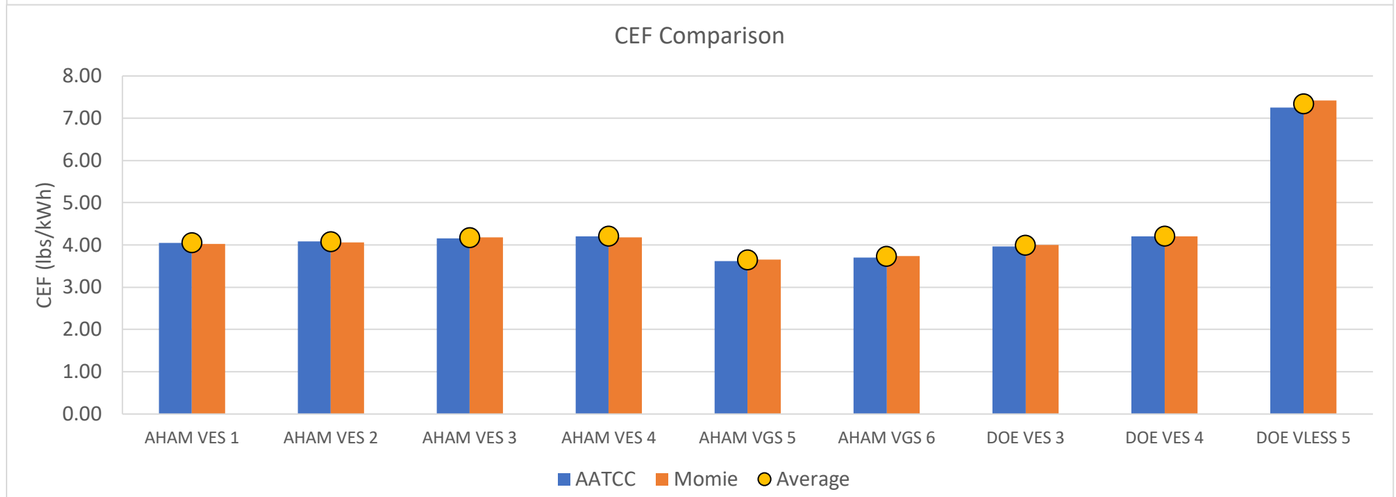
CEF

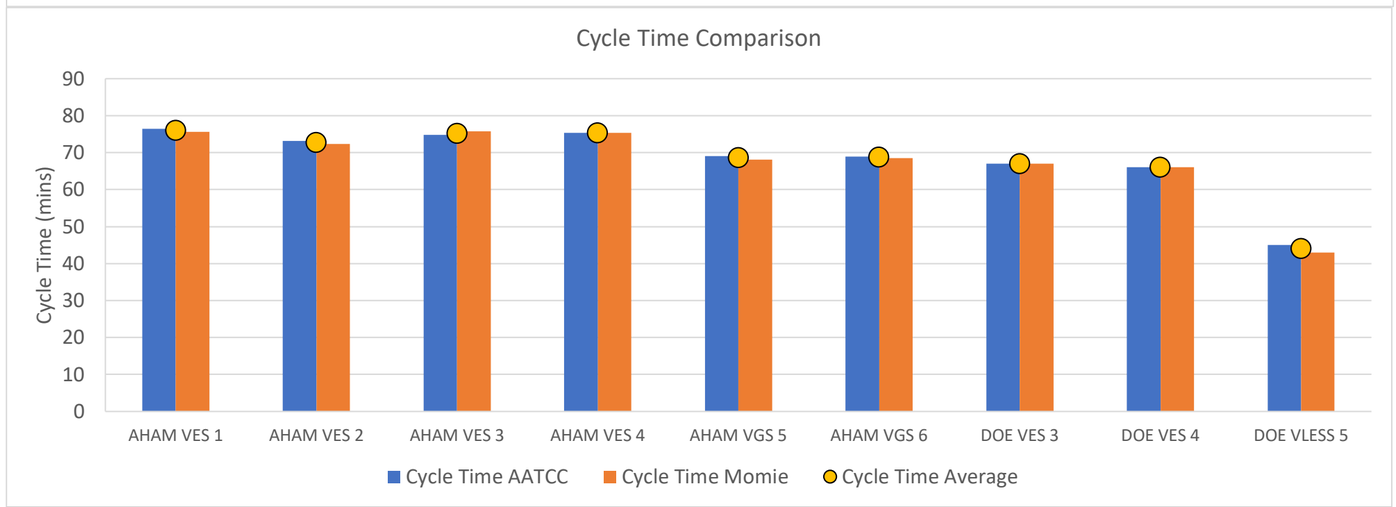
Model	AATCC	Momie	Average	Standard Dev
AHAM VES 1	4.05	4.03	4.04	0.0141
AHAM VES 2	4.08	4.06	4.07	0.0141
AHAM VES 3	4.16	4.18	4.17	0.0141
AHAM VES 4	4.21	4.18	4.20	0.0212
AHAM VGS 5	3.62	3.66	3.64	0.0283
AHAM VGS 6	3.70	3.74	3.72	0.0283
DOE VES 3	3.96	4.00	3.98	0.0283
DOE VES 4	4.21	4.20	4.21	0.0071
DOE VLESS 5	7.25	7.42	7.34	0.1202
	4.36	4.39		0.0181

Cycle Time

Model	AATCC	Momie	Average	Standard Dev
AHAM VES 1	76	76	76	0.5020
AHAM VES 2	73	72	73	0.5869
AHAM VES 3	75	76	75	0.6718
AHAM VES 4	75	75	75	0.0354
AHAM VGS 5	69	68	69	0.7425
AHAM VGS 6	69	69	69	0.3182
DOE VES 3	67	67	67	0.0000
DOE VES 4	66	66	66	0.0000
DOE VLESS 5	45	43	44	1.4142
	68.41	67.96		0.3174







	Clothes Washers			Clothes Dryers		
	IMEF	**IWF**	**RMC %**	**FMC %**	**CEF**	**Cycle Time**
AATCC	2.48	3.42	35%	1%	4.36	68
Momie	2.54	3.40	34%	1%	4.39	68
Standard Deviation	0.036	0.012	0.278%	0.068%	0.0181	0.3174

Appendix B -
attached as separate file

Appendix C

Summary of Evaluating the TESTFABRICS - DOE ENERGY CLOTHS
University of Kentucky Textile Testing Lab

Company:	AHAM DOE ENERGY TEST CLOTHS
Contact Person:	Travis Perkins
Product:	LOT 3345 – Rolls #1-37; Rolls #38-76 & Rolls #77-100
Date Received:	10/9/2023
Report Date:	11/20/2023
Technicians:	Sarah B, Sydney B, Dr. Easter

Sample Description

LOT #3345 – Eighteen unconditioned samples representing Rolls 1-100
LOT #3345 – Eighteen conditioned samples representing Rolls 1-100

Tests Performed:

AATCC TM 20-2013(2018)E & 20A-2020: *Qualitative & Quantitative Fiber Analysis*
ASTM D 3776/D3776M-20: *Standard Test Method for Mass per Unit Area (Weight) of Fabric and Mass per Unit Weight of Sample Cloth*
ASTM D 3775-17: *Standard Test Method for Fabric Count of Woven Fabrics*
ASTM D 1059-17: *Standard Method for Yarn Number Based on Short-Length Specimens*
AATCC TM135-2018t: *Dimensional Changes of Fabrics after Home Laundering*
AATCC TM118-2020: *Oil Repellency: Hydrocarbon Resistance Test*
AATCC TM79-2010e2(2018)e: *Absorbency of Textiles*
AATCC TM110-2015: *Whiteness of Textiles*

Procedures:

AATCC Test Method 20-2013(2018)e & 20A-2020: Qualitative & Quantitative Fiber Analysis:
To determine the fiber content of the energy stuffer cloths, a qualitative & quantitative fiber analysis, as outlined in AATCC Test Method 20 & 20A was conducted. Specimens were removed from four DOE cloths, approximately 1" x 1", and were cut and weighed separately. The specimens were placed in a 70% sulfuric acid solution at 38° Celsius for 20 minutes to dissolve any cotton in the fabric. The specimens were then rinsed, dried, and conditioned before being weighed again. The remaining portion of each specimen was then placed in 100% m-cresol solution at 139° Celsius for 5 minutes to dissolve any polyester present in the fabric. Any remaining specimens would then be thoroughly rinsed and dried before weighing.

ASTM D 3776/D3776M-20: Standard Test Method for Mass per Unit Area (Weight) of Fabric
This test method measures the mass per unit area (traditionally called "fabric weight". Option C-Small Swatch of Fabric was used as three 5.94in² circles were cut from four DOE energy cloths (A-I groups) using the Universal Sample Cutter. Each specimen was conditioned for twenty-four hours and weighed in grams to the nearest hundredth place. The weight was converted in oz/yard^{2,} and an average and standard deviation were calculated for each cloth.

ASTM D 3775-17: Standard Test Method for End (Warp) and Pick (Filling) Fabric Count of Woven Fabrics

This test method measures the end (warp) and picks (filling) count of woven fabrics. The fabric count of the DOE energy cloths was determined by evaluating three 1" x 1" sections from four energy stuffer cloths. Each specimen's warp yarns, and fill yarns were counted, and the totals for each specimen were averaged together to compute the overall average fabric count.

ASTM D 1059-17: Standard Test Method for Yarn Number Based on Short-Length Specimens

This test method determines the yarn number of yarns taken … from textile fabrics in which the yarns are intact and can be removed in measurable lengths. Ten warp yarns and ten filling yarns were removed from four samples of DOE energy cloths. Yarns were conditioned in a controlled environment as defined in ASTM D 1776. Each yarn was trimmed to 10" in length, and then ten yarns from each grouping (warp and filling) were weighed and recorded in grams. The yarns were examined to determine the yarn ply of each yarn. The indirect method calculation was used to calculate the yarn number using the following formula: [454(1+C)/(G*L)] Y*P.

AATCC TM118-2020: Oil Repellency: Hydrocarbon Resistance

This test detects the presence of a fluorochemical finish or other chemicals capable of imparting a low-energy surface on all types of fabrics by evaluating the fabric's resistance to wetting using a selected series of liquid hydrocarbons featuring different surface tensions. The cloths were placed flat on a smooth, horizontal surface. Beginning with the lowest number of test liquid (oil), five 5mm in diameter drops were gently placed horizontally across the test fabric using an eyedropper. After 30 seconds, the drops were observed for penetration or wetting of the fabric. The test locations were then evaluated using the AATCC alphabetical rating system.

AATCC TM79-2010e2(2018)e: Absorbency of Textiles

Absorbency is the propensity of a material to take in and retain a liquid, usually water. The original test method for measuring the absorbency of bleached textiles was developed to help textile dyeing and finishing mills determine the effect and efficiency of textile preparation and processing applications. Each DOE energy cloth was placed in an embroidery hoop, with the right side of the sample placed upward. The surface of the sample was kept taut and free of wrinkles without stretching or distorting the structure of the fabric. The embroidery hoop was placed with the sample surface 0.394 +/- 0.04 in. below the tip of a medicine dropper. One drop of deionized water is dropped on the cloth. A stopwatch is started immediately and then stopped once the drop of water has lost reflectivity. The time is recorded to the nearest second. This process was repeated four more times on each cloth (for a total of five drops per cloth).

AATCC Test Method 110-2015e2: Whiteness of Textiles

An objective evaluation was completed using a HunterLab LabScan Xe. Each cloth was folded to obtain four layers of fabric. The cloth was placed on the port and whiteness was read in the CIELab scale, with the UV filter inserted, CIELAB 10 degree/D65, an area view of 1.75", and a port size of 2". The cloth was rotated 90 degrees, and the whiteness reading was repeated. The instrument averages the two readings, and the results are recorded in the AATCC TM 110: Whiteness of Textiles spreadsheet. CIELab is a three-dimensional color space that describes a color using three coordinates. One dimension, L*, depicts the color's lightness on a scale from 0 to 100. A value of 0 indicates black; 100 indicates white. The a* dimension describes a color's location on a red-green continuum. A positive value is indicative of red, negative is indicative of green. The b* dimension describes a color's location on a blue-yellow continuum. A positive value signifies yellow, while negative signifies blue.

Subjective Evaluation of Optical Brighteners

Each cloth was viewed under a Gretag Macbeth light booth using an ultraviolet light source (fluorescent lamp). Fluorescent whitening agents (also called optical brighteners) absorb ultraviolet

light (which is not visible to the human eye) and remit the light in the blue visible light region. The effect results in an improvement of whiteness. During this evaluation, it was apparent that the thread used to hem the cloths and the attached label have been optically brightened with fluorescent whitening agents. The DOE energy cloths do not contain fluorescent whitening agents.

AATCC Test Method 135-2018t: Dimensional Changes of Fabrics after Home Laundering (Modified for preconditioning procedures.)

This test method determines the dimensional changes of fabrics when subjected to home laundering procedures. Note: the test method was modified according to the AHAM precondition of DOE energy cloths. UL's Lab: The DOE energy cloths were preconditioned at the UL labs. Five samples were measured in each direction. Three measurements were taken in the lengthwise and widthwise directions. The lengthwise and widthwise measurements were recorded, averaged, and SD calculated. The dimensional change was calculated by comparing the lengthwise and widthwise measurements of the preconditioned cloths to those of the new cloths.

Summary of Evaluating the TESTFABRICS - DOE ENERGY CLOTHS

Parameter	Current Targets / Tolerances	Results
Yarn Composition	cotton/polyester 50/50 c/p in warp and weft each 50% ± 4%	50.4 ± 0.9 percent cotton 49.1 ± 0.9 percent polyester
Mass per unit area (weight)	5.60 ± 0.25 oz/yd² 190 ± 8.4 g/m²	4.55 oz/yd² ± 0.02 153.4 ±1.1 g/m²
Weave	Momie	Plain Weave
Thread Count	Warp 65 / inch ± 2% Fill 57 / inch ± 2%	Preconditioned: 58 Warp ± 1.0 48 Filling ±1.0 Conditioned: 61 Warp ± 1.0, 51 Filling ± 1.0
Yarn Number	Warp 15/1 cotton count ±5% 35.5 tex Nm 28/1), ± 5% Fill 15/1 cotton count ± 5% 35.5 tex Nm 28/1), ± 5%	Warp = 15.4/1 ± 0.15 Fill = 15.7/1 ± 0.03
Finish	AATCC–118 Oil Repellency Test: D scores only AATCC–79 Absorbency Test: Wetting time ≤ 1 sec.	AATCC:118 Oil Repellency Score = 0 Score AATCC:79 Absorbency Score (Wetting time) = < 0.5 sec.
Color	White – no specification Optical Brighteners – not allowed. UV cloths do not contain optical brighteners (thread & labels do contain optical brighteners).	Cloths did not contain optical brighteners. Whiteness Index – 77.49 ± 1.9
Dimensional Change after Preconditioning	Lengthwise – no specification Widthwise – no specification	Lengthwise: -3.0 ± 0.11% shrinkage Widthwise: -7.2 ± 0.04 shrinkage
Weight loss after Preconditioning	No specification – Large cloth weight before precondition – 88.37 ±0.3 grams	Large cloth weight after preconditioning – 86.96 ±0.15 grams for a weight loss of 1.5 percent.

Appendix D

Rev E 9/25/23

Executive Summary of Intent.

- Allow the use of AATCC Laundering Ballast Type 3 (aka AATCC Dummy Type 3) material cut and hemmed to momie cloth dimensions for washer and dryer energy testing in addition to the existing momie cloth.
    - Restricted to the 16/1 greige/grey fabric yarn version of the AATCC Laundering Ballast Type 3 material.
- Align the cloth spec and preconditioning procedure to be the same for washers and dryers.
- Clarify that Fabric Weight and Thread Count are measured on "finished goods cloth prior to preconditioning".
- Define cut orientation of the larger test cloth in relation to the fabric roll.
- Align the spelling of "preconditioning" versus "pre-conditioning" between the washer and dryer appendices.

Appendix D1 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Clothes Dryers

(Use the same edits as noted below for D2)

Appendix D2 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Clothes Dryers

2.6 *Test Cloths.*

2.6.1 *Energy test cloth and energy stuffer cloth*~~. The energy test cloth~~ shall be clean and consist of the following:

(a) Must meet all applicable provisions ~~the specification in sections 3 through 3.7.2~~ of appendix J3 to this subpart. ~~Pure finished bleached cloth, made with a momie or granite weave, which is a blended fabric of 50 percent cotton and 50 percent polyester and weighs within + 10 percent of 5.75 ounces per square yard after test cloth preconditioning, and has 65 ends on the warp and 57 picks on the fill. The individual warp and fill yarns are a blend of 50 percent cotton and 50 percent polyester fibers.~~

~~(b) Cloth material that is 24 inches by 36 inches and has been hemmed to 22 inches by 34 inches before washing. The maximum shrinkage after five washes shall not be more than 4 percent on the length and width.~~

(e b) The number of test runs on the same energy test cloth and energy stuffer cloth shall not exceed 25 runs (after preconditioning as specified in appendix J3 to this subpart). All test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material must not be used for testing a clothes dryer.

2.6.2 *Energy stuffer cloths.* The energy stuffer cloths shall be made from energy test cloth material, and shall consist of pieces of material that are 12 inches by 12 inches and have been hemmed to 10 inches by 10 inches before washing. The maximum shrinkage after five washes shall not be more than 4 percent on the length and width. The number of test runs on the same energy stuffer cloth shall not exceed 25 runs after test cloth preconditioning.

2.6.32 *Test Cloth Preconditioning.*

A new test cloth load and energy stuffer cloths shall be treated as follows: preconditioned per appendix J3 to this subpart.

(1) Bone dry the load to a weight change of ±1 percent, or less, as prescribed in section 1.5.

(2) Place the test cloth load in a standard clothes washer set at the maximum water fill level. Wash the load for 10 minutes in soft water (17 parts per million hardness or less), using 60.8 grams of AHAM standard test detergent Formula 3. Wash water temperature is to be controlled at 140 ° ±5 °F (60 ° ±2.7 °C). Rinse water temperature is to be controlled at 100 ° ±5 °F (37.7 ±2.7 °C).

(3) Rinse the load again at the same water temperature.

(4) Bone dry the load as prescribed in section 1.5 and weigh the load.

(5) This procedure is repeated until there is a weight change of 1 percent or less.

(6) A final cycle is to be a hot water wash with no detergent, followed by two warm water rinses.

2.6.3 Test Cloth Material Verification Procedure.

The energy test cloth and energy stuffer cloth must meet the specification in sections 5.1 of appendix J3 to this subpart.

2.7 *Test loads.*

2.7.1 *Load size.* Determine the load size for the unit under test, according to Table 1 of this section.

Table 1—Test Loads

Unit under test	Test load (bone dry weight)
Standard size clothes dryer	8.45 pounds ± .085 pounds.
Compact size clothes dryer	3.00 pounds ± .03 pounds.

Each test load must consist of energy test cloths and no more than five energy stuffer cloths.

2.7.2 *Test load preparation.* Dampen the load by agitating it in water whose temperature is 60 °F ± 5 °F and consists of 0 to 17 parts per million hardness for approximately 2 minutes in order to saturate the fabric. Then, extract water from the wet test load by spinning the load to a target moisture content between 54.0–61.0 percent of the bone-dry weight of the test load. If after extraction the moisture content is less than 54.0 percent, make a final mass adjustment, such that the moisture content is between 54.0–61.0 percent of the bone-dry weight of the test load, by adding water uniformly distributed among all of the test cloths in a very fine spray using a spray bottle.

2.7.3 *Method of loading.* Load the energy test cloths by grasping them in the center, shaking them to hang loosely, and then dropping them in the dryer at random.

Appendix J to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers

2.7 ***Test cloths.*** The test cloth material and dimensions must conform to the specifications in appendix J3 to this subpart. The energy test cloth and the energy stuffer cloths must be clean and must not be used for more than 60 test runs (after preconditioning as specified in section 5 of appendix J3 to this subpart). All energy test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material must not be used for testing a clothes washer. The moisture absorption and retention must be evaluated for each new lot of test cloth using the standard extractor Remaining Moisture Content (RMC) procedure specified in appendix J3 to this subpart.

2.8 ***Test Loads.***

2.8.1 ***Test load sizes.*** Create small and large test loads as defined in Table 5.1 of this appendix based on the clothes container capacity as measured in section 3.1 of this appendix. Record the bone-dry weight for each test load.

2.8.2 ***Test load composition.*** Test loads must consist primarily of energy test cloths and no more than five energy stuffer cloths per load to achieve the proper weight.

2.11 ***Clothes washer ~~pre-conditioning~~ preconditioning.*** If the clothes washer has not been filled with water in the preceding 96 hours, or if it has not been in the test room at the specified ambient conditions for 8 hours, ~~pre-condition~~ precondition it by running it through a cold rinse cycle and then draining it to ensure that the hose, pump, and sump are filled with water.

Appendix J2 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-automatic Clothes Washers

2.7 ***Test cloths.*** The test cloth material and dimensions must conform to the specifications in appendix J3 to this subpart. The energy test cloth and the energy stuffer cloths must be clean and must not be used for more than 60 test runs (after preconditioning as specified in section 5 of appendix J3 to this subpart). All energy test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material must not be used for testing a clothes washer. The moisture absorption and retention must be evaluated for each new lot of test cloth using the standard extractor Remaining Moisture Content (RMC) procedure specified in appendix J3 to this subpart.

2.8 ***Test load sizes.*** Use Table 5.1 of this appendix to determine the maximum, minimum, and, when required, average test load sizes based on the clothes container capacity as measured in section 3.1 of this appendix. Test loads must consist of energy test cloths and no more than five energy stuffer cloths per load to achieve the proper weight.

Use the test load sizes and corresponding water fill settings defined in Table 2.8 of this appendix when measuring water and energy consumption. Use only the maximum test load size when measuring RMC.

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2.11 ***Clothes washer ~~pre-conditioning~~ preconditioning.***

2.11.1 ***Non-water-heating clothes washer.*** If the clothes washer has not been filled with water in the preceding 96 hours, ~~pre-condition~~ precondition it by running it through a cold rinse cycle and then draining it to ensure that the hose, pump, and sump are filled with water.

2.11.2 ***Water-heating clothes washer.*** If the clothes washer has not been filled with water in the preceding 96 hours, or if it has not been in the test room at the specified ambient conditions for 8 hours, ~~pre-condition~~ precondition it by running it through a cold rinse cycle and then draining it to ensure that the hose, pump, and sump are filled with water.

Appendix J3 to Subpart B of Part 430—Energy Test Cloth Specifications and Procedures for Preconditioning and Determining Correction Coefficients of New Energy Test Cloth Lots

Note:

DOE maintains an historical record of the standard extractor test data and final correction curve coefficients for each approved lot of energy test cloth. These can be accessed through DOE's web page for standards and test procedures for residential clothes washers at DOE's Building Technologies Office Appliance and Equipment Standards website.

1. Objective

This appendix includes the following: (1) Specifications for the energy test cloth to be used for testing clothes washers and clothes dryers; (2) procedures for preconditioning the energy test cloth for use in testing clothes washers and clothes dryers; (3) procedures for verifying that new lots of energy test cloth meet the defined material specifications; and ~~(3)~~ (4) procedures for developing a set of correction coefficients that correlate the measured remaining moisture content (RMC) values of each new test cloth lot with a set of standard RMC values established as an historical reference point. These correction coefficients are applied to the RMC measurements performed during testing according to appendix J or appendix J2 to this subpart, ensuring that the final corrected RMC measurement for a clothes washer remains independent of the test cloth lot used for testing.

2. Definitions

AATCC means the American Association of Textile Chemists and Colorists.

AHAM means the Association of Home Appliance Manufacturers.

Bone-dry means a condition of a load of test cloth that has been dried in a dryer at maximum temperature for a minimum of 10 minutes, removed and weighed before cool down, and then dried again for 10 minute periods until the final weight change of the load is 1 percent or less.

Dummy/plain weave fabric means test cloth made with plain weave fabric as specified in this appendix. This fabric is also known as 16/1 AATCC Laundering Ballast Type 3 (aka AATCC Dummy Type 3) fabric and is specified in AATCC LP1-2021.

Granite Weave means a broad classification of weave producing a small, irregular, pebbled surface similar to crepe fabrics. Fabrics made with a granite weave are generally interlaced tightly, and warp and filling yarns appear on the face.

Lot means a quantity of cloth that has been manufactured with the same batches of cotton and polyester during one continuous process.

Momie/granite weave fabric means test cloth made with granite weave fabric as specified in this appendix.

Plain Weave means a weave that the warp and weft threads cross at right angles, aligned so they form a simple criss-cross pattern. Each weft thread crosses the warp threads by going over one, then under the next, and so on. The next weft thread goes under the warp threads that its neighbor went over, and vice versa.

Roll means a subset of a lot.

3. Energy Test Cloth Specifications

The energy test cloths and energy stuffer cloths must meet the following specifications:

3.1 The test cloth material should come from a roll of material with a width of approximately 63 inches and approximately 500 yards per roll. However, other sizes may be used if the test cloth material meets the specifications listed in sections 3.2 through 3.6 of this appendix.

3.2 ~~***Nominal f***~~ ***Fabric type.*** Pure finished bleached cloth made with a ~~momie or granite~~ momie/granite weave fabric or dummy/plain weave fabric ~~weave~~, which is ~~nominally~~ 50 percent cotton and 50 percent polyester. (±4 percent)

3.3 ***Fabric weight.*** (Measured as finished goods prior to preconditioning) Granite weave: 5.60 ± 0.25 ounces per square yard (190.0 ± 8.4 g/m2) or Plain weave: 4.57 ± 0.29 ounces per square yard (155 ± 10 g/m2).

3.4 ***Thread count.*** (Measured as finished goods prior to preconditioning) Granite weave: 65 x 57 per inch (warp × fill), ±2 percent or Plain weave: 52 x 48 per inch (warp × fill), ±5 yarns/in.

3.5 ***Fiber content of warp and filling yarn.*** (Measured as greige/grey fabric prior to finishing) 50 percent ±4 percent cotton, with the balance being polyester, Granite weave: open end spun, 15/1 ±5 percent cotton count blended yarn or Plaine weave: ring spun, 16/1±5 percent cotton count blended yarn.

3.6 Water repellent finishes, such as fluoropolymer stain resistant finishes, must not be applied to the test cloth.

3.7. ***Test cloth dimensions.***

3.7.1 ***Energy test cloth.*** The energy test cloth must be made from energy test cloth material, as specified in section 3.1 of this appendix, that is 24 ± 1⁄2 inches by 36 ± 1⁄2 inches (61.0 ± 1.3 cm by 91.4 ± 1.3 cm) and has been hemmed to 22 ± 1⁄2 inches by 34 ± 1⁄2 inches (55.9 ± 1.3 cm by 86.4 ± 1.3 cm) before washing. The 24” inch dimension to be cut from

the warp/length of the role and the 36” dimension to be cut from the weft/width of the role. Figure 3.7.1 of this appendix illustrates the cut pattern orientation to the roll material.

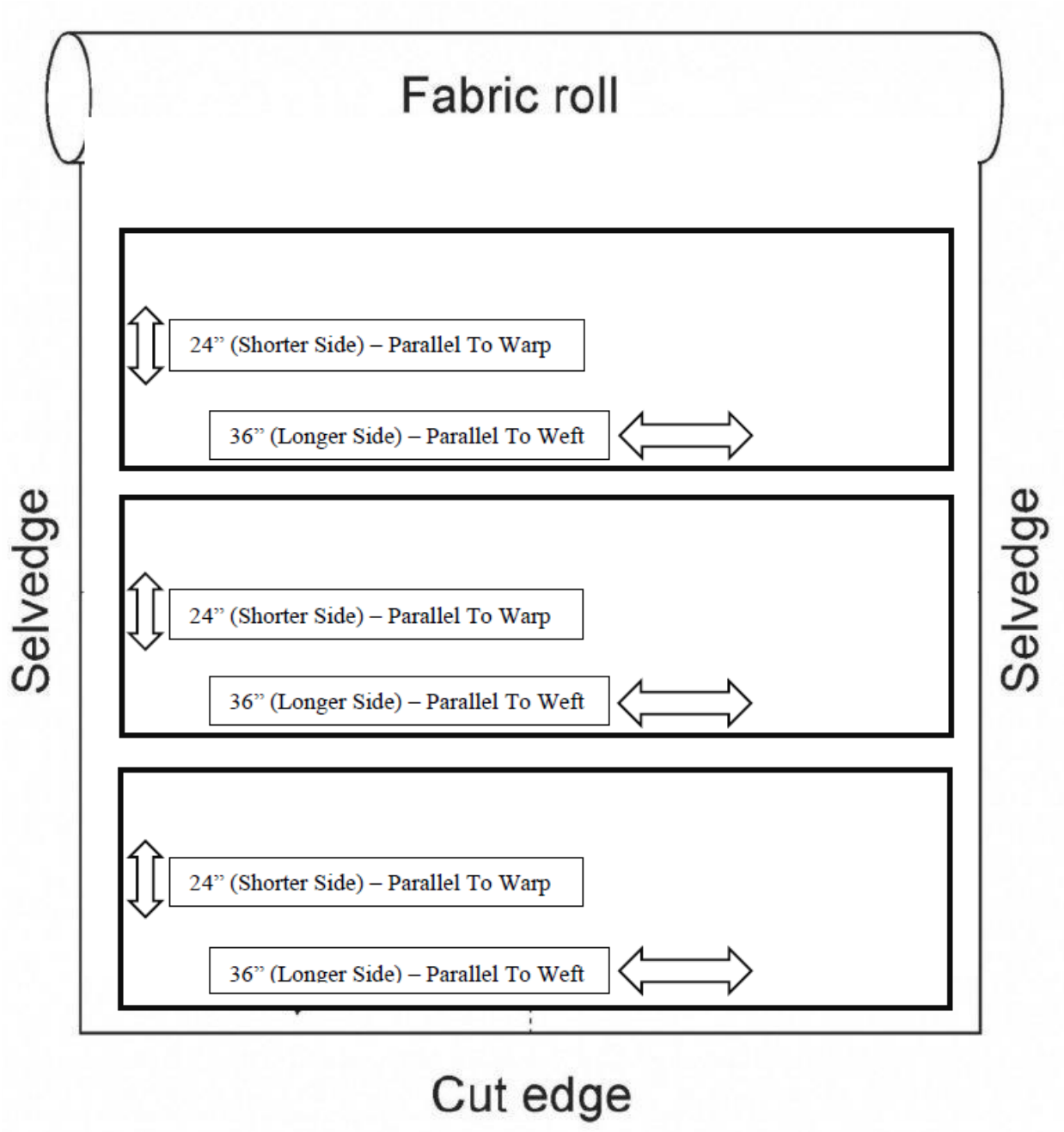

Figure 3.7.1 ----- Energy Test Cloth Cut Orientation to Roll Material

3.7.2 ***Energy stuffer cloth.*** The energy stuffer cloth must be made from energy test cloth material, as specified in section 3.1 of this appendix, that is 12 ± 1⁄4 inches by 12 ± 1⁄4 inches (30.5 ± 0.6 cm by 30.5 ± 0.6 cm) and has been hemmed to 10 ± 1⁄4 inches by 10 ± 1⁄4 inches (25.4 ± 0.6 cm by 25.4 ± 0.6 cm) before ~~washing~~ preconditioning.

3.8 The test cloth must be clean and must not be used for more than 60 test runs for clothes washers or more than 25 test runs for clothes dryers (after ~~pre-conditioning~~ preconditioning as specified in section 5 of this appendix). All test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material must not be used for testing a clothes washer according to appendix J or appendix J2 to this subpart or for testing a clothes dryer according to appendix D1 or appendix D2 to this subpart.

4. Equipment Specifications

4.1 ***Extractor.*** Use a North Star Engineered Products Inc. (formerly Bock) Model 215 extractor (having a basket diameter of 20 inches, height of 11.5 inches, and volume of 2.09 ft^3), with a variable speed drive (North Star Engineered Products, P.O. Box 5127, Toledo, OH 43611) or an equivalent extractor with same basket design (*i.e.*, diameter, height, volume, and hole configuration) and variable speed drive. Table 4.1 of this appendix shows the extractor spin speed, in revolutions per minute (RPM), that must be used to attain each required g-force level.

Table 4.1—Extractor Spin Speeds for Each Test Condition

“g Force”	**RPM**
100	594 ± 1
200	840 ± 1
350	1,111 ± 1
500	1,328 ± 1
650	1,514 ± 1

4.2 ***Bone-dryer.*** The dryer used for drying the cloth to bone-dry must heat the test cloth and energy stuffer cloths above 210 °F (99 °C).

5. Test Cloth ~~Pre-Conditioning~~ Preconditioning Instructions

Use the following instructions for performing ~~pre-conditioning~~ preconditioning of new energy test cloths and energy stuffer cloths as specified throughout section 7 and section 8 of this appendix, and before any clothes washer testing using appendix J or appendix J2 to this subpart or clothes dryer testing using appendix D1 or appendix D2 to this subpart: Perform five complete wash-rinse-spin cycles, the first two with current AHAM Standard detergent Formula 3 and the last three without detergent. Place the test cloth in a clothes washer set at the maximum water level. Wash the load for ten minutes in soft water (17 ppm hardness or less) using 27.0 grams + 4.0 grams per pound of cloth load of AHAM Standard detergent Formula 3. The wash temperature is to be controlled to 135 °F ± 5 °F (57.2 °C ± 2.8 °C) and the rinse temperature is to be controlled to 60 °F ± 5 °F (15.6 °C ± 2.8 °C). Dry the load to bone-dry between each of the five wash-rinse-spin cycles. The maximum shrinkage after preconditioning must not be more than 5 percent of the length and width. Measure per AATCC Test Method 135–2010 (incorporated by reference; see § 430.3).

6. Extractor Run Instructions

Use the following instructions for performing each of the extractor runs specified throughout section 7 and section 8 of this appendix:

6.1 ***Test load size.*** Use a test load size of 8.4 lbs.

6.2 Measure the average RMC for each sample loads as follows:

6.2.1 Dry the test cloth until it is bone-dry according to the definition in section 2 of this appendix. Record the bone-dry weight of the test load (WI).

6.2.2 Prepare the test load for soak by grouping four test cloths into loose bundles. Create the bundles by hanging four cloths vertically from one corner and loosely wrapping the test cloth onto itself to form the bundle. Bundles should be wrapped loosely to ensure consistency of water extraction. Then place the bundles into the water to soak. Eight to nine bundles will be formed depending on the test load. The ninth bundle may not equal four cloths but can incorporate energy stuffer cloths to help offset the size difference.

6.2.3 Soak the test load for 20 minutes in 10 gallons of soft (<17 ppm) water. The entire test load must be submerged. Maintain a water temperature of 100 °F ± 5 °F (37.8 °C ± 2.8 °C) at all times between the start and end of the soak.

6.2.4 Remove the test load and allow each of the test cloth bundles to drain over the water bath for a maximum of 5 seconds.

6.2.5 Manually place the test cloth bundles in the basket of the extractor, distributing them evenly by eye. The draining and loading process must take no longer than 1 minute. Spin the load at a fixed speed corresponding to the intended centripetal acceleration level (measured in units of the acceleration of gravity, g) ± 1g for the intended time period ± 5 seconds. Begin the timer when the extractor meets the required spin speed for each test.

6.2.6 Record the weight of the test load immediately after the completion of the extractor spin cycle (WC).

6.2.7 Calculate the remaining moisture content of the test load as (WC–WI)/WI.

6.2.8 Draining the soak tub is not necessary if the water bath is corrected for water level and temperature before the next extraction.

6.2.9 Drying the test load in between extraction runs is not necessary. However, the bone-dry weight must be checked after every 12 extraction runs to make sure the bone-dry weight is within tolerance (8.4 ± 0.1 lbs). Following this, the test load must be soaked and extracted once before continuing with the remaining extraction runs. Perform this extraction at the same spin speed used for the extraction run prior to checking the bone-dry weight, for a time period of 4 minutes. Either warm or cold soak temperature may be used.

7. Test Cloth Material Verification Procedure

7.1 ***Material Properties Verification.*** The test cloth manufacturer must supply a certificate of conformance to ensure that the energy test cloth and stuffer cloth samples used for prequalification testing meet the specifications in section 3 of this appendix. The material properties of one energy test cloth from each of the first, middle, and last rolls must be evaluated as follows, prior to ~~pre-conditioning~~ preconditioning:

7.1.1 ***Dimensions.*** Each hemmed energy test cloth must meet the size specifications in section 3.7.1 of this appendix. Each hemmed stuffer cloth must meet the size specifications in section 3.7.2 of this appendix.

7.1.2 ***Oil repellency.*** Perform AATCC Test Method 118–2007, Oil Repellency: Hydrocarbon Resistance Test, (incorporated by reference, see § 430.3), to confirm the absence of Scotchguard™ or other water-repellent finish. An Oil Repellency Grade of 0 (Fails Kaydol) is required.

7.1.3 ***Absorbency.*** Perform AATCC Test Method 79–2010, Absorbency of Textiles, (incorporated by reference, see § 430.3), to confirm the absence of Scotchguard™ or other water-repellent finish. The time to absorb one drop must be on the order of 1 second.

7.2 ***Uniformity Verification.*** The uniformity of each test cloth lot must be evaluated as follows.

7.2.1 ~~***Pre-conditioning***~~ *Preconditioning*. ~~Pre-condition~~ Precondition the energy test cloths and energy stuffer cloths used for uniformity verification, as specified in section 5 of this appendix.

7.2.2 ***Distribution of samples.*** Test loads must be comprised of cloth from three different rolls from the sample lot. Each roll from a lot must be marked in the run order that it was made. The three rolls are selected based on the run order such that the first, middle, and last rolls are used. As the rolls are cut into cloth, fabric must be selected from the beginning,

middle, and end of the roll to create separate loads from each location, for a total of nine sample loads according to Table 7.2.2.

Table 7.2.2—Distribution of Sample Loads for Prequalification Testing

Roll No.	Roll location
First	Beginning. Middle. End.
Middle	Beginning. Middle. End.
Last	Beginning. Middle. End.

7.2.3 Measure the remaining moisture content of each of the nine sample test loads, as specified in section 6 of this appendix, using a centripetal acceleration of 350g (corresponding to 1111 ± 1 RPM) and a spin duration of 15 minutes ± 5 seconds.

7.2.4 Repeat section 7.2.3 of this appendix an additional two times and calculate the arithmetic average of the three RMC values to determine the average RMC value for each sample load. It is not necessary to dry the load to bone-dry the load before the second and third replications.

7.2.5 Calculate the coefficient of variation (CV) of the nine average RMC values from each sample load. The CV must be less than or equal to 1 percent for the test cloth lot to be considered acceptable and to perform the standard extractor RMC testing.

8. RMC Correction Curve Procedure

8.1 ~~***Pre-conditioning***~~ *Preconditioning*. ~~Pre-condition~~ Preconditioning the energy test cloths and energy stuffer cloths used for RMC correction curve measurements, as specified in section 5 of this appendix.

8.2 ***Distribution of samples.*** Test loads must be comprised of randomly selected cloth at the beginning, middle and end of a lot. Two test loads may be used, with each load used for half of the total number of required tests. Separate test loads must be used from the loads used for uniformity verification.

8.3 Measure the remaining moisture content of the test load, as specified in section 6 of this appendix at five g-force levels: 100 g, 200 g, 350 g, 500 g, and 650 g, using two different spin times at each g level: 4 minutes and 15 minutes. Table 4.1 of this appendix provides the corresponding spin speeds for each g-force level.

8.4 Repeat section 8.3 of this appendix using soft (<17 ppm) water at 60 °F ± 5 °F (15.6 °C ± 2.8 °C).

8.5 Repeat sections 8.3.3 and 8.3.4 of this appendix an additional two times, so that three replications at each extractor condition are performed. When this procedure is performed in its entirety, a total of 60 extractor RMC test runs are required.

8.6 Average the values of the 3 replications performed for each extractor condition specified in section 8.3 of this appendix.

8.7 Perform a linear least-squares fit to determine coefficients A and B such that the standard RMC values shown in Table 8.7 of this appendix ($RMC_{standard}$) are linearly related to the average RMC values calculated in section 8.6 of this appendix (RMC_{cloth}):

$RMC_{standard} \sim A \times RMC_{cloth} + B$

where A and B are coefficients of the linear least-squares fit.

Table 8.7—Standard RMC Values

"g Force"	**RMC percentage**			
	Warm soak		**Cold soak**	
	15 min. spin (percent)	**4 min. spin (percent)**	**15 min. spin (percent)**	**4 min. spin (percent)**
100	45.9	49.9	49.7	52.8
200	35.7	40.4	37.9	43.1
350	29.6	33.1	30.7	35.8
500	24.2	28.7	25.5	30.0
650	23.0	26.4	24.1	28.0

8.8 Perform an analysis of variance with replication test using two factors, spin speed and lot, to check the interaction of speed and lot. Use the values from section 8.6 of this appendix and Table 8.7 of this appendix in the calculation. The "P" value of the F-statistic for interaction between spin speed and lot in the variance analysis must be greater than or equal to 0.1. If the "P" value is less than 0.1, the test cloth is unacceptable. "P" is a theoretically based measure of interaction based on an analysis of variance.

9. Application of the RMC Correction Curve

9.1 Using the coefficients A and B calculated in section 8.7 of this appendix:

$RMC_{corr} = A \times RMC + B$

9.2 Apply this RMC correction curve to measured RMC values in appendix J and appendix J2 to this subpart.

[87 FR 33403, June 1, 2022, as amended at 87 FR 78820, Dec. 23, 2022]

Included in this document for reference on the Dummy cloth AATCC material properties:

From: Table VII in AATCC LP1-2021 Laboratory Procedure for Home Laundering: Machine Washing

AATCC Laundering Ballast Type 3 (aka AATCC Dummy Type 3)

Table VII—Laundering Ballast Parameters

	Type 1	Type 3	Type 4
Fiber Content	100% cotton	50% cotton/50% polyester ± 3%	
Greige Fabric Yarns	16/1 ring spun	16/1 or 30/2 ring spun	
Greige Fabric Construction	52 x 48 ± 5 yarns/in., plain weave	52 x 48 ± 5 yarns/in., plain weave	Varies (Similar Material to fabric under test, as agreed upon by both parties)
Finished Fabric Weight	155 ± 10 g/m^2	155 ± 10 g/m^2	
Edges	All edges hemmed or over-edged	All edges hemmed or over-edged	
Finished Piece Size	920 x 920 ± 30 mm (36.0 x 36.0 ± 1 in.)	920 x 920 ± 30 mm (36.0 x 36.0 ± 1 in.)	
Finished Piece Weight	130 ± 10 g	130 ± 10 g	