Updated 4/2024

**Instructions for Manikin Tests on Clothing at KSU**

Two different tests can be done with our **adult manikin**, Stan.

* A. ASTM F 1291 for measuring the insulation value of a clothing system.
* B. ASTM F 2370 for measuring the evaporative resistance of a clothing system.

We can also measure the insulation value of children’s clothing using our **child manikin** – Sonny. The thermal insulation value of footwear or socks can be measured using our **thermal** **foot** and of helmets and headgear using our **thermal** **head** according to ASTM F 3426. There is no standard method for evaluating evaporative resistance of footwear or headwear, therefore the basic procedures in the whole body manikin standard ASTM F 2370 are followed. A separate submission form is available for headwear and footwear testing.

Every time you send a set of products for testing, please email the **KSU Submission Form for Clothing** file to [merediths@ksu.edu](mailto:merediths@ksu.edu). Please send the file in Word format – not PDF. Once you fill out the form, the only thing that should change is the product list. Only one form is needed for a set of garments; we will prepare one report and invoice. ***If you require a separate report and invoice for each test, then prepare separate submission forms.***

**1. Company Information.** Please enter your contact information on the form.

**2. Purchase Order, Invoice, and Payment.** Please enter your purchase order number on the form (if you have one) or indicate that a PO will be sent. We will put the PO number on the invoice that is sent to you. Companies may pay by check, wire transfer, or credit card. Instructions are given on the invoice. If you want the invoice sent to someone other than the company contact, please indicate this on the form.

**3. Test protocol and price.** Please indicate the type of tests that you want on the submission form.

Note: If you only send one product for testing, we will charge you for one rep of the **nude manikin insulation test and/or the nude manikin evaporative resistance test**. The nude manikin test measures the insulation and evaporative resistance provided by the air layer around the manikin; these values are needed to calculate intrinsic clothing insulation and evaporative resistance values. In addition, we periodically retest the ASTM calibration ensemble to show the repeatability of the manikin, but you will not be charged for this test.

**Local resistance values.** If you are trying to investigate the effects of changing garment design variables and/or materials in product development, we can isolate the body segments (zones) that are covered by the garments and calculate a local total insulation value and/or a local total evaporative resistance value. For example, if a jacket completely covers the chest, back, stomach, and arms, these body segments can be used in the calculation. This technique will maximize differences between two jackets. Alternatively, we can also provide a chart with the insulation values for all 20 zones. If you want this information, please indicate it on the form.

If we are using the foot or head apparatus, detailed zone information can be provided as well.

**Thermal imaging.** A FLIR E5-XT infrared camera will be used.Thermal imaging is only available as an add-on service to manikin testing. Images are considered supplemental information. Due to issues with emissivity and reflectivity of different surfaces, associated temperature scales will not be provided. Color scales of different photos/samples may not match.

**4. Garment samples – sizing, labeling, and sending samples.** The manikins’ measurements are given below. Please select the clothing size that will fit the manikin properly. Mixing sizes will lead to variability in the results.

**Adult Manikin: Stan's Body Measurements**

|  |  |  |
| --- | --- | --- |
| **Measurement Location** | **Amount** | |
|  | **cm** | **in** |
| Chest circumference at arm pit level | 90.8 | 35.75 |
| Natural waist circumference | 75.6 | 29.75 |
| Hip circumference (widest point) | 92.7 | 36.5 |
| Arm length from shoulder tip to wrist | 61 | 24 |
| Front length from neck base to natural waist | 43.2 | 17 |
| Back shoulder width from shoulder tip to shoulder tip | 44.4 | 17.5 |
| Inseam length to top of shoe (from crotch to ankle) | 78.7 | 31 |
| Foot length (taken on bottom of foot) **Men’s shoe and boot size 12** | 26.7 | 10.5 |
| Height | 177.2 | 69.75 |

**Child Manikin: Sonny’s Body Measurements (Boy’s size 8)**

|  |  |  |
| --- | --- | --- |
| **Measurement Location** | **Amount** | |
|  | **cm** | **in** |
| Chest circumference at arm pit level | 66.0 | 26 |
| Natural waist circumference | 62.2 | 24.5 |
| Hip circumference (widest point) | 71.1 | 28 |
| Inseam length to top of shoe (from crotch to ankle) | 59.7 | 23.5 |
| Foot length (taken on bottom of foot) **Kid’s shoe size 3.5 and boot size 4** | 19.8 | 7.8 |
| Height | 129.5 | 51 |

Note: The thermal foot form requires a US size 10.5 shoe and 11 boot for the left foot.

Please request a CAD drawing of the head for the proper fit of helmets.

Label each garment with a number code using a permanent felt-tip marker or a hang tag. Please list each ensemble by a code designation, followed by all of the garments in the ensemble and dressing instructions. This information will be copied and put in the report. If a garment is to be tested more than one way, please make this clear in your list of tests. If a clothing system has a hood, hat, or helmet, we will have to cut it to get it around the hook in the manikin’s head.

**Send the garments to:**

Meredith Schlabach  
Institute for Environmental Research  
Kansas State University Phone: 785-532-2284  
0056 Seaton Hall email: [merediths@ksu.edu](mailto:merediths@ksu.edu)  
Manhattan, KS 66506

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*If you are sending products from a country other than the United States, please make sure that you pay all customs duties and brokerage fees associated with the shipment.*

**Timing.** We test garments in the order they are received at KSU. We can test 1 ensemble (all three reps) for insulation in a 24 hour period. The sweating tests take longer because we cannot run overnight. During holiday times and campus vacation breaks, this will not be possible.

**Test report.** A test report will be prepared and saved as an electronic PDF file with the company’s name and technical report number as the file name (example: Nike16-64 clothing report).

**5. Return of garments.** Please provide us with your company’s preferred shipping company and account number for return shipping (e.g., Federal Express, UPS, DHL) on the form. Please let us know if you need overnight shipping. If you want us to donate the garments to charity, let us know.

**6. Export Controls Compliance.** Please indicate if you are contracting, working, or acting for or on behalf of a national government. Include information about the agency or the branch of a national government that you are associated with.