Updated 4/2024

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

The manikin test measures the insulation (clo) value of a cold weather clothing ensemble. Then the insulation value is used in a whole body heat loss model to predict the temperature for comfort under certain conditions at different activity levels.

Every time you send a set of products for testing, please email the **KSU Submission Form for CW 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.** We will assume that you will send one garment sample of a given type. We will put it on the manikin with the base ensemble and run three replications of the test in a row under steady-state conditions.

**Select a test type on the form.**

Option A is for adult clothing. The ASTM F 2732 provides a temperature rating range based on the insulation value of the cold weather clothing tested with a base ensemble and low and high activity levels. The temperature rating will decrease as the activity of the wearer increases.

Option B is for children’s clothing. We have a new size 8 child manikin, Sonny. We use a unique model to determine the temperature ratings of children’s clothing based on the physiology of a child at different ages and activity levels.

**Base ensemble.**  Jackets, cold weather pants, jacket/pants sets, and coveralls are tested over a base ensemble. To follow ASTM F 2732, the ASTM base ensemble #1 should be used under jackets, jacket/pant sets, and coveralls. It consists of briefs, socks, athletic shoes, jeans, knit mock turtleneck long-sleeve shirt, fleece cap, insulated fleece gloves. If cold weather pants are to be tested alone, a standard jacket will be added to the base ensemble (#2). If a company does not want to follow the ASTM procedure, it may provide its own set of garments. We can keep them at IER, if you wish.

**Local insulation values.** If you want to compare some garments made with different materials, designs, or construction, we can calculate the average insulation value for the body zones of the manikin covered by the garment. In the case of a jacket, we would use the zone data for the arms and torso.

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**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. Stan usually wears a men’s medium or women’s large size jacket.

**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 |

Label each garment with a number code using a permanent felt-tip marker or a hang tag. Please list the garment codes and descriptions on the form. This information will be copied and put in the report. If a garment is to be tested several ways, list it like the example below.

***15. Extreme Squall Jacket (Style #455822).***

***15A. Outer shell and fleece liner tested together.***

***15B. Outer shell of jacket tested only (without liner)***

***15C. Fleece liner tested only (without shell)***

 Note: In this example, there are 3 manikin tests done on jacket #15 ($600 x 3 = $1,800).

**Hoods.** Garments with a hood will have to be cut in order to get the hood around the hook in the manikin’s head. Then we will pin the hood back together for the test. We can leave the hood down, but the insulation value will be lower, and the temperature rating will be higher.

**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 2-3 ensembles (all three reps) in a 24 hour period. During holiday times and campus vacation breaks, this is not 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: LandsEnd16-84 jacket 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.