Testing Services for the Evaluation of

Fabric Systems, Clothing Systems, Sleeping Bag Systems,

and Bedding Systems

Kansas State University

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Kansas State University Schedule of Charges
Institute for Environmental Research
Effective December 9, 2025

Description of Services	External Cost Rate ($)
1. Dry hot plate test for measuring the insulation value of materials (ASTM D1518, ASTM F1868, ISO 11092) Unit of measure: 1 test result (average of 3 replications)	435
2. Sweating hot plate test for measuring the evaporative resistance of materials (ASTM F1868, ISO 11092) Unit of measure: 1 test result (average of 3 replications)	445
3. Hot plate tests for measuring the NFPA total heat loss value of materials (ASTM F1868) *Note: This is a combination of tests #1 and #2.* Unit of measure: 1 test result (average of 3 replications for each hot plate test and additional calculations)	880
4. Dry manikin test for measuring the insulation value of sleeping bags (ASTM F1720, ISO 23537) and determining the temperature rating for comfort Unit of measure: 1 test result (average of 3 replications in a row)	600
5. Dry manikin test for measuring the insulation value of sleeping bags (ASTM F1720, ISO 23537) and determining the temperature rating for comfort Unit of measure: 1 test result (average of 3 independent replications)	750
6. Dry manikin test for measuring the insulation value of clothing (ASTM F1291) and determining the temperature rating for comfort (ASTM F2732, ANSI ISEA 201) Unit of measure: 1 test result (average of 3 replications in a row)	600
7. Dry manikin test for measuring the insulation value of clothing (ASTM F1291) and determining the temperature rating for comfort (ASTM F2732, ANSI ISEA 201) Unit of measure: 1 test result (average of 3 independent replications)	750

8. Camping Mattress Test for consumer-facing claims Unit of measure: 1 test result (9 measurements)	750
9. Camping Mattress Test for prototypes Unit of measure: 1 test result (average of 3 measurements)	550
10. Environmental chamber (per day)	450
12. Senior researcher (per hour)	191
13. Research technician (per hour)	68
14. Graduate research assistant (per hour)	39
15. Computational Analysis Work (per hour)	123
16. Computational Analysis Work – Graduate Student (per hour)	59
17. Thermal Imaging (one image)	50

Important Notes:

- *A detailed description of each test follows.*
- *Prices include direct cost and indirect costs for the university (52%).*
- *Products are tested in the order that they are received at IER.*
- *If companies want work done in a rush (requiring work at night and on weekends), or if special protocols are needed for testing that require moving and modifying equipment, extra charges for labor will be applied.*
- *Companies are responsible for paying the shipping costs for returning the products via Federal Express, UPS, or DHL.*

Fabric Systems: Thermal Insulation

Property: Resistance to dry heat transfer (i.e., fabric insulation value)

Methods: ASTM D 1518 "Thermal Resistance of Batting Systems Using a Hot Plate"

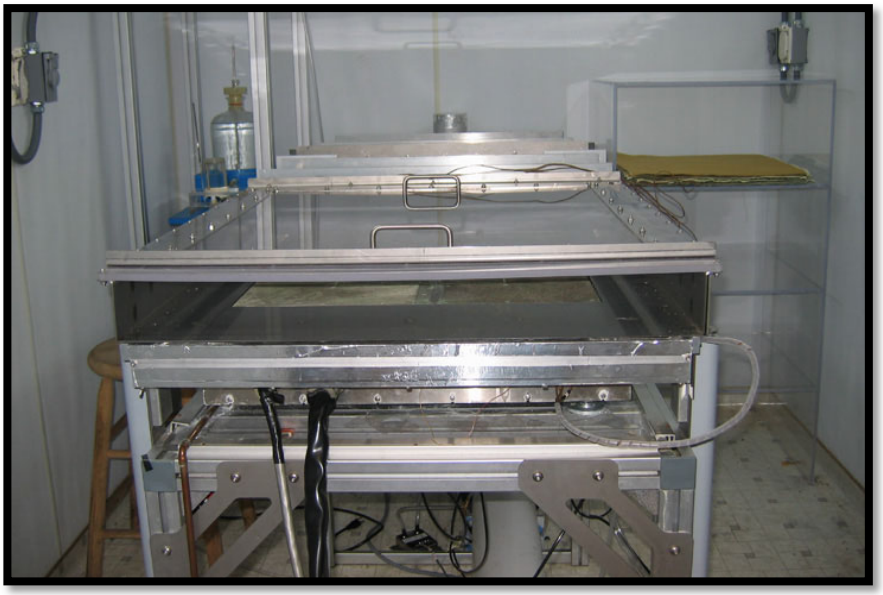
ASTM F 1868 “Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate Test” (Procedure Part A)

ISO 11092 "Textiles--Determination of Physiological Properties--Measurement of Thermal and Water-Vapour Resistance"

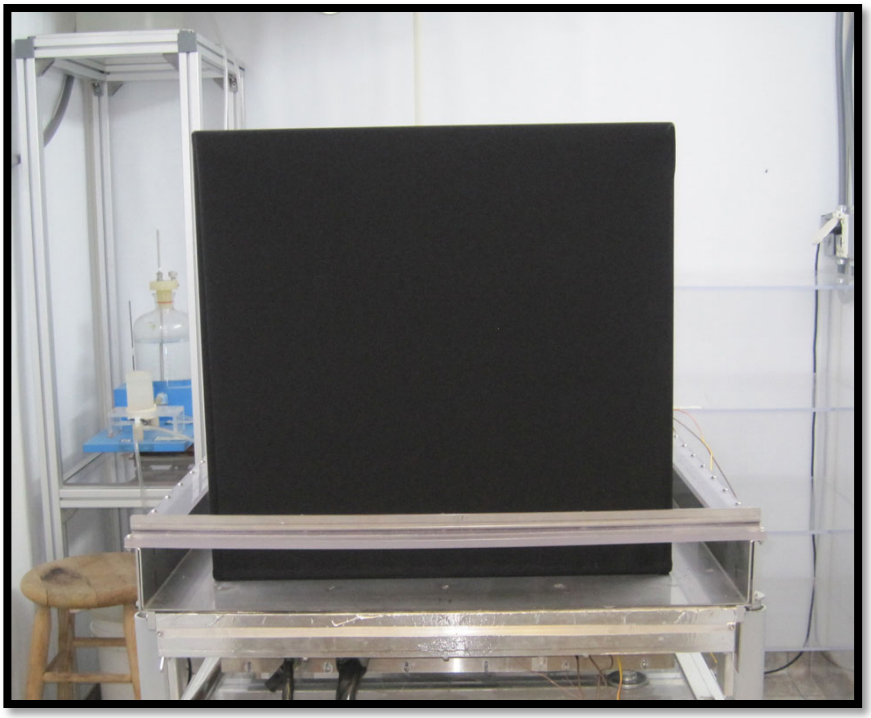
Instrument: Guarded hot plate in an environmental chamber; custom hoods provide either still air conditions, horizontal air flow, or vertical air flow at different levels

Specimen number and size: 3 20 x 20 inch squares

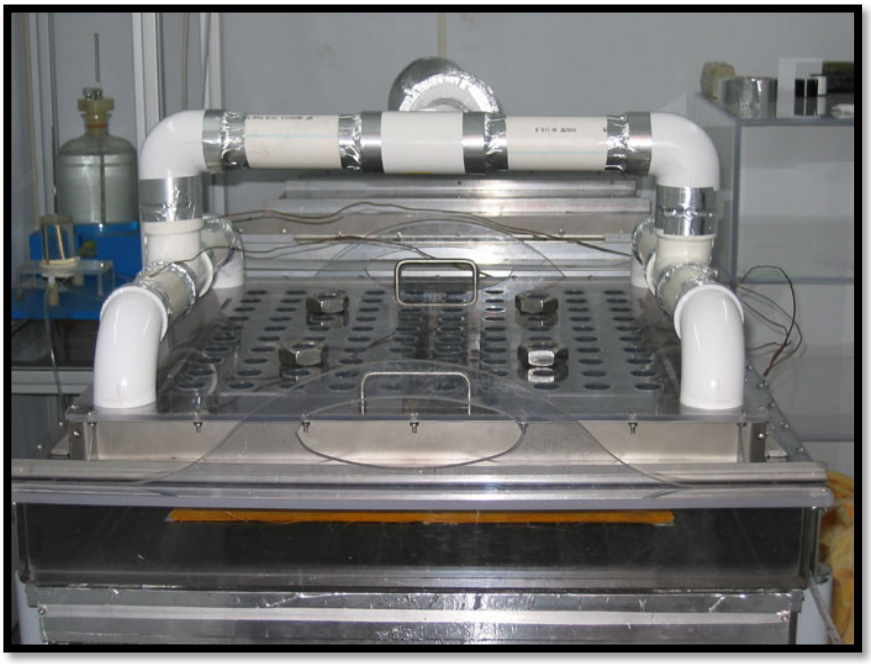
Cost: $435 per fabric type (3 reps)



Horizontal air flow hood over plate



Box hood (still air conditions)



Vertical air flow hood over plate

Fabric Systems: Evaporative Resistance

Property: Resistance to evaporative heat transfer

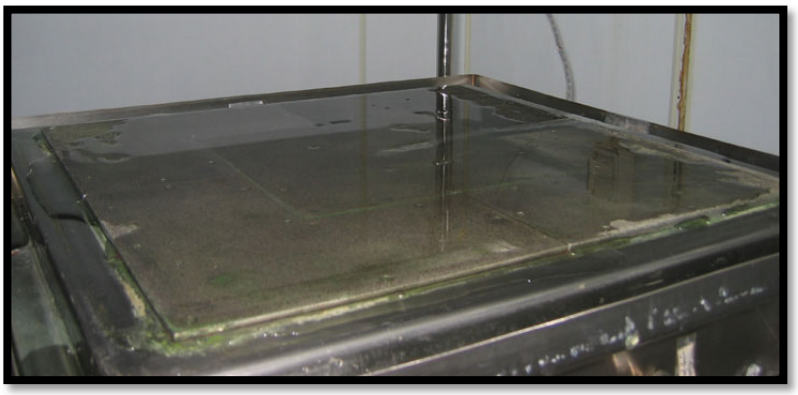
Methods: ASTM F 1868 “Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate Test” (Procedure Part B)

ISO 11092 "Textiles--Determination of Physiological Properties--Measurement of Thermal and Water-Vapour Resistance"

Instrument: Sweating hot plate in an environmental chamber; custom hoods provide either horizontal or vertical air flow at different levels

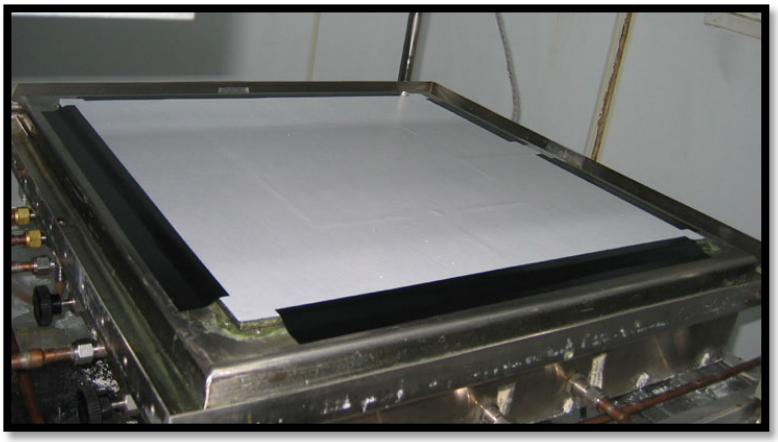
Specimen number and size: 3 20 x 20 inch squares

Cost: $445 per fabric type (3 reps)



Flooding the plate.

See photos of plate and hoods on previous page.



Water is covered with a PTFE liquid barrier to keep the fabric sample dry during the evaporative resistance test.

Fabric Systems: NFPA Total Heat Loss Test

Property: Total heat loss (from fire fighter fabrics)

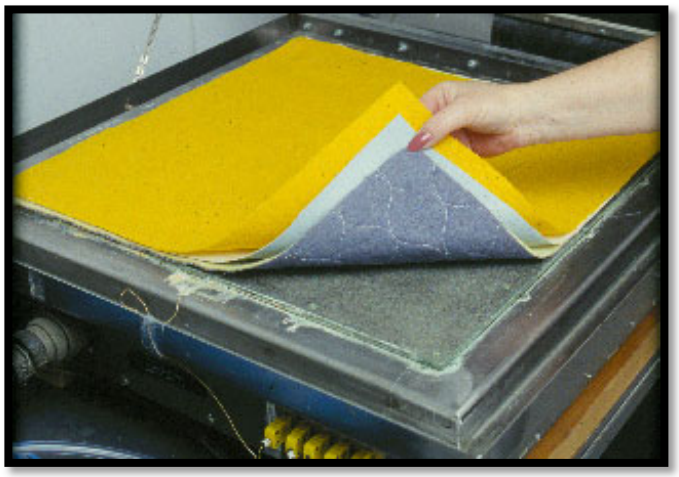
Method: ASTM F 1868 “Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate Test” (Procedure Part C)

THL Specification criteria are given in: NFPA 1951, NFPA 1971, NFPA 1977, NFPA 1992, NFPA 1994, NFPA 1999

Instrument: Sweating hot plate in an environmental chamber; custom hoods provide either horizontal or vertical air flow at different levels

Specimen number and size: 3 20 x 20 inch squares

Cost: $880 per fabric or fabric assembly (3 reps dry, 3 reps sweating)



Fire fighter turnout gear materials.

See other photos of the plate and air flow hoods on the previous two pages.

Cold Weather Clothing for Adults:
Thermal Insulation and Temperature Ratings

Property: Resistance to dry heat transfer (insulation value) provided by cold weather clothing systems

Method: ASTM F 2732 “Standard Practice for Determining the Temperature Ratings of Cold Weather Clothing”

Instrument: Thermal manikin in an environmental chamber

Specimen number and size: 1 set of garments sized to fit the manikin

Cost: $600 for 3 replications in a row or $750 for 3 independent replications

Temperature Ratings: Heat transfer models are used with the insulation value to determine the temperature ratings for comfort at different activity levels. No additional charge for these calculations.

Cold Weather Clothing for Children:
Thermal Insulation and Temperature Ratings

Property: Resistance to dry heat transfer (insulation value) provided by cold weather clothing systems

Method: ASTM F 1291 "Standard Test Method for Measuring the Thermal Insulation of Clothing Using a Heated Manikin" *modified using child-size manikin*

Instrument: Child thermal manikin (boy's size 8) in an environmental chamber

Specimen number and size: 1 set of garments sized to fit the manikin

Cost: $600 for 3 replications in a row or $750 for 3 independent replications

Temperature Ratings: Heat transfer models based on children's physiology at different ages are used with the insulation value to determine the temperature ratings for comfort at different activity levels. No additional charge for these calculations.

Clothing Systems: Thermal Insulation

Property: Resistance to dry heat transfer (insulation value) provided by clothing systems

Method: ASTM F 1291 "Standard Test Method for Measuring the Thermal Insulation of Clothing Using a Heated Manikin"

Instrument: Adult or child thermal manikin in an environmental chamber

Specimen number and size: 1 set of garments sized to fit the manikin

Cost: $600 for 3 replications in a row or $750 for 3 independent replications

Note: Children's clothing ensembles can be tested using these methods and our child-size manikin, Sonny. He is a boy's size 8.

Footwear: Thermal Insulation

Property: Resistance to dry heat transfer (insulation value) provided by footwear systems

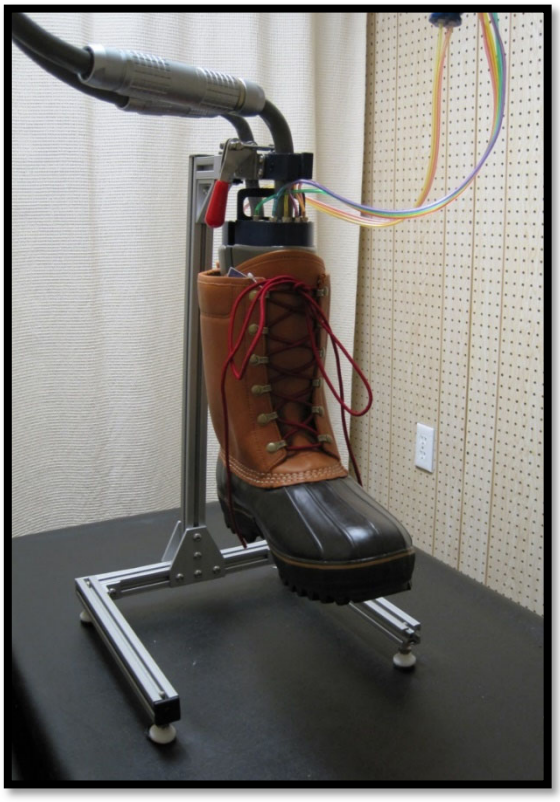
Method: ASTM F 3426 "Standard Test Method for Measuring the Thermal Insulation of Clothing Items Using Heated Manikin Body Forms"

Instrument: Thermal foot in an environmental chamber

Specimen number and size: 1 set of footwear sized to fit the left foot
(10 1/2 shoe; 11 boot)

Cost: $600 for 3 replications in a row or $750 for 3 independent replications

Note: We do not calculate temperature ratings for footwear for ethical reasons.



Headwear: Thermal Insulation

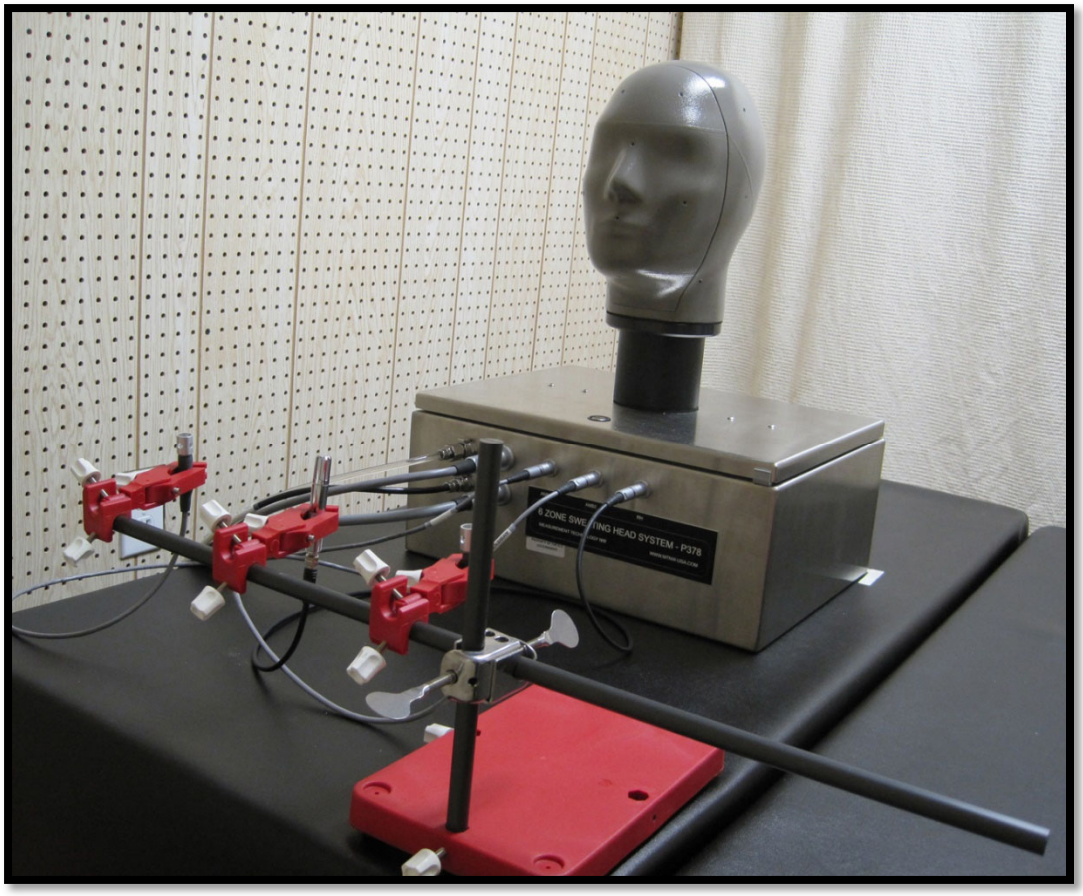
Property: Resistance to dry heat transfer (insulation value) provided by headwear and helmet systems

Method: ASTM F 3426 "Standard Test Method for Measuring the Thermal Insulation of Clothing Items Using Heated Manikin Body Forms"

Instrument: Thermal head in an environmental chamber

Specimen number and size: 1 set of garments sized to fit the head

Cost: $600 for 3 replications in a row or $750 for 3 independent replications



Sleeping Bag Systems for Adults:
Thermal Insulation and Temperature Ratings

Property: Resistance to dry heat transfer (insulation value) provided by sleeping bags or sleeping bag systems

Methods: ISO 23537 “Part 1: Thermal and Dimensional Requirements”

ASTM F 1720 "Standard Test Method for Measuring the Thermal Insulation of Sleeping Bags Using a Heated Manikin"

We also test according to military specifications.

Instrument: Thermal manikin on a cot in environmental chamber; for the ISO method, the bag is tested on a board with standard thermal underwear and socks, a face mask, and a 1 ½ in. self-inflating pad

Specimen number and size: 1 regular or long sleeping bag (auxiliary products like clothing, ground pad, etc. may be tested as part of a bag system; IER has these, or a company may provide them)

Cost: $600 for 3 replications in a row or $750 for 3 independent replications

Temperature Ratings: The comfort, limit, and extreme temperatures will be determined using the heat loss models in the ISO standard; KSU models can also be used with the ASTM standard; no additional charge for these calculations.

ISO 23537 standard test.

Sleeping Bag Systems for Children:
Thermal Insulation and Temperature Ratings

Property: Resistance to dry heat transfer (insulation value) provided by sleeping bags or sleeping bag systems

Method: ASTM F 1720 "Standard Test Method for Measuring the Thermal Insulation of Sleeping Bags Using a Heated Manikin" *modified using a child-size manikin*

Instrument: Child thermal manikin (boy's size 8) on a cot in an environmental chamber

Specimen number and size: 1 child-size sleeping bag (auxiliary products like clothing, ground pad, etc. may be tested as part of a bag system; IER has these, or a company may provide them)

Cost: $600 for 3 replications in a row or $750 for 3 independent replications

Temperature Ratings: Heat transfer models based on children's physiology at different ages are used with the insulation value to determine the temperature ratings for comfort during sleep. No additional charge for these calculations.

Child size sleeping bag test.

Sleeping Bags: Packing Volume

Property: Sleeping bag packing volume

Method: ASTM F 1853 “Test Method for Measuring Sleeping Bag Packing Volume”

Instrument: Plastic cylinder and weighted disk

Specimen number and size: 1 or 3 sleeping bags

Cost: $68 per hour for research technician labor (1 hour labor for setup, plus 1 hour labor for each bag tested)

Note: We will only measure packing volume if the bags are already at the lab for manikin testing.

Bedding Systems: Thermal Insulation and Temperature Ratings

Property: Resistance to dry heat transfer (insulation value) provided by bedding systems

Methods: ASTM F 1720 "Standard Test Method for Measuring the Thermal Insulation of Sleeping Bags Using a Heated Manikin" Option #2 *modified by placing the manikin on a bed*

ASTM F 1291 "Standard Test Method for Measuring the Thermal Insulation of Clothing Using a Heated Manikin" *modified by placing the manikin on a bed*

Instrument: Thermal manikin on a mattress in environmental chamber

Specimen number and size: 1 set of bedding (comforters, blankets, etc.)

Cost: $600 for 3 replications in a row or $750 for 3 independent replications

Temperature Ratings: Heat transfer models are used with the insulation value to determine the temperature for comfort during sleep; no additional charge for these calculations

Note: We can also evaluate the thermal properties of mattresses. Call the Testing Coordinator to discuss possible test protocols.

Camping Mattresses: Thermal Resistance

Property: Resistance to dry heat transfer (R-value)

Methods: ASTM F 3340 "Thermal Resistance of Camping Mattresses Using a Guarded Hot Plate Apparatus"

Instrument: Guarded hot plate and cold plate in an environmental chamber; the camping mattress is held under constant compressive force between the plates

For consumer-facing claims:

- Specimen number and size: 3 full-size specimens
- Cost: $750 per sample type (9 measurements)

For prototypes (not for consumer-facing claims):

- Specimen number and size: either 1 full-size specimen, or 1 made-to-fit specimen (20 x 20 inch square when inflated), or 3 made-to-fit specimens
- Cost: $550 per sample type (3 measurements)