



TESCOR

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AllTemp+
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Tescor Project #10-0789
AllTemp+ Cold Weather Clothing Evaluation

OBJECTIVE

The objective of this report is to present the results of the evaluation of AllTemp+ cold weather clothing when worn by an athlete running at -20°C for one hour, walking at -20°C for twenty minutes and after wearing the clothing for one hour at an ambient temperature of $+20^{\circ}\text{C}$. The results for each test are presented separately.

TEST-01: ALLTEMP+ CLOTHING COLD TEMPERATURE TEST

Clothing Description: Cold Temperature Test, the AllTemp+ clothing consisted of a hood, long sleeve shirt, long pants, glove liners and sock liners. The clothing material is 48.15% Polyester, 48.15% Thermolite Base and 3.7% Lycra. The test athlete also wore 100% cotton gloves, 100% cotton socks, running shoes and a pair of short pants. Ambient Temperature Test-2, the AllTemp+ clothing consisted of a long sleeve shirt, long pants and sock liners. The athlete also wore 100% cotton socks, running shoes and a pair of short pants.



Test-01 Procedure: The following test procedure was followed.

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- 1) The test athlete's skin temperature was measured with a Type "K" Thermocouple Probe and cross checked with an infrared thermometer while the athlete was in ambient conditions of 20°C to establish his baseline skin temperatures. The athlete's skin temperature was measured at the following locations, back of the hands, forearms, biceps, top of the feet, calves, thighs, chest and back (see Attachment "A" for locations and measured values).



- 2) The test athlete then entered Tescor's standard environmental test chamber which had been pre-soaked at -20°C (-4°F) for (1) hour. The athlete was connected to an ambient temperature air supply to provide warm moist air to protect his lungs during the test. The athlete was placed on a treadmill which was set for a speed of 6 mph. The athlete ran on the treadmill for 60 minutes at 6 mph.



- 3) At the completion of the 60 minutes the athlete was removed from Tescor's standard environmental test chamber and re-entered the 20°C ambient room. The athlete quickly removed the test clothing and his skin temperature was re-measured in the same locations as the baseline measurements. The first measurement was made 120 seconds after he left the -20°C test chamber (see Attachment "B" for locations and measured values).

Results and Data: See Test-01 Data Table and Chart-01 for the skin temperature results.

Athlete's Comments: The athlete commented that although he felt the cold he was able to run in the -20°C temperature without feeling any muscle tightening or cramping and he rated his comfort level a 6 on a scale from 1 to 10 where 1 is extremely uncomfortable and 10 is extremely comfortable.

Tescor's Observations: The most notable observation was the formation of frost on the exterior of the clothing while the athlete was running in the environmental chamber at -20°C . It appears that this was the result of the clothing pulling the athletes sweat away from his body while preventing his body heat from reaching the surface which allowed the sweat to freeze.



TEST-02: ALLTEMP+ w/ WINDBREAKER COLD TO AMBIENT TEMPERATURE TEST

Clothing Description: Cold to Ambient Temperature Test, the AllTemp+ clothing consisted of a hood, long sleeve shirt, long pants, glove liners and sock liners. The clothing material is 48.15% Polyester, 48.15% Thermolite Base and 3.7% Lycra. The test athlete also wore 100% cotton gloves, 100% cotton socks, running shoes, windbreaker pants and jacket. While at Ambient Temperature, the AllTemp+ clothing consisted of a long sleeve shirt, long pants and sock liners. The athlete also wore running shoes, windbreaker pants and jacket.



Test-02 Procedure: The following test procedure was followed.

- 1) The test athlete's skin temperature was measured with a Type "K" Thermocouple Probe and cross checked with an infrared thermometer while the athlete was in ambient conditions of 20°C to establish his baseline skin temperatures. The athlete's skin temperature was measured at the following locations, back of the hands, forearms, biceps, top of the feet, calves, thighs, chest and back (see Attachment "C" for locations and measured values).



- 2) The test athlete then entered Tescor's standard environmental test chamber which had been pre-soaked at -20°C (-4°F) for (1) hour. The athlete was placed on a treadmill which was set for a speed of 3 mph. The athlete walked on the treadmill for 20 minutes at 3 mph.



- 3) At the completion of the 20 minutes the athlete was removed from Tescor's standard environmental test chamber and re-entered the 20°C ambient room. The athlete quickly removed the test clothing and his skin temperature was re-measured in the same locations as the baseline measurements. The first measurement was made 120 seconds after he left the -20°C test chamber (see Attachment "D" for locations and measured values).
- 4) The athlete then put the AllTemp+ clothing back on and remained in the +20°C ambient room for (1) hour while performing normal low exertion activities while sitting, standing and walking.



- 5) At the completion of the 60 minutes his skin temperature was re-measured in the same locations as the baseline measurements (see Attachment "M" for locations and measured values).

Results and Data: See Test-02 Data Table and Chart-02, Chart-03, Chart-04 for the skin temperature results.

Athlete's Comments: The athlete commented that he felt much warmer while walking at -20°C for 20 minutes compared to when he was running for (1) hour with just the AllTemp+ clothing. He rated his comfort level an 8 on a scale of 1 to 10 where 1 is extremely uncomfortable and 10 is extremely comfortable. While in the ambient conditions for (1) hour the athlete felt very warm. He rated his comfort level a 6 on a scale of 1 to 10.

Tescor's Observations: The athlete's additional comfort while walking compared to running can be attributed to the added thermal insulation provided by the windbreaker layer of clothing along with the windbreaking ability of the additional layer.