

Thermal manikins— the ideal complement to human testing

Do you have a way to back up your bold product performance claims with data? Are you finding yourself in a position where you need to do product or physiological response testing, but the cost or availability of human test subjects just isn't feasible—especially right now due to COVID-19? Reliable, repeatable testing is important for all products—and critical for products affecting human safety and comfort.

Thermetrics and our partner laboratories have both the equipment and proven expertise to address your testing challenges.

The Thermetrics-developed [thermal manikin Newton](#)—designed in accordance with ASTM and ISO standards—supports a wide range of garment evaluation research needs. Additionally, when coupled with the physiology and comfort software module [ManikinPC](#), Newton can provide a detailed real-time simulation of the human thermoregulatory system. Simulations can measure heat and moisture transfer with the environment; and key physiological and comfort variables including core temperature, shivering, local sensation, and thermal comfort.

The benefits of using thermal manikins

Using a manikin provides many advantages over relying solely on human test subjects, such as:

- Higher precision, quantitative measurements of heat loss, physiological state, and predicted thermal comfort
- Massive cost and time savings by limiting the coordination and institutional review committees typically required to conduct human subject tests
- Elimination of the need for test subject COVID-19 protocols, especially in environments where people would be exerting themselves (think treadmill tests)
- A first-to-market advantage with shorter product design and evaluation cycles
- Far less variability in results with fewer test replications versus human wear trials required
- Results complementary to human subject protocols



Thermetrics is dedicated to developing industry-leading technology for thermal manikin systems and other thermal testing equipment. We are proud our products are used and trusted worldwide by commercial businesses, testing labs, and government clients. Thermetrics engineers approach design of all equipment with a thorough understanding of ASTM, AATCC, ISO, and other industry standards for thermal comfort research.



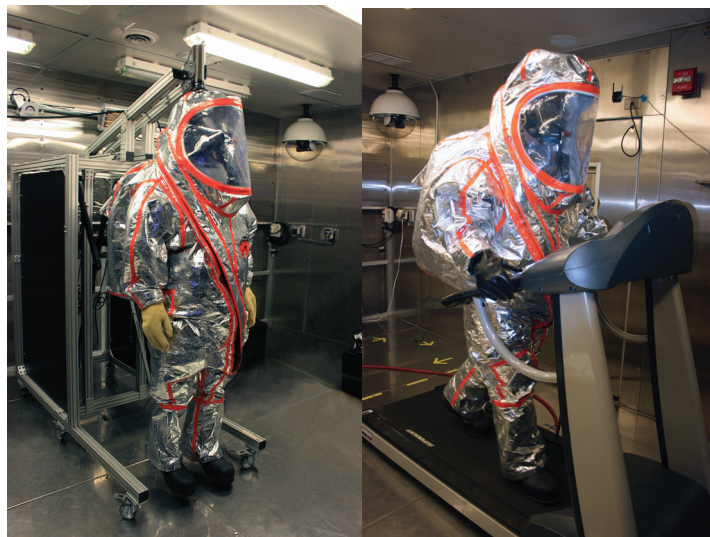
Whatever your scenario—whether you want to set up your own thermal manikin capability, rent equipment short term, or need testing services, contact Thermetrics—we've got you covered!



Thermal manikin use cases

The possibilities for using a thermal manikin with the ManikinPC software module are nearly endless. Just about any scenario related to a person's thermal comfort can be tested with a Thermetrics manikin, but some of the most common applications fit within the following categories:

Testing under extreme conditions. For obvious safety reasons, there are strict criteria in place for human subjects to be pulled from a test scenario should they reach specific hyper- or hypothermic states. Since manikins don't have these same risk-based requirements, the boundaries of test protocols can be pushed, including longer exposure times and varying recovery cycles. Supplementing testing with manikins means more data and predictability in critical extreme conditions to further bolster human safety.

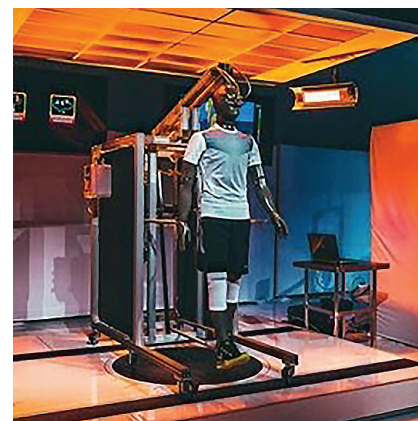


Taking your product development to the next level. In contrast to using human test subjects, the inherent repeatability and precision of thermal manikins allows testing as many incremental material and/or design changes as needed to maximize performance of your product. Thermal manikin instrumentation coupled with ManikinPC provides reliable data to quantify subtle differences such as change in skin temperature or sweat rate during an exercise cycle, or increasing exposure duration before reaching a critical core temperature. These small differences can really add up to give your product an edge over the competition.



Making good human studies even better. Everyone knows human physiological and comfort studies are challenging to plan and execute—but absolutely critical to understanding real-world performance. Given the high cost and high stakes, shifting some of the responsibility to a thermal manikin just makes sense. During test protocol planning, a thermal manikin can be used to simulate the entire protocol and inform clothing selection, work intensity, or interval durations, ultimately improving success of the human testing phase. Additionally, having a manikin participate in trials with human subjects provides replicate data, benchmarked to the human results.

Backing product performance claims. Understanding the wicking, cooling, and drying behavior of your garments can be a challenge. Even when it doesn't match humans perfectly, the use of a thermal manikin can generate realistic sweat volumes over the skin's surface to observe how and where it accumulates. A thermal manikin can generate quantitative data about product performance, in addition to qualitative or visual results that help product designers deliver maximum performance and solidify consumer confidence in your product.



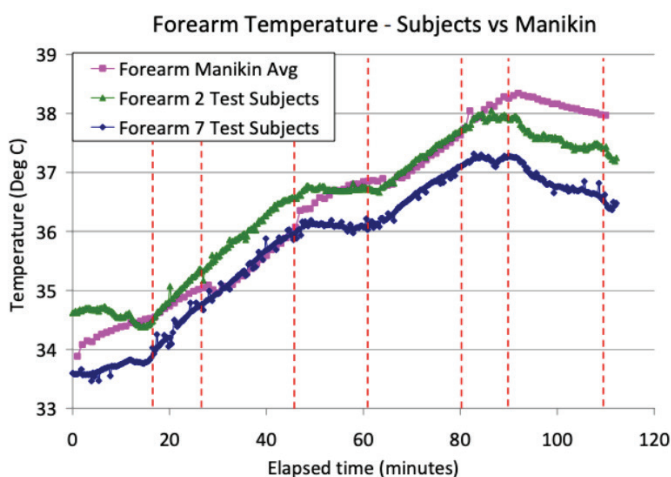
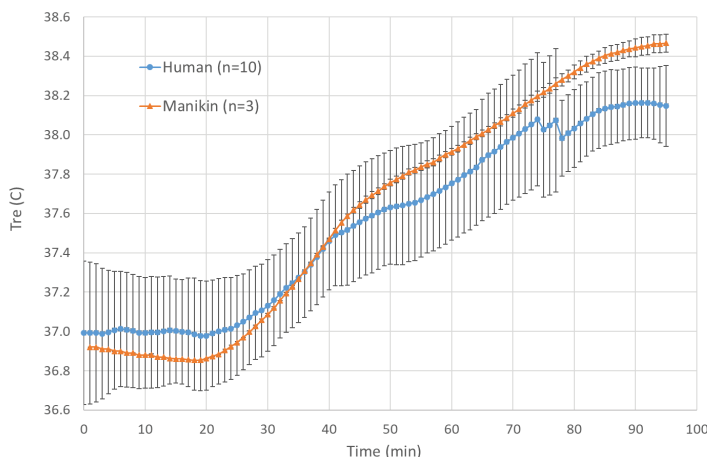
Thermal manikin test results

The Textile Protection and Comfort Center (TPACC) at North Carolina State University routinely uses the Newton manikin, coupled with ManikinPC to predict the impact of protective and performance clothing on human physiological response, including core temperature, skin temperature, and sweat rates at different environmental conditions and work rates.

One of their studies compared Newton with a 10-subject human wear trial that measured the effect of breathability of materials used in firefighter turnout suits and its effect on heat strain. The ***ManikinPC and Newton results were remarkably similar to the human-based experiment***, reinforcing the viability of using thermal manikins to supplement human-based testing of clothing related heat strain. Looking at core body temperature—a key indicator for determining how much heat the body is storing—all of the manikin core temperature predictions fell within one standard deviation of the measured rise in human core temperature for the firefighting gear tested.



Core temperature rise in turnout suit predicted by manikin and human response (TPACC)



¹ A. Shawn Deaton, Kyle Watson, Emiel A. DenHartog, and Roger L. Barker, "Effectiveness of Using a Thermal Sweating Manikin Coupled with a Thermo-regulation Model to Predict Human Physiological Response to Different Firefighter Turnout Suits," ASTM International, 2020, https://www.astm.org/DIGI-TAL_LIBRARY/STP/PAGES/STP162420190077.htm

