



Thermal Barrier Test Apparatus

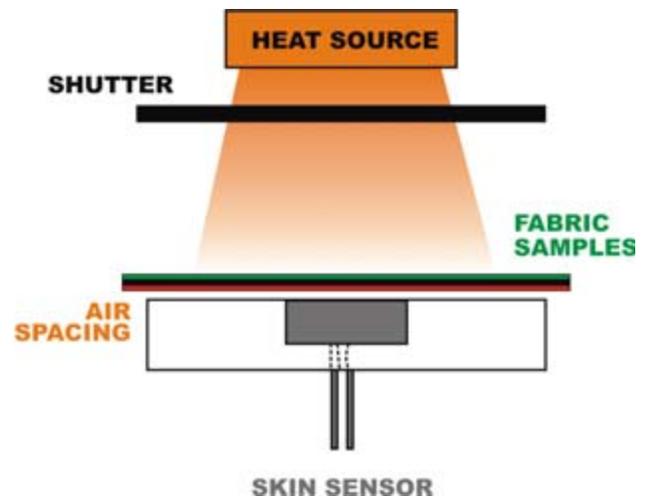
Overview:

The Natick Soldier Center has the capability to evaluate flame retardant materials based on their flame/thermal protective performance at a heat flux simulating battlefield flame/thermal hazards. The performance is measured using a skin sensor that can predict temperature changes on the human skin surface resulting from heat penetrating the fabric sample. Compared to other conventional tests, this simple bench-scale apparatus is a quick and inexpensive method to get valuable information such as skin temperature profiles and burn injury times.

Description:

This bench-scale test apparatus uses single or multiple layers of fabric samples (5" x 7"). The test sample is exposed to the heat flux of a flash fire (84 kW/m² or 2.0 cal/cm²-sec) for a specific short exposure time. The apparatus employs the following state-of-the-art components and concepts to improve its operational precision and accuracy:

- **Heat Source:** A high intensity infrared lamp simulates the heat flux of battlefield thermal/flame hazards.
- **Electro-mechanical Shutter:** A metal shield placed between the heater and the fabric sample is activated by two programmable digital timers and a 3-way solenoid valve to provide accurate exposure time.
- **Skin Sensor:** A thermistor is mounted inside a disk made from a 60/40 mixture of Urea formaldehyde and silica that has thermal and optical properties similar to those of human skin.
- **Basal Layer Temperature Measurement:** The signal from the thermistor is converted to basal layer temperature (the temperature at the epidermis and dermis interface).
- **Burn Injury Prediction:** Burn injuries are predicted based on the Omega (Ω) value calculated using Henrique's skin burn model.



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