

Stedfast USA

800 Mountain View Drive
Piney Flats, TN 37686

Phone: 888-673-8441

Fax: 450-378-1558



To whom it may concern:

ISO 11092 Ret is NOT the correct method for measuring sweat permeation rate through firefighter turnout gear. Ret IS an effective method for measuring sweat permeation for ONLY; textiles, thin porous materials and thin hydrophilic coated or laminated textiles (like consumer rainwear). The 'Indy Study' and many other studies presented recently confirmed this as well. The reason Ret is not effective for firefighter turnout gear is that Ret overestimates the amount of sweat that will migrate through the gear. The hydrophilic nature of the moisture barrier layer(s) and the air gaps that are inherent between the layers results in an over estimate in performance when testing under ISO 11092 Ret (iso-thermal conditions).

If a gear manufacturer or material supplier wishes to significantly improve the performance of their product(s) for the Ret test method they simply need to position a hydrophilic layer closer to the wet plate. This improves the performance of the composite by placing a material that works like a sponge to draw moisture off of the wet plate at a high rate for a short period of time. While it makes the composite appear to be much more breathable, in-fact it is only a temporary effect that the end-user does not benefit from.

Because ISO 11092 Ret is performed with the air temperature the same as the wet plate, the sweat vapor does not get a chance to re-condense within the thick layers. We know that sweat re-condenses when firefighters wear the gear, because the gear gains weight. The condensation greatly slows down the overall sweat permeation rate. But when testing for ISO 11092 Ret, condensation cannot occur. During the recent discussions of Ret at NFPA meetings presentations were made followed by engaging discussions. While many at the meetings still do not understand, Gore and Stedfast certainly do. It is unfortunate that a once Creatively Technical organization has had to resort to marketing games and test method trickery in order to introduce a new product. Until the release of Gore's NC State Marketing Study it was bewildering that Gore shifted their opinion away from the value of THL to promoting Ret. With the release of marketing information from the study it soon became clear that Gore's new product simply does not perform as well as in the THL test as do incumbent composite systems. And only by moving the Moisture Barrier closer to the wet plate does the new product perform well in ISO 11092 Ret.

Problems with Gore's Marketing Study at NC State:

1. 65-minutes of wearing turn-out gear does not happen when fighting a fire. The SCBA capacity will not allow for this. So the fact that participants had to stop exercising because they reached a physiological limit is not surprising. The study, while utilizing a standard and common work/rest cycle for rainwear, does not properly represent firefighter activities.

2. Garment Fit – All 10 test subjects wore the same garment size (Size 44 coat and Size 34 pants). Based on Table 1 of the study (pg. 6), this means that a 6-foot tall person weighing 163-lbs wore the same gear as a 6-foot tall person weighing 231-lbs. This is absurd! There is no way that these 2 individuals fit the gear in the same way. In fact, the images from the study show how the garments fit some subjects very loosely. While they fit others with little or no ‘bagginess’. It is well known that proper garment fit is very critical to have a valid human factors study.

3. Highest BMI Subjects were pulled – the 4 subjects pulled from the study were the 4 biggest people whom very likely had the poorest fitting garments. What is interesting is that based on all 10-subjects Garment X is the best performing garment based on Change in Core Temperature, T_{core} (see figure 9). When T_{core} vs. Duration is plotted for the 6 subjects that stayed in the study (see figure 12), Garment Z is the best performing garment. The plot for just the 4-subjects that were pulled (figure 15) demonstrates the extreme trends present in figure 9 are due to the 4 subjects pulled from the study.

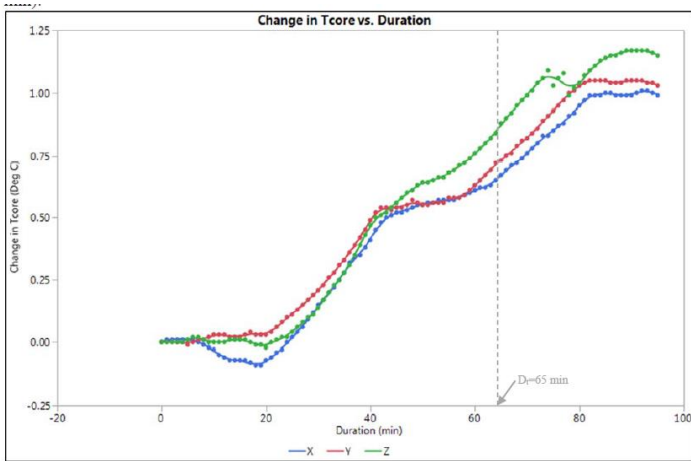


Figure 9: Average change in core temperature by test duration (includes all subjects, $N=10$)

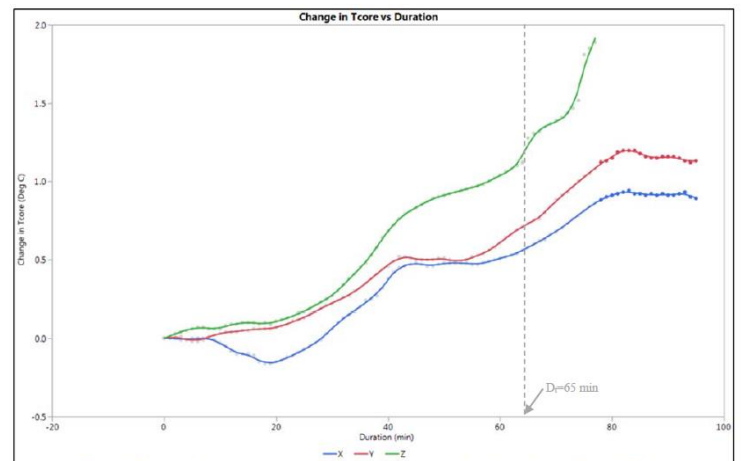


Figure 15: Average change in core temperature by test duration (only includes those pulled early, $N=4$)

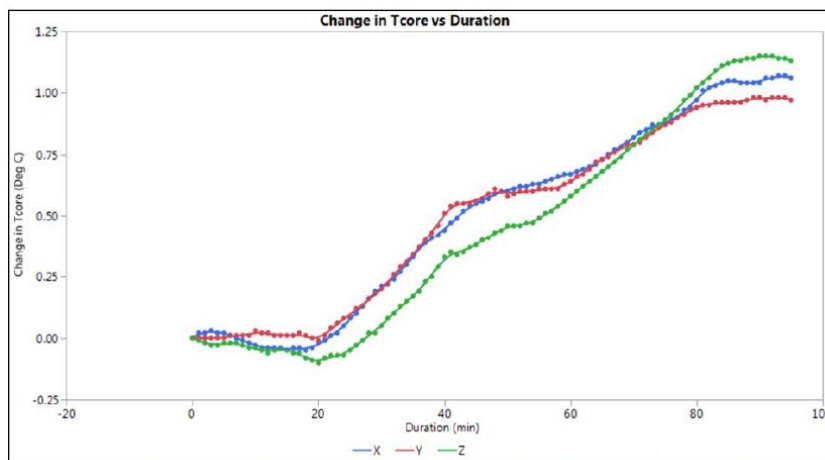


Figure 12: Average change in core temperature by test duration (does not include subjects pulled early, $N=6$)

*Plots were taken from: “A Report to W.L. Gore on the Characterization of Human Physiological Response for Three Firefighter Turnout Systems” T-PACC, College of Textiles, NCSU, Raleigh, NC. MARCH 2016.

4. The data analysis does not reveal how close these 4 subjects were to being pulled while wearing Garments X and Y.
5. Subjects were not fully dressed – The subjects did not wear a fire boots, a structural hood or SCBA during the study.
6. Subjects wore different footwear – each subject wore their own athletic shoes. The pant legs were taped at the ankles to prevent excess air exchange as would likely occur had the subject worn boots. This is a significant source of variability. From the photos, some subjects have the pant cuff taped near ankles. Other are taped high on the calf near the knee.
7. The study comments that during rest cycle “. . . the subjects were allowed to drink water . . .”. But there is no information concerning who drank, how much they drank or the temperature of the water. This would introduce a huge source of variability. A person drinking 45°F water while wearing one set of gear would have very different effect from wearing another set of gear and not drinking 45°F water. Just one more glaring source of variability and significant, missing information.
8. There is no information to reveal what the test subjects were doing during the time between each phase of the study. It is well know that hydration and activity, hours and days before the performance of a physiological study will have a significant effect on the outcome. This is always a significant source of variability. This study appears to have ignored it.
9. Weak Statistical Analysis
 - a. Only a simple T-test analysis was performed to investigate Garment X vs. Garment Y vs. Garment Z.
 - b. The study reports that many important responses were measured and there were many more factors where data was collected but no analysis was provided. When asked for the date or a more thorough analysis, Gore responded that they will not make the data available. The missing responses like Ensemble Weight Gain, Nude Weight Loss, Clothed Weight Loss, the effect of drinking water during rest, the effect of height, weight, BMI on the physiological measures.
 - c. The data is presented in only the simplest terms, average change. There are no error-bars on the graphical data to understand the impact of each individual subject.
 - d. There is no information concerning the performance of each individual. Perhaps they have the greatest effect on performance for T_{core} . But we will never really know.
 - e. There is no information to reveal what the test subject were doing during the time between each phase of the study.
10. The Caveats from Gore’s Marketing Study at NC State essentially puts the information ‘out there’ for marketing by ending with the “. . .intention (is not to) . . . predict the suitability of any commercial product for a particular end use.”