

Summary of relevant information contained in ASTM F 2733 Standard Specification for Flame Resistant Rainwear for Protection Against Flame Hazards

Scope: This specification establishes applicable test methods, minimum physical and thermal performance criteria, a suggested sizing guide, and suggested purchasing information for rainwear for use by workers who are potentially exposed to industrial hydrocarbon fires or other petrochemical fire hazards.

Key Definitions:

Burn Injury: Burn damage which occurs within human skin at various depths as a function of temperature and time and which can be described mathematically in a burn injury model.

Note: Burn injury in human tissue occurs when the tissue is heated above a critical temperature. The degree of burn injury—first, second or third degree—depends upon the level above the critical temperature, the duration above the critical temperature and the depth in the skin layers.

Breakopen: A material response evidenced by the formation of a hole in the (material) during the thermal exposure that results in the exposure energy in direct contact with the (body) surface or an undergarment.

Stoll Curve: Curve used to predict the onset of a second-degree burn on human tissue.

Thermal Protection: The property that characterizes the overall performance of a garment or protective clothing ensemble relative to how it prevents the transfer of heat that is sufficient to cause burn injury.

Design Test: One made on a sample treated as representative of an industrial product. Not intended to be re-done unless components of the material change.

Performance Requirements: Requirements shall be met initially as manufactured as well as after five cleanings.

Leak Resistance: Material must withstand water pressure of 30 psig without leaking. The seams of the rainwear must not exhibit any evidence of leakage when exposed to water at 3 psig for (2) two minutes.

Tear Resistance: Material shall have a trapezoidal tear resistance of 6 lbs in the warp direction and 6 lbs in the fill direction.

Moisture Vapor Transmission (Breathability): If the rainwear is marketed as being breathable, test according to ASTM E95 procedure BW and report results.

Markings and Reflective Materials: These materials attached to the rainwear shall be permanent and shall not degrade the performance of the rainwear.

Flame Resistance: Rainwear material shall be flame resistant and shall not melt and drip when tested in accordance with ASTM D6413 and shall exhibit no more than a 2 second after flame time and less than a 6" char length.

Thermal Protection: Rainwear material shall be tested in accordance with ASTM F1930, a design test, after 1 washing and 1 drying. Testing parameters are set at heat flux of $84 \pm 2 \text{ kW/m}^2$ [$2.0 \pm 0.05 \text{ cal/cm}^2\text{s}$] and an exposure time of 3 ± 0.1 seconds. The following information is determined:

- The average predicted total area of burn injury for the three specimens tested shall be equal to or less than 40%.
- Material response characteristics shall be reported for all exposures. Characteristics are: Afterflame time, breakopen, charring, melting, dripping, garment ignition, embrittlement, and shrinkage.

Rainwear Construction: Utilize materials, stitchings, tapes, coatings, fasteners, and closure materials that minimize heat conduction for the construction of compliant FR rainwear. Fasteners and closures used, for example, zippers, snaps, buttons, etc. that are made from metal, shall be covered with a layer of rainwear material on the inside of the garment such that these items of construction will not contact undergarments or skin.

- Structural seam integrity: Structural seams shall not exhibit a seam failure that creates a seam opening of greater than 51 mm (2 inches).
- Closure function: Closures shall function (open only) after the simulated fire exposure. Closures that do not fully open do not meet the performance requirements of this specification. Report all closures that do not fully open.

Labeling Requirements:

- **Manufacturer Label:** States size, catalog number, manufacturer's name and notation of conformance to F2733, and the label is permanently affixed in each rainwear item.
- **Statement of Conformance:** The statement of conformance to this specification shall be, "This rainwear meets or exceeds requirements for ASTM F2733 Standard Specification for Flame Resistant Rainwear for Fire Hazards."
- **Care Label:** States instructions for cleaning and care and shall be readable throughout the life of the garment.
- **Packaging Label:** States name of manufacturer, size, material, catalog number, date code and ASTM designation.