

---

## TECHNICAL DATA

### **CONDUCTIVE, COMPRESSIVE, HEAT RESISTANCE REQUIREMENT**

Commonly referred to as CCHR  
NFPA 1971, 2018 edition

#### **\*REQUIREMENT**

The CCHR test is required to be performed on the shoulder and knee areas and was originally included in the standard to insure that the shoulder and knee areas would provide the same level of protection when compressed as does the base three layer garment. The test is run in both the wet and dry conditions, and the 2000 edition of NFPA 1971, Standard on Protective Ensembles for Structural Fire Fighting, had established a minimum requirement of 13.5 seconds. For the 2007 revision, it was discovered that some base three layer composites were able to attain the 13.5 seconds without any additional padding or reinforcement in compressed areas and so the minimum requirement was raised to 25 seconds. With the 2013 edition, the requirement was changed to be 25 seconds until second degree burn, as opposed to just a rise in temperature, and this remains the requirement for the 2018 edition.

#### **\*BASE GARMENT**

For the 2000 edition, the base rating was determined on a hot plate set at 280°C, under a pressure of 1/2 psi, using a garment composite having the minimum TPP rating of 35. The CCHR rating was the time in seconds to achieve a temperature rise of 24° C under compression. The shoulder area was tested under 2 psi, which simulates a fire fighter wearing a fully loaded 40 lbs. SCBA tank, having a 2" wide SCBA shoulder strap. The knee section was tested at 8 psi, which had been established as the amount of force that a 180 lb. fire fighter would exert to the knee area when in the kneeling or crawling positions. The test is required to be run in both the wet and dry condition and the test parameters have remained the same.

#### **\*TEST METHOD**

The 2013 change in the CCHR test from a requirement based on a time to a 24°C temperature rise to the time for a prediction of second-degree burn injury was based partly on making measurements of thermal insulation more consistent in the standard. For example, TPP testing uses the same type of approach where the time to predicted second-degree burn injury is the basis of the TPP rating. Similarly, the conductive heat resistance test that was applied to gloves and footwear upper materials also uses a time to second-degree burn prediction as part of the criteria. The radiant protective performance ratings for proximity outer shell materials are likewise based on a predicted time to second-degree burn injury.

Up until the 2013 edition of the standard, the only exceptions for not using second-degree burn injury protection had been the CCHR test and two tests for footwear (radiant heat resistance test and sole conductive heat resistance) where temperature rise data are used as the principal criteria in those requirements. Burn prediction based results are considered to be more relevant because they relate to the intended purpose of providing insulation for the portion of the ensemble being evaluated. These predictions take into account the amount of heat that must be absorbed by the body's skin to cause burn injury. Copper calorimeters are used to make these measurements, because they simulate skin response to heat for relatively short periods of time. The response of the copper calorimeter is then compared with known human skin-heat response data for burn injury as the basis of prediction. In contrast, temperature rise data cannot necessarily be related to burn injury and so the NFPA Technical Committee continues to have the 2018 edition CCHR performance be based on the measurements of predicted burn injury.

### **\*EFFECT**

This requirement is to insure additional insulation in areas of high compression. The NFPA standard requires that the shoulder area being tested extend along the shoulder crown for a distance of four inches, with two inches extending over the front and back of the shoulder. For the knee area, the NFPA standard requires that the area being evaluated extend a minimum distance of six inches by six inches. The smallest Globe internal knee reinforcements measure 7" x 10" and we install not just a layer of thermal barrier, but also an additional layer of moisture barrier to provide a level of protection far and above the minimum requirement. Prior to the 2013 edition of NFPA 1971, the actual CCHR test value was reported by Underwriters Laboratories. However, with the 2013 edition, the test became a pass/fail criteria and actual values are no longer provided by UL.

### **\*ADDITIONAL INSULATION**

Since the standard CCHR reinforcements as described above will always meet and exceed the minimum requirements, garments that include additional reinforcements specified by the customer are not required to be tested. It should be noted that whenever a customer specifies additional layering, Globe never deletes or replaces the minimum, but always adds to it, which means that the thermal protection afforded is always substantially increased.

PAF 6/1/18  
Reprint 6/2019