

Arc Ratings ATPV vs. EBT: Best for Electric Arc Flash Protection: Training for Electrical Safety

Author: Hugh Hoagland

Publication: American Chronicle, December 2009

Do you know the difference between ATPV and EBT? See the explanation below.

In America it does not matter if the fabric is EBT or ATPV -- The important thing is the cal/cm² that the fabric can support:

Category 1 - 4 cal/cm²

Category 2 - 8 cal/cm²

Category 3 - 25 cal/cm²

Category 4 - 40 cal/cm²

A common question in arc flash clothing protection values is whether an ATPV or an EBT is better in protection in a garment system. When ASTM F1959 Standard Test Method for Determining the Arc Rating of Materials for Clothing was in development, THE committee ASTM F18, quickly recognized that some materials will allow skin burn prediction to be reached before they "broke open" and others would not. Initially these became two ratings. One was an ATPV, an arc thermal performance value and the other was an EBT, an energy breakopen threshold. Initially one company marketed one as better than the other because the materials they had tested did not exhibit the "breakopen" phenomena. This was erroneous and later IT WAS determined every fiber type can breakopen before its burn prediction level was reached.

Today EVERYBODY recognizes that knits usually breakopen before the burn point and woven cloth shows burns before the breakopen point. Each of these constructions and all fibers have their advantages and disadvantages. The committee decided to rename the term Arc Rating. One reason for arc rating was to make the labeling less technical and easier for the end user to understand, the other reason was to take away a false stigma from EBT.

With much consideration the committee decided to leave the term EBT and ATPV as a subscript or an addendum to the term Arc Rating for the safety professional to use if it made sense. So today you will see a label with Arc Rating (ATPV) = X cal/cm² or Arc Rating (EBT) = X cal/cm². Both are a 50% probability of the behavior at which the material compared to a burn model can give a second degree burn. The Arc Rating (EBT) fabric has not exhibited a second degree burn on the calorimeter sensors in most cases because the material has a one inch crack or a ½ square inch hole which is not directly over the sensor. Theoretically if this had happened over the sensor there would have been a burn predicted UNDER the crack or hole so we cut off the rating there. Both Arc Ratings are expressed in calorie/cm². The lowest is

always reported. So each material receives an EBT or an ATPV. Both values can be reported but only ONE is the Arc Rating for the fabric. Only the lowest can be used on the clothing label according to the ASTM F1506 specification as the Arc Rating. To be arc rated clothing in the ASTM F1506 standard the fabric has several tests it must pass including wash testing and vertical flammability testing using ASTM D6413 which is a small scale test but D6413 has no meaning by itself. To really be flame resistant for arc flash, flash fire or any real fire conditions, fabric must pass a battery of tests and/or a full scale test.

The definition of each of the two terms for an arc rating is below from the ASTM standards definitions:

ATPV (Arc Thermal Performance Value) - is the incident energy on a material that results in a 50% probability that sufficient heat transfer through the specimen is predicted to cause the onset of second-degree burn injury based on the Stoll Curve, cal/cm².

Energy Breakopen Threshold (EBT) - The incident energy on a material that results in a 50% probability of breakopen. Breakopen is defined as any open area at least 1.6 cm² (0.5 in.²)

ATPV and EBT are both evaluated in the same test (**ASTM F1959**) but the first one to be reached is the reported Arc Rating. IF the material has more thermal insulative value than arc tensile strength to heat then it breaks open first. If the opposite is true it will allow burns BEFORE it breaks open.

If an EBT value is determined and it is found to be equal to or below a determined ATPV, then the EBT value shall be reported as the arc rating value and noted as Arc Rating (EBT).

If an EBT value is determined and it is found to be above a determined ATPV, then the ATPV result shall be reported as the Arc Rating (ATPV) of the tested specimen.

An additional way to look at these ratings:

Arc Rating can be of **two types**.

ATPV: This is 50% probability of second degree burn in the 8kA arc test on a flat panel.

EBT: This is the 50% probability of a one inch crack in the material in the 8kA arc test on a flat panel.

Neither is better. Basically **EBT fabrics are typically more insulative than they are strong and ATPV materials are stronger than they are insulative**. Usually EBT indicates the garment is a knit and is more comfortable but essentially no less protective to the user. Never make a clothing protection decision based on the fact that clothing received an ATPV or an EBT. They are "functional equivalents".



www.e-hazard.com | (502) 716-7073