

# Reducing Fuse Ampere Rating Can Reduce Arc Flash Hazard

## The Time, Current, and Energy Relationship

Numerous factors affect the incident energy that results from an arcing fault. The higher the energy the greater the likelihood an exposed electrical worker will be severely burned. Though the following formula is not used to calculate incident energy during an arcing fault, it is useful for illustrating the relationship between energy, time, and current.

$$\text{Energy} = I^2 R t$$

In this formula, “I” represents the effective or RMS value of the current. The “t” represents the time the current is flowing. The “R” represents the resistance of the circuit element through which the current is flowing. In the case of an arcing fault, “R” could represent the resistance of the arc, “t” could represent the opening time of the fuse, and “I” could represent the effective value of the arcing current.

## A Lower Ampere Rated Fuse Opens Faster At a Given Current Level

Fuses have an inverse time current characteristic. This means the higher the level of current flow, the faster the fuse opens. An A6D100R (100 ampere Class RK1 fuse) will open in about 0.2 seconds with 1000 amperes applied. A 90 ampere version of the same fuse will open in about 0.07 seconds with 1000 amperes applied. As can be seen from this example, a relatively small reduction in fuse ampere rating can yield a significant decrease in opening time and less energy during arc fault conditions.

## Fuse Threshold

Current-limiting fuses are capable of clearing faults in less than ½ of an electrical cycle (less than 0.008 sec. in a 60HZ system). When a fuse performs in this fashion the fuse limits the RMS current that flows and reduces the time of the current flow. This type of performance provides an even greater reduction in incident energy. Fuse threshold is defined as the minimum current at which the fuse will open in less than ½ of an electrical cycle. A fuse with a lower ampere rating will have a lower current limiting threshold. Thus by reducing fuse ampere rating we increase the likelihood the fuse will limit both current and time during an arcing fault.

## Summary

Reducing fuse ampere rating can be an effective way of reducing arcing energy and hence providing better protection for equipment and for electrical workers. For more information on selecting fuses for arc flash hazard protection, visit: <http://us.ferrazshawmut.com/arcflash>



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