



DC Fuses

Workshop for Future DC Distribution, Golden Colorado

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October 2, 2024

Yes, fuses are still a one-shot device, always have a spare!



Fuse Types – Operating Characteristic

Time Delay – Fast Acting – High Speed – TCC (Time Current Characteristic / Curve)

Time Delay – Inductive high transient loads

Fast Acting – Resistive steady state loads

High Speed – Semiconductor Protection (DC)



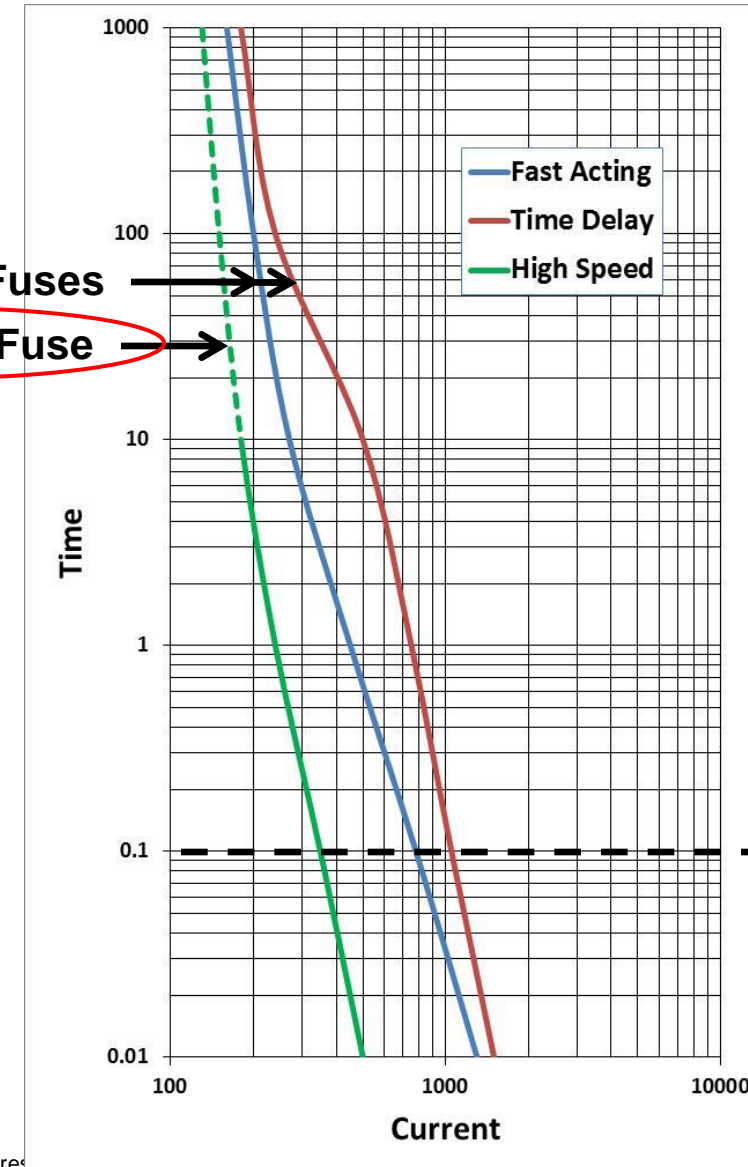
LPJ-100

JKS-100

DFJ-100

Full Range Fuses

Partial Range Fuse



OVERLOAD
SHORT CIRCUIT

Many DC fuse styles, shapes and sizes ...

Bussmann Series

Square Body (Ceramic)



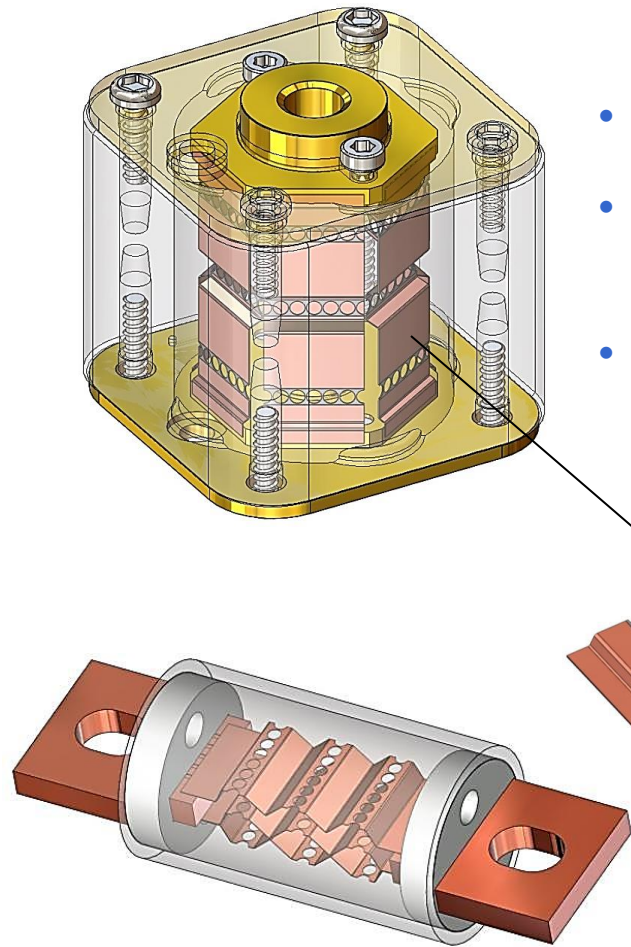
Up to 7500A
Up to 4000 V

Round Body (Composite)

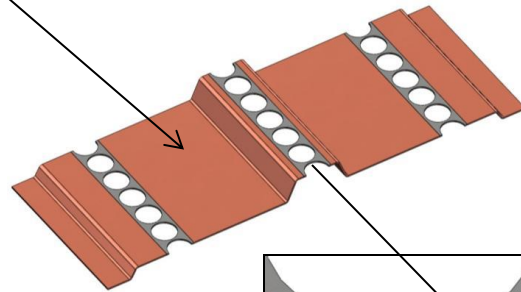


Up to 2000A
Up to 1000 V

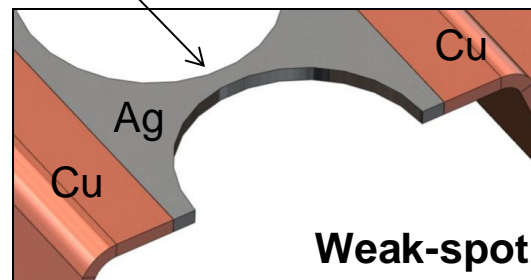
Simplicity, Reliability, Low-Cost Solution, Infinite Interruption ...



- Although fuses are a one-shot device, they offer simplicity and extreme reliability, at relatively low cost, and infinite current interruption capability.
- Solid-state metal element with no moving parts.
- Time-current operating response is programmed within the metal element shape, composition, and melting temperature.
- Today's power fuses provide the focus and isolation of overcurrent faults with current limitation by way of a dynamic melting impedance from the **weak-spot**.



- This current limiting mechanism can withstand and interrupt successfully a potentially infinite available short circuit current within the fuse voltage rating (+750kA tested).

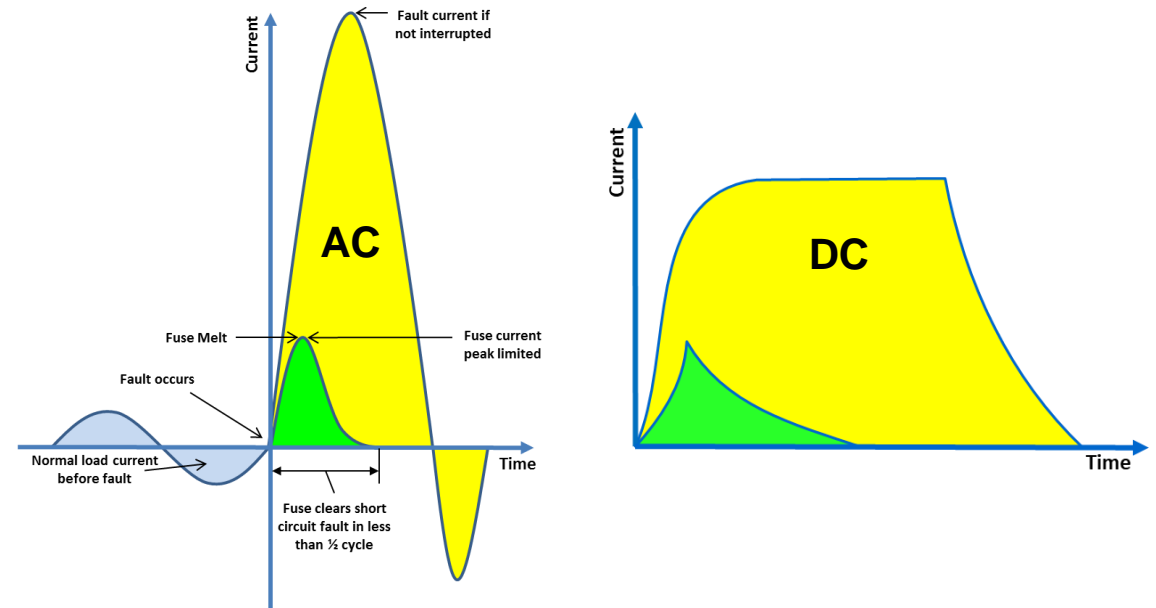


- The limiting peak current is established by the fuse element melting cross section and the metal melting temperature, typically made from copper or silver.

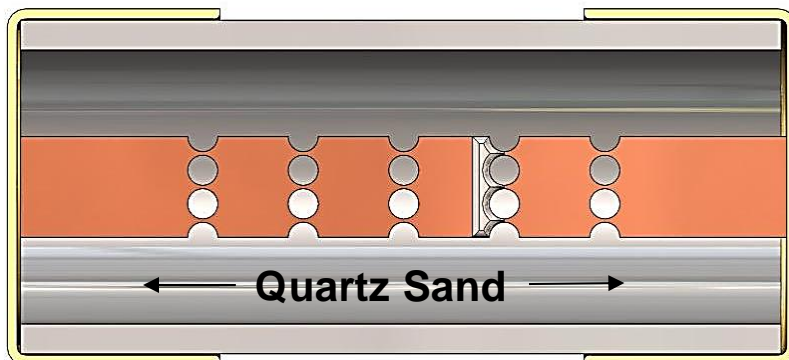
AC Fuse versus DC Fuse... What's the Difference?

None! Just the voltage rating.

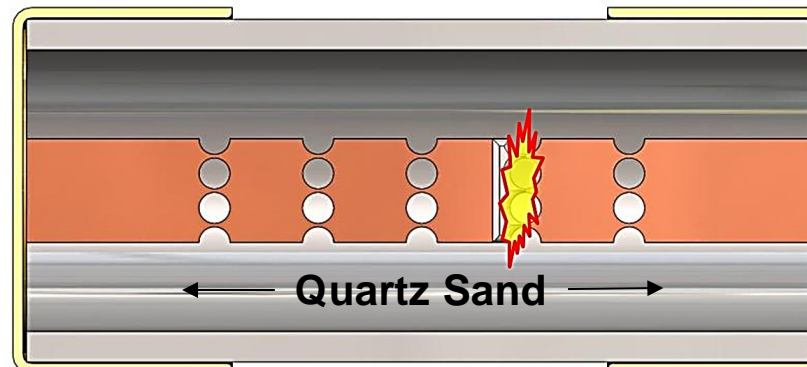
- AC fuses have the advantage with voltage zero crossing every 8.3ms to 10ms.
- DC fuses are at disadvantage due to positive voltage and LRC time constant
- **DC fuses typically have 50% of the AC voltage rating, especially for the industrial UL style fuses.**
- Long overload melting time results in a single point arcing along the fuse element, this is the voltage limiting factor.



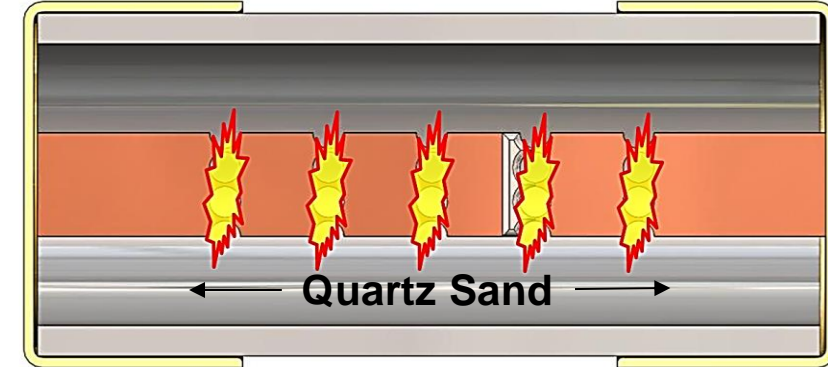
60A 600Vac / 300VDC Fuse



Overload Interruption



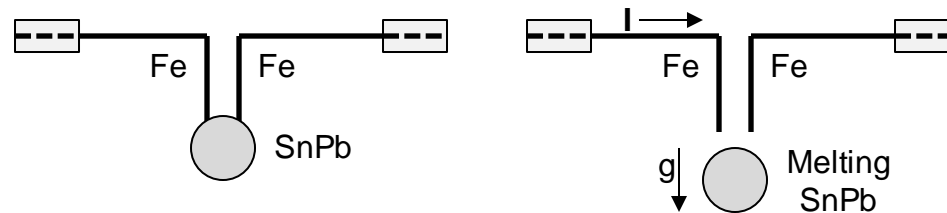
Short Circuit Interruption



The Weak-Spot and Current Limitation

Fuses have long been identified as the Weak-Link in an electrical system where overcurrent energy is quickly focused to force the fuse to open long before other thermal damage can occur along the circuit path. The first fuses were simple wires of reduced cross section as compared to the size of the primary circuit conductor.

Circa 1879 – Professor S. P. Thomson produced an "improved" wire fuse with dropout thermal load:



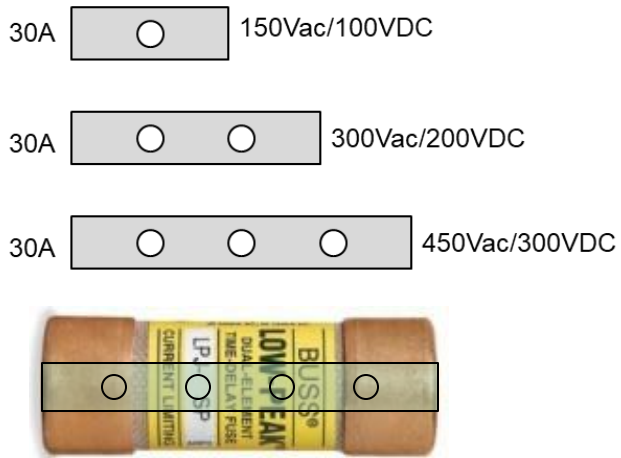
Today – The modern weak-spot and other metal systems provide the time-current response and current limitation effects for extremely reliable overcurrent protection. The weak-spot must deliver all circuit power for its entire life until called to interrupt a current fault threat.

Example: 600A Class J Fuse Current Limiting Weak-Spots

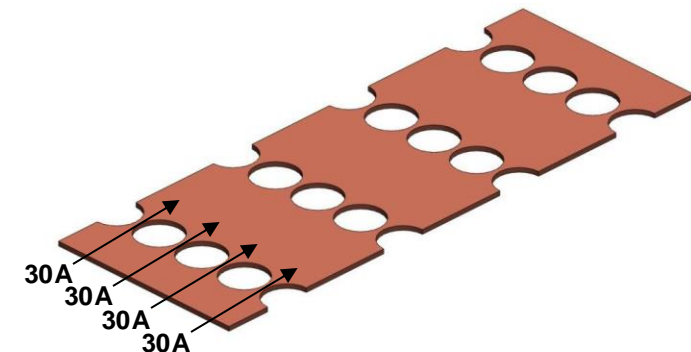


Fuse Operation for Ampacity, Voltage and Arc Suppression

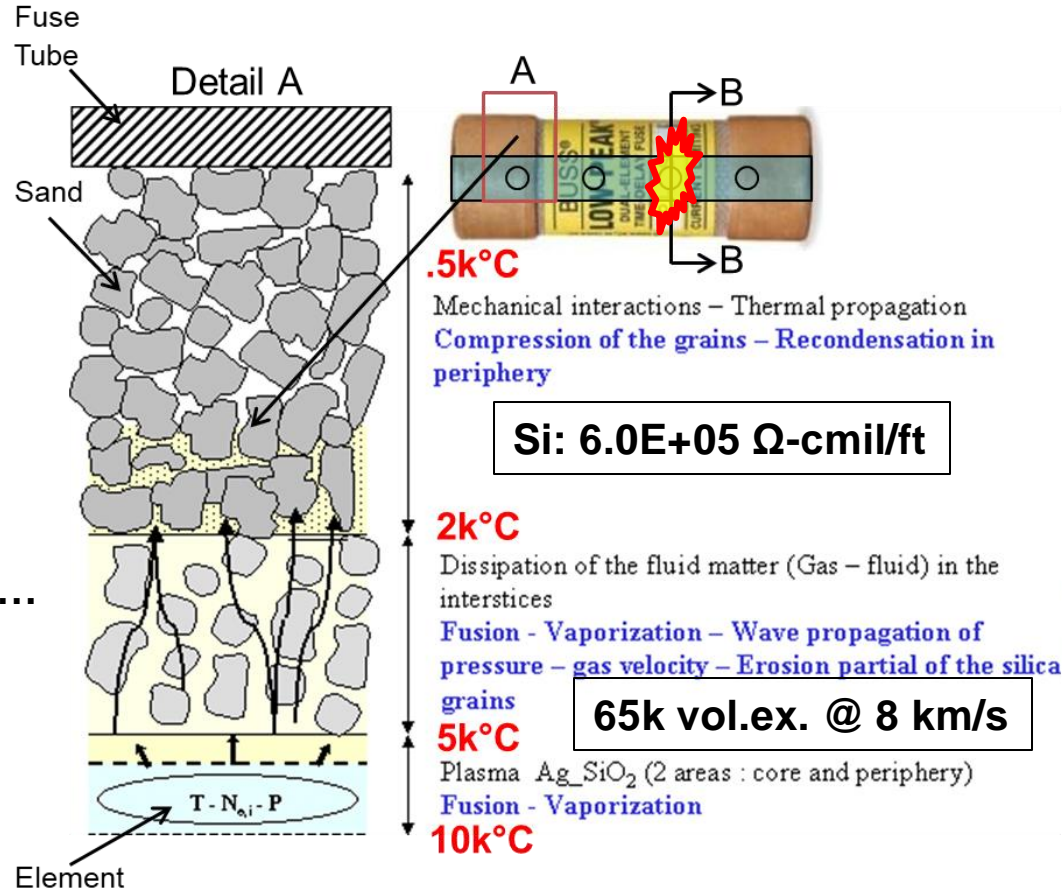
Series weak-spots for Voltage ...



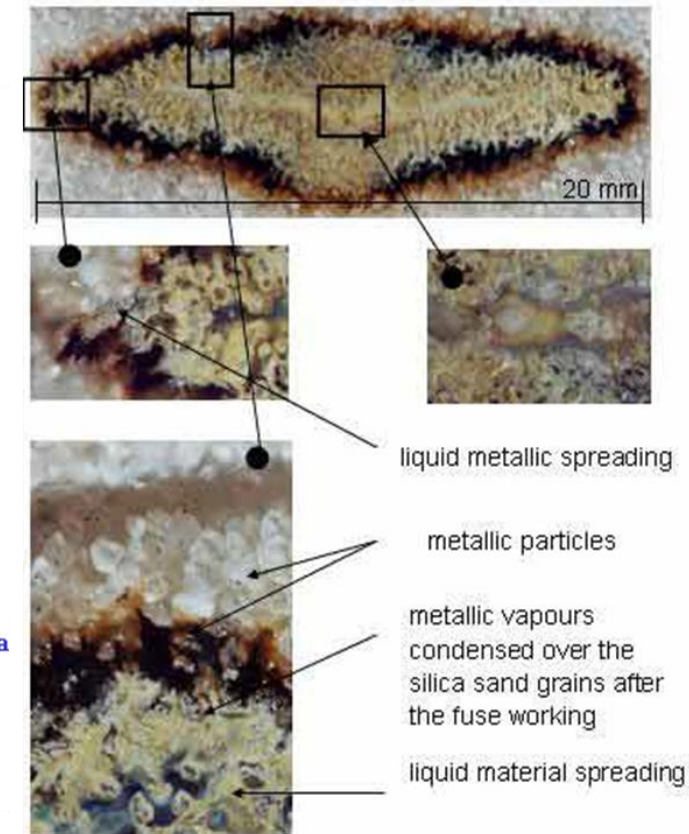
Parallel weak-spots for Ampacity ...



Quartz sand to manage the Arc ...



Section B-B



EBPS Pyro Fuse/Switch ... (self and remote triggered)

Bussmann Series



EBPSXXF40



EBPSXXF40A



Powering Business Worldwide

Rated Voltage and Continuous loading current

Catalogue numbers	Triggering Type	V d.c.	Continuous Amp. @85°C
EBPS65F40	Single Triggering	0-500	0-400 A
EBPS100F40		0-1000	
EBPS50F40A	Dual Triggering	0-500 External 100-500 Internal	
EBPS100F40A		0-1000 External 100-1000 Internal	

Breaking Capacity

Item	EBPS65F40	EBPS100F40	EBPS50F40A	EBPS100F40A
Breaking capacity	12kA @500Vdc & 20uH	16kA @1000Vdc & 15uH	15kA @500Vdc & 15uH	15kA @1000Vdc & 15uH
Operating time	<2ms	<2ms	<2ms or <2ms + C-T curve	<2ms or <2ms + C-T curve
Busbar Resistance	<50 $\mu\Omega$	<50 $\mu\Omega$	<70 $\mu\Omega$	<70 $\mu\Omega$
Isolation (busbar Vs triggering connector)	100M Ω			
Busbar resistance after operation	$\geq 2M\Omega$			
Recommended wiring	150 mm ² (For smaller cross section, please contact us)			
Operating and storage temperature range	-40°C to 85°C (-40°F to 185°F) (contact us for extended temperature range)			

FIN
