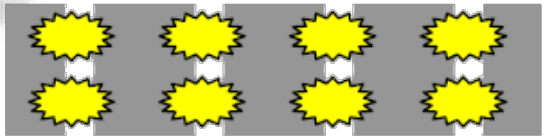
SAE DETROIT
An SAE International Section

Fusing Supplement

FSAE Spring Workshop 2017

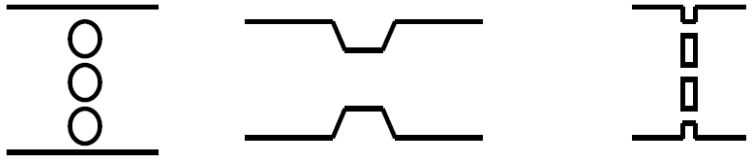
February 18, 2017

How Fuses Work

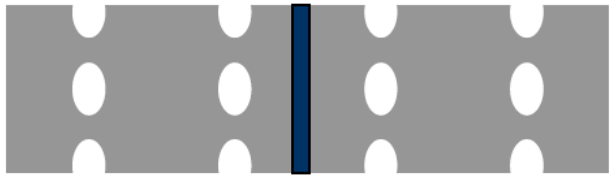


When fuse blows, arc's occur at bridges.

Sand in fuse helps extinguish arc.



Different restriction shapes lead to different shaped time current curves.

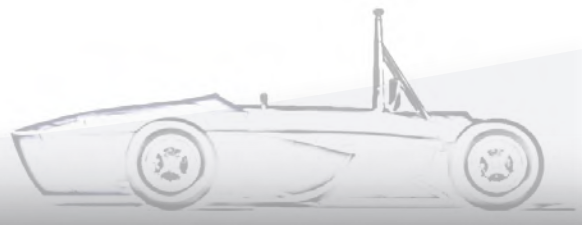


Some fuses use a strip of low temperature metal to get better protection of low overload.

Images from Ferraz Shawmut EduPack GB102 Behaviour and Operation of the Fuse

How to properly size your electrical system

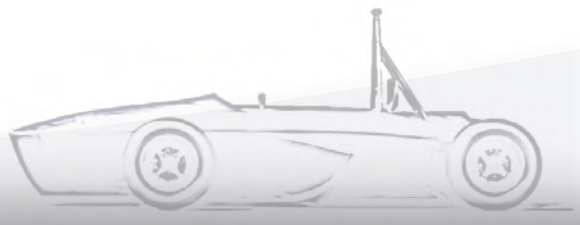
- Understand loads
  - Through simulation
- Pick fuse
  - Do you want to protect wiring only, or also devices?
  - Rule of thumb: 25% larger than continuous current
- Pick wire
  - Choose a wire size that is adequately protected by your fuse
- Check that everything is adequately protected



Picking the correct fuse

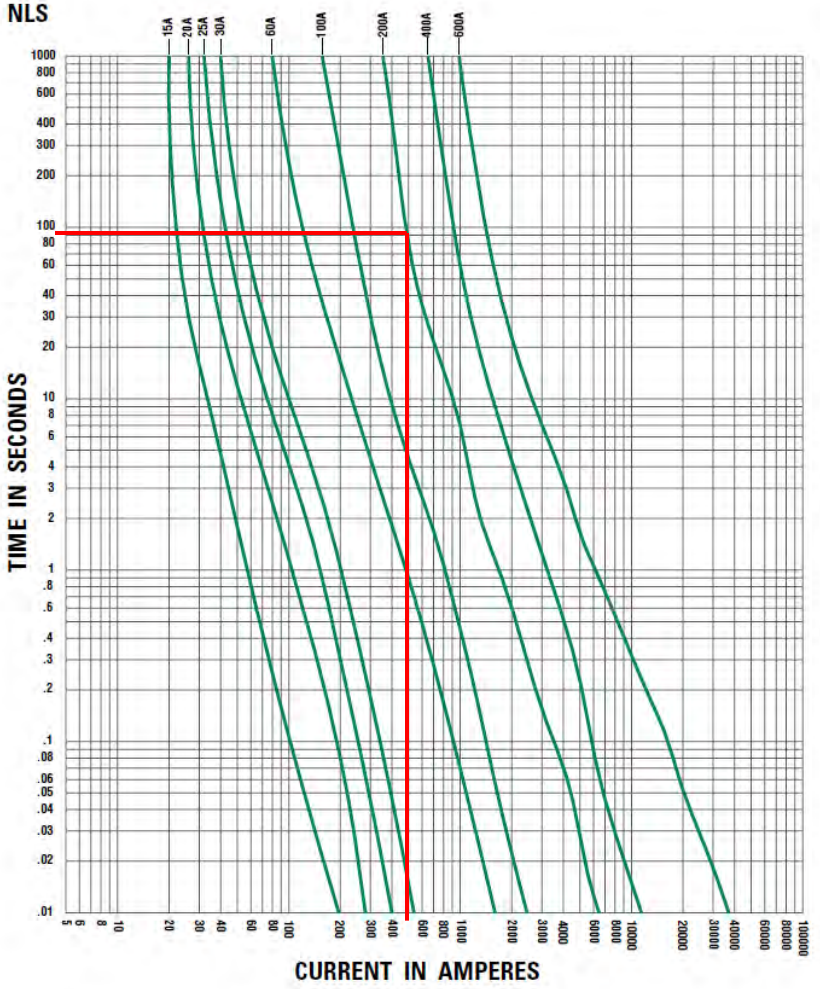
- For competition inspection purposes

Rating	Requirement
Current	Less than or equal to ampacity of smallest wire protected by fuse
Voltage	>= highest voltage in the system being protected. Must include correct DC vs AC rating
Interrupt	>= upstream fuse or short circuit current of source.



Picking the correct fuse

- Look at I^2t or time/current curve to find a fuse that will allow your peak currents through as well as continuous current



This fast acting 200A fuse will pass 500A for 90 seconds before blowing!

Picking the correct fuse

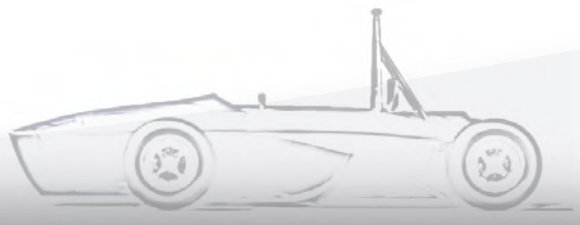
- Different fuses have different shaped curves.
- Packaging can be an issue. Some fuses rely on large size to dissipate heat
- Sometimes there are additional requirements for pulsed or peak currents to avoid thermal stress. Check the application notes/guide from the manufacturer.

Frequence of Occurence	Overloads (> 2 sec)	Impulse Loads (< 1 sec)
Less than one time per month	Imax< 80% x It	Imax < 70% x It
Less than twice per week	Imax < 70% x It	Imax< 60% x It
Severel times per day	Imax < 60% x It	Imax <50% x It

Example: Bussmann semiconductor fuse.

Why do the other fuse parameters matter?

- Voltage
  - It effects the amount of energy that must be absorbed from the arc during a fault
- AC/DC
  - In a DC system the fuse is the only thing forcing the current to 0A
- Clearing current
  - Affects the amount of energy absorbed from the arc



Where to locate fuses

- Rule of thumb, if the wire size changes, you probably need a fuse.
  - Don’t forget sense leads
- Fuse at the source end of the wire
- Supply to distribution boxes must be protected as well