



# Voltage

The sharing of the interrupting energy between the 2 bodies in parallel is not perfect.

The breaking capacity of 2 fuses in parallel can be less than the breaking capacity of 1 fuse.

**Consequence: the voltage rating of 2 fuses in parallel can be less than the voltage rating of a single fuse. The derating factor can be 15%.**

# Voltage

## The power factor

Power test stations are all different and the fault circuit inside an equipment protected by a fuse is different as well.

## We must test fuses according to IEC 60269

It means the test voltage must be between +10% and +15% above the rated voltage of the fuse (only 690V fuses are tested between 105% and 110% of the rated voltage). Therefore a fuse rated 1350V is tested between 1485V and 1559V (we try to get about 1510V). We need 3 successful tests under such voltages.

When a single fuse is operating close to its limits it will be working above limits when 2 fuses are paralleled and operate at the rated voltage of a single body fuse.

# Current rating of 2 fuses in parallel

When 2 fuses are in parallel the current rating is simply 2 times the current rating of 1 fuse providing:

## 1.Distance between the bodies:

It must be around 10 to 12mm or more but less than 30mm to avoid unbalanced resistance due to connections not symmetrical

## 2.Matching resistances:

It is also essential to try to keep the resistance of the fuses within about 5% .

# Current rating of 3 or more fuses in parallel

It is necessary to derate the fuse current carrying capability .

- For 3 and 4 bodies in parallel the current carrying capability becomes 90% the rating of 1 body multiplied by the number of fuses in parallel.

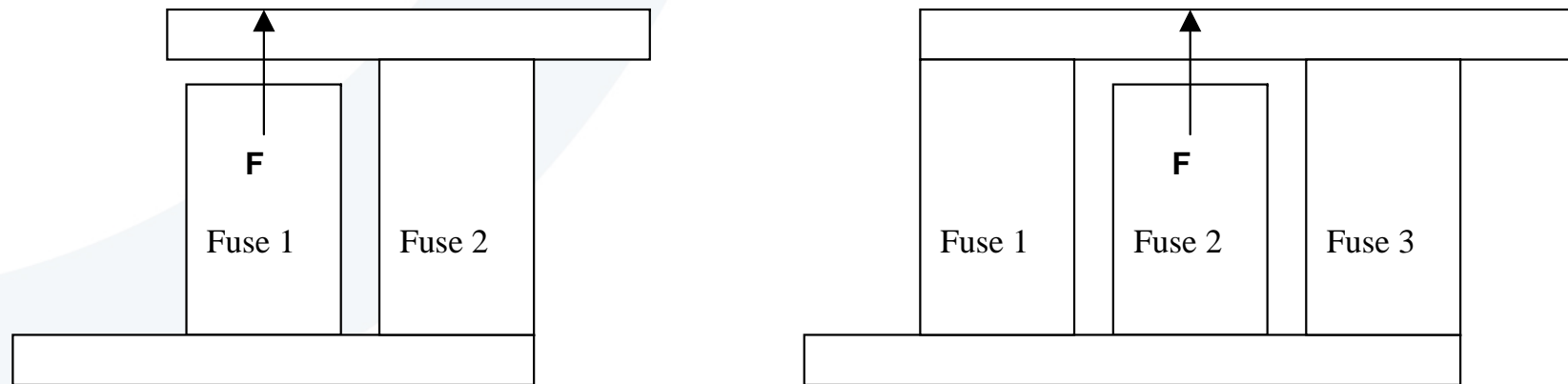
Due to their special flat design and space between bodies CV4 fuses are derated by 5% only.

- For more than 4 bodies it is necessary to check with the Mersen Technical Support. The mounting of the fuse assembly requires some special care. Information about the layout of the circuit is necessary because there are fields causing current sharing problems.

Another factor is to check carefully the resistance values of all branches created by the fuses in parallel.

## Mechanical problem when paralleling 2 or more fuses

The last problem to watch carefully is the mechanical damage due to the variations in the length of the fuse. Variations of the length of the fuses are mainly due to the variations of the length of the body.



Therefore as soon as 2 fuses are paralleled the connection on one side of the fuses must be flexible to avoid mechanical stress leading to damages on fuse elements inside one fuse.

## Other main data of N fuses in parallel

$I^2t$  of N fuses in parallel:  $N^2$  times the  $I^2t$  of 1 fuse

Peak let through current of N fuses in parallel:  $N^{\frac{2}{3}}$  times the peak current of 1 fuse (for the same short circuit current)

Arc voltage of N fuses in parallel: the **same** as for 1 single fuse

# Conclusion

Before paralleling 2 or more fuses it is necessary to check with the fuse manufacturer:

- What are the possible voltage and current ratings.
- What is the maximum acceptable difference on the resistance values of the fuses paralleled in the same assembly.

When possible use the double body fuses described in the Mersen catalog as they are tested as per IEC requirements.