

Aspen Breaker Modeling

Below are two example methods for modeling breakers in ASPEN:

Total Current Method.... Aspen uses fault current, contact parting time, and system X/R ratio to calculate the “actual” interrupted" current....

then Aspen compares it to the rated asymmetrical current calculated with the MVA rating...
$$I_{asym} = \frac{MVA}{\sqrt{3}V_{LL}}$$

Symmetrical Current Method.... Aspen uses fault current, contact parting time, and system X/R ratio to calculate the “actual” interrupted" current....

then Aspen divides it by the “rated" S factor corresponding to the breaker interrupt time...
then compares it to the symmetrical current rating.

Some findings from experimenting with Aspen results:

when using the S factors to convert from one method to the other.....

Aspen yields the same results if the X/R Ratio is large (greater than about 17)

if X/R ratio is Less Than about 17...

the method used for calculating symmetrical current described above would result in a calculated symmetrical current that is less than the symmetrical “steady-state” fault current.

Therefore, when the system X/R ratio is less than about 17...

Aspen substitutes the fault current for calculated symmetrical current (resulting in a %duty that is higher than practical)

This Authors Conclusion (2011):

the total current method would seem to be the method of choice, since it yields the same results for high X/R ratios, and more accurate %duty for low X/R ratios.

This issue may be addressed in future versions.

Aspen Breaker Modeling (cont.)

Example using Total Current Method

IEEE - Total Current (asymmetrical current used for SC MVA rating)
 If short circuit MVA is given...
 otherwise calculate: $MVA = \sqrt{3}V_{LL}I_{asym}$ or $MVA = \sqrt{3}V_{LL}SI_{sym}$

enter breaker ID

SC MVA if provided...
 otherwise calculate: $MVA = \sqrt{3}V_{LL}I_{asym}$

enter from data sheet

bus nominal voltage

description (model #)

$(\text{breaker interrupting time})/2 + 0.5$

number of operations
 (reclosing attempts + 1)

breakers should be derated
 if reclosing is enabled
 (leave this unchecked)

Circuit Breaker Info

Name= BKR# - Total Rating method= IEEE - Total current

Rated short circuit MVA= 500. Rated momentary amps= 24673.

Max design kV= 14.4 Interrupting time (cycles)= 2.0

Operating kV= 12.47 kV range factor= 1.

Memo: SDO-15-500

Tags: None

Protected Equipment Group 1

Bus: Example Bus 12.47kV

Must interrupt: Total group current Max. current in group Edit

Contact parting time (cycles)= 1.5

Total Ops = 1

Protected Equipment Group 2

None

Must interrupt: Total group current Max. current in group Edit

Contact parting time (cycles)= 4.5

Total Ops = 2 Intervals (s)= 60. Fwd faults only

Breaker Rating

Do not derate this breaker in reclosing operation No-ac-decay ratio= 1.

OK Cancel Help

Last changed May 13, 2010

enter if provided
 (close and latch capability)
 otherwise calculate = $1.6 \cdot I_{sym}$

breaker interrupt time rating (cycles)

K factor of an older breaker if known
 (otherwise use 1.0)

enter what this breaker protects...
 you must enter something
 (even if it is protecting the bus)
 for results to show up when
 running breaker analysis

usually max current in group
 consider the application

enter second group if needed

defaults to 1... leave it there
 consider decreasing if close to a
 generator with low inertia.

Aspen Breaker Modeling (cont.)

Same Breaker using Symmetrical Current Method

IEEE - Symmetrical Current (symmetrical current used for SC MVA rating) if symmetrical current is given...

$$\text{otherwise calculate: } I_{sym} = \frac{MVA_{SC}}{\sqrt{3}V_{LLS}}$$

Circuit Breaker Info

Name= BKR# - Sym Rating method= IEEE - Symmetrical current

Rated short circuit amps= 15421. Rated momentary amps= 24673.

Max design kV= 14.4 Interrupting time (cycles)= 2.0

Operating kV= 12.47 kV range factor= 1.

Memo: SDO-15-500

Tags: None

Protected Equipment Group 1

Bus: Example Bus 12.47kV

Must interrupt: Total group current Max. current in group Edit

Contact parting time (cycles)= 1.5

Total Ops = 1

Protected Equipment Group 2

None

Must interrupt: Total group current Max. current in group Edit

Contact parting time (cycles)= 4.5

Total Ops = 2 Intervals (s) = 60. Fwd faults only

Breaker Rating

Do not derate this breaker in reclosing operation No-ac-decay ratio= 1.

OK Cancel Help

Last changed May 13, 2010

enter breaker ID

symmetrical current interrupting capability...
otherwise calculate: $I_{sym} = \frac{MVA_{SC}}{\sqrt{3}V_{LLS}}$

enter from data sheet

bus nominal voltage

description (model #)

(breaker interrupting time)/2 + 0.5

number of operations
(reclosing attempts + 1)

breakers should be derated
if reclosing is enabled
(leave this unchecked)

enter if provided
(close and latch capability)
otherwise calculate = 1.6*I_{sym}
If this value is left as "N/A", zero, or blank...
Aspen defaults to a value of about 1.6*I_{sym}

breaker interrupt time rating (cycles)

K factor of an older breaker if known
(otherwise use 1.0)

enter what this breaker protects...
you must enter something
(even if it is protecting the bus)
for results to show up when
running breaker analysis

usually max current in group
consider the application

enter second group if needed

defaults to 1... leave it there
consider decreasing if close to a
generator with low inertia.



ΞΦΕΕ

Dedicated to Power Engineering

Questions or Comments ...

[contact us](#)