CB application guide C 37.010

- Status of the document
  - Approved 1999
  - Reaffirmed march 2005

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- References to be checked

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- Proposed work to be done
  - 5.13 Capacitance current switching
    - Significant changes in C 37.04a 2003
      - Introduction of restrike probability
      - Different circuit breaker classes C0, C1, C2

      ➔ Informations to be given on
        - Choosing class of CB
        - Choosing first pole to clear factor

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- Proposed work to be done
  - 5.14 Line closing (line-closing switching surge)
    - Is this an issue for modern circuit breakers?
    - Is this procedure used and followed?
    - How is the experience if used?

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- Proposed work to be done
  - 5.16 Shunt reactor switching
    - changes in C 37.015 2009
      - To be checked

      ➔ Informations to be given on
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- Proposed work to be done
  - Some general explanations to be added with regard to asymetrical currents
    - Occurence
    - Current level
    - Voltage stress
    - Etc.

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- Proposed new subclauses
  - 5.??? Controlled switching
    - Spec. Requirements for circuit breakers
      - Mech. Consistency
      - Dynamic dielectric informations
    - Req. For reactor switching
    - Req. For cap current switching
    - Req. Cap bank

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- Proposed work to be done discussed at the Meeting in Las Vegas
  - Treatment of asymmetric fault current (DC time constant) need to be revised. The “total current” method may be correct.
  - Effect of asymetry for shorter min relay times
  - Different X/R values than standard (X/R > 17)

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- Proposed work to be done discussed at the Meeting Myrtle Beach
  - Effect of asymmetry for minimum relay time less than 0.5 cycle (8.33 or 10 ms) ??
  - X/R > 17
    - how to treat it
    - How to calculate for different currents

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- Changes in IEEE C37.06
  - To be mentioned here??

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Proposals for wording

5.13 Capacitance current switching

Capacitance current switching is defined in IEEE Std. C37.04a 2003 as well as in IEEE Std C37.12. It is a switching case which occurs when switching no load lines, longer busbars or capactor banks.

The most important definitions in terms of circuit breaker switching capability and behavior are the restrike probability as well as the phase factors.

For high voltage circuit breakers three different classes of circuit breakers are defined:

C0 (undefined restrike probability)

C1 (low restrike probability)

C2 (very low restrike probability)

Basically, for a circuit breaker experiencing a low nr. Of switching operations during it's life (for example a line breaker), a low restrike probability could be expected due to the statistics behind.

A circuit breaker which is intended to be used for frequent switching operations should be specified as a C2 (very low restrike probability) breaker.

However, since the restrike probability also changes with the applied voltage a careful investigation of the the needed phase factor is necessary. A circuit breaker may be rated C2 for the lower phase factor but C1 for the higher phase factor. Since the lower phase factor occures during normal switching operations but the higher phase factor may occur in seldom failure cases such a breaker may be suitable for the system need.

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Proposals for wording

5.16 Shunt reactor switching

Tests for shunt reactor switching are defined in IEEE C37.015

Shunt reactor switching is not considered to be critical for the circuit breaker itself. However, depending on the circuit breaker characteristics the breaker may produce overvoltages which may be severe for the system itself..

The tests described in IEEE C37.015 is defined in order to gain informations about circuit breaker chopping characteristics. The outcome of this testprocedure can not be directly related to the chopping overvoltages in the real substation.

The circuit breaker characteristic gained from this testprocedure need to be used to calculate the expected overvoltages in the real application. The detailed description can be found in the IEEE C37.015.

An other way, how to deal with created overvoltage which may be a problem of other devices in the system is to use controlled switching in order to eliminate restrike overvoltages.

Doing so means to adjust the circuit breaker arcing times in such a way to avoid restrikes as well as too high overvoltages due to too long arcing times.

The breaker which should be used for controlled switching applications need to fulfill several requirements for succesfull operation.

These requirements are: stable operating times, fast enough closing speed, known prestrike characteristic, known min. aring time characteristic, known mechanical characteristic depneing on temperature and condition. The detailed requirements can be found in ???