Notes for Transformer connected to D-STATCOM

1. General

A transformer connected to the D-STATCOM is different from a general incoming transformer in the sense that it needs to take into account over-voltage, over-current, and harmonics as well as the general rated specifications because it needs to cover the operational range of D-STATCOM.

2. Necessary considerations for transformer specifications

2.1 Considerations for the operational range of STATCOM

During D-STATCOM operation, it is expected that there will be occurrences of over-voltage and over-current beyond the rated voltage and current because of its leading/lagging operation. The Hitachi D-STATCOM can operate over-voltage 10% (x 1.1) and over-current 10% (x 1.1) at the same time from the operation range of D-STATCOM as shown below. This same diagram can be found in "1.3 Specification of D-SVC, Fig. 1" in the Instruction Manual.

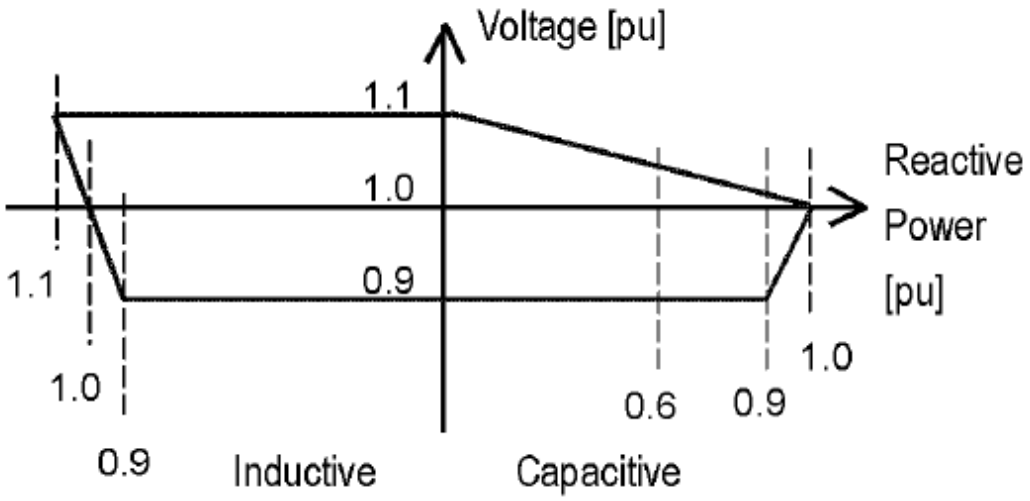

Fig 1. Operational Range of D-STATCOM

a) Over-voltage 10%

- The transformer should allow for margin of iron core magnetic flux density compared to its saturated magnetic flux density even in the case of over-voltage 10% from the rated voltage.

- The transformer should not cause excessive increase in temperature of iron core joint part as iron loss increases at under over-voltage conditions.

b) Over-current 10%

- When comparing over-current 10% to the rated current flows, the load loss of transformer increases as the square of current (I^2), which leads to 1.21 times the rated loss.

- The increased temperature of transformer winding should not violate the rated temperature value.

c) Transformer capacity

- The general rule of thumb for transformer capacity is that it should be sized at least 1.21 times greater than the rated capacity because D-STATCOM can operate with over-voltage 10% (x 1.1) and over-current 10% (x 1.1) at the same time.

2.2 Considerations for harmonic effects from the D-STATCOM

Unlike general incoming transformers which deal with pure sine-waves, the D-STATCOM-connected transformer will see a flow of harmonics. From this harmonics, the equivalent current (Ie = √(I1xI1 + I3xI3 + I5xI5 + ……)) increases and resistive load loss increases, and the stray load loss of load loss (i.e. resistive loss + stray loss) increases extensively.

Please take this increase of loss into account when sizing the transformer.

2.3 Do not violate the over-temperature limit

Check the cooling design of the transformer with consideration for increased iron loss and load loss because the iron loss and load loss increases with over-voltage, over-current and harmonics.

Generally, the factory test of transformer is done under the rated specifications, and the loss and increased temperature of test results are likely to be lower than actual loss and increased temperature during actual operation.

From the factory test, it should be confirmed that the transformer standard satisfies with the actual operation. Excessive over-temperature during actual operation would shorten the life of the transformer.

2.4 Other considerations

When transformer is excited, it has energizing inrush currents. There is sometimes limitation of energizing inrush currents, which depends on the target system.

If limitation is needed, the design to decrease energizing inrush currents should be taken into account.

The above 2.1 to 2.3 are common notes for a D-STATCOM-connected transformer, but 2.4 does not need to be considered at all times.