## Three – phase transformers

Previously we discussed about single phase transformers, and now we will discuss about three phase transformers. Three phase transformers are commonly used for transmission lines where large amount of power is being delivered. They are generally grouped together in banks.

In three phase systems two or three identical transformers may be used in banks. There are four standard ways of connecting a three-transformer bank, namely wye-wye (Y-Y), delta-delta ( $\Delta$ - $\Delta$ ), delta-wye ( $\Delta$ -y) and wye-delta (Y- $\Delta$ ). In two transformer bank the open-delta (V-V) is commonly used. Scott connection (T - T) is seldom used in some system. (Three phase autotransformers were discussed from the previous topic). When transformers are group together, it is customary to have similar kilovolt-ampere and voltage ratings and identical polarity markings. The markings are practices used by manufacturers to prevent confusion to customers.

The construction of 3 phase transformer is similar to the single phase transformers. There are two types of three phase transformers construction, the shell type and core type.

In core type three-phase transformer has a core with 3 legs or limbs. The magnetic path is formed between the yokes and limbs. Each limb contain both the primary and secondary winding. Each limb contain one phase of the three phase system. This construction is used for balanced load. If balanced load is applied, the sum magnetic flux in each leg is zero and no return leg is needed (the summation of current will be zero so no return leg is needed), If the load is unbalanced it is best to use three single phase transformers (one single phase transformer per phase). There is another construction of core type3 transformer whereas a leg is common to each phase



In shell type three phase transformers looks like three single phase shell type transformers that are vertically stacked to each other. The magnetic circuit is much more independent than core type transformer. The magnetic circuit of the transformer is connected in parallel. Due to this design the saturation effects in common magnetic paths are neglected. This type of construction is rarely used in practice. The figures on the next page shows the construction and the equivalent schamtic diagram for the shell type transformer