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Common Faults in Transformer and its Protections

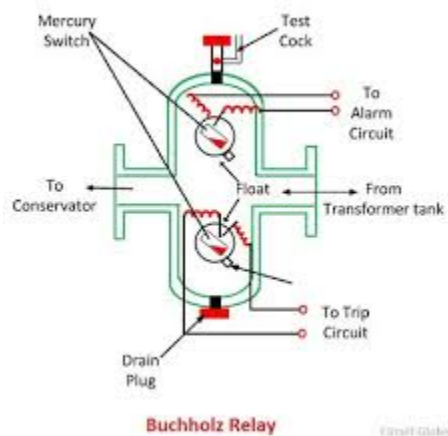
Transformer is a static device plus it is protected by the main circuit breaker thus there is almost no possibility of external fault to it other than internal faults like open circuit fault, over heating fault and winding short circuit fault.

Open circuit fault occurs when one phase of transformer become open which is relatively harmless just cause temperature rise that can be detected by temperature alarm and disconnect the transformer. Short circuit fault is relatively dangerous and need extra caution. A combination of protection system is needed for the complete protection of transformer. The deciding factors of requiring protection system are

- (1) Size of transformer.
- (2) Type of cooling system.
- (3) Transformer location in the network.
- (4) Load type & nature.
- (5) Importance of transformer.

A. Buchholz relay for transformer protection.

Buchholz relay for transformer protection is only applicable for oil immersed transformer- used mostly for transformers with ratings above 750KVA, it provides protection from all kinds of faults. It is positioned between transformer oil reservoir and transformer oil tank – in the piping system where the piping is inclined by 9.5 degree.



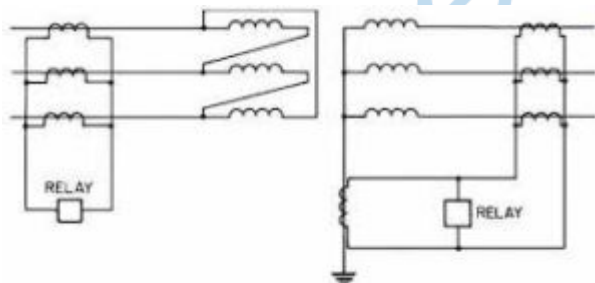
The concept of this relay is to utilize Hydrogen producing from fault heat. That is if a fault occurs either slow or fast there will be immense heat and this heat will create hydrogen from transformer oil. So if there is hydrogen in the transformer oil tank, there is fault happened.

Placement– Buchholz relay is placed between reservoir tank and transformer tank with a 9.5 degree angle piping system shown in the image.

The identification of fault by Buchholz relay is in two phase. One is slow fault another is fast fault. In slow fault there will be little amount of Hydrogen gathered on the top of relay slowly, where a tilting switch is set. If the created hydrogen pressure is as much to actuate the tilted switch then transformer fault is detected. In fast fault there will be immense heat generated which will create lots amount of Hydrogen gas, this will cause sudden inrush of transformer oil which will actuate the tilting switch placed bottom section of Buchholz relay.

B. Slow earth fault or leakage protection.

A severe earth fault leads in to a severe short circuit situation but the initiation occurs with a slow and simple earth fault. "Earth fault" means one of the core is being connected or leaked to the earthing or grounding. This happens when insulation is damaged and coil is in touch with transformer body and body of transformer is certainly connected to the ground for safety. A slow earth leakage does not do any big harm but if it is not rectified it would lead in to a severe fault in time plus cause injury to workers.

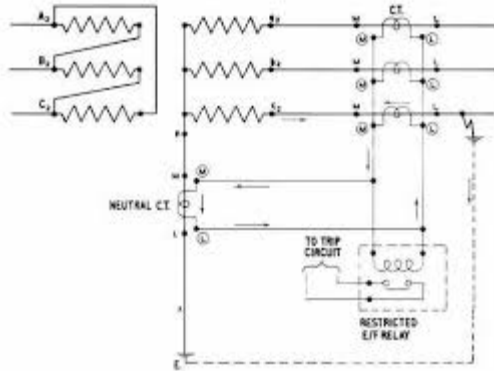


Here we can use a core balancing current transformer mechanism. The current transformer primary is measuring the vector sum of the three phase current which is zero in normal situation. If there is some value it would be in permissible range. But when one of the phase is carrying unbalanced current due to its associated core being earthed there will be some value in core balancing CT's secondary, this current can actuate the tripping circuit.

C. Combined earth fault and overload fault

protection.

Simple earth leakage relay can only protect against the slow earth leakage fault but what about over load / short circuit fault protection. We can combine both earth leakage fault and short circuit fault protection in a single circuit.



Here two over load relays can detect individual over load plus phase to phase fault and the earth fault relay is connected to the junction point of the secondaries of three phase CT. Under normal condition the current in the junction will be zero and in abnormal condition there will be current in the junction to actuate the earth fault relay.

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