5 On-site checks to inspect the transformer's health

Transformer on site checks

On-site inspection of the substation transformer usually exposes important condition changes and it initiates various suspicions that need to be investigated in detail. As with any other substation equipment, many things could go wrong during the transformer operation. For example, temperature indicators could stuck, or Buchholz relay's mechanism could falsely detect faults or even oil pump failure.

Not to speak of the oil leaks that can often indicate a potential for oil contamination, loss of insulation, or environmental problems. These are all very serious problems that substation maintenance staff must take care of very carefully when inspecting a transformer.

Such transformer inspection requires maintenance staff experienced in these techniques. Ok, let's name these checks and try to shed some light on each of them.

1. Check all temperature indicators while the transformer is online.

The winding temperature indicator should be reading approximately 15 degrees above the top oil temperature. If this is not the case, one or both temperature indicators are malfunctioning.

Check the top oil temperature next to the top oil indicator's thermo well with an infrared camera. Compare the readings with the top oil indicator. Reset all maximum indicator hands on the temperatures indicating devices after recording the old maximum temperature readings.

High temperature may mean overloading, cooling problems, or problems with windings, core, or connections.

Field testing has shown some of these indicators reading 15 °C to 20 °C lower than actual temperature.

This is hazardous for transformers because it will allow them to continuously run hotter than intended, due to delayed alarms and cooling activation. If thermometers are not tested and errors corrected, transformer service life may be shortened or premature failure may occur.

Figure 1 – Transformer thermometer

2.To Check the temperature Indicator offline

When the transformer is offline and has cooled to ambient temperature, check the top oil and winding temperature indicators. Both should be reading the same. If not, one or both temperature indicators are malfunctioning.

Check the calibration according to the proper procedure. Also compare these readings with the indicated temperature on the conservator oil level indicator.

3. To Check Conservator

Check the oil level gauge on the conservator. See Figure 2 below. This gauge indicates oil level by displaying a temperature. Compare the indicated temperature on the conservator level gauge with the top oil temperature indicator. They should be approximately the same.

Calibrate or replace the conservator oil level indicator if needed, but only after checking the top oil temperature indicator.

If atmospheric gases (nitrogen, oxygen, carbon dioxide) and perhaps moisture increase suddenly in the DGA, **a** leak may have developed in the conservator diaphragm or bladder.

With the transformer offline and under clearance, open the inspection port on top of the conservator and look inside with a flashlight. If there is a leak, oil will be visible on top of the diaphragm or inside the bladder. Reclose the conservator and replace the bladder or diaphragm at the first opportunity by scheduling an outage.

Figure 2 – Conservator oil level indicator

If there is no gas inside the Buchholz Relay, the transformer may be re-energized after bleeding the air out of the bladder failure relay. A DGA should be taken immediately to check for O2, N2, and moisture.

However, the transformer may be operated until a new bladder is installed, keeping a close eye on the DGAs. It is recommended that DGAs be performed every 3 months until the new bladder is installed. After the bladder installation, the oil may need to be de-gassed if O2 exceeds 10,000 ppm.

Also, carefully check the moisture level in the DGAs to ensure it is below recommended levels for the particular transformer voltage.

Check the desiccant in the breather often. Never let more than two-thirds become discolored before renewing the desiccant. All efforts should be made to keep the oxygen level below 2,000 ppm and moisture as low as possible.

4.To Check Conservator Breather

Check the Dehydrating (desiccant) breather for proper oil level if it is an oil type unit. Check the colour of the desiccant and replace it when approximately one-third remains in proper colour.

See figure for an oil desiccant breather.

Notice the pink desiccant at the bottom of the blue that this portion is water saturated. Notice also thst the oil is visible in the very bottom 1-inch or so of the unit. Many times, oil is clear ,and the oil level will not be readily apparent.

Figure 3 – Transformer silica gel dehydrating breather

Normally , there isa thin line around the breather near the glass. This indicates where the oil level should be. Compare the oil level with the level indicator line and refill, if necessary. Note the 1 ¼ inch pipe going from the breather to the conservator.

Small tubing(1/2 inch or so)is not large enough to admit air quickly when the transformer is de-energized in winter.

A transformer can cool so quickly that the vacuum can be created from oil shrinkage with enough force to puncture a bladder. When this happens, the bladder is destroyed and air is pulled into the conservator making a large bubble.

5.To Check Nitrogen system

If the transformer has a nitrogen blanket, check the pressure gauge for proper pressure. Look at the operators recording of pressure from the pressure gauge. If this does not change, the gauge is probably defective. Check the nitrogen bottle to insure the nitrogen is the proper quality.

Check for any increased usage of nitrogen which indicates a leak. Smaller transformers such as station service or smaller generator-step-up transformer may not have nitrogen bottles attached to replace lost nitrogen.

Be especially watchful of the pressure gauege and the operator's records of pressure with these. The pressure gauge can be defective for years, and no one will notice, and that's not good.

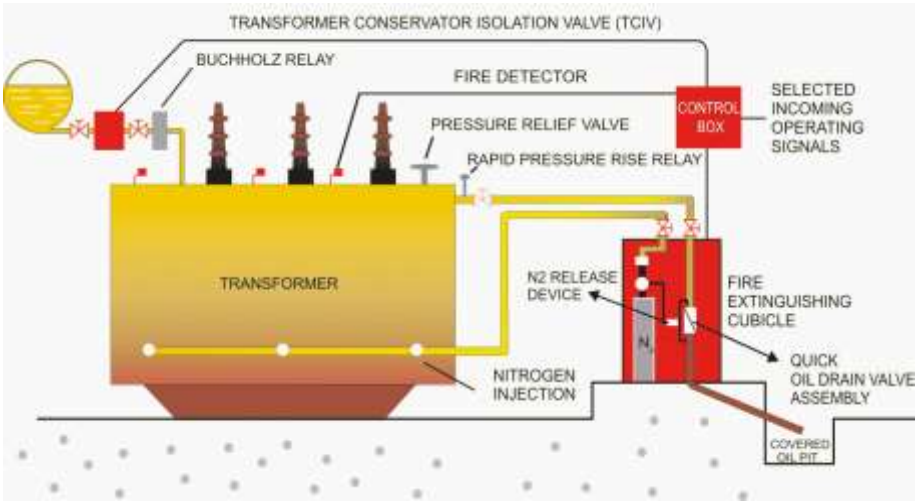

Figure-4 Injection based explosion prevention and froe extinguishing system

The gauge will read nearly the same and will not vary much over winter and summer or night and day. Meanwhile , Nitrogen leak can develop and all the N_2 will be lost. This allows air with oxygen and moisture to enter and deteriorate the oil and insulation. Watch for increased oxygen and moisture in the DGA.

An Ultrasonic and sonic leak detection instrument are usually for locating N_2 leaks.

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