Maintenance challenges for cast resin dry-type transformers

Two 25MVA 33/11kV dry-type cast resin transformers were installed in a substation to replace two oil-filled transformers which had reached the end of their serviceable life. Dry-type transformer technology was chosen due to the environmentally sensitive location of the substation. It is located close to a popular beach and the building shares walls with residential and commercial premises, so the consequences of an oil spill or a transformer oil fire would be significant.

About 5 years after the installation of these transformers, there were several faults involving flashovers across internal 33kV support insulators plus reports of audible partial discharge activity from the windings. Evidence of discharge and tracking was found on the rubber support blocks at the bottom of the windings and in other areas of high electrical stress. The cause of these failures was attributed to excessive atmospheric pollution within the transformer housing comprising airborne dust particles, sea salt, fine sand, moisture ingress and condensation.

There were several other contributing factors: the transformer bays were exposed to the external atmosphere via vents in the building roof; the transformer enclosures were specified for indoor application (IP21); the maintenance was inadequate for the application.

The core and coil assemblies were being cleaned every 6 months in conjunction with the recommended dry-type tap changer maintenance. However, the cleaning was evidently not thorough enough to prevent the discharge.

Corrective actions taken included: revision of the maintenance procedures; sealing of the vents in the transformer enclosure with a fan and filter system; and sealing of the substation building vents.

In this application, the transformers require more regular and more intrusive maintenance than the equivalent oil-immersed transformers. With the open-vented enclosures, a thorough cleaning of the main transformer components was required every 6 months, including cleaning of the ducts between winding layers. This is a rather uncomfortable and tedious task for field staff as access is difficult within the enclosures. Once the enclosures were sealed with filters and fans, the maintenance period could be extended to 12 months.

The timing of maintenance is also more critical than for oil-immersed transformers. Deferral of maintenance can lead to a build-up of contamination, an increase in discharge activity and an increased risk of flashovers and permanent damage to the active parts.

It is important to consider the local environmental conditions when deciding to use this technology. If these factors are duly considered and controlled, and maintenance activities are adequately planned, it can be a viable solution for special applications.