

INTERNAL ARC FAULT MODELLING

Customer: Network Rail

EPS was requested by Network Rail to assist in the internal arc testing of a new concept design called Containerised Air Insulated Switchgear (CAIS). This substation was constructed from a steel skeleton clad with steel panels. It housed open-frame Medium Voltage 25kV switchgear mounted on removable pallets in the MV chamber, and the associated low voltage protection & control gear in an adjacent annex.

Process

EPS imported the CAD design into its own 3D CAD environment. A study of the power levels and energy dissipation was conducted. An algorithm was developed that modelled the energy dissipation depending on a set of variables such as volume, voltage, frequency, air density, heat and pressure. The algorithm was then used to generate a pressure profile as the input to the EPS FEA CAD system to model the performance of the container during an internal arc event.

EPS managed the delivery of the prototype substation to a high-power laboratory in Germany, drafted the complete test plan and arranged for the reports of performance to be delivered to the client following a successful test. The substation was recovered and refurbished to be used as a training facility for the client.

Solution Proposed

EPS produced FEA results enabling the client to predict the breaching pressure related to the energy input from an internal fault in the substation. The prediction was that breach would occur 2.8ms after initiation of the given fault level. The client was invited to witness the live test and the breach occurred at 3ms. EPS managed the whole process of testing including writing the test program, booking the labs, transport and completing a detailed test report document. The client was now able to assess the impact of a design of a CAIS type substation with given variables as to whether additional internal arc protection strategies are required to be deployed and therefore optimise the cost of the future designs of this type of equipment.

Summary

EPS demonstrated a combination of expertise utilising state of the art design facilities that accurately predicted the failure of a given substation design due to an internal arc event. A formal document was written and approved to guide future designs of Containerised Air Insulated Switchgear (CAIS). This now gives the client confidence that their equipment deployed on their network is safe and reliable.

