ELECTRIC ARC IN G47 GROUND CABINET

QSE alert

Associated non-conformity code: NC2016002349

This document contains public information and it is intended to share the lessons learnt from incidents and risk situations that could be of interest to others in the same sector as Acciona Energía.
This document may undergo updates due to the collection and analysis of better information, because of technical advances and the proposed measures etc. For this reason, it is very important to check with Acciona Energía for the latest versions of the issued alerts.

SCOPE

☒ Worldwide ☐ Local. Country:

☐ All Businesses	☐ Construction	☒ Production	
☐ All Technologies	☒ Wind Power	☐ Hydraulic	☐ Thermo-electric
	☐ Photovoltaic	☐ High voltage	

☐ Others, Specify

FACTS

General accident context

The accident occurred in an Acciona Energía wind farm, April 2016.

A pair of "corrective maintenance" technicians went to a machine that was shut down because of the following alarm: **"Line self-protection trip"**. This is a common problem in G47 wind turbines and is caused by the failure of one or more components in this emergency line (fuses F200 and/or over-voltage F101, F103 or F104). The protocol to be applied for this alarm requires the verification of each component in the line until the "blown" element is found and can be replaced. According to this procedure, the checks should be performed with a multimeter while wearing insulating gloves, facemask and clothing providing protection against electric arcs.

All these line components are located in Ground Cabinet compartments "A" and "C" at the base of the wind turbine:

General view of the Ground cabinet compartments (ABB)

Accident description

The first verification carried out on the machine by the engineers was that of the 300 V over-voltage protections (compartment C), this was not the problem.

Then compartment A (690 V) was checked to verify the condition of over-voltage protection F101. The power transformer is located upstream from this area. Accessing this compartment requires the removal of the protective methacrylate that is clearly marked with "BEFORE REMOVAL, THE 20 kV POWER TRANSFORMER MUST BE DISCONNECTED" by means of the switchgear panel.

Close-up views of Ground cabinet compartment A in which the accident occurred.

Despite the warning on the methacrylate, the engineers removed this protection without de-energising the installation, stating that they required power to be applied in order to establish whether the components were "blown" or not.

During the verification of one of the over-voltage protections, "PHOENIX CONTACT" (F101), a short-circuit was caused, possibly due to simultaneous contact by one of the multimeter test leads between an auxiliary protection contact at 24 V and the corresponding phase at 690 V.

Consequences of electric arc

As a consequence of the arc, the affected engineer suffered temporary blindness and slight burns to the right side of his face.

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Area in which the short-circuit occurred. Simulated situation, NO POWER APPLIED

LESSONS LEARNT

- A physical protective **barrier against** direct contact with "live" parts must never be removed **without having first de-energised the installation**.

- **When performing operations, measurements, tests and verifications for electrical installations** in service in which there is a direct risk of exposure to "live" parts, the use of the following PPE against electric shock risk is mandatory: **insulated gloves, suitable for the applied voltage and protective clothing against the effects of an electric arc**.

- The is necessary **to thoroughly assess the risks in each electrical cabinet** and of the tasks to be carried out in them, as applicable:
  - → Improve accessibility to the components that are checked and replaced frequently so that verifications that require the removal of the methacrylate protections are reduced.
  - → Identify circuits that could benefit from additional protection (in this case, an isolation switch between the transformer and the machine mains input would have avoided having to disconnect the switchgear panel).
  - → Remove or disable any components that do not contribute to wind turbine control, but can still cause faults (eliminate unnecessary risk exposure).
  - → Assess the replacement of technically obsolete components for more advanced ones, (taking into account that this turbine dates from 1995). For example, in this case, the fixed installation over-voltage protectors could be replaced by surge arresters with "base + extractable cartridge" to facilitate extraction and replacement in case of failure.

- **The training and recycling of O&M personnel technical** knowledge **must be permanent**, just as with training in health and safety matters.