HVDC Networks and the Aircraft Electrical Installation

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Résumé

The new generations of aircrafts are introducing more and more electric actuators at the expense of hydraulic, pneumatic energies. This implies higher and higher voltages in order to minimize the consequences on the aircraft's weight. For non-propulsive systems, +/-270Vdc networks are envisaged while +/-1.5 kVdc voltages are mentioned for propulsion systems. The EWIS "Electrical Wiring Interconnection Systems" must adapt to the new constraints of these high voltage DC networks and in particular with regard to the phenomena of electric arcs caused by the damage of the insulators of the cables likely to arrive during the life of the plane. These parallel or serial arcing phenomena must be controlled so that the consequences remain acceptable from a safety and airworthiness point of view but also so as not to penalize operators in the case of long and costly repairs. A well-known phenomenon such as arc tracking was associated to the presence of aromatic polymer insulation. A simple protection principle was to design cables with materials not propagating the phenomena. Considering the new constraints imposed by HV, it is necessary to prepare a move from a protection based on material performances only, to a protection relying more on active means. Current protections based essentially on I^2t type curves do not allow a satisfactory response. Indeed, increasing the wiring installation clearances or putting additional protections around the electrical harnesses are very penalizing from a mass point of view. The circuit protection devices initially designed to limit cable damage during a short circuit must now incorporate other functions designed to detect arcing phenomena as early as possible in their occurrence in order to limit the consequences for the environment.

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