ROV Power Cable Ampacity In Areas With High Ambient Temperatures

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Abstract

Offshore operations, using Robotically Operated Vehicles (ROVs) in areas with high ambient temperatures require ampacity limitations to be established.
Specifically, the risk of overheating ROV umbilicals and tethers when running at high power, due to multiple layers on winch drums is a concern in areas like the Red Sea where the sea water at 1000m water depth is 27 DegC, compared to 5 DegC in other parts of the world. When working in the shallow water of the Red Sea and Arabian Gulf water temperature can be above 32 Deg C. Understanding the effects of reduced cooling will have on the ampacity of an ROV power supply system is therefore critical to understand with accuracy to avoid a system failure due to overheating.

The ROV electrical power systems has been analysed using the AC/DC and Heat Transfer Modules in COMSOL Multiphysics®. The heat buildup and current distribution on the power conductors that operate at 3000V, 60 Hertz were simulated considering the electromagnetic effects in the frequency domain as a first study, followed by second study considering the heat transfer effect in the time domain; the results have been compared to the international standard IEC-60287.
The system modeled consisted of two different winches, one in steel on deck for the 1600m umbilical , the other for the 650m tether was a winch in aluminum and normally submerged. The simulation included the cool-down rate for both the umbilical and tether when the tether management system (TMS) is recovered to deck after a period of work subsea. Based on the simulation results ROV ampacity limitations have been proposed for this type of subsea work in similar ambient conditions.
Furthermore, the physics model has been validated using a distributed temperature sensing (DTS) system, utilizing an internal optical fiber running the length of the winched cable system, during this testing the temperature rise under a steady electrical load and cool down was monitored. The results demonstrate the accuracy of the COMSOL Multiphysics® model used.