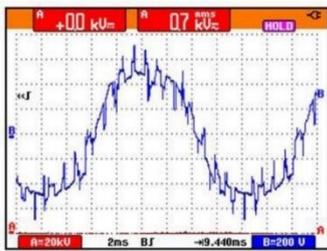


Safety Awareness Topic of the Month

Common Mode Voltage due to VFDs



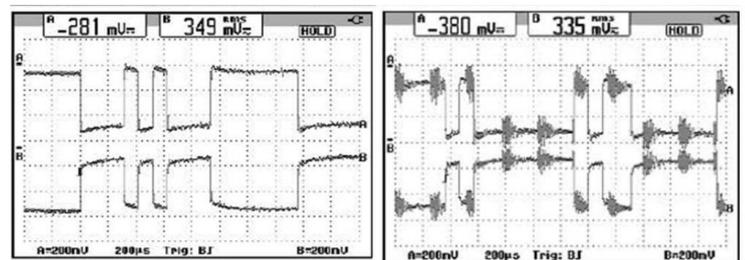
Below is the pulse train from a rig fire and gas detection system. LHS are normal pulses. The RHS pulse show the interference due to a 315kW VFD brought onboard and not installed correctly. The result was numerous, spurious fire and gas alarms and resultant evacuations.

Variable frequency drives (VFDs) have largely replaced SCRs drives on new rigs. Issues relating to harmonic voltage distortion should be addressed during the design phase and resolved. However, VFDs, if not installed in full compliance with EMC recommendations which requires special 'VFD cables' to the motors, dedicated EMC glands and equipotential grounding, can produce a phenomenon called "common mode voltage" (CMV). The result is the VFD IGBT inverter switching frequency superimposed on the phase to ground voltages.

Susceptible equipment connected to the same ground can be subject to spurious disruption (e.g. control and measurement systems, plcs, safety& alarms systems, HMIs, etc.)

Recently, a rig was unable to operate for an extended period of time due to the drawworks and top drive VFD common mode voltage affecting the control systems on cranes and other equipment.

Tens of millions of dollars in costs were incurred before the matter was resolved.



Pulse traces from fire and gas detection system. LHS is normal. RHS was distortion due to CMV.

Common mode current travels from the VFD to ground through the motor bearings. Micro-arcs at the VFD switching frequency produces flutes which damages/destroys the bearings. On VFD fed EExd explosion-proof motors, the additional danger of flameproof gap degradation exists in extreme cases, resulting in the risk of ignition of gases or vapours external to the motor carcass.

If you are experiencing unexplained disruptions and/or VFD fed motor bearing problems, the cause may be associated to common mode voltage.

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