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PATRICK RAFTER

SENIOR FORENSIC ENGINEER,
ELECTRICAL ENGINEERING SERVICES
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SPECIALTIES

- Power Generation
- Power System Analysis
- Power System Protection
- Power Quality and Harmonics
- Forensic Electrical Engineering
- Battery Energy Storage Systems
- Generator Voltage Regulator Troubleshooting and Repair
- Generator Stator Restack/Rewind and Testing
- Emergency/Standby Power Generation Systems Integration
- Motor controller design
- Machinery Control Monitoring System
- Electrical Fires, Explosions and Component Failures
- Commercial and Industrial Power Distribution
- Building IT/Telephony Systems
- Fire Alarm Systems

BIOGRAPHY

Patrick brings more than 20 years of design, analysis, testing and troubleshooting components commonly used in Power Generation and Distribution, as well as extensive experience in damage and failure analysis of electrical fires. He specializes in failure analysis of electrical power system components, analysis of power systems, and design/integration of power system components. Patrick has conducted a variety of investigations and studies involving electrical fires and explosions, power system transients, disturbances, short circuit analysis, outages, trip events, equipment failures, protective device coordination, arc flash events, switching failures, harmonics, electromagnetic interference and other electrical phenomena. He has extensive experience in investigating the root cause of failures to electrical systems and components after impact from power quality, design/installation/operation deficiencies, fire loss, and water intrusion. He is also well versed in medium voltage generation and distribution systems including steam turbine generator and diesel voltage regulators, motor generator sets, solid-state voltage frequency converters, variable frequency drives, switchboards, load centers, motor control centers, battery energy storage systems, motors, and transformers.

QUALIFICATIONS

Bachelor of Science in Electrical Engineering (BSEE), Virginia Polytechnic Institute and State University, Blacksburg, VA

INDUSTRY TRAINING, CERTIFICATIONS, LICENSES AND MEMBERSHIPS

- Engineer in Training

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- Electrical Relay Protection
- Thermal Imaging
- Hands-On Variable Frequency Drives

PROFESSIONAL EXPERIENCE

- Halliwell, Senior Forensic Engineer, Electrical Engineering Services
- Supervisor of Shipbuilding Conversion and Repair, Electronics and Fire Control Branch Head
- Supervisor of Shipbuilding Conversion and Repair, Senior Electrical Engineer
- Northrop Grumman Newport News, Electrical Engineer

REPRESENTATIVE ASSIGNMENTS

Power Quality

Ground detector anomalies | Newport News, VA
Led engineering teams on different occasions to investigate the abnormal indications on multiple 4160 VAC, 450 VAC and 120 VAC ground detectors. The medium voltage investigation test data revealed ferro-resonant conditions leading to the identification of multiple broken connections in high resistance ground detection transformers. For the low voltage ground detectors, the team also discovered capacitance imbalances due to single-phase load input electromagnetic interference (EMI) filters. Developed a protocol to address the deficiencies via in-house engineers and third-party contractors.

Permanent Magnet Electromechanical Actuator Failures | Newport News, VA
Led an engineering team to investigate an overnight loss of twenty-seven permanent magnet electro-mechanical actuator controllers. The investigation revealed the root cause as under-damped input EMI filter interaction with a DC bus overvoltage protection scheme. Advised contractor/vendor on appropriate retests to verify component re-design met specifications.

Pulsed and Ramp Load Effects on Electrical Characteristics | Newport News, VA
Led an engineering team to investigate the effects of newly installed pulsed loads may have on a steam turbine generator governor and power system electrical characteristics, specifically modulation in the voltage and frequency. Oversaw the design and installation of the power quality data acquisition system and reviewed subsequent data packages. The team determined modifications to the load profile.

Fires and Explosion

Class “C” Motor Controller Fires | Newport News, VA
Led an engineering team that investigated the root cause of reports of multiple motor controller fires over a short period. Identified gaps in contactor refurbishment procedures. The root cause of contactor failure involved mechanical interlock binding, improper lugging procedures, and incorrect contactor wipe-gap. Invoked 100% inspection, use of go/no-go gauges and retest of all controllers.

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Explosion of Energy Storage Capacitor Bank | Newport News, VA
Led an engineering team investigation to determine the root cause of an explosion of DC bus capacitors. The team identified the root cause as transient voltage due to a ground fault in a DC bus conductor which had exposed copper due to chaffing over a sharp metal bracket

Design/Installation/Component Deficiencies

Incorrect Voltage Regulator Wiring and Component Defects | Newport News, VA
Led an engineering team investigation to determine the root cause of incorrect voltage regulator and diesel governor interaction. Identified different issues in multiple voltage regulators. Issues involved current transformers installed backwards, leads installed on the wrong terminals of current transformers, and current transformer windings wound in the incorrect direction.

Generator Overexcitation | Newport News, VA
Member of an engineering team to identify the root cause of generator overexcitation events. Determined whether stator restack/rewind and rotor replacements were required. Witness stator testing and reviewed thermal imaging photographs to determine the extent of the damage. Reviewed oscillography to determine trip event time and correlations to power system state changes.

Automatic Voltage Regulator (AVR) Failure | Newport News, VA
Led an engineering team investigation to determine the root cause of the failure an automatic voltage regulator. Identified internal power supplies susceptibility to common-mode noise and possible solutions to resolve. Identified non-conforming bonding/grounding straps. Identified applicable testing to newly designed differential and common mode filter before installing in the system. Evaluated changes in component design to ensure no negative or un-intended results. Evaluated existing power distribution protection capabilities to determine adding back-up protection to AVR. Evaluated test results to confirm contractor resolution.

Semiconductor clearance violations | Newport News, VA
Independently investigated the root cause of class “C” fires in multiple identical power supplies. I identified two root causes. The first root cause is semiconductors pins violating clearance distance specification between pins and ground. The second root cause is the buildup of metallic debris from the construction environment which further shortened the clearance distance. Advised contractor/vendor of appropriate component modifications to meet specifications.

Erratic Valve Position Indicator | Newport News, VA
Led an engineering team investigation to determine the root cause of a valve position indicator not indicating true. The team identified that the issue occurred at energization of a variable frequency drive motor and suspected electromagnetic interference which led to the discovery of multiple bonding and grounding issues within the motor cable conduit and internal to the variable frequency drive, cable separation violations, and corroded filter capacitor leads.