NATIONAL ELECTRIC COIL®

Our Experience Generates Results!

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SES 503: Spark Erosion May Lead to Premature Winding Failure in Large Air-Cooled Generators

Application

Specialized Engineering Solution™ (SES) 503 discusses design solutions to prevent the reoccurrence of premature winding failures in large air-cooled generators models. These units have ratings ranging up to 240 MW. They suffer from spark erosion and rapid deterioration of the ground insulation. Many units have a strong smell of ozone. One of these modern large air-cooled generators is known to have failed in as little as four years from initial start-up.

NEC's Specialized Engineering Solution™

Many of the large air-cooled generators experiencing problems are less than 10 years old. Spark erosion of the stator groundwall insulation is very aggressive and can lead to a ground fault in a short period of time. Some of these units had to be rewound, and those that did not, show signs of rapid deterioration due to severe spark erosion activity. NEC has performed two failure analyses on two different machines from two different manufacturers. Both were found to be suffering from advanced deterioration resulting from spark erosion. Since 2003, National Electric Coil has lead the industry in identifying this trend of deterioration with large air-cooled units.

NEC's replacement winding includes design improvements that resolve OEM issues with spark erosion. Our improved design may include some or all of these options:

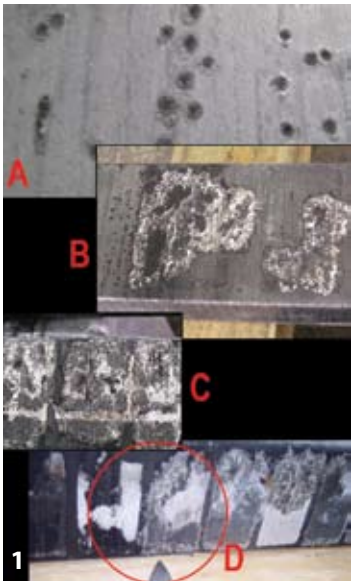
- Installation of robust semi-conductive side ripple springs that will maintain coil to core iron contact, negating the damaging spark erosion.
- Improvment of dielectric strength of the groundwall, reducing stresses on the coil insulation.
- Thorough inspection of the stator core slots for irregular surfaces that could create unwanted gaps between the coil and the iron.
- Special manufacturing process to ensure a super-smooth bar surface faces in the slot
- Use of an advanced semi-conductive compound in the slot to eliminate gaps that can lead to spark erosion
- Improvement in design clearances to lower the probability of partial discharge activity and damage in the end turns

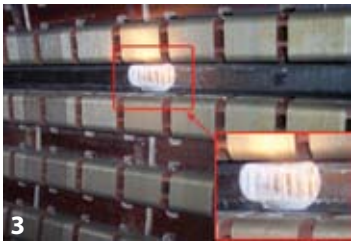
NEC Qualifications & Resources

National Electric Coil has specialized in the design and manufacture of generator windings for the last 90 years. These include windings for air-cooled generators, as well as inner-gas and water-cooled windings. NEC also has extensive capabilities for engineering design for the repairs, rewinds and upgrades of generators.

Call Us Today!

If you have additional technical questions, please call or email Bill Moore at (614) 488-1151 x125, bmoore@national-electric-coil.com or Steve Jeney at (614) 488-1151 x105, sjeney@national-electric-coil.com. NEC can help you with the initial inspection for this problem, or perform a rewind to permanently correct it.





(1) Examples A-D show the progression of groundwall deterioration initiated by spark erosion. In example D, the tip of a knife blade at the bottom of the circle points to the failure site. (2) In some units, premature bleaching of the slot cell semi-conductive tapes has been found. (3) Bleaching in the slot. (4) A number of bars from one unit were examined and tested in our factory in order to document failure sites and mechanisms. Design for the new winding has successfully addressed these issues.

Specialized Engineering Solution™ 503–ΩH–1008