GENERATOR ELECTRICAL DIAGNOSTIC TESTS: TRAINING FOR POWER STATION ENGINEERS.

INTRODUCTION

- Would you like to be able to analyze electrical test results from your generator, but lack the required knowledge or training?
- Would you like to understand why each of the various electrical tests is important, and what it tells you about the health of your machine?
- Would you like to increase your knowledge of such tests so that you can better evaluate the recommendations given to you by your generator service provider?

In the sea of available courses, it is difficult to find a tailor-made training dedicated to such a specific audience – power station engineers and operators who on a daily basis look after high voltage power generation equipment, including large turbo-generators. This training is based upon many "real-life" examples, which will help you to understand the selection of the most appropriate diagnostic tests and subsequent correct interpretation of the test results.

Over the years, the diagnostic techniques applied to our high voltage assets have evolved, and today's market has modern and possibly unfamiliar diagnostic methods which, when used correctly, help to ensure that your generators will remain in a healthy condition.

On the completion of this course, participants will be able to consciously choose the correct diagnostic methods to monitor the condition of the installed generators. Engineers will also acquire skills allowing them to make confident interpretation of the electrical test results performed on their electrical assets. The training consists of a number of exercises, to make sure that the knowledge acquired is consolidated and ready to deploy when needed.

Instructor: Wojciech Betlej Training Duration: 2 days Location: Buenos Aires, Argentina. Language: English

THE SCOPE OF TRAINING

Module 1. On-line diagnosis – test on the running machine:

• Partial Discharge (PD) Measurement

- What is Partial Discharge and when they are present
- What machine components are the most prone to high PD and why they exist
- Difference between off-line and on-line measurement
- What it is actually measured and why
- Test method
- Interpretation of test results





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- Shaft voltage and current measurements
 - What are shaft currents
 - Consequences of shaft currents
 - Preventing the shaft currents
 - Measurements of shaft currents
 - Test method
 - Interpretation of test results
- Stator endwinding vibration measurements
 - Why stator endwinding vibrate
 - Consequences of high stator endwinding vibrations
 - Preventing the endwinding vibrations
 - Test method
 - Interpretation of test results
- Rotor flux measurement
 - Rotor interturn faults what are they
 - Consequences of rotor interturn faults
 - Means to detect rotor interturn faults
 - Test method
 - Interpretation of test results
- RS0 test
 - When RSO test can be performed on-line
 - Test method
 - Interpretation of test results
 - Difference between off-line and on-line measurement
- Rotor impedance tests as an old method to find rotor interturn faults
 - History of the test
 - Test method
 - Interpretation of test results
- Open circuit tests as an old method to find rotor interturn faults
 - History of the test
 - Test method
 - Interpretation of test results

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Module 2 Stator diagnostic tests

- Insulation resistance and polarisation index test
 - Absorption current
 - Leakage current
 - Capacitive current
 - Influence of temperature
 - Influence of moisture
 - Impact of the test voltage on the result
 - Test method
 - Interpretation of test results and analysis of IEEE 43-2000

• High Voltage test AC i DC

- High Voltage test in accordance with ISO 60043
- Should you perform HV test at all?
- Test method
- Interpretation of test results
- Stator core flux test
 - Advantage and disadvantages of the test method
 - Test method
 - Interpretation of test results
- Stator core EL-CID test
 - Advantage and disadvantages of the test method
 - Test method
 - Interpretation of test results
- Winding resistance measurement
 - Test method
 - Interpretation of test results
- Partial Discharge test off-line
 - Summary and comments with reference to on-line method
 - Test method
- Tan delta test
 - Test method
 - Interpretation of test results
- Capacitance measurement
 - Test method
 - Interpretation of test results





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- Relationship between tan delta and capacitance
- Stator Wedge tightness measurements
 - Robotic inspection -advantage and disadvantages of the test method
 - Manual inspection- advantage and disadvantages of the test method
 - Interpretation of test results

Module 3 Rotor diagnostic tests

- RSO test
 - Summary and comments with reference to on-line method
- Insulation resistance test
- Rotor Polarisation Index is it worth performing PI on the rotor?
- Winding resistance
- Drop voltage test
 - Test method
 - Interpretation of test results



ABOUT THE INSTRUCTOR

Wojciech Betlej studied Electrical Engineering (MSc) at Wroclaw Technical University (PL) and Cork Institute of Technology (IRL) where he graduated with honors.

His whole career has been devoted to engineering design studies, calculations, and maintenance of turbo generators in range 10MW-1000MW.

Previously he worked for **ALSTOM** Poland where he was designing new generators and generator retrofits, then he moved to UK where he worked for **ALSTOM** generator service department, performing design studies and calculations as well as RCA of the generator breakdowns.

In 2012 Wojciech joined **QUARTZELEC** as an Engineer to lead all turbogenerator works. His involvement in generator upgrades, R&D works and different generator failure analysis around the world gave him an excellent knowledge to implement unique and bold design solutions on generators.

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QUARTZELEC OVERVIEW

Quartzelec Ltd is an independent electrical engineering group with a global presence delivering service locally from our workshop facilities strategically located across the UK, Middle East and Asia; ensuring our customers have access to the right people, with the right skills, at the right cost, of course as quickly as possible.

A multi-disciplined service provider, we deliver unparalleled engineering support in two distinct fields; Rotating Machines and Contracting Services.

This quotation is supplied from our Rotating Machines business which provides; repair, rewind, refurbishment and retrofitting service for rotating electrical machines; specifically motors and generators from 415V up to 22kV. Our scope also includes associated static electrical plant as well as mechanical balance of plant.

We actively leverage our unique and distinct heritage, tracing back to 1896 which allows us to offer solutions and services for all electrical rotating machines (up to 600MW) and associated static plant within the global market place. These services include but are not limited to:

- Mechanical repair, service and overhaul of AC/ DC rotating electrical equipment.
- Winding and re-insulation of electric motors and generators.
- In-house coil manufacture.
- On and off-site services.
- Marine and Naval Services for rotating electrical equipment and BOP.
- Cryogenic decontamination (cryogenic cleaning).
- In-situ installation of replacement components and ancillary equipment.
- Machining, including commutator skims for large DC drives.
- On and off-site diagnostic testing.
- Turnkey solutions.
- New machine manufacture, including Terminal Box replacements.
- Major spares support.
- Condition monitoring products and services.

We support the Power Generation, Oil & Gas and Petrochemical, Mining, Steel, Utilities, Naval and Marine markets and more with plant and equipment which includes:

- Steam turbine generators.
- Gas turbine generators.
- Hydro generators.
- Large AC motors (including FD and ID fan motors, BF pump and CW pump motors).
- Mill Motors.
- Ancillary equipment (which includes excitation, protection and control).





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Our Heritage

Throughout the Quartzelec business, everything we do is underpinned by our heritage of superb British engineering, acknowledged as the highest quality and most innovative in the world.

A privately owned, UK based business with headquarters in Rugby, England our specialist electrical engineering expertise combines and consolidates the heritage of our legacy companies; BTH, Metropolitan-Vickers, English-Electric, AEI, GEC Large Machines, GEC Alsthom and Cegelec. With direct access to over 100 years' of design files, original engineering drawings, tooling records and additional archived information associated with rotating electrical plant manufacture, we demonstrate a significant advantage when it comes to supporting these brands.



Quartzelec has maintained an in-house design capability to provide new equipment solutions and service to users of our installed plant worldwide. In addition we have the ability and initiative to repair, reverse-engineer or where required, re-manufacture machines or capital spares originally produced by our heritage brands as well as those of other OEM manufacture – utilizing the very best of modern design philosophy and materials.

Quartzelec Facilities

Quartzelec Rugby:

Quartzelec's purpose built facility is uniquely positioned to provide optimum service and resources for rotating electrical machine diagnostics, repair, maintenance and test.





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Global Presence:

Within the Rotating Machines business we have a strategically located service network of repair facilities ensuring we provide the necessary local support. These locations include:

UK: Aberdeen, Montrose, Sheffield, Grimsby, Bury St Edmunds, Rugby and Swansea. **International:** Middle East and Malaysia (imminent plans for the Philippines).

Quartzelec Accreditations

Quality Management System Environmental Management System Occupational Health & Safety Management ISO9001:2015 ISO14001:2015 ISO45001:2018

Additionally, Quartzelec has secured a number of 3rd party registrations and assessments further details of which can be viewed by visiting the Quartzelec Website: **www.quartzelec.com**

INFORMACIÓN E INSCRIPCIONES

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