

# NEWS: focus on electrical equipment

## Replacing or repairing a pump motor? Laborelec provides unbiased technical advice

**The Doel 1 Nuclear Power Plant in Belgium contacted Laborelec to identify the cause of a stator bar breakdown in a pump motor. Based on our independent expertise, we recommended motor replacement and oversaw the testing of the new motor.**

In the event of such a breakdown, there are two options: either repair or replace the component. Making the right choice requires the advice of an independent expert party, which is why the power plant called upon Laborelec for a root cause analysis.

### Partial discharges

Our experts cut the motor open to identify the cause of the problem. 'We determined that the breakdown had been caused by partial discharges in-between the copper conductors. These partial discharges destroyed the internal insulation, thus leading to the breakdown,' explains Gérard Platbrood. 'After additional microscopic and chemical analyses, we concluded that the motor had reached its end-of-life after 35 years of service.' Replacing the motor was therefore the only option.

### Overseeing new machine tests

The plant replaced the motor with the available spare unit. It requested that the manufacturer (OEM) produce new motors according to the specifications that Laborelec had helped to establish. Our experts reviewed the factory test procedures carried out by the OEM on the new motors. 'We oversaw the partial discharge measurements and verified that the tests were conducted in line with modern quality requirements,' states Platbrood. 'These measurements were executed on the coils at the end of the ageing tests. We communicated the results of our observations to the power plant, who used them during negotiations with the OEM concerning the motors' replacement.'

### Advice on motor replacement plan

Laborelec suggested that the acquired experience be used in maintenance planning for other nuclear plant pump motors as well. 'We advised both nuclear power plants in Belgium to establish a replacement schedule based primarily on partial discharge measurements for this type of pump motor in the coming years,' adds Platbrood. 'We also recommended the types of measurements to carry out on site in order to accurately monitor motor ageing.'

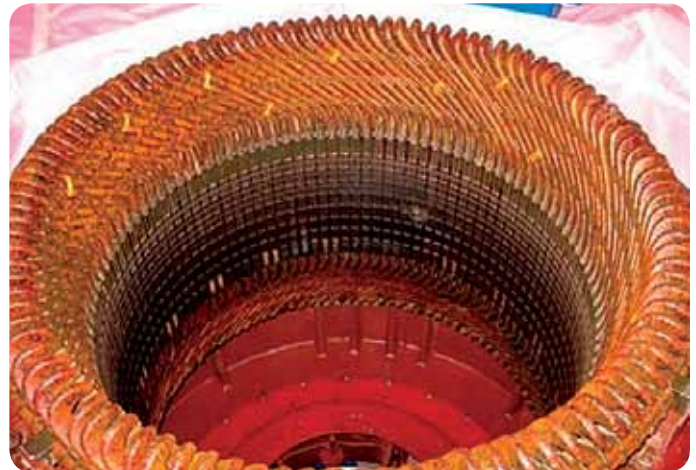


## Grabbing new opportunities related to electrical equipment

The many changes in the domain of electrical equipment have created new challenges and opportunities. The emergence of innovative technologies could radically modify today's grid design, opening up possibilities for more intelligent street lighting, among others. The ever-increasing amount of quality issues boosts the need for independent support during factory acceptance tests and commissioning of new equipment. The rise of new online and remote monitoring technologies creates a new context for operation and maintenance. This edition of Laborelec News highlights some of Laborelec's initiatives that focus on addressing these challenges.

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*The breakdown was due to partial discharges in-between the copper conductors of the stator bar.*



### In short

- Laborelec identified that a pump motor at the Doel 1 Nuclear Power Plant had reached its end-of-life
- Our experts helped establish specifications for the new motor and reviewed factory test procedures
- Laborelec also advised both nuclear plants in Belgium on a replacement schedule for pump motors



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## Thorough quality checks on medium voltage cables

**To reduce costs, power plants and industries are increasingly looking to emerging markets, rather than to local suppliers, when purchasing cables. Ordering from unfamiliar manufacturers, however, increases the need for quality audits. Laborelec offers a full range of material and electrical tests to assess cable quality.**

Laborelec carries out a wide range of quality assessments on the various components that determine cable quality. These tests answer key questions such as the following:

- > **Semi-conductors.** Does their conductivity meet the relevant specifications, and are the semi-conductors free of any impurities?
- > **External sheath.** Are the sheath's mechanical properties sufficient to ensure reliable operation?
- > **Insulating material.** Is the material in line with specifications, and is it able to withstand high temperatures?
- > **Cable dimensions.** Do the cable dimensions comply with what is announced by the manufacturer as well as with international standards?

Laborelec has both the tools and the knowledge to investigate each of these aspects.

## Presence detection lighting for bicycle paths

**Grid operators and public authorities are looking for ways to reduce the energy consumption of public lighting. One area of research focuses on lighting up bicycle paths only when cyclists are actually using them. Together with EANDIS, the grid operator of the Flemish region in Belgium, Laborelec is testing whether such a system can be implemented using LED luminaires and presence detection sensors.**

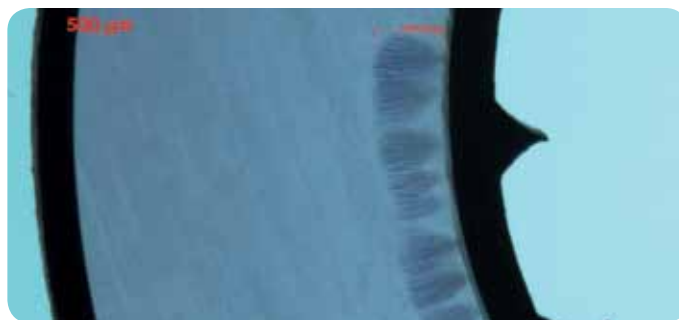
### LED technology enables rapid on/off operation

EANDIS and Laborelec have equipped a test path in order to evaluate the new system's potential. The setup features LED luminaires that not only switch on instantly but are also much more resistant to on/off operation. Such a setup would not be possible with traditional lighting technologies, since they require several minutes to reach their full luminous flux. In addition, with traditional technologies, continuous on/off operation results in significant wear.

'We monitor the installation's performance and compare its results with those of traditional systems,' states Jean-Michel Deswert. 'Initial measurements have shown that the presence detection system combined with LED technology consumes 45% less energy than traditional lighting.'

### Rapid insight into a cable's overall quality

'The numerous tests that we conduct on cable samples give customers a good idea of what they are purchasing,' says Blandine Hennuy. 'Accelerated water tree tests, for instance, enable the rapid assessment of a cable's ageing characteristics and its overall condition. The full range of tests can typically be carried out in three to four weeks. Test results are compiled into a detailed report that provides a clear evaluation of the cable's quality.'



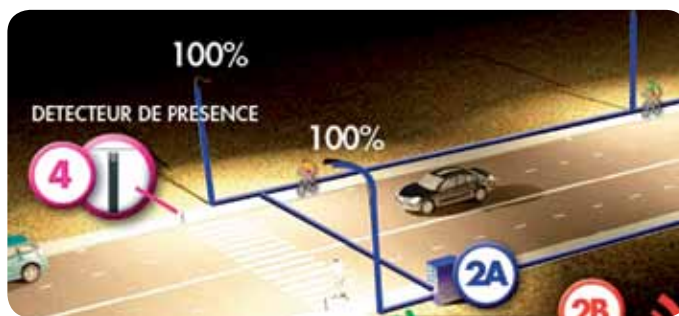
*Accelerated water tree tests enable the rapid assessment of a cable's condition.*



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### Testing a wide variety of sensor technologies

'To enable presence detection, a number of sensors will be placed in between the lights along the path,' explains Deswert. 'The goal is to test numerous sensor technologies—including radar, infrared, and camera-based ones—to identify which one is the most accurate and reliable. In addition, we are in the process of determining how many detectors need to be installed.'



*Presence detection systems enable savings up to 45% compared to traditional lighting systems.*



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## Assessing transformer quality before delivery

**Pre-tanking and Factory Acceptance Tests (FAT) on transformers are often carried out by the manufacturers. But do they always take the power plants' best interests into account? Calling upon a neutral expert can prevent costly unplanned plant shutdowns. Laborelec helps power plants avoid such shutdowns by overseeing the quality tests carried out before transformer delivery.**

Several GDF SUEZ power plants experienced issues with new transformers. 'These plants had not called upon an unbiased expert such as Laborelec to witness the pre-tanking and FATs on their transformers,' explains Marc Heylen. 'This highlights the importance of having quality tests overseen before delivery.'

### Avoiding unplanned downtime

Laborelec recently witnessed the pre-tanking inspection and FAT of the new transformers for the ultrasupercritical power plants in Wilhelmshaven, Germany, and Rotterdam, the Netherlands. These quality checks aimed to verify whether the machines comply with specifications, power plant requirements, and international standards.

## Remote rotor flux monitoring

**A growing number of power plants are operating in cycling mode. This generates additional stress on generator rotors, especially in the turn insulation, thus increasing the risk of short circuits in the rotor winding. To address this issue, Laborelec uses a flux probe that remotely monitors the presence of rotor shorted turns.**

During power plant operation, particularly in cycling mode, generator rotors are subjected to intense thermal and mechanical stresses. These can warp the rotor winding, hence creating the risk of conductors coming into contact with one another. The winding movement can also wear out the turn insulation. Such occurrences can lead to short circuits between turns. When occurring in a certain amount, shorted turns can entail rotor vibrations and thermal imbalances. Monitoring rotor condition is therefore important.

### Probe identifies changes in leakage flux

'We use rotor flux monitoring as a solution to prevent insulation and winding problems,' states Jean-Michel Meunier. 'A flux probe monitors the leakage flux emanating from each rotor slot. In the event of a shorted turn, the consequent change in the leakage flux is detected in the concerned slot, thus enabling the operator to locate the faulty slot and take the appropriate corrective action.'

'According to these standards, a number of quality and performance tests must be conducted before delivery,' notes Heylen. 'We checked, among other things, whether the dielectric tests to verify insulation material quality were carried out in compliance with specifications. We also verified that the temperature rises remained within the specified tolerances during warming up tests. Based on our assessment of the manufacturer's FAT and pre-tanking tests, the power plants can rest assured that their new equipment meets quality requirements.'



*Plant downtime can be avoided by having neutral experts such as Laborelec witness pre-tanking and factory acceptance tests on transformers.*

### From insulation to interpretation

Laborelec now offers a full service package in this field, from the selection and installation of the probe to the interpretation of flux monitoring data. 'We have already installed an online system that enables the remote monitoring of rotor flux at two combined cycle gas turbine power plants in Belgium,' adds Meunier. 'This remote monitoring enables the timely and accurate identification of short circuits. As a result, plant operators can more quickly incorporate repairs into their maintenance schedules.'



*Using a flux probe, short circuits in generator rotors can be detected remotely.*



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## Centrally monitoring transformer fleet

### Timely detection of transformer defect

For years now, Laborelec has been monitoring the condition of important transformers within the GDF SUEZ Group. This makes it possible for us to compare transformer behaviour and quickly identify internal problems. For instance, our oil experiences with the transformer of a French power plant enabled us to quickly detect a similar internal problem in the new transformer of a Dutch GDF SUEZ power plant and, thus, prevent any unplanned outage.

Thanks to transformer oil analyses, our experts identified an abnormally high gas concentration in the oil of a step-up transformer at a French power plant. Further operation of the transformer was judged too risky and, hence, the power plant had to cease operation for several months in order to repair the transformer.

#### Analyses reveal high gas concentration in transformer oil

Oil analyses in a Dutch power plant revealed that their step-up transformer was starting to display similar behaviour to that of the transformer in France. 'We increased the analysis frequency and decided to install more accurate online monitoring,' remembers Steve Eeckhoudt. 'This close follow-up confirmed the problem. Consequently, the contractor agreed to manufacture an identical replacement transformer.'

Because of the centralized follow-up, the defect was detected at an early stage. The transformer under discussion continued operation under strict monitoring conditions until its replacement, minimizing production loss.



#### Detecting Irgamet 30 in insulating oils

Oil suppliers sometimes incorporate additives into their oils to boost the oil's quality. In order to identify these additives and study their real impact, Laborelec has invested in new analysis equipment.

Using the UPLC MS/MS tool, we detected Irgamet 30 in different oil types. Steve Eeckhoudt explains that, 'Irgamet 30 is an undeclared substance that is added in order to temporarily increase oil quality during acceptance testing. It causes the oil to perform much better during accelerated ageing tests, but this effect disappears once the oil is in use.'

Based on our findings, some oil manufacturers already removed this undesirable additive from their oil composition.



*Thanks to central monitoring, Laborelec understands how to assess more accurately the condition of each transformer separately.*



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#### Sharing oil analysis expertise with Africa

Laborelec is contracted by UNIDO (United Nations Industrial Development Organization) for providing hands-on training to Algerian environmental experts on conducting PCB analyses. The agreement also includes independent PCB tests performed by Laborelec to confirm the results of the on-site analyses conducted by the local experts.

An African transmission system operator has also contacted Laborelec to screen the transformers of its high voltage grid, which covers parts of Mauritania, Senegal, and Mali. 'Our experts will rank all major transformers based on their condition in order to prioritize maintenance actions,' clarifies Steve Eeckhoudt.