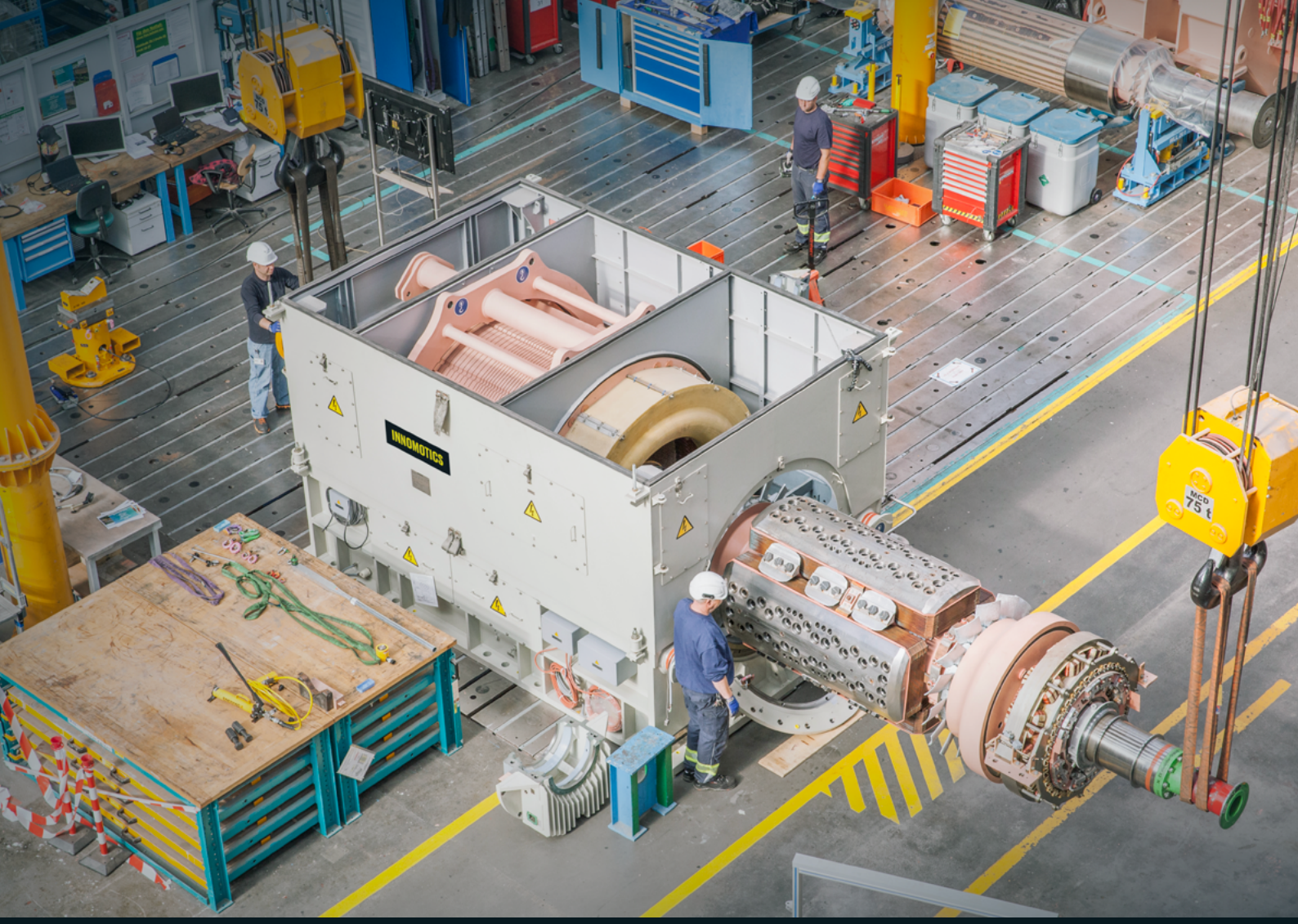


Lifecycle Services for Motors

Process critical machines – too important to fail.

INNOMOTICS

Aimed for the long run.

In every manufacturing or industrial plant, there are motors that are fundamentally important for all downstream processes. They are built to be particularly robust and reliable, but even this does not protect against component failures or the aging of materials in the long term. Regular maintenance helps to detect and eliminate emerging problems at an early stage – over the entire lifecycle.

Special machines require special attention.

Special machines carry the reason for particularly high attention already in their name. Their performance and the conditions under which they are to perform are special. And there are numerous influencing factors that could result in failure. Given the importance of the machines, it goes without saying that these factors must be continuously kept in mind.

Motor contamination

Many machines operate in environments that can lead to dust deposits. Although this may not directly affect the machine's components, it can affect the machine's cooling system. A clogged cooler reduces heat transfer in the engine's cooling circuit, which results in increased engine temperature. And because this is a gradual process, it may go unnoticed for quite a while, meaning too high motor temperatures affect the lifetime of its components.

Poor power quality

As your machine is supplied by the power grid, power quality becomes a decisive factor for its lifetime. Faults or changes in the power supply, such as voltage peaks caused by switching can cause undetected but progressing damage to the winding. On the other hand, transient voltage dips can cause prolonged start-ups or increased motor current during steady-state operation, which increases winding temperatures and aging.

External mechanical faults

The integration into the plant can also result in special loads, for example in the case of stuck working machines or blocking conditions, i.e. whenever an exceptionally high torque has to be applied. This not only stresses the motor shaft and the mechanical connections, it also accelerates the aging of the winding and increases the wear of components.

High strain during operation

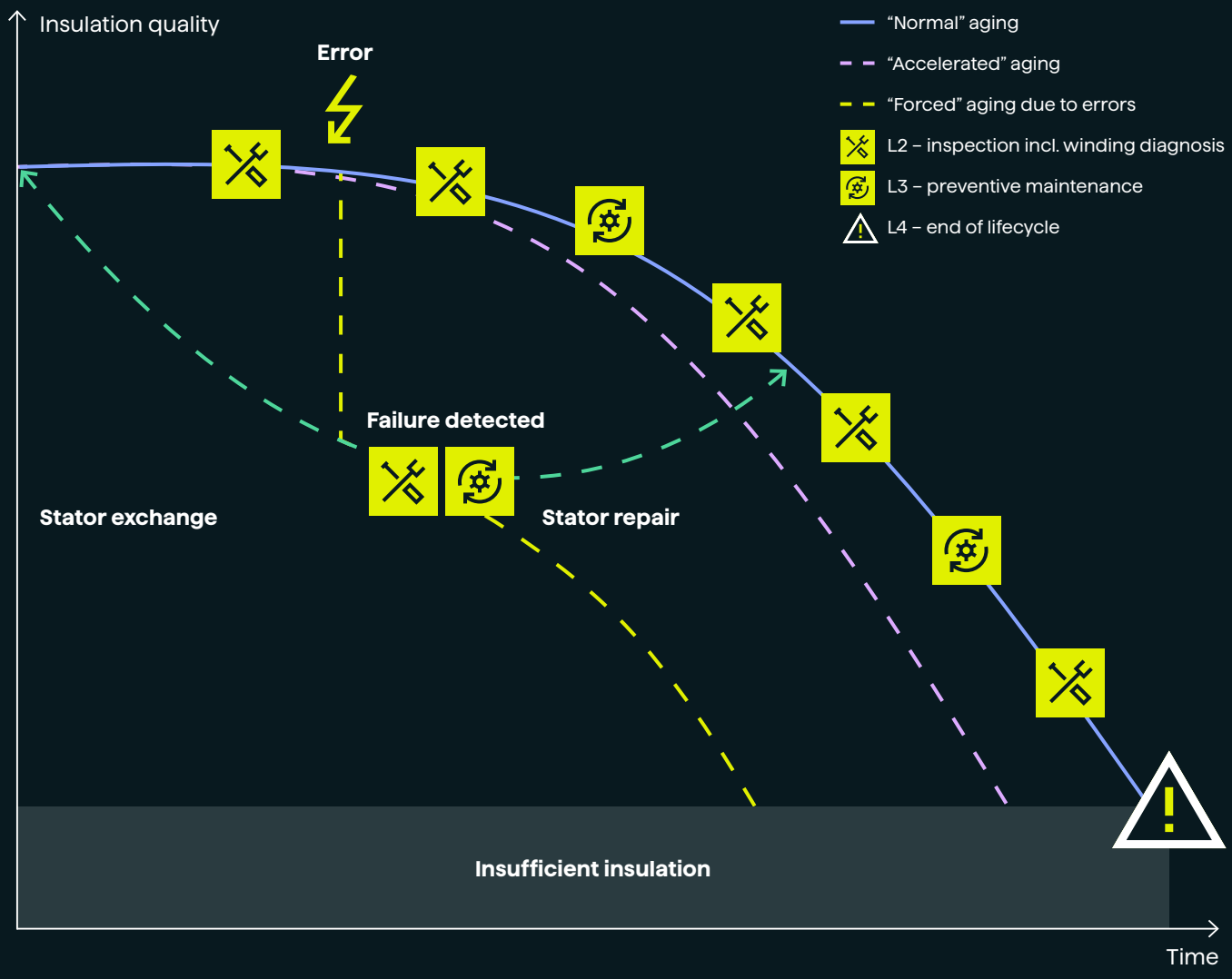
Even if the machine is well equipped for its tasks, high stress during operation can contribute to premature aging. This includes increased load and torque peaks, but also very frequent starts and operation beyond the thermal performance/capacity limits.

Conflicting objectives

Sometimes, conflicting production requirements have to be balanced against maintenance measures and budgets so that pending service cannot be carried out at the right time. The decision to continue operation is then accompanied by a reduction in service life. The same applies when tight production plans do not allow required downtimes, and maintenance measures are delayed.

Regular service helps to fight lifetime shortening factors.

How does regular service support your motor condition and reliability?



The graphic shows the immediate effect of regular maintenance on the condition and performance of the machine. Maintenance and replacement of the component in question (in this case, it is the stator) brings the machine back on the path of "normal life expectancy".

Profit from four tailored service level offerings.

In order to provide you with particularly reliable operation of your machine, we offer you four customized service level offerings for service intervals throughout the lifecycle. The packages complement each other, but are scheduled in a way that best suits the workload of your machine.
For example, inspections are scheduled annually, unlike preventive maintenance. Our maintenance plan gives you the greatest possible reliability with the least possible time burden on your processes.

Quality always starts with planning.

Perhaps we should explain what we as service specialists mean by quality. It's actually quite simple: The machine and our service are of high quality when the machine subsequently functions as planned. We emphasize the word planned, because this implies foresight and regular service measures.

Plan your maintenance

A scheduled service session always makes for a good service session. If you know what you are going to inspect and service, you can prepare for everything in good time, inform all people involved, and give them time to arrange for the shutdown. This includes downstream processes, avoiding potential follow-up costs. The table on the next page shows examples of the time intervals you need to plan for. You will receive a realistic estimate once we have precisely matched the upcoming work to your machine.

Plan your resources

With the right planning, you also succeed in keeping the downtime for service work as short as possible. If you know which parts of the plant are to be inspected, you can, for example, provide the necessary spare parts from stock or order new ones in advance, and also have all the necessary tools and, of course, the personnel ready.

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	Level 1 **Inspection**	Level 2 **Preventive inspection**	Level 3 **Preventive maintenance**[3]	Level 4 **End of lifecycle**
Maintenance over machine service life	Annually approx. 1 day, 1 FSE[1]	See schedule below, approx. 3–5 days, 1 FSE + TE[2]	See schedule below, approx. 8–10 days, 2–3 FSE	Based on motor condition, consideration of economical and technical aspects
	– I. and II. in operation – III. Motor at standstill – Open inspection covers[1]	– Motor at standstill – Water and power cables disconnected – Motor covers lifted off	– Same as Level 2 – Motor uncoupled – Suitable assembly area – Crane, supports and shaft extension	– Based on motor condition – Consideration of economical and technical aspects
	I. Data analysis e.g. vibrations, temperatures, partial discharges II. Visual inspection of the motor exterior e.g.: foundation cracks, motor anchoring, oil and water leakages, lose parts and other abnormalities III. Visual inspection of the accessible motor interior through the inspection covers for e.g.: dirt, debris, water, oil	Includes all level 1 measures plus: I. Repair/Replace according to the conclusions of earlier inspections II. Winding diagnosis of rotor and stator (insulation resistance [PI], winding resistance, PD measurement) III. Endoscopic inspection of airgap IV. Bearing: open, shells and seals inspection, resealing V. Heat exchanger inspection and pressure test according to manufacturers manual	Includes all level 1 & 2 measures plus: I. Extraction of rotor and stator II. Prepare components for inspection III. Deep inspection of stator and rotor IV. Exciter and rotating parts (sync. motor) V. Repairs if necessary VI. Thorough cleaning of components (dry ice, electric cleaner or wet clean and baking)	Options: I Repair (rewind) II. Rebuild or upgrade with new components III. Replace machine (Retrofit or replica)
Considerations for planned maintenance services	Annually, approx. 1 day, 1 FSE[1]	After approx. 35,000 hrs of operation or 4 years, approx. 3–5 days, 1 FSE + TE[2]	After approx. 113,000 hrs. of operation or 12 years approx. 8–10 days, 2–3 FSE	Based on motor condition, consideration of economical and technical aspects
	– Annual 1 day stop possible? – Evaluation of online monitoring systems	– Shutdown schedule – Crane availability/mobile crane site access – Safe working area around motor for works and testing – Working in Ex-zone (if applicable) – Availability of spare parts	Level 2 plus: – Accessibility of motor – Crane availability for heavy lift – Lift equipment – Supports/shaft extension – On-site or workshop? – Suitable assembly area – Transport way to workshop – Availability of spare components	Level 3 plus: – Availability of spare machine – Swap a complete machine – Shortest down time solution? – Expected plant operation time – Follow-up costs
Required spares for maintenance levels (motors)	Seals for inspection covers, earthing brushes, set of screws and washers, set of carbon brushes	Set of bearing shells (DE & NDE), set of bearing gaskets, cooler and gaskets, sealings for motor covers, 2 x bearing thermometers, 3 x air thermometers, 4 x vibration sensor (insulated), 1 x key phasor, 2 x motor space heater, leakage water sensor, set of screws, washers, nuts, bolts	Set of bearing shells (DE & NDE), set of bearing gaskets, cooler and gaskets, sealings for motor covers, winding repair material, 2 x bearing thermometers, 3 x air thermometers, 4 x vibration sensor (insulated), 1 x key phasor, 2 x motor space heater, leakage water sensor, set of screws, washers, nuts, bolts, set of shims, exciter parts (diodes, thyristors, TSE, firing unit)[4], hydrostatic spares (pump, piping), purge unit spares (if applicable)	Motor, stator, rotor, exciter rotor[4], exciter stator[4], slip-ring[4]

1) Field service engineer 2) Test engineer 3) Level 3 spares without winding materials = operational spares
4) Spare parts additionally for synchronous motors

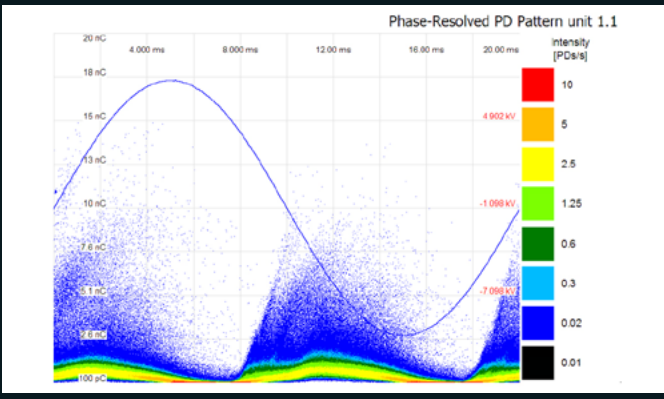
Process critical machines – too important to fail.

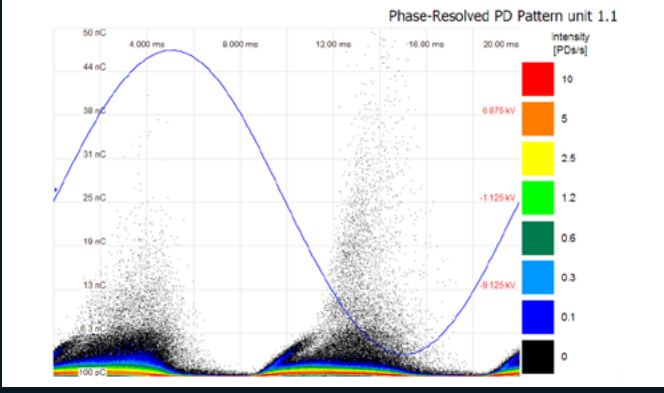
Avoid surprises.

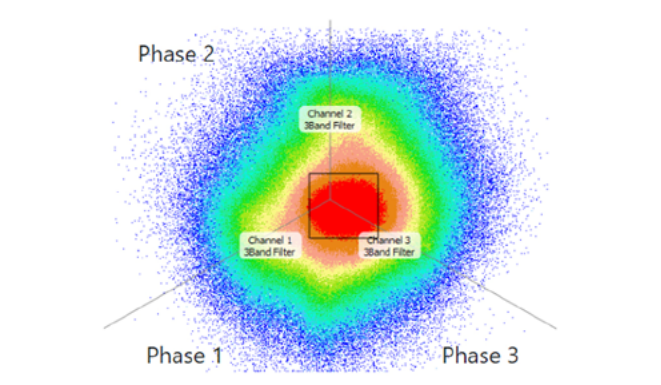
Regular winding tests through partial discharge measurement

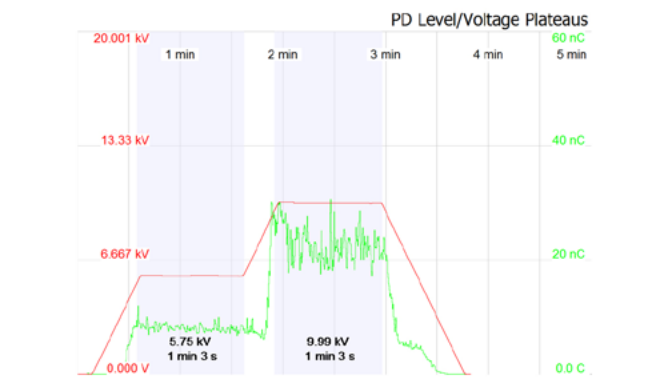
A reliable assessment of the condition of the winding insulation is crucial if you want to correctly estimate the remaining service life of your machines or detect imminent problems at an early stage. One method of doing this is to measure partial discharges (PD) within the insulation or between insulation surfaces and the ground potential. PDs are the result of local electrical voltage concentrations in the insulation or on the surface of the insulation.

PDs are characterized as localized electrical discharges/breakdowns between conductors in the electrical insulation of high-voltage windings that do not completely bridge the space between the conductors. The PD activity erodes the organic insulation components due to the discharge. Depending on the position, discharge intensity and frequency, this results in aging of the insulation and, eventually, its breakdown. PD measurement helps you evaluate the dielectric condition of your high voltage equipment, find local weak points in the insulation and consider the specific countermeasures you should take.









Process critical machines – too important to fail.

Consider a spare machine

In addition to regular maintenance work, depending on the importance of your machine, you should consider whether keeping a spare machine on hand might not be the right way forward for you. Ultimately, this can only be decided on a case-by-case basis, but in principle, issues such as the construction or delivery time of the machine and its adaptation to the conditions at your site (shaft height, mechanical and electrical parameters, etc.) and a certain lead time for ordering (capacities in the factory, procurement of components) must be taken into account.

From the point of view of minimizing downtime, a replacement machine is the silver bullet for greater availability and production reliability, because it can swiftly be installed to relieve any time pressure during the service work.

Need proof?

With Innomotics services, you can count on a dedicated team of over 2,000 engineers, technicians and specialists who are highly focused on every aspect of your machine. Safe, professional and state-of-the-art – and always there where you need us, 24/7. With decades of experience and more than 100,000 machines under our care, we offer a tailored solution that keeps your systems running trouble-free, in more than 44 countries worldwide.

Do you need more information?
Contact us

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Published by
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TH I06-240366 FL 0924