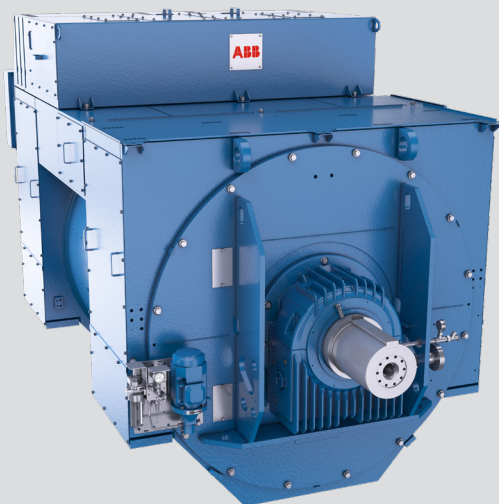


Diesel to gas engine conversion

Recommendations for continuous generator availability



The paper describes the recommended inspections, maintenance and upgrades when converting a combustion engine's generator from diesel to gas.

—
01 High voltage generator
for diesel and gas engines

Securing generator availability

When converting a combustion engine's generator from diesel to gas, the following inspections, maintenance and upgrades are recommended to secure the generator's continuous uptime and availability:

- L3 or L4 maintenance
- Hydrostatic jacking
- ABB Ability™ Condition Monitoring for HV motors
- Air gap inspection (not required if an L4 is executed)
- ABB Ability™ LEAP

L3 or L4 maintenance prior to engine conversion

L3 or L4 maintenance provides a snapshot of the generator's condition before combustion engine conversion. The snapshot provides a comparison of the generator's vibration and/or load cycle status, to gauge their impact before and after conversion.

The recommended maintenance program for ABB's synchronous generators consists of four levels, L1 - L4. L3 maintenance should be scheduled at least every 40,000 equivalent hours of operation, or maximum six years. L4 maintenance should be scheduled at least every 80,000 equivalent hours of operation, or maximum 12 years.

During L3 or L4, several critical inspections are performed and parts are replaced. Due to the vibration levels to which combustion engine driven generators are subjected, it is important to thoroughly inspect the generator for cracks and loose cable connections.

An L3 maintenance takes, on average, five days, while L4 maintenance is typically 10 days. Both L3 and L4 have a specific kit of recommended parts that should be at site when the maintenance starts.

For best results, it is recommended that ABB service specialists execute the maintenance.

Hydrostatic jacking

As a gas-driven generator turns more frequently at very low speeds than its diesel counterpart, it is recommended that hydrostatic jacking is fitted to the generator.

When the shaft rotates slower than designed, the oil film within the generator's sleeve bearings – which prevents contact between the shaft and bearing shells – does not work efficiently, causing wear to the sliding surface.

—
01 High voltage generator
for diesel and gas engines
with hydrostatic
jack-up unit

—
02 Hydrostatic
jack-up unit

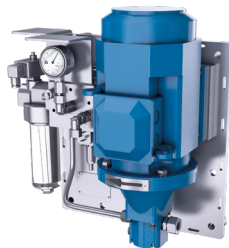
—
03 ABB Ability™
MACHsense-R data
acquisition unit

To avoid this wear, jack-up units ensure sufficient oil film is always present. A jack-up unit supplies oil at high pressure, lifting the shaft off the bearings and creating an oil film between the shaft and bearing.

ABB supplies all the materials and documentation for retrofitting the hydrostatic jacking to ABB generators. To ensure the best results, ABB service engineers can provide on-site installation assistance. To find out if the generator was originally fitted with hydrostatic jacking, contact ABB, quoting the generator's serial number. Alternatively, a visual inspection can verify if the corresponding pump and pump motor is fitted on the generator's frame, as shown in the images below.



01



02

ABB Ability™ Condition Monitoring for HV motors

The ABB Ability™ MACHsense-R data acquisition unit is a premium solution to convert electrical generators into smart, connected devices.

Installing ABB Ability™ MACHsense-R three months or more ahead of a combustion engine conversion ensures that the generator's operating behavior and trends are accurately documented. After the conversion, any changes are immediately detected and the operator is warned if any risks are identified.

The ABB Ability™ MACHsense-R data acquisition unit is configured using inputs from vibration accelerometers, magnetic field sensors and (if RTDs are available) winding and sleeve bearing temperatures.

Advanced algorithms – based on ABB's extensive know how and experience – analyze the data and produce meaningful information on the condition and performance of the generator. The data is available on a secure cloud-based server where it is stored in an encrypted form. Authorized users can easily access the information through a dedicated web portal, a cell phone app or even using an API.

ABB Ability™ MACHsense-R output parameters include:

- Bearing condition parameters
- Overall vibration (velocity RMS)
- Operating parameters (frequency and running speed)
- Vibration spectrum
- Rotor condition parameters
- Installation parameters (unbalance, alignment and eccentricity)



03

Air gap inspection

For those generators requiring only L3 maintenance, rather than L4, a thorough visual inspection should be carried out of stator and rotor inner surfaces, windings, wedges, stator teeth, air ducts, rotor support blocks and parts of the end windings.

If the air gap is at least 10mm the best option is to use the ABB Air Gap Inspector. For smaller air gaps a conventional boroscope method is used.

The ABB Air Gap Inspector is equipped with five cameras: three up front, one at the rear and one beneath.

The front-mounted, side-facing cameras can be angled to provide the best possible view of the stator teeth and air ducts. Output from the cameras passes through the tether to the display and the high-resolution video feed is recorded for future analysis. Light is provided by LEDs mounted next to the cameras, and the intensity can be set by the user.

04 ABB Air Gap Inspector

05 Stator insulation condition information provided by ABB Ability™ LEAP



04

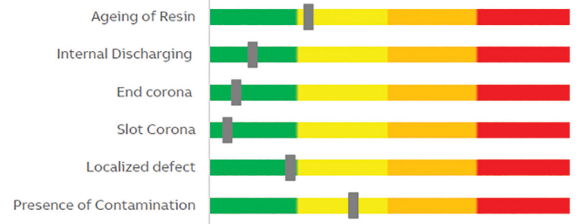
The crawler attaches itself to the stator using magnets fitted under the belts. The spacing of the track modules is configurable to allow the crawler to fit in a wide variety of generator designs. This is accomplished with configurable linkages between the tracks and crawler body, and at the hinge between the track halves.

ABB Ability™ LEAP

ABB Ability™ LEAP (Life Expectancy Analysis Program) analyzes the condition and expected lifetime of the stator winding insulation – the most uptime critical component in the generator.

A combination of dedicated equipment and traditional AC and DC tests mixed with exclusive ABB tests, ABB Ability™ LEAP creates a detailed picture of the stator insulation condition.

Access to information on the actual condition and expected lifetime of the insulation allows optimal planning of short- and long-term maintenance, thereby improving run/repair/replace decisions.

Stator insulation condition at a glance


05

Tests include:

- PDCA – Polarization-Depolarization Current Analysis
- TDCA – Tan Delta & Capacitance Analysis
- NLIBA – Non-Linear Insulation Behavior Analysis
- PDA – Partial Discharge Analysis

Report content:

- Visual executive summary
- Graph of expected remaining lifetime
- Recommendations
- Individual test details and comparison with norm values
- Explanations of each test



For more information please visit:

new.abb.com/motors-generators/service

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB Ltd does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB Ltd.
Copyright© 2021 ABB
All rights reserved