



Wind Turbine Service of Low Voltage Products

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The future of your low voltage equipment depends on the service provided since installation. ABB helps you to understand the importance of choosing the appropriate service strategy for your wind farms and all of its components. We have the expertise and experience to help you find and implement the right service for your devices at the right time, ensuring optimal performance of wind assets. ABB will guide you and support you throughout the entire lifetime of your low voltage products.

ABB is your best partner for ensuring a long and reliable life to your wind assets minimizing the Levelized Cost of Energy (LCOE) based on proven experience and expertise.



The maintenance of Circuit Breakers and Control Products, mainly contactors, is vital for ensuring the correct behavior of your wind turbines in case of fault conditions. This helps to avoid undesired malfunction and energy losses.

As the wind generated power gains importance in its industry, there is an ever increasing focus on optimizing the performances of the assets. Crucial to achieving this, is a proper maintenance plan, integrated with life cycle management services.



Any unexpected shut down of a turbine would lead to high financial losses; the fact that wind is not a constant and predictable energy source makes more important to avoid them since this profit loss could be higher during high wind speed periods.

A typical wind turbine requires routine service once or twice per year: oil and filters need to be changed, operating components need to be inspected, and bolts need to be torqued.

The electrical system has to be maintained with the same frequency: Circuit breakers and Control products have to be periodically maintained to ensure that they function correctly especially where environmental conditions are not the ideal ones.



Typical environmental conditions in turbines are:

- Harsh environments
- Temperature stresses
- Over utilization
- Salty atmosphere
- Vibrations

Any of the above conditions can greatly influence the life of any electro mechanic equipment. Circuit breakers and Control products are protective devices, therefore special attention should be taken to keep them in good conditions. For this reason ABB Low Voltage Product offers different Service solutions to support customers during the complete life of the wind turbine.

Good to know

In November 2014, in a historic joint announcement with China, President Obama laid out an ambitious but achievable target to reduce greenhouse gas emissions. China announced its intent to peak carbon emissions around 2030 and to double its share of zero-carbon energy to 20 percent.

In August 2015 the Clean Power Plan, an historic step in the Obama Administration's fight against climate change, announced by President Obama aims to reduce carbon dioxide emissions in USA by 32 percent from 2005 levels by 2030, 9 percent more ambitious than the proposal. One of the goal is to "Drive more aggressive investment in clean energy technologies than the proposed rule, resulting in 30 percent more renewable energy generation in 2030 and continuing to lower the costs of renewable energy".

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Service of Low Voltage Products

Low voltage circuit breakers and control products which are not maintained for years have a higher risk of fault. What could happen if they do not work when it is necessary to interrupt a the current?

- Loss of production
- Decreased efficiency
- Increased Risk of damages
- Risk of personell injuries
- Automated systems determine the operational parameters of a turbine. Systems must be reset after line or grid outages.

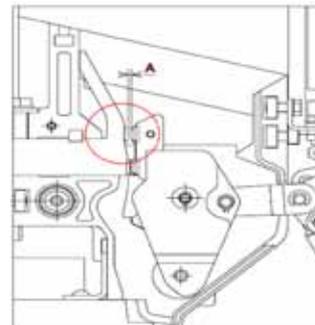
A massive utilization especially in harsh environments can negatively affect the health of any device.

In particular the following factors can cause major damages in a wind application:

Dust: can harden the grease present in the operating mechanism resulting in impaired movements in the opening of the breaker. It is recommended to periodically remove the old grease with a dedicated diluent and put some new. Not all the greases have a the same lubricating properties. For this reason ABB suggests to use specific and tested consumables giving clear instructions on the points involved in lubrication. An other important factor to consider is to avoid dust in between any contacts as it might affect the breaking capacity.



the mobile and fixed contacts. The wear of the contacts result in overheating during operations. For this reason periodic inspections are recommended.



Circuit Breaker	A
E1-E2-E3	≥ 1mm → OK
E4-E6	≥ 0,8mm → OK

Marine atmosphere: while circuit breakers are tested and certified to operate even in harsh environments (IEC 60068-2-11), marine atmosphere remains one of the most corrosive environments for the circuit breaker. The salt mist affects all parts of the breaker, from the small steel parts, to the conductive parts, and even to the lubricants.

Vibrations: high and frequent vibrations can cause contact points to loosen and overheating of lice parts. For this reason it is recommended to periodically verify the screws tightening. A controlled environment is always recommended, when it's not possible more frequent inspections must be implemented.

Temperature: components like metals, plastics and electronics PCB are influenced by thermal shocks. Temperature above or below the thresholds can cause mechanical stresses and a faster aging of the lubricant.

Utilization: The contactor main function is to switch and isolate the circuit. A circuit breaker has the double functions to carry and interrupt the current in normal and fault conditions. These functions are carried out respectively by

Do you feel confident with protecting and operating devices that are not maintained?

Are you prepared to bear the costs of an unexpected shutdown?

The life expectancy of any circuit breaker depends on wear and aging of the most sensitive components:

- **Arc chutes:** A regular inspection of the arc chutes is required to have an efficient cooling and breaking of the arc with an efficient interruption of the faults



Air circuit breaker (right) and contactor (left) arc chutes

Contacts: the function of the main contacts is to carry the nominal current. Such contacts are made with materials that minimize the contact resistance. Similarly the breaking contacts are made with a more resistant material in order to interrupt either the nominal and faults currents. The contacts wear increases the power losses, they must be checked and adjusted. In case of very bad conditions, the entire poles can be replaced



Operating mechanism: It is one of the most critical element as it is subjected to the mechanical wear. The presence of dust can significantly decrease the mechanical life of the operating mechanism, and also cause deterioration of the lubricant



Racking in/out device: only for draw out version of circuit breakers, it's a crucial components for the safe connection and disconnection of the breaker, from the switchboard



Jaw contacts: they connect the moving part to the corresponding cradle. Key point is here the presence of oxidation or burning that could affect the temperature performances.

Terminals: the clamp between terminals and bus-bars or cables has to be in accordance with ABB requirements. Loose connections can cause an electrical arc external to the circuit breaker or contactor resulting in hazards for plant personnel. Moreover the equipment placed nearby the breaker can irreversibly be damaged.



Control circuits: The vibrations may affect the stability of the connections of the auxiliaries with the relevant loosening of the continuity. It is suggested to periodically check the torque of the screws inside the terminals block.



Trip unit: Electronic components are particularly sensitive to temperature variations. It is strongly recommended not to exceed the temperature range given in the manual. Every year a test with the appropriate ABB tools (Ekip T&P or PR010/T or TS3) has to be performed. To check as well that the sequence of the flash of the LEDs or the information given on the display doesn't indicate any alarm nor warning.



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Service of Low Voltage Products

ABB has developed a series of Services to fulfill customers needs:

- Maintenance
- Replacement
- Retrofitting kits
- Repair
- Spare parts and consumables
- Trainings

Maintenance

Maintenance is needed to minimize the risk of failures and to guarantee the performances of the breaker during its lifetime ABB can increase the value for the customers by providing a well-organized service and professionally trained service personnel.

ABB low voltage has designed different types of maintenance programs mainly for Air Circuit Breakers:

- Preventive Maintenance Program (PMP)
- Predictive Maintenance Program (LEAP)

Maximize your investment, improve the efficiency, ensure safety for a better job satisfaction.

Preventive Maintenance Program (PMP) for all circuit-breaker families is based on ABB technical knowledge of the products and the experience from the field:

- Check the preservation and the efficiency status of the apparatus following the standards, directives and laws
- Anticipate the trend of deterioration of the circuit-breakers, signaling the need of replacement for excessively worn out components, where available, or suggest alternative solutions for bringing them up to date
- Increase the life cycle of the plant, proposing the replacement of obsolete components with the ones of new generation by dedicated retrofitting kits

The offer of preventive maintenance is structured in two levels: Ordinary and Extraordinary

Ordinary maintenance consists of:

- Visual inspection
- Cleaning, greasing and lubrication
- Tripping test with test unit:
 - Ekip T&P (New Emax, Emax 2, T7/X1, Tmax, XT)
 - PR010/T (Emax, Isomax)
- Checking of the contact wear and arc chambers
- Electrical test of the accessories (YO, YU, AUX, M, etc..)
- Locking devices: open/closed in-test-out key lock, ...
- Manual opening-closing (10 operations)
- Tightening the terminals screws

The customers when properly trained can manage on their own the ordinary maintenance.

Extraordinary

maintenance: ABB

proposes an extraordinary maintenance intervention, carried out by ABB experts every three years with the goal to extend the device life span and to re-establish



the original efficiency of the components. The replacement of the key components like operating mechanism or the poles can be included if needed.

The Preventive maintenance program is performed on a yearly basis, in the following sequence:

Extraordinary - Ordinary - Ordinary

Predictive Maintenance program - LEAP:

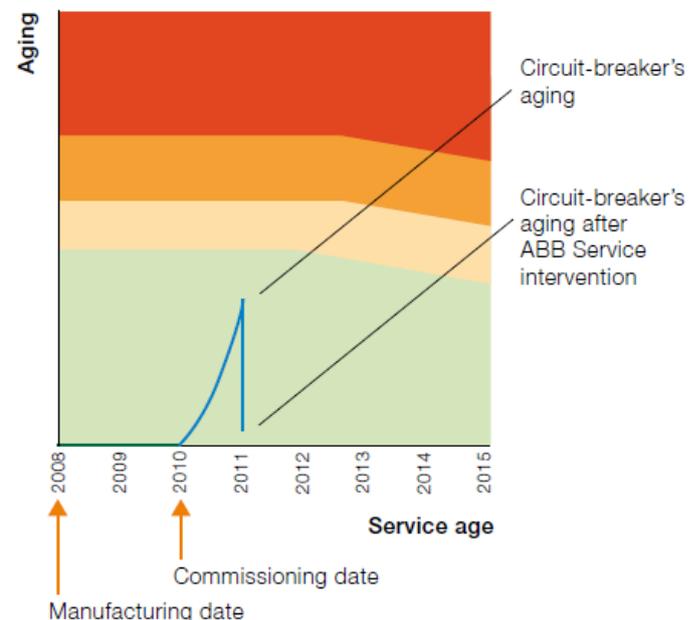
Life Expectancy Analysis Program LEAP is a predictive diagnostic analysis aimed at estimating the aging of the breaker.

The complete analysis is generated by ABB's patented software and it's structured in four phases:

1. Inspection: on site monitoring and data acquisition
2. Maintenance: carried out by an ABB field service engineer
3. Analysis: all data are transmitted to the ABB server and elaborated
4. Report: it contains the list of the maintenance actions performed, the aging curves of the breaker and recommended maintenance actions for the future

Moreover with the on site integration of GPRS Ekip Com module it is possible to have a remote diagnostic.

Then according to the output of the analysis the customer can prioritize the maintenance interventions to fix the most critical cases.



Replacement

In some cases circuit breakers or contactors are too old or too much worn out that any maintenance activity would be unworthy. In other cases, cost or design of the products itself do not justify or permit any maintenance.

The replacement of the device can be with the same product, if still produced, or with a retrofitting kit.

For each Low Voltage Products ABB defines the Product Life Cycle Management model (LCM) from the development to aftersales services, aimed at providing proactive services for maximizing availability and performances. The model divides a product's life cycle into four phases: Active, Classic, Limited and Obsolete.

ABB yearly informs its customers of any product's phase out giving information about Last buy date. Any update can be found visiting the Replacement Page in ABB Low Voltage Circuit Breakers WEB site.



Spare Parts and consumables

The key element in managing the risks to minimize the production disturbances is to be fully prepared for failures. ABB offers services to manage our clients' spare parts, meaning the support to the customers to define the minimum spares to stock to reduce the downtime when failures happen.

Most of the spare parts are accessible to any customer and equipped with clear instruction sheets and/or videos. Some of the spare parts are classified as critical components ("A Type") and only ABB expert personnel have the authorization and the proper skills to replace them. Dedicated maintenance kits and consumables are available as well to facilitate the job on site and to improve the quality of the intervention



Retrofitting kits

Replacing old circuit breaker with newer versions can be done using the ABB special conversion kits which enable quick installation without structural modifications to the original compartment to adapt the actual system to the new generation circuit breaker: the kits are designed and tested solutions to optimize and update the old system.

Visit ABB retrofitting kit page to discover more: www.abb.com



Contactors retrofitting kits consist in an adapter plate to fit the new contactor.

Repair

In some cases a damaged product have to be repaired. This could be done in ABB workshop or on site by certified ABB personnel. Repairs done in ABB workshop will extend the warranty of the product.

Trainings

Maintaining a wind turbine require technicians to have a deep knowledge of products. ABB Service arrange trainings to bring the technical staff at the appropriate level of skills and expertise. The topics object of the trainings are:

- General features of the products
- Installation procedures
- Setting and testing
- Ordinary maintenance

The training can be customized according to the installed base or specific needs from customers. Moreover they can be arranged either on site or in the classroom.



Contact us

For more information, please contact
your local ABB representative or visit:

www.abb.com/low-voltage/service

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