

Brochure Low Voltage Products Service

Preventive Maintenance (PMP) and Predictive Maintenance (LEAP) for Emax Air Circuit Breakers

ABB Low Voltage Breaker (LVB) Service

Every solution at your disposal

ABB Low Voltage Breaker Service offers a complete range of services to support customers in all stages of the product's life: repair, substitutions, spare parts, retrofitting solutions and any type of maintenance activities.

By integrating information with our customers, we can collect all requests for assistance and maintenance. In this way, our services are always immediate and of the highest level.

ABB Low Voltage Breaker Service offers every kind of maintenance solution for customers in order to maximize circuit breaker efficiency, safety, performance and life extension:

- On-site repairs performed by our field engineers who are highly specialized and equipped with the proper tools.
- Preventive and Predictive maintenance in order to maximize circuit breaker performance; increasing the reliability, safety and the lifetime of switchgear, switchboards and electrical power systems and reducing the total costs.

Technical support

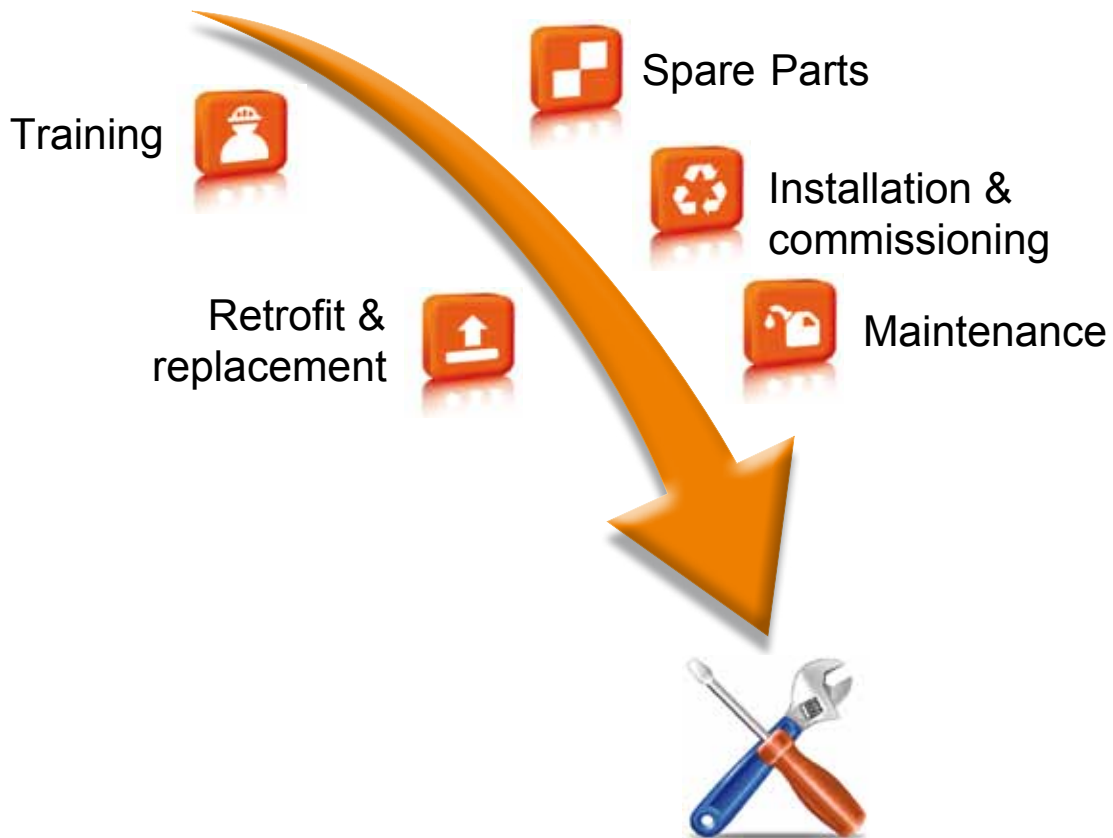


ABB LVB Service

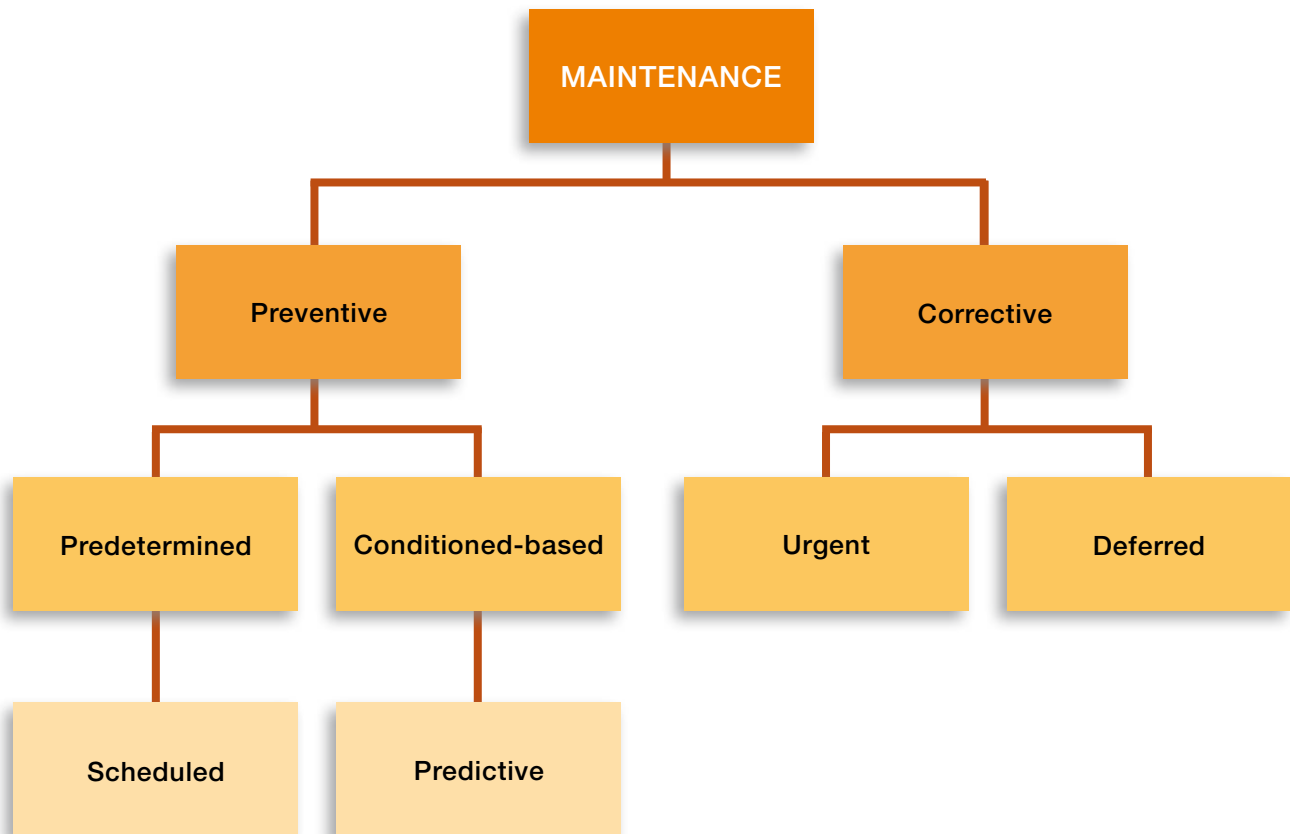
Maintenance with ABB Low Voltage Breaker

Circuit breakers are protection devices and require regular maintenance for a high level of performance and to avoid costly repairs.

Maintenance is mandatory for work safety standards set by OSHA and NFPA 70E, Standard for Electrical Safety in the Workplace.

Maintenance definitions

- Preventive maintenance
- Predictive maintenance
- Scheduled maintenance
- Condition based maintenance
- Corrective maintenance
- Predetermined maintenance



Why maintain your breaker?

Necessary circuit breaker maintenance implies inspection and checking of the integrity of the mechanical and electrical components. Replacing the parts that have ended their life cycle will keep performance level high.

Which components to maintain?

The life expectancy of any circuit breaker involves the wear and tear of the most sensitive components:

- Frame and plastic components
- Main contacts
- Jaw Type contacts
- Auxiliary contacts
- Operating mechanism
- Electrical and mechanical accessories
- Trip unit
- Lubricating products.

Environmental and utilization conditions

The ordinary aging process begins with the commissioning of the circuit breaker. However, the service age of the circuit breaker is not the only parameter to define the aging of the device. Environment and use are other important factors which can speed up the aging of the device.

Maintenance is particularly recommended where the environmental and utilization conditions cause both mechanical and electrical overstressing of the circuit breaker. Below is a list of the basic signs which could indicate a concern about increasing wear:

	Consequences	
Utilization conditions	High number of operations	– early wear of the operating mechanism and its mechanical components
	Breaking current (if short circuit)	– early wear on the plates of the main contacts and arcing chambers – insulation leakage
	High load percentage	– early aging of plastic components, lubricant, and electrical components
	Unused circuit breaker (always open or always closed)	– lubricant hardness which implies the mechanical compromising of the operating mechanism

Environmental Conditions	Consequences
High level of moisture	– corrosion and oxidation of the metal components: • arc chambers • main contacts • contacts • auxiliary contacts/shunt releases – reduction of the dielectric proprieties of the plastics – reduction of performance level of the electric components
High temperatures	– loss of insulation – aging of the lubricant inside the operating mechanism – Changing of the mechanical and dielectrical proprieties of the plastics – Early aging of the electronic components
High vibrations	– loss of continuity in the contacts – early aging of the operating mechanism due to mechanical wear – reduction of the tightening strength of the screws – breaking of the plastic parts and electrical components
Dusty or polluted environmental	– reduction of the operating mechanism's lifetime – reduction of insulation – increasing of the resistance in the contacts points
Salinity	– premature corrosion on the metal components – faults associated with secondary accessories – reduction of insulation



ABB Low Voltage Breaker Service Maintenance Packages

Extend the circuit-breaker life up to 100% in demanding environments

Investing in prevention of failure, rather than living with its consequences, such as loss of production and possible violation of health and safety legislation, is a primary concern for many businesses. Successful prevention of failure can make the difference as to whether or not a company manages to retain its long-term competitiveness.

Technical assistance in the form of ABB Low Voltage Breaker Service is effective and has a widespread network of numerous production facilities and certified service centers throughout the world.

ABB Field Service Engineers have extensive experience and product knowledge due to:

Continuous education

- On new products during regular training classes
- On any single component upgrade by direct contact with R&D and the production line.

Manufacturer dedicated service tools

- Factory authorized spare parts only
- Dedicated and state-of-the-art tooling
- Elaboration of the measurements found during the maintenance activity by ABB field Service Engineers: Monitoring and diagnosing the circuit breaker can help in identifying the correct information about circuit-breaker conditions in order to reduce the costs with specific maintenance interventions.

Professionalism and Safety

- ABB guarantees the highest level of safety at work
- All ABB field service engineers are authorized and certified by means of a regular verification process to maintain a high level of competence.

Thanks to our technical knowledge of the circuit breakers, ABB Low Voltage Breaker Service has maintenance plans tailored for any customer that will reduce the risk of failure and the aging of the circuit breaker.

In addition to the maintenance of a unit, which includes any type of emergency intervention, there are also complete preventive (PMP) and predictive (LEAP) maintenance service packages available. These tools ensure that those who manage the plant can gain considerable knowledge in terms of reliability, safety and reduction of costs.

An on-site audit carried out by our Field Service specialized Engineers is very important and will result in a proposal of short or long term maintenance actions.



Preventive Maintenance Program – PMP

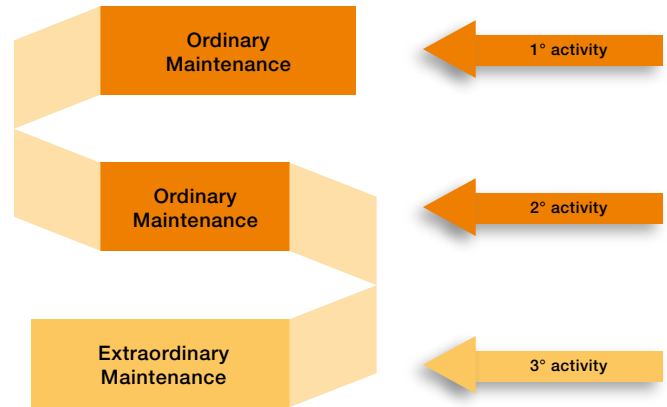
ABB Low Voltage Breaker Service offers a Preventive Maintenance Program – PMP – for new installations as well as existing equipment, to reduce the risk of failure and deterioration.

The program consists of a cycle of 3 maintenance activities:

1st - 2nd activities: Ordinary Maintenance on the circuit-breaker to make all needed checks and ensure correct function.

3rd activity: Extraordinary Maintenance on the circuit breaker, carried out only by highly qualified ABB personnel, to extend the life of the circuit breaker and increase its reliability and original efficiency.

For Circuit breakers older than 3 years, the first intervention is Extraordinary Maintenance.



EMAX	Year from the production																				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mechanical Components																					
Arcing Chambers				(R)			(R)			(R)			(R)			(R)			(R)		I
Arcing and main contacts				P			P			P			P			P			P		I
Operating Mechanism		I	I	P	I	I	P	I	I	P	I	I	P	I	I	P	I	I	P	I	I
Racking-in/out device (for withdrawable circuit-breakers)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Jaw-type isolating contacts (only for withdrawable circuit-breaker)				(R)			(R)			(R)			(R)			(R)			(R)		I
Main circuit - Busbars connections																					
Terminals		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Auxiliary Connections																					
Auxiliary Contacts		I	I	P	I	I	P	I	I	P	I	I	P	I	I	P	I	I	P	I	I
Electrical and mechanical accessories																					
Geared motor		I	I	P	I	I	P	I	I	P	I	I	P	I	I	P	I	I	P	I	P
Undervoltage release		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Shunt opening release		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Shunt closing release		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Circuit-breaker locked in the open position (with key or padlocks)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Circuit-breaker auxiliary contacts		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Locking devices for circuit-breakers connected and disconnected		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Interlocking devices between circuit-breakers mounted side by side and/or one on top of another		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Optional Performances																					
Thermographic check		(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)	(P)
Insulating resistance				(P)			(P)			(P)			(P)			(P)			(P)		
Electronical components																					
Protection trip unit		I	I	P	I	I	P	I	I	P	I	I	P	I	I	P	I	I	P	I	I

Legend

I (Inspection)	Inspections and tests, corrective actions and, if required, replacement of the component
P (Performance)	Tests, measurements and any "maintenance", "repair" or "replacement" activity, if required, aimed at improving the product life
(R) (Replacement under condition)	Any replacement of component suggested by ABB qualified technician after Ordinary and/or Extraordinary Preventive Maintenance Inspections
(P) (Performance under condition)	Tests performed only if provided for contract and/or if deemed necessary by ABB qualified technician
R (Replacement)	Obligatory replacement of component during preventive maintenance activity (never provided for this circuit breaker)

Predictive Maintenance Program LEAP

By integrating LEAP (Life Expectancy Analysis Program), and analyzing the specific environment and application, the preventative maintenance plan is now a predictive diagnostic tool that optimizes the efficiency of the Emax circuit breakers. The aim of LEAP is to give the customer a complete report, which shows the device's health before and after the Field Service Engineer's intervention, with very important suggestions about future maintenance activities. The complete analysis is generated by ABB's sophisticated and patented software. Three phases are followed:

Inspection

On site monitoring and acquisition of the parameters of the circuit breaker in standard condition:

Manual data ⁽¹⁾:

- Environmental data (temperature, moisture, salinity, etc...),
- Application data (application, Load, etc...).

Automatic data:

- Stored inside the electronic trip unit (trip history, contact wear, alarms, etc...).

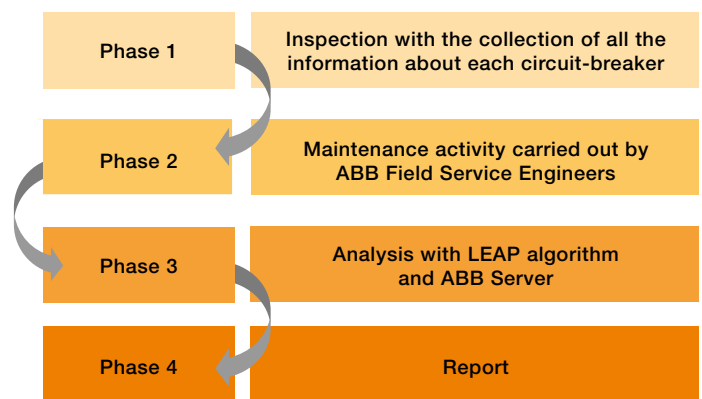
⁽¹⁾ Information about the environmental conditions to be supplied by customer

Maintenance

The manual data is completed with the list of the maintenance activities performed by the ABB Field Service Engineer.

Analysis

All the data is transmitted to the ABB Server via the Web and analyzed to understand the circuit-breaker use and age.



Predictive Maintenance Program LEAP

Report

The report is generated based on the information acquired in the field and includes:

- Characteristics of the circuit-breaker and of the switchboard in which it is contained, application, environmental conditions and working conditions
- Description of the main circuit-breaker components subjected to maintenance
- List of maintenance actions performed on each sensitive component, including replaced parts
- Suggested maintenance actions for the future
- Recommendations about the frequency of maintenance interventions
- 2 curves representing respectively the load and mechanical life at the moment of the maintenance activity
- A graph showing the risk of fault of the circuit-breaker as it relates to real working conditions.

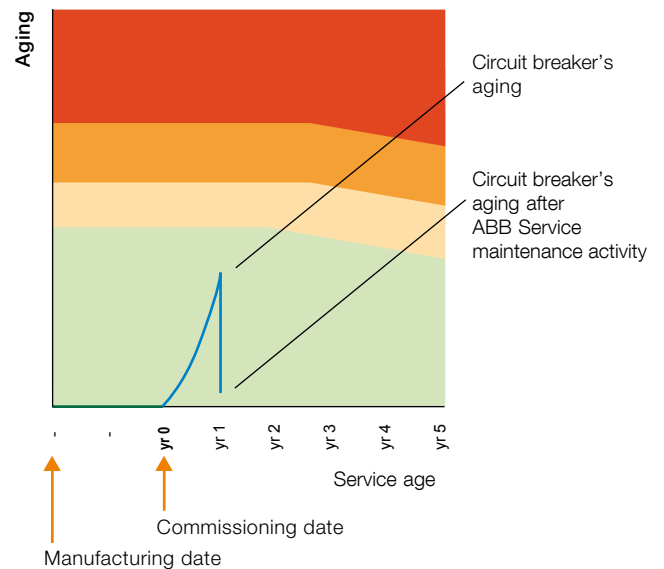
The four colored areas have different sizes according to the applications, the environment and the conditions of use.

Each color represents the risk probability for circuit breaker failure:

- **Red:** High
- **Orange:** Moderate
- **Yellow:** Medium
- **Green:** Low

There are 2 curves:

- **Green** → circuit-breaker aging curve from the production date to the commissioning date
- **Blue** → circuit-breaker aging curve from the commissioning date.



*See Appendix for full sample LEAP report

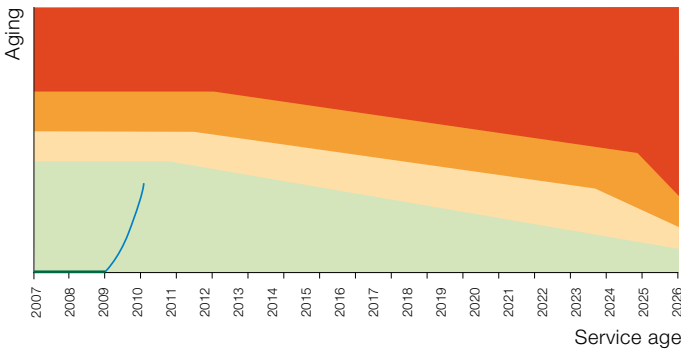
LEAP Offers

LEAP EASY AUDIT

The customer, after an online registration (LEAP EASY AUDIT), receives a user ID and a password to access a special online section of LEAP tool.

The customer inserts a few pieces of information about the circuit-breaker (i.e. number of operations, its application and the environmental conditions, etc...).

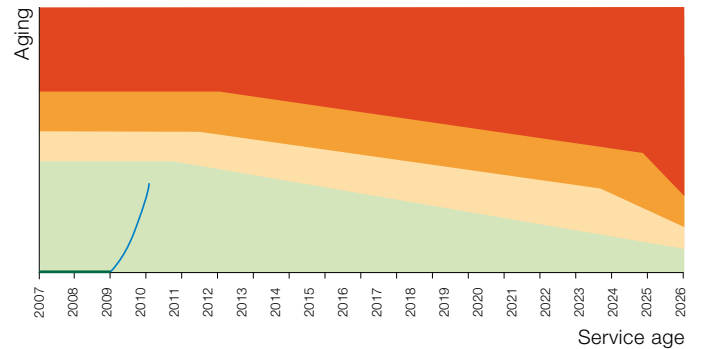
The result is an emailed health analysis of the circuit-breaker. The Report is developed on a purely theoretical and statistical basis in order to have an estimation of the circuit-breaker's health and to highlight the LEAP tool's potential.



LEAP AUDIT

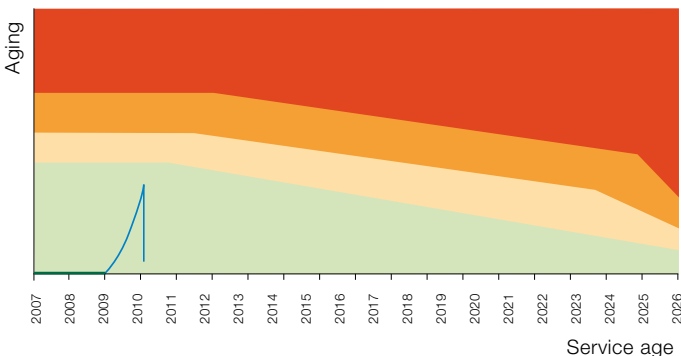
After an easy online registration (LEAP AUDIT), an ABB Service Sales representative will visit the customer's site to perform surveys and obtain a more accurate LEAP analysis. By using the data from the trip unit (with Ekip Connect SW) and a few pieces of manually acquired data about the application and the circuit-breaker operating and environmental conditions, it is possible provide a detailed Report with the LEAP Software.

The customer receives the Report via email with the real time circuit-breaker's health and the list of the recommended next maintenance activities to be performed.



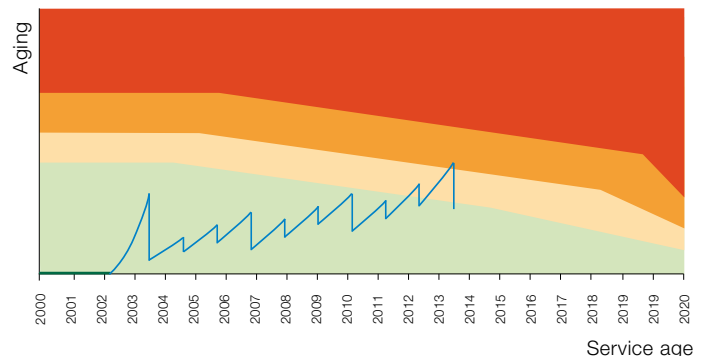
LEAP STAND ALONE

ABB Field Service Engineer performs a maintenance activity at the customer's site. The customer receives a complete Report with all the information about the installation conditions and the list of maintenance activities performed. The aging curve, which is included in all LEAP reports, shows the status of the circuit-breaker pre and post intervention. The report also contains a list of recommended future maintenance actions.



LEAP + PMP

LEAP, integrated into the preventive maintenance program (PMP), is the best solution for the customer: Targeted and scheduled maintenance provides the customer with immediate evidence of the added value of ABB based service. The graphic representation shows how each maintenance activity has improved the life of the circuit-breaker throughout the course of time. Customers can minimize costs by extending the device's life cycle and thereby reducing the risk of unscheduled outages and unwanted shutdowns.



Benefits

Customer benefits with PMP

- Ensure a high level of safety
- Increase production reliability
- Reduce overall costs:
 - direct costs of emergency maintenance
 - indirect costs due to loss of production (increasing the meantime before failure value)
- Support during all the phases of the product lifecycle
- ABB professional competence guaranteed.

Added benefits by utilizing LEAP

- LEAP is unique and certified software created by ABB that is able to give a detailed and objective diagnostic in terms of:
 - status of the circuit-breaker health
 - recommended time between maintenance activities according to the device's specific needs
- The report is detailed, transparent and complete
- Extend the product's life in demanding applications.



Appendix

LEAP REPORT

LEAP REPORT 0000541 EN
CB SERIAL NUMBER AL91044769



RMO NAM.US.2014.0006.001
ODV
NCR 3001111111

SURVEY DATE (YYYY.MM.DD) 2014.06.27
Leap Report 0000541
CB SERIAL NUMBER AL91044769

CUSTOMER SAMPLE REPORT
PLANT
ADDRESS
CONTACT 215-428-9750
INSERTED BY Kyle Striech

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LEAP REPORT

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Switchboard data

Switchboard data	
Name	tower1
Application	Railways, utility
Bar System	
Bar insulation:	
Dust protection	No dust protection (IP < 5y)
Cooling system	Vent
Pressurization system	No
Cables cubicle	Open
Drip	Absent
Altitude	500 - 1500 m

CB Data

Operations	
Number of operations per year (estimate)	500
Operations counter (value read from)	
Offset for the operations counter	
Generals	
CB Serial Number	AL91044769
CB manufacturing date	September 2008
Installation date	2012/03/12 (YYYY.MM.DD)
Last maintenance date	2014.06.16 (YYYY.MM.DD)
Type Data	
CB type	E2B-A1600/3P
Standard reference	UL
Rated uninterrupted current	1600
Execution	Withdrawable
Poles Number	3
Auxiliary voltage	No
Accessories	
Trip Units	
Trip Unit type	PR121
Trip Unit serial number	HA996Q07A
Trip Unit SW Version	02.02
Application	
Position of CB into the electric network	High (Close to the transformer)
Type of use	CB operated frequently
Average percent load	[50, 80] % In, 24/24h
Temporary overloads:	Yes
Utilization	Protection of generators
Environment	
Average environmental temperature :	< 0° C

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Shocks due to temperature range	Yes
Humidity:	[70, 85] %; Moderate humidity, generally found in zones close to water
Salt environment:	No salt mist.
Dust:	Low level of dust (civil installations or commercial buildings).
Corrosive atmosphere:	Moderate corrosive atmosphere. Zone close to polluting industrial activities (chemical plants, smelting plants, etc.).
Vibrations:	Low: < 0.2 g

Routine Tests

Test performed by factory

- Sight inspection and checking: materials and construction faultless and fully complying with the order specifications and rules
 - Mechanical operation checking: correct mechanical working on "off load" operation.
 - Dielectric rigidity 2,5 kV 50 Hz voltage was applied for 1 min between poles with the circuit breaker closed
 - poles and frame with the circuit breaker closed
 - across the terminals of each pole with the circuit breaker open a 2,5 kV 50 Hz voltage was applied between the auxiliary circuits and earthed main circuits
 - Thermal protection on overloads
 - The time-current with a current of 3In was checked starting from cold conditions.
 - Electromagnetic protection on overloads
 - The operation within +/- 20% the rating value was checked in the position of Im and the delayer was checked in the positions ----- secs. within +/- 10% the rating value.
 - Selective protection:
 - The operation with current value and delayed time within +/- 20% the rating value was checked in the position of 3In.
- Other tests: all routine tests prescribed by the standard IEC 60947 have been performed successfully

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List of Maintenance Activities Performed

1. Disconnect Checks and Repairs <input checked="" type="checkbox"/> Check device functionality <input checked="" type="checkbox"/> Check position lock <input checked="" type="checkbox"/> Bolts and screw	Parts Replaced
2. Arc chambers Checks and repairs <input checked="" type="checkbox"/> Dust removal <input checked="" type="checkbox"/> Carbonization signs check <input checked="" type="checkbox"/> Tracking phenomenon check	Parts replaced <input checked="" type="checkbox"/> Whole set of arc chambers
3. Contacts Checks and repairs <input checked="" type="checkbox"/> Contacts cleaning <input checked="" type="checkbox"/> Main contacts smoothing <input checked="" type="checkbox"/> Wearing level check <input checked="" type="checkbox"/> Tracing phenomenon check <input checked="" type="checkbox"/> Oxidation check <input checked="" type="checkbox"/> Contacts alignment check	Parts replaced
4. Operating mechanism Checks and repairs <input checked="" type="checkbox"/> Washing using CRC2-26 <input checked="" type="checkbox"/> Closing springs <input checked="" type="checkbox"/> Shunt closing release - YO functionality <input checked="" type="checkbox"/> Shunt opening release - YC functionality <input checked="" type="checkbox"/> Undervoltage release - YU functionality <input checked="" type="checkbox"/> Geamotor <input checked="" type="checkbox"/> Trip test <input checked="" type="checkbox"/> Electr/Mech sign. for tripped <input checked="" type="checkbox"/> Greasing <input checked="" type="checkbox"/> Trip coil pull-force <input checked="" type="checkbox"/> Sensor acquisition chain <input checked="" type="checkbox"/> Open/Closed Test operation	Parts replaced <input checked="" type="checkbox"/> Geamotor

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List of Maintenance Activities Performed

6. Final cleaning and greasing

Final Inspections

- External cleaning
- Removing of dust and old grease with dedicated diluent Henkel 273471 and compressed air
- Vaseline on contacts
- General greasing with "Mobilgrease or Mobiltemp SHC32" grease

Results

General conditions after maintenance	<input checked="" type="checkbox"/> Ok	<input type="checkbox"/> Notes
Final mechanical test	<input checked="" type="checkbox"/> Ok	<input type="checkbox"/> Notes
Final electric test	<input type="checkbox"/> Ok	<input checked="" type="checkbox"/> Notes

Notes

This is a test

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Life Expectancy Analysis

Plastic case

General description

An air circuit breaker consists in a steel frame and plastic components which assure the isolation of live parts, protecting the operator from any fault current.

The service required is: by visual inspection, any residual grease, dust and humidity, which may lead to reducing isolation has to be removed.

Temperatures above the threshold can cause a change in both mechanical and dielectric properties of plastics. This change is immediately recognizable by a significant change in the plastic color.

Maintenance plan

The environment dust, moisture, corrosion and average temperature values in which the circuit breaker works are within the range of moderately heavy use.

It requires a maintenance plan that includes:

- a) Monitoring the state of cleanliness of the unit, every 9 months
- b) Removing of dust and excess oil/grease with clean and dry rag, every 9 months
- c) Removing of dust deposits on the plastic parts with clean and dry rag, non-aggressive and compatible alcohol with plastic parts, every 9 months
- d) Checking for presence of the technical characteristic labels, every 9 months
- e) Perform the cleaning of the labels with a clean and dry rag, every 9 months
- f) Check for overheatings or cracks that can compromise the insulating parts of the circuit breaker, every 9 months
- g) Verify the absence of external objects in the circuit breaker compartment, every 9 months
- h) Make a thermographic analysis on the circuit breaker, every two years.

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Life Expectancy Analysis

Contacts

General description

The circuit breaker has a dual function: to carry and interrupt the current both in nominal and fault conditions.

These two functions are respectively carried out by two types of contacts.
The main contacts, made with a material that minimizes contact resistance, bring the current.
The breaking contacts, made with a more resistant material, can interrupt the nominal or faulty current.

An environment with humidity and a high number of interruptions (openings) affect the contacts life.
Through visual inspection it is necessary to ensure that the contacts plates are correctly placed at the distance recommended in the manual.

Maintenance plan

The environment in which the circuit breaker works is characterized by a moderately high moisture level.

It is required a maintenance plan that includes:

- a) Checking the status of contacts, every 9 months
- b) Checking of oxidation and / or peening on the contacts, every 9 months
- c) Checking of the arcing distance (A dimension in New Emax manual), every 9 months
- d) Checking the presence of plates, every 2 years
- e) Smoothing the contacts with abrasive cloth in case of wear and / or removing any peening, every 2 years
- f) Adjust if necessary the position of the command shaft (verifying it is within the range of A dimension), every 2 years

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Life Expectancy Analysis

Arc chambers

General description

The electric arc is a phenomenon that occurs during opening electrical circuit closing and opening.

It consists in a bright and conductive channel at very high temperature due to air ionization.

The arc chamber is made in metal plates that interrupt the continuity of the electric arc: absorbing the energy by reducing the voltage. The arc chamber shall be maintained in good conditions, because, in case of failure, it may not be able to absorb the energy produced by the arc, causing severe damages to the circuit breaker.

Attention: burn marks on the plates of the rooms are not necessarily indicative of damage, since openings of the contacts at currents close to the nominal one, generate an electrical arc with its release of gas.

It is also important to check that the section of vent is not blocked to prevent the generation of excessive pressure during current interruption.

The copper braid, designed to carry the rated current, must be intact after the inspection.

Maintenance plan

The environment in which the circuit breakers works has a moderately high moisture level.

It is required a maintenance plan that includes:

- Checking of the arcing chambers status verifying that chambers are intact and the plates are not corroded or damaged : Every 9 months
- Removing of the dust with compressed air and any traces of smokes or slags with a brush : Every 9 months
- Checking of the chambers and if it is necessary, replace them : Every 2 years

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Life Expectancy Analysis

Power connections

General description

The power connections have low contact resistance to facilitate the current flow minimizing the heat generation.

The clamp between terminals and barcode and / or cables has to be in accordance with ABB requirements.

In fact, the looseness of these connections can cause an electrical arc external to the circuit breaker that can irreversibly damage any equipment placed near it.

Particular attention must be paid in case of environment with continuous vibration.

The recommended maintenance on power connections requires a check of the tightness and a proper terminals cleaning.

Maintenance plan

The environment in which the circuit breakers works has high corrosion values. It means there should be paid special attention to the maintenance of the power connections especially in the case of withdrawable circuit-breakers.

! Warning: a high moisture level can cause the corrosion of metal surfaces: bluish marks on the copper parts and/or black marks on the silver parts

! Attention: the presence of high vibration can loosen the screws tightening with consequent increasing of the mechanical play.

It is required a maintenance plan that includes:

- Removing the dust and dirt with dry brushes and rags from the insulating parts; preferably using non-aggressive detergent, every 6 months

- Checking that there are no localized overheating marks on the terminals. The problem can be easily detected by the changing the color of the parts in contact (usually the contact parts should be silvery-white), every 9 months

- Checking of the bolts tightness every 9 months.

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Life Expectancy Analysis

Jaw type contacts

General description

The jaw type contacts connect the moving part to the corresponding fixed part.

Visual inspection allows to check that there is no trace of oxidation nor burning on the jaw contacts.

The correct alignment of the jaw contacts plates ensures that the normal contacting force respects the design parameters.

Maintenance plan

The environment in which the circuit breakers works has normal corrosion and dust values.

It is required a maintenance plan that includes:

- Annual removing of dust, mold, condensation or oxidation traces inside the fixed part of the circuit breaker
- Annual checking that there are no localized overheating marks on the insulating part of the circuit breaker
- Annual checking of the jaw type contacts integrity

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Life Expectancy Analysis

Auxiliary circuits

General description

The auxiliary circuits are connected to the circuit breaker terminal block.

Vibrations may affect the contact resistance of the auxiliary signalling contacts.

It is suggested to check the screws torque of the terminal block and to verify the wiring continuity with a multimeter.

Maintenance plan

The environment in which the circuit breakers works has normal corrosion and vibration values.

It is required a maintenance plan that includes:

- Annual checking of auxiliary circuits bolts tightness
- Ensuring proper wiring and straps
- Checking the electrical continuity. Every 3 years

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Life Expectancy Analysis

Operating mechanism (wear)

General description

The circuit breaker operating mechanism is one of the most critical elements as it is subject to mechanical wear.

Dust can significantly decrease the mechanical life of the operating mechanism, as it causes a decrease of the lubrication with a deterioration by friction (abrasive wear).

Vibrations concur to the mechanism aging for mechanical wear.

High temperature can causes a faster lubricant aging, while a sudden temperature change causes mechanical stress in the operating mechanism due to the components deformation.

Verify that the lubrication of the moving parts is in accordance with the requirements of the manual.

Maintenance plan

LEAP REPORT

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The circuit breaker works in moderately critical environment as the FSE (Field Service Technician) has noticed many factors which concur to aging the CB:

- corrosion
- vibration
- dust
- high thermal range
- inductive loads

It is required a maintenance plan that includes:

a) Perform at least 10 opening/closing operations locally, from remote and trip test :

Every 9 months: check the sequences:

- CB open - discharged springs;
- CB open - charged springs
- CB closed - discharged springs.

b) Check the lubrication of the moving parts of the CB and lubricate with Mobilgrease28 or Mobiltemp SHC32 greases the accessible points shown in the procedure 1SDH000469R0012: every 9 months

c) Dismount the operating mechanism and make a visual inspection on all the components: every 2 years

d) Remove with dry brushes and rags any dirt / dust and any oil or grease excess traces on the internal parts - use thinner for laminates: every 2 years

e) Lubricate the opening shaft and the opening/closing hooks with Mobilgrease28 or Mobiltemp SHC32 greases: Every 2 years

f) Check the lubrication of the movement parts: Lubricate with Mobilgrease28 or Mobiltemp SHC32 the supports of the main shaft: Every 2 years

g) Check the correct fixing screws tightening: every 2 years

h) Check the presence of all retaining rings and their proper insertion: every 2 years

i) Measure the stress both on the closing and opening pushbuttons: Every 2 years

j) Measure the stress on the opening shaft: Every 2 years

k) Check the correct functionality of the antipumping lever: Every 2 years

l) Check the position of the opening hook: Every 2 years

m) Check the position of the springs charged ratchet: Every 2 years

n) Check the position of the lever system hook: Every 2 years

o) Check the main shaft works without frictions: Every 2 years

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Life Expectancy Analysis

Operating mechanism (aging)

General description

The circuit breaker operating mechanism is one of the most critical elements as it is subject to mechanical wear.

Dust can significantly decrease the mechanical life of the operating mechanism, as it causes a decrease of the lubrication with a deterioration by friction (abrasive wear).

Vibrations concur to the mechanism aging for mechanical wear.

High temperature can cause a faster lubricant aging, while a sudden temperature change causes mechanical stress in the operating mechanism due to the components deformation.

Verify that the lubrication of the moving parts is in accordance with the requirements of the manual.

Maintenance plan

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The environment in which the circuit breakers works has moderately high vibration, corrosion and dusty values.

! Caution !

In case of high moisture a corrosion of the metal surfaces can occur: red traces of rust on the steel or very light traces of rust on zinc parts.

There are thermal excursions which can be a problem in affecting the wear of the operating mechanism.

The presence of inductive loads affects negatively on the wear of the main operating mechanism.

It is required a maintenance plan that includes:

a) - at least 10 opening/closing operations both locally and remote: Every 9 months following this sequence

- 1) CB open - discharged springs
- 2) CB open - charged springs
- 3) CB closed - discharged springs

b) Check the lubrication of the moving parts of the CB and lubricate with Mobilgrease28 or Mobiltemp SHC32 greases the accessible points: every 6 months

c) Dismount the operating mechanism: every 2 years

d) Remove with dry brushes and rags any dirt / dust and any oil or grease excess traces on the internal parts - use thinner laminates: every 2 years;

e) Lubricate the opening shaft and the opening/closing hooks with Mobilgrease28 or Mobiltemp SHC32 greases: Every 2 years

f) Check the lubrication of the movement parts: lubricate with Mobilgrease28 or Mobiltemp SHC32 the supports of the main shaft: Every 2 years;

g) Check the correct screws tightening: every 2 years;

h) check the presence of all retaining rings and their proper insertion: every 2 years

i) Measure the closing force on the closing pushbutton: Every 2 years

l) Measure the opening force on the opening shaft: Every 2 years

m) check the correct functionality of the antipumping lever: Every 2 years

n) check the position of the opening hook before and after the opening: Every 2 years

o) check the position of the recharging system before and after the charging: Every 2 years

p) check the position of the lever system hook before and after the operation: Every 2 years

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Life Expectancy Analysis

Electrical and mechanical accessories

General description

During the circuit breaker maintenance is important to check the correct functionality of the accessories.

In particular, for electrical accessories, carry out surveys at the minimum and maximum operating voltage and check for proper installation.

Charging spring motor: check the coil continuity.

Automatic remote trip reset: verify the fixing of the trip.

Among the mechanical accessories, please check the mechanical counter performing a sequence of opening / closing operations.

Maintenance plan

The circuit breakers works in an environment with moderate high vibration, corrosion and moisture values.

It is required a maintenance plan that includes:

a) Perform at least 10 opening/closing operations both locally and remotely following this sequence every 9 months :

- 1) CB open - discharged springs
- 2) CB open - charged springs
- 3) CB closed - discharged springs

b) Check the correct screws tightening between the CB and the terminals (lugs): Every 9 months

c) Check the correct functionality of the accessories - motor operator; shunt opening release, shunt closing release; undervoltage release, auxiliary contacts, locks in open position (with key or padlock) and racked in/out position, mechanical counter: Every 9 months

d) check the good conditions of the SOR, UVR and SCR (without wear, overheating, cracks): Every 9 months

e) check of the functionality of the mechanical interlocks: Every 9 months

f) Check the functionality of the trip coil 3 trips: Every 2 years

g) Annual check of the Motor operator, SOR, and SCR functionality: 85%...110%Un: Every 2 years

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Life Expectancy Analysis

Trip unit

General description

The trip unit is the main protection system of the breaker and, therefore, it should be checked regularly over the whole protection chain.

A trip unit has current sensors, a pcb able to measure the current (for more advanced versions even voltage, frequency, cos φ, peak factor, etc...) and an actuator (trip coil).

Electronic components are particularly susceptible to temperature variations.

It is strongly recommended not to exceed the temperature range given in the manual.

Every year it is recommended to perform at least one trip test (switch actuator with the consequent opening of the CB) to be made with Ekip T & P or PR010 / T or BT030 USB + Ekip Connect or TS3 or PR030.

Check that the sequence of flashing LEDs or the information given on the display doesn't indicate any alarm or warning.

Maintenance plan

The data from the trip unit show a heavy use of the circuit breaker.

It is required a more frequency maintenance plan that includes:

- Check the correct functionality of the trip unit: performs Trip Test and Autotest (if available): Every 6 months
- Check of the statistic data: number of trips, number of operations, trip history, etc...: every 6 months c) check the Wear percentage (lower than then 80%): every 6 months
- Test the trip unit with Ekip T&P: every 18 months
- Test the trip unit with TS3: every 18 months
- Test the functions of the trip unit and its accessories (PR021/K, HMI030, Flex Interface), the sensor chain, actuators and input/output signalling contacts contact (K51/YO e K51/YC, zone selectivity) with the SW Ekip Connect: every 18 months
- Verify of the CS status: every 18 months
- Check of the connection integrity between current sensors and trip unit: every 18 months

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Life Expectancy Analysis

Leap Analysis Per Components Summary

Components	Gravity	Frequency
Plastic case	Medium	basic every 9 months expert every 27 months
Contacts	Medium	basic every 9 months expert every 27 months
Arc chambers	Medium	basic every 9 months expert every 27 months
Power connections	High	basic every 6 months expert every 18 months
Jaw type contacts	Normal	basic every 12 months expert every 36 months
Auxiliary circuits	Normal	basic every 12 months expert every 36 months
Operating mechanism (wear)	Medium	basic every 9 months expert every 27 months
Operating mechanism (aging)	Medium	basic every 9 months expert every 27 months
Electrical and mechanical accessories	Medium	basic every 9 months expert every 27 months
Trip unit	High	basic every 6 months expert every 18 months

Conclusion

Recommended Maintenance for CB : Basic Maintenance every 6 months, Expert maintenance with L3 Field Service Engineer every 18 months.

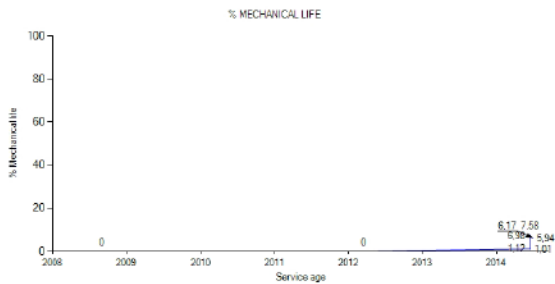
As after next maintenance the Circuit Breaker risks to remain in the red area it is highly advisable to schedule next maintenance as an expert maintenance.

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Life indicators

% MECHANICAL LIFE

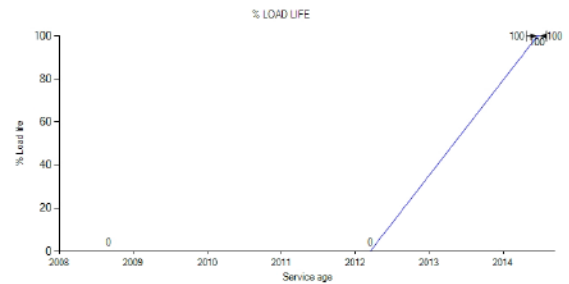


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Life indicators

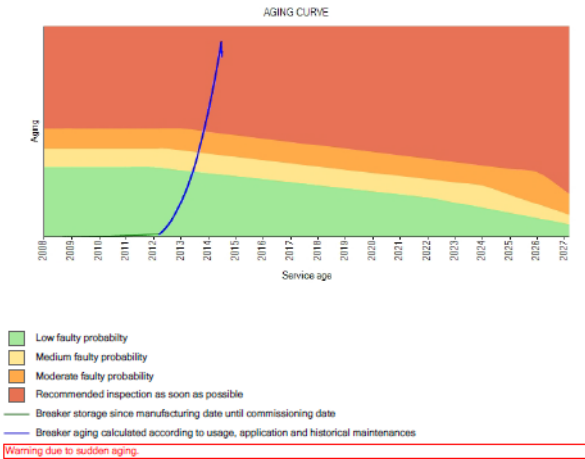
% LOAD LIFE



Appendix

Life indicators

Aging curve



Next Maintenance

1. Disconnecter
2. Arc chambers
3. Contacts
4. Operating mechanism

Contact us

ABB Inc.
Low Voltage Service
1425 Discovery Parkway
Wauwatosa, WI 53226

www.abb.com
www.abb.com/service

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