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.

Technical support

- Training
- Retrofit & replacement
- Spare Parts
- Installation & commissioning
- Maintenance

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.
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:

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

Switchboard data

- Name: Insert
- Application: Railways, utility
- Bar System: Yes
- Bar insulation: Yes
- Door protection: No door protection (PT + Ty)
- Cooling system: Yes
- Pressurization system: No
- Cabinet outside: Open
- Inlet air: Ambient
- Altitude: 0 - 1000 m

CB Data

- Number of operations per year: 50
- Operations counter: Value read from
- Offset to the operations counter: 

Conductors

- CB serial number: AL1244439
- CB manufacturing date: September 2008
- Installation date: 2020/12/12 (YYYY/MM/DD)
- Last maintenance date: 2014/06/12 (YYYY/MM/DD)
- Top unit type: P2
- Top unit serial number: H56201A
- Top unit U1 Version: 02.02

Type Data

- CB type: E2A-4100
- Standard extinguishing: UL
- Rated breaking capacity: 1600
- Voltage withstand: 50/60 Hz
- Rated number: 3
- Auxiliary voltage: NO

Accessories

- Average ambient temperature: < 25 °C

List of Maintenance Activities Performed

1. Disconnectors
   - Check and repair
   - Parts replaced

2. Arc chambers
   - Parts replaced
   - Whole set of arc chambers

3. Contacts
   - Parts replaced

4. Operating mechanism
   - Parts replaced
   - Operator
List of Maintenance Activities Performed

6. Final cleaning and greasing

- Final inspections
- Final cleaning
- Removal of dirt and old grease with degreaser (ABB branded)
- Inspection of contacts
- Cleaning of contacts with "Multiplex or Multiphon" airlub

- General condition after maintenance
- Final electrical test

Notes:

Life Expectancy Analysis

Plastic case

- General information
  - An air circuit breaker contains a steel frame and plastic components which ensure the extension of service life, protecting the material itself from failure.
  - The service life is based on visual inspection, any residual gases, dust and humidity, which may cause the insulation failure.
  - Temperatures above the threshold can cause a change in both mechanical and electric properties of plastics.
  - This change is immediately recognizable by a significant change in the plastic color.

- Maintenance plan
  - The user shall inspect, clean and maintain the plastic parts, subject to which the circuit breaker works, and either every 3 months or after 3000 operating cycles (1000 operations).
  - Check the cleanliness of the plastic parts with a clean and dry cloth, every 3 months.
  - Check the cleanliness of the plastic parts with a clean and dry cloth, every 3 months.
  - Check the cleanliness of the plastic parts with a clean and dry cloth, every 3 months.
  - Check the cleanliness of the plastic parts with a clean and dry cloth, every 3 months.

- Life Expectancy Analysis

Contacts

- Cleaning and inspection
  - The circuit breaker has a built-in function to clear and arrest the current, as well as to perform maintenance and test conditions.
  - The two functions are respectively carried out by two types of contacts.
  - The maintenance contact is used to determine the maintenance condition, while the current contact is used to determine the current condition.
  - The maintenance contact is used to determine the maintenance condition, while the current contact is used to determine the current condition.
  - The maintenance contact is used to determine the maintenance condition, while the current contact is used to determine the current condition.
  - The maintenance contact is used to determine the maintenance condition, while the current contact is used to determine the current condition.
  - Through visual inspection to ensure that the contacts are correctly aligned at the distance recommended in the literature.

- Maintenance plan
  - The environment in which the circuit breaker works is characterized by a moderately high moisture level.
  - It is a required maintenance plan that includes:
    a) Checking the status of contacts, every 6 months.
    b) Checking of isolator and / or operating the contacts, every 3 months.
    c) Checking of the opening distance (A dimension in free motion) every 4 months.
    d) Checking of the insulation of isolators, every 2 years.
    e)Smoothing the contacts with abrasive cloth in case of wear and / or removing any peeling, every 2 years.
    f) Adjusting the position of the contact with the help of a mediator if it is within the range of A dimension, every 2 years.

- Arc chambers

- General information
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.

- Maintenance plan
  - The environment in which the circuit breaker works is characterized by a moderately high moisture level.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.

- Life Expectancy Analysis

- Arc chambers

- General information
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.

- Maintenance plan
  - The environment in which the circuit breaker works is characterized by a moderately high moisture level.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.

- Life Expectancy Analysis

- Arc chambers

- General information
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.

- Maintenance plan
  - The environment in which the circuit breaker works is characterized by a moderately high moisture level.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.

- Life Expectancy Analysis

- Arc chambers

- General information
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.

- Maintenance plan
  - The environment in which the circuit breaker works is characterized by a moderately high moisture level.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
  - The arc chamber is used to extinguish the arc generated during the operation of the circuit breaker at the moment of interruption and during the operation of the circuit breaker at the moment of interruption.
Appendix

Life Expectancy Analysis

Power connections

**General Description**

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

- The current between terminals and busbars and / or cables has to be in accordance with ABB requirements.

- In fact, the responses of these connections can cause an electric arc external to the circuit breaker that can irreversibly damage any insulation present.

- Particular attention must be paid in cases of environments with continuous vibrations.

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

**Maintenance plan**

The environment in which the circuit breaker works has high contact ratios.

- Temperature of the terminals will be paid special attention to the maintenance of the power connections especially in the case of withstandable switch disconnectors.

- Cleaning a high moisture level can cause the corrosion of metal surfaces. Black marks on the copper parts and / or black marks on the power 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 by industries:

  - Checking the bus and/or switch disconnectors and tags for the insulating parts, preferably using a non-aggressive detergent, every 6 months.

  - Checking that the wires are localized over heating marks on the terminal.

  - The problem can be solved by changing the color of the terminal or changing (usually the contact parts should be delivered with, every 5 months).

  - Checking of the bus, tightening every 6 months.

Life Expectancy Analysis

Jaw type contacts

**General Description**

The jaw type contacts have good contact to the corresponding fixed part.

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

- The current alignment of the jaw contacts plays an important role as the contact diameter forms the design parameters.

**Maintenance plan**

The environment in which the circuit breaker works has high contact ratios and dust vectors.

- It is required a maintenance plan that includes:

  - Annual cleaning of dust marks, contamination or shelf marks inside the fixed part of the circuit breaker.

  - Annual checking that there are no related local or overheating marks on the insulating part of the circuit breaker.

  - Annual checking of the jaw type contacts integrity.

Life Expectancy Analysis

Auxiliary circuits

**General Description**

The auxiliary circuit is connected to the circuit breaker terminal blocks. It may affect the contact resistance of the auxiliary circuit.

- 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 breaker works has high contact ratios and oxidation

- It is required a maintenance plan that includes:

  - Annual checking of auxiliary circuits limits tightening.

  - Checking the wiring continuity.

  - Checking the tightening torque, every 3 years.

Life Expectancy Analysis

Operating mechanism (wear)

**General Description**

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

- Due to its design, the mechanical life of the operating mechanism is often the cause of its failure with a consequence of the breakdowns of the insulation.

- Vibration occurs in the mechanism causing for mechanical wear.

- High temperatures can cause a faster wear process, while a moderate temperature change causes mechanical stress in the operating mechanism due to the components deformation.

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

**Maintenance plan**
Life Expectancy Analysis

Operating mechanism (aging)

**General description**

Technical motion operating mechanism is one of the most vital elements in the substation equipment. Due to wear, it significantly decreases the mechanical lifetime of the operating mechanism, as it increases the load on the foundation, resulting in increased friction and wear.

**Wear**

Loss to the operating mechanism due to wear.

**High temperature**

High temperature causes a faster fatigue aging, within a sudden temperature change causes mechanical stress in the operating mechanism due to the components.

**Maintenance plan**

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

Life Expectancy Analysis

Electrical and mechanical accessories

**General information**

Checking the mechanical mechanism is important to check the correct functionality of the accessories. In addition, for electrical accessories, only on-site tests in the transformer. The test is performed during commissioning and the test report is carried out.

**Checking spring motor**

The test unit must be verified to the entire system of opening/closing operations.

**Maintenance plan**

The maintenance plan for electrical accessories includes:

**Checking the contact resistance of the accessories:**

- Perform a test of the contact resistance of accessories using a suitable device. The test is performed during commissioning and the test report is carried out.

- Check the correct opening/closing operation of both locally and remotely following the sequence every 3 months:
  - 1: movement start
  - 2: movement stop
  - 3: movement start
  - 4: movement stop

- Check the functionality of the mechanical mechanism:

- Check the functionality of the mechanical mechanism:
  - Check the correct opening/closing operation of both locally and remotely following the sequence every 3 months:
    - 1: movement start
    - 2: movement stop
    - 3: movement start
    - 4: movement stop

- Check the functionality of the mechanical mechanism:
  - Check the correct opening/closing operation of both locally and remotely following the sequence every 3 months:
    - 1: movement start
    - 2: movement stop
    - 3: movement start
    - 4: movement stop
Life Expectancy Analysis

Trip unit

General Description

The trip unit is the heart of the protection system of the circuit breaker. Therefore, it should be checked regularly over the whole protection chain.

A trip unit is tested at regular intervals to ensure that the connections between trips are secure and that the tripping mechanism is functioning correctly.

Electronics components are particularly susceptible to temperature variations.

It is strongly recommended that if the temperature range goes outside the normal range of 

Every year, it is recommended to perform a visual and manual test on the circuit breaker (the consequent opening of the Circuit Breaker) to test its readiness with Switch 1 and 2 on and Switch 3 on and off.

Maintenance plan:

The test is performed every 6 months.

Check the correct functionality of the trip unit, perform a Trip Test and Assert. Every 6 months:

- Acceptance test: Check the operation of the trip unit, number of operations, trip history, etc.
- Every 6 months:
  - Check the correct operation of the trip unit.
  - Test the trip unit with 50% TBP, every 6 months.
  - Test the trip unit with 100% TBP, every 6 months.
  - Check the correct operation of the trip unit.
  - Test the trip unit with 50% TBP, every 6 months.
  - Test the trip unit with 100% TBP, every 6 months.

Life indicators

% MECHANICAL LIFE

<table>
<thead>
<tr>
<th>Service life</th>
<th>% Mechanical life</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>100</td>
</tr>
<tr>
<td>3000</td>
<td>90</td>
</tr>
<tr>
<td>4000</td>
<td>80</td>
</tr>
<tr>
<td>5000</td>
<td>70</td>
</tr>
<tr>
<td>6000</td>
<td>60</td>
</tr>
</tbody>
</table>

% ELECTRICAL LIFE

<table>
<thead>
<tr>
<th>Service life</th>
<th>% Electrical life</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>100</td>
</tr>
<tr>
<td>3000</td>
<td>90</td>
</tr>
<tr>
<td>4000</td>
<td>80</td>
</tr>
<tr>
<td>5000</td>
<td>70</td>
</tr>
<tr>
<td>6000</td>
<td>60</td>
</tr>
</tbody>
</table>

Conclusion

Provisional Maintenance for Circuit Breaker:
- Basic Maintenance every 6 months.
- Repair maintenance with L7 Field Service Engineer every 18 months.

Life expectancy of the Circuit Breaker is limited, and the end of life is highly advisable to schedule more maintenance on an expert maintenance.

Life indicators

% MECHANICAL LIFE

<table>
<thead>
<tr>
<th>Service life</th>
<th>% Mechanical life</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>100</td>
</tr>
<tr>
<td>3000</td>
<td>90</td>
</tr>
<tr>
<td>4000</td>
<td>80</td>
</tr>
<tr>
<td>5000</td>
<td>70</td>
</tr>
<tr>
<td>6000</td>
<td>60</td>
</tr>
</tbody>
</table>

% ELECTRICAL LIFE

<table>
<thead>
<tr>
<th>Service life</th>
<th>% Electrical life</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>100</td>
</tr>
<tr>
<td>3000</td>
<td>90</td>
</tr>
<tr>
<td>4000</td>
<td>80</td>
</tr>
<tr>
<td>5000</td>
<td>70</td>
</tr>
<tr>
<td>6000</td>
<td>60</td>
</tr>
</tbody>
</table>
Contact us

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

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