LEAP REPORT

LEAP REPORT 00000840 EN

CB SERIAL NUMBER BA1000601

RMO	EMEA.IT.2012/0021.002
ODV	
NCR	

SURVEY DATE (YYYY.MM.DD)	2011.04.11
Leap Report	00000840
CB SERIAL NUMBER	BA1000601

CUSTOMER	ABB Inc.
PLANT	Southaven
ADDRESS	123 Industrial St.
CONTACT	
INSERTED BY	Kyle

LEAP REPORT

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Switchboard data

Switchboard data

Name	test2
Application	Solar
Bar System	Double
Bar insulation:	Other
Dust protection	No dust protection (IP < 5y)
Cooling system	No cooling system
Pressurization system	Yes
Cables cubicle	Close, Dry
Drip	Absent
Altitude	< 500 m

CB Data

Operations

Number of operations per year (estimate)	100
Operations counter (value read from)	10
Offeset for the operations counter	10

Generals

CB Serial Number	BA1000601
CB manufacturing date	January 2010
Date of start service	2012/01/15 (YYYY.MM.DD)
Last maintenance date	2012.11.29 (YYYY.MM.DD)

Trip Units

Trip Unit type	PR123
Trip Unit serial number	N3126Q08A
Trip Unit SW Version	02.03

Type Data

CB type	E4V4000/3P
Standard reference	IEC
Rated uninterrupted current	4000
Execution	Fixed
Poles Number	6
Auxiliary voltage	Yes

Application

Position of CB into the electric network	High (Close to the transformer)
Type of use	CB closed most of the time
Average percent load	<50% In, 8/24h
Temporary overloads:	Yes
Utilization	Protection of generators

Accessories

- Shunt opening release - YO
- Operations counter

Environment

Average enviromental temperature :	< -25° C
Shocks due to temperature range	No
Humidity:	[70, 85] %. Moderate humidity, generally found in zones close to water
Salt environment:	Moderate salt mist, zones < 10 km from sea.
Dust:	Low level of dust (civil installations or commercial buildings).
Corrosive atmosphere:	Low corrosive atmosphere. Rural zones or urban zones with low industrail activities or pollution.
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 3,5 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 3ith 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

List of Maintenance Activities Performed

1. Disconnector

Checks and Repairs	Parts Replaced
☑ Check position lock	

2. Arc chambers

Checks and repairs	Parts replaced
☑ Tracking phenomenon check	

3. Contacts

Checks and repairs	Parts replaced
☑ Contacts cleaning	

4. Operating mechanism

Checks and repairs	Parts replaced
☑ Shunt opening release - YC functionality	☑ Gearmotor
☑ Gearmotor	

Life Expectancy Analysis

Plastic case

General description

An air circuit breaker consists in a sheet 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 show a heavy use of the circuit breaker itself.
! Warning!
With high moisture values verify the corrosion level on metal surfaces: evident reddish rust on steel parts or rust with a very light color on the parts in zinc

! Attention: high moisture conditions can have effects on the deterioration of the dielectric properties of plastic parts, highlighted by very light color spots on the plastic parts.

It is required a maintenance plan that includes:
a) Monitoring the circuit breaker cleanling, every 6 months

b) Removing of excess of dust and oil/ grease with a clean and dry rag, every 6 months

c) Removing of dust on the plastic parts with a clean and dry rag and a non-aggressive alcohol compatible with plastic parts, every 6 months

d) Checking for presence of the technical characteristics labels, every 6 months

e) Performing the cleaning of the lables using a clean and dry rag, every 6 months

f) Checking for overheating or cracks that can compromise the insulating parts of the circuit breaker, every 6 months

g) Verifing that there are no external objects in the circuit breaker compartment, every 6 months

h) Make a thermographic analysis of the circuit breaker, every 18 months

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, as shown in the Installation and Service instructions), every 2 years

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 verifing 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

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 braker 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 normal corrosion values. It is required a maintenance plan that includes:

- Annual removing the dust and dirt with dry brushes and rags from the insulating parts - preferably using non-aggressive detergent

- Annual checking that there are no localized overheating marks on the terminals. The problem can be easy detected by the changing the color of the parts in contact (usually the contact parts should be silvery-white)

- Annual checking of the bolts tightness

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:

a) Annual removing of dust, mold, condensation or oxidation traces inside the fixed part of the circuit breaker

b) Annual checking that there are no localized overheating marks on the insutating part of the circuit breaker

c) Annual checking of the jaw type contacts integrity

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

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 lubrificant 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

The circuit breaker works in moderately critical enviroment 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 spings.

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 procesure 1SDH000460R0012: 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

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 causes a faster lubrificant 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

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 negatively affect the wear of the operating mechanism.

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

The calculated mechanical life reached 10%.

It is required a maintenance plan that includes:
a) At least 10 opening/closing operations both locally and remote: Immediately check following this the 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: immediately

c) Dismount the operating mechanism: immediately

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

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

f) Check the lubrication og the movement parts: lubricate with Mobilgrease28 or Mobiltemp SHC32 the supports of the main shaft: immediately;

g) Check the correct screws tightening: immediately

h) check the presence of all retaining rings and their proper insertion: immediately;

i) Measure the closing force on the closing push button: immediately;

l) Measure the opening force on the opening shaft: immediately;

m) check the correct functionality of the anti pumping lever: immediately;

n) check the position of the opening hook before and after the opening: immediately

o) check the position of the recharging system before and after the charging: immediately

p) check the position of the lever system hook before and after the operation: immediately

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 high vibration, corrosion and moisture values.

! Caution !
Corrosion of auxiliaries metal parts can break the winding of the coils:
red traces of rust on the steel parts or very light traces of rust on zinc parts.
It is required a maintenance plan that includes:
a)Perform at least 10 opening/closing operations both locally and remotely following this sequence every 6 months:
1) CB open - discharged springs
2) CB open - charged springs
3) CB closed - discharged spings

b) Check the correct screws tightening between the CB and the terminals (lugs): Every 6 months

c) Check the correct functionality of the accessories -
motor operator; shunt opering release, shunt closing release; undervoltage release, auxiliary contacts, locks in open position (with key or padlock) and racked in/out position, mechanical counter: Every 6 months

d) Check the good conditions of the SOR, UVR and SCR (without wear, overheating, cracks): Every 6 months

e) Check of the functionality of the mechanical interlocks: Every 6 months

f) Check the functionality of the trip coil: (3 trips): Every 18 months

g) Check of the Motor operator, functionality: 85%...110%Un: Every 18 months

h) Check the SOR, and SCR functionality: 70%...110%Un: Every 18 months

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 measur 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 dispaly doesn't indicates any alarm or warning.

Maintenance plan

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

It is required a more frequence maintenance plan that includes:
a) Check the correct functionality of the trip unit: performa Trip Test and Autotest (if available): Every 6 months

b) Check of the statistic data: number of trips, number of operations, trip hystory, etc...: every 6 months c) check the Wear percentage (lower then then 80%): every 6 months

c) Test the trip unit with Ekip T&P: every 18 months

d) Test the trip unit with TS3: every18 months

e) Test the functions of the trip unit and its accessories (PR021/K, HMI030, Flex Interface), the sensor chain, actuators and input/out signalling contacts contatti (K51/YO e K51/YC, zone selectivity) with the SW Ekip Connect: every 18 months

f) Verify of the CS status: every 18 months

g) Check of the connection integrity between current sensors and trip unit: every 18 months

Life Expectancy Analysis

Leap Analysis Per Components Summary

Components	Gravity	Frequency
Plastic case	High	basic every 6 months expert every 18 months
Contacts	Medium	basic every 9 months expert every 27 months
Arc chambers	Medium	basic every 9 months expert every 27 months
Power connections	Normal	basic every 12 months expert every 36 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)	High	basic every 6 months expert every 18 months
Electrical and mechanical accessories	High	basic every 6 months expert every 18 months
Trip unit	High	basic every 6 months expert every 18 months

Conclusion

Recommended Maintenance for CB : Basic Intervention 6 months, Expert 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.

Life indicators

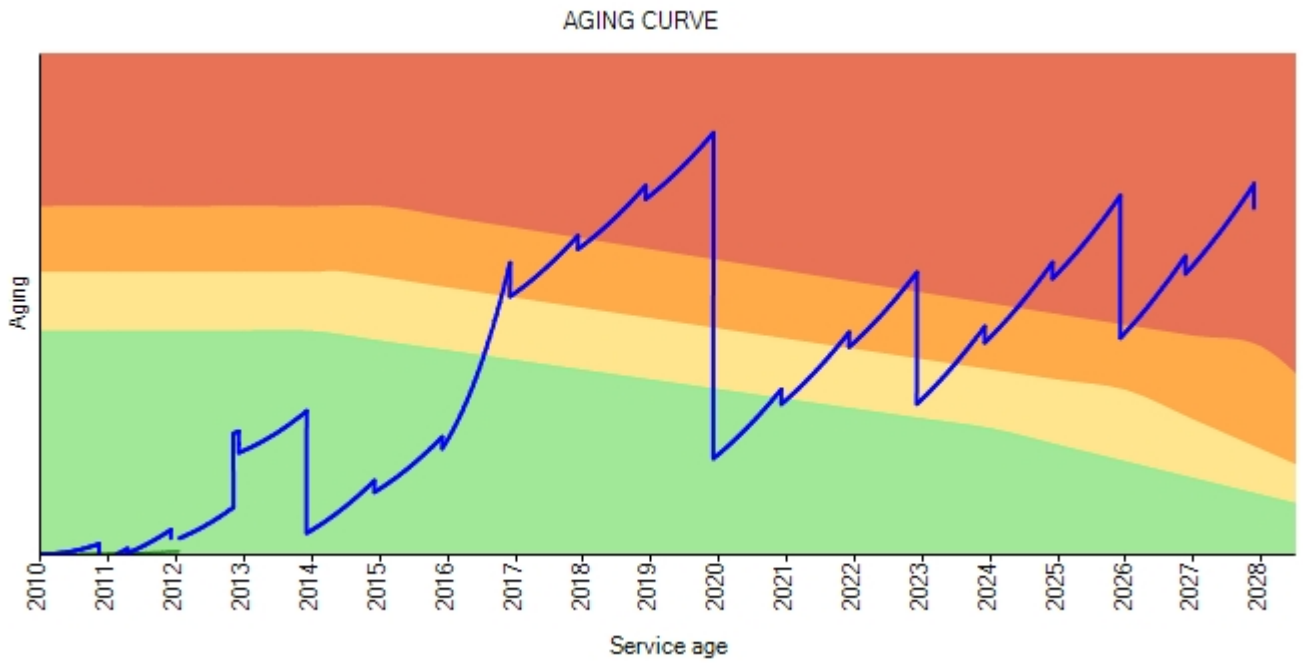
% MECHANICAL LIFE

Life indicators

% LOAD LIFE

Life indicators

Aging curve



- Low faulty probabilty
- Medium faulty probability
- Moderate faulty probability
- Recommended inspection as soon as possible
- Breaker storage since manufacturing date until commissioning date
- Breaker aging calculated according to usage, application and historical maintenances

Next Maintenance

1. Disconnector

- ☑ Trip lever
- ☑ Position lock

2. Arc chambers

- ☑ Whole set of arc chambers

3. Contacts

- ☑ Poles

4. Operating mechanism

- ☑ Shunt opening release - YO