Lifetime of Electrical Distribution Systems

Content

- General about Service and Maintenance of Electrical Systems
- Design for the right environment and operation
- Main factors that is influencing the lifetime
- Critical areas and essential system parts
- Traditional service & maintenance of Electrical Systems
- Possibilities with New Technology
ABB Low Voltage System Service

- A global service organization with well experienced Engineers, Technicians and Assembly workers available in 30 countries.
- The Service unit is always integrated in our switchgear factories. All in all more than 500 employees.
- Global installed base with operation for more than 40 years.
- Installed base consist of > 1,5 Millions cubicles installed in all kind of market segments.

Europe:
- DE, GB, FR, SE, FI, ES, NO, CH, DK, PL, CZ, IT, TR, GR, NL

Asia:
- CN, TH, SG, MY, AU, KR

Middle East:
- SA, DU, EG, ZA, IN

North & South America:
- USA, CA, AR, BR
Low voltage Switchgear is one of the most essential part in the Electrical network. It’s the Brain in the network!!

In modern industrial plants the electrical data for switchgear has increased:

- Higher nominal voltage
- Higher nominal current
- Higher short circuit currents

A short circuit or an electrical arc in a switchgear can cause serious consequences for the installation, for the production and also for the operational personal.

Therefore when working with maintenance and service in electrical switchgear, safety must have the highest priority.
Optimal life cycle and operational reliability:

- To achieve an optimal life cycle we need to start with the design, engineering, production and installation.
  - Get the correct electrical and environmental data (temperature, short circuit level, nominal current, diversity factor, degree of protection, etc.) and design the switchgear according to this data.
  - Design the switchgear with redundant supply for critical loads
  - Use redundant control voltage supply
  - Use a professional approach regarding installation and commissioning (follow the manufacturers requirements and use skilled personnel for the job)
All electrical components are sensitive for over-temperature over time. Therefore it is very important to keep the ambient temperature under control.

Some of the reasons why the temperature increases in a switchgear:

- To high temperature in the switchgear room
- Ventilation problems
- Overloaded motors and feeders
- Bad connections in bus bar joints and cable connections
- Over equipped cabinets / panels (diversity factor…)
- High switching cycles of motors and feeders
RAMS

We all want electrical systems which are:

- Reliable
- Available
- Maintainable
- Safe

To secure this, during a lifetime of 20 – 30 years we need a systematic service process to maintain both components and system parts.
Normal life cycle of a component.

- **Active** (~5 to 10 years)
  - The product with complete lifecycle services is available for purchase
  - Some product enhancements can be made

- **Classic** (~7 to 10 years)
  - The product with complete lifecycle services is available for plant extensions and spare parts

- **Limited** (~3 to 5 years)
  - Spare parts and repair services are available as long as materials can be obtained
  - Migration to the next product generation is recommended

- **Obsolete**
  - ABB cannot guarantee the availability of lifecycle services for technical reasons or within reasonable cost
  - Migration to the next product generation is recommended

- ABB’s lifecycle management model consists of four phases
- Many products are supported for more than 20 years
- ABB’s lifecycle services includes: Selection and dimensioning, installation and commissioning, training and learning, technical support and remote services, maintenance, spare parts, repair, retrofits, replacement, and recycling
Sources of Maintenance Costs

Chemical Plant: typical distribution

Asset types:
- Instruments
- Heat exchangers
- Pumps
- Compressors
- Motors & Drives
- Valves
- Vessels
- Switchgear
- Drives
- Electrical
- Piping
- Other

- Instruments: 20%
- Heat exchangers: 12%
- Pumps: 9%
- Compressors: 9%
- Valves: 8%
- Vessels: 8%
- Drives: 8%
- Electrical: 8%
- Piping: 5%
- Other: 5%
Maintenance of Electrical Systems

- **Upgrade, retrofit or replace**
- **Maintenance**
- **Aging**
- **Overhaul**
- **Repair**

Performance vs. Time
Traditional service & maintenance of Electrical Systems

- Because of limited knowledge of the condition of the switchgear, maintenance is carried out when the plant has a planned shut down (every year or every second year)

- A traditional check list is used in the process to measure and to analyze the conditions of the components

- Thermographic inspection is used to indicate if there is any hot spots in the main circuits, contacts etc.
1. Keep the assets *available* for production
2. Streamline maintenance workflow to make a faulty asset in *minimal time* available for production again
Traditional maintenance of electrical systems

- Reactive Maintenance: “Fix on Failure”
  - Expensive when considering
    - productivity impacts
    - unplanned downtime
    - secondary failures
    - overtime costs
  - Leads to fire-fighting mentality
Possibilities with New Technology

With new technology we are able to introduce “Proactive Maintenance”. This means we can continuously measure or control the condition of the essential parts in a switchgear:

- Collection of data and trends
- Get warnings and alarms in case of un-normal situation before a break down
- Localization of the fault
- Diagnostics
- Remote access and control
Condition Monitoring System

Asset Monitors

Condition Monitoring Package

Asset
Monitor

Asset
Monitor

Asset
Monitor

Asset
Condition
Document

MRO
maximo

SAP
Regular Condition Monitoring status reports

- **Objective:**
  - To provide a finger print of critical values
  - Early identification of anomalies in the LV-installation and process (motors, machines, etc.)
  - Pro-active initiation of service and maintenance actions to minimize unplanned process shut-downs

- **Typical logged measured values can be:**
  - Motor Current
  - Motor Temperature (PTC)
  - Thermal Image
  - Cos phi; power
  - Motor Start Time
  - Earth Leakage Current
  - Operating hours and their supervision
  - Switch cycles and their supervision of contactors K1, K2 and K3
  - Operation Supervision for seldom use and full runtime
  - Phase Voltages
  - Alarms and Trips
Condition Monitoring tool installed in the switchgear

**Objective:**
- Effective use of process related functionality and information to react correct and quickly in order to avoid process shut-downs

**Typical functions and condition based information for immediate action:**
- Start limitation
- Thermal overload protection
- Stall protection
- Under load protection
- Thermistor protection
- Earth leakage
- Fuse supervision
What is an Asset Monitor?

- The Asset Monitor provides information to prompt the right operator actions:
  - **What is the problem?**
    - Condition detail “description”
  - **Where is the problem?**
    - Location in switchgear or motor
  - **Which type and severity the present message has?**
    - Sub-Condition and Severity
  - **Who should initiate actions (e.g. electrical, mechanical)?**
    - Condition and Condition detail “suggested action”
  - **How the problem caused?**
    - Condition detail “possible cause”
  - **What specific actions are needed to solve the problem?**
    - Condition detail “suggested action”
Reactive maintenance improvement

Quick resolution of problem

Instant detection, accurate diagnosis and suggested actions for fast resolution

- Ability to share contextual information with those who need it—when they need it—reduces time-to-decision and action.

- Transmit the information to those able to act.
**Condition Monitoring: Optimum Performance**

It is possible to achieve both goals:

1. Higher availability of plant with Condition Monitoring
2. And lower total cost of maintenance

**Addition:**

- Migrate

- Conventional Maintenance Practice
- Condition Monitoring base maintenance practice

**Graph Elements:**

- Reactive
- Preventive
- Predictive
- Proactive

**Graph Axes:**

- Maintenance Cost
- Plant availability
Finally

- The technology is there!
- How we can use it? It is up to us!
Thank you for your attention!