INTRODUCTION

In today’s competitive environment; almost every individual end user such as private industries; SEB’s or Utilities have more focus on Asset Management. This is achieved mainly through cost reduction projects; increase in safety; reliability and optimum utilisation of existing equipment. In short more emphasis is to have a perfect balance between investing in new equipment with respect to maintenance cost; safety & down time.

In this paper I have tried to cover various aspects of Asset Management with respect to Medium Voltage Switchgear (henceforth referred as MV Switchgear). Conventional method is to replace the existing MV Switchgear when it has served its full life cycle which is approximately 30 to 35 years. Unfortunately this involves a high investment cost in new equipment. Also one has to consider other factors with respect to new switchgear; such as

a) Life of the plant & other equipments with respect to new switchgear.

b) Downtime.

c) High Investment Cost.

Therefore today’s MV Switchgear manufacturers tend to offer various alternatives to customers based on safety & life cycle management of the switchgear.

Alternative choices for customer under Asset Management of MV Switchgear includes: -

a) Repair

b) Replace

c) Refurbishment

d) Retrofit

Periodic Maintenance: Vacuum circuit breakers are characterized by their simple and robust construction. They have long life expectancy. Their operating mechanism has a low maintenance requirement, and the interrupters are maintenance free during their working life. There is no adverse effect on the vacuum, even from frequent switching of operating and short circuit currents. The servicing intervals and scope are determined by environmental influences, the switching sequences and number of short circuit breaking operations. With carefully performed inspections and servicing work, and under normal operating conditions, the circuit breaker service life of up to 20,000 operating cycles and more.

The periodic maintenance schedule may vary as per manufacturer; but broadly it can be as under

1) Panel & Circuit Breaker Inspection- Once in 2 year.

3) Lubrication- Once in 2 year.
4) Tightness of Fasteners of Power Circuit of Breaker & Panel- Once in 2 year.
5) Overhaul Operating Mechanism- Once in 5 years or after every 5000 operating cycles.
6) Insulating Parts- Once in 3 Years.
7) Control Circuit Connection Tightness & Component Functioning - Once in 3 Years.

Major Spares Parts to be maintained for periodic maintenance:
- Close Coil & Trip Coil
- Operating Counter
- Drive Insulator
- Limit Switch
- Auxillary Switch
- Spring Charging Motor
- Vacuum Interrupter

FAQ’s

What is Asset Management?
It is the management of both tangible as well as intangible assets. It is a systematic process of operating, maintaining, upgrading, and disposing of assets cost-effectively.

Asset Management – Medium Voltage Switchgear
It is the practice of managing the entire life cycle of MV Switchgear; this includes design & construction; installation & commissioning; operation & maintenance; repairing; modifying; replacing and decommissioning or disposal.

Why Asset Management for MV Switchgear?
Asset Management for MV Switchgear provides any of the following solutions to age old existing switchgear in service.

- a) Up gradation to more reliable & newer technology.
- b) Costly or unavailable spares.
- c) Improved Safety – For both; Life & Property.
- d) Minimise frequent outage due to switchgear failure.
- e) Minimises time span for regular & periodic maintenance.
- f) Improved support for maintenance.
- g) Improved documentation; such as SLD; BOQ; wiring diagram etc..
- h) Improved efficiency from existing infrastructure.
- i) Best use of limited CAPEX; O&M budget.
- j) Above all it’s Cost Effective Solution.

Assessment of Aged Switchgear
Assessment of aged switchgear enables the uses for taking the correct decision to be made on; whether to refurbish; retrofit; repair or completely replace the existing old switchgear and utilise the available CAPEX in best possible way. Following flow chart explains the various steps involved in assessment of aged switchgear.

When is it necessary?
Result of assessment provides user the analysis of historical fault & failure information for similar types of MV Switchgear. This helps to assess the remaining life of switchgear. Following factors affect the life of existing switchgear.

- 1) Mechanical problems.
- 2) Malfunctioning.
- 3) Insulation failure.
- 4) Failure due to improper cable termination.
- 5) Failure on VT & CT.
Servicing or renovation of older or damaged MV Switchgear brings it to a workable or better looking condition. Also it can be defined as Servicing, readjusting, and recalibrating Switchgear or instruments to bring them to near-new or original operational level.

In short refurbishment offers customer a life cycle extension of their switchgear cost effectively.

Refurbishment of Switchgear can be considered by those customers who expect an acceptable performance over short to medium life of Switchgear.

Refurbishment involves major overhauling of the Switchgear with replacement of parts which are time expired eg. Operating mechanism; insulation components etc..

Thus a normal Repair / Replace would solve a specific problem related to a HT VCB; while Refurbishment (good maintenance) combines repair with maintenance and or renewal activity.

Broadly Refurbishment of MV Switchgear can done with respect to

a) Dynamic Components
b) Static Components

**Refurbishment of Dynamic Components:**

Major Dynamic components such as main contacts in case of SF6 breakers; vacuum interrupter (VI) in case of VCB ; drive mechanism; potential free contacts; common drive rod; rack in rack out mechanism; motor for breaker charging etc are checked for their health & decision needs to be taken to overhauled or replaced individual component.

Other moving components such as bearing; cotter pins; hinges etc needs to be replaced fully.

**Refurbishment of Static Components:**

This type of refurbishment can be applied where the MV Switchgear is used & shifted frequently due to nature of its application for example on construction sites etc.

In this all the major static components are removed completely for example sheet metal components etc. and are cleaned or repainted completely as

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**Whom to refer?**

Sufficient technical expertise may not be available in house to carry out a risk assessment and decide on appropriate precaution. In such cases MV Switchgear owners / users should take advice from suitably competent organisation such as:

a) MV Switchgear Manufacturers.
b) Consulting Organisations specialised in MV Switchgear.
c) Maintenance contractors with experience in MV Switchgear.
d) Distribution Companies.

**REFURBISHMENT**

Refurbishment is the act or an instance of making neat, clean, or complete, as by renovating, re-equipping, or restoring old switchgear.
required. This activity can be done at customer site also. Insulation levels also needs to be checked for its values & should be replaced if required. All the switching components can be reused depending on its condition.

RETROFIT

Retrofitting of MV Switchgear is becoming more popular now days.

Retrofitting is an instance of modernizing or expanding with new or modified parts, devices, systems, or equipment.

Advantages
1) Improved technology.
2) Reduced Footprints; increased floor space.
3) Reduced moving parts means less maintenance.
4) Reduced inventory.
5) Up gradation of relays.
6) Up gradation of meters.
7) Insulation up gradation means improved safety.
8) Additional interlocks can be incorporated.
9) Panel addition deletion can be done.

Similar to refurbishment; retrofitting can be broadly classified as -

a) Retrofitting of Dynamic Components.

b) Retrofitting of Static Components.
   i. Mechanical Components.
   ii. Electrical Components.

Retrofitting of Dynamic Components:

This involves up gradation of major components such as circuit breakers. Most of the old circuit breakers still in service use old technology of arc quenching such as OIL & SF6.

Since Vacuum Circuit Breakers have advantage over OIL & SF6; people tend to prefer VCB. With retrofitting option available the same can be up graded to Vacuum with an economical option.

Retrofitting of Static Components:

a) Mechanical Components
   Mechanical components mainly includes fabricated panel. Retrofitting provides the end user more compact with new technology thus increased safety & better footprints. Improved protection against faults like internal arc due to improved designs. Condition of bus bar can be checked & can be replaced if required. Also inter phase insulations if any can be completely replaced or removed. New & improved interlocks can be integrated if desired.

b) Electrical Components
   On one side technology with respect to electrical & electronics components has developed rapidly which includes metering & protection instruments like relays & meter; current transformers & potential transformers; panel & inter- panel wiring.

   And on other side plant have modernised and uses more of process control which requires high level of accurate and system integration.

   Depending upon the application & requirement the end user can decide upon upgrading the relays from electromechanical to compact numerical communicable; meters from analogue to compact digital communicable; replacing the old oil filled CTs & PTs with new dry resin cast CTs & PTs or LTCTs.

   Also if desired a new protection scheme can replace the old one for better results.

PRECAUTION

The performance of retrofit panel depends mainly on the quality of work carried out during retrofitting by service team. Also any deviation without the knowledge of design group during the work; may lead to failure later on & it will be too late and costly to identify the cause of the failure by the designer later on. Some of the major points that need to be taken care are:

1) Proper engagement between fixed contact & isolating contacts is desired.

2) Interlock between breaker & panel is service position must be secured so that there is no play between them in service position; so as to prevent any arcing.
3) Depending upon customer requirement; retrofitted breakers needs to be type tested for STC & Short circuit test duties.

CONCLUSION

All new technological developments in the field of Asset Management of MV Switchgear such as refurbishment & retrofitting have provided the end user a range of options for economically improving safety & extending the life of their existing MV Switchgear. An in depth comparison of these options helps the user to identify the most suitable way of improving the performance of the electrical asset there by maintaining a competitive advantage in the market place.