

Maintenance of 220kv Substation Equipment

Khan Azharuddin¹, Shaikh Gulam Jilani², Sayed Mohd Javed³, Chaudhary
Mushtaque⁴, Yakub Khan⁵, Sayed Kaleem⁶
^{1, 2, 3, 4, 5, 6}(Electrical Engineering Department, AIKTC, India)

Abstract: *This paper will explore the maintenance of electrical equipment. Specifically it will look at: 1) why maintenance is performed on electrical equipment? 2) What, legal or other, drivers are behind performing electrical equipment maintenance? 3) Electrical equipment maintenance is performed on an interval, but what is the purpose of this interval and how is it determined? 4) What is the difference between breakdown, preventive, and predictive electrical equipment maintenance methods and when should each be applied? 5) What do available testing technologies, such as - insulation resistance, power factor, oil analysis, partial discharge, infrared, ultrasonic, functional analysis, etc., tell us about the condition of electrical equipment and when should they be applied to various types of electrical equipment? 6) What does analysis of electrical equipment maintenance data/information reveal about the frequencies, philosophies, and foundation on which maintenance is performed?*

Keywords: *National Electrical Code(NEC), Electrical Preventive Maintenance (EPM), Occupational Safety and Health Administration (OSHA)*

I. Introduction

The significance of above subject originates from the way that electric support organizations must deal with numerous electrical hardware (circuit breakers, transformers, links, encasings and so on.). The greater part of them have been in uncovering for quite a long time and are near the finish of their valuable lifetime and after that, they are bound to fall flat, being important a help with settling on a fitting and auspicious choices about their advantages. In light of the data procured from resource the board exercises (observing and analysis, upkeep procedures and hazard the executives), the basic leadership process is intended to keep up electrical gear in working state, in safe condition and financial proficiency for power organizations. With regards to vitality showcase deregulation for any organization in the power field either age, transmission and dissemination, its general target is to lessen costs while expanding hardware dependability, broadening gear lifetime and guaranteeing elevated amounts of wellbeing and security for task and upkeep work force, for the general population, and for the earth. Because of this reality, legitimate activity and support of major electrical gear (transformer, circuit breakers, and overhead lines) ends up critical in light of the fact that they have a place with the costly hardware class; - the expenses for upkeep of this gear speak to a vast level of support spending plans them disappointments, unfavourably influence the framework dependability and the current checking advances inside the power station. By and large target of the power organizations is currently, like never before, to limit operational expenses of the electrical gear and to guarantee that the framework is working all the more financially. A vital operational expense is the support cost. Upkeep streamlining is one conceivable procedure to diminish life cycle costs while improving unwavering quality. The power organization needs to actualize new methodologies for progressively compelling upkeep strategies. In this way, settling on choices about the gear upkeep exercises must have an unmistakable thought regarding what the support can perform, what support methodologies are accessible, what resources for perform support on, what dimension of support to perform, what explicit upkeep ventures to perform, and when to play out the chose upkeep.

II. Importance of Electrical Equipment Maintenance

This article gives knowledge into the upkeep prerequisites for overcurrent defensive gadgets and the potential effect on the circular segment streak episode vitality when support isn't performed appropriately. Electrical preventive upkeep and testing is a standout amongst the most essential capacities to be performed so as to keep up the unwavering quality and uprightness of electrical dispersion frameworks, just as for the assurance of gear and work force. Nonetheless, preventive upkeep of electrical frameworks and hardware, explicitly concerning overcurrent defensive gadgets is frequently ignored, or is performed rarely or insufficiently. An unexpected time delay in the activity of an electrical switch, because of a sticky working system, can cause the occurrence vitality of a circular segment glimmer to rise, once in a while drastically.

The National Electrical Code (NEC) expresses that overcurrent assurance for conduits and hardware is given to open the circuit if the flow achieves an esteem that will cause an unnecessary or hazardous

temperature in channels or transmitter protection. As to circuit breakers the best way to achieve this is through appropriate upkeep and testing of these gadgets, per the maker's guidelines.



Fig.1 Maintenance centre

III. Maintenance and Testing Considerations

Explicit support and testing methodology won't be tended to in this article, in any case, there are three essential advances that ought to be viewed as while tending to the upkeep and testing necessities for overcurrent defensive gadgets.

1. The initial phase in legitimately keeping up electrical gear and overcurrent defensive gadgets is to comprehend the necessities and suggestions for electrical hardware support from different sources. Instances of sources incorporate, however are not constrained, to the Manufacturer's Instructions, ANSI/NETA MTS [2], NFPA 70B [3], IEEE Std. 3007.2, [4]; NEMA AB-4 [5], and NFPA 70E [6].
2. The second step is to give sufficient preparing and capability to representatives. NFPA 70E, Section 205.1 states: Employees who perform upkeep on electrical gear and establishments will be qualified people... and will be prepared in and comfortable with, the particular support systems and tests required.
3. The Occupational Safety and Health Administration (OSHA), characterizes a certified individual as "One who has gotten preparing in and has shown abilities and information in the development and activity of electric hardware and establishments and the perils included." It is critical that representatives are legitimately prepared and fit the bill to keep up electrical gear so as to expand the hardware and framework unwavering quality, just as upgrade worker wellbeing for all who take a shot at, close, or interface with the hardware. [7] NFPA 70E states, as to electrical hardware support [6].
 - i. This standard tends to electrical wellbeing related work rehearses, security related upkeep prerequisites, and other managerial control for worker work environments .In an instructive note to section 110.1(A) it clarifies that "authoritative controls" incorporate confirmation of appropriate support and establishment, alarming strategies, evaluating necessities, and preparing necessities gave in the standard.
 - ii. Maintenance, was added to the 2015 release of NFPA 70E to require the state of upkeep as a piece of the by and large electrical wellbeing program
 - iii. Arc Flash Risk Assessment – Take into thought the structure of the overcurrent defensive gadget and its opening time, including its state of upkeep.
 - iv. Electrical gear will be kept up as per makers' guidelines or industry agreement benchmarks to decrease the danger of disappointment and the resulting introduction of workers to electrical risks.
 - v. Overcurrent defensive gadgets will be kept up as per the producers' guidelines or industry accord measures. Upkeep, tests, and assessments will be archived.
 - vi. Circuit breakers that intrude on shortcomings moving toward their appraisals will be examined and tried as per the producers' directions.
1. The third step is to have a composed, compelling Electrical Preventive Maintenance (EPM) program. NFPA 70B makes a few entirely unmistakable explanations around a successful EPM program.
 - i. Electrical hardware disintegration is ordinary, yet gear disappointment isn't unavoidable. When new gear is introduced, a procedure of typical decay starts. Unchecked, the decay procedure can cause glitch or an

electrical disappointment. A compelling EPM program distinguishes and perceives these components and furnishes measures for adapting to them.

- ii. In expansion to ordinary disintegration, there are other potential reasons for gear disappointment that can be recognized and adjusted through EPM. Among these are load changes or augmentations, circuit Adjustments, inappropriately set or inappropriately chosen defensive gadgets, and changing voltage conditions.
 1. The initial phase in appropriately keeping up electrical gear and overcurrent defensive gadgets is to comprehend the prerequisites and suggestions for electrical hardware upkeep from different sources. Instances of sources incorporate, yet are not constrained, to the Manufacturer's Instructions, ANSI/NETA MTS [2], NFPA 70B [3], IEEE Std. 3007.2, [4]; NEMA AB-4 [5], and NFPA 70E [6].
 2. The second step is to give satisfactory preparing and capability to representatives. NFPA 70E, Section 205.1 states: Employees who perform support on electrical hardware and establishments will be qualified people... and will be prepared in and comfortable with, the particular upkeep systems and tests required.
 3. The Occupational Safety and Health Administration (OSHA), characterizes a certified individual as "One who has gotten preparing in and has exhibited abilities and information in the development and task of electric hardware and establishments and the risks included." It is imperative that representatives are legitimately prepared and fit the bill to keep up electrical gear so as to build the hardware and framework unwavering quality, just as upgrade worker wellbeing for all who deal with, close, or connect with the gear. [7] NFPA 70E states, with respect to electrical gear support [6].
- iii. This standard tends to electrical wellbeing related work rehearses, security related upkeep necessities, and other regulatory control for representative work environments .In an educational note to passage 110.1(A) it clarifies that "managerial controls" incorporate confirmation of legitimate support and establishment, alarming methods, examining prerequisites, and preparing necessities gave in the standard.
- iv. Maintenance, was added to the 2015 release of NFPA 70E to require the state of upkeep as a piece of the generally electrical security program
- v. Arc Flash Risk Assessment – Take into thought the structure of the overcurrent defensive gadget and its opening time, including its state of support
- vi. Electrical gear will be kept up as per makers' guidelines or industry agreement gauges to diminish the danger of disappointment and the resulting presentation of workers to electrical risks.
- vii. Overcurrent defensive gadgets will be kept up as per the producers' guidelines or industry accord measures. Support, tests, and examinations will be archived.
- viii. Circuit breakers that intrude on shortcomings moving toward their appraisals will be examined and tried as per the makers' directions.
- ix. The third step is to have a composed, compelling Electrical Preventive Maintenance (EPM) program. NFPA 70B makes a few truly unmistakable explanations around a compelling EPM program.
- x. Electrical gear weakening is ordinary, however hardware disappointment isn't inescapable. When new gear is introduced, a procedure of typical crumbling starts. Unchecked, the disintegration procedure can cause glitch or an electrical disappointment. A compelling EPM program distinguishes and perceives these variables and gives measures for adapting them.
- xi. In expansion to typical decay, there are other potential reasons for hardware disappointment that can be identified and rectified through EPM. Among these are load changes or increments, circuit adjustments, inappropriately set or inappropriately chosen defensive gadgets, and changing voltage conditions.
- xii. A very much managed EPM program will lessen mishaps, spare lives, and limit exorbitant breakdowns and impromptu shutdowns of creation gear.
- xiii. NFPA 70E, Safety-Related Maintenance Requirements – ... these prerequisites distinguish just that upkeep straightforwardly connected with representative security ... it doesn't endorse explicit support techniques or testing strategies. It is left to the business to browse the different support techniques accessible to fulfil the prerequisites.

As noted in NFPA 70E, the upkeep prerequisites are vital for representative wellbeing, however this part does not determine unwavering quality issues, albeit appropriately keeping up gear will affect the dependability of the electrical hardware and frameworks. IEEE Std. 3007.2 states: In arranging an electrical preventive support (EPM) program, thought must be given to the expenses of security, the expenses related with direct misfortunes because of gear harm, and the roundabout expenses related with downtime or lost or wasteful creation. All upkeep and testing of electrical defensive gadgets must be practiced as per the producer's directions. Without the producer's directions, the most recent release of the ANSI/NETA MTS [2] is an amazing wellspring of data for playing out the required upkeep and testing of these gadgets. In any case, the producer's time-current bends would be profitable data for legitimately testing each overcurrent defensive gadget.

IV. Arc Flash Hazard Considerations

Upkeep and testing are fundamental to guarantee appropriate security of gear and the wellbeing of faculty. As to faculty insurance, NFPA 70E requires a bend streak chance appraisal be performed before anybody approaches uncovered invigorated electrical channels or circuit parts that have not been set in an electrically sheltered work condition. NFPA 70E, Section 130.5 states that the circular segment streak chance appraisal must think about the structure of the overcurrent defensive gadget and its opening time, including its state of upkeep. All figuring's for deciding the occurrence vitality of a circular segment streak require the bend clearing time of the overcurrent defensive gadget. This clearing time is gotten from the settings on the gadget, alongside the time-current bends. This data can likewise be gotten from a present building defensive gadget coordination think about, which depends on what the defensive gadgets should do. In the event that, for instance, a low-voltage control electrical switch has not been worked or kept up for quite a long while and the oil had turned out to be sticky or solidified, the electrical switch could take a few extra cycles, seconds, minutes, or longer to clear a blame condition. This inadvertent time deferral could have calamitous outcomes, because of the expansion in episode vitality, should a bend streak happen. In the event that the labourer is ensured dependent on what the electrical switch should do and an inadvertent time delay happens, the specialist could be genuinely harmed or killed in light of the fact that he/she was under secured. Support is critical to an electrical wellbeing program. Support must be performed by the maker's directions, or industry agreement standard, so as to limit the danger of having an inadvertent time delay in the task of the circuit defensive gadgets.

V. Conclusion

In So as to ensure electrical gear and faculty, legitimate electrical hardware preventive upkeep must be performed. The maker's guidelines, or industry accord principles, exist to help clients with electrical hardware upkeep and testing. At the point when the overcurrent defensive gadgets are appropriately kept up and tried for legitimate alterations and task, hardware harm and bend streak dangers can be restricted of course. Lamentably numerous in industry imagine that in light of the fact that the lights are on or the machines are running that all is well and that support isn't required, on the grounds that the electrical switch is working fine and dandy. No, the electrical switch isn't working, it is shut. Working is the point at which an over-burden, ground-blame, or short out happens and the electrical switch opens naturally in the time indicated or when it is physically opened or shut. Upkeep of overcurrent defensive gadgets is basic to electrical hardware and frameworks unwavering quality, just as for security of individual.

References

- [1]. Andrușca, M., Adam, M., Baraboi, A., Irimia, D.F., Aspects regarding the asset management of the electrical equipment into a power station. International Conference on Electrical Engineering and Energy Converts, Suceava, 2011.
- [2]. McCalley J., Kezunovic, M., Natti, S., Automated Integration of Condition Monitoring with an Optimized Maintenance Scheduler for Circuit Breakers and Power Transformers. Power Systems Engineering Research Centre, 2006.
- [3]. Pancu, C., Adam, M., Baraboi, A., Roman, C., New possibility for the electro erosion estimation of the circuit breakers contacts. 8th WSEAS International Conference on Electric Power Systems, High Voltages, Electric Machines "POWER '08", Venice, Italia, pp. 81-84, 2008.
- [4]. Ray Mohapatra, S. K., Mukhopadhyay, S., Risk and Asset Management of Transmission System in a Reformed Power Sector. Power India Conference, 2006.
- [5]. Endrenyi, J., Introduction to maintenance, IEEE tutorial on asset management–maintenance and replacement strategies, Tampa, USA, 2007.
- [6]. Abu-Elanien, E.B., Salama, M.M.A., Asset management techniques for transformers. Journal of Electric Power Systems Research 80, pages 456-464, 2010.
- [7]. Regulament de conducere și organizare a activităților de mentenanță, ANRE – Autoritatea Națională de Reglementare în domeniul Energiei, 2002.
- [8]. Adam, M., Baraboi, A., Pancu, C., Plesca, A., Reliability Centered Maintenance of the Circuit Breakers, International review of electrical engineering- IREE, vol 5, pp. 1218-1224, 2010.
- [9]. Florea, M., Leca, A., Considerations on the maintenance strategy of the electricity transmission grid and the need to promote live works to overhead lines. U.P.B. Sci. Bull., 2011.
- [10]. Live tank circuit breakers–applicationguide, ABB, 2010.
- [11]. Transmission Asset Management, Working group C1.16 (E. Rijks, G. Balzer, G Sanchis), Cigre, 2010.
- [12]. Cartea tehnică pentru întreruptoarele de tip GL 310, 311, 312 F1, AREVA, 2009.