Safety Measures

ELECTRICAL

"Elimination is the first priority! Ensure a risk assessment is completed before energized work tasks are completed."

Electrical Maintenance Program Risk Assessment Consequences

By Terry Becker, P.Eng., CESCP, IEEE Senior Member

An Electrical Maintenance Program (EMP) is an electrical equipment asset integrity management system. In a previous article preliminary information was provided related to developing an EMP following a Project Execution Plan (PEP) and that the EMP requires a recommended framework/table of contents that can be consistent with safety management systems. An integral component of the EMP is a risk assessment-based approach to determine specific maintenance strategies, inspection and test procedures (ITPs) and the specific maintenance intervals for the ITPs to achieve the desired outcome of a specific electrical equipment condition (e.g., Condition 1, 2 or 3 as identified in CSA Z463, NFPA 70B and ANSI/NETA MTS).

Asset integrity is the practice of ensuring industrial assets effectively and safely perform their intended functions throughout their entire lifecycle, from design to decommissioning, minimizing risks to people, the environment and operations. It involves a systematic, risk-based approach with key activities for electrical equipment of inspection, cleaning/lubrication, testing, and operating of electrical equipment and documenting the inspection and test results consistent with industry accepted best practices Standards such as CSA Z463 Maintenance of electrical systems Standard and NFPA 70B Standard for Electrical Equipment Maintenance. The inspections and testing procedures implemented at the determined maintenance interval will provide a maintenance for safety strategy, prevent catastrophic failures, limit unplanned breakdowns, extend electrical equipment asset life and maximize performance and reliability of the electrical equipment and the related electrical power distribution system for a facility.

With respect to the risk-based assessment an electrical equipment asset prioritization criteria is based on an evaluation of consequences that are evaluated against the desired electrical equipment condition. Maintenance strategies, specific ITPs and the maintenance intervals are determined to deliver the desired electrical equipment condition mitigating the specific consequences for an electrical equipment asset (e.g., transformer, generator, HV or LV switchgear, power circuit breaker/relay, MCC, switchboard/panelboard, UPS charger, UPS batteries, cable, motor, etc.). The CSA Z462 and NFPA 70B Standards define three conditions with a slightly different description as noted in Table 1.

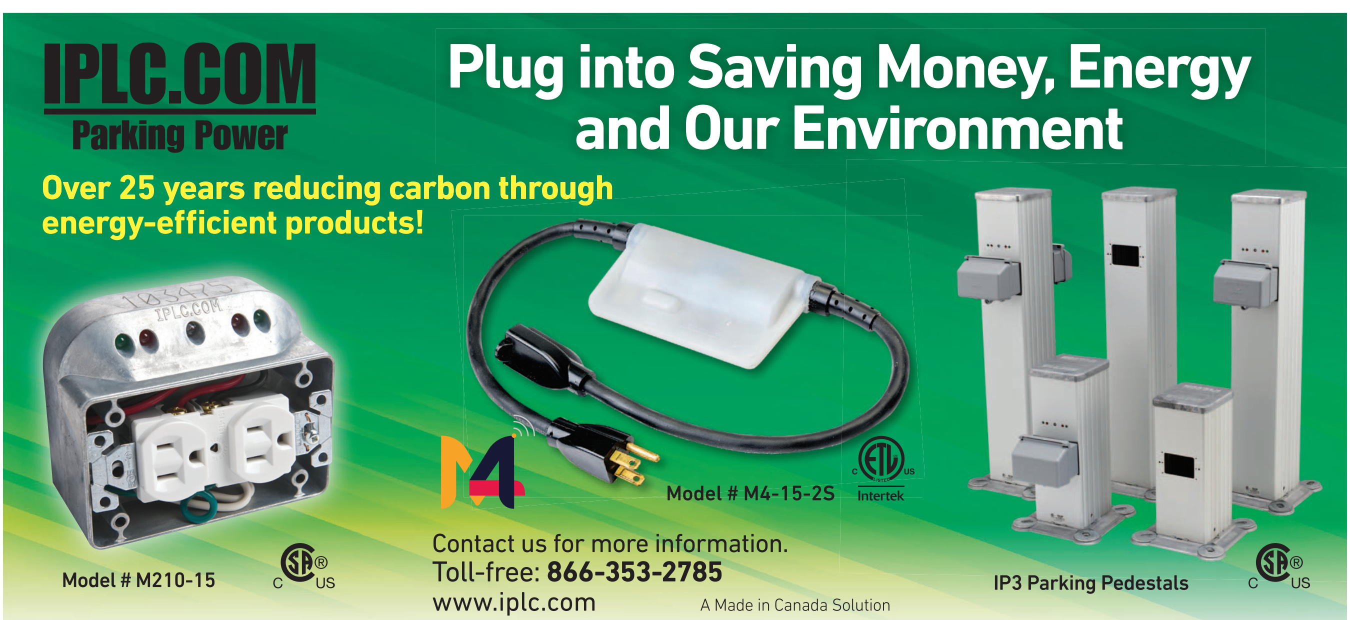
With respect to consequences, Table 2 outlines eight potential consequences. Not all of the consequences listed will be applicable to each individual electrical equipment asset. In most cases multiple consequences will apply with a different weighting assessed.

Table 1 – Electrical Equipment Condition Description

Standard	Determined Maintenance Interval, Months		
	Condition 1	Condition 2	Condition 3
CSA Z463 Annex M	Optimized Program for Critical or Severe Duty Application. Minimal Frequency	Good Electrical Practice	Maximum Frequency
Maintenance Interval Examples	1, 2, 3, 6, 12	24, 36, 48	60, 72
NFPA 70B Chapter 9 Table 9.2.2	Equipment Appears New. Clean. Maint. Up to Date. No Cont. Montit. Issues. No Acti. Recomm from PdM.	Deviation of Maint. Test Results from Norm. Prev. Maint. Required Repairs. Cont. Monit. Notifications Have Occurred. Active Recomm. From PdM.	Two Maint. Cycles Missed. Cont. Monit. Notification. Urgent Issues from PdM.
Maintenance Interval Examples	3, 12, 24, 60	3, 6, 12, 24, 36, 60	1, 3, 6, 12 Before Use

Table 2 – Electrical Equipment Asset Maintenance Prioritization Criteria

Item #	Maintenance Prioritization Consequence Criteria Description	Comments / Notes
1	OH&S Regulatory, Injury/Fatality	e.g. liability.
2	Other Regulatory Compliance	e.g., airports Canada TP 312, hospitals, etc..
3	Maintenance for Safety (e.g., abnormal arcing fault likelihood, electrical protective device opening times for incident energy calculations, etc.)	e.g., likelihood unknown non-interaction, calculated incident energy levels may be higher.
4	Criticality of Service (e.g., Uptime, Loss of Revenue)	e.g., profitability.
5	Equipment Damage, Replacement Cost	e.g., unplanned expense budget, critical spares identified and cost.
6	Legal, Contractual Obligations, Confidentiality	e.g., data centres financial penalties/confidential data, production commitments (e.g., miss deliverable and penalty), production targets, etc..
7	Insurance Requirements (may dictate specific maintenance intervals)	e.g., production loss penalties, reduced insurance premiums/ credit, premium increases, warranty void, equipment replacement costs.
8	Company Reputation, Valuation	e.g., license to operate, stock price.



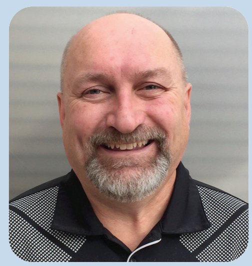
Historically electrical equipment maintenance may have been driven with the highest priority as Item 4, criticality of service, uptime and revenue. This consequence is important, but other consequences listed may be a higher priority depending on the company (e.g., commercial, industrial or institutional) and facility (e.g., large scale power generation, factory, petrochemical, forestry, mining, hospital, water & wastewater treatment, university, public school, municipal offices (e.g. administrative, fire department, police, recreational, etc.)).

An Electrical Maintenance Program will assist in the more effective management of electrical maintenance and ensuring specific consequences have been addressed based on an applied risk assessment process. Some of the benefits of the development, implementation and eventual auditing of the Electrical Maintenance Program are:

- Saving lives! Reducing risk to as low as reasonably practicable. Maintenance for safety!
- Ensure confidence and certainty with workers that will lead to increased productivity.
- Stronger electrical safety and maintenance culture and positive/proactive behaviors.
- Consistency across the Company.
- Ensure revenue targets or met, profitability.
- Reduce risk of negative impact to the operation of facilities and the potential negative impact on reputation if injuries or a fatality were to occur.
- Limits the likelihood of damage to electrical equipment and then the related repair costs, extended outage costs and need for proactive management.
- Forward realistic budgeting of costs related to electrical equipment maintenance.
- Improved technical quality and lower costs of maintenance. More effective planning and budgeting.
- Improved document management.
- More effective management of insurance risk.
- Comply with regulatory requirements, reduce risk of regulatory oversight.
- Limits the likelihood of legal costs incurred.

More on an Electrical Maintenance Program in future articles.

I will continue my efforts to communicate information in Electrical Safety Measures and share the knowledge and experience I have in an effort to “Get it Right!!” My electrical safety journey and mission will continue!! Knowledge is power! TAKE CONTROL of ARC FLASH! PLACE MORE FOCUS on ELECTRIC SHOCK!



Terry Becker, P.Eng., CESCP, IEEE Senior Member is a founding member and the First Past Vice-Chair of the CSA Z462 Workplace electrical safety Standard Technical Committee and currently a Voting Member and Clause 4.1 and Annexes Working Group Leader. Terry is also a Founding Member and a Voting Member on the CSA Z463 Maintenance of electrical systems Standard and a Voting Member of the IEEE 1584 Guide for Performing for Arc-Flash Hazard Calculations. Terry is also a voting member of the CAN/ULC S801 Workplace Electrical Safety Standard for Utility Generation, Transmission and Distribution. Terry has presented at over 95 Conferences and Workshops on electrical safety in Canada, USA, India, Australia and New Zealand. Terry is a Professional Engineer in the Provinces of BC, AB and ON. Terry is an Electrical Safety Specialist, Management Consultant, and can be reached at 587.433.3777 or by email **terry.becker@twbesc.ca**.