AMP 205 FUSE HOLDERS NOT SUBJECT TO ENVIRONMENTAL QUALIFICATION REQUIREMENTS (VERSION 2020)

Programme Description

The purpose of the AMP described herein is to provide reasonable assurance that the intended functions of the metallic clamps of fuse holders are maintained consistent with the current licensing basis through the intended period of operation [1-3]. Fuse holders (fuse blocks) are classified as a specialized type of terminal block because of the similarity in fuse holder design and construction to that of a terminal block. Fuse holders are typically constructed of blocks of rigid insulating material, such as phenolic resins. Metallic clamps (clips) are attached to the blocks to hold each end of the fuse. The clamps, which are typically made of copper, can be spring-loaded clips that allow the fuse ferrules or blades to slip in, or they can be bolt lugs, to which the fuse ends are bolted.

AMP 201 manages the ageing of insulating material but not the metallic clamps of the fuse holders. The AMP for fuse holders (metallic clamps) needs to account for the following ageing stressors if applicable: increased resistance of connection due to chemical contamination, corrosion, and oxidation or fatigue caused by ohmic heating, thermal cycling, electrical transients, frequent manipulation, or vibration. AMP 201 is based on only a visual inspection of accessible cables and connections. Visual inspection is not sufficient to detect the ageing effects from chemical contamination, corrosion, oxidation, fatigue, or vibration on the metallic clamps of the fuse holder.

Fuse holders that are within the scope according to national regulatory requirements are tested to provide an indication of the condition of the metallic clamps of the fuse holders. The specific type of test performed is determined prior to the initial test and is to be a proven test for detecting deterioration of metallic clamps of the fuse holders, such as thermography, contact resistance testing, or other proven test justified in the application.

Operating experience has shown that fuse holders experience a number of age-related failures. The major concern is that failures of a deteriorated cable system (cables, connections including fuse holders, and penetrations) might be induced during accident conditions. Since they are not subject to the environmental qualification requirements, an AMP is required to manage the ageing effects. This AMP ensures that fuse holders will perform their intended function for the intended period of operation [4-7].

Evaluation and Technical Basis

1. *Scope of the ageing management programme based on understanding ageing:*

This AMP manages fuse holders, within the scope according to national regulatory requirements, (metallic clamps) considered susceptible to the following ageing effects: increased resistance of connection due to chemical contamination, corrosion, oxidation, and fatigue caused by ohmic heating, thermal cycling, electrical transients, frequent manipulation, or vibration.

1. *Preventive actions to minimize and control ageing degradation:*

This is a condition monitoring programme and no actions are taken as part of this programme to prevent or mitigate ageing degradation.

1. *Detection of ageing effects:*

Fuse holders are to be tested on a periodic basis to provide an indication of the condition of the metallic clamp of the fuse holder. Testing may include thermography, contact resistance testing, or other proven test methods.

A population of aged fuse holders is tested on a periodical basis according to national regulations on a representative population (defined by the NPP). If negative operating experience is detected, defect fuse holders removed from the installation should be submitted to potential complementary tests to understand the ageing effect. Depending on the conclusions of the additional investigations, the population to be tested could be expanded.

1. *Monitoring and trending of ageing effects:*

Trending actions are not included as part of this AMP because the ability to trend test results is dependent on the specific type of test chosen. However, results that are trendable provide additional information on the rate of degradation.

1. *Mitigating ageing effects:*

This programme is a condition monitoring programme. This programme has no specific operations, maintenance, repair or replacement mitigation aspects.

1. *Acceptance criteria:*

The acceptance criteria for each test are defined by the specific type of test performed and the specific type of fuse holder tested. The metallic clamp of the fuse holder needs to be below the maximum allowed temperature for the application when thermography is used; otherwise, a low resistance value appropriate for the application when resistance measurement is used.

1. *Corrective actions:*

An engineering evaluation is performed and corrective actions are taken when the test acceptance criteria are not met in order to ensure that the intended functions of the fuse holders can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective action necessary, and the likelihood of recurrence.

1. *Operating experience feedback and feedback of research and development results:*

This AMP addresses the industry-wide generic experience. Relevant plant-specific operating experience is considered in the development of the plant AMP to ensure the AMP is adequate for the plant. The plant implements a feedback process to periodically evaluate plant and industry-wide operating experience and research and development (R&D) results, and, as necessary, either modifies the plant AMP or takes additional actions (e.g. develop a new plant-specific AMP) to ensure the continued effectiveness of the ageing management.

Operating experience has shown that loosening of fuse holders and corrosion of fuse clips are ageing mechanisms that, if left unmanaged, can lead to a loss of electrical continuity function. Operating experience in NUREG-1760 documented fuse holder failures due to fatigue and recommends maintenance procedures be reviewed to minimize removal and reinsertion of fuses to de-energize components (as this can lead to degradation of the fuse holders).

At the time when this AMP was produced, no relevant R&D was identified.

1. *Quality management:*

Site quality assurance procedures, review and approval processes, and administrative controls are implemented in accordance with the different national regulatory requirements (e.g. 10 CFR 50, Appendix B [8]).

References

1. UNITED STATES NUCLEAR REGULATORY COMMISSION, Fuse Holders, NUREG 1801 Rev.2 Chapter XI.E5, USNRC, December 2010.
2. INTERNATIONAL ATOMIC ENERGY AGENCY, Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants, Safety Guide No. SSG-48, IAEA, Vienna, 2018.
3. KERNTECHNISCHER AUSSCHUSS, Ageing Management in Nuclear Power Plants, KTA Standard 1403, KTA, Germany, November 2017.
4. UNITED STATES NUCLEAR REGULATORY COMMISSION, Loss of Offsite Power Upon an Automatic Bus Transfer, NRC Information Notice 86-87, USNRC, October 10, 1986.
5. UNITED STATES NUCLEAR REGULATORY COMMISSION, Diesel Generator Fuse Contacts, NRC Information Notice 87-42, USNRC, September 4, 1987.
6. UNITED STATES NUCLEAR REGULATORY COMMISSION, Status Indication of Control Power for Circuit Breakers Used in Safety-Related Application, NRC Information Notice 91-78, USNRC, November 28, 1991.
7. UNITED STATES NUCLEAR REGULATORY COMMISSION, Ageing Assessment of Safety-Related Fuses Used in Low- and Medium-Voltage Applications in Nuclear Power Plants, NUREG-1760, USNRC, May 31, 2002.
8. UNITED STATES NUCLEAR REGULATORY COMMISSION, 10 CFR Part 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants, Office of the Federal Register, National Archives and Records Administration, USNRC, 2015.