

Changes to VI ELECTRICAL COMPONENTS
A Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation	Basis for Change
VI.A-1 (LP-12)	VI.A.	Cable Connections (Metallic Parts)	Various metals used for electrical contacts	Air – indoor uncontrolled and Air – outdoor	Increased connection resistance Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Chapter XI.E6, "Electrical Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	<p>The environment air indoor is synonymous with air-indoor uncontrolled. Air-indoor will be functionally replaced by air-indoor uncontrolled. The environment air-indoor is to be deleted from GALL Table IX.D.</p> <p>The environment air-outdoor is shown for better technical clarity and to align with that shown in GALL Table IX.D.</p> <p>The term increased connection resistance more accurately describes the actual aging effect resulting from a loosening of bolted connections. Increased connection resistance is also the term defined in GALL Table IX.E. Loosening of bolted connections is to be deleted.</p>

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VI.A-2 (L-01)	VI.A.1-a	Conductor Insulation for electrical cables and connections (including terminal blocks, fuse holders, etc.)	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to Reduced insulation resistance (IR); electrical failure/ degradation of organics (Thermal/thermooxidative), radiolysis and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation, and moisture intrusion	Chapter XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	<p>Component name changed for technical accuracy. Connections do not have a conductor, only insulation.</p> <p>Parenthetical statement added to component for technical clarification. Connections include items such as terminal blocks, fuse holders, splices, etc.</p> <p>The term embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance; electrical failure should be consolidated into the actual aging effect <i>reduced insulation resistance</i> for better technical clarity. Reduced insulation resistance accurately defines the aging effect associated with cable and connection insulation materials.</p> <p>Electrical failure is a loss of intended function potentially caused by an aging effect. It is not an aging effect and is not a term defined in GALL Table IX.E.</p>

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VI.A-3 (L-02)	VI.A.1- b	Conductor Insulation for electrical cables and connections used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance (IR)	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to Reduced insulation resistance (IR); electrical failure/ degradation of organics (Thermal/thermooxidative), radiolysis and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation, and moisture intrusion	Chapter XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits"	No	<p>Component name changed for technical accuracy. Connections do not have a conductor, only insulation.</p> <p>The term embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance; electrical failure should be consolidated into the actual aging effect <i>reduced insulation resistance</i> for better technical clarity. Reduced insulation resistance accurately defines the aging effect associated with cable and connection insulation materials used in instrumentation circuits.</p> <p>Electrical failure is a loss of intended function potentially caused by an aging effect. It is not an aging effect and is not a term defined in GALL Table IX.E.</p>

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VI.A-4 (L-03)	VI.A.1- c	Conductor insulation for inaccessible medium-voltage (2kV to 35kV) cables (e.g., installed in conduit or direct buried)	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by exposure to moisture and voltage	Localized damage and breakdown of insulation leading to electrical failure Reduced insulation resistance/ moisture and voltage stress intrusion, water trees	Chapter XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	<p>To accurately define the aging effect associated with m-v wetted cables. Reduced insulation resistance is also the term defined in GALL Table IX.E.</p> <p>Electrical failure is a loss of intended function potentially caused by an aging effect. It is not an aging effect and is not a term defined in GALL Table IX.E.</p> <p>Water treeing is a degradation and long-term failure phenomenon. The degradation mechanism for m-v wetted cables is moisture and voltage stress.</p>

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VI.A-5 (L-04)	VI.A.2-a	Connector contacts for electrical connectors exposed to borated water leakage	Various metals used for electrical contacts	Air with borated water leakage	Increased connection resistance resulting from corrosion of connector contact surfaces/ intrusion of borated water	Chapter XI.M10, "Boric Acid Corrosion"	No	To accurately define the aging effect associated with connector contacts exposed to borated water. The term increased connection resistance more accurately describes the actual aging effect resulting from corrosion of connector contact surfaces due to intrusion of borated water. Increased connection resistance is also the term defined in GALL Table XI.E.

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VI.A-6 (LP-03)	VI.A.	Fuse Holders (Not Part of a Larger Assembly); Insulation	Insulation material— bakelite, phenolic melamine or ceramic, molded polycarbonate and other	Adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen or > 60-year service limiting temperature	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/ degradation (Thermal/ thermoxidative) of organics/thermoplastics; radiation-induced oxidation; moisture intrusion and ohmic heating	Chapter XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Line item VI.A.2 and generic item LP-02 already include fuse holders (insulation) under cable connections commodity and are managed by the same AMP. Since fuse holders (insulation) is already included under cable connections, there is no need to list fuse holders here as a separate line item since they are redundant.

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VI.A-76 (LP-02)	VI.A.	Fuse Holders (Not Part of a Larger Assembly active equipment); Insulation	Insulation material – bakelite, phenolic melamine or ceramic, molded polycarbonate and other	Air – indoor uncontrolled (Internal/External)	None	None	No	<p>The environment was changed to air-indoor uncontrolled because fuse holders do not have an internal and external environment. Hence, air-indoor uncontrolled is the external environment that applies consistent with line item VI.A-6.</p> <p>Line item VI.A-6 was deleted so due to the consolidation of line item numbering, the new VI.A-6 line item applies here.</p> <p>Component name changed to provide a technically accurate exclusion boundary for fuse holders. For AMR purposes, the term active equipment more closely aligns with the LR Rule than Larger Assembly</p>

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VI.A-87 (LP-01)	VI.A.	Fuse Holders (Not Part of a Larger Assembly active equipment); Metallic Clamp	Copper alloy Various metals used for electrical connections	Air – indoor uncontrolled	Increased connection resistance/ Fatigue/ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation or Fatigue/ ohmic heating, thermal cycling, electrical transients, frequent manipulation, or vibration	Chapter XI.E5, "Fuse Holders"	No	<p>Line item VI.A-6 was deleted so due to the consolidation of line item numbering, line item VI.A-7 applies here.</p> <p>Component name changed to provide a technically accurate exclusion boundary for fuse holders. For AMR purposes, the term active equipment more closely aligns with the LR Rule than Larger Assembly</p> <p>Material change to account for various other metals that may be used for the clamp.</p> <p>The environment air indoor is synonymous with air-indoor uncontrolled. Air-indoor will be functionally replaced by air-indoor uncontrolled. The environment air-indoor is to be deleted from GALL Table IX.D.</p> <p>The term increased connection resistance more accurately describes the actual aging effect resulting from chemical contamination, corrosion, and oxidation. Increased connection resistance is also the term defined in GALL Table XI.E.</p> <p>Chemical contamination, corrosion, and oxidation <u>do not</u> cause fatigue. Ohmic heating, thermal cycling, electrical transients, frequent manipulation, or vibration are aging mechanisms that may cause fatigue.</p>

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VI.A-98 (LP-07)	VI.A.	High voltage insulators	Porcelain, Malleable iron, aluminum, galvanized steel, cement	Air – outdoor	Reduced insulation resistance Degradation of insulator quality /presence of any salt deposits or surface contamination	A plant-specific aging management program is to be evaluated for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution).	Yes, plant-specific	Line item VI.A-6 was deleted due to the consolidation of line item numbering, line item VI.A-8 applies here. The term reduced insulation resistance more accurately defines the aging effect associated with h-v insulators. Reduced insulation resistance is also the term defined in GALL Table XI.E. Degradation of insulator quality is to be deleted.

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VI.A- 109 (LP-11)	VI.A.	High voltage insulators	Porcelain, Malleable iron, aluminum, galvanized steel, cement	Air – outdoor	Loss of material/ mechanical wear due to wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated.	Yes, plant-specific	Line item VI.A-6 was deleted so due to the consolidation of line item numbering, line item VI.A-9 applies here.

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VI.A- 44 10 (LP-04)	VI.A.	Metal enclosed bus Bus/connections	Various metals used for electrical bus and connections Aluminum/ Silver Plated Aluminum Copper/ Silver Plated Copper; Stainless steel, steel	Air – indoor uncontrolled and Air – outdoor	Increased connection resistance Loosening of belted connections/ thermal cycling and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No	<p>Line item VI.A-6 was deleted so due to the consolidation of line item numbering, line item VI.A-10 applies here.</p> <p>Material change to account for various other metals that may be used for the MEB bus and connections.</p> <p>The environment air indoor is synonymous with air-indoor uncontrolled. Air-indoor will be functionally replaced by air-indoor uncontrolled. The environment air-indoor is to be deleted from GALL Table IX.D.</p> <p>The environment air-outdoor is shown for better technical clarity and to align with that shown in GALL Table IX.D.</p> <p>The term increased connection resistance more accurately describes the actual aging effect resulting from thermal cycling and ohmic heating. Increased connection resistance is also the term defined in GALL Table XI.E. Loosening of bolted connections is to be deleted.</p>

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VI.A- 4211 (LP-10)	VI.A.	Metal enclosed bus Enclosure assemblies	Elastomers	Air – indoor uncontrolled and Air – outdoor	Change in material properties Hardening and loss of strength/ elastomer degradation	Chapter XI.S6, "Structures Monitoring Program" Chapter XI.E4, "Metal Enclosed Bus"	No	<p>Line item VI.A-6 was deleted so due to the consolidation of line item numbering, line item VI.A-11 applies here.</p> <p>The environment air indoor is synonymous with air-indoor uncontrolled. Air-indoor will be functionally replaced by air-indoor uncontrolled. The environment air-indoor is to be deleted from GALL Table IX.D.</p> <p>The environment air-outdoor is shown for better technical clarity and to align with that shown in GALL Table IX.D.</p> <p>The term change in material properties more accurately describes the actual aging effect due to elastomer degradation and encompasses other material parameters such as cracking, and shrinkage as well as hardening and loss of strength. Change in material properties is the term defined in Chapter IX.E. Hardening and loss of strength is to be deleted.</p> <p>During conduct of XI.E4 inspections, accessible gaskets and sealants will be inspected for degradation which could permit water to enter the bus.</p>

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VI.A- 13 12 (LP-06)	VI.A.	Metal enclosed bus Enclosure assemblies	Steel; galvanized steel; Aluminum	Air – indoor uncontrolled and Air – outdoor	Loss of material/ general corrosion	Chapter XI.S6, “Structures Monitoring Program”	No	Line item VI.A-6 was deleted so due to the consolidation of line item numbering, line item VI.A-12 applies here. Material change to account for other metals used for the MEB enclosure assembly. The environment air indoor is synonymous with air-indoor uncontrolled. Air-indoor will be functionally replaced by air-indoor uncontrolled. The environment air-indoor is to be deleted from GALL Table IX.D. The environment air-outdoor is shown for better technical clarity and to align with that shown in GALL Table IX.D.

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VI.A- 4413 (LP-05)	VI.A	Metal enclosed bus Insulation/insulators	Porcelain, xenoy, thermo- plastic organic polymers	Air – indoor uncontrolled and Air – outdoor	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to Reduced insulation resistance (IR); electrical failure/ thermal/thermooxidative degradation of organics/thermoplastics, radiation-induced oxidation; moisture/debris intrusion, and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No	<p>Line item VI.A-6 was deleted so due to the consolidation of line item numbering, line item VI.A-13 applies here.</p> <p>The environment air indoor is synonymous with air-indoor uncontrolled. Air-indoor will be functionally replaced by air-indoor uncontrolled. The environment air-indoor is to be deleted from GALL Table IX.D.</p> <p>The environment air-outdoor is shown for better technical clarity and to align with that shown in GALL Table IX.D.</p> <p>The term embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance; electrical failure should be consolidated into the actual aging effect <i>reduced insulation resistance</i> for better technical clarity. Reduced insulation resistance accurately defines the aging effect associated with MEB insulation and insulators.</p> <p>Electrical failure is a loss of intended function potentially caused by an aging effect. It is not an aging effect and is not a term defined in GALL Table IX.E.</p>

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VI.A- 15 14 (LP-09)	VI.A	Switchyard bus and connections	Aluminum, copper, bronze, stainless steel, galvanized steel	Air – outdoor	Loss of material/ wind induced abrasion and fatigue Loss of conductor strength/corrosion Increased connection resistance of connection / oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated.	Yes, plant-specific	<p>Line item VI.A-6 was deleted so due to the consolidation of line item numbering, line item VI.A-14 applies here.</p> <p>Fatigue will not cause a loss of material.</p> <p>Loss of conductor strength is not an aging effect for switchyard bus and connections.</p> <p>The corrosion aging mechanism is covered under the oxidation aging mechanism.</p> <p>The term increased connection resistance more accurately describes the actual aging effect resulting from oxidation or loss of pre-load. Increased connection resistance is also the term defined in GALL Table XI.E. Increased resistance of connection is to be deleted.</p>

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VI.A- 16 15 (LP-08)	VI.A	Transmission conductors and connections	Aluminum, steel	Air – outdoor	Loss of material/ wind induced abrasion and fatigue Loss of conductor strength/ corrosion Increased connection resistance of connection / oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated.	Yes, plant-specific	Line item VI.A-6 was deleted so due to the consolidation of line item numbering, line item VI.A-15 applies here. The term increased connection resistance more accurately describes the actual aging effect resulting from oxidation or loss of pre-load. Increased connection resistance is also the term defined in GALL Table XI.E. Increased resistance of connection is to be deleted