AP1000 SAFETY-RELATED VALVE DESIGN AND EQUIPMENT QUALIFICATION REQUIREMENTS

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Regulatory Criteria

- 10 CFR Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants.”
- 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."
- NUREG-0800, Sections 3.9.2, 3.9.3, 3.9.6, 3.10, 3.11,“Standard Review Plan.”

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AP1000 Design Control Document

- Specific Sections of Chapter 3 that are applicable for safety-related valves and qualification are:
  - Section 3.9, “Mechanical Systems and Components”
  - Section 3.10, “Seismic and Dynamic Qualification of Seismic Category I Mechanical and Electrical Equipment”
  - Section 3.11, “Environmental Qualification of Mechanical and Electrical Equipment”
  - Appendix 3D, “Methodology for Qualifying AP1000 Safety Related Electrical and Mechanical Equipment”

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Westinghouse Scope for the AP1000 Safety-Related Valves

- Westinghouse is responsible for
  - valve design and qualification specifications
  - procurement
  - factory production testing
  - environmental, seismic and pre-installation functionality qualification
  - As-built reconciliation
  - Safety-Related Valve ITAACs

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Valve Design Specification

- Incorporates valve/actuator industry programs to develop required operating loads, actuator capabilities and uncertainties.
- Industry programs include:
  - JOG Program for MOV Periodic Verification,
  - EPRI Motor Operated Valve Programs and
  - BWR Owners' Group DC Motor Performance Methodology
- Utilities and vendors inputs were included

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Valve Design Specification (Cont'd)

- Critical parameters were taken from the industry programs include:
  - Valve material pairs
  - Edge configurations
  - DC Motor Performance
  - Friction factors
  - Design features
- Uncertainties
  - Switch repeatability
  - Test equipment accuracy
  - Degraded voltage
  - Rate of Loading
  - Thermal binding
  - Temperature effect
- Margin

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Valve Procurement and Factory Testing

- The safety-related valves will be procured from qualified suppliers to the equipment specification.
- The supplier shall:
  - provide sizing for each valve in the proposal for review and approval
  - perform instrumented static testing on all valves prior to shipment from the valve supplier to verify valve setup.
  - perform instrumented differential pressure opening test will be performed
  - perform instrumented closure line pressure test
- Testing will confirm valve friction factor.

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Safety Related Valve Qualification

- All safety-related active valves are required to be functionally qualified to meet or exceed the plant environmental and seismic parameters.
- All safety-related active valve operators, appurtenances and accessories are required to be qualified to meet or exceed the plant environmental and seismic parameters.

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Valve Operability Program

- Active valves are those whose operability is relied upon to perform a safety-related function during transients or events considered in the respective operating condition categories.
- Active valves are subjected to a series of tests and inspections prior to service and during the plant life. These tests and inspections along with controls on maintenance and operation provide appropriate reliability of the valve for the design life objective of the plant.
- Westinghouse will employ ASME QME-1-2002 for the pre-installation operability qualification for the AP1000 active valves.

Qualification Regulations, Guides and Standards

- Regulations
  - 10 CFR 50.49, “Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants.”
- Regulatory Guides
  - Regulatory Guide 1.89, Revision 1, “Qualification of Class 1E Equipment for Nuclear Power Plants.”
  - NRC Regulatory Guide 1.100, Revision. 2, “Seismic Qualification of Electrical Equipment for Nuclear Power Plants.”

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Qualification Regulations, Guides and Standards (Cont'd)

- IEEE Standards
  - IEEE Std 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."
  - IEEE Std 344-1987, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations."
  - IEEE Std. 382-1996, "IEEE Standard for Qualification of Actuators for Power-Operated Valve Assemblies with Safety-Related Functions for Nuclear Power Generating Stations"

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