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1. **Governing Code / Standard** *(i.e. IEEE 323-1974 / IEC/IEEE 60780-323 / RCC-E)*	
Reference Number	**Tittle / Revision**
i.e. IEEE 323-1974 / RCCE	

2. Equipment Evaluation Summary:

Qualification acceptability (accident and post-accident), qualified life, maintenance requirements/constraints

(Provide a brief summary of the qualification)

(Document all outstanding issues that still require analysis)

3. References

All relevant test reports, correspondence, modifications used in the assessment

Type	Reference Number / Title
Environmental qualification test reports	
Seismic qualification test reports	
Design /Procurement / Purchase specification	
Other documents	

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4. Document Assumptions Made During Assessment:

(Provide any assumptions made during the qualification assessment)

5. Equipment Identification

Trigramme	Design Classification	Manufacturer & Model No	Location	No. of Operations Required	Duration Required	Submergence ***Yes*** *-equipment will be subjected to submergence* ***No*** *– No ossibility of submergence*

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6. Environmental Conditions

6a) Normal Environmental Conditions

References:

(i) SAR II-1.11

(ii) KBA 12 22 E02 038, “General Specification for Qualification to DBA Conditions”

(iii) KBA 1216 J10 256, “General Electric Installations – Studies and Supply: Appendix B and Appendix C”

Parameter	Required value & qualification method (type testing / analysis / Arrhenius / engineering justification)	Tested value & Qualification method (type testing / analysis / Arrhenius / engineering justification)	Justification for difference (where type testing were not used, where parameters were not enveloped, or where further analysis is required to prove acceptability)
Temperature	Minimum: 15 ºC (ref (iii)) Maximum: 50 ºC (ref (iii))		
Pressure	1 bar absolute ± 0.2 bar (ref (iii))		
Radiation	250 kGy for Normal Operation during 40 years operating life of the Unit (ref (i)).		

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	50 Rad/h (equal to 17,52 MRad or 175,2 kGray for 40 years) (ref (iii))		
Duration	Simulate 40 years		
Humidity	In operation: 50% (26ºC < θ < 50ºC) With reactor shut down: 95% (θ = 25ºC (ref (iii))		
Accuracy	Equipment specific		
Operational Cycling	Equipment specific		
Submergence	Equipment specific		
6b) Accident Environmental Conditions **References** : (i) SAR II-1.11 (ii) KBA 12 22 E02 038, “General Specification for Qualification to DBA conditions” (iii) KBA 1216 J10 256, “General electric Installations – Studies and Supply: Appendix B and Appendix C”			
Temperature	SAR table T-II-1.11-1 (ref (i)) Appendix C (ref (iii))		
Pressure	SAR table T-II-1.11-1 (ref (i)). Pressure of 0.55 MPa (ref (i)) and (ref (ii))		

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	Appendix B (ref (iii)): 5 bars (abs)		
Radiation	Accident and post-accident dose: 600 kGy for conditions up to 1 year after a design basis accident (ref (i)) Cobalt 60 source (ref ii) Total absorbed dose in 1 year: 60 x 10 Rad ref(iii) and ref(ii)		
Duration	4 days (96 hours) (ref (i))		
Relative humidity	100% (ref (iii))		
Chemical spray	The pH varies from between 4 and 6 at the beginning of direct spraying to 7.02 during the recirculation phase when all the liquids released in the containment following a LOCA are mixed. The design requirement is to maintain the pH to between 7.02 to 7.49 • Boric acid H3BO3: 2 500 mg B/kg in PTR 001 BA prior to injection. Hydrated trisodium phosphate Na3PO412H2O (TSP) in solid granular form. (ref (i))		
Accuracy	Equipment specific		

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Operational Cycling	Equipment specific		
Submergence	Equipment specific		
6c) Post Accident Environmental Conditions **References:** (i) SAR II-1.11 (ii) KBA 12 22 E02 038, “General Specification for Qualification to DBA conditions”			
Temperature	Equivalent to 50°C for 1 year. (ref (ii)) An accelerated ageing test is conducted at a temperature between 100 and 115 ºC to correspond to 1 year. The duration of the test can be anywhere from 100 h to 10 days depending on the temperature selected. (ref (i)) 100ºC for 10 days 115ºC for 100 hours (ref (ii))		
Pressure	200 kPa abs (ref (ii))		
Radiation	Accident and post-accident dose: 600 kGy for conditions up to 1 year after a design basis		

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	accident(ref (i)) Cobalt 60 source (ref ii)		
Duration	From 4 days to 1 year following the accident (ref (i))		
Relative humidity	80% to 100% (ref (ii))		
Accuracy	Equipment specific		
Operational Cycling	Equipment specific		
Submergence	Equipment specific		

7. Accident/Post-Accident Qualification ***(if specimen is qualified through similarity analysis)***	
7a. Similarity Analysis - Tested Vs Installed	
Test specimen identical to installed equipment traceability justification or similarity analysis?	
Were all tests performed on the same specimen?	
Modifications made to equipment or test specs after start of testing?	

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Evaluations to demonstrate that modifications have no impact on test validity?	
Installed equipment modified in accordance with test modifications?	
Equipment tested in position that simulates its installed configuration?	
Did equipment require additional components for qualification?	
Qualification of ancillary equipment documented?	
7b. Qualified Environment	
Chemical spray applied at or above max accident pressure and temperature conditions?	
Does the report show that test equipment / instruments were calibrated and tested to National Bureau of Standards or any acceptable standards?	
7c. Synergistic Effects	
Any known synergistic effects such as those caused by dose rate variations or sequential simultaneous testing simulated?	

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8. Qualification Test Sequence

(Were tests conducted in the sequence as required by IEEE 60780-323 / IEEE 323-1974 or any acceptable qualification standard?)

IEEE sequence	Actual sequence	Justification for difference
i. Inspection		
ii. Operation(baseline)		
iii. Operation(extremes)		
iv. Ageing:		
• Thermal		
• Radiation		
• Mechanical		
v. Seismic		
vi. DBA operation		
vii. Post DBA operation		
viii. Post Qualification Inspection		

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9. Margins for test profile

The following margins are recommended to apply to DBE service conditions (IEEE 60780-323 / IEEE 323-1974). Alternate margin values may be used.

(For installed or existing equipment qualified in accordance with IEEE 323-1971, where these margins cannot be proven, further guidance in accordance with NUREG-0588 category 2 will be sufficient.)

Parameters	Recommended Margins	Comments	Demonstrated Margins	References
Temperature (Peak)	+8°C	Applied to peak temperature		
Pressure (Peak)	+10%	Applied to peak gauge pressure. Note: Margin on temperature and pressure shall take into account dependence of these parameters for saturated steam.		
Total Radiation dose	+10%	Applied to accident radiation dose		
Electrical Characteristic	+10% +5%	Power supply voltage – margin added up to equipment design limits Line frequency – margin added to rated value		
Equipment Operating time	+10%	Percentage value of the period of time the equipment is required to operate following the start of the event		
Seismic vibration	+10%	Value added to the seismic acceleration requirements at the mounting point of the equipment		
Transients	The transient shall be applied at least twice			

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10. Operational / Performance Requirements

(Document electrical performance requirements.)

Parameter	Required	Tested	Justification for difference
Voltage			
Frequency			
Current			
Accuracy			
Other: (time reponse,etc)			
Operability requirements under normal/accident conditions: Continuous or intermittent?			
Was the operability verified before, during and after each test sequence?			
Was equipment electrically energised, simulated loads applied, or input signals applied during testing?			

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11. Functional testing	
Was the safety related function of the equipment simulated during the test?	

12. Acceptance criteria	
Did the test meet the specified acceptance criteria?	
Is the acceptance criteria established for test programme meet utility criteria or plant specific EQ profile?	

13. Ageing

13a. Thermal qualified life ***(to be used if Arrhenius methodology was used to determine qualified life or even when ageing was not performed as part of the analysis)***

13a1) Failure modes analysis/selection of activation energy:

Were non-metallic parts identified with their corresponding activation energies? Document all failure modes and activation energies (use Arrhenius methodology).

If ageing was not performed as part of the analysis (consider ageing susceptibility):

In accordance with NUREG-0588 category 2 (for equipment qualified in accordance with IEEE 323-1971), the qualification programs should address aging only to the extent that equipment that is composed, in part, of materials susceptible to aging effects should be identified, and a schedule for periodically replacing the equipment and/or materials should be established.

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The effects of aging should be accounted for if operating experience or testing indicates that the equipment may exhibit deleterious aging mechanisms.

Item no.	Part name	Material	Activation energy (eV) or Ageing susceptibility

13a2) Thermal ageing analysis

Specify thermal ageing temperature and time used during qualification testing. Transfer to expected plant conditions using Arrhenius Methodology.

Test conditions	Value	Unit	Comments
Temperature (T_{test})		**Kelvin**	Temp (K) = Temp(°C)+273,15
Duration (t_{test})		**Hours**	
Actual conditions			
Ambient Containment Temperature		**Kelvin**	Temp (K) = Temp(°C)+273,15
Additional Heating (due to process fluid/I^2R heat rise)		**Kelvin**	Temp (K) = Temp(°C)+273,15
Service Temperature ($T_{service}$)		**Kelvin**	∑(ambient containment temp +I^2R heat rise)
Boltzmann's Constant	8.617E-05	**eV/K**	

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Activation Energy (E_A)		**eV**	From 7a1
Corresponding Qualified Life (t_{qual})		**Hours**	$t_{qual} = t_{test} \times e^{\left[\frac{E_A}{B}\left(\frac{1}{T_s}-\frac{1}{T_{test}}\right)\right]}$

13b1. Radiation Qualified Life – METHOD 1 ***(Where normal ambient conditions were simulated as part of the tests)***

Does the tested dose envelope the required dose? If not, analyse qualified life due to radiation ageing.

In accordance with NUREG-0588 category 2 (for equipment qualified in accordance with IEEE 323-1971), the qualification programs should address aging only to the extent that equipment that is composed, in part, of materials susceptible to aging effects should be identified, and a schedule for periodically replacing the equipment and/or materials should be established. The effects of aging should be accounted for if operating experience or testing indicates that the equipment may exhibit deleterious aging mechanisms.

Required		**Tested dose**		**Comments**
Radiation source	**Total integrated dose**	**Radiation source**	**Total integrated dose**	

13b2. Radiation Qualified Life - METHOD 2 ***(where normal ambient conditions were NOT simulated as part of the tests)***

Does the tested dose envelope the required dose? If not, analyse qualified life due to radiation ageing.

In accordance with NUREG-0588 category 2, the qualification programs should address aging only to the extent that equipment that is composed, in part, of

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materials susceptible to aging effects should be identified, and a schedule for periodically replacing the equipment and/or materials should be established. The effects of aging should be accounted for if operating experience or testing indicates that the equipment may exhibit deleterious aging mechanisms.

Item no.	Part name	Material	Activation energy (eV) or Ageing susceptibility

13c. Cyclic Qualified Life (or Mechanical Cycles)

Was operational cycling demonstrated for:

Normal life	
Accident conditions	

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14. Conclusion
Is qualified life limited by a parameter other than temperature?

15. Test anomalies	
Were any deficiencies / anomalies identified during the test(s)?	
If yes, were the deficiencies or anomalies properly dispositioned?	
Did anomalies/disposition of deficiencies result in test specimen modification?	

16. Applicable Operating Experience (OE)

Identify any applicable OE (i.e. from NRC notices / EQDB notices/ EPRI/ EdF, IGALL, etc.) which potentially impact on the status of EQ, and evaluate the impact.

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17. EQ related maintenance / EQ surveillance requirements / EQ service condition monitoring requirements

Document any part/equipment replacements identified as a result of the evaluation for this equipment. Document all equipment and part replacement intervals/frequency.

Document installation requirements identified as a result of the evaluation for this equipment.

18. Seismic Qualification Assessment

Seismic requirements shall be specified in the design/purchase specifications.

IEEE Std 344™-2013, IEEE Standard for Seismic Qualification of Equipment for Nuclear Power Generating Stations

IEC 60980, Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations

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19. Conclusion

Does the qualification program of the equipment meet the EQ requirements?

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