WCAP 8587

"Equipment Qualification Data Packages"

Supplement 1

EQDP-AE-3

Chempump Canned Motor Pump (Outside Containment)

Revision 5

Instruction Sheet

The following instructional information and checklist is being furnished to help insert the following into WCAP-8587 Supplement 1 EQDP-AE-3 Class 3 (Non-Proprietary). Discard the old sheet and insert the new sheets as listed below. Revised information is indicated by a bar and number 5 on the outside margin of the page.

Remove (Front/Back)	Insert (Front/Back)
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EQUIPMENT QUALIFICATION DATA PACKAGE

This document contains information, relative to the qualification of the equipment identified below, in accordance with the methodology of WCAP 8587. The Specification section (Section 1) defines the assumed limits for the equipment qualification and constitute interface requirements to the user.

Chempump Canned Motor Pump (Outside Containment)

APPROVED: _____

E. P. Rahe, Manager
Nuclear Safety Department

Westinghouse Electric Corporation
Nuclear Energy Systems
P.O. Box 355
Pittsburgh, Pennsylvania 15230

SECTION 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1 Voltage: 190 to 575 VAC ±10% operating; +10%,-20% starting

1.1.2 Frequency: 50 or 60 Hz ±5%; 3 phase.

1.1.3 Load: 0.5 to 25 Hp.

1.1.4 Electromagnetic Interference: None.

1.1.5 Other: Motors have Class H insulation system.

1.2 Installation Requirements: As specified in the instruction manual provided with the equipment.

1.3 Auxiliary Devices: None required for safeguard operation.

1.4 Preventative Maintenance Schedule: Per the Westinghouse Equipment Qualification program, no preventive maintenance is required to support the equipment qualified life. This does not preclude development of a preventive maintenance program designed to enhance equipment performance and identify unanticipated equipment degradation as long as this program does not compromise the qualification status of the equipment. In fact, the motor qualification program presumes that the recommended maintenance procedure regarding bearing inspection are followed. Surveillance activities may also be considered to support the basis for/and a possible extension of the qualified life. 4 5

1.5 Design Life: 40 years.

1.6 Operating Cycles (Expected number of cycles during design life, including test): Boric Acid Transfer Pump motors, 43,800; Boron Injection Recirculation Pump Motors, 14,600.

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1.7 Performance Requirements for[b]: Boric Acid Transfer (212, 312, 412, 3XL, 4XL)

	Parameter	Normal Conditions	Abnormal Conditions	Containment Test Conditions	DBE Conditions(a) FLB/SLB	DBE Conditions(a) LOCA	Post DBE Conditions(a) Seismic	Post DBE Conditions(a) FLB/SLB	Post DBE Conditions(a) LOCA	Post DBE Conditions(a) Seismic
1.7.1	Time requirement	87,600 hrs.	12 hrs.	N/A	N/A	N/A	Event Duration	Same as Normal	Same as Normal	Continuous
1.7.2	Performance requirement	6 Hrs/Day Full Speed					Same as Normal	Same as Normal	Same as Normal	Same as Normal
1.8 Environmental Conditions for Same Function[b]										
1.8.1	Temperature(^{o}F)	40-120^{o}F[c]					Same as Normal			Same as Normal
1.8.2	Pressure (psig)	0	0				0			0
1.8.3	Humidity (% RH)	N/A since motor is sealed unit								
1.8.4	Radiation (R)	≤400	Same as Normal				Same as Normal			Same as Normal
1.8.5	Chemicals	None	None				None			None
1.8.6	Vibration (in.)[d]	0.002	Same as Normal				Same as Normal			Same as Normal
1.8.7	Acceleration (g)	None	None				Figure 1			Figure 1

Notes: a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: Maximum water temperature environment 175^{o}F.
d: Bearing housing vibration filtered to running speed.

1.7 Performance Requirements for[b]: Boron Injection Recirculation (212, 312, 412, 3XL, 4XL)

	Parameter	Normal Conditions	Abnormal Conditions	Containment Test Conditions	DBE Conditions(a) FLB/SLB	DBE Conditions(a) LOCA	DBE Conditions(a) Seismic	Post DBE Conditions(a) FLB/SLB	Post DBE Conditions(a) LOCA	Post DBE Conditions(a) Seismic
1.7.1	Time requirement	350,400 hrs.	12 hrs.	N/A	N/A	N/A	Event Duration	Same as Normal	Same as Normal	Continuous
1.7.2	Performance requirement	Continuous Full Speed					Same as Normal	Same as Normal	Same as Normal	Same as Normal
1.8	Environmental Conditions for Same Function[b]									
1.8.1	Temperature(^{o}F)	40-120^{o}F[c]					Same as Normal			Same as Normal
1.8.2	Pressure (psig)	0	0				0			0
1.8.3	Humidity (% RH)	N/A since motor is sealed unit								
1.8.4	Radiation (R)	≤400	Same as Normal				Same as Normal			Same as Normal
1.8.5	Chemicals	None	None				None			None
1.8.6	Vibration (in.)[d]	0.002	Same as Normal				Same as Normal			Same as Normal
1.8.7	Acceleration (g)	None	None				Figure 1			Figure 1

Notes: a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: Maximum water temperature environment 175^{o}F.
d: Bearing housing vibration filtered to running speed.

5 | 1.9 Qualified Life: The demonstrated qualified life is 5 years, based on 6 hours/day operation of the Boric Acid Transfer (BAT) pump and 24 hours/day for the Boron Injection Recirculation (BIR) 4 | pump. The qualified life is based on a 140°C rise above an assumed ambient of 40°C. Also see Table 1.

1.10 Remarks: Canned motors are hermetically sealed and protected from the outside environment.

SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

2.1 Equipment Description: Motorettes (random wound), Teflon and Nomex insulated leads. Lead connectors with Nomex insulated leads and Vespel and Kalrez seals.

2.2 Number Tested: Motorettes (28); Teflon leads (10), Vespel and Kalrez, seals (12 each), lead connectors with Nomex insulated leads (12), graphite bearings (16).

3

2.3 Mounting: Motorettes and motor lead connectors were bolted to a common support plate. The actual mounting configuration to be used in the field in accordance with the instruction manual is represented in the seismic analysis performed for the pump.

5

2.4 Connections: The qualification of the connecting power cabling is not a part of this test. The qualification of the connecting cabling and connection is the responsibility of the utility.

2.5 Aging Simulation Procedure: The motorettes were subjected to thermal, radiation, and vibration aging. The Teflon insulated leads were subjected to thermal aging only. Nomex insulated leads, Vespel and Kalrez seals, and motor lead connectors were subjected to thermal, mechanical and radiation aging (Reference 1).

2.6 Service Conditions to be Simulated by Test(1)

		Normal	Abnormal	Containment Test	Seismic	HELB	Post-HELB
2.6.1	Temp. (^{o}F)	Ambient	Included Under Normal	N/A	Included Under Normal	N/A	N/A
2.6.2	Pressure (psig)	0	0		0	N/A	N/A
2.6.3	Humidity (% RH)	N/A	N/A		N/A	N/A	N/A
2.6.4	Radiation (R)	10^{4}(a)	Included Under Normal		N/A	N/A	N/A
2.6.5	Chemicals	None	None		None	N/A	N/A
2.6.6	Vibration (b)	0.008 In. @ 60 Hz for 1 Hr.	Included Under Normal		Included Under Normal	N/A	N/A
2.6.7	Acceleration (g)	None	None		Figure 1	N/A	N/A

(a) Requirement is less than 10^{4}; however, radiation testing was extended to 2×10^{8} Rads for some components.

(b) Equipment is qualified for inservice vibration by experience, however, in addition this test was performed as suggested by IEEE-117-1974.

2.10 Type Test Data

2.10.1 Objective

The objective of this test program is to demonstrate, employing the recommended practices of Reg. Guide 1.89 (IEEE-323-1974) and Reg. Guide 1.100 (IEEE 344-1975), the capability of the canned pump motor to complete its safety-related function described in EQDP Section 1.7 while exposed to the applicable environments defined in EQDP Section 1.8. This objective is accomplished through test of critical components and evaluation of less critical components with well known material properties and performance characteristics.

2.10.2 Equipment Tested

Twenty-eight motorettes, twelve motor lead connectors, ten Teflon and twelve Nomex insulated leads, and twelve Vespel and Kalrez seals were tested.

2.10.3 Test Summary

2.10.3.1 Motorette and Motor Lead Connectors

Active canned pump motors used in Westinghouse plants are located outside of the reactor containment and will not be exposed to the adverse environmental conditions that may arise from a design base HELB. In addition, the canned pump motors are hermetically sealed isolating the motor environment from the external environment with the exception of temperature. Consequently, environment testing is only required to demonstrate equipment capability under normal and abnormal temperature extremes. 3

2.10.3.1.1 Aging and Radiation Testing

Prior to testing, the twenty-eight motorettes and motor lead connectors were subjected to a voltage screening test to verify the integrity of the electrical insulation.

The motorettes and motor lead connectors were baked in an oven to accelerate thermal aging. The aging was equivalent to 22 for the motor insulation and a minimum of 5 years for the connector. The motorette and motor lead connector electrical insulation integrity was again confirmed by the voltage check.

Subsequent to thermal aging, the motorettes and motor lead connectors were irradiated to an accumulated gamma dose of 2×10^8 Rads which is significantly greater than that expected from 40 years of normal and one year post accident operation. The insulation integrity was again confirmed.

2.10.3.1.2 Vibration Aging

The motor is qualified by experience and engineering judgement for the expected inservice vibration. However, in addition the motorettes and motor lead connectors were subjected to the vibration, or mechanical stress, test described in the qualification report, Reference 1. All motorettes and connectors passed the electrical insulation voltage tests after vibration.

2.10.3.1.3 Seismic Testing

The twenty-eight motorettes and motor lead connectors were seismically tested using a multi-axis multi-frequency input in accordance with Reg. Guide 1.100(1). The test response spectrum was significantly greater than the required response spectrum envelope generated from many Westinghouse plants, Figure 1. The post-seismic voltage test verified the integrity of the motorette and connector lead electrical insulation.

2.10.3.2 Teflon Insulated Leads

Ten (10) teflon insulated leads were thermally aged to an equivalent service life of 5 years. No changes or damage were evident from a visual examination. | 5

2.10.3.3 Graphite Bearings

Sixteen (16) graphite beaming were aged to the equivalent of 5 years of service life and exposed to 2×10^8 R of gamma radiation. No significant changes were noted. | 3

2.10.4 Conclusion

The qualified life of the canned pump motor is defined in Section 1.9. The results of aging and seismic testing, and seismic analysis combined with an assessment of components with known characteristics, ensure that the motor will meet the qualification criteria recommended by Reg. Guides 1.89 and 1.100.

2.11 Section 2 Notes

(1) The successfully completed motorette , motor lead connectors, Nomex insulated leads and Vespel and Kalrez seal seismic tests employ parameters designed to envelope a number of plant applications. Margin is a plant specific parameter and will be established by the applicant.

2.12 References

1. Marinkovich, Philip S., "Equipment Qualification Test Report for the Chempump Canned Pump Motor," WCAP-8687 Supplement 2-A03A (Proprietary). | 4 5

SECTION 3 - QUALIFICATION BY EXPERIENCE

Westinghouse does not employ operating experience in support of the qualification program for the Chempump canned motors with the exception 3 of gaskets and inservice vibration.

TABLE 1

ACTUAL QUALIFICATION TEST CONDITIONS

EQUIPMENT (1) SYSTEM/CATEGORY	LOCATION STRUCTURAL/AREA	MANUFACTURER TYPE/MODEL	ABNORMAL/ACCIDENT ENVIRONMENTAL EXTREMES PARAMETER	SPECIFIED (2)	QUALIFIED (3)	OPERABILITY REQ	OPERABILITY DEM	ACCURACY (.) REQ	ACCURACY (.) DEM	QUAL LIFE	QUAL METHOD	QUAL REF	QUAL PROGRAM STATUS
Boric acid transfer pump motor/ CVCS/ Category d	Safeguards building	Chem. Pump	Temperature Pressure Rel. humidity Radiation Chemistry		50°C Atmos. 95 4×10^2R(1) None	6 hrs. Per Day	6 hrs. Per Day	N/A	N/A	5 yrs.	Seq. Test	AE-3	Completed
Boron injection recirculation pump motor/ CVCS/ Category d	Safeguards building	Chem. Pump	Temperature Pressure Rel. humidity Radiation Chemistry		50°C Atmos. 95 4×10^2R(1) None	Cont. full speed	Cont. full spd	N/A	N/A	5 yrs.	Seq. Test	AE-3	Completed

NOTES

1. For definition of the category letters, refer to NUREG 0588 "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Appendix E, Section 2.
2. Plant specific environmental parameters are to be inserted by the applicant.
3. The values listed represent the design conditions plus margin. For completed programs, the values listed were met in the test. Any variations from the values listed were in a conservative direction or were not considered significant.