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.

Resistance Temperature Detectors: RCS Well Mounted

APPROVED: _____
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WCAP 8587

"Equipment Qualification Data Packages"

Supplement 1

EQDP-ESE-6

Resistance Temperature Detectors: RCS Well Mounted

Revision 3

Instruction Sheet

The following instruction information and checklist is being furnished to help insert Revision 3 into WCAP 8587 Supplement 1 EQDP-ESE-6 Class 3 (Non-Proprietary). Discard the old sheet and insert the new sheet as listed below. Revised information is indicated by a bar and number 3 on the outside margin of the page. Retain this sheet in the front of your WCAP.

Remove (Front/Back)	Insert (Front/Back)
Cover sheet/--	Cover sheet/--
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Rev. 3
June, 1981

SECTION 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1 Voltage: (Ref. 1.3 Auxiliary Devices with approximately 1 milliamp current))

1.1.2 Frequency: N/A

1.1.3 Load: N/A

1.1.4 Electromagnetic Interference: None

1.1.5 Other: Resistance 410 Ω at 525°F

1.2 Installation Requirements: Westinghouse Drawing 2650C31 Rev. 1 3

1.3 Auxiliary Devices: Thermowell, R/E or R/I Converter and the RTD requires an interface connection which will be subject to the same condition as the RTD. The qualification of this interface connection is not an objective of this program.

1.4 Preventative Maintenance Schedule: None

1.5 Design Life: 40 years

1.6 Operating Cycles (Expected number of cycles during design life, including test): Continuous duty

1.7 Performance Requirements for[b] Th and Tc Wide Range

	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) LOCA	Post DBE Conditions(a) FLB/SLB	Post DBE Conditions(a) Seismic
1.7.1	Time r[illegible]ement	Continuous	Included under normal	Test duration	Event duration	Event duration	Event duration	4 months	4 months	Continuous
1.7.2	Performance requirement	(C)		No damage	As normal	As normal	As normal	As normal	As normal	As normal

1.8 Environmental Conditions for Same Function[b]

1.8.1	Temperature(°F)	Fluid 700 Nominal Ambient 122 Maximum Ambient 140		Ambient	Fig. 2	Fig. 1	Ambient	Fig. 1	Fig. 2	Ambient
1.8.2	Pressure (psig)	-0.1 to .3 (RTD) 3125 (well)		70	Fig. 2	Fig. 2	0	Fig. 1	Fig. 2	0
1.8.3	Humidity (percent RH)	95		Ambient	100	100	Ambient	100	100	Ambient
1.8.4	Radiation (R)	7×10^7 γ (tip) (d) 4.5×10^6 γ cable (d)	None	None	Included under post DBE	Included under post DBE	None	1.1×10^8 γ (e) 9×10^8 β	1.1×10^5 γ (e) 7×10^5 β	None
1.8.5	Chemicals	None		None	Fig. 2	Fig. 2	None	Fig. 1	Fig. 2	None
1.8.6	Vibration	See Section 2.10		None	None	None	None	None	None	None
1.8.7	Acceleration (g)	None		None	None	None	2.10.3.3	None	None	None

Notes: a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: ± 0.2°F repeatability, first order time response 4.0 seconds w/o well for step change of at least 20°F with a water flow of 3 ft/sec.
d: 10 year life assumed for dose calculation's. Radioactive fluid defines normal rating dose.
e: Dose shown for cable. Postulated RCS contained accident dose is 1.5×10^8 γ(tip).

1.9 Qualified Life: 10 years at 122°F
5.9 years at 140°F

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1.10 Remarks: None

SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

2.1 Equipment Description: RdF Thermowell mounted resistance temperature detectors

2.2 Number Tested: Lot test performed on three (3) units

2.3 Mounting: Per Section 1.2

2.4 Connections: 4-wire cable to R/E converter

2.5 Aging Simulation Procedure:

Sequential simulation of thermal, radiation and vibration mechanisms as part of the overall test sequence.

		Required	Not Required
2.7.5	Category V - Electrical Characteristics		
2.7.5.1	Insulation Resistance		A,B,C
2.7.5.2	Output Voltage		A,B,C
2.7.5.3	Output Current		A,B,C
2.7.5.4	Output Power		A,B,C
2.7.5.5	Response Time		A,B,C
2.7.5.6	Frequency Characteristics		A,B,C
2.7.5.7	Simulated Load		A,B,C
2.7.6	Category VI - Mechanical Characteristics		
2.7.6.1	Thrust		A,B,C
2.7.6.2	Torque		A,B,C
2.7.6.3	Time		A,B,C
2.7.6.4	Load Profile		A,B,C
2.7.7	Category VII - Auxiliary Equipment (List Function and Required Measurements)		
2.7.7.1	R/E Converter Voltage (RTD analog out)	A,B,C	

A: HELB Test

B: Seismic Test

C: Radiation Test

2.8 Test Sequence Preferred

This section identifies the test sequences as specified in IEEE-323-1974

2.8.1 Inspection of Test Item
2.8.2 Operation (Normal Condition)
2.8.3 Operation (Performance Specifications Extremes, Section 1)
2.8.4 Simulated Aging
2.8.5 Vibration
2.8.6 Operation (Simulated High Energy Line Break Conditions)
2.8.7 Operation (Simulated Post HELB Conditions)
2.8.8 Inspection

2.9 Test Sequence Actual

This section identifies the actual test sequence which constitutes the qualification program for this equipment. A justification for anything other than the preferred sequence is provided. The normal operating condition referred to is a static calibration check at 32°F, 525°F and 625°F. Time response testing has been successfully performed via type testing on a sample model of this RTD. Performance under abnormal operating conditions is covered under Sections 2.8.2 and 2.8.6. Westinghouse has identified no mechanisms that
3 would cause a degradation in time response and not affect RTD calibration. Therefore, the calibration data taken during the test is adequate to monitor the performance of the RTD for both conditions. Since the probe materials are not sensitive to thermal degradation, time response testing has been excluded from the test sequence.

Test Sequence (from Section 2.8):

2.8.1 Inspection
2.8.2 Operation-Normal Condition (Static Calibration)
2.8.4 Thermal Aging, Thermal Cycling
2.8.2 Static Calibration

2.8.4 Radiation, Normal and Post-Accident

2.8.2 Static Calibration

2.8.4 Environmental Vibration Induced Aging

2.8.5 Operating Basis Earthquake, Safe Shutdown Earthquakes

2.8.2 Static Calibration

2.8.6 High Energy Line Break Simulation

2.8.7 Post HELB Simulation

2.8.2 Static Calibration

2.8.8 Inspection

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 RCS well mounted resistance temperature detectors to complete their safety related functions described in EQDP Section 1.7 while exposed to the applicable environments defined in EQDP Section 1.8.

2.10.2 Equipment Tested

Three RdF [illegible] mounted resistance temperature detectors were subjected to the test environments of the sequence shown in Section 2.9.

2.10.3 Test Summary

2.10.3.1 Normal Environment Testing

Operation of the well mounted RTD's under normal conditions is reflected by the numerous three-temperature static calibrations performed between each phase of the test sequence reported in Reference 1.

2.10.3.2 Simulated Aging

The test units were pre-conditioned to a simulated ten-year aged condition prior to subjecting them to the design basis seismic event and high energy line break simulation. The aged condition was achieved by separate phases of accelerated thermal aging, thermal cycling, gamma and beta radiation exposure to total integrated doses equivalent to a ten-year normal dose plus the design basis accident dose, and accelerated flow induced and pipe vibration aging simulation. Through all the pre-conditioning phases, the amplified RTD outputs were monitored to verify continuous operation.

2.10.3.3 Seismic Tests

The single design basis event capable of producing an adverse environment at the equipment location is a seismic event. The seismic testing reported in Reference 1 was completed on aged equipment employing many multi-axis, single-frequency inputs in accordance with Reg. Guide 1.100 (IEEE 344-1975). The generic required response spectrum (Figure 3) contains significant margin with respect to any single plant application referencing this program(1). Each plant should compair to assure that a 10 percent margin exists based on their actual plant location.

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2.10.3.4 High Energy Line Break/Post HELB Simulation

The well mounted RTD's were subjected to the HELB simulation temperature profile of Figure 1. Following the 420°F temperature peak, the temperature gradually declines to 250°F and is held at saturated steam conditions for 15 days, simulating a four-month period of post HELB operation.

2.10.4 Conclusion

The qualification status of the well mounted RTD's is demonstrated by the completion of the simulated aging and design basis event condition testing described herein and reported in Reference 1.

2.11 The generic tests completed by Westinghouse 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. Black, J.P., Skeers, D.M., Rens, T.E., "Equipment Qualification Report, Resistance Temperature Detectors - RCS Well Mounted (Seismic and Environmental Testing)" WCAP-8687, Supplement 2-E06A (Proprietary), WCAP-8587, Supplement 2-E06A (Non-Pro- prietary), March, 1981.

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SECTION 3 AND 4 QUALIFICATION BY EXPERIENCE AND/OR ANALYSIS

Westinghouse does not employ operating experience or analysis in support of the qualification program for the RCS Well Mounted RTD's.