### 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.

PROCESS PROTECTION SYSTEM

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#### SECTION 1 - SPECIFICATIONS

- 1.0 PERFORMANCE SPECIFICATIONS
- 1.1 Electrical Requirements
  - 1.1.1 Voltage: 118 + 5% VAC
  - 1.1.2 Frequency: 60 + 3% Hz; 5% max. harmonic distortion
  - 1.1.3 Lord: 21.5 amp. max. steady state; inrush 10 times steady state
  - 1.1.4 Electromagnetic Interference: Peak to peak S/N ratio 200:1

1.1.5 Other: N/A

- Installation Requirements: Installation in accordance with <u>U</u> drawings 8797D33 and 8797D34.
- Auxiliary Devices: Field mounted process sensors, Solid State Protection System, Nuclear Instrumentation System, various EQDP's.
- 1.4 Preventative Maintenance Schedule: The details of any preventative maintenance schedule, assumed in establishing the qualified life, will be specified in this section on completion of the Westinghouse Aging Evaluation Program.
- 1.5 Design Life: 40 years

1.7 Performance Requirements for (b): All safety related functions

			Normal	Abnormal	Containment Test	DBE CO	onditions(a)		Post D	BE Conditions	<u>(a)</u>
		Parameter	Conditions	Conditions	Conditions	FL8/SL8	LOCA	Seismic	FLB/SLB	<u>1004</u>	Seismic
	1.7.1	Time requirment	Continuous	12 hours	N/A	Event duration	Event duration	Event duration	Conitnuous	Continuors	Continuous
		requirement	Note c	Note d		Note c	Note c	ite c	Note c	Note c	Note c
1.8	Environ	mental Conditions	for Same Fun	ction <sup>(b)</sup>							
	1.8.1	Temperature( <sup>0</sup> F)	60-80	Fig. 1		Ambient	Ambient	^abient	Ambient	Ambient	Ambient
	1.8.2	Pressure (psig)	0	0		Conditions	Londitions	0	Conditions	Conditions	Conditions
	1.8.3	Humidity (% RH)	30-50	Fig. 1				Ambient			
	1.8.4	Radiation (R)	<400	None				None			
	1.8.5	Chemicals	None	None				None			
	1.8.6	Vibration	None	None				None			
	1.8.7	Acceleration (g)	Nor c	None				See Section			
								2.10.3.2			

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Notes: a: DBE is the Design Basis Event.

b: Margin is not included in the parameters of this section.

C: Channel accuracy  $\pm$  0.5% span, time response of 0.1 secs for a bistable output trip to an input step change. d: Channel accuracy  $\pm$  1.0% span, time response as c).

1.9 Qualified Life: The constrated qualified life will be specified in this section on completion of Subprogram C of the Westinghouse Aging Evaluation Program. (Appendix B to WCAP-858<sup>-1</sup>)

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1.10 Remarks: None

## SECTION 2 - QUALIFICATION BY TEST

- 2.U TEST PLAN
- 2.1 Equipment Description: Westinghouse-ISD Model 7300 rack mounted equipment. NIS and N-16 subsystems, 2-bay and 3-bay cabinets
- 2.2 Number lested: Type test on one (1) of each equipment type
- Mounting: Cabinet-floor mounted with bolts, cards-mounted in card frames.
- 2.4 Connections: Power and field wires to terminal strips. Output to multiconductor cables.
- 2.5 Aging Sim\_ tion Procedure:

By a separate component test program as described by Subprogram C of Appendix B to WCAP-8587.

2.6 Service Conditions to be Simulated by Test<sup>(1)</sup>

		Normal	Abnorma1	Containment Test	Seismic	HELB	Post-HELE
2.6.1	Temp. ( <sup>O</sup> F)	Ambient	Fig. 2	N/A	Ambient	N/A	N/A
2.6.2	Pressure (psig)	0	0		0		
2.6.3	Humidity (% RH)	Ambient	Fig. 2		Ambient		
2.6.4	Radiation (R)	None	None		None		
2.6.5	Chemicals	None	None		None		
2.6.6	Vibration	None	None		None		
2.6.7	Acceleration (g)	None	None		See Section		
					2.10.3.2		

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2.7 Measured Variables

This section identifies the parameters required to be measured during the test sequence(s).

2.7.1	Category	I - Environment	Required	Not Required
	2711	Tomograture	P	٨
	0710	Desseure	ь	A
	2.7.1.2	Maisture	p	A,D
	2.7.1.3	Composition	D	A D
	2.7.1.4	Composition		A,D
	2.7.1.5	Seismic Acceleration	A	В
	2.7.1.6	Time	А,В	
2.7.2	Category	II - Input Electrical Char	acteristics	
	2.7.2.1	Voltage	A,B	
	2.7.2.2	Current	A.B	
	2.7.2.3	Frequency	A.B	
	2.7.2.4	Power		A,B
	2.7.2.5	Other		A,B
2.7.3	Category	III - Fiuid Characteristic	s	
	2.7.3.1	Chemical Composition		A,B
	2.7.3.2	Flow Rate		A,B
	2.7.3.3	Spray		A,B
	2.7.3.4	Temperature		А,В
2.7.4	Category	IV - Radiological Features		
	2.7.4.1	Energy Type		A,B
	2.7.4.2	Energy Level		A,B
	2.7.4.3	Dose Rate		A,B
	2.7.4.4	Integrated Do se		A.B

			Required	Not Required
2.7.5	Category	V - Electrical Characteristics		
	2.7.5.1	Insulation Resistance		A.B
	2.7.5.2	Output Voltage	A,B	
	2.7.5.3	Output Current		A.P
	2.7.5.4	Output Power		A.B
	2.7.5.5	Response Time		A.B
	2.7.5.6	Frequency Characteristics		A.B
	2.7.5.7	Simulated Load		A,B
2.7.6	Category	VI - Mechanical Characteristics		
	2.7.6.1	Thrust		AR

		А,В
2.7.6.2	Torque	A.B
2.7.6.3	Time	A.B
2.7.6.4	Load Profile	4.B

2.7.7 Category VII - Auxiliary Equipment

None

- A. Se'smic Test
- B. O erational Test, Normal and Abnormal Conditions

## 2.8 Test Sequence Preferred

This section identifies the preferred test sequences as specified in IEEE-323-74

- 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 Actua

This section identifies the actual test sequence(s) which constitute the qualification program for this equipment. The separate subsections indicate the separate test sequences completed on different, but essentially identical, equipment and/or components. The justification for employing anything other than the preferred sequence is provided below:

The DBE is simulated during the Environmental and Seismic Test Sequence of Section 2.9.2. The HELB Tests (Sections 2.8.6 and 2.8.7) have been excluded since the 7300 Process Protection equipment is not exposed to the HELB environment due to their location. The aging test employs the preferred test sequence (Section 2.8) excluding HELB and Abnormal Extremes (Sections 2.8.6, 2.8.7 and 2.8.3) on a representatave sample of components from the process protection system. The Aging Tests will demonstrate that during the qualified life there are no in-service aging mechanisms capable of reducing the capability of the process protection system to perform during or after a seismic event. As a consequence, the seismic testing on the un-aged 7300 Series Process Protection equipment is not prejudiced by any in-service aging mechanisms.

	Step	Notes
2.9.1	Production 1	est Sequence
	2.8.1	
	2.8.2	System test performed on all
	2.8.8	production units
2.9.2	Environmenta	1 Sequence
	21	
	2.8.3	Abnormal environment simulation
	2.8.8	
2.9.3	Seismic Test	Sequence
	2.8.1	
	2.8.5	Seismic Simulation
	2.8.8	
2.9.4	Aging Test S	equence
	2.8.1	
	2.8.2	Aging to be addressed by separate testing as
	2.8.4	described in Subprogram C of Appendix B to
	2.8.5	WCAP-8587
	2.8.8	

#### 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 Process Protection System to perform its safety-related function(s) described in EQOP Section 1.7 while exposed to the applicable environments defined in EQDP Section 1.8.

## 2.10.2 Equipment Tested

## 2.10.2.1 Normal Environment Testing

A system test under normal environmental conditions is performed on each Process Protection System at the completion of the man<sup>1,6</sup> acturing process.

## 2.10.2.2 Abnormal Environment and Seismic Testing

Process Protection modules and components were assembled in a test system configuration and installed in a standard, three bay, 730B series process capinet. The modules selected for the test system were chosen to include at least one of each module used in Westinghouse Nuclear Steam Supply System Process Protection Systems. The test system was designed to provide automatic electrical exercising of many of the system modules during the abnormal environment test cycles.

## 2.10.2.3 Aging Evaluation Program

A representative sample of critical components from the Process Protection System will be included in Subprogram C of the Aging Evaluation Program described in Appendix B to WCAP-8587.

## 2.10.3 Test Summary

#### 2.10.3.1 Environment Test

Westinghouse requires that the 7300 Series Process Protection equipment be located such that it does not experience a consequent adverse environment when required to operate following a high energy line break either inside or outside containment. Therefore the only environmental testing required is to demonstrate equipment capability under normal and abnormal environmental extremes.

Reference 6 summarizes the results of available radiation testing of organic and inorganic materials and justifies that for radiation doses less than 10<sup>4</sup> rads, no deterioration in material structural properties is detectable. As a consequence, irradiation simulation is not required on this equipment, since estimated in-service radiation doses will not prejudice the capability of the equipment to perform under design basis event (i.e. seismic event) conditions.

The environmental testing reported in Reference 1 is intended to demonstrate the capability of the process protection modules, to meet the safety-related performance requirements specified in EQDP Section 1.7 when exposed to the variations

in temperature, humidity, voltage and frequency specified by Figure 2. The modules and system components were installed in a system configuration designed to simulate typical operating process channels. The testing successfully demonstrated the specified safety related requirements. Additional margin was, furthermore, included in this test by submitting the equipment to two additonal cycles of electrical and environmental extremes also described by Figure 2. This test is considered to satisfactorily demonstrate the Process Protection system capability to meet its safety-related functional requirements when exposed to the specified abnormal environments (EQCP Section 1.7) and the permitted range of frequency and voltage variations (EODP Section 1.1) in accordance with IEEE-323-1974 Section 6.3.2.(2) and (3).

## 2.10.3.2 Seismic Tests

The single design basis event capable of producing an adverse environment at the equipment location is a seismic event. Following the abnormal environment testing of and modules and the Nuclear Instrumentation/Nitrogen-16 subsystem modules and components were subjected to a multi- axis, multi-frequency inputs in accordance with requirements of Reg. guide 1.300 (IEEE 344-1975), as described in Reference 1. These modules are of limited use and were qualified to a reduced envelop. The seismic resting of 2300 series modules and cabinets reported in references 2. 3, 4 and 5 was completed on new equipment employing single-axis sine-beat (IEEE-344-71) and multi-axis, multi-frequency inputs in accordance with Reg Guide 1.100 (IEZE-344-1975). Reference 2 describes testing of the two and three bay cabinets. Frequency and

acceleration figures for different locations in the cabinets are compared with conditions to which the 7300 series modules have been tested. Comparison of these envelopes indicates that the "generic" qualification discussed in Reference 4 does not envelop all plants. Comparison must be done on a plant by plant basis.

## 2.10.3.3 Aging Evaluation

Subprogram C of the Westinghouse Aging Evaluation Program (Appendix B, WCAP 8587) will incorporate a representative sample of components from the Process Protection System. This program is currently in progress and will be Reported in WCAP-8587 Supplement 2, Appendix A, (Non-Proprietary) and WCAP-8687, Supplement 2, Appendix A (Proprietary). The objective of Subprogram C is to demonstrate that during the qualified life there are no in-service aging mechanisms capable of reducing the capability of the Process Protection System to perform during or after a seismic event.

## 2.10.4 Conclusion

The demonstrated qualified life of the Process Protection System will be established by Subprogram C of the Westinghouse Aging Evaluation Program. The results of the aging program, together with the seismic and environmental testing described herein, demonstrate the qualification of the Process Protection Equipment. The qualification status of each module is shown in Table 1.

#### 2.11 Notes

 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.

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SECTIONS 3 & 4 QUALIFICATION BY EXPERIENCE AND/OR ANALYSIS

Westinghouse does not employ operating experience or analysis in support of the qualification program for the Process Protection System.

### 2.12 References

- Skeers, D. M. "Equipment Qualification Test Report Process Protection System: WCAP-8687, Supplement 2-E13B (Proprietary), WCAP-8587, Supplement 2E13B (Non-Proprietary), January 1981.
- Coslow, B. J., Equipment Qualification Test Report, Process Protection System (Seismic Testing) WCAP 8687, Supplement 2-E-13A (Proprietary), WCAP 8587, Supplement 2-E13A (Non-Proprietary), October 1980.
- Jarecki, S. J., Coslow, B. J., Ellis, A. E., Miller, R. B., "Seismic Operability Demonstration Testing of the Westinghouse ISD 7300 Series Process Instrumentation Bistables," WCAP-8828 (Proprietary), WCAP-8829 (Non-Proprietary), December 1976.
- Reid, J. B., "Seismic Testing of Electrical and Control Equipment (<u>WCID</u>) Nucana 7300 Series) (Low Seismic Plants) WCAP-7817, Supplement 4, November 1972.
- Reid, J. B., "Seismic Testing of "ectrical and Control Equipment (<u>WCID Nucana 7300 Series</u>) (High Seismic Plants)," WCAP-7821, Supplement 3, September 1972.
- Damerow, F. W., "Effects of Gamma Radiation Doses Below 10<sup>4</sup> Rads on the Mechanical Properties of Materials," Appendix C WCAP 8587 (Non-Proprietary) January 1981.

## TABLE 1

# QUALIFICATION STATUS OF PROCESS PROTECTION SYSTEM DEVICES

A. Seismically Qualified by References 2 through 5 Environmentally Qualified by Reference 1

NAL	Signal Comparator	NMD	Multiplier/Divider
NCH	Function Generator	NRA	RTD Amplifier
NCT	Channel Test	NSA	Summing Amplifier
NLL	Lead/Lag Amplifier	NTC	Temperature Channel Test
NLP	Loop Power Supply	NTP	Test Point

B. Seismically and Environmentally Qualified by Reference 1

NIS	Amplifier	Field Cable Interface Panel
N-16	Amplifier	N-16 Detector Power Supply

# C. Environmentally Qualified by Reference 1

NAI	Annunciator Interface	NPL	Prom Logic
NAS	Auxiliary Solid State Relay	NQC	High Current Output
NCB	Controller	NQI	Quad Input
NCD	Controller Driver	NQO	Quad Output
NCI	Computer Input	NRC	Relay
NDI	Digital Input	NSC	Signal Converter
NMT	Master Test	NTD	Tracking Driver

NPC

Potentiometer





