

TOPICAL REPORT EVALUATION

POOR
ORIGINAL

Report Number: BAW-10003 Revision 4 (Non-Proprietary)
Report Title: Qualification Testing of Protection System Instrumentation
Report Date: April 1975
Originating Organization: Babcock and Wilcox, Company
Reviewed By: Section A - Electrical, Instrumentation and Control Systems
Branch, Division of Technical Review

Summary of Topical Report

The topical report presents the results of the seismic and environmental qualification testing of the protection system instrumentation used in Babcock and Wilcox nuclear steam systems including: detectors, signal conditioning instrumentation, power supplies, test signal generators, and relay logic.

Summary of Regulatory Evaluation

As a result of our review, we have concluded that this topical report provides satisfactory answers to the questions which were transmitted as a result of our review of Revisions 2 and 3 and is therefore an acceptable basis for the qualification of some equipment in older plants.

Summary of Regulatory Position

1. The subject report in its present form provides an acceptable basis for testing instruments and control devices to demonstrate the capability of this equipment to function with precision and reliability over the full range of transient and steady-state conditions of both the energy supply and the environment during normal, abnormal, and accident circumstances throughout which the instrumentation must perform.
2. The testing which is presented in the subject report does not satisfy all of the requirements of IEME Std 323-1974, which was published February 28, 1974 and can not be used as a basis for licensing plants docketed for a construction permit after that date.
3. BAW-10003 Revision 4 may be used as a basis for licensing plants in which construction permit second round questions were issued prior to April 30, 1974.
4. The subject report is not applicable to solid state logic systems such as RPS-II.
5. The subject report is only applicable to the following portions of the reactor protection system:

Group I - Amplifier Modules

Preamplifier
Count rate amplifier

8-002060 853

Rate-of-change amplifier
Buffer amplifier (a)
Linear amplifier
Logarithmic amplifier
Square root extractor
Linear bridge
Signal converter
Sum/difference amplifier
Function generator

Group II - Power Supply Modules

System power supply (a)
Detector power supply
Auxiliary power supply

Group III - Test Modules

Source range test
Intermediate range test
Power range test
Temperature test
Flow test (a)
Pressure test (a)
Contact monitor test

Group IV - Logic Modules

Bistable (a)
Contact monitor

Group V - Relay Modules

Auxiliary relay (a)
Reactor trip assembly
Contact buffer (b)
Logic buffer (b)
Logic test (b)
Unit control (b)
Trip logic (b)

(a) Modules that are interchangeable between the NI/RPS and the SFAS.

(b) Modules associated only with the SFAS (modules associated only with the NI/RPS have no indicator).

Detectors

Pressure (Foxboro)
Pressure (Motorola)

Differential Pressure (Bailey)
Temperature (Rosemount Models 177 GX, JD, and H)
Pressure Switch (Mercooid)
Neutron Detectors

Therefore, the seismic and environmental qualifications of the remainder of the Class IE equipment in an application must be reviewed separately.

6. The individual applications must demonstrate that the equipment will comply to the following interface criteria in its as installed condition:
- a. The still air temperature of the equipment must be maintained within a range of 40 to 110°F at relative humidities of 50%.
 - b. The interconnecting wiring and connectors must be qualified to meet the environmental and seismic plant design criteria.
 - c. The electrical power sources for the instrumentation shall maintain input to the cabinets of 107 to 127 V ac at 58 to 62 Hz.
 - d. The applicant's Chapter 15 analysis shall be based on assumed errors for the following equipment which are not less than those listed herein:
 - (1) Reactor Coolant Pressure
 - Foxboro Equipment $\pm 1.85\%$
 - Motorola Equipment $\pm 3.69\%$
 - (2) Reactor Coolant Flow $\pm 3.0\%$
 - (3) Reactor Coolant Temperature $\pm 1.0\%$
 - (4) Reactor Coolant Pump Status Monitor $\pm 0.88\%$
 - (5) Reactor Building Pressure $+1.0\%$
 -50%
 - (6) Neutron Monitoring
 - Total Flux $\pm 4.0\%$
 - Flux Imbalance $\pm 5.0\%$
 - e. If Motorola Pressure sensors are used, the technical specifications shall require calibration not less frequently than once every four months.
 - f. The analysis in Chapter 15 of the Safety Analysis Report shall be based on assumed response times which are equal to or greater than

the following times required for a response to 99% of the differential change from a step input:

(1) Pressure Detectors	250 msec.
(2) Differential Pressure Detectors (Flow)	250 msec.
(3) Temperature Detectors Models 177 GX and JD	5 sec*
Model 177 II	3 sec*
*time to change 63.2% of applied step change in input	
(4) Preamplifier	100 ns rise time
(5) Count rate amplifier	400 s @ 0.1 Hz 1 s @ 10^6 Hz
(6) Rate-of-change amplifier	<10s
(7) Buffer amplifier	50 ms, 1 s
(8) Linear amplifier	50 ms
(9) Logarithmic amplifier	10 s @ 10^{-11} A 0.1 s @ 10^{-3} A
(10) Square root extractor	Incr 250 ms Decr 500 ms
(11) Linear bridge	10 ms
(12) Signal converter (temp output)	300 ms
(13) Signal converter (press. output)	300 ms
(14) Sum/difference amplifier	
E_{out}	10 ms
Scaled E_o	10 ms
(15) Function generator	
Slope	15 ms

(16)	Bistable	100 ms
(17)	Reactor Trip (interlock or test trips)	30 ms
(18)	Contact Buffer Modules	
	energize	40 ms
	de-energize	100 ms
(19)	Logic Buffer Module	10 ms
(20)	Unit Control Module Trip	50 ms

- g. The applicant shall provide reactor coolant pump status monitors and detectors which shall have a combined accuracy of 0.88% and a response time of 6 ms or less.
- h. The applicant shall provide a description of and procedures for testing to assure that the equipment is more accurate than and responds in a shorter time than the limits presented in requirements (d), (f), and (g) above.