

U. S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT

April 14, 1982

Docket No.: 99900902/82-04

Environmental Qualification Program: Phase II Test Program for Rosemount  
1153 Series D and Foxboro N-E 10 Series Pressure Transmitters, Report No. 6,  
Design Basis Event - Seismic Tests.

Equipment Identification:

Rosemount

<u>Test Specimen No.</u>	<u>Serial No.</u>	<u>Mod. No</u>	<u>Type</u>	<u>Range</u>
R1	309352	1153DD3	Differential	0-30 inches water
R2	320344	1153DD5	Differential	0-750 inches water
R3	308551	1153HD7	Differential	0-3000 psia
R4	333241	1153AD6	Absolute	15-100 psia
R5	311863	1153GD9	Gauge	0-3000 psig

Foxboro

F1	4456838	N-E11GM-HIE2	Gauge	1600-2400 psig
F2	4456842	N-E11GH-IIM2	Gauge	0-3000 psig
F3	4456846	N-E13DM-IIM1	Differential	30-150 inches water
F4	4456849	N-E13DH-HIM1	Differential	0-200 inches water
F5	4456851	N-E13DH-IIH1	Differential	0-500 inches water

Test Organization: Wyle Laboratories (Eastern Operations), Scientific Services  
and Systems, 7800 Governors Drive West, Huntsville, Alabama 35807

Contract No.: Wisconsin Electric Power Company (For Utility Group), Purchase  
Order Number A-61384

Inspection Conducted: March 29-April 1, 1982.

Assigned Inspector

Alva L. Smith  
for A. R. Johnson, Equipment Qualification  
Section, Vendor Programs Branch, Region IV

8-11-82  
Date

Approved By:

Alva L. Smith  
for H.S. Phillips, Chief  
Equipment Qualification Section,  
Vendor Programs Branch, Region IV

8-11-82  
Date

Summary: The purpose of this inspection was to witness, observe, and review documentation of, the Design Basis Event Seismic Tests for the Rosemount 1153 Series D and Foxboro N-E 10 Series Pressure Transmitters, as part of the Phase II test program, to generically qualify class 1E equipment to Category I requirements of NUREG-0588, Rev. 1 (IEEE Std 323-1974). This inspection was a continuation of that performed by the NRC RIV on March 15-20, 1982 (Docket No. 99900902/82-02, Report No. 5).

Results: The review performed during this inspection indicated:

1. The detailed test procedures are in accordance with the test plans.
2. The Design Basis Event Seismic Tests were performed in accordance with the detailed test procedures.
3. All necessary information and data were collected to allow evaluation of test results in relation to the acceptance criteria.
4. The test results were well within the prescribed margins of acceptance.
5. Anomalies were properly documented and corrective actions approved.

Details Section  
Prepared by A. R. Johnson

A. Persons Contacted

Edward W. Smith - Director of Contracts, Wyle Laboratories  
Bruce Fowler - Lead Test Engineer, Wyle Laboratories  
Bernie Pinkerton - Staff Support, Wyle Laboratories  
John A. Sears - Corporate Engineering, Foxboro Company  
Roy K. Selander - Project Engineering, Foxboro Company  
Sharon Wildgen - Project Engineer, Rosemount  
Len Casella - WEPCO Utility Owners Group Representative, Florida Power  
and Light Company  
Robert E. Stanbridge - Sr. QA Engineer, Southern California Edison Company  
James Grier - Sr. QA Engineer, Toledo Edison Company  
Richard E. Dulski, Group Supervisor, NPD, Conax Company

B. General

The purpose of the subject test program was to qualify pressure transmitters manufactured by Rosemount and Foxboro for use in safety-related systems in nuclear power generating stations. Wyle qualification test plans No. 45352-1 and 45352-2, Rev. A, have incorporated NRC staff's recommendations and resolved their concerns, and appear to meet the requirements of IEEE Std. 323-1974 and NUREG-0588, Rev. 1.

Wyle Laboratories development of test procedures, No. 45592-1, dated August 19, 1981, and No. 45592-2, dated July 1, 1981, has been approved for use in implementing the methodologies and requirement of these test plans. The test procedures include checklist/data sheets which have been completed during the test program, providing auditable records of the qualification testing.

The purpose of this inspection, conducted by the RIV NRC inspector, was to assure that the Design Basis Seismic Event Tests were conducted in accordance with these test plans and procedures, and to review documented test records, completed by Wyle personnel during the test, for acceptance within prescribed margins to meet the IEEE Std 323-1974 and NUREG-0588, Rev. 1 requirements. The RIV NRC inspector accomplished this effort by review and inspection of checklist/data sheets, documented anomalies, qualification plans, test procedures, other selected documents, and discussion with Wyle Laboratory test personnel.

C. Design Basis Seismic Event Tests

1. Objectives

The objectives of the inspection of the Design Basis Seismic Event Tests were to:

- a. Review detailed test procedures for conformity to the qualification plans.

- b. Verify that the Design Basis Seismic Event Tests were performed in accordance with the detailed test procedures.
- c. To review test results documented in records, and verify that test results were well within the prescribed margins of acceptance.
- d. To determine that Notices of Anomalies (NOA), where required, were prepared in a timely manner.

## 2. Findings

- a. The five pressure transmitters, attached to the Wyle fabricated test fixture using seismic mounting hardware, were subjected to 30-second duration biaxial multifrequency random motion, which was amplitude controlled in 1/3 octave band widths and spaced 1/3 octave apart over the range of 1 to 40 Hz. Two simultaneous, independent, random signals were used to excite and to produce phase-incoherent horizontal and vertical table motions.
- b. Damping factors of 1/2, 1, 2, 3, and 5 were used against the resulting table motion, using a spectrum analyzer for the analysis, plotted at 1/3 octave intervals over the frequency range of 1 to 200 Hz. The Test Response Spectra (TRS) enveloped the Required Response Spectra (RRS) as prescribed in the Wyle test procedures 45592-1 and 45592-2. Five Operating Basis Earthquake (OBE) tests were performed in both front-to-back/vertical (FB/V) and side-to-side/vertical (SS/V) orientations. One Safe Shutdown Earthquake (SSE) test was performed in both FB/V and SS/V orientations.
- c. After completion of the generic testing specified above, the five pressure transmitters were subjected to the RRS requirements for the Southern California San Onofre Nuclear Plants. The above testing, as specified, was repeated with the following changes: The transmitters were subjected to 60-second duration, simultaneous horizontal and vertical inputs of random motion consisting of frequency bandwidths spaced 1.3 octave apart over the range of 1 to 40 Hz to envelope the RRS. Sine burst was necessary to superimpose the random signal, to meet these requirements, at frequencies of 1, 1.25, 1.6, and 2.0 Hz. The resulting table motion was analyzed by the spectrum analyzer at 5% damping. Five OBE tests were performed in both orientations prior to performing the SSF test in each orientation.

- d. A five-point calibration check, a voltage variation test, and a leak test were performed on each transmitter prior to, three times during, and at the completion of both generic and San Onofre seismic simulations.
- e. The analysis of the table motion for the generic OBE (FB/V) Test (Run No. 15) indicated that the TRS did not envelop the RRS at 1.0% damping; however, the TRS did envelop the RRS at 0.5% damping. The analysis of the table motion for the generic OBE (FB/V) Test (Run No. 16) indicated that the TRS did not envelop the RRS at 0.5% damping; however, the TRS did envelop the RRS at 1.0% damping. At the request of the Lead Utility Owners Representative, the TRS from Test Run No. 15 shall be used to show compliance with the RRS at 0.5% damping, and the TRS from Test Run No. 16 shall be used to show compliance with the RRS at 1.0% damping. Generic OBE (FB/V) test runs No. 15 and 16 were used out four attempts to meet the RRS (FB/V) which bordered on the test facility limitations.
- f. During the performance of generic OBE (FB/V) Test Run No. 28, the seismic test machine contacted the horizontal actuator cushions. The analysis of the table motion indicated that the TRS was approximately 5% low at a frequency of 1.0 Hz. This was not consistent with the bare table test in which the TRS enveloped the RRS without contacting the cushions. The shock response spectrum analyzer was removed from the control room and placed in the calibration laboratory. It was noted by the calibration laboratory that the center frequency of the 1.0 Hz filter was tuned to 1.02 Hz which attenuated the filter response approximately 15% at 1.0 Hz. The calibration laboratory returned the center frequency on the 1.0 Hz filter. The table motion was again analyzed and the TRS enveloped the RRS.
- g. At the conclusion of the generic Operating Basis Earthquake (OBE), generic Safe Shutdown Earthquake (SSE), San Onofre OBE, and San Onofre SSE tests, a leak test, as outlined in procedures 45592-1 and 45592-2, was performed. Bubble leakage was noted as follows:
- Transmitter R1 - Swagelok fitting on low pressure side process connection.
  - Transmitter R2 - Both sides of transmitter body and Swagelok fittings on both process connections.
  - Transmitter R3 - Swagelok fittings on both process connections.

Transmitter F1 - 1/2" National Pipe Thread (NPT) fitting and process connector/body interface at the conclusion of both the generic and San Onofre OBE and SSE tests.

Transmitter F2 - 1/2" NPT fitting at the conclusion of the generic, San Onofre OBE, and SSE tests. At the conclusion of the San Onofre OBE and SSE test, the tubing connector at the process connector end was also leaking.

Transmitter F4 - Body leakage noted after the generic SSE tests.

The Lead Utility Owners Representative was notified. The testing would continue without repair.

- h. Each of the above Foxboro/Rosemount pressure transmitters was visually examined at the conclusion of the Generic and San Onofre seismic simulations. During the examination Foxboro transmitter No. N-E13DH-IIH1 (F-5) upper left corner terminal block cover strip was broken. The Lead Utility Owners Representative was notified. The testing would continue without repair.

Notices of Anomalies (NOA) were issued for all of the above findings (paragraphs e through h) during this portion of the tests.

### 3. Summary

Based on the information above, the NRC-RIV inspector determined that: The Design Basis Seismic Event Tests and test records, for the above-subject electrical equipment, reasonably assure, as evidenced by test results within the prescribed margins, that the requirements of NUREG-0588, Rev. 1 (IEEE Std 323-1974) for seismic service have been met. The results of this report will be used by the NRC staff to evaluate the above subject equipment, pending completion of all environmental qualification tests as required.