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Reg. 87187
SQN PLANT
FOXBORO

CONTRACT 7203-9203
WBN & SQN

TEST REPORT NO. T3-1091

Seismic Vibration Test
of
E10 Series Transmitters
Tested at
Acton Environmental Testing Corp.
Acton, Ma.

SEQUOYAH NP WATTS BAR NP

72-92784

76-87187

APPROVED
This approval does not relieve the
Contractor from any part of his responsi-
bility for the correctness of design, details
and dimensions.
TENNESSEE VALLEY AUTHORITY
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1.0 Test Items

1.1 E11GM-ISAE2 Electronic Gauge Pressure Transmitter ("E" Capsule)

Supply Voltage Limits: 24-65 V dc
Test Supply Voltage: 30 V dc
Output Load Limits: 650 Ω +10, -20% Test Output Load: 650 Ω
Input Range Limits: 200-2,000 lbf/in²
Input Test Span: 0-1,000 lbf/in²
Serial No. 2713115
MCA/RRW/CI* Modifications with
"XJB" Junction Box - Cast Iron
Americoat 66 - Paint

1.2 E11GH-IINN2 Electronic Gauge Pressure Transmitter (Bourdon Tube)

Supply Voltage Limits: 24-65 V dc Test Supply Voltage: 30 V dc
Output Load Limits: 650 Ω +10, -20% Test Output Load: 650 Ω
Output Current: 4-20 mA dc
Input Range Limits: 1,000-6,000 lbf/in²
Input Test Span: 0-1,000 lbf/in²
Serial No. 2713116
MCA/RRW/CI* Modifications with
"XJB" Junction Box - Cast Iron
Americoat 66 - Paint

1.3 E13DH-ISAM5 Electronic Differential Pressure Transmitter

Supply Voltage Limits: 24-65 V dc Test Supply Voltage: 30 V dc
Output Load Limits: 650 Ω +10, -20% Test Output Load: 650 Ω
Output Current: 4-20 mA dc
Input Range Limits: 20-200" H₂O
Input Test Span: 0-100" H₂O
MWP - 6,000 lbf/in²
Serial No. 2713119
MCA/RRW/CI* Modifications with "XJB"
Junction Box - Cast Iron
Americoat 66 - Paint

1.4 E13DM-ISAMX Electronic Differential Pressure Transmitter

Supply Voltage Limits: 24-65 V dc Test Supply Voltage: 30 V dc
Output Load Limits: 650 Ω +10, -20% Test Output Load: 650 Ω
Output Current: 4-20 mA dc
Input Range Limits: 20-200" H₂O
Input Test Span: 0-100" H₂O
MWP - 2,000 lbf/in²
Serial No. 2713118
MCA/RRW/CI* Modifications with "XJB"
Junction Box - Cast Iron
Americoat 66 - Paint

2.0 Test Objective

To determine the ability of the E10 Series MCA/RRW Transmitter to perform without loss of function under the seismic vibration conditions specified herein.

Since the criteria for acceptable performance under seismic vibration vary with application requirements, they are not included in this document.

To conduct test in conformance with guidelines of IEEE Std 344-1971 Trial-Use Guide for Seismic Qualification of Class I Electric Equipment for Nuclear Power Generating Stations.

3.0 Summary and Conclusions

The four test transmitters operated without loss of function during all tests. The pressure integrity of all transmitters was maintained thru all tests.

Test results by unit are as follows:

E13DM

Maximum calibration shifts following individual seismic runs of zero, span and the five check points were generally <0.5%.

Output shifts in any plane during any test acceleration level were generally <-7.2%. Output bandwidths were $\pm 7.0\%$ in any plane or acceleration level.

Visual examination of the transmitter after all tests found no loose parts or screws.

E13DH

Calibration shifts of zero and span were <4.2 and -0.7% respectively, which were greater than those of the other units tested. Zero shifts after the 3.5 and 5.0g tests were larger than after the 10g tests which were done with a new force motor assembly. It is possible that a crack found after a 10g test in the vertical plane occurred during lower level tests. Although the force motor assembly was loose after the 10g vertical test, the unit still functioned but with a large zero shift. (See Comment 4 for further discussion.)

Most output shifts during the 3.5 and 5.0g sine beat tests were <5.0% with bandwidths <10.0%. Output shifts during the 10g sine beat test were -12.4% and bandwidths <9.0% as obtained with a new force motor assembly.

E11GM

Maximum calibration shifts following individual seismic runs were <0.3% for all planes and acceleration levels.

Output shifts were <6.0% and bandwidths <9.5% during seismic runs.

No loose parts or screws were found on visual inspection after all tests.

E11GH

The maximum calibration shifts following individual seismic runs were 0.6% or less at any level.

Maximum output shift during resonance survey was 2.0% and the maximum bandwidth was 16%. The maximum output shifts for the sine beat tests were 23% or less and bandwidths of 50% during seismic runs.

3.0 Summary and Conclusions (Cont.)

No loose parts or screws were found on visual inspection after all tests other than reported above relative to the E13DH.

Most large bandwidths occurred below 6 Hz and most large output shifts were below 12 Hz, with a few exceptions.

The most sensitive axis is the horizontal plane parallel to the zero adjustment.

Units were mounted on rigid fixtures because exact duplication of various mounting arrangements used in the field is impracticable. Figure No. 4 shows fixtures used.

Mechanical response measurements made during the resonance survey tests and indicated in Section 2.4 of the Acton Test Report No. 10486 had no greater amplifications than 1.3:1, but were generally at the transmissibility of 1.

The junction box assembly did not produce any amplified motions during the tests.

Process connectors were not used with the differential pressure transmitters during these tests. Signal connections were made directly into the transmitter bodies per the required fitting.

Where 5 sine beats are normally used under IEEE Std 344-1971 10 sine beats at each frequency were used in this test. Five sine beats at the test levels of 3.5 and 5.0g could be considered 1/2 SSE (Safety Shutdown Earthquakes) tests, therefore 10 sine beats would constitute two 1/2 SSE events at each level or four 1/2 SSE events. The 10g level could be considered an SSE event, therefore with 10 sine beats this would be equivalent to two SSE events. Viewed in this manner these units functioned through four 1/2 SSE and two SSE events at very high levels. Reference guideline IEEE 344-1971 Draft Revision 3, 2-13-74.

4.0 Comments and Observations

4.1 The force motor assembly of the E13DH transmitter was found to have a crack near an attachment hole after a 10g test. The force motor was replaced and testing at 10g level was redone for all planes. Test results indicate that the crack was propagating during lower level tests. Although unconfirmed the crack could have been caused when the unit was dropped by test lab personnel.

4.2 A video tape record of some of the test planes is on file.

4.3 After each pressure integrity test units were flushed with a solvent and air-dried to remove hydraulic oil.

4.4 All chart records and data will be maintained on file under the listed test number.

4.5 Figure No. 3 shows how output chart records were interpreted for output shifts and bandwidths.

5.0 Summary of Test Results

(All percentage shifts are based on percent of output span)

5.1. Resonance Survey - Test Procedure Section 6.0, Part 3.3.

Sine Wave, 0.5g Constant Accel., 1-35 Hz. Sweep Rate: 1 octave/min.

5.1.a. Test Item

E13DM-ISAMX S/N 2713118
Calibrated Test Range: 0-100" H₂O

5.1.a.1 Vibration Plane - Vertical5.1.a.1.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, <0.1 %, 0.5g
Maximum Output Bandwidth, 1.2% @ 1, 9-11 Hz., 0.5g
See Table No. 1

5.1.a.1.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift, <0.10%
Span Change, -0.10%
Maximum Error, -0.10%

5.1.a.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw5.1.a.2.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, -0.1% @ 11, 23-35 Hz, 0.5g
Maximum Output Bandwidth, 1.6% @ 25-26 Hz., 0.5g
See Table No. 1

5.1.a.2.b. Calibration Shifts - After Resonance Survey

(Reference to data taken before survey in this plane)

Zero Shift, -0.10%
Span Change, -0.13%
Maximum Error, -0.23%

5.0 Summary of Test Results (Cont.)

(All percentage shifts are based on percent of output span)

5.1.a.3. Vibration Plane - Horizontal: Parallel to Zero Adjusting Screw

5.1.a.3.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, +0.2% @ 32 Hz., 0.5g
Maximum Output Bandwidth, 1.8% @ 26 Hz., 0.5g
See Table No. 1

5.1.a.3.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift, <0.10%
Span Change, +0.33%
Maximum Error, +0.33%

5.1.b. Test Item

E13DH-ISAM5 S/N 2713119 ,
Calibrated Test Range: 0-100" H₂O

5.1.b.1. Vibration Plane - Vertical

5.1.b.1.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, 0.5% @ 6 Hz., 0.5g
Maximum Output Bandwidth, 1.0%, 10-11 Hz., 0.5g
See Table No. 2

5.1.b.1.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift, -0.10%
Span Change, -0.10%
Maximum Error, -0.20%

5.0 Summary of Test Results (Cont.)

(All percentage shifts are based on percent of output span)

5.1.b.2. Vibration Plane - Horizontal: Normal to Zero Adjusting Screw

5.1.b.2.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, -0.1% @ 10-34 Hz., 0.5g
Maximum Output Bandwidth, 2.6% @ 24 Hz., 0.5g
See Table No. 2

5.1.b.2.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift, -0.15%
Span Change, +0.30%
Maximum Error, -0.15%

5.1.b.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

5.1.b.3.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, -0.4% @ 34 Hz., 0.5g
Maximum Output Bandwidth, 2.5% @ 1-2 Hz., 0.5g
See Table No. 2

5.1.b.3.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift, -0.13%
Span Change, <0.10%
Maximum Error, -0.15%

5.0 Summary of Test Results (Cont.)

(All percentage shifts are based on percent of output span)

5.1.c. Test Item

E11GM-ISAE2 S/N 2713115
Calibrated Test Range: 0-1000 lbf/in²

5.1.c.1. Vibration Plane - Vertical

5.1.c.1.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, -0.2% @ 9-10 Hz., 0.5g
Maximum Output Bandwidth, 1.5% @ 8-9 Hz., 0.5g
See Table No. 3

5.1.c.1.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift, <0.10%
Span Change, <0.10%
Maximum Error, <0.10%

5.0 Summary of Test Results (Cont.)

(All percentage shifts are based on percent of output span)

5.1.c.2. Vibration Plane - Horizontal: Normal to Zero

Adjusting Screw

5.1.c.2.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, -0.2% @ 24, 26, 28, 30, 32 Hz., 0.5g
Maximum Output Bandwidth, 0.8% @ 20 Hz., 0.5g
See Table No. 3

5.1.c.2.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift, <0.10%
Span Change, <0.10%
Maximum Error, <0.10%

5.1.c.3. Vibration Plane - Horizontal: Parallel to Zero Adjusting Screw

5.1.c.3.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, -0.3% @ 8 Hz., 0.5g
Maximum Output Bandwidth, 3.5% @ 1 Hz., 0.5g
See Table No. 3

5.1.c.3.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift, <0.10%
Span Change, <0.10%
Maximum Error, <0.10%

5.1.d. Test Item

E11GH-IINM2 S/N 2713116
Calibrated Test Range: 0-1000 lbf/in²

5.1.d.1. Vibration Plane - Vertical

5.1.d.1.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, 0.10%, 0.5g
Maximum Output Bandwidth, 0.8% @ 1-3 Hz., 0.5g
See Table No. 4

5.0 Summary of Test Results (Cont.)

(All percentage shifts are based on percent of output span)

5.1.d.1.b. Calibration Shifts - After Resonance Survey

(Reference to data taken before survey in this plane)

Zero Shift,	-0.10%
Span Change,	<0.10%
Maximum Error,	-0.10%

5.1.d.2. Vibration Plane - Horizontal: Normal to Zero Adjusting Screw5.1.d.2.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, +0.2% @ 21 Hz., 0.5g
Maximum Output Bandwidth, 0.4% @ 1 Hz., 0.5g
See Table No. 4

5.1.d.2.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift,	-0.15%
Span Change,	+0.33%
Maximum Error,	-0.20%

5.1.d.3. Vibration Plane - Horizontal: Parallel to Zero Adjusting Screw5.1.d.3.a. Output Shifts - During Resonance Survey, Output @ 75%

Maximum Output Shift, -2.0% @ 1 Hz., 0.5g
Maximum Output Bandwidth, 16.0% @ 1 Hz., 0.5g
See Table No. 4

5.1.d.3.b. Calibration Shifts - After Resonance Survey

(Referred to data taken before survey in this plane)

Zero Shift,	<0.10%
Span Change,	+0.15%
Maximum Error,	+0.13%

5.0 Summary of Test Results (Cont.)

(All percentage shifts are based on percent of output span)

5.2. Sine Beat Test - Test Procedure Section 6.0, Parts 3, 4

Sine Beat, 3.5g Max., 1-35 Hz., 10 beats, 10 cycles/beat

5.2.a. Test Item

E13DM-ISAMX S/N 2713118
Calibrated Test Range: 0-100" H₂O

5.2.a.1. Vibration Plane - Vertical

5.2.a.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -1.2% @ 9 Hz., 3.5g
Maximum Output Bandwidth, 5.8% @ 2 Hz., 3.5g
See Table No. 5

5.2.a.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, +0.15%
Maximum Error, +0.15

5.2.a.2. Vibration Plane - Horizontal: Normal to Zero Adjusting Screw

5.2.a.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, ±0.4% @ 8, 32-34 Hz., 3.5g.
Maximum Output Bandwidth, 3.4% @ 35 Hz.
See Table No. 5

5.2.a.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, % -0.40%
Maximum Error, -0.45%

5.0 Summary of Test Results (Cont.)

5.2.a.3. Vibration Plane - Horizontal: Parallel to Zero Adjusting Screw

5.2.a.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, $\pm 0.4\%$ @ 10 and 23 Hz., 3.5g
Maximum Output Bandwidth, 5.0% @ 2 Hz., 3.5g
See Table No. 5

5.2.a.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data before Resonance Survey)

Zero Shift, <math><0.10\%</math>
Span Change, <math><0.10\%</math>
Maximum Error, <math><0.10\%</math>

5.2.a.4. Pressure Integrity Test - Test Procedure 6.0, Section 3.5

A 2000 lbf/in² hydraulic pressure was applied simultaneously to both process inputs for a 1 minute period. No leakage was noted.

5.2.b. Test Item

E13DH-ISAM5 S/N 2713119
Calibrated Test Range: 0-100" H₂O

5.2.b.1. Vibration Plane - Vertical

5.2.b.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -0.8% @ 10 Hz., 3.5g
Maximum Output Bandwidth, 5.0% @ 2 Hz., 3.5g
See Table No. 6

5.2.b.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -0.28%
Span Change, +0.28%
Maximum Error, -0.28%

5.0 Summary of Test Results (Cont.)5.2.b.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw5.2.b.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -1.4% @ 3 Hz., 3.5g
Maximum Output Bandwidth, 7.3% @ 2 Hz., 3.5g
See Table No. 6

5.2.b.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -2.03%
Span Change, -0.40%
Maximum Error, -2.42%

5.2.b.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw5.2.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -2.0% @ 12 Hz., 3.5g
Maximum Output Bandwidth, 9.0% @ 2 Hz., 3.5g
See Table No. 6

5.2.b.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, +0.48%
Span Change, +0.33%
Maximum Error, +0.48%

5.2.b.4. Pressure Integrity Test - Test Procedure 6.0, Section 3.5

A 6000 lbf/in² hydraulic pressure was applied simultaneously to both process inputs for a 1 minute period. No leakage was noted.

5.0 Summary of Test Results (Cont.)

5.2.c. Test Item

E11GM-ISAE2 S/N 2713115

Calibrated Test Range: 0-1000 lbf/in²

5.2.c.1. Vibration Plane - Vertical

5.2.c.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -1.3% @ 8-9 Hz., 3.5g
Maximum Output Bandwidth, 7.3% @ 2 Hz., 3.5g
See Table No. 7.

5.2.c.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, <0.10%
Maximum Error, +0.10%

5.2.c.a.2. Vibration Plane - Horizontal: Normal to Zero Adjusting Screw

5.2.c.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -0.4% @ 25 Hz., 3.5g
Maximum Output Bandwidth, 1.5% @ 23-24., 3.5g
See Table No. 7

5.2.c.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, <0.10%
Maximum Error, <0.10%

5.0 Summary of Test Results (Cont.)5.2.c.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw5.2.c.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -3.2% @ 1g Hz., 3.5g
Maximum Output Bandwidth, 9.0% @ 2 Hz., 3.5g
See Table No. 7

5.7.c.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, <0.10%
Maximum Error, <0.10%

5.2.c.4. Pressure Integrity Test - Test Procedure 6.0, Section 3.5

A 3,000 lbf/in² hydraulic pressure was applied to the single pressure connection for a 1 minute period. No leakage was noted.

5.2.d. Test Item

E11GH-I1NM2 S/N 2713116
Calibrated Test Range: 0-1,000 lbf/in²

5.2.d.1. Vibration Plane - Vertical5.2.d.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +1.4% @ 3 Hz., 3.5g
Maximum Output Bandwidth, 7.3% @ 3 Hz., 3.5g
See Table No. 8

5.2.d.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -0.10%
Span Change, <0.10%
Maximum Error, -0.10%

5.2.d.2. Vibration Plane - Horizontal: Normal to Zero Adjusting Screw5.2.d.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +1.1% @ 21 Hz., 3.5g
Maximum Output Bandwidth, 0.4% @ 22-35 Hz., 3.5g
See Table No. 8

5.0 Summary of Test Results (Cont.)

5.2.d.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift,	<0.10%
Span Change,	<0.10%
Maximum Error,	-0.15%

5.2.d.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

5.2.d.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +18.2% @ 3 Hz., 3.5g
Maximum Output Bandwidth, 38.0% @ 1 Hz., 3.5g
See Table No. 8

5.2.d.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift,	-0.58%
Span Change,	+0.20%
Maximum Error,	-0.58%

5.2.d.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 9,000 lbf/hydraulic pressure was applied to the single pressure connection for a 1 minute period. No leakage was noted.

5.3. Sine Beat Test - Test Procedure Section 6.0, Part 3.4

Sine Beat, 5.0g Max., 1-35 Hz, 10 beats, 10 cycles/beat

5.3.a. Test Item

E13DM-ISAMX S/N 2713118
Calibrated Test Range: 0-100" H₂O

5.3.a.1. Vibration Plane - Vertical

5.3.a.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -1.9% @ 29 Hz., 5.0g
Maximum Output Bandwidth, 6.3% @ 2 Hz., 5.0g
See Table No. 9

5.0 Summary of Test Results (Cont.)5.3.a.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift,	<0.10%
Span Change,	-0.35%
Maximum Error,	-0.43%

5.3.a.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw5.3.a.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -2.7% @ 35 Hz., 5.0g
Maximum Output Bandwidth, 4.0% @ 24 Hz., 5.0g
See Table No. 9

5.3.a.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift,	<0.10%
Span Change,	-0.35%
Maximum Error,	-0.43%

5.3.a.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

Maximum Output Shift, -3.8% @ 35 Hz, 5.0g
Maximum Output Bandwidth, 6.8% @ 3 Hz., 5.0g
See Table No. 9

5.3.a.3.b. Calibration Shifts - After Sine Beat Test

Zero Shift,	-0.48%
Span Change,	<0.10%
Maximum Error,	-0.50%

5.3.a.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 2,000 lbf/in² hydraulic pressure was applied simultaneously to both process inputs for a 1 minute period. No leakage was noted.

5.0 Summary of Test Results (Cont.)

5.3.b. Test Item

E13DH-ISAM5 S/N 2713119
Calibrated Test Range: 0-100" H₂O

5.3.b.1. Vibration Plane - Vertical

5.3.b.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +1.2% @ 24 Hz., 5.0g
Maximum Output Bandwidth, 3.5% @ 3-4 Hz., 5.0g
See Table No. 10

5.3.b.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -0.18%
Span Change, -0.10%
Maximum Error, -0.28%

5.3.b.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw

5.3.b.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -3.4% @ 34 and 35 Hz., 5.0g
Maximum Output Bandwidth, 7.8% @ 2 Hz., 5.0g
See Table No. 10

5.3.b.2.b. Calibration Shifts, After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -4.10%
Span Change, +0.40%
Maximum Error, -4.10%

Note: Unit rezeroed after the above calibration check.

5.3.b.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

5.3.b.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -4.8% @ 14 Hz., 5.0g
Maximum Output Bandwidth, 9.8% @ 3 Hz., 5.0g
See Table No. 10

5.0 Summary of Test Results (Cont.)5.3.b.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift,	-0.35%
Span Change,	-0.68%
Maximum Error,	-0.95%

5.3.b.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 6,000 lbf/in² hydraulic pressure was applied simultaneously to both process inputs for a 1 minute period. No leakage occurred.

5.3.c. Test Item

E11GM-ISA2 S/N 2713115
Calibrated Test Range: 0-1,000 lbf/in²

5.3.c.1. Vibration Plane - Vertical5.3.c.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -2.0% @ 8-10 Hz., 5.0g
Maximum Output Bandwidth, 7.3% @ 2 Hz., 5.0g
See Table No. 11

5.3.c.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift,	<0.10%
Span Change,	<0.10%
Maximum Error,	<0.10%

5.3.c.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw5.3.c.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -2.0% @ 35 Hz., 5.0g
Maximum Output Bandwidth, 3.5% @ 27 Hz., 5.0g
See Table No. 11

5.3.c.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift,	<0.10%
Span Change,	<0.10%
Maximum Error,	<0.10%

5.3.c.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

5.0 Summary of Test Results (Cont.)

5.3.c.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -4.4% @ 10, 11, 13 Hz., 5.0g
Maximum Output Bandwidth, 9.0% @ 1-2 Hz., 5.0g
See Table No. 11

5.3.c.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, <0.10%
Maximum Error, <0.10%

5.3.c.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 3,000 lbf/in² hydraulic pressure was applied to the single pressure connection for a 1 minute period.
No leakage occurred.

5.3.d. Test Item

E11GH-IINM2 S/N 2713116
Calibrated Test Range: 0-1,000 lbf/in²

5.3.d.1. Vibration Plane - Vertical

5.3.d.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +3.1% @ 21 Hz., 5.0g
Maximum Output Bandwidth, 7.5% @ 3 Hz., 5.0g
See Table No. 12

5.3.d.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -0.13%
Span Change, <0.10%
Maximum Error, -0.18%

5.3.d.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw

5.3.d.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +20.0% @ 34 Hz., 5.0g
Maximum Output Bandwidth, 1.0% @ 3 Hz., 5.0g
See Table No. 12

5.3.d.2.b. Calibration Shifts - After Sine Beat Test

Zero Shift, -0.15%
Span Change, <0.10%
Maximum Error, 0.20%

5.0 Summary of Test Results (Cont.)5.3.d.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw5.3.d.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +20.0% @ 2-4 Hz., 5.0g
Maximum Output Bandwidth, 50.0% @ 1 Hz., 1.0g
See Table No. 12

5.3.d.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -0.13
Span Change, +0.23
Max. Span Error, +0.18%

5.3.d.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 9,000 lbf/in² hydraulic pressure was applied to the single pressure connection for a 1 minute period. No leakage occurred.

5.4 Sine Beat Test - Test Procedure Section 6.0, Part 3.4

Sine Beat, 10.0g Max., 101 Beats, 10 cycles/beat

5.4.a. Test Item

E13DM-ISAMX S/N 2713118
Calibrated Test Range: 0-100" H₂O

5.4.a.1. Vibration Plane - Vertical5.4.a.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -7.2% @ 31 and 35 Hz., 10.0g
Maximum Output Bandwidth, 5% @ 4 and 5 Hz., 6.4, 8.2g
See Table No. 13

5.4.a.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -0.50%
Span Change, <0.10%
Maximum Error, -0.55%

5.4.a.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw

5.0 Summary of Test Results (Cont.)

5.4.a.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -2.5% @ 27, 33 and 34 Hz.
 Maximum Output Bandwidth, 2.5% @ 34 Hz., 10.0g
 See Table No. 13

5.4.a.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, +0.10%
 Span Change, +0.10%
 Maximum Error, +0.25%

5.4.a.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

5.4.a.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -1.8% @ 13, 17 and 23, 10.0g
 Maximum Output Bandwidth, 4.6% @ 3 Hz., 4.6g
 See Table No. 13

5.4.a.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
 Span Change, +0.33%
 Maximum Error, +0.25%

5.4.a.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 2,000 lbf/in² hydraulic pressure was applied simultaneously to both process inputs for a 1 minute period. No leakage occurred.

5.4.b. Test Item

E13DH-ISAM5 S/N 2713119
 Calibrated Test Range: 0-100" H₂O

Note: The following results were taken after a new force motor assembly, Part No. 148NH, was installed. See Comments Section 4 for details.

5.4.b.1. Vibration Plane - Vertical

5.0 Summary of Test Results (Cont.)

5.4.b.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -3.0% @ 11, 12 and 13 Hz., 10.0g
 Maximum Output Bandwidth, 8.2% @ 2 Hz., 2.8g
 See Table No. 15

5.4.b.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
 Span Change, -0.14%
 Maximum Error, -0.15%

5.4.b.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw

5.4.b.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -1.0% @ 17, 18, 24, 28-35 Hz., 10.0g
 Maximum Output Bandwidth, 3.8% @ 13 Hz., 10.0g
 See Table No. 15

5.4.b.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
 Span Change, <0.10%
 Maximum Error, -0.10%

5.4.b.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

5.4.b.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -12.4% @ 20 Hz., 10.0g
 Maximum Output Bandwidth, 5.5% @ 1 Hz., 1.0g
 See Table No. 15

5.4.b.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -0.93%
 Span Change, +0.25%
 Maximum Error, -0.93%

5.4.b.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 6,000 lbf/in² hydraulic pressure was applied simultaneously to both process inputs for a 1 minute period. No leakage occurred.

5.0 Summary of Test Results (Cont.)

5.4.c. Test Item

E11GM-ISAE2 S/N 2713115
Calibrated Test Range: 0-1,000 lbf/in²

5.4.c.1. Vibration Plane - Vertical

5.4.c.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -5.6% @ 35 Hz., 10.0g
Maximum Output Bandwidth, 7.0% @ 4 Hz., 6.4g
See Table No. 16

5.4.c.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, -0.25%
Span Change, +0.23%
Maximum Error, -0.25%

5.4.c.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw

5.4.c.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -2.0% @ 25 Hz., 10.0g
Maximum Output Bandwidth, 3.0% @ 15 Hz., 10.0g
See Table No. 16

5.4.c.2.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, -0.30%
Maximum Error, -0.23%

5.4.c.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

5.4.c.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, -5.6% @ 8 Hz., 10.0g
Maximum Output Bandwidth, 9.5% @ 2 and 3 Hz., 2.8, 4.6g
See Table No. 16

5.0 Summary of Test Results (Cont.)5.4.c.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, -0.28%
Maximum Error, -0.23%

5.4.c.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 3,000 lbf/in² hydraulic pressure was applied to the single pressure connection for a 1 minute period. No leakage occurred.

5.4.d. Test Item

E11GH-IINM2 S/N 2713116
Calibrated Test Range: 0-1,000 lbf/in²

5.4.d.1. Vibration Plane - Vertical5.4.d.1.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +22.5% @ 28, 34 Hz., 4.6g
Maximum Output Bandwidth, 7.5% @ 3 Hz., 4.6g
See Table No. 17

5.4.d.1.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, +0.18%
Span Change, -0.15%
Maximum Error, +0.20%

5.4.d.2. Vibration Plane - Horizontal - Normal to Zero Adjusting Screw5.4.d.2.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +15.2% @ 19 Hz., 10.0g
Maximum Output Bandwidth, 2.4% @ 3 Hz., 4.6g
See Table No. 17

5.4.d.2.b. Calibration Shifts - After Sine Beat Test

Zero Shift, -0.25%
Span Change, +0.18%
Maximum Error, -0.28%

5.0 Summary of Test Results (Cont.)

5.4.d.3. Vibration Plane - Horizontal - Parallel to Zero Adjusting Screw

5.4.d.3.a. Output Shifts - During Sine Beat Test, Output @ 75%

Maximum Output Shift, +23.0% @ 3 Hz., 4.6g
Maximum Output Bandwidth, 50.0% @ 1 Hz., 1.0g
See Table No. 17

5.4.d.3.b. Calibration Shifts - After Sine Beat Test

(Referred to data taken before sine beat test in this plane)

Zero Shift, <0.10%
Span Change, <0.10%
Maximum Error, <0.10%

5.4.d.4. Pressure Integrity Test - Test Procedure Section 6.0, Part 3.5

A 9,000 lbf/in² hydraulic pressure was applied to the single pressure connection for a 1 minute period. No leakage occurred.

6.0 TEST PROCEDURE