Calibrate Foxboro Model IAP20 Absolute Pressure Transmitter

**USQ # Routine Maintenance**

<table>
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<tr>
<th>Rev-Mod</th>
<th>Release Date</th>
<th>Justification</th>
<th>Summary of Changes</th>
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<tr>
<td>C-13</td>
<td>11/07/2018</td>
<td>Maintenance Request</td>
<td>Added Radiation and Contamination Control, Added new Figure(s), Added Attachment.</td>
</tr>
<tr>
<td>C-12</td>
<td>08/16/2017</td>
<td>PER 2016-2301</td>
<td>Added item to Section 4.1 three performance documents to Section 4.2, New Step5.1.1 and Sub steps 5.1.1.1 and 5.1.1.2, Attachment 6, and Figure 5.</td>
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<tr>
<td>C-11</td>
<td>05/03/2017</td>
<td>Maintenance Request</td>
<td>Deleted Step 5.1.4 and First Sentence in Note on Attachment 1 Page 19.</td>
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<tr>
<td>C-10</td>
<td>04/24/2017</td>
<td>Maintenance Request</td>
<td>Removed second technician signature line and added independent verification.</td>
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<td>C-9</td>
<td>04/12/2017</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for the calibration of Foxboro model IAP20 absolute pressure transmitter.

1.2 Scope

This procedure pertains to Foxboro model IAP20 absolute pressure transmitters.

2.0 INFORMATION

2.1 General Information

2.1.1 The CAL ATO function is not to be used with an Absolute Pressure Transmitter. If an absolute pressure transmitter is vented to atmosphere, it does not have zero pressure applied, but instead has the barometric pressure (approximately 14.7 psia) applied.

2.1.2 To maintain the integrity of the Safety Instrumented System (SIS), zero dependence between the performance of calibrations on redundant instrumentation must be maintained. To achieve this, the same personnel must not be used to perform calibrations on redundant instruments pairs. The calibrations also need to be separated by at least 1 minute. The specific instrumentation to which this applies is identified in the procedure steps.

2.2 Terms and Definitions

- LRV Lower Range Value
- URV Upper Range Value
- DMM Digital Multimeter.
3.0  PRECAUTIONS AND LIMITATIONS

3.1  Personnel Safety

3.1.1  If working around live circuits, extreme caution should be used. Failure to
follow electrical safety practices as outlined in DOE–0359, Hanford Site
Electrical Safety Program could result in injury.

3.1.2  If a lock and tag is required during the performance of this procedure,
perform Lockout/Tagout in accordance with DOE-0336 Hanford Site
Lockout/Tagout Procedure.

3.1.3  Failure to use hearing protection when working in or near noisy/loud areas
may result in hearing impairment. Job specific protective equipment
requirements should be addressed during the pre-job brief and be in
accordance with TFC-ESHQ-S_IS-C-02.

3.2  Radiation and Contamination Control

3.2.1  Work in radiological areas will be performed using a Radiological Work
Permit following review by Radiological Control per the ALARA Work
Planning procedure TFC-ESHQ-RP_RWP-C-03.

3.3  Limits

3.3.1  HNF-15279, 242-A Evaporator Technical Safety Requirement
•  LCO 3.1, C-A-1 Vessel Flammable Gas Control System.
4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

The following supplies may be needed to perform this procedure:
- Calibrated pressure/vacuum source
- Approximately 25 to 50 Vdc power supply (for bench calibration)
- Calibrated Digital Multimeter (DMM)
- 250 Ohm ±0.01%, Precision Resistor (for bench calibration)
- HART Communicator or Foxboro HHT, if performing Attachment 1 – Periodic Proof Test
- Water trap device (Figure 5)
- Other tools, equipment and supplies as identified by Shift Manager/OE/FWS/User.

4.2 Performance Documents

The following documents may be needed to perform this procedure:
- Foxboro Instruction Manual MI IAP20-A/IGP20-A.
- Radiological survey plan
- Waste planning checklist
- Pressure M&TE vendor manual.
5.0 PROCEDURE

5.1 Obtain As-Found Data

5.1.1 CONFIRM that 242-A Evaporator is in Shutdown mode.

5.1.2 IF performing this procedure on a system that has the potential for free liquids or moisture to enter the Pressure M&TE, USE a water trap device.

5.1.2.1 ENSURE the Water Trap is installed in a vertical position to operate correctly. (Figure 5)

5.1.2.2 IF liquids or moisture gets into the Water Trap or Pressure M&TE REFER to Attachment 6.

5.1.3 IF performing this procedure on a system that is potentially contaminated, FOLLOW Calibration Instructions. (Attachment 7)

5.1.4 IF any step is not required for procedure completion, RECORD “N/A” in the applicable space(s) on the Data Sheet AND DOCUMENT the explanation in Data Sheet’s Comments/Remarks section.

NOTE - Refer to Attachment 5 for clarification on range and operability of the Absolute Pressure instrument.

5.1.5 IF not calibrating PT-CA1-12 or PT-CA1-13, GO TO Step 5.1.9.
5.1 Obtain As-Found Data (Cont.)

NOTE: - The technicians performing the verification check must be independent of the technicians performing the calibration. The verification check is a technician who verifies the results are recorded correctly and the instrument passed the calibration.

5.1.6 IF calibrating both PT-CA1-12 and PT-CA1-13, ENSURE that the technician performing the calibrations are different than the technician performing the verification checks on each of these two transmitters. (TSR, LCO 3.1)

PRINT names (First & Last) below:
- IF calibrating PT-CA1-12,
  
  ______________________ / ______________________ 
  Technician        FWS

- IF independently verifying PT-CA1-12:
  
  ______________________ / ______________________ 
  Technician        FWS

- IF calibrating PT-CA1-13,
  
  ______________________ / ______________________ 
  Technician        FWS

- IF independently verifying PT-CA1-13:
  
  ______________________ / ______________________ 
  Technician        FWS

5.1.7 IF performing calibration on either PT-CA1-12 or PT-CA1-13, ENSURE the Fail Mode Output (OUTFAIL) is set to High by performing the following:

5.1.7.1 PRESS NEXT button until CONFIG is displayed AND
PRESS ENTER button.

5.1.7.2 PRESS NEXT button until OUTFAIL is displayed AND
PRESS ENTER button.

5.1.7.3 CONFIRM FAIL HI is displayed AND
IF FAIL HI is not displayed, REPEAT Step 5.1.7.1.

5.1.7.4 PRESS NEXT button until SAVE is displayed AND
PRESS ENTER button.
5.1 - Obtain As-Found Data (Cont.)

5.1.8 ENSURE transmitter HI side isolation valve is closed.

5.1.9 CONNECT valving assembly and test equipment per Figure 3 and Figure 1 or Figure 2 as applicable.

5.1.10 APPLY input values per Data Sheet AND

RECORD As-Found values on Data Sheet.

5.1.11 IF performing verification, RECORD each DMM value and calibration test point on appropriate As-Found lines of Data Sheet.

5.1.12 IF As-Found values are not within specified tolerance per Data Sheet, GO TO Calibration Section 5.2.

5.1.13 IF As-Found values are within specified tolerance, but deemed marginal, and optimization is desired, GO TO Calibration Section 5.2.

5.1.14 IF As-Found values are within specified tolerance, RECORD As-Found values in As-Left column of Data Sheet.

5.1.14.1 IF the As-Founds for PT-CA1-7 were within specified tolerance LEAVE test equipment connected AND

GO TO AND PERFORM Section 5.3.

5.1.14.2 FOR all other transmitters, GO TO Restoration, Section 5.4.
5.2 Calibration

NOTE - During calibration, a single change could affect several parameters. If an entry is entered in error, re-examine the entire database or use the CANCEL feature to restore the transmitter to its starting configuration and begin again.

- Transmitter calibration is performed via Local Display and the two button (Next and Enter) keypad (ref. Figure 4, Attachment 3 and Attachment 4).

**Lower Range Value - LRV**

5.2.1 APPLY Maximum Vacuum per Data Sheet.

5.2.2 PRESS the NEXT button (at Local Module Display, Figure 4) AND

At the CALIB prompt, PRESS ENTER (ref Attachment 3).

NOTE - CAL ATO function cannot be used to set zero on Absolute Pressure transmitters due to barometric pressure offset (± 14.7 psia).

5.2.3 PRESS NEXT to skip CAL ATO (ref Attachment 4) AND

AT the CAL LRV prompt, PRESS ENTER.

5.2.4 WHEN LRV DONE prompt is displayed, CHECK the 4ma output for tolerance.

5.2.4.1 IF 4mA output is not in tolerance, GO TO step 5.2.5.

OR

IF 4mA output is within tolerance, PRESS NEXT repeatedly UNTIL the SAVE prompt is displayed.

5.2.4.2 AT the SAVE prompt, PRESS ENTER to save changes and to return to online AND

GO TO Upper Range Value (URV) Calibration at Step 5.2.9.

5.2.5 PRESS NEXT UNTIL ADJ4mA is displayed AND

PRESS ENTER.
5.2 Calibration (Cont.)

Lower Range Value – LRV (Cont.)

NOTE - The incremental amount of change to the mA output value is determined by selecting the values from the Table below. Up arrows to increase value and down arrows to decrease value by the amount given.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADJ 4MA provides the following submenus</td>
<td></td>
</tr>
<tr>
<td>A 4mA△△ increase 4 mA output by large step (0.025mA)</td>
<td></td>
</tr>
<tr>
<td>A 4mA△ increase 4 mA output by small step (0.001mA)</td>
<td></td>
</tr>
<tr>
<td>Down arrows indicate decrease by the same amount</td>
<td></td>
</tr>
<tr>
<td>The same rules apply to ADJ 20MA</td>
<td></td>
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5.2.6 SELECT the desired 4mA adjustment prompt(s) from the Calibration Menu, Attachment 4 AND PRESS ENTER as necessary to bring mA value in tolerance per Data Sheet.

5.2.7 AFTER adjustment completion, PRESS NEXT repeatedly UNTIL the SAVE prompt is displayed.

5.2.8 AT the SAVE prompt, PRESS ENTER to save changes and to return to online.

Upper Range Value - URV

5.2.9 APPLY Minimum Vacuum per Data Sheet.

5.2.10 PRESS the NEXT button AND AT the CALIB prompt, PRESS ENTER.

5.2.11 PRESS NEXT repeatedly UNTIL the CAL URV is displayed.

5.2.12 AT the CAL URV prompt, PRESS ENTER.
5.2 Calibration (Cont.)

Upper Range Value – URV (Cont.)

5.2.13 WHEN URV DONE prompt is displayed, CHECK the 20mA output for tolerance.

5.2.13.1 IF 20mA output is within tolerance, GO TO Step 5.2.15.

OR

IF 20mA output is not in tolerance, PRESS NEXT UNTIL ADJ20MA is displayed AND

PRESS ENTER.

5.2.14 SELECT the desired 20mA adjustment prompt(s) from the Calibration Menu, Attachment 4 AND

PRESS ENTER as necessary to bring mA value in tolerance per Data Sheet.

5.2.15 PRESS NEXT repeatedly UNTIL the SAVE prompt is displayed.

5.2.16 AT the SAVE prompt, PRESS ENTER to save changes and to return to online.

5.2.17 APPLY inputs values per Data Sheet AND

CHECK output values for tolerance.

5.2.18 IF values are within tolerance per Data Sheet, RECORD As-Left values on Data Sheet AND

PERFORM one of the following:

5.2.18.1 IF calibration was performed on PT-CA1-7 GO TO/PERFORM Section 5.3.

5.2.18.2 IF performing maintenance on PT-CA1-12 or PT-CA1-13, GO TO/PERFORM Attachment 1 – Periodic Proof Test.

5.2.18.3 FOR all other transmitters, GO TO Restoration, Section 5.4.
5.2 Calibration (Cont.)

5.2.19 IF values are not within tolerance per Data Sheet, REPEAT Steps 5.2.1 through 5.2.18 until values are within tolerance

OR

IF values cannot be brought into tolerance, NOTIFY FWS for resolution AND

STOP WORK until further directed.
5.3 Functional Check of 242-A Evaporator HV-CA1-20

Special Instruction

This Section is only to be performed if the following is true:

- 242-A Evaporator is in the shutdown mode
- The As-Founds for PT-CA1-7 were found to be in tolerance or
- PT-CA1-7 was calibrated.

5.3.1 CONFIRM the 242-A Evaporator is in the Shutdown mode.

5.3.2 CONFIRM PT-CA1-7 has been calibrated or its As-Founds were within tolerance.

5.3.3 IF test equipment is not already connected PERFORM the following.

5.3.3.1 ENSURE transmitter HI side isolation valve is closed.

5.3.3.2 CONNECT valving assembly and test equipment per Figure 3 and Figure 1 or Figure 2.

5.3.4 ENSURE starting pressure on PT-CA1-7 is on or above 170 Torr.

NOTE - The purge air flow for the following steps can be observed at FIT-CA1-20.

5.3.5 USING installed calibration equipment, SIMULATE decreasing pressure until less than 170 Torr at PT-CA1-7.

5.3.6 CONFIRM HV-CA1-20 is closed by observing decreased flow at FIT-CA1-20.

5.3.6.1 CHECK (✓) either pass or fail that HV-CA1-20 closed.

Pass____Fail____

5.3.7 USING installed calibration equipment, SIMULATE increasing pressure until HV-CA1-20 opens.

5.3.8 WHEN HV-CA1-20 opens, CONFIRM (by observing increased flow at FIT-CA1-20) that the pressure is greater than 170 Torr, plus or minus 1.9 Torr.

5.3.8.1 CHECK (✓) either pass or fail that HV-CA1-20 opened.

Pass____Fail____
5.4 Restoration

NOTE – Step 5.4.1 only applies to PT-CA1-12 and PT-CA1-13. If not performing maintenance one of these two transmitters, continue on to Step 5.4.2.

5.4.1 IF any faults or alarms were tripped due to the performance of this procedure, RESTORE faults and alarms to As Found Condition per Attachment 2 – Reset STA Faults.

5.4.2 IF any problems were encountered with calibration, INFORM FWS.

5.4.3 IF not already removed; DISCONNECT AND REMOVE Test Equipment.

5.4.4 REQUEST Operations to open transmitter HI side shutoff valve and return system to normal operation.

5.4.5 RECORD the Test Equipment information and calibration status on Data Sheet.

5.4.6 CHECK equipment system restoration by observing indications are consistent with expected conditions.

5.4.7 NOTIFY Operations that testing is complete and system is returned to desired configuration.

5.5 Acceptance Criteria

Acceptance Criteria has been met when Steps in this procedure have been satisfactorily performed and As-Left values meet the specifications and tolerance(s) per the Data Sheet.

5.6 Review

5.6.1 INFORM FWS test is complete.

5.6.2 FWS REVIEW AND ENSURE the following:
- Completed Data Sheets meet the acceptance criteria
- Comments sections are filled out appropriately
- Work requests needed as a result of this procedure are identified and generated
- Work request number(s) of any work documents generated as a result of this procedure, are recorded in the Comments/Remarks section of the Data Sheet, as applicable.
5.7 Records

This procedure is performed within a work package, as such, the procedure in its entirety will be maintained as a record per the Work Control process.

The record custodian identified in the Company Level, Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.
Figure 1 – Bench Calibration Valving Setup

Bench Calibration Setup

HIGH PRESSURE SIDE

CALIBRATING VACUUM or PRESSURE SOURCE

BLEED VALVES (NEEDLE TYPE)
Figure 2 – Field Calibration Valving Setup
Figure 3 – Test Equipment Setup

Test Connection for 4 to 20 mA dc Output

Test Connection for 1 to 5 V dc Output
Figure 4 – Local Display Module
Figure 5 – How the Trap Works

1. Gas/Air enters through the top slot which goes into the chamber.
2. Dirt and Moisture particles are collected in the chamber, which is visible through the clear transparent glass window.
3. Then Gas/Dry Air goes into the centre slot where it enters the instrument.
Figure 6 - Negative Pressure Connection
Calibrate Foxboro Model IAP20 Absolute Pressure Transmitter

Figure 7 - Positive Pressure Connection
Attachment 1 – Periodic Proof Test

NOTE – Successfully completing the steps with in the procedure, along with Attachment 1 – Periodic Proof Test satisfies the Proof Test as outlined in Foxboro Manual MI 020-357.

**Additional Steps to Satisfy Proof Test**


2. **PRESS** OK to acknowledge Warning.

3. **SELECT** the “20 mA” **AND RECORD** value on Data Sheet.

4. **SELECT** the “4 mA” **AND RECORD** value on Data Sheet.

5. **RETURN** transmitter to normal mode.

6. **APPLY** an actual pressure to the transmitter that is above the configured URV per table on Data Sheet.

7. **RECORD/VERIFY** that the output reaches value per Data Sheet.

8. **RELEASE** applied pressure.

9. **APPLY** a vacuum to the transmitter that is 5 to 10 % below the as configured LRV per table on Data Sheet.

10. **RECORD/VERIFY** that the output reaches value per Data Sheet.

11. **CHECK** the recorded results from this proof test are within tolerance per Data Sheet.

12. **IF** any results from this proof test are outside of tolerance per Data Sheet. **NOTIFY** FWS.

13. **RETURN** to Step 5.1.14 to record As-Left values.
Attachment 2 – Reset STA Faults

NOTE – STA menu tree diagram is available for reference on the next page.

i. NAVIGATE STA until “CONFIG INPUT” is displayed.

ii. WHEN “CONFIG INPUT” is displayed, PRESS SELECT.

iii. USING the UP and DOWN buttons, LOCATE “RESET FAULT” AND PRESS SELECT.

iv. USING the UP and DOWN buttons, LOCATE “RESET YES” AND PRESS SELECT.
Attachment 3 – Top Level Structure Diagram - Calibration Menu

Diagram:

- Display Measurements
  - N
  - E: Local mode, go to calibration menu

- Calib
  - N
  - E: Off-line, go to configuration menu

- Config
  - N
  - E: On-line mode

- Tst DSP
  - N
  - E: Step through display test pattern

- Cancel
  - N
  - E: Exit mode select menu, return to on-line mode

N = NEXT BUTTON
E = ENTER BUTTON
Calibrate Foxboro Model IAP20 Absolute Pressure Transmitter

Attachment 4 – Calibration Structure Diagram - Calibration Menu
Calibrate Foxboro Model IAP20 Absolute Pressure Transmitter

Attachment 5 – Sample Operating Range of Absolute Pressure Transmitter

Vacuum/Pressure Relationship

4.0 mA
- 20 torr
- 396 "H₂O Vacuum
- 14.3 psi Vacuum

20.0 mA
- 200 torr
- 300 "H₂O Vacuum
- 10.8 psi Vacuum

Zero
psi

760 torr
14.7 psi
1 Atmosphere

Negative
Pressure

Positive
Pressure
Water Trap with Potentially Contaminated Liquid

1. If potentially contaminated liquid gets into Water Trap, Suspend the work.

2. Notify the FWS.

3. When provided approval from the FWS proceed as follows.

4. Remove Pressure M&TE from field.

5. Return to a RMA.

6. Disassemble the Water Trap.

7. Allow trap to dry overnight.

8. Survey disassembled trap components in accordance with Radcon survey plan.

9. If the Water Trap can be released, return it to tool crib.

10. If the Water Trap cannot be released, dispose of it per waste planning checklist.

Water Trap with Clean Liquid (NOT Contaminated)

1. If clean liquid gets into Water Trap, disassemble the Water Trap.

2. Allow Water Trap to dry overnight.

3. Re-assemble the Water Trap.

4. Return the Water Trap to the tool crib.
M&TE with Potentially Contaminated Liquid

1. If potentially contaminated liquid gets past water trap and inside Pressure M&TE, Suspend the work.
2. Notify FWS.
3. Wait for further directions.

M&TE with Clean Liquid (NOT Contaminated)

1. If clean liquid gets past the water trap disassemble and dry out Pressure M&TE per manufactures direction.
2. Return the M&TE to the tool crib.
3. Request the M&TE to be returned to NIST calibration lab for recalibration.
Positive pressure calibrations:

Note: Vent Valve assembly is required on all positive pressure calibrations to ensure MT&E is not contaminated by venting potential process air back through MT&E.
Install vent valve assembly Per Figure 7
Ensure IV is open and VV is closed
Proceed with calibration per work package
  ➢ Whenever venting is required during calibration steps, vent stored pressure as follows.

NOTE- Valve IV can remain open when reading is required via M&TE.

Ensure IV valve is closed
Ensure VV valve is opened
Repeat sequence as necessary to complete the calibration.
After all steps are completed for the calibration, perform RCT survey release plan XXX

Negative pressure calibrations:

Note: use of surrogate filter is required for negative pressure calibrations to ensure MT&E is not contaminated by pulling process air into MT&E while drawing Vacuum.
Negative calibrations should be performed as follows.
Ensure surrogate filter holder has media installed.
Connect filter in-line per Figure 6
Ensure IV is open.
Pull a representative vacuum into MT&E through filter
Ensure IV is closed.
Vent through VV
RCT to perform survey of the media.
IF no contamination found remove surrogate filter holder/manifold and proceed with calibration.