Staplex High Volume Air Sampler Calibration

Tank Farm Maintenance Procedure

MAINTENANCE

Changes “Other Than Inconsequential” Require These Additional Reviews:
- 222-S Laboratory
- Radiological Controls
- Central Radcon Organization

USQ #NA-4

CHANGE HISTORY (≤ LAST 5 REV-MODS)

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<th>Rev-Mod</th>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for calibrating Staplex High Volume Air Sampler.

1.2 Scope

This procedure applies to Staplex High Volume Air Samplers.

2.0 INFORMATION

NONE

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Radiation and Contamination Control

Work in radiological areas will be performed using a radiation work permit following review by Radiological Control per the ALARA Work Planning procedure TFC-ESHQ-RP_RWP-C-03.
4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

The following supplies may be needed to perform this procedure:

- Calibration labels
- Hearing protection, as required
- Torque seal compound
- Variac 120V, 20A (used to seat new brushes)
- Calculator
- Other tools, equipment and supplies as identified by Shift Manager/OE/FWS/User.

M&TE Equipment

- Go/No-Go plug gauge set (0.062"/0.089")
- Depth Caliper (± 0.005") (based on ideal clearance of 0.25")
- Digital Manometer or equivalent, ± 2% (± 0.07" H2O)
- Temperature Indicator (± 1.4 °F)
- Temperature Probe (± 1.4 °F)
- Barometric Pressure (± 0.58" Hg).

STANDARDS

4.1.1 CHECK the serial number of the Cal. Kit matches the serial number of the certificate.

- CKHV High Volume Calibration Kit.
5.0 PROCEDURE

NOTE - If performance of any steps in this procedure is not required for procedure completion, steps not performed are to be marked, "N/A" in appropriate Worksheet signoff space, and explained in comments/remarks section of Worksheet.

- On new units ensure filter screen and filter brace is removed.
- Follow manufacturer instructions for new units.

5.1 Staplex High Volume Air Sampler Functional Check/Calibration

5.1.1 IF potential for radiological contamination exists, PERFORM equipment survey prior to beginning maintenance or removal of equipment or component from its installed location.

5.1.2 INSPECT (visually) Staplex unit AND RECORD condition on comments sheet.

As-Found Readings

5.1.3 ENSURE AKI head is attached and Staplex is plugged to 120 VAC outlet.

5.1.4 PLACE planchet on intake (Figure 1).

5.1.5 HOLD planchet on AND TURN Staplex power on.

5.1.6 ALLOW for air flow to stabilize and a warm up time of 3–5 minutes prior to taking readings.

5.1.7 RECORD the Staplex Rotometer As-Found reading on Worksheet.

5.1.8 TURN OFF power to Staplex Air Sampler.

5.1.9 ENSURE gasket is in place between impactor head and body of sampler.

5.1.10 RECORD the barometric pressure on Worksheet.

5.1.11 RECORD the ambient temperature on Worksheet.

5.1.12 USING instructions on Worksheet, CALCULATE $P_2$ and $T_2$ AND RECORD results on Worksheet.
5.1 Staplex High Volume Air Sampler Functional Check/Calibration (Cont)

5.1.13 **USING** the last performed Worksheet Graph, **FIND** the slope \( (m_2) \) and intercept \( (b_2) \) points **AND**

**RECORD** values on Worksheet as \( m_2 \) and \( b_2 \).

5.1.14 **PERFORM** the following calculation to determine the As-Found True Air Flow:

\[
\left( \frac{1}{m_2} \right) \left[ \frac{40}{\sqrt{(P_2/P_{STD})(T_{STD}/T_2)}} \right]^{-b_2}
\]

Where:
- \( m_2 \) = Slope value from last performed Worksheet Graph,
- \( b_2 \) = Intercept value from last performed Worksheet Graph,
- \( P_2 = P_{2} \) taken from Worksheet,
- \( T_2 = T_{2} \) taken from Worksheet,
- \( P_{STD} = 760 \text{ mmHg} \), and
- \( T_{STD} = 298.16 \text{ °K} \).

5.1.15 **RECORD** the As-Found True Air Flow on the work sheet.

5.1.16 **CALCULATE** the percent error using formula on the worksheet **AND**

**RECORD** results on work sheet.

5.1.17 **IF** greater than 10% error, **INFORM** FWS so the RadCon Engineer can be notified.

**AKI Dimensional Checks**

5.1.18 **INSPECT** (visually) impactor to be used **AND**

**RECORD** the condition on comments sheet.

5.1.19 **MEASURE** the AKI head-slit-width with the Go/No-Go plug gauges at four locations approximately 90° apart to verify width is within tolerance specified on Figure 2 **AND**

**RECORD** the As-Found average on Worksheet.
5.1 Staplex High Volume Air Sampler Functional Check/Calibration (Cont)

5.1.20 MEASURE the AKI head nozzle-to-planchet distance at four locations approximately 90° apart to verify width is within tolerance specified on Figure 2 AND

RECORD the As-Found average on Worksheet.

5.1.21 IF the four measurements are not within specified tolerance, ADJUST set screw for tolerance (ref Figure 2) AND

RECORD the As-Left average measurements on Worksheet,

OR

IF the four measurements are within specified tolerance, but deemed marginal, and optimization is desired, ADJUST set screw to the optimal setting AND

RECORD the As-Left average measurements on Worksheet,

OR

IF not adjustable within tolerance, NOTIFY FWS that head should be replaced AND

RECORD results on comments section of Data Sheet.

Worksheet Construction

5.1.22 ATTACH AKI impactor head.

5.1.23 PLACE planchet on intake (Figure 1).

5.1.24 HOLD planchet on AND

TURN Staplex power on.

NOTE - Flow should be stabilized before readings can be taken.

5.1.25 ADJUST Staplex rotometer to 40 CFM AND

RECORD adjustment made on Worksheet.

5.1.26 TURN OFF power to Staplex Air Sampler.
5.1 Staplex High Volume Air Sampler Functional Check/Calibration (Cont)

5.1.27 INSTALL Calibrator Orifice plate per Worksheet AND SCREW into Staplex housing (ref Figure 1).

5.1.28 CONNECT vacuum line from Calibrator Orifice to M&TE (Figure 1) AND ZERO the M&TE.

5.1.29 TURN ON power to Staplex Air Sampler AND PERFORM leak check (by placing hand over inlet).

5.1.30 IF unable to obtain zero flow reading on rotometer (due to leakage), NOTIFY FWS for resolution.

NOTE - Flow should be stabilized before readings can be taken.

5.1.31 RECORD the \( \Delta H \) \( \text{ "H}_2\text{O} \) in Column #2 of Worksheet.

5.1.32 OBSERVE Staplex rotometer reading AND RECORD the reading in column #3 of Worksheet.

5.1.33 REPEAT Steps 5.1.26 thru 5.1.32 for each additional plate.

5.1.34 TURN Staplex off.

5.1.35 CALCULATE \( \Delta H_{\text{STD}} \) \( \text{ "H}_2\text{O} \) as follows:

\[
\Delta H_{\text{STD}} \text{ "H}_2\text{O} = \sqrt{\Delta H \left( \frac{P_2}{P_{\text{STD}}} \right) \left( \frac{T_{\text{STD}}}{T_2} \right)}
\]

Where: \( \Delta H \) \( \text{ "H}_2\text{O} \) = Value taken from column 2, Worksheet,

\( P_2 = P_2 \) taken from Worksheet,

\( T_2 = T_2 \) taken from Worksheet,

\( P_{\text{STD}} = 760 \text{ mmHg} \), and

\( T_{\text{STD}} = 298.16 \text{ °K} \).

5.1.35.1 RECORD results in column #4 on Worksheet.
5.1 Staplex High Volume Air Sampler Functional Check/Calibration (Cont)

5.1.36 **CALCULATE** Observed STD Flowmeter Reading (referenced to ambient temperature and pressure) as follows:

\[ Q_{STD} = I \sqrt{\left( \frac{P_2}{P_{STD}} \right) \left( \frac{T_{STD}}{T_2} \right)} \]

Where:
- \( I \) = Value taken from column 3, Worksheet,
- \( P_2 \) = \( P_2 \) taken from Worksheet,
- \( T_2 \) = \( T_2 \) taken from Worksheet,
- \( P_{STD} \) = 760 mmHg, and
- \( T_{STD} \) = 298.16 °K.

5.1.36.1 **RECORD** results in column #5 on Worksheet.

5.1.37 **CALCULATE** \( Q_{STD} \) True Air Flow in M\(^3\)/Minute as follows:

\[ \frac{M^3}{\text{Min.}} = \frac{y-b_1}{m_1} \]

**NOTE** - The Intercept (\( b_1 \)) and Slope (\( m_1 \)) values are unique to each calibration kit and are provided on the Certificate of Calibration.

5.1.37.1 **USE** the data in column “Y-AXIS 1” from the vendor certification calibration sheet.

Where:
- \( y \) = value in column 4 (\( \Delta H_{STD} \) “H\(_2\)O”) of Worksheet,
- \( b_1 \) = Intercept value from calibration kit, and
- \( m_1 \) = Slope value from calibration kit.

5.1.37.2 **RECORD** calculated value in column 6 of Worksheet.

5.1.38 **CALCULATE** \( Q_{STD} \) True Air Flow in CFM as follows:

\[ \text{CFM} = 35.315 \times \frac{M^3}{\text{Min.}} \]

Where: \( M^3/\text{Min.} \) value is taken from column 6 Worksheet.

5.1.38.1 **RECORD** calculated value in column 7 of Worksheet.
5.1 Staplex High Volume Air Sampler Functional Check/Calibration (Cont)

5.1.39 PLOT graph using excel program AND PERFORM linear regression, using values from Worksheet column 5 and column 7 (this will also produce new slope and intercept values for this graph).

5.1.40 PERFORM the following calculation to determine the As-Left setting of the rotometer.

\[
\left(1/m_3\right) \left[ \left(40 \sqrt{\frac{P_2}{P_{STD}} \left( \frac{T_{STD}}{T_2} \right)} \right)^{-b_3} \right]
\]

Where:
- \(m_3\) = Slope value from NEW performed Worksheet Graph,
- \(b_3\) = Intercept value from NEW performed Worksheet Graph,
- \(P_2\) = \(P_2\) taken from Worksheet,
- \(T_2\) = \(T_2\) taken from Worksheet,
- \(P_{STD}\) = 760 mmHg, and
- \(T_{STD}\) = 298.16 °K.

5.1.41 RECORD the value from Step 5.1.40 as the calculated As-Left on Worksheet Graph.

5.1.42 INSTALL impactor to be used on Staplex (Figure 1 model AKI with air sampler).

5.1.43 PLACE planchet on intake (Figure 1).

5.1.44 HOLD planchet on AND TURN Staplex power on.

5.1.45 ADJUST Staplex rotometer to read As-Left from Step 5.1.40.

5.1.46 RECORD the As-Left rotameter (nearest whole number) on Worksheet.

5.1.47 TURN Staplex power OFF.

5.1.48 APPLY a torque seal compound to rotometer adjustment screw.
Staplex High Volume Air Sampler Calibration

5.1 Staplex High Volume Air Sampler Functional Check/Calibration (Cont)

5.1.49 ATTACH (two) matching Cal Stickers; one to the Air Sampler, and one to the AKI head (over the set-screw hole) stating “MATCHED SET” AND DOCUMENT the following on the Cal Stickers:

- Calibration Due Date (from Data Sheet)
- Date Performed
- Initial of Individual Performing Test
- Serial Number
- (CFM) Flow-Rate per the Worksheet.
5.2 Restoration

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

5.2.2 DISCONNECT AND REMOVE Test Equipment as necessary.

5.2.3 RECORD the M&TE and Standards information and calibration status on Data Sheet as applicable.

5.2.4 ENSURE completed calibration stickers are attached in accordance with Steps 5.1.49 and for Staplex TFIA/AKI heads.

5.3 Acceptance Criteria

Acceptance Criteria have been met when Steps in this procedure have been satisfactorily performed and when 6 data points have been recorded for plotting the As-Left graph.

5.4 Review

5.4.1 INFORM FWS test is complete.

5.4.2 FWS REVIEW AND ENSURE the following:

- IF any out-of-tolerances were found, NOTIFY RadCon Engineering
- 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.

5.5 Records

The performance of this procedure generates no records. However PM Data Sheets associated with the procedure are record material and are maintained in the work package as record material.

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 – Exploded View of Staplex

Exploded View of Staplex

Model AKI with Air Sampler

Staplex with Orifice Calibrator Installed
Figure 2 – AKI Tolerance

- SET SCREWS
- HEAD
- TUBE
- RING
- NOZZEL TO PLANCHET DISTANCE - 0.250"
  (Tolerance 0.234" to 0.266")
- PLANCHET
- SLIT WIDTH - 0.0787"
  (Tolerance 0.062" - 0.089")