IC041098

Revision 5

U/G EXHAUST MASS FLOW MEASUREMENT SYSTEM FOR FANS 700A, B & C

Maintenance Procedure
Continuous Use
[VU01]

APPROVED FOR USE

1.0 INTRODUCTION

Specifically, this work will accomplish the following:

- Calibration verification test and alignment of the U/G exhaust mass flow measurement system.

This procedure generates the following Quality records in accordance with WP 13-1, QAPD.

- Attachment 1 signoff and data sheets.

2.0 REFERENCES

BASELINE (DEVELOPMENTAL)

WP 04-AD3011	Equipment Tagout/Lockout
WP 10-AD3005	Control and Use of Maintenance Locks
WP 10-2	MOIM
WP 10-WC3010	Maintenance PM/MWI Controlled Document Processing
WP 10-WC3011	Maintenance Process
WP 12-HP3600	Radiological Work Permits
WP 12 IS.01	Industrial Safety Program
VARIOUS	Manufacturer's Operation and Maintenance Manuals

REFERENCED (REQUIRED ON-HAND)

MSDS – W0297	Ethyl Alcohol

3.0 MATERIAL LIST

ITEM	MATERIAL DESCRIPTION	QTY	UNIT	PR / WHSE STOCK NO.
	N/A			

4.0 EQUIPMENT LIST

- Electronic manometer with temperature probe and 48” standard pitot tube
- Temperature extension wand & cord with manometer temperature probe
- Ladder or platform
- Solution of water and mild soap (as required for sensor cleaning)
- Alcohol rinse (for water displacement and drying)
- Eye Protection
- Gloves

5.0 PRECAUTIONS

The JOB HAZARDS CHECKLIST indicates types of hazards that may be present during the performance of this work. See the indicated section for precautions and mitigating actions.

JOB HAZARDS CHECKLIST

HAZARD	MITIGATED AT SECTION
RADIOLOGICAL HAZARD	[ ] 8.2
CONFINED HAZARD	[ ] 8.2
ROTATING HAZARD	[ ] 8.2.6
OTHER HAZARD - (Slick or Wet Footing)	[ ] 8.2.7
HEIGHT HAZARD	[ ] 8.1
CHEMICAL HAZARD	[ ] 7.2.2

6.0 LIMITATIONS

[ ] 6.1. HOLD AND WITNESS POINTS

None

[ ] 6.2. TAGOUT/LOCKOUT

TAGOUT/LOCKOUT

TYPE OF LOCKING DEVICE	USED AT STEP
NON-PLD	[ ] 8.2.5

[ ] 6.3. OTHER LIMITATIONS

- The order of completion of this work may be modified, or sections may be performed in parallel provided that proper Tagout/Lockout is observed and that no hold points are bypassed.
- Brackets at the beginning of steps are place keeping aids, and should be checked off as work progresses.
- All personnel affixing initials to this package shall provide the information listed in the PERSONNEL DATA TABLE.
- Troubleshooting or other activities outside the scope of this PM may require the initiation of a work order as directed by the Responsible Engineer or Zone Team Leader.

7.0 PREREQUISITES

[ ] 7.1. ADMINISTRATIVE

[ ] 7.1.1. Personnel performing this work review these work instructions and appropriate sections of the references listed in the REFERENCED (REQUIRED ON HAND) section.

[ ] 7.1.2. Record work order number on Attachments.

[ ] 7.1.3. Record fan number on Attachment 1.

[ ] 7.1.4. Notify CMR Operator that this procedure is being performed.

[ ] 7.2. TASK PREPARATION

[ ] 7.2.1. Obtain materials and equipment shown in Materials and Equipment section.

WARNING

Chemical Hazard Exists

This warning applies to section [ ] 7.2.2

Personnel shall be familiar with the chemical manufacturer's Material Safety Data Sheet for chemicals used during the performance of this work.

[ ] 7.2.2. Clean pitot tube with alcohol and inspect tube for visible damage, tip deformation and clogging or obstruction of ports.

[ ] 7.2.2.1. All personnel involved in the performance of this work discuss hazards, precautions and mitigating actions to be taken for the chemical being used (alcohol).

SIGN-OFF

[ ] 7.2.3. Mark insertion depths (as necessary) on the pitot tube as listed on Data Block 1.

[ ] 7.2.4. Record Measurement and Test Equipment (M&TE) data as shown at M&TE Documentation table and verify all M&TE is within current calibration cycle.

SIGN-OFF

NOTE - IMPORTANT

This note applies to section 8.0

- All work performed under this procedure must meet the requirements of 40CFR264.15. The date, time and names of personnel involved are required for all inspection data. Be sure to record time and date in the space provided on each data sheet used. Record any remedial action in the Comments section along with time, date and initials of personnel who performed the work.

- If the duct is entered for any reason, Steps [ ] 8.2.1 through [ ] 8.2.6.1.1 must be performed.

8.0 PERFORMANCE

WARNING

Working Height Hazard Exists

This warning applies to section [ ] 8.1

- Lanyards three feet long or less can be attached to the breast (front) 'D' ring on the harness. Six-foot lanyards must be attached to the back 'D' ring of harness.
- Employees standing six feet or higher on a ladder will either secure the ladder to prevent tipping or have a second employee hold the ladder.
- Employees will use both hands for climbing. Tools will be carried in tool belts. Other materials will be raised or lowered using a hand line.
- When work requires that an employee leave the platform to perform work, and the work is within 6 feet of an unprotected edge, the employee must remain tied off to the platform.
- Platform occupants must follow manufacturer's fall protection requirements.

[ ] 8.1. AS FOUND PITOT TRAVERSE SERIES

[ ] 8.1.1. Elevated Platform Work Requirements

[ ] 8.1.1.1. Barrier area below platform.

[ ] 8.1.1.2. All personnel involved in the performance of this work discuss Working Height hazards, precautions and mitigating actions to be taken.

SIGN-OFF

[ ] 8.1.2. Request Facility Operations establish normal operating flow rate at the affected U/G exhaust fan.

[ ] 8.1.3. Allow flow to stabilize before performing traverse.

NOTE

This note applies to section [ ] 8.1.4

Work in this section requires the use of the following equipment:
MULTIMETER, AIR DATA, Range 25-10,000, Accuracy _3.0% _5 fpm, Recommend SHORTRIDGE Model ADM-870, Calibrated

NOTE

This note applies to section [ ] 8.1.4

FloSonic CMS readings are in percent (0-100%). Multiply this number by 350 to get flow in KSCFM. The points are BV700A, BV700B & BV700C in LPU 836 on AO1.

[ ] 8.1.4. Perform a single traverse at each of the six access ports in the duct, recording those readings as well as Sensor Flow (digital display outside box) and CMS readings on Data Block 1.

[ ] 8.1.5. Calculate the average velocity (V_{AVG}) for each traverse and record on Data Blocks 1 & 2.

[ ] 8.1.6. Calculate reference method flow (Q_{RM}) as shown in Data Block 2.

[ ] 8.1.7. Calculate average flow (SF_{AVG}) from sensor readings as shown on Data Block 1 and record on both Data Blocks 1 & 2.

[ ] 8.1.8. Calculate relative percent difference (RPD) between SF_{AVG} and Q_{RM} as shown in Data Block 2.

[ ] 8.1.9. Calculate average CMS flow (CMS_{AVG}) from CMS readings as shown in Data Block 1 and record on both Data Blocks 1 & 2.

[ ] 8.1.10. Calculate RPD between CMS_{AVG} and Q_{RM} as shown in Data Block 2.

[ ] 8.1.11. If as found values are within tolerance, go to Section [ ] 8.4. Otherwise, continue on to next section, Sensor Cleaning.

WARNING

Confined Space Hazard Exists
This warning applies to section [ ] 8.2
Duct at U/G exhaust fans is a NON-PERMIT CONFINED SPACE.

[ ] 8.2. SENSOR CLEANING

[ ] 8.2.1. Verify all entrants have read and understood the confined space procedure for spaces posted as NON-PERMIT CONFINED SPACE. Contact Industrial Hygiene (extension 8685) before entering.

[ ] 8.2.2. Review the WIPP Confined Space Evaluation record for known hazards and minimum entry requirements.

[ ] 8.2.3. All personnel involved in the performance of this work read and discuss confined space hazards, precautions and mitigating actions to be taken.

SIGN-OFF

WARNING

Radiological Hazard Exists
This warning applies to section [ ] 8.2

[ ] 8.2.4. RADIOLOGICAL WORK PERMIT (RWP) REQUIREMENTS

[ ] 8.2.4.1. Operations Health Physics (OHP) perform an RWP evaluation and record number on Sign-Off Sheet. If not required, N/A this step.

SIGN-OFF OHP

[ ] 8.2.4.2. If RWP is required, all personnel read the RWP, discuss radiological hazards, precautions and mitigating actions to be taken as shown in the RWP. If an RWP is not required, mark sign-off 'N/A' and continue.

SIGN-OFF OHP

[ ] 8.2.5. TAGOUT/LOCKOUT

NOTE

The **PERSONAL LOCKING DEVICE** (PLD) **IS NOT RECOMMENDED** for this work.

The Tagout/Lockout listed in Tagout/Lockout Table. Operations will be responsible for Tagout/Lockout performance.

Tagout/Lockout Table

FAN NUMBER	ISOLATING DEVICE	DEVICE POSITION	TAG	LOCK	LOCATION
700A	25P-STR-700A	OPEN	DANGER	YES	41-B-700A
700B	25P-STR-700B	OPEN	DANGER	YES	41-B-700B
700C	25P-STR-700C	OPEN	DANGER	YES	41-B-700C

[ ] 8.2.5.1. Verify that components are positioned, tagged, and locked in accordance with WP 04-AD3011. Install Maintenance Locks as required.

SIGN-OFF

WARNING

Mechanical Energy Hazard Exists

This warning applies to section [ ] 8.2.6

Personnel shall follow Moving Machinery Hazard requirements during the performance of this work.

[ ] 8.2.6. VERIFICATION OF ABSENCE OF MECHANICAL ENERGY

[ ] 8.2.6.1. Verify absence of mechanical energy at associated U/G exhaust fan by performing the following:

[ ] 8.2.6.1.1. Facility Operations attempt to start associated U/G exhaust fans to verify it will not operate.

SIGN-OFF

WARNING

This warning applies to section [ ] 8.2.7

Duct floor may be slick and wet. Dry walking surface with rags if necessary.

[ ] 8.2.7. Open entry hatch and enter duct.

[ ] 8.2.8. Clean sensor with a solution of water and mild soap.

NOTE

This note applies to section [ ] 8.2.9
Digital display will flicker during adjustment, and is an indication that the sensors are aligned with one another. If the display becomes fixed, this means that sensors have lost signal integrity, thus out of alignment.

[ ] 8.2.9. Check alignment of sensors using a laser pen and adjust as necessary. Observe the digital display during adjustment to verify signal integrity.

[ ] 8.2.10. Inspect manual damper just up stream of the sensors. Ensure damper is in the full open position and free of any obstruction that will restrict normal flow.

[ ] 8.2.11. Verify all personnel have exited duct and all equipment taken in has been removed.

[ ] 8.2.12. Secure duct entry hatch.

[ ] 8.2.13. Remove maintenance locks and tags and request Operations to remove Tagout/Lockout from the equipment.

SIGN-OFF

[ ] 8.2.14. Record date of sensor cleaning and alignment check. Record any remedial actions in Comments section along with initials and date.

SIGN-OFF

[ ] 8.3. AS LEFT PITOT TRAVERSE SERIES

[ ] 8.3.1. Obtain second copy of blank data sheets (Data Blocks 1 & 2).

[ ] 8.3.2. Request Facility Operations establish normal operating flow rate at the affected U/G exhaust fan.

[ ] 8.3.3. Allow flow to stabilize before performing traverse.

[ ] 8.3.4. Perform a single traverse reading at each of the six access ports in the duct, recording those readings as well as sensor flow and CMS readings on Data Block 1.

[ ] 8.3.5. Calculate the average velocity (V_{AVG}) for each traverse and record on Data Blocks 1 & 2.

[ ] 8.3.6. Calculate reference method flow (Q_{RM}) as shown in Data Block 2.

[ ] 8.3.7. Calculate average flow (SF_{AVG}) from sensor readings as shown on Data Block 1 and record on both Data Blocks 1 & 2.

[ ] 8.3.8. Calculate relative percent difference (RPD) between SF_{AVG} and Q_{RM} as shown in Data Block 2.

[ ] 8.3.9. Calculate average CMS flow (CMS_{AVG}) from CMS readings as shown in Data Block 1 and record on both Data Blocks 1 & 2.

[ ] 8.3.10. Calculate RPD between CMS_{AVG} and Q_{RM} as shown in Data Block 2.

[ ] 8.3.11. If values are not within tolerance, notify Zone Maintenance Manager and/or Zone Team Leader.

[ ] 8.4. TASK VERIFICATION

[ ] 8.4.1. Operational Testing

[ ] 8.4.1.1. Satisfactory completion of calibration check satisfies any retest requirements.

[ ] 8.5. RESTORATION TO OPERATIONAL STATUS

[ ] 8.5.1. Replace all plugs in traverse penetrations.

[ ] 8.5.2. Apply calibration sticker to associated flow sensor display unit.

[ ] 8.5.3. Notify CMRO and Fac Ops that this work order is complete.

ATTACHMENT 1 – SIGN-OFF SHEET

M&TE Documentation

Instrument Description	Used At Step	Instrument Number	Date Cal Due	M&TE Initials
MULTIMETER, AIR DATA, Range 25-10,000; Accuracy ± 3.0%, ± 7 fpm; Recommend SHORTRIDGE Model ADM-870; Calibrated Actual Equipment Used:	[ ] 8.1.4			

PREREQUISITES

Section	Action	Initials
[ ] 7.2.2.1	All personnel involved in the performance of this work discuss hazards, precautions and mitigating actions to be taken for the chemical being used.	**CRAFT____**
[ ] 7.2.4	Record Measurement and Test Equipment (M&TE) data as shown at M&TE Documentation table and verify all M&TE is within current calibration cycle.	**CRAFT____**

PERFORMANCE

Section	Action	Initials
[ ] 8.1.1.2	All personnel involved in the performance of this work discuss Working Height hazards, precautions and mitigating actions to be taken.	**CRAFT____**
[ ] 8.2.3	All personnel involved in the performance of this work read and discuss confined space hazards, precautions and mitigating actions to be taken.	**CRAFT____**
[ ] 8.2.4.1	RWP No. _____	**OHP____**
[ ] 8.2.4.2	Personnel read the RWP, discussed radiological hazards, precautions and mitigating actions to be taken. If an RWP is not required, mark sign-off 'N/A'.	**OHP____**

Section	Action	Initials
[ ] 8.2.5.1	Verify that components are positioned, tagged, and locked in accordance with WP 04-AD3011. Install Maintenance Locks as required.	**CRAFT____**
[ ] 8.2.6.1.1	Qualified Operator attempt to operate associated 700 Fan. Equipment shall not operate.	**CRAFT____**
[ ] 8.2.13	Remove maintenance locks and tags and request Operations to remove Tagout/Lockout from the equipment.	**CRAFT____**
[ ] 8.2.14	Record date of sensor cleaning and alignment check. Record any remedial actions in Comments section along with initials and date. Date: _____	**CRAFT____**

Comments:

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PERSONNEL DATA

PRINTED NAME	SIGNATURE	INITIALS	DATE

ATTACHMENT - AS FOUND / AS LEFT TRAVERSE DATA SHEET

___ As Found / ___ As Left Nominal Flow Rate _____ KSCFM

Date/Time: _____ Fan #: _____

Data Block 1 - Traverse Data

Depth inches	V_A KSFM	V_B KSFM	V_C KSFM	V_D KSFM	V_E KSFM	V_F KSFM
2.50						
8.00						
14.00						
21.25						
30.00						
42.75						
Sensor Flow *						
CMS Flow ** (% x 350)						
Average Flows & Velocity	$\frac{\Sigma V_A + \Sigma V_B + \Sigma V_C + \Sigma V_D + \Sigma V_E + \Sigma V_F}{36}$				$\frac{\Sigma SF}{6}$	$\frac{\Sigma CMS}{6}$

* Sensor Flow read from display on the outside of the enclosure (standard flow).
** CMS Points (SCFM): 700A/BV700A, 700B/BV700B, 700C/BV700C (LPU836–AO1)

ATTACHMENT - ACCEPTANCE CRITERIA CALCULATION SHEET

___ As Found / ___ As Left Nominal Flow Rate _____ KSCFM

Data Block 2 - Relative Percent Difference Calculation

Reference Method Flow		
V_{AVG} KSFM	$Q_{RM} = V_{AVG} \times 78.5398\ ft^2$	Reference Method Flow (Q_{RM}) KSCFM
Sensor Flow		
SF_{AVG} KSCFM	$RPD = \frac{\lvert SF_{AVG} - Q_{RM} \rvert}{Q_{RM}} \times 100$	Relative Percent Difference ACCEPTANCE CRITERIA ± 5%
CMS Flow		
CMS_{AVG} KSCFM	$RPD = \frac{\lvert CMS_{AVG} - Q_{RM} \rvert}{Q_{RM}} \times 100$	Relative Percent Difference ACCEPTANCE CRITERIA ± 5%