

OPERATING THE SOLAR TRITIUM AIRNET SAMPLER

Purpose This Meteorology and Air Quality Group (MAQ) procedure describes the steps to operate the Solar-powered tritium sampler air sampling station used for sampling air for the AIRNET project.

Scope This procedure applies to the individuals assigned to operate and maintain the Solar Tritium Air Sampler.

In this procedure This procedure addresses the following major topics:

Topic	See Page
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CONTROLLED DOCUMENT

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General information about this procedure

Attachments This procedure has the following attachments:

Number	Attachment Title	Pages
1	Hazard Review	2
2	Diagram of pump assembly	2

History of revision This table lists the revision history and effective dates of this procedure.

Revision	Date	Description of Changes
0	12/4/03	New document.
1	2/26/04	Quick-change revision to update reference to employee orientation in Attachment 1 (HCP).
2	2/8/05	Quick-change revision to convert HCP to HR.

Who requires training to this procedure? The following personnel require training before implementing this procedure:

- MAQ personnel assigned to collect and process AIRNET samples.

Personnel previously trained to revision 1 of this procedure do not require retraining to this revision.

Training method The training method for this procedure is **on-the-job** training by a previously trained individual and is documented in accordance with the procedure for training (MAQ-024).

Prerequisites In addition to training to this procedure, the following training is also required prior to performing this procedure:

- MAQ-011, "Logbook Use and Control"
- MAQ-204, "Sampling of Ambient Airborne Tritium"
- MAQ-205, "Calibration of Air Sampling Stations"
- First Aid
- Cardiopulmonary Resuscitation (CPR)

References The following documents are referenced in this procedure:

- MAQ-024, "Personnel Training"
- MAQ-202, "Environmental Sampling of Ambient Airborne Radionuclides"
- MAQ-204, "Sampling of Ambient Airborne Tritium"
- MAQ-205, "Calibration of Air Sampling Stations"
- MAQ-207, "Evaluation of AIRNET Sampler Sites Against Siting Criteria"
- MAQ-217, "Installation of New AIRNET Stations"

Setting up the sampler

Description of system The Solar Sampler is a battery-powered sampler that will pull air at any rate between 0 and 300 cc per minute. The water vapor sample will be collected using the standard silica cartridge used by the AIRNET project (see MAQ-204). The solar sampler uses up to one solar generator that will recharge the external 12V battery unit and operate the sampler continuously. The flow is controlled by a control panel and total sampler time is recorded by a timer.

Siting the sampler The sampler will generally be used in remote locations where electrical power is not available. The **Air Quality Monitoring Project Leader** will determine the location.

Guidance for siting the station is provided in MAQ-207 (“Evaluation of AIRNET Sampler Sites Against Siting Criteria”). Follow the applicable parts of MAQ-217 (“Installation of New AIRNET Stations”) when moving and locating the sampler housing. **Wear steel-toed shoes** whenever moving the station or the batteries.

For optimum performance, the solar array must face true south and have unobstructed access to the southern sky. Any shading of the modules by trees, buildings, wires, antennas, etc. will substantially reduce the performance of the system, and may cause eventual failure.

Use a magnetic compass to find true south. Be sure to adjust for the magnetic declination in your area (for example, North Central New Mexico, true south is 12 degrees east of magnetic south).

Observe the solar access to the southern sky. If there are obstructions that cannot be removed, try to find another location where the array will not be shaded.

Install the control panel in weather housing Install the solar sampler control panel by bolting it down to the housing. Connect the cable from the solar panels to the Brailsford 12V pump.

Setting up the sampler, continued

Battery handling

A sealed type battery should be used to avoid the hazards of a wet battery that contains acid. Sealed batteries may be transported or stored in any position without fear of leakage.

Wear steel-toed shoes while carrying batteries. Two people should be used to move batteries.

Do not package batteries with any other materials. During transport, individually box or otherwise secure batteries so that the batteries do not shift or tip. To help prevent accidental shorting of the terminals, label each outer box "Sealed Batteries - This Side Up" with an arrow indicating the top.

Battery WARNING

USE EXTREME CAUTION WHEN WORKING WITH A BATTERY! DO NOT ALLOW WRENCHES OR OTHER METALLIC OBJECTS TO COME IN CONTACT WITH BOTH TERMINALS SIMULTANEOUSLY- SERIOUS INJURY AND DESTRUCTION OF THE BATTERY MAY OCCUR.

Equipment needed

Before traveling to the sampler site, collect the following equipment:

- Pre-weighed silica gel cartridge
 - Palm computer
 - Chain-of-custody form from MAQ-204, or equivalent
 - Electrical tools, DC Voltmeter, pliers, and electrical tape.
 - 5/16" Straight blade screw driver
 - 9/64" Straight blade screw driver
 - Combination Wrench Set
 - 3/8" Drive Socket Set
 - Magnetic Compass
 - Housing with control panel
 - Solar generator: battery box, battery, standing solar panel
-

Steps to set up the sampler

To set up the sampler for a sampling job, perform the following steps:

Step	Action
1	Install weather housing and control panel.
2	Insert the conduit end marked "FLOBOSS" into the appropriate 3/4" threaded hole in the battery box enclosure and tighten.

Steps continued on next page.

Setting up the sampler, continued

Step	Action
3	Bond the green equipment ground wire to the common grounding point for the whole system, at the battery box.
4	Terminate the power leads to the pump; RED lead to (+) and BLACK (-). If the load has a plug connector, leave it unplugged until voltage and polarity have been verified below. If it is hard-wired, double check your connections and verify they are correct before proceeding.
Install and connect the battery	
6	Remove the top insulation piece inside the enclosure.
7	Remove the appropriate stickers from the battery label to indicate the month and year of installation. THIS STEP IS VERY IMPORTANT FOR TRACKING BATTERY PERFORMANCE AND WARRANTY INFORMATION.
8	Place the battery into the enclosure with the terminals toward the back. Push it all the way back into the insulation.
9	Remove the nuts from both battery terminal bolts. Connect the RED lead to POSITIVE (+) battery terminal, and then tighten the nut. WARNING: BE CAREFUL WITH THE WRENCH AND THE BATTERY TERMINALS! Slide the rubber boot over the terminal.
10	Repeat Step 9 for the BLACK battery lead and the negative battery terminal. Place the foam piece on the top of the battery.
Wire the module (if not already set up)	
11	Remove the module junction box cover.
12	Remove the plug from the appropriate hole.
13	Remove the strain relief locknut from the cable/conduit end marked "ARRAY" coming from the battery enclosure. Insert the end into the junction box, replace the locknut, and tighten.
14	Terminate the wire ends RED to the POSITIVE (+) terminal and the BLACK to the NEGATIVE (-) terminal, being careful not to over-tighten the screws. Replace cover.
Verify the array connection	
15	Open the battery box door and locate the charger regulator inside near the top. The red "CHARGING" light should be ON. If it is NOT ON, go back and check your connections.
Power up the load	
16	Disconnect (+) battery terminal.
17	Connect wires to pump: red to red, black to grey.
18	Reconnect (+) battery terminal.
19	Use the voltmeter to measure the DC voltage at the charge regulator. Verify correct polarity and a voltage reading of 12 to 14.5 volts DC.
20	Verify that the load has power and is operational.

Steps continued on next page.

Setting up the sampler, continued

Step	Action
Final inspection	
21	Calibrate the flow through the cartridge according to procedure MAQ-205.
22	Check module orientation using the compass; make sure it is facing true south. Verify that there are no obstructions that will shade the module.
23	Check all mounting fasteners for tightness.

Set up the sampling parameters

During sampling, the sampler will be run continuously (as the battery charge allows) and the samples will be collected every two weeks during the regular AIRNET sample changeout (see MAQ-202 and -204). If different sampling schedules are called for, follow the schedule specified by the Air Monitoring Project Leader.

Changing the filter

Follow the instructions of the Air Monitoring Project Leader for changing the collected tritium samples. Generally, the samples will be collected, labeled, and shipped in the same manner as those collected under procedure MAQ-204.

Maintenance

Maintenance The Brailsford pump needs rebuilding every 6 months of use. Obtain a rebuild kit from the manufacturer.

See attachment 2 for rebuilding steps and disassembly diagrams.

Records resulting from this procedure

Records There are no records generated as a result of this procedure.

HAZARD REVIEW FOR OPERATING THE SOLAR TRITIUM AIRNET SAMPLER

Work tasks/Steps	Hazards, Concerns, and Potential accidents; Likelihood/ Severity	Controls, Preventive Measures (e.g., safety equipment, administrative controls, etc.)	Hazard Level from IMP 300-00-00 Hazard Grading Matrix
As part of sampling work, enter radiation areas and explosives testing areas.	<p>Site-specific hazards such as high explosives testing (TA-15, TA-16, TA-49) or radiation Areas (TA-54- Area-G, TA-16)</p> <p>Remote / Negligible = Minimal</p>	<p>Comply with all site-specific access requirements.</p> <p>Existing facility access controls include site-specific training, sign-in/sign-out, and scheduling procedures.</p> <p>Area-G and TA-15 require entry through manned access control gates.</p>	Low
Step: Transport batteries.	<p>Acid burns from spilled battery gel, arcing from shorting.</p> <p>Occasional / moderate = low</p>	<p>Always wear safety shoes (or removable toe guards) when carrying the heavy automotive-type batteries. Do not package batteries with any other materials. Individual batteries will be boxed in a secure manner so that the batteries do not shift or tip during transport. Label each outer box "This Side Up" with an arrow indicating the top. Disconnect all power when performing station maintenance. Be careful not to short the battery terminals against metal cases or with tools. Use plastic caps on the 12V batteries to prevent accidental shorts.</p>	
Task: Move, transport, load, and unload station equipment and battery according to steps in this procedure.	<p>Dropping materials on feet.</p> <p>Critical / Improbable = Low</p>	<p>Wear steel-toed shoes whenever carrying or moving large pumps, station houses, timbers, batteries, or other heavy equipment.</p>	Low

Work tasks/Steps	Hazards, Concerns, and Potential accidents; Likelihood/ Severity	Controls, Preventive Measures (e.g., safety equipment, administrative controls, etc.)	Hazard Level from IMP 300-00-00 Hazard Grading Matrix
Task: Set up solar sampler according to steps in this procedure.	Handling awkward objects (loading/unloading/transporting/positioning) – awkward equipment is hard to handle and can cause strains. Occasional / Moderate = Minimal	Use proper lifting techniques. Two people are required to move station housings and timbers. Request help for other equipment if you are uncomfortable moving equipment alone.	Low
Steps: Connect battery to solar panels and pump according to steps in this procedure.	Electrical shock, arcs, vaporized materials, battery explosion. Improbable / moderate = minimal	Voltages are only 12 V so shock hazard to humans is low. However, be aware of sparks, arcs, flashes, and vaporized metal if metal connects the terminals of the battery or if the energized wires touch. Double-check the connections before making final connection to battery.	Low
Use hand tools as needed to assemble and connect equipment.	Injuries from use of hand tools Improbable / moderate = minimal	Use the proper tool for the job, use common sense and care.	Low

Wastes or residual materials resulting from process

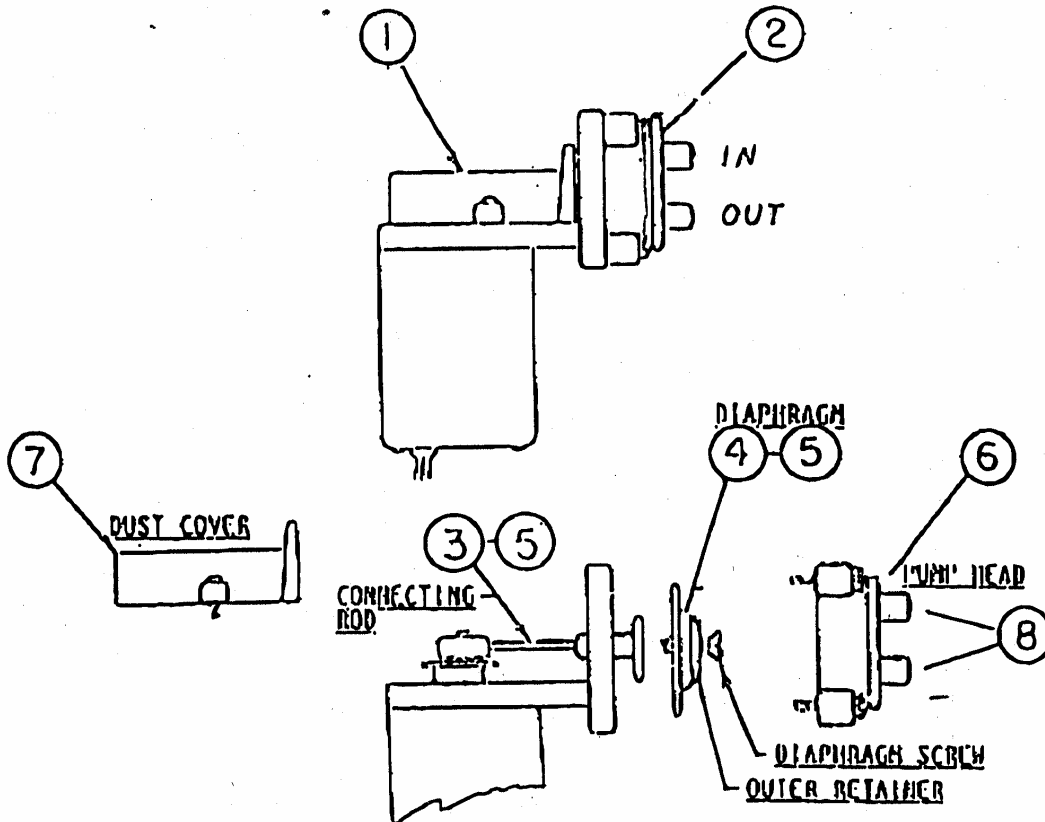
None.

Emergency actions to take in event of control failure

For all injuries, provide first aid and see that injured person is taken to Occupational Medicine (only if immediate medical attention is not required) or the hospital. Notify supervisor and group office as soon as possible. For any exposed, energized electrical wires, contact an electrician or the appropriate authority to turn off the power. Follow all site-specific emergency plans for any radiation or explosives emergencies.

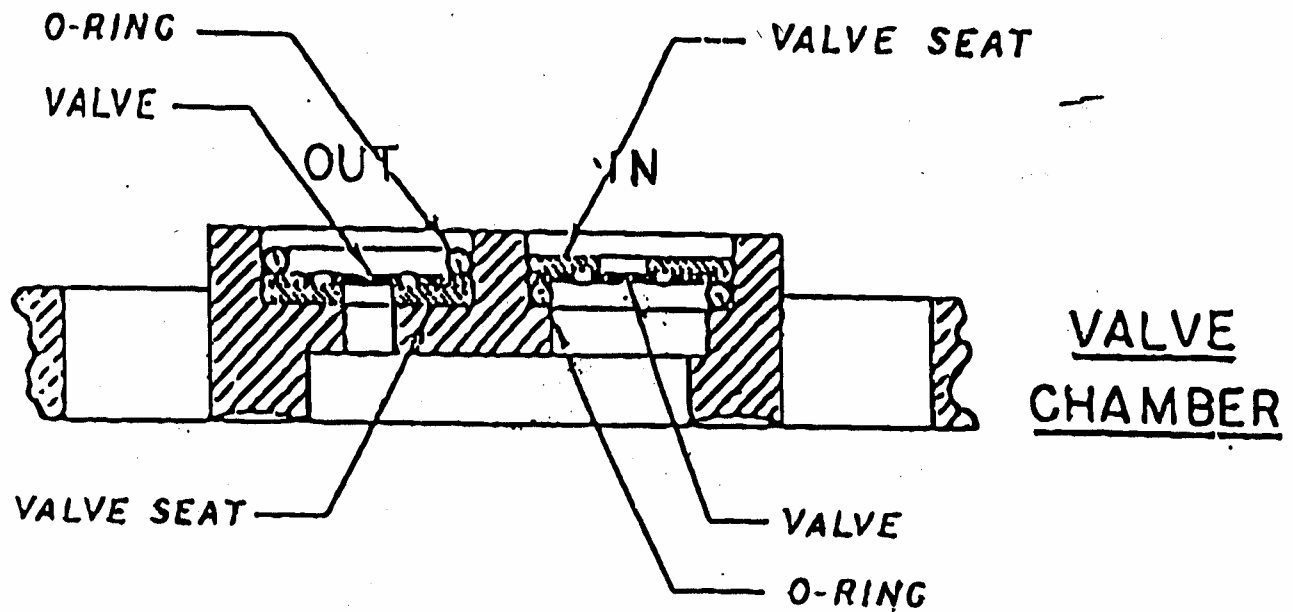
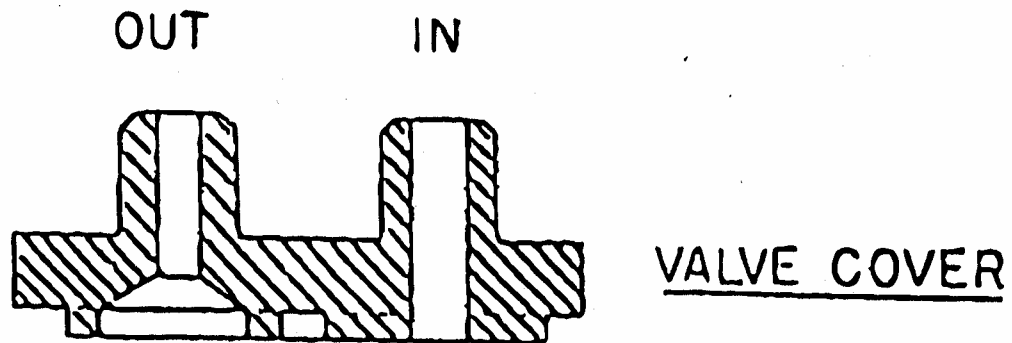
ATTACHMENT 2

DIAGRAM OF PUMP ASSEMBLY



- ① UNSCREW TWO PHILLIPS HEAD SCREWS AND REMOVE PLASTIC DUST COVER
- ② UNSCREW FOUR BINDING HEAD SCREWS AND REMOVE PUMP HEAD.
- ③ GRASP CONNECTING ROD WITH FINGERS, AND
- ④ UNSCREW SINGLE FLAT HEAD SCREW TO REMOVE OLD DIAPHRAGM.
- ⑤ GRASP CONNECTING ROD AGAIN, AND INSTALL NEW DIAPHRAGM. NOTE THAT THE LIP ON THE PLASTIC OUTER RETAINER MUST ENGAGE THE CENTER HOLE OF THE DIAPHRAGM. TIGHTEN DIAPHRAGM SCREW.
- ⑥ REINSTALL PUMP HEAD WITH DESIRED ORIENTATION OF THE INLET & OUTLET. INSURE THAT RIM OF DIAPHRAGM IS PROPERLY SEATED IN THE CONCAVE GROOVE IN THE PUMP HEAD. DO NOT TWIST DIAPHRAGM WHEN TIGHTENING THE FOUR PUMP HEAD SCREWS.
- ⑦ REINSTALL DUST COVER.
- ⑧ FORM NEW DIAPHRAGM WITH THE PUMP RUNNING; FOR VACUUM-BY MOMENTARILY BLOCKING INLET PORT; FOR PRESSURE-BY BLOCKING OUTLET PORT.

NOTE THAT PUMP PERFORMANCE CAN BE DEGRADED IF THE PUMP IS ALLOWED TO INGEST FOREIGN MATTER. PUMP HEADS CAN BE DISASSEMBLED AND CLEANED, OR REPLACED. IF PROBLEM CONTINUES, INSTALLATION OF A LOW LOSS INLET FILTER IS SUGGESTED.



NOTE: ASSEMBLE VALVE COMPONENTS IN ORDER SHOWN.
VALVES MUST LIE FLAT.
VALVE SURFACES MUST BE CLEAN & FREE OF DEBRIS
OBSERVE PROPER ORIENTATION OF VALVE COVER WITH
RESPECT TO VALVE CHAMBER.

