Appendix D

APPENDIX D

PROCEDURES FOR ROUTINE MAINTENANCE AND PERFORMANCE CHECKS OF MECHANICAL TEST EQUIPMENT

TIME REQUIREMENTS

All portable test equipment, including pumps, dry test meter, tanks, thermometers, thermocouple potentiometers, magnehelic gauges, pitot tubes, and tanks, is inspected, serviced (as necessary) and performance-checked at six-month intervals.

Records of service are kept in the maintenance log.

PROCEDURES

A. PUMPS

1. Pumps which have been used very infrequently during the preceding maintenance interval and have not contacted contaminating or corrosive materials need not be serviced or tested. "Not used" should be entered in the log, in such a case.

2. Disassemble, inspect and clean valves, seals, and air-contacting surface. Repair and clean or replace mechanical parts as necessary.

3. Repair or replace electrical connections or cords, if necessary.

4. Repair or replace gauges, if necessary.

5. Clean and fill oil reservoirs on oil-lubricated pumps.

6. Measure the maximum pressure, vacuum, and flow generated by the pump.

7. Record the date obtained in 6, describe any repairs made, and enter the date of next service in the maintenance log.

B. GAS FLOW AND VELOCITY METERS

Types of Meters in Use

1. Velocity meters (orifice, rotameter)
2. Dry gas meters
3. Roots gas meters
4. Turbine meters

Orifices, rotameters, etc. These devices are calibrated by connecting them in series with a more accurate volume meter, such as a calibrated wet-test meter. Calibration should be performed at least every 12 months, depending on frequency of usage. Calibration curves with deviations of no more than 1% should be established for each device.

Gas flow meters in use are calibrated twice each year. These meters are calibrated against an NBS primary standard or equivalent. Acceptable primary standards are (1) bell type spirometer, or a (2) wet-test meter that was calibrated using an NBS standard flow meter. A calibration curve giving efficiency versus flow rate is plotted for each meter. Acceptance limits are ±1% of volume measured using an NBS traceable standard flow meter. Meters which are found to exceed the acceptance limits are taken out of service.

1. Meters which have been very infrequently used during the preceding maintenance interval need not be tested. Enter "not used" in the log in such a case.

2. Check meters for good operation.

3. Send operational meters to California Division of Measurement Standards for calibration. Attach the calibration record to the maintenance log, and indicate the calibration and date of next inspection on each meter.

C. PITOT TUBES

1. Type S pitot tubes should be calibrated against a standard pitot tube in a wind tunnel with a diameter at least 10 times the maximum dimension which the pitot tube presents perpendicular to the gas stream. Both the standard and type S tubes should be connected to water manometers or equivalent.

   Type S – pitot tubes calibration. Compare with a standard type pitot tube by inserting both pitot tubes into a forced air duct and measuring the velocity at a specified point. A correction factor C_p is then calculated as shown in Table A.

TABLE A

EXAMPLE DETERMINATION OF PITOT TUBE CALIBRATION

Standard Pitot Reading		Type S Pitot Reading		
H_o	$\sqrt{H_o}$	H_1	$\sqrt{H_1}$	Ratio $\frac{\sqrt{H_o}}{\sqrt{H_1}} = C_p$
0.3	0.5477	0.415	0.642	0.853
0.5	0.7071	0.700	0.837	0.844
1.0	1.000	1.44	1.200	0.833
				$C_p = 0.843$

H_o = Velocity head ("H_2O)
H_1 = Velocity head ("H_2O)
C_p = Pitot tube coefficient

The type S pitot tube is inverted and an average C_p for the other leg is obtained using the same procedure. The averages are compared and if they differ by more than 2% the type S pitot tube is disregarded.

If the pitot tube is acceptable, record the date of the calibration in the maintenance log, and indicated the date of next scheduled calibration.

D. TANKS

1. Disassemble and clean the valve, if corroded.

2. Evacuate the tank, note the vacuum gauge reading, and check the gauge after 24 hours. No change should be noticed. Correct any leak or tag the tank "unserviceable."

3. Record the date of inspection and the date of next inspection on the tank and in the maintenance log.

E. POTENTIOMETERS

1. Test the battery and replace, if necessary.

2. Connect the potentiometer to an appropriate thermocouple and insert the thermocouple in a beaker of boiling water. If potentiometer is temperature-compensated, record the temperature indication; if it is not compensated, record the millivolt output. Repeat the procedure in a beaker of ice water. Then subtract the two millivolt or temperature measurements and convert to degrees C.

3. Record the potentiometer outputs and the date of next inspection on the potentiometer and in the maintenance log.

4. If the output difference between the 0° and 100° tests is not between 98°C and 102°C, the potentiometer is unserviceable.

F. THERMOMETERS

1. Record the thermometer reading in a beaker of ice water and a beaker of boiling water. Calculate the average deviation from 0°C to 100°C. If the deviation is over 4°C, the thermometer is unserviceable.

   Bimetallic dial-type thermometers are commonly used. These should be checked against an NBS mercury-in-glass thermometer and adjusted to read correctly. All thermometers used in a sampling program should be checked against an NBS thermometer prior to use and should be adjusted to the following limits:

150°F.	± 2°
150-500°	± 5°
500°	± 10°

2. Tag the date of inspection and next inspection on the thermometer along with the deviation.

G. MAGNEHELIC GAUGES

1. Zero the gauge then test at 25%, 50% and 75% of range against a water manometer or an inclined manometer. Calculate the average deviation from the correct pressures. If the average deviation exceeds 5% of full scale, the gauge is unserviceable.

2. Record the average deviation, date of inspection and date of next inspection in the maintenance log.