

STATE OF CALIFORNIA
AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME V

AUDIT PROCEDURES
FOR
AIR QUALITY MONITORING

APPENDIX AL

MAINTENANCE PROCEDURES
FOR
AUDIT VAN INSTRUMENTS

MONITORING AND LABORATORY DIVISION

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California Environmental Protection Agency



Standard Operating Procedure (SOP) Approval

Title: Maintenance Procedures for Audit Van Instruments

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Section: Quality Assurance Section

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Approval: This SOP has been reviewed and approved by:

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Date

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FOR
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AL.1.0 INTRODUCTION

The primary goal of an auditing program is to identify system errors that may result in suspect or invalid data. The accuracy and validity of the data obtained from any instrument depends upon the performance of the instruments and operator proficiency in maintaining the instruments.

AL.1.1 GENERAL INSTRUMENT MAINTENANCE PROCEDURES

It is important that ambient air analyzers used to produce data are tested, inspected, and maintained in excellent condition. Every piece of equipment has an expected life span. Through proper testing, inspection, and maintenance programs, users can be assured that equipment is capable of operating at acceptable performance levels.

Most of the ambient air instruments used by the Quality Assurance Section to conduct performance audits are Teledyne API analyzers. The Teledyne API analyzers incorporate a series of test functions accessible at the front panel. These parameters provide information about the present operating status of the instrument and are useful during troubleshooting. The analyzers also incorporate automated diagnostic utilities, including failure warnings and alarms built into the firmware of each analyzer, warning the operator that the instrument is operating outside normal parameters. The test functions can also be used to predict failures by observing how the instrument values change over time.

Any maintenance performed, including tests, repairs, certifications, calibrations, or changes made to the instruments, should be noted, in detail, in an appropriate Logbook. If a Maintenance Record or checksheet is used, it should be referenced in the Logbook. Logbooks and maintenance records should be periodically reviewed by the Section Manager.

AL.2.0 MAINTENANCE PROCEDURES FOR GASEOUS INSTRUMENTS

The objective of this section is to provide standard maintenance procedures for specific instruments used for performance audits. The instruments will be maintained in accordance with the standard operating procedures (SOP) developed by the Air Quality Surveillance Branch (AQSB). The SOPs are available on the internet at <http://www.arb.ca.gov/airwebmanual/index.php>.

The instruments mounted in the Quality Assurance audit vehicles operate in a unique environment. To compensate for these differences, the following practices will be integrated into a maintenance program.

NOTE: Electronic versions of Teledyne's instrument manuals are available at <http://www.teledyne-api.com/manuals/>.

NOTE: The inline particulate filters are located behind the front panel for Teledyne API analyzer models 200E, 300E, and 400. Replace the dirty filters with Millipore, 5 micron filters. Containers of new filters are available in MLD's supply room.

NOTE: Record the test parameters for Teledyne API analyzer models 200E, 300E, and 400 on the appropriate forms. Using the "Test" button of the front panel of each analyzer, begin with the "Current Time" and then record each displayed parameter that is displayed on the form. The forms match the parameter readouts.

AL.2.1. Teledyne API Model 200E NO_x Analyzer Maintenance Procedures

Quarterly, record the test parameters on form MLD/QAS-200E (Figure AL.2.1). The inline particulate filter should be changed annually, or earlier as needed.

AL.2.2 Teledyne API Model 300E Carbon Monoxide Analyzer Maintenance Procedures

Quarterly, record the test parameters on form MLD/QAS-300E, (Figure AL.2.2). The inline particulate filter should be changed annually, or earlier as needed.

AL.2.3 Teledyne API Model 400 Ozone Analyzer Maintenance Procedures

Semi-annually, the Standards Laboratory will perform an ozone certification on the unit. Quarterly, record the test parameters on form MLD/QAS-400, Figure AL.2.3 (Ref: AQSB SOP 001). The inline particulate filter should be changed annually, or earlier as needed.

AL.2.4 Teledyne API Model 701 Zero Air Module Maintenance Procedures

Annually, maintenance is to be conducted by a qualified auditor. Annual maintenance consists of: (Ref: Teledyne API 701 Operation Manual).

- Replacing the charcoal in the charcoal scrubber.
- Replacing the Purafil® in the NO - NO₂ scrubber.
- Replace the particulate filter on the rear panel.
- Check the water trap for excessive corrosion and replace if necessary.

AL.2.5 Envionics 9100 Gas Calibrator Maintenance Procedures

If the ozone target values have drifted beyond acceptable levels (± 10 percent) a qualified auditor will perform an ozone calibration using form MLD/QAS-9100, (Figure AL.2.4). If it is determined that the air and gas flows are out of tolerance, take the instrument to the Standards Laboratory or Instrument Laboratory for calibration. (Ref: AQSB 700 SOP AC)

AL.2.6 Eurotherm, 180 mm Paperless Graphic Recorder

The paperless chart recorder is used to record the audit van's instrument responses for each pollutant being audited along with temperature and time stamps. Data files are stored on a memory card and then transferred to the online Cabinet for archival purposes. (Ref: Eurotherm Manual, at S:\General Shared\Instrument Manuals)

AL.2.6.1 Eurotherm Touch Screen Cleaning

The touch-sensitive screen used in the graphic recorder is designed for use by hand or by the stylus supplied only. The use of sharp or pointed implements such as pens, keys, and fingernails to operate the instrument must be avoided, or irreparable damage will be done to the surface material. When cleaning the touch-screen, a moist cloth should be used, if necessary with a minimal amount of mild soap solution.

CAUTION: ALCOHOLS SUCH AS ISOPROPYL ALCOHOL MUST NEVER BE USED ON THE SCREEN.

AL.2.6.2 Eurotherm Battery Replacement

Battery replacement in the graphic recorder is recommended at least every three years. Low battery voltage is indicated when the current date and time functions are not held following the restoration of AC power. In order to eliminate the risk of user contact with hazardous voltages, the recorder must be isolated from its AC power source before its top cover is removed.

The battery (BR2330) is of poly-carbonmonofluoride/lithium construction and should be disposed of according to local regulations covering this type of battery.

Note: All battery backed RAM data is lost during battery change. See the Eurotherm manual, Annex A for details of restoring data in the graphic recorder.

To remove the battery, isolate the recorder from supply power and remove the recorder from the panel, as shown in Illustration 2.6.2 (A and B). Remove the recorder cover by removing the Four Torx headed screws (A) and the Pozidriv-headed screw B, and then lifting the cover up and out, under the gasket (C).

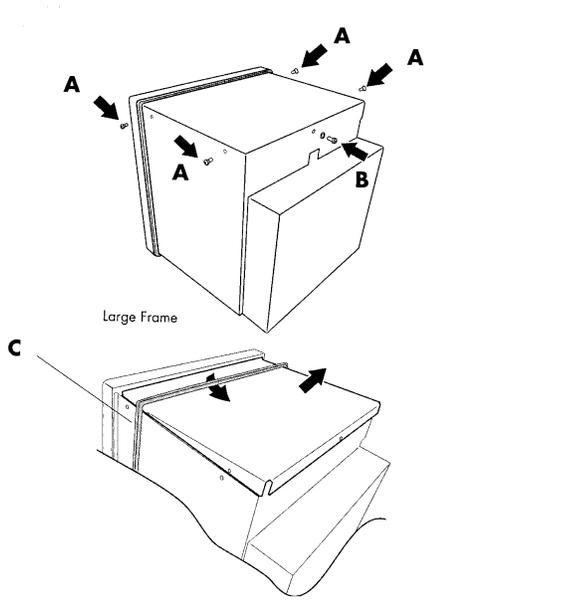


Illustration 2.6.2 (A)
Recorder Cover Screws

- With the cover removed, the battery board is accessible, allowing the exhausted battery to be slid out of its holder and the replacement battery to be inserted with the positive terminal up. Disconnect the connector for access to battery for removal.

NOTE: It is recommended that the battery, BR2330, be purchased from a retailer prior to installation and it is not necessary that they be stockpiled.

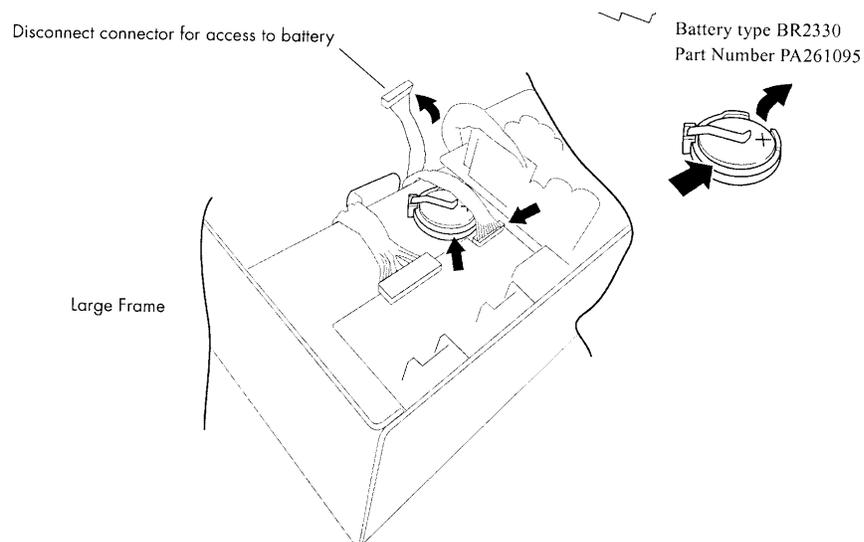


Illustration 2.6.2 (B)
Recorder Battery Location

**MONITORING AND LABORATORY DIVISION
 QUALITY ASSURANCE SECTION
 MAINTENANCE RECORD**

Audit Vehicle: _____

Year: _____

API 200E NO/NO₂/NO_x Analyzer

ARB No: _____

Checked by:				
Check Dates				

Test Parameters		Readings			
Time	Current				
Range	1000 ppb				
Stability	≤1 ppb w/ Zero Air				
Samp Flow	500 ± 50 ccm				
Ozone Flow	80 ± 15 ccm				
PMT (/w Zero Air)	-20 to 150 mv				
Norm PMT*	0 - 3000 mv (at SPAN)				
AZero	-20 to 150 mv				
HVPS	450 - 900 V				
Recell Temp	50 ± 1°C				
Box Temp	ambient ± 5°C				
PMT Temp	7 ± 2°C				
Moly Temp	315 ± 5°C				
RCEL Pres	4 - 10 inHg				
Sample Pres	ambient ± 1 inHg				
NOx Slope	1.0 ± 0.3				
NOx Offset	-50 to +150				
NO Slope	1.0 ± 0.3				
NO Offset	-50 to +150				
Inline Particulate Filter Changed					

*Norm PMT reading was taken with Zero Air

Operator Instructions:

Quarterly: Record test parameters.

Yearly: Change inline particulate filter.

Manager's Review:				
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MLD/QAS-200E (Rev. 05/2012)

Figure AL.2.1
 Teledyne API Model 200E NOX Analyzer

**MONITORING AND LABORATORY DIVISION
 QUALITY ASSURANCE SECTION
 MAINTENANCE RECORD**

Audit Vehicle: _____

Year: _____

API 300E Carbon Monoxide Analyzer

ARB No: _____

Checked by:				
Check Dates				

Test Parameters		Readings			
Time	Current				
Range	50 ppm				
Stability	≤ 0.05 ppm w/ Zero Air				
CO Meas	2500 - 4800 mV				
CO Ref	2500 - 4000 mV				
MR Ratio	1.1 - 1.3 w/ Zero Air				
Sample Press	15 - 35 inHg				
Sample Flow	800 ± 80 cc				
Sample Temp	48° C ± 4°				
Bench Temp	48° C ± 2°				
Wheel Temp	68° C ± 2°				
Box Temp	ambient +7° C ± 10°				
PHT Drive	250 - 4750 mV				
Slope	1.0 ± 0.3				
Offset	0 ± 0.3				
Inline Particulate Filter Changed:					

Operator Instructions:

Quarterly: Record test parameters.

Yearly: Change inline particulate filter.

Manager's Review: _____

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MLD/QAS-300E (Rev. 05/2012)

Figure AL.2.2
 Teledyne API Model 300E Carbon Monoxide Analyzer

**MONITORING AND LABORATORY DIVISION
 QUALITY ASSURANCE SECTION
 MAINTENANCE RECORD**

Audit Vehicle: _____

Year: _____

API 400A Ozone Analyzer

ARB No: _____

Checked by:				
Check Dates				

Test Parameters		Readings			
Time	Current				
Range	500 ppb				
Stability	≤1 ppb w/ Zero Air				
O3 Meas	2500-4700 mV				
O3 Ref	2500-4700 mV				
Vacuum	8 - 14 inHg				
Sample Press	25 - 35 inHg				
Sample Flow	800 ± 80 cc				
Sample Temp	20 - 45 °C				
Photo Lamp	52 ± 0.5 °C				
Box Temp	8 to 50 °C				
DCPS	2500 ± 100 mV				
Slope	1.0 ± 0.1				
Offset	0.0 ± 5 ppb				
Inline Particulate Filter Changed:					
Calibration Date:					

Operator Instructions:

- Quarterly: Record test parameters.
- Semi-annually: Calibrate analyzer (Standards Lab).
- Yearly: Change inline particulate filter.

Manager's Review: _____

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MLD/QAS-400A (Rev. 05/2012)

Figure AL.2.3
 Teledyne API Model 400A Ozone Analyzer

**MONITORING AND LABORATORY DIVISION
 QUALITY ASSURANCE SECTION
 MAINTENANCE RECORD**

Audit Vehicle: _____

Date: _____

EnviroNics 9100 Gas Calibrator

ARB No: _____

Checked by: _____

Ozone Target Values	1 st Point	2 nd Point	3 rd Point
0.400			
0.300			
0.250			
0.200			
0.150			
0.100			
0.080			

Note: Run all points in "Concentration Mode", then enter values in "Ozone Calibration" screen. Usually, only requires first point to be entered and the second point is used as verification. Refer to the Operating Manual for more specific details.

Password: Last four numbers in serial #; or keys: ↑, ↓, F7, F8

Operator Instructions:

As Required: When Ozone values begin to drift, air and gas flow calibrations will be performed by the Standards Laboratory or Instrument Laboratory.

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MLD/QAS-9100 (Rev. 05/2012)

Figure AL.2.4
 EnviroNics 9100 Gas Calibrator

AL.3.0 MAINTENANCE PROCEDURES FOR METEOROLOGICAL EQUIPMENT

The meteorological support equipment must be calibrated annually. The normal period for yearly maintenance is December. If necessary, create service contracts early.

AL.3.1 Wind Speed Anemometer Drive

The Standards Laboratory is the primary re-certification facility.

AL.3.2 Digital Thermometer

The Standards Laboratory is the primary re-certification facility. A suggested alternate vendor is: Davis Inotek Instruments, 5730 Ayala Avenue, Irwindale, CA 91706, (626) 815-2622.

AL.3.3 Barometric Pressure Sensor

The Standards Laboratory is the primary re-certification facility. A suggested alternate vendor is: Davis Inotek Instruments, 5730 Ayala Avenue, Irwindale, CA 91706, (626) 815-2622.

AL.4.0 MAINTENANCE PROCEDURES FOR FLOW DEVICES

The flow devices must be certified or calibrated annually. This is normally performed in December. A contract for outside vendors must be obtained before servicing the units.

AL.4.1 TetraCal/DeltaCal

The manufacturer is the primary re-calibration facility. The point of contact is: BGI Instruments, 58 Guinan Street, Waltham, MA 02451, (781) 891-9380.

AL.4.2 BGI Variable Orifice (Hi-Vol)

Gaskets for the unit can be found in MLD's supply room, and should be replaced as needed. The Standards Laboratory is the primary re-certification facility. If they are unable to provide the service, return the units to the manufacturer. The point of contact is: BGI Instruments, 58 Guinan Street, Waltham, MA 02451, (781) 891-9380.

AL.5.0 MAINTENANCE PROCEDURES FOR MASS ANALYSIS LABORATORY EQUIPMENT

The laboratory weights and devices must be certified and/or calibrated annually. The normal period for yearly maintenance is December. If necessary, create service contracts early.

AL.5.1 PM Mass Analysis Weights

A vendor must re-certify the weights using traceable National Institute of Standards and Technology standards and methods. A suggested vendor is: Heusser Neweigh, 1400 Willow Pass Court, Concord, CA 94520-5223, (925) 798-8900.

AL.5.2 Temperature/Humidity Meters

The Standards Laboratory is the primary re-certification facility. If they are unable to provide the service, purchasing new meters is nearly as cheap as having the units re-certified. A suggested vendor is: Tektronix Service Solutions, 1411 N. Grand Ave., Suite 300, Covina, CA 91724, (800) 438-8165 ext. 808. An alternate vendor is: Davis Calibration, 5730 Ayala Avenue, Irwindale, CA 91706, (800) 253-5648.