

EQUIPMENT SPECIFICATIONS
CARBON MONOXIDE (CO) ANALYZER

These specifications describe the minimum acceptable quality and/or performance level of the equipment to be purchased. Superior alternatives will be considered as compliant to the specifications. Unless otherwise defined in these specifications, technical terms and testing procedures shall be interpreted as defined in Title 40 of the Code of Federal Regulations (CFR), Part 53.23.

A. GENERAL SPECIFICATIONS

1. Equipment Description - Each Carbon Monoxide (CO) analyzer shall continuously monitor concentrations of CO in ambient air using the Gas Filter Correlation (GFC) analysis technique.
2. EPA Designation - Each analyzer must be designated as an automated reference or automated equivalent method for the measurement of concentrations of Carbon Monoxide (CO) in ambient air by the United States Environmental Protection Agency (U.S. EPA) as defined in 40 CFR Part 53. Each analyzer shall meet all performance specifications listed herein while operating in the equivalent mode as approved by the US EPA.
3. Operating and Service Manuals – Two (2) printed copies of the operating and service manual shall be provided for each analyzer purchased. Each manual shall contain installation, operation and maintenance procedures, detailed flow schematics and complete electrical drawings. Each manual shall also contain a complete list of spare parts and recommended spare parts storage levels. The manuals shall give detailed instructions for the use of the delivered analyzers with all options. The manuals shall be of the same quality as required by the U.S. EPA for reference and equivalent analyzers.
4. Shipment - The vendor shall ship each analyzer no later than 120 days after receipt of a purchase order.
5. Guaranty - The vendor shall provide a written guaranty covering each analyzer, including components, parts and field service. The guaranty period shall be for two years and five years on the Gas Filter Correlation Wheel.
6. Technical Support - The vendor shall provide free unlimited telephone and email technical support by instrument manufacturer for the life of each analyzer without any pre-conditions (e.g. training).

7. Support History - The vendor shall have a history of providing the Hawaii State Department of Health, Air Surveillance & Analysis Section, free manufacturer's technical support by telephone which includes:
 - a. Responding in a timely manner, even if just to acknowledge receipt of the request;
 - b. Providing technical support during the hours of 8am to 12 pm HST, minimum;
 - c. Providing technical support from someone who has the technical expertise and the necessary skills to help troubleshoot and solve advanced technical issues;
 - d. Communicating technical solutions clearly and concisely.
8. Training - The vendor shall be able to provide manufacturer's technical and service training at the manufacturer's facility and on-site in Hawaii.
9. Service and Repairs - The vendor shall be able to provide manufacturer's service and repairs at the manufacturer's facility.
10. Web Site - The vendor's web site shall have web-based support tools for service and support from the manufacturer.

B. PHYSICAL SPECIFICATIONS

1. Each analyzer shall be modular in design fully enclosed in a metal cabinet, allowing for easy access for servicing. It shall be supplied with all the hardware, including slides and brackets, necessary for mounting in a 19" wide by 25" deep instrument rack. Telescoping slides must provide a safety-locking device to hold empty rails in-place during installation to prevent personnel injuries and damage to the analyzer.
2. The total weight of each analyzer shall not exceed 60 pounds.
3. Each analyzer shall have a 3 conductor AC input power cord with a standard 3 prong grounded plug.
4. The front panel of each analyzer shall have a LCD color touch screen interface which shows:
 - a. The actual concentration of CO being measured by the analyzer in the currently selected units of measure;

- b. Information such as warning messages, operational data, test function values, and response messages during interactive tasks;
 - c. Control buttons displaying dynamic, context sensitive labels on each button;
 - d. Analyzer status indicating if the unit is operating in sample, calibration, or fault modes.
5. The rear panel of each analyzer shall include 1/4" Swagelok® (of equivalent) bulkhead fittings for sample and exhaust gases, analog output wiring termination connector, AC power cord receptacle, RS-232 and Ethernet ports. All electric and pneumatic connections are made at the rear panel.
 6. All major components in each analyzer such as the pump, optical bench, electronics, and valves shall be mounted inside the metal cabinet.
 7. All tubing in each analyzer shall have connections, controls and fittings that are designed for rapid, easy and repeated disassembly and reassembly as may be required for cleaning and repair. All tubing, connections, fittings and controls shall be constructed of materials which will not react with atmospheric or higher concentrations of CO. The materials, design and construction of tube fittings shall be such that no leaks will develop as a result of repeated disassembly and reassembly. All gas handling systems and components shall be free of leaks.
 8. Each analyzer shall have an analog voltage output for CO. Readings shall be continuously available; proportional to the concentration of the gas being measured.
 9. Each analyzer shall utilize a flow control assembly to maintain a constant flow rate of sample gas through the instrument.
 10. Each analyzer shall have a pneumatic pressure sensor which is used to compensate the concentration measurement for changes in air pressure.
 11. Each analyzer shall have a pneumatic sample flow sensor which is used to measure the sample flow through the instrument.
 12. Each analyzer shall have a control system to maintain constant temperatures of the sample chamber and GFC wheel.
 13. Each analyzer shall have a RS-232 serial communications and Ethernet ports.
 14. Each analyzer shall be microprocessor controlled with software capable of viewing test variables during operation.

15. Each analyzer shall have an internal data logging capability with programmable averaging periods.
16. Each analyzer shall display a label or sticker the indicating the reference designation number assigned by U.S. EPA to show that the instrument is acceptable for use in air quality surveillance systems by U.S. EPA.
17. All components in each analyzer shall be mounted so that they can be easily and quickly serviced, removed and reinstalled. All units and subunits shall be interchangeable and shall be of modular construction. All modules shall be capable of replacement with maximum service of 30 minutes using only screwdrivers and/or crescent wrenches.
18. Each analyzer shall be equipped with an internal pump. Also must include one spare pump for future replacement.
19. Each analyzer shall be equipped with a Teflon particulate filter assembly for the sample stream and also include 100 spare Teflon particulate filters for periodic replacement.

C. PERFORMANCE SPECIFICATIONS

1. The full-scale range of each analyzer shall be selectable from 0-1 ppm to 0-1000 ppm (dual range and auto range supported). Each analyzer shall be U.S. EPA approved for operation on the 0-50 ppm range.
2. The measurement units of each analyzer shall be in parts per million or parts per billion, user selectable.
3. The analog output voltage ranges of each analyzer shall be 1V, 5V, 10V user selectable and proportional to the selected analyzer range.
4. The lower detectable limit of each analyzer shall be equal to or less than 0.04 ppm.
5. The precision of each analyzer shall be the greater of 0.5% of reading or 0.2 ppm.
6. The response of each analyzer shall be linear, with an inaccuracy of no more than $\pm 1\%$ of full scale.
7. The span response of each analyzer shall not drift more than 0.5% of reading in 24 hours.

8. The zero response of each analyzer shall not drift more than ± 0.1 ppm in 24 hours.
9. The response time of each analyzer shall be such that the digital display on the front panel and the analog output voltage reach 95% of the final concentration within 60 seconds after the air sample being measured is introduced into the sample inlet.
10. The noise exhibited by each analyzer shall be less than 0.02 ppm when sampling zero air and less than 0.5% of reading at a span value of 40 ppm.
11. Each analyzer shall be equipped with a test function which displays analyzer operating parameters on the front panel digital display. The parameters displayed shall include (but not limited to):
 - a. Sample flow rate;
 - b. Operational range;
 - c. Sample pressure;
 - d. Sample temperature;
 - e. Bench temperature;
 - f. Wheel temperature;
 - g. Chassis temperature;
 - h. Slope of last calibration activity;
 - i. Offset of last calibration activity.
12. A change in ambient temperature of 10 to 40 °C shall not cause a permanent change to the zero or span response of each analyzer.
13. The humidity range of each analyzer shall be 0-95% RH, non-condensing.
14. Each analyzer shall automatically display warning messages on the front panel display.
15. Each analyzer shall include a Windows 7 compatible software program that will allow users to:
 - a. Establish a link from a remote location to the analyzer through direct cable connection via RS-232 modem or Ethernet;

- b. View the instrument's front panel and remotely access all functions that could be accessed manually on the instrument;
 - c. Remotely edit system parameters and set points;
 - d. Download, view, graph and save data for predictive diagnostics or data analysis;
 - e. Retrieve, view, edit, save and upload analyzer data acquisition system configurations;
 - f. Check on system parameters for troubleshooting and quality control.
16. Each analyzer shall have RS-232 serial ports with selectable baud rates of 9600-115,200.
17. Each analyzer shall be unaffected by normal vibration associated with air monitoring instrument operation and vibration of normal transport.
18. The supply voltage for each analyzer shall be 115 VAC, 60 Hz.