# MODEL ZAG - 6L

# INSTRUCTION MANUAL

This manual describes installation, and operation of California Analytical Instruments, Inc. Model ZAG-6L Zero Air Generators.

To assure correct operation and accurate results, it is recommended that the user carefully read this document.

**October 1, 2001**

**Version 1.03**

**P/N 970066 0000**

**ZAG INSTRUCTION MANUAL**

**$25.00 EACH**

# DANGER

## ELECTRICAL SHOCK HAZARD

Do not operate without the cover secured. Servicing requires access to live electrical components which can cause death or serious injury. Refer servicing to qualified service personnel. For safety and proper performance, this unit must be connected to a properly grounded three wire receptacle.

## HOT AREAS

This unit also contains areas clearly marked “HOT”. Components in these areas may reach temperatures in excess of 100 ° C. Any contact with these areas could cause severe burns. The hot areas include the 3 inch copper coil on the outlet of the oxidizer.

## AIR REQUIREMENTS

1. Air supply shall be at least 80 ±10 PSIG at 25 CFH (12 l/min) and have a maximum dewpoint of 37.5 °F (3.0 °C) at 100 PSIG (-6 °F (-21 °C) at atmospheric pressure).

2. Particulate matter filtration of solid liquid water and oil particles shall be less than 1 micron (1.0-ppm w/w maximum remaining oil content).

3. Particulate matter filtration of fine oil aerosols shall be less than 0.01 micron (0.001-ppm w/w maximum remaining oil content).

4. Oil vapor removal of hydrocarbon vapors normally absorbable by activated carbon shall be less than 0.01 micron (0.333-ppm w/w maximum remaining oil content).

**NOTE:** The above minimum requirements must be maintained in order to avoid damage to the catalyst and other internal components in the unit. Failure to comply with these requirements will void the warranty.

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# SECTION I

## UNPACKING INSTRUCTIONS

Open the shipping container and carefully remove the zero air generator from the packing materials. Inspect the unit for any sign of damage. Remove the Top Cover retaining screws. Verify all electrical connectors are properly seated. If all internal components look normal, re-install the cover.

## REPORTING DAMAGE

Should there be any apparent damage to either the inside or outside of the unit, due to shipping or handling, immediately notify the shipper. Shipping container or packing materials should be saved for inspection by the shipper.

# SECTION II

## INTRODUCTION

The CAI Models ZAG-6L and ZAG-3L Zero Air Generators have been designed to operate continuously 24 hours per day, 7 days per week to provide a pure air source of “zero air” for use in analytical gas analysis equipment. The ZAG completely eliminates the inconvenience and high costs of precision blended zero air cylinders. This is particularly important with instrumentation which, in addition to zero calibration air, requires pure air for burner combustion flame Ionization detectors and ozone production for chemiluminescence analyzers. In these types of applications requiring a continuous supply of zero air, payback for the ZAG is usually less than eight months. The generator is quiet and easy to install requiring only 120 VAC and a source of compressed air. The ZAG-6L will continuously provide up to 6 liters per minute of zero air and requires no consumable supplies or routine maintenance. . The ZAG-3L will continuously provide up to 3 liters per minute and has been designed for the O.E.M. and is intended to mounted within their system, and consequently, is not provided with a protective cover. These units will meet the specifications for zero air requirements for Inspection and Maintenance emissions test programs.

The contents of this manual include:

- **Electrical Specifications**
- **Installation Requirements, Mechanical & Electrical**
- **Operation Instructions**
- **Complete Schematic Circuit and Flow Diagram**

**INTRODUCTION** (Continued)

## SPECIFICATIONS

**REDUCTION METHOD:** Oxidation and Absorption

**OUTPUT FLOW RATE:** 6.0 L/min./3.0 L/min. ±1.5 L/min.

**OUTPUT PRESSURE:** 0 to 90 psig (Based on Inlet Pressure)

**INPUT AIR:** 7.0 liters/min. @ 60-125 psig

**MAXIMUM SAMPLE TEMPERATURE:** 45 Degrees C

**MAXIMUM INLET AIR DEW POINT:** 45 Degrees C

**OPTIONAL INLET AIR PRESSURE REGULATOR** 0 to 125 psig

**MAXIMUM BACKGROUND CONCENTRATION**

50 ppm NOx
200 ppm THC (as Methane)
200 ppm CO
1,500 ppm CO2
20 ppm SO2

**MAXIMUM OUTPUT CONCENTRATION (Standard Unit)**

<1.0 ppm NOx (NO/NO2)
<1.0 ppm THC (as Methane)
<1.0 ppm CH4
<1.0 ppm CO
<1.0 ppm CO2
<1.0 ppm SO2

**STANDARD BUFFER TANK:** 10 Liter

**MAXIMUM OUTPUT CONCENTRATION (Emissions Unit)**

<1.0 ppb NOx (NO/NO2)
<0.1 ppm THC (as Methane)
<0.1 ppm CH4
<0.1 ppm CO
<0.1 ppm CO2
<1.0 ppb SO2

**EMISSIONS BUFFER TANK:** 60 Gallon

**FRONT PANEL:** Power Indication & Switch

**AMBIENT TEMPERATURE:** 5 to 45 Degrees C

**OUTPUT DEW POINT:** - 70 Degrees C (-100 F)

**WARM-UP TIME:** 1 Hour

**FITTINGS:** 1/4 Inch Tube

**POWER REQUIREMENTS:** 115/230 (±10%) VAC 50/60 Hz; 300 Watts

**DIMENSIONS:** 26 H × 17 W × 5 D (Inches)

**RELATIVE HUMIDITY:** Less than 90% RH

**WEIGHT:** 32 Pounds

## ZAG OPTIONS

External Buffer Tank
Nema 4 Enclosure
Inlet Particulate Coalescing Filters
Inlet & Outlet Pressure Regulators
Dehumidifier

# SECTION III

## INSTALLATION

### GENERAL

The unit is designed for industrial applications and vehicle emission applications. These installation instructions are for a typical site. Any questions regarding specific installation situations should be directed to the **Technical Service** Department of California Analytical Instruments, Inc.

### SITE & MOUNTING

NOTE

The following **precautions** must be carefully observed.

1. Select a site free from direct sunlight, radiation from a high temperature surface, or abrupt temperature variations.
2. When installed outdoors, shelter the unit from wind and rain.
3. Select a site where the air is clean. Avoid exposing the unit to corrosive or combustible gases.
4. The unit must not be subjected to severe vibration. If severe vibration is present, use isolation mounts.
5. Do not install near equipment emitting electromagnetic interference (EMI). See page 6.
6. The unit **MUST** be mounted vertically.

**INSTALLATION** (Continued)

## ELECTRICAL

All electrical service enters the unit via the power entry assembly.

NOTE

A defective ground may affect the operation of the unit.

## INLET AND OUTLET AIR CONNECTIONS

Remove the shipping caps from the inlet, outlet and vent fittings. The inlet and outlet air connections are connected to the 1/4 inch tube connections located at the rear of the unit. The tubing from the air compressor system to the zero air generator should be made from corrosive-resistant material such as Teflon*, stainless steel or polyethylene. Optimum tube internal diameter is 0.16 inch (4 mm). Couplings to the unit are ¼ Inch tube.

NOTE

Be sure tubing and joints are clean.
Dust entering the unit may cause it to malfunction.

## SITE REQUIREMENTS

1. **Filtration**

   Dust must be eliminated completely. Use filters as necessary. The final filter must be capable of removing particles larger than 4 microns.

2. **Condensation**

   If the unit is being used on a standard centralized compressed air supply utilizing a reservoir tank, care must be taken to assure removal of oil and water droplets from the inlet air. Dew point of the supply air must be lower than the ambient temperature to prevent accidental condensation within the unit. When water vapor is present, pass the sample through a water separator to reduce the dew point to approximately ambient conditions. An optional dehumidifier is available from CAI.

NOTE

*Teflon is a trademark of Du Pont.

**INSTALLATION** (Continued)

**SITE REQUIREMENTS** (Continued)

3. **Presence of Corrosive Gases**

   Useful service life of the unit will be shortened if high concentrations of corrosive gases such as $Cl_2$, $F_2$, HCl, etc., are present in the inlet supply air.

4. **Air Temperature**

   Inlet air temperature should have a maximum temperature of the unit 122 ºF (50 ºC).

5. **Inlet Pressure and Flow Rates**

   The compressed air entering the unit must be controlled to 60 - 90 PSIG by external pressure regulators.

6. **Outlet Pressure and Flow Rates**

   The outlet open flow rate is 6 L/min. nominal to ambient at 60 PSIG inlet pressure. Outlet pressures can be controlled by an external forward pressure regulator and may be adjusted from zero to a maximum of the inlet pressure.

# SECTION IV

## OPERATION

### Power On

After the unit has been installed per the instructions above, depress the front panel power switch. The red light in the power switch will illuminate indicating power is applied to the unit. NOTE: The power entry module on the rear of the unit contains a 5 amp fuse. If the switch is depressed and the red light fails to illuminate, check and replace if necessary.

### Warm Up

The unit is shipped with protective covers on the gas line connections. Thes help to prevent excess contamination of the internal flow components. However, due to possible shocks to the ZAG during shipment, it is recommended to allow a 24 hour warm up period upon initial start up. After initial start up or relocation, the unit should be allowed to warm up for a minimum of 1 hour before the introduction of compressed air. Although damage will not occur to the unit by introducing compressed air prior to warm up, the output zero air specifications may not be met.

### Inlet Air Connection

After the dry filtered inlet air tube is attached, turn on the external inlet air valve. Pure zero air is now available on the outlet. Assure the inlet air pressure is between 60 and 90 PSIG and contains no visible condensation.

### Outlet Air Connection

Connect the outlet air tube to the equipment requiring pure zero air. NOTE: An outlet pressure regulator MAY be required for equipment which requires a maximum pressure on the inlet supply. An optional outlet forward pressure regulator is available from CAI.

### Outlet Air Buffer Tank

An optional outlet air buffer tank may be required if the zero air generator is supplying zero air to a product which is sensitive to fluctuations of the oxygen content of the zero air such as a Flame Ionization Detector THC analyzer. Also, sudden changes in zero air requirements which may occur during introducing zero air for zero instrument calibration may cause a momentary fluctuation in outlet pressure. These momentary pressure changes may be detected by the instrument. An option buffer tank is available from CAI.

### Outlet Air Storage Tank

An optional air outlet air storage tank is available from CAI if the intermittent outlet flow requirements exceed the maximum ZAG continuous output flow rate. Consult CAI for specifications and a chart of tank sizes vs. pressures vs. Flow rates vs. duration.

### Inlet Air Pressure Regulator with Coalescing Filter and Gauge

An optional compressed air inlet pressure regulator with coalescing filter and gauge is available to reduce the inlet pressure to meet the specified maximum of 90 PSIG. The regulator also contains a oil and water filter to meet the specified dry, oil free requirement.

# SECTION V

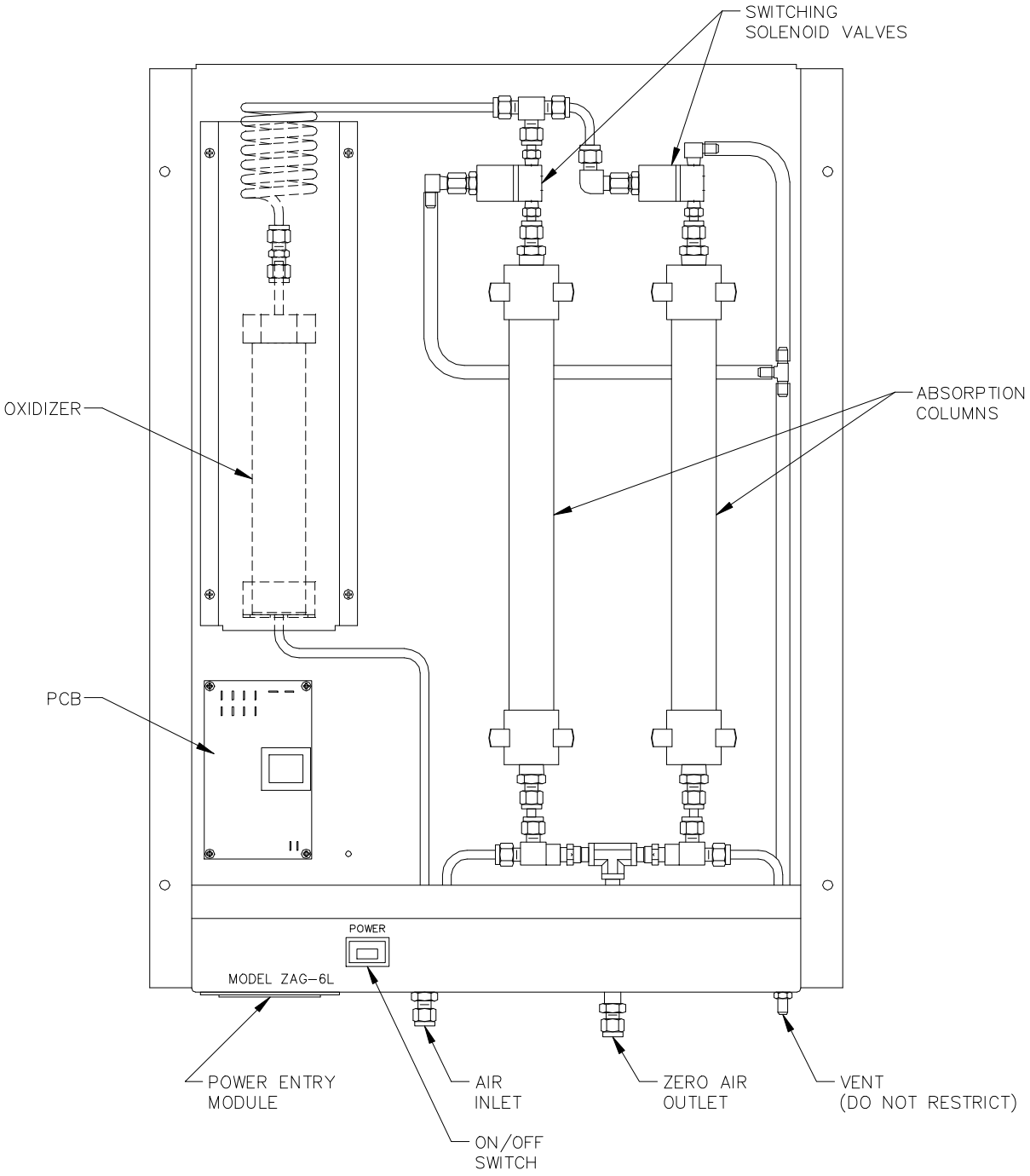
## Operating Principle

The inlet air supply with contaminants is first routed through an oxidizer where all hydrocarbons and carbon monoxide in the inlet air are converted to carbon dioxide and water. This hydrocarbon free air is then directed to one of two absorption columns. These columns remove all the H2O CO2, NO2 and SO2. The active column is at a pressure of 4 to 6 times atmospheric pressure and of sufficient size to remove all the contaminants during it's duty cycle which is approximately 1 minute. The other column is being regenerated using a portion of the pure zero air in a back flush mode. In this manner the two tubes are switched in and out of the sample stream while the inactive tube is being rejuvenated. Continuos pure zero air is produced at the outlet.

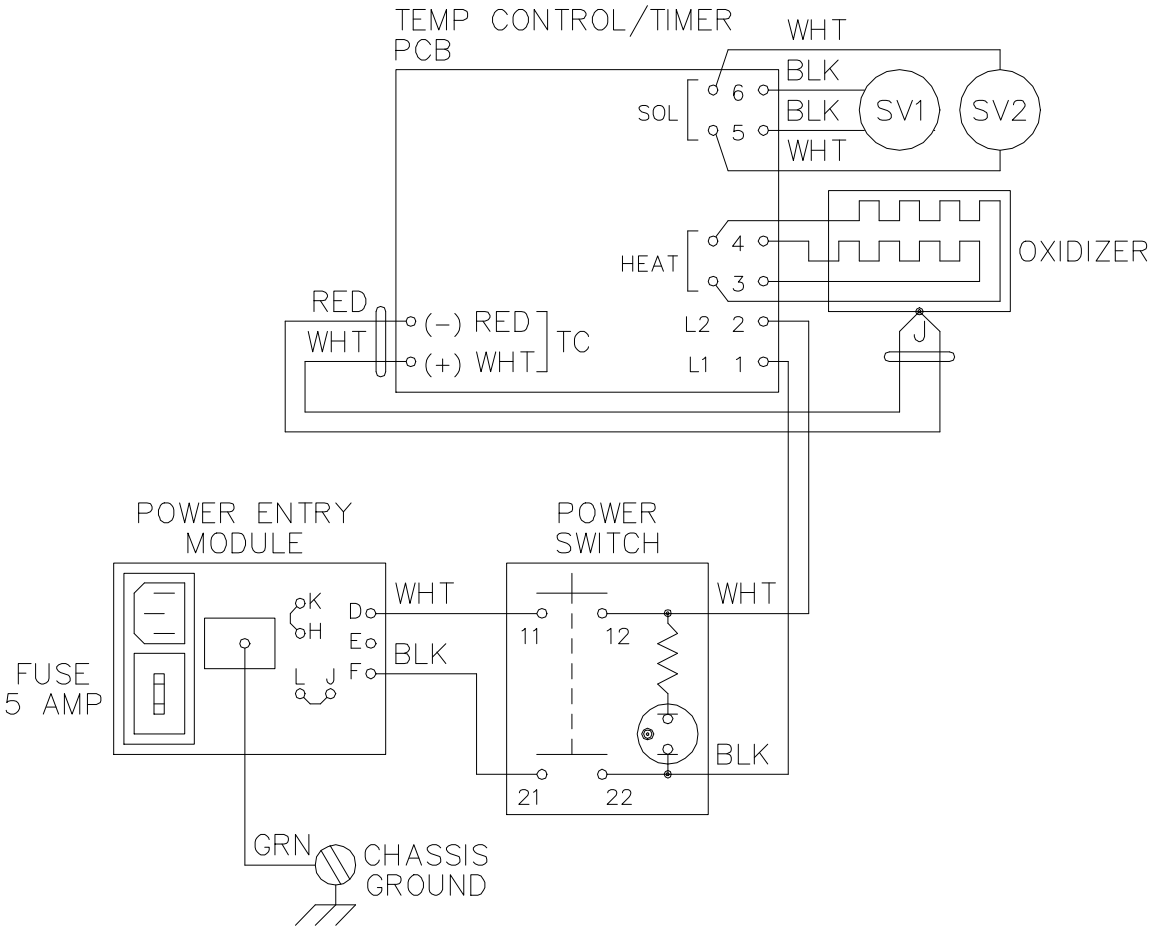
The entire unit contains no re-chargeable material. The absorption columns do not require maintenance and are estimated to remain operational for up to 6 years.

# SECTION VI

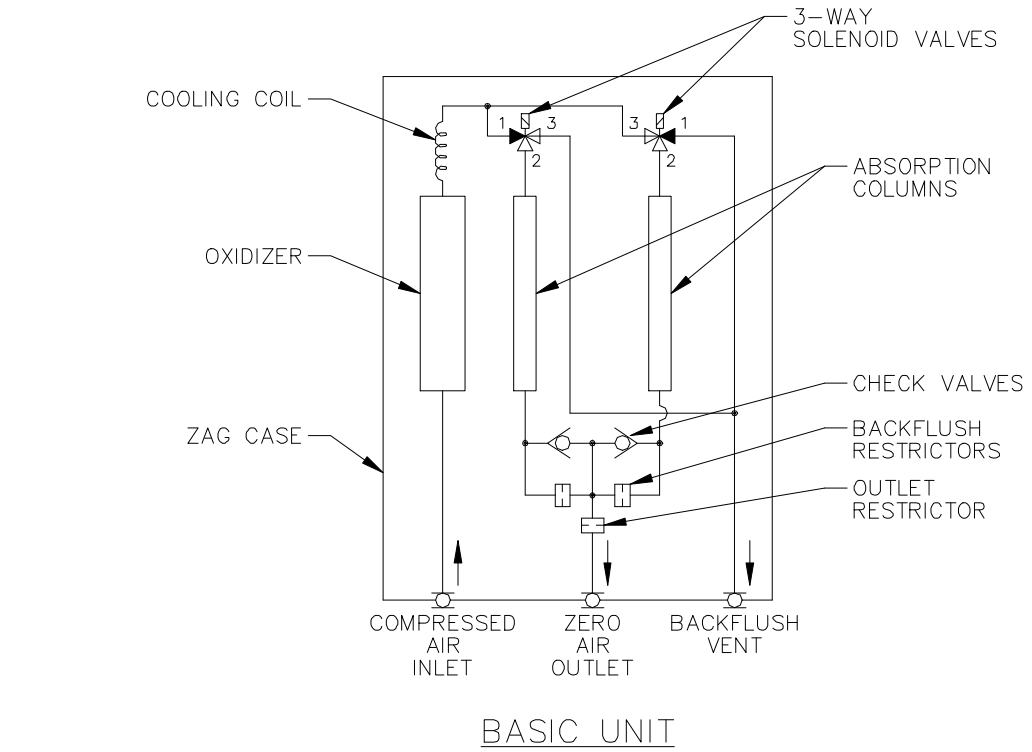
## Component Layout



## Electrical Schematic



## Flow Diagram



## SPARE PARTS

| Part Number | Description | Price |
|---|---|---|
| 310516 | Molecular Sieve Tube (Two Used) | $ 150.00 |
| 410511 | Temperature Controller and Timer Board | $ 125.00 |
| 410519 | Front Panel Power Switch | $ 45.00 |
| 110217 | Oxidizer Assembly | $ 450.00 |
| 110220 | Power Entry Module | $ 75.00 |
| 110222 | Solenoid Valve Assembly (White) | $ 160.00 |
| 110223 | Solenoid Valve Assembly (Black) | $ 150.00 |
| 110227 | Fuse Kit (3) | $ 5.00 |