

Aadco Pure Air Generators

The AADCO 737-series Pure Air Generators have gained universal acceptance as the instruments of choice where there is a requirement for a reliable, absolute source of zero air. Hundreds of these units are now distributed throughout the world, providing zero air for calibration purposes or relieving users from the tedious problems associated with stored air cylinders. Users include most federal and state air monitoring boards, foreign air monitoring networks, many federal analytical laboratories and a considerable number of industrial laboratories. Their ruggedness and compactness permit their use for in-plant process applications as well. In addition to serving as a source for zero air they provide clean, dry air for valving, solenoids and other process equipment. The life span of process instrumentation is greatly prolonged and maintenance is minimized through use of clean, dry air.

OUTPUT PURITY

The air product from the 737-series Pure Air Generators will easily satisfy the most demanding requirement for purity. AADCO's purity specifications: < 1 ppb ozone, methane, hydrocarbons, NO/NO_x, H₂S, SO₂, CO₂, CO, CO₂, SF₆ and fluorocarbons. All particulates are removed from the source air and never appear in the air product. It is typical for air monitoring equipment, calibrated to zero with cylinder air which is labeled as zero air, to indicate a greater deflection through zero when connected to a 737-series Pure Air Generator, clearly demonstrating the greater purity over cylinder air. In addition, the dewpoint of the air product from any 737-series Pure Air Generator will not exceed -60 F, making this the ideal air source. Equally important, the oxygen concentration is a constant 21%, as found in the ambient environment. This, again, is in contrast with zero air cylinders where a 6-8% variation in the oxygen concentration is not unusual. This variation has a profound effect when calibration of ozone generators and ozone monitors or total hydrocarbon analyzers is attempted. This oxygen variation effect becomes even more pronounced when multiple instruments and locations are involved.

CONSISTENT ZERO AIR

The specified purity described above remains absolutely constant from day-to-day, month-to-month and year-to-year. This consistent purity is available from one AADCO pure air generator to the next, anywhere in the world, assuring more positive collaboration between widely separated laboratories which had previously depended upon locally obtained cylinders of zero air. The stable, reproducible output permits precise zero calibration of all ambient air monitoring instruments, regardless of location. It also allows those researchers pursuing environmental impact studies to reliably determine the natural ambient background of any environment. Analysts concerned with the analysis of air from environmental chambers, ambient air, the contents of air cylinders, physiological respirations, etc. are now able to practice vacancy chromatography, differential response chromatography or direct analysis by using the pure air generator output as reference air. Laboratory use of a pure air generator, such as using air as an aid for such activities as evaporation, concentration and derivitization, can avoid side reactions and sample contamination with pure, dry air instead of air from questionable sources such as air cylinders or laboratory stopcocks.

SAFE ELIMINATION OF AIR CYLINDERS

In addition to generating consistently clean air, the AADCO pure air generators have effectively eliminated air cylinders and their associated regulators from a great number of laboratories. They now offer an element of safety and convenience for laboratory personnel which has been unavailable until now. All of the inconveniences associated with air cylinders are eliminated the handling of bulky cylinders, mismatched regulators, storage of unused cylinders and the possible mislabeling of FULL and EMPTY, causing uncertainty over residual volume and pressure, demurrage, leaks, dangers of explosions, unavailability of air at critical times due to either poor cylinder deliveries, ordering delays, etc. With floor space at a premium in most laboratories, use of a pure air generator frees that space normally occupied by air cylinders and clean air is always available. These generators are also found in mobile laboratories and remote monitoring stations where zero air is required but cylinder deliveries and changeouts are difficult logistical problems. Some of the AADCO high output units have found application as dry spec, etc. Those applications and techniques which involve Inordinate consumption of quality air, such as atomic absorption, some high pressure liquid chromatography Instruments and flame photometers are best served by pure air generators. These units have proven to be more convenient and economical over the battery of air cylinders which are required to sustain these operations.

COMPLETELY SELF-CONTAINED

All AADCO 737-series Pure Air Generators are completely self-contained units, with their own oil-less air compressors and unique contaminant removal systems. They are offered in a range of output volumes from 1-Liter/minute to 100 Liters/minute. The small, 1-Liter/minute unit is completely self-contained within one cabinet, including compressor. Its compactness, less than two cubic feet, and light weight, less than thirty pounds, permit easy portability from one work area to another. Bench space requirements are minimal—12 inches wide by 18 inches deep. All connections are made externally to the unit and start-up is accomplished in less than 5 minutes. Every 737-Series Pure Air Generator contains a purification reactor, input and output pressure gauges for ease in monitoring the condition of the compressor systems and establishing output pressure for the receiving equipment, 9-inch rotameter calibrated for the full range of output for each pure air generator, completely variable output flow adjust valve and output pressure regulator. No pressure regulator systems need be supplied by the user. Output flow and output pressure are constant without the use of ballast tanks.

MODELS AVAILABLE

AADCO offers a variety of models from which selection is made depending upon application, output volume and mounting requirements. Mounting options include either bench mounting or rack-mounting for all units, regardless of output volume. For those instruments producing volumes greater than 0-Liters/ minute, larger components are entailed which necessitate a larger housing.

Bench Top Units

Aadco manufactures units that house components capable of output volumes of 0-50 and 0-100 liters/minute; 0-20 and 0-30 Liters/minute and 0-1, 0-5 and 0-10 Liters/ minute respectively. We manufacture the full family of bench-mounted pure air generators whose output volumes are described above. Dimensions of the instruments are: 21"H x 17¹/₂"W x 25"D; 15"H x 17Y2"W x 21"D; 15"H x 17Y2"W x 18D, respectively. All units contain a purification reactor, input and output pressure gauges, 9-inch rotameter, output flow adjust valve—all components sized to the output flow requirements of the particular instrument. All of these instruments function exactly alike, differing only in power requirements, component sizing and cabinet dimensions.

The 737-12 bench-mounted Pure Air Generator system, with maximum output volume of 0-30 Liters/min. @ 0-50 psi, is available complete with compressor. The upper unit contains the purification system, with methane reactor and heat status indicator systems. A cycling heat indicator lamp gives assurance of temperature maintenance of the methane reactor at its preset operating temperature. Should the indicator lamp be suspect, front panel test jacks permit monitoring with a VOM for further verification of heat status. All fuses are front panel mounted for rapid and easy accessibility- All electrical controls are also located on the generator front panel, including the power switch to the compressor, even though the compressor is located in a separate unit. Electrical connection between the two units is made through a twist-lock umbilical which can also be connected to any AC outlet without special adapters.

The lower unit houses the compressor, mounted on a special vibration-isolation support. High volume cooling fans sustain a compatible internal temperature for optimum operation. Air enters through a strategically placed opening in the top of the unit, passes through a baffle system to eliminate sound from the unit, across the compressor and out through several openings located on the rear floor of the unit. Should there be a failure of the air circulating fans, an automatic thermal switch cuts off electrical power to the compressor, avoiding overheating and possible damage. This same thermal safety is incorporated in all compressors which AADCO supplies with pure air systems or as replacements. The complete interior of the unit is covered with high density sound absorptive insulating material, including the baffle system. Placement of the generator and compressor units may be side-by-side or one above the other, as shown. The high temperature connecting air hose which runs between the two units is of sufficient length to permit either configuration.

Rack Mounted Units

This purification unit is mounted immediately above the compressor unit, for all systems other than the 737 R-1 pure air generator. This one particular generator system, which has a maximum output volume of 1-Liter/minute, contains within a single cabinet both the compressor and purification systems, as with the 737-1 bench-mounted unit. All other rack-mounted systems require separate cabinets for the purification and compressor sections. The same attention to detail is paid to selection of components for the rack-mounted systems as with the bench-mounted units. Heat indicator lamp, test jacks and front panel fuses are also standard with these units affording ease of service and component accessibility to the operator. The rack-mounted compressor units sustain the same baffle system and high volume cooling as described for the bench-mounted systems. The same safety features prevail, including the thermal safety switch for the compressor in the event of failure of the cooling system. Soundproofing is also an available option, as are slides, selected for weight capacity, with extenders to fit any size cabinet. All front panels are a full 19-inches, with mounting slots. Output volumes for these rack-mounted units range from 1-Liter/minute to 30-Liters/minute. Purchases may be made to include or exclude compressor or silencer housing. Consult the price list or the factory for full listing. Factory technical recommendations for applicability or appropriate size considerations is especially suggested, particularly for those who are considering their first system in order to ensure purchase of systems which will satisfy all of the requirements of the user.

The Purification Reactor

The reactor is the heart of the purification system. It produces clean, dry air from any air source of appropriate pressure and flow. Every 737-series pure air generator is supplied with a purification reactor designed to meet the particular requirements of the user. In addition to being selected for size appropriate to output volume, the user also selects that type which is most appropriate for the intended application, i.e.; the "A" or ambient unit which produces clean, dry air containing 21% oxygen, as found in the ambient environment, or the "B" unit which produces clean, dry, hyper oxygenated air. The "A" purification reactor is employed where maintenance of the oxygen concentration at ambient levels is important, as with air monitoring equipment. The "B" purification reactor is solely for those situations where the increased oxygen concentration is advantageous, as with flame ionization detectors and other combustion-type detectors associated with gas chromatography. AH of AADCO's sales to the gas chromatography market involve the "B" reactor. The hyperoxygenation, regardless of the claims by the commercial manufacturer of a particular flame ionization detector, always produces a three to ten-fold increased response with no increase in noise level. This hyperoxygenation, as opposed to pure oxygen alone, does not decrease detector life but actually prolongs it over the use of air alone by keeping the flame tip clean and cool due to the presence of the nitrogen. Experimentation with six different commercially available flame ionization detectors bears this out. Note the following chromatograms which illustrate the increased response when each gas chromatograph is operated under the same conditions with cylinder air and then air from a 737-series pure air generator equipped with "B" reactor. The oxygen concentration from these units is carefully set at the optimum level for producing a maximum response without an increase in noise level. An added advantage to the "B" system is that the hydrogen flow to the flame ionization detector can be reduced with no resultant loss in sensitivity. The ancient GC rule of thumb "equal flows of carrier and hydrogen" no longer holds. A ratio of 5:4 or 6:4 of carrier: hydrogen will be preferable due to the improved ionization efficiencies. It should be noted, however, that the "B" purification systems should NOT be used to produce air which is to serve as diluent in the production of air blends, standards, etc. for air monitoring equipment

nor for any instrumentation which uses air as carrier gas or alternate support air as with Total Hydrocarbon Analyzers. The increased response due to the hyperoxgenation will appear as hydrocarbon response even though the air is hydrocarbon-free. This will produce difficulties with calibration.

The "A" purification reactor should be used in those instances where the "B" reactor is specifically not recommended. In addition, the "A" system should be used with TOC analyzers which utilize either NDIR or FID detection systems. Typical GC applications involving the "B" system have been in the fields of toxicology, forensic medicine, pharmacokinetics, drug analysis, trace gas analysis, etc., in short, those applications where high sensitivity is required or where the possibility for a high sensitivity requirement may appear in the future.

It should be noted that the "A" and "B" purification reactors are completely interchangeable. On-site swapout can be performed in a few minutes with minimum tools and expertise. Those users whose areas of interest may cover both trace analysis and ambient air analysis usually purchase one pure air generator with either the "A" or "B" reactors installed, depending upon which analytical area would be of greater importance, and the alternate purification reactor shipped separately for later installation by the user, as required.

Chromatograms typifying the flame ionization signal enhancement achieved through utilization of combustion air produced by 737-series pure air generators equipped with "B" reactors are shown on the following pages. All operating conditions, including electrometer settings, are given for each analysis.

Sample: 10 cc 1 ppm VCM in N₂
Atmospheric pressure

Column: Supelco 0.4%
Carbowax 1500 on Carbopack A,
6 x 1/8", SS, at ambient temp.

Nitrogen carrier at 25 cc/min.

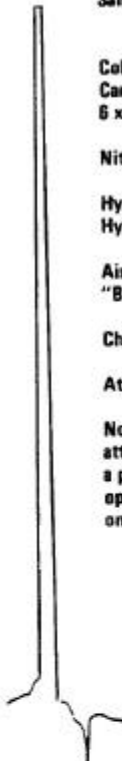
Hydrogen from AADCO 1225
Hydrogen Generator

Air from AADCO 737 with
"B" Reactor

Chart: 1/2" per min.

Attenuation: 1 x 8

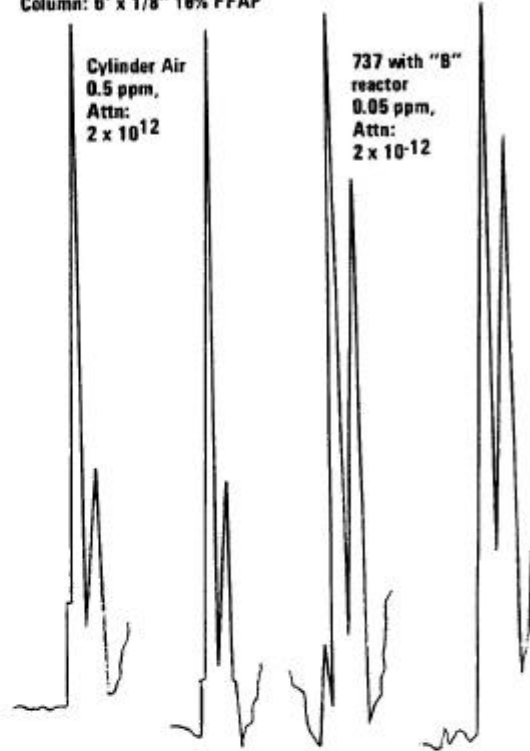
Note: When same sample run at
attenuation of 1 x 32, produced
a peak of 70 divisions. When
operated with cylinder air gave
only 11 divisions.



Replicate 3 ul injections vinyl chloride extract in CCl₄
H/P 5750 FID
Column: 6' x 1/8" 18% FFAP

Cylinder Air
0.5 ppm,
Attn:
2 x 10¹²

737 with "B"
reactor
0.05 ppm,
Attn:
2 x 10⁻¹²

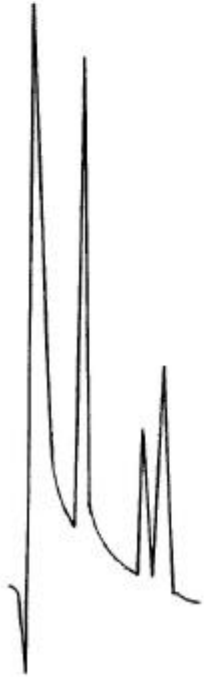


5 ul Sample
Cinnamic Alcohol 100 ppm
Ethyl Vanillin 100 ppm
Vanillin 200 ppm

737 Pure Air Generator
with "B" Reactor
1125 Hydrogen Generator

F & M 402 FID

Attn: 10 x 8



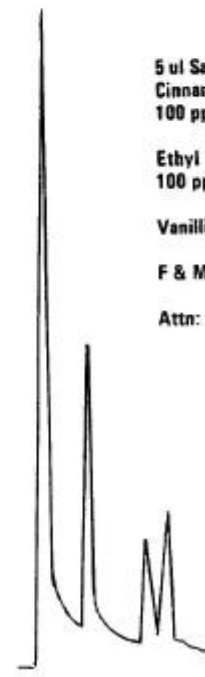
5 ul Sample
Cinnamic Alcohol,
100 ppm

Ethyl Vanillin,
100 ppm

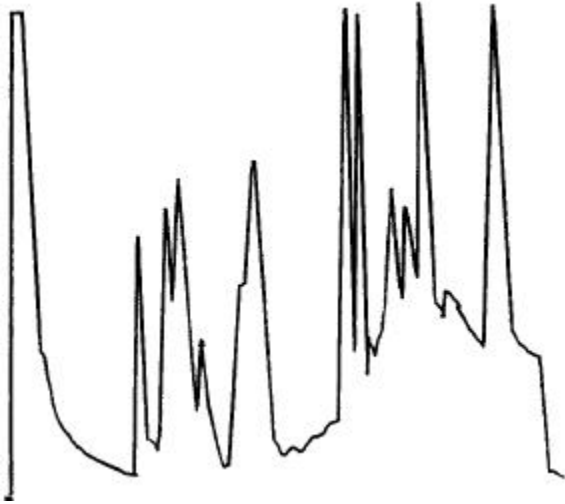
Vanillin, 200 ppm

F & M 402 FID

Attn: 10 x 2



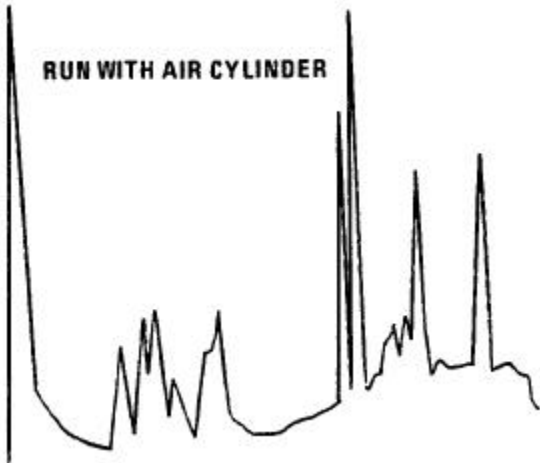
RUN WITH 737 PURE AIR GENERATOR
"B" REACTOR



PTH AMINO ACIDS 2.0 nm each Temp. Prog. Run
NUCLEAR/Chicago 4740 FID

NUCLEAR/Chicago 4740 FID

RUN WITH AIR CYLINDER



THE "B" REACTOR

Earlier text in this brochure has described the availability of the "B" and "A" purification reactors, with mention of the oxygen output from each, particularly the hyperoxygenated air from the "B" unit. Not mentioned was the production process within this reactor whereby the hyperoxygenation takes place. The degree of hyperoxygenation is achieved through chromatographic separation and is controlled through pressure and residence time within the reactor. This separation of the air into its various components permits selective deletion of a portion of the nitrogen from the resultant pure air product with a subsequent increase in the relative oxygen concentration. If the oxygen output during the production process were monitored with an oxygen meter or other oxygen-sensing device one would observe the usual gaussian peaks associated with chromatography, the emergence of the oxygen peak preceding the

Nitrogen peak. Monitoring of the nitrogen peak allows determination of the optimum moment for cutting the nitrogen peak and backflushing the balance of the nitrogen and all other contaminants. Once this has been determined for a particular reactor, setting of its timer cycle becomes a simple procedure for fixing a particular oxygen concentration.

One of the more sensitive oxygen sensors, though usually not thought of or used as such, is the flame ionization detector, this Detector will respond to changes in oxygen concentration at the 10 ppm level (0.001%). Since this detector is most favored for application of the "B" reactor and since it does respond to very slight shifts in oxygen concentration, it is necessary to homogenize the effluent from the "B" reactor prior to introduction to the flame. This homogenization step is achieved through specially designed mixer-receivers. A unique quill with geometrically sized and spaced orifices carries the air from the "B" reactor to the inside of the canister, usually at four or more atmospheres, where it is disgorged in a manner so as to offer rigorous homogenization. The resultant air product then emerges at a fixed oxygen concentration. If these mixer-receivers were not present and the output from the flame ionization detector were followed through an electrometer and recorder, a series of huge sine waves would be presented as baseline. This would be the detector following the oxygen output from the reactor. Obviously, this would offer serious qualitative and quantitative difficulties. The mixer-receivers prevent this and are therefore mounted within the cabinets of all pure air generators with "B" reactor.

OPTIONAL AIR SOURCES

Should the operator have access to a secondary air supply, such as "house" air or perhaps have his own compressor, purchase can be made of any pure air generator without compressor, provided these "on-hand" secondary sources meet the air volume and pressure requirements of the pure air generator being considered.

Performance of the pure air generator will be just as with its own compressor and the output purity will be the same. This also includes operation of the "B" reactor with "house" air.

AADCO offers a special laboratory stopcock adapter for direct connection to "house" air. This adapter, with its own shut-off valve, will drop out most of the oil and water found in this unreliable air supply before admission to the pure air generator. Firm endorsement is made that this item be purchased if the user is considering connection of an AADCO unit to his own air source.

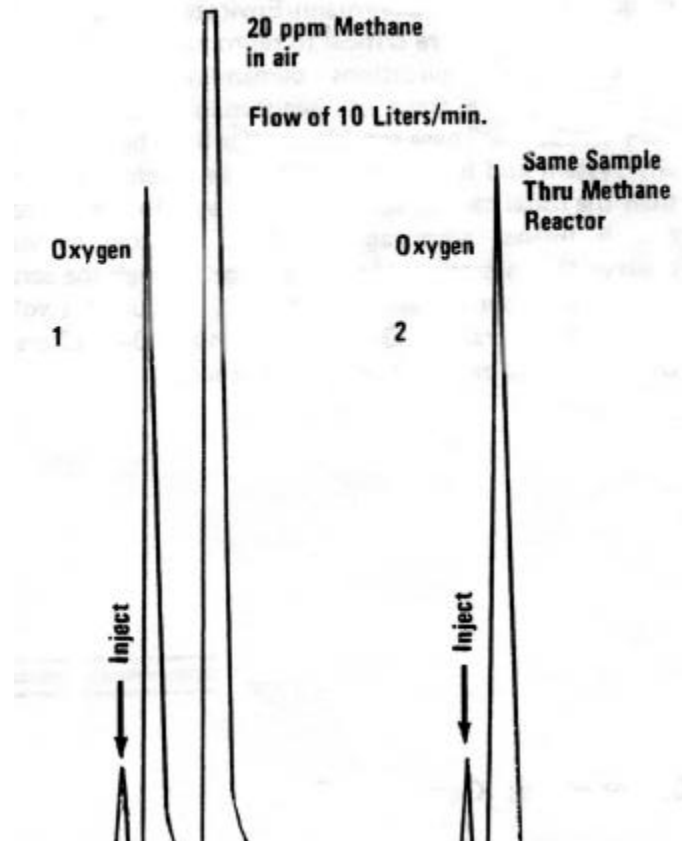
A front panel source selector valve is mounted on all 737-series Pure Air Generators without output volumes of 10-Liters/minute or less. This allows the user the flexibility of simultaneous connection of both "house" air and the pure air generator's own compressor. Both sources would be connected to the appropriately marked bulkhead fittings at the rear of the unit. In this manner, when the "house" air is out of service for repairs or shutdown for any reason, the compressor supplied with the instrument would permit uninterrupted operation by simply turning the source selector valve to the proper position, without disassembling fittings.

METHANE FREE AIR

One of the most difficult contaminants to remove from any air supply is methane. To fulfill the requirement for air which is hydrocarbon-free and, particularly, methane-free, AADCO offers an optional methane reactor. This unit mounts within the pure air generator cabinet and contains its own heating and temperature control system. It is also offered as a free-standing module for those who may wish to incorporate this capability within a system of their own design. Please note cut to the right showing both units and chromatograms which depict the efficiency of oxidation. These modules are special low-temperature catalytic oxidation systems whose effluent does not exceed 35 C during operation. All competitive units utilize hopcalite or other catalysts operated at 900° — 1000 C in order to remove methane. Historically, they are shortlived. AADCO does not have this problem. In addition, the AADCO methane reactors are available in a number of models based upon output volume requirements. Please consult price list and factory for full listing.

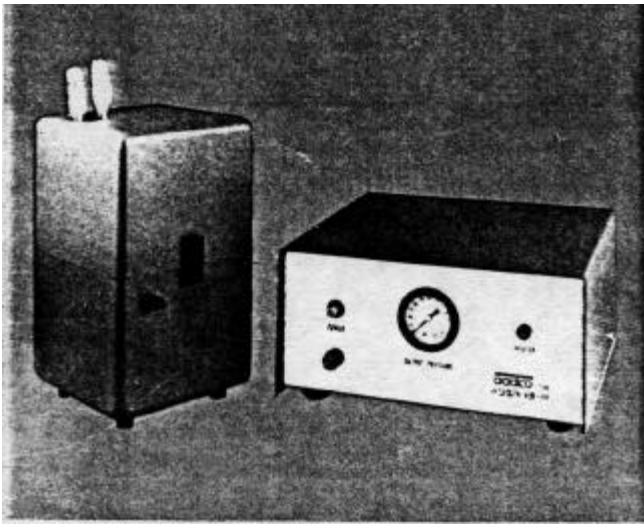
It should be recognized that ambient air can contain methane at concentrations as high as 20 ppm. "House" air can exceed 350 ppm. Because of this, in all cases where "house" air is to be the source air for the pure air generator, the methane reactor should be included. This is especially true if this air is to be used as support air for any flame ionization or flame photometric detector. Use of the methane reactor will nullify the high background and noise generated by the methane with the flame ionization detector and will eliminate the quenching effect with the flame photometric detector. An added bonus to the user is that all CO is oxidized to CO₂ and all NO_x is converted to N₂.

Chromatograms at right exemplify the efficiency of the AADCO 737-40 series methane reactors. Chromatogram No. 1 shows the sample with 20 ppm methane separated and seen with the FID. Chromatogram No. 2 shows the same sample, separated and seen with the FID, after passage through a methane reactor.



FAMILY OF PURIFIERS

In order to be in a position to supply optimum gases for all types of instrumentation, AADCO has developed a family of gas purifiers. They are shown in photo on the next page. These inexpensive and compact units permit the users to be assured that all gases which are employed in the laboratory are really clean. This purifier family includes the AADCO model 560-series of hydrogen purifiers which have been eagerly accepted by those analysts whose instrumentation is adversely affected by dirty hydrogen. Applications include: the Hall detector; the Coulson detector; all thermionic-type detectors used for Phosphorus and/or Nitrogen analyses; Total Organic Carbon Analyzers utilizing the conversion of CO₂ to methane and subsequent detection by flame ionization detectors as with the Dohrmann/Envirotech DC-50, DC-52 and DC-54 series instruments as well as all trace gas systems incorporating the CO or CO₂ conversion to methane. Use of this module will preclude the possibility of ever having a dirty or unusable cylinder of hydrogen in the laboratory.



MAINTENANCE

Several minutes each week is the full amount of time required to maintain a continuously operating pure air generator system. This time is devoted solely to release of any water in the input ballast tank which accumulates due to the compression of room air by the the compressor system. The draining is accomplished while the unit is operating—with no downtime to the system. The pressure of the system is utilized to force the accumulated water from the tank into any receiver.

Casual observation of the input pressure gauge will give rapid indication of compressor fault. Low input pressure usually indicates either a leak or wear within the compressor itself. Should there be problems with the compressor, AADCO offers a swapout service of a rebuilt unit for the defective one. There is little inconvenience to the user since the compressor is shipped complete with silencer housing and the user simply replaces the defective unit with the rebuilt one, returning the defective instrument to the factory. Cost to the user is slight.

Another of the more popular purifiers is the AADCO model 153 Inert Gas Purifier, which will purify cylinders of helium, nitrogen or argon, removing all hydrocarbon from any grade of those gases. Tests in our laboratories have shown marked decreases in background levels for flame ionization detectors which are operated directly from a "dirty" cylinder and then operated from the same cylinder but through an AADCO model 153. Equally pronounced have been the effects of this purifier when used in conjunction with Dohrmann/Envirotech TOC systems, where gas purities are critical to reproducibility.

For those applications demanding CO₂-free gases, AADCO offers a range of "see-through" indicating in-line CO₂ scrubbers. These scrubbers offer little back pressure to any system and have been found to be much more efficient than the usual caustic scrubbers such as Lithium hydroxide, etc. A further advantage lies in being able to visually observe the migration of color change through the scrubber tube as scrubber material is depleted. Throughput volumes cover 0-10 Liters/min. 0-20 Liters/min and 0-40 Liters/min. Other sizes are available on special order.

WARRANTY

AADCO has an unconditional 1-year warranty on all parts and labor for an3 instruments manufactured by AADCO. After this 1-year warranty period, repairs are at AADCO's low rates for parts and service.

FOREIGN SALES

Those foreign laboratories considering the purchase of any AADCO system must specify both voltage and frequency when ordering, to be certain that all components are compatible with the user's electrical system. This information is required, in addition to any notation of intended application and output volume requirements.

Call or write: Generator Sales

aadco

aadco

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