



# FOCUSED ON CHROMATOGRAPHY

AGS-Chromatography-E



ENGINEERING **YOUR** SUCCESS.



## FOCUSED ON PURITY

Offering a wide range of advantages over traditional cylinder gas supply, gas generators are increasingly becoming the popular choice in many laboratories.

In chemical sectors such as pharmaceuticals, polymer, environmental monitoring, CRO, and forensics, scientists rely upon specialized instruments for fast and accurate analysis of compound properties.

A consistent, safe supply of high-purity make-up, carrier, and fuel gases is essential to ensure precise results in separation techniques such as gas chromatography.

The challenge is to find a gas supply solution that meets the quality criteria while being easy to use, cost-efficient, and reliable.



Parker on-site gas generation allows us to have a high-purity, safe, and consistent supply of gas.





### Consistent, reliable purity

Gas purity varies significantly from cylinder to cylinder, and impurities can be introduced via the pipeline during changeover. In contrast, on-site generators consistently supply high-purity gas, preventing variations in quality, and ensuring ultra-sensitive analysis, every time.

Supported by proven, advanced technologies you can trust, Parker gas generators to deliver the reliability and consistency your work demands.

### Expert gas generation solutions

With a history of expertise in gas generation, Parker is perfectly placed to support profitable operations in analytical science. Working with partners in laboratories across a range of sectors, our industry-leading solutions enable consistent accuracy through a constant, on-demand supply of nitrogen, hydrogen, and zero air for carrier, make-up, and fuel gas.

# FOCUSED ON PERFORMANCE

## A safer choice

High-pressure cylinders are inherently linked to safety issues – from the chance of injury through manual handling to the risk of gas leaks, which can make the atmosphere potentially explosive or deficient in oxygen.

Gas generators from Parker are a safe alternative, thanks to leak detection technology with 'auto shut off' and integral alarms. They also operate at a fraction of the pressure and with low volumes of stored gas, further reducing the potential for harm.

These generators eliminate many of the inconveniences of dependence on outside vendors, such as uncontrollable price increases, dewar ice and condensation, contract negotiations, long term commitments, and tank rentals. With a Parker generator, you control your gas supply.

## Cost-efficient with the lowest lifetime cost

In some cases, you can expect to have recouped the cost of your gas generator in less than one year. Energy efficient technologies keep running costs down, there are no hidden charges such as on-going delivery costs, cylinder rental or storage fees for spares and empty cylinders, and maintenance and part replacement costs are minimal.







### Global support for your peace of mind

We know that business continuity is vital to your work. That's why we offer a comprehensive package of expert service, care, and maintenance across our complete analytical gas systems range, worldwide.

From installation, scheduled maintenance, and in very rare cases, emergency assistance, wherever you are, you can trust Parker to give you complete peace of mind.

### Continuous supply, available on-demand

Parker gas generators are engineered to transform standard compressed air into high quality analytical gas at safe, regulated pressures, on demand, without operator attention. Engineered for easy installation, operation, and long term performance, and permanently installed at the point of use, an on-site generator provides you with straightforward access to an unlimited supply of gas. Always at the correct pressure, flow, and temperature, Parker gas generators improve the stability of your instruments and the accuracy of your results.



## NitroVap Gas Generators

Parker NitroVap Nitrogen Generators provide clean, ultra-dry (to  $-20^{\circ}\text{F}$ ) dewpoint evaporator grade nitrogen at high output flows from any standard laboratory compressed air source.

Nitrogen is produced by utilizing a combination of filtration and membrane separation technologies. A high efficiency prefiltration system pretreats the compressed air to remove all contaminants down to 0.01 micron.

Hollow fiber membranes subsequently separate the clean air into a concentrated nitrogen output stream and an oxygen enriched permeate stream, which is vented from the system. The combination of these technologies produces a continuous, on-demand supply of pure nitrogen.

Unique membrane separation technology allows immediate nitrogen delivery to the sample concentrator. "Lock-it-and-leave-it" operation of the sample concentrator is maintained without downtime and without running out of gas mid blow-down.

### NitroVap-1LV & -2LV

- Ideal for any combination of sample evaporators - up to 100 nozzle positions
- Accelerates evaporation by decreasing the partial vapor pressure above the solvent liquid
- Recommended and used by many sample concentrator and sample evaporator manufacturers
- Payback period of typically less than one year
- Sleep economy mode - eliminate compressed air consumption when the sample concentrator is not in use
- Silent operation
- Minimal operator attention required
- Compact; frees up valuable floor space







## Principal Specifications

NitroVap-1LV & -2LV	
Nitrogen Dewpoint	Down to -20°F (-29°C) atmospheric
Maximum Nitrogen Flow Rate	<b>NitroVap-1LV</b> up to 80 slpm @ 100 psig input up to 140 slpm @ 125 psig input
	<b>NitroVap-2LV</b> up to 160 slpm @ 100 psig input up to 287 slpm @ 125 psig input
Electrical Requirements	None
Nitrogen Outlet Pressure	0-15 psig user controlled
Dimensions	10.63" w x 14.1" d x 16.5" h (26.92cm x 35.81cm x 41.91cm)
Inlet Port/Outlet Port	1/4" NPT (female)
Shipping Weight	53 lbs/24 kg

## Ordering Information

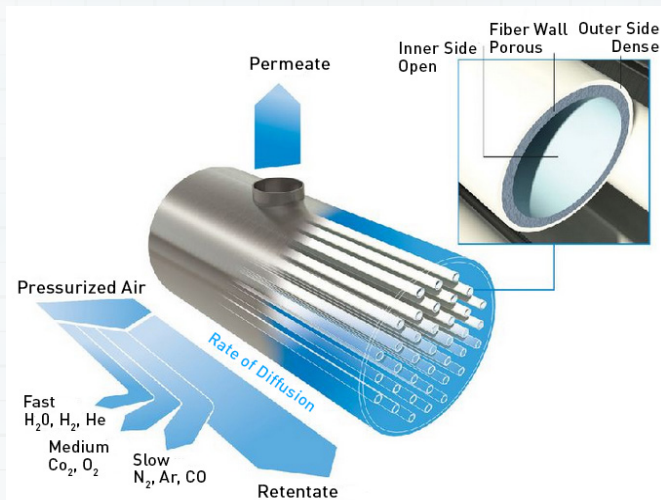
for assistance, call 800-343-4048

Description	Model
NitroVap Nitrogen Generators	NitroVap-1LV and NitroVap-2LV
Maintenance Kit (Includes 1 each filter cartridge, and 1 each membrane cartridge)	MKNITROVAP
Preventive Maintenance Plan	NITROVAP-1LV-PM, NITROVAP-2LV-PM
Extended Support with 24 Month Warranty	NITROVAP-DN2

## Use with These and Other Blowdown Evaporators

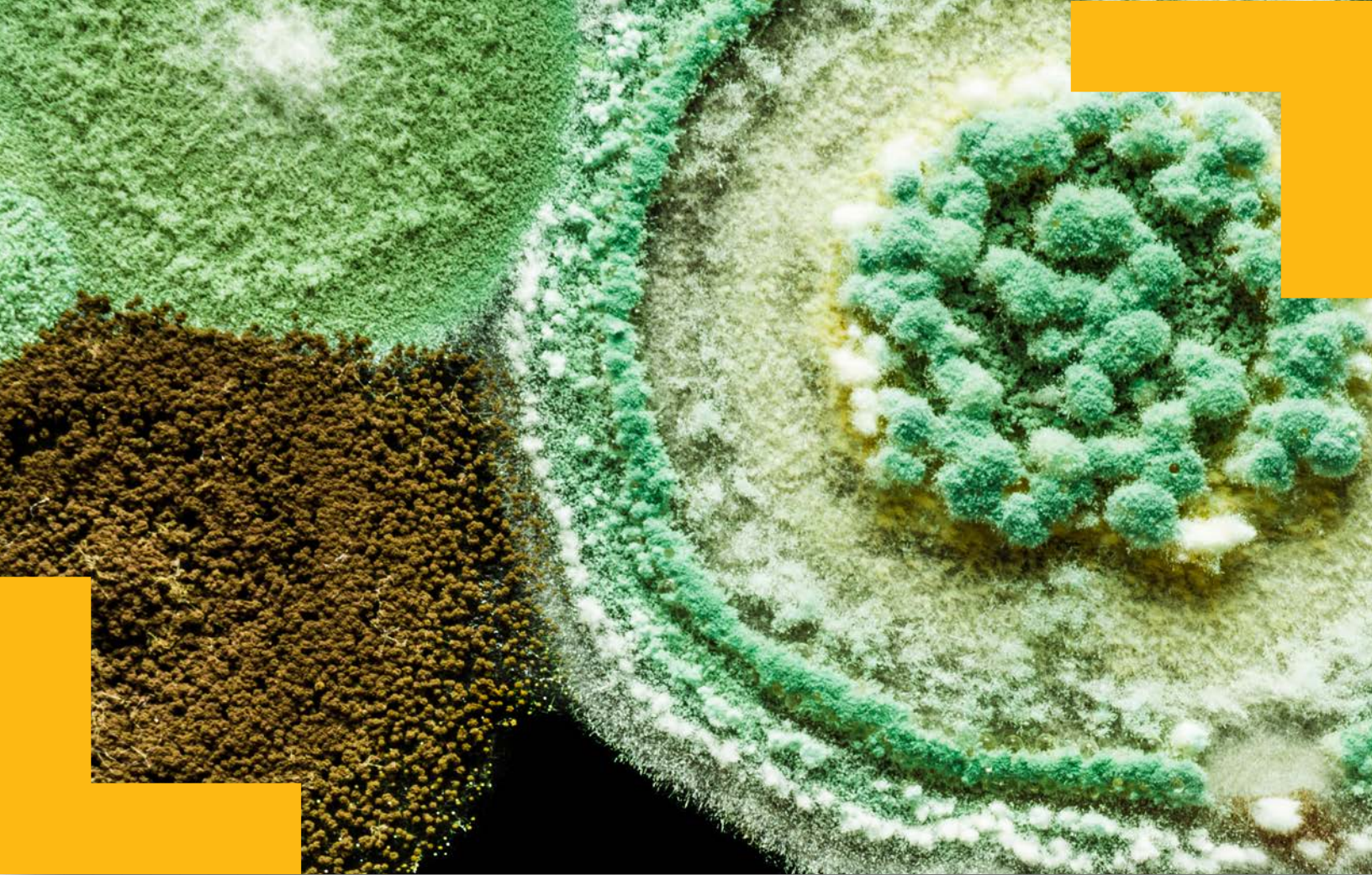
- TurboVap from Biotage
- N-Evap from Organomation
- RapidVap from LabConco
- Reacti-Vap from Fisher Pierce
- Duo-Vap from Jones Chromatography
- DryVap from Horizon Technology
- Evaporex from Apricot

## Gas Separation Membrane



Featuring Parker Advanced HiFlux Fiber





## FID Gas Stations

Parker FID Gas Stations provide both hydrogen gas and zero grade air to FID detectors on gas chromatographs. These systems are specifically designed to provide fuel gas and support air to 5-6 flame ionization detectors, flame photometric detectors, or total hydrocarbon analyzers.

Hydrogen gas is produced from deionized water using a proton exchange membrane cell. The hydrogen generator compartment utilizes the principle of electrolytic dissociation of water and hydrogen proton conduction through the membrane. The hydrogen supply produces up to 250 cc/min of 99.9995% pure hydrogen with pressures to 60 psig.

Zero air is produced by purifying on-site compressed air to a total hydrocarbon concentration of < 0.1 ppm (measured as methane). The zero air compartment produces up to 2500 cc/min of zero grade air.

### FID Gas Station

- Ideal for up to 5-6 FIDs
- Increases the accuracy of analysis
- Reduces the cleaning requirement for the detector
- Recommended and used by many GC and column manufacturers
- Typical payback period of less than one year
- Automatic water fill
- Silent operation
- Minimal operator attention required
- Exceed NFPA 504 and OSHA 1910.103 regulations
- Meet toughest laboratory standards in the world: CSA, UL, and IEC1010





## Principal Specifications

Model	FID-1000NA	FID-2500NA
Hydrogen Purity	99.9995%	99.9995%
Zero Air Purity	< 0.1 ppm (total hydrocarbon as methane)	< 0.1 ppm (total hydrocarbon as methane)
Maximum Hydrogen Flow Rate	90 cc/min	250 cc/min
Maximum Zero Air Flow Rate	1000 cc/min	2500 cc/min
Electrical Requirements	120/230VAC, 60/50Hz, 4 Amps	120/230VAC, 60/50Hz, 4 Amps
Hydrogen Outlet Pressure	60 psig	60 psig
Zero Air Outlet Pressure	40-125 psig	40-125 psig
Certifications	IEC 1010-1; CSA 1010; UL 3101; CE Mark	IEC 1010-1; CSA 1010; UL 3101; CE Mark
Dimensions	10.5" w x 17" d x 16.5" h, (27cm x 43cm x 42cm)	
Inlet Port	1/4" NPTF compressed air supply	1/4" NPTF compressed air supply
Outlet Ports	1/8" compression	1/8" compression
Shipping Weight	53 lbs / 24 kg	53 lbs / 24 kg

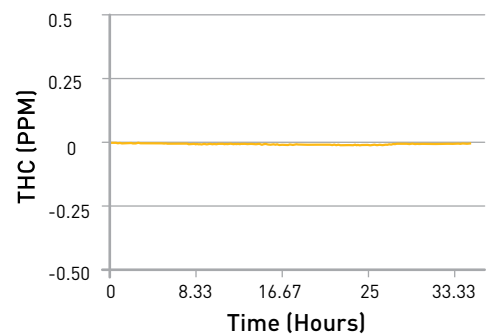
## Ordering Information

for assistance, call 800-343-4048

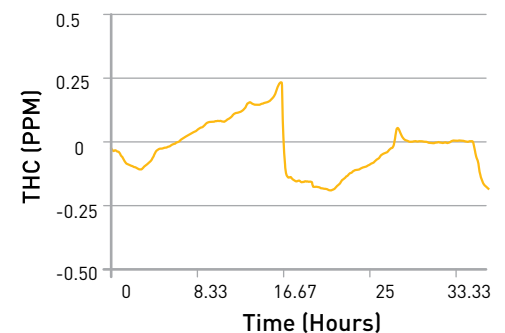
Description	Model
FID Gas Station	FID-1000NA, FID-2500NA
Installation Service	FID-1000-INST, FID-2500-INST
Annual Maintenance Kit	MKFID1000
Preventive Maintenance Plan	FID-1000-PM, FID-2500-PM
Extended Support (24 Month Warranty)	FID-1000-DN2, FID-2500-DN2

The chromatograms below compare baselines produced by a Parker FID gas station and bottled fuel air. The baseline produced by the Parker generator is very flat, with no fluctuations or peaks, in comparison with the chromatogram of the bottled air fuel supply, which has many peaks ranging from .25 ppm to -.25 ppm.

### Baseline FID-2500 Gas Station



### Baseline Bottled Fuel Air



# Hydrogen Generators for Fuel Gas

Parker's fuel gas hydrogen generators utilize proton exchange membrane, which eliminates the use of liquid electrolytes with hydrogen generators.

Deionized water is all that is required to generate hydrogen for weeks of continuous operation. Automatic water filling is available for all fuel gas hydrogen generators. Simply connect your in-house supply of deionized water to the nitrogen generator for virtually hands-free operation.

With an output capacity of up to 510 cc/min, one generator can supply 99.9995% pure hydrogen for up to several FIDs. Based on cylinder gas savings alone, a Parker hydrogen generator pays for itself in less than one year.

## H2PEM Hydrogen Generator

- Ideal for fuel gas for up to 14 FID's
- Exclusive water management system and control circuitry maximize uptime
- Unique display lighting changes color for easy status checks and water level indication
- Remote control and remote monitoring capable by adding USB options bay controller
- Compact - only one square foot of bench space required
- No liquid caustics required
- Includes 2 year cell warranty
- Little maintenance or monitoring required
- Pays for itself in less than one year
- Exceeds NFPA 504 and OSHA 1910.103 regulations
- Meet toughest laboratory standards in the world: CSA, UL, and IEC1010





## Principal Specifications

Model	H2PEM-100	H2PEM-165	H2PEM-260	H2PEM-510
Purity	99.9995%	99.9995%	99.9995%	99.9995%
Flow Rates	100 cc/min	165 cc/min	260 cc/min	510 cc/min
Outlet Port	1/8" compression	1/8" compression	1/8" compression	1/8" compression
Electrical Requirements	100/230VAC, 60/50Hz	100/230VAC, 60/50Hz	100/230VAC, 60/50Hz	100/230VAC, 60/50Hz
Delivery Pressure	5-100 psig ± 0.5 psig	5-100 psig ± 0.5 psig	5-100 psig ± 0.5 psig	5-100 psig ± 0.5 psig
Shipping weight	70 lb (32 kg) dry	70 lb (32 kg) dry	70 lb (32 kg) dry	70 lb (32 kg) dry
Dimensions	17" h x 13.4" w x 18" d (43cm x 34.2cm x 45cm)	17" h x 13.4" w x 18" d (43cm x 34.2cm x 45cm)	17" h x 13.4" w x 18" d (43cm x 34.2cm x 45cm)	17" h x 13.4" w x 18" d (43cm x 34.2cm x 45cm)

## Ordering Information

for assistance, call 800-343-4048

Description	Model
Desiccant Cartridge (1 each)	MKH2PEM-D
6 Month Service Kit	MKH2PEM-6M
24 Month Service Kit	MKH2PEM-24M
Preventative Maintenance Plan	H2PEM-100-PM H2PEM-165-PM H2PEM-260-PM H2PEM-510-PM
Installation Service	H2PEM-100-INST H2PEM-165-INST H2PEM-260-INST H2PEM-510-INST
USB Remote Control Accessory	604970894



# Hydrogen Generators for Fuel and Carrier Gas

## H2PD & H2PEMPD Series

The Parker hydrogen generator is an excellent source of ultra pure, dry hydrogen for a wide range of laboratory uses.

The **H2PD and H2PEMPD series** are used extensively with gas chromatographs, as a fuel gas for flame ionization detectors (FID), as a reaction gas for hall detectors, and as a carrier gas to ensure absolute repeatability of retention times. In high sensitivity trace hydrocarbon analyzers and air pollution monitors, the hydrogen produced ensures the lowest possible background noise.

Other applications include using hydrogen for hydrogenation reactions and for FIDs used in the analysis of engine gas emissions in the automobile industry.



### H2PD Series

- Automatic water fill for endless operation
- Produces a continuous supply of 99.99999+% pure hydrogen gas without snap on downstream purifiers
- Compact - only one square foot of bench space required
- Designed to run continuously 24 hours/day
- Unique (NM) no maintenance palladium membrane prevents baseline drift unlike auto-drying technologies
- Exceeds OSHA 1910.103 and NFPA 50A safety guidelines

Hydrogen gas is produced by electrolytic dissociation of water. The resultant hydrogen stream then passes through a palladium membrane to assure carrier grade purity. Only hydrogen and its isotopes can penetrate the palladium membrane; therefore, the purity of the output gas is guaranteed to be 99.99999+% consistently. This technology produces hydrogen at a guaranteed purity two orders of magnitude greater than desiccant or silica gel technologies. Generator flow capacities of up to 300 cc/min. of ultra high purity hydrogen are available.



Our H2 generator has saved us time, space, and money over a traditional tank configuration. We realized a return on our investment in less than one year and no longer have to manage bulky and unsightly tanks in the lab.”

John Ross  
Director Corporate Quality  
Ungerer & Company





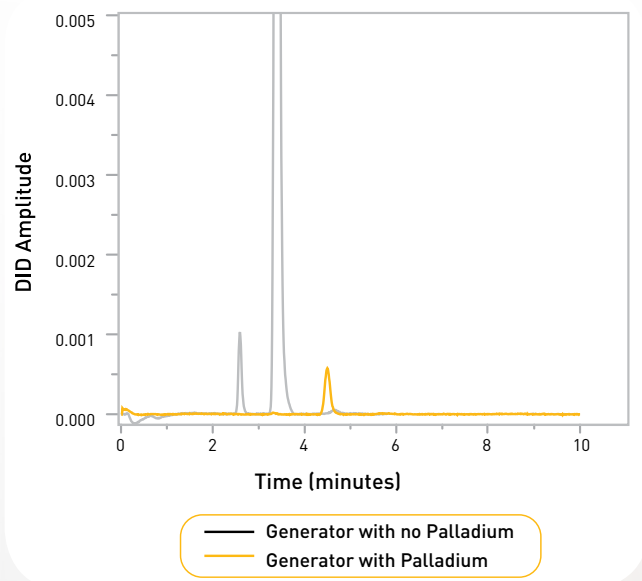
## H2PEMPD Series

- Flow capacity up to 1,300 cc/min
- Delivery pressure of up to 175 PSIG; ideal for high speed and fast GC applications
- Produces a continuous supply of 99.9999+% pure hydrogen gas; palladium membrane prevents baseline drift unlike auto-drying technologies
- Compact - only one square foot of bench space required
- Standard automatic water feed for 24/7 operation
- Optional cascading feature enables users to connect as many as 32 H<sub>2</sub> generators together to supply a large number of instruments
- Remote monitoring via PC
- Advanced PEM electrochemical cell protection system with microprocessor controls
- Little maintenance or monitoring required
- Pays for itself in less than one year
- Includes 3 year cell warranty
- Exceeds OSHA 1910.103 and NFPA 50A safety guidelines

The Parker **H2PEMPD series** of Hydrogen generators use a proton exchange membrane (PEM) to produce hydrogen on demand. Each generator incorporates a maintenance free palladium purifier module to remove oxygen down to <0.01 ppm and moisture down to <1.0 ppm. Only 100 mL of hydrogen gas is stored in the system at any time.

The **H2PEMPD series** of hydrogen generators incorporate break-through software and microprocessor controls to provide many new features. Up to 32 hydrogen generators can be connected together using Parker's cascading, load balancing software to supply gas to a large gas delivery system. Data logging of gas generator performance is incorporated into the H2PEMPD series for use in regulated environments where system validation may be required.





**Simple Experimental:** The two merged baselines in the right chromatogram were created using a Gow-Mac Gas Chromatograph Series 590 equipped with a (DID) discharge ionization detector with hydrogen separator. In creating both baselines (black and red) the gas sample is hydrogen from a hydrogen generator. Both generators are the same - as hydrogen gas is produced from water via electrolytic disassociation, but differ slightly as one generator incorporates a desiccant drying tube as a final purifier while the second generator has a palladium membrane as the final purifier.

The large black peak represents a combined 12 ppm concentration of oxygen and nitrogen, suitable for hydrogen fuel gas while the corresponding point in the red baseline represents a combined 12 ppb concentration of oxygen and nitrogen, suitable for either fuel or carrier gas.

## Principal Specifications

Model	H2PD-150	H2PD-300
Hydrogen Purity	99.99999+%	99.99999+%
Oxygen Content	< 0.01 ppm	< 0.01 ppm
Moisture Content	<1.0 ppm	< 0.01 ppm
Max Hydrogen Flow Rate	150 cc/min	300 cc/min
Electrical Requirements	120/230 VAC, 60/50 Hz, 3.5 Amps	120/230 VAC, 60/50 Hz, 3.5 Amps
Hydrogen Outlet Pressure	Adjustable, 0 to 60 psig	Adjustable, 0 to 60 psig
Certifications	IEC 1010-1; CSA; UL 3101; CE Mark	IEC 1010-1; CSA; UL 3101; CE Mark
Dimensions	12" w x 12" d x 22" h (30cm x 33cm x 58cm)	12" w x 12" d x 22" h (30cm x 33cm x 58cm)
Outlet Ports	1/8" compression	1/8" compression
Shipping Weight	55 lbs (25 kg)	55 lbs (25 kg)

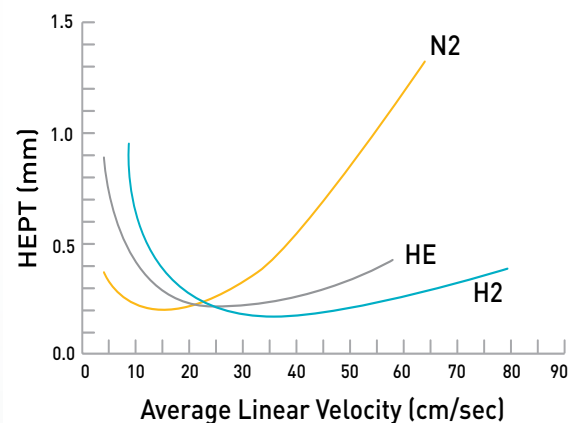
Model	H2PEMPD-510	H2PEMPD-650	H2PEMPD-850	H2PEMPD-1100	H2PEMPD-1300
Hydrogen Purity	99.99999+%	99.99999+%	99.99999+%	99.99999+%	99.99999+%
Max Hydrogen Flow Rate	510 cc/min	650 cc/min	850 cc/min	1100 cc/min	1300 cc/min
Oxygen Content	< 0.01 ppm	< 0.01 ppm	< 0.01 ppm	< 0.01 ppm	< 0.01 ppm
Water Content	< 0.01 ppm	< 0.01 ppm	< 0.01 ppm	< 0.01 ppm	< 0.01 ppm
Max Outlet Pressure <sup>(1)</sup>	100 or 175 psig (6.8 or 11.9 Bar)	100 or 175 psig (6.8 or 11.9 Bar)	100 or 175 psig (6.8 or 11.9 Bar)	100 or 175 psig (6.8 or 11.9 Bar)	100 or 175 psig (6.8 or 11.9 Bar)
Electrical Requirements	100 to 230 VAC, 50/60 Hz	100 to 230 VAC, 50/60 Hz	100 to 230 VAC, 50/60 Hz	100 to 230 VAC, 50/60 Hz	100 to 230 VAC, 50/60 Hz
Outlet Connection	1/4" Compression	1/4" Compression	1/4" Compression	1/4" Compression	1/4" Compression
Dimensions	17.1" h x 13.5" w x 21" d (43.5cm x 34cm x 53cm) for all models				
Shipping Weight	94 lb (42.6 kg)	94 lb (42.6 kg)	94 lb (42.6 kg)	94 lb (42.6 kg)	94 lb (42.6 kg)

### NOTES

- H2PEMPD Hydrogen Generators are available with maximum pressure of either 100 or 175 PSIG. See Ordering Information for pressure selection



The Van Deemter Curves (right) show a comparison of nitrogen, helium and hydrogen carrier gases. A Parker hydrogen generator will also allow the user to exploit the benefits of using hydrogen carrier gas instead of helium. Increased flow velocity can shorten analysis time by 50%.



**Ordering Information** for assistance, call 800-343-4048

Description	Model
Hydrogen Gas Generator	H2PD-150, H2PD-300
Installation Kit	IK7532
Preventive Maintenance Plan	H2PD-150-PM, H2PD-300-PM
Extended Support (24 Month Warranty)	H2PD-150-DN2, H2PD-300-DN2

Description	H2PEMPD-510	H2PEMPD-650	H2PEMPD-850	H2PEMPD-1100	H2PEMPD-1300
Max Outlet Pressure to 100 PSIG (6.8 bar)	H2PEMPD-510-100	H2PEMPD-650-100	H2PEMPD-850-100	H2PEMPD-1100-100	H2PEMPD-1300-100
Max Outlet Pressure to 175 PSIG (11.9 bar)	H2PEMPD-510-175	H2PEMPD-650-175	H2PEMPD-850-175	H2PEMPD-1100-175	H2PEMPD-1300-175
Annual Preventive Maintenance	H2PEMPD-510-PM	H2PEMPD-650-PM	H2PEMPD-850-PM	H2PEMPD-1100-PM	H2PEMPD-1300-PM
Semi Annual Preventive Maintenance	H2PEMPD-510-PMPLUS	H2PEMPD-650-PMPLUS	H2PEMPD-850-PMPLUS	H2PEMPD-1100-PMPLUS	H2PEMPD-1300-PMPLUS



# Zero Air Generators

## HPZA Series

- Produce UHP zero air from house compressed air (<0.05 ppm THC)
- Easy installation and operation
- Increase the accuracy of analysis and reduce the cleaning requirement of the detector
- Qualitative SMART-Display provides operational status at a glance
- Recommended and used by many GC and column manufacturers
- Typical payback period of less than 1 year
- Silent operation and minimal operator attention required
- Models available to service up to 66 FIDs



Number of FIDs	Model Number
Up to 2	75-83NA
Up to 8	HPZA-3500
Up to 16	HPZA-7000
Up to 40	HPZA-18000
Up to 66	HPZA-30000

Based on a 450 ccm fuel air rate.

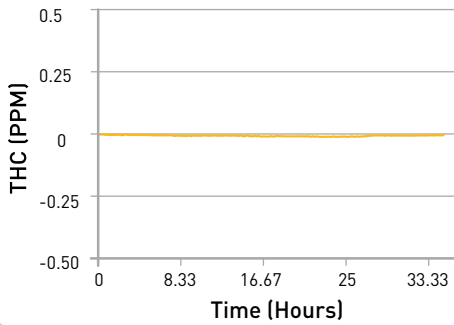




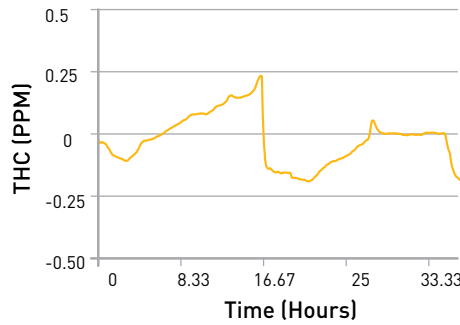
# Principal Specifications

Model	75-83NA	HPZA-3500	HPZA-7000	HPZA-18000	HPZA-30000
Max Zero Air Flow Rate	1 lpm	3.5 lpm	7 lpm	18 lpm	30 lpm
Outlet Hydrocarbon Concentration (as methane)	< 0.1 ppm	< 0.05 ppm	< 0.05 ppm	< 0.05 ppm	< 0.01 ppm
Min/Max Inlet Air Pressure	40 psig/125 psig	40 psig/125 psig	40 psig/125 psig	40 psig/125 psig	40 psig/125 psig
Max Inlet Hydrocarbon Concentration (as methane)	100 ppm	100 ppm	100 ppm	100 ppm	100 ppm
Pressure Drop at Max Flow Rate	4 psig	4 psig	4 psig	4 psig	4 psig
Max Inlet Air Temperature	78°F (25°C)	78°F (25°C)	78°F (25°C)	78°F (25°C)	78°F (25°C)
Inlet/Outlet Ports	1/4" NPT (female)	1/4" NPT (female)	1/4" NPT (female)	1/4" NPT (female)	1/4" NPT (female)
Electrical Requirements	120/230V, 60/50Hz	120/230V, 60/50Hz	120/230V, 60/50Hz	120/230V, 60/50Hz	120/230V, 60/50Hz
Dimensions	10" w x 3" d x 12" h (25cm x 8cm x 30cm)	1" w x 13" d x 16" h (27cm x 34cm x 42cm)	1" w x 13" d x 16" h (27cm x 34cm x 42cm)	1" w x 13" d x 16" h (27cm x 34cm x 42cm)	1" w x 13" d x 16" h (27cm x 34cm x 42cm)
Shipping Weight	7 lbs. (3 kg)	41 lbs. (19 kg)	41 lbs. (19 kg)	41 lbs. (19 kg)	41 lbs. (19 kg)

**Baseline 75-83NA  
Zero Air Generator**



**Baseline Bottled Fueled Air**



The chromatograms (left) compare baselines produced by a Parker zero air generator and bottled fuel air. The baseline produced by the Parker generator is very flat, with no fluctuations or peaks, in comparison with the chromatogram of the bottled air fuel supply, which has many peaks ranging from .25 ppm to -.25 ppm.

## Ordering Information

for assistance, call 800-343-4048

Description	Model
Zero Air Generator	75-83NA, HPZA-3500, HPZA-7000, HPZA-18000, HPZA-30000
Maintenance Kit for Model 75-83NA	MK7583
Maintenance Kit for All Other Models	MK7840
Installation Kit for All Models	IK76803
Preventive Maintenance Plan	75-83-PM, HPZA-3500-PM, HPZA-7000-PM, HPZA-18000-PM, HPZA-30000-PM
Extended Support (24 Month Warranty)	75-83-DN2, HPZA-3500-DN2, HPZA-7000-DN2, HPZA-18000-DN2, HPZA-30000-DN2



## Nitrogen Generator with Research Grade Purity

### Model UHPN2-1100

- Compact design frees up valuable laboratory floor space
- Ideal for carrier gas applications

**The UHPN2 Nitrogen Generator is engineered to transform standard compressed air into 99.9999% nitrogen, exceeding the specification of UHP cylinder gas.**

This system can produce up to 1.1 lpm of UHP nitrogen gas by utilizing a combination of state-of-the-art purification technologies and high efficiency filtration. Pressure swing adsorption removes O<sub>2</sub>, CO<sub>2</sub>, and water vapor. A catalyst module is incorporated in the UHPN2 Series to oxidize hydrocarbons from the inlet air supply. High efficiency coalescing prefilters and a 0.01 micron (absolute) membrane filter is also incorporated into the design of the generators. Typical applications include GC carrier and make-up gas and low flow sample concentrators.







## Principal Specifications

Description	UHPN2-1100
Max Nitrogen Flow Rate	See flow table
Nitrogen Purity	99.9999%
Max Nitrogen Output Pressure	See flow table
CO Concentration	<1 ppm
CO <sub>2</sub> Concentration	<1 ppm
O <sub>2</sub> Concentration	<1 ppm
H <sub>2</sub> O Concentration	<1 ppm
Argon Concentration	0.9%
Min/Max Inlet Pressure	60 psig/125 psig
Recommended Inlet Temperature	78°F (25°C)
Ambient Operating Temperature	60°F-100°F (16°C-38°C)
Max Air Consumption	42 lpm (1.5 scfm)
Inlet Connection	1/4" NPT (female)
Outlet Connection	1/8" NPT (female)
Electrical Requirements	120/230 VAC, 60/50 Hz
Power Consumption	700 Watts
Dimensions	12" w x 16" d x 35" h (31cm x 41cm x 89cm)
Shipping Weight	137 lbs. (62 kg)

## Flow Table

Inlet Air Pressure (psig)	Max Outlet Flow (cc/min.)	Max Outlet Pressure (psig)
125	1100	85
110	1000	75
100	900	65
90	800	60
80	700	50
70	600	45
60	500	35

## Ordering Information for assistance, call 800-343-4048

Description	Model
Ultra High Purity Nitrogen Generator	UHPN2-1100
Optional Prefilter Scrubber Assembly	76080
Maintenance Kit	MK7694
Installation Kit	IK7694
Preventive Maintenance Plan	UHPN2-1100-PM
Extended Support (24 Month Warranty)	UHPN2-1100-DN2

### NOTES

1. Purity specification for Nitrogen does not include Argon concentration.

# Zero Nitrogen Generators for GC Carrier Gas and Makeup Gas Applications

## UHPZN2 Series



Parker Zero Nitrogen Generators are engineered to transform standard compressed air in to a safe regulated supply of 99.9995% pure nitrogen, with <0.1ppm of hydrocarbons.

- Ideal for make-up and carrier gas applications including ECD
- Integral oil free compressors with noise reduction technology
- Economy mode: increasing compressor life and reducing ongoing running costs
- Designed to run 24 hours a day

Typical applications include GC make up gas and carrier gas, including ECD (Electron Capture Detector), DSC (Differential Scanning Calorimeter), and virtually any analytical instrument that requires a small flow of ultra high purity zero nitrogen.

Innovative design features include integral compressors with economy mode as standard. This extends compressor life and reduces ongoing running costs.

Nitrogen is produced by utilizing a combination of filtration and pressure swing adsorption (PSA) technology. Standard compressed air is filtered by high efficiency coalescing filters to remove all contaminants down to 0.01 micron. For ultra sensitive applications such as ECD, units also include the addition of a heated catalyst module to ensure hydrocarbons are removed to < 0.1ppm.

The air then passes through two columns filled with proprietary carbon molecular sieve (CMS) which adsorb O<sub>2</sub>, CO<sub>2</sub>, moisture and hydrocarbons. These are desorbed to atmosphere during the pressure swing cycle leaving a supply of ultra pure nitrogen.





## Principal Specifications

Description	UHPZN2-1000C-W	UHPZN2-3000C-W
Purity	99.9995%	99.9995%
Hydrocarbon Concentration	<0.1ppm	<0.1ppm
CO Concentration	<1 ppm	<1 ppm
CO <sub>2</sub> Concentration	<1 ppm	<1 ppm
H <sub>2</sub> O Concentration	<1 ppm	<1 ppm
Flow Rates	1 L/min	3 L/min
Inlet Pressure	N/A	N/A
Outlet Pressure	75 psig (5 bar)	75 psig (5 bar)
Integral Compressor	Yes	Yes
Inlet Connection	N/A	N/A
Outlet Connection	1/8"	1/8"
Ambient Temperature	60 to 77°F (15 to 25°C)	60 to 77°F (15 to 25°C)
Electrical Requirements	120/230VAC, 60/50Hz	120/230VAC, 60/50Hz
Power Consumption	1250 Watts	1250 Watts
Dimensions (HxWxD)	34.2" x 13.6" x 26.3" (869mm x 345 mm x 668 mm)	34.2" x 13.6" x 26.3" (869mm x 345 mm x 668 mm)
Shipping Weight	212 lbs (96 Kg)	212 lbs (96 Kg)

## Ordering Information

for assistance, call 800-343-4048

Description	Model
1,000 ml/min Zero UHP Nitrogen Generator with Integral Compressor	UHPZN2-1000C-W
3,200 ml/min Zero UHP Nitrogen Generator with Integral Compressor	UHPZN2-3000C-W
Installation Kit	IK7694

Maintenance Items	Model Number	Change Frequency
Filter Kit - All Non Compressor Models	MKUHPZN2-FK	12 months
Filter Kit - All Compressor Models	MKUHPZN2CL-FK	12 months
Compressor Kit 230V - All Models	MKN2-CK230L	14,000 hours or 12 months (whichever comes sooner)



## High Purity Nitrogen Generators for GC and Other Analytical Applications

Nitrogen on demand, up to 3,200 ml/min

### UHPN2 Series

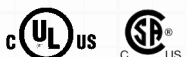
**Parker High Purity Nitrogen Generators are engineered to transform standard compressed air in to a safe regulated supply of 99.9995% nitrogen.**

- Produces a continuous supply of high purity nitrogen 99.9995% for analytical applications
- Minimal operator attention and maintenance required
- Integral oil free compressors with noise reduction technology
- Economy mode: increasing compressor life and reducing ongoing running costs
- Designed to run 24 hours a day

Nitrogen is produced by utilizing a combination of filtration and pressure swing adsorption (PSA) technology. Standard compressed air is filtered by high efficiency coalescing filters to remove all contaminants down to 0.01 micron.

The air then passes through two columns filled with proprietary carbon molecular sieve (CMS) which adsorb O<sub>2</sub>, CO<sub>2</sub>, moisture and hydrocarbons. These are desorbed to atmosphere during the pressure swing cycle leaving a supply of ultra pure nitrogen.

Typical applications include GC make up gas, solvent evaporation, DSC (Differential Scanning Calorimeter) and virtually any analytical instrument that requires a small flow of ultra high purity nitrogen.





## Principal Specifications

	UHPN2-600	UHPN2-600C	UHPN2-800	UHPN2-800C	UHPN2-1600	UHPN2-1600C	UHPN2-3200	UHPN2-3200C
Purity	99.9995%	99.9995%	99.9995%	99.9995%	99.9995%	99.9995%	99.9995%	99.9995%
Hydrocarbon Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CO Concentration	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm
CO <sub>2</sub> Concentration	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm
H <sub>2</sub> O Concentration	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm
Flow Rates	600ml/min	600ml/min	800ml/min	800ml/min	1600ml/min	1600ml/min	3200ml/min	3200ml/min
Inlet Pressure	115-145 psig (8-9.9 bar)	N/A	115-145 psig (8-9.9 bar)	N/A	115-145 psig (8-9.9 bar)	N/A	115-145 psig (8-9.9 bar)	N/A
Outlet Pressure	75 psig (5 bar)	75 psig (5 bar)	75 psig (5 bar)	75 psig (5 bar)	75 psig (5 bar)	75 psig (5 bar)	75 psig (5 bar)	75 psig (5 bar)
Integral Compressor	No	Yes	No	Yes	No	Yes	No	Yes
Inlet Connection	1/4"	N/A	1/4"	N/A	1/4"	N/A	1/4"	N/A
Outlet Connection	1/8"	1/8"	1/8"	1/8"	1/4"	1/4"	1/4"	1/4"
Ambient Temperature	60 to 77°F (15 to 25°C)	60 to 77°F (15 to 25°C)	60 to 77°F (15 to 25°C)	60 to 77°F (15 to 25°C)	60 to 77°F (15 to 25°C)	60 to 77°F (15 to 25°C)	60 to 77°F (15 to 25°C)	60 to 77°F (15 to 25°C)
Electrical Requirements	120/230VAC, 60/50Hz	120/230VAC, 60/50Hz	120/230VAC, 60/50Hz	120/230VAC, 60/50Hz	120/230VAC, 60/50Hz	120/230VAC, 60/50Hz	120/230VAC, 60/50Hz	120/230VAC, 60/50Hz
Power Consumption	85 Watts	606 Watts	85 Watts	606 Watts	88 Watts	698 Watts	88 Watts	698 Watts
Dimensions (HxWxD)	34" x 14" x 16" (869 x 345 x 417mm)	34" x 14" x 16" (869 x 345 x 417mm)	34" x 14" x 16" (869 x 345 x 417mm)	34" x 14" x 16" (869 x 345 x 417mm)	34" x 14" x 16" (869 x 345 x 417mm)	34" x 14" x 16" (869 x 345 x 417mm)	34" x 14" x 16" (869 x 345 x 417mm)	34" x 14" x 16" (869 x 345 x 417mm)
Shipping Weight	97lbs (44Kg)	110lbs (50Kg)	97lbs (44Kg)	110lbs (50Kg)	185lbs (84Kg)	205lbs (93Kg)	185lbs (84Kg)	205lbs (93Kg)

## Ordering Information

for assistance, call 800-343-4048

Description	Model
600 ml/min UHP Nitrogen Generator	UHPN2-600
600 ml/min UHP Nitrogen Generator with Integral Compressor	UHPN2-600C
800ml/min UHP Nitrogen Generator	UHPN2-800
800ml/min UHP Nitrogen Generator with Integral Compressor	UHPN2-800C
1600ml/min UHP Nitrogen Generator	UHPN2-1600
1600ml/min UHP Nitrogen Generator with Integral Compressor	UHPN2-1600C
3,200 ml/min UHP Nitrogen Generator	UHPN2-3200
3,200ml/min UHP Nitrogen Generator with Integral Compressor	UHPN2-3200C
Installation Kit	IK7694

Description	Model Number	Change Frequency
Filter Kit - All Non Compressor Models	MKUHPN2-FK	12 months
Filter Kit - UHPN2-600C/800C Models	MKUHPN2C-FK	12 months
Filter Kit UHPN2-1600C / 3200C Models	MKUHPN2CL-FK	12 months
Compressor Kit 230V - UHPN2-600C/800C Models	MKN2CK230S	8,000 hours or 24 months (which ever comes first)
Compressor Kit 230V UHPN2-1600C/3200C Models	MKN2-CK230L	8,000 hours or 24 months (which ever comes first)

# Flame-Proof Zero Air Generator



## Model 75-82S

The Parker Model 75-82S Zero Air Generator produces up to 1,000 cc/min. of high purity zero grade air from a standard compressed air supply. The generator utilizes state-of-the-art catalytic technology to continuously convert compressed air into zero-grade air, at safe regulated pressures, without need for operator attention.

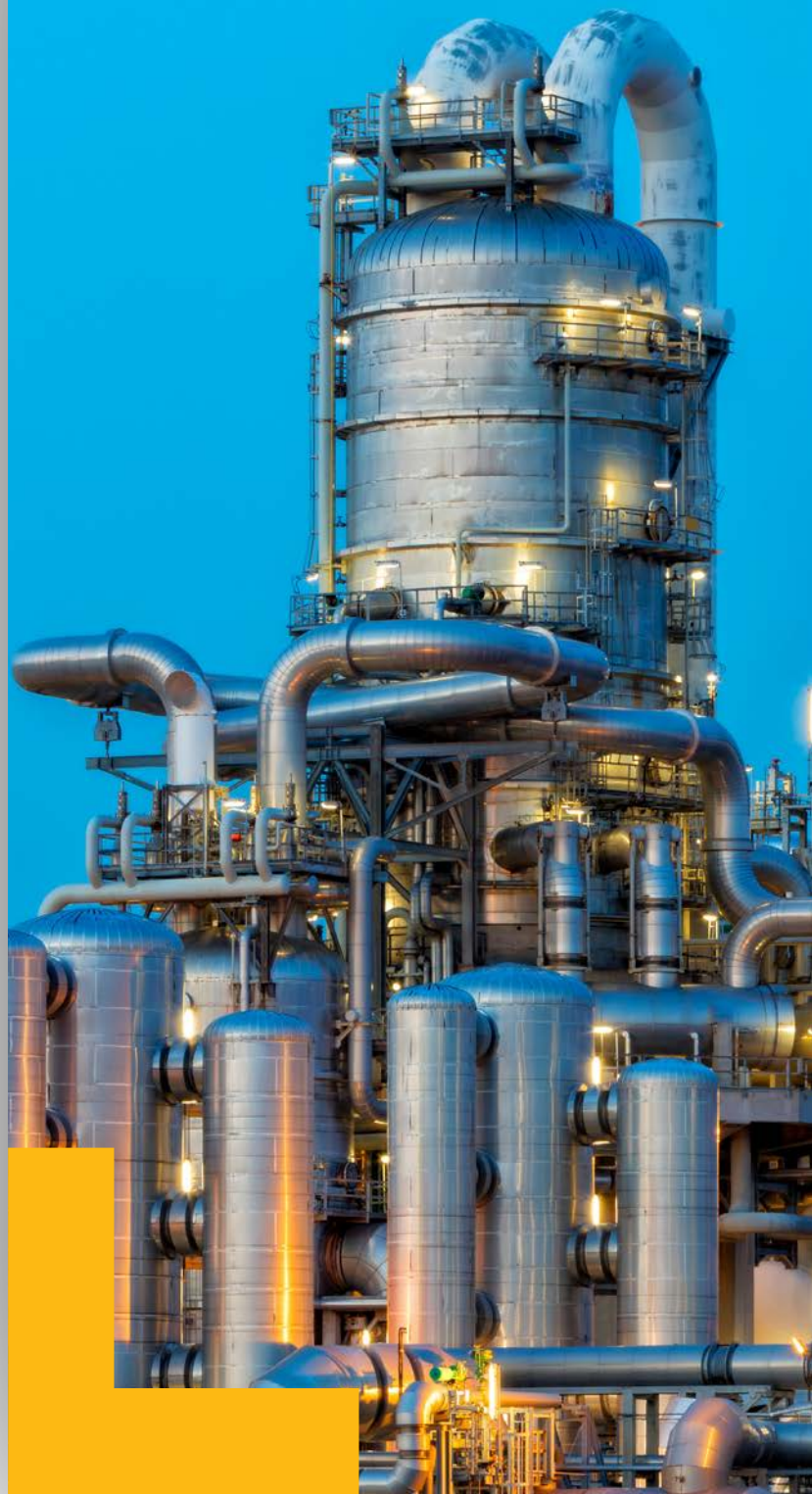
- Safe, even in explosive environments
- Low maintenance
- Produces a continuous supply of ultra high purity zero grade air
- Compact - frees up valuable floor space
- Designed to mount on Unistrut® framing or directly on the wall

The housing is a standard Crouse-Hinds® flame-proof enclosure designed to operate in a class 1, division 1, groups B, C, or D environment. The internals are all stainless steel.

Model 75-82S Zero Air Generator can be used as a fuel air supply to process GC-FIDs, and as a zero grade gas supply/zero reference for process analytical instruments.

Zero grade air is produced from compressed air by means of catalytic oxidation. The compressed air is channeled into a heated catalyst bed where the hydrocarbons are converted to carbon dioxide and water vapor, producing zero-grade air with less than 0.1 ppm hydrocarbon content (measured as methane).

The use of a 75-82S Zero Air Generator has advantages over the conventional sources of fuel air for GC analysis. For example, a lower and more stable baseline signal can be obtained. Lower baseline noise means higher signal-to-noise ratio, giving rise to higher sensitivity or larger peak areas. The result is increased accuracy and reduced cleaning requirement of the detector.







## Principal Specifications

Description	Model
Zero Air Generator	75-82S
Flame-Proof Certification (CSA NRTL/C)	Class 1, Division 1, Groups B, C, and D
Maximum Flow Rate	1000 cc/min.
Total Hydrocarbon Concentration	< 0.1 ppm (measured as methane)
Min./Max. Inlet Pressure	40 psig/125 psig
Maximum Inlet Hydrocarbon Content	100 ppm
Maximum Inlet Air Dewpoint	10°F (5°C) above ambient
Pressure Drop at Max. Flow Rate	< 8 psid
Ambient Temperature	40°F to 100°F (4°C to 38°C)
Electrical Requirements <sup>(1)</sup>	120/230 VAC, 60/50 Hz
Shipping Weight	28 lbs. (13 kg)
Dimensions	11" w x 7" h x 6" d (28 x 18 x 15 cm)

## Ordering Information

for assistance, call 800-343-4048

Description	Model
Zero Air Generator	75-82S
Replacement Catalyst Module	75398
Final Filter Cartridge	75820
Optional Prefilter Assemblies	2002N-1B1-DX, 2002N-1B1-BX
Installation Kit	IK76803
Preventive Maintenance Plan	75-82S-PM
Extended Support (24 Month Warranty)	75-82S-DN2

## Recommended Gas Generators for Analytical Instruments

Instrument	Gas Requirements	Gas Purity Requirements	Flow Rates	Generator Recommendation/Model
Atomic Absorption (AA) with Flame	Air for Oxidant Gas	Clean, dry	1-7 SCFM	<b>AA Gas Purifier</b> Model 73-100
Atomic Thermal Desorber	Zero Air Hydrogen for FID Fuel	Clean, dry, hydrocarbon-free Clean, dry, high purity	Up to 1600 ml/ min.	<b>Zero Air or TOC Gas Generator</b> HPZA-3500 or TOC-1250
Atmospheric Pressure Ionization (API-MS)	Air for nebulizer gas, nitrogen for curtain, sheath, and shield gas	Clean, dry, hydrocarbon-free 99% or higher (Nitrogen or Zero Air)	20-67 lpm	<b>Nitrogen Generator</b> N2-14, N2-22, N2-35, N2-45, N2-80, N2-135, N2-200, Nitroflowlab, Nitroflow60, NitroflowTG1, NitroflowTG2, 76-98-N100, 76-98-N200, 76080
Autosamplers for Various Instruments	Air for pneumatic controls, nitrogen for sample injector	Clean, dry Ultra high purity	<1 SCFM <550 cc/min	<b>Membrane Air Dryer</b> 64-02 <b>UHP Nitrogen Generator</b> UHPN2-1100
CO <sub>2</sub> Analyzers	Calibration Air	CO <sub>2</sub> free	0.5-1.0 SLPM	<b>FT-IR Purge Gas Generator</b> Spectra15, Spectra30
Continuous Emissions Monitoring (CEM)	Calibration Air Dilution Air	Dry, CO <sub>2</sub> , SO <sub>2</sub> , NO <sub>x</sub> , Hydrocarbon-free	10-15 SLPM	<b>CEM Zero Air Generator</b> 75-45-M744
Emissions Analyzers	Zero Air	Hydrocarbon-free	2-15 SLPM	<b>Zero Air Generator</b> HPZA-18000
Fourier Transform Infrared Spectrometer (FT-IR)	Air for sample compartment, optics, and/or air-bearing	Clean, dry, CO <sub>2</sub> -free	0.5-3 SCFM	<b>FT-IR Purge Gas Generator</b> Spectra 15, Spectra 30 <b>Lab Gas Generator</b> 74-5041NA
Gas Chromatograph (GC) GC-FID	Zero air as flame support air Hydrogen as flame fuel gas Hydrogen as capillary carrier gas Nitrogen as packed carrier gas Nitrogen as make up gas	Clean, hydrocarbon-free Ultra high purity Ultra high purity Ultra high purity, zero grade Ultra high purity, zero grade	150-600 cc/min. 30-40 cc/min. Varies Varies <100 cc/min	<b>Zero Air Generator</b> HPZA-3500 <b>Hydrogen Generator</b> H2PEM-260 <b>Hydrogen Generator</b> H2PD-300 <b>UHP Nitrogen Generator</b> UHPN2-1100 <b>UHP Nitrogen Generator</b> UHPN2-1100
GC-FPD	Zero Air as Flame Support Air Hydrogen as Flame Fuel Gas Hydrogen as Capillary Carrier Gas Nitrogen as Packed Carrier Gas	Clean, hydrocarbon-free Ultra high purity Ultra high purity Ultra high purity	<200 cc/min 50-70 cc/min Varies Varies	<b>Zero Air Generator</b> HPZA-3500 <b>Hydrogen Generator</b> H2PEM-260 <b>Hydrogen Generator</b> H2-1200 <b>UHP Nitrogen Generator</b> UHPN2-1100
GC-NPD	Zero Air to Rubidium/Thermonic Bead Hydrogen as Detector Support Gas Hydrogen as Capillary Carrier Gas Nitrogen as Packed Carrier Gas	Dry, clean, hydrocarbon-free Ultra high purity Ultra high purity Ultra high purity	<200 cc/min <10 cc/min Varies Varies	<b>Zero Air Generator</b> HPZA-3500 <b>Hydrogen Generator</b> H2PEM-100 <b>Hydrogen Generator (Palladium)</b> H2PD-300 <b>UHP Nitrogen Generator</b> UHPN2-1100
GC-ECD	Nitrogen as carrier gas Nitrogen as make up gas	Ultra high purity, zero grade Ultra high purity, zero grade	Varies <100 cc/min	<b>UHP Nitrogen Generator</b> UHPN2-1100 <b>UHP Nitrogen Generator</b> UHPN2-1100
GC-ELCD, HALL	Hydrogen as reaction gas	Ultra high purity	70-200 cc/min	<b>Hydrogen Generator</b> H2PD-300



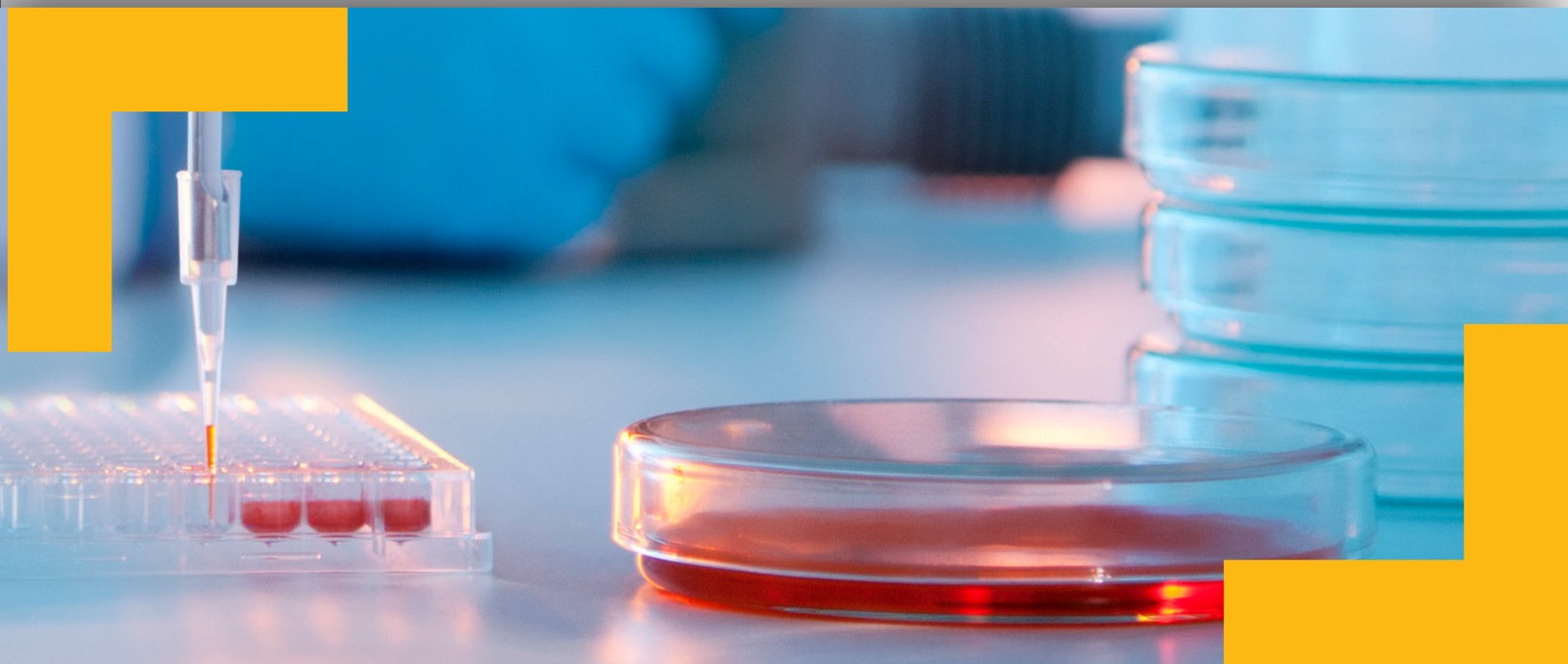
Instrument	Gas Requirements	Gas Purity Requirements	Flow Rates	Generator Recommendation/Model
GC-TCD	Hydrogen as carrier & reference gas	Ultra high purity	Varies	<b>Hydrogen generator</b> H2PD-300
LC-MS	Nitrogen as a curtain gas	LC-MS Grade	3-30 lmp	<b>Nitrogen generator</b> N2-14, NitroFlowLab, NitroFlow60, N2-35
ICP Spectrometer	Nitrogen as Optic/Camera Purge	Ultra high Purity	<1-5 lmp	<b>Nitrogen generator</b> 76-98NA
Nuclear Magnetic Resonance (NMR)	Air for lifting, spinning	Clean, dry	<10 SCFM	<b>Air dryer</b> UDA-300NA <b>Lab gas generator</b> 74-5041NA
Ozone generator	Supply air	Clean, dry	.3-20 SCFM	<b>Air dryer</b> 64-01, 64-02, 64-10, UDA-300NA
Protein analyzer	Dry air, nitrogen	Clean, dry	Up to 5 SCFM	<b>Nitrogen generator</b> N2-14, N2-22, NitroFlowLab, N2-35
Solvent evaporators (sample concentrators)	Nitrogen	Clean, dry nitrogen	2-15 SLPM	<b>Zero Air Generator</b> Nitrovap-1LV, Nitrovap-2LV
Stack gas sampler	Dilution air	Clean, dry	<1.0 SCFM	<b>CEM zero air generator</b> (75-45-M744)
Total oxygen demand (TOD)	Nitrogen as a carrier gas	Ultra high purity	300 cc/min	<b>Nitrogen Generator</b> UHPN2-1100
Thermal gravimetric analyzer (TGA)	Nitrogen as furnace purge	Clean, dry, inert	<100 cc/min	<b>Zero Air Generator</b> HPZA-3500 <b>Hydrogen Generator</b> H2PEM-260 <b>Hydrogen Generator</b> H2PEMPD-1300-100 <b>UHP Nitrogen Generator</b> UHPN2-1100
Differential scanning calorimeter (DSC)	Air for air shield	Clean, dry	<100 cc/min	<b>Dry Air Generator</b> 64-01, UDA-300
Total hydration analyzer (THA)	Zero Air for FID Hydrogen as flame fuel gas	Clear, hydrocarbon free Ultra high purity	50-500 cc/min 5-50 cc/min	<b>Zero Air Generator</b> 75-82S, 75-83NA <b>Hydrogen Generator</b> H2PEM-100
Total organic carbon analyzer (TOC)	Dry air or nitrogen for carrier gas Combustion gas	Clean, dry, hydrocarbon-free, CO <sub>2</sub> Free, Ultra high purity	100-500 SLPM 50-700 cc/min	<b>TOC gas generator</b> TOC-625, TOC-1250 <b>UHP Nitrogen Generator</b> UHPN2-1100

## Legal Notifications



### WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE. This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met. The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.



# Worldwide Filtration Manufacturing Locations

## North America

### Compressed Air Treatment

#### Industrial Gas Filtration and Generation Division

Lancaster, NY  
716 686 6400  
[www.parker.com/igfg](http://www.parker.com/igfg)

Haverhill, MA  
978 858 0505  
[www.parker.com/igfg](http://www.parker.com/igfg)

### Engine Filtration

#### Racor

Modesto, CA  
209 521 7860  
[www.parker.com/racor](http://www.parker.com/racor)

Holly Springs, MS  
662 252 2656  
[www.parker.com/racor](http://www.parker.com/racor)

### Hydraulic Filtration

#### Hydraulic & Fuel Filtration

Metamora, OH  
419 644 4311  
[www.parker.com/hydraulicfilter](http://www.parker.com/hydraulicfilter)

Laval, QC Canada  
450 629 9594  
[www.parkerfarr.com](http://www.parkerfarr.com)

Velcon  
Colorado Springs, CO  
719 531 5855  
[www.velcon.com](http://www.velcon.com)

### Process Filtration

#### domnick hunter Process Filtration SciLog

Oxnard, CA  
805 604 3400  
[www.parker.com/processfiltration](http://www.parker.com/processfiltration)

### Water Purification

#### Village Marine, Sea Recovery, Horizon Reverse Osmosis

Carson, CA  
310 637 3400  
[www.parker.com/watermakers](http://www.parker.com/watermakers)

## Europe

### Compressed Air Treatment

#### domnick hunter Filtration & Separation

Gateshead, England  
+44 (0) 191 402 9000  
[www.parker.com/dhfn](http://www.parker.com/dhfn)

#### Parker Gas Separations

Etten-Leur, Netherlands  
+31 76 508 5300  
[www.parker.com/dhfn](http://www.parker.com/dhfn)

#### Hiross Zander

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+49 2054 9340  
[www.parker.com/hzfd](http://www.parker.com/hzfd)

Padova, Italy  
+39 049 9712 111  
[www.parker.com/hzfd](http://www.parker.com/hzfd)

### Engine Filtration & Water Purification

#### Racor

Dewsbury, England  
+44 (0) 1924 487 000  
[www.parker.com/rfde](http://www.parker.com/rfde)

#### Racor Research & Development

Stuttgart, Germany  
+49 (0)711 7071 290-10

### Hydraulic Filtration

#### Hydraulic Filter

Arnhem, Holland  
+31 26 3760376  
[www.parker.com/hfde](http://www.parker.com/hfde)

Urdala, Finland  
+358 20 753 2500

#### Condition Monitoring Parker Kittiwake

West Sussex, England  
+44 (0) 1903 731 470  
[www.kittiwake.com](http://www.kittiwake.com)

### Process Filtration

#### domnick hunter Process Filtration Parker Twin Filter BV

Birtley, England  
+44 (0) 191 410 5121  
[www.parker.com/processfiltration](http://www.parker.com/processfiltration)

## Asia Pacific

### Australia

Castle Hill, Australia  
+61 2 9634 7777  
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+86 21 5031 2525  
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### Thailand

Bangkok, Thailand  
+66 2186 7000  
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## Latin America

### Parker Comercio Ltda.

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Sao Paulo, Brazil  
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[www.parker.com/br](http://www.parker.com/br)

### Pan American Division

Miami, FL  
305 470 8800  
[www.parker.com/panam](http://www.parker.com/panam)

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