

# TECHNICAL INFORMATION

## Installation, Operation and Maintenance Parker Balston® Vehicle Emissions Monitor- ing Zero Air Generator Model VEM 6000

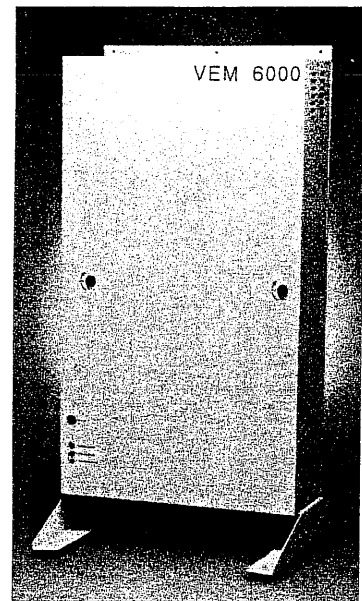


Figure 1 - Parker Balston Vehicle  
Emissions Monitoring Zero Air Generator  
VEM 6000



These instructions must be thoroughly read and understood before installing and operating this product. Failure to operate this product in accordance with the instructions set forth in this manual and by other safety governing bodies will void the safety certification of this product and could jeopardize the safety of the operator. Modification of the unit will result in voiding the warranty. If you have any questions or concerns, please call the Technical Services Department at 800-350-5063, 8AM to 5PM Eastern Time (North America only). For other locations, please contact your local representative.

### Component Description

- General Description** The Parker Balston Vehicle Emissions Monitoring Zero Air Generator Model VEM 6000 (see Figure 1), is a completely engineered system capable of purifying contaminated compressed air into emissions grade zero air. The system is designed to replace the use of high pressure gas cylinders as a source of air to purge and zero instruments used in vehicle emissions testing.
- The Parker Balston VEM 6000, removes nitrogen oxides ( $\text{NO}_x$ ), hydrocarbons (HC), water vapor, carbon monoxide (CO) and carbon dioxide ( $\text{CO}_2$ ) down to part per million (ppm) levels. This product is approved by the California Bureau of Automotive Repair (BAR) for use in BAR 97 and I/M 240 programs.
- Engineered System** The system is designed to run continuously, providing 6 liters per minute (LPM) of zero grade air at 30 psig of pressure. The oxygen content varies due to the air drying /  $\text{CO}_2$  removal process, so an internal reservoir is added to meet the required oxygen specifications.
- The Parker Balston VEM 6000 purifies compressed air in five stages: prefiltration,  $\text{NO}_x$  removal, HC/CO oxidation, air drying/ $\text{CO}_2$  removal and final filtration (see Figure 2). Integrated diagnostics monitor the product performance, attract operator attention when necessary (via indicator lights and audible alarms), and shut down the unit if a fault occurs.
- Prefiltration** A single prefiltration stage (Balston Grade BX) for water, oil and particulate removal is integrated into the Parker Balston VEM 6000. Particulate and aerosol contamination are removed from the compressed air at an efficiency of 99.99% at 0.1 micron. The prefilter is equipped with a solenoid valve to automatically drain the liquid from the filter housing.
- $\text{NO}_x$  Removal** The  $\text{NO}_x$  scrubber consists of an absorbent material that scavenges  $\text{NO}_x$  molecules down to extremely low levels, and prevents the reintroduction of unconverted NO or  $\text{NO}_2$  gas molecules into the atmosphere during the water/ $\text{CO}_2$  removal process. The absorbent must be replaced on an annual basis in order to ensure that the generator meets purity specifications and OSHA standards.

## Hydrocarbon Removal

An oxidation catalyst is used to convert all hydrocarbons (including methane) and CO, into CO<sub>2</sub> and water vapor (H<sub>2</sub>O). The catalyst is housed in a temperature-controlled assembly that maximizes the conversion of all hydrocarbons and CO in the compressed air, to less than 1 ppm. The minimum lifetime of the catalyst module is three years (running time).

## Water/CO<sub>2</sub> Removal

Pressure swing adsorption (PSA) technology is used to reduce the water vapor and CO<sub>2</sub> content in the compressed air to less than 1 ppm. The PSA system utilizes two adsorbent beds. As one bed removes water vapor and CO<sub>2</sub> from the air stream, the other bed regenerates itself by purging the CO<sub>2</sub> and water vapor into the atmosphere.

## Final Filtration

The final filter on the Parker Balston VEM 6000 is a high efficiency filter that removes particulate contamination to 0.1 micron. This final filter ensures that the outlet air from the Parker Balston VEM 6000 is virtually particle-free.

## Controls

**Power Light** - A green power light on the front panel will be illuminated when the generator is turned on.

**System Ready** - The "System Ready" light (green) will be illuminated after the generator has completed its warmup cycle (30 minutes). After the "System Ready" light turns on, the internal valve will open to feed zero grade air to the downstream instrumentation at the rated flow and pressure.

**System Check** - The "System Check" light will be illuminated if there is a pressure interruption. See "Operation" section of this bulletin.

**Service System** - The "Service System" light will be illuminated if there is a fault in the hydrocarbon catalyst module, or if 3 years run time has elapse and it is time to change the catalyst module. As a reminder, there will be an audible beep from the generator before the catalyst needs to be changed out (Note: This light is illuminated during start-up).

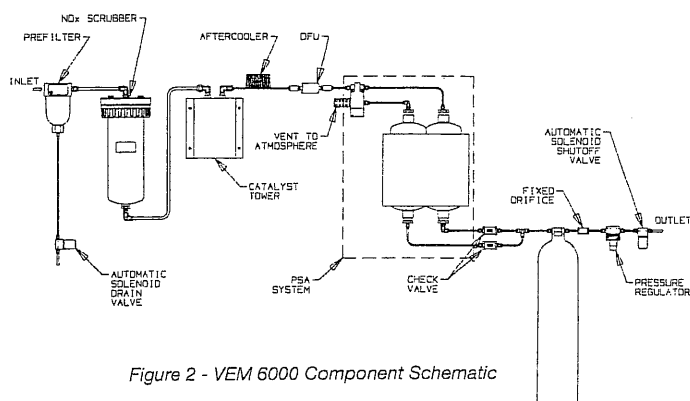


Figure 2 - VEM 6000 Component Schematic

# Installation

**NOTE:** All installation, operation and maintenance activities for the Parker Balston VEM 6000 Vehicle Emissions Monitoring Zero Air Generator should be performed by suitable personnel using reasonable care.

## General

The Parker Balston VEM 6000 is designed to mount to a wall. Figure 3 shows the mounting dimensions of the unit and the location of the inlet port, outlet port and the drain port. All the ports are 1/8" female NPT fittings. The unit can be configured to stand on the floor using the Parker Balston Mounting Stand Assembly (P/N 78306) which mounts to the base of the unit.

At a minimum, the user should install a manual shutoff valve and pressure regulator (P/N 72-130) upstream from the generator inlet flow port (see Figure 4). The valve can be used for isolating the compressed air from the generator during routine maintenance or troubleshooting activities. The pressure regulator is needed to ensure that the inlet air pressure is set between 60 and 90 psig (70 psig being the optimum) for the generator.

## Location

The Parker Balston VEM 6000 is designated for indoor use only. Do not install the unit outdoors. The generator should be located in an area where the ambient temperature is between 40°F and 100°F (4°C and 40°C) to ensure proper operation.

**NOTE:** If the compressed air supply has a pressure dewpoint which is less than the ambient temperature, the generator can function in ambient temperatures as low as 0°F (-18°C) and as high as 110°F (43°C) and with a relative humidity of 100%. To lower the pressure dewpoint it is recommended that either a refrigerant dryer or a Parker Balston Aftercooler Assembly (P/N 72-100) be installed upstream from the generator (see Figure 4).

The generator should be located in close proximity to the analyzer to decrease the amount of time required to purge the line between the generator and the analyzer, and as close as possible to the electrical and air supplies. There is no limitation on distances between the generator and the analyzer, as long as the tubing size, cleanliness and pressure drop are taken into account.

## Wall Mounting

The generator is designed for vertical operation only. Any other orientation other than the one shown in Figure 3 will void the warranty. Pre-drill the mounting holes using the dimensions shown in Figure 3. Secure the generator to the wall using mounting hardware adequately sized to support the weight of the unit (70 lbs). All mounting should be in compliance with the National Electrical Code (NEC), and local building code guidelines. Allow 7" (18 cm) clearance around the sides of the generator for adequate ventilation.

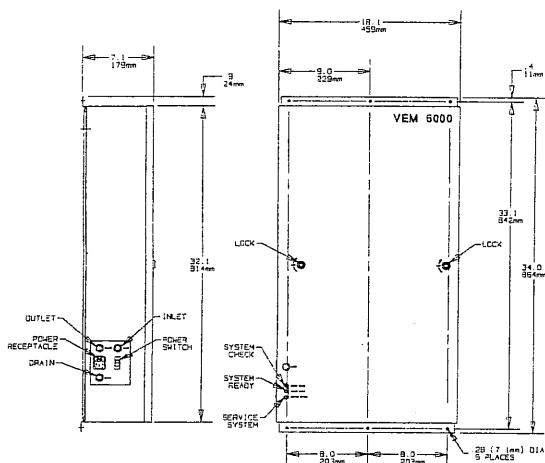


Figure 3 - External dimensions and port locations of Front and Side view

## Compressed Air

Parker Balston requires that the VEM 6000 compressed air be clean and dry. Supplied pressure should be between 60 psig and 90 psig pressure. The compressor must be able to supply a minimum flow rate of 13 SLPM. The pressure dewpoint of the supply air should be lower than room temperature.

The compressed air source should be as close to instrument quality as possible (see note in Location section above), and relatively free of oils and particulate matter. Connect the air supply to the 1/8" NPT port marked INLET, located on the left side of the generator. If the compressed air supply for the generator contains excess water, oil or particulate matter, install either a refrigerant dryer or a Parker Balston Aftercooler Assembly (P/N 72-100) upstream from the generator. Figure 4 shows a recommended installation configuration of the system using the Parker Balston Aftercooler Assembly. The assembly includes two coalescing filters that help remove excess water, oil or particulate matter from the compressed air line.



**NOTE:** The generator will be damaged by a variety of solvents and elements stored or used near the compressor inlet. Chlorinated solvents and chloro-fluorocarbons (such as those used in air conditioning systems) will damage components downstream from the catalyst module. High concentrations of sulfur, lead, phosphorous, and other heavy metals will contaminate the catalyst.

If possible, the inlet feed to the air compressor should be external to the facility. If venting is not possible, and chlorinated solvents are used, contact Parker Balston to order a special Scrubber Assembly (P/N 72-905), used to remove volatile organic carbons and chlorinated hydrocarbons. See Figure 4 for installation location.

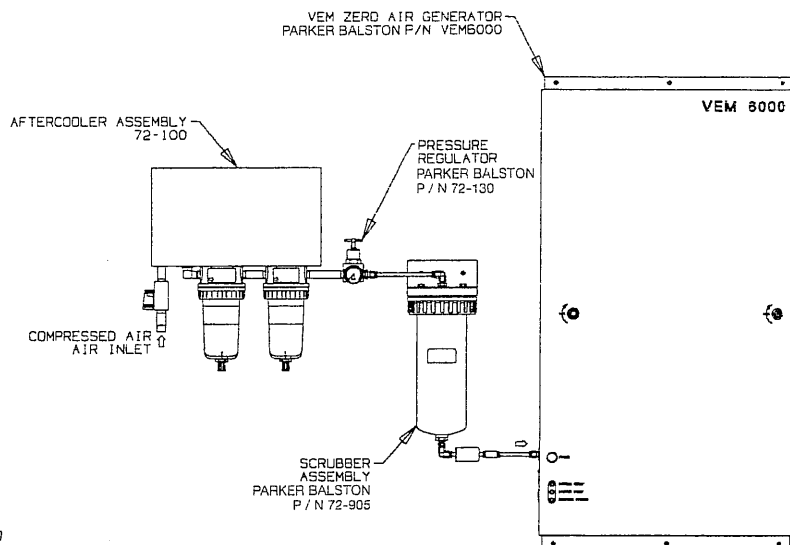


Figure 4 - Recommended Installation

## Power

A 120 VAC, 60 Hz power supply line is required to operate the Parker Balston VEM 6000 generator. To connect the generator to the power supply, make sure the power switch located on the left side of the generator (see Figure 3) is in the OFF position. Plug the female end of the electrical cord into the power receptacle on the left side of the generator, plug the opposite end into a nearby three-pronged earth-grounded receptacle.

## Recommended Piping

The inlet, outlet and drain ports are all 1/8" female NPT fittings located on the left side of the generator (see Figure 3). Tubing quality used on the automatic drain port is not critical; therefore, plastic tubing may be used. Anchor the tubing since it will be under full inlet pressure when the drain is activated. Be sure to use an appropriate container that is suitable to accept liquids removed from the compressed air.

Inlet tubing and fittings should be clean and rated for 100 psig minimally. The outlet tubing downstream from the generator should be clean stainless steel or pre-cleaned refrigeration-grade copper tubing (1/4" x 0.030") rated for a minimum of 100 psig. Do not use plastic or rubber tubing downstream from the generator. These materials can "out-gas" and contaminate the zero-grade air. Use Teflon<sup>®</sup> tape on all NPT fittings as threadsealing compounds will also contaminate the zero-grade air stream.

If pre-cleaned copper tubing is not available, standard copper tubing may be used if properly cleaned. To clean the tubing, connect one end to a clean inert gas supply such as N<sub>2</sub> or He. Flow the gas through the tubing approximately 10 minutes. While the inert gas is still flowing through the tube, heat the external portion of the tube using a propane torch. Holding the torch approximately 4 inches from the tubing, move it at a slow rate of about 1/2"/sec following the same direction as the gas flow. This procedure removes waxes and oils used in the manufacturing of the tubing.

## Operation

### Startup

**NOTE:** The warm-up period for the VEM 6000 is 30 minutes after the compressed air supply and power supply to the generator are turned on.

Before the compressed air supply is connected to the generator, and the unit is plugged into the power supply, make sure the power switch is in the "OFF" position. Open the inlet air supply valve (customer supplied, see Installation section) and adjust the inlet pressure to be between 60 psig and 90 psig using the (customer supplied) pressure regulator. The optimal pressure setting is 70 psig.

\* Teflon<sup>®</sup> is a registered trade mark of the DuPont Company.

## Operation

Turn the power switch to the "ON" position. The unit will begin its 30-minute warm-up. During the first 5 minutes of the warm-up period, the yellow "Service System" light will be illuminated while the catalyst module heats up. If an audible beep should sound during warm-up, verify that the inlet compressed air pressure is at least 60 psig.

At the end of the warm-up period, the "System Ready" light (green) will illuminate and the outlet flow of zero gas will begin.



**NOTE:** Newly installed systems should run for 24 hours in order to establish the required zero air purity. Generators that have been shut down for a week or more should be run for 24 hours prior to use.

The system is designed to run continuously at 6 LPM, providing that compressed air is available. An outlet flow orifice is used to prevent overflow of the generator, thus ensuring the outlet air purity specifications.

## Diagnostics



All troubleshooting should be performed by suitable personnel using reasonable care.

There are 3 diagnostic indicator lights on the front panel of the generator (see Figure 3).

**System Ready** (Green) - The "System Ready" light will illuminate at the completion of the 30 minute warm-up period, when the outlet valve opens and flow of zero air commences. The "System Ready" light will remain illuminated during operation, unless there is a system fault.

**System Check** (Yellow) - The "System Check" light has two functions: to indicate low inlet air pressure (<60 psig) or to indicate malfunctioning of the pressure swing adsorption towers. If the compressed air supply pressure drops below 60 psig, both the "System Check" light and the "System Ready" light will be illuminated. If the air pressure is corrected within 3 minutes of illumination of the "System Check" light, the "System Check" light will go off, and the unit will continue to supply zero air to the instrumentation. After 3 minutes of low inlet pressure, the "System Ready" light will go out and the outlet valve will close. At this point, if the low pressure is corrected within 20 minutes, outlet flow will resume, the "System Check" light will go out, and the "System Ready" light will illuminate within 1 minute. If the pressure is not corrected within 20 minutes, the generator will enter a 30-minute warm-up phase once the problem is corrected.

**Service System** (Yellow) - The "Service System" light also has two functions: to indicate a temperature fault in the catalyst module, and to indicate the approach of the catalyst module service date. If there is a fault within the module, the "Service System" light will illuminate solid, an audible alarm will sound, and the outlet valve will close. The unit will remain shut down until the problem is corrected.

Two months prior to the 3-year run time service date for the catalyst module, the "Service System" light will blink on and off (one minute on, one minute off), and an audible beep will sound every 4 hours. During this time, the green "System Ready" light will stay illuminated. At the end of the 3-year run time, the outlet valve will close, the "System Ready" light will turn off, the "Service System" light will continue to blink, and the beep rate of the alarm will increase to once per minute. The catalyst module must be replaced to return the system to operational status.

## Shutdown

The VEM 6000 is designed for continuous use. If a shutdown is required, turn off the compressed air supply prior to turning the power switch to the "OFF" position.

# Maintenance

## General



Suitable personnel using reasonable care should perform all maintenance. Entry to the VEM 6000 box is key access only. Safety glasses should be worn during all maintenance procedures.

Prior to servicing the VEM 6000 Zero Air generator, shut off the compressed air supply. Let the generator run without compressed air for 5 minutes to depressurize the components upstream from the check valve. Turn off the power switch and unplug the VEM 6000 generator to isolate it from the electrical supply.

**NOTE:** The generator will need to cool a minimum of 2 hours prior to catalyst module change.

The primary maintenance tasks required by the VEM 6000 are changing the prefilter cartridge (annually), replacing the NO<sub>x</sub> scrubber (annually), and replacing the hydrocarbon catalyst module (3 years run time). These parts are easily accessible by removing the front panel of the generator using the key provided. A summary of the replacement part numbers and recommended service frequency is shown at the end of this Maintenance section. See Figure 5 for the location of the maintenance items.

For convenience, the replacement prefilter (P/N 100-09-BX) and NO<sub>x</sub> scrubber (P/N 78305) have been assembled into a Maintenance Kit, P/N MKVEM6000.



**Do not use water, aerosols, or other cleaning agents on the unit.** If necessary, the VEM 6000 Zero Air Generator can be wiped down with a clean dry cloth on an as needed basis. Use of any liquid detergent to clean the generator could present an electrical hazard.

## prefilter Cartridge

Only an adjustable wrench is required to change the inlet prefilter cartridge (P/N 100-09-BX) located near the bottom left of the unit (see Figure 5). To remove the filter bowl, unscrew the large nut located on the bottom of the bowl with the wrench. Unscrew the filter bowl from the filter head by hand. Remove the element retaining disc holding the cartridge by unscrewing it from the tie rod. Slide the filter cartridge off and replace it with a new one. Replace the rest of the filter parts in the reverse order.

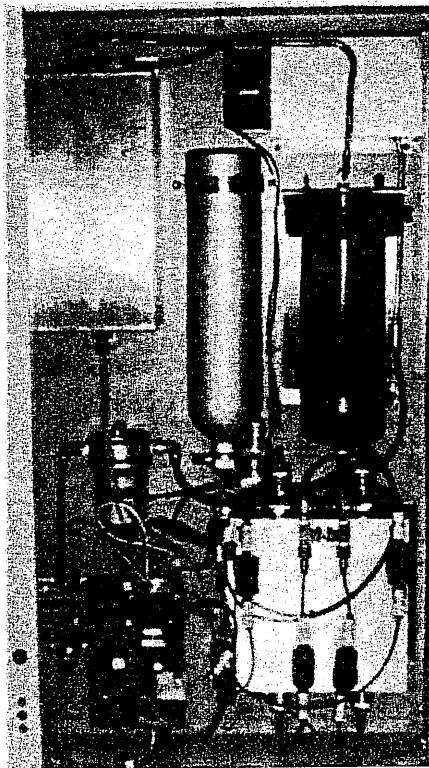


Figure 5 - VEM 6000 Internals

## NO<sub>x</sub> Scrubber

Only two adjustable wrenches and a flat head screwdriver are needed to change the NO<sub>x</sub> Scrubber. Remove the plastic tubing from the bottom of the NO<sub>x</sub> scrubber by pushing the plastic collar away from the tubing using your fingers. Pull the tubing out of the fitting while pushing the collar away. Use the adjustable wrench (with another adjustable wrench as an anchor) to remove the fitting from the top of the scrubber. With the flat head screwdriver, undo the aluminum band holding the bottom of the scrubber to the bracket. Finally, using your fingers, undo the wing nut screws holding the scrubber to the top of the bracket. Replace with a new NO<sub>x</sub> scrubber and reconnect all the fittings in the reverse order. When reattaching the plastic tubing, be sure to push it into the fitting until it bottoms out. Return the spent scrubber to Parker Balston for core credit (if applicable).

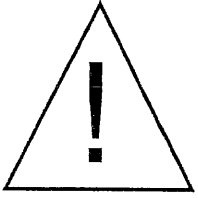
**NOTE:** The unit should be allowed to cool for at least two hours prior to catalyst module replacement.

## Catalyst Module Replacement

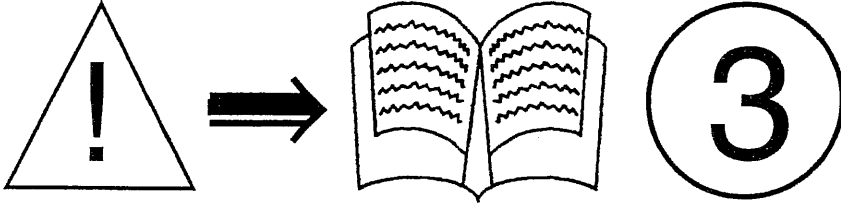
The catalyst module (P/N 76860) in the VEM 6000 Vehicle Emissions Monitoring Zero Air Generator should be changed after 3 years running time to maintain proper specifications of the unit. Two months prior to the end of three years of use, the yellow "Service System" light will blink at a rate of

Symbol

Description



Caution, refer to accompanying documents for explanation.



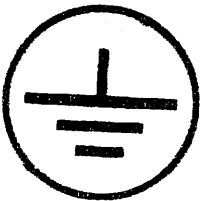
Refer to Installation and Operation Manual, warning note #3 for explanation.



Caution, risk of electric shock.



Caution, Hot Surface



Protective Conductor Terminal

one minute ON, one minute OFF and a beep will sound once every 4 hours. The green "System Ready" light will stay illuminated. When the three year mark is reached, the generator will automatically shut down the outlet flow, the "Service System" light will continue to blink, and the beep rate will increase to once per minute.

The tools required to change the module are as follows: a 9/16" wrench, an adjustable wrench, a large Philips head screwdriver, and rubber gloves. Follow the procedure below to replace the catalyst module, using Figure 5 as a guide to the various locations.



- 1 Close the (customer installed) inlet air valve between the compressor and the generator (see Figure 4). Allow the generator to run for 5 minutes to depressurize the unit upstream from the check valve.
- 2 **To prevent electrical shock and burns, switch off the power to the VEM 6000 unit and unplug the generator from the power receptacle. Allow the generator to cool for at least 2 hours.**
- 3 Unlock both locks using the key provided and remove the generator cover by pulling it toward you. The cover will hang by a cable attached to the generator.
- 4 Disconnect the catalyst wiring harnesses that connect the circuit board to the catalyst module by unclipping the white plastic Molex connector and the gray plastic Wago connector (see Figure 5).
- 5 Using the 9/16" wrench and the adjustable wrench as an anchor, disconnect the copper tubing from the inlet fitting on the top of the catalyst module. The fitting will remain with the copper tube. Next disconnect the catalyst module from the outlet tubing using the 9/16" and adjustable wrench. This fitting will also remain with the catalyst module.

**NOTE: Leave the fittings on the module, disconnecting only the tubing from the module.**

- 6 Remove the two screws from the top of the catalyst housing assembly using the Philips head screwdriver. Lift the catalyst assembly up to remove it from the bottom lip. Replace the spent catalyst assembly with a new assembly.
- 7 Replace the assembly by refitting the lower ledge into the lip. Reattach the assembly to the chassis using the two screws. Reconnect the tubing to the catalyst module and the reconnect the wiring harnesses to the printed circuit board.
- 8 Check for leaks in the line at the catalyst module by opening the valve between the compressor and the generator. This will pressurize the system up to the check valve. Check for leaks using a gas leak detector or solution around the tube fittings that were just re-attached.



**NOTE: Do not get the electrical connections or the circuit board wet if using leak detector solution.**

- 9 Plug the generator back into the power receptacle and turn on the generator power switch.
- 10 Replace the VEM 6000 generator cover and lock the unit with the supplied key.
- 11 Begin operation of the unit as described in the Operation/Start-up section of this manual.
- 12 Return the spent catalyst module to Parker Balston for core credit (see below).

## Fuse Replacement



Occasionally, the fuse in the VEM 6000 may burn out. The fuse is located in the power receptacle on the left hand side of the generator. **Before servicing the fuse, turn the generator off and disconnect the power cord from both the power supply and the generator power receptacle.**



To access the fuse, use a small screwdriver to remove the fuse holder located in the power receptacle of the generator. Replace the fuse as necessary and re-assemble. **To maintain the safety and performance integrity of the product, use only the fuse of the size and type detailed in the specifications section of this bulletin.**



## Core Credits

In some areas, Parker Balston offers a core credit for the return of a spent NO<sub>x</sub> scrubber (P/N 78305) and hydrocarbon catalyst module (P/N 76862). At the time of the replacement order, please request a Return Authorization (RA) number for return of the spent scrubber or catalyst. Use the RA label (or reference the RA number on the package) for return shipment and to ensure proper credit.

NOTE: The Return Authorization (RA) number is required for any returned items.



**Principal Specifications**

<b>Model Number</b>	<b>VEM 6000</b>
<b>UL 3101-1, First Edition</b>	
<b>CAN / CSA 22.2 No. 1010.1-92</b>	
<b>IEC 1010 Install Category</b>	Category II
<b>IEC 1010 Pollution Category</b>	Degree 2
<b>Max. Flow (continuous)</b>	6 LPM
<b>Product Start-up Time</b>	30 minutes
<b>Oxygen Content</b>	20.9% ±3%
<b>Inlet Concentrations (ppm)</b>	50 NO, 200 THC, 200 CO, 1500 CO <sub>2</sub>
<b>Outlet Concentrations (ppm)</b>	NO, THC, CO ≤ 1 ppm CO <sub>2</sub> <10 ppm (≤ 1 ppm after 1 hour)
<b>Warranty on Catalyst</b>	3 years run time
<b>Warranty on filters</b>	1 year
<b>Inlet Pressure</b>	60 psig - 90 psig
<b>Outlet Pressure</b>	30 psig
<b>Air Consumption</b>	13 SLPM
<b>Min./Max. Ambient Temp.(1)</b>	40°F/100°F (4°C/38°C)
<b>Max. Relative Humidity (1)</b>	80%
<b>Electrical Requirements</b>	120 VAC, 60 Hz
<b>Power Consumption</b>	400 Watts @ 3.5 amps
<b>Fuse</b>	T, 5 Amp 250V
<b>Product Dimensions</b>	34"H x 18"W x 7"D (86cm x 46cm x 18cm)
<b>Weight / Shipping Weight</b>	73 lbs. / 78 lbs. (33 kg / 35 kg)
<b>Inlet/Outlet/Drain Ports</b>	1/8" NPT (female)

**Accessories**

<b>Replacement Parts</b>	<b>Parker Balston Part Number</b>	<b>Change Frequency</b>
Replacement Filters and NO <sub>x</sub> Scrubber	MKVEM6000	Annually
Replacement Catalyst Module	76860	3 years run time

<b>Optional Accessory</b>	<b>Parker Balston Part Number</b>
Pressure Regulator (0-130 psig, 0-8.8 barg)	W-405-4032-000
Aftercooler Assembly	72-100
Prefilter Assembly	A912A-DX, A912A-BX
Halogenated Hydrocarbon Scrubber Assembly	72-905
External Receiver	76067
Floor Mounting Bracket	78306

**Notes:**

1 See Installation/Location section for other ambient temperatures and higher relative humidities.

**WARRANTY (NORTH AMERICA ONLY)**  
(FOR INFORMATION CONTACT YOUR LOCAL REPRESENTATIVE)

Parker Hannifin guarantees to the original purchaser of this product, that if the product fails or is defective within 12 months from the date of purchase, when this product is operated and maintained according to the instructions provided with the product, then Parker guarantees, at Parker's option, to replace the product, repair the product, or refund the original price for the product. This warranty applies only to defects in material or workmanship and does not cover: ring and valve wear on compressors, routine maintenance recommended by the instructions provided with this product, or filter cartridges. Any modification of the product without written approval from Parker will result in voiding this warranty. Complete details of the warranty are available on request. This warranty applies to units purchased and operated in North America.

