

# Safe Geometry Vacuum System

Designed to Ensure Nuclear Criticality Safety  
for Vacuum Cleaner Operations



PASCHAL \* GROSS

ENTERPRISES

## Applications

Operations involving fissile materials (e.g.,  $^{235}\text{U}$ ,  $^{239}\text{Pu}$ ) introduce the risk of a criticality accident resulting in a release of radiation that can be lethal to nearby workers. Experience has shown that such operations can be performed safely and economically when proper precautions are taken.

Over the years, the criticality safety community has been challenged with finding a safe geometry vacuum cleaner designed to ensure the system will remain sub-critical regardless of the amount of material held-up or collected in the vacuum interior volume. Sites have made assumptions or placed restrictions on use of vacuum cleaners for cleanup of fissile material spills/debris.

Paschal Gross Enterprises (PGE) has developed a safe geometry vacuum cleaner for removal of dust and debris in areas that contain fissile isotopes, such as  $^{235}\text{U}$  or  $^{239}\text{Pu}$ . The design makes novel use of on-axis fan technology and PGE-developed baffles that separate particulate and air flow to allow collection of material into user-supplied external containers, such as a poly bottle. The configuration and design allow the inlet, flow baffles, internal HEPA filtration, fan and exhaust to fit within a cylinder diameter that is a safe geometry for fissile materials, such as  $^{235}\text{U}$  or  $^{239}\text{Pu}$ . The design can also be incorporated into a cage assembly that provides passive spacing from other potential sources of fissile material in order to provide interaction control to prevent accidental nuclear criticality accidents.

The model and associated parts provided in this catalog are safe from a criticality safety standpoint for uranium enriched to 100 weight %  $^{235}\text{U}$ . PGE will build other vacuum cleaners with varying diameters to meet the needs of your facility.

## Order and Contact Information

Our goal at Paschal-Gross Enterprises is to provide our customers with the best solution for your specific business need. To order or obtain additional information about our product, please contact us.

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## PGE SGV-45\* Vacuum Cleaner

The PGE SGV-45\* vacuum cleaner is designed for collection of spills and debris associated with fissile material operations. The design allows the inlet, flow baffles, internal HEPA filtration, fan and exhaust to fit within a cylinder diameter with an inside diameter less than 4.1 inches.

### SPECIFICATIONS:

General	
Shell Material	The shell is available in the following materials: <ul style="list-style-type: none"> <li>• Monel (Model PGE SGV-45M)</li> <li>• SS304 (Model PGE SGV-45S)</li> <li>• Aluminum (Model PGE SGV-45A)</li> <li>• Plastic (Model PGE SGV-45P)</li> </ul>
Shell Inside Diameter	< 4.1 inches
Electrical	
Standard	115V 50/60 Hz.
Supplies	
HEPA Filter	Part No. SGV-PT-238
Collection Container	Works with Nalgene™ Large Wide-Mouth 2000 mL Bottle (Model No. 2120-0010)
<b>Optional Features:</b> Cage used to provide passive spacing control from other items	



For a quote, contact us at  
270-705-9037 or  
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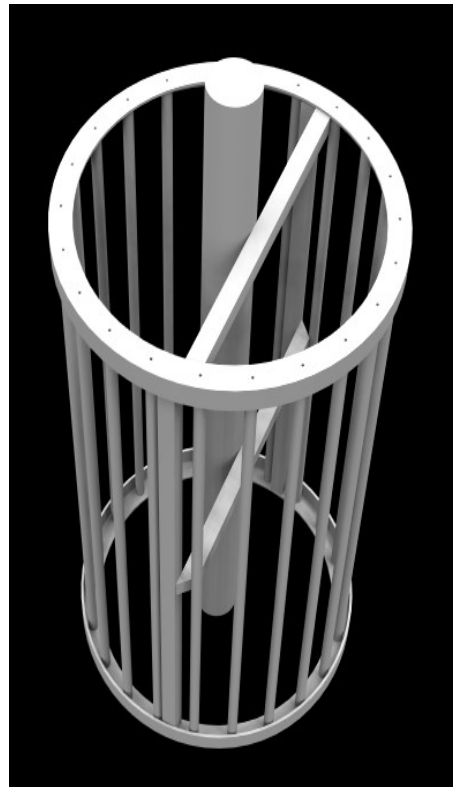
## PGE SGV-45 VACUUM CLEANER UPGRADES

### **PGE SGV-45\* Cage Upgrade (Part Number SGV-45-CU-332)**

The cage is an optional feature used to provide passive spacing from other sources of fissile material. The original module used a mesh for the cage wall. The cage has been upgraded to a slat design using ASTM 6061 aluminum which is lighter weight. The cage can be provided in different colors and materials at the customer's request. The original PGE SGV-45 vacuum cleaners can be upgraded to include the improved cage.

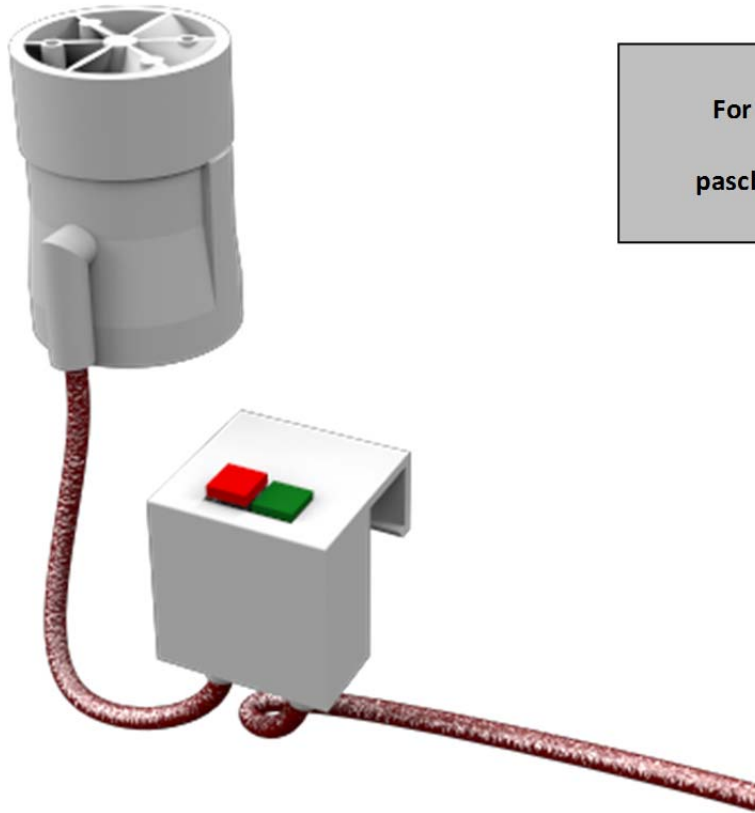


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### **PGE SGV-45\* Power Unit Upgrade (Part Number SGV-45-PU-322)**

Improvements were made to the power unit to aid in filter change out. All new vacuum cleaner purchases will be equipped with the new power unit design. The original PGE SGV-45 vacuum cleaners may be upgraded to include the improved power unit. The Power Unit Upgrade includes the motor, top cap, on/off switch box, and cord.



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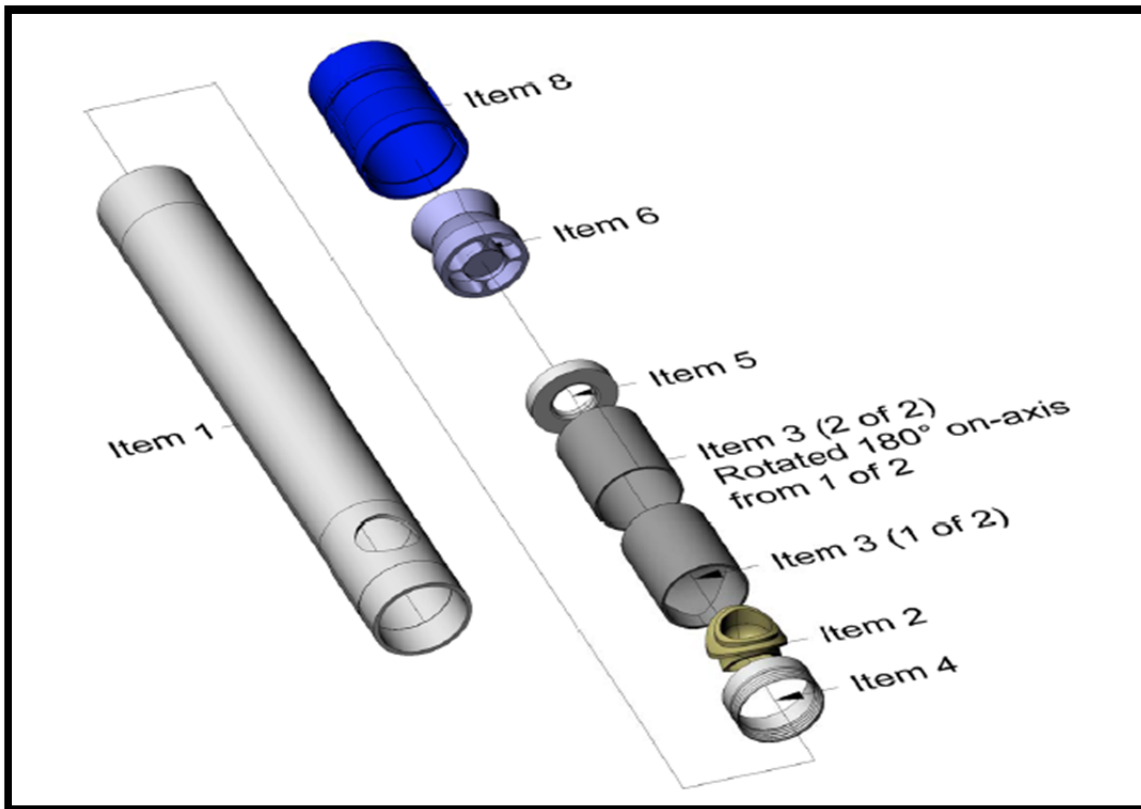
## List of Replacement Parts

Item numbers are identified on exploded view figure below.

Item 1 – Shell (Part No. SGV-45-PT221)  
 Item 2 – Inlet (Part No. SGV-45-PT222)  
 Item 3 – Flow Baffle (Part No. SGV-45-PT223)  
 Item 4 – Threaded Collar (Part No. SGV-45-PT224)  
 Item 5 – Filter Base (Part No. SGV-45-PT225)  
 Item 6 – HEPA Filter Top Flow Baffle (Part No. SGV-45-PT226)  
 Item 8 – Cap (Part No. SGV-45-PT228)

The items below are not shown on exploded view.

Item 7 - Flow-Through Fan/Motor (Part No. SGV-45-PT227)  
 Cage (Part No. SGV-45-PT233)  
 Castor Wheel (Part No. SGV-45-PT234)  
 Hose Kit (Part No. SGV-45-PT235)  
 ON/OFF Switch (Part No. SGV-45-PT236)  
 Electrical Cord (Part No. SGV-45-PT237)  
 Filter (Part No. SGV-45-PT238)  
 U-bolts (Part No. SGV-45-PT239)



Exploded View

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**U.S. Patent No.: 9,812,229 B2**  
**Date of Patent: November 7, 2017**

Paschal Gross Enterprises

**Item 1: Shell (Part No. SGV-45-PT221\*)**

The shell is the safe geometry cylinder, machined to accommodate vacuum motor mounting and inlet assembly. The figure below shows the shell (as transparent) with the inserted baffle assemblies. The shell is available in the following materials: Monel (SGV-45-PT221M), SS304 (Model SGV-45-PT221S), Aluminum (Model SGV-45-PT221A), or Plastic (Model SGV-45-PT221P).



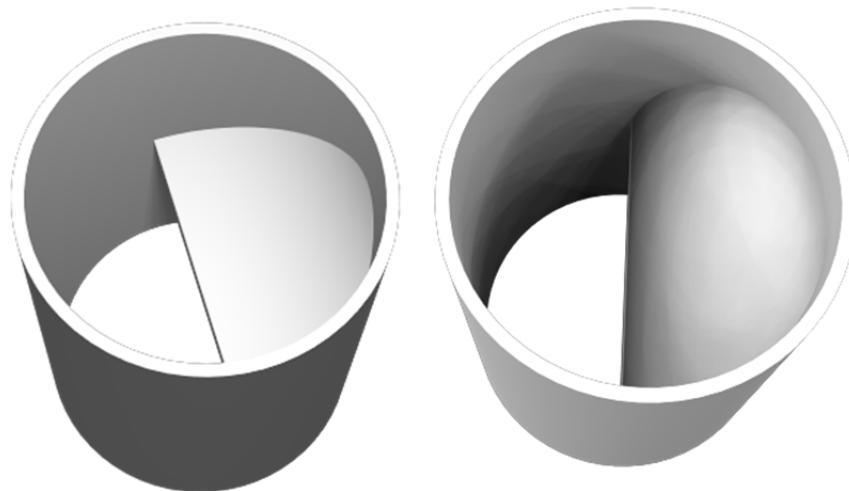


**Item 2: Inlet (Part No. SGV-45-PT222)**

The inlet is the radial intake designed to attach the vacuum hose.

**Item 3: Flow Baffle (Part No. SGV-45-PT223)**

The internal flow separator baffles control the air/particulate flow-path in order to minimize resistance to air flow resulting in effective separation of particulate matter. A 2-baffle configuration is used in the base configuration. Additional baffle stages can be incorporated for improved particle separation. Shown below is the bottom-up view (Left) and top-down view (Right).

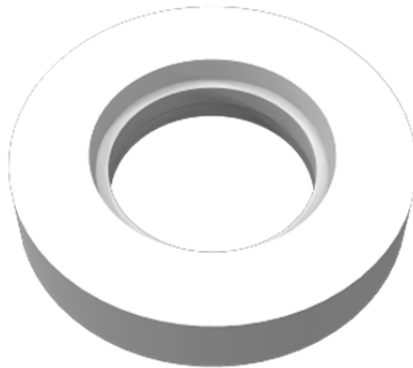


**Item 4: Threaded Collar (Part No. SGV-45-PT224)**

The vacuum cleaner is designed with a threaded collar that allows users to select readily available, off-the-shelf collection containers for use with the vacuum system.

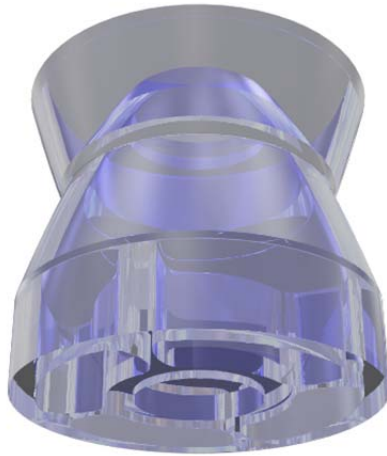
**Item 5: Filter Base (Part No. SGV-45-PT225)**

HEPA cartridge support fixture that allows use of readily available, off-the-shelf, filters.



**Item 6: HEPA Filter Top Flow Baffle (Part No. SGV-45-PT226)**

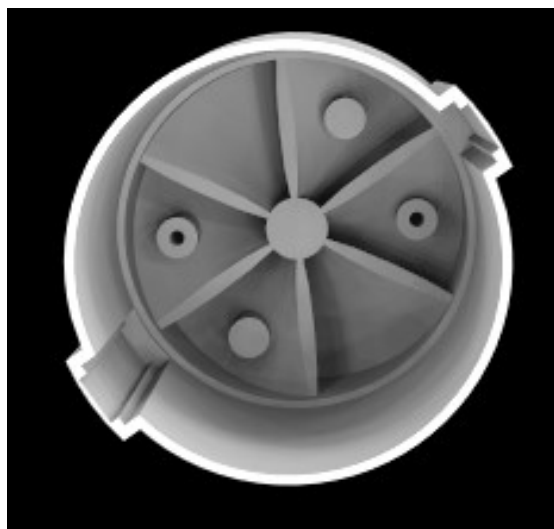
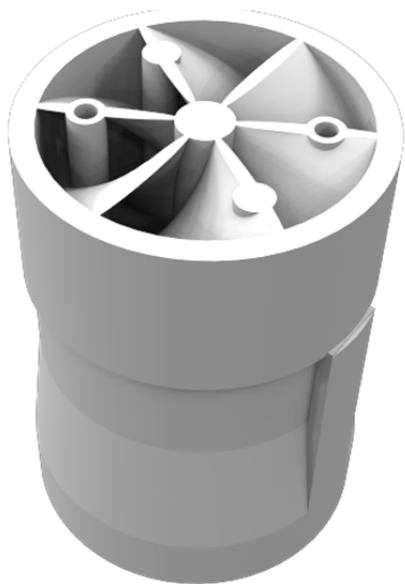
The HEPA filter top flow baffle is designed to minimize pressure drops and direct air-flow from HEPA exterior diameter flow path to vacuum motor inlet.

**Item 7: Flow-Through Fan/Motor (Part No. SGV-45-PT227)**

The flow-through fan or high-speed axial fan operates with air-flow parallel to the shell centerline axis, to afford effective volume flow rate and shutoff pressure ratings in a geometry that will fit within the confines of the safe geometry shell.

**Item 8: Cap (Part No. SGV-45-PT228)**

The fan outlet is capped with a diffuser assembly that ensures minimal pressure drop and provides a safe design that prevents operator access to motor blades and windings. Shown below is the top-down view (Left) and bottom-up view (Right).



### **Hose Kit (Part No. SGV-45-PT235)**

The hose kit includes a hose with the following attachments:

- Extension Wand
- Crevice Tool
- Flat Head Floor Tool
- Dust Brush

### **ON/OFF Switch (Part No. SGV-45-PT236)**

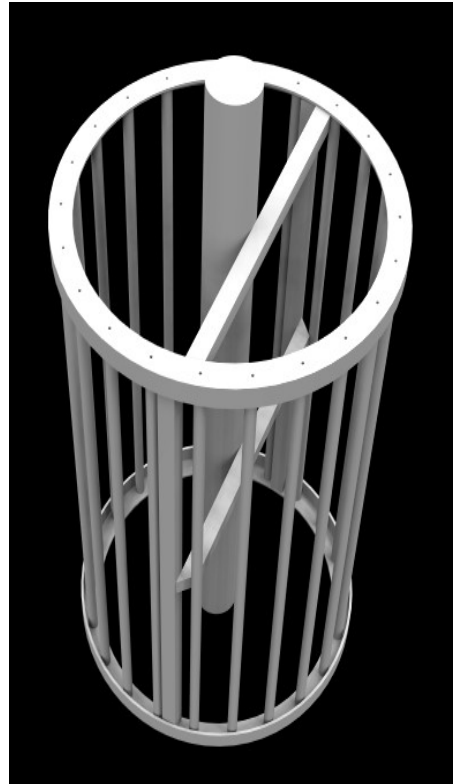
Replacement ON/OFF switch for models SGV-45 Series Vacuums.

### **Replacement Power Cord (Part No. SGV-45-PT237)**

Replacement power cord for models SGV-45 Series Vacuums.

### **Cage (Part No SGV-45-PT233)**

The cage provides passive interaction control from adjacent items (an important feature for nuclear criticality safety).



**Castor Wheels (Part No. SGV-45-PT234)**

The cage assembly can be installed on casters for easy transport with or without a dolly or hand-cart.

**U-Bolts (Part No. SGV-45-PT239)**

Replacement U-bolts for SGV-45 Series Vacuums.

**HEPA Filter (Part No. SGV-45-PT238)**

Designed according to strict HEPA standards, the media in this filter traps particles 75 times smaller than a human hair. This includes 99.97% of dust mite debris, animal dander, molds and pollen.

