USER GUIDE

Generator Probes & Sealed Chamber Assemblies for Mixer, Macro & Macro ES

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This product has been engineered for safety; however, basic safety precautions and common sense must always be demonstrated when using any electrical product.

- Use this product only for its intended purpose.
- Keep this product away from heated surfaces.
- **DO NOT** attempt to modify any part of this product.
- **DO NOT** allow the machine to be submerged in any liquid.
- **DO NOT** use in any setting other than an indoor laboratory.
- **DO NOT** use attachments not recommended by the manufacturer.
- **DO NOT** operate the product if it is damaged in any way.
- **DO NOT** operate the product with the safety ground disconnected.
- **DO NOT** modify the plug or cord that is provided.

WARNING: Reduce the risk of unintentional starting; make sure the machine is OFF before plugging into a power supply.
WARNING: Damaged or worn power cords should be repaired or replaced immediately by a qualified electrician.
WARNING: Improper connection of the equipment can result in a risk of electric shock.

Proper Equipment Operation
To reduce the risk of electric shock, do not remove the cover. No user serviceable parts are inside. Refer to qualified service personnel if help is required. Use this product only in the manner described in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

FCC
This device complies with part 15 of the FCC (United States Federal Communications Commission) Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference
- This device must accept any interference received, including interference that may cause undesired operation.

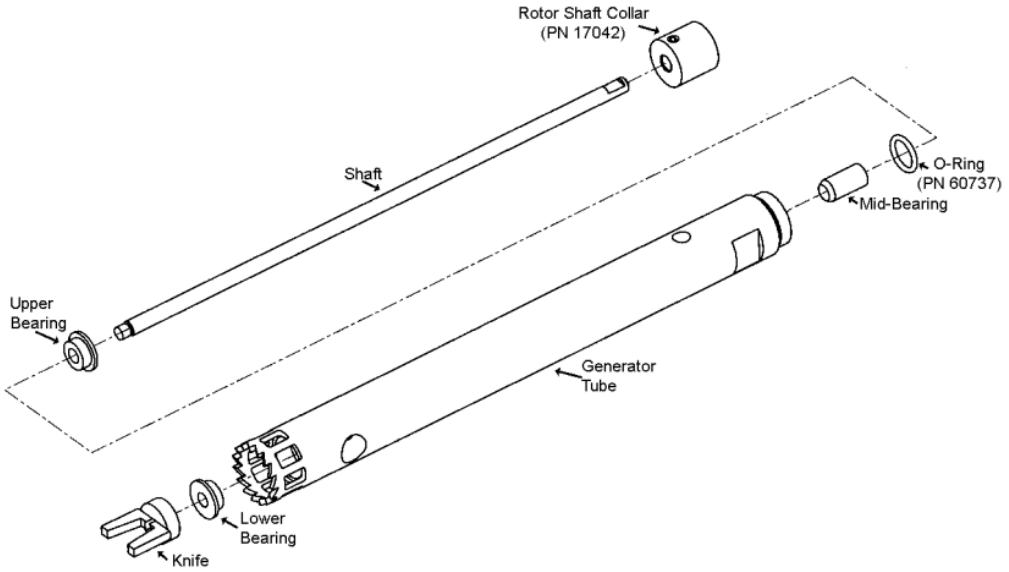
CE/UKCA
This device complies with all CE and UKCA rules and requirements.
Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Table of Contents

Choosing the Optimal Generator Probe

Q. How do rotor stator generator probes work?

The rotor shaft is coupled directly to the drive motor and spins at up to 20,000 rpm (depending on product choice). The rotating knife makes up the rotor portion of the rotor stator generator probe. The tube and collar assembly attaches to the motor housing, but does not spin, and is therefore called the stator. As the knife spins within the stator, it creates a pumping action which pulls liquid into the open end of the generator probe, and forces the liquid out through windows in the stator portion of the generator probe. The interaction of the knife with these windows sets up a shearing action, much like a pair of scissors might, and thereby works to reduce the particle size of sample being forced through the windows. The speed differential between the rapidly moving liquid being pumped by the rotating knife, and the relatively stationary liquid which makes up the rest of the sample, sets up a second force, called cavitation. This force literally acts to pull the sample apart, and therefore further reduces particle size. Constant circulation continues to re-subject the sample to these forces, and therefore further reduces particle size as a function of processing time. A practical limit of minimum particle size is generally determined by the material itself, the processing time, and the spacing between the rotor knife and the stator's tube and collar.



Q. What diameter generator probe should I use?

Choose a diameter size according to the volume of sample being processed when working with liquids, or according to the inside diameter of your vessel when working with solids. Optimal operating efficiency is generally achieved when the vessel diameter is approximately ten times the diameter of the generator probe. For solids, try to choose a generator probe whose diameter is as large or larger then the initial particle size of the sample being processed.

Q. Should I choose a saw tooth or flat bottom generator probe?

Saw tooth generator probes perform better with tissue samples and other fibrous material. Flat bottom generators are useful for gentler applications, such as creating emulsions, basic mixing, or liquid processing.

Q. What length should I choose for my generator probe?

Your generator probe should be long enough to almost reach the bottom of your processing vessel while keeping the upper aeration hole above your sample level. Processing efficiency is affected by the distance of your generator probe from your vessel's bottom, the vessels size and geometry as well as by the sample itself. It may be beneficial to experiment with a variety of distances between the generator probe and vessel bottom. A location of 1/3 of the distance from the bottom to the liquid level is a good starting point.

Q. Are generator probes easy to clean?
Yes, they are easy to disassemble and clean. Complete instructions are included with all generator probes.

Q. Should I be concerned about material leaching?
For some applications, such as soil analysis for instance, some of our customers have expressed concern about elemental leaching from the generator probe to the sample. In many cases, titanium generator probes can solve this problem. Please call Revvity at 1-800-776-4431 for details.

Q. Should I worry about sample to sample contamination?
In some applications, such as DNA or RNA extraction for PCR, elimination of sample to sample cross contamination can be critical. Our Stainless Steel generator probes are easy to clean. In other cases, it may be important to keep the sample safely sealed and isolated from the environment. For this application, sealed chamber assemblies are recommended. Call Revvity for complete details.

Q. Do I need to be concerned about aerosols?
If you are processing potentially hazardous or pathogenic material, we strongly urge you not use an open container, since the homogenization process will create aerosols. For this application, sealed chamber assemblies are recommended. Call your representative or Revvity for complete details.

Q. Will my samples foam during processing?
Some foaming is always possible, but our generator probes are specifically designed to be foam reducing.

Q. What is the difference between rotor-stator and ultrasonic homogenization?
Rotor-stator generator probes disrupt samples by means of mechanical shearing. Ultrasonic homogenizers disrupt samples by means of high-intensity ultrasonic waves, which create microscopic bubbles referred to as "cavitation." Ultrasonic homogenizers are ideal for cellular disruption, e coli, yeast, fungi, and bacteria processing. Rotor-stator generator probes are more effective at processing fibrous or hard tissue. Rotor-stator technology also emits much less heat and noise when compared to ultrasonic homogenizers. Both types of technology can minimize or eliminate cross contamination and sample carryover.

Q. What if my sample is very granular, or extremely fibrous?
Open blades can be an ideal method for pre-processing the sample, prior to processing with a generator probe. In many cases, the open blade alone is capable of performing the entire processing task.

Q. How can I reduce the swirling that sometimes occurs when using a generator probe?
The processing vessel's shape can have major impact on the flow characteristics of the sample. A fluted vessel, or a vessel with corners, can disrupt swirling flow patterns and significantly increase processing efficiency.

Q. At what speed, or what setting should I operate my homogenizer for maximum efficiency?
The smaller generator probes, 10mm and below in diameter can be operated at full speed, although many applications may call for gentler or slower processing. Larger generator probes, 20mm and above should not be operated above their "optimal speed range". Exceeding the recommended maximum speed will actually decrease the efficiency of the system. For the Mixer or Macro, a motor speed indicator is recommended to determine exact motor speed.

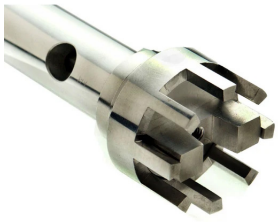
Q. How can I find out more about processing my specific application?
Revvity has thousands of customers around the world, many of whom share their problems and successes with our applications staff. Please call us at 1-800-776-4431, and we will do our best to help you succeed with your specific need.

Generator Probe Selection Guide

Part Number	Diameter	Length	Type	Particle Size	Processing Range
15051	10 mm	95 mm	Saw Tooth	Fine - Medium	1.5 mL - 100 mL
15051W	10 mm	95 mm	Saw Tooth	Medium - Coarse	1.5 mL - 100 mL
15010	10 mm	195 mm	Saw Tooth	Fine - Medium	1.5 mL - 100 mL
15201	20 mm	100 mm	Saw Tooth	Fine - Medium	50 mL - 2 L
15401	20 mm	145 mm	Saw Tooth	Fine - Medium	50 mL - 2 L
15401W	20 mm	145 mm	Saw Tooth	Medium - Coarse	50 mL - 2 L
15020	20 mm	195 mm	Saw Tooth	Fine - Medium	50 mL - 2 L
15020W	20 mm	195 mm	Saw Tooth	Medium - Coarse	50 mL - 2 L
150-30NA-195	30 mm	195 mm	Flat Bottom	Fine - Medium	75 mL - 10 L
150-30WA-195	30 mm	195 mm	Flat Bottom	Medium - Coarse	75 mL - 10 L
150-45NA-195	45 mm	195 mm	Flat Bottom	Fine - Medium	200 mL -25 L
150-55NA-195	55 mm	195 mm	Flat Bottom	Fine - Medium	300 mL -50 L

10 mm

20 mm



30 mm

45 mm

55 mm

Generator Probe Operation

Generator probes can be used in open containers or in sealed chamber assemblies. Sample processing efficiency is effected by:

- Amount of material processed vs. size and speed of the generator probe.
- Container geometry and size (round vessels encourage swirling, while fluted or cornered vessels disrupt flow patterns for more effective mixing/processing).
- Processing speed optimal speed.
- Size and type of material and flow characteristics (material particles must be small enough to be carried into the generator head for optimal processing

To operate the generator probe simply remove the blue protective cap from the end of the generator probe. Keep the blue protective cap on the tip of the generator probe when the generator probe is not being used.

WARNING: DO NOT process pathogenic material in an open container, since aerosols created during normal processing could be inhaled by the operator.

Sealed Chamber Assemblies

Sealed chamber assemblies are available as separately ordered items for use with the entire Mixer product line. They consist of chambers, many of which are fluted to facilitate mixing by inhibiting swirling, gasket screw on cover seals to inhibit aerosol release, a shaft assembly, and a sharpened stainless steel blade or generator probe. Chamber materials include stainless steel, glass, polycarbonate, and polypropylene. A full range of titanium chamber assemblies is also available for applications requiring protection from leached elemental components. Please contact Revvity for complete details.

Rotor Stator Generator Probes vs. Unique Cutting Blades

Each of our sealed chamber assemblies offer Unique Cutting Blades or efficient Rotor Stator Generator Probes. It is important to choose the correct configuration for the sample being processed.

Blade Assemblies are offered with a choice of Oilite or PTFE bearings, depending on particular application requirements. To choose the best bearing for a blade assembly, keep in mind that Oilite bearings wear longer than PTFE, but cannot be autoclaved or used for trace analysis applications since leaching may occur. PTFE bearings are FDA approved, inert and corrosion resistant, but also are more subject to wear and must be replaced more frequently.

Generator Probe Assemblies consist of an inner rotating shaft with rotor knife, an outer stationary tube with windows, an upper PTFE or stainless steel bearing and a lower PTFE bearing. Generator Probes create mechanical shear and pressure differentials to efficiently process most samples in mere minutes or seconds. They can be taken apart just as quickly for cleaning, enabling the user to replace the bearings and consumables to extend the life of the product.

To choose the optimal size Generator Probe, the following factors must be considered; the total volume including sample plus buffer; the physical properties of the sample such as dimensions and viscosity; and the type, shape and size of the vessel being used. The generator probe head must be smaller than the inside diameter of the vessel used, and should be submerged until the bottom of 1/3 of the liquid level is reached and the stator windows are completely covered in order to create an optimal flow pattern. Suggested volume ranges as specified for each generator probe apply only to low viscosity samples such as liquids, as processing ranges and motor requirements will vary with increased viscosity.

Flat Bottom Generator Probes are recommended for liquid or soft tissues while Saw Tooth and Extended Blades are best for fibrous tissues. Generator Probes with Oversized Windows are best for frozen tissues or solid samples.

Generator Probe Assemblies are also offered with a choice of Stainless Steel or PTFE bearings. Stainless Steel bearing are quieter and last longer than PTFE bearings, but they are more easily subject to corrosion and can damage the generator probe if not properly maintained. Also, Stainless Steel bearings should not be autoclaved or used with organic solvents.

Again, PTFE bearings are FDA approved, inert and corrosion resistant, but are also more subject to wear and must therefore be replaced more frequently. PTFE bearings must be used when autoclaving the generator probe as an entire unit, and a spare PTFE bearing is supplied with each generator probe for this purpose.

WARNING: When is it necessary to process volatile, flammable, toxic, pathogenic, radioactivity or other hazardous materials, standard laboratory precautions should be followed, such as venting, operating in a fume hood,

Contamination

Always be aware of the possibility of biological or radioactive contamination, and take normal laboratory precautions. Use standard decontamination procedures should contamination occur.

WARNING: Although the chamber is enclosed, its contents, under certain circumstances, can leak past the bearings, causing an explosion hazard to the operator since the motor is not of explosion-proof construction.

	Stainless Steel Chamber Assemblies	Glass Chamber Assemblies	
Chamber Size (mL)	400	473	946
Operating Capacity (mL)	100 - 500	150-400	200 - 800
	Cutting Blade Assemblies (P/N)		
Blade Assembly with PTFE Bearings	17079	17080	17081
	Generator Probe Assemblies (P/N)		
Fine to medium Particle Size	15400	15080	15081

	Polycarbonate Chamber Assemblies		
Chamber Size (mL)	473	946	1892
Operating Capacity (mL)	150 - 400	200 - 800	300 - 1,800
	Cutting Blade Assemblies (P/N)		
Blade Assembly with PTFE Bearings	17065	17097	17098
	Generator Probe Assemblies (P/N)		
Fine to medium Particle Size	15065	N/A	N/A

	Rotor Stator Generator Probes	Unique Cutting Blades
Sample Type	Liquid and Small Solids	Frozen or Solid Tissue in Lipids
Resulting Particle Size	1-2 Microns	0-15 Microns
Open or Sealed	Sealed or Open Processing	Sealed Processing Only

473 mL

946 mL

473 mL

946 mL

1892 mL

400 mL

Using Sealed Chamber Assemblies

Stainless Steel or Titanium - These chamber assemblies are intended for liquid and semi-solid materials. Homogenization and mixing will normally be completed within 30 seconds to one minute. Load the material to be processed in the chamber. It is recommended that only 60% of the available chamber volume be used. Processing of larger volumes could force liquid up through the rotor shaft. At revolutions higher than 8,000 rpm, limit processing time per run to ten minutes with liquids.

Glass and Plastic - These assemblies are available in plastic or stainless steel, and should be used in the same manner as described for glass, plastic, and stainless steel above.

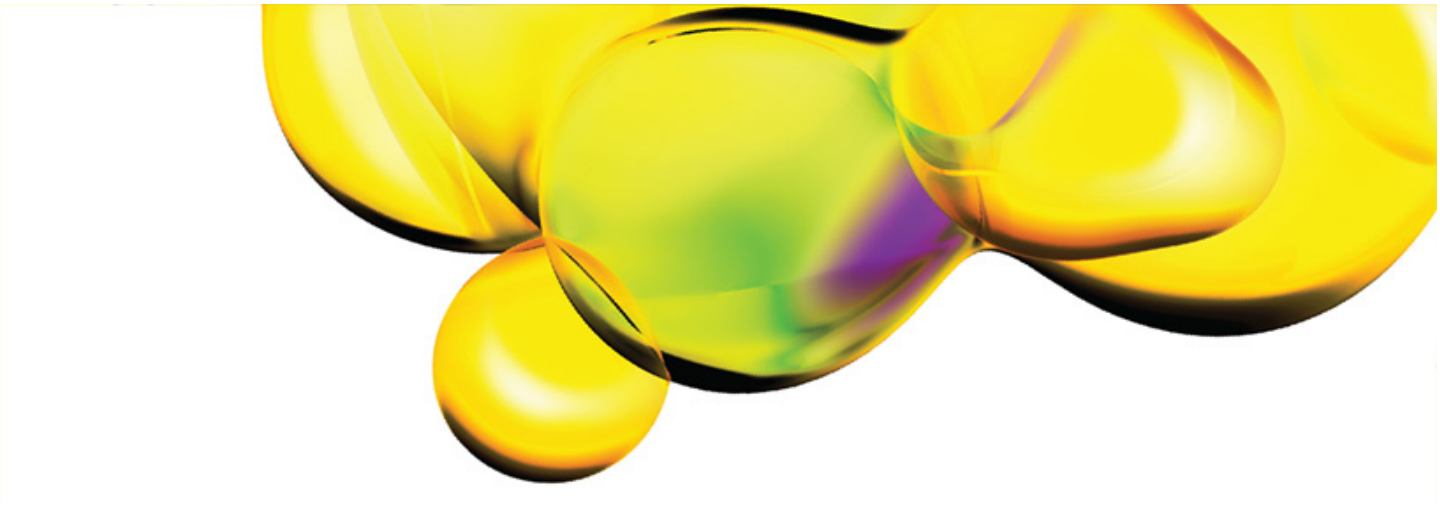
Breaking Down Specimen Particles - At speeds below 5,000 rpm, specimen particles may be broken down in the Mixer by using hard materials, such as glass beads. The Mixer will act as a “bead mill”, agitating the chamber while the hard materials do the work. Since sharpness is not essential, a dull blade should be used.

Homogenizing - For more complete homogenization of some materials, it may be helpful to rock the motor drive unit slightly during processing in order to churn up the specimen within the chamber.

WARNING: It is recommended that “bead mill” processing should not be undertaken in a glass vessel.

Adding a Grinding Medium - To attain the desired effect (cell breakdown) a combination of procedures may be useful. First homogenize the specimen in solution at maximum speed with a sharp knife blade. Then change to a dull knife blade, add a grinding medium and run the homogenizer at **5,000** rpm for ten to fifteen minutes.

Using Generator Probes - To facilitate homogenization of some materials, it may be useful to pre-process the sample by using one of the techniques described above, and then completing the process by using a generator probe. Generator probes can achieve particle size reduction to less than 2 microns.



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Revvity, Inc.
940 Winter Street
Waltham, MA 02451
USA
www.revvity.com

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