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8500 SHATTERBOX[®]

OPERATING MANUAL

TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
1.	Introduction	3
2.	Specifications	4
3.	Unpacking	5
4.	Setting Up.....	7
5.	Operation	6
6.	Maintenance	8
7.	Accessories	9
8.	Parts List & Item Locator	11
9.	Assembly Diagrams & Parts	12
10.	Trouble Shooting.....	14
11.	Warranty	15

1.0 INTRODUCTION

Since its introduction over three decades ago, the SPEX CertiPrep Shatterbox has become the most popular “swing mill” in America. Now as then, it is the most efficient device to pulverize up to 100 grams of brittle material to analytical fineness.

The material to be ground is placed into a hard cylindrical grinding container, which contains a puck of the same composition, and an additional internal ring (in larger containers). The Shatterbox swings the grinding container in a tight, high-speed, horizontal, off-axis circle. As these grinding elements swing freely inside the container, the sample is rapidly crushed. Grinding times are usually between two and five minutes, with resultant particle size well below 200 mesh. With grinding aids, smaller samples can be reduced below 10 microns.

Swung like a “Hula-Hoop,” the puck (and ring) crushes the sample against the bottom and sidewalls of the container. A neoprene O-ring seals the lid to the container to prevent sample leakage.

Flexibility is achieved by the choice of grinding container. To reduce noise decibels below OSHA limits, perhaps you should consider ordering an Enclosed Shatterbox (Model 8515). This is actually the same Shatterbox (model 8500) inside a special soundproof housing lined with plastic foam laminate. This model not only helps attenuate some of the sound produced by the grinding of the samples, but the enclosure also provides a 10-minute timer control pad, and a convenient stand for the Shatterbox. The model 8515 Shatterbox is supported at a comfortable working height of 32 inches (81 cm) above the floor.

8500-115/60 Shatterbox Laboratory Mill

For 115 V/60 Hz operation. For grinding samples from 10 ml to 100 ml. Perforated metal skirt provides ventilation for continuous operation; rubber cover protects against dust. Also included: anti-skid wood/rubber floor mount and extra set of drive belts. Timer and grinding container not included.

8500-230/50 Shatterbox Laboratory Mill

For 230 V/50 Hz operation. Same as 8500-115/60 Shatterbox, but with 230 V/50 Hz motor. Supplied with continental European CEE 7/7 two-prong plug.

2.0 SPECIFICATIONS

Type of mill: orbital grinding mill, a.k.a. swing mill, puck-and-ring mill

Grinding mechanism: dish-shaped container with puck, or puck and ring

Weight (empty, without container): 126 lbs. (57 Kg)

Dimensions: 13 in (33 cm) x 13 in (33 cm) x 23 1/2 in (60 cm)

Grinding Containers Available (see page 9):

Cat. #	Description	Recommended Load
8501	Hardened Steel Grinding Container	20-50 ml
8504	Tungsten Carbide Grinding Container	20-60 ml
8505	Alumina Ceramic Grinding Container	15-40 ml
8506	Zirconia Grinding Container	15-40 ml
8507*	Small Hardened Steel Grinding Container	5-20 ml
8508*	Small Tungsten Carbide Grinding Container	5-20 ml
8521	Large Hardened Steel Grinding Container	30-100 ml

*8507R Rack, required to hold 1 or 3 8507 or 8508 containers

Note: in practice, the sample capacity of any particular container depends on the properties of the sample, particle-size requirements, and other considerations.

Electrical: available in 115 or 230V 50Hz

Cord: 115V 60HZ version, 3-prong grounded cord supplied.

230V 50HZ version, with European CEE 7/7 two-prong plug supplied.

NOTE: Operator is responsible for supplying alternate line cord/plug if required.

Motor: 1/3 Hp @ 825 RPM

3.0 UNPACKING

Any visible damage to the shipping container should immediately be reported to the carrier. If there is no visible damage, remove all packing documents from the exterior of the box, and after completion of your inspection, put them in your records file.

Open the top of the shipping box. Remove the foamed-in-place packing material. Carefully grasp the mill from both sides, exercising caution while using proper lifting techniques to remove the unit from the carton (the unit weighs 126 lbs).

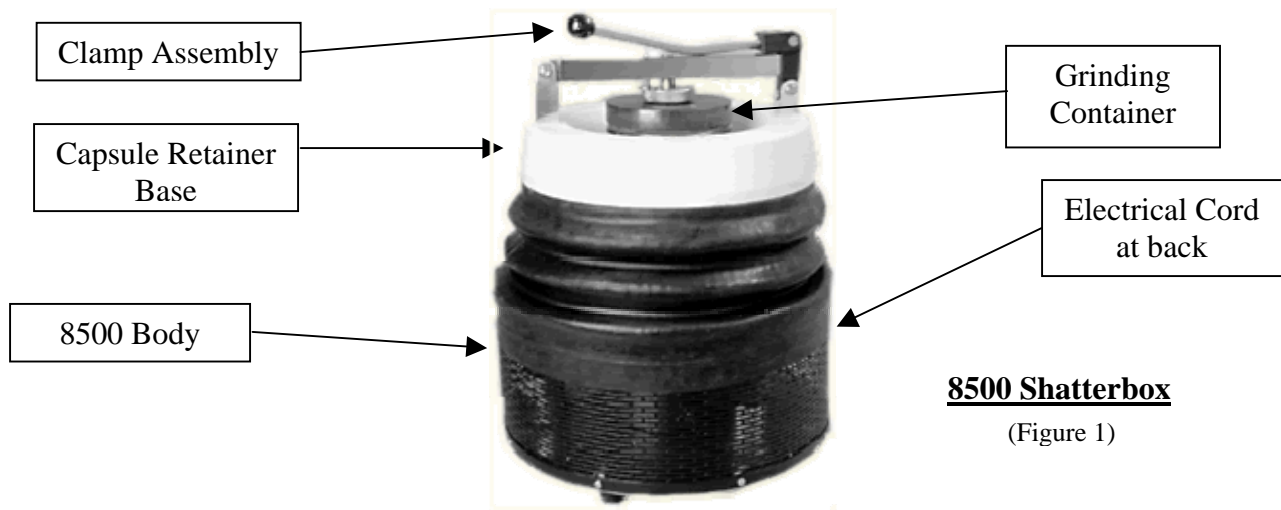
After the instrument is removed from the shipping carton, it should be placed on the floor or another similarly solid support base. If it is placed on a table, be sure there is sufficient surface friction to prevent "walking" (the wooden base with the rubber bottom, supplied with the Shatterbox, will prevent "walking" on most surfaces).

Carefully inspect the unit for any hidden damage that may have occurred during shipping.

Follow a logical sequence of steps as you inspect the unit (see Figure 1). For example:

1. Inspect the outside of the unit for any visible damage.
2. Is the Clamp mechanism damaged?
3. Does the power cord look damaged?
4. Is the motor damaged?
5. Are the drive belts hooked up?
6. Inspect the accessory pack. Compare with the packing list.

If everything seems to be okay, proceed to the next section "SETTING UP."



4.0 SETTING UP

Once the instrument is removed from the shipping carton, if it has not been located in the area that it is to be stationed at, then re-locate it to that area before continuing. Again we caution that if the unit is placed on a table, be sure there is sufficient surface friction to prevent "walking."

NOTE: The 8500 Shatterbox as supplied will run when it is plugged in. It is the user's responsibility to provide a timer.

5.0 OPERATION

The Shatterbox is driven by a special open motor, permanent split capacitor type, 50° C temperature rise, class B insulated, rated for 50% duty cycle up to one hour maximum cycle duration.

The unit uses four sizes of grinding containers, each one of which has different requirements for sample size and grinding time. The following instructions are for the #8501 Hardened Steel Grinding Container. While the sample volume and grinding time will vary for other grinding containers, the general procedures are the same.

Place up to about 50 ml of sample in the container after the ring and puck are in place. (The actual sample quantity you settle on will depend not only on the size of the container but also on the grinding time and the required final particle size.) Material can be split evenly in the spaces between the puck and the ring, and between the ring and the dish. In general it is good practice to keep the initial particle size of the sample under 1/4 inch (6 mm) for steel, tungsten carbide, and zirconia ceramic grinding containers, and under 1/8 inch (3 mm) for the alumina ceramic grinding container.

The cam-action of the clamp (see Diagram A, parts 10-13, page 12) makes it possible to hold any SPEX CertiPrep Shatterbox grinding container firmly in place without applying excessive pressure to the lever. The clamp can also be adjusted easily for containers of different heights, or to compensate for wear. To use the clamp, first swing the clamp lever (part A13) to the right, to free the clamp arm (part A11), then swing the clamp arm to the left. Then place a grinding container squarely in the recess of the capsule retainer (part A3). (If the container is not firmly seated, it can work loose during grinding.) The use of a 31688 Friction Disc in the capsule retainer recess, under the grinding container, is recommended at all times; it lessens noise, aids the gripping action of the clamp, and prevents rapid wear of the capsule retainer.

When the grinding container is in place, swing the clamp arm to the right, so the guide (part A12) fits over the boss (raised protuberance) in the center of the container lid. Then bring up the clamp lever so that the open gate at its base fits over the end of the clamp arm; the roller in the clamp lever assembly should nest in the curved recess of the clamp arm.

Swing the clamp lever over to the left, but don't force it. If the guide is properly adjusted, the lever will meet some resistance as it is pushed over the center of its arc, then become easier to move.

5.0 OPERATION

(Continued)

If the guide is set too loose, the lever will meet little or no resistance, and the grinding container can be rotated in place; disengage the lever and tighten the guide. If the guide is set too tight, the lever will meet strong resistance when still approximately vertical; do not force the lever, but disengage it and re-adjust the guide. The guide may be tightened or loosened by disengaging its locking pin (item 4, diagram A, pg 13) and screwing the guide away from the clamp arm to tighten it, or toward the clamp arm to loosen it. When adjustment is complete, check the locking pin to make sure it is engaged. Please Note: While these instructions for adjusting the clamp seem cumbersome, in practice the clamp is easy to use and adjust.

NOTE: For a proper functioning of the Cam-Action Clamp, it is absolutely necessary that the lever assembly roller rotate smoothly. It may be necessary to oil it from time to time, for if the roller locks up, the clamp can be easily damaged

For uniform performance from sample to sample as well as ease of operation, it is recommended that the Shatterbox electrical cord be plugged into a laboratory timer switch rated 10 amps or more. ***Remember: the unit will immediately run, as soon as it is connected to electrical power or the laboratory timer switch is turned on.***

Turn the machine on for 2-6 minutes. Due to packing of sample under the puck with some types of material, the grinding action might stop within a few seconds, due to the puck or ring jamming. The puck may be freed by simply turning off the machine. When you hear the puck begin to hit the sides of the container as the machine slows down, restart the machine. Examine the sample for size and adjust grinding time accordingly.

Containers may be cleaned with water or with compressed air. For more thorough cleaning, grind some clean quartz sand with soap and hot water. "Rinsing" with a small amount of the next material to be ground can also reduce inter-sample contamination to a minimum.

5.1 Grinding Hints

The addition of a grinding aid is extremely helpful in preventing packing and speeding up the pulverization. For many materials, a slurry with 1, 1, 1-trichloroethylene has proved satisfactory although requiring an extra drying step afterward. "Tide" and other household detergents have been found excellent as dry grinding aids; between 1 and 10% of the detergent is added to the sample. Further information about grinding aids is in the SPEX Certiprep *Handbook of Sample Preparation and Handling*.

In most analytical work, it is important to reproduce particle size distribution from sample to sample. Like other grinders, the Shatterbox requires strict adherence to a fixed routine in order to accomplish this. For example, it is necessary to start with the same amount of sample of approximately the same particle size. When loading containers with a puck and ring, split the sample on either side of the ring. The Shatterbox itself must be kept on a level surface. While it is not a good plan to bolt the instrument down (efficiency will be reduced somewhat) any degree of walking will, of course, change the degree of impact and therefore the ultimate particle size distribution. Placing the 8500 Shatterbox on the included plywood base should prevent walking.

6.0 MAINTENANCE

The 8500 MILL has been designed to provide trouble-free operation over a long period of time. To assure proper performance, perhaps an important factor is overall cleanliness. Any spilled powders or liquids should be wiped up immediately with a damp cotton cloth after every use. This should minimize the buildup of any powders, mold/mildew, or unsightly gunk over the life of the unit. Depending on how dusty the environment is it will be necessary to clean the machine regularly. This is simply done after lifting the black rubber skirt, by vacuuming the motor and mechanism clean.

NOTE: UNPLUG the unit from its power source (or laboratory timer switch) FIRST before repairing or maintaining the unit!

Special O-rings are used as drive belts (item 22, diagram B, pg 14). These should be replaced if worn and can be reached after the dust cover is lifted up. It is highly recommended that when replacing belts, all four be replaced at a time. When installing drive belts, check the clearance between the coupling arm and eccentric arm. There should be at least 1/16" up to 1/8" clearance between them, and all four drive belts should be parallel.

For a properly functioning Cam-Action Clamp, it is absolutely necessary that the lever assembly roller rotate smoothly. Clean off any excess dust or dirt from the outer segments of the clamp, with special attention being placed on the hinge sections and on the roller. It may be necessary to oil the hinge and the roller from time to time. If the roller locks up, the clamp can be easily damaged.

Bearings on the motor and mechanism are sealed and lubricated for life.

If it is necessary to remove the top section of the Shatterbox, lift the black rubber skirt (item 2, diagram A, pg 13) and remove the O-rings and screws. The top section will then lift off.

To remove the funnel (item 31, diagram B, pg 14), loosen the setscrew and unscrew the screw, remove it along with the eccentric arm assembly, and loosen the funnel setscrew. The funnel can then be removed from the shaft. To replace the rubber support columns placed into position on the base assembly, remove and save the screws holding the columns in place. Pull columns out. Install new columns, drill holes through top and bottom, and re-insert screws

If you have any questions about the operation and maintenance of your Shatterbox, please contact our specialists by phone at 1-800 LAB-SPEX (522-7739) or 732-549-7144, or by e-mail at sampleprep@spexcsp.com

7.0 Accessories: Grinding Containers

(If not included in your Order, they are Available for Purchase at Additional Cost)

8501 Hardened Steel Grinding Container

Outer Dimensions (dia. x height): 17.5 x 7.5cm,
Weight: 8kg Recommended Load: 20-50ml
Complete with: Dish, Lid, Ring, Puck, & Gasket



8504 Tungsten Carbide Grinding Container ¹

Outer Dimensions (dia. x height): 17.5 x 8cm
Weight: 12.5kg Recommended Load: 20-60ml
Complete with: Dish, Lid, Ring, Puck, & Gasket



8505 Alumina Ceramic Grinding Container ¹

Outer Dimensions (dia. x height): 15.2 x 8cm
Weight: 5kg Recommended Load: 15-40ml
Complete with: Dish, Lid, Puck, & Gasket



8506 Zirconia Grinding Container ¹

Outer Dimensions (dia. x height): 15.2 x 8cm
Weight: 6kg Recommended Load: 15-40ml
Complete with: Dish, Lid, Puck, & Gasket



8521 Large Hardened Steel Grinding Container

Outer Dimensions (dia. x height): 20.3 x 8.2cm
Weight: 13kg Recommended Load: 30-100ml
Complete with: Dish, Lid, Ring, Puck, & Gasket



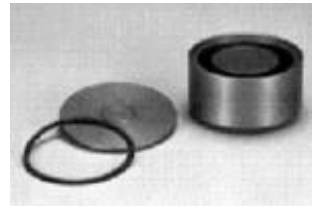
¹Tungsten carbide, zirconia ceramic and alumina ceramic are brittle as well as extremely hard, and cannot be guaranteed against chipping or breaking. If handling instructions are followed, these containers will provide years of useful service.

7.0 Accessories: Grinding Containers

(If not included in your Order, they are Available for Purchase at Additional Cost)

8507 Small Hardened Steel Grinding Container

Outer Dimensions (dia. x height): 9 x 5.4cm
Weight: 1.9kg Recommended Load: 5-20ml
Complete with: Dish, Lid, Puck, & Gasket



8508 Small Tungsten Carbide Grinding Container ¹

Outer Dimensions (dia. x height): 9.2 x 5.9cm
Weight: 3.5kg Recommended Load: 5-20ml
Complete with: Dish, Lid, Puck, & Gasket



8507R Rack ²

Holds one or three 8507 or 8508 grinding containers.
Rack base assembly and lid included; rack with three grinding containers lifts easily in and out of Shatterbox.
Please note that 8507 and 8508 containers cannot be mixed during the same run.

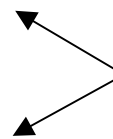


31688 Shatterbox Friction Disc

Durable rubber pad reduces operating noise and wear when placed under grinding container.

51793 Shatterbox Drive Belt

Special elastomer O-ring. **Note:** Drive belts should always be replaced as a set to ensure proper operation, 4 required. For models 8500 and 8515 only.



To Order any of these, or the above accessories, call Customer Service at 800-522-7739 or 732-549-7144 Fxt. 465

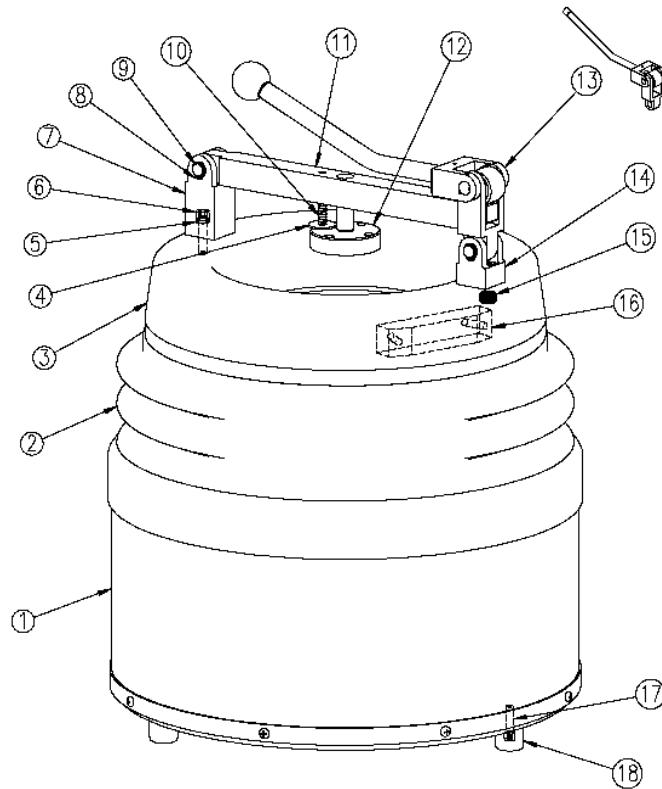
¹Tungsten carbide, zirconia ceramic and alumina ceramic are brittle as well as extremely hard, and cannot be guaranteed against chipping or breaking. If handling instructions are followed, these containers will provide years of useful service.

²Smaller tungsten carbide (8508) and steel (8507) grinding containers require 8507R rack for proper use.

8.0 PARTS LIST & ITEM LOCATOR

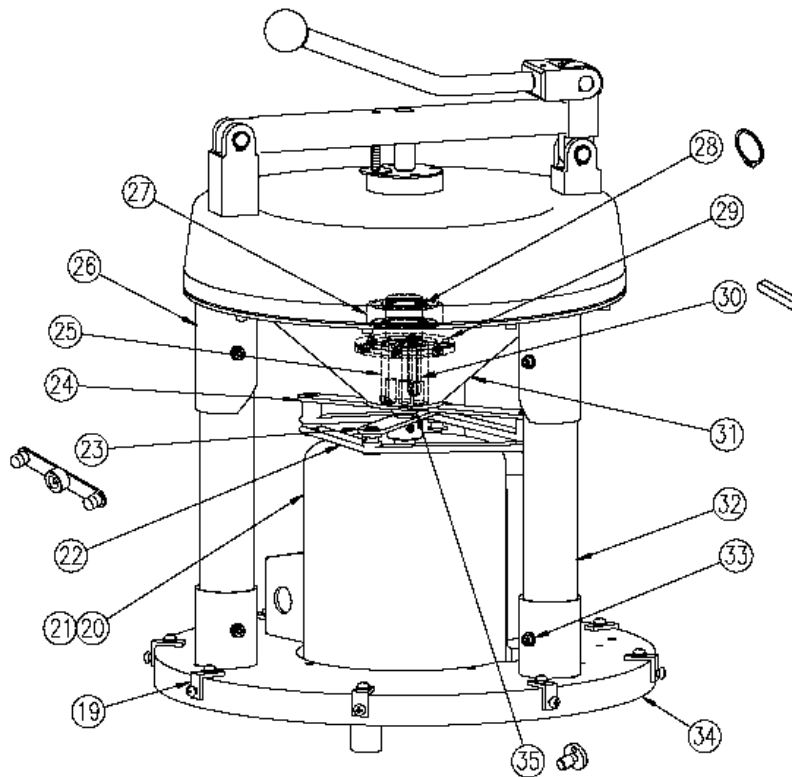
<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Location</u> (Diagram, Page #)
1	22465	Skirt, Perforated Metal	A, 12
2	22463	Dust Cover, Rubber Skirt	A, 12
3	22460	Capsule Retainer	A, 12
4	38276	Guide Locking Pin	A, 12
5	38407	Washer for Yokes	A, 12
6	38396	Shoulder Bolt for Yokes	A, 12
7	38279	Yoke, Long	A, 12
8	50541	Retaining Ring for Pins	A, 12
9	22456	Pin, 1 ½" for Yokes	A, 12
10	38373	Spring for Locking Pin	A, 12
11	38284	Lever	A, 12
12	38278	Guide	A, 12
13	38285	Clamp Lever with Roller Assembly	A, 12
14	38282	Yoke, Short	A, 12
15	38386	Threaded Insert for Capsule Retainer	A, 12
16	22454	Block (Counterweight)	A, 12
17	61177	Screw for Rubber Foot	A, 12
18	93726	Rubber Foot (3 Required)	A, 12
19	22450	Bracket	B, 13
20	96261	Motor 115/230-60HZ	B, 13
21	96265	Motor 115/230-50HZ	B, 13
22	51793	Drive Belt (4 required)	B, 13
23	31772	Coupling Arm Assembly	B, 13
24	31771	Eccentric Arm (Assembly)	B, 13
25	22467	Shaft	B, 13
26	31991	Ring Assembly	B, 13
27	50016	Bearing	B, 13
28	50536	Retaining Ring	B, 13
29	22468	Ring	B, 13
30	32823	Key	B, 13
31	22459	Funnel	B, 13
32	22464	Column for 8500 (3 required)	B, 13
33	50619	Screw	B, 13
34	31992	Base (Assembly)	B, 13
35	22469	Screw	B, 13
36	31688	Friction Disk	

9.0 DIAGRAM "A"



<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	22465	Skirt, Perforated Metal
2	22463	Dust Cover, Rubber Skirt
3	22460	Capsule Retainer
4	38276	Guide Locking Pin
5	38407	Washer for Yokes
6	38396	Shoulder Bolt for Yokes
7	38279	Yoke, Long
8	50541	Retaining Ring for Pins
9	22456	Pin, 1 1/2" for Yokes
10	38373	Spring for Locking Pin
11	38284	Lever
12	38278	Guide
13	38285	Clamp Lever with Roller Assembly
14	38282	Yoke, Short
15	38386	Threaded Insert for Capsule Retainer
16	22454	Block (Counterweight)
17	61177	Screw for Rubber Foot
18	93726	Rubber Foot (3 Required)

9.1 DIAGRAM "B"



<u>Item</u>	<u>Part No.</u>	<u>Description</u>
19	22450	Bracket
20	96261	Motor 115/230-60HZ
21	96265	Motor 115/230-50HZ
22	51793	Drive Belt (4 required)
23	31772	Coupling Arm Assembly
24	31771	Eccentric Arm (Assembly)
25	22467	Shaft
26	31991	Ring Assembly
27	50016	Bearing
28	50536	Retaining Ring
29	22468	Ring
30	32823	Key
31	22459	Funnel
32	22464	Column for 8500 (3 required)
33	50619	Screw
34	31992	Base (Assembly)
35	22469	Screw

10. TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
1 The unit does not turn on	No current	Make sure power cord is plugged into outlet
2 The unit does not turn on	No current	Check outlet for power and correct as required
3 The unit does not turn on	No current	Check laboratory timer and correct as required
4 The unit does not turn on	No current	Power Cord broken
5 Unit does not run	Motor Failure	Replace Motor
6 Unit does not run	Disconnected harness	Re-connect wiring harness to motor
7 Motor runs but mill doesn't work	Drive belts broken or disconnected	Replace belts, straighten drive arm(s) if necessary.
8 Mill works but grinding action is minimal	Eccentric arm installed 180° off	Reverse eccentric arm
9 The Clamp assembly doesn't lock	Clamp set too tight	Loosen Guide on Clamp
10 The Grinding Container moves in the Clamp	Clamp set too loose	Tighten Guide on Clamp
11 The unit walks all over the place	Surface too slippery	Move unit to higher friction surface

11. WARRANTY

SPEX CertiPrep Inc. guarantees its products and new equipment against defects in materials or workmanship for two years from the date of original shipment. Repairs, replacements, or parts are guaranteed for 30 days or for the remaining original warranty period (whichever is greater) for the item that was repaired or replaced. Items not produced by SPEX CertiPrep, Inc. carry the manufacturer's warranty only.

11.1 Product Specifications

Every effort has been made to provide complete and accurate product operation and information in this manual. However, since specifications are subject to change without notice, changes may be made from time to time to improve the performance of the product. Therefore slight changes that are not reflected in the current illustrations should be considered minor and inconsequential for the purposes of this operating manual.

11.2 To Arrange A Return Shipment

We want you to be happy with whatever you purchase from SPEX CertiPrep. Please bring any problem to our attention, but please DO NOT RETURN any item before contacting us for a Return Authorization Number and instructions. Unauthorized returns will be refused. Cost for all return transportation is the responsibility of the customer. Credit for returned merchandise will be issued only after goods have been received and inspected. Returned goods are subject to a 25% restocking charge up to a maximum of \$200.00.

To Contact Us

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