Cole-Parmer®
sampleprep

SM-200 Shatterbox®

Rock and Mineral Grinder (Ring and Puck Mill) for Spectroscopy Applications

Operation Manual

For 115V (04578-25)

For Product Information

ShatterBox®

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SPEX SamplePrep is now part of Cole-Parmer®.
The Cole-Parmer® SM-200 Shatterbox was formerly known as SPEX 8530 Shatterbox.

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1.0 INTRODUCTION

Since its introduction three decades ago, the Shatterbox has become the most popular "swing mill" in America. Now as then, it remains the most efficient way to pulverize up to 100 ml in volume (or 100 g in weight) of brittle material to analytical fineness. The SM-200 has many advanced features, including an electronic timer, a cam-action clamp, a safety-interlocking lid with pneumatic cylinders, and lockable casters.

The Shatterbox swings a dish-shaped grinding container, with a puck and (often) a ring inside, in a tight high-speed circle; the sample is quickly crushed between the wall and floor of the container and the moving puck/ring grinding elements. Smaller grinding containers and those made with ceramics have a puck-shaped grinding element; larger containers add a ring. Most grinding containers are fitted with a gasket to prevent sample loss during grinding.

Since grinding containers are chosen for specific tasks, there is no "standard" Shatterbox grinding container. In general, grinding times average two-to-five minutes, with resultant particle size well below 200 mesh, and in some cases below 10 microns. Typical samples include cements, soils, ceramics, slag, rocks, and ores, but the Shatterbox has also ground sulfur pellets, dried marsh-grass, pharmaceuticals, and many other materials. To maximize grinding capability and minimize contamination, grinding containers are available in hardened steel, tungsten carbide, alumina ceramic, and zirconia ceramic. The full range of Shatterbox grinding containers is described in detail in the ***Cole-Parmer Accessories Manual.***

The Shatterbox's advanced design features:

1. A cam action clamp lever assembly that engages the end of the clamp bar, and holds it down firmly as the lever is pushed into place. *The clamp must be carefully adjusted for each grinding container and should never be overtightened. (See instructions before use. Overtightening the clamp voids the warranty.)*
2. A programmable digital timer with Run, Stop, and Pause functions and visual display. Indicates minutes and seconds up to 10:00, the program time limit. Timer is programmed in 10-second intervals, counts down in 5-second intervals. The pause function freezes a run, retains time left to run.
3. Safety features include a safety lid interlock and gas cylinders for the lid, as well as a sound-insulated steel cabinet and lockable casters with which the mill can be fixed in place. The lid stays locked and timer displays RUN COMPLETE for 5 seconds after the motor stops.

2.0 SPECIFICATIONS

Type of mill: Grinding Mill
Grinding mechanism: Grinding containers with ring and puck
Weight: 225 lbs. (102 Kg)
Dimensions: 19 in (48 cm) x 19 in (48 cm) x 40 in. (102 cm)
Grinding Containers:

8501 Hardened Steel Grinding Container
8504 Tungsten Carbide Grinding Container
8505 Alumina Ceramic Grinding Container
8506 Zirconia Grinding Container
8507 Small Hardened Steel Grinding Container
8508 Small Tungsten Carbide Grinding Container
8521 Large Hardened Steel Grinding Container

NOTE: In practice, the sample capacity of any grinding container depends on the properties of the sample, particle-size requirements, and other considerations.

Electrical: CE Approved. Available in 115V/60Hz (15-amp fuse).

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

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

Fuses: 115V/60Hz version, 15-amp slow-blow fuse in inlet module,

Important: these fuses are "slow-blow" fuses, meant to withstand a temporary voltage peak in excess of the fuse's current rating. (Electric motors of the type used in the Shatterbox draw more amperage than normal while getting up to speed.) When replacing a fuse, remember to unplug the Shatterbox first, and always use a "slow-blow" type fuse.

Motor: 1/3 horsepower dual-winding 825-RPM motor powers the SM-200 Shatterbox. The low horsepower rating of the motor is based on its low fixed speed, but the motor has high torque (especially when starting up) and is more powerful than its HP power rating implies.

Safety Features: Lid Interlock prevents mill from running if lid is not closed and keeps lid locked down for 5 seconds after motor shuts off to allow mechanism to come to a stop.

Recommended operating conditions: Indoors, in ambient air, temperature between 40° and 90° F. (4° – 35° C), humidity between 0% and 95%.

3.0 UNPACKING

The SM-200 Shatterbox mechanism and its cabinet are shipped assembled, and carefully packed to avoid damage during shipping. 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, file in your records.

Before unpacking the SM-200 Shatterbox, place the shipping carton upright and as close as possible to the mill intended location. Open the top of the shipping box. Remove the top and body of the carton. Note that if the tape holding the carton's bottom piece together is slit on one side, that flap can be folded down and the Shatterbox rolled off after unlocking the casters.

A plug-in line cord, an extra set of 51793 drive belts, an extra set of fuses, and a 31688 Friction Disc are included with your new Shatterbox. One Friction Disc (a circle of thin rubber matting) should always be kept in the recess off the capsule container, to cushion the grinding container, reduce the noise of the grinding, and prevent unnecessary and rapid wear of the clamp and capsule retainer.

Move the mill to the location where it is likely to stay, lock the casters, and open the lid. Please note that the Shatterbox should always be installed and operated on a level surface. Check the power switch, which is on the back of the cabinet, next to the electrical inlet; this switch should be in the off position (the 0 should be pushed in) when the power cord is first attached. Look for any hidden damage that may have occurred during shipping.

The SM-200 Shatterbox comes fully assembled. However, **before plugging the Shatterbox in and using the controls for the very first time, first inspect the drive mechanism to make sure it is properly linked and aligned**. The Shatterbox was tested before shipment, but there are four flexible belts connecting two drive arms, one on the motor and one on the capsule retainer. The belts can become dislodged during shipping. **If the Shatterbox is run with the drive mechanism uncoupled or misaligned, damage can result**.

To inspect the drive mechanism, remove the access panel on the back of the case. (Note that in general this panel should not be removed without unplugging the power cord.) Check the belt linkage between the arm on the motor and the arm on the rotating funnel on the bottom of the capsule assembly. The two arms should be parallel and unbent, connected by four belts (O-rings) in a diamond pattern that overlaps at the corners. (The coupling arm is attached to the top of the motor shaft. The eccentric arm is attached to the bottom of the rotating funnel.) Spin the arms by hand; the motor arm and the funnel arm should rotate together smoothly.

If the drive belts have come off, replace them: in a diamond pattern, two belts up and two belts down. Spin the arms by hand.

3.0 UNPACKING (Cont'd)

If either arm has become bent, straighten it; the arms are made of a soft alloy which can be bent without harming it. Spin the coupling arm by hand; the eccentric arm and the funnel should rotate together freely. The hubs of the coupling arm and the eccentric arm should be between 1/16" and 1/8" apart; if they are not, the coupling arm may have ridden up or down the motor shaft. Correct this by loosening the setscrews holding the coupling arm, and adjusting its position on the motor shaft. When the drive belts are aligned and the hubs of the two arms properly separated, tighten the setscrews (use a 1/8" Allen wrench).

As re-installing the access panel, note the electrical inlet, on/off switch, and the fuse holder on the left side of the access panel opening. The 115V 60Hz Shatterbox takes two 15-amp "slow blow" fuses.

Plug the cabinet power cord into an approved electrical outlet: in North America, a 3 prong grounded 115V outlet on a circuit fused at 20 amps.

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

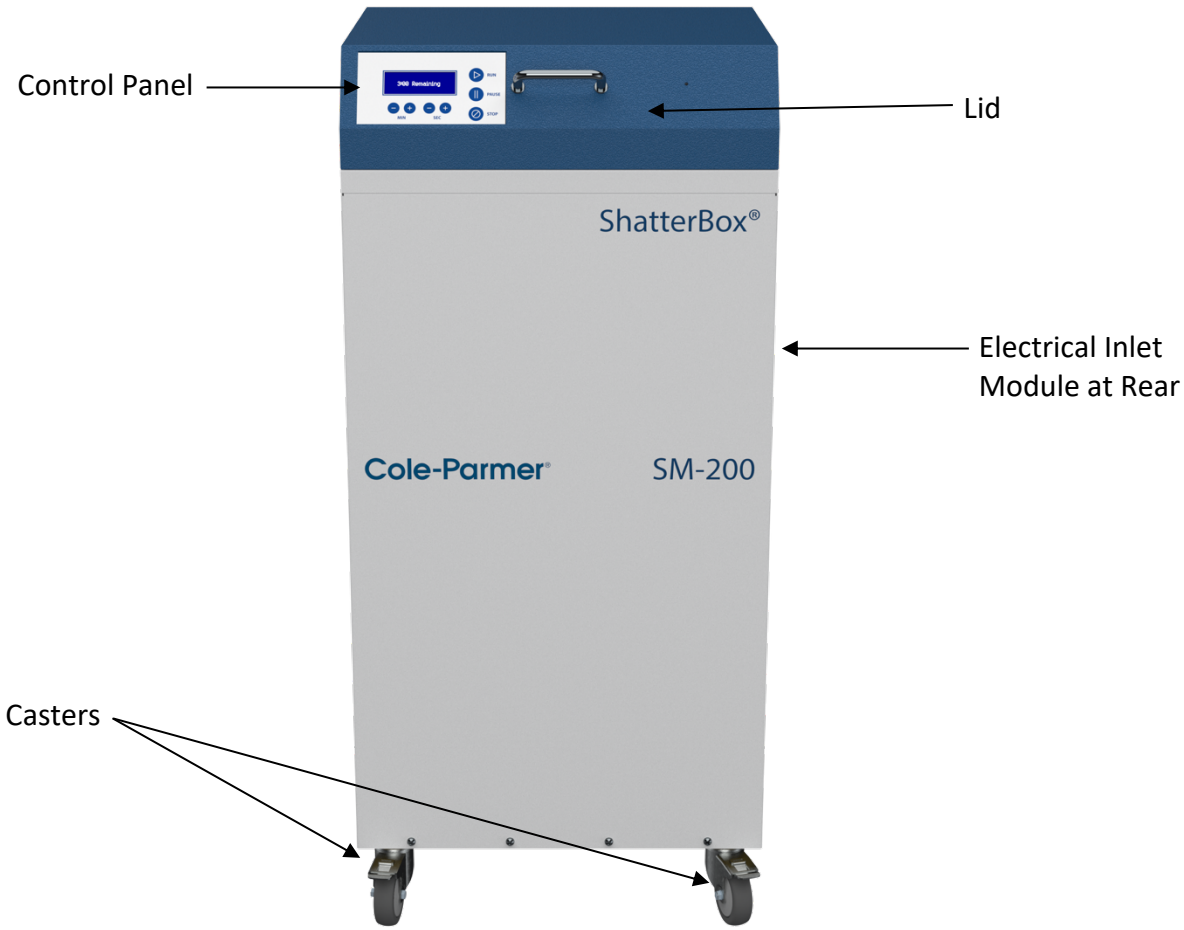


Figure 1 - SM-200 Shatterbox (exterior)

4.0 SETTING UP

After the initial unpacking and setup of the Shatterbox, you are ready to prepare the unit for actual use.

As you make the Shatterbox ready to grind samples, become familiar with the grinding Container you will use. The sample is placed in a container with a puck (and sometimes a ring); then the container is swung in a tight circle while the puck (and ring) crushes the sample against the bottom and wall of the container. Most of the Shatterbox containers have an O-ring or gasket that prevents leakage during grinding. Grinding containers are available in several sizes and in a range of materials to minimize objectionable contamination: hardened steel (Cat. Nos. 8501, 8507, and 8521), tungsten carbide (Cat. Nos. 8504, 8508), alumina ceramic (Cat. No. 8505), and zirconia ceramic (Cat. No. 8506).

Before operating your new SM-200 Shatterbox, it is important that you become familiar with its special features. This section explains in detail how each part of the Shatterbox works. Directions for operation (minus these detailed descriptions) are given in "Operations." There are four important conditions of operation, which bear repeating:

1. ALWAYS CLAMP A CONTAINER IN PLACE WHEN RUNNING THE SHATTERBOX.
2. DO NOT OVERTIGHTEN THE CLAMP.
3. DO NOT OPEN THE LID UNTIL THE LID LATCH IS DISENGAGED.
4. ALWAYS UNPLUG THE MILL BEFORE OPENING THE CABINET ACCESS PANEL.

While familiarizing yourself with the operation of the Shatterbox you may wish to clamp in place a grinding container without its puck/ring. Read the clamp instructions first.

4.1 Locking Casters

All four casters swivel, and can be locked and unlocked with the foot. Each caster has a downward sloping pedal with a small tab projecting up. To lock the casters, press the pedal down. To unlock the casters, push the tab back. To move the SM-200 Shatterbox easily, unlock the casters; to keep it in place, lock them. Always lock the casters before operating the Shatterbox.

4.2 Pneumatic Cylinders

There is one on either side of the lid, to hold it firmly in the open or closed positions. Open and close the lid several times to get the "feel" of lowering the lid gently. Keep fingers and objects off the rim of the Shatterbox cabinet when lowering the lid, as the pneumatic cylinders will not slow its descent during the last few inches.

4.3 Safety Interlock

The SM-200 Shatterbox is designed so the lid cannot be lifted while the capsule retainer is moving. When the Run button is pushed, it activates a solenoid that locks down the lid. Not until the lid locks down will the Shatterbox motor start. At the end of a run when the timer reaches zero, the motor shuts off, the timer displays RUN COMPLETE, and the lid stays latched for 5 seconds to allow the grinding mechanism to slow down. After 5 seconds the lid unlatches with an audible click, and the timer re-sets. *Always wait until the lid is unlatched before opening it.*

If the safety interlock cannot engage, the mill will not start, and ERROR: LATCH FAILURE appears in the timer display. When the problem has been corrected and the Interlock can engage, the ERROR display will continue until the stop button is pushed. Only when the time setting (example: 3:00 REMAINING) reappears in the display can the Shatterbox be started.

4.4 Cam-Action Clamp

The cam-action of the clamp makes it possible to hold any Cole-Parmer 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. **It is absolutely necessary to adjust the clamp properly before using it, as overtightening the clamp can damage it. Such damage is not covered by the warranty**.

To use the clamp, first swing the clamp lever to the right and the clamp arm to the left side of the cabinet. Then place a grinding container squarely in the recess of the capsule retainer. (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 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 clamp arm; the roller in the clamp lever assembly should rest in the curved recess of the clamp arm. Swing the clamp lever over to the left. **If the lever meets strong resistance, STOP! The clamp is not properly adjusted and must be loosened. Overtightening the clamp can break the cam mechanism.**

The best way to adjust the clamp is to screw the guide back into the clamp bar until contact with the grinding container is loose. Then extend (unscrew) the guide until the clamp becomes snug. The ideal tightness for the clamp is just past the point where the grinding container can be rotated with the clamp lever down. When the clamp is perfectly adjusted, the lever will meet moderate resistance as it is pushed through the top of its arc, then close easily.

4.4 Cam-Action Clamp (Cont'd)

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 as it approaches the vertical. We repeat, **never force the lever**, but disengage it and loosen the guide.

The guide may be tightened or loosened by screwing it away from, or toward the clamp arm. First disengage the locking pin by pushing its flange toward the spring. Then screw the guide away from the clamp arm to tighten it, or toward the clamp to loosen it. Test the fit by closing the clamp. When the clamp is adjusted, make sure the locking pin is engaged.

4.5 Controls

4.5.1 *Main Power Switch*

This is the rocker switch on the back of the cabinet, next to the electrical inlet. It controls the flow of current to the controls and motor. When you press this switch to the on position (I) the timer display will light up. The timer can now be programmed. Pressing this switch to the off position (0) will switch off power to the mill.

4.5.2 *Digital Timer*

The timer includes minutes: seconds numerical display, pushbuttons for the run, stop and pause functions, and buttons to change the timer setting. The display indicates the programmed grinding time when the mill is not running: 3:00 REMAINING means the Shatterbox is programmed for a 3-minute run. During a run, the timer counts down the time remaining in 5-second increments: 2:05, 2:00, 1:55, etc. The time is displayed in minutes and seconds; for example, 1:30 equals one minute and thirty seconds.

Time is programmed in 5-second increments, by pressing the minus (-) or plus (+) buttons below the timer display.

The timer display also includes three status screens:

- PAUSED is displayed when the pause button has been pressed.
- RUN COMPLETE is displayed for 5 seconds after the run is over; and
- ERROR: LATCH FAILURE is displayed when the lid interlock cannot engage.

NOTE: ***Before setting the timer and operating the SM-200 Shatterbox, clamp a grinding container firmly in place. Also, while learning how to operate the Shatterbox you may want to use a grinding container with its puck/ring grinding elements removed.***

4.5 Controls (Cont'd)

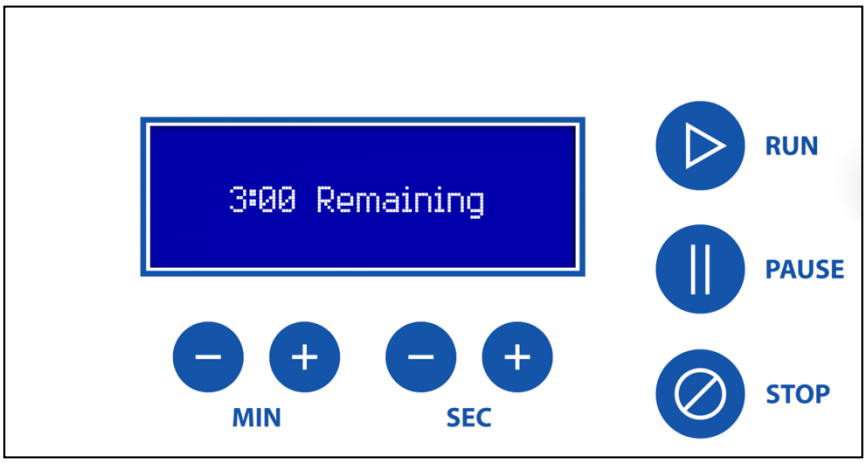


Figure 2 - Digital Timer Screen and Controls

4.5.3 *Setting the Timer*

When power is switched on, the timer will first display the Cole-Parmer logo, followed by:

COLE-PARMER
SM-200 SHATTERBOX

The timer will then display the default timer setting of three minutes (3:00). Assuming a grinding container is clamped into the capsule retainer and the lid is down, pressing RUN will initiate a run of 3 minutes. First there will be a delay of several seconds for the lid latch to engage, then the timer will start counting down in 5-second increments: 2:55, 2:50, 2:45, etc.

Every time power is turned off and back on, the timer will revert to the 3:00 default setting. To keep another timer setting, leave the power on. If power is not interrupted, the timer will display the most recently programmed setting.

Set the grinding time with the four buttons below the timer display. There are Plus (+) and Minus (-) buttons for minutes, and Plus (+) and Minus (-) buttons for seconds. The MIN buttons will change the minute setting 1 minute at a time, and the SEC buttons will change the seconds setting 5 seconds at a time. 10:00 is the maximum running time; increasing the minutes setting past 10 will take the setting to zero. 50 is the maximum setting for seconds; increasing the seconds past 50 will take the setting to zero. If a button is pushed and immediately released, it will change its setting by one unit.

4.5.4 *Starting and Running the Shatterbox*

Push the run button to begin a grinding cycle. There will be a short pause while the lid interlock engages, and then the Shatterbox motor will start. The timer counts down 5 seconds at a time, showing the time left in the run. When the timer reaches zero and the motor shuts off, the timer will display RUN COMPLETE for 5 seconds while the lid latch stays locked. This allows the capsule retainer mechanism to slow down. When the interlock releases the lid (with an audible click), the timer display will return to its prior setting. **Never try to open the lid before the interlock releases; this can damage the lid latch.**

4.5.5 *Using the Stop and Pause Buttons*

To stop the mill during a run, push the stop button. This will shut off the motor and re-set the timer. RUN COMPLETE will be displayed for 5 seconds and the lid will stay latched. After 5 seconds the original timer setting will re-appear and the lid latch will release.

To have the mill pause during a run and retain the timer setting, push the pause button. The motor will shut off and PAUSED will appear in the display. The lid latch will not release. To resume the run, push RUN; the timer will briefly display the exact number of seconds left in the run and then count down in 5-second increments. To abort the run, push STOP; RUN COMPLETE will be displayed for five seconds and the lid latch will release.

4.5.6 *Timer/Lid Latch Interlock*

The timer is connected to the safety interlock, a latch in the lid that hooks under the front edge of the cabinet when the RUN button is pressed, and locks the lid down. If the Shatterbox lid cannot be locked down when RUN is pressed, the motor will not start and ERROR: LATCH FAILURE will appear in the timer display. When this happens, correct any problems with the interlock latch, then press STOP to clear ERROR: LATCH FAILURE from the display, and restore the timer setting. Only when the timer setting is restored can the Shatterbox be started again.

5.0 OPERATION

The following sequence is typical. It supposes familiarity with the chief features of the Shatterbox, as described in "**SETTING UP**." First, these cautions:

Never operate the Shatterbox without a grinding container and friction disc clamped firmly in place. (If it is necessary to run the Shatterbox without grinding a sample, remove the grinding element(s) from the container.) ***Never remove the access panel in the back of the cabinet unless the mill is first unplugged.***

1. Switch the power on. The timer display will light up. Initially it will flash the Cole-Parmer logo and then display Cole-Parmer SM-200 SHATTERBOX, but this will shortly change to the default timer setting of 3:00.

2. Program the timer, using the buttons immediately below the numerical display. The left minus (-)/plus (+) buttons control the minutes, and the right minus (-)/plus (+) buttons control the seconds.

5.0 OPERATION (Cont'd)

3. Load the grinding container with sample. If running the Shatterbox without grinding anything, remove the grinding element(s) from the container. Clamp the container into the capsule retainer. Make sure that the friction disc is properly placed and the grinding container is firmly seated. If the clamp is properly adjusted, the clamp lever should work smoothly with some resistance at the top of its arc, but you should not be able to rotate the container in place once the clamp lever is down. If the clamp is too tight or too loose, adjust it.

4. Shut the lid, and press the run button. There will be a brief pause while the lid locks down, and then the Shatterbox motor will start. As it runs, the timer display will count down the minutes and seconds remaining, in 5-second increments. When the timer reaches zero, RUN COMPLETE will appear in the timer display for five seconds while the lid remains latched; this gives the grinding mechanism time to slow down. Then the timer setting will re-appear and the lid will unlatch, with an audible click. *Always wait for the lid to unlatch before opening it.*

Open the lid, unclamp the grinding container, and remove it for emptying and cleaning.

If ERROR: LATCH FAILURE is displayed instead of numerals when the run button is pressed, the interlock is not properly engaged. Clear the timer by pressing the stop button, and correct the problem.

5.0.1 *Loading a Shatterbox Grinding Container*

Before using a Shatterbox grinding container, check to make sure that it is clean and that the gasket or O-ring is in good condition. Before it is loaded into the container, the sample should be crushed to proper feed size as discussed previously: approx. 1/4" for the steel and tungsten carbide containers, and 1/8" for the alumina and zirconia ceramic containers.

Place the sample in the grinding container AFTER the ring or ring-and-puck is in place. Do not overload the grinding container. If loading a steel or tungsten carbide grinding container with a ring as well as a puck, place the sample evenly on both sides of the ring.

Before putting the cover on the grinding container, check the position of the O-ring, and make sure no sample is on the rim of the container, or underneath or on top of the ring and puck. A good way to tell whether the cover is firmly seated is to rotate it slightly, or slide it from side to side; if sample particles are preventing the cover from closing tightly, this will be apparent.

If the cover of the grinding container is not firmly seated when the container is clamped into place, it is likely that the clamp will loosen during grinding. At best the grinding container will leak. At worst, the container can leave the clamp, causing damage to both the mill and container.

5.0.2 *Emptying and Cleaning the Grinding Container*

The grinding container is usually emptied by brushing out the ground sample. Typically, a technician will start by brushing the sample off the underside of the cover into the container, and brushing off the tops of the puck and ring. Then the ring is lifted partway out of the container and brushed off, followed by the puck. Finally, the container is tilted and the entire sample brushed out. Some technicians recommend coarse-bristled brushes (for example, inexpensive Nylon paintbrushes) because they are easy to clean.

***WARNING*: Finely pulverized sample always presents a respiratory hazard; a dust mask or other protection should be worn when working with it.**

Grinding containers should be cleaned after use. Methods have included wiping with a damp paper towel, blowing out with an air hose, rinsing with water or alcohol, etc. Most of these methods are not very effective, and blowing the dust out of a container with an air hose causes a respiratory hazard. We recommend a two-minute period of grinding with a mixture of clean quartz sand, hot water, and soap or laboratory detergent. The residue is easily and safely washed out of the container, which then may be dried.

Technicians who are particularly concerned about cross-sample contamination may adopt the "grind and discard" technique. After sample A has been ground and the grinding container nominally cleaned, a portion of sample B is ground and discarded, and the container cleaned again. Now it should be possible to grind a portion of sample B without contaminating it with sample A.

A cleaned grinding container, which will not be used for some time, should be stored in a plastic bag. Hardened steel grinding containers should always be dried and stored carefully, as they are prone to surface rusting.

5.0.3 Grinding Hints

It is risky to give exact formulas for sample grinding because there are so many variables. Few types of sample have the same grinding characteristics. Grinding containers are made of different materials, all of which grind differently; furthermore, a worn grinding container will be less efficient than a new one. While there are many analytical techniques that require finely ground samples, the necessary particle size for proper analytical results may vary from instrument to instrument and from sample to sample. Consequently, these guidelines are general.

For any grinding container, the smaller the overall sample size, the finer it can be ground in a given time. Unless a sample cakes during grinding, the longer it is ground, the finer it will get. Particle size can almost always be lowered further by reducing the sample size or lengthening the grinding time, or both.

Dry grinding is relatively efficient for most brittle materials, but at small particle sizes (below 50 microns) there is a tendency for particles to agglomerate, or "cake." There are many

5.0.3 Grinding Hints (Cont'd)
grinding aids to prevent caking. Water, alcohol, solvents, and other liquids can be added to create slurries whose mean particle size after grinding can be well below 10 microns, but for most analytical techniques the liquid must be removed before analysis. Dry grinding aids include soap powders, detergents, stearates, and aspirin, all added to comprise 1% to 10% of the total sample weight. Cole-Parmer recommends a technique pioneered by Howard Kanare of Construction Technology Laboratory: ethylene glycol or propylene glycol is added to the sample in the amount of one drop for every five to ten grams of sample.

In most analytical work it is important to reproduce particle size from sample to sample. Like other laboratory mills, the Shatterbox requires a fixed routine to accomplish this: a uniform sample weight, grinding aid, grinding time, container, etc.

6.0 MAINTENANCE

6.1 Cleaning the Shatterbox

Depending on how dusty the working environment is it may be necessary to clean the Shatterbox regularly. The clamp and capsule retainer should be vacuumed or wiped off. Any spilled powders or liquids should be wiped up immediately with a slightly 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. To clean the Shatterbox mechanism, remove the access panel on the back of the cabinet (after unplugging the mill) and vacuum the exposed surfaces.

For a properly functioning Cam-Action Clamp, it is **absolutely necessary** that the lever assembly roller rotates 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.

NOTE: It is important to unplug the unit from its power source before beginning any cleanup or maintenance work that is to be performed on the mill.

7.0 CHANGING THE FUSES

If the Shatterbox will not operate when the run button is pressed, it is possible that one or both fuses may have blown. To access the fuses, first remove the power cord from the back of the Shatterbox. Then open the door on the fuse compartment by gently prying it open at the top and flipping it down. Use a small screwdriver to gently pry the red fuse holder out of the compartment, as shown in Figure 3. Remove the fuses and check them using a continuity tester. If either fuse is blown or defective, replace both with 3AG 15-amp. Position the fuse holder such that the appropriate operating voltage appears on top. Return the fuse holder to the fuse compartment and close the access door. Check the window of the fuse compartment to make sure that it shows the appropriate voltage. If not, the fuse holder is upside down and must be turned around before attempting to operate the Shatterbox.

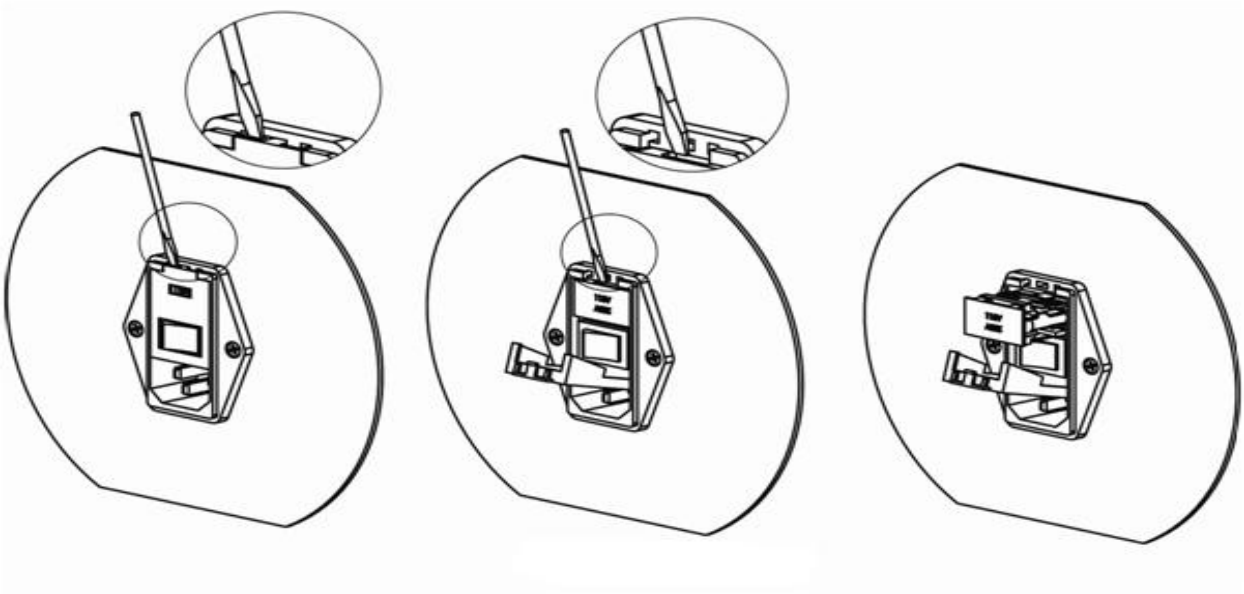


Figure 3 – Changing The Fuses

8.0 TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
The unit does not turn on.	No current. No current. Blown fuse. Power switch not turned on.	Make sure the power cord is plugged into the outlet. Check outlet for power and correct as required. Replace fuses. Press power switch to ON position.
Unit does not run. Display shows ERROR: LATCH FAILURE.	Safety interlock switch	Make sure the lid is completely closed. Press STOP to clear the display. Adjust latch if necessary (See Section 4.3).
Unit does not run. No error message.	Disconnected harness.	Re-connect wiring harness to motor.
Display reads RUN COMPLETE, but lid is locked.	Lid opened too soon.	Wait 5 seconds before lifting lid.
Display reads RUN COMPLETE, but lid cannot be opened 5 sec. after motor stops.	Lid latch jammed.	Push latch to off position with knife blade, open lid, and adjust latch.
Grinding container locked up, will not grind.	Too much sample is in the vial or sample pieces are too large.	Reduce sample quantity or size of sample pieces.
Excessive vibration, unit "walks".	Casters not locked.	Lock casters.
Grinding container leaks.	Clamp loose.	Adjust clamp. (See Section 4.4).
Clamp will not close.	Clamp too tight.	Adjust clamp (See Section 4.4).

9.0 WARRANTY

Cole-Parmer® guarantees its products against defects in materials or workmanship for one year 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 Cole-Parmer® carry the manufacturer's warranty only.

The warranty excludes wear parts. These are parts that wear out through use and must be replaced periodically for proper operation. SM-200 Shatterbox wear parts include the following which can be changed by the user.

Wear Parts	
Part No.	Description
51793	Drive Belt
38372	Gas Cylinder

In the event that these or other parts require service, please contact Cole-Parmer to arrange a return shipment.

The customer pays return freight for warranty claims. If the warranty claim is valid, Cole-Parmer® will pay return freight to the customer. However, Cole-Parmer® reserves the right to judge whether a malfunction during the warranty period is due to defects in materials or workmanship, or to wear, negligence, or misuse.

9.1 Product Specifications

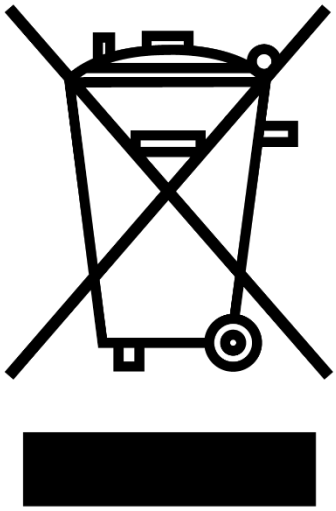
Every effort has been made to provide complete and accurate product operation and information in this manual. However, since specifications are subject to change without notice, changes may be made from time to time to improve the performance of the product.

9.2 To Arrange a Return Shipment

We want you to be satisfied with your purchase from Cole-Parmer®. 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. The 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.

10.0 INSTRUMENT DISPOSAL

In accordance to the EU Directive 2012/19/EU covering Waste Electrical and Electronic Equipment, all equipment with the disposal symbol must not be disposed of with general waste. (Figure 4)



Disposal Label is located on the back of unit.

Figure 4 - Disposal Symbol

Throughout the European Community, guidelines regarding disposal regulations may vary from territory to territory. Please contact the national legislation or local authority for more information on proper disposal of all equipment with this symbol.

11.0 CONTACT US

Repair Service
Phone: 1.732.623.0465

Cole-Parmer SamplePrep
65 Liberty St
Metuchen, NJ 08840
US
Attn: Service and Repair
Please include RA Number on the shipping label.

65 Liberty Street
Metuchen, NJ. 08840
USA

Phone: +1.732.623.0465
Email: sampleprep@coleparmer.com
Web: cpsampleprep.com