UDY CYCLONE SAMPLE MILL

PRINCIPLES OF OPERATION

The Cyclone Sample Mill uses a high velocity air-flow, an abrasive surface, and centrifugal forces to grind material. Figures 1 and 2 identify the main parts. The Impeller rotates at a high speed creating the high velocity flow of air to propel articles against the abrasive surface.

When material is added to the Mill, the rotation of the Impeller and centrifugal force throw the particles to the perimeter of the Grinding Chamber where the air-flow pushes them along the abrasive tungsten carbide surface. When the particles become small enough, they move with the air-flow out of the Grinding Chamber and are deposited in a sample Collection Bottle by cyclone action.

The air-flow prevents accumulation inside the Grinding Chamber eliminating the need to clean out the Mill between samples. The air-flow also minimizes heating of the materials accumulation inside the Grinding Chamber eliminating the need to clean out the Mill between samples. The air-flow also minimizes heating of the material to avoid thermal degradation.

The Mill creates a relatively uniform particle size. The Screen only has an indirect effect on the particle size, because most particles do not escape the Grinding Chamber until they are small enough to flow with the air stream. However, impact with the Impeller throws some larger particles toward the Grinding Chamber exit. The Screen provides an upper limit of the size particles that can be thrown prematurely. Finer screens reduce the air-flow and consequently, the particle size the air can carry, as well as limiting the maximum particle size.

An optional Sample Feed Controller provides a uniform feed rate of material into

the Mill. This significantly increases the uniformity of the particle size of the ground samples. It also makes sample addition more convenient and eliminates the possibility of Mill overloading.

The Cyclone Sample Mill is available in Direct Drive and Belt Drive versions. The Belt Drive version is recommended for almost all applications. The Direct Drive version can be used only for light duty application where uniform particle size distribution is not needed. It uses a .500 H.P. series wound universal motor with a speed of about 10,000 to 20,000 rpm depending on the load. The Belt Drive version is much quieter and has a higher grinding capacity. It rotates the Impeller at a relatively constant 12,600 rpm (10,500 for 50 Hz. Mills), using a ¾ HP totally enclosed induction motor. Additional general information about the Mill such as materials millable, sample feed into the Mill, initial and final particle sizes, etc. may be found in the color brochure of the Mill.

Set-Up

Place the Mill in the desired location. Verify that a screen and the Cyclone Air Separator are in place, then place the Cover on the top o the Mill. Secure the Cover by simultaneously tightening two Clamps on diagonally opposite sides of the Mill. Tighten the remaining two Clamps. Plug the Mill into a suitable power outlet. Plug the Air Outlet Filter Assembly (not used when using the Sample Feed Controller) into the Cover outlet. If a Sample Feed Controller is to be used, remove the Bin Gate and slide the Sample Feed Controller Plate Mounting Plate into the Bin Gate slot. Rest the motor on the top edge of the Sample Bin. Secure the Sample Feed Controller by tightening the Bin gate Set Screw. Plug the Sample Feed Controller into the Socket of the backside of the Base (3010-017 and 301-018 models or those newer models with the optional plug in the Base) or into a separate power outlet.

OPERATION

Position a Sample Collection Bottle under the Cyclone Body by depressing the spring loaded Bottle Support. Then turn the Mill on. DO NOT ADD SAMPLE BEFORE THE MILL IS TURNED ON AND UP TO SPEED.

The first time material is ground or after changing types of samples using the standard Cover without a Sample Feed Controller, determine the proper Bin Gate position. The Bin Gate should be positioned to prevent material from entering the Mill fast enough to slow the Motor. Do not dump sample into the Sample Bin only to prevent overloads in case the sample is accidentally poured into the Bin too fast.

Slowly pour the sample into the Mill from a small container that holds the desired sample size. Do not grind so much sample that it builds up in the Cyclone Body with Bottle Seal above the Collection Bottle. The standard 210 ml glass Collection Bottles hold up to 40 grams of wheat (approximately 50 ml before it is ground). The maximum weight of other materials will vary. The optional 500 and 1000 ml plastic Collection Bottles' capacities have to be determined. Material will often pile up in them and reach the Cyclone Body w/Bottle Seal before completely filling the bottles. Gently tapping the bottles can level out the material and permit grinding larger quantities at one time. When using the optional Nylon

Collection Bag, it must be tied on securely to avoid blowing out the sample. Position the Bag so that the drawstring tightens about 1 to 2 cm above the end of the Cyclone Body w/Bottle Seal; then wrap the string around the Bag and the Cyclone Body w/Bottle Seal before tying it.
When a Forage Cover is used to grind bulky low-density materials, the materials must be added carefully to avoid overloads. Pre-chopping the material and placing a large Funnel on the Forage Cover is helpful. Funnels are available through UDY Corporation or they can be purchased from most hardware stores. The stem diameter should be 38 mm or slightly less.

When a Sample Feed Controller is used, the sample is dumped into the Hopper Funnel of the Sample Feed Controller after the Mill is turned on. The power switch on the Sample Feed Controller is ordinarily left on so when the Mill is turned on, the Sample Feed Controller also comes on (Models 3010-017 and 3010-018) of the older models or with the newer models with the plug installed in the Base.

DO NOT TURN THE MILL OFF UNTIL ALL THE MATERIAL HAS EMPTIED FROM THE SAMPLE BIN AND THE SAMPLE FEED CONTROLLER, IF USED, UNLESS A PROBLEM OCCURS.

If it becomes necessary to shut the Mill off before all the material has fed into and exited from the Mill, manual clean out of the Grinding Chamber may be required. When the Sample Feed Controller is turned off with the material in it, some may slowly leak from it and enter into the Mill, especially the Mill is left on.

When no more sample appears in the Cyclone Body w/Bottle Seal, the Mill can be turned off. If the Mill is to be left running continuously, press the Air Inlet Plug Assembly down momentarily while the Sample Collection Bottle. Otherwise, dust will be expelled into the room. However, do not block the air-flow through the Mill for more than a few seconds.
Seal the Collection Bottle with a cap, then shake thoroughly to obtain a homogenous sample mixture.

During the operation of the Mill, be alert for unusual sounds and conditions. Problems are rare, but ones can occur when can result in damage to the Mill. Heat build-up caused by material under the Impeller or blocked air-flow can ruin the Grinding Chamber. Alertness for decreased air-flow or increased temperature of the exhaust air is advised especially when grinding materials which tend to build up in the Grinding Chamber.

GENERAL INFORMATION

DO NOT OPERATE THE MILL WITHOUT A SCREEN IN PLACE. THE GRINDING CHAMBER WILL BE DAMAGED BY THE SAMPLE ABRASION.
IF THE MOTOR SLOWS DOWN, THE FEED RATE IS TOO FAST. Excessive feeding will reduce the particle size consistency and may result in material build-up in the Grinding Chamber. NOTE: ON EARLIER MODELS OF THE MILL (60 HZ SERIAL NUMBERS BELOW 4000 AND 50 HZ MODELS WITH SERIAL NUMBERS BELOW 2100) loading to the point of slowing the motor down causes

belt failure. Proper fee rate is automatic when using a Sample Feed Controller of the proper speed is used. Uniform feed rates lead to a more uniform particles size and improved accuracy for NIR analysis. Use of the Sample Feed Controller, is therefore, highly recommended when possible, especially if NIR instruments are to be used for testing. If a Mill will no longer operate without slowing, when a Sample Feed Controller is used, the Impeller or Grinding Ring, or both, are probably excessively worn.

The maximum dimension of sample particles fed into the Mill should not exceed 5 mm unless the particles are of low mass such as leaves or forages. Large particles may be reduced by a variety of means including crushing in a bag with a hammer, blenders, coffee grinders, and other special mills. Foliage leaves and stems may be fed directly into the Mill when the optional Forage Cover is used. Scissors or shears can be used to chop up long pieces.

Larger quantities of material can be conveniently ground and collected using the Nylon Sample Collection Bag (part no. 30-0311) in place of a Sample Collection Bottle connected to the lower portion of the Cyclone Body w/Bottle Seal. Other bottles may be used with adapters or by modifying the Cyclone Body w / Bottle Seal or Bottle Support or both.
Occasionally, because of high moisture or oil content in a product (typically 15% or more moisture or 20% or more oil), or other properties of materials, the self-cleaning action of the Mill may be hampered. In these cases, additional air-flow through the Mill is recommended. To increase the air-flow, a canister or tank vacuum cleaner may be connected directly to the collar at the air outlet in place of the Air Outlet Filter Assembly. Contrary to the expectation, this will decrease sample loss and improve performance because of the increased centrifugal forces caused by the higher air-flow. However, this slightly increases the average particle size.

When materials contain so much oil or moisture that increasing the air-flow is not sufficient, grinding may still be possible. Safflower seed, sunflower seed, meat and bone meal, etc. can be ground in the Mill after a pre-grinding with benonite clay or Filter Aid (Part no 30-0511)m an inert diatomaceous earth, if samples are not being tested by NIR or other methods which might give inaccurate results due to the added material. Pre-grinding can be done in a blender. Typical ratios are 1 part sample with 2 to 3 parts absorbent. For quantitative analytical work, the amount of absorbent and the amount of sample must be weighed; the correct new sample weight must be calculated. Multiply the usual specified weight by the total weight of the sample plus absorbent and divide by the weight of the sample.

To minimize the dust, a vacuum, other filters, or a vent tube to another area can be connected to the air outlet instead of the Air Outlet Filter Assembly.
MAINTENANCE

The cover on the Air Outlet Filter Assembly should be removed and the Air Outlet Filter Media is cleaned by vigorous shaking or vacuuming whenever the air-flow through the Mill is reduced. Obstruction of the air-flow is also indicated by a significant warming of the air and the loss of suction into the Mill.
After every 1,000 samples, or whenever samples begin clinging to the surface,

wipe the inside surface of the Cyclone Body w/Bottle Seal with a cloth moistened with Anti-static Solution (part no. 35-0505). Allow the surfaces to completely dry before using the Mill.

If the Mill is turned off before all the material exits, the Grinding Chamber must be cleaned out before the Mill is restarted. Remove the Impeller and vacuum any material accumulated under the Impeller. Be careful not to poke the plastic seal of the bearings with a sharp object. DO NOT clean the Chamber with liquids (If any liquid enters the bearings, they will be ruined, and many liquids will cause corrosion of the Grinding Ring).

If material is prone to collecting under the Impeller, the feed rate may be too fast. If the materials collects under the Impeller with slow feed rates, the Impeller is defective and should be replaced.

The Screen, Impeller, and Grinding Ring are all subject to wear and need periodic replacement. The frequency depends on the abrasiveness of the samples and other factors such as the type of testing being done on samples. NIR testing generally requires replacement after little wear to avoid calibration shifts. Screen need replacement as they are worn away because the enlarged holes permit larger particles to pass through them. The vanes on the Impeller wear down (get shorter and outside edges of the vanes become tapered like the edge of a knife) (instead of rounded edges). Thus, the air-flow is reduced. As air-flow is reduced, the grinding capacity is lowered, and the samples must be added at a slower rate. As the carbide abrasive ring (Grinding Ring) is worn, additional time to mill the particles and the grinding capacity is lowered.

Typical lifetimes for the Screen, Impeller, and Grinding Ring area are approximately 2000 to 3000; 6000 to 9000; and 12000 to 18000 samples of weight, respectively. The ratio of using up to three screens for each Impeller and three Impellers for each Grinding Ring is common; but there are significant exception for other types of samples. Some forges are abrasive enough to wear out both the Screen and the Impeller after several hundred samples. Having spare parts available to permit comparison of old and new components (to show degree of wear) as well as for back-ups in case of a rock or other foreign debris damages the parts. Having spare parts on hand can also prevent shut-downs.

The Impeller is replaced by loosening the set screw holding it in place on the Drive Bearing Shaft. Be sure the replacement is firmly seated with the top of the Impeller flush with the top of the Drive Bearing Shaft and the set screw fully tightened into the flat of the Drive Bearing Shaft. DO NOT OVERTIGHTEN.

INSTALLATION OF THE DRIVE BELTS

The Drive Belts are designed to give years of service, even with severe overloading. Spares are not recommended since unused belts may deteriorate nearly as fast as the ones in the Mill. Do not apply belt dressing. If a Mill is used in a critical operation, having a spare set of belts may be advisable, especially

after belts are several years old. Should it become necessary to change your drive belts, replacement is as follows:

1. Turn the Mill off and unplug the electrical cord from the wall receptacle.

2. Remove the two small screws (8-32 x ¼ phillister head) holding the Belt Access Ring in place. Loosen the nuts on the bottom of the Mill, if necessary, to free the Belt Access Ring.

3. Slip the Belt Access Ring down and lay the Mill on its side.

4. Tighten the Belt Tension Release Screw clockwise to release tension on the belts. Do not attempt to tight the screw further after a strong resistance is felt.

5. Remove both old belts and install both new drive belts. Forceps and other similar tools are helpful in doing this. Make sure the Drive Pulleys are clean (if the old belts overheated). Do not use grease or chemicals. BELTS MUST BE CHANGED IN MATCHED PAIRS. The ridged side of the Joined Belts must be facing out.

6. Fully loosening tensioning screw to tighten the belts. Full tension is being applied if the head of the screw begins moving out, away from the Mill.

7. Replace the Belt Access Ring.

Bearing failure is rare although some types of samples such as forages cause more frequent failure. The Bearings are sealed and should not be oiled or have greased applied. Oil and grease will accumulate dust and accelerate failure. If the Drive Bearings are making noise or running abnormally hot, they must be replaced or the Grinding Chamber will be damaged. Do not replace the Drive Bearings with ones obtained from any other sources than UDY Corporation. They are special bearings and the complete manufacturers code is not represented on the bearings. Installing bearings other than those obtained through UDY Corporation will void the warranty, if the unit is under warranty. Special tools are also required for installation of the bearings. Improper installation of the Drive Bearings will cause damage. Replacement bearings on the shaft are available through UDY Corporation. Installation instructions are also included. The replacement of the Drive Bearing Assembly is not difficult for skilled repair-persons.
The replacement requires Ring Pliers and measurement of the Pulley spacing (tool available) to within 0.1 mm (0.004”). Repair at UDY Corporation is recommended, however, because it provides an opportunity for knowledgeable and thorough examination of the Mill.
Belt tensioning assembly and motor failures are best serviced by UDY

Corporation. Repaired and updated Mills function like new. Our repair rates are very reasonable encouraging frequent maintenance.

Spare parts that are recommended: Screen(s), Grinding Rings, Impellers 8 mm, Sample Collection Bottles 120 ml, Anti-static Soln, and Air Outlet Filter Media.

INSTALLATION OF THE GRINDING RING
ALWAYS TURN YOUR MILL OFF AND DISCONNECT FROM THE ELECTRICAL SOURCE

1. Remove the Cover and the Impeller from the Mill.

2. Remove the old Grinding Ring by bending it in toward the center of the Grinding Chamber. Start at the seam opposite the sample outlet.

3. Clean out all the sealant residue.

4. Apply a small bead of (approximately 2 –3 mm) of 100% silicon sealant (obtained from your local hardware store) or caulking around the perimeter of the Grinding Chamber. DO NOT USE ADHESIVE. Spreading it out in a thin layer is suggested, but not required.

5. Position the Grinding Ring so that the seam side is approximately 1-3 mm into the Grinding Chamber and the offset for the Screen is lined up with the offset in the Grinding Chamber. Note that the top edge of the Grinding Ring is indicated by arrows on the Grinding Ring.

6. Push the Grinding Ring from both sides of the outlet opening to shape the Grinding Ring and get it started into the Grinding Chamber. Support the Mill so the Grinding Ring can be pressed toward the seam and into the Grinding Chamber without the Mill moving. Be careful to not distort the Grinding Ring near the sample outlet. The Grinding Ring will seem too long, but it is not.

7. Verify the outlet opening is properly aligned. If not, remove the Grinding Ring and adjust its position. After the Grinding Ring is started into the Grinding Chamber and aligned, remove the tape (on the Grinding Ring) joining the seam.

8. Using a rubber mallet or a wooden block and hammer, GENTLY, tap the Grinding Ring all around to press it down into

position. Use care to have it go straight down into position. When it is all the way down into position, the top edge should be a uniform very small distance above the top of the Grinding Chamber or flush with it. DO NOT use a metal hammer directly on the Grinding Ring since dents and rough areas on the Grinding Ring will result in leaks where the Cover “O” ring is and will not seal properly.

9. Remove any excess sealant. It may be easier to wait until it sets and then peel it away (especially it there is an excess). The sealant must set before the Mill is placed in operation.

10. Install a screen. If necessary, shape the sample outlet so that a Screen will slip down into the slot between the Grinding Ring and the Grinding Chamber outlet opening. Screens must not extend higher then the Grinding Ring.

11. Check the top edge of the Grinding Ring for rough spots and carbide particles. If there are any, remove them. Carbide particles should scrape off fairly easily. A file may be used. Do not remove enough material to make the top edge of the Grinding Ring lower than the top surface of the Grinding Chamber.

12. Replace the Impeller and the Cover.