

6370 LUSK BLVD, SUITE F-111
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OWNER'S MANUAL



MODEL	T50
PURCHASER	
MANUFACTURER	Torrey Hills Technologies
REVISION DATE	December 2015

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Thank you for choosing Torrey Hills Technologies as your three roll mills supplier.

This manual is designed to provide detailed information on how to operate, troubleshoot and maintain your three roll mills.

Contact Torrey Hills Technologies for further assistance on the operation and maintenance of your machine, or if you have any comments on the content of this manual. Our primary concern is to satisfy the needs of our customers and your feedback is of great value to us.

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SAFETY INFORMATION

WARNING

Before operating this machine, please take the following basic safety measures to reduce the risk of machine damage and personal injury.

1. Read and understand all instructions.
2. Pay attention to the common knowledge of using mechanical and electronics equipment.
3. Pay attention to the warning messages and instructions in all attached documents.
4. If you find conflict messages between the operation instruction and safety caution information, please stick to safety caution information. You may have misunderstood the operation instruction. Please contact the sales representative or service representative for help.
5. Tie back long hair and restrict loose clothing that might get caught in the mill.
6. Wear goggles when milling.
7. Do not place any objects on top of the unit.
8. Do not move the unit during operation.
9. Only connect the unit to the electricity supply voltage indicated on the unit's rating plate. An incorrect electricity supply voltage may cause damage to the unit.
10. Before cleaning the machine, please shut down the electricity supply. Do not clean the rollers with erosive liquid or gas sprays.
11. In order to avoid accidents, do not dismantle the machine randomly. Opening or dismantling the cover can expose you to high voltage or other dangers. Incorrect reassembly will cause danger to the ensuing operation.
12. If the machine needs repair, please contact suitably qualified personnel who are familiar with the unit and who have been trained in its potential hazards.
13. Always disconnect the unit from the electricity supply before performing maintenance.

1. INTRODUCTION

1.1 MACHINE DESCRIPTION

A three roll mill is a machine tool that uses the shear force created by three horizontally positioned rolls rotating at opposite directions and different speeds relative to each other to mix, refine, disperse, or homogenize viscous materials fed into it. They are widely used to mix pharmaceuticals, electronic thick film inks, high performance ceramics, cosmetics, plastisols, carbon/graphite, paints, printing inks, chemicals, glass coatings, dental composites, pigment, coatings, adhesives, sealants, and food products.

Our recently redesigned T50 three roll mill model has demonstrated powerful performance with its state-of-the-art control, streamlined design and modern all stainless steel structure. In a compact size, this three roll mill is the ideal tool in laboratories and small-volume production for mixing pharmaceuticals, electronic thick film inks, high performance ceramics, cosmetics, paints, printing inks, adhesives, epoxy, sealants, and many other viscous materials.

This three roll mill lab model offers faster roller speeds and higher throughput up to 3.3 gallons or 11 kilograms per hour, depending on different materials fed. The fast roller runs at 723 RPM. Variable frequency drive allows stepless speed control and slow speed runs. Roller spacing adjustment is set manually with quick engagement mechanism by the use of two small marked knobs. Slow-speed wash-up mode capability and nip guard (optional) make this three roll mill very safe to operate. Other advantages include self-lubricating gears and Teflon end plates.

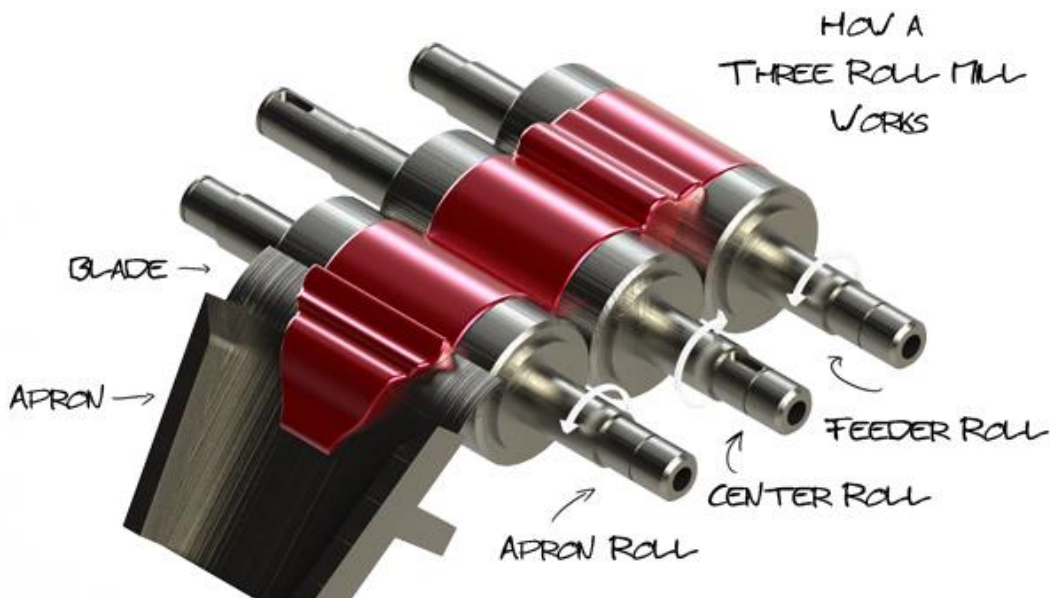
1.2 Technical Parameters

Input Voltage	110V 60Hz
Roll Diameter	Φ50 mm / 2.0"
Roll Working Length	178 mm / 7.0"
Roll Rotating Speed(RPM)	219
	394
	723
Motor	120W
Three Roll Speed Ratio	1 : 1.8 : 3.3
Dimension LxWxH	15" x 10" x 9.5"
	380 mm x 255 mm x 240 mm
Weight	45.4 lb / 20.6 kg

2. OPERATION MECHANISM

2.1 How a three roll mill works

As you can see in the illustration, the material is loaded between the rear roller and the center roller. Due to the narrowing space between the rollers, most of the mixture is rejected to the feed region. The part that does make it through experiences very high shear force and the fine particles are well dispersed in the binder. As it comes out from the other side, the material that remains on the center roll moves through to the nip between the center roll and the apron roll, experiencing even higher shear force due to the higher speeds. A blade automatically scrapes the processed mixture off the apron roll and transfers it to the apron. The three roll milling cycle is repeated many times until the material is perfectly dispersed and the particle size is in the good range.



3. STRUCTURE OF THE THREE ROLL MILL

3.1 Overall

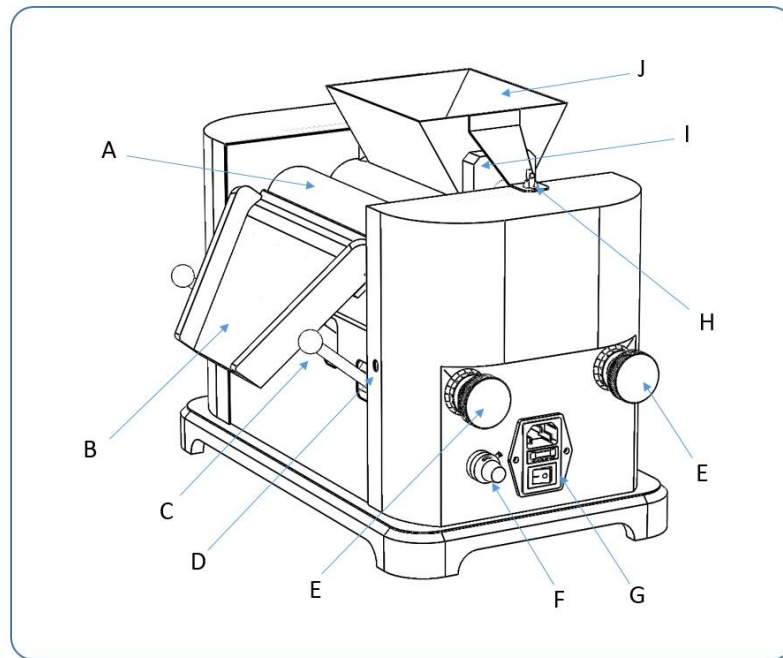


Figure 1: Overview

A three roll mill machine is made up of the following:

- A: Front, center and rear rollers
- B: Apron plate
- C: Rod for dischargeable apron plate
- D: Fine adjustment socket
- E: Quick adjustment knobs for roller gaps
- F: Speed adjustment knob
- G: Power switch
- H: Fastening screw for hopper
- I: End guide
- J: Hopper

There are a total of six bearing bases for high speed roller, medium speed roller and low speed roller supported by base orbit. Among them, the medium speed roller is fixed to the base and cover. The front and rear rollers can be moved horizontally by turning the gap adjustment hand wheels to reach the desired grinding fineness.

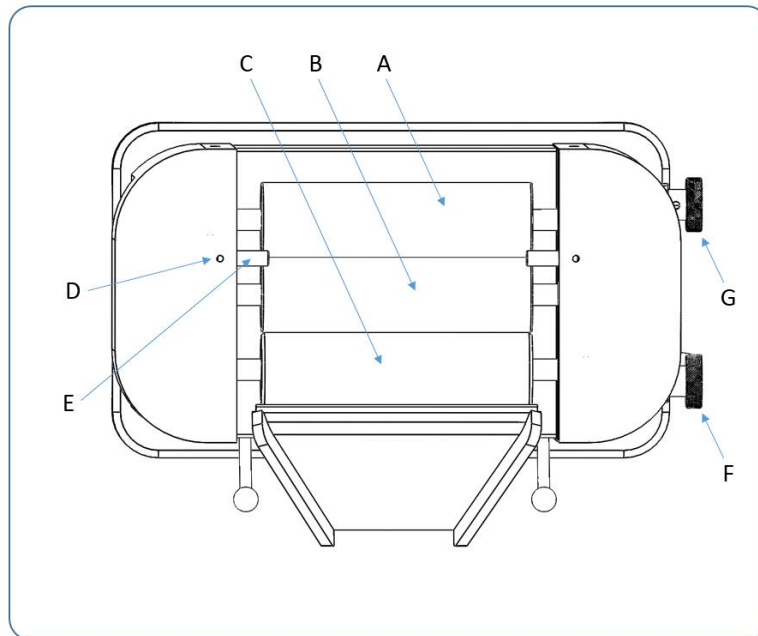


Figure 2: Top view

- A: Rear roller
- B: Central roller
- C: Front roller
- D: Fastening hole
- E: Guide positioning holder
- F: Quick adjustment knob for front gap
- G: Quick adjustment knob for rear gap

3.2 Transmission System

The drive pulley drives the adjustable pulley. The high speed (front) gear on high speed roller will drive the medium speed roller (central) gear. Consequently, the medium speed (central) roller gear will drive the low speed (rear) roller gear. The illustration below shows the entire transmission system.

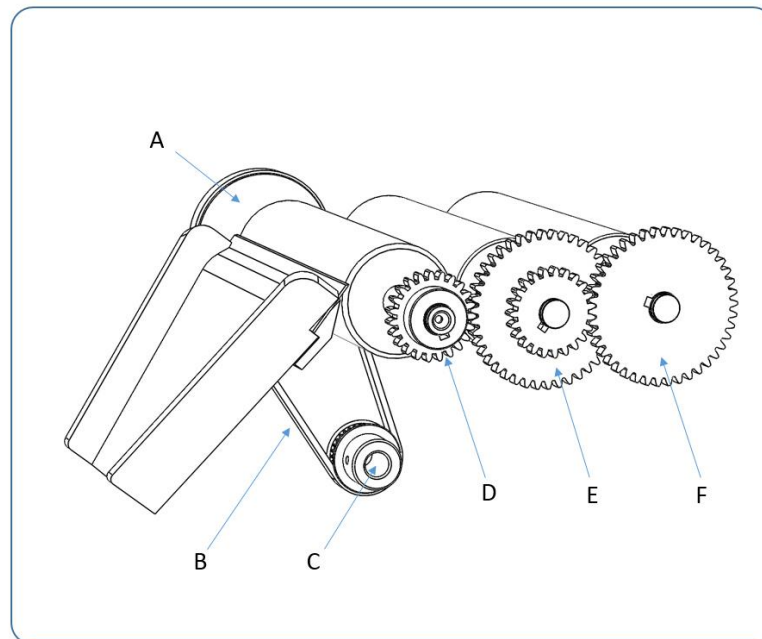


Figure 3: Transmission system

- A: Adjustable pulley
- B: Belt
- C: Drive pulley
- D: Front gear
- E: Central gear
- F: Rear gear

3.3 Rollers

The rollers are made from 420J2 stainless steel and by centrifuge casting with a hardness of 50-60 HRC. Two axle heads of the roller are made from premium quality steel after heat treatment. The axle head is connected to the roller by cold pressure technology so that it can be fixed to the roller body firmly and stably. The left axle head is connected to the transmission gear.

For ceramic models, the rollers are made from cold iso-static pressed and fired 99.5% alumina (aluminum oxide) ground to 5 μ m concentricity and 0.5 μ m surface finish. The hardness is around 9 on Mohs scale of hardness.

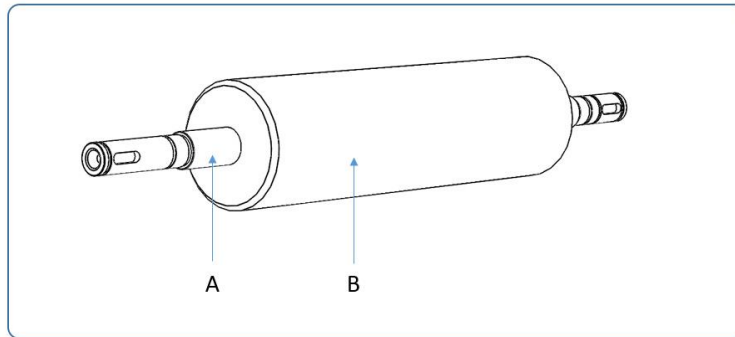


Figure 4: Roller

- A: Roller axle
- B: Roller

3.4 Feeding Parts

This part is made up of two pieces of Teflon end guides and positioning holders. The blade is installed on the working arc between the rear roller and the central roller. They can stop the material from flowing outside to the end of the rollers. The Teflon end guides are fixed by the positioning holders. The end plate fixture has an automatic adjustment feature to accommodate the expansion of the rollers during operation. The end guides can be taken out for cleaning.

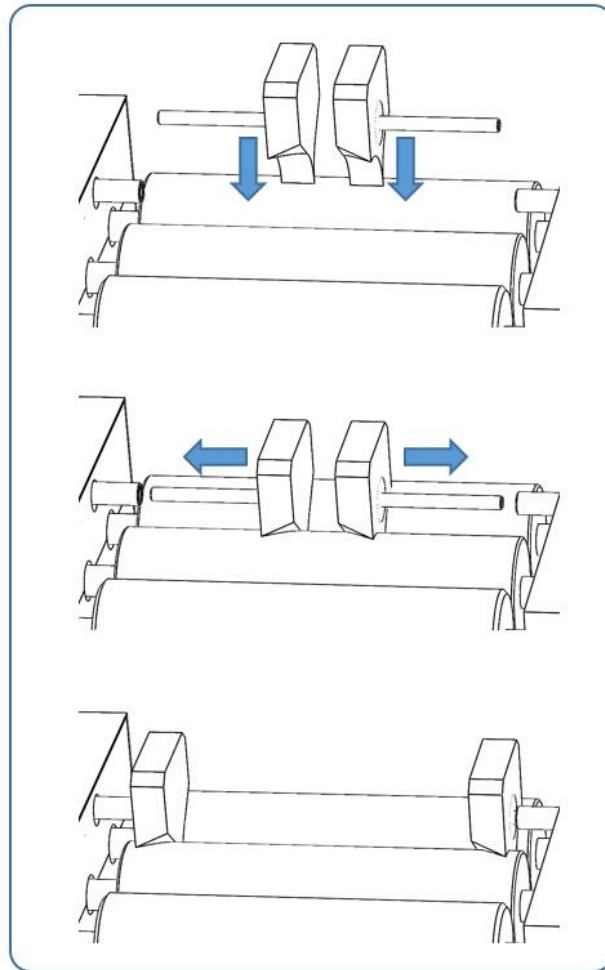


Figure 5: End guides installation

3.5 Hopper

The hopper can be applied when large amount of input is required.

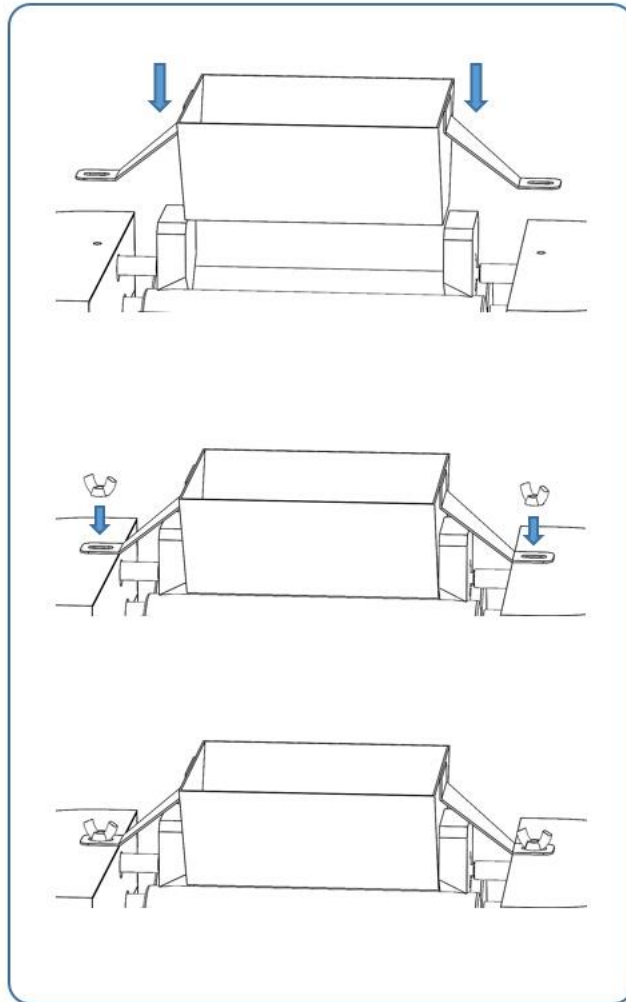


Figure 6: Hopper installation

3.6 Roller Adjustment

The adjustment system is made up of two Quick Adjustment Knobs and four Fine Adjustment Screws with tensioning springs.

3.6.1 Quick Adjustment

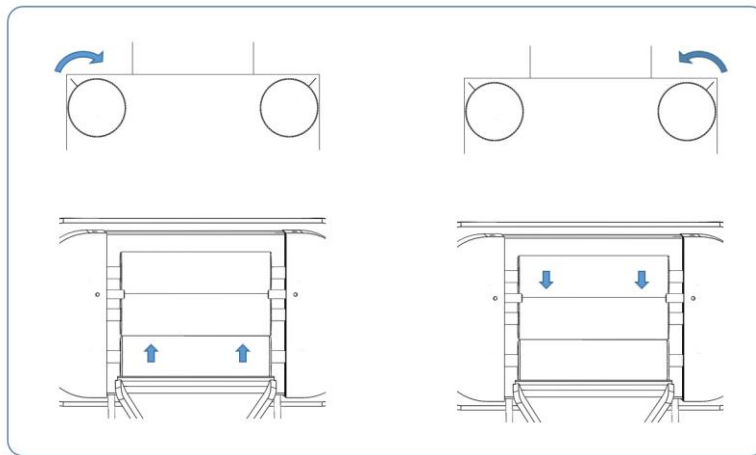


Figure 7: Decrease the gap sizes

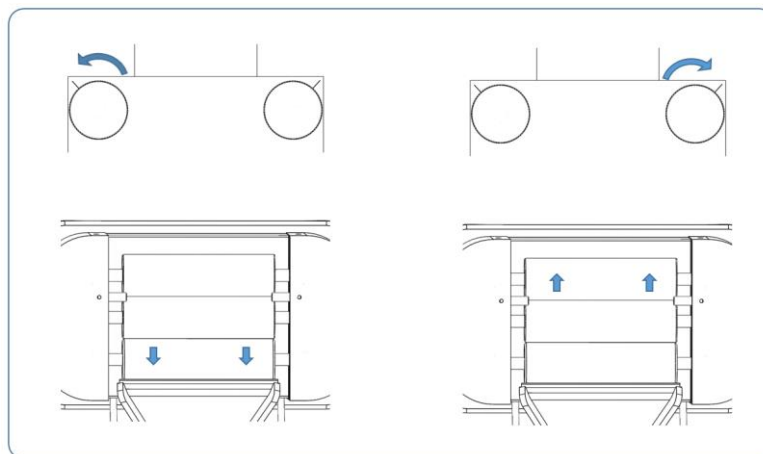


Figure 8: Increase the gap sizes

3.6.2 Fine Adjustment

A 3mm hex key may be needed to complete the calibration of the rollers.

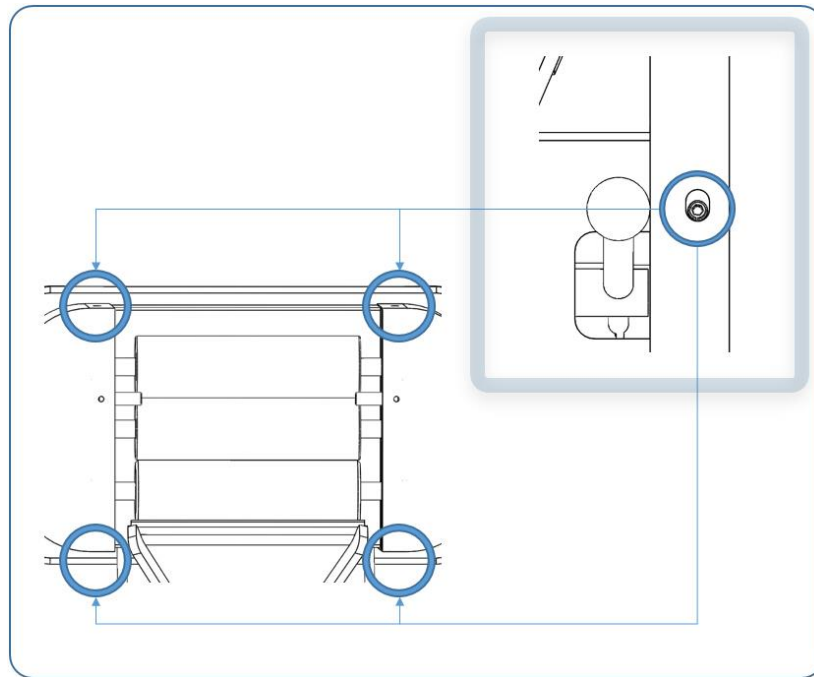
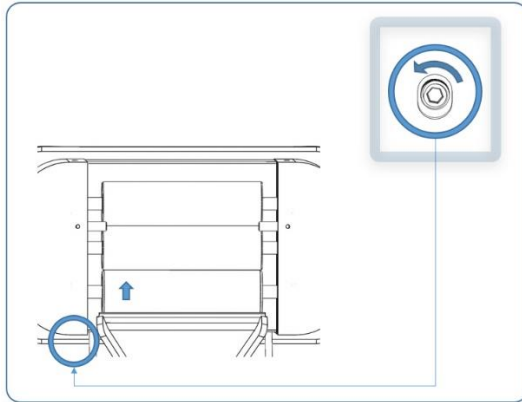
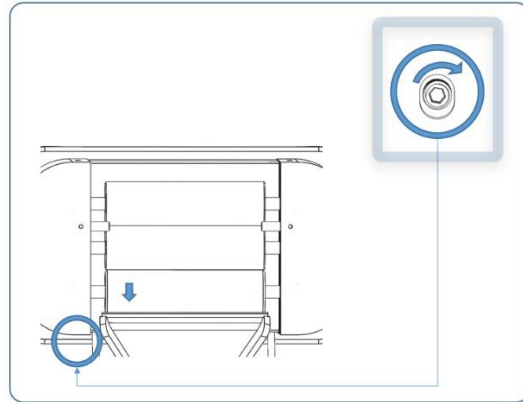


Figure 9: Fine adjustment screws

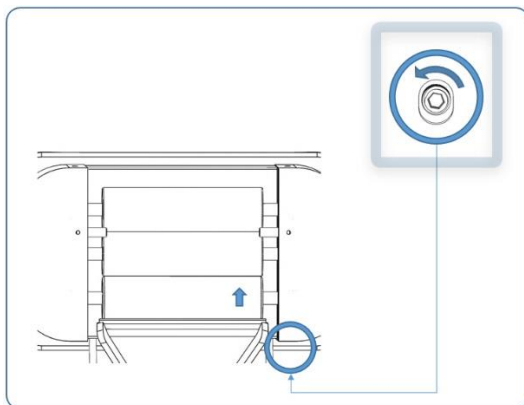


(a) Decrease gap size

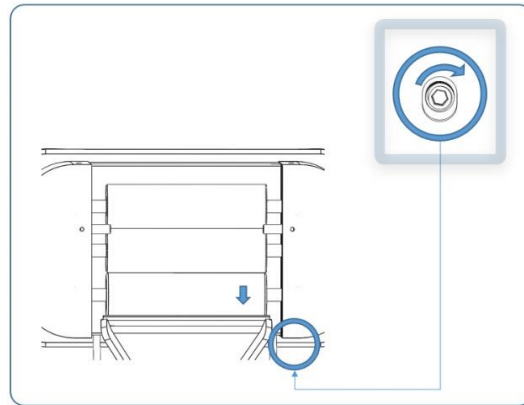


(b) Increase gap size

Figure 10: Left front gap sizing

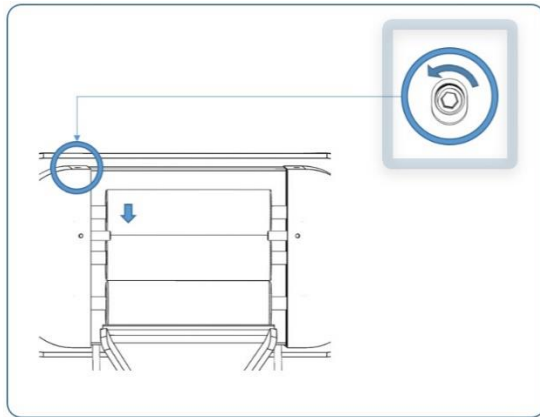


(a) Decrease gap size

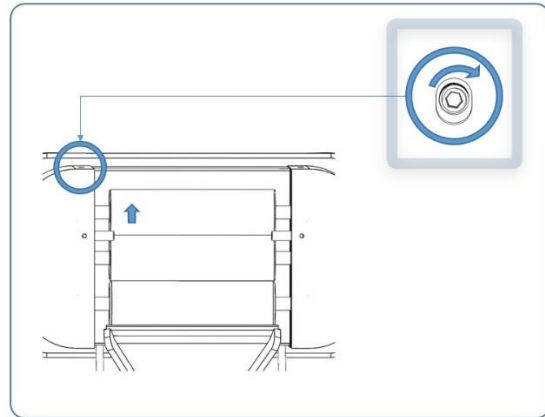


(b) Increase gap size

Figure 10: Right front gap sizing

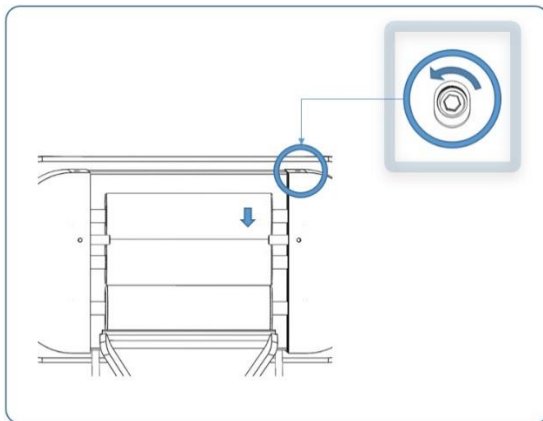


(a) Decrease gap size

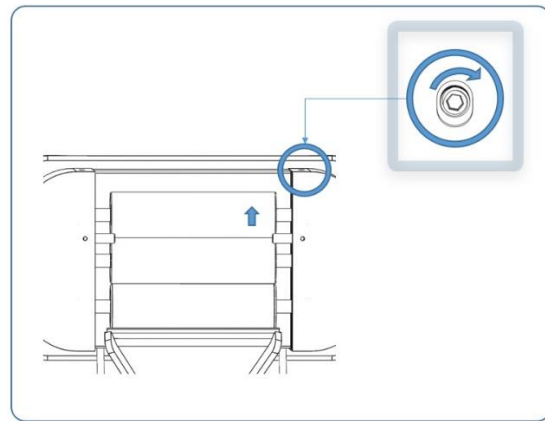


(b) Increase gap size

Figure 10: Left rear gap sizing



(a) Decrease gap size



(b) Increase gap size

Figure 10: Right rear gap sizing

3.7 Discharging Parts

3.7.1 Discharging Apron Plate and Scraper Blade

The discharge apron plate is installed onto a discharge holder frame. There is a scraper blade installed on the edge of the dischargeable apron. The screw system for the scraper blade can be adjusted to make the scraper blade move closer or more distant to fast roller surface. The edge position of the scraper blade should be a little bit higher than the center of the roll (approximately 6mm higher), so that it can remove the ground material from the surface of the fast roller after grinding.

3.7.2 Discharging Apron Removal Rod

The discharging scraper blade can be disengaged by pushing the discharging apron removal rod.

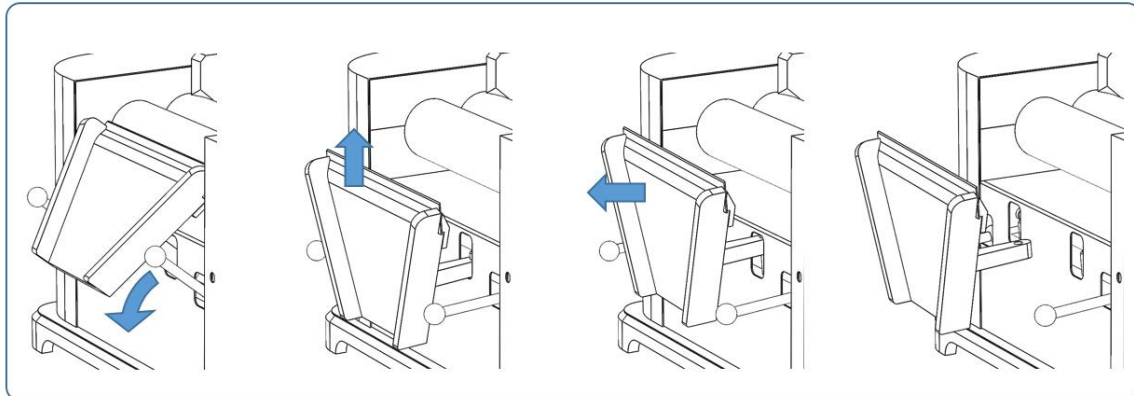


Figure 11: Discharge the apron plate

3.7.3 Discharging Blade Tension Adjustment

The tension between the edge of the scraper blade and the front roller has been preset for best working efficiency before shipment. If for some reasons the user needs higher or lower pressure between them, they can do so by adjusting the connection of the tensioning spring inside the base of the machine.

4. INSTALLATION AND TRIAL OPERATION

4.1 Installation

This machine has all stainless steel structure and does not need a floor bolt in order to be stably fixed. A rubber mat may be put underneath the machine to help reduce the vibration. Be sure to adjust with a horizontal level if a rubber mat is used. If there is a need for the user, a floor bolt can be used to fix the machine. Please refer to the basic machine diagram while doing so.

NOTE

Before connecting to the power source, check your power supply and confirm whether it is rated at 110V or 220V. Make sure the emergency stop button is released before turning on the machine.

4.2 Trial Operation

Get the machine ready before trial operation. Adjust the Teflon End Guides and Apron Plate and put them against the roller. Check for potential situations that can cause an accident. Then start trial operation.

NOTE

The lab model is pre-lubricated and ready to be used. The transmission system is self-lubricated.

Before connecting to the power source, check your power supply and confirm whether it is rated at 110V or 220V.

The control panel is located on the right side of the machine. When you are ready for operation, press the ON/OFF button to get the rollers running. To adjust the speed of the rollers (roller speed ratio remains constant), turn the Speed Adjustment Knob to achieve desired level, from 0 to 9.

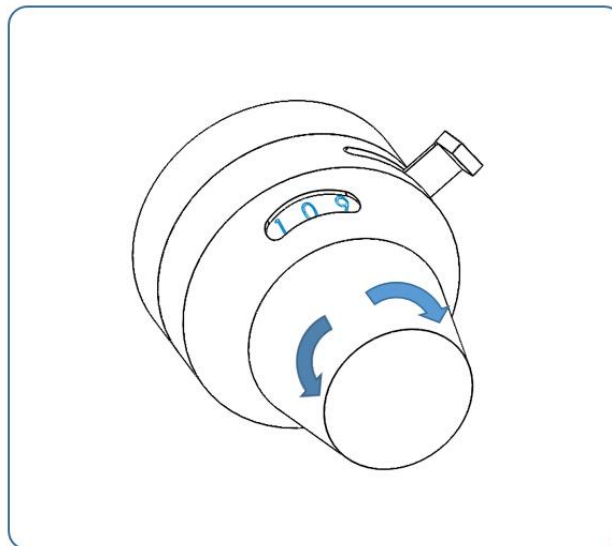


Figure 12: Speed adjustment

To save the current speed, simply turn the switch to the right.

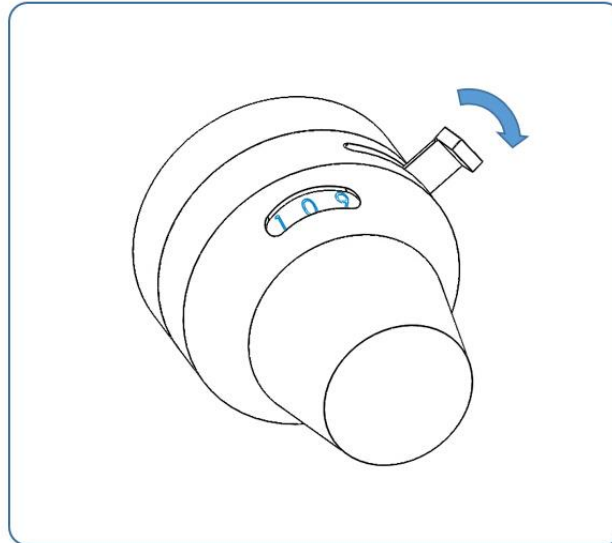


Figure 13: Save the desired speed

During the initial set up, first separate the front rollers by 0.5-1 mm and then adjust the gap of rear rollers to about 50 microns to 75 microns. Turn the machine on, use the speed adjustment knob to set the rollers at low speed, put a little material on the rolls (about 2 cm wide) and check if the material is running smoothly without moving to either end. Adjust the roller gap on one side if needed until the material stays on the roller in one place for about 1-2 minutes. Then start setting up the front rollers. Stop the machine and set the front gap to about 25 microns to 75 microns, then start the machine with a little material on the central and rear rollers (again no wider than 2 cm). The material should go straight through the rollers. If needed, adjust the gap on one side. Generally, if the gap on one side is smaller than the other, the material will move towards the smaller gap side. If the rollers are perfectly parallel, the material should go straight.

During trial operation, check whether the transmission gears engage well and whether there is any abnormal sound. All the rotary and moving parts shall stay at the correct positions.

5. OPERATION

5.1 Preparation

After installation and trial operation, if it is confirmed no malfunctions have occurred, some key issues shall be attended to before operation. Please find them in the NOTE below.

NOTE

- Check the rollers to see if the surface is clean.
- Check if the front roller and the rear speed roller keep some distance from the central speed roller.
- Check if the Apron Blade is at normal position

WARNING

After the machine is powered on, during the production process or when the rollers are pushing against each other, it is absolutely prohibited that there be no material or material supply be cut off. This will likely damage the rollers or burn the motor.

5.2 During Operation

The gap distances between the rollers shall be adjusted constantly because of heat expansion. When they expand too much and the rollers get stuck, the motor will be damaged and cause accident.

- a. Adjust the gap sizes.
- b. Adjust the Teflon End Guides. Please do not press the End Guides too tight against the rollers. The End Guides fixture has an automatic adjustment feature to accommodate the expansion of the rollers during operation. The working width on the roller can be adjusted during operation depending on actual situation.
- c. Start the machine according to instructions in 4.2 Trial Operation.
- d. Feed the material and carry out precise adjustment to achieve desired fineness. If the material is colorful, the color on the roller surface should be consistent after the correct adjustment. It is also normal that the material appears slightly lighter in color in the middle part of roller than on both ends. After a while the color will become same.

6. GENERAL MAINTENANCE INSTRUCTIONS

6.1 General Information

To achieve the highest level of equipment performance and maximize the useful service life of various equipment components, a quality maintenance program is essential. A chain is no stronger than its weakest link, and maintenance is a critical link in every chain.

We recommend that you establish a regular maintenance program in conjunction with a maintenance log to record all pertinent data. Information accumulated can be used in predicting the obtainable length of uninterrupted operation and the kind of spare parts that should always be stocked in-house. Although a quality maintenance program and a good maintenance log will not eliminate unexpected problems and/or production stoppages, both have the potential to minimize these occurrences.

Information in these instructions is of general nature. Part of it pertains to virtually every type of three roll mill produced by Torrey Hills Technologies.

NOTE

The instructions in this form, Form GEN83006 are of a general nature representing only one of several sets of standard maintenance instructions available. Maintenance instructions pertaining to specific equipment covered by this manual are also included in this section of the manual. Please take the time to read all the information provided for each equipment category within this manual.

As noted, these instructions are of a general nature. They cover a variety of maintenance activities. However, the maintenance procedures described below do **NOT** apply to every piece of Torrey Hills equipment. Therefore, the User must select those procedures that are applicable and ignore the non-applicable procedures.

WARNING

Be sure to read the IMPORTANT MAINTENANCE SAFETY INFORMATION, Form **GEN82001**, contained in Section I of this manual. It is provided for YOUR safety.

6.2 Maintenance Instructions

- a. Disconnect the unit from main electricity supply prior to performing any maintenance.
- b. If concaved area in the middle of the roller, roller surface erosion, or roller surface distortion is found, please stop the operation and repair the rollers (by polishing) immediately.
- c. If the roller has been repaired too many times and the diameter is more than 1mm smaller than its original size, the gap between rollers would be too big to grind the material well. The gear must be replaced under this condition to accommodate the reduced diameter, or the roller must be replaced.
- d. The edge of the scraper blade must be very sharp and smooth. Any burrs or splits are seriously prohibited. When the blade is short, just loosen the screws to take the blade out more. If the blade is completely worn and you need to change to a new Scraper Blade.
- e. If the mill has not been operated for a long time, please apply anticorrosion grease (Vaseline) on the roller surface and other relevant places to avoid pinholes. Thorough inspection shall be carried out before the next operation.
- f. For information about alignment, please read [3.6.2 Fine Adjustment](#).