FINE GRINDER INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

Model:_________________________

Serial NO.:_______________________

2 Sammons Court Bolingbrook, IL 60440
Phone 630-759-9595 • Fax 630-759-6099

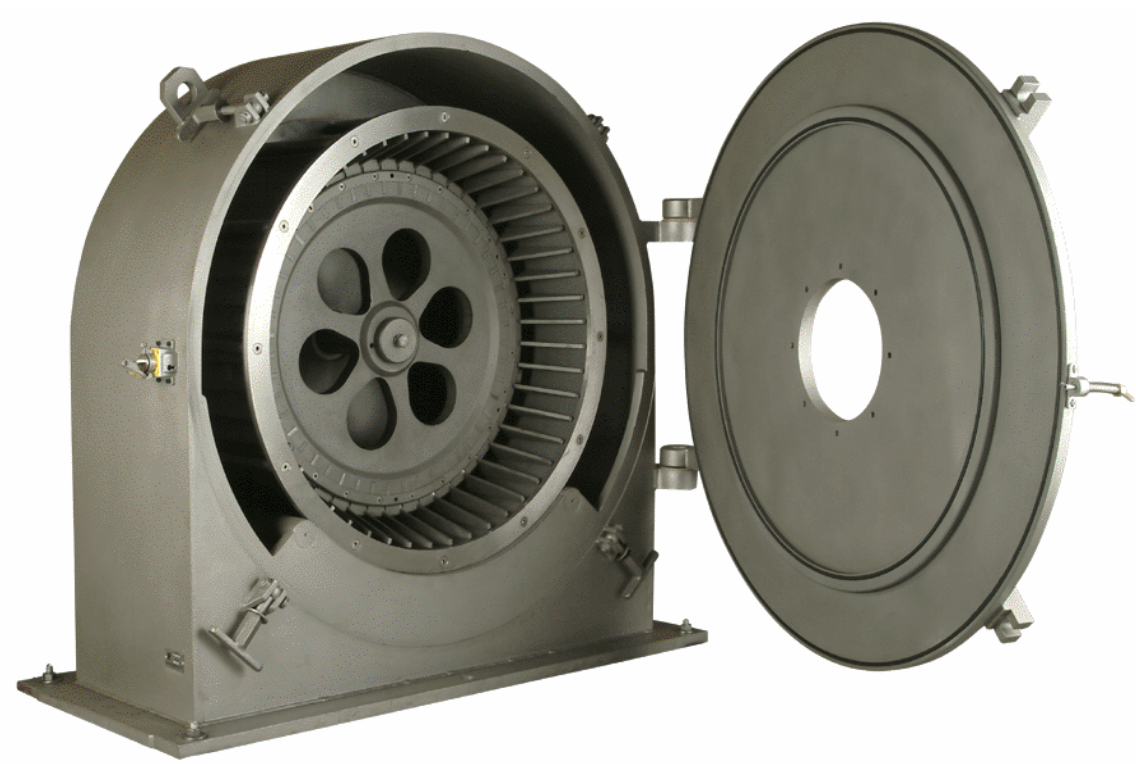


TABLE OF CONTENTS

Section
1

Section 1: Safety Rules

1.1 Safety Rules

Safety must be considered through all facets of operation and maintenance on any mechanical device. Using proper tools and methods will help prevent accidents and serious injury to you and your fellow workers.

Proper operating procedures and safety precautions are listed throughout this manual. Study them carefully and follow instructions; insist that those working with you do the same. Most accidents are caused by someone's carelessness or negligence.

Examples of the four types of safety notices (Danger, Warning, Caution and Notices) in this manual are listed below:

⚠DANGER	**DANGER: INDICATES AN IMMINENTLY HAZARDOUS SITUATION IN WHICH PERSONAL INJURY OR DEATH MAY OCCUR.**
⚠WARNING	**WARNING: INDICATES A POTENTIALLY HAZARDOUS SITUATION IN WHICH PERSONAL INJURY OR DEATH MAY OCCUR.**
CAUTION	**CAUTION: INDICATES A SITUATION WHERE DAMAGE TO THE EQUIPMENT COULD RESULT.**
NOTICE	**PROVIDES HELPFUL INFORMATION FOR PROPER OPERATION OF THE FINE GRINDER.**

1.2 Safety Precautions

WARNING

OPERATORS MUST BE INSTRUCTED NOT TO PUT HANDS, FINGERS OR OTHER FOREIGN OBJECTS IN THE MACHINE, AND NOT TO REMOVE ANY COVER, DOOR, HATCH OR OTHER PROTECTIVE DEVICES PLACED ON THIS MACHINE FOR THE SAFETY OF THE OPERATOR. ANY ATTEMPT TO DEFEAT THESE DEVICES COULD RESULT IN SERIOUS INJURY.

DANGER

ELECTRICAL SERVICE TO THE MACHINE MUST BE LOCKED OUT WHILE ANY REPAIRS OR ADJUSTMENTS ARE BEING MADE OR WHILE ANY COVER, DOOR, HATCH OR OTHER PROTECTIVE DEVICE IS NOT IN PLACE.

DANGER

WHEN PROCESSING MATERIALS THAT MAY REACT TO A SPARK CAUSED BY METAL HITTING METAL OR STONES, ETC., THE USE OF A MILL DUST COLLECTOR EQUIPPED WITH AN EXPLOSION VENT IS STRONGLY RECOMMENDED. SEE APPENDIX G FOR MORE INFORMATION ABOUT EXPLOSION VENTING.

The precautions listed in this manual may not be all inclusive and others might exist, that are specific to your operation or industry. In addition, nearly all employers are now subject to the Federal Occupational Safety and Health Act of 1970, as amended, which require that an employer be kept abreast of regulations, which will continue to be issued under its authority.

The Fine Grinder must always be operated in accordance with the instructions and precautions in this manual and on the caution plates attached to the equipment. Only workers completely familiar with the instructions and precautions in this manual should be permitted to operate the unit. The operators should thoroughly understand these instructions and precautions before attempting to operate this equipment.

Illustration 1-1 is a checklist of safety precautions and proper operating procedures. Failure to observe and follow the precautions may result in serious personal injury or property damage.

Safety Checklist

ALWAYS operate Fine Grinder in accordance with the instructions in this manual.

DO NOT open inspection doors while unit is in motion.

NEVER work on unit and related components unless electric power and motor drive have been locked out and tagged. The National Electrical Code requires a manually operable disconnect switch located within sight of the motor, or a controller disconnecting means capable of being locked if not within sight of the motor.

DO NOT use the Fine Grinder for processing of material other than the specific application for which it was designed.

AVOID poking or prodding into unit openings with bar or stick.

ALWAYS have a clear view of unit loading and unloading points and all safety devices.

KEEP area around unit, drive, and control station free of debris and obstacles.

NEVER operate unit without guards and all safety devices in position and functioning.

ALWAYS allow unit to stop naturally. DO NOT attempt to artificially brake or slow motion of unit.

NEVER put your hand near or in the inlet or outlet of the Fine Grinder while it is operating or stalled.

Illustration 1-1: Prater Fine Grinder **Safety Check List**

1.3 Fine Grinder Safety Labels

Illustration 1-2 shows the labels used on the Fine Grinder. These labels are important for worker information and must not be removed from the unit.

Illustration 1-2: Fine Grinder Safety Labels

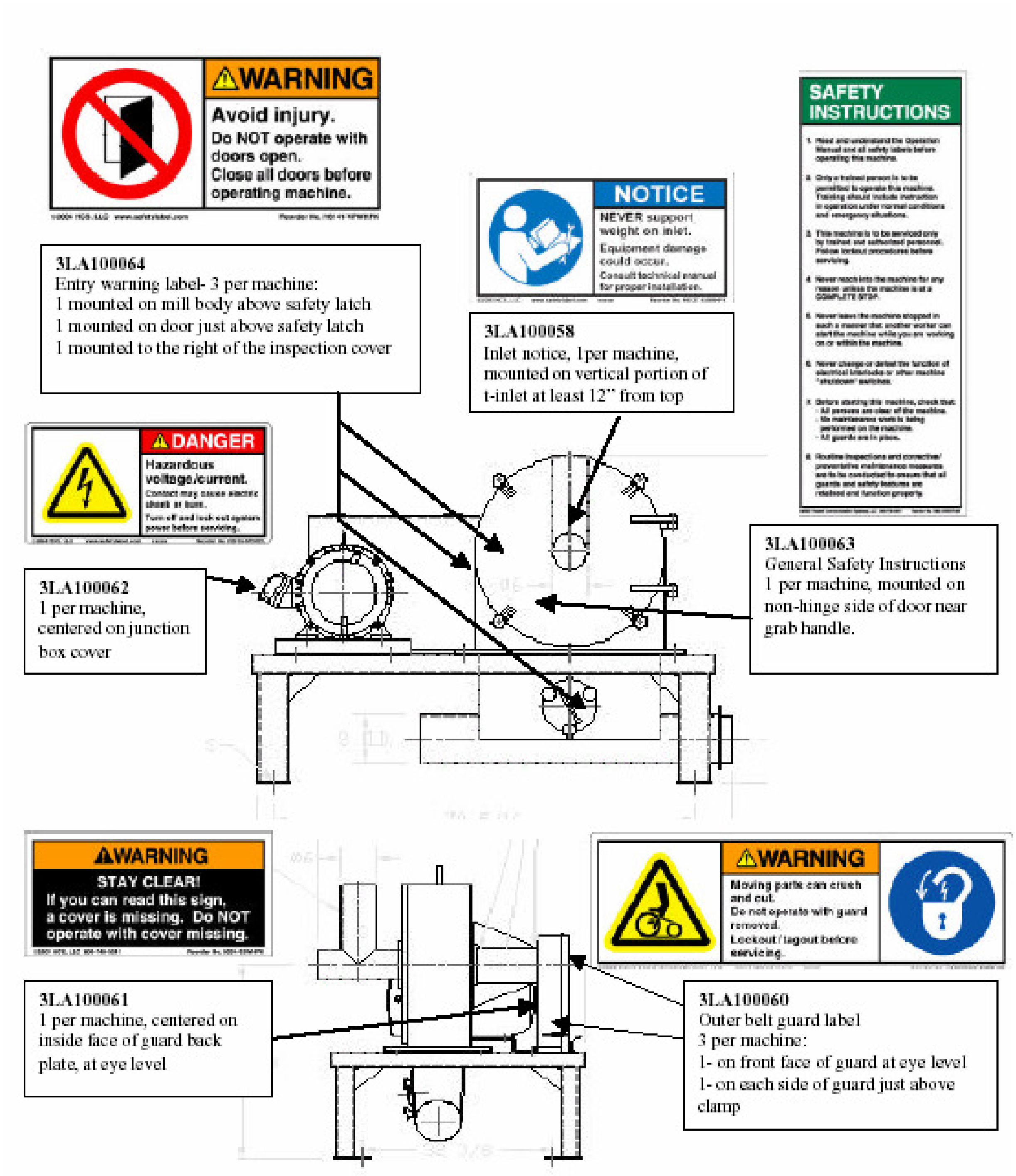


Illustration 1-3: Fine Grinder Safety Label Placement for standard and explosion proof mills

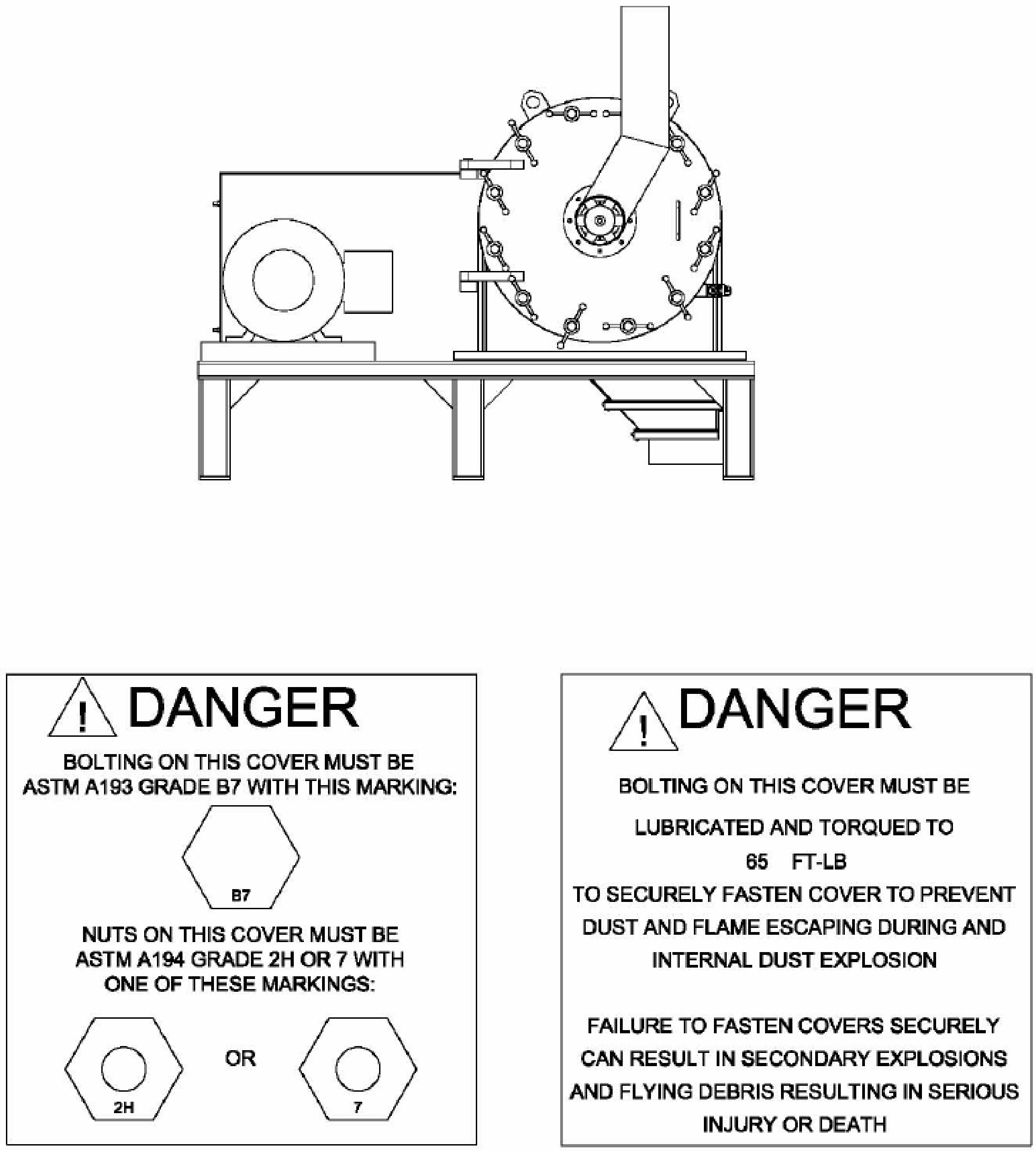


Illustration 1-4: Fine Grinder Safety Label Placement for standard and explosion proof mills

1.4 Fine Grinder Pinch Points

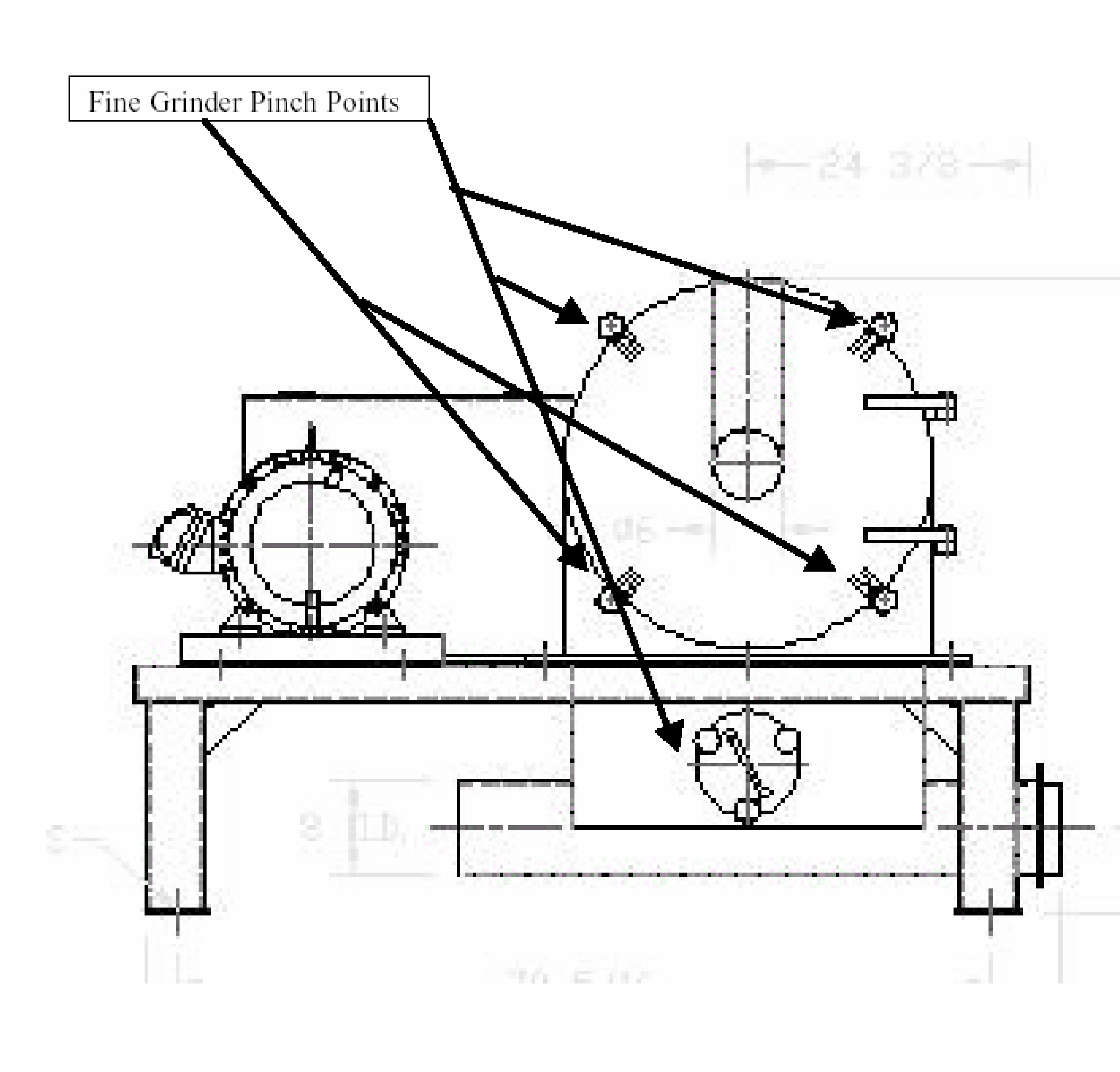


Illustration 1-5: Fine Grinder Pinch Points

WARNING

The Fine Grinder contains several points where care is needed to avoid bodily injury when opening or closing access doors. Always make sure care is used when opening or closing Fine Grinder doors, access hatches, and guards. Failure to do so may result in serious injury.

Section

2

Section 2: Introduction

2.1 Manual Overview

This manual describes the installation requirements, procedures, and routine maintenance of **Prater's** Fine Grinder, Model #'s M-19, M-21, M-36, M-51, M-76, and M-101. Refer to this manual before beginning and during installation. Keep this manual available for future reference. Cross section and exploded views are located in the rear of the manual. The procedures throughout this manual refer to these drawings. Locate the view for your Model Fine Grinder and refer to the view for clarification.

Reliable operation, personnel safety, and long service life of this equipment depend on three important considerations:

- The care exercised during installation.
- The frequency/quality of maintenance and periodic inspections.
- A common sense approach to the Fine Grinders operation.

To keep operating costs down and profits up, carefully follow the instructions listed for installation, operation, safety, and maintenance.

2.2 Receiving The Unit

When your shipment arrives, thoroughly inspect the Fine Grinder and all related equipment. In the event of shipping damage, note the problem on the bill of lading or freight bill and make sure you obtain the driver's signature for a possible claim against the delivering carrier.

The Fine Grinder is always supplied with the mill pulley (Figure 6.8, 5) mounted and the motor pulley and V-belts supplied loose (except when motor and base are factory supplied).

The rotor is supplied loose and must be properly installed before operating the unit. Inspect the rotor and locate the serial number, which is stamped along with the letter F or FRONT on one side of the rotor on the center hub or near the bore for the shaft. Rotor installation procedures are covered later in this manual.

NOTICE

The RECEIVER is responsible for Inspection and filing claims against the CARRIER for any damage to the Fine Grinder in transit.

WARNING

IN SOME SITUATIONS, THE FINE GRINDER HOUSING (FIGURE 6.4, M-1) IS SHIPPED LOOSE FROM THE FINE GRINDER BASE. IN THESE SITUATIONS, DO NOT OPEN THE FINE GRINDER DOOR (FIGURE 6.4, M-4) BEFORE PROPERLY INSTALLING THE FINE GRINDER HOUSING ONTO THE BASE. THERE IS A POTENTIAL FOR THE UNIT TO TIP AND CAUSE PERSONAL INJURY OR DEATH AS WELL AS SEVERE DAMAGE TO THE UNIT.

2.3 Before Installation

Be sure the installation crew or millwrights are aware of installation requirements. If they have any questions or are unsure of proper procedures, clarify the matter to avoid improper installation. Section 2 of this manual covers important steps to ensure safe, vibration-free installation. Personnel responsible for installation should be familiar with these procedures.

In preparing for installation, make sure you provide for all appropriate safety devices. **Prater** provides a door lock and rotor motion detection system as standard on all mills, unless specifically instructed by the customer, in writing, not to supply this device because the customer will use his own protective system. Prater Industries, Inc. does not install your machine. It is your responsibility to provide lockout switches, guards, and other safety devices and safety procedures to protect the machine operator or maintenance personnel.

NOTICE

If the mill is to be installed in an enclosed room it is important to allow adequate venting to provide proper air volume to the Fine Grinder. Inadequate air volume will severely restrict throughput of the system and may cause other problems.

2.4 Before Operation

Make sure operating personnel are well trained in procedures for operating and maintaining the Fine Grinder. In particular, make sure they understand the essential safety precautions described in Section 1.6.

2.5 Fine Grinder Applications

The Prater Fine Grinder can be used for a wide range of applications in the field of fine and very fine particle size reduction. Typical applications for the Prater Fine Grinder include processing chemicals, pharmaceuticals, natural products, foodstuffs, cereal grains, organic and inorganic pigments, and resins. Its design provides efficient utilization of applied horsepower.

2.6 Unit Design

NOTICE

THIS PARAGRAPH REFERS TO FIGURE 6.4 IN THE REAR OF THE MANUAL.

The Fine Grinder housing assembly (M1) is a rigid welded construction, with a bolted on bearing assembly (B1-B21), which can be exchanged in one piece. The mill shaft (B3) runs on ball bearings (B6 and B11) and carries the rotor assembly (R1-R4).

The rotor assembly is designed symmetrically. A single disc rotor (R1) has wear resistant blades (R3) positioned in grooves. Retaining rings (R2) hold the blades in the grooves.

NOTICE

Fine Grinder model M 19 incorporates a single piece rotor design and does not use the retaining rings or replaceable blades.

The screen assembly is arranged around the rotor assembly, and rests on a recessed shoulder on the rear wall of the body assembly (M1). The rotor (R1-R4) and the screen assembly (S1-S4) are carefully machined to maintain an accurate gap between the rotor assembly and the screen assembly for precise control of particle size. The large door (M4) provides easy and sufficient access to all internal parts for inspection and maintenance.

2.7 Operating Principle

NOTICE

THIS PARAGRAPH REFERS TO FIGURE 6.8 IN THE REAR OF THE MANUAL.

Prater Fine Grinders operate on a high-speed impact principle. Material together with the necessary amount of air is fed through the product inlet (1), either by gravity or within a conveying air stream, into the center of the Fine Grinder.

Prater highly recommends that the user install a magnet in the feed inlet to capture most ferrous materials (1). Unless other arrangements have been made Prater does not normally supply this magnet. In addition to the feed inlet magnet, for maximum production security, it is strongly recommended that magnetic separation be incorporated into the system prior to the Fine Grinder as well. If other foreign materials, such as stainless steel, aluminum, rock, etc may be contained in the product, additional separation or screening should be used to maintain suitable screen and rotor life.

The rotor blades (2) act as a fan and generate an air stream through the Fine Grinder. Particles move outward, impacting on each other, and then through both the inner and outer sides of the rotor blades (2). After this initial impact, particles are then projected tangentially across the screen (6), shearing between the blades surfaces and the screen, and optional grinding jaws (S2, Figure 6.6) causes further particle reduction. This action occurs until particles are small enough to pass through the screen openings.

Close tolerances between the rotating and stationary surfaces maintain an accurate gap for precise control of fine particle size. Depending on the material being processed, a variety of screen sizes and grinding jaw configurations are available.

The ground product is then collected in a hopper underneath the Fine Grinder or air conveyed into dust collecting equipment.

2.8 Fine Grinder Specifications

2.8.1 Dimensions

Table 2-1

Fine Grinder Dimensions

Fine Grinder	M-19	M-21	M-36	M-51	M-76	M-101
Rotor Diameter (Inches)	6-3/4	8-1/2	11-1/2	17-3/8	26-1/2	37
Rotor Width (Inches)	2-1/4	3-9/16	5-5/8	8-1/4	11-7/8	15-3/4
Motor Size (HP)	3 – 7 1/2	10 – 20	20 – 40	40 – 60	75 – 125	125 - 250
Motor Speed (RPM)	3600	3600	3600	3600	1800	1800
Weight (LBS)	75	505	810	1,050	2,650	4,350

2.8.2 Speeds

Table 2-2

Fine Grinder Speeds

Rotor	**AVAILABLE RPM per Fine Grinder**					
Speed	**M-19**	**M-21**	**M-36**	**M-51**	**M-76**	**M-101**
At 120 M/S	13,368	10,615	7,802	5,161	3,389	2,429
At 100 M/S	11,140	8,846	6,540	4,301	2,824	2,024
At 80 M/S	8,912	7,077	5,230	3,441	2,259	1,619
At 60 M/S	6,684	5,308	3,920	2,581	1,694	1,214

Section

3

Section 3: Installation

3.1 Introduction

Proper installation of Prater's Fine Grinder is critical for efficient and productive operation. The proper site preparation and placement of the Fine Grinder and related equipment will insure that the grinder operates safely and to its fullest capacity.

The following are important considerations in Fine Grinder installations:

3.1.1 Location

Make sure the operating location will provide strong, vibration-free base support and allow easy access to all parts of the Fine Grinder. See Section 3.2.

3.1.2 Leveling

The Fine Grinder must be mounted horizontally on a flat surface if not supplied on an air pick-up base. This flat surface requires sufficient strength to prevent deflections of more than 0.003" and be large enough to incorporate the full base of the Fine Grinder with a discharge opening as shown in Table 3-1. Sections 3.3 and 3.4 explain how to check for proper leveling and prevention of vibration damage during operation.

TABLE 3-1 DISCHARGE OPENINGS

MODEL	WIDTH	LENGTH
M-19	3-1/4	10
M-21	4	16-1/2
M-36	6	21-3/8
M-5l	8-7/8	26-7/8
M-76	12-3/4	38-1/2
M-101	16-1/2	51-3/16

3.1.3 Drive

The Fine Grinder is always supplied with the mill pulley (Figure 6.8, 5) mounted and the motor pulley and V-belts supplied loose (except when motor and base are factory supplied). Section 3.6 explains proper drive installation.

3.1.5 Grounding the Fine Grinder.

Effective July 1, 2007 all Fine Grinders will be shipped with grounding lugs installed to easily make a connection from the mill base to earth ground. Failure to properly connect the unit to earth ground can result in extensive damage to the mill bearings and rotor assembly. Refer to **Appendix F** for more information on static electricity and the importance of properly grounding the unit.

3.2 Mill Base Foundation

The Fine Grinder must be supported in a vibration free location. The Fine Grinder M-19, M-21, and M-36 are bolted down with four bolts. The Fine Grinder M-51, M-76 and M-101 are bolted down with six bolts. All Fine Grinders need a gasket between the grinder and the flat mounting surface to prevent any leakage of product or air.

In most instances Prater Industries will supply the stand. If however the user desires to construct the stand the stand need only be designed for a dead weight loading. The Fine Grinder is balanced to very rigid specifications, eliminating any additional dynamic loading conditions.

The mill must be mounted on a foundation that will not only support the weight of the mill but will provide a vibration free environment as well. The foundation sizes in Table 3-2 are recommended.

Model	Mill Weight (with largest motor) (lbs.)	Required Foundation Mass (lbs.)	Foundation Dimensions Length x Width (ft.)	Min. Depth of Concrete (using 150 lb/ft^3 concrete) (inches)
M-19	300	900	4 x 4	4 ½
M-21	905	2,715	6 x 4 ½	8
M-36	1,660	4,980	7 ½ x 5	10 ½
M-51	2,050	6,150	8 ½ x 5 ½	10 ½
M-76	4,490	13,470	10 x 7	15 ½
M-101	7,150	21,450	11 ½ x 8 ½	18

Table 3-2: Fine Grinder Foundation

Anchors should be placed a minimum of 12” away from the edges of the foundation.

It is the customer’s responsibility to determine if the underlying soil load capacity and building structure is sufficient for the installation. If the area in which the mill is to be mounted does not meet these weight or dimensional recommendations, a structural engineer should be consulted to design a sufficient structure and foundation to meet the unique requirements of the installation. Problems resulting from vibration or frame flexing caused by an insufficient foundation will void the equipment warranty.

In most cases mounting the mill to the floor will require some shimming of the footpads to accommodate irregularities in the floor. In some cases it may be necessary to create concrete pads on the floor to properly level and support the Fine Grinder. After proper support and leveling of the Fine Grinder, the unit must be securely bolted to the floor. Prater recommends securing the mill with the fasteners in Table 3-2.

TABLE 3-3 RECOMMENDED FASTENERS

MODEL	ANCHOR DIAMETER	ANCHOR LENGTH
M-21	3/8"	6"
M-36	3/8"	6"
M-51	½"	8"
M-76	¾'	10"
M-101	7/8"	12"

Prater Fine Grinder bases can be equipped with optional vibration dampeners (SHIPPED IN A SEPARATE BOX), to minimize transmissions of high frequency noise and reduce vibration transmission to the Fine Grinder from other surrounding equipment.

3.3 Clearance

There should be sufficient open space in all directions around the Fine Grinder to allow access for changing screens and other maintenance operations. No excessive weight can be resting on or supported from the Fine Grinder.

3.4 Installing the Fine Grinder Rotor

⚠WARNING

Fine Grinder Rotors contain sharp edges, which may cause personal injury if not handled properly. Always use care when working with Fine Grinder Rotors. Fine Grinder Rotors can be very heavy. Always insure that proper methods and adequate support are used at all times.

CAUTION

Rolling the Fine Grinder Rotor on the rotor blades may seriously damage the rotor. Never lift the fine grinder rotor using the rotor blades. Always use the holes in the main rotor disk for lifting the rotor.

Depending on the size of the unit power/mechanical assistance installing the rotor may be necessary. Prater Industries manufactures many assistive tools designed specifically for rotor installation and removal. **Contact Customer Service for details and pricing information.** Refer to Figure 6.9 in the rear of the manual.

- ✓ Remove the Screen frame (Figure 6.9, 1)
- ✓ Locate the serial number and the F or Front, which should be stamped on the rotor and face the door after installation (Figure 6.9, 2).
- ✓ Slide the rotor (2) onto shaft (5).
- ✓ Align key ways and insert key (13).
- ✓ The rotor and key should slide smoothly and seat onto the shaft shoulder.

✓ Install end cap, lock washer, and bolt (14,15,12) and using the following table, tighten to the recommended torque.

		Grade 8	SS F593C/D
Mill	Bolt Size	Torque (in -lb)	Torque (in -lb)
M 19	¼” - 20	109	75
M 21	5/16” - 18	221	132
M 36	½” - 13	969	517
M 51	5/8” - 11	1904	1110
M 76	¾” - 10	3400	1530
M 101	7/8”- 9	4500	2328

CAUTION

NEVER BLOCK THE ROTOR USING THE ROTOR BLADES TO PREVENT ROTATION DURING TIGHTENING OF THE BOLT.

Table 3-4: Fine Grinder Rotor fastener Torque Specifications

3.5 Vibration

The Prater Fine Grinder is constructed to run without noticeable vibration. Vibration indicates a problem that must be found and corrected immediately. If left uncorrected, vibration will cause: Fine Grinder damage, Structural damage. There are several conditions that cause vibration, including:

- ❖ Uneven base (See Section 3.2)
- ❖ Loose motor fasteners
- ❖ Defective motor or Fine Grinder bearings (See Section 4)
- ❖ Other equipment transferring vibration thru contact with the Fine Grinder.
- ❖ Worn, missing or broken rotor blades (Figure 6.5, R3)
- ❖ Material buildup on rotor disk or blades

3.6 Drive

The Fine Grinder has been supplied with the proper size pulley, balanced and properly mounted. In case it’s necessary to change the speed, always change only the pulley on mill shaft (Figure 6.9, 6). A maximum tip or circumferential speed however, of 120 meters per second (23, 616 FPM) should never be exceeded. The motor pulley is also standard, and is properly balanced and sized to provide the proper tip speed.

Alignment of pulleys after motor installation is very important because of the high rotational speeds. Improper alignment causes rapid bearing failure on motor and/or Fine Grinder (Illustration 3-1). Proper belt tensioning is very important. The belts are a matched set and require sufficient tension to prevent slippage under full motor load. New units are shipped with the pulleys laser aligned with a preset centerline distance to insure proper tensioning. The belts should be inspected frequently during the first few days of operation and then periodically thereafter. The new belts have a tendency to stretch, causing them to loosen up and squeal. (See any standard belt manufacturer’s catalogue for tensioning specifications).

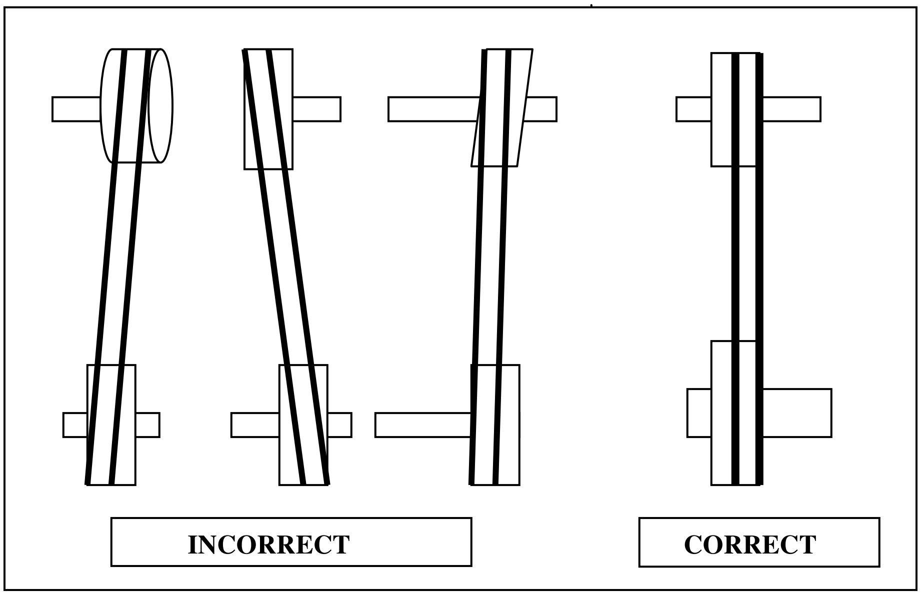


Illustration 3-1/Pulley Alignment

A V-belt guard will be provided with all Fine Grinders, unless the customer requests, in writing, that the guard need not be provided. The guard is built to rigid specifications to our standard center distances and locations. "OSHA" requirements mandate guarding all drives; therefore the customer MUST supply an approved design guard if they request **Prater** Companies not to supply one. Exposed V-belts are a HAZARDOUS condition.

3.7 Bearing Assembly Air Purge

Units shipped after January 1, 2012 will incorporate a bearing cover/air purge assembly as an integral part of the mill bearing assembly. Prater Industries, Inc. strongly recommends that customers utilize the air purge. The purge is installed to protect the mill bearings from product contamination due to dusty conditions and water during any cleaning of the mill and support equipment. **To be effective the air purge must operate at all times.** As received the mill bearing assembly incorporates a 1/8" NPT tapped hole in each of the end caps, which is plugged at the factory. This port is located in the front and rear bearing covers, which incorporates an air-assisted seal for operation with the air purge assembly. The air supply to the purge must be clean, dry, compressed air at 2 – 4 psi. The air volume requirements will be 4 – 10 ACFM depending on the size of the mill.

3.8 Feeding

NOTICE	The capacity and/or fineness listed will only be achieved if the density, particle size, shape, moisture content, and chemical make up of the feed material is consistent and IDENTICAL to that which we tested or specified, and is fed evenly and uniformly in a controlled manner to the PRATER unit(s) shown.

After the Fine Grinder is mounted in place, the product inlet (Figure 6.8, 1) must be connected to a device capable of providing a uniform-controlled feed rate to the mill. Prater Industries, Inc. recommends that feeding devices be operated with a Variable Frequency Drive to allow for adjustments due to changes in the feed material characteristics.

IT IS ESSENTIAL THAT THE FEED BE CONTROLLED in order to prevent overfeed, or uncontrolled pulsations which can overload the Fine Grinder. Any device, such as a slide gate, rotary feeder, vibrating trap feeder, screw conveyor, etc., may be used, as long as it provides a uniform-controlled feed. The feeding device should be supported from the building or other static structure. **DO NOT** support the feeder on the mill feed inlet (Figure 6.8, 1).
Establishing feed rate by averaging total feed over a period of time may allow non-uniform feed. There are no guarantees that short feeding cycles may not be too high or provide erratic feed during the run.

3.8.1 Protecting the Mill from Tramp Material Damage

The **Prater** Fine Grinder must be protected from damage by tramp material. One way to provide this protection is to provide an in-line magnet in the incoming product stream **immediately** before the Mill inlet. It is the user's responsibility to provide this protection. Damage caused to the Mill because it lacks such protection will not be covered by the Prater warranty.

3.9 Required Air Flow

Table 3-3 lists the Fine Grinder models matched with the required airflow volumes in cubic feet per minute.

NOTICE

Beginning in June 2008, Prater will offer the low air base as an option to replace the standard air-pickup base.

TABLE 3-5 RECOMMENDED AIRFLOW RANGES

MODEL	STD. CFM	LOW AIR CFM
M-19	150 – 300	NA
M-21	500 – 750	250 - 400
M-36	750 – 1200	400 - 600
M-51	1200 – 2400	800 - 1200
M-76	3000 – 4800	1500 - 2200
M-101	6000 – 9600	2800 - 4800

NOTICE

The airflow for each system has been calculated based on the testing performed. If you are not sure what the proper setting is for your Fine Grinder contact Prater Customer Service.

3.10 Electrical Requirements

Install connections to meet all national and local electrical codes. Consult with your local power company before installation.

NOTICE	THE NATIONAL ELECTRICAL CODE REQUIRES A MANUALLY OPERABLE DISCONNECT SWITCH LOCATED WITHIN SIGHT OF THE MOTOR, OR A CONTROLLER DISCONNECTING MEANS CAPABLE OF BEING LOCKED IF NOT WITHIN SIGHT OF THE MOTOR.

Effective October 31, 1989, OSHA requires that all energy disconnect devices be capable of accepting a lock-out/tag-out device. This requirement is mandatory for any new equipment being installed or for replacement, repair, or modification of older equipment. The employer must:

- Produce a written program explaining the procedure.
- Conduct an annual inspection to verify compliance.
- Provide documented employee training in these procedures.

The **Prater** Fine Grinder may be started "across the line" if such a procedure is acceptable to your local power company. In order to limit overload on the power supply, M-76 and M-101 models may require reduced voltage compensating starters to "soft start" motors in many areas.

3.10.1 Electrical Interlocking

As a general guide, the last piece of process equipment is started first with subsequent starts working up the line to the feeder, which is the last item started.

NOTICE	A TIME DELAY IS ALWAYS REQUIRED BETWEEN START-UP OF THE FINE GRINDER AND START UP OF THE FEEDER, TO ALLOW THE FINE GRINDER TO REACH FULL OPERATING SPEED BEFORE PRODUCT IS INTRODUCED.

NOTICE	ON SHUT DOWN, A TIME DELAY IS REQUIRED TO ASSURE THAT ALL OF THE PRODUCT HAS CLEARED THE FINE GRINDER.

3.11 Unit Check

After installation is complete, carefully inspect all work before the installation crew leaves to see that all instructions have been properly followed.

3.12 Adjustments
To achieve the most efficient performance with the Fine Grinder through all possible adjustments it is important to remember how particle size reduction is achieved through impact and acceleration.

The following adjustments will influence the grinding results.

3.12.1 SPEED - Changing the pulley on the mill shaft.

Larger: slows tip speed – coarser product.
Smaller: raises tip speed – fine product.

3.12.2 SCREEN - Different screen hole sizes give different particle sizing.

Larger holes – coarser product.
Smaller holes – finer product.

3.12.3 JAWS - Adds to impact – finer product

3.12.4 AIRFLOW – Higher - airflow leads generally to coarser grind and higher capacity.
Lower - airflow usually gives finer grind and lower capacity.

3.12.5 FEED In some cases a finer pregrind will increase capacity.

3.12.6 Uniform feed – smooth, uniform amperage draw, efficient operation, high capacity
Non-uniform feed – pulsating amperage draw, inefficient operation, low capacity

The more non-uniform the feed rate the greater the amperage pulsating and the higher the reduction in capacity. In the case of rotary valve type feeders Prater requires a minimum of 15 RPM to insure a uniform feed. Speeds less than 15 RPM will result in larger amperage pulsations, inconsistent finished product particle distribution and inefficient electrical use.

Section
4

Section 4: Operation

4.1 Introduction

Pre-run inspections and safety checks throughout this section insure that the Fine Grinder is in proper operating condition. Other aspects of operation covered in this section include: start-up and shut down sequences.

4.2 Pre-Run Inspection

Before attempting to run the Fine Grinder even to check rotation, perform the following inspection:

⚠ DANGER

ELECTRICAL SERVICE TO THE MACHINE MUST BE LOCKED OUT WHILE ANY REPAIRS OR ADJUSTMENTS ARE BEING MADE OR WHILE ANY COVER, DOOR, HATCH OR OTHER PROTECTIVE DEVICE IS NOT IN PLACE.

1. Open access door (Figure 6.4, M4).
2. Remove the screen assembly. Remove screw (B14), lock washer (B15), end cap (B9), and rotor assembly (R1-R4). Remove any loose material or foreign matter lying in the Fine Grinder. Reinstall the rotor assembly and secure with End cap (B9), lock washer (B15), and screw (B14).
3. Reinstall the screen assembly.
4. Turn the rotor assembly by hand to see that it turns freely.
5. Close and lock door (M4).
6. Inspect the mill drive for proper sheave alignment and belt tensioning

4.3 Safety Check-Up

Before starting the Fine Grinder check the following:

- ✓ The inside of the Fine Grinder for foreign material, i.e., nuts, bolts, wire.
- ✓ That screen assembly is properly installed.
- ✓ That the rotor assembly moves freely and not hitting surrounding parts.
- ✓ That all guards are mounted and secure.
- ✓ That all inspection doors are closed and locked.
- ✓ That all electrical starting equipment, meters, disconnect switches, and other control devices are clearly visible readily accessible to the operator.
- ✓ Check the rotor rotation (See Section 3.4).

4.4 Rotor Rotation

The Fine Grinders installed on the standard Air Pickup Base are designed to run in either direction when wear is significant in one direction. The rotation can be reversed electrically, removing the rotor and rotating it 180 degrees and reinstalling is not recommended. If the mill incorporates a pneumatic conveying system reversing rotation will generally result in approximately 10% reduced capacity when rotation at the bottom is counter to the direction of the airflow. To avoid this it is recommended that the rotation and orientation of the rotor remain the same, rotating the rotor can cause serious vibration problems. Fine Grinders installed on the low air base, can only rotate in one direction.

⚠WARNING

FINE GRINDING SYSTEMS CAN GENERATE NOISE LEVELS THAT MAY SEVERELY DAMAGE HEARING. IF THE FINE GRINDER IS OPERATING IN AN ENCLOSED AREA EAR PROTECTION MUST BE WORN AT ALL TIMES WHEN THE SYSTEM IS RUNNING. PRATER INDUSTRIES CAN PROVIDE MUFFLING DEVICES TO REDUCE THIS NOISE UPON REQUEST.

4.5 Start-Up Sequence

This start-up sequence is intended as a general guide. The start-up sequence you use will depend on your specific operation and any unique characteristics of your installation.

As a general guide to electrical interlocking, you turn on equipment in reverse order from product flow. The final piece of equipment to be started should be the product feeder.

NOTICE

A TIME DELAY IS ALWAYS REQUIRED BETWEEN START-UP OF THE FINE GRINDER AND START UP OF THE FEEDER, TO ALLOW FINE GRINDER TO REACH FULL OPERATING SPEED BEFORE PRODUCT IS INTRODUCED. ON SHUT DOWN, A TIME DELAY IS REQUIRED TO ASSURE THAT ALL OF THE PRODUCT HAS CLEARED THE FINE GRINDER

4.6 Running the Fine Grinder For The First Time

A. Insure that all equipment has been “bumped” to insure proper rotation
B. If the system is being controlled by a PLC discuss the start and shut down sequence with the programmer. In a standard FG installation the sequence is as follows:
    1. Start the system chiller, dryer, etc. if installed.
    2. Start the system fan, pulse, finished product, discharge equipment and any post milling equipment, i.e. sifters, mixers, etc.
    3. Start the mill.

The first time the mill is started perform the following:

1. Feel the bearing assembly to determine if there is any excessive vibration.

2. By feel determine if any vibration exists between the bearing housing front plate and the mill rear wall.
3. Check the mill floor mounts by feel to determine if there is any vibration between the mill footpads and the floor mount.
4. If the vibration feels excessive and correcting items 2 – 4 does not alleviate the problem follow this procedure:

   A. If the rotor was unmarked reverse the rotor and repeat item 3a above.
   B. If the rotor is marked and properly installed recheck the rotor for loose blades.
   C. Next tighten all the fasteners for the mill housing, motor, motor base, bearing housing, and feed inlet.
   D. Restart the mill and keep it running until bearing temperature is stable / falling or the unit reaches 175 degrees F.
   E. If the housing temperature reaches 175 degrees F stop the unit and call Prater for consultation.

5. If the vibration initially feels normal then while the bearing temperature rise is being monitored, set the system dampers and perform the system airflow readings.
6. The normal arrangement for the dampers should be an approximate 40/60 split between the feed inlet and the APUB on the standard base. If readings are not available to make the split the Operator should set the dampers by feel. The low air base does not require any damper adjustments on the mill.
7. Start the feed to the mill at about 50 percent of the rated capacity or 60 percent of the motor full load amps. Continue running at this setting until the system stabilizes. Stabilization occurs when the fluctuation in the mill motor current draw is between 5 and 10 percent of the FLA rating of the motor. This value is determined by voltage, hp, and operator experience.
8. If stabilization does not occur at this setting it may still be possible to achieve stabilization at a higher feed rate. After a sample has been collected, analyzed, and any necessary changes to the mill have been completed, the feed rate should be increased in increments.
9. Once the maximum sustainable feed rate has been achieved a sample should be collected for analysis. At this time a means of determining the feed rate should be found. Acceptable methods for attaining this are:
   a. Direct timing from the feed mechanism.
   b. Direct timing from the discharge of a cyclone.
   c. Shift timing in an operation where the mill is being continuously fed over a shift of at least eight hours.

   Unacceptable methods for attaining this are:
   a. Direct timing from the discharge of a new uncoated dust collector or one where the filters have recently been changed.
   b. Shift timing in an operation where the feed is anything other than continuous.

4.7 Initial inspection after 2 days or 48 hours running time

After not more than 48 hours of operation, the customer should open the mill up and inspect the mill internals.

- Inspect the rotor for any blade loosening and retighten as needed.
- Inspect all the internal parts for any wear or material buildup.
- Inspect the parts for impact damage from foreign material.

While inspecting the blades and securing the fasteners it is important to check each individual blade to insure there are no loose ones before the rotor is installed. After each eight hours of running the blades should be checked and retightened to see if any loose blades are identified. These checks should continue until two consecutive inspections reveal no loose blades.

The customer should inspect the mill monthly for materials that tend to be abrasive. For softer items, i.e. sugar, the inspection interval should be quarterly. The customer should use these inspections to determine the life of the internal components and implement a Preventive Maintenance Program to insure continuous operation.

Section

5

Section 5: Maintenance

NOTICE

The Fine Grinder has been specifically sized to grind your material to a certain fineness or PSD. Changes in the feed material will result in changes to the finished PSD. It is important to remember that changing the characteristics of the feed will result in changes to the output of the system. Changes in the characteristics of the feed material will void all warranty guarantees. If you intend to change the operation of the mill, you should first consult with Prater Industries, Inc. to ensure compatibility with your new process.

5.1 Introduction

The Fine Grinder is designed to operate with minimal maintenance. Routine inspections and regular maintenance will identify any worn or broken parts before they become a problem. Worn or broken parts are damaging to the Fine Grinder and its output. When operated without vibration or foreign materials entering the screen assembly, only those parts subject to the heaviest wear, i.e. drive belts, rotor blades, and screens will require maintenance.

⚠WARNING

DO NOT OPEN FINE GRINDER OR ATTEMPT ANY FORM OF INSPECTION UNTIL THE FINE GRINDER HAS COME TO A COMPLETE STOP AND THE ELECTRICAL DISCONNECT HAS BEEN LOCKED IN THE OPEN POSITION.

5.2 Routine Inspection

High speed rotating equipment requires regular routine preventative maintenance procedures.

Regular inspection of the rotor blades (Figure 6.5, R3) should be carried out particularly where abrasive materials are being processed. The wear pattern on the rotor blades (R3) will vary depending upon operating conditions. Visual inspection will show the necessity for change.

Prater fine grinder blades are manufactured from a special alloy steel designed to give them strength and durability. The blades are inspected for cracks or defects prior to being installed at the factory or shipped as replacement parts. The service life of the blades is dependent on several factors such as: abrasiveness of material being ground in the mill, contact with foreign material in the feed (i.e. metal, stones, etc.), excessive vibration over a period of time, foreign material entering the mill, and unintentional damage prior to being installed in the rotor such as being dropped on the floor or miss-handled in shipping.

To help prevent the problems mentioned above, Prater recommends the following:

1. Install components in the process before the mill to remove foreign material and break-up or remove large product agglomerations.
2. Prater recommends inspecting the blades every 30 days for wear or damage.
3. When inspection indicates that damage has occurred (bending, gouging, pitting, discoloration, etc.), replace all blades in the mill with new ones. The old <u>undamaged</u> blades can be magnetic-particle tested and possibly reused.
4. Install vibration detection equipment to help detect a problem before a blade breaks.
5. Instruct maintenance personnel in regard to proper handling of the blades during installation.

The blade-retaining ring (R2) should be inspected for sign of wear and replaced if necessary, and the screen (Figure 6.6, S3) should not be allowed to wear so thin as to break up.

The rotor disc (Figure 6.5, R1) is statically and dynamically balanced to a high standard to ensure smooth, vibration-free running. Should increased vibration develop, immediately stop the machine.

NOTICE

The M-19 rotor is single-piece and fully-machined, and as such the entire rotor must be replaced at the end of the effective service life.

5.3 Screens

The screens (Figure 6.6, S3) help control the particle size of the final product. Inspect the screens frequently to maintain the desired output and clean as necessary. The screens may require replacement if they are showing signs of wear.

5.3.1 Screen Replacement

DANGER

DO NOT OPEN FINE GRINDER OR ATTEMPT ANY FORM OF INSPECTION UNTIL THE FINE GRINDER HAS COME TO A COMPLETE STOP AND THE ELECTRICAL DISCONNECT HAS BEEN LOCKED IN THE OPEN POSITION.

5.3.1.1 M-19, M-21, M-36, M-51, and M-76

1. Turn off the Fine Grinder and allow the rotor (Figure 6.9, 2) to come to a complete stop.
2. Lock out electrical power to the Fine Grinder.
3. Open door (Figure 6.9, 3) and remove the screen frame assembly.

4. Remove screws (Figure 6.6, S4) and main ring (S1) from one side of the screen assembly.
5. Remove screen (S3).
6. To replace spacer (not shown) or grinding jaw (S2), remove remaining screws (S4).

NOTICE	**For the M 19 jaw assembly, tabs on the ends of the jaws are used to position and seat them in the screen frame assembly. After removal of the front screen ring, the jaws may be removed by lifting them out of the rear screen ring.**

7. Reverse procedure for reassembly of screen frame. Make sure the recess on the rear wall of body assembly (Figure 6.4, 2, M1) is clean. The rear of the screen assembly should rest tightly on that surface.

5.3.1.2 M-101

1. Turn off the Fine Grinder and allow the rotor (Figure 6.9, 2) to come to a complete stop.
2. **<u>Lock out electrical power</u>** to the Fine Grinder.
3. Open door (Figure 6.9, 3).

NOTICE	**THE SCREEN ASSEMBLY CAN BE REMOVED IN ONE PIECE BY REMOVING SCREWS (S8) AND WASHERS (S9), FIGURE 6.7. HOWEVER, THE SCREEN SEGMENTS (S11) AND GRINDING JAWS (S1) CAN BE EASILY REPLACED WHILE STILL MOUNTED IN BODY ASSEMBLY (FIGURE 6.4, M3).**

4. Remove screws (Figure 6.7, S7) and outer Ring (S2). Slide screen segments (S11) out the front of the unit.

NOTICE	**NEW SCREENS CAN BE INSTALLED AT THIS TIME. IF GRINDING JAWS (S1) NEED REPLACEMENT, PROCEED WITH THE FOLLOWING STEPS.**

5. To replace spacer pins (S5) or grinding jaws (S1), remove screws (S10) and inner ring (S3).
6. Spacer pins are threaded into main ring (58) and can be removed by rotating counterclockwise.

NOTICE	**Appendix A details installation and proper orientation of Triangular Screens.**

5.4 Rotor Blade Replacement

DANGER	DO NOT OPEN FINE GRINDER OR ATTEMPT ANY FORM OF INSPECTION UNTIL THE FINE GRINDER HAS COME TO A COMPLETE STOP AND THE ELECTRICAL DISCONNECT HAS BEEN LOCKED IN THE OPEN POSITION.

Turn off the Fine Grinder and allow the rotor (Figure 6.9, 2) to come to a complete stop. Lock out electrical power to the Fine Grinder. Open door (3) and remove the screen assembly.

NOTICE	THE ROTOR (2) DOES NOT HAVE TO BE REMOVED FROM MILL SHAFT (5); HOWEVER, PRATER INDUSTRIES, INC. RECOMMENDS REMOVAL OF THE ROTOR TO INSURE THAT BOTH RETAINING RINGS ARE PROPERLY TIGHTENED.

Remove screws (Figure 6.5, R4) and retaining rings (R2) from the outside of rotor disk (R1). Screws (R4) can be used in the lapped holes in rings (R2) to aid in removal. The position of the rings in the disk should be marked so that they can be installed in the same position during reassembly to maintain rotor balance. Blades (R3) can now be removed from rotor disk (R1) and new ones installed.

Proper installation of the rotor blades is critical to insure continued vibration-free operation and unnecessary downtime due to excessive vibration. Rotor blades purchased from Prater Industries, Inc. are shipped as a matched set. A matched set of blades is a set of blades where the deviation between the heaviest and lightest blades are within Prater tolerances, and does not mean the blades are all the same weight. Prater Industries, Inc. recommends that customers weigh the individual blades to insure uniform weight distribution around the rotor.

NOTICE	WHEN REPLACING DAMAGED OR WORN BLADES WITH NEW BLADES, IT IS NECESSARY TO ALSO REPLACE THE BLADE DIRECTLY OPPOSITE THE WORN BLADE. IF THE BLADES ARE PROPERLY MATCHED THIS SHOULD KEEP THE ROTOR IN BALANCE.

CAUTION	IF ONE BLADE IS CRACKED, IT IS RECOMMENDED THAT ALL BLADES BE MAGNETIC PARTICLE TESTED TO DETECT ANY UNSEEN HAIRLINE CRACKS. BLADES WITH THESE IMPERFECTIONS WILL PROBABLY BREAK AND CAUSE ADDITIONAL BLADE FAILURES AND OTHER EQUIPMENT DAMAGE. USED BLADES, WHICH SHOW NO CRACKS OR IMPERFECTIONS AFTER MAGNETIC-PARTICLE TESTING, ARE NORMALLY SAFE TO REINSTALL. IF IN DOUBT OR IF YOU HAVE ANY QUESTIONS, CONTACT PRATER INDUSTRIES FOR HELP AND/OR RETURN OF THE ROTOR FOR FURTHER INSPECTION AND TESTING.

Position retaining ring (R2) and secure with screws (R4). When tightening the screws be sure to tighten them in the proper sequence, i.e. 12 o'clock, 6 o'clock, 9 o'clock, 3 o'clock etc. Be sure screws (R4) are secured properly before the rotor is run again.

After replacing the blades and securing the fasteners it is important to check each individual blade to insure there are no loose ones before the rotor is installed. After each eight hours of running the blades should be checked and retightened to see if any loose blades are identified. These checks should continue until two consecutive inspections reveal no loose blades.

5.5 Greasing Bearings

All Fine Grinder bearings are shielded bearings that are "greased for life." They require no additional lubrication for the life of the bearing. Replace bearings at normal maintenance intervals, or when the bearing is damaged or contaminated. Prater recommends that bearings be changed yearly or after 2500 hours running time, whichever occurs first.

5.6 Bearing Assembly

5.6.1 M 21 and M 36 Bearing Disassembly

⚠ DANGER

DO NOT OPEN FINE GRINDER OR ATTEMPT ANY FORM OF INSPECTION UNTIL THE FINE GRINDER HAS COME TO A COMPLETE STOP AND THE ELECTRICAL DISCONNECT HAS BEEN LOCKED IN THE OPEN POSITION.

This section refers to Figure 6.9 in the back of the manual.

- Turn off the Fine Grinder and allow the rotor (Figure 6.9, 2) to come to a complete stop.
- **Lock out electrical power** to the Fine Grinder.
- Open door (3) and remove screen assembly.
- Remove bolt (12), lock washer (15), and end cap (14).
- Withdraw rotor (2) from shaft (5). Tapped holes for a simple withdrawal tool will be found in the rotor disc for M-76 and M-101 mills allowing use of special disassembly equipment.
- Remove key (13) from mill shaft (5).
- Remove the drive belts guards and release belt tension until the drive belts can be removed from the pulleys without damage.
- Remove mill pulley (6) from mill shaft (5).
- Remove the air lines from the fittings in the end caps.
- Remove bolts securing bearing housing to the mill body.
- On a clean worktable, remove the bearing end caps (Figure 6.3, 3 and 4).
- The M 36 end caps contain O rings (Figure 6.3, 14) to help seal the assembly. These are not part of the M 21 assembly.
- Remove the wave spring (Figure 6.3, 17).

This section refers to Figure 6.3

Mill shaft (2) is now ready for removal. Using a rubber mallet or similar device, displace shaft from the drive side to move the shaft axially one to three inches and out the rotor side of the housing (1). Once the shaft is clear of the bearing seats, it can be pulled out from the rotor side of the housing. Remove the drive bearing (15) by removing the locknut (12) and lock washer (13). Make sure to bend tab on lock washer so it is clear of the locknut. Remove the rotor bearing (16) by removing the inner shaft sleeve (18) and pressing the bearing off the drive end of the shaft.

5.6.2 M 21 and M 36 Bearing Reassembly

Assemble bearings (Figure 6.3, 15 & 16) on mill shaft (2) using the following procedure: Before starting the assembly, inspect all parts to be sure they are clean of dirt, grease, burrs, etc. Lay all parts on the assembly table on a clean, dry surface. Inspect the labels on the boxes containing the bearings to be assembled and be sure they have the green inspection sticker, which ensures Prater has inspected the critical dimensions. Be sure your hands are free of any grease, metal chips or dirt. Remove the bearings from the box and verify that the bearings contain the 2Z, C3, and JEM designations. This is extremely important. Do not use a bearing that does not say 2Z and C3 in the part designation. Check both sides of the bearing to be sure the shields are not damaged. Once the bearing is out of the box, always lay it on a clean, dry and flat surface. Bearings have three external parts; the inner race, the shields, and the outer race. When assembling a bearing housing, the shields on the bearings should never be touched by any tools or even squeezed between the fingers. This could cause undetected damage to the internal parts of the bearing, resulting in premature bearing failure. Prater recommends that the critical bearing dimensions (ID, OD, etc.) be measured to insure they are within the manufacturers tolerances if Prater did not supply the bearings.

Assembling without an Induction Heater

The pressure applied to the bearing must be on the inner race, and the inner race only. Never put pressure on the outer race to press a shaft into the inner race of a bearing. Be sure the tool being used to apply pressure to the inner race is only touching the inner race. Never apply pressure to one bearing while using the opposite bearing for resistance or as a stop. This will damage the opposite bearing. The assembly operation starts by pressing the rotor side bearing (16) onto the shaft (2). Install inner shaft sleeve (18). Press the drive side bearing (15) onto the shaft (2). Replace lock washers and lock nuts so they are tight against the inner race. Make sure tab in lock washer is bent down onto the locknut.

Assembling with an Induction Heater

Using an induction heater, heat the rotor side bearing and insert it on the shaft and against the shaft shoulder and let it cool. **MAXIMUM temperature is 230˚F (110˚C).** Slide the inner sleeve (18) over the shaft. Heat the drive side bearing and insert it on the shaft and against the shaft shoulder and let it cool. **MAXIMUM temperature is 230˚F (110˚C).** Replace lock washers and lock nuts so they are tight against the inner race. Make sure tab in lock washer is bent down onto the locknut.

Once the bearings are pressed onto the shaft, the bearing and shaft assembly can be pressed into the housing. The first bearing into the housing is the one that resides closest to the pulley. Since this bearing cannot be directly pushed into its seat in the housing, it is important to be sure it is inserted as straight and accurate as possible. A little care will go a long way.

The inner bearing, the one closest to the rotor, is then pushed into the housing by applying pressure to the outer race of this bearing. Be sure the tool being used to apply pressure to the outer race is only touching the outer race. Do not use excessive pressure to push this bearing into place. If the interference is too great, contact a **Prater** customer service rep for more information. Do not force the bearing into place with undue pressure. This will only damage the internal parts of the bearing and result in premature failure of the bearing.

Once the outer bearing is in place, install the wave spring so that it rests on the outer race of the drive-side bearing. The bearing caps (3 & 4) are installed to lock the outer race of the bearings into the housing. Before installing the caps, carefully inspect the Inpro seals to ensure that they are not worn or damaged; replace if necessary. Install the bearing caps (3 & 4) with the proper hardware. Reinstall bearing assembly into mill body and reconnect the air purge lines.

CAUTION	Be careful not to damage the shaft seal (Figure 6.4, M8) during shaft replacement into the mill body.

Replace rotor (Figure 6.9, 2), end cap (14), bolt (12), key (13), and lock washer (15). Check for smooth rotation and zero endplay. Install and tension the drive belts then close and secure the drive belts guard.

5.6.3 M 51 Bearing Disassembly

This section refers to Figure 6.9 in the back of the manual.

- Turn off the Fine Grinder and allow the rotor (Figure 6.9, 2) to come to a complete stop.
- **Lock out electrical power** to the Fine Grinder.
- Open door (3) and remove screen assembly.
- Remove bolt (12), lock washer (15), and end cap (14).
- Withdraw rotor (2) from shaft (5). Tapped holes for a simple withdrawal tool will be found in the rotor disc for M-76 and M-101 mills allowing use of special disassembly equipment.
- Remove key (13) from mill shaft (5).
- Remove the drive-belts guards and release belt tension until the drive belts can be removed from the pulleys without damage.
- Remove mill pulley (6) from mill shaft (5).
- Remove the air lines from the fittings in the end caps.
- Remove bolts securing bearing housing to the mill body.
- On a clean worktable, remove the bearing end caps (Figure 6.2, 7 & 8).
- The end caps contain O rings (Figure 6.2, 12 & 13) to help seal the assembly. Visually inspect these for any damage and replace if necessary.

- Remove the wave spring (Figure 6.2, 18).

This section refers to Figure 6.2

Mill shaft (2) is now ready for removal. Using a rubber mallet or similar device, displace shaft from the drive side to move the shaft axially one to three inches and out the rotor side of the housing. Once the shaft is clear of the bearing seats, it can be pulled out from the rotor side of the housing. Remove the drive bearing (6) by removing the locknut (15) and lock washer (14). Make sure to bend tab on lock washer so it is clear of the locknut. Remove the rotor bearing (5) by removing the locknut (17) and lock washer (16).

5.6.4 M 51 Bearing Reassembly

Assemble bearings (Figure 6.2, 5 & 6) on mill shaft (2) using the following procedure: Before starting the assembly, inspect all parts to be sure they are clean of dirt, grease, burrs, etc. Lay all parts on the assembly table on a clean, dry surface. Inspect the labels on the boxes containing the bearings to be assembled and be sure they have the green inspection sticker, which ensures Prater has inspected the critical dimensions. Be sure your hands are free of any grease, metal chips, or dirt. Remove the bearings from the box and verify that the bearings contain the 2Z, C3, and JEM designations. This is extremely important. Do not use a bearing that does not say 2Z and C3 in the part designation. Check both sides of the bearing to be sure the shields are not damaged. Once the bearing is out of the box, always lay it on a clean, dry, and flat surface. Bearings have three external parts; the inner race, the shields, and the outer race. When assembling a bearing housing, the shields on the bearings should never be touched by any tools or even squeezed between the fingers. This could cause undetected damage to the internal parts of the bearing, resulting in premature bearing failure. Prater recommends that the critical bearing dimensions (ID, OD, etc.) be measured to insure they are within the manufacturer's tolerances if Prater did not supply the bearings.

Assembling without an Induction Heater

The pressure applied to the bearing must be on the inner race, and the inner race only. Never put pressure on the outer race to press a shaft into the inner race of a bearing. Be sure the tool being used to apply pressure to the inner race is only touching the inner race. Never apply pressure to one bearing while using the opposite bearing for resistance or as a stop. This will damage the opposite bearing. The assembly operation starts by pressing the rotor side bearing (5) onto the shaft (2). Install the lock washer and locknut so they are tight against the inner race. Press the drive side bearing (6) onto the shaft (2). Replace lock washers and locknuts so they are tight against the inner race. Make sure tab in lock washer is bent down onto the locknut.

Assembling with an Induction Heater

Using an induction heater, heat the rotor side bearing and insert it on the shaft and against the shaft shoulder and let it cool. **MAXIMUM temperature is 230˚F (110˚C).** Heat the drive side bearing and insert it on the shaft and against the shaft shoulder and let it cool. **MAXIMUM temperature is 230˚F (110˚C).** Replace lock washers and lock nuts so they are tight against the inner race. Make sure tab in lock washer is bent down onto the locknut.

Once the bearings are pressed onto the shaft, the bearing and shaft assembly can be pressed into the housing. The first bearing into the housing is the one that resides closest to the pulley. Since this bearing cannot be directly pushed into its seat in the housing, it is important to be sure it is inserted as straight and accurate as possible. A little care will go a long way.

The inner bearing, the one closest to the rotor, is then pushed into the housing by applying pressure to the outer race of this bearing. Be sure the tool being used to apply pressure to the outer race is only touching the outer race. Do not use excessive pressure to push this bearing into place. If the interference is too great, contact a **Prater** customer service rep for more information. Do not force the bearing into place with undue pressure. This will only damage the internal parts of the bearing and result in premature failure of the bearing.

Once the outer bearing is in place, install the wave spring so that it rests on the outer race of the drive-side bearing. The bearing caps (7 & 8) are installed to lock the outer race of the bearings into the housing. Before installing the caps, carefully inspect the Inpro seals (3 &4) to ensure that they are not worn or damaged; replace if necessary. Install the bearing caps (7 & 8) with the proper hardware. Reinstall bearing assembly into mill body and reconnect the air purge lines.

CAUTION	**Be careful not to damage the shaft seal (Figure 6.4, M8) during shaft replacement into the mill body.**

Replace rotor (Figure 6.9, 2), end cap (14), bolt (12), key (13), and lock washer (15). Check for smooth rotation and zero endplay. Install and tension the drive belts, then close and secure they drive belts guard.

5.6.5 M 76 and M 101 Bearing Disassembly

This section refers to Figure 6.9 in the back of the manual.

- Turn off the Fine Grinder and allow the rotor (Figure 6.9, 2) to come to a complete stop.
- **Lock out electrical power** to the Fine Grinder.
- Open door (3) and remove screen assembly.
- Remove bolt (12), lock washer (15), and end cap (14).
- Withdraw rotor (2) from shaft (5). Tapped holes for a simple withdrawal tool will be found in the rotor disc for M 76 and M 101 mills allowing use of special disassembly equipment.
- Remove key (13) from mill shaft (5).
- Remove the drive belts guards and release belt tension until the drive belts can be removed from the pulleys without damage.
- Remove mill pulley (6) from mill shaft (5).
- Remove the air lines from the fittings in the end caps.

- Remove bolts securing bearing housing to the mill body.
- On a clean worktable remove the bearing end caps (Figure 6.1, 7 and 8).
- The end caps contain O rings (Figure 6.1, 13 & 14) to help seal the assembly. Visually inspect these for any damage and replace if necessary.
- Remove the wave spring (Figure 6.1, 15).

This section refers to Figure 56.1

Mill shaft (2) is now ready for removal. Using a rubber mallet or similar device, displace shaft from the drive side to move the shaft axially one to three inches and out the rotor side of the housing. Once the shaft is clear of the bearing seats, it can be pulled out from the rotor side of the housing. Remove the drive bearing (3) by removing the locknut (6) and lock washer (5). Make sure to bend tab on lock washer so it is clear of the locknut. Remove the rotor bearing (4) by removing the locknut (6) and lock washer (5).

5.6.6 M 76 and M 101 Bearing Reassembly

Assemble bearings (Figure 6.1, 3 & 4) on mill shaft (2) using the following procedure:
Before starting the assembly, inspect all parts to be sure they are clean of dirt, grease, burrs, etc. Lay all parts on the assembly table on a clean, dry surface. Inspect the labels on the boxes containing the bearings to be assembled and be sure they have the green inspection sticker, which ensures Prater has inspected the critical dimensions. Be sure your hands are free of any grease, metal chips, or dirt. Remove the bearings from the box and verify that the bearings contain the 2Z, C3, and JEM designations. This is extremely important. Do not use a bearing that does not say 2Z and C3 in the part designation. Check both sides of the bearing to be sure the shields are not damaged. Once the bearing is out of the box, always lay it on a clean, dry, and flat surface. Bearings have three external parts; the inner race, the shields, and the outer race. When assembling a bearing housing, the shields on the bearings should never be touched by any tools or even squeezed between the fingers. This could cause undetected damage to the internal parts of the bearing, resulting in premature bearing failure. Prater recommends that the critical bearing dimensions (ID, OD, etc.) be measured to insure they are within the manufacturer's tolerances if Prater did not supply the bearings.

Assembling without an Induction Heater

The pressure applied to the bearing must be on the inner race, and the inner race only. Never put pressure on the outer race to press a shaft into the inner race of a bearing. Be sure the tool being used to apply pressure to the inner race is only touching the inner race. Never apply pressure to one bearing while using the opposite bearing for resistance or as a stop. This will damage the opposite bearing. The assembly operation starts by pressing the rotor side bearing (4) onto the shaft (2). Install the lock washer and locknut so they are tight against the inner race. Press the drive side bearing (3) onto the shaft (2). Replace lock washers and locknuts so they are tight against the inner race. Make sure tab in lock washer is bent down onto the locknut.

Assembling with an Induction Heater

Using an induction heater, heat the rotor side bearing and insert it on the shaft and against the shaft shoulder and let it cool. **MAXIMUM temperature is 230˚F (110˚C).** Heat the drive side bearing and insert it on the shaft and against the shaft shoulder and let it cool. **MAXIMUM temperature is 230˚F (110˚C).** Replace lock washers and lock nuts so they are tight against the inner race. Make sure tab in lock washer is bent down onto the locknut.

Once the bearings are pressed onto the shaft, the bearing and shaft assembly can be pressed into the housing. The first bearing into the housing is the one that resides closest to the pulley. Since this bearing cannot be directly pushed into its seat in the housing, it is important to be sure it is inserted as straight and accurate as possible. A little care will go a long way.

The inner bearing, the one closest to the rotor, is then pushed into the housing by applying pressure to the outer race of this bearing. Be sure the tool being used to apply pressure to the outer race is only touching the outer race. Do not use excessive pressure to push this bearing into place. If the interference is too great, contact a **Prater** customer service rep for more information. Do not force the bearing into place with undue pressure. This will only damage the internal parts of the bearing and result in premature failure of the bearing.

Once the outer bearing is in place, install the wave spring so that it rests on the outer race of the drive-side bearing. The bearing caps (7 & 8) are installed to lock the outer race of the bearings into the housing. Before installing the caps, carefully inspect the Inpro seals (9) to ensure that they are not worn or damaged; replace if necessary. Install the bearing caps (7 & 8) with the proper hardware. Reinstall bearing assembly into mill body and reconnect the air purge lines.

CAUTION

Be careful not to damage the shaft seal (Figure 6.4, M8) during shaft replacement into the mill body.

Replace rotor (Figure 6.9, 2), end cap (14), bolt (12), key (13), and lock washer (15). Check for smooth rotation and zero endplay. Install and tension the drive belts, then close and secure the drive belts guard.

New Bearing Run-in Procedure for Fine Grinders

Bearing Temperatures

Initial bearing running temperatures and stabilization time will vary depending upon the following factors:

1. Rotational speed (RPM)
2. Installed bearing internal clearance
3. Grease fill volume
4. Bearing size
5. Ambient temperature

It is recommended to start new bearings running at half speed (if a VFD is available) for about one hour. Then increase to full speed and run until both bearing temperatures stabilize below 140˚ F. If VFD is not available, try an initial warm-up procedure of power-on, then power-off the mill drive motor to achieve an average break-in speed of about half the normal running speed for the first 15 minutes of running time.

Bearings with less internal clearance will run warmer initially and take longer to stabilize. Generally, larger bearings will run warmer than smaller bearings, since the rolling elements must spin at a higher velocity.

It is not uncommon for a new bearing to reach 160˚ F during initial run-in, but in no case should a bearing temperature be allowed to exceed 180˚ F for an extended period of time. Grease may begin to bleed above 180˚ F. Grease life is best if the bearing temperature stabilizes below 140˚ F.

Depending upon the variables given above, bearing temperatures should reduce to a stabilized running temperature below 140˚ F within the first 24 hours of operation. The final stabilized temperature for a particular bearing will depend on ambient temperature and bearing internal clearance.

5.7 Belt Tension

⚠WARNING

DO NOT OPEN FINE GRINDER OR ATTEMPT ANY FORM OF INSPECTION UNTIL THE FINE GRINDER HAS COME TO A COMPLETE STOP AND THE ELECTRICAL DISCONNECT HAS BEEN LOCKED IN THE OPEN POSITION.

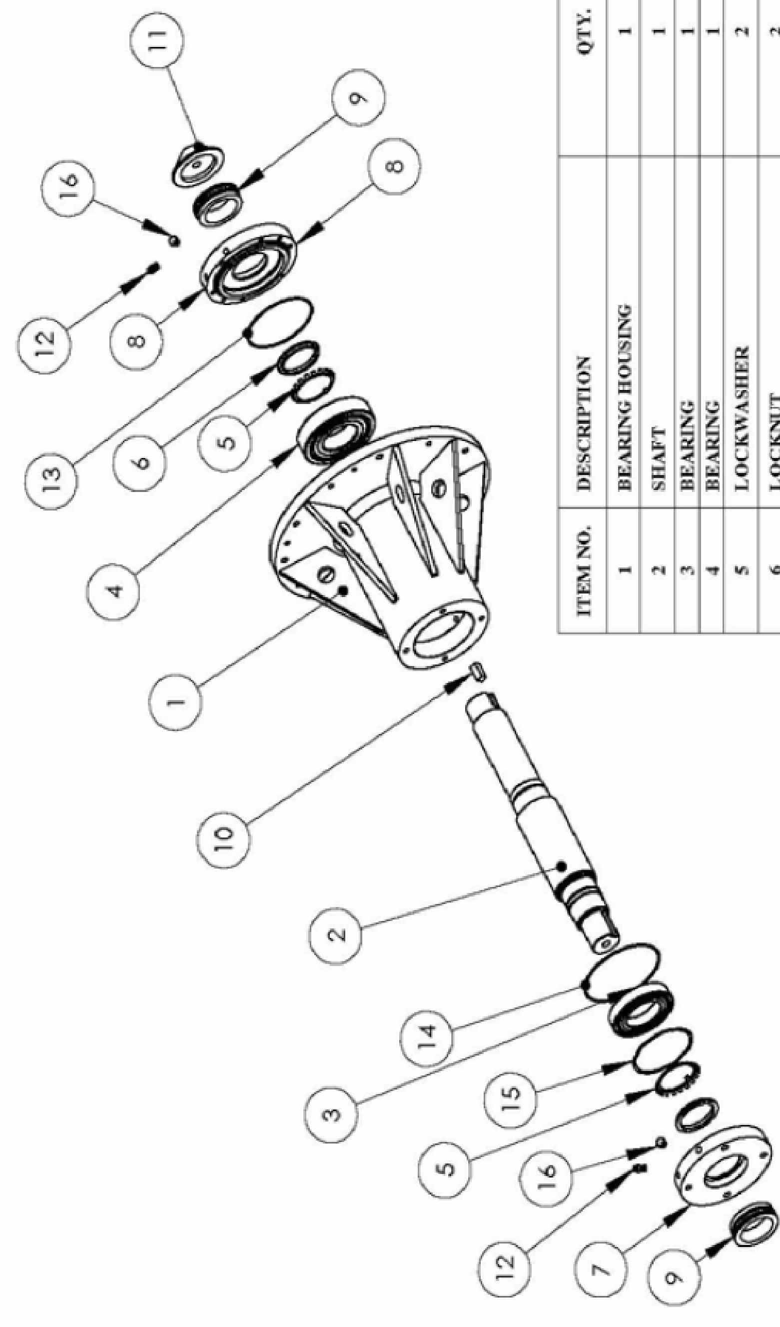
- Turn off the Fine Grinder and allow the rotor (Figure 6.9, 2) to come to a complete stop.
- **Lock out electrical power** to the Fine Grinder.
- Open drive guard door by releasing the two clasps and raising the grated door section.
- Press firmly on the mid-point of belt and measure the belt deflection. Deflection should be 1/4" or less.
- If deflection is more than 1/4", loosen the motor mounting bolts, tighten the belt, and tighten the mounting bolts.
- Install the drive guard.

Section

6

Section 6: Drawings and Parts List

The following figures and illustrations are provided to assist in the operation and maintenance of Prater Fine Grinders as well as a general reference for any spare or replacement parts for Prater Fine Grinders. For specific Fine Grinder questions please contact Prater Customer Service.



ITEM NO.	DESCRIPTION	QTY.
1	BEARING HOUSING	1
2	SHAFT	1
3	BEARING	1
4	BEARING	1
5	LOCKWASHER	2
6	LOCKNUT	2
7	END COVER, DRIVE SIDE	1
8	END COVER-ROTOR SIDE	1
9	SEAL, INPRO	2
10	KEY, ROTOR SIDE	1
11	ROTOR END CAP	1
12	CONNECTOR	2
13	O-RING	1
14	O-RING	1
15	SPRING	1
16	PLUG,O-RING	2

Figure 6.1: M 76 and M 101 Bearing Assembly Exploded View and Parts List

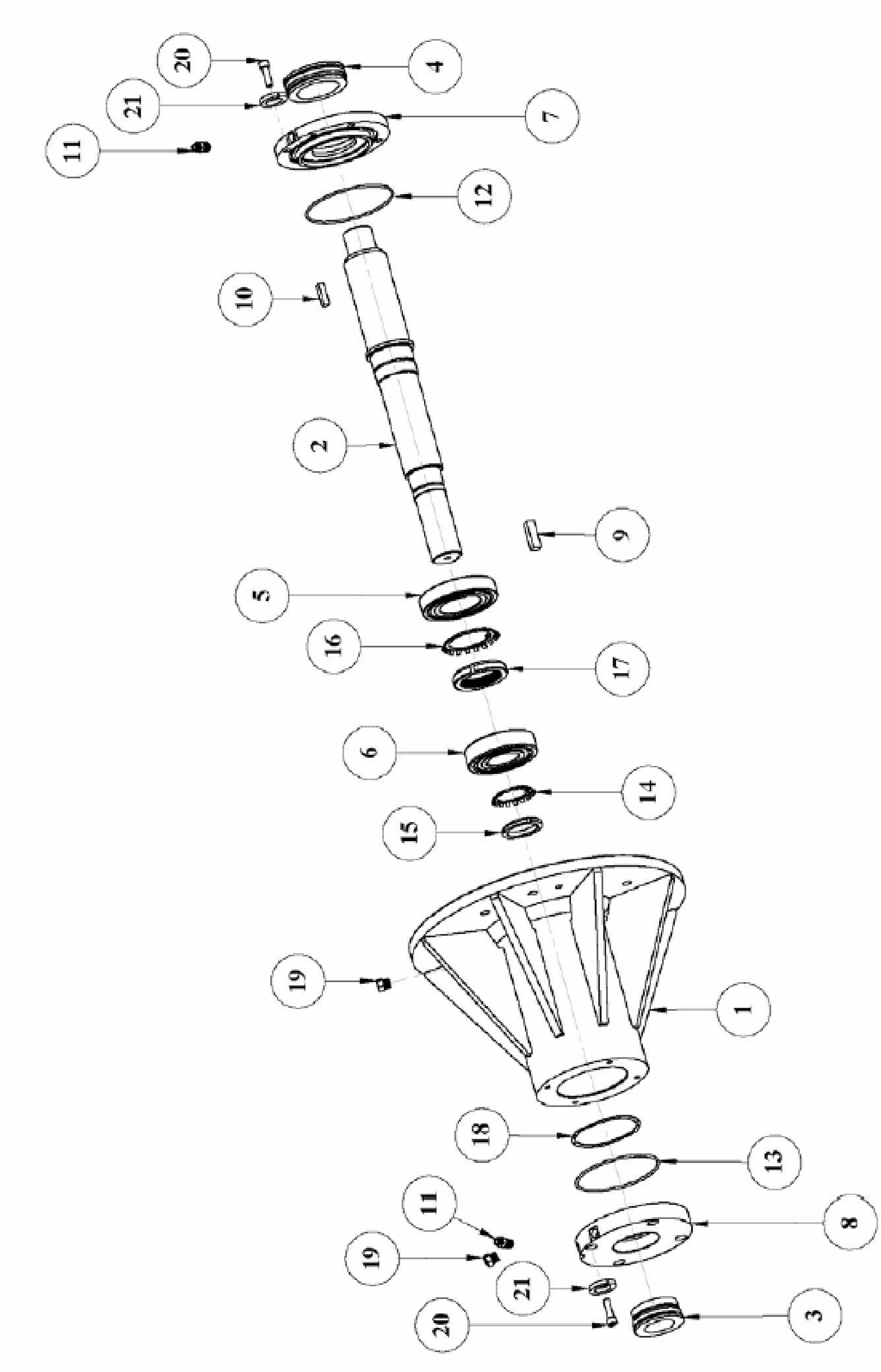


Figure 6.2: M 51 Bearing Assembly Exploded View

Item	Description	Qty
1	BEARING HOUSING ASSEMBLY	1
2	SHAFT	1
3	SEAL, AIR-ASSISTED,GROUNDED	1
4	SEAL, AIR-ASSISTED	1
5	BEARING	1
6	BEARING	1
7	ROTOR SIDE END CAP	1
8	DRIVE SIDE END CAP	1
9	KEY, DRIVE	1
10	KEY, ROTOR	1
11	CONNECTOR	2
12	O-RING	1
13	O-RING	1
14	LOCK WASHER	1
15	LOCKNUT	1
16	LOCK WASHER	1
17	LOCKNUT	1
18	WAVE SPRING	1
19	PLUG	2
20	SOCKET HEAD CAP SCREW	8
21	LOCK WASHER	8

Table 6.2: M 51 Bearing Assembly Parts List

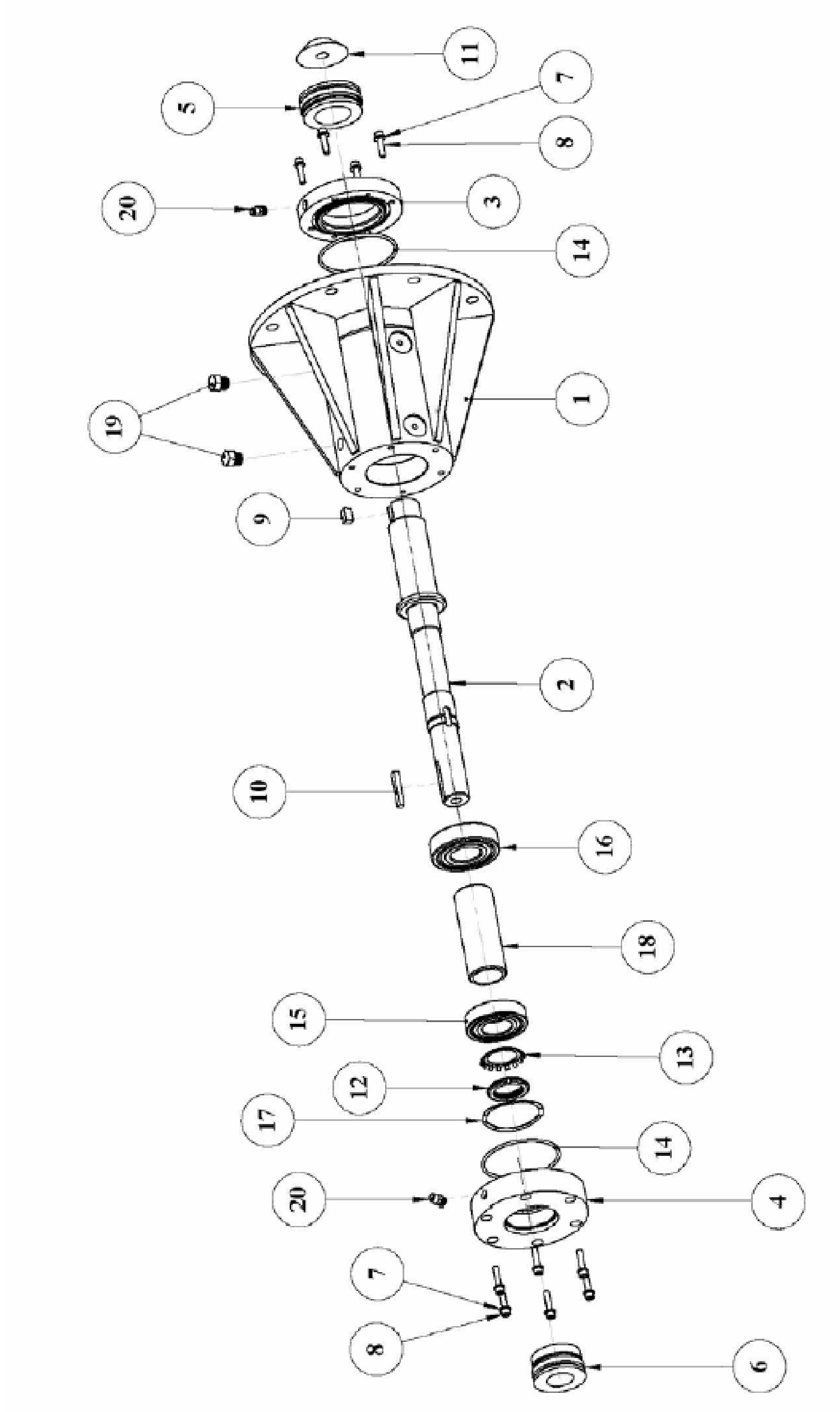


Figure 6.3: M 21 and M 36 Bearing Assembly Exploded View

Item No.	Description	Qty
1	BEARING HOUSING ASSEMBLY	1
2	SHAFT	1
3	ROTOR SIDE END CAP	1
4	DRIVE SIDE END CAP	1
5	SEAL, AIR-ASSISTED	1
6	SEAL, AIR-ASSISTED, GROUNDING	1
7	LOCK WASHER	10
8	SHCS	10
9	KEY, ROTOR SIDE	1
10	KEY, DRIVE SIDE	1
11	CAP	1
12	LOCKNUT	1
13	LOCK WASHER	1
14	O-RING (M 36 ONLY)	2
15	BEARING, DRIVE SIDE	1
16	BEARING, ROTOR SIDE	1
17	WAVE SPRING	1
18	SHAFT INNER SLEEVE	1
19	PLUG, GREASE	2
20	CONNECTOR, AIR	2

Figure 6.3: M 21 and M 36 Bearing Assembly Parts List

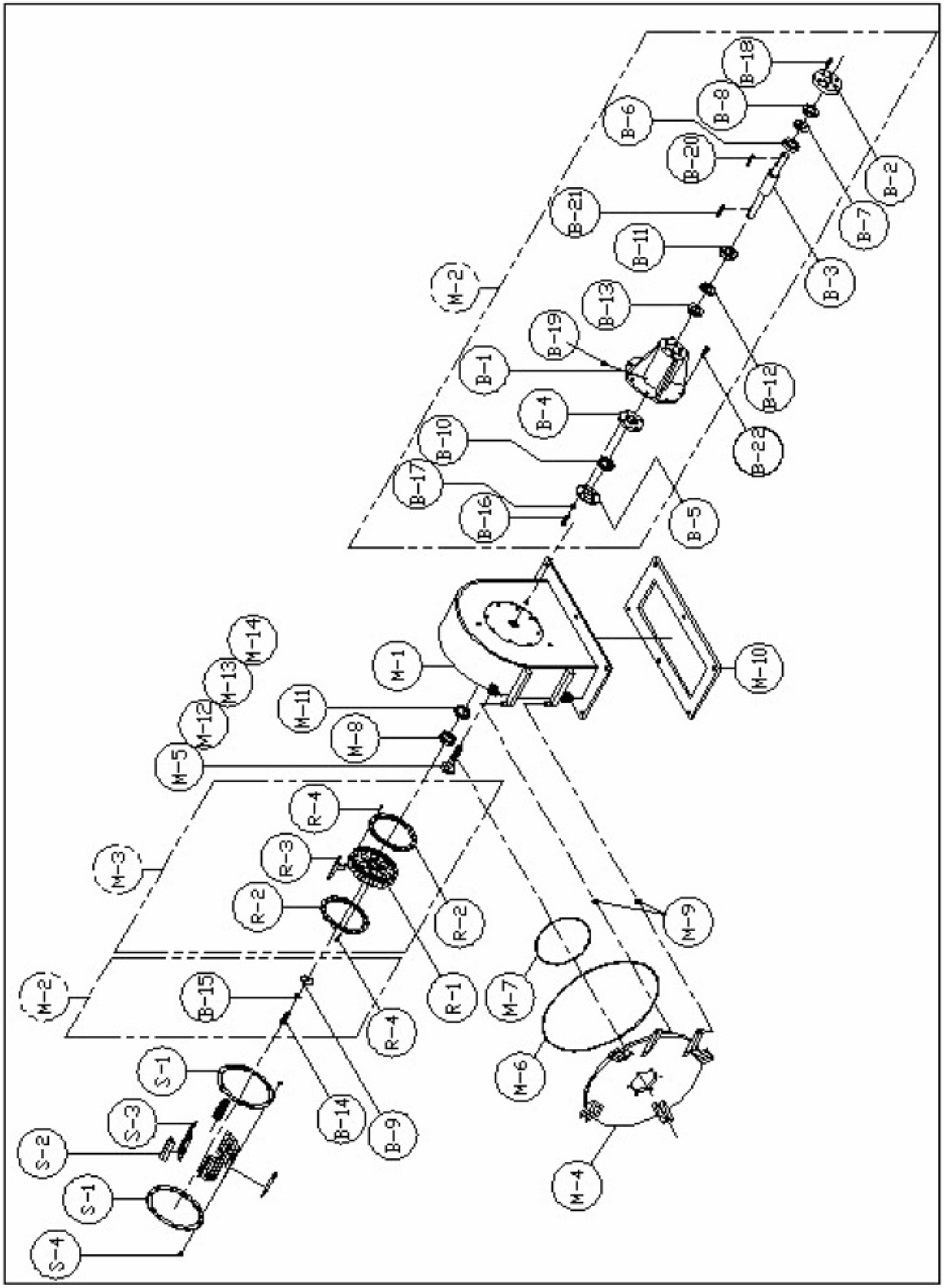
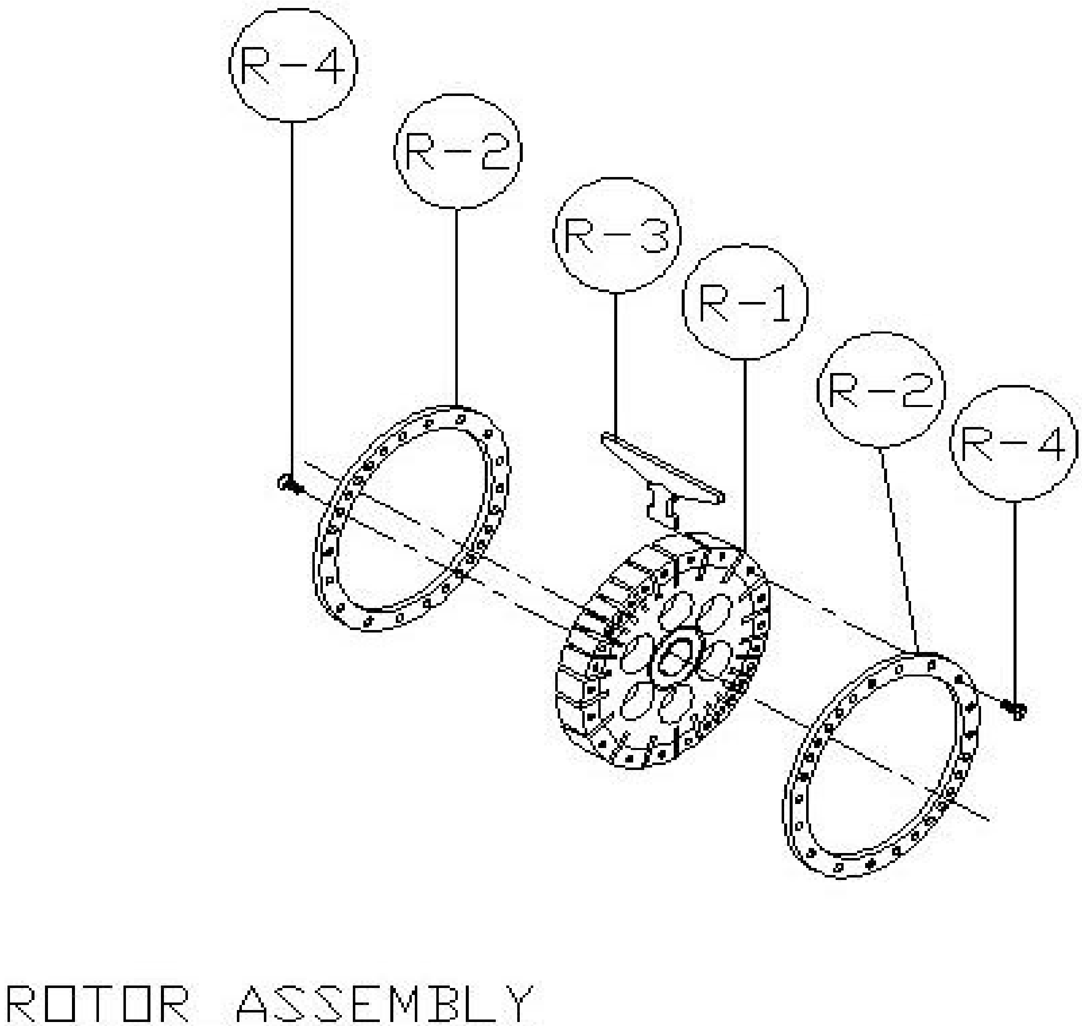


Figure 6.4: Fine Grinder Main Assembly Exploded View

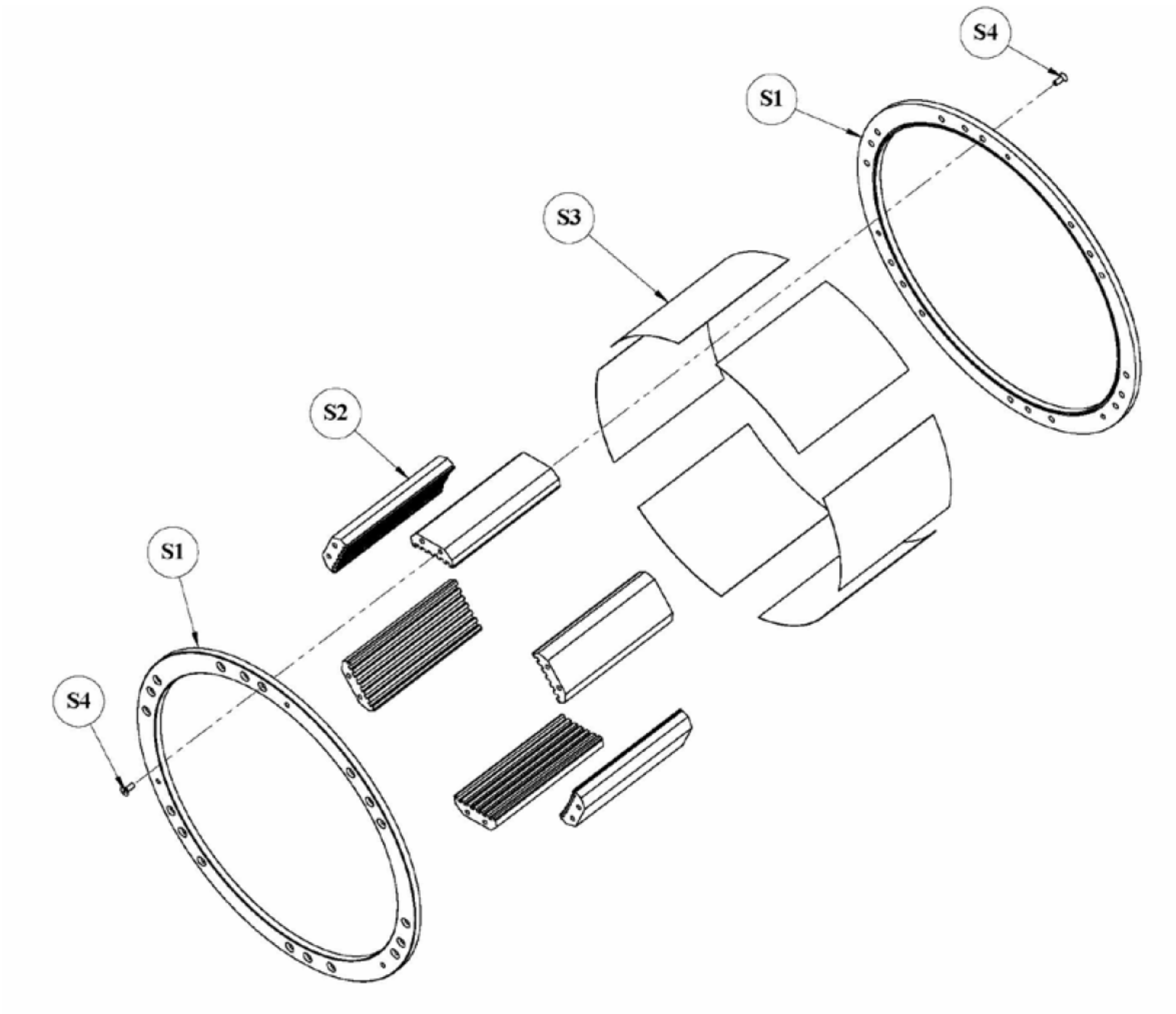
Item	Description	QTY
M1	MILL HOUSING ASSEMBLY	1
M2	BEARING ASSEMBLY	1
M3	ROTOR ASSEMBLY	1
M4	DOOR ASSEMBLY	1
M5	SHANK KNOB	4
M6	FRAME SEAL	1
M7	DOOR SEAL	1
M8	SHAFT SEAL	1
M9	THRUST BEARING	2
M10	BASE GASKET	1
M11	SNAP RING	1
M12	SWING BOLT	4
M13	WASHER	4
M14	HEX NUT	4

Table 6.4: Fine Grinder Main Assembly Parts List



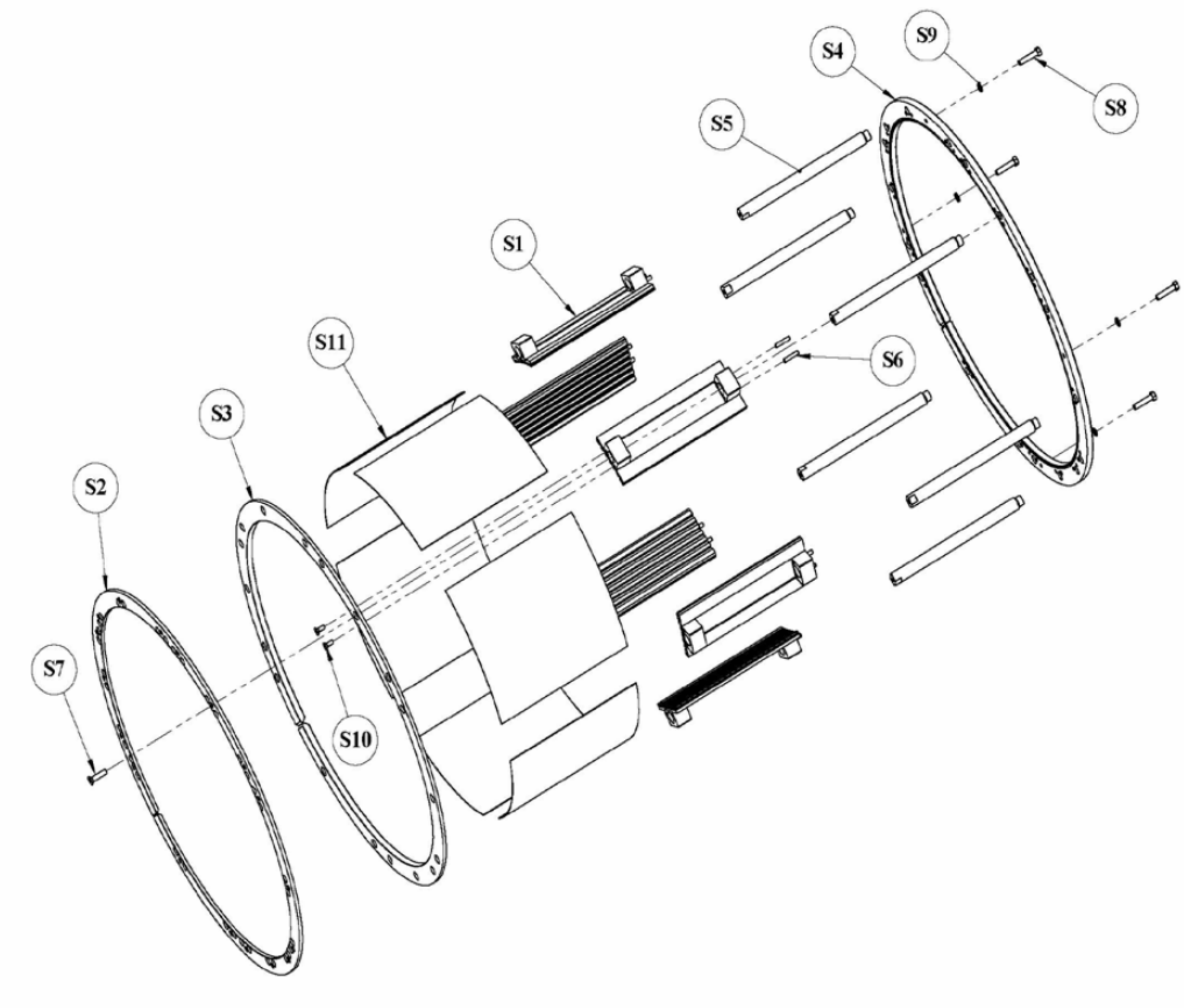
Item	Description	QTY
R1	**ROTOR DISC.**	1
R2	**RETAINING RING**	2
R3	**ROTOR BLADE**	24-48
R4	**H.H.C.S.**	24-48

Figure 6.5: Rotor Assembly Exploded View and Parts List for M 21, 36, 51, 76, 101



Item	Description	QTY
S1	**SCREEN RING**	2
S2	**PLATE, GRINDING**	0-6
S3	**SCREEN**	1-6
S4	**F.H.S.C.S. W/NYLOCK**	8-24

Figure 6.6: Screen Frame Assembly Exploded View and Parts List for M 21, 36, 51, 76



ITEM NO.	Description	QTY
S1	Grinding Plate	0-6
S2	Outer Screen Ring	1
S3	Inner Screen Ring	1
S4	Rear Screen Ring	1
S5	Spacer Pin	6
S6	Grinding Plate Pin	12
S7	F.H.S.C.S.	12
S8	H.H.C.S.	4
S9	Lock Washer	4
S10	F.H.S.C.S.	12
S11	Screen	1-6

Figure 6.7: Screen Frame Assembly Exploded View and Parts List for M 101

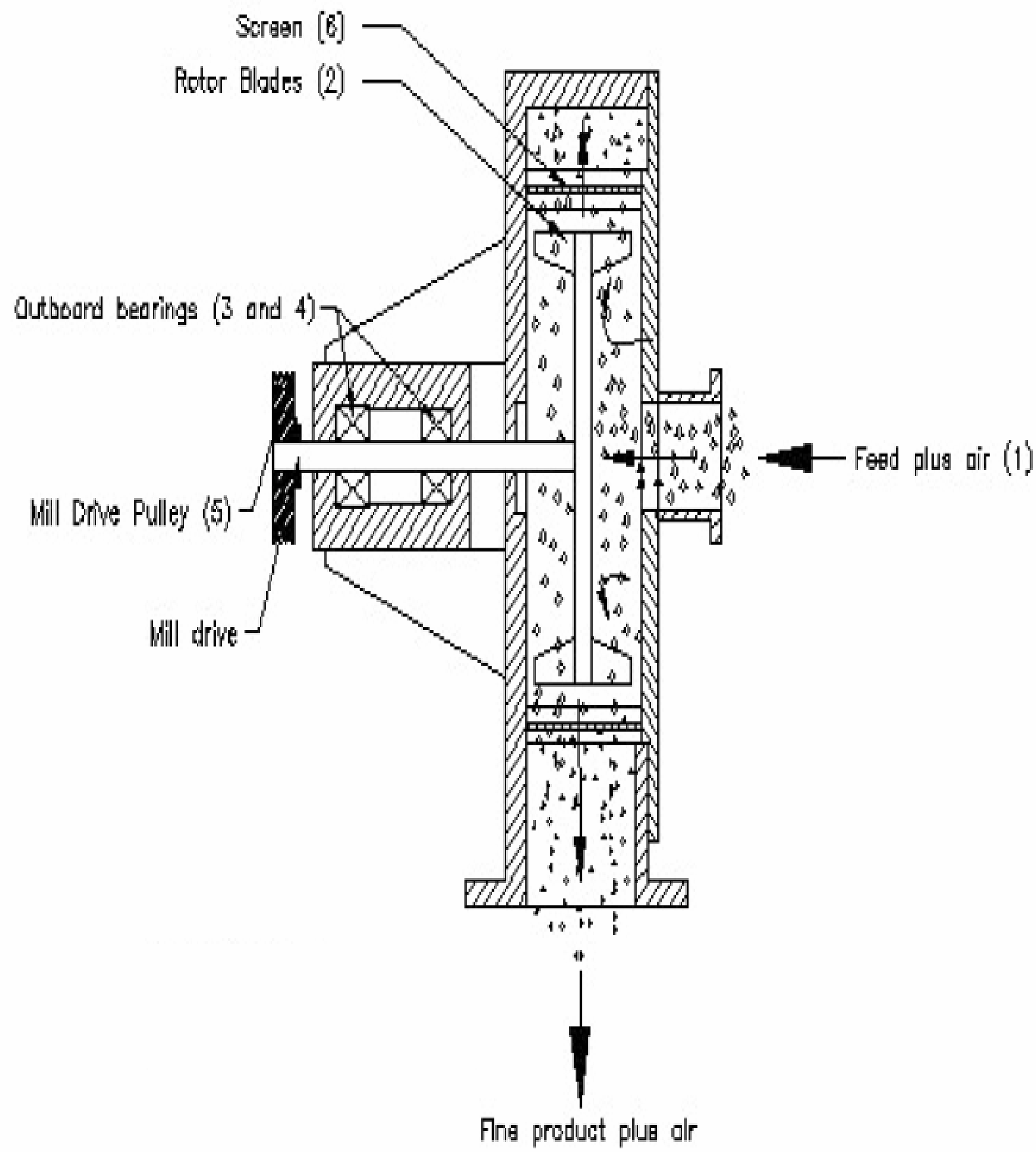
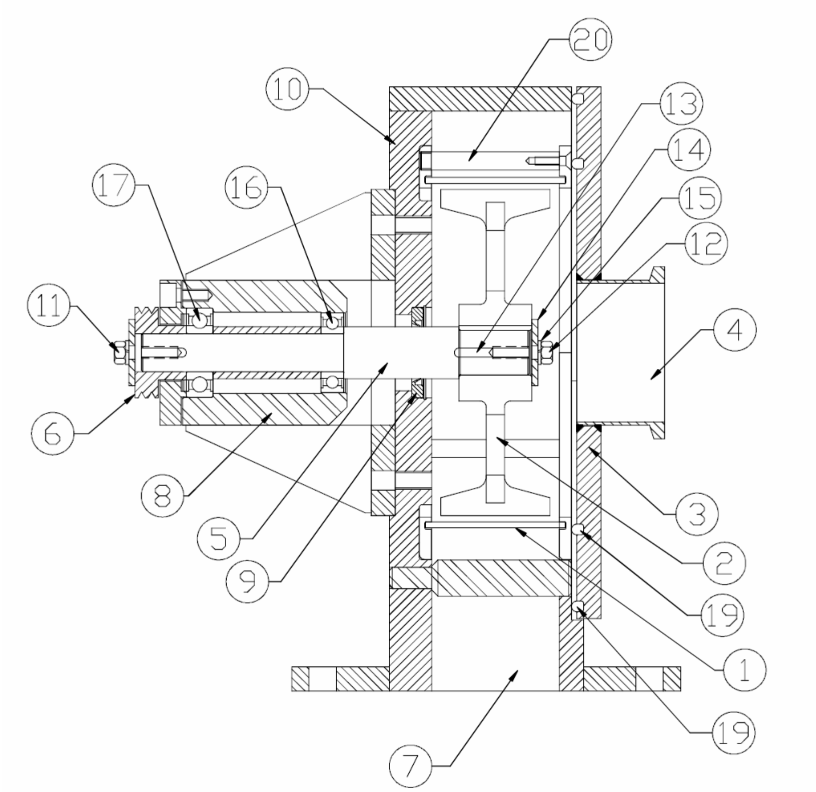


Figure 6.8: Operating Principle

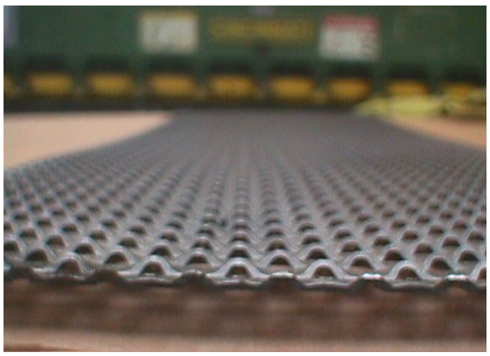


1	Screen
2	Rotor
3	Door
4	Feed Inlet
5	Shaft
6	Pulley
7	Discharge Opening
8	Bearing Housing
9	Shaft Seal
10	Housing
11	Pulley Bolt
12	Rotor Bolt
13	Key
14	Rotor Cap
15	Lock Washer
16	Rotor Bearing
17	Drive Bearing
18	Frame Seal
19	Door Seal
20	Jaw

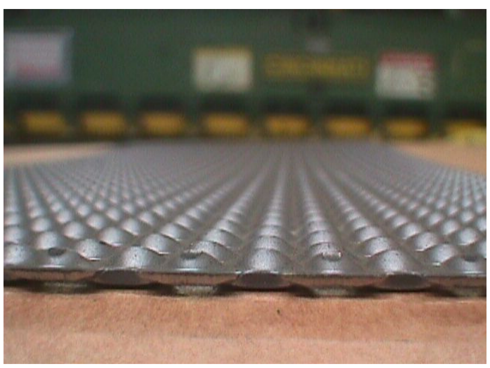
Figure 6.9: M 19 Main Assembly

Appendix A: DETERMINING PROPER INSTALLATION OF PRATER INDUSTRIES TRIANGLE SCREENS

Prater’s triangle screens are directional and must be installed in the forward direction to achieve proper airflow and grind. Proper installation is achieved when the forward direction of the screen(s) match the direction of rotation of the grinder. Below are pictures that show how to determine the forward direction of these screens.



The picture at the left shows a view looking down the forward direction of the screen. In this direction, the hole openings are visible to the eye. When these holes face the direction of rotation of the grinder rotor, the screen is installed in the “forward” direction. In this manner, proper air and product flow is maintained.

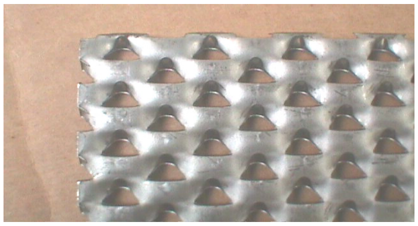


The picture at the left shows a view looking down the reverse direction of the screen (opposite direction of the top left photo). In this direction, the hole openings are not visible to the eye. When installed so that the rotation of the mill rotor sweeps the screen in this direction, air and product flow are restricted. This is considered the backward direction and is not usually the correct way to install the screen.

The picture at the left shows a side profile view of the screen. As you can see, the stamping process for this screen creates a form very similar to a cheese grater. These screens would be installed in the forward direction when the direction of rotation of the grinding rotor sweeps left (relative to the picture shown).

<<<<<Direction of rotation for forward direction.

This last picture shows the screen as viewed from the backside. As you can see, the stamping process creates a “triangular” shaped hole. The direction in which these triangles point also indicates the forward direction of the screen. In this case, the forward direction is pointing to the top of the page. When the screen is rolled to its final shape and installed in the mill, the triangles will point in the direction of rotation when installed “forward” and against the direction of rotation when installed “backward.”



Appendix B: Fine Grinder Start Worksheet

Fine Grinder Start-up Worksheet

Customer: ________________________ **Date:** ________________________

Contact: ________________________ **Title:** ________________________

Equipment: **Model M -**______________ **S/N:** ________________________

Section 1 Mill Inspection

Motor Pulley Diameter: ___________ Rotor Pulley Diameter: _____________

Motor RPM: ________ Drive Ratio: _________ Calculated Rotor RPM: ________

Pulley Alignment: ______Belt Tension: ______ Mill Monitor: __________________

Installation: _____Floor ______Steel Platform _______ Structural Steel

Vibration Pads Installed ? (Y/N): ________ Mill Level ? (Y/N): ________

Mounting Hardware Size: ______________

Section 2 System Inspection

Chiller Installed (Y/N): ________ Dryer Installed (Y/N): ____________

Feed Inlet Filter (Y/N): ________ APUB Filter (Y/N): _____________

System Piping Dia: Feed Inlet: ______ APUB: _______ Mill – DC: __________

Dust Collector Type: ____________________ Cloth Area: _____________Sq/Ft

Fan Manufacturer: ______________________ Type: ____________________

Model: ______________________ Horsepower: __________ RPM: ___________

Fan Rating: _______CFM @ _____" Static Pressure Damper Installed (Y/N): ___

Pulse timing set to ______ seconds off and _______ seconds on @ _______ PSI

Feeder Type: ___________ Manufacturer: ____________ Size: ____________

Appendix C – Airflow Abstract

Proper airflow is essential for efficient production. This discussion outlines methods for measuring airflow in an operating system.

Air Flow and Air Pressure Relationships

We must first review some basic principles of airflow and pressure, and then show how to obtain the required value of Velocity Pressure. In the illustrations that follow, we show a simple U-shaped glass tube connected to an air duct with flexible tubing. The U-tube holds water and has marked graduations showing inched of water column on both legs of the tube. In determining static pressure, one end of the U-tube is open to atmospheric pressure and the other end is connected to a port at the side of the air duct.

The total pressure measurement differs from static pressure in that a rigid elbow extends into the duct to gage the force of the moving air stream as shown in Figure C-1.
The velocity pressure measurement connects both ends of the U-tube to the air duct; one to the side and the other in the air stream with a rigid elbow as shown in Figure C-1.
The three types of pressures are related in the manner:
Ptot = Pvel + Pst
Pvel = Ptot - Pst

Sample Calculation

The following example shows how to calculate airflow in cubic feet per minute.
If using the U-tube as shown in Figure C-1, you measure:
Pst at 14.0” W.C. (inches water column)
Ptot at -12.5” W.C. (inches water column)
And you know
The duct diameter to be 10”
Then, you can use the formula:
Ptot = Pvel + Pst
To calculate the correct airflow in cubic feet per minute as follows:
-12.5 = Pvel + (-14.0)
Pvel = 14 - 12.5 = 1.5
Using Table C-1, locate the intersecting columns for Pvel at 1.5, and Duct Diameter at 10".
The Air Flow for this example is 2565 CFM.

Velocity Pressure can also be measured with a pitot tube in a configuration such as shown in Figure C-1. The determination shown has the advantages of simplicity and of providing a direct reading of Velocity Pressure in inches of water column.

Velocity Pressure and Air Volume

With a value for Pvel obtained by any appropriate method, Table C-1 allows a direct reading of airflow in cubic feet per minute. The table covers duct diameters 4 to 18 inches and Velocity Pressures up to 2-1/2 inches of water column.

The examples shown describe the Negative air systems. In Positive systems the total pressure would be higher than the static pressure.

Duct OD (Inches)		4	5	6	8	10	12	14	16	18
Duct ID (Inches)		3.83	4.83	5.83	7.79	9.79	11.79	13.79	15.79	17.74
Duct Area (SQ. FT)		.081	.128	.187	.331	.523	.758	1.037	1.360	1.716
Velocity Pressure (Inches WC)	Air Speed (fpm)	Air Flow CFM (Cubic Feet per Minute)								
.10	1266	103	162	237	419	662	960	1313	1722	2172
.20	1791	145	229	335	593	937	1358	1857	2436	3073
.30	2194	178	281	410	726	1147	1663	2275	2984	3765
.40	2533	205	324	474	838	1325	1920	2627	3445	4347
.50	2832	229	362	530	937	1481	2147	2937	3852	4860
.60	3102	251	397	580	1027	1622	2351	3217	4219	5323
.70	3351	271	429	627	1109	1753	2540	3475	4557	5750
.80	3582	290	458	670	1186	1873	2715	3715	4872	6147
.90	3799	308	486	710	1257	1987	2880	3940	5167	6519
1.00	4005	324	513	749	1326	2095	3036	4153	5447	6873
1.10	4200	340	538	785	1390	2197	3184	4355	5712	7207
1.20	4387	355	562	820	1452	2294	3325	4549	5966	7528
1.30	4566	370	584	854	1511	2388	3461	4735	6210	7835
1.40	4739	384	607	886	1569	2478	3592	4914	6445	8132
1.50	4905	397	628	917	1624	2565	3718	5086	6671	8417
1.60	5066	410	648	947	1677	2650	3840	5253	6890	8693
1.70	5222	423	668	977	1728	2731	3958	5415	7102	8961
1.80	5373	435	688	1005	1778	2810	4073	5572	7307	9220
1.90	5521	447	707	1032	1827	2887	4185	5725	7509	9474
2.0	5664	459	725	1059	1875	2962	4293	5874	7703	9719
2.10	5804	470	743	1085	1921	3035	4399	6019	7893	9960
2.20	5940	481	760	1111	1966	3107	4503	6160	8078	10193
2.30	6074	492	777	1136	2010	3177	4604	6299	8261	10423
2.40	6205	503	794	1160	2054	3245	4703	6435	8439	10648

Table C-1
Air Volume Measurements

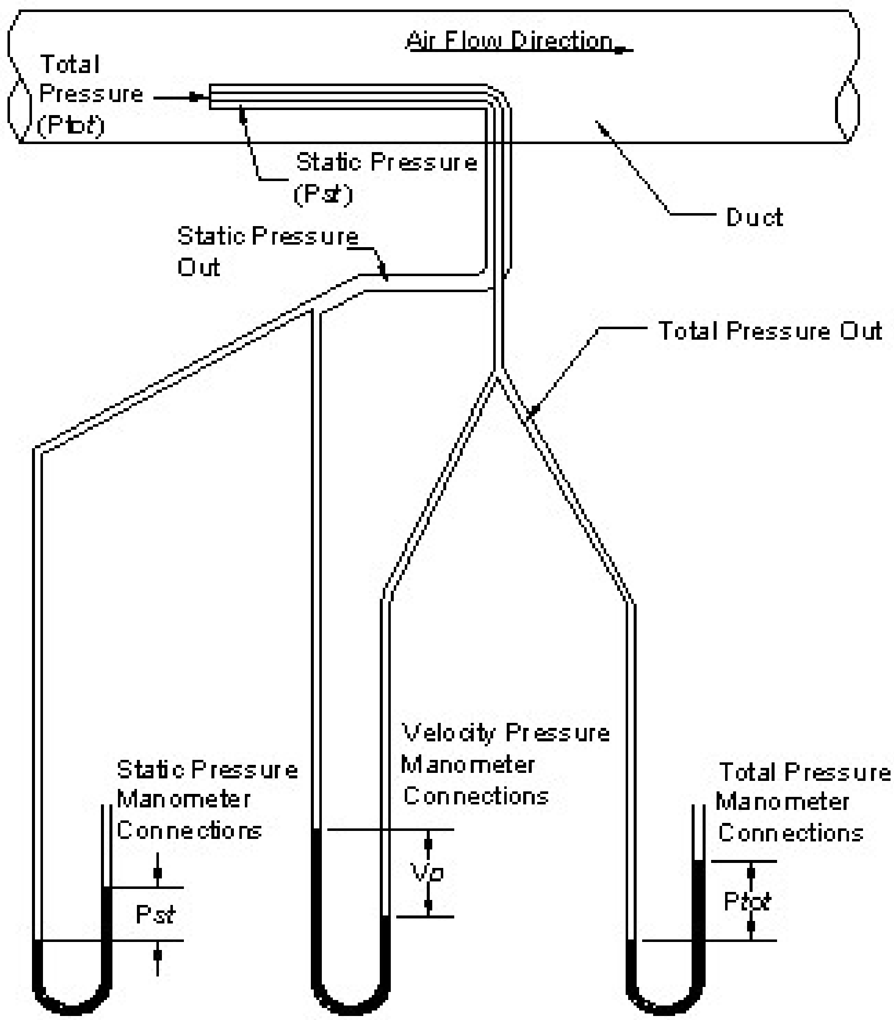

Air Flow Direction
Total
Pressure
(Ptot)
Static Pressure
(Pst)
Duct
Static Pressure
Out
Total Pressure Out
Velocity Pressure
Manometer
Connections
Static Pressure
Manometer
Connections
Total Pressure
Manometer
Connections
Pst
Vp
Ptot

FIGURE C-1

APPENDIX D: TROUBLESHOOTING GUIDE

This section covers some common operating problems that might be encountered with the Prater Industries, Inc. Fine Grinder. This is offered as a general guide to analyzing and correcting common problems with the Fine Grinder. This is not intended as a guide to every problem you might encounter with the milling system. If after reviewing this section and making any necessary adjustments you have not identified the specific cause of the problem, contact Prater Industries, Inc. Customer Service for further assistance.

Ground Product Too Coarse

1. Obtain a sample of the feed material and perform an evaluation of the sample for particle size, moisture, and oil content. If any of these parameters have changed, an adjustment to the mill speed or screen frame may be necessary. Prater recommends contacting Prater Industries, Inc. Customer Service for further guidance.
2. Check to ensure the proper screen size and screen frame configuration is being used.
3. Check for wear on the rotor blades, grinding jaws, and screens.
4. Check the speed of the mill using a tachometer to determine if the speed has changed due to electrical or belt slippage problems.
5. Check to ensure the mill is being fed the proper rate, and does not have large variations in the current draw due to pulsing of the feed.
6. Check to ensure proper air volume entering the mill with the feed.

Ground Product Too Fine

1. Obtain a sample of the feed material and perform an evaluation of the sample for particle size, moisture, and oil content. If any of these parameters gave changed an adjustment to the mill speed or screen frame may be necessary. Prater recommends contacting Prater Industries, Inc. Customer Service for further guidance.
2. Check to ensure the proper screen size and screen frame configuration is being used.
3. Check the speed of the mill using a tachometer to determine if the speed has changed due to electrical or belt slippage problems.
4. Ensure proper air volume thru mill feed inlet. Check for obstructions in piping or buildup on the dust collector filters, check the system fan.

Low Capacity

1. Obtain a sample of the feed material and perform an evaluation of the sample for particle size, moisture, and oil content. If any of these parameters gave changed an adjustment to the mill speed or screen frame may be necessary. Prater recommends contacting Prater Industries, Inc. Customer Service for further guidance.
2. Check to ensure the proper screen size and screen frame configuration is being used.
3. Check the speed of the mill using a tachometer to determine if the speed has changed due to electrical or belt slippage problems.
4. Ensure proper air volume thru mill feed inlet. Check for obstructions in piping or buildup on the dust collector filters, check the system fan.
5. Check for wear on the rotor blades, grinding jaws, and screens.

6. Check to ensure the mill is being fed properly, and does not have large variations in the current draw due to pulsing of the feed.

Excessive Vibration/High Bearing Temperature

If you are running the Fine Grinder for the first time refer to sections 2 and 3 in the manual to insure proper installation requirements have been met. Section 3.6: Running the Fine Grinder for the first time contains a comprehensive procedure to assist in diagnosing vibration problems on new and old units. If the Fine Grinder has been in service for some time and vibration suddenly increases, this is an indication of a serious problem. Review the items in Sections 2 and if everything seems to be in order the following procedure should be used to assist in diagnosing the problem:

1. Stop the Fine Grinder and allow the rotor to come to a complete stop. Lock out power to the Fine Grinder.
2. Open the mill access door and visually inspect the rotor for bent, or broken blades.
3. Visually inspect the screen frame assembly for damaged grinding jaws or screens.
4. Manually rotate the rotor to determine if there is any contact between the moving and stationary components. If contact occurs proceed with the following:
    a. Contact between moving and stationary parts indicates a serious problem.
    b. After the rotor returns to a complete stop, remove the screen frame assembly.
    c. Firmly grasp each individual rotor blade and by feel determine if there is any looseness of any blades in any direction. If looseness exists refer to section 4.4 Rotor Blade Replacement.
    d. If no loose blades are identified and no visual damage to the rotor has been identified, remove the rotor assembly and the drive belts.
    e. Manually rotate the shaft and determine if by feel any roughness exists in the assembly.
    f. If the assembly feels smooth, determine by feel if there is any play or looseness in the assembly.
    g. If items e and/or f fail the inspection, replace the bearings.
    h. Attach a Dial Indicator to the rear wall of the mill and determine deflection of the bearing assembly, this should be less than 0.002”.
    i. Remove the shaft/bearing assembly from the housing and visually inspect the bearing housing for wear. If the housing shows visible wear, contact Prater Industries, Inc. for further instructions.
    j. If all of the above steps do not reveal the problem, contact Prater Industries, Inc. for further instructions.
5. If no contact occurs proceed with the following:
    a. Firmly grasp each individual rotor blade and by feel determine if there is any looseness of any blades in any direction. If looseness exists refer to section 4.4 Rotor Blade Replacement.
    b. If no loose blades are identified and no visual damage to the rotor has been identified, remove the rotor assembly and the drive belts.
    c. Manually rotate the shaft and determine if by feel any roughness exists in the assembly.

d. If the assembly feels smooth, determine by feel if there is any play or looseness in the assembly.
e. If items e and/or f fail the inspection, replace the bearings.
f. If all of the above steps do not reveal the problem contact Prater Industries, Inc. for further instructions.

Rotor Blade Breakage

A broken rotor blade usually indicates a serious problem in the system and Prater Industries, Inc. highly recommends a service call by a Prater Industries, Inc. Technician to assist in evaluating the cause and extent of the damage. If you choose not to have Prater Industries, Inc. Technicians assist in the evaluation and rebuild the following procedure must be used to evaluate the potential damage caused by the breakage.

1. Remove bearing assembly from the housing.
2. Visually and by feel inspect the housing looking for grooving of the bearing seat.
3. If grooving is present, the housing will need to be replaced
4. Remove bearings from shaft and discard.
5. Inspect shaft for bending, deflection of more than 0.002" is over tolerance and the shaft will need to be replaced.
6. Mark the position of the rotor retaining rings in the rotor disk and remove both rings.
7. Remove all the blades and discard the broken blades.
8. Inspect the remaining blades and discard any bent, chipped, and scarred blades.
9. Have the remaining blades magna-fluxed.
10. Inspect the retaining rings where the blades failed for grooves cut into the rings when the blade(s) broke. If the blade(s) cut a groove in the rings they will need to be replaced.
11. Inspect the rotor disk and determine if any corruption of the slots has occurred.
12. If it is determined that one or more slots have been corrupted, it is recommended to return the disk to Prater for inspection.
13. If this is not possible, leave the corrupted slots and the 180-degree opposite slots empty. This is not recommended if more than 10 percent of the slots are corrupted.
14. If all the parts are inspected and are within tolerances, reassemble the bearing assembly using new bearings.
15. Reinstall both retaining rings into the disk and install the rotor less blades.
16. Run the rotor (less blades) and determine if vibration level is within tolerance.
17. If vibration is within tolerance it is then necessary to weigh all the blades and install the blades following the procedure in the manual.
18. If all of the above is done and the mill still vibrates a service call must be scheduled or the rotor, bearing and screen frame assemblies will need to be sent to Prater for further inspection and repair.

APPENDIX E: Vibration Standards

The following table lists the vibration standards for the Prater-Sterling Fine Grinders. The vibration in mils listed is the recommended maximum vibration allowable for safe trouble free operation of the mill.

Effective September 20, 2000

	Mill Model	M19	M21	M36	M51	M76	M101
Tip Sped							
60 m/s							
RPM		6684	5307	3923	2596	1702	1219
Standard		< .35 mils	< .50 mils	< .68 mils	< 0.9 mils	< 1.0 mils	< 1.0 mils
80 m/s							
RPM		8912	7077	5230	3462	2270	1626
Standard		< .27 mils	< .37 mils	< .49 mils	< .75 mils	< 1.0 mils	< 1.0 mils
100 m/s							
RPM		10026	8846	6538	4327	2837	2032
Standard		< .20 mils	< .27 mils	< .38 mils	< .58 mils	< 0.9 mils	< 0.9 mils
110 m/s							
RPM		11254	9730	7192	4760	3121	2235
Standard		< .18 mils	< .20 mils	< .34 mils	< .52 mils	< .85 mils	< 0.8 mils
120 m/s							
RPM		13368	10615	7846	5193	3405	2439
Standard		< .15 mils	< .18 mils	< .28 mils	< .47 mils	< .75 mils	< 0.7 mils
130 m/s							
RPM		14482	11499	8500	5626	3689	2642
Standard		< .12 mils	< .15 mils	< .24 mils	< .43 mils	< .70 mils	< 0.65 mils

APPENDIX F: PROTECTING THE FINE GRINDER FROM STATIC ELECTRICITY

Bearing Failures from Static Electricity

In many applications the processing of certain materials may generate static electricity inside the Fine Grinder. Another source of static electricity is the friction that develops between the belts and the drive sheaves. Without proper grounding of the mill rotor shaft this static may build to a point where the voltage is great enough to overcome the resistance of the thin film of oil in the bearings. Once this occurs the static buildup will discharge to ground typically through the mill housing causing fusion craters in the bearings. Over a short period of time these craters increase in size and number resulting in frosting, pitting, fluting, and eventually bearing failure. If there is no condition monitoring installed on the mill this will likely lead to a catastrophic rotor failure if the mill is not stopped immediately after the bearing failure

Rotor Blade Failures from Static Electricity

In some applications, particularly where the feed material is pneumatically conveyed into the mill, static buildup may discharge inside the grinding chamber. This discharge may occur between the rotor blades and the rotor disk, the rotor blades and the retaining rings, and the rotor blades and the screen frame assembly. This may result in catastrophic rotor failure, which causes extensive and expensive damage to the mill internal components. As in bearing failures, if there is no condition monitoring installed on the mill this failure may result in a bearing failure as well.

Protecting the Fine Grinder from Static Electricity

NOTICE

Effective July 1, 2007 all Prater Fine Grinders will be equipped with a grounded bearing assembly and a lug on the frame for connection to earth ground.

Prater recommends that all Fine Grinders be equipped with a microfiber brush. Grounding brushes provides a direct route to earth ground for any static buildup in the grinding chamber that allows the charge to reach ground without going thru the bearings. Additionally this will protect the bearings from any static generated by friction between the belts and the sheaves.

In any application where the feed material is pneumatically conveyed into the mill, the feed inlet must incorporate a ground probe just prior to the entrance of the mill. The ground probe should be connected to earth ground to allow any static buildup from conveying to discharge outside the mill.

APPENDIX G: DUST COLLECTOR EXPLOSION VENTING

This guide applies to the design, location, installation, maintenance, and use of devices and systems that vent the combustion gases and pressures resulting from a deflagration within an enclosure so that structural and mechanical damage is minimized. A deflagration can result from the ignition of a flammable gas, mist, or combustible dust. 1.1.2 This guide should be used as a companion document to NFPA 69, Standard on Explosion Prevention Systems, which covers explosion prevention measures and can be used in place of, or in conjunction with, NFPA 68. The choice of the most effective and reliable means for explosion control should be based on an evaluation that includes the specific conditions of the hazard and the objectives of protection. Venting of deflagrations only minimizes the damage that results from combustion. 1.1.3. This guide does not apply to detonations, bulk autoignition of gases, or unconfined deflagrations, such as open-air or vapor cloud explosions. 1.1.4* This guide does not apply to devices that are designed to protect storage vessels against excess internal pressure due to external fire exposure or to exposure to other heat sources. 1.1.5 This guide does not apply to emergency vents for runaway exothermic reactions or self-decomposition reactions. 1.1.6 This guide does not apply to pressure relief devices on equipment such as oil-insulated transformers. It also does not apply to pressure relief valves on tanks, pressure vessels, or domestic (residential) appliances.

Dust Explosion Venting

NFPA 68, Venting of Deflagrations, applies to equipment or enclosures needing to withstand more than 1.5 psig pressure. Most dust collectors need additional reinforcement for that capability. The maximum pressure that will be reached during an explosion will always be greater than the pressure at which the vent device releases. NFPA 68 calls for a pressure differential of at least 50 lbs./ft2 or 0.35 psi between the vent release pressure and the resistive pressure of the dust collector (enclosure). This NFPA guide lists the following basic principles that are common to the venting of deflagrations. You should become familiar with these principles so that you can correctly specify the conditions the dust collector and explosion vent must satisfy.

1. The vent design must be sufficient to prevent deflagration pressure inside the dust collector from exceeding two-thirds of the ultimate strength of the weakest part of the dust collector, which must not fail. This criterion does anticipate that the dust collector may deform. So do expect some downtime with the dust control system after an explosion.

2. Snow, ice, sticky materials or similar interferences must not affect dust vent explosion operation.
3. Dust explosion vent closures must have a low mass per unit area to reduce opening time. NFPA recommends a maximum total mass divided by the area of the vent opening of 2.5 lbs./ft2.
4. Dust explosion vent closures should not become projectiles as a result of their operation. The closure should be properly restrained without affecting its function.
5. Vent closures must not be affected by the process conditions, which it protects, or by conditions on the non-process side.
6. Explosion vent closures must release at overpressures close to their design release pressures. Magnetic or spring-loaded closures will satisfy this criterion when properly designed.
7. Explosion vent closures must reliably withstand fluctuating pressure differentials that are below the design release pressure.
8. Dust explosion vent closures must be inspected and properly maintained in order to ensure dependable operation. In some cases, this may mean replacing the vent closure at suitable time intervals.
9. The supporting structure for the dust collector must be strong enough to withstand any reaction forces developed as a result of operation of the dust explosion vent.
10. Industrial exhaust system ductwork connected to the dust collector may also require explosion venting.

APPENDIX H: ROTOR BLADE PLACEMENT PROCEDURES

BLADE INSTALLATION

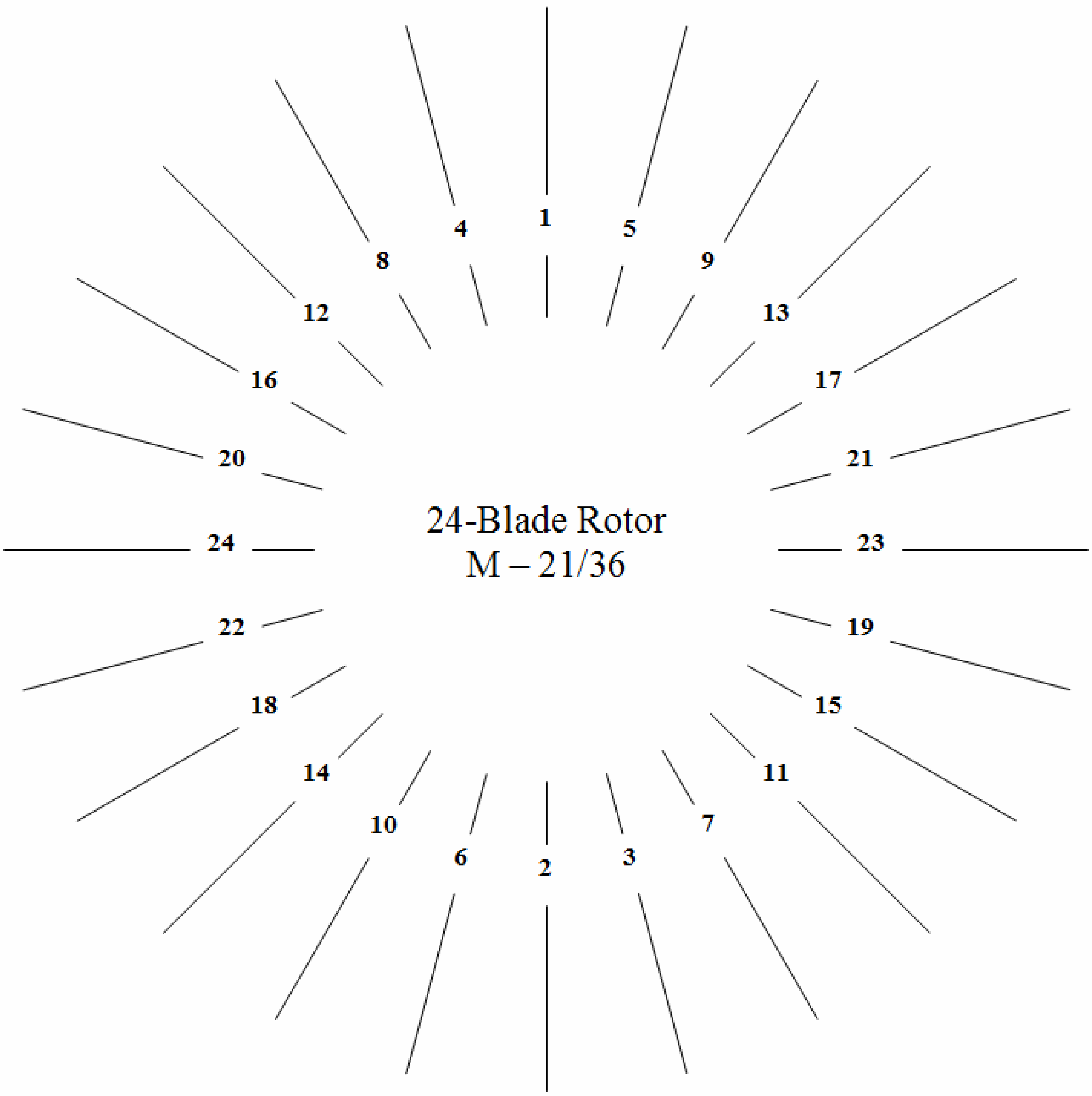
Customer:______________________

Model:_________________________

Serial Number:_________________

Date:__________________________

Name:_________________________



M 20/21 & M 35/36 Rotor Blade Installation Procedures

Weigh all blades using a scale with 0.1 gram resolution and arrange them in ascending order by weight. The lightest blade will be #1 and the heaviest #24. Thoroughly clean the blade slots and the seat for the retaining ring before beginning the blade placement. Using the weight that was added to the bare rotor as reference, install blade number one, into slot number one next to the weight. Continue to install blades into corresponding slots on the diagram as shown. Write down weights of blades on diagram for reference.

BLADE INSTALLATION

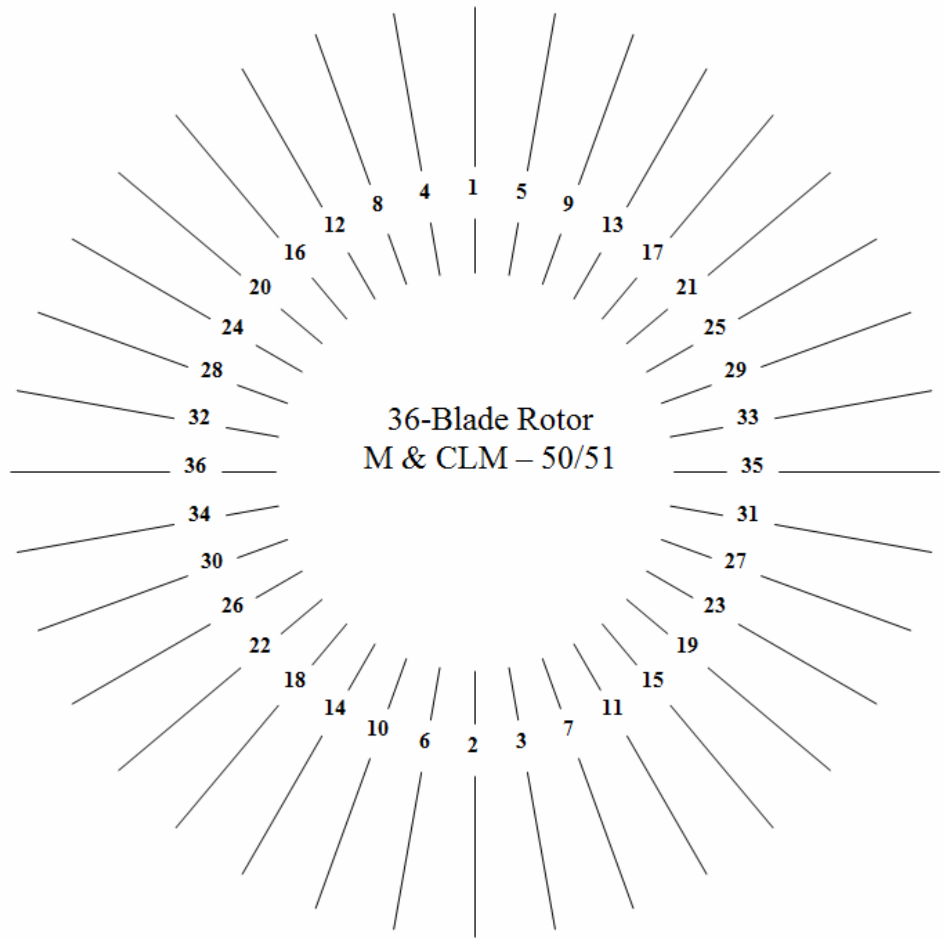
Serial Number:________________

Customer:____________________

Date:________________________

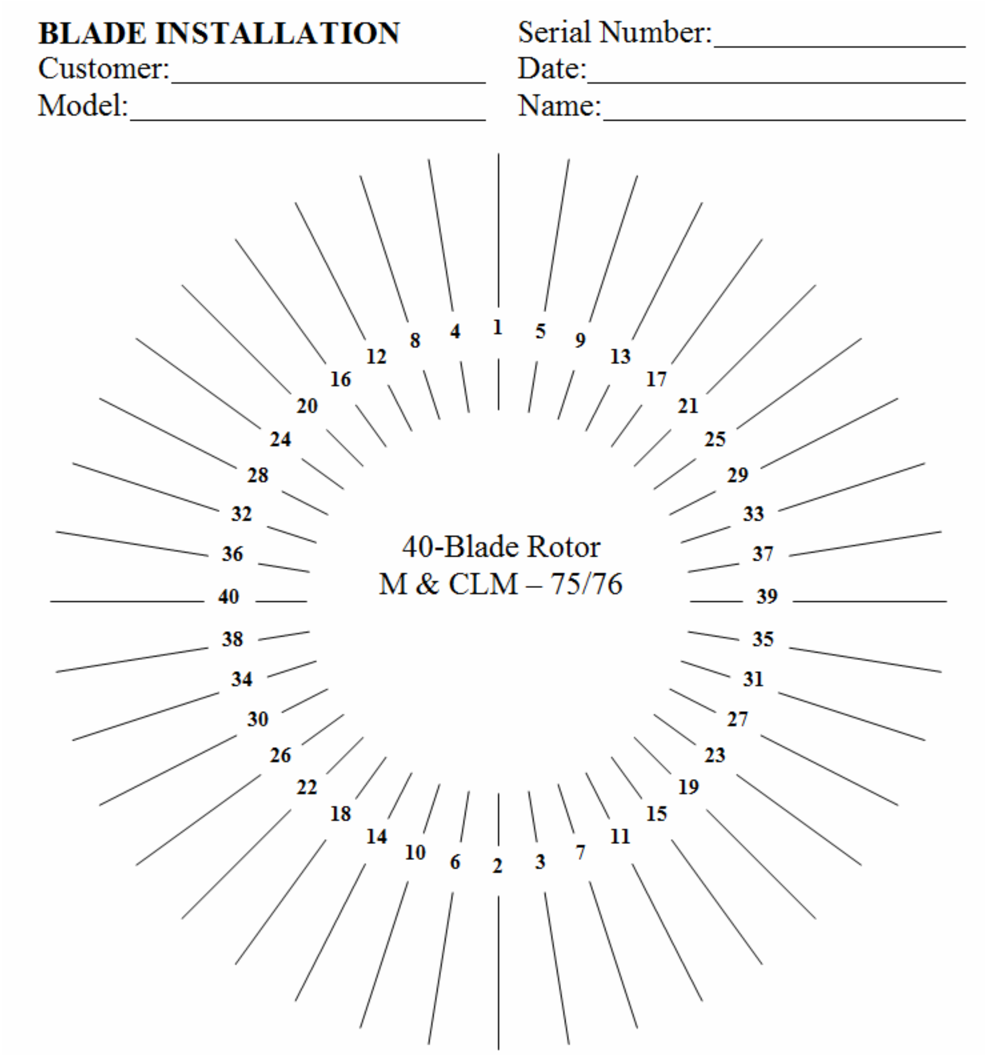
Model:______________________

Name:_______________________



M – 50/51 Rotor Blade Installation Procedure

Weigh all blades using a scale with 0.1 gram resolution and arrange them in ascending order by weight. The lightest blade will be #1 and the heaviest #36. Thoroughly clean the blade slots and the seat for the retaining ring before beginning the blade placement. Using the weight that was added to the bare rotor as reference, install blade number one, into slot number one next to the weight. Continue to install blades into corresponding slots on the diagram as shown. Write down weights of blades on diagram for reference.



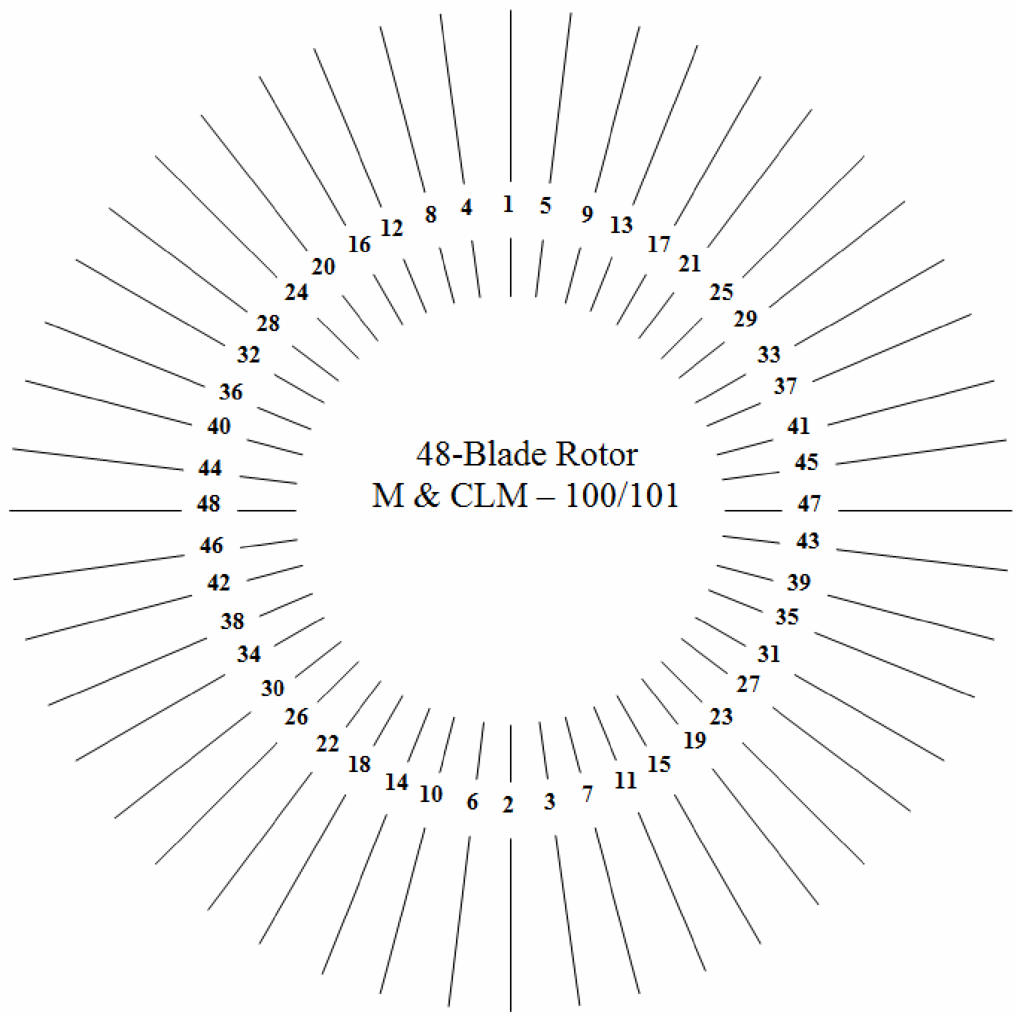
M – 75/76 Rotor Blade Installation Procedures

Weigh all blades using a scale with 0.1 gram resolution and arrange them in ascending order by weight. The lightest blade will be #1 and the heaviest #40. Thoroughly clean the blade slots and the seat for the retaining ring before beginning the blade placement. Using the weight that was added to the bare rotor as reference, install blade number one, into slot number one next to the weight. Continue to install blades into corresponding slots on the diagram as shown. Write down weights of blades on diagram for reference.

BLADE INSTALLATION Serial Number:________________

Customer:____________________ Date:__________________________

Model:________________________ Name:_________________________



M-100/101 Rotor Blade Installation Procedure

Weigh all blades using a scale with 0.1 gram resolution and arrange them in ascending order by weight. The lightest blade will be #1 and the heaviest #48. Thoroughly clean the blade slots and the seat for the retaining ring before beginning the blade placement. Using the weight that was added to the bare rotor as reference, install blade number one, into slot number one next to the weight. Continue to install blades into corresponding slots on the diagram as shown. Write down weights of blades on diagram for reference.