

PMR Rotary Feeder

Service & Maintenance Manual



Feeder Size: _____

S/N: _____

Rotor Helix: LH / RH

Rotation: CW / CCW

Temperature: _____

Congratulations!

You have purchased the most rugged and durable rotary feeder on the market. You should experience long, reliable service from the Precision PMR Rotary Feeder.

Please carefully review all of the material in this Manual. It contains important information about the start-up and run-in of the PMR, descriptions of simple maintenance procedures, and information on ordering replacement parts.

The Precision PMR Rotary Feeder is designed for a long service life, and ease of operation with low maintenance. Familiarization with the feeder and its function is a must; along with a routine maintenance plan. A rigorous maintenance schedule will optimize the efficiency and life of the feeder.

We stand ready to answer any questions and assist you as necessary to help you get the optimum performance from your PMR rotary feeder. Please contact our office in Eugene, Oregon USA at (541) 484-9841.

If there is anything further that we can do to assist you, please contact us. Your feedback is important to us.

Thanks for your business!

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Safety

Safety is a primary concern at Precision Machine and Manufacturing, Inc. and we encourage our customers to make it their top priority also.

State and local rules vary from location to location, and it is the user's responsibility to follow those standards. These procedures are a must for the safe operation and maintenance of the Precision PMR Rotary Feeder:

- Personal Protection Equipment must be worn while working on the feeder.
- All guards and safety devices must be in place while the feeder is in operation.
- If maintenance is performed with the feeder in place, all appropriate lockout and tag-out devices must be in place to prevent power to the feeder.
- Normal operation of the feeder may create burrs and sharp edges. Caution must be taken when handling the feeder and its components.
- The feeder and many of the components are very heavy. Sufficient manpower and/or hoists must be used when they are moved.

The safety decals, shields, and other protective features designed into the PMR Rotary Feeder and furnished with it or recommended for it are there for your protection.

The operation and maintenance of the PMR should be restricted to only those personnel trained in its use.

The various precautions and recommendations detailed in this Service & Maintenance Manual are not necessarily all inclusive. This Manual is designed to provide general safety and operational guidance relating to typical installations with which we are familiar.

If you have any safety or operational questions pertaining to the design, operation, or application of your PMR Rotary Feeder, we encourage you to contact Precision for assistance.

Warnings

1. Lockouts required for this equipment should be installed prior to initial start-up and operation.

→ *These lockouts are not the responsibility of Precision Machine & Manufacturing, Inc.*

2. Rotary feeders can cause severe physical injury if proper safety procedures are not observed during the course of operation, maintenance, inspection, or clearing of an equipment jam.

→ *The drive motor must be locked out before inspection or service of this equipment.*

3. Welding or burning on any part of the rotary feeder is not recommended. Any distortion of the feeder caused by welding or burning could cause the rotor to seize in the housing.
4. Power and control wiring should be installed by a licensed and experienced electrician to assure safe and productive operation of the PMR Rotary Feeder.

Introduction

The system operator should fully understand the function of the PMR Rotary Feeder to know its proper operation. The unit serves primarily as a feeder, to feed a bulk product into an air stream. The rigid design structure of the housing and rotor help prevent deformation, while the tight internal clearances minimize loss of air while material is being transferred. The replaceable knives will shear oversize material to minimize jamming.

The machined tolerance between the rotor and feeder housing maintains the air seal for the PMR Rotary Feeder. When abrasion causes the hard chromed surfaces to become scored, pitted, or otherwise worn, gaps for air passage are opened until unacceptable air leakage is observed. The precisely machined tolerances in the PMR components can be damaged by tramp metals or maladjustment.

The PMR Rotary Feeder is a precise, accurate, machined piece of equipment. Internal clearances are held to a tolerance of .001" per side per inch of rotor diameter at ambient temperature conditions (i.e. 30" diameter rotor = .015"/side clearance) to prevent excessive air

loss. For higher temperature applications, the rotor diameter is calculated for thermal expansion to prevent the rotor from locking up.

Rotor-to-Barrel Clearance

<u>Diameter</u>	<u>Factory Setting *</u>
14"	.007 to .009" per side
16"	.008 to .010" per side
20"	.010 to .012" per side
25"	.013 to .015" per side
30"	.015 to .017" per side
35"	.018 to .020" per side
45"	.023 to .025" per side

**For ambient temperatures; for elevated temperatures contact Precision*

In addition to its function as an airlock, the second primary function of the Precision PMR Rotary Feeder is to act as a metering device. With a known rotor volume turning at a known speed, volumetric throughput can be calculated once the pocket fill has been determined. If the product bulk density is known, the volumetric throughput can be readily translated into tons/hour or tons/day.

The knife and helical rotor in a PMR Rotary Feeder are designed to shear off oversized material in the product stream. The PMR is not intended to shred or grind material. If the product stream includes a high percentage of oversized material, regular attention to condition of the knife and the adjustment of the knife are very important. While it is not always possible to have a product stream that is completely free of foreign materials, the presence of rocks, metals, ceramics, or other non-wood materials can seriously damage the feeder and lead to expensive repairs or to the destruction of the feeder.

Precision PMR Rotary Feeders are available in a number of combinations of rotor helix and rotations. The standard configuration is a RH rotor helix with a CCW rotation but other configurations are available and may be more appropriate depending on the plant.

Appendix #1 illustrates the four possible feeder configurations, along with the orientation of the feeder relative to the pneumatic conveying line (if applicable.)

The key considerations in determining which feeder configuration is the optimal one for a particular plant are:

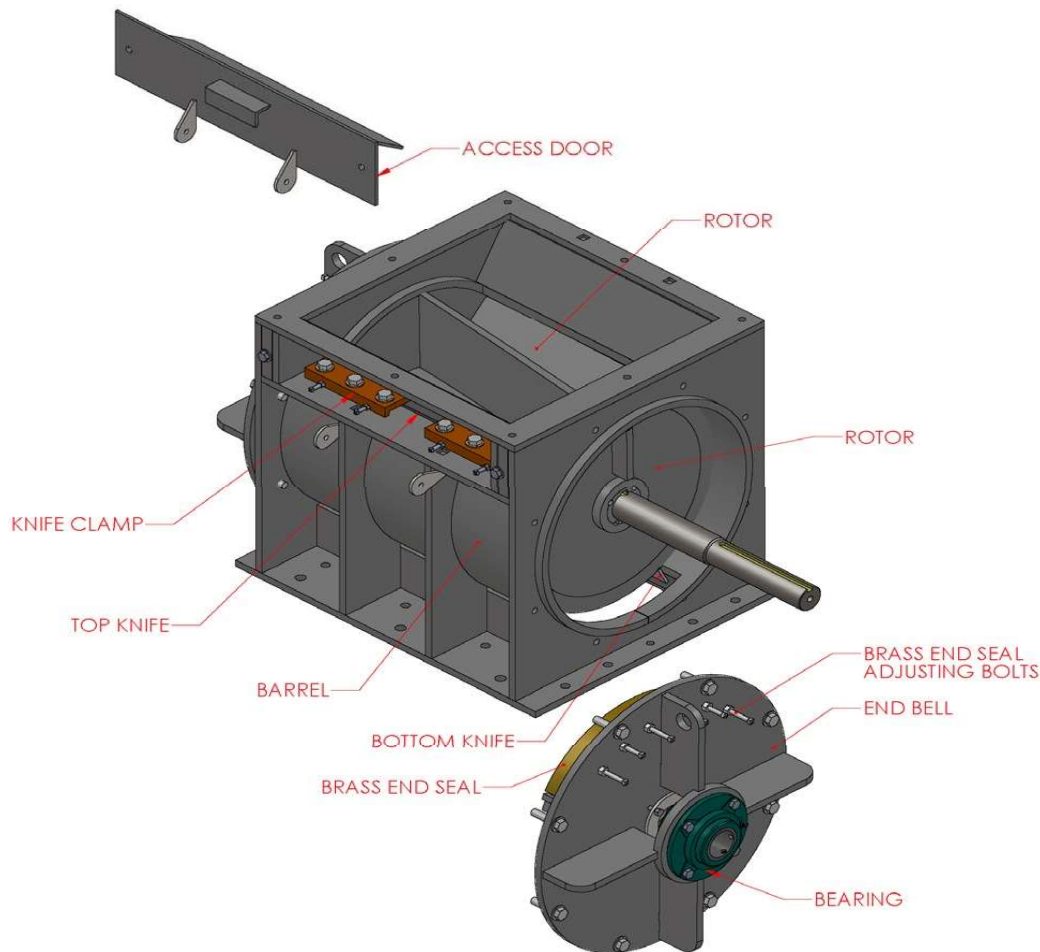
1. Physical space and/or obstructions, including access for service
2. Pneumatic line flow direction (if applicable)
3. Most importantly, infeed geometry

For best feeder performance, Precision strongly recommends that material drop into the feeder on the side of the feeder opposite of the knife. Feeding material “on top of” the knife can lead to plugging and/or incomplete shearing of oversized material.

The diagrams in **Appendix #2** show the optimal arrangement of the feeder under several different types of infeed equipment.

The overall feeding system design and proper mounting of the Precision PMR Rotary Feeder is the responsibility of the plant owner and/or the system designer or installer.

PMR Feeder Terminology



All Precision PMR Rotary Feeders are built with a “helical” rotor that shears material as the rotor turns into the stationary knife. The scissoring action creates “clean” cuts and is energy efficient.

The hinged access door allows service technicians to inspect the knife, adjust the knife as needed, and visually inspect the rotor pockets in the event of a jam or blockage of the feeder

The brass seals in the endbells form a seal up against each rotor end in order to minimize the flow of pressurized air that might migrate up through the feeder in a pneumatic conveying application. The fit of the brass seals against the rotor ends is maintained with the adjusting bolts in each endbell.

In most cases, the rotor body is attached to the drive shaft with internal keys and keyways and held in the proper lateral position with taperlock bushings and hubs. This design makes it possible to replace either the rotor body or the drive shaft without replacing the other if only one is damaged.

Initial Inspection

Before installation, check the feeder configuration and confirm that the proper configuration has been ordered for your plant.

While the Precision PMR Rotary Feeder is a heavy, sturdy piece of equipment it is possible for it to become damaged in shipment. Visually inspect the feeder for any damage. We have found that the drive shaft is particularly susceptible to damage in transport and/or unloading.

Every Precision PMR Rotary Feeder is carefully checked for proper clearances and adjustments to the knife, shaft seal, brass seal, and rotor position prior to release from the factory. Prior to installation, you should be able to move the rotor by hand to check for any tightness, interference, or ticking noises. Be very careful as the knife is extremely sharp!

If the rotor will not move or if you notice any rubbing noise coming from the either end of the rotor, it is possible that the rotor's lateral position in the housing may have shifted in transit. This can be confirmed by inspecting or measuring to determine if the rotor is centered equally under the eyebrows at each end of the feeder. If the rotor has shifted position, the rotor must be re-centered in the inlet opening.

This is done by loosening the bearing locking collars and drive coupling, and centering the rotor in the housing. To assist in moving the rotor you can use a C-clamp large enough to reach inside of one of the rotor pockets and squeeze from the outside of the unit until the rotor measures equal distance on both sides of the inlet.

NOTE: DO NOT USE A LARGE HAMMMER TO MOVE THE ROTOR

If you notice a ticking sound when the rotor is turned by hand, the most likely cause is a shifting of the knife during transport or unloading. See **Appendix #4** for instructions on resetting the proper knife-to-rotor clearance.

Shaft Packing Run-In

After approximately 8 hours of initial operation, the shaft packing seals should be adjusted. See the instructions in section "Bi-Monthly Service" below.

Daily Inspection

NOTE: BEFORE ANY INSPECTION OR MAINTENANCE, YOU MUST FOLLOW STANDARD 'LOCK-OUT/TAG-OUT' PROCEDURES FOR ALL POWER SOURCES AS DEFINED BY OSHA. SEE WARNINGS

1. Visually inspect knives through the access door for any signs of damage to the knives or mis-adjustment of the knives. See the sections below on Knives, Knife Adjustment, and Knife Replacement, along with **Appendix #4**; all of which have information on maintaining optimal knife performance.
2. Listen carefully to the feeder in operation; if the sound of metal-on-metal scraping or knocking is heard, discontinue operation, lock-out the drive, and visually inspect all components for wear or mis-alignment
3. Visually inspect bearings for evidence of adequate grease supply

Bi-Monthly Service

NOTE: BEFORE ANY INSPECTION OR MAINTENANCE, YOU MUST FOLLOW STANDARD 'LOCK-OUT/TAG-OUT' PROCEDURES FOR ALL POWER SOURCES AS DEFINED BY OSHA. SEE WARNINGS

Adjust the shaft packing seals – All rotary feeders incorporate a shaft seal/packing gland that is filled with square graphite impregnated mechanical packing, and is located between the bearing and the back of the end bell. These seals should be checked on a regular basis and if air or dust is found to be leaking, then the packing gland should be tightened.

Adjust the shaft packing seals by tightening the packing gland screws evenly until resistance is detected.

At the end of its life, the packing gland will bottom out and the packing material must be replaced. See instructions in the section Packing Replacement.

Lubricate bearings – Precision recommends the use of a good-quality, all-purpose grease that is appropriate for the temperature conditions where the feeder is installed. Too much grease will damage bearing seals, and should be avoided.

Check knife-to-rotor clearance – With a set of feeler gauges, confirm that the knife-to-rotor clearance is maintained at 0.008" to 0.010". It is important to confirm that the clearance is consistent along the knife; Precision recommends checking the clearance in 2-3 spots along the length of the knife. If time is available, it is a good practice to check the clearances on all of the rotor vanes.

Knives

The single most important factor in determining the life of a rotary feeder and its performance is the maintenance of the knife. As the knives become nicked, rounded or improperly fitted, wear on both the rotor and the barrel will accelerate.

Regular maintenance of knives is important to insure proper function of the feeder, and to reduce or prevent:

- Scoring and deterioration of the chrome plating on the housing
- Excessive build-up of wood pitch or other resins
- Unequal wear of the rotor and the housing
- Abnormal loading on structural and drive components
- Loss of the knife shearing action of materials will allow unwanted material to pass through the feeder causing wear or jamming

Visual inspection through the access door and measured clearance checks with a feeler gauge should be made on a regular basis. Precision recommends that the knives be visually inspected daily and that an inspection of the knife-to-rotor clearance with a feeler gauge be conducted at least bi-monthly.

The frequency with which knives must be replaced or re-sharpened will depend on the number of hours the rotary feeder has been in use, the type of material being handled, the rotor speed, and the amount of foreign material in the product stream.

See **Appendix #3** for knife dimensions and part numbers if you need to order replacement knives.

Knife Adjustment

NOTE: BEFORE ANY INSPECTION OR MAINTENANCE, YOU MUST FOLLOW STANDARD 'LOCK-OUT/TAG-OUT' PROCEDURES FOR ALL POWER SOURCES AS DEFINED BY OSHA. SEE WARNINGS

Inspect knives through the knife door opening for damage and proper adjustment.

For **ambient temperature applications**, knives should be adjusted, using a feeler gauge, to approximately .008" - .010" clearance from the rotor blades.

For **elevated temperature applications**, knives should be adjusted, using a feeler gauge, to approximately half the factory setting of the clearance between the rotor and the barrel.

To adjust the knives, remove the access doors and loosen the 5/8" clamping bolts. Adjust the knife position with the 3/8" adjustment screw on the back side of each clamp. Tighten the clamping bolts per the correct torque, which is approximately 75-100 ft-lbs.

Knife Replacement

NOTE: BEFORE ANY INSPECTION OR MAINTENANCE, YOU MUST FOLLOW STANDARD 'LOCK-OUT/TAG-OUT' PROCEDURES FOR ALL POWER SOURCES AS DEFINED BY OSHA. SEE WARNINGS

Dull, chipped, or cracked knives should be replaced immediately.

See **Appendix #3** for knife dimensions and part numbers if you need to order replacement knives.

If the knives are only worn to a dull condition, they may be re-sharpened. The proper angle on the knife in a PMR rotary feeders is 43°.

Detailed instructions for replacing the knife in the PMR rotary feeder, can be found in **Appendix #4**

Packing Replacement

NOTE: BEFORE ANY INSPECTION OR MAINTENANCE, YOU MUST FOLLOW STANDARD 'LOCK-OUT/TAG-OUT' PROCEDURES FOR ALL POWER SOURCES AS DEFINED BY OSHA. SEE WARNINGS

When the packing no longer responds to adjustment (as described in the section "Bi-Monthly Service") to seal the end bell at the shaft, the following steps should be followed to replace the packing:

1. Remove the bolts from the packing gland, and slide the packing gland outward and up against the bearing.
2. Clean out the packing gland area of the end bell.
3. Install two wraps of packing into the end bell (one on top of the other).
4. Reposition gland in the end bell, and sequentially tighten bolts until snug. **Do not over tighten.**

Brass End-Seal Adjustment

The brass seals in the endbells are not as vulnerable to misalignment or tolerance variation as are the knives and do not need adjusting as often. Clearances for the seals are set at the

factory at .010" to .020" and should be checked on a regular basis. The clearance is set by adjusting the set screws protruding through the feeder end bell. See **Appendix #5** – "Brass end-seal adjustment"

Feeder Rebuilding

By their nature, feeders are subject to continuous wear and the feeder's performance will decline over time. While proper preventive maintenance and close attention to the condition of the knife will extend the life, all feeders will eventually require refurbishment or replacement.

Every plant has different parameters for acceptable and unacceptable feeder performance so it is difficult for Precision to make broad recommendations for when your feeder will need to be rebuilt. A general rule that we have found to be useful is as follows:

When the clearance between the rotor and barrel reaches approximately 2-3 times the original factory clearance, it is time to consider the possibility of a rebuild.

Feeder rebuilds normally include:

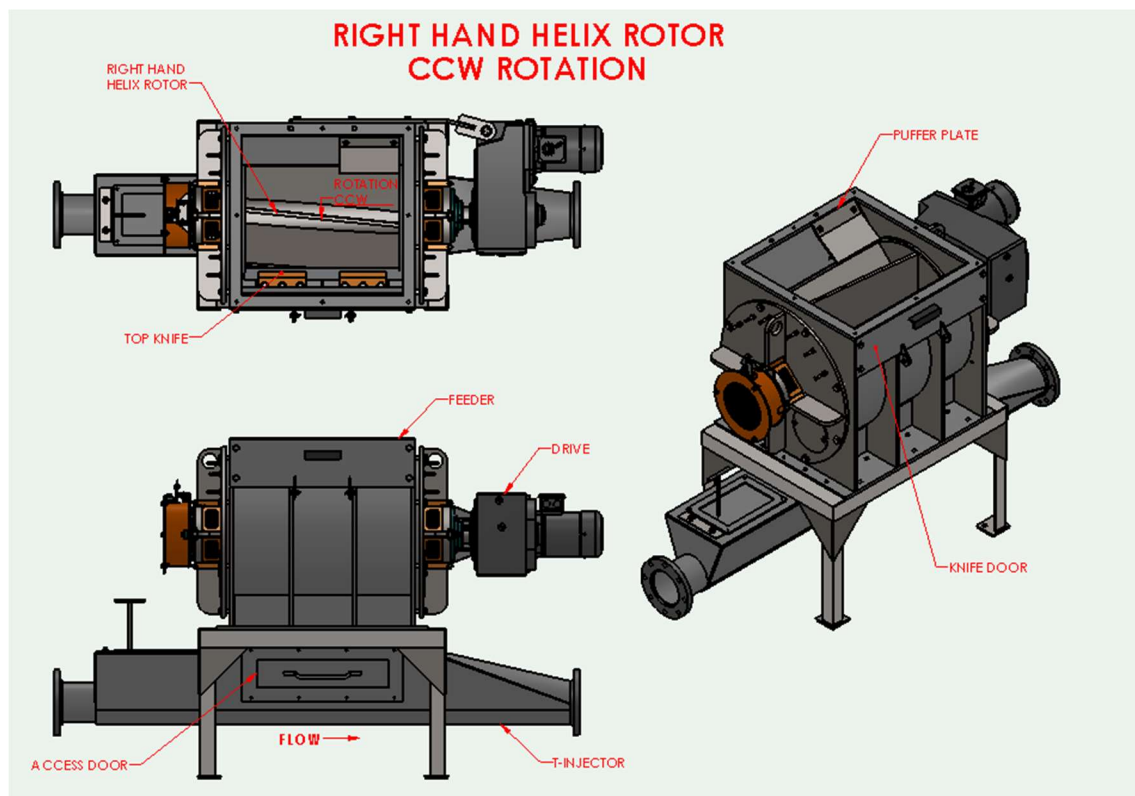
- A rotor rebuild that includes a ring-and-vane replacement to restore the rotor to a full diameter
- Replacement of bearings, shaft packing, brass endbell seals, and the knife
- Boring the feeder barrel to a "clean-up" diameter that removes any deep gouges, grooves, and deep pitting; followed by the application of a new industrial chrome finish

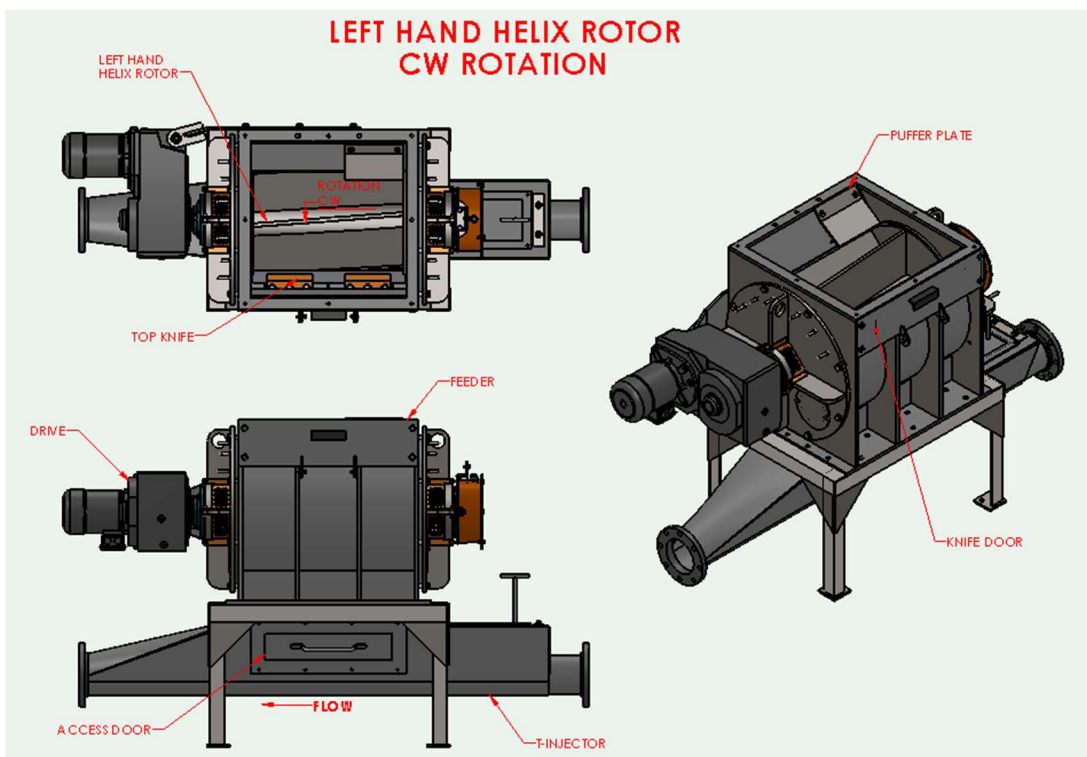
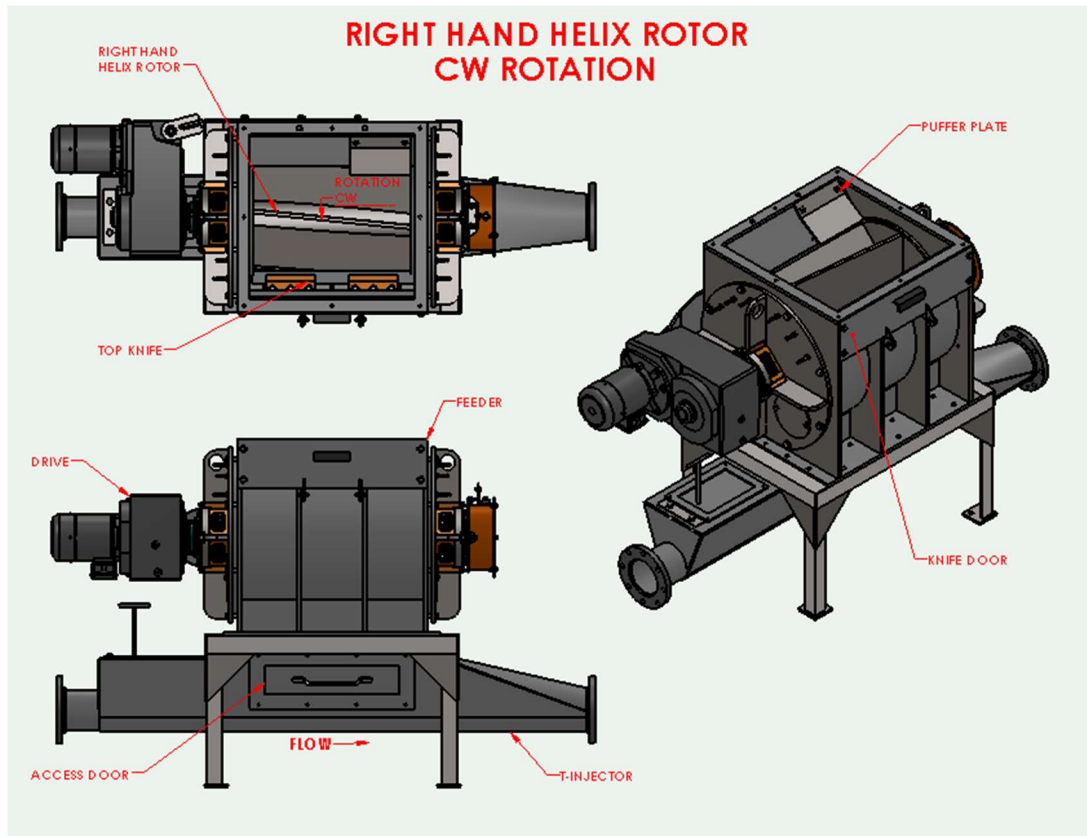
Please contact Precision for information on feeder rebuilds.

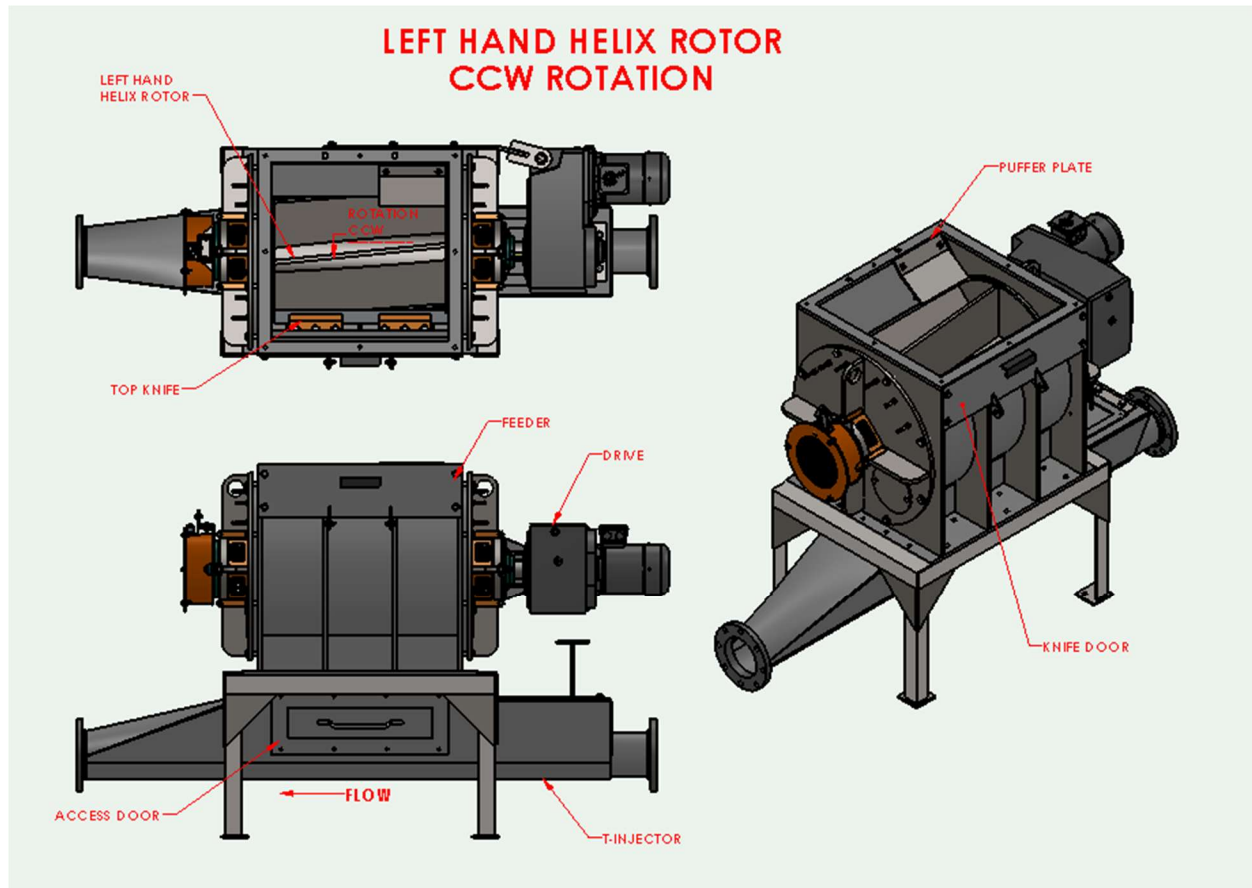
Appendix #1 – Feeder Configurations

Choosing the correct rotary feeder configuration for your plant and installing the feeder in the proper orientation relative to the pneumatic line flow under the feeder are very important. Left-handed and right-handed rotors each have two specific configurations that provide a smooth transition of the material being conveyed out of the rotor and into the T-injector and the pneumatic line.

The helix will always rotate towards the knife, but the drive rotation (CCW/CW) and air flow direction (left to right/right to left), will change per application. It is important to apply this correctly. As the helix rotates it should always “open” downstream of the air flow, so that the first material to exit the rotor pocket is at the T-injector’s exit. Examples of correct orientation and installation are shown on the following pages:

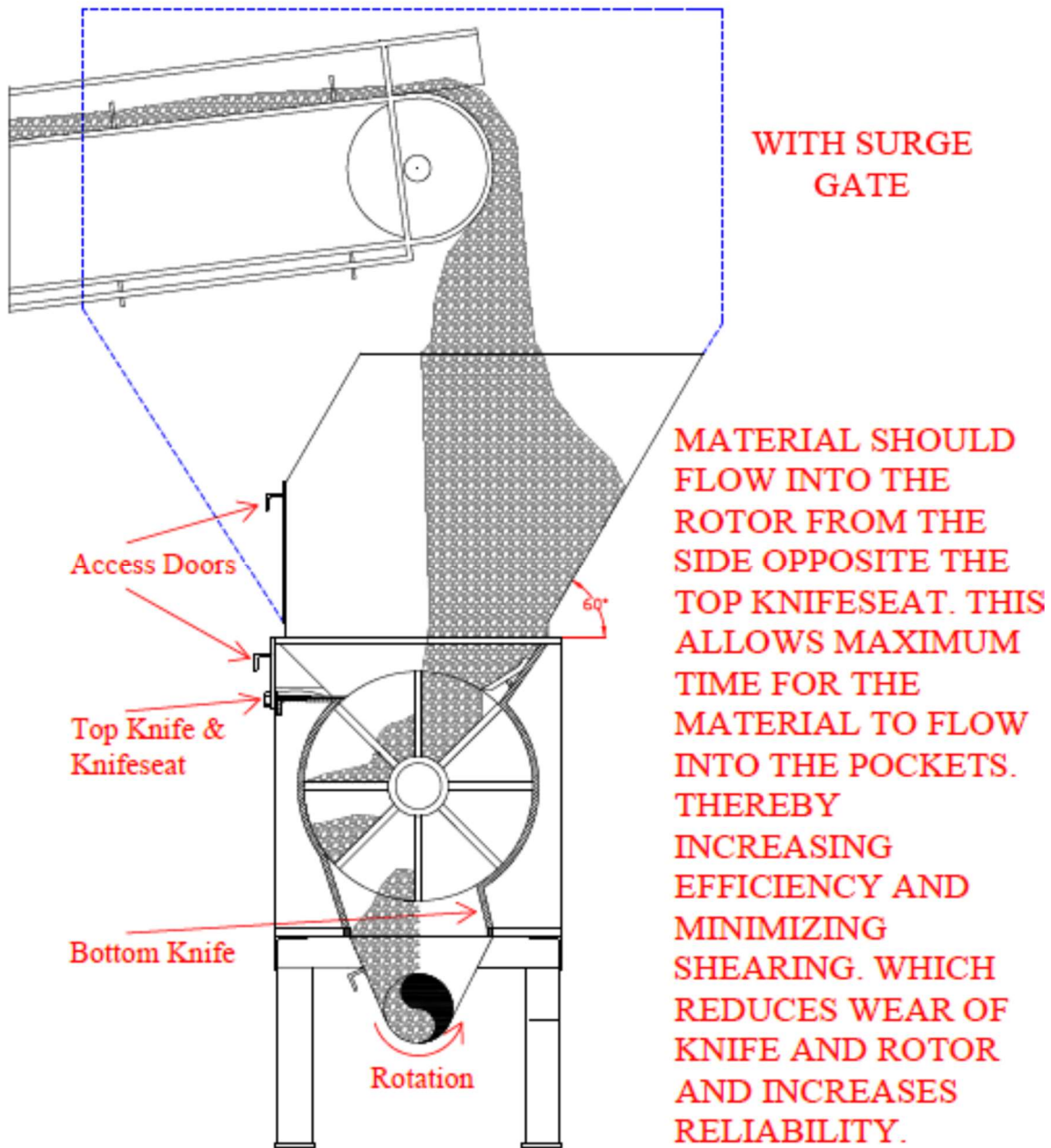




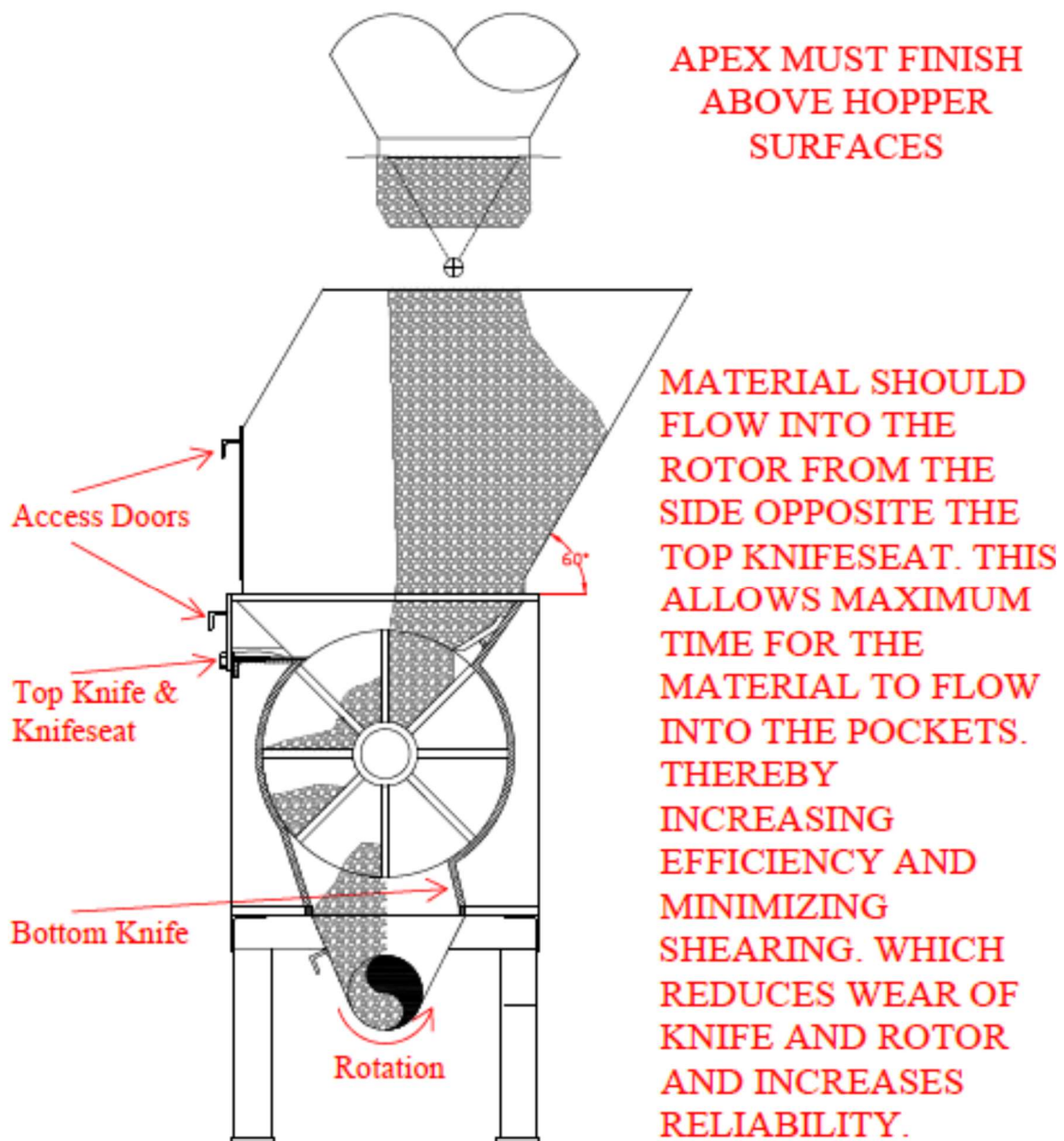


Appendix #2 – Feeder Installations

Chain/Belt Conveyor

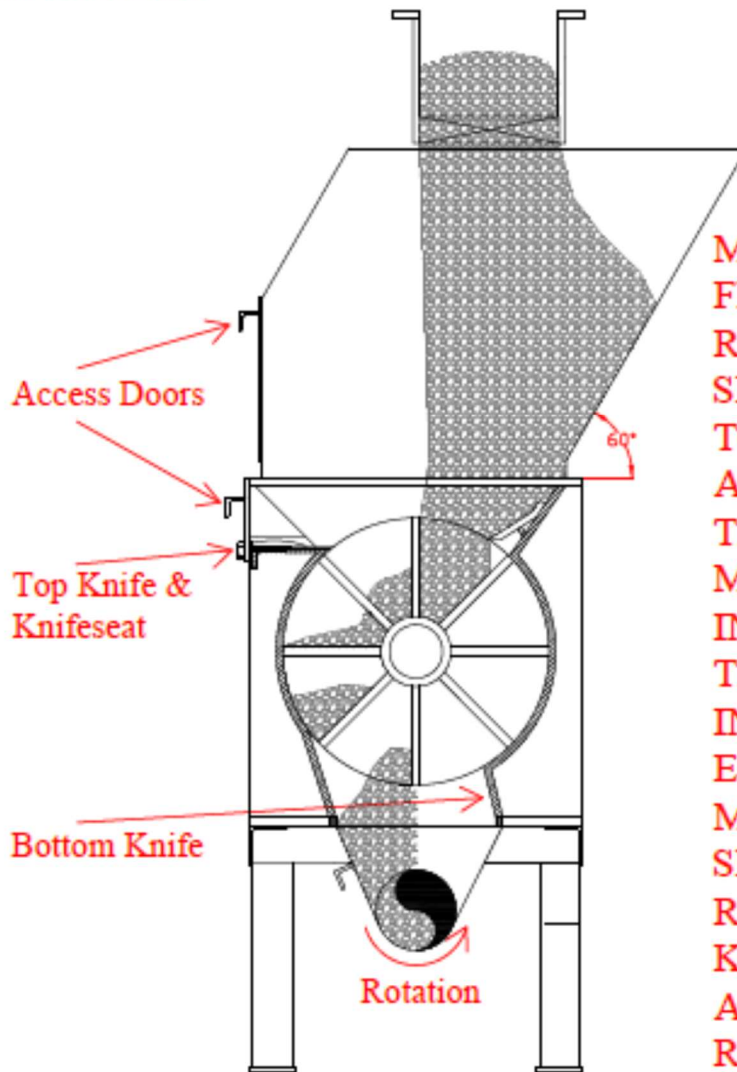


Cyclone/Baghouse Tailspout



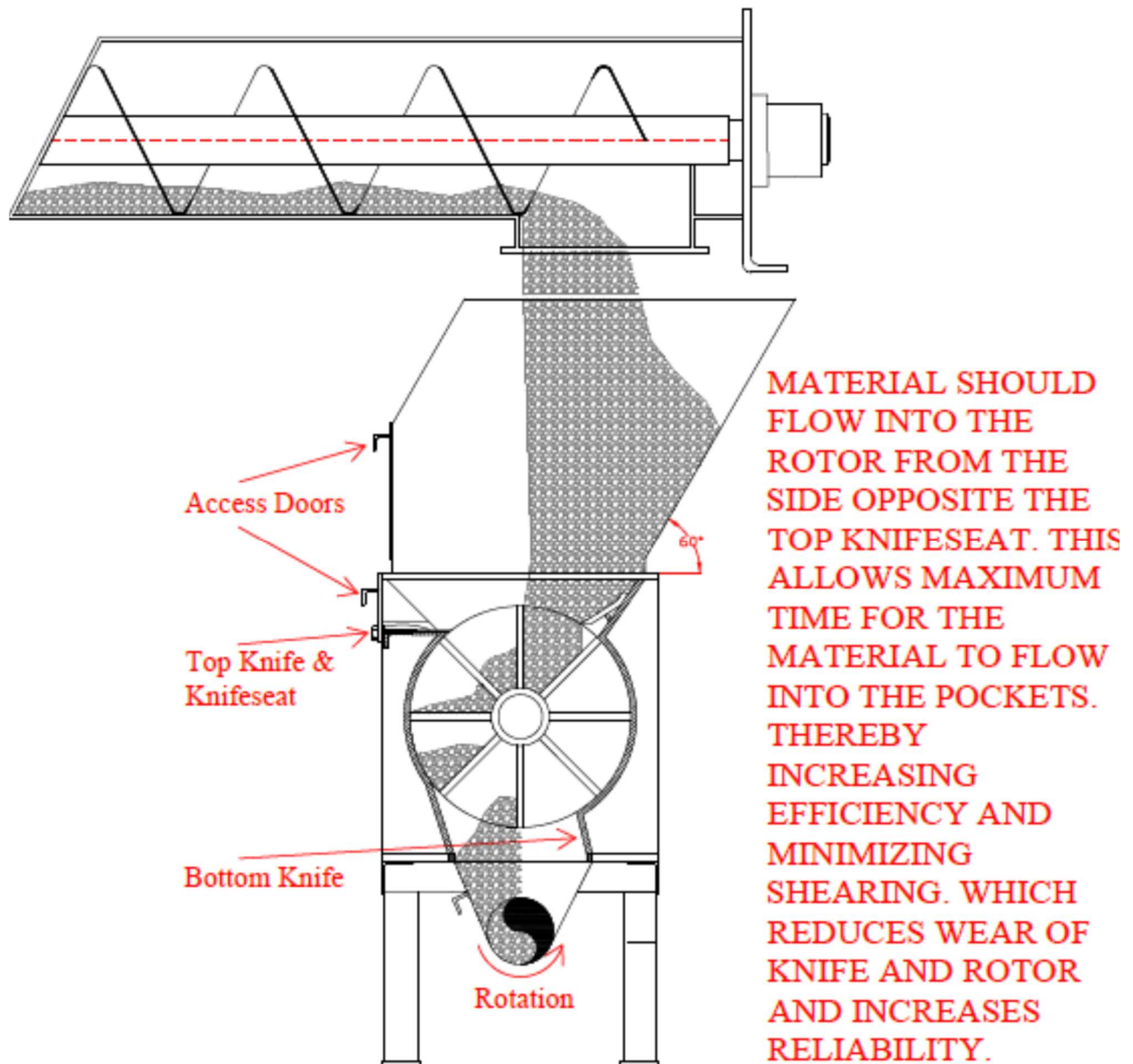
Infeed Conveyor

PARALLEL WITH
PIPE LINE
MATERIAL
TRAJECTORY TO BE
DETERMINED

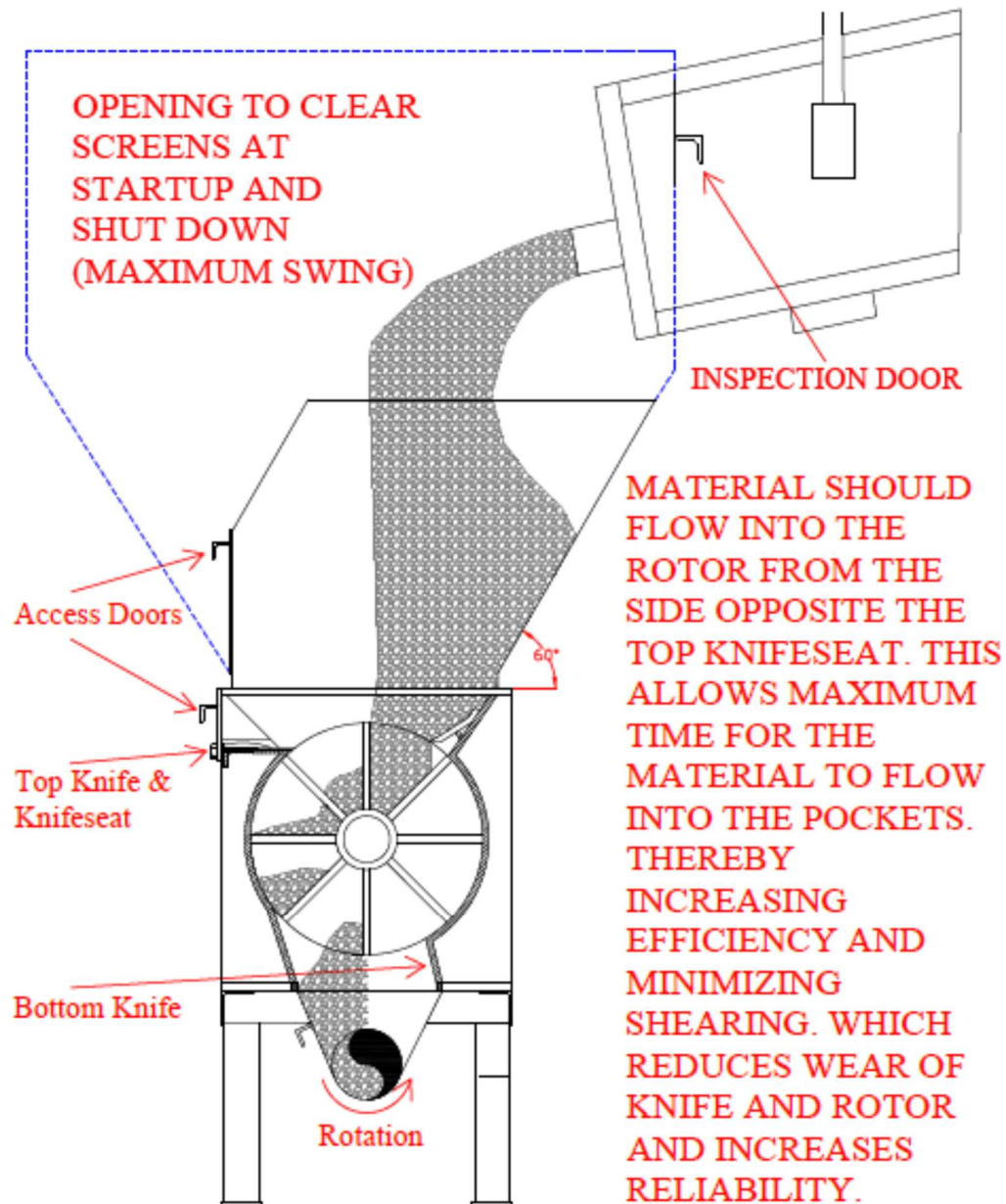


MATERIAL SHOULD
FLOW INTO THE
ROTOR FROM THE
SIDE OPPOSITE THE
TOP KNIFESEAT. THIS
ALLOWS MAXIMUM
TIME FOR THE
MATERIAL TO FLOW
INTO THE POCKETS.
THEREBY
INCREASING
EFFICIENCY AND
MINIMIZING
SHEARING. WHICH
REDUCES WEAR OF
KNIFE AND ROTOR
AND INCREASES
RELIABILITY.

Screw Conveyor



Vibrating Screen



Appendix #3 – PMR Rotary Feeder Knives

Top Knife

Feeder	Part Number	Thickness	Width	Length	Angle °
14x18	3021006001	1/4	2	14 5/8	43
16x20	3021006002	1/4	2	16 1/8	43
20x20	3021006003	1/4	2	16 1/8	43
20x25	3021006004	1/4	2	20 5/8	43
20x30	3021006005	1/4	2	26 1/8	43
25x30	3021006006	1/4	2	26 5/8	43
25x35	3021006007	1/4	3	30 5/8	43
30x30	3021006008	1/4	3	25 5/8	43
30x35	3021006009	1/4	3	30 5/8	43
30x40	3021006010	1/4	3	34 5/8	43
30x45	3021006011	1/4	3	39 1/8	43
35x45	3021006012	3/8	4	41 3/8	43
35x50	3021006013	3/8	4	47 3/8	43
35x55	3021006014	3/8	4	51 3/8	43
45x45	3021006015	*	*	*	*
45x55	3021006016	*	*	*	*

Bottom Knife

Feeder	Part Number	Thickness	Width	Length
14x18	3021006101	1/4	2	15
16x20	3021006102	1/4	2	16
20x20	3021006103	1/4	2	16
20x25	3021006104	1/4	2	21
20x30	3021006105	1/4	2	26 1/2
25x30	3021006106	1/4	2	27
25x35	3021006107	1/4	3	31
30x30	3021006108	1/4	3	26
30x35	3021006109	1/4	3	31
30x40	3021006110	1/4	3	35
30x45	3021006111	1/4	3	39 1/2
35x45	3021006112	3/8	4	42
35x50	3021006113	3/8	4	48
35x55	3021006114	3/8	4	52
45x45	3021006115	*	*	*
45x55	3021006116	*	*	*

Appendix #4 – Knife Replacement

1. Measure the length of the inside of the rotor. (See Figure 1.)
2. Add 5/8" to this measurement. The knife should cover half the thickness of the rotor end. (See Figure 2.)
3. Cut knife to length, (+/- 1/8"); a hot saw works best.
4. Install knife with knife clamps.
5. Use a feeler gauge set the knife clearance. For ambient temperature applications, the clearance should be set at .008 to .010" between the knife and rotor. For elevated temperature applications, the knife-to-rotor clearance should be set at half of the factory setting for rotor-to-housing clearance. See page 5 of this Manual for information on rotor-to-housing clearance.
6. Tighten knife clamp bolts to 75-100 ft-lbs.



Figure 1



Figure 2

Appendix #5 – Brass End-Seal Adjustment

Each end bell has six (6) 3/8" square-head set screws with lock nuts – see page 24. These set screws are in the upper half of the end bell. Number the set screws 1 through 6 (moving in a clockwise direction.) Set screws 1, 3, 4 and 6 are Pusher Bolts (threaded holes) while set screws 2 and 5 are Puller Bolts (through holes) – see page 24.

Precision has manufactured a limited number of rotary feeders with only five (5) set screws. If you have one of these rotary feeders, please contact Precision for information on Brass End-Seal Adjustment.

The brass end-seal to rotor gap is set at the factory prior to shipment and, under normal conditions, adjustments are not necessary prior to start-up. Should adjustments be required (as a result of misalignment from shipping/installation or as part of a periodic maintenance program), follow the procedure below:

Loosen the lock nuts several turns on all six adjusting bolts

With a small hammer, lightly tap the heads of bolts 2 and 5 until you feel the brass seat against the rotor end.

Finger tighten adjusting bolts 1, 3, 4 and 6 until you feel them snug against the brass seal. With a wrench put very light pressure of these four (4) bolts against the rotor end. **DO NOT TIGHTEN!** At this point the rotor will not turn.

Next, tighten up the lock nuts on bolts 2 and 5. Give these nuts approximately ¼ turn after they are snug. This will put pressure on the brass seal pulling it away from the rotor. The rotor still may not turn at this point.

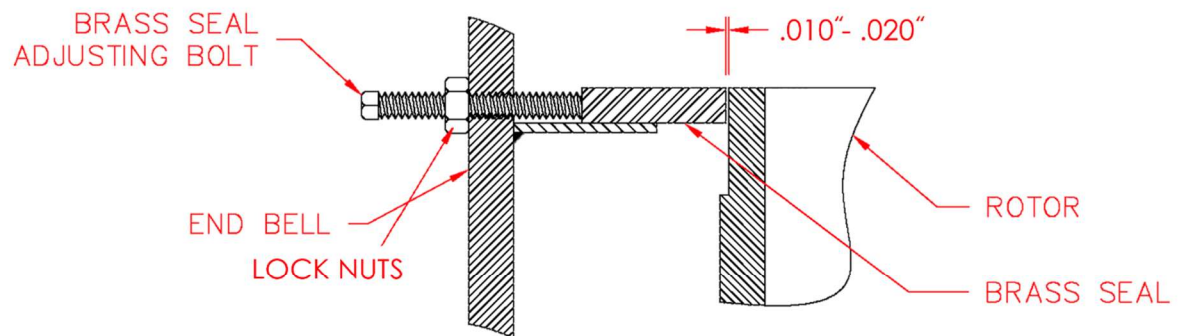
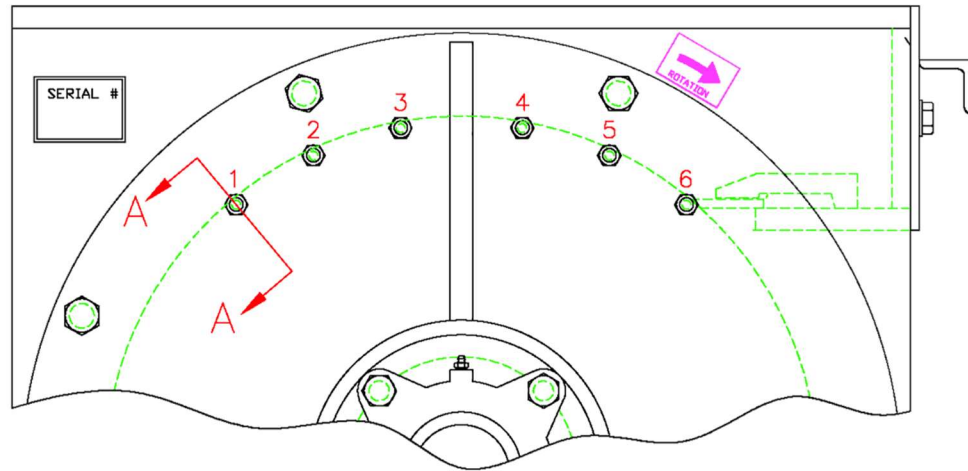
Gently loosen adjusting bolts 1, 3, 4 and 6, evenly, until the rotor turns with minimal resistance. This should give a brass clearance of approximately .010" to .020". There is no way to verify this clearance from outside the feeder. It is important that all four (4) of these bolts are loosened evenly.

When proper clearance has been achieved and the rotor turns with minimal resistance, tighten all locknuts firmly. **DO NOT OVER-TIGHTEN** as this can bind the unit or pull the threads from the brass.

Repeat procedure on the opposite end of the feeder.

A video illustrating this procedure can be found on Precision's website. Click on Service, then Service Videos, and then PMR Rotary Feeder: Setting Brass Seals

Brass End-Seal Adjustment



Section "A-A"
2X Scale

Appendix #6 – Nord Drive Installation Procedure

The Precision PMR feeder, the Nord drive package, and the Precision mounting bracket are all heavy and should be lifted and positioned using proper techniques and equipment to assure the safety of personnel working on the installation.

The Nord drive should have been ordered with mounting hardware that comes in a small box and will contain two (2) rubber bumpers, a bolt, a “fixing element” that looks like a large washer with a counter-bore in it, and one or more shaft keys.

Step 1	Install the Precision mounting bracket on to the side of the feeder housing – at this point use only four bolts (one in each corner of the mounting bracket) and tighten only enough to hold the mounting bracket in place for further alignment.
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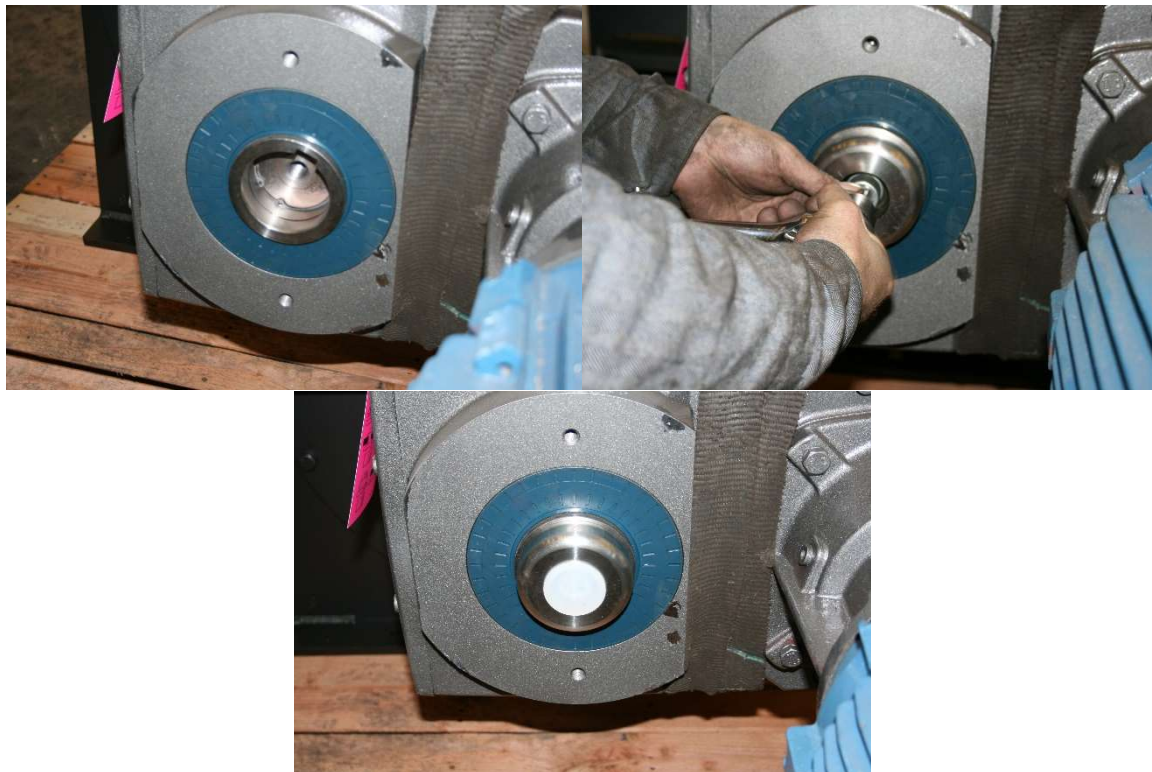
Step 2	Check to make sure that there is a snap ring already installed inside the bore of the gearbox – on larger Nord gearboxes, the snap ring is factory-installed by Nord. If it is not pre-installed, contact Precision for instructions.
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Step 3	Coat the feeder driveshaft with a thin film of a “never-seize” product and install the key(s) in the keyway on the feeder driveshaft.
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Step 4	Slide the Nord drive onto the feeder drive shaft; make sure that the end of the drive shaft is firmly seated up against the snap ring inside the gearbox bore.
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Step 5	Install the “fixing element” onto the end of the feeder shaft with the bolt supplied and tighten the bolt to pull the gearbox snap ring up tight to the end of the feeder drive shaft.
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<p>Step 6</p>	<p>The Precision mounting bracket is shipped with two (2) loose mounting “ears” that are to be welded to the mounting bracket once the drive package is installed onto the feeder drive shaft and the mounting bracket is secured to the side of the feeder. The ears have a notch cut-out so that they can slide over the Precision mounting bracket.</p> <p>These two ears and the rubber bumpers are sandwiched on either side of the cast “eye” in the gearbox. From top to bottom, the stack-up of these components should be in the following order: Precision mounting ear, rubber bumper, cast eye in the gearbox, rubber bumper, and Precision mounting ear. Arrange the components in this order and insert a bolt through all and fasten firmly with a nut. <u>Do not</u> tighten so that the rubber bumpers are compressed.</p> <p>Nord does not supply this long bolt as mounting arrangements can vary considerably from drive to drive.</p>
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<p>Step 7</p>	<p>Once all components are properly stacked up and aligned, tack weld the two mounting ears in place on the Precision mounting bracket.</p>
<p>Step 8</p>	<p>Disassemble the bumper arrangement by removing the long bolt and nut. Then remove the Precision mounting bracket from the side of the feeder.</p>

Step 9	Weld the mounting ears onto the Precision mounting bracket – a continuous weld with good penetration will provide the most durable attachment. In operation, the mounting bracket can be under considerable torque and a solid weld is important to trouble-free operation
Step 10	Reinstall the mounting bracket onto the side of the feeder and install bolts in all holes; tighten firmly
Step 11	Reinstall the rubber bumpers and long bolt with a nylock nut and tighten firmly

WARRANTY

Precision Machine and Manufacturing, Inc. warrants products of its manufacture to be free from defects in material and workmanship if properly installed, maintained, and operated under normal conditions with competent supervision.

No person, agent, representative or dealer is authorized to give any warranties on behalf of Precision Machine and Manufacturing, Inc. nor to assume for Precision Machine and Manufacturing, Inc. any other liability in connection with any of Precision Machine and Manufacturing, Inc. products.

This warranty shall extend for one (1) year from date of installation provided this equipment has been put into service within ninety (90) days after shipment from Precision Machine and Manufacturing, Inc. factory. If repairs or replacements are made by the Purchaser without Precision Machine and Manufacturing, Inc. prior written consent, Precision Machine and Manufacturing, Inc. warranty shall cease to be in effect. No allowance will be granted for any repairs or alterations made by the Purchaser without Precision Machine and Manufacturing, Inc. prior written consent.

Machinery, equipment and accessories furnished by Precision Machine and Manufacturing, Inc. but manufactured by others, are warranted only to the extent of the original manufacturer's warranty to Precision Machine and Manufacturing, Inc.

Precision Machine and Manufacturing, Inc. agrees at its option to repair at the point of shipment or to replace without charge f.o.b. point of shipment, any part or parts of products of Precision Machine and Manufacturing, Inc. manufacture, which within the specified warranty period shall be proved to Precision Machine and Manufacturing, Inc. satisfaction to have been defective when shipped, provided the Purchaser promptly notified Precision Machine and Manufacturing, Inc., in writing, of such alleged defect.

Precision Machine and Manufacturing, Inc. liability to Purchaser, whether in contract or in tort arising out of warranties, representations, instructions, or defects from any cause shall be limited to repairing or replacing of the defective part or parts as aforesaid, f.o.b. point of shipment.

No liability whatsoever shall attach to Precision Machine and Manufacturing, Inc. until said products have been paid for.

EXCEPT AS STATED IN THIS SECTION AND IN THE PRECEDING SECTION TITLED "WARRANTY" AND EXCEPT AS TO TITLE, THERE ARE NO GUARANTEES OR WARRANTIES OF MERCHANTABILITY, FITNESS, PERFORMANCE OR OTHERWISE, EXPRESS, IMPLIED OR STATUTORY, AND PRECISION MACHINE AND MANUFACTURING, INC. SHALL HAVE NO LIABILITY FOR CONSEQUENTIAL, INCIDENTAL OR OTHER DAMAGES, HOWSOEVER CAUSED.

DATE INSTALLED _____

MODEL _____

SERIAL # _____