PRECISION
PRECISION MACHINE & MANUFACTURING, INC.

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Portland, Oregon

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Precision Machine & Mfg

→ Manufacturer of Screw Conveyors, Rotary Feeders, and PMV Rotary Valves

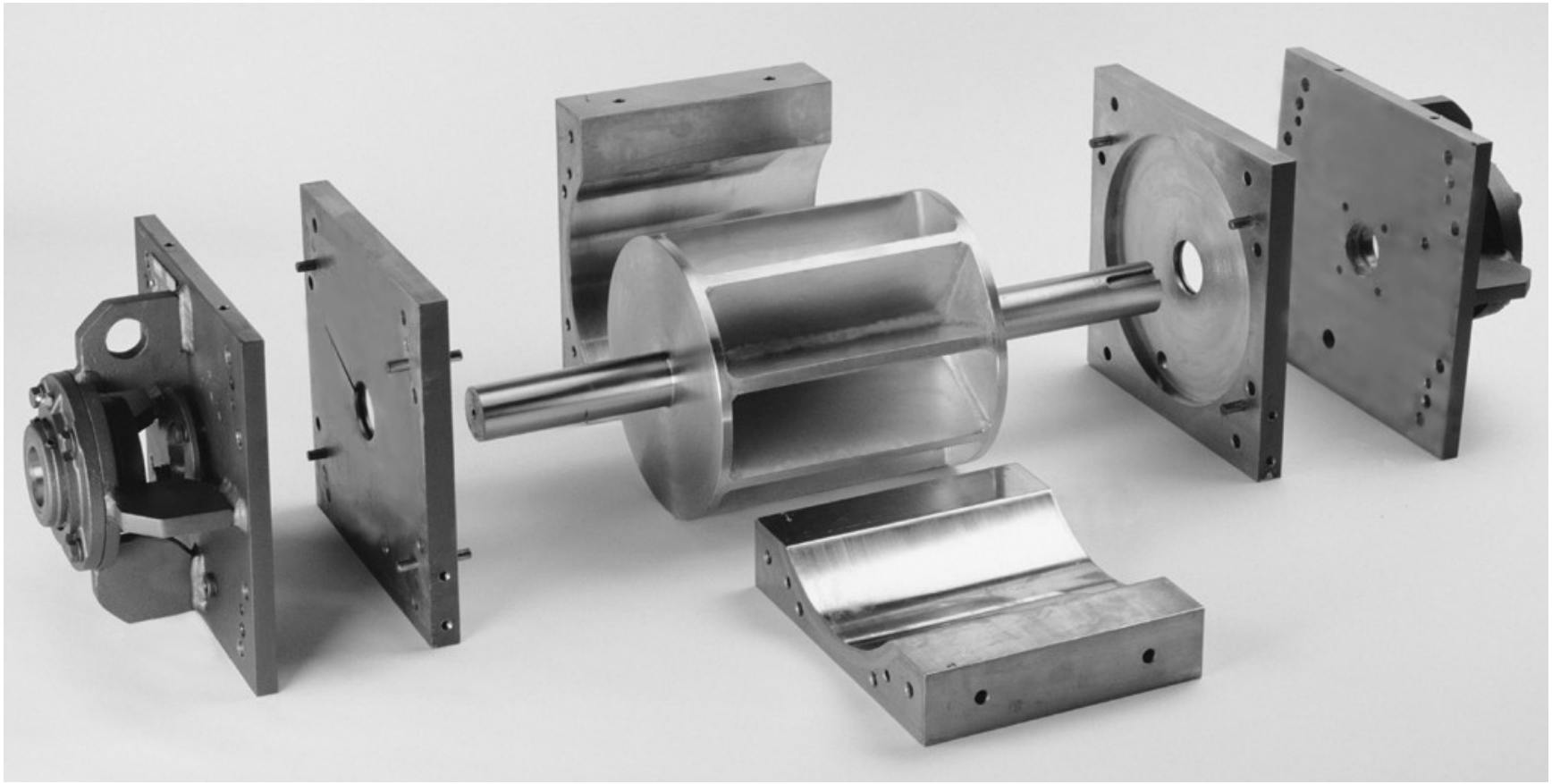
→ Located in Eugene, Oregon

→ 100% USA production

→ Active in a variety of markets:

- Wood products manufacturing, including pulp & paper, sawmills, pellet mills, OSB & plywood plants, MDF & particleboard production
- Coal-fired and biomass-fired electric power generation
- Minerals processing
- Cement production

PMV Rotary Valve



PMV Rotary Valve

→ A revolution in rotary valves…
  – The only full-line rotary valve in the world that does not use a casting for the valve body

→ Standard replaceable parts so the entire valve does not have to be rebuilt
  – Often, worn components can be replaced while the valve remains in place

→ Exceptional materials and surface treatments chosen for maximum durability

→ Components machined to precise tolerances for maximum performance and to assure replacement parts fit

Rotary Feeders

→ Designed for feeding all types of wood and forest products, including bark, shavings, chips, waste wood

→ Top shear knife and rotor configured to provide a positive shearing action

→ Constructed of highly durable materials and the barrel is coated with industrial chrome for exceptional life

→ Re-buildable

→ Wide range of capacities

Screw Conveyors

→ Flights, screws, troughs, or complete conveyor systems

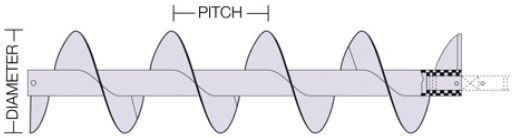
→ Designs for the most difficult applications imaginable

→ Wide range of materials to fit many applications: stainless steel, AR400, TriBraze, mild steel, and many others

→ Custom-designed for the customer's specific dimension, capacity, and operations – we specialize in extreme duty applications

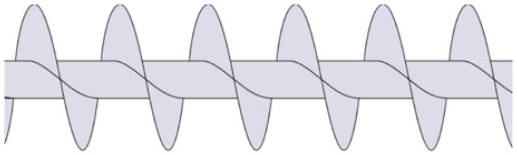
Screw Conveyors

SECTIONAL FLIGHTS AND SCREWS



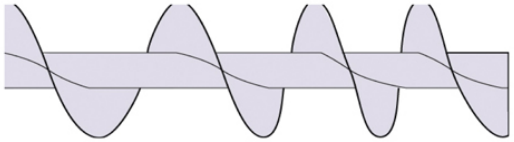
Flights of uniform thickness from OD to ID available in most alloys and hardnesses. Ideal for applications where wear is an issue. Available in diameters and pitches that are not available in helicoid. Longer life than helicoid screws.

SHORT PITCH



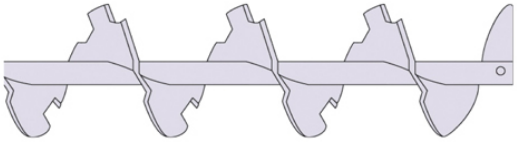
For inclined screw applications. For materials that aerate and become fluid.

VARIABLE PITCH



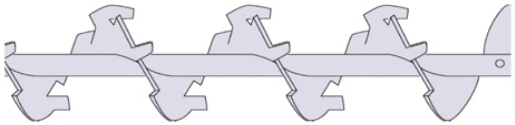
Combination of various pitches. For uniform withdrawal of fine free-flowing materials over the full length of inlet opening.

CUT FLIGHTS



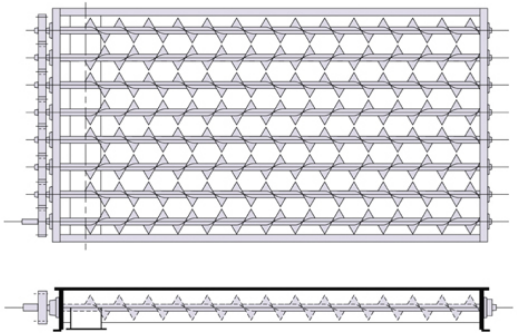
For mixing and agitating materials in transit. For materials that tend to pack.

CUT AND FOLDED



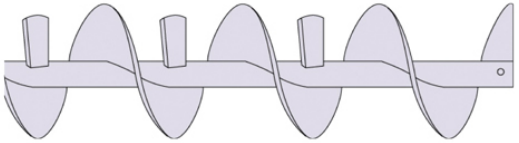
For aerating light materials. Folded segments lift and spill material. Partially retarded flow provides thorough mixing action.

LIVE BOTTOM FEEDER



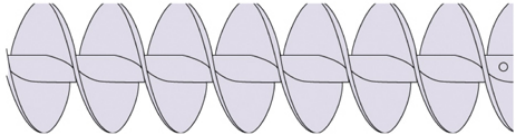
Works best with materials that pack or bridge easily, and is designed to be used on straight-sided bins. The bin bottom is composed of tandem feeder screws which draw material out equally from the full width.

MIXING PADDLES



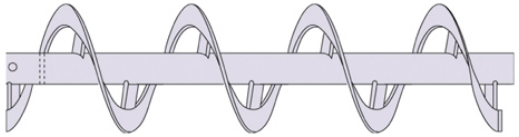
Any screw design can be fitted with paddles for greater mixing action and to slow material flow. The paddles are welded opposite to the hand of the screw flighting. They are adjustable in hand and pitch, if necessary.

DOUBLE FLIGHT



Two separate helices for smooth uniform flow.

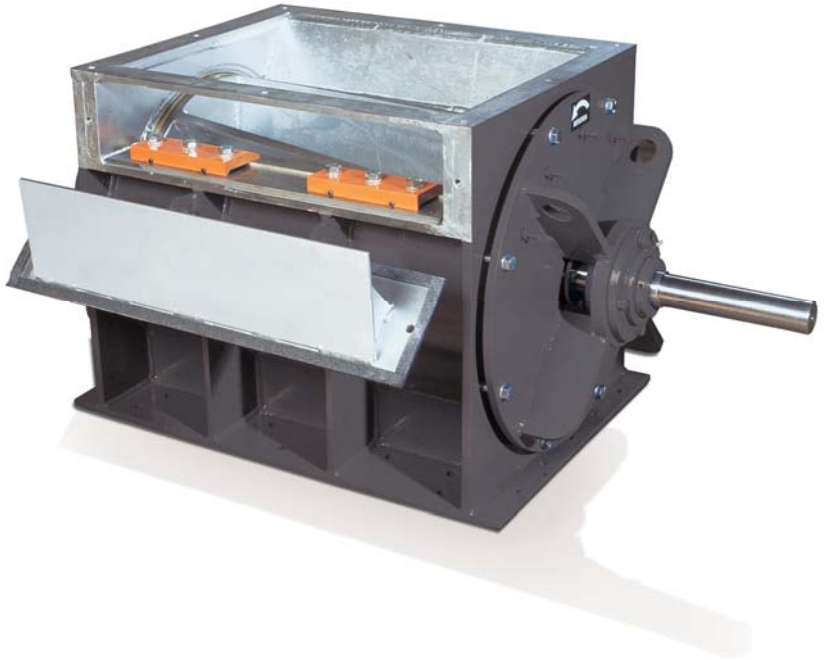
RIBBON SCREW



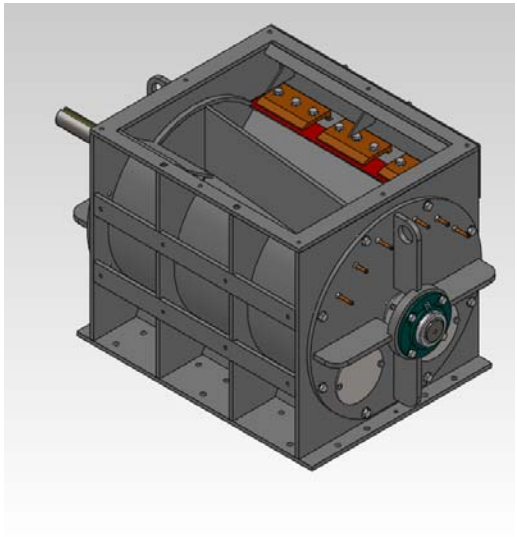
For conveying sticky or viscous materials. The open flight eliminates collection and build-up of material.

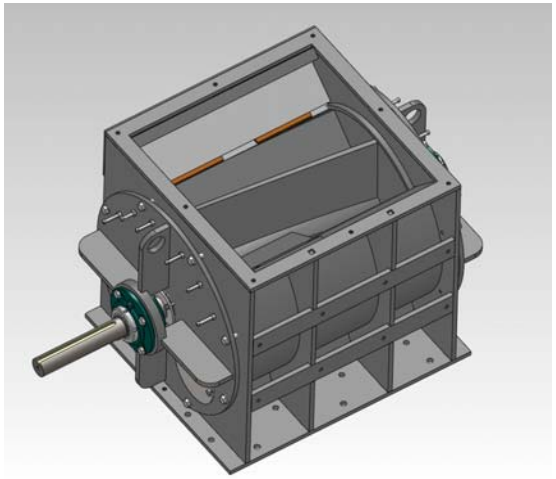
Rotary Feeder Reliability

1. Basic design, components, & terminology – The Basics
2. Proper sizing
3. Proper installation
4. Recommended service
5. Trouble-shooting
6. Rebuilding



Rotary Feeder Reliability – The Basics





→ Terminology
- Rotation: CW or CCW
- Sizes: 14x18 to 30x45 or larger
- Rotor Helix: RH or LH
- Knives:
  - Single/Double
  - Top/Bottom

→ RPM target

Rotary Feeder Reliability – The Basics

→ Feeders from Precision Machine are a highly precise, machined piece of equipment built to tight tolerances to assure maximum performance

- In manufacturing, internal clearance (rotor to barrel) is held at 0.001” per side per inch of rotor diameter
- A 30” inch diameter rotor would have a clearance of 0.015” per side

→ If the material being handled is at a temperature above ambient, Precision machines the rotor diameter to account for thermal expansion to prevent rotor lock-up

Rotary Feeder Reliability – Proper Sizing

Sizing feeders - *a math problem driven by key assumptions and key targets; and subject to judgment and experience*

→ Desired throughput – how many lbs or tons per hour

→ Material & bulk density – wet or dry; mixed or pure; bulk density (in the real world of the mill…)

→ Feeding/loading – under a full head of material? Intermittently fed? Variable?

→ Other factors that may enter into the math:

- Temperature of material
- Fed by…
- Feeding into…

20 tons per hour
20 x 2000 = 40,000 lbs/hour

Bulk density = 15 lbs/cu ft
40,000 ÷ 15 = 2667 cu ft/hr

50% pocket loading
2667 x 2 = 5334 cu ft/hr

60 min/hour
5334 ÷ 60 = 89 cu ft/min

25x30 feeder has a CFR of 5.94
89 ÷ 5.94 = 14.98 RPM, which is an acceptable speed

Rotary Feeder Reliability – Proper Installation & Start-Up

→ Part One – Before Initial Start-Up
- LOCKOUT/TAGOUT ALL POWER
- Lubricate all bearings and gear reducers
- Check to be sure that no tools or foreign objects are in the feeder
- Turn drive unit by hand to check for any misalignments or obstructions
- Check all safety devices and covers for proper installation and function

→ Part Two – Initial Start-Up, *Without Material*
- Reenergize power to feeder and start conveyor briefly; check for proper rotation and correct if necessary
- Run for several hours as a break-in period; check for unusual noises, high bearing temperatures, etc
- Stop feeder and LOCKOUT/TAGOUT ALL POWER
- Open door and inspect knife clamps and internal clearances

→ Part Three – Initial Start-Up, *With Material*
- Reenergize power and run feeder for several minutes without material; gradually introduce material to feeder until design capacity is reached
- Operate the feeder at design capacity for several hours; check motor amperage under load and compare to full load amperage capacity of motor
- Stop feeder and LOCKOUT/TAGOUT ALL POWER; open door and check knife clamps and internal clearances

Rotary Feeder Reliability – Recommended Service

→ Do not…weld on the feeder

→ Do…inspect and adjust knife clearance regularly

→ Do…inspect and adjust brass end seals regularly

→ Do…periodically inspect bearings for proper lubrication

→ Do…inspect shaft seal/packing gland

→ Do…inspect rotor for wearing of the rotor vanes and tips

→ Do…replace knives if they are excessively worn

Rotary Feeder Reliability – Knife Maintenance

The life of a rotary feeder depends on the maintenance of the knives!!!

→ Poor knife maintenance will:

- Lead to premature scoring and deterioration of the barrel's chrome plating
- Lead to a loss of shearing action which can cause large pieces to jam in the feeder
- Lead to a build-up of pitch or other resins on feeder components
- Lead to unequal wearing of feeder components causing poor performance

→ As knives become nicked, rounded, or improperly fitted the housing and the rotor will experience excessive wear

→ Knives can be re-ground or replaced; frequency will vary depending on run-time and type of material being handled

Rotary Feeder Reliability – Knife Maintenance

→ Visually inspect knife condition by opening the access door and examining the knife
  - Look for missing clamps or clamp bolts
  - Look for misaligned or loose knives or clamps
  - Look for chips or other damage to the knives

→ Check knife clearances using a feeler gauge and re-set clearance as appropriate
  - Clearance between knife and rotor tips should be approximately ½ of the clearance between the rotor and housing
  - Be sure to check clearances in several positions along the knife

Rotary Feeder Reliability – Brass End Seals

→ The rotor brass end seals are not as prone to misalignment or varying clearances as the knives and therefore do not need to be checked as frequently

→ Clearances are set at the factory at 0.002" – 0.004"

→ See the two-page "Brass End-Seal Adjustment" handout at the back of this packet for detailed instructions on how to properly adjust clearances

Rotary Feeder Reliability – Trouble-Shooting

Symptom: *Excessive material blow-by*

Corrective Action:

1) Adjust brass seals to proper clearance
2) If seal adjustment doesn't reduce blow-by, may be time for a rebuild

Symptom: *Feeder stalling*

Corrective action:

1) Brass seals may be too tight – adjust to proper clearance
2) Material build-up or pitch build-up – use cleanouts

Symptom: *Not discharging sufficient material*

Corrective Action:

1) Check RPM – likely running too fast
2) Check for system changes – has feed rate changed?
3) Contact Precision to check feeder sizing

Symptom: *Feeder jamming*

Corrective Action:

1) Check for foreign objects in feedstock or in the feeder itself
2) Check for dull, broken, or missing knives
3) Check for oversized materials in feedstock

Rotary Feeder Reliability – Trouble-Shooting

Symptom: *Feeder not turning*

Corrective Action:

1) Check for broken shaft
2) Check for broken hub or bushing
3) Check for foreign object wedged in feeder

Rotary Feeder Reliability – Rebuilding

→ Indicators that it may be time to rebuild:

- Visual inspection of the barrel shows excessive gouging or cuts in the metal
- Complete or nearly complete wearing off of the chrome treatment to the barrel
- Rotor tip material completely worn off and rotor-to-barrel clearance that has reached 2X to 3X the original specified clearance

→ Limitations to rebuilding

- Barrels that have already been rebuilt two or more times likely have too little barrel material left to make rebuilding practical
  - Barrel replacement can be an option but will increase the cost of rebuilding

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Questions on Rotary Feeder Reliability?

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Thanks for your Time and Attention!

BRASS END-SEAL ADJUSTMENT

Each end bell has either five (5) or six (6) 3/8" square head set screws with lock nuts in the upper half of the end bell. Number the set screws 1 through 5 or 1 through 6 (moving in a clockwise direction). Set screws 1, 3 and 5 (or 1, 3, 4 and 6) are Pusher Bolts while set screws 2 and 4 (or 2 and 5) are Puller Bolts. (See Sketch)

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

1. Loosen all lock nuts.

2. Using feeler gauges, push or pull evenly on the brass (using the bolts) until the brass/rotor clearance is .002 to .004.

   Note: Turning the Pusher Bolts 1, 3 & 5 (or 1, 3, 4 & 6) clockwise will decrease the gap and turning the Lock Nuts on Puller Bolts 2 and 4 (or 2 and 5) clockwise will increase the gap.

3. When this has been achieved, tighten all lock nuts firmly. **DO NOT OVER TIGHTEN** or use excessive wrench force. This can bind the unit.

Should it be impractical to use feeler gauges, the following procedure may be used:

1. Loosen all lock nuts.

2. Back off the lock nuts for Pusher Bolts 2 and 4 (or 2 and 5) approximately ¼ turn.

3. Using a small hammer, tap the Puller Bolts lightly.

4. Finger tighten Pusher Bolts 1, 3 and 5 (or 1, 3, 4 and 6).

5. Tighten all lock nuts firmly. **DO NOT OVER TIGHTEN** or use excessive wrench force. This can bind the unit.

If the unit does not turn freely, the clearance is too tight. Repeat the procedure.

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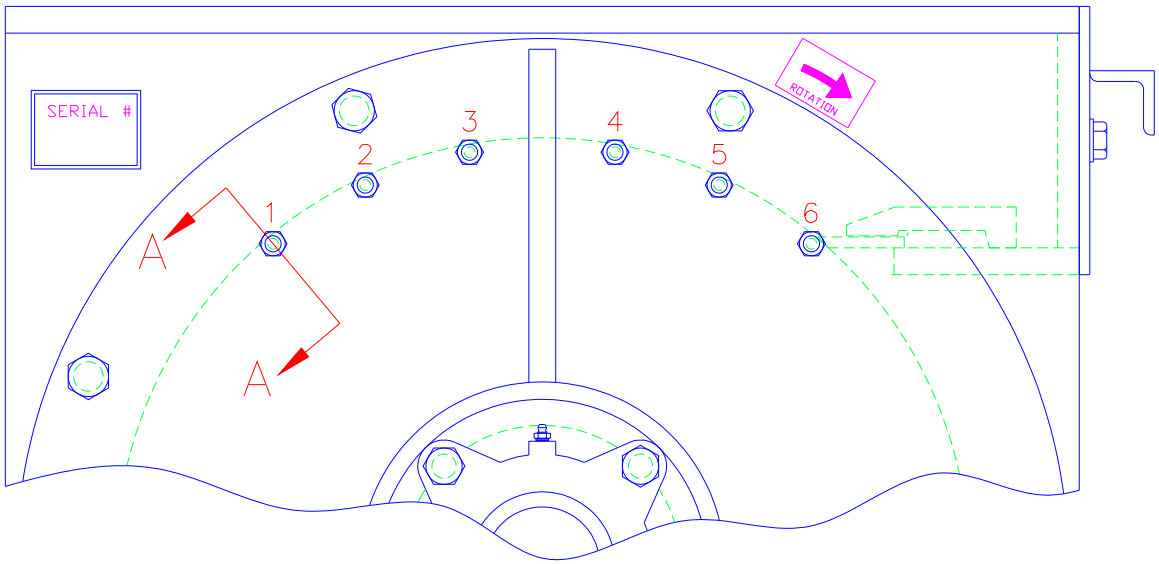
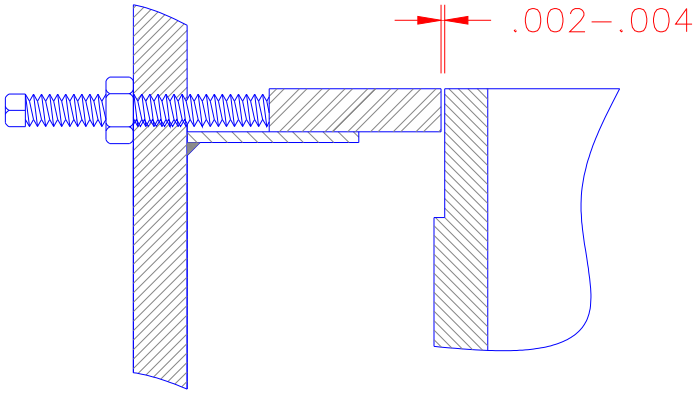
BRASS END-SEAL ADJUSTMENT





Section "A–A"
2X Scale