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Rev 6-14-06

# 5RP MANUAL

**Model 06M43 & Newer**

**Table of Contents**

## 1. SAFETY

1.1.1. Read this entire document before attempting to install, operate or maintain this machine.
1.1.2. Install the machine on a suitable foundation described herein and in available documents.
1.1.3. Lock out power to machine at wall disconnect before changing tools or motor belts or performing maintenance.
1.1.4. Wear safety goggles.
1.1.5. Do not use a tool without knowing its rated speed.
1.1.6. Do not spin tools above their rated speed. The Sawing Systems' 10" polisher disk has a maximum rated speed of 1,000 RPM. (Check the rating of the polishing or grinding wheels for this disk. They may be rated for a lower speed.)
1.1.7. Do not use tools that may be imbalanced or otherwise damaged or unevenly worn.
1.1.8. Do not run spindle without belt guards in place.
1.1.9. Use the polishing head only with the locking pins installed.
1.1.10. When practical, use a worktable with sideboards to protect against water spray and broken tooling.

## 2. QUICK OPERATION

2.1.1. For tool speeds below 2500 RPM, set the drive belt to low ratio (Place belt on small diameter pulley on motor and on large diameter pulley on spindle.)
2.1.2. Adjust the work piece height to the spindle by touching on 4 corners.
2.1.3. Pull the Control Power button to energize the machine.
2.1.4. Balance the Spindle (See details below.)
2.1.5. Pull the Spindle Motor switch to Start.
2.1.6. Rotate the Speed selector switch to change spindle speed.
2.1.7. Warm the spindle for 2 minutes at 2500 RPM before going to 10,000 RPM
2.1.8. Push the Spindle Motor switch to Stop to stop the spindle.
2.1.9. Push the Control Power button to de-energize the control panel.

## 3. FEATURES

3.1. General

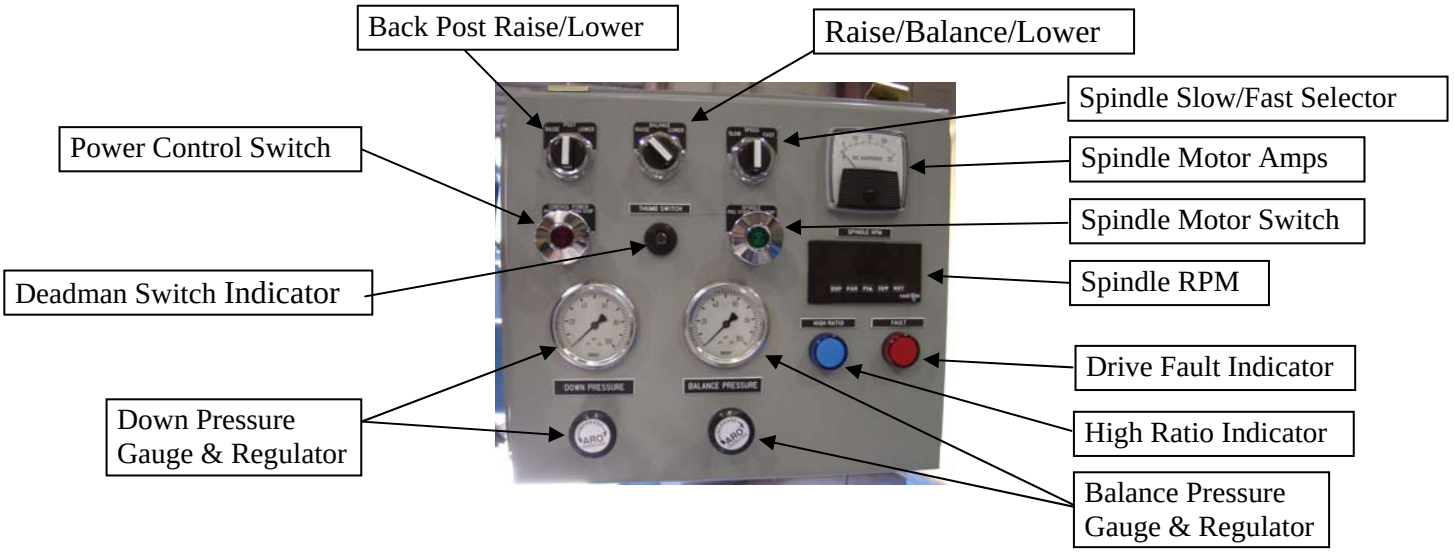
3.1.1. The 5 R/P machine is a complete Work Center for countertop finishing. It is a heavy-duty radial arm router/polisher suited to drop bowl holes, drill faucet holes, create drain boards, profile edges and polish the top and edges. It is a cost effective alternative to expensive CNC and low-power hand tools.
3.1.2. The machine has a single spindle powered by a conventional 5HP inverter motor. A simple two-position belt system enables a dual range of speeds and torque. The high-speed range can deliver over 10,000 RPM, making it ideal for dropping bowl holes with a diamond "finger bit". For other tools, the high-torque range can deliver up to 28 ft-lbs of constant torque for heavy-duty polishing and stock removal without the nuisance of spindle stalling.
3.1.3. The spindle is mounted on the end of a radial arm that can swing 360°. The arm can fold as close as 26" or extend as far as 79" from the post (82" with optional post raise and lower). This range of movement allows a 10ft long countertop or 4ft

square island to be finished in one set up or up to (3) 8ft countertops or (4) 4ft islands can be set up at once around the post.

3.1.4. The spindle has 4" of air-assisted vertical travel. The pneumatics provide controlled down force for polishing, drilling and dropping bowl holes. An air-balance feature allows for feather-light or heavy polishing. The balance feature also allows profiling tools to track on the top surface of a countertop for precise placement of the profile. A travel stop enables the spindle to be locked in any vertical position. Cooling water for the tool may be fed either through the center hole or via external, adjustable nozzles.

3.1.5. For work piece positioning there are several options. There is an option for 12" of power-actuated raise and lower at the back post. Adjustable sawhorses are available or the customer can buy a wood table from Sawing Systems or build the table from a set of plans. Additional table options include a vacuum table and accessories for convenient countertop clamping.

3.2. Electrical Controls



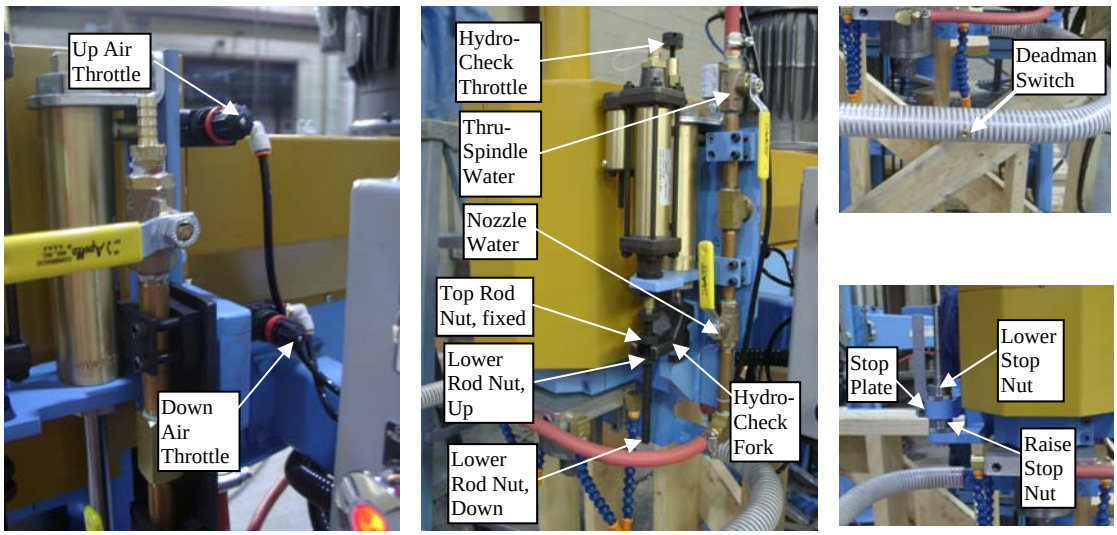

3.2.1. Power Control Switch to energize machine. Pull for power on. Push for E-Stop.
3.2.2. Back Post Raise – Lower (optional)
3.2.3. Raise/Balance/Lower switch for spindle positioning.
3.2.4. Pull/Push switch for Spindle Motor Start/Stop.
3.2.5. Spindle Slow/Fast speed adjustment switch.
3.2.6. Spindle Motor Amp Meter
3.2.7. Spindle RPM indicator
3.2.8. High Ratio Indicator light. "On" indicates belt is in high ratio position.
3.2.9. Drive Fault Indicator light. "On" indicates the spindle motor drive faulted out or the motor overheated.

3.3. Pneumatic Controls

3.3.1. Balance Pressure Gauge and Regulator to counteract the dead weight of the spindle and tooling to enable feather-light float for very light polishing or low drilling force.

3.3.2. Down Pressure Gauge and Regulator to enable heavy drilling or polishing force on the spindle.

3.3.3. Deadman switch indicator. "On" indicates deadman switch is activated. (See Deadman Switch Operation below).




3.4. Mechanical Controls

3.4.1. Air Throttle Valves limit up and down velocity of spindle.

3.4.2. Hydro-Check (Optional) precisely throttles the down-speed of the spindle for drilling or smooth vertical oscillation (see Hydro-Check Operation below).

3.4.3. Water valves direct cooling water to the tooling either through the spindle core or via external adjustable nozzles. (Always adjust the flow of spindle water either off or high enough to prevent water flow out the leakage drain in the side of the rotary water union on top of the machine.)

3.4.4. Stop Nuts can be used to limit raise and lower spindle travel.

## 4. MACHINE OPERATION

4.1. Hydro-Check Operation

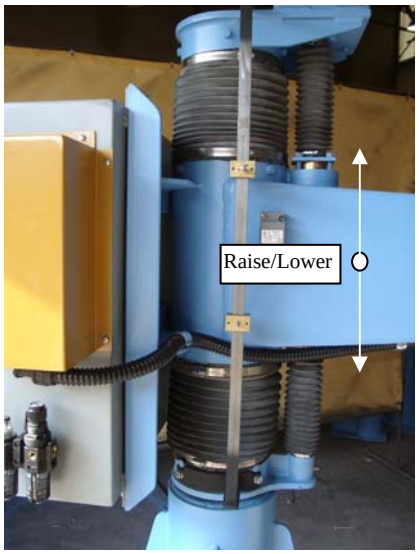
4.1.1. The Hydro-Check should only be engaged for specialty operations when needed, such as slow, controlled drilling operations or smooth vertical oscillation for even wear of drum-type tools. To engage the Hydro-Check, adjust the Lower Rod Nut finger tight to the Up position against the Fork and Top Rod Nut shown above. Adjust the Hydro-Check Throttle to limit down velocity. To disengage the Hydro-Check, adjust the Lower Rod Nut to the down position shown above. For maximum float sensitivity, disengage the Hydro-Check when not in use.

4.2. Deadman Switch Operation

4.2.1. A brass button on the handlebar of the machine actuates a switch to control the down force of the spindle. Cover the hole of the button with your thumb to lower the spindle and apply the desired down force as set by the Down Pressure regulator. If the "Raise*Balance*Lower" selector switch is in the Raise position, releasing the deadman will cause the spindle to rise. If the selector switch is in the Balance position, releasing the deadman will cause the down force to be removed, but the spindle will stay in place (if balanced properly). If the selector switch is in the Lower position, it over-rides the deadman switch and down force is applied continuously with a force as set by the Down Pressure regulator.

4.3. Back Post Raise and Lower (Optional)

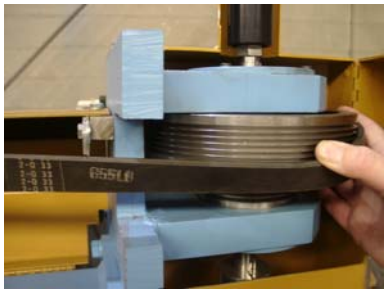
4.3.1. The 4” vertical float travel of the spindle is designed to accommodate different types of tooling from finger bits to polishing plates to edge profilers without having to change the height of the work piece. Occasionally tooling may be too short or long. If you have such a tool, consult Sawing Systems for a possible adapter of a different length that will make work piece movement unnecessary.




4.3.2. Optional back post raise and lower avoids this problem. It is also handy to lift the spindle up and out of the work area of a table with side splash guards. It is handy for lifting the spindle and tooling clear of the work piece for easy assembly and removal of tools. Total back post vertical raise and lower travel is 10”.

4.4. Drive Belt





4.4.1. The spindle drive system includes a two-position drive belt for two ranges of speed. The high ratio is primarily for the high speed finger-bit. A pilot light on the operator’s control panel will illuminate when in high ratio.

4.4.2. The above pictures illustrate changing the belt ratio from low to high. After disconnecting the machine power at the wall disconnect, open the front and side belt guards. Raise the belt tension lever as shown. Then pinch the belt halves together to pull the motor and loosen the belt. Roll the belt off the large pulley and onto the small. (Pull the belt to the right while pulling down.) At the other end, roll the belt onto the large diameter pulley. (Hold the belt on the large pulley while turning the pulley to the left.) Pull the lever back down to re-tension the belt. Close the guards then re-energize the machine.

4.5. Set up the Work Piece

4.5.1. Practice on scrap material.

4.5.2. Determine the horizontal range of travel of the spindle and place the work piece within this range on the work surface (saw horses, wood table, vacuum table, etc.). If the machine is equipped with power raise and lower (in the back post), set the arm about 2" above the bottom of the available 12" stroke. With the spindle at the bottom of its 4" stroke, adjust the elevation of the bottom of the work piece 2-1/4" below the bottom of the spindle. Install the various tools to be used in the spindle and confirm that the work piece is set properly for the horizontal range of the arm and the vertical range of the spindle. The spindle will be near the top of its travel to accommodate the surface polishing plate and the spindle will be near the bottom of its travel to accommodate an edge-polishing drum.

4.5.3. NOTES: If using saw horses and the material is too delicate to support itself (especially around a bowl hole), set the material on stiffeners. Try to locate the bowl hole a distance from the center post that provides for the machine arm to be half folded. This will minimize operator fatigue, since the machine arm is easiest to manipulate when the arm is half folded.

4.5.4. Level the work piece height relative to the spindle, i.e. adjust the table or work piece until the distance from the spindle to the top of the work piece is the same all around the edges (except when routing a drain board). A handy way of doing this is to install a tool adapter or finger bit in the spindle. Place a 1/4"-1/2" thick plate (any firm material) on top of the work piece. Adjust the spindle height to just touch the plate and lock the spindle at that height with the spindle stop. Remove the plate and move it to various points around the perimeter of the work piece. At each point, adjust the work piece to just kiss the bottom of the bit with the plate. Leveling is most critical for accurate profiling, but perhaps less critical for other operations.

4.6. Install Tooling

4.6.1. CHECK THE RPM RATING OF THE TOOLING AND DO NOT EXCEED THAT RATING. The spindle speed is displayed on the control panel. For any tool other than a finger bit, the drive belt should be positioned in the Low Ratio position.

4.6.2. Use Never Seez™ or equivalent on tool threads.

4.6.3. The spindle has an internal ½" gas thread (1/2" straight pipe thread with a tapered seat) to accept tooling with a male gas thread.

4.6.4. Only tooling with a right-hand thread may be used and the spindle may only turn clockwise (looking down from above).

4.6.5. The machine also comes with a rocker pin coupling for mounting a surface polishing plate. The coupling is made to attach to the OD of the spindle, which has two flats for securing the coupling to the spindle shaft.

4.6.6. The polishing plate is equipped with two vertical holes for insertion of locking pins.

4.6.7. Adapters will be required to fit tools with other types of connections. The machine comes with an adapter with a male 5/8-11 thread to fit tools with a popular 5/8-11 female thread.

4.6.8. When using a template and finger bit, it may be necessary to install and remove the tool while the spindle is over the hole of the template if your machine does not have optional raise/lower.

4.7. Energize the Machine

4.7.1. Pull the Control Power button to energize the machine.

4.8. Adjust Air Controls

4.8.1. Adjust the supply pressure regulator to 90PSI (70 PSI or possibly 60PSI is adequate if not using the Hydro-Check). This supply regulator is located on the control box on the main swivel post of the machine.

4.8.2. Disengage the Hydro-Check (see Hydro-Check Operation, above). Adjust the Down Pressure regulator on the front control panel to 40 PSI. Rotate the "Raise*Balance*Lower selector switch alternately to Raise and Lower and adjust the throttle valves at the ports of the air cylinder so that the cylinder completes its stroke in about 2 seconds. The top valve regulates the up stroke and the bottom valve regulates the down stroke.

4.8.3. Set the selector switch to Balance. Turn the Balance Pressure regulator on the front control panel to zero then slowly turn it up until the spindle begins to rise (approximately 57 PSI). Note the pressure. Slowly turn the Balance Pressure regulator down until the spindle begins to fall (approx. 43 PSI) and note the pressure. Add the two pressures and divide the sum by two (approx. 50 PSI) to get the average pressure. Set the Balance Pressure to this average pressure.

4.8.4. Set the Down Pressure regulator to 20 PSI. More or less down pressure may be desirable once the operation and feel of the machine is fully experienced for different processes and materials.

4.9. Start the Spindle

4.9.1. Pull the spindle motor switch to start the spindle motor. The spindle will begin turning at 100RPM in low ratio or 400RPM in high ratio.

4.9.2. The PLC program prevents the Spindle from exceeding 2,100 RPM until after a 2 minute warm-up period. During the warm-up period the motor control light flashes. After the warm-up period the motor control light is on steady and the speed may be increased above 2,100 RPM.

4.9.3. To change spindle speed, rotate the Spindle Slow/Fast selector switch to the desired spindle speed.

4.9.4. Only the finger bit should require the high ratio belt position to achieve rated speed. Tools needing less than 2500 RPM should be run in low ratio for maximum torque.

4.9.5. Turn on the cooling water. Select either through-the-spindle or external nozzle water flow or both. Diamond tooling must not be run without water. Adjust the flow of coolant through the spindle high enough to prevent water flowing down the leakage tube connected to the side of the water rotary union on top of the spindle.

4.9.6. Push the spindle motor switch to stop the spindle.

4.10. Spindle Motor Fault

4.10.1. The fault light indicates either a drive fault or motor overheat. The most likely problem is a drive fault.

4.10.2. Open the back control panel and look for an error message on the variable frequency drive. Stay away from high voltage. Try pressing the reset button on the face of the drive to clear the fault. If the problem repeats call Sawing Systems for help in diagnosing the problem.

4.10.3. If there is no fault indicated on drive, or if the machine was being used under excessive load for more than several minutes the thermal switch inside the spindle motor may have tripped. If so, wait 10 minutes or so for the motor to cool down and the switch will automatically reset itself.

## 5. PROCESSING SUGGESTIONS

5.1. Routing

5.1.1. For routing work, cool the tooling using center cooling if the tool is designed for such. Also use the four external water nozzles. Direct at least some of the water at the point where the cutting surface converges into the work piece. Direct the rest of the water at the tool and work piece interface at the leading side the cut.

5.2. Drilling:

5.2.1. For drilling cool the tool with center and external nozzle cooling water.

5.2.2. Use core drills to make the faucet holes.

5.2.3. To prevent core drills from walking off center, guide the drill with a "drill bushing". To make a drill bushing, make a hole in a piece of scrap or wood or stone and clamp this to the work piece.

5.3. Bowl Holes

5.3.1. To cut out a bowl hole, use a small diameter (typical 20mm) "finger bit" with a long shank. A template should be used to guide the finger bit around the inside of the desired cut line. For best results, use Sawing Systems finger bit assembly B-4114-73A. This has a water-cooled and lubricated journal bearing. The bearing is larger in diameter than the cutting tip so it cuts inside the dimensions of the template. This leaves some stock for finishing operations.

5.3.2. Balance the Spindle then adjust the Down Pressure to about 30PSI. Set the "Raise*Balance*Lower" selector switch to Raise. Test-jog the Deadman switch to confirm the spindle drops when pressed and raises when released. Release the Deadman and set the selector switch to Balance.

5.3.3. Install the tool and raise the spindle to the top of its 4" vertical travel.

5.3.4. Support, level, shim and clamp the granite as required to bring the top of the granite about 2-3/8" below the tip of the finger bit. Add support under the edges of the proposed bowl cut-out to prevent the core from dropping out and breaking the outside edge of the cut-out.

5.3.5. Clamp the template where desired on 1-1/2" shims (2x4 thickness). The lower end of the bushing of the finger bit should ride on the edge of the template. Test-move the handle around the perimeter of the template to ensure free movement and no interference with clamps.

5.3.6. Lower the Spindle by hand (grab the water manifold block and push down) to place the bottom of the cutting tip about 1/8" above the top of the granite. Set the Bottom Stop Nut up against the bottom of the Stop Plate. This will prevent the tip from coming up too high and possibly damaging the guide edge of the template.

5.3.7. There are at least two techniques for cutting out the bowl hole. One is to step-cut and another is to continuously spiral cut. Step cutting is easier to control but requires more stop and go. Continuous spiral cutting may be difficult to control on granite of varying hardness or if the template has sharp or reversing corners.

5.3.8. To step-cut, set the tip of the finger bit on the top of the granite and set the Top Stop Nut down on the Stop Plate then back it off about 1 turn or about 1/16". This will allow the finger bit to penetrate only 1/16". Start the Spindle Motor and increase the speed to 10,000 RPM. Press and hold the Deadman switch to lower the finger bit down into the granite then move the tip around the circumference of the template. Release the deadman and back off the Top Nut another 1/16" and traverse the template again. Repeat until the tip cuts through the bottom of the granite.

5.3.9. To spiral-cut, set the tip of the finger on the top of the granite and set the Top Stop Nut above the Stop Plate about 1/16" less than the thickness of the granite. This will allow the tip to penetrate to within 1/16" of the bottom of the granite and prevent it from breaking through unexpectedly. Start the Spindle Motor and

increase the speed to 10,000 RPM. Start moving the spindle continuously around the template without pausing and press the deadman switch.

5.3.10. If it is too difficult to push the spindle around the template reduce the depth of cut per pass. For step cutting reduce the step. For spiral cutting reduce the down pressure. To reduce the number of passes around the template either increase the step depth or increase the down pressure.

5.3.11. To pause or rest while spiral cutting, release the Deadman first, then stop moving around the template. If you pause too long in one spot or if the granite has sections of varying hardness, the finger bit will plunge unevenly. Level out the path by setting Top Stop Nut down on the Stop Plate to prevent any further drop of the Spindle.

5.4. Templates

5.4.1. Templates are typically made from ¾" thick polyethylene sheet. The patterns can typically be downloaded as a dxf file from the bowl manufacturer's website. Sawing Systems can mill the pattern from these dxf files for a fee. Consult an SSI salesperson.

5.5. Finger Bits

5.5.1. For best results, use Sawing Systems finger bit assembly B-4114-73A. This has a water-cooled and lubricated journal bearing. The bearing is larger in diameter than the cutting tip so it cuts inside the dimensions of the template by about 1/16". This leaves some stock for finishing operations. There are other brands and configurations of finger bits available from stone tool supply houses. Beware that the shanks of these are often smaller than the cutting tool, which will result in cutting "outside the line". Such bits can be used if you use an undersize template. Replaceable cutting tips are available for the SSI finger bit assembly in different shapes and bonds. Tips with a beveled or rounded end work better for spiral plunging. When step-plunging, a square bottom edge tool works satisfactorily. The diamond bond should be hard for granite and softer for marble.

5.6. Miscellaneous Techniques

5.6.1. If free-hand cutting the bowl hole without a template, the bit will want to walk off to the left as you push it forward due to the right-hand rotation of the tool. Move the arm in a clockwise direction around the inside of a hole and it will want to walk into the cut line and may accidentally remove excess material. Move counterclockwise and it will walk away from the desired cut line, possibly preventing a mistake.

5.6.2. When possible, use drill bushings or a template and tools with bearing cam followers. These will reduce over cuts and operator fatigue brought on by fighting tool walk.

5.6.3. Hang a shortened shower curtain from the handlebar to shield the operator from water spray. The operator may also want to wear a rubberized apron and high boots. Sawing Systems recommends the use of a work table with pop-up side-walls that will block most of this water and also act as a safety barrier between the operator and the tooling. Tables or table designs are available from Sawing Systems.

5.7. Drain Boards

5.7.1. To mill a sloped drain board into the countertop, the countertop must be sloped in the opposite direction by the amount of slope desired. Use a template to control the perimeter cut and use straight-edge guides to make the channels and other straight shapes.

5.8. Edging and Profiling

5.8.1. Tooling and Practice. Edge Profiling requires special tooling with a top-edge follower plate. It will require practice on scrap and possibly different techniques with different shape profiles. Edge profiles such as bull noses and ogee patterns are height-sensitive and must be accurately positioned on the countertop relative to the top surface. To create such profiles, it is necessary to use tools with a top-guide bearing plate as well as the usual shaft guide bearing. This type of tool was created for hand-grinder type profilers. Such tools are made by Alpha Professional Tools among others. These profiler tools have a top bearing plate that slides along the top of the countertop to hold the tool at the right height. A shaft bearing follows the edge of the granite. Tools meant for portable routers such as the Master or Ghines Sector do not have the top follower bearing plate and may not work satisfactorily. These machines have built in follower plates. Sawing Systems is developing an optional follower plate that mounts on the Spindle and this will enable it to use Sector-type tools. The plate rides on the top of the countertop to hold the spindle at the right height for any type tool. Contact your SSI salesperson for anticipated availability.

5.8.2. Install the profile tool. Start the Spindle motor and set the Spindle RPM to the correct speed for the tool. Adjust the Balance Pressure a few PSI on the low side so the spindle is slightly heavy, i.e. so that the spindle tends to drift up rather than down. Set the Down Pressure to about 10 PSI. The vibration of the motor will help make the pressure adjustment more sensitive. Stop the Spindle.

5.8.3. Level the four corners of the countertop to the spindle. Move the spindle along all edges. Shim and clamp as required to hold the granite flat and at the same height to the spindle or tool along all edges.

5.8.4. Adjust the Stop Nuts for the spindle travel so the bottom of the follower plate moves about ¼" above and below the top of the granite. Do not lock the spindle or attempt to use Master or Sector-type tooling. The arm of the 5RP is not and can not be rigid enough to produce an even profile with a locked spindle or unguided tools.

5.8.5. Set the selector switch to Balance. Set the edge of the top follower plate on the top edge of the Granite. Start the Spindle motor and increase speed to the proper RPM for the tool. Move the tool into the granite. Profiles such as demi-bulls (half bullnose) and ogees will tend to ride up. Rough the entire edge with the top follower on the high side then go back and press the Deadman switch as required to bring the follower plate down onto the granite while moving along the edge. Be careful to not fall on the handle or otherwise cause the machine arm to move beyond the float capability of the Spindle. Use the Deadman only to get down to the right height. Adjust the down pressure high enough to drive the tool but not so high as to deflect the top follower plate and cause an uneven profile.

5.8.6. Full bullnose and similar tools that cut symmetrically will not tend to ride up. For these types of tools, little or no down pressure will be required.

5.9. Polishing or Grinding

5.9.1. For face polishing or grinding, set the Raise*Balance*Lower selector switch to Raise. Press the Deadman switch to lower the polishing plate onto the surface. Release the Deadman to lift the polishing plate clear of the surface. If you don't want the plate to rise off the surface, set the selector switch to Balance.

5.9.2. For additional polishing instructions see TSB 05T02 Surface Polishing Process.

## 6. INSTALLATION

6.1. Working Space

6.1.1. The machine arm can swing around the center post and reach as far as 82" (almost 7 feet). Add another 1 foot for the handle and 3 feet clearance for the operator and the machine can require a working space equal to a 22-foot diameter circle or 11-foot radius semi-circle if installed near a wall. The post should not be installed closer than 3 feet to a wall to provide enough room for the machine footing or mounting plate. The machine arm can fold on itself to bring the center of the spindle as close as 26" to the centerline of the post.

6.2. Safety Barrier

6.2.1. The operator and surrounding work areas should be protected from water slinging and the possibility of a broken tool bit or flying debris. Sawing Systems recommends the use of a worktable with 8" high fold-down sides. This table or plans for same can be purchased from Sawing Systems. Alternately the machine may be isolated by surrounding it with a wooden barrier constructed of 2" lumber and extending from the floor to at least 12" above the maximum working height (normally a 4ft high wall will be sufficient). If using a wall barrier, a smaller, portable barrier on casters should be placed between the work piece and operator. It should extend 6" above and as wide as the work piece. Alternately, the barrier may be a minimum of four feet wide and moved with the operator.

6.3. Foundation

6.3.1. The 5RP like any radial arm machine or machine with a large overhung load requires careful consideration of the foundation. Sawing Systems Inc and its personnel can only relate typical conditions and installation practices. The machine weighs 1500 lbs. The cantilevered arm can create an over-turning moment of 6350 ft-lbs. This includes an allowance for tooling and a 300 lb operator putting his full weight down on the handle. Professional design and installation of the footing is recommended if the floor quality is not known. Absolute minimum requirements for installation direct to the floor are 4" thick, 3000 lb concrete strength, and no cracking or deterioration. It is preferable to install an independent concrete footing 5ft x 5ft x 1ft thick on firm, stable soil. Sawing Systems can provide a typical foundation design, but the customer is responsible for his particular footing or floor load capacity and the holding power of the concrete anchors even if those anchors are installed by Sawing Systems since Sawing Systems does not know the quality of the floor or footing.

6.3.2. The machine base has (4) 1-1/16" anchor holes on a 27.5" bolt circle (holes are at the corners of a square 19-7/16" x 19-7/16"). Anchors must be rated for a minimum of 2000 lbs allowable load and 7750 lbs ultimate load each as installed in the floor or footing in the condition such as it is.

6.3.3. An optional mounting plate is available in lieu of an independent foundation for installation of the machine directly to a 6" thick industrial concrete floor. The plate is 1 inch thick and 5 feet in diameter to effectively support and distribute the load. An industrial-rated concrete floor in good condition is still required. Bear in mind that this plate will elevate the machine an additional 1" off the floor and may present a tripping hazard or interfere with worktable legs.

6.3.4. Outriggers are another option for installation directly to a 4" thick industrial concrete floor. Outriggers are steel channels bolted to the top of the base plate that extend toward the back at 45 degree angles. These are bolted to the floor and act to further stabilize the overhung load.

6.4. Electric

6.4.1. 208-230/460 three-phase power is required. If only single phase is available, either a phase converter can be used or the machine must be ordered specifically for single phase power at extra cost. The electrical installation requires a disconnect box with a lockout capability rated 40 amps @230V. This must be installed within sight of the machine and according to applicable building codes. Because the machine can swivel 360°, a flexible ceiling drop is ideal for the connection to the machine control box. Care should be taken to prevent the cord from winding up due to excessive rotations in one direction.

6.5. Compressed Air

6.5.1. Less than 1CFM @ greater than 80PSI. The equivalent of a 1/3 HP compressor with a 1-gallon air tank is adequate. Air should be free of heavy scale and water.

6.6. Water

6.6.1. Approximately 2.5gpm at a minimum of 20 PSI. A typical garden hose supply is adequate. Water should be clear without abrasive particulates and non-acidic and may be lightly chlorinated but need not be of drinking quality.

6.6.2. Re-circulated water may be used if filtered to 25 micron to protect the seal faces of the water rotary union on top of the spindle. The use of re-circulated water could cause scratches on polished surfaces.

6.6.3. If your machine is equipped with a split water supply option, you can connect fresh water to the spindle and unfiltered re-circulated water to the external nozzles. The spindle consumption is ½ gpm and the water nozzle consumption is about 2 gpm.

6.7. Drainage

6.7.1. Provision for collecting the wastewater must be provided. A sloped floor and collection pit with a means for filtration and recirculation is ideal. Another option is a water collection pan and water recirculation system under the worktable. These options are available from Sawing Systems.

6.7.2. The tooling will throw water at waist-high level. If a safety barrier or splashguards are not provided around the work piece, then the operator should wear a rubberized rain suit or bibs and rubber boots.

## 7. MAINTENANCE

7.1. Cleaning

7.1.1. Wipe down and use mild detergent if necessary. Do not hose down. A dilute 1% solution of phosphoric acid followed by a dilute 1% solution of baking soda applied to steel surfaces with a spray bottle helps to passivate bare steel and reduce rust. Wipe dry or blow dry with compressed air.

7.2. Lubrication

7.2.1. Fill the oil reservoir of the air supply Filter/Regulator/Lubricator with air tool oil.

7.2.2. Wipe off the bulk of old grease and stone dust with a clean rag.

7.2.3. Every three months or 500 hours clean then apply grease to the spline shaft, linear slides, and sawhorse screws.

7.2.4. Every six months and if equipped with back post R/L:

7.2.4.1. Drop two bellows covers on back post and two on R/L screw. Coat post tube and R/L screw (both above and below arm) with grease.

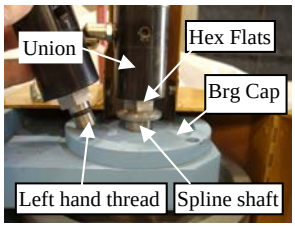
7.2.5. Check oil level in R/L gearbox. Top off with gear oil per gearbox manufacturer.

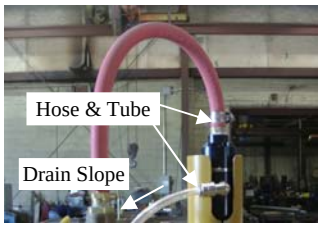
7.2.6. Grease should be polyurea-based industrial bearing grease. Use a stiff fiber grease brush to apply sparingly. Excess is wasteful, will be scraped off by mating surfaces and will cake up and collect stone dust.

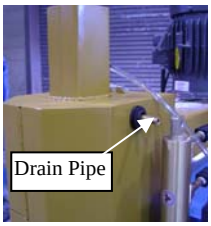
## 8. REPAIRS

8.1. Water Rotary Union

8.1.1. **WARNING – If water leaks from the Drain Pipe (below picture on right), shut off the water to the spindle immediately.**




8.1.2. A defective union may leak from the underside of the body just above the hex flats on the rotary union shaft. If this water gets to the pulley bearings below the Bearing Cap, the bearings will be destroyed. Bearings damaged by water will not be warranted. They are expensive and precision and their installation is so critical they must be replaced at SSI.

8.1.3. Open the guard to determine the source of the leak. If it is from a fitting, repair or replace the leaking fitting. If the leak is from the rotary union body, the union must be replaced.

8.1.4. To remove the union, unscrew it from the spline shaft. The thread is left hand. Just below the housing of the union is a hex nut. Turn the nut clockwise (looking down from above) to unscrew the union from the shaft. Do not apply a wrench to the Spline Shaft. To prevent the Spline Shaft from turning, restrain the drive pulley or apply a wrench to the wrench flats at the bottom of the Spindle Shaft.

8.1.5. There is a slinger ring between the hex flats and the top of the spline shaft. There is a #019 Buna O'ring seal at the joint between the slinger ring and spline shaft.

8.1.6. There is a flow restrictor inside the top of the spline shaft below the rotary union connection. This restrictor creates sufficient pressure at low flow to close the seal faces in the rotary union. Do not omit this restrictor.

8.1.7. To remove the drain tube from the union, press and hold the locking ring on the fitting toward the fitting, then pull the tube out of the fitting.

8.1.8. Remove the supply hose and barb fitting from the union. You must remove the union first from the shaft before removing the hose barb from the union to avoid putting strain on the bearings on the union shaft.

8.1.9. Brief leakage of water out the clear plastic drain tube connected to the side of the rotary union is normal when water flow to the spindle is started. When water is flowing with sufficient volume, water pressure causes carbide shaft seal faces in the union to come together to prevent drain leakage. When water is not flowing, the seal faces separate and allow the union to run at high speed without over-heating. This feature makes the union suitable for dry running without any water at all.

8.1.10. Avoid very low water flow to the spindle that will not close the seal faces. At such a low volume the drain will leak continuously. This will damage the union.

8.1.11. The drain must be sloped to function as a gravity drain and it must not be blocked.

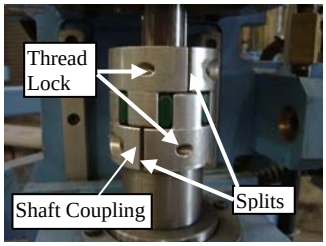
8.2. Belt Replacement

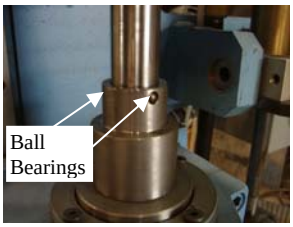
8.2.1. Follow the same steps for changing belt ratio except remove the fixed half of the front guard and lower the fixed half of the side guard to enable the belt to be completely removed.

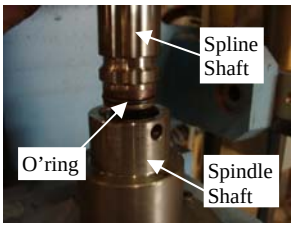
8.2.2. The new belt will need to be properly tensioned. The motor is mounted on a slide plate that is bolted to the machine arm. Loosen these bolts just enough to slide the plate. With the tension release lever down (normal operating position), move the mounting plate to achieve the correct belt tension, then retighten the slide bolts and recheck belt tension.

8.3. Spindle Shaft Coupling

8.3.1. Loosen both halves of the coupling and slowly slide the coupling up the spline shaft to reveal the ball bearings in the connecting collar of the spindle shaft.




8.3.2. Extract the bearings with a magnet or a bit of grease on the end of a screwdriver.

8.3.3. Pull the spline shaft out of the spindle shaft and raise it up high enough to remove/replace the shaft coupling.

8.3.4. Inspect the O'ring on the end of the spline shaft for damage and replace if necessary with #016 Buna O'ring. Grease the O'ring with Vaseline™. Insert the spline shaft into the spindle shaft with a slight twisting motion.

8.3.5. This is a precision balanced high speed coupling. If separating the halves, note and mark their orientation and be sure to replace them in the same relative position.

8.3.6. Apply thread lock compound to the clamping screws.

8.4. Spindle Cartridge

8.4.1. The spindle is built as a cartridge assembly for easy replacement. It is recommended that the spindle be returned to the factory for repairs. Bearings not installed by Sawing Systems are not guaranteed.

8.4.2. Slide the shaft coupling up the spline shaft and pull the spline shaft out of the spindle shaft. See Spindle Shaft Coupling.

8.4.3. Put a plank under the spindle or something else to prevent an accidental fall to the floor. Loosen the four socket head cap screws on the two spindle mounts to release the clamping pressure on the spindle housing. The housing should fall free. If not, twist and pull down to assist.

8.4.4. Should repair of the spindle be attempted, take a few precautions. The bearings are angular contact types. They can take high axial load in one direction and no more than 10 lbs of thrust in the other direction. If pressed too hard in the wrong direction, the races will separate and the bearing will be destroyed. A broken bearing must not be reassembled and reused. A dot on the end face of the inner race indicates the surface that can be pushed on while holding the outer race. Pay attention to bearing orientation according to the spindle assembly drawing. These precision high-speed bearings must undergo a break-in routine after installation. Increase spindle speed in 2000 RPM increments for 5 minutes each up to 10,000 RPM. Feel the temperature at each end of the housing. It may get warm but not hot (140° F) to the touch. If it gets hot stop and let the spindle cool and try again. If it gets hot again, incorrect assembly is suggested. Double check bearing orientation and shaft and shoulder surfaces to ensure bearings are running true. Check roundness of components and free-running clearances of the labyrinth seals.

8.5. Ball Spline Nut

8.5.1. Remove the water rotary union from the top of the spline shaft. See instructions for the Rotary Union. Remove the Slinger Ring and Top Bearing Cap. Remove the four mounting screws from the top face of the ball spline nut and pull the nut up out of the pulley shaft. Use caution when removing or installing the nut as the ball bearings can be easily dislodged from their races in the nut.

8.6. Pulley Bearings

8.6.1. NOTE: Sawing Systems will not guarantee the bearings in this head assembly that are not installed by Sawing Systems. It is recommended that the head be returned to the factory for replacement of the pulley bearings. See section 8.9 below. Should you elect to do this yourself, refer to Technical Service Bulletin TSB 05T10 included on the CD that came with the purchase of your machine.

8.6.2. Use caution when removing/installing/ handling angular contact type precision ball bearings. These are designed to take high axial load in one direction, but they have little load capacity in the opposite direction. If you push the races in the wrong direction, the races will separate and the bearing will be ruined and can't be reassembled. A dot on one end face of the inner race indicates the side of the inner race (and opposite face of the outer race) that can be pushed on.

8.6.3. Care and orientation are critical for installation of angular contact bearings. The faces of the inner race with the dots must be installed inward toward the pulley. To install the bearings, push evenly on the outer races (bearings can take thrust in this direction) to push the inner races onto the pulley shaft. The bearing should slide on if the shaft is not burred and the bearing is not cocked.

8.6.4. The pulley bearings require a break in procedure the same as for the spindle housing bearings. See Spindle Assembly.

8.7. Pulley Shaft and Pulley

8.7.1. In the unlikely event the pulley or shaft must be removed, first remove the rotary union, spline nut and top pulley bearing. Remove the four retaining screws that secure the top end face of the pulley shaft to the pulley. All but the earliest model machines have jack screw holes in the shaft face. Pull the shaft up and out of the pulley. The pulley can then be pulled out from between the two bearing housing blocks.

8.8. Spindle Slide Bearings

8.8.1. Put a plank and a stack of (4) 2x4s under the spindle shaft to support the weight of the spindle and slide plate assembly. Alternately, if you have adjustable saw horses, crank these up to bear the weigh of the assembly. Cover the wood or saw horses with a cloth.

8.8.2. Slide the shaft coupling up the spline shaft (See Shaft Coupling). Remove the upper spindle stop nut. Disconnect the rod end of the balance air cylinder. Caution: The spindle assembly will be free to fall once the rod end is disconnected.

8.8.3. Remove the 2x4s or lower the saw horses to lower the slide plate off of the linear rail race. Ease the blocks straight off the rail to prevent knocking the ball bearings out of the block races. Hold up the corners of the cloth to catch the balls should they come out.

8.8.4. Bearings can be popped back into the race if they are clean and undamaged. Races will have room for the equivalent of about one ball when full. To clean the runner blocks, push the balls out with a soft (copper) wire and flush the races and balls with kerosene. Blow out the races with air, reinstall the balls and re-lubricate with polyurea-base industrial grade light bearing grease.

8.8.5. Alignment of the runner blocks is critical for free movement. Mount the runner blocks but leave the screws loose. Remove the rail from the back plate or before mounting the new rail slide it through both blocks. Tighten the blocks with the rail in place. Remove the rail and mount it on the back plate.

8.8.6. The earliest models of the 5RP have dual linear rails. When re-installing the bearings or linear races on dual-slide machines, the sequence of tightening is important. Tighten the right race (the one up against a machined edge), then bearings on that race then the left bearings then the left race. Check that the slide plate moves freely and without binding then reinstall the spindle and other hardware.

8.8.7. Slide the slide plate and runner blocks onto the rail on the back plate. Reattach the rod end and reinstall the stop nut.

8.9. Spindle Head Removal

8.9.1. In lieu of making any of the repairs in sections 8.3-8.8, consider returning the entire spindle head to the factory for repair. Sawing Systems will not warrant the bearings in this head assembly that are not installed by Sawing Systems.

8.9.2. Required tools.

8.9.2.1.Wrench set, box/open sizes: 5/16" (optional), 7/16", 9/16", 3/4", 15/16"

8.9.2.2.Wire or twine (to hang machine handle)

8.9.2.3.Wrench, 1-1/4" adjustable (to hold spindle shaft)

8.9.2.4.¼" flat screwdriver (for hose clamps)

8.9.3. Open the long belt guard and remove the spindle guard. There are four ¼" cap screws with 7/16" hex head on most machines.

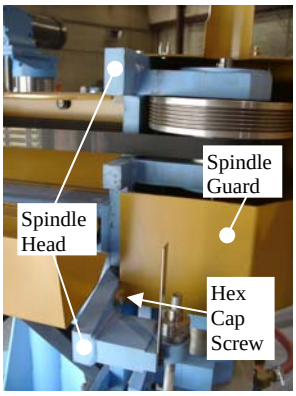
8.9.4. Remove rotary union from spline shaft. This is a left hand thread. Apply wrench to the hex flats below the union. Restrain the shaft from turning by holding a wrench to the wrench flats on the end of the spindle shaft. Do not apply a wrench to the spline shaft below the union.

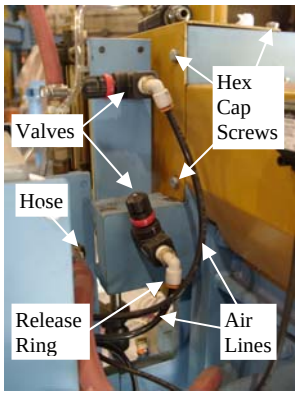
8.9.5. Release belt tension and remove the drive belt.

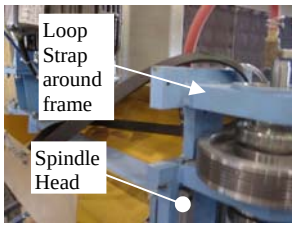
8.9.6. Remove the hose and drain tube from the rotary union.

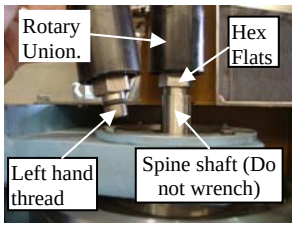
8.9.7. Remove the two plastic air lines from the two valves connected to the air balance cylinder. To release the tubing, press and hold the release ring then pull the tube.

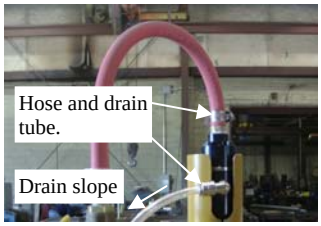
8.9.8. Remove the water hose from the water manifold at the back of the head.



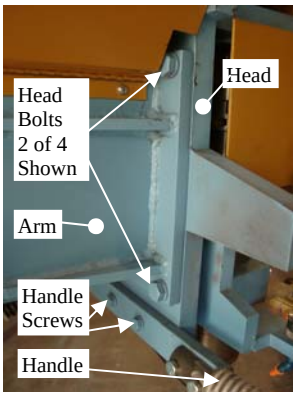

8.9.9. Remove the handle from the head and tie it from the arm of the front control panel so as to not put tension on the air line to the handle.

8.9.10. Loop a strap around the head where shown above. Lift up on the strap with a hoist or fork truck to hold the weight of the head (about 150 lbs).

8.9.11. Remove the four bolts that secure the head to the machine arm.

8.9.12. The head is keyed into the arm. Push or pry the head away from the arm off the key.

8.9.13. If returning the head to Sawing Systems for repair, wrap the head in plastic and set it back-side down onto a pallet or preferably pack it into a sturdy wood box for transport. Wrap and pack the rotary union so we can inspect it, but keep the guard, handle, valves and screws.




8.9.14. Reinstall components in reverse order.

8.9.15. If replacing bearings yourself, they must undergo a break-in procedure before they are run at high speed. Bearings installed at the factory are broken in at the factory before the head is returned.

8.9.16. If bearings run hot, it is recommended the head be returned to the factory for a thorough evaluation.

8.10. Back Post Bellows


8.10.1. For minor repairs to the bellows on the back post or raise lower screw, use (black) duct tape.

8.10.2. To replace the bellows, extensive disassembly is required by a capable mechanic. Refer to the assembly drawing in the operating manual (in CD format).

8.10.3. Lubricate the back post and screw every six months.

8.10.3.1. Clean the bellows with a water spray followed by compressed air.

8.10.3.2. Loosen the screw clamps at the top of each of the four bellows.

8.10.3.3. The cuffs of the bellows may stick to the connecting collars. Carefully peel the edge of the cuff away from the collar.

8.10.3.4. Pull the bellows down to expose the post tube and the raise/lower screw in four places.

8.10.3.5. Clean and inspect the tube for damage. Inspect the screw for wear.

8.10.3.6. Apply a fresh coat of polyurea-base industrial grease.

8.10.3.7. Reinstall the bellows.