Servo RS™ 1500 Series
Double Side Planetary Lapping & Polishing Machine

The P.R. Hoffman Servo RS™ 1500 Series double sided lapping and polishing machine can be adapted to finish many different materials. The planetary action simultaneously removes equal amounts of material from both sides of the pieces. Asymmetrical removal is easily programmed. The Servo RS™ 1500 planetary lapping and polishing machine can be modified to meet your processing requirements by the addition of a wide variety of optional accessories.

GENERAL DESCRIPTION

Weight: Machine weight: 2,090 pounds (950 Kg)(approx)
Shipping weight: 2,500 pounds (1,150 Kg)(approx)

Floor Space: Left to Right: 56" [142cm]
Front to Back: 37” [94cm]
Height: 86” [218cm] Shipping Height: 93” [236cm]

Plates: Outside Diameter 32 Tooth 13.8" [350mm] 15" [381mm] 14.8" [376mm]
50 Tooth 15" [381mm] 15" [381mm] 6.2" [157mm]
66 Tooth 14.8" [376mm] 6.2" [157mm] 4.3" [109mm]

Diameter Inside 2" [51mm] 3.1" [79mm] 3.1" [79mm]

Track Width: 2" [51mm] 3.1" [79mm] 4.3" [109mm]

Carriers: Carriers per Load (12) 32 Tooth (8) 50 Tooth (5) 66 Tooth
Maximum Part Circle 2.1" [53mm] 3.6" [91mm] 5" [127mm]
Minimum Thickness 001" [.03mm] .004" [.1mm] .005" [.13mm]

Standard Top Plate Drive: 1.0 HP (.75KW) D.C.
Electric Ring Gear Drive: 1.0 HP (.75KW) D.C.
Utility: Center Gear Drive: 1.0 HP (.75KW) D.C.
Utility: 208/230 VAC, 50 or 60 Hz, 3 Phase, 15 Amps
380 VAC, 50 or 60 Hz, 3 Phase, Consult Factory (Optional)
STANDARD FEATURES

The **Servo RS™** machines have a touch screen display for editing the 14 step recipes. The parameters that are controlled in each of the 14 steps include:

- **Automatic Speed Calculation**
- **Automatic Plate Flattening using High or Low Mode (Choice of one)**
- **Auto Cycle cycles High & Low Mode**
- **Stop Step starts Shutdown Sequence**
- **Ramp Step up to 3 minutes for both speed and load.**
- **Lap Steps, 999 minute each capability**
- **Slurry Flow (Auto On or Off)**
- **Flush Water (Auto On or Off)**
- **Top Plate RPM**
- **Ring Gear RPM (Auto or Manual)**
- **Center Gear RPM (Auto or Manual)**
- **Load (Downforce on Parts)**
- **Automatic Digital Gage Shutoff**
- **Digital "Crash Protection"**
- **Timed Cycles (All Steps)**

- Top Plate Speed, Center Gear Speed and Ring Gear Speed all have the ability to gently ramp to the desired RPM over a period as long as 3:00 minutes.
- For those customers who require an asymmetrical top to bottom removal ratio, the **Servo RS™** series is easily programmed for ratios as high as 50:1. This technology allows removal of material from one side of a substrate while minimally affecting the opposite side of the product.
- Automatic slurry feed system with a DC variable flow peristaltic pump and a DC variable speed propeller style mixer.
- Two hand controls for raising and lowering the top plate.
- Cast iron smooth lapping plates.
- Cast iron ring and center gears.
- Stainless steel top subplate with stainless steel hardware and PVC slurry trough.
Controls:
The machine operation is controlled through a single board computer. Unlimited recipes with 14 steps each can be stored on board, allowing processes for different products to be changed quickly. The controller governs all of the process operations. Ring sprocket, center sprocket, and top plate speeds and direction as well as acceleration and deceleration ramping are controlled functions. Speed changes can be coordinated to avoid abrupt changes and shock to the parts.

Top plate downforce is controlled by a servo driven ball screw. The servo is signaled by the computer, based on constant feedback from a load cell mounted on the top plate drive shaft. This allows extremely precise control of downforce on the parts. The lapping force range is from 15 to 275 pounds (6.8 to 125 Kg). Changes are made gradually through the servo motor. This same motor is used to raise and lower the top plate.

Abrasive slurry is fed through the top plate. A peristaltic pump, set to the desired flow rate, is switched on and off by the program.

The recipe is selected and the program is displayed and controlled on a touch screen supported by Windows®. During operation the touch screen presents information to the operator on the progress of the process such as recipe step, speeds and top plate weight. The programming is done through various edit icons displayed on the touch screen. The 3100, as delivered, is fully programmed for lapping and for plate conditioning. Additional programs, customized for your application, can be written and altered easily.

The top plate is raised and lowered with two hand push buttons. Normal, rapid and emergency stop push buttons are included.

Construction:
Our philosophy toward designing and building planetary lapping and polishing machines includes the use of heavy gauge materials. While rugged construction gives it a long life even in abusive environments, the primary purpose is to form a stable platform for producing flat parts.

The cross-section of the plate and subplate is extremely thick with respect to their diameter to prevent distortion from heat and force, in turn offering a flatter surface against which to lap or polish. Our stationary bottom plate presents a very stable stage for close alignment with the top plate, ring gear and center sprocket.

Stainless steel hardware, and polyurethane paint protects parts exposed to process fluids against corrosion and makes cleaning easier.
Drives:
Independent D.C. velocity servo brushless motors drive the three rotating elements through cycloidal speed reducers in order to achieve the level of programming and control needed for this application. These motors provide accurate digital speed feed-back to their individual controllers and to the control display panel. The torque output over the full speed range is far superior to that of a standard D.C. motor, and there is none of the slippage associated with variable speed clutches.

Automatic Plate Flatness Control:
Flatness of the top and bottom plates is controlled during the processing cycle by automatically changing the relative speeds of the ring and center sprockets. The plates are typically held flat within 0.0002".

Slurry System:
A peristaltic pump, operated through the programmable controller, feeds slurry to a distribution ring on the top plate. The mixer and propeller were chosen to protect shear sensitive suspension agents used in many slurries.

End of Cycle Flush:
A part rinse program can be designed into recipes. Water is sent to the top plate slurry distribution ring in place of slurry to begin rinsing abrasive from the parts. A hand held sprayer augments the automatic system, and can be used for cleaning the machine.

Retractable Ring Gear:
When processing is complete and the top plate raised, the ring sprocket may be lowered by 1-1/8", placing it below the level of the bottom plate. After first removing the carriers, small or fragile parts may be easily slid off the edge of the plate without damage.

Pad Punch:
For polishing applications, a plastic “backer plate” and “pad punch” are supplied. After pads are applied, the top plate is lowered onto the backer plate. The pad punch, inserted through the slurry holes, provides a clean, perfectly aligned slurry hole in the pad.

Carriers:
The 1500 can be configured for (5) 66 tooth, (8) 50 tooth, or (12) 32 tooth carriers.

Set-Up and Training:
All machines include set-up, operator training, and maintenance training. This is usually done over a one week period (including travel time). Continuing support is then provided by telephone, e-mail and fax.
OPTIONAL EQUIPMENT

Automatic Sizing Control:
The automatic sizing control system measures parts up to .065" thick. One piezo electric quartz crystal is loaded into the center of a workholder and processed along with the parts.

As the quartz is lapped, its resonant frequency increases and is monitored by an electrode inserted into the bottom plate. When the crystal resonates at the frequency preset on the ALC, the machine is stopped.

Digital Sizing Control:
The digital gauge sizing device approximates the thickness of the parts being processed by direct measurement of the distance between the plates. The digital gauge probe is mounted on the top lapping plate, and makes contact with a tungsten-carbide anvil mounted on the machine center shaft. By presetting the digital gauge sizing device at the instant the machine ramps up to speed (approximately 5 seconds), this device accounts for the slurry fluid boundary thickness and for plate wear.

The operator presets the amount of material to be removed and enters this quantity at the instant the machine reaches speed. The digital sizing device then shuts the machine off when this amount of material is removed. Typically, this device can be used to process parts to tolerances of +/-0.0002" [0.005mm] or better.

Part Out of Carrier and Crash Protection:
The Servo RS Series machines will automatically sense a "crash" and terminate the lapping or polishing cycle. If parts are improperly loaded into the carriers during machine loading, the machine will not start the lapping or polishing cycle and a caution message will be displayed.

This option is only available with the purchase of the Digital Sizing Control.

Special Lapping or Polishing Plates:
Lapping and polishing plates can be provided in a variety of materials and configurations to meet your processing requirements. Popular variations include radial or cross-hatched serrations, and stainless steel.
Serration Option on Cast Iron Plates:
Serrate standard cast iron plates when running large parts to reduce hydroplaning.

Stainless Steel Option on Polishing Plates:
Replace the standard cast iron plates when greater corrosion protection is required.

Stainless Steel Option on Ring and Center Gears:
Replace the standard cast iron gears when greater corrosion protection is required.

Lap Plate Cooling / Heating Option (Bottom Plate ONLY):
Special bottom subplate provides passages for re-circulating cooled or heated water. This aids in maintaining consistent processing temperature. Water is directed through a closed circuit flow to the non-rotating bottom plate.

Water Cooling / Heating System:
A self contained chiller / heater system can be provided for maintaining coolant temperature for water cooled / heated plates.

Flatness Gauge:
The lap plate flatness measuring gauge comes complete with a digital indicator and protective case. Regular checking of plate flatness with this gauge will allow determination of when resurfacing of the plates is needed before part flatness and parallel falls out of tolerance. Recommended with the first machine purchase.

Carriers (workholders):
Carriers are manufactured in spring steel, Lamitex™ (fiberglass), Lexan®, PVC, and phenolic. Workholes of any size and shape are available. Other materials are available.

Conditioning Gears:
A set of rigid dressing gears is used to remove irregularities on the surface of the lapping plates such as scratches or rust deposits, and to flatten the plates as necessary.
Brush Carriers for Polishing Pads:
Brush carriers with scrubbing bristles are used with a water flush to clean polishing pads loaded with polishing debris and spent slurry. If multiple polishing slurries are used, we recommend a separate set for each size polishing abrasive used. Can also be used to clean serrated, cast iron lap plates.

Freight:
Freight charges are collect, F.O.B. Factory in Carlisle, Pennsylvania.

Warranty:
All processing machines are warranted by Seller to be free from defects in materials and workmanship for a period of one year after the date of shipment by Seller. Seller's warranty of processing machines covers parts only, does not cover labor, and does not cover any machine which has been abused, misused or negligently operated or maintained. If Buyer notifies Seller in writing within ten days after discovery of a defect during the warranty period only, and if such defect appears in Seller's sole judgment to be a defect in material and workmanship attributable to Seller, Seller will make such repair or replacement to correct such defects as Seller in its sole judgment shall deem appropriate. The above warranties supersede all warranties of merchantability or fitness for a particular purpose. There are no warranties, express or implied, which extend beyond the warranties contained herein.

The foregoing remedy shall be Buyer's sole and exclusive remedy against Seller. Broken or faulty parts must be returned to P.R. Hoffman for inspection and new or repaired parts will be returned.