



SM-5000

Servo
Precision Sensitive Drill Press
&
Micro Milling/Drilling Machines
**OPERATING
AND
MAINTENANCE
INSTRUCTIONS**

SERVO PRODUCTS COMPANY

540 WEST WOODBURY ROAD, ALTADENA, CALIFORNIA 91001 • P.O. BOX B • TELEPHONE (213) 798-0515

SERVO SENSITIVE DRILL PRESS

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INTRODUCTION

Servo Products Company proudly offers the finest and most complete line of precision sensitive drill presses, micro-milling/drilling machines and accessories in the industry. Ideally suited to small hole drilling or milling in the range of .004" to 1/8"/.1mm to 3.2mm with a speed range from 200 to 20,000 rpm. Designed to match virtually any precision drilling or micro milling requirement, in all types of materials, such as steel, stainless steel, non-ferrous metals, plastic, printed circuit boards, graphite and diamond drilling in ceramics, sapphire and glass, all models feature:

- Sensitive Feel
- Less Drill Or End Mill Breakage
- Fewer Costly Scrapped Parts
- Ease Of Operation
- Reliability
- Built-in Work Light

1. Smooth, quiet operation is ensured since the tension of the belt is not reflected on the bearings in the spindle, but is taken by separate carrier ball bearings in the spindle drive assembly. The spindle is driven by a floating-splined, high-strength plastic mechanism. All rotating parts are precision balanced.

2. The quill is hardened and ground and the quill bore is hard anodized then lapped to exact size. The ground spindle rotates on precision sealed ball bearings.

3. The rack and pinion drive maintains a sensitive feel to the operator, because the rack is spring

loaded, thus maintaining continuous contact with the handle pinion driving gear, which eliminates backlash in the quill drive system. This allows the operator to feel the cutting forces on the drill or end mill.

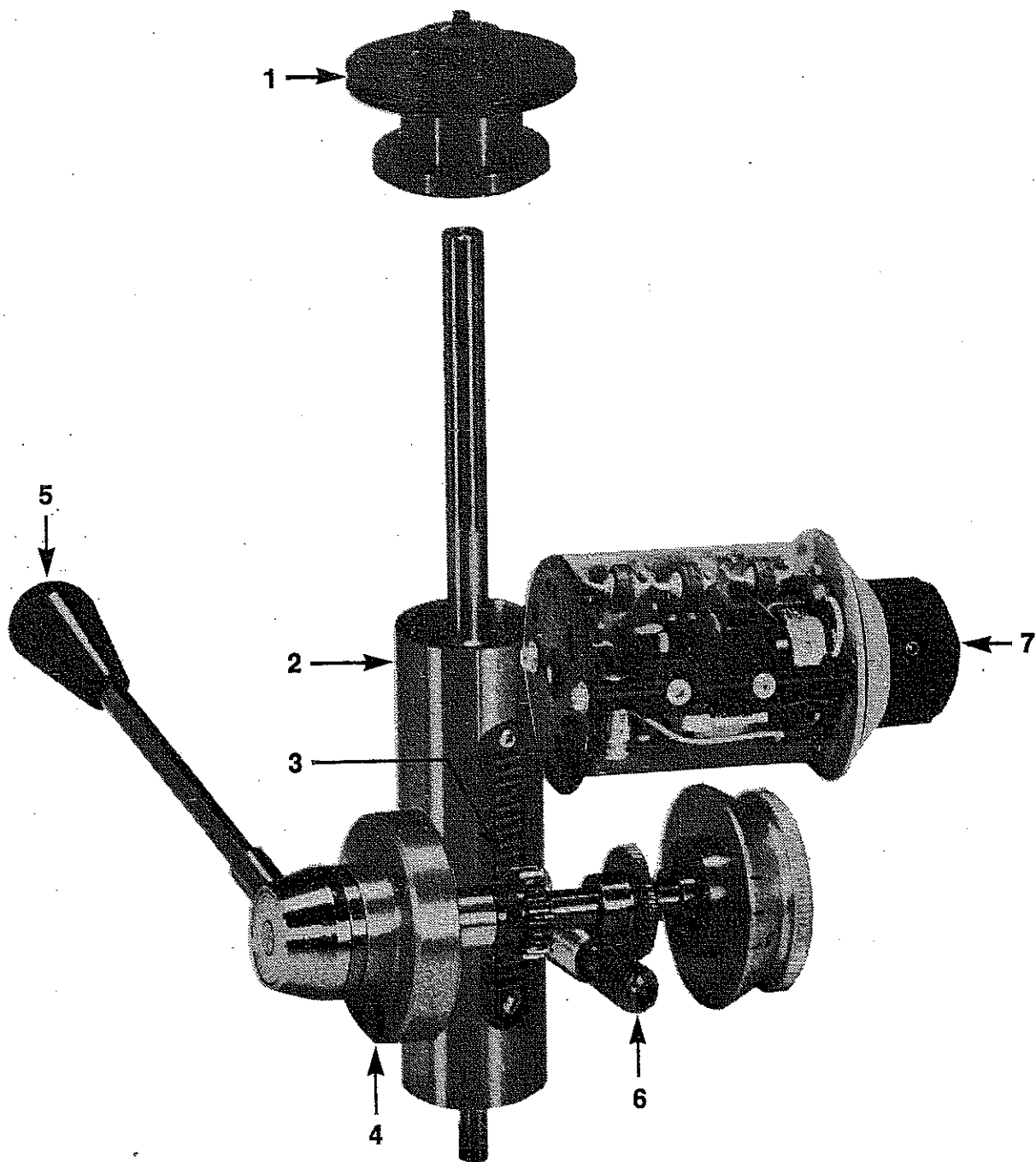
4. The weight of the quill is counterbalanced by a spring mechanism which automatically returns the quill to its up position. This mechanism can be adjusted to just counterbalance the quill so that it is "dead" throughout its travel. This is of particular value when using drill sizes below .015"/.38mm in diameter.

5. The quill lever is infinitely adjustable with respect to position for operator convenience.

6. The adjustable calibrated quill stop can be utilized as either a down stop or up stop. This allows the quill to be locked in a fully extended down or up position. This may also be used as a fine down feed drive at .1"/2.54mm per revolution or as a continuously adjustable down stop for controlled incremental pecking. This capability is very important in deep hole drilling.

7. A full wave thyristor direct current speed control is infinitely variable over two belt position ranges, 200 to 4000 and 1000 to 20,000 rpm. All machines are capable of speeds from 200 rpm down to approximately 10 rpm at reduced torque. Spindle speed easily adjusts to drill geometry, feed rate and material of the work piece.

See Photo On Next Page

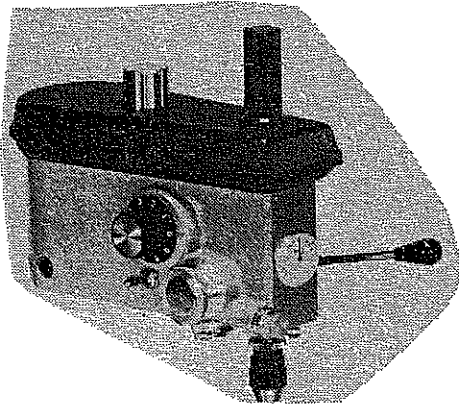


SAFETY INSTRUCTIONS

1. **GROUNDING INSTRUCTIONS.** This tool should be grounded while in use to protect the operator from electric shock. The tool is equipped with an approved three-conductor cord and a three-prong grounding type receptacle. The green conductor in the cord is the grounding wire. Never connect the green wire to a live terminal. An adapter is available for connecting plugs to two-prong receptacles. The green grounding wire extending from the adapter must be connected to a permanent ground such as to a properly grounded outlet box. Use only three-wire extension cords which have three-prong grounding type plugs and three-pole receptacles which accept the tool's plug. Replace or repair damaged or worn cord immediately.
2. **KEEP GUARDS IN PLACE** and in working order.
3. **REMOVE ADJUSTING KEYS AND WRENCHES.** Form habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
4. **KEEP WORK AREA CLEAN.** Cluttered areas and benches invite accidents.
5. **AVOID DANGEROUS ENVIRONMENT.** Don't use power tools in damp or wet locations. Keep work area well lit.
6. **KEEP CHILDREN AWAY.** All visitors should be kept safe distance from work area.
7. **MAKE WORKSHOP KID PROOF** with padlocks, master switches, or by removing starter keys.
8. **DON'T FORCE TOOL.** It will do the job better and safer at the rate for which it was designed.
9. **USE RIGHT TOOL.** Don't force tool or attachment to do a job it was not designed for.
10. **WEAR PROPER APPAREL.** No loose clothing or jewelry to get caught in moving parts. Rubber-soled footwear is recommended for best footing.
11. **USE SAFETY GLASSES.** Also use face or dust mask if cutting operation is dusty.
12. **SECURE WORK.** Use clamps or a vise to hold work when practical. It's safer than using your hand and it frees both hands to operate tool.
13. **DON'T OVERREACH.** Keep proper footing and balance at all times.
14. **MAINTAIN TOOLS WITH CARE.** Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.
15. **DISCONNECT TOOLS** before servicing when changing accessories such as blades, bits, cutters, etc.
16. **AVOID ACCIDENTAL STARTING.** Make sure switch is in OFF position before plugging in.
17. **USE RECOMMENDED ACCESSORIES.** Consult the owner's manual for recommended accessories. The use of improper accessories may cause hazards.
18. **WARNING - FOR YOUR OWN SAFETY, DON'T WEAR GLOVES** when operating a drill press.

DRILL PRESS HEAD DESCRIPTION

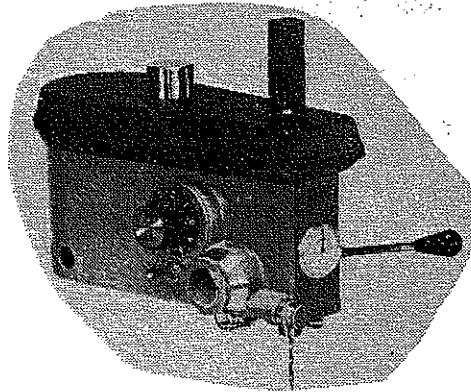
The Chuck Type Drill Press Head with depth gages and down stops is used in Models 7000-7010-7030-7040 and 7100-7110-7130-7140.



This versatile model is ideal for both laboratory and prototype applications, and for precision production work. An easily read, front-mounted dial indicator shows depth in either .001" or .05mm increments. This allows monitoring of the feed rate and makes "pecking" easy even for inexperienced operators.

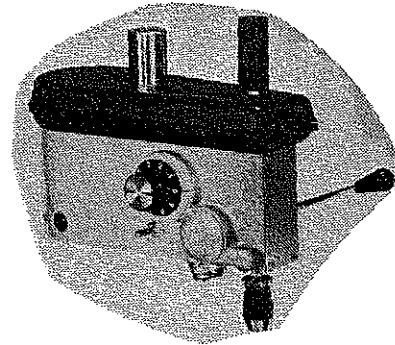
A precision down stop or up stop can be set by adjusting the knob on the front left side of the drill head. With a .001" or .05mm per division scale, the down stop is easily and accurately adjusted for depth, and does not apply side loading on the quill. It may also be used as a fine down feed drive at .1"/2.5mm per revolution or as a continuously adjustable down stop for controlled incremental pecking. The depth gages and down stop may be easily reset to zero at any point throughout the travel of the spindle.

The Collet Type Drill Press Head with depth gages and down stops is used in Models 7050-7060-7070-7150-7160 and 7170.



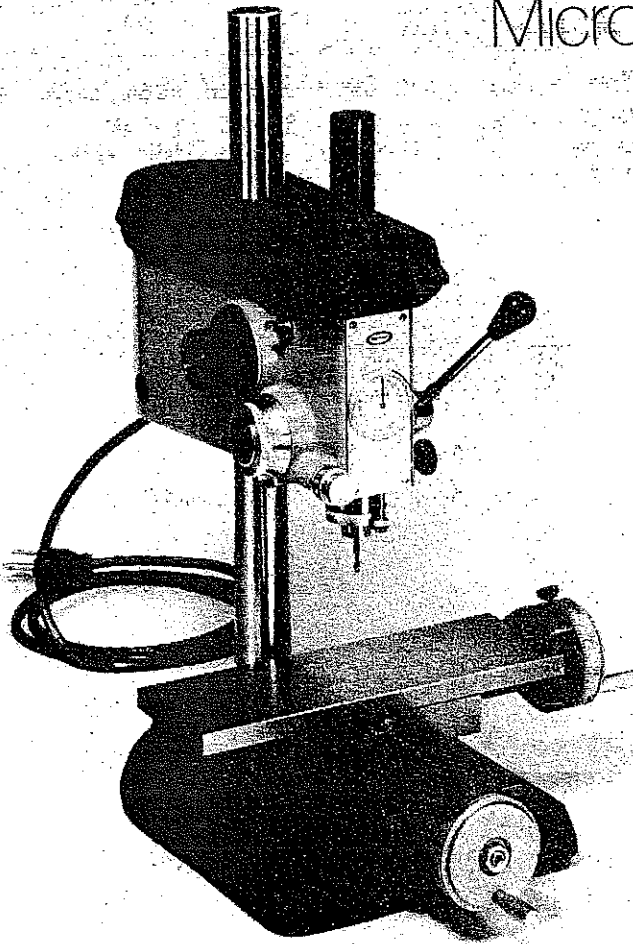
This unit is the same as Model 7000/7100 series but is equipped with a spindle which receives WW collets in place of a chuck.

The Chuck Type Drill Press Head less depth gages and down stops is used in the Model 7020.

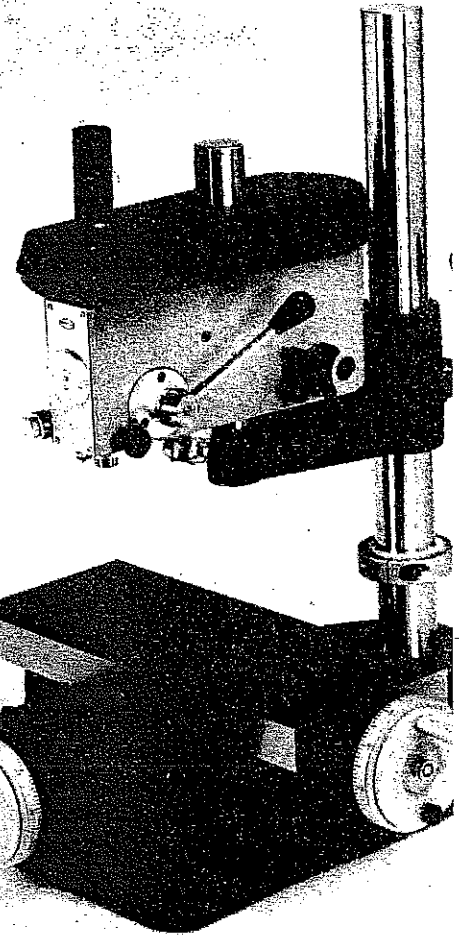


This unit is the same as Model 7000/7100 series with the exception of depth gages and down stops when these are not required such as in the through hole drilling of printed circuit boards.

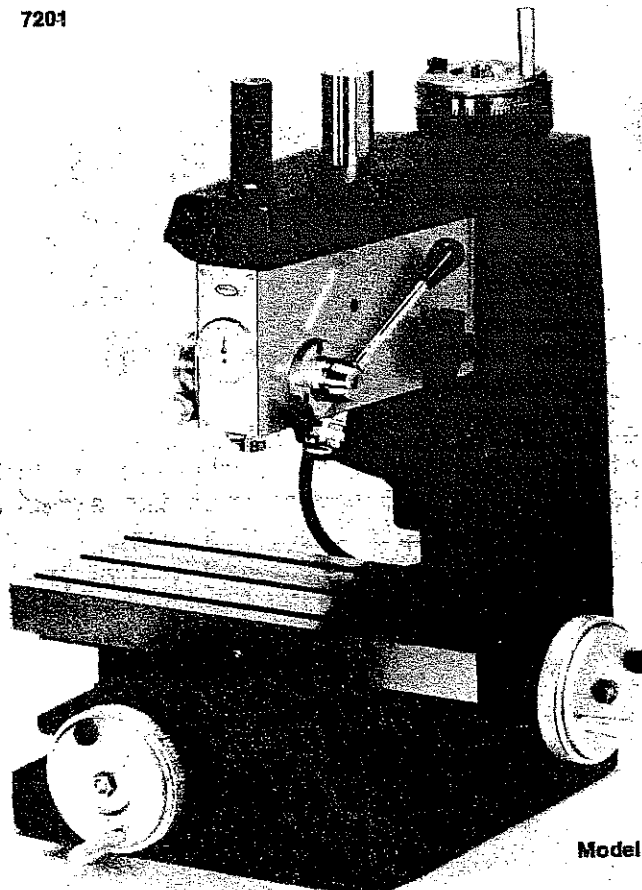
Micro-milling/drilling machines



Model 7200 | 7201



Model 7220 | 7221



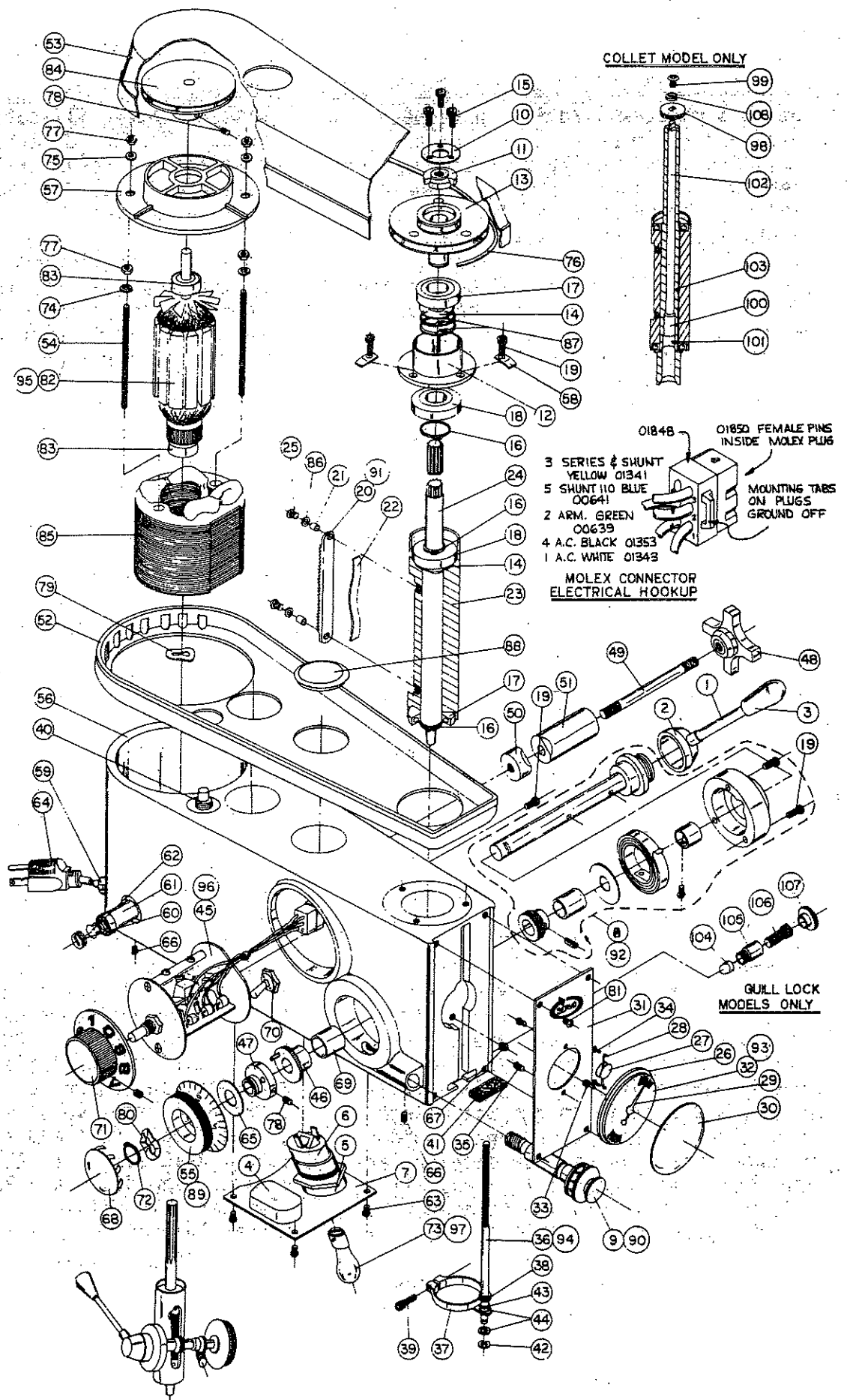
Model 7230 | 7231

Servo's micro-mill/drills have been designed for precision milling or drilling in virtually any ferrous, non-ferrous or plastic material. Their versatility makes them ideal for both prototype and research applications and for production work. Travel on Model 7200 table is 4"/101.6mm on the x axis and 2.5"/63.5mm on the y axis. Model 7220 is 6"/152.4mm on the x axis and 4"/101.6mm on the y axis. The throat depth of Model 7200 is 3.5"/88.9mm and the chuck-to-table height is 9"/228.6mm. For the Model 7220, the throat depth is 9.4"/238.8mm and the chuck-to-table height is 12.5"/317.5mm.

Both utilize a Servo collet type drill press head which has been modified including the addition of a quill lock. The quill lock enables the quill to be held in any position through its entire travel. Both operate over a wide range of speeds from 200 to 20,000 rpm. This high spindle speed not only allows the operation of conventional high speed steel end mills but also those of solid carbide. For precision routing operations in such highly abrasive materials as fiberglass and printed circuit boards, solid carbide routers can be utilized to their maximum advantage. The x-y tables are precision-ground on all surfaces, and employ set screw adjustment which provides full bearing contact, long life and greater accuracy. The gib is never overhung and therefore not subject to damage. The x and y axis dials are .1"/2.54mm per turn graduated in .001"/.0254mm steps. The dials are satin chrome with black graduations. Table locks are provided for each axis. While both machines are rated for a maximum drill or end mill cutter size of 1/8"/3.2mm in diameter, cutting tools up to 1/4"/6.35mm can be held by the WW collets for work in most non-ferrous metals and plastics. Both machines lend themselves for use

with miniature fly-cutters or boring heads. The speed versatility and precision of Servo milling machines make them ideal for the widest variety of uses.

From the first introduction of Servo precision micro milling machines, we have been asked to provide a model where one could raise and lower the milling head and retain accurate positioning. To satisfy this need the Model 7230/7231 is now available utilizing the same milling/drilling head as the Model 7220/7221. The XY slide compound that is used on the 7230/7231 is also the same as on the 7220/7221. For those operations where it is necessary to raise and lower the head and still retain accurate position of the head, the Model 7230/7231 has employed a slide system on the Z axis. The travel is 4"/101.6mm on the Z axis. The spindle head rotates 90° on each side of the vertical plane and has the ability of slight rotation on the Y plane for sweeping the spindle square to the table surface. The table on the Model 7230/7231 comes standard with three T-slots for attaching vises or a hold-down fixture of your choice, and gives you a working area of 12" x 5". The dovetail slides are precision machined and lapped to be square and parallel to within .001" per foot. The lead screws have preloaded bearings and provide accuracy of .0005" over the full travel of the table with maximum backlash of .001". This is obtained by the use of precision ground lead screws and a 1 3/4" long 1/2-10 acme nut SAE 660 bronze. The dials are 3.25" in diameter. The dials utilize an offset locking screw that locks the dial securely without shifting zero settings.



SERVO DRILL PRESS HEAD PARTS LIST

In order for the factory to ship the proper parts, the following information is required:

- A. Serial Number
- B. Model Number
- C. Voltage of Unit

<u>ITEM</u>	<u>QTY</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>115 Volt Models, 50/60 hertz</u>			
1	1	A-1075	Hand Lever
2	1	A-1077	Assembly-Hand Lever
3	1	00822	Knob
4	1	00816	Switch
5	1	A-1281	Bushing-Lamp
6	1	00815	Panel Light
7	1	00931	Bracket-Lamp
8	1	B-1069	Assembly-Cross Shaft
9	1	D-1061	Assembly-Down Stop
10	1	A-1841	Clamp Disc
11	1	A-1843	Drive Ring
12	1	A-1849	Pulley-Support Housing
13	1	B-2793	Spindle Pulley
14	2	A-3331	Washer-Wavy
15	3	01211	4-40 x 1/4 Soc. Hd. Cap Sc.
16	3	01207	Tru-Arc
17	2	01309	Bearing
18	2	01310	Bearing
19	7	00796	6-32 x 3/8 Soc. Hd. Cap Sc.
20	1	A-1067	Rack-Quill
21	2	A-1279	Bushing-Rack
22	1	A-1280	Spring-Rack
23	1	B-1847	Quill
24	1	B-1879	Spindle
25	2	01088	2-56 x 1/4 Phil. Pan Hd. Sc.
26	1	A-1354	Housing-Dial Indicator
27	1	A-1355	Roller-Dial Indicator
28	1	A-1356	Spring-Dial Indicator
29	1	A-3347	Minerva Hand
30	1	00859	Crystal
31	1	00934	Face Plate
32	1	00949	Dial
33	1	01019	Pinion
34	2	01333	U-Drive Screw
35	2	00863	4-40 x 1/8 Phil. Pan Hd. Sc.
36	1	A-1334	Rack
37	1	A-1838	Dial Indicator Clamp
38	1	A-1857	Zero-Knob
39	1	00609	4-40 x 1/4 Phil. Pan Hd. Sc.
40	1	01149	Circuit Breaker 1.8 Amp
41	1	01025	Seal-Felt
42	1	00739	Tru-Arc
43	1	01292	O-Ring

ITEM	QTY	PART NUMBER	DESCRIPTION
<u>115 Volt Models, 50/60 Hertz</u>			
44	2	00751	Fiber Washers
45	1	C-3414	Assembly-Circuit Board & Heat Sink
46	1	A-2808	Assembly Worm Gear
47	1	A-2809	Assembly Dial Bushing
48	1	A-2741	Knob
49	1	A-2740	Screw-Column Clamp
50	1	A-1057	Nut-Column Clamp
51	1	A-1056	Sleeve-Column Clamp
52	1	D-2796-1	Cover-Bottom
53	1	B-2798	Assembly-Cover-Top
54	2	A-1076	8-32 x 3 Screw
55	1	A-1080	Dial Cross Shaft
56	1	D-1858	Housing
57	1	A-3805	Motor End Bell
58	2	A-2977	Clip-Front
59	1	A-2978	Clip-Rear
60	2	00573	Brush Cap
61	2	01282	Brush Holder
62	2	01283	Assembly Brush
63	4	00609	4-40 x 1/4 Phil. Pan Hd. Sc.
64	1	00951	Beldon Line Cord
65	1	00936	Friction Gasket
66	3	00864	4-40 x 1/8 Soc. Set Sc.
67	1	00507	10-32 x 1/4 Soc. Set Sc.
68	1	00899	Snap Plug Button
69	1	01291	Bushing
70	1	00987	Toggle Switch
71	1	01409	Knob-Speed Control
72	1	00821	Tru-Arc
73	2	00817	G. E. Lamp
74	2	00520	#8 Split Washer
75	2	01118	#8 Lock Washer
76	1	01242	O-Ring-Drive Belt
77	4	01117	8-32 Hex Nut
78	2	01745	6-32 x 3/16 Soc. Set Sc.
79	1	00555	Washer-Wavy
80	1	00790	Washer-Wavy
81	4	00811	2-56 x 3/16 Phil. Pan Hd. Sc.
82	1	B-1155	Assembly Armature-(Includes Items 87 & 88)
83	2	00553	Bearing
84	1	B-2794	Pulley
85	1	B-349-2	Assembly-Field
86	2	01862	Steel Washers
87	2	01938	Truarc
88	1	00952	Cap Plug BPF-1 3/16

For Quill lock bushing models, collet models, 220 volt models, and metric models, see the next page.

<u>ITEM</u>	<u>QTY</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>Metric Models</u>			
89	1	A-1080-1	Dial Cross Shaft (Delete No. 55)
90	1	D-3498	Dial Down Stop Ass'y (Delete No. 9)
91	1	A-1067-1	Quill Rack (Delete No. 20)
92	1	B-3497	Quill Gear (Delete No. 8)
93	1	01498	Metric Dial (Delete No. 32)
94	1	A-1334-1	Rack (Delete No. 36)
<u>220 Volt Models</u>			
95	1	A-3342	Ass'y Armature (Delete No. 86)
96	1	C-3437	Ass'y Speed Control (Delete No. 45)
97	1	01556	G. E. Lamp (Delete No. 77)
<u>Collet Models</u>			
98	1	A-1878	Knob Draw Bar
99	1	01078	8-32 x 1/4 Button Head Socket Screw
100	1	A-2503	Sleeve Threaded
101	1	00744	.062 x .375-12 Groove Pin
108	1	00520	Split Lock Washer
<u>Quill Lock Bushing Models</u>			
104	1	A-3254	Shoe
105	1	B-2792	Quill Lock Bushing
106	1	01777	1/4-28 x 1/2 Socket Head Cap Screw
107	1	01481	Shear Lock Thumb Screw

SPECIFICATIONS	7000/7100		7020		7040/7140		7200/7201		7220/7221	
	7050/7150	7010/7110	7060/7160	7030/7130	7070/7170	7230/7231				
Capacity										
Chuck Models										
Quill Travel (Stroke)	.012"-.126"	.012"-.126"	.012"-.126"	.012"-.126"	.012"-.126"	.012"-.126"	.004"-.252"	.004"-.252"	.004"-.252"	.004"-.252"
Spindle Center to Column	3mm-3.2mm	3mm-3.2mm	3mm-3.2mm	3mm-3.2mm	3mm-3.2mm	3mm-3.2mm	.1mm-6.4mm	.1mm-6.4mm	.1mm-6.4mm	.1mm-6.4mm
	.004"-.252"	.004"-.252"	.004"-.252"	.004"-.252"	.004"-.252"	.004"-.252"	1.5"/38.1mm	1.5"/38.1mm	1.5"/38.1mm	1.5"/38.1mm
	.1mm-6.4mm	.1mm-6.4mm	.1mm-6.4mm	.1mm-6.4mm	.1mm-6.4mm	.1mm-6.4mm	3.5"/88.9mm	3.5"/88.9mm	3.5"/88.9mm	3.5"/88.9mm
	1.5"/38.1mm	1.5"/38.1mm	1.5"/38.1mm	1.5"/38.1mm	1.5"/38.1mm	1.5"/38.1mm	9.4"/238.8mm	9.4"/238.8mm	9.4"/238.8mm	9.4"/238.8mm
	3.5"/88.9mm	3.5"/88.9mm	3.5"/88.9mm	3.5"/88.9mm	3.5"/88.9mm	3.5"/88.9mm				
Chuck to Base or x-y table:										
Standard Column	6"/152.4mm	6"/152.4mm	6"/152.4mm	6"/152.4mm	6"/152.4mm	6"/152.4mm	9"/228.6mm	9"/228.6mm	12.5"/317.5mm	12.5"/317.5mm
Special Column										
(Models 7010, 7060, 7110 & 7160)	13"/330.2mm	13"/330.2mm	13"/330.2mm	13"/330.2mm	13"/330.2mm	13"/330.2mm				
Base working area										
Width	6.5"/165.1mm	6.5"/165.1mm	6.5"/165.1mm	6.5"/165.1mm	6.5"/165.1mm	6.5"/165.1mm	9.6"/243.8mm	9.6"/243.8mm		
Depth	6"/152.4mm	6"/152.4mm	6"/152.4mm	6"/152.4mm	6"/152.4mm	6"/152.4mm	12.75"/323.9mm	12.75"/323.9mm		
Milling/Drilling x-y table										
Table length (x axis)									12"/304.8mm	12"/304.8mm
Table width (x axis)									4"/101.6mm	4"/101.6mm
Longitudinal Travel (x axis)									6"/152.4mm	6"/152.4mm
Cross Travel (y axis)									4"/101.6mm	4"/101.6mm
Vertical Travel (z Axis 7230/7231 Only)									4"/101.6mm	4"/101.6mm
Dial Calibrations (x & y axis)									1"/Turn,.001 graduations	1"/Turn,.001 graduations

ACCURACY

Spindle run out	.0002"/.0051mm-TIR
Spindle square to base	.0005in/in-.005mm/cm

ELECTRICAL

Volts	115VAC or 230VAC
Hertz	50/60 Hertz
Watts	250 Watts

Operating Controls - Models 7000, 7100, 7020

On-Off Switch

This switch is located on the left side of the housing under the speed control knob.

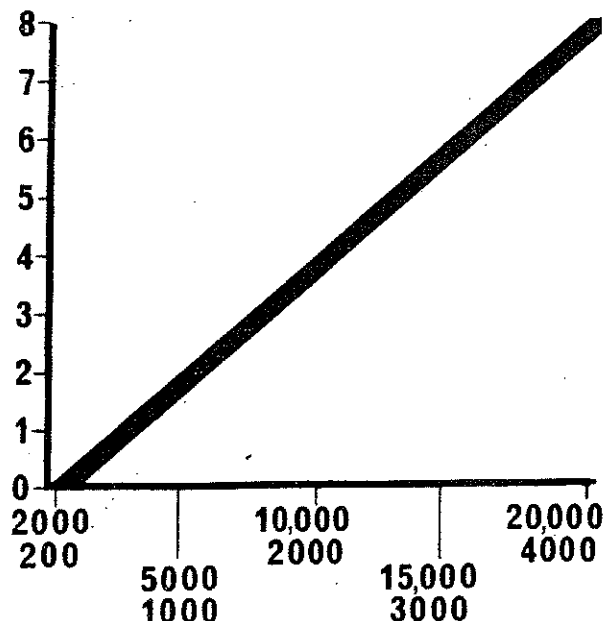
Light Switch

This switch is under the left mid-section near the light.

Variable Speed Control

The D.C. motor is controlled with a full wave thyristor control, giving variable speed from 200 to 20,000 rpm. Two belt ranges are provided, one 200 to 4000 rpm, the other 1000 to 20,000 rpm. To change belt ranges, lift off cover. The top pulley positions the 1000 to 20,000 rpm range.

A graduated knob provides reference marks for the operator. The approximate rpm calibration is graphed below:



Quill Lever

The quill lever can be adjusted to operate at any convenient angle. To adjust, turn the black knob counter-clockwise and move the lever to the desired position. Firmly tighten the knob in the clockwise direction.

Depth Gage

The dial on the front of the machine is calibrated in .001"/.05mm increments. It reads .200"/2.5mm per revolution. This dial can be zeroed by rotating the knurled wheel at the bottom of the front panel. Another dial located on the left side of the machine that turns with the quill lever is calibrated in .1"/5mm increments and is friction loaded so that it can be zeroed at any point throughout the travel of the quill. This dial serves as an accumulator to keep track of the turns made by the front dial indicator, (not on the Models 7020).

Depth Stop

A graduated knob to the left of the front panel sets the depth stop. This can be set anywhere over the 1.5" range of the quill movement. Each graduation is .001". Turning clockwise raises the quill. The graduated dial is friction loaded and can be turned to zero at any point (not on the Model 7402).

Height Adjustment

The column clamping knob is located on the right side of the machine. Grasp the drill press head and loosen the knob. Then adjust the height and the angular position

of the head as desired. CAUTION:
Do not loosen the clamping knob
without holding on to the head.

Chuck

The Albrecht chuck is a keyless precision chuck which is opened and closed by holding the top rim stationary and twisting the body in the appropriate direction. Some machines may be furnished with the Jacobs #0 key type chuck such as when the Model 709 drill tap control is provided. The chuck is mounted on a #0 Jacobs taper.

To remove the chuck, use two flat blade screw drivers. Lay cloth or cardboard under the chuck, and insert the two blades diametrically opposed between the shoulder of the spindle and the chuck and pry down.

To install the chuck, clean both tapers thoroughly. With the jaws completely retracted and using a thin piece of wood to protect the chuck nose, tap the chuck into place on the spindle. Check for run-out. If excessive, remove chuck and repeat procedure.

Installation

Plug into electrical supply. When operating voltage is not otherwise specified, 115V AC, 50/60 Hertz, is to be utilized. Do not cut off the grounding plug. This is installed for the protection of operation personnel and should not be removed.

Operating Controls - Models 7050 &
7150

Collet Spindle

The collets improve drilling accuracy by better centering the drill and allowing it to be held closer to the spindle bearing, eliminating the overhang of chuck type machines. This is particularly important in high speed, small hole drilling where small imbalances and large overhang can result in drilling difficulty. Type WW collets are available in a complete range of sizes from .004"-.252"/.1mm-6.4mm. A 1/8" / 3.2mm Albrecht chuck can be adapted to the Model 7401 spindle by utilizing an appropriate arbor for collet style WW to Jacobs No. 0 taper. See accessory Model 704 on Servo price list.

To install the WW collet in the spindle, remove the top cover. This will expose the drawbar knob (part no. 106 on the exploded view). Push the WW collet into the collet receptacle at the lower end of the spindle and rotate the collet until it locates in the index groove and tighten by turning drawbar knob clockwise. A boring head, WW type, may be used for fly cutting. It is most important to use the hole in the drawbar knob to secure the head properly. A small hole is put in the side of the drawbar knob to allow you to tighten and loosen the assembly by employing a small pin or a 1/8" Allen wrench.

To install the arbor (Servo Model 704) when using the Jacobs #0 chuck on these models, follow the same directions as if installing a WW collet.

No other controls change on this series of models.

MAINTENANCE

Lubrication

(a) Quill - as required.
For smooth operation, wipe quill clean with oily cloth or clean paper towel. Repeat as required, depending upon environment. If the quill becomes excessively dirty, cleaning may be accomplished by spraying with a light lubricant such as WD40.

Spare Parts

(a) Belt
The belt is our part #01242. A spare is included with the shipment.

(b) Brushes
The brushes are part #01283. They are accessible under the black caps provided at the rear of the machine.

CAUTION

Brushes are at line potential. Unplug the machine before changing the brushes.

Commutator

After brushes have been replaced twice, it may be necessary to turn the commutator. To remove the armature, take off the cover and belt and remove screws holding the motor end bell in place. Remove the brushes before removing the armature. Pull the motor assembly out and remove the armature. When turning the armature, use a very sharp tool to give the smoothest possible finish. Commutator must not run out more than .0005 TIR. The armature may need to be undercut after the armature has been turned. Slot width is .025". Be sure the brushes are not in place before reinstalling the armature. Install the brushes after the armature is in place.

Circuit Breaker

If the unit should suddenly refuse to run, check the circuit breaker. The circuit breaker is part number 40 on the exploded view. Wait for a few minutes before attempting to reset the circuit breaker to allow the circuit breaker to cool off.

Speed Control

If replacing the fuse does not fix the unit, repair or replacement of the speed control may be required.

(a) CAUTION: Do not remove or install the speed control without unplugging the drill press from the A.C. line.

(b) Remove the socket screw that is located on the middle right side of the machine.

(c) Pull the speed control out by grasping the speed control knob and pulling straight out. The speed control will hang by its wires. Do not disconnect any wires. The speed control can be removed from the unit by disconnecting the molex connector. Reinstall the new speed control in the reverse manner.

(d) When reinstalling the speed control, rotate so that the speed reference mark is closest to the front of the machine.

Light Bulb

The light bulb is a G.E. part 6S-6DC (Servo part #00817) for 120V units, and GE part number 10S-6DC (Servo part #01556) for 220V units. A red plastic tube is supplied with each drill press as an aid to bulb removal and installation. Push the red gripper over the bulb and turn

counterclockwise to loosen the bulb.

Note: When installing a new bulb, lightly file the contacts as they are too high as supplied by the manufacturer. Do not take off too much.

Warranty

All Servo Products Company products are warranted against defects in material and workmanship. This warranty applies for one year from the date of delivery to the customer. We will repair or replace at our own option products which prove to be defective during the warranty period, provided they are returned to Servo Products Company, freight prepaid. This guarantee does not include repair or replacement required because of misuses, abuse or normal wear and tear. Repairs made by other than the factory terminate Servo Products Company's liability under this guarantee.

This guarantee is made expressly in place of all other guarantees or warranties, expressed or implied, with respect to quality, merchantability, or fitness for a particular purpose.

Servo Products Company reserves the right to make changes without notice or obligation in specifications or models.

Repair Instructions

When a product requires service, it should be delivered, or carefully packed to prevent damage and mailed, prepaid, to Servo Products Company. Provide full information about the product and the difficulty you have experienced, including date you received the product. Clearly print your complete name and address on the package and on the letter of explanation packed with it.

TIPS ON SMALL HOLE DRILLING

The following information is provided solely for customer information in regards to small hole drilling. Servo Products can in no way assume any responsibility for damage.

General

The product line of precision sensitive drill presses and micro milling/drilling machines outlined in this instruction manual are suited for small hole drilling or milling in the range of .004" - 1/8"/.1mm-3.2mm. Cutting tools up to 1/4"/6.35mm can be held by the WW collet type of machines, Models 7050, 7150, and 7200 series. The size range from 1/8"-1/4"/3.2mm-6.35mm is for work only in most non-ferrous metals and plastics.

For purposes of this discussion, small hole drilling will be defined as covering the range from .004"-1/16"/.1mm-1.59mm.

One of the most important factors involved in small hole drilling is the ability of the cutting tool to accomplish "work" at a pre-determined rate. This ability is considerably reduced with small cutting tools over their larger counterparts due to the delicate nature of their construction and the problems encountered with uniform hand feeding rates. The percentage of "runout" relative to their diameter is an additional factor when using small cutting tools. As an example, if a .500"/12.7mm diameter cutting tool has a TIR* of 5%, this would amount to .025"/.64mm. This amount of runout would be readily noticeable to the operator. However, when the same percentage of TIR is applied to a

diameter of .005"/.127mm, this results in a runout of only .00025"/.00635mm which would not be readily observed by the operator. From the above comparison it is apparent that, while the amount of TIR is relatively small as an absolute amount for the .005"/.127mm diameter, it is just as damaging to the finished hole size and to potential drill breakage as the TIR is for the .500"/12.7mm diameter cutting tool.

The above comparison outlines the importance of maintaining the TIR to as low a percentage of the tool diameter as practical. This is the reason the collet system of chucking is preferred over the three-jaw chuck since the TIR for the collet system is approximately 1/5 to 1/3 the value of the three-jaw chuck.

Generally speaking, the TIR of the collet system will run within .0002"/.0051mm - .0003"/.0076mm. The TIR for the three-jaw chuck will run within .0005"/.027mm - .0015"/.0381mm.

Cutting Tool RPM

The rpm is most important when drilling small holes, particularly in the more exotic ferrous metals covering all of the high strength steels including stainless steel. The best rule to follow is to start at a low rpm such as 1,000 and gradually increase the speed as a "feel" is developed for the proper feed rate to maintain a continuous chip structure. When the drill starts to enter the work, it is extremely important that the feed pressure be maintained in a sufficient amount to immediately start cutting while at the same time not overloading the drill, which would cause breakage. This technique

*Total Indicated Runout

will prevent "work hardening" on the surface of the material to be drilled during the early entry stages of the drill point. A typical speed range for these materials would be between 1,000 and 5,000 rpm.

The rpm for non-ferrous metals can generally be increased approximately three times over the ones outlined above. Some materials such as hard brass, etc. would be required to start at a slower speed and slowly increase the rpm until the proper chip is produced.

The drilling of plastics and printed circuit boards can generally be accomplished in the higher ranges of speeds between 10,000 and 20,000 rpm.

When using diamond drills in hard materials such as glass, ceramics, sapphire, etc., rpm would be in the 2,000-5,000 region. It is most important that the diamond drill be permitted to cut the work without being forced and the rate of "pecking" be in the 1-3 second time interval.

FOCUS ON:

Precision Drill Presses Small Hole Drilling

What is small hole drilling? How small is small?
Why is drill runout important?
What else should I know about?

The Servo Products Company line of precision sensitive drill presses are suited for small hole drilling in the range of 0.004 inch (0.1 mm) to 1/8 inch (3.2 mm). Cutting tools up to 1/4 inch (6.35 mm) can be held by the WW collet type of machines. The size range from 1/8 inch (3.2 mm) to 1/4 inch (6.35 mm) is for work only in most non-ferrous metals and plastics. For purposes of this discussion, we will define small hole drilling as covering the range from 0.004 inch (0.1 mm) to 1/16 inch (1.59 mm).

One of the most important factors involved in small hole drilling is the ability of the cutting tool to accomplish "work" at a predetermined rate. This ability is considerably reduced with small cutting tools over their larger counterparts due to the delicate nature of their construction and the problems encountered with uniform hand feeding rates.

Drill Runout

An additional factor when using small cutting tools is the percentage of "runout" relative to their diameter. As an example, if a 0.500" (12.7 mm) diameter cutting tool has a Total Indicated Runout (TIR) of 5%, this would amount to 0.025 inch (0.64 mm). This amount of runout would be readily noticeable to the operator. However, when the same percentage of TIR is applied to a diameter of 0.005 inch (0.127 mm), this results in a runout of only 0.00025 inch (0.00635 mm) which would not be readily observed by the operator. From the above comparison, it is apparent that while the amount of TIR is relatively small as an absolute amount for the 0.005 inch (0.127 mm), it is just as damaging to the finished hole size and to potential drill breakage as the TIR is for the 0.500 inch (12.7 mm) diameter cutting tool.

The above comparison shows the importance of maintaining the TIR to as low a percentage of the tool diameter as practical. This is the reason the collet system of chucking is preferred over the three-jaw chuck since the TIR for the collet system is approximately 1/5 to 1/3 the value of the three-jaw chuck. Generally speaking, the TIR of the collet system will run within 0.0002 inch (0.0051 mm) to 0.0003 inch (0.0076 mm). The TIR for the three-jaw chuck will run within 0.0005 inch (0.027 mm) to 0.0015 inch (0.0381 mm). Additional factors to minimize tool runout include making the tool overhang (length projecting from collet or chuck) as short as possible, as well as using the shortest possible tool.

Cutting Tool Feeds and Speeds

The spindle's revolutions per minute (rpm) is important when drilling small holes. For the more exotic **ferrous metals** covering all of the high strength steels including stainless steel, the best rule to follow is to start at a low rpm such as 1,000 and gradually increase the speed as a "feel" is developed for the proper feed rate to maintain a continuous chip structure. When the drill starts to enter the work, it is extremely important to maintain the feed pressure in a sufficient amount to immediately start cutting while at the same time not overloading the drill, which would cause breakage. This technique will prevent "work hardening" on the surface of the material to be drilled during the early entry stages of the drill point. A typical speed range for these materials would be between 1,000 and 5,000 rpm. The rpm for **non-ferrous metals** can generally be increased approximately three times over the ones outlined above. Some materials such as hard brass, etc. would be required to start at a slower speed and slowly increase the rpm until the proper chip is produced. (Continued)

Focus On: Small Hole Drilling

Cutting Tool Feeds and Speeds (continued)

The drilling of plastics and printed circuit boards can generally be accomplished in the higher ranges of speeds between 10,000 and 20,000 rpm. When using diamond drills in hard materials such as glass, ceramics, and sapphire, for example, rpm's should be in the 2,000 to 5,000 region. It is most important that the diamond drill is permitted to cut the work without being forced and the rate of "pecking" is in the 1-3 second time interval.

Slower feed rates and higher drill speed can help minimize buckling and point walking, but if the material is abrasive and/or subject to work hardening, these conditions can increase tool wear and may cause breakage. Tune the spindle speed and feed rate to reduce harmonics, which can induce vibration and chatter. Also make sure the part is held rigidly.

Maximum depths in drilling small holes from 0.004" (0.10 mm) diameter range up to 20 or more times the diameter. Deep hole drilling of small holes generally requires slower speeds, and is usually accomplished by gradually increasing the hole diameter and depth, using the most rigid drills possible. Peck drilling (frequent tool withdrawal) is generally required to clear chips and prevent packing, and to apply lubricant.

Material Considerations

As the hole gets smaller, the material being drilled acts less homogeneous and less machinable. Materials with inclusions, microscopic voids, carbide or alloy segregates, and the grain structure itself can cause problems when using extremely small drills. The hole should start on a flat, unblemished surface perpendicular to the axis of the drill or at a pre-drilled center or pilot hole. When a drill's chisel edge first contacts the drilling surface, irregularities on that surface may immediately deflect the drill, causing it to break. Also, make sure that the surface was not work-hardened by a prior operation.

Drills

The type and quality of the drill bit itself is important. Center, pivot, spade, and straight shank drills are among the types used for small hole drilling. Small drills are designed to compensate for loss of rigidity. The webs or center sections of small diameter drills are thicker than those of larger drills because it is not practical to manufacture them with the same percentage of web. This increases the rigidity of the drills, but it also decreases the length of the cutting lips. Also, thicker webs at the points increase the end pressures required to force the drills into the workpieces. Tool materials include high-speed steels, cobalt (M42), carbide, and diamond. You may need to test various types to find the correct drill for your application. Center drills are the most rigid. Inspect the drills; even new tools are not necessarily made right, and even small variations in tool geometry, such as web thickness or off-center points, make the drilling process and tool life unpredictable. The annual "Buyers Guide" issue of *Cutting Tool Engineering* magazine lists manufacturers of miniature drills. (www.ctemag.com or 847-498-9100)

Cutting fluids

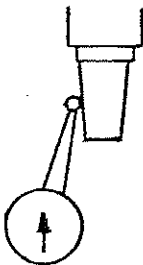
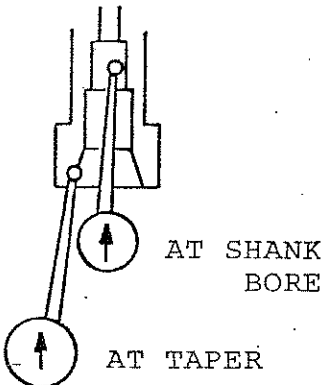
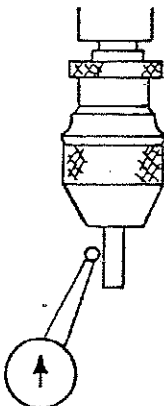
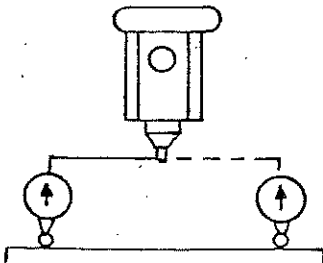
For wet cutting, the preferred cutting fluids are a water soluble coolant or thin oil. Heavier viscosity fluids, such as cutting oil, tend to work against chip evacuation on small diameter holes. They do, however, become necessary on materials that require more lubricity during the cut.

NOTE *This bulletin was compiled from a variety of industry sources and is provided solely for customer information in regards to small hole drilling guidelines. Servo Products Company can in no way assume any responsibility for damage.*

For Additional Information

Contact your Servo dealer or Servo Regional Sales Manager or
Servo Products Company Technical Support:
Phone: 800-521-7359 or 440-942-9999 or FAX 440-942-9100
Website: www.servoproductsco.com



MEASUREMENT	ILLUSTRATION	PERMISSIBLE ERROR	MEASURED ERROR
SPINDLE RUNOUT JACOBS "O" TAPER		.0002 TIR	
SPINDLE RUNOUT "WW" COLLET RECEIVER	 <p>AT SHANK BORE</p> <p>AT TAPER</p>	.0002 TIR .0002 TIR	
CHUCK RUNOUT		.003	
SQUARENESS OF SPINDLE TO BASE		.0005 IN/IN	

MODEL

SER. No.

INSPECTOR

DATE



SERVO DRILL PRESS HEAD PARTS LIST

(Models without work light)

Repair Cal-Metric
1 800-726-8438

Ordering instructions:

1. Serial number and model number must be specified on all parts orders.
2. Parts may be ordered as complete assembly or individually where listed.
3. For Quill Lock, Collet, and Metric Models, see following pages.

Item	Qty	Part #	Description
1	1	2770	Assembly - Power Cord
2	1	3886	Assembly - Hand Lever
3	1	1077	Assembly - Hand Lever Clamp Ring
4	1	1075	Shaft Hand Lever
5	1	00822	Knob
6	1	0349	Assembly - Field
7	1	1054	Assembly - Column Clamp
8	1	1057	Nut Column Clamp
9	1	05294	Knob, 4 Prong Black Phen.
10	1	1056	Sleeve Column Clamp
11	1	05295	1/4-20 x 3" Threaded Steel Stud
12	1	1155	Assembly - Armature
13	1	2794	Pulley
14	2	00553	Bearing
15	2	01745	6-32 x 3/16" Socket Set Screw
16	1	2798	Assembly - Cover
17	1	2808	Assembly - Worm Gear
18	1	2809	Assembly - Dial Bushing
19	1	1069-1	Assembly - Cross Shaft (inch)
20			No longer used.
21	1	1856	Assembly - Spindle Pulley
22	1	1849	Pulley Support Housing
23	1	2793	Spindle Pulley
24	2	3331	Washer Wave
25	1	01207	Retaining Ring
26	2	01938	Retaining Ring
27	1	05244	Bearing
28	1	05244	Bearing
29	1	2184-1	Assembly - Dial Indicator
30	1	2185-1	Assembly - Dial Indicator Rack
31	1	1061-1	Assembly - Down Stop
32	1	1874-1	Assembly - Quill Inch
33	2	1279	Bushing Rack
34	1	1280	Spring Rack
35	2	3331	Washer Wave
36	1	1879	Spindle
37	1	1067-2	Rack Quill
38	1	1847	Quill
39	2	05001	4-40 x 1/4 Phillips Pan Head Screw
40	2	04926	SS Flat Washer
41	2	01207	Retaining Ring
42	1	05244	Bearing
43	1	05244	Bearing
44	1	3414-1	Assembly - Circuit Board
45	2	05603	Stud - Field
46	1	1081	Gasket - Friction

Model: 7000

Serial: 10697

Date: 6/14/99

34.25

Item	Qty	Part #	Description
47	1	1841	Clamp - Disc
48	1	1843	Drive - Ring
49	2	2977	Clip - Cover
50	1	3805	Motor - End Bell
51	1	57925	Clamp - Dial Indicator
52	1	1080-2	Dial - Cross Shaft
53	1	1858-1,-2	Housing - Drill Press
54	1	3762-1	Cover - Bottom
55	4	00811	2-56 x 3/16 Phillips Pan Head Screw
56			No longer used.
57	1	05060	8-32 x 5/16 Long Socket Set Screw w/ Nylon Patch
58	6	00796	6-32 x 3/8 Socket Head Cap Screw
59	1	05063	6-32 x 3/16 Half Dog Pt. Socket Set Screw
60	1	00507	10-32 x 3/16 Half Dog Pt. Socket Set Screw
61	4	01117	8-32 Hex Nut
62	2	00520	#8 Split Lockwasher
63	2	01118	#8 Lockwasher
64	2	00555	Washer - Wave
65	1	00751	Washer - Fiber
66	1	00790	Washer - Wave
67	1	00739	Retaining Ring
68	1	00821	Retaining Ring
69	1	01864	Heyco Clip
70	1	01291	Bushing
71	1	1310	Seal Felt
72	1	00899	Cap Plug
73	1	00952	Cap Plug
74	1	01292	O-Ring
75	2	02800	Drive Belt
76	1	01409	Knob Speed Control
77	1	00987	Power Switch
78	1	01149	Circuit Breaker 1.8A
79			No longer used.
80	2	00573	Brush Cap
81	2	5744	Brush Holder
82	2	01283	Brush
83	1	01859	4/40 x 1/2 Socket Head Cap Screw
84	3	02481	4-40 x 3/8 Socket Head Cap Screw
85	1	00944	Chuck Albrecht Model 30, $\phi - 1/8$
QUILL LOCK (MILL HEAD)			"Germany"
86	1	3254	Shoe
87	1	2792	Quill Lock Bushing
88	1	01777	1/4-28 x 1/2 Socket Head Cap Screw
89	1	01481	Shear Lock Thumb Screw
COLLET			
90	1	1836-1	Assembly - Quill (Inch)
91	1	4829	Assembly - Spindle Collet with Groove Pin
92	1	57659	Draw Bar
93	1	57272	Knob - Draw Bar
94	1	57861	Screw - Draw Bar
95	1	05667	Washer - Conical

\$ 34.66

\$ 6.24

\$ 298.

on top "30-10" $\phi - 3$ ← actual model
 of chuck
 chuck mount: JO
 part number: 70020

\$ 334.

METRIC

Item	Qty	Part #	Description
96	1	1069-2	Assembly - Cross Shaft
97	1	2184-2	Assembly - Dial Indicator
98	1	2185-2	Assembly - Dial Indicator Rack
99	1	1061-2	Assembly - Down Stop
100	1	1874-2	Assembly - Quill
101	1	1067-3	Rack Quill
102	1	1080-3	Dial Cross Shaft

ITEMS OUT OF SEQUENCE DUE TO CHANGES

103	1	57997	Seal, Slinger, Chuck
104	2	01745	6-32 x 3/16 Lg Socket Set Screw
105	1	05586	6-32 x 3/8 Nylon Filister Head Screw
106	1	57629	Seal, Slinger, Collet
107	1	1844	Spindle, Collet
108	3	00803	Washer, shim

DRILL PRESS HEAD MODELS

Model Description

M-7400	ALBRECHT CHUCK SPINDLE, INCH VERISON
M-7401	WW COLLET SPINDLE, INCH VERSION
M-7402	ALBRECHT CHUCK SPINDLE, NO DIAL INDICATOR
M-7403	ALBRECHT CHUCK SPINDLE, METRIC VERSION
M-7404	WW COLLET SPINDLE, METRIC VERSION

MILLING/DRILLING HEAD MODELS (include quill lock)

M-7405	WW COLLET SPINDLE, INCH VERSION
M-7406	WW COLLET SPINDLE, METRIC VERSION

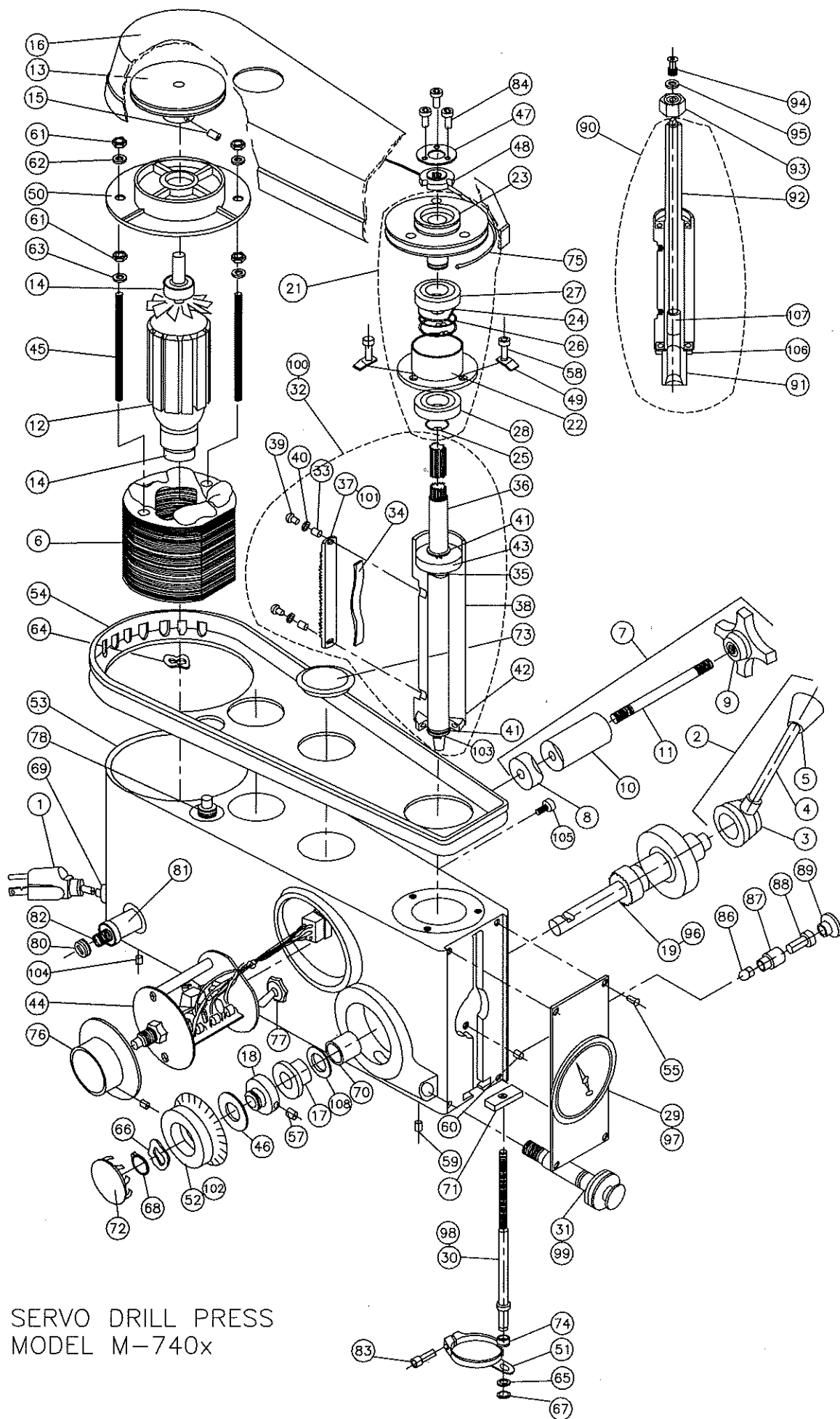
TOOLING

00944	ALBRECHT KEYLESS CHUCK (.012" TO .126" CAPACITY #30J0) (requires 01841 arbor when used with WW collet models)
01276	ALBRECHT KEYLESS CHUCK (.008" TO .065" CAPACITY #15J0) (requires 01841 arbor when used with WW collet models)
01275	JACOBS KEY CHUCK (0 TO 5/32 CAPACITY #0) (requires 01841 arbor when used with WW collet models)
01841	WW ARBOR TO JACOBS "0" TAPER
01250	TRANSFORMER (transform 220 volts to the required 115 volts)
various	WW COLLETS (89 sizes available from .0039"/.1 mm to .252"/6.4 mm))

CONTACT YOUR SERVO DEALER OR SERVO PRODUCTS COMPANY FOR COMPLETE PRICING, ACCESSORIES, AND OPTIONS.

SERVO PRODUCTS COMPANY

34940 Lakeland Blvd., Eastlake, OH 44095 USA
Phone: 800.521.7359 or 440.942.9999 Fax: 440.942.9100
Web: www.servoproductsco.com
Call for the location of our regional Service Centers.



SERVO DRILL PRESS
MODEL M-740x