



***SETCO™ Grinding Spindles  
and Accessories***

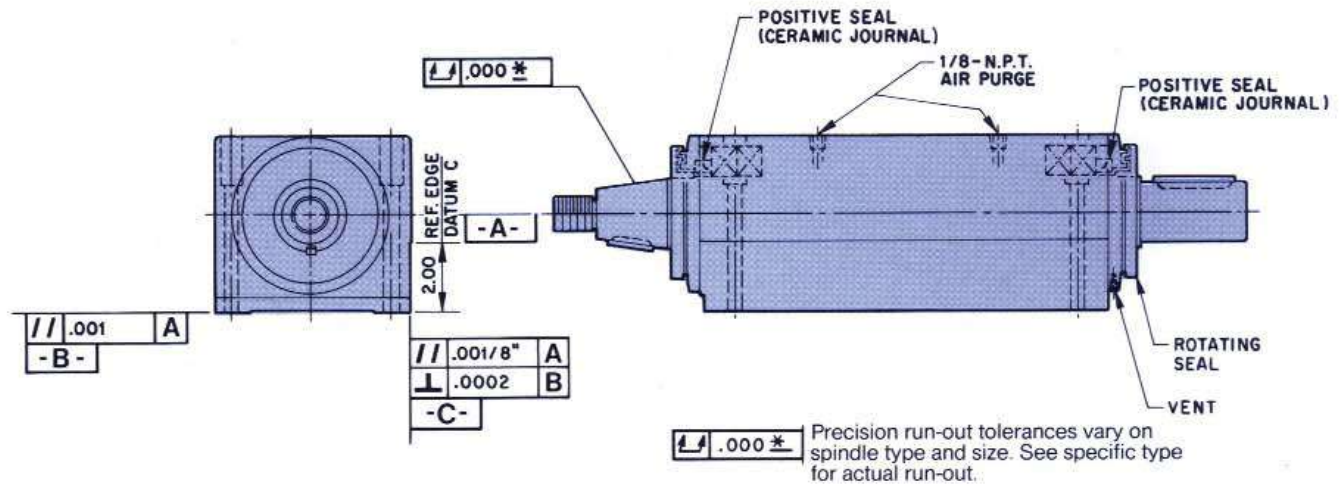
**SETCO™**



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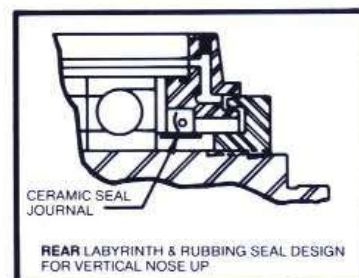
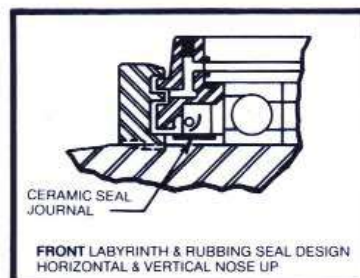
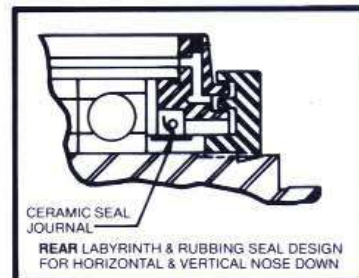
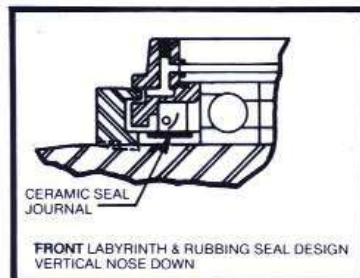
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# Standard Features



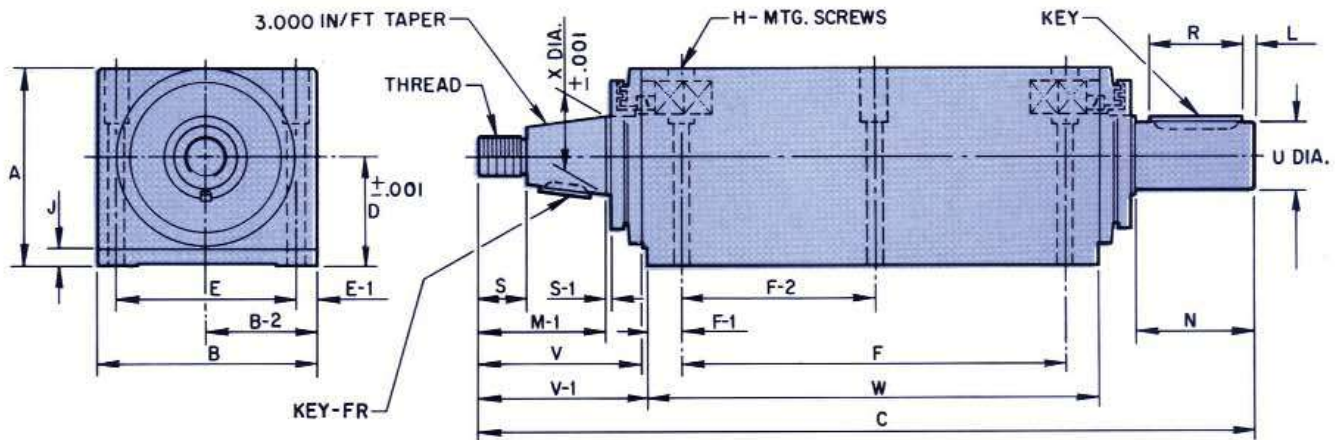
1. Spindle arranged for reversible rotation (optional on 4001G and 4002G Series Belt Driven).
2. Air purge, front and rear, 1/8-27 NPT inlets for 4200G, 4300G and 4400G Series with air purge front only on most other belt driven and most motorized spindles.
3. Positive rubbing seal with ceramic journal (front and rear) when S.F.P.M. permits.
4. Maze labyrinth seal (front and rear) where rubbing seals are not possible because of high seal journal velocity.
5. Enveloping shroud (front and rear) for maximum protection against contamination.
6. Bearings are permanently grease lubricated.
7. Vibrometer reading .000050 maximum.
8. Heavy duty anti-friction angular contact ABEC-7 extra precision ball bearings.
9. Right hand edge of base machined parallel with spindle centerline for reference.
10. Straight locating surface with square key is provided for drive pulleys.
11. One piece spindle arbor is heat treated and finish ground.
12. Heavy, rugged 40,000 P.S.I. tensil gray iron housing, stress relieved and properly normalized to minimize distortion.
13. Each spindle registered with SETCO's exclusive Gold Line TCT Certificate verifying tested performance.

## SETCO'S UNIQUE POSITIVE SEAL DESIGN





# How to Order



I Specify the (a) quantity of spindles required, (b) SETCO type number, (c) R.P.M. required at which spindle will be operated, (d) H.P. of drive motor, (e) spindle mounting position (horizontal, angular, vertical nose up or vertical nose down), (f) list any optional equipment or accessories, (g) any special dimensions required—specify by letter reference from drawing above (ref. page 19 for motorized).

II Let SETCO's Proposal Engineering Department select the spindle to meet with your exact application. It is very important that all pertinent information be submitted with your request; specifically (a) type of grinding operation to be performed (furnish sketch and/or part print), (b) diameter and length of surface to be ground, (c) diameter and type of wheel being used, (d) stock removed, (e) rough, semi-finish or finishing operation, (f) spindle R.P.M., (g) horsepower required by operation, (h) spindle mounting position (horizontal, angular, vertical nose up or vertical nose down), (i) type of drive, (j) space available for mounting spindle (width, center height, length and center distance between spindles).

III Quotations on special spindles—when no standard spindle shown in the catalog meets with your exact requirements, (a) include all the information required above for assisting SETCO's Proposal Engineers in the selection or (b) furnish a sketch illustrating your application or (c) reference a similar standard type with modification noting changes by letter designations for each change (use letter drawing above or page 19 for motorized).

IV When replacing any SETCO spindle assembly, (a) specify the serial number of the spindle to be replaced, (b) its style or type number, (c) spindle speed, (d) drawing number, etc. ... the new SETCO spindle styles are interchangeable with earlier models.

# Table of Wheel Speeds

WHEEL DIA. ∅ in.	WHEEL RATING—PERIPHERAL (SURFACE) SPEED S.F.P.M. (m/s)											
	4,000 (20.3)	4,500 (22.9)	5,000 (25.4)	5,500 (27.9)	6,000 (30.5)	6,500 (33)	7,000 (35.6)	7,500 (38.1)	8,000 (40.6)	8,500 (43.2)	9,000 (45.7)	9,500 (48.3)
	R.P.M.											
¼"	61,115	68,755	76,394	84,034	91,673	99,312	106,952	114,591	122,231	129,870	137,510	145,149
½"	30,558	34,377	38,197	42,017	45,836	49,656	53,476	57,296	61,115	64,935	68,755	72,574
¾"	20,372	22,918	25,465	28,011	30,558	33,104	35,651	38,197	40,744	43,290	45,836	48,383
1"	15,279	17,189	19,098	21,008	22,918	24,828	26,737	28,647	30,558	32,467	34,377	36,287
1¼"	12,223	13,751	15,279	16,807	18,335	19,862	21,390	22,918	24,446	25,974	27,502	29,030
1½"	10,186	11,459	12,732	14,006	15,279	16,552	17,825	19,099	20,372	21,645	22,918	24,191
1¾"	8,731	9,822	10,913	12,005	13,096	14,187	15,279	16,370	17,461	18,553	19,644	20,736
2"	7,639	8,594	9,549	10,504	11,459	12,414	13,368	14,328	15,278	16,238	17,188	18,143
2½"	6,111	6,875	7,639	8,403	9,167	9,931	10,695	11,459	12,223	12,987	13,751	14,515
3"	5,093	5,729	6,366	7,003	7,639	8,276	8,913	9,549	10,186	10,822	11,459	12,115
3½"	4,365	4,911	5,457	6,002	6,548	7,094	7,639	8,185	8,731	9,276	9,822	10,368
4"	3,820	4,297	4,775	5,252	5,729	6,207	6,685	7,162	7,640	8,116	8,595	9,072
4½"	3,395	3,820	4,244	4,668	5,093	5,517	5,942	6,366	6,791	7,215	7,639	8,064
5"	3,056	3,438	3,820	4,202	4,584	4,966	5,348	5,730	6,112	6,494	6,876	7,258
5½"	2,778	3,125	3,472	3,820	4,167	4,514	4,861	5,209	5,556	5,903	6,250	6,598
6"	2,546	2,865	3,183	3,501	3,820	4,138	4,456	4,775	5,092	5,411	5,729	6,048
7"	2,183	2,455	2,728	3,001	3,274	3,547	3,820	4,092	4,366	4,638	4,911	5,183
8"	1,910	2,148	2,387	2,626	2,865	3,103	3,342	3,580	3,820	4,058	4,297	4,535
9"	1,698	1,910	2,122	2,334	2,546	2,758	2,970	3,182	3,396	3,606	3,820	4,032
10"	1,528	1,719	1,910	2,101	2,292	2,483	2,674	2,865	3,056	3,247	3,438	3,629
12"	1,273	1,432	1,591	1,751	1,910	2,069	2,228	2,386	2,546	2,705	2,864	3,023
14"	1,091	1,228	1,364	1,500	1,637	1,773	1,910	2,046	2,181	2,319	2,455	2,592
16"	995	1,074	1,194	1,313	1,432	1,552	1,672	1,791	1,910	2,029	2,149	2,268
18"	849	955	1,061	1,167	1,273	1,379	1,485	1,591	1,698	1,803	1,910	2,016
20"	764	859	955	1,050	1,146	1,241	1,337	1,432	1,528	1,623	1,719	1,814
22"	694	781	868	955	1,042	1,128	1,215	1,302	1,388	1,476	1,562	1,649
24"	637	716	796	875	955	1,034	1,115	1,194	1,274	1,353	1,433	1,512
26"	588	661	734	808	881	955	1,028	1,101	1,176	1,248	1,322	1,395
28"	546	614	682	750	818	887	955	1,023	1,092	1,159	1,228	1,296
30"	509	573	637	700	764	828	891	955	1,018	1,082	1,146	1,210
32"	477	537	597	656	716	776	836	895	954	1,014	1,074	1,134
34"	449	505	562	618	674	730	786	843	898	955	1,011	1,067
36"	424	477	530	583	637	690	742	795	848	902	954	1,007
38"	402	452	503	553	603	653	704	754	804	854	904	955
40"	382	430	478	525	573	620	669	716	764	812	860	908
42"	366	409	454	500	545	591	636	682	732	775	818	863
44"	347	390	434	478	521	564	608	651	694	737	780	824
46"	333	375	416	458	500	541	582	624	666	708	750	791
48"	318	358	398	438	478	517	558	597	636	676	716	756
53"	288	324	360	395	432	468	503	539	576	612	648	683
60"	255	287	319	350	387	414	446	478	510	542	574	606
72"	212	239	265	291	318	345	371	398	424	451	477	504

**WARNING**—Never Exceed The Maximum Safe Operating Speed Of Any Grinding Wheel.  
CONSULT ANSI B7.1-1978 SAFETY CODE FOR USE, CARE AND PROTECTION OF ABRASIVE WHEELS.

# S/4300G SERIES —Grin

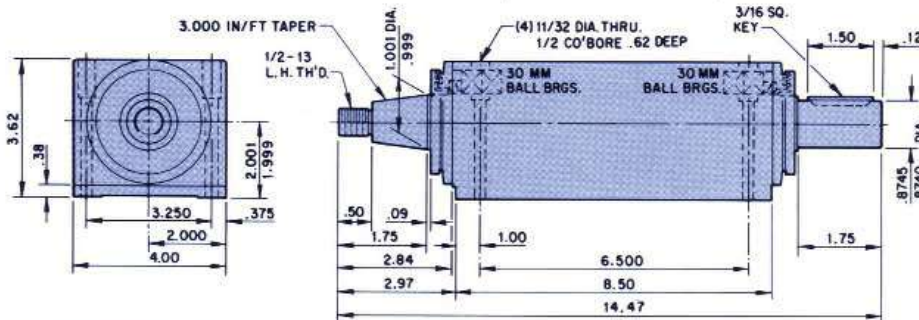
Photo #3993  
Foot Mount  
Design



The 4300G Series of Super Precision Grinding Spindles feature heavy duty construction both in internal design and bearing size to facilitate radial and axial thrust loads associated with grinding applications.

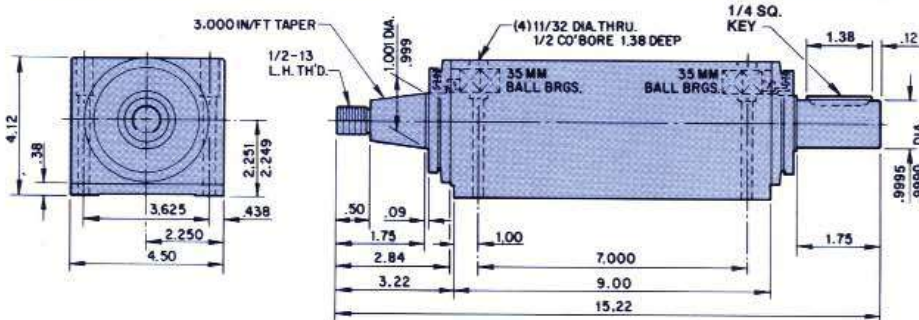
These spindles include air purge front and rear, reversible rotation (optional on Sizes 4301G & 4302G) and keyed straight shaft drive end (optional taper shaft). Alternate spindle housings are shown on page 9. Optional nose designs are illustrated on page 29.

Reference pages 3 & 4 for standard features and lettered dimensional drawing. Spindle accessories are located on pages 30 thru 34. These spindles are available in smaller and larger sizes than stated below. Spindles can be modified to meet with your exact requirements. Collar nut furnished as standard with spindle.



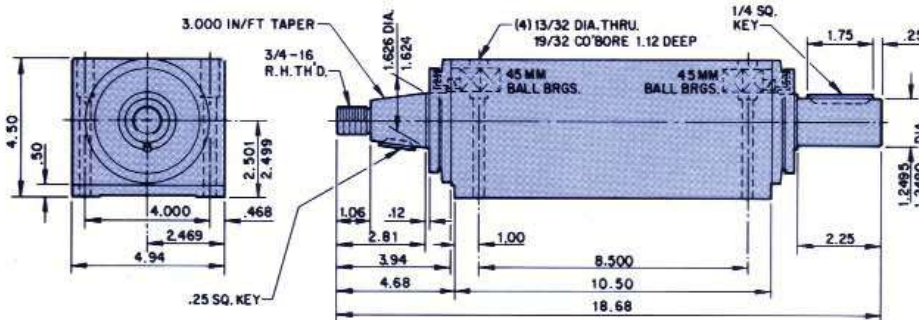
## 4301G

1. Recommended std. size wheel holders (ref. pg. 38):  
Type —1B 1.5B 2B 2.5B  
Max. Wheel Dia. —6" 6" 8" 12"  
Max. RPM for 6500 S.F.P.M. —4100 4100 3100 2100
2. Operating Speed—Grease Lubrication:  
4400 RPM max. with rubbing seals;  
15,000 RPM max. with labyrinth seals
3. Max. Torque Rating—50 in. lbs. 1/1250 H.P./Rev. (.008)
4. Run-out tolerances Taper  
.0002 T.I.R. max.
5. wk<sup>2</sup> of spindle=2 lbs. in.<sup>2</sup>
6. Weight Approx. 45 lbs.



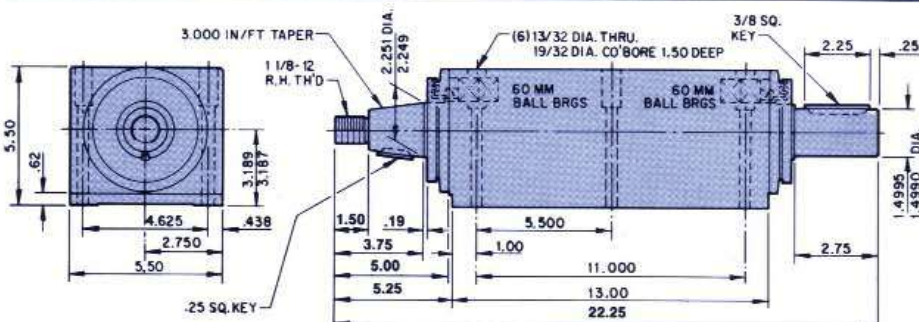
## 4302G

1. Recommended std. size wheel holders (ref. pg. 38):  
Type —1B 1.5B 2B 2.5B  
Max. Wheel Dia. —6" 6" 8" 12"  
Max. RPM for 6500 S.F.P.M. —4100 4100 3100 2100
2. Operating Speed—Grease Lubrication:  
3700 RPM max. with rubbing seals;  
13,000 RPM max. with labyrinth seals
3. Max. Torque Rating—60 in. lbs. 1/1000 H.P./Rev. (.001)
4. Run-out tolerances Taper  
.0002 T.I.R. max.
5. wk<sup>2</sup> of spindle=4 lbs. in.<sup>2</sup>
6. Weight Approx. 50 lbs.



## 4303G

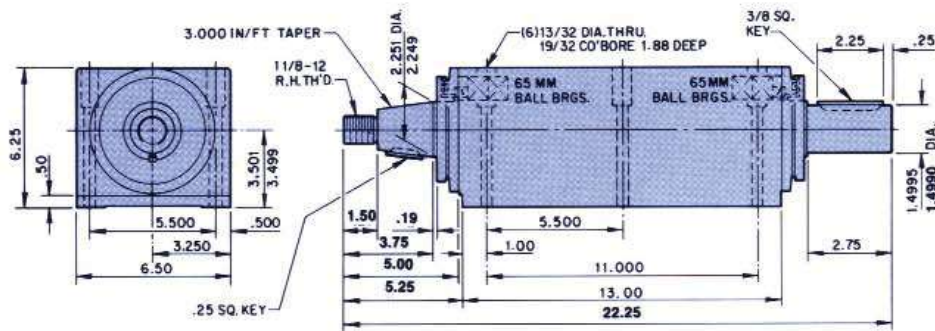
1. Recommended std. size wheel holders (ref. pg. 38):  
Type —4B 6A  
Max. Wheel Dia. —8" 14"  
Max. RPM for 6500 S.F.P.M. —3100 1750
2. Operating Speed—Grease Lubrication:  
3000 RPM max. with rubbing seals;  
10,800 RPM max. with labyrinth seals
3. Max. Torque Rating—70 in. lbs. 1/900 H.P./Rev. (.0011)
4. Run-out tolerances Taper  
.0002 T.I.R. max.
5. wk<sup>2</sup> of spindle=10 lbs. in.<sup>2</sup>
6. Weight Approx. 65 lbs.



## 4304G

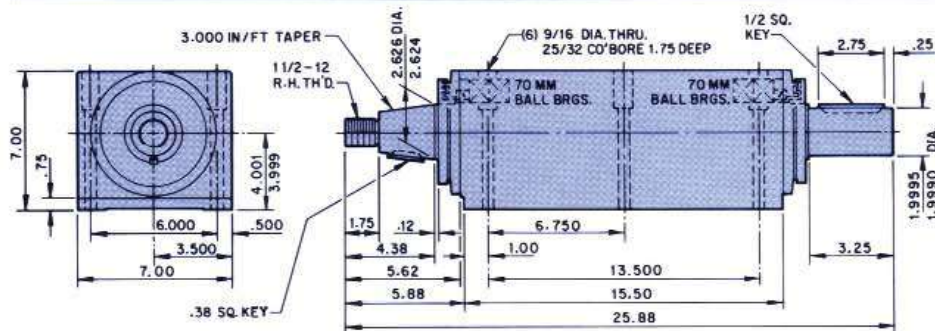
1. Recommended std. size wheel holders (ref. pg. 38):  
Type —5B 7A 8A  
Max. Wheel Dia. —14" 18" 22"  
Max. RPM for 6500 S.F.P.M. —1750 1375 1125
2. Operating Speed—Grease Lubrication:  
2200 RPM max. with rubbing seals;  
8300 RPM max. with labyrinth seals
3. Max. Torque Rating—500 in. lbs. 1/125 H.P./Rev. (.008)
4. Run-out tolerances Taper  
.0002 T.I.R. max.
5. wk<sup>2</sup> of spindle=29 lbs. in.<sup>2</sup>
6. Weight Approx. 110 lbs.

# ding Spindles



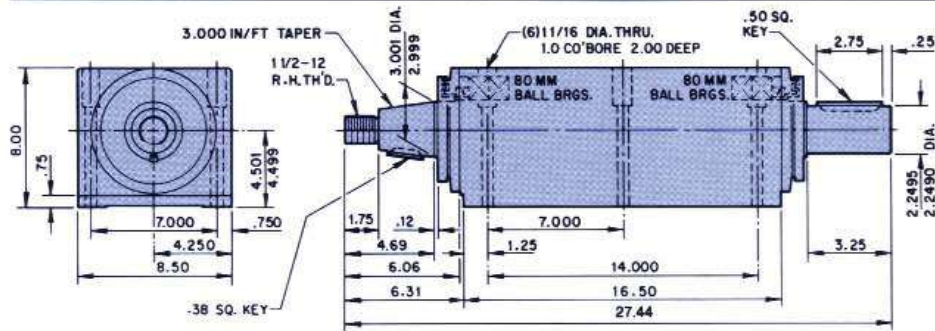
## 4305G

- Recommended std. size wheel holders (ref. pg. 38):  
Type — 5B 7A 8A  
Max. Wheel Dia. — 14" 18" 22"  
Max. RPM for 6500 S.F.P.M. — 1750 1375 1125
- Operating Speed — Grease Lubrication:  
2100 RPM max. with rubbing seals;  
7400 RPM max. with labyrinth seals
- Max. Torque Rating — 900 in. lbs. 1/70 H.P./Rev. (.014)
- Run-out tolerances Taper .0002 T.I.R. max.
- wk<sup>2</sup> of spindle = 39 lbs. in.<sup>2</sup>
- Weight Approx. 155 lbs.



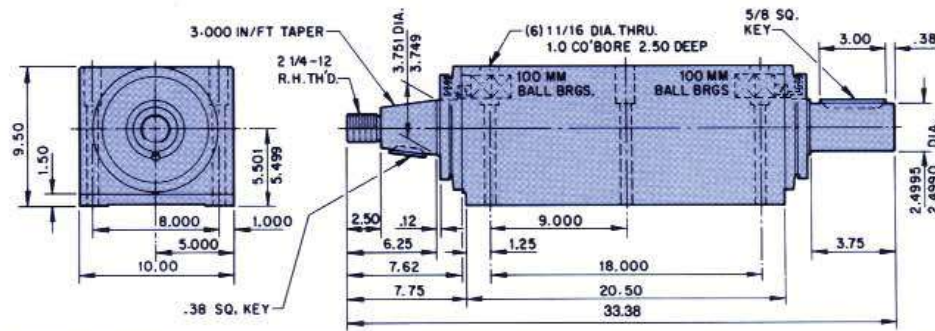
## 4307G

- Recommended std. size wheel holders (ref. pg. 38):  
Type — 17A 18A  
Max. Wheel Dia. — 18" 26"  
Max. RPM for 6500 S.F.P.M. — 1375 950
- Operating Speed — Grease Lubrication:  
1900 RPM max. with rubbing seals;  
6800 RPM max. with labyrinth seals
- Max. Torque Rating — 950 in. lbs. 1/60 H.P./Rev. (.0166)
- Run-out tolerances Taper .0002 T.I.R. max.
- wk<sup>2</sup> of spindle = 64 lbs. in.<sup>2</sup>
- Weight Approx. 210 lbs.



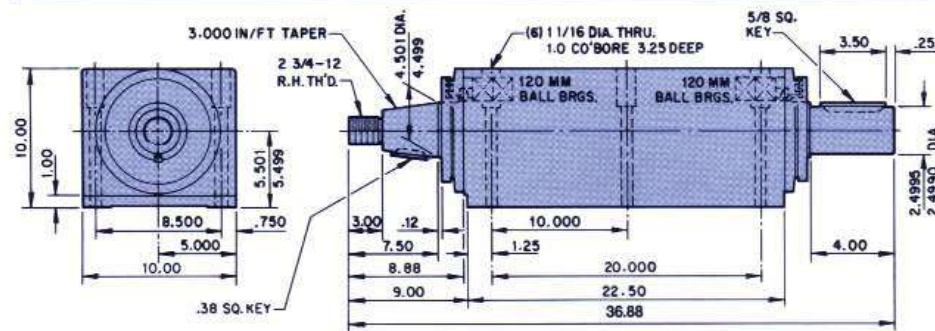
## 4308G

- Recommended std. size wheel holders (ref. pg. 38):  
Type — 11A 13A 14A  
Max. Wheel Dia. — 18" 22" 26"  
Max. RPM for 6500 S.F.P.M. — 1375 1125 950
- Operating Speed — Grease Lubrication:  
1700 RPM max. with rubbing seals;  
6000 RPM max. with labyrinth seals
- Max. Torque Rating — 1700 in. lbs. 1/40 H.P./Rev. (.025)
- Run-out tolerances Taper .0003 T.I.R. max.
- wk<sup>2</sup> of spindle = 134 lbs. in.<sup>2</sup>
- Weight Approx. 295 lbs.



## 4309G

- Recommended std. size wheel holders (ref. pg. 38):  
Type — 19A 20A  
Max. Wheel Dia. — 26" 42"  
Max. RPM for 6500 S.F.P.M. — 920 590
- Operating Speed — Grease Lubrication:  
1400 RPM max. with rubbing seals;  
4800 RPM max. with labyrinth seals
- Max. Torque Rating — 3550 in. lbs. 1/20 H.P./Rev. (.05)
- Run-out tolerances Taper .0003 T.I.R. max.
- wk<sup>2</sup> of spindle = 294 lbs. in.<sup>2</sup>
- Weight Approx. 500 lbs.

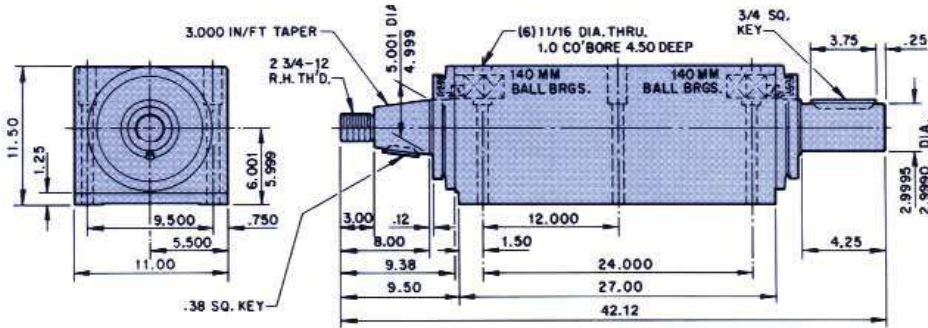


## 4310G

- Recommended std. size wheel holders (ref. pg. 38):  
Type — 21A 22A  
Max. Wheel Dia. — 30" 60"  
Max. RPM for 6500 S.F.P.M. — 825 420
- Operating Speed — Grease Lubrication:  
1200 RPM max. with rubbing seals;  
4500 RPM max. with labyrinth seals
- Max. Torque Rating — 6350 in. lbs. 1/10 H.P./Rev. (.10)
- Run-out tolerances Taper .0003 T.I.R. max.
- wk<sup>2</sup> of spindle = 728 lbs. in.<sup>2</sup>
- Weight Approx. 745 lbs.



# 4300G SERIES



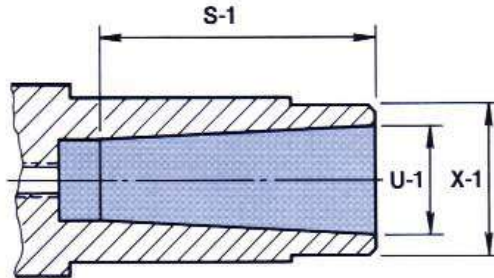
## 4311G

- Recommended std. size wheel holders (ref. pg. 38):  
 Type — 23A 24A  
 Max. Wheel Dia. — 42" 60"  
 Max. RPM for 6500 S.F.P.M. — 590 420
- Operating Speed — Grease Lubrication:  
 1000 RPM max. with rubbing seals;  
 3800 RPM max. with labyrinth seals
- Max. Torque Rating — 7950 in. lbs. 1/8 H.P./Rev. (.125)
- Run-out tolerances Taper .0003 T.I.R. max.
- Wk<sup>2</sup> of spindle = 1445 lbs. in.<sup>2</sup>
- Weight Approx. 1025 lbs.

## SELECTION OF INTERNAL TAPERS

This chart and the drawing show data on internal tapers. The chart lists the maximum arbor diameters for various bearing housing diameters such as the heavy duty grinding spindles on pages 6, 7 and 8. Shown are the maximum internal taper sizes allowable in these arbors. The arbor sizes shown with NMTB tapers are

not necessarily those of our standard 4300M Series of milling spindles. The 4300M Series have larger arbor diameters and bearings on the taper end. The chart also shows the maximum hole diameter for hollow shafts and Erickson/Universal maximum collet capacity.



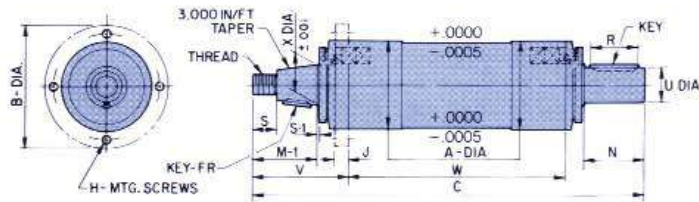
Spindle Bearing Bore	Spindle Arbor Dia.	JARNO			B & S			MORSE			NMTB			Hole Dia. Hollow Shaft	Maximum Capacity For Collet		
		X-1	No.	U-1	S-1	No.	U-1	S-1	No.	U-1	S-1	No.	U-1			S-1	
30 mm	1"					7	.7254	3.00	2	.700	2.69				1/2"	.013-.750	
35 mm	1 1/4"	6	.750	3.0		8	.8987	3.56	3	.938	3.75	20	.875	2.0	1/2"	.013-.750	
		7	.875	3.5													
40 mm	1 3/8"	8	1.000	4.0					3	.938	3.19				3/4"	.013-1.00	
45 mm	1 1/2"	9	1.125	4.5		9	1.0670	4.00							3/4"	.013-1.00	
50 mm	1 7/8"	10	1.250	5.0		10	1.2892	5.69	4	1.231	4.06	30	1.250	2.87	1"	.013-1.00	
		11	1.375	5.5													
60 mm	2 1/4"	12	1.500	6.0		11	1.5318	6.75	5	1.748	5.19	40	1.750	3.87	1 1/4"	.013-2.125	
		13	1.625	6.5													
		14	1.750	7.0		12	1.7968	7.12								1 1/4"	.093-2.125
70 mm	2 3/8"	15	1.875	7.5		13	2.0730	7.75									
		16	2.000	8.0													
		17	2.125	8.5													
80 mm	3"	18	2.250	9.0								50	2.750	5.50	1 1/2"	.093-2.125	
90 mm	3 1/4"	19	2.375	9.5		14	2.3440	8.25							1 1/2"		
100 mm	3 3/4"	20	2.500			15	2.6146	8.75	6	2.494	7.25				2"		
110 mm	4"					16	2.8584	9.25							2 1/4"		
						17	3.1562	9.75									
120 mm	4 1/2"					18	3.4271	10.25	7	3.270	10.0				2 1/2"		
140 mm	5"											60	4.250	8.62	3"		



# Alternate Spindle Housings

## 40/4100G SERIES

Cartridge and Flanged Cartridge Design

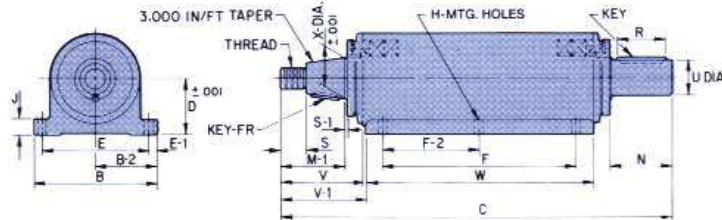


TYPE	A	B*	C	H	J	KEY	KEY-FR	M-1	N	R	S	S-1	THREAD	U	V	W	X
40/4101G	2.9990	4.25	14.47	1 1/32	.62	3/16 SQ.	OPT.	1.75	1.75	1.50	.50	.09	1/2-13	.875	3.46	8.0	1.000
40/4102G	3.4990	4.75	15.22	1 1/32	.62	1/4 SQ.	OPT.	1.75	1.75	1.38	.50	.09	1/2-13	1.000	3.46	8.75	1.000
40/4103G	3.9990	5.25	18.68	3/32	.62	1/4 SQ.	1/4 SQ.	2.81	2.25	1.75	1.06	.12	3/4-16	1.250	4.56	10.62	1.625
40/4104G	4.6240	6.62	20.62	1 1/8	.50	1/4 SQ.	1/4 SQ.	3.62	2.75	2.25	1.37	.19	1 1/8-12	1.125	5.37	11.25	2.250
40/4105G	5.4990	7.25	22.25	1 1/32	.75	3/8 SQ.	1/4 SQ.	3.75	2.75	2.25	1.50	.19	1 1/8-12	1.500	5.75	12.50	2.250
40/4107G	5.9990	7.75	25.88	3/16	.75	1/2 SQ.	3/8 SQ.	4.38	3.25	2.75	1.75	.12	1 1/2-12	2.000	6.37	15.00	2.625
40/4108G	6.9990	9.00	27.31	1 1/16	1.00	1/2 SQ.	3/8 SQ.	4.69	3.25	2.75	1.75	.12	1 1/2-12	2.250	7.06	15.75	3.000
40/4109G	7.9990	10.00	<b>27.44</b>	1 1/16	1.00	3/8 SQ.	3/8 SQ.	6.25	3.75	3.00	2.50	.12	2 1/4-12	2.500	8.62	19.62	3.750
40/4110G	8.9990	11.50	<b>33.38</b>	1 1/16	1.50	5/8 SQ.	3/8 SQ.	7.50	4.00	3.50	3.00	.12	2 3/4-12	2.500	10.38	21.12	4.500
40/4111G	9.9990	12.50	<b>36.88</b>	1 1/16	1.50	3/4 SQ.	3/8 SQ.	8.00	4.25	3.75	3.00	.12	2 3/4-12	3.000	10.88	25.62	5.000

Air purge front only on 4100G Series, no air purge on 4000G Series.  
\*Applicable to 4100G Series Only

## 4200G SERIES

Foot Mount Design

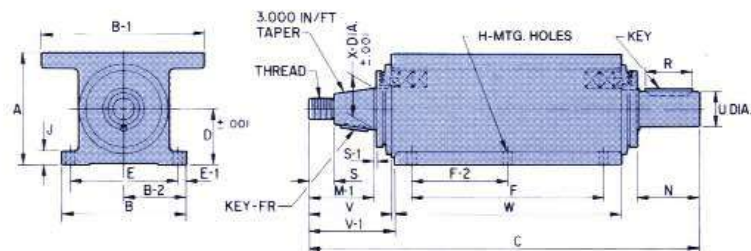


TYPE	B	B-2	C	D	E	E-1	F	F-2	H	J	KEY	KEY-FR	M-1	N	R	S	S-1	THREAD	U	V	V-1	W	X
4201G	6.50	3.250	14.47	2.000	5.250	.625	6.500		1 1/32	.75	3/16 SQ.	OPT.	1.75	1.75	1.50	.50	.09	1/2-13	.875	2.84	2.97	8.50	1.000
4202G	7.00	3.500	15.22	2.250	5.750	.625	7.000		1 1/32	.75	1/4 SQ.	OPT.	1.75	1.75	1.38	.50	.09	1/2-13	1.000	2.84	3.22	9.00	1.000
4203G	8.00	4.000	18.68	2.500	6.500	.750	8.500		1 3/32	.69	1/4 SQ.	1/4 SQ.	2.81	2.25	1.75	1.06	.12	3/4-16	1.250	3.94	4.68	10.50	1.625
4204G	8.50	4.250	22.25	3.188	7.000	.750	11.000	5.500	1 3/32	1.00	3/8 SQ.	1/4 SQ.	3.75	2.75	2.25	1.50	.19	1 1/8-12	1.500	5.00	5.25	13.00	2.250
4205G	8.50	4.250	22.25	3.500	7.500	.500	11.000	5.500	1 3/32	1.00	3/8 SQ.	1/4 SQ.	3.75	2.75	2.25	1.50	.19	1 1/8-12	1.500	5.00	5.25	13.00	2.250
4207G	9.00	4.500	25.88	4.000	7.500	.750	13.500	6.750	3/16	.88	1/2 SQ.	3/8 SQ.	4.38	3.25	2.75	1.75	.12	1 1/2-12	2.000	5.62	5.88	15.50	2.625
4208G	12.00	6.000	27.31	4.500	10.000	1.000	14.000	7.000	1 1/16	1.12	1/2 SQ.	3/8 SQ.	4.69	3.25	2.75	1.75	.12	1 1/2-12	2.250	6.06	6.31	16.50	3.000
4209G	14.00	7.000	<b>27.44</b>	5.500	12.000	1.000	18.000	9.000	1 1/16	1.25	5/8 SQ.	3/8 SQ.	6.25	3.75	3.00	2.50	.12	2 1/4-12	2.500	7.62	7.75	20.50	3.750
4210G	14.00	7.000	<b>33.38</b>	5.500	12.000	1.000	20.000	10.000	1 1/16	1.50	5/8 SQ.	3/8 SQ.	7.50	4.00	3.50	3.00	.12	2 3/4-12	2.500	8.88	9.00	22.50	4.500
4211G	14.00	7.000	<b>36.88</b>	6.000	12.000	1.000	24.000	12.000	1 1/16	1.50	3/4 SQ.	3/8 SQ.	8.00	4.25	3.75	3.00	.12	2 3/4-12	3.000	9.38	9.50	27.00	5.000

Air purge front and rear on 4200G Series.

## 4400G SERIES

'I' Type Design



TYPE	A	B	B-1	B-2	C	D	E	E-1	F	F-2	H	J	KEY	KEY-FR	M-1	N	R	S	S-1	THREAD	U	W	X
4401G	3.62	6.50	9.50	3.250	14.47	2.000	5.250	.625	6.500		1 1/32	.75	3/16 SQ.	OPT.	1.75	1.75	1.50	.50	.09	1/2-13	.875	8.50	1.000
4402G	4.12	7.00	9.50	3.500	15.22	2.250	5.750	.625	7.000		1 1/32	.75	1/4 SQ.	OPT.	1.75	1.75	1.38	.50	.09	1/2-13	1.000	9.00	1.000
4403G	4.50	8.00	10.00	4.000	18.68	2.500	6.500	.750	8.500		1 3/32	.69	1/4 SQ.	1/4 SQ.	2.81	2.25	1.75	1.06	.12	3/4-16	1.250	10.50	1.625
4404G	5.50	8.50	11.00	4.250	22.25	3.180	7.000	.750	11.000	5.500	1 3/32	1.00	3/8 SQ.	1/4 SQ.	3.75	2.75	2.25	1.50	.19	1 1/8-12	1.500	13.00	2.250
4405G	6.25	8.50	11.00	4.250	22.25	3.500	7.500	.500	11.000	5.500	1 3/32	1.00	3/8 SQ.	1/4 SQ.	3.75	2.75	2.25	1.50	.19	1 1/8-12	1.500	13.00	2.250
4407G	7.00	9.00	12.00	4.500	25.88	4.000	7.500	.750	13.500	6.750	3/16	1.00	1/2 SQ.	3/8 SQ.	4.38	3.25	2.75	1.75	.12	1 1/2-12	2.000	15.50	2.625
4408G	8.00	12.00	14.00	6.000	27.31	4.500	10.000	1.000	14.000	7.000	1 1/16	1.12	1/2 SQ.	3/8 SQ.	4.69	3.25	2.75	1.75	.12	1 1/2-12	2.250	16.50	3.000
4409G	9.50	14.00	16.00	7.000	<b>27.44</b>	5.500	12.000	1.000	18.000	9.000	1 1/16	1.25	5/8 SQ.	3/8 SQ.	6.25	3.75	3.00	2.50	.12	2 1/4-12	2.500	20.50	3.750
4410G	10.00	14.00	18.00	7.000	<b>33.38</b>	5.500	12.000	1.000	20.000	10.000	1 1/16	1.50	5/8 SQ.	3/8 SQ.	7.50	4.00	3.50	3.00	.12	2 3/4-12	2.500	22.50	4.500
4411G	11.50	14.00	18.00	7.000	<b>36.88</b>	6.000	12.000	1.000	24.000	12.000	1 1/16	1.50	3/4 SQ.	3/8 SQ.	8.00	4.25	3.75	3.00	.12	2 3/4-12	3.000	27.00	5.000

Air purge front and rear on 4400G Series.



# Application Photos



Photo #3843  
Special Type 4305GY Grinding Spindle designed for Waterbury Farrel.

Photo #3959  
Type 4204GY Foot Mounted Grinding Spindle with special Poly-V pulley and electroless nickel plated 6AY Balancing Wheel Holder.

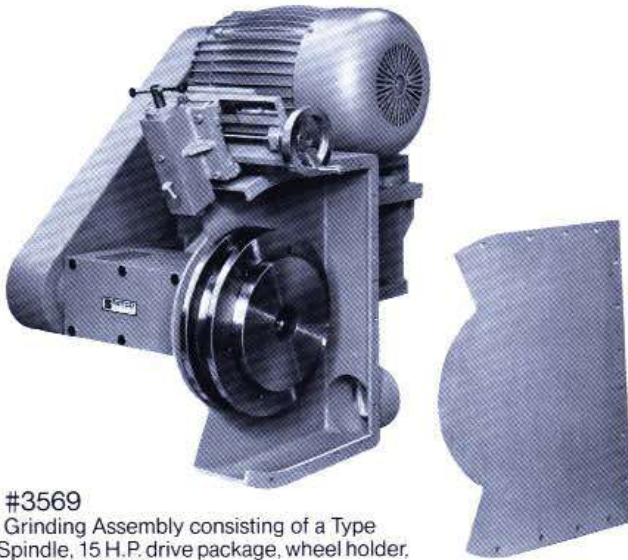


Photo #3569  
Special Grinding Assembly consisting of a Type 4305G Spindle, 15 H.P. drive package, wheel holder, guard and wheel dresser.



Photo #3938  
Standard Type 6101.5-36G Motorized Grinding Spindle arranged with a #7 Brown & Sharpe Internal Taper.

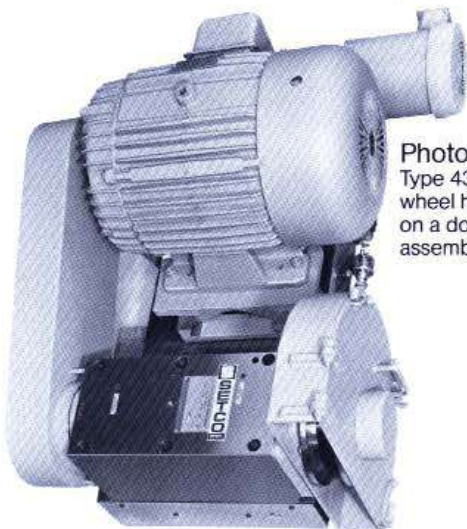


Photo #3875  
Type 4308G complete with 30 H.P. drive assembly, wheel holder and 16" wheel guard. Spindle mounted on a dovetail slide with single speed motor drive assembly.

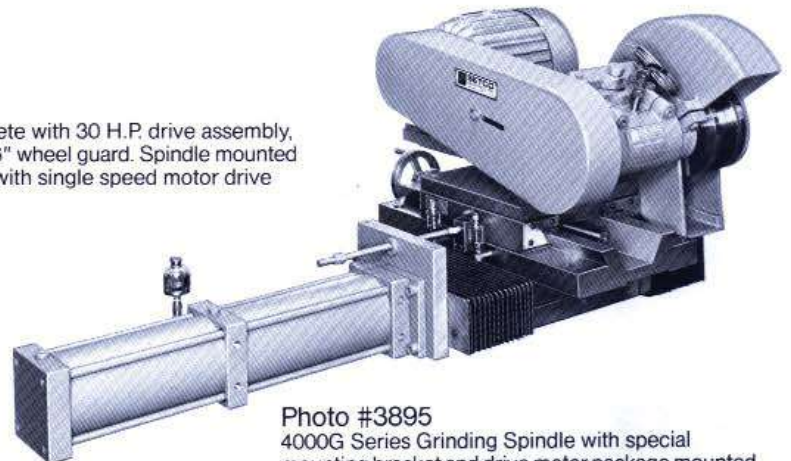


Photo #3895  
4000G Series Grinding Spindle with special mounting bracket and drive motor package mounted on a Type M55 Dovetail Slide with air/oil cylinder assembly.



Photo #3994  
Flanged cartridge style grinding spindle Type 4104G with wheel nut and arranged for reversible rotation.



Photo #3882  
Type 4104GY Flanged Cartridge Spindle with 7AY Balancing Wheel Holder and milled flange.



Photo #3254  
Type 4205GY Foot Mounted Grinding Spindle arranged for 5000 R.P.M. with oil mist lubrication and Type 7A Wheel Holder.



Photo #3157  
Special Grinding Assembly consisting of two 4405G 'I' Type Grinding Spindles with wheel holders mounted on a Type MN5FS-34-12/12-6-BDRLY dovetail slide.

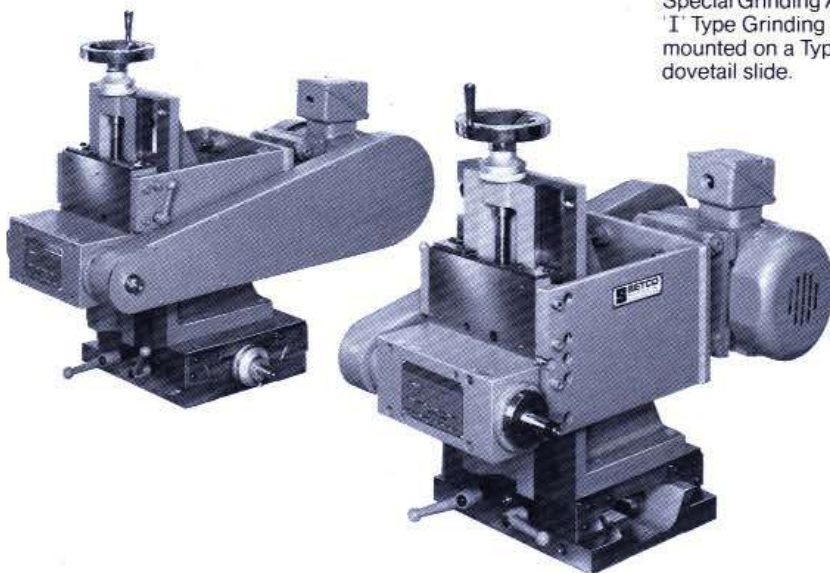


Photo #3931  
Special rise/fall spindle assembly with a Type 4301G Spindle and special bracket drive package mounted on M4 (10" wide) Dovetail Slide.



Photo #1708  
Designed for Harvill-Johnson Corporation this special Type 4001DRY Cartridge Style Spindle incorporates 5.5" O.D. center located wheel flanges.

# Internal 'Deep Hole'

Photo #3980

Photo #3942



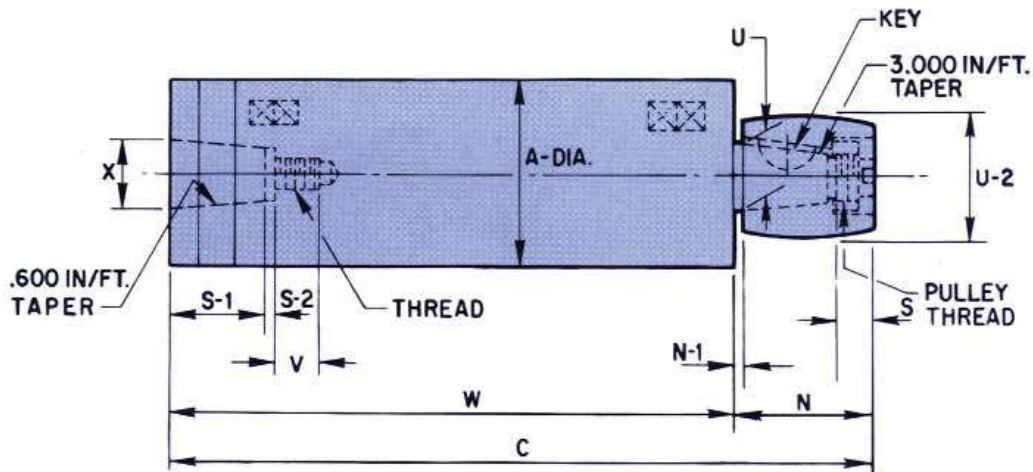
The Springfield and Campbell Super Precision Cartridge Style Spindle equivalents are designed for a wide range of 'deep hole' internal and external grinding applications. These cartridge style spindles have been designed to convert vertical turret lathes and boring mills, for grinding. All the cartridge style spindles in this section come equipped with flat belt or Poly-V J-Section Pulley Assembly and precision balanced wheel holder, except the Type 3100 Series which uses a variety of interchangeable quills (reference pages 32 and 33 for quills). Rotation as seen from wheel end is counter-clockwise (clock-wise or reversible rotation available; reversible rotation not available on 3100 Series).

As a general rule for internal grinding, the wheel diameter should be approximately two-thirds of the I.D being ground. Considering this factor, the diameter of the extension should be as large as possible and the length of the extension should be at a minimum for maximum rigidity and accuracy. For best grinding results, the length of the spindle extension should not exceed five (5) times its diameter. In the event that the 5:1 ratio is exceeded, we recommend the use of highly rigid materials such as carbide or molybdenum alloy for the arbor or housing assembly.

All spindles are of a heavy duty construction with bearings permanently grease packed for life. These spindles are designed to mount directly in the existing machine or in standard mounting brackets as shown on page 31. Spindles can be modified to meet with your exact requirements.

## Springfield Cartridge Spindle Equivalent

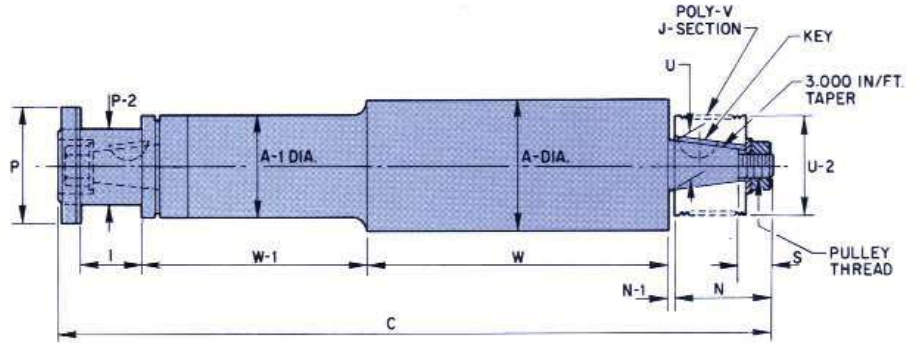
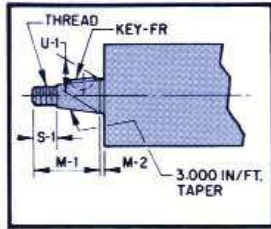
### QUILL TYPE SPINDLES



SPRINGFIELD MACHINE NO. 2A-TR AND 3-TR									
TYPE	MAX. RPM	A	C	N	N-1	S-1	U-2	W	X
3102A	10,000	4.5000	22.88	2.75	.13	2.88	2.625	20.00	1.375
3102AY	18,000	4.5000	23.00	2.88	.12	2.88	1.812	20.00	1.375
3102AY1	20,000	4.5000	28.12	3.00	.12	2.25	1.812	25.00	1.000

# Grinding Spindles

## SLEEVE TYPE SPINDLES



SPRINGFIELD MACHINE NO. 1B-TR												
TYPE	MAX. RPM	A	A-1	C	I	N	N-1	P	P-2	U-2	W	W-1
3401	11,000	3.5000	1.750	23.00	1.00	2.19	.12	1.750	.88	1.75	13.00	6.00
3402	11,000	3.5000	1.750	23.00	1.00	2.19	.12	1.750	.88	1.75	9.00	10.00
3403	9,600	3.5000	2.000	23.00	1.00	2.19	.12	2.000	.88	2.00	13.00	6.00
3404	9,600	3.5000	2.000	23.00	1.00	2.19	.12	2.000	.88	2.00	9.00	10.00
3405	8,500	3.5000	2.250	22.75	1.00	2.19	.12	2.250	1.25	2.25	13.00	6.00
3406	8,500	3.5000	2.250	22.75	1.00	2.19	.12	2.250	1.25	2.25	9.00	10.00
3407	7,700	3.5000	2.500	22.81	1.00	2.19	.12	2.500	1.25	2.50	13.00	6.00
3408	7,700	3.5000	2.500	22.81	1.00	2.19	.12	2.500	1.25	2.50	9.00	10.00
3409	7,000	3.5000	2.750	22.81	1.00	2.19	.12	2.750	1.25	2.75	13.00	6.00
3410	7,000	3.5000	2.750	22.81	1.00	2.19	.12	2.750	1.25	2.75	9.00	10.00
3411	6,400	3.5000	3.000	22.81	1.00	2.19	.12	3.000	1.25	3.00	13.00	6.00
3412	6,400	3.5000	3.000	22.81	1.00	2.19	.12	3.000	1.25	3.00	9.00	10.00
3413	5,900	3.5000	3.250	22.93	1.00	2.19	.12	3.250	2.50	3.25	13.00	6.00
3414	5,900	3.5000	3.250	22.93	1.00	2.19	.12	3.250	2.50	3.25	9.00	10.00
3415	5,500	3.5000	3.500	22.93	1.00	2.19	.12	3.500	2.50	3.50	13.00	6.00

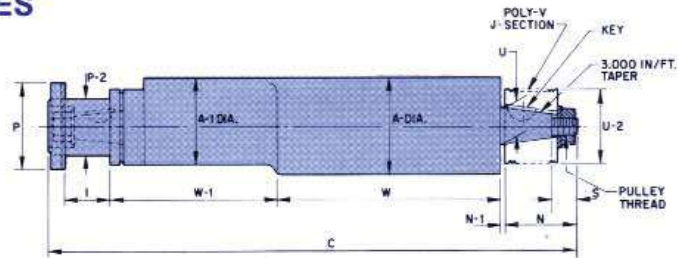
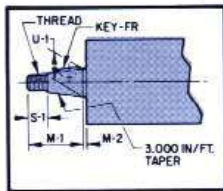
SPRINGFIELD MACHINE NO. 2A-TR AND 3-TR												
TYPE	MAX. RPM	A	A-1	C	I	N	N-1	P	P-2	U-2	W	W-1
3501	7,700	4.5000	2.500	28.88	1.00	2.75	.12	2.500	1.25	2.50	16.50	8.00
3502	7,700	4.5000	2.500	29.38	1.00	2.75	.12	2.500	1.25	2.50	13.00	12.00
3503	6,400	4.5000	3.000	28.88	1.00	2.75	.12	3.000	1.25	3.00	16.50	8.00
3504	6,400	4.5000	3.000	29.38	1.00	2.75	.12	3.000	1.25	3.00	13.00	12.00
3505	5,100	4.5000	3.500	29.00	1.00	2.75	.12	3.500	2.50	3.50	16.50	8.00
3506	5,100	4.5000	3.500	29.00	1.00	2.75	.12	3.500	2.50	3.50	12.50	12.00
3507	4,800	4.5000	4.000	29.00	1.00	2.75	.12	4.000	2.50	3.75	16.50	8.00
3508	4,800	4.5000	4.000	29.50	1.00	2.75	.12	4.000	2.50	3.75	13.00	12.00
3509	4,800	4.5000	4.000	29.50	1.00	2.75	.12	4.000	2.50	3.75	10.00	15.00
3510	4,300	4.5000	4.500	29.62	1.00	2.75	.12	4.500	2.50	4.12	13.00	12.00
3511	4,300	4.5000	4.500	35.19	1.00	2.75	.12	4.500	2.50	4.12	16.50	14.00
3512	4,300	4.5000	4.500	37.19	1.00	2.75	.12	4.500	2.50	4.12	16.50	16.00
3513	4,300	4.5000	4.500	32.19	1.00	2.75	.12	4.500	2.50	4.12	16.50	11.00
3514	7,700	4.5000	2.500	36.88	1.00	2.75	.12	2.500	1.25	2.50	16.50	16.00

SPRINGFIELD MACHINE NO. 3-TR AND 3½-TR												
TYPE	MAX. RPM	A	A-1	C	I	N	N-1	P	P-2	U-2	W	W-1
3601	7,700	5.5000	2.500	37.69	1.00	3.06	.12	2.500	1.25	2.50	23.00	10.00
3602	7,700	5.5000	2.500	37.69	1.00	3.06	.12	2.500	1.25	2.50	18.00	15.00
3603	6,400	5.5000	3.000	37.69	1.00	3.06	.12	3.000	1.25	3.00	23.00	10.00
3604	6,400	5.5000	3.000	37.69	1.00	3.06	.12	3.000	1.25	3.00	18.00	15.00
3605	5,100	5.5000	3.500	37.81	1.00	3.06	.12	3.500	2.50	3.50	23.00	10.00
3606	5,100	5.5000	3.500	37.81	1.00	3.06	.12	3.500	2.50	3.50	18.00	15.00
3607	4,800	5.5000	4.000	37.81	1.00	3.06	.12	4.000	2.50	3.75	23.00	10.00
3608	4,800	5.5000	4.000	37.81	1.00	3.06	.12	4.000	2.50	3.75	18.00	15.00
3609	4,800	5.5000	4.000	37.81	1.00	3.06	.12	4.000	2.50	3.75	10.00	23.00
3610	4,300	5.5000	4.500	38.00	1.00	3.06	.12	4.500	2.50	4.12	18.00	15.00
3611	4,300	5.5000	4.500	38.00	1.00	3.06	.12	4.500	2.50	4.12	10.00	23.00
3612	4,000	5.5000	5.000	38.00	1.00	3.06	.12	5.000	2.50	4.75	18.00	15.00
3613	4,000	5.5000	5.000	37.81	1.00	3.06	.12	5.000	2.50	4.75	10.00	23.00
3614	3,500	5.5000	5.500	37.81	1.00	3.06	.12	5.500	2.50	5.25	18.00	15.00
3615	3,500	5.5000	5.500	37.81	1.00	3.06	.12	5.500	2.50	5.25	10.00	23.00

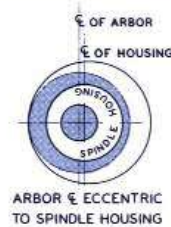


# Internal 'Deep Hole' Grinding Spindles

## SLEEVE TYPE 'ECCENTRIC' SPINDLES



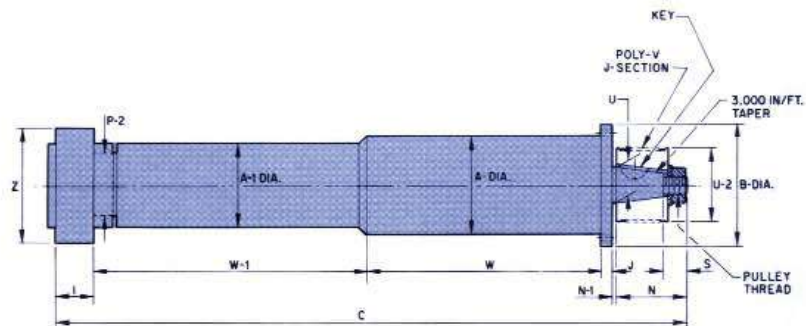
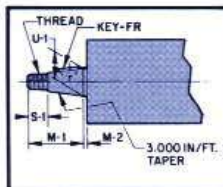
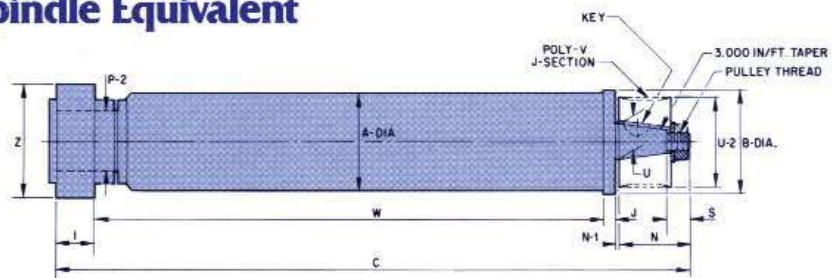
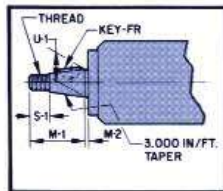
SPRINGFIELD MACHINE NO. 2A-TR, 2 1/2 A-TR AND 3-TR												
TYPE	MAX. RPM	A	A-1	C	I	N	N-1	P	P-2	U-2	W	W-1
3501H	7,700	4.5000	3.500	28.88	1.00	2.75	.12	2.500	1.25	2.50	16.50	8.00
3502H	7,700	4.5000	3.500	29.38	1.00	2.75	.12	2.500	1.25	2.50	13.00	12.00
3503H	6,400	4.5000	3.750	28.88	1.00	2.75	.12	3.000	1.25	3.00	16.50	8.00
3504H	6,400	4.5000	3.750	29.38	1.00	2.75	.12	3.000	1.25	3.00	13.00	12.00
3505H	5,100	4.5000	4.000	29.00	1.00	2.75	.12	3.500	2.50	3.50	16.50	8.00
3506H	5,100	4.5000	4.000	29.00	1.00	2.75	.12	3.500	2.50	3.50	12.50	12.00



Figures A and B show two types of eccentricity available on special 3500H Series Internal Grinding Spindles:

- Figure A illustrates the spindle housing being bored off-center. Within limits, the centerline of the spindle can be moved by rotating the spindle housing. This allows the grinding wheel to be positioned 'on centers'.
- Figure B illustrates the spindle housing being machined eccentric. The left side of the housing has been machined down, providing maximum clearance for wheel wear. The opposite side of the housing is full thickness, providing maximum resistance to the radial loads or force generated by the grinding action.

## Campbell Cartridge Spindle Equivalent



# Application Photos



Photo #3978  
Type 3506Y 'Deep Hole' Flanged Cartridge Style Grinding Spindle Assembly with wheel holder designed to mount on a Campbell grinder.

Photo #3997  
Flanged Mounted 'Deep Hole' Grinding Spindle with foot mounted bracket arranged to mount on a Campbell grinder.

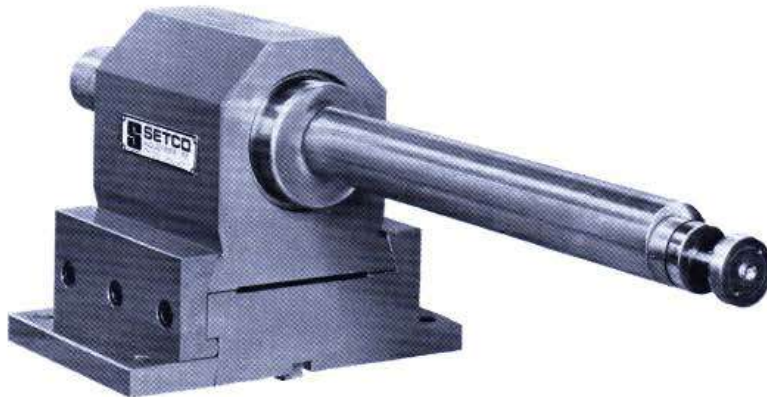


Photo #3980-2  
Type 3404HY Eccentric Style 'Deep Hole' Grinding Spindle with an extension diameter (A-1 dimension) of 2" and an extension length (W-1 dimension) of 14.9". Spindle arranged to operate at 14,400 R.P.M.



Photo #3996  
This photo illustrates the range of cartridge style spindles available. Spindles are designed to customer's exact specifications by using the lettered dimensional drawings in this section.



Photo #2064  
Eccentric Style 'Deep Hole' Grinding Spindle with wheel holder for a 2.75" diameter x 1" face wheel.

# S Heald Belt Driven Eq

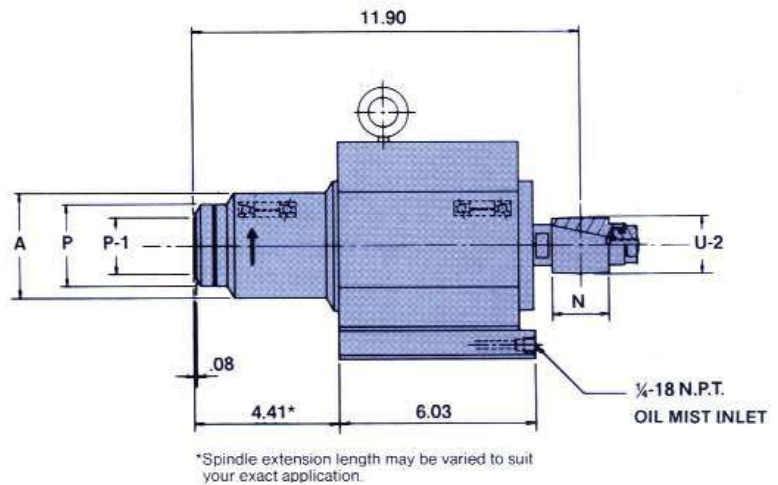
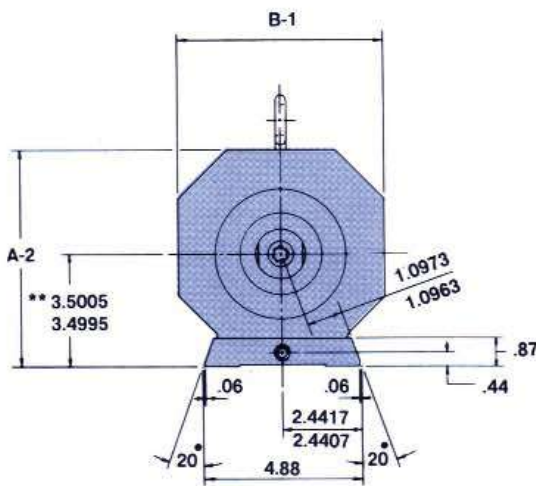
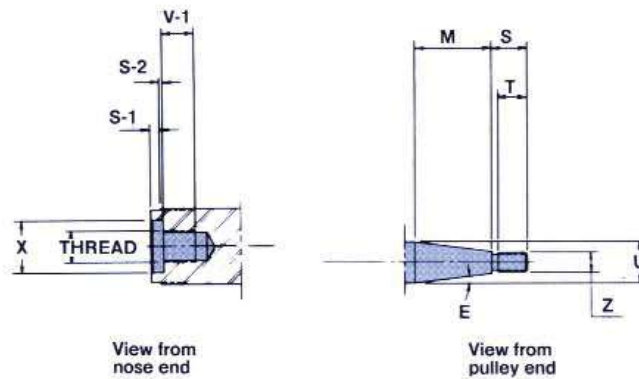
The straight shank, quill style and 'A' frame style, Belt Driven Internal Grinding Spindles are designed and manufactured with the same quality and craftsmanship as the other precision spindles in this catalog. These belt driven grinding spindles are of a rigid design primarily used for production or batch work and are available in speeds up to 50,000 r.p.m.

Each precision workhead is equipped with a standard pulley assembly and a precision ground and fitted dovetail or 'A' frame mounting bracket. These spindles

are arranged for oil mist lubrication to both front and rear mounted bearings. Standard or modified precision quills and collet chucks to meet your exact requirements are available for the different models of internal grinding spindles. The various internal grinding spindles are directly interchangeable with the Heald wheel-heads as listed below. Additional interchangeable wheelheads for the Heald, Bryant, Nova, Okamoto, Overbeck, etc., Model Internal Grinding Machines are available upon request.

## Straight Shank, Quill Style:

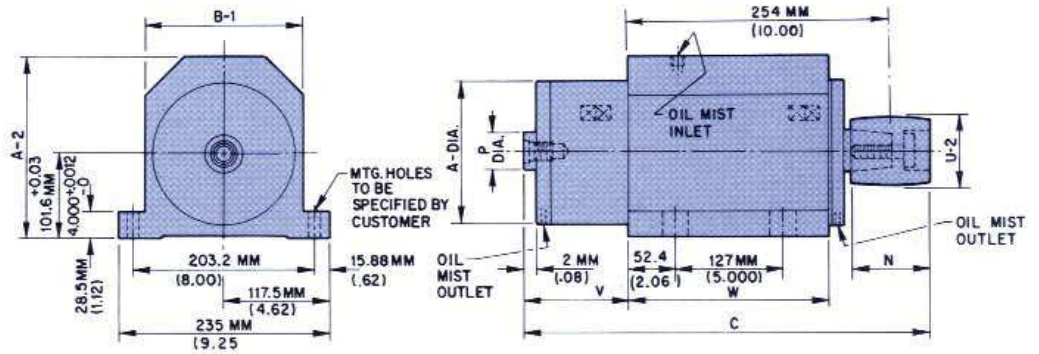
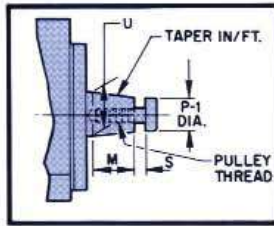
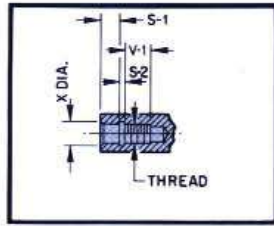
■ For Heald Machine Models 271, 272, 273A, 2EF73, 274, 275, 276, 280, 280A, 281, 290, 290A, 291, 170A, 180A & 190A



\*\*Other Centerline heights available.

SPINDLE TYPE	MAX. R.P.M.	HEALD EQUIVALENT	FRONT & REAR BRG. BORE	A DIA.	A-2	B-1	N	P DIA.	P-1 DIA.	S-1	S-2	THREAD	U DIA.	U-2 DIA.	V-1	X DIA.
4200Y-TRH1	45,000	401-250200	20 mm	3.150	6.26	5.5	1.57	2.363	.729	.28	.08	7/16" x 20	.59	.98	.67	.437
4200Y-TRH5	25,000	405-250200	25 mm	3.150	6.26	5.5	2.76	2.363	.866	.31	.08	1/2" x 20	.91	1.32	.71	.625
4201Y-TRH7	17,000	407-250200	35 mm	3.544	6.26	5.5	2.76	—	1.260	.31	.08	5/8" x 18	1.25	1.85	.98	.875
4201Y-TRH9	14,000	409-250200	45 mm	4.331	6.65	6.3	2.76	—	1.615	.31	.08	3/4" x 16	1.25	1.85	.98	1.250
4202Y-TRH11	11,000	411-250200	55 mm	4.725	6.65	6.3	2.76	—	2.008	.31	.08	7/8" x 14	1.25	1.85	.98	1.375
4204Y-TRH13	10,000	413-250200	60 mm	4.725	6.65	6.3	2.76	—	2.205	.31	.08	1" x 14	1.25	1.85	.98	1.625





## 'A' Frame (Standard) Style:

- For Heald Machine Models 1CF70, 1CF71, 1CF80, 1CF81, 1CF90, 1CF91, 2CF90, 2CF91, 1EF70, 1EF71, 1EF90 & 1EF91

SPINDLE TYPE	MAX. R.P.M.	HEALD EQUIVALENT	FRONT & REAR BRG. BORE	A DIA.	A-2	B-1	C	N	P DIA.	S-1	S-2	TAPER IN/FT.	THREAD	U DIA.	V	V-1	W	X DIA.
4200Y-H	40,000	401-252500	25 mm	3.346	6.22	4.5	12.8	2.00	.728	.27	.08	1.750	1/16" x 20	.59	2.50	.67	7.87	.437
4201Y-H	30,000	405-252500	30 mm	3.346	6.22	4.5	12.7	1.75	.866	.31	.08	1.750	1/2" x 20	.59	2.50	.71	7.87	.625
4202Y-H	24,000	407-252500	40 mm	4.527	7.09	5.9	12.8	1.87	1.260	.31	.08	3.000	5/8" x 18	.91	2.50	.98	7.87	.875
4203Y-H	20,000	409-252500	50 mm	4.527	7.09	5.9	12.9	2.18	1.614	.31	.08	3.000	3/4" x 16	1.25	2.50	.98	7.87	1.125
4204Y-H	15,000	411-252500	60 mm	6.496	8.07	7.9	12.9	2.18	2.008	.31	.08	3.000	7/8" x 14	1.25	2.50	.98	7.87	1.375
4205Y-H	10,000	413-252500	75 mm	6.496	8.07	7.9	12.9	2.18	2.205	.31	.08	3.000	1" x 14	1.25	2.50	.98	7.87	1.625
4207Y-H	8,000	415-252500	85 mm	6.496	8.07	7.9	12.9	2.18	2.756	.31	.08	3.000	1" x 14	1.25	2.50	.98	7.87	1.625

## 'A' Frame (Extended) Style:

- For Heald Machine Models 1CF70, 1CF71, 1CF80, 1CF81, 1CF90, 1CF91, 2CF90 & 2CF91

SPINDLE TYPE	MAX. R.P.M.	HEALD EQUIVALENT	FRONT & REAR BRG. BORE	A DIA.	A-2	B-1	C	N	P DIA.	S-1	S-2	TAPER IN/FT.	THREAD	U DIA.	V	V-1	W	X DIA.
4201Y-HE	25,000	405-254500	30 mm	3.346	6.22	4.5	15.45	1.75	.866	.31	.08	1.750	1/2" x 20	.59	5.25	.71	7.87	.625
4202Y-HE	17,500	407-254500	40 mm	4.527	7.09	5.9	15.55	1.87	1.260	.31	.08	3.000	5/8" x 18	.91	5.25	.98	7.87	.875
4203Y-HE	14,000	409-254500	50 mm	4.527	7.09	5.9	15.65	2.18	1.614	.31	.08	3.000	3/4" x 16	1.25	5.25	.98	7.87	1.125
4204Y-HE	11,000	411-254500	60 mm	6.496	8.07	7.9	15.65	2.18	2.008	.31	.08	3.000	7/8" x 14	1.25	5.25	.98	7.87	1.375



Photo #3976

Type 4205Y-HE Super Precision 'A' Frame Extended Style Belt Driven Grinding Spindle rated to operate at a max. speed of 10,000 R.P.M. with a special extension ('V' dimension) of 6" Equivalent to a Heald Type 415-252500-10 for a Model 1CF90 Grinding Machine.



# 6100G Series—Moto

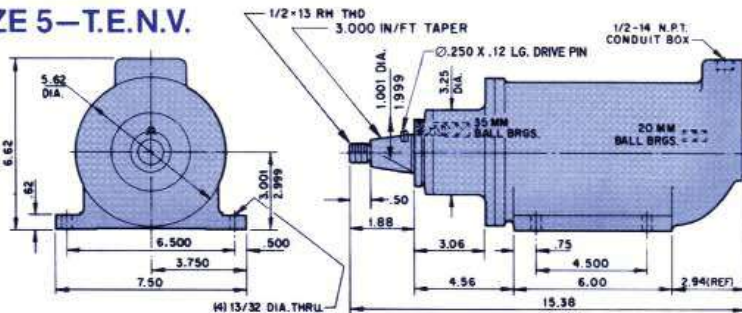
Photo #4003



The SETCO 6100G Series of Super Precision Motorized Grinding Spindles are ruggedly designed to offer long trouble-free service. These heavy duty grinding spindles have been used to convert planers, milling machines and other special applications requiring close tolerance grinding. The 'foot mounted' design is easily adapted to the saddle portion of our dovetail or hardened steel way slides (reference catalogs 389 & 287). The standard grinding spindle has an external taper nose (Style 'GT') for acceptance of a precision wheel holder. All spindles are available with dual speed motor windings or infinitely variable speeds up to 120 hertz (reference 16100G Series for operation over 120 hertz). The standard electrical specifications are: 230/460 volts, 3 phase, 60 hertz with special voltages and frequencies as optional. Rotation is *reversible* as standard for all sizes. Specify mounting attitude of spindle when ordering.

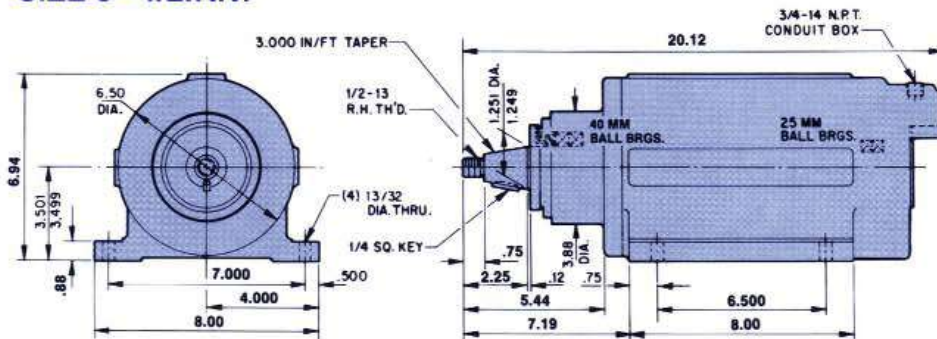
Reference page 3 for standard features. Wheel holders, guards and other optional accessories are illustrated on pages 30 through 34. Optional nose designs are illustrated on page 29. All spindles can be designed to meet your exact application (reference lettered dimensional drawing on page 19).  
Air purge, 1/8-27 NPT inlet, on front end.

## SIZE 5—T.E.N.V.



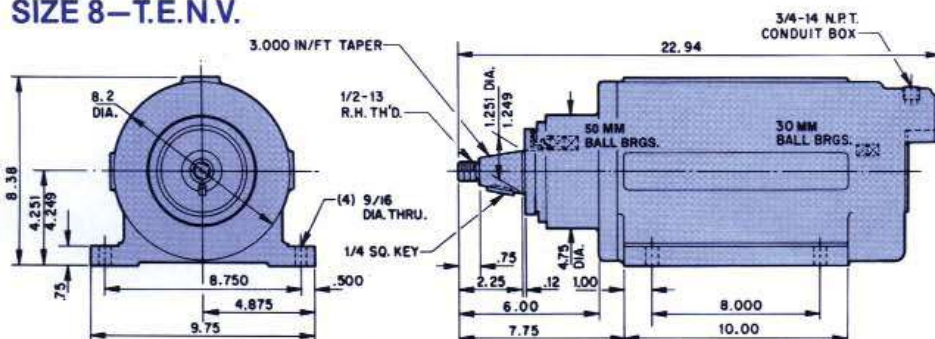
TYPE	H.P.	SPEED	WEIGHT
6100.5-36G	1/2	3600	75
6100.5-18G	1/2	1800	70
6100.5-12G	1/2	1200	70
6100.7-36G	3/4	3600	75
6100.7-18G	3/4	1800	70
6101-36G	1	3600	75
6101-18G	1	1800	75
6101.5-36G	1 1/2	3600	75

## SIZE 6—T.E.N.V.



TYPE	H.P.	SPEED	WEIGHT
6100.7-12G	3/4	1200	80
6101-12G	1	1200	85
6101.5-18G	1 1/2	1800	85
6101.5-12G	1 1/2	1200	85
6102-36G	2	3600	85
6102-18G	2	1800	90
6103-36G	3	3600	90

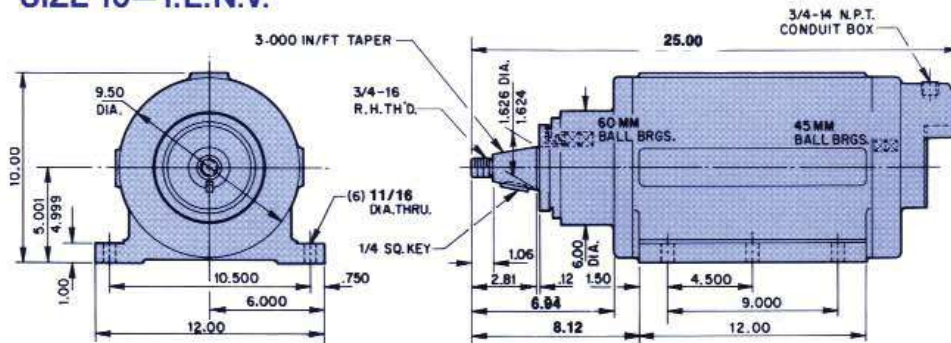
## SIZE 8—T.E.N.V.



TYPE	H.P.	SPEED	WEIGHT
6101.5-09G	1 1/2	900	122
6102-12G	2	1200	127
6103-18G	3	1800	127
6105-36G	5	3600	130

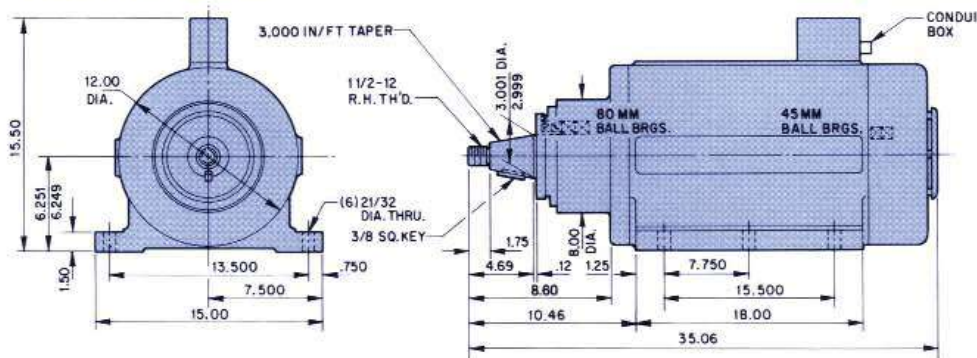
# Standard Sized Grinding Spindles

## SIZE 10—T.E.N.V.



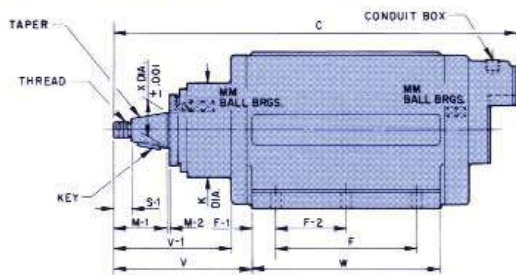
TYPE	H.P.	SPEED	WEIGHT
6102-09G	2	900	260
6103-12G	3	1200	250
6105-18G	5	1800	260
6105-12G	5	1200	290
6107.5-36G	7½	3600	275
6107.5-18G	7½	1800	300
6110-36G	10	3600	320

## SIZE 12—T.E.F.C.

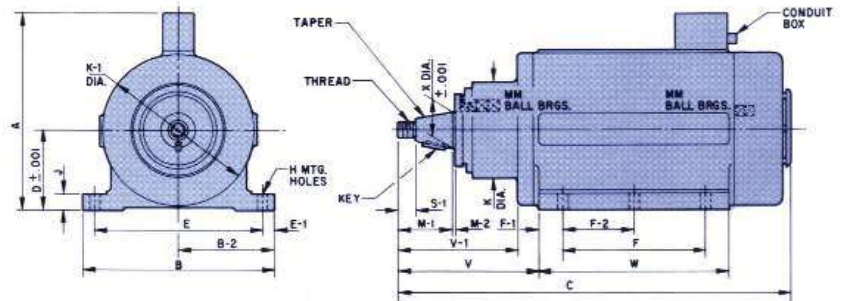


TYPE	H.P.	SPEED	WEIGHT
6103-09G	3	900	440
6105-09G	5	900	450
6107.5-12G	7½	1200	445
6107.5-09G	7½	900	460
6110-18G	10	1800	490
6110-12G	10	1200	490
6115-36G	15	3600	490
6115-18G	15	1800	500
6120-36G	20	3600	500
6120-18G	20	1800	520

## (DIMENSION DRAWING)



T.E.N.V.



T.E.F.C.



Photo #3995  
Type 6101-36G/M2L Standard Size 5 Grinding Spindle with feet milled to flush mount on an M2L (6" wide) Dovetail Slide with gib lock. Spindle is illustrated with 2B Wheel Holder and a 4" adjustable cup wheel guard.



# S 2700/2800 Series—

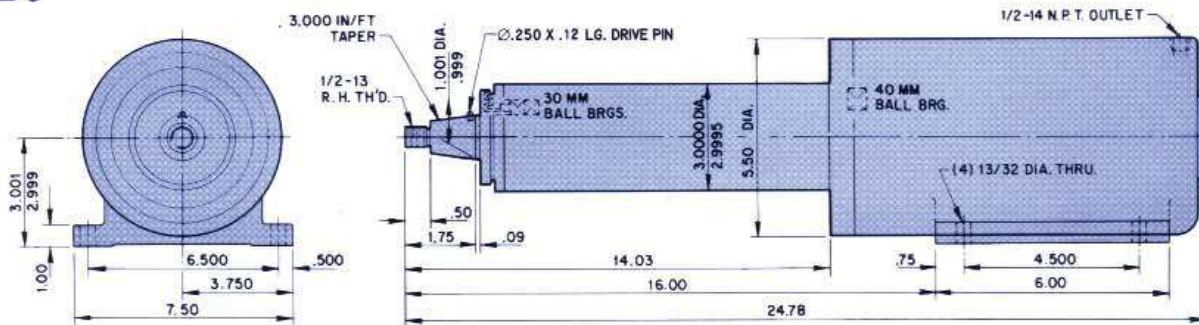
Photo #3934



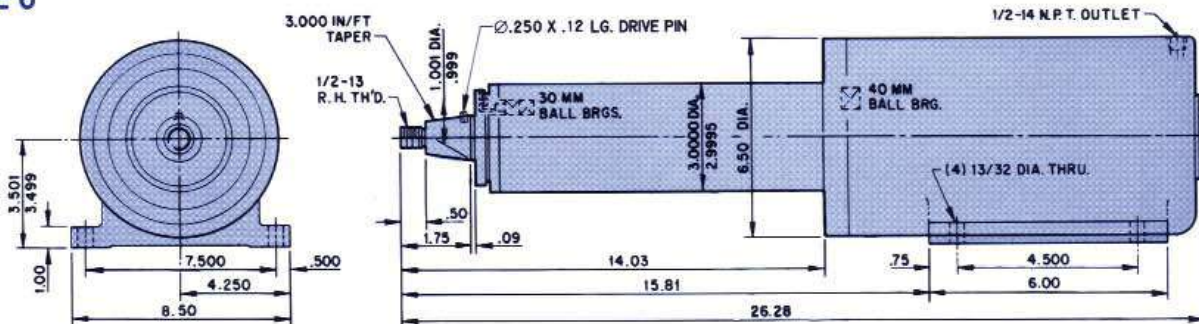
The 2700 and 2800 Series of Super Precision Motorized Surface and Internal Grinding Spindles offer the same high quality standards as the other spindles in this catalog. The 2700 Series is primarily used in surface grinding applications and other special machine applications requiring the spindle to be mounted in a bracket (reference page 31 for mounting brackets). The 2800 Series (foot mounted type) of internal grinding spindles are used in conversions on planers, lathes, vertical boring mills, vertical turret lathes, etc. This Series of Spindles can be supplied with

the feet milled to adapt directly on standard dovetail or hardened steel way slides (reference catalogs 389 & 287). Both the 2700 and 2800 Series come equipped with tapered arbor for acceptance of a precision wheel holder, wheel nut and provision for air purge. The standard electrical specifications are 230/460 volts, 3 phase, 60 hertz with special voltages and frequencies as optional. The standard rotation is *reversible*. It is necessary to specify the spindle mounting attitude when ordering. Reference page 3 for standard features. Wheel holders, guards and other optional accessories are illustrated on pages 30 through 34. Optional nose designs are illustrated on page 29. All spindles can be designed to meet your exact application (reference lettered dimensional drawing on bottom of page 21).

## SIZE 5



## SIZE 6



### SIZE 5—T.E.N.V.

*TYPE	H.P.	SPEED	WEIGHT	
			2700	2800
27/2800.5-36	1/2	3600	65	75
27/2800.5-18	1/2	1800	70	80
27/2800.5-12	1/2	1200	72	82
27/2800.7-36	3/4	3600	74	84
27/2800.7-18	3/4	1800	72	82
27/2801-36	1	3600	74	84
27/2801-18	1	1800	74	84
27/2801.5-36	1 1/2	3600	74	84

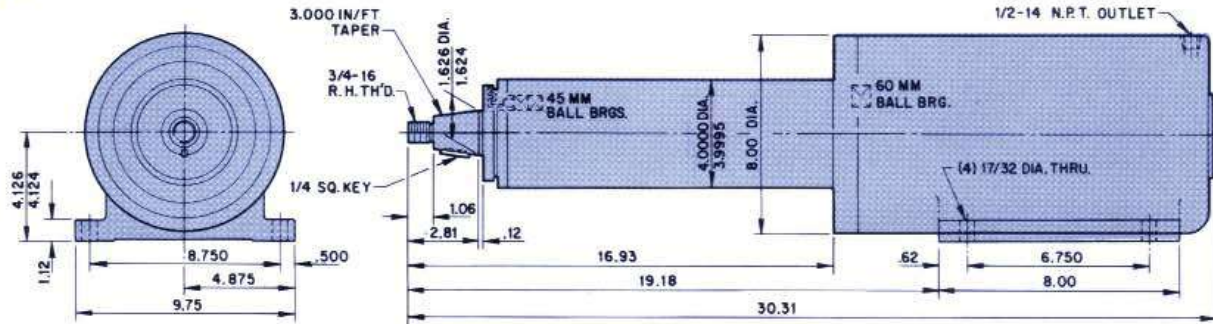
### SIZE 6—T.E.N.V.

*TYPE	H.P.	SPEED	WEIGHT	
			2700	2800
27/2800.7-12	3/4	1200	77	87
27/2801-12	1	1200	79	89
27/2801.5-18	1 1/2	1800	79	89
27/2801.5-12	1 1/2	1200	83	93
27/2802-36	2	3600	83	93
27/2802-18	2	1800	85	95
27/2803-36	3	3600	85	95

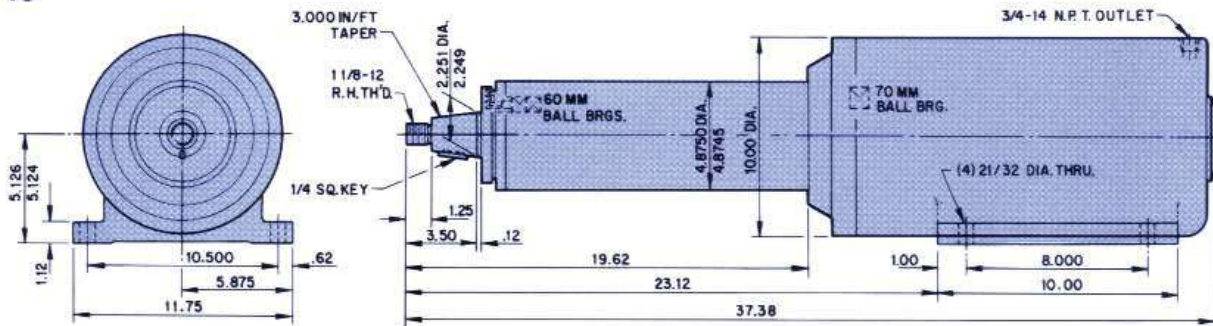
\*Specify 2700 Series (for mounting bracket) or 2800 Series (foot mounted) when ordering.

# Surface Grinding Spindles

## SIZE 8



## SIZE 10



### SIZE 8—T.E.N.V.

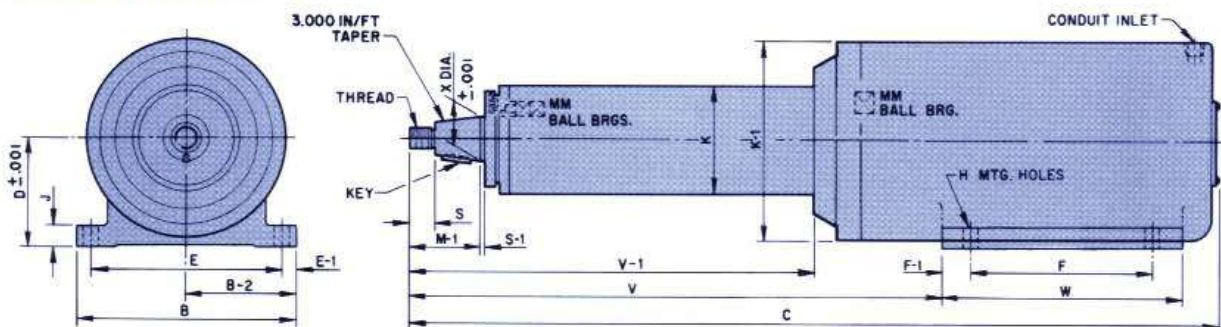
*TYPE	H.P.	SPEED	WEIGHT	
			2700	2800
27/2801.5-09	1½	900	145	185
27/2802-12	2	1200	150	190
27/2803-18	3	1800	180	220
27/2805-36	5	3600	200	240

### SIZE 10—T.E.N.V.

*TYPE	H.P.	SPEED	WEIGHT	
			2700	2800
27/2802-09	2	900	310	360
27/2803-12	3	1200	310	360
27/2805-18	5	1800	320	370
27/2805-12	5	1200	340	390
27/2807.5-36	7½	3600	340	390
27/2807.5-18	7½	1800	370	420
27/2810-36	10	3600	370	420

\*Specify 2700 Series (for mounting bracket) or 2800 Series (foot mounted) when ordering.

## (DIMENSION DRAWING)





# Application Photos

Photo #3929

Spindle/slide assembly consisting of a Type 6101.5-18G complete with 16BX Wheel Holder and guard mounted to a compound dovetail slide/swivel assembly.



Photo #3926

Type 6105-18GY/SS12 Spindle and Swivel Assembly mounted on a special adapter which was added to an overhead support to grind shear blades.

Photo #3853

Special motorized spindle and dovetail slide assembly complete with fixture slide and riser assembly.

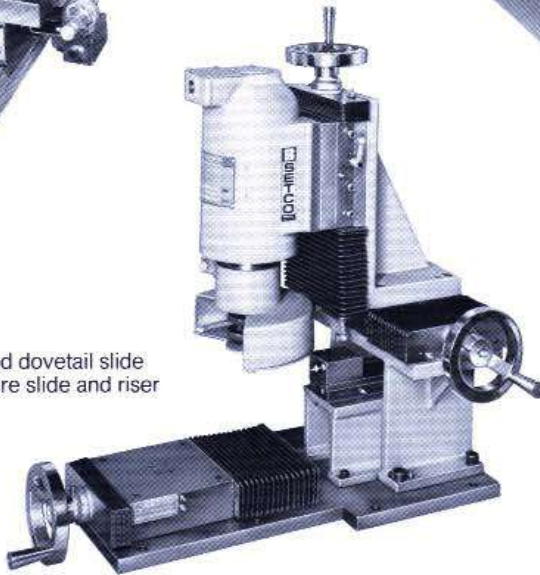


Photo #3873

Standard Type 6101-36G Motorized Grinding Spindle with mounting feed milled off to flush mount on a standard M2 (6" wide) Dovetail Slide.



Photo #3893

Spindle/slide assembly consisting of a 6103-18G Spindle with accessories mounted on a standard SS10 Swivel and special dovetail slide and fabricated bridge assembly.



Photo #3963

Type 2702.5-12Y Surface Grinding Spindle rated 2 1/2 H.P. at 1200 R.P.M. with groove in extension.



Photo #3975  
Type 2700.3-12Y Grinding Spindle rated 1/3 H.P. at 1200 R.P.M. and including special extension and wheel holder to customer's specifications.



Photo #3838  
Standard Type 2815-18 Foot Mounted Fan Cooled Surface Grinding Spindle rated 15 H.P. at 1800 R.P.M. with balancing wheel holder.



Photo #3790  
Type 6150-18G fan cooled 50 H.P. at 1800 R.P.M. Motorized Grinding Spindle with external taper nose.



Photo #3662  
Type 6107.5-18GY Motorized Spindle Assembly arranged with a 12" diameter spindle nose and special rectangular housing.



Photo #3998  
Type F80 Internal/External 'Metric' Style Grinding Spindle complete with wheel holder and Types A, B & C Quills.



Photo #2539  
Type 2705-36G Surface Grinding Spindle with mounting bracket, wheel holder and mounted on an M2R (6" wide) dovetail slide.



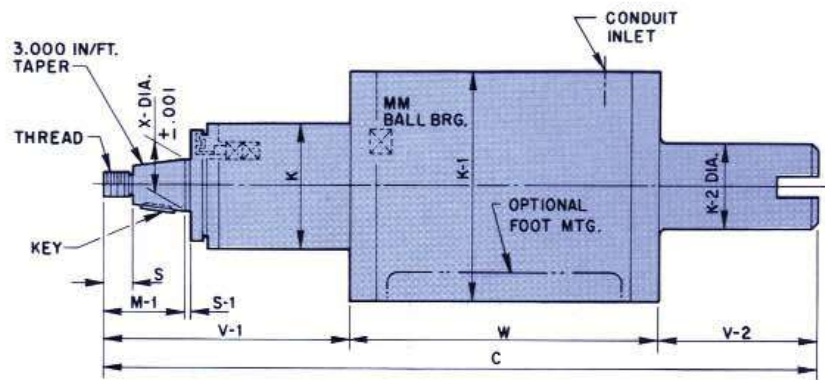
# 2700S/6100S Series— Shank Mounted Spindles

Photo #3990



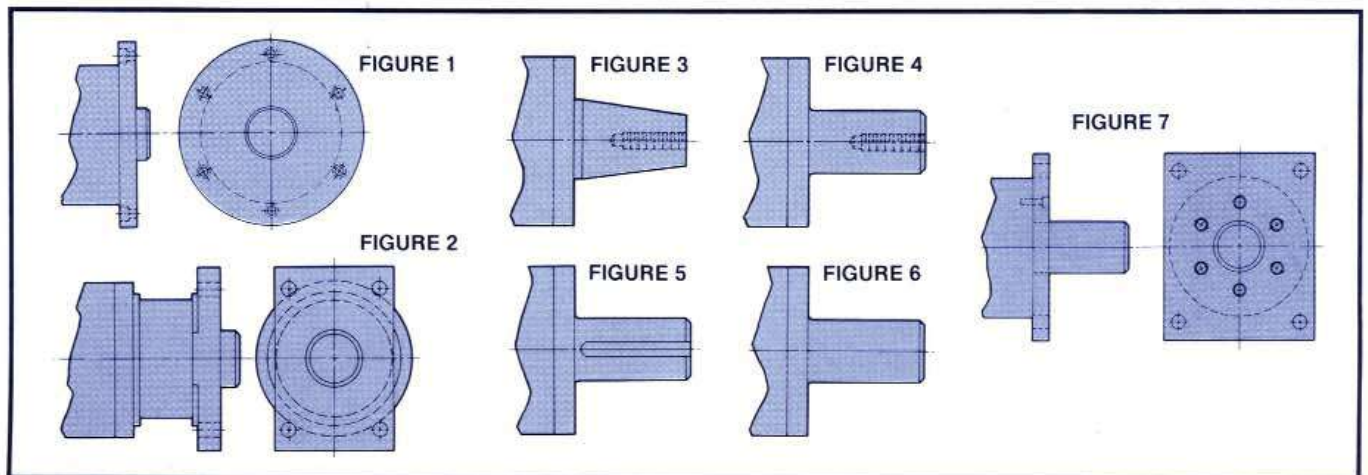
The 2700S and 6100S Series of Precision Shank Mounted Motorized Grinding Spindles are designed to adapt to a variety of types of turning, boring and milling machines. The various types of shank mounts can be interchanged on the same spindle to offer additional flexibility for all your machine requirements. The K-2 dimension (shank diameter) and V-2 dimension (shank length) are designed to customer's exact specifications. Optional foot mounting is available for both the 2700S and 6100S Series.

The standard electrical specifications are 230/460 volt, 3 phase, 60 hertz with special voltages and frequencies as optional. Specify machine type to be adapted, rotation of spindle and shank mount type when ordering. Wheel holders, guards and other optional accessories are illustrated on pages 30 through 34. Optional nose designs are illustrated on page 29. All spindles can be designed to meet your exact requirements.



SPINDLE TYPE	H.P.	SPEED	K	K-1	KEY	M-1	S	S-1	THREAD	V-1	X
2701-36S	1	3600	3.000	5.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2701-18S	1	1800	3.000	5.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2701-12S	1	1200	3.000	6.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2701.5-36S	1 1/2	3600	3.000	5.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2701.5-18S	1 1/2	1800	3.000	6.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2701.5-12S	1 1/2	1200	3.000	6.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2701.5-09S	1 1/2	900	4.000	8.00	1/4 SQ.	2.81	1.06	.12	3/4-16	16.93	1.625
2702-36S	2	3600	3.000	6.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2702-18S	2	1800	3.000	6.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2702-12S	2	1200	4.000	8.00	1/4 SQ.	2.81	1.06	.12	3/4-16	16.93	1.625
2703-36S	3	3600	3.000	6.50	—	1.75	.50	.09	1/2-13	14.03	1.000
2703-18S	3	1800	4.000	8.00	1/4 SQ.	2.81	1.06	.12	3/4-16	16.93	1.625
2705-36S	5	3600	4.000	8.00	1/4 SQ.	2.81	1.06	.12	3/4-16	16.93	1.625

SPINDLE TYPE	H.P.	SPEED	K	K-1	KEY	M-1	S	S-1	THREAD	V-1	X
6101-36S	1	3600	3.25	5.62	—	1.75	.50	.12	1/2-13	4.93	1.000
6101-18S	1	1800	3.25	5.62	—	1.75	.50	.12	1/2-13	4.93	1.000
6101-12S	1	1200	3.88	6.50	1/4 SQ.	2.00	.50	.12	1/2-13	5.18	1.250
6101.5-36S	1 1/2	3600	3.25	5.62	—	1.75	.50	.12	1/2-13	4.93	1.000
6101.5-18S	1 1/2	1800	3.88	6.50	1/4 SQ.	2.00	.50	.12	1/2-13	5.18	1.250
6101.5-12S	1 1/2	1200	3.88	6.50	1/4 SQ.	2.00	.50	.12	1/2-13	5.18	1.250
6101.5-09S	1 1/2	900	4.75	8.12	1/4 SQ.	2.25	.75	.12	1/2-13	6.00	1.250
6102-36S	2	3600	3.88	6.50	1/4 SQ.	2.00	.50	.12	1/2-13	5.18	1.250
6102-18S	2	1800	3.88	6.50	1/4 SQ.	2.00	.50	.12	1/2-13	5.18	1.250
6102-12S	2	1200	4.75	8.12	1/4 SQ.	2.25	.75	.12	1/2-13	6.00	1.250
6103-36S	3	3600	3.88	6.50	1/4 SQ.	2.00	.50	.12	1/2-13	5.18	1.250
6103-18S	3	1800	4.75	8.12	1/4 SQ.	2.25	.75	.12	1/2-13	6.00	1.250
6105-36S	5	3600	4.75	8.12	1/4 SQ.	2.25	.75	.12	1/2-13	6.00	1.250





# 2900 Series—Planetary Motorized Grinding Spindles

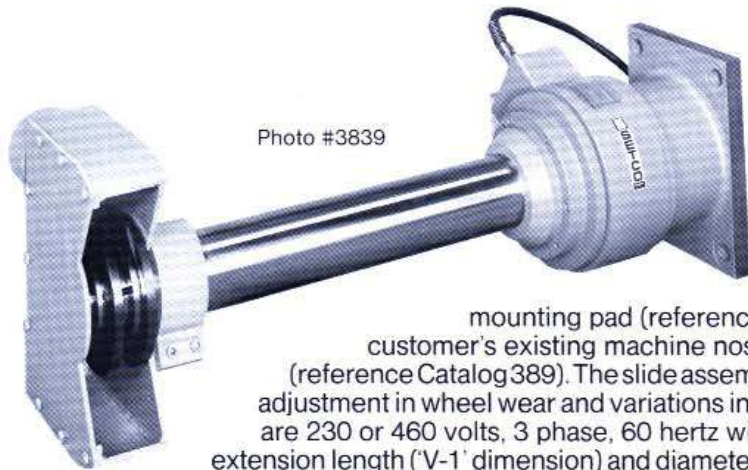
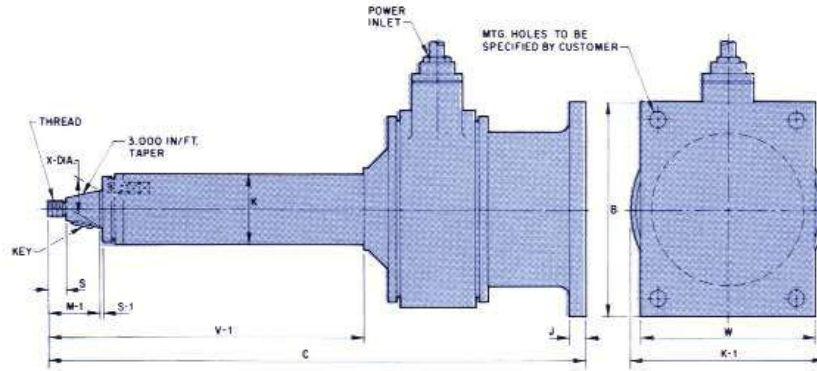


Photo #3839

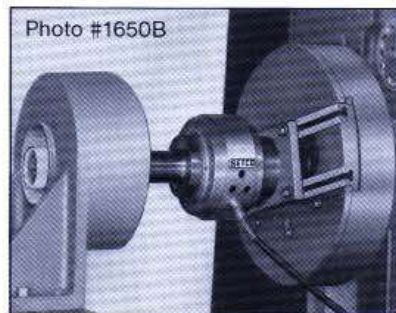
The SETCO 2900 Series of Precision Motorized Grinding Spindles are designed to eliminate extra set-ups in internal and external grinding on horizontal boring, drilling and milling machines. This series allows the spindle to orbit the hole being ground without winding the power supply cable around the spindle. The supply cable is attached to a ball bearing equipped brush rigging housing which remains stationary as the spindle orbits the I.D. or O.D. of the work piece. The standard spindle

mounting pad (reference 'B' and 'W' dimensions) is designed to adapt to the customer's existing machine nose assembly or to a SETCO Dovetail Slide Assembly (reference Catalog 389). The slide assembly on which the grinding spindle is mounted provides adjustment in wheel wear and variations in work piece I.D. The standard electrical specifications are 230 or 460 volts, 3 phase, 60 hertz with special voltages and frequencies as optional. The extension length ('V-1' dimension) and diameter ('K' dimension) can be varied to suit your exact grinding application. Wheel holders, guards and other optional accessories are illustrated on pages 30 through 34. Specify clockwise or counterclockwise rotation when ordering. All spindles can be designed to meet your exact requirements.

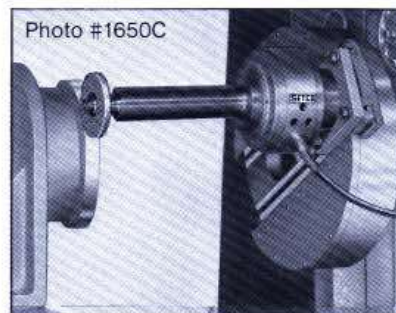


## 2900 SERIES

TYPE	H.P.	R.P.M.	B	C	J	K	K-1	KEY	M-1	S	S-1	THREAD	V-1	W	X
2901-36	1	3600	8.5	24.72	1.00	3.000	9.87	—	1.75	.50	.09	1/2-13	14.03	7.25	1.000
2901-18	1	1800	8.5	28.00	1.00	3.000	9.87	—	1.75	.50	.09	1/2-13	14.03	7.25	1.000
2901.5-36	1½	3600	8.5	24.72	1.00	3.000	9.87	—	1.75	.50	.09	1/2-13	14.03	7.25	1.000
2901.5-18	1½	1800	8.5	24.72	1.00	3.000	9.87	—	1.75	.50	.09	1/2-13	14.03	7.25	1.000
2902-36	2	3600	8.5	28.00	1.00	3.000	9.87	—	1.75	.50	.09	1/2-13	14.03	7.25	1.000
2902-18	2	1800	12.0	30.19	1.25	4.000	10.25	¼ SQ.	2.81	1.06	.12	¾-16	16.93	9.50	1.625
2903-36	3	3600	12.0	30.19	1.25	4.000	10.25	¼ SQ.	2.81	1.06	.12	¾-16	16.93	9.50	1.625
2903-18	3	1800	12.0	30.19	1.25	4.000	10.25	¼ SQ.	2.81	1.06	.12	¾-16	16.93	9.50	1.625
2905-36	5	3600	12.0	30.19	1.25	4.000	10.25	¼ SQ.	2.81	1.06	.12	¾-16	16.93	9.50	1.625



Here, a Type 2901-36 grinding spindle is mounted on a horizontal boring machine to perform an internal grinding operation on a large workpiece.



Typical external grinding application on the facing head of a horizontal boring mill.



# Ram Conversions

SETCO ram conversions double the versatility of existing vertical boring mills by transforming the ram into a dual-purpose internal/external precision grinding and metal turning machine.

Consider the time and money saving possibilities when you can turn and grind with a single set-up... merely by removing the turning tool holder and adding the grinding wheel assembly which couples to the motorized spindle provided in the SETCO ram conversion. With interchangeable precision internal and external grinding spindles, SETCO ram conversions are available for all makes of boring mills. These conversions are adaptable to rams up to 172" long with standard 5 hp to 30 hp drives.

Specify machine type and/or supply a drawing of the ram when inquiring. All SETCO ram conversions are designed to the customers' exact requirements. Wheel holders, guards and other optional accessories are illustrated on pages 30 through 34.

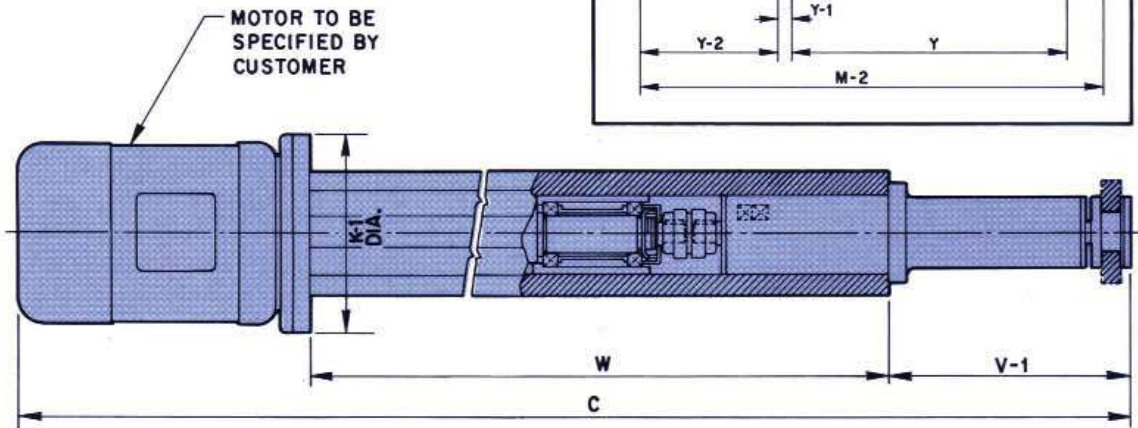


Photo #3614



1979Y Ram Conversion on Niles 52" long ram. 15 HP, 1800 RPM, with telescopic wheel guard for 11" diameter backing plate mounted wheel. Overall length is 87".

Photo #3599



Dual speed ram conversion; 5 HP, 1800/3600 RPM drive, provided with interchangeable external grinding spindle with wheel guard and special sleeve reducer to allow use of existing tooling.

Photo #1132



A. Ram conversion for King boring mill; ram length is 14'-6"; 7½ HP, 1800 RPM.

B. Ram conversion for Niles boring mill; 15 HP, 1800 RPM.

# 1990 Series Precision Grinding Attachments

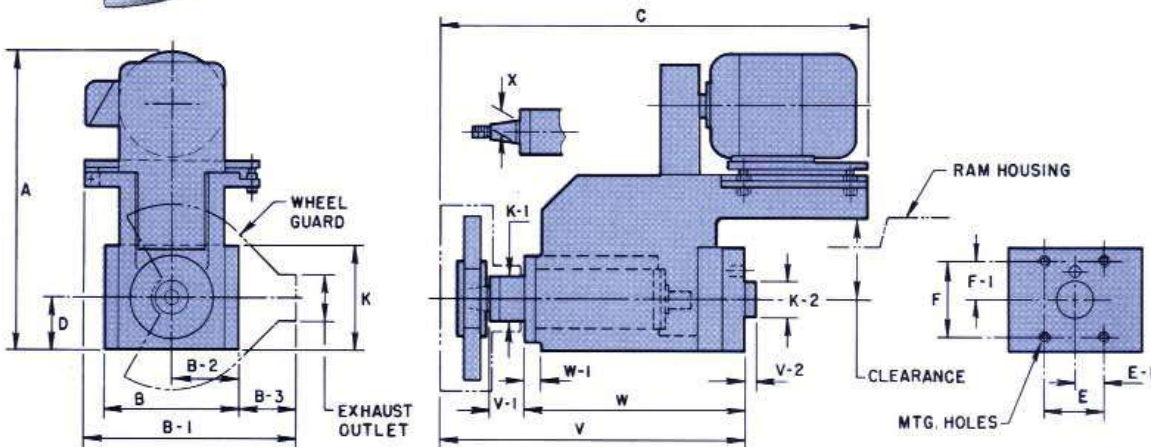


Photo #2821

The SETCO 1990 Series of precision grinding attachments are ruggedly designed to permit low cost conversion to grinding on boring mills and vertical turret lathes. These grinding attachments are available in both belt driven and motorized packages for internal and external grinding applications.

Each precision grinding attachment is individually designed to mount directly to the machines existing ram or turret. The standard grinding attachment comes equipped with either an internal or external grinding spindle, universal adapter plate (optional right angle adapter for horizontal mounting of spindle), mounting bracket, wheel guard, wheel holder, belt and pulleys, belt guard, adjustable motor plate (for belt tensioning) and drive motor.

Optional 'split-knuckle' (ref. Photo #2015) or 'in-line' (ref. Photo #1509) mounting designs are available. Specify machine type and model, spindle mounting configuration and clearance needs when inquiring.



TYPE	H.P.	CLEARANCE FOR MOUNTING TO RAM	EXTERNAL SPINDLE TYPE 2B			W E I G H T	INTERNAL SPINDLE TYPE 2A	
			WHEEL DIA.	ARBOR DIA. 'X'	R.P.M.		TYPICAL DIMENSIONS OF STD. SPINDLES	
							V-1	K-1
1990	5	6 3/4", 8 1/2" OR 11 3/4" SPECIFY	14"	1.625 OR 2.250	1700	680	8", 10", 12", 14"	3" OR 4"
1991	5		14"	SPECIFY	1700	710	8", 10", 12", 14", 16", 18", 20"	4" OR 5"
1995	7 1/2		14"		1700	705	8", 10", 12", 14"	3" OR 4"
1996	7 1/2		14"		1700	735	8", 10", 12", 14", 16", 18", 20"	4" OR 5"



Photo #2015  
Motorized grinding spindle with split knuckle to accept adapter bar. Extension should be held to minimum.

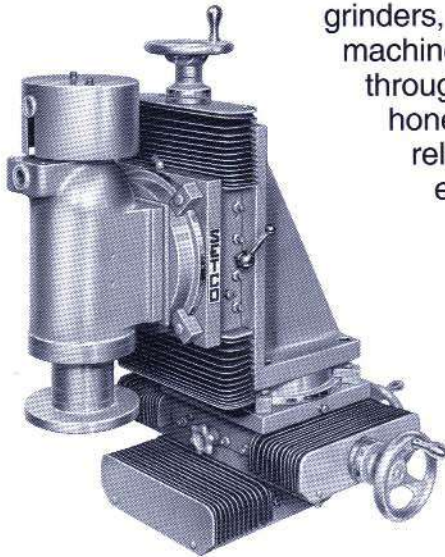


Photo #1509  
Belt-drive grinding assembly designed to fit on VTL slide in place of turret.



# Electrolytic Grinding Spindles

The SETCO Series of Electrolytic Grinding Spindles have been used by a variety of OEM and special electrolytic grinding machine manufacturers to convert tool and cutter grinders, surface grinders, cylindrical-universal grinders, lathes, milling machines, planers, etc., into electrolytic grinding machines. The materials machined range from ordinary metals and alloys through carbides, including exotic materials that are typified by aircraft honeycomb. Applications include jet engine blades, tubing for satellite relays, hypodermic needles, special missile parts, carbide bits, jet engine shrouds and carbide reamers.



Electrolytic grinding is a very fast form of “electroplating in reverse” or simultaneous fast etching and lapping. It is a cool process with light abrasive action and can be used to machine most conductive materials. The speed of metal removal is practically independent of material hardness. The process is ideal for applications where heat could damage the work-piece and where burr-free edges are required.

Electrolytic grinding virtually eliminates heat checks, machining stresses, metallurgical changes, burrs, “lay-overs”, work hardening, distortion and warping. The process also increases wheel life.

Surface finishes obtained range between 2 and 12 micro-inches. Tolerances depend on the inherent accuracy of the machine used.

Electrolytic grinding requires a machine designed for the process or a machine tool converted to this use. Included are: an electrolytic grinding spindle (cathode), the worktable (anode), a power supply and the machine with positioning and feeding elements. Also required is a mist collecting system, pump, tank and an electrolyte filter.

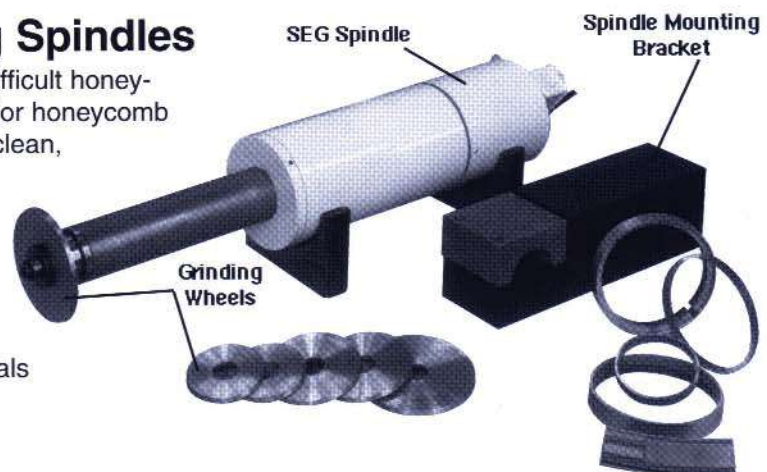
SETCO's spindle design prevents DC current from passing through the bearings, which causes pitting and premature failure. The brush rigging provides maximum brush life consistent with maximum current carrying characteristics.

Wheel holders, guards and other optional accessories are illustrated on pages 30 through 34.

## Spark Erosion Grinding Spindles

SETCO'S SEG Spindles are made for difficult honeycomb finishing jobs. But unlike other major honeycomb grinding devices, the SEG spindles are clean, easy to operate and provide many additional benefits, such as:

- They work with existing grinding or finishing equipment.
- They use standard coolant for current transmission.
- They use inexpensive electrode materials and grinding wheels.
- They virtually eliminate deburring.

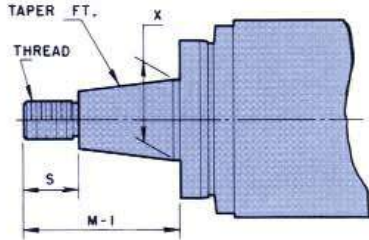


# Alternate Nose Designs

All of the belt driven and motorized grinding spindles illustrated in this catalog (except 'metric' grinding spindles) can be arranged with alternate spindle nose configurations. Described below are only a few of the common alternate nose designs.

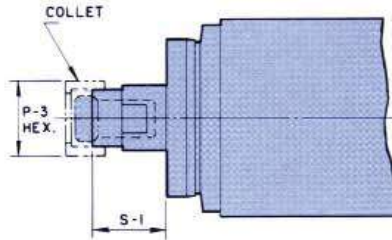
## 1. STANDARD EXTERNAL TAPER

The external taper is available in both 3.000"/ft. and 3.500"/ft. and is designed to accept wheel holders as described on page 30.



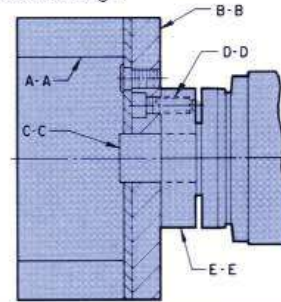
## 2. UNIVERSAL/ERICKSON COLLET NOSES

A wide range of collet sizes are available with the modification of a collet chuck nose. Reference page 8 for maximum collet capacities.



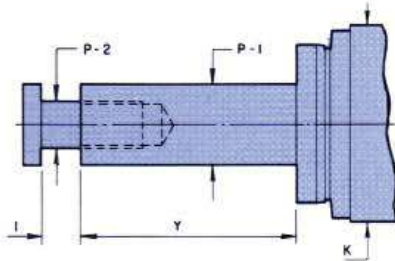
## 3. ADAPTER PLATE NOSE

Arrangement for plate mounted wheels or a combination plate mounted and straight wheel adapter can be added to any belt driven or motorized grinding spindle design.



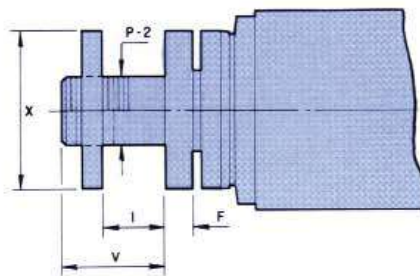
## 4. STRAIGHT SHAFT WITH WHEEL SCREW

This extended arbor design is primarily used for internal grinding applications.



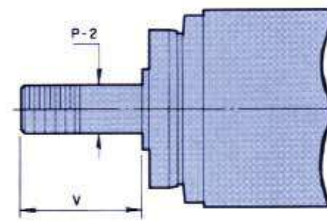
## 5. DEEP-HOLE GRINDING NOSE

The standard Type 3400, 3500, 3500H and 3600 series grinding spindles (ref. pages 13 and 14) come equipped with this design. Available on other internal grinding spindles.



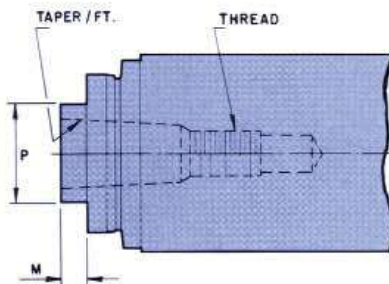
## 6. STRAIGHT SHAFT WITH THREADED NOSE

Designed to accept special wheel configurations where conventional taper or flanged wheel holder noses are inadequate.



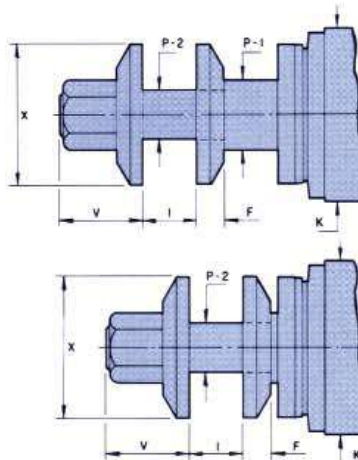
## 7. JARNO, MORSE, BROWN & SHARPE TAPERS

All of these tapers are available on both the belt driven or motorized grinding spindle designs. A wide selection of quills for use with these tapers are described on pages 32 and 33.



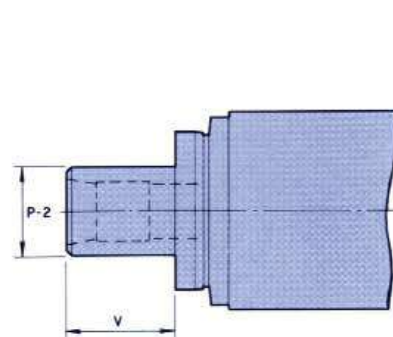
## 8. FLANGED & EXTENDED FLANGED NOSES

Arranged for single purpose straight wheel grinding applications. One of the more economical noses available.



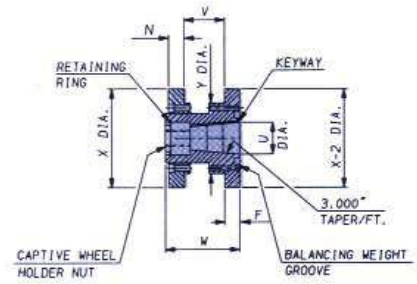
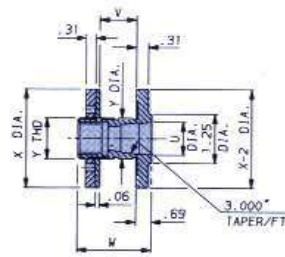
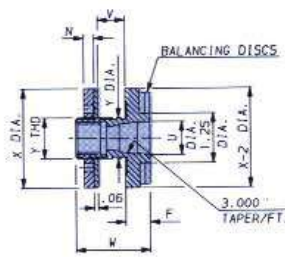
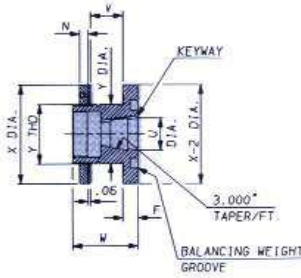
## 9. 5C COLLET NOSE

A wide range of collet noses are available for workholding spindle applications. The collet nose is available with power actuation.



# S Spindle Accessories

## WHEEL HOLDERS



### STYLE 1

Type B and BX  
Balancing or Non-Balancing  
Right or Left Hand Rotation

### STYLE 2

Type B and BX  
Balancing or Non-Balancing  
Right or Left Hand Rotation

### STYLE 3

Type B  
Non-Balancing only  
Right or Left Hand Rotation

### STYLE 4

Type A and AX  
Balancing or Non-Balancing  
Reversible Rotation

### STYLE 1-2-3

Front flange screws onto rear flange. With self-pulling design, backing-off the nut pulls the wheel holder free from the tapered arbor.

Type B wheel holders are furnished with puller and wrench. Type BX have larger rear flange diameter to support thrust of cup wheels.

Front flange held to rear flange by mounting bolts. Type AX has larger rear flange diameter to support thrust of cup wheels.

TYPE		U	STYLE	MAX WHEEL DIA.	Y		V	X	X-2	N	F	W	KEYWAY
STRAIGHT WHEEL	CUP WHEEL				DIA.	THD.							
1 B.B.L (OR R)		1.000	2	6	1.250	1.25-16	50-.75	2.25	2.25	.38	.75	2.00	—
1 B.N.L (OR R)		1.000	3	6	1.250	1.25-16	50-.75	2.25	2.25	—	—	1.88	—
1.5 B.B.L (OR R)		1.000	2	6	1.250	1.25-16	75-1.00	2.25	2.25	.38	.75	2.25	—
1.5 B.N.L (OR R)		1.000	3	6	1.250	1.25-16	75-1.00	2.25	2.25	—	—	2.25	—
2 B.B.L (OR R)		1.000	2	8	1.250	1.25-16	25-1.00	3.00	3.00	.38	.75	2.25	—
2.5 B.B.L (OR R)		1.000	2	12	1.250	1.25-16	25-1.00	4.25	4.25	.41	1.00	2.50	—
	2 BX B.L (OR R)	1.000	2	8	1.250	1.25-16	25-1.00	3.00	7.00	.38	.81	2.25	—
	2.5 BX B.L (OR R)	1.000	2	12	1.250	1.25-16	25-1.00	4.25	11.00	.41	1.00	2.50	—
16 B.B.L (OR R)		1.250	1	12	3.000	3.00-16	50-1.00	4.25	4.25	.56	1.00	2.75	250
	16 BX B.L (OR R)	1.250	1	12	3.000	3.00-16	50-1.00	4.25	11.00	.56	1.00	2.75	250
4 B.B.L (OR R)		1.625	1	8	3.000	3.00-16	1.25-2.00	5.00	5.00	.44	.88	3.56	250
	4 BX B.L (OR R)	1.625	1	8	3.000	3.00-16	1.25-2.00	5.00	7.00	.44	.88	3.56	250
6 A B		1.625	4	14	5.000	—	.75-1.75	7.00	7.00	.50	.50	2.81	250
	6 AX B	1.625	4	14	5.000	—	.75-1.75	7.00	13.00	.50	.50	2.81	250
5 B.B.L (OR R)		2.250	1	14	3.000	3.00-16	1.00-2.50	5.00	5.00	.56	1.00	4.25	250
	5 BX B.L (OR R)	2.250	1	14	3.000	3.00-16	1.00-2.50	5.00	7.00	.56	1.00	4.25	250
7 A B		2.250	4	18	5.000	—	1.00-2.50	7.00	7.00	.50	.50	3.56	250
	7 AX B	2.250	4	18	5.000	—	1.00-2.50	7.00	13.00	.50	.50	3.56	250
8 A B		2.250	4	22	8.000	—	1.75-3.00	10.00	10.00	.50	.50	4.06	250
	8 AX B	2.250	4	22	8.000	—	1.75-3.00	10.00	19.00	.50	.50	4.06	250
17 A B		2.625	4	18	5.000	—	1.50-2.75	7.00	7.00	.50	.88	4.18	.375
	17 AX B	2.625	4	26	12.000	—	1.75-3.00	14.00	14.00	.62	.62	4.31	.375
11 A B		3.000	4	18	5.000	—	1.50-2.75	7.00	11.00	.50	.88	4.18	.375
	11 AX B	3.000	4	18	5.000	—	1.75-3.00	7.00	13.00	.50	.88	4.68	.375
13 A B		3.000	4	22	8.000	—	1.75-3.00	10.00	10.00	.62	.50	4.31	.375
	13 AX B	3.000	4	22	8.000	—	1.75-3.00	10.00	19.00	.50	.50	4.31	.375
14 A B		3.000	4	26	12.000	—	1.75-3.00	14.00	14.00	.62	.62	4.31	.375
	14 AX B	3.000	4	26	12.000	—	1.75-3.00	14.00	13.00	.50	.88	4.68	.375
19 A B		3.750	4	26	8.000	—	2.25-4.00	10.00	10.00	.62	.62	5.50	.375
	19 AX B	3.750	4	26	8.000	—	2.25-4.00	10.00	19.00	.62	.62	5.50	.375



Photo #2066  
Type 5B.B.L  
With balancing weights



Photo #3993  
Type 6A.N  
Without balancing weights

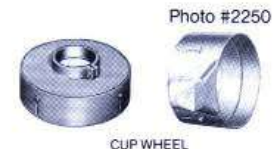
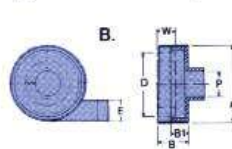
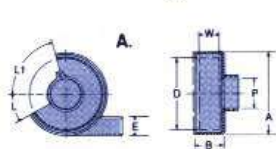


Photo #3993  
Type 1B.N.L Wheel Holder with  
puller and wrench

ROTATION: R = RH THDS. = CCW ROTATION  
L = LH THDS. = CW ROTATION

Designation: 2B.B.L. Balancing  
2B.N.L. Non-Balancing

**WHEEL GUARDS** Guards for straight and cup wheels are available with or without exhaust outlet. The straight wheel guard is standard with enclosing cover. The abrasive height of a cup wheel is required, so that the telescopic shroud can be designed for proper adjustment (ref. letter dimensional drawing). Stainless steel and Cadmium plated wheel guards available upon request.



**WARNING:** OSHA regulations, safety and good grinding practice require proper guarding of grinding wheels. SETCO will design and manufacture guards as we interpret OSHA regulations and good grinding practice requirements, that satisfy specifications of wheel and grinding conditions provided by the customer. SETCO cannot be responsible for guard modifications by the "user" or changes in the "users" requirements, grinding condition, or wheel changes that would affect proper guard design and utilization. "Wheel breakage can result in serious personal injury." Do not attempt to operate a grinding machine or component without properly designed, applied and maintained guards.

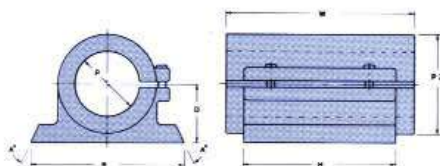
## MOUNTING BRACKETS

A wide variety of mounting brackets are available for all sizes of Cartridge and Flanged Cartridge Spindles, in both English and Metric dimensions. English mounting brackets are of a rigid cast iron construction (metric are of rigid cast steel), both normalized and stress relieved. The housing bores and mounting surfaces are precision ground to eliminate possible spindle vibration and to provide maximum grinding results. Modified mounting brackets are available to meet your exact requirements.

### ENGLISH MOUNTING BRACKETS (INCHES)

No.	COMMON TO ALL STYLE D, F, L, N & P BRACKETS						Style D F L N			Style P	
	P	P2	W	H	B	D	D	O	D	O	
53	2 1/4	3 1/2	6	6	6	2	4	1 1/2			
54	2 3/4	3 3/4	8	6	6	2 1/4	4 1/2	1 3/4			
55	3	5	8	6	8	2 1/2	5	1 1/2			
56	3	5	10	8	8	2 1/2	5	1 1/2			
57	3 1/2	5	8	8	8	2 3/4	5 1/2	1 3/4			
58	3 1/2	5	10	8	8	2 3/4	5 1/2	1 3/4			
59	4	5 1/2	10	8	8	3	6	2			
60	4 3/4	6 1/2	12	10	10	3 3/4	7	2 3/4			
61	4 3/4	6 1/2	12	10	10	3 3/4	7 1/2	2 3/4			
62	6	8	12	12	12	4	7 1/2	3			

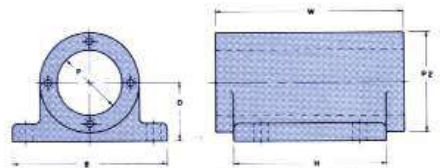
Mounting Hole locations to be specified by customer.  
On Style D: A° to be specified by customer.



Style D for plain cartridge spindle



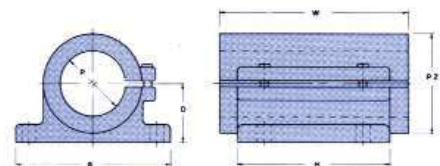
Photo #1998  
Style DY with taper bore  
(suitable for Head grinders)



Style F for flanged cartridge spindle



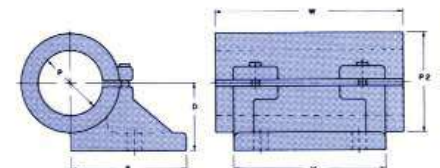
Photo #2040-1  
Style L standard



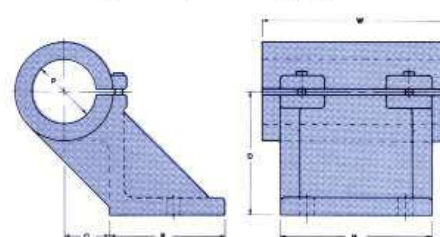
Style L for plain cartridge spindle



Photo #2040-2  
Style L with  
extended D dimension



Style N for plain cartridge spindle



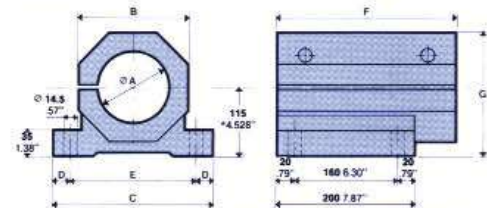
Style P for plain cartridge spindle



Photo #955  
Style P standard

### METRIC MOUNTING BRACKETS

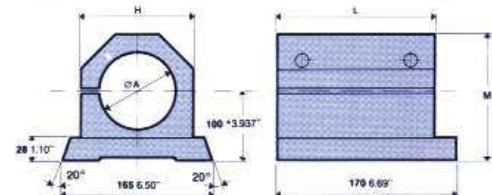
#### Type SP — Foot mounted design



TYPE	∅ A mm Inches	B mm Inches	C mm Inches	D mm Inches	E mm Inches	F mm Inches	G mm Inches
SP115/80	80 3.15"	120 4.72"	210 8.27"	22.5 .89"	165 6.50"	140 5.51"	175 6.89"
SP115/100	100 3.94"	150 5.91"	240 9.45"	22.5 .89"	195 7.68"	170 6.69"	190 7.48"
SP115/120	120 4.72"	170 6.69"	270 10.63"	25 .98"	220 8.66"	170 6.69"	200 7.87"
SP115/140	140 5.51"	200 7.87"	300 11.81"	25 .98"	250 9.84"	200 7.87"	215 8.46"
SP115/170	170 6.69"	230 9.06"	330 12.99"	25 .98"	280 11.02"	250 9.84"	230 9.06"

\*Optional centerline heights of 4.5", 4" & 3.5" available.

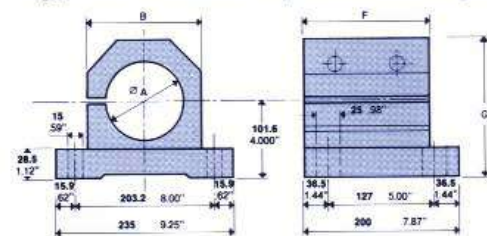
#### Type SO — Dovetail mounted design



TYPE	∅ A mm Inches	H mm Inches	L mm Inches	M mm Inches
SP100/80	80 3.15"	122 4.80"	140 5.51"	161 6.34"
SP100/100	100 3.94"	146 5.75"	170 6.69"	173 6.81"
SP100/120	120 4.72"	168 6.61"	170 6.69"	184 7.24"

\*Optional centerline heights of 4.5", 4" & 3.5" available.

#### Type SP — Head equivalent design



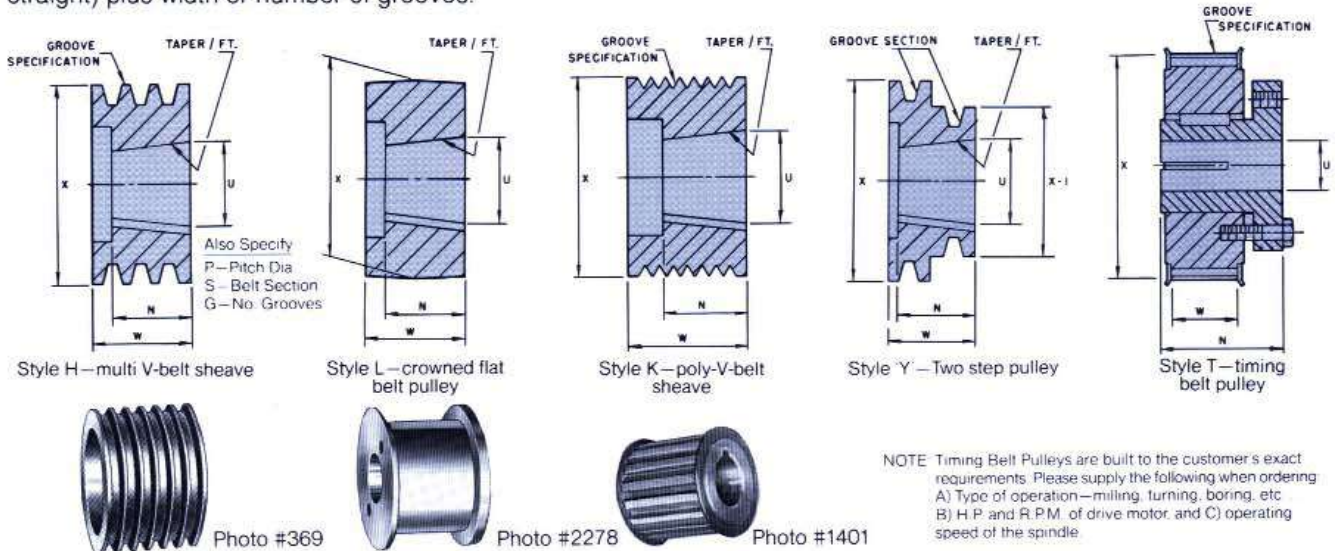
TYPE	∅ A mm Inches	B mm Inches	F mm Inches	G mm Inches
SP101.80/80	80 3.15"	125 4.92"	140 5.51"	164 6.46"
SP101.8/100	100 3.94"	145 5.70"	170 6.69"	174 6.85"
SP101.8/120	120 4.72"	165 6.50"	170 6.69"	184 7.24"
SP101.8/140	140 5.51"	185 7.28"	170 6.69"	194 7.64"
SP101.8/170	170 6.69"	215 8.46"	200 7.87"	212 8.34"



# Spindle Accessories

## PULLEYS

Various types of pulleys are available. These are precision balanced before assembly and again checked for imbalance and vibration after assembly. When ordering: specify type of pulley, pitch diameter and bore (tapered or straight) plus width or number of grooves.



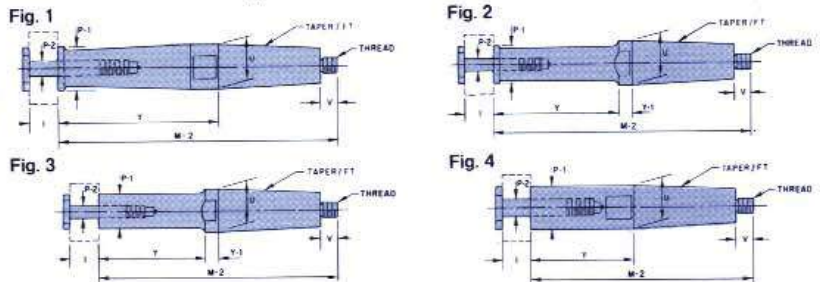
## QUILLS

The SETCO series of precision quills are designed to the customer's exact specifications. Listed below are only a few of the standard designs and sizes available. To obtain maximum grinding results, select quills with the shortest length ('Y' Dimension) and largest diameter ('P-1' Dimension).



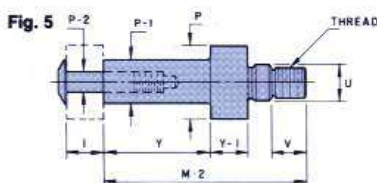
### FIGURES 1, 2, 3 and 4

The taper shank quills as listed in Figures 1 through 4 are available for a variety of Brown & Sharpe, Morse and Jarno Tapers. These quills are used for grinding a wide range of parts necessitating frequent quill changes. This job variety is typical of tool room work applications.



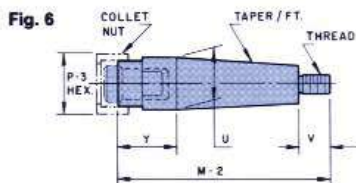
### FIGURE #5

The straight shank quills are located by a pilot (reference 'U' Dimension), squared against an adjacent shoulder and are primarily used in production runs. The straight shank quills with wheelscrew design offers a fast, affordable way of replacing damaged or worn quills instead of costly spindle replacements.



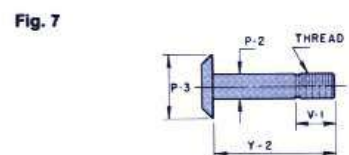
### FIGURE #6

Collet chuck quills are available for Brown & Sharpe, Morse & Jarno Tapers. These collet chucks provide the superior gripping power and accuracy required for today's high performance machines. Mating surfaces are precision ground to hold concentricity well within .0005" TIR at the nose.



### FIGURE #7

A variety of standard wheelscrews are available to accommodate a wide range of wheel sizes. These wheelscrews have a ground pilot diameter ('P-2' Dimension) which mates with the ground hole in the quill to prevent run-out and vibration.





QUILL TYPE	FIG.#	I	P-1	P-2	U	Y
1155	3	.63	.38	.19	.750	1.00
1156	3	.63	.38	.19	.750	1.50
1157	3	.63	.38	.19	.750	2.00
1158	3	.75	.44	.25	.750	1.00
1159	3	.75	.44	.25	.750	1.50
1160	3	.75	.44	.25	.750	2.00
1161	3	.75	.50	.25	.750	1.00
1162	3	.75	.50	.25	.750	1.50
1163	3	.75	.50	.25	.750	2.00
1164	2	.75	.50	.25	.750	2.50
1165	3	.75	.56	.25	.750	1.00
1166	3	.75	.56	.25	.750	1.50
1167	3	.75	.56	.25	.750	2.00
1168	2	.75	.56	.25	.750	2.50
1169	3	1.00	.63	.38	.750	1.00
1170	3	1.00	.63	.38	.750	1.50
1171	3	1.00	.63	.38	.750	2.00
1172	3	1.00	.63	.38	.750	2.50
1173	2	1.00	.63	.38	.750	3.00
1174	3	1.00	.69	.38	.750	1.00
1175	3	1.00	.69	.38	.750	1.50
1176	3	1.00	.69	.38	.750	2.00
1177	3	1.00	.69	.38	.750	2.50
1178	2	1.00	.69	.38	.750	3.00
1179	4	1.00	.75	.38	.750	1.00
1180	4	1.00	.75	.38	.750	1.75
1181	4	1.00	.75	.38	.750	2.50
1182	4	1.00	.75	.38	.750	3.25
1183	1	1.00	.75	.38	.750	4.00
1190	3	.75	.50	.25	1.000	1.00
1191	3	.75	.50	.25	1.000	1.50
1192	3	.75	.50	.25	1.000	2.00
1193	2	.75	.50	.25	1.000	2.50
1194	3	.75	.56	.25	1.000	1.00
1195	3	.75	.56	.25	1.000	1.50
1196	3	.75	.56	.25	1.000	2.00
1197	2	.75	.56	.25	1.000	2.50
1198	3	1.00	.63	.38	1.000	1.00
1199	3	1.00	.63	.38	1.000	1.50
1200	3	1.00	.63	.38	1.000	2.00
1201	3	1.00	.63	.38	1.000	2.50
1202	2	1.00	.63	.38	1.000	3.00
1203	3	1.00	.69	.38	1.000	1.00
1204	3	1.00	.69	.38	1.000	1.50
1205	3	1.00	.69	.38	1.000	2.00
1206	3	1.00	.69	.38	1.000	2.50
1207	2	1.00	.69	.38	1.000	3.00
1208	3	1.00	.75	.38	1.000	1.00
1209	3	1.00	.75	.38	1.000	1.75
1210	3	1.00	.75	.38	1.000	2.50
1211	2	1.00	.75	.38	1.000	3.25
1212	2	1.00	.75	.38	1.000	4.00
1213	3	1.00	.81	.38	1.000	1.00
1214	3	1.00	.81	.38	1.000	1.75
1215	3	1.00	.81	.38	1.000	2.50
1216	2	1.00	.81	.38	1.000	3.25

QUILL TYPE	FIG.#	I	P-1	P-2	U	Y
1217	2	1.00	.81	.38	1.000	4.00
1218	3	1.00	.88	.38	1.000	1.00
1219	3	1.00	.88	.38	1.000	1.75
1220	3	1.00	.88	.38	1.000	2.50
1221	2	1.00	.88	.38	1.000	3.50
1222	2	1.00	.88	.38	1.000	4.50
1223	3	1.00	.94	.38	1.000	1.00
1224	3	1.00	.94	.38	1.000	1.75
1225	3	1.00	.94	.38	1.000	2.50
1226	2	1.00	.94	.38	1.000	3.50
1227	2	1.00	.94	.38	1.000	4.50
1228	4	1.00	1.00	.38	1.000	1.00
1229	4	1.00	1.00	.38	1.000	2.00
1230	1	1.00	1.00	.38	1.000	3.00
1231	1	1.00	1.00	.38	1.000	4.00
1232	1	1.00	1.00	.38	1.000	5.00
1240	3	1.00	.75	.38	1.375	1.00
1241	3	1.00	.75	.38	1.375	1.75
1242	3	1.00	.75	.38	1.375	2.50
1243	2	1.00	.75	.38	1.375	3.25
1244	2	1.00	.75	.38	1.375	4.00
1245	3	1.00	.81	.38	1.375	1.00
1246	3	1.00	.81	.38	1.375	1.75
1247	3	1.00	.81	.38	1.375	2.50
1248	2	1.00	.81	.38	1.375	3.25
1249	2	1.00	.81	.38	1.375	4.00
1250	3	1.00	.88	.38	1.375	1.00
1251	3	1.00	.88	.38	1.375	1.75
1252	3	1.00	.88	.38	1.375	2.50
1253	2	1.00	.88	.38	1.375	3.50
1254	2	1.00	.88	.38	1.375	4.50
1255	3	1.00	.94	.38	1.375	1.00
1256	3	1.00	.94	.38	1.375	1.75
1257	2	1.00	.94	.38	1.375	2.50
1258	2	1.00	.94	.38	1.375	3.50
1259	2	1.00	.94	.38	1.375	4.50
1260	3	1.00	1.00	.38	1.375	2.00
1261	2	1.00	1.00	.38	1.375	3.00
1262	2	1.00	1.00	.38	1.375	4.00
1263	2	1.00	1.00	.38	1.375	5.00
1264	3	1.00	1.13	.38	1.375	1.50
1265	3	1.00	1.13	.38	1.375	2.50
1266	2	1.00	1.13	.38	1.375	3.50
1267	2	1.00	1.13	.38	1.375	4.50
1268	2	1.00	1.13	.38	1.375	5.50
1269	3	1.00	1.25	.63	1.375	2.00
1270	3	1.00	1.25	.63	1.375	3.00
1271	2	1.00	1.25	.63	1.375	4.00
1272	2	1.00	1.25	.63	1.375	5.00
1273	2	1.00	1.25	.63	1.375	6.00
1274	4	1.00	1.38	.63	1.375	2.00
1275	4	1.00	1.38	.63	1.375	3.50
1276	1	1.00	1.38	.63	1.375	4.50
1277	1	1.00	1.38	.63	1.375	5.50
1278	1	1.00	1.38	.63	1.375	6.50

**WARNING**—Never Exceed The Maximum Safe Operating Speed Of Any Grinding Wheel.  
CONSULT ANSI B7.1-1978 SAFETY CODE FOR USE, CARE AND PROTECTION OF ABRASIVE WHEELS.

# S Spindle Accessories

## ADJUSTABLE MOTOR MOUNTING PLATES

Two types of motor mounting systems for the 4300 series rectangular style housings are available:  
 — Type 'A' design (ref. Photo #3715) is a multiple mounting plate construction designed for each

specific application with motor frame size and spindle speed dictating the exact size. This type is recommended when motor mounting to the side or rear of the spindle is not permitted.

Type 'A'

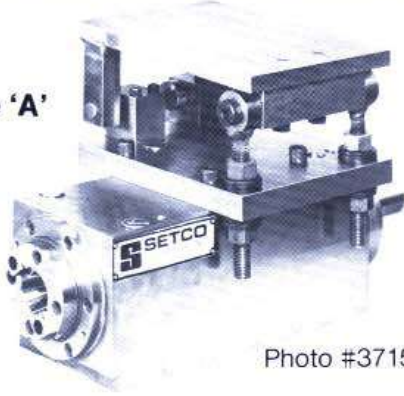
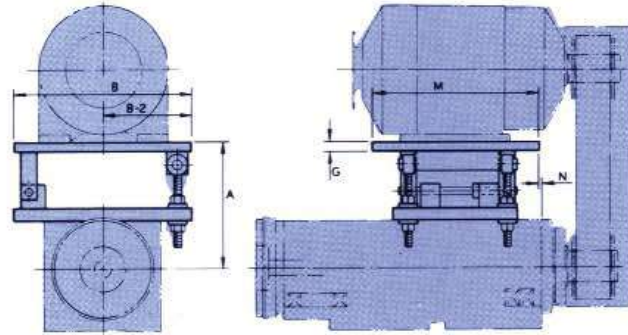


Photo #3715



— Type 'B' design (ref. Photo #4088) is an integral motor mounting bracket/belt guard system capable of

being positioned in one of many mounting attitudes. This design uses 'C' flange mounted motors.

Type 'B'

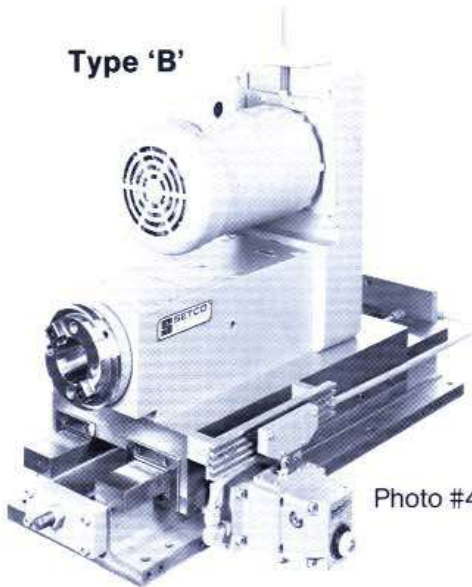
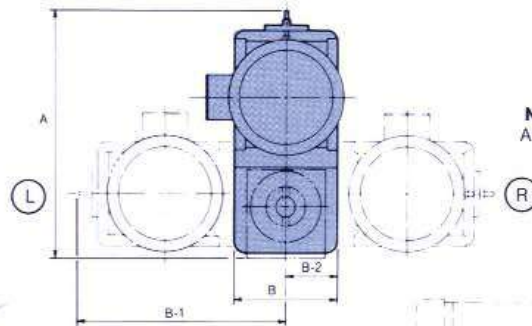
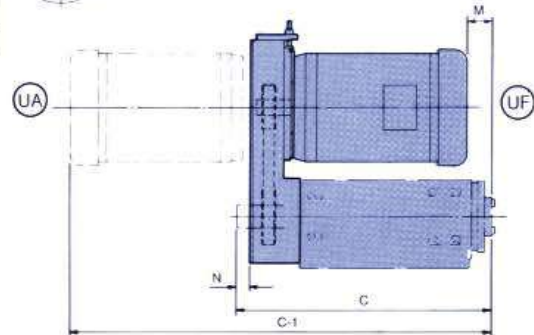


Photo #4088



**Note:** Specify Motor Mounting Attitude when ordering, L, R, UA or UF.



## OIL MIST LUBRICATORS

All SETCO Oil Mist Lubrication Systems are designed, calibrated and approved to operate with a particular precision spindle assembly. These systems produce a fine mist fog of oil particles which are introduced through the spindle housing into the rear and front anti-friction bearings to provide proper lubrication and to carry away heat generated by the bearings and stator/rotor. These systems permit higher operating speeds and the use of larger bearings for increased rigidity and power capabilities.

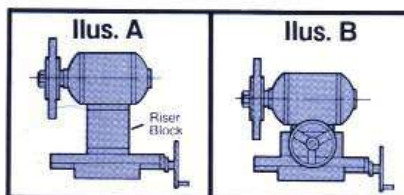
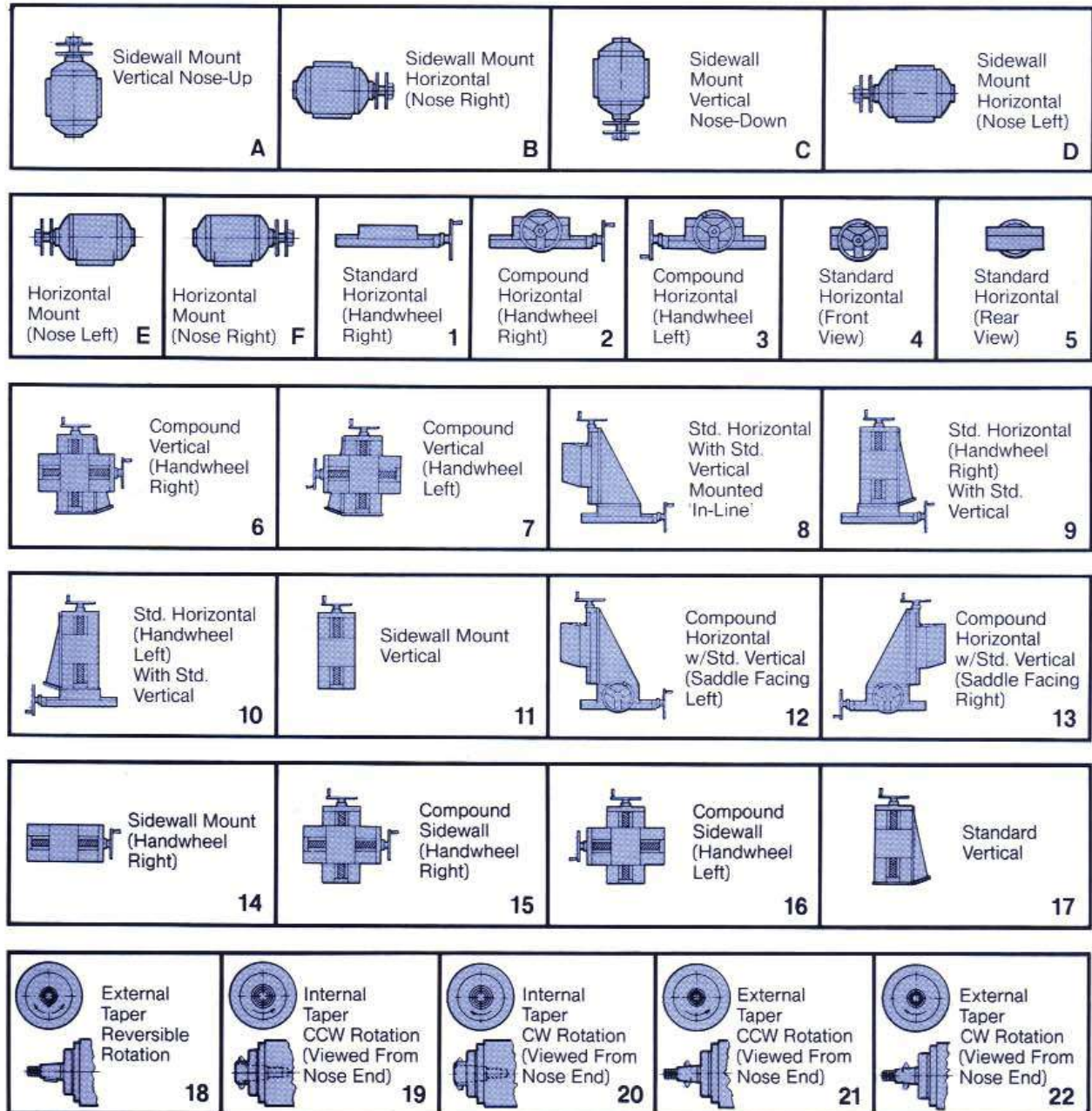


Photo #4142

# Spindle/ Slide Mounting Positions

The following sketches will assist you in specifying the mounting relationship of the spindle, its rotation and, in the event that the spindle will be mounted on slides, (Reference Catalog #183) the mounting relationship of the spindle with respect to the slides.

When inquiring for a spindle and/or slide combination, wherein a specific or special requirement may be involved, a sketch will be helpful in assisting our Proposal Engineering group to analyze your application.



## WHEEL OR GUARD INTERFERENCE

When the wheel or guard interferes with the slide or the slides' accordion protectors, a riser block (ref. Illus. 'A') is required. Riser blocks are usually not required when mounting on a compound with the top slide being perpendicular to the spindle centerline (ref. Illus. 'B').

The information compiled in this section is intended as a guide in selecting the proper parameters for a particular grinding application.

The process of selecting the proper horsepower, speed, feed, wheel, etc., should be based on experience and testing. There are no general equations that can adequately describe the selection process without use of test results for the particular application.

The SETCO precision grinding spindles in this catalog have listings of the maximum horsepower and speed along with other parameters to aid the customer in proper selection. On special applications, we invite you to use the services of the SETCO Proposal Engineering or Sales Engineering Departments.

All of the standard spindles in this catalog can be modified to meet your exact specifications. We ask that you reference the letter dimensional drawings on pages 4 and 9 for the belt driven grinding spindles and pages 19 and 21 for the T.E.N.V. and T.E.F.C. motorized grinding spindles. The standard features related to the spindles in this catalog are listed on page 3. Page 5 illustrates a table of wheel speeds for quick reference in grinding wheel ratings (S.F.P.M.).

## GENERAL GUIDES FOR SURFACE GRINDING

1. To minimize heat and warpage in the work piece; use fast table speeds, light down feeds and dress the wheel before final size.
2. When using wheels larger than a 14" diameter; use a one grade softer band.

## GENERAL GUIDES FOR SURFACE GRINDING—VERTICAL SPINDLE, ROTARY TABLE

1. To produce smoother work piece finish and closer tolerances; use a faster table speed, lighter down feed and proper sparkout.
2. To increase material removal rate; increase table speed and down feed rate.

## GENERAL GUIDES FOR CYLINDRICAL GRINDING

1. When using wheels larger than a 14" diameter; use a one grade softer band.
2. For heavier stock removal; use a faster traverse feed rate and a slower work speed and/or increase the depth of cut.
3. To improve work piece finish; use a slower traverse feed rate and a faster work speed and/or decrease the depth of cut.
4. When using wider wheels; use a softer grade wheel (infeed grinding).
5. When using narrower wheels; use a harder grade wheel (infeed grinding).

## GENERAL GUIDES FOR INTERNAL GRINDING

1. For long bores; use softer grade wheels and wider wheels if possible.
2. For low powered machines; use softer grade wheels
3. For light spindle machines; use softer grade wheels.

## GENERAL GUIDES FOR GRINDING

TO... USE...➔	COARSER GRAIN WHEEL	FINER GRAIN WHEEL	HARDER GRADE WHEEL	SOFTER GRADE WHEEL	DENSER STRUC- TURE WHEEL	MORE OPEN STRUC- TURE WHEEL	LESS FRIABLE ABRASIVE ON WHEEL	MORE FRIABLE ABRASIVE ON WHEEL	WET GRIND	DRESS WHEEL TO FINE FINISH	MAINTAIN WHEEL SHARP- NESS
REMOVE A SUBSTANTIAL AMOUNT OF STOCK									•		
REMOVE STOCK FASTER	•					•	•				
PRODUCE A SMOOTHER FINISH		•			•		•			•	
GENERATE FORM		•			•						
GRIND LARGE AREAS	•			•							
GRIND SMALL AREAS		•	•								
GRIND SOFT METALS	•		•								
GRIND HARD METALS		•		•							
MINIMIZE HEAT, WARPAGE, & SURFACE DAMAGE IN THE WORKPIECE											•
KEEP GRINDING WHEEL FROM BREAKING DOWN TOO FAST			•		•		•				
KEEP GRINDING WHEEL FROM GLAZING & BURNING				•		•		•			

## STANDARD MAXIMUM WHEEL SPEEDS

The maximum operating speed as determined by the manufacturer is dependent on the wheel shape and strength. It is the responsibility of the wheel user to make sure that under no conditions is a wheel to be operated faster than the maximum surface feet per minute established by the wheel manufacturer. Serious personal injuries can result from wheel breakage.

CLASSIFICATION NUMBER	TYPES OF WHEELS	MAXIMUM WHEEL SPEED, fpm					
		INORGANIC BONDS			ORGANIC BONDS		
		Low Strength	Medium Strength	High Strength	Low Strength	Medium Strength	High Strength
1	Type 1—Straight Wheels—except classifications 6, 9, 10, 11, 12, 13, and 14 below. Type 4*—Taper Side Wheels Types 5, 7, 20, 21, 22, 23, 24, 25, 26 Recessed, Dovetailed and/or relieved wheels (Except Classification 14 below.) Type 12—Dish Wheels Type 13—Saucer Wheels Types 16, 17, 18, 19—Cones and Plugs	5,500	6,000	6,500	6,500	8,000	9,500
2	Type 2—Cylinder Wheels including plate mounted, inserted nut and projecting stud—Segments	5,000	5,500	6,000	5,000	6,000	7,000
3	Cup Shape Tool Grinding Wheels (For Fixed Base Machines) Type 6—Straight Side Cups Type 11—Flaring Cups	4,500	5,000	6,000	6,000	7,500	8,500
4	Cup Shape Snagging Wheels (For Portable Machines) Type 6—Straight Side Cups Type 11—Flaring Cups	4,500	5,500	6,500	6,000	8,000	9,500
5	Abrasive Discs: Plate Mounted Inserted Nut and Projecting Stud: Solid or Segmental	5,500	6,000	6,500	5,500	7,000	8,500
6†	Reinforced Wheels Type 1 Max. Dia. 4" Max. Thickness 1/4"	NA	NA	NA	9,500	12,500	16,000
	Max. Dia. 10" Max. Thickness 1/2"	NA	NA	NA	9,500	12,500	14,200
	All Other Diameters and Thicknesses	NA	NA	NA	9,500	12,500	12,500
	Reinforced Wheels—Types 27 and 28 Max. Dia. 9" Max. Thickness 3/8" Max. Dia. 9"—Over 3/8" Thick	NA	NA	NA	9,500	12,500	14,200
8	Diamond and Cubic Boron Nitride Wheels	NA	NA	6,500	NA	NA	9,500
	Exceptions: 1. Metal Bond	NA	NA	12,000	NA	NA	NA
	2. Steel Centered Cutting-off Wheels	NA	NA	16,000	NA	NA	16,000
9	Cutting-off Wheels Types 1 and 27A Larger than 16" dia., Including Reinforced Organic	NA	NA	NA	9,500	12,000	14,200
10	Cutting-off Wheels Type 1 and 27A 16" dia., and Smaller—Including Reinforced Organic	NA	NA	NA	9,500	12,000	16,000
11	Thread and Flute Grinding Wheels	8,000	10,000	12,000	8,000	10,000	12,000
12	Crankshaft and Camshaft Grinding Wheels	5,500	8,000	8,500	6,500	8,000	9,500
14	Internal Wheels—Type 1 and 5 Maximum dia. 6"	5,500	8,000	8,500	6,500	8,500	9,500
15	Mounted Wheels (See standard for limitations)	NA	NA	10,000	NA	NA	10,000

SOURCE: ANSI B7.1-1978, Pgs. 64 & 65 (Reference Section 1 for Type definitions).

NOTE: Abrasive wheels are produced in a wide range of specifications to perform satisfactorily in a wide range of grinding applications. Different wheel grades have different strengths; harder grade wheels are generally stronger than softer grade wheels, although other ingredients such as grit size, structure and bond type play a part in the overall strength of an abrasive wheel specification. Therefore, the maximum allowable operating speeds vary depending on the strength of the wheel. It is for this reason that speeds shown are listed in columns labeled Low, Medium, and High Strength. Consult the wheel manufacturer for proper wheel selection and application.

\*Non-standard shape.  
†Classification 6 excludes cutoff wheels.  
NA = not applicable.



# Application Photos

Photo #3133

Type 2715-12HSY Motorized Hydro-Static Grinding Spindle Assembly rated 15 H.P. at 1200 R.P.M. for use on a Mattison Surface Grinder.

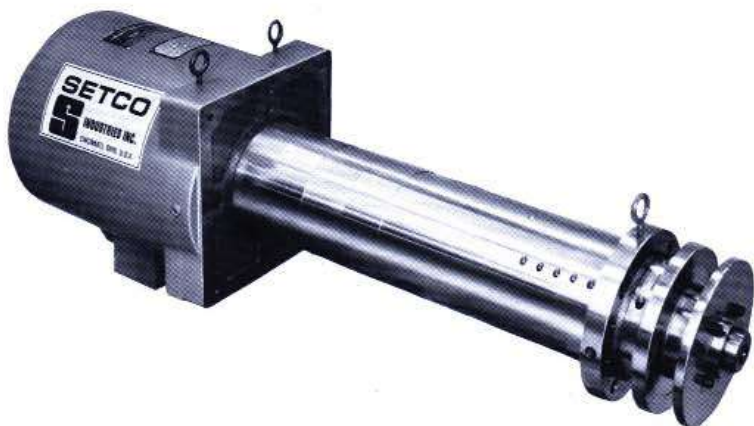


Photo #3903

Special spindle conversion of an ELB grinding spindle to ball bearing construction.



Photo #3810

Type 1990Y Belt Driven stem mounted spherical Grinding Attachment designed to mount on a Vertical Boring Mill.



Photo #1754

Type 2820-18GY Surface Grinding Spindle with special square extension and swivel to adapt to customer's existing column.

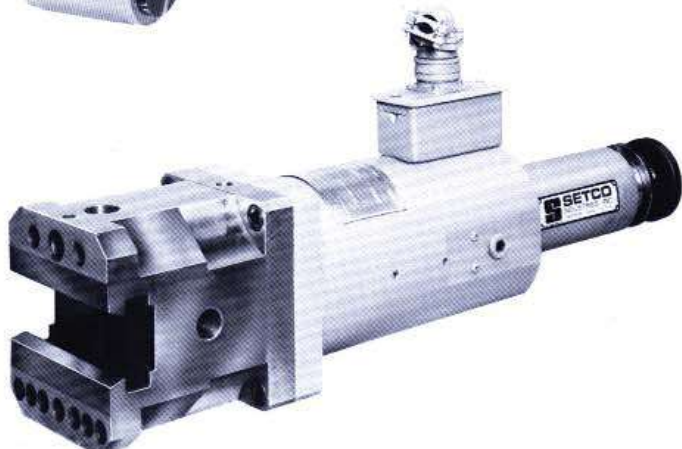


Photo #3808

This Motorized Grinding Spindle was designed to shank mount on a Bullard Tool Block and includes electrical quick disconnect and reversible rotation.



Photo #3340

High Speed Grinding Spindle Type 12701-36Y rated to operate at a maximum 8000 R.P.M. at 1½ H.P., 133 hertz. Spindle includes special tapered extension with wheel holder.

Photo #3590

Grinder conversion package mounted on a 24" wide hardened steel way slide assembly complete with D.C. servo drive and arranged to adapt to a Lucas Boring Mill.

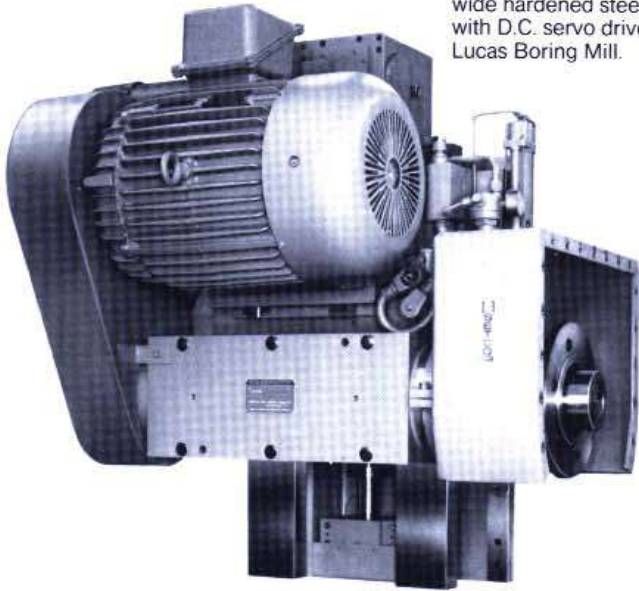


Photo #3627

Special work holding spindle assembly which was adapted to customers existing dovetail way on their O.D. Grinder. Unit includes Erickson air operated collet chuck nose for 1/2" diameter rod.

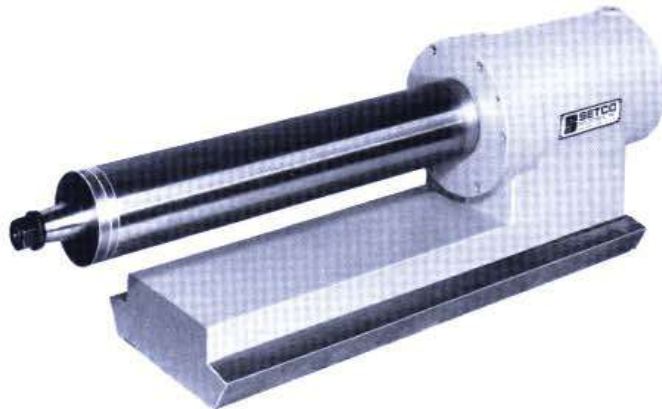


Photo #3844

Type 2803-18Y Surface Grinding Spindle arranged to column mount in a Mattison Surface Grinder.

Photo #3753

Designed for a Summit 60" Boring Mill, this Type 3612/SHL12FRD Spindle/Hardened Steel Way Slide Assembly affords a great deal of versatility in grinding operations.

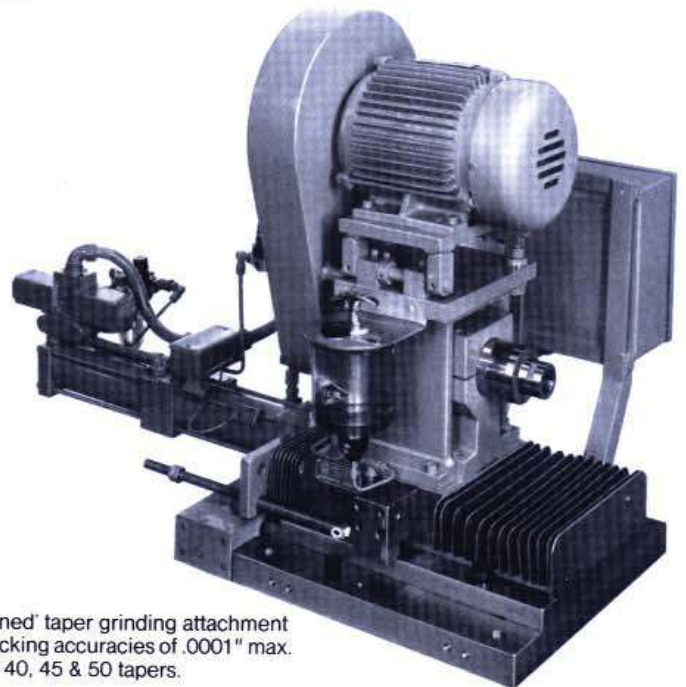


Photo #3969

Portable 'self-contained' taper grinding attachment with special slide tracking accuracies of .0001" max. side to side to grind 40, 45 & 50 tapers.

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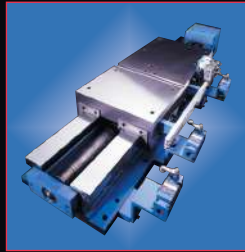
## PRODUCTS



Dovetail Slides



Linear Recirculating Bearing Slides



Hardened Steel Way Slides



Grinding Spindles and Accessories



Boring and Milling Spindles



Sentry Belt-Driven Spindles



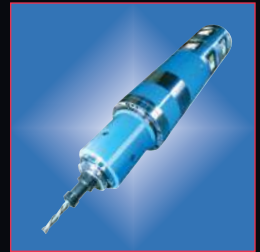
Spindle/Slide Combinations



3-Axis Machining Modules



ProMetrix Belt-Driven Spindles



Smart Closed-Loop Motorized Spindles

## SERVICES



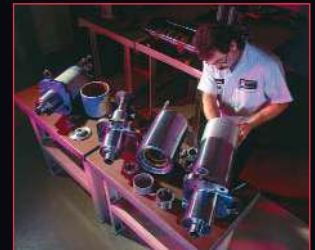
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