Gilman USA LLC
SOLUTIONS FOR LINEAR & ROTARY MOTION

Cartridge and block spindles

A wide selection for milling, drilling, boring and other rotational processes

Gilman USA complete spindle selection

Cartridge and block belt-driven spindles

Catalog No. 606
- Six standard tool interface styles
- Multiple bearing setups
- 8 spindle sizes: 1.25" to 8" cartridge dia.
- 36 lb. thrust to 4700 lb. thrust
- Up to 27,200 RPM max.
- Up to 30 HP
- All components in stock

Integral motor spindles

MECH-TRONIX:
Catalog No. 401
- Complete spindle systems
  - Chillers
  - Drives
  - Tool adapters
- 3 standard tool interfaces
- 4 bearing structures
- 11,800 RPM max.
- Up to 20 HP (SI duty)

Compact milling spindles:
- Torque up to 200 Nm and speeds up to 15,000 RPM
- Pneumatic or hydraulic unclamping units
- SK40, ANSI 40, BT 40, CAT 40, HSK-A63 & HSK-E63 tool tapers

High speed milling spindles

Visit www.GilmanUSA.com for more information.

Grinding spindles:
Catalog No. 5448/E
- Horizontal grinding spindles up to 60 kW and up to 180,000 RPM
- Vertical grinding spindles up to 40 kW and up to 6,000 RPM
- Surface grinding spindles up to 7 kW and up to 20,000 RPM
- Hydrostatic grinding spindles up to 62 kW and up to 60,000 RPM
- Hydrodynamic grinding spindles up to 21.5 kW and up to 50,000 RPM

Hyperspin magnetic bearing spindles:
- Non contacting high reliability, very high speed
- Low vibration

Visit www.revolve.com for more information on magnetic bearing spindles.

Gilman brand spindles

Gilman USA delivers new quality products and services

Take advantage of exclusive Gilman USA technologies and precision craftsmanship.

- Whether your end application is a special machine or an OEM product line, the Grafton, WI plant - along with three Gilman USA spindle facilities worldwide - assure you responsive engineering, precision manufacturing and prompt, efficient after-sale service.
- Emerging Gilman USA bearing technology allows Gilman USA to "push the envelope" in high speed belt driven performance: up to 12,000 RPM in 50 Taper and 15,000 RPM in 40 Taper tooling/tool holders. Gilman USA also provides OEM spindles, special retrofits and cluster spindle modules.

The "Engineering Handbook" for Gilman USA's belt-driven spindle line.

- In addition to drilling, milling, grinding and turning, Gilman brand spindles have tackled many types of specialized machining operations, including computer hard disk finishing, silicon wafer cutting, glass finishing and servo memory to name just a few call us to discuss your specialized applications.
- Unlike some products machined for accuracy after assembly, Gilman USA's components are precision manufactured with state-of-the-industry boring and grinding equipment to millionths-of-inch tolerances before being assembled in our Class 10,000 clean room.
- Gilman USA is ISO 9001, 14001, and 18,000 certified for quality systems and environmentally friendly processes.

Table of contents

All dimensions in inches unless otherwise indicated.

Product features

The Gilman brand spindle line

This catalog presents the current line of standard Gilman brand spindles, which are normally available for quick delivery from our extensive inventory stock. In these pages you'll find a wide variety of spindle sizes and speeds, in configurations to meet most machine applications.

Standard Gilman brand spindles can be motorized belt-driven; they range in size from 1¦3 to 30 horsepower and are available at fixed speeds. We can also supply a full range of spindle accessories including draw bars, coolant unions, wrenches, bearing sensors, lubricators and others.

If none of these standard spindles meet your requirements, a custom-designed spindle may well be the answer. Please refer to pages 44 and 45 for a review of Gilman USA custom capabilities. Then dial 1-800-445-6267 (In WI 262-377-2434) to discuss your needs with one of our application engineers.

Key features of Gilman brand spindles

Every Gilman brand precision spindle is built from the highest quality materials and components, to deliver high performance and long life. Features include:

- **High-quality alloy steel shaft.** Case hardened and precision ground, the shaft combines a hard outer surface with a tough, resilient core. Shaft threads are also precision ground, resulting in excellent accuracy.
- Precision grade ABEC-7 angular contact **ball bearings** are provided as standard. (Model 1250 and 1875 spindles feature ABEC-7 shielded deep groove ball bearings.) Bearings are lubricated with high performance synthetic grease.
- Close-grain, stress-relieved **cast iron housings** provide excellent dampening and heat-transfer properties.
- **Precision runout tolerances** down to .0001 T.I.R. are standard, depending on the size of the spindle unit. (Please refer to the adjoining chart.) **Spindles with even higher precision (lower T.I.R. values) can be furnished on request.**
- **Highly effective standard sealing design** includes labyrinth seals with flinging grooves and a gravity drain. Lower speed models feature Nitrile rubber V-ring seals. Air purging can be specified if desired. Models 1250 and 1875 feature a sealing method described on pages 7 and 8.
- Special materials and sealing methods can be used with any Gilman brand spindle, as may be required by unusual **environmental situations.**
- **Motorized spindles** incorporate a 230/460 volt 3-phase 60-Hz totally-enclosed fan-cooled motor, with timing belt drives, as standard. (Model 1875 spindles are furnished with a totally-enclosed non-ventilated motor.) Poly-V, V-belt, and flat belt drives are available for applications where high speed and minimum vibration are required.
- **Vertical travel spindle units** combine a motorized spindle with a slide assembly. The precise and rigid Gilman slide unit is constructed with oil-grooved low-friction bearing material on the saddle wear surfaces, guided on two precision-ground and hardened rectangular steel ways. Saddle tracking accuracy is .0005 inch per 3 feet of travel. Three different slide drives are offered: manual lead screw right angle drive, powered ball lead screw, and hydraulic cylinder.

Spindle selection and ordering

Please refer to page 5 for information on selecting the proper size spindle to match your application. Detailed ordering information can be found on page 6.

Need assistance in selecting a spindle? Just call our application engineering department (1-800-445-6267; in Wisconsin call 262-377-2434; FAX 262-377-9438). Or, write us regarding your application, and we will recommend a standard design or modification, or a custom-engineered spindle to meet your needs. Please describe the application fully, including the type of machine in which the spindle will be used, speed, horsepower, configuration, and envelope or size requirements. Gilman USA Inc., 1230 Cheyenne Avenue, P.O. Box 5, Grafton, WI 53024.

Spindle Runout

		Model							
Nose style	**Runout location**	**1250**	**1875**	**2750**	**3500**	**4000**	**5500**	**6500**	**8000**
N.M.T.B.	Mounting face radial diameter internal taper			.0002 .0002 .0001	.0002 .0002 .0001	.0002 .0002 .0001	.0002 .0002 .0001	.0003 .0003 .0002	.0003 .0003 .0002
Boring nose or HSK	Pilot bore mounting face			.0001 .0001	.0001 .0001	.0001 .0001	.0001 .0001	.0002 .0002	.0002 .0002
Collet and Morse taper	Internal taper		.0003	.0001	.0001				
Straight bore	Internal bore		.0003	.0002					
Arbor	Radial diameter	.0003	.0003						

Please note: It is the established policy of Gilman USA to seek continuing improvement of our products.
Accordingly, all dimensions, designs and specifications presented in this catalog are subject to change without notice.

Sizing instructions

Proper spindle sizing is important to ensure a long and dependable life. To help select the correct spindle, the following factors should be considered.

General rules for sizing

1 Always select the largest spindle that will fit your particular space and comply with the speed requirements. This will give you the maximum spindle stiffness and longest life.

2 Keep tool overhang to a minimum, particularly when boring, end milling or nonsupported arbor milling. As you move farther from the spindle bearings, bearing loads increase and spindle stiffness decreases. Use the specification charts to find the maximum overhang distance.

3 When boring, the spindle nose bearing I.D. should be as large or larger than the hole being machined.

4 To minimize any shaft or bearing loading, keep within the maximum torque rating given on the specification charts.

5 Consider the environment in which the spindle is used. If the conditions are dusty, air purging is recommended. If there is heavy coolant or chips, it is advisable to supply a deflector cover to keep coolant or chips from directly attacking the spindle. Contact seals should be used unless speed requirements do not allow.

6 Specify the correct bearing arrangement. For mostly radial loaded applications, use a bearing pair at the nose end. For high axial loads, combination axial and radial loading or heavy or interrupted cuts, use a triplex bearing set at the nose end.

7 Gilman USA's engineering and sales staff is always available to help select the correct spindles for your applications. When asking for assistance, please supply the following information:

a) Type of operation and stock removal amounts

b) Tooling description

c) Part material specification

d) Spindle orientation

e) Environmental conditions

f) Space limitations

g) Horsepower and RPM required

Whenever possible, supply a part print along with any other information that may be useful in spindle selection.

Ordering instructions

Each spindle assembly is defined by the model number, which consists of a maximum of seven code symbols.

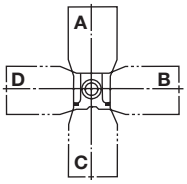
Cartridge and block spindles are identified by the first five code symbols. The first symbol determines the size of the spindle. The second symbol identifies the cartridge mounting or block configuration. The third symbol identifies the internal construction type and the fourth identifies the nose end bearing preload. The fifth symbol identifies the type of spindle nose.

Specify speed when ordering. Brackets are available for all cartridge spindles, see dimension sheets for model numbers.

Motorized Spindles use the first five code symbols of the cartridge assembly, and the sixth code symbol to describe the type of motor drive.

On most belt drive units, the motor can be positioned at four locations around the spindle (see drawing at right), but motor positions are not field changeable. Position "A" will be furnished unless otherwise specified. ***Motor dimensions and frame size may vary. If exact dimensions are required, request certified print.***

Specify spindle speed when ordering. All motors will be supplied 230/460 volt, 3 phase 60 cycle. Consult factory for other motor specifications and spindle speeds not shown in charts.



Motor positions

Motorized vertical travel spindles use all seven code symbols. The last symbol identifies the slide drive. All vertical travel belt drive units use the B1 belt drive in Position "A".

You can readily determine the spindle model number as you decide on size, cartridge mounting, internal construction, shaft type and if motorized or vertical travel drives are required.

Check to see that each code symbol in the model number is indicated under the size selected and to the left in the column under the assembly selected. These are the spindle assemblies that are available.

We can give prompt accurate service if complete information is provided with the order. If you have any questions, please phone our Sales Engineering Department at (262) 377-2434.

Specify air purge if required. Fittings will be supplied upon request on nose end of cartridge spindles and each end of block spindles.

Model number code

● Motorized vertical travel spindle
● Motorized spindle
● Block spindle
● Cartridge spindle

2750C-X1M-30-B1-E1

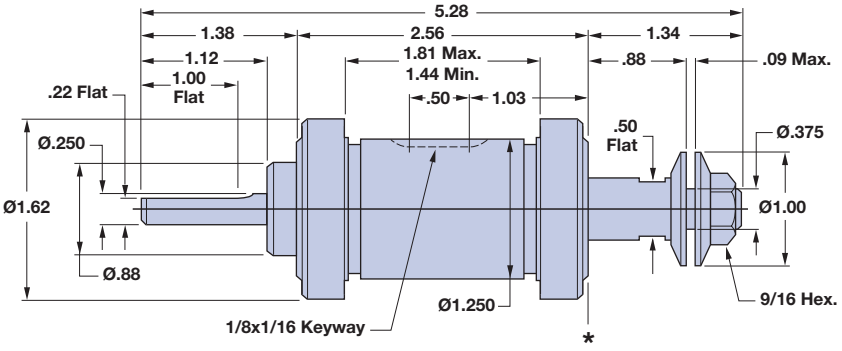
Size 1250	1875	2750	3500	4000	5500	6500	8000	Description	Code
								Type	
			●	●	●				
			●	●	●			Plain housing cartridge	P
	●		●	●	●			Positioning nut cartridge	N
●	●		●			●	●	Flange housing cartridge	C
	●	●				●	●	Block housing	B
								Internal construction	
●	●	●	●	●	●	●	●	Duplex ball nose end, contact seal	X1
●	●	●	●			●	●	Duplex ball nose end, labyrinth seal	X2
●	●	●	●			●	●	Duplex ceramic ball nose end, lab seal	X2C
●	●	●	●			●	●	Triplex ball nose end, contact seal	X3
●	●	●	●			●	●	Triplex ball nose end, labyrinth seal	X4
●	●	●	●			●	●	Triplex ceramic ball nose end, lab seal	X4C
								Nose end bearing preload	
●	●	●	●			●	●	Light preload	L
●	●	●	●	●	●	●	●	Medium preload	M‡
●	●	●	●			●	●	Heavy preload	H
								Shaft nose	
	●		●	●	●			Arbor	AR°
	●		●		●			Morse taper	MT
●	●	●	●		●	●		Straight bore	ST
●	●	●	●			●	●	Boring nose	BN
●	●	●	●		●	●	●	Collet	CE
●	●	●	●			●	●	HSK manual adapter	HM
●	●	●	●			●	●	30 NMTB	30
●	●	●	●					40 NMTB	40
●	●	●	●				●	50 NMTB	50
								Motor drive	
●	●				●	●	●	Belt – motor drive end (high HP)	B1+
	●				●	●	●	Belt – motor nose end (high HP)	B2
	●					●	●	Belt – motor drive end (low HP)	B3
	●					●	●	Belt – motor nose end (low HP)	B4
								Slide drive	
●						●	●	Ball lead screw powered drive	D1,M1,D2,M2,D3,M3
●						●	●	Lead screw right angle manual drive	E1
●						●	●	Hydraulic cylinder stop rod	H2

° 1250 Arbor nose not available in motorized. + B1 available in 6500 vertical travel motorized spindle.
‡ Medium preload is offered as standard. Light and heavy preload are available upon request. 1250 and 1875 only available with medium preload.

The engineering department of Gilman USA reserves the right to change specifications without notice. Do not base final decisions on catalog drawings — ask for a certified print when you order a spindle.

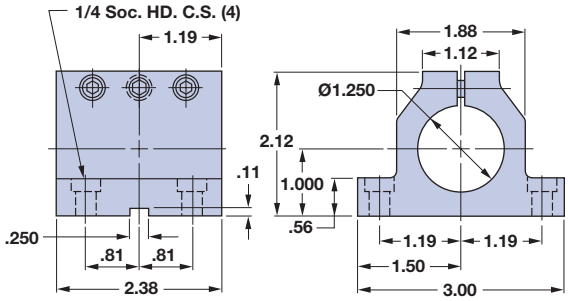
If servicing should be required on any Gilman spindle, we suggest the unit be returned for factory service to assure optimum performance and life.

Gilman 1250P, N
Cartridge spindles

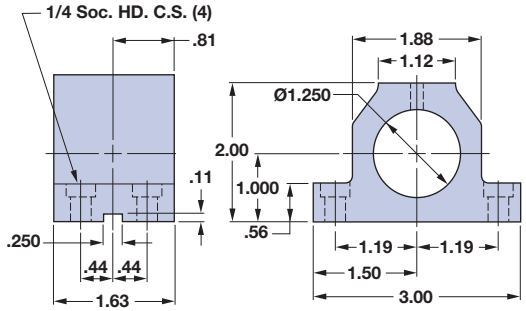


AR - ø.375 Arbor shaft

1250P & 1250N Brackets



Clamp type B20307-2



Positioning nut type B20308-2

Gilman 1250 cartridge spindles are available in plain and positioning nut types. Positioning nut models feature two .001-inch-graduated nuts at each end of the cartridge for axial adjustment of the spindle. They are available in one standard nose type and one standard internal construction.

Nose types:

- .375 diameter arbor

Internal construction:

- XIM duplex shielded ball bearing at nose end

Two types of brackets are available: clamp type for plain cartridges and positioning nut type. Both are manufactured from close grain, stress relieved cast iron.

Refer to the 1250 specification chart as well as the sizing instructions on page 5 to select the proper spindle for your rotational requirements. Special designs are also available to meet your specific needs.

1250 Approx. wt. 1 lb.

1250 Specification chart

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs/in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X1M	36	14,000	5,060	8 mm I.D. duplex ball	Shielded bearing	8 mm I.D. single row ball	Shielded bearing

* Maximum tool overhang (from *) = 1 1/4 (in.)
Maximum torque = 5 (in.- lbs.)
WK^2 = .023 (lb.- $in.^2$)
Note: Tool overhang pertains to boring, end milling and nonsupported arbor milling.

Gilman 1875P, N
Cartridge spindles

1875 cartridge spindles are available in plain and positioning nut types. Positioning nut models feature two .001-inch-graduated nuts at each end of the cartridge for axial adjustment of the spindle. Also available are four standard nose types and one standard internal construction.

Nose types:

- 1/16 to 3/8 ER16 collet
- .500 diameter arbor
- .500 diameter straight bore
- #1 Morse taper

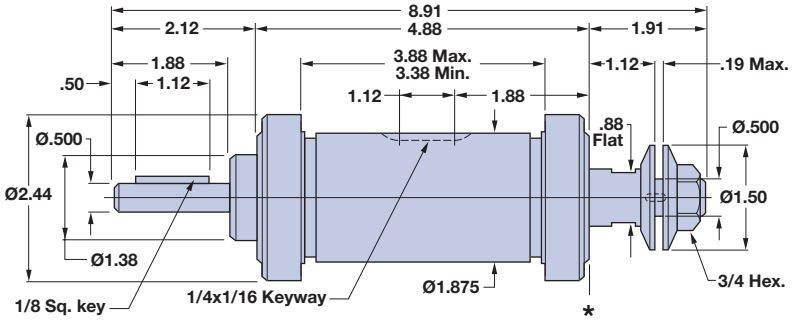
Internal construction:

- XIM duplex shielded ball bearing at nose end

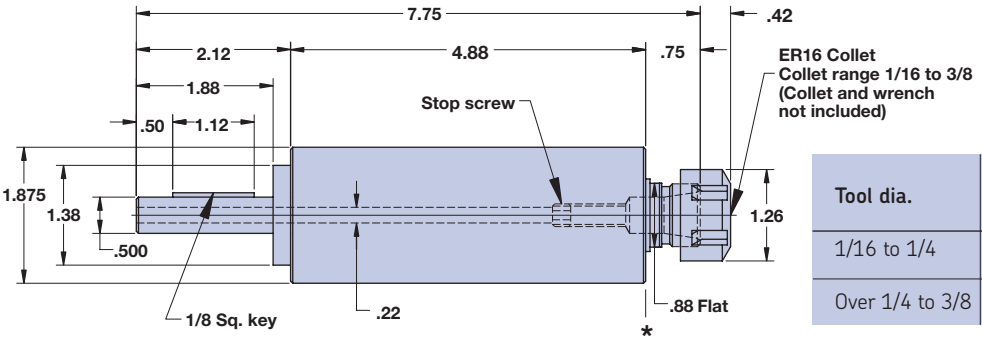
Two types of brackets are available, clamp type for plain cartridges and positioning type. Both are manufactured from close-grain, stress-relieved cast iron.

Refer to the 1875 specification chart as well as the sizing instructions on page 5 to select the proper spindle for your rotational requirements. Special designs are also available to meet your specific needs.

1875 Approx. wt. 4 lbs.

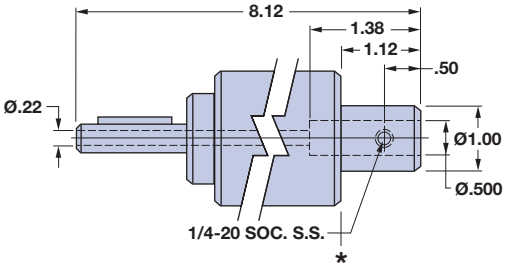


AR - Ø.500 Arbor shaft with 3/32 x 3/64 keyway

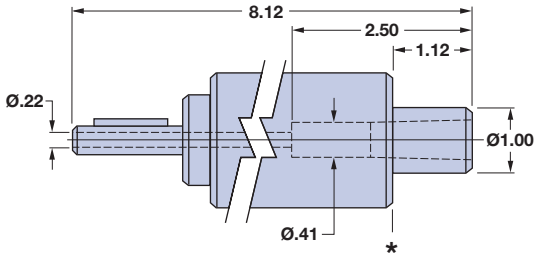


CE - ER16 Collet shaft

Tool dia.	Collet shaft max tool depth
1/16 to 1/4	2 in.
Over 1/4 to 3/8	1-3/16 in.

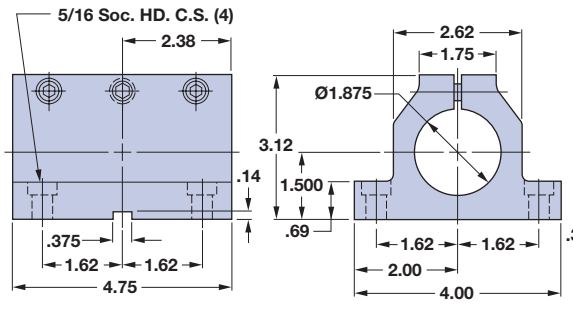


ST - Straight bore shaft

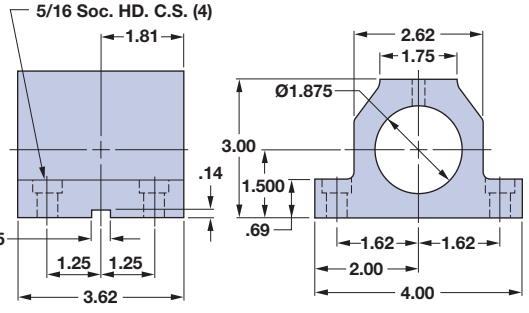


MT - #1 Morse taper shaft

1875P & 1875N Brackets



Clamp type C30168-2



Positioning nut type C30176-2

1875 Specification chart

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X1M	45	15,800	33,444	17 mm I.D. duplex ball	Shielded bearing	17 mm I.D. Single row ball	Shielded bearing

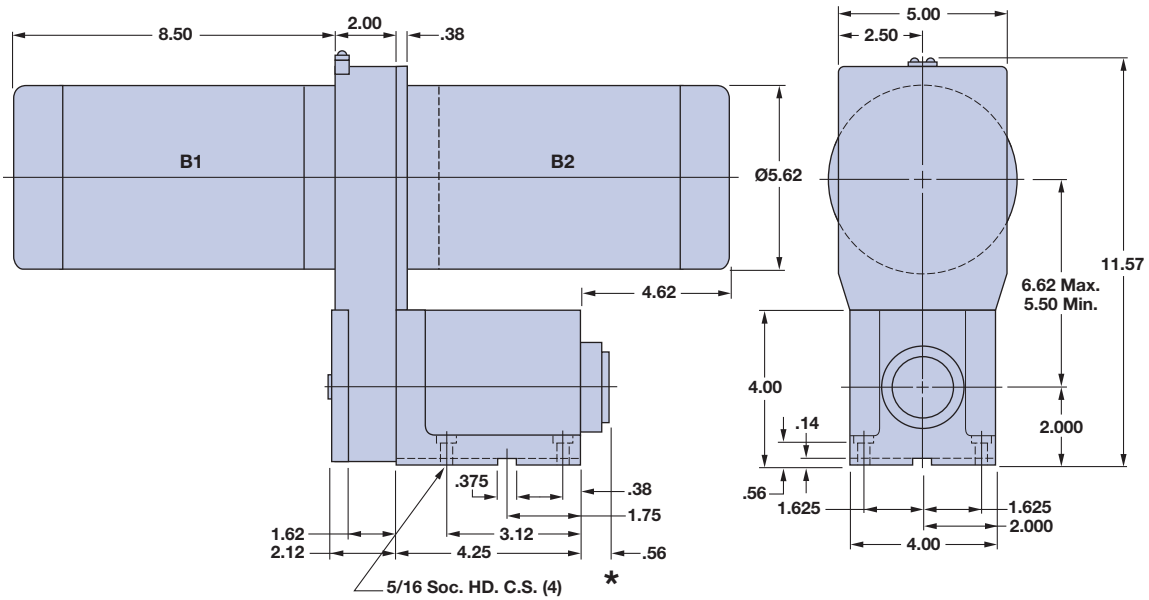
* Maximum tool overhang (from *) = 2 1/2 (in.)
Maximum torque = 35 (in.- lbs.)
WK^2 = .205 (lb.- $in.^2$)
Note: Tool overhang pertains to boring, end milling and nonsupported arbor milling.

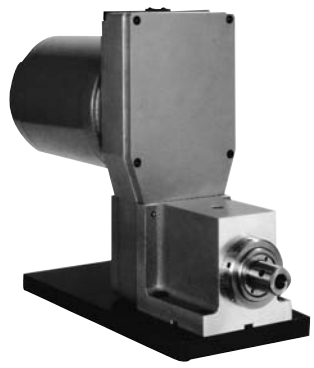
Gilman 1875N
Motorized spindles

1875N B1 & B2

Spindle R.P.M.		Motor		
Minimum	Maximum	R.P.M.	H.P.	Frame
800	2350	1160	1/3	48C
1150	3500	1750	1/4 or 1/2	48C
2300	10500	3500	1/3 or 1/2	48C

1875N motorized spindles are fixed-speed units incorporating a timing belt drive for positive power transmission. Poly-V, V-belt and flat-belt drives are available at additional cost where high speed and minimum vibration are required. For 1875N spindle capabilities reference the 1875 specification chart.*





Approx. wt. 35 lbs.

Note: * See 1875N spindles on page 8.

Gilman 2750C
Cartridge spindles

2750C cartridge spindles and 2750B block spindles are available with five standard nose types and six standard internal construction types.

Nose types:

- #30 N.M.T.B. taper
- Boring nose
- HSKC40 manual clamp
- 1/16 to 3/4 ER32 collet
- .750 diameter straight bore

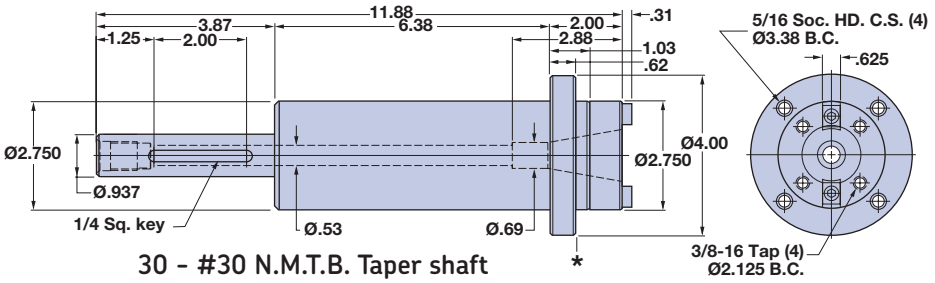
Internal constructions:

- X1 duplex ball bearing at nose end with contact seal
- X2 duplex ball bearing at nose end with labyrinth seal
- X2C duplex ceramic ball bearing at nose end with labyrinth seal
- X3 triplex ball bearing at nose end with contact seal
- X4 triplex ball bearing at nose end with labyrinth seal
- X4C triplex ceramic ball bearing at nose end with labyrinth seal

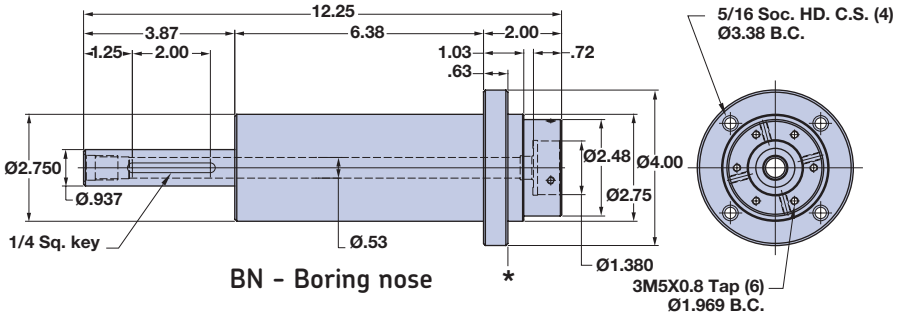
Refer to the 2750C/2750B specification chart, as well as the sizing instructions on page 5, to select the proper spindle for your rotational requirements. Special designs are also available to meet your specific needs.

2750C Approx. wt. 15 lbs.

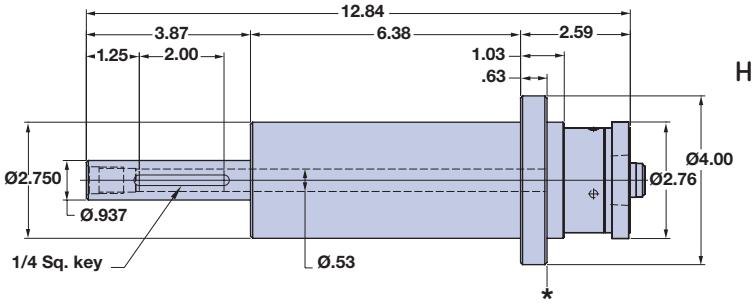
For cartridge spindle brackets, see "Gilman spindle accessories", page 47.



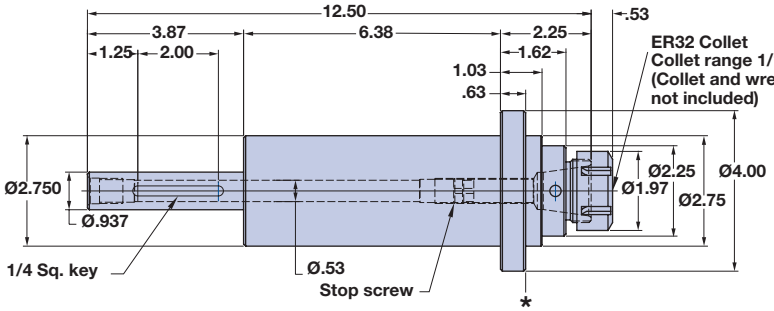
30 - #30 N.M.T.B. Taper shaft



BN - Boring nose

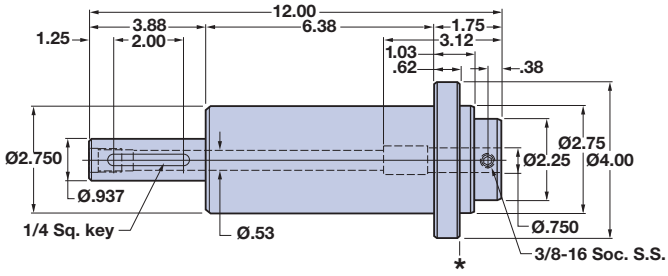


HM - HSKC40 Manual clamp
(T-wrench not included)



CE - ER32 Collet shaft

Tool dia.	Max tool depth
1/16 to 9/16	4 in.
Over 9/16 to 3/4	2 in.



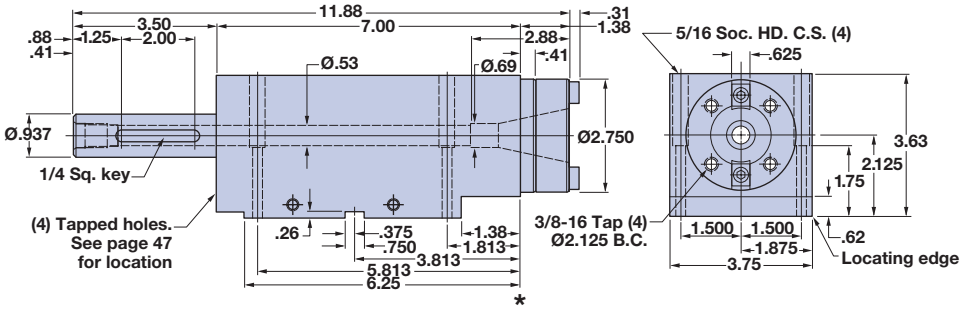
ST - Straight bore shaft

2750C & 2750B Specification chart

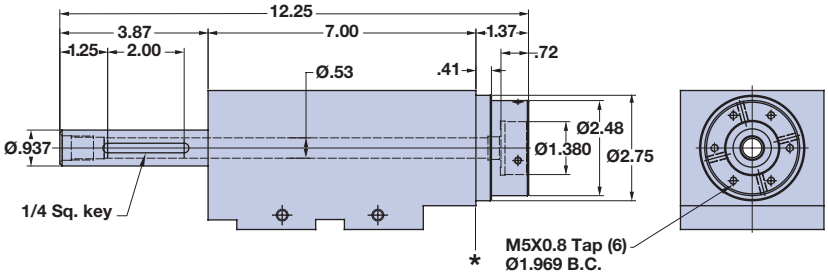
Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X1L X1M X1H	46 139 289	5,300 5,300 5,300	180,000 200,000 210,000	30 mm I.D. duplex ball	Contact	25mm I.D. duplex ball	Labyrinth
X2L X2M X2H	46 139 289	17,500 15,600 10,400	180,000 200,000 210,000	30 mm I.D. duplex ball	Labyrinth	25mm I.D. duplex ball	Labyrinth
X2CL X2CM	34 70	27,200 23,800	180,000 200,000	30 mm I.D. duplex ceramic ball	Labyrinth	25mm I.D. duplex ceramic ball	Labyrinth

Continued on next page

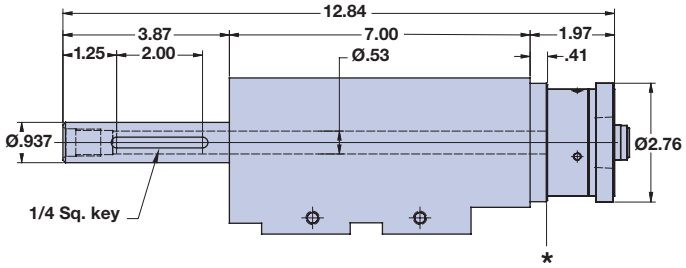
Gilman 2750B
Block spindles



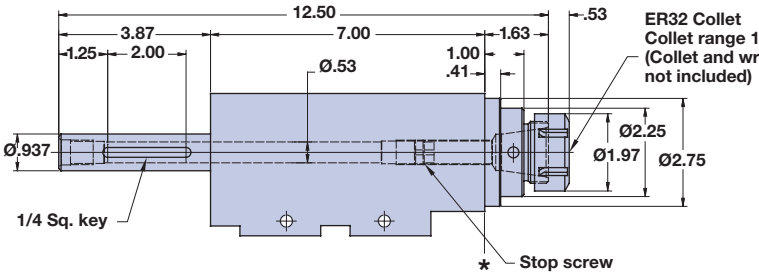
30 - #30 N.M.T.B. Taper shaft



BN - Boring nose

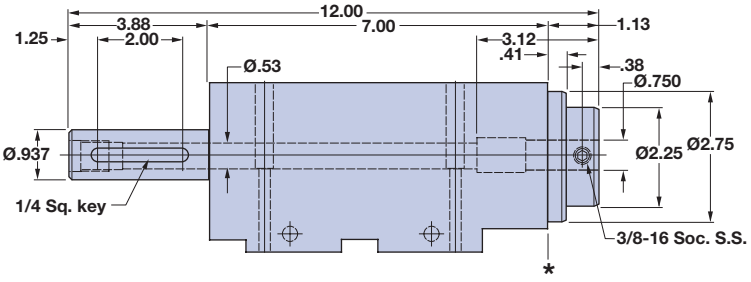


HM - HSKC40 Manual clamp
(T-wrench not included)



CE - ER32 Collet shaft

Tool dia.	Max tool depth
1/16 to 9/16	4 in.
Over 9/16 to 3/4	2 in.



ST - Straight bore shaft

2750B Approx. wt. 25 lbs.

2750C & 2750B Specification chart (continued)

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X3L X3M X3H	92 290 655	5,300 5,300 5,300	260,000 290,000 300,000	30 mm I.D. triplex ball	Contact	25mm I.D. duplex ball	Labyrinth
X4L X4M X4H	92 290 655	15,600 10,400 8,300	260,000 290,000 300,000	30 mm I.D. triplex ball	Labyrinth	25mm I.D. duplex ball	Labyrinth
X4CL X4CM	67 138	23,800 18,700	260,000 290,000	30 mm I.D. triplex ceramic ball	Labyrinth	25mm I.D. duplex ceramic ball	Labyrinth

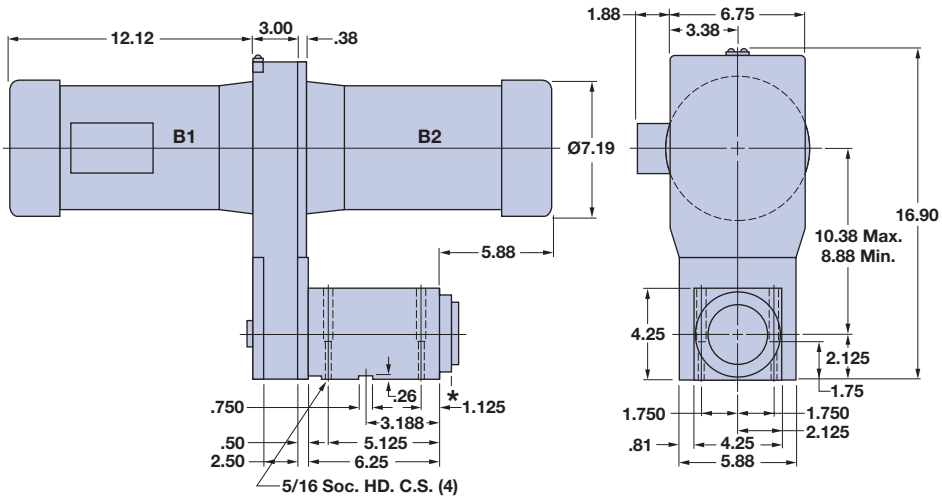
* Maximum tool overhang
(from *) = 3 (in.)
Maximum torque = 133 (in.- lbs.)
WK^2 = 2.8 (lb.- $in.^2$)
Note: Spindles are supplied with medium bearing preloads as standard. Light and heavy bearing preloads are available.
Tool overhang pertains to boring, end milling and nonsupported arbor milling.

Gilman 2750C
Motorized spindles

2750C and 2750B motorized spindles are fixed-speed units incorporating a timing belt drive for positive power transmission. Poly-V, V-belt and flat-belt drives are available at additional cost where high speed and minimum vibration are required. The 2750C and 2750B are available in two sizes: the B1/B2 units (high horsepower) or B3/B4 units (low horsepower). For 2750 spindle capabilities reference the 2750 specification charts.*

2750C B1 & B2

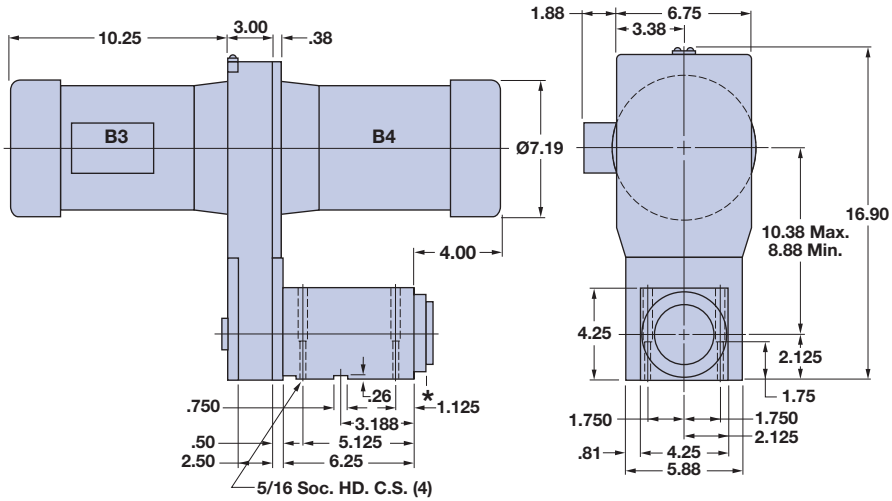
Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	900 900	2350 1900	1160	1 1/2	145TC
A & C B & D	1450 1450	3500 2050	1750	1 1/2 or 2	145TC
A & C B & D	3300 3300	7700 6250	3500	2 or 3	145TC



2750C B3 & B4

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	800 800	2350 2350	1160	1/3 or 1/2	56C
A & C B & D	1200 1200	3500 3500	1750	1/2 or 3/4	56C
A & C B & D	2400 2400	7700 6250	3500	3/4 or 1	56C

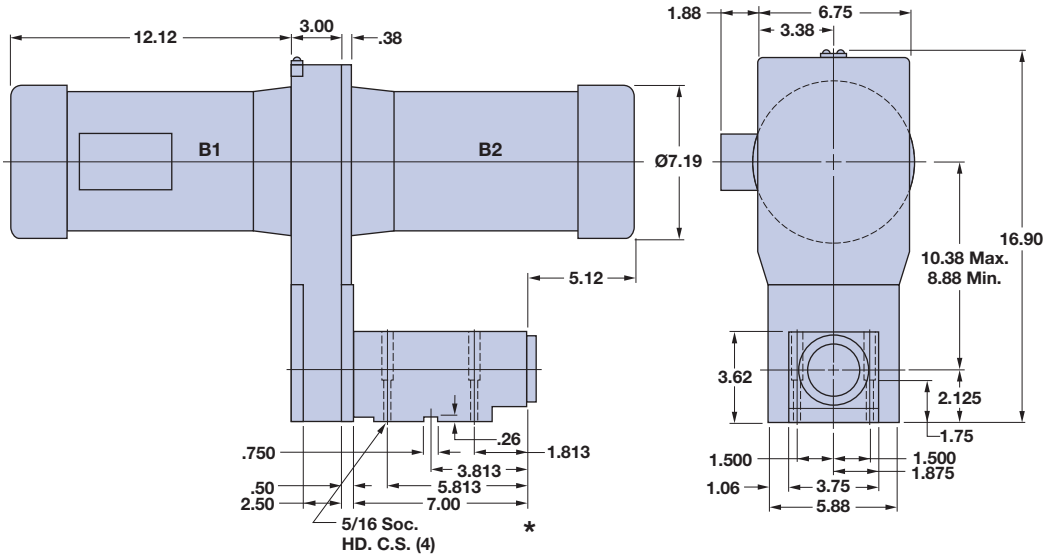
Approx. wt. 95 lbs.



Note: * See 2750C cartridge spindles on page 10.

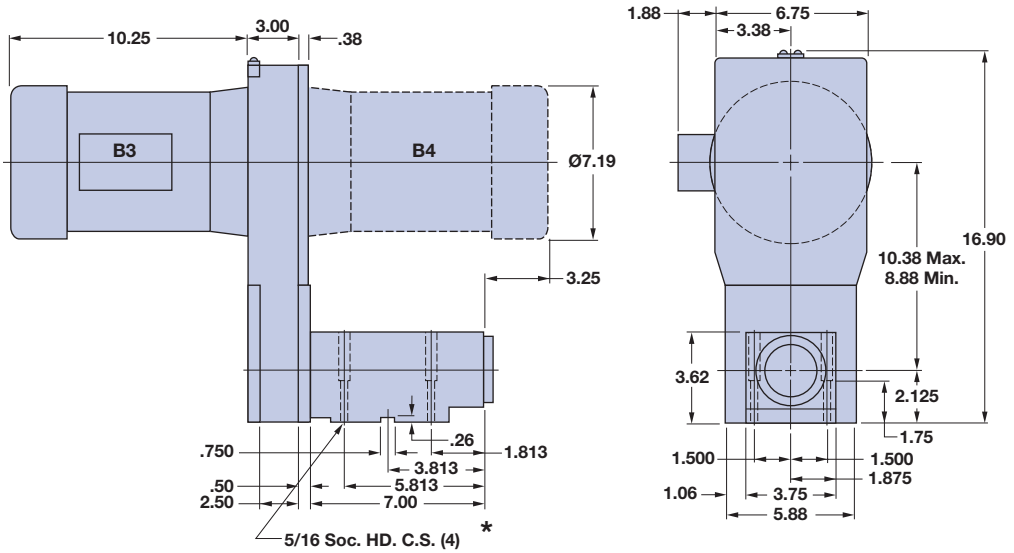
2750B B1 & B2

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	900 900	2350 1900	1160	1 1/2	145TC
A & C B & D	1450 1450	3500 2050	1750	1 1/2 or 2	145TC
A & C B & D	3300 3300	7700 6250	3500	2 or 3	145TC



2750B B3 & B4

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	800 800	2350 2350	1160	1/3 or 1/2	56C
A & C B & D	1200 1200	3500 3500	1750	1/2 or 3/4	56C
A & C B & D	2400 2400	7700 6250	3500	3/4 or 1	56C



Approx. wt. 85 lbs.

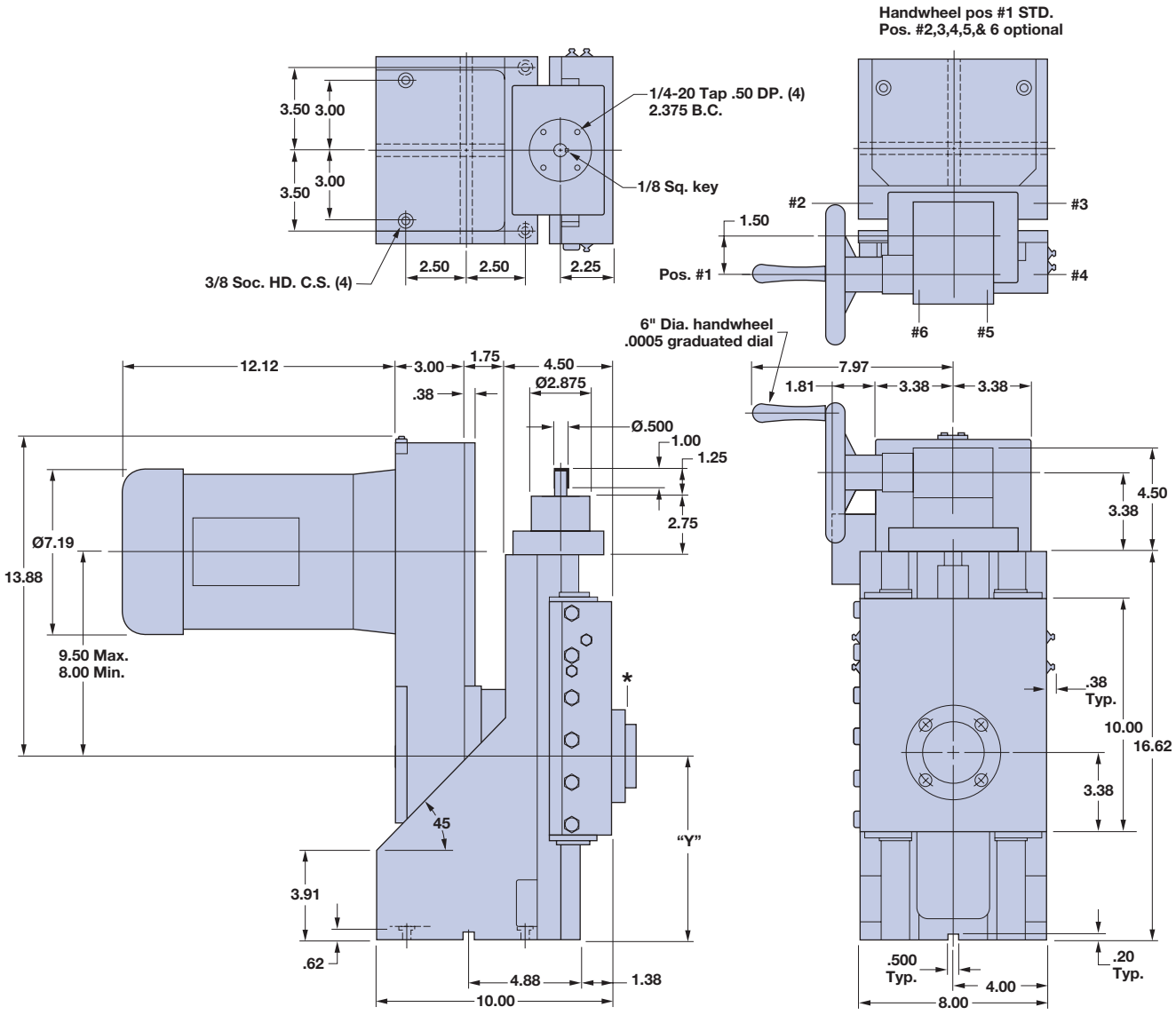
Note: * See 2750B block spindles on page 11.

Gilman 2750C

Motorized vertical travel spindles

2750C motorized vertical travel spindle units are fixed-speed units that combine a motorized timing belt drive spindle with a vertical hardened steel way slide assembly. Vertical positioning of the saddle and spindle can be accomplished with one of the eight standard drive types.

The lead screw manual drive is a 2:1 reduction right angle drive and can be positioned six ways with position #1 as standard (specify position number when ordering). For 2750C spindle capabilities, reference the 2750 specification charts.*



D1, M1 - Lead screw power drive
.750-.200 Rolled ball screw R.H. Thd.

D2, M2 - Lead screw power drive
.750-.200 Ground ball screw R.H. Thd.

D3, M3 - Lead screw power drive
20mm-5mm Ground ball screw R.H. Thd.

E1 - Lead screw power drive
.750-.100 Acme screw L.H. Thd.

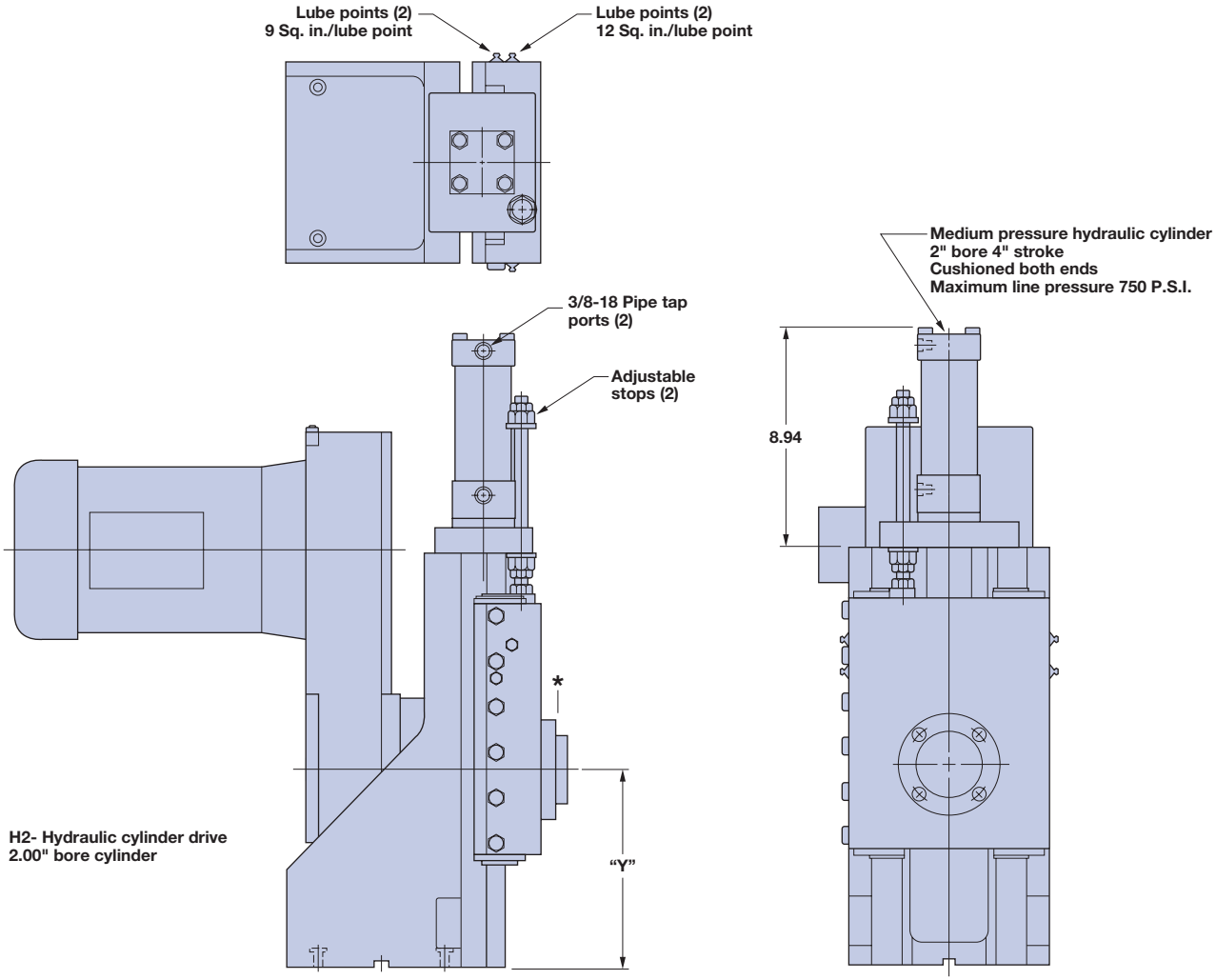
Drive	"Y" Min.	"Y" Max.
D1, M1	4.00	8.00
D2, M2	4.00	7.00
D3, M3	4.00	7.00
E1	4.50	9.00
H2	4.00	8.00

Note: * See 2750C cartridge spindles on page 10.

**M1, M2, M3 - Motor mount for customer supplied motor. Consult factory for specifications.

Gilman 2750C

Motorized vertical travel spindles



2750C Vertical travel

Spindle R.P.M.		Motor		
Minimum	Maximum	R.P.M.	H.P.	Frame
500	2350	1160	1 1/2	145TC
1000	3500	1750	1 1/2 or 2	145TC
2250	7700	3500	2 or 3	145TC

Approx. wt. 230 lbs.

Note: * See 2750C cartridge spindles on page 10.

Gilman 3500C
Cartridge spindles

3500C cartridge spindles and 3500B block spindles are available with four standard nose types and six standard internal construction types.

Nose types:

- #30 N.M.T.B. taper
- Boring nose
- HSKC50 manual clamp
- 1/16 to 3/4 ER32 collet

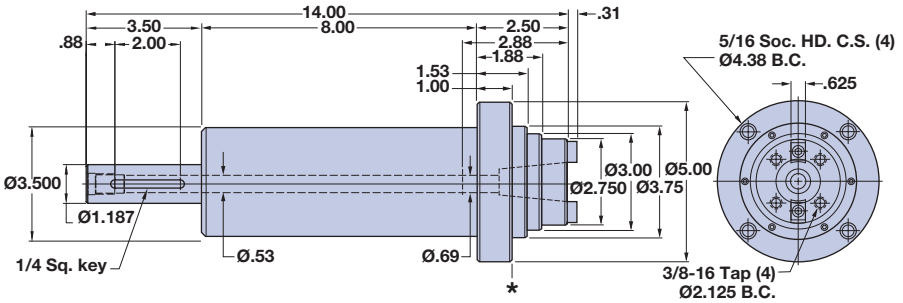
Internal constructions:

- X1 duplex ball bearing at nose end with contact seal
- X2 duplex ball bearing at nose end with labyrinth seal
- X2C duplex ceramic ball bearing at nose end with labyrinth seal
- X3 triplex ball bearing at nose end with contact seal
- X4 triplex ball bearing at nose end with labyrinth seal
- X4C triplex ceramic ball bearing at nose end with labyrinth seal

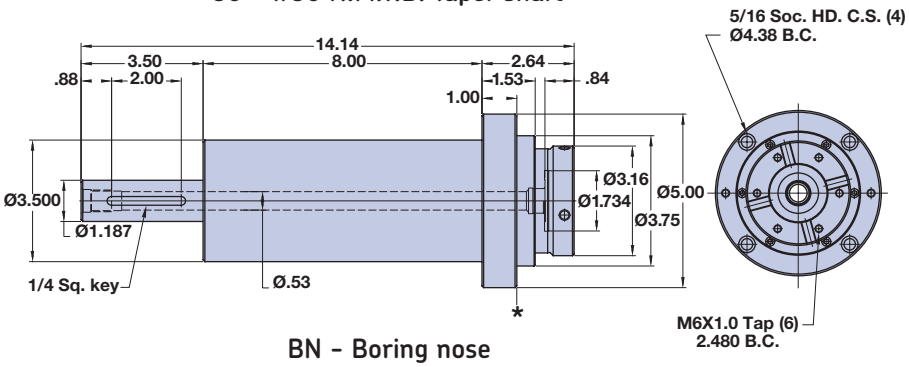
Refer to the 3500C/3500B specification chart as well as the sizing instructions on page 5 to select the proper spindle for your rotational requirements. Special designs are also available to meet your specific needs.

3500C Approx. wt. 30 lbs.

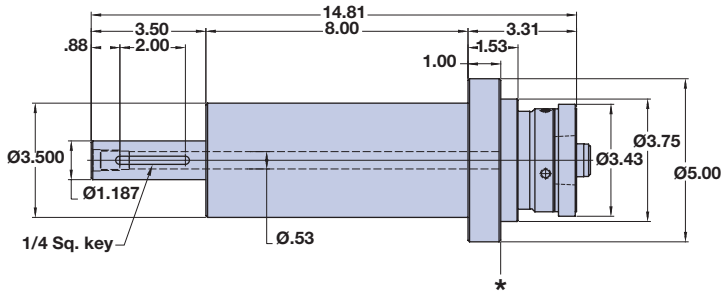
For cartridge spindle brackets, see "Gilman spindle accessories", page 47.



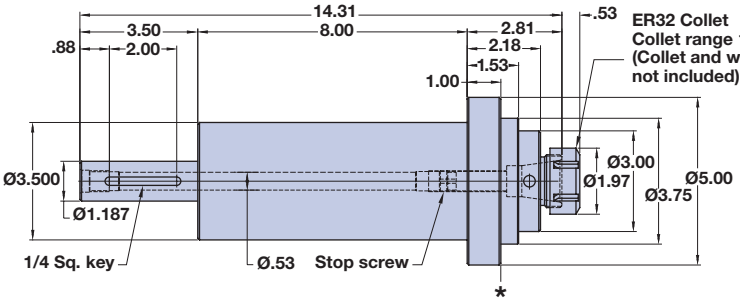
30 - #30 N.M.T.B. Taper shaft



BN - Boring nose



HM - HSKC50 Manual clamp
(T-wrench not included)



CE - ER32 Collet shaft

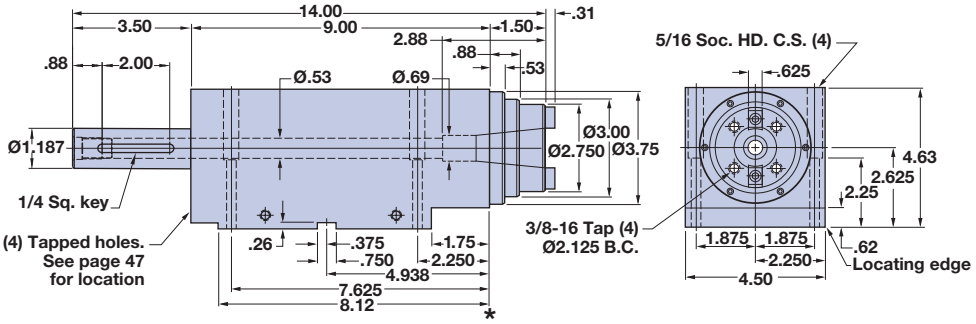
Tool dia.	Max tool depth
1/16 to 9/16	4 in.
Over 9/16 to 3/4	2 in.

3500C & 3500B Specification chart

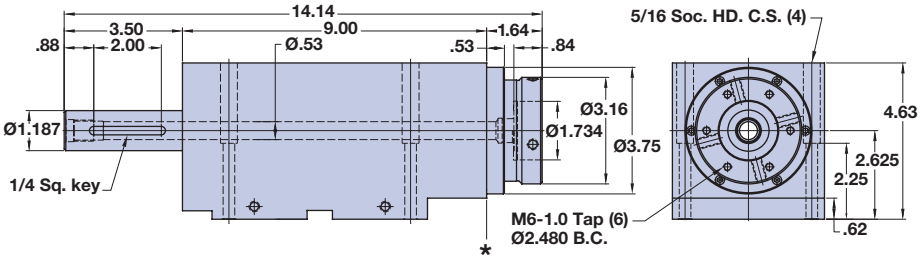
Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X1L X1M X1H	100 265 560	3,750 3,750 3,750	430,000 490,000 530,000	45 mm I.D. duplex ball	Contact	35 mm I.D. duplex ball	Labyrinth
X2L X2M X2H	100 265 560	13,900 10,800 7,200	430,000 490,000 530,000	45 mm I.D. duplex ball	Labyrinth	35 mm I.D. duplex ball	Labyrinth
X2CL X2CM	77 162	17,600 15,400	430,000 490,000	45 mm I.D. duplex ceramic ball	Labyrinth	35 mm I.D. duplex ceramic ball	Labyrinth

Continued on next page

Gilman 3500B
Block spindles

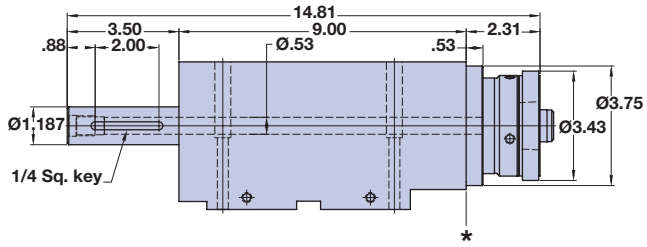


30 - #30 N.M.T.B. Taper shaft

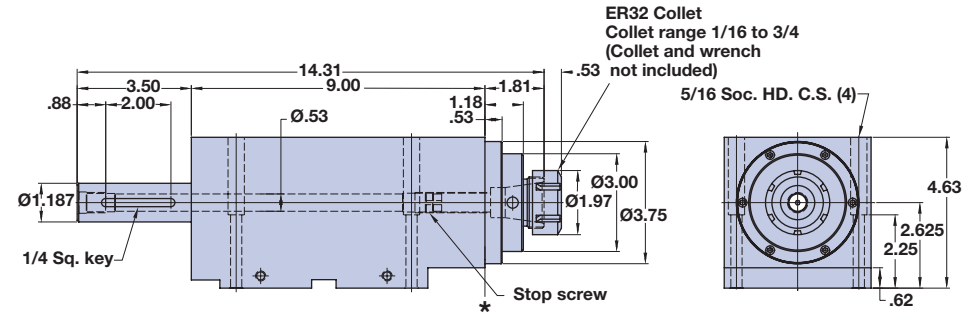


BN - Boring nose

3500B Approx. wt. 45 lbs.



HM - HSKC50 Manual clamp
(T-wrench not included)



CE - ER32 Collet shaft

Tool dia.	Collet shaft max tool depth
1/16 to 9/16	4 in.
Over 9/16 to 3/4	2 in.

3500C & 3500B Specification chart (continued)

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X3L X3M X3H	207 527 1,191	3,750 3,750 3,750	670,000 750,000 820,000	45 mm I.D. triplex ball	Contact	35 mm I.D. duplex	Labyrinth
X4L X4M X4H	207 527 1,191	10,800 7,200 5,700	670,000 750,000 820,000	45 mm I.D. triplex ball	Labyrinth	35 mm I.D. duplex ball	Labyrinth
X4CL X4CM	153 319	15,400 12,100	670,000 750,000	45 mm I.D. triplex ceramic ball	Labyrinth	35 mm I.D. duplex ceramic ball	Labyrinth

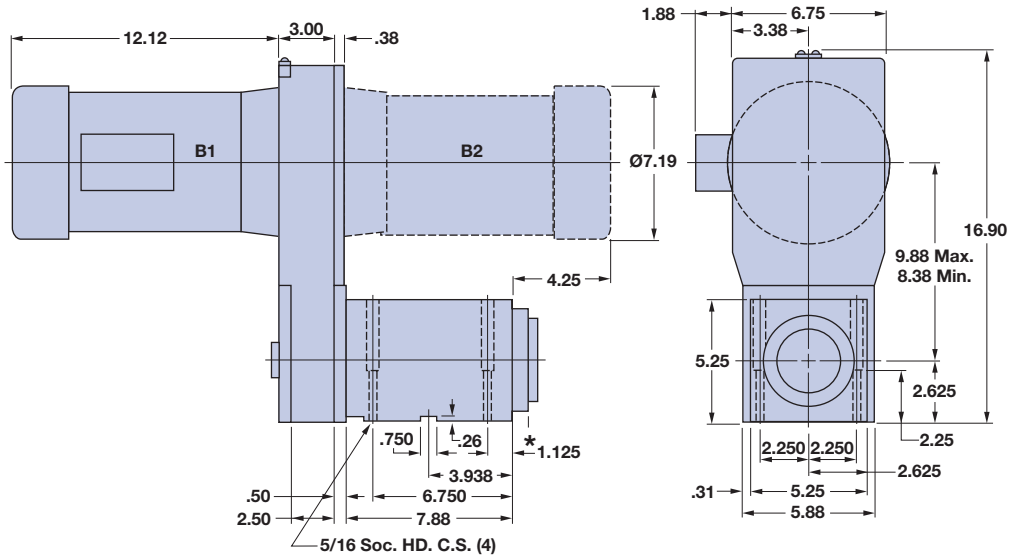
* Maximum tool overhang
(from *) = 3 7/8 (in.)
Maximum torque = 527 (in.- lbs.)
WK^2 = 6.2 (lb.- $in.^2$)
Note: Spindles are supplied with medium bearing preloads as standard. Light and heavy bearing preloads are available.
Tool overhang pertains to boring, end milling and nonsupported arbor milling.

Gilman 3500C
Motorized spindles

3500C and 3500B motorized spindles are fixed-speed units incorporating a timing belt drive for positive power transmission. Poly-V, V-belt and flat-belt drives are available at additional cost where high speed and minimum vibration are required. The 3500C and 3500B are available in two sizes: the B1/B2 units (high horsepower) or B3/B4 units (low horsepower). For 3500 spindle capabilities reference the 3500 specification charts.*

3500C B1 & B2

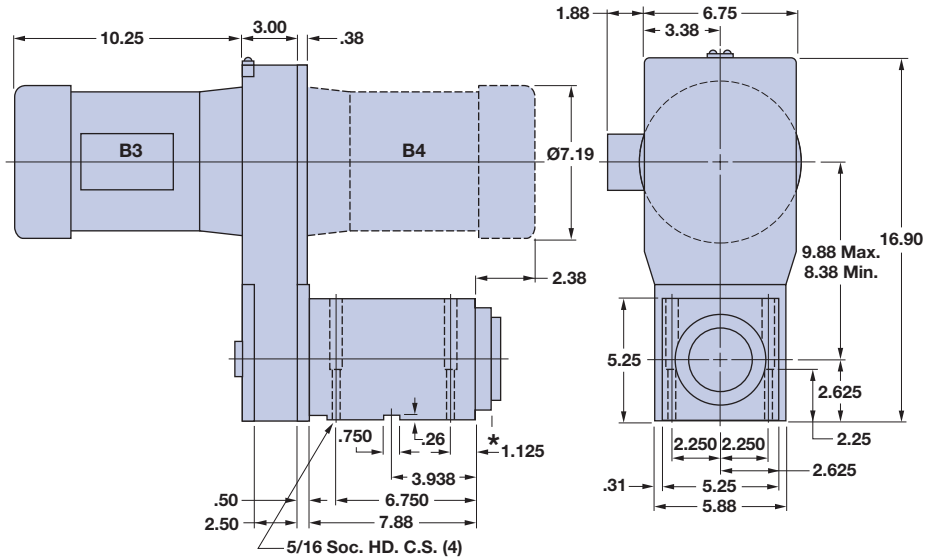
Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	650 650	2150 2150	1160	1 1/2	145TC
A & C B & D	1150 1150	3250 3250	1750	1 1/2 or 2	145TC
A & C B & D	2600 2600	6450 5250	3500	2 or 3	145TC



3500C B3 & B4

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	650 650	2350 2350	1160	1/3 or 1/2	56C
A & C B & D	950 950	3500 3500	1750	1/2 or 3/4	56C
A & C B & D	1950 1950	6450 6450	3500	3/4 or 1	56C

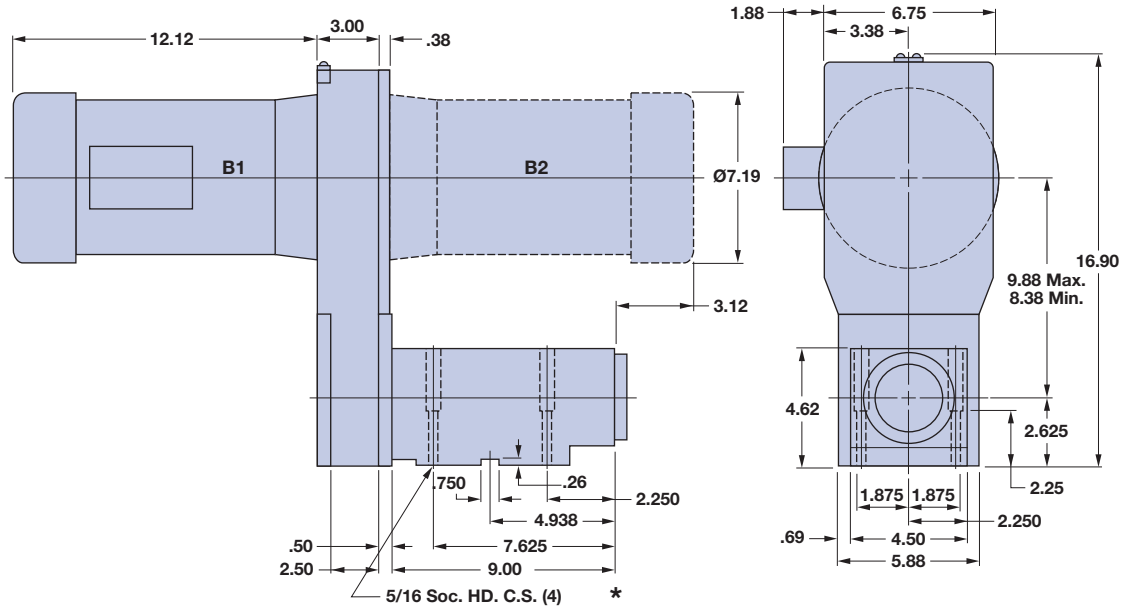
Approx. wt. 125 lbs.



Note: * See 3500C cartridge spindles on page 16.

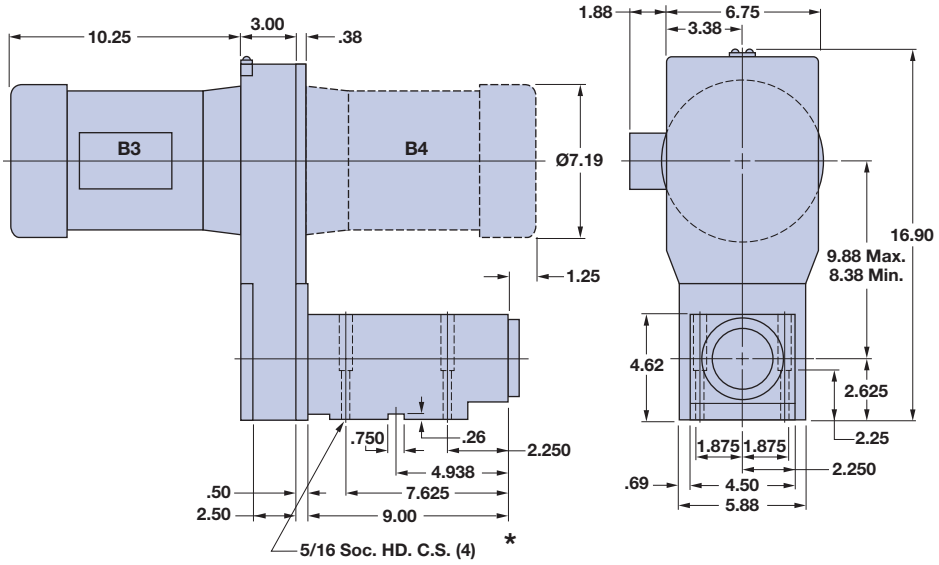
3500B B1 & B2

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	650 650	2150 2150	1160	1 1/2	145TC
A & C B & D	1150 1150	3250 3250	1750	1 1/2 or 2	145TC
A & C B & D	2600 2600	6450 5250	3500	2 or 3	145TC



3500B B3 & B4

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	650 650	2350 2350	1160	1/3 or 1/2	56C
A & C B & D	950 950	3500 3500	1750	1/2 or 3/4	56C
A & C B & D	1950 1950	6450 6450	3500	3/4 or 1	56C



Approx. wt. 105 lbs.

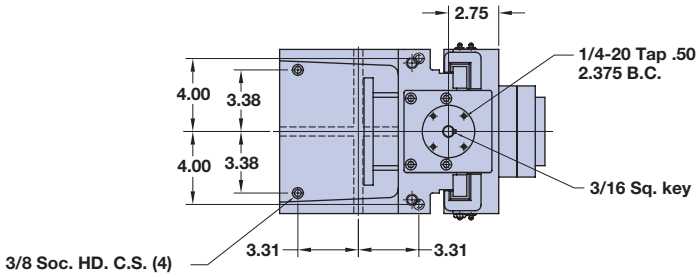
Note: * See 3500B cartridge spindles on page 17.

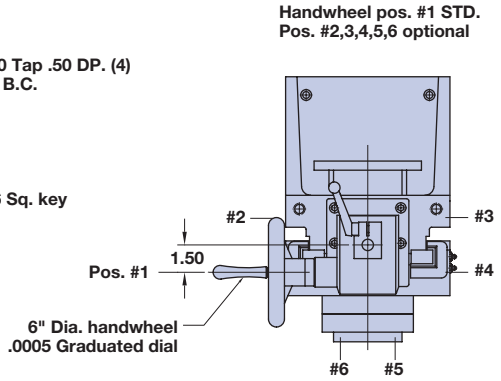
Gilman 3500C

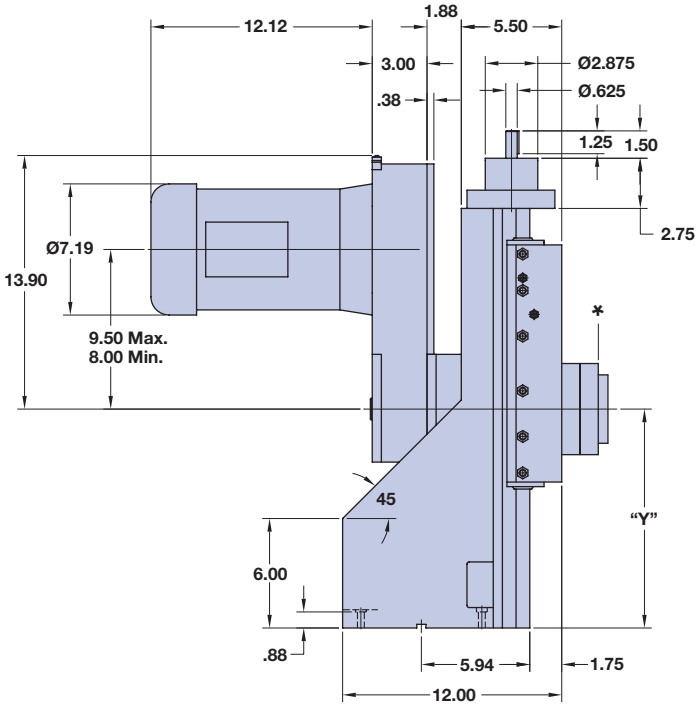
Motorized vertical travel spindles

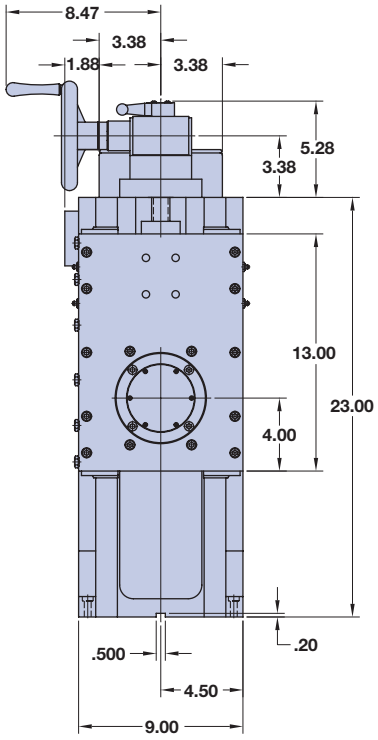
3500C motorized vertical travel spindle units are fixed-speed units that combine a motorized timing belt drive spindle with a vertical hardened steel way slide assembly. Vertical positioning of the saddle and spindle can be accomplished with one of the eight standard drive types.

The lead screw manual drive is a 2:1 reduction right angle drive and can be positioned six ways with position #1 as standard (specify position number when ordering). For 3500C spindle capabilities, reference the 3500 specification charts.*









D1, M1 - Lead screw power drive
1.000-.250 Rolled ball screw R.H. Thd.

D2, M2 - Lead screw power drive
1.000-.250 Ground ball screw R.H. Thd.

D3, M3 - Lead screw power drive
25mm-5mm Ground ball screw R.H. Thd.

E1 - Lead screw power drive
1.000-.100 Acme screw L.H. Thd.

Drive	"Y" Min.	"Y" Max.
D1, M1	5.00	11.00
D2, M2	5.00	10.00
D3, M3	5.00	10.00
E1	5.00	11.50
H2	5.00	12.00

Note: * See 3500C Cartridge spindles on page 16.

** M1, M2, M3 - Motor mount for customer supplied motor. Consult factory for specifications.

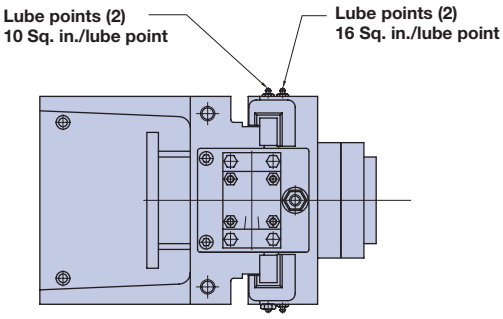
Gilman 3500C

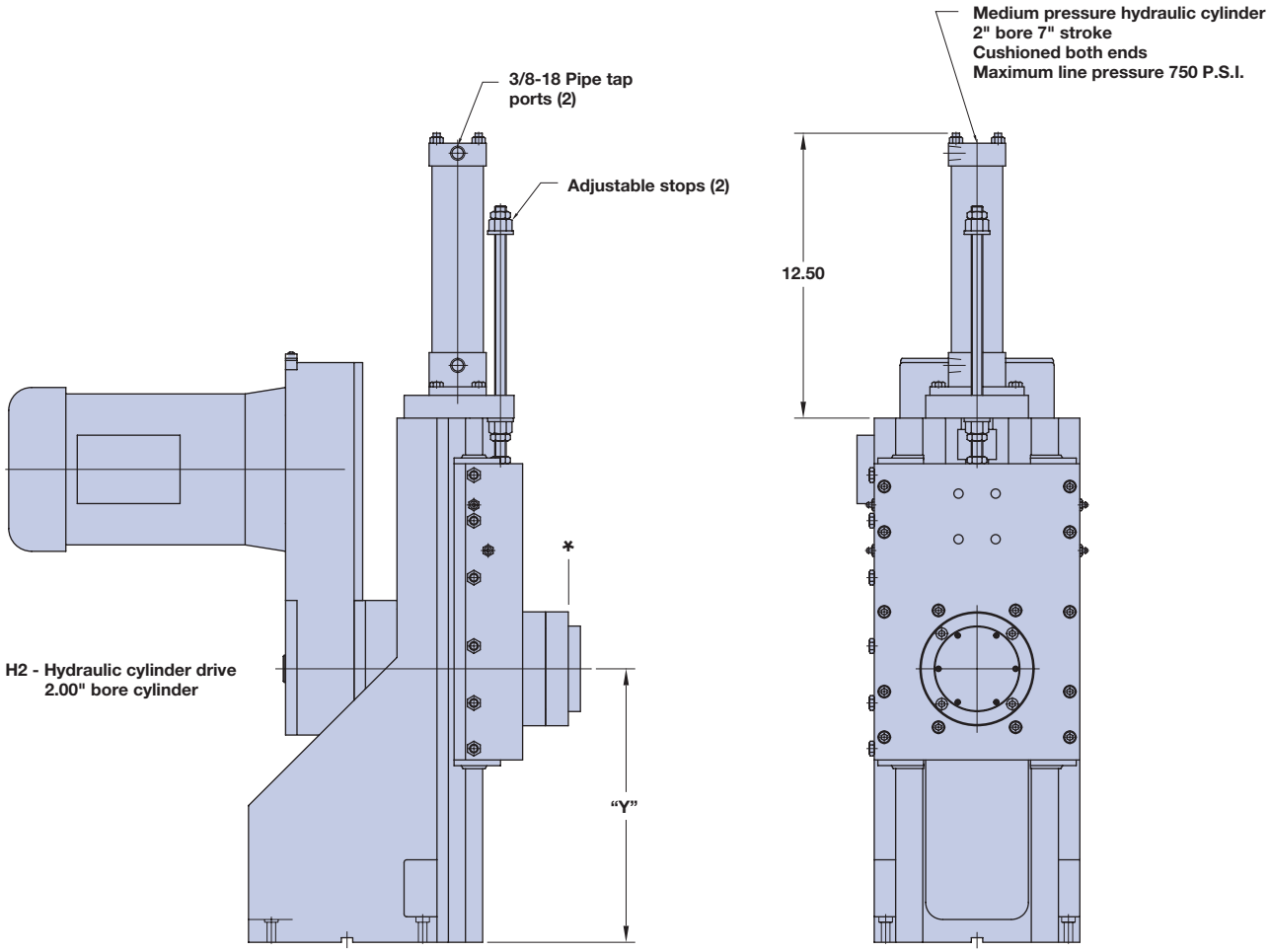
Motorized vertical travel spindles

3500C Vertical travel

Spindle R.P.M.		Motor		
Minimum	Maximum	R.P.M.	H.P.	Frame
500	2350	1160	1 1/2	145TC
1000	3500	1750	1 1/2 or 2	145TC
2250	7000	3500	2 or 3	145TC

Approx. wt. 520 lbs.





Note: * See 3500C cartridge spindles on page 16.

Gilman 4000C
Cartridge spindles

4000C cartridge spindles and 4000B block spindles are available with three standard nose types and six standard internal construction types.

Nose types:

- #40 N.M.T.B. taper
- Boring nose
- HSKC63 manual clamp

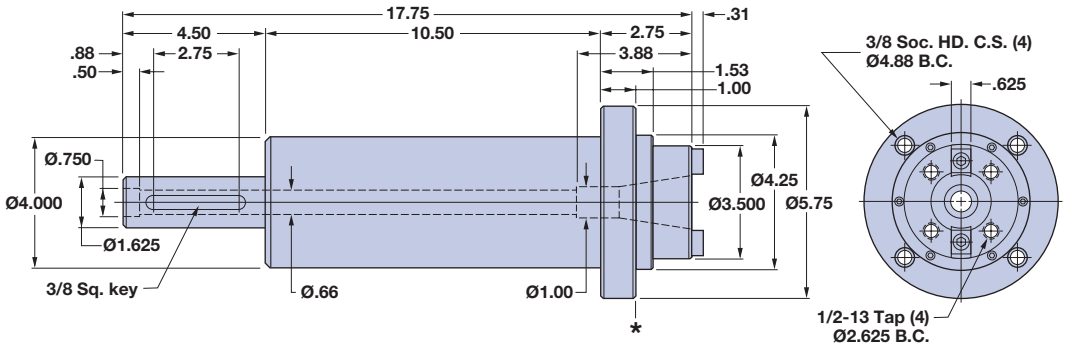
Internal constructions:

- X1 duplex ball bearing at nose end with contact seal
- X2 duplex ball bearing at nose end with labyrinth seal
- X2C duplex ceramic ball bearing at nose end with contact seal
- X3 triplex ball bearing at nose end with labyrinth seal
- X4 triplex ball bearing at nose end with labyrinth seal
- X4C triplex ceramic ball bearing at nose end with labyrinth seal

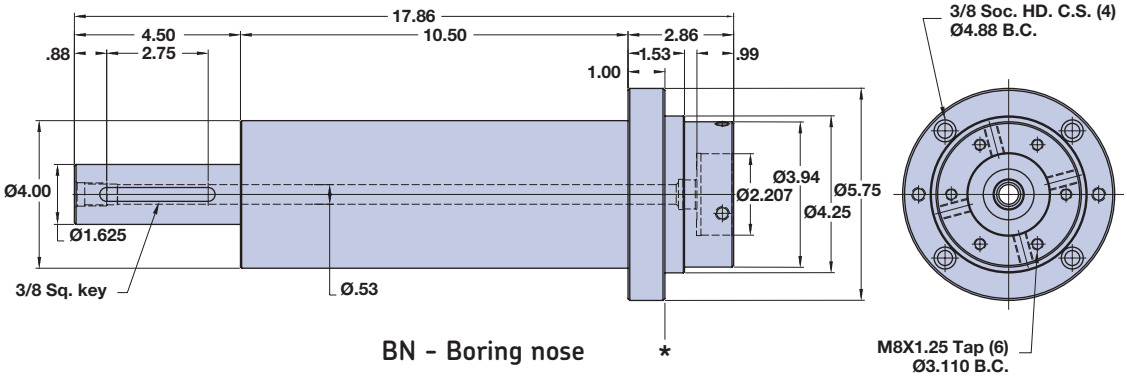
Refer to the 4000C/4000B specification chart, as well as the sizing instructions on page 5, to select the proper spindle for your rotational requirements. Special designs are also available to meet your specific needs.

4000C Approx. wt. 38 lbs.

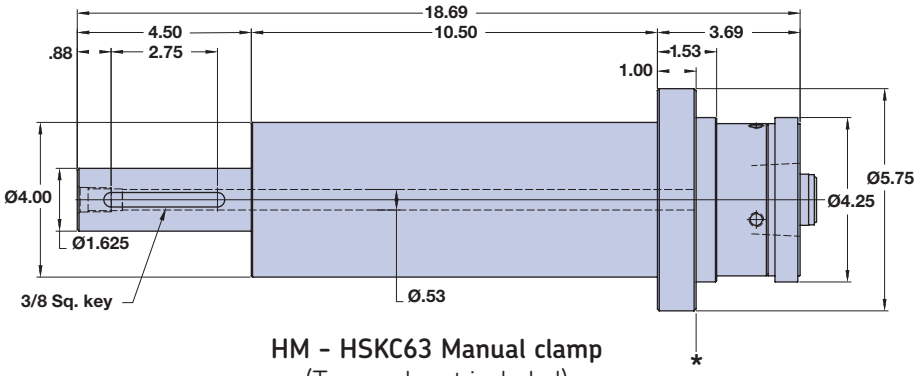
For cartridge spindle brackets, see "Gilman spindle accessories", page 47.



40 - #40 N.M.T.B. Taper shaft



BN - Boring nose



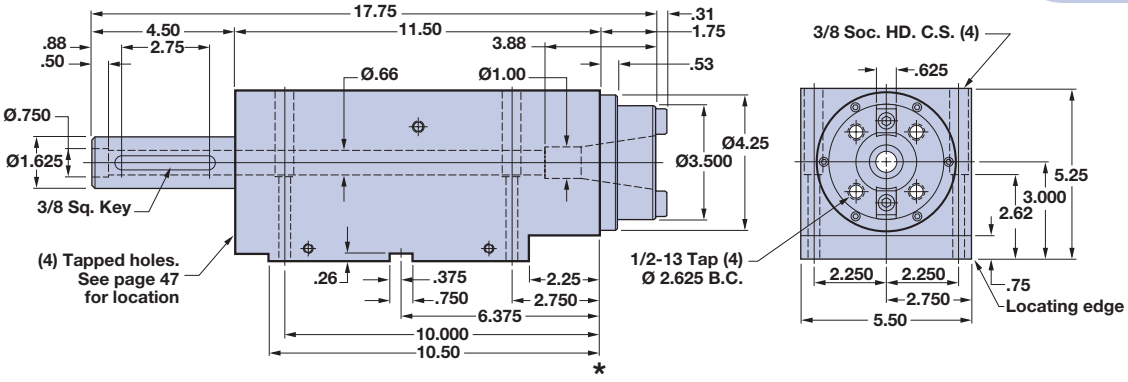
HM - HSKC63 Manual clamp
(T-wrench not included)

4000C & 4000B Specification chart

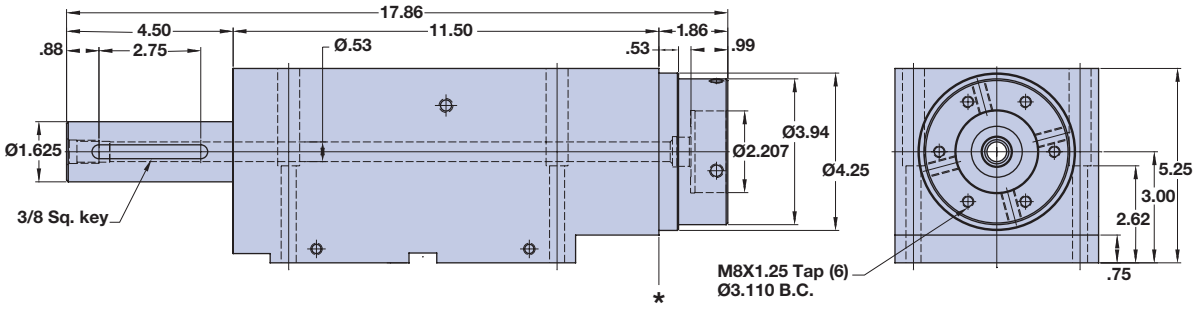
Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X1L X1M X1H	161 394 855	3,150 3,150 3,150	460,000 510,000 540,000	55 mm I.D. duplex ball	Contact	45 mm I.D. duplex ball	Labyrinth
X2L X2M X2H	161 394 855	10,800 9,200 6,100	460,000 510,000 540,000	55 mm I.D. duplex ball	Labyrinth	45 mm I.D. duplex ball	Labyrinth
X2CL X2CM	105 220	14,400 12,600	460,000 510,000	55 mm I.D. duplex ceramic ball	Labyrinth	45 mm I.D. duplex ceramic ball	Labyrinth

Continued on next page

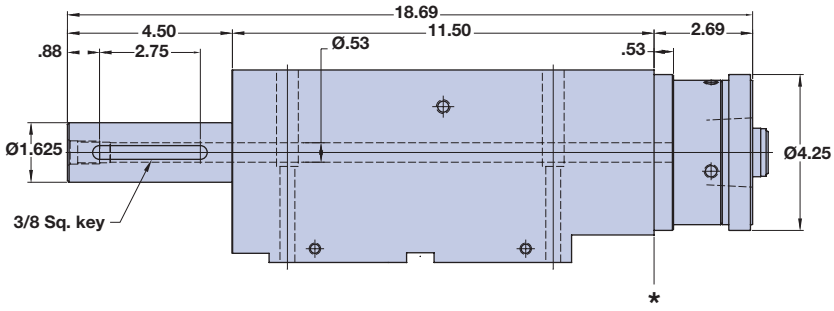
Gilman 4000B
Block spindles



40 - #40 N.M.T.B. Taper shaft



BN - Boring nose



HM - HSKC63 Manual clamp
(T-wrench not included)

4000B Approx. wt. 78 lbs.

4000C & 4000B Specification chart (continued)

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X3L X3M X3H	322 847 1693	3,150 3,150 3,150	800,000 890,000 950,000	55 mm I.D. triplex ball	Contact	45 mm I.D. duplex ball	Labyrinth
X4L X4M X4H	322 847 1693	9,200 6,100 4,900	800,000 890,000 950,000	55 mm I.D. triplex ball	Labyrinth	45 mm I.D. duplex ball	Labyrinth
X4CL X4CM	207 433	12,600 9,900	800,000 890,000	55 mm I.D. triplex ceramic ball	Labyrinth	45 mm I.D. duplex ceramic ball	Labyrinth

* Maximum tool overhang
(from *) = 5 1/8 (in.)
Maximum torque = 1000 (in.- lbs.)
WK^2 = 17.0 (lb.- $in.^2$)
Note: Spindles are supplied with medium bearing preloads as standard. Light and heavy bearing preloads are available.
Tool overhang pertains to boring, end milling and nonsupported arbor milling.

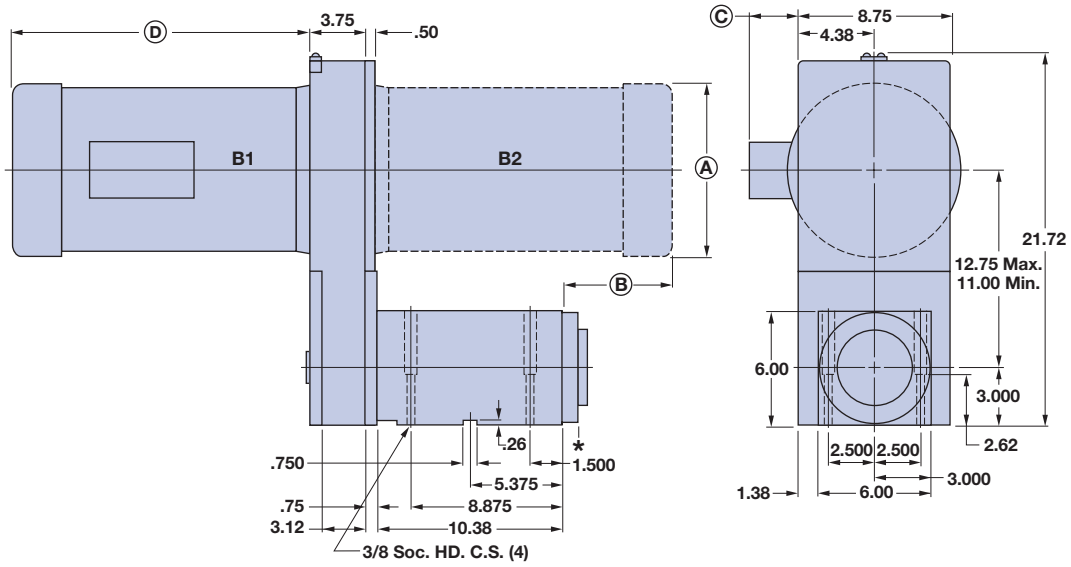
Gilman 4000C

Motorized spindles

4000C and 4000B motorized spindles are fixed-speed units incorporating a timing-belt drive for positive power transmission. Poly-V, V-belt, and flat-belt drives are available at additional cost where high speed and minimum vibration are required. The 4000C and 4000B are available in two sizes: the B1/B2 units (high horsepower) or B3/B4 units (low horsepower). For 4000 spindle capabilities, reference the 4000 specification charts.*

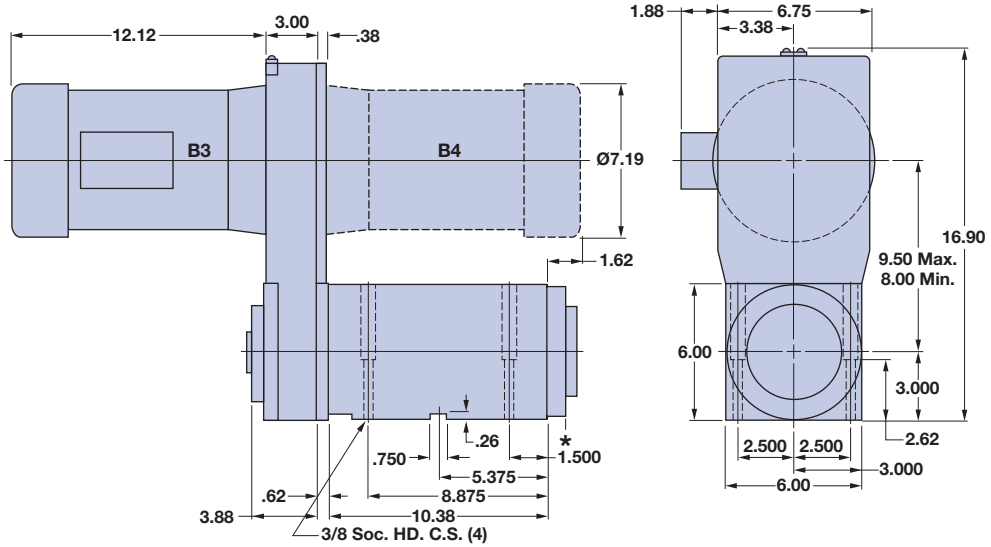
4000C B1 & B2

Spindle R.P.M.			Motor						
Position	Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	D
A & C B & D	800 800	2350 2350	1160	5	215TC	10.19	5.81	3.00	16.31
A & C B & D	1250 1250	3500 3500	1750	5 or 7 1/2	184TC 213TC	8.50 10.19	4.94 5.81	1.50 3.00	15.44 16.31
A & C B & D	2500 2500	6400 4700	3500	5 or 7 1/2	184TC	8.50	4.94	1.50	15.44



4000C B3 & B4

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	550 550	2150 2150	1160	1 1/2	145TC
A & C B & D	1000 1000	3000 3000	1750	1 1/2 or 2	145TC
A & C B & D	2250 2250	5850 5850	3500	2 or 3	145TC

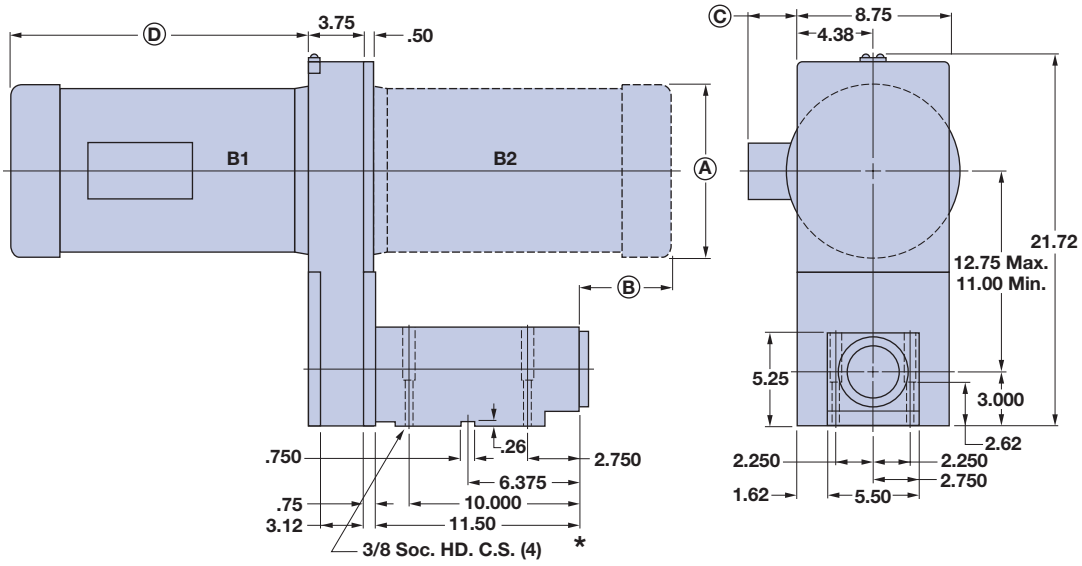


Approx. wt. 300 lbs.

Note: * See 4000C cartridge spindles on page 22.

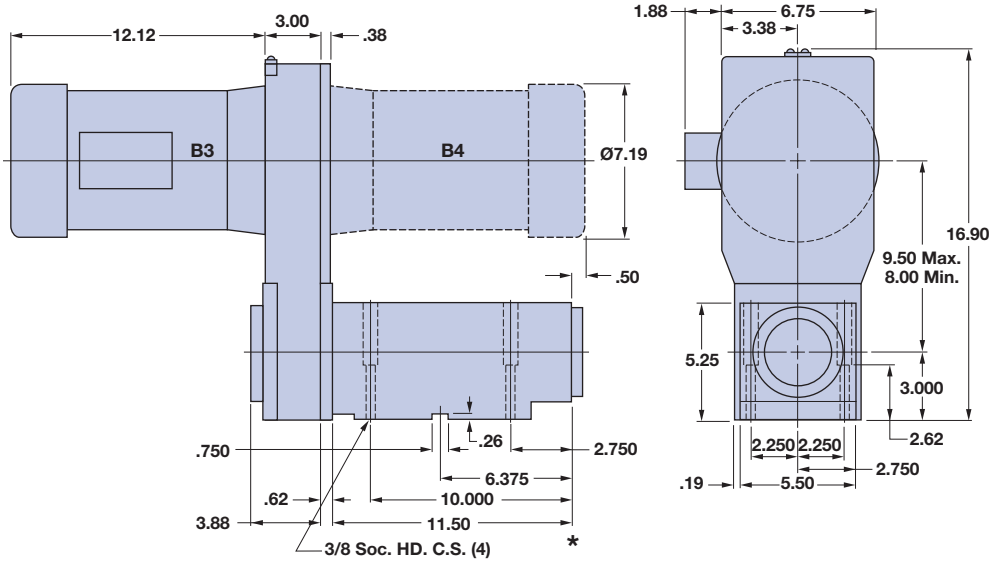
4000B B1 & B2

Spindle R.P.M.			Motor						
Position	Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	D
A & C B & D	800 800	2350 2350	1160	5	215TC	10.19	5.81	3.00	16.31
A & C B & D	1250 1250	3500 3500	1750	5 or 7 1/2	184TC 213TC	8.50 10.19	4.94 5.81	1.50 3.00	15.44 16.31
A & C B & D	2500 2500	6400 4700	3500	5 or 7 1/2	184TC	8.50	4.94	1.50	15.44



4000B B3 & B4

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	550 550	2150 2150	1160	1 1/2	145TC
A & C B & D	1000 1000	3000 3000	1750	1 1/2 or 2	145TC
A & C B & D	2250 2250	5850 5850	3500	2 or 3	145TC



Approx. wt. 290 lbs.

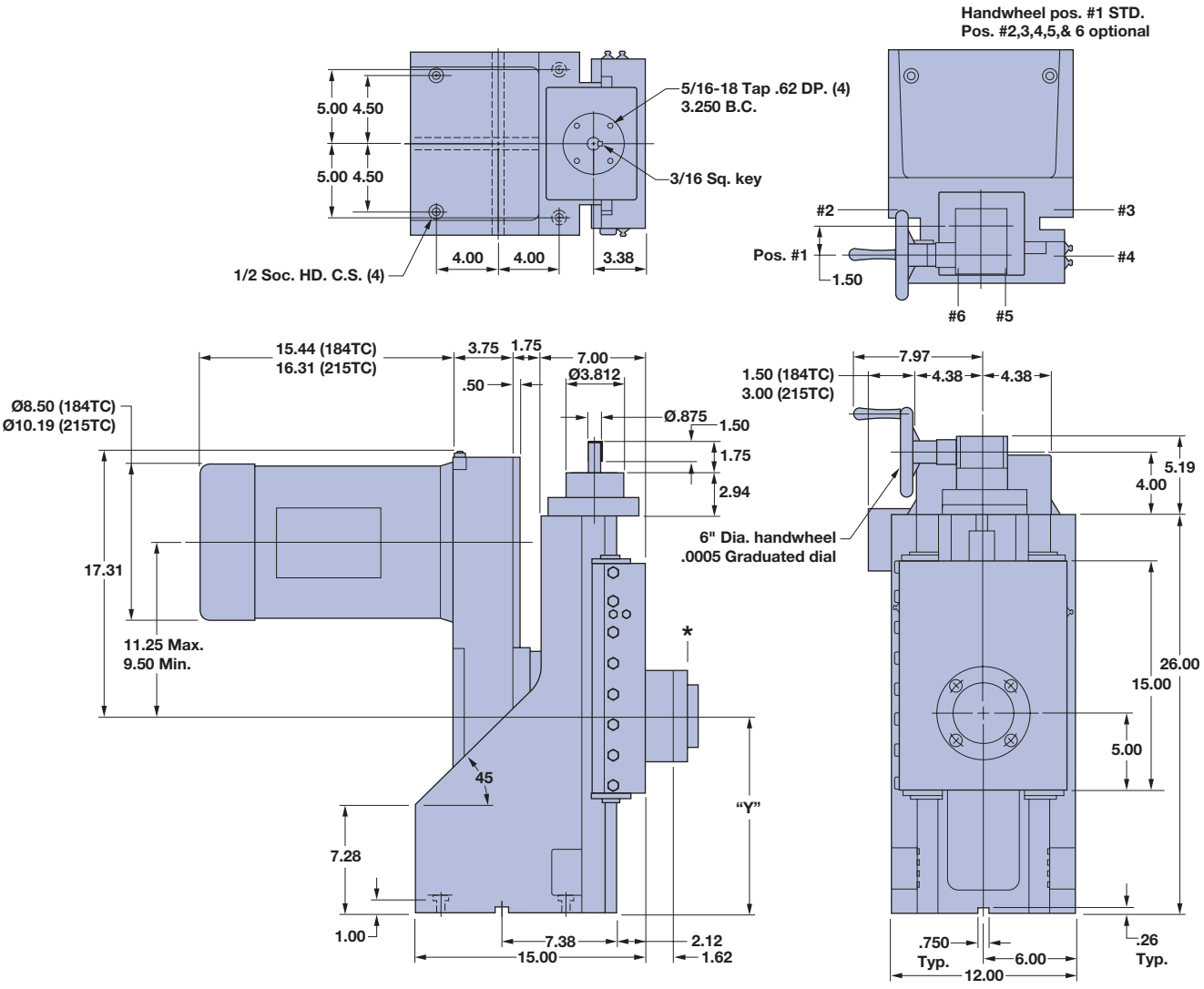
Note: * See 4000B cartridge spindles on page 23.

Gilman 4000C

Motorized vertical travel spindles

4000C motorized vertical travel spindle units are fixed-speed units that combine a motorized timing belt drive spindle with a vertical hardened steel way slide assembly. Vertical positioning of the saddle and spindle can be accomplished with one of the eight standard drive types.

The lead screw manual drive is a 2:1 reduction right angle drive and can be positioned six ways with position #1 as standard (specify position number when ordering). For 4000C spindle capabilities, reference the 4000C specification charts.*



D1, M1 - Lead screw power drive
1.500-.250 Rolled ball screw R.H. Thd.

D2, M2 - Lead screw power drive
1.250-.250 Ground ball screw R.H. Thd.

D3, M3 - Lead screw power drive
32mm-5mm Ground ball screw R.H. Thd.

E1 - Lead screw power drive
1.250-.100 Acme screw L.H. Thd.

Drive	"Y" Min.	"Y" Max.
D1, M1	6.00	13.00
D2, M2	6.00	12.00
D3, M3	6.00	12.00
E1	6.50	14.00
H2	6.00	14.00

Note: * See 4000C cartridge spindles on page 22.

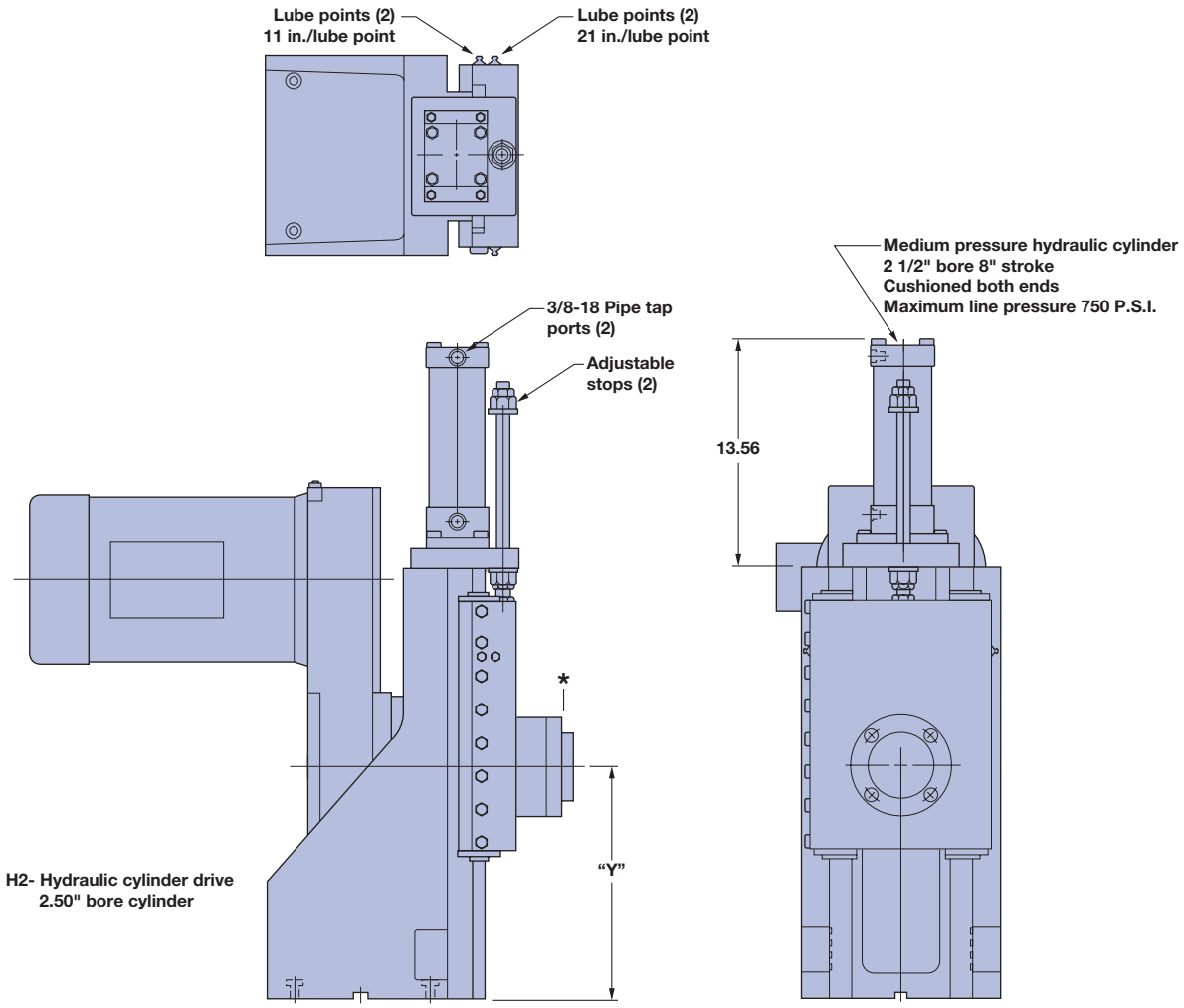
**M1, M2, M3 - Motor mount for customer supplied motor. Consult factory for specifications.

Gilman 4000C

Motorized vertical travel spindles

4000C Vertical travel

Spindle R.P.M.		Motor		
Minimum	Maximum	R.P.M.	H.P.	Frame
550	2350	1160	5	215TC
850	3500	1750	5 or 7 1/2	184TC 213TC
1750	7000	3500	5 or 7 1/2	184TC



Note: * See 4000C cartridge spindles on page 22.

Gilman 5500C
Cartridge spindles

5500C cartridge spindles and 5500B block spindles are available with three standard nose types and six standard internal construction types.

Nose types:

- #40 N.M.T.B. taper
- Boring nose
- HSKC63 manual clamp

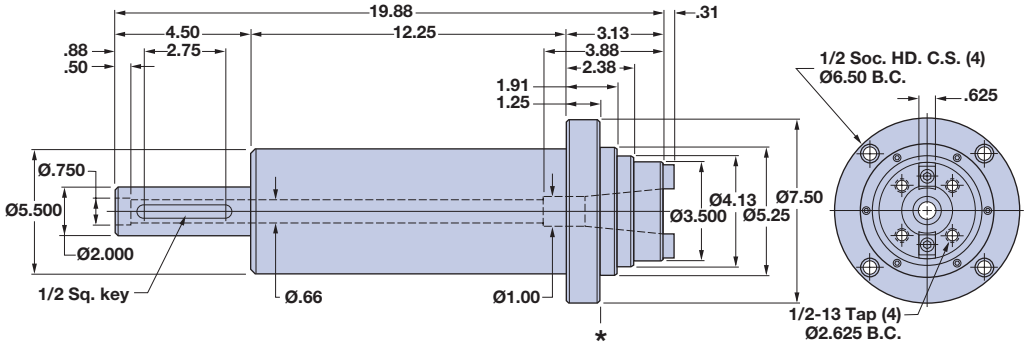
Internal constructions:

- X1 duplex ball bearing at nose end with contact seal
- X2 duplex ball bearing at nose end with labyrinth seal
- X2C duplex ceramic ball bearing at nose end with contact seal
- X3 triplex ball bearing at nose end with contact seal
- X4 triplex ball bearing at nose end with labyrinth seal
- X4C triplex ceramic ball bearing at nose end with labyrinth seal

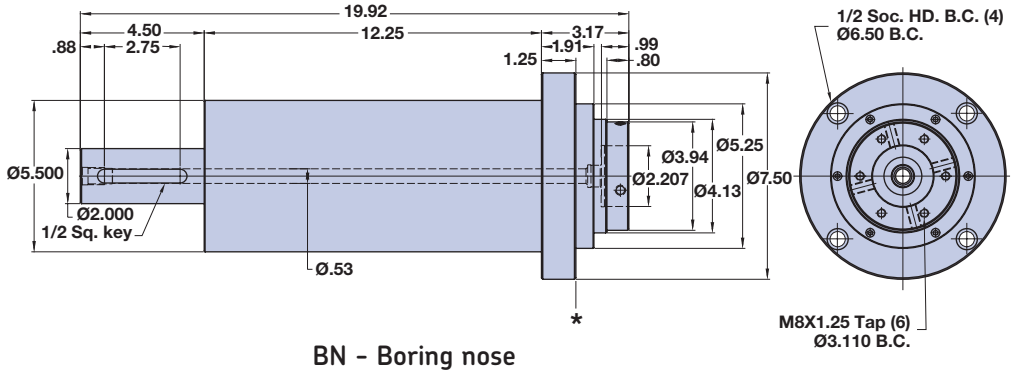
Refer to the 5500C/5500B specification chart, as well as the sizing instructions on page 5, to select the proper spindle for your rotational requirements. Special designs are also available to meet your specific needs.

5500C Approx. wt. 82 lbs.

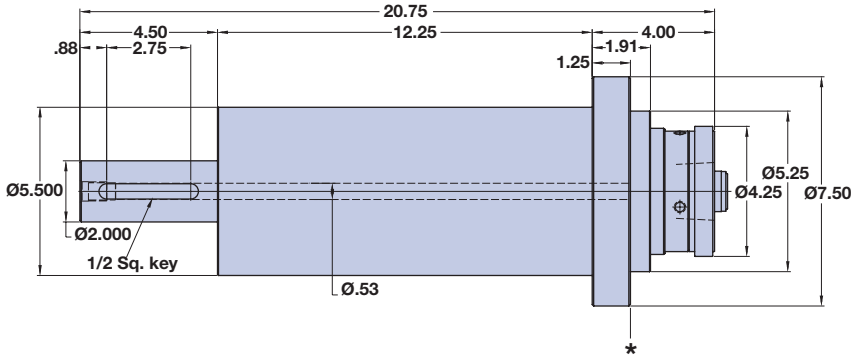
For cartridge spindle brackets, see "Gilman spindle accessories", page 47.



40 - #40 N.M.T.B. Taper shaft



BN - Boring nose



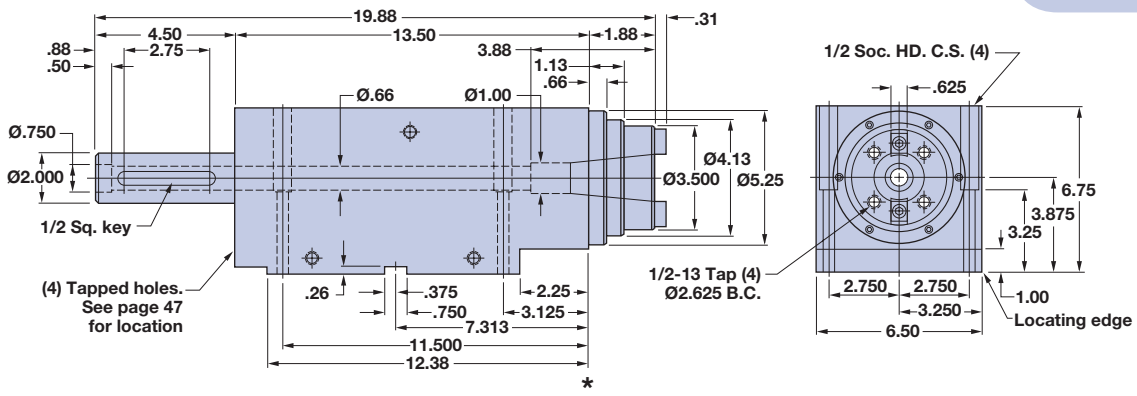
HM - HSKC63 Manual clamp
(T-wrench not included)

5500C & 5500B Specification chart

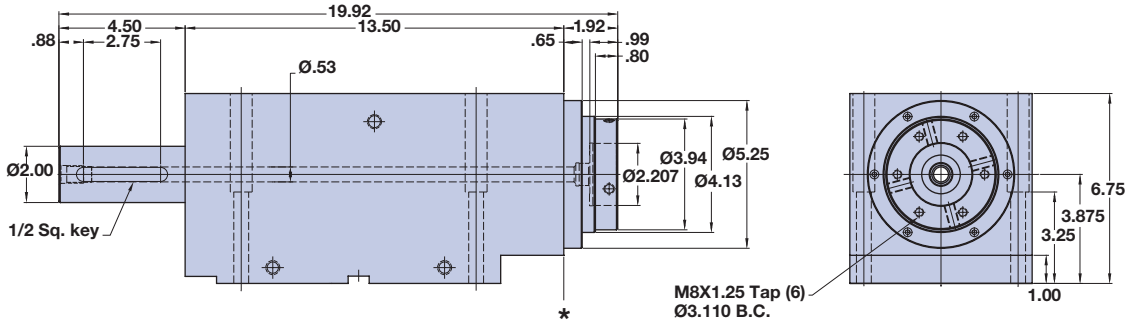
Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X1L X1M X1H	200 560 1,160	2,500 2,500 2,500	750,000 850,000 930,000	70 mm I.D. duplex ball	Contact	55 mm I.D. duplex ball	Labyrinth
X2L X2M X2H	200 560 1,160	9,200 7,100 4,750	750,000 850,000 930,000	70 mm I.D. duplex ball	Labyrinth	55 mm I.D. duplex ball	Labyrinth
X2CL X2CM	140 192	12,000 10,500	750,000 850,000	70 mm I.D. duplex ceramic ball	Labyrinth	55 mm I.D. duplex ceramic ball	Labyrinth

Continued on next page

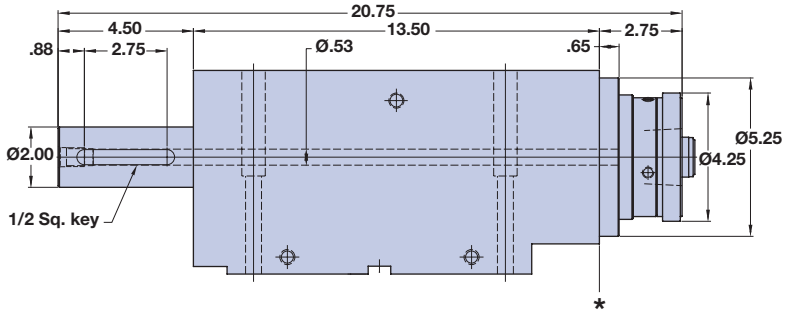
Gilman 5500B
Block spindles



40 - #40 N.M.T.B. Taper shaft



BN - Boring nose



HM - HSKC63 Manual clamp
(T-wrench not included)

5500B Approx. wt. 138 lbs.

5500C & 5500B Specification chart (continued)

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X3L X3M X3H	425 1,175 2,625	2,500 2,500 2,500	1,150,000 1,290,000 1,380,000	70 mm I.D. triplex ball	Contact	55 mm I.D. duplex ball	Labyrinth
X4L X4M X4H	425 1,175 2,625	7,100 4,750 3,800	1,150,000 1,290,000 1,380,000	70 mm I.D. triplex ball	Labyrinth	55 mm I.D. duplex ball	Labyrinth
X4CL X4CM	276 576	10,500 8,250	1,150,000 1,290,000	70 mm I.D. triplex ceramic ball	Labyrinth	55 mm I.D. duplex ceramic ball	Labyrinth

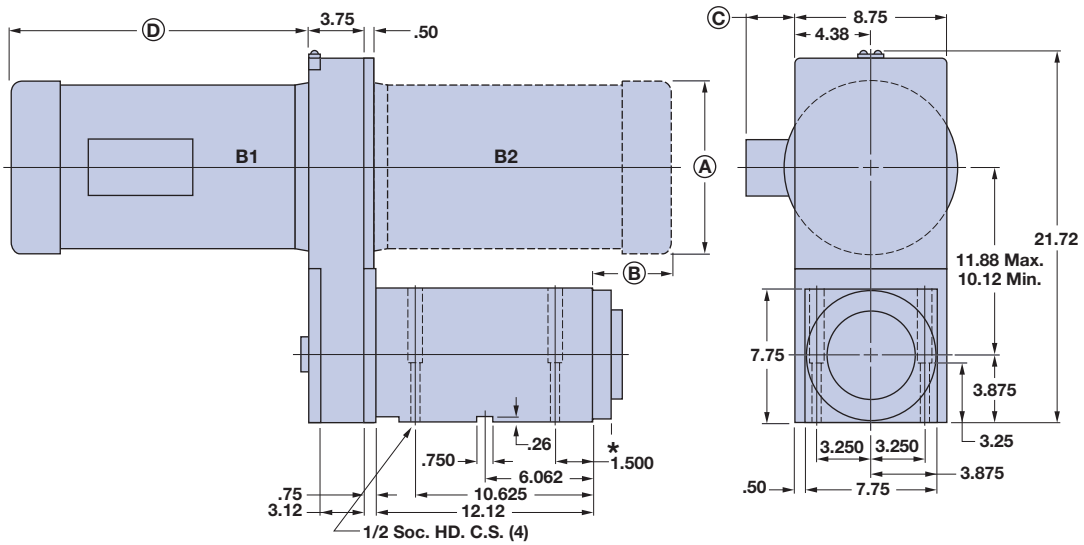
* Maximum tool overhang
(from *) = 6 1/8 (in.)
Maximum torque = 2164 (in.- lbs.)
WK^2 = 47.2 (lb.- $in.^2$)
Note: Spindles are supplied with medium bearing preloads as standard. Light and heavy bearing preloads are available.
Tool overhang pertains to boring, end milling and nonsupported arbor milling.

Gilman 5500C
Motorized spindles

5500C and 5500B motorized spindles are fixed-speed units incorporating a timing belt drive for positive power transmission. Poly-V, V-belt and flat-belt drives are available at additional cost where high speed and minimum vibration are required. The 5500C and 5500B are available in two sizes: the B1/B2 units (high horsepower) or B3/B4 units (low horsepower). For 5500 spindle capabilities reference the 5500 specification charts.*

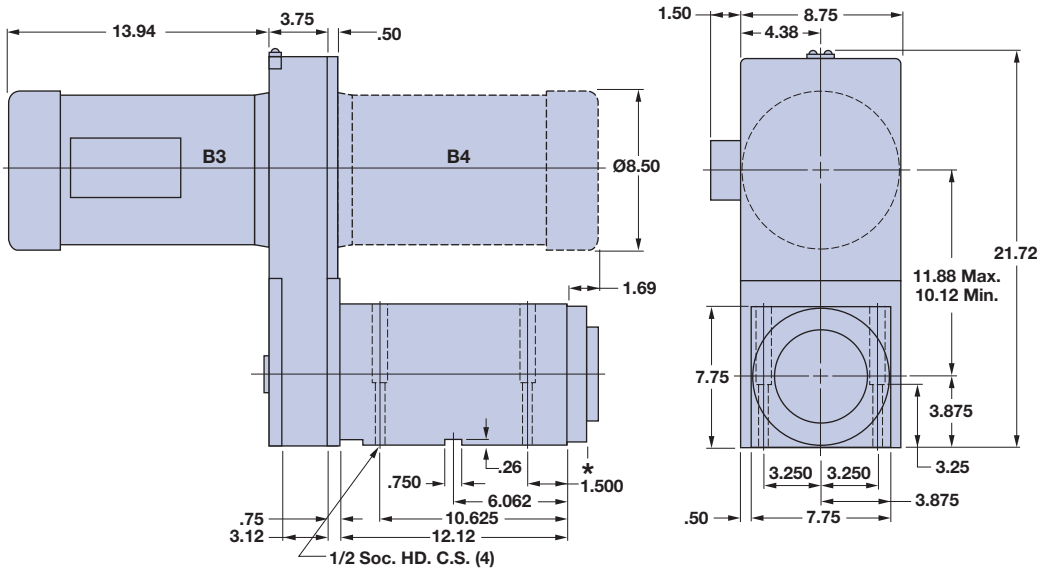
5500C B1 & B2

Spindle R.P.M.			Motor						
Position	Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	D
A & C B & D	600 600	2150 2150	1160	5	215TC	10.19	5.81	3.00	16.31
A & C B & D	950 950	3250 3250	1750	5 or 7 1/2	184TC 213TC	8.50 10.19	4.94 5.81	1.50 3.00	15.44 16.31
A & C B & D	1900 1900	6450 6450	3500	5 or 7 1/2	184TC	8.50	4.94	1.50	15.44



5500C B3 & B4

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	500 500	2150 2150	1160	2	184TC
A & C B & D	850 850	3250 3250	1750	3	182TC
A & C B & D	1750 1750	6450 6450	3500	3	182TC

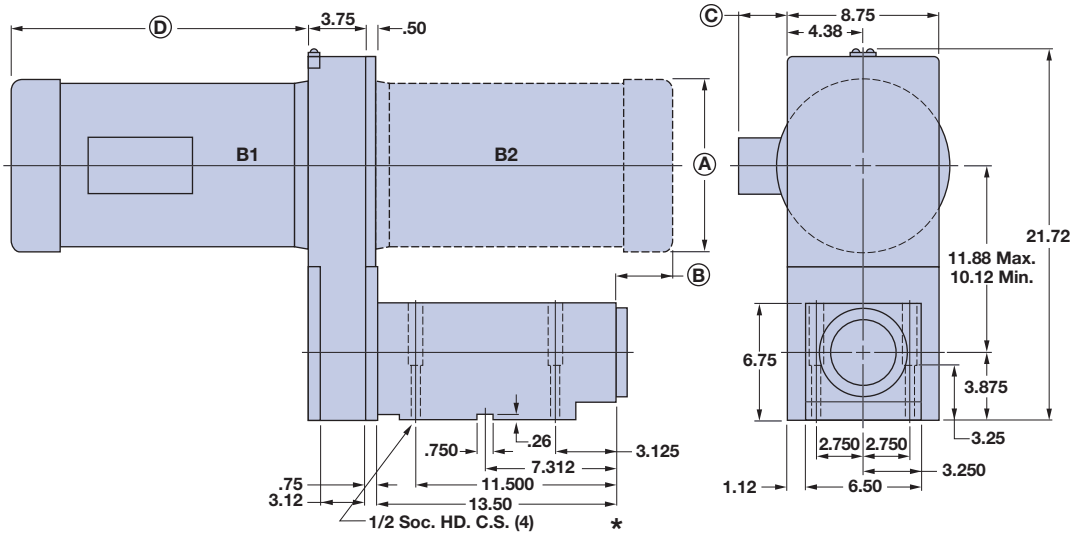


Approx. wt. 395 lbs.

Note: * See 5500C cartridge spindles on page 28.

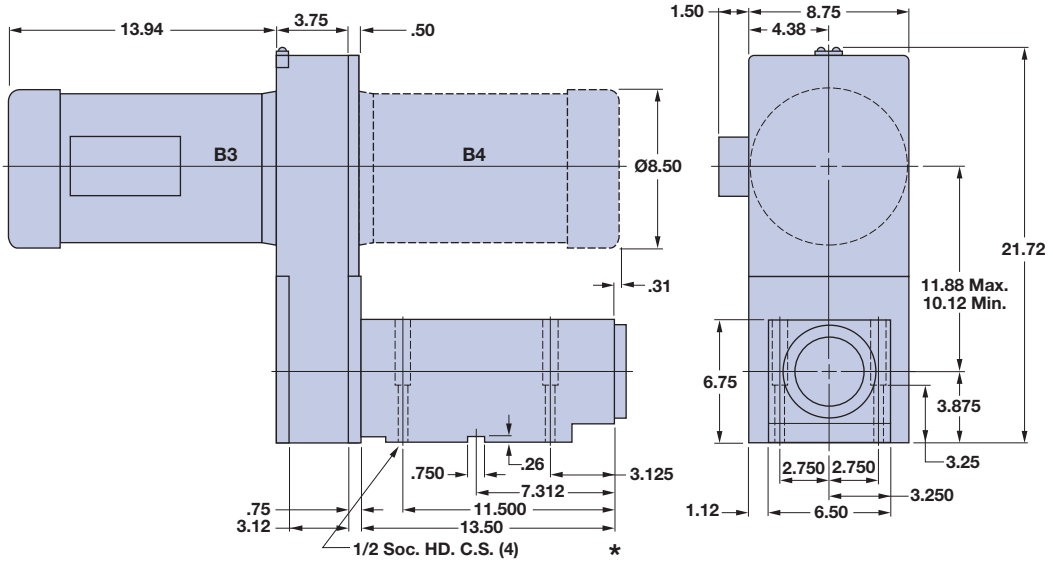
5500B B1 & B2

Spindle R.P.M.			Motor						
Position	Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	D
A & C B & D	600 600	2150 2150	1160	5	215TC	10.19	5.81	3.00	16.31
A & C B & D	950 950	3250 3250	1750	5 or 7 1/2	184TC 213TC	8.50 10.19	4.94 5.81	1.50 3.00	15.44 16.31
A & C B & D	1900 1900	6450 6450	3500	5 or 7 1/2	184TC	8.50	4.94	1.50	15.44



5500C B3 & B4

Spindle R.P.M.			Motor		
Position	Minimum	Maximum	R.P.M.	H.P.	Frame
A & C B & D	500 500	2150 2150	1160	2	184TC
A & C B & D	850 850	3250 3250	1750	3	182TC
A & C B & D	1750 1750	6450 6450	3500	3	182TC



Approx. wt. 310 lbs.

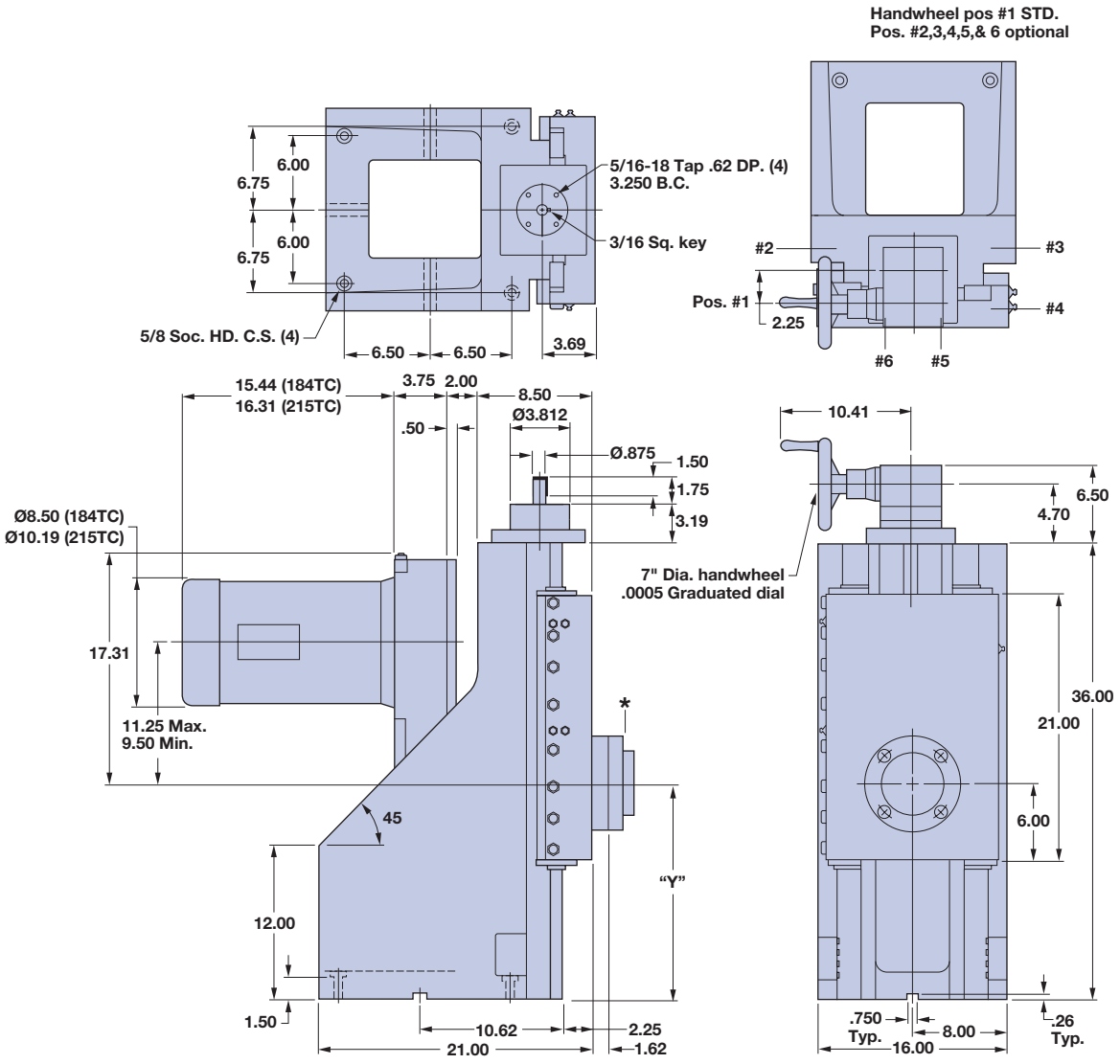
Note: * See 5500B cartridge spindles on page 29.

Gilman 5500C

Motorized vertical travel spindles

5500C motorized vertical travel spindle units are fixed-speed units that combine a motorized timing belt drive spindle with a vertical hardened steel way slide assembly. Vertical positioning of the saddle and spindle can be accomplished with one of the eight standard drive types.

The lead screw manual drive is a 2:1 reduction right angle drive and can be positioned six ways with position #1 as standard (specify position number when ordering). For 5500C spindle capabilities, reference the 5500C specification charts.*



D1, M1 - Lead screw power drive
1.500-.250 Rolled ball screw R.H. Thd.

D2, M2 - Lead screw power drive
1.500-.250 Ground ball screw R.H. Thd.

D3, M3 - Lead screw power drive
40mm-5mm Ground ball screw R.H. Thd.

E1 - Lead screw power drive
1.500-.100 Acme screw L.H. Thd.

Drive	"Y" Min.	"Y" Max.
D1, M1	7.00	18.00
D2, M2	7.00	17.00
D3, M3	7.00	17.00
E1	7.00	19.00
H2	7.00	19.00

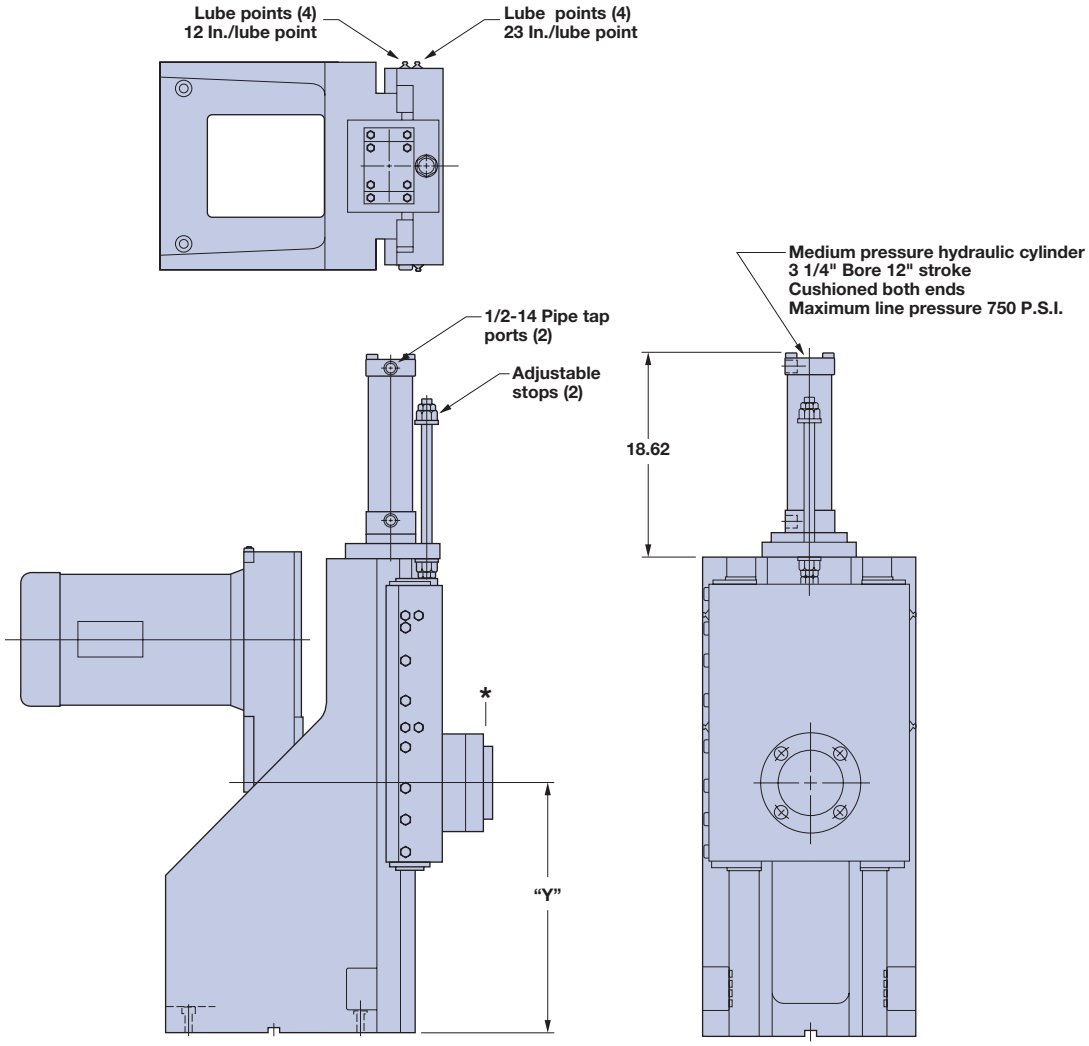
Note: * See 5500C cartridge spindles on page 28.

**M1, M2, M3 - Motor mount for customer supplied motor. Consult factory for specifications.

Gilman 5500C
Motorized vertical travel spindles

5500C Vertical travel

Spindle R.P.M.		Motor		
Minimum	Maximum	R.P.M.	H.P.	Frame
550	2150	1160	5	215TC
850	3250	1750	5 or 7 1/2	184TC 213TC
1750	6450	3500	5 or 7 1/2	184TC



H2- Hydraulic cylinder drive
3.25" cylinder

Approx. wt. 1,520 lbs.

Note: * See 5500C cartridge spindles on page 28.

Gilman 6500C
Cartridge spindles

6500C cartridge spindles and 6500B block spindles are available with three standard nose types and six standard internal construction types.

Nose types:

- #50 N.M.T.B. taper
- Boring nose
- HSKC100 manual clamp

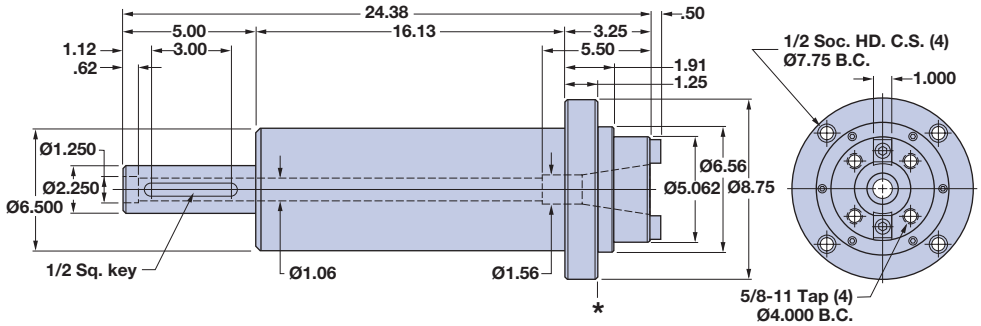
Internal constructions:

- X1 duplex ball bearing at nose end with contact seal
- X2 duplex ball bearing at nose end with labyrinth seal
- X2C duplex ceramic ball bearing at nose end with labyrinth seal
- X3 triplex ball bearing at nose end with contact seal
- X4 triplex ball bearing at nose end with labyrinth seal
- X4C triplex ceramic ball bearing at nose end with labyrinth seal

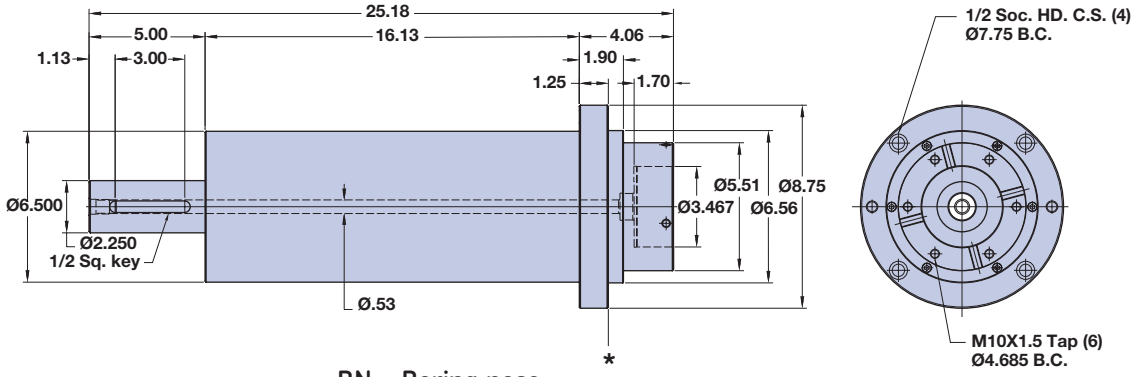
Refer to the 6500C/6500B specification chart, as well as the sizing instructions on page 5, to select the proper spindle for your rotational requirements. Special designs are also available to meet your specific needs.

6500C Approx. wt. 195 lbs.

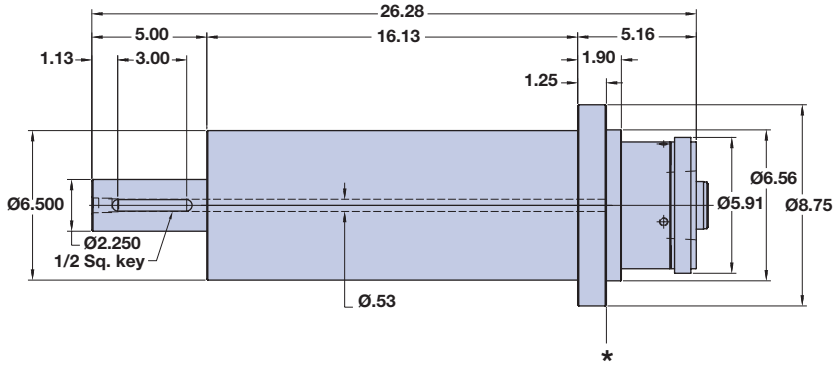
For cartridge spindle brackets, see "Gilman spindle accessories", page 47.



50 - #50 N.M.T.B. Taper shaft



BN - Boring nose



HM - HSKC100 Manual clamp
(T-Wrench Not Included)

6500C & 6500B Specification chart

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X1L X1M X1H	280 765 1380	2,125 2,125 2,125	960,000 1,080,000 1,160,000	85 mm I.D. duplex ball	Contact	70 mm I.D. duplex ball	Labyrinth
X2L X2M X2H	280 765 1,380	7,600 5,700 3,800	960,000 1,080,000 1,160,000	85 mm I.D. duplex ball	Labyrinth	70 mm I.D. duplex ball	Labyrinth
X2CL X2CM	174 363	10,400 9,100	960,000 1,080,000	85 mm I.D. duplex ceramic ball	Labyrinth	70 mm I.D. duplex ceramic ball	Labyrinth

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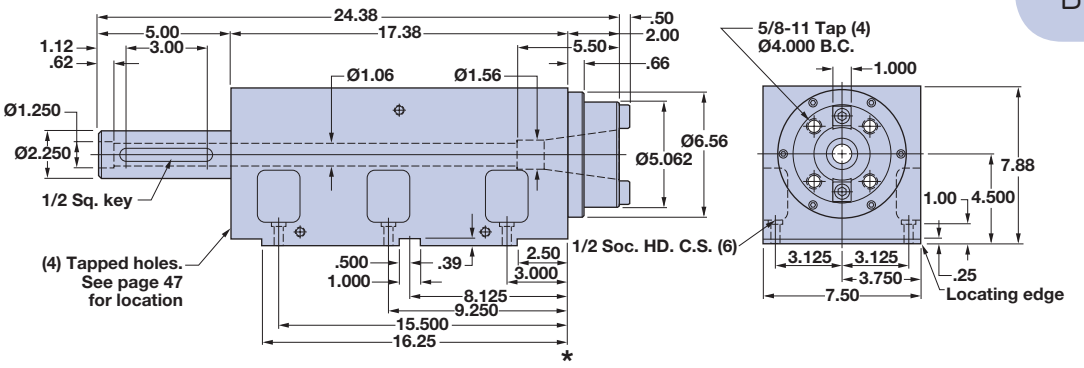
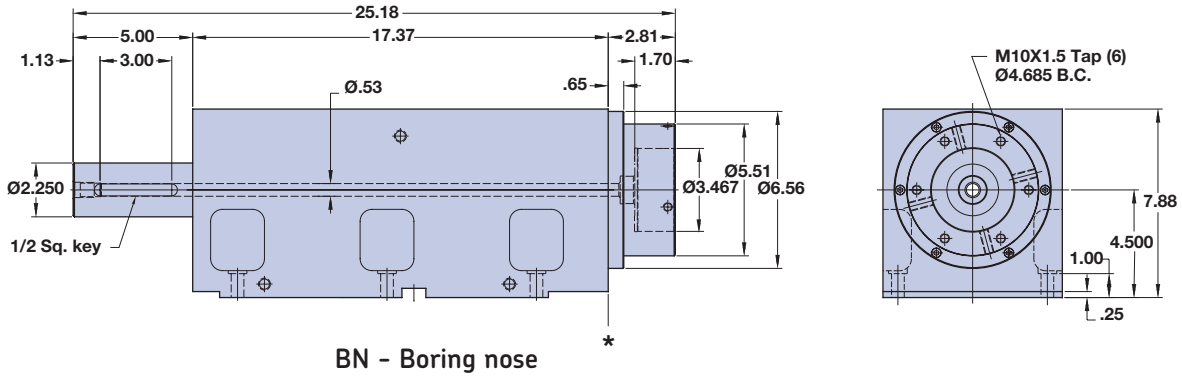
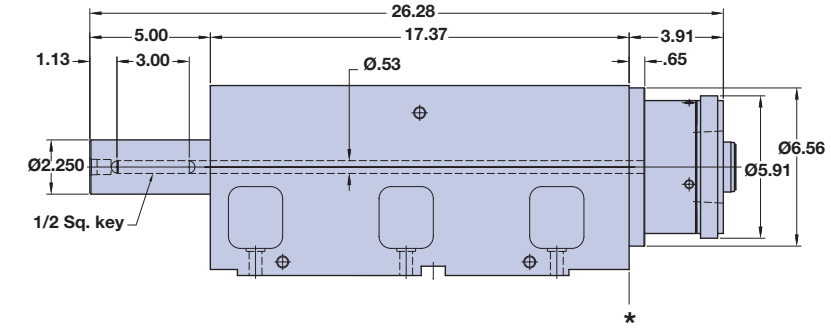


50 - #50 N.M.T.B. Taper shaft



BN - Boring nose



HM - HSKC100 Manual clamp
(T-wrench not included)

6500B Approx. wt. 225 lbs.

6500C & 6500B Specification chart (continued)

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X3L X3M X3H	570 1695 3790	2,125 2,125 2,125	1,450,000 1,620,000 1,700,000	85 mm I.D. triplex ball	Contact	70 mm I.D. duplex ball	Labyrinth
X4L X4M X4H	570 1695 3790	5,700 3,800 3,000	1,450,000 1,620,000 1,700,000	85 mm I.D. triplex ball	Labyrinth	70 mm I.D. duplex ball	Labyrinth
X4CL X4CM	343 714	9,100 7,150	1,450,000 1,620,000	85 mm I.D. triplex ceramic ball	Labyrinth	70 mm I.D. duplex ceramic ball	Labyrinth

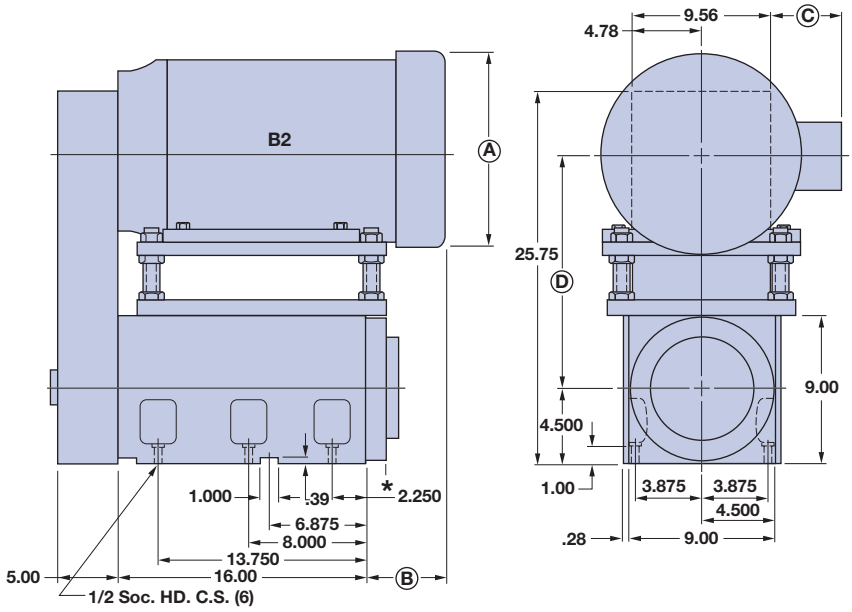
* Maximum tool overhang
(from *) = 8 (in.)
Maximum torque = 4100 (in.- lbs.)
WK^2 = 104.2 (lb.- $in.^2$)
Note: Spindles are supplied with medium bearing preloads as standard. Light and heavy bearing preloads are available.
Tool overhang pertains to boring, end milling and nonsupported arbor milling.

Gilman 6500C
Motorized spindles

6500C and 6500B motorized spindles are fixed-speed units incorporating a timing belt drive for positive power transmission. Poly-V, V-belt and flat-belt drives are available at additional cost where high speed and minimum vibration are required. The 6500C and 6500B are available in two sizes: the B2 unit (high horsepower) or B3/B4 units (low horsepower). For 6500 spindle capabilities reference the 6500 specification charts.*

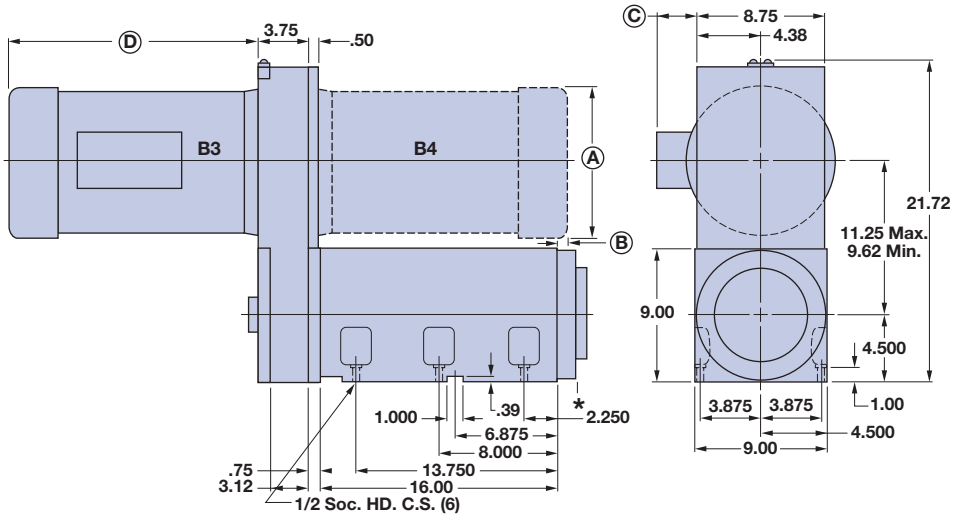
6500C B2

Spindle R.P.M.		Motor						D	
Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	Min.	Max.
550	1750	1160	10 or 15	256T 284T	12.94 14.62	3.19 7.19	4.94 8.38	14.00 14.75	16.00 16.75
850	2650	1750	15 or 20	254T 256T	12.94	1.12 3.19	4.94	14.00	16.00
1750	4300	3500	15 or 20	254T 256T	12.94	1.12 2.88	4.94	14.00	16.00



6500C B3/B4

Spindle R.P.M.		Motor						
Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	D
550	1650	1160	3 or 5	213TC 215TC	9.56	-0.44 0.69	3.00	15.56 16.69
850	2450	1750	5 or 7 1/2	184TC 213TC	8.88 9.56	-2.00 -0.44	1.50 3.00	13.94 15.56
1750	4850	3500	5 or 7 1/2	184TC	8.88	-2.00 -0.59	1.50	13.94 15.44

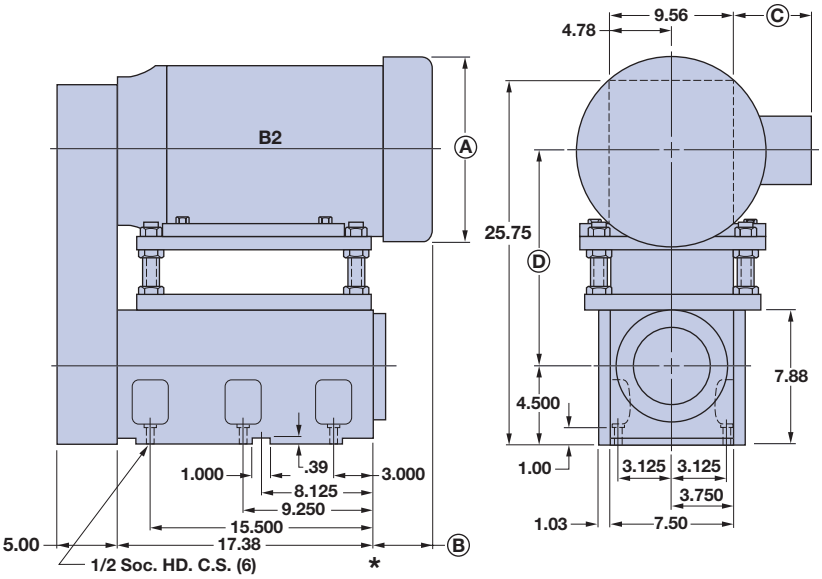


Approx. wt. 930 lbs.

Note: * See 6500C cartridge spindles on page 34.

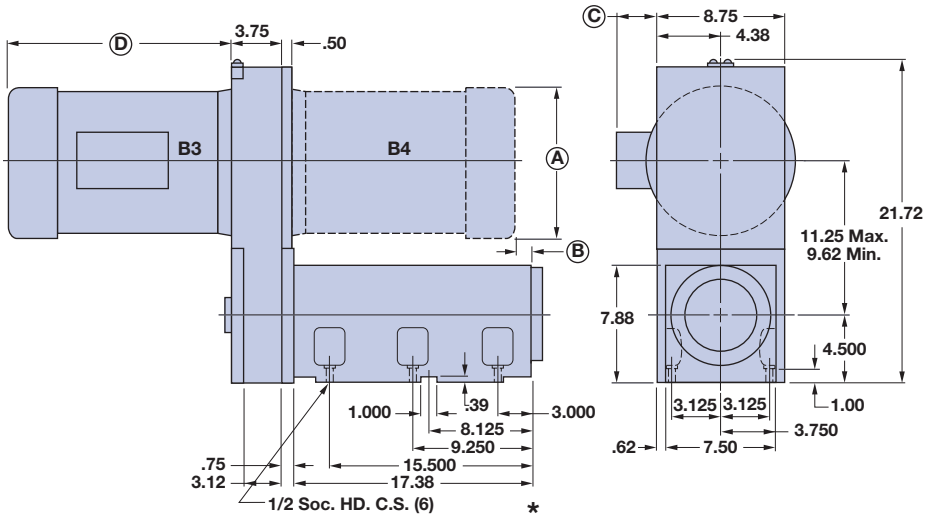
6500B B2

Spindle R.P.M.			Motor					D	
Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	Min.	Max.
550	1750	1160	10 or 15	256T 284T	12.94 14.62	1.81 5.81	4.94 8.38	12.88 13.62	14.88 15.625
850	2650	1750	15 or 20	254T 256T	12.94	-0.25 1.81	4.94	12.88	14.88
1750	4300	3500	15 or 20	254T 256T	12.94	-0.25 1.50	4.94	12.88	14.88



6500B B3/B4

Spindle R.P.M.		Motor						
Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	D
550	1650	1160	3 or 5	213TC 215TC	9.56	-1.81 -0.69	3.00	15.56 16.69
850	2450	1750	5 or 7 1/2	184TC 213TC	8.88 9.56	-3.38 -1.81	1.50 3.00	13.94 15.56
1750	4850	3500	5 or 7 1/2	184TC	8.88	-3.38 -1.97	1.50	13.94 15.44



Approx. wt. 755 lbs.

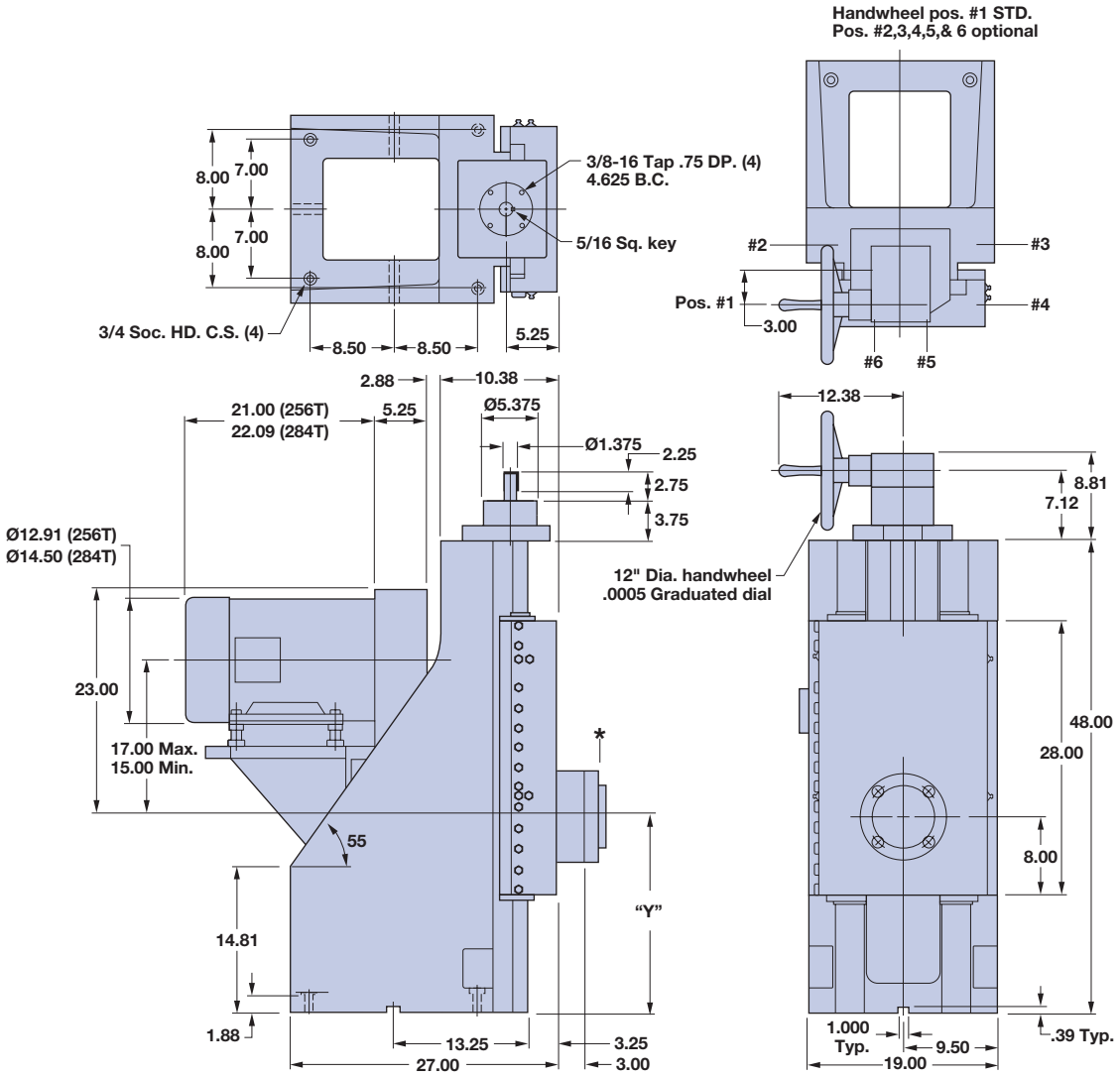
Note: * See 6500B cartridge spindles on page 35.

Gilman 6500C

Motorized vertical travel spindles

6500C motorized vertical travel spindle units are fixed-speed units that combine a motorized timing belt drive spindle with a vertical hardened steel way slide assembly. Vertical positioning of the saddle and spindle can be accomplished with one of the eight standard drive types.

The lead screw manual drive is a 2:1 reduction right angle drive and can be positioned six ways with position #1 as standard (specify position number when ordering). For 6500C spindle capabilities, reference the 6500 specification charts.*



D1, M1 - Lead screw power drive
2.000-.500 Rolled ball screw R.H. Thd.

D2, M2 - Lead screw power drive
2.000-.500 Ground ball screw R.H. Thd.

D3, M3 - Lead screw power drive
50mm-10mm Ground ball screw R.H. Thd.

E1 - Lead screw power drive
2.500-.250 Acme screw L.H. Thd.

Drive	"Y" Min.	"Y" Max.
D1, M1	9.00	22.00
D2, M2	9.00	23.00
D3, M3	9.00	23.00
E1	9.00	25.00
H2	9.00	25.00

Note: * See 6500C cartridge spindles on page 34.

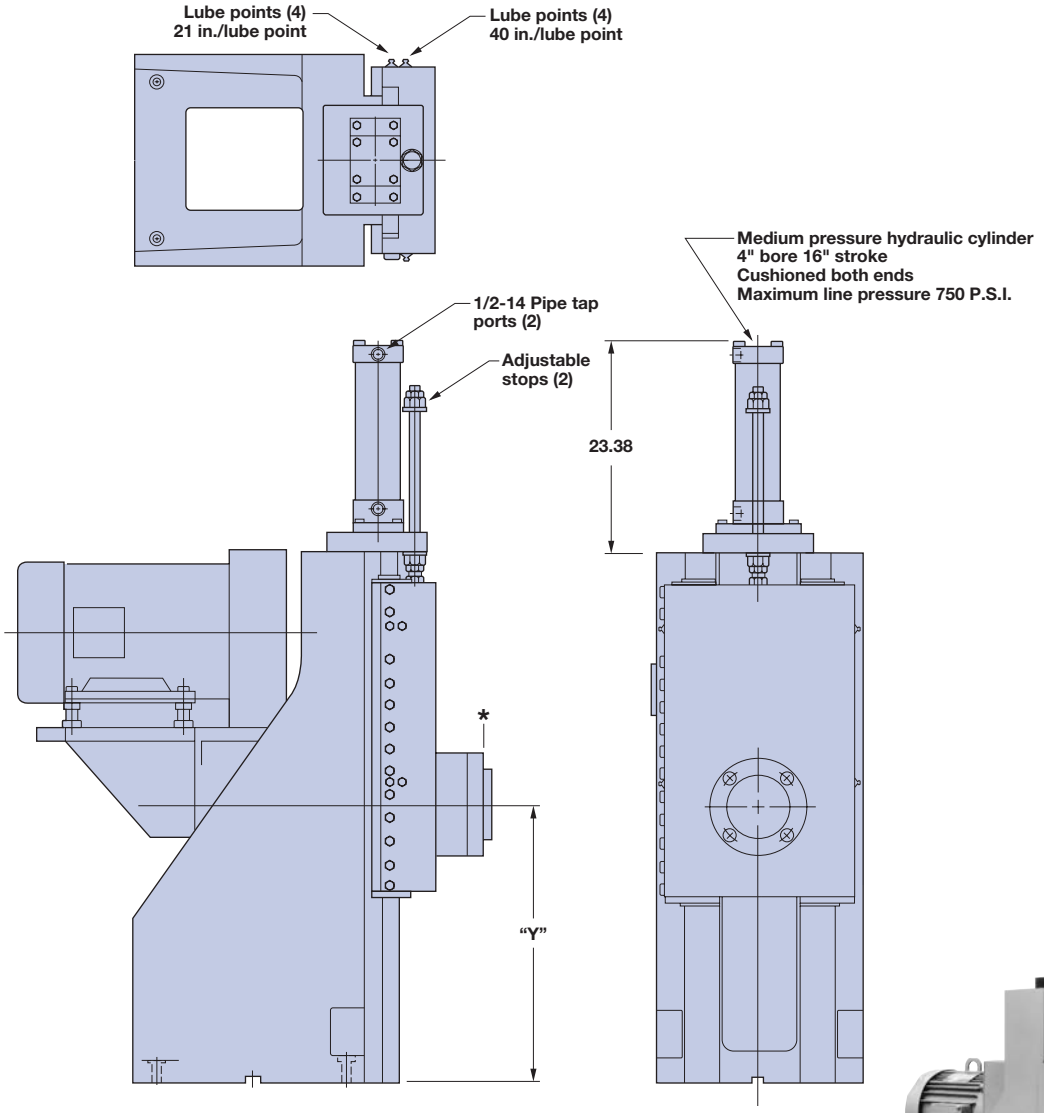
**M1, M2, M3 - Motor mount for customer supplied motor. Consult factory for specifications.

Gilman 6500C

Motorized vertical travel spindles

6500C Vertical travel

Spindle R.P.M.		Motor		
Minimum	Maximum	R.P.M.	H.P.	Frame
550	1750	1160	10 or 15	256T 284T
850	2650	1750	15 or 20	254T 256T
1750	4300	3500	15 or 20	254T 256T



H2- Hydraulic cylinder drive
4.00" bore cylinder

Approx. wt. 2,600 lbs.

Note: * See 6500C cartridge spindles on page 34.

Gilman 8000C
Cartridge spindles

8000C cartridge spindles and 8000B block spindles are available with three standard nose types and six standard internal construction types.

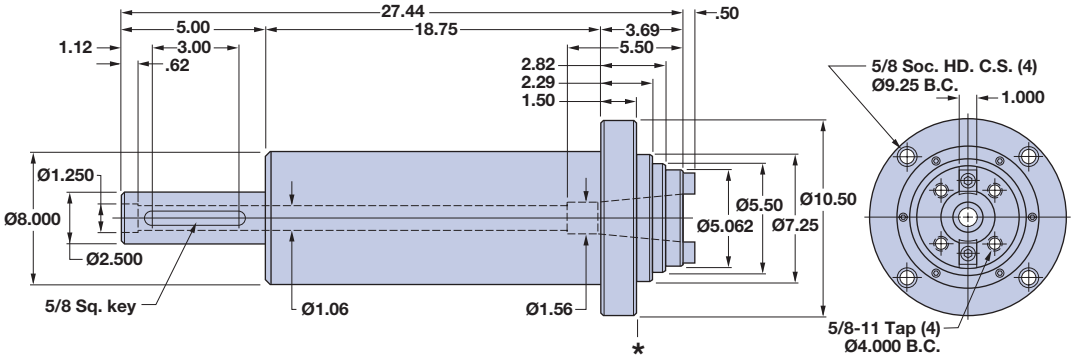
Nose types:

- #50 N.M.T.B. taper
- Boring nose
- HSKC100 manual clamp

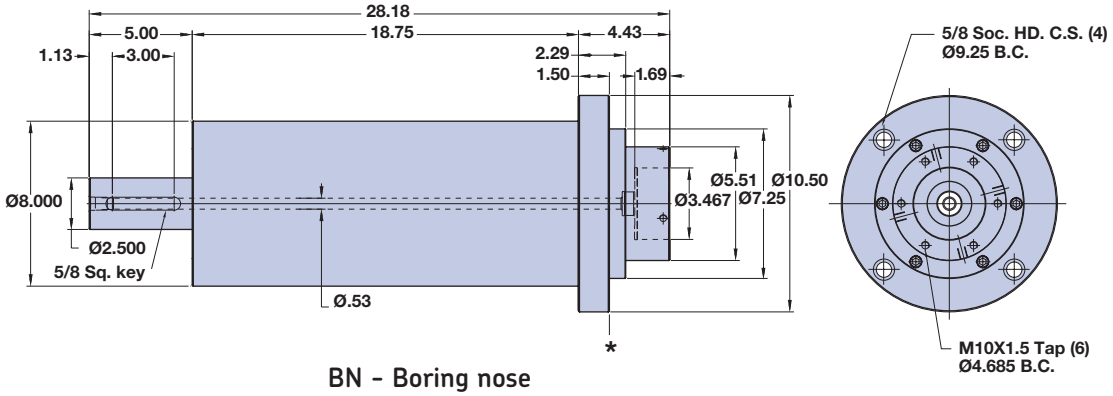
Internal constructions:

- X1 duplex ball bearing at nose end with contact seal
- X2 duplex ball bearing at nose end with labyrinth seal
- X2C duplex ceramic ball bearing at nose end with labyrinth seal
- X3 triplex ball bearing at nose end with contact seal
- X4 triplex ball bearing at nose end with labyrinth seal
- X4C triplex ceramic ball bearing at nose end with labyrinth seal

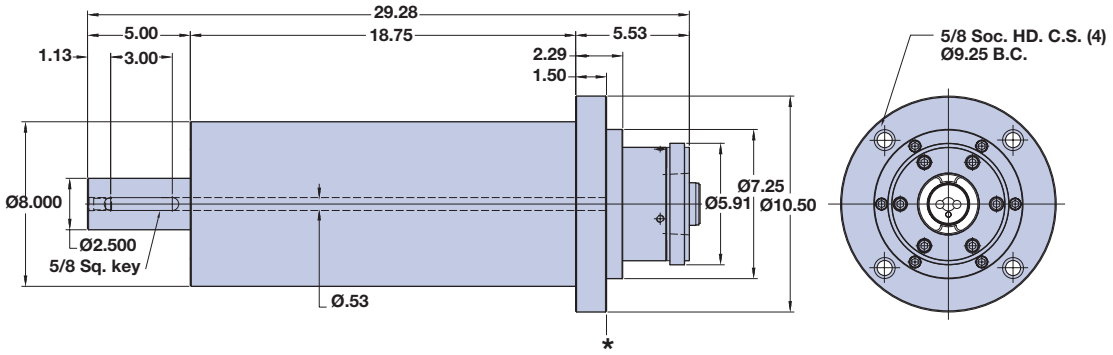
Refer to the 8000C/8000B specification chart, as well as the sizing instructions on page 5, to select the proper spindle for your rotational requirements. Special designs are also available to meet your specific needs.



50 - #50 N.M.T.B. Taper shaft



BN - Boring nose



HM - HSKC100 Manual clamp
(T-wrench not included)

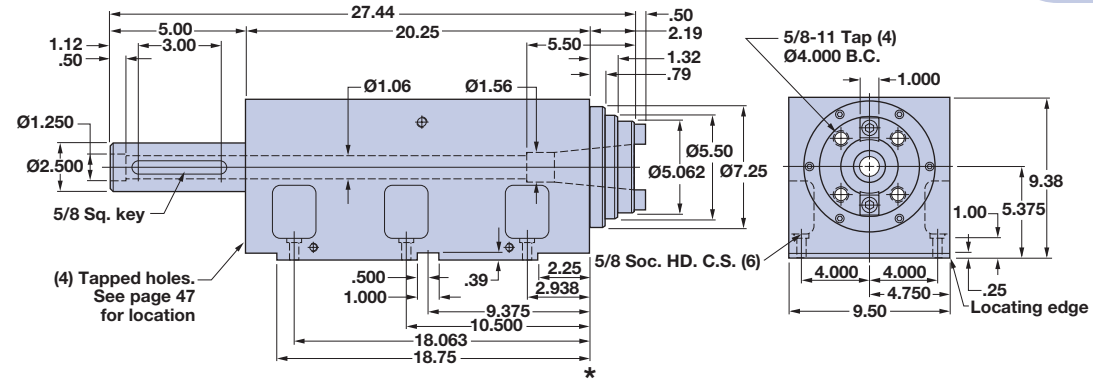
8000C Approx. wt. 260 lbs.

8000C & 8000B Specification chart

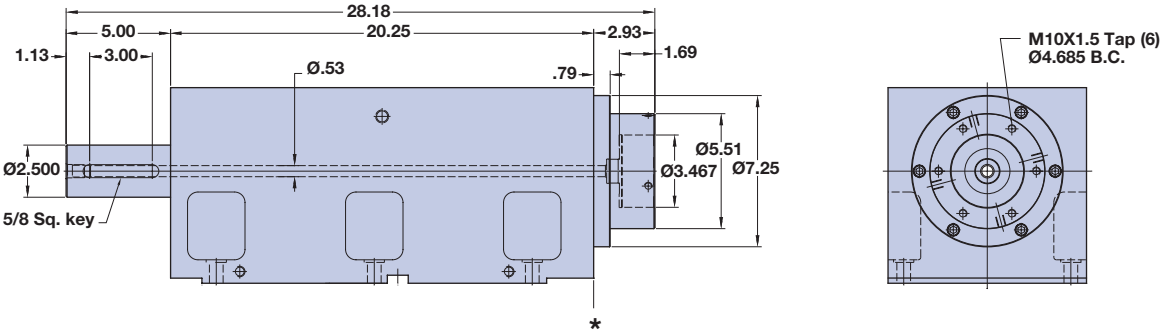
Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X1L X1M X1H	370 950 2,045	1,800 1,800 1,800	1,430,000 1,630,000 1,780,000	100 mm I.D. duplex ball	Contact	85 mm I.D. duplex ball	Labyrinth
X2L X2M X2H	370 950 2,045	5,700 4,600 3,100	1,430,000 1,630,000 1,780,000	100 mm I.D. duplex ball	Labyrinth	85 mm I.D. duplex ball	Labyrinth
X2CL X2CM	215 448	8,000 7,000	1,430,000 1,630,000	100 mm I.D. duplex ceramic ball	Labyrinth	85 mm I.D. duplex ceramic ball	Labyrinth

Continued on next page

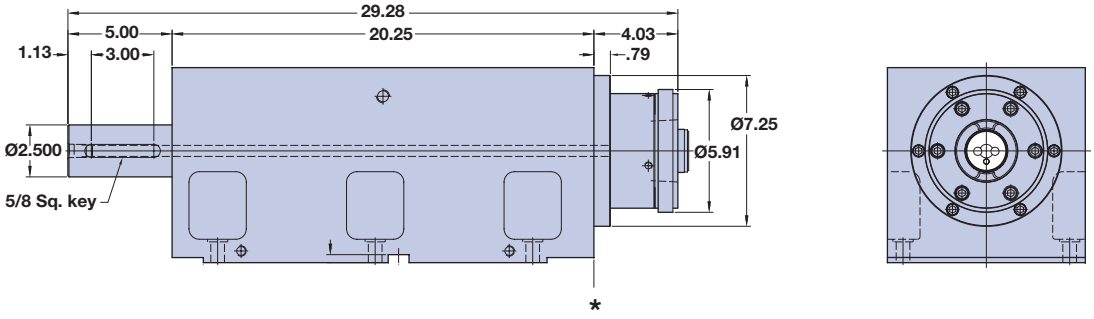
For cartridge spindle brackets, see "Gilman spindle accessories", page 47.



50 - #50 N.M.T.B. Taper shaft



BN - Boring nose



HM - HSKC100 Manual clamp
(T-wrench not included)

8000C & 8000B Specification chart (continued)

Bearing and seal construction number	Maximum thrust (lbs.)	Maximum R.P.M.	Radial stiffness at nose (lbs./in.)	Nose end		Drive end	
				Bearing	Seal	Bearing	Seal
X3L X3M X3H	750 2100 4700	1,800 1,800 1,800	2,150,000 2,450,000 2,630,000	100 mm I.D. triplex ball	Contact	85 mm I.D. duplex ball	Labyrinth
X4L X4M X4H	750 2100 4700	4,600 3,100 1,800	2,150,000 2,450,000 2,630,000	100 mm I.D. triplex ball	Labyrinth	85 mm I.D. duplex ball	Labyrinth
X4CL X4CM	425 884	7,000 5,500	2,150,000 2,450,000	100 mm I.D. triplex ceramic ball	Labyrinth	85 mm I.D. duplex ceramic ball	Labyrinth

* Maximum tool overhang
(from *) = 9 3/8 (in.)
Maximum torque = 7460 (in.- lbs.)
WK^2 = 210.1 (lb.- $in.^2$)
Note: Spindles are supplied with medium bearing preloads as standard. Light and heavy bearing preloads are available.
Tool overhang pertains to boring, end milling and nonsupported arbor milling.

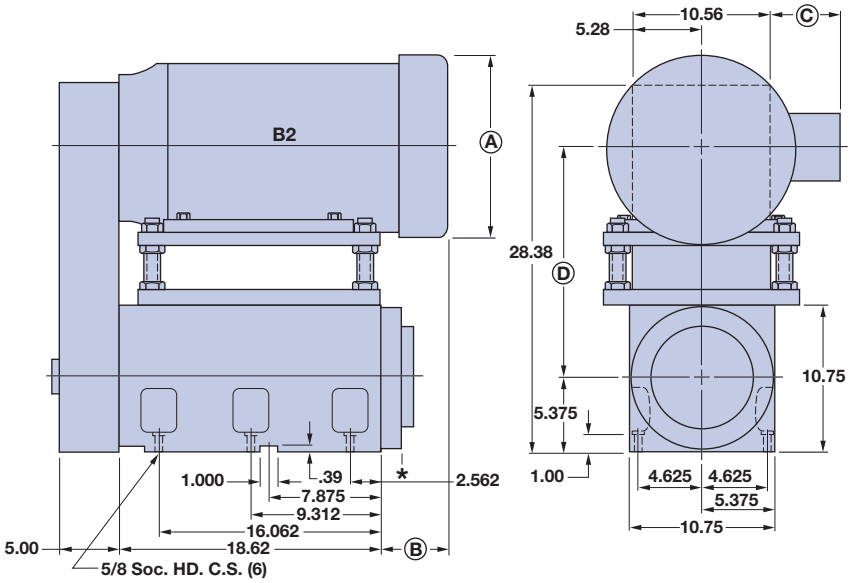
Gilman 8000C

Motorized spindles

8000C and 8000B motorized spindles are fixed-speed units incorporating a timing belt drive for positive power transmission. Poly-V, V-belt and flat-belt drives are available at additional cost where high speed and minimum vibration are required. The 8000C and 8000B are available in two sizes: the B2 unit (high horsepower) or B4 units (low horsepower). For 8000 spindle capabilities reference the 8000 specification charts.*

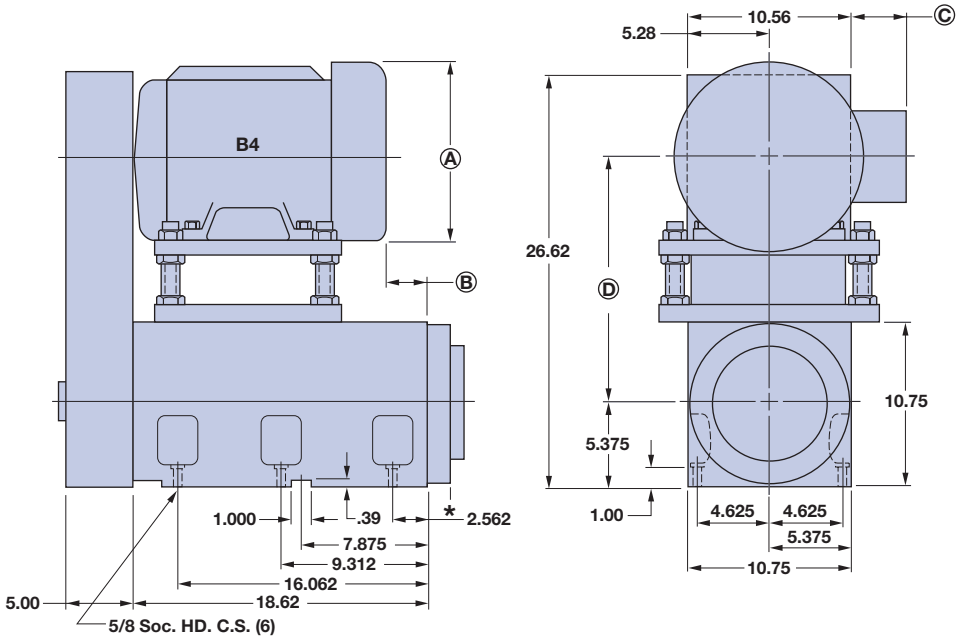
8000C B2

Spindle R.P.M.		Motor						D	
Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	Min.	Max.
550	1950	1160	10 or 15	256T 284T	12.94 14.62	0.56 4.50	4.38 7.88	14.88 15.62	16.88 17.62
850	2850	1750	20	256T	12.94	0.56	4.38	14.88	16.88
1750	4400	3500	25 or 30	284TS 286TS	14.62 14.62	2.75 2.75	7.88 7.88	15.62 15.62	17.62 17.62



8000C B4

Spindle R.P.M.		Motor						D	
Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	Min.	Max.
550	1950	1160	5	215T	9.56	3.50	0.62	13.88	15.88
850	2950	1750	5 or 7 1/2	184T 213T	7.88 9.56	6.12 3.50	2.12 0.62	13.12 13.88	15.12 15.88
1750	3950	3500	5 or 7 1/2	184T 213T	7.88 9.56	6.12 3.50	2.12 0.62	13.12 13.88	15.12 15.88

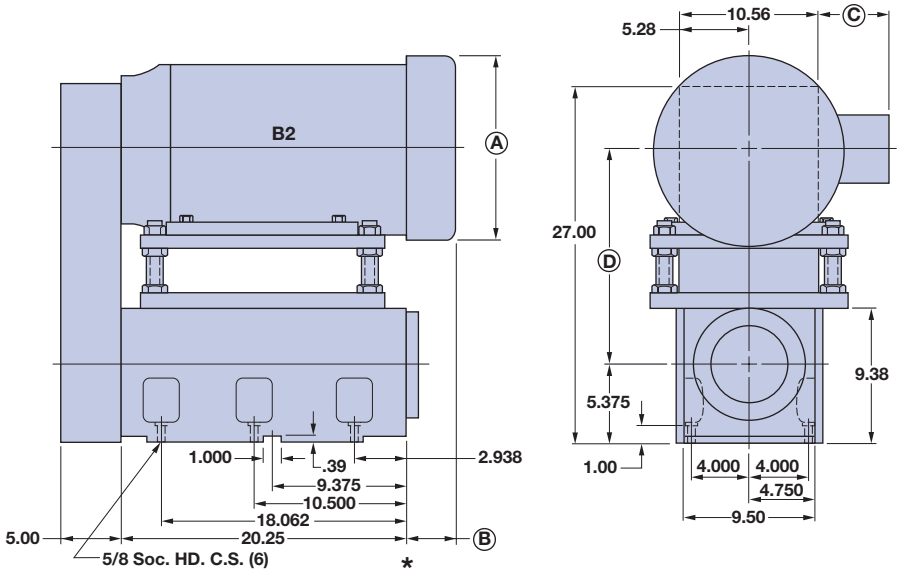


Approx. wt. 1210 lbs.

Note: * See 8000C cartridge spindles on page 40.

8000B B2

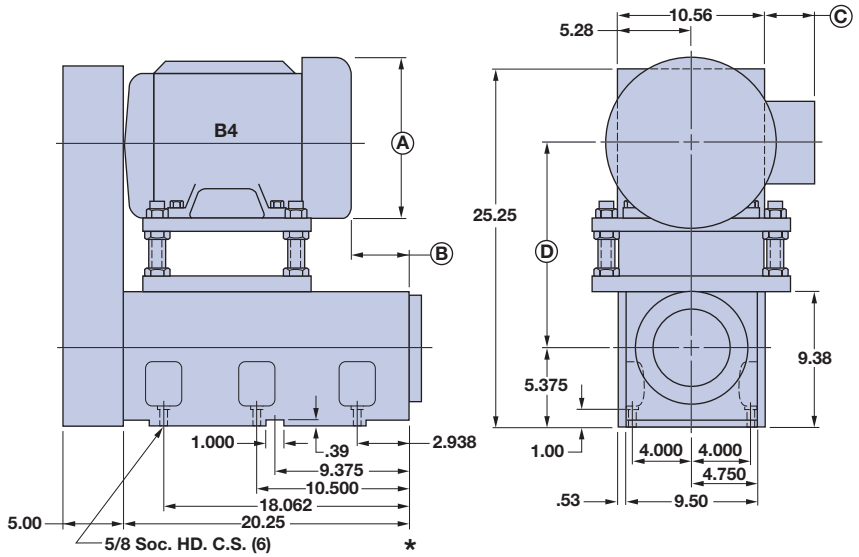
Spindle R.P.M.		Motor						D	
Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	Min.	Max.
550	1950	1160	10 or 15	256T 284T	12.94 14.62	-1.06 2.88	4.38 7.88	13.50 14.25	15.50 16.25
850	2850	1750	20	256T	12.94	-1.06	4.38	13.50	15.50
1750	4400	3500	25 or 30	284TS 286TS	14.62 14.62	1.12 1.12	7.88 7.88	14.25 14.25	16.25 16.25



8000B B4

Spindle R.P.M.		Motor						D	
Minimum	Maximum	R.P.M.	H.P.	Frame	A	B	C	Min.	Max.
550	1950	1160	5	215T	9.56	5.12	0.62	13.88	15.88
850	2950	1750	5 or 7 1/2	184T 213T	7.88 9.56	7.75 5.12	2.12 0.62	13.12 13.88	15.12 15.88
1750	3950	3500	5 or 7 1/2	184T 213T	7.88 9.56	7.75 5.12	2.12 0.62	13.12 13.88	15.12 15.88

Approx. wt. 1110 lbs.



Note: * See 8000B cartridge spindles on page 41.

Gilman special spindle modules

Special applications may require a special spindle module. Engineers at Gilman USA have years of experience fitting modules to the most challenging applications. Available as specials (except on 1250 and 1875 spindles) are various nose types such as Universal Kwik-Switch, Air Gage, HSK, Kennametal, Komet ABS, 3 1¦2 in./ft. grinding taper and a variety of collet types to meet your tooling requirements. Other special nose configurations are available.

Pictured below are just a few of the many special spindle modules assembled by Gilman USA for customers around the world. For information on these or other special spindle requirements, contact Gilman USA's sales engineering for personalized assistance.

1 18083

Special vertical travel grinding spindle consisting of a special model 2750C grinding spindle driven by an AC motor and poly-V belt with a ground ball screw driven HWL9 vertical slide.

2 17746

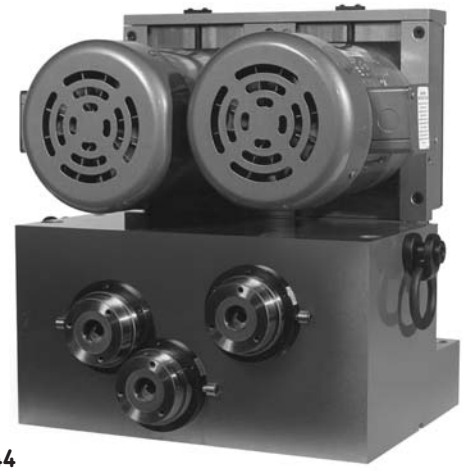
Two model 3500 cluster spindles with provision for adding a third spindle at a later date. AC motor driven with poly-V belt drive.

3 17747

Special model 5500B arbor spindle with piggyback mounted AC motor and V-belt drive.

4 17765

Dual model 4000C #40 N.M.T.B. nose motorized vertical travel spindle assembly with AC motor, timing belt drive and hydraulic cylinder powered hardened steel way vertical slide.



5 17744

Three-spindle cluster featuring (3) model 5500 boring nose spindles. Two AC motors and poly-V belt drives power the spindles.

Gilman special spindle modules

6 17749

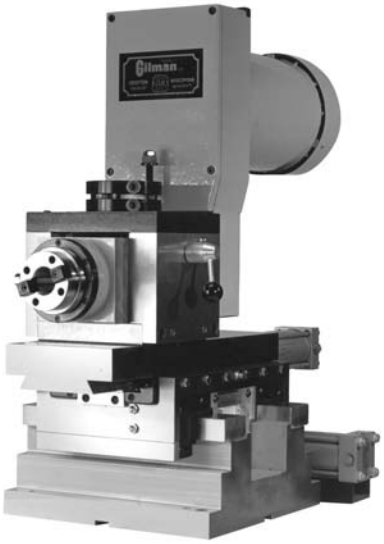
Four-spindle cluster featuring (2) model 3500 and (2) model 5500 boring nose spindles. Two AC motors and timing belt drives power the spindles.

7 17625

Model 6500 #50 quick change nose "Quad-Quill" quill feed spindle allows for 6 in. of in and out feed.

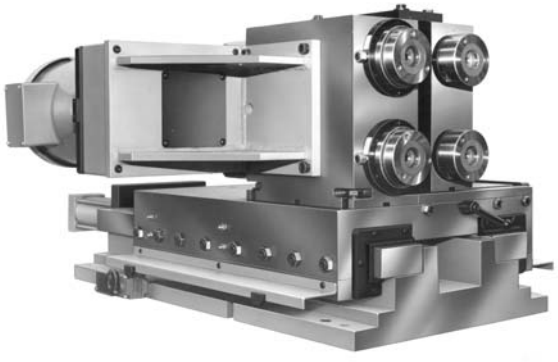
8 17750

Dual model 3500 timing belt driven motorized spindle assembly with two axis hardened steel way slide assembly.



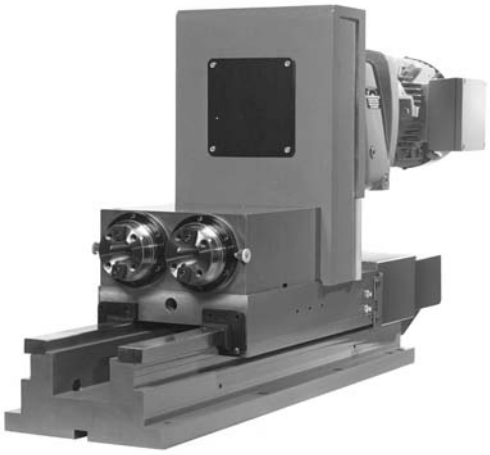
9 18084

Three-axis milling unit consisting of a hardened way slide, dovetail slide and a special vertical travel unit featuring a model 3500 #30 N.M.T.B. nose spindle.



10 17748

Four-spindle cluster mounted on a HWL12 slide. The cluster unit consists of (2) model 3500 and (2) model 2750 boring nose spindles with AC motors and poly-V belt drives. Designed to allow for variable spindle center-to-center distances.



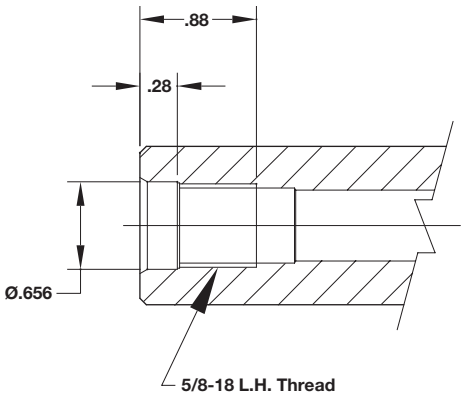
11 17745

Dual-motorized spindle unit featuring (2) model 4000 spindles with #40 N.M.T.B. nose, and powered by an AC gearmotor and timing belt mounted on a HWS12 slide.

Gilman spindle accessories

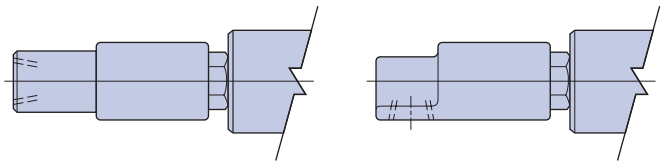
1 Coolant union connection

When needed, coolant can be fed through the spindle via a rotary union, by adding a coolant union connection to all spindles (except for 40 and 50 MNTB) with through-hole shafts.



2 Rotating coolant unions

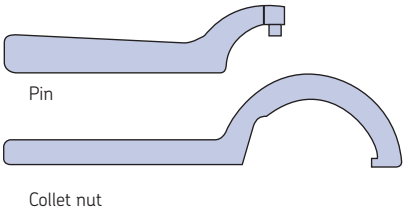
Rotary coolant unions are available in straight-through or 90° designs. They allow coolant to enter the drive end of the spindle and pass through the shaft to the tool. To install, a coolant union adapter must be used.



3 Wrenches

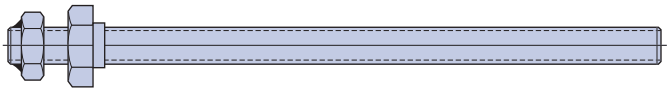
Wrenches for spindle collet locknuts must be ordered separately from the spindle. Refer to chart for correct wrench number corresponding with spindle model.

Model	Pin	Collet nut
1875	------	A11293
2750	A10016-2	A11599
3500	A10278-2	A11599



4 Manual draw bar

Precision Manual draw bars for spindles with #30, #40 and #50 N.M.T.B. tapers are made to operate at high speeds with minimal vibration.



5 Power draw bar systems

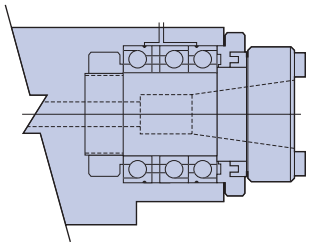
Offering high speed operation and strong clamping power, these power draw bars provide short tool change cycles for automatic tool change applications. Available in #30, #40 and #50 milling tapers and with solid shaft or coolant–through design.

6 Air purge fittings

A #10-32 tapped hole is located on the nose end of the cartridge spindles (except 1250 and 1875 models) and on both the nose and drive ends of the block spindles for air purging. A push type fitting for 5/32" O.D. plastic tubing can be supplied for ease of connection.

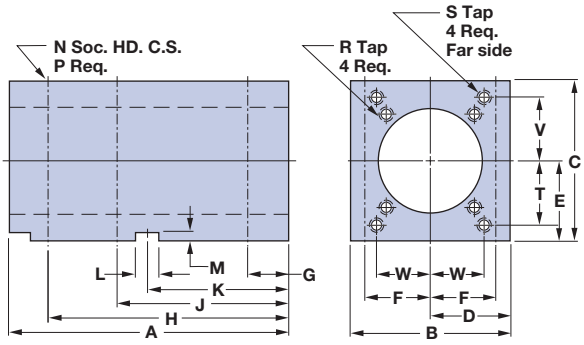
7 Bearing force monitoring system

Bearing force monitoring systems can detect tool wear, tool breakage and bearing temperatures during milling, boring, turning, drilling and tapping applications.



8 Brackets

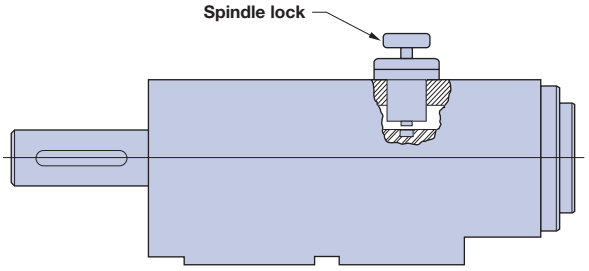
Gilman spindle brackets are manufactured from close grain, stress relieved cast iron. Models 1250 and 1875 have two types of brackets: positioning nut and clamp type. The 2750, 3500, 4000, 5500, 6500 and 8000 models have block type brackets for mounting flanged spindles.



Model	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	V	W	WT.	Dwg. NO
2750	6.25	4.25	4.25	2.125	2.125	1.75	1.12	5.12	•	3.188	.750	.26	5/16	4	5/16-18	5/16-18	1.50	1.12	1.50	20	D40364-2
3500	7.88	5.25	5.25	2.625	2.625	2.25	1.12	6.75	•	3.938	.750	.26	5/16	4	5/16-18	5/16-18	2.00	1.62	1.88	35	D40365-2
4000	10.38	6.00	6.00	3.000	3.000	2.50	1.50	8.88	•	5.375	.750	.26	3/8	4	3/8-16	3/8-16	2.00	1.75	2.25	60	D40366-2
5500	12.12	7.75	7.75	3.875	3.875	3.25	1.50	10.62	•	6.062	.750	.26	1/2	4	1/2-13	3/8-16	3.12	2.38	2.75	105	D40367-2
6500	16.00	9.00	9.00	4.500	4.500	3.88	2.25	13.75	8.00	6.875	1.000	.39	1/2	6	1/2-13	3/8-16	3.88	3.00	3.12	185	D40368-2
8000	18.62	10.75	10.75	5.375	5.375	4.62	2.56	16.06	9.31	7.875	1.000	.39	5/8	6	5/8-11	3/8-16	4.75	3.62	4.00	290	D40369-2

9 Manual spindle lock

A spindle lock is used to prevent the spindle shaft from rotating while tooling is being changed. Hold–to–lock or twist–lock styles are available. When using the twist–lock version, a motor interlocking switch is required to prevent spindle start–up while the lock is in position. Available on block spindles only.



10 Oil lubricators

When very high speeds are required or high ambient temperatures and humidity are present, an oil mist or oil + air lubricator may be used to keep the spindle running at peak performance.

11 Vertical travel accessories

Vertical travel spindle assemblies include many of the same accessories as Gilman USA's hardened steel way slides. Items such as limit switches, one–shot or automatic lubrication systems, and covers can all be used on vertical travel spindle assemblies. Refer to the Hardened Steel Way Catalog and consult factory for price and availability.

Gilman spindle accessories

Oil air lubrication system

The Gilman USA oil air lubrication system is designed to meet the needs of the latest generation of high-speed machining centers where one of the drawbacks of grease lubrication is the requirement for frequent refilling.

The system can control oil delivery as accurately as 0.012 cc injections every few minutes for stable temperature in the spindle.

The controller series is designed for up to eight outlets, each of them independently controlled to fit the needs of a large variety of spindle designs.

Visit www.GilmanUSA.com for more information.

Spindle monitoring and recording unit

Maintenance of spindles is costly because the running hours and operating conditions largely depend on the type of operation. It is difficult to know when the spindle is near the end of its life period.

The Spindle Monitoring and Recording Unit (SMRU) has been designed to register spindle temperatures, rotational speed and running hours. It is meant as a tool for maintenance planning and to record if the spindle has run outside the normal operating conditions.

The SMRU is a black box that can be either integrated into the spindle or bolted to it. Therefore, the SMRU can provide a means of identification of the Spindle. It can hold specific information about the Spindle as to its use, maintenance history and its identity. A fleet of SMRUs can be managed in a network.

Visit www.GilmanUSA.com for more information.

Application engineering data

Boring

Material		H.S.S. Tool		Carbide tool		P
		Speed FPM	Feed IPR	Speed FPM	Feed IPR	
Steel	Soft 85-200 BHN	100-180	.005-.010	360-675	.006-.015	1.4
	Medium 200-325 BHN	55-145	.004-.010	240-570	.005-.015	1.7
	Hard 325-450 BHN	30-60	.003-.007	155-250	.004-.009	1.9
Stainless steel†	Soft 135-275 BHN	80-150	.004-.008	315-500	.005-.010	1.6
	Hard 275-425 BHN	30-70	.003-.007	135-325	.004-.009	1.7
Cast iron	Soft 120-220 BHN	60-140	.005-.010	250-460	.007-.015	1.0
	Hard 220-320 BHN	20-50	.003-.008	105-225	.004-.010	1.7
Ductile iron 140-260 BHN		65-140	.006-.010	195-460	.008-.015	1.3
Malleable iron 110-240-BHN		60-165	.005-.010	205-625	.007-.015	1.2
Aluminum Except die castings		540-750	.008-.015	990-1600	.010-.020	.3
Aluminum die castings		105-135	.008-.015	375-475	.010-.020	.3
Magnesium		700-800	.008-.015	1800-2000	.010-.020	.2
Brass & bronze		250-480	.006-.015	500-950	.008-.020	1.2
Copper		90-115	.005-.008	180-225	.007-.010	1.2

Gun Drilling — Carbide tool

Material		Speed FPM	Hole dia. and feed IP R					P
			5/64-5/32	5/32-1/4	1/4-1/2	1/2-3/4	3/4-1	1-2	
Steel	Soft 85-200 BHN	425-675	.00015	.0003	.0006	.0008	.001	.0015	1.1
	Medium 200-325 BHN	225-450	.00025	.0005	.0006	.0008	.001	.0015	1.4
	Hard 325-450 BHN	130-200			.0006	.0008	.001	.0015	1.7
Stainless steel†	Soft 135-275 BHN	250-300	.00015	.0003	.0006	.0008	.001	.0015	1.1
	Hard 275-425 BHN	150-225	.00025	.0005	.0005	.0007	.0008	.001	1.2
					.0006	.0008	.001	.0015	
Cast iron	Soft 120-220 BHN	250-350	.00015	.0003 .001	.0015	.003	.005	.007	1.1
	Hard 220-320 BHN	150-200	.00025	.0003 .0005	.001	.002	.0025	.003	1.6
Ductile iron 140-260 BHN		200-300	.00015 .00025	.0003 .0005	.0006	.0008	.0015	.002	1.3
Malleable iron 110-240-BHN		250-350	.00015 .00025	.0003 .0005	.0006	.0008	.0015	.002	1.2
Aluminum Except die castings		650	.00015 .00025	.0003 .001	.003	.005	.008	.010	.2
Aluminum die castings		650	.00015 .00025	.0003 .001	.003	.005	.008	.010	.2
Magnesium		650	.00015 .00025	.0003 .001	.003	.005	.008	.010	.2
Brass & bronze		500-600	.00015 .00025	.0003 .001	.001 .003	.003 .005	.005 .008	.008 .010	.8
Copper		350	.00015 .00025	.0003 .0005	.001	.003	.005	.008	.9

MILLING — Face — Side & slot w/cutters — Slot w/end mills

Material		H.S.S. tool		Carbide tool *		P
		Speed FPM	Feed IPR	Speed FPM	Feed IPT	
Steel	Soft 85-200 BHN	65-325	.001-.012	290-840	.007-.014	1.4
	Medium 200-325 BHN	40-225	.0005-.012	200-650	.006-.014	1.8
	Hard 325-450 BHN	25-95	.0005-.008	150-375	.004-.010	2.2
Stainless steel†	Soft 135-275 BHN	60-250	.0005-.010	205-625	.007-.014	1.7
	Hard 275-425 BHN	25-105	.0005-.007	165-400	.004-.009	1.9
Cast iron	Soft 120-220 BHN	55-235	.0007-.016	300-630	.007-.020	.9
	Hard 220-320 BHN	25-85	.0005-.010	150-400	.005-.010	1.4
Ductile iron 140-260 BHN		50-195	.0005-.016	250-665	.007-.020	1.1
Malleable iron 110-240-BHN		55-330	.0007-.016	250-800	.007-.020	1.0
Aluminum Except die castings		200-1500	.0005-.022	1200-Max.	.010-.020	.4
Aluminum die castings		125-325	.0005-.020	800-2200	.010-.020	.4
Magnesium		450-1500	.001-.022	1200-Max.	.010-.020	.2
Brass & bronze		155-600	.001-.020	400-1300	.007-.018	1.2
Copper		75-150	.001-.010	200-350	.005-.010	1.2

*Not for slot end mills. †Free machining. *Data courtesy of Metcut Research Associates, Inc.*

The following data is a partial listing of information needed to assist in determining the approximate size of a spindle for a particular application.

For more complete information on speeds, feeds, materials, operations, power requirements, etc., consult Machinability Data Center (Metcut Research Associates, Inc.) handbook or similar publications.

- Use **lower speeds** for side and slot milling, heavy roughing cuts, hard, tough or abrasive materials, rigid parts and fixtures and maximum tool life.
- Use **higher speeds** for face milling, light finishing cuts, soft materials and less rigid parts and fixtures.
- Use **slower feeds** for side and slot milling, light finishing cuts, hard materials and less rigid parts and fixtures.
- Use **faster feeds** for face milling heavy roughing cuts, soft, or abrasive materials and rigid parts and fixtures.

The above information and data in tables at right is generally accepted as good practice, however variables such as part configuration, type of fixturing, dimensional tolerances, surface finish, tool geometry, tool overhang etc., all affect performance. Therefore the recommendations for speeds, feeds and horsepower are nominal and should be considered as good starting points. For final selection, consult a cutting tool specialist for the latest in cutting tool performance data.

Some helpful suggestions: keep cutter or tool extension to a minimum, use sufficient and the proper type of coolant, prevent chips from accumulating near cut, protect spindle from coolant and chips with adequate guarding.

Consult Gilman USA's Engineering and Sales Department for assistance in selecting a spindle suitable for a particular application providing the following information:

1. Material being machined and hardness.
2. Tool material, diameter, and number of teeth.
3. Type of operation face milling, slot milling, boring etc.
4. Maximum depth and width of cut or maximum area of material being machined in plane at right angles to the direction of feed.
5. HP and RPM required.

Machining formulas

FPM = Peripheral speed of tool in feet per minute
RPM = Speed of tool in revolutions per minute
IPT = Feed rate of tool in inches per tooth
IPR = Feed rate of tool in inches per revolution
IPM = Feed rate of tool in inches per minute
D = Tool diameter in inches
N = Number of teeth in tool
d = Depth of cut in inches
w = Width of cut in inches
A = Area of material machined at right angles to direction of feed
P = Unit power factor in HP per cu. in. per min. (At motor, corrected for 80% drive eff.)

$RPM = 3.82 \times \frac{FPM}{D}$ $\quad FPM = RPM \times \frac{D}{3.82}$

IPM = RPM x IPT x N = RPM x IPR
Boring HP = 12 x FPM x IPR x d x P
Gundrilling HP = .79 x D^2 x IPM x P
Milling HP = d x w x IPM x P = A x IPM x P
Torque (in.- lbs.) = $\frac{HP \times 63025}{RPM}$

Application examples

The following application examples will help familiarize you with the charts and formulas required to determine correct spindle selection.

Application example #1

- Boring 1 7/8" diameter hole in die cast aluminum
- Rough size 1 5/8"
- Carbide inserts, 5" tool overhang from front of housing

Step 1

Determine the peripheral speed of tool (FPM), feed rate of tool (IPR) and Unit Power Factor (P) from the chart under Boring, Aluminum Die Casting and Carbide Tooling.

Results: 475 FPM, .020 IPR and .3 HP/in.^{3}/min.

Step 2

Determine the depth of cut.

Results: $\frac{1.88 - 1.62}{2} = .13$ in.

Step 3

Calculate the required horsepower using the Boring HP formula.

Results: Boring HP = 12 x 475 FPM x .020 IPR x .13 in. x .3 HP/in.^{3}/min.

Boring HP = 4.45

Step 4

Calculate the speed and torque required.

Results: $RPM = 3.82 \times \frac{475\ FPM}{1.88\ in.}$

$RPM = 965$

$Torque = \frac{4.45\ HP \times 63025}{965\ RPM}$

Torque = 291 in.-lbs.

Step 5

Compare the tool overhang, hole diameter and torque to values on Spindle Specification Charts and follow the sizing rules on page 5.

Results: 4000 Spindle

Front bearing bore 55mm > 1.88 in. (48mm)
Maximum tool overhang 5 1/8 > 5 in.
Maximum torque 1000 in.-lbs. > 291 in.-lbs.

3500 Spindle

Front bearing bore 45mm < 1.88 in. (48mm)
Maximum tool overhang 3 7/8 < 5 in. maximum torque 527 in.-lbs. > 291 in.-lbs.

By comparing the results, model 4000C-X1 M-BR would be the spindle of choice.

Application example #2

- Face mill a 2 1/2" wide, 1/8" deep pad in 225 BHN steel with a 4" diameter 6-tooth carbide insert cutter

Step 1

Determine the peripheral speed of tool (FPM), feed rate of tool (IPT) and Unit Power Factor (P) from the chart under Milling, Steel Medium 200-325 BHN and Carbide Tooling.

Results: 200 FPM, .006 IPT and 1.8 HP/in.^{3}/min.

Step 2

Calculate the speed of tool in RPM

Results: $RPM = 3.82 \times \frac{200\ ft./min.}{4\ in.}$

RPM = 191

Step 3

Calculate the feed rate of tool in in./min. (IPM)

Results: IPM = 191 rev./min. x 6 teeth x .006 in./tooth
IPM = 6.88

Step 4

Calculate the required horsepower using the Milling HP formula.

Results: Milling HP = .12 in. x 2.5 in. x 6.881PM x 1.8 HP/in.^{3}/min.

Milling HP = 3.72

Step 5

Calculate the torque requirements.

Results: $Torque = \frac{3.72\ HP \times 63025}{191\ RPM}$

Torque = 1228 in.-lbs.

Step 6

Compare the speed and torque to the values on the Spindle Specification Charts and follow the sizing rules on page 5.

Results: 4000 Spindle

Maximum torque 1000 in.-lbs.

5500 Spindle

Maximum torque 2164 in.-lbs.

By comparing the results, model 5500B-X3M-40 would be the spindle of choice.

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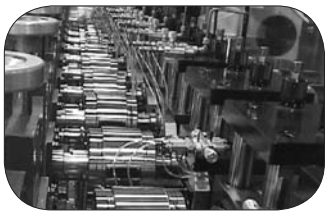
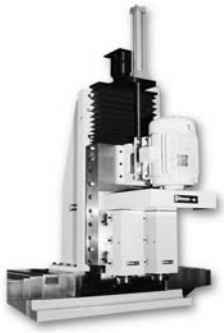
Idea bulletins

To equip the world with Gilman USA knowledge

The following pages contain applications that companies have used to solve manufacturing challenges. Gilman USA is there, rising to the occasion every time, to provide technical consultation and expertise. Whatever the requirements, Gilman USA can meet industry needs while working to the highest standards worldwide. Don't believe it? Visit our Grafton, Wisc., plant and we'll show you firsthand, the facility where Gilman USA precision spindles are born.



Idea bulletins



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Spindles

Idea bulletin

Three spindle cluster module

Special fast track design, close tolerances eliminated adjustment mechanism

Application

Three spindle cluster module for an outdoor power equipment manufacturer's engine transfer line.

Challenge

On time delivery and tolerances for spindle centerline location within the work envelope were critical issues for this job. Another important factor was the customer's desire to use special tooling with the units.

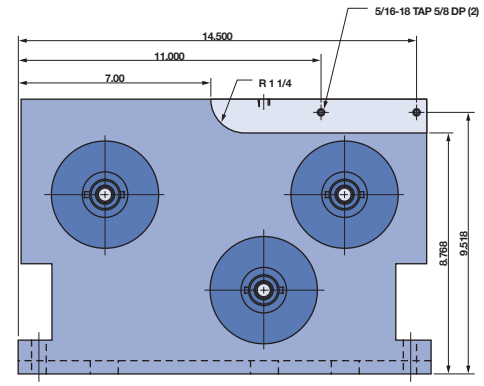
Gilman USA's design produced such accurate centerline locations that the requirement for an adjustment capability was eliminated.

Solution

Gilman USA worked closely with the customer to establish and meet the necessary delivery date. In fact, Gilman USA was able to ship a few days earlier than the required date. This timing was noteworthy, considering the special spindle shafts necessary to accommodate the customer's desired tooling.

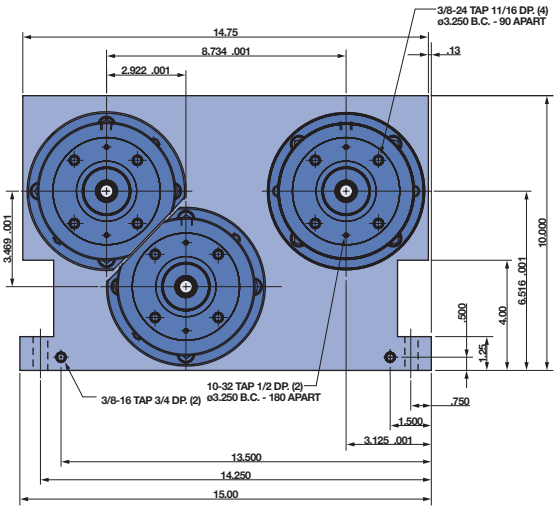
The issue of spindle-to-spindle centerline location tolerances was where Gilman USA's commitment to the best in manufacturing technology allowed a finished product that exceeded the customer's expectations. Originally, the design called for adjustments to be built into the assembly that would allow on-site "steering" of the three spindle centerlines to keep their relative location in spec. The Gilman USA SIP Jig Borer allowed such accurate bore location that the requirements for "steering" adjustments were dropped from the design specifications by the customer. Of the original bore location specification of .0005", Gilman USA's actual test results of the complete assemblies showed bore locations accurate to within .0002". The cluster spindle modules were mounted on Gilman Hardened Way slide assemblies. The slides were driven by hydraulic cylinders.

Three spindle cluster module

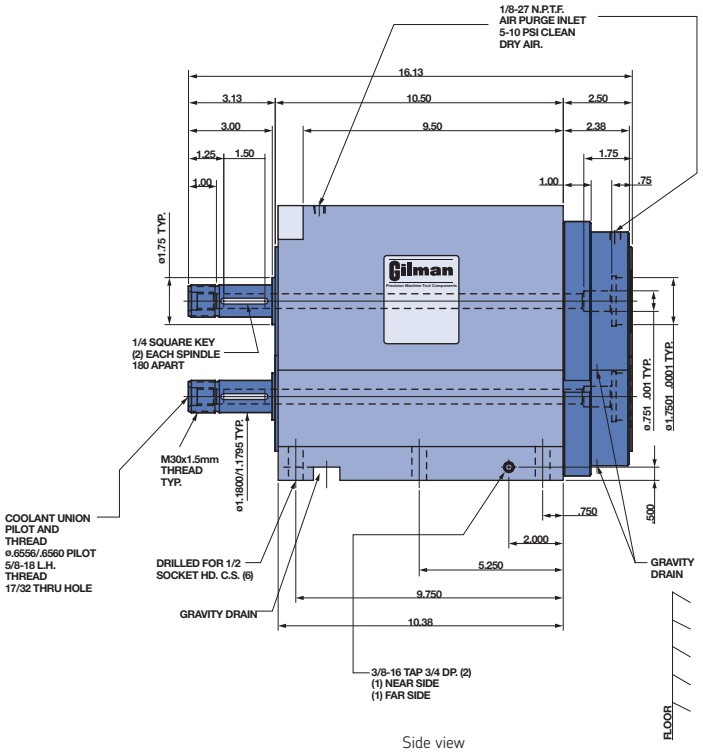


Front view

SPINDLE NOTES:
- PRELOADED PAIR, ABEC 7, 15 ANGULAR CONTACT BALL BEARING, MEDIUM PRELOAD 55 mm I.D., NOSE END. MEDIUM PRELOAD 45 mm I.D., DRIVE END.
- SYNTHETIC GREASE LUBRICATION.
- LABYRINTH SEAL EACH END.
- MAXIMUM THRUST INTO SPINDLE 394 LBS.
- OPERATING SPEED: SPINDLE #103 - 4620 RPM MAXIMUM SPINDLE #104 - 4620 RPM MAXIMUM SPINDLE #115 - 2310 RPM MAXIMUM
- VIBRATION SPECIFICATION PER LAMB LV 2.0 FILTERED READINGS FOR CLASS 7 BALL BEARINGS VELOCITY, AND ACCELERATION ONLY.
- SPECIAL PAINT. CUSTOMER SUPPLIED.
- TOLERANCES MEASURED AT 74 F.



Back view



Side view

Details

The three spindle cluster module was designed for one of six stations on a dial-type machine. The three spindles are belt driven from the rear. Two spindles operate at 4,620 RPM and one spindle operates at 2,310 RPM. The spindles are positioned to machine three areas of a casting for an outdoor power equipment engine part. (Lawn and Garden equipment engine.)

The spindles are based on a Gilman 4000C (-X2M-SBM) spindle with 55mm bearings at the nose and 45mm bearings at the drive end. The bearings are medium preload ABEC 7, 15° angular contact units. Synthetic grease lubrication and labyrinth seals are used. Air purge provisions are designed into both the front and drive ends of the spindles with fittings on the assembly housing. Coolant unions allow coolant through the tooling.

Specials

Idea bulletin

Dual head rise and fall assemblies

Heat transfer core manufacturing machinery made modular and more accurate

Application

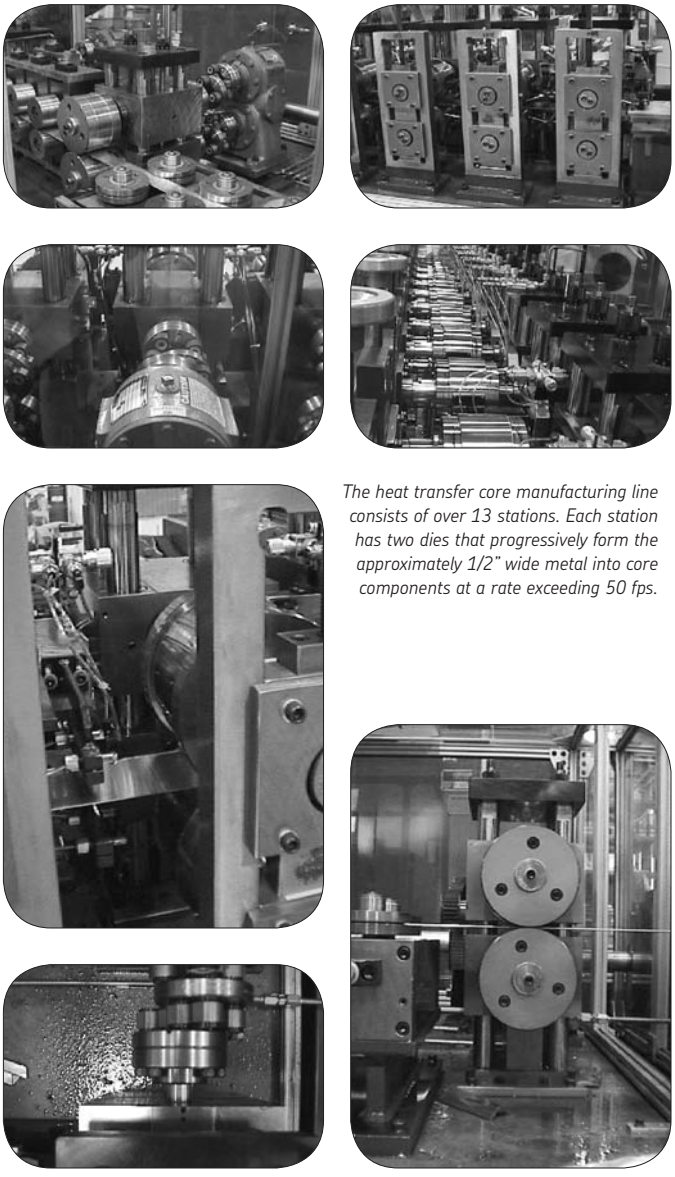
Building patented, 12 1000ths tolerance aluminum tube heat transfer cores for the automotive industry.

Challenge

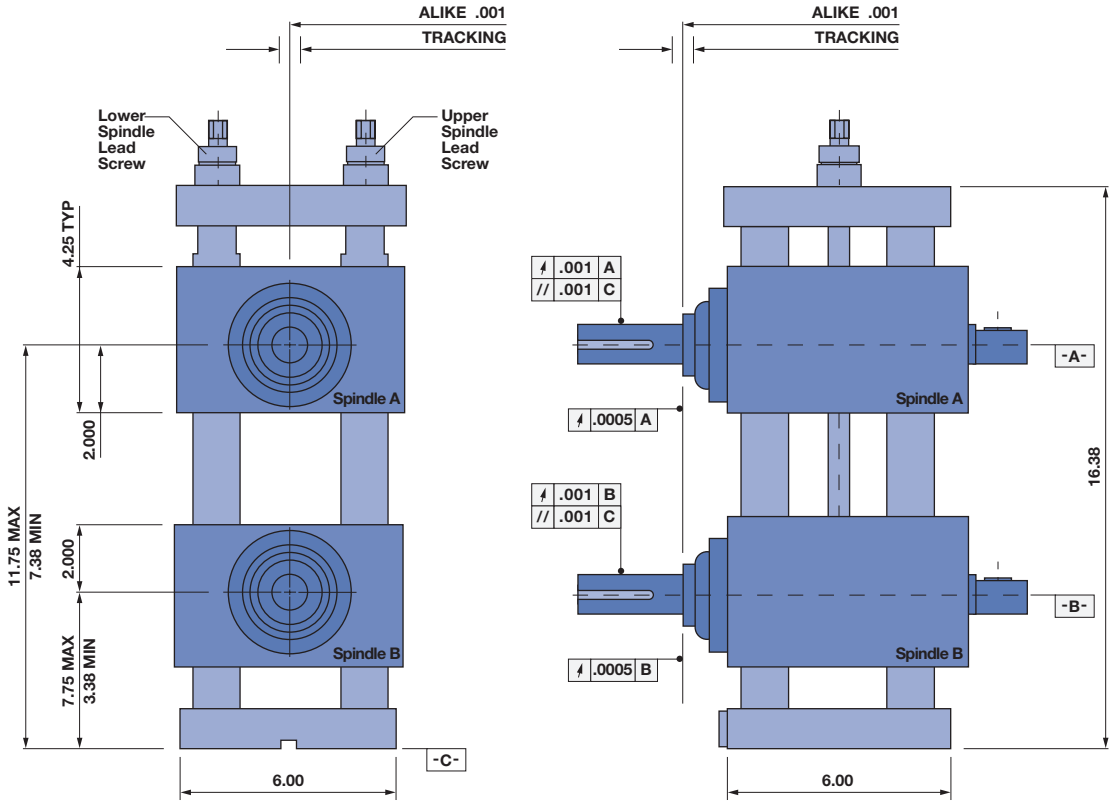
Gilman USA was given an opportunity to improve the manufacturer's 15-year-old welding process and help design an entirely new patented machine design for decreased tolerance and modularity. This manufacturer of 2.5 million heat transfer cores a year wanted standard, adjustable and interchangeable machine assemblies, and most importantly, accuracy equivalent to a machine tool. Setting up the new machines had to be simple. Each spindle also needed to be independently adjustable.

Solution

Gilman USA design improvements, developed over a seven year period, allowed the manufacturer to replace the induction welding method with a more efficient brazing method, producing a lighter, smaller and less costly core. The new machines produced cores with .0001 tolerance, compared to the previous method which yielded tolerances of .001-.005. The Statistical Process Control produced 2-3 CPK on the dimension (5-7 10ths). The redesigned configuration made the cores lighter, 75% of the width and 2.5-3% less expensive, saving $.50 per core. The cost of retooling was quickly offset by the ease of installation. Gilman USA was involved in the setup for six months. The Gilman brand components could be installed right out of the box so they required considerably less manpower. Installed spindles were held to a tolerance of 3.5 tenths. The Gilman brand components also used considerably less space on the factory floor.



The heat transfer core manufacturing line consists of over 13 stations. Each station has two dies that progressively form the approximately 1/2" wide metal into core components at a rate exceeding 50 fps.



Details

Each spindle/slide is adjusted by an independent lead screw. The two spindle units are independently adjusted based on the job being done on the machine. The amount of slide travel varies from job to job.

Technical specifications

Spindle:

- Belt-driven
- Preload pairs, ABEC 7 angular contact ball bearings
  Medium preload 35mm I.D. nose end
  Medium preload 25mm I.D. drive end
- Contact seal nose end, labyrinth seal drive end
- Synthetic grease lubrication
- Operating speed 500 RPM

Slide:

- Each slide (upper and lower) has a travel of 3-3/8”
- 1/2 - 10 Acme lead screws (2)
- .001 graduated micrometer dials

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Service

Idea bulletin

Large motorized machining spindle rebuilt

Speedy domestic spindle service saves time, money and trouble for U.S. machine tool builder

Application

Used in the automotive and heavy equipment industries to hold brake drums, fly wheels, hubs, rotors, differential cases and housings while machining is performed, these spindles typically produce over 2,000 brake rotors per day, the spindles themselves acting as loading/unloading devices.

Challenge

The machine tool spindle being used was foreign-made, and servicing the spindles was problematic for domestic installations. Because the spindles were of a proprietary design, spindle rebuild was difficult.

Solution

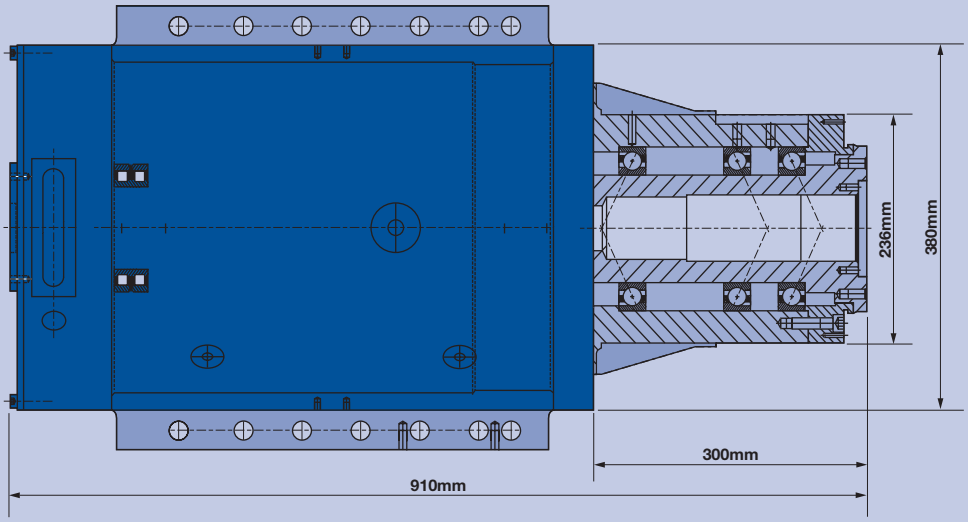
With complete capabilities to perform both the engineering and the manufacturing required for the spindles' rebuild, Gilman USA's Spindle Service Center was the logical choice for faster, more economical, on-shore rebuilding.

Cost savings

By having Gilman USA's Grafton, WI Spindle Service Center do the work instead of shipping the spindles overseas, the manufacturer realized savings of thousands of dollars per spindle.

Time line

By eliminating the time required to ship overseas, Gilman USA was able to reduce the turnaround time on rebuilt spindles by weeks.



Spindle rebuild process

- Disassembly and inspection of spindles
- Inspect shaft-bearing journal diameters for sizing and concentricity
- Inspect housing-bearing bores for sizing and concentricity
- Remanufacturing spindle parts as necessary and aline tolerances to original specifications
- Inspect motor parts and repair
- Each spindle receives a runoff test and carries a new spindle warranty upon leaving the Gilman USA Spindle Service Center

Technical specifications

Weight:	1,050 lbs.
Bearings:	110mm ball bearings - front 85mm cylindrical roller bearings - rear
Max. speed:	4,000 RPM
Operating speed:	3,000 RPM
Max. forces:	Axial load: 2,300N Radial load: 9,000N
Lubrication:	Grease
Running accuracy:	Axial and radial runout < 5 µm
Balancing quality:	G 2.5
Power (100% operation):	PS1 = 28 kW between n=900 and 4,000 RPM
Torque (100% operation):	Mnom S1 = 340 Nm at n=900 RPM

Gilman USA LLC
SOLUTIONS FOR LINEAR & ROTARY MOTION

Spindles

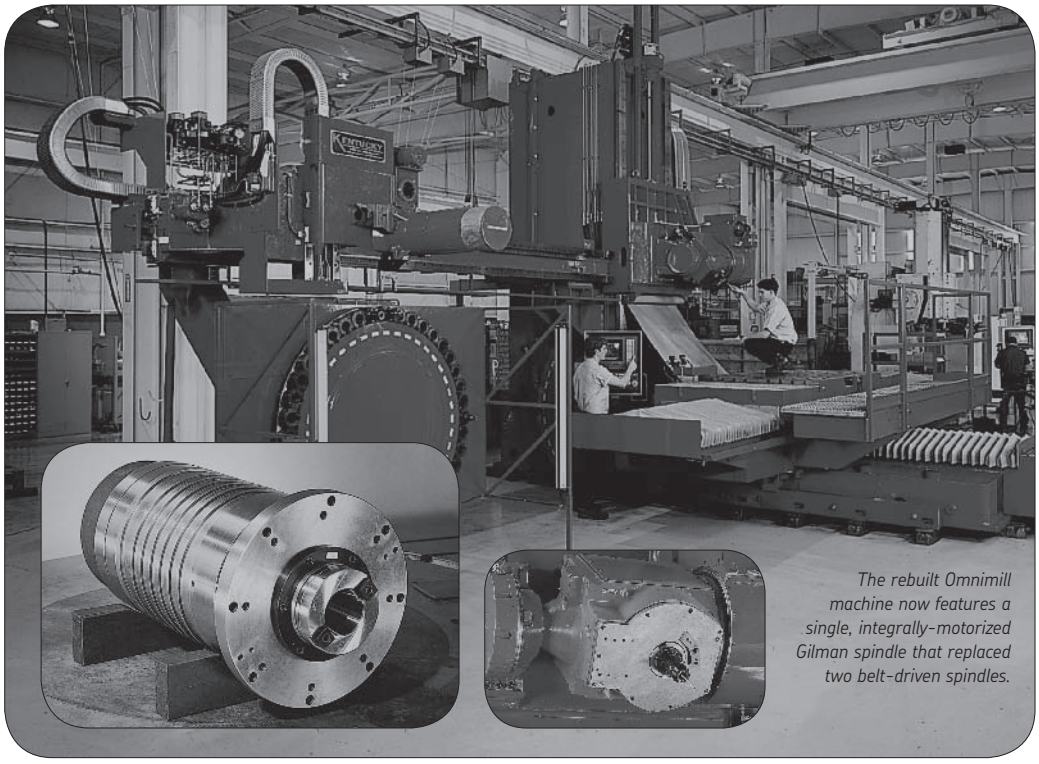
Idea bulletin

OM-3 and OM-4 Sundstrand Omnimills' spindle upgrade

Single, 25 hp, CAT 50 integrally-motorized spindle replaces two belt-driven spindles

Application

A major aircraft engine manufacturer wanted to upgrade the spindle on its OM-3 and OM-4 Sundstrand Omnimills (5-axis machining centers with a 150 degree tilting head). Material being machined was Inconel, Titanium and other aerospace alloys.



The rebuilt Omnimill machine now features a single, integrally-motorized Gilman spindle that replaced two belt-driven spindles.

Challenge

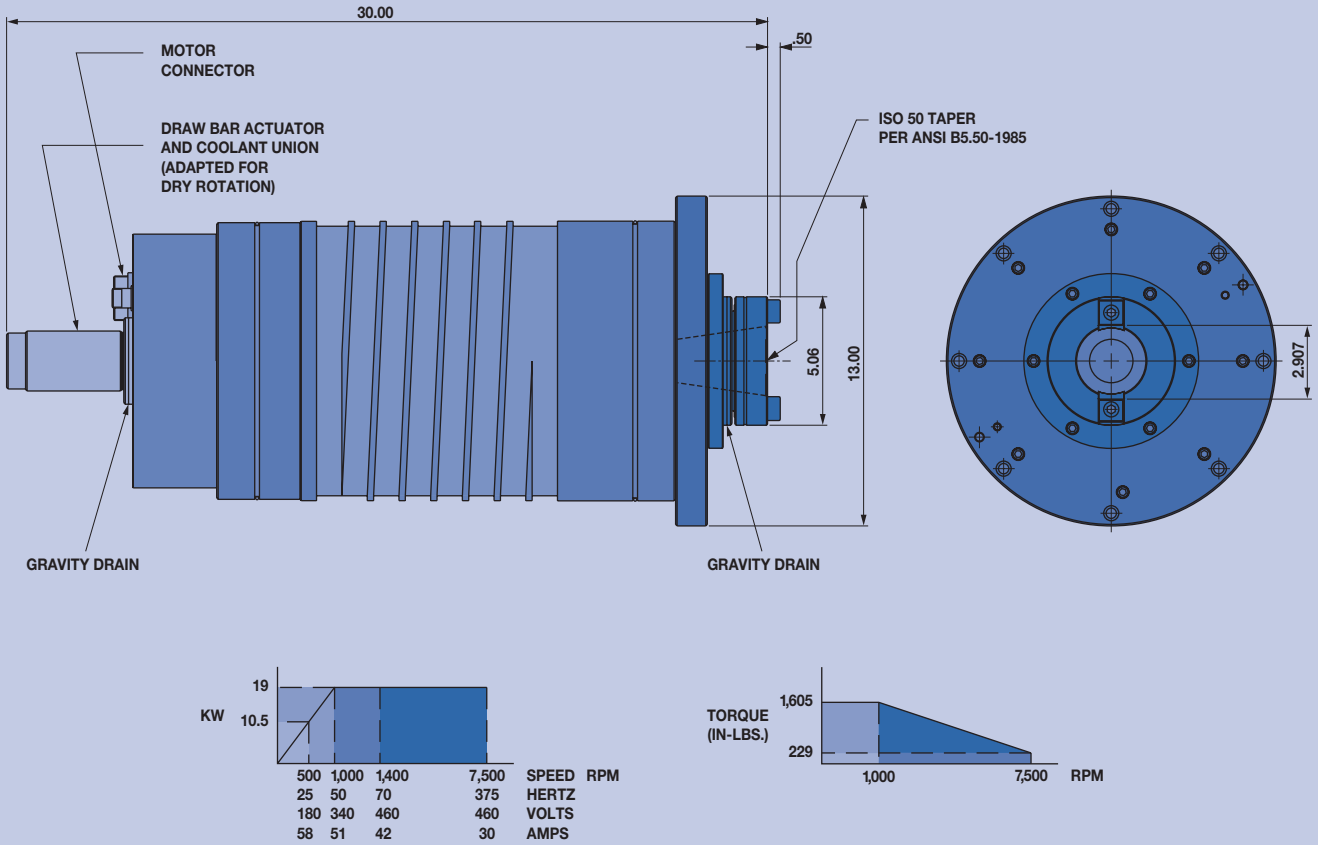
Converting the original two-spindle arrangement (a low-speed spindle to handle large tools and a high-speed spindle for small tools) presented a number of challenges.

A conventional rebuild would require a completely new slide casting together with a two-speed, timing, belt-coupled spindle cartridge requiring oil-bath bearing lubrication, a complicated design that would be both hard to adjust and maintain.

Solution

Instead of redesigning the head to accommodate a conventional belt-driven spindle, the machine builder suggested an integrally-motorized spindle for better functionality. Ultimately, the solution came in the form of a single, 25 hp (18.6 kW) spindle capable of 7,500 RPM, with CAT 50 taper and through-spindle coolant.

A stock spindle being unavailable, an Gilman USA engineering team visited the rebuilder to review the application. After research, the engineers recommended Indramat windings to fit within the severe space constraints of the head. A new head casting configura-tion, machined to allow coolant to circulate around the spindle body, allowed the spindle to drop into the housing and bolt through a flange, making spindle removal an under-30-minute job. To eliminate the problem of a hose band moving with the tilt head, the housing is also inner-drilled and plumbed to handle all hydraulic, coolant and electrical requirements.



All dimensions in inches unless otherwise indicated.

Technical specifications

Spindle:

- Preloaded Triplex set ABEC 7, 25° hybrid ceramic angular contact ball bearings nose end (90mm I.D.)
- Preloaded pair ABEC 7, 15° angular contact ball bearings back end (70mm I.D.)
- Kluber NBU15 grease lubrication
- Inpro VBX seals each end
- Indramat encoder feed back for closed loop operation with Indramat drive
- OTT Hydraulic draw bar with coolant thru and taper air blast cleaning
- 7,500 RPM maximum
- Maximum thrust into spindle 1,200 lbs.

Motor:

- The spindle is driven by an Indramat intelligent AC vector drive. Stop and orient mode takes less than 3 seconds at 7,500 RPM. The rebuilt machine has a wide range of speeds without gear changes.

Cost savings

Redesigning and rebuilding saved the user approximately one half the cost of a new machine. Six machines have been converted to date.

Time line

Total project time, from initial consultation to spindle delivery, was 18 weeks. Since the first spindle was delivered four years ago, not a single problem has been reported.

Gilman USA LLC
SOLUTIONS FOR LINEAR & ROTARY MOTION

Multi-axis

Idea bulletin

High speed dual spindle multi-axis boring machine

Rigidity of vertical travel improved for faster feed rates

Application

An American motorcycle manufacturer was gearing up for increased production of their large touring motorcycles. Operations required on this dual spindle multi-axis boring machine were center drill and spot face for the first spindle and 1-1/2" boring operations for the second spindle. The material being worked was Timken cast iron.

Challenge

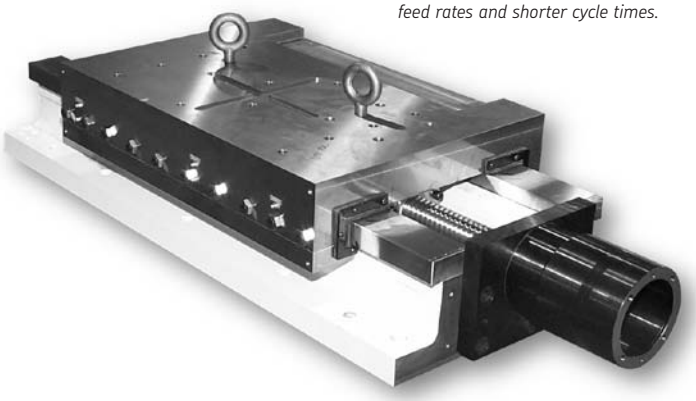
Because the existing 10-year-old dual spindle drilling and boring machine could not keep up with required production rates, the manufacturer decided to replace it.

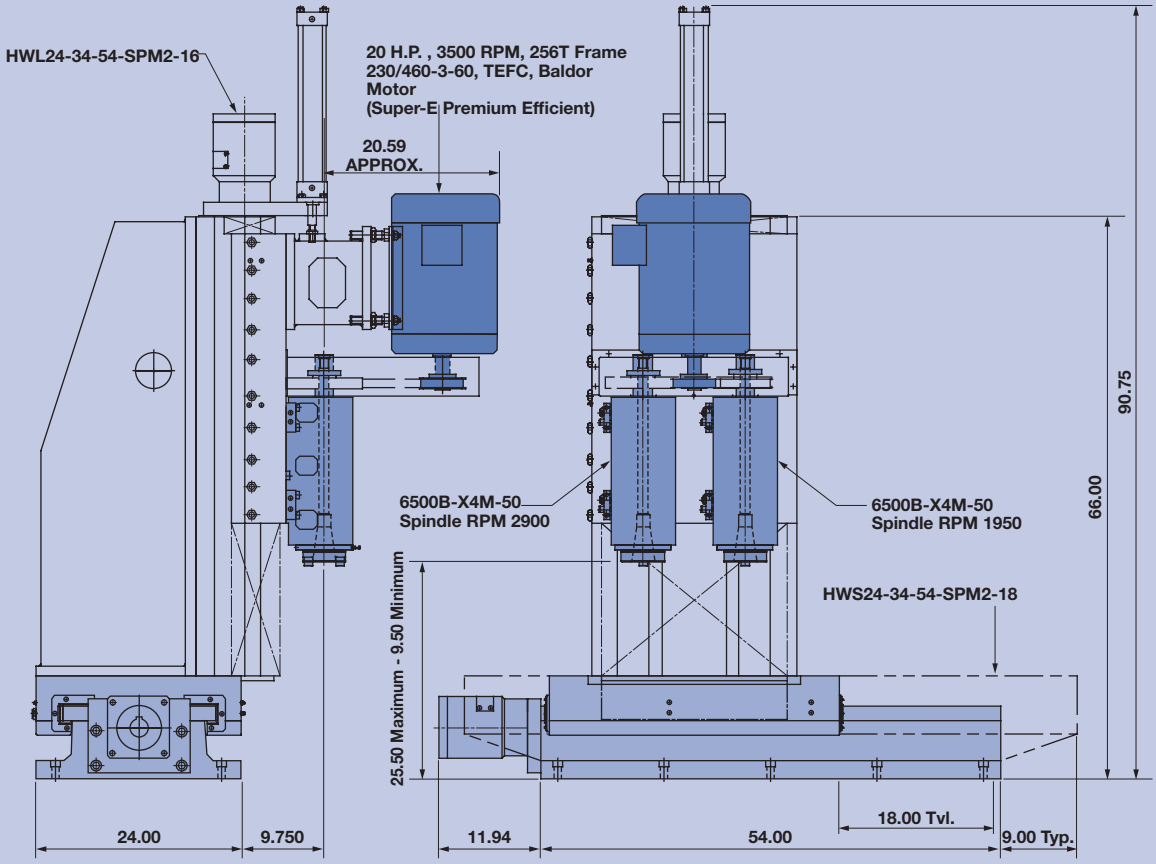
Among the highest priorities for the replacement machine was a design with more vertical rigidity to allow for faster feed rates and shorter cycle times.

Solution

Through a joint development process including the manufacturer, the machine tool builder and Gilman USA, a unit was designed that met all of the end-use requirements. The base chosen was a hardened steel way slide with preloaded ground ball screw driven by a single phase motor.
A vertical angle bracket supports another hardened steel way slide with a preloaded ground ball screw driven by a single-phase motor. Spindles chosen were all Gilman model 6500B with a block housing and triplex ball nose bearing arrangement and labyrinth seal. The shaft nose was 50 NMTB taper. The design retained the single motor drive. The customer-supplied reduction unit turns the first spindle at 2,900 RPM and the second spindle at 1,950 RPM.

Custom designed boring machine with more vertical rigidity to allow for faster feed rates and shorter cycle times.





Cost savings

Factoring in increased production, the machine investment is predicted to begin returning dividends in 18 months. The rugged design has a safety factor of 1.5 of current capacity and allows for future improvements in tooling and new materials.

Time line

This was a very short delivery schedule; total time from initial concepts to cutting was 14 weeks.

Technical specifications

6500B Spindle:

- Preloaded triplex set, ABEC 7, 15° angular contact ball bearings, medium preload 85mm I.D., nose end. Preloaded pair, ABEC 7, 15° angular contact ball bearings, medium preload 70mm I.D., drive end
- Synthetic grease lubrication
- Labyrinth seal each end
- Maximum thrust into spindle 1,695 LBS.
- Shaft supplied with coolant union pilot and threads
- Air purge fitting

HWS24-34-54-SPM2-18

Slide:

- L.H. GIB
- Telescoping steel way covers both ends
- 2.500-.500 R.H. thread ground ball screw - preloaded nut, 1,420 in. LBS. maximum input torque, 350 IPM maximum traverse rate
- Saddle width 24”
- Saddle length 34”
- Base length 54”
- Travel 18”

HWL24-34-54-SPM2-16

Slide:

- Accordion way covers drive end
- Steel plated accordion way covers opposite drive end
- 2.000-.500 R.H. thread ground ball screw - preloaded nut, 770 in. lbs. maximum input torque, 350 IPM maximum traverse rate
- Saddle width 24”
- Saddle length 34”
- Base length 54”
- Travel 16”

Gilman USA LLC
SOLUTIONS FOR LINEAR & ROTARY MOTION

Spindles

Idea bulletin

GLS120 integrally motorized spindles mounted on a hardened way slide

Motorized spindles finish wrist-pin bores to perfection

Application

A transfer line processing automotive engine pistons in groups of four required a compact finishing station for the wrist-pin bore. While the machining done at the station would be light, the location accuracy, inside diameter dimension and surface finish quality had to be "dead on" when the parts left the station.

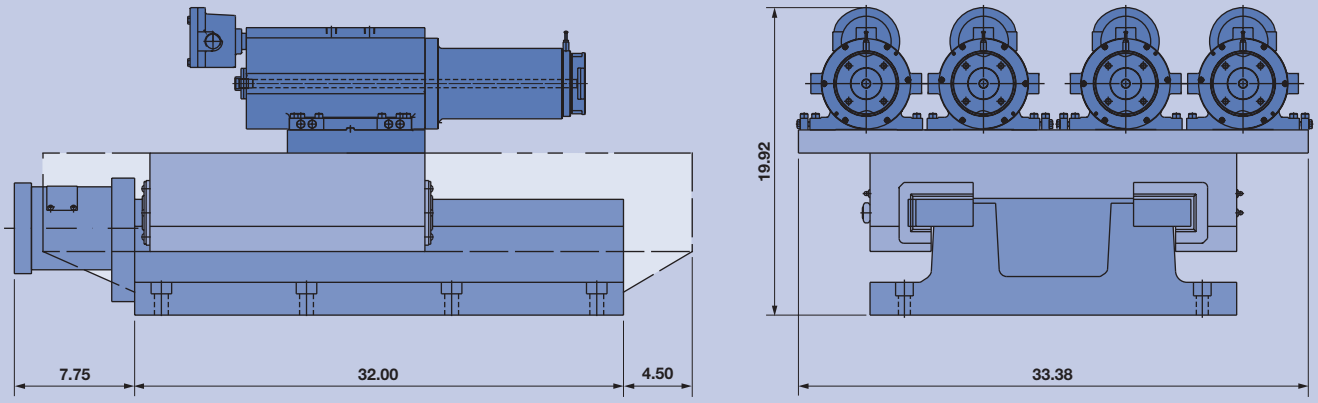
Challenge

The spindles at each of the four processing positions had to be highly accurate and vibration free to achieve the end user's surface finish needs. They also had to be mounted close together and maintain a center-to-center dimension of .001". Since the four spindles would have to move up to the work and then back away from it after the operation was complete, a precision slide would be required. Overall reliability of the station had to meet the "24-7-365" production needs of today's automotive manufacturing environment.

Solution

Four Gilman GLS120 motorized spindles mounted on a HWL24 "low profile" hardened way slide were chosen as the solution. The spindles featured flanged-foot housings secured to a precision mounting plate atop the ground ball screw-driven slide. The GLS120 spindles were extremely low in vibration. Their integral motor design minimized the number of moving parts and the spindle shaft and rotor were precision balanced before assembly. Precision Gilman USA ABEC 7/9 bearings, a triplex set in the spindle nose and a duplex in the rear, delivered

(continued)



All dimensions in inches unless otherwise indicated.

Solution (continued)

rotational accuracy with a maximum runout of .0001". Liquid cooling of the spindle housing provided a clean and stable environment for the bearings and motor. The integral motor design of the spindles also contributed to a very compact station.

Individual integral motors also helped achieve a control goal for the builder. The ability of the line to process fewer than the four parts per station was felt to be a key feature that would keep the line running in the event that any of the processing positions at any of the line's stations went down.

The rough cut boring station that preceded this finishing station also featured Gilman USA spindles and slide components.

Technical specifications

HWL24-18-32-D2-12
Slide:

- Base width 24"
- Saddle length 18"
- Travel 12"
- Plumbing for lubrication distribution
- 2.000-.500 R.H. thread ground ball screw - preloaded nut

GLS120 Spindle:

- Nose end, 55mm I.D., light preloaded, triplex set, ABEC 7, 15° angular contact ball bearings
- Drive end, 25mm I.D., medium preloaded, duplex set, ABEC 7, 15° angular contact ball bearings
- Synthetic grease lubrication
- Labyrinth seal on each end
- Operating speed 1,800-8,000 RPM
- Coolant thru-the-spindle shaft
- Tolerances measured at 74° F

Integral motor:

- Totally-Enclosed Liquid-Cooled (TELC) type motor
- Inverter-duty type motor

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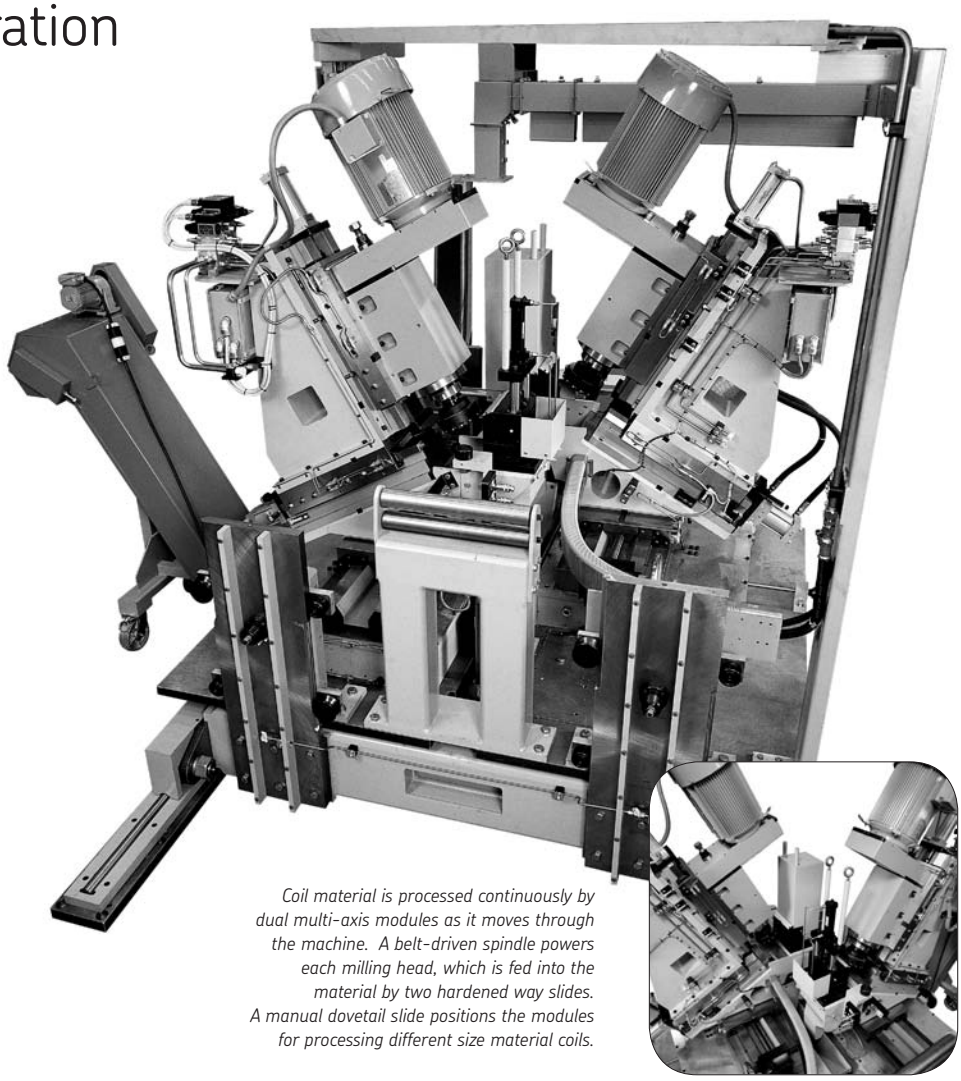
SOLUTIONS FOR LINEAR & ROTARY MOTION

Multi-axis

Idea bulletin

Programmable, adjustable, opposing milling modules

Upstream design and continuous operation save setup time



Coil material is processed continuously by dual multi-axis modules as it moves through the machine. A belt-driven spindle powers each milling head, which is fed into the material by two hardened way slides. A manual dovetail slide positions the modules for processing different size material coils.

Application

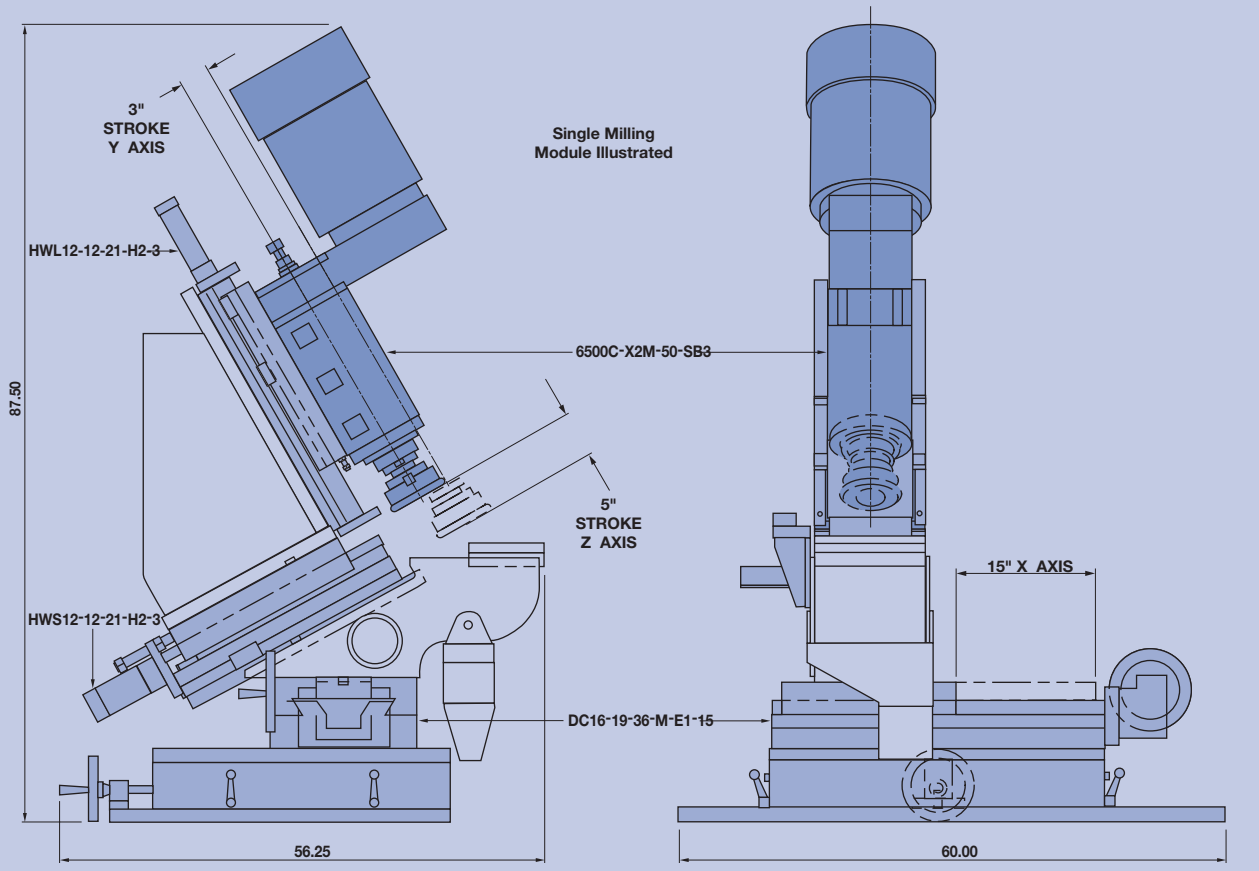
A processor of coiled metal wanted to reduce handling time and automate machining operations. The problem was that several different widths and thicknesses of material and hundreds of different milling patterns were combined to produce the company's thousands of products.

Challenge

Originally the milling operations were done after the material was cut to length. The machine envisioned would position a length of material while still connected to the coil and mill a specific pattern. The company wanted to eliminate the handling and fixturing required for machining after cutting to length.

Solution

After intensive analysis of the multiple operations required downstream of the cutting-to-length operation, it was determined that the milling operation would be better performed before the material was cut off from the coil. To meet all requirements, this custom machine tool was designed to be adjustable in five axes. The material strip is processed continuously as it moves through the machine. The multi-tooth milling head is first fed into the material in two axes. Second, the material is fed through the machine and into the milling head for the required distance. Belt driven spindles are used for the milling operation. The "Y" and "Z" axes hardened way slides feeding the spindle are controlled by hydraulic cylinders. The "X" axis is a dovetail slide used for manual adjustments of the two spindles relative to each other. The fourth and fifth axes are for adjusting milling angles and material widths. The machine has been a tremendous success. Hundreds of complicated and error prone operations have been eliminated. Productivity has increased, and the company has been able to expand its product offering with no additional machinery or personnel required.



Cost savings

Not only is the design and operation of the machine successful, but the Gilman components that made it possible are all stock or standard products. This use of existing designs kept the project cost low.

Sales point

By using stock and standard components to achieve the customer's design goals, cost and delivery time were both minimized.

Technical specifications

- 2 each HWS12-12-21-H2-3 slide assembly with hydraulic cylinder drive
- 2 each HWL12-22-30-H3-5 slide assembly with hydraulic cylinder drive
- 2 each DC16-19-36-M-E1-15 slide assembly with Acme screw with right angle hand wheel
- 2 each 6500C-X2M-50-SB3 belt-driven, motorized spindle
- The customer provided the angle brackets and assembled the machine on their shop floor.

Scanning the horizon for enhanced spindle performance

Previously published in *Modern Machine Shop* June 2002

There are a lot of things that a job shop can do to improve the performance of a machining tool spindle. From predicting spindle replacement to taking advantage of new high-speed tooling, spindle enhancements can increase uptime and improve performance. The following suggestions come from Chris Hetzer, Vice President of Engineering, Gilman USA (formerly Russell T. Gilman, Inc.).

Monitor that spindle

Installing a spindle monitoring and recording unit (SMRU) helps keep track of critical maintenance issues. Maintenance of spindles is hard to predict because they are designed to work in a certain temperature range for a certain period in time. For example, when operated at 15°C above normal, grease-life decreases by a factor of two. SMRUs record temperature, speed and running hours. In one brand of these units, the Gilman USA iSpindle SMRU, the information is stored in a histogram form which provides the maintenance engineer with information to assess how long the spindle has been running and to make a prediction of the remaining grease-life. The unit can be integrated into the spindle or bolted to it. A maximum of 255 uniquely addressable units can be connected to a wireless wide area network. PC software is available for configuration of the SMRU's identification, recording settings, user comments, real-time display of temperatures and speed information and database storage in MS Word or HTML.

Ceramics are cool

Consider replacing a spindle's bearings with hybrid ceramic bearings. On a grinder, 25 percent higher RPM can be achieved by replacing steel ball bearings using oil/air-mist running at 10,000 to 15,000 RPM with hybrid ceramic bearings and synthetic grease lubricant. Grinding spindles with hybrid ceramics spindles may run 4,000 hours without problems, compared to 3,000 hours with steel bearings. Gilman USA reports running hybrid bearings up to 5,000 hours at speeds exceeding 2.0 million ndm before part degradation occurs. (Ndm is the bearing pitch diameter in millimeters multiplied by RPM, a value that compares the relative performance of bearings of different sizes.) Some steel bearings quit after 700 hours. Hybrid ceramic bearings can lower temperatures nearly 50 percent and last as many as seven times longer than steel bearings. In a horizontal ram-type machining center, switching from steel to hybrid bearings has been shown to drop bearing temperature from 60°C to 36°C at 12,000 RPM.

Belt drives can be hip, too

Conventional belt-driven spindles, which use a pair of angular contact bearings at the belt-drive end, may have problems with spindle deflection and premature failures. At high speeds, the belt pull loads the bearings radially and also restricts the axial movement of the bearings to compensate for the thermal growth of the spindle system. In a typical hybrid ceramic roller bearing upgrade for a 40-taper vertical machining spindle operating at 15,000 rpm, the rear bearing set is a single row, hybrid ceramic roller bearing with a composite plastic cage, while the front bearings may be triplex angular contact hybrid ceramic ball bearings such as Gilman USA 71914ACD/P4ATBA. Lubrication is synthetic grease. The hybrid ceramic roller bearing offers twice the radial rigidity than the original angular contact set and allows for smooth shaft thermal elongation. The entire spindle system is more rigid, which allows for a higher first flexural critical speed. The operating performance of the cylindrical roller bearing with grease may be as high as 1,162,500 ndm at an operating temperature of 36°C.

Shielded is faster

Upgrading to shielded ball bearings can eliminate the need for air purge or spot oil lubrication while reducing contamination and allowing increased spindle speed. Standard shielded bearings have the same internal geometry, ball diameter, speed rating, load ratings, preload classes, matching criteria and contact angles as the bearings they replace. Double-shielded bearings are dependent solely upon the pre-packed lubricant of the bearing. An Gilman USA high- speed double-shielded design incorporates smaller diameter rolling elements, the rings have been designed with open conformities for high-speed performance. This design has higher speed capability but lower load ratings than the corresponding size of the CD/ACD bearing. These high speed shielded grease bearings will run faster than spot oil lubricated standard bearings.

Let the "Force" seal it

Gilman USA's air seals use an air distribution ring and a rotating metal cased elastic sealing member combining the advantages of contact seals and air purge. The elastic sealing member slightly lifts from the contact surface as the spindle rotation increases the centrifugal force. The metal case slings away any oncoming contaminants. The air-distribution ring allows for uniform airflow, which ensures that the seal will ride on a thin film of air while rotating. The air also pushes contaminants away from the spindle. In a static condition the elastic seal provides a positive contact by keeping contaminants from entering the spindle. The result is a highly effective seal.

HSK means high speed "Kapacity"

The German translation of HSK literally means "hollow taper shank," but upgrading the spindle to HSK tooling will improve rigidity and high-speed machining performance. HSK tooling allows deeper cuts and higher feed rates in milling and boring operations. HSK has metal-to-metal contact both radially and axially. The radial stiffness of HSK tool holders is up to five times greater than CAT, SK or BT. In the axial direction, the accuracy of a CAT (SK, BT) connection can vary as much as 0.004 inches compared to an HSK shank. HSK is not subject to bell-mouthing of the machine spindle, which occurs as a result of wear. It also has a higher natural frequency allowing higher speeds before chatter. HSK tooling transfers significantly greater torque and is more resistant to pullout forces. The tool-changing capability of HSK is faster than steep-taper shanks because of the short length of the HSK taper and the lighter weight of its hollow shank. The HSK connection prevents the shank from pulling back into the receiver during high-speed operation, changing the Z-axis position.

Gilman USA spindle network offers solutions for machine tool builders and users worldwide

Gilman USA serves a broad cross section of the world's leading companies with a constantly evolving product line and engineering capabilities.

You are invited to further explore the benefits of a partnership with Gilman USA as your preferred supplier of precision machine tool components by touring our facilities. Gilman USA's Spindle Service Centers provides complete remanufacturing services for conventional spindles and special applications.

Gilman USA is part of the world's largest bearing and linear motion component supplier. The U.S.-based Gilman USA Bearing Service Center provides unique bearing and preload configurations. In addition to Gilman USA's Spindle Service Center in Grafton, WI, Spindle Service Centers are located in Gothenburg, Sweden; Schweinfurt, Germany; Steyr, Austria; Chino, Japan; Luton, UK; Ozoir, France; Torino, Italy; São Paulo, Brazil; Moscow, Russia; and Chinchwad, India. Gilman USA also offers an Engineering Resource Center (Gilman USA ERC) for developing new bearings, lubrication technology and future applications. For more information and the name of the Gilman USA representative in your area, please call, write, fax or visit our web site.

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