



SERVICE MANUAL

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I. INTRODUCTION

This service manual was prepared to insure proper installation and performance of the RBS ball screw assembly throughout the life of the screw. It is only meant as a convenient reference and not a complete guide of the topics within.

The products shown in this catalog are intended for industrial use only and should not be used to lift, support or otherwise transport people, unless you obtain a written authorization for each individual application from Rockford Ball Screw Co. The specifications and data in this publication are believed to be accurate and reliable. However, it is the responsibility of the product user to determine the suitability of Rockford Ball Screw products for a specific application.

II. ASSEMBLY OF A STANDARD BALLNUT

- 1** Remove the return tube clamp and the return tube from the ballnut.
- 2** Place the nut mid-way on the screw and align the ball grooves in the nut with those on the screw.
- 3** Place a short length of rod or dowel into one return tube hole to prevent loss of balls.
- 4** Place balls successively into the other return tube hole, rotating the screw so that the balls are fed along the thread and through the nut until the ball circuit is completely full.
- 5** Remove rod or dowel, being careful not to rotate the nut. The balls must not be in the return tube holes. Balls should only be in the mesh between the ball nut and screw.
- 6** On both ends of the return tube, place a small amount of light grease.
- 7** Load this half tube full of balls.
- 8** Place the second half of the return tube over the balls and hold the two halves tightly together.
- 9** Place the return tube ends into the ball circuit holes in the nut (the grease in the tube holes will prevent the balls from dropping out).
- 10** Place the tube clamp over the tube (taking care to keep the two halves together) and secure with the clamp screws.

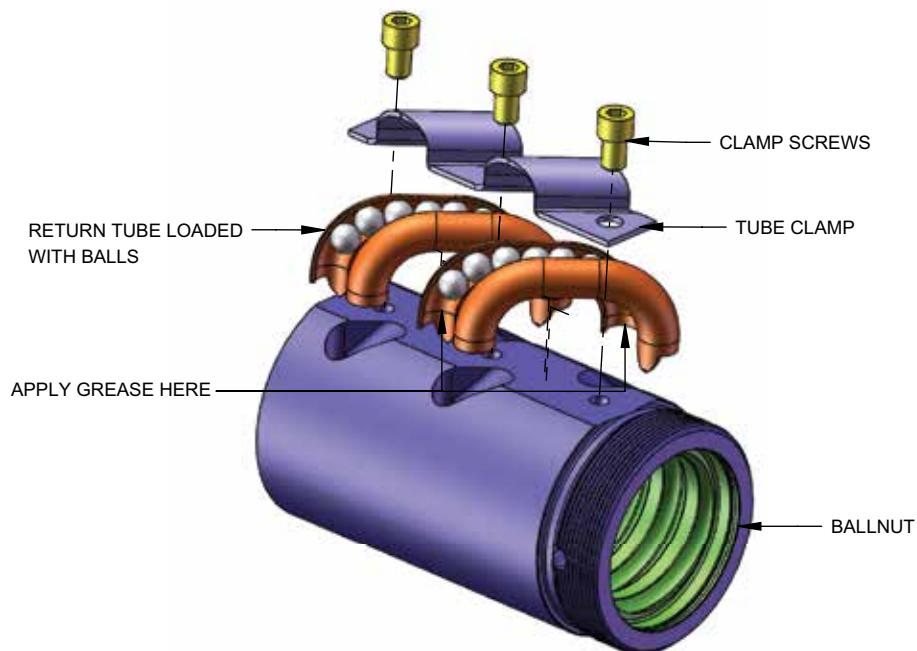


FIGURE 1
BALLNUT ASSEMBLY

III. MOUNTING OF A STANDARD BALLNUT

(Not a preload nut or Bridgeport nut)

- 1 Remove the tie from the ballnut/arbtor assembly.
- 2 Butt the assembly onto the end of the screw while continuously holding the arbor (cardboard tube) steady. Align the bottom of the return tube with the beginning of the first thread. Do not allow arbor to come out of contact with screw thread. Failure to do so could result in the loss of balls from within the assembly. (See figure 2).
- 3 If you find that the arbor does not fit up to the beginning of the thread due to interference from

the journal, (See figure 3). Then it is recommended that the journal be wrapped in masking tape or something similar so that the journal OD equals that of the arbor. This in effect would act as an extension to the arbor and would fill the same role.

- 4 Then gently rotate and apply pressure onto the nut to mount the nut. The arbor should only lose contact with the end of the screw when the ballnut is engaged on the screw.

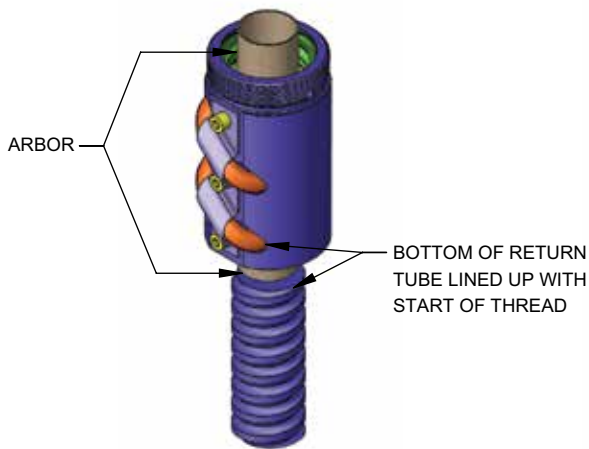


FIGURE 2
MOUNTING ALIGNMENT

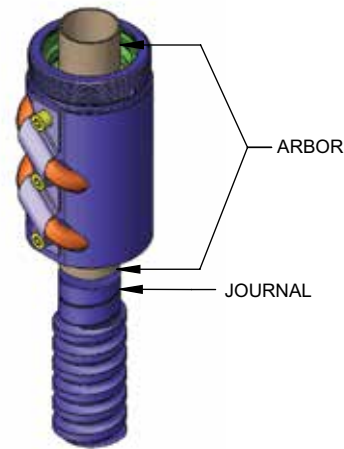


FIGURE 3
JOURNAL INTERFERENCE

IV. INSTRUCTION FOR PRELOAD INSTALLATION

- 1 Remove the tie that is through the arbor, being careful not to let the arbor sliding out from within the assembly.
- 2 Align the nut assembly to appear like drawing figure 4.
- 3 The tangs of the coupler are to be aligned so as to mate with the ballnuts. An external preload coupler needs to engage the roll pins to prevent rotation.
- 4 Transfer the assembly to the screw with some downward pressure till the threads are engaged then roll the nut on. Be sure to hold the arbor while transferring the screw. The arbor should not come out of contact with the screw until the nuts are fully engaged. The preload nut is now ready to be set.

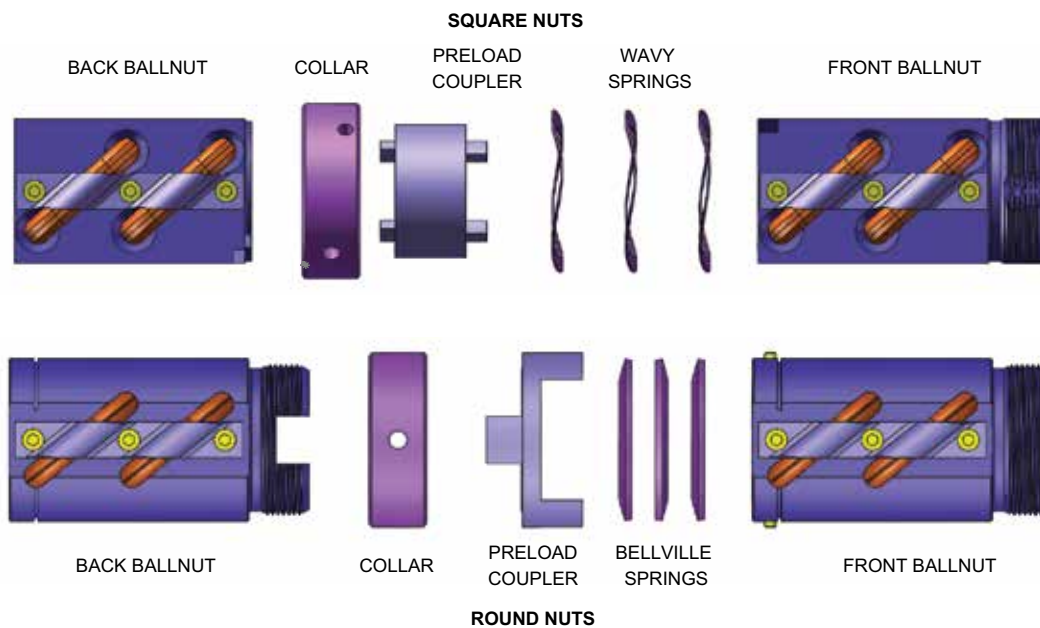


FIGURE 4
DISSASSEMBLED PRELOAD

V. SETTING THE PRELOAD BALLNUT

- 1 Remove the setscrews in the adjusting collar.
- 2 With a spanner wrench (see table 1), tighten the collar until the desired load is achieved (see table 2, page 7).
- 3 Put the set screws back in and tighten the set screws in order to not let the adjusting collar back off. It is preferred not to tighten the setscrews on the tang section of the coupler.

Note: Setting the preload increases the torque on screw by $.034 \times \text{preload setting} \times \text{lead of screw}$.

TABLE 1: SPANNER WRENCH SIZING

MODEL #	SPANNER WRENCH HOLE SIZE
RP-10 to RP-16	1/8"
RP-20 to RP-46	3/16"
RP-50 to RP-58	1/4"
RP-60 to RP-74	3/8"
RP-80	1/2"

V. SETTING THE PRELOAD BALLNUT - *CONTINUED*

TABLE 2: PRELOAD SETTINGS

MODEL NO.	RECOMMENDED		MAXIMUM	
	PRELOAD (LB)	# OF TURNS	PRELOAD (LB)	# OF TURNS
RP10	15	0.10	45	0.30
RP11	30	0.20	90	0.50
RP12	17	0.10	51	0.30
RP15	3	0.03	8	0.05
RP16	5	0.03	15	0.10
RP20	85	0.10	255	0.30
RP21	14	0.05	42	0.20
RP30/31	83	1.25	248	1.50
RP30A/31A	165	1.25	495	1.50
RP32	17	0.30	51	0.90
RP34/34A	190	0.30	570	1.00
RP35/35A	95	0.20	285	0.50
RP36	16	0.05	48	0.10
RP37	340	0.60	1020	1.25
RP38	60	0.10	180	0.30
RP40/41	163	0.10	488	0.30
RP40A/40AR/40RF/41LF	325	0.20	975	0.60
RP40B	450	0.30	1350	0.80
RP42	345	0.20	1035	0.60
RP43	425	0.40	1275	1.10
RP44	230	0.20	690	0.40
RP45/47	245	0.20	735	0.50
BRP45/47	145	0.10	435	0.30
RP46	49	0.05	147	0.10
RP48	330	0.20	990	0.60
RP50	905	0.60	2715	1.80
RP50A/51A	1290	1.20	3870	3.20
RP53/54	425	0.80	1275	2.00
RP53A/54A	640	1.30	1920	2.00
RP55/56	800	0.50	2400	1.70
RP57	1005	0.60	3015	2.00
RP58/58A	735	0.50	2205	1.60
RP60/63	1980	1.20	5940	2.00
RP60A	2970	1.80	8910	2.10
RP61	2250	0.40	6750	1.20
RP62	1800	0.30	5400	1.00
RP70	2200	1.20	6600	2.80
RP71	2650	1.50	7950	2.80
RP74	630	0.80	1890	2.00
RP75	3250	0.60	9750	1.90
RP80/80A/81A	4200	1.80	12600	3.20

Note: Due to spring load tolerances, these figures are $\pm 20\%$, use the number of turns as a guide only.

VI. LUBRICATION

Apply lubrication between the ball & raceway to avoid friction failure, deformation, and the shortening of life of the ball screw. It is only necessary to prevent the ball nut assembly from becoming dry. Lubrication should be applied on the surface of the shaft or through the fitting into the nut. A 90% reduction in ball bearing screw life should be allowed where dry operation is unavoidable.

At speeds greater than 200 in/min it is recommended oil be used. Grease can be used for speeds below 200

in/min. In the event that oil or grease is not an option, dry film lubrication is recommended. Surfaces should be phosphate coated before being coated with dry film lubrication.

For a list of acceptable lubricants see table 3.

TABLE 3: ACCEPTABLE LUBRICANTS

LUBRICANT	BRAND NAME	MANUFACTURER
Grease	Alvania No. 2	Shell
	Mobilux No. 2	Mobil
	Beacon 2	Esso
Oil	Tellus 33	Shell
	D.T.E. Heavy Medium	Mobil
	Teresso 52	Esso
Dry Film	Dow Corning 321 Perma-Silk	Dow Corning EM Corporation

Note: For general application use, the range of NLGI 2-3 of lithium base grease or the range of 46-100 CST at 40 °C of oil is recommended. Graphite based lubricants are not recommended due to their abrasive qualities.

VII. BELLOWS AND WIPERS

Conditions for Wipers, Wiper Installation

Wipers are recommended in any conditions where the ball nut and/or screws are exposed to debris.

Slide two wipers into the ballnut along the screw. Make sure the brush and wiper is held entirely within the nut. Push the snap ring into the snap ring groove just inside the nut. Repeat this process for the other side.

Installation of ballnut onto the screw would be made more difficult if wipers are already installed in the ballnut.

Dynatech Manufacturing

2300 S Calhoun Rd
New Berlin, WI 53151
phone: (262) 317-919
fax: (262) 786-3280

Heeco Protekto Boots

P.O. Box 9279
Tampa, FL 33674
phone: (813)886-7584
fax: (813) 885-2350

Hennig Inc

9900 N Alpine RD
Machesney Park, IL 61115
phone: (815) 636-9900
fax: (815) 636-9737

If you prefer the wiper could be temporarily removed to ease installation. However, it is not possible to remove wipers that have been installed in the nut with epoxy.

Bellows

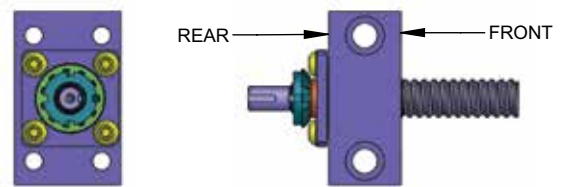
Bellows (or boot) should be considered when a wiper is unable to adequately prevent the entry of debris into the nut. Here is a list of manufactures to consider when ordering a bellows.

VIII. BEARING MOUNTS

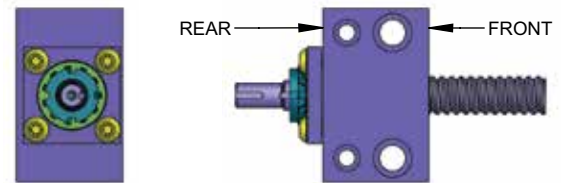
BM Series Bearing Mounts are **SIMPLE** supports that utilize a set of angular contact ball bearings mounted back to back. These bearing mounts are designed to support radial and axial load components of force. (see page 11)

BMF Series Bearing Mounts are **FIXED RIGID** supports that utilize a set of spaced angular contact ball bearings. These bearing mounts are designed to support radial and axial load components of force. (see page 12)

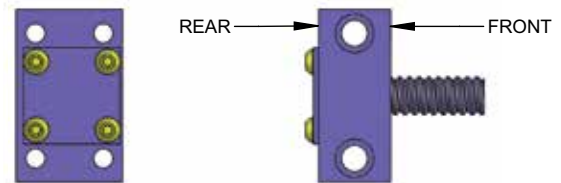
BMR Series Bearing Mounts are **SIMPLE RADIAL** supports utilizing shielded radial ball bearings for supporting radial load components. These bearing mounts are **NOT** intended to support axial load components of force. (see page 13)



BM BEARING BLOCK



BMF BEARING BLOCK



BMR BEARING BLOCK

**FIGURE 5
BEARING MOUNT**

Note:

- 1 A tubular arbor should be made from aluminum to prevent damage to the journal and bearings. The arbor's OD is to be the same diameter as rear ring seal and ID to have clearance on journal.
- 2 Do not over tighten the bearings, this will increase the drag torque and shorten the life of the bearings.
- 3 Rockford Ball Screw is not responsible for damage or personal injury due to incorrect assembly, sizing or mounting of R/B/S bearing block assemblies.

TABLE 4: LOCKNUT TORQUE TABLE FOR BEARING MOUNT MODEL #BM/BMF/BMR

Bearing Size	10	12	15	20	25	30	45
Torque (FT-LB)	10-20	10-20	10-20	12-35	23-50	32-60	32-60

VIII. BEARING MOUNTS - CONTINUED

BM Bearing Series Installation Instructions

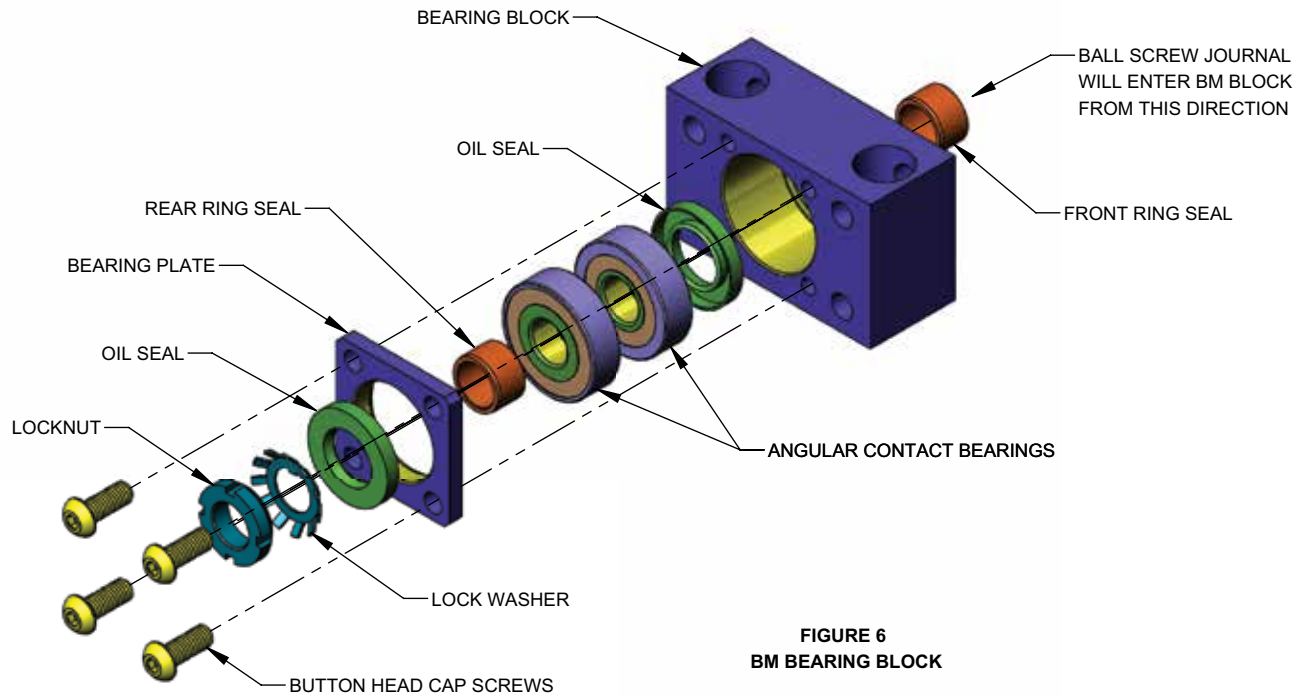
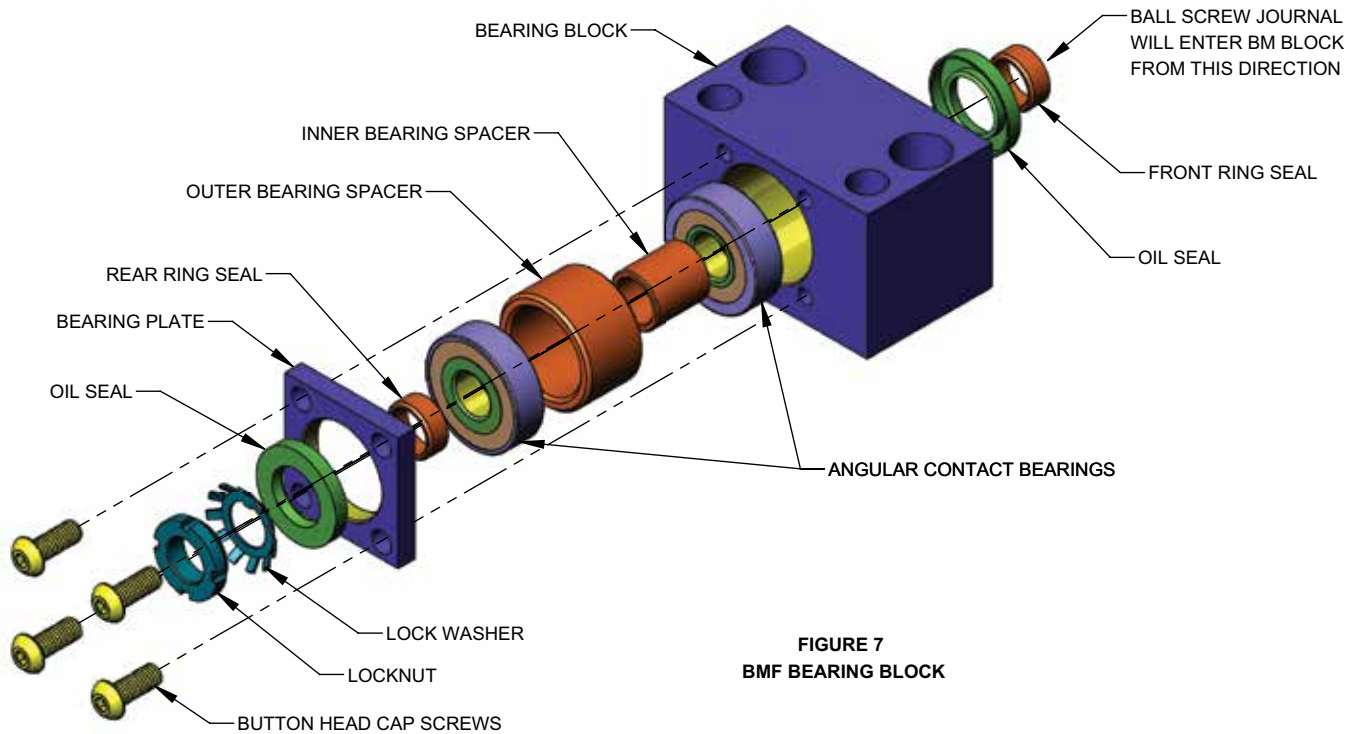


FIGURE 6
BM BEARING BLOCK

- 1** Install the entire block either horizontal or vertical onto the journal of the screw until the bearings and front ring seal are seated against the shoulder of the ball screw's journal.
- 2** Next, install rear ring seal, locknut and lock washer; torque the locknut to the proper setting (See table 4, page 10 for recommended torque).
- 3** Tighten the four button head cap screws until there is no axial or radial play in the bearing block, this will cause a slight increase in drag of the bearings.

VIII. BEARING MOUNTS - CONTINUED

BMF Bearing Series Installation Instructions



- 1** Install the entire block either horizontal or vertical onto the journal of the screw until the bearings and front ring seal are seated against the shoulder of the ball screw's journal.
- 2** Next, install rear ring seal, locknut and lock washer; torque the locknut to the proper setting (See table 4, page 10 for recommended torque).
- 3** Tighten the four button head cap screws until there is no axial or radial play in the bearing block, this will cause a slight increase in drag of the bearings.

VIII. BEARING MOUNTS - *CONTINUED*

BMR Bearing Series Installation Instructions

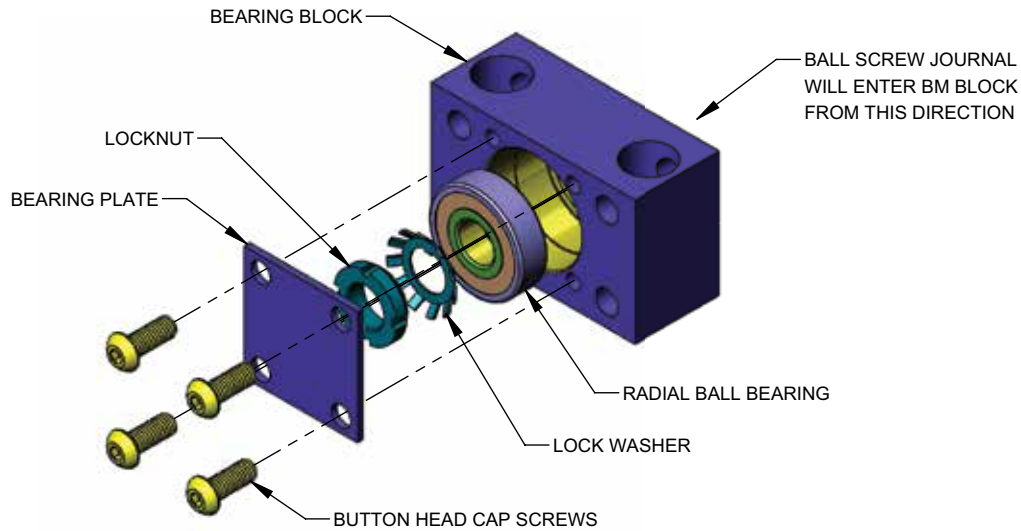


FIGURE 8
BMR BEARING BLOCK

- 1** Install the entire block either horizontal or vertical onto the journal of the screw until the bearing is seated against the shoulder of the ball screw's journal.
- 2** Next, install locknut and lock washer; torque the locknut to the proper setting (See table 4, page 10 for recommended torque).

IX. TROUBLESHOOTING

BALLSCREW WOBBLER/VIBRATES DURING OPERATION:

- 1** Inspect mounts; check to make sure ballnut and end supports are tight and properly aligned.
- 2** Check critical speed and column loading per R/B/S catalog. Do not exceed the safe critical speed or column loading as stated in the catalog.
- 3** Check straightness of screw.
- 4** Consult Factory.

BALLSCREW MAKING EXCESSIVE NOISE:

- 1** Make sure adequate and proper lubrication is present on screw.
- 2** Check for excessive debris on screw or in nut.
- 3** Check alignment and mounting areas for adequate rigidity. Be sure to inspect for moment (cocking) loading on the nut. This could cause ball binding and reduction in life.
- 4** Consult factory.

EXCESSIVE BACKLASH IN SYSTEM:

- 1** Inspect mounting areas for tight assembly.
- 2** Inspect support bearing backlash to determine if backlash is coming from bearings.
- 3** If preloaded ballnut assembly, tighten per pages 6 & 7 in this manual.
- 4** Consult factory.

BALLNUT DRIFTING (BACK-DRIVING) UNDER LOAD:

- 1** Install motor brake to hold load. Consult catalog to determine torque required.
- 2** Consult factory (a screw with a finer lead may be required).

BALLSCREW EXPERIENCING PREMATURE FAILURE:

- 1** Premature failure may be caused by many reasons such as, lack of lubrication, misalignment, metal chips or other debris, over loading of screw and excessive speed.
- 2** Consult R/B/S catalog or WEB Site.

X. RETROFIT FOR BRIDGEPORT SERIES 1 MILLS

ASSEMBLY INSTRUCTIONS: RETROFIT FOR BRIDGEPORT SERIES 1 MILLS

The Rockford Ball Screw retrofit kits are factory set with the proper preload. Should the ball nut and screw become disengaged, please contact Rockford Ball Screw Co. Upon receiving screw, make sure the packing slip lists the proper screws for your machine.

REMOVING EXISTING SCREWS

- 1 Run the table all the way (Y-Axis) out toward you.
- 2 Remove the jam nuts and all three bearing brackets. (One bracket for Y-Axis, one each end of X-Axis.) The brackets are not all the same so remember where each one belongs.
- 3 Remove the gib adjusting screw and pull out the gib.
- 4 The table should now be loose; slide the table onto a flat surface which has the same height as the table. CAUTION: The table is quite heavy.
- 5 Remove the support housing cap screws and 5/32" oil lines attached to support housing. (Be careful not to kink or bend oil lines excessively.)
- 6 Unscrew both X & Y acme screws from support housing and remove support housing.

INSTALLING RETROFIT KIT

- 1 Insert the X-Axis ball screw in the housing. Install (2) 5/16"-24 cap screws provided. Tighten, finger tight only. The return tubes on ball nut should face up and fit within slot opening at top of housing.
- 2 Place housing (and X-Axis screw) in opening in saddle. The ball nut flange should face to the left. The bolt holes for the Y-Axis face back of machine.
- 3 Insert the (4) 3/8" bolts you removed from the old support housing into the holes in the supplied housing. Tighten bolts finger tight only.
- 4 By hand, rotate the Y-Axis nut towards the unmachined end of the screw. Stop about 1-1 1/2" from the end of the screw. DO NOT rotate the end of the screw into the ball nut.
- 5 Angle the Y-Axis screw into the saddle opening. (Fig. #1)

- 6 Push the ball nut beyond the slot in the bottom of the supplied housing. Then slide the screw into the slot and pull the ball screw assembly back towards yourself to seat ball nut in housing.
- 7 Slide chip plates forward until a 4" x 4" hole appears behind the supplied housing.
- 8 Fasten the Y-Axis flange to the housing, using (3) 5/16"-24 screws furnished. This is done through the chip plate hole behind the saddle. An extension on a 1/4" socket hex head or a long length of 1/4" hex stock will make the screw tightening easier. Make sure the three screws are tight at this time.
- 9 Clean the ways and oil grooves on the machine. Test the Bijur System (if applicable) to see if oil is flowing through the oil holes and through the 5/32" tubing that lubricates the screw. If you have proper lubrication, proceed.
- 10 Install the 5/32" lubrication tubing into the 5/32" diameter holes located in the flanges on each ball nut assembly. Just press the tubing into hole as far as it will go.

ALIGNMENT & REASSEMBLY

- 1 Replace the bearing bracket (see "Replacement of Bearings" below) onto the Y-Axis screw. Place one of the woodruff keys (remove from original screws) into the Y-Axis screw. Install the handle assembly. Replace and tighten the bearing bracket bolts.
- 2 Rotate the Y-Axis handle counterclockwise to move the table towards you. Snug (slightly) the four bolts that attach the housing to the saddle. Rotate the screw to move the table away from you. Let the housing find its "center" and tighten the screws a bit more. Repeat this procedure until the torque to turn the Y-Axis screw seems to be the same throughout the travel of the screw. Tighten the screws to secure the housing to the saddle. You may want to drill some pin holes to secure the housing to the saddle (optional).
- 3 Make sure the X-Axis screw ends are equidistant from center of housing.
- 4 Install the other woodruff keys into the ends of the screw.

X. RETROFIT FOR BRIDGEPORT SERIES 1 MILLS - *CONTINUED*

- 5 Slide table back onto ways and assemble the table gib.
- 6 Reassemble the right-hand table bearing bracket finger tight.
- 7 Reassemble the left-hand table bearing bracket (see "Replacement of Bearings" below) finger tight.
- 8 Assemble the dials and handles on both ends. Run the table through its complete travel in both directions to center the ball nut within the support housing. With the table as far to the left (thrust bearing end) as possible. (Allowing room between the ball nut and thrust bearings to tighten the cap screw.) You will need approximately 7" of extension with a 1/4" hex end to reach the 5/16"-24 screws that secure the X-Axis nut to support housing.
- 9 Tighten the X-Axis screws that secure the flange on the ball nut to the support housing.
- 10 Tighten the thrust bearing bracket.
- 11 Run table to far right end. Tighten right hand end bracket.
- 12 Check both X-Axis and Y-Axis for full travel and check torque for alignment. Realign if necessary.

ASSEMBLY INSTRUCTIONS: RETROFIT FOR BRIDGEPORT SERIES 1 MILLS

PROBLEM	CAUSES	SOLUTION
X-Axis screw won't accept bearing brackets.	#1 - Wrong screw length. #2 - Misalignment.	#1 - Check packing slip and overall length of screw. #2 - Realign.
Backlash and/or "spring" in handle.	#1 - Original bearings are overly worn. #2 - Preload setting not tight enough.	#1 - Replace bearings with angular contact bearings. See attached sheet. #2 - Consult factory.
Supplied housing bolt holes won't line up with saddle.	Slight differences in saddle assembly.	Elongate holes in housing.
Screw(s) hard to turn towards end of travel.	Screw(s) misaligned.	Elongate holes in housing.
Rough feel to screw.	#1 - Lack of lubrication. #2 - Excessive chips or dirt on screw.	#1 - Check lubrication.* #2 - Clean off screws.

*Lubrication with light weight oil (SAE 5 or 10) is required periodically. If central lube system (Bijur or equivalent) is available on machine, install a 5/32 diameter line from oil system to ball nut flange. Lubricate with way oil periodically.

X. RETROFIT FOR BRIDGEPORT SERIES 1 MILLS - *CONTINUED*

CROSS VIEW OF FINAL ASSEMBLY

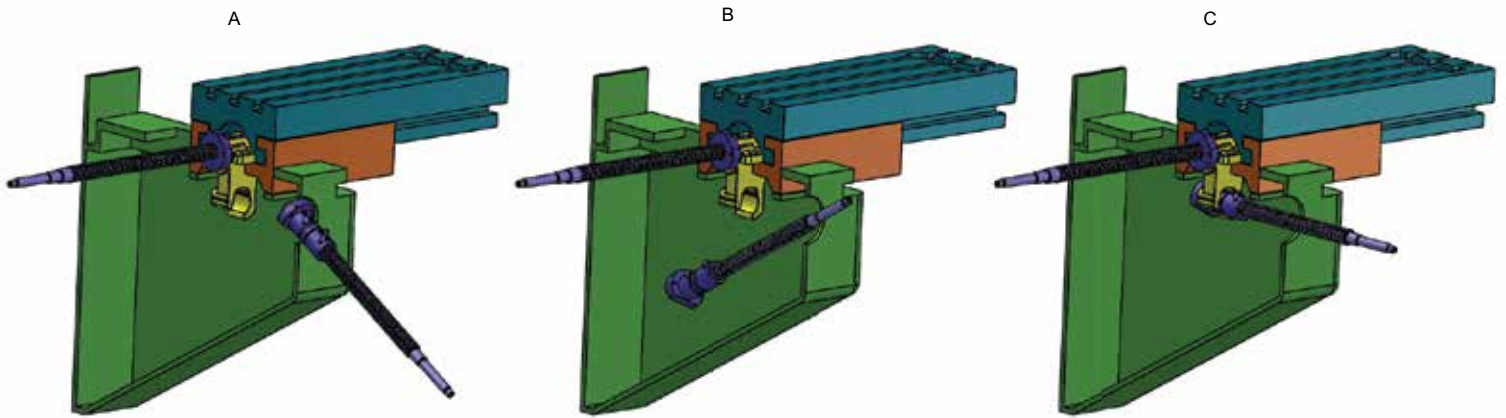


FIGURE 9
CROSS VIEW OF FINAL ASSEMBLY

REPLACEMENT OF BEARINGS

The Y-Axis and left-hand end of X-Axis have factory thrust bearings. These bearings are adequate for use with acme screws. But if you require zero backlash and repeatability that our preloaded ball screws allow, changing the bearings may be required.

There are different grades of angular contact bearings. The 7204 series of angular contact bearings are the size required. Be sure to purchase sets that have ground faces. The minimum type bearings are as follows (or equivalent):

- Fafnir 7204 WNSU
- FAG 7204B. TVP. UA
- SKF 7204 BYG

There are more precise bearings (much more expensive), but for most applications on Series I mills, they are not necessary.

All of the angular contact bearing sets are going to require a set of spacers. The inner race spacer should be .115 - .120 thick, an I.D. of .790/.800 and an O.D. of 1.195/1.205. The outer race spacer should be the same thickness (.115-.120), I.D. of 1.255/1.265 and O.D. of 1.848/1.838 diameter. The inner race spacer should be placed on the screw before the bearings. The outer race spacer should be placed in the bearing bore before installing the bearings. When tightening the bearing retaining ring, be sure not to tighten too tight. The bearing retaining ring is made of aluminum and the screw heads can break through.

The bearings should be packed with grease prior to assembling and periodically re-greased.

If you have any further problems with bearing installation, contact your bearing supplier.



940 Southrock Dr. Rockford, IL 61102

800-475-9532

P 815-961-7700

F 815-961-7703

sales@rockfordballscrew.com

rockfordballscrew.com