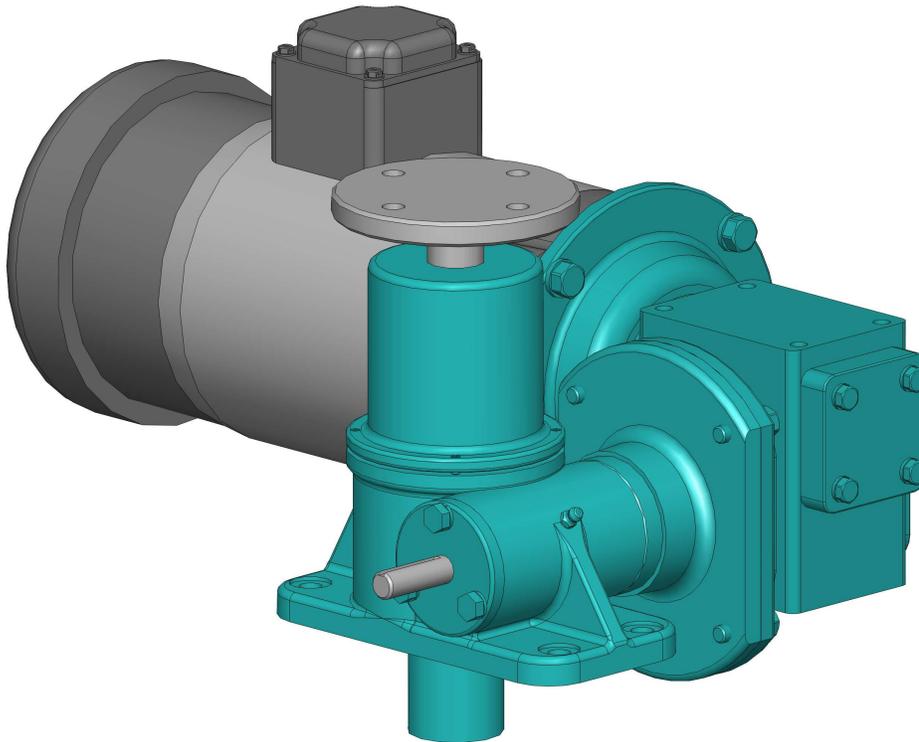




Joyce/Dayton Corp.

**Operation and Maintenance Manual for Joyce/Dayton
Ball Screw ComDRIVE® Actuators**



The recommendations in this manual for installation, operation and maintenance must be followed to ensure safe use. All persons responsible for the installation and use of Joyce ball screw ComDRIVE® actuators must be familiar with the contents of this manual.

The customer is responsible for travel stops, guards and other protective devices and ensuring that ComDRIVE® usage conforms with local and national operating and safety codes appropriate to the class of equipment into which the Ball Screw ComDRIVE® is installed. Series CDB, CDBL, CDHB, and CDHBL ComDRIVEs® are not self-locking. A brake motor or other external locking device must be provided.

Adjustable extending stop collars are included on standard ComDRIVE® actuators. The customer is responsible for providing travel limits.

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Section I General Information

1-1 Contact Joyce Dayton Corp.

Joyce Dayton Corp.
P.O. Box 1630
Dayton, OH 45401
(800) 523-5204 (US and Canada)
(937) 294-6261 (937) 297-7173 Fax
Email: sales@joycedayton.com
Website: www.joycedayton.com

1-2 Purpose and Scope

This manual provides installation, operation and maintenance instruction for standard Joyce/Dayton ball screw ComDRIVE® actuators. Although this manual covers the standard ball screw ComDRIVE® and most variations of the ball screw ComDRIVE®, there may be some that vary significantly from this manual. For special units not covered please contact Joyce/Dayton Corp. for assistance.

1-3 Receipt of Product

All equipment should be immediately inspected upon receipt for any damage and to verify correct product and quantities. Any problems should be reported to Joyce/Dayton Corp. and the freight carrier as soon as possible. Products returned without a *Return Goods Authorization (RGA)* form will not be accepted.

1-4 Warranty

Seller warrants its products to be free from defects in material and workmanship under normal and proper use in accordance with instruction of seller for a period of one year from the date of shipment to buyer. Seller's liability under such warranty or in connection with any other claim relating to the products shall be limited to the repair, or at seller's

option, the replacement or refund of the purchase price, of any products or parts or components thereof which are returned to seller freight prepaid and which are defective in material or workmanship. Products or parts or components thereof, which are repaired or replaced by seller, will be returned to buyer freight collect. This warranty is not intended to cover consumer products, as defined in the Magnuson-Moss Warranty-Federal Trade Commission Improvement Act, 15 U. S. C. Sections 2301-12, which are purchased by buyer for purposes other than resale. If buyer is not intending to resell the products, and if the products are consumer products as defined in the Magnuson-Moss Act, the foregoing warranty, but not the limitation of seller's liability, shall be null and void. EXCEPT AS EXPRESSLY STATED ABOVE, SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, WHETHER OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE OR OTHERWISE, ON THE PRODUCTS, OR ON ANY PARTS OR LABOR FURNISHED DURING THE SALE, DELIVERY OR SERVICING OF THE PRODUCTS.

1-5 Precautions of Use and Installation

- 1. Side loading of the lifting screw is not permitted in the dynamic operation of the jack. A limited side load is allowable in the static condition. Contact Joyce/Dayton for the allowable side load for a specific application.**
- 2. Extending mechanical stops are provided on the actuator lifting screw. It is the customer's responsibility to provide travel limit devices on all ball screw ComDRIVEs®. The mechanical stop is only an auxiliary device to limit the travel of the lifting screw. Engaging a mechanical stop during operation can cause damage to the internal jack mechanism.**
- 3. In most applications, factory or manufacturer-assisted installation is not required. However, it is necessary that appropriate, qualified personnel perform the installation of Joyce/Dayton products.**
- 4. Joyce/Dayton ball screw ComDRIVE® actuators are not rated for shock-loading, extreme vibration or critical speed conditions (high speed or long-length screw.) It is the responsibility of the user to ensure these conditions are not imposed on the actuator or the power transmission equipment. Contact Joyce/Dayton for technical assistance.**
- 5. In the event that service or maintenance is required, the load must be secured or removed before any work can begin.**
- 6. Ball screw ComDRIVE® actuators can be mounted and operated in any orientation. When used with the lifting screw in a horizontal position, the worm should be mounted parallel with the horizon and below the gear to ensure proper lubrication. Standard ball screw ComDRIVE® actuators are shipped with all holes plugged. The user must insert the vent in the highest location at final installation.**
- 7. Never allow the actuator to retract beyond the minimum closed position, as damage to the jack can occur.**
- 8. Boots or protective bellows covers should be used to protect and keep the lifting screw clean in dusty or abrasive environments.**
- 9. For continuous or high-duty cycles inquire with your local sales representative or consult Joyce/Dayton Corp. regarding Bevel Ball actuators.**

1-6 General Installation instructions

- 1. Ensure that all personnel who will service or operate equipment are familiar with its use and limitations.**
- 2. Secure or remove the load before any installation procedures begin.**
- 3. Be certain the rating of the ball screw ComDRIVE® meets or exceeds the load.**
- 4. Ball screw ComDRIVEs® must be mounted on a structure sufficient to support the maximum possible load. The structure must be rigid. An under-designed structure could lead to bending of the lifting screw causing premature wear or failure.**
- 5. In a system with shafts, miter boxes, etc., confirm that the shafts and actuators operate without binding or excessive force before powered drive devices are engaged.**

Drive shaft alignment is critical. Mis-alignment will cause reversing stresses in rotating members and will lead to fatigue failure. Correct coupling specification is important.

6. When fastening the load to a ball screw actuator, make sure the actuator is in the retracted position. This positions the load accurately with respect to the lifting screw centerline. Never pull the screw to one side to make connection with your structure. Fully extend the actuator to make sure the load is aligned with the lifting screw.
7. All ball screw ComDRIVE® actuators are designed to be mounted with S.A.E. Grade 8 bolts or equivalent.
8. Torque all mounting bolts in a symmetric pattern to avoid damage to the sleeve.
9. Shaft and coupling guards are the responsibility of the user.
10. Optional limit switches furnished with the actuator are NOT preset and require field adjustment before use.

Section II Maintenance

2-1 Lubrication

Jacks

1. Ball screw ComDRIVE® actuators are lubricated before leaving the factory.
2. For normal operation, jacks should be greased at least once per month. Under extended use, grease twice monthly or as conditions dictate. Grease thru the fittings on the jack with hand or power operated equipment. Grease with No. 1 Consistency Grease. Do not allow jacks to operate without lubrication. It is the responsibility of the user to maintain sufficient lubrication of the jack and to the lifting screw.
3. The products listed below are recommended by the lubricant manufacturers to meet the requirements for normal operation. The listing of brand names is solely for the convenience of users of Joyce equipment and their lubricant suppliers; it does not constitute any endorsement. Joyce/Dayton assumes no responsibilities for the quality, performance or availability of any listed products

<u>COMPANY</u>	<u>BRAND NAME</u>
Mobil Grease.....	XHP 461
Mobil Grease.....	XHP 221
Mobilith.....	SHC221
Mobilith.....	SHC 460

4. For operation above 250°F or extreme loading, consult the Engineering Department of Joyce/Dayton Corp.
5. Ball screw and ball nut (on KFTN models) should be lubricated with a spindle or 10-weight oil applied to the ball screw.
6. Do not operate jack without lubrication.
7. Total grease capacity by jack type:

Jack Capacity	Number of Shots	Approximate Weight	Jack Capacity	Number of Shots	Approximate Weight
2 ton	13	4.5 oz	20 ton	95	33 oz.
5 ton	26	9 oz.	30 ton	135	47 oz.
10 ton	50	17 oz			

Reducers

1. Standard ball screw ComDRIVE reducers are lubricated before leaving the factory. The standard lubrication used in the reducers is AGMA 7 Compounded oil (ISO Grade 460).
2. The products listed below are recommended by the lubricant manufacturers to meet the requirements for normal operation. The listing of brand names is solely for the convenience of users of Joyce equipment and their lubricant suppliers; it does not constitute any endorsement. Joyce/Dayton assumes no responsibilities for the quality, performance or availability of any listed products.

<u>COMPANY</u>	<u>BRAND NAME</u>
Mobil Oil.	Mobil 600W Cylinder Oil
Mobil Oil.....	Mobil 85W100

3. Synthetic lubricants are also recommended, especially under severe service. These lubricants are more viscosity/temperature stable and provide service over a broad range of temperatures. These lubricants have a longer service life, require fewer oil changes and increase the life of the gearbox by reducing friction and wear. This lubricant is also compatible with nitrile seal material and alloy bronze gear material.

<u>COMPANY</u>	<u>BRAND NAME</u>
Mobil Oil.	Mobil SHC 634

4. The oil in the reducer must be maintained at the proper level. The reducer must be at rest when the oil level is checked.
5. In a new unit, the oil should be changed (or filtered) after four weeks (or 100 hours) of use. The case should be flushed with light oil to remove any foreign substances.
6. After the initial oil change, the oil should be changed once every 6 months or 2500 hours, whichever occurs first.
7. More frequent oil changes may be necessary when there are severe duty or dirty conditions present.
8. Special order speed reducers supplied with ComDRIVE® actuators may or may not be factory lubricated. In this case, a separate O&M can be provided for the special reducer.

2-2 Repair Parts

Repair parts may be obtained by emailing, sales@joycedayton.com, calling Joyce/Dayton Customer Service at (800) 523-5204, (937) 294-6261, (937) 297-7371 (facsimile) or contacting your local sales representative. When ordering repair parts, please supply the ball screw ComDRIVE serial number, located on the jack nameplate.

The following parts are recommended for repair or rebuild. Exploded View Section 3.1 and Parts List Section 3.2.

- A. (2) Worm shaft bearing and race - Item 11
- B. (1) Shim kit - Assortment of item 12
- C. (2) Worm shaft seal - Item 15
- D. (1) Thrust bearing - Item 2
- E. (1) Ball Nut / Wormgear assembly - Item 3
- F. (1) Boot (if signs of wear are evident) - Item 34
- G. (1) Worm - Item 10
- H. (1) Ball screw - Item 7
- I. (1) Motor - 25
- J. (1) Gear Reducer - Item 20

2-3 Disassembly of Ball Screw ComDRIVE® Jacks

First remove the motor and reducer from the Ball Screw ComDRIVE®

Remove the four bolts and washers (item 22 and 23) from the adapter/reducer flange (item 17). The reducer and motor can now be removed from the jack. The motor included with the ball screw ComDRIVE® is not user serviceable, however, it can be replaced. Loosen bolts (item 26) to separate the motor from the gear reducer.

Disassembling the ball screw jack portion of the ComDRIVE®

Use the appropriate disassembly procedure. If the ball nut (with the re-circulating ball bearings) is on the screw outside the sleeve, the jack is a Keyed for Traveling Nut (KFTN) model. This is also called a “rotating screw” jack. If the ball nut is inside the jack sleeve, the jack is a translating or keyed model. Handle machined parts with care, and maintain an “order of disassembly” to aid in re-assembly. Remove all couplings, screw support bearings, etc. before beginning disassembly.

Disassembly Procedure for KFTN (rotating screw) Models: Sections 3-1 & 3-2

1. Tape or otherwise secure the ball nut (item 35) to the ball screw (item 7). Removal of the ball nut from the screw would allow all of the ball bearings to be released. If the jack is equipped with boots, remove the boot clamps, collapse boots, and remove them as needed.
2. On upright jacks loosen the four set screws (item 5) in the sleeve cap assembly, which includes the sleeve cap (item 4), bushing, and seal. Loosen the sleeve cap assembly by rotating counter-clockwise (CCW.)
3. On inverted KFTN models remove the sleeve cap (item 4) by loosening the four set screws (item 5) and rotating CCW. The inverted model has a solid sleeve cap without a bushing or seal.
4. On upright KFTN models, the ball screw assembly (with the sleeve cap assembly) can now be removed from the jack sleeve. The ball screw assembly consists of the ball screw (item 7), the ball nut (item 35), thrust bearings (item 2), key (item 36) and the wormgear (item 3). Unthread the wormgear from the ball screw and it will slide off the end of screw with the upper thrust bearing, then the sleeve cap assembly can be removed from the ball screw.
5. On inverted KFTN models, the ball screw assembly is removed from the bottom of the sleeve. First, remove the upper thrust bearing (item 2) and the inverted bushing (not shown). Push the ball screw (item 7) and the key (item 36), out the bottom of the sleeve. Remove the wormgear (item 3) and the lower thrust bearing (item 2) from the sleeve.
6. It is not recommended to remove the ball nut (item 35) from the ball screw (item 7) unless it is being replaced. For instructions on removing the ball nut, see Section 2- 6, Ball Nut Disassembly and Rebuild.
7. Remove three screws (item 16) from the bearing cap (item 13) on one side and three screws (item 19) from the adapter cap (item 14) on the other side. Remove the caps and seals (item 15) carefully to avoid damaging seals. Make sure worm shaft keys (item 21) have been removed first.
8. Carefully remove the shims (item 12) from the jack sleeve, bearing cap, or adapter cap. NOTE: there will not necessarily be an equal quantity of shims per side. Keep track of the number of shims on each side of the jack.
9. Remove the worm bearings (item 11). The cup may be press-fit. Use a dead-blow, plastic or other non-marring mallet to remove the worm (item 10).

Disassembly Procedure for Translating and Keyed Models: Section 3-1 & 3-2

1. If the ball screw ComDRIVE is quipped with a boot, remove the boot clamps, collapse and remove the boot.
2. On both upright and inverted translating models, loosen the four set screws (item 4) and loosen the sleeve cap (item 5) by rotating CCW. The ball nut must be removed on T2 (load pad) and T4 (male clevis) end conditions, otherwise, the sleeve cap will be captured between the end condition and the ball nut. For these instructions see Section 2.6 – Ball Nut Disassembly and Rebuild. The inverted model has the protection tube (item 28) attached to the sleeve cap. Use a strap wrench or similar tool to unthread the protection tube from the sleeve cap.
3. On upright translating models, the ball screw assembly is removed through the top of the sleeve. The assembly consists of the ball nut (not shown), thrust bearings (item 2) and wormgear (item 3).
4. On inverted translating jacks, the ball screw assembly is removed through the top of the jack for a T1 (plain) or T3 (threaded) end condition. The ball screw assembly consists of the ball screw (item 7), ball nut (not shown), thrust bearings (item 2) and wormgear (item 3).
5. NOTE: The wormgear may be unscrewed from the ball nut, but removal will require heating the thread adhesive to 500°Fahrenheit. If this is necessary, first remove the set screw. It is not recommended that the ball nut be removed from the ball screw unless it is being replaced. For ball nut removal, see Section 2.6 – Ball Nut Disassembly and Rebuild.
6. On inverted translating jacks, the ball screw is removed through the bottom of the jack for T2 (load pad) or T4 (male-clevis) end condition. Loosen the set screw in the ball nut (not shown) and unscrew the ball nut from the wormgear (item 3.) Removal will require heating the thread adhesive to 500°Fahrenheit, then remove the ball nut from the ball screw; see Section 2.6 – Ball Nut Disassembly and Rebuild. Remove the ball screw from the bottom of the sleeve and the thrust bearings (item 2) and wormgear (item 3) from the top of the sleeve.
7. NOTE: the bearing races may remain pressed into the sleeve cap (upper bearing race) and the sleeve (lower bearing race). These should not be removed unless they are being replaced. Always replace bearings in sets.
8. Upright translating and have a protection tube (item 28) in the bottom of the jack sleeve. It is threaded into the sleeve and may be removed if required. Inverted jacks have a protection tube in the sleeve cap and they also include a bushing.
9. Remove three screws (item 16) from the bearing cap (item 13) on one side and three screws (item 19) from the adapter cap (item 14) on the other side. Remove the caps and seals (item 15) carefully to avoid damaging seals. Make sure worm shaft keys (item 21) have been removed first
10. Carefully remove the shims (item 12) from the jack sleeve, bearing cap, or adapter cap. NOTE: there will not necessarily be an equal quantity of shims per side. Keep track of the number of shims on each side of the jack.
11. Remove the worm shaft bearings (item 11). The cup may be press-fit. Use a dead-blow, plastic or other non-marring mallet to remove the worm (item 10).

2-4 Inspection of Components

1. Before any inspection, it will be necessary to clean all parts of the jack thoroughly. Use caution with any machined or fragile part.
2. Inspect the cleaned sleeve (item 1) and sleeve cap (item 4) for any signs of stress or fracture, especially around the mounting bolt locations.
3. Inspect the worm (item 10) and thrust bearings (item 2) for any signs of Brinelling, abrasive wear or spalling. Test for smooth, quiet operation of bearings.
4. Inspect bearing cap and adapter cap (items 13 & 14) for any signs of stress.

5. Inspect the keyway on the worm (item 10) and roll worm on a flat surface to look for wobble in the shaft. Threads on worm should not show a heavy buildup of bronze gear material.
6. Replace all seals when a complete disassembly is done.
7. Inspect Aluminum-Bronze wormgear (item 3) for signs of excessive wear.
8. Check boots for wear or cracks
9. Check ball screw (item 7) for straightness or excess wear in ball threads.

2-5 Assembly of Ball Screw jacks

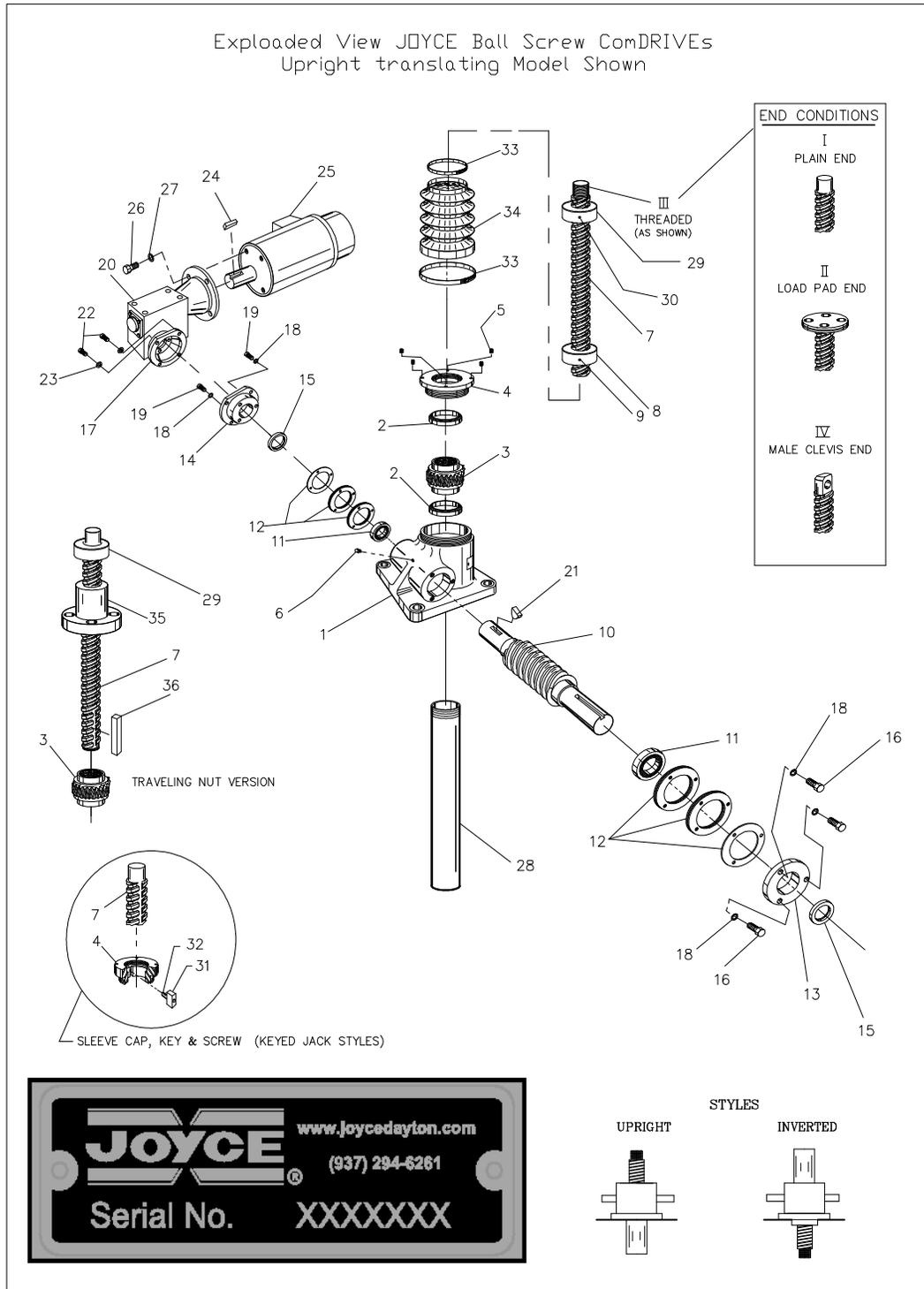
1. Assure that all bearings are packed with grease. Coat seals with light oil and put masking tape on keyway and other sharp surfaces to avoid seal damage.
2. Assembly of jack is reverse of the disassembly procedure. Make sure all bearings and seals seat properly. The bearing cap screws and sleeve cap should only be hand tightened initially. Some jacks may require the wormgear and thrust bearing be installed first, as they will not pass the worm, if already installed.
3. Tighten bearing cap and adapter cap bolts. Check the input shaft for excessive axial or lateral movement. If the input shaft feels loose remove shims, if it feels tight, add shims. Give the input shaft a solid blow on each end (in axial direction) with a soft mallet and re-check the feel. If it feels OK, continue to next step, otherwise continue adding (if tight) or removing (if loose) shims. This is a trial and error operation. The correct set-up has a solid feel without play (axial or lateral) and the input shaft rotates with an even, smooth but snug feel.
4. When jack is re-assembled, the thrust bearing pre-load needs to be set. Check by rotating the input shaft, while tightening the sleeve cap. Continue to check the rotation of the input shaft as sleeve cap is tightened. Use a dead-blow hammer on top of sleeve cap to help it seat. Tighten sleeve cap until it will not tighten further by hand.

2-6 Ball Nut Disassembly and Rebuild

1. This requires the use of an arbor. An arbor can be acquired from Joyce/Dayton, or it can be manufactured. The arbor is usually a tube or bar that can be made out of plastic, stiff cardboard or steel and should be at least 4 inches longer than the ball nut. The outer diameter is approximately equal to the minor diameter of the ball screw thread. Its purpose is to prevent the ball bearings from falling out of the ball nut. Place the arbor at the end of the screw and carefully un-thread the ball nut onto the arbor. After the ball nut is transferred to the arbor, secure it in place with tape or a clamp.
2. Remove the return tubes, one at a time and empty ball bearings from return tube and internal ball nut path in ball nut into a container.
3. Continue to remove ball return tubes and empty all ball bearings. There could be up to three return tubes and ball bearing paths.
4. Discard the return tubes and used ball bearings (if ball nut is being rebuilt.)
5. Flush all components with a clean degreasing solvent.
6. Check ball nut threads for damage and replace if necessary.
7. Check retaining wire location. Some are free to rotate to other part of nut when the return tubes are removed.
8. Lightly oil (Spindle or 10 weight) all components to aid in re-assembly.
9. Thread ball nut onto ball screw or arbor.
10. Begin re-filling ball bearing paths and return tubes. After the return tube is filled, a small dab of grease will hold the balls in the tube during assembly. Remove one or two balls (for clearance) and assemble return tube and ball nut.

Section III Views & Parts List

3-1 Exploded View



3-2 Parts List – Translating and KFTN Ball Screw ComDRIVES®

Table 3-2 Parts list

Item	Translating	Item	KFTN- Keyed For Traveling Nut
1	Sleeve	1	Sleeve
2	Thrust Bearing	2	Thrust Bearing
3	Nut (Wormgear)	3	Nut (Wormgear)
4	Sleeve Cap	4	Sleeve Cap
5	Sleeve cap set screw (4)	5	Sleeve cap set screw (4)
6	Grease Fitting	6	Grease Fitting
7	Ball Screw	7	Ball Screw
8	Screw Stop	8	-----
9	Pin or Set Screw	9	-----
10	Worm (Input Shaft)	10	Worm (Input Shaft)
11	Worm Shaft Bearing (2)	11	Worm Shaft Bearing (2)
12	Shims	12	Shims
13	Bearing Cap	13	Bearing Cap
14	Adapter Cap	14	Adapter Cap
15	Worm Shaft Seal (2)	15	Worm Shaft Seals (2)
16	Bearing Cap Screw (3-4)	16	Bearing Cap Screw (3-4)
17	Adapter	17	Adapter
18	Lock Washer (6-8)	18	Lock Washer (6-8)
19	Adapter Cap Screw (3-4)	19	Adapter Cap Screw (3-4)
20	Gear Reducer	20	Gear Reducer
21	Woodruff Key	21	Woodruff Key
22	Hex Head Cap Screws (3-4)	22	Hex Head Cap Screws (3-4)
23	Lock Washers (3-4)	23	Lock Washers (3-4)
24	Key – Motor Key	24	Key – Motor Key
25	Electric Motor	25	Electric Motor
26	Hex Head Cap Screws (3-4)	26	Hex Head Cap Screws (3-4)
27	Lock Washers (3-4)	27	Lock Washers (3-4)
28	Protection Tube	28	-----
29	Screw Stop (1) extending	29	Screw Stop (1) (extending)
30	Pin or Set Screw	30	-----
31	Key – keyed jacks	31	-----
32	Key Screw – keyed jacks	32	-----
33	Boot Clamp	33	Boot Clamp
34	Bellows Boot	34	Bellows Boot
35	-----	35	Traveling Nut
36	-----	36	Key - KFTN

