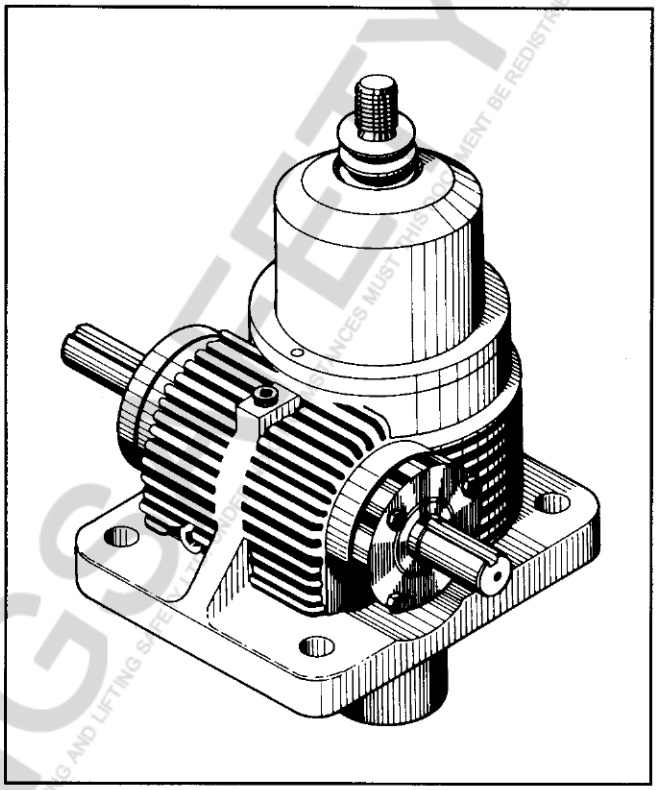
Duff-Norton®

INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS

WITH PARTS LIST

PUBLICATION PART NO. SK-7515-20-1

HIGH DUTY CYCLE ACTUATORS



7500 SERIES

IMPORTANT — CAUTION

This manual contains important information for the correct installation, operation and maintenance of the equipment described herein. All persons involved in such installation, operation, and maintenance should be thoroughly familiar with the contents. To safeguard against the possibility of personal injury or property damage, follow the recommendations and instructions of this manual and keep it for further reference.

WARNING

The equipment shown in this manual is intended for industrial use only and should not be used to lift, support, or otherwise transport people.

Duff-Norton

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SECTION I

GENERAL INFORMATION

1-1. General

This manual contains maintenance instructions for Duff-Norton® 7500 Series High Duty Cycle Actuator. It describes and details procedures for disassembly, cleaning, inspection, rebuilding and assembly of these actuators.

1-2. Industrial Use Only

The actuators described and illustrated in this manual are intended for industrial use only and should not be used to lift, support or otherwise transport people unless you have a written statement from Duff-Norton which authorizes the specific actuator unit, as used in your application, as suitable for moving people.

1-3 TABLE OF SPECIFICATIONS

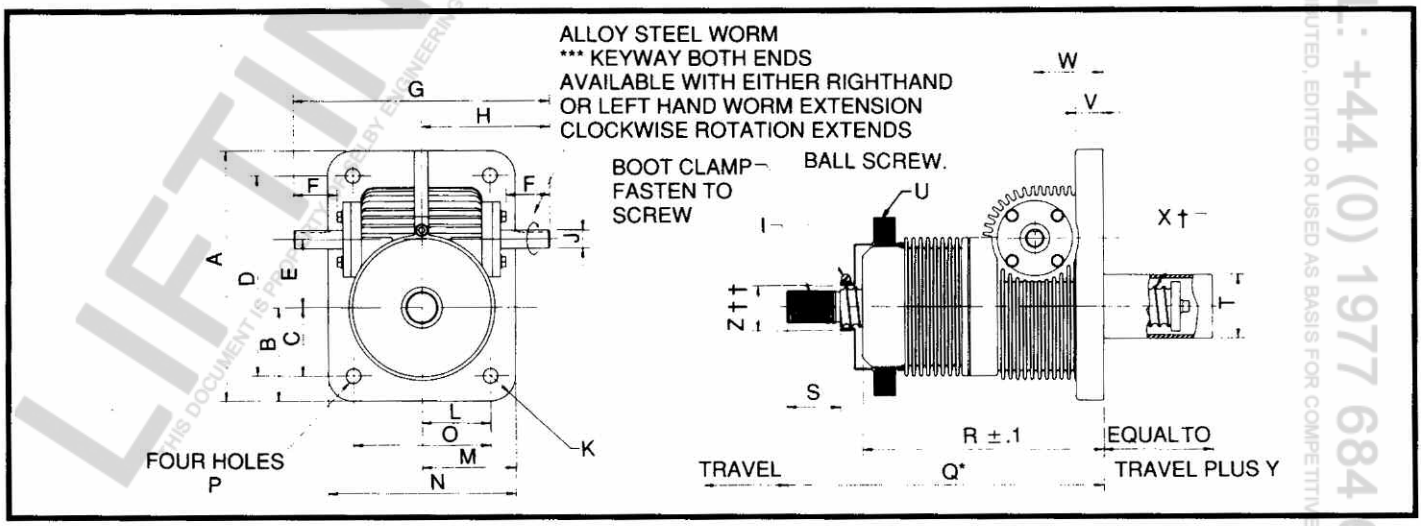
SPECIFICATIONS — 7500 Series High Duty Cycle Actuator

MODEL NO.	7511	7515	7522
Max Load Cap. (Lbs.)	3,500	12,000	27,000
Rated Load Cap. (Lbs.)	2,000	5,200	13,000
Diameter of Lifting Screw (Inches)	1.171 .413 Lead	1.5 .473 Lead	2.250 .50 Lead
Closed Height (Inches)	10¼	12¼	16½
Base Size (Inches)	5½ 7.0	7½ 8¾	10¼ 13¾
Worm Gear Ratio	6:1	8:1	10⅔:1
Turns of Worm for 1" Raise	14.5	16.888	21.333
Horsepower per Jack (Maximum) @ 1750 rpm	2	5	10

MODEL NO.	7511	7515	7522
Starting Torque Max. (Load (In. Lbs.)	75	200	420
Running Torque Max. (Load (In. Lbs.)	60	170	350
Jack Efficiency Rating (Percentage)	70	70	65
Hold Back Torque* at Rated Load (Lb. Ft.)	7	9	12
Weight with Base Raise of 6" (Lbs.)	19	43	95
Weight for Each Additional 1" Raise (Lbs.)	.42	.85	1.50

* Hold Back Torque is restraining torque at the worm shaft, to keep load from running down.

1-4 DIMENSIONS
TYPICAL DUFF-NORTON 7500 SERIES ACTUATOR WITH UPRIGHT TRANSLATING SCREW



Model No.	Dimensions (Inches)																								
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q*	R	S	T	U**	V	W	X†	Y	Z††
7511	7	2 3/4	2.20	6	±.001 −.703	1.12	8.6	4.3	3/4- 16UNF-2A	+.000 −.002 .500	1/2 R	2 1/4	2 3/4	5 1/2	4 1/2	13/32	±.06 10.4	±.06 8.4	1 1/8	1 21/32	7 O.D. × 4 I.D.	3/4	±.005 2.500	1.171 Dia. 4130 Lead	2	1.5
7515	8 3/4	2 7/8	2	7	+.003 −.000 2.598	1.68	11	5.5	1- 14UNS-2A	+.000 −.002 1.000	7/8 R	2 7/8	3 3/4	7 1/2	5 3/4	11/16	±.1 11.2	±.1 9.2	1 1/8	2 3/8	7 O.D. × 4 3/4 I.D.	1	±.005 2.750	1 1/2 Dia. .474 Lead	2	—
7522	13 3/4	5 1/8	3 3/4	11	+.005 −.000 3.750	2.38	14	7.0	1 3/4- 12UN-2A	+.000 −.002 1.000	2 3/8 R	3 3/4	5 1/8	10 1/4	7 1/2	13/16	±.1 16.6	±.1 13.2	2 1/4	3 1/2	9.8 O.D. × 6.8 I.D.	1 1/2	±.005 3.750	2 1/4 Dia. .500 Lead	3	—

* Closed height
** Bellows Boot (optional)
† Dimension includes diameter of ball screw with indicated lead for right hand single thread. NOTE: When ordering, specify load and duty cycle.
†† Hub dia. for boot attachment. ***Keyway for Model 7511 is 1/8 X 5/64 X 15/16 LG. Keyway for Models 7515 and 7522 is 1/4 × 1/8 × 1 1/2

1-5. Important Precautions

In order to ensure that 7500 Series actuators provide good service over a period of years the following precautions should be taken:

1. Select an actuator that has a rated capacity greater than the maximum load that may be imposed on it.
2. The structure on which the actuators are mounted should have ample strength to carry the maximum load, and should be rigid enough to prevent undue deflection or distortion of the actuator supporting members.
3. It is essential that the actuators be carefully aligned during installation so that the lifting screws are perfectly plumb and the connecting shafts are exactly in line with the worm shafts. After the actuators, shafting, gear boxes, etc. are coupled together, it should be possible to turn the main drive shaft by hand. If there are no signs of binding or misalignment, the actuator system is then ready for normal operation.
4. The High Duty Cycle actuators should have a greater travel than is needed in the actual installation. Should it be necessary to operate the actuators at the extreme limits of travel, it should be done cautiously.

CAUTION

Do not allow actuator travel to go beyond catalog closed height of actuator or serious damage to internal jack mechanism may result. Refer to table of specifications (par. 1.3) for closed height of respective units.

5. The worm shaft speed for these actuators should not exceed 1750 RPM without consulting Duff-Norton.
6. The lifting screw should not be permitted to accumulate dust and grit on the threads. If possible, lifting screws should be returned to closed position when not in use.
7. The ball screw should be checked periodically for excessive backlash and spalling of race ways.

CAUTION

Where the screw is not protected from air-borne dirt, dust, etc., do not leave a heavy film of lubricant on the screw. Keep the ball screw barely damp with the lubricant. Inspect at regular intervals to be certain a lubricating film is present. Ball screws should never be run dry.

8. The lubrication procedures for normal and severe service conditions, as described in Section II, paragraph 2-1, should be closely followed.
9. Due to high efficiency of Ball Screw actuators, a brake must be used in conjunction with motor selected to position actuator (refer to current catalog for brake selection data).

1-6. Warranty and Warranty Repair

Subject to the conditions stated herein, Duff-Norton will repair or replace, without charge, any parts proven to Duff-Norton's satisfaction to have been defective in material or workmanship. Claims must be made within one year after date of shipment, except that claims involving Rotating Joint products must be made within 90 days after date of shipment. Duff-Norton will not repair or replace any parts that become inoperative because of improper maintenance, eccentric loading, overloading, chemical or abrasive action, excessive heat, or other abuse.

Equipment and accessories not of Duff-Norton's manufacture are warranted only to the extent that they are warranted by the manufacturer, and only if the claimed defect arose during normal use, applications and service. Equipment which has been altered or modified by anyone without Duff-Norton's authorization is not warranted by Duff-Norton. EXCEPT AS STATED HEREIN, DUFF-NORTON MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

If you have any question concerning warranty repair, please contact Customer Service for the name and address of your nearest Duff-Norton warranty repair facility.

Authorization for return must be received from Duff-Norton before returning any equipment for inspection or warranty repair.

SECTION II

MAINTENANCE

2-1. Lubrication

1. Unless otherwise specified, actuators are shipped filled with oil which should be sufficient for the life of the unit under normal operating conditions. Under normal operation the oil temperature should not exceed a 100° rise above ambient or 200°F whichever is lower. If the actuator operating temperature exceeds 200°F for an extended period of time, it is strongly recommended the oil be changed using any of the recommended oils listed on the lubrication specification. (SK-7515-16) (See page 15.)
2. The lifting screw should not be permitted to accumulate dust and grit on the threads. If possible, lifting screws should be returned to closed position when not in use.
3. The ball screw should be checked periodically for excessive backlash and spalling of race ways.
4. Lubricate periodically the exposed ball screw grooves with a cloth dampened with a good grade 10W30 oil for most applications. An instrument grade oil should be used in dirty and heavy dust environments while bearing grease is recommended for operating environments at extremely high temperatures. Extremes of temperature and other environmental conditions should be referred to Duff-Norton for recommended lubrication procedures.

CAUTION

Where the screw is not protected from airborne dirt, dust, etc., do not leave a heavy film of lubricant on the screw. Keep the ball screw barely damp with the lubricant. Inspect at regular intervals to be certain a lubricating film is present. Ball screws should never be run dry.

2-2. Rebuild Procedure

Duff-Norton recommends the following procedures for assembly and disassembly of 7500 Series High Duty Cycle actuators.

1. Tag critical parts to facilitate reassembly.
2. Mark mating surfaces to ensure proper meshing.
3. Clean and lubricate all parts as required.
4. All seals must be replaced when rebuilding.
5. All screws, washers and other small common parts must be replaced if damaged in any way.
6. Replace damaged or frozen lubrication fittings with new ones.

2-3. Required Tools

A bearing puller and press, soft jaw table clamp and common hand tools are necessary for proper assembly and disassembly.

2-4. Disassembly

(See figures 1 and 3. When a numerical index number is referred to, the reference is to figure 3. Reference should be made to figure 1 when an alphabetical index number is used.)

NOTE. Disassembly should be accomplished on a clean cloth. This is particularly important when disassembling the ball nut assembly (7).

1. Remove any attachments that may be fastened to the end of the ball screw (6). Remove oil plugs (22) and drain oil.
2. Loosen and remove set screws (1) in shell cap (2) and remove the shell cap from the shell (3).

NOTE. It may be necessary to break the shell cap (2) loose with a strap wrench.

CAUTION

It is very important that the ball screw (6) not be allowed to run out of the ball nut assembly (7). At this point, it is advisable to wrap tape around the last few ball screw threads to prevent this from happening.

3. Remove the bottom pipe (5) from the shell (3).
4. Remove cap screws (14), and flanges (16).

NOTE: Be careful not to lose shims (17).

5. Press oil seal (18) out of worm flange (16).

NOTE: The ball nut (7), retainer (8), gear (10), and cylinder (30) assembly cannot be removed until the worm (19) has been positioned to the side.

6. Remove worm bearing (20) cups from shell (3) by tapping on end of worm (19) with a soft head mallet or hammer. This will allow worm (19) to be positioned to the side.
7. With worm (19) positioned to the side away from gear (10) remove the ball nut (7), retainer (8), gear (10), and cylinder (30) assembly from the shell (3) by grasping the top end of the ball screw (6) and lifting out.
8. If ball nut assembly (7), worm gear (10), or load bearing cones (4) are found to be worn or damaged, disassemble these parts from each other. To do this, break loose the sealing cylinder (30) by first cutting the sealant with a knife and then twisting the cylinder free from the gear (10) and bearing retainer (8), To remove the gear (10) and bearing retainer (8) lightly clamp the ball nut (7) into a soft jaw table clamp just tight enough to prevent it from turning.

CAUTION

Care should be taken not to damage the ball guides (26A) or (26B).

9. Remove the set screws (9) from the worm gear (10) and set screws (33) from the bearing retainer (8).
10. With a softhead mallet or hammer, tap the bearing retainer (8) off the ball nut (7) and remove over ball screw (6).
11. Unscrew (counterclockwise) the worm gear (10) from the ball nut assembly (7). A leather or nylon strap wrench should be used.
12. When the worm gear (10) is free from the ball nut assembly (7), remove the retaining disc (13). Slide the worm gear (10) off the ball screw (6) and replace the retaining disc (13) on the screw (6).

13. Unless the maintenance personnel are trained in servicing ball screws, we do not recommend disassembling the ball nut assembly (7). Follow Cleaning Step 1 and Inspection Step 5 to ascertain that the ball nut assembly is faulty before disassembling it. If inspection determines the ball nut assembly to be defective and trained personnel are not available, we recommend that both the ball nut assembly and ball screw (6) be replaced. When trained personnel are available, disassemble per step 14.

14. Figure 1 shows two types of ball nut assembly recirculation systems. One type (C1) has yoke deflectors (F) for directing the bearing balls (E) into the return circuit ball guides (C). The other type (C2) has pick-up fingers which are a part of the ball guides.

    a. Remove ball guide clamp(s) (G) by removing the attaching nuts (D).

CAUTION

When a ball guide clamp (G) holds more than one ball guide (C), secure each remaining ball guide with tape to prevent premature removal of the components of those circuits.

    b. Remove both halves of one ball return guide (C) simultaneously to prevent distortion.

    c. Remove bearing balls (E) from this circuit by rotating the ball screw (A) or the ball nut (H) slowly and allowing the balls to drop onto the cloth on which disassembly is taking place.

    d. Repeat steps a. thru c. for each remaining circuit.

    e. Remove the ball nut (H) from the ball screw (A). On units with yoke deflectors (F), the ball nut must be rotated during removal since the yoke deflectors act as a thread in the ball screw grooves.

    f. When present, remove yoke deflector(s) (F) from the ball nut (H).

NOTE: Identify the two deflectors (F) removed from the opposite ends of the ball nut (H) so that they can be used for reference during the inspection procedures.

15. Remove "O" ring (32) from shell (3).

16. With a wooden or lead mallet, drive the worm (19) and worm bearing (20) out of the shell (3) by striking one end of the worm.

17. If the worm (19) or worm bearings (2) are worn or damaged, remove the worm bearings with a puller or press.

18. If the load bearing (4) cups are found to be worn, remove the cups by oven heating the parts to approximately 400°F. A sharp rap on the casting may be needed to dislodge the cones.

Disassembly is complete.

2-5. Cleaning

1. Use a non-acid degreasing or dry cleaning solvent to remove dirt, grease or oil from all parts. Be sure to flush the ball nut assembly (7) thoroughly while running the assembly along the screw shaft (6) several times.

WARNING: Provide adequate ventilation during the use of cleaning agents; avoid prolonged breathing of fumes and contact with skin.

2. Use clean water or soap solution of 1/4 pound of soap chips to one gallon of hot water for general cleaning of painted surfaces.

3. If the sealing cylinder (30) has been removed, scrape or sand the silicone adhesive sealant from the gear (10), bearing retainer (8) and sealing cylinder (30).

4. Dry parts thoroughly with moisture-free compressed air.

NOTE: Before installing new parts, remove any rust preventive, protection grease, etc.

2-6. Inspection

1. Make a visual inspection of shell (3) for broken, cracked or distorted areas. Check threads of all bores for burrs or broken threads.

2. Check shell cap (2), bottom pipe (5), worm gear assembly and flanges (16) for burrs or scratches on their working or mating surfaces.

3. Check small common components (screws, etc.) and replace as required.

4. Check bearings (4) and (20) for seizure, galling or play and replace as required.

5. Inspect the ball nut assembly (B) and ball screw (A) as follows:

    a. Lubricate the ball nut assembly and ball screw with a cloth dampened with a good grade 10W30. An instrument grade oil should be used if actuator will be used in dirty and heavy dust environments.

    b. Inspect the ball screw grooves (J) for signs of excessive wear, pitting, gouges, corrosion, spalling or brinelling. It is usually less expensive to replace the ball screw when any of the above conditions exist. If you feel, however, that it can be reworked, return it to Duff-Norton for final evaluation.

    c. If none of the above conditions exist, check backlash. Secure the ball screw in a table clamp or similar fixture. Make sure that the screw shaft cannot rotate. Push firmly on the ball nut assembly, first in one direction and then in the opposite direction. This axial movement of the ball nut assembly is the backlash. While making sure that neither member rotates, measure the backlash with a dial indicator. **NOTE:** Measure backlash at points of maximum usage. Backlash of .001" to .010" is acceptable.

    d. If the backlash is over .010" and the ball screw appears usable, disassemble according to Disassembly Step 14.

    e. Inspect ball return guides (C) for distortion or excessive wear.

f. (1) If there is more than one circuit in the ball nut assembly (B), count the bearing balls from each circuit. Each circuit should have the same number (within a variation of three balls).

(2) Check random samples (about 1/4 of the balls for a circuit) for the following:

(a) True roundness (.0001 inch maximum variation allowed)

(b) Signs of scuffing or fish scaling

(c) More than .0001 inch diameter variation between balls of the same circuit.

Where the random sampling shows balls out of round, signs of scuffing or variations of diameter in excess of .0001, or short count in any circuit, replace all balls in the unit with a complete set of new bearing balls.

CAUTION

In order to ensure proper operation and long life of the serviced assembly, IT IS IMPERATIVE that the diameters of all the replacement balls do not vary in excess of .00005 inch. Make certain that balls used meet the above specification. (NOTE: Use only chrome alloy steel balls — carbonized balls or carbon steel balls will not provide adequate life.)

g. Where units include deflector yokes, check the ends of the yokes for wear or brinelling. Wear can be determined by comparison with the unused ends of the two outside yokes. (These were marked in Disassembly Step 14.f.) Since these ends have not been subjected to wear from balls they are in a like-new condition. Where excessive wear or brinelling is evident, replace the yokes.

h. Where units have pick-up fingers (short extensions at the end of the ball return guides), inspect for brinell impressions at the tips. Remove any burrs on the fingers.

i. Inspect the internal grooves of the ball nut (J) for signs of excessive wear, pitting, gouges, corrosion, spalling or brinelling in the ball groove area. On large ball nuts, running the tip of your finger along the groove will enable you to detect a secondary ridge in the ball nut groove (J) when wear is excessive or brinelling has occurred. (The extended lead of a mechanical pencil can also be used as a groove probe.) If inspection indicates any of these flaws, all components of the ball nut assembly should be replaced. The exact ball nut assembly (7) is available on an arbor. When ball nut is usable proceed with reassembly.

NOTE: Be sure all components are clean and dry before reassembly.

2-7. Assembly

NOTE: If ball nut assembly (7) has not been removed from the ball screw (6), go to step 2. If the ball nut assembly (7) has been removed from the ball screw (6), proceed with step 1.

CAUTION

In order to ensure proper operation and long life of the serviced assembly, it is imperative that the diameters of all the replacement balls do not vary in excess of .00005". The following information is supplied for informational purposes only.

Basic Actuator No.	Nominal Ball Diameter	Number of Circuits	Approx. No. of Balls
M-7511	9/32	2	60
M-7515	11/32	2	86
M-7522	3/8	2	154

1. Assemble the ball nut assembly (7) as follows:

a. Where the ball nut assembly is equipped with deflector yokes (F), install these and secure temporarily by running the lock nuts down the studs and tightening slightly.

b. Position the ball nut (H) on the ball shaft. (All ball nuts with deflector yokes must be screwed on. Other ball nuts should slide up the ball shaft without trouble.)

c. Using dowels with an outside diameter approximately equal to the diameter of the bearing balls, center ball nut grooves with the ball shaft grooves by inserting dowels into each of the ball nut return circuit holes. Remove the second dowel from one end. With the ball return holes up, fill the circuit with bearing balls from the container corresponding to that circuit. Turning the screw in the ball nut will help to feed the balls into the groove. When the circuit is full, the balls will begin to lift the end dowel from its position. To be sure there are no voids, lightly tap the top bearing ball and see if the end dowel moves. The remaining balls in the container should fit into one of the halves of the return guide with space for about two to four balls left.

NOTE: There must be some free space in the ball circuit so the balls will roll and not skid. Do not try to add extra balls into a circuit.

d. Place a dab of bearing grease at each end of the half return guide (C) to hold the balls in place. Now, take the other half of the return guide and place it over the ball nut circuit that has been filled with bearing balls and insert the two ends of the ball guide into the respective holes in the ball nut. Seat by tapping gently with rawhide or plastic mallet.

NOTE: Where more than one ball circuit must be filled in the ball nut, tape the ball return circuit guide to the ball nut to prevent accidental removal.

e. Repeat the filling procedure for the remaining ball circuits. With all ball circuits filled and all return guides in place, secure the return guides with retaining clamp(s) (G) and nuts (D).

CAUTION

Care should be taken to ensure that balls are not accidentally trapped between circuits in units having pick-up fingers. (In deflector type design, the deflectors fill this void space.) Be sure screw and ball nut are properly lubricated. See page 6 (2-1).

f. Wrap tape around the ball grooves at the ends of the screw shaft to prevent the ball nut from accidentally rolling off. Inspect the assembly for free movement of the ball nut assembly along the entire stroke. There should be no binding, squeal, or roughness at any point.

g. Check backlash per Inspection Step 5.c. If backlash exceeds .010 inch, one of the two corrective steps may be followed.

(1) The ball nut assembly and/or ball screw may be replaced.

(2) Backlash can be reduced by replacing all the bearing balls with a larger size. If the diameters of the bearing balls are increased by .001 inch, backlash is decreased by .003 inch.

CAUTION

In order to ensure operation and long life of the serviced assembly, it is IMPERATIVE that the diameters of all the replacement balls do not vary in excess of .00005 inch. Make certain that balls used meet this specification. Use only chrome alloy steel balls — carbonized balls or carbon steel balls will not provide adequate life.

2. Ball nut retainer gear and cylinder assembly (7A). See Figure 2.

a. Thread ball nut (7) into worm gear (10).

b. Spot drill ball nut. Thread O.D. (Use carbide tip drill slightly smaller than tapped set screw hole.) Remove chips. Apply Loctite Primer T (H-9017) to tapped hole and set screws (9) in tapped hole and tighten against spot drill in ball nut (7) thread, (apply Loctite 290 Wicking Adhesive Sealant (H-7945) to set screw hole, only a small drop is required).

c. Clean bearing retainer (8) and O.D. of ball nut (7). Apply Loctite Primer T (H-9017) to bearing retainer (8), upper part of ball nut (7) O.D. and set screws (33).

d. Apply 3-4 drops of Loctite Retaining Compound 680 (H-9018) to bearing retainer (8) and press bearing retainer (8) onto ball nut (7) being sure the opening on the retainer (8) is positioned over the ball nut return tubes (26A) and (26B). Apply Loctite Primer T (H-9017) to tapped hole and set screws (33).

CAUTION

Be sure that bearing retainer remains flat against ball nut.

e. Assemble retainer set screws (33) and tighten against ball nut body. (Apply Loctite 290 Wicking Adhesive Sealant (H-7945) to set screw holes, only a small drop is required.)

NOTE: Before applying adhesive sealant to the assembly, clean oil, dirt, and moisture from the areas to be sealed. (See figure 2).

e. Apply Silicon Adhesive Sealant RTV162 (H-7788) or equal into the corner of the spot face on the worm gear (10).

f. After the adhesive sealant has been applied into the spot face, immediately seat the sealing cylinder (30) into the spot face thus sealing the gear (10) and cylinder (30) together.

NOTE: Do not rotate sealing cylinder after it has been seated into undercut.

g. Apply adhesive sealant into the chamfer provided between the sealing cylinder (30) and bearing retainer (8) (see figure 2) and around the perimeter of the sealing cylinder where it joins the gear.

CAUTION

A large quantity of silicone sealant is not required for a good seal. Excessive amounts applied to the assembly may allow the excess to flow into the gear teeth or onto the top of the bearing retainer where the load bearing will rest. Excess sealant should be removed before it cures.

NOTE: At normal temperatures the adhesive sealant will be tachfree in 15 to 30 minutes. Full cure may require 24 hours or longer, depending on how deeply moisture must penetrate.

h. Check the sealed areas for possible leaks and spot seal as required.

i. Press bearing cones (4) on the worm gear (10) and bearing retainer (8). The small end of the cone should point to the outside.

NOTE: Pack bearing cones with a NLG1 No. 1 or No. 2 grease before assembly.

3. Press worm bearings (20) cones onto worm shaft (19) making sure bearings are seated properly. The small end of the cone should point away from threads.

NOTE: Pack bearing cones with a NLG1 No. 1 or No. 2 grease before assembly.

4. Press gear oil seals (31) into the shell (3) and shell cap (2) with sealing elements pointing inward.

5. Press load bearing cups (4) into shell (3) and shell cap (2) after applying an anti-seize compound to the bearing bores.

CAUTION

Be sure cups are seated against bearing seat.

NOTE: Small cup diameter should point toward oil seal.

6. Install "O" ring (32) in shell (3) groove just below shell cup thread.

7. Assemble worm (19) into shell (3). Position worm (3) to side (away from gear). Assemble gear (10), ball nut (7) and bearing (8) assembly into shell (3) until worm (19) and worm gear mesh while bottom load bearing (4) seats into its cup.

NOTE: The shell oil seal (31) should be examined in case sealing lip was rolled back by gear.

8. Tap worm bearing cups (20) into place in the shell (3).

9. Press oil seals (18) into worm flanges (16).

NOTE: Sealing element should point inward.

10. Position worm flanges (16) with at least one shim (17) on each flange. Apply non-hardening industrial sealant such as Permatex No. 2 to the flange bolts. Bolt flange into place. This should be done carefully to prevent keyway from cutting seal. Applying a strip of tape over keyseat will help in preventing keyseat cutting seal.

11. Strike each end of worm shaft sharply with a wooden mallet to seat bearings properly. Check flange bolts for tightness. Worm should turn freely with minimum drag and end play. If too much end play is present, remove shims as required. If worm does not turn freely, add shims as required.

12. Attach the retaining disc (13) to the ball screw (6).

NOTE: Remove tape used to prevent ball nut from running off screw (disc end).

13. Screw bottom pipe (5) into the shell (3) (upright models) or into the shell cap (2) (inverted models).

14. Apply non-hardening industrial sealant such as Permatex No. 2 to the shell cap threads.

15. Install shell cap (2) and tighten.

16. Screw the lower oil plug (22) into place and add oil to the actuator until the level reaches the centerline of the worm or the gear and worm mesh whichever is higher. (See approved lubricant listing, 3-3 page 15. Install remaining plugs (22).

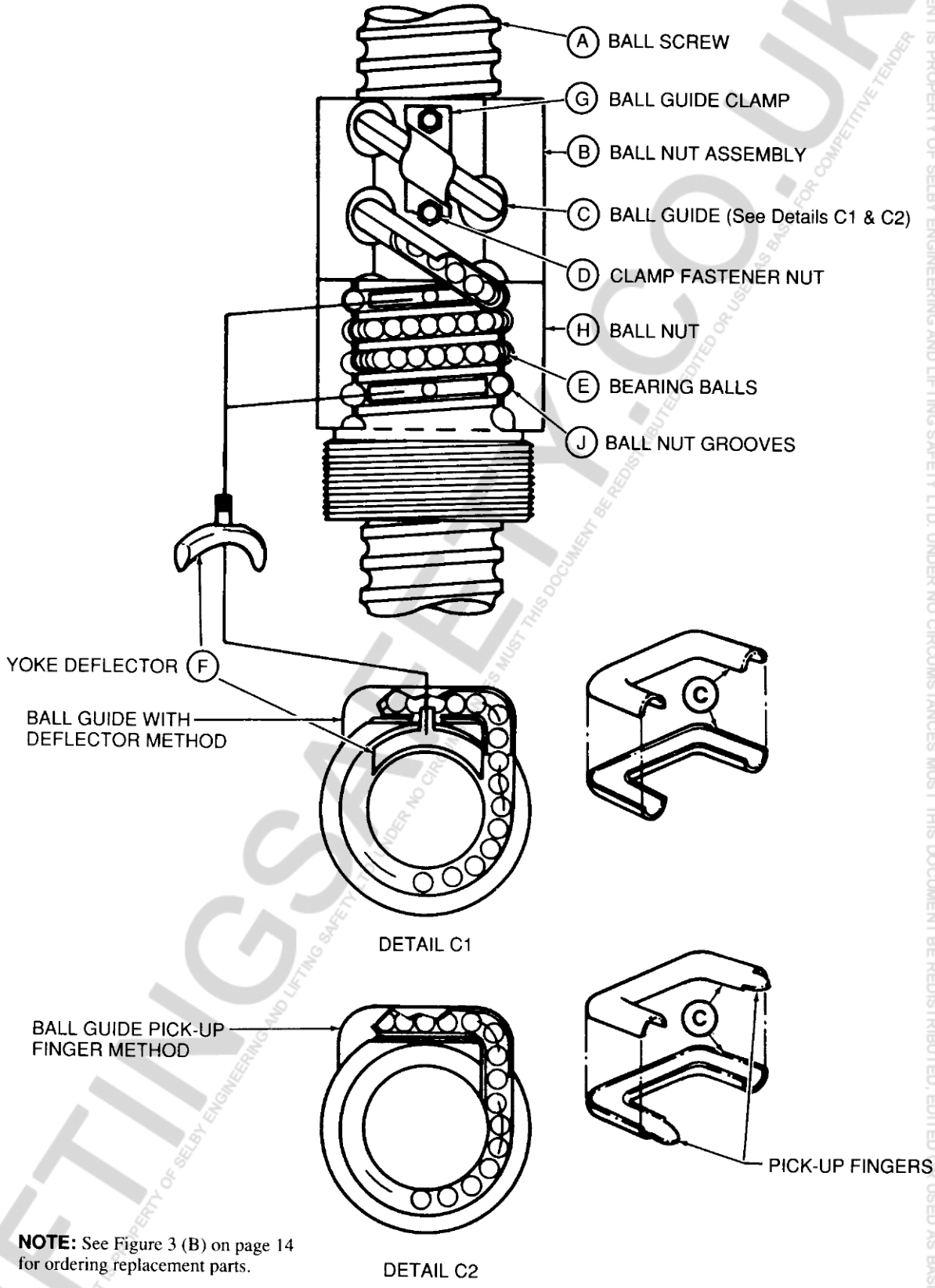
17. In order to eliminate free play in the load bearings (4), preload the actuator load bearings (4) by tightening the shell cap (2) until worm torque is equal to torques in table.

WORM TORQUE

Basic Model No.	Inches/Lbs.
7511	9-12
7515	32-38
7522	67-83

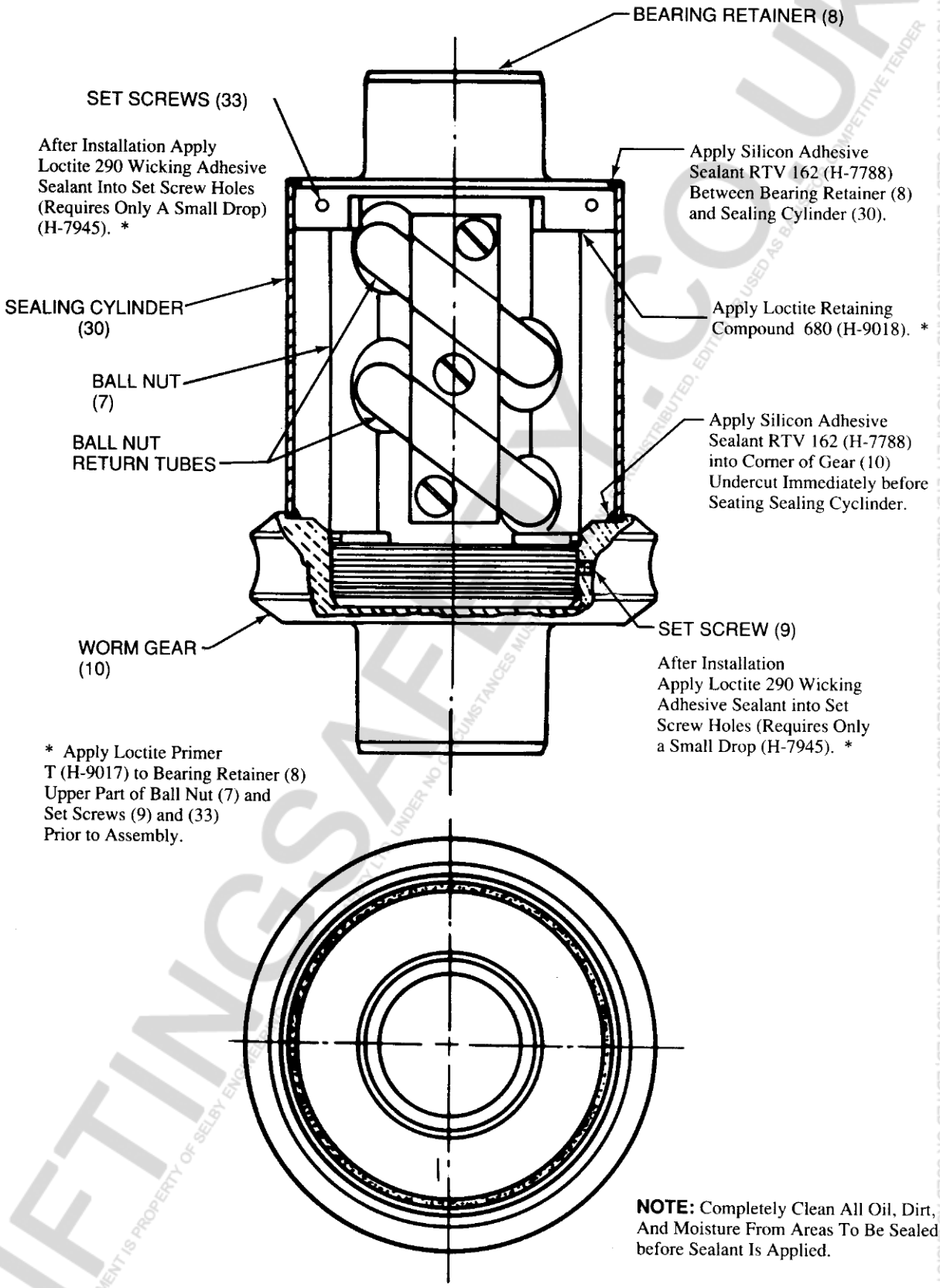
18. After the shell cap (2) has been tightened, spot drill. Remove chips and install set screws (1).

19. Assembly is complete.



NOTE: See Figure 3 (B) on page 14 for ordering replacement parts.

FIGURE 1. BALL NUT AND SCREW ASSEMBLY B



BALL NUT-RETAINER GEAR AND CYLINDER ASSEMBLY ADHESIVE SEALANT APPLICATION

FIGURE 2 ASSEMBLY (7A)

SECTION III

3-1. General

This section contains an exploded illustration of 7500 Series High Duty Cycle Actuators. The number adjacent to each part on the illustration is the index number. Keyed to this index number on the parts list is the part name.

When ordering spare parts be sure to include:

1. The nameplate model number of your actuator.
2. Index number and name of part.

3-2 PARTS LIST

Index No.	Part Name	No. Req.	
1	SCREW, set	2	
2	CAP, Shell	1	
3	SHELL	1	
4	BEARING, Load	2	
5	PIPE, Bottom	1	
6	BALL SCREW	1	
7	BALL NUT ASSEMBLY (Consists of Index Numbers 24 thru 29)	1	
8	BEARING RETAINER	1	
9	SCREW, Set	3	
10	WORM GEAR	1	
11	SCREW, Cap	1	
12	WASHER, Lock	1	
13	DISC, Retaining	1	
14	SCREW, Hex Head Cap and Washer	8	
16	FLANGE	2	
17	SHIM, Flange	2	
18	SEAL, Oil	2	
19	WORM	1	
20	BEARING, Worm	2	
21	BUSHING, Guide (inverted models only)	1	
22	OIL PLUG	2	
23	NAMEPLATE	1	
24*	BALL NUT (BODY)	1	
25*	DEFLECTOR, Yoke	As Required	B
26A*	GUIDE, Ball (used when yoke deflectors are used)	As Required	B
26B*	GUIDE, Ball (used when yoke deflectors are not used)	As Required	B
27*	CLAMP, Ball Guide	As Required	B
28*	NUT, Clamp Fastener	As Required	B
29**	BEARING BALLS, (replace only in sets)	1	
	(specify if oversized balls are required)	See Below	
30	SEALING CYLINDER	1	
31	OIL SEAL	2	
32	"O" RING	1	
33	SCREW, Set	3	

* Not sold as spares. Order Index No. 7 Ball Nut Assembly.

** **CAUTION: In order to ensure proper operation and long life of the serviced assembly, it is imperative that the diameters of all the replacement balls do not vary in excess of .00005". The following information is supplied for informational purposes only.**

Basic Actuator No.	Nom. Ball Diameter	No. of Circuits	Approx. No. Of Balls	No. of Balls Per Circuit
M-7511	9/32	2	60	30
M-7515	11/32	2	86	43
M-7522	3/8	2	154	77

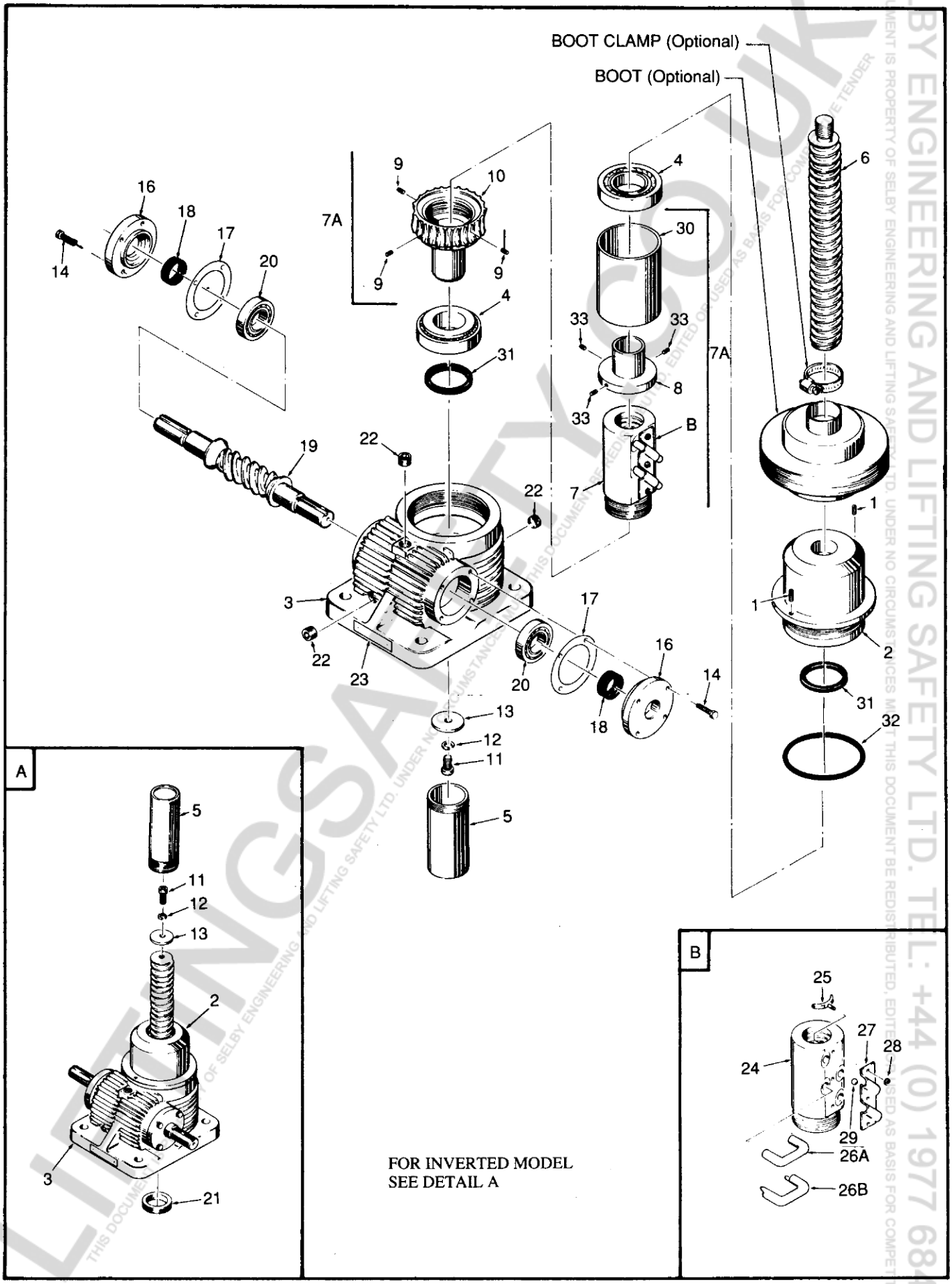


FIGURE 3. 7500 SERIES ACTUATOR (BALL SCREW)

3-3 SUGGESTED LUBRICANTS FOR HIGH DUTY CYCLE ACTUATOR † †

Ambient Temp. Degrees Fahrenheit	
† 15-50°F.	50-125°F.
8 EP	8 EP
8 EP	8 EP

Extracted from AGMA Standard 250.04 "Lubrication" of Industrial Enclosed Gear Drives.

VISCOSITY RANGE FOR VARIOUS AGMA LUBRICANTS	
AGMA LUBRICANT NO.	**VISCOSITY RANGE cSt @ 40°C**
7 EP	414-506
8 EP	612-748

NOTE: All oils listed meet AGMA minimum viscosity index specification of 90.

† Pour Point of the oil used should be less than the minimum ambient temperature expected.

ACTUATOR NO.	APPROXIMATE OIL CAPACITY
7511	16 oz.
7515	16 oz.
7522	24 oz.

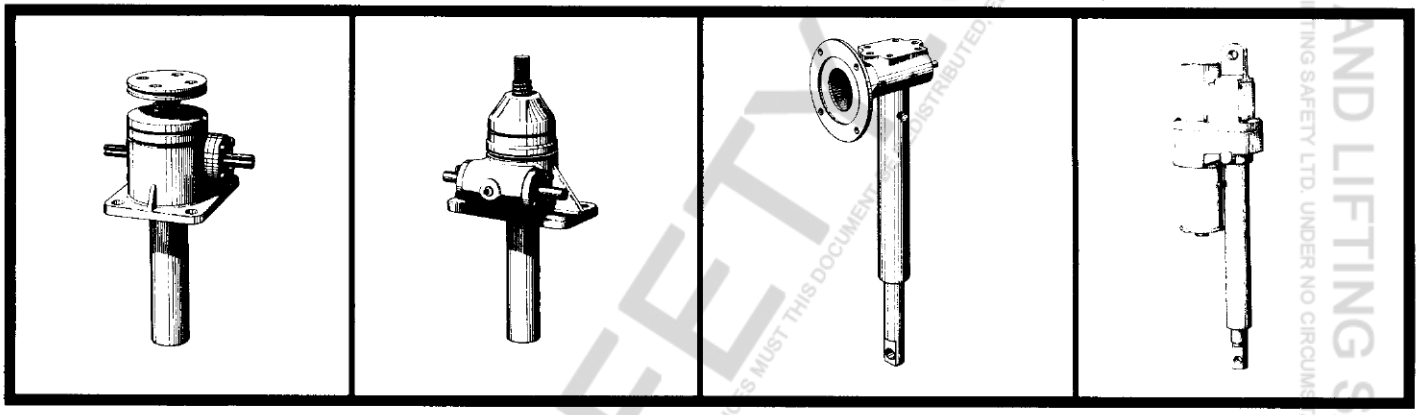
AGMA 7 EP			AGMA 8 EP			
BRAND NAME	**POUR POINT OF**	**VISCOSITY @ 40°C cSt**	**BRAND NAME**	**POUR POINT OF**	**VISCOSITY @ 40°C cSt**	**MANUFACTURER**
OMALA 460	10	431	OMALA 680	10	633	SHELL OIL CO.
ENERGEAR EP 460	5	432	ENERGEAR EP 680	5	626	BP OIL CO.
CHEVRON NL 460	0	437	CHEVRON NL 680	5	646	CHEVRON OIL CO.
MOBILGEAR SHL 460	−20	440	MOBILGEAR SHL 680	−9	645	MOBIL OIL CO.

† † The listing is incomplete. The customer may use other oils if he verifies equivalency to those listed.

DUFF-NORTON OFFERS A COMPLETE LINE OF MECHANICAL AND ELECTROMECHANICAL ACTUATORS FOR PRECISE POSITIONING OF LOADS UP TO 250 TONS.

For reliable motion — in-line or through an arc — Duff-Norton® has the right actuator to put your designs in motion. You can select from a comprehensive line of machine screw, ball screw, high-duty cycle, electro-mechanical and modular models to solve your design and production problems.

Duff-Norton actuators are easy to specify, install and operate. Compact and self-contained, they do not require bothersome selection of individual components nor the attendant maintenance of leaky hydraulic hoses, valves or couplings. They provide many options in meeting a wide range of lifting, pushing, pulling and tensioning requirements.



Machine Screw Actuators. Capacities from 1/4 to 250 tons. Worm gear ratios from 5:1 to 50:1. More than 200 standard combinations to choose. Can be operated manually or by gear motor. Used to push, pull, apply pressure, or as linear actuators. Hold loads indefinitely without creep, when not subject to vibration.

Ball Screw Actuators. Capacities from 1/2 to 50 tons. Ball bearing screw and nut design reduces friction, increases efficiency as much as 70%. Permits linear motion up to 300 in./min. @ 1800 rpm worm shaft speed. Available in 40 standard models. Multiple units may be synchronized for uniform raises to 10 feet.

Modular Actuators. Capacities to 2,000 pounds depending on actuator gear ratio and motor horsepower. Engineered for 56 frame motor, C-Face mounting. Choice of 5:1 or 20:1 gear ratios in rotating screw or translating tube models. Travel lengths to 24 inches. Lift speeds to 170 inches per minute.

Electromechanical Actuators. Capacities to 3/4 ton. Choice of 115 VAC or 12 VDC motors for indoor or outdoor applications. Standard raises from 3" to 24". Speeds to 145 in./min. All components sealed in a corrosion-resistant, aluminum alloy die-cast housing. Fully-adjustable limit switches available on some models.

For more information on these or other Duff-Norton® actuators, ask your local distributor or Duff-Norton District Sales Manager for Catalog 172. Or write factory.

WARNING: The equipment shown in this manual is intended for industrial use only and should not be used to lift, support, or otherwise transport people unless you have a written statement from Duff-Norton which authorizes the specific actuator unit, as used in your application, as suitable for moving people.

AVAILABLE FROM YOUR LOCAL ACTUATOR DISTRIBUTOR:

Duff-Norton
P.O. Box 7010
Charlotte, NC 28241-7010

Phone (800) 477-5002
FAX (704) 588-1994

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