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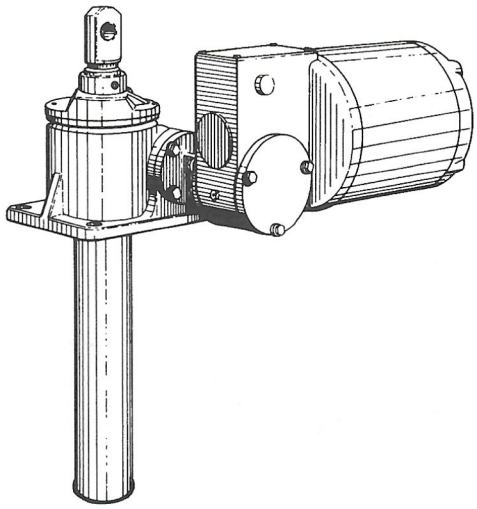
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Duff-Norton®
Mechanical Actuators

Installation, Operating and Maintenance Instructions

MAXI-PAC® Translating Machine Screw Actuators



Publication Part No. SK-2428

⚠ 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 instructions for maintenance of the actuator unit. It contains descriptions of and procedures for installation, disassembly, cleaning, inspection, and assembly of the actuator unit.

1-2. Applications

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.

The Maxi-Pac provides a convenient integrated package of actuator, transmission and motor. These units are intended for a clean, non-corrosive environment with ambient temperatures ranging from -20 to 120 ° F. If your environment is dirty and/or contains abrasive particles it is important to protect the screw with a boot. If your atmosphere is corrosive it is important to specify a non-corrosive material or finish. Duff-Norton can provide stainless steel, nickel plated or epoxy coated units. If your duty is high or your use severe, more frequent lubrication should be employed. Duff-Norton publishes a Mechanical Actuator Design Guide, Catalog No. 2003, which you may find helpful in the selection and application of mechanical actuators. If you need additional help, please contact Duff-Norton at (800) 477-5002.

Note

For loads from 25% to 100% of actuator capacity, torque requirements are approximately proportioned to the load.

1-3. Specifications

Table 1 MAXI-PAC® Translating Machine Screw Actuators

Actuator Configuration	Standard or Special	Actuator Number	Rated Lifting Capacity (lbs)	Lifting Speed (in/min) Single-Speed Motor	Diameter of Lifting Screw (in.)	Maximum Bending Moment (in-lbs)	Minimum Closed Height (in.)	Base Size (in)	Weight with 6-in. Raise (lbs)	Weight for each addl. 1-in. Raise (lbs)
Inverted	Standard	9704	3000	18	1 1/2 .375 Pitch Acme	4000	2 1/2	6 x 8	77	0.9
	Special	10704	5000	9						
Upright	Standard	9705	3000	18	1 1/2 .375 Pitch Acme	4000	7	6 x 8	77	0.9
	Special	10705	5000	9						
Double Clevis	Standard	CCM9705	3000	18	1 1/2 .375 Pitch Acme	4000	10 3/4 + raise (Pin to Pin)	6 x 8	79	1
	Special	M10705	5000	9						
Inverted	Standard	9709	5200	6	2 .500 Pitch Acme	9600	2 3/4	7 1/2 x 8 3/4	94	1.4
	Special	10709	9200	3						
Upright	Standard	9710	5200	6	2 .500 Pitch Acme	9600	8 1/4	7 1/2 x 8 3/4	94	1.4
	Special	10710	9200	3						
Double Clevis	Standard	CCM9710	3000	6	2 .500 Pitch Acme	9600	11 3/4 + raise (Pin to Pin)	7 1/2 x 8 3/4	96	1.6
	Special	M10710	5000	3						

1-4. Important Precautions

1. Select an actuator that has a rated capacity greater than the maximum load that may be imposed upon 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, gearboxes, etc., are coupled together, it should be possible to turn the main driveshaft by hand. If there are no signs of binding or misalignment, the actuator system is then ready for normal operation.
4. The actuators should have a greater raise 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 or serious damage to internal mechanism may result. Refer to table of specifications for closed height of respective units.

5. 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.
6. When using an actuator, a periodic check of backlash of the lifting screw thread is recommended to check wear of the worm gear internal threads. The normal backlash on a new unit of this type is approximately .010 inch. Backlash of 50% or more of the thread thickness indicates the need to replace the worm gear.
7. Unless otherwise specified, actuators are shipped packed with grease which should be sufficient for one month of normal operation. For normal operation the actuator should be lubricated about once a month, using Shell Albida LC EP-2 grease (Shell Product Code 70311).

This grease has been thoroughly evaluated in Duff-Norton actuators and has demonstrated superior lubricating properties affecting both wear life and maximum duty cycle. **Duff-Norton is not aware of an equivalent grease.** If this grease is not available in your area please contact your local supplier for their recommendations. Greases containing molybdenum disulfide should never be used.

For severe service conditions, the actuator should be lubricated more frequently using the above grease (daily to weekly depending upon conditions). If duty is heavy, an automatic lubrication system is strongly recommended. If ambient temperatures exceed 200˚F, consult lubricant manufacturers.

1-5. 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. Duff-Norton will not repair or replace any parts that become inoperative because of improper maintenance, eccentric loading, overloading, chemical or abrasive action, excessive wear, 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 questions concerning warranty repair, please contact Duff-Norton.

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

Section II

Maintenance of Transmission

2-1. Lubrication

Unless otherwise specified, actuators are shipped packed with grease which should be sufficient for one month of normal operation. For normal operation, the actuator should be lubricated once a month using Shell Albida LC EP2 grease,(Shell Product Code 70311).

This grease has been thoroughly evaluated in Duff-Norton actuators and has demonstrated superior lubricating properties affecting both wear life and maximum duty cycle. **Duff-Norton is not aware of an equivalent grease.** If this grease is not available in your area please contact your local supplier for their recommendations. Greases containing molybdenum disulfide should never be used.

For severe service conditions, the actuators should be lubricated more frequently using the above grease (daily to weekly depending upon the conditions). If duty is heavy, an automatic lubrication system is strongly recommended.

Note

Lifting screws should never be run dry. Inspect frequently at regular intervals to be certain that a lubrication film is present.

2-2. Rebuild Procedure

Duff-Norton recommends the following procedures for assembly and disassembly of 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 Figure 1)

1. Remove the four machine screws (8) from cover plate (9) and remove plate gasket (10). Disconnect lead wires and identify for later reassembly.
2. Remove four cap screws (10) and lockwashers (14) from end of motor and remove motor. (See Figure 3)
3. Remove three cap screws (16) and lockwashers (17) from end cap (15) and remove cap and gasket (13).

Note

It will probably be necessary to tap around cap

with a hammer or pry with a screwdriver to remove it. Also, note that the bearing will remain on the worm shaft.

4. Remove three cap screws (16) and lockwashers (17) and slip transmission housing assembly off actuator worm shaft. With a suitable gear puller, remove bearing (14) from end of actuator worm shaft.
5. Remove retaining ring (1) from housing (7) and retaining ring (2) from worm (4).
6. To remove the worm (4) and bearings (3) and bearings (5), tap gently against the side of the worm thread with a brass drift pin. The worm and both bearings should come out together.

Note

Do not strike very hard. This would separate bearing (5) from worm (4) and a small gear puller would be necessary to remove it from housing.

After removal of the worm assembly from the housing, remove bearing (3) and bearing (5) from worm (4).

Note

Use a soft face hammer to tap against bearing for removal from worm.

7. Remove plug (6) from worm (4).

Note

The above parts should be identified and set aside for later reassembly.

2-5. Cleaning

1. Use degreasing solvent to remove grease or oil from all parts.

Note

Remove grease from unit and do not reuse old grease.

Fig No.	Part Name	No. Req.
1	Ring, Retaining (Housing)	1
2	Ring, Retaining (Worm)	1
3	Bearing, (Worm)	1
4	Worm	1
5	Bearing (Housing)	1
6	Plug, Drive-In	1
7	Housing, Gear	1
8	Screw, Machine	4
9	Plate, Cover	1
10	Gasket, Cover Plate	1

Fig No.	Part Name	No. Req.
11	Plug, Pipe	2
12	Fitting, Grease	1
13	Gasket, End Cap (one not shown)	2
14	Bearing, End Cap	1
15	Cap, End	1
16	Screw, Cap (three not shown)	6
17	Washer, Lock (three not shown)	6
18	Motor (Complete w/ Mounting Screws)	1

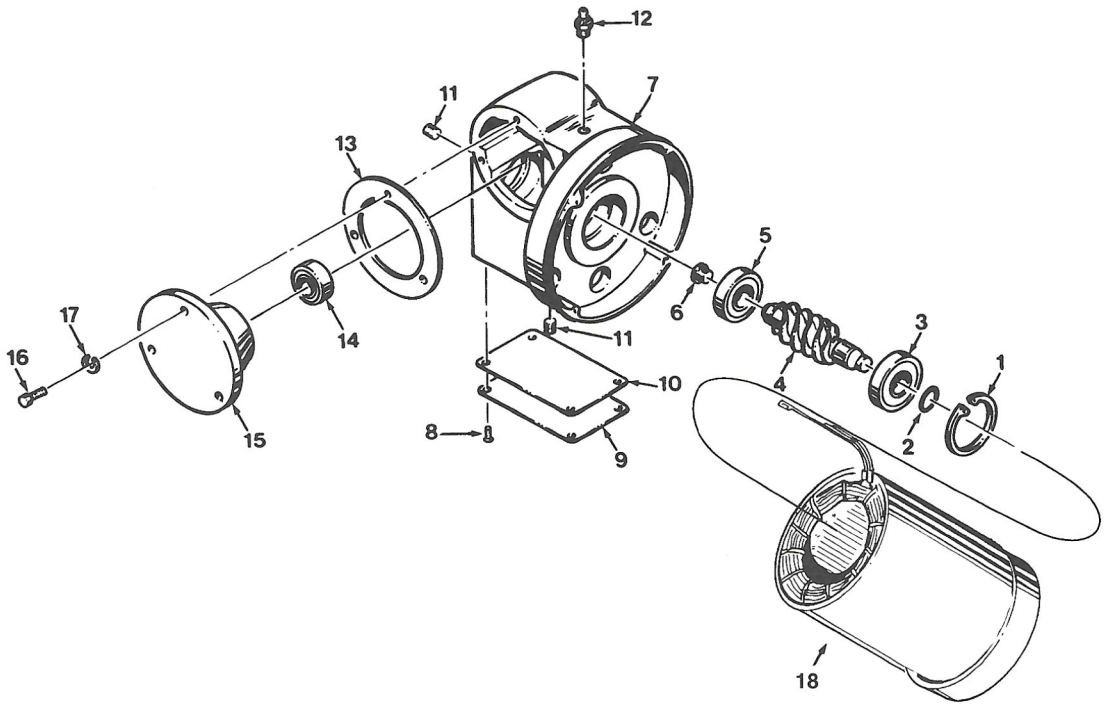


Figure 1. Transmission

⚠ Warning

Provide adequate ventilation during the use of cleaning agents; avoid prolonged breathing of fumes and contact with skin. Read and follow maintenance instructions.

2. Use clean water or a soap solution of 1/4 pound of soap chips to one gallon of hot water for general cleaning of painted surfaces.
3. Dry parts thoroughly with moisture-free compressed air.

Note

Before installing new parts, remove any rust preventative, protection grease, etc.

2-6. Inspection (See Figure 1)

1. Make a visual inspection of housing (7) for broken, cracked or distorted areas. Check threads of all bores for burrs or broken threads.
2. Check worm (4) for burrs or scratches on working or mating surfaces.
3. Check fit of spline in worm (4) and motor shaft. If fits are excessively loose, replace parts as required.
4. Check bearings (3), (5), and (14) for seizure, galling, or play and replace parts as required.
5. Check small common components: (screws, washers, retaining rings, etc.) Replace parts as required.

2-7. Assembly (See Figure 1)

1. Use just a drop of Loctite on drive in plug (6) and drive into worm (4) until seated.
2. a. Slip bearing (5) and bearing (3) onto worm (4) making sure that bearing (3) is on end with retaining ring groove. Slip this assembly into housing (7). When bearing (3) slips into bore, bearing (5) will be lined up for assembly. Use a suitable arbor (such as a piece of tubing) and gently tap bearings into place. Tap against bearing (3) until seated and retaining ring groove can be seen. Assemble retaining ring (2) onto worm.

Note

Gently tap bearing (3) again with an arbor to make sure that retaining ring is seated in groove.

b. Assemble retaining ring (1) into housing (7).

Note

Gently tap bearing (3) again with an arbor to make sure that retaining ring is seated in groove. Worm should turn freely by hand after these steps have been taken.

3. Assemble transmission housing onto actuator adapter flange using three cap screws (16), three lockwashers (17) and one gasket (13) (Angle shown in Figure 1 does not illustrate these seven items.)

Note

It will probably be necessary to turn the housing a little for ease of assembly. Take care when assembling gasket since the three holes are not 120° apart and damage to the gasket could result.

4. Slip bearing (14) onto actuator worm shaft.

Note

Tap gently to make sure bearing is seated against shoulder on worm.

5. Assemble end cap (15) and gasket (13) with three cap screws (16) and lockwashers (17).
6. Assemble motor onto housing with four cap screws and lockwashers.

Note

Make sure that all leads are through hole in housing so they will not be pinched by motor and housing. Connect motor leads as necessary.

7. Assemble the cover plate (9) and gasket (10) with four machine screws (8).

Note

It will be necessary to replace decal on gasket if gasket is replaced.

Section III
Maintenance of Actuator

3-1. Lubrication

Unless otherwise specified, actuators are shipped packed with grease which should be sufficient for one month of normal operation. For normal operation, the actuator should be lubricated once a month using Shell Albida LC EP2 grease,(Shell Product Code 70311).

This grease has been thoroughly evaluated in Duff-Norton actuators and has demonstrated superior lubricating properties affecting both wear life

and maximum duty cycle. **Duff-Norton is not aware of an equivalent grease.** If this grease is not available in your area please contact your local supplier for their recommendations. Greases containing molybdenum disulfide should never be used.

For severe service conditions, the actuators should be lubricated more frequently using the above grease (daily to weekly depending upon the conditions). If duty is heavy, an automatic lubrication system is strongly recommended.

Note

Lifting screws should never be run dry. Inspect frequently at regular intervals to be certain that a lubrication film is present.

3-2. Rebuild Procedure

Duff-Norton recommends the following procedures for assembly and disassembly of 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.

3-3. Required Tools

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

3-4. Disassembly (See Figure 3)

1. Remove retaining ring (21), worm gear (22), woodruff key (23), (and retaining ring (21) from worm shaft on 5-ton actuator only).
2. Remove four cap screws (9) and lockwashers (10) from flange adapter (8) and from flange (11) and remove adapter and flange.

Note

Take care not to loosen flange shims (12).

3. With a lead mallet, tap worm shaft back into actuator housing until worm drops free inside of shell.
4. Remove bottom pipe (4) from shell (3) (upright models), or from shell cap (2) (inverted models).
5. Loosen two set screws (20) and remove stop nut (19) from end of lifting screw (5).
6. Loosen and remove two set screws (1) in shell cap (2) and remove cap from shell (3).

Note

It may be necessary to break shell cap loose with a hammer.

7. Lift the worm so that the worm threads do not interfere with the worm gear threads. Then grasp the lifting screw (5) and pull the screw, worm gear (6), top load bearing (7), and shell cap (2) from the actuator housing.
8. Unscrew worm gear (6) from lifting screw (5) and slip off the shell cap (2).
9. Remove top load bearing (7) that may be attached to either the shell cap (2) or worm gear (6).

Note

Use only a soft face hammer to tap bearings loose.

10. Remove bottom load bearing (7), which may be attached to shell (3) or worm gear (6).
11. Press oil seal (13) out of flange (11).
12. Remove worm (14) and bearing (15) subassembly from actuator housing.

*13. Remove worm bearings (15) from worm (14) with a bearing puller or press.

***Note**

This step will not be necessary if worm bearings are not damaged.

14. If actuator is keyed, remove cap screw and lockwasher from shell cap and tap key out of keyway.

3-5. Cleaning

1. Use degreasing solvent to remove grease or oil from all parts.

Note

Remove grease from unit and do not reuse old grease.

⚠ Warning

Provide adequate ventilation during the use of cleaning agents; avoid prolonged breathing of fumes and contact with skin. Read and follow manufacturer's instructions.

2. Use clean water or a soap solution of 1/4 pound of soap chips to one gallon of hot water for general cleaning of painted surfaces.
3. Dry parts thoroughly with moisture-free compressed air.

Note

Before installing new parts, remove any rust preventative, protection grease, etc.

3-6. Inspection (See Figure 3)

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 (4), lifting screw (5), and worm gear (6) for burrs or scratches on working or mating surfaces.
3. Check fit between lifting screw thread and internal thread in worm gear. If fit is excessively loose, replace worm gear or lifting screw as required.
4. Check fit of worm gear (22), woodruff key (23) and worm (14) and replace as necessary.
5. Check bearings (7) and (15) for seizure, galling or play and replace as required.

3-7. Assembly (See Figure 3)

1. Press worm bearing cones (15) onto worm shaft (14) making sure that bearing cone is seated properly against shoulder.

Note

Taper roller bearings are used; the small end of the cone should point to the worm end.

2. Position worm shaft (14) in shell (3).

Note

Taper roller bearings are used; tap worm bearing cups (15) into place in shell and assembly bearings.

3. Press oil seal (13) into worm flange (11).

Note

The sealing element should point inward.

4. Position flange adapter (8) with shim (12), (one only), and bolt in place with four cap screws (9) and lockwashers (10).
5. Position flange (11) with two shims (12) and bolt in place with four cap screws (9) and lockwashers (10).
6. Assemble one retaining ring (21) onto worm (14). Put woodruff key (23) into place and slip worm gear (22) onto worm shaft. On 5-ton actuator assemble other retaining ring (21) onto shaft.
7. Position bottom load bearing (7) into shell (3).
8. Install worm gear (6) in shell (3).

Note

Strike each end of worm shaft sharply with a soft face hammer to seat bearing properly. Recheck 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.

9. Install top load bearing (7) on worm gear (6).
10. Install shell cap (2) and screw down until tight.

Note

Shell cap does not have to bear down against top of shell. There will usually be a gap. This will put a drag on worm. If worm is too hard to turn, back off slightly on shell cap.

11. Spot-drill and lock set screws (1) in place.

Note

If new parts have been installed, it may be necessary to respot holes for these screws.

12. Fill housing fully with grease.
13. Brush lifting screw (5) with a light film of grease and install in actuator.

Note

If lifting screw (5) has been replaced, the stop ring (24) will have to be assembled onto the screw before assembly. On inverted models only, install guide bushing (16) and stake threads on inside and outside of actuator housing. Then install lifting screw (5).

14. Assemble stop nut (19) onto lifting screw (5) and retighten set screws (20).
15. Screw bottom pipe (4) into shell (3) (upright models) or into shell cap (2) (inverted models).
16. If actuator is keyed, line up keyway and install key in shell cap (2) and bolt in place.
17. Operate unit to ensure proper functioning of all components prior to final assembly with transmission and motor (See Figures 1 and 2).

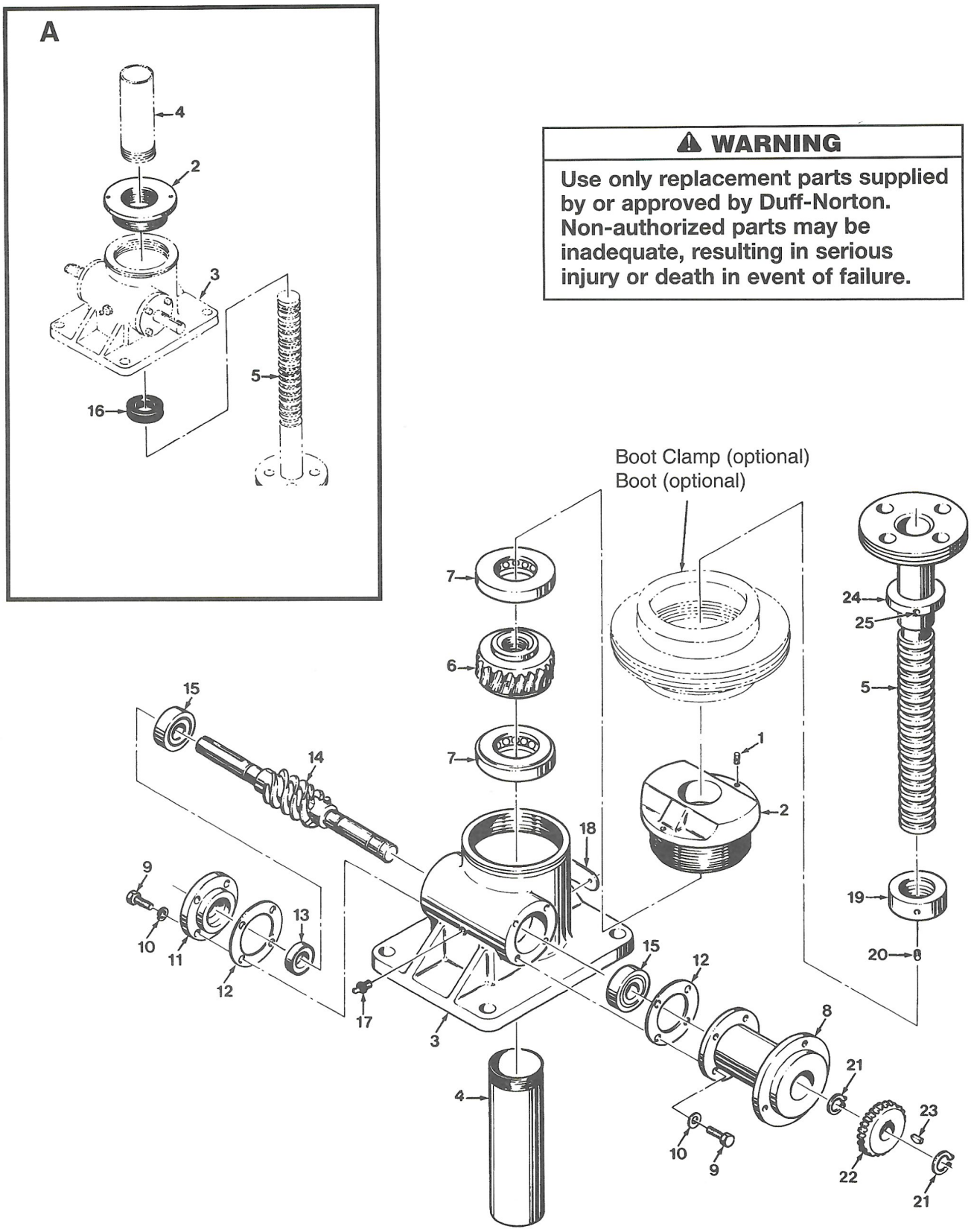
Section IV
Illustrated Parts List

4-1. General

This section contains an exploded illustration of the translating machine screw 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

4-2. Parts ListTranslating Machine Screw Actuators

Fig No.	Part Name	No. Req.
1	Screw, Set	2
2	Cap, Shell	1
3	Shell, Actuator	1
4	Pipe, Bottom	1
5	Screw Assembly, Lifting	1
6	Worm Gear	1
7	Bearing, Load	2
8	Flange, Adapter	1
9	Screw, Cap	8
10	Washer, Lock	8
11	Flange, Worm	1
12	Shim. Flange	3
13	Seal, Oil	1
14	Worm	1
15	Bearing, Worm	2
16	Bushing, Guide (Inverted Models Only)	1
17	Fitting, Grease	1
18	Nameplate	1
19	Stop Nut, Bottom	1
20	Screw, Set	2
21	Ring, Retaining	2
22	Worm Gear, Worm Shaft	1
23	Key, Woodruff	1
24	Stop Ring, Top	1
25	Spring Pin, Stop Rlng	1



⚠ WARNING

Use only replacement parts supplied by or approved by Duff-Norton. Non-authorized parts may be inadequate, resulting in serious injury or death in event of failure.

Figure 3. Actuator



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Duff-Norton®

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

General Office (704) 588-0510
Customer Service (800) 477-5002
Customer Service (704) 588-4610
FAX (704) 588-1994

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