



## SuperCylinders



### **SCN Series SuperCylinder Linear Actuators**

***Installation, Operation  
& Maintenance Instructions***

**Publication Part  
No. NZ100**

#### **⚠ 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.

# TABLE OF CONTENTS

	PAGE
<b>SECTION I</b>	<b>INTRODUCTION</b>
1-1. General .....	3
1-2. Applications.....	3
1-3. Important Precautions.....	3
1-4. Warranty and Warranty Repair.....	3
<b>SECTION II</b>	<b>INSTALLATION</b>
2-1. Inspection.....	4
2-2. Trunnion Mounting.....	4
2-3. Clevis Pins.....	4
2-4. Orientation.....	4
2-5. Vent Plugs.....	4
2-6. Wiring.....	5
2-7. Limit Switch Adjustment.....	5
<b>SECTION III</b>	<b>LUBRICATION</b>
3-1. Screw and Load Bearings.....	6
3-2. Gearbox Lubrication.....	6
3-3. Motor Bearings.....	6
3-4. Clevis and Trunnion Pins.....	6
<b>SECTION IV</b>	<b>MAINTENANCE</b>
4-1. Disassembly.....	7
4-2. Screw and Tube Disassembly.....	7
4-3. Screw Removal.....	7
4-4. Screw and Nut Inspection.....	7
4-5. Ball Nut Removal.....	7
4-6. Cleaning.....	8
4-7. Inspection.....	8
4-8. Assembly.....	8
<b>SECTION V</b>	<b>ILLUSTRATED PARTS LIST</b>
5-1. Part Identification.....	9
FIGURE 5-1. Exploded Parts Illustration.....	9

# SECTION I INTRODUCTION

## 1-1. General

This manual contains installation and maintenance instructions for Duff-Norton SCN Series SuperCylinders. It may be supplemented by individual instructions for the motor, brake, or gear reducer used as part of the SuperCylinder. To ensure satisfactory service, read and understand the information in this and any accompanying literature.

## 1-2. Applications

1. **(Industrial Use Only)** The linear 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.
2. Do not use actuators with standard motors in areas containing flammable vapors, liquids, gases or combustible dusts or fibers. Refer to Article 500 of The National Electric Code. Do not use in highly corrosive or wet environments. Do not use in applications involving extended exposure to temperatures below -20°F or above 140°F.
3. The actuator rod clevis must be restrained from rotating. The amount of restraining torque is a function of screw geometry and load. Consult Duff-Norton for expected values.

## 1-3. Important Precautions

In order to ensure that Duff-Norton acutators provide good service over a period of years the following precautions should be taken:

1. SuperCylinders are normally supplied without controls. The installer must provide adequate electrical controls that provide motor thermal protection and incorporate limit switches to ensure that the actuator is not jammed against internal or external stops.
2. SuperCylinders do not incorporate any protection against mechanical overloading, either externally applied or through internal

jamming. In applications where overloading is a possibility, appropriate electronic or mechanical devices should be incorporated to prevent operation of the actuator if overloaded.

3. Do not install an electric motor on a SuperCylinder with horsepower rating greater than that shown in the SuperCylinder catalog.

### CAUTION

Do not allow actuator to go beyond specified (catalog) closed height, or serious damage to internal mechanism may result.

## 1-4. 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 INSTALLATION

The Duff-Norton SuperCylinder can be used in an unlimited number of positions and applications. Consequently, installation procedures will vary depending on the environment.

### 2-1. Inspection

Check the SuperCylinder for any shipping damage. Be sure that motor fan does not rub fan shroud. Look for any attached hardware or instructions.

### 2-2. Trunnion Mounting

Actuator trunnion pins are designed to fit standard dimension radial spherical plain bearings (Torrington type SF, or SKF type GEZ, for example). It is strongly recommended that trunnion pins be supported by some type of self-aligning bearing, as perfect alignment of trunnion support bearings is difficult to achieve. Standard pillow blocks are not recommended, as their maximum static load rating is usually less than that of the SuperCylinder. In addition, most pillow blocks use cast gray iron frames which are subject to fracture under heavy loads. Duff-Norton offers Trunnion Blocks to facilitate the installation of SCN Series SuperCylinders. These blocks are solid steel and house a properly sized spherical plain bearing. The blocks are drilled for mounting either as a conventional pillow block or as a flange unit. Heat treated fasteners should be used for all attachments.

Order mounting blocks per the following chart:

SuperCylinder series	Mounting Blocks (2 req'd)
NZ03, NL03, NU03	Part No. NZ03-510
NZ06, NL06, NU06	Part No. NZ06-510
NZ12, NL12, NU12	Part No. NZ12-510
NZ25, NL25, NU25	Part No. NZ25-510

### 2-3. Clevis Pins

The SuperCylinder should be attached with a steel clevis pin that is a close fit in the clevis hole. Duff-Norton recommends the use of pins with hardness of at least Rockwell C-28. Socket head cap screws or SAE grade 8 screws may be used, if their length is such that the threaded portion is not placed in shear. Use of an anti-seize compound or extreme pressure grease on the clevis pin will reduce wear and possible noise. For extreme service, mount the clevis pin on outboard bearings.

### 2-4. Orientation

1. The application will usually dictate the orientation of the SuperCylinder. In applications exposed to dripping water or

dirt, pointing the tube down to reduce the entry of foreign material is preferred.

2. The SuperCylinder motor can be rotated 90° to change the terminal box location. On actuators with close coupled motors, the gasketed face of the motor retains gearbox oil. Support the actuator with the motor pointing straight up before loosening close coupled motors, to avoid loss of gearbox oil.
3. Several different limit switch mountings are utilized, depending on model. If optional flange holes are apparent, the limit switch may be repositioned by rotating.
4. Factory orientation of the outer tube grease fitting and vent plug is random (tube is screwed down tight). Plugs may be moved to an alternate set of holes at 90° if required.

### 2-5. Vent Plugs

1. Gearbox venting: The gearbox has three pipe plugs at various locations. (Note: models NZ03, NL03, and NL06 use unvented gearboxes). Two plugs are solid. The third plug is brass colored and contains a spring loaded pressure relief valve for venting built-up pressure. The pressure relief plug must always be the highest plug on the gearbox. If this plug is not the highest, swap it with another plug to make it the highest. Position the gearbox while doing this to avoid loss of gearbox oil. Failure to properly locate the vent plug will lead to loss of oil and premature gearbox failure.
2. SuperCylinder tube venting: The pumping action of the tube extension and retraction, as well as temperature changes, require that the SuperCylinder tube be vented to atmosphere. This vent is critical in preventing blown out seals and/or water entry into the actuator. Depending on the orientation of the SuperCylinder and the relubrication schedule, excess grease may occasionally be pumped out of this vent. This is normal and necessary.
3. Replumbing of vent in wet locations: If SuperCylinder is subject to wet conditions, tube vent should be repositioned to

prevent water entry. The exact technique will depend on orientation and degree of moisture. The tube vent has a hood; however, if any water is collecting on this vent, the high volume of air passing through the vent can suck water into the actuator. A street elbow can be used to reorient the vent. Another option is to replace the vent with a hose barb fitting and attach several inches of vinyl tubing - secured in a downward position. Use a tubing large enough to avoid capillary suction in the tube.

## 2-6. Wiring

Wiring of motor, brake, and/or limit switch should be done according to the wiring diagrams supplied with those components. Limit switches are not internally connected and must be wired into motor contactor control circuits. All wiring should be according to local and national electrical codes. Motor controls should be properly sized to provide adequate motor overload protection. See motor nameplate as to any internal motor protection.

Particular note should be given to the brake wiring connections. The brake on "Nord" brand motors can be wired directly to the motor windings (diagram 1 from motor instructions) or wired through an auxiliary contact on the motor contactor (diagram 2 or 3). Use of the auxiliary contact will provide faster brake engagement.

Three phase motors must be properly connected to check for proper phasing relative to controls and limit switches. Wiring connections to the SuperCylinder must be made with flexible conduit or cable to allow for movement of the actuator during its operation.

## 2-7. Limit Switch Adjustment

Limit switches (if fitted) are not factory set and must be adjusted to prevent jamming and damage to the actuator and/or mating equipment. Before setting limit switches, the installer should make certain that the actuator has sufficient travel in both directions to produce the range of travel required by the installation. If there is any question about this, the rod end clevis pin should be disconnected and the rod rotated by hand, in each direction, to its internal stops. The length of extended rod can be measured in these two extremes and the measurements used for reference while setting limit switches.

Two types of limit switches are used. NZ and NL models use a traveling nut switch. NU models use a geared cam switch. Refer to the appropriate setting instructions:

### WARNING

Do not touch any internal parts of limit switch unless power has been disconnected.

Traveling nut adjustment (NZ, NL models):

1. Remove limit switch cover.
2. Run actuator or rotate tube to desired retracted position. Be careful not to jam actuator. Turn off power.
3. Lift nut guide just enough to turn nuts, and turn brass nut toward switch until the switch clicks. Turn 3 notches farther. Drop nut guide into notch.
4. Restore power. Run actuator out a little, and run back in until the switch stops it. Do not let tube rotate. Check the stopping point.
5. If more adjustment is necessary, turn off power and adjust a few notches. Each notch is approx. 1/16". Turning nut toward switch makes the actuator stop sooner; turning nut away from switch makes the actuator travel farther.
6. Repeat steps 4 and 5 until desired setting is obtained.
7. Run actuator to the desired extended position, being careful not to jam. Turn off power.
8. Repeat steps 3 through 6 for the silver nut, to set the extend limit.

Geared cam adjustment (NU models)

1. The following instructions are based on the lower switch controlling the extend circuit, and the upper switch controlling the retract circuit. Run actuator or rotate tube to desired retracted position. Be careful not to jam actuator. Turn off power and remove limit switch cover.
2. Loosen the visible setscrew (1/16" hex key) and rotate the top cam clockwise until the switch just clicks. Tighten screw.
3. Restore power. Run actuator out an inch or two and run back in until switch stops it. Do not let tube rotate. Check stopping point.
4. If setting needs further adjustment, turn off power and tweak cam setting until proper stopping point is achieved.
5. Run actuator to the desired extended position, being careful not to jam. Turn off power.
6. Loosen the setscrew that is recessed in the hole on the cam hub. Rotate the lower cam counter-clockwise until the switch clicks. Tighten screw.
7. Repeat step 4 for the lower cam.

## SECTION III LUBRICATION

The SuperCylinder screw and load bearings are grease lubricated. The gearbox is oil-filled. Each section has its own lubrication requirements.

### 3-1. Screw and Load Bearings

The screw and load bearings are factory lubricated with Shell, Albida LC EP #2. This grease has been thoroughly evaluated by Duff-Norton and has demonstrated superior lubricating properties. If this grease is not available in your area, please contact your local supplier for their recommended replacement.

1. Lubrication Points - The SuperCylinder has two grease fittings, one in the trunnion housing and one at the tube guide bushing. Shell Albida LC EP #2 is recommended for both.
2. Frequency - The lubrication schedule will vary depending on the severity of use. Lubrication every 100 hours of actual operation is suggested as a guideline.
3. Quantity – Depending on the orientation of the actuator, there may be migration of grease away from the outer tube guide bushing, and possibly some loss through the tube wiper seal. The actual quantity of grease needed to replenish this grease cannot readily be determined. Using a standard hand-pumped grease gun, a rough rule of thumb is to inject into each grease fitting one pump of grease for every 1000 pounds of actuator capacity. Over lubrication will not cause damage, but may increase grease loss.
4. Grease Loss - Over time, spent grease will accumulate inside the tube. A considerable volume of grease can exist there without noticeable effects. Depending on the orientation of the actuator, it may eventually begin to ooze grease from the tube vent or from the wiper seal. This is not an indication of a problem, but evidence of internal lubricant circulation. If these grease emissions are objectionable, the outer tube may be removed and surplus grease cleaned out.

### 3-2. Gearbox Lubrication

Unless loss of oil is apparent, the gearbox will not normally require relubrication.

1. Recommended lubricant- For normal operating temperatures (20°F to 104°F) an ISO 220 viscosity grade is recommended. Higher or lower viscosity oils may be recommended for extreme temperatures. All gearboxes with fill plugs use Mobilgear 630 mineral oil. Smaller gearboxes, without fill plugs, use Mobil, SHC630 synthetic oil. Synthetic oil may be used in any gearbox to extend operating temperature limits.
2. Quantity – Gearboxes should be approximately half full of oil. There should be a pipe plug at approximately the horizontal centerline of the gearbox (except models NZ03, NL03, NL06). Fill with oil up to this plug level. Smaller gearboxes, without plugs, use approximately one pint (500ml) of oil. These boxes will require removal of the motor or the bottom plate to add oil.

### 3-3. Motor Bearings

All standard motors for this product should have permanently sealed and lubricated bearings that do not require maintenance.

### 3-4. Clevis and Trunnion Pins

Clevis pins are subject to wear and can be a source of creaking or popping noises. Pins should be lightly greased at installation. SuperCylinders use a high performance, PTFE fiber bushing in the clevis. This bushing can be replaced if worn or damaged.

The use of the recommended trunnion bearing (see 2-2) will minimize the need for trunnion maintenance. One light shot of grease at standard maintenance intervals should be sufficient, except in corrosive environments.

## SECTION IV MAINTENANCE

Other than the lubrication described in the previous section, regular maintenance should not be required. If disassembly is required to repair damage or a failure, the following procedure may be followed.

### 4-1. Disassembly (Refer to Figure 5-1)

1. Remove SuperCylinder from installation and move to a work area.
2. Remove limit switch (if fitted).
3. Loosen two setscrews on outer tube. Unscrew tube and pull off. Clean excess grease from screw and tube.
4. Remove the metric socket head screws holding the trunnion housing to the gearbox, and separate the housings.

### 4-2. Screw & Tube Disassembly

<b>Note</b>
Do not disassemble ball nut from tube unless ball nut inspection or repair is necessary.

1. Spread and remove nylon nut guide from inner end of translating tube.
2. Loosen two setscrews holding lifting nut. These are installed with thread locking adhesive and may require heating.
3. Clamp lifting nut in vise. Insert bar in clevis hole and unscrew translating tube.

### 4-3. Screw Removal

1. Remove the two pipe plugs from the trunnion housing.
2. Use a long pin punch to drive grooved pin out of the screw (note direction of groove taper). Support screw to avoid bearing damage.
3. Remove slotted nut and withdraw screw.

### 4-4. Screw and Nut Inspection

1. Clean excess grease from the screw and nut. Inspect the screw thread areas for any wear, pitting, gouges, spalling, brinelling, or corrosion. Any deterioration of the thread contact surfaces is cause for replacement.
2. If screw is undamaged, clamp it in a vise with soft jaws and check the nut for

backlash. Push back and forth on the nut, without rotation. Movement should be no more than shown in Table 1. Use a dial indicator if available.

**Table 1**

Screw O.D	Max Backlash
1.0"	.008"
1.17-2.50"	.025"
3.0"	.050"

3. It is not uncommon for nuts to exhibit wear before any damage to the screw. If this is the case, a new nut can be fitted without screw replacement.

### 4-5. Ball Nut Removal

<b>Note</b>
Removal of a ball nut from the screw is not recommended unless there is a reason to do so.

1. Clamp screw in vise with soft jaws and use an impact wrench to loosen the stop washer bolt in the end of the screw. This bolt is installed with high strength locking adhesive. The use of heat is recommended.
2. Ball screw nuts, if already determined to need replacement, can be screwed off, with balls being lost as it comes off the screw.
3. If ball nuts are to be reused, it is recommended that an arbor be made for capturing balls. This will eliminate the need to reload balls. The arbor can be made from any stiff material and should be about 2" longer than the ball nut. A piece of tubular material is easier to secure inside the nut, but a solid bar can be used. Arbor diameters are given in Table 2.

**Table 2**

Screw O.D	Arbor Dia.
1.17"	.88"
1.5"	1.156"
2.25"	1.88"
3.0"	2.50"

4. Hold arbor tight against and centered with the end of the screw (a pilot to engage in the screw hole is helpful). Turn the nut down the screw and continue running it over the arbor until it is completely off the screw.
5. Use wire, tape, cable ties, or similar to prevent the arbor from falling through the nut.

## 4-6. Cleaning

Clean all parts and inspect for wear or damage.

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

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

<b>Note</b>
Remove grease from unit and do not reuse old grease. Before installing new parts, remove any rust preventive, protection grease, etc.

2. Use clean hot water or a soap solution for general cleaning of painted surfaces.
3. Dry parts thoroughly after cleaning.

## 4-7. Inspection

Inspect bearings for damaged race surfaces. Inspect seals for cut or brittle lips. Replace any defective parts, using only Duff-Norton supplied or approved parts

## 4-8. Assembly (Refer to Figure 5-1)

1. Install ball nut on screw. Hold ball nut arbor against screw and twist on nut, being careful not to lose balls.
2. Install stop washer and bolt. Use high strength thread locking adhesive on bolt.
3. Pack load bearings with grease and install in trunnion housing. Insert journal bushings into bearings. Slide screw through bushings.
4. Install slotted nut on screw. On models with ball bearings, tighten nut finger tight. On models with tapered roller bearings, tighten nut enough to provide some preload, but not so much as to make the screw hard to turn by hand.
5. Install pin through slotted nut. If pin is not secure in hole it must be replaced. Install two pipe plugs in trunnion housing.
6. Fill translating tube about half full of grease (see 3-1). Screw translating tube onto ballnut.

If new nut is being used, spot drill the nut threads for the setscrews. Setscrews must not protrude above the surface of the tube, to avoid interference with nylon nut guide.

<b>Note</b>
It is critical that these setscrews be spot-drilled, tightened, and secured with thread locking adhesive.

7. Pump grease into the trunnion housing until it oozes around bearing.
8. Be sure nylon nut guide is in place.
9. Be sure guide bushing and wiper seal are in outer tube. Slide outer tube over translating tube and screw all the way onto trunnion housing. Tighten outer tube setscrews.
10. Pump several ounces of grease into the guide bushing grease fitting.
11. Coat drive key(s) with anti-seize compound or moly-sulphide grease. Reinstall any keys, bushings, or retaining rings used on drive end of screw.
12. Slide trunnion housing and gearbox together, with adapter flange, if used. Install metric screws.
13. Reinstall limit switch. Be sure to readjust limit switch after installation.

## SECTION V ILLUSTRATED PARTS LIST

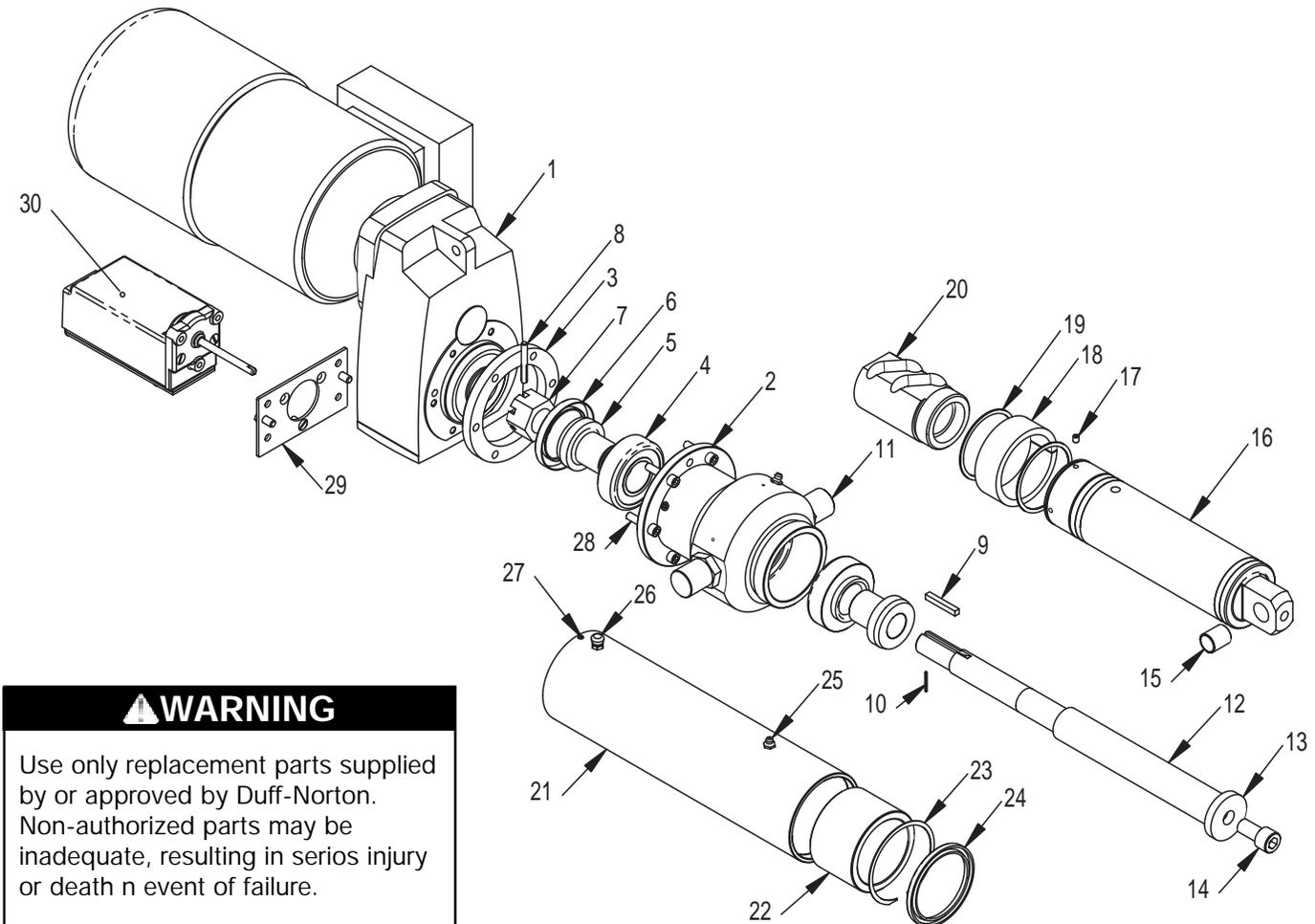
### 5-1. Part Identification

The following exploded parts view shows the components of the Duff-Norton SuperCylinder. Due to the wide range of models and configurations, exact part numbers are not shown. Some models may contain additional bushings, rings, etc. not illustrated in Fig. 5-1. To order parts, contact Duff-Norton with the SuperCylinder model number (example: NZ03-0949-123) and the item number from the following illustration. For any motor, brake, or gearbox part, also include the serial number from the nameplate on the gearbox.

Index No.	Part Name	Index No.	Part Name
1	Gearbox*	16	Translating tube
2	Trunnion housing	17	Setscrew
3	Flange adapter or spacer	18	Nut guide
4	Load bearing	19	Spiral ring
5	Bearing journal	20	Ball Nut
6	Oil seal or o-ring	21	Outer tube
7	Slotted hex nut	22	Guide bushing
8	Grooved pin	23	Retaining ring
9	Square key	24	Wiper seal
10	Roll pin	25	Grease fitting
11	Trunnion pin	26	Air vent
12	Ball screw	27	Setscrew
13	Stop washer	28	Metric cap screw
14	Stop washer screw	29	Limit switch flange
15	Self-lube bushing	30	Limit switch assembly

\* - Provide gearbox serial number for brake, motor, or gearbox parts.

**Figure 5-1. Exploded Parts Illustration**



### **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.



## DUFF-NORTON ALSO MANUFACTURES



**Mechanical Actuators**



**Electromagnetic Actuators**



**Rotary Unions**



**Mechanical Jacks**

### **WARNING**

The equipment shown in this catalog 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 the Duff-Norton Company which authorizes the specific actuator unit as used in your applications suitable for moving people.



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

Phone: (800) 477-5002 • (704) 588-4610

Fax: (704) 588-1994

Email: [duffnorton@cmworks.com](mailto:duffnorton@cmworks.com)

[www.duffnorton.com](http://www.duffnorton.com)



© Yale Industrial Products, Inc., Duff-Norton Division, 2005  
All rights reserved by Yale Industrial Products, Inc., Duff-Norton Division.  
May not be copied in whole or in part.  
**Printed in the USA**

NZ100  
200/1205  
ECO 98875