



# Duff-Norton®

## Electromechanical Linear Actuators

### ***Installation, Operating & Maintenance Instruc- tions***

*with parts list*

#### **TAC Models**

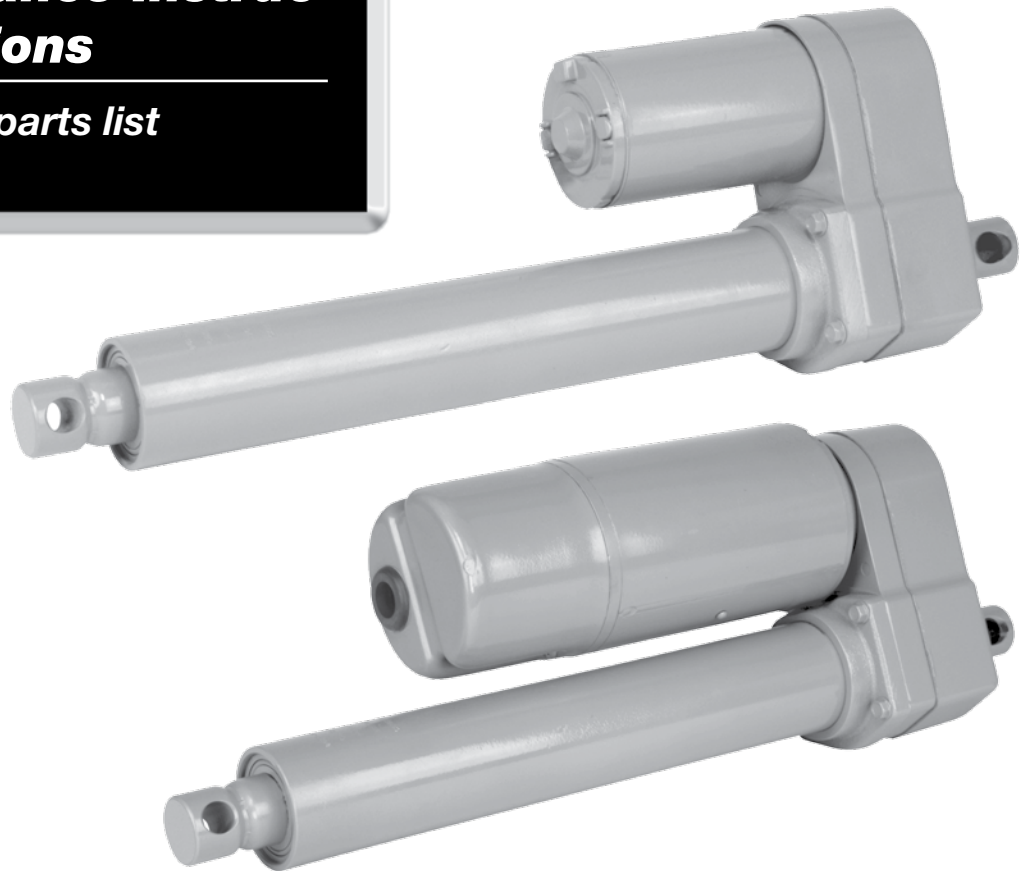
with Clutch

#### **TAL Models**

with Limit Switches

#### **TAC Models**

with Limit Switches  
and Potentiometer



***Publication Part No. EM-1050-200***

***Electromechanical Actuators with Acme Screw***

#### **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.

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# Section I General Information

## 1-1. General Information

This manual provides information for the installation, operation and repair of Duff-Norton electromechanical actuators.

## 1-2. Application Information

The actuators described in this manual are intended for industrial use only and should not be used to lift, support or otherwise transport people or loads over people, unless you have obtained written authorization from Duff-Norton that the actuator is suitable for the particular application.

The actuator is designed for lifting or pushing loads no more than its load rating, on an intermittent basis, not for applications requiring continuous operation. The actuator is designed for clevis mounting and cannot support side loading of the translating tube.

## 1-3. Inspection

Every actuator is tested at the factory under full rated load to ensure that the actuator operates properly and that limit switches precisely stop its travel. Limit switch settings must be rechecked at installation, since rotation of the translating tube will change set points.

Inspect the actuator before installation for any evidence of shipping damage or loose parts.

## 1-4. Warranty and Warranty Repair

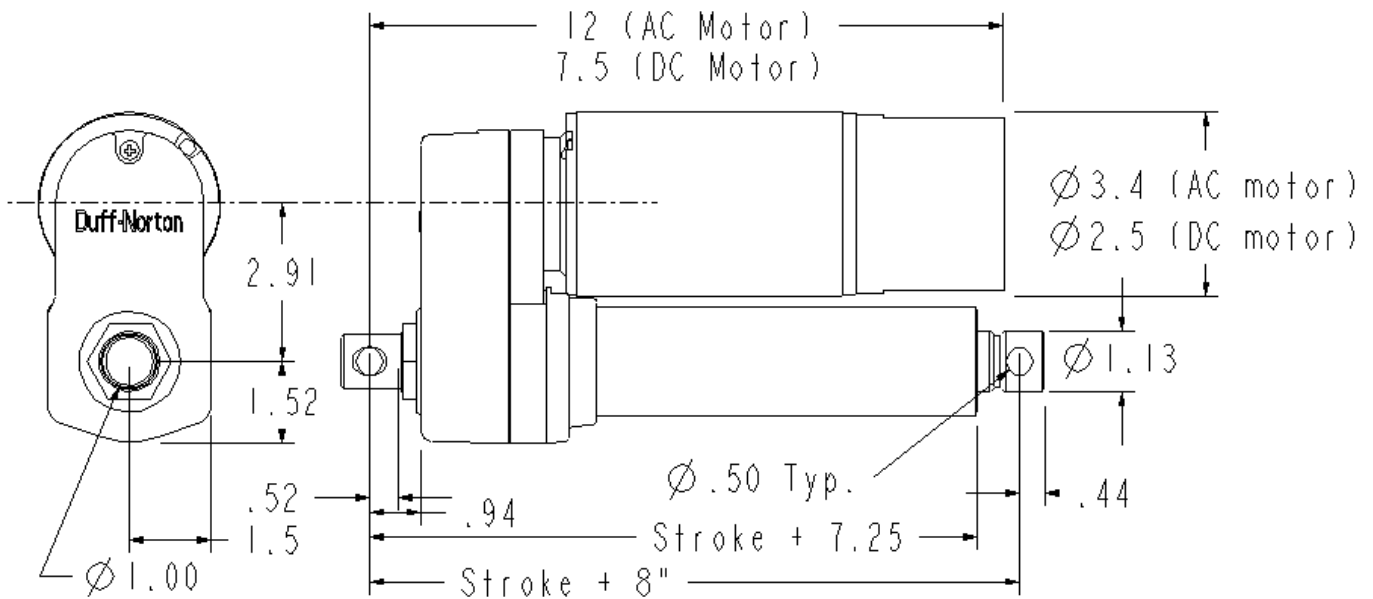
Subject to the conditions stated herein,

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 heat, or other abuse.

Equipment and accessories not of Duff-Norton's manufacture are warranted only to the extent 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.

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



**Table 3-1. Dimensions in Inches**

**Table 1-1. TA500 Performance at Rated Load**

Available Models	Clutch	Limit Switch	Potentiometer	Voltage	Speed	Amps	Duty
TAL05-1A10-#		X		115Vac, 60Hz	52 in/min	4.0 amps	17.5%
TAP05-1A10-#		X	X				
TAL05-2A10-#		X		230Vac, 60 Hz [220Vac, 50 Hz]	54 in/min [45 in/min]	2.0 amps [2.5 amps]	17% [14%]
TAP05-2A10-#		X	X				
TAC05-1D20-#	X			12 Vdc	27 in/min	10 amps	40%
TAC05-2D20-#	X			24 Vdc	27 in/min	5 amps	40%

**Table 1-2. TA1000 Performance at Rated Load**

Available Models	Limit Switch	Potentiometer	Voltage	Speed	Amps	Duty
TAL10-1A20-#	X		115Vac, 60Hz	26 in/min	4.0 amps	17.5%
TAP10-1A20-#	X					
TAL10-2A20-#	X		230Vac, 60 Hz (220Vac, 50 Hz)	27 in/min (22 in/min)	2.0 amps (2.5 amps)	17% (14%)
TAP10-2A20-#	X	X				

# = Actuator stroke. Standard strokes are 4, 8 and 12 inches (101, 203 and 305 mm)

Custom stroke lengths are available.

Performance figures at rated load. Data is approximate.

## Section II Installation

### 2-1. Clevis Connections

Refer to Fig. 1-1 for appropriate mounting dimensions. The actuator should be connected with .50 inch diameter steel clevis pins, or bolts with enough unthreaded length to provide full clevis support. Lightly grease clevis pins to prevent wear and noise.

### 2-2. Motor Capacitor

All AC units use permanent split capacitor motors requiring an external motor run capacitor. Capacitor ratings are listed below.

Voltage	Rating	Duff-Norton No.
115VAC	50uf,370VAC	SK6405-7-15
230VAC	15uf,440VAC	SK6405-7-14

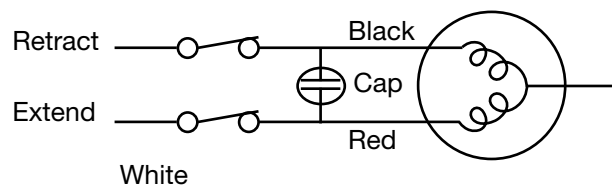
If actuators are never operated at more than 50% of rated load, capacitance may be reduced by up to 33%, resulting in lower current and motor operating temperature.

### 2-3. Wiring Connections

All wiring connections for AC units can be made to the

terminal block under the motor cover. Refer to Fig. 2-1 for wiring schematic and Fig. 2-2 for Terminal Block Connections.

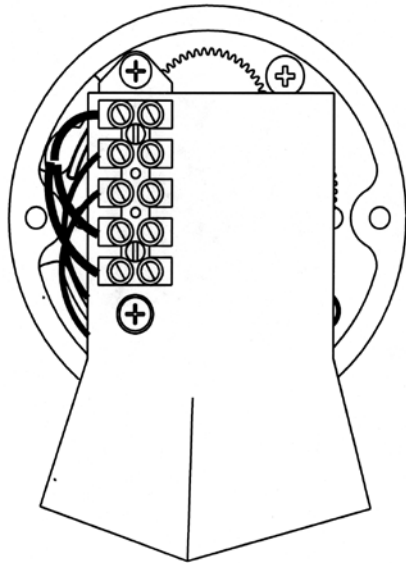
Connections to DC units are made directly to motor leads. Use wire adequate for the rated motor amps.



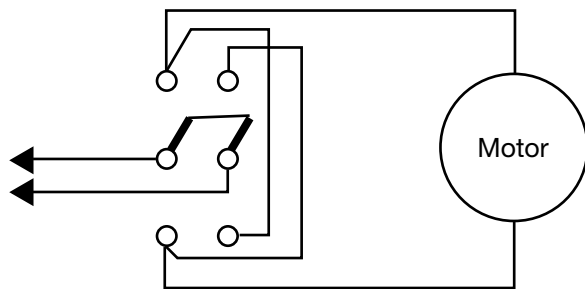
**Figure 2-1. Wiring Schematic**

Connect AC neutral to 'Common' and switched motor power to 'Extend' and 'Retract'. Capacitor may be connected without regard to polarity.

Connecting cable may be run through the grommet supplied, or a 1/2" size conduit fitting may be connected to the cover. If using fitting, check for clearance between fitting and installed cover.



**Figure 2-2. Terminal Block Connections (AC)**



**Figure 2-3. Wiring Schematic DC with Clutch**

DC models with clutch may be operated through relays or by utilizing a momentary action, Double Pole, Double Throw, Center-off toggle switch (Duff-Norton part EM534). If actuator runs opposite the desired direction, reverse the red and black motor wires.

#### 2-4. Limit Switch Adjustment

1. With translating tube unrestrained, run the actuator toward the retracted position until the switch cam actuates the switch.
2. Rotate the translating tube by hand to the desired retracted position.
3. With the translating tube restrained against rotation, run the actuator to the desired extended position.

#### **⚠ DANGER**

To avoid electric shock hazard and possible electrocution, disconnect power before making any adjustments inside motor cover.

4. **Disconnect power.** Remove motor cover. **On Potentiometer models only:** remove two screws holding the terminal block plate and pull plate and

potentiometer straight off, firmly holding limit switch cams.

5. Raise the flap of the electrical insulator sheet to expose the limit switch cams. Holding the cam gear to prevent loading of the small gears, loosen the two screws holding the top cam. Rotate the cam toward the switch until the switch just clicks. Again holding the gear, tighten the screws.
6. Restore power and operate actuator to check limit switch settings.
7. If settings are correct, **disconnect power** and reinstall motor cover.

#### **NOTE**

1. Exercise care to avoid jamming the actuator.
2. With no load, some actuator drift is typical. If precise setting is required, it must be done with the expected operating load.
3. If problems are encountered setting the Retract switch, check to see if motor is turning while the translating tube is being twisted. If so, use a small screwdriver to hold the end of the motor shaft while twisting translating tube.
4. Rotating the translating tube will change the settings of both switches by 1/6 inch per revolution of the tube.

#### 2-5. Potentiometer Adjustment

1. Actuator limit switches must be set prior to potentiometer installation.
2. The potentiometer is 5000 ohm single turn. Resistance changes approximately 235 ohms per inch for a 20:1 ratio actuator, or 117 ohms per inch for a 10:1 ratio.
3. Retract the actuator until the limit switch cuts it off. **Disconnect power.**
4. Loosen 1/2" nut on potentiometer bushing. Press potentiometer shaft into upper limit switch cam and mount terminal block plate with two screws and standoffs.
5. Use an ohmmeter to measure resistance between potentiometer terminals **S** and **CW**. Twist potentiometer body to minimize resistance between these terminals. Use a thin 1/2" end wrench to tighten pot nut. Recheck for continuity between **S** and **CW**.
6. Terminal **S** is the potentiometer slider, with actuator extension increasing the resistance between **S** and **CW**.

## Section III Operation Precautions

### 3-1. Motor

The motor used on this actuator has a very high power output for its size. Consequently, heat generation in the motor is more rapid than in more conventional motors. Duty cycle limitations must be recognized at all times, whether or not the actuator is loaded.

Motors are equipped with thermal protectors to guard against winding burnout. Once tripped, it may take 10 – 15 minutes for the motor to cool sufficiently to reset the thermal protector. Repeated thermal trips can be an indicator of excessive load or duty, low voltage, or weak capacitor(AC only).

#### **WARNING**

When operated near duty limits, external motor temperature may be hot enough to cause burns. Actuator should be installed with appropriate precautions to prevent injury to personnel.

### 3-2. Clevis Pins

The clevis pins must be maintained parallel to each other during the full stroke of the actuator. Side loading or torquing as a result of non-parallel clevises can cause serious actuator damage. Any creaking noise at the clev-

ises is an indication that pins need lubrication to prevent pin wear.

### 3-3. Jamming

#### **CAUTION**

Actuators with limit switches have no inherent mechanical overload protection. Repeated jamming of the actuator, internally or against an external stop, will result in very rapid wear and eventual failure. Be sure that limit switches are functioning properly to stop the actuator within its stroke limits.

No-load operation will produce additional drift. Limit switches should be set far enough from ends of stroke to accommodate this if no-load operation is anticipated.

Actuators with clutches have a degree of protection against internal or external jamming or overloading; however, extended slipping of the clutch will cause accelerated wear and premature actuator failure. To provide acceptable long-term operation at rated load, clutches are set somewhat above rated load. Do not depend on the clutch to gage an acceptable load. Clutches are not adjustable for wear.

## Section IV Maintenance

### 4-1. Lubrication

The load bearing and the screw and translating tube are adequately lubricated for the life of the unit. Gearing receives a light brush coat of grease at the factory. If the actuator is removed for repair or inspection, the gear lubricant may be replenished by filling the gear tooth spaces with a heavy, tacky gear grease. A few drops of oil should be placed on the porous bronze bearings at the same time.

### 4-2. Disassembly

Remove the one Phillips head screw from the gear housing and the four hex head screws from the tube flange. Separate housing and housing plate. All mechanical parts should now be accessible. The lifting nut is threaded and staked to the translating tube. Disassembly of the screw and translating tube assembly is not possible nor anticipated to be necessary, due to the expected long life of the screw and lifting nut.

### 4-3. Load Bearing

The bearing is permanently lubricated and not readily relubricated. A bearing which shows any sign of roughness should be replaced. Clamp screw in a vise with soft jaws and remove retaining nut. Use thread locking adhesive on nut when replacing bearing.

### 4-4. Reassembly

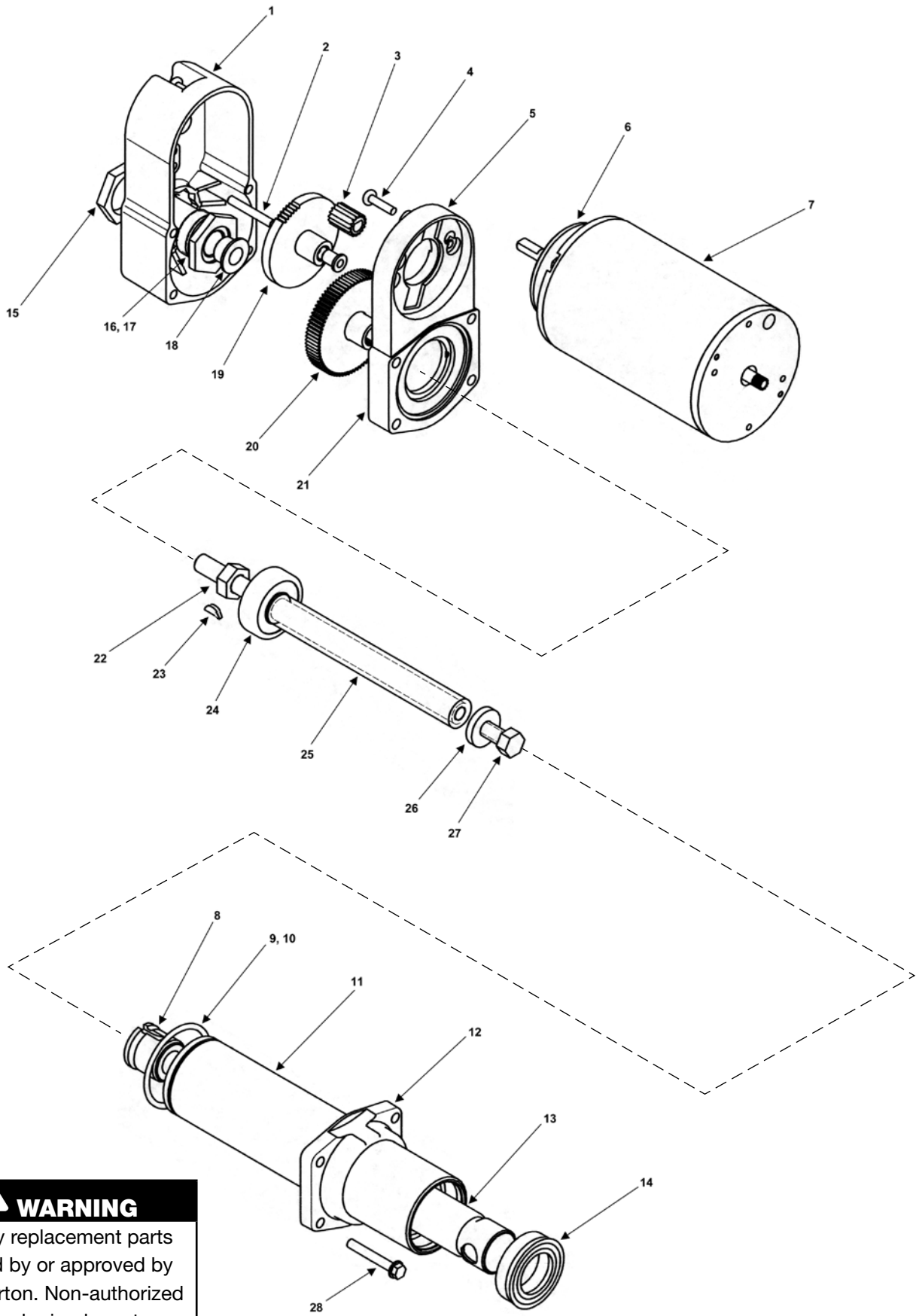
Assembly is the opposite of disassembly, with no special techniques required. Tube flange screws are self-tapping style and should be started by hand to avoid possible cross-threading.

## Section V Illustrated Parts List

### Table 5-1. Linear Actuator Parts List

Index Number	Part Name	Qty. Req.	Part Number
1	Gear housing	1	EM1050-2
2	Shaft, cluster gear	1	SK3410-43
3	Pinion	1	SK3410-7
4	Screw, 10-32 x 3/4	3	H2695PC
5	Housing plate	1	EM1050-1
6	O-ring, -142	1	X6477-137
7	Motor, 115 VAC	1	EM1050-24
7a	Motor, 220-230 VAC	1	EM1050-25
7b	Motor, 12 VDC	1	EM1050-26
7c	Motor, 24 VDC	1	EM1050-27
8	Lifting nut	1	EM1050-33
9	O-ring	1	X6477-136
10	Spiral ring	1	S61-2C
11	Outer tube, 4" stroke	1	EM1050-6-4
	Outer tube, 8" stroke	1	EM1050-6-8
	Outer tube, 12" stroke	1	EM1050-6-12
12	Flange, tube	1	EM1050-3
13	Translating tube, 4" stroke	1	EM1050-5-4
	Translating tube, 8" stroke	1	EM1050-5-8
	Translating tube, 12" stroke	1	EM1050-5-12
14	Rod seal	1	EM1050-54
15	Clevis nut	1	SK3410-33
16	O-ring, -022	1	X6477-101
17	Top clevis	1	EM1050-7
18	Flanged bushing	1	SK3410-44
19	Cluster gear, 20:1	1	EM1050-36
	Cluster gear, 10:1	1	SK3410-5
20	Output gear, limit switch models	1	EM1050-45
	Clutch, 500 pound models	1	EM1050-58
21	Gasket, housing	1	SK3410-25
22	Nut, 1/2-20	1	S12-38C
23	Woodruff key, #304	1	S23-4C
24	Bearing, 6302Z	1	EM1050-302
25	Screw, 4" stroke	1	EM1050-4-4
	Screw, 8" stroke	1	EM1050-4-8
	Screw, 12" stroke	1	EM1050-4-12
26	Stop washer	1	EM1050-35
27	Screw, 3/8-24 x 3/4	1	H2413C
28	Screw, 12-24 x 2	4	H2696PC



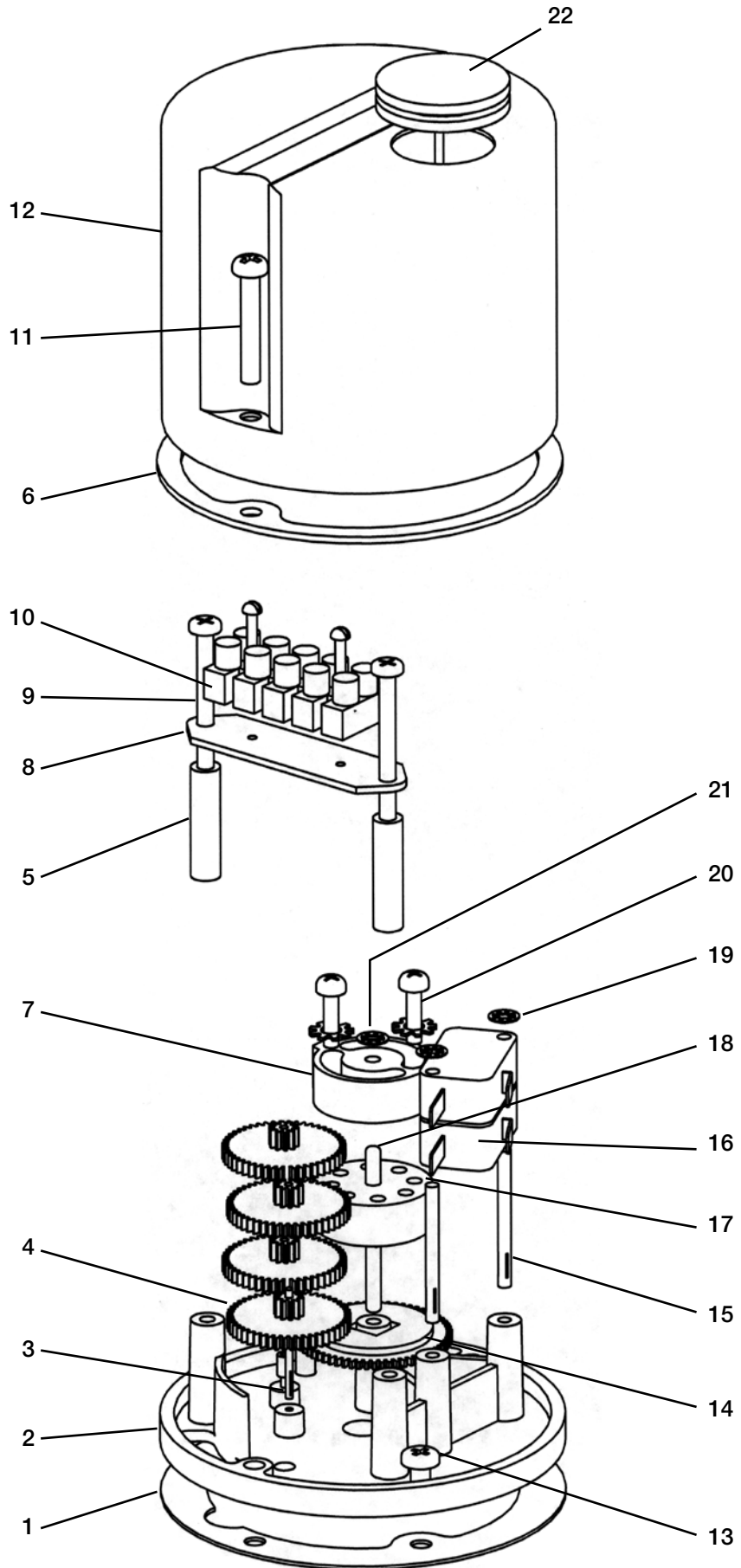


**⚠ WARNING**  
 Use only replacement parts supplied by or approved by Duff-Norton. Non-authorized parts may be inadequate, resulting in serious injury or death in event of failure.

**Figure 5-1. Linear Actuator Exploded Illustration**

**Table 5-1. Limit Switch Parts List**

Index Number	Part Name	Qty. Req.	Part Number
1	Gasket	1	EM1050-65
2	Limit switch base	1	EM1050-72
3	Grooved pin, 1/16"	2	S57-10C
4	Cluster gear	4	SK3275-20
5	Standoff	2	EM1050-59
6	Gasket, cover	1	EM1050-66
7	Cam, upper	1	SK3275-21
8	Plate, terminal block	1	EM1050-61
9	Screw, #6 x 1.5	2	H2706PC
10	Terminal block	1	EM1050-60
11	Screw, 8-32 x 1-1/4"	2	S62-4C
12	Cover	1	EM1050-68
13	Screw, 8-32 x 3/8	2	S62-2C
14	Cam gear	1	SK3275-19
15	Grooved pin, 7/64"	2	S57-12C
16	Switch	2	SK3275-31
17	Cam, lower	1	SK3275-22
18	Pin, 1/8"	1	S51-4C
19	Retainer, 7/64"	2	SK3275-28
20	Screw, #8 x 5/8	2	H2926C
21	Retainer, 1/8"	1	SK3275-37
22	Grommet	1	EM1050-67



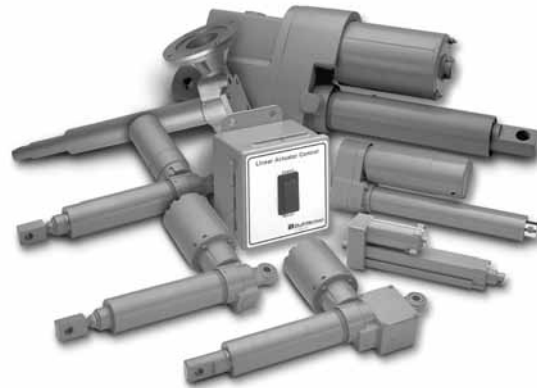
**⚠ WARNING**  
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**Figure 5-2. Limit Switch Exploded Illustration**

## Duff-Norton also Manufactures



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