

March 11, 1980

140-FOOT DEFORMABLE SUBREFLECTOR WITH DUFF-NORTON ACTIVATORS

S. C. Smith

To help overcome the gravitational astigmatism of the 140-foot telescope, the deformable subreflector now has the capabilities to deform the rim of the subreflector by  $\pm 8.00$  mm. The accuracy is better than 5.0%. Nutating and deforming occur simultaneously with no apparent damage.

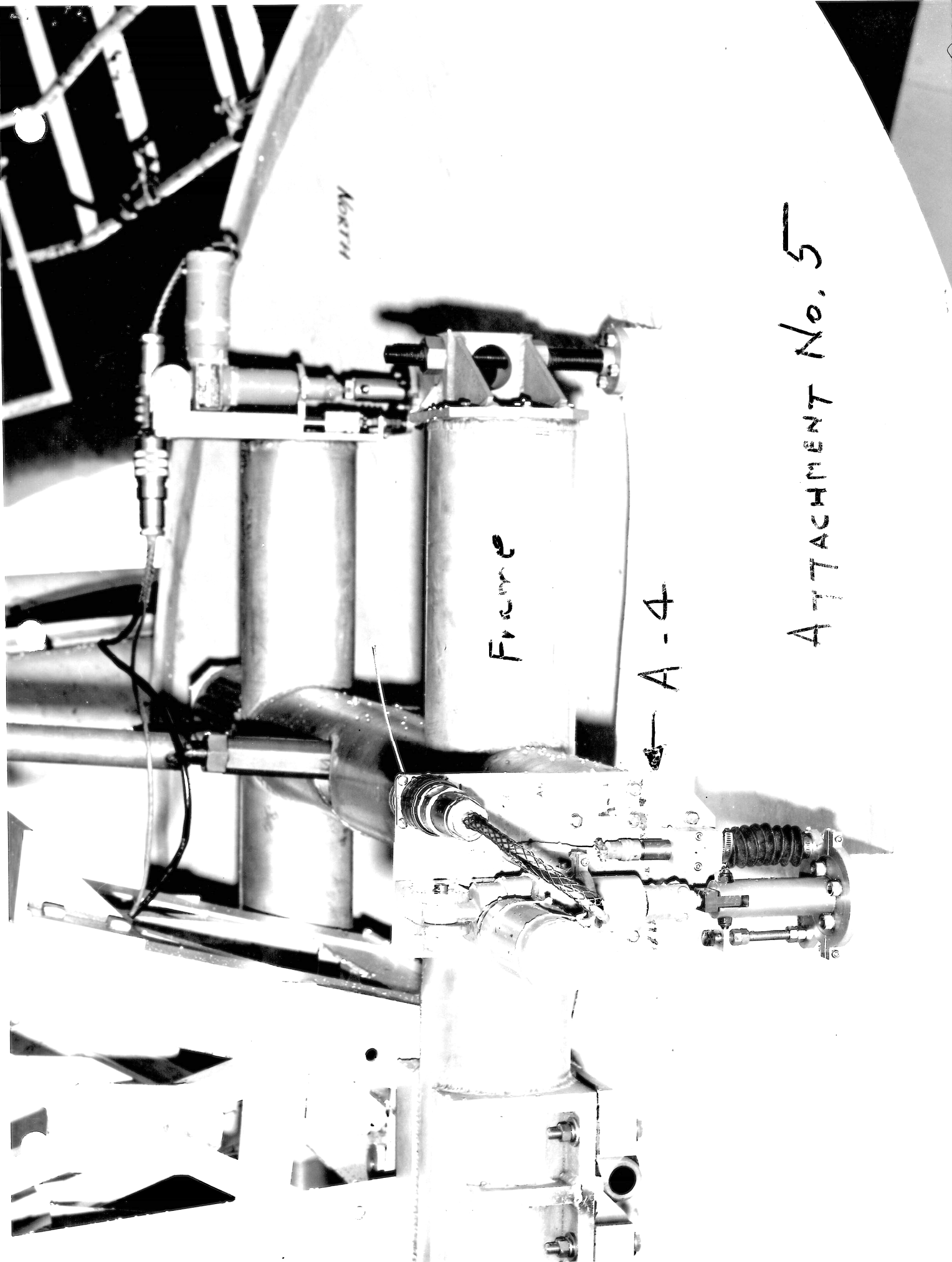
After showing that a deformable subreflector helped the gravitational astigmatism (see Engineering Division Internal Report Nos. 109, 110, Memo 128 and Electronics Division Internal Report No. 193), it was decided to increase the deformable capabilities.

To accomplish this, we first tried to increase the range of the units we had; they did not have the force needed. We then unhooked the power source of one unit and replaced it with a turn buckle and spring scale. We found we needed between 400 and 500 pounds of force to deform the subreflector  $\pm 6$  mm we needed at the lip. Then two redesigns were looked at -- the first around the Duff-Norton Micro-Miniature Jactuator, a light precision unit; the second around a standard Duff-Norton Mini-Pac Mechanical Actuator.

With a prototype we found we could control a Mini-Pac to the 0.2 mm accuracy we needed (see attachment Nos. 1, 2 and 3). As the cost of a Mini-Pac was around \$106.00, we bought 8 of them and put the four with the least backlash on the subreflector. We got the standard D.C. model with a 3.0 inch stroke.

The Mini-Pac was interfaced to the subreflector frame by an aluminum plate shown on NRAO Drawing 30D00025 (see attachment No. 4). We used the same position transducers as before. With a factor of three more travel than needed, no attempt was made to stiffen the subreflector frame. Because of the large motors the controller had to be redesigned (see Electronics Division Internal Report No. \_\_\_<sup>\*</sup>). See attachment No. 5 for over-all view.

\*To be completed in the near future.

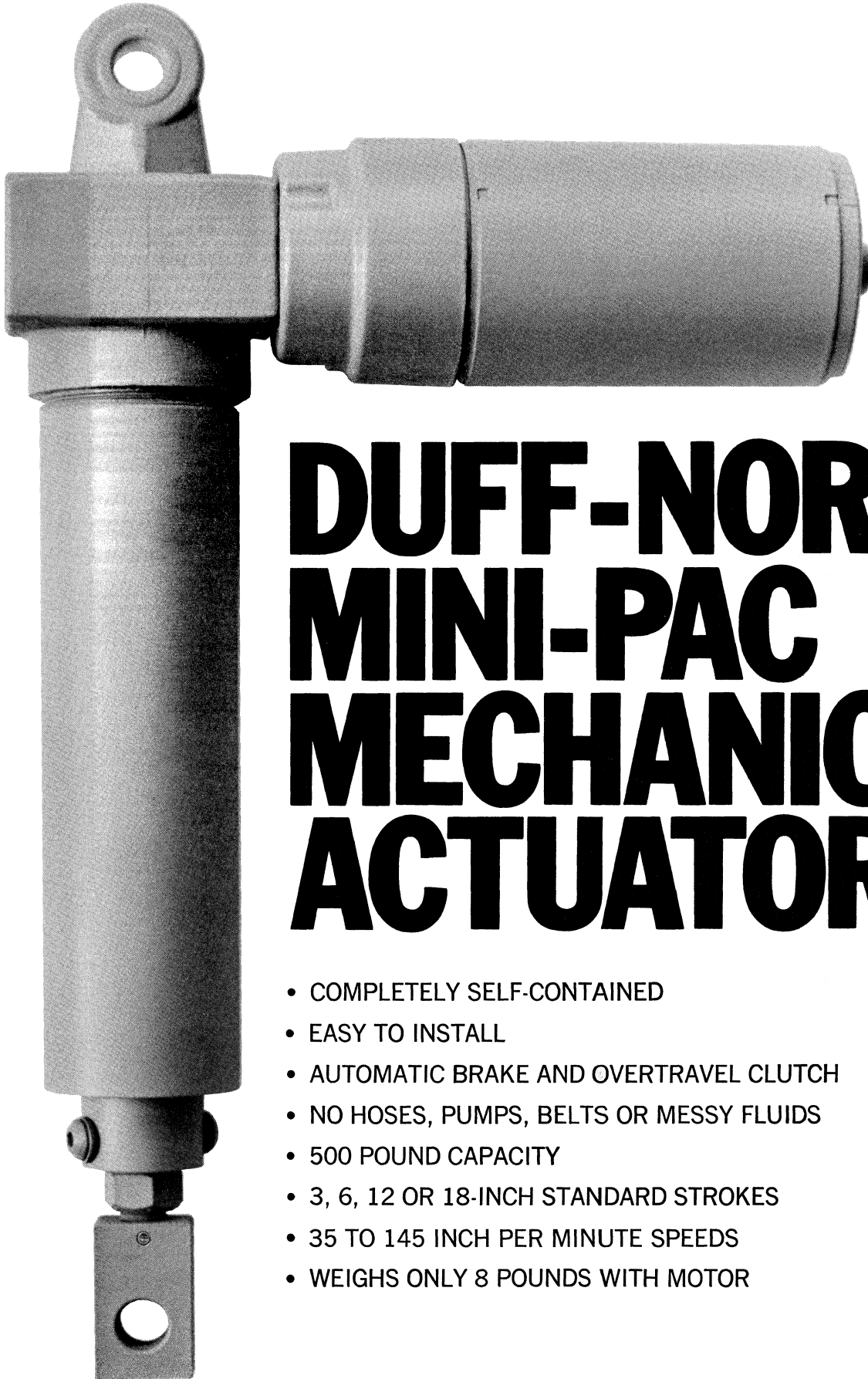


North

Frame

A-4

ATTACHMENT No. 5



# DUFF-NORTON MINI-PAC MECHANICAL ACTUATORS

- COMPLETELY SELF-CONTAINED
- EASY TO INSTALL
- AUTOMATIC BRAKE AND OVERTRAVEL CLUTCH
- NO HOSES, PUMPS, BELTS OR MESSY FLUIDS
- 500 POUND CAPACITY
- 3, 6, 12 OR 18-INCH STANDARD STROKES
- 35 TO 145 INCH PER MINUTE SPEEDS
- WEIGHS ONLY 8 POUNDS WITH MOTOR

**Amstar**  
CORPORATION

ATTACHMENT No. I

# DUFF-NORTON MINI-PAC ACTUATORS

Duff-Norton's Mini-Pac Mechanical Actuator is a completely self-contained, motorized, linear actuator package.

Its compact size, high speed and ease of installation, make it ideally adaptable to a wide variety of power applications. It requires little maintenance.

It can be used indoors or outdoors, for stationary or mobile equipment — wherever there is a requirement for up to 18 inches of linear motion of loads up to 500 pounds at speeds to 145 inches per minute. Speed varies with load and stroke.

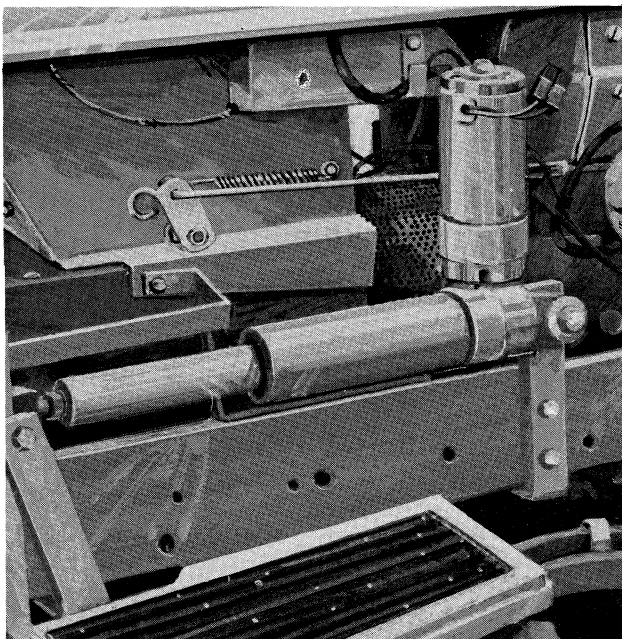
The Mini-Pac package, which weighs about 8 pounds, consists of an enclosed electric motor, an overtravel protector and load limiting friction-disc clutch, a patented automatic set, spring brake, Hypoid gear set, and mechanical screw and nut with steel translating tube and end fitting. All components are sealed in a corrosion-proof, aluminum alloy, die-cast housing with integral pivot mount, ready to be installed. An optional universal pivot mount with threaded insert is available at extra cost.

Installation is fast and simple. Since the Mini-Pac Actuator is a totally electro-mechanical power package, it has no leaky reservoirs, hoses, tubes, fittings, valves, belts, pumps or expensive controls to install or maintain. It needs only to be supported with a single pin, attached to its load with another single pin, and wired to its power source and controls.

Motor may be specified for operation on standard 115 VAC, single phase, 60 Hz (for stationary applications), or on a 12 VDC battery system (for mobile applications).

Since it is electrically powered, the Mini-Pac Actuator lends itself to convenient operation from remote locations such as from another building or from a central control console in the same building or vehicle.

The standard, built-in friction-disc clutch can be set externally to slip at any desired capacity, thereby protecting the actuator and your equipment from excessive shock loads. However, limit switches are recommended to protect the motor.

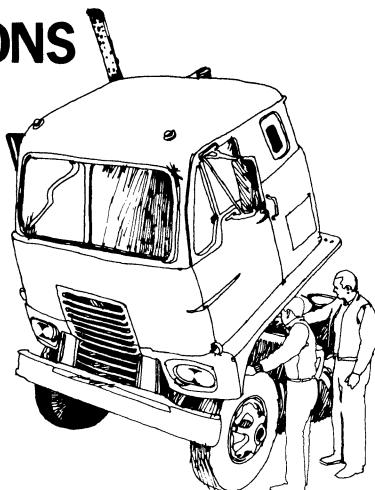


The Mini-Pac Actuator is compact, reliable and easy to install on all types of mobile equipment, either at the factory or in the field. It is ideal for raising and lowering garden tractor implements and accessories.

## TYPICAL APPLICATIONS

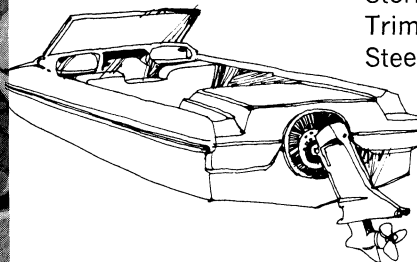
### Vehicles

- Garden tractor implement adjustment
- Hay or cotton baler belt tensioners
- Truck cab tilters
- Bus door openers
- Operator seat adjustment
- Spreader control
- Street sweeper brush positioner



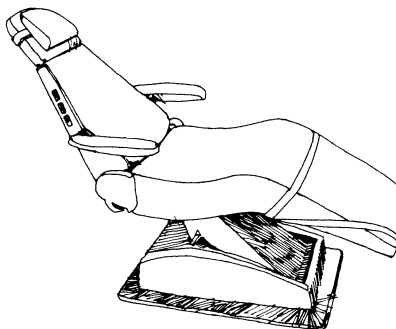
### Boats

- Stern drive or outboard motor tilters
- Trim tab adjustment
- Steering controls



### Industrial

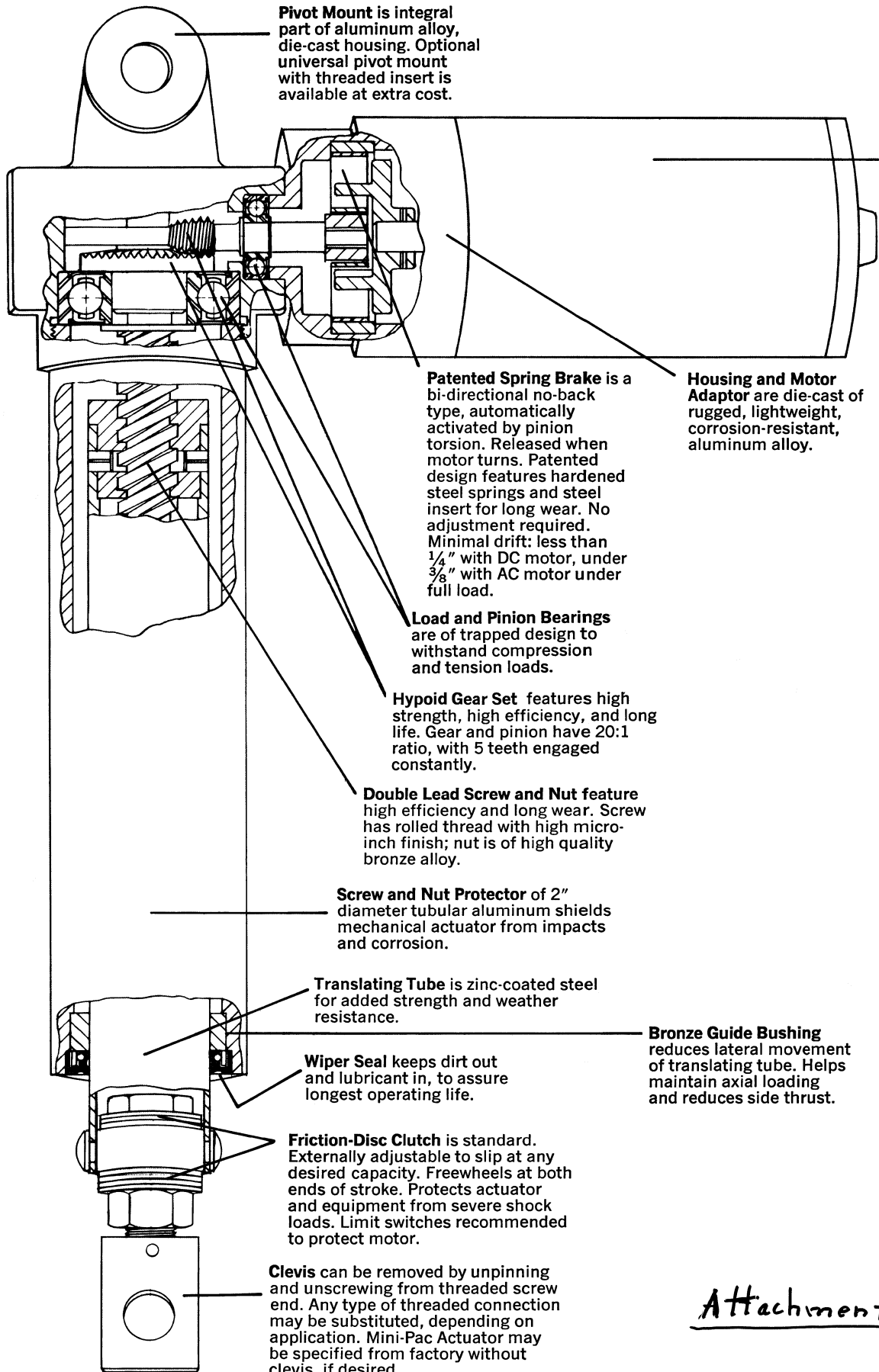
- Valve actuators
- Heating/air conditioning flue and damper actuators
- Break foundry molds
- Position fixtures
- Door openers for laundry extractors, furnaces, incinerators, freezers
- Conveyor height adjustment
- Idler wheel positioning for belt-tension
- Web edge positioning
- Printing press roll adjustment
- Height adjustment for TV cameras
- Tennis racquet stringers
- Feed chute openers
- Small floor crane actuators



### Medical

- Hospital bed adjustment
- Height and position adjustment for examination table
- Tilt X-ray table
- Adjust positions of invalid chair
- Raise and lower dental chair

# PUT POWER IN YOUR DESIGNS



**Pivot Mount** is integral part of aluminum alloy, die-cast housing. Optional universal pivot mount with threaded insert is available at extra cost.

**115 VAC or 12 VDC Motor** may be specified as prime mover. A high speed DC motor is available at extra cost. See data on back page.

**Patented Spring Brake** is a bi-directional no-back type, automatically activated by pinion torsion. Released when motor turns. Patented design features hardened steel springs and steel insert for long wear. No adjustment required. Minimal drift: less than  $\frac{1}{4}$ " with DC motor, under  $\frac{3}{8}$ " with AC motor under full load.

**Housing and Motor Adaptor** are die-cast of rugged, lightweight, corrosion-resistant, aluminum alloy.

**Load and Pinion Bearings** are of trapped design to withstand compression and tension loads.

**Hypoid Gear Set** features high strength, high efficiency, and long life. Gear and pinion have 20:1 ratio, with 5 teeth engaged constantly.

**Double Lead Screw and Nut** feature high efficiency and long wear. Screw has rolled thread with high micro-inch finish; nut is of high quality bronze alloy.

**Screw and Nut Protector** of 2" diameter tubular aluminum shields mechanical actuator from impacts and corrosion.

**Translating Tube** is zinc-coated steel for added strength and weather resistance.

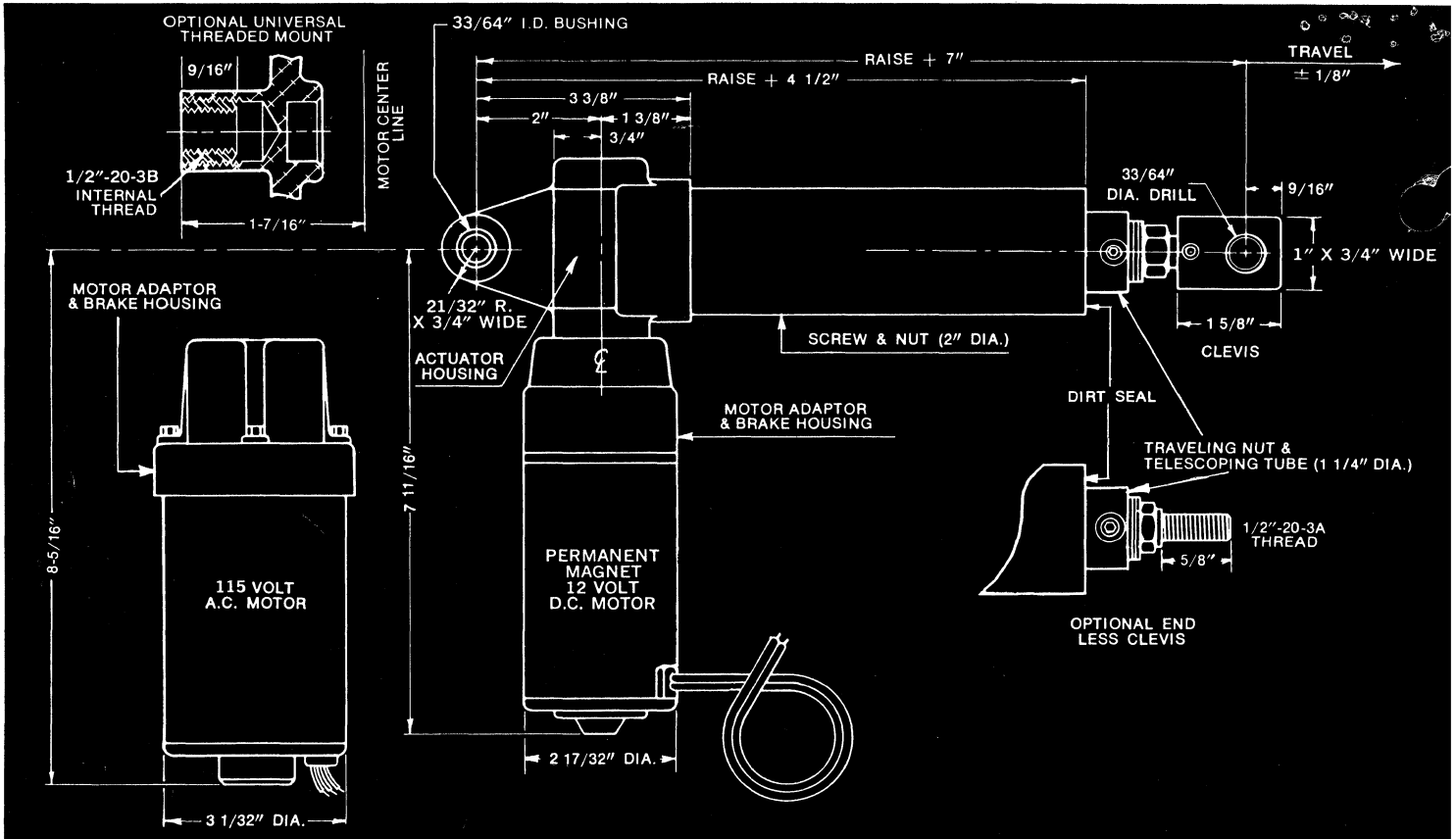
**Bronze Guide Bushing** reduces lateral movement of translating tube. Helps maintain axial loading and reduces side thrust.

**Wiper Seal** keeps dirt out and lubricant in, to assure longest operating life.

**Friction-Disc Clutch** is standard. Externally adjustable to slip at any desired capacity. Freewheels at both ends of stroke. Protects actuator and equipment from severe shock loads. Limit switches recommended to protect motor.

**Clevis** can be removed by unpinning and unscrewing from threaded screw end. Any type of threaded connection may be substituted, depending on application. Mini-Pac Actuator may be specified from factory without clevis, if desired.

Attachment No. 2



**NOTE:** Telescoping tube is not keyed; clevis must be restrained from rotating.

**WITH 115 V. 60 Hz AC MOTOR (MPA-6405)**

Load (Lbs.)	Speed (In./Min.)	Amps
100	42	1.95
200	41	2.00
300	39	2.05
400	37	2.20
500	35	2.30

**WITH 12 V. DC MOTOR**

Load (Lbs.)	Speed (In./Min.)		Amps	
	Standard Motor (MPD-6405)	Optional High Speed Motor (HMPD-6405)	Standard Motor	Optional High Speed Motor
100	68	145	6	21
200	60	132	10	28
300	52	120	13	36
400	42	—	17	—
500	32	—	20	—

**DUTY CYCLE CHART**

Load (Lbs.)	# Duty Cycle—(Inches Per Hour)		
	AC Motor	DC Motor	
	Standard 28-33 mfd. Capacitor	Standard DC Motor	High Speed DC Motor
100	660	2800	1350
200	650	1750	1000
300	630	1050	700
400	620	650	—
500	600	350	—

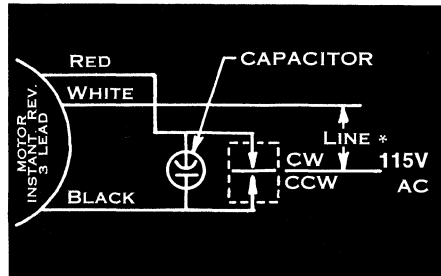
\* Total inches travel (up and down) per hour with equally timed intervals between cycles.

**CONTINUOUS DUTY CHART†**

Load (Lbs.)	AC Motor 28-33 mfd. Capacitor	Standard DC Motor	High Speed DC Motor
100	350 Inches	680 Inches	440 Inches
300	350 Inches	440 Inches	270 Inches
500	350 Inches	200 Inches	—

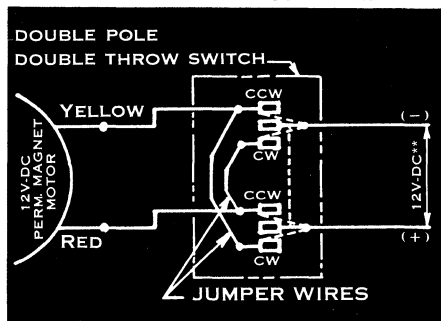
† Total inches travel (up and down) until thermal overload relay cuts out.

The thermal overload relay resets in 10 sec. for std. DC motor; 4 min. for high speed DC motor; 10 min. for AC motor. Both duty charts based on 75°F ambient temperature.



\* Minimum voltage 103.5 CW = Retract CCW = Extend

**115 VAC Motor** is enclosed, permanent split capacitor induction type. Load/no-load speeds are approximately equal. Equipped with thermal overload which opens and resets automatically. Minimum voltage 103 VAC; draws about 2 amps. Requires 28-33 mfd capacitor (supplied by customer or Duff-Norton at additional cost). See wiring diagram.



\*\*20 amps running; 30 amps stall CW = Retract; CCW = Extend

**12 VDC Motor** is totally enclosed, weather-resistant, permanent magnet type. Magnets act as secondary brake for added safety. Smaller, more efficient, cooler running, with higher duty cycle than series-wound designs. Lower current draw for longer battery life. Built-in thermal overload trips after 5-second stall; resets automatically in 10 seconds. Rotation reversible by reversing two color-coded leads; torque-equal in both directions. A high speed DC motor is available at extra cost.



ATTACHMENT No. 3

Duff-Norton Company, P.O. Box 1719, Charlotte, North Carolina 28201 (704) 588-0300  
The Canadian Duff-Norton Co., Ltd., 15 Lockport Avenue, Toronto 540, Ontario (416) 239-3525

