Linear and Rotary Actuators

Catalog

The information presented in this brochure is for informational purposes only. For actual design assistance please contact Andco Actuators or your local representative.

ANDCO LINEAR AND ROTARY ACTUATORS

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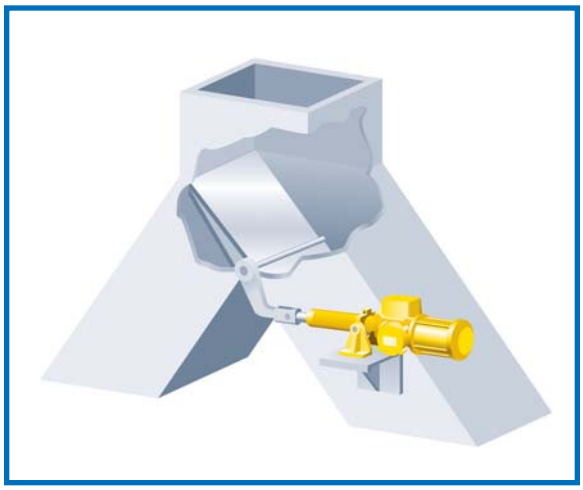
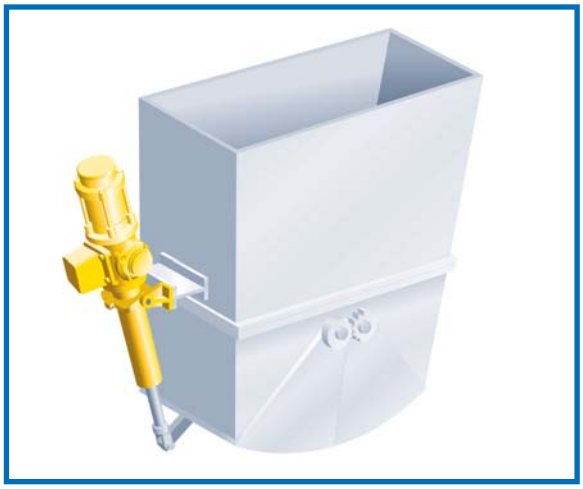
TYPICAL APPLICATIONS



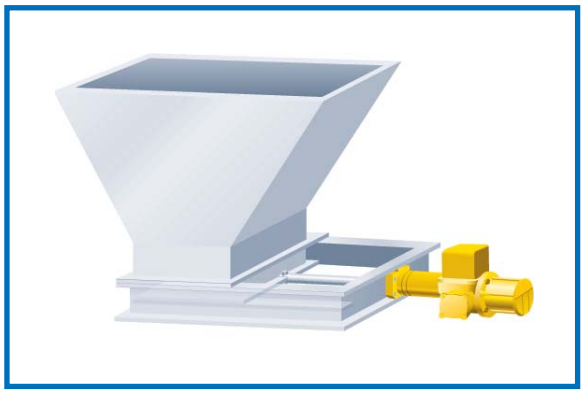
DIVERTER GATE VALVE

- Non-backdriving
- Thrust limit protection
- Accurate positioning



CLAM SHELL GATE

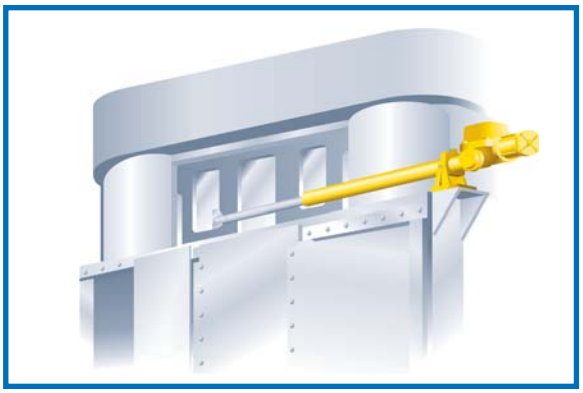
- High breakaway forces
- Positive closing
- Thrust overload protection



SLIDE GATES

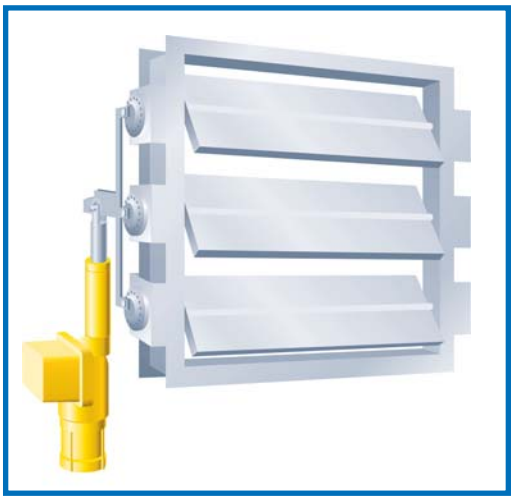
- Slow speeds for regulating flow
- High speeds for weighing and loadout
- Well suited for computer and programmable control

TYPICAL APPLICATIONS



INDUSTRIAL DOORS

- Long strokes
- Low maintenance
- Enclosures suitable for most environments

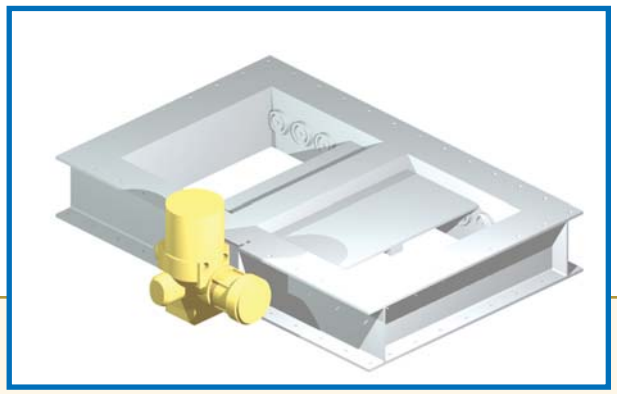


LOUVER DAMPER

- Modulating control
- High seating forces
- Convenient mounting

ANTENNA

- Accurate position feedback
- Slow speed
- Capable of high static loading



RACK AND PINION DRIVE

- High starting torque
- Compact

EAGLE® LINEAR ACTUATORS

FEATURES

- Non-rotating drive rod
- Non-backdriving
- All metal gearing
- Compact with electromechanical repeatability
- Simple to mount; easy to wire
- Comparable cost to pneumatic or hydraulic systems
- Equivalent in size to hydraulic or pneumatic cylinders
- Operating range -40°F to +150°F

Temperature Range

Ambient: -40°F to +150°F

Motor Data

115V, 1Ph, 2.6A*
230V, 3Ph, .52A*
460V, 3Ph, .26A*
575V, 3Ph, .75A*
CSA approval
Class B Insulation
NEMA “D” design

* Full load current (Amps).

STANDARD EQUIPMENT

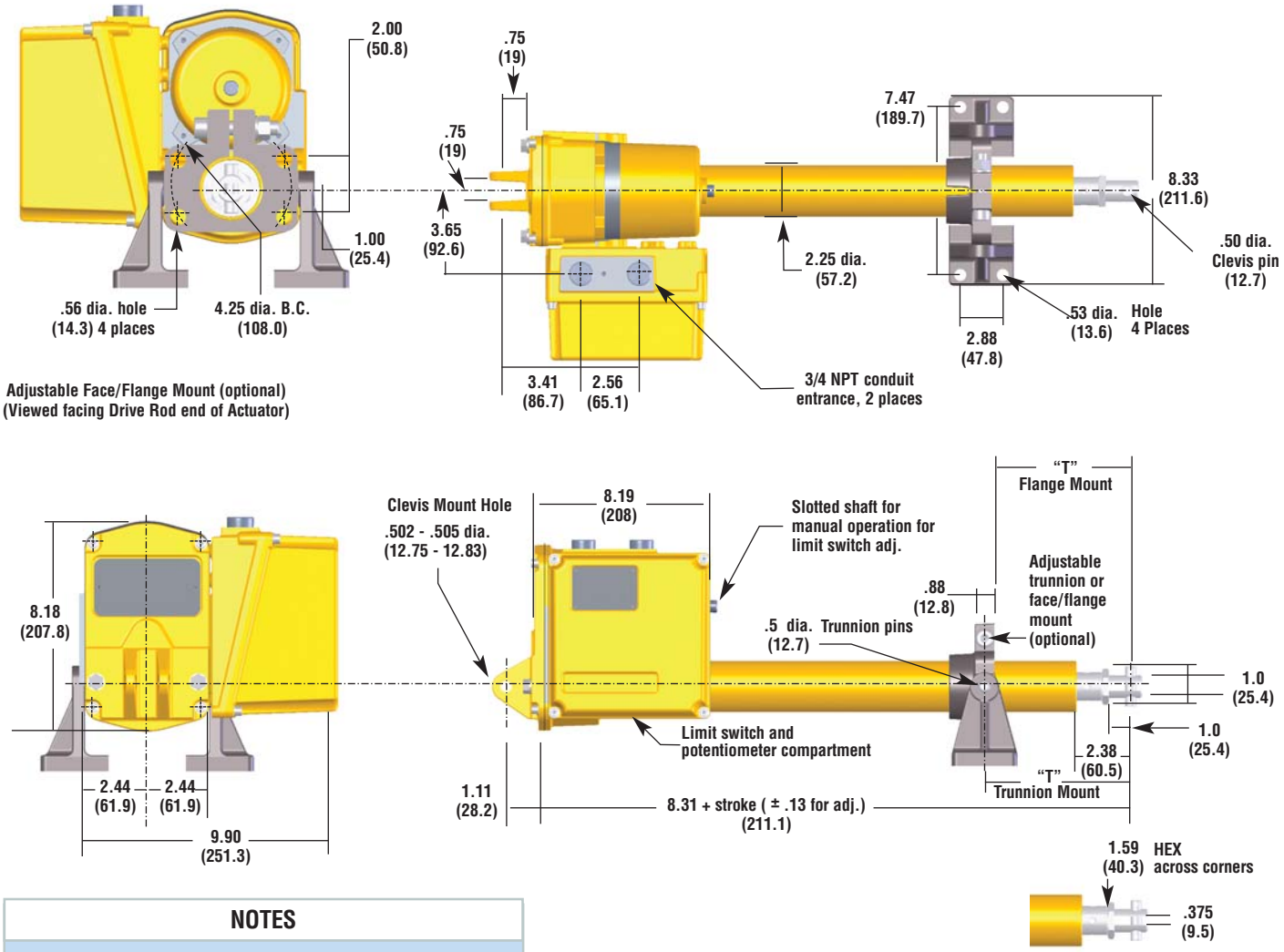
- Thermal switch in motor winding
- Two independently adjustable, gear driven position limit switches with all metal gearing
- Nickel-plated drive rod
- Clevis and pin on drive rod end
- Weatherproof and/or Dust-Ignition proof (Class II, Division 1 & 2, Groups E, F and G) enclosure
- Anti-friction bearings on all drive components
- All metal gearing
- Cast aluminum construction
- Clevis mount on the motor end
- Permanently lubricated for maintenance-free operation
- Heavy duty industrial motor; 115 VAC, 60 Hz, single phase,TENV, permanent split capacitor, high starting torque, low inertia

OPTIONAL EQUIPMENT

- 230 VAC, 460 VAC and 575 VAC, 60 Hz, 3 Phase Motor
- Potentiometer (all metal gear driven)
- Integral position process control board for modulating applications
- 4-20mA Position Transmitter
- Adjustable trunnion mount and trunnion brackets
- Adjustable face/flange mount
- Manual override

EAGLE® LINEAR ACTUATORS

DIMENSIONS



NOTES

1. Unbracketed dimensions are in inches
2. Bracketed dimensions () are in millimeters
3. Dimensions shown with actuator fully retracted

EAGLE ELECTRICAL CYLINDER PERFORMANCE

3100 Series				
Velocity (in./sec.)	Breakaway Force (lbs)	Running Force (lbs. at 5% duty)	Weight Range (lbs.)	Stroke (in.)
0.2	2000	1000	35-75	6, 12
0.4	1500	750		18, 24
0.8	750	340		30 & 36
2.0	500	200		

ADJUSTABLE TRUNNION OR FACE/FLANGE

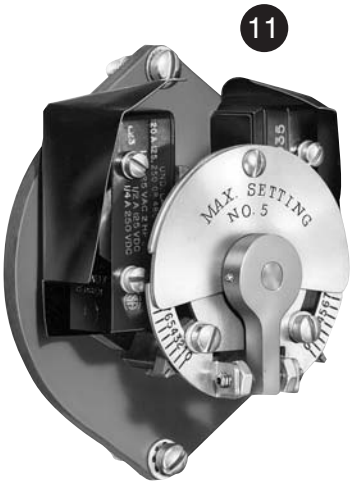
"T" Adjustable Dimension		
Stroke	Inches	Millimeters
6	2.38 - 2.88	(60.45 - 73.15)
12	2.38 - 8.00	(60.45 - 203.20)
18	2.38 - 14.00	(60.45 - 355.60)
24	5.38 - 20.00	(60.45 - 508.00)
30	11.38 - 26.00	(12.85 - 660.40)
36	17.38 - 32.00	(365.25 - 812.80)

7000 SERIES LINEAR ACTUATORS

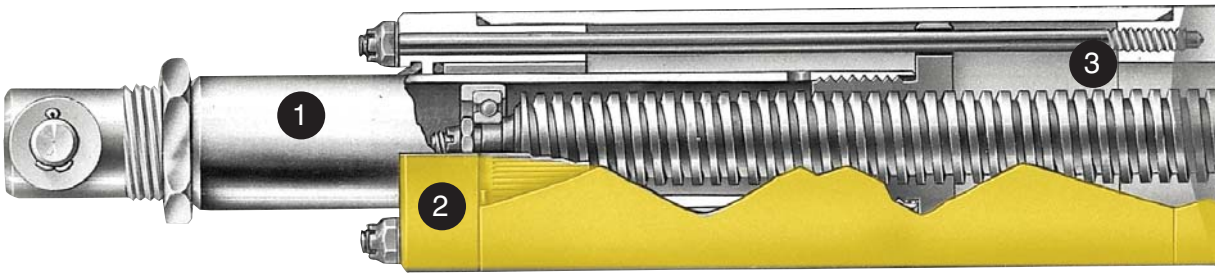
The Andco® 7000 Series linear actuators are completely self-contained, electro-mechanical devices. Designed and fabricated for dependable, long-life operation, these actuators are used for positioning, automation of material handling, or flow control equipment.

7000 Series actuators are driven by a high starting torque, low inertia motor connected to a drive screw through a set of gears. When the motor rotates the drive screw, the mating nut and attached extension rod move axially.

Upon completion of stroke, the gear driven position limit switch interrupts power to the motor. If movement of the extension rod is prevented in either direction at any point in actuator travel due to an external mechanical overload, a thrust switch will interrupt power to the motor.



1. High strength ground and plated extension rod
2. Front end cap with bearing support, rod wiper and grease seal
3. Four tie-rod construction with guided drive nut
4. Thrust limit disc springs and spring limit sleeve to prevent total spring deflection
5. Anti-friction bearings
6. High strength alloy steel cut gears
7. Gear driven potentiometer or encoder drives
8. Heavy duty motor, TENV, NEMA D design, high starting torque, low inertia motor provides high breakaway forces and good positioning characteristics. Class F insulation is standard.
9. Versatile mounting, clevis (7100 only) trunnion or face/flange



10. Adjustable position limit switch. A two position gear driven position limit switch for end-of-travel actuator shutoff and a set of contacts for light indication are included as standard. Each position is independently adjustable and can be set anywhere within the full actuator travel.

    The heavy duty rotary drum, double break switch with wiping contacts feature a patented mechanism that ensures internal gear engagement after adjustment.

11. Adjustable thrust limit switches. An adjustable thrust switch for each direction of travel is provided as standard. The switch assembly will automatically shut off the actuator if the set force is exceeded. The switch protects driven equipment from damage due to excessive forces and can also be used as a mechanism for positive seating.

OTHER FEATURES

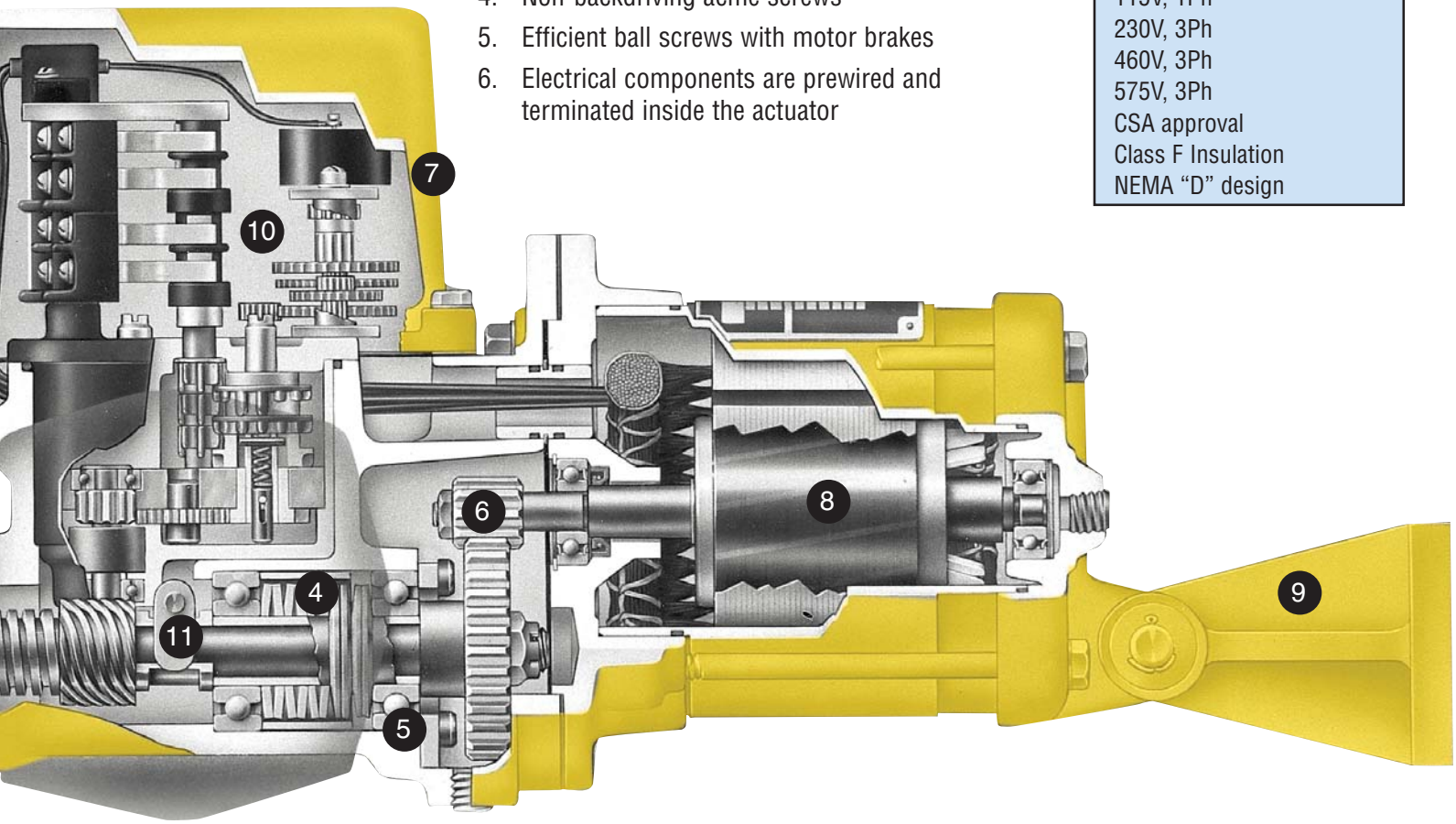
1. Weatherproof or dust-ignition proof construction
2. Plated external hardware
3. Permanently lubricated
4. Non-backdriving acme screws
5. Efficient ball screws with motor brakes
6. Electrical components are prewired and terminated inside the actuator

Temperature Range

Ambient: -30°F to +120°F

Motor Data

115V, 1Ph
230V, 3Ph
460V, 3Ph
575V, 3Ph
CSA approval
Class F Insulation
NEMA “D” design



7000 SERIES LINEAR ACTUATORS

7000 SERIES ACME SCREW LINEAR ACTUATORS

Model	Velocity (in./sec.)	Breakway Thrust Rating (lbs.)	Running Thrust Rating (lbs.)			Stroke Range (ins.)	Approx. Weight Range (lbs.)
			5% Duty	10% Duty	25% Duty		
7102S (1-Phase)	0.8	975	450	330	130	6-24	50-80
	1.1	750	325	240	95		
	2.0	410	175	135	50		
	2.8	290	125	90	35		
7105T	1.1	2,100	650	240	95	6-24	45-80
	2.0	1,225	350	135	50		
	2.8	875	250	90	35		
7202S (1-Phase)	1.1	750	330	330	260	6-36	55-100
	1.5	460	240	240	180		
	2.8	300	130	130	100		
	4.0	215	90	90	70		
7205T	1.5	1,700	480	460	–	6-36	50-100
	2.8	900	260	255	–		
	4.0	650	185	180	–		
7210T	1.5	2,100	1,000	–	–	6-36	50-100
	2.8	1,815	510	–	–		
	4.0	1,300	370	–	–		
7310T	1.4	2,530	1,100	1,050	525	6-60	85-185
	2.1	1,750	700	700	350		
	3.2	1,130	455	455	225		
7317T	2.1	4,220	1,300	1,300	–	6-60	100-200
	3.2	2,750	850	520	–		
7324T	2.0	5,900	1,750	–	–	6-60	100-200
	3.2	3,800	1,250	–	–		
74-7330T	2.8	5,200	2,850	–	–	6-60	120-240
	3.6	4,000	2,200	–	–		

7000 SERIES ACME SCREW LINEAR ACTUATORS WITH GEARBOX ASSEMBLY

Model	Velocity (in./sec.)	Breakway Thrust Rating (lbs.)	Running Thrust Rating (lbs.)			Stroke Range (ins.)	Approx. Weight Range (lbs.)
			5% Duty	10% Duty	25% Duty		
7202S (1-Phase)	0.2	2,100	1,100	1,100	1,100	6-36	65-110
7205T	0.5	2,100	1,100	1,100	1,100	6-36	65-110
7302S (1-Phase)	0.2	4,560	1,845	1,845	1,845	6-60	95-190
	0.4	2,130	920	920	920		
	0.7	1,130	490	490	490		
7305T	0.4	6,200	1,795	1,795	1,795	6-48	90-160
7324T	1.1	7,000	3,075	–	–	6-48	115-205
74-7330T	1.5	7,000	5,100	–	–	6-60	130-250

7000 SERIES LINEAR ACTUATORS

7300 SERIES BALL SCREW LINEAR ACTUATORS

Model	Velocity (in./sec.)	Breakaway Thrust Rating (lbs.)	Running Thrust Rating (lbs.)				Stroke Range (ins.)	Approx. Weight Range (lbs.)
			5% Duty	20% Duty	40% Duty	60% Duty		
7302S (1-Phase)	1.4	1,990	670	670	670	670	6-48	110-190
	2.1	1,370	460	460	460	460		
	3.2	890	300	300	300	300		
	4.2	690	230	230	230	230		
	6.4	450	150	150	150	150		
	12.2	240	80	80	80	80		
7310T	1.4	7,000	2,680	2,680	2,680	2,680	6-48	110-190
	2.1	5,780	1,850	1,850	1,850	1,850		
	4.2	2,900	920	920	920	920		
	6.4	1,875	600	600	600	600		
	12.2	940	320	320	320	320		
7317T	2.1	7,000	3,230	2,700	2,150	1,800	6-48	110-210
	4.2	7,000	1,610	1,610	1,610	1,610		
	6.4	4,550	1,050	1,050	1,050	1,050		
	12.2	2,400	550	550	550	550		
7324T	4.2	7,000	3,400	2,300	–	–	6-48	120-260
	6.4	6,600	2,200	1,500	–	–		
	12.2	3,400	1,150	790	–	–		

7400 SERIES BALL SCREW LINEAR ACTUATORS

Model	Velocity (in./sec.)	Breakaway Thrust Rating (lbs.)	Running Thrust Rating (lbs.)			Stroke Range (ins.)	Approx. Weight Range (lbs.)
			5% Duty	10% Duty	25% Duty		
7430T	4.2	12,000	5,100	4,900	4,700	12-60	135-350
7450T	5.5	16,000	7,000	6,100	4,900	12-60	125-375

7500 SERIES BALL SCREW LINEAR ACTUATORS

Model	Velocity (in./sec.)	Breakaway Thrust Rating (lbs.)	Running Thrust Rating (lbs.)			Stroke Range (ins.)	Approx. Weight Range (lbs.)
			5% Duty	10% Duty	25% Duty		
7530T	2.0	24,000	12,000	11,000	10,000	12-60	275-575
7550T	2.0	42,000	20,000	16,000	12,500	12-60	275-625

NOTES

1. The suffix S in the model number indicates a 115 VAC, single phase motor. 220 VAC, single phase is optional.
2. The suffix T in the model number indicates a 230 or 460 VAC, 60 cycle three phase. 380 VAC, 50 cycle and 575 VAC, 60 cycle are optional
3. Strokes are available in 6 inch increments up to 36 inches and 12 inch increments up to 60 inches.
4. All stroke lengths can be adjusted downward with the position limit switch.
5. Actuators with greater force and nonstandard strokes and velocities quoted upon request.
6. The information contained herein is in effect at the time of printing and the company reserves the right to make changes.

7000 SERIES ACME SCREW LINEAR ACTUATORS

Model	6" Stroke		12" Stroke		18" Stroke		24" Stroke		30" Stroke		36" Stroke		48" Stroke		60" Stroke	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
7102S	26.32	18.14	32.32	24.14	38.32	30.14	44.32	36.14	–	–	–	–	–	–	–	–
7105T	25.32	18.14	31.32	24.14	37.32	30.14	43.32	36.14	–	–	–	–	–	–	–	–
7202S	26.17	18.58	32.17	24.58	38.17	30.58	44.17	36.58	50.17	42.58	56.17	48.58	–	–	–	–
7205T	25.17	18.58	31.17	24.58	37.17	30.58	43.17	36.58	49.17	42.58	55.17	48.58	–	–	–	–
7210T	26.17	18.58	32.17	24.58	38.17	30.58	44.17	36.58	50.17	42.58	56.17	48.58	–	–	–	–
7310T	32.45	24.88	38.45	30.88	44.45	36.88	50.45	42.88	56.45	48.88	62.45	54.88	74.45	66.88	86.45	78.88
7317T	32.88	24.88	38.88	30.88	44.88	36.88	50.88	42.88	56.88	48.88	62.88	54.88	74.88	66.88	86.88	78.88
7324T	33.82	24.88	39.82	30.88	45.82	36.88	51.82	42.88	57.82	48.88	63.82	54.88	75.82	66.88	87.82	78.88
74-7330T	39.30	29.36	45.30	35.36	51.30	41.36	57.30	47.36	63.30	53.36	69.30	59.36	81.30	71.36	93.30	83.36

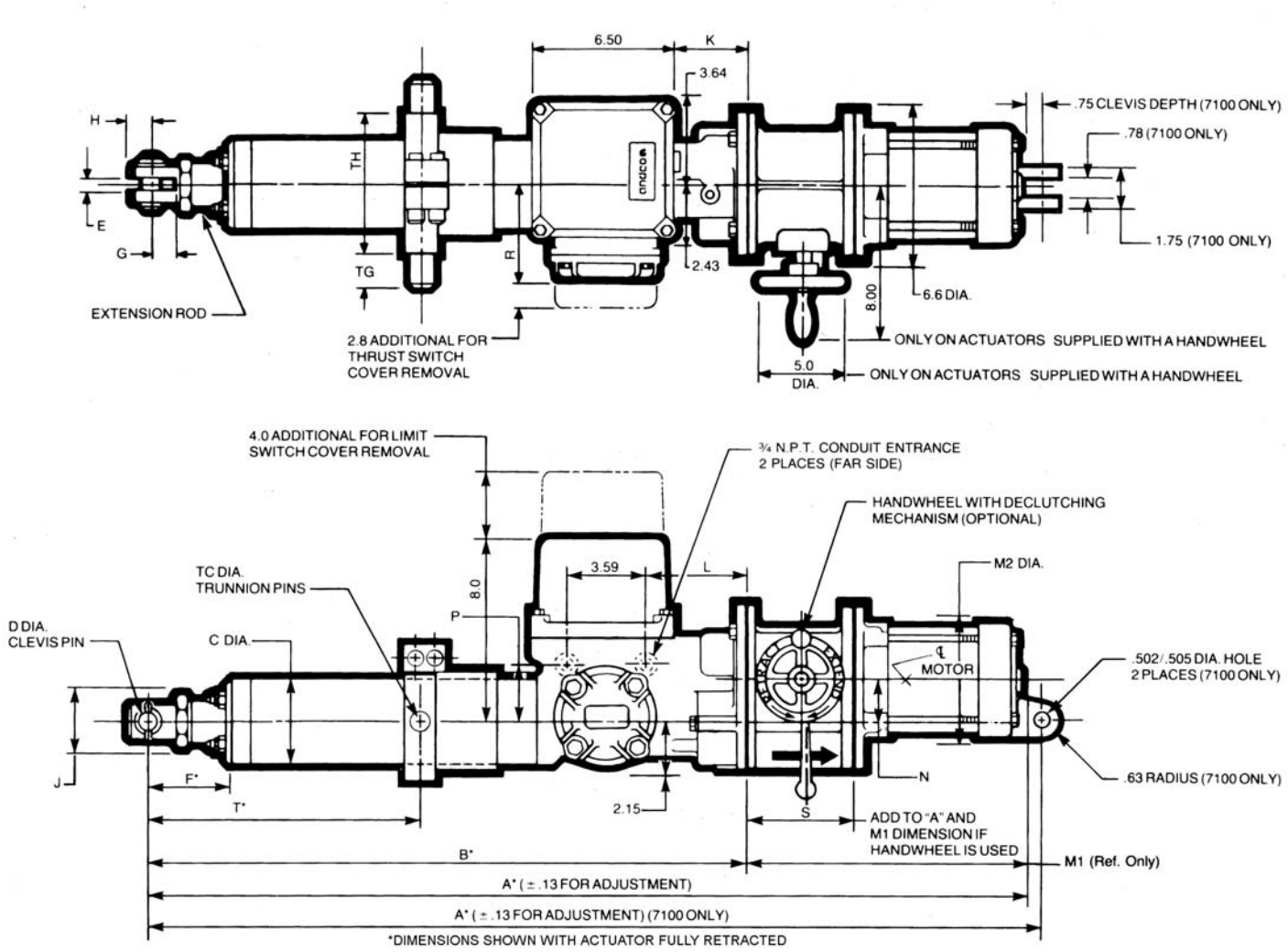
Model	C	D	E	F	G	H	J	K	L	M1	M2	N	P	R	S
7102S	2.50	.375	.38	2.53	1.00	.38	1.63	0.94	2.32	8.18	6.00	1.60	2.65	3.60	4.68
7105T										7.18					
7202S	2.75	.500	.50	2.40	1.00	.50	1.63	0.94	2.32	7.59	6.00	1.60	2.65	3.60	4.68
7205T										6.59					
7210T										7.59					
7310T	3.88	.750	.63	4.32	1.13	.75	2.25	3.29	4.72	7.57	6.00	2.00	2.82	4.19	5.18
7317T										8.00	6.86				
7324T										8.94	6.86				
74-7330T	4.38	1.25	1.26	6.13	2.00	1.25	3.25	3.29	4.72	9.94	6.86	2.00	2.82	4.19	5.18

7000 SERIES ACME SCREW LINEAR ACTUATORS WITH GEARBOX ASSEMBLY

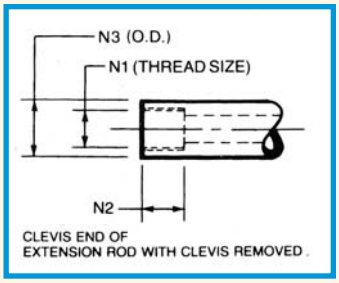
Model	6" Stroke		12" Stroke		18" Stroke		24" Stroke		30" Stroke		36" Stroke		48" Stroke		60" Stroke	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
7102S	30.88	18.58	36.88	24.58	42.88	30.58	48.88	36.58	54.88	42.58	60.88	48.58	–	–	–	–
7205T	29.88	18.58	35.88	24.58	41.88	30.58	47.88	36.58	53.88	42.58	59.88	48.58	–	–	–	–
7302S	37.63	24.88	43.63	30.88	49.63	36.88	55.63	42.88	61.63	48.88	67.63	54.88	79.63	66.88	91.63	78.88
7305T	36.63	24.88	42.63	30.88	48.63	36.88	54.63	42.88	60.63	48.88	66.63	54.88	78.63	66.88	90.63	78.88
74-7330T	53.20	29.36	59.20	35.36	65.20	41.36	71.20	47.36	77.20	53.36	83.20	59.36	95.20	71.36	107.20	83.36

7000 SERIES LINEAR ACTUATORS

7000 SERIES ACME SCREW LINEAR ACTUATORS



Series	N1	N2	N3
7100	1"-20UN	1.00	1.187
7200	1-1/4"-20UN	1.12	1.433
7300	1-5/8"-16UN	1.18	1.860
74-7300	1-1/8"-16UN	2.06	2.350



Model	C	D	E	F	G	H	J	K	L	M1	M2	N	P	R	S
7102S	2.75	.50	.50	2.50	1.00	.50	1.63	.94	2.32	12.30	6.00	1.60	2.65	3.60	4.68
7205T										11.30					
7302S	3.88	.75	.63	4.32	1.13	.75	2.25	3.29	4.72	12.75	6.00	2.00	2.82	4.19	5.18
7305T										11.75	6.00				
74-7330T	4.38	1.25	1.26	6.13	2.00	1.25	3.25	3.29	4.72			2.00	2.82	4.19	5.50

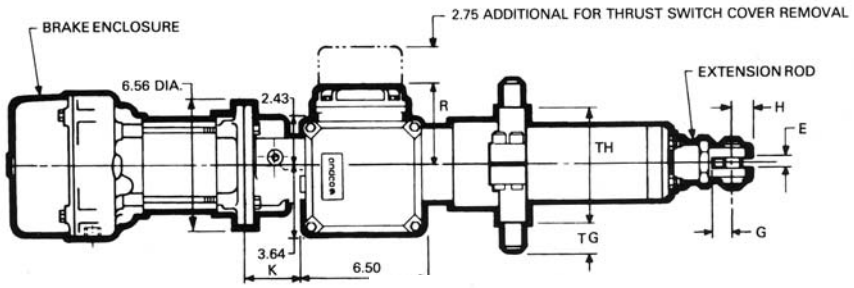
NOTES

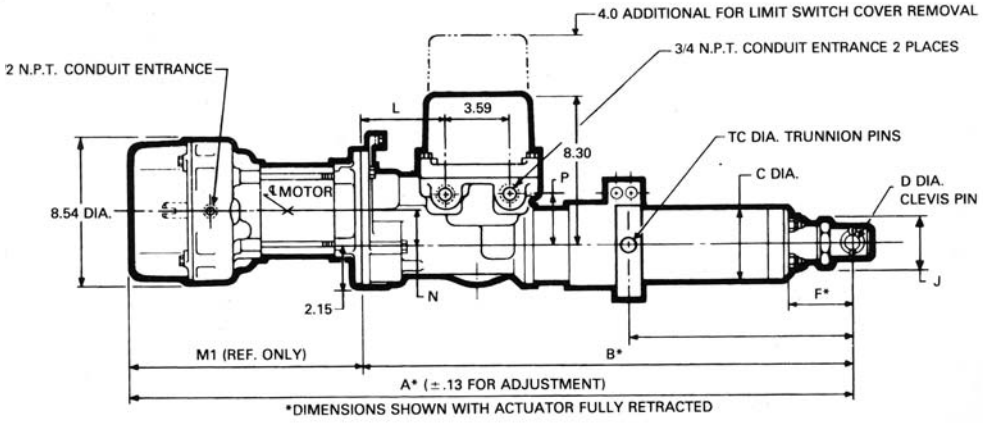
For trunnion, clevis, and face flange mount dimensions see pages 14 and 15. Dimensions are for reference only. Contact Andco for certified drawings.

7000 SERIES BALL SCREW LINEAR ACTUATORS

Model	6" Stroke		12" Stroke		18" Stroke		24" Stroke		30" Stroke		36" Stroke		48" Stroke		60" Stroke	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
7302S	40.50	27.70	46.50	33.70	52.50	39.70	58.50	45.70	64.50	51.70	70.50	57.70	82.50	69.70	-	-
7310T	40.50	27.70	46.50	33.70	52.50	39.70	58.50	45.70	64.50	51.70	70.50	57.70	82.50	69.70	-	-
7317T	40.83	27.70	46.83	33.70	52.83	39.70	58.83	45.70	64.83	51.70	70.83	57.70	82.83	69.70	-	-
7324T	41.70	27.70	47.70	33.70	53.70	39.70	59.70	45.70	65.70	51.70	71.70	57.70	83.70	69.70	-	-
7430T	–	–	65.10	50.10	71.10	56.10	77.10	62.10	–	–	89.10	74.10	101.10	86.10	113.10	98.10
7450T	–	–	68.50	50.10	74.50	56.10	80.50	62.10	–	–	92.50	74.10	104.50	86.10	116.50	98.10
7530T	–	–	82.40	58.60	88.40	64.60	94.40	70.60	–	–	106.40	74.10	118.40	86.10	130.40	98.10
7550T	–	–	82.40	58.60	87.80	64.60	93.80	70.60	–	–	105.80	74.10	117.80	86.10	129.80	98.10

Model	C	D	E	F	G	H	J	K	L	M1	N	P	R	TC	TG	TH
7302S	3.88	0.750	0.63	4.00	1.13	0.75	2.25	3.29	4.72	12.80	2.00	2.82	4.19	0.875	1.19	6.50
7310T										12.80						
7317T										13.13						
7324T										14.00						
7430T	4.38	1.250	1.26	6.13	2.00	1.25	3.25	3.29	4.72	15.00	2.00	2.82	4.19	1.000	1.50	7.50
7450T										18.40						
7530T	6.50	1.500	1.54	5.75	2.38	1.75	4.56	3.29	4.72	23.80	2.00	2.82	4.19	1.750	2.50	10.00
7550T										23.20						





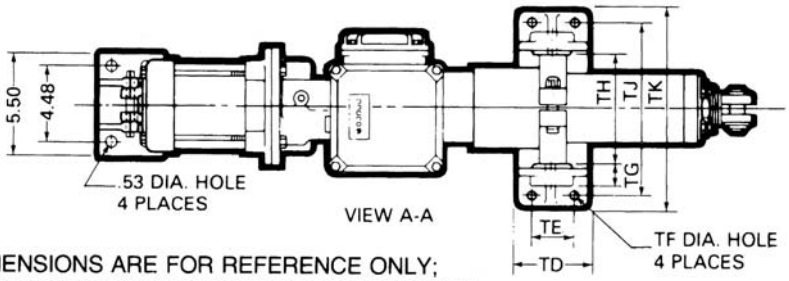
Series	N1	N2	N3
7200	1-1/4"-20UN	1.12	1.43
7300	1-5/8"-16UN	1.18	1.86
7400	2-1/8"-16UN	2.06	2.35
7500	2-1/2"-16UN	2.75	3.00

NOTES

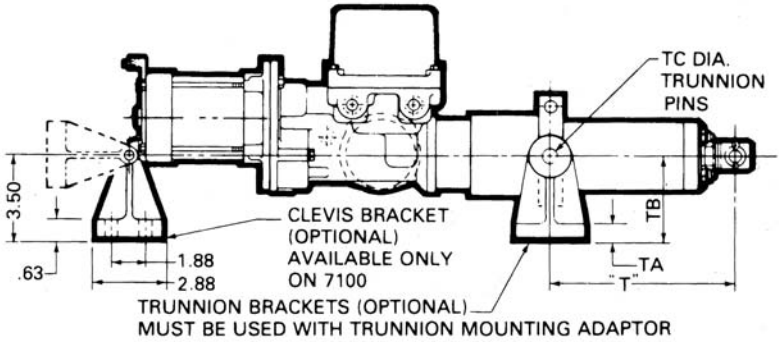
For trunnion, clevis, and face flange mount dimensions see pages 14 and 15. Dimensions are for reference only. Contact Andco for certified drawings.

7000 SERIES LINEAR ACTUATORS

TRUNNION AND CLEVIS MOUNTING



DIMENSIONS ARE FOR REFERENCE ONLY;
CONTACT ANDCO FOR CERTIFIED DRAWINGS



TRUNNION MOUNTING

Series	TA	TB	TC	TD	TE	TF	TG	TH	TJ	TK
7100-A	0.63	3.50	0.50	4.00	1.88	0.53	0.75	4.75	7.47	9.25
7200-A	0.63	3.50	0.50	4.00	1.88	0.53	0.75	4.75	7.47	9.25
7300-A	0.75	4.66	0.87	7.56	5.50	0.66	1.19	6.50	9.50	11.25
74-7300-A	0.75	4.66	1.00	7.56	5.50	0.66	1.43	7.50	10.50	12.25
7300-B	0.75	4.66	0.87	7.56	5.50	0.66	1.19	6.50	9.50	11.25
7400-B	0.75	4.66	1.00	7.56	5.50	0.66	1.50	7.50	10.50	12.25
7500-B	1.50	6.00	1.75	8.50	6.00	1.06	2.50	10.00	14.50	17.00

"T" (SHOWN WITH ACTUATOR FULLY RETRACTED)

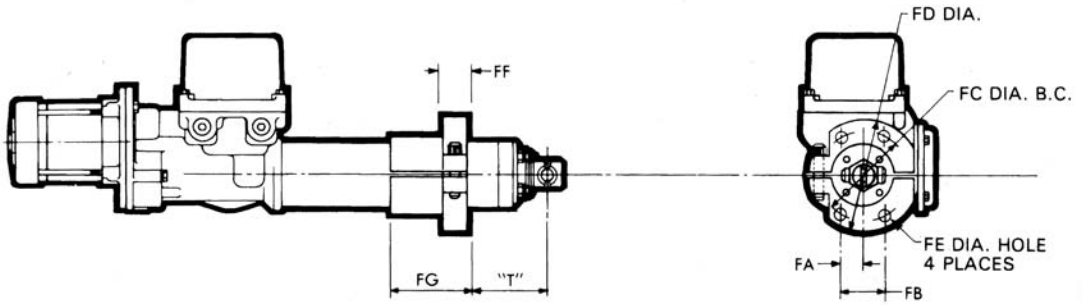
Series	6" Stroke		12" Stroke		18" Stroke		24" Stroke		30" Stroke		36" Stroke		48" Stroke		60" Stroke	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
7100-A	6.63	7.63	11.63	13.63	16.63	19.63	19.63	25.63	–	–	–	–	–	–	–	–
7200-A	6.63	7.63	11.63	13.63	16.63	19.63	19.63	25.63	25.63	31.63	31.63	37.63	–	–	–	–
7300-A	10.00	11.50	13.50	17.50	17.00	23.50	21.00	29.50	26.00	35.50	32.00	42.50	38.00	53.50	44.00	65.50
74-7300-A	12.00	14.25	17.00	20.25	20.00	26.25	23.00	32.25	26.00	38.25	32.00	44.25	38.00	56.25	44.00	68.25
7300-B	13.00	14.00	18.00	20.00	21.00	26.00	24.00	32.00	28.00	38.00	32.00	44.00	40.00	56.00	–	–
7400-B	–		33.62		39.62		45.62		–		57.62		69.62		81.62	
7500-B	–		36.44		42.44		48.44		–		60.44		72.44		84.44	

NOTES

1. An adjustable trunnion mount is standard on 7200, 7300, and 74-7300 Series actuators (optional on 7100 and 7400 Series).
   For 7400 Series ball screw actuators with an adjustable trunnion mount use "T" dimension from the 7400 flange mount table.
   Fixed location trunnion pins are standard on 7400 and 7500 Series actuators.
2. Trunnion brackets are optional on all models.
3. Actuators supplied with adjustable trunnion mounting are set at the maximum dimension unless otherwise specified.

FACE/FLANGE MOUNTING

DIMENSIONS ARE FOR REFERENCE ONLY; CONTACT ANDCO FOR CERTIFIED DRAWINGS



FACE/FLANGE MOUNTING

Series	FA	FB	FC	FD	FE	FF	FG
7100-A	1.00	2.00	4.25	5.50	0.56	1.00	4.00
7200-A	1.00	2.00	4.25	5.50	0.56	1.00	4.00
7300-A	1.50	3.00	5.75	7.00	0.69	1.38	4.00
74-7300-A	2.25	4.50	6.50	8.00	0.81	1.00	5.00
7300-B	1.50	3.00	5.75	7.00	0.69	1.38	4.00
7400-B	2.30	4.60	6.50	8.00	0.81	1.00	5.00

"T" (SHOWN WITH ACTUATOR FULLY RETRACTED)

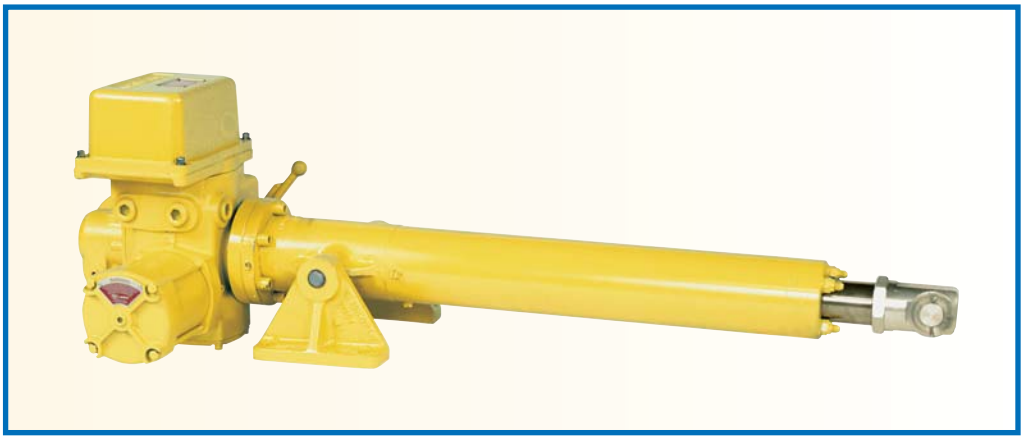
Series	6" Stroke		12" Stroke		18" Stroke		24" Stroke		30" Stroke		36" Stroke		48" Stroke		60" Stroke	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
7100-A	3.32	6.75	3.32	12.75	6.63	18.75	12.63	24.75	–	–	–	–	–	–	–	–
7200-A	3.32	6.75	3.32	12.75	6.63	18.75	12.63	24.75	18.63	30.75	24.63	36.75	–	–	–	–
7300-A	10.00	11.00	16.00	17.00	22.00	23.00	28.00	29.00	34.00	35.00	40.00	41.00	52.00	53.00	64.00	65.00
74-7300-A	11.00	13.25	17.00	19.25	23.00	25.25	29.00	31.25	35.00	37.25	41.00	43.25	53.00	55.25	65.00	67.25
7300-B	12.00	13.50	18.00	19.50	24.00	25.58	30.00	31.50	36.00	37.58	42.00	43.50	54.00	55.50	–	–
7400-B	–	–	20.00	24.00	25.00	30.00	30.00	36.00	–		38.00	43.00	40.00	46.00	43.00	50.00

NOTES

1. Face/flange actuator may be rotated 90° from arrangement shown.
2. Face/flange location is set at maximum dimension unless otherwise specified.

8000 SERIES LINEAR ACTUATORS

ELECTRIC LINEAR ACTUATORS



The Andco® Series 8000 Linear Actuator is a completely self-contained electro-mechanical device, designed and fabricated for dependable long life operation.

The Series 8000 is driven by a high-starting torque motor connected to a drive screw through gearing. When the motor rotates the drive screw, the mating drive nut and attached extension rod move axially. The gear-driven position limit switch interrupts power to the motor upon completion of stroke. If during actuator travel some external obstacle prevents the extension rod from moving, the thrust limit switch will interrupt power to the motor.

The 8400 and 8500 Series Actuators contain an additional spring assembly to protect the actuator drive components from shock loads. When compressed, the inherent spring load will provide automatic compensation for wear, temperature change, or material compression.

8000 SERIES LINEAR ACTUATORS

SERIES 8200 ACME SCREW LINEAR ACTUATORS

Velocity in/sec	Actuator Thrust Rating (lbs.)				Stroke Range (ins.)	Approx. Weight Range (lbs.)
	Model 8202S		Model 8205T			
	Running	Breakaway	Running	Breakaway		
0.06	2000	4000	–	–	0 - 36	60 - 120
0.12	1800	2500	–	–		
0.18	1200	1700	2000	4000		
0.36	700	1100	1800	3275		

SERIES 8300 ACME SCREW LINEAR ACTUATORS

Velocity in/sec	Actuator Thrust Rating (lbs.)						Stroke Range (ins.)	Approx. Weight Range (lbs.)
	Model 8302S		Model 8305T		Model 8310T			
	Running	Breakaway	Running	Breakaway	Running	Breakaway		
0.23	975	1375	2450	4100	3000	7000	0 - 60	90 - 200
0.50	–	–	1425	3000	2625	5700		
0.80	–	–	900	1750	1650	3300		

SERIES 8400 ACME SCREW LINEAR ACTUATORS

Velocity in/sec	Actuator Thrust Rating (lbs.)				Stroke Range (ins.)	Approx. Weight Range (lbs.)
	Model 8417T		Model 8424T			
	Running	Breakaway	Running	Breakaway		
0.3	5075	10,275	10,000	13,500	0 - 60	120 - 250
0.6	3000	6,600	5,900	9,300		

SERIES 8300 BALL SCREW LINEAR ACTUATORS*

Velocity in/sec	Actuator Thrust Rating (lbs.)						Stroke Range (ins.)	Approx. Weight Range (lbs.)
	Model 8302S		Model 8305T		Model 8310T			
	Running	Breakaway	Running	Breakaway	Running	Breakaway		
0.9	650	1125	1600	3400	2900	6400	0 - 48	110 - 200
1.6	–	–	1000	2000	1875	3750		

SERIES 8400 BALL SCREW LINEAR ACTUATORS*

Velocity in/sec	Actuator Thrust Rating (lbs.)						Stroke Range (ins.)	Approx. Weight Range (lbs.)
	Model 8410T		Model 8417T		Model 8424T			
	Running	Breakaway	Running	Breakaway	Running	Breakaway		
0.23	11,000	16,000	–	–	–	–	0 - 60	125 - 275
0.5	5,500	12,000	9,200	16,000	–	–		
1.0	–	–	5,400	13,300	10,700	16,000		

* Actuator has motor brake as standard.

8000 SERIES LINEAR ACTUATORS

SERIES 8500 BALL SCREW LINEAR ACTUATORS

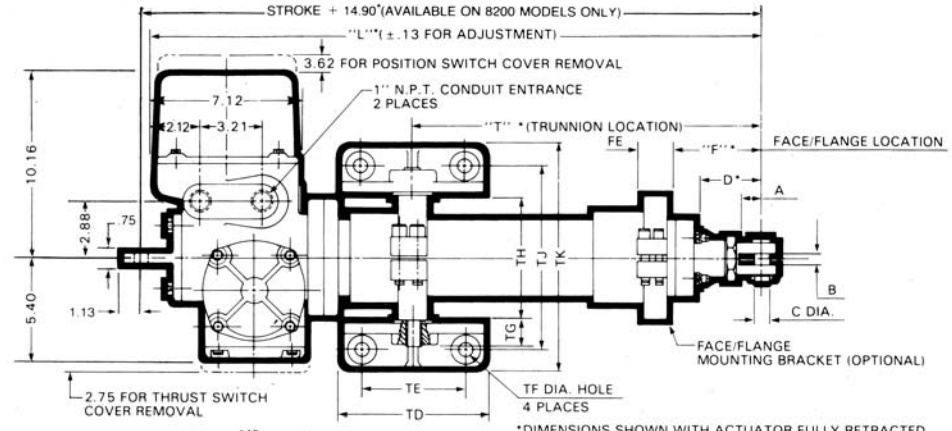
Velocity in/sec	Actuator Thrust Rating (lbs.)				Stroke Range (ins.)	Approx. Weight Range (lbs.)
	Model 8517T		Model 8524T			
	Running	Breakaway	Running	Breakaway		
0.50	9,200	20,600	18,300	27,000	0 - 60	225 - 575
1.0*	–	–	10,700	18,600		
1.9*	–	–	5,350	9,300		

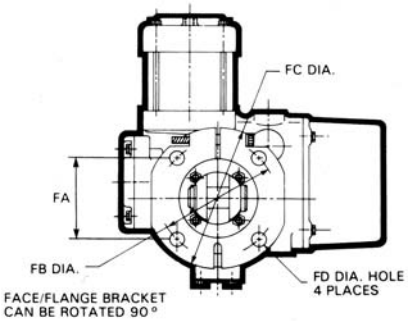
SERIES 8500 BALL SCREW LINEAR ACTUATORS WITH GEARBOX

Velocity in/sec	Actuator Thrust Rating (lbs.)						Stroke Range (ins.)	Approx. Weight Range (lbs.)
	Model 8510T		Model 8517T		Model 8524T			
	Running	Breakaway	Running	Breakaway	Running	Breakaway		
0.09	25,100	51,000	41,000	80,000	–	–	0 - 60	275 - 625
0.15	–	–	24,500	51,000	50,000	70,000		
0.3	–	–	12,300	25,800	25,000	35,000		

* Actuator has motor brake as standard.

STANDARD MODELS 8200, 8300, 8400 AND 8500 LINEAR ACTUATORS





NOTES

1. Models 8202S and 8302S are 115 VAC, single phase. All other models are 230/460 VAC, 60HZ, 3 phase.
2. All units are furnished with two adjustable thrust limit switches and a two position, one contact per position gear-driven position limit switch as standard equipment.
3. Strokes are available in 6 inch increments up to 36 inches and 12 inch increments up to 60 inches.
4. Running forces are based on 5% duty cycle.
5. Do not use actuators above their rated duty cycles without consulting factory.

SERIES 8000 POSI TORK ACTUATORS

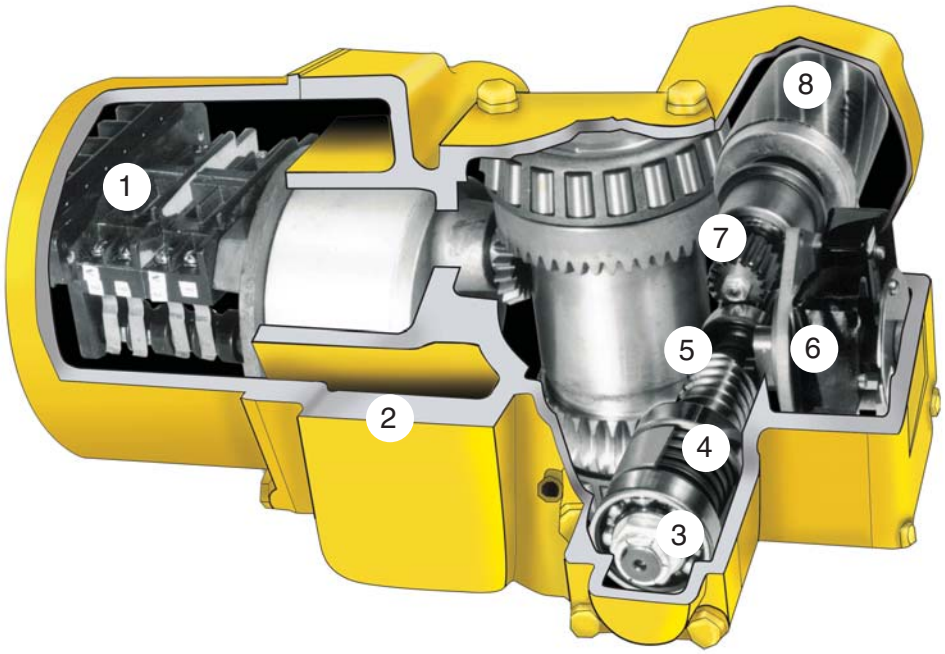
MODEL	DRIVE TYPE	A	B	C	D	E	M1	M2	FA	FB	FC	FD	FE	TA	TB	TC	TD	TE	TF	TG	TH	TJ	TK	STROKE	"L"	"F"		"T"	
																										MIN.	MAX.	MIN.	MAX.
8202S	ACME SCREW	1.00	0.50	.500	2.50	2.75	11.06	6.00	2.00	4.25	5.50	0.56	1.00	0.75	4.66	0.50	7.56	5.50	0.66	0.75	4.75	7.75	9.50	6	20.1	5.50	6.50	5.50	6.50
																								12	26.1	10.50	12.50	10.50	12.50
8202T							8.50																	18	32.1	15.50	18.50	15.50	18.50
8203T							10.06																	24	38.1	18.00	22.00	18.00	22.00
8205T							10.06																	30	44.1	20.00	25.00	20.00	25.00
																								36	50.1	22.00	28.00	22.00	28.00
8302S	ACME SCREW	1.13	0.63	.750	4.32	3.88	11.06	6.00	3.00	5.75	7.00	0.69	1.38	0.75	4.66	.875	7.56	5.50	0.66	1.19	6.50	9.50	11.25	6	24.2	9.50	10.50	9.50	10.50
																								12	30.2	14.50	16.50	14.50	16.50
8303T							10.06																	18	36.2	19.00	22.00	19.00	22.00
8305T							10.06																	24	42.2	21.00	25.00	21.00	25.00
																								30	48.2	23.00	28.00	23.00	28.00
8310T							11.06																	36	54.2	25.00	31.00	25.00	31.00
																								48	66.2	29.00	37.00	29.00	37.00
																								60	78.2	33.00	43.00	33.00	43.00
8302S	BALL SCREW	1.13	0.63	.750	4.00	3.88	11.06	6.00	3.00	5.75	7.00	0.69	1.38	0.75	4.66	.875	7.56	5.50	0.66	1.19	6.50	9.50	11.25	6	27.0	12.00	13.00	12.00	13.00
																								12	33.0	17.00	19.00	17.00	19.00
8303T							10.06																	18	39.0	22.00	25.00	22.00	25.00
8305T							10.06																	24	45.0	25.00	29.00	25.00	29.00
																								30	51.0	27.00	32.00	27.00	32.00
8310T							11.06																	36	57.0	29.00	35.00	29.00	35.00
																								48	69.0	33.00	41.00	33.00	41.00
8417T	ACME SCREW	2.00	1.26	1.250	6.13	4.38	12.58	6.86	4.60	6.50	8.00	0.81	1.00	0.75	4.66	1.000	7.56	5.50	0.66	1.43	7.50	10.50	12.25	6	36.1	12.00	13.00	22.12	22.12
																								12	42.1	17.00	19.00	28.12	28.12
																								18	48.1	22.00	25.00	34.12	34.12
8424T							13.52																	24	54.1	24.00	28.00	40.12	40.12
																								30	60.1	26.00	31.00	26.00	31.00
																								36	66.1	28.00	34.00	28.00	34.00
																								48	78.1	32.00	40.00	32.00	40.00
																								60	90.1	36.00	46.00	36.00	46.00
8410T	BALL SCREW	2.00	1.26	1.250	6.13	4.38	11.06	6.00	4.60	6.50	8.00	0.81	1.00	0.75	4.66	1.000	7.56	5.50	0.66	1.43	7.50	10.50	12.25	6	41.6	15.00	16.00	27.62	27.62
																								12	47.6	20.00	22.00	33.62	33.62
8417T							12.58	6.86																18	53.6	25.00	28.00	39.62	39.62
																								24	59.6	28.00	32.00	45.62	45.62
																								30	65.6	30.00	35.00	30.00	35.00
8424T							13.52	6.86																36	71.6	32.00	38.00	32.00	38.00
																								48	83.6	36.00	44.00	36.00	44.00
																								60	95.6	40.00	50.00	40.00	50.00
8517T	BALL SCREW	2.38	1.54	1.500	5.75	6.50	12.58	6.86	—	—	—	—	—	1.50	6.00	1.750	8.50	6.00	1.06	2.50	10.00	14.50	17.00	6	50.5	—	—	30.44	30.44
																								12	56.5	—	—	36.44	36.44
																								18	62.5	—	—	42.44	42.44
8524T							13.52	6.86																24	68.5	—	—	48.44	48.44
																								30	74.5	—	—	54.44	54.44
																								36	80.5	—	—	60.44	60.44
																								48	92.5	—	—	72.44	72.44
																								60	104.5	—	—	84.44	84.44
8510T	BALL SCREW with GEAR BOX	2.38	1.54	1.500	5.75	6.50	11.06	6.00	—	—	—	—	—	1.50	6.00	1.750	8.50	6.00	1.06	2.50	10.00	14.50	17.00	6	56.5	—	—	30.44	30.44
																								12	62.5	—	—	36.44	36.44
																								18	68.5	—	—	42.44	42.44
8517T							12.58	6.86																24	74.5	—	—	48.44	48.44
																								30	80.5	—	—	54.44	54.44
																								36	86.5	—	—	60.44	60.44
																								48	98.5	—	—	72.44	72.44
8524T							13.52	6.86																60	110.5	—	—	84.44	84.44

QR & QRG SERIES ROTARY

ELECTRIC ROTARY ACTUATORS

The QR Series Posi-Tork® Rotary Actuators are completely self-contained, electric mechanical devices. Designed and fabricated for dependable, long-life operation, these actuators are used for positioning, automation of material handling or flow control equipment. Series QR Posi-Tork® Actuators are driven by a high-starting torque, low inertia motor. The motor rotates the output drive sleeve through a worm gear set and single reduction spur gearing.

Upon completion of travel, the gear driven position limit switch interrupts power to the motor. If during actuator travel, some external obstacle prevents movement, the torque limit switch will interrupt power to the motor.

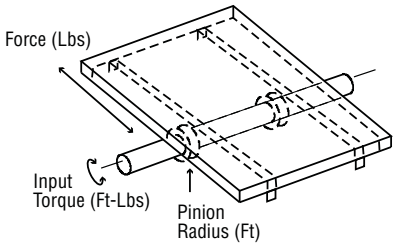


1. Adjustable Position Limit Switch. A two position gear driven limit switch for end of travel actuator shut-off is included as standard. Each position is independently adjustable and can be set anywhere within the full actuator travel. The heavy duty rotary drum, double break switch with wiping contacts, features a patented mechanism that ensures internal gear engagement after adjustment.
2. Weatherproof and/or Dust-ignition proof (Class II, Division 1 & 2, Groups E, F and G).
3. Anti-friction bearings throughout, including the output drive sleeve.
4. Torque limit disc springs and spring limit sleeve to prevent total spring deflection.
5. Non-backdriving high strength worm gear set.
6. Adjustable Torque Limit Switch. An adjustable torque switch for each direction of travel is provided as standard. The switch assembly will automatically shut-off the actuator if the set torque is exceeded. The switch protects driven equipment from damage due to excessive torque and can also be used as a mechanism for positive seating.
7. High strength alloy steel cut gears.
8. Heavy duty motor, TENV, NEMA D design, high-starting torque, low-inertia motor provides high breakaway torque and good positioning characteristics. Class F insulation is standard.

Other features:

- Plated external hardware.
- Permanently lubricated.
- Electrical components prewired and terminated inside actuator.

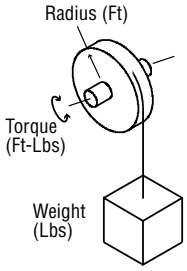
GENERAL APPLICATIONS



Linear Velocity (In/Sec) = $\left(\frac{\text{Input RPM}}{60}\right) \times \left(\frac{\text{Pinion Dia.}}{\text{(In.)} \times 3.14}\right)$

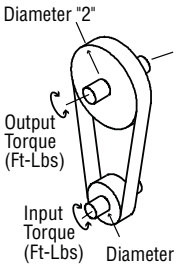
Force = $\frac{\text{Input Torque x (0.9 Efficiency)}}{\text{Pinion Radius}}$

Input Torque = Force x (Pinion Radius/0.9 Efficiency)



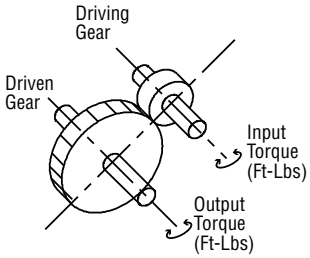
Torque (Running) = Radius x Weight

(Actuator selection must be based on running torque for constant load applications)



Output Torque = Input Torque x $\left(\frac{\text{Dia."2"}}{\text{Dia."1"}}\right)$

Output RPM = Input RPM x $\left(\frac{\text{Dia."1"}}{\text{Dia."2"}}\right)$



Output Torque = Input Torque x $\left(\frac{\text{N.G.}}{\text{N.P.}}\right)$

N.G. = No. of Teeth on Driven Gear

N.P. = No. of Teeth on Driving Pinion

The above formulas are intended as a guide.They neglect any effects of friction of bearings, belts, chains, or gears. For specific application assistance or for our application brochure, contact Andco Actuators.

RACK AND PINION FORCE — TORQUE CONVERSIONS

Force (lbs.)	Approximate Torque Required (ft.-lbs.)					
	2.0 Inch Dia Pinion	2.5 Inch Dia Pinion	3.0 Inch Dia Pinion	3.5 Inch Dia Pinion	4.0 Inch Dia Pinion	4.5 Inch Dia Pinion
50	5	6	7	8	10	11
100	10	12	14	16	19	21
250	23	29	35	41	47	53
500	46	58	70	81	93	105
1000	93	116	140	162	186	209
1500	139	174	208	243	278	313
2000	185	232	278	325	371	417
2500	—	290	348	405	463	521
3000	—	—	417	487	556	625
3500	—	—	—	568	649	730
4000	—	—	—	—	741	834
4500	—	—	—	—	834	—

Above torques are calculated assuming a 10% friction loss between the rack and pinion.

LINEAR SPEEDS FOR RACK AND PINION GATES

Actuator Output RPM	Gate Velocity (Inches/ Second)					
	2.0 Inch Dia Pinion	2.5 Inch Dia Pinion	3.0 Inch Dia Pinion	3.5 Inch Dia Pinion	4.0 Inch Dia Pinion	4.5 Inch Dia Pinion
2.2	—	—	0.35	0.40	0.46	0.52
3.4	—	0.45	0.53	0.62	0.71	0.80
4.8	0.50	0.63	0.76	0.88	1.01	1.13
6.5	0.68	0.85	1.02	1.19	1.36	1.53
10.5	—	—	—	1.92	2.20	2.47
11	1.15	1.44	1.73	2.02	2.30	2.59
17	1.78	2.23	2.67	3.12	3.56	4.00
18	—	—	—	3.30	3.77	4.24
24	2.51	3.14	3.77	4.40	5.03	5.66
34	3.56	4.45	5.34	6.23	—	—
54	5.66	—	—	—	—	—

QR & QRG SERIES ROTARY

SERIES QR ROTARY ACTUATORS (MAXIMUM BORE 1-1/4" DIA. X 1/4" KEYWAY)

Output Speed (RPM)	Max* Output Rev.	Actuator Output Torque Rating (ft.-lbs.)									
		Model QR2-25S		Model QR2-05T		Model QR2-10T		Model QR2-17T		Model QR2-24T	
		B.A.	Run	B.A.	Run	B.A.	Run	B.A.	Run	B.A.	Run
11	80	80	38	—	—	—	—	—	—	—	—
17	80	55	26	—	—	—	—	—	—	—	—
24	80	40	19	110	48	225	67	—	—	—	—
34	80	30	15	80	36	160	62	225	62	—	—
54	80	17	10	50	24	95	44	—	—	—	—
58	80	—	—	—	—	—	—	160	50	225	50

B.A.— Breakaway Torque; Run — Running (Constant Load) Torque.

SERIES QRG ROTARY ACTUATORS (MAXIMUM BORE 1-3/4" DIA. X 3/8"KEYWAY)

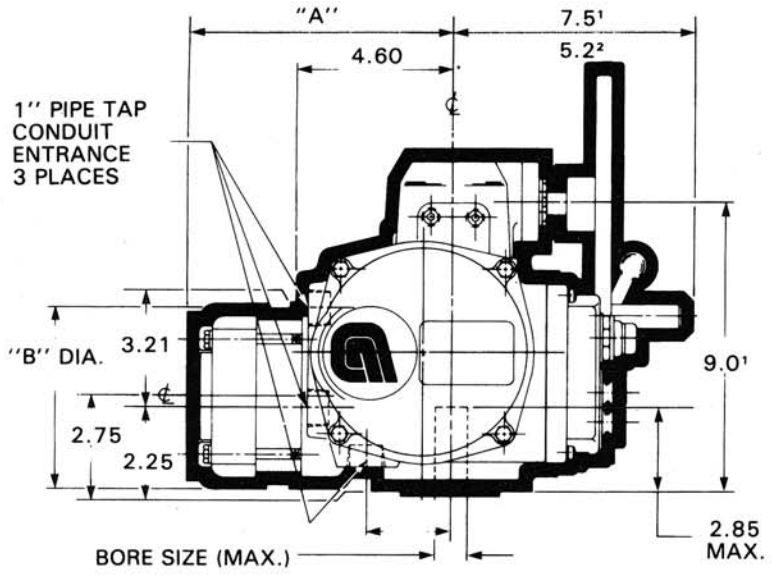
Output Speed (RPM)	Max* Output Rev.	Actuator Output Torque Rating (ft-lbs.)									
		Model QRG2-25S		Model QRG2-05T		Model QRG2-10T		Model QRG2-17T		Model QRG2-24T	
		B.A.	Run	B.A.	Run	B.A.	Run	B.A.	Run	B.A.	Run
2.2	15	350	175	—	—	—	—	—	—	—	—
3.4	15	240	120	—	—	—	—	—	—	—	—
4.8	15	175	85	475	220	850	305	—	—	—	—
6.5	15	—	—	345	165	690	280	850	280	—	—
10.5	25	—	—	—	—	430	175	600	175	—	—
18.0	25	—	—	—	—	—	—	—	—	600	144

B.A.— Breakaway Torque; Run — Running (Constant Load) Torque.
*Consult factory for applications exceeding maximum output revolutions listed.

NOTES

1. Actuator Weight Ranges (approximately):
   Series QR2: 75-90 lbs.
   Series QRG2: 95-115 lbs.
2. Actuator Models QR2-25S and QRG2-25S are 115 VAC, 60 Hz, 1 Ph.
   All other models are 230/460 or 575 VAC, 60 Hz, 3 Ph. For 50 Hz applications consult factory.
3. Running torque is listed at 25% maximum duty.

QR2 SERIES STANDARD WITH OPTIONAL HANDWHEEL

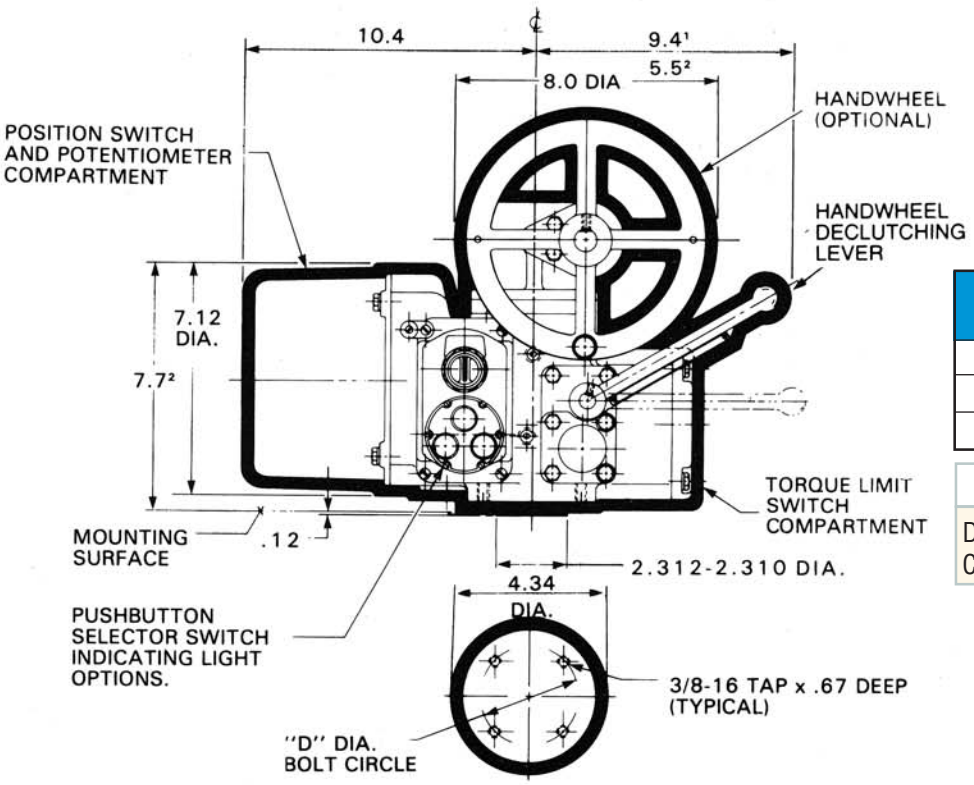


Model No.	"A"	"B"	"D"
QR2-25S	11.06	6.00	3.50
QR2-05T	10.06	6.00	3.50

QR 2 MODELS—1-1/4" DIA. x 1/4" KEYWAY

¹DIMENSIONS APPLY TO ACTUATORS WITH HANDWHEELS

²DIMENSIONS APPLY TO ACTUATORS WITHOUT HANDWHEELS

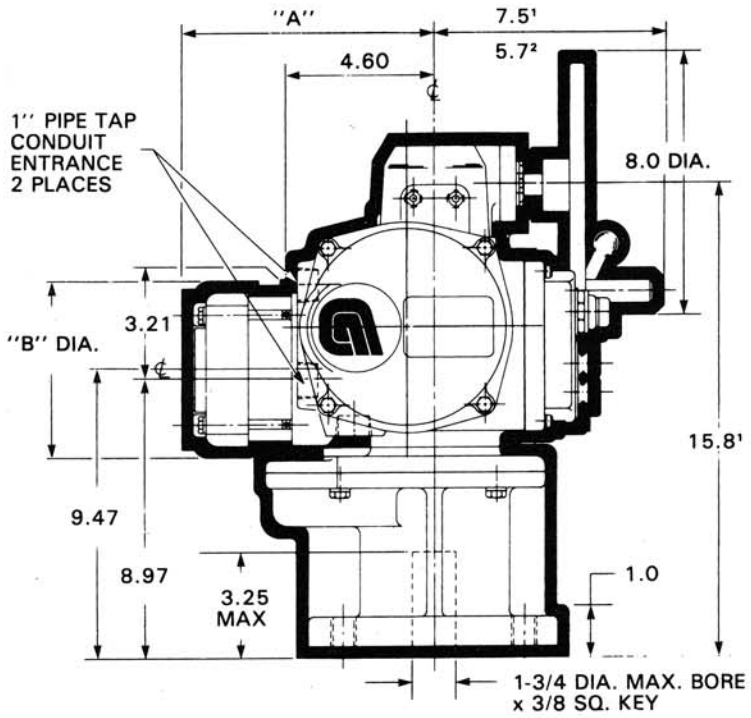


Model No.	"A"	"B"	"D"
QR2-10T	11.06	6.00	3.50
QR2-17T	12.70	6.86	3.50
QR2-24T	13.63	6.86	3.50

NOTES

Dimensions are for reference only.
Contact Andco for certified drawings.

ORG2 SERIES STANDARD WITH OPTIONAL HANDWHEEL

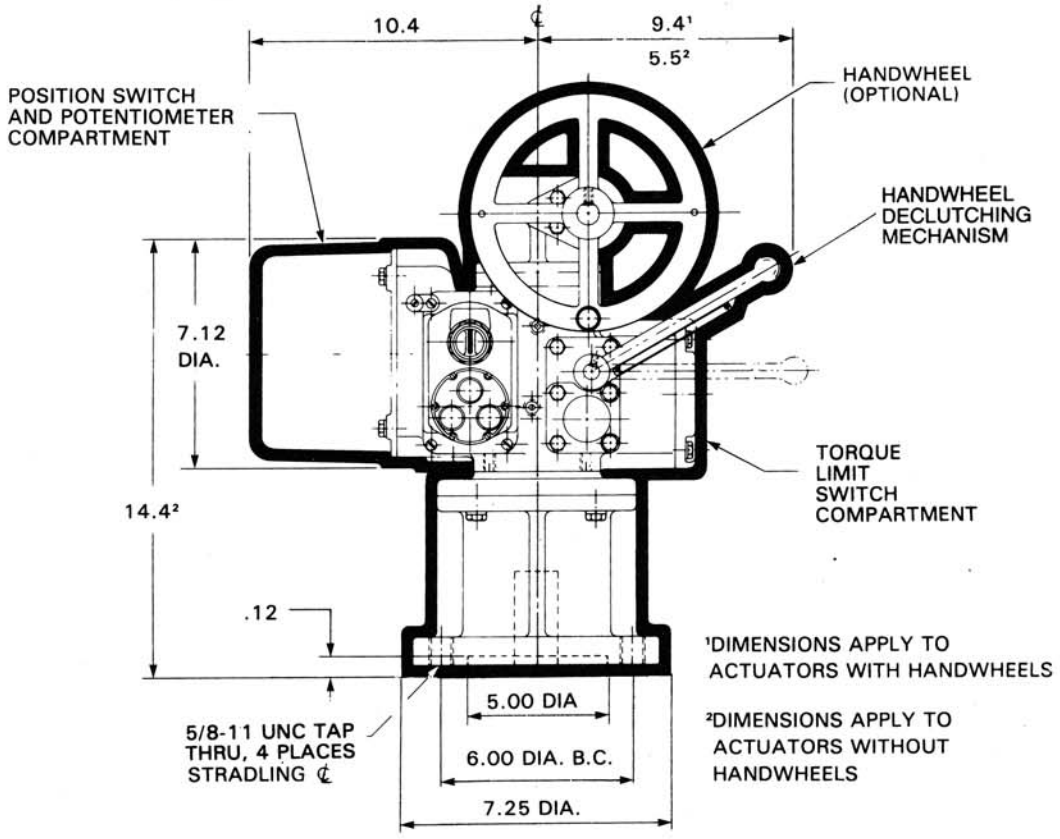


Model No.	"A"	"B"
QR2-25S	11.06	6.00
QR2-05T	10.06	6.00

Model No.	"A"	"B"
QR2-10T	11.06	6.00
QR2-17T	12.70	6.86
QR2-24T	13.63	6.86

NOTES

Dimensions are for reference only.
Contact Andco for certified drawings.



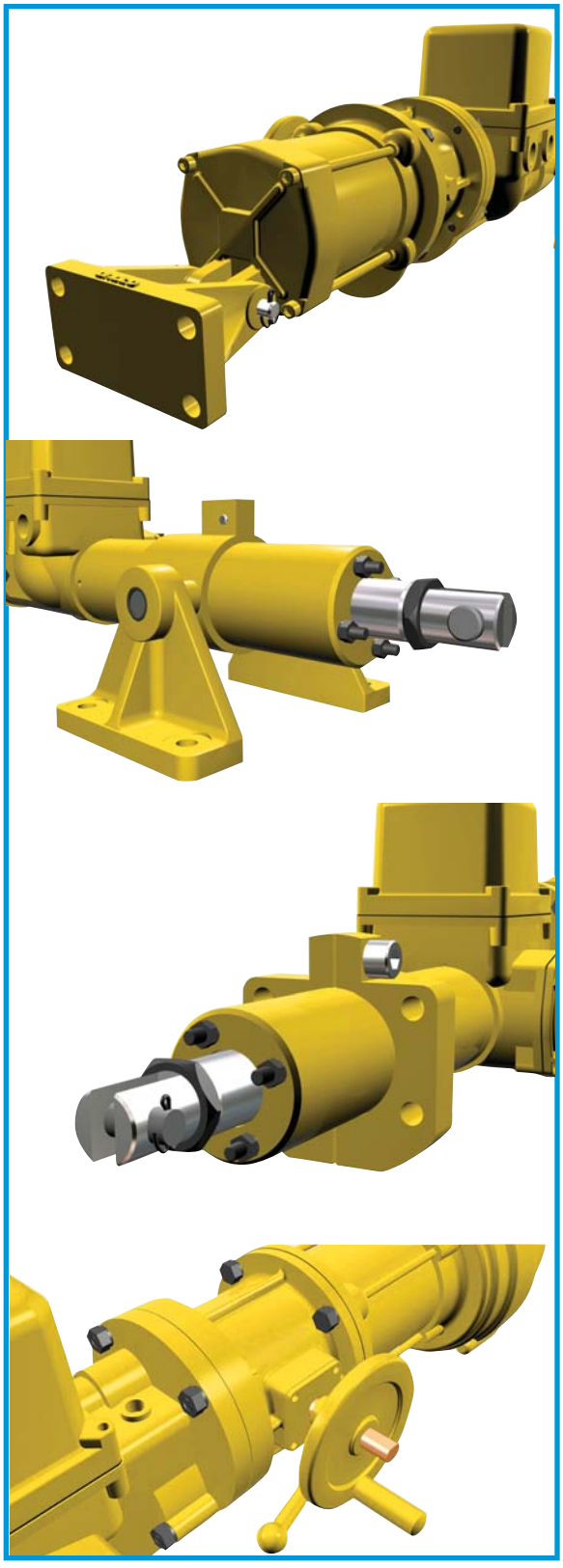
STANDARD OPTIONS

CLEVIS MOUNT
A cast iron clevis mount is standard on Eagle and 7100 Series actuators. The bracket will allow the actuator to pivot or can be used as a support on rigid mount applications.

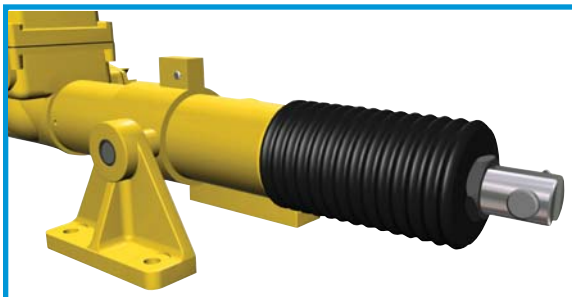
ADJUSTABLE TRUNNION MOUNT AND TRUNNION MOUNTING BRACKETS
Adjustable, high strength, malleable cast iron trunnion mount with alloy steel, heat treated pins, is supplied as standard equipment on all 7200, 7300 and 74-7300 actuators. Adjustable trunnion mounting is optional on Eagle, 7100 and 7400 actuators.The 7400 and 7500 Series actuators are supplied with alloy steel, heat treated, fixed location trunnion pins as standard. Heavy duty cast and machine trunnion mounting brackets are available as an option on all 7000 Series actuators.

ADJUSTABLE FACE/FLANGE MOUNT
An adjustable, high strength, malleable iron face/flange mount is available as an option on the Eagle Series, 7100, 7200, 7300, 74-7300, and 7400 Series actuators where rigid mounting is required.

MANUAL OVERRIDE
A handwheel assembly with declutching mechanism is available for manual operation of the 7000, 8000 and rotary actuators. Whenever the handwheel is operated, a mechanical override is used to disengage the motor. The actuator can then be positioned manually without risk of injury in the event the motor resumes operation. The actuator will remain in manual operation until the motor is re-energized. A handwheel is not available on ball screw actuators. Manual override without declutching mechanism is available on the Eagle Series.



STANDARD OPTIONS



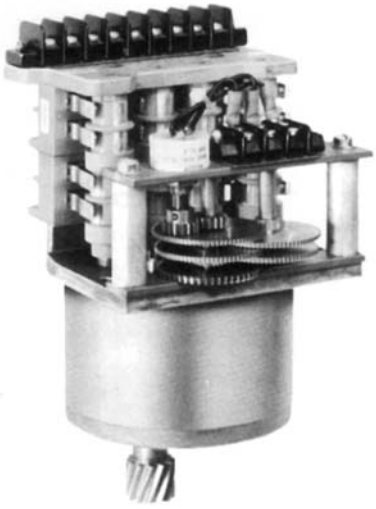
EXTENSION ROD COVER

The standard plate drive rod resists abrasion and corrosion. Together with the seals in the end cap, the extension rod is a long-life component.
For specific applications, such as those requiring protection of the extension rod from dust buildup or chemical splash, rod covers are recommended.

ADJUSTABLE GEAR DRIVEN POSITION LIMIT SWITCH

All actuators are supplied with two independently adjustable heavy duty position limit switches for end-of-travel shutoff as standard.

Two additional switches are available for intermediate positioning on the 7000 Series, 8000 Series and Rotary Models.



GEAR DRIVEN POTENTIOMETERS

A heavy duty gear driven single or dual potentiometers can be supplied as an integral component of the position limit switch.

The potentiometer provides position feedback for remote indication or when a proportional feedback signal is needed for interfacing with automatic control equipment.

An actuator potentiometer is required when using Andco controls.

STANDARD OPTIONS

ELECTRIC MOTOR BRAKE
An electric brake option is available for all sizes of Andco actuators (standard on all ball screw actuators). The brake is recommended where high vibration is present or for accurate positioning applications when inertial coast is not permitted. The predictable coast of the actuator varies with velocity for each model and with the opposing load the actuator is moving. Consult factory for specific applications.

SINGLE PHASE ELECTRONIC (DYNAMIC) MOTOR BRAKING
Automatically applies a D.C. motor voltage to the actuator motor upon shutoff of A.C. power. The brake is prewired and terminated in the actuator. Input voltage is 115 VAC, 60 Hz single phase. The unit is not available on ball screw actuators.

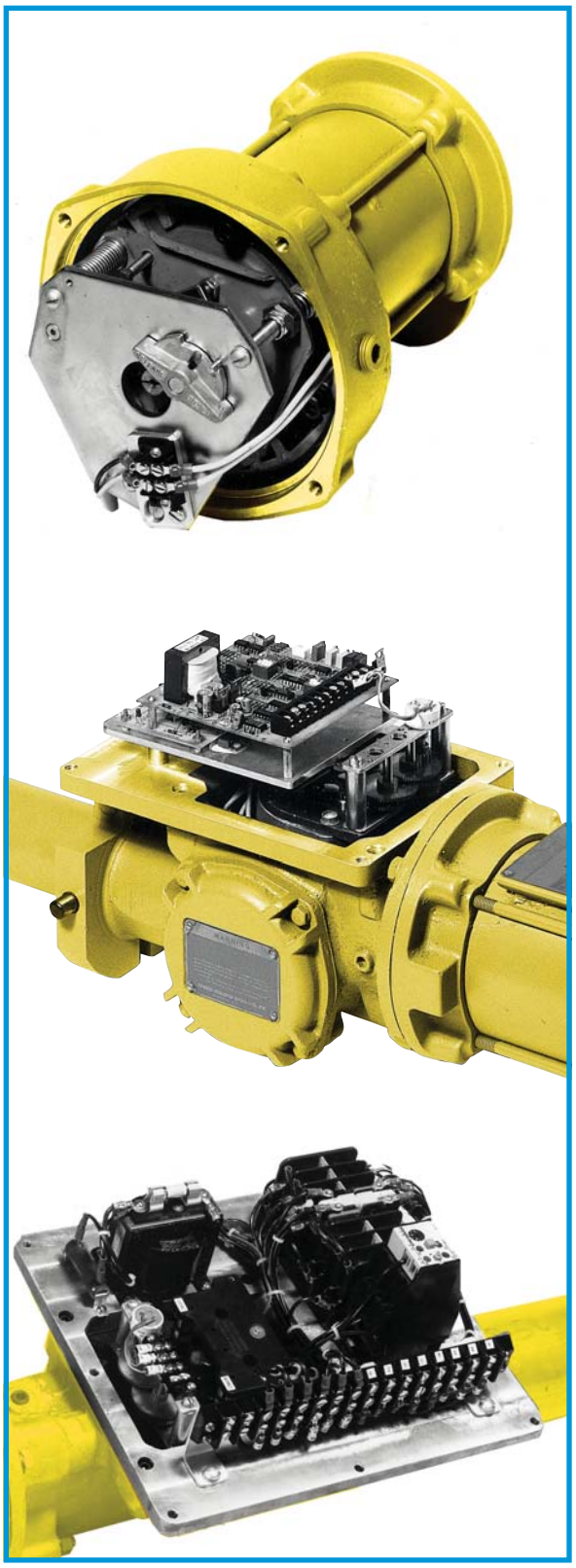
SINGLE PHASE SOLID STATE REVERSING STARTER/PROGRAMMABLE CONTROLLER INTERFACE
Directly drives Andco 115 VAC, single phase motors. Accepts a contact closure as an input.

- Input power: 115 VAC, single phase
- Output power: 115 VAC, single phase (directional for reversing control)
- Contact closure switching characteristics: 15 VDC, 10ma.

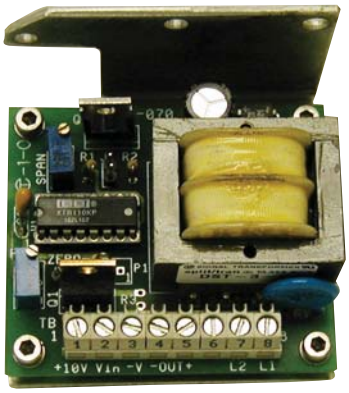
Starter includes an electrical interlock. All starter components are prewired with connections terminated inside the actuator. Single phase starter is also available with single phase electronic (dynamic) motor braking.

THREE PHASE MOTOR CONTROL
All 7000 Series three phase actuators can be furnished with an integral motor control that includes:

- Reversing contractor
- Thermal overload
- Control transformer with fuse
- Compartment space heater
- Prewired with all connecting points terminated



SEPARATELY MOUNTED OPTIONS



MODEL 4100 POSITION INDICATING METER

A percent-of-full-travel meter is supplied with a trim potentiometer resistor, terminal block and connectors. A potentiometer is required in the actuator for feedback.

PUSHBUTTON/SELECTOR SWITCH STATION

Conduit or wall mount weatherproof enclosure with a three pushbutton switch for actuator control. The station can also be supplied with two position indicating lights. (A two position, two contact per position switch is required in the actuator).

A dust-ignition proof enclosure is available as an option.

THREE PHASE MOTOR CONTROL

All 7000 Series three phase actuators can be supplied with a separately mounted motor control that includes a reversing contactor, thermal overload, control transformer with fuse, factory wired and mounted in a NEMA 12 enclosure.

Optional equipment includes a three pushbutton station, power on indicating light, end-of-travel indicating lights and fused disconnect with mechanical interlock.

POSITRAN™ TRANSMITTER

This position transmitter outputs a 4-20mAdc signal proportional to actuator position. The signal can be used for the following functions:

- Drive a position indicating meter
- A feedback or control signal for other control devices

A potentiometer and compartment heater are required with the actuator.

POSITION/PROCESS CONTROL REMOTE MODEL 5100

Solid-state, closed-loop, panel-mount controller for use with single phase, motor-driven Actuators. Automatically directs Actuator movement in response to a signal generated by a command potentiometer mounted to the Controller face (Figure 1) or a 4-20 mAdc, 10-50 mAdc or 1-5 VDC control signal (Figure 2).

DESCRIPTION

The Andco Model 5100 Control is a solid state servo device capable of driving a 10 Amp inductive load. It is designed for position or process control of an electric motor driven actuator.

A mode selection switch allows control with either the command potentiometer mounted on the controller face or a 4-20 mAdc (STD) 10-50 mAdc or a 1-5 VDC control signal. The selected mode signal is compared with the signal from the actuator feedback potentiometer. If an imbalance exists, the controller automatically directs actuator movement in the appropriate direction until the two signals match.

For positioning accuracy, an electronic braking circuit is provided. This circuit applies dynamic braking to the motor, stopping the motor rotor with 20 milliseconds.

Upon loss of the process command signal, the controller can control the actuator to stay in the last position, move to full open, move to full closed or switch to the command potentiometer position (specify).

For protection during system imbalance, the maximum number of motor starts is automatically limited to 25 per minute.

The output board is a separate plug-in module, electrically isolated from the main control board. An active filter is incorporated to reject electrical noise, normally eliminating the use of the shielded cable.

STANDARD EQUIPMENT INCLUDES:

- Position Indicator
- Motion Indicator
- Power On-Off Switch with Indicator
- Auto/Manual Switch with Indicator
- Command Potentiometer with 0-100% Dial
- Panel Mount Enclosure

Feedback Potentiometer

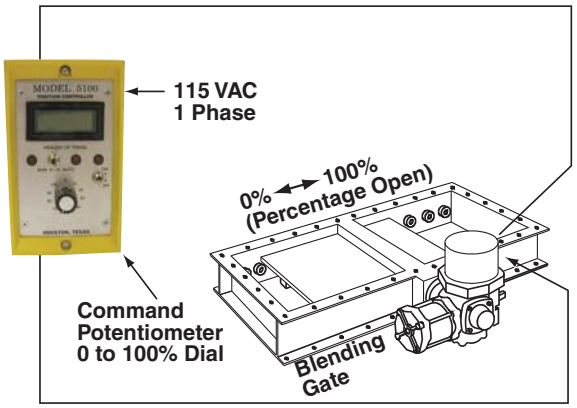


Figure 1

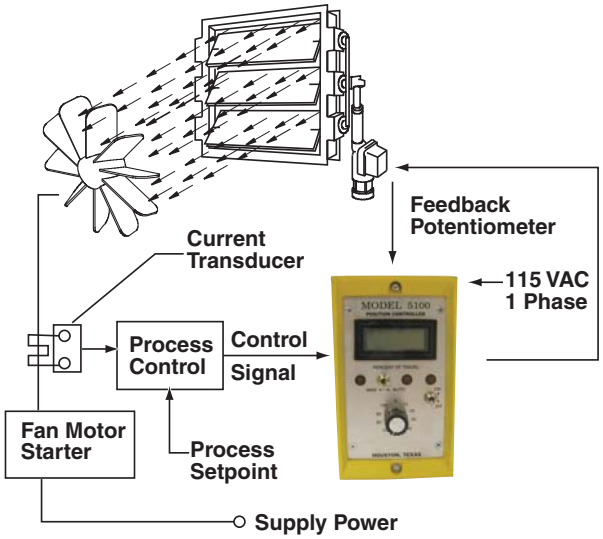
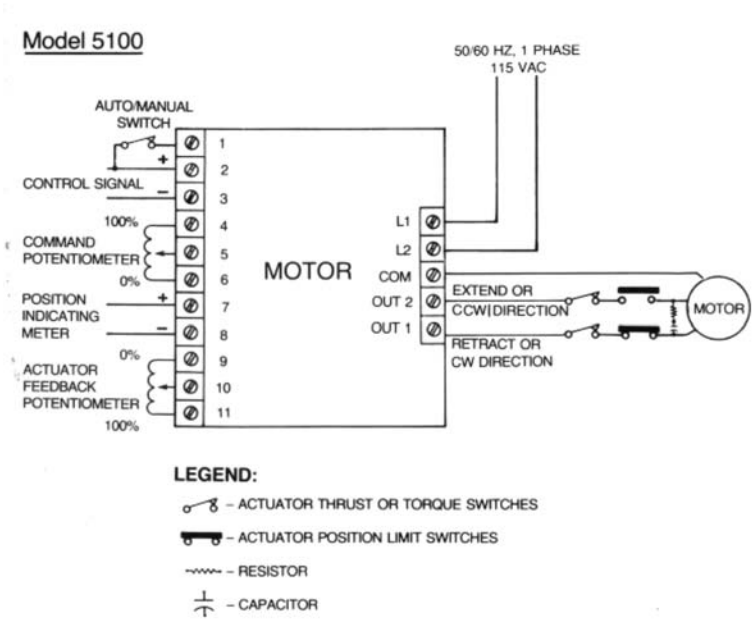


Figure 2

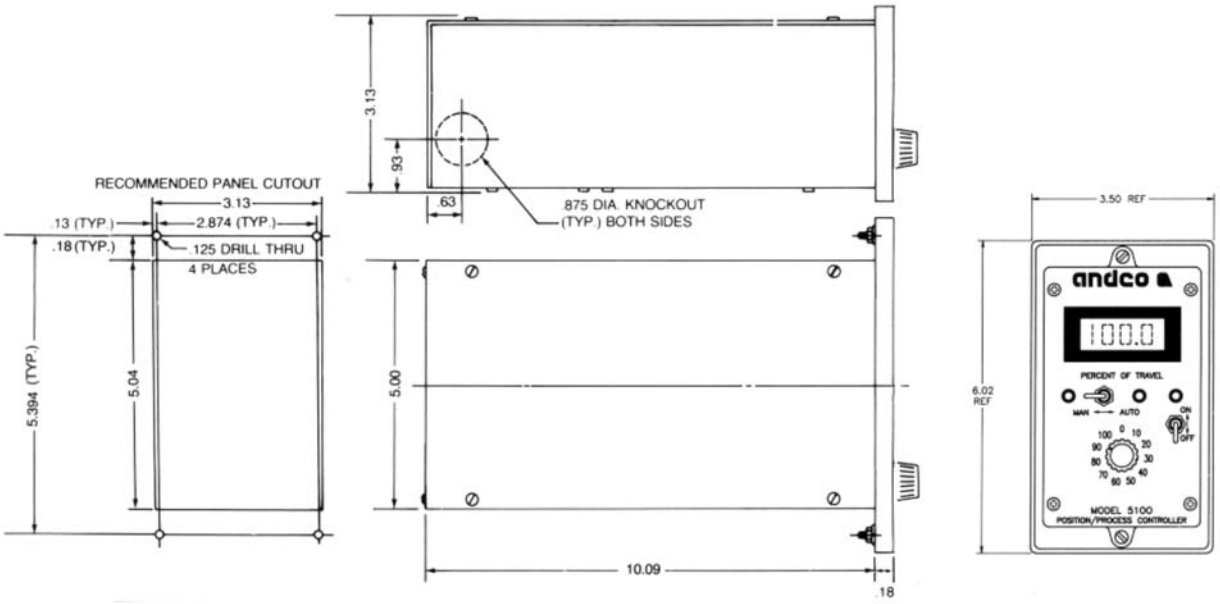
POSITION/PROCESS CONTROL
REMOTE MODEL 5100

CONNECTION DIAGRAM

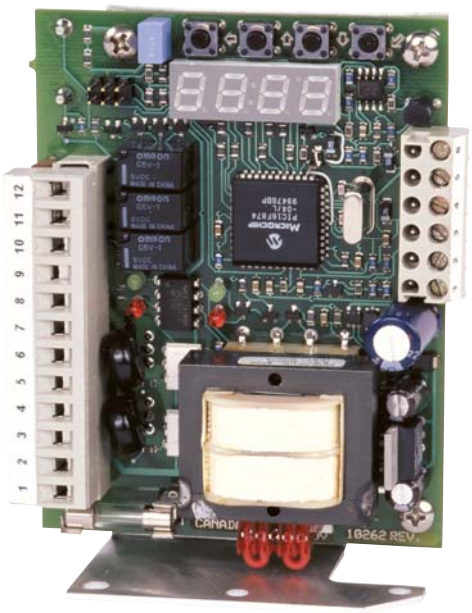


TECHNICAL NOTES	
Power, single phase	115 VAC 50/60 Hz
Manual Mode Input (command potentiometer)	0-1000 Ohms
Auto Mode Input (control signal)	4-20 mAdc 10-50 mAdc or 1-5 VDC
Feedback Input (actuator potentiometer)	0-1000 Ohms
Active Filter, 60Hz Rejection	-24 dB
Temperature Range	0° to 65°C (150°F)
Position Indicating Meter Range	0-100 percent of full travel
Output (two triacs)	10 Amp inductive load

OUTLINE DRAWING



EASC - ELECTRIC ACTUATOR SMART CONTROLLER
MODEL: SCC10



Models	Models
SCC10–115/230 V **115 or 230 Volt A.C. Actuators** **SCC10–24 VAC** **24 Volt A.C. Actuators**	**SCC10–24 VDC** **12 or 24 Volt D.C. Actuators**

EASC (MICRO-PROCESSOR BASED ANALOG CONTROLLER)

The Electric Actuator Smart Controller (EASC) card provides accurate positioning control of electric motor actuators using an analog input signal. Setup and calibration is greatly simplified using microprocessor based technology. There are no dip switches to set or trim pots to adjust. Setup is quick and easy using the EASC menu viewed on an LED display. No external meters are required, even for potentiometer setup. Once the initial menu settings are chosen, the EASC performs a self-calibration routine, applying the menu selections to actual actuator performance. Calibration values are then stored in permanent non-volatile memory.

EASC - ELECTRIC ACTUATOR SMART CONTROLLER
MODEL: SCC10

FEATURES

- Onboard LED display facilitates setup and calibration using the EASC Menu Setup.
- Menu selection of input/output ranges including 4-20 ma, 1-5 VDC, 2-10 VDC and 0-10 VDC, or virtually any custom range required.
- Automatic calibration; no resistors to add; no jumpers, trim pots or dip switches to adjust. Calibration is as simple as pressing a button.
- Three relay outputs: fault, full closed and full open. (A.C. Models only.)
- Current sensing (over torque protection).
  — Optional on A.C. Models. Standard on D.C. Models.
- Menu selectable fail options.
- Intelligent positioning reduces motor cycling, increases motor life and extends the actuator duty.
- Auto-jog feature. Constantly corrects and refines the positioning accuracy.
- Quick disconnect terminal strips facilitate fast and easy actuator maintenance and troubleshooting.
- Always wires the same; no need to determine rotation direction during installation; rotation is selected using the EASC Menu.
- Robust power switching components, designed specifically for actuator motors, virtually eliminates field failures.

SPECIFICATIONS

Power Requirements

Model SCC-115/230A: 115 or 230 VAC, 1 Phase, 50/60 Hz. (Jumper selectable)

Model SCC-24VAC: 24 VAC, 50/60 Hz.
Model SCC-24VDC: 10-28 VDC

Input Command Signal

Menu selectable factory defaults:
— 4-20 mAdc
— 1-5 VDC
— 2-10 VDC
— 0-10 VDC
Infinite adjustment using EASC Menu System

Signal Impedance

Input: 250 current, 200K voltage
Output: maximum load 500Ωcurrent, 500 voltage

Size

3-1/2 x 1-5/8 x 4 in.

Output Command Signal

Menu selectable factory defaults:
— 4-20 mAdc
— 1-5 VDC
— 2-10 VDC
— 0-10 VDC
Infinite adjustment using EASC Menu System

Power Output

Solid state, isolated from the input command and output position signals and rated at:
— 5 amps continuous at 115 VAC
— 5 amps continuous at 230 VAC
— 5 amps continuous at 24 VAC
— 10 amps continuous at 24 VDC
All ratings assume the EASC is mounted on the actuator base plate.

Sensitivity

Fully adjustable from 0.5% of total span, factory set to 1% of total span.

Dead Band

Automatically set during calibration. Factory default at 1% of total span. Additional settings available using the EASC Menu System.

Zero Adjustment

Automatically set during calibration.

Span Adjustment

Automatically set during calibration.

Split Range

Settable within the span range using at least 1.5 VDC or 3mA of input.

Ambient Temperature

-40°F (with heater) to +150°F (-40°C to +65°C)

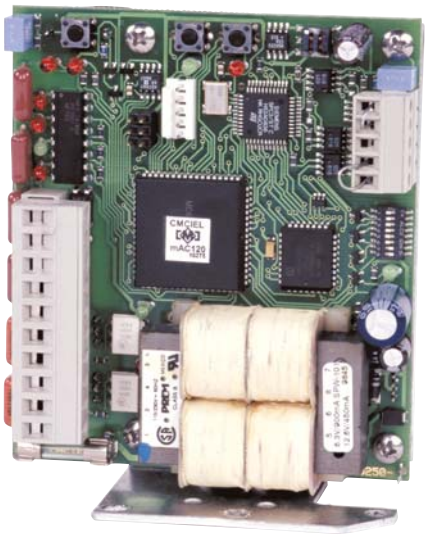
Action or Loss of Command Signal

Factory default:
— Fail in last position (no movement)
Additional settings available through EASC menu:
— Fail open (maximum signal value)
— Fail closed (minimum signal value)
— Fail to a preset position

Relay Outputs - A.C. Models Only

Three dry contacts outputs:
— Fault indicating loss of power, fuse failed, command signal loss or failure to move to position in preset time.
— End of travel open
— End of travel closed
— Contact Ratings: 1A @ 30 VDC, 0.5A @ 135 VAC resistive

PROFIBUS® DP



Models	Models
DPC-100 **12 or 24 Volt D.C. Actuators**	**DPC-120** **115 Volt A.C. Actuators**

APPLICATION

Protocol: Profibus® DP (Distributed Process)
For on/off or positioning control of motorized valves, it also serves as the vital intelligence link between PLC's in the control room and the actuators in the field. Up to 126 actuated valves can be controlled on a single network. The automatic calibration feature requires no loop tuning. All operating parameters can be set from the communications center over the bus.

FEATURES

- Two wire control reduces installation and start up time compared to multi-cable wiring.
- Automatic calibration cuts down on start up time.
- No deadband eliminates need for field adjustments.
- On line configuration of 36 operational arameters using generic Profibus software.
- Low power consumption; does not require ventilation.
- Electronic overload protection with built-in current monitoring.
- LED indicators for input, outputs and communication channel.
- Automatic calibration with local pushbutton or remote command.
- Dynamic breaking eliminates overshooting.
- Robust power switching components, designed specifically for actuator motors, virtually eliminates field failures.

SPECIFICATIONS

Power Supply

DPC-100: 24/12 VDC
DPC-120: 120 VAC

Communication Interface

Profibus® Standard

Protocol

Profibus® DP (Distributed Process)

Feedback

Potentiometer 1000 Ohms/Optical Encoder

Position Input Accuracy

1.0% full scale standard, Maximum 0.1%

Temperature

-40°C to +70°C (-40°F to +158°F)

Relative Humidity

0 to 90% non-condensing

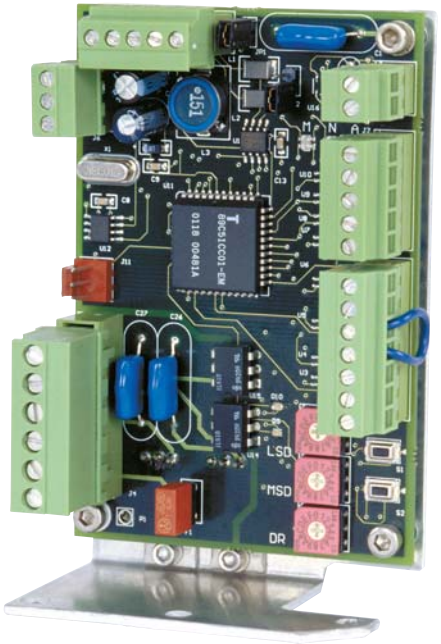
Dimensions

DPC-100: 4.0 x 1.5 x 2.5 in.
DPC-120: 4.25 x 1.75 x 3.75 in.

The DPC-100 & DPC-120 provide the following status and fault signals:

Valve full closed	Valve opening or closing manually
Valve full open	Valve jammed/current limiting
Percentage of open	Motor still energized after stop or end of travel
Valve seeking position	Controller self-test (detects problems)
Motor running	Communication failure
Valve closing	Average running current load
Valve opening	Peak running current load
Motor thermostat tripped	Idle current load
Incomplete travel	

DEVICE NET™



APPLICATION

For on/off or positioning control of motorized valves. DeviceNet™ is a type of communication network that allows up to 63 field devices to be linked together with a singe five-conductor cable. DeviceNet™ is a product of Allen-Bradley and is an open, non-proprietary, bus network. Typically, a DeviceNet™ system is used with the Allen-Bradley PLC5 and SLC series of programmable logic controllers. A standard DeviceNet™ Scanner interface is available for both types. Devices in the field are connected via a drop line to a 5 conductor trunk-line that is then routed to the scanner card.

FEATURES

- Provides open/stop/close or positioning control with limit switch status feedback.
- Provides instantaneous motor reversal protection.
- Command and end-of-travel verification alarm.
- Conforms to ODVA standards.
- Easy-to-see LED indicators for all control outputs, status inputs and diagnostic alarm.
- ESD functions for 'go open', 'stay put', or 'go closed'.

Hardware Specifications

Supply Power:	2W @ 24 VDC
Operating Temperature:	-20°C – 70°C
Storage Temperature:	-40°C – 80°C
Humidity:	90% Non Condensing
Solid State Outputs:	(2) Isolated 600 VAC 15A
Digital Inputs:	(8) Dry Contacts
Analog Inputs:	(2) Channels (see below)
Processor:	Temic 89C51CC01
RAM:	1K
Flash:	32K
EEPROM:	32K

Models

DNET115
115 Volt A.C. Actuators

Analog Inputs Specification

Resolution:	10bit
Accuracy:	1% of FS.
Linearity:	1% of FS.
Temperature Drift:	2% of FS.
Range:	0 to 5 V or 0-20 mA input for AI1 1-5 K Potentiometer for the Position Feedback.

Serial Interfaces

One CAN 2.0 port.

Network Communication Protocols

Module Supports DeviceNet™ Group 2 Slave.

SPECIFICATIONS

Technical Summary of DeviceNet™

Network Size:	Up to 64 nodes (including scanner)
Network Length:	Up to 1,640 ft. at 125 Kbps.
Data Packets:	0-8 bytes
Bus Topology:	Trunkline/Dropline
Cable:	5-Conductor cable (2 for power, 2 for communication, and 1 for ground).
Thick Trunk Lines:	Belden 3082A or 3083A
Thin Drop Lines:	Belden 3084A or 3085A
Drop Lines:	Max. drop length is 20 ft. with cumulative drop length of 512 ft.
Repeaters:	Not currently, but expected in future revisions of specifications.

Input/Output Listing

Digital Input Status:

Bit 0	Communication Loss
Bit 1	Reserved
Bit 2	Loss of Position Signal
Bit 3	Motor Stall
Bit 4	Limit Calibration Incorrect
Bit 5	Thermostat Trip
Bit 6	Manual Operation
Bit 7-15	Reserved

Digital Output Command:

Bit 0	Open Command
Bit 1	Close Command
Bit 2	Stop Command
Bit 3	ESD Command
Bit 4-7	Future

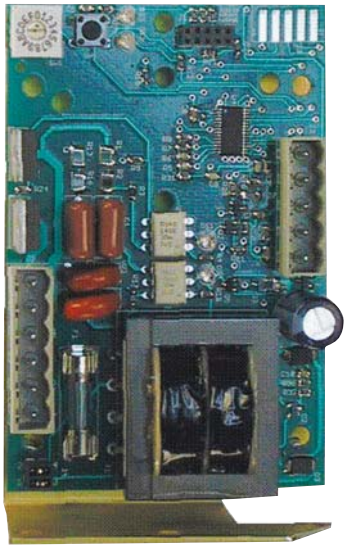
Environmental

Temperature Range:
Storage: -40°C to +90°C
Operating: -20°C to +80°C

Humidity Range:
5% to 95% at 25°C non-condensing

Vibration:
IEC 6B-2-6 1G @ 40-50 Hz.,
0.012p-p @ 10-40 Hz.

MODBUS®



APPLICATION

This application specific controller, designed for positioning electric actuators using rotary feedback. Typical devices include rotary and linear actuators. Feedback may be via a potentiometer or a quadrature optical encoder. Controller outputs can drive small electric motors or motor starters directly.

A Modbus®-485 communication network allows up to 100 devices on a single channel. Powered by 24 VDC and provides four supervisory inputs, configurable as limit switches or force open/close signals.

Automatic calibration is provided which requires no loop tuning. All operating parameters can be set as registers in the Modbus® communications map.

FEATURES

- High resolution position input for up to 0.1% accuracy.
- 4-120/240 VAC inputs for open & closed limit switches and 2 general purpose inputs.
- Simple 4-wire Modbus®-485 communication network includes supervisory power.
- Robust communication, up to 500m cable length.
- Pluggable terminal strips for easy field installation.
- Direct mounting within the actuator.
- Low power consumption; does not require ventilation.
- Electronic overload protection with built-in current monitoring optional.
- High power outputs can directly drive small motors.
- LED indicators on inputs, outputs and communication channel.
- Automatic calibration using local push button or remote command.
- Multi-vendor PLC support through the standard Modbus® communication module.

SPECIFICATIONS

Actuator	
Voltage	120/240 VAC 1Ø
Current	4A (2 minute 25% duty-cycle)
Fuse	GMA 4 replaceable
Supervisory	
Voltage	10 to 25 VDC
Current	30 mA @ 24 VDC
Auxiliary Inputs	
Voltage	120/240 VAC
Current	min 10 mA/max 20 mA
Communication	
Standard	Modbus®-RS485 differential
Distance	500m (1,640 ft.)
Input Load	12K ohm, standard
Termination	120 balanced line
Position	
Resolution	12 bit (1 part in 4096)
Accuracy	0.1% full scale
Potentiometer	1000 typical (500 to 10kΩ)
Quadrature Optical Encoder	1000 to 4096 pulses
Environment	
Temperature	-40°C to +70°C (-40°F to +158°F)
Relative Humidity	0 to 95% non-condensing
Dimensions	
Length	96 mm (3.75 in)
Width	70 mm (2.75 in)
Height	36 mm (1.40 in)

TYPICAL APPLICATIONS

- Blending of bulk materials.
- Liquid flow control.
- Level control for maintaining process supply.

APPLICATION GUIDE

INTRODUCTION

All Andco actuators are self-contained electro-mechanical machines with built in switches for control and protection. At high starting torque, low inertia electric motor is standard. The high starting torque is essential because more power is required to start an object in motion as opposed to keeping it in motion. Low inertia results in good positioning and stopping characteristics. All components are designed, constructed and tested with the intent of providing long and reliable service.

HOW TO USE THIS APPLICATION GUIDE

The Andco Actuator Application Guide will assist you in the proper application and selection of our actuators.

Several applications are illustrated with descriptions of operation, definitions of terminology, formulas to find required forces or torques and descriptive examples.
Reference is made to the included data tables whenever this information is required.

To use this Guide, find the section that best typifies your application and follow the step-by-step methods and instructions that appear on the particular page.

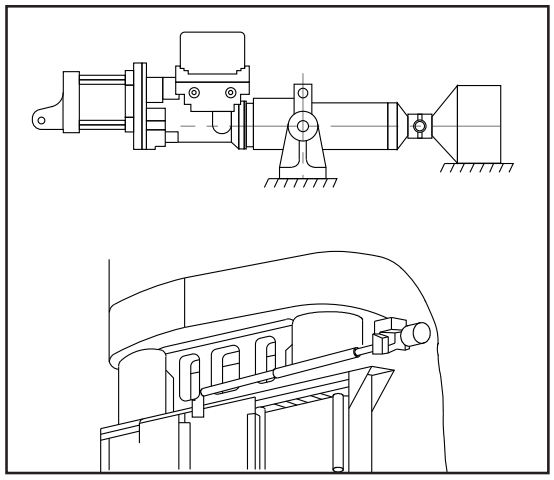
If you should encounter any difficulty or have an application that does not appear in this Guide, please contact our Sales Office or Area Representative for assistance.

DISCLAIMER

The information contained in this catalog is provided merely as a service to assist User in understanding Andco's products and their possible application to User's requirements. Andco, however, accepts no liability whatsoever with respect to the information, diagrams and formulas provided herein and EXPRESSLY DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. Please also note that Andco reserves the right to amend or delete the information at any time without being required to give notice to any other party.

LINEAR APPLICATIONS

PUSHING AND PULLING



Legend	
μ1 & μ3	coefficients of starting (μ1) and running friction (μ3)(Table1)
W	weight of object being moved (lbs)
BAf	required breakaway force (lbs)
Rf	required running force (lbs)
a	acceleration factor (Table 3)

Reference Tables on Page 45.

Formulas

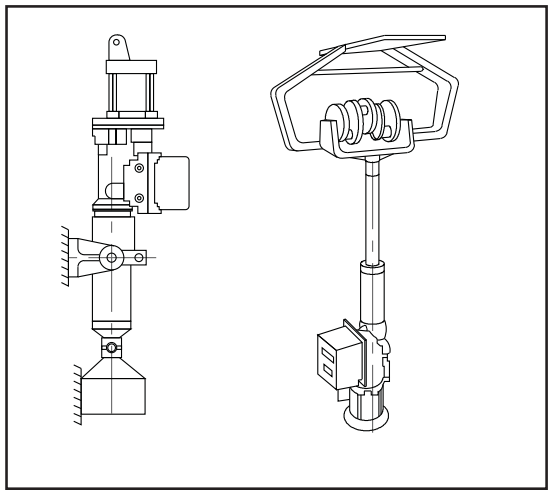
BAf = W (lbs) x μ1 x a = _____ lbs
Rf = W (lbs) x μ3 =_____ lbs

Example

Determine the force required to move a 1500 lb. safety door that is supported on ball bearings.
BAf = 1500 lbs x 0.08 x 1.2* = 144 lbs
Rf = 1500 lbs x 0.05 = 75 lbs

* Acceleration factor based on velocity of 3.5 in/sec or less.

LIFTING AND LOWERING



Legend	
W	weight of object being moved (lbs)
BAf	required breakaway force (lbs)
Rf	required running force (lbs)
a	acceleration factor (Table 3)

Reference Tables on Page 45.

Formulas

BAf = W (lbs) x a = _____ lbs Rf = W (lbs) =_____ lbs

$$\text{Duty cycle} = \frac{\text{Running time (sec)/Hour}}{\text{3600 sec/hour}} \times 100\% = \_\_\_\_\_\%$$

APPLICATION NOTES

1. For lifting or constant load applications select the actuator according to running load requirements.

Example

A linear actuator is to lift a carriage (75 lbs) that supports a crankshaft (50 lbs). The linear velocity should be 10 in/sec with an actuator stroke length of 36 inches. Determine the actuator forces and duty at a rate of 250 crankshafts per hour.

BAf = 125 lbs. x 1.4 = 175 lbs Rf = 125 lbs.

Running time = 36 inch stroke ÷10 inch/sec = 3.6 sec/stroke x 2 strokes/cycle = 7.2 sec/cycle

7.2 sec/cycle x 250 cycles/hour = 1800 sec/hour

Duty cycle = (1800 sec/hour ÷ 3600 sec/hour) x 100% = 50% duty

GENERAL APPLICATIONS

LEVER AND MOMENT ARMS

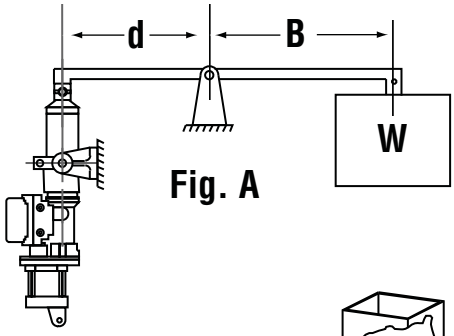


Fig. A

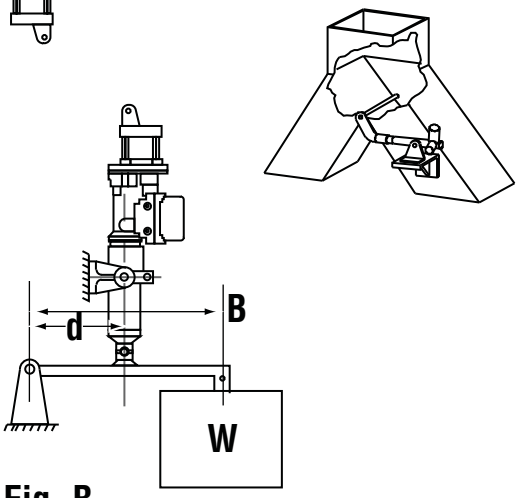


Fig. B

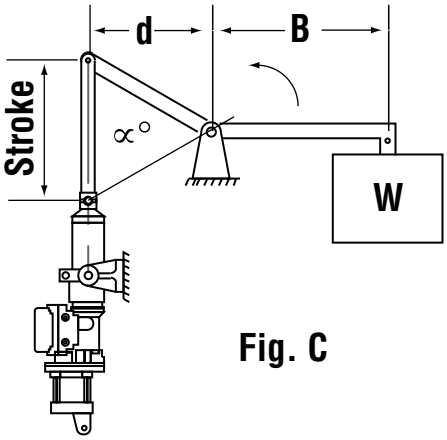


Fig. C

Formulas
$BAf = \frac{B\ (ft) \times W\ (lbs) \times a}{d\ (ft)} = \_\_\_\_\_\ lbs$
$Rf = \frac{B\ (ft) \times W\ (lbs)}{d\ (ft)} = \_\_\_\_\_\ lbs$

Example
From Fig C: If the actuator stoke is 6 inches, B = 4 ft, W = 800 lbs and ∝° = 30°. Determine the necessary actuator forces.
$BAf = \frac{4\ ft \times 800\ lbs \times 1.2^*}{0.93\ (ft)\ (Table\ 4)} = 4129\ lbs$
$Rf = \frac{4\ ft \times 800\ lbs}{0.93\ (ft)\ (Table\ 4)} = 3440\ lbs$
* Acceleration factor based on velocity of 3.5 in/sec or less.

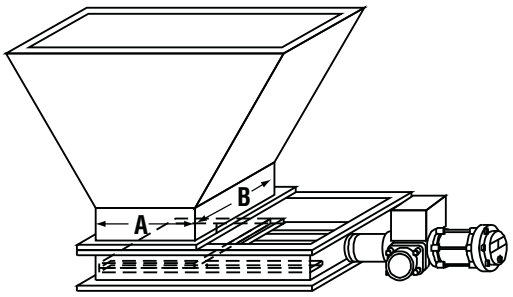
Legend	
W	weight of object being moved (lbs)
B	distance from pivot point to center of weight of the object being moved (ft)
d	effective lever arm length (Table 4)
BAf	required breakaway force (lbs)
Rf	required running force (lbs)
a	acceleration factor (Table 3)

Reference Tables on Page 45.

APPLICATION NOTES

1. For lifting or constant load applications select the actuator according to running load requirements.

SLIDE GATES



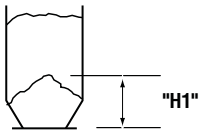


Fig. 1
(fully loaded hopper)

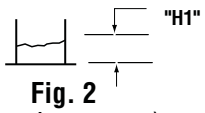


Fig. 2
(gate under a conveyor)

Gate Operation: The maximum force required to operate a slide gate occurs when opening from a fully closed position with material resting on the gate blade. To move the gate, static friction must be overcome (μ1 and μ2). Once moving, the material weight on the gate is reduced, the friction is lower and the required force is reduced proportionally as the gate opens.

Required Information: Dimensions A and B, material being handled, effective height of material on the gate blade "H1", type of gate guide (steel plate, rollers, etc.)

Formulas

H1 = Larger of A or B dimensions x "h" factor from Table 2 = _____ ft

W2 = A (ft) x B (ft) x H1 (ft) x W1 (lbs/ft^3) (material in the hopper) = _____ lbs

W3 = A (ft) x B (ft) x Gate thickness (ft) x 490 (lbs/ft^3) (steel) = _____ lbs

$$BAf = [(W2\ lbs \times \mu 2) + ((W2\ lbs + W3\ lbs) \times \mu 1)] \times a = \_\_\_\_\_ lbs$$

$$Rf\ (avg) = \frac{(W2\ lbs \times \mu 4) + [(W2\ lbs + W3\ lbs) \times \mu 3]}{1.75} = \_\_\_\_\_ lbs$$

Example

Find the force required to operate a 3 foot square slide gate underneath a fully loaded 50 ft high storage hopper of grain. The gate blade is made of 1 inch thick steel supported on steel rollers.

W2 = 3 ft x 3 ft x (3 ft x 4.75) x 40 lbs/ft^3 = 5130 lbs

W3 = 3 ft x 3 ft x (1in/12 ins/ft) x 490 lbs/ft = 368 lbs

$$BAf = [(5130\ lbs \times 0.32) + ((5130\ lbs + 368\ lbs) \times 0.15)] \times 1.2^* = 2960\ lbs$$

$$Rf = \frac{(5130\ lbs \times .0.2) + [(5130\ lbs + 368\ lbs) \times 0.10]}{1.75} = 900\ lbs$$

* Acceleration factor based on velocity of 3.5 in/sec or less.

Legend

A	length of gate opening (ft) (also actuator travel)
B	width of gate opening (ft)
H1	effective height of material on the gate blade (ft). See Figure 1 and 2
W1	average material specific weight (lbs/ft) (Table 2)
W2	material weight on gate blade (lbs) (Table 2)
W3	gate weight (lbs) (Table 2)
a	acceleration factor (Table 3)
μ2 &μ4	coefficients of starting (μ2) and running (μ4) friction between the material in the hopper and the gate blade (Table 2)
μ1 &μ3	coefficients of starting (μ1) and running (μ3) friction between the gate blade and the gate guides. (Table 1)
Baf	required breakaway force (lbs)
Rf (avg)	average required running force (lbs)
Fig 1	Material in a hopper will start to bridge or support itself a certain height (H1) above the gate blade. To find H1 use the "h" factor from Table 2 and the formula as referenced.
Fig 2	If the actual material above the gate blade is less than the calculated value of "H1" use the actual height in feet.

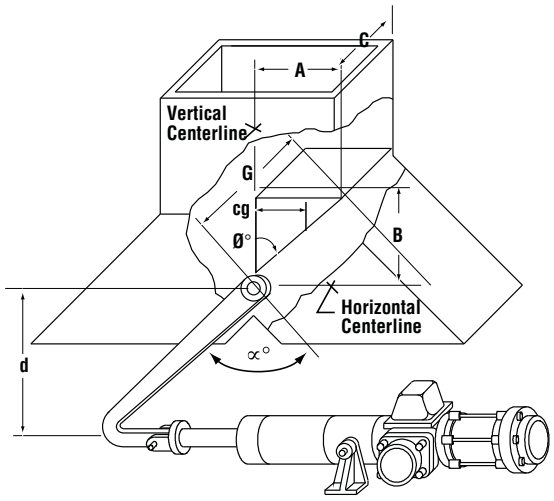
Reference Tables on Page 45.

APPLICATION NOTES

1. Select actuator according to breakaway force requirements.
2. For rack and pinion slide gates use above forces.

GENERAL APPLICATIONS

DIVERTER GATES



Gate Operation:

- A diverter gate will produce a torque at the gate shaft directed away form the vertical centerline.

  Torque (ft-lbs) (gate) = total weight (lbs) (W2 + W3) x distance (ft) (A/2)

- To move the gate back toward the centerline a torque must be produced by the actuator through a lever arm that will exceed the gate torque.

  Torque (ft-lbs) (operating) = actuator force (lbs) x effective lever arm (ft) (d)

Required Information:

Dimensions C, G and angular travel Ø°. Dimensions A and B must be found.

A = G x (SIN Ø°) = _____ ft B = G x (COS Ø°) = _____ ft

Legend	
A	projected length of gate opening (ft) (measured from vertical centerline)
B	projected height of gate (ft) (measured from horizontal centerline)
C	width of gate (ft)
cg	assumed center of gravity of the gate (ft)
d	effective lever arm length (ft) (Table 4)
G	length of gate (ft)
Ø°	maximum angular travel of the gate from the vertical center line (degrees)
α°	total angular travel (degrees)
W1	average material specific weight (lbs/ft^3) (Table 2)
W2	assumed material weight hitting the gate (lbs). (Not used if gate is moved when no material is flowing)
W3	gate weight (lbs)
a	acceleration factor (Table 3)
Rf	required running force (lbs)
BAf	required breakaway force (lbs)

Reference Tables on Page 45.

Ø°	15°	30°	45°	60°
SIN Ø°	0.26	0.50	0.71	0.87
COS Ø°	0.97	0.87	0.71	0.50

Formulas

$cg = \frac{A\ ft}{2}$ $W2 = \frac{A\ ft \times B\ ft \times C\ ft}{2} \times W1\ (lbs/ft^3) = \_\_\_\_\_\ lbs$

W3 = C (ft) x G (ft) x total gate plate thickness (ft) (2 plates are often used) x 490 (lbs/ft^3) = _____ lbs

$Rf = \frac{[W2\ lbs\ (if\ applicable) + W3\ lbs] \times (cg)\ (ft)}{d\ (ft)} = \_\_\_\_\_\ lbs$

BAf = Rf (lbs) x a = _____ lbs

APPLICATION NOTES

1. Select actuator according to running force requirements.
2. If the gate is non-symmetrical use the larger of the two angles for Ø°.

Example

Find the force required to move a 6 ft. long by 4 ft. wide diverter gate through a moving stream of coal. The total angular travel is 60° (30° from the vertical centerline). The gate is fabricated from 2-3/8 inch steel plates. Due to space given requirements the actuator stroke should be 18 inch (max).

Given: C = 4 ft, G = 6 ft, Ø° = 30°, W1 = 55 lbs/ft^3

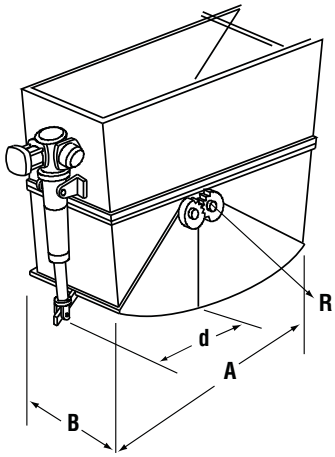
Calculations: A = 6 ft x 0.5 = 3 ft, B = 6 ft x 0.87 = 5.22 ft

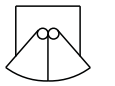
$W2 = \frac{3\ ft \times 5.22\ ft \times 4\ ft}{2} \times 55\ lbs/ft^3 = 1723\ lbs$ $W3 = (4\ ft \times 6\ ft) \times \left[\frac{(0.375\ (inch) \times 2\ plates}{12\ (in/ft)}\right] \times 490\ (lbs/ft^3) = 735\ lbs$

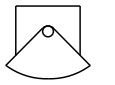
$Rf = \frac{(1723\ lbs + 735\ lbs) \times 1.5\ ft}{1.3\ ft} = 2836\ lbs$ BAf = 2836 lbs x 1.2* = 3403 lbs

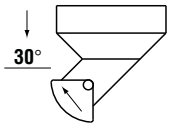
* Acceleration factor based on velocity of 3.5 in/sec or less.

CLAM SHELL OR UNDERCUT GATES




Clamshell Gate


Undercut Gate



Undercut Gate with an Angled Chute
(Use "H1" x .87)

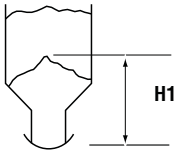


Fig 1
(Fully Loaded Hopper)

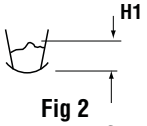


Fig 2
(Partially Filled Gates)

Gate Operation: The maximum force required to operate a clam shell and undercut gates occur when opening from a fully closed position when material is resting on the gate blade. To move the gate, static friction ($\mu 2$) must be overcome. Once moving, the material weight on the gate is reduced, the coefficient of friction is lower and the required force is reduced proportionally as the gate opens.

Required Information: Dimensions A, B, d* and R,* material being handled, gate weight (W3) and approximate material height above the gate blade "H1". *See legend if dimensions are not known.

Formulas

$$H1 = \left[\begin{array}{c}\text{Larger of A or B}\\ \text{dimensions}\end{array}\right] \times \left[\begin{array}{c}\text{"h" factor from}\\ \text{Table 2}\end{array}\right] = \_\_\_\_\_ \text{ ft}$$

$$W2 = [A \text{ ft} \times B \text{ ft} \times H1 \text{ ft}] \times W1 \text{ (lbs/ft}^3\text{)} = \_\_\_\_\_ \text{ lbs}$$

$$BAf = \frac{[(W2 \text{ lbs} \times \mu 2) + W3 \text{ lbs}] \times R \text{ (ft)} \times a}{d \text{ (ft)}} = \_\_\_\_\_ \text{lbs}$$

$$Rf(avg) = \frac{[(W2 \times \mu 4) + W3 \text{ lbs}] \times R \text{ (ft)}}{d\text{(ft)} \times 1.75} = \_\_\_\_\_ \text{lbs}$$

Example

Determine the actuator force required to open a 4 ft. square coal refuse clam shell gate. The total weight of the gate is 750 lbs. No other dimensions are known.

$W2 = 4 \text{ ft} \times 4 \text{ ft} \times (4 \text{ ft} \times 2.0) \times 45 \text{ (lbs/ft}^3\text{)} = 5760 \text{ lbs}$

$W3 = 750 \text{ lbs}$, $R = (4 \text{ ft}/2 \times 1.5) = 3 \text{ ft.}$, $d = 4 \text{ ft}/1.9 = 2.11 \text{ ft}$

$$BAf = \frac{[(5760 \text{ lbs} \times .75) + 750 \text{ lbs}] \times 3 \text{ ft} \times 1.2}{2.11 \text{ ft}} = 8650 \text{ lbs}$$

$$Rf \text{ (avg)} = \frac{[(5760 \text{ lbs} \times 0.5) + 750 \text{ lbs}] \times 3 \text{ ft}}{2.11 \text{ ft} \times 1.75 \text{ ft}} = 2950 \text{ lbs}$$

* Acceleration factor based on velocity of 3.5 in/sec or less.

Legend

A	length of gate opening (ft)
B	width of gate opening (ft)
d	effective length of lever arm (ft) (If specific dimension is not known use length of gate "A"/1.9)
H1	effective height of material on the gate blade (ft). See Figure 1 and 2
R	radius of gate (ft). If specific dimension is not known use (A/2 x 1.5).
W1	average material specific weight (lbs/ft^3) (Table 2)
W2	material weight on gate blade (lbs).
W3	gate weight (lbs).
$\mu 2$ & $\mu 4$	coefficients of starting ($\mu 2$) and running ($\mu 4$) friction between the material in the hopper and the gate blade. (Table 2)
a	acceleration factor (Table 3)
Baf	required breakaway force (lbs)
Rf (avg)	average required running force (lbs)
Fig 1	Material in a hopper will start to bridge or support itself a certain height (H1) above the gate blade. To find "H1" use the "h" factor from Table 2, and the formula.
Fig 2	If the actual material above the gate blade is less than the calculated value of "H1" use the actual height in feet.

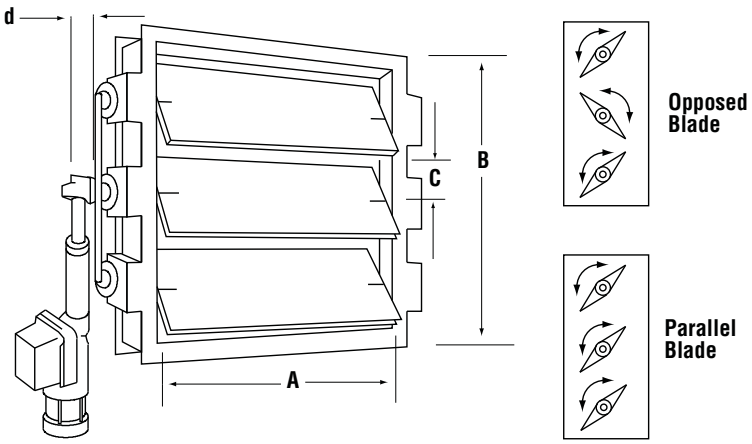
Reference Tables on Page 45.

APPLICATION NOTES

1. Select actuator according to breakaway force requirements.

GENERAL APPLICATIONS

LOUVER DAMPER



Opposed blade louver dampers: Typically used for gas or air flow control. Applications include baghouses, boilers, precipitators and scrubbers.

Parallel blade louver dampers: Used mainly for isolation or shut-off. Edges of adjacent blades usually overlap or contact seating bars or angles when damper is full closed.

Required Information: Damper size, blade size, number of blades.

Legend	
A	width of damper, or length of blade (in)
B	height of damper opening (in)
C	total half blade width (in) (see formula)
d	effective length of lever arm (ft) Table 4
N	number of blades
R	contact pressure rate for blade to blade sealing (lbs/lineal inch)

Reference Tables on Page 45.

APPLICATION NOTES

1. Effects of high gas temperatures are not included in above formulas.
2. For isolation or shut-off dampers select actuator according to breakaway torque or force requirements.
3. For control damper select actuator according to running torque or force requirements.

Formulas

$$C\ (in) = \frac{B\ (inches)}{2 \times (N)} = \_\_\_\_\_\ inches$$

Shut off Damper closure torque (in-lbs) $= [A\ (in) \times C\ (in) \times R\ (lbs/in) \times (N + 1)] + 2\ [C^2\ (in) \times R\ (lbs/in) \times N] = \_\_\_\_\_\ in/lbs$

* Control damper operating torque (in-lbs) $= \frac{75\ [0.025 \times A\ (in) \times B\ (in)]^2}{(A\ (in) \times N)} = \_\_\_\_\_\ in\text{-}lbs$

*Operating torque is based on 3600 feet per minute gas velocity.

$$Torque\ (ft\text{-}lbs) = \frac{torque\ (in\text{-}lbs)}{12\ (in/ft)} = \_\_\_\_\_\ ft/lbs \qquad Force\ (lbs) = \frac{torque\ (ft/lbs)}{d\ (ft)} = \_\_\_\_\_ lbs$$

Example

Determine the torque required to tightly close a parallel blade shut-off louver damper in a boiler flue gas duct 4 ft. wide by 6 ft. high. The damper has 4 blades and requires the closed blade edges to contact each other with a pressure of 4 lbs/in to obtain satisfactory gas shut off. Determine the force required if a 9 inch (.75 ft) effective lever arm length is used. Total damper rotation is 90°.

$$C = \frac{6\ ft \times 12\ in/ft}{(2 \times 4\ blades)} = 9\ inches$$

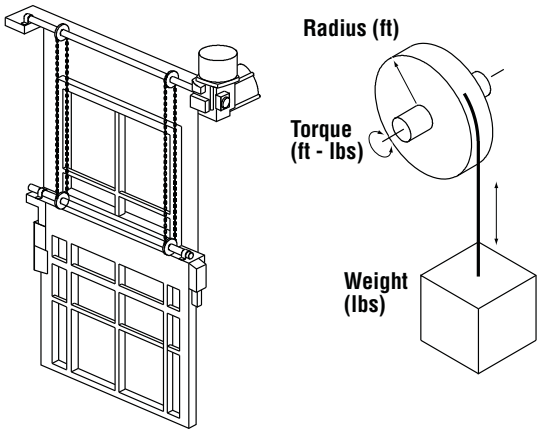
Shut off Damper closure torque (in/lbs) $= [(4\ ft \times 12\ (in/ft)) \times 9\ in \times 4\ (lbs/in) \times (4\ blades + 1)] + 2\ [9\ in \times 4\ (lbs/in) \times 4\ blades] = 8928\ in\text{-}lbs.$

$$Torque\ (ft/lbs) = \frac{8928\ in/lbs}{12\ in/ft} = 744\ ft/lbs; \qquad Effective\ lever\ arm\ (ft) = \frac{9\ in}{12\ in/ft} = 0.75\ ft$$

$$Force\ (lbs) = \frac{744\ ft/lbs}{0.75\ ft} = 992\ lbs$$

ROTARY APPLICATIONS

PULLEYS AND SPROCKETS



Formulas

Radius = $\frac{\text{Diameter (in)}}{2}$ = _____ in; Radius = $\frac{\text{radius (in)}}{\text{12 (in-ft)}}$ = _____ft

Breakaway Torque = $\frac{\text{Radius (ft) of pulley or sprocket} \times \text{Weight (lbs)} \times \text{(a) Acceleration factor (Table 3)}}{\text{belt/pulley or sprocket/chain efficiency}}$ = _____ft/lbs

Running Torque = $\frac{\text{radius (ft) of pulley or sprocket} \times \text{Weight (lbs)}}{\text{belt/pulley or sprocket/chain efficiency}}$ = _____ft/lbs

Actuator RPM = $\frac{\text{Velocity (in/sec) x 60 (sec/min)}}{\text{pitch dia. (in) x 3.14}}$ = _____RPM

Example

A rotary actuator is required to operate a 500 lb. vertical door though a chain and 6 inch dia. sprocket. The door travel is 65 inches and should close in approximately 10 sec. What actuator torque and RPM is required? Assume and efficiency of 85% between the chain and sprocket.

Radius of sprocket = $\frac{\text{6 (in) dia.}}{2}$ = 3 inch

Radius of sprocket = $\frac{\text{3 (in) radius}}{\text{12 (in/ft)}}$ = 0.25 ft

Breakaway Torque = $\frac{\text{0.25 (ft) x 500 (lbs) x 1.4 (ft)}}{\text{0.85 efficiency}}$ = 206 ft/lbs

Torque = $\frac{\text{0.25 (ft) x 500 lbs}}{\text{0.85 efficiency}}$ = 147 ft/lbs

Linear Velocity= 6.5 (in) travel/10 seconds operating time = 6.5 in/sec

Actuator RPM = $\frac{\text{6.5 (in/sec) x 60 (sec/min)}}{\text{6 (in) dia. sprocket x 3.14}}$ = 21 RPM

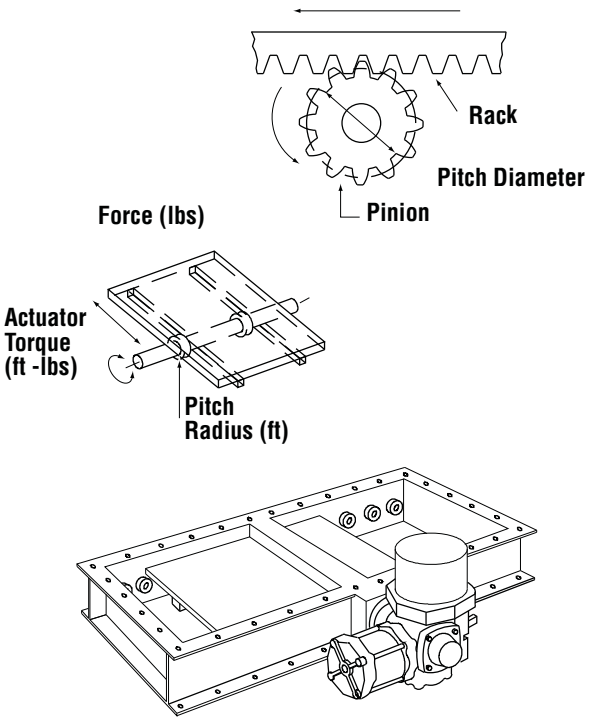
APPLICATION NOTES

1. For lifting or constant load applications select the actuator according to running load requirements.

Reference Tables on Page 45.

GENERAL APPLICATIONS

RACK AND PINION GATES



Formulas

Pitch dia. = $\frac{\text{No. of teeth on pinion}}{\text{Diametral pitch}}$ = _____in

Pitch Radius = $\frac{\text{Pitch dia.(in)}}{2}$ = _____in

Pitch Radius = $\frac{\text{Pitch Radius (in)}}{12\ (\text{in/ft})}$ = _____ft

Actuator RPM = $\frac{\text{Velocity (in/sec) x 60 (sec/min)}}{\text{pitch dia. (in) x 3.14}}$ = _____RPM

VEL. = $\frac{\text{Act. RPM}}{60\ (\text{sec/min})}$ x Pitch dia. (in) x 3.14 = _____in/sec

No. of Output Revolutions = $\frac{\text{Total Travel (in)}}{\text{Pitch dia. (in) x 3.14}}$ = _____revs

Actuator Torque = Force (lbs) x $\left[\frac{\text{Pitch radius (ft)}}{0.9}\right]$ = _____ft-lbs

(Assumed efficiency between Rack and Pinion Gears)

Example

A 18 inch x 18 inch slide gate is found to require 1600 lbs. of breakaway force. Find the actuator torque and RPM required to obtain a minimum linear velocity of 2.5 ins/sec using a 2 inch pitch dia. pinion.

Pitch Radius = $\frac{\text{2 (in) pitch dia.}}{2}$ = 1 inch

Pitch Radius = $\frac{\text{1 (in) pitch radius}}{12\ (\text{in/ft})}$ = 0.083 ft

Actuator Torque = 1600 lbs x $\left[\frac{0.083\ \text{ft}}{0.9\ \text{efficiency}}\right]$ = 148 ft/lbs

Actuator RPM = $\frac{\text{2.5 (in/sec) x 60 (sec/min)}}{\text{2 (in) pitch dia. x 3.14}}$ = 24 RPM

APPLICATION NOTES

For each rack and pinion slide gates find:

1. Force required to operate the gate
2. Pinion pitch diameter

Reference Tables on Page 45.

TABLE 1

Guide Type	Coefficient of Friction Between Steel Plate and Various Type Guides			
	Dry		Lubricated	
	Starting (μ1)	Running (μ3)	Starting (μ1)	Running (μ3)
Ball Bearings	–	–	0.08	0.05
Steel Rollers	–	–	0.15	0.10
Bronze	0.45	0.20	0.2	0.15
Steel	0.4-0.8	0.2-0.4	0.2-0.4	0.15-0.2

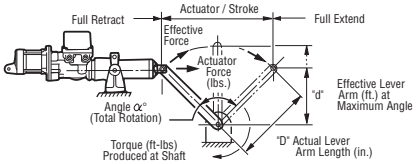
TABLE 2

Material	Coefficient of Friction Between Steel Plate and Various Materials		Specific Weights "W1" (lbs/ft3)	Column Height Factor "h"
	Starting (μ2)	Running (μ4)		
Ash (fly)	0.6-0.7	0.3	40-45	3.0
Ash (wet) (coal refuse)	0.75-0.95	0.5	45-50	2.0
Cement (portland)	0.6-0.65	0.3	95-100	3.0
Cement (clinker)	0.55-0.6	0.3	80-95	4.0
Coal (anthracite)	0.50-0.55	0.25	55-60	4.5
Coal (bituminous)	0.55-0.6	0.3	45-55	3.0
Coke	0.55-0.6	0.3	25-35	3.5
Grain	0.32-0.40	0.2	40-50	4.75
Iron Ore	0.55-0.65	0.3	125-180	3.5
Limestone (crushed)	0.55-0.65	0.3	80-90	3.5
Rock (crushed)	0.65-0.7	0.3	125-140	4.0
Sand (dry)	0.5-0.55	0.3	90-110	4.0
Sand (damp)	0.6-0.65	0.4	110-125	2.5
Slag (blast furnace)	0.4-0.45	0.2	80-90	5.5
Steel	See Table 1	See Table 1	490	–
Taconite	0.35-0.4	0.2	120-130	8.25
Wood chips	0.75-0.8	0.4	10-30	2.5

TABLE 3

Velocity (in/sec.)	0.1 to 3.5	3.6 to 6.4	6.4 to 12.2	12.3 to 25.0
Acceleration Factor (a)	1.2	1.3	1.4	1.5

Symmetrical Mounting



Non-Symmetrical Mounting

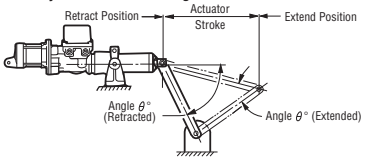


TABLE 4

Angle a	6" Stroke		12" Stroke		18" Stroke		24" Stroke	
	d'	D"	d'	D"	d'	D"	d'	D"
30°	.93	11.6	1.87	23.2	2.80	34.8	3.73	46.4
45°	.60	7.8	1.21	15.7	1.81	23.5	2.41	31.4
60°	.43	6.0	.87	12.0	1.30	18.0	1.73	24.0
90°	.25	4.2	.50	8.5	.75	12.7	1.00	17.0

Angle a	30" Stroke		36" Stroke		48" Stroke		60" Stroke	
	d'	D"	d'	D"	d'	D"	d'	D"
30°	4.67	58.0	5.60	69.5	7.46	92.7	9.33	115.9
45°	3.02	39.2	3.62	47.0	4.83	62.7	6.04	78.4
60°	2.17	30.0	2.60	36.0	3.46	48.0	4.33	60.0
90°	1.25	21.2	1.50	25.5	2.00	33.9	2.50	42.4

Angle Ø°	5°	15°	30°	45°	60°	75°	90°
Force Factor	0.09	0.26	0.50	0.71	0.87	0.97	1.00

Effective force (lbs) = Actuator force (lbs) x force factor
Effective lever arm (ft) = Actual length arm (ft) x force factor

NOTES

1. For non-symmetrical mounting the angle Ø° will change as the actuator moves through its travel. The angle Ø° is formed between the actuator drive rod centerline and the lever arm axis.

Torque (ft/lbs) = Effective lever arm (ft) x actuator force (lbs)
Force Required (lbs) = Torque (ft/lbs) ÷ Effective lever arm (ft)

APPLICATION NOTES

1. **Operation at 50 Cycle** – When an actuator is operated at 50 HZ, the velocity or output RPM will be 1/6th less than at 60 HZ, whereas the torque or force ratings remain the same. (60 HZ speed x 0.83 = _____ 50 HZ speed). Class F motor insulation should be used. Always specify if an actuator is going to be run at 50 cycle.
2. **Motor Insulation** – Class B insulation is supplied as standard. Class F motor insulation should be used for ambient temperatures above 40°C. (approx. 100°F) and for installations in high altitudes (3300 ft. and above).
3. **Temperature Limits** – Actuators can be supplied for ambient temperatures up to 200°F. For any temperatures below -60°F, and above 150°F, please specify.
4. **Simultaneous Control of Multiple Actuators** – Actuators can be run simultaneously if operated from a common control.

HYDRAULIC AND PNEUMATIC CYLINDER FORCES

Force (extend) = Pressure (psi) x Area of Bore Dia. (in^2) = _____lbs.

Force (retract) = Pressure (psi) x Area of Bore Dia. (in^2) - Area of Rod Dia. (in^2) = _____lbs.

$$\text{Cylinder Velocity} = \frac{231 \times \text{Flow Rate (GPM)}}{60 \times \text{Area } (in^2)} = \_\_\_\_\_ \text{ (in/sec)}$$

OTHER FORMULAS AND CONVERSIONS

Area of Circle = πR^2 = _____(in^2), π = 3.14, R = Radius (in)

Circumference of a Circle = π D, π = 3.14, D = Diameter (in)

$$\text{Torque} = \frac{\text{H.P.} \times 5250}{\text{RPM}} = \_\_\_\_\_ \text{ft.-lbs}$$

Inches of Water (Water Column) x 0.03613 = _____psi

Feet of Water x 0.4335 = _____psi

Inches of Mercury x 0.4912 = _____psi

Millimeters/25.4 = _____inches

Kilogram x 2.21 = _____lbs (force)

DEFINITION OF TERMS

Acceleration Factor – Acceleration is rate of velocity change with respect to time. Actuator acceleration occurs from the time an object is initially placed in motion until full speed (velocity) is obtained. A recommended Acceleration Factor is given in Table 3. (Higher velocity → higher acceleration factor)

Acme Screw Drive – Type of actuator drive that has a rotating drive screw with a mating drive nut that moves axially along the length of the screw. Sliding contact exists between the nut and screw. Andco Actuators are designed to have optimum efficiency while still having self-locking features in the back drive mode.

Ball Screw Drive – An actuator drive screw and nut with matching helical grooves running between them. Captured within the grooves are recirculating ball bearings. The efficiency is very high allowing actuators to run at high duties and high velocities.

Breakaway Force – The starting or initial force required to produce motion. An Andco Actuator can develop its full breakaway thrust at any point in travel, however it should only be applied as a momentary force.

Breakaway Torque – Same context as above except torque implies rotation.

Center of Gravity – The point of an object about which it will balance. In this manual, the center of gravity is sometimes referred to as the center of weight.

Closed Loop Control – Automatic measuring of a process medium (temperature, pressure, current, etc.) for the purpose of controlling a valve, damper, etc. to maintain a desired process level. Typically a process signal (4-20 ma dc, etc.) is supplied to Andco Controller that will signal the final control element (Andco Actuator) to move an appropriate amount for positioning a valve, damper, etc.

Coefficient of Running Friction - A factor of resistance to movement between two contacting surfaces that have motion between them. (See Tables 1 and 2).

Coefficient of Starting Friction – A factor of resistance to movement between two contacting surfaces at rest. (See Tables 1 and 2).

Differential Pressure (Δ p) – The difference in pressure between two locations within a system. A common unit of measurement is pounds per square inch (psi).

Duty Cycle – Actual operating time of actuator as compared to off time during a one hour time period.

$$\text{Duty cycle} = \frac{\text{Actual Running Time (sec.)}}{\text{3600 Seconds/Hour}} \times 100\% = \_\_\_\_\_\%$$

Hammerblow – An actuator feature that permits the motor to attain full speed before the actuator output drive sleeve begins to move the load. This feature serves as an impact type device which aides in starting an object in motion. The hammerblow effect will be encountered every time the actuator is reversed (QR &QRG Series Actuators are supplied with the hammerblow feature as standard). This is sometimes referred to as a **LOST MOTION DEVICE.** (See No Lost Motion).

Hazardous Location – An area containing explosive or flammable vapor, gas fibers or dust in sufficient quantity to cause an explosion or fire. (Specify class, division and group).

	Class I	Flammable vapors and gases.
	Class II	Combustible dust.
	Division I	Hazard is present under normal conditions.
	Division II	Hazard is present under abnormal conditions.
Class I	Group A	Atmospheres containing acetylene.
	Group B	Atmospheres containing hydrogen and others.
	Group C	Atmospheres containing carbon monoxide, ethylene, hydrogen sulfide and others.
	Group D	Atmospheres containing gasoline, hexane, naphtha, benzine, butane, proposane acetone, benzol, alcohol, lacquer solvent vapors, natural gas and others.
Class II	Group E	Atmospheres containing metal dust.
	Group F	Atmospheres containing carbon black, coke or coal dust.
	Group G	Atmospheres containing grain, starch, or flour dust.

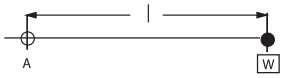
DEFINITION OF TERMS

Modulating Service:

Continuous Modulating Actuator Service– Frequent or at times continuous incremental movement. Actuators that are part of closed loop process control should be rated for continuous modulating service

Intermittent Modulating Actuator Service – Frequent incremental movement for limited periods of time. The controlled mechanism is not subject to constant regulation (i.e. mixing or blending of materials).

Moment Arm – Perpendicular distance (l) from the center of gravity to the pivot point (A).



Motor Brake – An electro-mechanical device that will prevent motor rotation when the actuator is de-energized. Brakes are used on actuators to hold position under load. (i.e. ball screw drives, acme screw drives that are subject to high vibration causing the motor shaft to rotate and the actuator to creep.)

Motor Starter – A device that controls and protects a motor. The individual components that normally are supplied with a starter are described below:

Contactor – The main power contacts of the starter. For a three phase reversing motor three contacts are used for each direction of rotation. The main contacts carry the three phase (primary) voltage supply. The primary contacts are opened and closed by means of auxiliary contacts that are activated from a 115 Volt (nominal coil).

Control Circuit – The low voltage (secondary) circuit that contains any pushbutton, selector or actuator limit switches that will activate or deactivate the 115 Volt coil to open or close the main contacts of the starter. Also contained in the control circuit are secondary fuses and a mechanical interlock.

Control Transformer – Connected across any two of the high voltage (primary) power leads. The transformer reduces the high voltage to a 115 VAC (nominal) control voltage (secondary) which acts as a control circuit voltage supply.

Mechanical Interlock – Prevents opposite rotation main power contacts from being energized at the same time (i.e., if the extend and retract pushbuttons were pushed at the same time only one direction would energize.)

Overload Relay – Connected between the main power contacts and the actuator motor. The relay will open the circuit if excessive current is present for a certain period of time.

No Lost Motion Drive – For applications that require frequent reversals or incremental movement (i.e., modulating control) the output drive should engage with a minimum amount of free play upon reversal. (Specify No Lost Motion) (See Hammerblow.)

On-Off Duty (Control) – Actuator will move to either full extend or full retract, full open or full close positions. The actual actuator running time should be less than 5%.

Pressure Drop – Another term for differential pressure. (See Differential Pressure.)

Specific Weight – Weight per unit volume of a particular material (lbs/ft^3). (See Table 2).

Torque – The product of force and perpendicular distance from a pivot point. Torque will tend to produce rotation about the pivot point.

ANDCO ORDERING INFORMATION

WHEN ORDERING OR REQUESTING A QUOTATION PLEASE SPECIFY THE FOLLOWING:

1. Desired breakaway and running force (pounds)
2. Desired velocity (inches/second)
3. Desired stroke (inches)
4. Desired duty
5. Ambient temperature if below -30° F or above 120°F
6. Power and control voltage and other relevant electrical specifications:
    a. Motor voltage, frequency and phase
    b. Motor insulation
    c. Motor brake
    d. Motor space heater
7. Enclosure (weatherproof or dust-ignition proof)
8. Desired mounting (clevis, trunnion or face/flange)
9. Desired options:
    a. Additional position limit switches or contacts
    b. Potentiometer(s) or encoder
    c. Limit switch compartment heater
    d. Motor heater
    e. Handwheel
    f. Rod cover
    g. Single or Three Phase Motor Control
    h. Motor brake
10. Internal Controls:
    a. Positran Transmitter
    b. Electric Actuator Smart Control (EASC)
    c. Profibus® D.P.
    d. DeviceNet™
    e. ModBus®
11. Separately mounted options
    a. 4100 Position Indicator
    b. 5100 Remote Position/Process Control

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