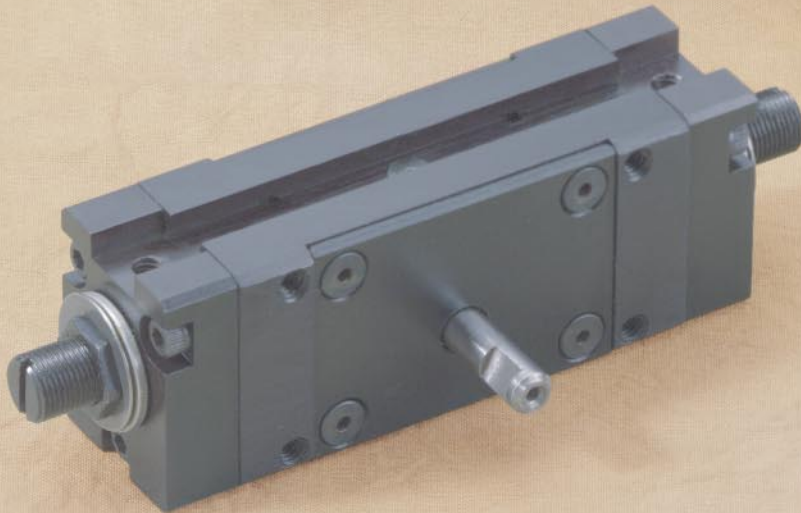
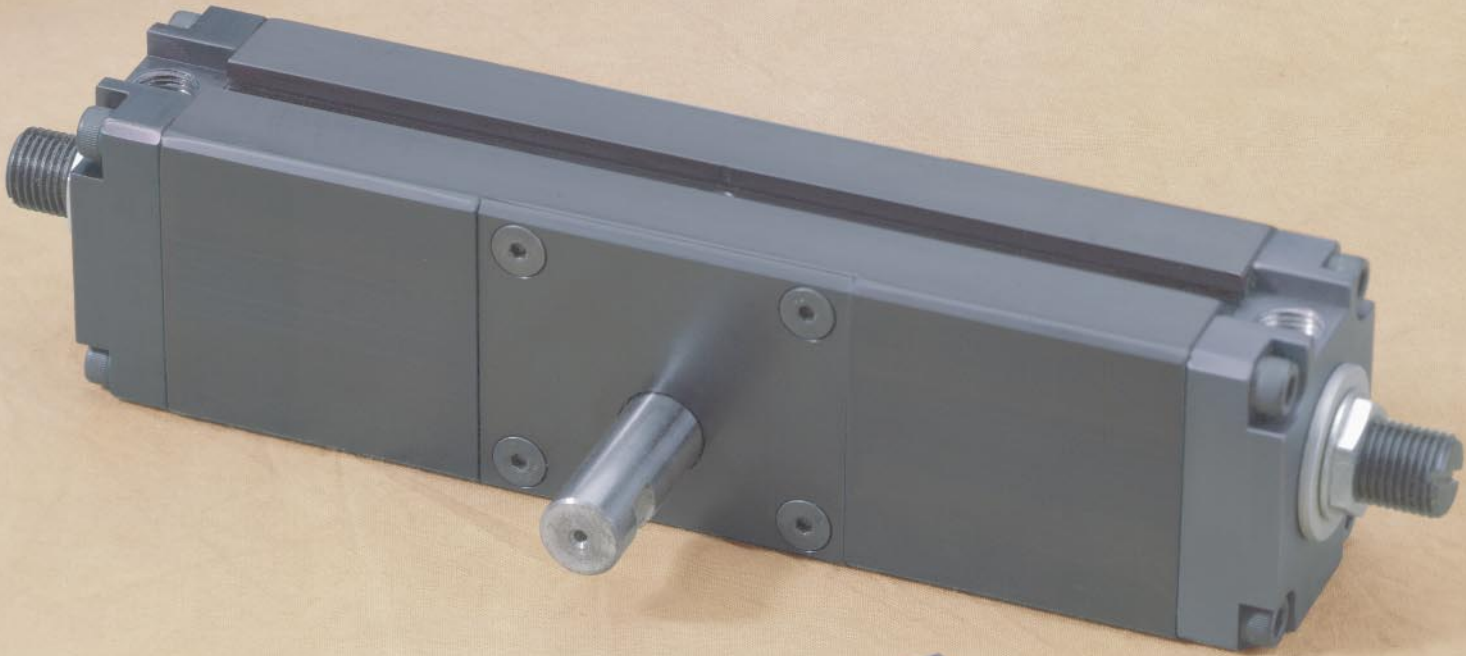
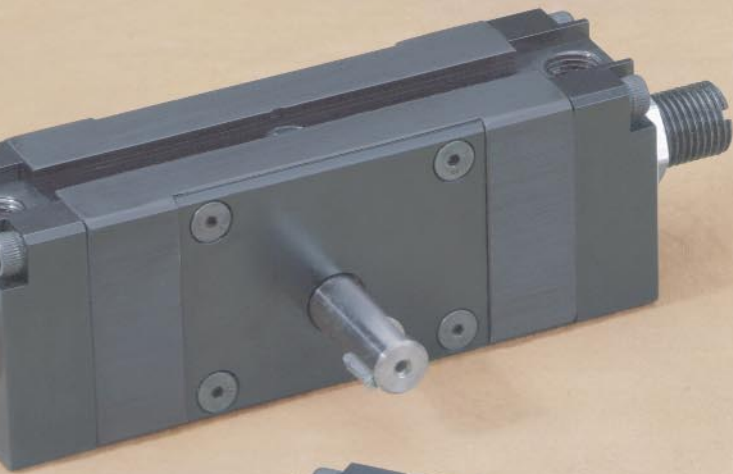


RACK & PINION ROTARY ACTUATORS



RACK & PINION ROTARY ACTUATORS

In comparison with other rotary actuators, Tol-O-Matic's rack and pinion rotary actuator has one of the highest torque per weight ratios and features a light-weight, compact package. Available in 3/4", 1" and 1-1/4" bore sizes with rotation options of 0° to 180° and 0° to 360°, these actuators fill a wide variety of application requirements.

Its low-profile, single rack design gives it a big advantage over bulkier double rack models and its anodized

extruded aluminum housing makes it durable and light-weight.

Sintered bronze guide block eliminates backlash by preloading the rack into the pinion throughout the stroke. Ball bearings reduce friction for maximum efficiency, rigidity and support to pinion shaft and allow the actuator shaft to withstand substantial side loads.

Adjustable stops with nylon bumpers offer stroke adjustment and shock absorption on low-inertia applications. Shock absorbers can be mounted in place of the adjustable stops to decelerate and limit travel in high inertia

applications. Optional adjustable cushions can be utilized for end of travel deceleration. Additional options include Hall-effect sinking or sourcing sensors for signaling position.

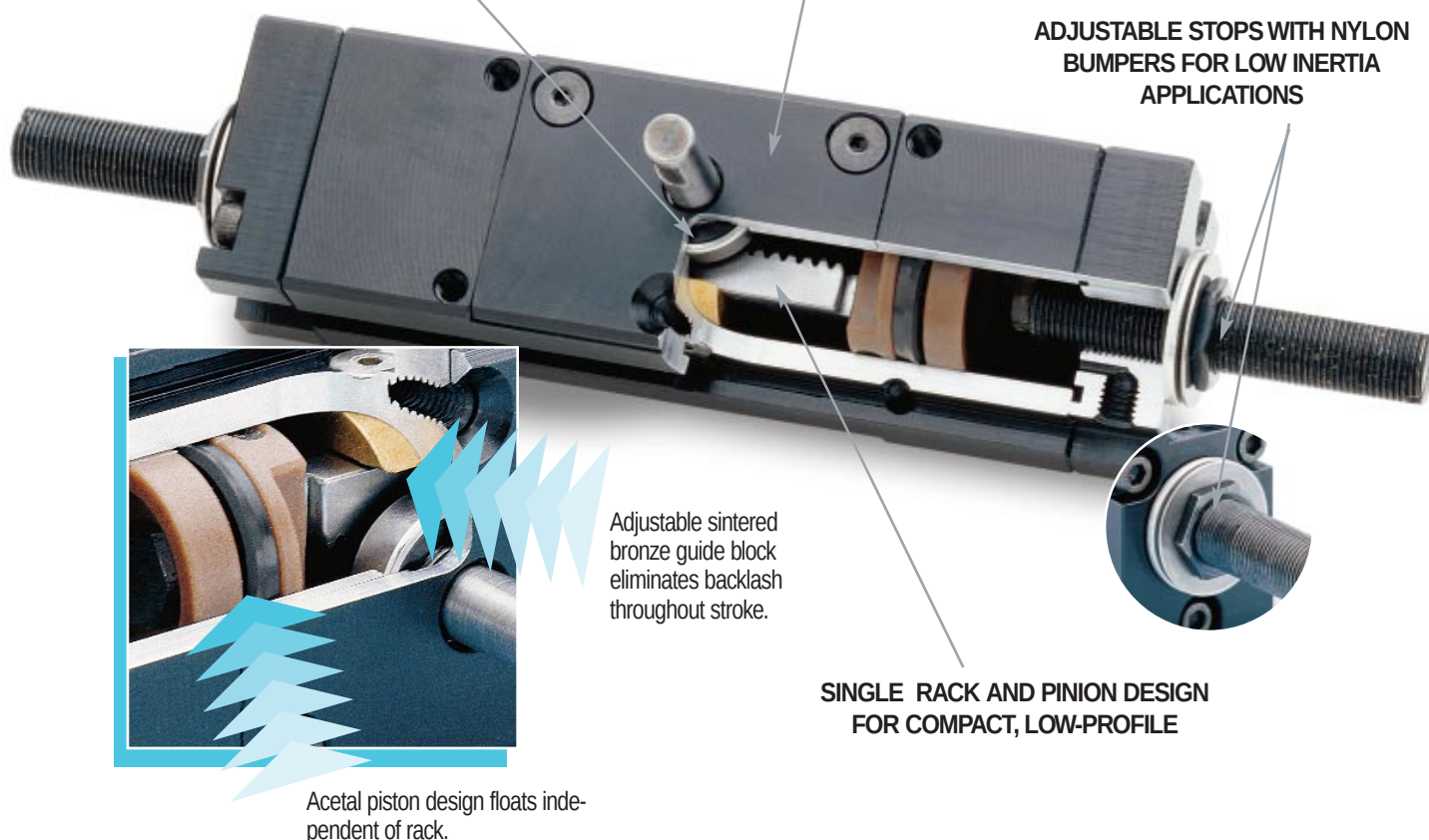
All Tol-O-Matic rack and pinion rotary actuators are prelubricated, easily field repairable and are rated for 10,000,000 cycles under normal operating conditions.

**BALL BEARING REDUCES FRICTION
AND PROVIDES SUPPORT AGAINST
SIDE LOADING OF PINION AND SHAFT**

**EXTRUDED, LIGHT-WEIGHT,
ANODIZED ALUMINUM HOUSINGS**

**PRETAPPED MOUNTING HOLES
ON BACKSIDE OF HOUSING**

**ADJUSTABLE STOPS WITH NYLON
BUMPERS FOR LOW INERTIA
APPLICATIONS**



RACK & PINION ROTARY ACTUATORS



Rack and pinion rotary actuators are available in three bore sizes of ¾", 1" and 1¼" with 0° to 180° or 0° to 360° rotations.

RACK & PINION ROTARY ACTUATOR OPTIONS

CUSHIONS 177
SEALS OF VITON® MATERIAL
SHOCK ABSORBERS 177
SWITCHES (HALL-EFFECT) . . 214

APPLICATION GUIDELINES . . 241
ORDERING 178
SELECTION 179

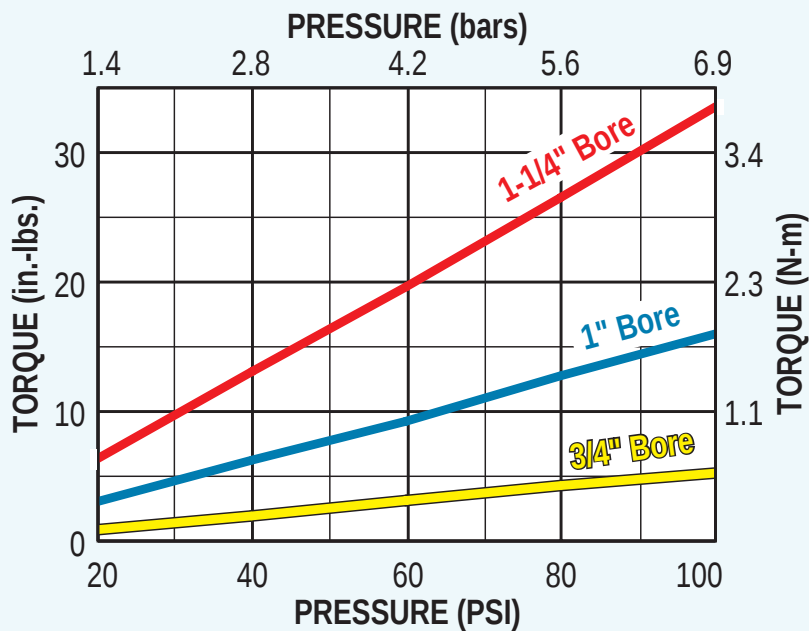
OVERALL SPECIFICATIONS

SPECIFICATION	MODEL NUMBER		
	RA075	RA100	RA125
Bore Diameter (in.)	0.750	1.000	1.250
Degree of Rotation	180 / 360	180 / 360	180 / 360
Base Weight (lbs.) w/180° rotation	0.60	0.78	1.35
Base Weight (kgs.) w/180° rotation	0.27 kgs.	0.35 kgs.	0.61 kgs.
Base Weight (lbs.) w/360° rotation	0.71	1.02	1.81
Base Weight (kgs.) w/360° rotation	0.32 kgs.	0.46 kgs.	0.82 kgs.
Shaft Style:	Single	Single	Single
Theoretical Torque Specs	0.072 in. lb. / psi	0.196 in. lb. / psi	0.409 in. lb. / psi
Theoretical Torque Specs	0.008 N.m. / psi	0.022 N.m. / psi	0.046 N.m. / psi
Maximum Operating Pressure:	150 PSI	150 PSI	150 PSI
Maximum Operating Pressure:	10.3 bars	10.3 bars	10.3 bars
Maximum Breakaway Pressure:	10 PSI	7 PSI	5 PSI
Maximum Breakaway Pressure:	0.69 bars	0.48 bars	0.34 bars
Effective cushion range:	30°	30°	30°
Standard Rotations:	180°, 360° fully adjustable	180°, 360° fully adjustable	180°, 360° fully adjustable
Operating Temperature:*	0°F to 180°F (Buna-N seals) 0°F to 240° F (Viton® seals)	0°F to 180°F (Buna-N seals) 0°F to 240° F (Viton® seals)	0°F to 180°F (Buna-N seals) 0°F to 240° F (Viton® seals)
Operating Temperature:*	-18°C to 82°C (Buna-N seals) -18°C to 116° C (Viton® seals)	-18°C to 82°C (Buna-N seals) -18°C to 116° C (Viton® seals)	-18°C to 82°C (Buna-N seals) -18°C to 116° C (Viton® seals)
Keyway Timing:	12 O'clock position at midstroke	12 O'clock position at midstroke	12 O'clock position at midstroke
Housing Material:	Aluminum	Aluminum	Aluminum
Shaft Material:	Steel	Steel	Steel
Rack Material:	Steel	Steel	Steel
Maximum Angular Backlash	1.5°	1.0°	1.0°
Rotational Tolerance	+10° / -00°	+7° / -00°	+5° / -00°
Volume/Degree of Rotation	.0012 in. ³	.0055 in. ³	.0071 in. ³
Volume/Degree of Rotation	0.020 mm. ³	0.090 mm. ³	0.116 mm. ³

*180° F (82° C) is the maximum operating temperature when using magnets. Therefore magnets should not be used with the seals of Viton® material.

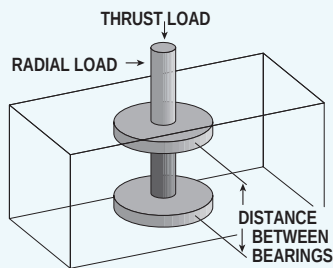
PERFORMANCE DATA

TORQUE VS PRESSURE (Actual)



BEARING LOAD CAPACITIES

Model	Radial (lbs.)	Radial (kgs.)	Thrust (lbs.)	Thrust (kgs.)	Bearing Spread (in.)	Bearing Spread (mm)
RA075	105	47.6	26	11.8	0.68	17.3
RA100	235	106.6	59	26.8	0.84	21.3
RA125	360	163.3	90	40.8	1.06	26.9



KINETIC ENERGY RATINGS

Kinetic Energy Absorption / Stop

ADJUSTABLE STOPS		
Model	KE/Stop (in.-lbs)	KE/Stop (N-m)
RA075	0.14	0.016
RA100	0.26	0.029
RA125	0.26	0.029

OPTIONAL - CUSHIONS		
Model	KE/Stop (in.-lbs)	KE/Stop (N-m)
RA075	0.50	0.056
RA100	0.92	0.104
RA125	1.84	0.208

OPTIONAL - SHOCK ABSORBERS			
Model	KE/Stop (in.-lbs)	KE/Stop (N-m)	Max. Cycles/Hr.
RA075	1.00	0.113	3896
RA100	3.00	0.339	5195
RA125	4.00	0.452	3911

RA075, RA100, RA125

DIMENSIONAL DATA

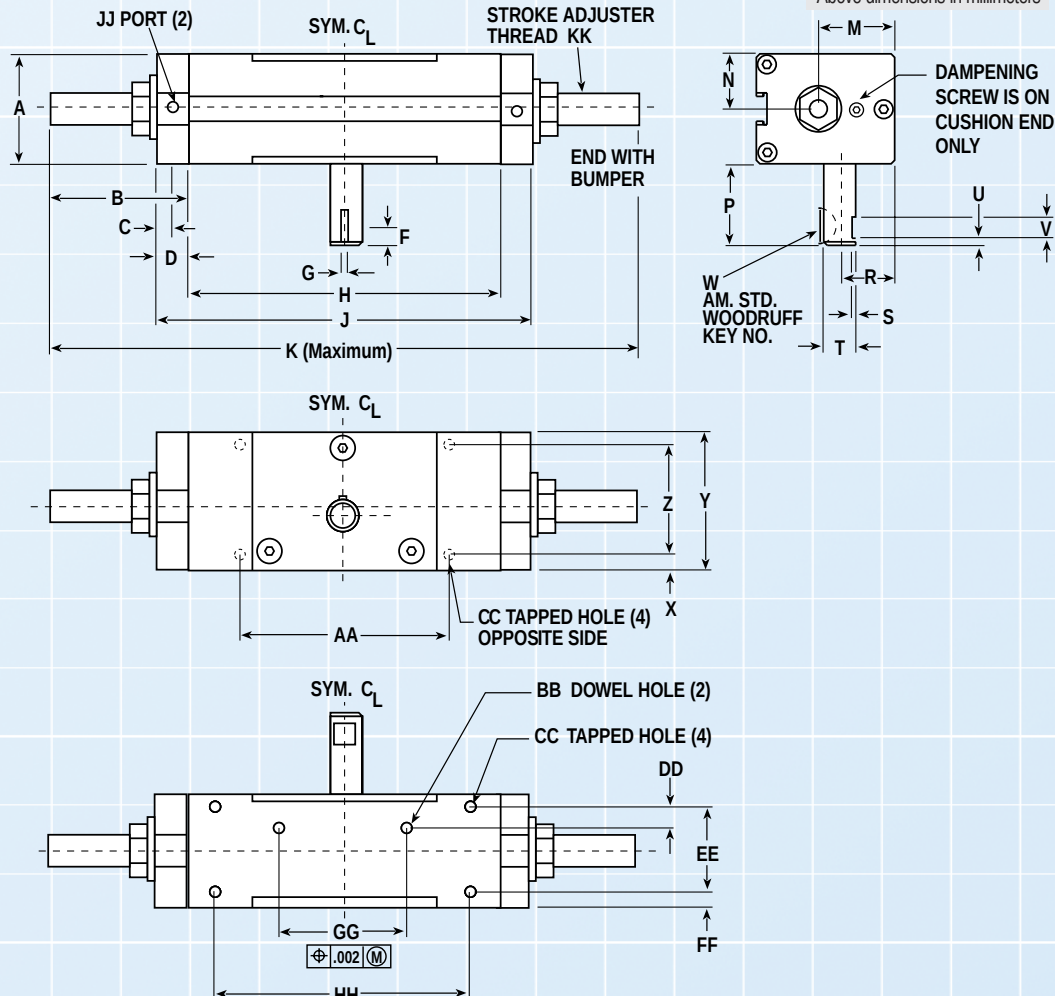
*K is adjustable. Dimension is maximum value

MODEL	Bore	A	B	C	D	F	G	H	J	K*	M	N	P	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK
RA075-180	0.75	1.062	1.08	.219	.438	.220	.063	2.750	3.625	4.910	.688	.531	.687	.525	.047	.250	.09	.260	#202.5	0.141	1.344	1.063	2.094	0.1250 x .22	8-32 x .31"	.187	.750	.156	1.250	2.500	10-32	3/8-32
RA075-360	0.75	1.062	1.08	.219	.438	.220	.064	3.771	4.646	5.930	.688	.531	.687	.525	.047	.250	.09	.260	#202.5	0.141	1.344	1.063	2.094	0.1240 x .22	8-32 x .31"	.187	.750	.156	1.250	2.500	10-32	3/8-32
RA100-180	1.00	1.313	1.43	.328	.594	.220	.094	3.375	4.563	6.240	.875	.656	.943	.625	.063	.375	.09	.260	#303	0.156	1.625	1.313	2.438	0.1250 x .22	10-24 x .38"	.250	1.000	.156	1.500	3.000	1/8-27	1/2-20
RA100-360	1.00	1.313	1.43	.328	.594	.220	.095	4.946	6.134	7.810	.875	.656	.943	.625	.063	.375	.09	.260	#303	0.156	1.625	1.313	2.438	0.1240 x .22	10-24 x .38"	.250	1.000	.156	1.500	3.000	1/8-27	1/2-20
RA125-180	1.25	1.562	1.43	.328	.594	.380	.125	4.125	5.313	6.990	.989	.781	1.219	.656	.094	.500	.25	.260	#405	0.172	1.906	1.563	2.625	0.1250 x .22	10-24 x .38"	.359	1.219	.172	1.750	3.188	1/8-27	1/2-20
RA125-360	1.25	1.562	1.43	.328	.594	.380	.126	6.219	7.406	9.080	.989	.781	1.219	.656	.094	.500	.25	.260	#405	0.172	1.906	1.563	2.625	0.1240 x .22	10-24 x .38"	.359	1.219	.172	1.750	3.188	1/8-27	1/2-20

Above dimensions in inches

MODEL	Bore	A	B	C	D	F	G	H	J	K*	M	N	P	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK
RA075-180	0.75"	27.0	27.4	5.6	11.1	5.6	1.6	69.9	92.1	124.7	17.5	13.5	17.4	13.3	1.2	6.4	2.3	6.6	#202.5	3.6	34.1	27.0	53.2	3.18 x 5.6	8-32 x .31"	4.7	19.1	4.0	31.8	63.5	10-32	3/8-32
RA075-360	0.75"	27.0	27.4	5.6	11.1	5.6	1.6	95.8	118.0	150.6	17.5	13.5	17.4	13.3	1.2	6.3	2.3	6.6	#202.5	3.6	34.1	27.0	53.2	3.15 x 5.7	8-32 x .31"	4.7	19.1	4.0	31.8	63.5	10-32	3/8-32
RA100-180	1.00"	33.4	36.3	8.3	15.1	5.6	2.4	85.7	115.9	158.5	22.2	16.7	24.0	15.9	1.6	9.5	2.3	6.6	#303	4.0	41.3	33.4	61.9	3.18 x 5.6	10-24 x .38"	6.4	25.4	4.0	38.1	76.2	1/8-27	1/2-20
RA100-360	1.00"	33.4	36.3	8.3	15.1	5.6	2.4	125.6	155.8	198.4	22.2	16.7	24.0	15.9	1.6	9.5	2.3	6.6	#303	4.0	41.3	33.4	61.9	3.15 x 5.7	10-24 x .38"	6.4	25.4	4.0	38.1	76.2	1/8-27	1/2-20
RA125-180	1.25"	39.7	36.3	8.3	15.1	9.7	3.2	104.8	135.0	177.5	25.1	19.8	31.0	16.7	2.4	12.7	6.4	6.6	#405	4.4	48.4	39.7	66.7	3.18 x 5.6	10-24 x .38"	9.1	31.0	4.4	44.5	81.0	1/8-27	1/2-20
RA125-360	1.25"	39.7	36.3	8.3	15.1	9.7	3.2	158.0	188.1	230.6	25.1	19.8	31.0	16.7	2.4	12.7	6.4	6.6	#405	4.4	48.4	39.7	66.7	3.15 x 5.7	10-24 x .38"	9.1	31.0	4.4	44.5	81.0	1/8-27	1/2-20

Above dimensions in millimeters



RACK & PINION ROTARY ACTUATORS - OPTIONS



CUSHIONS

For low inertia applications, cushions may be added to decelerate the load at the end-of-stroke. Adjustable cushions are available on all sizes of rack and pinion rotary actuators and feature a floating cushion seal for positive load deceleration and fast exiting of the cushion on the return stroke.

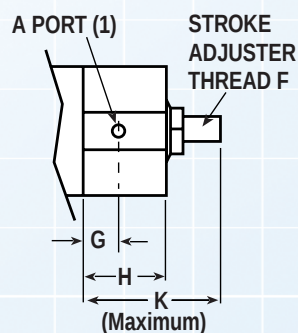


SHOCK ABSORBERS

For high inertia or cyclic applications, optional shock absorbers can be used to increase the rotary actuators life and broaden the application range. Shocks utilize same thread sizes as standard adjustable stops, making them easily interchangeable and field retrofittable.

DIMENSIONAL DATA

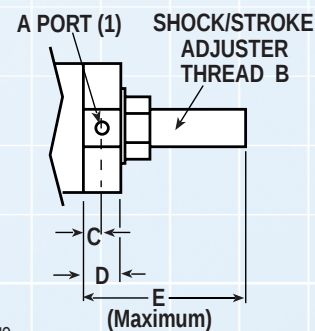
CUSHION



SEE KINETIC ENERGY RATINGS ON PAGE 175

*E & K are adjustable. Dimension is maximum value

SHOCK ABSORBER

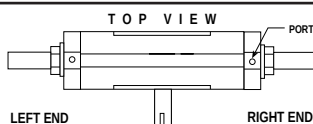


MODEL	A	B	C	D	E*	F	G	H	K*
RA075	10-32	3/8-32	.219	.438	1.61	1/4-20	.281	.750	1.25
RA100	1/8-27	1/2-20	.328	.594	3.24	1/4-20	.344	.813	1.25
RA125	1/8-27	1/2-20	.328	.594	3.24	1/4-20	.344	.813	1.25

Above dimensions in inches

MODEL	A	B	C	D	E*	F	G	H	K*
RA075	10-32	3/8-32	5.56	11.13	40.89	1/4-20	7.14	19.05	31.75
RA100	1/8-27	1/2-20	8.33	15.09	82.30	1/4-20	8.74	20.65	31.75
RA125	1/8-27	1/2-20	8.33	15.09	82.30	1/4-20	8.74	20.65	31.75

Above dimensions in millimeters



When ordering cushions or shock absorbers for Rack and Pinion Rotary Actuators, specify left or right end. Refer to the illustration shown at left as viewed from the port side.

RA - ORDERING

MODEL, BORE, SHAFT, AND ROTATION

1.	2.	3.	4.
R A	1 2 5	S F S	R O 3 6

ACCESSORIES AND OPTIONS

5.	6.	7.	8.
	C U R		K M 1

The above example describes a Rack and Pinion Rotary Actuator with 1¼" (1.25 in.) bore, Single Output Shaft and 360° rotation. Optional items are Cushion End for the Right Side and one Hall-effect (Sinking) Switch Quick Disconnect with 5 meter lead.

Boxes above represent the number of fields available for each section and not all of them will be used in every application. Omit empty boxes when you construct your configurator number (placeholders are not required). For the above example, the order string as it is typed would appear as follows:

RA125SFSRO36CURKU1.

1. MODEL TYPE

Enter:

RA for Rack and Pinion Rotary Actuator

2. BORE SIZE

Enter:

075 for ¾" (0.75 in.)

100 for 1.00 in.

125 for 1¼" (1.25 in.)

3. SHAFT OUTPUT

Enter:

SFS for Single Output Shaft.

4. ROTATION

Enter:

RO18 for 180° rotation.

RO36 for 360° rotation.

5. SEALS

Enter:

Leave blank for standard Buna N

V for Viton®.

(Seals of Viton® material are not available when ordering switches)

6. CUSHIONS

Enter:

CUR for Cushion End on Right Side*.

CUL for Cushion End on Left Side*.

CUB for Cushion End on Both Sides.

7. SHOCKS

Enter:

SHR for Shock End Right Side*.

SHL for Shock End Left Side*.

SHB for Shock End Both Sides.

*To identify left/right end see drawing on page 177.

8. SWITCHES

Enter:

KT for Hall-effect (Sinking) 5 meter lead.

KM for Hall-effect (Sinking) 5-meter lead Quick-disconnect

TT for Hall-effect (Sourcing) 5 meter lead.

TM for Hall-effect (Sourcing) 5-meter lead Quick-disconnect

Enter:

Number of switches in third box.

NOTE: Only Universal Mini Hall-effect switches are available for Rotary Actuators

VANE ROTARY ACTUATOR

ORDERING INFO . . . 164, 166 , & 168



For the available field retrofit options and accessories, refer to kit listings on page 210 for part numbers.

SELECTION ROTARY ACTUATOR

To select a rack and pinion rotary actuator or vane rotary actuator, the following application data is required:

- Torque required to rotate the load.
- Degree of rotation.
- Pressure available (PSI).
- Radial and/or thrust loads.

Refer to the performance charts for rack & pinion rotary actuators on page 175 and vane rotary actuator on page 163 to determine the following selection specifications.

1. DETERMINE TORQUE OUTPUT AT AVAILABLE PRESSURE

Refer to the Torque vs Pressure chart and choose a rotary actuator based on its torque output at the available operating pressure that will rotate the load.

2. DETERMINE ACTUATORS BEARING LOAD CAPACITY

Consult the Bearing Load Capacity chart. Bearing loads must not exceed the values shown for radial and/or thrust loading.

3. CALCULATE KINETIC ENERGY IF APPLICABLE

Kinetic energy comes into play if the actuator will decelerate the load. In these applications, both torque output to rotate the load and kinetic energy absorption to stop the load must be considered to correctly size a rotary actuator.

Once the KE value per stop has been calculated, refer to the Rotary Actuator Kinetic Energy Rating chart and determine if standard adjustable stops with bumpers are adequate or if

optional cushions or shock absorbers will be required.

How to calculate kinetic energy is shown below.

KINETIC ENERGY CALCULATION

$$KE = \frac{1}{2} J_m \omega^2$$

$$\omega = 0.035 \times \frac{\text{angle traveled (deg.)}}{\text{rotation time (sec.)}}$$

where

KE = Kinetic Energy per stop (in.-lbs.)

J_m = Rotational mass moment of inertia (in.-lbs.-sec.²)

ω = Peak Velocity (rad./sec.)
(assuming twice average velocity)

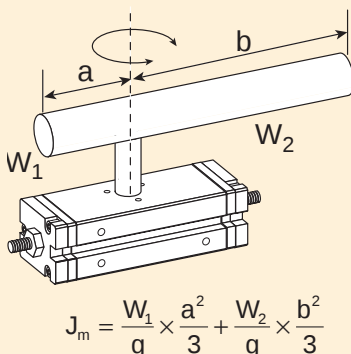
W = Weight of load (lbs.)

g = Gravitational constant =
386.4 in./sec.²

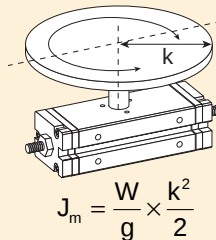
k = Radius of gyration (in.)

MOMENTS OF INERTIA EXAMPLES

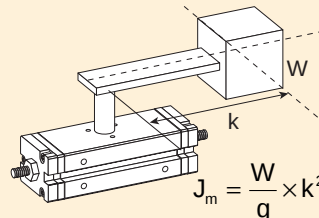
SLENDER ROD MOUNTED OFF CENTER



THIN DISK MOUNTED ON CENTER



POINT LOAD



THIN RECTANGULAR PLATE MOUNTED OFF CENTER

