VANE ROTARY ACTUATOR

VANE ROTARY ACTUATOR

Tol-O-Matic's pneumatic vane rotary actuator offers an unbeatable combination of high torque, compact design, low breakaway and low price. This actuator family has three series of models: the l-inch bore 1810 series, the 1¾-inch bore 1817 series and the 2½-inch bore 1825 series. Together they offer a torque range from a few inch-pounds to as high as 325 inch-pounds.

All series are based on a similar design of extruded aluminum housings with integral stators; rotor shafts; Buna-N double-lip vane and stator seal and a unique shaft and end cap design.

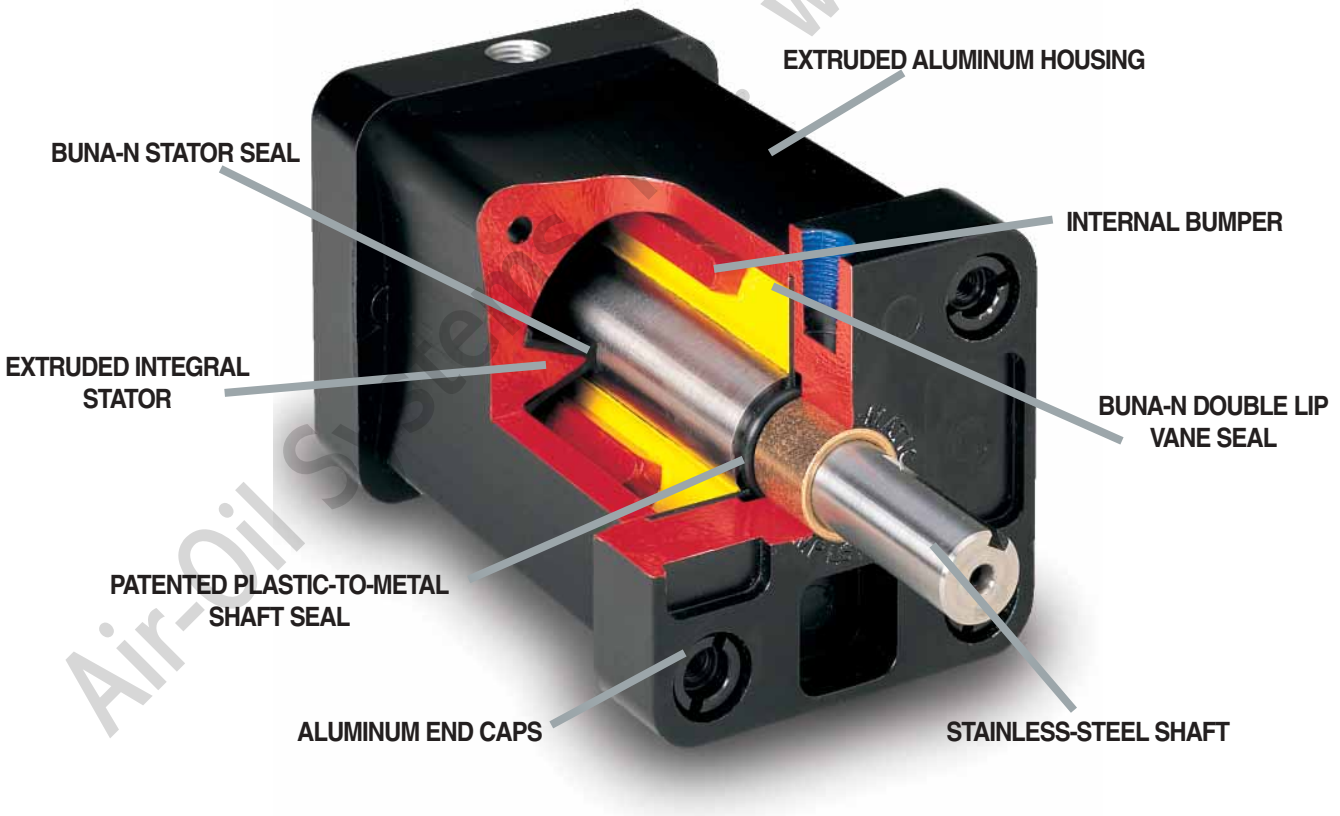
The double-lip seal design reduces breakaway by providing a tighter seal, resulting in higher efficiency. The seal design also prevents squeegeeing of lubricant from the circumference of the housing.

The patented* shaft and end cap seal design eliminates the rubber O-ring commonly used to seal the shaft and the end cap. Instead, the shouldering part of the shaft is slightly longer than the housing. When assembled it causes a thin wall of plastic in the end caps to deflect, creating an air-tight seal which shows no wear after millions of cycles. All Tol-O-Matic vane rotary actuators are permanently pre-lubricated at the factory.

The actuators are available in 100° and 280° rotations, with single or double-ended shafts. All bore sizes can be based-mounted with tapped mounting holes provided. Front mounting is also an option on 1-inch and 1¾-inch bore sizes with front mounting flanges, and on 2½-inch bore sizes with tapped front mounting bolts.

Optional infinitely adjustable stops are available for the 1817 and 1825 Series.

**U.S. Patent No. 4817504*



Tol-O-Matic Vane Rotary Actuators Feature:

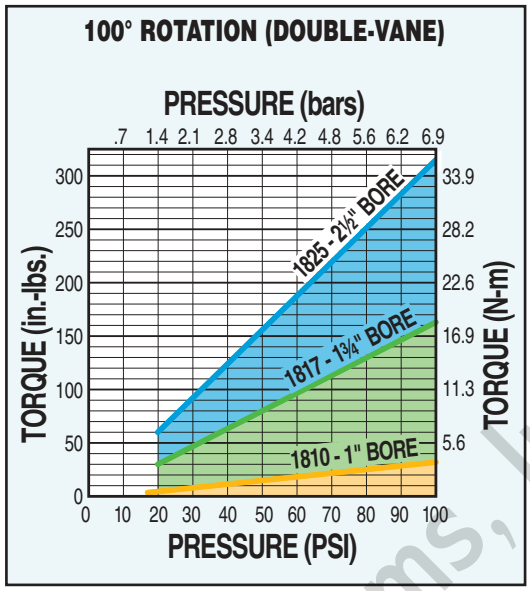
•Highest Torque •Lowest Breakaway •Compact Design •Lowest Price •Lightest Weight

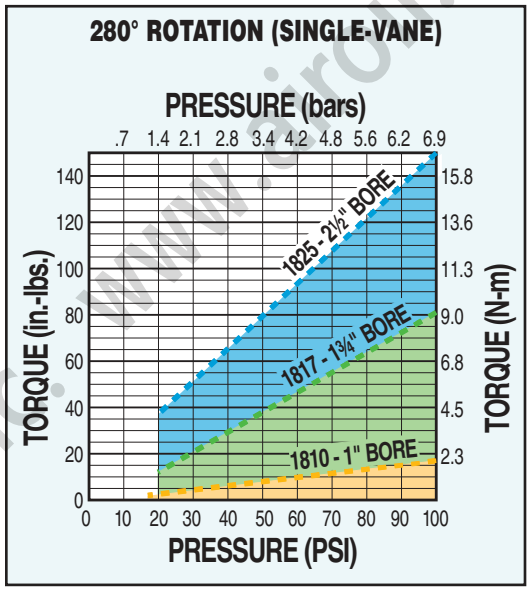
The graphs on this page are intended for a quick reference to help in determining the Vane Rotary Actuator that will work for your project.

Refer to page 172 in this section to find step by step directions to size and select the best rotary actuator for the job.

The following pages detail each of the three sizes of the VRA, giving bore size, weights, force, bearing load capacity, kinetic energy rating, and available options.

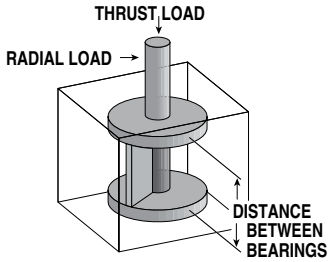
VANE ROTARY ACTUATORS - TORQUE vs PRESSURE





BEARING LOAD CAPACITIES

Model	Radial (lbs.)	Radial (kgs.)	Thrust (lbs.)	Thrust (kgs.)
1810	6.0	2.7	1.0	.45
1817	18	8.2	2.5	1.13
1825	35	15.9	4.0	1.81



KINETIC ENERGY RATINGS

Kinetic Energy Absorption/Stop

Model	KE/Stop (in.-lbs.)	KE/Stop (N-m)
1810	.15	.02
1817	.35	.04
1825	.70	.08

1" BORE - 1810 SERIES

Available Models

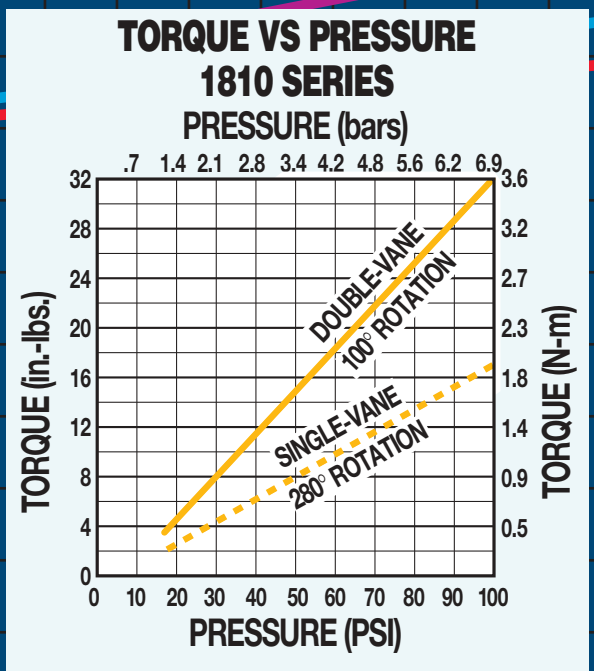
STANDARD ACTUATOR	
Assembly Number	Model
1810-0200	Double-Vane, Single Shaft, 100° Rotation
1810-0201	Single-Vane, Single Shaft, 280° Rotation
1810-0202	Double-Vane, Double Shaft, 100° Rotation
1810-0203	Single-Vane, Double Shaft, 280° Rotation

FRONT FLANGE MOUNT ACTUATOR	
Assembly Number	Model
1810-0700	Double-Vane, Single Shaft, 100° Rotation
1810-0701	Single-Vane, Single Shaft, 280° Rotation
1810-0702	Double-Vane, Double Shaft, 100° Rotation
1810-0703	Single-Vane, Double Shaft, 280° Rotation

Specifications

Weight	7 ounces	(.20kgs.)
Operating Pressure	100 PSI Pneumatic	(6.9 bars)
Maximum Actual Torque		
100° Rotation	32 inch-pounds	(3.6 N-m)
280° Rotation	16 inch-pounds	(1.8 N-m)
Operating Temperature	0° to 125° F	(-18° to 52° C)

Performance Data

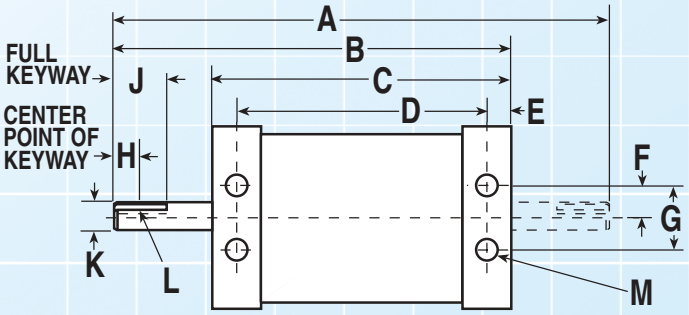


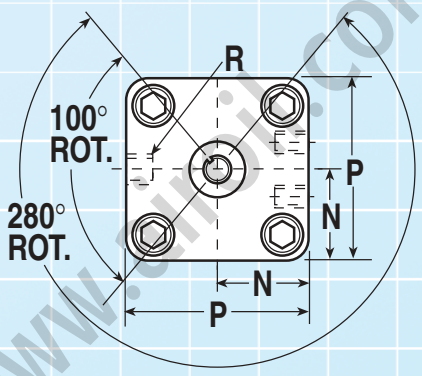
BEARING LOAD CAPACITY				
Model	Radial (lbs.)	Radial (kgs.)	Thrust (lbs.)	Thrust (kgs.)
1810	6.0	2.7	1.0	.45

KINETIC ENERGY RATING		
Model	KE/Stop (in.-lbs.)	KE/Stop (N-m)
1810	.15	.02

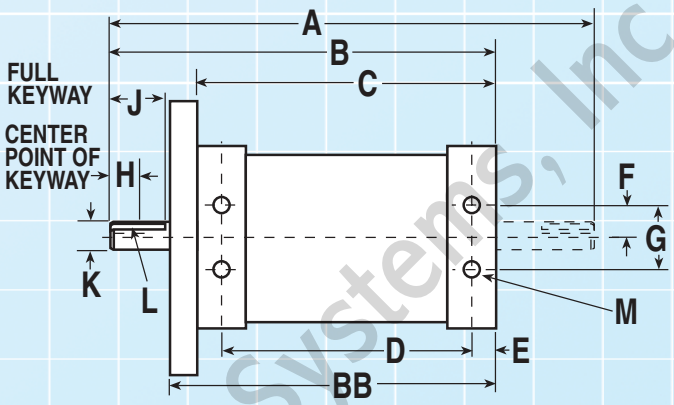
DIMENSIONAL DATA

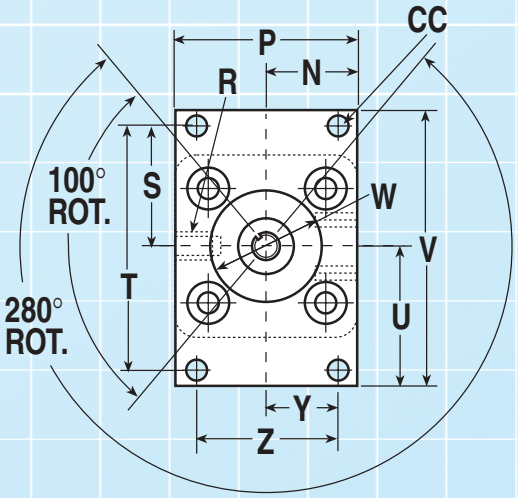
STANDARD SERIES





FRONT FLANGE MOUNT





MODEL DIMENSIONS IN INCHES																
MODEL	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
1810	1"	4.23	3.39	2.56	2.14	0.21	0.25	0.50	0.31	0.62	.250	#203 Woodruff	#8-32 x .25	0.75	1.50	10-32 Port

MODEL DIMENSIONS IN INCHES												
MODEL	BORE	S	T	U	V	W	X	Y	Z	AA	BB	CC
1810	1"	1.06	2.12	1.31	2.62	0.87	.205	0.50	1.00	-	2.69	.205

MODEL DIMENSIONS IN MILLIMETERS																
MODEL	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
1810	1"	107.4	86.1	65.0	54.4	5.3	6.4	12.7	7.9	15.8	6.4	#203 Woodruff	#8-32 x .25	19.1	38.1	10-32 Port

MODEL DIMENSIONS IN MILLIMETERS												
MODEL	BORE	S	T	U	V	W	X	Y	Z	AA	BB	CC
1810	1"	26.9	53.9	33.3	66.6	22.1	5.21	12.7	25.4	-	68.3	5.20

1¾" BORE 1817 SERIES

AVAILABLE MODELS

STANDARD ACTUATOR	
Assembly Number	Model
1817-0200	Double-Vane, Single Shaft, 100° Rotation
1817-0201	Single-Vane, Single Shaft, 280° Rotation
1817-0202	Double-Vane, Double Shaft, 100° Rotation
1817-0203	Single-Vane, Double Shaft, 280° Rotation

FRONT FLANGE MOUNT ACTUATOR	
Assembly Number	Model
1817-0700	Double-Vane, Single Shaft, 100° Rotation
1817-0701	Single-Vane, Single Shaft, 280° Rotation
1817-0702	Double-Vane, Double Shaft, 100° Rotation
1817-0703	Single-Vane, Double Shaft, 280° Rotation

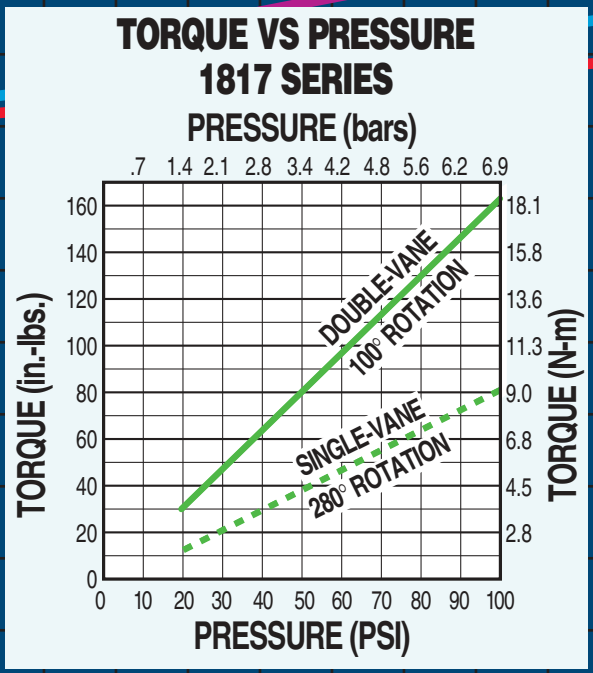
1817 SERIES VRA OPTIONS

FRONT MOUNTING FLANGE
ADJUSTABLE STOPS 171

SPECIFICATIONS

Weight	2 Pounds (.9kgs.)
Operating Pressure	100 PSI Pneumatic (6.9bars)
Maximum Actual Torque	
100° Rotation	170 inch-pounds (19.2 N-m)
280° Rotation	85 inch-pounds (9.6 N-m)
Operating Temperature	0° to 125° F (-18° to 52° C)

PERFORMANCE DATA

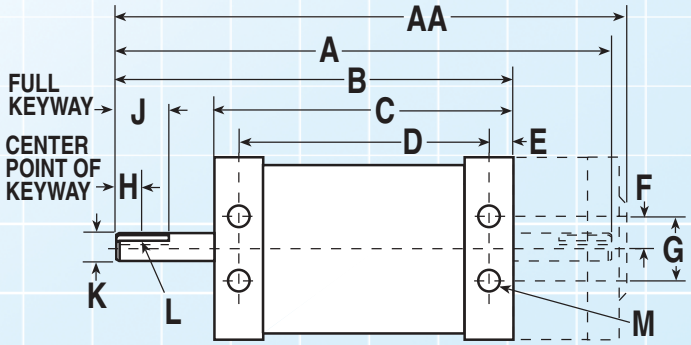


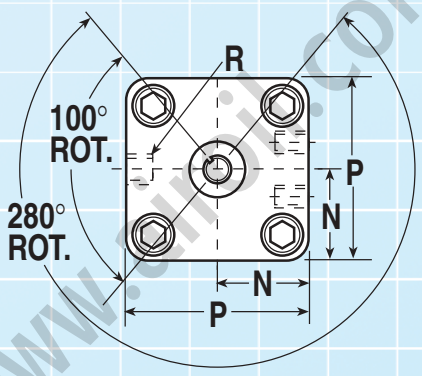
BEARING LOAD CAPACITY				
Model	Radial (lbs.)	Radial (kgs.)	Thrust (lbs.)	Thrust (kgs.)
1817	18	8.2	2.5	1.13

KINETIC ENERGY RATING		
Model	KE/Stop (in.-lbs.)	KE/Stop (N-m)
1817	.35	.04

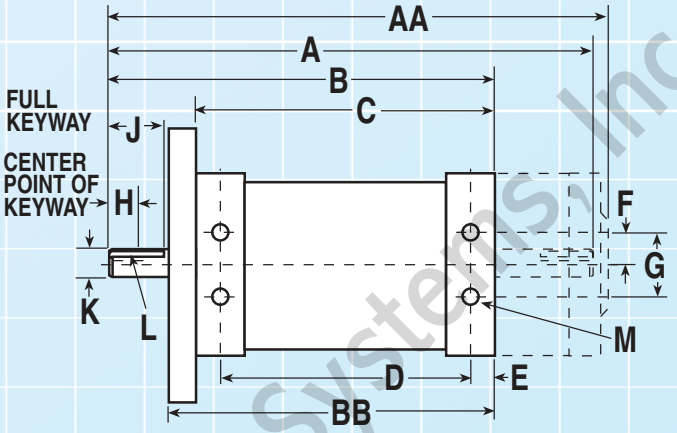
DIMENSIONAL DATA

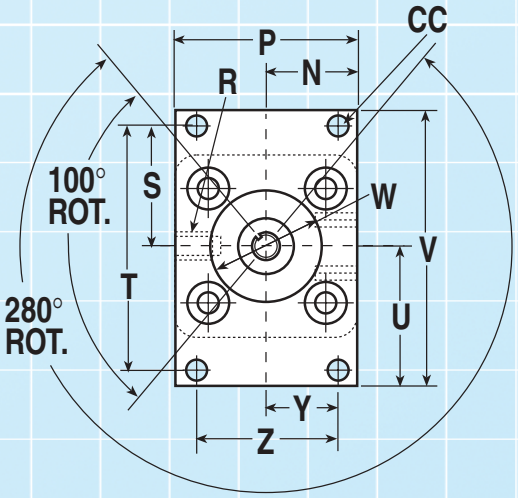
STANDARD SERIES





FRONT FLANGE MOUNT





MODEL DIMENSIONS IN INCHES																
MODEL	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
1817	1¾"	6.50	5.25	4.00	3.37	0.31	0.50	1.00	0.44	0.87	.500	.125 Square Key	#10-32 x .50	1.25	2.50	1/8-27 NPT

MODEL DIMENSIONS IN INCHES												
MODEL	BORE	S	T	U	V	W	X	Y	Z	AA	BB	CC
1817	1¾"	1.50	3.00	1.75	3.50	1.87	.281	1.00	2.00	6.75	4.38	.281

MODEL DIMENSIONS IN MILLIMETERS																
MODEL	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
1817	1¾"	165.1	133.4	101.6	85.6	7.9	12.7	25.4	11.1	22.1	12.7	.125 Square Key	#10-32 x .50	31.8	63.5	1/8-27 NPT

MODEL DIMENSIONS IN MILLIMETERS												
MODEL	BORE	S	T	U	V	W	X	Y	Z	AA	BB	CC
1817	1¾"	38.1	76.2	44.5	88.9	47.5	7.14	25.4	50.8	171.5	111.3	7.14

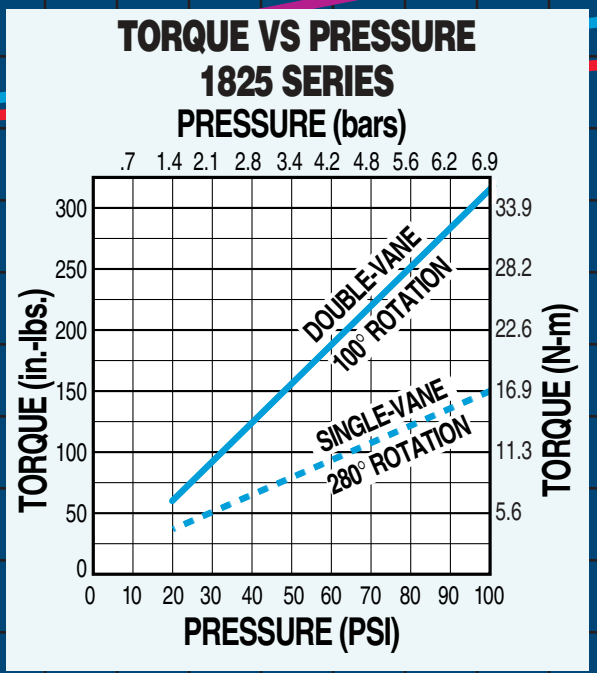
2½" BORE 1825 SERIES

AVAILABLE MODELS

STANDARD ACTUATOR	
Assembly Number	**Model**
1825-0001	Double-Vane, Single Shaft, 100° Rotation
1825-0002	Single-Vane, Single Shaft, 280° Rotation
1825-0003	Double-Vane, Double Shaft, 100° Rotation
1825-0004	Single-Vane, Double Shaft, 280° Rotation

1825 SERIES VRA OPTIONS	
ADJUSTABLE STOPS	 171

PERFORMANCE DATA



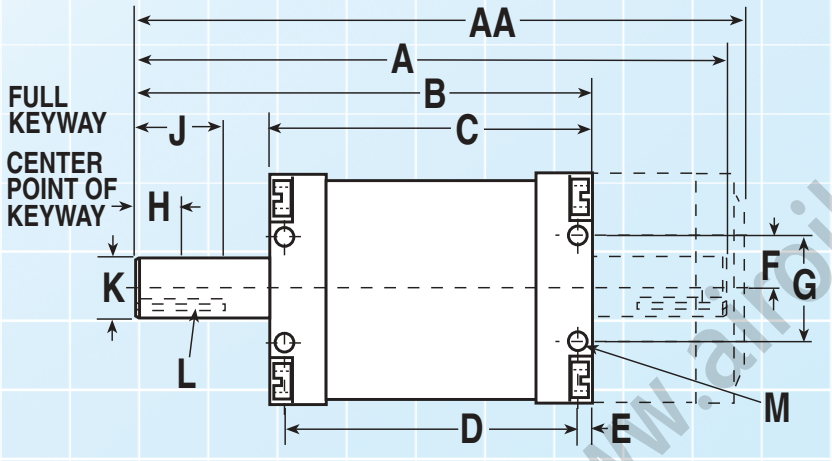
BEARING LOAD CAPACITY				
Model	**Radial (lbs.)**	**Radial (kgs.)**	**Thrust (lbs.)**	**Thrust (kgs.)**
1825	35	15.9	4.0	1.81

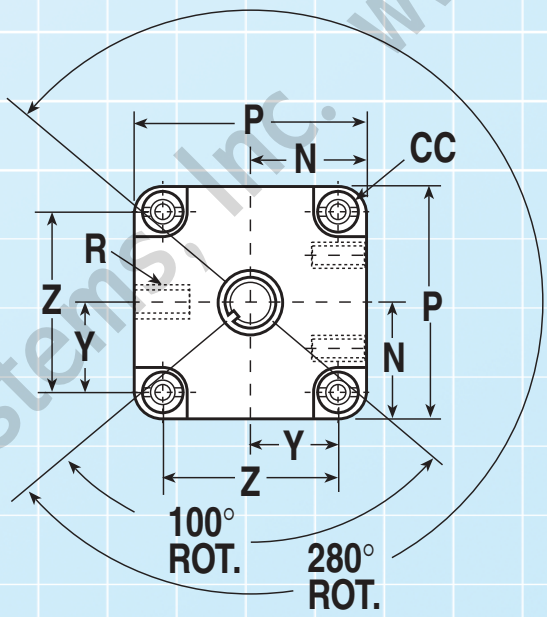
KINETIC ENERGY RATING		
Model	**KE/Stop (in.-lbs.)**	**KE/Stop (N-m)**
1825	.70	.08

SPECIFICATIONS

Weight	4 pounds, 3 ounces (1.9 kgs.)
Operating Pressure	100 PSI Pneumatic (6.9 bars)
Maximum Actual Torque	
100° Rotation	325 inch-pounds (36.7 N-m)
280° Rotation	145 inch-pounds (16.4 N-m)
Operating Temperature	0° – 125° F (-18° to 52° C)

DIMENSIONAL DATA





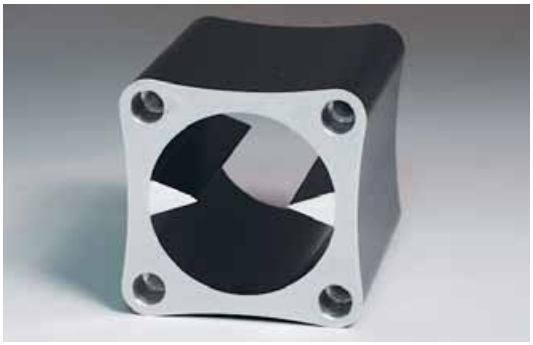
MODEL DIMENSIONS IN INCHES																
MODEL	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
1825	2½"	8.09	6.25	4.45	3.95	0.25	0.75	1.50	0.50	1.00	.750	3/16 Square Key	5/16-18x .62DP	1.50	3.00	1/4-18 x.62 NPT

MODEL DIMENSIONS IN INCHES											
MODEL	BORE	S	T	U	V	W	X	Y	Z	AA	BB	CC
1825	2½"	-	-	-	-	-	-	1.218	2.437	8.25	-	1/4-20x.50DP

MODEL DIMENSIONS IN MILLIMETERS																
MODEL	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
1825	2½"	205.5	158.8	113.0	100.3	6.4	19.1	38.1	12.7	25.4	19.1	3/16 Square Key	5/16-18x .62DP	38.1	76.2	1/4-18 x.62 NPT

MODEL DIMENSIONS IN MILLIMETERS												
MODEL	BORE	S	T	U	V	W	X	Y	Z	AA	BB	CC
1825	2½"	-	-	-	-	-	-	30.9	61.9	209.6	-	1/4-20x.50DP

FEATURES



EXTRUDED HOUSING

Black anodized on both the exterior and the internal bore, the housing is made of extruded aluminum with integral stators. Coating the internal bore ensures a smooth finish for lower breakaway and extended seal life. Using integral extruded stators eliminates a major leak path common to most vane rotary actuators.

DOUBLE LIP SEALS

The double-lip rotor seals of Buna-N rubber are molded onto the shaft/vane assembly. This same double-lip concept is used with the stator seal which fits over the integral extruded stators and are held rigidly in place by the end caps. When one lip is pressurized, the other remains relaxed, lowering the breakaway pressure required to move the vane and yet providing an extremely tight seal and improving the actuator's efficiency.

ROTOR SHAFTS

Rotor Shafts are centerless-ground stainless steel. Vanes are made of stamped steel bonded into machined grooves in the rotor shaft. Seals are molded to both the vanes and the rotor shaft ensuring a tight fit. Bumpers are located in the central part of each vane, providing space for air inlet ports. Designed to provide maximum air flow to the vane surface for increased effected area results in lower breakaway.

UNIQUE SHAFT SEALING

Instead of the usual abrasive rubber-to-rubber seal, the Tol-O-Matic vane rotary actuator uses a metal-to-plastic seal. The shouldered portion of the polished, stainless steel shaft is .005 inch longer than the extruded housing. When assembled, the shaft causes a thin, highly polished, plastic insert plate housed in the end cap to deflect slightly (0.0025 inch), creating an air-tight seal which has shown no wear after millions of cycles of operation.

END CAPS

Tol-O-Matic Vane Rotary Actuators have end caps with some unique designs. The air ports have a tear-drop shape which make the most of the triangular-shaped air space created by the bumpers.

End caps for the vane rotary actuators are made of machined aluminum with a plastic insert plate and Oilite® bronze bushings. They are ideal for applications where high strength material is desired.

INFINITELY ADJUSTABLE STOPS

An infinitely adjustable stop mechanism is available for Tol-O-Matic's 1817 and 1825 Series Vane Rotary Actuators. The mechanism allows the user to dial in rotational stops other than the 100° or 280° standard rotations.

The mechanism is available on all 1817 and 1825 Series actuator models with double-ended shafts.

To set the stops, remove the plastic dust cap, loosen the four cap screws and adjust the stops to the desired locations. Then, retighten the cap screws and replace the plastic dust cap.

AVAILABLE MODELS

1817 SERIES (1¾" BORE)	
Assembly Number	**Model**
1817-0206	Double-Vane, 100° Rotation
1817-0207	Single-Vane, 280° Rotation
1817-0706	Double-Vane, 100° Rotation - Front Flange Mount
1817-0707	Single-Vane, 280° Rotation - Front Flange Mount

1825 SERIES (2½" BORE)	
Assembly Number	**Model**
1825-0007	Double-Vane, 100° Rotation
1825-0008	Single-Vane, 280° Rotation

To select a 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.*

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.

How to calculate kinetic energy is shown below.

KINETIC ENERGY CALCULATION

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

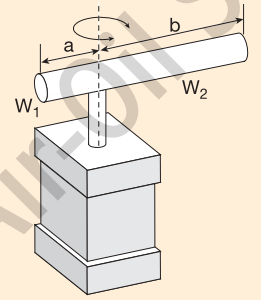
$$\omega = 0.035 \times \frac{\text{angle traveled (deg.)}}{\text{rotation time (sec.)}}$$

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.)

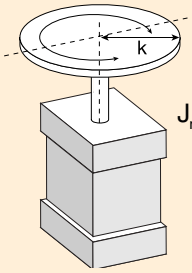
MOMENTS OF INERTIA EXAMPLES

SLENDER ROD MOUNTED OFF CENTER



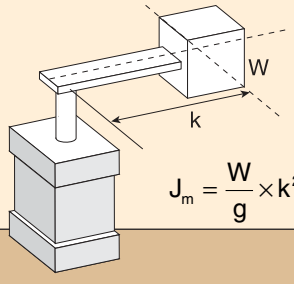
$$J_m = \frac{W_1}{g} \times \frac{a^2}{3} + \frac{W_2}{g} \times \frac{b^2}{3}$$

THIN DISK MOUNTED ON CENTER



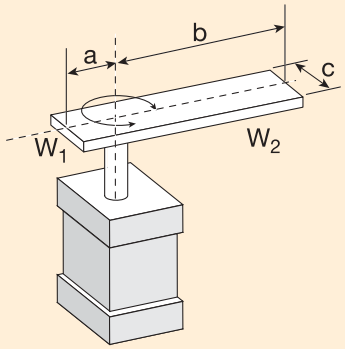
$$J_m = \frac{W}{g} \times \frac{k^2}{2}$$

POINT LOAD



$$J_m = \frac{W}{g} \times k^2$$

THIN RECTANGULAR PLATE MOUNTED OFF CENTER



$$J_m = \frac{W_1}{g} \times \frac{4a^2 + c^2}{12} + \frac{W_2}{g} \times \frac{4b^2 + c^2}{12}$$