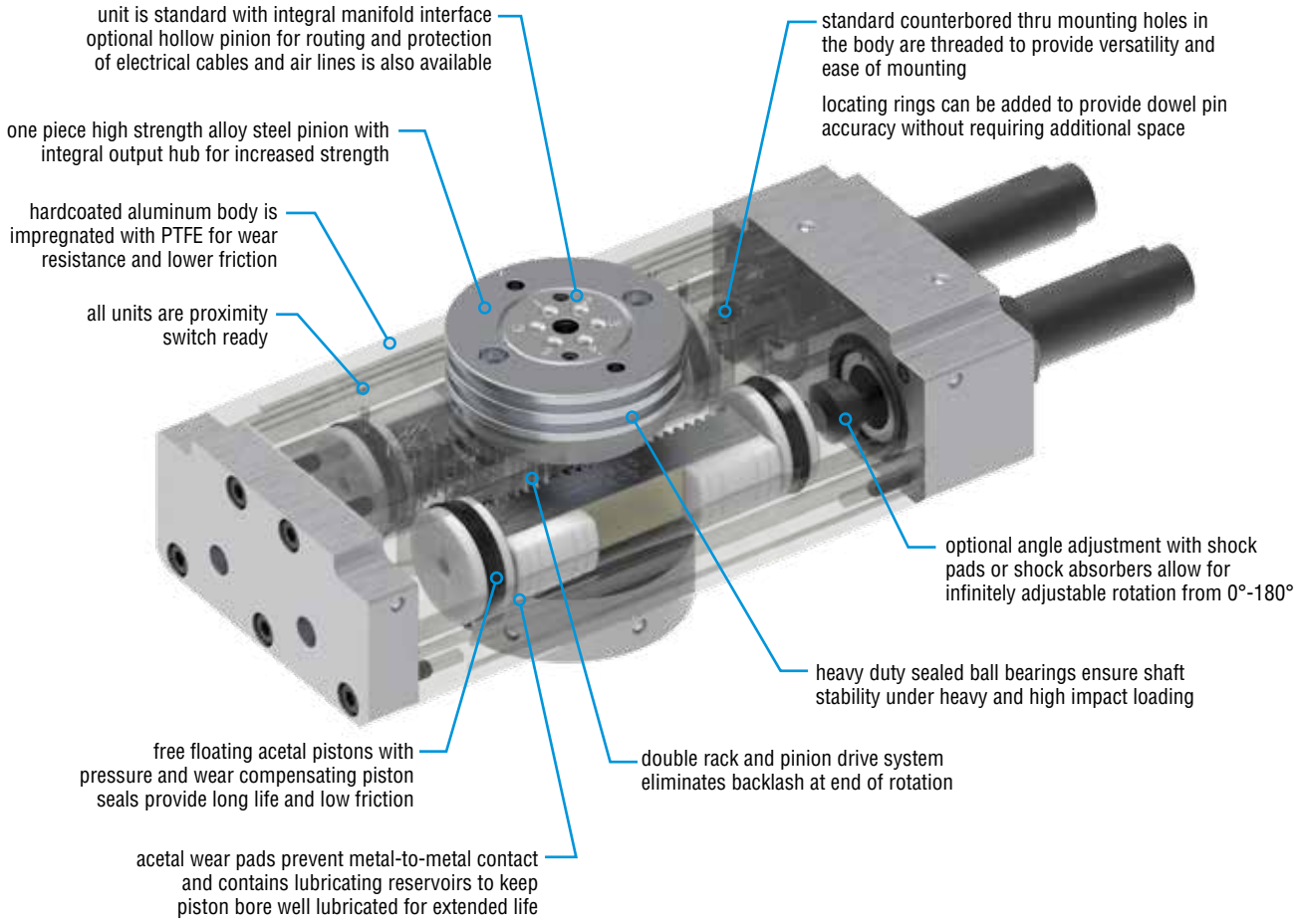
RI

Major Benefits

- High torque
- High axial and radial bearing load
- Thru hole shaft for built-in air communication ports



ORDERING DATA: Series RI Rotary Actuators

TO ORDER SPECIFY:
Product, Series, Type, Design No., Bore Size, Rotation, and Options.

TYPE

	BORE Ø	TORQUE at 87 psi
S SINGLE RACK	25 mm	32 in-lb [3.6 Nm]
	32 mm	63 in-lb [7.1 Nm]
	50 mm	207 in-lb [23.4 Nm]
D DOUBLE RACK	25 mm	64 in-lb [7.2 Nm]
	32 mm	127 in-lb [14.3 Nm]
	50 mm	414 in-lb [46.8 Nm]

THREE POSITION UNITS
Only 90° Mid-position on Double Rack Units are available.

PRODUCT
R - Rotary

HOLLOW PINION
H - Hollow Pinion
Leave blank if standard.

BORE SIZE
25 mm
32 mm
50 mm

MID-POSITION
90°
On 3-position only. Must be specified.

ANGLE ADJUSTMENT
AB - Angle adjustment with shock pad installed both ends
AC - Angle adjustment with shock pad installed counterclockwise 90°
AW - Angle adjustment with shock pad installed clockwise 90°
See Note 1.

3	R	I	D	H	1	25	x	180	x	90	-	NB	-	PB	-	AB	-	M

SERIES
I - Internal Passage

DESIGN NO.

	Imperial	Metric
For RISx50	2	6
For All Others	1	5

ROTATION
180°

SHOCK ABSORBERS
NB - Shock installed both directions
NC - Shock installed counterclockwise
NW - Shock installed clockwise
See Note 1.

OPTIONS
M - Magnet for use with PHD Series JC1 Switches

ROTATION SPEED CONTROL VALVE
(See Note 3)
PB - Rotational Speed Controls supplied for both directions
PC - Rotational Speed Controls supplied for counterclockwise
PW - Rotational Speed Controls supplied for clockwise

NOTES:
1) Either optional angle adjustments or shock absorbers **must** be ordered on all units. (Either option is mandatory.)
2) Switches and switch bracket kits must be ordered separately. See Options pages for complete switch information.
3) Speed control valves are not assembled to unit.

ROTATION SPEED CONTROL

UNIT SIZE	KIT NO.
RIx125	70695-01
RIx525	70696-01
RIx132	70695-03
RIx532	70696-03
RID150	70695-03
RID550	70696-03
RIS250	70695-03
RIS650	70696-03

NOTE: One flow control fitting per kit

SHOCK ABSORBERS

UNIT SIZE	KIT NO.
RISxx25	69146
RIDxx25	69153
RISxx32	69147
RIDxx32	69154
RISxx50	75423
RIDxx50	69156

PORTING PLATES

UNIT SIZE	KIT NO.
RIx125	71972
RIx525	71997
RIx132	71973
RIx532	71998
RID150	71975
RID550	72000
RIS250	71975
RIS650	72000

Kits include: 1 Porting Plate, 2 Locating Rings, 4 Fasteners, Required O-Rings

⚠ Options may affect unit length. See dimensional pages and option information details.

SERIES JC1 SOLID STATE AND REED SWITCHES

JC1 SWITCH	DESCRIPTION
JC1SDN-5	NPN DC Solid State, 5 meter cable
JC1SDP-5	PNP DC Solid State, 5 meter cable
JC1SDN-K	NPN DC Solid State, Quick Connect
JC1SDP-K	PNP DC Solid State, Quick Connect
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect

NOTE: See Switches and Sensors catalog for additional switch information and complete specification. Switches must be ordered separately.

CORDSETS FOR SERIES JC1 SOLID STATE AND REED

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 3 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

SPECIFICATIONS	SERIES RI
OPERATING PRESSURE	20 to 100 psi max [1.4 to 6.8 bar]
OPERATING TEMPERATURE	-20° to 160°F [-29° to 71°C]
RATED LIFE	5 million cycles
ROTATIONAL TOLERANCE	Nominal rotation +13° to -180° with angle adjustment
BACKLASH AT END OF ROTATION*	0°
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

NOTE: *Angle adjustment screw must be engaged or adjusted to achieve 0° backlash.

SIZE	ROTATION/ MID ROT	BASE WEIGHT		BORE DIAMETER		DISPLACEMENT VOLUME/deg		THEORETICAL TORQUE OUTPUT		ROTATIONAL VELOCITY MAX	MAX AXIAL BEARING LOAD		MAX RADIAL BEARING LOAD	
		lb	kg	in	mm	in^3	mm^3	in-lb/psi	Nm/bar	deg/sec	lb	N	lb	N
RISxx25	180°	3.0	1.36	0.984	25	0.006	0.098	0.37	0.61	180°/0.13	292	1300	572	2546
RIDxx25	180°	3.5	1.59			0.012	0.196	0.74	1.21	180°/0.23				
3RIDxx25	180°/90°	4.1	1.86			0.014	0.229	0.37	0.61	180°/0.23				
RISxx32	180°	7.6	3.44	1.260	32	0.012	0.196	0.73	1.20	180°/0.11	511	2275	1206	5365
RIDxx32	180°	8.0	3.63			0.024	0.393	1.45	2.38	180°/0.28				
3RIDxx32	180°/90°	9.6	4.36			0.027	0.442	0.73	1.20	180°/0.28				
RISxx50	180°	14.3	6.48	1.969	50	0.041	0.671	2.38	3.90	180°/0.13	697	3100	1850	8229
RIDxx50	180°	15.0	6.80			0.082	1.343	4.76	7.80	180°/0.28				
3RIDxx50	180°/90°	17.6	7.98			0.092	1.507	2.38	3.90	180°/0.28				

MANIFOLD PINION SPECIFICATIONS

UNIT SIZE	NUMBER OF PASSAGES	FLOW THROUGH PASSAGES @ 87 psi [6 bar]		CENTER THROUGH HOLE DIAMETER	
		CFM	Liter/Min	in	mm
RISxx25	4	1	28.3	0.197	5
RIDxx25	4	1	28.3	0.197	5
RISxx32	6	1.3	36.8	0.276	7
RIDxx32	6	1.3	36.8	0.276	7
RISxx50	8	1.5	42.5	0.433	11
RIDxx50	8	1.5	42.5	0.433	11

BACKLASH SPECIFICATIONS

UNIT SIZE	BACKLASH MID ROTATION (degrees)	REPEATABILITY +/- (degrees)	BACKLASH THREE POSITION UNIT (degrees)	REPEATABILITY THREE POSITION UNIT (degrees)
RISxx25	0.26	0.14	—	—
RIDxx25	0.26	0.53	1.25	0.16
RISxx32	0.23	0.42	—	—
RIDxx32	0.23	0.94	0.65	0.10
RISxx50	0.21	0.12	—	—
RIDxx50	0.21	0.35	0.40	0.06

ROTATION RATES

UNIT SIZE	ROTATION RATES at 87 psi (seconds maximum)		
	SHOCK PAD	SPEED CONTROL	SHOCK
RISxx25	0.13	0.18	0.18
RIDxx25	0.23	0.41	0.23
RISxx32	0.11	0.11	0.31
RIDxx32	0.28	0.30	0.32
RISxx50	0.13	0.22	0.29
RIDxx50	0.28	0.40	0.78

(No load conditions)

Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at **www.phdinc.com/apps/sizing**

SIZING AN RI UNIT WITH ANGLE ADJUSTMENTS

STEP 1:
Determine Rotational Mass Moment of Inertia (J_m)

Select the illustration from the application types on page 42 that most resembles your specific application. Several separate calculations may be necessary to fully describe your application. Using the appropriate application equation, calculate the mass moment of inertia for the type of condition illustrated. The total mass moment of inertia is the sum of the individual calculations.

STEP 2:
Determine Necessary Acceleration (α_S)

This equation calculates the acceleration required to move the desired rotation in the desired time. The solution is given in radians/sec^2.

Acceleration (rad/sec^2) = α_S = (0.035 x rotation angle in degrees) / (time of rotation in seconds)^2

STEP 3:
Calculate the Required Starting Torque (T_A)

Select the illustration from the application types on page 42 that most resembles your specific application. Several separate calculations may be necessary to fully describe your application. Using the appropriate application equation, calculate the torque for each for each type of condition illustrated that matches your application. The total torque will be the sum of the individual calculations. **NOTE:** Torque calculations are theoretical, an appropriate safety factor should be considered. PHD recommends a minimum safety factor of 2 to account for friction loss, air line and valve size, and attached accessories.

Starting Torque (in/lb) = T_A, T_{Ag}
Balanced Load $T_A = J_m \times \alpha_A \times SF$
Unbalanced Load $T_{Ag} = [(J_m \times \alpha_A) + (F_g \times k)] \times SF$

STEP 4:
Calculate the Peak Velocity (ω)

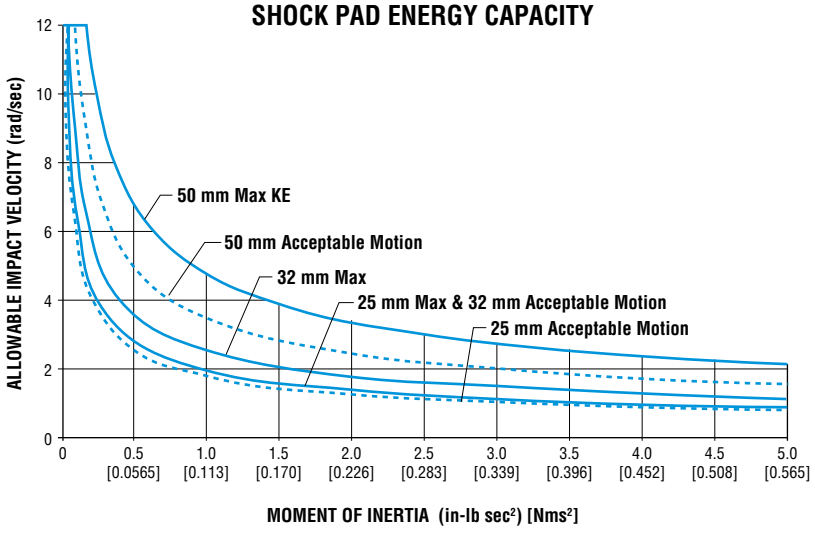
This formula estimates the peak velocity of the Series RIx in operation, and is used to determine the stopping capacity of the rotary actuator. The solution is given in radians/sec.

Average Velocity (deg/sec) = (0.035 x rotation angle in degrees) / time of rotation in seconds

STEP 5:
Compare Peak Velocity (ω) to Allowable Impact

Compare your peak velocity to the maximum allowable velocity for the given Mass Moment of Inertia (J_m) of your application. The chart is labeled Shock Pad Energy Capacity. The charts represent the total amount of energy that is able to be absorbed and provide acceptable motion of the actuator. Acceptable motion is defined as a maximum of one degree of motion reversal when the load comes to end of stroke. **NOTE:** You may run slightly higher velocities and loads than these charts provide and not damage the unit; however, you may find the motion profile unacceptable. Please contact PHD if you are considering using the Series RIx actuator outside of the recommended energy range and shock absorbers are not a desired option. If the shock pad does not provide enough stopping capacity for your application, go to the next sizing section titled "Sizing a RIx Unit with Shocks."

SHOCK PAD ENERGY CAPACITY



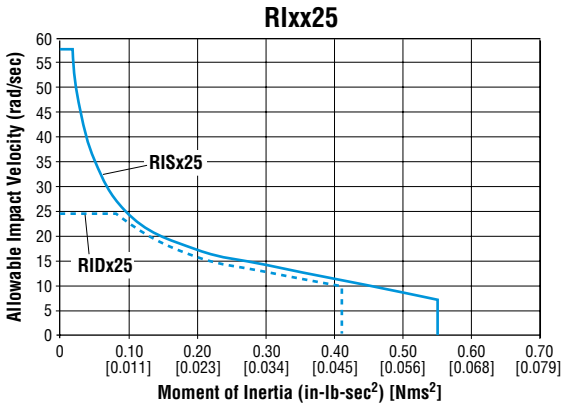
SIZING AN RI UNIT WITH SHOCKS

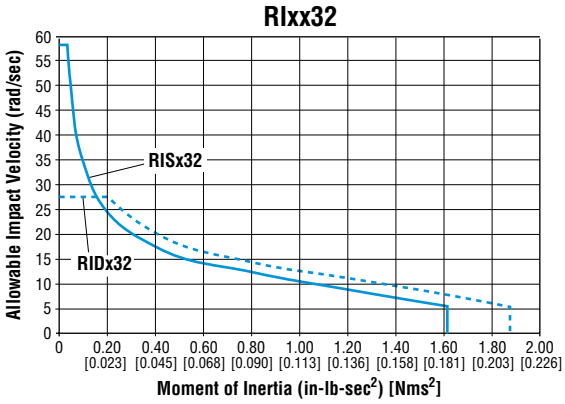
STEP 6:

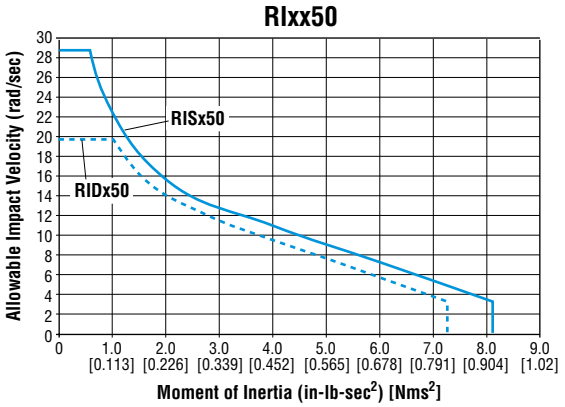
Compare Peak Velocity (ω) to Allowable Impact

Compare your peak velocity to the maximum allowable velocity for the given Mass Moment of Inertia (Jm) of your application. The chart is labeled Shock Energy Capacity. The charts represent the total amount of energy that is able to be absorbed and provide acceptable motion of the actuator. Acceptable motion is defined as a maximum of one degree of motion reversal when the load comes to end of stroke. **NOTE:** You may run slightly higher velocities and loads than these charts provide and not damage the unit; however, you may find the motion profile unacceptable. Please contact PHD if you are considering using the Series RIxxx actuator outside of the recommended energy and load range.

SHOCK ENERGY CAPACITY







STEP 7:

Calculate the Kinetic Energy (K_e)

This formula calculates the kinetic energy of your application. This value will be used to calculate the actual total energy to be compared to the maximum allowable total energy.

$$\text{Kinetic Energy (in-lb [Nm])} = K_e = 1/2 \times J_m \times \omega^2$$

STEP 8:

Calculate the Propelling Energy (P_e)

These formulas calculate the additional amount of energy that the shock will experience due to the piston force of the actuator.

UNIT SIZE	P_e = PROPELLING ENERGY	
	in-lb	Nm
RISxx25	0.3572 x psi	0.5852 x bar
RIDxx25	0.7144 x psi	1.170 x bar
RISxx32	0.935 x psi	1.5321 x bar
RIDxx32	1.471 x psi	2.409 x bar
RISxx50	2.769 x psi	4.538 x bar
RIDxx50	5.539 x psi	9.0768 x bar

STEP 9:

Calculate the Total Energy (E_t)

This formula sums all of the energies that the shock will experience.

$$\text{Total Energy } E_t \text{ (in-lb [Nm])} = K_e + P_e$$

STEP 10:

Compare the Total Energy (E_t) to the Maximum Total Energy (E_m) and also Acceptable Motion (E_a)

If Acceptable Motion is desired as defined in STEP 6, the total energy should be less than both of the charted values given below. If some additional bounce is acceptable, (E_t) can be up to the same value as (E_m). If not, go to a larger actuator or contact PHD for application assistance.

STEP 11:

Calculate Energy per Hour (E_h)

Compare your applications energy per hour requirement against the charted maximum.

$$\text{Energy/Hour (in-lb [Nm])} = \text{Cycles/Hour} \times E_t$$

MAX ALLOWABLE CHART (E_m)

UNIT SIZE	E_T		ENERGY/HOUR	
	in-lb	Nm	in-lb/Hr	Nm/Hr
RISxx25	80	9.04	300,000	33,890
RIDxx25	116	13.1	300,000	33,890
RISxx32	175	19.8	400,000	45,190
RIDxx32	233	26.3	400,000	45,190
RISxx50	577	65.2	600,000	67,791
RIDxx50	804	90.8	600,000	67,791

ACCEPTABLE MOTION CHART (E_a)

UNIT SIZE	E_T*		VELOCITY
	in-lb	Nm	rad/sec
RISxx25	66	7.46	57.7
RIDxx25	96	10.8	24.2
RISxx32	154	17.4	58.5
RIDxx32	213	24.1	27.6
RISxx50	527	59.5	28.9
RIDxx50	754	85.2	19.7

*Acceptable motion is defined as a maximum of one degree of motion reversal when the load comes to end of stroke.

DETERMINING ALLOWABLE ATTACHED LOAD WEIGHT

Following are the steps required to determine the allowable attached load weight on the Series RIx rotary actuator. You will need to know the weight of the attached load, the orientation of the rotary, and the center of gravity distance of the load from the hub face. Please refer to the supplied formulas to determine each of the allowable conditions.

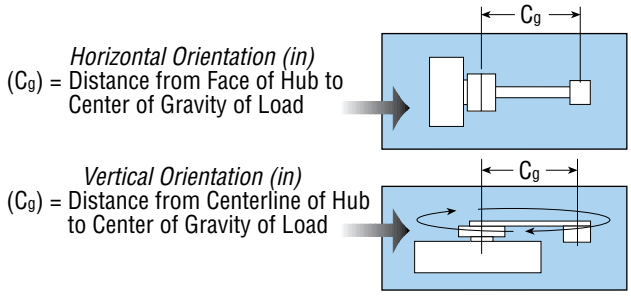
STEP 12:
Determine Allowable Attached Load Weight (L_f)

The next step in determining the proper Series RIx actuator size is to determine the bearing capacity of the unit according to your application requirements.

STEP 13:
Calculate Maximum Actuator Radial Loading (L_m)

This formula calculates the maximum radial loading allowed for the Series RI actuator based on 5,000,000 cycles and the axial load (L_a) that you are placing on the bearings. **NOTE:** Center of Gravity distance is different depending on if the unit is horizontal or vertical. In horizontal applications, (C_g) is the distance from the mounting face of the hub to the (C_g) of the load. In vertical applications, (C_g) is the distance from the centerline of the hub to (C_g) of the load.

L_a = Axial Load Weight (lb)



MAX ACTUATOR RADIAL LOADING (L_m)

UNIT SIZE	IMPERIAL	METRIC
RISxx25	$L_m = \frac{-1.4175\ (L_a) + 1106.86}{1.933 + C_g}$	$L_m = \frac{-36.0024\ (L_a) + 125042.4}{49.1 + C_g}$
RISxx32	$L_m = \frac{-1.8138\ (L_a) + 3015.57}{2.5 + C_g}$	$L_m = \frac{-46.0702\ (L_a) + 340706.2}{63.5 + C_g}$
RISxx50	$L_m = \frac{-2.699\ (L_a) + 6573.92}{3.553 + C_g}$	$L_m = \frac{-68.5696\ (L_a) + 742656}{90.25 + C_g}$

STEP 14:
Calculate Propelling Torque (T_p)

This formula is one of the components required when comparing reaction forces on the bearing. You may use the formula or simply look up the torque produced by the rotary actuator at a specified pressure.

UNIT SIZE	PROPELLING TORQUE (T_p)	
	in-lb	Nm
RISxx25	0.369 x psi	0.6047 x bar
RIDxx25	0.737 x psi	1.2077 x bar
RISxx32	0.727 x psi	1.1913 x bar
RIDxx32	1.454 x psi	2.3827 x bar
RISxx50	2.378 x psi	3.8969 x bar
RIDxx50	4.755 x psi	7.7921 x bar

STEP 15:
Calculate the Deceleration (α_d)

This formula calculates the deceleration of the unit based on the peak velocity of the individual actuator. The solution is given in radians/sec^2.

UNIT SIZE	α_d = DECELERATION (rad/sec^2)
RISxx25	ω^2 / 1.75
RISxx32	ω^2 / 2.1
RIDxx32	ω^2 / 2.1
RISxx50	ω^2 / 2.45
RIDxx50	ω^2 / 2.45

STEP 16:
Calculate Stopping Torque (T_d)

This is the stopping torque energy used to stop a rotary load to your application conditions. This formula is one of the components required when comparing reaction forces on the bearing. Using the identical illustrations and formulas on page 42 used when calculating the required starting torque, replace the acceleration value with the deceleration value. This is the reaction torque required to stop the load. PHD recommends a safety factor of 1 to 1.25.

Stopping Torque (in-lb) = T_A, T_{Ag}
Balanced Load $T_A = J_m \times \alpha_d \times SF$
Unbalanced Load $T_{Ag} = [(J_m \times \alpha_d) + (F_g \times k)] \times SF$

STEP 17:
Calculate Radial Bearing Load At Stopping (L_s)

This formula converts the sum torque's of the propelling torque and stopping torque into the reaction force on the two bearings.

UNIT SIZE	RADIAL BEARING LOAD AT STOPPING (L_s)	
	lb	N
RISxx25	$(T_p + T_d) / 0.96875$	$(T_p + T_d) / 0.0246$
RIDxx32	$(T_p + T_d) / 1.1667$	$(T_p + T_d) / 0.0296$
RIDxx50	$(T_p + T_d) / 1.5625$	$(T_p + T_d) / 0.0399$

STEP 18:
Calculate Max. Fixed Radial Load (L_f)

This formula will produce the maximum radial load weight that can be safely attached to the rotary actuator, given the axial load weight and (C_g) distance of your application.

Max Fixed Radial Load (L_f) = L_m - L_s

STEP 19:
Compare (L_f) to Actual Load Affixed to Actuator (L_r)

Compare the (L_f) value to the weight of the attached load. If the attached load is less than the (L_f) value, the actuator is correct for your application. If the attached load is greater than the (L_f) value, go to the next size actuator and rerun the above calculations until the (L_f) value is greater than the attached load weight.

L_r = Weight of Attached Load

IMPERIAL UNITS:

Jm = Rotational Mass Moment of Inertia (in-lb-sec^2) (Dependent on physical size of object and weight)
g = Gravitational Constant = 386.4 in/sec^2 | F_g = Weight of Load (lb) | k = Radius of Gyration (in)
T = Torque required to rotate load (in-lbs) | α = Acceleration (rad/sec^2) | t = time (sec)
SF = Safety Factor

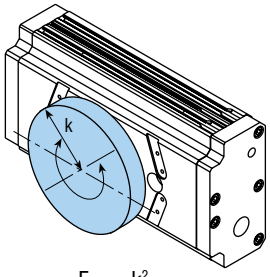
METRIC UNITS:

Jm = Rotational Mass Moment of Inertia (N-m-sec^2) (Dependent on physical size of object and weight)
g = Gravitational Constant = 9.81 m/sec^2 | F_g = Weight of Load (N) | k = Radius of Gyration (m)
T = Torque required to rotate load (N-m) | α = Acceleration (rad/sec^2) | t = time (sec)
M = Mass = F_g / g (kg) | SF = Safety Factor

BALANCED LOADS

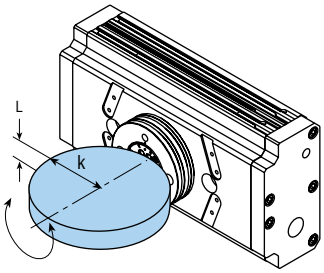
$T = Jm \times \alpha \times SF$

Disk
Mounted on center



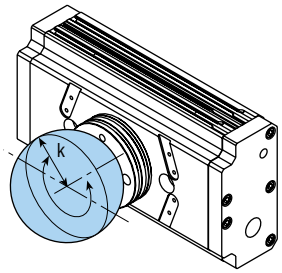
$$Jm = \frac{F_g}{g} \times \frac{k^2}{2}$$

Disk
End mounted on center



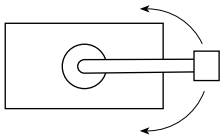
$$Jm = \frac{F_g}{g} \times \frac{1}{4} \times \left(\frac{L^2}{3} + k^2\right)$$

Solid Sphere
Mounted on center

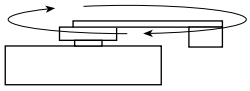


$$Jm = \frac{2}{5} \times \frac{F_g}{g} \times k^2$$

LOAD ORIENTATION

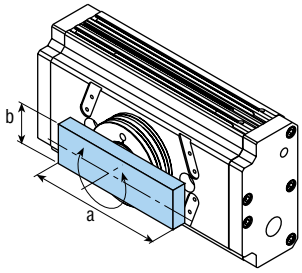


T_g = Rotating Vertically (with gravity)



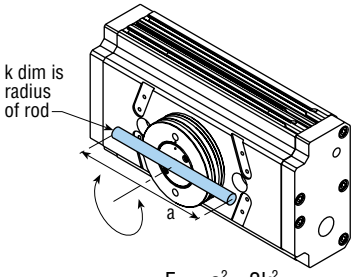
T = Rotating Horizontally (without gravity)

Rectangular Plate
Mounted on center



$$Jm = \frac{F_g}{g} \times \frac{a^2 + b^2}{12}$$

Rod
Mounted on center



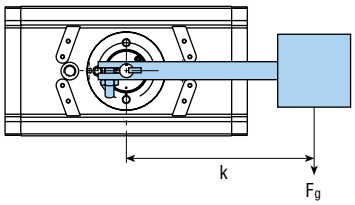
$$Jm = \frac{F_g}{g} \times \frac{a^2 + 3k^2}{12}$$

UNBALANCED LOADS

$T_g = [(Jm \times \alpha) + (F_g \times k)] \times SF$

$T = Jm \times \alpha \times SF$

Point Load



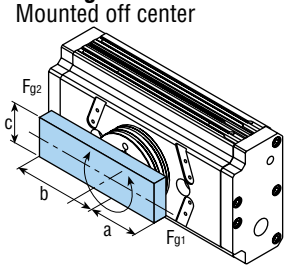
$$Jm = \frac{F_g}{g} \times k^2$$

UNBALANCED LOADS

$T_g = [(Jm \times \alpha) + [(F_{g2} - F_{g1}) \times (a + (\frac{b-a}{2}))]] \times SF$

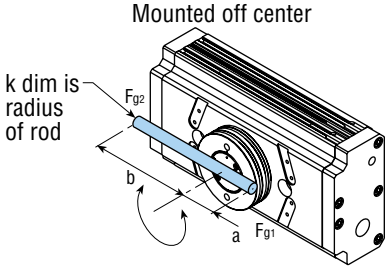
$T = Jm \times \alpha \times SF$

Rectangular Plate
Mounted off center



$$Jm = \frac{F_{g1}}{g} \times \frac{4a^2 + c^2}{12} + \frac{F_{g2}}{g} \times \frac{4b^2 + c^2}{12}$$

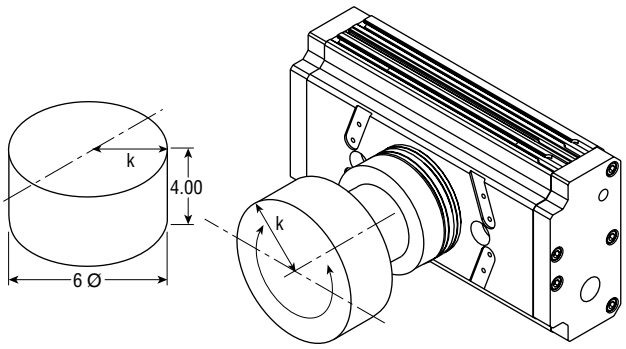
Rod
Mounted off center



$$Jm = \left(\frac{F_{g1}}{g} \times \frac{(4a^2 + 3k^2)}{12}\right) + \left(\frac{F_{g2}}{g} \times \frac{(4b^2 + 3k^2)}{12}\right)$$

APPLICATION INFORMATION - EXAMPLE 1

Weight = 32.2 lb
Rotation Angle = 180°
Pressure = 87 psi
Orientation = Horizontal
Center of Gravity Distance = 2"
Desired Cycle Rate = 0.75 sec
Safety Factor: Acceleration = 2, Deceleration = 1
Axial Load (L_a) = 0
Radial Load (L_r) = 32.2 lb
Cycles per Minute = 40



EXAMPLE 1

Determine Required Starting Torque for Application

STEP 1: Determine (J_m)
$J_m = (F_g / g) \times (k^2 / 2) = (32.2 / 386.4) \times (3^2 / 2)$
$J_m = 0.0833 \times 4.5 =$ 0.375 in-lb-sec²

STEP 2: Determine (α_A)
$\alpha_A = 0.035 \times$ (angle rotation (deg) / time of rotation (sec²))
$\alpha_A = 0.035 \times (180 / (0.75)^2) =$ 11.2 rad/sec²

STEP 3: Starting Torque
$T = J_m \times \alpha_A \times SF$
$T = 0.375 \times 11.2 \times 2 =$ 8.4 in-lb
RISxx25 WILL PRODUCE SUFFICIENT TORQUE

Check for Stopping Capacity

STEP 4: Calculate Peak Velocity (ω) - RISxx25
$\omega = 0.035 \times$ average velocity (refer to page 39)
$\omega = 0.035 \times (180 / 0.75) =$ 11.2 rad/sec

STEP 5: Compare to Graph (refer to page 39)
SHOCK PAD WILL NOT PERFORM AS DESIRED
This velocity is greater than the shock pad allows, go to the section labeled "Sizing an RIx Unit with Shocks"

STEP 6: Compare Peak Velocity to Allowable Impact Velocity for a given (J_m) Load using Shock Absorbers. Compare to graph on page 40. RISx is acceptable for this application.

STEP 7: Calculate Kinetic Energy (K_e)
$K_e = 1/2 \times J_m \times \omega^2$
$K_e = 1/2 \times 0.375 \times (11.2)^2 =$ 23.52 in-lb

STEP 8: Calculate Propelling Energy (P_e)
RISx25 = $0.3572 \times$ psi
$P_e = 0.3572 \times 87 =$ 31.08 in-lb

STEP 9: Calculate Total Energy (E_t)
$E_t = K_e + P_e$
$E_t = 23.52 + 31.08 =$ 54.60 in-lb

STEP 10: Compare Maximum Total Energy (E_m) to Total Energy (E_t) and Acceptable Motion Energy to Total Energy
$E_m \geq E_t$ 80 ≥ 54.60
$E_a \geq E_t$ 66 ≥ 54.60
SHOCKS WILL PERFORM AS DESIRED

STEP 11: Calculate Energy per Hour (E_h)
Cycles/Hour = Cycles/Minute x 60
Cycles/Hour = 40 x 60 = 2400
$E_h = 2400 \times 54.60$ in-lb = 131,040 in-lb/hr
300,000 ≥ 131,040

STEP 12: Calculate Allowable Attached Load Weight
Axial Load from Application = L_a
$L_a = 0$

STEP 13: Calculate Max Actuator Radial Loading (L_m)
Determine C_g Distance = 2"
$L_m = (-1.4175 (L_a) + 1106.86) / (1.933 + C_g)$
$L_m =$ 281.43 lb

STEP 14: Calculate Propelling Torque (T_p)
$T_p = 0.369 \times$ psi
$T_p = 0.369 \times 87$ psi = 32.103 in-lb

STEP 15: Calculate Deceleration (α_d)
$\alpha_d = \omega^2 / 1.75$
$\alpha_d = (11.2)^2 / 1.75$
$\alpha_d =$ 71.68 rad/sec²

STEP 16: Calculate Stopping Torque (T_d)
(from STEP 16 on page 41)
$T_d = J_m \times \alpha_d \times SF$
$T_d = 0.375 \times 71.68 \times 1 =$ 26.88

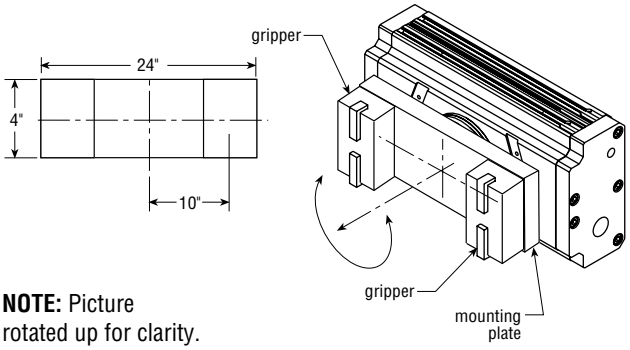
STEP 17: Calculate Radial Bearing Load at Stopping (L_s)
(from chart on page 41)
$L_s = (T_p + T_d) / 0.96875$
$L_s = (32.103 + 26.88) / 0.96875$
$L_s =$ 60.9 lb

STEP 18: Calculate Max Fix Radial Load (L_f)
$L_f = L_m - L_s$
$L_f = 281.43 - 60.9$
$L_f =$ 220.53

STEP 19: Compare Max Fix Radial Load (L_f) to Actual Load Affixed to Actuator (L_r)
$L_f \geq L_r$
220.53 ≥ 32.2 lb
RISxx25 FITS THIS APPLICATION

APPLICATION INFORMATION - EXAMPLE 2

Weight = 15 lb mounting plate & two - 8 lb grippers
Rotation Angle = 180°
Pressure = 65 psi
Orientation = Vertical (grippers facing down)
Center of Gravity Distance = 10"
Desired Cycle Rate = 1.25 sec
Safety Factor: Acceleration = 2, Deceleration = 1
Cycles per Minute = 20 cyc/min = 1200 cyc/hr
Axial Load (La) = 31 lb
Radial Load (Lr) = 0



NOTE: Picture rotated up for clarity.

EXAMPLE 2

Determine Required Starting Torque for Application

STEP 1: Determine (J_m) for Mounting Plate
$J_m = (F_g / g) \times ((a^2 + b^2) / 12)$
$J_m = (15 / 386.4) \times ((24^2 + 4^2) / 12)$
$J_m = 0.0388198 \times 49.333 =$ 1.9151 in-lb-sec²

Jm for 2 Point Loads (Gripper)
$J_m = (F_g / g) \times k^2$
$J_m = (8 / 386.4) \times 10^2 = 2.0704$ in-lb-sec²
Total $J_m = 1.9151 + (2 \times 2.0704) =$ 6.056 in-lb-sec²

STEP 2: Determine (α_A)
$\alpha_A = 0.035 \times$ (angle rotation (deg) / time of rotation (sec²))
$\alpha_A = 0.035 \times (180 / (1.25)^2) =$ 4.032 rad/sec²

STEP 3: Starting Torque
$T_A = J_m \times \alpha_A \times SF$
$T_A = 6.056 \times 4.032 \times 2 =$ 48.836 in-lb
RIDxx32 WILL PRODUCE SUFFICIENT TORQUE

Check for Stopping Capacity

STEP 4: Calculate Peak Velocity (ω) - RIDxx32
$\omega = 0.035 \times$ average velocity (refer to page 39)
$\omega = 0.035 \times (180 / 1.25) =$ 5.04 rad/sec

STEP 5: Compare Peak Velocity to Allowable Impact Graph (page 39) This velocity is in the range of shock pads but not with the attached load J_m of 6.055. Go to "Sizing an RIxx Unit with Shocks"

STEP 6: Compare Peak Velocity to Allowable Impact Velocity for a given (J_m) Load using Shock Absorbers. Compare to graph on page 40. RIDxx32 is not acceptable for this application. Use larger size RISxx50 for this application.

STEP 7: Calculate Kinetic Energy (K_e)
$K_e = 1/2 \times J_m \times \omega^2$
$K_e = 1/2 \times 6.056 \times 5.04^2 =$ 76.9 in-lb

STEP 8: Calculate Propelling Energy (P_e)
RISx50 = 2.769 x psi
$P_e = 2.769 \times 65$ psi = 179.99 in-lb

STEP 9: Calculate Total Energy (E_t)
$E_t = K_e + P_e$
$E_t = 76.9 + 179.99 =$ 256.88 in-lb

STEP 10: Compare Max. Total Energy (E_m) to Total Energy (E_t)
$E_m \geq E_t$ 577 ≥ 256.9
$E_a \geq E_t$ 527 ≥ 256.9
SHOCK WILL PERFORM AS DESIRED

STEP 11: Calculate Energy per Hour (E_h)
Cycles/Hour = Cycles/Minute x 60
Cycles/Hour = 20 x 60 = 1200
$E_h = 1200 \times 172.5$ in-lb = 207,018 in-lb/hr
207,018 ≤ 600,000

STEP 12: Calculate Allowable Attached Load Weight
Axial Load Weight = 31 lb = (L_a)

STEP 13: Calculate Max Actuator Radial Loading (L_m)
Determine C_g Distance = 10"
$L_m = (-2.699 (L_a) + 6573.92) / (3.553 + C_g)$
$L_m = (-2.699 (31) + 6573.92) / (3.553 + 10) =$ 478.90 lb

STEP 14: Calculate Propelling Torque (T_p) - RISx50
$T_p = 2.378 \times$ psi
$T_p = 2.378 \times 65$ psi = 154.57 in-lb

STEP 15: Calculate Deceleration (α_d)
$\alpha_d = \omega^2 / 2.45$
$\alpha_d = (5.04)^2 / 2.45 =$ 10.368 rad/sec²

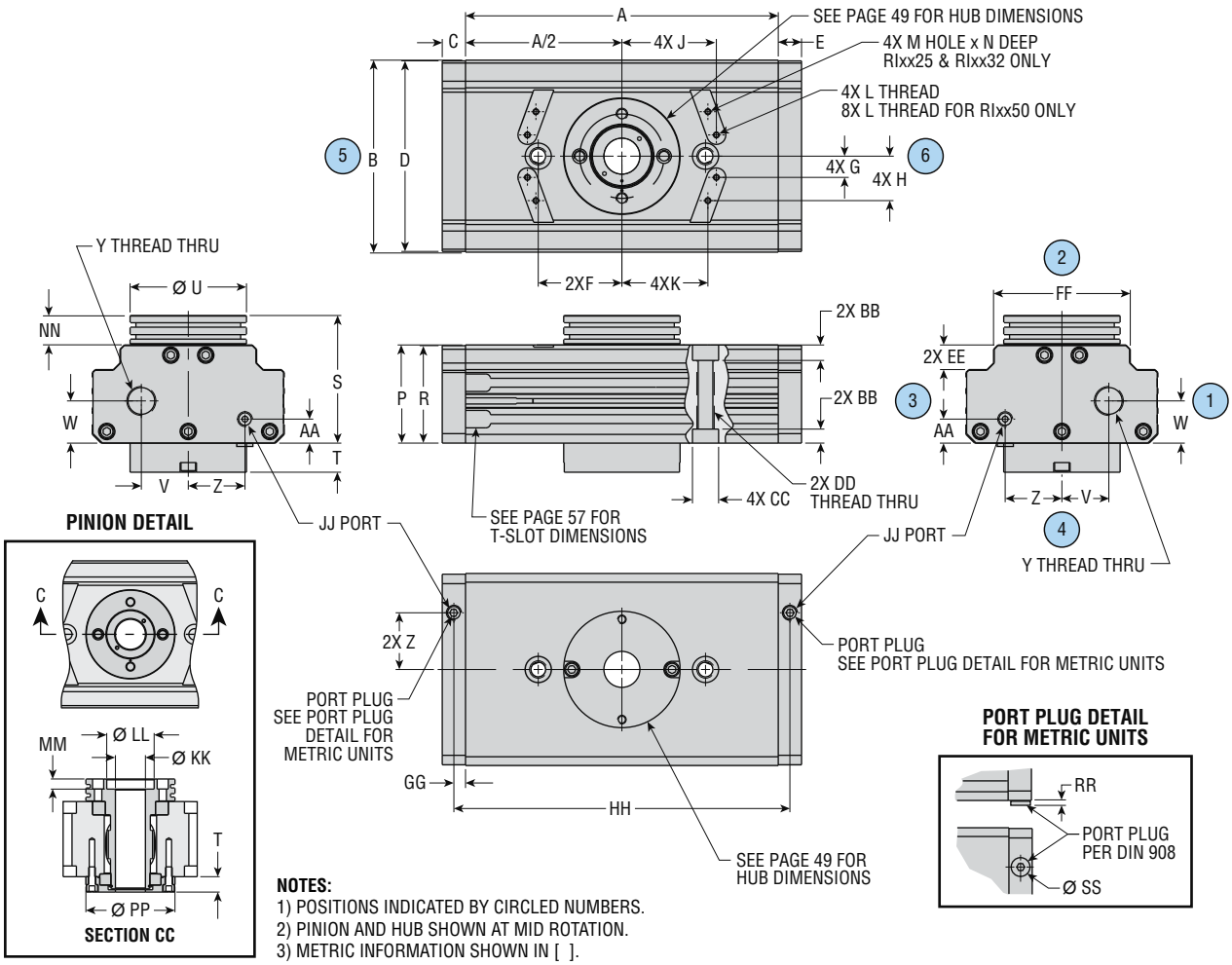
STEP 16: Calculate Stopping Torque (T_d)
(from STEP 16 on page 41)
$T_d = 6.056 \times 10.368 \times 1 =$ 62.79 in-lb

STEP 17: Calculate Radial Bearing Load at Stopping (L_s)
(from chart on page 41)
$L_s = (T_p + T_d) / 1.5625$
$L_s = (154.57 + 62.79) / 1.5625$
$L_s = 217.36 / 1.5625 =$ 139.11 lb

STEP 18: Calculate Max Fix Radial Load (L_f)
$L_f = L_m - L_s$
$L_f = 478.90 - 139.11 =$ 339.76 lb

STEP 19: Compare Max Fix Radial Load (L_f) to Actual Load Affixed to Actuator (L_r)
$L_f \geq L_r$
339.76 lb ≥ 31 lb
RISxx50 FITS THIS APPLICATION

DIMENSIONS: Series RISH Rotary Actuators - Single Rack



NOTES:
1) POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) METRIC INFORMATION SHOWN IN [ ].

UNIT SIZE	LETTER DIMENSION																
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
RISH125	5.425	3.071	0.472	3.031	0.472	1.477	0.406	0.738	1.823	1.698	M3 x 0.5	0.102	0.098	1.398	1.417	1.889	0.417
RISH525	[137.8]	[78.0]	[12.0]	[77.0]	[12.0]	[37.5]	[10.3]	[18.7]	[46.3]	[43.1]	M3 x 0.5	[2.6]	[2.5]	[35.5]	[36.0]	[48.0]	[10.6]
RISH132	6.384	3.858	0.630	3.819	0.630	1.969	0.758	1.070	2.004	1.838	M3 x 0.5	0.102	0.118	1.890	1.909	2.519	0.374
RISH532	[162.2]	[98.0]	[16.0]	[97.0]	[16.0]	[50.0]	[19.3]	[27.2]	[50.9]	[46.7]	M3 x 0.5	[2.6]	[3.0]	[48.0]	[48.5]	[64.0]	[9.5]
RISH250	8.464	5.197	0.630	5.157	0.630	2.264	0.575	1.204	2.557	2.328	M4 x 0.7	—	—	2.638	2.657	3.454	0.543
RISH650	[215.0]	[132.0]	[16.0]	[131.0]	[16.0]	[57.5]	[14.6]	[30.6]	[64.9]	[59.1]	M4 x 0.7	—	—	[67.0]	[67.5]	[87.7]	[13.8]

UNIT SIZE	LETTER DIMENSION													
	U	V	W	Y	Z	AA	BB	CC	CC TOL ±	DD	EE	FF	GG	HH
RISH125	1.969	0.731	0.618	M14 x 1.5	0.709	0.394	0.197	0.4715	0.0004	5/16-24	0.158	2.283	0.197	5.819
RISH525	[50.0]	[18.6]	[15.7]	M14 x 1.5	[18.0]	[10.0]	[5.0]	[11.98]	[0.01]	M8 x 1.25	[4.0]	[58.0]	[5.0]	[147.8]
RISH132	2.520	0.888	0.854	M20 x 1.5	0.787	0.649	0.197	0.4715	0.0004	5/16-24	0.236	2.598	0.315	7.014
RISH532	[64.0]	[22.6]	[21.7]	M20 x 1.5	[20.0]	[16.5]	[5.0]	[11.98]	[0.01]	M8 x 1.25	[6.0]	[66.0]	[8.0]	[178.2]
RISH250	3.150	1.270	1.142	M25 x 1.5	1.535	0.649	0.419	0.7077	0.0004	1/2-20	0.667	3.701	0.315	9.094
RISH650	[80.0]	[32.2]	[29.0]	M25 x 1.5	[39.0]	[16.5]	[10.6]	[17.98]	[0.01]	M12 x 1.75	[16.9]	[94.0]	[8.0]	[231.0]

UNIT SIZE	LETTER DIMENSION							
	JJ	Ø PP	Ø KK	Ø LL	MM	NN	RR	SS
RISH125	10-32	2.244	0.677	1.063	0.236	0.472	—	—
RISH525	M5 x 0.8	[57.0]	[17.2]	[27.0]	[6.0]	[12.0]	—	—
RISH132	1/8-27 NPT	2.677	0.846	1.339	0.276	0.610	—	—
RISH532	1/8-28 BSPP	[68.0]	[21.5]	[34.0]	[7.0]	[15.5]	[2.5]	[15.0]
RISH250	1/8-27 NPT	3.150	1.060	1.676	0.354	0.797	—	—
RISH650	1/8-28 BSPP	[80.0]	[26.9]	[42.6]	[9.0]	[20.2]	[2.5]	[15.0]

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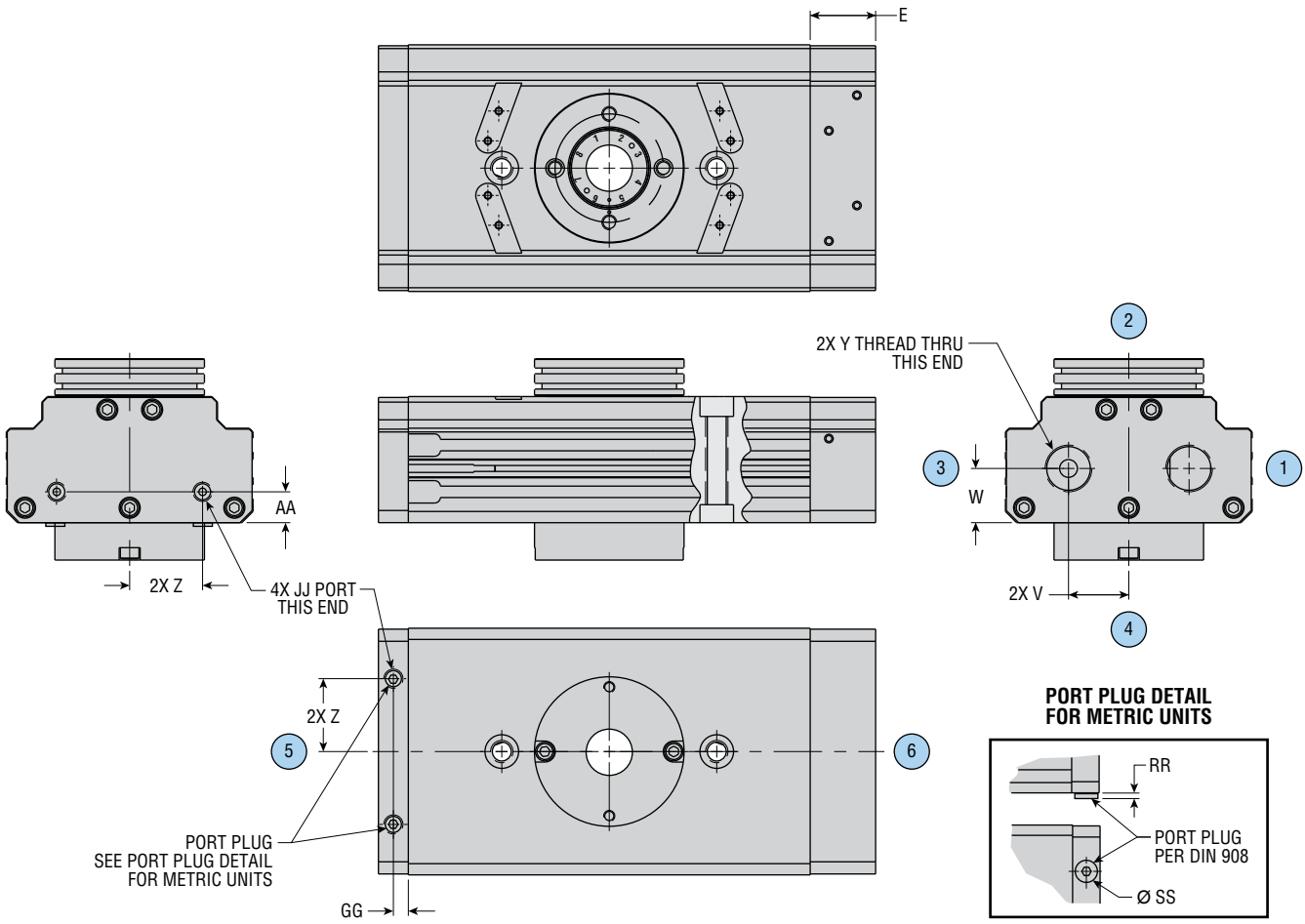

UNIT SIZE	LETTER DIMENSION									
	E	V	W	Y	Z	AA	GG	JJ	RR	SS
RIDH125	1.280	0.731	0.618	M14 x 1.5	0.709	0.394	0.197	10-32	—	—
RIDH525	[32.5]	[18.6]	[15.7]	M14 x 1.5	[18.0]	[10.0]	[5.0]	M5 x 0.8	—	—
RIDH132	1.378	0.888	0.854	M20 x 1.5	0.787	0.650	0.315	1/8-27 NPT	—	—
RIDH532	[35.0]	[22.6]	[21.7]	M20 x 1.5	[20.0]	[16.5]	[8.0]	1/8-28 BSPP	[2.5]	[15.0]
RIDH150	1.378	1.270	1.142	M25 x 1.5	1.535	0.650	0.315	1/8-27 NPT	—	—
RIDH550	[35.0]	[32.2]	[29.0]	M25 x 1.5	[39.0]	[16.5]	[8.0]	1/8-28 BSPP	[2.5]	[15.0]

NOTES:
1) POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) FOR DIMENSIONS NOT GIVEN, SEE RISH SINGLE RACK DIMENSIONS. SEE PREVIOUS PAGE.
4) METRIC INFORMATION SHOWN IN [ ].

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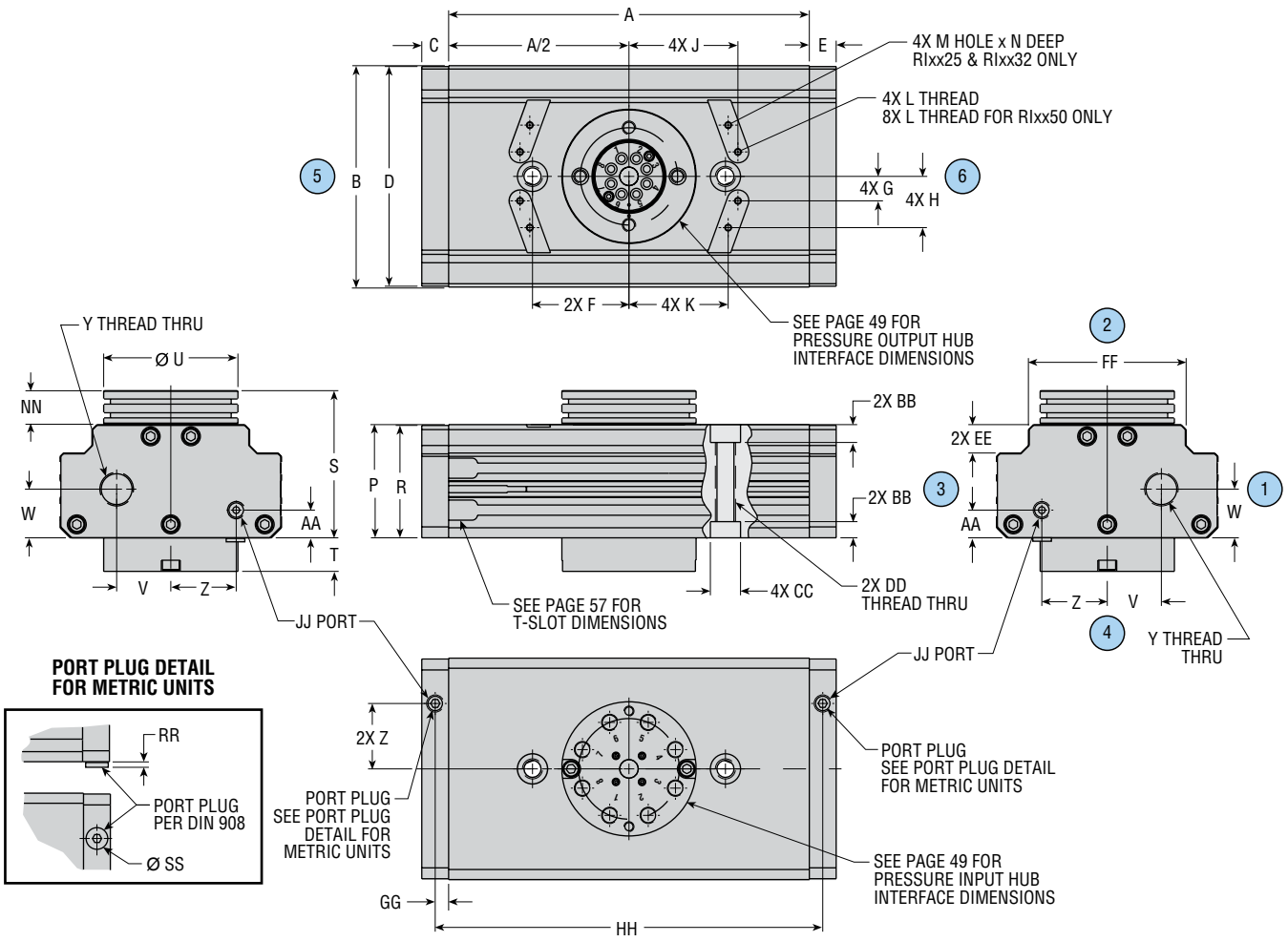

UNIT SIZE	LETTER DIMENSION																
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
RIS125	5.425	3.071	0.472	3.031	0.472	1.477	0.406	0.738	1.823	1.698	M3 x 0.5	0.102	0.098	1.417	1.398	1.889	0.709
RIS525	[137.8]	[78.0]	[12.0]	[77.0]	[12.0]	[37.5]	[10.3]	[18.7]	[46.3]	[43.1]	M3 x 0.5	[2.6]	[2.5]	[36.0]	[35.5]	[48.0]	[18.0]
RIS132	6.384	3.858	0.630	3.819	0.630	1.969	0.758	1.070	2.004	1.838	M3 x 0.5	0.102	0.118	1.909	1.890	2.519	0.787
RIS532	[162.2]	[98.0]	[16.0]	[97.0]	[16.0]	[50.0]	[19.3]	[27.2]	[50.9]	[46.7]	M3 x 0.5	[2.6]	[3.0]	[48.5]	[48.0]	[64.0]	[20.0]
RIS250	8.464	5.197	0.630	5.157	0.630	2.264	0.575	1.204	2.557	2.328	M4 x 0.7	—	—	2.657	2.638	3.454	0.787
RIS650	[215.0]	[132.0]	[16.0]	[131.0]	[16.0]	[57.5]	[14.6]	[30.6]	[64.9]	[59.1]	M4 x 0.7	—	—	[67.5]	[67.0]	[87.7]	[20.0]

UNIT SIZE	LETTER DIMENSION													
	U	V	W	Y	Z	AA	BB	CC	CC TOL ±	DD	EE	FF	GG	HH
RIS125	1.969	0.731	0.618	M14 x 1.5	0.709	0.394	0.197	0.4715	0.0004	5/16-24	0.158	2.283	0.197	5.819
RIS525	[50.0]	[18.6]	[15.7]	M14 x 1.5	[18.0]	[10.0]	[5.0]	[11.98]	[0.01]	M8 x 1.25	[4.0]	[58.0]	[5.0]	[147.8]
RIS132	2.520	0.888	0.854	M20 x 1.5	0.787	0.649	0.197	0.4715	0.0004	5/16-24	0.236	2.598	0.315	7.014
RIS532	[64.0]	[22.6]	[21.7]	M20 x 1.5	[20.0]	[16.5]	[5.0]	[11.98]	[0.01]	M8 x 1.25	[6.0]	[66.0]	[8.0]	[178.2]
RIS250	3.150	1.270	1.142	M25 x 1.5	1.535	0.649	0.419	0.7077	0.0004	1/2-20	0.667	3.701	0.315	9.094
RIS650	[80.0]	[32.2]	[29.0]	M25 x 1.5	[39.0]	[16.5]	[10.6]	[17.98]	[0.01]	M12 x 1.75	[16.9]	[94.0]	[8.0]	[231.0]

UNIT SIZE	LETTER DIMENSION			
	JJ	NN	RR	SS
RIS125	10-32	0.472	—	—
RIS525	M5 x 0.8	[12.0]	—	—
RIS132	1/8-27 NPT	0.610	—	—
RIS532	1/8-28 BSPP	[15.5]	[2.5]	[15.0]
RIS250	1/8-27 NPT	0.797	—	—
RIS650	1/8-28 BSPP	[20.2]	[2.5]	[15.0]

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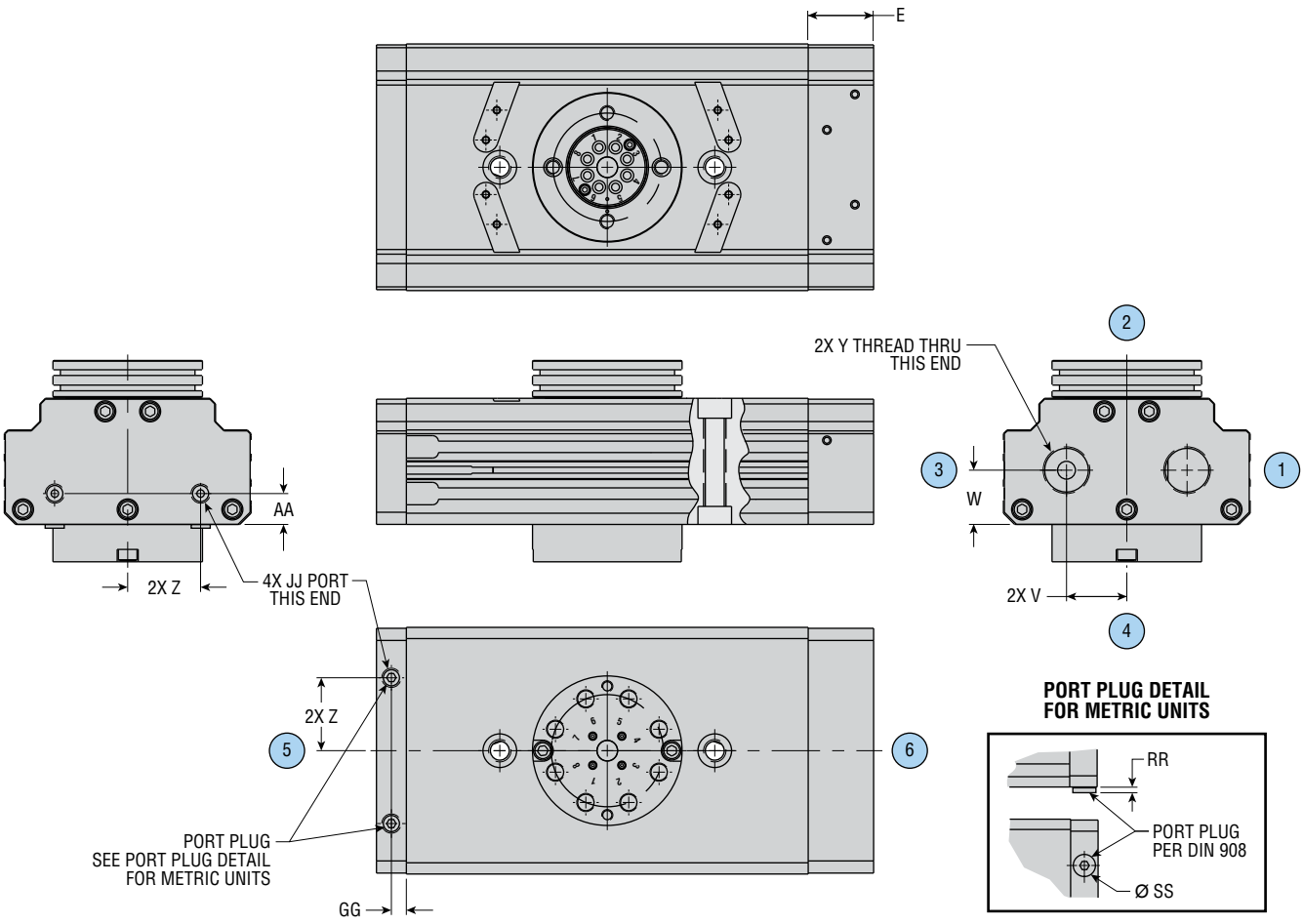

UNIT SIZE	LETTER DIMENSION									
	E	V	W	Y	Z	AA	GG	JJ	RR	SS
RID125	1.280	0.731	0.618	M14 x 1.5	0.709	0.394	0.197	10-32	—	—
RID525	[32.5]	[18.6]	[15.7]	M14 x 1.5	[18.0]	[10.0]	[5.0]	M5 x 0.8	—	—
RID132	1.378	0.888	0.854	M20 x 1.5	0.787	0.650	0.315	1/8-27 NPT	—	—
RID532	[35.0]	[22.6]	[21.7]	M20 x 1.5	[20.0]	[16.5]	[8.0]	1/8-28 BSPP	[2.5]	[15.0]
RID150	1.378	1.270	1.142	M25 x 1.5	1.535	0.650	0.315	1/8-27 NPT	—	—
RID550	[35.0]	[32.2]	[29.0]	M25 x 1.5	[39.0]	[16.5]	[8.0]	1/8-28 BSPP	[2.5]	[15.0]

NOTES:
1) POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) FOR DIMENSIONS NOT GIVEN, SEE RISH SINGLE RACK DIMENSIONS. SEE PREVIOUS PAGE.
4) METRIC INFORMATION SHOWN IN [ ].

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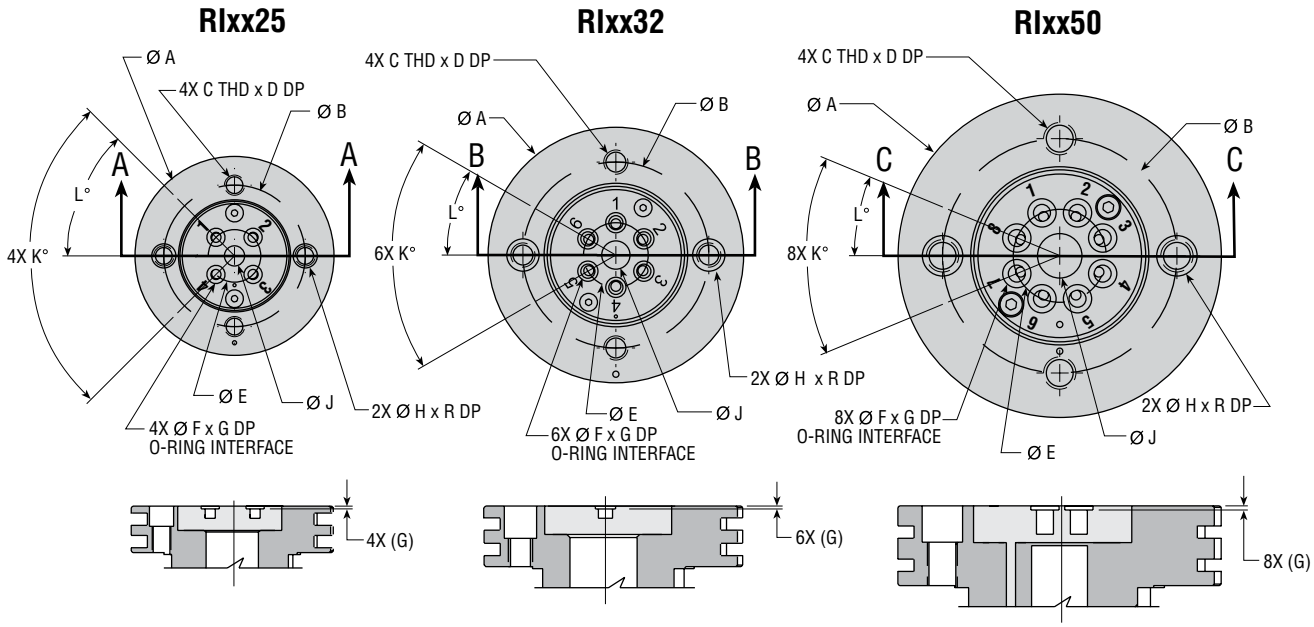
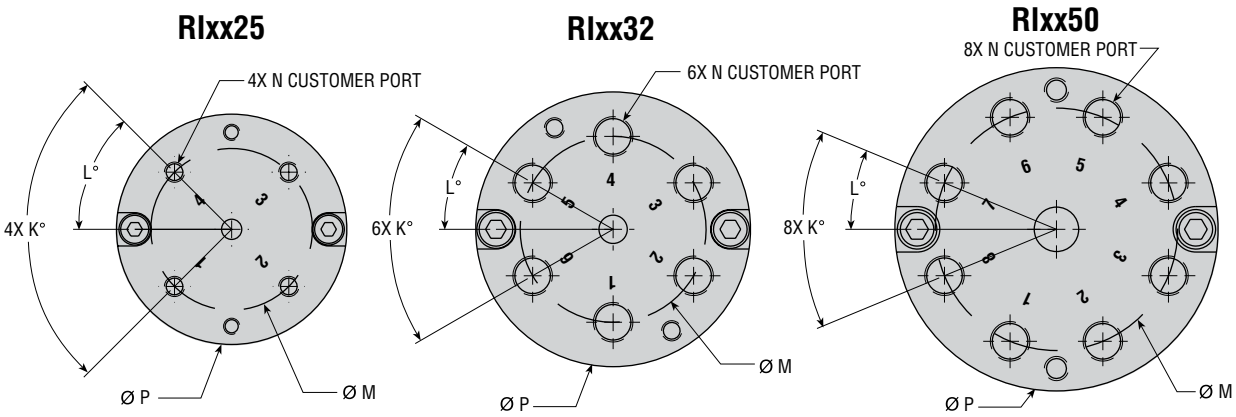
PRESSURE OUTPUT HUB O-RING INTERFACE



PRESSURE INPUT PORT INTERFACE



UNIT SIZE	LETTER DIMENSION																
	A	A TOL ±	B	C	D	E	F	G	H	H TOL ±	J	K°	L°	M	N	P	R
RIS125 & RID125	1.969	0.002	1.378	10-32	0.472	0.512	0.177	0.026	0.2355	0.0003	0.197	90.0	45.0	1.575	10-32	2.244	0.197
RIS525 & RID525	[50]	[0.05]	[35.0]	M5 x 0.8	[12.0]	[13.0]	[4.5]	[0.7]	[5.98]	[0.008]	[5.0]	90.0	45.0	[40.0]	M5 x 0.8	[57.0]	[5.0]
RIS132 & RID132	2.520	0.002	1.811	1/4-28	0.610	0.630	0.197	0.026	0.3147	0.0003	0.276	60.0	30.0	1.811	1/8-27 NPT	2.677	0.315
RIS532 & RID532	[64.0]	[0.05]	[46.0]	M6 x 1.0	[15.5]	[16.0]	[5.0]	[0.7]	[7.99]	[0.008]	[7.0]	60.0	30.0	[46.0]	1/8-28 BSPP	[68.0]	[8.0]
RIS250 & RID150	3.150	0.002	2.283	5/16-24	0.797	0.906	0.276	0.039	0.3940	0.0003	0.433	45.0	22.5	2.362	1/8-27 NPT	3.150	0.354
RIS650 & RID550	[80.0]	[0.05]	[58.0]	M8 x 1.25	[20.2]	[23.0]	[7.0]	[1.0]	[10.01]	[0.008]	[11.0]	45.0	22.5	[60.0]	1/8-28 BSPP	[80.0]	[9.0]

NOTES:
1) PINION AND HUB SHOWN AT MID ROTATION.
2) METRIC INFORMATION SHOWN IN [ ].

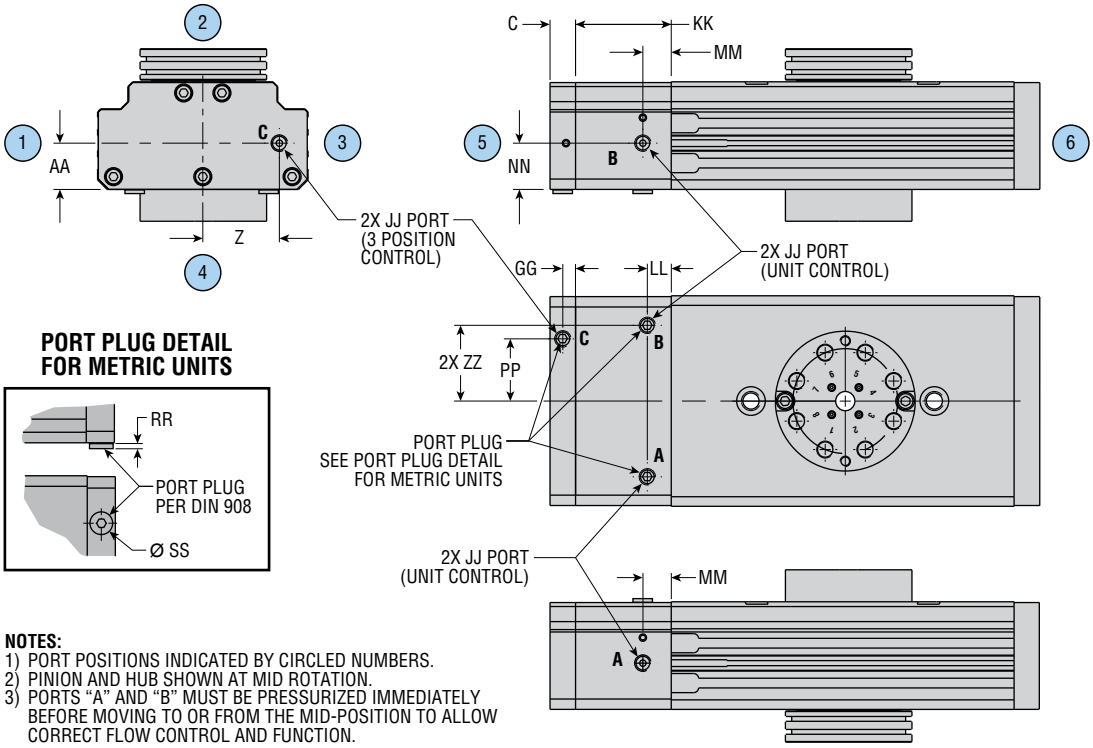
CAD & Sizing Assistance

Use PHD's free online Product Sizing and
CAD Configurator at **phdinc.com/myphd**

All dimensions are reference only unless specifically toleranced.

DOUBLE RACK
SIZE 25, 32, & 50

FOR DIMENSIONS NOT SHOWN HERE:
SERIES RIxH SEE PAGES 45 AND 46
SERIES RIx SEE PAGES 47 AND 48



PORT PLUG DETAIL FOR METRIC UNITS

NOTES:
1) PORT POSITIONS INDICATED BY CIRCLED NUMBERS.
2) PINION AND HUB SHOWN AT MID ROTATION.
3) PORTS "A" AND "B" MUST BE PRESSURIZED IMMEDIATELY BEFORE MOVING TO OR FROM THE MID-POSITION TO ALLOW CORRECT FLOW CONTROL AND FUNCTION.

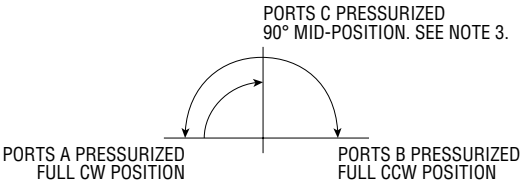
UNIT SIZE	LETTER DIMENSION								
	AA	JJ	KK	LL	MM	NN	RR	SS	ZZ
3RID125	0.618	10-32	1.496	0.354	0.354	0.618	—	—	0.807
3RID525	[15.7]	M5 x 0.8	[38.0]	[9.0]	[9.0]	[15.7]	—	—	[20.5]
3RID132	0.854	1/8-27 NPT	1.965	0.492	0.571	0.854	—	—	1.161
3RID532	[21.7]	1/8-28 BSPP	[49.9]	[12.5]	[14.5]	[21.7]	[2.5]	[15.0]	[29.5]
3RID150	1.142	1/8-27 NPT	2.362	0.591	0.701	1.142	—	—	1.870
3RID550	[29.0]	1/8-28 BSPP	[60.0]	[15.0]	[17.8]	[29.0]	[2.5]	[15.0]	[47.5]

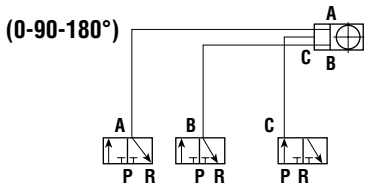
METRIC INFORMATION SHOWN IN [ ].

DOUBLE RACK DIMENSIONS

UNIT SIZE	LETTER DIMENSION			
	C	Z	GG	PP
3RID125	0.472	0.709	0.197	0.295
3RID525	[12.0]	[18.0]	[5.0]	[7.5]
3RID132	0.630	1.496	0.315	0.472
3RID532	[16.0]	[38.0]	[8.0]	[12.0]
3RID150	0.630	1.890	0.315	1.535
3RID550	[16.0]	[48.0]	[8.0]	[39.0]

METRIC INFORMATION SHOWN IN [ ].





CAD & Sizing Assistance

Use PHD's free online Product Sizing and
CAD Configurator at **phdinc.com/myphd**

All dimensions are reference only unless specifically toleranced.

AB ANGLE ADJUSTMENTS WITH SHOCK PAD INSTALLED BOTH ENDS

AC ANGLE ADJUSTMENTS WITH SHOCK PAD INSTALLED COUNTERCLOCKWISE 90°

AW ANGLE ADJUSTMENTS WITH SHOCK PAD INSTALLED CLOCKWISE 90°

Angle adjustment options and/or shock absorber options must be ordered on each unit. Both provide mechanical stops and angle adjustment of -90° from both ends of rotation.

The standard rotation for Series RI is 180°. The ability to adjust over a wide range eliminates the need to order special units for specific angles of rotation.

The angle adjustment screw has a shock pad as standard providing quiet actuator operation in less demanding applications. In more demanding applications, the optional shock absorbers should be specified to handle the higher energy dissipation.

UNIT SIZE	LETTER DIMENSION			
	A	B	C	D
RIS125	0.200	2.578	0.551	0.770
RIS525	[5.1]	[65.5]	[14.0]	[19.6]
RIS132	0.240	3.392	0.787	1.100
RIS532	[6.1]	[86.2]	[20.0]	[27.9]
RIS250	0.310	3.373	0.984	1.360
RIS650	[7.9]	[85.7]	[25.0]	[34.5]

METRIC INFORMATION SHOWN IN [ ].

UNIT SIZE	LETTER DIMENSION			
	A	B	C	D
RID125	0.369	1.770	0.551	1.094
RID525	[9.4]	[45.0]	[14.0]	[27.8]
RID132	0.424	2.644	0.787	1.375
RID532	[10.8]	[67.2]	[20.0]	[34.9]
RID150	0.505	2.625	0.984	1.750
RID550	[12.8]	[66.7]	[25.0]	[44.5]

METRIC INFORMATION SHOWN IN [ ].

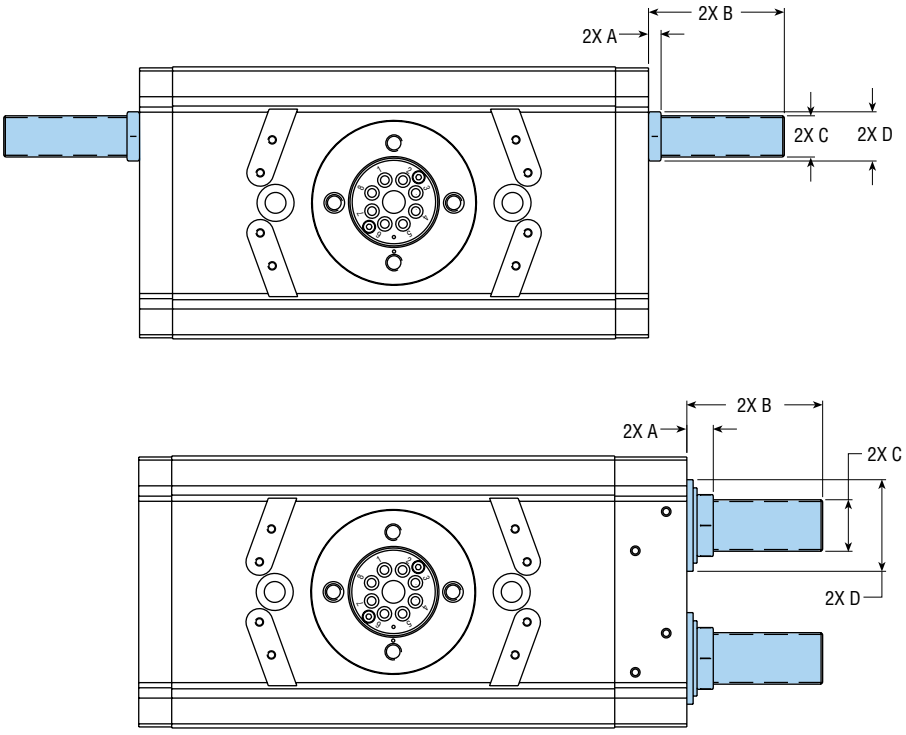
UNIT SIZE	ANGLE ADJUSTMENT KIT NO.*
RISxx25	69223-01
RIDxx25	69230-01
RISxx32	69226-01
RIDxx32	69231-01
RISxx50	75424-01
RIDxx50	69233-01

*ANGLE ADJUSTMENT KITS INCLUDE:

FOR RISxx UNITS: 1 ANGLE ADJUSTMENT SCREW AND 1 NUT

FOR RIDxx UNITS: 1 ANGLE ADJUSTMENT SCREW, 1 NUT, 1 THREAD SEAL, AND 1 SEAL WASHER

1 KIT REQUIRED PER END OF ADJUSTMENT DESIRED.



All dimensions are reference only unless specifically toleranced.

NB **SHOCK ABSORBER INSTALLED BOTH DIRECTIONS**

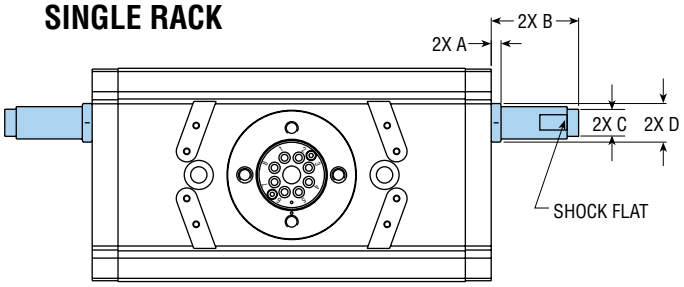
NC **SHOCK ABSORBER INSTALLED COUNTERCLOCKWISE DIRECTION**

NW **SHOCK ABSORBER INSTALLED CLOCKWISE DIRECTION**

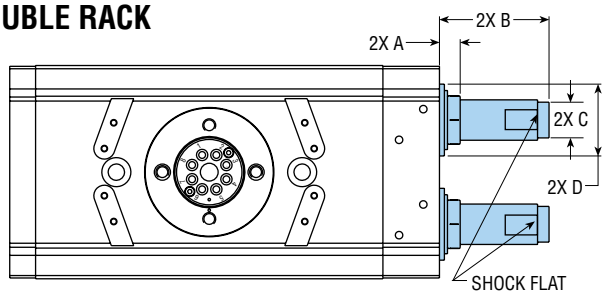
Either angle adjustment options and/or shock absorber options must be ordered on each unit. Both provide mechanical stops and angle adjustment of -90° from both ends of rotation.

The shock absorber options provide maximum deceleration control and rotational stopping ability. The -NB, -NC, and -NW options provide the Rotary Actuator with the shock absorber factory installed in the Series RI Rotary Actuator. See page 41 for details on unit stopping capacity with installed shock absorbers. Reference the Shock Absorber Specifications Chart for nominal effective angle of rotation in each direction.

SINGLE RACK



DOUBLE RACK



UNIT SIZE	LETTER DIMENSION			
	A	B	C	D
RIS125	0.200	2.847	0.470	0.770
RIS525	[5.1]	[72.3]	[11.9]	[19.6]
RIS132	0.240	3.263	0.660	1.100
RIS532	[6.1]	[82.9]	[16.8]	[27.9]
RIS250	0.310	3.924	0.870	1.360
RIS650	[7.9]	[99.7]	[22.1]	[34.5]

METRIC INFORMATION SHOWN IN [ ].

UNIT SIZE	LETTER DIMENSION			
	A	B	C	D
RID125	0.369	2.039	0.470	1.094
RID525	[9.4]	[51.8]	[11.9]	[27.8]
RID132	0.424	2.515	0.660	1.375
RID532	[10.8]	[63.9]	[16.8]	[34.9]
RID150	0.505	3.176	0.870	1.750
RID550	[12.8]	[80.7]	[22.1]	[44.5]

METRIC INFORMATION SHOWN IN [ ].

SHOCK ABSORBER SPECIFICATIONS

UNIT SIZE	SHOCK ABSORBER KIT NO.	THREAD TYPE	STROKE		SHOCK ABSORBER WEIGHT		KINETIC ENERGY LOAD		SHOCK ABSORBER LENGTH		ACROSS SHOCK FLATS		SHOCK ABSORBER EFFECTIVE ANGLE
		mm	in	mm	lb	kg	in-lb	Nm	in	mm	in	mm	
RISxx25	69146	M14 x 1.5	0.42	10.7	0.12	0.05	150	17	4.00	101.6	0.47	11.9	50
RIDxx25	69153	M14 x 1.5	0.42	10.7	0.12	0.05	150	17	4.00	101.6	0.47	11.9	50
RISxx32	69147	M20 x 1.5	0.625	15.9	0.28	0.13	225	25	4.67	118.6	0.69	17.5	60
RIDxx32	69154	M20 x 1.5	0.625	15.9	0.28	0.13	360	40	4.67	118.6	0.69	17.5	60
RISxx50	75423	M25 x 1.5	0.91	23.1	0.76	0.34	600	68	5.51	140.0	0.88	22.4	70
RIDxx50	69156	M25 x 1.5	0.91	23.1	0.76	0.34	1200	136	5.51	140.0	0.88	22.4	70

SHOCK ABSORBERS KITS INCLUDE:
FOR RISxx UNITS: 1 SHOCK AND 1 NUT
FOR RIDxx UNITS: 1 SHOCK, 1 NUT, 1 THREAD SEAL, AND 1 SEAL WASHER
1 KIT REQUIRED PER END OF ADJUSTMENT DESIRED.

NOTE: The shock absorber doubles as the rotation adjustment. Shock absorbers or angle adjustment option must be installed in the rotary actuator prior to operating the unit. Operation of units without installed shocks or angle adjustment can damage the units and void any and all warranties. Only shock absorbers specified by PHD should be used in Series RI Rotary Actuators. The use of any other shock absorbers will affect actuator performance and life expectancy.

PHD recommends replacing shocks every 1,000,000 cycles to maintain peak actuator performance and life.

All dimensions are reference only unless specifically toleranced.

PB ROTATION SPEED CONTROL BOTH DIRECTIONS

PC ROTATION SPEED CONTROL COUNTERCLOCKWISE DIRECTION

PW ROTATION SPEED CONTROL CLOCKWISE DIRECTION

The PHD Series RI offers optional external compact flow control fittings for adjusting output hub rotation speed. The speed of the hub is controlled by regulating the cylinder exhaust. The control fittings are unidirectional flow control valves where intake air flows freely through the flow control and exhaust is metered out through an adjustment screw. Intake capacity is slightly greater than the full open exhaust capacity, enabling maximum variation of hub rotation speed.

The PHD Series RI flow control fittings supplied with this option screw into the cap port(s) and provide an integral tube fitting connection. They also swivel 360° around the ports, easing tube routing installation. Rotational velocities are adjusted and maintained by the captivated fine adjustment screw with a locking nut to ensure precise velocity control and repeatability in output hub rotation speed.

NOTE: Flow control fitting is effective between 15 to 100 psi [1.0 to 7.0 bar] and from 5° to 160°F [-15° to 71.1°C].

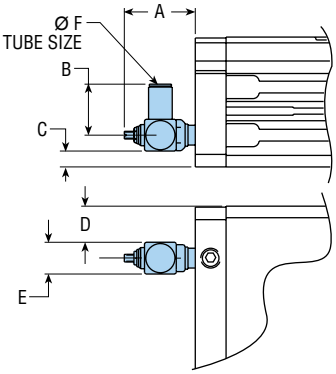
UNIT SIZE	LETTER DIMENSION					
	A	B	C	D	E	F
RIxx125	0.984	0.827	0.197	0.630	0.394	0.156
RIxx525	[25.0]	[21.0]	[5.0]	[16.0]	[10.0]	[4.0]
RIxx132	1.614	1.043	0.069	0.817	0.650	0.250
RIxx532	[41.0]	[26.5]	[1.8]	[20.8]	[16.5]	[6.4]
RIxx150	1.693	1.043	0.069	0.743	0.650	0.250
RIxx550	[43.0]	[26.5]	[1.8]	[18.9]	[16.5]	[6.4]

METRIC INFORMATION SHOWN IN [ ].

UNIT SIZE	ROTATION SPEED CONTROL KIT NO.
RIxx125	70695-01
RIxx525	70696-01
RIxx132	70695-03
RIxx532	70696-03
RIxx150	70695-03
RIxx550	70696-03

1 KIT REQUIRED PER END OF ADJUSTMENT DESIRED

NOTE: ONE FLOW CONTROL FITTING PER KIT

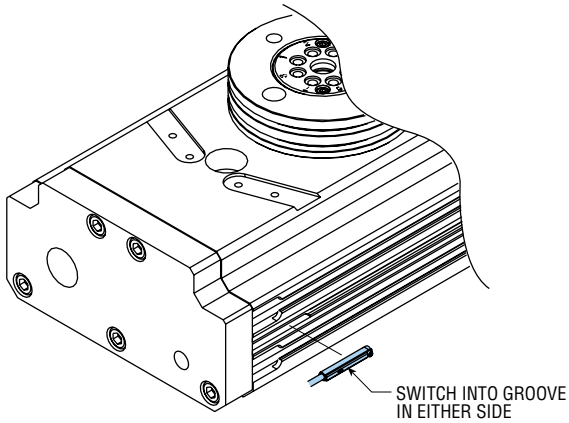


M MAGNETS FOR PHD SERIES JC1 SWITCHES

This option equips the rotary actuator with magnets on the rack for use with PHD Series JC1 Switches. These switches mount easily to the actuator using the switch slots in the sides of the body.

PHD Series JC1 Switches are designed specifically to provide an input signal to various types of programmable controllers or logic systems. See Switches and Sensors catalog for complete switch specifications.

Hand tighten the setscrew until the switch is securely retained. Do not overtighten.



SERIES JC1 SOLID STATE AND REED SWITCHES

JC1 SWITCH	DESCRIPTION
JC1SDN-5	NPN DC Solid State, 5 meter cable
JC1SDP-5	PNP DC Solid State, 5 meter cable
JC1SDN-K	NPN DC Solid State, Quick Connect
JC1SDP-K	PNP DC Solid State, Quick Connect
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect

NOTE: See Switches and Sensors catalog for additional switch information and complete specification. Switches must be ordered separately.

CORDSETS FOR SERIES JC1 SOLID STATE & REED SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 3 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

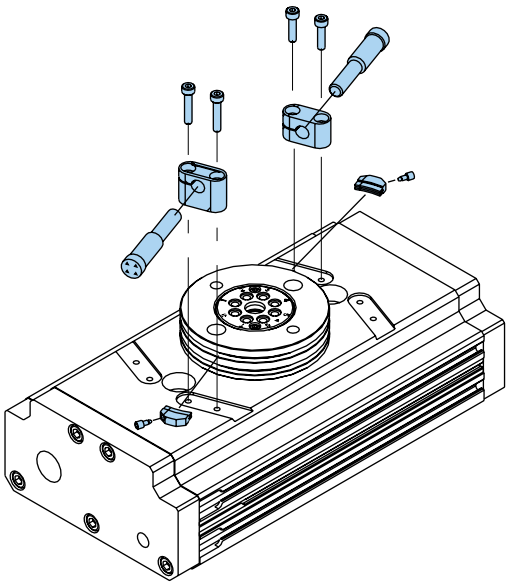
All dimensions are reference only unless specifically toleranced.

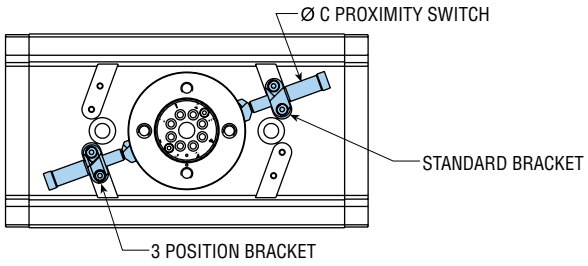
EXTERNAL PROXIMITY SWITCHES

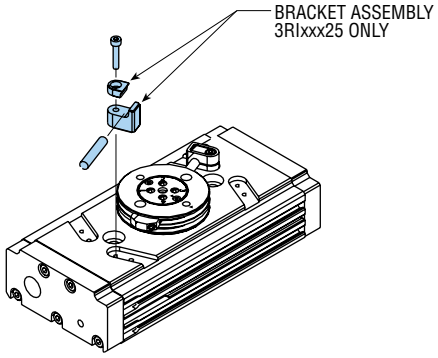
This accessory provides for the external mounting of round metal sensing proximity switches. One switch mounting kit is required per switch and includes the plastic bracket with the required mounting hardware. A steel switch target is also included in each external proximity switch mounting kit.

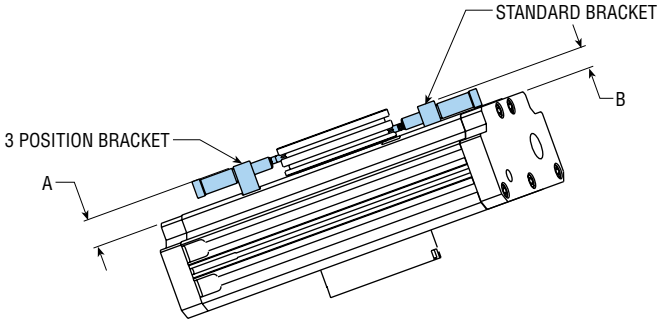
The Series RI body accepts up to four external proximity switches. The typical application requires two switch mounting kits; however, if the three position model has been ordered, the three position switch bracket kit must also be ordered. This kit utilizes the top target groove in the hub and therefore positions the proximity switch higher from the body.

Proximity switches are supplied by the customer, see chart below for switch diameter specifications, dimension C.









VIEW AA

UNIT SIZE	LETTER DIMENSION		
	A	B	C
RIxx125	0.456	0.413	0.197
RIxx525	[11.6]	[10.5]	[5.0]
RIxx132	0.571	0.452	0.197
RIxx532	[14.5]	[11.5]	[5.0]
RIxx150	0.748	0.571	0.315
RIxx550	[19.0]	[14.5]	[8.0]

METRIC INFORMATION SHOWN IN [ ].

UNIT SIZE	STANDARD PROXIMITY KIT NO.
RIxxx25	69181
RIxxx32	69182
RIxxx50	69184

STANDARD PROXIMITY KITS INCLUDE:
- 1 TARGET ASSEMBLY(1 CAM PIN AND 1 TARGET)
- 1 BRACKET OR BRACKET ASSEMBLY WITH REQUIRED MOUNTING HARDWARE

UNIT SIZE	3 POSITION PROXIMITY KIT NO.
3 RIDxx25	70207
3 RIDxx32	70208
3 RIDxx50	70209

3 POSITION PROXIMITY KITS INCLUDE:
- 1 TARGET ASSEMBLY(1 CAM PIN AND 1 TARGET)
- 1 BRACKET OR BRACKET ASSEMBLY WITH REQUIRED MOUNTING HARDWARE

All dimensions are reference only unless specifically toleranced.

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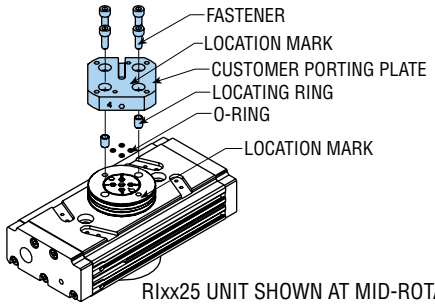
PORTING PLATE

This accessory provides a convenient conversion from the manifold output hub interface to a threaded port interface. It allows the use of the manifold hub feature of the Series RI Rotary Actuator, without the need to drill communication holes through the attached tooling. It also allows the plumbing of secondary actuators using the fittings and tubing of your choice.

The porting plate is made from 6061-T6 aluminum and is machined on all sides ensuring flat and parallel mounting surfaces. Four drilled and tapped holes are provided to attach your tooling. Location accuracy is maintained through the use of locating rings and dowel pin holes.

The porting plate also features numbered ports corresponding to the rotary actuator input ports. A location mark keeps proper port alignment simple during assembly.

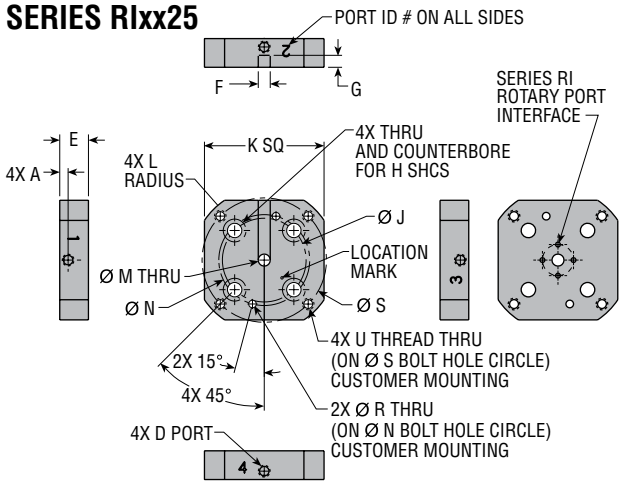


RIxx25 UNIT SHOWN AT MID-ROTATION

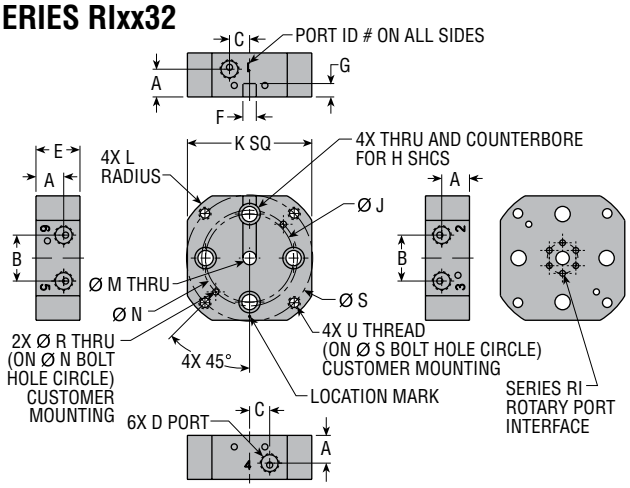
UNIT SIZE	KIT NO.	SCREW SIZE (SHCS)	REQUIRED SCREW TORQUE	
			in-lb	Nm
RIS125 & RID125	71972	10-32 x 0.5	75	8.5
RIS525 & RID525	71997	M5 x 0.8 x 12	75	8.5
RIS132 & RID132	71973	1/4-28 x 0.75	150	16.9
RIS532 & RID532	71998	M6 x 1.0 x 22	150	16.9
RIS250 & RID150	71975	5/16-24 x 0.875	250	28.2
RIS650 & RID550	72000	M8 x 1.25 x 25	250	28.2

KITS INCLUDE: 1 PORTING PLATE, 2 LOCATING RINGS, 4 FASTENERS, AND REQUIRED O-RINGS

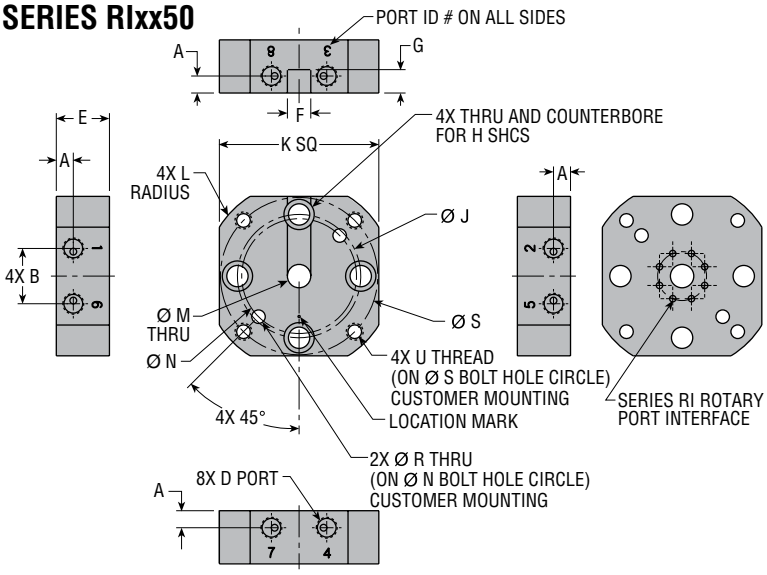
SERIES RIxx25



SERIES RIxx32



SERIES RIxx50



UNIT SIZE	LETTER DIMENSION					
	A	B	C	D	E	F
RIS125 & RID125	0.138	—	—	10-32	0.472	0.197
RIS525 & RID525	[3.5]	—	—	[M5 x 0.8]	[12.0]	[5.0]
RIS132 & RID132	0.571	0.945	0.413	1/8 NPT	0.906	0.276
RIS532 & RID532	[14.5]	[24.0]	[10.5]	[1/8 BSPP]	[23.0]	[7.0]
RIS250 & RID150	0.315	1.024	—	1/8 NPT	0.984	0.433
RIS650 & RID550	[8.0]	[26.0]	—	[1/8 BSPP]	[25.0]	[11.0]

UNIT SIZE	LETTER DIMENSION					
	G	H	J	K	L	M
RIS125 & RID125	0.197	10-32	1.378	1.969	1.181	0.197
RIS525 & RID525	[5.0]	[M5 x 0.8]	[35.0]	[50.0]	[30.0]	[5.0]
RIS132 & RID132	0.276	1/4-28	1.811	2.559	1.496	0.276
RIS532 & RID532	[7.0]	[M6 x 1.0]	[46.0]	[65.0]	[38.0]	[7.0]
RIS250 & RID150	0.433	5/16-24	2.283	2.953	1.732	0.433
RIS650 & RID550	[11.0]	[M8 x 1.25]	[58.0]	[75.0]	[44.0]	[11.0]

UNIT SIZE	LETTER DIMENSION			
	N	R	S	U
RIS125 & RID125	1.496	0.1252	2.047	10-24
RIS525 & RID525	[38.0]	[3.005]	[52.0]	[M5 x 0.8]
RIS132 & RID132	1.969	0.1252	2.598	1/4-20
RIS532 & RID532	[50.0]	[3.005]	[66.0]	[M6 x 1.0]
RIS250 & RID150	2.126	0.2503	2.913	5/16-18
RIS650 & RID550	[54.0]	[6.007]	[74.0]	[M8 x 1.25]

METRIC INFORMATION SHOWN IN [ ].

All dimensions are reference only unless specifically toleranced.

MANIFOLD O-RING SEAL KIT

This accessory provides the necessary o-rings to fit the manifold hub of the Series RI Rotary Actuator. This allows the rotary actuator to easily interface to customer supplied tooling. The o-rings are 70 durometer, Buna-N rubber.

MANIFOLD O-RING SEAL KIT SPECIFICATIONS

UNIT SIZE	O-RING MANIFOLD KIT NO.	NUMBER OF O-RINGS IN KIT	O-RING SIZE
RIxx25	69202	10	2 mm I.D. x 1 mm C.S.
RIxx32	69203	10	3 mm I.D. x 1 mm C.S.
RIxx50	69205	10	4 mm I.D. x 1.5 mm C.S.

LOCATION RINGS

These accessories provide accurate body and hub positioning. The location sleeve fits into either the top or bottom H7 tolerance counter bore holes on the PHD Series RI body or hub. They provide dowel pin accuracy without requiring the additional space for a dowel. Location rings allow either through bolt or tapped body mounting to be used. The mounting bolt is placed through the location ring, simultaneously securing and locating the mating parts.

The body locating ring kit consist of two hardened and ground steel sleeves sized to press into the H7 tolerance counter bored holes on either the top or bottom of the Series RIS body.

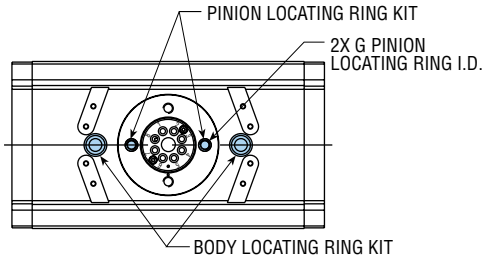
The hub locating ring kit consists of two hardened and ground steel sleeves, sized to press into the hub counter bores located on the top of the Series RI hub.

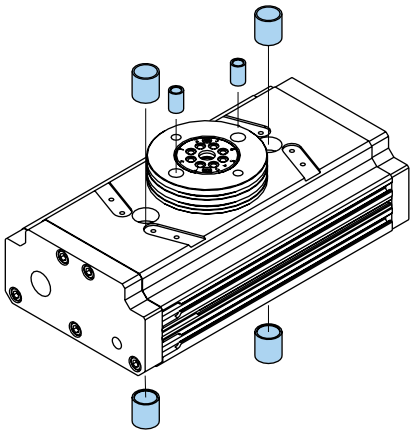
UNIT SIZE	BODY LOCATING RING KIT NO.
RIxxx25	69210
RIxxx32	69210
RIxxx50	69212

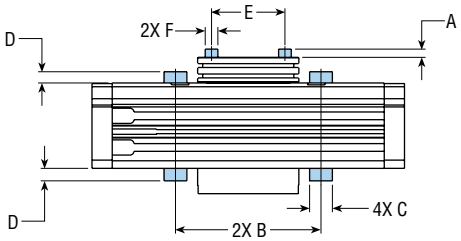
BODY LOCATING RING KITS INCLUDE 2 LOCATING RINGS

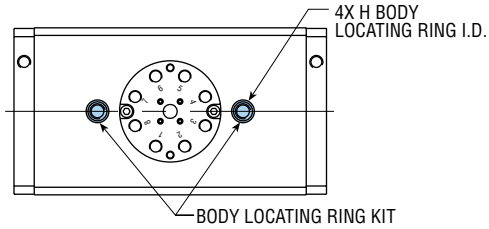
UNIT SIZE	PINION LOCATING RING KIT NO.
RIxxx25	69216
RIxxx32	69217
RIxxx50	69219

PINION LOCATING RING KITS INCLUDE 2 LOCATING RINGS









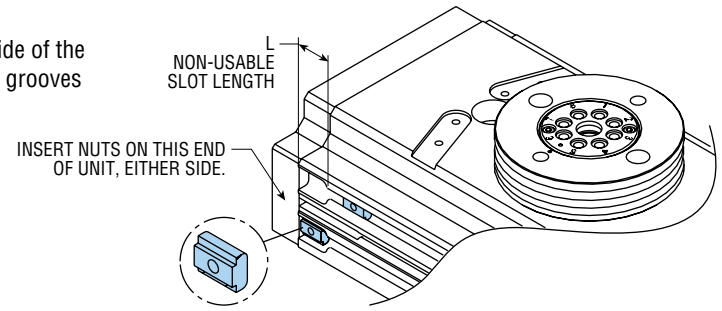
UNIT SIZE	LETTER DIMENSION									
	A	B	Ø C	C TOL.	D	E	Ø F	F TOL.	Ø G	Ø H
RIxx125	0.118	2.954	0.472	+0.0002/-0.0005	0.236	1.378	0.236	+0.0001/-0.0007	0.197	0.354
RIxx525	[3.0]	[75.0]	[12.0]	[+0.005/-0.013]	[6.0]	[35.0]	[6.0]	[+0.003/-0.018]	[5.0]	[9.0]
RIxx132	0.079	3.938	0.472	+0.0002/-0.0005	0.236	1.811	0.315	+0.0001/-0.0007	0.252	0.354
RIxx532	[2.0]	[100.0]	[12.0]	[+0.005/-0.013]	[6.0]	[46.0]	[8.0]	[+0.003/-0.018]	[6.4]	[9.0]
RIxx150	0.079	4.528	0.709	-0.0002/-0.0006	0.349	2.283	0.394	+0.0001/-0.0007	0.315	0.591
RIxx550	[2.0]	[115.0]	[18.0]	[-0.005/-0.015]	[8.9]	[58.0]	[10.0]	[+0.003/-0.018]	[8.0]	[15.0]

METRIC INFORMATION SHOWN IN [ ].
NOTE: LOCATING RINGS ARE TO BE PRESSED INTO BODY AND PINION

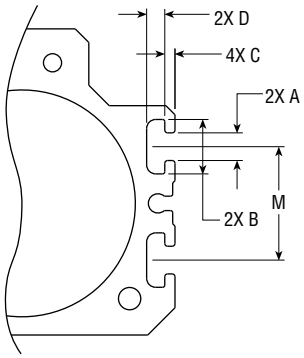
All dimensions are reference only unless specifically toleranced.

T-NUTS

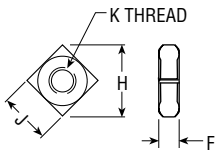
T-nuts allow the rotary actuator to be mounted from the side of the unit. T-nuts can be positioned at any point along the t-slot grooves which are 90° to the pinion hub.



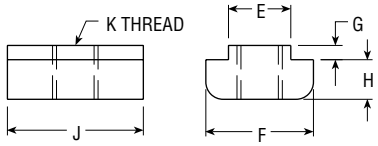
SLOT DIMENSIONS
TYPICAL BOTH SIDES (POSITION 1 & 3)



NUT DIMENSIONS



Size 25



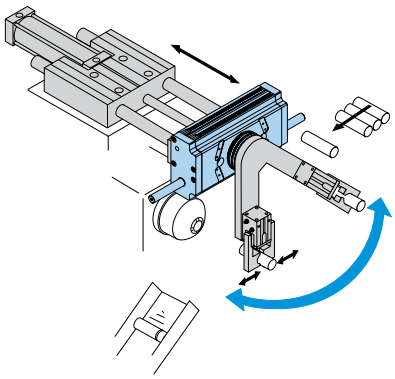
Sizes 32 & 50

UNIT SIZE	SLOT DIMENSIONS				NUT DIMENSIONS								NUT PART NO.
	A	B	C	D	E	F	G	H	J	K	L	M	
RIxx125	0.177	0.315	0.079	0.138	—	0.125	—	0.389	0.275	M4 x 0.7	0.472	0.630	3204-051-01
RIxx525	[4.5]	[8.0]	[2.0]	[3.5]	—	[3.2]	—	[9.8]	[7]		[12.0]	[16.0]	
RIxx132	0.240	0.472	0.088	0.157	0.216	0.374	0.050	0.137	0.472	M4 x 0.7	0.669	0.787	63759-xx
RIxx532	[6.1]	[12.0]	[2.2]	[4.0]	[5.5]	[9.5]	[1.3]	[3.5]	[12.0]		[17.0]	[20.0]	
RIxx150	0.240	0.472	0.088	0.157	0.216	0.374	0.050	0.137	0.472	M4 x 0.7	0.669	0.984	63759-xx
RIxx550	[6.1]	[12.0]	[2.2]	[4.0]	[5.5]	[9.5]	[1.3]	[3.5]	[12.0]		[17.0]	[25.0]	

NOTES: METRIC INFORMATION SHOWN IN [ ]. -xx = -00 INDICATES STANDARD PLATING, -03 INDICATES -Z1 PLATING.

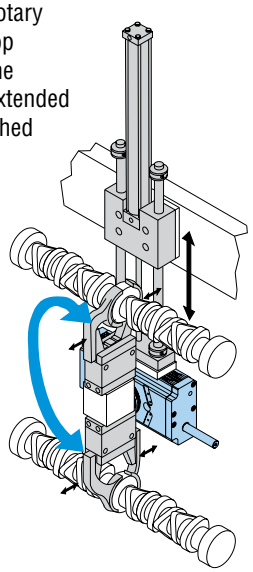
LATHE LOADER

In this application, a combination of a slide, two grippers, and a rotary actuator load and unload parts from a lathe. One Series 190 Gripper grasps a blank part on a holding rack while another Series 190 Gripper grasps a finished part in the lathe. A Series SK Slide extends out, and the finished part is removed from the lathe while the blank part is removed from the holding rack. A Series RI Rotary Actuator then rotates clockwise. The slide retracts, the blank part is loaded into the lathe, and the finished part is released into a holding bin. The Series RI Rotary Actuator is beneficial for this application due to its high torque output and the capability of routing airlines and switch cables through the pinion. This feature eliminates any external airlines, which could wear or sever causing catastrophic damage.



CAM SHAFT FINISHING PROCESS

In this application, two grippers are combined with a Series RI Rotary Actuator to load and unload cam shafts into a grinding machine for finishing. First a Series SK Slide, mounted to a gantry, will provide the reaching motion as a Series 5300 Gripper picks up the unfinished cam shaft. The Series RI Rotary Actuator rotates the grasped cam to the top position. The gantry then cycles back to the grinding machine, the second gripper is extended down into the machine to pick up the finished cam shaft, the slide retracts, the rotary actuator rotates the grippers and shafts, and the unfinished cam is loaded into the machine. Finally the finished cam shaft is moved and placed in a completion tray on a conveyor. The Series RI Rotary Actuator is ideal for this application due to its high torque output and the capability of routing airlines and switch cables through the pinion.



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