POWER
COMPONENTS, INC.

Power Lift® Actuators
Series 1-4

Catalog No. 98C100A

POWER COMPONENTS, INC.

Power Components, Inc.'s Power Lift® Actuators are rack and pinion units which convert linear to rotary or rotary to linear motion when connected with a power source. Ideal for synchronized force applications, the Power Lift® Actuator can raise, lower, rotate, clamp, check, position, push, pull, or actuate any unit load or fixture simply and economically.

Compact Housing Design

Power Components, Inc.'s Power Lift® Actuator features a ductile iron housing containing a rugged gear and hub assembly, suspended by sealed ball bearings. A replacable wear plate is provided in the rack slot.

Long Life

Power Components, Inc.'s Power Lift® Actuators offer reliable performance and extremely long life. Series 1-3 are provided with a zirk fitting for external lubrication, while Series 4 is provided with a dry lubricant.

Capabilities

- Series 1: Positive lifting for limited space applications
- Series 2: High capacity lifting
- Series 3: 1:1 or 2:1 ratio
- Series 4: Universal mounting

Mounting Versatility

The standard mount for Series 1 is a bar mount. Series 2 and Series 3 are supplied with a standard angle mount. Series 1-3 also can accommodate several optional mounts for maximum versatility. Series 4 is supplied with a standard keyed mount. The keyed mount allows for true alignment and firm positioning. All mounts give positive, rigid, and true alignment. See page 10 for additional information.

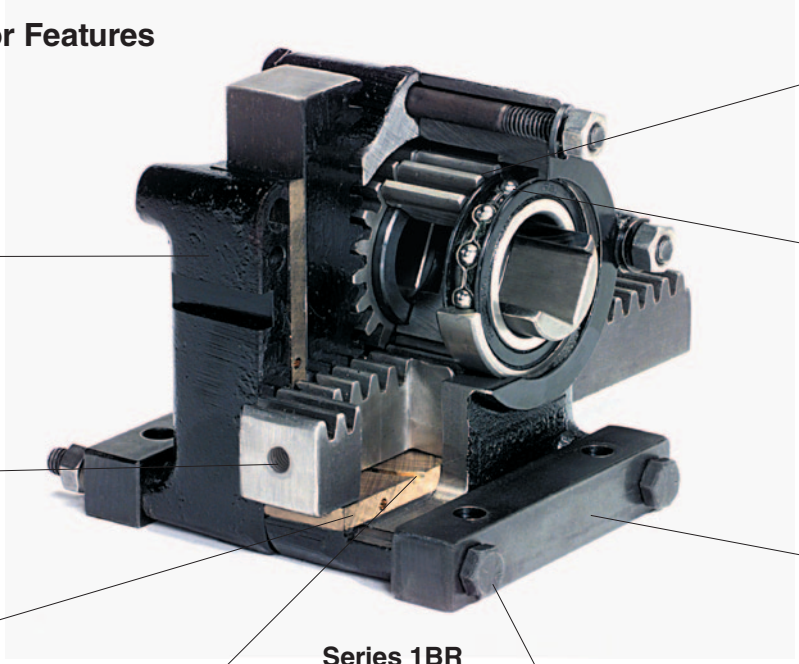
Hub Variations

For timing convenience, the standard hub for the Power Lift® Actuator units is the square hub. Alternate hubs are available for most units. Additional hub information can be found on page 11.

Templates

All units, mounts, hubs, and accessories are available on both tracing and CAD disk templates.

Power Lift® Actuator Features



Series 1BR

Gear
Surface hardened steel gear for long life

Ball Bearings
Long life, pre-lubed, double sealed, ball bearings reduce friction and wear

Housing
Ductile iron cast housing for strength and toughness

Rack
Square rack with tapped holes on both ends

Mounts
Various standard and optional mounts available (see page 10)

Wear Plates
Wear-resistant aluminum bronze wear plates for added life

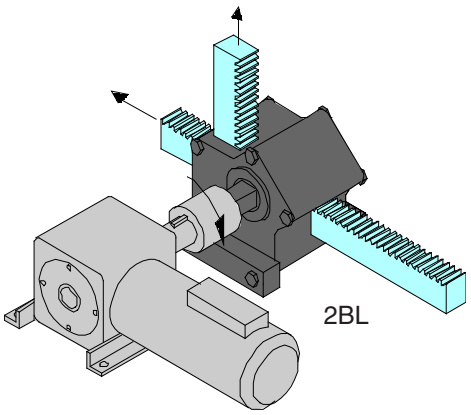
Lubrication Grooves
Grooves to provide lubrication to the face between the wear plate and rack

Anchor Bolts
Mounts attached with high tensile strength anchor bolts with nuts and lock washers

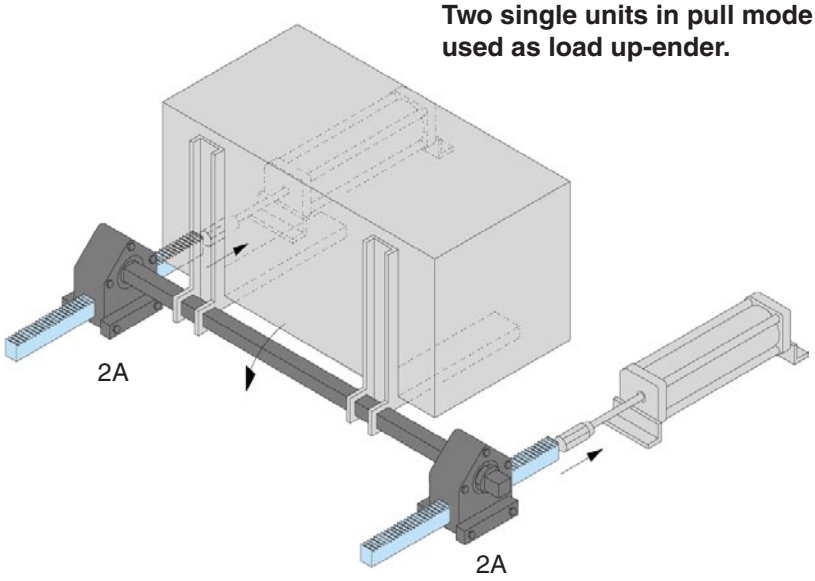
Phone: (734) 207-2200

Application Examples

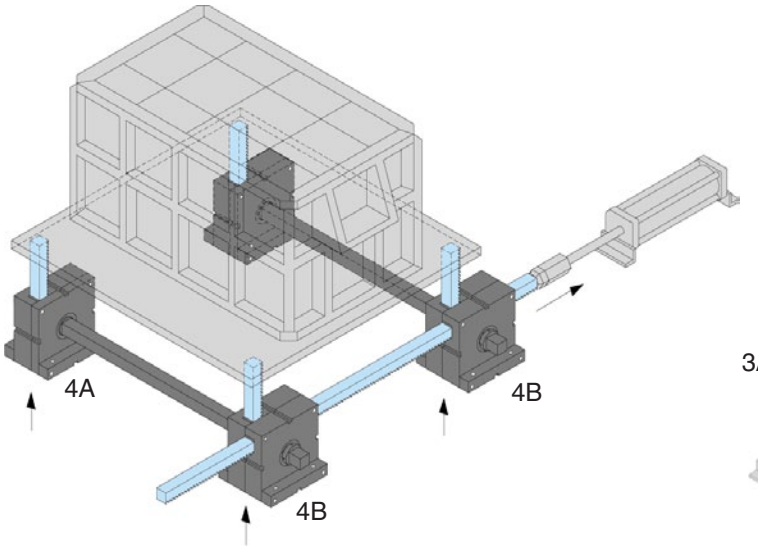
Horizontal or vertical action from rotating shaft or torque motor



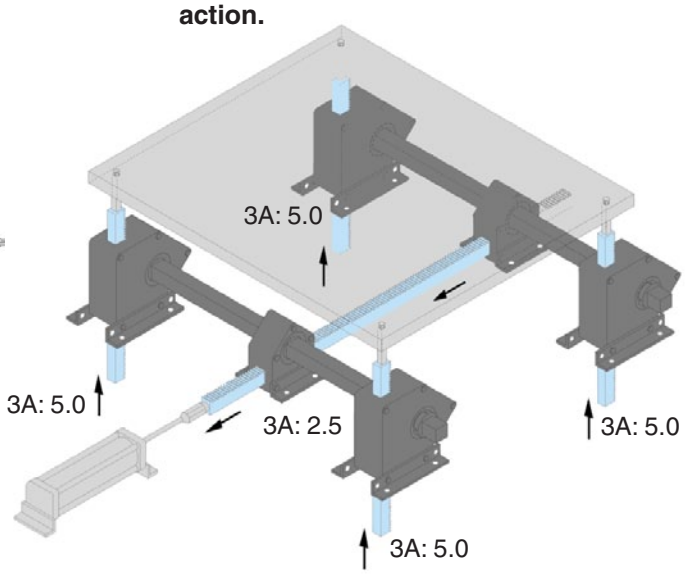
Two single units in pull mode used as load up-ender.



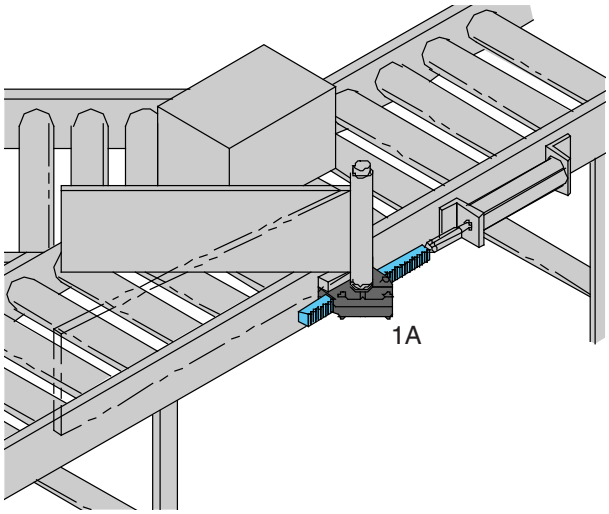
Combination of single and double units in pull mode to lift a heavy foundry flask.



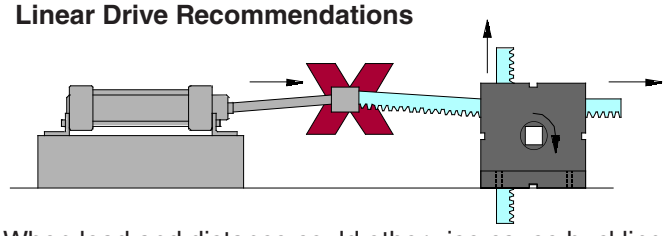
A lift of 2" is achieved by horizontal travel of 1" through a pull mode lift action.



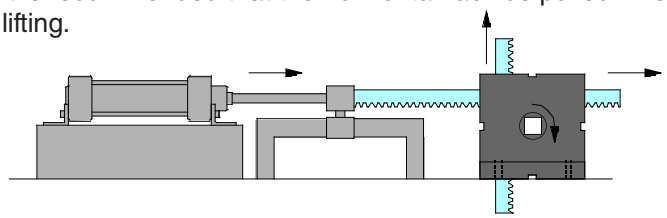
Single unit used to divert packages from main conveyor line to spur line.



Linear Drive Recommendations



When load and distance could otherwise cause buckling, it is recommended that the horizontal rack be pulled when lifting.



In the instance that an application is only suitable for push to lift, horizontal rack connections should be guided by an external slide.

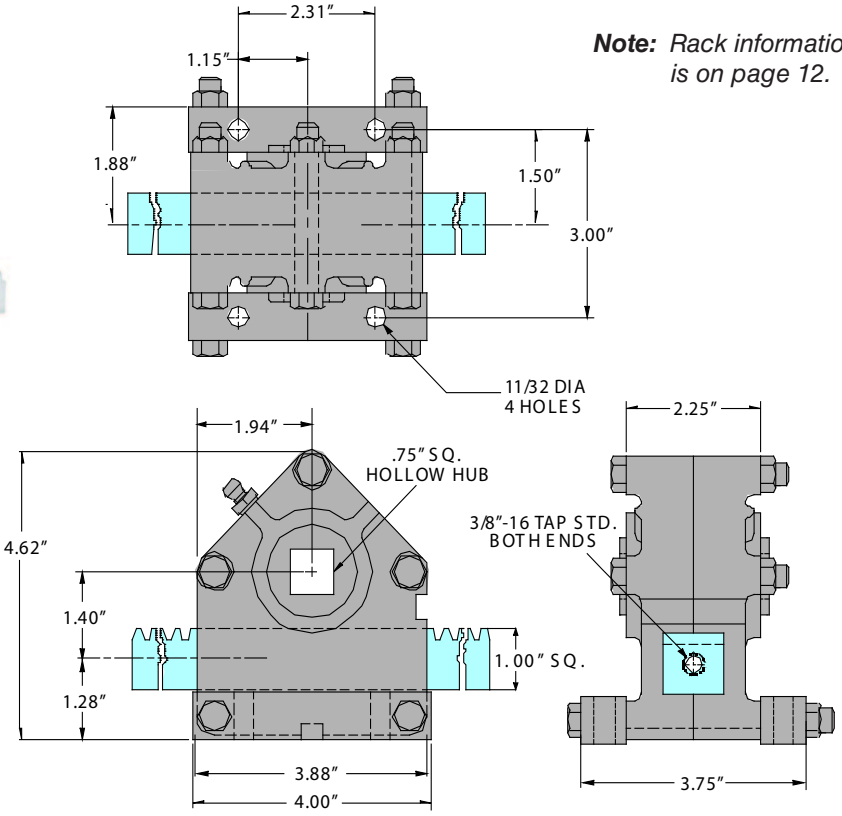
Series 1

Limited Space Applications

The smallest in the Power Lift® Actuator family, the Series 1 actuator is designed to provide positive lifting action in limited space applications. This unit has a maximum load capacity of 1600 pounds.

Single Units - 1A

Weight (less rack):	6 lbs.
Standard Mount:	Bar
Standard Hub:	SQ. .75"
Max. Load Capacity:	1600 lbs.

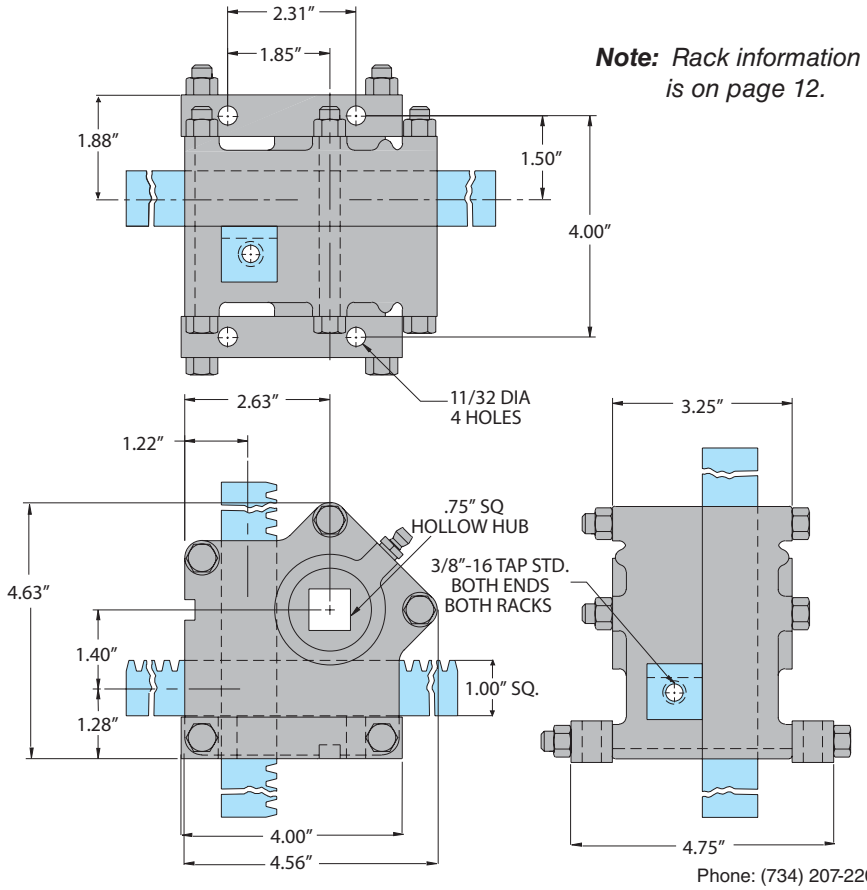


Note: *Rack information is on page 12.*

Double Units - 1B

Weight (less rack):	8.5 lbs.
Standard Mount:	Bar
Standard Hub:	SQ. .75"
Max. Load Capacity:	1600 lbs.
Gear Ratio:	1:1

Note: *For information on determining right or left hand units see page 10.*



Note: *Rack information is on page 12.*

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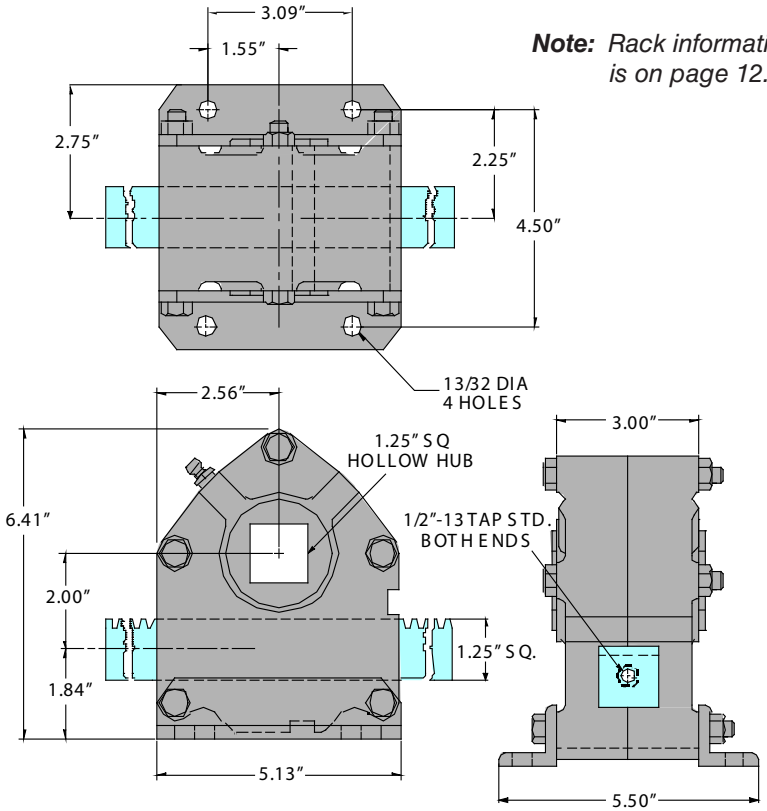
High Capacity Lifting

The Series 2 has a 1.25" gear face and rack, offering lifting capacity of up to 3000 pounds.

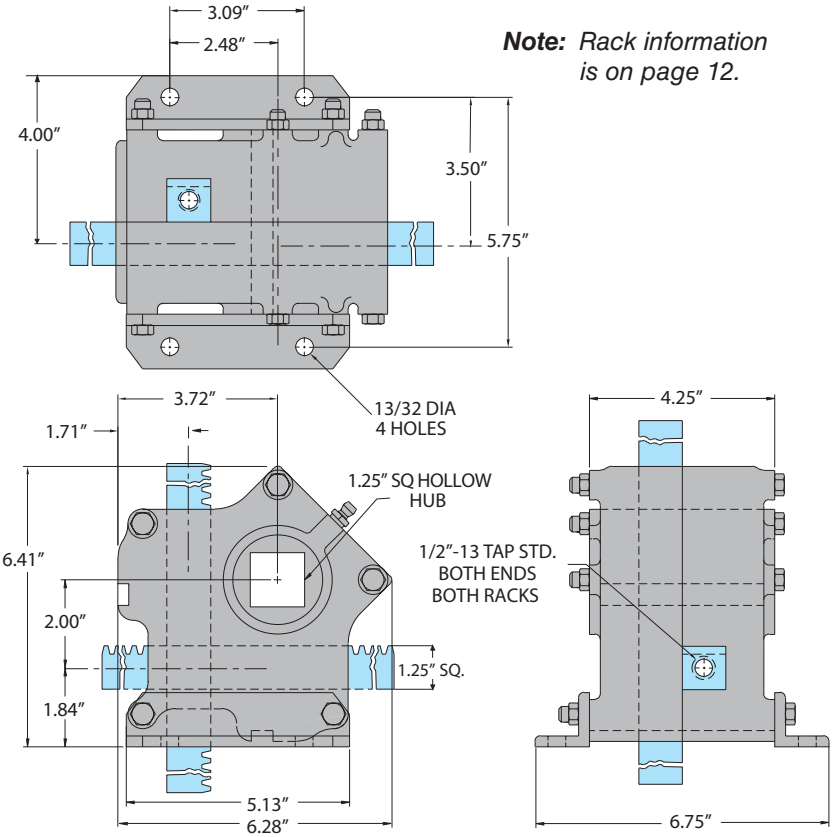
Single Units - 2A



Note: *Rack information is on page 12.*

Weight (less rack):	10.5 lbs.
Standard Mount:	Angle
Standard Hub:	SQ. 1.25"
Max. Load Capacity:	3000 lbs.

Double Units - 2B



Note: *Rack information is on page 12.*

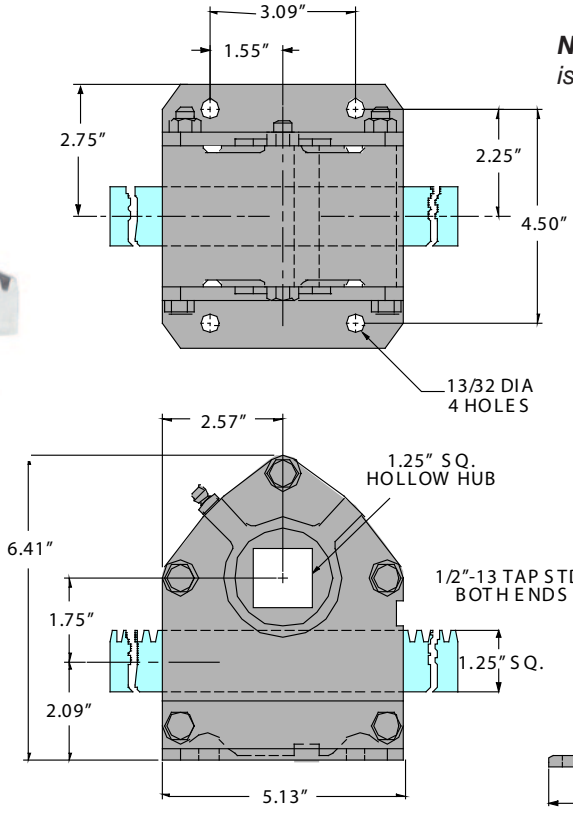
Weight (less rack):	21.5 lbs.
Standard Mount:	Angle
Standard Hub:	SQ. 1.25"
Max. Load Capacity:	3000lbs.
Gear Ratio:	1:1

Note: *For information on determining right or left hand units see page 10.*

Series 3

The Series 3A offers high capacity lifting up to 3000 pounds. Series 3A units are available with a 2.5" gear or a 5.0" gear. When the 2.5" gear is the drive unit in combination with the 5.0" gear, creating a 2:1 gear ratio, the maximum load capacity is 1500 pounds.

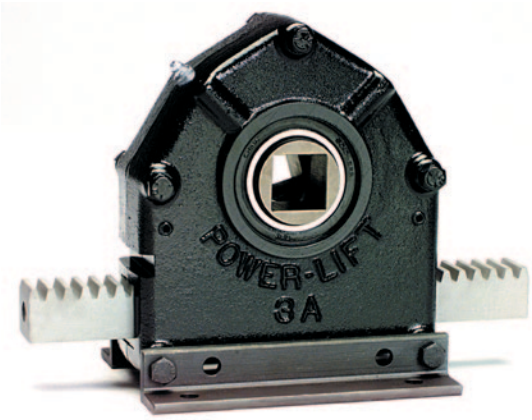
Single Units - 3A: 2.5

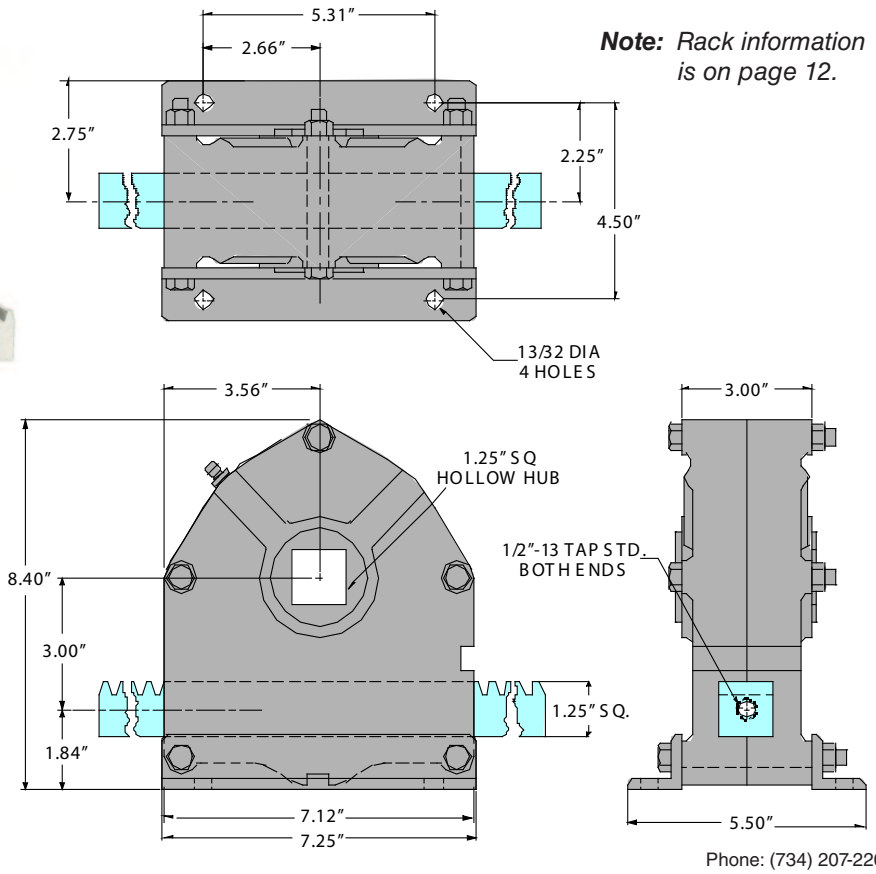


Note: *Rack information is on page 12.*

Weight (less rack):	10.5 lbs.
Standard Mount:	Angle
Standard Hub:	SQ. 1.25"
***Max. Load Capacity:**	3000 lbs.

Single Units - 3A: 5.0





Note: *Rack information is on page 12.*

Weight (less rack):	26 lbs.
Standard Mount:	Angle
Standard Hub:	SQ. 1.25"
***Max. Load Capacity:**	3000 lbs.

*When the 2.5" gear is the drive unit in combination with the 5.0" gear, creating a 2:1 gear ratio, the maximum load capacity is 1500 lbs.

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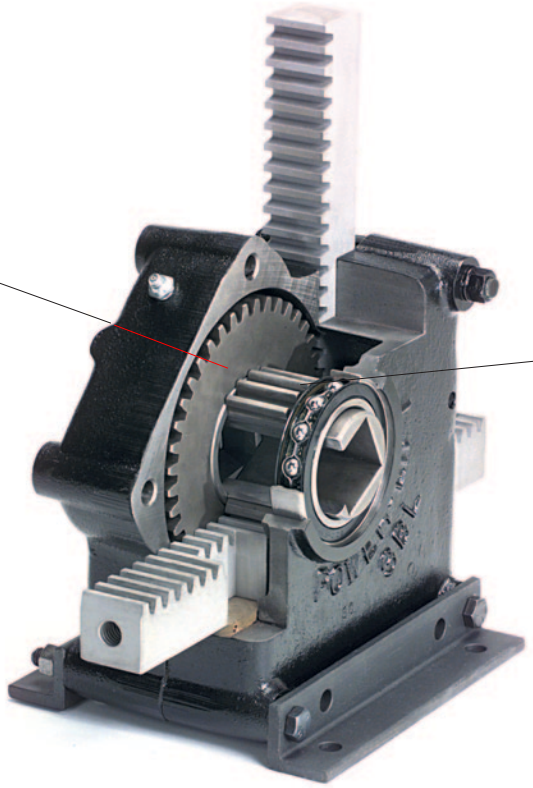
3B - 2:1 Capabilities

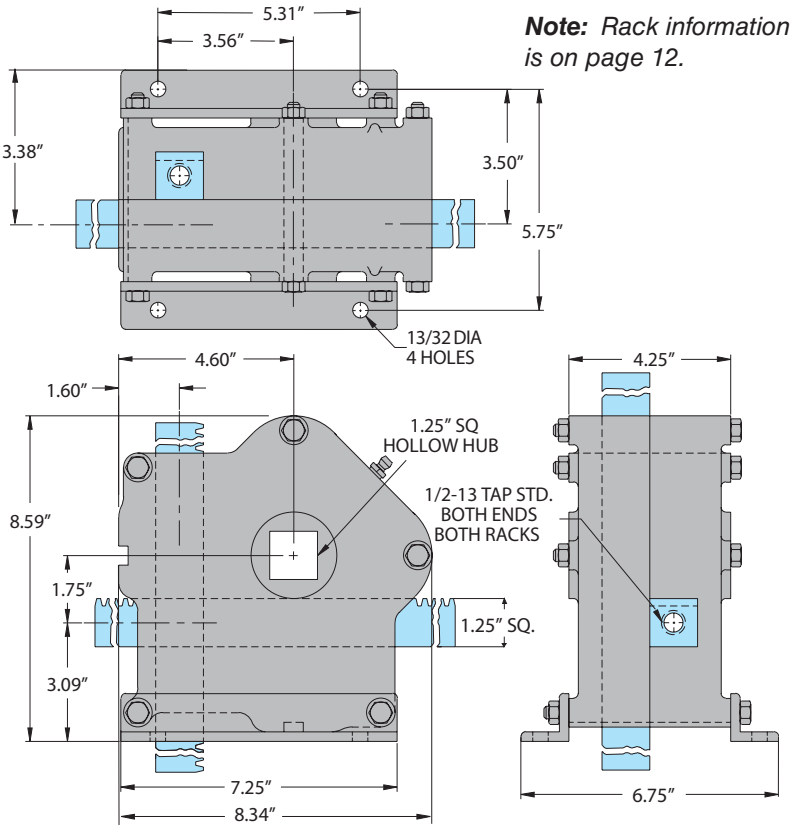
Series 3B cutaway: 2:1 gear ratio

The Series 3B has a 2:1 gear ratio offering a maxium load capacity of 1500 pounds.



See page 2 for full features of the unit.

Double Units - 3B



Note: *Rack information is on page 12.*

Weight (less rack):	35 lbs.
Standard Mount:	Angle
Standard Hub:	SQ. 1.25"
Max. Load Capacity:	1500 lbs.
Gear Ratio:	2:1

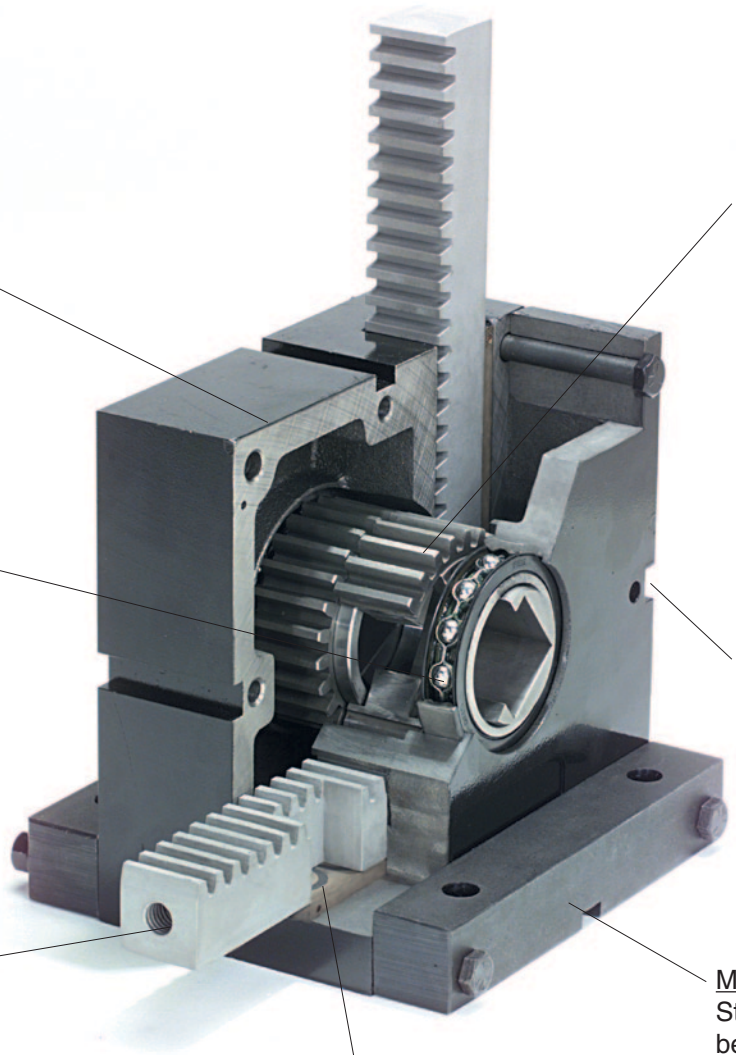
Note: *For information on determining right or left hand units see page 10.*

Series 4

Universal Mounting

The Series 4 Power Lift® Actuator is designed to provide universal mounting. The square body simplifies installation and the keyway mount ensures true alignment. The double unit can be easily rotated to change the location of the rack from left hand to right hand or vice versa without the use of any additional mount. It is provided with dry lubrication.

Series 4B Cutaway



Housing
Ductile iron cast housing for strength and toughness

Gear
"Floating" gear and flanged hub assembly simplifies timing of the independent gear rack

Ball Bearings
Long life, pre-lubed, double sealed, ball bearings reduce friction and wear

Keyway in Casting
Located on all four sides for versatile mounting positions

Rack
Square rack with tapped holes on both ends

Mount
Standard Keyed Mount can be mounted on any of the four sides

Wear Plates
Wear-resistant aluminum bronze wear plates for added life

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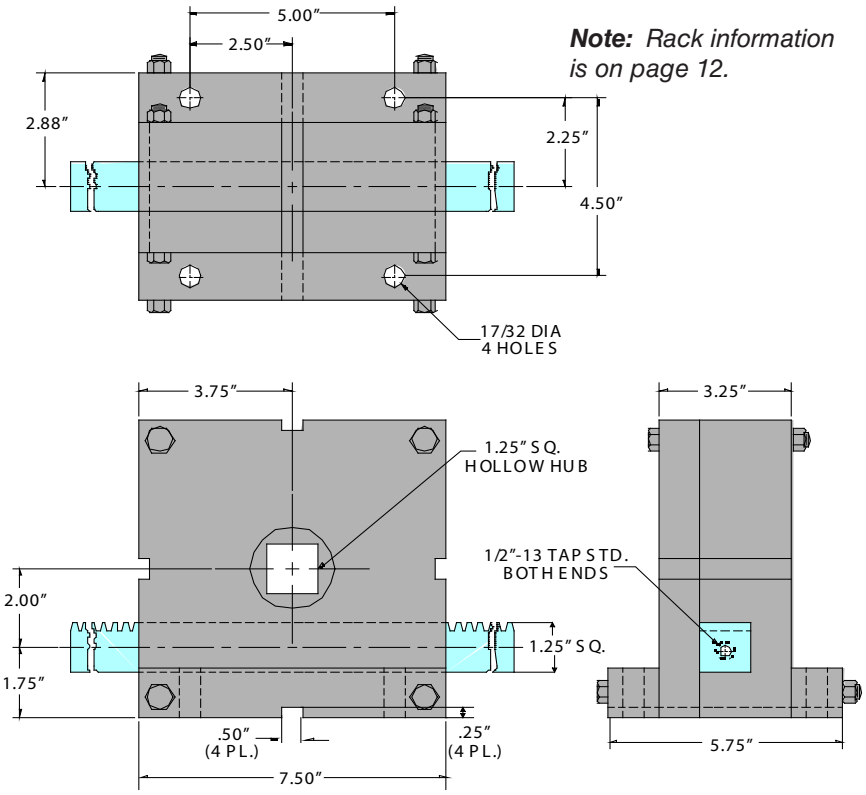
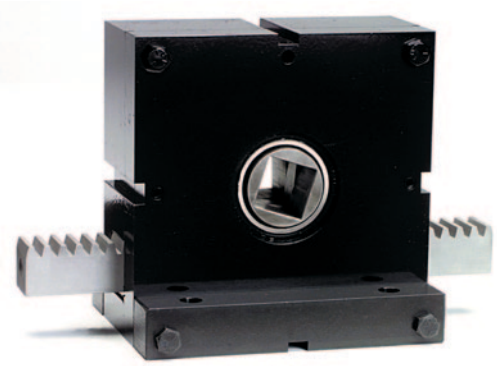
Single Units - 4A

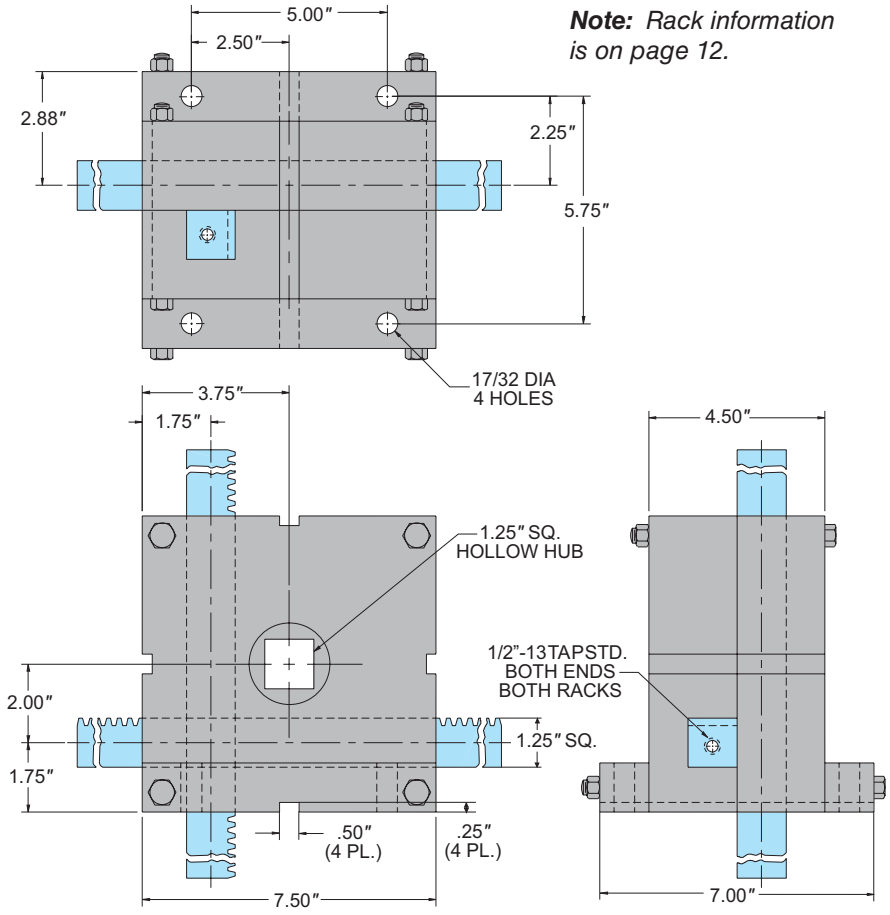


Note: *Rack information is on page 12.*



Weight (less rack):	40 lbs.
Standard Mount:	Keyed
Standard Hub:	SQ. 1.25”
Max. Load Capacity:	3000 lbs.

Double Units - 4BL 4BR



Note: *Rack information is on page 12.*

Weight (less rack):	48 lbs.
Standard Mount:	Keyed
Standard Hub:	SQ. 1.25”
Max. Load Capacity:	3000 lbs.
Gear Ratio:	1:1

Mount Options

All mounts and mounting variations are available on both tracing and CAD disk templates. For more information, contact Power Components, Inc.

Standard Mount - Mount N

Each unit has a standard mount which is supplied unless another mount is specified.

Series 1A & 1B:
Bar Mount

Series 2A & 2B:
Angle Mount

Series 3A & 3B:
Angle Mount

Series 4A & 4B:
Keyed Mount

Inverted orientation may be achieved with the standard mount in Series 4.

Alternative Mounts

Cradle Mount - Mount C

Units in the pull mode of operation are preferably cradle mounted. The Cradle mount inverts Series 1-3 units, so that the horizontal rack is positioned above the pinion with the rack teeth facing down. In this inverted orientation horizontal rack teeth avoid most contamination from falling debris.

Series 1-3 Power Lift® Actuator units can be inverted using the Cradle mount.

Cradle Mount

1BR

Keyed Mount - Mount K

To ensure firm positioning and true alignment, the Keyed Mount fits on either side of the unit. The Keyed Mount is the standard for Series 4 and an option for Series 1-3.

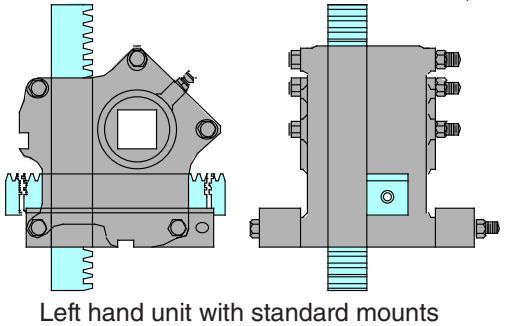
Keyed Mount

How to Determine Left and Right Hand Units

Series 1 - 3 (Series 4 is Universal)

How to Determine Left Hand Units

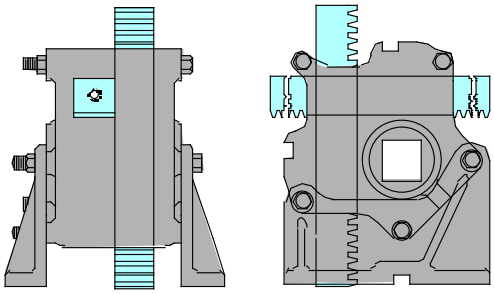
Turn the teeth of the vertical rack towards you. When viewing the left hand, the vertical rack will be to the left of the housing centerline, and the horizontal rack will be to the right of both the vertical rack and the housing centerline.



Left hand unit with standard mounts

How to Determine Right Hand Units

Turn the teeth of the vertical rack towards you. When viewing the right hand, the vertical rack will be to the right of the housing centerline. The horizontal rack will be to the left of both the vertical rack and the housing centerline.



Illustrations indicate changing of rack positions when unit is changed from standard mount to cradle mount.

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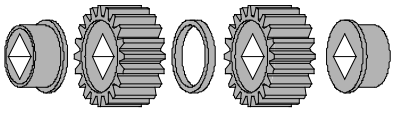
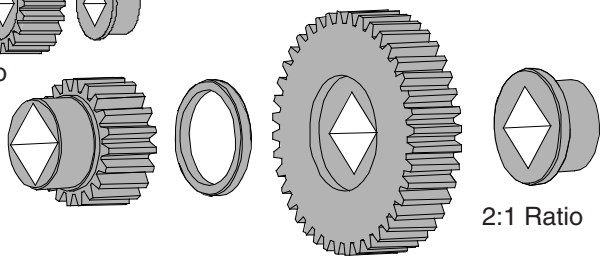
Standard Hub - Square Hub - SQ

The Square Hub has the gear(s) counterbored both sides and a square drive. The outer hubs are flanged and have a square broached center hole. The square "floating" gear and hub assembly simplifies timing of multiple lifting units by enabling the racks and gears to be positioned independently while the square drive shaft is retracted. This hub type provides the simplest set-up and use.

Hub	Series 1	Series 2, 3	Series 4
Square Dimension	.75"	1.25"	1.25"
Extension	.25"	.13"	0


1:1 Ratio

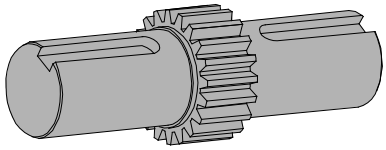

2:1 Ratio

Alternative Hubs

Solid Hub - SDH

The Solid Hub is a one piece gear and hub with a solid shaft. Hub extension is provided on both sides of the unit unless specified otherwise.

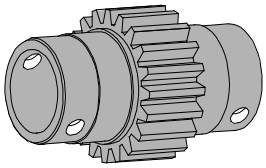
Hub	Series 1	Series 2, 3A 5.0
Outside Diameter	1.25"	1.97"
Double Extension	2"	2.50"
Keyway	.25" x .13"	.50" x .25"



Round Hub - RD

The Round Hub is a one piece gear and hub that has a hollow center with crossholes for pinning the drive shaft. This style is designed especially for applications that need high precision and less backlash from the gears.

Hub	Series 1	Series 2
Inside Diameter	1.0"	1.25"
Extension	.63"	.75"
Crosshole	.31"	.38"

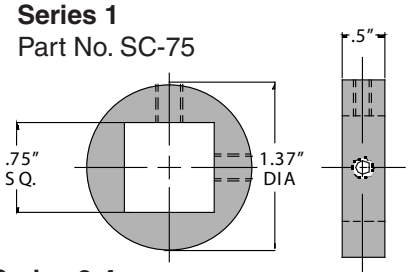


Accessories

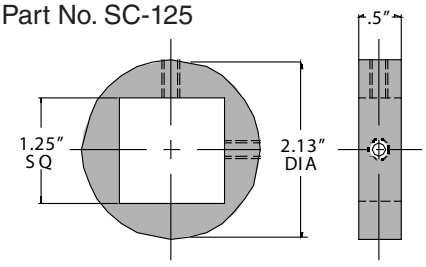
Stop Collar

Stop collars are used to prevent the square drive shaft from "walking out" of the Power Lift® Actuator unit. Two set screws firmly lock the collar onto the bar.

Series 1
Part No. SC-75

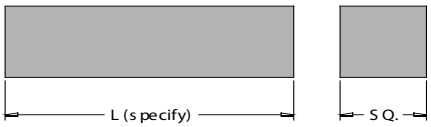


Series 2-4
Part No. SC-125



Square Drive Shafts

Power Lift® Actuators can be linked using a Square Drive Shaft (SDS). This shaft allows the vertical and horizontal racks to be adjusted independently for simplified timing. Shaft length may be manufactured to the customer's specifications.



Drive Shaft Sizes	Part Number
SQ = .75"	SDS-75-__
SQ = 1.25"	SDS-125-__

Note: *Stand alone double units with square hubs require a square drive shaft and two stop collars.*

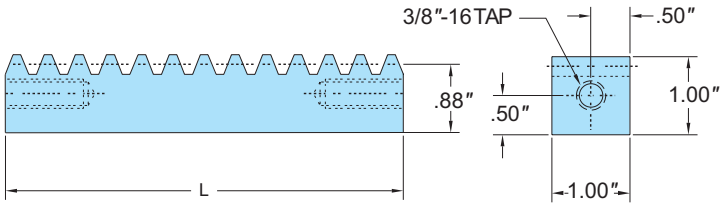
Rack and Rack Accessories

The rack is an essential component of the Power Lift® Actuator unit. The Power Components, Inc. rack is designed to withstand maximum load and wear.

Series 1 Rack Ordering Information

Rack Style	Length (L) in Inches	Max. Stroke
RPN100	L	(L - 4″)

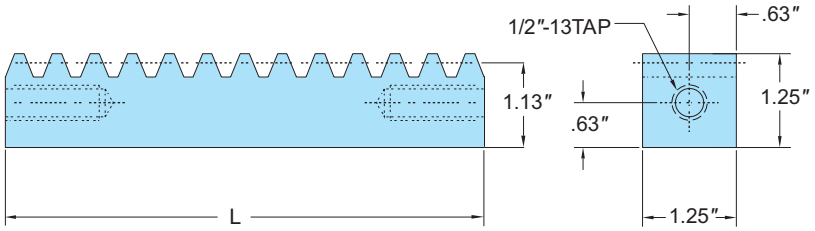
Series 1 standard rack is tapped 3/8”-16.
Other sizes available on request.



Series 2-4 Rack Ordering Information

Rack Style	Length (L) in Inches	Max. Stroke Series 2	Max. Stroke Series 3-4
RPN125	L	(L - 6″)	(L - 8″)

Series 2-4 standard rack is tapped 1/2”-13.
Other sizes available on request.



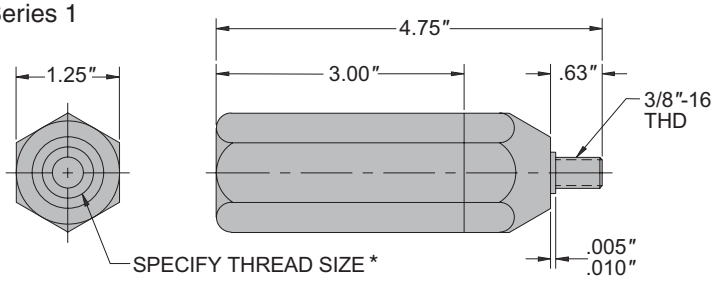
Cylinder and Rack Connector

The Cylinder and Rack Connector has spherical movement and axial float to accommodate slight misalignment between the cylinder and the rack providing added stability. It is ideal for all pull to lift applications.

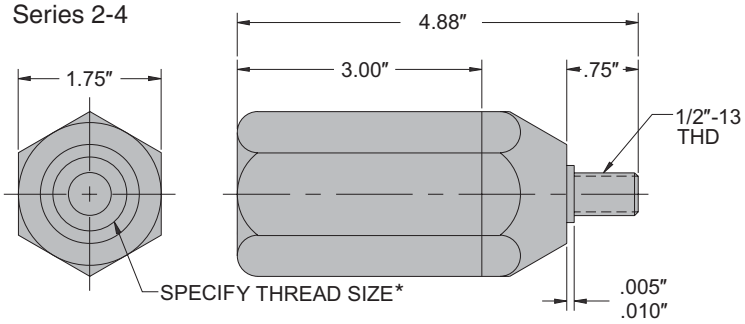
Cylinder Thread Size*	Series 1 Part Number	Series 2-4 Part Number
3/4″-16	CRC-7516-1	CRC-7516-A
7/8″-14	CRC-8714-1	CRC-8714-A
1″-8	CRC-10008-1	CRC-10008-A
1 1/4″-12	NA	CRC-12512-A
1 1/2″-12	NA	CRC-15012-A

Note: *Other thread sizes are optional.**

Series 1

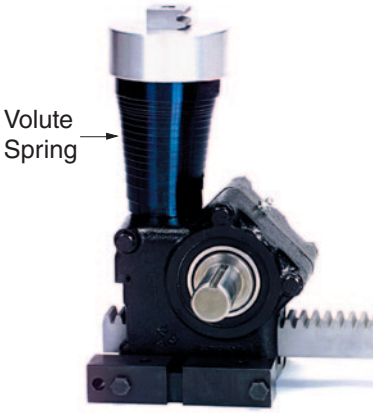


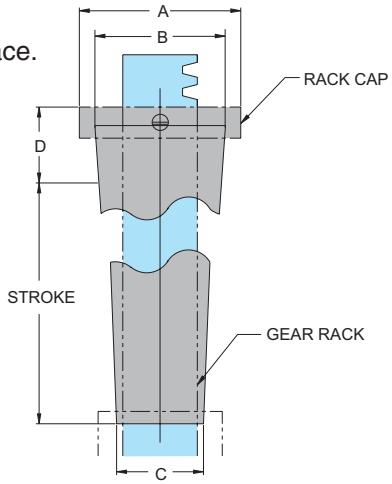
Series 2-4



Rack Cover

The Rack Cover helps to protect the Power Lift® Actuator rack by preventing metal chips and other foreign materials from jamming in the teeth. This product is supplied complete with an end cap and set screws to lock the cap in place.





Series 1					
Part Number	Max. Stroke	A	B	C	D
SDG-210	8.62″	3.00″	2.25″	1.50″	2.00″
SDG-214	12.00″	3.00″	2.25″	1.50″	2.63″
SDG-218	16.00″	3.00″	2.38″	1.50″	2.63″
SDG-224	22.00″	3.00″	2.50″	1.50″	2.63″
Series 2-4					
Part Number	Max. Stroke	A	B	C	D
SDG-310	8.62″	3.94″	3.38″	2.25″	2.00″
SDG-312	10.62″	3.94″	3.38″	2.25″	2.00″
SDG-314	12.00″	3.94″	3.38″	2.25″	2.63″
SDG-318	16.00″	3.94″	3.63″	2.25″	2.63″
SDG-324	21.50″	3.94″	3.75″	2.25″	3.13″

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Ordering Information

Series 1

PLA 1 - A - SQ - H - ___

A-Single Unit
BL-Double Unit
Left Hand
BR-Double Unit
Right Hand

Hub Type
SQ-Square
SDH-Solid
RD-Round

Mount
*N-Bar, K-Keyed, C-Cradle
supplied as standard when blank

Orientation
*H-Horizontal, V-Vertical
supplied as standard when blank

Series 2

PLA 2 - A - SQ - H - ___

A-Single Unit
BL-Double Unit
Left Hand
BR-Double Unit
Right Hand

Hub Type
SQ-Square
SDH-Solid
RD-Round

Mount
*N-Angle, K-Keyed, C-Cradle
supplied as standard when blank

Orientation
*H-Horizontal, V-Vertical
supplied as standard when blank

Series 3

PLA 3 - A 2.5 - SQ - H - ___

A-Single Unit
Gear Size: 2.5
5.0
BL-Double Unit
Left Hand
BR-Double Unit
Right Hand

Hub Type
SQ-Square
SDH-Solid
(available with 3A: 5.0 gear only)

Mount
*N-Angle, K-Keyed, C-Cradle
supplied as standard when blank

Orientation
*H-Horizontal, V-Vertical
supplied as standard when blank

Series 4

PLA 4 - A - SQ - H - ___

A-Single Unit
BL-Double Unit
Left Hand
BR-Double Unit
Right Hand

Hub Type
SQ-Square
SDH-Solid

Mount
*N-Keyed
supplied as standard when blank

Orientation
*H-Horizontal, V-Vertical
supplied as standard when blank

Hub Specifics

Square (SQ) Standard	Series 1	Series 2	Series 3A 2.5	Series 3A 5.0	Series 3B	Series 4
SQ. Dimension	.75”	1.25”	1.25”	1.25”	1.25”	1.25"
Extension	.25”	.13”	.13”	.13”	.13”	0
Solid (SDH)						
Outside Diameter	1.25”	1.97”	NA	1.97”	NA	NA
Double Extension	2.0”	2.50”	NA	2.50”	NA	NA
Keyway	.25” x .13”	.50” x .25”	NA	.50” x .25”	NA	NA
Round (RD)						
Inside Diameter	1.0”	1.25”	NA	NA	NA	NA
Extension	.63”	.75”	NA	NA	NA	NA
Crosshole	.31”	.38”				

NA = Not Available

Rack

RPN100 -12

Rack Number
RPN100
RPN125

Length in Inches

Tap Size
*RPN100: 3/8”-16
*RPN125: 1/2”-13
*supplied as standard when blank

Accessories

Example: **SDG - 312**

Part Number

Technical Data

Power Lift® Actuator

The Power Lift® Actuator has a painted finish as standard. It is also available nickel plated, or unfinished. For high heat applications consult Power Components Inc.'s engineering department for a suitable finish.

Operating Temperature

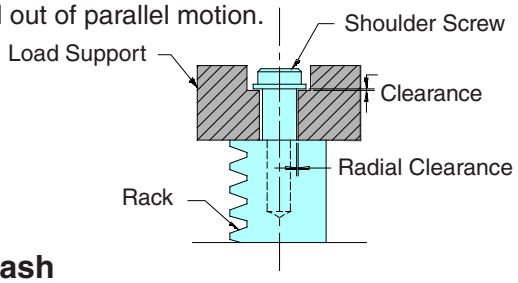
For maximum life, Power Lift® Actuators should be operated below 107° C (225° F).

Maintenance

A multipurpose auto grease (NLGI grade 2) is recommended for filling Series 1, 2, and 3 housings to lubricate the rack and gear. Industry specific grease may be used where appropriate. All component parts including wear plates, gears, and hubs are available for replacement if necessary.

Vertical Rack Connection

To prevent binding of the bushings and gears during operation, rack connections must have adequate clearance. This allows for freedom of movement, rotation, tolerance stack-up, and out of parallel motion.



Gear Backlash

Where minimal backlash is critical, best results can be achieved with solid or round hubs with integral shaft and gear.

Maximum Backlash			
	SQ	SDH	RD
Single Unit	.03”	.005”	.005”
Double Unit	.06”	.010”	.010”

Rack Timing

To establish rack timing as shown in Fig. A, dimensions are related to the centerline of the hub with the square drive as shown to ensure uniformity for all systems and replacement racks. Units are shipped with the racks and gears tied to ensure the orientation of the racks are correct when received by the customer. Please supply drawing at time of request.

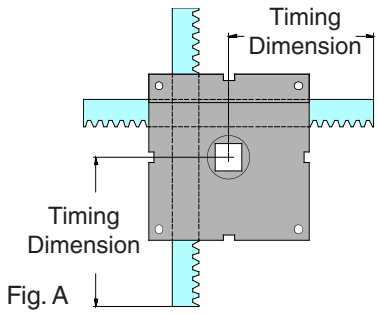


Fig. A

Power Lift® Actuators with a single connecting rack should have an increment of gear circular pitch if the ends of the vertical racks are to be timed for vertical lift as shown in Fig. B.

Circular Pitch in.	
Series 1	.31416”
Series 2-4	.3927”

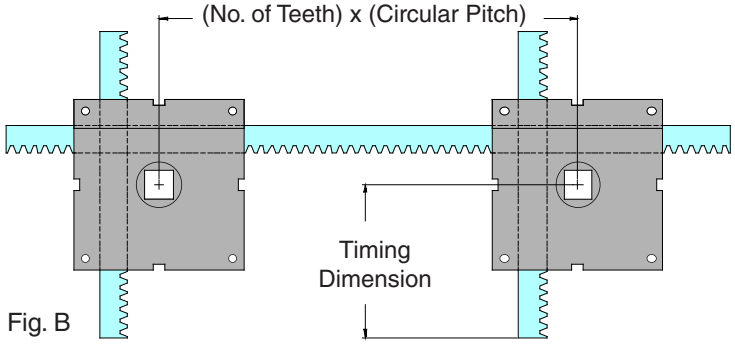


Fig. B

Operating Force

The operating force to actuate the drive rack is obtained from the sum of the effective load for each unit to operate the system. The resulting tooth load must not exceed the recommended value in any unit throughout the system. The operating force for each unit is calculated by multiplying the lift load by the load factor (LF) of 1.15 and the velocity factor (VF) as shown below.

Note: *The lift capacity of the 3B or combination of the 3A:2.5 and 3A:5.0 is only 50% of the applied load as a result of the 2:1 ratio.*

Velocity Factor (VF)

The rack speed should not exceed 90 feet/min. A velocity factor (VF) must be applied in proportion to the speed of the rack within the 90 feet/min. range, as found in the chart below.

Load Factor (LF)

When evaluating tooth load and force requirements, compensation must be made for friction in the system. The static load must be multiplied by a **load factor (LF)** of **1.15** to determine the operating load.

Ft./min.	0-10	11-30	31-50	51-70	71-90
VF	1.0	1.2	1.3	1.4	1.5

Example: *The theoretical operating effort required to lift 1200 lbs.@ 50 feet/min. would be calculated as follows:*

Operating Force = Load (lbs.) x (LF) x (VF)

= 1200 x 1.15 x 1.3

= 1794 lbs.

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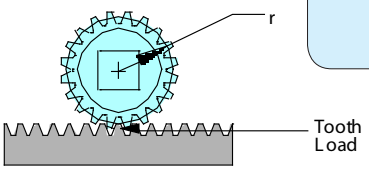
Torque

To determine the maximum tooth load caused by torque as shown in Figs. 1, 2, and 3 use the formula below. The maximum value must be used for 'R' in usage range.

Tooth Load = Force x R/r

r = pitch radius of gear
'R' = radius from CG to centerline of unit.



Sample Calculation: On a system similar to Fig. 2 utilizing a Series 2A unit having a gear pitch radius, where r =1.5 in., and the force, 100 lb, on the arm at a radius where R = 36 in. The theoretical tooth load would be as follows:
Tooth Load (lbs.) = (100 lbs. x 36 in.)/1.5 in. = 2400 lbs.

The larger the pitch radius (r) used in the unit driving the system, the lower the value of the tooth load. This is significant when selecting the size of number of units to be used in the system. The effective tooth load on the rack must always include speed and efficiency factors for the system.

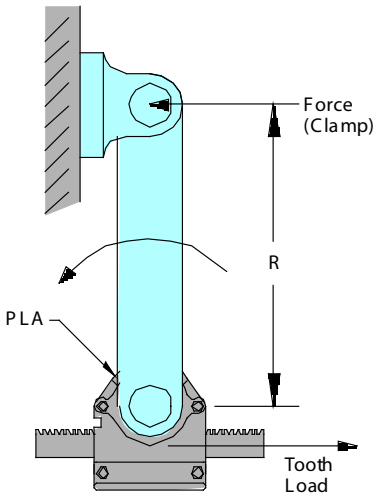


Fig. 1

Applying force through torque arm radius 'R' to clamp a component

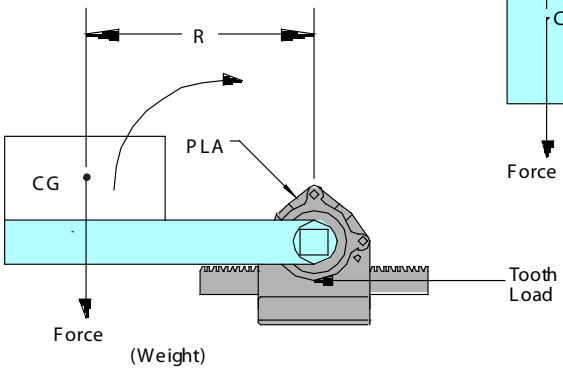


Fig. 2

Tilting a box with offset loading.

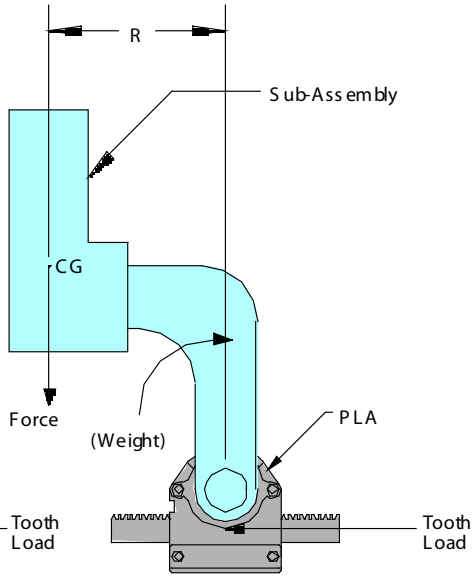


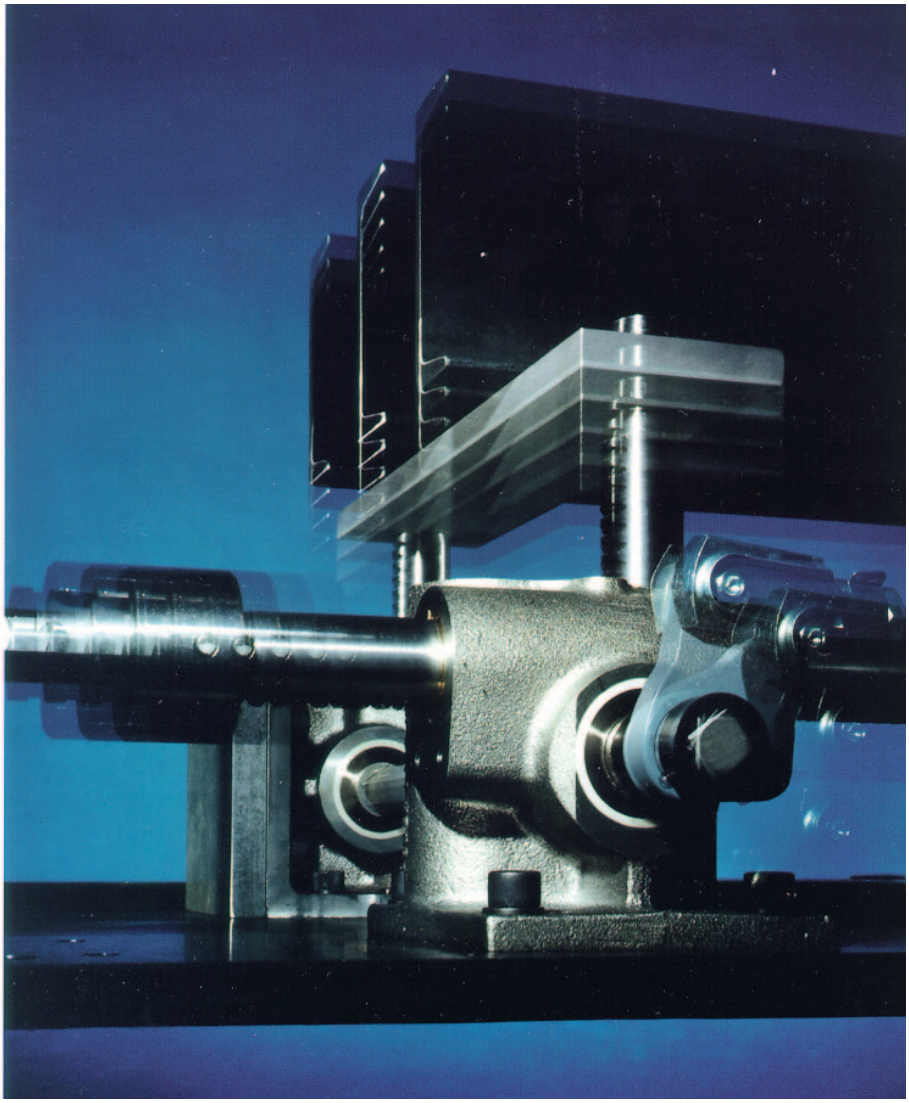
Fig. 3

Rotating a component or sub-assembly during manufacturing.

Specifications

Model	Gear Pitch Diameter	Diametral Pitch - Pressure Angle	Gear Face (width)	Rack Ratio	Rack Travel (at 360° gear revolution)	Max. Torque Limits (in./lbs.)	Recommended Torque Limits (in./lbs.)	Max. Shear Stock Load (lbs.)	Max. Tooth Load Capacity (lbs.)
1A	2"	10-14.5°	1"	NA	6.28"	8,000	1,600	8,000	1,600
1B	2"	10-14.5°	1"	1:1	6.28"	8,000	1,600	8,000	1,600
2A	3"	8-14.5°	1.25"	NA	9.42"	9,330	4,500	14,000	3,000
2B	3"	8-14.5°	1.25"	1:1	9.42"	9,330	4,500	14,000	3,000
*3A	2.5"	8-14.5°	1.25"	NA	7.85"	5,600	3,750	14,000	3,000
*3A	5"	8-14.5°	1.25"	NA	15.70"	11,200	7,500	14,000	3,000
3BL-3BR	2.5"	8-14.5°	1.25"	2:1	7.85"	5,600	3,750	7,000	1,500
3BL-3BR	5"	8-14.5°	1.25"	2:1	15.70"	5,600	3,750	7,000	1,500
4A	3"	8-14.5°	1.25"	NA	9.42"	9,330	4,500	14,000	3,000
4B	3"	8-14.5°	1.25"	1:1	9.42"	9,330	4,500	14,000	3,000

* Torque and load limits are 50% when 2:1 ratio applies.



Series 5 Power Lift® Actuator
Metric Rack & Pinion Lifters

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