SERIES ESU-RB DESIGN 5 LINEAR ACTUATOR INFORMATION SHEET

ORDERING DATA

PRODUCT
Slide

SIZE
5
6
8

BALL SCREW CONFIGURATION

Size		Lead mm
5	RB010	10
5	RB016	16
6	RB010	10
6	RB020	20
8	RB010	10
8	RB032	32

RB000 = Passive Unit (without drive)
Must be ordered with QL00 option.

MOTOR CONFIGURATION
QL11 - Inline with 1:1 ratio
QF11 - Foldback with 1:1 Ratio
QF21 - Foldback with 2:1 Ratio
QL00 - No Shaft (Passive Configuration), Must be ordered with RB000 option.

END/MID SUPPORTS
Head Support Qty
KS**0**xx or KS1xx
Qty Support (Max 1)
Mid Support Qty
KSx**0**x to KSx**9**x
Qty Support (Max 9)
See Options page for recommended spacing
Cap Support Qty
KSxx**0** or KSxx**1**
Qty Support
(Max 1, Motor End)

ESU S 5 5 x 300 - RBxxx - QL11 - Wxxxx x Y5 - KSxxx - SCxxx

TYPE
S - Single Saddle
D - Dual In-Line Saddle

DESIGN NO.
5 - Metric

TRAVEL (MAX.)

Size	mm
5	1000
6	1000
8	1000

50 mm minimum travel in 50 mm increments

MOTOR MOUNT CODE
Wxxxx - Open Architecture
W0000 - Blank Motor Mount
Blank - Slide Only (No motor mount)

FOOD GRADE
Y - Food Grade Lube on Slide Only

SWITCH BUNDLE (OPTIONAL)
S C N K 2

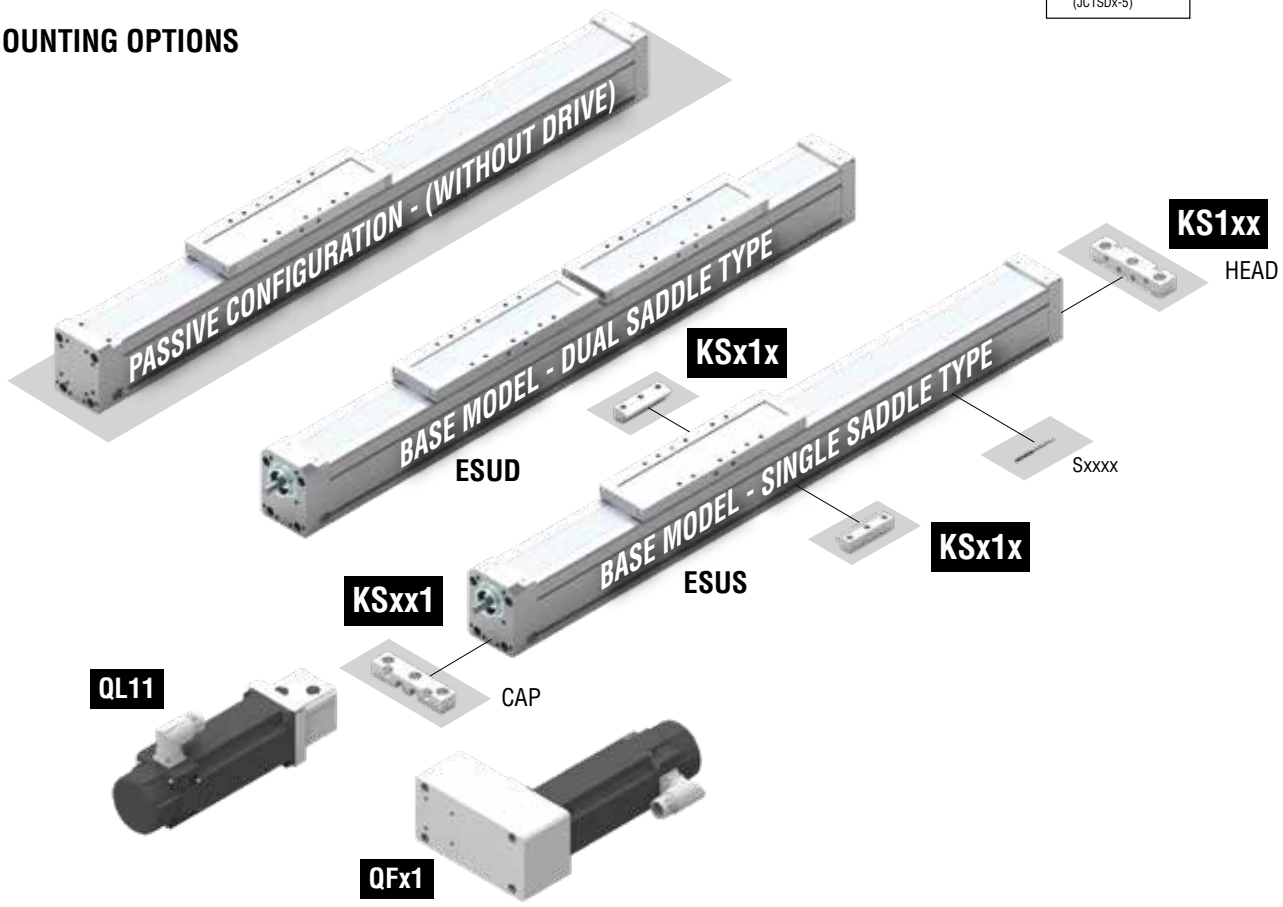
SWITCH SERIES
C - JC1SDx-x Series Single Position

SWITCH CIRCUITRY
N - NPN (Sink)
P - PNP (Source)

QUANTITY
1 to 9 (JC1SDx-x)

CABLE TYPE
K - Quick Connect only (JC1SDx-K)
5 - 5 Meter Length Cable (JC1SDx-5)

MOUNTING OPTIONS



SERIES ESU-RB DESIGN 5 LINEAR ACTUATOR INFORMATION SHEET

SPECIFICATIONS	BALL SCREW SERIES ESU -RB
REPEATABILITY	±0.01 mm [±0.0004 in]
TRAVEL TOLERANCE	+2.5/-0.0 mm [+0.100/-0.000 in]
MAXIMUM BACKLASH	0.025 mm [0.001 in]
DUTY CYCLE	100%
OPERATING TEMPERATURE	4 - 65°C [40 - 150°F]
LUBRICATION INTERVAL	Rail bearing system - Factory lubricated for life
	Ball Screw - Horizontal: 2500 km [100 mil. inches], Vertical: 1500 km [60 mil. inches]
ENCAPSULATION CLASS	IP54

SPECIFICATIONS				SIZE					
				5		6		8	
MECHANICS	DRIVE MECHANISM			Ball Screw					
	GUIDE			Recirculating Ball - Linear Motion Guide & Rail System					
	MAX. TRAVEL[1]		mm [in]	1000 [39.37]					
	BALL SCREW DIAMETER		mm	15		20		32	
	SCREW CONFIGURATION			-RB010	-RB016	-RB010	-RB020	-RB010	-RB032
	PITCH (LINEAR TRAVEL PER REVOLUTION)		mm [in]	10	16	10	20	10	32
SPEED	MAXIMUM SPEED[2]		mm/s [in/sec]	1000 [39.3]	1600 [63.0]	1000 [39.3]	2000 [78.7]	1000 [39.3]	3200 [126.0]
	MAXIMUM ACCELERATION	-QL11	m/s^2 [in/s^2]	19.6 [772]					
		-QFx1		9.8 [386]					
THRUST	MAXIMUM THRUST[3]		N [lbf]	2430 [547]	1520 [342]	4410 [992]	2510 [565]	10210 [2297]	5478 [1233]
TORQUE	MAXIMUM PERMISSABLE DRIVE TORQUE[4]	-QL11	Nm [in-lb]	4.3 [38.06]		7.8 [69.03]		16.3 [144.2]	31.0 [274.3]
		-QFx1		3 [26.55]		5.46 [48.32]		11.4 [101]	21.7 [192]
	NO-LOAD TORQUE		Nm [in-lb]	0.40 [3.54]		0.55 [4.87]		1.50 [13.27]	
WEIGHT	TOTAL @ ZERO STROKE (W_{OT})	STANDARD	kg [lb]	4.83 [10.67]	4.91 [10.84]	10.36 [22.87]	10.54 [23.27]	21.23 [46.86]	21.26 [46.94]
		DUAL SADDLE	kg [lb]	8.01 [17.68]	8.09 [17.85]	17.03 [37.59]	17.21 [38.00]	33.63 [74.23]	33.66 [74.31]
	TOTAL TRAVEL ADDER (W_{LT})		kg/mm [lb/in]	0.008 [0.436]	0.008 [0.436]	0.012 [0.700]	0.012 [0.700]	0.022 [1.224]	0.022 [1.224]
	MOVING @ ZERO TRAVEL (W_{OM})	STANDARD	kg [lb]	1.53 [3.36]	1.61 [3.54]	3.28 [7.22]	3.46 [7.61]	6.00 [13.21]	6.03 [13.29]
		DUAL SADDLE	kg [lb]	2.66 [5.86]	2.74 [6.04]	5.78 [12.73]	5.96 [13.13]	9.86 [21.74]	9.90 [21.82]
MOMENT OF INERTIA	ACTUATOR @ ZERO STROKE (J_O)	STANDARD	kg-m^2 [lb-in^2]	8.36×10^{-6} [0.029]	8.94×10^{-6} [0.031]	2.98×10^{-5} [0.102]	2.94×10^{-5} [0.101]	2.52×10^{-4} [0.860]	2.82×10^{-4} [0.964]
		DUAL SADDLE	kg-m^2 [lb-in^2]	1.50×10^{-5} [0.051]	1.63×10^{-5} [0.056]	5.38×10^{-5} [0.184]	5.29×10^{-5} [0.181]	4.71×10^{-4} [1.611]	5.42×10^{-4} [1.853]
	TRAVEL ADDER (J_L)		kg-m^2/mm [lb-in^2/in]	2.64×10^{-8} [2.29×10^{-3}]	2.95×10^{-8} [2.56×10^{-3}]	8.0×10^{-8} [6.94×10^{-3}]	7.81×10^{-8} [6.78×10^{-3}]	5.49×10^{-7} [4.77×10^{-2}]	6.50×10^{-7} [5.65×10^{-2}]
	EXTERNAL PAYLOAD ADDER		kg-m^2/kg [lb-in^2/lb]	2.53×10^{-6} [3.93×10^{-3}]	6.48×10^{-6} [1.01×10^{-2}]	2.53×10^{-6} [3.93×10^{-3}]	1.01×10^{-5} [1.57×10^{-2}]	2.53×10^{-6} [3.93×10^{-3}]	2.59×10^{-5} [4.02×10^{-2}]
	MOTOR CONFIGURATION	-QL11	kg-m^2 [lb-in^2]	6.11×10^{-6} [0.021]	6.11×10^{-6} [0.021]	4.04×10^{-5} [0.138]	4.04×10^{-5} [0.138]	1.71×10^{-4} [0.583]	1.71×10^{-4} [0.583]
		-QF11		2.03×10^{-4} [0.694]	2.03×10^{-4} [0.694]	1.96×10^{-4} [0.669]	1.96×10^{-4} [0.669]	2.65×10^{-3} [9.055]	2.65×10^{-3} [9.055]
		-QF21		3.59×10^{-4} [1.227]	3.59×10^{-4} [1.227]	8.02×10^{-4} [2.742]	8.02×10^{-4} [2.742]	1.17×10^{-2} [39.921]	1.17×10^{-2} [39.921]

NOTES:
1) STRONGLY RECOMMENDED:
   ORDERED TRAVEL = WORKING TRAVEL + SAFETY TRAVEL ON BOTH ENDS
2) REFER TO SPEED VS. TRAVEL CHART
3) REFER TO THRUST VS. LIFE CHART
4) REFER TO TORQUE VS. THRUST CHART

WEIGHT AND INERTIAL CALCULATIONS:

TOTAL WEIGHT = W_{OT} + (W_{LT} x TRAVEL) + MOTOR MOUNT WEIGHT
TOTAL MOVING WEIGHT = W_{OM} + (W_{LM} x TRAVEL) + EXTERNAL PAYLOAD

FOR Qx11:
INERTIA $_{Reflected}$ = J_O + (J_L x TRAVEL) + (J_M x TOTAL MOVING WEIGHT) + J_Q

FOR -QF21:
INERTIA $_{Reflected}$ = [J_O + (J_L x TRAVEL) + (J_M x TOTAL MOVING WEIGHT)] / 4 + J_Q

DYNAMIC LOADS AND MOMENTS

f_C = Equivalent Load Factor

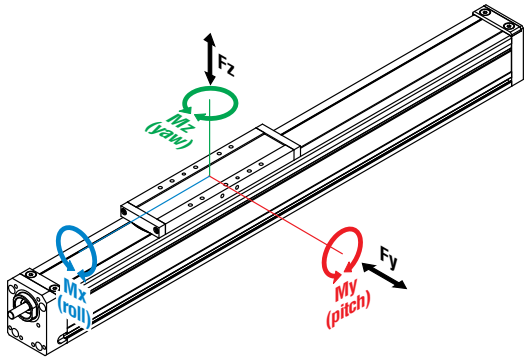
			5	6	8
Load (Max)	Fz	N [lb]	4903 [1103]	7648 [1720]	11410 [2567]
	Fy	N [lb]	3923 [883]	6120 [1377]	9129 [2054]
Bending Moments (Max)	Mx	Nm [in-lb]	43 [381]	94 [832]	166 [1469]
	My	Nm [in-lb]	380 [3363]	715 [6328]	1466 [12975]
	Mz	Nm [in-lb]	380 [3363]	715 [6328]	1466 [12975]

$$f_C = \frac{Fz}{Fz\ max} + \frac{Fy}{Fy\ max} + \frac{Mx}{Mx\ max} + \frac{My}{My\ max} + \frac{Mz}{Mz\ max} \leq 1$$

NOTE: Max Loads and Moments correspond to 5000 km of actuator life when applied individually to single saddle slide.

Mx, My and Mz are total Moments (Static + Dynamic)

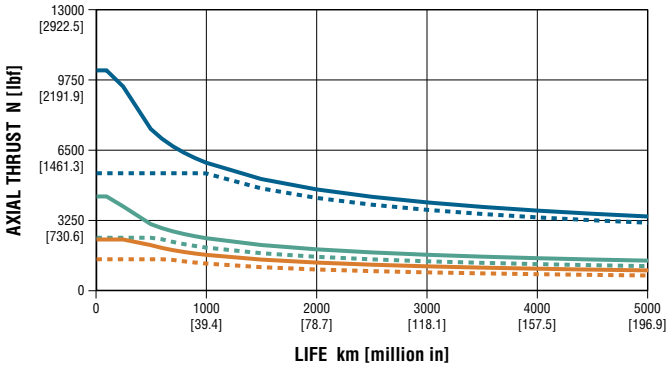
To make the selection process quick and simple, refer to PHD's sizing software.



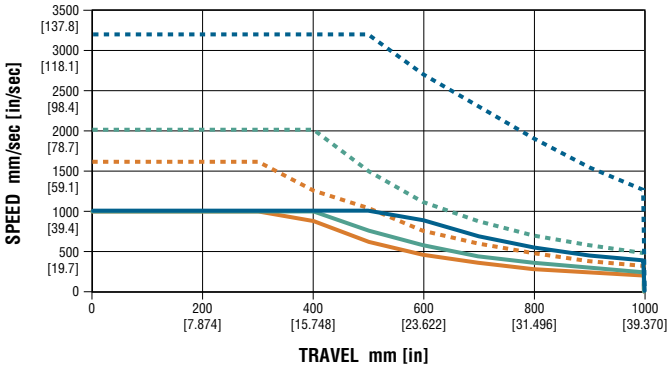
SERIES ESU-RB DESIGN 5 LINEAR ACTUATOR INFORMATION SHEET

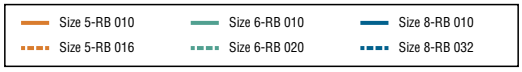
This section contains information on the capabilities of the Series ESU -RB version. It is not intended to be a comprehensive selection guide. To make the selection process simple and quick, refer to PHD's sizing software. You may request application assistance from your distributor or PHD's Inside Sales Department.

THRUST / LIFE

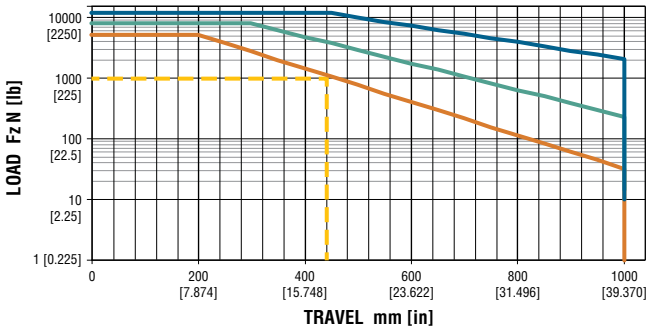


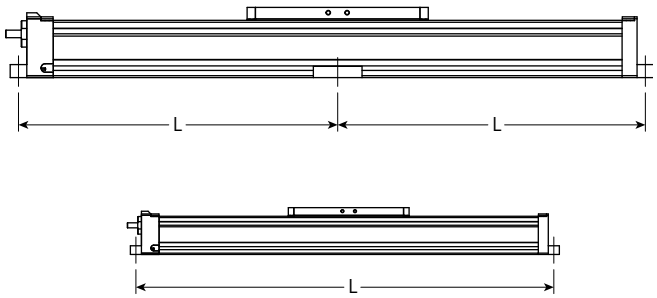
SPEED / TRAVEL





Load Fz/Fy vs. Maximum Unsupported Length





Mid-Support Calculation illustrated by dashed yellow line in graph above.

MID-SUPPORT CALCULATION

Example (Application Requirements)

Actuator – ESUS size 5
Load Fz – 1000 N [225 lb]
Travel – 1000 mm

Use Load Fz/Fy vs Maximum Unsupported Length graph

1) Find **Maximum Unsupported Length** from the above graph [1000 N = 440 mm]
2) Calculate **Total Actuator Length** (refer to Dimensions page 69 of the product catalog)
   Total Travel + Dimension A = Total Actuator Length

   1000 + 308.5 = **1308.5 mm**
3) Determine **number of required mid-supports**
   (Total Actuator Length / Maximum Unsupported Length) - 1 = Required mid-supports
   (1308.5 mm / 440 mm) - 1 = **2 mid-supports** (round up to next whole number)

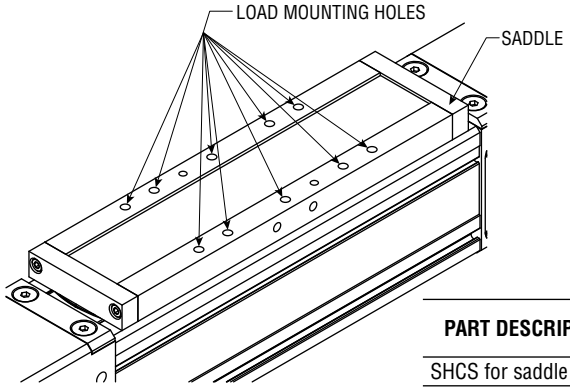
MOUNTING INFORMATION:

START-UP PROCEDURE

- Series ESU Linear Actuator should be securely mounted before powering up the electric motor. When mounting the unit on your machine, apply the recommended fastener tightening torques as specified on page 5. For a list of available mounting options, refer to the End/Mid Supports options page in the product catalog.
- Care should be taken to provide adequate space around the saddle and the attached load/tooling.
- Ensure that the electric motor and the motor mount kit are securely mounted to the linear actuator and fastened with the recommended tightening torques.
- Due to possible shifting of the outer seal band during handling, be sure to verify that the sealing band is centered, and no gaps exist between the band and slide. For adjustment, loosen the band clamps, adjust the band, and retighten the band clamps. Failure to ensure proper fit may lead to band damage.

OPERATING CONDITIONS

- It is strongly recommended that the load/tooling be fastened to the saddle using all 10 threaded mounting holes, as shown below. If the tooling is very long, a dual saddle should be used to prevent excessive overhang and corresponding bending moments.



PART DESCRIPTION	TORQUE in-lb [Nm]		
	55	56	58
SHCS for saddle to load	100 [11]	100 [11]	230 [26]

OPERATING CONDITIONS

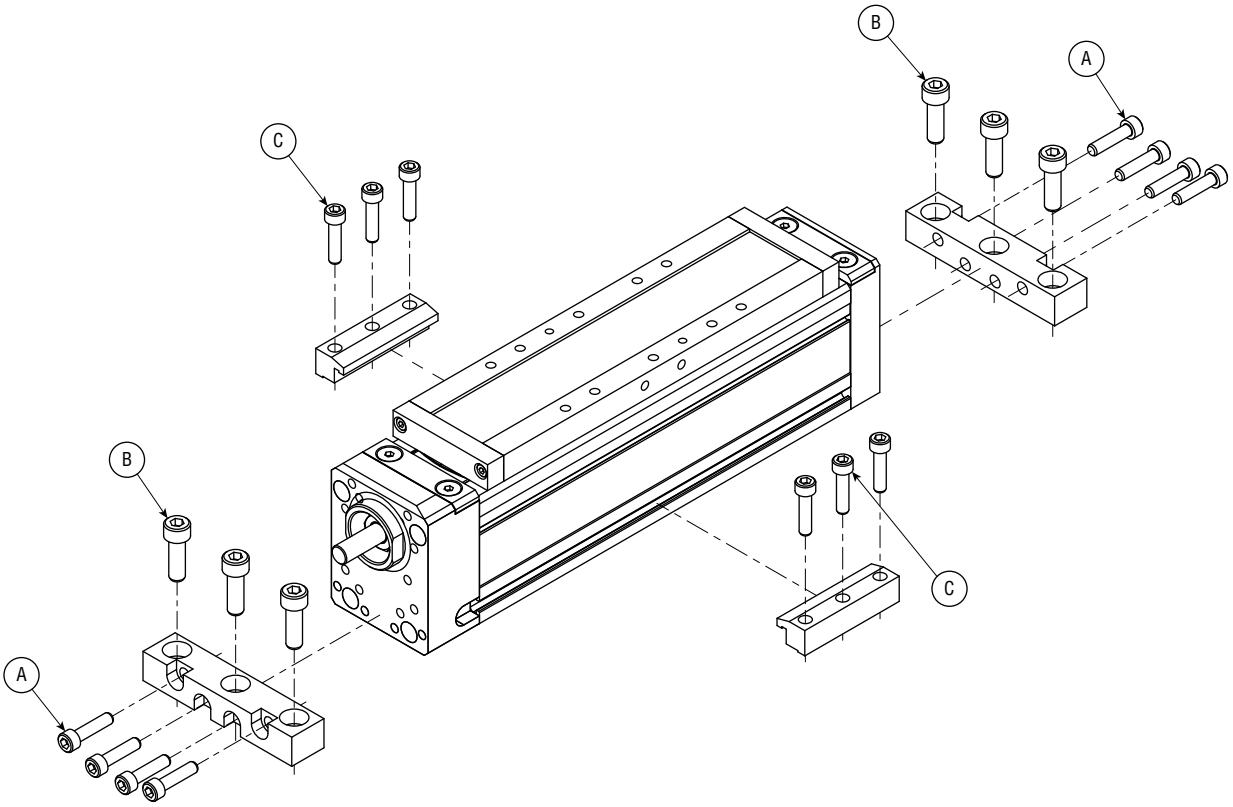
- The mechanical stop for the saddle, on both ends of the linear actuator, should not be used as the end of travel! Always add safe travel of about 25 to 50 mm on both ends to avoid accidental end of travel impact.
- Use the “Load Vs. Maximum Unsupported Length” chart on page 3 to calculate whether you need any mid supports for the linear actuator. This is very important for proper functioning of the linear actuator.
- The maximum input torque and speed should not exceed the values specified in the engineering data on page 2.
- Use ESU sizing software to select the right linear actuator for your application. This will ensure that maximum moments and loads are not exceeded.
- The linear actuator is designed for use in a clean industrial environment. The design prevents any solid particles from entering the cylinder. Some indirect splashing of fluids is permitted. Consult factory for more details.

MAINTENANCE

- The ESU-RB is not field-repairable.
- Ball screw and nut should be relubricated with Castrol Longtime PD2 Grease (NLGI Class 2), at following intervals (see instructions on page 6).
  - Horizontal application - 2500 km (100 million inches)
  - Vertical application - 1500 km (60 million inches)
- The linear guides and rail are factory lubricated for life.
- If the stainless steel sealing band shows signs of excessive wear, relubricate the band after 5000 km of life (see instructions on page 6). If required, replace the steel band with a new one from PHD.

MOUNTING INFORMATION:

TIGHTENING TORQUES FOR KSxxx END/MID SUPPORTS

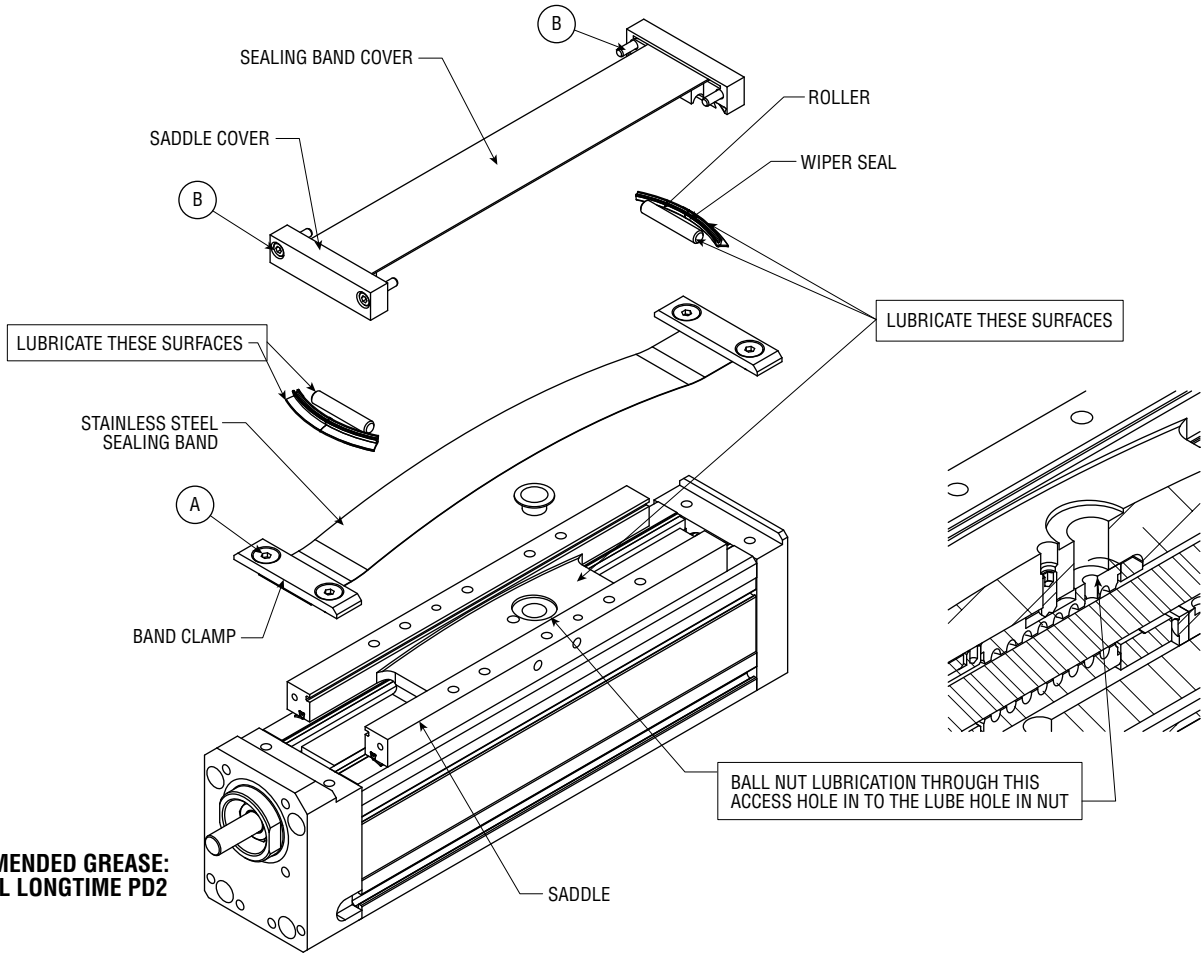


PART DESCRIPTION	FASTENER	TORQUE in-lb [Nm]		
		55	56	58
SHCS for KS1x1 End Supports	A (4 per side)	100 [11]	230 [26]	400 [45]
	B (3 per side)	230 [26]	400 [45]	400 [45]
SHCS for KSx1x Mid Supports	C (3 or 4 per side)	100 [11]	100 [11]	230 [26]

SERIES ESU-RB DESIGN 5 LINEAR ACTUATOR INFORMATION SHEET

MAINTENANCE:

RELUBRICATING BALL NUT / SADDLE / SEALING BAND



RECOMMENDED GREASE:
CASTROL LONGTIME PD2

1. Remove the four FHCS screws **A** to take off the band clamps.
2. Remove the four SHCS screws **B** to take off the saddle covers on both ends.
3. Pull the sealing band cover from the saddle and take off the sealing band.

BALL NUT LUBRICATION

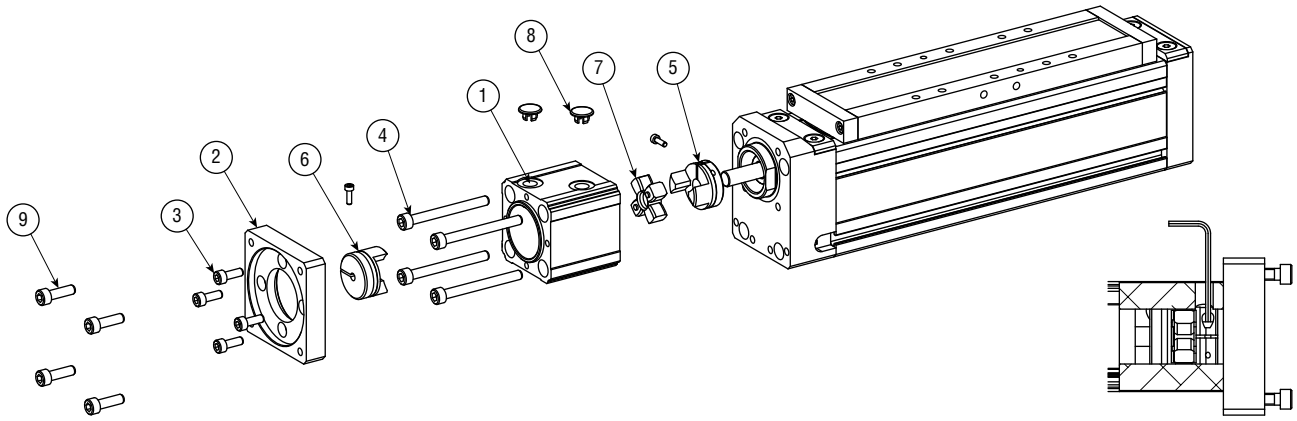
4. Using a grease gun pump, grease into the ball nut through the access hole, as shown above, making sure the grease actually enters the ball nut as shown in the detail above.

SADDLE AND SEALING BAND LUBRICATION

5. Lubricate the convex surface of the saddle with the recommended grease.
6. Also lubricate the wiper seal and plastic roller in the saddle covers.
7. Reinstall one end of the sealing band using the band clamp and screws **A**, with a torque of 60 in-lb [6.7 Nm].
8. Place the sealing band over the saddle onto the other end of the actuator. Install the saddle covers and the sealing band cover on the saddle. Tighten the four screws **B** to 40 [4.5], 80 [9], and 130 [15] in-lb [Nm] respectively for Series ESU sizes 55, 56, and 58.
9. Reinstall the other end of the sealing band using the screws **A**, with a torque of 60 in-lb [6.7 Nm].

MOTOR MOUNTS:

QL11: INLINE MOTOR MOUNT OPTION



ITEM	PART DESCRIPTION	QTY.	TORQUE in-lb [Nm]		
			55	56	58
1	HOUSING; COUPLING	1			
2	PLATE; MOUNTING, MOTOR	1			
3	FASTENERS; METRIC, BRITE ZINC PLATE (SHCS, LHCS)	4	50 [5.5]	50 [5.5]	350 [39.5]
4	FASTENERS; METRIC, BRITE ZINC PLATE (SHCS)	4	100 [11]	230 [26]	350 [39.5]
5	HUB; COUPLING, ROTEX	1	18 [2]	80 [9]	100 [11]
6	HUB; COUPLING, ROTEX	1	18 [2]	80 [9]	100 [11]
7	SPIDER; COUPLING, ROTEX	1			
8	PLUG; HOLE	2			
9	SCREW; MOTOR	4	Depends on screw sizes on your motor		

(Please use Loctite 248 or equivalent on all fasteners)

1. Mount the coupling hub half **5** on the ESU shaft. Make sure to maintain the gap, as shown in Figure 5, between the coupling hub and the pilot on the linear actuator. Tighten the cap screw with the recommended torque.

ESU SIZE	DIMENSION L in [mm]
55	0.295 [7.5]
56	0.178 [4.5]
58	0.598 [15.2]

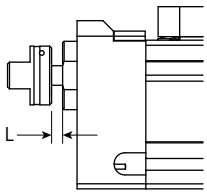
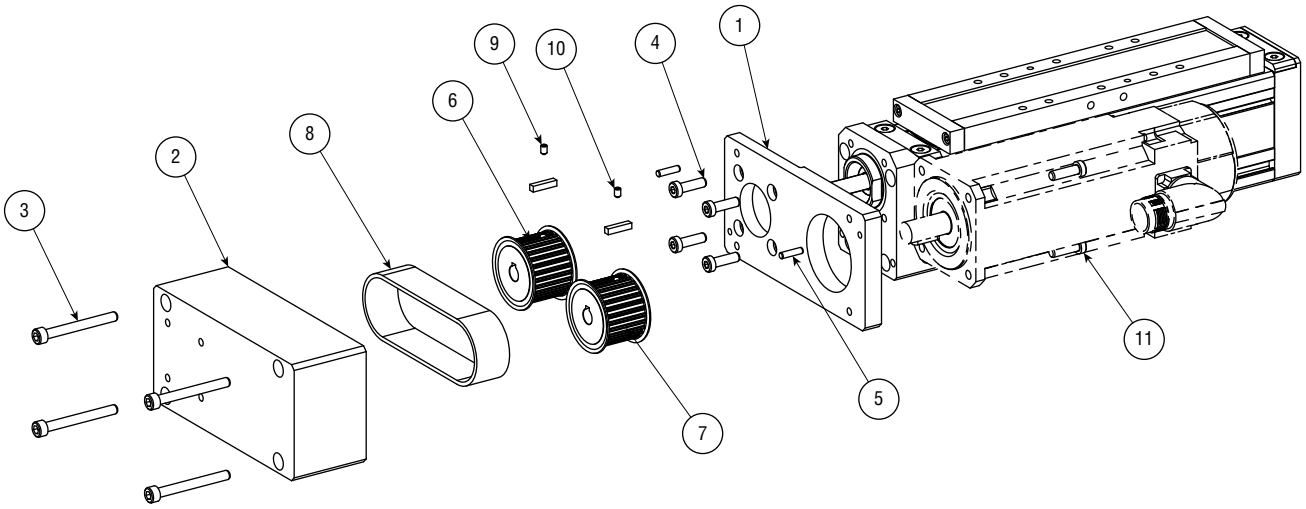


FIGURE 5

2. Insert the spider **7** into the coupling hub **5**.
3. Mount the other coupling hub **6** on the spider **7**. Loosen the cap screw on the coupling hub **6**.
4. Using the four screws **4**, fasten the housing **1** to the actuator.
5. Mount the motor mounting plate **2** to the housing using the four fasteners **3** and tighten with the recommended torque.
6. Insert the motor through the motor mounting plate **2** such that the motor shaft enters the hole in the coupling hub **6**. You may have to apply force to fully insert the motor shaft in the coupling hub.
7. With the flange on the motor in surface contact with the motor mounting plate, use the mounting screws **9** to fasten the motor to the mounting plate **2**.
8. At this point the cap screw on the coupling hub **6** is still loose. To tighten this screw, align the head of this screw with the hole in the coupling housing as shown below. You may either rotate the motor or push/pull the saddle to do this alignment.
9. Through this hole in the housing, tighten the cap screw on the coupling hub **6** on the motor shaft, using the recommended torque.
10. Plug the two holes on the coupling housing using the plastic plugs **8**.

MOTOR MOUNTS:

QFx1: FOLDBACK MOTOR MOUNT OPTION



ITEM	PART DESCRIPTION	QTY.	TORQUE in-lb [Nm]		
			55	56	58
1	PLATE; MOUNTING, MOTOR	1			
2	COVER; DRIVE	1			
3	FASTENERS; METRIC, BRITE ZINC PLATE (SHCS, SFHCS, LHCS, SBHCS)	4	100 [11]	100 [11]	230 [26]
4	FASTENERS; METRIC, LHCS, DIN 7984, GRADE 10.9, BRITE ZINC	4	100 [11]	230 [26]	350 [39.5]
5	PIN; DOWEL, MET	2			
6	PULLEY; BRECOFLEX, AT5, 27 TOOTH	1			
7	PULLEY; AT5, FINISHED	1			
8	BELT; TIMING, AT5	1			
9	SCREW; SOCKET SET, METRIC	1	27 [3]	27 [3]	60 [7]
10	SCREW; SOCKET SET, METRIC	1	See Note 1 below		
11	SCREW; MOTOR	4			

NOTES:
1. The torque on these screws will depend on the screw sizes on your motor.
2. The key shown with the cylinder side pulley will be factory fitted on the cylinder shaft.
3. The key shown with the motor side pulley to be used from the customer's motor.

ASSEMBLY INSTRUCTIONS

(Please use Loctite 248 or equivalent on all fasteners.)

1. Mount the motor mounting plate **1** to the actuator using the four cap screws **4** and apply the specified torque.
2. **Pulleys Assembly:** The following two methods are recommended to assemble the pulleys and timing belt. See the following two pages.

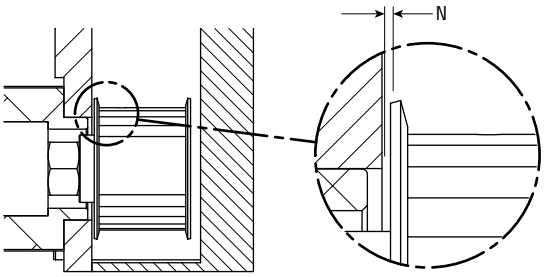
MOTOR MOUNTS:

QFx1: FOLDBACK MOTOR MOUNT OPTION

(Pulleys Assembly continued)

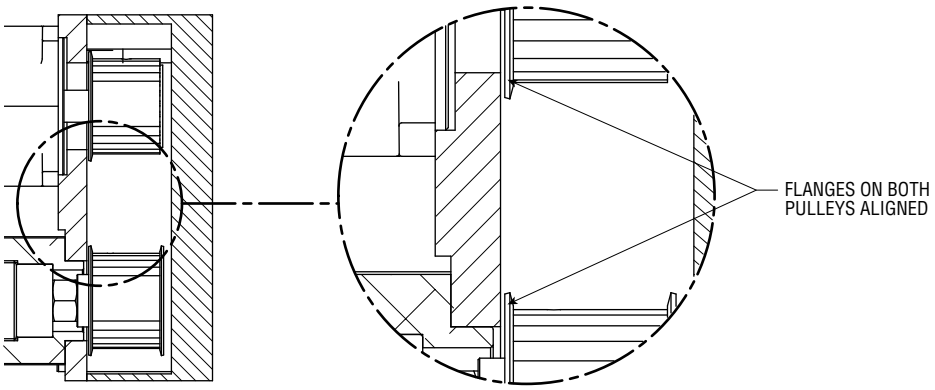
METHOD 1

- Assemble pulley **6** on the actuator (ball screw) shaft, with the hub on pulley facing inwards (towards the actuator) as shown in the graphic below. Make sure to install the key in the keyway of the ball screw.
- Check that the gap between the flange on the pulley and motor mount plate is at least as per the table below.



ESU SIZE	DIMENSION N in [mm]
55	0.067 [1.7]
56	0.047 [1.2]
58	0.118 [3.0]

- Thread in the set screw **9** in pulley **6** and tighten to the specified torque.
- Mount the motor on the mounting plate and hand tighten the four screws **11**.
- Assemble the pulley **7** on the motor shaft. If your motor shaft uses a key, you will receive a pulley with a keyway and a set screw hole. If your motor shaft has one or two flats on it, you will receive a pulley with two set screw holes.
- Make sure that the flange on the pulley **7** is aligned with the flange on the pulley **6** as shown below.



- Thread in the set screw **10** in pulley **7** and tighten it to the required torque. If there are two set screw holes, thread in both the screws.
- To mount timing belt **8** on the two pulleys - first remove the four screws **11** from the motor.
- Tilt the motor's axis towards the actuator's axis, wrapping the belt on the cylinder pulley stretch and wrap it over the motor pulley.
- Once the belt is centered on both the pulleys, reassemble the four screws **11** and tighten them to the required torque.

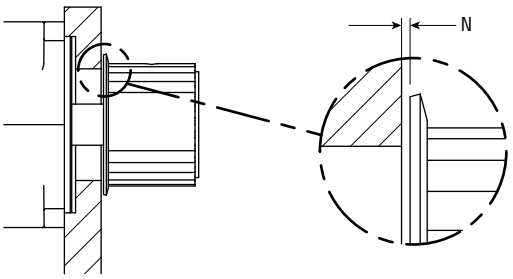
MOTOR MOUNTS:

QFx1: FOLDBACK MOTOR MOUNT OPTION

(Pulleys Assembly continued)

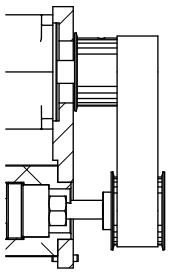
METHOD 2

- Mount the motor on the mounting plate **1**.
- Thread in the four screws **11** and tighten to the required torque.
- Mount pulley **7** on the motor shaft. Make sure to maintain the clearance between the pulley's flange and mounting plate **1** as shown below.



ESU SIZE	DIMENSION N in [mm]
55	0.067 [1.7]
56	0.047 [1.2]
58	0.118 [3.0]

- If your motor shaft uses a key, you will receive a pulley with a keyway and a set screw hole from PHD. If your motor shaft has one or two flats on it, you will receive a pulley with two set screw holes.
- Thread in the set screw **10** in pulley **7** and tighten to the required torque. If there are two set screw holes, thread in both the screws.
- Mount the pulley **6** on the cylinder shaft, such that it is positioned as shown below with respect to the motor pulley **7**.



- With the two pulleys aligned as shown, wrap the timing belt over the pulley **6** and align it to the tooth on the pulley **7**.
- Stretch and slide the belt over the pulley **7** and at the same time push the pulley **6** on the cylinder shaft.
- Push the pulley **6** further until the flanges of both pulleys are aligned as shown above.
- Thread in the set screw **9** in pulley **6** and tighten to the specified torque.

3. Assemble the two dowel pins **5** in the mounting plate **1**.
4. Mount the drive cover **2** on the mounting plate using the dowel pins for location.
5. Thread in the four screws **3** and tighten to the specified torque.