

**MA** **ELECTRIC**  
**CYLINDERS**

**RACO**

# RACO ELECTRIC LINEAR CYLINDERS FOR TODAY'S INDUSTRY

Electro-mechanical linear cylinders are gaining more and more importance in replacing hydraulic and pneumatic cylinders. More than 30 years of experience and unique patented features make the RACO Electric Linear Cylinder the standard in the industry.

The most important advantages of RACO Electric Linear Cylinders are the RACO motor, specifically developed for cylinder duty, and the patented nut system.

The RACO motor, which does not have a breakdown torque, provides a soft acceleration of loads. In connection with the patented hammerblow bolt in the nut housing, the RACO motor produces a breakaway thrust much larger than the nominal thrust.

RACO Electric Cylinders are economical to operate, since they usually work for just a few seconds and consume energy only during that short period. Contrary to hydraulic and pneumatic systems, no energy is consumed during idle periods.

The size of the drive motor can be kept very small due to high efficiency of the electro-mechanical system. Feeding the electrical energy through cables is easy and non-contaminating. Leaking and freezing problems, which occur in other systems, are not probable.

High and freezing temperatures, dust, humidity, and vibrations are normal operating conditions for RACO Electric Linear Cylinders.

Even under extreme conditions they work with precision and reliability, proven by their wide range of applications throughout all industries. They operate ladle pre-heaters in steel mills and position parabolic antennas for space applications. They are even used in explosive environments in the chemical industry as well

as in coal mining.

The electro-mechanical RACO system fulfills the highest requirements for cleanliness and environmental protection, even for applications in the food industry.

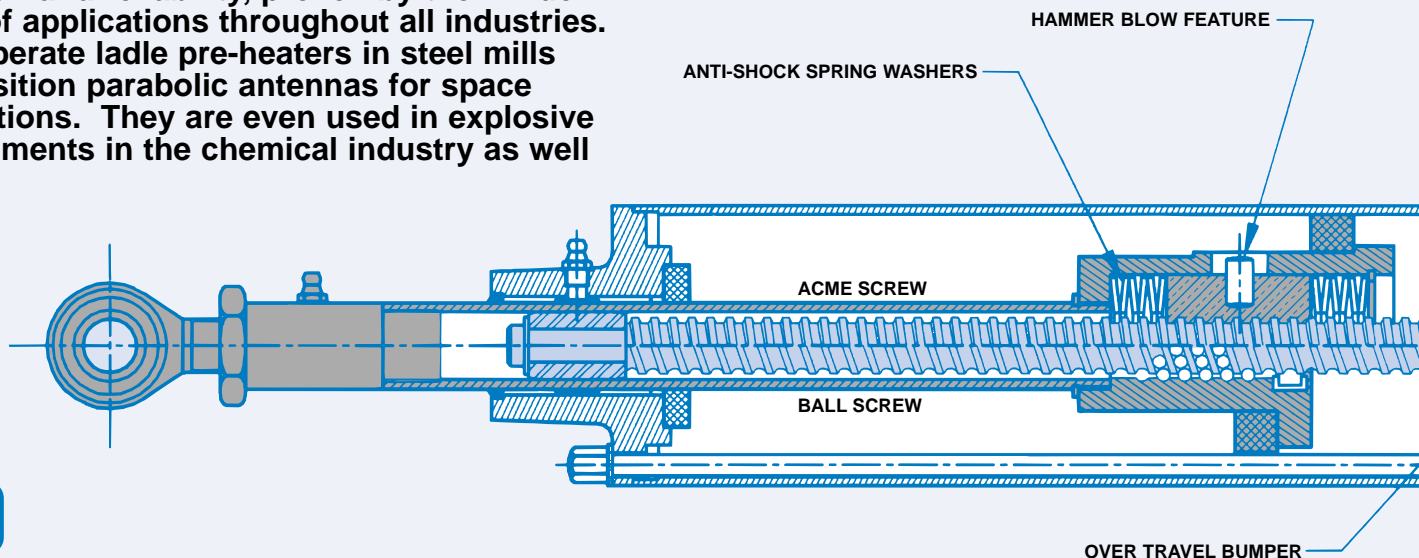
## ACME SCREWS VERSUS BALL SCREWS

The rotational movement produced by the electric motor will be converted into a linear movement by acme or ball screws installed within the thrust unit.

Acme screws can be made self-locking by selecting a low lead. Static loads, which can always be higher than the nominal thrust, can be safely maintained in all positions. Different leads for the screw can be easily produced to have lower or higher rod speeds. Higher leads, however, do not have the self-locking feature, so the cylinder will be equipped with an electro-magnetic brake to maintain position.

Ball screws have a rolling friction versus the sliding friction of acme screws. The use of ball screws results in a higher duty cycle, longer lifetime, and better positioning. Each position can be approached with a high degree of accuracy, and a fast reacting motor brake ensures repeatability since ball screws are not self-locking.

Due to the efficiency of RACO ball screws of higher than 95%, the capacity of the drive motor can be reduced and smaller motor starters and controls produce additional savings. A ball screw should also be used when a safety application requires the cylinder to automatically run to a defined position in the event of a power failure.



## SOME OF THE UNLIMITED APPLICATIONS

- Actuating slide gates, diverter gates, clam gates, conveyor gates, or telescoping chutes in bulk material handling.
- Actuating ladle or tundish preheaters, dummy bars, stopper rods, or coke wharf gates in steel mills.
- Positioning main or sub-reflectors on radio telescopes.
- Positioning of car assembly components or spray paint systems.
- Positioning of samplers, tools or components for machining or on automated ground vehicles.
- Manipulating fixture jigs in machine tool applications.
- Feeding magazines and rack systems.
- Manipulating motor blocks for machining.
- Operating clamping devices...and much more.

## WIDE VARIETY OF MOTORS

The wide range of drive motors for different operating conditions and enclosures offers the optimum solution for each application. The flexibility of the RACO Modular System permits the use of drive motors other than the RACO motor, such as DC motors or servo and stepping motors.

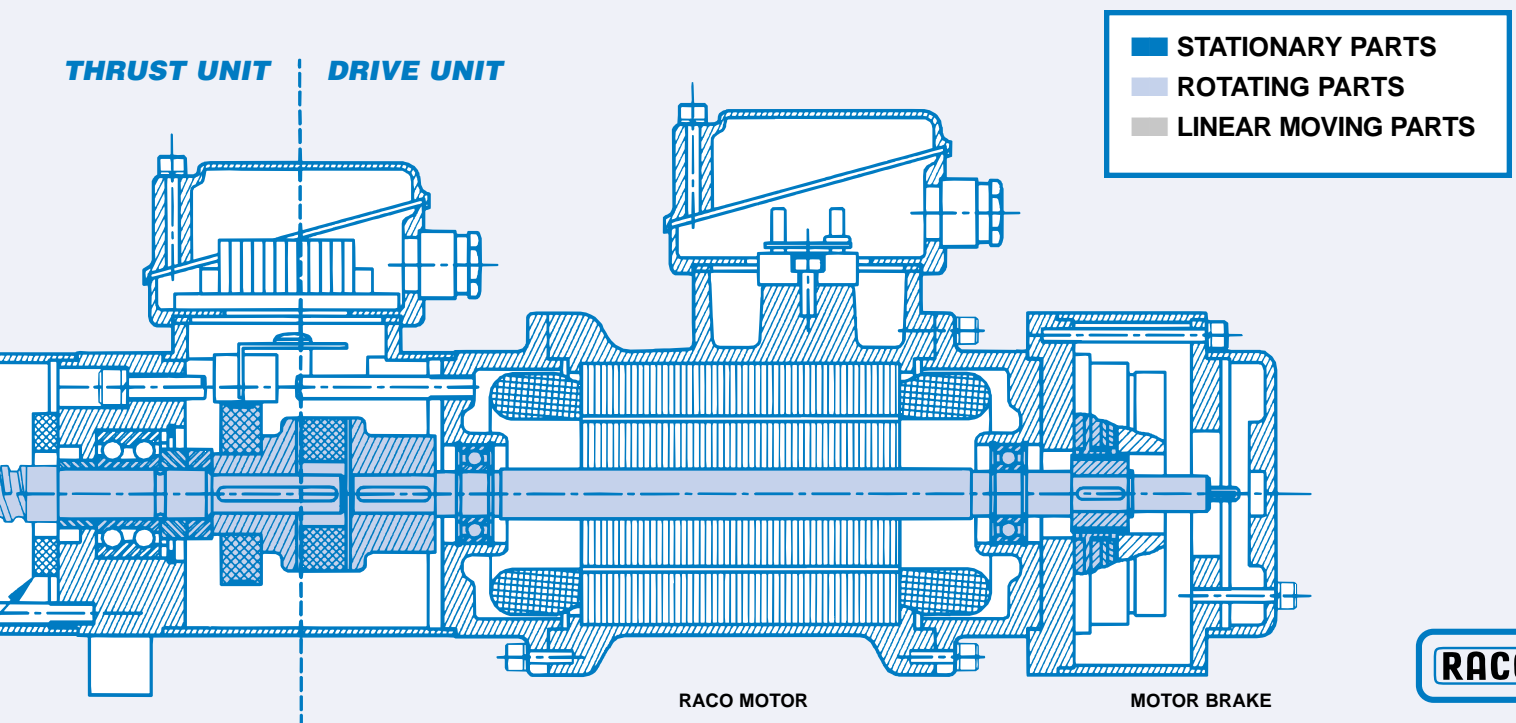
## STANDARD SIZES AND LINEAR FORCES (THRUST)

Size 2	..... up to	175 lb thrust
Size 3	..... up to	440 lb thrust
Size 4	..... up to	1,100 lb thrust
Size 5	..... up to	2,200 lb thrust
Size 6	..... up to	4,400 lb thrust
Size 7	..... up to	8,800 lb thrust
Size 8	..... up to	17,600 lb thrust
Size 9	..... up to	33,000 lb thrust
Size 10	..... up to	66,000 lb thrust
Size 11	..... up to	132,000 lb thrust

## WIDE VARIETY OF ACCESSORIES

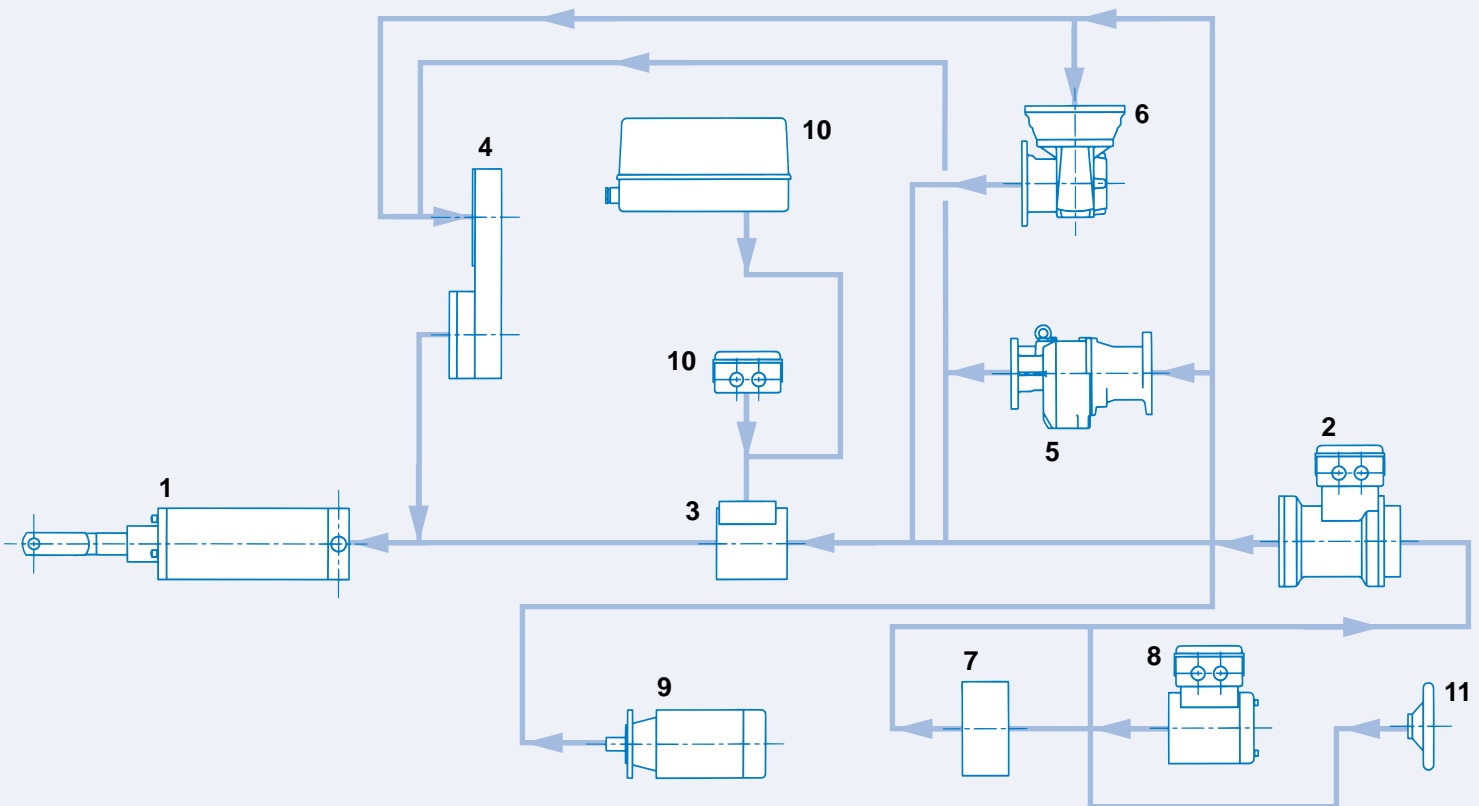
There is a wide range of controls for RACO Electrical Linear Cylinders, such as switches, starters, relays, potentiometers, inductive transmitters, contactless sensors and controllers, and all of them have a high degree of reliability.

Feedback devices and adjustable limit switches are built into the cylinder and are completely protected. No conversion of control commands or feedback signals from a different power source into electrical energy is necessary, eliminating possibilities of malfunctioning.



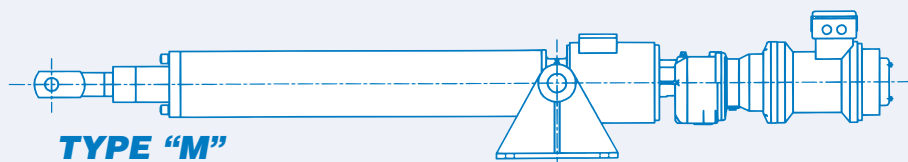
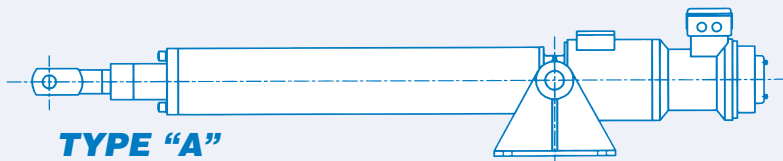
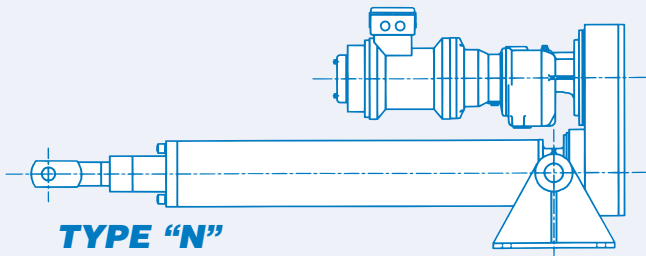
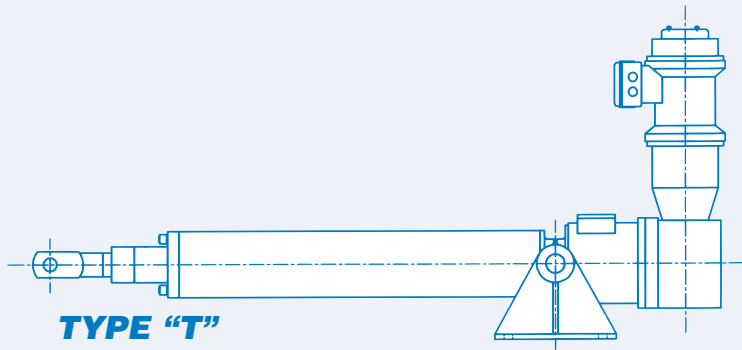
# THE FLEXIBLE RACO MODULAR SYSTEM

1. **Thrust unit** with self-locking acme screw or non-locking ball screw, to convert rotational into linear movement. Shield tube made of aluminum for sizes 3-5, steel for larger sizes, with optional interior paint coating for tropical-proof requirements. Thrust tubes made of stainless steel thru size 6, with hard chromium plating on larger sizes. Front cap with seal and extra long bushings to withstand small lateral forces. Available with double and special high or low temperature seal.
2. The **RACO motor** is totally enclosed, has a high starting torque and provides a smooth acceleration of loads. Standard is insulation Class F, TENV and torque characteristics better than NEMA D. Motor windings are double impregnated under vacuum. For high rod speeds, motors are directly coupled to the cylinder power screw with resilient or no backlash coupling.
3. **Coupling housing** with large lateral accessory box instead of rear accessory housing. (Necessary if overall length must be reduced, if handwheel is installed behind motor, or if drive motor other than RACO is used.) In addition to stroke limit switches and feedback potentiometers we can incorporate:
  - Blinking signal light to indicate cylinder motion.
  - Pulse transmitter for electronic thrust overload protection.
  - Pulse transmitters for digital positioning control.
4. **Drive housing** for cylinder type "C" or "N" (timing belt driven) for shortest overall length. In addition to a direct ratio of 1:1, step-up and step-down ratios 1:1.5, 1:2.0, and 1:2.5 are possible.
5. **Parallel gear** to reduce motor revolutions for low linear speeds, and boost the motor torque.





# CUSTOM MADE LINEAR CYLINDERS FOR YOUR APPLICATION



6. **Right angle gear** to reduce motor revolutions for slow speeds, and to reduce over-all length.

7. **Electro-magnetic brake type "L"** (applies braking force when power is off) is required with a ball screw or a high-lead acme screw, neither of which is self-locking. Exact positioning applications also require this brake. Depending on the application, the brake can be wired for a short, medium, or fast reaction time.

**Electro-magnetic brake type "B"** (applies braking force when power is on) for safety applications requiring the cylinder to backdrive to a desired safe position in case of a power failure. Counterweights or springs must be used in connection with non-locking ball screws to provide backdriving force.

8. **Rear accessory housing** for stroke limit switches, feedback potentiometer, and position emitter.

9. Many types of **customer specified motors** such as **AC, DC, servo, stepping** motors and gear motors are adaptable.

10. **Lateral accessory housings** can be used on all cylinders. All the available accessories can be mounted in these housings.

11. **Solid handwheel** is available for manual operation/adjustment of the cylinder. Optional mechanical and electrical disengaging mechanisms are also available. All accessories are installed in the lateral accessory housing when the cylinder is furnished with a hand wheel.

# STANDARD RACO ELECTRIC LINEAR CYLINDER COMBINATIONS

The RACO Modular System allows a wide variety of combinations in type, size, thrust, speed, etc. The charts on the next pages list the standard cylinders. Numerous special combinations are available. Call us if your desired thrust/speed/stroke is not listed.

## THRUST UNIT SIZE

There are 11 RACO cylinder sizes available. The sizes 3-8 are available as "A", "C", "M", "N", and "T" type with the special RACO Cylinder Duty Motor. The sizes 9-11 are generally furnished with an appropriate commercial parallel or right angle gear motor.

## THRUST (LINEAR FORCE)

RACO Electric Linear cylinders cover a thrust range from 65 lb. to 132000 lb. The listed thrust is the nominal force. Considerably higher thrusts are permissible for a certain limited number of cycles or limited time.

## STROKE (LINEAR TRAVEL)

The standard available strokes are:

in	3.9	7.9	11.8	15.7	19.7	23.6	31.5
mm	100	200	300	400	500	600	800
in	39.4	47.2	55.1	63.0	70.9	78.7	
mm	1000	1200	1400	1600	1800	2000	

The selection charts are listing the available stroke ranges for a certain size, thrust, speed.

All standard strokes are not available in all sizes.

## SPEED (LINEAR VELOCITY)

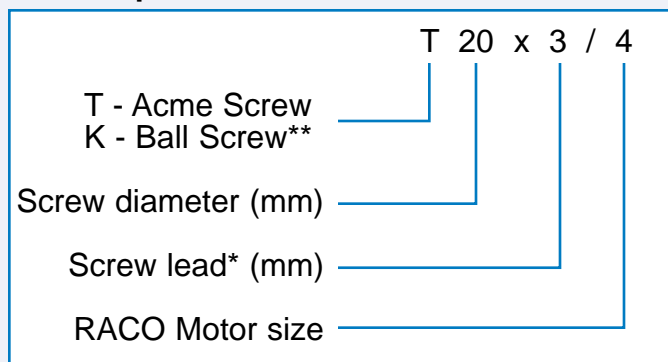
The listed speed (linear velocity) of the cylinder rod is based on the RACO high slip, cylinder duty AC motor full load speed. To maintain a certain desired linear velocity and boost the motor torque, appropriate gear reducers and/or a timing belt stage is utilized.

## SCREW TYPE/RACO MOTOR SIZE

This column in the charts gives valuable information about the utilized screw dimensions and the recommended RACO motor size.

The meaning of the listed code is as follows:

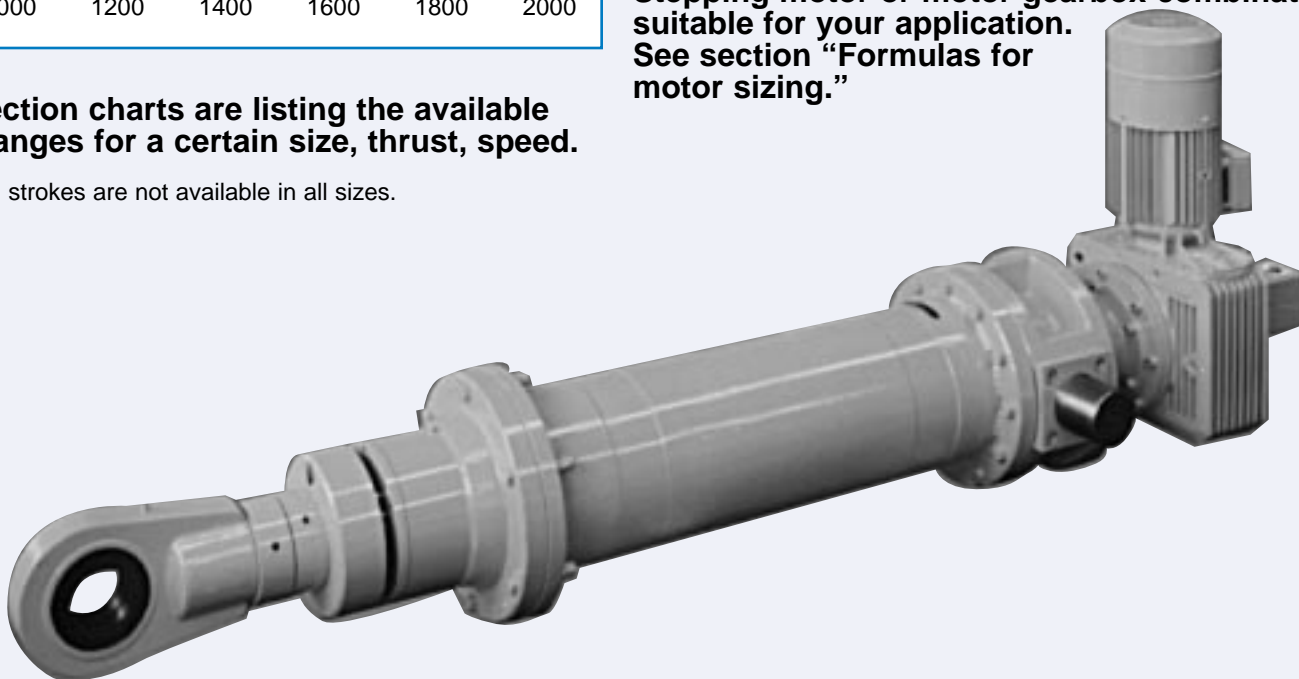
Example:



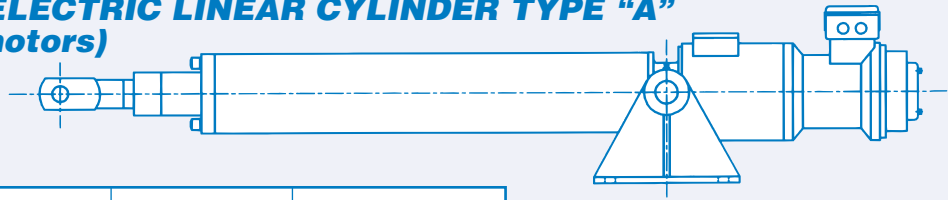
\*Additional non-listed special leads are available upon request.

\*\*Ball screws require holding brakes.

The above mentioned screw data can be used to size and select an AC, DC, Servo or Stepping motor or motor gearbox combination suitable for your application. See section "Formulas for motor sizing."



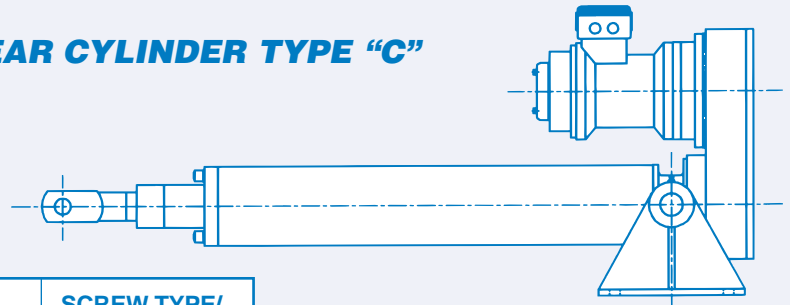
## SELECTION CHARTS ELECTRIC LINEAR CYLINDER TYPE "A" (with direct drive motors)



THRUST UNIT SIZE	THRUST (LINEAR FORCE)		STROKE RANGE (LINEAR TRAVEL)		SPEED (LINEAR VELOCITY)		SCREW TYPE/ RACO MOTOR SIZE	
	LB	N	in	mm	in/s	mm/s		
3	220	1000	3.9-39.4	100-1000	1.9	48	T14x2/3	
			3.9-15.7	100-400	5.7	144		K14x6/3
4	550	2500	3.9-39.4	100-1000	2.8	71	T20x3/4	
			3.9-39.4	100-1000	5.7	144	T20x3/4	K20x6/4
5	1100	5000	3.9-39.4	100-1000	3.7	93	T26x4/5	
			3.9-39.4	100-1000	7.6*	193	T26x8/5	K25x8/5
6	2200	10000	7.9-78.7	200-2000	4.7	119	T32x5/6	
			7.9-78.7	200-2000	7.6*	193	T32x8/6	
			7.9-78.7	200-2000	9.4	238		K32-10/6
7	3300	15000	7.9-78.7	200-2000	5.7	144	T40x6/7	

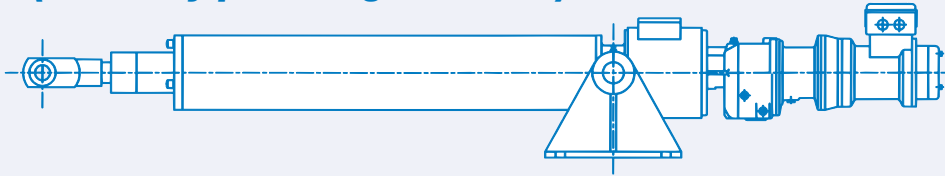
\*Not Self Locking - Brake "L" Recommended

## SELECTION CHARTS ELECTRIC LINEAR CYLINDER TYPE "C" (driven via a timing belt)



THRUST UNIT SIZE	THRUST (LINEAR FORCE)		STROKE RANGE (LINEAR TRAVEL)		SPEED (LINEAR VELOCITY)		SCREW TYPE/ RACO MOTOR SIZE	
	LB	N	in	mm	in/s	mm/s		
3	440	2000	3.9-39.4	100-1000	0.9	22	T14x2/3	
	220	1000	3.9-39.4	100-1000	1.9	48	T14x2/3	
			3.9-15.7	100-400	3.7	93		K14x6/3
			3.9-15.7	100-400	5.7	144		K14x6/3
4	1100	5000	3.9-39.4	100-1000	1.4	35	T20x3/4	
	550	2500	3.9-39.4	100-1000	2.8	71	T20x3/4	K20x6/4
			3.9-39.4	100-1000	5.7	144	T20x3/4	K20x6/4
5	2200	10000	3.9-39.4	100-1000	1.4	35	T26x4/5	
	1100	5000	3.9-39.4	100-1000	3.7	93	T26x4/5	K25x8/4
			3.9-39.4	100-1000	7.6	193	T26x8/5	K25x8/5
6	2200	10000	7.9-78.7	200-2000	2.8	71	T32x5/5	
			7.9-78.7	200-2000	4.7	119	T32x5/5	K32x10/5
			7.9-78.7	200-2000	7.6	193	T32x5/5	
			7.9-78.7	200-2000	9.4	238		K32x10/6
7	4400	20000	7.9-78.7	200-2000	2.8	71	T40x6/7	
	3300	15000	7.9-78.7	200-2000	5.7	144	T40x6/7	K40x12/6
			7.9-78.7	200-2000	7.6	193		K40x12/7

**SELECTION CHARTS Cont.**  
**ELECTRIC LINEAR CYLINDER**  
**TYPE "M"**  
*(driven by parallel gear motor)*

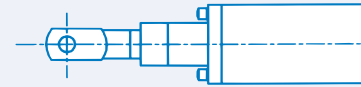


THRUST UNIT SIZE	THRUST (LINEAR FORCE)		STROKE RANGE (LINEAR TRAVEL)		SPEED (LINEAR VELOCITY)		SCREW TYPE/ RACO MOTOR SIZE	
	LB	N	in	mm	in/s	mm/s		
3	440	2000	3.9-39.4	100-1000	0.2	5	T14x2/3	
			3.9-39.4	100-1000	0.5	12	T14x2/3	
			3.9-39.4	100-1000	0.7	17	T14x2/3	
			3.9-39.4	100-1000	0.9	22	T14x2/3	K14x6/3
			3.9-15.7	100-400	0.2	5		K14x6/3
			3.9-15.7	100-400	0.5	12		K14x6/3
			3.9-15.7	100-400	0.9	22		K14x6/3
			3.9-15.7	100-400	1.9	48		K14x6/3
4	1100	5000	3.9-39.4	100-1000	0.2	5	T20x3/3	K20x6/3
			3.9-39.4	100-1000	0.5	12	T20x3/3	K20x6/3
			3.9-39.4	100-1000	0.7	17	T20x3/4	K20x6/3
			3.9-39.4	100-1000	1.4	35	T20x3/4	K20x6/4
			3.9-39.4	100-1000	2.8	71		K20x6/4
			3.9-39.4	100-1000	0.2	5	T26x4/3	K25x8/3
			3.9-39.4	100-1000	0.5	12	T26x4/4	K25x8/3
			3.9-39.4	100-1000	0.7	17	T26x4/4	K25x8/4
5	2200	10000	3.9-39.4	100-1000	1.4	35	T26x4/5	K25x8/4
			3.9-39.4	100-1000	3.7	93		K25x8/4
			3.9-39.4	100-1000	0.2	5	T32x5/4	K32x10/3
			3.9-39.4	100-1000	0.5	12	T32x5/4	K32x10/4
			3.9-39.4	100-1000	0.7	17	T32x5/5	K32x10/4
			3.9-39.4	100-1000	1.4	35	T32x5/5	K32x10/5
			3.9-39.4	100-1000	2.8	71		K32x10/5
			3.9-39.4	100-1000	4.7	119		K32x10/5
6	4400	20000	7.9-78.7	200-2000	0.2	5	T40x6/5	K40x12/5
			7.9-78.7	200-2000	0.5	12	T40x6/5	K40x12/5
			7.9-78.7	200-2000	0.7	17	T40x6/5	K40x12/5
			7.9-78.7	200-2000	1.4	35	T40x6/6	K40x12/5
			7.9-78.7	200-2000	2.8	71	T40x6/6	K40x12/5
			7.9-78.7	200-2000	5.7	144		K40x12/6
			7.9-78.7	200-2000	0.2	5	T65x10/5	K63x16/5
			7.9-78.7	200-2000	0.5	12	T65x10/6	
7	8800	40000	7.9-78.7	200-2000	0.7	17	T65x10/6	K63x16/5
			7.9-78.7	200-2000	1.2	30		K63x16/6
			7.9-78.7	200-2000	1.4	35	T65x10/6	
			7.9-78.7	200-2000	2.8	71		K63x16/6
			7.9-78.7	200-2000	0.2	5		K80x25/*
			7.9-78.7	200-2000	0.5	12		K80x25/*
			7.9-78.7	200-2000	0.7	17		K80x25/*
			7.9-78.7	200-2000	0.9	22		K80x25/*
8	17600	80000	7.9-78.7	200-2000	1.4	35		K80x25/*
			7.9-78.7	200-2000	0.2	5		
			7.9-78.7	200-2000	0.5	12		
			7.9-78.7	200-2000	0.7	17		
			7.9-78.7	200-2000	0.9	22		
			7.9-78.7	200-2000	1.4	35		
			7.9-78.7	200-2000	0.2	5		
			7.9-78.7	200-2000	0.5	12		
9	33000	150000	7.9-78.7	200-2000	0.7	17		
			7.9-78.7	200-2000	0.9	22		
			7.9-78.7	200-2000	1.4	35		
			7.9-78.7	200-2000	0.2	5		
			7.9-78.7	200-2000	0.5	12		
			7.9-78.7	200-2000	0.7	17		
			7.9-78.7	200-2000	0.9	22		
			7.9-78.7	200-2000	1.4	35		

\* Commercial Gear Motor

**RACO**

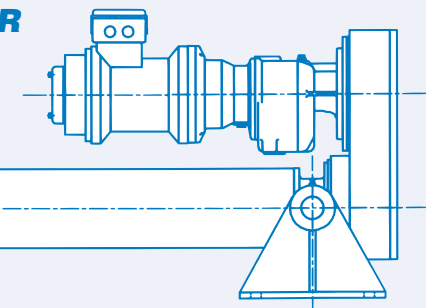
**ELECTRIC LINEAR CYLINDER**  
**TYPE "N"**  
*(driven by parallel gear motor via timing belt)*



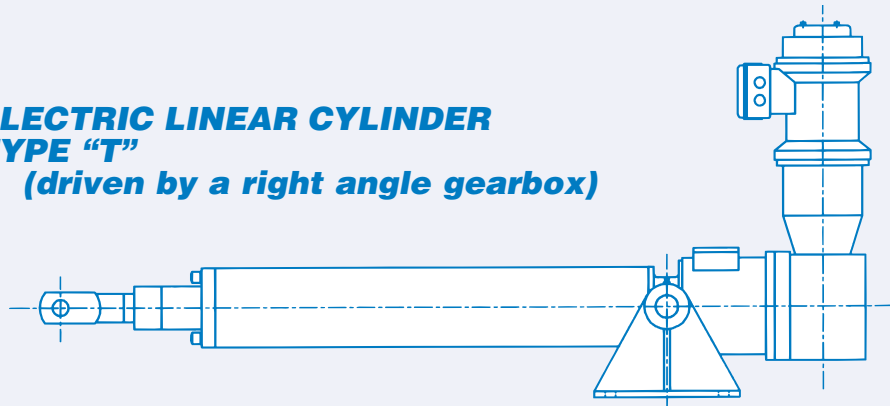
THRUST UNIT SIZE	THRUST (LINEAR FORCE)		STROKE RANGE (LINEAR TRAVEL)	
	LB	N	in	mm
3	440	2000	3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-15.7	100-400
			3.9-15.7	100-400
			3.9-15.7	100-400
			3.9-15.7	100-400
4	1100	5000	3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-15.7	100-400
			3.9-15.7	100-400
			3.9-15.7	100-400
			3.9-15.7	100-400
5	2200	10000	3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-39.4	100-1000
			3.9-15.7	100-400
			3.9-15.7	100-400
			3.9-15.7	100-400
			3.9-15.7	100-400
6	4400	20000	7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
7	8800	40000	7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
8	17600	80000	7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
9	33000	150000	7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000
			7.9-78.7	200-2000

\* Commercial Gear Motor





## ELECTRIC LINEAR CYLINDER TYPE "T" (driven by a right angle gearbox)



SPEED (LINEAR VELOCITY)		SCREW TYPE/ RACO MOTOR SIZE	
in/s	mm/s		
0.2	5	T14x2/3	
0.5	12	T14x2/3	
0.7	17	T14x2/3	
0.9	22	T14x2/3	
0.2	5		K14x6/3
0.5	12		K14x6/3
0.9	22		K14x6/3
1.9	48		K14x6/3
0.2	5	T20x3/3	K20x6/3
0.5	12	T20x3/3	K20x6/3
0.7	17	T20x3/4	K20x6/3
1.4	35	T20x3/4	K20x6/4
2.8	71		K20x6/4
0.2	5	T26x4/3	K25x8/3
0.5	12	T26x4/4	K25x8/3
0.7	17	T26x4/4	K25x8/4
1.4	35	T26x4/5	K25x8/4
3.7	93		K25x8/4
0.2	5	T32x5/4	K32x10/3
0.5	12	T32x5/4	K32x10/4
0.7	17	T32x5/5	K32x10/4
1.4	35	T32x5/5	K32x10/5
2.8	71		K32x10/5
4.7	119		K32x10/5
0.2	5	T40x6/5	K40x12/5
0.5	12	T40x6/5	K40x12/5
0.7	17	T40x6/5	K40x12/5
1.4	35	T40x6/6	K40x12/5
2.8	71	T40x6/6	K40x12/5
5.7	144		K40x12/6
0.2	5	T65x10/5	K63x16/5
0.5	12	T65x10/6	
0.7	17	T65x10/6	K63x16/5
1.2	30		K63x16/6
1.4	35	T65x10/6	
2.8	71		K63x16/6
0.2	5		K80x25/*
0.5	12		K80x25/*
0.7	17		K80x25/*
0.9	22		K80x25/*
1.4	35		K80x25/*

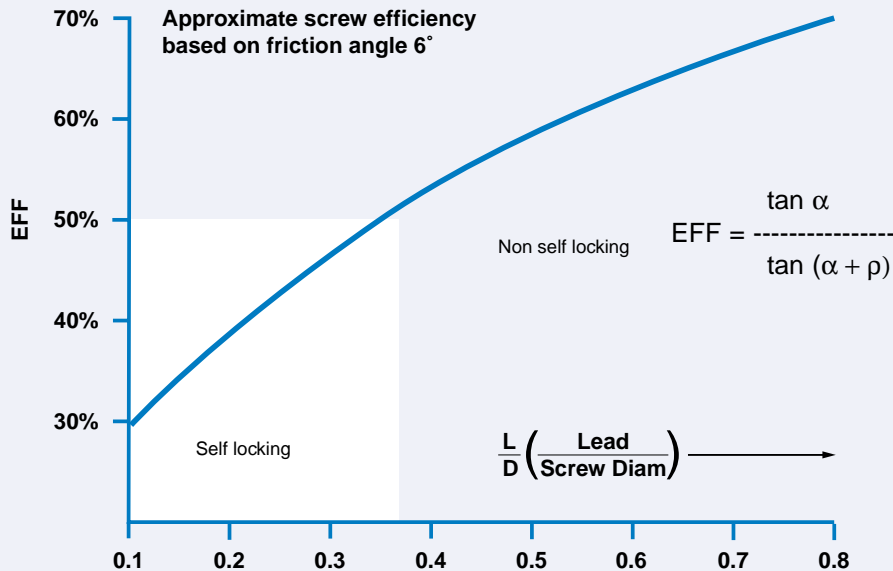
THRUST UNIT SIZE	THRUST (LINEAR FORCE)		STROKE RANGE (LINEAR TRAVEL)		SPEED (LINEAR VELOCITY)		SCREW TYPE/ RACO MOTOR SIZE	
	LB	N	in	mm	in/s	mm/s		
3	440	2000	3.9-39.4	100-1000	0.2	5	T14x2/3	
			3.9-39.4	100-1000	0.5	12	T14x2/3	
			3.9-39.4	100-1000	0.7	17	T14x2/3	
			3.9-15.7	100-400	0.2	5		K14x6/3
4	1100	5000	3.9-15.7	100-400	0.5	12		K14x6/3
			3.9-15.7	100-400	0.9	22		K14x6/3
			3.9-39.4	100-1000	0.2	5	T20x3/3	K20x6/3
			3.9-39.4	100-1000	0.5	12	T20x3/3	K20x6/3
5	2200	10000	3.9-39.4	100-1000	0.7	17	T20x3/3	K20x6/3
			3.9-39.4	100-1000	0.2	5	T26x4/3	K25x8/3
			3.9-39.4	100-1000	0.5	12	T26x4/4	K25x8/3
			3.9-39.4	100-1000	0.7	17	T26x4/4	K25x8/4
6	4400	20000	3.9-39.4	100-1000	1.4	35		K25x8/4
			7.9-78.7	200-2000	0.2	5	T32x5/4	K32x10/3
			7.9-78.7	200-2000	0.5	12	T32x5/4	K32x10/4
			7.9-78.7	200-2000	0.7	17	T32x5/5	K32x10/4
7	8800	40000	7.9-78.7	200-2000	0.2	5	T40x6/5	K40x12/5
			7.9-78.7	200-2000	0.5	12	T40x6/5	K40x12/5
			7.9-78.7	200-2000	0.7	17	T40x6/5	K40x12/5
			7.9-78.7	200-2000	1.4	35		K40x12/5
8	17600	80000	7.9-78.7	200-2000	0.2	5	T65x10/5	K63x16/5
			7.9-78.7	200-2000	0.5	12	T65x10/6	
			7.9-78.7	200-2000	0.7	17	T65x10/6	K63x16/5
			7.9-78.7	200-2000	1.2	30		K63x16/6
9	33000	150000	7.9-78.7	200-2000	1.4	35	T65x10/6	
			7.9-78.7	200-2000	0.2	5		K80x25/*
			7.9-78.7	200-2000	0.5	12		K80x25/*
			7.9-78.7	200-2000	0.7	17		K80x25/*
10	66000	300000	7.9-78.7	200-2000	0.9	22		K80x25/*
			7.9-78.7	200-2000	1.4	35		K80x25/*
			7.9-78.7	200-2000	0.2	5		K100x25/*
			7.9-78.7	200-2000	0.5	12		K100x25/*
11	132000	600000	7.9-78.7	200-2000	0.7	17		K100x25/*
			7.9-78.7	200-2000	0.9	22		K100x25/*
			7.9-78.7	200-2000	1.4	35		K100x25/*
			7.9-78.7	200-2000	0.2	5		K125x30/*
			7.9-78.7	200-2000	0.5	12		K125x30/*
			7.9-78.7	200-2000	0.7	17		K125x30/*
			7.9-78.7	200-2000	0.9	22		K125x30/*
			7.9-78.7	200-2000	1.4	35		K125x30/*

\* Commercial Gear Motor

# FORMULAS FOR CYLINDER/MOTOR SIZING

## EFFICIENCY OF THE SCREW/NUT SYSTEM

Acme screw-The Efficiency can be also fast determined from the graph below based on the L/D (lead to diameter) ratio. (For the L and D values, see "screw type" pages 6, 7, 8, and 9.)



Please note, if the efficiency approaches 0.5 (50%), the screw is not self-locking. An additional holding brake might be required, depending upon application.

Ball screw-The Efficiency of the RACO ball screws is 0.85 (85% or higher). None of the ball screws are self-locking.

## Torque Requirement To Generate a Linear Force

$$T = F \frac{D \cdot \tan (\alpha + \rho)}{2000} \text{ (Nm)}$$

$$T = F \frac{D}{2} \tan (\alpha + \rho) \text{ (Lb in)}$$

$$T = F \frac{L}{2000 \pi \text{ EFF}} \text{ (Nm)}$$

$$T = F \frac{L}{2 \pi \text{ EFF}} \text{ (Lb in)}$$

## Power Requirement For Steady Motion

$$P = \frac{F \cdot V}{10^6 \text{ EFF}} \cdot S \text{ (kw)}$$

$$P = \frac{F \cdot V}{6600 \text{ EFF}} \cdot S \text{ (hp)}$$

$$P = \frac{T \cdot \text{RPM}}{9550} \cdot S \text{ (kw)}$$

$$P = \frac{T \cdot \text{RPM}}{63025} \cdot S \text{ (hp)}$$

## Linear Velocity of the Rod

$$V = \text{RPM} \frac{L}{60} \text{ (mm/s)}$$

$$V = \text{RPM} \frac{L}{60} \text{ (in/s)}$$

## Reflected Load Inertia

$$J_L = \frac{M \cdot L^2}{10966} \text{ (kgm}^2\text{)}$$

$$J_L = \frac{W \cdot L^2}{39.48} \text{ (Lb in}^2\text{)}$$

## Screw Inertia

$$J_s = \frac{\pi \cdot D^4 \cdot \ell}{4.1 \times 10^{12}} \text{ (kgm}^2\text{)}$$

$$J_s = \frac{\pi \cdot D^4 \cdot \ell}{112.68} \text{ (Lb in}^2\text{)}$$

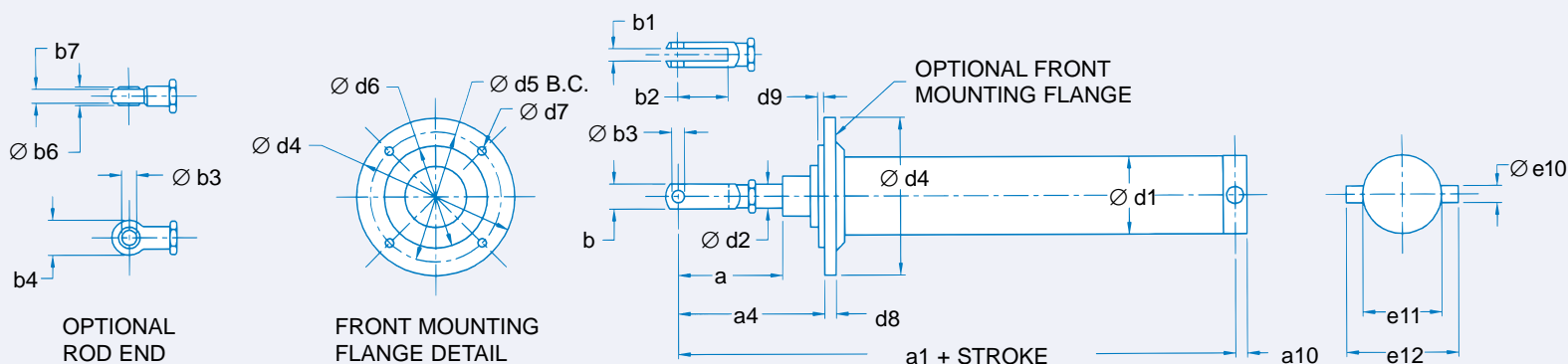
## Terms and symbols used in the calculation formulas

**L-mm/rev (in/rev)** Lead, amount of linear travel per revolution  
**D-mm (in)** . . . . . Screw diameter  
 $\alpha - ^\circ$  . . . . . Lead angle ( $\tan \alpha = \frac{L}{\pi D}$ )  
 $\rho - ^\circ$  . . . . . Friction angle (For the RACO Acme Screw  $\rho \approx 6^\circ$ )  
**EFF-(.xx)** . . . . . Efficiency of the screw  
**F-N (Lb)** . . . . . Linear force (thrust)  
**T-Nm (Lb in)** . . . Required driving torque to generate "F"  
**V-mm/s (in/s)** . . . Linear velocity  
**RPM-rev/min** . . . Screw rotational speed  
**J-kgm<sup>2</sup> (Lb in<sup>2</sup>)** . Inertia  
 $\ell$ -mm (in) . . . . . Screw length  
**M-kg** . . . . . Load mass  
**W-lb** . . . . . Load weight  
**S** . . . . . Service factor for motor sizing  
**P-kw (HP)** . . . . . Power

**\*NOTE:** Left hand side formulas use metric units. The right side formulas use English units.

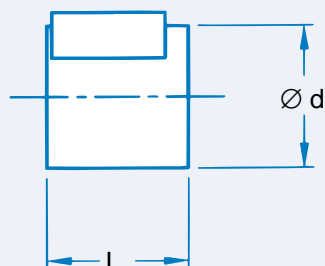
# DIMENSIONS

## THRUST UNIT



UNIT SIZE																		
	3		4		5		6		7		8		9		10		11	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
a	3.31	84	5.197	132	4.72	120	7.01	178	7.2	183	7.48	190	9.65	245	17.44	443	17.44	443
a1	8.4	213.36	13	330.2	14	355.6	18.5	470	21.4	543.56	22.9	581.66	26.75	679.5	35.8	909.32	41.3	1049.02
a4	4.488	114	7.28	185	7.52	191	10	254	10.51	267	11.02	280						
a10	0.55	14	.055	14	.709	18	1.063	27	1.89	48	3.52	89.5	6.69	170	9.19	233.5	9.84	250
b	.787	20	1.26	32	1.575	40	2.165	55	3.15	80								
b1	.40	10.2	.65	16.5	.787	20	1.10	28	1.26	32								
b2	1.575	40	2.5	63.5	1.575	40	2.2	56	2.36	60								
b3	.394	10	.63	16	.787	20	1.102	28	1.59	40.5								
b4	1.139	29	1.5	38	2.42	61.5	2.869	73	4.61	117	4.61	117	6.06	154	9.06	230	10.43	265
b5	.394	10	.63	16	.984	25	1.18	30	1.969	50	1.97	50	2.76	70	3.937	100	4.331	110
b6	.55	14	.825	21	.787	20	.866	22	1.575	40	1.58	40	2.17	55	2.76	70	3.15	80
b7	.415	10.5	.563	14.3	.629	16	.75	19	1.457	37	1.46	37	1.93	49	2.76	70	2.76	70
d1	2.955	75	3.94	100	4.5	114	5.5	140	7.087	180	8.66	220	9.65	245	11.73	298	12.76	324
d2	.85	21.6	1.165	29.6	1.480	37.6	1.953	49.6	2.362	60	3.819	97	6.102	155	6.890	175	6.890	175
d4	5.51	140	7.87	200	7.87	200	9.843	250	11.81	300	13.78	350						
d5	4.53	115	6.5	165	6.5	165	7.91	201	10.43	265	11.81	300						
d6	3.74	95	5.118	130	5.118	130	7.09	180	9.06	230	9.84	250						
d7	.354	9	.43	11	.512	13	.512	13	.55	14	.71	18						
d8	.394	10	.59	15	.59	15	.63	16	.787	20	.787	20						
d9	.118	3	.118	3	.118	3	.157	4	.157	4	.197	5						
e10	.868	22	.868	22	1.181	30	1.575	40	1.575	40	1.969	50	2.756	70	3.937	100	4.331	110
e11	3.94	100	3.94	100	6.89	175	6.89	175	7.87	200	9.65	245	12.99	330	16.54	420	18.11	460
e12	5.5	140	5.5	140	9.25	235	10.04	255	11.02	280	13.58	345	18.5	470	24.41	620	27.56	700

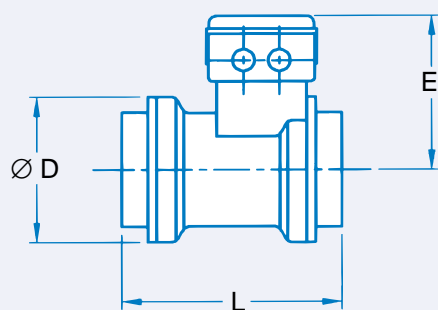
## COUPLING HOUSING



UNIT SIZE						
3/4			5/6/7		8	
	in	mm	in	mm	in	mm
Ød	3.937	100	6.693	170	7.874	200
L*	3.937	100	7.09	180		

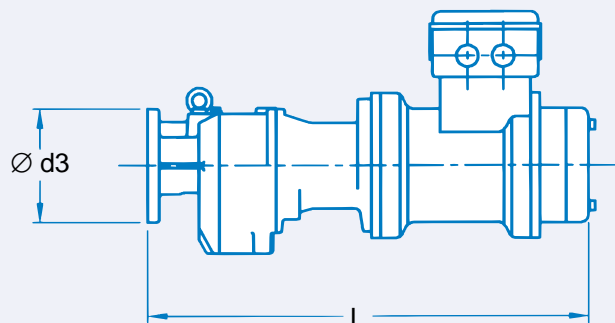
\*NOTE: Lengths vary with gearbox selection.

## MOTOR



MOTOR SIZE				
	3/4		5/6/7	
	in	mm	in	mm
ØD	5.04	128	6.74	171
L	8.43	214	11.18	284
E	5.24	133	5.91	150

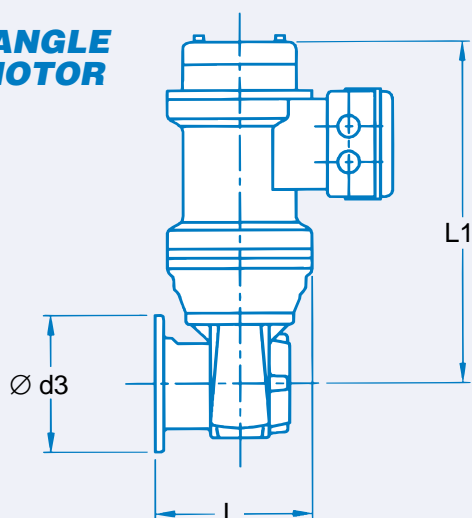
## PARALLEL GEAR MOTOR



MOTOR SIZE				
	3/4		5/6/7	
	in	mm	in	mm
Ød3	4.72	120	6.3	160
L*	15.6	396	19.5	495

\*NOTE: Lengths vary with gearbox selection.

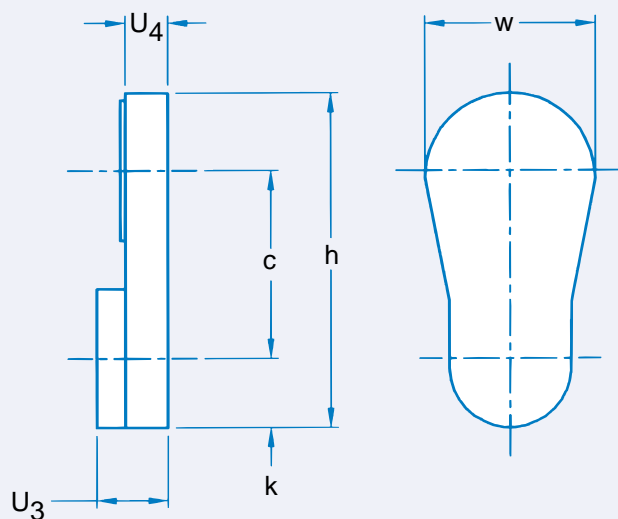
## RIGHT ANGLE GEAR MOTOR



MOTOR SIZE				
	3/4		5/6/7	
	in	mm	in	mm
Ød3	4.72	120	6.3	160
L*	5.6	142	8.2	208
L1*	13.5	343	18.58	472

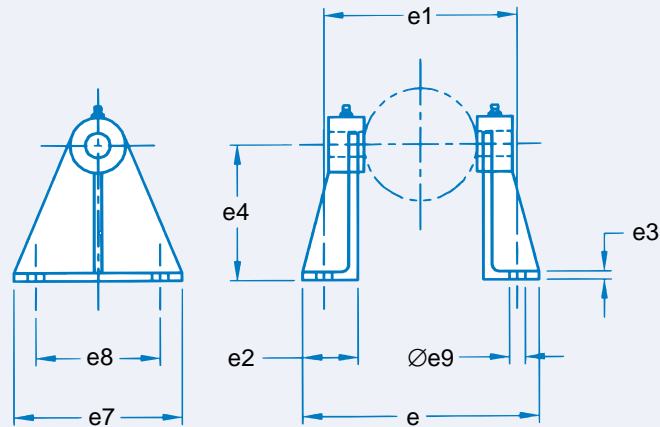
\*NOTE: Lengths vary with gearbox selection.

## "C" DRIVE HOUSING



UNIT SIZE						
	3/4		5/6/7		8	
	in	mm	in	mm	in	mm
c	6.1	155	7.87	200	13.5	343
h	11.57	294	15.9	405	22.83	580
w	5.90	150	8.26	210	9.37	238
U <sub>3</sub>	2.9	73	4.57	116	5.71	145
U <sub>4</sub>	1.85	47	3.52	90	5.71	145

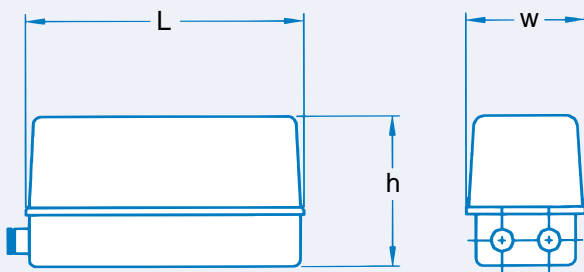
## TRUNNION BRACKETS (Optional)



UNIT SIZE																		
	3		4		5		6		7		8*		9*		10*		11*	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
<b>e</b>	8.268	210	8.268	210	11.22	285	12.8	325	13.78	350	16.34	415	21.65	550	27.56	700	30.71	780
<b>e1</b>	6.65	169	6.65	169	9.65	245	10.43	265	11.42	290	13.976	355	11.81 19.69	300 500	15.75 25.20	400 640	17.72 27.95	450 710
<b>e2</b>	1.988	50.5	1.988	50.5	1.97	50	2.756	70	2.756	70	3.15	80	5.91	150	7.09	180	7.874	200
<b>e3</b>	.363	9.2	.363	9.2	.315	8	.472	12	.472	12	.512	13	.335	8.5	.91	23	1.26	32
<b>e4</b>	4.71	120	4.71	120	4.72	120	6.34	161	6.34	161	7.87	200	10.24	260	11.81	300	13.78	350
<b>e7</b>	5.9	150	5.9	150	5.9	150	10.236	260	10.236	260	9.45	240	12.6	320	15.75	400	15.75	400
<b>e8</b>	4.33	110	4.33	110	4.33	110	7.87	200	7.87	200	3.937 7.087	100 180	10.24	260	12.6	320	12.6	320
<b>e9</b>	.55	14	.55	14	.55	14	.709	18	.709	18	.709	18	.91	23	1.02	26	1.3	33

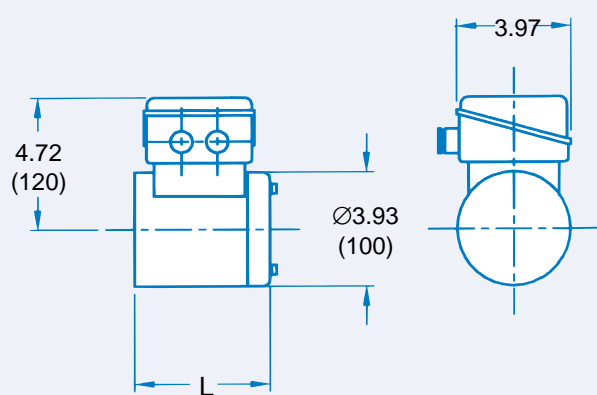
**\*NOTE:** Brackets have four mounting holes each spaced as specified.

## LATERAL ACCESSORY HOUSING "D", "E"



	D		E	
	in	mm	in	mm
<b>L</b>	9.7	246	14.6	371
<b>h</b>	5.2	133	5.3	134
<b>w</b>	4.15	105.4	4.7	120

## REAR ACCESSORY HOUSING "A", "B", "C"



	A		B		C	
	in	mm	in	mm	in	mm
<b>L</b>	5.10	130	6.50	165	9.06	230

## BRAKE

**NOTE:** The brake is mounted to the rear of motor. Depending on brake type and size selection add 3 to 5 in. to the motor, gearmotor "L" dimension. Call factory for more details.



# STANDARD/OPTIONAL EQUIPMENT

	Standard	Optional
Fork Type Front Clevis (Standard on sizes 2-7)	X	
Spherical Rod End (Standard on sizes 8-11)		X
Trunnion Mounting Pins	X	
Trunnion Mounting Brackets		X
Rigid Foot Mount for T.M. Brackets		X
Rear Clevis Mounting (Only certain models, consult factory)		X
Flange Mounting (Consult factory)		X
Hand Wheel		X
Hand Wheel with Disengaging Mechanism and Elec. Interlock Switch		X
Flexible Rod Covers		X
Solid Rod Covers		X
High Temp Rod Covers		X
Wiper Seal in Front Cap	X	
Double Wiper Seal in Front Cap		X
High Temperature Wiper Seal in Front Cap		X
High Temperature Lubricant		X
Stainless Steel or Hard Chrome Plated Thrust Tube	X	
Weather Proof Cylinder (NEMA 4 Equivalent /IP54)	X	
Weather Proof Motor (TENV/IP54)	X	
Class "F" Motor Insulation	X	
Class "H" Motor Insulation		X
Tropical Proof Corrosion Protection Package		X
Explosion Proof (Commercial Motor UL. Approved)		X
Motor Thermal Switches	X	
Motor Thermistor Sensors (Standard with RPM4/RPM5/RPM6)		X
RACO Motor Warranty 2 years (4 years with RPM4/RPM5/RPM6)	X	

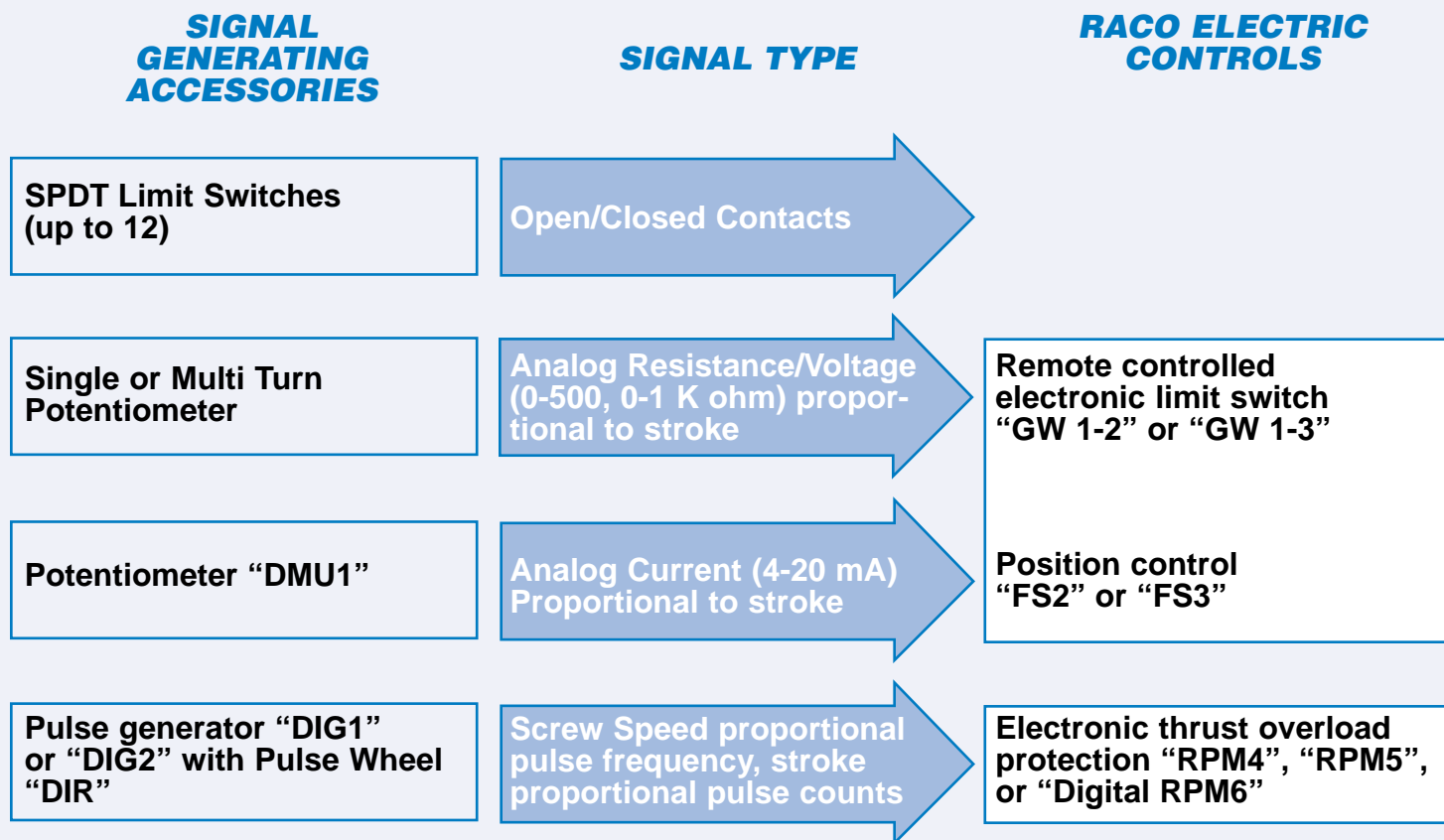
# ACCESSORY HOUSING/ACCESSORIES

INSTALLATION OF ACCESSORIES				
Accessory Housing	Accessories which can be installed	Accessory Housing	Accessories which can be installed	These accessories can be added to D and E
A	1 pr. SPDT stroke limit switches 2 pr. SPDT stroke limit switches 1 Potentiometer 1 Electronic position emitter 4-20mA DMU1	D	1 pr. SPDT stroke limit switches 1 pr. SPDT switches + pot 2 pr. SPDT switches 1 Multi-turn pot	1 Pulse transmitter for RPM4, RPM5, RPM6 or pulse feedback signal
B	1 pr. SPDT switches + pot 1 pr. SPDT switches + tandem pot 1 pr. SPDT switches + DMU1 1 Multi-turn pot	E	1 pr. SPDT switches + DMU1 2 pr. SPDT switches + tandem pot 2 pr. SPDT switches + pot 2 pr. SPDT switches + tandem pot 2 pr. SPDT switches + DMU1 3 pr. SPDT switches 3 pr. SPDT switches + pot 3 pr. SPDT switches + tandem pot 3 pr. SPDT switches + DMU1	
C	2 pr. SPDT switches + pot 2 pr. SPDT switches + tandem pot 2 pr. SPDT switches + DMU1 3 pr. SPDT switches 3 pr. SPDT switches + pot			
F COUPLING HOUSING	1 Pulse transmitter for RPM4,RPM5 or RPM6 or for pulse feedback signal			
Accessory housings D and E, mounted onto motor or coupling housing will also be used to install integral reversing motor starters (optional) including transformer, heater, and terminal blocks. In this case, SPDT limit switches will be pre-wired directly to motor starters. All accessory housings are equipped with 1/2" flexible conduit fitting.				
One pair SPDT stroke limit switches is standard, all other accessories are optional.				

# ACCESSORIES, ELECTRIC SWITCHES, FEEDBACK SIGNALS, ELECTRONIC CONTROLS

RACO International offers a wide variety of optional accessories such as built in limit switches, position output signal generating devices, electronic thrust controls, position controls electronics, etc. Utilizing these optional accessories, a remote and automatic control of the RACO Electric Linear Cylinder

is easily accomplished. Using the position output signals from the cylinders, they can also be connected into an appropriate existing control system, such as PLC or computer. (For more details about the listed accessories contact factory.)



## INPUT CONTROL DEVICE

Manual dial position controller "SG2" to select 0-100% stroke

## VISUAL MONITORING DEVICE

Analog Position Indicator "IA 72" to visualize 0-100% stroke

**NOTE:** A wide variety of other customer specified signal generating devices, controls and displays are available.

# **RACO ELECTRIC ACTUATORS FOR TODAY'S INDUSTRY**

*Other Products Offered By RACO*

## **RACO LM RACO 2060**

### **RODLESS CYLINDERS**

- Acme, Ballscrew or Synchronous Belt Type
- Carriage on Slides or Wheels
- Speeds up to 400 in/sec.
- Strokes in excess of 40 ft.
- Thrust up to 4500 lb.
- Servo, Stepper, AC or DC Motor Driven
- Custom Controls and Systems

## **RACO Compact**

- Smaller installed envelope size
- Thrust capacities to 9000 lbs.
- Standard stroke lengths to 23.6 inches
- Ball or acme power screw thread configuration
- Multiple leads available in every size to optimize motor / reduction / output speed capability
- Complete line of standard controls and options
- ISO 9001 Manufacturing
- Typical delivery 2-3 weeks

## **RACO RM**

- Available in seven sizes to 10,000 lb-ft of torque
- Fractional or multiple turn rotations
- Output speeds thru 90 degrees in 1 to 30 seconds
- Hollow or solid shaft output
- Adjustable rotation limit switches
- Analog or digital position feedback
- Electronic torque control
- Modular design allows custom solutions



### **RACO International, Inc.**

3350 Industrial Blvd.  
Bethel Park, PA 15102  
(888) BUY-RACO (888) 289-7226  
Ph: (412) 835-5744  
Fx: (412) 835-0338  
email: [raco@racointernational.com](mailto:raco@racointernational.com)  
Home page: [www.racointernational.com](http://www.racointernational.com)