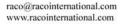


RACO International, L.P. Bethel Park, PA

(B)

INTERNATIONAL, L.P.

100



RACO Introduction



History of RACO

- **Founded over 60 Years ago in Germany**
- **The Roots are in the Coal Industry**
- Grist Actuators where used for:
 - Door Locks
 - **Coal Chutes**



Unit train Loading Facility with SM2 Actuator

- Gates for Loading and Unloading of Coal
- **Diverter Gates**

SM2 Actuator

Control Contro

INTERNATIONAL, L.P.

RACO Introduction



History of RACO

- Since over 50 Years in the USA, Bethel Park
- Over the Decades Business has spread into a wide Area of Industries:
 Aggregates: Coal, Gravel, Copper, Ore, Organic Compounds
 Material Handling: Gates, Flop Gates, Diverter Gates
 Automation: Machine Components, Press Applications, Positioning
 Marine: Moveable Bridges, Lock and Dam, Flood Control
 Transportation: Monorail, People Mover,
 Government: DOT, DOD, DOE, NASA,
 And still Supporting the Coal Industry with Reliable Actuators



Modular Actuator MA



Main Features of MA Actuators

- Heavy Duty
 Eight Sizes Available (4 to 11)
 From 550 lbs to 225,000 lbs
- Stroke from 3.9" to 263"
- Five Arrangement Types A, C, N, M, T
- Huge Selection of Accessories
- ☞ Temperature Range from -40°F to 180°F
- Explosion Proof Version Available
- Pure Electro-Mechanic, no Fluids
- Anti Rotation Device, Standard in all Actuators
- Environmentally Friendly
- High Energy Efficient



Compact Actuator



Main Features of Compact Actuators

- Shortest Overall Dimension by Longest Stroke
- Four Sizes Available (2, 4, 6, 7)
- From 112 lbs to 9,000 lbs
- Speed from 0.08"/sec to 3.5"/sec
- Stroke from 3.9" to 39.3"
- Four Arrangement Types A, C, N, M
- Huge Selection of Accessories
- Temperature Range from -4°F to 150°F



Rotary Actuator



Main Features of Rotary Actuator

- Seven Sizes from 300 to 10,300 lb-ft
- I/4, 1/2, 3/4, Full, Multiple or Custom Turns
- Speed from 1 to 30 sec for ¼ turn
- Rugged Flange Mounting Standard
- Hollow or Solid Output Shaft
- Standard Configuration Features the RACO Motor
- Other Motors (DC, Servo) Available
- Full Range of Position Feedback Devices:
- I. Limit Switches
- 2. Potentiometer
- 3. Electronic Digital Positioning, EPS 02 / 06
- Temperature Range from -40°F to 180°F
- Explosion Proof Version Available
- Environmentally Friendly
- High Energy Efficient



Linear Modules LM



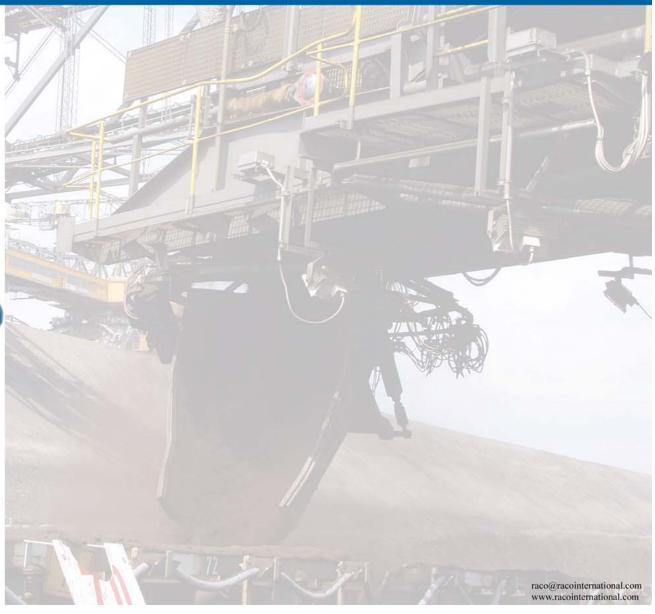
Main Feature of LM Actuators

- Two Sizes LM 3 & LM 4
- Extremely Fast, up to 200 inch/sec
- Loads up to 800lbs, Side Loads 400lbs
- Stroke Length up to 240" without Splice
- Extremely Durable, > 1,000,000 Cycles
- Repeatability of +/- 0.003"
- Steel Cord Reinforced Belt
- Delrin Tires on Ball Bearing
- Temperature Range from -5°F to 185°F
- Flexible Arrangement in X, XX, XXY, XXYYZ



Modular Actuator MA

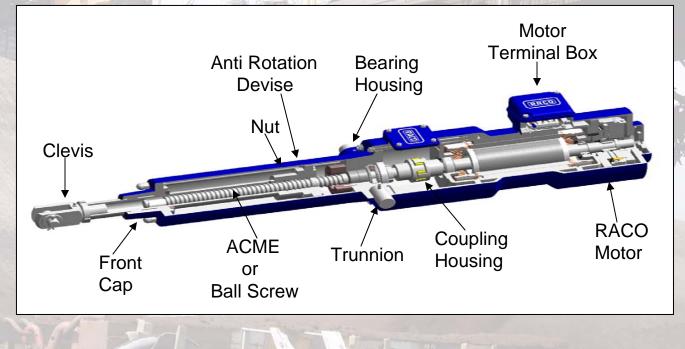






ACME Screw

The rotational energy, produced by the electric motor, will be converted into a linear movement by the ACME or Ball Screw installed within the thrust unit. ACME screws are typically self-locking. Based on a low lead selection and the resulting large surface area between the nut and the screw provides a robust power transfer assembly and a high capability for shock loading. Static loads, which can always be higher than the nominal thrust, can be safely maintained in all positions.





ACME Screw Spring Loaded Nut Housing

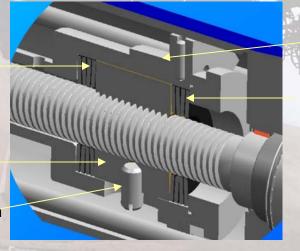
- Large Surface Area between Nut and Screw
- Self Locking
- High Static Load
- Excellent Shock Resistance
- Hammer Blow Feature
- Adjustable Spring Package, front / back

Hammer Blow Pin

Front Spring Package

ACME Nut

Hammer Blow Pin



Nut Housing

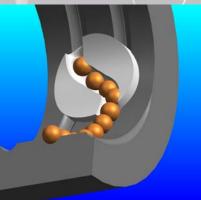
Rear Spring Package



Ball Screw

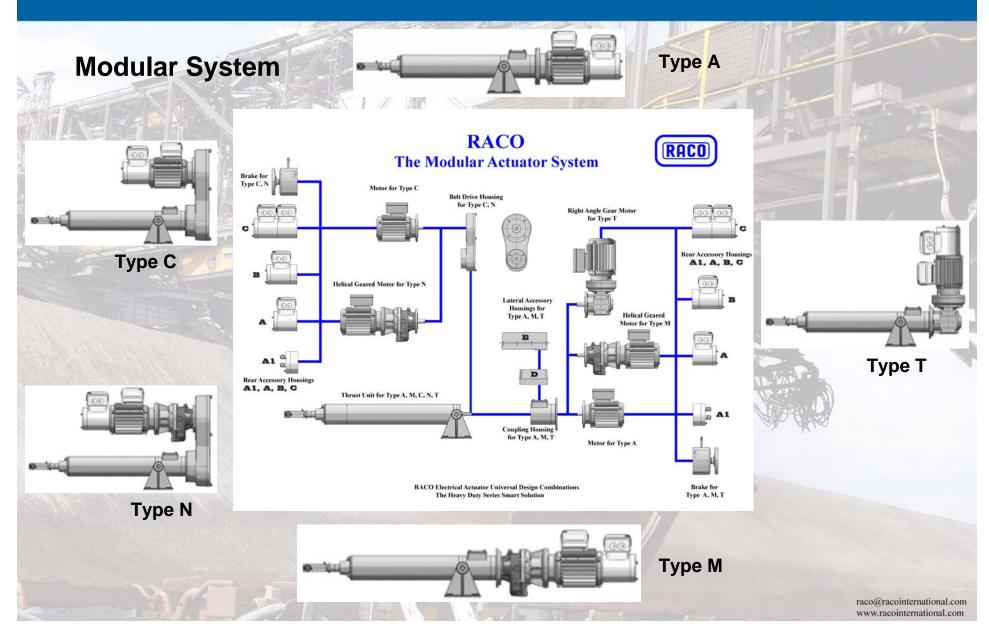
Inherent to the Ball Screw design, the contact between the ball nut and the ball screw are point to point connections provided by a number of re-circulating high precession balls. The rolling friction of the balls is extremely low compared to the temperature range, smaller drive motor, starter and infrastructure due to the high efficiency, and an extremely high position accuracy and repeatability. In combination with a spring package, counter weight or other means which would provide a source of stored energy, a defined failsafe position can be obtained in case of a electrical power loss or other mechanical interruption or failure.

Very High Accuracy
High Efficiency, >=95%
Long Life
High Speed
Internal Ball Return



RACO Ball Nut with Internal Cross Over Ball Return

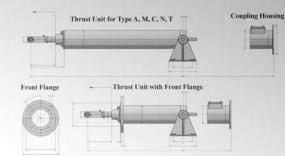




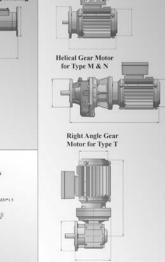


Modular System

RACO ACTUATOR DIMENSIONS



Trunsion Brackets Trunsion Prace Trunsion Pr



Motor for Type A & C

Bell Drive Housing for Ty

Front Clevis & Rod Eye

21 I H

ATTEN B

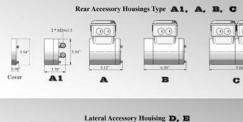
- for

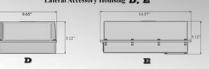
RACO

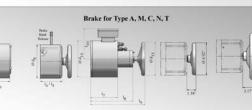
RACO

Belt Drive Housing for Type C, N

RACO ACTUATOR DIMENSIONS





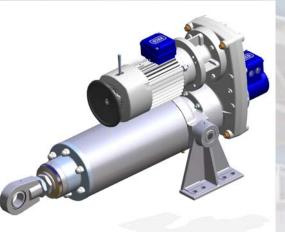


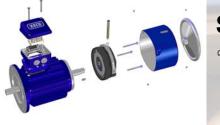
Page 3 of 5



RACO Motors

Standard RACO AC Motor
3 Phase, 60 Hz, 230VAC or 460VAC
Pole: 2, 4, 6, 8
Frame Size: 63, 72, 80, 90, 100, 132
From 0.1kW to 6.6 kW





Special Features:

Suitable for Adaptable Accessories as Brake, Hand Wheel, Limit Switches, Analog Position Encoder, Thrust Overload Protection...

Hand Wheel Disengage with Interlock Brake Release

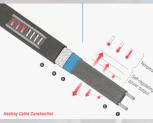


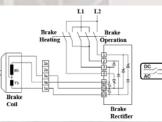
RACO Motors

Motor Heater: Imbedded Resistive Winding Heater Self Regulating Heating Tape Reduced 2 Phase Motor Voltage

Brake Heater: Brake Rectifier Self Regulating Heating Tape

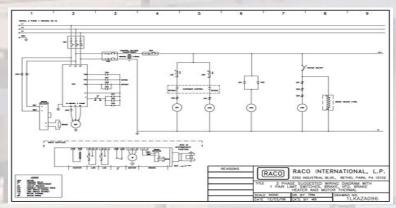
Compartment Heater: Self Regulating Heating Tape Space Heater





Heating Tape

Brake Rectifier



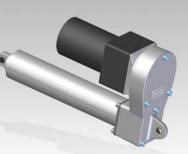
Reduced Voltage

RACO Motors

RACO Smart Motor:
On Board VFD & Processor Board
Internal PID Position Control
Variable Speed & Position Setpoint
Up to 16 Binary Position Setpoints
One Analog Position Setpoint
One Analog Speed Setpoint



RACO DC Motor: 12V & 24V with Electronic Position Limit Switches







Mounting Accessories

- Trunnion Brackets
- Cardanic Trunnion Mount
- **Front Flange**
- Rear Eye
- Clevis
- Spherical Rod Eye
- Threaded Male Stud
- Trunnion Cradle Mount
- Spring Loaded Front Clevis









raco@racointernational.com www.racointernational.com



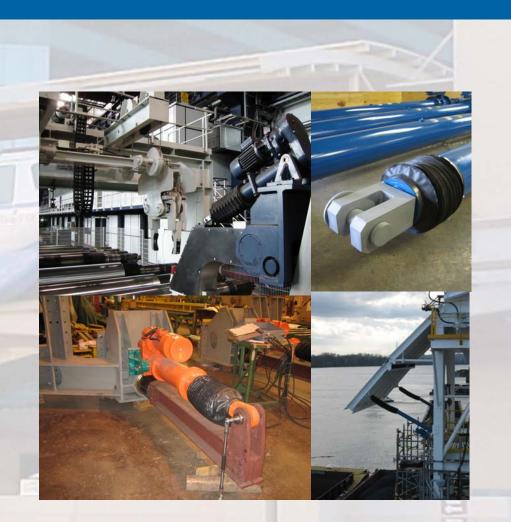
Rod Cover

Features:

- Neoprene/Nylon -40°F to185°F
- ☞Teflon/Fiberglas -40°F to 300°F
- Flexible Accordion
- Air Breather
- Solid PVC Rod Cover
- Stainless Steel Rod Cover

Function:

Protection against dust, rain, salt water, ice buildup, varmints, radiant heat, water run off, mechanical protection of thrust tube and wiper seal, ...





Movable Bridge Actuators

Standard Features:

Marine Type Coating (Macropoxy 646) Inner Corrosion Paint Sealed Joints and Connections Double Front Cap Seal & Ice Wiper Synthetic Long Life Lubrication (Exxon Mobile SHC 460)

Brake Motor with Disengage Hand Wheel Nut Housing with Belville Springs Large Terminal Boxes & Accessory Housing with Compression Fittings

Optional Features: Rod Cover Motor / Brake & Compartment Heater







OVER STROKE PROTECTION !

NEW

Rear Absorber

K1R10 Ballscrew Actuator

Nominal Force: 112,500 lbs. Nominal Speed: 0.7"/sec. Nominal Stroke: 15.7"

RACO's:

High Performance Elastomer Impact Shock Absorbing Rings. The Ultimate Equipment Protection for Accidental Over Travel.



OVER STROKE PROTECTION !

NEW

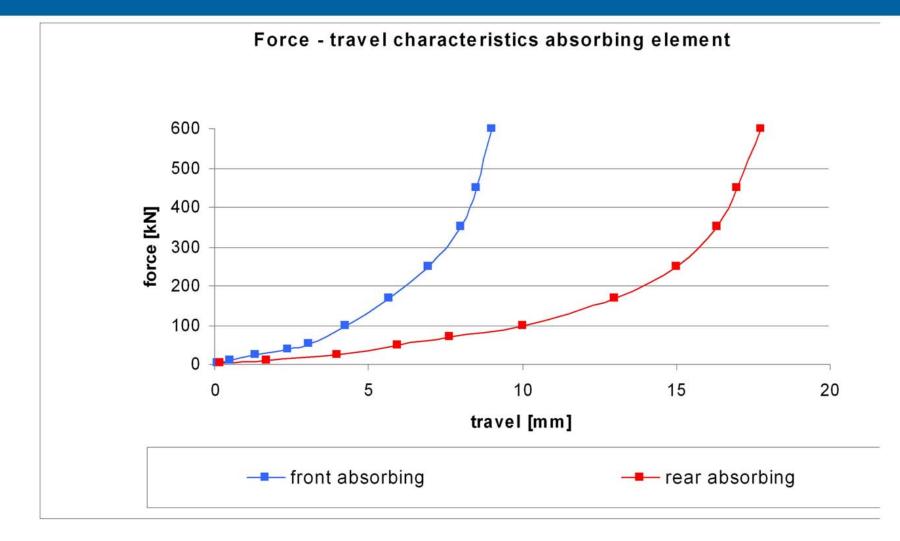
Features:

- * High tear resistance
- * High impact resilience
- * Reduced compression set
- * Almost constant shear modulus
- * Reduced temperature dependence
- * Excellent dynamic resistance to wear
- * Good resistance to UV-radiation, ozone, fats & oils

K1R10 Ballscrew Actuator

Nominal Force: 112,500 lbs. Nominal Speed: 0.7"/sec. Nominal Stroke: 15.7" Front Absorber



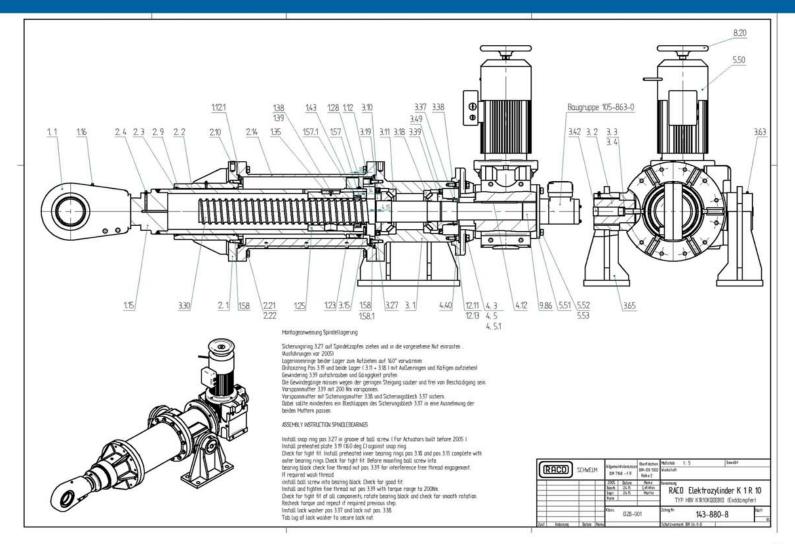






PHYSICAL PROPERTY	UNIT	HARDNESS				
Hardness A		80	90	95	-	-
Hardness D				50	60	75
100% Modulus	PSI	680	1000	2200	3700	5000
300% Modulus	PSI	1050	1700	4100	6500	-
Tensile Strength	PSI	3000	4100	6500	7000	7500
Ultimate Elongation	%	550	450	350	310	230
Split Tear	PLI	65	65	125	115	145
Die C Tear	PLI		370	500	630	950
Resilience	%	57	50	42	42	
Compression Set (24 Hours at 70C	%	29	25	32	28	-
Compressive Modulus	PSI					
5%		135	210	500	1000	2300
10%		220	350	840	1600	3950
15%		308	490	1200	2200	5100
20%		415	680	1650	3000	6000
25%		572	940	2100	4000	8000
Brittle Point	F	-	-94	-94	-94	-94
Specific Gravity		(<u>4</u>	1.08	1.13	1.16	1.2





Products Compact Actuator





Products Compact Actuator



Compact Actuator

Design:

- Equipped with ACME or Ball Screw
- Front and Rear Eye Mount
- Trunnion Bracket Mount
- Clevis or Rod Eye
- Standard Configuration Features the RACO Motor
 - with all Accessories
- Other Motors Available (Servo, DC, Stepper,...)
- Permanently Lubricated
- Anti Rotation Device, Standard in all Compact Actuators



Products Compact Actuator



Compact Actuator

Applications:

- Laminate Press & Handling
- Stacking, Loading & Un-Loading
- Industrial Parts Material Handling
- Security, Fire, Paint Chamber Door Lock and Opening Actuator
- Food & Beverage Filling, Mixing, Sorting
- Building Window Ventilation, Shading
- Pallet Handling, Packaging
- Manipulator, Material Handling, Lift Assist
- Conveyor Belt / Roll Steering
- General AGV, Automated Guided Vehicle
- Test Labs, Furniture, Automotive, Appliances





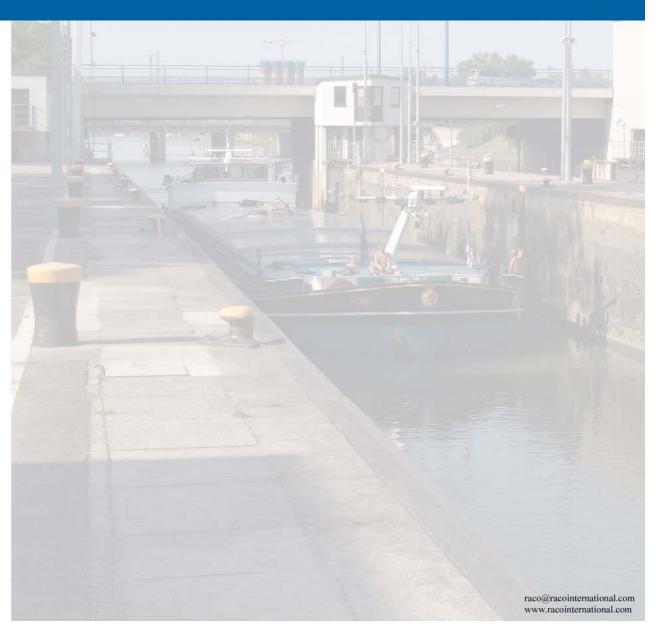


Products Rotary Actuator



Rotary Actuator





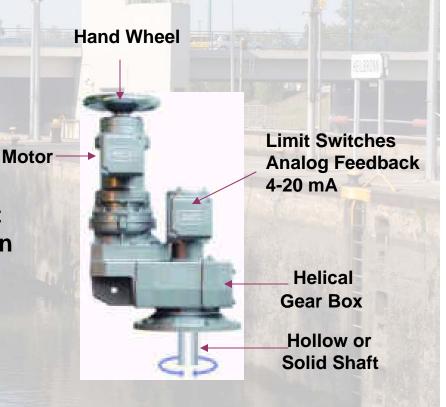
Products Rotary Actuator



Rotary Actuator

Main Features:

- Output Torque from 300 to 10,300 lb-ft
- Speed from 1 to 30 sec for 90° Rotation
- Configurable Rotation 90°, 180°, 360°,
 Multi Turn or Custom Selection
- Hollow or Solid Shaft Output
- Standard RACO Motor Accessories Available
- Flange Mounting Standard
- Environmentally friendly



Products Rotary Actuator



Applications:

Air Volume, Intake, Exhaust, Pressure, Flow Control Diverter Gates Water Valves / Gates Rack & Pinion Butterfly Valves Turn Tables Turrets



Flow Valve Rack & Pinion



Louver

Air Damper

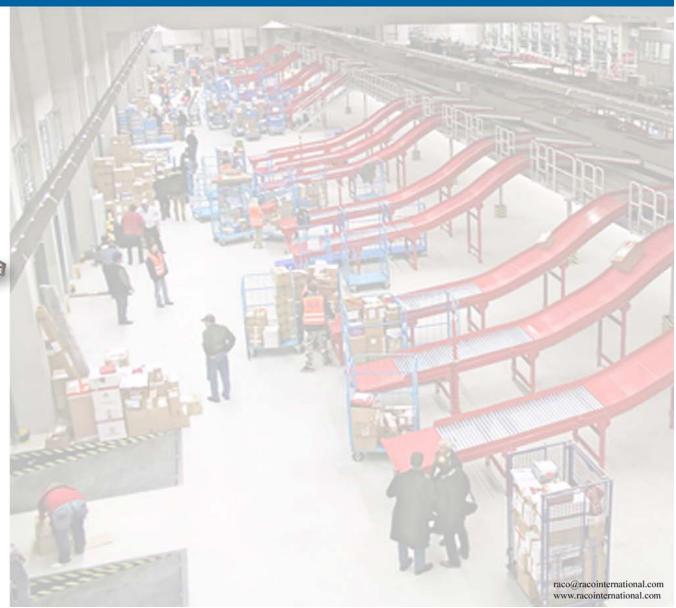






Linear Modules LM



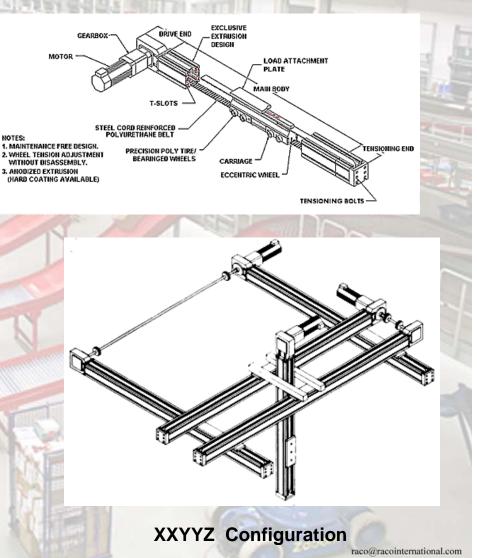




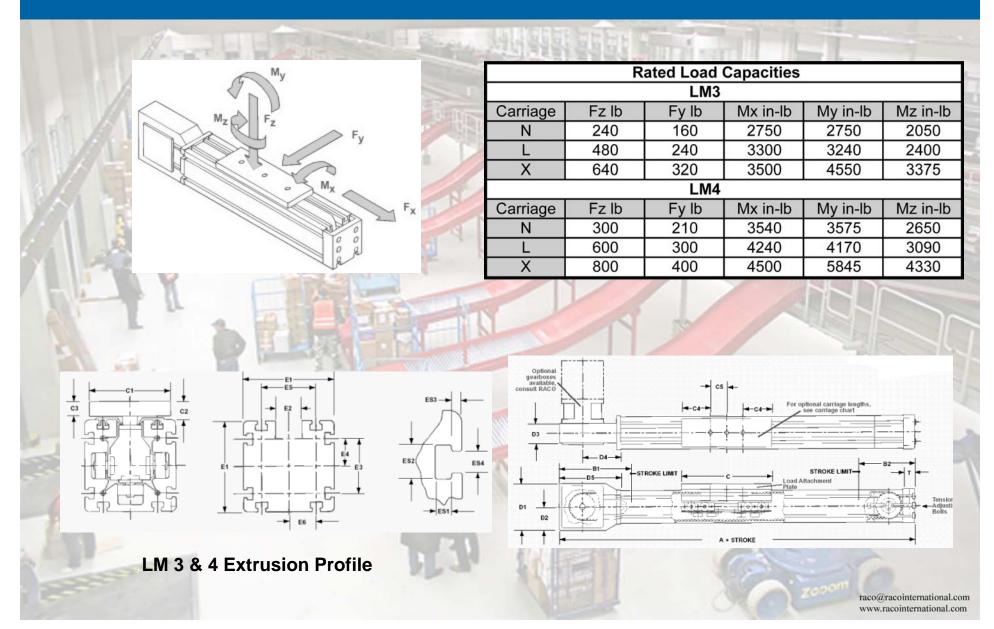
LM 3 & LM 4

Main Components:

- CM 3 & LM 4 Precision Extrusion Alloy 6063
- Carriage with 12, 18, 24 Rollers
- Ball Bearing with Delrin Tires
- Load Attachment Plate
- Steel Cord Reinforced Belt
- Zero Backlash Pulley
- Tension End
- Drive End
- Attachment to Gearbox, Planetary Gearbox, or direct Drive Motor









Main Applications: Material Handling Work Cell Applications Testing Sorting & Stacking Packaging Spray & Painting Plywood **Edge Rigidizing Fire Retardant** Logo Silk Screening Glass Cutting **Edge Flaming Emulsion Spraying** Textile, Bolt Rollout Welding Guide











Drive Wheel

is in almost perfect shape.

NO Maintenance



TESTING TECH. SPECS. Weight on carriage: 250 LBS Carriage Speed: 31 inches/sec Accelleration/Deceleration: 300 inches/sec² Stroke: 86.5 inches Cycle Time: 8.2 seconds Pulley Speed: 183.3 RPM Pulley Diameter: 3.258 inch Gearbox Ratio: 3:1 Motor Speed: 550 RPM VFD Frequency: 20 Hz

> Has hit 2 Million cycles!!

AFTER 2 MILLION CYCLES OR 4 MILLION STROKES, TRAVELING 5,461 MILES OR 346 MILLION INCHES

TEST RESULTS ARE IN....

The Belt

dirty from grease and dust but teeth in very good condition.

Continuous Duty









Systems Components

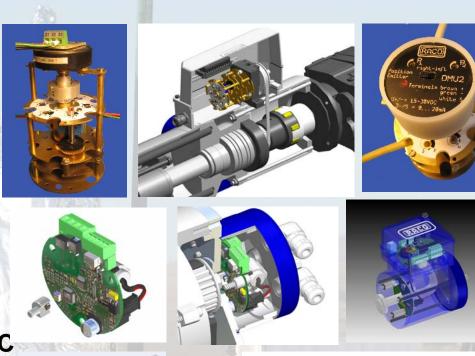


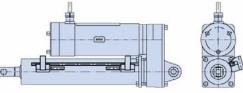
Electrical Accessories

- Mechanical Limit Switches Up to 6 pair
- Analog Potentiometer
 0 to 10V DC
- Analog 4-20mA, DMU2
- Electronic Limit Switch, EPS02
 One Pair, Relay Contacts
- Electronic Limit Switch, EPS06

 One Pair, Relay Contacts
 Three Pair, Open Collector 24VDC
 Analog 4-20mA, 0-10VDC
 PWM, Encoder A&B
 Thrust Overload Protection

 Proximity Switches



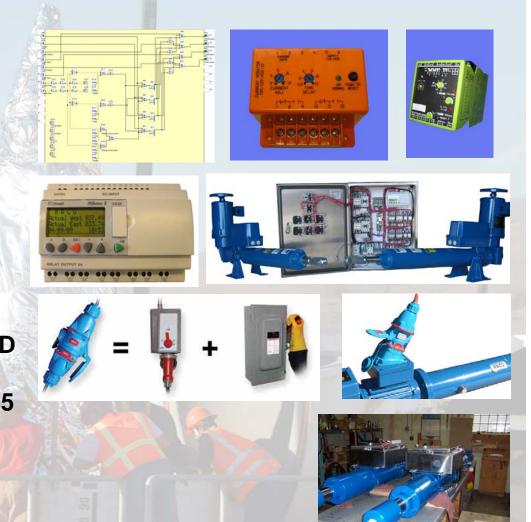


Systems Components



Electrical Accessories

- Thrust Overload Protection Current Monitoring Power Monitoring
 Position Controller Single Actuator
 - Synchronized Movement Electrical Engineering Programming
- Variable Frequency Drives, VFD
- Control Panel Construction
- Power Plug & Control Plug IP65
- On Board Control, Plug & Play



Electric Actuator Advantages



- Size Thrust Up to 224,500 lbs
- Fewer Base components:
 - Thrust Unit, Coupling Housing and Drive Motor
- Self Contained
- Costs Much Lower Initial and Turn Key
- **Environment Well suited for Harsh Environments**
- Energy Efficient
- Simple to Interface
- Positioning Capability Very Precise and Accurate
- Operating Costs Low
- General Maintenance Infrequent Intervals
- Easily Automated Servo, VFD, Position Feedback Option
- Identical behavior extending or retracting

Electric Actuator Advantages



Disadvantages of Hydraulic Systems

- Sizes Hydraulic Systems only Economical in Very Large Sizes.
 Base Components
 - Hydraulic Systems need Many Components: Cylinder Rod, Piston, Seals, Cushions, Pump, Piping or Hoses, Rod Gland.
- Costs Initial and Turn Key Very High; Installation Time, Flushing...
- **Environment Be careful, Potentially Harmful to the Surroundings**
- Operating Costs High, Not Energy Efficient
- Maintenance LEAKS
- Control Complex, Temperature Dependent
- Positioning only with Elaborate Feedback Devices
- Construction of the second second
- Small Orifices, Receptive to Clogging due to Debris

Electric Actuator Advantages



raco@racointernational.com

Disadvantages of other Mechanical Systems (Screw Jack)

- Sizes Not all Sizes Available
- **CACME or Ball Screw with Low Duty Cycle**
- Costs Cheap
- Environment If not Enclosed, Problematic
- Operating Costs and Maintenance Must be Greased Often
- Inefficient Worm Gear Driven, Backlash
- **Solution** Not often Automated Hand Crank Mainly
- High Startup Torque Required

RACO Repair Service



RACO In-House Repair Service



- **50 Years of Experience**
- Repair Service with Warranty
- Load Test & Diagnostic Capability
- Reliable Service
- Carge Inventory of Parts
- Quick Turn-Around

Customer List



RACO Customer Reference List – 2009

- Image: Image
- Adolph Coors
- AK Steel Corp
- General Ge
- S Amtrak
- Arcelor Mittal
- Bechtel Corp
- Sembardier
- Carrier Corporation
- **Caterpillar**
- China Steel
- **Chrysler**
- Consol Coal
- Continental Grain Co. Morton Salt
- Corning

- **Dick Corp** ŝ
- S **Dravo Corp**
- Eastman Kodak
- Se FMC Corp
- **Ford Motor Company** S
- General Electric
- General Foods
- General Motors
- ☞ James Hardie
- Kraft Foods
- S Krupp
- S Maglev

S

- Mead Paper Company 3
 - **Morgan Engineering & Construction**

- PPG Industries
- Pratt & Whitney
- Proctor & Gamble
- Rockwell International
- Scott Paper Company
- Stelco Ltd
- Se Timken
- Union Carbide
- US Post Office
- Walt Disney







RACO

Application

Examples





Cold Rolling Mill / Steel Coil Production Messurment Arm on Roll Grinding Mashine RACO Electric Actuator: Type T1N6



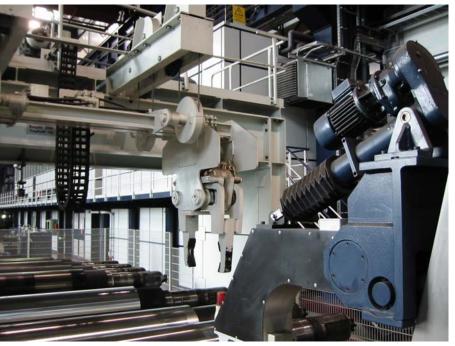


Cold Rolling Mill / Steel Coil Production

Messurment Arm on Roll Grinding Mashine

RACO Electric Actuator: Type T1N6







Cold Rolling Mill / Steel Coil Production

Positioning Device for Strip Cutting System

RACO Electric Actuator: Type T1R5 & T6L4-140









Cold Rolling Mill / Steel Coil Production Positioning Device for Strip Cutting System RACO Electric Actuator: Type T1T5

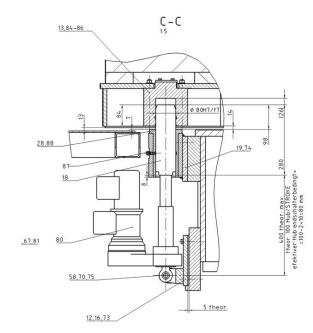


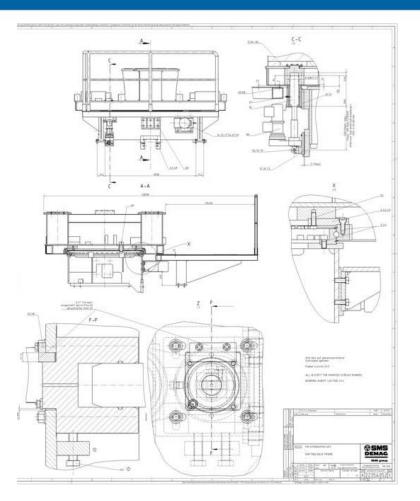


Cold Rolling Mill / Steel Coil Production

Locking Device for Strip Cutting System

RACO Electric Actuator: Type T6C4-140 Technical Data: 1.150lbf, 3.9", 1"/sec







Steel Industry, Tube Mill

Flying Shear: High Dynamic Tube Cutting Application Severe Environment

RACO Electric Actuator: Type K1C7 with Servo Motor







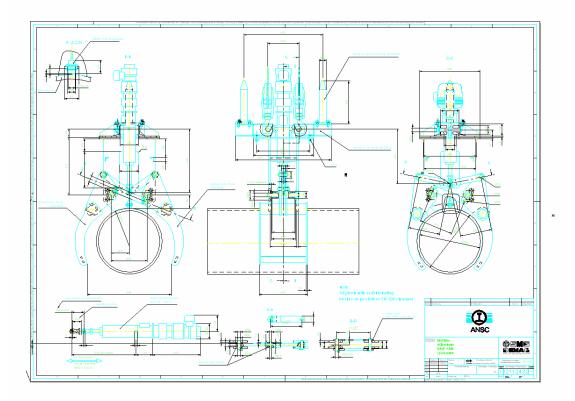


Cold Rolling Mill / Steel Coil Production Material Handling / Overhead Crain

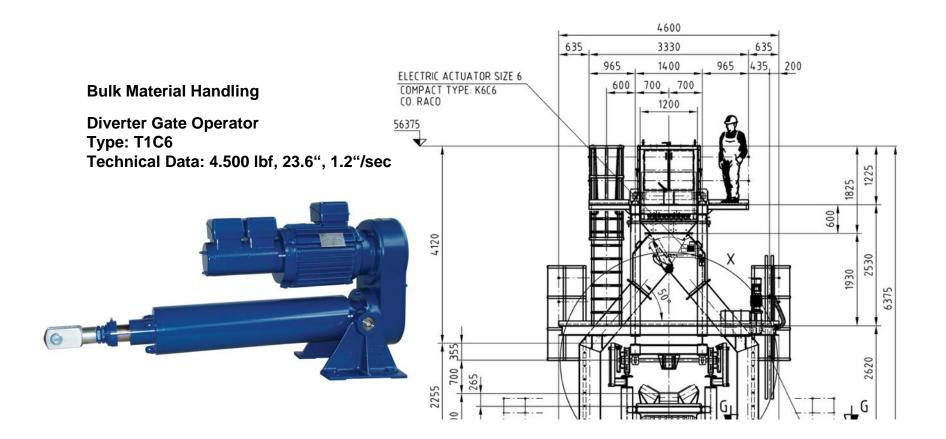
Coil Gripper

RACO Electric Actuator: Type T1M4 Technical Data: 1.150lbf, 15.7", 0.7"/sec













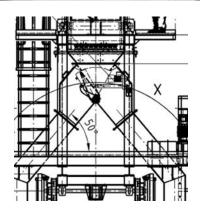
Technical Data: 9.000 lbf, 23.6", 1.2"/sec





Bulk Material Handling

Diverter Gate Actuator / Type: T1M7 Technical Data: 9.000 lbf, 23.6", 1.2"/sec







Bulk Material Handling / Coal Conveyor Belt

Snow Plow Actuator / Type: T1K8 Technical Data: 27.000 lbf, 39.4", 0.2"/sec







Bulk Material Handling / Coal Conveyor Belt

Snow Plow Actuator / Type: T1K8 Technical Data: 27.000 lbf, 39.4", 0.2"/sec





Bulk Material Handling, Coal Strip Mining

Excavator Tip Actuator / Type: T1N7 Technical Data: 9.000 lbf, 23.6", 1.2"/sec







Bulk Material Handling, Coal Fired Power Plant

Boiler Coal Shoot Gate Actuator / Type: T1K5, Explosion Proof Environment, Class II, Division I & II, Group F Technical Data: 2.250 lbf, 31.5", 1.2"/sec





Bulk Material Handling, Ammoniac Ship Un-loading Facility

Conveyor Belt Roll Tension Actuator / Type: T1M8 Technical Data: 18.000 lbf, 31.5", 1.2"/sec









Bulk Material Handling, Ammoniac Ship Un-loading Facility

Conveyor Belt Roll Tension Actuator / Type: T1M8 Technical Data: 18.000 lbf, 31.5", 1.2"/sec







Bulk Material Handling, Basalt & Asphalt Mixing

Gate Valve Actuator / Type: T1M6 Technical Data: 4.500 lbf, 31.5", 1.2"/sec







Bulk Material Handling, Suggar Beet Processing Plant

Conveyor Belt Steering Actuator / Type: T1M6 Technical Data: 4.500 lbf, 31.5", 1.2"/sec





Industrial Machinery & Equipment

Laminated Flooring Press, Material Positioning (Vertical and Horizontal Control)







Industrial Machinery & Equipment

Laminated Flooring Press, Material Positioning (Vertical and Horizontal Control)









Automotive Machinery & Equipment Assembly Line Lift System

Type: T6Q7





Automotive Machinery & Equipment

Hexapod Sheet Metal Press Line Loading & Unloading System Type: K1E6







Telecomunication, Radio Relay Systems

Positioning of Parabolic Dishes







Telecomunication, Radio Relay Systems

Positioning of Parabolic Dishes





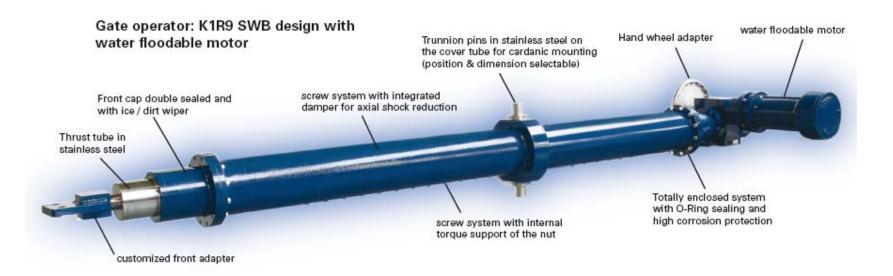






Lock & Dam, Hydro Mechanical Equipment

Lock Door Actuator, Type: K1R9









Lock & Dam, Hydro Mechanical Equipment Lock Door Actuator, Type: K1R9

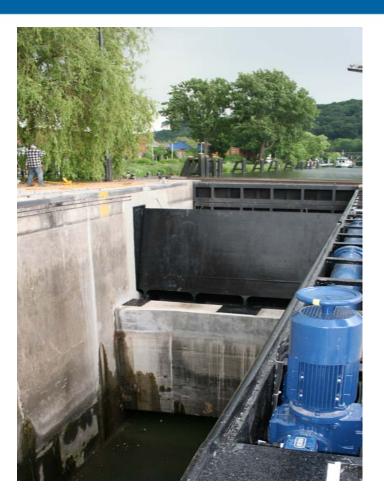




Lock & Dam, Hydro Mechanical Equipment

Lock Door Actuator, Type: K1R9







Movable Bridges / Wedges, Lifting & Locking Pin Equipment

Locking Pin Bascule Bridge, Type: K1R8







Movable Bridges / Wedges, Lifting & Locking Pin Equipment

Lifting Bridge Actuator, Type: T1R8













