

Industrial Shock Absorbers

Safety Shock Absorbers, Velocity & Feed Controllers, Hydraulic Dampers



Enertrols[®]

WORLDWIDE SPECIALISTS IN ADVANCED
LINEAR DECELERATION TECHNOLOGY





The Most Effective Way to **STOP** a Moving Object!

Any mechanism that moves and that must be stopped is a potential application for controlled linear deceleration. There is no more effective way to achieve that control than through the use of Enertrols shock absorbers. With them, you can quickly and safely stop any type of motion including: straight-line, rotary, free-falling, sliding, rolling, etc. It makes no difference if the motion is driven electrically, mechanically, hydraulically, or pneumatically. Listed below are a few areas where Enertrols shock absorbers have replaced solid stops, deceleration valves, flow control valves, cylinder cushions, springs, rubber bumpers, dash-pots, feed controls, hydraulic checks, complicated and costly circuits and conventional industrial shock absorbers.

Automotive: press welders, extractors, blank loaders, transfer shuttles, roll overs, pivoting pillars, K.D. fixtures, drop-away clamps, end stops, overhead cranes, destackers, iron hands, conveyors, lift and carry units, walking beams, welding guns, flying shears, press weld trans. and more.

Foundry: core machines, flask stops, pattern shuttles, rammer carriage stops, roll overs, cope & drag pick off, overhead cranes, turntables, cooling lines, disappearing stops, cope & drag punch out, cope mold closer, drag mold set on, drag mold lift off, sand shields, push off cylinder, elevator stop, conveyor stop

Packaging: drop packer, tunnel packer, traffic cop, index stations, turn tables, conveyor stops, filling, palletizers, bagging

Rubber: tire curing press - loading arm, post tire inflator, vertical load head; tire building machine-bead set, collapsing drum, servicer tray; bias cutter, guillotine cutter, skivers, tread cutter, force variation machine, wig-wag, conveyors, calendars

Steel: up enders, down enders, strip support arms, coil buggies, ingot buggies, transfer cars, bloom stops, entry table stops, fly shears, manipulators, run-out tables, c-car at coilers, overhead cranes, banding & strapping, bar turners, furnace stops, tube stops, draw benches

Lumber/Paper/Textile/Other: roll stops, weighing stations, saw cut-off, drop chutes, vernier calipers, saw carriages, log turners, stops, picker arms, loom shuttles, fabric rolls, carpet presses, injection molding doors, die-cast machine transfers, pick-off arms

Industrial Hydraulic Shock Absorbers

Benefits...

By eliminating the damage-causing impact forces created by moving loads and objects through controlled linear deceleration, Enertrols shock absorbers...

- Increase operating speeds
- Increase operating loads
- Increase system performance
- Increase reliability
- Reduce stress in equipment
- Reduce design & fabrication costs
- Reduce noise levels
- **INCREASE PROFITS!**



For years, industry was faced with the problem of stopping moving objects used in manufacturing without destroying them, or the stopping device. Everything that moves possesses kinetic energy that must be dissipated to stop movement. The heavier the object, and/or the faster it moves, the higher the kinetic energy becomes. Impact forces due to stopping become extremely high and damaging unless properly controlled.

As today's sophisticated automated machines evolve they demand higher operating speeds and shorter stopping times, greatly multiplying the build-up of kinetic energy and the problem of controlling it.

Some commonly used stopping devices such as springs, rubber bumpers and dashpots, add to shock loading rather than reducing it. They do not dissipate energy at a uniform rate. The moving object is subjected to high shock loading at either the end, or the beginning, of the deceleration stroke.

When stopping a moving weight or load, hydraulic shock absorbers convert kinetic energy to thermal energy (heat). The optimum operating condition occurs when this energy is dissipated at a nearly constant rate as the load is decelerated to zero velocity in the least distance in the least amount of time with no abrupt force peaks throughout the stroke. We call it **controlled linear deceleration**.

By installing Enertrols industrial hydraulic shock absorbers, you can reduce damaging impact forces significantly enough to permit higher speeds and production rates thereby increasing your profits. Of all existing deceleration methods, ***Enertrols shock absorbers are quite simply the best and most cost-effective means to stop a moving object.***



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Quality Assurance

Enertrons, an ISO 9001: 2000 certified manufacturer, is focused daily on providing the highest quality products for the industrial marketplace. All Enertrons components and products are inspected directly at Enertrons or by certified suppliers for quality and performance prior to shipment.

Management, engineering and manufacturing are committed to producing products that offer outstanding reliability and dependability.

Enertrons products are backed by a Lifetime Warranty guaranteeing products to be free of defects in materials and workmanship.



Why Enertrons?

Enertrons believes that all of the products it manufactures and ships are of the highest quality, assuring our customers the utmost in reliability and production uptime. There are six major reasons why Enertrons is your best value on the industrial shock absorber market today:

- **HEAVY-DUTY DESIGN.** Enertrons shock absorbers deliver more inch-lbs of capacity per cycle. This often permits you to downsize to a smaller size shock absorber than would be possible with a competitive brand.

- **TECHNICAL SUPPORT.**

Enertrons has a complete technical support group available to engineering departments and build sources. It will follow your project, from concept through production, with computer-aided application engineering design assistance. Application engineers are available to recommend the correct shock absorber for your application, at no cost to you.

- **POSITIVE & MOUNTING STOP COLLARS.**

They provide precise work positioning, as an integral part of the shock absorber, while eliminating costly external stops. Their use can mean substantial savings on any applicable mounting installation.

- **PRICE AND DELIVERY**

- **LIFETIME WARRANTY**

Enertrons products are guaranteed to be free of defects in materials and workmanship. Enertrons will repair or replace any of its products determined to have a defect in materials or workmanship at any time for the life of the product.

- **ISO 9001 : 2000 Certification**

Enertrons is committed to supplying world-class industrial shock absorbers, and continually strives to improve not only the quality of our products, but every step in the concept, design, build, test and final installation in the customers plant. Quality is our benchmark at all times; with 100% follow-through by all employees.

**Enertrons is focused daily on continuous improvement.
Therefore, Enertrons reserves the right to change models,
dimensions or specifications without notice or obligation.**



The Enertrols Product Line

Enertrols high-performance industrial shock absorbers offer energy capacities ranging from 9 to over 1 ½ million inch-lbs per cycle. Adjustable and self compensating models are offered. Versatile Enertrols models are available with internal or external accumulators.

Rugged sub-miniature and miniature models mount easily in confined spaces. Proven Mid-Size self-compensating models offer four effective weight ranges for handling a wide range of applications. All Enertrols Mid-Size models include Weartec Plus on the threaded outer tubes for outstanding corrosion protection.

Gold Line® primary and fixed flange adjustable models offer energy per cycle ratings from 1,350 to 224,000 inch-lbs per cycle. SILVERLINE® models are available for low velocity, high propelling force applications.

EA adjustable and ECA self-compensating industrial shock absorbers are ideal for handling the demanding linear deceleration applications of the steel, foundry, marine, lumber and other heavy equipment industries.

Enertrols ESCS and ECB shock absorbers are available for handling emergency related applications for automated storage and retrieval systems, overhead cranes and more.

Enertrols also offers long-life shock absorbers for glass bottle and PET container industry equipment.

Additional products include: EHB hydraulic dampers, EDVC and EVC velocity and feed controllers, gas springs and elastomeric bumpers.



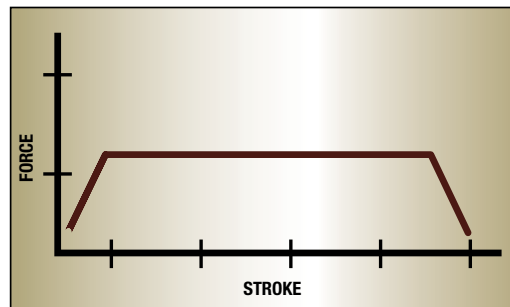
Controlled Linear Deceleration

The most effective way to stop a moving object

To achieve controlled linear deceleration, the pressure on the piston area must remain as constant as possible throughout the deceleration stroke. Enertrols adjustable hydraulic shock absorbers meter oil through a computer-calculated series of exponentially spaced orifices in a high-pressure inner tube as the piston rod moves through its stroke. The cross-sectional area of all the orifices is selected by rotating an adjustor.

As the piston moves through its compression stroke, it sequentially closes off each orifice. The piston velocity decreases while maintaining a constant oil pressure as it travels down the bore to the end of its stroke. Oil displaced by the piston rod makes room for itself by compressing a closed-cell, sponge-like material in self-contained, internal accumulator models. Displaced oil may also be routed to an external accumulator for cooling if high cycle rates cause excessively high temperatures.

Dashpots, snubbers and cylinder cushions have only a single, fixed-area orifice, which is why they cannot dissipate energy at a uniform rate. More efficient Enertrols Gold Line adjustable shock absorbers deliver true linear deceleration over a broad range of speed and weight combinations, compensating for changes in both weight and velocity. They are easily fine-tuned to obtain maximum cycle rates with soft, non destructive stops every time.





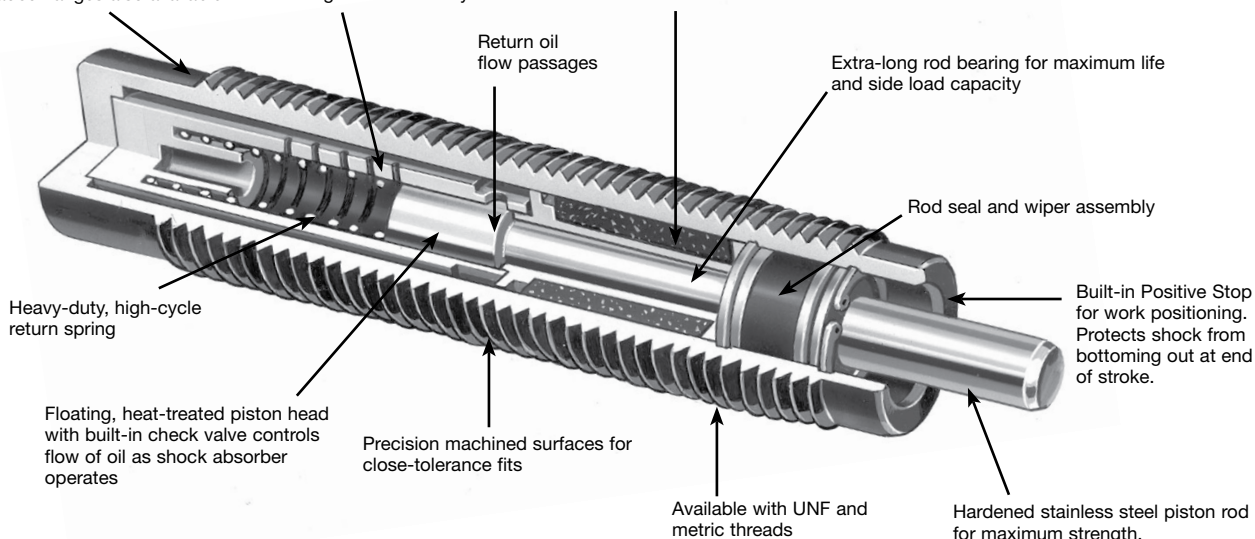
Construction & Design Features

Miniature Adjustable & Self-Compensating (Shown) (Typical for SNALD 150 to 600 Models)

Versatile full threaded-body can be mounted in any position using furnished lock nut. Screw-on threaded flanges also available.

Hardened steel metering tube has metering holes with knife edges for high flow efficiency

Closed-cell accumulator sponge is compressed by oil forced through metering holes. It expands to help force oil back into bore as spring returns piston to its original position



Standard Primary Mount & Fixed Flange Models

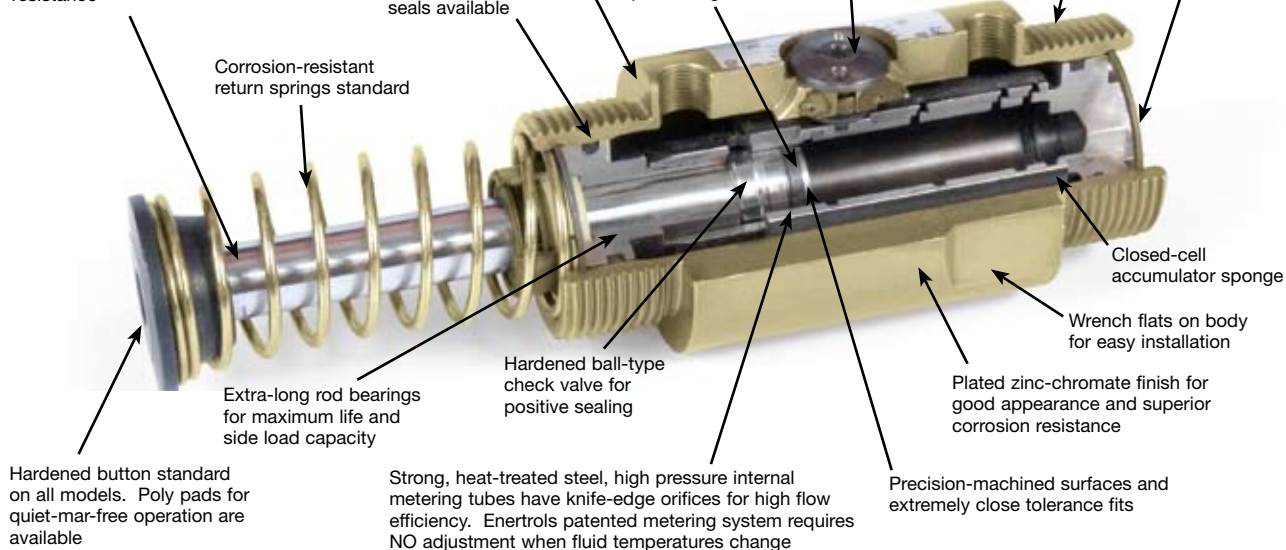
Precision machined shoulders provide exact positioning. This permits rotation of the body for easy access to the side-located adjuster, without changing set-down dimension of the installation

Versatile Primary-Mount Series can be front or rear mounted, using threads at either end of the heavy-duty steel body

Extra-large diameter, solid one-piece piston and rod for maximum strength. Rod is heat treated, ground and chrome-plated for excellent corrosion and wear resistance

Adjuster turns through a full 360 degrees, from 'Hard' to 'Soft' and back to 'Hard' in one revolution. More precise adjustment than competitive limited-range designs

Easily disassembled for fast field repairs. All component parts and seals are readily available



Standard Shock Absorbers

Sub-Miniature, Self-Compensating Series

Enertrols sub-miniature, self-compensating industrial shock absorbers offer energy per cycle capacities from 9 to 75 inch-lbs. A variety of effective weight ranges are available for handling a wide range of applications.

These fully threaded versatile models are easily mounted in confined spaces. Select models such as the SM 25 and SM 75 include Weartec Plus on the outer tubes for outstanding corrosion protection.

Applications include: small linear slides, material handling and packaging equipment, office and medical equipment, instrumentation and more.



Miniature, Self-Compensating Series

Enertrols versatile, high-capacity, miniature, self-compensating industrial shock absorbers offer true linear deceleration to protect relatively small, high-speed moving machines and equipment. These dependable models are available in a number of effective weight ranges to help eliminate equipment impact damage.

A built-in positive stop prevents bottoming out damage and provides a positive work-positioning point.

Applications include: small, high-speed moving machines and equipment, material handling equipment, robotics, packaging equipment, pick and place systems and more.



Miniature, Adjustable Series

Miniature, adjustable series industrial shock absorbers from Enertrols feature fully-threaded outer tubes for unlimited mounting versatility. Models such as the SA 35, SA 50 and SA 150 include Weartec Plus on the outer tubes for outstanding protection against corrosion, erosion and the ravages of time.

These dependable models can be easily adjusted to obtain optimum linear deceleration.

Applications include: linear slides, material handling and packaging equipment, robotics, pick and place systems, office and medical equipment and much more.



Mid-Size, Self-Compensating 33, 45 & 64 Series

Enertrols larger Mid-Size self-compensating shock absorbers are designed for higher energy capacities to a maximum effective weight capacity of 140,400 lbs. Four effective weight ranges are offered for handling a wide range of applications. Threaded outer tubes of these durable models include, as standard, Weartec Plus for outstanding corrosion protection.

Applications include: automotive manufacturing and production equipment, material handling and packaging equipment, lumber industry equipment, theme park rides, robotics and more.





Standard Shock Absorbers

Gold Line® Series

Gold Line® adjustable shock absorbers are recommended for most deceleration applications, especially where it is desirable to use the same model on a number of different installations. They perform well under a very wide range of conditions. For example, the weight range of these units is approximately 250:1, meaning maximum weight capacity can be as much as 250 times greater than minimum weight capacity. The adjustable fine-tuning feature provides maximum performance on virtually any application with a velocity ranging from 1-15 fps. By keeping impact forces to a minimum, they provide the softest stop, especially when critical and precise work-positioning is required.



Primary Mounting Type ½, ¾ & 1 ⅞ " Bore Sizes

This larger series also features versatility of mounting through use of optional accessories that are threaded on either end of the shock absorber body and securely locked against a machined shoulder. Primary series units are heavily used in environments that require a number of different style mountings of the same basic bore size and stroke length shock absorbers.



Fixed Flange Mounting Type ¾" to 2 ¼" Bore Sizes

Conventional Fixed Flange Enertrols shock absorbers have permanently attached front or rear flanges plus foot and clevis mount options. They are ideally suited for use by cost-conscious OEM's using the same basic shock absorber in large volume. Positive set-down positioning when changing units is a major feature of this type.



Heavy-Duty 2, 3 & 4" Bore Self-Compensating & Adjustable Shock Absorbers

These high-capacity Enertrols models were designed to handle extremely heavy-duty applications. Rugged 2, 3 & 4" bore models offer stroke lengths from 2 to 16 inches. Energy per cycle capacities range from 32,000 in-lbs (3,616 Nm) to 1,120,000 in-lbs (126,500 Nm).

Applications for these rugged performers include: foundry, steel mill, marine, lumber, heavy equipment industries and more.



Standard Shock Absorbers for Special Applications

3/4" & 1 1/8", 1 1/2" & 2 1/4" Bore SILVERLINE® Series for Low-Velocity High Effective Weight Applications

Enertrols SILVERLINE® Fixed Flange and Primary Mount Series adjustable shock absorbers are designed for compact, high-energy automated equipment that operates at low velocities from 0.25 to 2.0 feet/second coupled with high effective weight conditions. Most robotic installations involve rotary motion and shock absorbers are typically positioned near pivot points for increased clearance and more room in the work area.

Rotary motion installations are almost always subjected to high effective weight conditions caused by low velocity. As a result, most of the energy comes from the propelling force instead of inertia. These conditions usually meant ordering special shocks with larger bore sizes, stop tubes and heavier oils, resulting in longer lead times and higher prices. With SILVERLINE® shock absorbers, it is no longer necessary to order special models. Enertrols solves these problems with lower-cost, standard, off-the-shelf products.

Any application position (rotary, vertical, horizontal and incline) where low velocity and high effective weight exists, is an excellent application for Enertrols SILVERLINE® shock absorbers. They are designed to operate in a velocity range of 0.25 to 2.0 fps and in an effective weight range of 300 lbs to 3,175,000 lbs maximum. All models use standard weight hydraulic oil for fast rod return on high cycling applications.



19mm & 28mm Bore High-Precision Metric (HPM™) Fixed Flange Series

This series of fixed-flange adjustable shock absorbers is rapidly becoming an international automotive standard. They provide an exceptional high-positioning accuracy - **positive set-down positioning repeatable within +/- .05mm** - with easy "bolt-in place" installation. They are interchangeable with all Enertrols Gold Line® Primary Mount shock absorbers with screw-on flanges and all standard Enertrols Gold Line® welded flange models, as well as other manufacturers models of the same bore size.

Welded front flange models are equipped with positive stop bars. Welded rear flange models are equipped with Enertrols positive stop collars. There are 14 models available in two configurations, two bore sizes and three stroke lengths. Four models are available for Low-Velocity applications (0.25 to 2.0 fps).



1 1/8" Bore Quick-Change Mount Shock Absorber

Enertrols patented QCM™ (Quick-Change Mount) adjustable hydraulic shock absorber is designed to directly replace existing shock absorbers on horizontal extractors, shuttles, loaders and unloaders. Easy, fast removal and reinstallation of the QCM shock is its major feature.

Since it is a true linear decelerator, the QCM unit reduces deceleration time and increases cycle rates. It also reduces impact forces at the end-of-stroke, even with today's high shuttle speeds. There are no threads to nick or trap weld flash and other contaminants.





Accessories & Special Application Shock Absorbers

Poly Pads

Enertrols Poly Pads (shown installed on a 3/4" - bore Gold Line™ Primary Mount shock absorber) are available in five sizes to fit securely over the piston rod button of all 3/8", 1/2", 3/4", 1 1/8" and 1 1/2" bore-size models. They are made of tough, long-wearing polyurethane to reduce noise and/or marring of the object impacting on the steel button.



Standard Air-Over-Oil Tanks

Enertrols Air-over-Oil Tanks (AOT) are available in the four stock sizes shown for use with all ALD and ALDS models, 1/2" through 4"-bore sizes. The three largest tanks are made of high-strength steel, use no soft seals and have easy-to-read sight gauges.



Tow Bar Snubbers

Enertrols tow bar snubbers are ideal for use on high-speed material handling systems. The higher speeds utilized today on power and free handling systems greatly increase the potential for both product and/or system damage due to the rapid acceleration/deceleration speeds generated.

The tow bar snubber is designed to absorb and smooth rapid acceleration/deceleration when starting and stopping. This prevents stretching and compressing load conditions, reduces maintenance and increases the up-time of the material handling system.



PSS Positive Stop Systems

for Gold Line® & SILVERLINE® Shock Absorbers

Mounting Stop Collars

Enertrols Mounting Stop Collar (MSC), shown installed on a Gold Line® Primary-Mount Series shock absorber. The MSC provides a secure front mounting with an integral, tamper proof positive stop. The FSC Flanged Stop Collar (not shown) provides a front flange type mount with an integral positive stop. Available to fit all Gold Line® and SILVERLINE® Primary-Mount Models.



Positive Stop Collars

Enertrols Positive Stop Collar (PSC) shown, installed on a Gold Line® Primary-Mount Series (also for SILVERLINE® Primary-Mount Models.) It is not used to mount the unit, but only to establish a fixed, tamper proof work-positioning point that also provides a positive stop to protect the shock absorber from bottoming out. You do not need to calculate clearance to prevent bottoming out. It's automatic!



Positive Stop Bars and Collars

Enertrols Positive Stop Collars and Bars establish a fixed work-positioning point with no need to calculate clearance to prevent bottoming out of Gold Line® Fixed Flange and SILVERLINE® Fixed Flange shock absorbers. They are not used to mount the shock absorber. The precision-machined and hardened steel bars are securely bolted to the flange.

Positive Stop Collars for Fixed Rear Flange models fit snugly over the front of the shock absorber body. Set screws secure the collar after a recessed shoulder is located against the shock absorber. This collar also aids in protecting the return spring, rod and seals from weld spatter, metal chips and other contaminants.





Selecting the Correct Type of Shock Absorber

Before beginning the manual mathematical calculations to determine the correct size shock absorber you need, Enertrols suggests first considering the type, style and options that will be best suited to your application.

Enertrols also offers and recommends using the **EnertrolsSize** software program available on CD-ROM or for downloading from the Enertrols website at www.enertrols.com

If you prefer, Enertrols will size your application for you. There is no charge for this service. Simply contact Enertrols Applications Department at 734-595-4500.

Full Threaded-Body Type

These shock absorbers offer real mounting versatility. Stud mounting, in or through a threaded hole; universal mounting brackets, threaded on and locked anywhere on the body allow you to install these miniature units almost anywhere. Available in both adjustable and self-compensating models.

Primary Mounting Type

This larger series also features versatility of mounting through use of optional accessories that are threaded on either end of the shock absorber body and securely locked against a machine shoulder. Primary series units are heavily used in environments that require a number of different style mountings of the same basic bore size and stroke length shock absorbers.

Fixed Flange Mounting Type

Conventional fixed flange Enertrols shock absorbers have permanently attached flanges. They are ideally suited for use by cost-conscious OEM's using the same basic shock absorber in large volume. Positive set-down positioning when changing units is a major feature of this type.

Type of Mounting

Enertrols shock absorbers are available in a number of mounting configurations to meet most any need. For fixed flange series you must specify front or rear mount flanges, which are available in square, rectangular, lug or clevis-type choices. Primary series do not require choice of front or rear mounting since you may thread flanges on either end.

Type of Accumulator

Internal accumulators are the most widely used and permit immediate installation and use with no piping or fitting required. High cycle rates and/or extremely high energy requirements may require an external accumulator for cooling the oil by recirculating it outside the shock absorber body.

Type of Rod Return

Spring return piston rods, used with internal accumulators, are the most common type. Air (or mechanical) returns, used with external accumulators, permit delayed rod return type installations where required.

Type of Options

Certain types of options should also be selected at this time: positive stop collars, mounting stop collars and positive stop bars have been among Enertrols fastest growing options items. They provide a unique, tamper proof positive stop that establishes an accurate work-positioning point. These attachments also prevent impact damage that might be caused by bottoming the shock absorber piston. As standard, stock items, they also eliminate the cost to design and fabricate external positive stops into your system.

Poly pads, molded polyurethane pads that snap over the hardened steel impact button of our shock absorbers, prevent marring of the object being stopped and help reduce noise.

On-board proximity sensors are available for most of the shock absorbers in the Enertrols line. They electronically signal the end-of-stroke, or home position of the piston rod to control interlocking motions, devices, etc.



Selecting the Correct Model Shock Absorber

The model type of an Enertrols shock absorber is determined by:

- Type of accumulator—self-contained or external air/oil tank (AOT)
- Method of piston rod return—spring, air or mechanical

Model and mounting selection are usually determined by the application. Self-contained models are generally preferred over the external accumulator-equipped models. They are pre-filled at the factory and ready to use when received. No external piping or other system components are required.

Because Enertrols shocks stop a moving object in less time than non-linear decelerating devices, you should select a unit with the longest possible stroke that can be accommodated without exceeding side-loading limits. This will minimize impact forces on the mounting structure and the moving object being stopped.

Accumulators

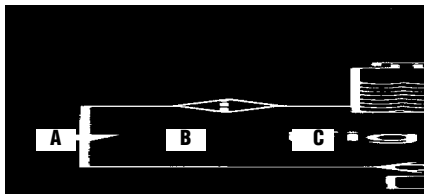
With internal accumulator models, the fluid displaced by the piston rod under impact is forced against a nitrogen-filled, closed cell sponge in the body of the shock absorber. As the piston rod is returned, the sponge expands to help force fluid back into the high-pressure tube. Where conditions permit, internal accumulator models are preferred.

Where more energy per hour (E_d), or heat dissipation is needed, as found in high duty-cycle applications, or high-temperature environments, external accumulator models should be used. The external accumulator is a tank or reservoir, either open or closed to atmosphere, that is connected to the shock absorber with appropriate size piping. The oil flows back and forth between it and the shock absorber, helping to cool the oil as the unit is cycled. The air/oil tank (AOT) of external accumulator-equipped models must be above the shock absorber and should be located as close to the shock absorber as possible. A 10-micron filter, installed between the exit of the air/oil tank and the shock absorber, is recommended.

If the AOT must be located at a substantial distance from the shock use a positive oil recirculation circuit (Fig 2B). Otherwise, oil may simply move back and forth in the lines and never reach the tank to be cooled.

Piston Rod Return

The return of the piston rod is accomplished in one of three ways (spring, air/oil, or mechanically). Mechanical returns usually make use of clevis-mounting designs and may be operated by a lever arm actuated by some other moving part of the equipment. On self-contained models, or air/oil models with a spring, an externally mounted spring returns the rod when the load is removed.



In external accumulator models, an air/oil system, or some other mechanical means, must be used to return the piston rod. ALD models permit a variable rate of rod return, time delay and/or lower rod return forces. This is accomplished by adding a pressure regulator (Fig. 2B) to the air/oil system, or by adding a 3-way valve and pressure regulator (Fig. 2C) to the system.

ALDS models are shipped with a rod return spring installed. Thus, even when an external accumulator is used to improve heat dissipation, it need not be pressurized. The spring will provide the necessary rod return force. For best results, the accumulator should be vented to the atmosphere with a filter/breather unit. Recommended air pressure for air oil tanks is 70-100 psi depending on the application.

Type of Accumulator	Method of Piston Rod Return	Model
Internal	Spring	SA
Internal	Spring	SALD
External	Air (or Mechanical)	ALD
Internal	Mechanical	ALDA
External	Spring	ALDS
Internal	Spring (self-compensating)	SM
Internal	Spring (self-compensating)	SNALD
External	Air or Mech. (self-compensating)	NALD
Internal	Spring (SILVERLINE)	SASL
External	Air (SILVERLINE)	ASL
External	Spring (SILVERLINE)	ASLS
Internal	Mechanical (SILVERLINE)	ASLA



Selecting the Correct Size Shock Absorber

There are a number of factors that must be considered when selecting a hydraulic shock absorber. First, determine how much energy must be dissipated during each deceleration stroke (cycle). Second, find the total amount of energy that must be dissipated during one hour of operation. Third, be sure to consider the effective weight of your application.

The formulas used to determine the amount of kinetic energy per cycle are derived from the equation $KE = \frac{1}{2}MV^2$. When used in the form $KE = 0.2WV^2$, the equation yields an answer in inch-lbs that can be correlated directly to the shock absorber energy rating charts. A moving object's energy will always consist of either pure inertia, or a combination of that inertia and a propelling force.



Sub-Miniature and Miniature full threaded-body adjustable shock absorbers are ideal for small, motor-driven, linear applications such as business machines (copiers, scanners & printers).

Enertrols Primary Mounting Series shocks are most widely used models because of their versatility and energy capacity ratings. You can install them almost anywhere and handle impact loads from 10 to 150,000 lbs of Effective Weight.

You might think slow-moving loads (less than 2 ft./second) wouldn't present much of a shock problem. Not so! In fact they are one of the toughest to handle. Most applications involving rotary motions are slow movers. Enertrols developed its SILVERLINE® Series especially for these applications.



When you need heavy-duty, Enertrols Gold Line® Fixed Flange shocks and 2,



3 & 4" bore models are your answer. Energy per cycle ratings range from

3,000 in.-lbs (339 Nm) to 1,120,000 in.-lbs (126,500 Nm). You'll find a lot of them on vertical, horizontal and inclined plane free-falling applications.

Basic Formulas

$E_1 = 0.2WV^2$ (or $W \times H$ for free falling objects) in. -lbs.

$E_2 = F \times S$ (or $W \times S$ for free-falling objects) in. -lbs.

$E_3 = E_1 + E_2$ in.-lbs.

$E_4 = E_3 \times C$ (cycles/hour) in.-lbs./hr.

$V = \sqrt{5.36 \times H}$ determines velocity of free-falling object-ft./sec.

$g = \frac{.2 \times V^2}{S}$ to determine G force, or stroke (S)

$V = \frac{\text{Dis in feet}}{t}$ to determine impact velocity when weight is moving at a constant speed over a distance-ft./sec.

$V = \frac{2 \times \text{Dis in feet}}{t}$ to determine impact velocity when weight is accelerating over a distance from a stopped position-ft/sec.

$F = D^2 \times .78 \times \text{PSI}$ to determine cylinder force in pounds

$F = \frac{1375 \times \text{HP}}{V}$ to determine Propelling Force in pounds when using an Electric Motor

$t = \frac{S}{6V}$ stopping time through stroke

Energy Calculation Symbols

t = Time in seconds
S = Shock absorber stroke in inches
R_s = Radius to shock absorber in inches
R_c = Radius to cylinder in inches
K = Radius to center of gravity (c.g.)
V = Impact velocity in feet/second
g = Deceleration in G's
D = Diameter in inches
Dis = Distance in feet
W = Weight in pounds (lbs.)
W_E = Effective Weight (lbs.)
H = Height in inches (in.)
F = Propelling Force (lbs.)
C = Cycles per hour
E₁ = Inertial energy (in.-lbs./cycle)
E₂ = Propelling Force energy (in.-lbs./cycle)
E₃ = Total energy per cycle
E₄ = Total energy to be dissipated per hour
PSI = Pressure (pounds per square inch)
HP = Horsepower
T = Torque (in.-lbs.)
L = Distance (in.)

Effective Weight

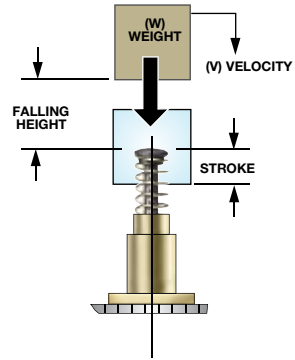
The determination of effective weight has become an important factor in correctly sizing a shock absorber. Effective weight will indicate if the shock absorber can be adjusted to perform properly. It prevents improper selection (over or under sizing) where propelling forces are involved, or velocities are very low or very high. A rough "rule of thumb" frequently used is to select the next larger bore size when impact velocities are below 1 ft/sec and/or propelling force energy ($F \times S$) exceeds $\frac{1}{2}$ of the E_3 value, as calculated. Or, you may want to use an Enertrols SILVERLINE® shock absorber if your requirements permit short-stroke models. If in doubt, contact your local rep, or the factory for additional sizing information.

However, high effective weight generates high set-down force at the end of the shock absorber stroke. Low effective weights can cause very high impact forces at the beginning of the stroke. These conditions must be considered for they may lead to severe damage over a period of time. All Enertrols shock absorbers carry effective weight ratings. Effective weight is calculated using the equation:

$$W_E = E_3 / 0.2V^2 \text{ or } E_3 / H \text{ \{for free-falling objects\}}$$

From the Rating Chart (page 22), select an Enertrols Model EA 2 x 8 shock absorber. This unit will handle the energy per cycle and energy per hour requirements of the application. It also meets effective weight requirements. Following are a variety of examples selected to represent the most widely used installations of Enertrols shock absorbers. Although the calculations may look formidable at first glance, they are actually quite simple to use. When you have a new application, just substitute your numbers in the example that comes closest to your own. If you think you need additional help, contact your Enertrols representative, or contact the factory. There is no obligation.

As an example of how to calculate and use Effective Weight in sizing an Enertrols shock absorber, consider the following examples:



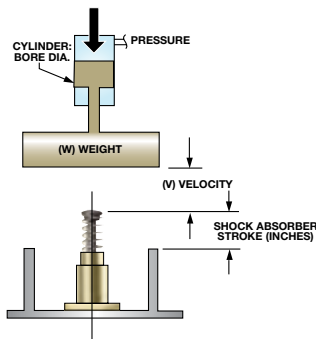
**Example 1
Vertical Free-Falling Weight**

W = 1800 lbs.
H = 40 inches
C = 200/hour in.
S = 8 inches*
 *Selected stroke

Calculations:

$E_1 = W \times H = 1800 \times 40 = 72,000 \text{ in.-lbs.}$
 $E_2 = W \times S = 1800 \times 8 = 14,400 \text{ in.-lbs.}$
 $E_3 = E_1 + E_2 = 72,000 + 14,400 = 86,400 \text{ in.-lbs.}$
 $E_4 = E_3 \times C = 86,400 \times 200 = 17,280,000 \text{ in.-lbs./hr.}$
 $W_E = \frac{E_3}{H} = \frac{86,400}{40} = 2,160 \text{ lbs.}$
 $V = \sqrt{5.36 \times H} = \sqrt{5.36 \times 40} = 14.6 \text{ feet/second}$

Example 2 Vertical Load Propelled Downward

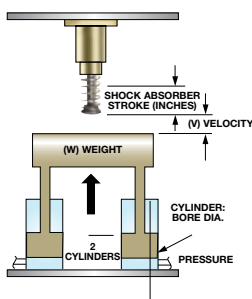


W = 950 lbs.
V = 4 ft./sec.
Cyl. Dia = 2 in.
PSI = 80
S = 4 in. *
C = 100/hr.

$E_1 = .2WV^2 = .2 \times 950 \times (4)^2 = 3,040 \text{ in.-lbs.}$
 $F = \text{Cyl. Force} = .78 \times D^2 \times \text{PSI} = .78 \times 2^2 \times 80 = 250 \text{ lbs.}$
 $E_2 = (F + W) \times S = (250 + 950) \times 4 = 4,800 \text{ in.-lbs.}$
 $E_3 = E_1 + E_2 = 3,040 + 4,800 = 7,840 \text{ in.-lbs.}$
 $E_4 = E_3 \times C = 7,840 \times 100 = 784,000 \text{ in.-lbs./hr.}$
 $W_E = E_3 / [.2V] = 7,840 / [.2(4)^2] = 2,450 \text{ lbs.}$

Model Selection: **SALD 1-1/8 x 4**

Example 3 Vertical Load Propelled Upward



W = 950 lbs.
V = 4 ft./sec.
Cyl. Dia = 4 in. (2 cyl. used)
PSI = 80
S = 4 in. *
C = 100/hr.

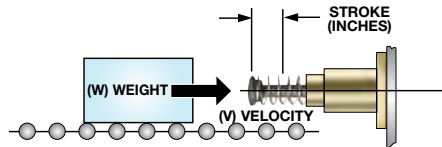
$E_1 = .2WV^2 = .2 \times 950 \times (4)^2 = 3,040 \text{ in.-lbs.}$
 $F = \text{Cyl. Force} = 2(.78 \times D^2 \times \text{PSI}) = 2(.78 \times 4^2 \times 80) = 1,997 \text{ lbs.}$
 $E_2 = (F - W) \times S = (1,997 - 950) \times 4 = 4,188 \text{ in.-lbs.}$
 $E_3 = E_1 + E_2 = 3,040 + 4,188 = 7,228 \text{ in.-lbs.}$
 $E_4 = E_3 \times C = 7,228 \times 100 = 722,800 \text{ in.-lbs./hr.}$
 $W_E = E_3 / [.2V] = 7,228 / [.2(4)^2] = 2,259 \text{ lbs.}$

Model Selection: **SALD 1-1/8 x 4**

*Note: These items will vary with individual applications and were selected for illustration purposes only.



Example 4 Moving Load No Propelling Force

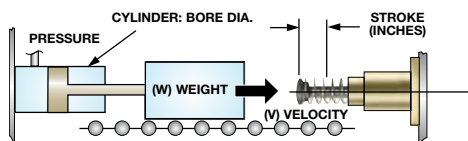


$$\begin{aligned} W &= 1,950 \text{ lbs.} \\ V &= 5 \text{ ft./sec.} \\ F &= 0 \\ C &= 200/\text{hr.} \end{aligned}$$

$$\begin{aligned} E_1 &= .2WV^2 = .2 \times 1,950 \times 5^2 = 9,750 \text{ in.-lbs.} \\ E_2 &= 0 \\ E_3 &= E_1 + E_2 = 9,750 \text{ in.-lbs} \\ E_4 &= E_3 \times C = 9,750 \times 200 = 1,950,000 \text{ in.-lbs./hr.} \\ W_E &= E_3 / [.2V^2] = 1,950 \end{aligned}$$

Model Selection: **SALD 1-1/8 x 4**

Example 5 Moving Load With Propelling Force

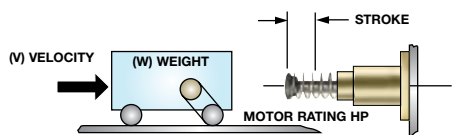


$$\begin{aligned} W &= 1,950 \text{ lbs.} \\ V &= 5 \text{ ft./sec.} \\ \text{Cyl. Dia} &= 2 \text{ in.} \\ \text{PSI} &= 80 \\ S &= 2 \text{ in.}^* \\ C &= 100/\text{hr.} \end{aligned}$$

$$\begin{aligned} E_1 &= .2WV^2 = .2 \times 1,950 \times 5^2 = 9,750 \text{ in.-lbs.} \\ F &= \text{Cyl. Force} = .78 \times D^2 \times \text{PSI} = .78 \times (2)^2 \times 80 = 250 \text{ lbs.} \\ E_2 &= F \times S = 250 \times 2 = 500 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 9,750 + 500 = 10,250 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 10,250 \times 100 = 1,025,000 \text{ in.-lbs./hr.} \\ W_E &= E_3 / [.2V^2] = 10,250 / [.2(5)^2] = 2,050 \text{ lbs.} \end{aligned}$$

Model Selection: **SALD 1-1/8 x 2**

Example 6 Moving Load Motor Driven

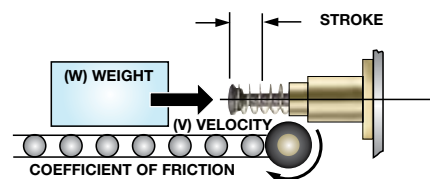


$$\begin{aligned} W &= 1,950 \text{ lbs.} \\ V &= 5 \text{ ft./sec.} \\ \text{HP} &= 1 \text{ Horsepower} \\ S &= 2 \text{ in.}^* \\ C &= 100/\text{hr.} \end{aligned}$$

$$\begin{aligned} E_1 &= .2WV^2 = .2 \times 1,950 \times 5^2 = 9,750 \text{ in.-lbs.} \\ F &= 1,375 \times \text{HP} / [V] = 1,375 \times 1 / [5] = 275 \text{ lbs.} \\ E_2 &= F \times S = 550 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 9,750 + 550 = 10,300 \text{ in.-lbs} \\ E_4 &= E_3 \times C = 10,300 \times 100 = 1,030,000 \text{ in.-lbs./hr.} \\ W_E &= 10,300 / [.2V^2] = 2,060 \text{ lbs.} \end{aligned}$$

Model Selection: **SALD 1-1/8 x 2**

Example 7 Moving Load Propelled by Drive Rollers (Chain/Belt Drive Conveyor)



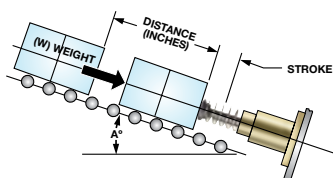
$$\begin{aligned} W &= 1,950 \text{ lbs.} \\ V &= 5 \text{ ft./sec.} \\ F &= \text{Coefficient of friction} \times W \\ &\text{Coefficient of friction in this} \\ &\text{example} = .18 \\ S &= 2 \text{ in.}^* \\ C &= 100/\text{hr.} \end{aligned}$$

$$\begin{aligned} E_1 &= .2WV^2 = .2 \times 1,950 \times 5^2 = 9,750 \text{ in.-lbs.} \\ E_2 &= F \times S = (.18 \times W) \times 2 = 702 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 9,750 + 702 = 10,452 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 10,452 \times 100 = 1,045,200 \text{ in.-lbs./hr.} \\ W_E &= E_3 / [.2V^2] = 10,452 / [.2(5)^2] = 2,090 \text{ lbs.} \end{aligned}$$

Model Selection: **SALD 1-1/8 x 2**

*Note: These items will vary with individual applications and were selected for illustration purposes only.

Example 8 Moving Load Down an Inclined Plane

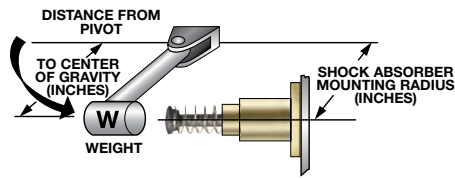


$$\begin{aligned} W &= 1,950 \text{ lbs.} \\ \text{Angle of Incline} &= 15^\circ \\ L &= \text{Distance traveled} \\ &= 30 \text{ in.} \\ S &= 2 \text{ in.}^* \\ C &= 100/\text{hr.} \end{aligned}$$

$$\begin{aligned} E_1 &= W \times \sin A \times L = 1,950 \times .26 \times 30 = 15,210 \text{ in.-lbs.} \\ E_2 &= W \times \sin A \times S = 1,950 \times .26 \times 2 = 1,014 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 15,210 + 1,014 = 16,224 \text{ in.-lbs} \\ E_4 &= E_3 \times C = 16,224 \times 100 = 1,622,400 \text{ in.-lbs./hr.} \\ V_s &= \sqrt{5.36 \times (\sin A) \times L} = \sqrt{5.36 \times .26 \times 30} = 6.4 \text{ ft./sec.} \\ W_E &= E_3 / [.2V_s^2] = 16,224 / [.2(6.4)^2] = 1980 \text{ lbs.} \end{aligned}$$

Model Selection: **SALD 1½ x 2**

Example 9 Horizontal-Moving Load-Rotary



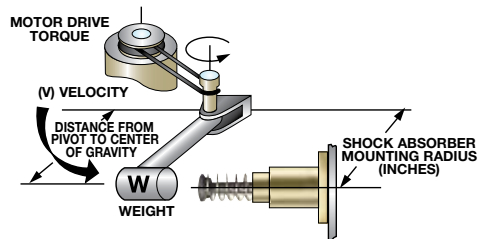
Model Selection: **SALD ½ x 1**

K = Distance to C.G.
from Pivot = 30 in.
W = 900 lbs.
A = Rotation angle = 90°
t = Time thru angle = 3 sec
R_s = Shock absorber mtg.
radius = 29 in.
F = 0
S = 1 in. *
C = 100/hr.
V_s = Vel. @ **R_s** (ft./sec.)

Velocity of Load =

$$\begin{aligned} (A \times K) / [688t] &= 90 \times 30 / [688 \times 3] = 1.31 \text{ ft./sec.} \\ E_1 &= .2WV^2 = .2 \times 900 \times (1.31)^2 = 309 \text{ in.-lbs.} \\ E_2 &= 0 \\ E_3 &= E_1 + E_2 = 309 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 309 \times 100 = 30,900 \text{ in.-lbs./hr.} \\ V_s &= (A \times R_s) / [688t] = 90 \times 29 / [688 \times 3] = 1.26 \text{ ft./sec.} \\ W_E &= E_3 / [.2V_s^2] = 309 \text{ in.-lbs.} / [.2(1.26)^2] = 973 \text{ lbs.} \end{aligned}$$

Example 10 Horizontal-Propelled Moving Load-Rotary



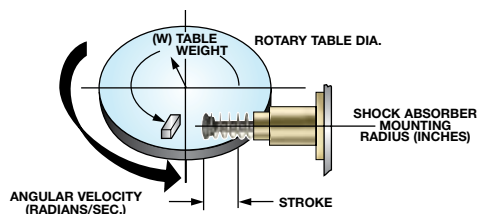
Model Selection: **SALD ¾ x 2**

*Note: These items will vary with individual applications and were selected for illustration purposes only.

W = 900 lbs.
K = Distance to C.G.
from Pivot = 30 in.
V = Linear Velocity
at C.G. = 4 ft./sec.
R_s = 29 in.
S = 2 in. *
C = 100/hr.
HP = 1 Horsepower
V_s = Vel. @ **R_s** (ft./sec.)

$$\begin{aligned} E_1 &= .2WV^2 = .2 \times 900 \times 4^2 = 2,880 \text{ in.-lbs.} \\ V_s &= V \times R_s / [K] = 4 \times 29 / [30] = 3.87 \text{ ft./sec.} \\ F &= 1,375 \times \text{HP} / [V_s] = 1,375 \times 1 / [3.87] = 355 \text{ lbs.} \\ E_2 &= F \times S = 355 \times 2 = 710 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 2,880 + 710 = 3,590 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 3,590 \times 100 = 359,000 \text{ in.-lbs./hr.} \\ W_E &= E_3 / [.2V_s^2] = 3,590 / [.2(3.87)^2] = 1,199 \text{ lbs.} \end{aligned}$$

Example 11 Horizontal-Rotary Index Table

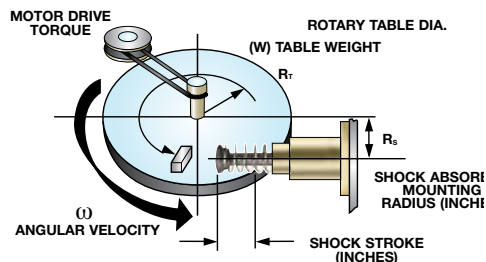


Model Selection: **SALD ½ x 2**

W = 900 lbs.
V_T = 4 ft./sec. at 36 in.
from Pivot
C = 100/hr.
F = 0
R_s = 30 in.
D_T = Table Dia. = 72 in.
R_T = 36 in.
V_s = Vel. @ **R_s** (ft./sec.)

$$\begin{aligned} E_1 &= .1WV_T^2 = .1 \times 900 \times 4^2 = 1,440 \text{ in.-lbs.} \\ E_2 &= 0 \\ E_3 &= E_1 + E_2 = 1,440 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 1,440 \times 100 = 144,000 \text{ in.-lbs./hr.} \\ V_s &= (V_T \times R_s) / [R_T] = (4 \times 30) / [36] = 3.3 \text{ ft./sec.} \\ W_E &= E_3 / [.2V_s^2] = 1,440 / [.2(3.3)^2] = 661 \text{ lbs.} \end{aligned}$$

Example 12 Horizontal-Rotary Index Table Propelled



Model Selection: **SALD ¾ x 2**

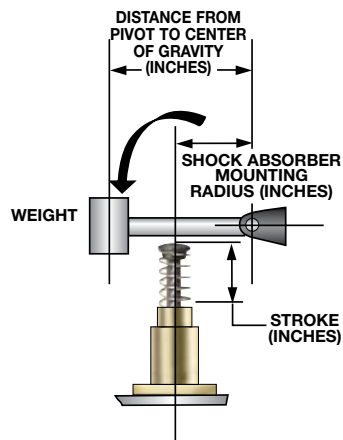
*Note: These items will vary with individual applications and were selected for illustration purposes only.

W = 900 lbs.
w = 2 Radians/sec.
T = 1,500 in.-lbs. at table
S = 2 in. *
C = 100/hr.
R_s = 30 in.
R_T = Radius of table = 36 in.
V_s = Vel. @ **R_s** (ft./sec.)

$$\begin{aligned} V_T &= (w \times R_T) / [12] = (2 \times 36) / [12] = 6 \text{ ft./sec.} \\ E_1 &= .1WV_T^2 = .1 \times 900 \times 6^2 = 3,240 \text{ in.-lbs.} \\ F &= T / R_s = 1,500 / 30 = 50 \text{ lbs.} \\ E_2 &= F \times S = 50 \times 2 = 100 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 3,240 + 100 = 3,340 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 3,340 \times 100 = 334,000 \text{ in.-lbs./hr.} \\ V_s &= (w \times R_s) / [12] = 2 \times 30 / [12] = 5 \text{ ft./sec.} \\ W_E &= E_3 / [.2V_s^2] = 3,340 / [.2(5)^2] = 668 \text{ lbs.} \end{aligned}$$



Example 13 Vertical-Rotary

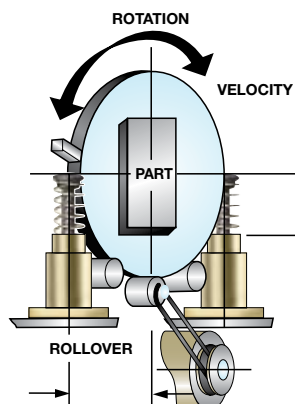


$W = 500 \text{ lbs.}$
 $K = \text{Distance to C.G.} = 34 \text{ in.}$
 $V = 4 \text{ ft./sec. @ } 34 \text{ in.}$
 $R_s = \text{Shock absorber mtg. radius} = 32 \text{ in.}$
 $S = 2 \text{ in.}^*$
 $C = 100/\text{hr.}$
 $V_s = \text{Vel. @ } R_s \text{ (ft./sec.)}$

$E_1 = .2WV^2 = .2 \times 500 \times 4^2 = 1,600 \text{ in.-lbs.}$
 $F = (W \times K) / R_s = 500 \times 34 / 32 = 531 \text{ lbs.}$
 $E_2 = F \times S = 531 \times 2 = 1,062 \text{ in.-lbs.}$
 $E_3 = E_1 + E_2 = 1,600 + 1,062 = 2,662 \text{ in.-lbs.}$
 $E_4 = E_3 \times C = 2,662 \times 100 = 266,200 \text{ in.-lbs./hr.}$
 $V_s = V \times R_s / [K] = 4 \times 32 / [34] = 3.76 \text{ ft./sec.}$
 $W_E = E_3 / [.2V_s^2] = 2,662 / [.2(3.76)^2] = 941 \text{ lbs.}$

Model Selection: **SALD ¾ x 2**

Example 14 Vertical-Rollover-Turn Over



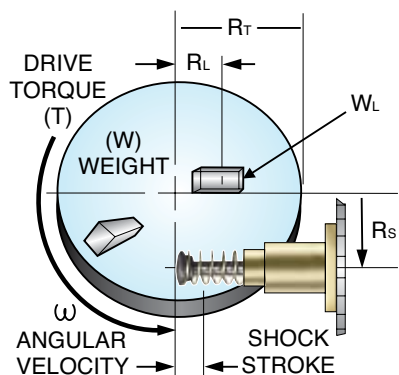
$W = 1,500 \text{ lbs.}$
 $A = 180^\circ \text{ Angle of Rotation}$
 $R_s = 62 \text{ in.}$
 $T = 12,000 \text{ in.-lbs.}$
 $S = 2 \text{ in.}^*$
 $C = 100/\text{hr.}$
 $R_R = 60 \text{ in. Radius of Rollover}$
 $V_R = \text{Vel. @ } R_R \text{ (ft./sec.)}$
 $V_s = \text{Vel. @ } R_s \text{ (ft./sec.)}$
 $t = 3 \text{ sec. Time of Rotation}$

$V_R = R_R \times A / [688t] = 60 \times 180 / [688 \times 3] = 5.24 \text{ ft./sec.}$
 $E_1 = .1WV_R^2 = .1 \times 1,500 \times 5.24^2 = 4,119 \text{ in.-lbs.}$
 $F = T / [R_s] = 12,000 / [62] = 194 \text{ lbs.}$
 $E_2 = F \times S = 194 \times 2 = 388 \text{ in.-lbs.}$
 $E_3 = E_1 + E_2 = 4,119 + 388 = 4,507 \text{ in.-lbs.}$
 $E_4 = E_3 \times C = 4,507 \times 100 = 450,700 \text{ in.-lbs./hr.}$
 $V_s = R_s \times A / [688t] = 62 \times 180 / [688 \times 3] = 5.4 \text{ ft./sec.}$
 $W_E = E_3 / [.2V_s^2] = 4,507 / [.2(5.4)^2] = 722 \text{ lbs.}$

Model Selection: **SALD 1½ x 2**

*Note: These items will vary with individual applications and were selected for illustration purposes only.

Example 15 Horizontal Application Moving Load- Rotary Table Motor Driven with Additional Load Installed

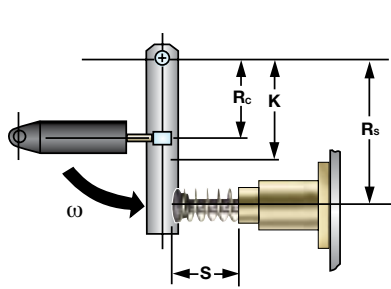


$W = 440 \text{ lbs.}$
 $W_L = \text{Additional weight} = 100 \text{ lbs.}$
 $R_L = \text{Radius to load C.G. from pivot} = 8 \text{ in.}^*$
 $S = 1 \text{ in.}^*$
 $C = 1/\text{hr.}$
 $w = 1 \text{ radian/sec.}$
 $R_s = 8.86 \text{ in.}$
 $T = 2,200 \text{ in.-lbs.}$
 $R_T = 20 \text{ in.}$
 $V_T = \text{Vel. @ } R_T \text{ (ft./sec.)}$
 $V_L = \text{Vel. @ } R_L \text{ (ft./sec.)}$
 $V_s = \text{Vel. @ } R_s \text{ (ft./sec.)}$

$V_T = w \times R_T / [12] = 1 \times 20 / [12] = 1.67 \text{ ft./sec.}$
 $E_{1(TABLE)} = .1WV_T^2 = .1 \times 440 \times 1.67^2 = 123 \text{ in.-lbs.}$
 $V_L = w \times R_L / [12] = 1 \times 8 / [12] = .67^2 = 9 \text{ ft./sec.}$
 $E_{1(ADD'L LOAD)} = .2W_LV_L^2 = .2 \times 100 \times .67^2 = 9 \text{ in.-lbs.}$
 $E_{1(TOTAL)} = E_{1(TABLE)} + E_{1(ADD'L LOAD)} = 123 + 9 = 132 \text{ in.-lbs.}$
 $F = T / R_s = 2,200 / 8.86 = 248 \text{ in.-lbs.}$
 $E_2 = F \times S = 248 \times 1 = 248 \text{ in.-lbs.}$
 $E_3 = E_1 + E_2 = 132 + 248 = 380 \text{ in.-lbs.}$
 $E_4 = E_3 \times C = 380 \times 1 = 380 \text{ in.-lbs./hr.}$
 $V_s = w \times (R_s / 12) = 1 \times 8.86 / [12] = .74 \text{ ft./sec.}$
 $W_E = E_3 / [.2V_s^2] = 380 / [.2(.74)^2] = 3,470 \text{ lbs.}$

Model Selection: **SALD ¾ x1** (Due to effective weight)

Example 16 Vertical-Rotating Beam Driven by Air Cylinder



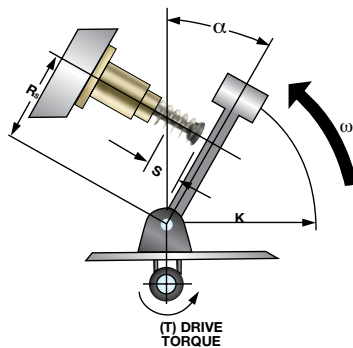
Cyl Dia. = 3 in.
PSI = 70
w = 3 rad./sec.
W = 1,900 lbs. at C.G.
K = 20 in. to beam C.G.
S = 2 in. *
C = 100/hr.
R_s = 32 in.
V_s = Vel. @ R_s (ft./sec.)
R_c = 18 in.

$$\begin{aligned} I &= W \times K^2 / [386] = 1,900 \times 20^2 / [386] = 1,969 \text{ in.-lbs./sec.}^2 \\ F &= .78 \times D^2 \times \text{PSI} \times R_c / [R_s] = .78 \times 3^2 \times 70 \times 18 / [32] = 276 \text{ lbs.} \\ E_1 &= I \times w^2 / [2] = 1,969 / [2] \times 3^2 = 8,861 \text{ in.-lbs.} \\ E_2 &= F \times S = 276 \times 2 = 552 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 8,861 + 552 = 9,413 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 9,413 \times 100 = 941,300 \text{ in.-lbs./hr.} \\ V_s &= 0.83 \times R_s \times w = 0.83 \times 32 \times 3 = 8.00 \text{ ft./sec.} \\ W_E &= E_3 / [.2V_s^2] = 9,413 / [.2(8)^2] = 735 \text{ lbs.} \end{aligned}$$

Model Selection: **SALD 1-1/8 x 2**

*Note: These items will vary with individual applications and were selected for illustration purposes only.

Example 17 Vertical-Motor Driven Rotating Arm with Attached Load Opposing Gravity

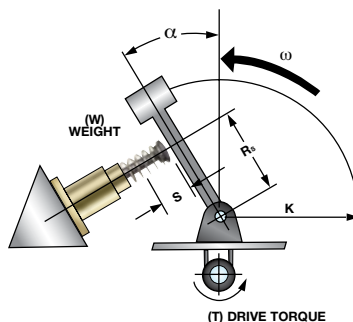


W = 150 lbs.
K = 36 in.
R_s = 27 in.
w = 3 rad./sec.
a = 30°
T = 3,000 in.-lbs.
S = 2 in. *
C = 175/hr.
V_s = Vel. @ R_s (ft./sec.)

$$\begin{aligned} I &= W / [386] \times K^2 = 150 / [386] \times 36^2 = 504 \text{ in.-lbs./sec.}^2 \\ F &= T - W \times K \times \sin a / [R_s] = 3,000 - (150 \times 36 \times 0.5) / 27 = 11 \text{ lbs.} \\ E_1 &= I \times w^2 / [2] = 504 \times 3^2 / [2] = 2,268 \text{ in.-lbs.} \\ E_2 &= F \times S = 11 \times 2 = 22 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 2,268 + 22 = 2,290 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 2,290 \times 175 = 400,750 \text{ in.-lbs./hr.} \\ V_s &= .083 \times R_s \times w = .083 \times 27 \times 3 = 6.72 \text{ ft./sec.} \\ W_E &= E_3 / [.2V_s^2] = 2,290 / [.2(6.72)^2] = 254 \text{ lbs.} \end{aligned}$$

Model Selection: **SALD 3/4 x 2**

Example 18 Vertical-Motor Driven Rotating Arm with Attached Load Aided by Gravity



W = 350 lbs.
K = 36 in.
R_s = 27 in.
w = 3 rad./sec.
a = 40°
T = 2,500 in.-lbs.
S = 2 in. *
C = 175/hr.
V_s = Vel. @ R_s (ft./sec.)

$$\begin{aligned} I &= W \times K^2 / [386] = 350 / [386] \times 36^2 = 1,175 \text{ in.-lbs./sec.}^2 \\ F &= T + W \times K \times \sin a / [R_s] = 2,500 + (350 \times 36 \times .643) / [27] = 393 \text{ lbs.} \\ E_1 &= I \times w^2 / [2] = 1,175 \times 3^2 / [2] = 5,288 \text{ in.-lbs.} \\ E_2 &= F \times S = 393 \times 2 = 786 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 5,288 + 786 = 6,074 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 6,074 \times 175 = 1,062,950 \text{ in.-lbs./hr.} \\ V_s &= 0.83 \times R_s \times w = 0.83 \times 27 \times 3 = 6.72 \text{ ft./sec.} \\ W_E &= E_3 / [.2V_s^2] = 6,074 / [.2(6.72)^2] = 673 \text{ lbs.} \end{aligned}$$

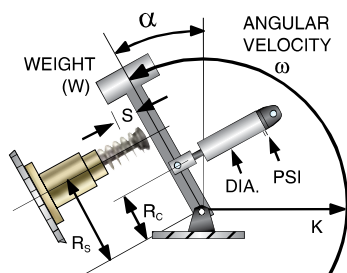
Model Selection: **SALD 1-1/8 x 2***

Note: These items will vary with individual applications and were selected for illustration purposes only.



Example 19

Vertical Rotating Arm – Cylinder Driven (Push Type) with Attached Load Aided by Gravity



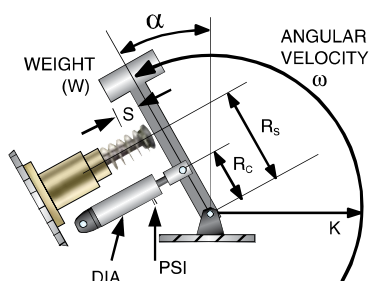
D (Cyl. Dia.) = 2.5 in.
PSI = 80
R_c = 15 in.
W = 250 lbs. At C.G.
K = 30 in.
R_s = 25 in.
w = 3 rad./sec.
a = 45°
S = 2 in. *
C = 100/hr.

$$\begin{aligned}
 I &= W / [386] \times K^2 = 250 / [386] \times 30^2 = 583 \text{ in.-lbs./sec.}^2 \\
 T &= .78 \times D^2 \times \text{PSI} \times R_c = .78 \times 2.5^2 \times 80 \times 15 = 5,850 \text{ in.-lbs.} \\
 F &= T + W \times K \times \sin a / [R_s] = 5,850 + (250 \times 30 \times 7.07) / [25] = 446 \text{ lbs.} \\
 E_1 &= I \times w^2 / [2] = 583 \times 3^2 / [2] = 2,623 \text{ in.-lbs.} \\
 E_2 &= F \times S = 446 \times 2 = 892 \text{ in.-lbs.} \\
 E_3 &= E_1 + E_2 = 2,623 + 892 = 3515 \text{ in.-lbs.} \\
 E_4 &= E_3 \times C = 3515 \times 100 = 351,500 \text{ in.-lbs./hr.} \\
 V_s &= 0.83 \times R_s \times w = 0.83 \times 25 \times 3 = 6.23 \text{ ft./sec.} \\
 W_E &= E_3 / [.2V_s^2] = 3515 / [.2(6.23)^2] = 453 \text{ lbs.}
 \end{aligned}$$

Model Selection: **SALD ¾ x 2**

Example 20

Vertical Rotating Arm – Cylinder Driven (Pull Type) with Attached Load Aided by Gravity



D (Cyl. Dia.) = 2.5 in.
D₁ (Cyl. Rod Dia.) = 1 in.
PSI = 80
R_c = 15 in.
W = 250 lbs. At C.G.
K = 30 in.
R_s = 25 in.
w = 3 rad./sec.
a = 45°
S = 2 in. *
C = 100/hr.

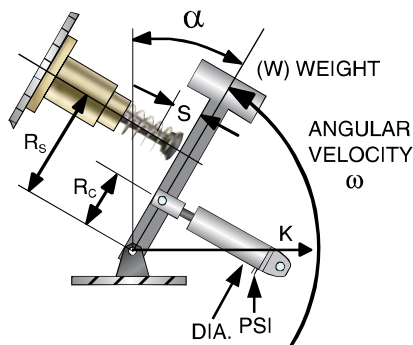
$$\begin{aligned}
 I &= W / [386] \times K^2 = 250 / [386] \times 30^2 = 583 \text{ in.-lbs./sec.}^2 \\
 T &= ((.78 \times D^2) - (.78 \times D_1^2)) \times \text{PSI} \times R_c = \\
 &= ((.78 \times 2.5^2) - (.78 \times 1^2)) \times 80 \times 15 = 4,914 \text{ in.-lbs.} \\
 F &= T + (W \times K \times \sin a) / [R_s] = \\
 &= 4,914 + (250 \times 30 \times 7.07) / [25] = 409 \text{ lbs.} \\
 E_1 &= I \times w^2 / [2] = 583 \times 3^2 / [2] = 2,623 \text{ in.-lbs.} \\
 E_2 &= F \times S = 409 \times 2 = 818 \text{ in.-lbs.} \\
 E_3 &= E_1 + E_2 = 2,623 + 818 = 3,441 \text{ in.-lbs.} \\
 E_4 &= E_3 \times C = 3,441 \times 100 = 344,100 \text{ in.-lbs./hr.} \\
 V_s &= .083 \times R_s \times w = .083 \times 25 \times 3 = 6.23 \text{ ft./sec.} \\
 W_E &= E_3 / [.2V_s^2] = 3,441 / [.2(6.23)^2] = 443 \text{ lbs.}
 \end{aligned}$$

Model Selection: **SALD ¾ x 2**

*Note: These items will vary with individual applications and were selected for illustration purposes only.

Example 21

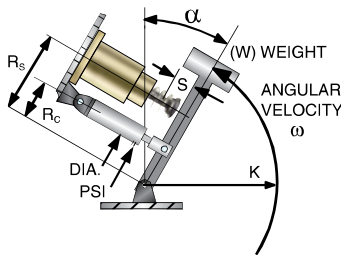
Vertical Rotating Arm – Cylinder Driven (Push Type) with Attached Load Opposing Gravity



D (Cyl. Dia.) = 2.5 in.
PSI = 80
R_c = 15 in.
W = 150 lbs. At C.G.
K = 30 in.
R_s = 25 in.
w = 3 rad./sec.
a = 30°
S = 2 in. *
C = 100/hr.

$$\begin{aligned}
 I &= W / [386] \times K^2 = 150 / [386] \times 30^2 = 350 \text{ in.-lbs./sec.}^2 \\
 T &= .78 \times D^2 \times \text{PSI} \times R_c = .78 \times 2.5^2 \times 80 \times 15 = 5,850 \text{ in.-lbs.} \\
 F &= T - (W \times K \times \sin a) / [R_s] = 5,850 - (150 \times 30 \times .5) / [25] = 144 \text{ lbs.} \\
 E_1 &= I \times w^2 / [2] = 350 \times 3^2 / [2] = 1,575 \text{ in.-lbs.} \\
 E_2 &= F \times S = 144 \times 2 = 288 \text{ in.-lbs.} \\
 E_3 &= E_1 + E_2 = 1,575 + 288 = 1,863 \text{ in.-lbs.} \\
 E_4 &= E_3 \times C = 1,863 \times 100 = 186,300 \text{ in.-lbs./hr.} \\
 V_s &= .083 \times R_s \times w = .083 \times 25 \times 3 = 6.23 \text{ ft./sec.} \\
 W_E &= E_3 / [.2V_s^2] = 1,863 / [.2(6.23)^2] = 240 \text{ lbs.}
 \end{aligned}$$

Model Selection: **SALD ½ x 2**

Example 22**Vertical Rotating Arm – Cylinder Driven (Pull Type) with Attached Load Opposing Gravity**

D (Cyl. Dia.) = 2.5 in.

D₁ (Cyl. Rod Dia.) = 1 in.

PSI = 80

R_c = 15 in.

W = 150 lbs. At C.G.

K = 30 in.

R_s = 25 in.

w = 3 rad./sec.

a = 30°

S = 2 in. *

C = 100/hr.

$$I = W \times K^2 / [386] = 150 \times 30^2 / [386] = 350 \text{ in.-lbs./sec.}^2$$

$$T = ((.78 \times D^2) - (.78 \times D_1^2)) \times \text{PSI} \times R_c = ((.78 \times 2.5^2) - (.78 \times 1^2)) \times 80 \times 15 = 4,914 \text{ in.-lbs.}$$

$$F = T - (W \times K \times \sin a) / [R_s] = 4,914 - (150 \times 30 \times .5) / [25] = 107 \text{ lbs.}$$

$$E_1 = I \times w^2 / [2] = 350 \times 3^2 / [2] = 1,575 \text{ in.-lbs.}$$

$$E_2 = F \times S = 107 \times 2 = 214 \text{ in.-lbs.}$$

$$E_3 = E_1 + E_2 = 1,575 + 214 = 1,789 \text{ in.-lbs.}$$

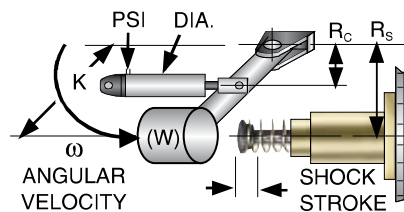
$$E_4 = E_3 \times C = 1,789 \times 100 = 178,900 \text{ in.-lbs./hr.}$$

$$V_s = .083 \times R_s \times w = .083 \times 25 \times 3 = 6.23 \text{ ft./sec.}$$

$$W_E = E_3 / [.2V_s^2] = 1,789 / [.2(6.23)^2] = 231 \text{ lbs.}$$

Model Selection: **SALD ½ x 2**

*Note: These items will vary with individual applications and were selected for illustration purposes only.

Example 23**Horizontal Rotary Load – Propelled by a Cylinder**

D (Cyl. Dia.) = 2.5 in.

PSI = 80

R_c = 15 in.

W = 900 lbs. At C.G.

K = 30 in.

R_s = 20 in.

A = Rotation angle = 90°

t = 3 sec.

S = 1 in. *

C = 100/hr.

$$V = A \times K / [688t] = 90 \times 30 / [688 \times 3] = 1.3 \text{ ft./sec}$$

$$E_1 = .2WV^2 = .2 \times 900 \times (1.3)^2 = 304 \text{ in.-lbs.}$$

$$F = .78 \times D^2 \times \text{PSI} \times R_c / [R_s] = .78 \times 2.5^2 \times 80 \times 15 / [20] = 293 \text{ in.-lbs.}$$

$$E_2 = F \times S = 293 \times 1 = 293 \text{ in.-lbs.}$$

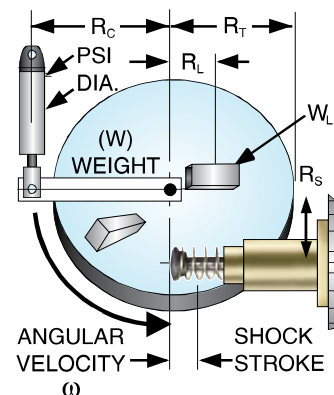
$$E_3 = E_1 + E_2 = 304 + 293 = 597 \text{ in.-lbs.}$$

$$E_4 = E_3 \times C = 597 \times 100 = 59,700 \text{ in.-lbs./hr.}$$

$$V_s = A \times R_s / [688t] = 90 \times 20 / [688 \times 3] = 0.87 \text{ ft./sec}$$

$$W_E = E_3 / [.2V_s^2] = 597 / [.2(.87)^2] = 3,944 \text{ lbs.}$$

Model Selection: **SASL ¾ x 1** (Due to velocity and effective weight)

Example 24**Horizontal Rotary Table – Propelled by a Cylinder, with or without additional load**

D (Cyl. Dia.) = 2.5 in.

PSI = 80

R_c = 10 in.

W = 440 lbs.

R_r = 20 in.

R_L = 8 in.

W_L = 100 lbs.

R_s = 8.86 in.

A = Rotation angle = 90°

t = 1 sec.

S = 1 in. *

C = 10/ hr.

$$V_r = A \times R_r / [688t] = 90 \times 20 / [688 \times 1] = 2.6 \text{ ft./sec}$$

$$E_1 (\text{TABLE}) = .1WV_r^2 = .1 \times 440 \times (2.6)^2 = 297 \text{ in.-lbs.}$$

$$V_L = A \times R_L / [688t] = 90 \times 8 / [688 \times 1] = 1.04 \text{ ft./sec}$$

$$E_1 (\text{ADD'L LOAD}) = .2 \times 100 (1.04)^2 = 22 \text{ in.-lbs.}$$

$$E_1 (\text{TOTAL}) = E_1 (\text{TABLE}) + E_1 (\text{ADD'L LOAD}) = 297 + 22 = 319 \text{ in.-lbs.}$$

$$F = .78 \times D^2 \times \text{PSI} \times R_c / [R_s] = .78 \times 2.5^2 \times 80 \times 10 / [8.86] = 440 \text{ lbs.}$$

$$E_2 = F \times S = 440 \times 1 = 440 \text{ in.-lbs.}$$

$$E_3 = E_1 + E_2 = 319 + 440 = 759 \text{ in.-lbs.}$$

$$E_4 = E_3 \times C = 759 \times 10 = 7,590 \text{ in.-lbs.}$$

$$V_s = A \times R_s / [688t] = 90 \times 8.86 / [688 \times 1] = 1.16 \text{ ft./sec}$$

$$W_E = E_3 / [.2V_s^2] = 759 / [.2(1.16)^2] = 2,820 \text{ lbs.}$$

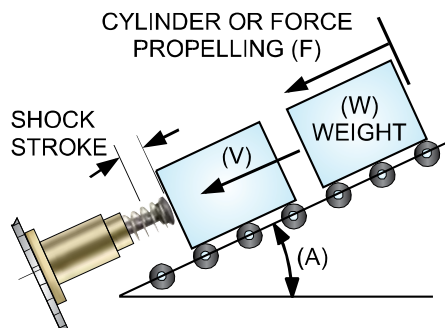
Model Selection: **SALD ¾ x 1**

*Note: These items will vary with individual applications and were selected for illustration purposes only.



Example 25

Inclined Plane – Moving Load Propelled Down by a Cylinder



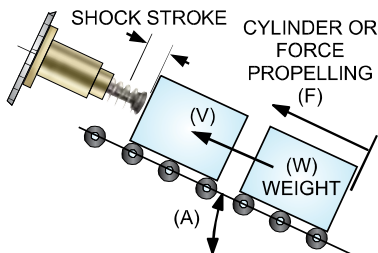
D (Cyl. Dia.) = 2.5 in.
 PSI = 80
 V = 5 ft./sec.
 W = 500 lbs.
 A = Angle of incline = 15°
 S = 2 in. *
 C = 100 / hr.

$$\begin{aligned} E_1 &= .2WV^2 = .2 \times 500 \times (5)^2 = 2,500 \text{ in.-lbs.} \\ F &= .78 \times D^2 \times \text{PSI} = 390 \text{ lbs.} \\ E_2 &= (F + (W \times \sin A)) \times S = \\ &= (390 + (500 \times .26)) \times 2 = 1,040 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 2,500 + 1,040 = 3,540 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 3,540 \times 100 = 354,000 \text{ in.-lbs./hr.} \\ W_E &= E_3 / [.2V_s^2] = 3,540 / [.2(5)^2] = 708 \text{ lbs.} \end{aligned}$$

Model Selection: **SALD ¾ x 2**

Example 26

Inclined Plane – Moving Load Propelled Up by a Cylinder



D (Cyl. Dia.) = 2.5 in.
 PSI = 80
 V = 5 ft./sec.
 W = 300 lbs.
 A = Angle of incline = 15°
 S = 1 in. *
 C = 100 / hr.

$$\begin{aligned} E_1 &= .2WV^2 = .2 \times 300 \times (5)^2 = 1,500 \text{ in.-lbs.} \\ F &= .78 \times D^2 \times \text{PSI} = 390 \text{ lbs.} \\ E_2 &= (F - (W \times \sin A)) \times S = (390 - (300 \times .26)) \times 1 = 312 \text{ in.-lbs.} \\ E_3 &= E_1 + E_2 = 1,500 + 312 = 1,812 \text{ in.-lbs.} \\ E_4 &= E_3 \times C = 1,812 \times 100 = 181,200 \text{ in.-lbs./hr.} \\ W_E &= E_3 / [.2V_s^2] = 1,812 / [.2(5)^2] = 362 \text{ lbs.} \end{aligned}$$

Model Selection: **SALD ¾ x 1**

*Note: These items will vary with individual applications and were selected for illustration purposes only.

EnertronsSize and 3D Solid Model CAD Files



Enertrons sizing program, EnertronsSize, patterned in the spreadsheet format, enables you to select the proper industrial shock absorber or elastomeric bumper for your application.

The program is available on CD-ROM and soon will be available for downloading from the Enertrons website. To receive a CD-ROM simply email Enertrons direct at customerservice@enertrons.com.

If you prefer, Enertrons will size your application for you. There is no charge for this service. Contact Enertrons Applications Department at 734-595-4500.

3D solid model CAD file drawings are available for downloading by visiting the Enertrons website at www.enertrons.com.

Model Rating Charts

Shock Absorber Selection Suggestions...After determining the energy requirements of your application using the formulas and examples on the previous pages, select the required model and stroke size from the charts below. Enertrols recommends that you select a model with 20% more capacity than your calculations indicate necessary. This extra capacity allows for changes if the weight, velocity or cycle rates increase in the future.

Enertrols also recommends using the longest stroke possible when calculating. This will provide maximum deceleration performance with the lowest impact forces. **If you prefer, an Enertrols application engineer will size your application for you and recommend the correct shock absorber for your linear deceleration requirement. There is no cost for this service.**

Self-Compensating Sub-Miniature Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
SM 9M-1 SM 9M-2	0.20	9.0	1.35 - 7.0 1.75 - 9.0	18,000	N/A	N/A
SM 10EL SM 10EH	0.20	11.0 11.0	0.75 - 6.0 1.5 - 11	35,000	N/A	N/A
SM 10ML SM 10MH	0.20	4.0 7.0	0.75 - 6.0 1.5 - 11	35,000	N/A	N/A
SM 25L SM 25 SM 25H	0.26	20	1.5 - 5.0 4 - 12 10 - 30	200,000	N/A	N/A
SM 30M1 SM 30M2 SM 30M3	0.32	31	1.0 - 4.30 3.97 - 11.90 11.02 - 33.07	50,000	N/A	N/A
SM 75-1 SM 75-2 SM 75-3	0.40	75	0.5 - 2.5 2 - 14 6 - 80	250,000	N/A	N/A

Self-Compensating Miniature Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
SNALD 150 SNALD 150H SNALD 150H2	0.50	150	2 - 22 19 - 190 150 - 450	300,000	N/A	N/A
SNALD 225 SNALD 225H SNALD 225H2	0.50	225	5 - 55 50 - 500 400 - 2,000	400,000	N/A	N/A
SNALD 450 SNALD 450H SNALD 450H2	1.00	450	5 - 35 20 - 130 80 - 500	600,000	N/A	N/A
SNALD 600 SNALD 600H SNALD 600H2	1.00	600	20 - 300 250 - 2,500 880 - 5,000	600,000	N/A	N/A
SNALD 1/2x1-S-1 SNALD 1/2x1-S-2 SNALD 1/2x1-S-3 SNALD 1/2x1-S-4	0.94	1,350	20 - 80 68 - 272 230 - 920 780 - 3,120	750,000	N/A	N/A
SNALD 1/2x2-S-1 SNALD 1/2x2-S-2 SNALD 1/2x2-S-3 SNALD 1/2x2-S-4	1.94	2,700	40 - 160 136 - 544 460 - 1,840 1,560 - 6,240	870,000	N/A	N/A

Adjustable Miniature Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
SA 30M	0.32	31	0.5 - 31.0	50,000	N/A	N/A
SA 35	0.40	35	13 - 125	53,000	N/A	N/A
SA 50M	0.28	50	10 - 45	120,000	N/A	N/A
SA 150	0.50	200	2 - 240	300,000	N/A	N/A
SA 1/4x1/2-S	0.50	200	2 - 240	400,000	N/A	N/A
SALD 3/8x1-S	1.00	600	10 - 1,200	600,000	N/A	N/A
SALD 1/2x1-S	1.00	1,500	10 - 3,000	750,000	N/A	N/A
SALD 1/2x2-S	2.00	3,000	21 - 6,000	870,000	N/A	N/A



Self-Compensating Mid-Size Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
SNALD 3325-1	0.91	1,350	20 - 80	670,000	1,100,000	1,500,00
SNALD 3325-2			68 - 272			
SNALD 3325-3			230 - 920			
SNALD 3325-4			780 - 3,120			
SNALD 3350-1	1.91	2,700	40 - 160	760,000	1,200,000	1,600,000
SNALD 3350-2			136 - 544			
SNALD 3350-3			460 - 1,840			
SNALD 3350-4			1,560 - 6,240			
SNALD 4525-1	0.91	3,000	50 - 200	950,000	1,400,000	1,700,000
SNALD 4525-2			170 - 680			
SNALD 4525-3			575 - 2,300			
SNALD 4525-4			1,950 - 7,800			
SNALD 4550-1	1.91	6,000	100 - 400	1,000,000	1,700,000	2,200,000
SNALD 4550-2			340 - 1,360			
SNALD 4550-3			1,150 - 4,600			
SNALD 4550-4			3,900 - 15,600			
SNALD 4575-1	2.91	9,000	150 - 600	1,300,000	2,000,000	2,500,000
SNALD 4575-2			510 - 2,040			
SNALD 4575-3			1,730 - 6,920			
SNALD 4575-4			5,850 - 23,400			
SNALD 6450-1	1.91	15,000	300 - 1,200	1,300,000	2,600,000	3,400,000
SNALD 6450-2			1,020 - 4,080			
SNALD 6450-3			3,460 - 13,840			
SNALD 6450-4			11,700 - 46,800			
SNALD 64100-1	3.91	30,000	600 - 2,400	1,700,000	3,400,000	4,400,000
SNALD 64100-2			2,040 - 8,160			
SNALD 64100-3			6,920 - 27,680			
SNALD 64100-4			23,400 - 93,600			
SNALD 64150-1	5.91	45,000	900 - 3,600	2,200,000	4,400,000	5,700,000
SNALD 64150-2			3,060 - 12,240			
SNALD 64150-3			10,380 - 41,520			
SNALD 64150-4			35,100 - 140,400			

Adjustable Gold Line® Primary Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
SALD 1/2x1-P	1.00	1,350	10 - 2,700	750,000	1,300,000	
SALD 1/2x2-P	2.00	2,700	21 - 5,400	870,000	1,400,000	
SALD 3/4x1-P	1.00	3,000	20 - 18,000	1,100,000	1,600,000	
SALD 3/4x2-P	2.00	6,000	35 - 32,000	1,300,000	2,000,000	
SALD 3/4x3-P	3.00	9,000	50 - 46,000	1,600,000	2,400,000	
SALD 1-1/8x2-P	2.00	16,000	120 - 50,000	1,500,000	3,000,000	
SALD 1-1/8x4-P	4.00	32,000	160 - 100,000	2,000,000	4,000,000	
SALD 1-1/8x6-P	6.00	48,000	200 - 150,000	2,500,000	5,000,000	

Adjustable Gold Line® Fixed Flange Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
SALD 3/4x1	1.00	3,000	20 - 18,000	1,100,000	1,600,000	
SALD 3/4x2	2.00	6,000	35 - 32,000	1,300,000	2,000,000	
SALD 3/4x3	3.00	9,000	50 - 46,000	1,600,000	2,400,000	
SALD 1-1/8x2	2.00	16,000	120 - 50,000	1,500,000	3,000,000	
SALD 1-1/8x4	4.00	32,000	160 - 100,000	2,000,000	4,000,000	
SALD 1-1/2x2	2.00	21,000	300 - 80,000	3,200,000	4,000,000	
SALD 1-1/2x3-1/2	3.50	36,750	350 - 120,000	5,600,000	7,000,000	
SALD 1-1/2x5	5.00	52,500	400 - 160,000	8,000,000	10,000,000	
SALD 1-1/2x6-1/2	6.50	68,250	450 - 200,000	10,400,000	13,000,000	
SALD 2-1/4x2	2.00	56,000	1,200 - 100,000	16,000,000	20,000,000	
SALD 2-1/4x4	4.00	112,000	1,500 - 200,000	20,000,000	25,000,000	
SALD 2-1/4x6	6.00	168,000	1,800 - 300,000	24,000,000	30,000,000	
SALD 2-1/4x8	8.00	224,000	2,100 - 410,000	28,000,000	35,000,000	

Self-Compensating ECA Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
ECA 2x2-1	2.00	32,000	1,600 - 4,800	9,600,000	12,000,000	15,600,000
ECA 2x2-2			4,000 - 12,000			
ECA 2x2-3			10,000 - 30,000			
ECA 2x2-4			25,000 - 75,000			
ECA 2x4-1	4.00	64,000	3,200 - 9,600	12,000,000	15,000,000	19,500,000
ECA 2x4-2			8,000 - 24,000			
ECA 2x4-3			20,000 - 60,000			
ECA 2x4-4			50,000 - 150,000			
ECA 2x6-1	6.00	96,000	4,800 - 14,400	14,400,000	18,000,000	23,500,000
ECA 2x6-2			12,000 - 36,000			
ECA 2x6-3			30,000 - 90,000			
ECA 2x6-4			75,000 - 225,000			
ECA 2x8-1	8.00	128,000	6,400 - 19,200	1,000,000	1,700,000	2,200,000
ECA 2x8-2			12,000 - 36,000			
ECA 2x8-3			30,000 - 90,000			
ECA 2x8-4			75,000 - 225,000			
ECA 2x10-1	10.00	160,000	8,000 - 24,000	1,300,000	2,000,000	2,500,000
ECA 2x10-2			20,000 - 60,000			
ECA 2x10-3			50,000 - 150,000			
ECA 2x10-4			125,000 - 375,000			
ECA 3x5-1	5.00	125,000	6,400 - 19,200	1,300,000	2,600,000	3,400,000
ECA 3x5-2			16,000 - 48,000			
ECA 3x5-3			40,000 - 120,000			
ECA 3x5-4			100,000 - 300,000			
ECA 3x8-1	8.00	200,000	10,240 - 30,720	1,700,000	3,400,000	4,400,000
ECA 3x8-2			25,600 - 76,800			
ECA 3x8-3			64,000 - 192,000			
ECA 3x8-4			160,000 - 480,000			
ECA 3x12-1	12.00	300,000	15,360 - 46,080	2,200,000	4,400,000	5,700,000
ECA 3x12-2			38,400 - 115,200			
ECA 3x12-3			96,000 - 288,000			
ECA 3x12-4			240,000 - 720,000			
ECA 4x6-3	6.00	420,000	8,000 - 19,000	27,000,000	45,000,000	58,000,000
ECA 4x6-5	6.00	420,000	19,000 - 41,000	27,000,000	45,000,000	58,000,000
ECA 4x6-7	6.00	420,000	41,000 - 94,000	27,000,000	45,000,000	58,000,000
ECA 4x8-3	8.00	560,000	11,000 - 25,000	30,000,000	50,000,000	65,000,000
ECA 4x8-5	8.00	560,000	25,000 - 55,000	30,000,000	50,000,000	65,000,000
ECA 4x8-7	8.00	560,000	55,000 - 125,000	30,000,000	50,000,000	65,000,000
ECA 4x16-3	16.00	1,120,000	22,000 - 50,000	50,000,000	80,000,000	110,000,000
ECA 4x16-5	16.00	1,120,000	50,000 - 110,000	50,000,000	80,000,000	110,000,000
ECA 4x16-7	16.00	1,120,000	110,000 - 250,000	50,000,000	80,000,000	110,000,000

Adjustable EA Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
EA 2 x 2	2.00	32,000	560 - 170,000	9,600,000	12,000,000	15,600,000
EA 2 x 4	4.00	80,000	510 - 160,000	12,000,000	15,000,000	19,500,000
EA 2 x 6	6.00	120,000	570 - 190,000	14,400,000	18,000,000	23,500,000
EA 2 x 8	8.00	170,000	580 - 200,000	16,800,000	21,000,000	27,000,000
EA 2 x 10	10.00	210,000	720 - 250,000	19,200,000	24,000,000	31,000,000
EA 3 x 5	5.00	140,000	1,050 - 340,000	20,000,000	25,000,000	32,500,000
EA 3 x 8	8.00	250,000	1,200 - 400,000	32,000,000	40,000,000	52,000,000
EA 3 x 12	12.00	390,000	1,350 - 450,000	48,000,000	60,000,000	78,000,000

Adjustable SILVERLINE® Models for Low Velocity, High Propelling Force Applications

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
SASL 3/4x1	1.00	3,000	300 - 260,000	1,100,000	1,600,000	
SASL 3/4x2	2.00	6,000	350 - 500,000	1,300,000	2,000,000	
SASL 1-1/8x1	1.00	9,000	700 - 700,000	1,250,000	2,500,000	
SASL 1-1/8x2	2.00	16,000	850 - 1,300,000	1,500,000	3,000,000	
SASL 1-1/2x2	2.00	21,000	22,000 - 1,360,000	3,200,000	4,000,000	
SASL 2-1/4x2	2.00	56,000	50,000 - 3,175,000	16,000,000	20,000,000	



Adjustable High-Precision Metric (HPM) Models

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
HP-3000	1.00	3,000	20 - 18,000	1,100,000	1,600,000	
HP-6000	2.00	6,000	35 - 32,000	1,300,000	2,000,000	
HP-9000	3.00	9,000	50 - 46,000	1,600,000	2,400,000	
HP-16000	2.00	16,000	120 - 50,000	1,500,000	3,000,000	
HP-32000	4.00	32,000	160 - 100,000	2,000,000	4,000,000	

Adjustable High-Precision Metric HPSL (HPM™) Series, Fixed Flange & Primary (-P)

Model Number	Stroke-Inches 1 inch = 25.4 mm	E3 Max. Energy/Cycle inch lbs 1 in lb = .11 Nm	WE (lbs.) Effective Weight lbs, 1 lb = .45 kg	E4 Max. Energy/Hour, in lbs/hour 1 in lb/hour = .11 Nm/hour		
				Self Contained	A/O Tank	A/O Re-circulating
HPSL-3000	1.00	3,000	300 - 260,000	1,100,000	1,600,000	
HPSL-6000	2.00	6,000	350 - 500,000	1,300,000	2,000,000	
HPSL-8000	1.00	9,000	700 - 700,000	1,250,000	2,500,000	
HPSL-16000	2.00	16,000	850 - 1,300,000	1,500,000	3,000,000	

SNALD Mid-Size Emergency Shock Absorber Ratings

What if your system fails, a runaway occurs or the limit switch malfunctions? SNALD Mid-Size shock absorbers can handle up to 5 times the maximum energy for a single cycle or up to 3 times the maximum energy for 1,000 application cycles.

SNALD 33 Series-Emergency Ratings

Model Number	Self- Compensating Ratings		Hydro Shock Ratings		Main Catalog Maximum Energy Ratings
	1 CYCLE E3 Energy/Cycle in lbs (Nm)	1,000 CYCLES E3 Energy/Cycle in lbs (Nm)	1 CYCLE E3 Energy/Cycle in lbs (Nm)	1,000 CYCLES E3 Energy/Cycle in lbs (Nm)	E3 Energy/Cycle in lbs (Nm)
SNALD 3325-1			6,750 (765)	4,050 (459)	
SNALD 3325-2	4,050 (459)	2,700 (306)	9,000* lbs (40,034 N)	5,800* lbs (25,800 N)	1,350 (153)
SNALD 3325-3					
SNALD 3325-4					
SNALD 3350-1			13,500 (1,525)	8,100 (915)	
SNALD 3350-2	8,100 (915)	5,400 (610)	10,500* lbs (46,706 N)	6,500* lbs (28,913 N)	2,700 (305)
SNALD 3350-3					
SNALD 3350-4					

*Maximum allowable reaction force.

SNALD 45 Series-Emergency Ratings

Model Number	Self- Compensating Ratings		Hydro Shock Ratings		Main Catalog Maximum Energy Ratings
	1 CYCLE E3 Energy/Cycle in lbs (Nm)	1,000 CYCLES E3 Energy/Cycle in lbs (Nm)	1 CYCLE E3 Energy/Cycle in	1,000 CYCLES E3 Energy/Cycle in lbs (Nm)	E3 Energy/Cycle in lbs (Nm)
SNALD 4525-1			15,000 (1,695)	9,000 (1,017)	
SNALD 4525-2	9,000 (1,017)	6,000 (678)	24,000* lbs (106,757 N)	13,000* lbs (57,827 N)	3,000 (339)
SNALD 4525-3					
SNALD 4525-4					
SNALD 4550-1			24,000 (2,712)	18,000 (2,034)	
SNALD 4550-2	18,000 (2,034)	12,000 (1,356)	24,000* lbs (106,757 N)	13,000* lbs (57,827 N)	6,000 (678)
SNALD 4550-3					
SNALD 4550-4					
SNALD 4575-1			36,000 (4,067)	27,000 (3,050)	
SNALD 4575-2	27,000 (3,051)	18,000 (2,034)	24,000* lbs (106,757 N)	13,000* lbs (57,827 N)	9,000 (1,017)
SNALD 4575-3					
SNALD 4575-4					

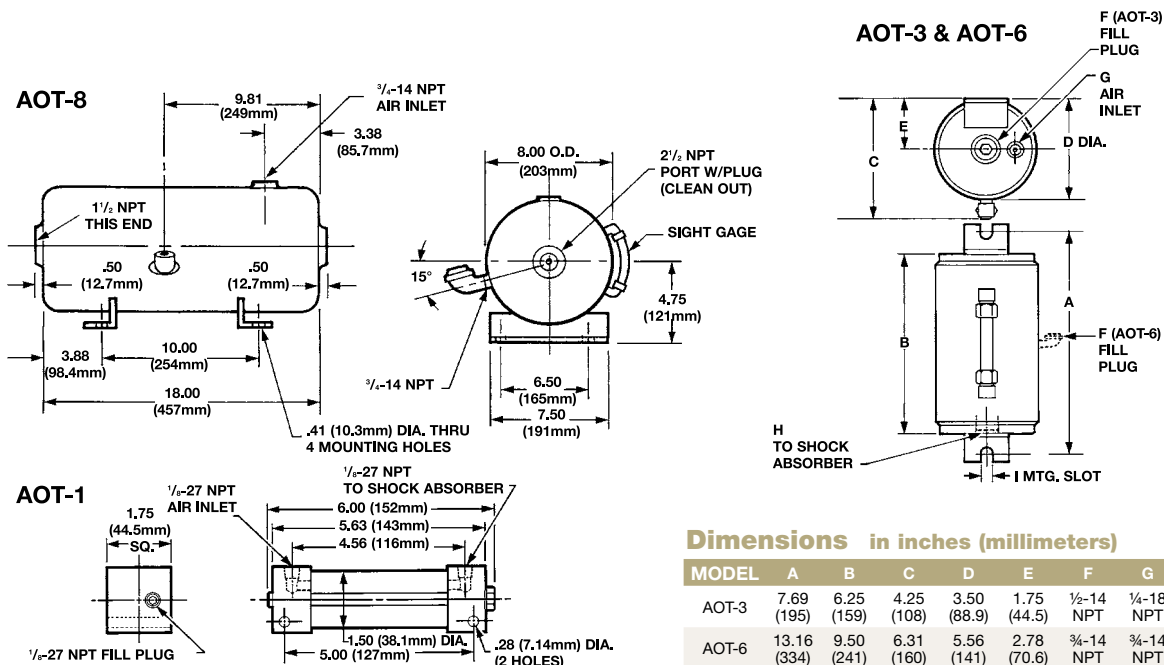
*Maximum allowable reaction force.

General Information





Air/Oil Tank Dimensions



External Accumulator Circuits

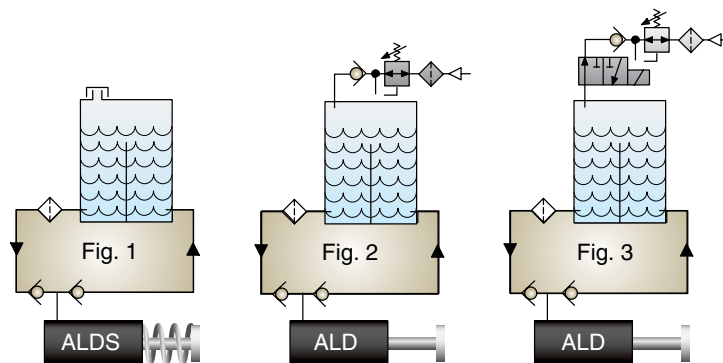
Air/Oil Systems provide a convenient way for additional heat dissipation and extends the cycles per hour capability of a shock absorber. Air/Oil Systems also can be used to extend the functionality of a shock absorber by delaying the piston rod return.

Units requiring an external accumulator, or fluid reservoir, are normally installed in one of three system configurations.

Figure 1 is the simplest and is utilized purely for heat dissipation. The oil has a positive circulation path to supply cool oil to the shock absorber. The air/oil tank may be either closed, or open and vented through a filter breather unit. Specify a spring or mechanical return shock absorber model with an external accumulator.

Figure 2 provides a filtered, pressurized, positive cool oil circulation path. Specify an air or mechanical return shock absorber model with an external accumulator. Operating pressure 50 to 100 PSI or 3.3 to 6.6 Bar.

Figure 3 uses a solenoid valve to return the shock absorbers piston rod to the extended position on demand. The system also uses a filtered, pressurized, positive cool oil circulation path. Specify an air return shock absorber model with an external accumulator. Operating pressure 50 to 100 PSI or 3.3 to 6.6 Bar.



Installation Tips for Air/Oil Systems

1. Do not install Air/Oil Systems with any shock that has an internal accumulator.
2. Make certain that all air return shocks are used with an Air/Oil tank.
3. Install shocks with the ports facing up and the Air/Oil Tank elevated above the shocks.
4. Check for proper size tank, especially when using one (1) tank with two (2) shocks.
5. Check tank for proper oil level and correct bleeding-approximately half-full.
6. Do not allow a shut-off valve to be installed between the tank and the shock.
7. Fittings and line size should be equal to or greater than the shock connection port.
8. On recirculating installations, make sure the check valves are properly installed.
9. Make sure incoming air is filtered to remove all water and contaminants.

Installation Recommendations and Tips

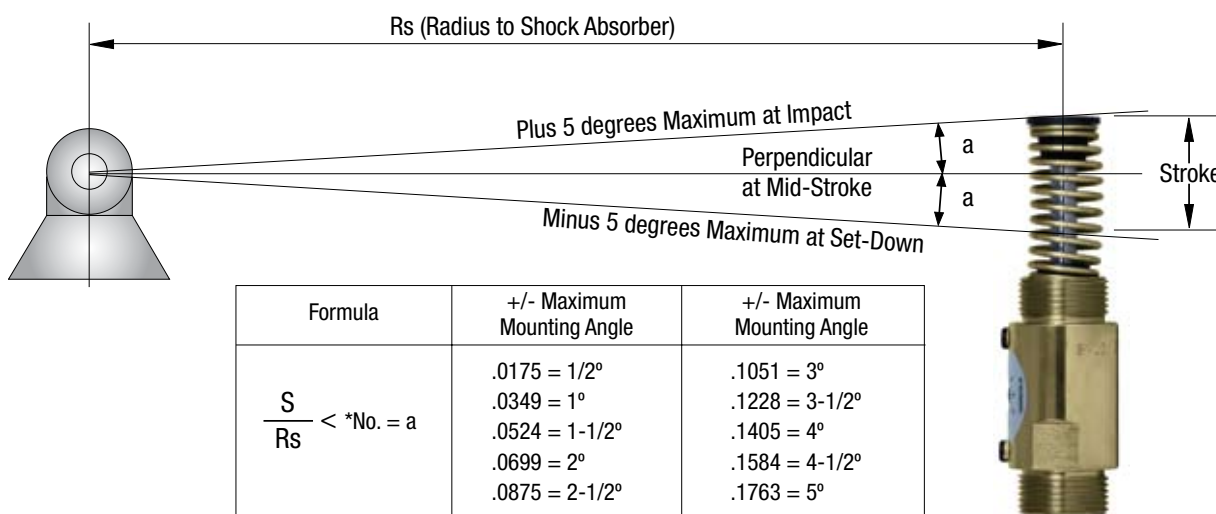
Mounting Structure Considerations

Enertrols shock absorbers should be rigidly bolted to a non-flexing mounting structure. Refer to the "Mounting Strength Required" column in the Energy Capacity table for the model you have selected.

Avoid side loads of more than 5° (3° for miniature models) and align the centerline of the piston as closely as possible to the impacting object's center of gravity. When using more than one shock absorber for a direction, be sure to balance the load as equally as possible between the shock absorbers.

Rotary Installation Requirements

The shock absorber should be mounted so that it is perpendicular to the pivot at mid stroke. This allows the maximum 5 degrees on the first 1/2 stroke and the maximum 5 degrees for the second 1/2. Miniature shock absorbers only are limited to plus or minus 3 degrees. Poly pads should not be used with rotary applications.



*Miniature models; 3 degrees maximum, all others 5 degrees maximum

General rule of thumb for minimum shock mount radius is a 6:1 ratio (Rs to S). For example with 1 inch (25mm) of shock absorber stroke, the minimum "Rs" mount radius is 6 inches (150mm).

External Stop Recommendations

Every type of automation equipment requires some form of external stop for two reasons; (1) to provide a firm work positioning point and (2) to prevent the shock absorber from bottoming out. All shock absorber manufacturers recommend to use an external stop to prevent damage to their product. Enertrols recommends shock absorber installations to use full stroke minus .06" or 1.6mm from the bottom of stroke.

Enertrols "Positive Stop Systems" are easy to use and the most economical answer in new applications. The Positive Stop Options provide a substantial, hardened steel work position stop (.06" or 1.6mm from bottom of stroke) as well as shock absorber mounting arrangements. They are available for Gold Line®, SILVERLINE®, Mid-Size, HPM, in Primary and Fixed Flange models.

How Short Stroking Affects a Shock Absorbers Performance

Enertrols recommends choosing a shock absorber with the proper stroke and using the full stroke for deceleration. Short stroking a shock absorber produces undesirable results, that may permanently damage the shock absorber as well as the equipment it is mounted on.

Short stroking changes the intended function of a shock absorber so that it cannot be adjusted easily or properly. There will be a hard impact at the beginning of stroke. Velocity will not be dissipated sufficiently through stroke, allowing for a hard impact set down. The last problem incurred is overheating and or damage from excessive internal pressures produced by the energy and not using all the internal orifices as designed.



Installation Recommendations and Tips

Making Shock Absorber Adjustments

Enertrols shock absorbers are to be adjusted at installation start up. Shock absorbers are shipped with adjustment preset at 90°, which is midway between "hard" and "soft". A properly adjusted shock absorber should show no noticeable impact at the beginning of the deceleration stroke and no hard set-down at the end of stroke.

1. Starting with a properly sized and installed shock absorber.
2. Loosen dial lock screw and set to mid range (number 9 on dial).
3. Cycle the machine and observe: Hard bump end of stroke, adjust in gradual increments to a lower number. Hard bump at beginning of stroke, adjust in gradual increments to a higher number. Repeat procedure and adjust until no bump is noticed at either end of stroke. In most installations, you will not be able to see the actual deceleration when properly adjusted.
4. Lock the dial set screw after final adjustment.
5. If the final adjustment is set less than "2", a larger unit should be considered for the application.



NOTE: Installations with 2 or more shocks; adjust simultaneously with final setting the same on each.

General Installation Tips For All Applications

1. Make certain you have properly sized and selected the shock absorber with appropriate mounting options for the application.
2. Shock alignment must be set for the moving load to strike the button or rod squarely. The load contact should strike more than half of the surface of the button or rod. Rotary applications refer to Tip number 15.
3. The machine structure must be adequate for the application. Example: With a flange mount shock the attaching structure should be at least as thick as the shock absorbers flange.
4. For models or mounting options that do not include positive stops make certain the shock absorber piston does not bottom out at end of stroke. The shock absorber must be positioned to prevent piston travel 1/32" to 1/16" from bottom. Metric 0.75mm to 1.5mm from bottom stroke.
5. Do not short stroke a shock absorber. The result will be excessive energy transmitted to the machine, overheating and possible permanent damage the shock absorber.
6. Mounting Stop Collar installations: make sure the attaching structure is the specified thickness for the shock installation. Failure may result in short stroke or bottoming out of the shock absorber.
7. Check clearances of moving parts near the shock absorber to prevent damage.
8. Check ambient temperature around shocks Over 125° F. or 52° C. Consult factory.
9. Check for any foreign material that will affect the shock, such as chemicals, acids, steam, high degree of weld flash, abrasive dust, etc.
10. Do not paint any part of a shock absorber. This may cause the piston rod to stick, oil to leak or overheating. All resulting in loss of functionality. Remove paint only with a material that will not have an effect on nitrite rubber, polyurethane or any sealing surfaces.
11. Never weld any part of a shock absorber.
12. Make certain the personnel using the shock understand how the dial adjustment indicator works: LOWER NUMBER-more resistance; HIGHER NUMBER-less resistance.
13. If 2 or more shocks are used for one deceleration direction, the dial setting should be the same. Do not use different strokes or manufacturer brands together.
14. Air cylinders with cushions should be set fully open when used with shock absorbers.
15. Rotary installations: shocks must be mounted to minimize side loads and located so they are perpendicular to the rotating load at mid-stroke. Maximum side load for miniature shocks are 3° all others are 5°. Poly pads are not recommended to be used in rotary applications.

Additional Enertrols Products

Shock Absorbers for Glass Bottle Industry



Enertrols has the shock absorbers designed to handle the extreme demands of glass bottle industry production equipment. The take-out-in, take-out-out and blow-head mechanisms are subjected to both high heat and high cycle rates.

Enertrols glass shocks are specifically designed to operate over long periods of time and eliminate damaging shock loads as well as bounce. These rugged performers allow cycle rates to be increased, which directly relates to increased production and improved profitability.

Shock Absorbers for PET Container Industry



Enertrols has the proven soft-touch shock absorbers to handle the damage causing impact forces and rapid production rates of PET industry equipment. The demands are high for these fast-paced production machines.

PET shock absorbers from Enertrols provide initial soft-touch contact, fast through-stroke time and a longer stroke. The result is reduced reaction forces, reduced stress on equipment and increased system performance.

Gas Springs



Enertrols gas springs remove the need for muscle power and provide controlled motion for lids, hoods, machine guards, panels and more. Available models include: push type, pull type (traction) and lockables.

Body diameters are available from 15 mm to 40 mm with forces ranging from 10 N to 5,000 N. Forces can be adjusted to meet your specific requirements. A variety of end fittings are available for ease of installation.

Elastomeric Bumpers



Elastomeric bumpers from Enertrols outperform rubber, urethane and coiled steel. These high-performance bumpers are highly engineered products that absorb more energy per unit of weight and volume than many known materials.

These durable bumpers are comprised of a thermal plastic co-polyester material that is excellent in resisting oil, grease, chemicals, salt water, ultra-violet light and microorganisms.



Sub-Miniature Shock Absorbers Self-Compensating

SM 9 to SM 75

Enertrols Sub-Miniature SM self-compensating, versatile industrial shock absorbers are ideal for use on relatively small, high-speed equipment. They offer energy per cycle capacities from 4 in-lbs (0.45 Nm) to 75 in-lbs (8 Nm). These highly-engineered, fully-threaded models are easily mounted in confined spaces. Wide effective weight ranges enable these durable shock absorbers to handle a multitude of load conditions.

Integral mechanical stops are built into each unit. Select models such as the **SM 25** and **SM 75** include outer tubes with **Weartec Plus** for outstanding corrosion protection.

Applications include: small robotics, material handling and packaging equipment, small linear slides, business machines, instrumentation, as well as office and medical equipment and much more.



Ordering Information

SM 75 -1				
SM Series	Model Number	Mounting Thread	Effective Weight	Button Options
	9	SM 9M	SM 9M	SM 9M & 10
	10			Standard No Button
	25	M M6 x 0.5 Metric	1 Light	-B Delrin Button
	30	SM 10	2 Medium	
	75	M M8 x 1 Metric		SM 25 & 75
		E M8 x 0.75 Metric	L Light Range	Standard with Button
		SM 25	H Heavy Range	-NB *No Button, Short Rod
		Standard (UNEF)		-880 No Button, Standard Rod
		M M10 x 1 Metric	L Light Range	-BP Steel Button/Urethane
		SM 30M	Standard Range	Cap Assembly
		M M8 x 1 Metric	H Heavy Range	
		SM 75		SM 30M
		Standard (UNEF)	1 Light	Standard with Steel Button
		M M12 x 1 Metric	2 Medium	-NB No Button, Short Rod
			3 Heavy	-BP Steel Button/Urethane
				Cap Assembly
			SM 75	
			-1 Light	
			-2 Medium	
			-3 Heavy	

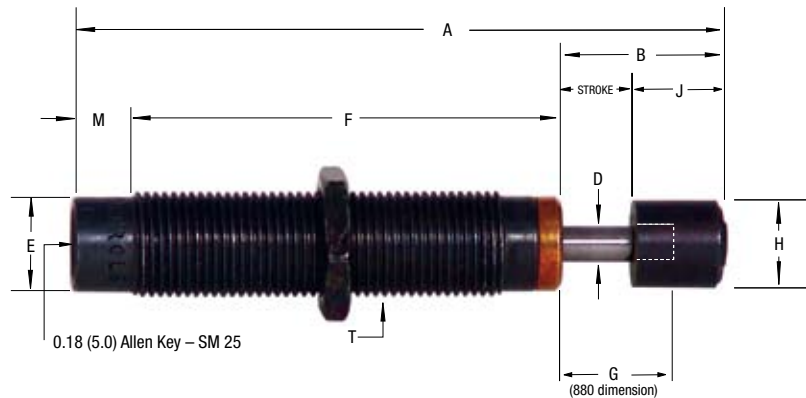
Button Option:

The Enertrols steel button/urethane cap assembly (-BP) is available if more quiet equipment operation is desired. (SM 25, 30 & 75 only)

SM 9 to SM 75

Sub-Miniature Shock Absorbers

Self-Compensating



For overall length of SM 9 and SM 10 without buttons, deduct the J dimension from the A dimension.

Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	F	G	H	J	M	T
SM 9M	.20 (5.0)	1.42 (36.0)	.40 (10.0)	N/A	.08 (2.0)	.20 (5.0)	.83 (21.1)	N/A	.19 (4.7)	.20 (5.0)	.10 (2.5)	M6 x 0.5
SM 10E	.20 (5.0)	1.52 (38.6)	.40 (10.0)	N/A	.08 (2.0)	.25 (6.4)	.83 (21.1)	N/A	.19 (4.7)	.20 (5.0)	.19 (4.8)	M8 x 0.75 M8x1
SM 25	.26 (6.6)	2.27 (57.7)	.57 (14.5)	N/A	.13 (3.3)	.33 (8.4)	1.3 (33.0)	.45 (11.4)	.30 (7.6)	.32 (8.1)	.20 (5.0)	3/8-32 UNEF M10x1
SM 25M												
SM 30M	.32 (8.1)	2.13 (54.0)	.52 (13.2)	N/A	.10 (2.5)	.25 (6.5)	1.35 (34.3)	N/A	.25 (6.5)	.20 (5.0)	.16 (4.1)	M8x1
SM 75	.40 (10.2)	2.76 (70.1)	.72 (18.1)	N/A	.13 (3.3)	.41 (10.4)	1.74 (44.2)	.60 (15.2)	.30 (7.6)	.32 (8.1)	.18 (4.6)	1/2-20 UNF M12x1
SM 75M												

Specifications

Model	We Effective Weight lbs (kg)	E ₃ Energy per Cycle in lbs (Nm)	E ₄ Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
SM 9M1	1.35 - 7.0 (0.6 - 3.2)	9.0 (1.0)	18,000 (2,000)	0.31 - 0.85 (1.38 - 3.78)	0.30	0.01 (0.004)
SM 9M2	1.75 - 9.0 (0.8 - 4.1)					
SM 10L	0.75 - 6.0 (0.34 - 3)	11.0 (1.24)	35,000 (3,950)	0.5 - 1.0 (2.22 - 4.45)	0.20	0.02 (0.01)
SM 10H	1.5 - 11 (0.68 - 5)	11.0 (1.24)				
SM 25L	1.5 - 5.0 (0.68 - 2)	20 (2)	200,000 (22,500)	0.8 - 1.7 (3.56 - 7.56)	0.20	0.06 (0.03)
SM 25	4 - 12 (2 - 5)					
SM 25H	10 - 30 (5 - 14)					
SM 30M1	1.0 - 4.3 (0.45 - 1.95)	31 (3.5)	50,000 (5,650)	1.16 - 1.57 (5.1 - 7.0)	0.30	0.02 (0.01)
SM 30M2	3.97 - 11.9 (1.8 - 5.4)					
SM 30M3	11.02 - 33.0 (5.0 - 15.0)					
SM 75-1	.5 - 2.5 (0.23 - 1)	75 (8)	250,000 (28,240)	1.0 - 2.5 (4.45 - 11.12)	0.30	0.1 (0.04)
SM 75-2	2 - 14 (0.91 - 6)					
SM 75-3	6 - 80 (3 - 36)					

Technical Data

Impact velocity range:

SM 9M: 0.5 to 6 ft/sec (0.15 to 1.8 m/sec)

SM 10: 0.5 to 5 ft/sec (0.15 to 1.5 m/sec)

SM 25: 0.5 to 8 ft/sec (0.15 to 2.4 m/sec)

SM 30M: 2.2 to 12.9 ft/sec (0.67 to 3.93 m/sec)

SM 75: 0.5 to 12 ft/sec (0.15 to 3.66 m/sec)

Operating temperature:

SM 9M and SM 10: 14° to 150°F (-10° to 66°C)

SM 25, 30M, & 75: 32° to 150°F (0° to 66°C)

Mechanical stop: Integral mechanical stop built into front of units.

Oil type: Silicone

Oil type SM 30M: Hydraulic oil

Materials: Steel body with Weartec Plus finish.
Hardened stainless steel piston rod.

Maximum side load depends on application. For additional information contact Enertrols Applications Department.

Lock nut included with each shock absorber.

Note: All dimensions and tolerance values listed in this catalog are nominal and subject to change without notice.



Miniature Shock Absorbers Self-Compensating

SNALD 150 to 600

Enertrols SNALD 150 to 600 Series self-compensating industrial shock absorbers offer versatility and high-energy capacity ratings. Numerous effective weight ranges are available, enabling these rugged performers to handle a variety of applications.

A built-in positive stop prevents bottoming out damage and provides a positive work-positioning point.

Applications include: relatively small, high-speed moving machines and equipment, material handling equipment, robotics, machine tools, packaging equipment, pick and place systems and more.

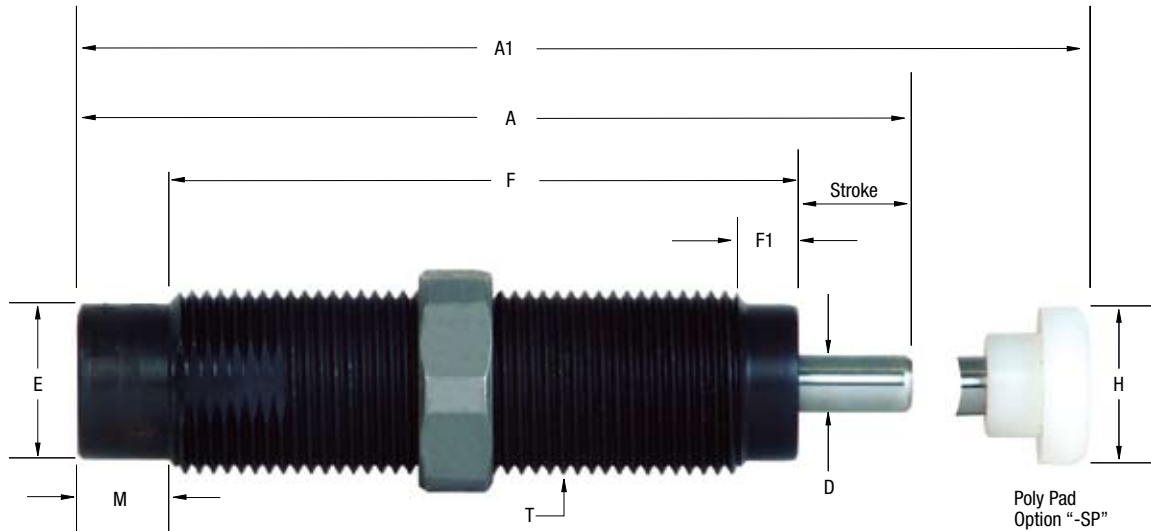


Ordering Information

SNALD 225 - H				
Series	Model Number	Mounting Thread		Effective Weight
SNALD	150	-	Standard (UNF)	Standard Range
	225	M	Metric	H Heavy Range
	450			H2 Extra Heavy Range
	600			
				Button Options
				Standard No Button
				SP Poly Pad

SNALD 150 to 600

Miniature Shock Absorbers Self-Compensating



Dimensions in inches (millimeters)

Model	Stroke	A	A1	D	E	F	F1	H	M	T
SNALD 150 SNALD 150M	0.47 (11.9)	3.43 (87.1)	3.70 (94.0)	.19 (4.8)	0.47 (11.9)	2.56 (65.0)	0.16 (4.1)	0.47 (11.8)	0.40 (10.2)	9/16-18 UNF M14x1.5
SNALD 225 SNALD 225M	0.47 (11.9)	3.50 (88.9)	3.69 (93.7)	.25 (6.4)	0.67 (17.0)	2.64 (67.0)	0.22 (5.6)	0.67 (17.0)	0.39 (9.9)	3/4-16 UNF M20x1.5
SNALD 450 SNALD 450M	0.97 (24.6)	5.53 (140.5)	5.72 (145.3)	.25 (6.4)	0.67 (17.0)	4.17 (105.9)	0.22 (5.6)	0.67 (17.0)	0.39 (9.9)	3/4-16 UNF M20x1.5
SNALD 600 SNALD 600M	0.97 (24.6)	5.87 (149.1)	6.12 (155.4)	.31 (7.9)	0.88 (22.4)	4.40 (111.7)	0.18 (4.6)	0.88 (22.4)	0.50 (12.7)	1-12 UNF M25x1.5

Specifications

Model	Effective Weight lbs (kg)	Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
SNALD 150 SNALD 150H SNALD 150H2	2 - 22 (0.91 - 10) 19 - 190 (8.6 - 86) 150 - 450 (68 - 204)	150 (17)	300,000 (33,896)	0.66 - 1.55 (2.94 - 6.91)	0.04 0.04 1.5	0.20 (0.09)
SNALD 225 SNALD 225H SNALD 225H2	5 - 55 (2.3 - 2.5) 50 - 500 (22.7 - 227) 400 - 2,000 (181 - 908)	225 (25.4)	400,000 (45,194)	1.38 - 2.18 (6.14 - 9.71)	0.3	0.30 (0.14)
SNALD 450 SNALD 450H SNALD 450H2	5 - 35 (2.3 - 16) 20 - 130 (9 - 59) 80 - 500 (36 - 227)	450 (51)	600,000 (67,791)	1.25 - 2.01 (5.56 - 8.95)	0.3 0.3 3.5	0.45 (0.20)
SNALD 600 SNALD 600H SNALD 600H2	20 - 300 (9 - 136) 250 - 2,500 (113 - 1,135) 880 - 5,000 (400 - 2270)	600 (68)	600,000 (67,791)	5.25 - 10.81 (23.35 - 48.09)	0.3	0.80 (0.36)

Technical Data

Impact velocity range

SNALD 150: 0.3-12.0 ft/sec (0.09-3.66 m/sec)

SNALD 225: 0.2-12.0 ft/sec (0.06-3.66 m/sec)

SNALD 450: 0.5-12.0 ft/sec (0.15-3.66 m/sec)

SNALD 600: 0.2-12.0 ft/sec (0.06-3.66 m/sec)

Operating Temperature: 32° to 150°F (0° to 66°C)

Mechanical Stop: Integral mechanical stop built into shock absorber

Oil type: Standard petroleum oil

Materials: Steel body with standard black oxide finish. Hardened stainless steel piston rod.

Maximum side load depends on application. For additional information contact Enertrols Applications Department.

Lock nut included with each shock absorber.



Miniature Shock Absorbers Self-Compensating

SNALD 1/2 Bore x 1, 2"

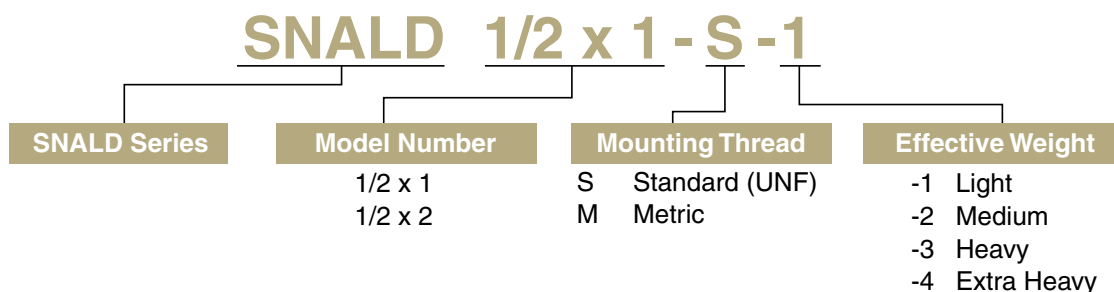
Enertrols SNALD 1/2" Bore Series self-compensating industrial shock absorbers offer high-energy capacity ratings along with four different effective weight ranges for handling numerous applications.

A built-in positive stop prevents bottoming out damage and provides a positive work-positioning point.

Applications include: relatively small, high-speed moving machines and equipment, material handling equipment, robotics, machine tools, packaging equipment, pick and place systems and more.

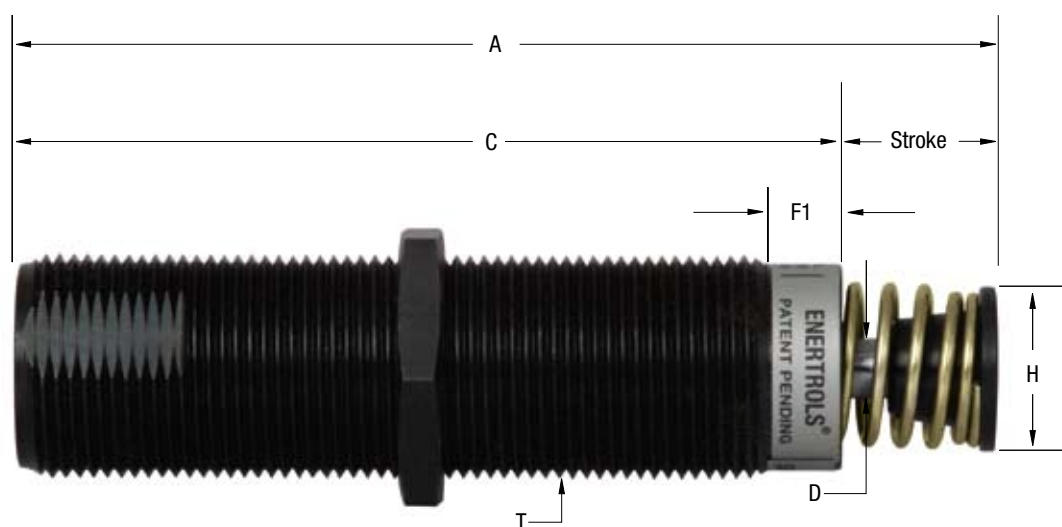


Ordering Information



SNALD 1/2 Bore x 1, 2"

Miniature Shock Absorbers Self-Compensating



Dimensions in inches (millimeters)

Model	Stroke	A	C	D	F1	H	T
SNALD 1/2 x 1	0.94 (23.8)	5.94 (150.9)	5.0 (127.0)	0.38 (9.5)	0.25 (6.4)	1.0 (25.4)	1-3/8"-12 M36x1.5
SNALD 1/2 x 2	1.94 (49.2)	7.94 (201.7)	6.0 (152.4)	0.38 (9.5)	0.25 (6.4)	1.0 (25.4)	1-3/8"-12 M36x1.5

Specifications

Model	We Effective Weight lbs (kg)	E ₃ Energy per Cycle in lbs (Nm)	E ₄ Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec
SNALD 1/2 x 1-S-1	20 - 80 (9 - 36)	1,350 (153)	750,000 (84, 739)	18.4 (81.8)	.04
SNALD 1/2 x 1-S-2	68 - 272 (30 - 124)				
SNALD 1/2 x 1-S-3	230 - 920 (104 - 418)				
SNALD 1/2 x 1-S-4	780 - 3,120 (354 - 1418)				
SNALD 1/2 x 2-S-1	40 - 160 (18 - 73)	2,700 (305)	870,000 (98,297)	28.85 (128.3)	.07
SNALD 1/2 x 2-S-2	136 - 544 (61 - 247)				
SNALD 1/2 x 2-S-3	460 - 1,840 (209 - 836)				
SNALD 1/2 x 2-S-4	1,560 - 6,240 (709 - 2836)				

Technical Data

Impact velocity range

SNALD 1/2 x 1: 1-15 ft/sec (0.3-4.6 m/sec)

SNALD 1/2 x 2: 1-15 ft/sec (0.3-4.6 m/sec)

Operating Temperature: 32° to 150°F (0° to 66°C)

Mechanical Stop: Integral mechanical stop built into shock absorber

Oil type: Standard petroleum oil

Materials: Steel body with standard black oxide finish.
Hardened steel piston rod.

Maximum side load depends on application.
For additional information contact Enertrols
Applications Department.

Lock nut included with each shock absorber.



Miniature Shock Absorbers Adjustable

SA 30 to 150 & 1/4" Bore

Enertrols SA Miniature Series adjustable shock absorbers offer high energy capability in confined spaces. SA Series models mount easily into your production equipment and easily interchange with competitor models. The SA 150 shock absorber features a rolling diaphragm seal for long cycle life, petroleum based oil and integral mechanical stop. SA 35, 50 and 150 model outer tubes include a Wearthec Plus finish for outstanding corrosion protection.

The durable SA 1/4 x 1/2" shock absorber includes: a nitrile accumulator, steel body and hardened stainless steel piston rod.

Applications include: machine tool and packaging equipment, material handling, medium robotics, pick and place systems and more.

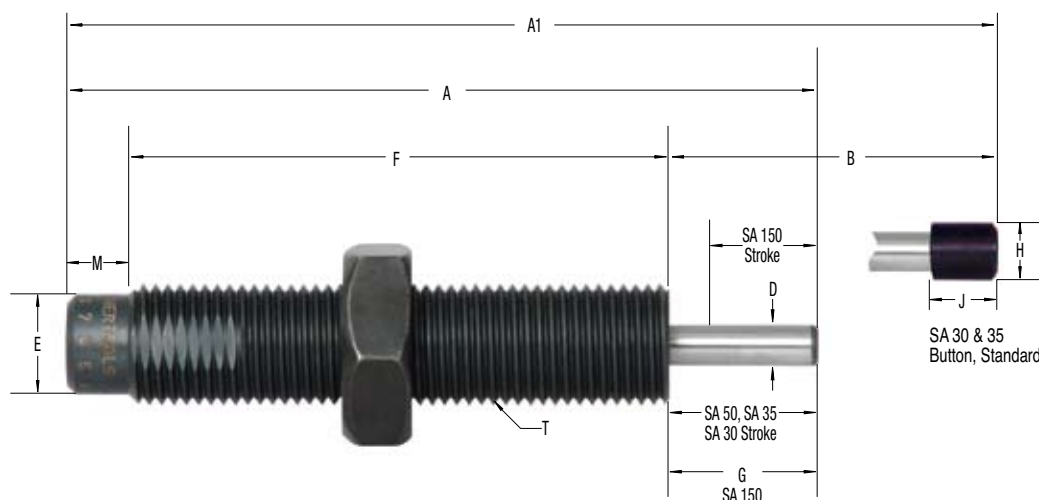


Ordering Information

SA 150 - B			
SA Series	Model Number	Mounting Thread	Button Options
Adjustable	30	SA 30M	SA 30M
	35	M Metric	Standard with Button
	50	SA 35	-NB No Button, Short Rod
	150	- Standard (UNF)	SA 35
	1/4 x 1/2	M Metric	Standard with Button
		SA 50M	-NB No Button, Short Rod
		M Metric	SA 50M
		SA 150	Standard No Button
		- Standard (UNF)	-B Button (Steel with Elastomer Insert)
		M Metric	SA 150
		ME Fine Metric	Standard No Button
		SA 1/4 x 1/2	-B Nylon Button
		-S Standard (UNF)	SA 1/4 x 1/2
		M Metric	Standard No Button
			-B Nylon Button
			-BS Steel Button

Button Option: SA 30 to SA 150
The Enertrols **steel button/urethane cap assembly (-BP)** is available if more quiet equipment operation is desired.

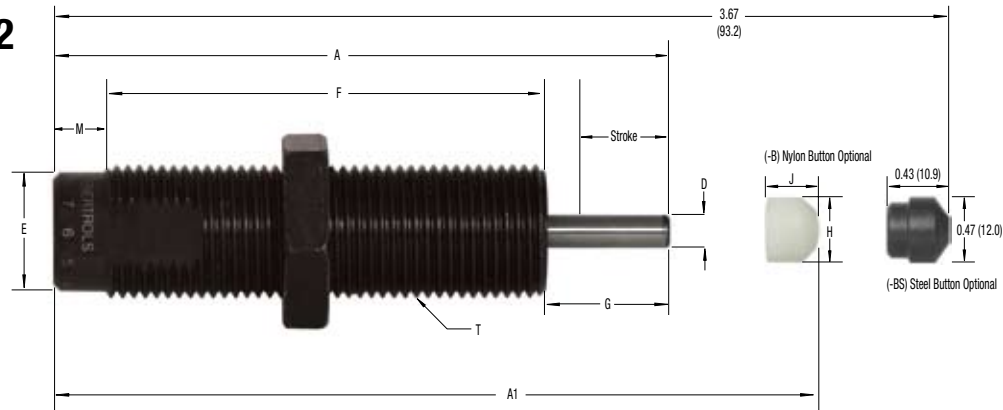
SA 30 to SA 150 Series



SA 30 to 150 & 1/4" Bore Miniature Shock Absorbers

Adjustable

SA 1/4 x 1/2



Dimensions in inches (millimeters)

Model	Stroke	A	A1	B	D	E	F	G	H	J	M	T
SA 30M	.32 (8.1)	—	2.42 (61.4)	.52 (13.2)	.10 (2.5)	.25 (6.5)	1.64 (41.7)	N/A	.25 (6.5)	.20 (5.0)	.16 (4.1)	M8x1
SA 35 SA 35M	.40 (10.1)	—	3.31 (84.1)	.72 (18.3)	.13 (3.3)	.42 (10.6)	2.41 (61.2)	N/A	.30 (7.6)	.32 (8.0)	.18 (4.6)	1/2-20 UNF M12x1
SA 50M	.28 (7.2)	2.24 (57.0)	2.55 (64.7)	.69 (17.5)	.12 (3.2)	.34 (8.5)	1.66 (42.2)	N/A	.30 (7.7)	.31 (7.8)	.20 (5.1)	M10x1
SA 150 SA 150M SA 150ME	.50 (12.7)	3.42 (86.7)	3.60 (91.4)	.19 (4.8)	.46 (11.6)	2.44 (62.0)	.70 (17.7)				.28 (7.1)	9/16-18 UNF M14x1.5 M14x1
SA 1/4 x 1/2-S SA 1/4 x 1/2M	.50 (12.7)	3.42 (86.7)	3.60 (91.4)	—	.19 (4.8)	.66 (16.7)	2.44 (62.0)	.70 (17.7)	.47 (12.0)	.37 (9.4)	.28 (7.1)	3/4 -16 UNF M20x1.5

Specifications

Model	We Effective Weight lbs (kg)	E ₃ Energy per Cycle in lbs (Nm)	E ₄ Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
SA 30M	0.5 - 31.0 (0.23 - 15.0)	31 (3.5)	50,000 (5,650)	1.16 - 1.57 (5.1 - 7)	0.30	.02 (0.009)
SA35	13 - 125 (6 - 57)	35 (4)	53,000 (5,988)	1.20 - 2.60 (5.33 - 11.56)	0.17	.10 (0.04)
SA50M	10 - 45 (4.5 - 20.4)	50 (5.6)	120,000 (13,440)	.47 - 1.8 (2.1 - 8.0)	0.2	0.05 (0.022)
SA150	2 - 240 (0.91 - 109)	200 (23)	300,000 (33,890)	0.70 - 1.20 (3.12 - 5.34)	0.40	.12 (0.05)
SA 1/4 x 1/2	2 - 240 (0.91 - 109)	200 (23)	400,000 (45,190)	0.70 - 1.20 (3.12 - 5.34)	0.40	.25 (0.11)

Technical Data

Impact velocity range

SA 30M: 2.2 - 14.6 ft/sec (0.67 - 4.45 m/sec)

SA 35: Maximum 3.3 ft/sec (1.0 m/sec)

SA 50M: 2.4 to 5.2 ft/sec (.73 to 1.6 m/sec)

SA 150: 0.5 to 12 ft/sec (0.15 to 3.66 m/sec)

SA 1/4 x 1/2: 0.67 to 23.1 ft/sec (0.20 to 7.06 m/sec)

Operating Temperature: 32° to 150°F (0° to 66°C)

Mechanical Stop: Integral mechanical stop built into front of units.

Oil type:

SA 30M, SA 35: Enertrols #5

SA 50M: CADCO X-900

SA 150: Petroleum based oil

SA 1/4 x 1/2: American Industries 150

Materials: Steel body with black oxide finish. SA 35, SA 50 and SA 150 models include Weartec Plus finish. Hardened stainless steel piston rod.

Adjustment: On models SA 30M, SA 35, SA 50M and SA 150 and SA 1/4 x 1/2: by turning the adjustment screw at rear. After installation, cycle the machine a few times and turn the adjustment screw until optimum deceleration is achieved (i.e. smooth deceleration throughout stroke).

Hard impact at start of stroke-turn adjuster toward 9.

Hard set-down at end of stroke-turn adjuster toward 0.

Maximum side load depends on application. For additional information contact Enertrols Applications Department.

SA 150 & SA 1/4 x 1/2 models may be mounted into pressure chambers of pneumatic actuators.

Lock nut included with each shock absorber.

SA 30 and SA 150 models can be utilized as velocity controls.



Miniature Shock Absorbers Adjustable

SALD 3/8 Bore x 1"

Enertrols 3/8 x 1" bore adjustable miniature shock absorber offers high energy capacity and a wide effective weight range for handling a variety of applications. A unique feature of the multi-orifice 3/8 x 1" bore is the optional rear slot adjuster. Adjustment can be made by turning the frontal adjuster to the preferred setting, or by turning the rear slot adjuster if desired.

Applications include: slides, material handling equipment, robotics, machine tools, pick and place systems, packaging equipment and more.



Ordering Information

SALD 3/8 x 1 - S - D					
Return Method & Accumulator Style	Bore	Stroke	Mounting Thread	Button Options	Adjuster
SALD Spring Return, Internal Accumulator ALDA Mechanical (clevis) Return, Internal Accumulator	3/8	1	-S Standard UNF M Metric	Standard with Button -SP Poly Pad	-D Optional Rear Adjuster For Double Adjustment

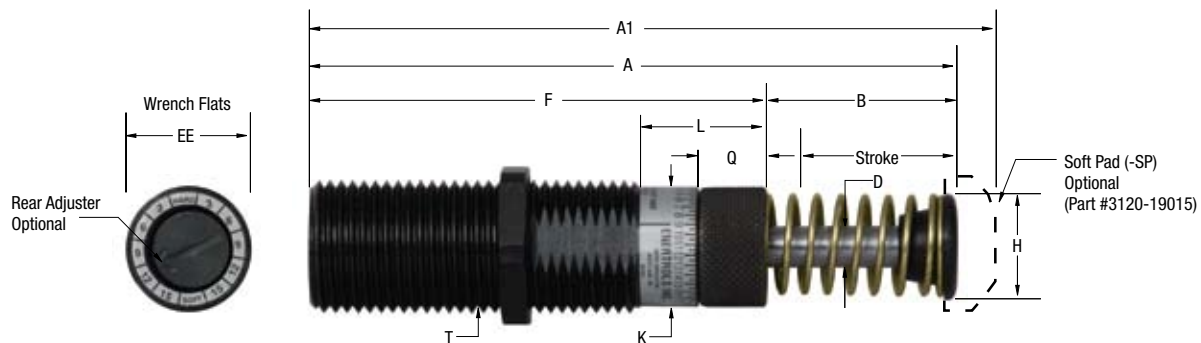
Stop Collar



Part No. 3120-34000 U.S.
Part No. 3120-34501 Metric

SALD 3/8 Bore x 1"

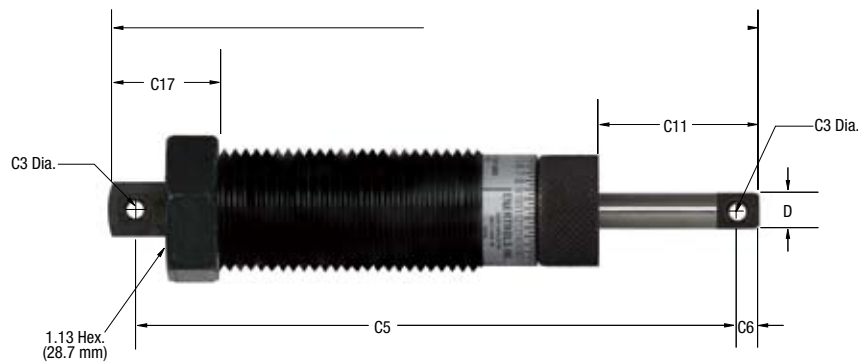
Miniature Shock Absorbers Adjustable



Dimensions in inches (millimeters)

Model	Stroke	A	A1	B	D	F	H	K	L	Q	T	EE
SALD 3/8 x 1	1	4.75	5.00	1.38	0.31	3.37	0.75	0.87	0.93	0.5	1-12	0.88
SALD 3/8 x 1M	(25.4)	(120.0)	(127.0)	(35.0)	(7.9)	(85.6)	(19.1)	(22.1)	(23.6)	(12.7)	(M25 x 1.5)	(22.2)

Clevis Mount



Model	A	C3	C5	C6	C11	C17	D
ALDA 3/8 x 1	5.50 (139.7)	0.16 (4.0)	5.13 (130.2)	0.19 (4.8)	1.50 (38.1)	1.06 (27.0)	0.31 (7.9)

Specifications

Model	We Effective Weight lbs (kg)	E ₃ Energy per Cycle in lbs (Nm)	E ₄ Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
SALD 3/8 x 1	10 - 1,250	600	600,000	6 - 11	0.03	.50
SALD 3/8 x 1M	(4.5 - 545)	(68)	(67,791)	(27 - 49)		(0.22)

Technical Data

Impact velocity range: 1.6 - 15 ft/sec (0.49 - 4.6 m/sec)

Operating Temperature: 10° to 150°F (-12° to 66°C)

Oil type: ISO 46AW

Materials: Steel body with standard black oxide finish.
Hardened stainless steel piston rod.

Maximum side load depends on application.
For additional information contact Enertrols
Applications Department.

Lock nut included with each shock absorber.



Miniature Shock Absorbers Adjustable

SALD 1/2 Bore x 1, 2"

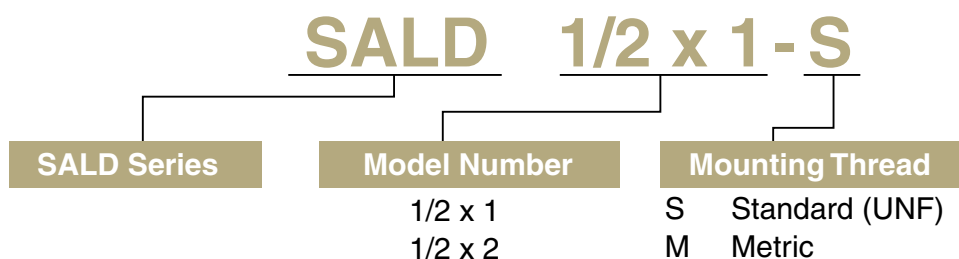
Enertrols SALD 1/2" Bore Series adjustable industrial shock absorbers offer high-energy capacity. Easily adjustable, these dependable models were designed to handle numerous applications.

A built-in positive stop prevents bottoming out damage and provides a positive work-positioning point.

Applications include: relatively small, high-speed moving machines and equipment, material handling equipment, robotics, machine tools, packaging equipment, pick and place systems and more.

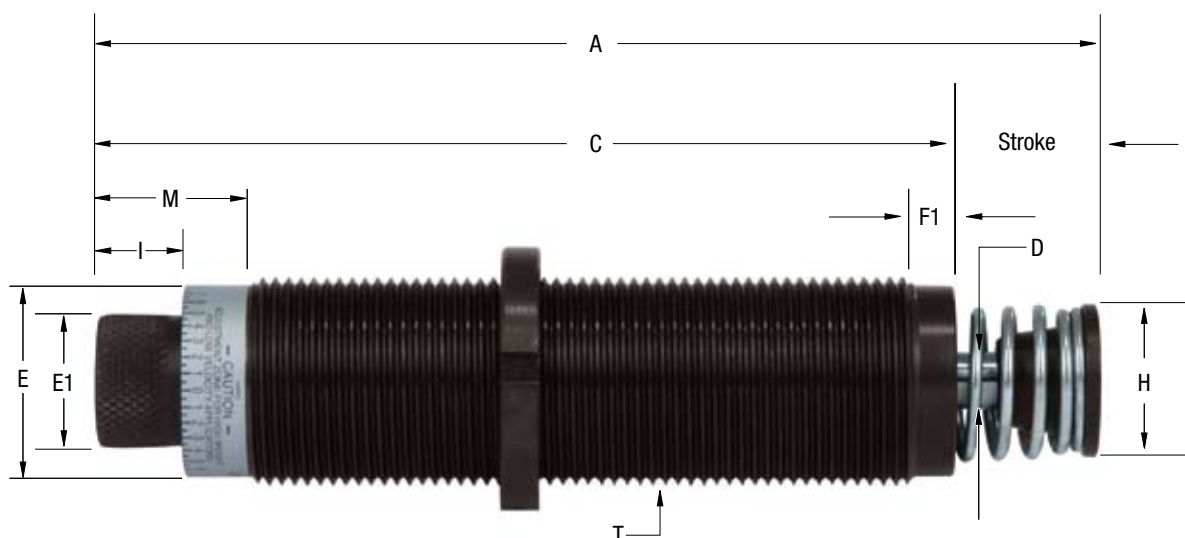


Ordering Information



SALD 1/2 Bore x 1, 2"

Miniature Shock Absorbers Adjustable



Dimensions in inches (millimeters)

Model	Stroke	A	C	D	E	E1	F1	H	I	M	T
SALD 1/2 x 1	0.94 (23.8)	6.50 (165.0)	5.56 (141.2)	0.38 (9.5)	1.25 (31.8)	0.88 (22.2)	0.25 (6.4)	1.0 (25.4)	0.56 (15.0)	0.99 (25.2)	1-3/8"-12 (M36 x 1.5)
SALD 1/2 x 2	1.94 (49.2)	8.50 (215.9)	6.56 (166.6)	0.38 (9.5)	1.25 (31.8)	0.88 (22.2)	0.25 (6.4)	1.0 (25.4)	0.56 (15.0)	0.99 (25.2)	1-3/8"-12 (M36 x 1.5)

Specifications

Model	We Effective Weight lbs (kg)	E ₃ Energy per Cycle in lbs (Nm)	E ₄ Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec
SALD 1/2 x 1	10 - 2,500 (4.5 - 1,135)	1,200 (169)	750,000 (84,739)	18.4 (81.8)	.04
SALD 1/2 x 2	21 - 5,000 (9.52 - 2,270)	2,400 (339)	870,000 (98,297)	28.85 (128.3)	.07

Technical Data

Impact velocity range

SALD 1/2 x 1: 1-15 ft/sec (0.3-4.6 m/sec)

SALD 1/2 x 2: 1-15 ft/sec (0.3-4.6 m/sec)

Operating Temperature: 32° to 150°F (0° to 66°C)

Mechanical Stop: Integral mechanical stop built into shock absorber

Oil type: Standard petroleum oil

Materials: Steel body with standard black oxide finish.
Hardened steel piston rod.

Maximum side load depends on application.
For additional information contact Enertrols
Applications Department.

Lock nut included with each shock absorber.

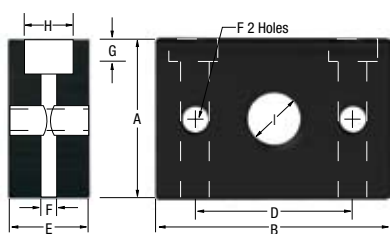


Miniature Series

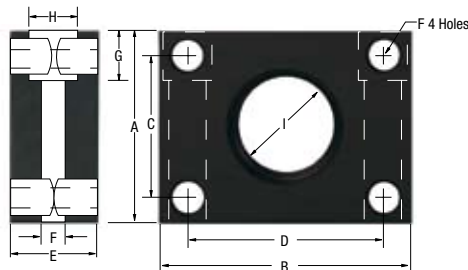
Adjustable & Self-Compensating Models

Accessories

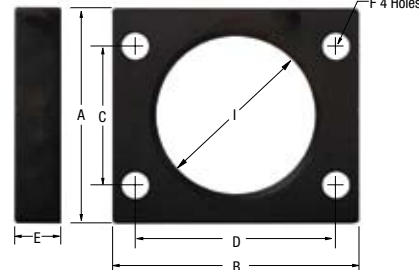
Series 25, 35, 50, 75, 150



Series 225, 450, 600, SA 1/4, SALD 3/8



Series SNALD 1/2, SALD 1/2



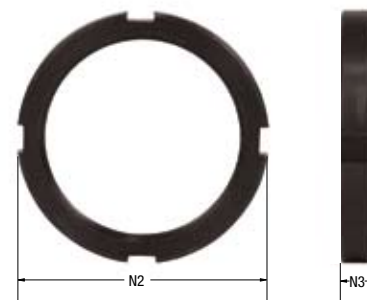
Mounting Block in inches (millimeters)

Model	US Part #	Metric Part #	A	B	C	D	E	F	G	H	I
25, 50	3110-07005 (25 only)	3110-07501	1.00 (25.4)	1.50 (38.1)	—	1.00 (25.4)	0.56 (14.2)	0.18 (4.6)	0.21 (5.3)	0.32 (8.1)	3/8"-32 M10x1.0
35, 75	3113-07005	3113-07501	1.00 (25.4)	1.50 (38.1)	—	1.00 (25.4)	0.56 (14.2)	0.18 (4.6)	0.21 (5.3)	0.32 (8.1)	1/2"-20 M12x1.0
150	3115-07005	3115-07501	1.14 (29)	1.77 (45)	—	1.38 (35)	0.63 (16)	0.18 (4.6)	0.21 (5.3)	0.32 (8.1)	9/16"-18 M14x1.5
225, 450, SA 1/4	3116-07005	3116-07501	1.38 (35)	1.81 (46)	1.00 (25.4)	1.38 (35)	0.63 (16)	0.22 (5.6)	0.41 (10.4)	0.41 (10.4)	3/4"-16 M20x1.5
600, SALD 3/8	3120-07005	3120-07501	1.38 (35)	1.81 (46)	1.00 (25.4)	1.38 (35)	0.63 (16)	0.22 (5.6)	0.41 (10.4)	0.41 (10.4)	1"-12 M25x1.5
SNALD 1/2, SALD 1/2	3125-07008	3125-07508	1.75 (44.5)	2.00 (50.8)	1.13 (27)	1.63 (46.3)	0.38 (9.5)	0.22 (5.6)	—	—	1-3/8"-12 M36x1.5

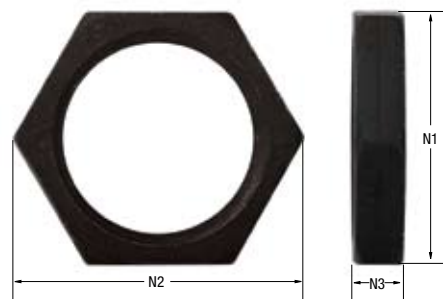
Lock Nut in inches (millimeters)

Used With	N1	N2	N3	Used With	N1	N2	N3	Used With	N1	N2	N3
SM 9M	.31 (8)	.36 (9.3)	0.9 (2.5)	SNALD 150	0.88 (22.4)	.24 (6.1)		SA 1/4 x 1/2	.99 (25.1)	1.14 (28.9)	.24 (6.1)
SM 10E	.43 (11)	.48 (12.3)	0.8 (2.0)	SNALD 150M	0.67 (17)	.20 (5)		SA 1/4 x 1/2M	.91 (22.8)	.96 (24.3)	.31 (8)
SM10M	.39 (10.0)	.44 (11.3)	.12 (3.0)	SNALD 225	1.00 (25.4)	.32 (8)		SALD 3/8 x 1	1.25 (31.8)	1.44 (36.6)	.25 (6.4)
SM 25	.50 (12.7)	.56 (14.2)	.09 (2.3)	SNALD 225M	.91 (23)	.24 (6.1)		SALD 3/8 x 1M	1.18 (30.0)	1.24 (31.6)	.39 (10.0)
SM 25M	.47 (12.0)	.53 (13.6)	.16 (4.0)	SNALD 450	1.00 (25.4)	.32 (8)		SALD 1/2 x 1	N/A	1.75 (44.4)	.25 (6.3)
SA 50M	.47 (12.0)	.53 (13.6)	.16 (4.0)	SNALD 450M	.91 (23)	.24 (6.1)		SALD 1/2 x 1M	N/A	1.75 (44.4)	.25 (6.3)
SM 30M	.39 (10.0)	.44 (11.3)	.12 (3.0)	SNALD 600	1.25 (31.8)	.39 (10)		SALD 1/2 x 2	N/A	1.75 (44.4)	.25 (6.3)
SA 35	.62 (16.5)	.70 (17.8)	.13 (3.3)	SNALD 600M	1.18 (30)	.32 (8)		SALD 1/2 x 2M	N/A	1.75 (44.4)	.25 (6.3)
SA 35M	.55 (14.0)	.62 (15.8)	.20 (5.0)								
SM 75M	.87 (22.2)	1.00 (25.4)	.31 (7.9)	SNALD 1/2 x 1	1.63 (41.3)	.25 (6.4)					
SA 150	.67 (17.0)	.76 (19.4)	.23 (6.0)	SNALD 1/2 x 1M	1.63 (41.3)	.25 (6.4)					
SA 150M	.67 (17.0)	.77 (19.5)	.20 (5.0)	SNALD 1/2 x 2	1.63 (41.3)	.25 (6.4)					
SA 150ME	.67 (17.0)	.77 (19.5)	.20 (5.0)	SNALD 1/2 x 2M	1.63 (41.3)	.25 (6.4)					

SALD 1/2" Bore Lock Nut



Model	Standard Lock Nut US Part #	Metric Part #	Stainless Steel Lock Nut US Part #	Metric Part #	Poly Pad Part #
9	—	3106-09505	—	—	—
10E	—	3108-09505	—	—	—
10M, 30M	—	3108-09506	—	—	—
25	3110-09005	3110-09505	—	—	—
35, 75	3113-09005	3113-09505	—	—	—
50M	—	3110-09505	—	—	—
150	3115-09005	3115-09505	3115-09009	3115-09509	3115-19015
225, 450, 1/4	3116-09005	3116-09505	3116-09009	3116-09509	3116-19015
600	3120-09005	3120-09505	3120-09009	3120-09509	3119-19015
3/8	3120-09005	3120-09505	3120-09009	3120-09509	3120-19015
1/2	3125-09503	3125-09504	3125-09009	3125-09509	—



Weartec Plus

Standard Corrosion Protection on Mid-Size and Select Miniature Models



**Beat Corrosion...
Team Up with
Weartec Plus**

**STANDARD
CORROSION
PROTECTION**

Ideal for
Food & Packaging
Industries in
Wash Down Areas.

Extreme Rust Build-up...
Outer tube without *Weartec Plus*

Enertrols now offers standard Weartec Plus protection against corrosion, erosion and ravages of time on all Mid-Size and select miniature models (SM 25, SM 75, SA 35, SA 50 and SA 150).

Aggressive independent laboratory salt-spray testing has confirmed that Weartec Plus offers superior corrosion protection compared to: Armoloy, nickel plate, hard chrome, black oxide and platinum. It's ideal for battling corrosion in wash down areas for the food and packaging industries as well as outdoor environments.

Weartec Plus, is available now on UNF and metric threaded models at no additional cost.

- 30% better than Platinum
- 30% better than Armoloy & Nickel Plate
- 67% better than Hard Chrome
- 150% better than Black Oxide



Mid-Size Shock Absorbers Self-Compensating

SNALD 33, 45 & 64 Series

Enertrols SNALD Mid-Size 33 to 64 Series industrial shock absorbers offer some of the highest energy capacity ratings in the industry. Smaller models of this series have the capability to outperform larger more costly competitor models.

Four effective weight ranges per model are available for handling a wide range of applications.

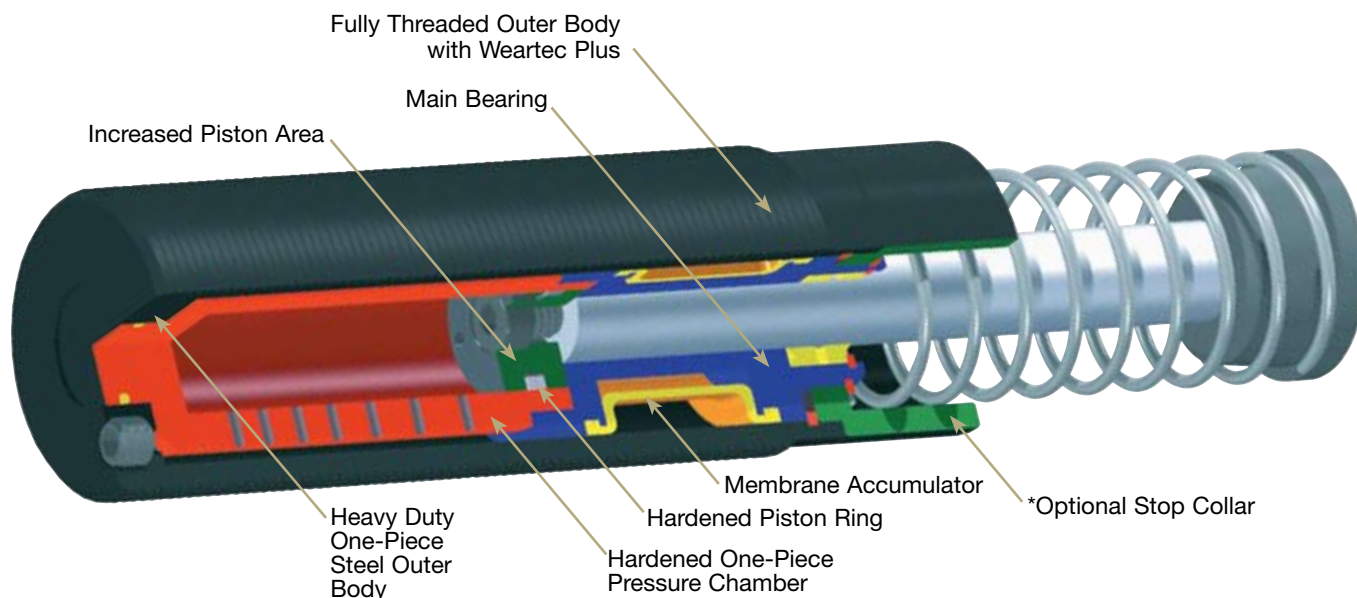
These rugged models include Weartec Plus standard corrosion protection on each threaded outer tube. Weartec Plus is ideal for combating corrosion in wash down areas for the food and packaging industries as well as outdoor environments.

All Enertrols SNALD Mid-Size models are fully threaded allowing for ease of installation. An optional stop collar is available if desired.

Applications include: heavy conveyors, robotics, automotive manufacturing and production equipment, packaging and lumber industry equipment, theme park rides and more.



Mid-Size 33, 45 & 64 Series

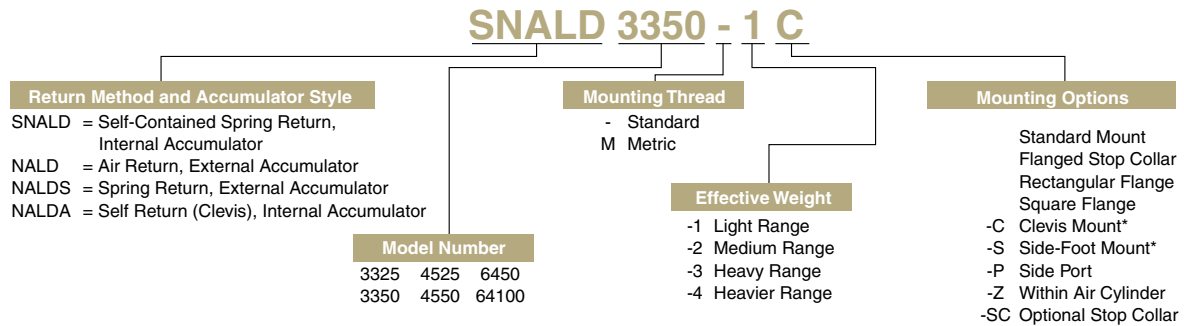


*Optional stop collar available for SNALD 33, 45 & 64 Series models

SNALD 33, 45 & 64 Series Mid-Size Shock Absorbers

Self-Compensating

Ordering Information



***Optional stop collar (-SC) for SNALD 33, 45 & 64 Series Models**



Mid-Size Shock Absorbers Self-Compensating

SNALD 33 Series

Mid-Size 33 Specifications

Model	We		E ₃	Energy per Hour in lbs/hour (Nm/hour)			Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
	Effective Weight lbs	(kg)		Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)			
SNALD 3325-1	20-80	(9-36)	1,350 (153)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.00 (0.45)
SNALD 3325-2	68-272	(31-123)							
SNALD 3325-3	230-920	(104-417)							
SNALD 3325-4	780-3,120	(354-1,415)							
SNALD 3350-1	40-160	(18-73)	2,700 (305)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.2 (0.54)
SNALD 3350-2	136-544	(62-247)							
SNALD 3350-3	460-1,840	(209-835)							
SNALD 3350-4	1,560-6,240	(708-2,830)							

Technical Data

Impact velocity range: 0.5 to 16.5 ft/sec (0.15-5 m/sec)

Operating Temperature: 10° to 150°F (-12° to 66°C)

Operating temperature, high-temp option:

Up to 300°F (149°C) for SNALD models except 4575 and 64150. It is available for NALD air return models including the 4575 and 64150. Add -HT to end of model code when ordering.

Oil type: ATF

Lock nut included with each shock absorber.

Materials: Steel with Weartec Plus finish. Piston rod high tensile steel, hardened and chrome plated. Rod end button hardened steel with black oxide finish. Zinc plated return spring. For optimum heat dissipation, **do not** paint shock absorber.

A side port can be adapted to Enertrols 33 NALD and NALDS models and is a special adder item. A side port adapter ring is molded onto the outer tube and increases the overall diameter by 0.25 inches (6.3 mm) in the area of the ring. The side port centerline is located 0.81 inches (20.7 mm) from the front of the outer tube.

Lock nut included with each shock absorber.

Mid-Size 33 Dimensions in inches (millimeters)

Model	Stroke	A	B	D	G	H	I	J	T	W	C1
SNALD 3325	0.91 (23.1)	5.44 (138.1)	2.19 (55.6)	0.375 (9.5)	0.99 (25.1)	1.00 (25.4)	1/8 NPT MALE	0.75 (19.1)	1-1/4-12 M33x1.5	1.50 (38.10)	0.50 (12.7)
SNALD 3350	1.91 (48.5)	7.44 (189)	3.19 (81)							1.56 (39.71)	

Model	C2	C3	C4	C5	C6	C7	C8	C9	C10	C12	C13
SNALD 3325	0.76 (19.3)	0.25 (6.40)	0.32 (8.1)	6.58 (167)	0.25 (6.4)	0.48 (12.2)	0.50 (12.7)	0.25 (6.4)	2.64 (67.1)	0.50 (12.7)	0.75 (19.1)
SNALD 3350				8.58 (217.8)					3.64 (92.5)		

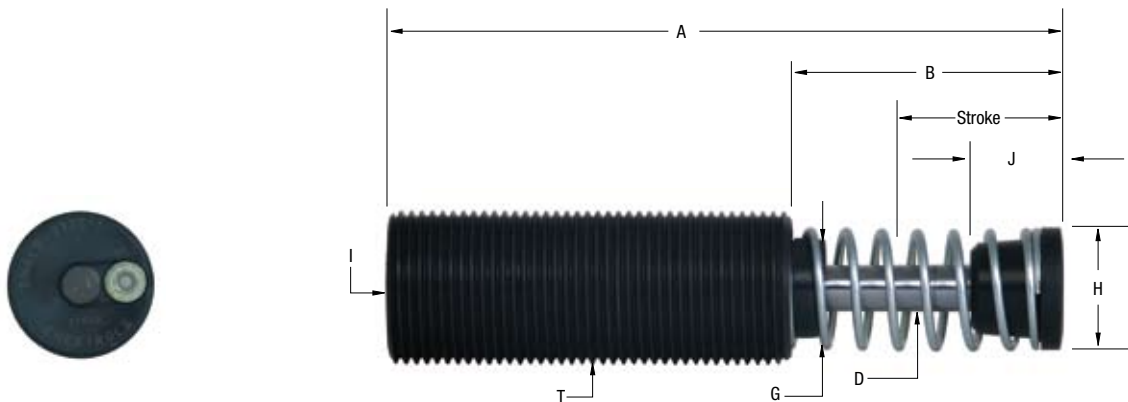
Model	C14	F1	F2	F3	F4	F5	F6	F7	F8	F9
SNALD 3325	N/A	0.25 (6.4)	3.75 (95.3)	1.94 (49.3)	0.87 (22.1)	0.25 (6.4)	2.75 (69.9)	2.37 (60)	0.50 (12.7)	0.28 (7.1)
SNALD 3350			4.75 (120.7)	2.94 (74.7)						

Enertrols recommends that side load not exceed 5°. Maximum side load depends on application.
For additional information consult Enertrols Applications Department.

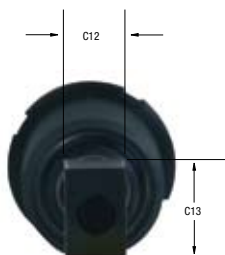
SNALD 33 Series

Mid-Size Shock Absorbers Self-Compensating

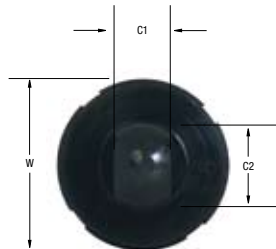
Primary Mount



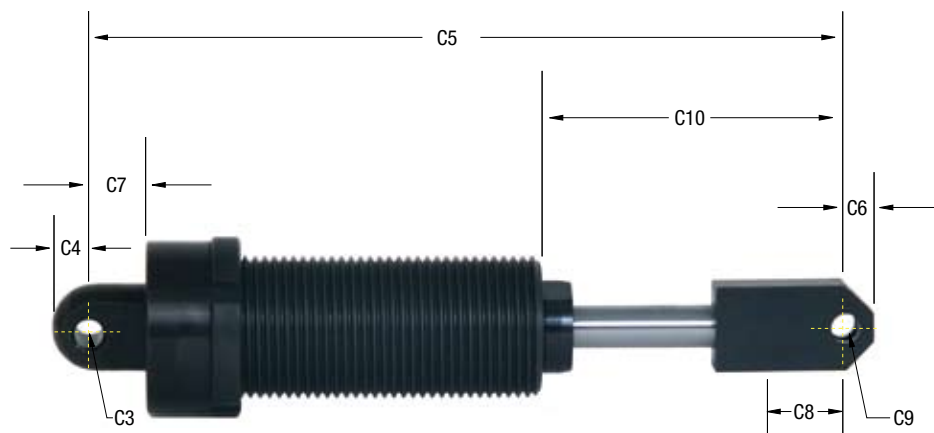
Front View



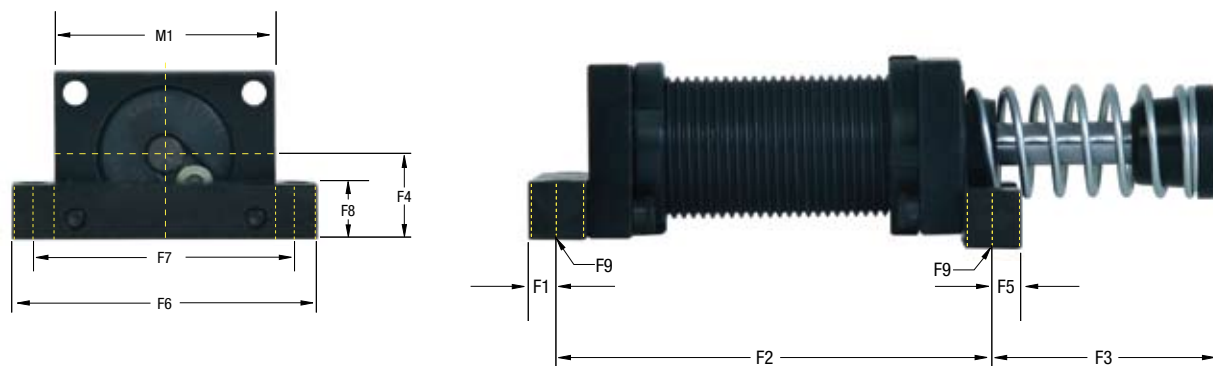
Rear View



Clevis Mount



Side-Foot Mount





Mid-Size Shock Absorbers Self-Compensating

SNALD 45 Series

Mid-Size 45 Specifications

Model	Effective Weight lbs (kg)	Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour)			Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
			E ₃	E ₄	E ₄			
SNALD 4525-1	50-200	(23-91)	3,000 (339)	950,000 (107,000)	1,400,000 (158,000)	1,700,000 (192,000)	15.1-22.8 (67-101)	0.03
SNALD 4525-2	170-680	(77-300)						
SNALD 4525-3	575-2,300	(261-1,043)						
SNALD 4525-4	1,950-7,800	(885-3,538)						
SNALD 4550-1	100-400	(45-181)	6,000 (678)	1,000,000 (112,000)	1,700,000 (192,000)	2,200,000 (248,000)	15.1-32.2 (67-143)	0.08
SNALD 4550-2	340-1,360	(154-617)						
SNALD 4550-3	1,150-4,600	(522-2,087)						
SNALD 4550-4	3,900-15,600	(1,769-7,076)						
SNALD 4575-1	150-600	(68-272)	9,000 (1,017)	1,300,000 (146,000)	2,000,000 (225,000)	2,500,000 (282,000)	11.7-40.3 (52-179)	0.11
SNALD 4575-2	510-2,040	(231-925)						
SNALD 4575-3	1,730-6,920	(785-3,139)						
SNALD 4575-4	5,850-23,400	(2,654-10,614)						

Technical Data

Impact velocity range: 0.5 to 16.5 ft/sec (0.15-5 m/sec)

Operating Temperature: 10° to 150°F (-12° to 66°C)

Operating temperature, high-temp option:

Up to 300°F (149°C) for SNALD models except 4575 and 64150. It is available for NALD air return models including the 4575 and 64150. Add -HT to end of model code when ordering.

Oil type: ATF

Lock nut included with each shock absorber.

Materials: Steel with Weartec Plus finish. Piston rod high tensile steel, hardened and chrome plated. Rod end button hardened steel with black oxide finish. Zinc plated return spring. For optimum heat dissipation, **do not** paint shock absorber.

A side port can be adapted to Enertrols 45 NALD and NALDS models and is a special adder item. A side port adapter ring is molded onto the outer tube and increases the overall diameter by 0.5 inches (12.7 mm) in the area of the ring. The side port centerline is located 1.04 inches (26.4 mm) from the front of the outer tube.

Lock nut included with each shock absorber.

Mid-Size 45 Dimensions in inches (millimeters)

Model	Stroke	A	B	D	G	H	I	J	T	W	C1	C2	C3	C4
SNALD 4525	0.91 (23.1)	5.69 (144.5)	1.97 (50)											
SNALD 4550	1.91 (48.5)	7.69 (195.3)	2.97 (75.4)	0.50 (12.7)	1.36 (34.5)	1.38 (34.9)	1/8 NPT	0.87 (22.1)	1-3/4-12 M45x1.5	2.25 (57.20)	0.75 (19.1)	1.00 (25.4)	0.50 (12.7)	0.50 (12.7)
SNALD 4575	2.91 (73.9)	9.69 (246.1)	3.97 (100.8)											

Model	C5	C6	C7	C8	C9	C10	C12	C13	C14	F1	F2	F3	F4	F5
SNALD 4525	7.85 (199.4)					2.57 (65.3)					3.50 (88.9)	1.94 (49.3)		
SNALD 4550	9.85 (250.2)	0.50 (12.7)	1.06 (26.9)	0.69 (17.5)	.37 (9.6)	3.57 (90.7)	1.00 (25.4)	1.00 (25.4)	0.50 (12.7)	0.50 (12.7)	4.38 (111.8)	3.06 (77.7)	1.16 (29.5)	0.37 (9.5)
SNALD 4575	11.85 (301)					4.57 (116.1)					5.38 (136.6)	4.06 (103.1)		

Model	F6	F7	F8	F9
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SNALD 4525

SNALD 4550 3.75
(95.3) 3.00
(76.2) 0.56
(14.2) 0.35
(8.9)

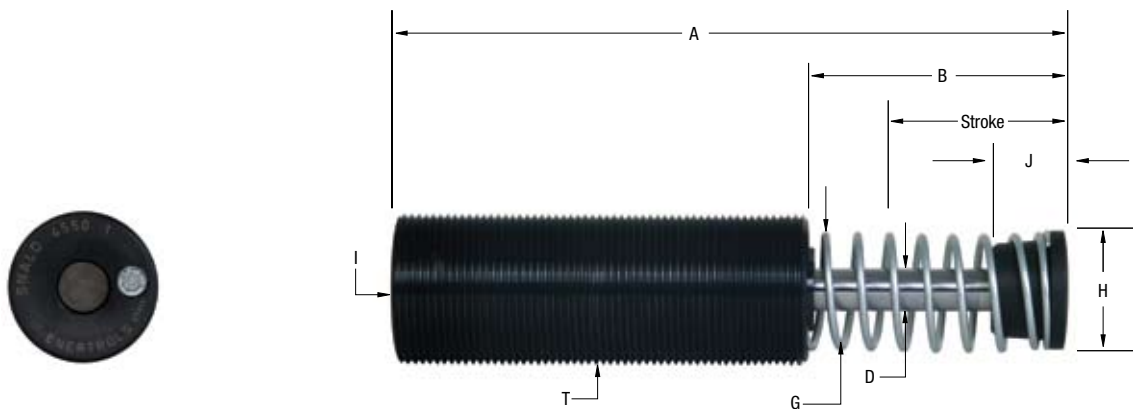
SNALD 4575

Enertrols recommends that side load not exceed 5°. Maximum side load depends on application. For additional information consult Enertrols Applications Department.

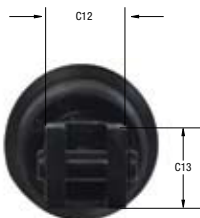
SNALD 45 Series

Mid-Size Shock Absorbers Self-Compensating

Primary Mount



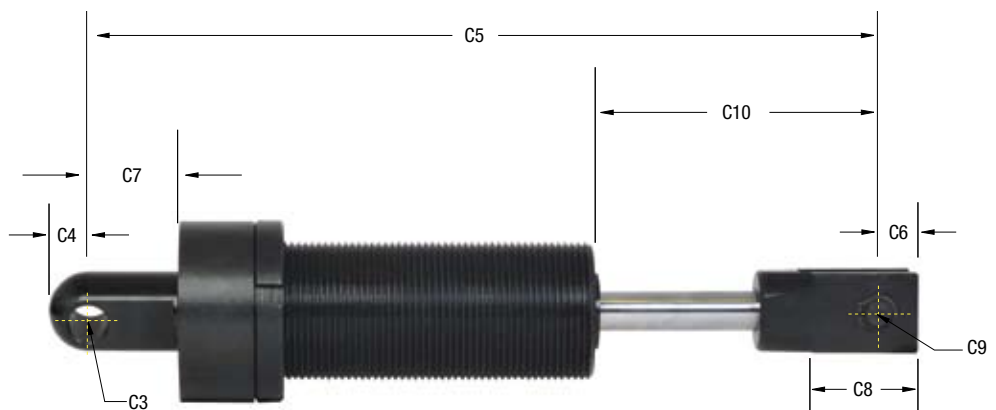
Front View



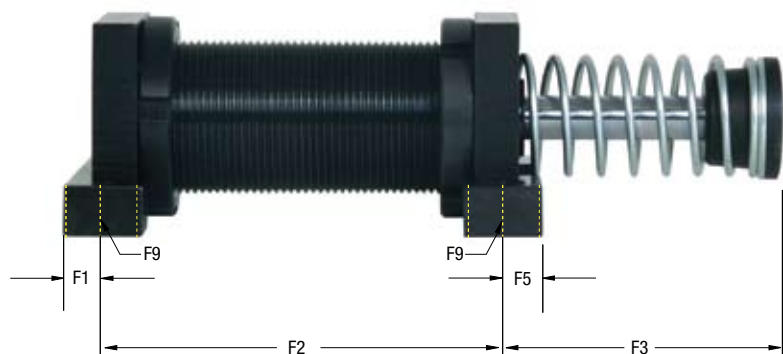
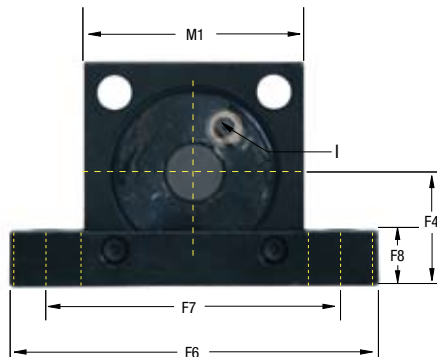
Rear View



Clevis Mount



Side-Foot Mount





Mid-Size Shock Absorbers Self-Compensating

SNALD 64 Series

Mid-Size 64 Specifications

Mid-Size 64 Specifications			Energy per Hour in lbs/hour (Nm/hour)						
We		E ₃	E ₄						
Model	Effective Weight lbs (kg)	Energy per Cycle in lbs (Nm)	Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)	
SNALD 6450-1	300-1,200	(136-544)	15,000 (1,695)	1,300,000 (146,000)	2,600,000 (293,000)	3,400,000 (384,000)	20.1-34.9 (89-155)	0.12	6.4 (2.90)
SNALD 6450-2	1,020-4,080	(463-1,851)							
SNALD 6450-3	3,460-13,840	(1,569-6,278)							
SNALD 6450-4	11,700-46,800	(5,307-21,228)							
SNALD 64100-1	600-2,400	(272-1,089)	30,000 (3,390)	1,700,000 (192,000)	3,400,000 (384,000)	4,400,000 (497,000)	23.5-61 (104-271)	0.34	8.15 (3.70)
SNALD 64100-2	2,040-8,160	(925-3,701)							
SNALD 64100-3	6,920-27,680	(3,139-12,556)							
SNALD 64100-4	23,400-93,600	(10,614-42,457)							
SNALD 64150-1	900-3,600	(408-1,633)	45,000 (5,084)	2,200,000 (248,000)	4,400,000 (497,000)	5,700,000 (644,000)	16.9-82.2 (75-366)	0.48	11.25 (5.10)
SNALD 64150-2	3,060-12,240	(1,388-5,552)							
SNALD 64150-3	10,380-41,520	(4,708-18,883)							
SNALD 64150-4	35,100-140,400	(15,921-63,685)							

Technical Data

Impact velocity range: 0.5 to 16.5 ft/sec (0.15-5 m/sec)

Operating Temperature: 10° to 150°F (-12° to 66°C)

Operating temperature, high-temp option:

Up to 300°F (149°C) for SNALD models except 4575 and 64150. It is available for NALD air return models including the 4575 and 64150. Add -HT to end of model code when ordering.

Oil type: ATF

Lock nut included with each shock absorber.

Materials: Steel with Weartec Plus finish. Piston rod high tensile steel, hardened and chrome plated. Rod end button hardened steel with black oxide finish. Zinc plated return spring. For optimum heat dissipation, **do not** paint shock absorber.

A side port can be adapted to Enertrols 64 NALD and NALDS models and is a special adder item. A side port adapter ring is molded onto the outer tube and increases the overall diameter by 0.5 inches (12.7 mm) in the area of the ring. The side port centerline is located 1.47 inches (37.3 mm) from the front of the outer tube.

Lock nut included with each shock absorber.

Mid-Size 64 Dimensions in inches (millimeters)

Model	Stroke	A	B	D	G	H	I	J	T	W	C1	C2	C3	C4	C5	C6
SNALD 6450	1.91 (48.6)	8.85 (224.8)	3.35 (85.1)												12.12 (307.9)	
SNALD 64100	3.91 (99.4)	12.85 (326.4)	5.35 (135.9)	0.75 (19.1)	1.86 (47.2)	1.90 (48.3)	1/4 NPT	1.06 (26.9)	2-1/2-12 M64x2	3.00 (76.20)	1.25 (31.8)	1.50 (38.1)	0.75 (19.1)	0.75 (19.1)	16.12 (409.5)	0.63 (16.0)
SNALD 64150	5.91 (150.1)	17.73 (450.4)	8.23 (209)		2.31 (58.7)	2.38 (60.3)		1.25 (31.8)							20.87 (530.1)	
NALD 64150	5.91 (150.1)	17.60 (447)	8.10 (205.7)		N/A	1.90 (48.3)		1.06 (26.9)		N/A	N/A	N/A	N/A	N/A	N/A	N/A

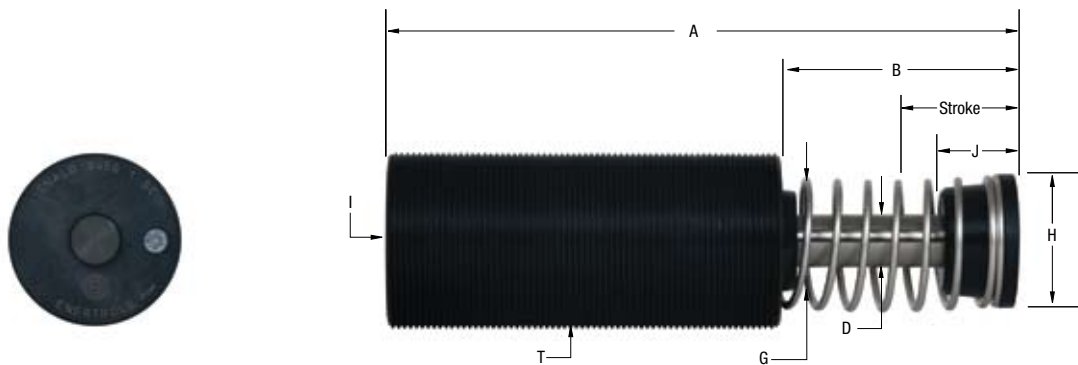
Model	C7	C8	C9	C10	C12	C13	C14	F1	F2	F3	F4	F5	F6	F7	F8	F9
SNALD 6450				4.75 (120.7)					5.00 (127.0)	3.56 (90.4)						
SNALD 64100	1.29 (32.8)	1.40 (35.6)	0.75 (19.1)	6.75 (171.5)	1.50 (38.1)	1.25 (31.8)	0.62 (15.9)	0.69 (17.5)	7.00 (177.8)	5.56 (141.2)	1.78 (45.2)	0.69 (17.5)	5.62 (142.8)	4.88 (124.0)	0.75 (19.1)	0.42 (10.7)
SNALD 64150				9.50 (241.3)					9.00 (228.6)	8.44 (214.4)						
NALD 64150	N/A	N/A	N/A	N/A	N/A	N/A	N/A			8.31 (211.1)						

Enertrols recommends that side load not exceed 5°. Maximum side load depends on application. For additional information consult Enertrols Applications Department.

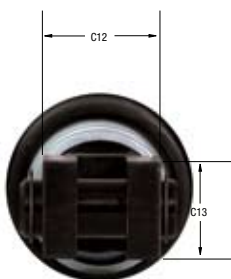
SNALD 64 Series

Mid-Size Shock Absorbers Self-Compensating

Primary Mount



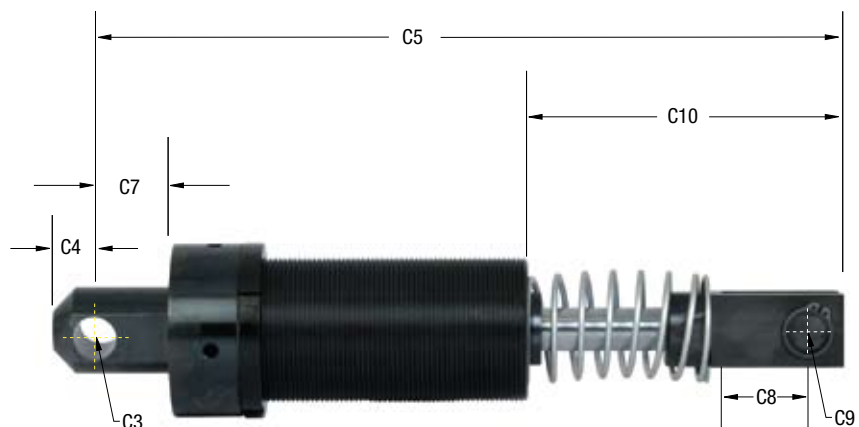
Front View



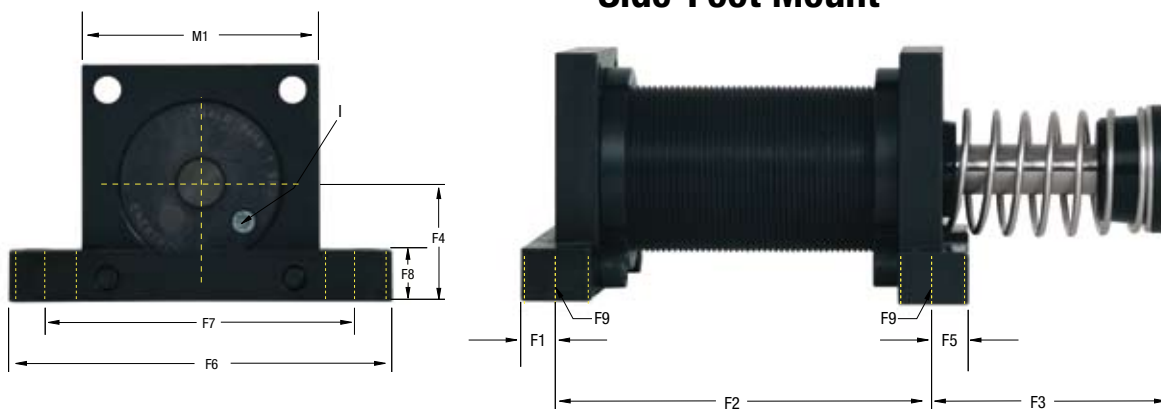
Rear View



Clevis Mount



Side-Foot Mount



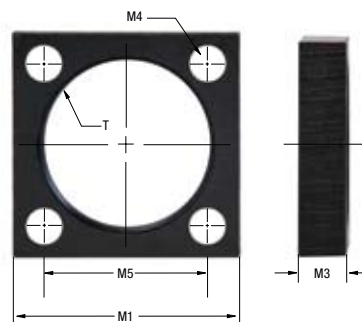


SNALD Mid-Size 33, 45 & 64 Series Self-Compensating

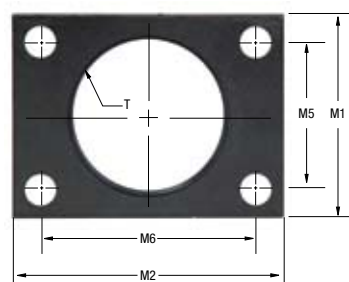
Square and Rectangular Flanges in inches (millimeters)

Used With	Square Flange	Rect Flange	T	M1	M2	M3	M4	M5	M6
SNALD 33	N/A	6225-00016	1-1/4-12 UNF	1.50 (38.1)	2.00 (50.8)	0.38 (9.5)	0.21 (5.6)	1.12 (28.4)	1.62 (41.2)
SNALD 33M	N/A	6325-00293	M33x1.5	1.62 (41.1)	2.12 (53.8)	0.38 (9.5)	.278 (7.1)	1.10 (28.0)	1.65 (42.0)
SNALD 45	6236-00023	6236-00024	1-3/4-12 UN	2.25 (57.2)	3.00 (76.2)	0.50 (12.7)	0.34 (8.7)	1.62 (41.2)	2.38 (60.5)
SNALD 45M	6336-00298	6336-00299	M4x1.5	2.25 (57.2)	3.00 (76.2)	0.50 (12.7)	0.39 (10.0)	1.57 (40.0)	2.36 (60.0)
SNALD 64	6241-00028	N/A	2-1/2-12 UN	3.50 (88.9)	N/A	0.62 (15.9)	0.41 (10.4)	2.75 (69.6)	N/A
SNALD 64M	6341-00302	N/A	M64x2	3.50 (88.9)	N/A	0.62 (15.9)	0.41 (10.4)	2.75 (69.6)	N/A

Square Flange

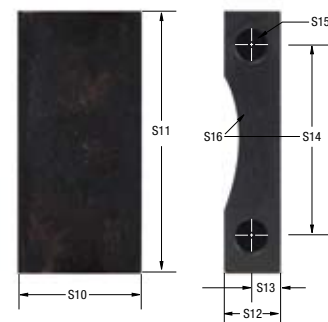
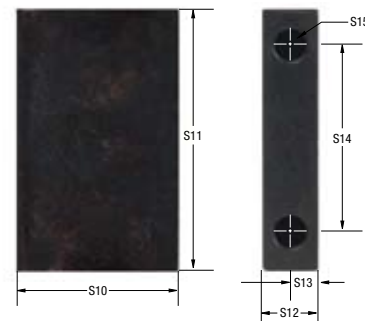


Rectangular Flange



Stop Bars in inches (millimeters)

Used With	Part #	S10	S11	S12	S13	S14	S15	S16
SNALD 33	6225-00426	1.28 (32.5)	1.50 (38.1)	0.38 (9.7)	0.19 (4.8)	1.12 (28.4)	10-32 UNF	N/A
SNALD 33M	6325-00427	1.28 (32.5)	1.50 (38.1)	0.38 (9.7)	0.19 (4.8)	1.10 (28.0)	M5x0.8	N/A
SNALD 45	6236-00428	1.03 (26.2)	2.25 (57.2)	0.63 (16.0)	0.31 (7.9)	1.62 (41.3)	5/16-24 UNF	N/A
SNALD 45M	6336-00639	1.03 (26.2)	2.25 (57.2)	0.63 (16.0)	0.31 (7.9)	1.62 (41.3)	M8x1.25	N/A
SNALD 6450 SNALD 64100	6241-00430	1.44 (36.5)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	3/8-24 UNF	1.37 (34.8)
SNALD 6450M SNALD 64100M	6341-00640	1.44 (36.5)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	M10x1.5	1.37 (34.8)
SNALD 64150	6241-00432	2.31 (57.7)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	3/8-24 UNF	1.37 (34.8)
SNALD 64150M	6341-00641	2.31 (57.7)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	M10x1.5	1.37 (34.8)
NALD 64150	6241-00435	2.18 (55.4)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	3/8-24 UNF	1.37 (34.8)
NALD 64150M	6341-00649	2.18 (55.4)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	M10x1.5	1.37 (34.8)



Hard metric stop bars available upon request.

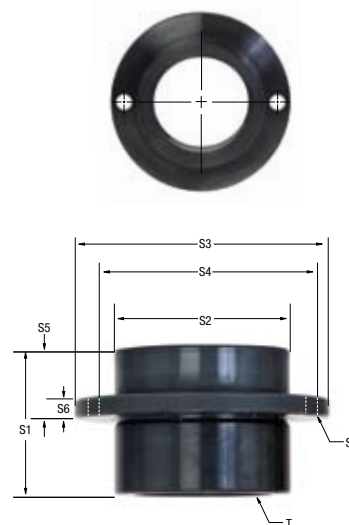
Stop bars come in pairs, two bars per package.

Accessories

SNALD Mid-Size 33, 45 & 64 Series Self-Compensating

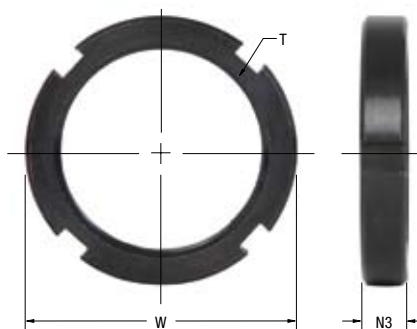
Flanged Stop Collars (-FSC) in inches (millimeters)

Used With	Part #	T	S1	S2	S3	S4	S5	S6	S7
SNALD 33	6225-00070	1-1/4-12 UNF	2.00 (50.8)	1.50 (38.1)	2.50 (63.5)	2.00 (50.8)	0.88 (22.4)	0.25 (6.4)	0.35 (9.00)
SNALD 33M	6325-00071	M33x1.5	2.00 (50.8)	1.50 (38.1)	2.50 (63.5)	2.00 (50.8)	0.88 (22.4)	0.25 (6.4)	0.35 (9.00)
SNALD 45	6236-00072	1-3/4-12 UN	1.85 (47.0)	2.25 (57.2)	3.25 (82.6)	2.75 (69.9)	0.88 (22.4)	0.25 (6.4)	0.35 (9.00)
SNALD 45M	6336-00073	M45x1.5	1.85 (47.0)	2.25 (57.2)	3.25 (82.6)	2.75 (69.9)	0.88 (22.4)	0.25 (6.4)	0.35 (9.00)
SNALD 6450 SNALD 64100	6241-00074	2-1/2-12 UN	2.25 (57.2)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.35 (9.00)
SNALD 6450M SNALD 64100M	6341-00075	M64x2	2.25 (57.2)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.35 (9.00)
SNALD 64150	6241-00076	2-1/2-12 UN	3.13 (79.4)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.35 (9.00)
SNALD 64150M	6341-00077	M64x2	3.13 (79.4)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.35 (9.00)



Lock Nuts in inches (millimeters)

Used With	Part #	T	W	N3
SNALD 33	6225-00038	1-1/4-12 UNF	1.50 (38.1)	0.25 (6.4)
SNALD 33M	6325-00292	M33x1.5	1.56 (39.6)	0.25 (6.4)
SNALD 45	6236-00041	1-3/4-12 UN	2.25 (57.2)	0.37 (9.4)
SNALD 45M	6336-00297	M45x1.5	2.25 (57.2)	0.37 (9.4)
SNALD 64	6241-00042	2-1/2-12 UN	3.00 (76.2)	0.37 (9.4)
SNALD 64M	6341-00301	M64x2	3.00 (76.2)	0.37 (9.4)



One lock nut included with each shock absorber where appropriate

Side Load Adapters

Increase the life of your Enertrols Mid-Size shock absorbers with the addition of side load adapters. Side load in excess of 5° will cause increased wear of the rod bearings. The result is reduced shock absorber life and increased cost to keep your production equipment operating at peak efficiency.

Model Used With	Part #
SNALD 3325M	6325-00736
SNALD 3350M	6325-00750
SNALD 4525M	6336-00739
SNALD 4550M	6336-00761
SNALD 6450M	6341-00134





Gold Line® Primary Series Adjustable

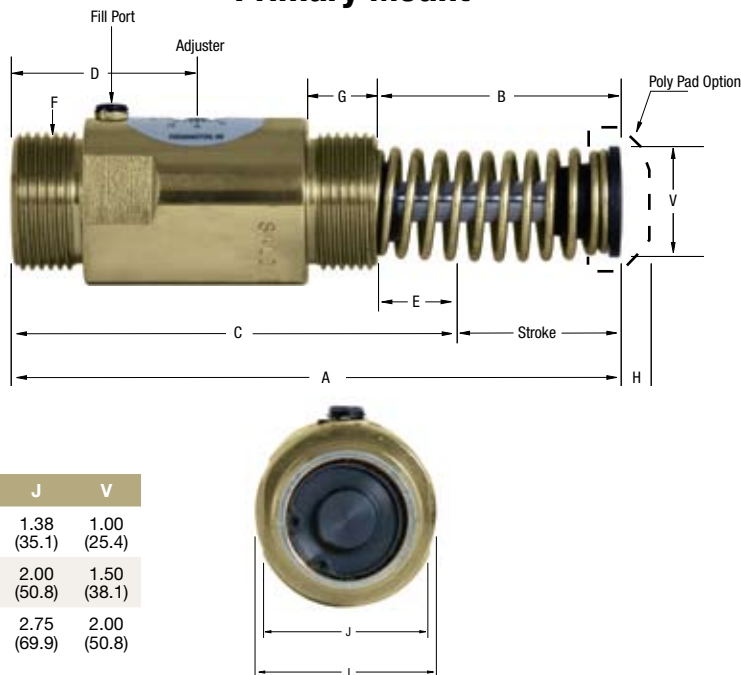
SALD 1/2 x 1, 2-P, SALD 3/4 x 1, 2, 3-P
SALD 1-1/8 x 2, 4, 6-P

Primary Mount in inches (millimeters)

Model	Stroke	A	B	*C	D	*E
SALD 1/2x1-P	1"	5.44 (138.1)	2.19 (55.6)	4.44 (112.7)	1.63 (41.3)	1.19 (30.2)
SALD 1/2x2-P	2"	7.44 (188.9)	3.19 (81)	5.44 (138.1)	2.13 (54)	1.19 (30.2)
SALD 3/4x1-P	1"	5.69 (144.5)	1.97 (50)	4.69 (119.1)	1.86 (47.2)	0.97 (24.6)
SALD 3/4x2-P	2"	7.69 (195.3)	2.97 (75.4)	5.69 (144.5)	2.36 (59.9)	0.97 (24.6)
SALD 3/4x3-P	3"	9.69 (246.1)	3.97 (100.8)	6.69 (169.9)	2.86 (72.6)	0.97 (24.6)
SALD 1-1/8x2-P	2"	8.88 (225.4)	3.38 (85.7)	6.88 (174.6)	2.75 (69.9)	1.38 (34.9)
SALD 1-1/8x4-P	4"	12.88 (327)	5.38 (136.5)	8.88 (225.4)	3.75 (95.3)	1.38 (34.9)
SALD 1-1/8x6-P	6"	17.75 (450.9)	8.25 (200.6)	11.75 (298.5)	4.75 (120.7)	2.25 (57.2)

Model	Port	Rod	F	G	H	I	J	V
SALD 1/2x1,2-P	1/16 NPT	0.38 (9.7)	1-1/4-12 UNF	0.63 (15.9)	0.44 (11.2)	1.50 (38.1)	1.38 (35.1)	1.00 (25.4)
SALD 3/4x1,2,3-P	1/8 NPT	0.50 (12.7)	1-3/4-12 UN	0.91 (23)	0.69 (17.5)	2.25 (57.2)	2.00 (50.8)	1.50 (38.1)
SALD 1-1/8x2,4,6-P	1/4 NPT	0.75 (19.0)	2-1/2-12 UN	1.03 (26.2)	0.69 (17.5)	3.00 (76.2)	2.75 (69.9)	2.00 (50.8)

Primary Mount



Side-Foot Mount & Clevis Mount

Model	Stroke	A	B	*C	D	*E	AA	BB	*CC
SALD 1/2x1-P	1"	5.94 (151)	2.19 (55.6)	1.94 (49.2)	3.75 (95.3)	1.19 (30.2)	6.56 (167)	2.62 (66.6)	5.56 (141.2)
SALD 1/2x2-P	2"	7.94 (202)	3.19 (79.8)	2.94 (74.6)	4.75 (121)	1.19 (30.2)	8.56 (217)	3.62 (91.9)	6.56 (166.6)
SALD 3/4x1-P	1"	5.94 (151)	1.97 (50)	2.06 (52.3)	3.38 (85.5)	0.97 (24.6)	7.84 (199)	2.78 (70.6)	6.84 (173.7)
SALD 3/4x2-P	2"	7.94 (202)	2.97 (75.4)	3.06 (77.7)	4.38 (111)	0.97 (24.6)	9.84 (250)	3.78 (96)	7.84 (199)
SALD 3/4x3-P	3"	9.94 (252)	3.97 (101)	4.06 (103)	5.38 (136)	0.97 (24.6)	11.84 (301)	4.78 (121.4)	8.84 (224.5)
SALD 1-1/8x2-P	2"	9.25 (235)	3.38 (85.8)	3.56 (90)	5.00 (127)	1.38 (34.9)	12.16 (308.9)	4.78 (121)	10.16 (258)
SALD 1-1/8x4-P	4"	13.25 (337)	5.38 (136)	5.56 (141)	7.00 (178)	1.56 (39.6)	16.16 (410)	6.78 (172)	12.16 (308.9)
SALD 1-1/8x6-P	6"	18.13 (460)	8.25 (210)	8.44 (214)	9.00 (229)	2.25 (57.2)	21.03 (534.2)	9.64 (244.8)	14.08 (357.6)

PREFIX

Description

SALD-	Internal accumulator, spring return
ALDA-	Internal accumulator, mechanical return
ALDS-	External accumulator, spring return
ALD-	External accumulator, air or mech. return

Model	Port	Rod	F	G	H	I	J	K	L	M	N	O	R	V
SALD 1/2x1,2-P	1/16 NPT	0.38 (9.7)	0.50 (12.7)	0.50 (12.7)	0.44 (11.1)	0.25 (6.4)	0.25 (6.4)	2.38 (60.3)	2.00 (50.8)	2.75 (69.9)	0.50 (12.7)	0.88 (22.4)	0.23 (5.6)	1.00 (25.4)
SALD 3/4x1,2,3-P	1/8 NPT	0.50 (12.7)	0.88 (22.2)	0.88 (22.2)	0.69 (17.5)	0.38 (9.5)	0.50 (12.7)	3.00 (76.2)	2.25 (57.2)	3.75 (95.3)	0.56 (14.2)	1.16 (29.4)	0.34 (8.7)	1.50 (38.1)
SALD 1/8x2,4,6-P	1/4 NPT	0.75 (19.0)	1.00 (25.4)	1.00 (25.4)	0.69 (17.5)	0.56 (14.2)	0.69 (17.5)	4.88 (124)	3.50 (88.9)	5.63 (143)	0.75 (19.1)	1.75 (44.5)	0.41 (10.3)	2.00 (50.8)

Model	Port	Rod	EE	FF	GG	HH	II	KK	LL	MM	NN	PP	RR	TT
SALD 1/2x1,2-P	1/16 NPT	0.38 (9.7)	0.75 (19.1)	0.25 (6.4)	0.50 (12.7)	0.31 (7.9)	1.50 (38.1)	0.75 (19.1)	0.50 (12.7)	N/A	0.43 (10.9)	0.25 (6.4)	0.25 (6.4)	0.50 (12.7)
SALD 3/4x1,2,3-P	1/8 NPT	0.50 (12.7)	1.00 (25.4)	0.50 (12.7)	0.75 (19.1)	0.50 (12.7)	2.25 (57.2)	1.00 (25.4)	1.00 (25.4)	0.52 (13.2)	0.88 (22.4)	0.50 (12.7)	0.50 (12.7)	0.83 (21.1)
SALD 1-1/8x2,4,6-P	1/4 NPT	0.75 (19.0)	1.50 (38.1)	0.75 (19.1)	1.25 (31.8)	0.75 (19.1)	3.00 (76.2)	1.25 (31.8)	1.50 (38.1)	0.63 (16.0)	1.32 (33.5)	0.62 (15.7)	0.75 (19.1)	1.25 (31.8)

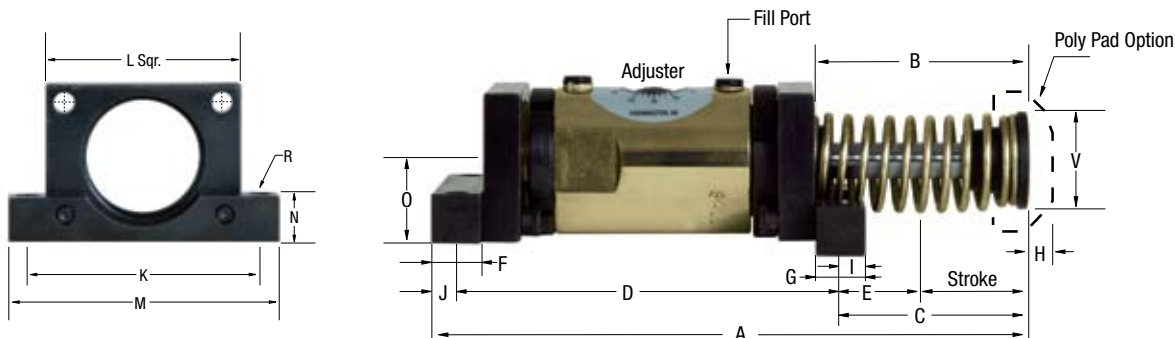
*Recommended length when an external mechanical stop is installed, add .06" (1.5 mm) to marked dimensions.

SALD ½ x 1, 2-P, SALD ¾ x 1, 2, 3-P
SALD 1-1/8 x 2, 4, 6-P

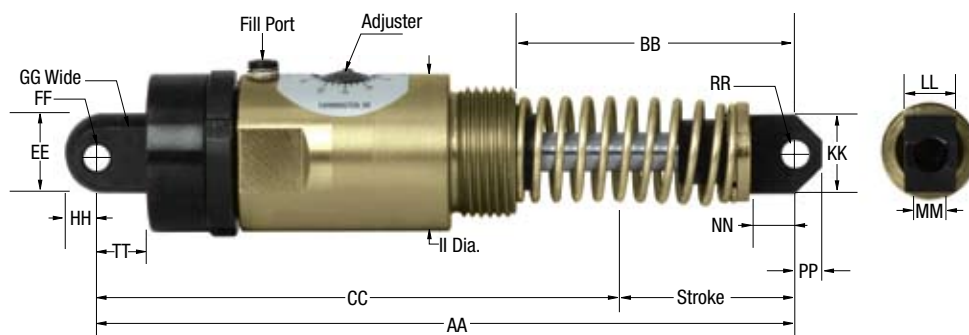
Gold Line® Primary Series

Adjustable

Side-Foot Mount



Clevis Mount



Model	Effective Weight Min/Max lbs (kg)	Max. Energy/Cycle in lbs (Nm)	Energy per Hour		Mounting Strength 2.5 x E ₃ (Max) Stroke lbs (N)
			Internal Accumulator in. lbs (Nm)	External Accumulator in. lbs (Nm)	
SALD 1/2x1 P	10-2,700 (4.5-1,225)	1,350 (153)	750,000 (84,739)	1,300,000 (146,881)	3,375 (15,000)
SALD 1/2x2 P	21-5,400 (9.5-2,449)	2,700 (305)	870,000 (98,297)	1,400,000 (158,179)	3,375 (15,000)
SALD 3/4x1 P	20-18,000 (9-8,165)	3,000 (339)	1,100,000 (124,284)	1,600,000 (180,776)	7,500 (33,300)
SALD 3/4x2 P	35-32,000 (16-14,515)	6,000 (678)	1,300,000 (146,881)	2,000,000 (225,970)	7,500 (33,300)
SALD 3/4x3 P	50-46,000 (23-20,866)	9,000 (1,017)	1,600,000 (180,776)	2,400,000 (271,164)	7,500 (33,300)
SALD 1-1/8x2 P	120-50,000 (54-22,680)	16,000 (1,808)	1,500,000 (169,478)	3,000,000 (338,955)	20,000 (89,000)
SALD 1-1/8x4 P	160-100,000 (73-45,360)	32,000 (3,616)	2,000,000 (225,970)	4,000,000 (451,940)	20,000 (89,000)
SALD 1-1/8x6 P	200-150,000 (91-68,040)	48,000 (5,423)	2,500,000 (282,463)	5,000,000 (564,925)	20,000 (89,000)



Gold Line® Primary Series Adjustable

**SALD ½ x 1, 2-P, SALD ¾ x 1, 2, 3-P
SALD 1-1/8 x 2, 4, 6-P**

Technical Data

Impact velocity range:

SALD ½ x 1,2-P: 1-15 ft/sec (0.3-4.6 m/sec)

SALD ¾ x 1,2,3-P: 1-15 ft/sec (0.3-4.6 m/sec)

SALD 1-1/8 x 2,4,6-P: 1-15 ft/sec (0.3-4.6 m/sec)

For low velocity range, see SILVERLINE data.

Any other out of range velocities, consult factory.

Operating temperature: 10° to 150° F (-12° to 66° C)

Oil type: Petroleum oil

Materials: Steel body, hardened steel piston rod.

Fill ports Primary Series: Models using air-oil tanks have 2 ports, other models have 1 port.

Ordering Information for Gold Line® Primary Models

SALD 1/2 x 1 - P - RF			
SALD Series	Bore x Stroke	Primary	Mounting Options
SALD - Internal accumulator, spring return	1/2 x 1-P		Basic Mounting Threads and one Lock Nut
ALDA - Internal accumulator, mechanical return	1/2 x 2-P		-SF Square Flange - (not available 1/2 bore)
ALDS - External accumulator, spring return	3/4 x 1-P		-RF Rectangle Flange - (not available 1-1/8 bore)
ALD - External accumulator, air or mech. return	3/4 x 2-P		-L Side Foot Mount
	3/4 x 3-P		-C Clevis Mount
	1-1/8 x 2-P		-Z Blind-end Air Cylinder Mounting
	1-1/8 x 4-P		
	1-1/8 x 6-P		

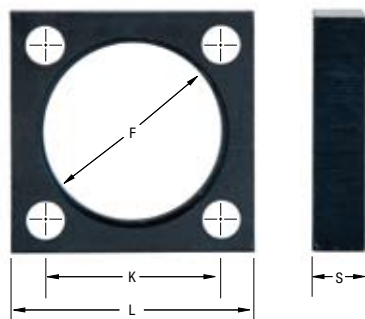
PRIMARY Mount and Option Description	
None	Basic Mounting Threads and one Jam Nut
-SF	Square Flange - (not available 1/2 bore)
-RF	Rectangle Flange - (not available 1-1/8 bore)
-L	Side Foot Mount
-C	Clevis Mount
-Z	Blind-end Air Cylinder Mounting
-SP	Poly Pad - not used with -PSC, -MSC, -FSC, C, or -Z Option
-PCS	Positive Stop Collar - for Basic or Rear Mount Only
-FSC	Flanged Stop Collar - for Basic Mount Only (n/a 1-1/8x6 bore)
-MSC	Mounting Stop Collar - for Basic Mount Only

PRIMARY Mount and Option Description	
-RK	Retention Kit - Only used with "MSC" option
-V	Viton Seals
-FRFV	Fire Resistant Fluids
-LVO	Low Viscosity Oil
_MVO	Medium Viscosity Oil
-HVO	High Viscosity Oil
-ATF	Automatic Transmission Fluid
-SG	Sight Gauge
-PS-1	MINI (AC - DC) Proximity Switch
-PS-2	MICRO (AC - DC) Proximity Switch
-PS-2	MICRO (DC) Proximity Switch (Metric - SATURN only)

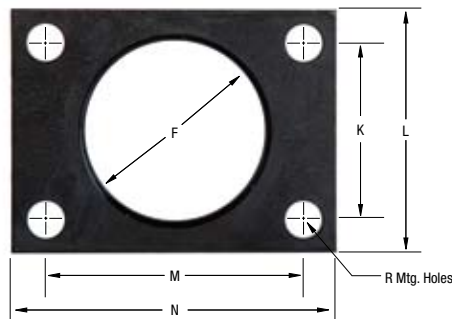
Gold Line® & SILVERLINE® Primary Series Accessories

Adjustable

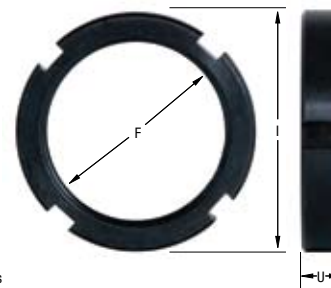
Square Flange
3/4, 1-1/8



Rectangle Flange
1/2, 3/4



Lock Nut



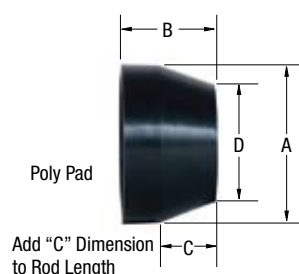
Dimensions in inches (millimeters)

Bore	F	H	I	K	L	M	N	R	S	U	X	Y
1/2	1-1/4-12 UNF	0.44 (11.2)	1.50 (38.1)	1.13 (28.7)	1.50 (38.1)	1.63 (41.4)	2.00 (50.8)	0.22 (5.6)	0.38 (9.7)	0.25 (6.4)	0.93 (23.6)	0.75 (19.1)
3/4	1-3/4-12 UN	0.69 (17.5)	2.25 (57.2)	1.63 (41.4)	2.25 (57.2)	2.38 (60.5)	3.00 (76.2)	0.34 (8.6)	0.50 (12.7)	0.38 (9.7)	1.33 (33.8)	1.00 (25.4)
1-1/8	2-1/2-12 UN	0.69 (17.5)	3.00 (76.2)	2.75 (69.9)	3.50 (88.9)	N/A	N/A	0.41 (10.4)	0.63 (16)	0.38 (9.7)	1.83 (46.5)	1.00 (25.4)

Bore	Square Flange		Rectangle Flange		Lock Nut		Poly Pad Part Number
	U.S. P/N	Metric P/N	U.S. P/N	Metric P/N	U.S. P/N	Metric P/N	
1/2	N/A	N/A	3125-07005	31125-07505	3125-09005	3125-09501	3125-09015
3/4	3136-08005	3136-08506	3136-07005	3136-07501	3136-09005	3136-09501	3136-19015
1-1/8	3141-08005	N/A	N/A	N/A	3141-09005	3141-09501	3141-19015

Poly Pad Bore	A	B	C	D
1/2	1.25 (31.8)	0.75 (19.1)	0.44 (11.2)	0.93 (23.6)
3/4	1.75 (44.5)	1.00 (25.4)	0.69 (17.5)	1.33 (33.8)
1-1/8	2.25 (57.2)	1.00 (25.4)	0.69 (17.5)	1.83 (46.5)

NOTE: Do not use poly pads with positive stop systems.





Positive Stop Systems

Gold Line® & SILVERLINE® Primary Mount Dimensions

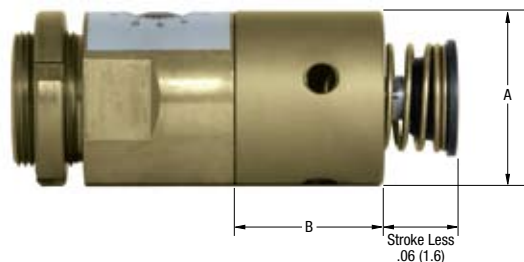
These systems are the strongest, least expensive and best way of providing a tamper-proof positive stop and a precision fixed work-positioning point at the same time. Enertrols uses a hardened steel construction (Rc 55-58 standard on all models) that will not deform or change with heavy cycling installations.

PSC - POSITIVE STOP COLLAR

Provides integral positive stop for rear-mounted Primary Model Shock Absorbers

Dimensions in inches (millimeters)

Bore	A	B	Part Number
1/2	1.50 (38.1)	1.86 (47.2)	3125-34010
3/4	2.25 (57.2)	1.91 (48.4)	3136-34010
1-1/8	3.00 (76.2)	2.45 (62.3)	3141-34010 (1, 2, 4" stroke)
1-1/8	3.00 (76.2)	3.32 (84.3)	3141-34106 (6" stroke)

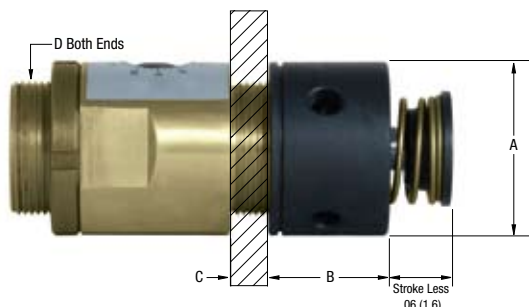


MSC - MOUNTING STOP COLLAR

Through-hole front-mount plus integral, positive stop for Primary Model Shock Absorbers

Dimensions in inches (millimeters)

Bore	A	B	C	D	Part Number
1/2	1.50 (38.1)	1.63 (41.3)	0.25 (6.4)	1.25 (31.8)	3125-34000
3/4	2.25 (57.2)	1.56 (39.7)	0.38 (9.5)	1.75 (44.5)	3136-34000
1-1/8	3.00 (76.2)	1.97 (50)	0.50 (12.7)	2.50 (63.5)	3141-34000 (1, 2, 4" stroke)
1-1/8	3.00 (76.2)	2.83 (71.6)	0.50 (12.7)	2.50 (63.5)	3141-34107 (6" stroke)

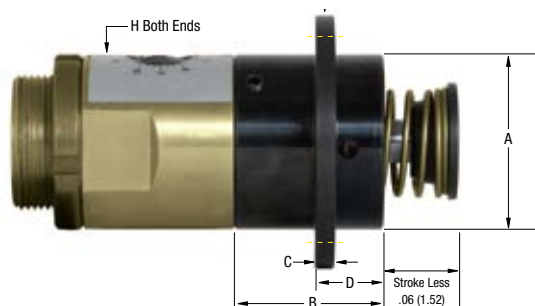


FSC - FLANGED STOP COLLAR

Flange front-mounting and integral, positive stop for Primary Model Shock Absorbers

Dimensions in inches (millimeters)

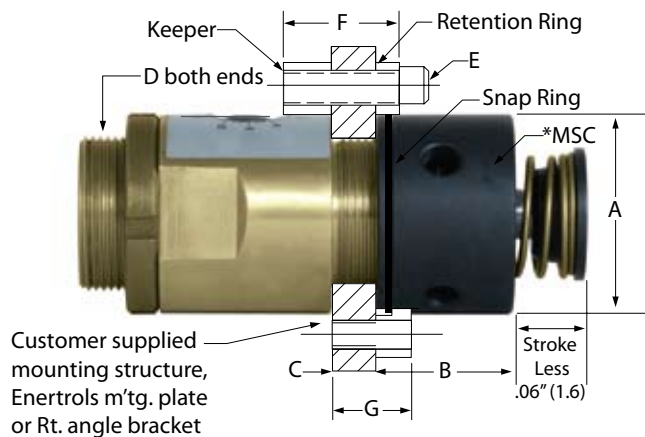
Bore	A	B	C	D	E	F	G	H	Part Number
1/2	1.50 (38.1)	1.86 (47.2)	0.25 (6.4)	0.88 (22.4)	2.50 (63.5)	0.28 (7.1)	2.0 (50.8)	1.50 (38.1)	3125-34510
3/4	2.25 (57.2)	1.91 (48.4)	0.25 (6.4)	0.88 (22.4)	3.25 (82.6)	0.28 (7.1)	2.75 (69.9)	2.25 (57.2)	3136-34510
1-1/8	3.00 (76.2)	2.45 (62.3)	0.38 (9.5)	1.00 (25.4)	4.25 (108)	0.28 (7.1)	3.50 (88.9)	3.00 (76.2)	3141-34510 (1, 2, 4" stroke)



Retention Kit for MSC Installations

"Guarantees the Integrity of your Positive Stop"

The kit permits removal of the shock absorber and leaves the MSC stop collar intact. Another feature is the exclusive keeper mechanism that also locks the shock absorber body to prevent any danger of loosening due to rotation during extremely heavy-duty applications.



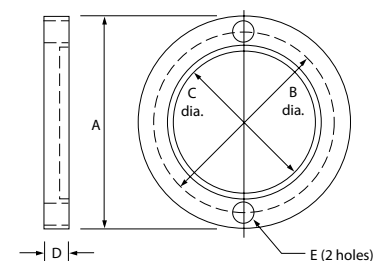
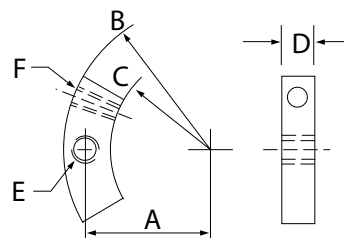
*MSC, Mounting Stop Collar not included with retention kit

KEEPER

Bore	A	B	C	D	E	F	Part Number
1/2	1.00 (25.4)	1.25 (31.8)	0.76 (19.3)	0.25 (6.4)	1/4-20 UNC	8-32 UNC	3125-31013
3/4	1.44 (36.6)	1.69 (42.9)	1.14 (28.9)	0.38 (9.5)	5/16-18 UNC	10-24 UNC	3136-31013
1-1/8	2.00 (50.8)	2.25 (57.2)	1.52 (38.6)	0.38 (9.5)	5/16-18 UNC	10-24 UNC	3141-31013

RETENTION RING

Bore	A	B	C	D	E	Part Number
1/2	2.50 (63.5)	2.00 (50.8)	1.51 (38.4)	0.25 (6.4)	0.28 (7.1)	3125-31014
3/4	3.38 (85.8)	2.88 (73.2)	2.26 (57.4)	0.38 (9.5)	0.34 (8.6)	3136-31014
1-1/8	4.50 (114.3)	4.00 (101.6)	3.01 (76.5)	0.38 (9.5)	0.34 (8.6)	3141-31014



RETENTION KIT

Bore	A	B	C	D
1/2	1.50 (38.1)	1.63 (41.3)	0.25 (6.4)	1.25 (31.8)
3/4	2.25 (57.2)	1.56 (39.7)	0.38 (9.5)	1.75 (44.5)
1-1/8	3.00 (76.2)	1.97 (50)	0.50 (12.7)	2.50 (63.5)
1-1/8	3.00 (76.2)	2.83 (71.6)	0.50 (12.7)	2.50 (63.5)

E	F	G	Part Number
1/4-20 x 3/4 SHCS or HEX	0.75 (19.1)	0.5 (12.7)	3925-01055
5/16-18 x 1-1/4 SHCS or HEX	1.13 (28.6)	0.76 (19.3)	3936-01055
5/16-18 x 1-1/4 SHCS or HEX	1.25 (31.5)	0.88 (22.4)	3941-01055
5/16-18 x 1-1/4 SHCS or HEX	1.25 (31.5)	0.88 (22.4)	3941-01055 6" Stroke only

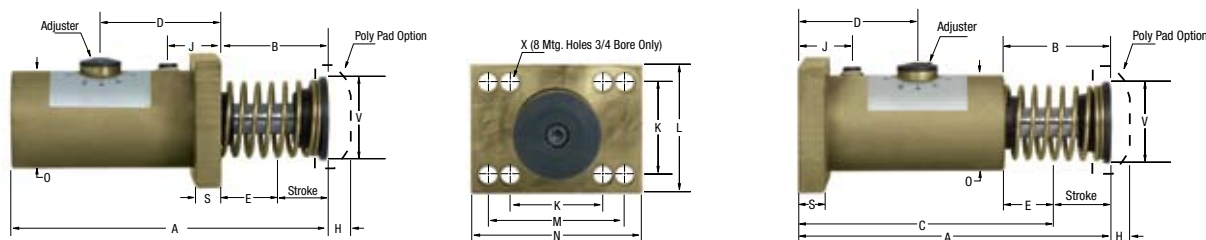


Enertrols®

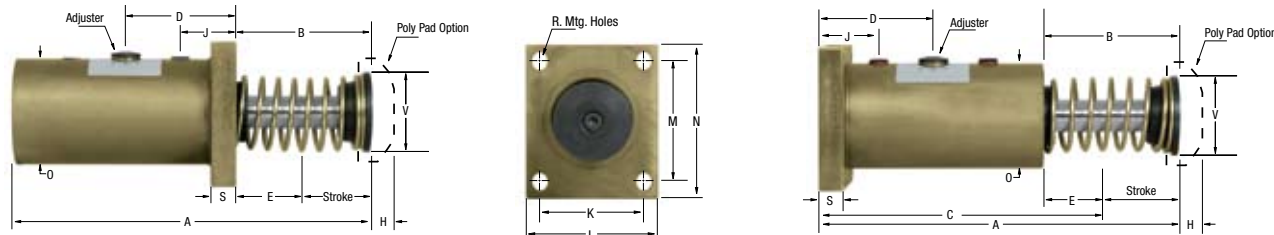
Gold Line® Fixed Flange Series Adjustable

**SALD 3/4, 1-1/8,
1-1/2, 2-1/4**

3/4 Bore Rectangle Flange Front & Rear Mount



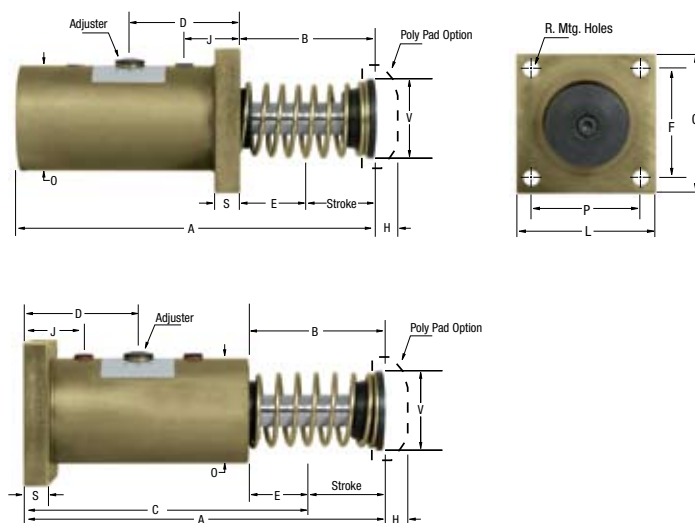
1 1/2 Bore Rectangle Flange Front & Rear Mount



Dimensions in inches (millimeters)

SALD Model	Stroke	A	B	*C	D	*E
3/4	1"	5.69 (144.5)	1.97 (50)	4.69 (119.1)	1.86 (47.2)	0.97 (24.6)
	2"	7.69 (195.3)	2.97 (75.4)	5.69 (144.5)	2.36 (59.9)	0.97 (24.6)
	3"	9.69 (246.1)	3.97 (100.8)	6.69 (169.9)	2.86 (76.6)	0.97 (24.6)
1-1/8	2"	8.88 (225.4)	3.38 (85.7)	6.88 (174.6)	2.75 (69.9)	1.38 (34.9)
	4"	12.88 (327)	5.38 (136.5)	8.88 (225.4)	3.75 (95.3)	1.38 (34.9)
1-1/2	2"	9.69 (246)	4.13 (104.7)	7.69 (195.3)	3.53 (89.7)	2.13 (54)
	3-1/2"	12.69 (322.3)	5.63 (142.9)	9.19 (233.4)	3.53 (89.7)	2.13 (54)
	5"	15.69 (398.5)	7.13 (181)	10.69 (271.5)	3.53 (89.7)	2.13 (54)
	6-1/2"	19.44 (493.7)	9.38 (238.1)	12.94 (328.6)	3.53 (89.7)	2.88 (73)
2-1/4	2"	12.31 (312.7)	4.31 (109.5)	10.31 (261.9)	4.00 (101.6)	2.31 (58.7)
	4"	16.31 (414.3)	6.31 (160.3)	12.31 (312.7)	4.00 (101.6)	2.31 (58.7)
	6"	20.31 (515.9)	8.31 (211.1)	14.31 (363.5)	4.00 (101.6)	2.31 (58.7)
	8"	25.31 (642.9)	11.31 (287.3)	17.31 (439.7)	4.00 (101.6)	3.31 (84.1)

1 1/8, 1 1/2, 2 1/4 Bore Square Flange Front & Rear Mount



Dimensions in inches (millimeters)

SALD Model	Rod	Port	F	G	H	J	K	L	M	N	O	P	R	S	V	X
3/4	0.56 (14.3)	1/8 (NPT)	-	-	0.69 (17.5)	1.16 (29.4)	1.63 (41.4)	2.25 (57.2)	2.38 (60.5)	3.00 (76.2)	1.75 (44.5)	-	-	0.48 (12.2)	1.50 (38.1)	0.34 (8.6)
1-1/8	0.81 (20.6)	1.4 (NPT)	2.75 (69.9)	3.50 (88.9)	0.69 (17.5)	1.38 (34.6)	-	3.50 (88.9)	-	-	2.63 (66.7)	2.75 (69.9)	0.41 (10.4)	0.61 (15.5)	2.00 (50.8)	-
1-1/2	1.13 (28.6)	1/2 (NPT)	3.00 (76.2)	4.00 (101.6)	0.75 (19.1)	2.00 (50.8)	3.00 (76.2)	4.00 (101.6)	4.00 (101.6)	5.00 (127)	3.50 (88.9)	3.00 (76.2)	0.53 (13.5)	0.73 (18.5)	2.75 (69.8)	-
2-1/4	1.75 (44.5)	3/4 (NPT)	4.38 (111.1)	5.50 (139.7)	-	2.00 (50.8)	-	5.50 (139.7)	-	-	5.00 (127)	4.38 (111.2)	0.66 (16.7)	0.98 (24.9)	4.38 (111.2)	-

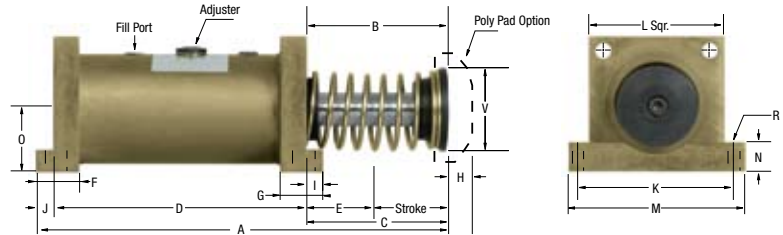
*Recommended length when an external mechanical stop is installed, add .06" (1.52 mm) to marked dimensions.

SALD 3/4, 1-1/8, 1-1/2, 2-1/4

Gold Line® Fixed Flange Series Adjustable

SALD Model	Stroke	A	B	C	D	*E
1-1/2	2"	10.13 (257.3)	3.94 (100.1)	4.31 (109.5)	5.19 (131.8)	2.13 (54)
	3-1/2"	13.13 (333.5)	5.44 (138.2)	5.81 (147.6)	6.69 (169.9)	2.13 (54)
	5"	16.13 (409.7)	6.94 (176.3)	7.31 (185.7)	8.19 (208)	2.13 (54)
	6-1/2"	19.88 (505)	9.19 (233.4)	9.56 (242.9)	9.69 (246)	2.88 (73)
2-1/4	2"	13.56 (344.4)	4.12 (104.6)	3.44 (87.3)	9.50 (241.3)	2.31 (58.7)
	4"	17.56 (446)	6.12 (155.5)	5.44 (138.1)	11.50 (292.1)	2.31 (58.7)
	6"	21.56 (547.6)	8.12 (206.2)	7.44 (188.9)	13.50 (342.9)	2.31 (58.7)
	8"	26.56 (674.6)	11.12 (282.4)	10.44 (265.1)	15.50 (393.7)	3.31 (84.1)

1 1/2, 2 1/4 Bore Side-Foot Mount



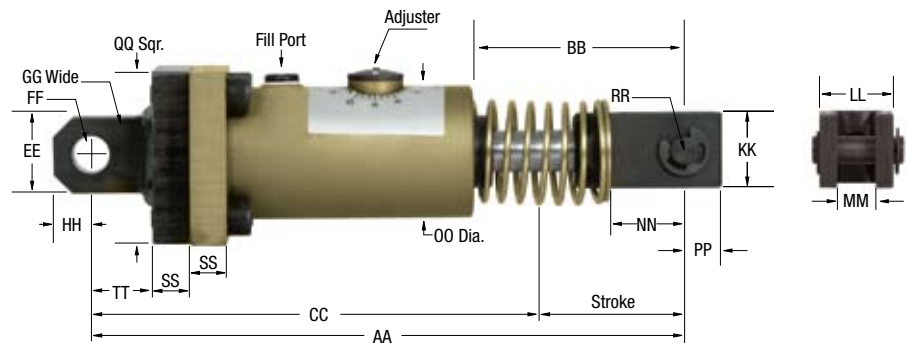
Dimensions in inches (millimeters)

SALD Model	Rod	Port	F	G	H	I	J	K	L	M	N	O	R	V
1-1/2	1.13 (28.6)	1/2 NPT	1.25 (31.8)	1.75 (44.5)	0.75 (19.1)	0.88 (22.4)	0.63 (16)	5.50 (139.7)	4.00 (101.6)	6.50 (165.1)	0.75 (19.1)	2.03 (51.7)	0.53 (13.5)	2.75 (69.8)
2-1/4	1.75 (44.5)	3/4 NPT	1.25 (31.8)	1.25 (31.8)	-	0.63 (16)	0.63 (16)	6.50 (165.1)	5.50 (139.7)	8.00 (203.2)	1.50 (38.1)	3.13 (79.4)	0.66 (16.7)	2.75 (69.8)

*Recommended length when an external mechanical stop is installed, add .06" (1.52 mm) to marked dimensions.

SALD Model	Stroke	AA	BB	*CC
3/4	1"	7.84 (199)	2.78 (70.6)	6.84 (173.7)
	2"	9.84 (250)	3.78 (96)	7.84 (199)
	3"	11.84 (300.8)	4.78 (121.4)	8.84 (224.5)
1-1/8	2"	12.16 (309)	4.78 (121)	10.16 (258)
	4"	16.16 (410.4)	6.78 (172.2)	12.16 (309)
1-1/2	2"	12.97 (329.4)	5.40 (137.2)	10.97 (278.6)
	3-1/2"	15.97 (405.5)	6.90 (175.3)	12.47 (316.7)
	5"	18.97 (481.8)	8.40 (213.4)	13.97 (354.8)
	6-1/2"	22.72 (577)	10.65 (270.5)	16.22 (412)
2-1/4	2"	17.00 (431.8)	6.00 (152.4)	15.00 (381)
	4"	21.00 (533.4)	8.00 (203.2)	17.00 (431.8)
	6"	25.00 (635)	10.00 (254)	19.00 (482.6)
	8"	29.00 (736.6)	12.00 (304.8)	21.00 (533.4)

3/4, 1-1/8, 1 1/2, 2 1/4 Bore Clevis Mount



Dimensions in inches (millimeters)

SALD Model	Rod	Port	EE	FF	GG	HH	KK	LL	MM	NN	OO	PP	QQ	RR	SS	TT
3/4	0.56 (14.3)	1/8 (NPT)	1.00 (25.4)	0.50 (12.7)	0.75 (19.1)	0.50 (12.7)	1.00 (25.4)	1.00 (25.4)	0.52 (13.2)	0.88 (22.4)	1.75 (44.5)	0.50 (12.7)	2.25 (57.2)	0.50 (12.7)	0.48 (12.2)	0.83 (21.1)
1-1/8	0.81 (20.6)	1.4 (NPT)	1.50 (38.1)	0.75 (19.1)	1.25 (31.8)	0.75 (19.1)	1.25 (31.8)	1.50 (38.1)	0.63 (16.0)	1.32 (33.5)	2.63 (66.7)	0.62 (15.7)	3.50 (88.9)	0.751 (19.1)	0.61 (15.5)	1.25 (31.8)
1-1/2	1.13 (28.6)	1/2 (NPT)	1.50 (38.1)	0.75 (19.1)	1.25 (31.8)	0.75 (19.1)	1.25 (31.8)	1.50 (38.1)	0.63 (16.0)	3.50 (88.9)	3.50 (88.9)	0.63 (15.9)	4.00 (101.6)	0.751 (19.1)	0.75 (19.1)	1.25 (31.8)
2-1/4	1.75 (44.5)	3/4 (NPT)	2.25 (57.2)	1.00 (25.4)	1.50 (38.1)	1.00 (25.4)	2.00 (50.8)	3.50 (88.9)	1.50 (38.1)	1.50 (38.1)	5.00 (127)	1.00 (25.4)	5.50 (139.7)	1.00 (25.4)	1.00 (25.4)	2.00 (50.8)

*Recommended length when an external mechanical stop is installed, add .06" (1.52 mm) to marked dimensions.

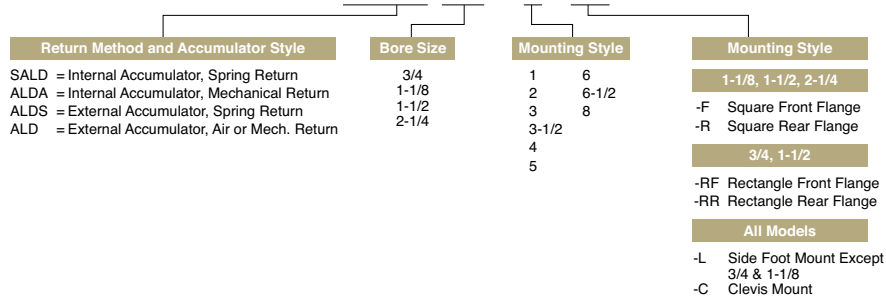


Gold Line® Fixed Flange Series Specifications

Adjustable

SALD Model	Stroke in.	Effective Weight		Max. Energy Cycle in lbs (Nm)	Energy per Hour		Mounting Strength 2.5 x E ₃ (Max) Stroke lbs (N)
		Min/Max lbs (kg)	We		E ₃	E ₄	
SALD 3/4x1	1	20-18,000 (9-8,165)		3,000 (339)	1,100,000 (124,284)	1,600,000 (180,776)	
SALD 3/4x2	2	35-32,000 (16-14,515)		6,000 (678)	1,300,000 (146,881)	2,000,000 (225,970)	7,500 (33,300)
SALD 3/4x3	3	50-46,000 (23-20,866)		9,000 (1,017)	1,600,000 (180,776)	2,400,000 (271,164)	
SALD 1-1/8x2	2	120-50,000 (54-22,680)		16,000 (1,808)	1,500,000 (169,478)	3,000,000 (338,955)	
SALD 1-1/8x4	4	160-100,000 (73-45,360)		32,000 (3,616)	2,000,000 (225,970)	4,000,000 (451,940)	20,000 (89,000)
SALD 1-1/2x2	2	300-80,000 (136-36,288)		21,000 (2,373)	3,200,000 (361,552)	4,000,000 (451,940)	
SALD 1-1/2x3-1/2	3-1/2	350-120,000 (159-54,432)		36,750 (4,152)	5,600,000 (632,716)	7,000,000 (790,895)	
SALD 1-1/2x5	5	400-160,000 (181-72,576)		52,500 (5,932)	8,000,000 (903,880)	10,000,000 (1,129,850)	
SALD 1-1/2x6-1/2	6-1/2	450-200,000 (204-90,720)		68,250 (7,711)	13,000,000 (1,175,044)	13,000,000 (1,468,805)	
SALD 2-1/4x2	2	1,200-100,000 (544-43,360)		56,000 (6,327)	16,000,000 (1,807,760)	20,000,000 (2,259,700)	
SALD 2-1/4x4	4	1,500-200,000 (680-90,720)		112,000 (12,654)	20,000,000 (2,259,700)	25,000,000 (2,824,625)	
SALD 2-1/4x6	6	1,800-300,000 (816-136,080)		168,000 (18,981)	24,000,000 (2,711,640)	30,000,000 (3,389,550)	
SALD 2-1/4x8	8	2,100-410,000 (953-185,976)		224,000 (25,309)	28,000,000 (3,163,580)	35,000,000 (3,954,475)	70,000 (311,000)

SALD 3/4 x 1 - RF



Ordering Information

OPTIONS		OPTIONS	
-Z	Blind-end Air Cylinder Mount (Front Flange Models Only)	-ATF	Automatic Transmission Fluid
-SP	Poly Pad - except with 2-1/4", -PSC, -PSB, -C, or -Z	-T1/4	Stop Tube = 1/4" Length
-PSC	Positive Stop Collar to Rear Flange 3/4" to 2-1/4" Bore Only	-T1/2	Stop Tube = 1/2" Length
-PSB	Positive Stop Bars for Front Flange 3/4" to 2-1/4" Bore Only	-T1	Stop Tube = 1" Length
-V	Viton Seals	-T2	Stop Tube = 2" Length
-FRFV	Fire Resistant Fluids	-T3	Stop Tube = 3" Length
-LVO	Low Viscosity Oil	-SG	Sight Gauge
-MVO	Medium Viscosity Oil	-PS-1	MINI (AC - DC) Proximity Switch (1-1/2" Bore Only)
-HVO	High Viscosity Oil	-PS-2	MICRO (AC - DC) Proximity Switch (1-1/2" Bore Only)
		-PS-3	MICRO (DC) Proximity Switch (Metric - SATURN 1-1/2" Bore Only)

Technical Data

Impact velocity range: 1 to 15 ft/sec (0.3 to 4.6 m/sec)

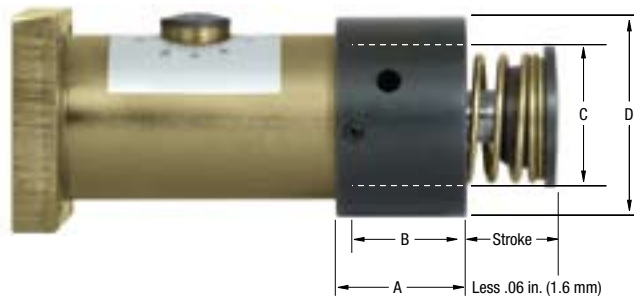
Operating temperature: 10° to 150° F (-12° to 66° C)

Oil type: petroleum oil

Materials: steel body, hardened steel piston rod.

Positive Stop Collar (-PSC) for Fixed Flange, Rear Mounted Shock Absorbers for Gold Line® & SILVERLINE® Series

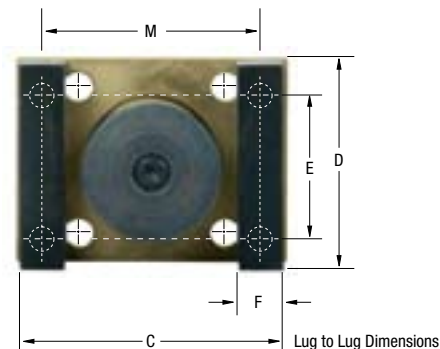
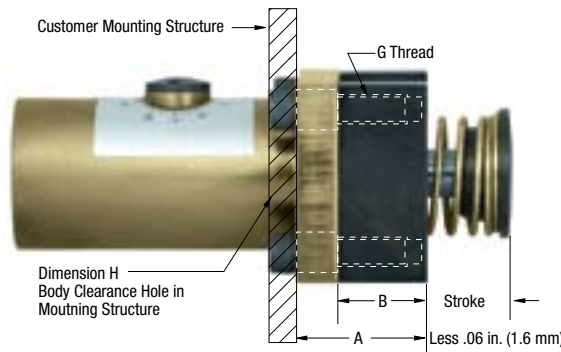
3/4, 1-1/8, 1-1/2,
2-1/4 Bore



Bore	Stroke	Part Number	A	B	C	D
3/4	1, 2 or 3	3137-34010	1.38 (35)	1.02 (25.8)	1.56 (39.7)	2.13 (54)
1-1/8	2 or 4	3142-34015	1.91 (48.4)	1.42 (36.1)	2.13 (54)	3.13 (79.4)
1-1/2	2, 3-1/2 or 5	3147-34105	2.69 (68.3)	2.19 (55.6)	3.00 (76.2)	4.00 (102)
	6-1/2	3147-34106	3.44 (87.4)	2.94 (74.7)	3.00 (76.2)	4.00 (102)
2-1/4	2, 4 or 6	3152-34106	2.88 (73.2)	2.38 (60.5)	4.63 (118)	5.50 (140)
	8	3152-34108	3.88 (98.6)	3.38 (85.9)	4.63 (118)	5.50 (140)

NOTE: 1½ bore rectangle mounting flange shown 90 degrees from actual location.

Positive Stop Bars (-PSB) for Fixed Flange, Front Mounted Shock Absorbers 3/4, 1 1/8, 1 1/2, 2 1/4 Bore for Gold Line® & SILVERLINE® Series



Bore	Stroke	Part Number	A	B	C	D	E	F	G	H	M
3/4	1, 2 or 3	3137-34011	1.50 (38.1)	1.02 (25.8)	3.00 (79.4)	2.25 (57.2)	1.63 (41.3)	0.50 (12.7)	5/16-18 x 3/4 DEEP	2.13 (54)	2.38 (60.5)
1-1/8	2 or 4	3142-34011	2.03 (51.6)	1.42 (36.1)	3.50 (88.9)	3.50 (88.9)	2.75 (69.9)	0.50 (12.7)	3/8-16 x 3/4 DEEP	3.13 (79.4)	2.75 (69.9)
1-1/2	2, 3-1/2 or 5	3147-34011	2.92 (74.2)	2.19 (55.6)	5.00 (127)	4.00 (102)	3.00 (76.2)	0.75 (19.1)	1/2-13 x 7/8 DEEP	4.00 (102)	4.00 (102)
	6-1/2	3147-34012	3.67 (93.2)	2.94 (74.7)							
2-1/4	2, 4 or 6	3152-34011	3.36 (85.3)	2.38 (60.5)	5.50 (140)	5.50 (140)	4.38 (111)	1.00 (25.4)	5/8-16 x 1/1/4 DEEP	5.38 (137)	4.38 (111)
	8	3152-34012	4.36 (110.7)	3.38 (85.9)							

NOTE: 1½ bore with Positive Stop Bar option available rectangle flange only and the mounting flange is shown 90 degrees from actual location.



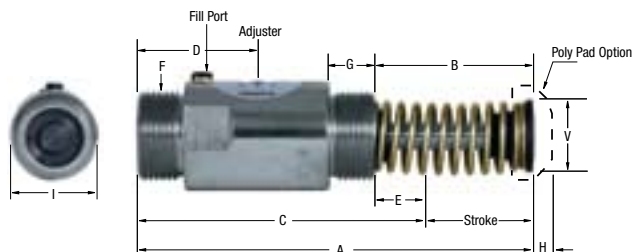
SILVERLINE® Series

SILVERLINE® Models for low velocity (0.25 to 2.0 ft/sec., or 0.076-0.61 meters/sec.)

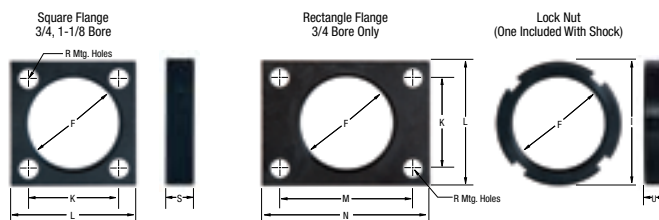
High effective weight and for high propelling force applications (E_2 over 50% of E_3 Maximum)

Primary Models $\frac{3}{4}$ and $1\frac{1}{8}$, Bore Primary and Flange Mounts

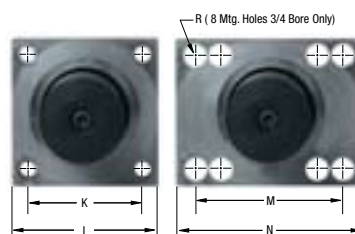
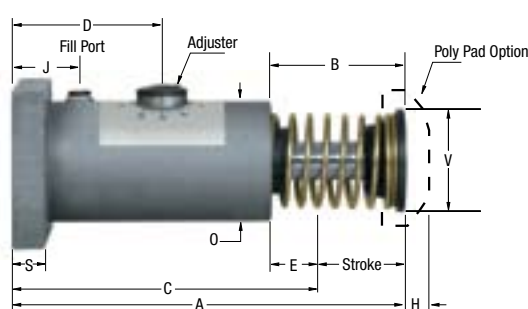
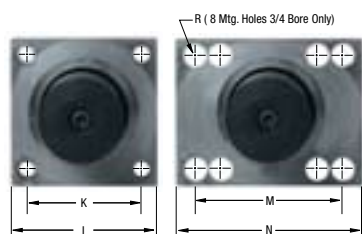
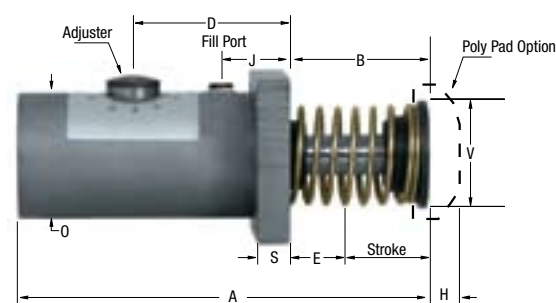
See page 56 for accessory part numbers.



Fixed Flange Models $\frac{3}{4}$, $1\frac{1}{8}$, $1\frac{1}{2}$, & $2\frac{1}{4}$ Bore - Front Mount



Fixed Flange - Rear Mount

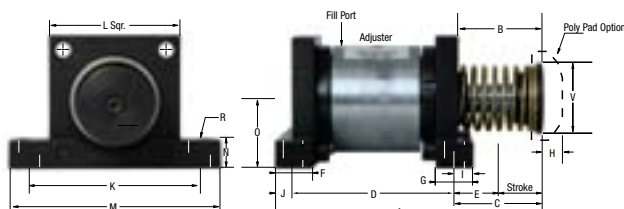


NOTE FIXED FLANGE MODELS: $\frac{3}{4}$ bore available rectangle mount only with both square and rectangle mounting holes. $1\frac{1}{8}$ and $2\frac{1}{4}$ bore available in square mount only. $1\frac{1}{2}$ bore available in square or rectangle flange and the rectangle mounting is shown 90 degrees from actual location. For shock absorber clearance hole diameter in a mounting structure, see Dimension H under Positive Stop Bar dimensions on page 62.

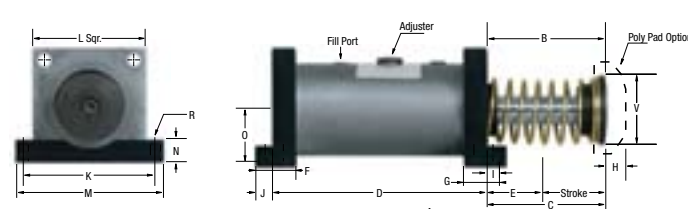
Dimensions in inches (millimeters)

SASL Model	Stroke	Rod	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	R	S	U	V
$\frac{3}{4}$	1	0.56 (14.3)	5.69 (144.5)	1.97 (50)	4.69 (119.1)	1.86 (47.2)	0.97 (24.6)	1-3/4-12 UNF (23.1)	0.91 (17.5)	0.69 (17.5)	2.25 (57.2)	1.16 (29.4)	1.63 (41.4)	2.25 (57.2)	2.38 (60.5)	3.00 (76.2)	1.75 (44.5)	0.34 (8.6)	0.50 (12.7)	0.38 (9.6)	1.50 (38.1)
	2	0.56 (14.3)	7.69 (195.3)	2.97 (75.4)	5.69 (144.5)	2.36 (59.9)	0.97 (24.6)	1-3/4-12 UNF (23.1)	0.91 (17.5)	0.69 (17.5)	2.25 (57.2)	1.16 (29.4)	1.63 (41.4)	2.25 (57.2)	2.38 (60.5)	3.00 (76.2)	1.75 (44.5)	0.34 (8.6)	0.50 (12.7)	0.38 (9.6)	1.50 (38.1)
$1\frac{1}{8}$	1	0.81 (20.6)	6.88 (174.6)	2.38 (60.3)	5.88 (149.2)	2.25 (57.2)	1.38 (34.9)	2-1/2-12 UNF (26.1)	1.03 (26.1)	0.69 (17.5)	3.00 (76.2)	1.38 (34.6)	2.75 (69.9)	3.50 (88.9)	-	-	2.63 (66.7)	0.41 (10.4)	0.63 (16)	0.38 (9.6)	2.00 (50.8)
	2	0.81 (20.6)	8.88 (225.4)	3.38 (85.7)	6.88 (174.6)	2.75 (69.9)	1.38 (34.9)	2-1/2-12 UNF (26.1)	1.03 (26.1)	0.69 (17.5)	3.00 (76.2)	1.38 (34.6)	2.75 (69.9)	3.50 (88.9)	-	-	2.63 (66.7)	0.41 (10.4)	0.63 (16)	0.38 (9.6)	2.00 (50.8)
$1\frac{1}{2}$	2	1.13 (28.6)	9.69 (246)	4.13 (104.7)	7.69 (195.3)	3.53 (89.7)	2.13 (54)	-	-	0.75 (19.1)	-	2.00 (50.8)	3.00 (76.2)	4.00 (101.6)	4.00 (101.6)	5.00 (127)	3.50 (88.9)	0.53 (13.5)	0.75 (19.1)	-	2.75 (69.8)
$2\frac{1}{4}$	2	1.75 (44.5)	12.31 (312.7)	4.31 (109.5)	10.31 (261.9)	4.00 (101.6)	2.31 (58.7)	-	-	-	-	2.00 (50.8)	4.38 (111.1)	5.50 (139.7)	-	-	5.00 (127)	0.66 (16.7)	1.00 (25.4)	-	2.75 (69.8)

Primary - Side-Foot Mount $\frac{3}{4}$ and $1\frac{1}{8}$, Bore



Fixed Flange Side-Foot Mount $1\frac{1}{2}$, & $2\frac{1}{4}$ Bore

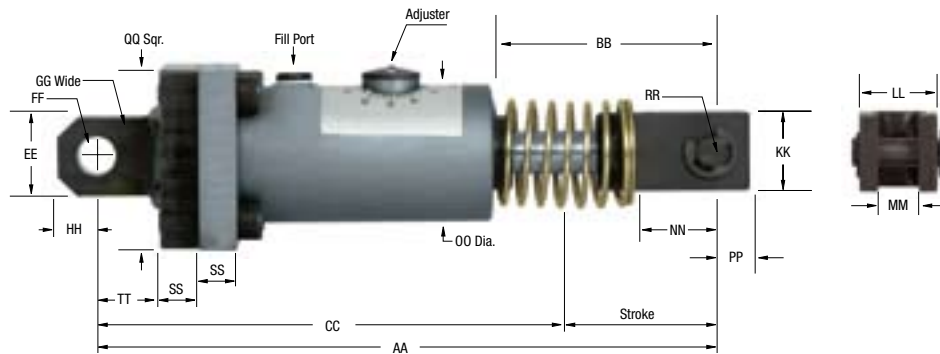


SILVERLINE® Series

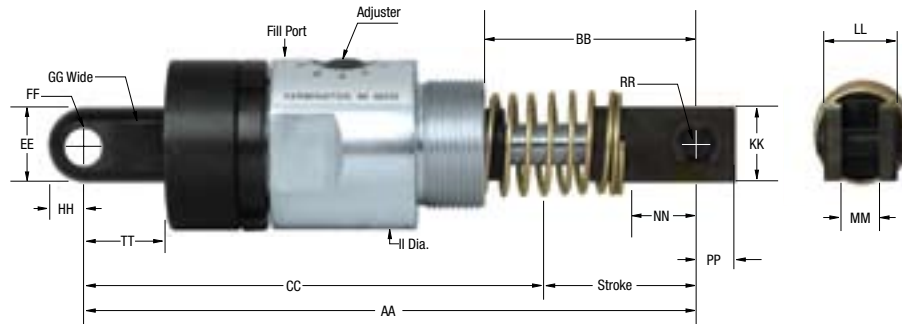
Dimensions in inches (millimeters)

SASL Model	Stroke	Rod	Port	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	R	V
3/4	1	0.56 (14.2)	1/8 NPT	5.94 (151)	1.97 (50)	2.06 (52.3)	3.38 (85.5)	1.09 (27.8)	0.88 (22.2)	0.88 (22.2)	0.69 (17.5)	0.38 (9.5)	0.50 (12.7)	3.00 (76.2)	2.25 (57.2)	3.75 (95.3)	0.56 (14.2)	1.16 (29.4)	0.34 (8.7)	1.50 (38.1)
	2	0.56 (14.2)	1/8 NPT	7.94 (202)	2.97 (75.4)	3.06 (77.7)	4.38 (111)	1.09 (27.8)	0.88 (22.2)	0.88 (22.2)	0.69 (17.5)	0.38 (9.5)	0.50 (12.7)	3.00 (76.2)	2.25 (57.2)	3.75 (95.3)	0.56 (14.2)	1.16 (29.4)	0.34 (8.7)	1.50 (38.1)
1-1/8	1	0.81 (20.6)	1/4 NPT	7.25 (184)	2.38 (60.5)	2.56 (65)	4.00 (102)	1.56 (39.7)	1.00 (25.4)	1.00 (25.4)	0.69 (17.5)	0.56 (14.2)	0.69 (17.5)	4.88 (124)	3.50 (88.9)	5.63 (143)	0.75 (19.1)	1.75 (44.5)	0.41 (10.3)	2.00 (50.8)
	2	0.81 (20.6)	1/4 NPT	9.25 (235)	3.38 (85.8)	3.56 (90)	5.00 (127)	1.56 (39.7)	1.00 (25.4)	1.00 (25.4)	0.69 (17.5)	0.56 (14.2)	0.69 (17.5)	4.88 (124)	3.50 (88.9)	5.63 (143)	0.75 (19.1)	1.75 (44.5)	0.41 (10.3)	2.00 (50.8)
1-1/2	2	1.13 (28.6)	1/2 NPT	10.13 (257.3)	3.94 (100)	4.31 (109.5)	5.19 (131.8)	2.31 (58.6)	1.25 (31.8)	1.75 (44.5)	0.75 (19.1)	0.88 (22.4)	0.63 (16)	5.50 (129.7)	4.00 (101.6)	6.50 (165.1)	0.75 (19.1)	2.03 (51.6)	0.53 (13.5)	2.75 (69.8)
2-1/4	2	1.75 (44.5)	3/4 NPT	13.56 (344.4)	4.06 (103.1)	3.44 (87.3)	9.50 (241.3)	1.44 (36.6)	1.25 (31.8)	1.25 (31.8)	-	0.88 (22.4)	0.63 (16)	6.50 (165.1)	5.50 (139.7)	8.00 (203.2)	1.50 (38.1)	3.13 (79.4)	.66 (16.7)	2.75 (69.8)

Fixed Flange - Clevis



Primary - Clevis



Dimensions in inches (millimeters) - Clevis, Fixed Flange and Primary

Bore	Stroke	Rod	Port	AA	BB	CC	EE	FF	GG	HH	II	KK	LL	MM	NN	OO	PP	QQ	RR	SS	TT
3/4	1	0.56 (14.3)	1/8 NPT	7.84 (199)	2.78 (70.6)	6.84 (173.7)	1.00 (25.4)	0.50 (12.7)	0.75 (19.1)	0.50 (12.7)	2.25 (57.2)	1.00 (25.4)	1.00 (25.4)	0.52 (13.2)	0.88 (22.4)	1.75 (44.5)	0.50 (12.7)	2.25 (57.2)	0.50 (12.7)	0.48 (12.2)	0.83 (21.1)
	2	0.56 (14.3)	1/8 NPT	9.84 (250)	3.78 (96)	7.84 (199)	1.00 (25.4)	0.50 (12.7)	0.75 (19.1)	0.50 (12.7)	2.25 (57.2)	1.00 (25.4)	1.00 (25.4)	0.52 (13.2)	0.88 (22.4)	1.75 (44.5)	0.50 (12.7)	2.25 (57.2)	0.50 (12.7)	0.48 (12.2)	0.83 (21.1)
1-1/8	1	0.81 (20.6)	1/4 NPT	10.16 (258)	3.78 (96)	9.16 (232.7)	1.50 (38.1)	0.75 (19.1)	1.25 (31.8)	0.75 (19.1)	3.00 (76.2)	1.25 (31.8)	1.50 (38.1)	0.63 (16.0)	1.32 (33.5)	2.63 (66.7)	0.62 (15.7)	3.50 (88.9)	0.75 (19.1)	0.61 (15.5)	1.25 (31.8)
	2	0.81 (20.6)	1/4 NPT	12.16 (309)	4.78 (121)	10.16 (258)	1.50 (38.1)	0.75 (19.1)	1.25 (31.8)	0.75 (19.1)	3.00 (76.2)	1.25 (31.8)	1.50 (38.1)	0.63 (16.0)	1.32 (33.5)	2.63 (66.7)	0.62 (15.7)	3.50 (88.9)	0.75 (19.1)	0.61 (15.5)	1.25 (31.8)
1-1/2	2	1.13 (28.6)	1/2 NPT	12.97 (329.4)	5.40 (137.2)	10.97 (278.6)	1.50 (38.1)	0.75 (19.1)	1.25 (31.8)	0.75 (19.1)	-	1.25 (31.8)	1.50 (38.1)	0.63 (16.0)	1.31 (33.3)	3.50 (88.9)	0.63 (15.9)	4.00 (101.6)	0.75 (19.1)	0.75 (19.1)	1.25 (31.8)
2-1/4	2	1.75 (44.5)	3/4 NPT	17.00 (431.8)	6.00 (152.4)	15.00 (381)	2.25 (57.2)	1.00 (25.4)	1.50 (38.1)	1.00 (25.4)	-	2.00 (50.8)	3.50 (88.9)	1.50 (38.1)	1.50 (38.1)	5.00 (127)	1.00 (25.4)	5.50 (139.7)	1.00 (25.4)	1.00 (25.4)	2.00 (50.8)



SILVERLINE® Series Specifications

**3/4, 1-1/8, 1-1/2,
2-1/4 Bore**

SILVERLINE® Specifications

SASL Model	Stroke in.	Effective Weight Min/Max lbs (kg)	Max. Energy/Cycle in lbs (Nm)	Energy per Hour		Mounting Strength 2.5 x E ₃ (Max) Stroke lbs (N)
				Internal Accumulator in. lbs (Nm)	External Accumulator in. lbs (Nm)	
SASL 3/4x1	1	300-260,000 (136-117,936)	3,000 (339)	1,100,000 (124,284)	1,600,000 (180,776)	7,500 (33,300)
SASL 3/4x2	2	350-500,000 (159-226,800)	6,000 (678)	1,300,000 (146,881)	2,000,000 (225,970)	7,500 (33,300)
SASL 1-1/8x1	1	700-700,000 (318-317,520)	8,000 (904)	1,250,000 (141,231)	2,500,000 (282,463)	20,000 (89,000)
SASL 1-1/8x2	2	850-1,300,000 (386-589,680)	16,000 (1,808)	1,500,000 (169,478)	3,000,000 (338,955)	20,000 (89,000)
*SASL 1-1/2x2	2	22,000-1,360,000 (9979-616,896)	21,000 (2,373)	3,200,000 (361,552)	4,000,000 (451,940)	26,250 (117,000)
*SASL 2-1/4x2	2	50,000-3,175,000 (22,680-1,440,180)	56,000 (6,327)	16,000,000 (1,807,760)	20,000,000 (2,259,700)	32,500 (144,600)

*Special order, check availability

Ordering Information

SASL 3/4 x 1 P - SF					
Return Method and Accumulator Style	Bore Size	Stroke	Series	Mounting Style & Options	
SASL = Internal Accumulator, Spring Return ASLA = Internal Accumulator, Mechanical Return ASLS = External Accumulator, Spring Return ASL = External Accumulator, Air or Mech. Return	3/4 1-1/8 1-1/2 2-1/4	1 2	Fixed Flange P-Primary	Primary, 3/4 & 1-1/8 Basic Mounting Threads and one Jam Nut -SF Square Flange -RF Rectangle Flange - (not available 1-1/8 bore) -L Side-Foot Mount -C Clevis Mount -Z Blind-end Air Cylinder Mounting -SP Poly Pad except with -PSC, -MSC, -FSC, -C, or -Z -PSC Positive Stop Collar - for Basic or Rear Mount Only -FSC Flanged Stop Collar - for Basic Mount Only -MSC Mounting Stop Collar - for Basic Mount Only	
				Fixed Flange 3/4 to 2-1/4 -F Square Front Flange (1-1/8, 1-1/2, 2-1/4 bore) -R Square Rear Flange (1-1/8, 1-1/2, 2-1/4 bore) -RF Rectangle Front Flange - (3/4, 1-1/2 bore) -RR Rectangle Rear Flange - (3/4, 1-1/2 bore) -L Side-Foot Mount (1-1/2, 2-1/4 bore) -C Clevis Mount -SP Poly Pad except with 2-1/4 bore, -PSC, -PSB, -C, or -Z -PSC Positive Stop Collar - for Rear Flange Mount Only -PSB Positive Stop Bars - for Front Flange Mount Only	

Technical Data

Impact velocity range: 0.25 to 2 ft/sec (0.076 to 0.61 m/sec)

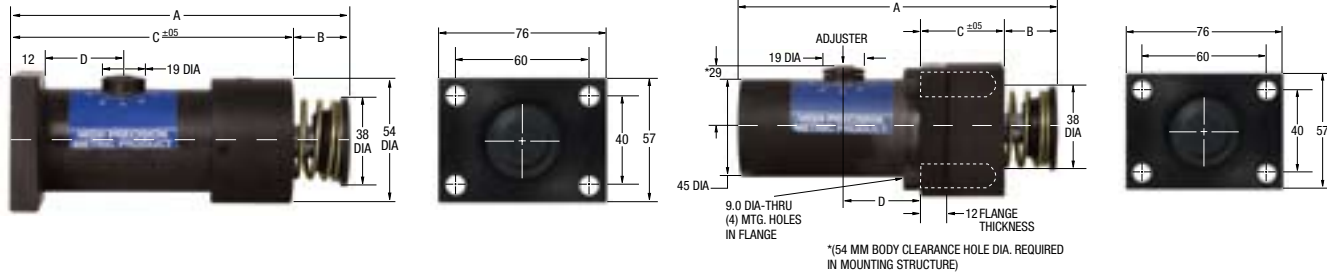
Operating temperature: 10° to 150° F (-12° to 66° C)

Oil type: ISO 46 AW

Materials: Steel body, hardened steel piston rod.

Enertrols recommends that you select a model with 20% more capacity than your calculations indicate necessary. This extra capacity allows for changes if weight, velocity, or cycle rates should increase in the future.
For velocities out of range, consult factory.

High Precision Metric (HPM™) Series Fixed Flange - 19 mm Bore Mounting



Rear Flange

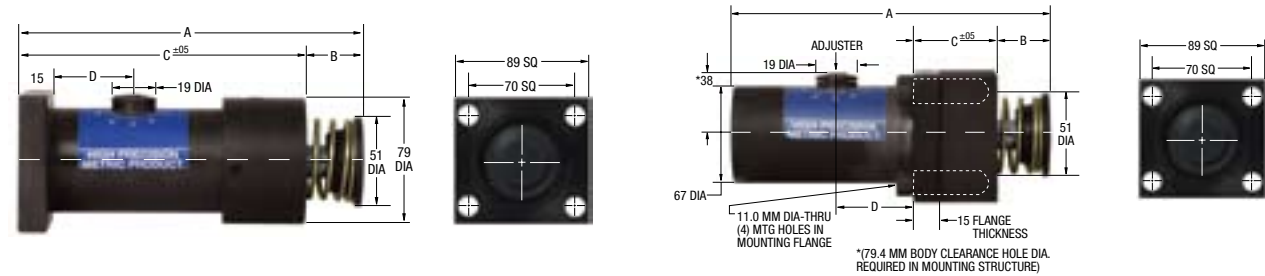
Bore	Model	A (mm)	B (mm)	C (mm)	D (mm)
19	HPSL** - 3000 RRM PSC	144	24	120	35
	HPSL** - 6000 RRM PSC	195	50	145	47
	HP - 3000 RRM PSC	144	24	120	35
	HP - 6000 RRM PSC	195	50	145	47
	HP - 9000 RRM PSC	246	75	171	60

Front Flange

Bore	Model	A (mm)	B (mm)	C (mm)	D (mm)
19	HPSL** - 3000 RFM PSB	144	24	38	35
	HPSL** - 6000 RFM PSB	195	50	38	47
	HP - 3000 RFM PSB	144	24	38	35
	HP - 6000 RFM PSB	195	50	38	47
	HP - 9000 RFM PSB	246	75	38	66

**SILVERLINE models for low-velocity applications

High Precision Metric (HPM™) Series Fixed Flange - 28mm Bore Mounting



Rear Flange

Bore	Model	A (mm)	B (mm)	C (mm)	D (mm)
28	HPSL** - 8000 RM PSC	175	24	150	42
	HPSL** - 16000 RM PSC	225	50	175	55
	HP - 16000 RM PSC	225	50	175	55
	HP - 32000 RM PSC	327	101	226	80

Front Flange

Bore	Model	A (mm)	B (mm)	C (mm)	D (mm)
28	HPSL** - 8000 FM PSB	175	24	51	42
	HPSL** - 16000 FM PSB	225	50	51	55
	HP - 16000 FM PSB	225	50	51	55
	HP - 32000 FM PSB	327	101	51	80

**SILVERLINE models for low-velocity applications

Energy Capacity Ratings

Bore	Stroke	Model No.	(We) Effective Weight (min/max) lbs. (kg)	Max. Capacity in lbs/cycle (Nm/cycle)
19	1"	HPSL** - 3000	300-260,000 (136-117,936)	3,000 (339)
	2"	HPSL** - 6000	350-500,000 (159-226,800)	6,000 (678)
	1"	HP 3000	20-18,000 (9-8,165)	3,000 (339)
	2"	HP 6000	35-32,000 (16-14,515)	6,000 (678)
	3"	HP 9000	50-46,000 (23-20,866)	9,000 (1,017)
	4"	HP 12000	70-42,000 (32-19,072)	12,000 (1,337)
28	1"	HPSL** - 8000	700-700,000 (227-317,520)	8,000 (791)
	2"	HPSL** - 16000	850-1,300,000 (386-589,680)	16,000 (1,582)
	2"	HP 16000	120-50,000 (54-22,680)	16,000 (1,582)
	4"	HP 32000	100-100,000 (73-45,360)	32,000 (3,164)



Positive Stop Collars for Fixed Flange, Rear Mounted Shock Absorbers 19 mm - 28 mm Bore Size HPM™ Series

Bore	Part Number
19	3137-34514
28	3142-34514

Positive Stop Bars for Fixed Flange, Front Mounted Shock Absorbers 19 mm - 28 mm Bore Size HPM™ Series

Bore	Part Number
19	3137-34516
28	3142-34516



Heavy Industrial Shock Absorbers Self-Compensating

ECA 2 to ECA 4

Enertrols durable ECA 2, ECA 3 and 4" Bore Series of self-compensating shock absorbers have been designed to handle extremely heavy-duty applications and to provide controlled linear deceleration under changing conditions.

Energy per cycle ratings for these proven performers range from 32,000 in-lbs (3,616 Nm) to 1,120,000 in-lbs (126,500 Nm). These dependable models also offer wide effective weight ranges for handling numerous applications. They are available self-contained or for use with an external air/oil tank. A variety of mounting options are available including: front and rear flanges, side-foot mount and clevis mount.

Applications include: foundry, steel, marine, lumber and other heavy equipment industries.

Technical Data

Impact velocity range: 1 to 16.5 ft/sec (0.30 to 5 m/sec)

Operating temperature: 10° to 150° F (-12° to 66° C)

Mechanical stop:

2", 3" bore: Must be provided .09 inch (2.3 mm) before end of stroke.

4" bore: Must be provided 0.09 inch (2.3 mm) before end of stroke.

Oil type: ATF

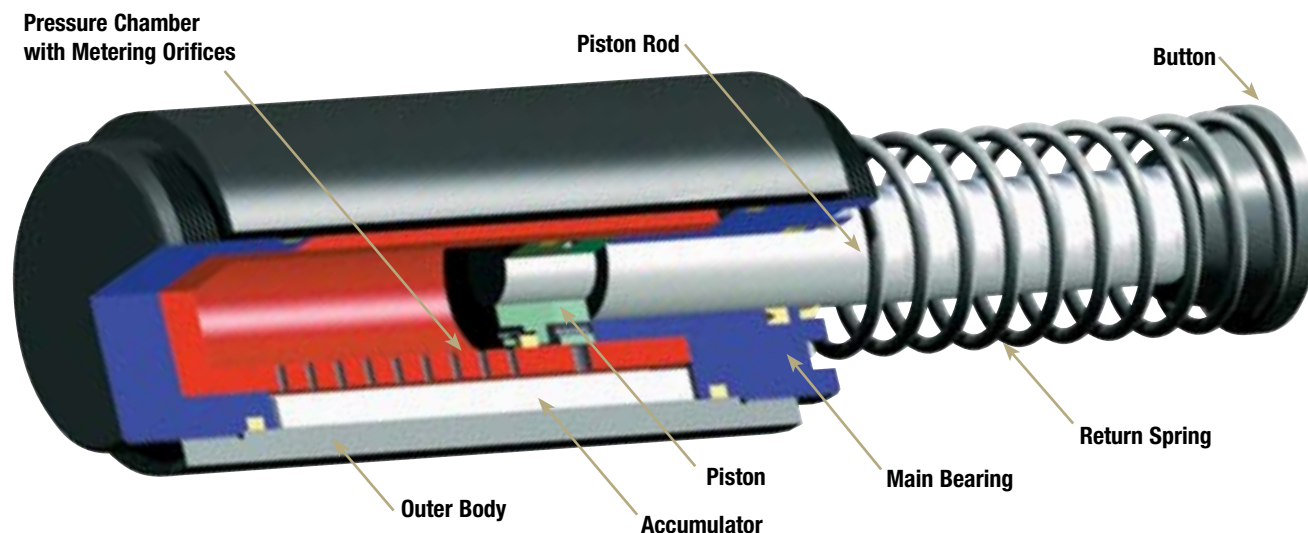
Materials: Steel body with black oxide finish. Piston rod high tensile steel, hardened and chrome plated. Return spring zinc plated.



Heavy Industrial Shock Absorbers ECA 2 to ECA 4

Self-Compensating

Illustration depicts ECA 2 and ECA 3 design only.



EA 2 to EA3

Heavy Industrial Shock Absorbers

Adjustable

Enertrols rugged EA 2 and EA 3 Series heavy industrial adjustable shock absorbers are available to handle your most demanding linear deceleration applications.

Energy capacity ratings are high with wide effective weight ranges, resulting in the capability of handling a wider range of applications and increases in velocity. The units are easily adjusted by means of a 5/16 inch (8 mm) hex socket adjuster located at the bottom of the outer body. These adjustable shock absorbers are maintenance free and are available self-contained or for use with an external air/oil tank.

Features include: an internal accumulator and threaded mounting brackets, easily adaptable to the front or rear of the outer body.

Applications include: foundry, steel, marine, lumber, and other heavy equipment industries.

Technical Data

Impact velocity range: 0.33 to 16.5 ft/sec (0.1 to 5 m/sec)

Operating temperature: 10° to 150° F (-12° to 66° C)

Mechanical stop: Must be provided .09 inch (2.3 mm) before end of stroke.

Oil type: ATF

Materials: Steel body with black oxide finish. Piston rod high tensile steel, hardened and chrome plated. Return spring zinc plated. To avoid reducing heat dissipation, do not paint.

Adjustment: After installation of the shock absorber, cycle the machine a number of times. Turn the hex socket adjuster against the scale marked 0 to 9, until optimum deceleration is achieved (i.e. smooth deceleration throughout the stroke).

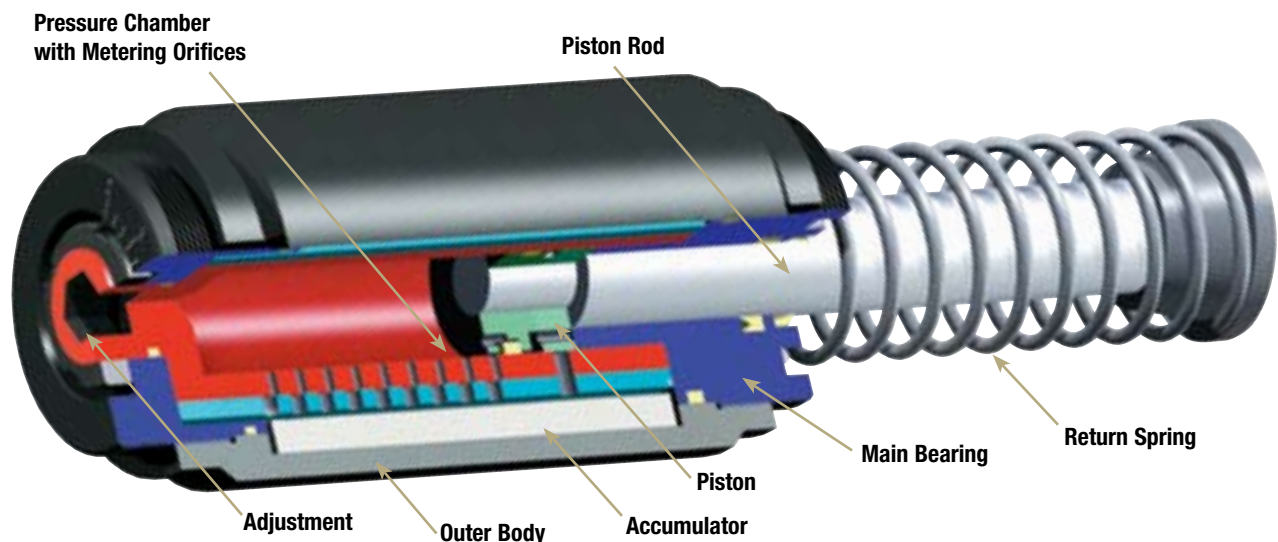
Hard impact at the start of stroke-turn adjuster toward 9.

Hard set-down at the end of stroke-turn adjuster toward 0.



Heavy Industrial Shock Absorbers EA 2 and EA 3

Adjustable



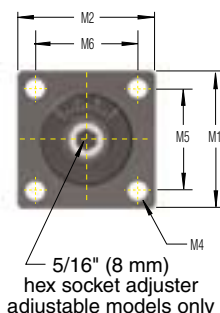
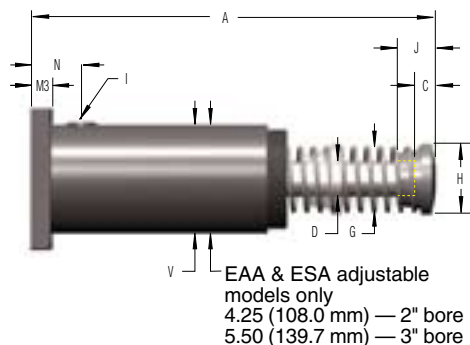


Heavy Duty Models

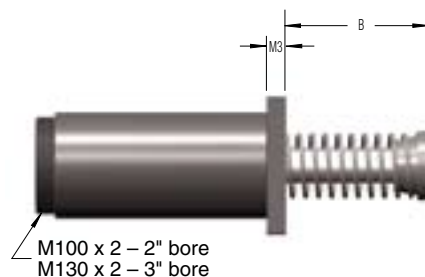
ECA and EA 2", 3" Bore Series

ECA Self-Compensating & EA Adjustable

Rear Flange

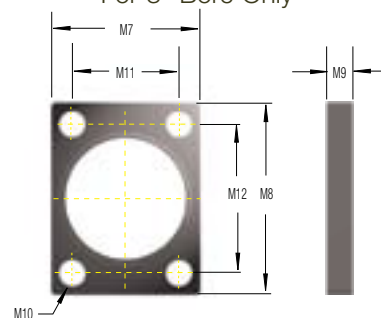


Front Flange

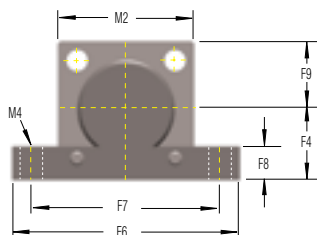
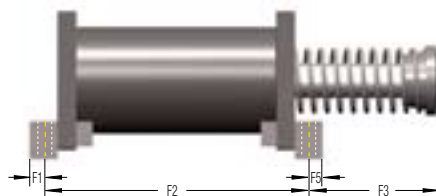


Rectangular Flange

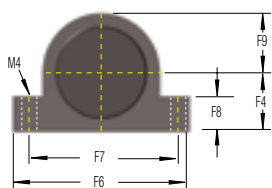
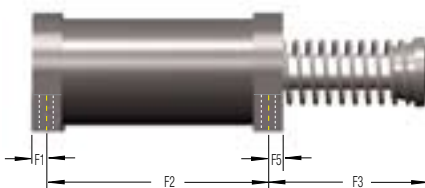
For 3" Bore Only



2" Bore Side-Foot Mount

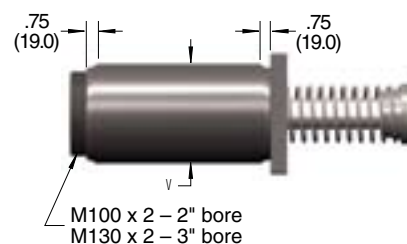


3" Bore Side-Foot Mount

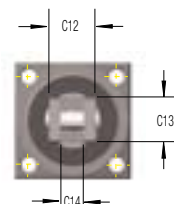
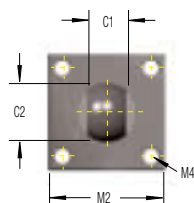
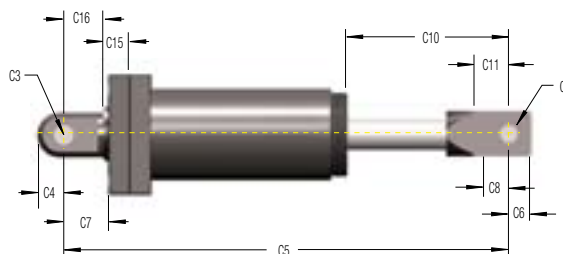


(EA) Adjustable

2" & 3" Bore Models



Clevis Mount



ECA and EA 2", 3" Bore Series

ECA Self-Compensating & EA Adjustable

Heavy Duty Models

Self-Compensating and Adjustable Models Dimensions in inches (millimeters)

Size	Stroke	A	B	C	D	G	H	I	J	N	V	C1	C2	C3	C4	C5	C6	C7	C8	C10	C11
ECA 2x2 EA 2x2	2.00 (50.8)	12.37 (312.7)	4.31 (109.5)	0.82 (20.8)	1.38 (35.1)	3.06 (77.7)	2.73 (69.3)	3/4 NPT	1.38 (35.1)	3.50 (88.9)	ECA 4.25 (108.0)	1.50 (38.1)	2.25 (57.2)	1.00 (25.5)	1.00 (25.4)	17.00 (431.8)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	6.05 (153.7)	2.50 (63.5)
ECA 2x4 EA 2x4	4.00 (101.6)	16.37 (414.0)	6.31 (160.3)	0.82 (20.8)	1.38 (35.1)	3.06 (77.7)	2.73 (69.3)	3/4 NPT	1.38 (35.1)	3.50 (88.9)	ECA 4.25 (108.0)	1.50 (38.1)	2.25 (57.2)	1.00 (25.5)	1.00 (25.4)	21.00 (533.4)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	8.05 (204.4)	2.50 (63.5)
ECA 2x6 EA 2x6	6.00 (152.4)	20.37 (515.9)	8.31 (211.1)	0.82 (20.8)	1.38 (35.1)	3.63 (92.2)	2.73 (69.3)	3/4 NPT	1.38 (35.1)	3.50 (88.9)		1.50 (38.1)	2.25 (57.2)	1.00 (25.5)	1.00 (25.4)	25.00 (635)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	10.05 (255.2)	2.50 (63.5)
ECA 2x8 EA 2x8	8.00 (203.2)	25.37 (642.9)	11.31 (287.3)	1.82 (46.2)	1.38 (35.1)	4.00 (101.6)	3.63 (92.2)	3/4 NPT	2.38 (60.5)	3.50 (88.9)	EA* 4.63 (118.0)	1.50 (38.1)	2.25 (57.2)	1.00 (25.5)	1.00 (25.4)	29.00 (736.6)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	12.05 (306.1)	2.50 (63.5)
ECA 2x10 EA 2x10	10.00 (254)	29.37 (744.5)	13.31 (338.1)	1.82 (46.2)	1.38 (35.1)	4.50 (114.3)	4.25 (108.0)	3/4 NPT	2.38 (60.5)	3.50 (88.9)	EA* 4.63 (118.0)	1.50 (38.1)	2.25 (57.2)	1.00 (25.5)	1.00 (25.4)	33.00 (838.2)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	14.05 (365.9)	2.50 (63.5)
ECA 3x5 EA 3x5	5.00 (127)	19.31 (490.4)	8.25 (209.6)	2.00 (50.8)	1.75 (44.5)	4.75 (120.7)	4.38 (111.3)	3/4 NPT	2.38 (60.5)	3.13 (79.5)	ECA 5.50 (139.7)	1.50 (38.1)	2.25 (57.2)	1.01 (25.5)	1.00 (25.4)	23.00 (584.2)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	9.05 (229.9)	1.12 (28.4)
ECA 3x8 EA 3x8	8.00 (203.2)	25.31 (642.9)	11.25 (285.8)	2.00 (50.8)	1.75 (44.5)	4.75 (120.7)	4.38 (111.3)	3/4 NPT	2.38 (60.5)	3.13 (79.5)		1.50 (38.1)	2.25 (57.2)	1.01 (25.5)	1.00 (25.4)	29.00 (736.6)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	12.05 (306.1)	1.12 (28.4)
ECA 3x12 EA 3x12	12.00 (304.8)	30.09 (769.3)	17.03 (432.6)	2.00 (50.8)	1.75 (44.5)	4.84 (122.9)	4.38 (111.3)	3/4 NPT	2.38 (60.5)	3.13 (79.5)	EA* 6.00 (152.4)	1.50 (38.1)	2.25 (57.2)	1.01 (25.5)	1.00 (25.4)	38.78 (985)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	17.83 (452.9)	1.12 (28.4)
Size	Stroke	C12	C13	C14	C15	C16	F1	F2	F3	F4	F5	F6	F7	F8	F9	M1	M2	M3	M4	M5	M6
ECA 2x2 EA 2x2	2.00 (50.8)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	0.63 (16.0)	9.5 (241.3)	3.44 (87.4)	3.13 (79.5)	0.63 (16.0)	8.00 (203.2)	6.50 (165.1)	1.50 (38.1)	2.75 (69.9)	5.50 (139.7)	5.50 (139.7)	0.75 (19.1)	0.66 (16.8)	4.38 (111.3)	4.38 (111.3)
ECA 2x4 EA 2x4	4.00 (101.6)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	0.63 (16.0)	11.5 (292.1)	5.44 (138.2)	3.13 (79.5)	0.63 (16.0)	8.00 (203.2)	6.50 (165.1)	1.50 (38.1)	2.75 (69.9)	5.50 (139.7)	5.50 (139.7)	0.75 (19.1)	0.66 (16.8)	4.38 (111.3)	4.38 (111.3)
ECA 2x6 EA 2x6	6.00 (152.4)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	0.63 (16.0)	13.5 (342.9)	7.44 (189.0)	3.13 (79.5)	0.63 (16.0)	8.00 (203.2)	6.50 (165.1)	1.50 (38.1)	2.75 (69.9)	5.50 (139.7)	5.50 (139.7)	0.75 (19.1)	0.66 (16.8)	4.38 (111.3)	4.38 (111.3)
ECA 2x8 EA 2x8	8.00 (203.2)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	0.63 (16.0)	15.5 (393.7)	10.44 (265.2)	3.13 (79.5)	0.63 (16.0)	8.00 (203.2)	6.50 (165.1)	1.50 (38.1)	2.75 (69.9)	5.50 (139.7)	5.50 (139.7)	0.75 (19.1)	0.66 (16.8)	4.38 (111.3)	4.38 (111.3)
ECA 2x10 EA 2x10	10.00 (254)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	0.63 (16.0)	17.5 (444.5)	12.44 (316.0)	3.13 (79.5)	0.63 (16.0)	8.00 (203.2)	6.50 (165.1)	1.50 (38.1)	2.75 (69.9)	5.50 (139.7)	5.50 (139.7)	0.75 (19.1)	0.66 (16.8)	4.38 (111.3)	4.38 (111.3)
ECA 3x5 EA 3x5	5.00 (127)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	1.00 (25.4)	10.25 (260.4)	8.50 (215.9)	3.15 (80.0)	1.00 (25.4)	10.00 (254.0)	8.50 (215.9)	1.73 (43.9)	3.15 (80.0)	6.00 (152.4)	6.50 (165.1)	1.00 (25.4)	0.66 (16.8)	4.88 (124.0)	5.38 (136.7)
ECA 3x8 EA 3x8	8.00 (203.2)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	1.00 (25.4)	13.25 (336.6)	11.50 (292.1)	3.15 (80.0)	1.00 (25.4)	10.00 (254.0)	8.50 (215.9)	1.73 (43.9)	3.15 (80.0)	6.00 (152.4)	6.50 (165.1)	1.00 (25.4)	0.66 (16.8)	4.88 (124.0)	5.38 (136.7)
ECA 3x12 EA 3x12	12.00 (304.8)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	1.00 (25.4)	17.25 (438.2)	17.28 (438.9)	3.15 (80.0)	1.00 (25.4)	10.00 (254.0)	8.50 (215.9)	1.73 (43.9)	3.15 (80.0)	6.00 (152.4)	6.50 (165.1)	1.00 (25.4)	0.66 (16.8)	4.88 (124.0)	5.38 (136.7)

Size	M7	M8	M9	M10	M11	M12
ECA 3 EA 3	Rectangular Flange 6.50 (165.1)	8.00 (203.2)	1.00 (25.4)	0.78 (19.8)	4.50 (114.3)	6.50 (165.1)

* See rear flange illustration on page 69 for EAA and ESA model dimensions.

Size	A	J	H
EAA 2x8	24.37 (619.0)	1.38 (35.1)	2.73 (69.3)
EAA 2x10	28.37 (720.6)	1.38 (35.1)	2.73 (69.3)

EAA 2x8 and EAA 2x10 Dimensions in inches (millimeters)

Specifications Self-Compensating Models

Model	Effective Weight lbs (kg)	Energy per Cycle in lbs (Nm)	Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	A/O Tank (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
ECA 2 x 2-1 ECA 2 x 2-2 ECA 2 x 2-3 ECA 2 x 2-4	1,600-4,800 4,000-12,000 10,000-30,000 25,000-75,000	(726-2,177) (1,814-5,443) (4,536-13,608) (11,340-34,019)	32,000 (3,616)	9,600,000 (1,084,650)	12,000,000 (1,355,820)	15,600,000 (1,762,564)	48-63 (214-280)	0.25 (12.79)
ECA 2 x 4-1 ECA 2 x 4-2 ECA 2 x 4-3 ECA 2 x 4-4	3,200-9,600 8,000-24,000 20,000-60,000 50,000-150,000	(1,452-4,354) (3,629-10,886) (9,072-27,216) (22,680-68,039)	64,000 (7,231)	12,000,000 (1,355,820)	15,000,000 (1,694,770)	19,500,000 (2,203,200)	34-63 (151-280)	0.50 (14.79)
ECA 2 x 6-1 ECA 2 x 6-2 ECA 2 x 6-3 ECA 2 x 6-4	4,800-14,400 12,000-36,000 30,000-90,000 75,000-225,000	(2,117-6,532) (5,443-16,329) (13,608-40,823) (34,019-102,058)	96,000 (10,847)	14,400,000 (1,626,980)	18,000,000 (2,033,730)	23,500,000 (2,655,140)	34-90 (151-400)	0.60 (16.87)



Heavy Duty Models

ECA and EA 2", 3" Bore Series

ECA Self-Compensating & EA Adjustable

Specifications Continued Self-Compensating Models

We			E ₃	Energy per Hour in lbs/hour (Nm/hour)					
				E ₄					
Model	Effective Weight lbs (kg)		Energy per Cycle in lbs (Nm)	Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	A/O Tank (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
ECA 2 x 8-1	6,400-19,200	(2,903-8,709)	128,000 (14,462)	16,800,000 (1,898,150)	21,000,000 (2,372,680)	27,000,000 (3,050,590)	51-144 (227-641)	0.70	42.6 (19.32)
ECA 2 x 8-2	16,000-48,000	(7,257-21,772)							
ECA 2 x 8-3	40,000-120,000	(18,144-54,431)							
ECA 2 x 8-4	100,000-300,000	(45,359-136,708)							
ECA 2 x 10-1	8,000-24,000	(3,629-10,886)	160,000 (18,078)	19,200,000 (2,169,310)	24,000,000 (2,711,640)	31,000,000 (3,502,530)	35-101 (156-449)	0.80	50.2 (22.77)
ECA 2 x 10-2	20,000-60,000	(9,072-27,216)							
ECA 2 x 10-3	50,000-150,000	(22,680-68,039)							
ECA 2 x 10-4	125,000-375,000	(56,700-170,097)							
ECA 3 x 5-1	6,400-19,200	(2,903-8,709)	125,000 (14,123)	20,000,000 (2,259,700)	25,000,000 (2,824,620)	32,500,000 (3,672,010)	59-156 (262-694)	0.60	63.8 (28.94)
ECA 3 x 5-2	16,000-48,000	(7,257-21,772)							
ECA 3 x 5-3	40,000-120,000	(18,144-54,431)							
ECA 3 x 5-4	100,000-300,000	(45,359-136,078)							
ECA 3 x 8-1	10,240-30,720	(4,645-13,934)	200,000 (22,597)	32,000,000 (3,615,520)	40,000,000 (4,519,390)	52,000,000 (5,875,210)	62-162 (275-721)	0.80	73.6 (33.38)
ECA 3 x 8-2	25,600-76,800	(11,612-34,836)							
ECA 3 x 8-3	64,000-192,000	(29,030-87,090)							
ECA 3 x 8-4	160,000-480-000	(72,575-217,724)							
ECA 3 x 12-1	15,360-46,080	(6,967-20,902)	300,000 (33,896)	48,000,000 (5,423,270)	60,000,000 (6,779,090)	78,000,000 (8,812,820)	60-160 (267-712)	1.20	89.4 (40.55)
ECA 3 x 12-2	38,400-115,200	(17,418-52,254)							
ECA 3 x 12-3	96,000-288,000	(43,545-130,625)							
ECA 3 x 12-4	240,000-720,000	(108,862-326,587)							

Specifications Adjustable Models

			Energy per Hour in lbs/hour (Nm/hour)					
We		E ₃	E ₄					
Model	Effective Weight lbs (kg)	Energy per Cycle in lbs (Nm)	Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	A/O Tank (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
EA 2 x 2	560-170,000 (254-77,111)	32,000 (3,616)	9,600,000 (1,084,650)	12,000,000 (1,355,820)	15,600,000 (1,762,564)	48-63 (214-280)	0.25	31.5 (14.29)
EA 2 x4	560-180,000 (254-81,646)	80,000 (9,039)	12,000,000 (1,355,820)	15,000,000 (1,694,770)	19,500,000 (2,203,200)	34-63 (151-280)	0.50	36.9 (16.74)
EA 2 x6	570-190,000 (259-86,183)	120,000 (13,558)	14,400,000 (1,626,980)	18,000,000 (2,033,730)	23,500,000 (2,655,140)	34-90 (151-400)	0.60	42.6 (19.32)
EA 2 x8	580-200,000 (263-90,719)	170,000 (19,207)	16,800,000 (1,898,150)	21,000,000 (2,372,680)	27,000,000 (3,050,590)	51-144 (227-641)	0.70	49.1 (22.27)
EA 2 x10	720-250,000 (327-113,399)	210,000 (23,727)	19,200,000 (2,169,310)	24,000,000 (2,711,640)	31,000,000 (3,502,530)	35-101 (156-449)	0.80	57.8 (26.22)
EA 3 x 5	1,050-340,000 (476-154,223)	140,000 (15,818)	20,000,000 (2,259,700)	25,000,000 (2,824,620)	32,500,000 (3,672,010)	59-156 (262-694)	0.60	72.1 (32.70)
EA 3 x 8	1,200-400,000 (544-181,439)	250,000 (28,246)	32,000,000 (3,615,520)	40,000,000 (4,519,390)	52,000,000 (5,875,210)	62-162 (275-721)	0.80	84.9 (38.51)
EA 3 x 12	1,350-450,000 (612-204,119)	390,000 (44,064)	48,000,000 (5,423,270)	60,000,000 (6,779,090)	78,000,000 (8,812,820)	60-160 (267-712)	1.20	105.0 (47.63)

ECA and EA 2", 3" Bore Series

ECA Self-Compensating & EA Adjustable

Heavy Duty Models

Ordering Information Self-Compensating Models

ECA 2 x 8 R - 3					
Return Method and Accumulator Style	Bore Size	2" Bore Stroke Length		Mounting Style	Effective Weight
ECA = Spring Return, Internal Accumulator	2	2	8	-F Front Flange	-1 Light
ECAA = Air Return, External Accumulator	3	4	10	-R Rear Flange	-2 Medium Light
ECSA = Spring Return, External Accumulator		6		-RF *Rectangular Front Flange	-3 Medium Heavy
ECNA = Self (Cleviss) Return, Internal Accumulator		3" Bore Stroke Length		-RR *Rectangular Rear Flange	-4 Heavy
		5		-S Side Foot Mount	
		8		-C Cleviss Mount	
		12		* For 3" Bore only	

Ordering Information Adjustable Models

EA 2 x 8 R				
Return Method and Accumulator Style	Bore Size	2" Bore Stroke Length		Mounting Style
EA = Spring Return, Internal Accumulator	2	2	8	-F Front Flange
EAA = Air Return, External Accumulator	3	4	10	-R Rear Flange
ESA = Spring Return, External Accumulator		6		-RF *Rectangular Front Flange
ENA = Self (Cleviss) Return, Internal Accumulator		3" Bore Stroke Length		-RR *Rectangular Rear Flange
		5		-S Side Foot Mount
		8		-C Cleviss Mount
		12		* For 3" Bore only

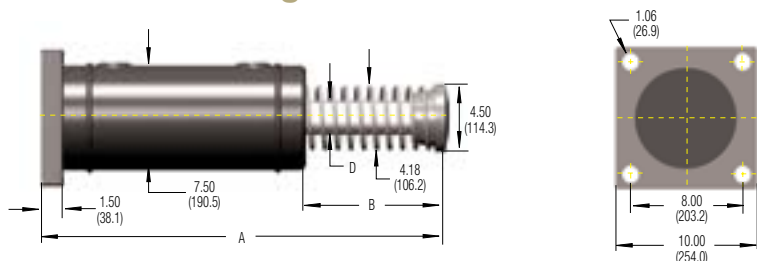
Note: A no button option is available on the 3" Bore only as a special.



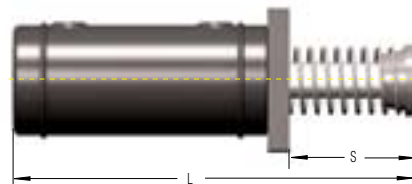
Heavy Duty Models Self-Compensating

ECA 4" Bore Series

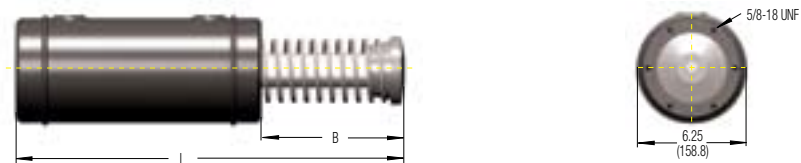
Rear Flange



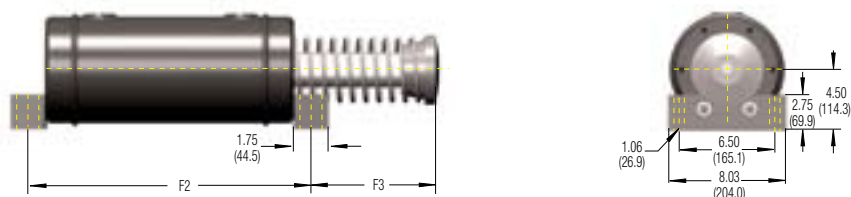
Front Flange



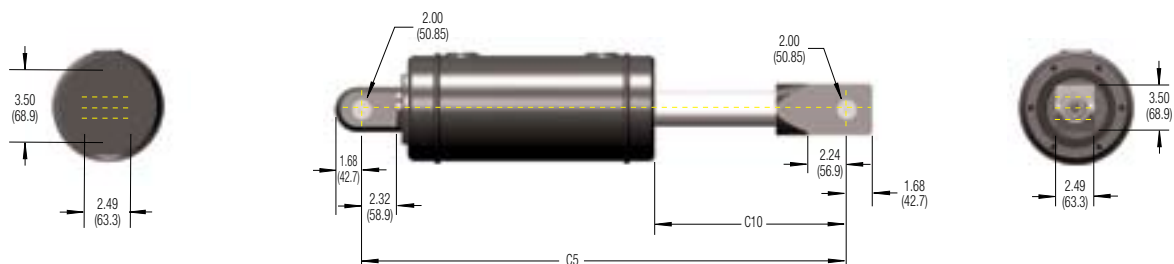
Standard Mount



Side-Foot Mount



Clevis Mount



Technical Data

Impact velocity range: 1 to 16.5 ft/sec (0.30 to 5 m/sec)

Operating temperature: 10° to 150° F (-12° to 66° C)

Mechanical stop: Must be provided 0.09 inch (2.3 mm) before end of stroke.

Oil type: ATF

ECA 4" Bore Series

Heavy Duty Models Self-Compensating

Dimensions in inches (millimeters)

Size	Stroke	A	B	D	H	L	S	C5	C10	F2	F3
ECA 4 x 6	6.00 (152.4)	28.21 (716.5)	10.96 (278.4)	2.12 (53.8)	4.50 (114.3)	26.71 (678.4)	9.46 (240.3)	33.03 (839.0)	12.90 (327.7)	17.50 (447.5)	10.09 (256.3)
ECSA 4 x 6											
ECAA 4 x 6	6.00 (152.4)	26.21 (665.7)	8.96 (227.6)	2.12 (53.8)	4.50 (114.3)	24.71 (678.4)	7.46 (188.0)	31.03 (788.2)	10.90 (276.9)	17.50 (447.5)	8.09 (205.5)
ECNA 4 x 6		N/A	N/A			N/A	N/A			N/A	N/A
ECA 4 x 8	8.00 (203.2)	32.31 (818.1)	12.96 (329.2)	2.12 (53.8)	4.50 (114.3)	30.71 (780.0)	11.46 (291.1)	37.03 (940.6)	14.90 (378.5)	19.50 (495.3)	12.09 (307.1)
ECSA 4 x 8											
ECAA 4 x 8	8.00 (203.2)	30.21 (767.3)	10.96 (278.4)	2.12 (53.8)	4.50 (114.3)	28.71 (729.2)	9.46 (240.3)	35.03 (889.8)	12.90 (327.7)	19.50 (495.3)	10.09 (256.3)
ECNA 4 x 8		N/A	N/A			N/A	N/A			N/A	N/A
ECA 4 x 16	16.00 (406.4)	51.21 (1,300.7)	23.96 (608.6)	2.50 (63.5)	5.00 (127.0)	49.71 (1,262.6)	22.46 (570.5)	56.03 (1,423.2)	25.90 (657.9)	27.50 (698.5)	23.09 (586.5)
ECSA 4 x 16											
ECAA 4 x 16	16.00 (406.4)	46.21 (1,173.7)	18.96 (481.6)	2.50 (63.5)	5.00 (127.0)	44.71 (1,135.6)	17.46 (443.5)	51.03 (1,296.2)	20.90 (530.9)	27.50 (698.5)	18.09 (459.5)
ECNA 4 x 16		N/A	N/A			N/A	N/A			N/A	N/A

Specifications

We			E ₃	Energy per Hour in lbs/hour (Nm/hour)				
Model	Effective Weight lbs (kg)		Energy per Cycle in lbs (Nm)	Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
4 x 6-3	8,000-19,000	(3,600-8,600)	420,000 (47,500)	27,000 (3,000,000)	45,000,000 (5,100,000)	108-222 (480-1,000)	Consult Factory	132 (60)
4 x 6-5	19,000-41,000	(8,600-18,600)						
4 x 6-7	41,000-94,000	(18,600-42,700)						
4 x 8-3	11,000-25,000	(5,000-11,400)	560,000 (63,300)	30,000,000 (3,400,000)	50,000,000 (5,600,000)	71-222 (310-1,000)	Consult Factory	150 (68)
4 x 8-5	25,000-55,000	(11,400-25,000)						
4 x 8-7	55,000-125,000	(25,000-57,000)						
4 x 16-3	22,000-50,000	(10,000-23,000)	1,120,000 (126,500)	50,000,000 (5,600,000)	85,000,000 (9,600,000)	Consult Factory	Consult Factory	321 (146)
4 x 16-5	50,000-110,000	(23,000-50,000)						
4 x 16-7	110,000-250,000	(50,000-114,000)						

Ordering Information

ECA 4 x 8 R - 5				
Return Method and Accumulator Style	Bore Size	Stroke Length	Mounting Style	Effective Weight
ECA = Spring Return, Internal Accumulator	4	6	-F Front Flange	-3 Light
ECAA = Air Return, External Accumulator		8	-R Rear Flange	-5 Medium
ECSA = Spring Return, External Accumulator		16	-RP Rear Standard	-7 Heavy
ECNA = Self (Clevis) Return, Internal Accumulator			-FP Front Standard	
			-FRP Front and Rear Standard	
			-S Side Foot Mount	
			-C Clevis Mount	



Stacker Crane Shock Absorbers ESCS-38 to 63

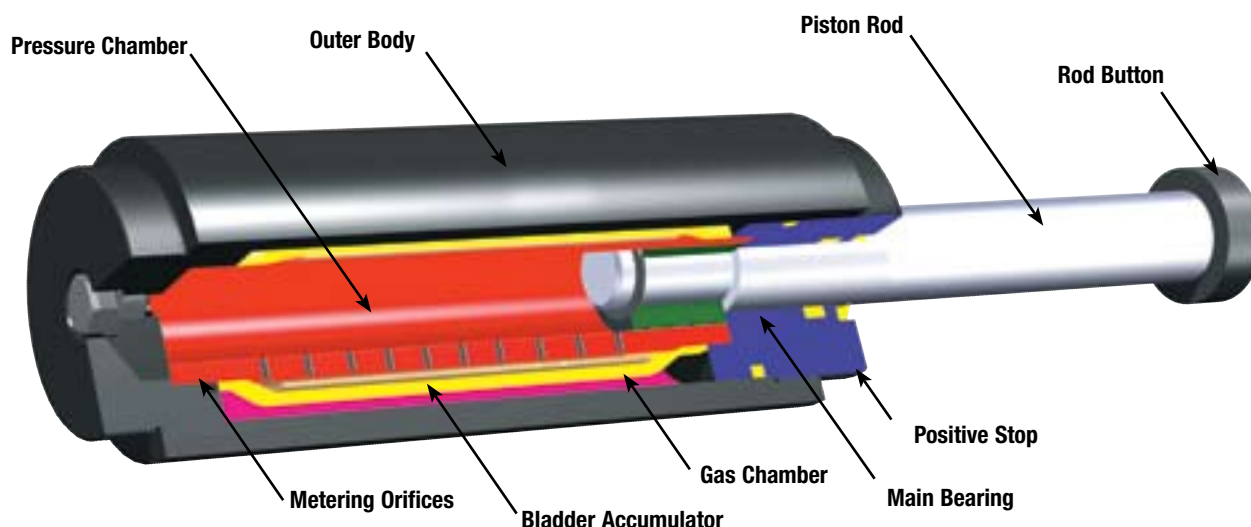
Enertrols Stacker Crane Shock Absorbers (ESCS Series) are designed primarily for emergency applications to improve the performance and safe operation of equipment such as automated storage and retrieval systems. During normal operation, the shock absorbers are required to provide only minimal resistance, but are designed to function under full load conditions when necessary. In an emergency condition, when the velocity of the system carriage is greater than normal, the ESCS shock absorber responds to protect the installation by providing controlled deceleration.

In the normal ready condition the piston rod is fully extended. When the impacting load strikes the absorber, the hydraulic oil behind the piston is forced out through a series of metering orifices. The number of metering orifices in action reduces proportionally through the stroke and the load velocity is thereby smoothly reduced to zero. The internal pressure and thus the reaction force remains constant throughout the entire stroke length. The displaced oil is stored in the bladder accumulator. The integrated gas chamber, containing low pressure nitrogen, provides the return force to reset the rod to its extended position and functions as an accumulator for the hydraulic oil displaced during operation.

Applications include: automated storage and retrieval systems, automotive manufacturing and production equipment, theme park rides, and small overhead cranes.



Stacker Crane Shock Absorbers ESCS-38 to 63

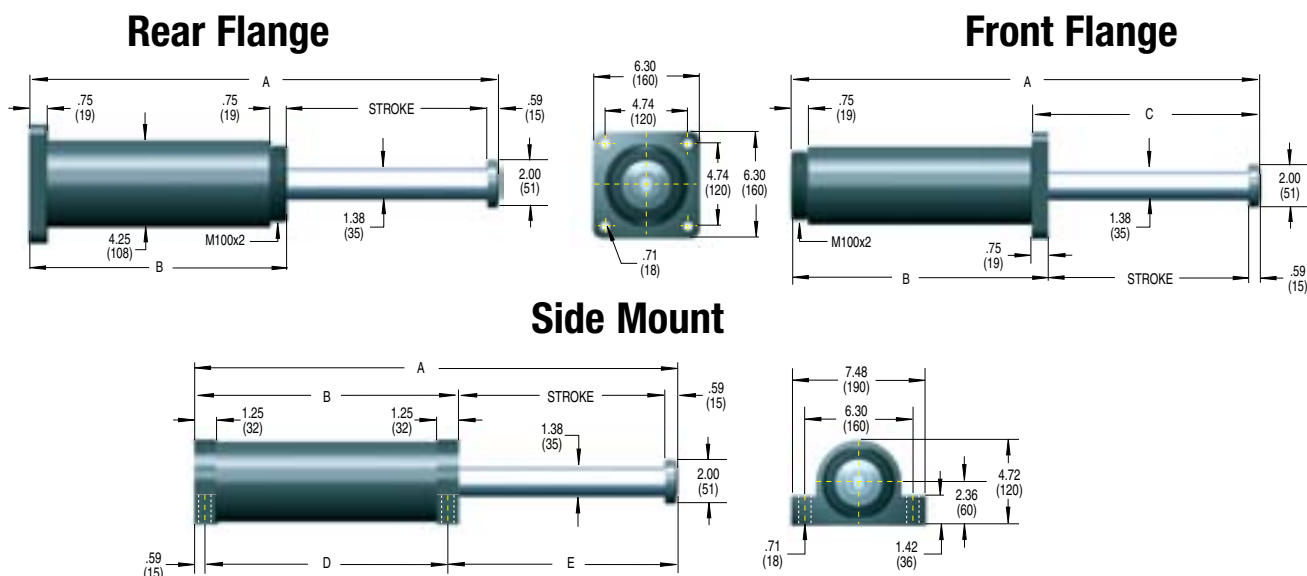


Ordering Information

ESCS-38-200-F- -X

ESCS Series	Bore Diameter (mm)	Stroke Length (mm)	Flange Location	Application Number	Specials
Stacker Crane Shock Absorbers	38	50	F Front Flange		Environmental Finish
	50	100	R Rear Flange		Custom Flanges
	63	150	S Side Mount		Fluid
		200			
		250			
		300			
		700			
		800			
		1000			
		1200			

Stacker Crane Shock Absorbers ESCS-38



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	E ₃ Energy per Cycle in lbs (kNm)	W _e Effective Weight Range lbs (kg)	Shipping Weight lbs (kg) F&R S
ESCS-38-50	1.97 (50)	10.63 (270)	8.07 (205)	3.31 (84)	6.89 (175)	3.15 (80)	32,000 (3.6)	750-19,600 (340-8,900)	27.3 (12.4) 29.1 (13.2)
ESCS-38-100	3.94 (100)	14.57 (370)	10.04 (255)	5.28 (134)	8.77 (225)	5.21 (132)	64,000 (7.2)	1,500-39,200 (680-17,800)	32.0 (14.5) 33.8 (15.4)
ESCS-38-150	5.91 (150)	18.50 (470)	12.01 (305)	7.24 (184)	10.83 (275)	7.08 (180)	96,000 (10.8)	2,250-58,900 (1,020-26,700)	35.9 (16.3) 37.8 (17.1)
ESCS-38-200	7.87 (200)	22.44 (570)	13.98 (355)	9.21 (234)	12.80 (325)	9.05 (230)	127,000 (14.4)	3,000-78,500 (1,360-35,600)	39.9 (18.1) 41.7 (18.9)
ESCS-38-250	9.84 (250)	26.38 (670)	15.94 (405)	11.18 (284)	14.77 (375)	11.02 (280)	159,000 (18.0)	3,750-97,900 (1,700-44,400)	43.8 (19.9) 45.6 (20.7)
ESCS-38-300	11.81 (300)	30.91 (785)	18.50 (470)	13.15 (334)	17.33 (440)	12.99 (330)	191,000 (21.6)	4,500-117,500 (2,040-53,300)	48.9 (22.2) 50.7 (23.0)
ESCS-38-350	13.78 (350)	34.84 (885)	20.47 (520)	15.12 (384)	19.29 (490)	14.96 (380)	223,000 (25.2)	5,250-137,100 (2,380-62,200)	52.8 (23.9) 54.6 (24.8)
ESCS-38-400	15.75 (400)	39.37 (1,000)	23.03 (585)	17.09 (434)	21.85 (555)	16.93 (430)	255,000 (28.8)	6,000-156,700 (2,720-711,000)	57.9 (26.2) 59.7 (27.1)
ESCS-38-500	19.69 (500)	47.83 (1,215)	27.56 (700)	21.02 (534)	26.38 (670)	20.56 (530)	319,000 (36.0)	7,500-196,000 (3,400-88,900)	66.9 (30.3) 68.7 (31.2)
ESCS-38-600	23.62 (600)	56.30 (1,430)	32.09 (815)	24.96 (634)	30.91 (785)	24.80 (630)	382,000 (43.2)	8,990-235,200 (4,080-106,700)	75.9 (34.4) 77.7 (35.3)
ESCS-38-700	27.56 (700)	64.76 (1,645)	36.61 (930)	28.90 (734)	35.43 (900)	28.74 (730)	446,000 (50.4)	10,490-274,300 (4,760-124,400)	84.9 (38.5) 86.7 (39.3)
ESCS-38-800	31.50 (800)	73.23 (1,860)	41.14 (1,045)	32.83 (834)	39.97 (1,015)	32.67 (830)	510,000 (57.6)	11,990-313,500 (5,440-142,200)	93.9 (42.6) 95.7 (43.4)

Technical Data

Maximum force: 18,000 lbs (80 kN)

Impact velocity range: 3-15 ft/sec (0.9 to 4.6 m/s)

Minimum return force: 45 lbs. (0.2 kN)

Operating temperature: 10° to 150°F (-12°C to 66°C)
(Consult factory for optional ranges).

Oil type: ATF

Custom environmental protection options of paint, plating, rod bellows, etc. are available. Consult factory for your specific needs.

Note: Buttons are standard on all stacker crane shock absorbers.

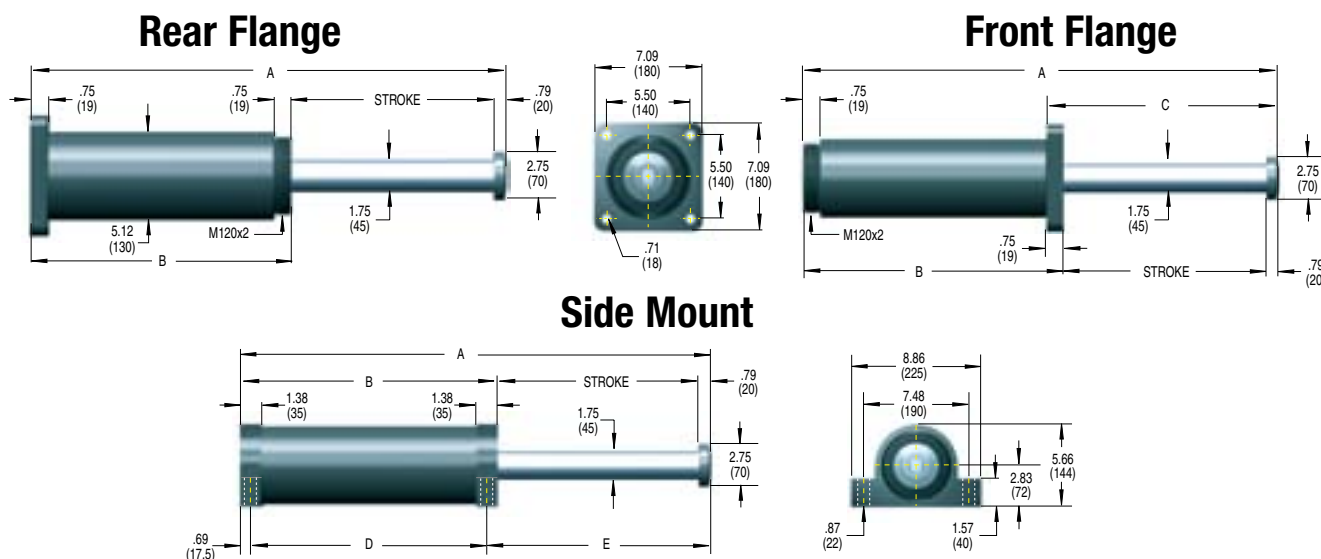
Note: An integral mechanical stop is built into the front of all units.

All stacker crane shock absorbers have special orifice designs and must be sized per application.

Note: All dimensions and tolerance values listed in this catalog are nominal and subject to change without prior notice.



Stacker Crane Shock Absorbers ESCS-50



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	E ₃ Energy per Cycle in lbs (kNm)	W _e Effective Weight Range lbs (kg)	Shipping Weight lbs (kg) F&R S
ESCS-50-100	3.94 (100)	15.35 (390)	10.63 (270)	5.47 (139)	9.25 (235)	5.41 (138)	124,000 (14)	2,950-172,000 (1,340-78,000)	48.1 (21.8) 51.3 (23.3)
ESCS-50-150	5.91 (150)	19.29 (490)	12.60 (320)	7.44 (189)	11.22 (285)	7.38 (188)	186,000 (21)	4,430-258,000 (2,010-117,000)	53.7 (24.4) 57.0 (25.8)
ESCS-50-200	7.87 (200)	23.23 (590)	14.57 (370)	9.41 (239)	13.19 (335)	9.35 (238)	248,000 (28)	5,910-344,000 (2,680-156,000)	59.1 (26.8) 62.3 (28.3)
ESCS-50-250	9.84 (250)	27.17 (690)	16.54 (420)	11.38 (289)	15.16 (385)	11.32 (288)	310,000 (35)	7,390-428,000 (3,350-194,000)	64.9 (29.4) 68.1 (30.9)
ESCS-50-300	11.81 (300)	31.69 (805)	19.09 (485)	13.35 (339)	17.71 (450)	13.29 (338)	372,000 (42)	8,860-514,000 (4,020-233,000)	71.6 (32.5) 74.9 (34.0)
ESCS-50-350	13.78 (350)	35.63 (905)	21.06 (535)	15.31 (389)	19.69 (500)	15.25 (387)	434,000 (49)	10,340-600,000 (4,690-272,000)	77.2 (35.0) 80.4 (36.5)
ESCS-50-400	15.75 (400)	40.16 (1,020)	23.62 (600)	17.28 (439)	22.25 (565)	17.22 (438)	496,000 (56)	11,820-686,000 (5,360-311,000)	84.2 (38.2) 87.5 (39.7)
ESCS-50-500	19.69 (500)	48.62 (1,235)	28.15 (715)	21.22 (539)	26.77 (680)	21.16 (538)	620,000 (70)	14,750-858,000 (6,690-389,000)	96.8 (43.9) 100.1 (45.4)
ESCS-50-600	23.62 (600)	57.09 (1,450)	32.68 (830)	25.16 (639)	31.30 (795)	25.10 (638)	743,000 (84)	17,700-1,030,000 (8,030-467,000)	109.4 (49.6) 112.7 (51.1)
ESCS-50-700	27.56 (700)	65.55 (1,665)	37.20 (945)	29.09 (739)	35.83 (910)	29.03 (737)	867,000 (98)	20,660-1,199,000 (9,370-544,000)	122.0 (55.3) 125.2 (56.8)
ESCS-50-800	31.50 (800)	74.02 (1,880)	41.73 (1,060)	33.03 (839)	40.36 (1,025)	32.97 (838)	991,000 (112)	23,590-1,371,000 (10,700-622,000)	134.6 (61.0) 137.8 (62.5)
ESCS-50-1000	39.37 (1,000)	90.94 (2,310)	50.79 (1,290)	40.91 (1,039)	49.40 (1,255)	40.85 (1,038)	1,239,000 (140)	29,540-1,715,000 (13,400-778,000)	159.7 (72.4) 163.0 (73.9)

Technical Data

Maximum force: 36,000 lbs (160 kN)

Impact velocity range: 2-15 ft/sec (0.6 to 4.6 m/s)

Minimum return force: 72 lbs. (0.3 kN)

Operating temperature: 10° to 150°F (-12°C to 66°C)
(Consult factory for optional ranges).

Oil type: ATF

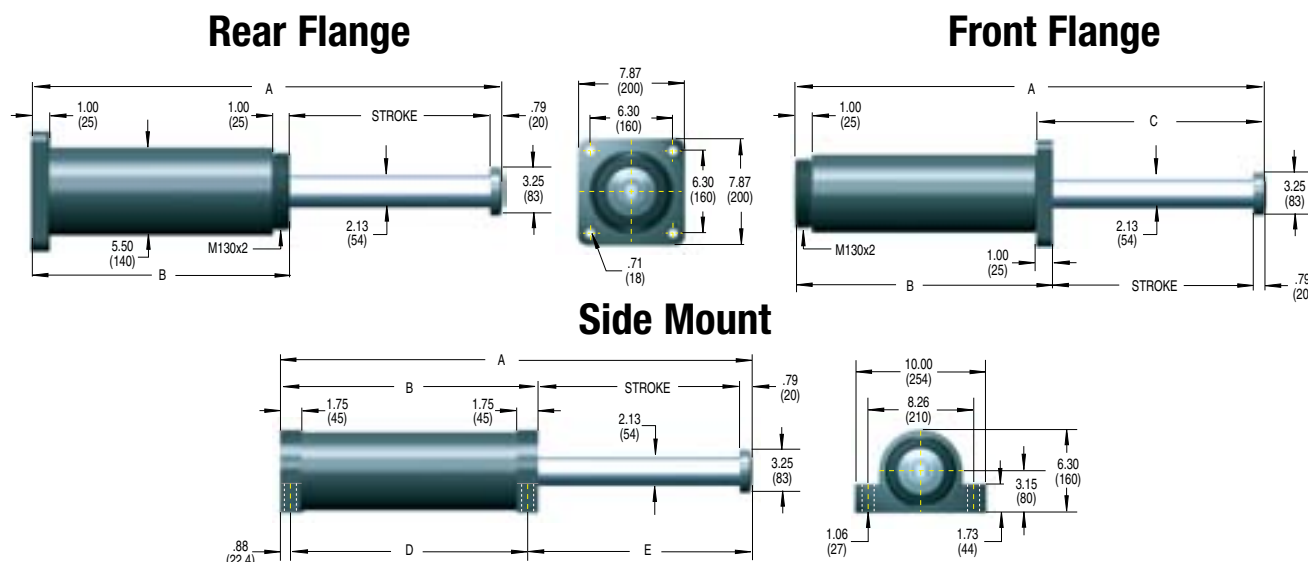
Custom environmental protection options of paint, plating, rod bellows, etc. are available. Consult factory for your specific needs.

Note: Buttons are standard on all stacker crane shock absorbers.

Note: An integral mechanical stop is built into the front of all units.

All stacker crane shock absorbers have special orifice designs and must be sized per application.

Stacker Crane Shock Absorbers ESCS-63



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	E ₃ Energy per Cycle in lbs (kNm)	W _e Effective Weight Range lbs (kg)	Shipping Weight lbs (kg) F&R S
ESCS-63-100	3.94 (100)	15.94 (405)	11.22 (285)	5.71 (145)	9.47 (241)	5.59 (142)	159,000 (18)	3,750-317,000 (1,700-144,000)	62.8 (28.5) 71.2 (32.3)
ESCS-63-150	5.91 (150)	19.88 (505)	13.19 (335)	7.68 (195)	11.44 (291)	7.56 (192)	239,000 (27)	5,620-476,000 (2,550-216,000)	69.6 (31.6) 78.0 (35.4)
ESCS-63-200	7.87 (200)	23.82 (605)	15.16 (385)	9.65 (245)	13.41 (341)	9.53 (242)	319,000 (36)	7,500-635,000 (3,400-288,000)	76.4 (34.6) 84.7 (38.4)
ESCS-63-250	9.84 (250)	27.76 (705)	17.13 (435)	11.61 (295)	15.39 (391)	11.49 (292)	398,000 (45)	9,370-794,000 (4,250-360,000)	83.2 (37.7) 91.6 (41.5)
ESCS-63-300	11.81 (300)	31.69 (805)	19.09 (485)	13.58 (345)	17.35 (441)	13.46 (342)	478,000 (54)	11,240-952,000 (5,100-432,000)	90.0 (40.8) 98.3 (44.6)
ESCS-63-350	13.78 (350)	36.42 (925)	21.85 (555)	15.55 (395)	20.11 (511)	15.43 (392)	558,000 (63)	13,120-1,111,000 (5,950-504,000)	99.3 (45.1) 107.7 (48.9)
ESCS-63-400	15.75 (400)	40.35 (1,025)	23.82 (605)	17.52 (445)	22.01 (561)	17.40 (442)	637,000 (72)	15,010-1,270,000 (6,810-576,000)	106.1 (48.1) 114.5 (51.9)
ESCS-63-500	19.69 (500)	49.02 (1,245)	28.54 (725)	21.46 (545)	26.80 (681)	21.34 (542)	797,000 (90)	18,760-1,587,000 (8,510-720,000)	122.3 (55.5) 130.7 (59.3)
ESCS-63-600	23.62 (600)	56.89 (1,445)	32.48 (825)	25.39 (645)	30.74 (781)	25.30 (642)	956,000 (108)	22,510-1,905,000 (10,210-864,000)	135.9 (61.6) 144.2 (65.4)
ESCS-63-700	27.56 (700)	65.55 (1,665)	37.20 (945)	29.33 (745)	35.46 (901)	29.21 (746)	1,115,000 (126)	26,260-2,222,000 (11,910-1,008,000)	152.0 (69.0) 160.4 (72.8)
ESCS-63-800	31.50 (800)	73.43 (1,865)	41.14 (1,045)	33.27 (845)	39.40 (1,001)	33.15 (842)	1,275,000 (144)	29,980-2,540,000 (13,600-1,152,000)	165.6 (75.1) 174.0 (78.9)
ESCS-63-1000	39.37 (1,000)	89.96 (2,285)	49.80 (1,265)	41.14 (1,045)	48.06 (1,221)	41.02 (1,042)	1,593,000 (180)	37,480-3,175,000 (17,000-1,440,000)	195.4 (88.6) 203.7 (92.4)
ESCS-63-1200	47.24 (1,200)	106.50 (2,705)	58.46 (1,485)	49.02 (1,245)	56.72 (1,441)	48.90 (1,242)	1,912,000 (216)	44,970-3,810,000 (20,400-1,728,000)	225.1 (102.1) 233.5 (105.9)

Technical Data

Maximum force: 47,200 lbs (210 kN)

Impact velocity range: 1.6-15 ft/sec (0.5 to 4.6 m/s)

Minimum return force: 106 lbs. (0.5 kN)

Operating temperature: 10° to 150°F (-12°C to 66°C)
(Consult factory for optional ranges).

Oil type: ATF

Custom environmental protection options of paint, plating, rod bellows, etc. are available. Consult factory for your specific needs.

Note: Buttons are standard on all stacker crane shock absorbers.

Note: An integral mechanical stop is built into the front of all units.

All stacker crane shock absorbers have special orifice designs and must be sized per application.



Enertrols

Industrial Crane Bumper Shocks ECB-63 to 160

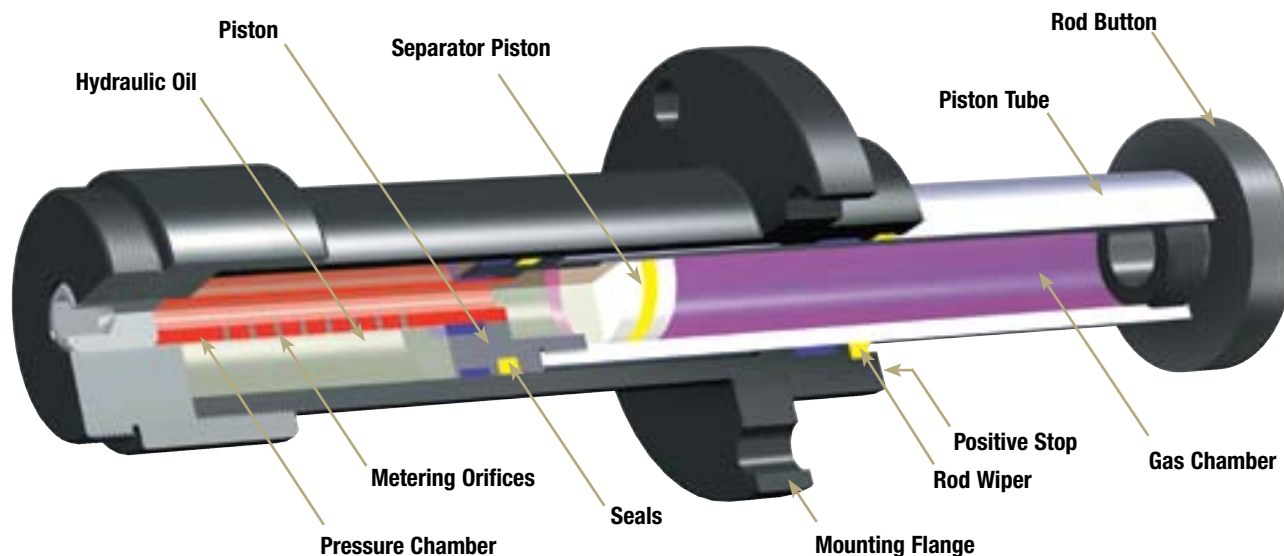
Enertrols ECB Series Heavy Industrial Shock Absorbers are designed for emergency deceleration and improved performance of large industrial equipment. During normal operation at low velocity, the shock absorbers provide minimal pneumatic resistance. In an emergency or high velocity condition, the shock absorbers respond hydraulically to protect the installation from damaging reaction forces by providing controlled deceleration.

Enertrols Crane and Heavy Industrial Shock Absorbers are self-contained devices which utilize multiple orifices to provide controlled linear deceleration while minimizing reaction forces. In the ready and normal position, the piston rod is extended. When the impact load strikes the shock absorber, hydraulic fluid is displaced by a piston through the orifices in the metering tube. As the shock absorber continues through the stroke, the orifices are progressively closed and the velocity is reduced while the kinetic energy is converted to thermal energy. As a result, the load is brought to rest without the high recoil forces and low efficiencies associated with helical springs and rubber bumpers. The displaced oil passes into a gas pressurized piston accumulator located within the piston rod. By controlling the flow of the fluid, the rod is smoothly returned to the extended and ready position for the next cycle.

Applications include: overhead cranes, conveyors, turntables, dockside equipment, steel/foundries, elevators, lumber mills, offshore rigs, bridges and more.



Industrial Crane Bumper Shocks ECB-63 to 160



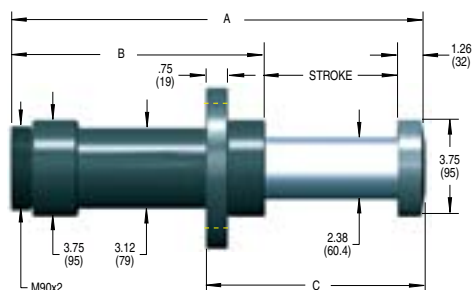
Ordering Information

ECB-63-100-F-B- -X

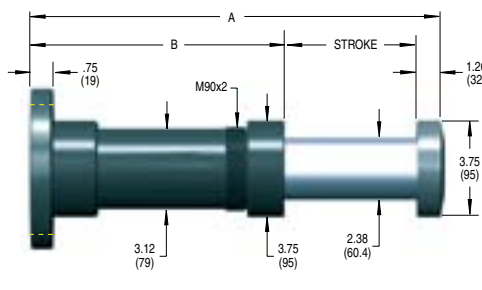
ECB Series	Bore Diameter (mm)	Stroke Length (mm)	Flange Location	Crane Button and Safety Cable	Application Number	Specials
Industrial Crane	63	100	500	F Front Flange		Environmental Finish
Bumper Shock	100	200	600	R Rear Flange		Custom Flanges
	160	300	800	B Optional Larger Button (includes safety cable)		Fluid
		400				

Industrial Crane Bumper Shocks ECB-63

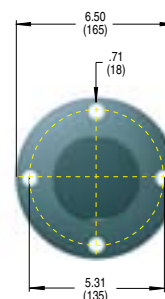
Front Flange



Rear Flange



Flange



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	Rod Return Force lbs (kN) Fully Out Fully In		E ₃ Energy per Cycle in lbs (kJm)	We Effective Weight Range lbs. (kg)	Shipping Weight lbs (kg)
ECB-63-100	3.94 (100)	16.54 (420)	11.34 (288)	7.56 (192)	344 (1.5)	3,669 (16.3)	141,600 (16)	3,330-282,000 (1,510-128,000)	28.0 (12.7)
ECB-63-200	7.87 (200)	27.56 (700)	18.43 (468)	11.50 (292)	344 (1.5)	4,815 (21.4)	283,200 (32)	6,660-564,000 (3,020-256,000)	36.8 (16.7)
ECB-63-300	11.81 (300)	38.58 (980)	25.51 (648)	15.43 (392)	344 (1.5)	5,393 (24.0)	424,800 (48)	10,010-847,000 (4,540-384,000)	45.8 (20.8)
ECB-63-400	15.75 (400)	49.61 (1,260)	32.60 (828)	19.37 (492)	344 (1.5)	5,720 (25.4)	566,400 (64)	13,340-1,129,000 (6,050-512,000)	54.6 (24.8)
ECB-63-500	19.69 (500)	60.63 (1,540)	39.69 (1,008)	23.31 (592)	344 (1.5)	5,949 (26.5)	708,000 (80)	16,670-1,411,000 (7,560-640,000)	63.5 (28.8)

Technical Data

Maximum force: 42,000 lbs. (187 kN)

Impact velocity range: 1.6-15 ft/sec (0.5 to 4.6 m/s)

Minimum return force: 106 lbs. (0.5kN)

Operating temperature: 10° to 150°F (-12°C to 66°C)
(Consult factory for optional ranges).

Oil type: ATF

Note: An integral mechanical stop is built into the front of all units.

Note: Buttons are standard on all industrial crane bumper shock absorbers. Safety cable is optional.

Custom environmental protection options of paint, plating, rod bellows, etc. are available.
Consult factory for your specific needs.

All crane bumper shock absorbers have special orifice designs and must be sized per application.
Enertrols crane bumper shock absorbers are designed to AISE standards.

Optional Larger Button

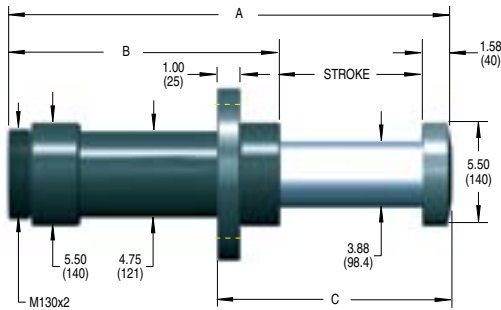
(Optional larger button includes safety cable)

Diameter Z	ECB-63 EEB-63	ECB-100 EEB-100	ECB-160
inch	5.00	7.00	9.00
(mm)	(127)	(178)	(229)

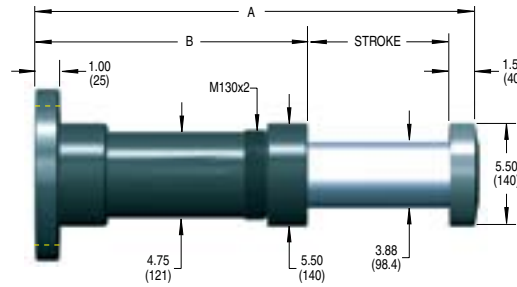


Industrial Crane Bumper Shocks ECB-100

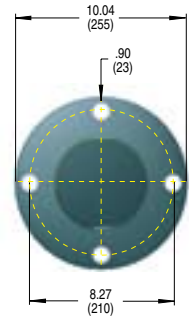
Front Flange



Rear Flange



Flange



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	Rod Return Force		E ₃ Energy per Cycle in lbs (kNm)	We Effective Weight Range lbs (kg)	Shipping Weight lbs (kg)
					Fully Out	Fully In			
ECB-100-200	7.87 (200)	28.94 (735)	19.49 (495)	12.60 (320)	880 (3.9)	8,850 (39.4)	708,000 (80)	16,670-1,411,000 (7,560-640,000)	93.7 (42.5)
ECB-100-300	11.81 (300)	39.57 (1,005)	26.18 (665)	16.54 (420)	880 (3.9)	11,196 (49.8)	1,062,000 (120)	25,000-2,116,000 (11,340-960,000)	112.1 (50.8)
ECB-100-400	15.75 (400)	50.20 (1,275)	32.87 (835)	20.47 (520)	880 (3.9)	12,912 (57.4)	1,416,000 (160)	33,330-2,822,000 (15,120-1,280,000)	130.4 (59.1)
ECB-100-500	19.69 (500)	60.83 (1,545)	39.57 (1,005)	24.41 (620)	880 (3.9)	14,216 (63.2)	1,770,000 (200)	41,670-3,527,000 (18,900-1,600,000)	148.7 (67.5)
ECB-100-600	23.62 (600)	71.46 (1,815)	46.26 (1,175)	28.35 (720)	880 (3.9)	15,237 (67.8)	2,124,000 (240)	50,000-4,233,000 (22,680-1,920,000)	167.0 (75.8)

Technical Data

Maximum force: 105,000 lbs. (467 kN)

Impact velocity range: 1.6-15 ft/sec (0.5 to 4.6 m/s)

Minimum return force: 106 lbs. (0.5kN)

Operating temperature: 10° to 150°F (-12°C to 66°C)
(Consult factory for optional ranges).

Oil type: ATF

Note: An integral mechanical stop is built into the front of all units.

Note: Buttons are standard on all industrial crane bumper shock absorbers.

Safety cable is optional.

Custom environmental protection options of paint, plating, rod bellows, etc.
are available. Consult factory for your specific needs.

Optional Larger Button

(Optional larger button includes safety cable)

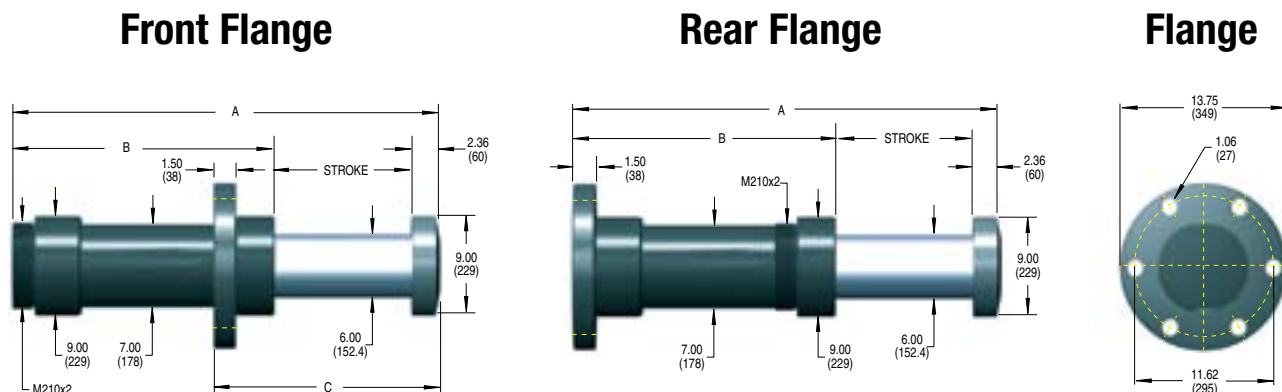
Diameter Z	ECB-63 EEB-63	ECB-100 EEB-100	ECB-160
inch	5.00	7.00	9.00
(mm)	(127)	(178)	(229)



All crane bumper shock absorbers have special orifice designs and must be sized per application.

Enertrals crane bumper shock absorbers are designed to AISE standards.

Industrial Crane Bumper Shocks ECB-160, EEB-160



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	Rod Return Force lbs (kN)		E ₃ Energy per Cycle in lbs (kJm)	We Effective Weight Range lbs (kg)	Shipping Weight lbs (kg)
ECB-160-400	15.75 (400)	55.12 (1,400)	37.01 (940)	23.62 (600)	2,148 (9.6)	14,124 (62.8)	2,124,000 (240)	50,000-4,233,000 (22,680-1,920,000)	340.9 (154.6)
ECB-160-600	23.62 (600)	78.74 (2,000)	52.76 (1,340)	31.50 (800)	2,148 (9.6)	14,135 (62.9)	3,186,000 (360)	75,000-6,349,000 (34,020-2,880,000)	414.4 (188.0)
ECB-160-800	31.50 (800)	102.36 (2,600)	68.50 (1,740)	39.37 (1,000)	2,148 (9.6)	14,146 (62.9)	4,248,000 (480)	100,000-8,466,000 (45,360-3,840,000)	487.9 (221.3)

Technical Data

Maximum force: 157,000 lbs. (700 kN)

Impact velocity range: 1.6-15 ft/sec (0.5 to 4.6 m/s)

Minimum return force: 106 lbs. (0.5kN)

Operating temperature: 10° to 150°F (-12°C to 66°C)
(Consult factory for optional ranges).

Oil type: ATF

Note: An integral mechanical stop is built into the front of all units.

Note: Buttons are standard on all industrial crane bumper shock absorbers. Safety cable is optional.

Custom environmental protection options of paint, plating, rod bellows, etc. are available. Consult factory for your specific needs.

EEB Emergency Buffer Models

These low return force units are ideal for applications where it is preferred to have equipment not accelerate in the opposite direction after completing its linear deceleration.

Consult Enertrols or your distributor for additional information.

Model	Rod Return Force lbs (kN)	
	Fully Out	Fully In
EEB-160-400	421 (1.87)	4,071 (18.1)
EEB-160-600	474 (2.1)	4,225 (18.8)
EEB-160-800	535 (2.4)	4,380 (19.5)

Optional Larger Button

(Optional larger button includes safety cable)

Diameter Z	ECB-63 EEB-63	ECB-100 EEB-100	ECB-160
inch	5.00	7.00	9.00
(mm)	(127)	(178)	(229)



All crane bumper shock absorbers have special orifice designs and must be sized per application.
Enertrols crane bumper shock absorbers are designed to AISE standards.



Hydraulic Dampers

EHB Hydraulic Dampers from Enertrols are maintenance free, self-contained and sealed units. They are available with body diameters from 15 mm to 40 mm and with stroke lengths of up to 800 mm (40 mm model).

Enertrols hydraulic dampers are durable and feature single or double acting-designs. The travel speed can be easily adjusted and remains constant throughout the stroke. The single acting version is controllable in one direction only, with free flow in the opposite direction.

Adjustment is easily achieved by pulling out fully and turning the rod until the desired damping speed is attained. A variety of end fittings are available for ease of operation and installation.

These dependable units offer a minimum of 250,000 cycles and are available for QUICK DELIVERY.

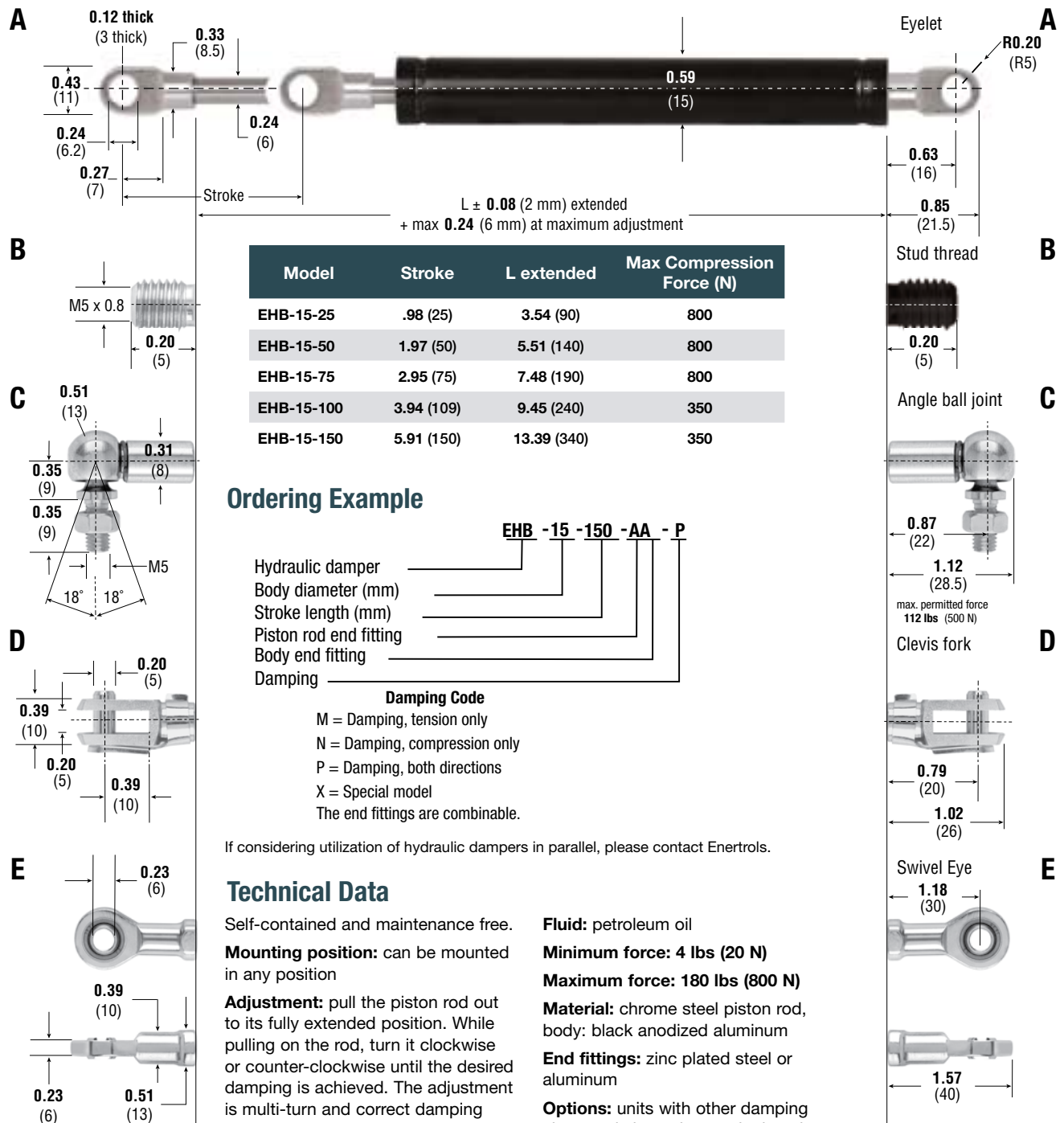
Enertrols EHB Hydraulic Dampers are the ideal fit for applications in industries such as: defense, medical, packaging, bottling, printing, fitness equipment, transportation, RV, lawn equipment, furniture, amusement and more.

Specific selected applications include: machine guards, drilling and tapping equipment, pick and place operations, swinging loads, tooling fixtures, fire safety doors as well as lids and slides.



Hydraulic Damper EHB-15

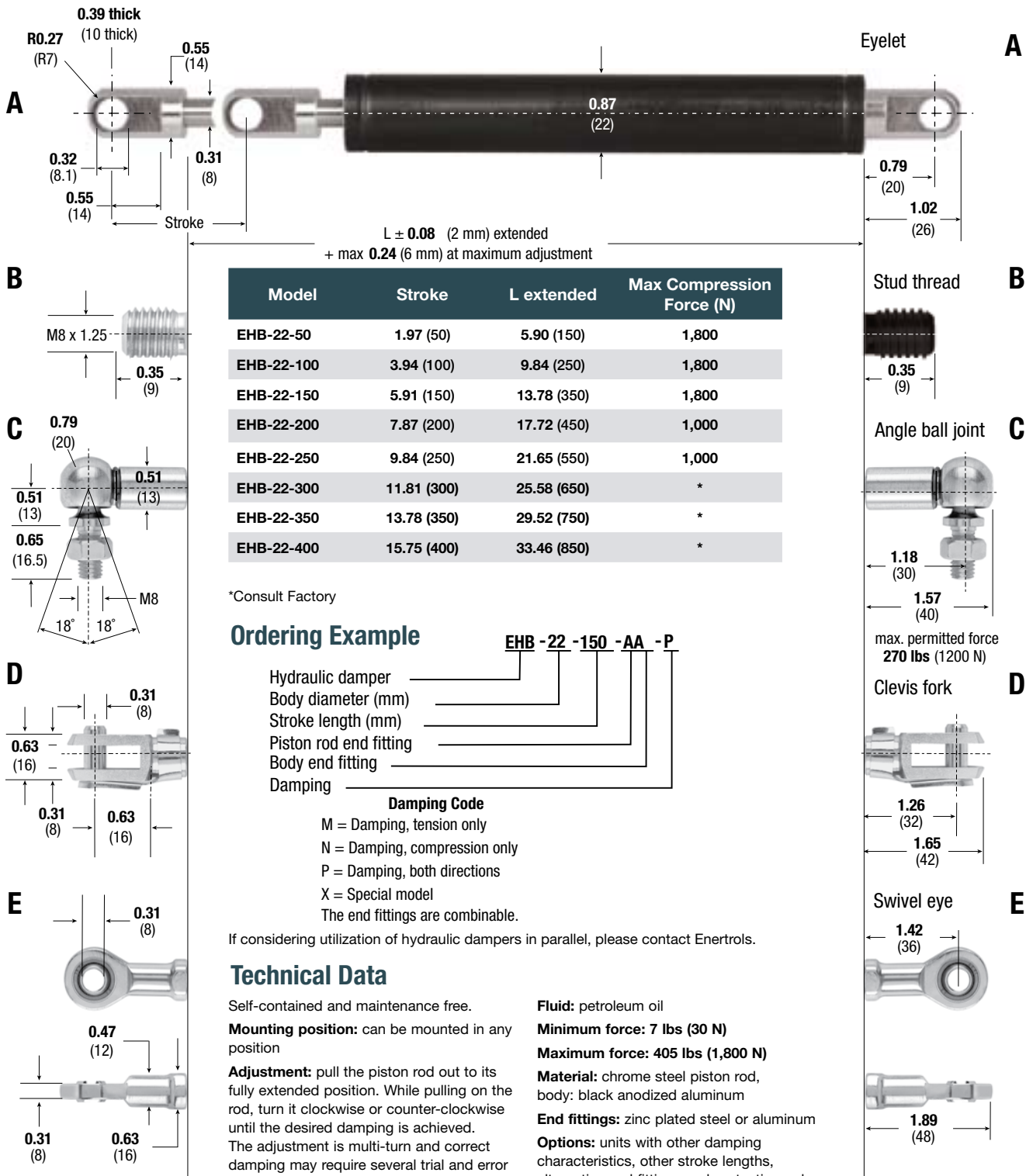
Dimensions in inches and (mm)





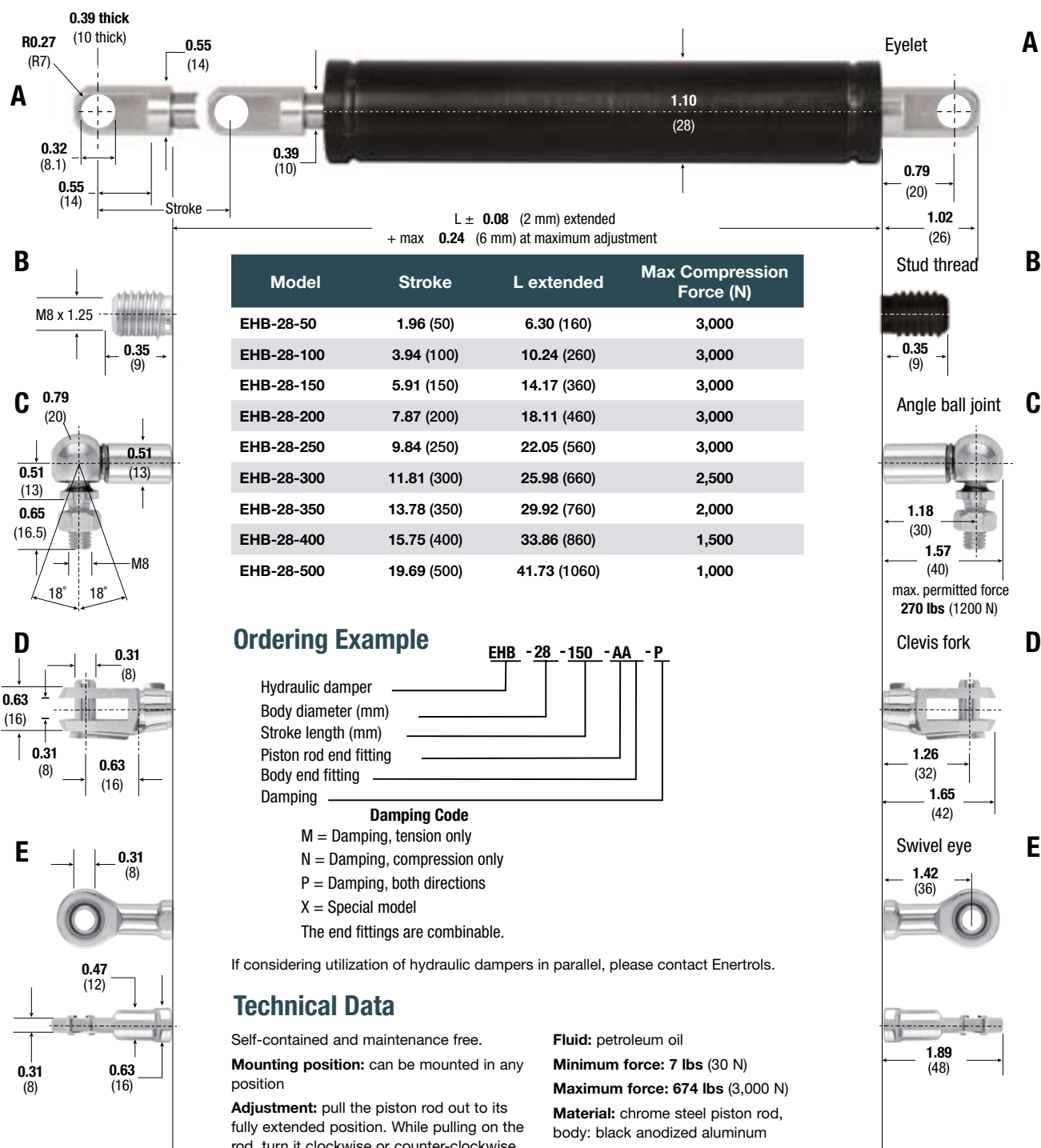
Hydraulic Damper EHB-22

Dimensions in inches and (mm)



Hydraulic Damper EHB-28

Dimensions in inches and (mm)

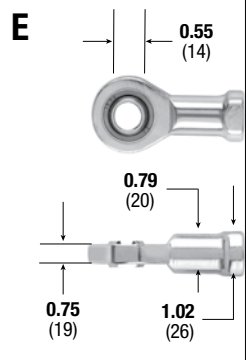
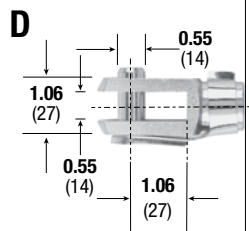
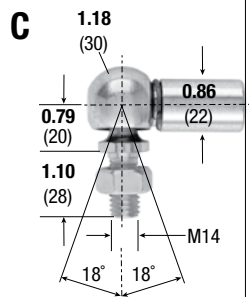
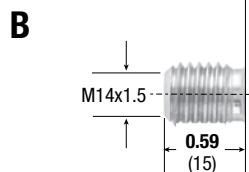
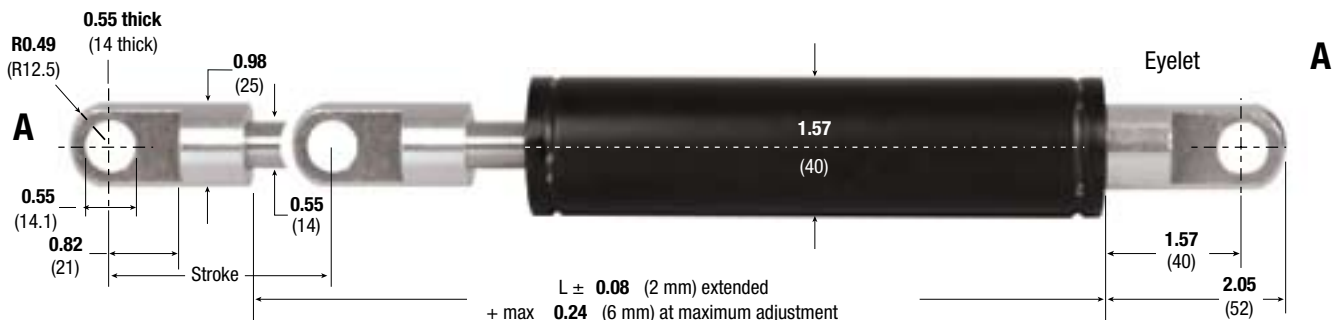




Enertrols

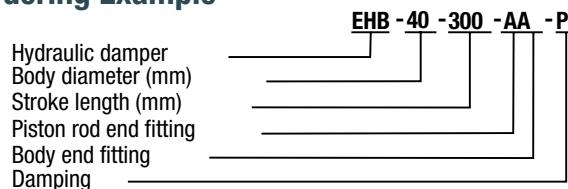
Hydraulic Damper EHB-40

Dimensions in inches and (mm)



Model	Stroke	L extended	Max Compression Force (N)
EHB-40-100	3.94 (100)	10.83 (275)	10,000
EHB-40-150	5.91 (150)	14.76 (375)	10,000
EHB-40-200	7.87 (200)	18.70 (475)	10,000
EHB-40-300	11.81 (300)	26.57 (675)	10,000
EHB-40-400	15.75 (400)	34.45 (875)	8,000
EHB-40-500	19.69 (500)	42.32 (1075)	6,000
EHB-40-600	23.62 (600)	50.20 (1275)	4,000
EHB-40-700	27.56 (700)	58.07 (1475)	3,000
EHB-40-800	31.50 (800)	65.94 (1675)	3,000

Ordering Example



Damping Code

- M = Damping, tension only
 - N = Damping, compression only
 - P = Damping, both directions
 - X = Special model
- The end fittings are combinable.

If considering utilization of hydraulic dampers in parallel, please contact Enertrols.

Technical Data

Self-contained and maintenance free.

Mounting position: can be mounted in any position

Adjustment: pull the piston rod out to its fully extended position. While pulling on the rod, turn it clockwise or counter-clockwise until the desired damping is achieved. The adjustment is multi-turn and correct damping may require several trial and error adjustments.

Attention: dampers have free travel accounting for approximately 20% of stroke

Mechanical stop: required 1 to 1.5 mm before end of stroke

Temperature range: -22° to +176°F (-30° to +80°C), with special seals up to 248°F (120°C)

Fluid: petroleum oil

Minimum force: 7 lbs (30 N)

Maximum force: 2,248 lbs (10,000 N)

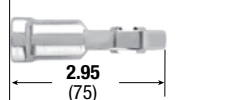
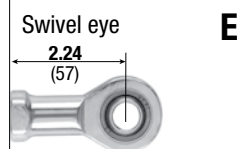
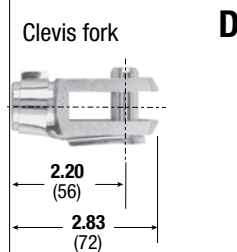
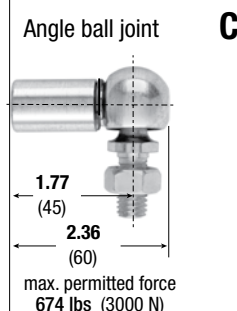
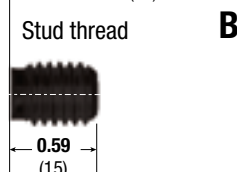
Material: chrome steel piston rod, body: black anodized aluminum

End fittings: zinc plated steel or aluminum

Options: units with other damping characteristics, other stroke lengths, alternative end fittings and protective rod sleeves

Mounting bracket: A and E end fittings adapt to mounting bracket ME14.

See page 88 for mounting bracket information



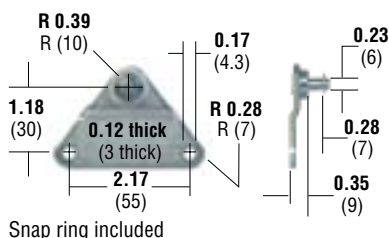
Mounting Brackets for Hydraulic Dampers

Dimensions in inches and (mm)

Material: zinc plated steel

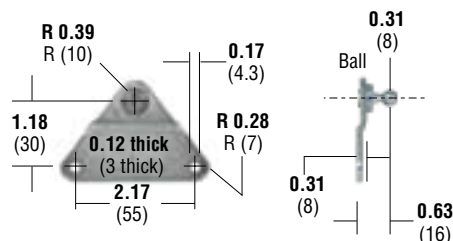
GSB-01

max. force **112 lbs** (500 N)



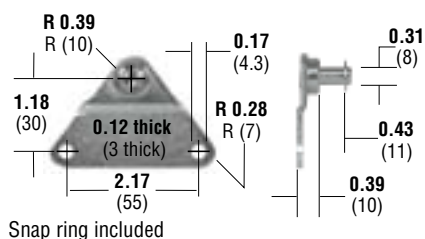
GSB-02

max. force **112 lbs** (500 N)



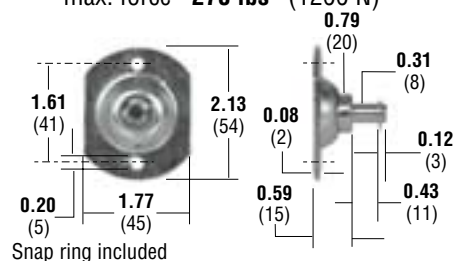
GSB-03

max. force **270 lbs** (1200 N)



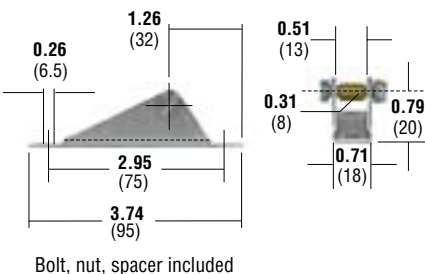
GSB-04

max. force **270 lbs** (1200 N)



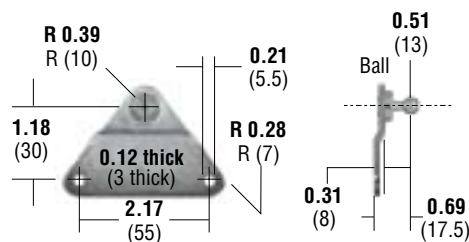
GSB-05

max. force **405 lbs** (1800 N)



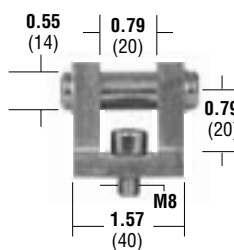
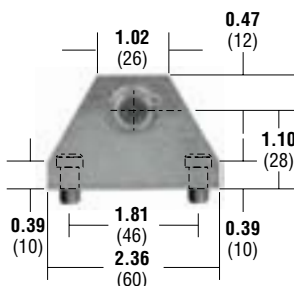
GSB-06

max. force **270 lbs** (1200 N)



ME14

max. force **2,248 lbs** (10,000 N)



See individual model pages for specific information on the correct end fittings for each mounting bracket.



EDVC Velocity & Feed Controllers



Hydraulic Speed/Feed Controllers from Enertrons are self-contained sealed units designed for precise control of speed in both directions of travel. The travel speed can be adjusted independently in each direction of travel.

These dependable, Enertrons dual velocity controls (EDVC's) are designed to solve automated control and velocity damping problems. EDVC models regulate the speed of moving machinery parts and equipment. They are ideal for applications requiring self-contained units that are simple to install and operate.

Features include: adjustable or fixed orifices, single or dual controls and heavy-duty construction.

Applications include: pick and place automation equipment, drill and tapping equipment, machine slides and guards, lids, swinging loads and tooling fixtures.

Technical Data

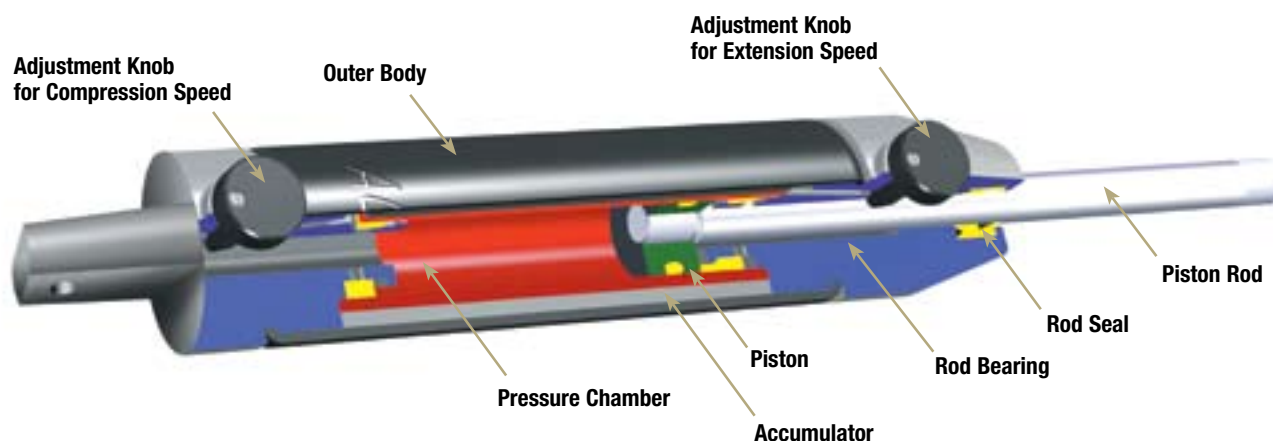
Maximum operating temperature: 150°F (66°C).

Mechanical stop: Provide mechanical stop .04 to .06 inch (1 to 1.5 mm) before end of each stroke direction.

Operating fluid: Automatic Transmission Fluid (ATF) at 104°F (40°C).

Material: Black anodized, aluminum body. Hard chrome plated, steel piston rod. Zinc plated, steel end fittings.

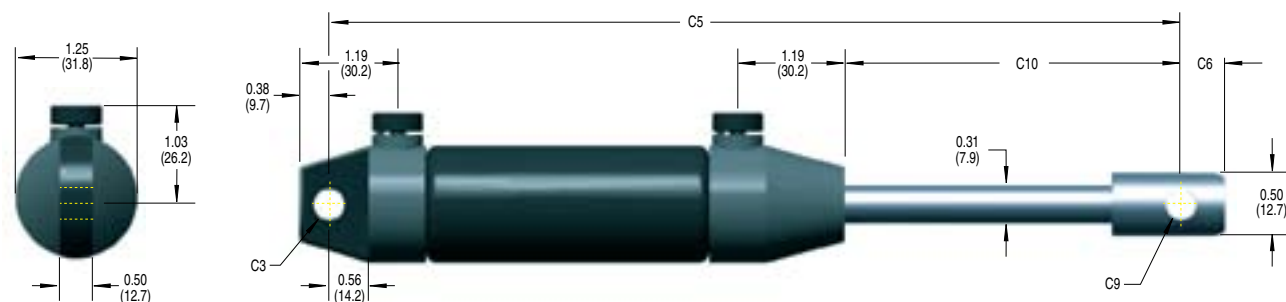
To special order: Special oils and external finishes. Uni-directional damping (free flow in reverse direction).



Ordering Information

EDVC 2 - CCO			
EDVC Series	Stroke Length	Mounting Clevis	Velocity Controls
Enertrons Dual Velocity Control	2 (2" or 50 mm) 4 (4" or 100 mm) 6 (6" or 150 mm)	- Standard M Metric	- Controlled, both directions -CCO Controlled, compression only -CTO Controlled, tension only

EDVC Velocity & Feed Controllers



Shown in extended position

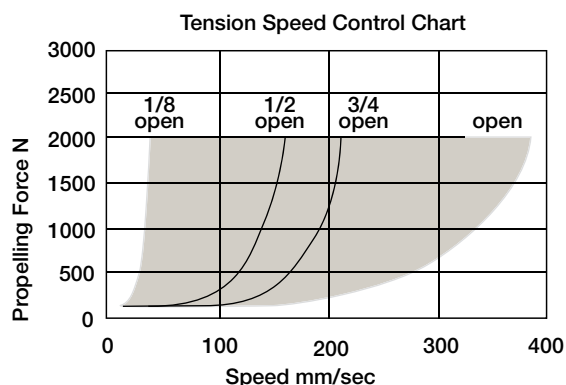
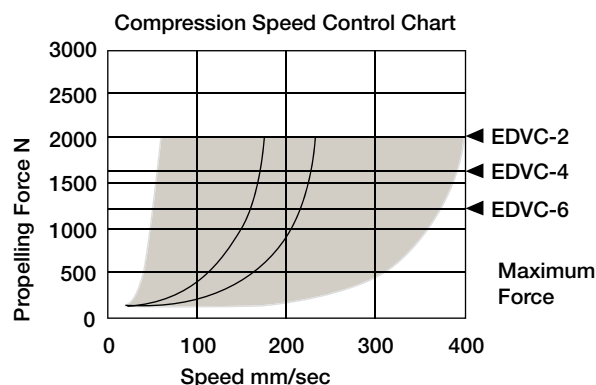
Dimensions in inches (millimeters)

Model	Stroke	C3	C5	C6	C9	C10
EDVC-2	2.00	0.25	9.81	0.25	0.25	2.93
EDVC-2M	(50.0)	(6.0)	(250.0)	(6.4)	(6.0)	(75.2)
EDVC-4	4.00	0.25	13.81	0.25	0.25	4.93
EDVC-4M	(100.0)	(6.0)	(350.0)	(6.4)	(6.0)	(124.4)
EDVC-6	6.00	0.25	17.81	0.25	0.25	6.93
EDVC-6M	(150.0)	(6.0)	(450.0)	(6.4)	(6.0)	(173.6)

EDVC Specifications

Model	Tension		Compression		Shipping Weight lbs (kg)
	Maximum Propelling Force	Minimum Force to Operate Through Full Stroke	Maximum Propelling Force	Minimum Force to Operate Through Full Stroke	
EDVC-2	450 lbs	9.5 lbs	450 lbs	9.5 lbs	0.75 lbs
EDVC-2M	2,000 N	(42 N)	2,000 N	(42 N)	0.34 kgs
EDVC-4	450 lbs	(External Mechanical Stops Required)	375 lbs	(External Mechanical Stops Required)	0.90 lbs
EDVC-4M	2,000 N		1,670 N		0.41 kgs
EDVC-6	450 lbs		300 lbs		1.06 lbs
EDVC-6M	2,000 N		1,335 N		0.48 kgs

Speed Controls





Enertrols

EVC Velocity & Feed Controllers with Fine Adjustment



Enertrols EVC Precision Feed Controls are sealed hydraulic units fitted with a high precision metering element. When the piston rod is depressed the hydraulic oil is forced through the adjustable precision metering orifice. This provides a constant and precise feed control throughout the stroke length. The feed rate can be adjusted over a wide range by turning the external adjuster knob at the rear end of the unit. The optional threaded outer body helps to simplify installation and the adjustment of feed control travel limits.

Enertrols Precision Feed Controls provide exact speed control for machine motion. They are self-contained, maintenance free, leakproof, temperature stable and stick-slip free. The rolling diaphragm seal, on models 2515 to 2555, provides a hermetically sealed unit and also provides an integral accumulator for the oil displaced during operation. The high precision, adjustable metering system can provide accurate feed rates from as little as 0.47 in/min (12 mm/min) with low propelling forces.

Applications include: saws, cutters, drill feeds, grinding and boring machines in the plastics, metal, wood and glass industries.

Technical Data

Feed rate range: min. 0.51 in/min with 90 lbs. (0.013 m/min with 400 N) propelling force. Maximum 1500 in/min with 787 lbs. (38 m/min with 3500 N) propelling force.

Do not rotate piston rod. If excessive rotation force is applied, rolling seal may rupture (only applies to EVC 2515 to EVC 2555).

Outer body: Smooth body standard 0.94 inch (23.8 mm) dia., threaded body optional.

When mounting **take care not to damage the adjuster knob.**

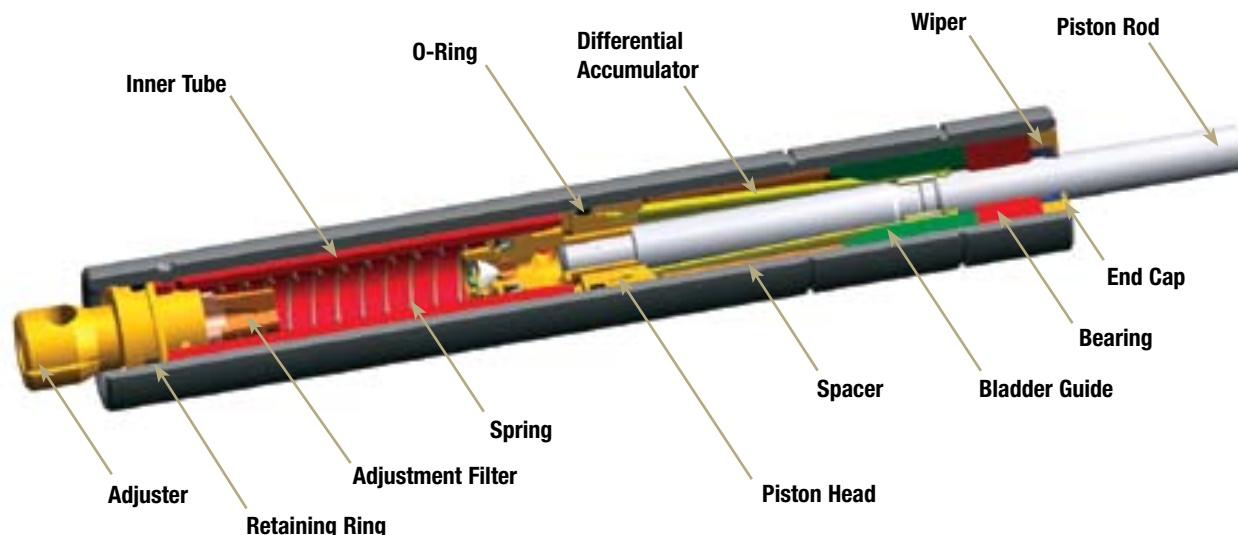
Temperature range: 32° to 140°F (0° to 60°C).

Material: Body heavy-duty steel tube with black oxide. Piston rod with hard chrome plating.

Adjustment: Adjust EVC unit by turning adjustment knob at rear. Zero is full open (fast) and 20 is fully closed (slow).

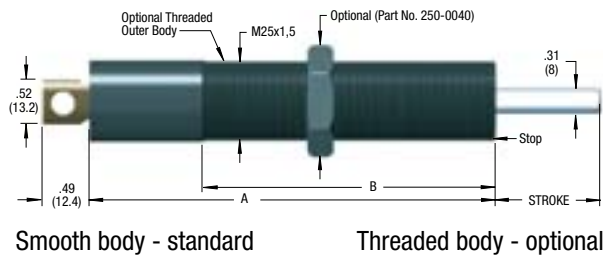
Note: If the EVC feed control will be in contact with petroleum based oils or cutting fluids, specify optional neoprene rolling seal or install Air Bleed Collar model ESP 25 (only applies to EVC 2515 to EVC 2555).

EVC Precision Hydraulic Feed Controller, Models 2515-2555



EVC Velocity & Feed Controllers with Fine Adjustment

Model EVC 25..

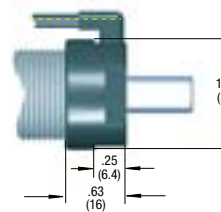


Smooth body - standard

Threaded body - optional

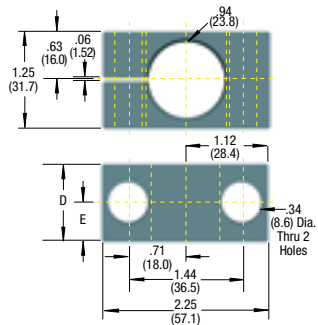
Air Bleed Collar

Model ESP-25



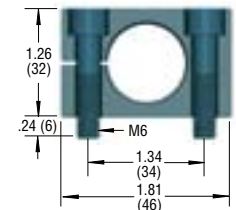
Part No. 10783-000

Clamp Mount for Smooth Body



See chart below for D & E dimensions

Clamp Mount for Optional Threaded Body



Part No. 10780-000
(all EVC FT Models)

Thickness: .98 (25 mm)
(Mounting bolts not included)

Dimensions in inches (millimeters)

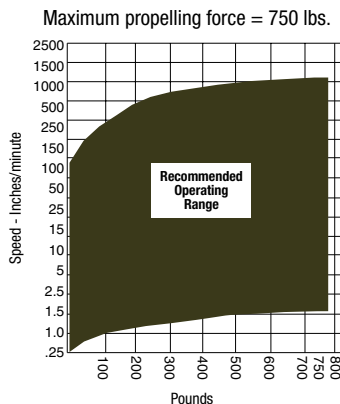
Standard Model	Threaded Model	Stroke	A	B	Weight lbs.	kg.
EVC 2515-F	EVC 2515-FT	0.59 (15)	5.04 (128)	3.15 (80)	0.88	(0.4)
EVC 2530-F	EVC 2530-FT	1.18 (30)	6.34 (161)	4.33 (110)	1.10	(0.5)
EVC 2555-F	EVC 2555-FT	2.16 (55)	8.23 (209)	5.19 (130)	1.32	(0.6)
EVC 2575-F	EVC 2575-FT	2.95 (75)	11.14 (283)	5.90 (150)	1.76	(0.8)
EVC 25100-F	EVC 25100-FT	3.94 (100)	12.13 (308)	5.90 (150)	1.98	(0.9)
EVC 25125-F	EVC 25125-FT	4.92 (125)	13.13 (333.5)	5.90 (150)	2.20	(1.0)

F = fine adjuster/smooth body FT = fine adjuster/threaded body

EVC Specifications

Standard Model	Threaded Model	Propelling Force N		Return Force N		Rest Time
		lbs.	(N)	lbs.	(N)	seconds
		min max	min max	min max	min max	
EVC 2515-F	EVC 2515-FT	6.74 - 787	(30 - 3,500)	1.12 - 2.25	(5 - 10)	0.2
EVC 2530-F	EVC 2530-FT	6.74 - 787	(30 - 3,500)	1.12 - 3.37	(5 - 15)	0.4
EVC 2555-F	EVC 2555-FT	7.87 - 787	(35 - 3,500)	1.12 - 4.50	(5 - 20)	1.2
EVC 2575-F	EVC 2575-FT	11.24 - 787	(50 - 3,500)	7.39 - 11.56	(33 - 51)	1.7
EVC 25100-F	EVC 25100-FT	13.49 - 787	(60 - 3,500)	6.00 - 11.56	(27 - 51)	2.3
EVC 25125-F	EVC 25125-FT	15.74 - 787	(70 - 3,500)	5.23 - 11.23	(23 - 50)	2.8

Speed Controls



Dimensional Chart for Smooth Body Clamp

Model	D	E	Clamp Part No.
EVC 2515-F	1.25	.63	250-0465
EVC 2530-F	(31.7)	(16.0)	
EVC 2555-F			
EVC 2575-F	2.00	1.00	250-0466
EVC 25100-F	(50.8)	(25.4)	
EVC 25125-F			

Mounting Examples



Mounting with Clamp Mount



Installed with Air Bleed Collar SP 25



Feed Controller Installation Examples

Drilling Sheet Metal

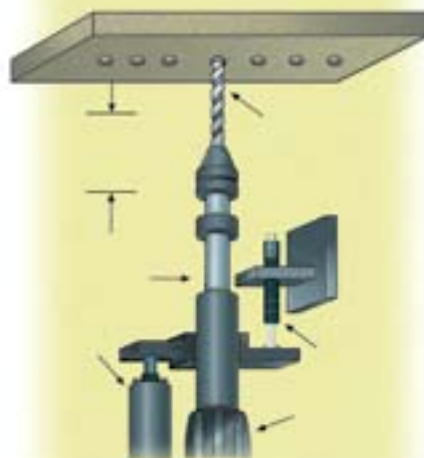


A high force is necessary at the start of drilling when the drill first contacts the sheet.

After the initial cut this high force causes the drill to break through. This results in jagged edges rather than a smooth clean hole and also causes tool breakage.

By installing an Enertrols EVC Feed Control it is possible to precisely control the rate of drill advance. As a result the drilled holes are clean and consistent and drill breakage is considerably reduced.

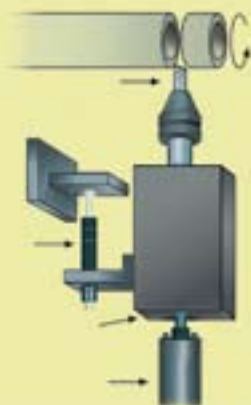
Cutting Holes in MDF Furniture Panels



Originally a pneumatic tandem cylinder was used to provide the initial fast advance. This was then slowed to cutting speed by a complicated regulating device. Despite this the control and adjustability was unsatisfactory.

After installing the Enertrols EVC Feed Control the feed rate could be adjusted precisely. The expensive and special tandem cylinder could be replaced by a standard one and the complicated regulating device was no longer required.

Cutting and Chamfering of Plastic Tubes



Precisely adjustable cutting and feed speeds are required depending on the particular material being processed. A standard Enertrols EVC Feed Control with its fine adjustment enables the cutter to be controlled exactly for different materials.

Sawing Aluminum and Plastic Profiles



Varying material types, as well as hardness and wear on the saw blade causes the cutting pressure to vary greatly. However the saw advance speed should remain constant as changes cause breakage of the material being cut or of the saw blade.

An Enertrols EVC Feed Control fitted directly to the cutting head provides a simple and low cost solution. The cutting speed remains constant and can be easily preset.

Stocking Distributors

USA, Canada and Mexico

United States

Location	City	Distributor	Telephone
Alabama	Birmingham	Flow Dynamics & Automation Inc.	(205) 581-1200
Arizona	Phoenix	Hei-Tek Automation	(602) 269-7931
	Tucson	Flordraulic Group	(520) 790-4000
Arkansas	N. Little Rock	Arkansas Industrial Machine	(501) 758-2745
California	Anaheim	Provoast Automation	(714) 996-9417
	Hayward	Air Concepts & Controls	(510) 471-4470
	Poway	Provoast Automation	(858) 748-2237
Colorado	Thornton	Sunsorce Inc.	(303) 650-1500
Connecticut	Worcester, MA	Kinepower Corporation	(508) 754-6901
	Wakefield, MA	Minuteman Controls	(781) 245-9550
Delaware	Broomall, PA	Rankin Automation	(610) 544-6800
Florida	Birmingham	Flow Dynamics & Automation Inc.	(205) 581-1200
	Oldsmar	Braas Company	(813) 855-4425
Georgia	Conyers	Georgia Automation	(770) 388-7300
	Dickson, TN	Modern Automation	(615) 446-1990
Hawaii	Farmington Hills, MI	Enertrols	(734) 595-4500
Idaho	Salt Lake City, UT	Disco Associates	(801) 268-3500
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Illinois	Chicago	Flodraulic Group	(800) 545-5414
	Hanover Park	Flodyne, Inc.	(630) 563-3600
	St. Louis, MO	John Henry Foster Co.	(314) 427-0600
Indiana	Chicago, IL	Flodraulic Group	(800) 545-5414
	Dayton, OH	Gem Air Controls	(937) 890-5922
	Fort Wayne	Indiana Fluid Power	(260) 489-4575
	Noblesville	Sidener Engineering	(317) 773-8119
Iowa	Cedar Rapids	Iowa Fluid Power	(319) 395-7000
	Urbandale	The Hartfiel Company	(515) 309-0670
Kansas	Lenexa	The Hartfiel Company	(913) 894-6545
	Olathe	Innovative Fluid Power	(913) 768-7008
Kentucky	West Chester, OH	Henry M. Wood	(513) 755-4060
Louisiana	Shreveport	Hydragear Inc.	(318) 221-2083
	Jefferson	Huber Inc.	(504) 733-0900
Maine	Worcester, MA	Kinepower	(508) 754-6901
	Wakefield, MA	Minuteman Controls	(781) 245-9550
Maryland	Broomall, PA	Rankin Automation	(610) 544-6800
Massachusetts	Worcester	Kinepower	(508) 754-6901
	Wakefield	Minuteman Controls	(781) 245-9550
Michigan	Grand Rapids	Bond Fluidaire	(616) 942-1060
	Farmington Hills	Enertrols	(734) 595-4500
	Flint	R.G. Kenrick Co.	(810) 733-7440
Minnesota	Eden Prairie	The Hartfiel Company	(952) 974-2500
	Minneapolis	Innovative Fluid Power	(763) 252-1181
	Savage	Universal Power Conv.	(952) 736-1544
Mississippi	Birmingham, AL	Flow Dynamics & Automation Inc.	(205) 581-1200
	N. Little Rock, AR	Arkansas Industrial Machine	(501) 758-2745
Missouri	St. Louis	John Henry Foster Co.	(314) 427-0600
	Lenexa, KS	The Hartfiel Company	(913) 894-6545
Montana	Thornton, CO	Sunsorce Inc.	(303) 650-1500
Nebraska	Thornton, CO	Sunsorce Inc.	(303) 650-1500
	Urbandale, IA	The Hartfiel Company	(515) 309-0670

United States

Location	City	Distributor	Telephone
Nevada	Anaheim	Provoast Automation	(714) 996-9417
	Thornton, CO	Sunsorce Inc.	(303) 650-1500
	Poway, CA	Provoast Automation	(858) 748-2237
New Hampshire	Worcester, MA	Kinepower	(508) 754-6901
	Wakefield, MA	Minuteman Controls	(781) 245-9550
New Jersey	Broomall, PA	Rankin Corporation	(610) 544-6800
	Warrendale, PA	Intek Systems, Inc.	(724) 776-5669
New Mexico	Phoenix, AZ	Hei-Tek Automation	(602) 269-7931
	Thornton, CO	Sunsorce	(303) 650-1500
New York	Ontario	Component Supply	(585) 265-4330
	Syracuse	Trol-Mation	(315) 437-4100
North Carolina	Mauldin, SC	Barker Air & Hydraulics	(864) 288-3537
North Dakota	Eden Prairie, MN	The Hartfiel Company	(952) 974-2500
Ohio	Toledo	Enertrols	(734) 595-4500
	West Chester	Henry M. Wood	(513) 755-4060
	Bath/Cleveland	Mann Fluid Power	(330) 659-6671
Oklahoma	Lenexa, KS	The Hartfiel Company	(913) 894-6545
	Plano, TX	Hartfiel South Inc.	(972) 633-0000
Oregon	Portland	Northwest Pneumatics	(503) 620-5670
Pennsylvania	Saxonburg	James J. Port Company	(724) 352-0300
	Warrendale, PA	Intek Systems, Inc.	(724) 776-5669
	Broomall	Rankin Corporation	(610) 544-6800
Rhode Island	Worcester, MA	KinePower Corporation	(508) 754-6901
	Wakefield, MA	Minuteman Controls	(781) 245-9550
South Carolina	Mauldin	Barker Air & Hydraulics	(864) 288-3537
South Dakota	Eden Prairie	The Hartfiel Company	(952) 974-2500
Tennessee	Memphis	Arkansas Industrial Machine	(901) 363-2200
	Knoxville	Machine Automation	(865) 588-7473
	Dickson	Modern Automation	(615) 446-1990
Texas	Plano	Hartfiel South Inc.	(972) 633-0000
Utah	Thornton, CO	Sunsorce Inc.	(303) 650-1500
	Salt Lake City	Disco Associates	(801) 268-3500
Vermont	Worcester, MA	Kinepower	(508) 754-6901
	Wakefield, MA	Minuteman Controls	(781) 245-9550
Virginia	Knoxville, TN	Machine Automation	(865) 588-7473
	Broomall, PA	Rankin Corporation	(610) 544-6800
	Roanoke	Maxim Systems, Inc.	(540) 265-9050
Washington	Seatac	B-W Controls	(206) 241-1901
West Virginia	Broomall, PA	Rankin Corporation	(610) 544-6800
Wisconsin	Menomonee Falls	Techmaster, Inc.	(262) 255-2022
	Savage, MN	Universal Power Conversion	(952) 736-1544
Wyoming	Thornton, CO	Sunsorce Inc.	(303) 650-1500
	Salt Lake City, UT	Pro Automation	(801) 485-5500

Canada

Location	City	Distributor	Telephone
Ontario	London	ASCO Numatics Ltd.	(519) 452-1777
New Brunswick	Saint John (Nova Scotia only)	Integrated Pneumatics Ltd.	(506) 658-8004

Mexico

Location	City	Distributor	Telephone
	Monterrey	Cilindros Y Valvulas	(52) 81-8123-3604

Pacific Rim and Worldwide

Australia	Dandenong	Hoerbiger Origa Pty. Ltd.	(61) 3) 9794-8444
	Ringwood	Pneutech Pty. Ltd.	(61) 3) 9876-6499
Japan	Tokyo	Japan Machinery Company	(81) 33573-5421
New Zealand	Rotorua	Fincco Pneumatics Ltd.	(64) 7347-4446
Singapore	Singapore	Automated Controls & Machinery	(65) 62872022
Taiwan R.O.C.	Taichung	Over Bright Trading Co., Ltd.	886-7-7011763
Argentina	Langenfeld	Enertrols/Germany	(49) 2173-922610
Brazil	Vila Moreira	ATM Automacao	(55) 11-6441-3868
Denmark	Hedehusene	AVS Denmark	(45) 4656-4343
Finland	Langenfeld	Enertrols/Germany	(49) 2173-922610
Germany	Langenfeld	Enertrols/Germany	(49) 2173-922610
Hungary	Budapest	IMI International KFT. NH Div.	(36) 1-2840 9000
Ireland	Waterford	Airpower	(353) 0-51-373937
Italy	Milan	Cosmotecnica S.R.L.	(39) 02 51650059
Netherlands	Langenfeld	Enertrols/Germany	(49) 2173-922610
Slovenija	Langenfeld	Enertrols/Germany	(49) 2173-922610
Spain	San Sebastian	Haskel Espana S.R.L.	(34) 943-474566
Switzerland	CH-6341 Baar	Schlumpf Industrieprodukte GmbH	(41) 417-618-887
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